NCHRP 08-36 (140): PREDICTIONS V. REALITIES – ASSESSING ACTUAL TRANSPORTATION IMPACTS OF THE 2005 BRAC DECISIONS

FINAL REPORT

May 2018

The information contained in this report was prepared as part of NCHRP Project 08-36, Task 140, National Cooperative Highway Research Program (NCHRP).

FINAL REPORT: ASSESSING ACTUAL TRANSPORTATION IMPACTS OF THE 2005 BRAC DECISIONS

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May 2018

This work was sponsored by one or more of the following as noted:

☒American Association of State Highway and Transportation Officials, in cooperation with the Federal Highway Administration, and was conducted in the National Cooperative Highway Research Program,

☐ Federal Transit Administration and was conducted in the Transit Cooperative Research Program,

☐Federal Aviation Administration and was conducted in the Airport Cooperative Research Program,

☐ Research and Innovative Technology Administration and was conducted in the National Cooperative Freight Research Program, χ Pipeline and Hazardous Materials Safety Administration and was conducted in the Hazardous Materials Cooperative Research Program,

☐Federal Railroad Administration and was conducted in the National Cooperative Rail Research Program,

which is administered by the Transportation Research Board of the National Academies of Sciences, Engineering, and Medicine

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EXECUTIVE SUMMARY

The 1990 Defense Base Closure and Realignment (BRAC) Act created the Base Closure and Realignment Commission (BRAC Commission), an independent commission appointed by the President to make recommendations on the military base needs of the Department of Defense (DoD). For BRAC 2005, the DOD analytical teams focused on the future needs of a "transformed military service" and not the approaches used in previous rounds of BRAC. The 2005 BRAC process focused not only on economic and operational efficiency in military base closure and consolidation, but also on enhancing the joint and cross-service evaluation of installations. Previous rounds projected future defense needs only six years into the future, while the BRAC analysis in 2005 focused on projecting defense needs in 2025 (20 years).

In implementing these significant changes, the 2005 BRAC process created new challenges for the DoD and the host communities of military bases. These included negative economic and social effects in host communities for facilities that were closed or expanded. At the same time, the host communities for the 18 military facilities to be expanded also faced great challenges, including transportation, infrastructure, and environmental issues. Although the high-level criteria for the 2005 BRAC process do include infrastructure capacity and environmental impact (criteria 7 and 8), these are among the "Other Considerations," which are a lower priority than the criteria pertaining to "Military Value."

In response to the transportation system issues associated with BRAC 2005, Congress provided funding through 2010 defense appropriations for a study by the Transportation Research Board (TRB) of BRAC 2005 transportation impacts and funding issues.[1] TRB Special Report 302 (SR 302) evaluated the BRAC 2005 process, and conducted a case study analysis of planning, preparation, and impacts at six military bases that were expanded:

- Walter Reed National Military Medical Center – Bethesda, MD
- Fort Belvoir – Fairfax County, VA / The Mark Center – Alexandria, VA
- Fort Meade – Anne Arundel County, MD
- Joint Base Lewis – McChord – Pierce County, WA
- Eglin Air Force Base – Santa Rosa, Okaloosa, and Walton Counties, FL
- Fort Bliss – El Paso, TX

TRB SR 302 focused on issues related to planning, coordination, and funding in state, local, and MPO transportation planning and programming process versus military processes and protocols.

TRB Special Report 302 developed findings principally related to planning, institutional coordination, and funding of infrastructure improvements for the BRAC 2005 process. It recommended that military planners consider needs not only within the base, but also outside the base, and that military base leadership improve coordination and communication with municipalities, state DOTs, and MPOs, which could be broadened to include participation by military base representatives. SR 302 also found that in the BRAC 2005 process, funding expectations were not clearly established between military and civilian authorities, with each

[1] *Transportation Research Board. 2011. Federal Funding of Transportation Improvements in BRAC Cases: Special Report 302. Washington, DC.*

expecting the other to provide a greater share of investment to address transportation impacts of military base realignments. It recommended that DoD and civilian authorities both plan for greater expenditures to accommodate increased demand associated with military base expansions. SR 302 also recommended that future military base realignments take a more multimodal perspective on accommodating increased travel demand, with transportation demand management (TDM) programs that discourage drive-alone travel and facilitate ride-sharing, riding transit, walking, and bicycling.

For this BRAC 2005 Predictions v. Realities research project, the research team conducted a comprehensive review of transportation data and analysis related to the proposed BRAC 2005 realignment plans at the six case study facilities that were evaluated in TRB Special Report 302. This entailed a review of the transportation system and issues surrounding the six case study facilities; the transportation impacts that these realignment proposals were predicted to cause; and the actual impacts that the BRAC 2005 realignments had on the transportation system based on measured post-BRAC 2005 implementation data and performance measures. Resources reviewed included Environmental Impact Statements (EIS), other environmental impact analyses, traffic impact studies, traffic volume data, base master plans, census data, public transit/mode split statistics, and safety data. The following are some of the central findings of the research project about the actual versus predicted impacts of the BRAC 2005 realignments at these case study facilities.

The BRAC 2005 realignments at the six case study facilities were predicted to increase travel demand. Thus, general roadway system traffic volumes were expected to increase for the predicted condition relative to the baseline condition for all six case study facilities. However, based on post-BRAC peak hour traffic counts and/or annual average daily traffic (AADT) counts, actual traffic volumes around several facilities were lower than predicted. Around some facilities, notably those in the National Capital Area, traffic volumes were significantly lower than predicted. For example, at Fort Meade, available data shows that actual traffic volumes were even lower than in the baseline condition; data also suggested a similar pattern at the Mark Center.

Consistent with the predictions for traffic volumes, traffic conditions at study area intersections were generally predicted to worsen at study area intersections around the six case study facilities. Even assuming implementation of intersection improvement projects, more intersections were expected to worsen under predicted conditions than to improve. However, based on actual traffic conditions that were measured after BRAC 2005 implementation, study area intersections were more likely to improve relative to baseline conditions than to worsen.

For each case study facility, Table 1 shows the percentage of study area intersections that were predicted to improve or worsen relative to baseline (pre-BRAC 2005) conditions; the percentage of intersections that improved or worsened relative to baseline conditions; and whether the actual traffic conditions were better, worse, or the same as predicted (based on a count of intersections that improved or worsened). Pre-BRAC 2005 data collection for these facilities was generally conducted between 2006 and 2009, while the data collection for the “actual” post-BRAC condition was generally executed between 2011 and 2014.

Table 1: Level of service (LOS) trends at study area intersections

	Level of Service (LOS) at Study Area Intersections				Actual Conditions Relative to Predicted
	Predicted vs. Baseline		Actual vs. Baseline		
	Improve	Worsen	Improve	Worsen	
Walter Reed National Military Medical Center (WRNMMC)	7%	73%	46%	23%	Better
Main Post and Fort Belvoir North	24%	50%	56%	38%	Better
Mark Center	0%	71%	57%	43%	Better
Fort Meade	0%	100%	0%	100%	Same as predicted
Joint Base Lewis-McChord	*Missing data*				*Unknown*
Eglin Air Force Base	1%	22%	13%	12%	Better
Fort Bliss	32%	44%	8%	56%	Worse

More study area intersections improved and fewer worsened than what was predicted at four of the case study facilities: WRNMMC, Fort Belvoir, the Mark Center, and Eglin AFB. This may reflect national trends in total vehicle miles traveled (VMT); coincident with the impacts of the Great Recession on economic activity and travel demand, national VMT decreased between 2007 and 2011 and then remained essentially constant through 2014, before beginning to increase measurably starting in 2015. These national trends of flat or decreasing VMT and travel demand largely coincided with the period of BRAC 2005 implementation and evaluation of impacts.

Public transit ridership, availability, and significance as a travel mode varied widely among the six case study facilities. At only two facilities, Walter Reed National Military Medical Center (WRNMMC) and Fort Belvoir/Mark Center, was public transit a significant component of the travel mix. WRNMMC was the only location where actual post-BRAC public transit mode share reached predicted levels; in fact, actual WRNMMC public transit ridership exceeded predicted, with a 40 percent actual transit mode share compared to a predicted 30 percent, which were both significantly higher than the 11 percent baseline transit mode share. At Fort Belvoir, transit mode share increased slightly, from a four percent baseline to a six percent actual level, which was well short of the 18 percent predicted. At the Mark Center, the actual transit mode share was 17 percent, which was below the predicted 28 percent and far below the pre-BRAC baseline of 59 percent. At Fort Meade, the transit mode share remained at approximately one percent, which was below the predicted six percent. Public transit ridership was not a significant consideration in the reports and filings for JBLM, Eglin AFB, or Fort Bliss; no data was collected, no future predictions were made, and U.S. Census American Community Survey (ACS) data indicated very low levels of transit ridership.

Walking and bicycling volumes were not a significant consideration for most of the six case study facilities. Walking and bicycling volumes counts were only conducted at WRNMMC, and only for baseline and actual conditions; walking and bicycling increased moderately between the baseline and actual conditions. Future pedestrian and bicycle volumes were not predicted at any of the six case study facilities. Future walking and bicycling mode shares were only predicted for WRNMMC and the Mark Center; no other case study provided predicted mode shares. ACS information for walking and bicycling mode share generally indicated constant walking and bicycling mode shares, or modest increases.

The amount of mitigation and the progress on implementing these mitigation measures also varied widely among the case studies. Infrastructure investments and transportation system improvements were an important element of mitigation at all the case study facilities. Many transportation infrastructure improvement projects that were initiated to address predicted BRAC 2005 impacts are still in design or construction, well beyond the deadline for full implementation of BRAC 2005 in 2011. This is a result of funding limitations, environmental assessment and impacts as well as design and construction timelines. In many cases, the roughly six-year schedule for planning and implementing the BRAC 2005 realignments did not provide adequate time to complete major infrastructure improvement projects. As a result, the actual effects of strategies implemented to mitigate BRAC 2005 impacts still may not be fully understood. This makes thorough comparison of predicted and actual impacts difficult in some cases, and the status of mitigation measures must be considered in evaluating this comparison.

Travel demand management (TDM) strategies, including parking management and mode shifting measures, were implemented at all the case study facilities, though these strategies were generally more effective in the National Capital Region due to the nature of the facilities and the greater range of available travel options. Parking supply restrictions generally proved to be an effective TDM strategy, especially where travelers had viable alternatives to driving alone. Case study facilities located in areas with reliable transit options were more successful in augmenting those services and encouraging mode shift to transit, while facilities with limited transit options showed minimal increases in transit mode share, new transit programs and services.

This review and update to the case studies made it clear that the availability of data and analytical reports varied widely among the case studies. Data and analysis were focused principally on automobile volumes and traffic operations for all facilities except WRNMMC, which is a compact facility in an urban area with good transit, pedestrian, and bicycle access. Peak hour level of service (LOS) information along key roadways and intersections was available for most or all conditions as part of each case study. For the three facilities in the National Capital Region, there was generally comprehensive information available from MPO, state DOT or military base resources. Traffic impacts and multimodal transportation access were a particular concern at WRNMMC and the Mark Center; the BRAC realignments for these facilities entailed a great deal of planning, data collection, and analysis. Data for non-automobile modes, however, was much less available for the suburban and rural facilities outside of the National Capital Region. It was difficult to identify and contact individuals knowledgeable about BRAC 2005 transportation impacts.

At most of the case study facilities, the BRAC 2005 realignment and expansion processes prompted increased coordination among military base officials, civilian agencies, and the public to plan for the impacts of the realignments, including transportation impacts. Public engagement strategies for each case study were generally organized around review of traffic impact studies and environmental impact statement processes for transportation system improvements. Case study facilities that established "partnering" relationships among DoD, state DOT, MPO, FHWA, local governments, and the public were often better prepared to establish and implement successful transportation mitigation strategies. In many cases, the coordination that was initiated through planning and implementation of BRAC 2005 mitigation projects has resulted in ongoing partnerships that have improved communication and cooperation among military base representatives, civilian authorities, and the public.

This research project has produced insights on the transportation impact assessment processes undertaken for the six case study military facilities, the data and analysis produced, and the limitations of that data and analysis for assessing transportation impact. Based on these, the following are suggested avenues for future research that might prove useful in planning for future military base expansions and realignments.

- *Best practices for evaluating transportation impacts at military facilities*. Lack of transportation impact data and data inconsistency have been significant challenges for conducting this research project. A research project could develop a guidebook or best practices manual for evaluating the transportation impacts of military facility expansions or realignments, and the outcomes of mitigation measures.
- *Review of Department of Defense smart growth land use strategies and review of their impact on military transportation behavior*. Land use and development patterns are integrally connected to travel behavior and transportation impacts. Therefore, land use is an important issue for consideration in military base planning and future BRAC initiatives. An evaluation of land use and development effects could facilitate a better understanding of the military smart growth and sustainability initiatives, and enable consideration during future BRAC processes of smart growth land use and transportation strategies that are appropriate to military facility context.
- *Toolkit of transportation mitigation measures*. A toolkit of transportation mitigation measures and strategies, including both infrastructure improvement and travel demand management (TDM) strategies, could be useful for managing military facility operations, expansions, and realignments. Such a toolkit should offer a range of options that could be tailored to the facility's geographic context and its functional mission.
- *Best practices for military/civilian transportation coordination*. Coordination on transportation impacts was not well-established among military facility officials, civilian authorities, and the public at the start of the BRAC 2005 implementation process. Research on approaches to this coordination, outcomes, and best practices could help to facilitate improved early coordination for future BRAC processes.

1. INTRODUCTION

1.1. REPORT OVERVIEW

The primary objectives of this report are:

- To evaluate the actual transportation impacts associated with the 2005 Base Closure and Realignment (BRAC) process relative to the impacts that were predicted in the transportation impact evaluation;
- To identify factors and issues that contributed to differences between predicted impacts and actual impacts, either directly (base- or community-driven actions) or indirectly; and,
- To propose lines of future research that could expand understanding of the transportation – military facility connection.

1.2. ORGANIZATION OF REPORT

This report is organized into chapters that address the primary objectives of the report. Each chapter is described below.

Chapter 2 provides a review of the approach employed by the Department of Defense (DoD) during the 2005 BRAC process, and a summary of some of the key findings of Transportation Research Board (TRB) Special Report 302 (SR 302). Chapter 2 summarizes the findings of the six military base case studies included in SR 302, along with the findings on transportation impacts and recommendations for mitigation at military bases slated for expansion under BRAC 2005.

Chapter 3 fulfills the first and second objectives of the research project and lays the foundation for executing the third objective. This entails a comprehensive update and review of data and analysis related to the proposed BRAC 2005 realignment plans at the six case study facilities that were evaluated in TRB Special Report 302, the transportation system impacts that these realignment actions were predicted to cause, and the actual impacts that the BRAC 2005 realignments had on the transportation system based on measured post-BRAC 2005 implementation data and performance measures. The team addresses the second research objective by conducting quantitative analyses of this data and information, assessing the transportation system, and evaluating the predicted impacts of the 2005 BRAC action relative to the actual impacts for the six case study facilities.

In Chapter 4, the research team reviews the qualitative and quantitative findings from Chapter 3, assesses the causes and contributors to the differences between predicted and actual impacts, and examines difference between the six case study facilities. Chapter 4 also addresses the third objective by proposing future lines of research and inquiry.

2. REVIEW OF BRAC 2005 TRANSPORTATION ISSUES

Chapter 2 provides a review of the approach employed by the Department of Defense (DoD) during the 2005 Base Closure and Realignment (BRAC) process. This includes an examination of the principal drivers and major elements of BRAC 2005 and some of the key outcomes of that process, especially as they relate to the impacts these decisions were expected to have on the transportation network in the military base host communities. The BRAC 2005 review is based largely on the 2005 Defense Base Closure and Realignment Commission Report (September 8, 2005). It includes a summary of the BRAC 2005 process, as well as a discussion of some of the overarching transportation issues initially identified during the BRAC 2005 process.

Chapter 2 also provides a summary of some of the key findings of Transportation Research Board (TRB) Special Report 302 (SR 302), "Federal Funding of Transportation Improvements in BRAC Cases." This includes a discussion of the challenges that SR 302 evaluated related to funding of transportation improvements and programs to address transportation impacts of BRAC 2005, including military funding programs and investment for transportation improvements, civilian funding sources, and general transportation funding constraints. Chapter 2 also reviews planning and timing issues in state, local, and MPO transportation planning and programming process versus military processes and protocols. It summarizes the findings of the six military base case studies included in SR 302, along with the findings on transportation impacts and recommendations for mitigation at military bases slated for expansion under BRAC 2005.

2.1. SUMMARY OF 2005 DEFENSE BASE CLOSURE AND REALIGNMENT COMMISSION REPORT

2.1.A. Background

The scale of the United States military and the physical infrastructure to support US military forces have risen and fallen over time. In 1990, the Defense Base Closure and Realignment (BRAC) Act created the Base Closure and Realignment Commission (BRAC Commission), an independent commission appointed by the President to make recommendations on the military base needs of the Department of Defense (DoD).

Under the BRAC process, each branch of the US military – the Army, Navy, Marine Corps and Air Force – employed their established facility assessment processes to make recommendations to the DoD. This review also included the Army National Guard and Air National Guard installations. The BRAC Commission then reviewed the recommendations provided by the DoD and solicited input from communities as well as others affected by the changes proposed by the DoD. All the information and input provided was evaluated by the Commission before supporting, amending or rejecting specific aspects of the DoD recommendations and summarizing in a report to the President.

In its first several rounds (1991, 1993 and 1995), the BRAC Commission recommendations focused on opportunities for improving efficiency and reducing military spending mostly through closures of military bases. With the collapse of the Soviet Union, costs savings through military base closures – the so-called "Peace Dividend" – were a high priority in the 1990s.

2.1.B. 2005 BRAC Process

While the 2005 BRAC process was guided by the BRAC Act and followed the same basic approach as previous rounds, many elements of BRAC 2005 were significantly different from previous rounds. The circumstances and mission of the U.S. military in the early to mid-2000s were very different from those in the 1990s. Faced with the challenges of two foreign wars, in Afghanistan and Iraq, and the Global War on Terrorism, the DoD undertook a BRAC process that was focused on long-range military needs and transformation of the U.S. military.

Instead of focusing on individual military departments, the BRAC 2005 process focused on enhancing the joint and cross-service evaluation of installations. Previous rounds projected future defense needs only six years into the future, while the BRAC analysis in 2005 focused on projected defense needs in 2025 (20 years). The DOD analytical teams focused on the future needs of a "transformed military service" and not on historical needs and military models.[1]

As a result, the 2005 BRAC process represented a change in approach and effects. The focus of the 2005 BRAC round was to align infrastructure with military strategy in order to maximize fighting capacity and efficiency. In keeping with this approach, the 2005 BRAC process amended the 1990 BRAC Act to establish criteria for base closure and realignment recommendations:

Military Value (higher priority criteria)

1. The current and future mission capabilities and the impact on operational readiness of the total force of the Department of Defense, including the impact on joint warfighting, training, and readiness.
2. The availability and condition of land, facilities, and associated airspace (including training areas suitable for maneuver by ground, naval, or air forces throughout a diversity of climate and terrain areas and staging areas for the use of the Armed Forces in homeland defense missions) at both existing and potential receiving locations.
3. The ability to accommodate contingency, mobilization, surge, and future total force requirements at both existing and potential receiving locations to support operations and training.
4. The cost of operations and the manpower implications.

Other Considerations

1. The extent and timing of potential costs and savings, including the number of years, beginning with the date of completion of the closure or realignment, for the savings to exceed the costs.
2. The economic impact on existing communities near military installations.
3. The ability of the infrastructure of both the existing and potential receiving communities to support forces, missions, and personnel.
4. The environmental impact, including the impact of costs related to potential environmental restoration, waste management, and environmental compliance.[2]

Based on these criteria, the BRAC Commission made 222 recommendations resulting in 24 major base closures, 24 major realignments and 765 lesser actions.[3] This included consolidating 26 military bases to create 12 joint bases with multiple military branches (Army, Navy, Marine Corps, Air Force) co-located at a single facility, as well as combining the functions of military installations at a smaller number of facilities. It also involved relocation of military personnel and dependents from facilities to be closed or reduced in size, to other facilities. In all, the BRAC 2005 realignments, which were required to be complete by September 2011, resulted in population growth at and around a total of 18 military bases across the United States. It is important to note that although the eight high-level criteria for the 2005 BRAC process do include infrastructure capacity and environmental impact (criteria 7 and 8), these are among the "Other Considerations," which were assigned a lower priority in BRAC 2005 decision-making than the criteria pertaining to "Military Value."

The total cost of implementation was $35.1 billion, including $24.5 billion for military construction and another $10.6 billion for environmental mitigation; moving personnel and equipment; and providing required supplemental base resources. BRAC 2005 has resulted in a total of about $4 billion in recurring annual savings, the highest of any BRAC round. These cost savings represent the annual expenditures involved with base operating support, personnel and leasing costs if 2005 BRAC recommendations had not been implemented.[4]

2.1.C. Department of Defense Initiatives

In addition to the personnel increases at military facilities directly related to BRAC 2005 recommendations, there were several other DoD initiatives that also entailed reassignment and relocation of military personnel at the same time the BRAC 2005 changes were happening. These initiatives included the Global Defense Posture Realignment, which moved many overseas military personnel back to domestic military bases to facilitate a more responsive force that can take better advantage of technological tools;[5] a change in US Army organizational structure from a division-based force to a more modular and flexible brigade-based force, which entailed command structure and geographic shifts for some Army personnel;[6] and the Grow the Force initiative, which called for a permanent increase in force of more than 74,000 soldiers in the US Army and 27,000 marines in order to provide the forces necessary for the demands of the Global War on Terror.[7]

Together with these other military force realignment initiatives, the BRAC 2005 process was unprecedented in its scope and complexity. The final DoD recommendations by Secretary of Defense Donald Rumsfeld to the BRAC Commission entailed 190 separate DoD recommendations, with 837 discrete "close" or "realign" actions. This exceeded the total number of actions and recommendations in all previous BRAC rounds combined.[8]

The recommendations and actions forwarded by the BRAC Commission and approved by President George W. Bush entailed 22 major closures and 33 major realignments, including 18 military facilities to be significantly expanded under BRAC 2005. These facilities were slated to be expanded by 181,800 military and civilian personnel; these personnel would be accompanied by an estimated 173,200 dependents, for a total increase of 355,000 people in the affected communities.[9] An estimated 98,000 personnel and dependents, or 28 percent of the total population increase, were to be transferred to bases in metropolitan areas, including major metropolitan areas with heavy demands on their transportation systems and high levels of existing traffic congestion.

2.1.D. Transportation Issues

In implementing these significant changes, the 2005 BRAC process created new challenges for the DoD and the host communities of military bases. While the base closures had major negative economic and social effects in their host communities, the host communities for the 18 military facilities to be expanded also faced major challenges. With the base realignments required by law to be completed by September 15, 2011, there was little time for military and civilian transportation professionals to conduct the complex and involved process required to implement transportation mitigation: evaluate the impacts of the 2005 BRAC realignments, recommend specific improvements to mitigate those impacts, identify available funding to pay for those improvements, complete the environmental review process, design the improvements, coordinate and relocate utilities, conduct the construction contracting process, and build the improvements.

Even though these military force realignments were anticipated to produce rapid, major changes in employment and population in the communities around these 18 military facilities, neither the DoD nor the civilian transportation system was well-prepared to absorb or mitigate the transportation impacts associated with these changes. As a result, some transportation agencies and professionals worked together to expedite processes, combine funding and share resources to address the BRAC 2005 realignment impacts on an accelerated schedule. Other agencies were less fortunate, finding instead a lack of adequate funding, few partnerships, and delays from the application of traditional processes. This resulted in late or inadequate improvements to accommodate the influx of military and civilian personnel at these military facilities.

2.2. SUMMARY OF TRB SPECIAL REPORT 302

2.2.A. Background

In response to these challenges, the DoD, military base host communities, transportation agencies, and other stakeholders raised several concerns about the BRAC 2005 process and its impacts on host communities. As a result, Congress included funding in the 2010 defense appropriations for a study of transportation impacts and funding for transportation improvements associated with military base expansions, in particular BRAC 2005.[10] The 2010 legislation, which was addressed by the Transportation Research Board (TRB) research committee and consultants that prepared Special Report 302, required that the following topics of research be investigated:

1. Examine case studies of congestion caused on metropolitan road and transit facilities when BRAC requirements cause shifts in personnel to occur faster than facilities can be improved through the usual state and local processes;

2. Review the criteria used by the Defense Access Roads (DAR) program for determining the eligibility of transportation projects and the appropriate Department of Defense (DoD) share of public highway and transit improvements in BRAC cases;

3. Assess the adequacy of current federal surface transportation and DoD programs that fund highway and transit improvements in BRAC cases to mitigate transportation impacts in urban areas with preexisting traffic congestion and saturated roads;

4. Identify promising approaches for funding road and transit improvements and streamlining transportation project approvals in BRAC cases; and

5. Provide recommendations for modifications of current policy for the DAR and Office of Economic Adjustment programs, including funding strategies, road capacity assessments, eligibility criteria, and other government policies and programs the National Academy of Sciences may identify to mitigate the impact of BRAC-related installation growth on preexisting urban congestion.[11]

TRB Special Report 302 entitled "Federal Funding of Transportation Improvements in BRAC Cases" was authored by Edward Weiner, Consultant, under the direction of Stephen R. Godwin, Director of Studies and Special Programs for TRB and members of the Committee for a Study on Federal Funding of Transportation Improvements in Base Realignment and Closure (BRAC) Cases. It was published in 2011.

2.2.B. SR 302 Analysis

The principal focus areas of TRB Special Report 302 research were sources of funding for mitigation of transportation impacts from military base expansion; the processes and responsibilities of the different parties involved in the military base expansion and the surrounding transportation system; and the timing and implementation of mitigation measures. TRB Special Report 302 evaluated these issues through an examination of six cases studies, each of which focused on a military base to be expanded per BRAC 2005; an examination of processes through which transportation infrastructure surrounding military bases can be improved; and a review of potential funding sources for these improvements.

Case Studies

The committee established for Special Report 302 selected a group of six diverse case studies for military facilities where transportation impacts were anticipated to be "major challenges" and existing funding was inadequate to mitigate those impacts for each base and the surrounding communities. Four of the case study facilities are located within a major metropolitan area, one in a mid-sized city, and the last one is in a more rural area. The six case study facilities are described below, along with a summary of proposed BRAC 2005 changes and a brief assessment of transportation challenges that these facilities faced at the time that SR 302 was written:

Walter Reed National Military Medical Center

The Walter Reed National Military Medical Center (WRNMMC), one of the nation's largest military medical centers, was created by combining the National Naval Medical Center and Walter Reed Army Medical Center in September of 2011 because of the BRAC 2005 process. WRNMMC has approximately 8,500 employees and is in Bethesda, MD, adjacent to the National Institute of Health (NIH) campus.

The BRAC 2005-related additions and modifications to WRNMMC added approximately 2.4 million square feet of facility space that was designed to accommodate an estimated additional 1,800 to 1,900 patients and visitors daily. Projected transportation impacts included over 2,200 additional trips during peak periods at the WRNMMC, with significant increases in traffic, congestion, transit demand, and pedestrian crossings of Rockville Pike between Medical Center Metro Station and WRNMMC.

The funds required to provide the transportation improvements needed to accommodate the BRAC 2005 changes were more than the Maryland Department of Transportation (DOT), Montgomery County, and the City of Bethesda could address. Maryland DOT initiated several projects to improve three intersections nearest to the WRNMMC with state and federal funds, though full funding to complete these improvements was uncertain. A 2009 Montgomery County study prepared for the DoD Office of Economic Adjustment (OEA) estimated a funding gap of $225 million to improve pedestrian access to Metro and address the most significantly affected intersections serving WRNMMC and NIH.

Fort Belvoir, VA

Fort Belvoir is a military base located south of Washington, DC, in Fairfax County, VA. It is separated into three separate geographic components: Main Post (South), Fort Belvoir North, and the Mark Center (discussed separately). Each location has its own unique set of transportation issues that have been studied to address the additional demand on the state and local roadways.

The OEA conducted extensive analysis on the existing and proposed conditions surrounding Fort Belvoir and estimated that an additional 13,000 daily travelers were expected at Fort Belvoir's Main Post and Fort Belvoir North because of increased employment related to BRAC 2005.[12] Based on a total projected increase in employees, OEA anticipated significant adverse impacts on the region's transportation system, especially along Richmond Highway (U.S. Rt. 1). In addition to the growth anticipated at the Main Post and North Post, this area of southern Fairfax County had experienced a tremendous increase in jobs, businesses, and residential development in the decades prior to BRAC 2005.[13]

Planners for Fort Belvoir's BRAC 2005 realignment determined that the Main Post and Fort Belvoir North could not accommodate all of the personnel required to satisfy the military needs for the facility. Therefore, approximately 6,400 personnel from 24 different DoD organizations were proposed to be relocated to a new military campus to be built at the Mark Center, an established mixed-use business parking in Alexandria, Virginia. Plans for the site included two multistory office towers (15 to 17-stories), parking garages, a public transportation center, and ancillary support facilities.[14] The decision to relocate personnel to the Mark Center was controversial. The Mark Center site was in one of the most congested corridors in the region; local stakeholders and community members feared that the relocation would significantly worsen congestion and push roadway networks past capacity.[15]

Several transportation reports and analyses reviewed the anticipated impacts of Fort Belvoir (including the Mark Center) and identified transportation system improvements that would be required to addressed those impacts. The cost estimates for the required transportation improvements ranged from $626 million (U.S. Army estimate) to $1.9 billion (Fairfax County and the Virginia Department of Transportation estimate).[16] The higher estimate includes approximately $600 million to extend Metro to Fort Belvoir as well as road improvements not included in the Army's estimate. Only one third (10 of 30) of the identified major highway or transit projects deemed necessary received partial funding, while only 13 percent (4 of 30) obtained full funding.

Fort Meade, Maryland

Fort George G. Meade (commonly known as Fort Meade) is located between Washington, DC and Baltimore, MD. The installation lies approximately five miles east of Interstate 95 and one-half mile east of the Baltimore-Washington Parkway, between Maryland State Routes 175, 32 and 198. Local communities near Fort Meade include Odenton, Laurel, Columbia and Jessup, MD. With approximately 52,000 employees, Fort Meade is Maryland's largest employer and has the third-largest workforce of any Army installation in the U.S.[17]

The BRAC 2005 recommendations entailed moving three defense agencies – the Defense Information Systems Agency (DISA), the Collocation of Defense/Military Adjudication Activities, and the Defense Media Activity – and adding an expected 5,700 military, DoD civilian, and contractor employees to Fort Meade. At the same time, growth in National Security Administration (NSA) staff and increased on-base contractor activity was projected to combine with the BRAC 2005 actions to add a total of as many as 22,000 new military, civilian, and contractor employees to Fort Meade between 2009 and 2015, a roughly 50 percent increase over pre-BRAC 2005 personnel at the base.[18]

The main routes between Baltimore, MD and Washington, DC that provide access to the base include I-95 and the Baltimore-Washington Parkway (Maryland State Highway 295). These major highways both feed the Patuxent Freeway–SR 32, a four-lane east–west divided highway that bisects the northern part of the base. Approximately 89 percent of the pre-BRAC workforce arrived at Fort Meade by single-vehicle trips on roads and highways characterized as operating at or near capacity. A regional planning effort funded through the OEA identified six intersection improvements with a total estimated cost of $671 million as "critical and immediate" needs, for which only $48 million in funding was available.[19] Roadways facing major transportation impacts from the force expansion at Fort Meade include State Route 175, State Route 32, and the Washington Beltway (Interstate 495).[20] Public transit service to Fort Meade was very limited, and pedestrian and bicycle facilities provided only local connections within the base and to immediately adjacent areas.

Joint Base Lewis-McChord, Washington State

The BRAC 2005 initiative combined U.S. Army's Fort Lewis and McChord Air Force Base into a single facility under the name Joint Base Lewis–McChord (JBLM). This joint base, located between Olympia and Tacoma in Washington State, contains more than 30 units from the Army, Air Force, Navy, Marine Corps, Reserve and National Guard, along with several DoD agency units.[21] JBLM is divided by the I-5 corridor, which has several interchanges that access the base. JBLM supports an on-base population and neighboring communities of more than 130,000, including military personnel, families, civilian and contract employees, and their families.[22] JBLM is the third largest employer (after Boeing and state government) in Washington, with an estimated net economic impact of about $2.2 billion annually.[23]

The BRAC 2005 realignment itself did not have major impacts on JBLM, since the creation of the joint base mostly streamlined the administration of the two individual bases into a single authority.

While this did not result in major changes in on-base personnel, it did necessitate greater administrative and command coordination. Other military initiatives (Grow the Army, Army Modular Force, and Global Defense Posture Review), however, have contributed to the growth of JBLM since 2005. Growth at Fort Lewis was projected to be approximately 23,000 soldiers and dependents by 2015, which is a 48 percent increase from 2005 levels (58,100).[24] This growth in base-related personnel was expected to increase traffic and congestion on Interstate 5 (I-5), the principal expressway near the joint base, which carried approximately 145,000 vehicles per day, as well as traffic within the base. Based on the traffic analysis conducted for the planned realignment, 20 of the bases' 38 intersections operated at LOS E in the peak period prior to implementation of BRAC 2005.

Eglin Air Force Base, Florida

Eglin Air Force Base (AFB) comprises three military installations, including Eglin AFB, the host unit for the 96th Air Base Wing; Hurlburt Field, headquarters to Air Force Special Operations Command; and Duke Field, which houses the 919th Special Operations Wing, the only special operations unit in the Air Force Reserve.[25] Known as the Eglin complex, it is the largest air force installation in the world. Business directly related to the Eglin complex and indirectly generated by active duty and civilian employees at the Eglin complex accounts for more than 34 percent of the economic activity in northwest Florida and more than 70 percent of the economic activity in Okaloosa County.[26]

Prior to the BRAC 2005 realignment, approximately 16,500 military personnel and 4,500 civilians worked at the Eglin complex. BRAC 2005 relocated several military groups to the Eglin complex: 6,100 people associated with the Army 7th Special Forces Group moved to the Eglin complex, including 2,200 military, 1,500 spouses, and 2,400 children. The joint strike fighter (JSF) initial training center added an estimated 4,900 people, including 2,300 JSF personnel and contractors, 1,200 spouses, and 1,400 children.

I-10 is the major east/west freeway that is located on the north side of the complex; it connects with SR-85, a four-lane road that travels north/south through the heart of the complex that provides primary access for the facility. It was anticipated that the personnel added to the Eglin complex would increase traffic on SR-85 during peak travel times, resulting in increased congestion for motorists. In keeping with Florida's Growth Management Act, SR-85 was required to have adequate capacity (as measured by LOS) to handle the expansion of the Eglin complex before the changes would be allowed to occur. To help fund the improvements needed to expand SR-85 to accommodate the added personnel, a TIGER grant application was submitted to fund road, interchange, and park-and-ride improvements.[27] The total cost of these improvements was projected to be $420 million, with the TIGER grant covering $298 million and the County and Mid-Bay Bridge Authority covering the balance. Note: The TIGER grant application was not awarded for these improvements.

Fort Bliss, Texas

Fort Bliss, located in northeast El Paso, TX, accommodates many military units, including the 1st Armored Division, the 32nd Army Air and Missile Defense Command, the Future Force Integration Directorate, the William Beaumont Army Medical Center, the U.S. Army Sergeants

Major Academy, and the German Air Force Command Air Defense Center. The installation's active duty personnel increased by 2,000 to 3,000 soldiers per year between 2006 and 2009, at which time it had a total of roughly 19,000 soldiers, 29,000 dependents, 3,000 civilian workers, and 2,000 private contractors. Fort Bliss is one of the fastest-growing U.S. Army bases in the United States.

The BRAC 2005 recommendations were anticipated to add approximately 11,000 soldiers to the base. In addition, Army initiatives such as Grow the Army, Army Campaign Plan, and Army Modularity Force were expected to continue to increase the installation's personnel through 2012. These initiatives were expected to result in a total of approximately 33,500 soldiers and 48,000 family members residing at Fort Bliss, with another 6,000 civilian staff and 3,000 contractors working at Fort Bliss.[28] This would equate to a tripling of the on-site population between 2005 and 2012.

Transportation was identified as a significant concern for the Fort Bliss area arising from the BRAC 2005 recommendations.[29] The primary highways with access to Fort Bliss include east-west routes such as I-10, US-180, and US-62; north–south routes like US-54 and Purple Heart Boulevard–SR-375; and local and base roads that intersect with these major routes. In order to address the project highway network impacts, approximately $667 million in local interchange and highway improvements were identified as needed to serve the projected increase of military personnel, dependents, and civilian workers. The Fort Bliss post commander's leadership in establishing partnerships with elected officials, local government, and TxDOT during BRAC 2005 implementation was identified in SR 302 as a "best practice" for future BRAC decisions.

2.2.C. DoD versus Civilian Transportation Investment Processes

TRB Special Report 302 identified a lack of consistency between the military decision-making process and civilian transportation project implementation as a principal challenge and constraint on transportation infrastructure investment for military base expansions. The process for the realignment of military bases and personnel is a poor match for the way in which transportation infrastructure is typically improved, both in terms of timing and coordination. In the civilian transportation planning and investment process, the US DOT allocates funding to states for investment in transportation infrastructure. In metropolitan areas, which include many of the case study bases and other facilities affected by BRAC 2005, transportation improvement projects must be programmed in metropolitan planning organization (MPO) Transportation Improvement Programs and Long Range Transportation Plans to be eligible for federal funding. Major transportation improvement projects also frequently require significant non-federal funding from state, municipal, and private sources. It typically takes a major transportation project 10 years or more to move through planning, environmental permitting, design, and construction phases.

In contrast, the DoD conducts its planning for military facility realignment without civilian coordination. Military bases conduct their own master planning exercises, with a focus on internal base infrastructure. This base planning is independent of the regional planning that MPOs conduct for the transportation system that provides access to and from the base. Investment in a military base's physical plant depends upon the master plan's priority list, which does not usually consider off-base access. Meanwhile, BRAC and other military realignment processes that may entail major, rapid relocation of personnel and dependents often conduct planning in isolation due to concerns about political influence. As a result, these processes do not always provide time for the slower, comprehensive, consultative civilian process to respond to these needs.

2.2.D. Funding Options

Improvements to address transportation impacts from military facility realignments such as BRAC 2005 and the other initiatives are constrained by lack of available funds, on both the military and the civilian sides. As noted above, military facilities' planning activities and investment priorities are focused within the military base, not on access to and from the base. In general, it is DoD policy that civilian authorities are responsible for off-base infrastructure investments, and that civilian funding and user fees (i.e. gas tax, tolls, other transportation-related revenues) should be utilized to address these needs. In many cases, these needs are in direct competition with other high priority transportation improvement needs at the regional, state and local level for the limited transportation funding available.

There is one DoD funding program, the Defense Access Roads (DAR) Program, which provides funding for off-base roadway improvements. Its requirements, however, are restrictive, and require that a military action have "sudden and unusual" transportation impacts to qualify for DAR funds. The specific criteria for spending DAR funds entail such requirements as the need for construction of new roads for added access or congestion, or investments to mitigate congestion follow a doubling of traffic on existing roads. These requirements are geared more toward military facilities in uncongested rural areas, rather than robust, congested urban transportation systems. There are no provisions in DAR for non-roadway investments.[30]

At the same time, funding for the civilian transportation system also faces significant pressure. Federal transportation funding has been essentially level-funded for many years. The federal gas tax that supports the federal Highway Trust Fund has not been raised since 1993. Since then, improved fuel efficiency has prevented overall gas tax revenue from growing with demand, while inflation has eroded the purchasing power of each tax dollar by 36 percent.[31] States also struggle to raise adequate revenue to meet rising demands for transportation system maintenance and expansion, with a resulting national shortfall estimated at $30 billion annually between actual spending and spending required to maintain existing system condition and performance.[32]

As a result, there is a high level of competition for transportation system funding. As noted in the discussion of transportation project funding processes, federally-funded projects in urban areas must compete for limited funding, which often entails waiting for funding capacity to become available. This makes it very difficult for military-related projects with short schedules to compete for funding.

2.2.E. BRAC Study Committee Findings and Recommendations

Based on the analysis of BRAC 2005 case studies and the review of funding sources and processes, the BRAC Study Committee developed a range of findings and recommendations for TRB Special Report 302 (Table 2). The following is a high-level review of the key findings and recommendations of TRB Special Report 302:

Planning and Institutional Coordination

Military facilities should engage in master planning processes that consider issues and needs within the base, as well as outside the base. These plans should address the potential for expansion, evaluate anticipated travel demand and transportation system impacts, and develop travel demand management measures. Military bases and civilian authorities should improve coordination and communication through such channels as the MPO process, which could be broadened to include participation by military base representatives.

Funding

In BRAC 2005, funding expectations were not clearly established between military and civilian authorities, with each expecting the other to provide a greater share of investment to address transportation impacts of military base realignments.

1. DoD should consider allocating more funding for off-base transportation system improvements to address impacts, analogous to mitigation measures or impact fees assessed on private developers when developments have significant transportation system impacts. Private land developers face issues that are similar in many ways to those faced by DoD through BRAC and other military realignments: the development of land uses that increase travel demand and transportation impacts, with a short schedule that may be inconsistent with the MPO and state DOT processes and funding constraints. In contrast with DoD, however, civilian authorities can hold private land developers responsible for mitigation measures and/or impact fees through environmental and land use permitting processes. DoD should expand the criteria for DAR, increase the funding for this program, and segregate funding for off-base transportation system improvements to better address transportation impacts. DoD should also allocate funding for multimodal transportation system improvements, not just roadway and motor vehicle improvements.
2. States and municipalities that host military bases realize economic benefits from military expansions and realignments through increased economic activity and tax revenues. These civilian jurisdictions should make incremental investments for infrastructure improvements to address the transportation impacts of these military base expansions.

Implementation of Mitigation Measures

Mitigation for military base realignment traffic impacts should be carefully planned and implemented to ensure a balanced, multimodal transportation system, especially in congested urban areas. In such congested areas, incremental motor vehicle traffic can have a nonlinear, disproportionate impact on congestion and operations.

1. Transportation system mitigation for impacts of military realignments should take a comprehensive approach to travel access. These mitigation programs should focus not only on increasing roadway capacity for motor vehicles, but also on mode shift, travel demand management, and multimodal access, rather than just automobile capacity expansion.
2. Impact assessment should undertake detailed evaluation of impacts to ensure that bottlenecks and congestion from base expansion are being addressed, even if they are miles from the base (e.g. access from residential districts, etc.)

These findings and recommendations from TRB SR 302 have informed the analysis for this research project. They have provided context and focus for the evaluation of the actual versus predicted transportation impacts, and a starting point for the development of research findings and proposals for additional research.

Table 2: TRB Special Report 302 findings and recommendations (summary)

Source: Special Report 302, Federal Funding of Transportation Improvements in BRAC Cases, TRB, 2011

GENERAL			
#	**Findings**	**#**	**Recommendations**
1	Increased highway traffic generated by base growth due to BRAC 2005, policies to grow the size of the military services, and rapid redeployments have worsened or will worsen traffic congestion in some metropolitan areas. The potential problems are quite serious for civilian and military users of transport systems in these areas.	-	N/A
2	Military personnel and civilians working for the military are adversely affected by growing congestion.	-	N/A
INSTITUTIONAL MISALIGNMENT			
#	**Findings**	**#**	**Recommendations**
3	There is a substantial institutional misalignment between base planning by the military and planning by civilian authorities responsible for regional transportation infrastructure that the military depends on.	1	Military base master plans should be developed in cooperation with the metropolitan planning organization (MPO) transportation-planning process to ensure that (a) military transportation needs are integrated into the overall regional transportation context, (b) the bases' impacts on surrounding communities are accounted for in civilian plans, and (c) military base expansion plans are consistent with civilian plans.
-	N/A	2	DoD should require base commanders to address off-base access congestion problems and should provide them with guidance, expertise, and resources. It should allow commanders who do good planning and save money in energy and other base operating accounts to keep such funds and apply them to base and off-base transportation needs. DoD should also require base commanders to collaborate with communities to address base impacts on these communities.
-	N/A	3	The U.S. Department of Transportation (USDOT) should direct MPOs to include military base transportation needs in their planning processes. To assist in accomplishing this activity, USDOT should require MPOs to include military representatives on an ongoing basis as liaisons on decision-making boards of MPOs with other major stakeholders.

-	N/A	4	The role of the OEA should be increased; the agency should provide ongoing support to military and civilian planning agencies and not be brought in simply to help fix problems after decisions are made. Resources should be provided to enable this expanded role.
4	There is an additional disconnect within the military between planning and budgeting processes.	-	N/A
5	The outcome of decisions made to relocate civilian workers and troops suggests that insufficient attention was paid to off-base impacts. To the extent to which BRAC 2005 relied on information collected on surrounding community transportation capacity during the BRAC information-gathering phase, it may have been misinformed.	5	When considering moving personnel into congested metropolitan areas, DoD should consider regional congestion impacts and mitigation costs at a greater level of detail than in the past.
NATURE OF REQUIRED SOLUTIONS			
#	**Findings**	**#**	**Recommendations**
6	Transportation programs to reduce congestion that may appear to be small can have large benefits.	-	N/A
7	A broad range of transportation strategies are required to address metropolitan area congestion and access needs.	6	A wide range of options should be used to ameliorate traffic congestion and travel time delay caused by base expansions.
8	Short- and long-term strategies will be needed to address traffic congestion problems.	-	N/A
9	Looking toward the future, changes in institutional processes and improved communication and planning could avoid the severity of congestion impacts expected and being experienced because of BRAC 2005 and other military policies and decisions.	-	N/A
10	A variety of funds are available to improve transportation facilities and services; these funds are always highly contested but are unusually so in the current budget environment.	-	N/A
11	Other than the DAR program, the military traditionally accepts no responsibility for transportation congestion and transportation-related environmental impacts outside the gates of its bases.	7	DoD should pay its share of base access transportation needs in a region, regardless of where they occur, on par with costs imposed on private developers.
12	The DAR program is inadequate for addressing military base transportation impacts in metropolitan areas.	8	The DAR criteria should be updated to respond to base transportation needs in dense metropolitan areas.
-	N/A	9	DAR funds should be fenced within MILCON so that once funds have been committed for a transportation project they cannot be pulled back to serve some other purpose, short of an emergency. In addition, the 5-year constraint on obligation of funds should be extended parallel to USDOT funding.
-	N/A	10	A new DoD capital and operating assistance program should be created for non-highway

			capital improvement projects to mitigate base transportation impacts in a MILCON account dedicated to this purpose. As with the DAR program, this funding should be fenced.
13	Personnel increases at military bases benefit surrounding communities.	11	State and local agencies should pay their share of base access transportation needs.
-	N/A	12	Military bases should work through states and MPOs to seek regular local, state, and federal transportation funds.
14	There is substantial evidence that in an unusually short period an extraordinary amount of new traffic will be added to already congested facilities serving some military bases around the country. These problems cannot be addressed with current funding and processes, nor would they be addressed by the recommendations made above.	13	Congress should consider either (a) a one-time, out-of-budget cycle, special appropriation or (b) a reprogramming of uncommitted stimulus act funds to address the transportation problems caused by BRAC 2005 relocations.

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3. CASE STUDIES

Chapter 3 provides updates and analysis for the six case studies presented in TRB Special Report 302. The six facilities reviewed for the case studies are:

- Walter Reed National Military Medical Center – Bethesda, MD
- Fort Belvoir – Fairfax County, VA / The Mark Center – Alexandria, VA
- Fort Meade – Anne Arundel County, MD
- Joint Base Lewis – McChord – Pierce County, WA
- Eglin Air Force Base – Santa Rosa, Okaloosa, and Walton Counties, FL
- Fort Bliss – El Paso, TX

These facilities encompass a range of different facility types and settings. These differences have significant ramifications for their interaction with the transportation system, and the transportation impacts of their operations and the BRAC 2005 realignments.

- The three facilities in the National Capital Area – Walter Reed National Military Medical Center (WRNMMC), Fort Belvoir/Mark Center, and Fort Meade – are all located in a highly congested Washington DC metropolitan area. Although these facilities have different specific contexts – from the urban setting of WRNMMC to the more suburban surroundings for the other bases – all of these facilities are served by a highly congested roadway network as well as a robust transit system.

- Joint Base Lewis – McChord (JBLM) and Fort Bliss are located near smaller cities, Tacoma, WA and El Paso, TX, respectively, and Eglin Air Force Base (AFB) is in a rural area of northwestern Florida. These are generally less congested areas with more limited multimodal travel options.

- WRNMMC is a major medical center, while Fort Belvoir North Area and the Mark Center are essentially office complexes. These facilities are more like civilian work sites, with more conventional commuting patterns typified by employees living off-site and commuting to and from the site. In the case of WRNMMC, the travel patterns have a broader range of times due to varying employee shifts and patient appointments throughout the day.

- Fort Meade and the Fort Belvoir Main Post are facilities that accommodate a mix of uses, including office-oriented agencies and units that are staffed by both military and civilian personnel, along with active duty military units. These are secure facilities that generate significant amounts of peak period commuter traffic related to the office uses.

- The other case study facilities – JBLM, Eglin AFB, and Fort Bliss – are all more traditional military bases. These facilities occupy larger areas and are more spread out; on-base activities are focused on military readiness and are executed primarily by active duty personnel, many of whom live on the base; and the facilities are secure, with perimeter control and access-controlled gates. These characteristics influence travel behavior to a large degree. Not all facility personnel would need to complete a traditional home-to-work commute via the regional transportation system. Several factors, such as the spread-out development patterns and secure entry points, make travel by modes other than single-occupancy vehicle (SOV) more challenging.

For each site, the research team reviewed the status of the case study base; assessed baseline (pre-BRAC) transportation conditions and predicted BRAC impacts; evaluated actual versus predicted impacts; and summarized the updated case study findings.

The enclosed case study updates review and compare three basic conditions:

1. Baseline – Measured existing conditions prior to BRAC 2005 implementation
2. Predicted – Projected future conditions, reflecting anticipated impacts for a future-build condition in which BRAC 2005 has been implemented
3. Actual – Post-BRAC 2005 conditions, reflecting measured impacts

The main objective of the case study review is to understand how actual conditions, which reflect the measured impacts of the BRAC 2005 realignments, compare to predicted impacts and to pre-BRAC baseline conditions. Specific issues examined include roadway access and traffic conditions, public transit availability and use, pedestrian and bicyclist facilities, travel demand management strategies, and progress towards completing infrastructure improvement projects.

An important element of the context for the case studies, and the predicted and actual transportation impacts resulting from BRAC 2005, is the national trend in travel and driving demand. As shown in Figure 1 and Figure 2, the total number of miles driven in the United States increased consistently from 1970 through 2007, except for a few years in the late 1970s/early 1980s. Starting in 2007, however, annual vehicle miles traveled (VMT) in the U.S. dropped significantly and remained fairly flat until 2014, when national VMT began to increase again. This has been attributed primarily to the impact of the Great Recession on employment and travel; this unusual travel pattern also coincided with the years of BRAC 2005 implementation, as well as the horizon years for predicted BRAC 2005 transportation impacts. Although this trend did not significantly affect the BRAC 2005 realignments or the level of travel demand at the six case study facilities, it most likely contributed to reduced background traffic on roadway systems surrounding the case study facilities. This may have contributed to better actual congestion and traffic operations than those predicted based on pre-recession traffic assumptions.

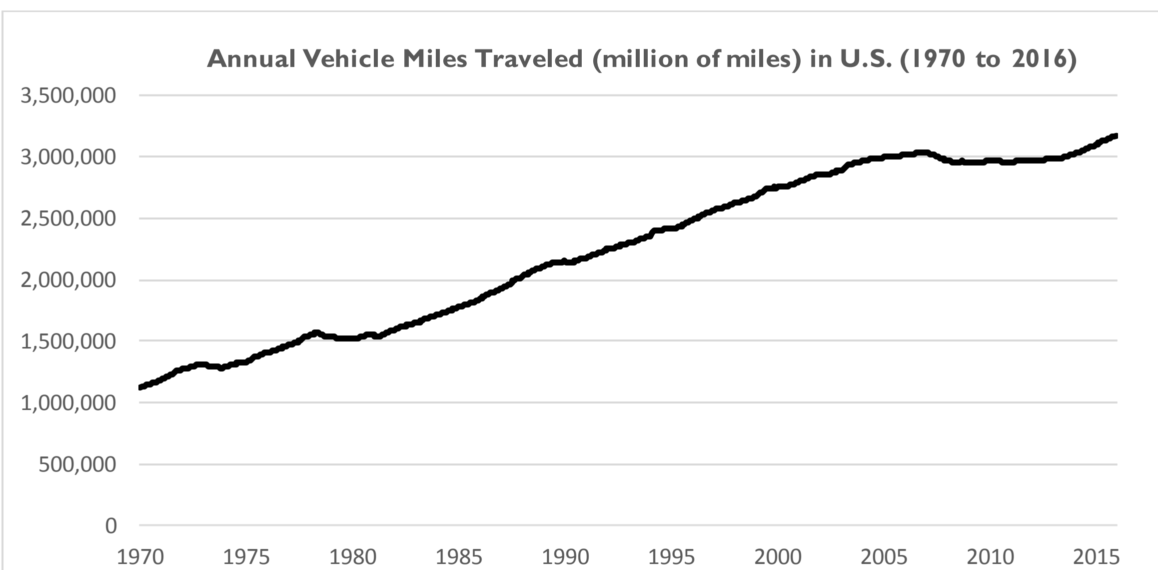


Figure 1: Annual Vehicle Miles (VMT) traveled within US from 1970 through 2016[33]

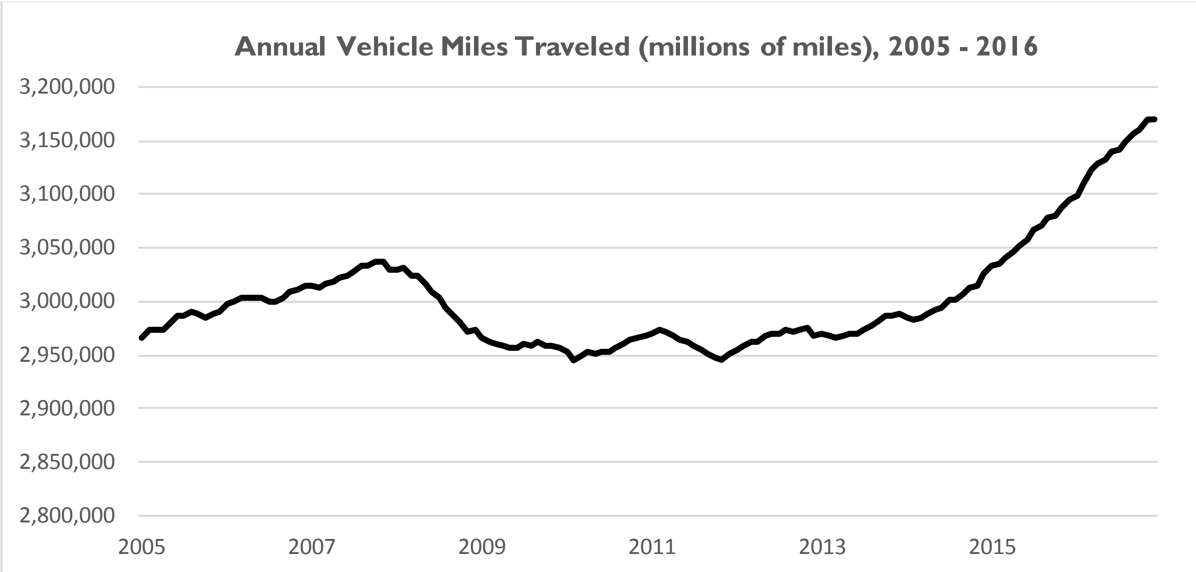


Figure 2: Annual Vehicle Miles Traveled (VMT) within U.S. from 2005 to 2016[34]

The evaluation of the predicted versus actual impacts is based as much as possible upon data and performance measures that can be compared across these three conditions. Data and performance measures reflecting the full range of transportation modes are the quantitative basis for making comparisons among baseline conditions, pre-realignment predictions for transportation impacts, and post-realignment actual impacts. These performance measures have been evaluated to determine discrepancies between projected and actual BRAC impacts; degree of mitigation proposed and implemented for the realignment process; effectiveness of various mitigation measures; and ongoing transportation issues and problems.

An important measure for comparing baseline, predicted, and actual transportation impacts is the mode split of travel to and from the facility. The central transportation-related issues at each facility were the growth of travel demand, predicted increases in traffic and congestion, and strategies for reducing traffic and managing congestion. Mode split – the distribution of trips across different modes of travel, such as drive-alone, carpool, public transit, walking, bicycling, or telework – is a key metric for evaluating the level of demand for various modes, the potential for shifting commuters out of automobiles, and the outcomes of these efforts.

For the case study facilities located in the congested National Capital Area – Walter Reed National Military Medical Center, Fort Belvoir/Mark Center, and Fort Meade – officials conducted employee travel surveys to determine the commuting mode split for personnel working at those facilities. However, the survey data was incomplete for Fort Meade (e.g. data on actual post-BRAC mode split was missing), and no surveys were conducted at the case study facilities located outside the National Capital Area (Joint Base Lewis – McChord, Eglin AFB, and Fort Bliss.

In order to compensate for the missing mode split data at these case study facilities, the research team also compiled data on mode split from the U.S. Census American Community Survey (ACS). ACS data, including data on commuting mode, is collected annually by the U.S. Census Bureau through a sample of residents in each Census Designated Place (CDP). Because it is based on a sample of residents, rather than employees, within a given CDP, ACS mode split data is not an ideal indicator of anticipated mode split at an employment site.

The case study facilities that do not have any surveyed mode split data are all active duty military bases, so the ACS mode split data for these facilities are for commuting by military personnel who live on-base. As such, the ACS mode split principally provide information on the transportation network within the secure boundaries of the military base, and not about broader regional access by military personnel and civilians who live off-base and commute to the case study facility.

The research team also presents findings from each case study, with an evaluation of the differences between baseline, predicted, and actual impacts, and a review of the ways that BRAC 2005 actions affected the surrounding areas.

3.1. WALTER REED NATIONAL MILITARY MEDICAL CENTER

The Walter Reed National Military Medical Center (WRNMMC) is one of the world's largest military medical centers. The facility, which opened in September 2011, was created through the consolidation of the National Naval Medical Center (NNMC) and Walter Reed Army Medical Center through BRAC 2005. Located on the former grounds of the National Naval Medical Center (NNMC) in Bethesda, Maryland and adjacent to the National Institutes of Health (NIH) campus, WRNMMC currently employs nearly 8,500 civilian and military personnel and serves over one million patients per year.[35]

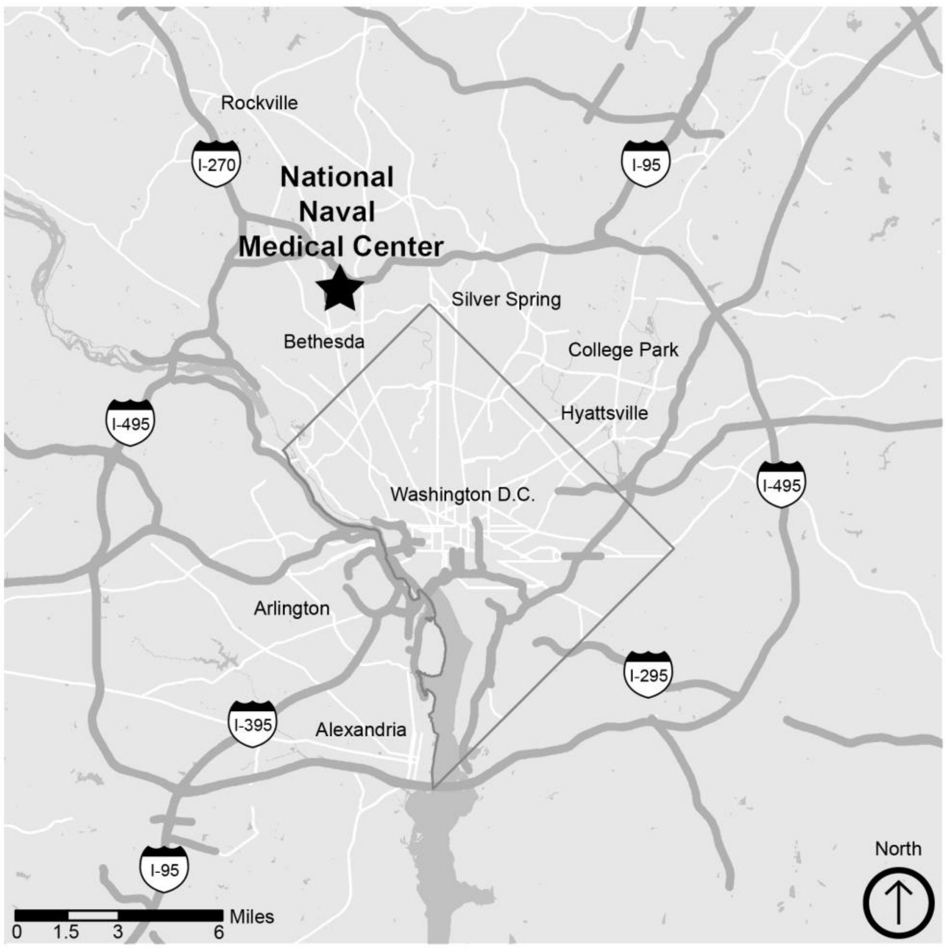


Figure 3: Regional map, National Naval Medical Center

Neighboring northwest Washington, D.C., Bethesda is one of Montgomery County's dense urban centers. In 2014, the population of Montgomery County was approximately 7.0 million and is expected to grow by 29 percent by 2040.[36] According to the U.S. Census Bureau, the population of Bethesda was 63,374, a 4 percent increase from the 2010 population.[37] Bethesda is also a regional employment area and, as of 2014, the area housed about 70,000 workers during the day, or even more workers than residents.[38] The NIH is the top employer in Montgomery County and employs just over 17,000 personnel. Naval Support Activity Bethesda (NSAB), the entity responsible for operating the military base on which WRNMMC is a tenant, is the third largest employer in Montgomery County, with approximately 11,700 personnel.[39]

The WRNMMC campus is located approximately 1.5 miles north of downtown Bethesda, and is served by a robust multimodal transportation network, as shown in Figure 4.

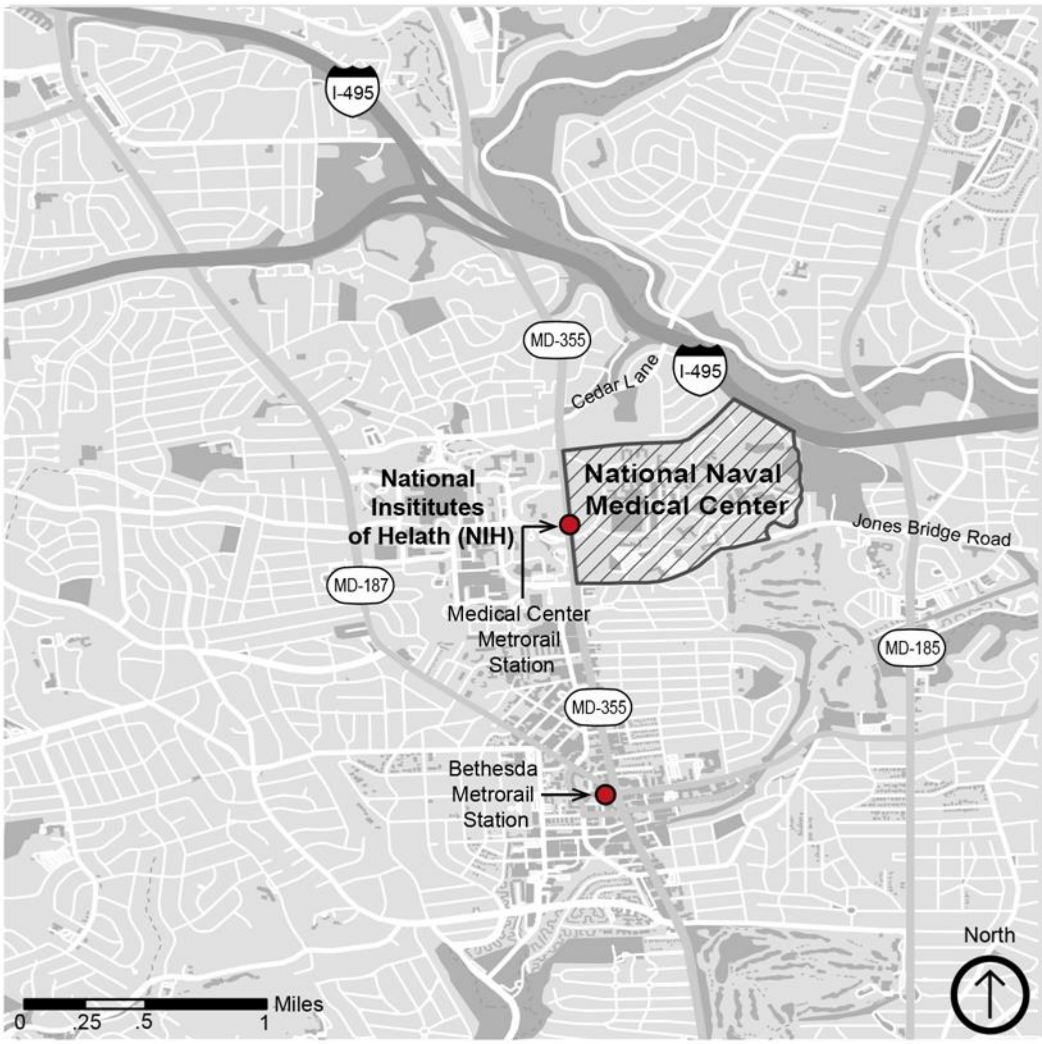


Figure 4: Area map, Walter Reed National Military Medical Center

3.1.A. Case Study Update

Baseline Condition – Existing condition prior to BRAC implementation

The Washington, D.C. metropolitan area has a robust multimodal transportation system, with very high levels of traffic congestion throughout the urban transportation network. In 2008, the year during which much of the baseline Condition data was collected and analyzed, the Washington, D.C. metropolitan area ranked fifth in the nation for annual average hours of delay per commuter, with 86 hours of delay per year, and second nationally for cost of congestion per commuter, at $1,877 per year.[40]

Facility Profile

Prior to the BRAC 2005 realignment, NNMC was one of the nation's largest and best-known military medical centers. Since its founding in 1940, NNMC provided medical care for sailors and marines, as well as war heroes and presidents. Before consolidation with the Walter Reed Army Medical Center, NNMC was staffed by about 2,700 military and 1,900 civilian personnel.

Transportation System Condition and Performance

Roadway Access and Traffic Conditions

Roadway access to NNMC was provided by the Capital Beltway (I-495) and I-270. The facility could be accessed directly via Rockville Pike (MD 355) to the west, Connecticut Avenue (MD 185) to the east, and Jones Bridge Road to the south. Prior to 2011, traffic congestion was commonplace along the roadways surrounding NNMC.

A traffic study conducted as part of the U.S. Navy's 2008 Final Environmental Impact Statement (FEIS) for NNMC showed existing peak-hour traffic congestion in the eastbound direction along I-495 during PM peak hours as well as congestion on MD 355, Old Georgetown Road (MD 187), and MD 185 in the southbound direction during AM peak hours. The FEIS also analyzed 27 nearby intersections (see Table B2); seven of these intersections were operating at LOS E or lower during at least one peak hour.[41]

According to a 2009 report by the Maryland State Highway Administration (Maryland SHA), key gateway intersections for the NMMC operated with high levels of congestion (see Table B1). Of the seven key gateway intersections, four operated at Level of Service (LOS) F, or very high levels of congestion, delay, and queuing, during at least one peak hour. During the AM peak hour, two additional intersections operated at LOS E, or very high levels of congestion, delay, and queuing; in the PM peak hour, one additional intersection operated at LOS E.

NOTE: Level of service is a commonly-used metric for summarizing the quality of transportation services and operations for a variety of travel modes and facilities; a summary of LOS is provided in Appendix A.

Gates/Entry Points to the Facility

Personnel and visitors entered and exited NNMC at five vehicle gate entry points accessible from MD 355 and Jones Bridge Road. Inbound gate volumes and queue lengths observed in 2009 are provided in

Table 3.

Table 3: Baseline NNMC inbound gate volumes and queue length[42]

Gate	Gate #	Baseline (2009)		
		AM Peak Hour (6:30 to 7:30 AM) Volume	PM Peak Hour (4:15 to 5:15 PM) Volume	AM Peak Queue
North (North Wood Road at MD 355)	1	913	29	11
South (South Wood Road at MD 355)	2	400	194	22
Navy Exchange (Gunnel Rd at Jones Bridge Rd)	3	360	90	7
Navy Lodge (Grier Road at Jones Bridge Road)	4	21	0	3
USU (University Road at Jones Bridge Road)	5	310	0	6

Gate	Gate #	Baseline (2009)		
		AM Peak Hour (6:30 to 7:30 AM) Volume	PM Peak Hour (4:15 to 5:15 PM) Volume	AM Peak Queue
TOTAL		2,004	313	

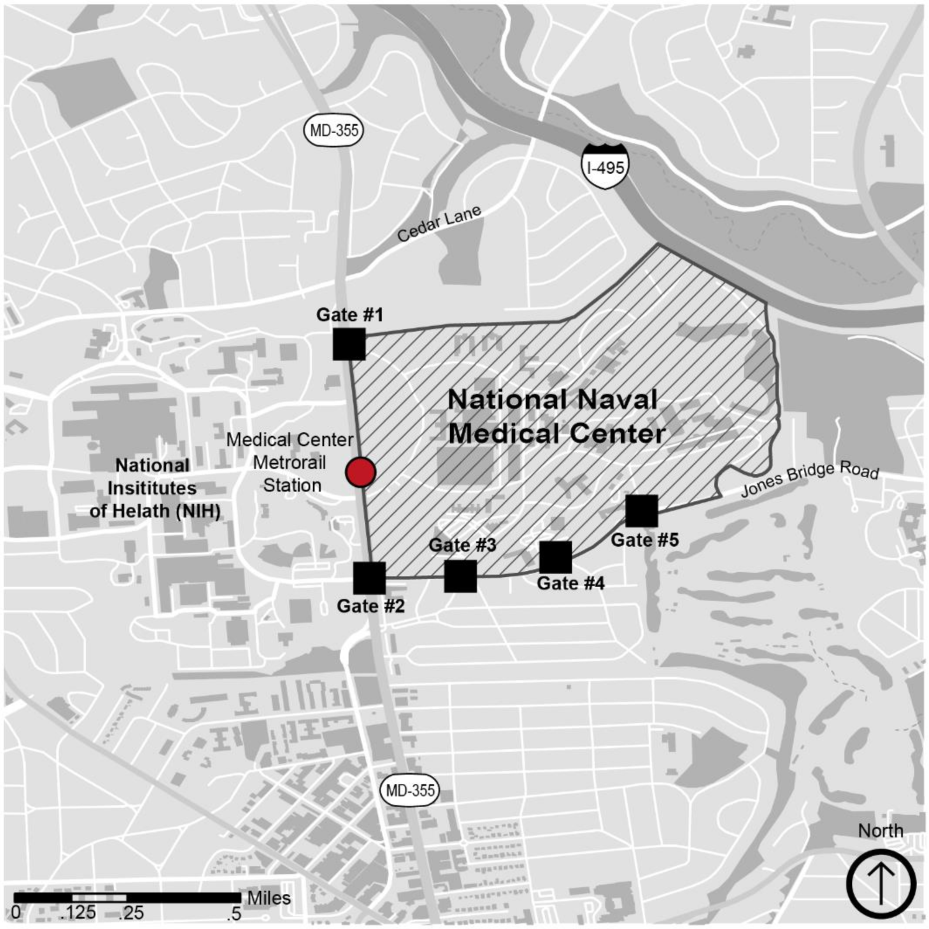


Figure 5: Gate locations, National Naval Medical Center

Parking

Prior to the BRAC 2005 realignment, NMMC provided just over 6,100 total available parking spots for personnel, patients, and visitors.[43]

Public Transit

Metrorail's Red Line, administered by the Washington Metropolitan Area Transit Authority (WMATA), stops in downtown Bethesda and serves WRNMMC directly at the Medical Center station located on MD 355 at South Drive/South Wood Road. The WMATA Medical Center Metrorail station located on the western side of NNMC provided the most convenient public transit access. In 2010, just over 11,000 passengers (about 5,600 boardings and 5,500 alightings) passed through the Medical Center station each weekday. About 13 percent of passengers traveled to NNMC and 77 percent traveled to NIH.[44]

The Medical Center station was accessible by multiple Metrobus routes as well as several Montgomery County Ride-On bus routes. NNMC also provided free shuttle buses from the Medical Center Metrorail station for patients, visitors, and staff during the weekdays.[45] Maryland Rail Commuter (MARC), available six miles away in Rockville, could also be used to access the NNMC campus via a transfer to Metrorail.

Transportation Demand Management

To encourage personnel to use public transit, NNMC offered military and civilian personnel Metrocheck vouchers through the Mass Transit Fringe Benefit (MTFB) program sponsored by the Maryland Department of Transportation (MDOT). In 2008, up to $110 dollars per month worth of tax-free benefits were available to cover commuting expenses. As of November 2006, 24 percent of NNMC personnel were enrolled in the Metrocheck. In order to participate in the Metrocheck program, personnel were required to give up parking privileges on the NNMC campus.[46]

Pedestrian and Bicycle

The at-grade signalized crossing at MD 355 and South Drive/South Wood Road served as the connection between NNMC and the Medical Center Metrorail station and was heavily traversed by pedestrians. Prior to the BRAC realignment, over 2,400 pedestrians and bicyclists crossed the intersection at MD 355 and South Drive/South Wood Road each day, 47 including about 320 pedestrians and bicyclists crossing this intersection during the AM peak hour, and about 260 pedestrians and bicyclists during the PM peak hour. 48 The baseline pedestrian and bicyclist volumes are shown in

Table 4.

A 2006 inventory by WMATA showed that the Medical Center station offered 88 bike racks and 38 secure bike lockers. On average, 35 percent of the bike racks and 100 percent of the bike lockers were used in 2006.[49] Before 2011, there was no exclusive bicycle infrastructure within the NNMC campus, but there were shared use paths in the vicinity, including the following:

- A (substandard) eight-foot wide shared use path on the west side of MD 355
- The North Bethesda Trail between Rockville and Bethesda
- The Capital Crescent Trail connecting downtown Bethesda to Georgetown
- The Bethesda Trolley Trail connecting to Rock Creek and the Rock Creek Park trail network to the north and the North Bethesda Trail to the south

Table 4: Baseline pedestrian/bicyclist crossings at the Rockville Pike (MD 355) and South Drive/South Wood Road intersection[50]

Count Period	2010 Crossings
AM Peak Hour (6:30 to 7:30 AM)	320
PM Peak Hour (4:15 to 5:15 PM)	260
Three Hour AM Peak (6:00 to 9:00 AM)	695
Three Hour PM Peak (3:00 to 6:00 PM)	780

Count Period	2010 Crossings
24-Hour Total	2,440

Travel Behavior

As part of the planning for BRAC 2005 implementation, NSAB conducted a survey of NNMC commuting behavior in 2007. According to this survey, about 72 percent of NNMC personnel drove alone to work and approximately 14 percent were part of carpool or vanpool. Just over 11 percent of personnel used public transit to reach campus and about two percent walked, bicycled, or were dropped off.[51] Baseline mode splits are shown in Table 5.

Table 5: Baseline mode splits at NNMC, personnel survey[52]

Mode	Baseline (2007)
Drive alone	72.4%
Carpool	8.8%
Vanpool	4.7%
Transit	11.3%
Walk, bike, drop off	2.3%
Flextime or telework	n/a

Prior to BRAC 2005, NNMC strongly encouraged personnel to use ridesharing to reach campus. In exchange for participating in a regular rideshare, participants were allotted a reserved parking space.[53] However, average vehicle occupancy remained low and was only an estimated 1.12 persons per vehicle according to the 2008 NSAB Transportation Management Program.

Safety Record

Pedestrian, bicyclist, and motorist safety along MD 355 was a concern prior to the opening of WRNMMC in 2011. At the intersection of MD 355 and South Drive/South Wood Road – one of the entry points to NNMC – large numbers of pedestrians, bicyclists, and motorists came into conflict. Crash data for the period of January 2003 through January 2007 show that there was a total of 64 reported crashes at the intersection. Of the 64 crashes, six were collisions between a vehicle and pedestrian. Rear-end collisions were most common followed by left turn collisions. Sixteen reported crashes resulted in an injury with six out of the 16 resulting in a serious injury; none of the reported crashes resulted in a fatality.[54]

Predicted Condition – Projected Future Conditions

Facility Realignment Plan

The proposed BRAC 2005 realignment entailed the consolidation of NNMC and Walter Reed Army Medical Center at the NNMC site in Bethesda. This consolidation was expected to expand current medical and administrative staff by about 14 percent or 2,200 to 2,500 jobs by 2011.[55] Personnel were to be relocated from the Walter Reed Army Medical Center, which had been located in Northwest Washington, D.C., to WRNMMC by September 2011. Increases in number of patient appointments and other visitors were predicted as well. It was estimated that patient appointments and other visits would nearly double, increasing from 497,000 to 981,000 annually.[56] To accommodate the larger number of visitors and patients, the consolidation proposal entailed an increase in parking from just over 6,100 parking spaces to approximately 7,700 spaces on campus.[57]

Predicted Transportation System Performance

Traffic Impacts and Mitigation

Overall, traffic volumes were expected to rise after implementation of BRAC 2005. Traffic volume increases were expected to result from higher background traffic and additional trips generated by the WRNMMC facility. Montgomery County Department of Transportation (MCDOT) predictions are shown in Table 6. The numbers shown in parentheses represent additional traffic volume expected to result from BRAC 2005; these WRNMMC volumes were predicted to be relatively small compared to the expected non-BRAC related growth. An overall increase between seven and nine percent was projected for AM and PM peak hours.

Table 6: Existing and forecasted 2030 peak volumes at the Rockville Pike and South Drive/South Wood Road intersection[58]

Intersection Leg	AM Peak Hour Existing Volume	PM Peak Hour Existing Volume	AM Peak Hour 2030 Build Volume (BRAC volume)	PM Peak Hour 2030 Build Volume (BRAC volume)	% Change, AM Peak Hour	% Change, PM Peak Hour
Northbound Rockville Pike	1,440	2,660	1,580 (5)	2,835 (0)	9.7%	6.6%
Southbound Rockville Pike	2,680	1,885	2,890 (20)	2,025 (5)	7.8%	7.4%
Eastbound South Drive (NIH)	175	305	195 (0)	335 (0)	11.4%	9.8%
Westbound South Wood Road (NNMC)	140	425	150 (5)	465 (20)	7.1%	9.4%
TOTAL	**4435**	**5275**	**4,815 (30)**	**5,660 (25)**	**8.6%**	**7.3%**

Table 7 shows the U.S. Navy's post-BRAC projections from their 2008 FEIS, which predict generally higher traffic volumes along MD 355 in 2011 than the MCDOT 2030 projections.

Table 7: Predicted future build traffic volumes[59]

Count Location	Direction	Predicted Future Build Traffic Volumes (2011)	
		AM Peak	PM Peak
Rockville Pike (MD 355) between Pooks Hill Road and Cedar Lane	Northbound	1,728	3,383
	Southbound	3,539	2,134
Rockville Pike (MD 355) between Wilson Drive and Gate 2	Northbound	1,657	2,790
	Southbound	2,732	2,216
Rockville Pike (MD 355) between Gate 2 and Jones Bridge Road	Northbound	1,353	2,250
	Southbound	2,567	2,185

Count Location	Direction	Predicted Future Build Traffic Volumes (2011)	
		AM Peak	PM Peak
Rockville Pike (MD 355) between Jones Bridge Road and Woodmont Avenue	Northbound	1,663	2,592
	Southbound	3,289	1,686
Average of Rockville Pike (MD 355) Corridor	**Northbound**	**1,600**	**2,754**
	Southbound	**3,032**	**2,055**

The U.S. Navy predicted that congestion and LOS would worsen on the roadway network.

Table B4 shows baseline and predicted future build LOS as estimated by the U.S. Navy in their 2008 FEIS. Eleven out of 15 intersections were expected to become more congested during at least one peak hour. Additionally, seven intersections were expected to operate LOS E or lower during at least one peak hour.

To prepare for the opening of the WRNMMC campus in 2011, various agencies proposed improvements to the roadway network and entry gates. This section discusses these improvements and their projected impacts.

- **Maryland SHA Intersection Improvements.** Maryland SHA's 2009 report, *Traffic and Intersection Improvement Studies for Base Realignment and Closure: Bethesda National Naval Medical Center*, projected that traffic volumes would increase and exceed the roadway network's capacity. The report recommended improvements be made at seven surrounding intersections to ensure all intersections continue to operate at LOS E or better:
    - Rockville Pike (MD 355)/Grosvenor Lane
    - Rockville Pike (MD 355)/Cedar Lane
    - Old Georgetown Road (MD 187)/West Cedar Lane/Oakmont Avenue
    - Rockville Pike (MD 355)/North Drive
    - Rockville Pike (MD 355)/North Wood Road
    - Rockville Pike/Wisconsin Avenue (MD 355)/Center Drive/Jones Bridge Road
    - Connecticut Avenue (MD 185) and Jones Bridge Road/ Kensington Parkway
- **Gate Improvements.** The U.S. Navy proposed improvements at each of the five entry gates to the new WRNMMC campus. At each gate, traffic signal modifications were proposed to mitigate the predicted increases in traffic volume. A new Visitor Center/ID office was proposed for the North Gate, and new sidewalks and improved bicycle access were proposed at all gates.[60]

Transit Impacts and Mitigation

The planned staff expansion and growth in patient appointments and visitors were expected to increase ridership levels at the Medical Center Metrorail station. WMATA predicted that NIH and WRNMMC personnel would comprise 72 percent of total Medical Center boardings and alightings by 2020, with patients and visitors comprising 5 percent.[61] Ridership estimates for 2030 projected a 56 percent increase in passengers totaling just over 16,200 passengers per weekday, with 20 percent of the increase (about 990 passengers) caused by BRAC 2005. The 2030 estimate had a larger share of Medical Center station passengers traveling to/from WRNMMC than the 2010 figure; in 2030, about 24 percent of total passengers were projected to travel to WRNMMC versus 61 percent to NIH.[62]

Pedestrian and Bicycle Impacts and Mitigation

The U.S. Navy 2008 FEIS predicted that the number of pedestrians crossing MD 355 at South Drive/Wood Road near the Metrorail station would rise from 3,000 to 7,000 persons per day by 2020. Even though the number of crossings at MD 355 was expected to more double, the additional pedestrian volume at a signalized intersection was not expected to decrease roadway capacity because the analysis determined that the intersection and signal design was adequate to accommodate the pedestrian demand.[63]

Both MCDOT and the U.S. Navy, however, recognized the need to improve pedestrian and bicycle infrastructure around the new WRNMMC campus. Of particular concern was the MD 355 and South Drive/Wood Road intersection due to its proximity to the Medical Center station and the large predicted increase in pedestrian demand. To prepare for this and begin the process of making improvements, MCDOT completed a study investigating possible strategies for improving the crossing in September 2011.[64] MCDOT also proposed additional bicycle paths on Jones Bridge Road and Cedar Lane, as well as widened sidewalks along MD 355 in front of the campus.

Safety Impacts and Mitigation

Specific predictions outlining how implementation of BRAC 2005 would affect safety were not available. However, many proposed roadway improvements were designed to address intersection design issues and were expected to improve safety and decrease the number of crashes.

Travel Demand Management Strategies

To address the increased staff and patient activity levels at the consolidated facility, NSAB developed very aggressive travel demand and congestion reduction targets. To achieve these targets, NSAB proposed multiple strategies to manage the projected increase in travel demand among staff and visitors to WRNMMC. These strategies included the following:

- Limit the construction of new parking spots;
- Allow only patients, vendors, and special personnel to park onsite;
- Encourage teleworking and flextime;
- Incentivize carpooling;
- Improve the availability of transit benefits; and
- Enhance multimodal access to the site, specifically pedestrian and bicycle access.

The goal of improving pedestrian access and mobility between the Medical Center Metrorail station and WRNMMC was stated in the 2008 FEIS and later adopted by MCDOT as a specific project to improve the crossing at MD 355. This, along with NMMC's other proposed travel demand management efforts, are reflected in the NSAB's projected mode splits (below in the Outcomes section).

Travel Behavior

As part of its travel demand management plan, NSAB committed itself to increasing the share of WRNMMC personnel using public transit from 11 to 30 percent; increasing vehicle occupancy rates from 1.12 persons per vehicle to 1.5 persons per vehicle; and increasing the percentage of personnel who carpool from approximately nine percent to 15 percent.[65] To limit the amount of staff accessing the campus during peak hours, eight percent of staff were expected to telework or make use of flextime.[66] Given the amount of new staff added, NSAB's 2011 projected mode splits were ambitious. Decreasing the share of personnel driving alone from over 70 percent to just under 30 percent would be a particularly difficult task, even with the aggressive TDM program that was proposed.

Table 8: Mode splits at WRNMMC – baseline vs. predicted[67]

Mode	Baseline (2007)	Predicted (2011)
Drive alone	72.4%	28.0%
Carpool	8.8%	15.0%
Vanpool	4.7%	9.0%
Transit	11.3%	30.0%
Walk, bike, drop off	2.3%	10.0%
Flextime or telework	n/a	8.0%

Actual Condition – Measured post-BRAC implementation conditions

The following section discusses actual, measured post-BRAC (2011 and after) conditions in and around the WRNMMC campus.

Actual Post-BRAC Facility Profile

Today, WRNMMC is one of the nation's largest military medical centers. It occupies 243 acres of land and has more than 2.4 million square feet of clinical space. The facility provides care to over one million patients per year. As of 2016, approximately 8,500 civilian and military personnel were employed at the facility.[68] BRAC 2005 realignment projections for increases in personnel and volumes of patients and visitors have been exceeded – 2016 facility staff has grown by nearly 4,000 employees, while the number of annual patients and visitors has grown to over one million – both of these levels surpass the predictions for post-BRAC numbers.

Plans are currently in progress to expand the medical facilities at WRNMMC. The need for further expansion was identified after the BRAC 2005 consolidation plans were finalized. The project calls for the construction of a new 533,000-square-foot five-story medical facility to replace five existing hospital buildings, internal renovations to hospital buildings, the construction of temporary facilities to provide uninterrupted patient care during construction, utility upgrades, and assorted improvements to campus accessibility and appearance.[69]

Actual Transportation Mitigation

Roadway Network Improvements

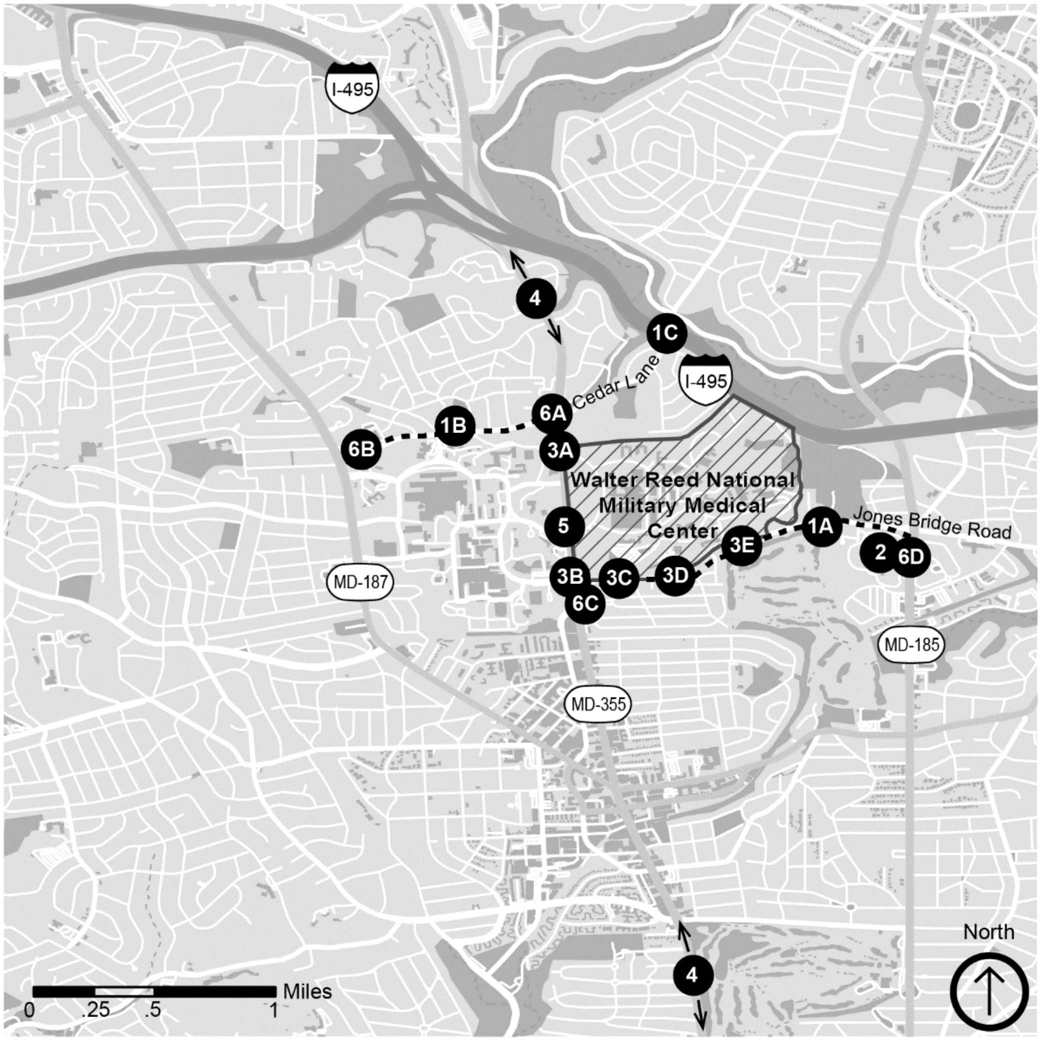


Figure 6: Project map, Walter Reed National Military Medical Center

Projects Completed Prior To 2011

1. **MCDOT Bike Paths and Sidewalks.** To improve pedestrian and bicyclist safety, MCDOT added bicycle paths, sidewalks, and improved signage to certain areas around the WRNMMC campus (Project 1, Figure 6). All pedestrian and bicycle improvement work was completed by the end of 2011.[70]
2. **Spring Valley Interim Traffic Signal and Platt Ridge Drive Extension.** The interim traffic single proposed for Jones Bridge Road and Spring Valley Road (Project 2, Figure 6) was installed in 2011 prior to the opening of the WRNMMC campus. The long-term solution proposed in the 2010 study, an extension of Platt Ridge Drive north to connect with Montrose Drive, is expected to be completed by November 2017.[71]

3. **Gate Improvements.** Improvements have been made to all five entry and exit gates as proposed (Project 3, Figure 6). The U.S. Navy made traffic flow improvements and added sidewalks for pedestrian access at all gates. Previously, not all gates had been easily accessible to pedestrians. The South Gate, located at MD 355 and South Wood Road is the only gate to currently offer pedestrian access 24 hours each day.[72] All gate improvements were completed by the end of 2012.[73]

In Progress

4. **Montgomery County BRT Plans.** Montgomery County is currently working on plans for bus rapid transit (BRT) route along the Columbia Pike (U.S. 29) corridor (Project 4, Figure 6). While not in the immediate vicinity of WRNMMC or proposed as part of original plans to prepare for BRAC 2005, the County's plans may eventually be expanded to include a BRT route along MD 355.[74]
5. **MCDOT MD 355 Crossing BRAC Project.** MCDOT is moving forward with a project to improve the pedestrian crossing at the MD 355 and South Drive/South Wood Road intersection (Project 5, Figure 6).[75] The MD 355 Crossing project was developed to address many of the safety and access issues identified by Maryland SHA in the 2009 Traffic and Intersection Improvement Study, as well as suggestions made by the U.S. Navy in the 2008 FEIS. When the MD 355 Crossing Project is complete, it is expected that the share of personnel using transit, walking, or biking will increase.
6. **Maryland SHA Intersection Improvements.** Maryland SHA's intersection proposed improvements are underway (Project 6, Figure 6). All four of the priority intersections from Maryland SHA's 2009 report are scheduled for improvement. Work began in phases in 2012 and is expected to be completed, pending the release of additional funds, by 2020.[76]

Travel Demand Management Strategies

To accommodate the growth in personnel, patients, and visitors, NSAB implemented multiple travel demand management strategies, and these strategies have yielded some success.

- **Parking.** In keeping with the consolidation proposal, the parking supply was increased from just over 6,100 parking spaces to approximately 7,700 spaces.[77] WRNMMC's travel demand management policies rely heavily upon restricting parking supply; this increase in parking is much lower than the increase in activity at the facility. While employment increased by approximately 14 percent, and patient visits roughly doubled, the parking supply was only increased by about 25 percent. To discourage personnel from driving to campus, new parking restrictions were implemented in August 2011. Under the new restrictions, on-site parking is available only for patients, vendors, special personnel, and carpools. Regular personnel wishing to commute to WRNMMC by private motor vehicle can park in downtown Bethesda, about 1.5 miles from the WRNMMC campus, and then take the bus or Metrorail to the Medical Center station located across from the campus.
- **Travel Incentives.** "Smart Benefits" TDM incentives were made available to both civilian and active duty military staff as part of the Mass Transit Fringe Benefit (MTFB) program. Up to $255 per month can be set aside tax-free to cover the costs of commuting via transit. MTFB can be applied the cost of transit but not to public parking expenses. The

share of staff enrolled in the program has increased by about 10 percent since 2006 and about 34 percent of staff are currently enrolled.

- **Telework and Flexible Schedules.** In preparation for the opening of WRNMMC in September 2011, NSAB implemented a telework policy in January 2011. Because of the plan, about 9.4 percent of personnel began to telework regularly.[78] Flexible schedules were also introduced, and they continue to be encouraged to limit the number of personnel who travel to and from campus during peak hours.

Community Involvement Process

Community engagement efforts were undertaken for the U.S. Navy's 2008 and 2013 FEISs, and for various mitigation project. Throughout the BRAC 2005 implementation process stakeholders, including the U.S. Navy, MCDOT, and Maryland SHA, have made efforts to engage the Montgomery County community. A BRAC Integration Committee (BIC) was established in 2007 and continues to meet quarterly. In addition, Montgomery County appointed a BRAC coordinator who is charged with interacting with the community, chairing BIC meetings, and fielding comments and concerns from the public.

Actual Transportation System Performance

Travel Behavior

According to a 2011 commuter survey conducted online by NSAB, about 40 percent of WRNMMC personnel drove alone to reach campus. Although this is above the prediction of 28 percent drive-alone share in the post-BRAC 2005 condition, this is significantly down from the measured 2007 level of 72 percent. Vehicle occupancy was estimated to be about 1.17, slightly higher than 1.12 recorded in 2007 but significantly lower than the target of 1.5 persons per vehicle.[79] The share of personnel using transit also increased significantly since 2007. In 2011, 40 percent reported that they used transit for their commute; this is well above the NSAB's desired 2011 projection of 30 percent. Table 9 outlines the post-BRAC 2011 mode splits.

Table 9: Mode splits – baseline, predicted, and actual

Mode	Baseline (2007)[80]	Predicted (2011)[81]	Actual (2011)[82]
Drive alone	72.4%	28.0%	36.1%
Carpool/Vanpool	13.5%	24.0%	10.3%
Transit	11.3%	30.0%	40.3%
Walk, bike, drop off	2.3%	10.0%	4.7%
Telework	n/a	8.0%	8.6%

Traffic Operations

Following the opening of WRNMMC in 2011, the U.S. Navy conducted a study of traffic conditions in the area as part of its 2013 Medical Facilities Development and University Development FEIS. As expected, inbound gate volumes have increased with the increase in the number of staff, patients, and visitors. Table B6 shows the actual measured 2011 inbound volumes at all five entry gates. In 2009, prior to consolidation and opening of WRNMMC, inbound gate volume was estimated at about 2,000 vehicles. In 2011, after the opening of the new campus, inbound gate volume had more than doubled to 5,250 vehicles in the AM Peak. [83]

Transit Operations

In 2009, prior to implementation of BRAC 2005, an estimated 5,600 boardings were observed at the station.[84] In 2015, WMATA estimated 5,650 average weekday passenger boardings at the Medical Center Metrorail station. This represents a 10 percent decrease from the approximately 6,200 boardings recorded in 2013 (an all-time high). While ridership has generally increased at the Medical Center station since the opening of WRNMMC in 2011, the most recent boarding data shows a slight decline in ridership.

Pedestrian and Bicycle Access Impacts

The heaviest pedestrian traffic continues to occur at the intersection of MD 355 and South Drive/ Wood Road, the closest intersection to the Medical Center station and primary gateway to WRNMMC. It is expected that completion of the MD 355 Crossing Project will increase the share of personnel using transit, walking, or biking to reach campus.

There are 17 bicycle parking locations with 630 spaces in the bicycle parking racks.[85] Since the implementation of BRAC in 2011, new bicycle paths have been added along West Cedar Lane Bicycle and along Jones Bridge Road between MD 355 and MD 185. Additionally, along Cedar Lane just north of the campus, the Rock Creek Bridge was reconstructed to include a shared bike and pedestrian path.

Most streets within the WRNMMC campus have sidewalks; as part of gate improvement efforts, WRNMMC added or improved sidewalks at each gate entrance. The North, South, and USU gates (Gates 1, 2, and 5) currently have dedicated bicycle lanes and there are plans to add a dedicated bike lane to the Navy Lodge Gate (Gate 4).[86]

Safety Impacts

While improvements, described previously, are currently being made to the MD 355, motor vehicle, pedestrian, and bicycle safety remain a concern. Along the segment of MD 355 that crosses in front of WRNMCC, between Cedar Lane and Woodmont Avenue, there were 112 total crashes between 2011 and 2013. This crash rate is above Maryland's statewide average for similar roadways. The most common types of crashes were rear-end, left-turn, and vehicle-pedestrian collisions.[87]

3.1.B. Evaluation of Actual Versus Predicted Conditions

Facility Changes – Baseline v. Proposed Build v. Actual

BRAC 2005 actions increased personnel at WRNMMC by nearly 4,000 (see Figure 7), about an 85 percent increase, and more than doubled the number of patients and visitors. The campus footprint, about 243 acres in Bethesda, has remained the same. Today, WRNMMC has more than 2.4 million square feet of clinical space, employs approximately 8,500 personnel, and provides care to over one million patients per year.

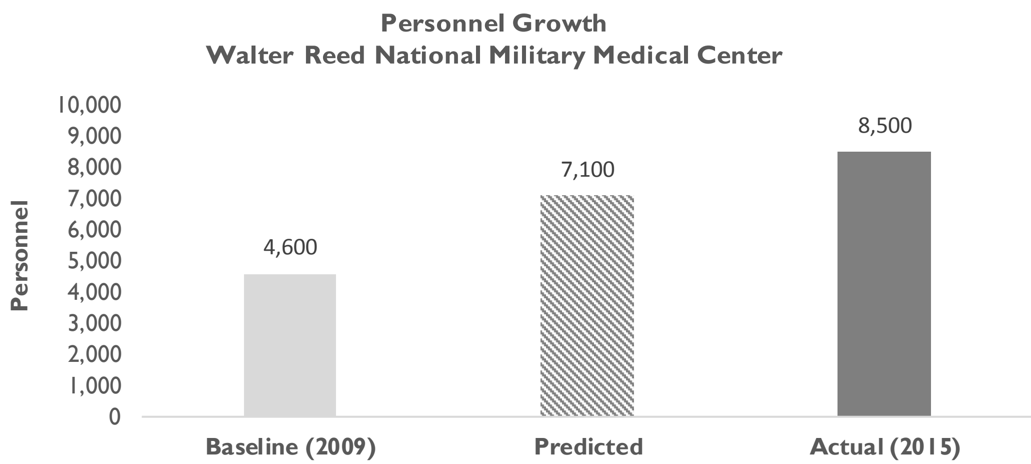


Figure 7: Personnel growth at WRNNMC[88]

Transportation Demand – Baseline v. Predicted v. Actual

Between 2005, when BRAC actions were proposed, and 2014, after the actions were completed, combined AADT declined along Rockville Pike (MD 355) and Connecticut Avenue (MD 185). Overall traffic volume reductions along both roadway segments were similar in magnitude; from 2005 to 2014, AADT declined by nearly 13 percent at Rockville Pike and Jones Bridge Road and by 12 percent at Connecticut Avenue and Jones Bridge Road. Figure 8 shows AADT on these facilities from 2005 through 2014. This is not consistent with predictions, since background traffic growth and the increase in personnel and patients at WRNMMC was expected to increase traffic on adjacent roadways.

From 2005 to about 2008 or 2009, before the effects of BRAC actions were felt at WRNMMC, AADT on Connecticut Avenue and Rockville Pike decreased slightly. This decline in AADT may reflect the national decrease in VMT between 2007 and 2012. In the years immediately before and after BRAC 2005 implementation in 2011, AADT on the two roadways was relatively constant. However, from 2012 to 2013, Rockville Pike showed a modest increase of approximately five percent, while Connecticut Avenue showed a decrease in volume of a similar magnitude. The increase on Rockville Pike and comparable decrease on Connecticut Avenue may reflect traffic displacement. Increases in volume were observed at all gates; since most gates can be accessed more easily via Rockville Pike than Connecticut Avenue, it is possible that drivers shifted their routes.

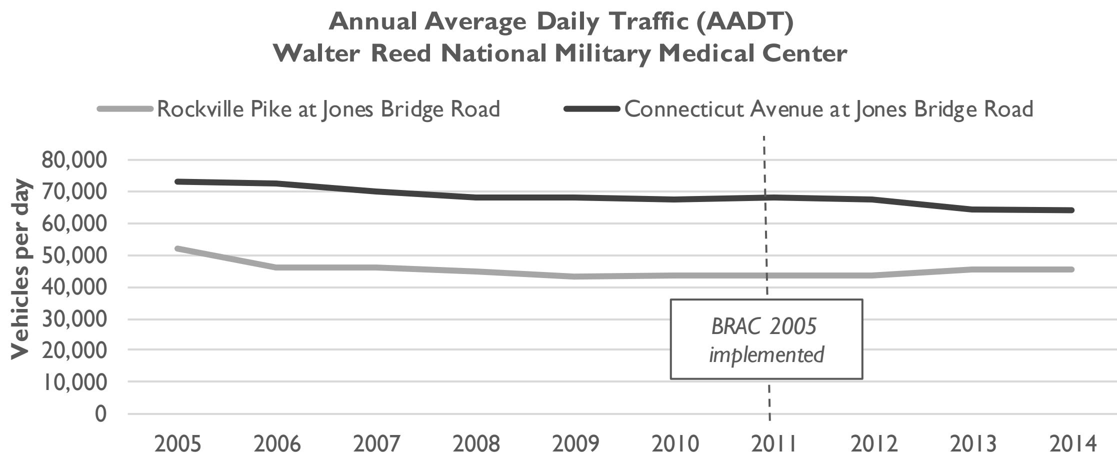


Figure 8: AADT from 2005 through 2014 at WRNMMC[89]

The changes in volume may also reflect roadway capacity constraints. According to the Florida Department of Transportation's (FDOT) 2013 Quality/Level of Service Handbook, a generally used reference that provides capacity and operating information based on roadway classification use, a six-lane divided major arterial reaches LOS D at an AADT of 59,900. This means that Connecticut Avenue was carrying traffic volumes that exceeded the LOS D roadway capacity when it showed a decline in AADT, while Rockville Pike had some reserve capacity when it showed a slight increase in AADT.

Comparing predicted and actual traffic volumes, the NSAB's 2013 FEIS found that actual AM and PM peak hour traffic volumes were 17 to 18 percent lower, respectively, than predicted along Rockville Pike between Gate 2 and Jones Bridge Road (see Figure 9). These volumes reflect not just WRNMMC traffic, but also general area traffic. Therefore, this lower level of traffic may reflect national VMT trends discussed previously.

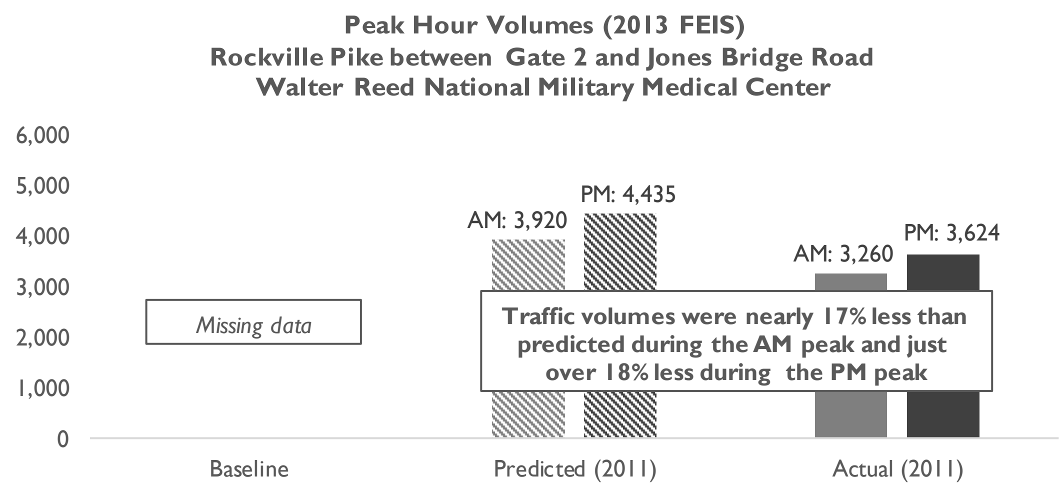


Figure 9: 2013 FEIS AM and PM peak hour traffic volumes at WRNMMC along Rockville Pike between Gate 2 and Jones Bridge Road[90]

Consistent with the increases in personnel, patients, and visitors, total gate volumes at WRNMMC have more than doubled over baseline levels (see Figure 10). While predicted gate volumes were not available, projected increases in visitors, patients, and personnel and mode split targets indicate that a significant increase would have been predicted, so predicted gate volumes were extrapolated based on the predicted increase in driving access to WRNMMC.

As expected, AM peak hour gate entry volumes were much higher than PM entry volumes under all conditions. As shown in Figure 11, Gate 1 at North Wood Road was the most heavily used gate, both before and after BRAC 2005 implementation, and it experienced the biggest jump in volume. Gates 2 and 3, located at South Wood Road and Jones Bridge Road respectively, were commonly used as well and had significant increases in demand after BRAC 2005 implementation.

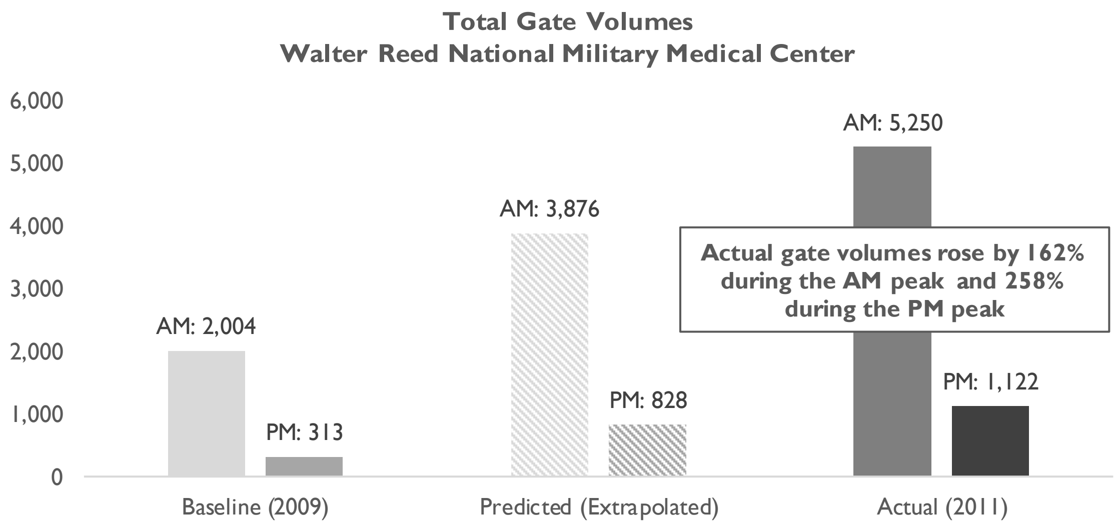


Figure 10: Total AM and PM peak hour gate volumes at WRNMMC[91]

Note: Predicted volumes were extrapolated from baseline (2009) volumes utilizing projected increases in visitors, patients, and personnel and post BRAC 2005 mode split targets.

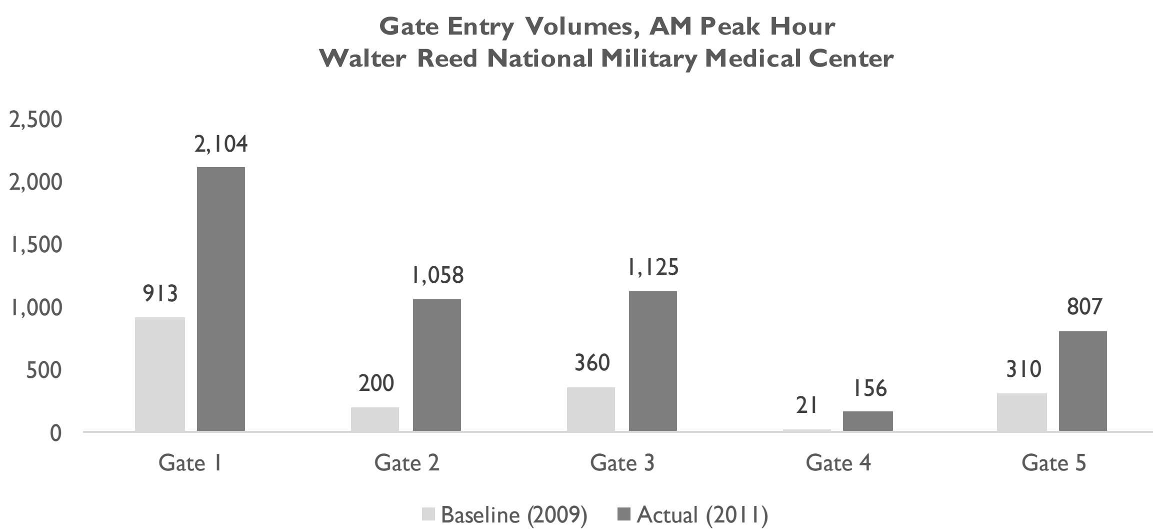


Figure 11: Individual AM and PM peak hour gate volumes at WRNMMC[92]

Transit demand has also increased, as shown in Figure 12. The transit commute mode share to WRNMMC is 10 percent higher than predicted and 29 percent higher than baseline levels.

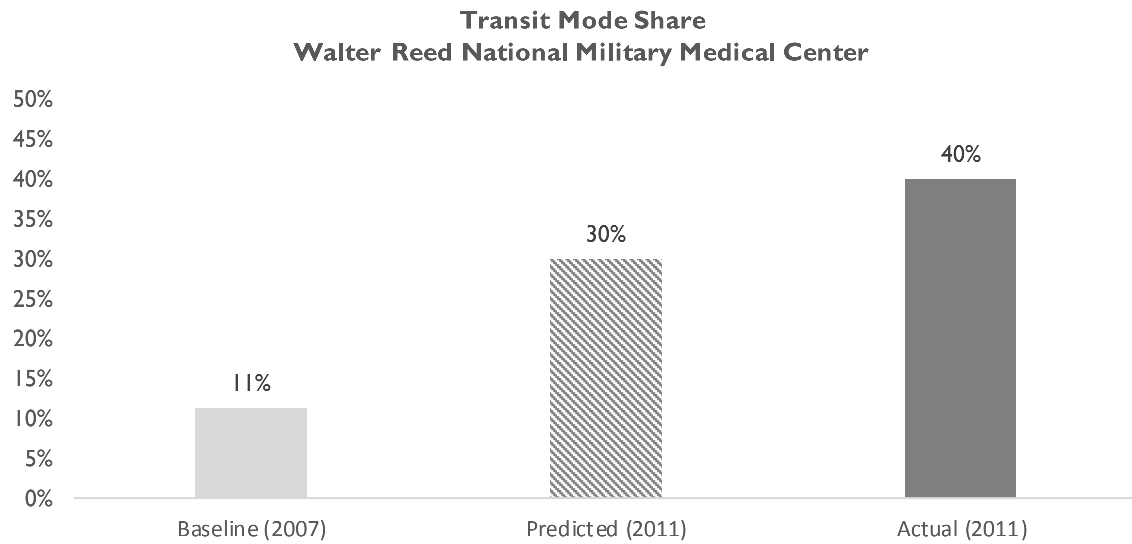


Figure 12: Transit mode share at WRNMMC[93]

Increases have also been observed in the volumes of personnel walking and biking (see Figure 13). Based on projected increases in visitors, patients, and personnel and on aggressive walking and biking mode split targets, a sizable increase in the number of walking and biking trips would have been predicted. Walking and biking volumes under actual conditions have not reached predicted levels. However, compared to baseline levels, volumes have increased significantly, by 18 percent in the AM peak hour and 34 percent in the PM peak hour.

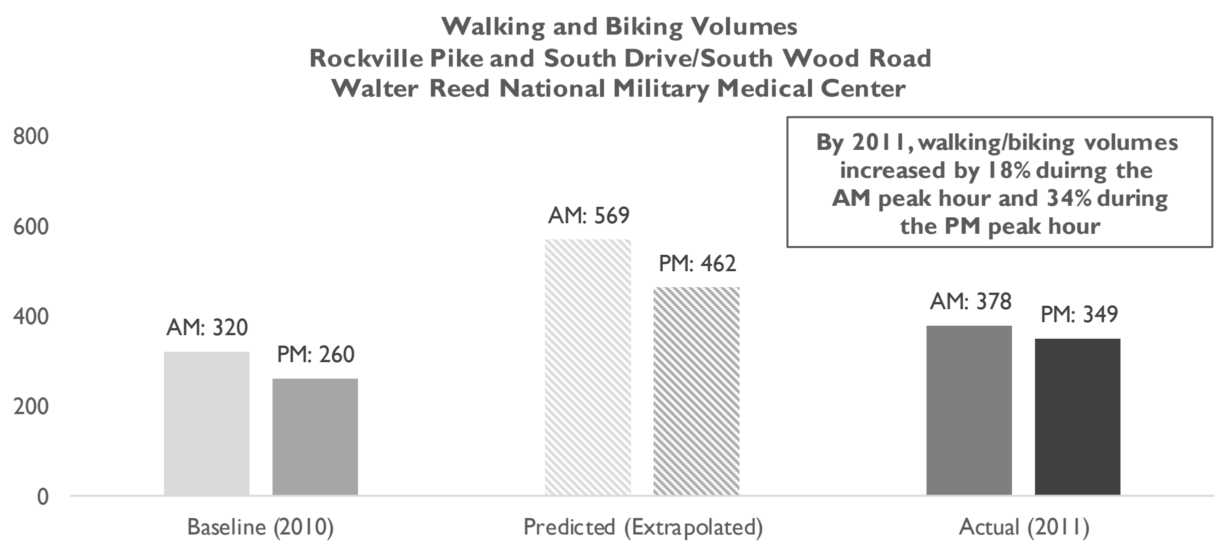


Figure 13: Walking and biking volumes during AM and PM peak hours at WRNMMC[94]

Note: Predicted volumes were extrapolated from baseline (2010) volumes utilizing projected increases in personnel and post BRAC 2005 mode split targets. As the breakdown of visitors, patients and personnel walking and biking during peak hours is unknown, it was assumed that 60 percent of users were personnel and 40 percent were patients and visitors.

Mitigation Measures – Proposed Build v. Actual

A broad range of TDM strategies was used by WRNMMC to discourage employees from driving to and from the facility. Among the most effective TDM strategies was the strict parking limitation that prohibited most employees from parking on-site. While the number of parking spaces increased over baseline levels, the increase in parking supply was much lower than the increase in personnel, patients, and visitors. Parking supply increased by only 25 percent (see Figure 14), despite a doubling of patients and visitors and the addition of 4,000 personnel; strict parking limits were required to keep parking demand consistent with supply. Other TDM strategies included transit pass subsidies, improving access to nearby transit connections, encouraging car and vanpooling, and incentivizing personnel to use flextime or telework.

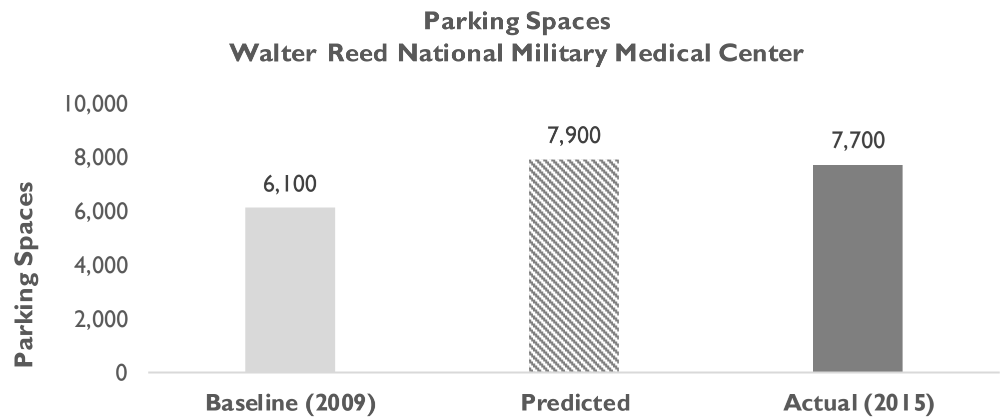


Figure 14: Parking spaces at WRNMMC[95]

A variety of transportation system improvement projects were also proposed and undertaken as mitigation for the BRAC actions. While most of the mitigation projects, which are described in

Table 10, aimed to improve or increase the capacity of local roadways, several projects to improve transit connections and pedestrian and bicycle networks were funded as well. Of the seven major projects, five were focused on roadways, two addressed transit, and three had some pedestrian or bicycle component; several of these projects are anticipated to improve more than one mode. The highest profile project, MCDOT's MD 355 Crossing BRAC project, is predicted to lead to improvement across all modes and is expected be completed in 2020. Because of resource constraints, major roadway projects, such as Maryland SHA's intersection improvements and the Platt Ridge Drive Extension, were not completed prior to implementation of BRAC 2005 and are still underway.

Table 10: Mitigation Projects at WRNMMC

	Project Type			Improvements	Project Status			Project Cost
	Road	**Transit**	**Ped/ Bike**		**Complete Before 2011**	**Complete After 2011**	**Under -way**	
MCDOT Bike Paths and Sidewalks			X	Implement shared-use paths, wider sidewalks, and improved signage on Rockville Pike, Jones Bridge Rd, Cedar Lane	X			$5,400,000[96]
Spring Valley Interim Traffic Signal	X			Install traffic signal at Jones Bridge Road and Spring Valley Road	X			*Missing data*
Platt Ridge Drive Extension	X			Extend Platt Ridge Drive			X	$3,700,000[97]
Gate Improvements	X		X	Improve traffic flow, add sidewalks for pedestrian access at all gates	X			$26,000,000[98]
Montgomery County Bus Rapid Transit MD 355 Corridor		X		Develop BRT route along Columbia Pike			X	$422,000,000 (initial estimate)[99]
MCDOT MD 355 Crossing BRAC Project	X	X	X	Build the following improvements: • Rockville Pike underpass • Deep high-speed elevators at Medical Center station • New traffic signals, shared use paths, improved medians, and improved stormwater facilities • Expanded curb radius, new shared use path, new pedestrian crossing, new traffic signal, and upgraded drainage and paving at Rockville Pike and Jones Bridge Road/Center Dr			X	$68,200,000[100]
Maryland SHA Intersection Improvement	X			Implement improvements at the intersections of Rockville Pike/Cedar Lane, Old Georgetown Road/West Cedar Lane/Oakmont Avenue. Rockville Pike/Center Drive/Jones Bridge Road, and Connecticut Avenue/Jones Bridge Road			X	$29,000,000[101]
TOTAL	**5**	**2**	**3**		**3**	**0**	**4**	**$554.3 million**

Transportation Impacts – Baseline v. Predicted v. Actual

When actual and predicted conditions were compared, intersections around WRNMMC generally operated with better levels of service and lower congestion in actual conditions. Figure 15 and Figure 16 compare LOS under baseline, predicted, and actual conditions. In the baseline condition, seven out of 15 study area intersections operated at LOS E or worse during at least one peak hour. Under predicted conditions, 73 percent of intersections were expected to worsen and become more congested, with seven expected to operate at LOS E or worse.

As of 2011, actual traffic and congestion conditions were better than predicted, and a larger share of intersections had improved rather than worsened. Additionally, the share of intersections operating at LOS E or worse under actual conditions was lower than predicted during both the AM and PM peak hours (see Figure 16). Congestion has remained an issue, as LOS E or worse was observed at three intersections (see Figure 15), but operations at other intersections had not deteriorated as much as predicted. When comparing baseline with actual LOS, twice as many intersections showed an improvement as showed a degradation.

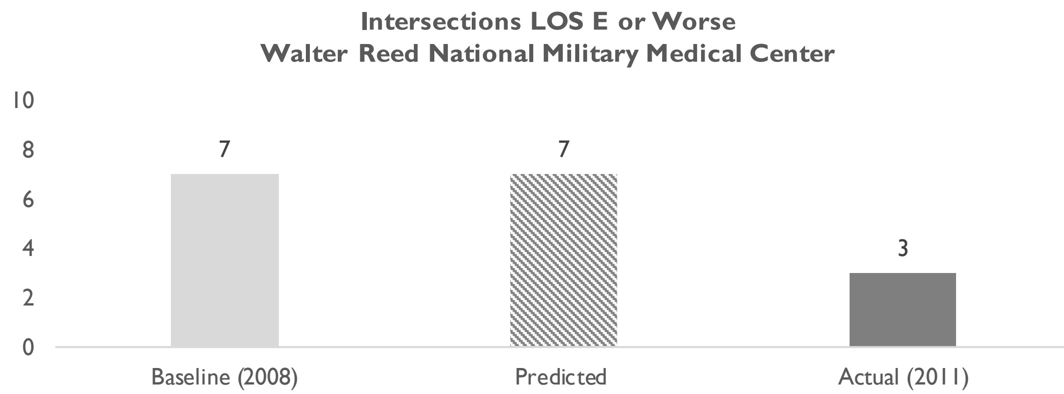


Figure 15: Intersections LOS E or worse near WRNMMC[102]

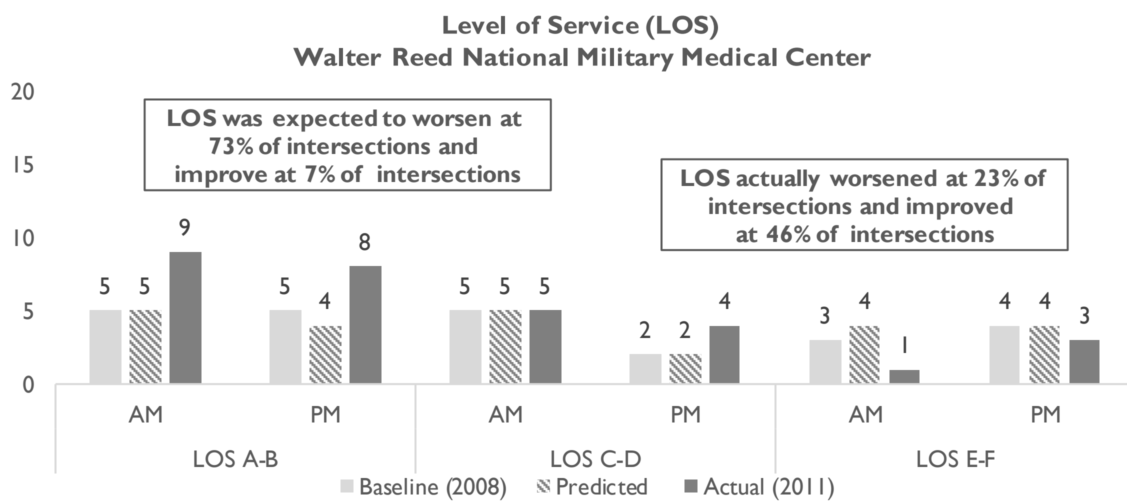


Figure 16: LOS at study area intersections near WRNMMC[103]

Analysis of baseline, predicted, and actual personnel mode splits suggest that mitigation efforts at WRNNMC have been successful in in reducing drive alone travel and encouraging use of other modes. As shown in Table 11 and Figure 17, the percentage of personnel driving alone was down from the baseline condition, and the share using transit more than doubled relative to the baseline. Efforts to increase the share of personnel using telework have also been successful and actual levels slightly surpassed predictions. The shifts in travel mode from driving alone towards transit and telework are likely attributable to a coordinated program of strict parking restrictions that prohibit most personnel from parking on campus, supported by the WRNMMC's proximity to multiple transit modes as well as additional TDM strategies that facilitate use of other modes, including transit pass subsidies, transit service enhancements, and improvements to pedestrian and bicycle access.

Table 11: Mode splits at WRNMMC[104]

Mode	Baseline (2007)	Predicted (2011)	Actual (2011)
Drive alone	72.4%	28.0%	36.1%
Carpool/Vanpool	13.5%	24.0%	10.3%
Transit	11.3%	30.0%	40.3%
Walk, bike, drop off	2.3%	10.0%	4.7%
Telework	n/a	8.0%	8.6%

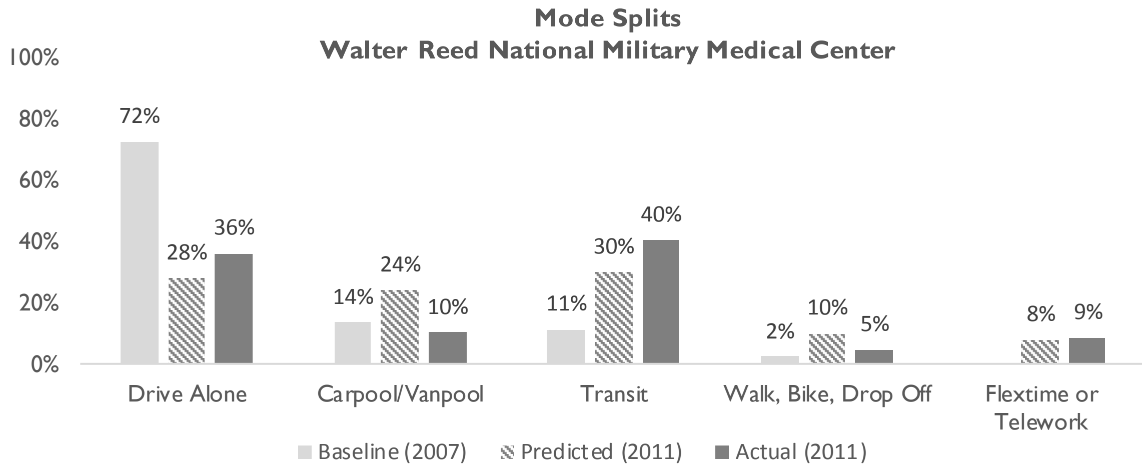


Figure 17: Mode splits at WRNMMC[105]

3.1.C. Findings

Overview

Through a broad-based, cooperative capital improvement and TDM effort, military and civilian authorities have mitigated transportation impacts of the BRAC 2005 realignment of WRNMMC in a mostly successful manner. Even though projections for increases in personnel, patients, and visitors have been exceeded at WRNMMC, actual (2011) traffic volumes on surrounding roadways have fallen below predicted levels. Despite these lower-than-predicted traffic volumes, congestion remains an issue on surrounding roadways.

This may be due at least in part to the fact that many of the roadway improvements proposed to minimize congestion and handle transportation demand increases are still under construction. This may contribute to ongoing congestion from construction-related constraints and from the fact that the improvements are not in place to relieve congestion.

NSAB TDM strategies have generally been effective. The share of personnel driving alone to work has decreased, from 72.4 percent to 36.1 percent, and the share taking transit has increased significantly, from 11.3 percent to 40.3 percent. Additionally, when compared to the 2011 predictions from the 2008 BRAC FEIS, the actual traffic counts along major arterials were lower, particularly on Rockville Pike and Jones Bridge Road.

Facility Changes

- Growth at WRNMMC surpassed original predictions: by 2015, the number of employees had nearly doubled, growing by 85 percent from about 4,600 to about 8,500. Patient and visitor levels had more than doubled, which exceeds initial predictions for growth.
- The U.S. Navy's recently-announced expansion plans will further increase transportation demand at WRNMMC. It is likely that the new facilities will attract more personnel, patients, and visitors, and have additional impacts on traffic and transportation conditions in the surrounding area. [106]

Transportation Demand

- Traffic volume on Rockville Pike (see Figure 8) paralleled national VMT trends, with a reduction in AADT starting in 2007 and a rebound beginning in 2012 (see Figure 1 and Figure 2). On Connecticut Avenue, AADT followed a similar trend around 2007, but did not rebound after 2012 (see Figure 8). Although gate volumes more than doubled, the opening of WRNMMC did not have a discernible impact because gate volumes account for a relatively small share of AADT on Rockville Pike and Connecticut Avenue.
- Actual demand for transit has increased, from an 11.3 percent mode share in the baseline condition to 40.3 percent in the actual post-BRAC 2005 condition. This is significantly higher than the baseline, and is even higher than predicted levels, which were 30.0 percent. Factors that may have contributed to this significant increase include the parking restrictions; WRNMMC's proximity to transit, especially its location adjacent to Metrorail's Medical Center station; and the improvements to pedestrian access between the station and WRNMMC.

Studies have measured walking and biking volumes; actual walking and biking volumes increased, but not to the levels predicted. These predictions, however, were made for 2030, at which point MCDOT's MD 355 Crossing project will be complete; this $68 million multimodal project (see

- Table 10) is anticipated to significantly improve walking and biking access and facilitate travel by these modes.
- Compared to baseline conditions, actual walking and bicycling counts at WRNMMC gates have increased by 18 percent during the AM peak hour, from 320 to 378, and 34 percent during the PM peak hour, from 260 to 349. These volumes do not include transit riders walking from the Metrorail Medical Center station.

Mitigation Measures

- The most effective TDM strategy employed at WRNMMC was the parking restriction prohibiting regular personnel from parking on campus. Despite large increases in staff, patient, and visitor volumes, the restrictions meant parking could not increase proportionally, an important consideration given that the site footprint was not expanded. Parking restrictions have been successful in discouraging employees from commuting via private auto, leaving more of the site's limited space for facilities and patient parking.
- Changes to entry and exit gates that improved traffic flow and added pedestrian access were cited as one of the most useful mitigation projects by multiple stakeholders. It is also likely that pedestrian access improvements contributed to the higher transit mode share by making it easier to access WRNMMC by walking to and from the nearby Medical Center Metrorail station.[107]
- Infrastructure improvements to accommodate increasing activity levels and travel demand at WRNMMC continue to be implemented. Lower-cost improvements that could be completed more quickly, including expanding the pedestrian and bicyclist network, were completed prior to WRNMMC's opening in 2011. The most significant roadway improvements were not completed before 2011. Some major projects are still under construction, including the project to improve the Rockville Pike crossing in front of WRNMMC and reconfigure nearby intersections to lessen congestion. Construction of major roadway system improvements has been completed in phases, and all improvements are expected to be complete by 2020.

Transportation Impacts

- Contrary to predicted impacts, actual LOS based on measured post-BRAC traffic volumes improved at about 70 percent of the intersections studied. This was a greater improvement than expected, but congestion remains an issue in certain areas.
- All three study area intersections operating at LOS E or worse under actual (2011) conditions were identified by Maryland SHA as high priorities for improvement, and work on these improvements is currently underway.
- Mode splits indicate that TDM strategies have had benefits. While the percentage of personnel driving alone has not decreased to predicted levels, it is much less than it was in 2007. Actual measured increases in the share of employees taking transit are higher than predicted. This may be due to the effectiveness of NSAB's parking restrictions as well as the increased availability of subsidies and incentives for commuting via transit.

- While the share of personnel walking and/or biking increased from just over two percent to nearly five percent of the overall workforce, it has not reached the predicted share of 10 percent. This may be because pedestrian and bicycle improvements are still underway. Although NSAB's improvements to the gates and MCDOT's improvements to the local roadway network were completed prior to 2011, the MCDOT MD 355 Crossing BRAC project will not be completed until 2020.
- The actual share of personnel using a carpool or vanpool to reach WRNMMC has not increased to predicted levels.

Data and Analysis Issues

- Data on the number of users for each transit mode was unavailable. While mode splits based on commuter surveys were available, a full set of rider data was not.
- Comparable data for baseline, predicted, and actual peak hour traffic volumes was not available for many performance measures. Baseline peak hour volumes were only available from a 2013 MCDOT report, while predicted and actual volumes were only available from NSAB's 2013 FEIS. Baseline, predicted, and actual volumes did not measure traffic on the same stretch of Rockville Pike and therefore could not be directly compared.

3.2. FORT BELVOIR/MARK CENTER

Fort Belvoir is located in Northern Virginia. The 8,500-acre facility consists of three geographically separate sites located throughout Fairfax County and Alexandria, Virginia. The Main Post, the largest area, is in southern Fairfax County near the Prince William County border, south of where I-95 connects to the Capital Beltway (I-495). Fort Belvoir North, formerly known as the Engineer Proving Grounds (EPG), is also in Fairfax County, approximately two miles northwest of the Main Post area on the other side the I-95. The Mark Center, a separate location that was added to the Fort Belvoir complex in 2011, is located approximately eight miles north of the Main Post in Alexandria, Virginia within the Capital Beltway near I-395.

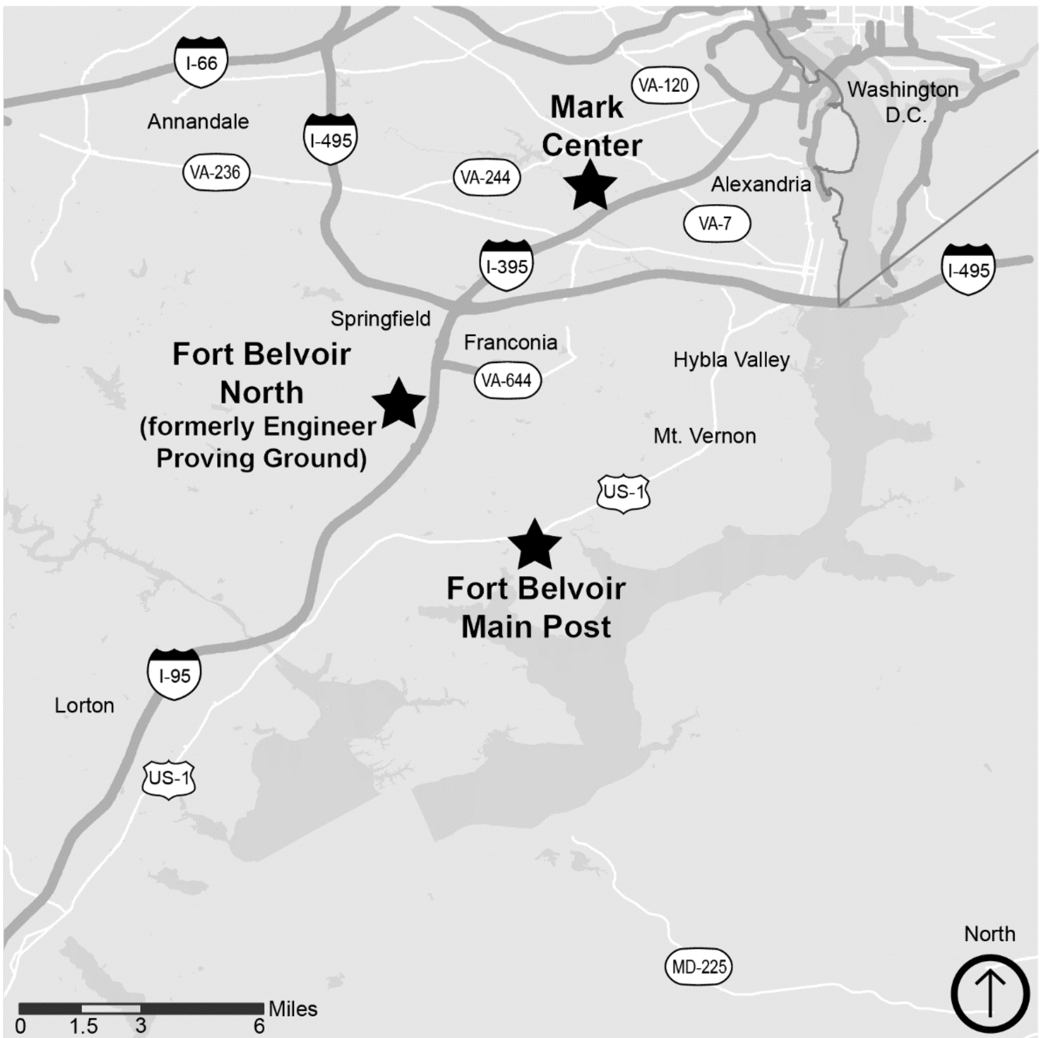


Figure 18: Regional map, Fort Belvoir/Mark Center

As of the 2010 Census, the population in Fairfax County was approximately 1.1 million.[108] By 2040, it is estimated that population will grow by just over six percent.[109] Fort Belvoir is the largest employer in Fairfax County and currently employs approximately 50,000 personnel. It serves as the headquarters for over 140 partner military organizations including the U.S. Army Intelligence and Security Command, the Missile Defense Agency, the National Geospatial-

Intelligence Agency, and all agencies of the U.S. Department of Defense. It is also home to the Virginia National Guard's 29th Infantry Division and various army reserves and commands. Fort Belvoir Community Hospital, which opened in 2011 as part of the changes mandated by BRAC 2005, is located on the Main Post. [110]

While all three geographic components comprising Fort Belvoir are part of the same facility, the Mark Center is located significantly closer to the Washington DC downtown core, in a higher density urban area within the Capital Beltway. As a result, the Mark Center is served by a different transportation network from the network that serves the Main Post and Fort Belvoir North, and it has its own unique transportation concerns. Therefore, the Mark Center is treated separately from the Main Post and Fort Belvoir North in this case study update.

3.2.A. Case Study Update

Baseline Condition – Existing condition prior to BRAC implementation

This section outlines the baseline conditions at Fort Belvoir prior to the 2011 implementation of BRAC 2005. Some of conditions described still exist and others, discussed in later sections, have changed.

Facility Profile

Before 2011, Fort Belvoir comprised two main areas, the Main Post and the EPG (now Fort Belvoir North), with the Main Post accounting for 90 percent of the 8,500 acres that the facility occupied. [111] These sites are in suburban Fairfax County. The Fort Belvoir Main Post accommodated a range of military units. Prior to the 2011 implementation of BRAC 2005, Fort Belvoir employed approximately 26,000 personnel. The majority of personnel were housed at the Main Post; fewer than 100 personnel were stationed at the Engineering Proving Grounds (EPG).[112]

The third component of Fort Belvoir, the Mark Center, was added to the overall facility complex as part of the BRAC 2005 realignment. It was completed in 2011 on a vacant portion of an existing office complex, and had not existed in the baseline condition. As a result, the Mark Center is not examined as part of the baseline condition.

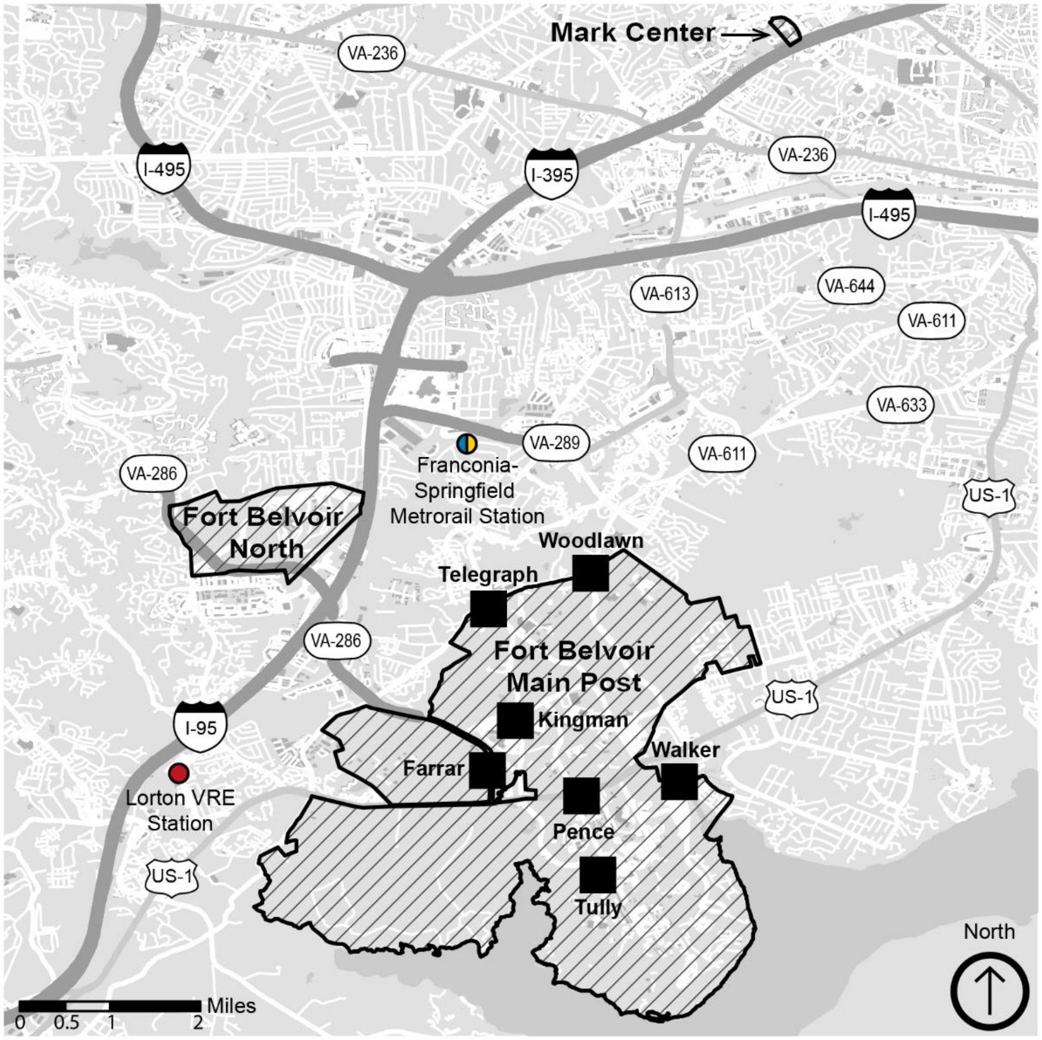


Figure 19: Gate locations, Fort Belvoir Main Post

Transportation System Condition and Performance

Roadway Access and Traffic Conditions

In the baseline condition, Fort Belvoir's Main Post and EPG could be accessed via several interstate highways – I-95, I-495, and I-395 – that are major commuter routes also serving long distance non-commuter traffic. Prior to 2011, Richmond Highway (U.S. Route 1) provided access to the Main Post and the Fairfax County Parkway (VA 286) provided access to the EPG. Before implementation of BRAC 2005, the roadway network around Fort Belvoir was congested due to Fairfax County's rapid development and significant employment growth. According to the U.S. Army Corps of Engineers' 2007 FEIS, the area was one of the busiest and most congested corridors in the country. [113] A 2010 report from the U.S. Army confirmed this, noting that the roadway network surrounding the Main Post and EPG was overtaxed with up to 35,000 trips per day.[114] A 2008 study conducted by the Fairfax County Department of Planning and Zoning found that many of the intersections surrounding the Main Post and EPG were congested, with nine out of 19 intersections studied operating at LOS E or F during the morning and/or afternoon peak hours.

Gates/Entry Points to the Facility

There were seven gates used to enter the Main Post prior to 2011. During a typical weekday, just over 26,000 vehicles entered the gates. Table 12 shows the inbound gate volumes during the AM peak hour. The Tully Gate, the main visitor's entrance located on Pohick Road just south of U.S. Route 1, saw the highest volume during the AM peak hour.

Entry points into EPG were minimal and gate volumes were not available due to security concerns. However, the fact that so few staff were posted to the facility in the baseline condition suggests that traffic volumes were not significant prior to BRAC 2005.

Table 12: Inbound gate volumes at Main Post during AM peak hour[115]

Gate	Baseline (2006)	
	Gate Serves	AM Peak Hour (6:15 to 7:15 AM) Volume
Tully	Main Post	1,519
Pence	Main Post	585
Walker	Main Post	301
Kingman	Main Post	651
Telegraph	Main Post	597
Farrar	Main Post	40
Woodlawn	Main Post	200
TOTAL		**3,893**

Parking

Free parking was available to all personnel prior to implementation of BRAC 2005, with most of the personnel and most of the parking located at the Main Post.

Public Transit Access

Public transit access to the Main Post and EPG was not direct or convenient prior to BRAC 2005. The closest rail stations to the Main Post and EPG were WMATA's Metrorail stations at Franconia-Springfield and Huntington, but these stations were not within walking distance to either site and a bus connection was required to reach the Main Post or EPG.

Commuter rail service was available through the Virginia Railroad Express (VRE). VRE's Lorton Station is located parallel to I-95 about 1.5 miles west of the Main Post and south of EPG along VRE's Fredericksburg line. As with Metrorail, any personnel or visitors attempting to reach the Main Post or EPG by VRE needed to use another mode of transit to complete the last miles of their trip.

Bus service to or near Fort Belvoir was available on 21 bus routes operated by WMATA's Metrobus, Fairfax County's Fairfax Connecter, and the Potomac and Rappahannock Transportation Commission (PRTC). These routes provided connections to the rail stations discussed above, as well as other surrounding residential areas and activity centers. While several bus routes directly served the Main Post and stopped at the entry gates, the routes serving EPG only served the nearby area and did not take passengers to the gates.

Pedestrian and Bicycle Access

Consistent with the suburban, somewhat isolated locations of the Main Post and EPG, pedestrian and bicycle facilities were lacking prior to implementation of BRAC 2005. Pedestrian crossings and sidewalks were limited and often disconnected from transit stops, especially along U.S. Route 1 near the Main Post. Bicycle access was limited to a few shared use paths in the general vicinity. The U.S. Army Corps of Engineers' 2007 Final Environmental Impact Statement (FEIS) evaluating impacts of the BRAC 2005 actions on Fort Belvoir noted the lack of pedestrian and bicycle facilities, and repeatedly emphasized the need for facilities to be improved as part of BRAC 2005 implementation.

Travel Behavior

The U.S. Army conducted a survey of commuter behavior in 2008 to assess baseline travel conditions at Fort Belvoir and to identify potential travel demand management opportunities. Prior to 2011, most personnel lived in South Fairfax County and Prince William County. Consistent with the suburban location of the sites, the lack of rapid transit options, and the provision of free on-site parking, nearly 85 percent of personnel drove alone to reach the Main Post and EPG. Carpool or vanpool was the second largest mode share, with nearly 10 percent mode share. Public transit accounted for only four percent of the mode split, likely due to the relatively low frequency of any given bus connection, the fact that buses experience the same roadway congestion as cars, and the provision of free on-site parking for personnel. Mode splits for 2008, based on responses to the commuter survey, are shown in Table 13.[116]

Table 13: Mode split at Fort Belvoir, personnel survey[117]

Mode	Baseline (2008)
Drive alone	84.8%
Carpool/Vanpool	9.9%
Transit	4%
Walk, bike, drop off	0.7%
Other	0.6%

Predicted Condition – Projected Future Conditions

Facility Realignment Plan

The BRAC 2005 realignment plan called for relocating just over 20,000 personnel across all three Fort Belvoir complex sites. Over six million square feet of new office space were proposed to accommodate new personnel after implementation of BRAC 2005.[118]

Main Post and Fort Belvoir North

Under the BRAC 2005 plan, the Main Post would host 5,500 additional personnel, build a new medical center, and lease more space for Army units. The plan also called for changing the name of EPG to Fort Belvoir North, relocating about 8,500 personnel from the National Geospatial Intelligence Agency (NGIA) to Fort Belvoir North, and creating a new campus. No changes to the geographic area or footprint of the Main Post or the EPG/Fort Belvoir North site were proposed.

Prior to the BRAC 2005 realignment, most of the 8,500 personnel to be relocated to Fort Belvoir North lived in Northern Virginia, especially Fairfax and Loudoun Counties. A significant portion, about 40 percent, lived in Maryland and approximately five percent lived in Washington, D.C. The travel shifts from previous worksites to Fort Belvoir North were predicted to add significant new traffic volumes to I-95.[119] It was expected, however, that over time the geographic distribution of personnel residences would gravitate closer to Fort Belvoir North through voluntary moves, attrition, and replacement with personnel living closer to the new site.[120]

Mark Center

Another 6,200 personnel from 24 different DoD organizations were proposed to be relocated to the Fort Belvoir complex. After determining that the Main Post and Fort Belvoir North could not accommodate these personnel, DoD developed plans for a military office complex at the Mark Center, an established mixed-use business park approximately eight miles from the Main Post and Fort Belvoir North in Alexandria, Virginia. Plans for the site included two multistory office towers (15 to 17-stories), parking garages, a public transportation center, and ancillary support facilities.[121]

The decision to relocate personnel to the Mark Center, often referred to as BRAC 133, was controversial. The Mark Center site is located along I-395, one of the most congested corridors in the region. Local stakeholders and community residents feared that the relocation would significantly worsen congestion and push roadway networks past capacity.[122]

Approximately 70 percent of DoD personnel relocating to the Mark Center commuted from within Virginia, roughly one-quarter from Maryland, and six percent from Washington, D.C. Many personnel were previously located in offices accessible via Metrorail or VRE. As of 2009, nearly 60 percent of personnel to be relocated to the Mark Center used public transit for some or all of their commute. Since the Mark Center site is not located near a Metrorail station, commuting behavior was predicted to change significantly unless measures to promote transit and other modes were encouraged.

Predicted Transportation System Performance

This section describes the predicted future impacts of BRAC 2005 on the transportation network surrounding the Main Post, Fort Belvoir North, and the Mark Center.

Traffic Impacts

Main Post and Fort Belvoir North

For personnel assigned to the Main Post and Fort Belvoir North, the highway network was expected to remain the principal means of access to the sites. Traffic volumes were expected to grow, with major increases along I-95; VA 286 (Fairfax County Parkway) and the I-95/VA 286 interchange; U.S. Route 1; Telegraph Road; and secondary roads in the Springfield and Fort Belvoir areas.[123]

As a result of increased personnel and higher travel demand, LOS at nearby intersections was expected to worsen. Ten out of 17 intersections studied were expected to worsen in LOS in the future build condition without mitigation, and 12 out of 17 were expected to operate at LOS E or lower during at least one peak hour.

Mark Center

The Mark Center site is bounded by I-395 to the east, Seminary Road to the north, North Beauregard Street and Mark Center Drive to the west, and the Winkler Botanical Preserve to the south. Under the BRAC 2005 proposal, site access would be at North Beauregard Street and Mark Center Drive to the west and Seminary Road and Mark Center Drive to the northwest. Two garages would provide parking for personnel and visitors.

Analysis from VDOT predicted that queues for northbound and southbound traffic exiting I-395 at Seminary Road would likely back up along I-395, a significant issue because I-395 was already highly congested prior to 2011.[124] In addition to VDOT's study, several other traffic studies were conducted before 2011 to determine the impact of BRAC 2005 on the surrounding roads; all concluded that traffic volumes on roadways surrounding the Mark Center would increase.

Roadway Improvements

To address the anticipated impacts from increased traffic in the areas around the Main Post, Fort Belvoir North, and the Mark Center, various agencies proposed multiple roadway network improvement projects.

Main Post and Fort Belvoir North

- **Virginia Department of Transportation (VDOT) Route 1 Centerline Design Study.** This VDOT study recommended widening U.S. Route 1 from the section that passes in front of the Main Post to where it intersects with the Capital Beltway.[125]
- **Fort Belvoir Main Post Roadway Network.** The U.S. Army Corps of Engineers proposed widening or building new roadway links serving the Main Post before 2011, including widening Gunston Road from two to four lanes; widening Belvoir Road from two to four lanes; widening 9th Street from two to four lanes; and building a new access control point to serve the north side of the Main Post.
- **VA 286 (Fairfax County Parkway) Improvements.** VDOT and the U.S. Army proposed several projects to improve VA 286 in preparation for BRAC 2005, including extending VA 286 to better connect with Fort Belvoir North; improving VA 286 between I-95 and Kingman Road; reconstructing the I-95/VA 286 Interchange to accommodate high occupancy vehicle (HOV) and single occupancy (SOV) connections; creating an interchange at VA 286 and Kingman Road; and creating an interchange at U.S. Route 1 and VA 286[126]
- **Additional or Improved Ramps to and from I-95 for Fort Belvoir North.** To accommodate additional traffic volumes resulting from BRAC 2005, the Federal Highway Administration (FHWA), the U.S. Army, and VDOT proposed constructing two access ramps from I-95 to Fort Belvoir North.[127]
- **Improvements to Beulah, Rolling, and Telegraph Roads.** Projects were proposed to widen roadways, improve signalization, and incorporate safety measures, such as improved crosswalks and lighting, to enhance flow of increased traffic volumes.[128]

Mark Center

After plans for the Mark Center were announced, several transportation studies concluded that roadway network improvements would be needed.

- **Interim Improvements at the Mark Center.** DoD planned a program of short and medium term improvements for implementation by September 2011 to ensure that the roadway network would not be overwhelmed by the sudden relocation of over 6,000 personnel. These improvements focused on the major access routes to the Mark Center: Seminary Road, North Beauregard Street, Mark Center Drive, and I-395 ramps.[129]
- **I-395 HOV/Transit Ramp.** VDOT proposed building a new HOV ramp to connect I-395's HOV lanes with Seminary Road.

Transit Impacts and Mitigation

To address the low level of transit ridership and reduce growth in single-occupancy vehicle trips, several transit system improvements were proposed.

Main Post and Fort Belvoir North

In 2010, WMATA conducted a study BRAC 2005 transit impacts and potential at Fort Belvoir. The study estimated that nine to 18 percent of personnel would be willing to use transit for access to Fort Belvoir North, while only about five to 10 percent would be willing to use transit for access to the Main Post. WMATA's proposed service enhancements to accommodate BRAC 2005 implementation at the Main Post and Fort Belvoir North included:

- *Direct local bus service* via a new Fairfax Connector route 333
- *Direct express bus service* to and from major trip generators: Tysons Corner via I-95, Herndon via VA 286, Vienna via I-66 and I-495 (modified PRTC route), and Dale City and Woodbridge (new PRTC route)
- *Improved connections to major transit centers*, especially the Franconia-Springfield Metrorail and Lorton VRE stations, through new or expanded bus routes and shuttle services
- *A new transit center* outside the Main Post's Pence gate was proposed to accommodate Metrobus REX and other direct bus services.[130]

Mark Center

The BRAC 2005 implementation plan for the Mark Center included construction of a publicly accessible transportation center to accommodate all transit services, including WMATA's Metrobus and Alexandria's DASH.[131] DoD also proposed creating a comprehensive shuttle service to connect Mark Center staff to off-site transit nodes. The proposed shuttle would provide access to five regional Metrorail stations.[132]

WMATA's 2010 *Transit Service Impacts of BRAC* estimated that between 13 and 26 percent of personnel would use transit to reach the Mark Center. To reach this goal and meet demand, WMATA recommended adding the following services:

- *Direct local bus service* via seven Metrobus routes, two DASH routes, and a new circulator service serving the Mark Center, Seminary Road, and Beauregard Street

- *Direct express bus service* via a new OmniRide route from Seminary Road to Lake Ridge and an express route from Franconia-Springfield and Pentagon Metrorail stations.
- *More connections to major transit centers*, such as Pentagon, King Street, Braddock Road, and Orange Link stations, via buses and shuttles[133]

Proposed shuttle service, described above, was meant to ensure a similar share of personnel continue to use Metrorail or VRE. When predicting the 2010 rail mode share, it was assumed that all personnel who used rail transit would also use the shuttle. [134]

Pedestrian and Bicycle Impacts and Mitigation

Main Post and Fort Belvoir North

BRAC 2005 plans for the Main Post and Fort Belvoir North provided bike lockers and showers, and examined proposals for the design and construction of shared use paths and pedestrian trails along the roads within the Main Post and Fort Belvoir North. A proposal to create a shared use path between the Franconia-Springfield Metrorail station, the Main Post, and Fort Belvoir North was evaluated but not recommended for funding.[135]

Mark Center

Prior to the BRAC 2005 creation of a military facility at the Mark Center, pedestrian facilities were in poor condition. Sidewalk width (four feet or less) and pavement conditions were substandard, sidewalk coverage was discontinuous, and signage at pedestrian crossings was inconsistent. Plans for the Mark Center included widening sidewalks to six feet or more; adding high visibility pavement markings; creating pedestrian refuge areas and crossings at major intersections and closer to activity centers; adding more lateral separation between traffic and pedestrians; and adding plantings, new streetscaping, and lighting.[136]

Previously existing regional bicycle facilities (Holmes Run Trail, the Washington and Old Dominion Trail, and Four Mile Run Trail) were expected to provide access to the Mark Center. No improvements were planned for these bicycle pathways or for bicycle access to the site prior to implementation of BRAC 2005. Nearly 170 bicycle racks were proposed in the parking garages, and shower facilities were to be provided for commuters in the fitness center.[137]

Travel Demand Management Strategies

Main Post and Fort Belvoir North

The transportation management plan (TMP) for the Main Post and Fort Belvoir North included strategies to encourage change in personnel's travel modes, trip timing, frequency, length, and travel routes. The goal of the TMP was to encourage alternative commuting modes and travel behavior to reduce traffic congestion and demand for parking by reducing drive alone private vehicle trips to 60 percent of commuter trips. The TMP emphasized ridesharing, promoted transit, implemented telework strategies, and promoted the use of compressed and variable work schedules.[138] In addition, the BRAC 2005 realignment plan for Fort Belvoir also limited parking to include space for only 60 percent of personnel, consistent with the trip reduction goal.[139]

Mark Center

It was estimated that the new facilities at the Mark Center would generate 1,900 vehicle trips during the AM peak hour and 1,800 vehicle trips during the PM peak hour. To minimize impacts on the surrounding community and facilitate site access, the U.S. Army's travel demand management plan set a target of 40 percent or more of personnel commuting by a mode other than drive alone private vehicle trips. To do this, the TDM plan sought to create a viable transportation program to help personnel choose non-drive-alone commuting modes.

To reach the mode share goal, parking at the Mark Center was limited, a comprehensive DoD shuttle program was planned, and an aggressive employee benefits program aimed at promoting the use of public transportation, carpooling, vanpooling, and off-site/telework was proposed. Just over 3,700 parking spaces in two on-site garages were to be available for personnel. Approximately 300 spaces would be reserved for carpool and vanpool vehicles, 190 spaces for alternative fuel vehicles, and nearly 50 handicapped parking spaces. Because the Mark Center site is not near a rail transit station, the TMP included plans to implement DoD shuttle service from nearby rail stations and add a bus stop on campus to accommodate personnel accustomed to riding public transit to previous work sites.

Additionally, since 11 percent of personnel to be relocated to the Mark Center lived within two miles of the site, the TDM plan promoted walking and biking and proposed improvements to pedestrian and bicycle networks. It was assumed that a rising share of staff would telecommute or work a flexible schedule to justify a reduction in private vehicle trips.[140] Transportation fringe benefits were to be made available as part of the Mass Transit Fringe Benefits (MTFB) program for public transit and vanpools.[141]

Actual Condition – Measured post-BRAC implementation conditions

The following section discusses actual measured post-BRAC (2011 and after) conditions in and around Fort Belvoir's Main Post, Fort Belvoir North, and the Mark Center.

Actual Post-BRAC Facility Profile

The Fort Belvoir complex has generally grown as expected. As of 2014, Fort Belvoir complex employed approximately 50,000 personnel. After implementation of BRAC 2005, approximately 18,000 personnel were added or relocated to Fort Belvoir and the Mark Center.[142] The Main Post gained an estimated 3,400 personnel, Fort Belvoir North gained nearly 8,500, and the Mark Center gained 6,400. The total Fort Belvoir complex footprint increased by approximately 16 acres, exclusively due to the addition of the Mark Center campus.

Since they were first proposed, plans for the Mark Center have been questioned by local stakeholders and the community, in particular the U.S. Army's decision to relocate the facility several miles from a Metrorail station. After the Mark Center opened as scheduled in September 2011, personnel were relocated to the Mark Center in phases to address community concerns over sudden increases in traffic on the roadways. Relocation of 6,400 personnel began in September 2011 and was completed by the end of 2012.[143]

Actual Transportation Mitigation

Roadway Network Improvements

Several major roadway network improvements in the area have helped accommodate the major increases in personnel at the Main Post, Fort Belvoir North, and the new campus at the Mark Center. Some of these projects, such as the improvements to the Main Post roadway network and the VA 286 improvements, were planned and implemented as mitigation for the impacts of the BRAC 2005 realignment. Many of the other improvements, however, in particular those that entail changes to I-95 and I-395, are major projects that were needed to address regional congestion and access issues, and are not a direct result of the Fort Belvoir/Mark Center BRAC plans. While numerous projects were proposed during the BRAC 2005 planning, many significant projects were not completed until after implementation of the BRAC realignment in 2011. Given the scope and complexity of many of these projects, it is not unexpected that they would take significant time to complete.

Main Post and Fort Belvoir North: Projects Completed By 2011

1. **I-95 Fourth Lane Widening Project.** VDOT began construction in March 2008 to add a fourth lane in each direction on a six-mile portion of I-95 between VA 286 and Route 123 (Project 1, Figure 20). The additional lane was constructed to relieve bottlenecks and congestion in this area, and provide improved traffic flow to and from the recently completed Springfield Interchange. The project was completed in 2011.[144]
2. **Fort Belvoir Main Post Roadway Network.** At the Main Post, the U.S. Army made improvements to the roadway network to better accommodate the flow of traffic and improve north-south connectivity. Projects included widening Gunston Road from two to four lanes between 12th Street and John J. Kingman Road and providing a viaduct over U.S. Route 1 (Project 2A, Figure 20); widening Belvoir Road from two to four lanes between 12th Street and U.S. Route 1 (Project 2B, Figure 20); widening 9th Street from two to four lanes between Gunston and Belvoir Roads (Project 2C, Figure 20); and constructing new access control point to serve the north side of the Main Post (Project 2D, Figure 20). All improvements were completed by September 2011.

Main Post and Fort Belvoir North: Projects Completed After 2011

3. **VA 286 (Fairfax County Parkway), Phase III.** In 2012, Fairfax County, VDOT, and FHWA completed the third phase of VA 286 construction between the Franconia-Springfield Parkway interchange and the Barta Road interchange (Project 3, Figure 20). Construction included a six-lane divided highway, relocating the Franconia-Springfield Parkway interchange to Hooes Road, widening ramps, and constructing a new bridge that carries Rolling Road over the parkway.[145]
4. **I-95 Defense Access Road HOV Ramp for Fort Belvoir North.** FHWA, VDOT, and U.S. Army, completed construction of new access ramps to Fort Belvoir North in 2013 (Project 4, Figure 20).[146]
5. **I-95 High Occupancy Toll (HOT) Lanes.** To further improve mobility along I-95, VDOT began construction on approximately 29 miles of HOT lanes in 2012 (Project 5, Figure 20). Construction stretched from the Capital Beltway south to Stafford County. The project was completed in 2014.[147]
6. **VA 286 (Fairfax County Parkway) and Rolling Road.** In 2016, VDOT completed a project to upgrade the loop ramp from VA 286 onto Franconia-Springfield Parkway (Project 6, Figure 20). The project included widening the inner loop ramp, adding new shoulders, upgrading traffic signals along VA 286, and shared use path improvements along Rolling Road and Hunter Village Drive. The project was completed in August 2016.[148]

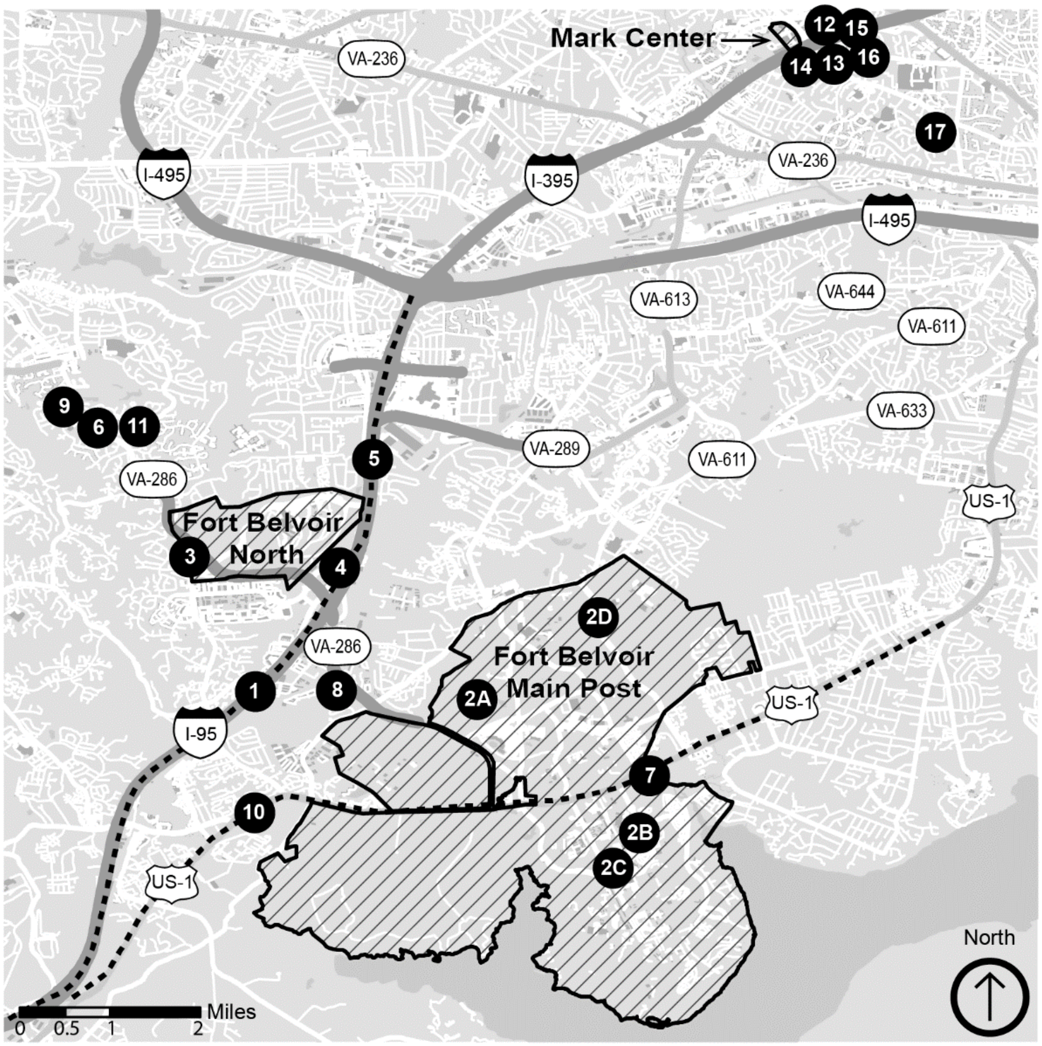


Figure 20: Project map, Fort Belvoir/Mark Center

7. **U.S. Route 1 Improvements at Fort Belvoir.** FHWA, VDOT, Fairfax County, and the U.S. Army partnered on a project to widen a 3.7-mile segment of U.S. Route 1 from Telegraph Road to Mount Vernon Highway (Project 7, Figure 20).[149] The project began in April 2013 and was completed in August 2017.[150]
8. **Intersection Improvements at VA 286 (Fairfax County Parkway) and Terminal Road.** VDOT completed safety improvements to the intersection at VA 286 and Terminal Road (Project 8, Figure 20) in November 2017.[151]

Main Post and Fort Belvoir North: Pending

9. **Rolling Road Widening.** VDOT plans to reduce congestion and improve safety by widening Rolling Road from two to four lanes and add pedestrian and bicycle facilities between Viola Street and Old Keene Mill Road (Project 9, Figure 20). The project is

currently in design; construction on the first phase is scheduled to begin in mid-2019, and the second phase is expected to begin construction in early 2023.[152]

10. **Virginia Department of Rail and Public Transportation (DRPT) Route 1 Multimodal Alternatives Analysis.** This DRPT study proposed phased implementation of multimodal improvements along a 15-mile stretch of U.S. Route 1extending from the Capital Beltway to Route 123 in Fairfax County (Project 10, Figure 20), including widening U.S. Route 1 from four lanes to six lanes; creating continuous facilities for pedestrians and bicyclists; implementing Bus Rapid Transit (BRT) in the Route 1 median to connect the Huntington Metro Station with Route 123; and extending Metrorail's Yellow Line 3 miles south from the Huntington Station to a new station at Hybla Valley.[153] While a portion of U.S. Route 1 is already being expanded, the funding and feasibility of DRPT's recommendations are still being examined.
11. **VA 286 (Fairfax County Parkway) & Franconia-Springfield Parkway Corridor Study.** The Fairfax County Department of Transportation and VDOT are currently working on completing a multimodal corridor study for the Fairfax County and Franconia-Springfield Parkways (Project 11, Figure 20). The study will analyze existing transportation issues and include recommendation for short-term multimodal improvements that can be implemented in the next 10 years. The study was completed in June 2017.[154]

Mark Center: Projects Completed After 2011

12. **Short-Term Improvements at the Mark Center.** FHWA, VDOT, DoD, and the City of Alexandria completed the following improvements by September 2012 (Project 12, Figure 20 and Figure 21):

    - Restripe I-395 northbound off-ramp with two through-lanes and a right-turn lane
    - Widen Seminary Road westbound approach from the rotary to the Mark Center Avenue intersection from one to two lanes
    - Widen Seminary Road eastbound approach to Mark Center Avenue to three through-lanes
    - Widen Mark Center Avenue northbound approach to four lanes: three right-turn lanes and one shared left/through lane
    - Widen Seminary Road eastbound and the I-395 southbound on-ramp from Mark Center Avenue to the ramp meter signal to provide a continuous two-lane ramp
    - Improve signal timing at intersection surrounding the Mark Center[155]

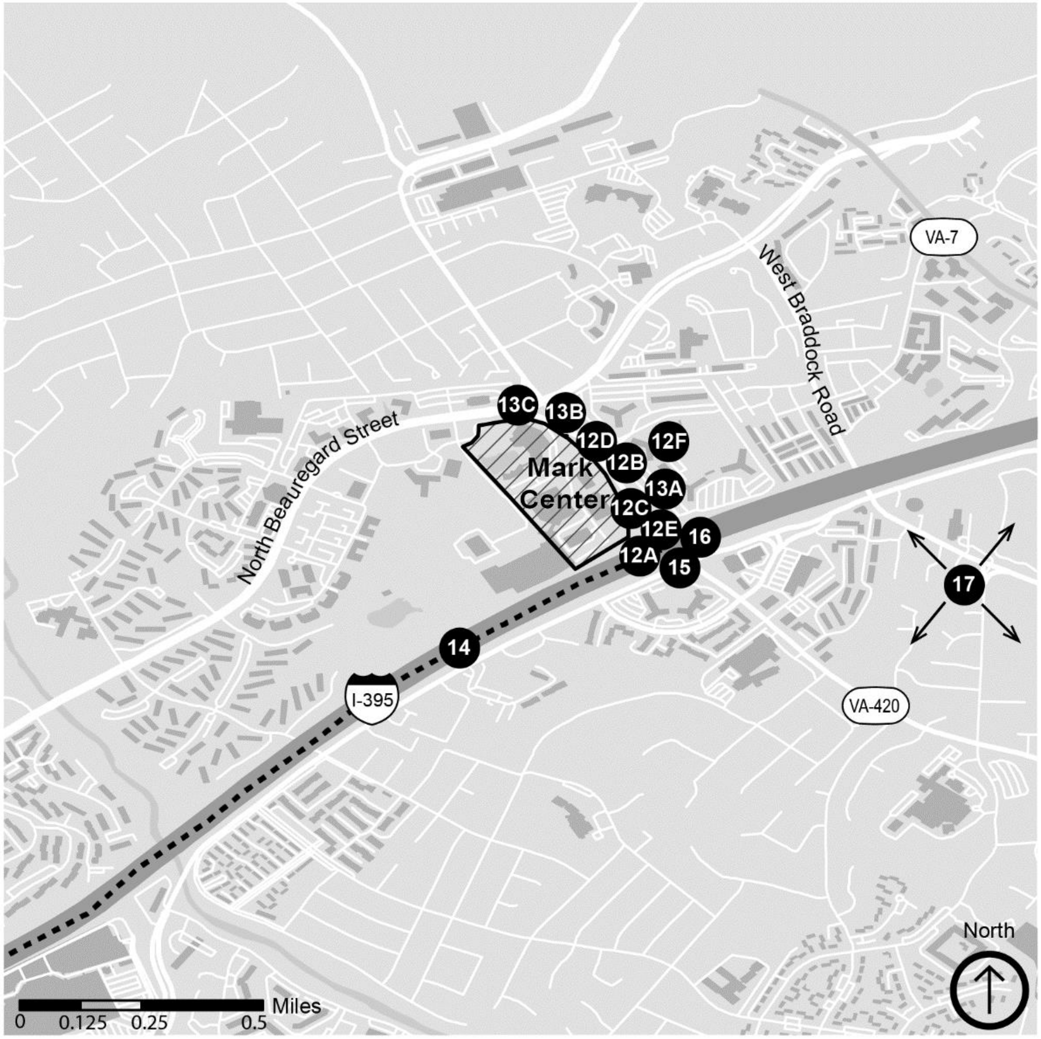


Figure 21: Project map, Mark Center

13. **Medium-Term Improvements at the Mark Center.** FHWA, VDOT, DoD, and the City of Alexandria completed the following projects by July 2013 (Project 13, Figure 20 and Figure 21):
    - Widen Seminary Road to provide a dedicated right-turn lane from westbound Seminary Road to southern portion of Mark Center
    - Widen Seminary Road westbound approach to provide deceleration lane
    - Widen Beauregard Street northbound approach to provide acceleration lane and add dedicated right-turn lane at Mark Center Drive and Seminary Road[156]
14. **I-395 Auxiliary Lane.** In February 2015, VDOT completed construction of a northbound auxiliary lane on I-365 to connect the northbound on-ramp at Duke Street to the northbound off-ramp at Seminary Road (Project 14, Figure 20 and Figure 21).[157]
15. **I-395 High Occupancy Vehicle (HOV) and Transit Ramp.** VDOT built a reversible HOV and transit ramp on I-395 at Seminary Road (Project 15, Figure 20 and Figure 21). The ramp was completed in January 2016.[158]

16. **Seminary Road Bridge and Pedestrian Bridge over I-395.** VDOT constructed a new Seminary Road Bridge over I-395 and a new pedestrian bridge over I-395 (Project 16, Figure 20 and Figure 21). The Seminary Road Bridge was completed in January 2016 and the pedestrian bridge was completed in May 2016.[159]

Mark Center: In Progress

17. **Beauregard Small Area Plan.** In June 2012, the City of Alexandria adopted the Beauregard Small Area Plan (Project 17, Figure 20 and Figure 21). The plan for the Beauregard Street corridor, including the Mark Center, calls for upzoning the corridor to create 5,500 total units of housing; implementing bus rapid transit (BRT) along the entire corridor; creating an oval roundabout at Seminary and Beauregard Roads; and expanding the street-grid with smaller block sizes.[160]

Travel Demand Management Strategies

Main Post and Fort Belvoir North

Travel demand strategies have focused on increasing mobility options for personnel to decrease the drive-alone mode share. The U.S. Army, regional, state, and local agencies have agreed to cooperate on improving public transit, walking, and bicycling as viable options for Fort Belvoir commuting.[161] Other TDM strategies include reduction of parking supply to 60 percent of personnel, transit pass subsidies, and promoting telework and flexible schedules.

Mark Center

While relocation to the Mark Center meant that facilities would no longer be easily accessible by Metrorail, many travel demand strategies were adopted to minimize the share of personnel making drive alone trips. Parking restrictions were implemented, with a reduction in the parking cap from the originally planned 3,700 spaces to roughly 2,000 spaces; this reduction was done by federal statute (in an appropriations bill) to address concerns about traffic impacts raised by community groups and the DoD Inspector General's report.[162]

DoD implemented shuttle service and built a new bus station, the Mark Center Transit Station. To incentivize personnel to use transit, transit subsidies are available to all and personnel can receive up to $255 per month of pre-tax transit benefits to apply to their commute. Additionally, DoD personnel boarding buses at the Mark Center Transit Station can ride free by showing the driver their Mark Center ID.[163] DoD also encouraged employees to telework and removed obstacles to better enable them to do so.[164]

Community Involvement Process

Community outreach began with the drafting of Environmental Impact Statements (EISs). Two environmental impact statements were developed: one for the Main Post and Fort Belvoir in 2007 and one for the Mark Center in 2008. As with all EISs, the environmental review for Fort Belvoir and the Mark Center entailed public meetings and opportunity for public comment. Community stakeholders were also involved in the development of all transportation management plans, primarily through the BRAC Advisory Group, which was established in early 2009 and held weekly meetings through February 2012. Representatives from the U.S. Army attended monthly meetings of the BRAC Advisory Group and shared their plans.

In addition to BRAC Advisory Group meetings, public hearings were held for each major transportation project. Because of the controversy surrounding the Mark Center and the need to better engage the community, DoD formed the BRAC 133 Ad Hoc Committee, with representatives from DoD, the City of Alexandria, and the public to promote continued planning and communication between area residents and the U.S. Army.

Actual Transportation System Performance

Travel Behavior

Main Post and Fort Belvoir North

Driving alone continues to be the dominant mode used to access the Main Post and Fort Belvoir North. Table 14 shows the 2013 mode splits based on a commuter survey conducted as part of the U.S. Army Corps of Engineers' 2014 TMP update. Approximately 83 percent of personnel drove alone to reach the Main Post and Fort Belvoir North.[165] This figure is much higher than the desired 60 percent mode share included in past travel management plans, and it is very close to the baseline from 2008. In fact, the shares for all modes are very similar to the baseline, and significantly different from the predicted.

Table 14: Mode splits at Main Post and Fort Belvoir North, 2008 vs. 2013[166]

Mode	Baseline (2008)[167]	Actual (2013)[168]
Drive alone	84.8%	83%
Carpool/Vanpool	9.9%	8%
Transit	4%	6%
Walk, bike, drop off	0.7%	2%
Other	0.6%	<1%

Mark Center

Table 15 shows the actual mode split for the Mark Center based on a survey conducted in 2012 by the National Capital Regional Planning Board. Driving alone in a private vehicle is the predominant mode at the Mark Center, and the share of personnel driving alone is higher than predicted. However, the share of personnel using rideshare, carpool, or vanpool has increased beyond projections. While parking restrictions were not strict enough to more significantly reduce the share of personnel driving alone, they may have had an effect on the larger-than-expected share of personnel using rideshare, carpool, or vanpool.

Although the share of personnel using transit is lower than predicted, it is similar to the share using it as their sole mode prior to BRAC 2005 implementation in 2009. It is possible that this mode share could increase in the future. Ridership on buses serving the Mark Center has increased since 2011 and this is likely to continue.[169]

Table 15: Mode splits at the Mark Center, predicted future build vs. actual[170]

Mode	2009*			Predicted (2010)	Actual (2012)
	This Mode Only	This Mode with Others	Total		
Drive alone	41%	14%	55%	57%	66%
Ridesharing/ Carpool/Vanpool	9%	10%	19%	11%	15%
Transit	17%	59%	76%	28%	17%
Walk, bike, drop off	2%	6%	8%	4%	2%

*Values for 2009 are for travel to the previous employment site for employees relocated to the Mark Center. They do not total to 100 since respondents were given the option of selecting more than one mode of travel to best reflect their travel behavior.

These surveys collected information on employees' regular commuting mode. As a result, telework does not show up as an option, since it is only an occasional option for any employee. In the baseline condition, less than two percent of survey respondents indicated that they telecommuted at least one day per week, but 19 percent indicated that they telecommuted multiple times per year.[171] Similarly, in the actual post-BRAC condition, staff at the City of Arlington reported that an estimated 40 percent of Mark Center employees telecommuted occasionally, though not regularly.[172]

Traffic Operations

Main Post and Fort Belvoir North

Roadway improvements have been successful in managing congestion around the Main Post and Fort Belvoir North. Total gate volumes at the Main Post have increased by nearly 50 percent over pre-BRAC levels (see Table B11); despite these increased traffic volumes, local intersections seem to be functioning with acceptable operations.

Traffic operations have generally improved over pre-BRAC conditions, especially at Fort Belvoir North. Six out of seven intersections near Fort Belvoir North and three out of nine near the Main Post showed improvements in LOS during at least one peak hour. Of these, only three operated at LOS E or worse during at least one peak hour. Pre-BRAC, five intersection had operated at LOS E or worse during at least on peak hour. The improvements in LOS near Fort Belvoir North may be the result not only of the effects of roadway improvements, but also of peak spreading. National Geospatial Intelligence Agency (NGA) personnel, who were relocated to Fort Belvoir North, have more flexible schedules than other personnel, and can set their schedules to arrive outside of peak travel times.[173]

Mark Center

Overall, traffic volumes and congestions on the roadways around the Mark Center have not reached predicted levels. In fact, traffic volumes on the surrounding roadway network have decreased slightly despite increases in traffic traveling to and from the Mark Center, because these increases were more than offset by decreases in off-site background traffic. Based on LOS, overall traffic conditions around the Mark Center slightly worsened. Table B13 shows 2014 and pre-BRAC LOS. Of the seven intersections, two now operate at LOS E or worse during at least one peak hour, and three have declined during at least one peak hour. While this marks a deterioration from pre-BRAC conditions, VDOT has deemed the conditions acceptable based on industry and Northern Virginia standards.[174]

These results, which show less impact to LOS than anticipated, are unexpected given previous predictions and local opposition to relocation plans. VDOT has identified four main reasons for the result:

- Drops in background off-site traffic mean that major routes are less congested, so commuters have not been accessing the Mark Center using alternative routes
- Completion of incremental short- and mid-term roadway improvements by VDOT and the City of Alexandria
- Travel demand management strategies were more effective than predicted
- Implementation of a congressionally mandated parking cap limiting the total number of vehicles allowed to park at the Mark Center[175]

The decline in background traffic, which likely played a significant role in lessening impact, may be the result of a national trend toward lower traffic volumes during and after the Great Recession.

Transit Operations

Main Post and Fort Belvoir North

Since 2011, the bus network around the Main Post and Fort Belvoir North and the connections to the WMATA system have expanded. Service has not been added by WMATA, so Metrorail and Metrobus options remain the same. In the future, service may be decreased along the REX Metrobus route; WMATA is considering eliminating or decreasing service along the REX fine to address its budget deficit. Despite enhancement to the bus network, transit travel time is still not competitive with private vehicle travel time.[176]

Mark Center

Relocation of many DoD worksites to the Mark Center meant that employees would no longer have easy commuting access by Metrorail. To address this shortcoming, DoD worked with transit providers to add several options to the bus network and also built a new bus station, the Mark Center Transit Station. It includes five bus bays to accommodate service from Metrobus, DASH, and other providers.[177] DoD personnel boarding buses at the Mark Center Transit Station can ride free by showing the driver their ID.[178] Ridership for both Metrobus and the DASH bus have grown since the Mark Center opened in 2011, and an estimated 17 percent of personnel use transit to reach the Mark Center.[179]

Pedestrian and Bicycle Access Impacts

Main Post and Fort Belvoir North

As part of BRAC 2005, the U.S. Army constructed on-street dedicated bike lanes throughout the Main Post and Fort Belvoir North. Bike lanes were added to Belvoir, Gunston, Pohick, and Mount Vernon Roads and 9th Street on the Main Post, and to Heller and Barta Roads at Fort Belvoir North. All primary roadway within the sites include sidewalk and on street bicycle facilities.[180]

Outside of the facility, however, pedestrian and bicycle facilities continue to be minimal, making these modes less attractive travel options. Pedestrian crossings along U.S. Route 1 are infrequent, long, and disconnected from existing transit stops. Crosswalks are spaced at significant distances from one another, with the longest gap exceeding 1.8 miles. Crossing distance commonly exceeds 100 feet. There are few bicycle facilities nearby, so access remains a challenge. U.S. Route 1 is singled out as corridor "of caution" for bicyclists in Fairfax County Bicycle Master Plan. Bicyclists generally try to avoid U.S. Route 1 near Fort Belvoir due to the narrow shoulders, poor sight distances, high traffic volumes, and high traffic speeds.[181]

Mode shares for walking and bicycling continue to be low, at less than one percent. In their 2015 *Route 1 Multimodal Alternatives Study* report, the Virginia Department of Rail and Public Transportation (DRPT) recommended numerous improvements to the pedestrian and bicycle network. The U.S. Army and Fairfax County have also emphasized the need for improvement. Some of the projects in progress along Route 1 include provisions for improving pedestrian and bicycle facilities.

Mark Center

Pedestrian and bicycle facilities have been enhanced since the opening of the Mark Center. A new pedestrian bridge over I-395 was constructed in May 2016 and provides improved access for pedestrians and bicyclists to the Mark Center. Additionally, improvements to sidewalks and the street grid will likely be part of Alexandria's Beauregard Small Area Plan. Bicycle parking is available on the Mark Center site and 36 designated bicycle shower rooms have been added to the fitness center.[182]

Safety Impacts

In Fairfax County, crashes have remained relatively constant since 2012. In 2015, 14,024 crashes occurred, 30 of which resulted in a facility and 7,677 resulted in an injury.[183] Near the Main Post and Fort Belvoir North, jaywalking continues to be an issue along U.S. Route 1. From 2010 to 2012, VDOT reported 18 pedestrian crashes and 2 bicycle crashes along the U.S. Route 1 corridor.[184]

Detailed data on safety and crashes was unavailable for the roadway network surrounding the Mark Center. In Alexandria, where the Mark Center is located, crashes have been increasing steadily since 2012. In 2015, a total of 1,912 crashes occurred, 4 of which resulted in fatalities and 731 resulted in an injury.[185]

3.2.B. Evaluation of Actual Versus Predicted Conditions

Facility Changes – Baseline v. Proposed Build v. Actual

BRAC 2005 actions resulted in multiple changes across Fort Belvoir's three sites. Nearly 18,000 personnel were relocated, and a new site, the Mark Center, was added. At the Main Post, 3,400 additional personnel were added and a new medical center was constructed. The Engineer Proving Grounds (EPG) was renamed "Fort Belvoir North" and 8,500 personnel from the National Geospatial Intelligence Agency (NGA) were relocated to this site. Approximately 6,400 personnel from 24 different DoD organizations were relocated to the newly master-planned, 16-acre Mark Center site.

When BRAC 2005 actions were completed in 2011, Fort Belvoir employed over 44,000 personnel (see Figure 22). DoD predicted that personnel would increase by 20,200; as of 2011, actual personnel numbers fell just short of this estimate. Since 2011, Fort Belvoir has continued to grow, and it accommodated approximately 50,000 personnel by 2014.

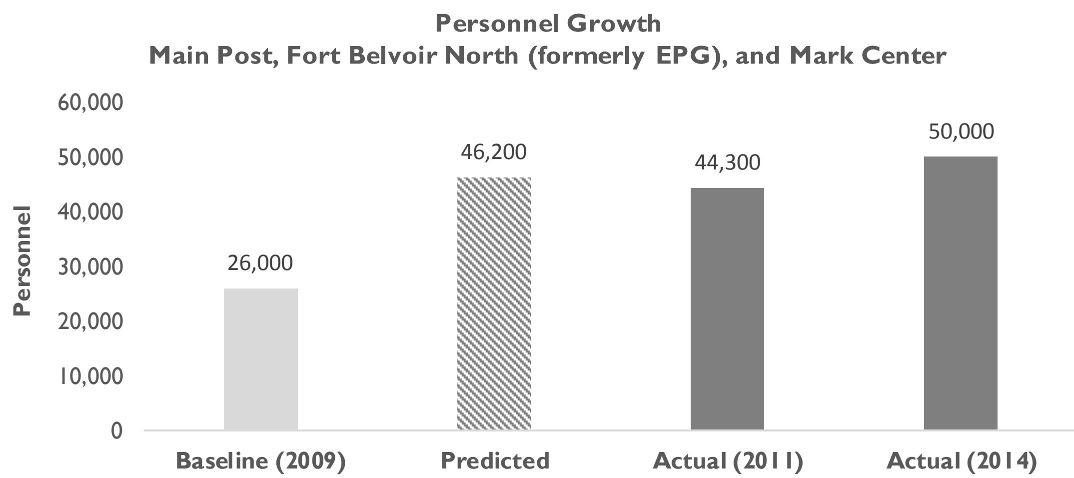


Figure 22: Personnel growth at Fort Belvoir[186]

Transportation Demand – Baseline v. Proposed Build v. Actual

At the Main Post, AADT along U.S. Route 1 at Gunston Road (see Figure 23) has increased by just over 18 percent since 2005. In 2008, AADT jumped by approximately 30 percent. While AADT has been declining since 2011, it is still above 2005 levels.

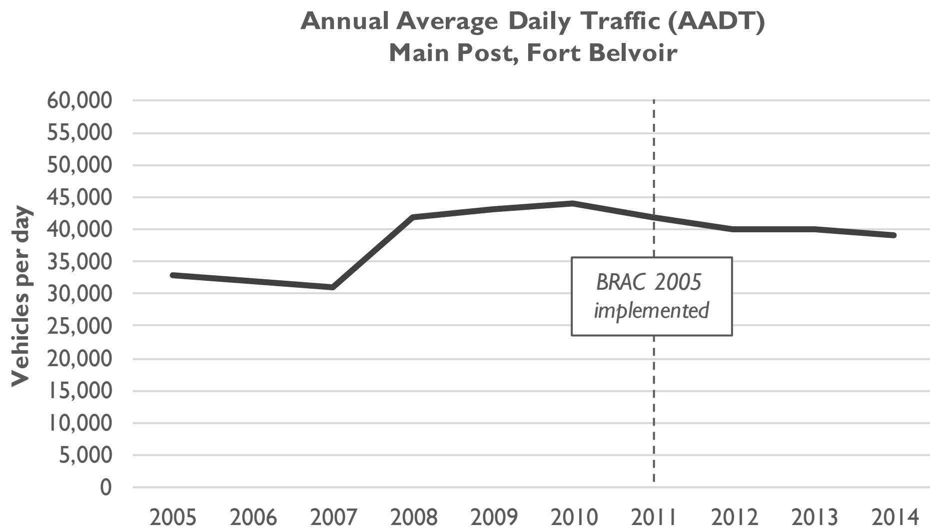


Figure 23: AADT from 2005 through 2014 on U.S. Route 1 at Gunston Road adjacent to Fort Belvoir's Main Post[187]

Given the Mark Center's denser surroundings and proximity to I-395, AADT is higher overall around the Mark Center than near the Main Post. Along Seminary Road between Beauregard Street and I-395, AADT averaged approximately 52,000 vehicles per day. Between 2005 and 2014, as shown in Figure 24, AADT increased by just over 14 percent.

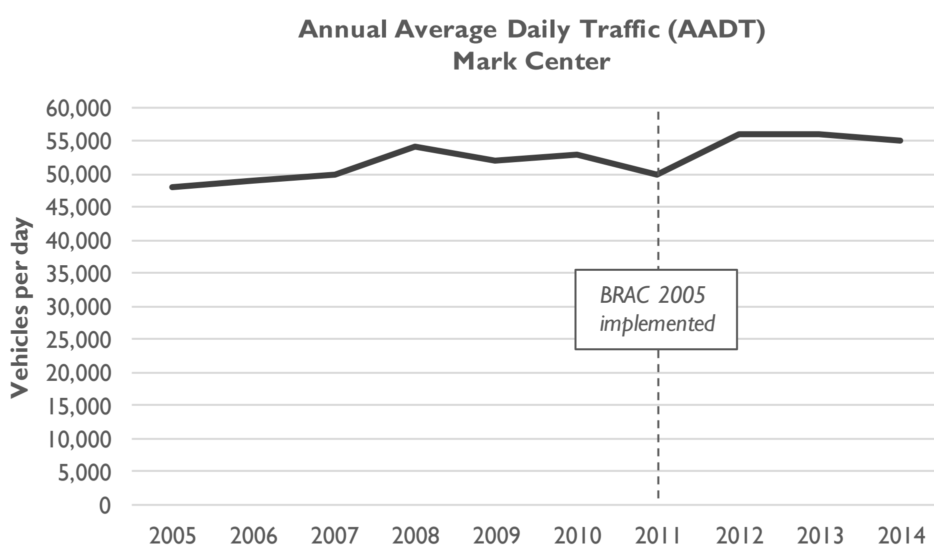


Figure 24: AADT from 2005 through 2014 at Seminary Road between Beauregard Street and I-395 adjacent to the Mark Center[188]

While reports cite declining peak traffic volumes around the Mark Center, not enough data is available to perform a thorough analysis. As shown in Figure 25, traffic volumes were predicted to increase by eight percent in the morning peak hour and by 22 percent in the evening peak hour. However, according to VDOT's 2014 *Mark Center Traffic Monitoring Task Force Revised Final Report*, volumes on the surrounding roadway network decreased slightly. In this report, VDOT attributes the decreases in area traffic to declines in background traffic, which offset the measured increases in traffic traveling to the Mark Center (see Figure 26, below).

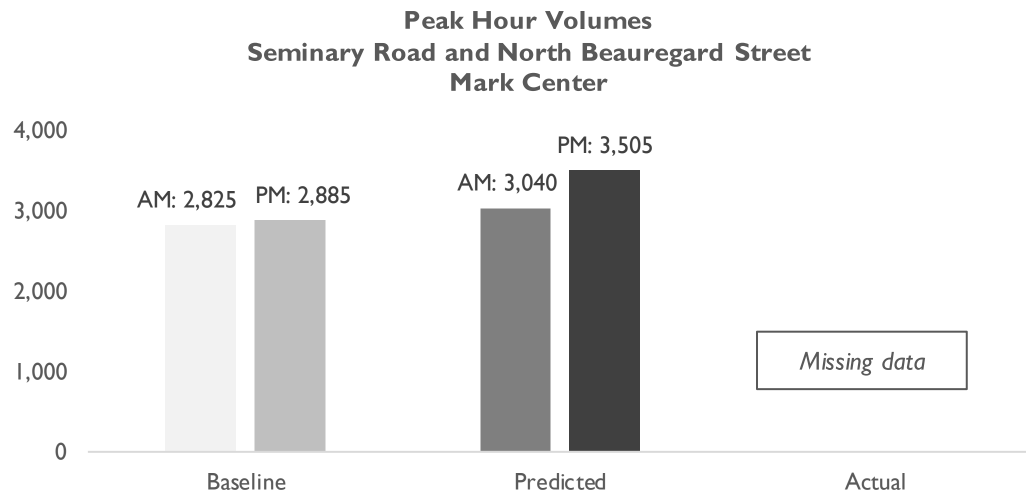


Figure 25: AM and PM peak hour traffic volumes at the Mark Center[189]

Actual post-BRAC traffic count data is not available for the Main Post and Fort Belvoir North. Total gate volumes, which were only available for baseline and actual conditions during the AM peak hour, show an increase of nearly 38 percent (see Figure 26). Extrapolating predicted conditions based on available personnel and mode split data suggests that a small decrease in gate volumes would be predicted due to the ambitious drive alone mode split target, which was approximately 25 percent lower than baseline.

As shown in Figure 27, the Tully and Kingman gates were most used before and after BRAC 2005. The Kingman and Walker gates, both located along or near U.S. Route 1, experienced the largest increases in AM peak hour volume, while the Tully gate, located at the southern end of the Main Post, saw a slight decline.

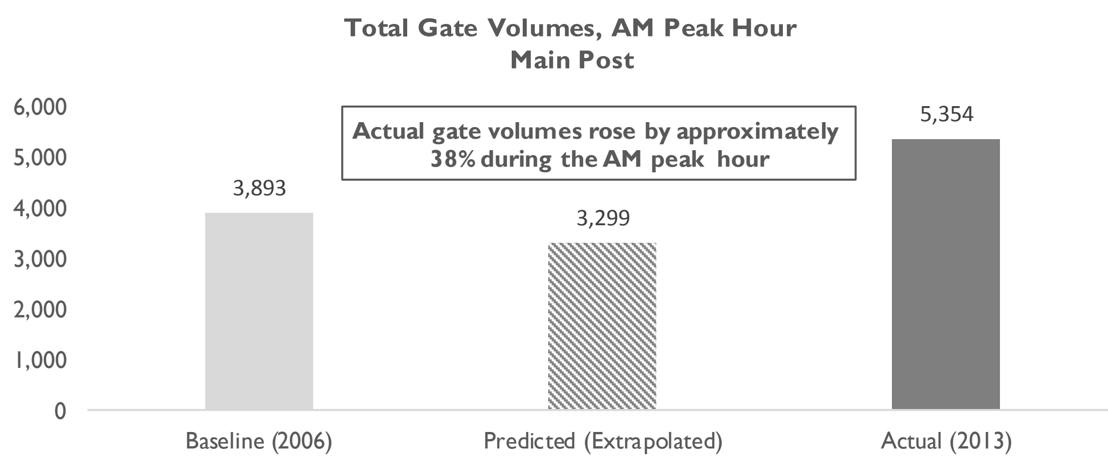


Figure 26: AM peak hour total gate volumes at the Main Post[190]

Note: Predicted volumes were extrapolated from baseline (2009) volumes utilizing projected increases in visitors, patients, and personnel and available mode split targets.

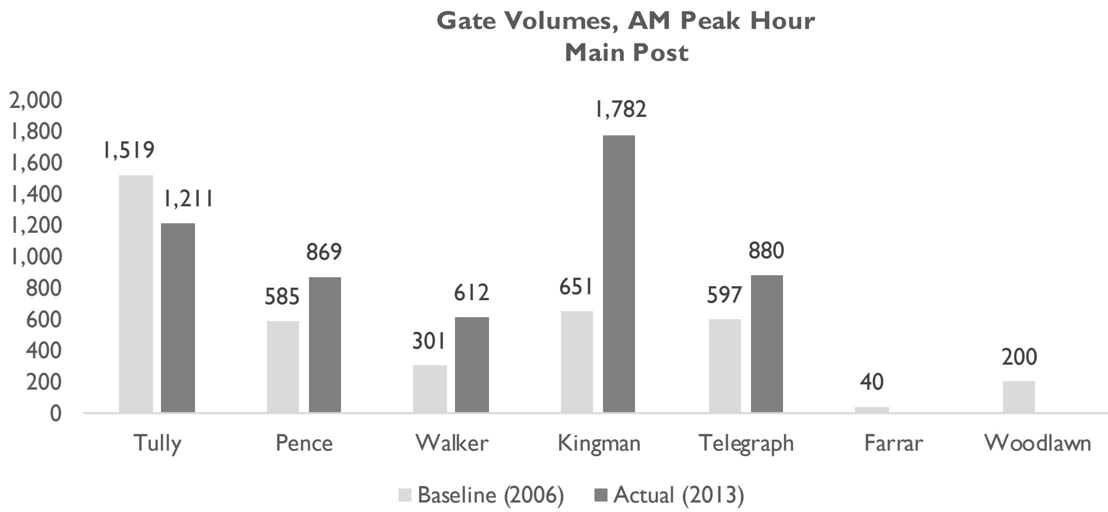


Figure 27: Individual AM peak hour gate volumes at the Main Post[191]

Figure 28 depicts transit mode share at the Main Post and Fort Belvoir North. Despite the suburban location of the facilities, transit mode share was predicted to increase by 14 percent over baseline levels. Actual transit demand did not reach predicted levels, but it did exceed baseline levels by two percent; this is most likely due to expanded bus and shuttle options.

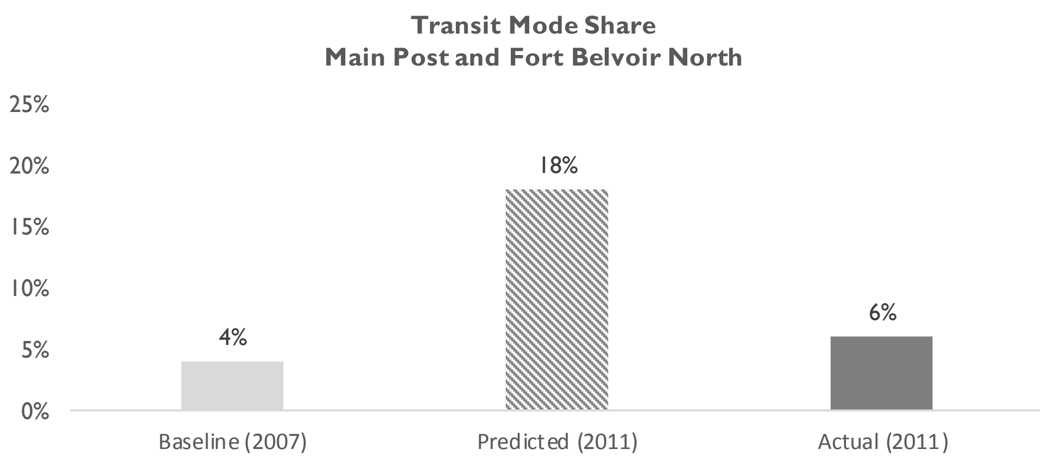


Figure 28: Transit mode share at Main Post and Fort Belvoir North[192]

At the Mark Center, transit demand has remained constant. Many personnel were relocated from locations easily accessible via Metrorail to the Mark Center. Although this proved controversial, it meant that a sizable share of personnel was accustomed to commuting by public transit and might be open to that mode if feasible.

Baseline demand was developed from 2009 travel patterns, with personnel located at their previous work sites. While actual transit demand did not reach predicted levels, it has remained similar to baseline levels despite relocation to a less transit accessible site (see Figure 29). TDM strategies that might have contributed to employee use of transit included the addition of bus and shuttle service from nearby Metrorail stations, the construction of an on-site transit center, and parking restrictions.

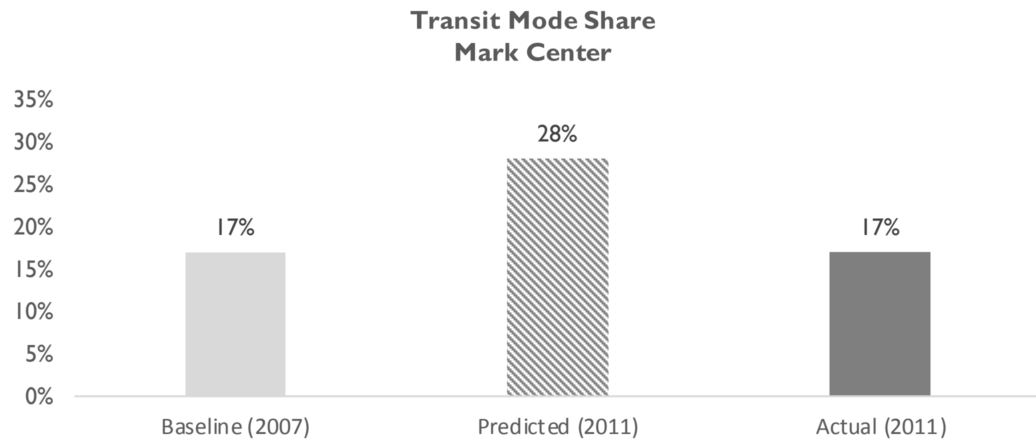


Figure 29: Transit mode share at the Mark Center[193]

Mitigation Measures – Proposed Build v. Actual

While Fort Belvoir is composed of three separate sites, many of the same TDM strategies were implemented at each site. Despite their different locations, transit access was enhanced at all three sites. At the Main Post and Fort Belvoir North, the local bus network was expanded to provide direct service to both sites, while the Mark Center added shuttle buses from nearby Metrorail stops and constructed a new on-site transit station. Additionally, transit pass subsidies were provided to all personnel. Ridesharing, telework, and flexible schedules were also promoted at all sites.

Parking restrictions, typically one of the most effective TDM strategies, were implemented at each site, and likely contributed to the observed increases in transit ridership. The Main Post and Fort Belvoir followed the U.S. Army's guidelines and provided parking for only 60 percent of personnel. At the Mark Center, 3,700 parking spaces, enough for about 60 percent of personnel, were originally planned. However, parking was later capped by federal statute at 2,000 spaces, enough for only 32 percent of personnel, in response to community concerns (see Figure 30).

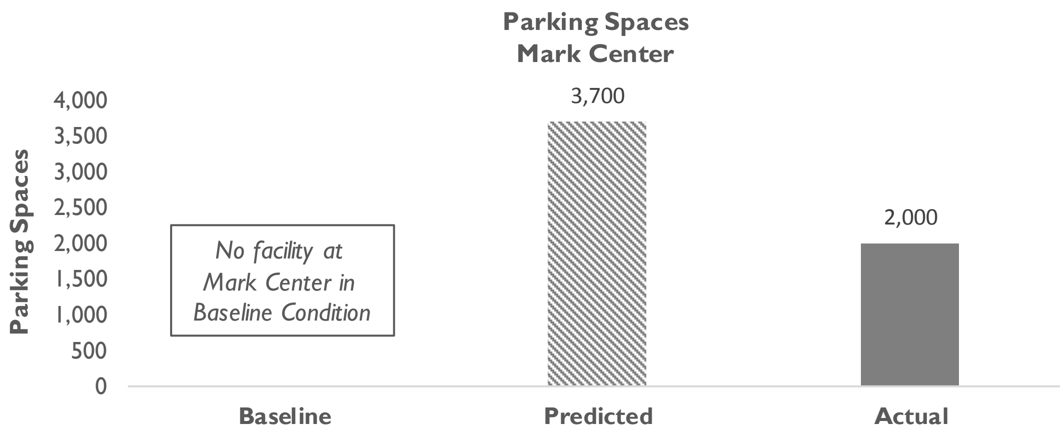


Figure 30: Parking spaces at the Mark Center[194]

Mitigation projects at Fort Belvoir focused predominantly on improving the roadway network. Projects adopted by all three of Fort Belvoir's sites are described in

Table 16. Of the 13 projects discussed, 11 were focused on roadways, three addressed transit, and five had some pedestrian or bicycle components (several of the projects are anticipated to improve more than one mode). Resource constraints meant that most of these projects, nearly 85 percent, were completed after BRAC implementation or are still underway. In January 2016, major improvements to I-395 were completed near the Mark Center. Construction of the third phase of Fairfax County Parkway, as well as improvements to U.S. Route 1, are both still in progress and expected to result in further improvements to operating conditions on the roadway network.

Table 16: Mitigation projects around Fort Belvoir

	Project Type			Improvement	Project Status			Cost
	Road way	Transit	Ped/ Bike		Complete Before 2011	Complete After 2011	Under-way	
Fort Belvoir – Main Post/Fort Belvoir North								
I-95 Fourth Lane Widening Project	X			Add fourth lane in each direction on 6-mile stretch of I-95 between Fairfax County Parkway and VA 123	X			$123 m[195]
Main Post Roadway Network	X			Improve roadway network to better accommodate traffic flow and north-south connectivity	X			$34 m[196]
Fairfax County Parkway, Phase III	X			Construct 6-lane divided highway, improve parkway interchange, widen ramps, build new Rolling Road bridge		X		$21 m [197]
I-95 HOV Ramp for Fort Belvoir North	X			Construct new access ramp to Fort Belvoir North		X		*Missing data*
I-95 High Occupancy Toll (HOT) Lanes	X			Construct 29 miles of HOT lanes on I-95 from Capital Beltway to Stafford County		X		$925 m [198]
Fairfax County Parkway and Rolling Road	X		X	Upgrade loop ramp from Fairfax County Parkway onto Franconia-Springfield Parkway		X		$14 m [199]
U.S. Route 1 Improvements	X		X	Widen 3.7-mile segment of U.S. Route 1, and add share use paths, sidewalks, and on-road bicycle accommodations			X	$180 m [200]
Improvements at Fairfax County Parkway and Terminal Road	X			Make safety improvements to Fairfax County Parkway and Terminal Road intersection			X	$2 m [201]
Rolling Road Widening, Viola St to Old Keen Mill Rd	X		X	Widen Rolling Road from two to four lanes and add pedestrian and bicycle facilities			X	$36 m [202]
Mark Center								
Short- and Medium-Term Improvements	X		X	Restripe and widen approaches at key intersections.		X		$20 m [203]
I-395 Auxiliary Lane, High Occupancy Vehicle (HOV) and Transit Ramp, and Seminary Road Bridge	X	X	X	• Additional NB auxiliary lane on I-395 to connect ramps at Duke Street and Seminary Road • Reversible HOV and transit ramp on I-395 at Seminary Road • New Seminary Road Bridge, ped bridge over I-395		X		$76 m [204]
Mark Center Transit Station		X		Add new transit station at Mark Center complex to receive buses and shuttles		X		*Missing data*
DoD Shuttle Service to Mark Center		X		Launch shuttle connecting West Falls Church, King Street, Pentagon, and Franconia-Springfield Metrorail stations with Mark Center		X		*Missing data*
TOTAL	**11**	**3**	**5**		**2**	**8**	**3**	**$1.43 billion**

Transportation Impacts – Baseline v. Proposed Build v. Actual

Figure 31 and Figure 32 compare aggregate study area intersection LOS under baseline, predicted, and actual conditions. In the baseline condition, six out of 17 intersections around the Main Post and Fort Belvoir North operated at LOS E or worse during at least one peak hour. Under predicted conditions, 59 percent of intersections around the Main Post and Fort Belvoir North were expected to worsen and become more congested; 10 of those were expected to operate at LOS E or worse. Based on traffic counts from 2012-2103, actual conditions were better than predicted. A larger share of intersections has improved and became less congested, and fewer intersections than predicted operate at LOS E or worse during AM and PM peak hours. Congestion remains an issue, and three intersections still operate at LOS E or worse, but intersection traffic operations are better under actual conditions than predicted.

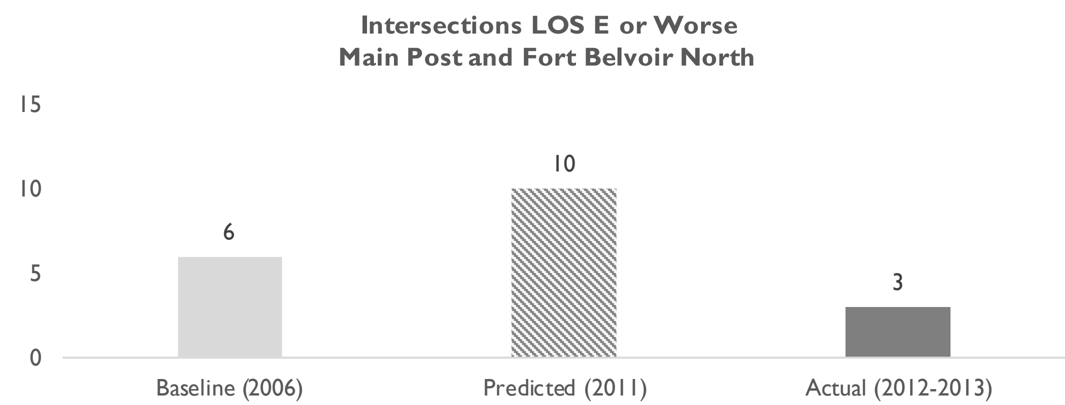


Figure 31: Intersections LOS E or worse near the Main Post and Fort Belvoir North [205]

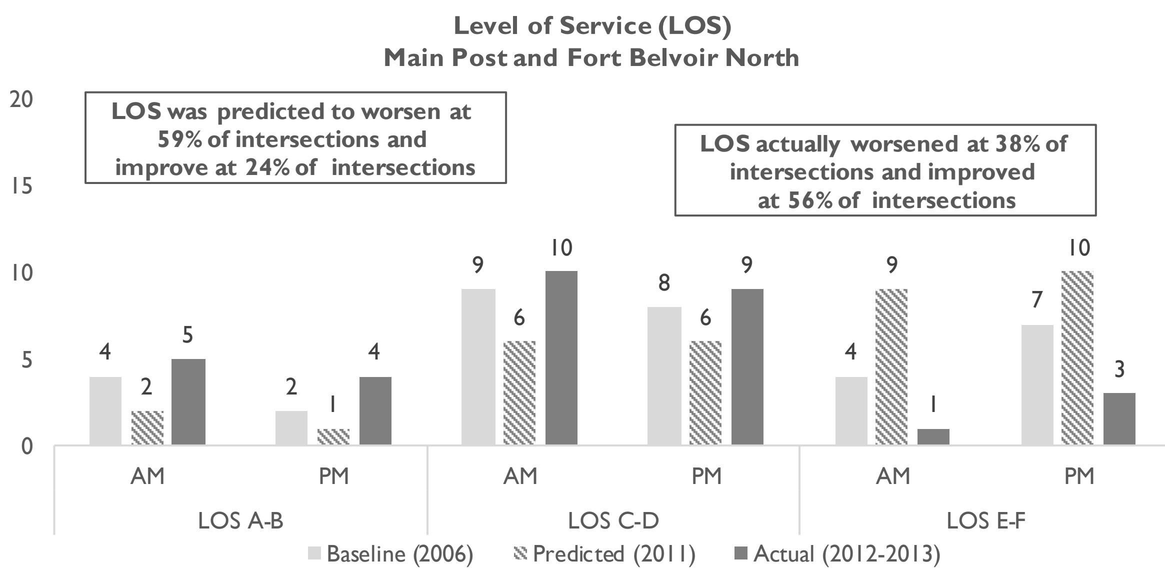


Figure 32: LOS at study area intersections near the Main Post and Fort Belvoir North [206]

A similar trend was observed at the Mark Center. Figure 33 and Figure 34 compare aggregate study area intersection LOS under baseline, predicted, and actual conditions. In the baseline condition, two out of seven study area intersections operated at LOS E or worse. In 2011, under predicted conditions, 71 percent of intersections were expected to become more congested, with three intersections expected to operate at LOS E or worse; none of the seven intersections analyzed were expected to become less congested.

As of 2014, actual conditions were significantly better than predicted conditions. Worsening LOS was observed at just over 40 percent of intersections and improvements were seen at nearly 60 percent of intersections. Congestion is still an issue—two intersections operate at LOS E or worse—but not to the extent predicted.

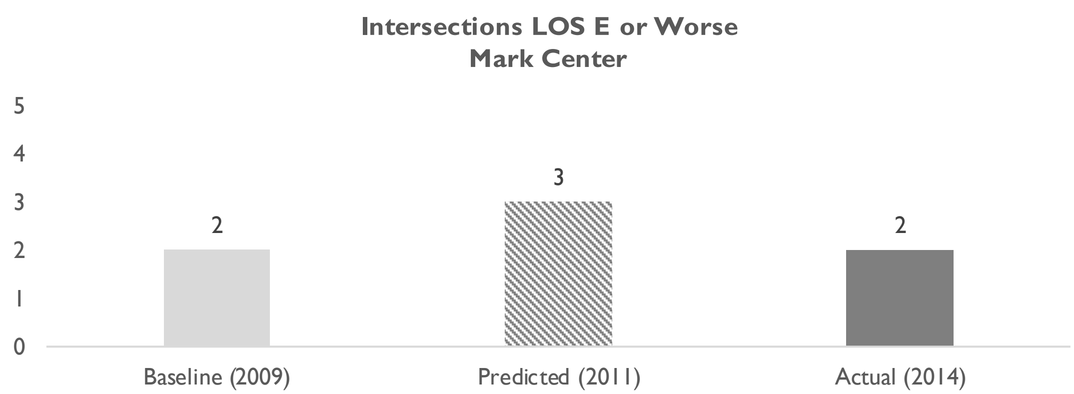


Figure 33: Intersections LOS E or worse near the Mark Center[207]

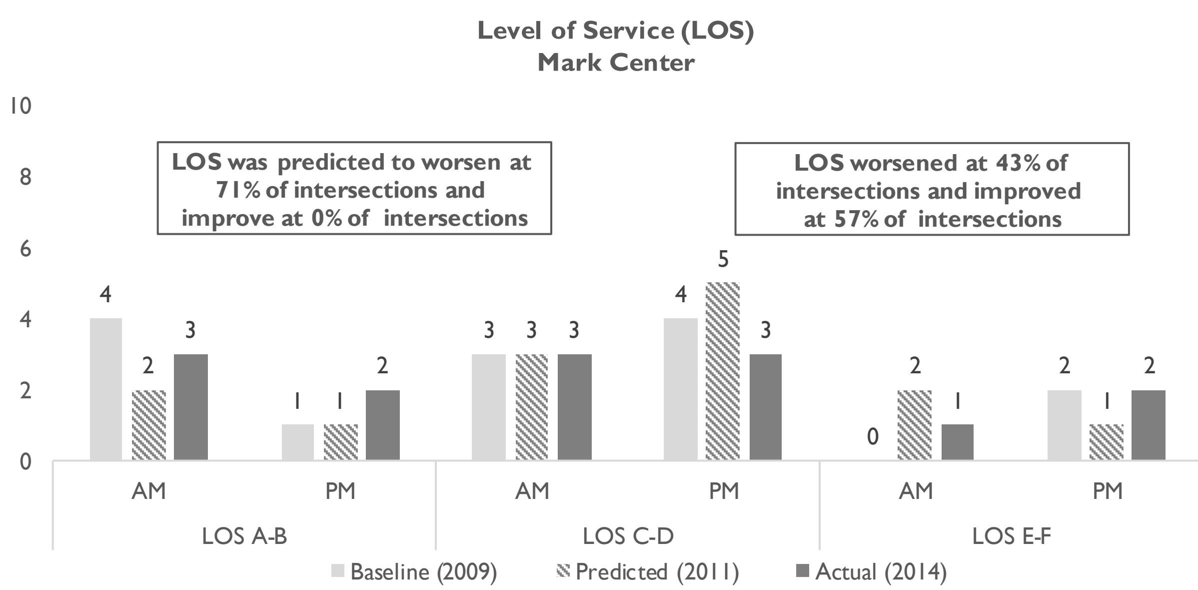


Figure 34: LOS at study area intersections near the Mark Center[208]

At the Main Post and Fort Belvoir North, mode splits were available from two sources: a survey of personnel and through the U.S. Census American Community Survey (ACS). Mode splits from these sources are shown in Table 17 and Table 18 as well as in Figure 35 and Figure 36. Both sources show small declines in the share of personnel driving alone and increases in the share using transit; they also recorded a small increase in the share of personnel walking and biking.

Table 17: Mode splits at the Main Post and Fort Belvoir North, Personnel Survey[209]

Mode Splits	Baseline (2008)	Predicted	Actual (2013)
Drive Alone	84.8%	60.0%	83.0%
Carpool/Vanpool	9.9%	*Missing data*	8.0%
Transit	4.0%		6.0%
Walk, Bike, Drop Off	0.7%		2.0%
Other	0.6%		<1%

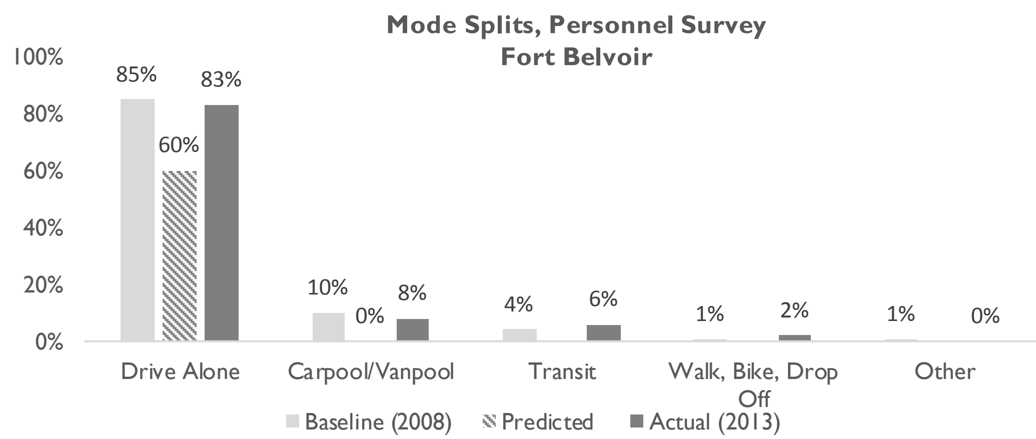


Figure 35: Mode splits at the Main Post and Fort Belvoir North, Personnel Survey[210]

Table 18: Mode splits at the Main Post and Fort Belvoir North, ACS[211]

Mode Splits	Baseline (2006-2010)	Predicted	Actual (2011-2015)
Drive Alone	81.0%	60.0%	76.5%
Carpool/Vanpool	7.2%	*Missing data*	8.4%
Transit	6.7%		8.8%
Walk	1.5%		2.6%
Bike and other	1.9%		2.4%
Telework	1.8%		1.3%

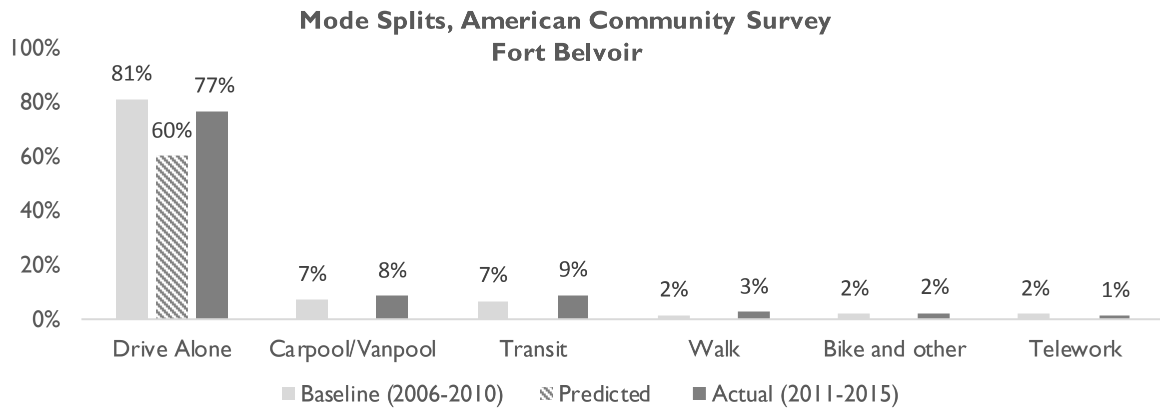


Figure 36: Mode splits at the Main Post and Fort Belvoir North, ACS[212]

At the Mark Center, analysis of baseline, predicted, and actual mode splits suggest that mitigation efforts have seen some early success; Table 19 and Figure 37 show mode splits at the Mark Center during each period. Despite the relocation of personnel to a less transit-accessible location, the share of personnel using transit has remained constant. Additionally, the share of personnel using rideshare has increased more than expected. Driving alone has not declined to the level predicted and is slightly higher than baseline levels, but, as discussed previously, the effect on peak traffic volumes has not been significant and volumes have decreased overall.

Table 19: Mode Splits at the Mark Center, Personnel Survey[213]

Mode Splits	Baseline (2009)			Predicted (2011)	Actual (2012)
	This Mode Only	This Mode, with Other Modes	Total Using This Mode		
Drive Alone	40.8%	14.3%	55.1%	57.0%	66.0%
Carpool/Vanpool	9.2%	10.0%	19.1%	11.0%	15.0%
Transit	17.6%	40.9%	58.5%	28.0%	17.0%
Walk, Bike, Drop Off	1.8%	6.4%	8.2%	4.0%	2.0%

Note: Baseline (2009) mode splits add up to less than 100 percent. Baseline figures are from the U.S. Army Corps of Engineers' 2010 TMP for BRAC 133 (Mark Center), which noted that values did not total to 100 percent as respondents were given the option of selecting more than one mode of travel.

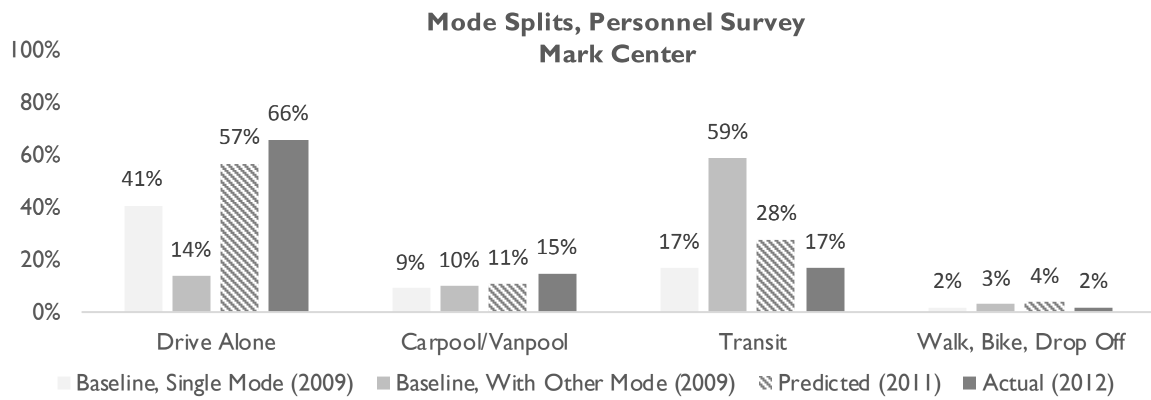


Figure 37: Mode splits at the Mark Center, Personnel Survey[214]

3.2.C. Findings

Overview

The expansion of Fort Belvoir and the creation of a new campus at the Mark Center brought changes to the surrounding communities and roadway network. The Main Post and Fort Belvoir North both significantly expanded the number of on-site employees, while the Mark Center realignment relocated many personnel from sites easily accessible by transit to a site that is less accessible and located in an already congested area.

To manage the influx of personnel, major regional roadways were improved and a comprehensive TDM program was implemented for each site. Most personnel arrive and depart via drive alone private vehicles at all three Fort Belvoir sites, and the share of drive alone commuting exceeds the predicted levels at all three sites, despite TDM measures. Nevertheless, decreases in general background traffic levels and implementation of major roadway improvements, many recently completed and others still in progress, have enabled the system to handle the increased volume.

Facility Changes

- Actual personnel growth at Fort Belvoir and the Mark Center fell short of the predicted growth just after BRAC implementation in 2011, due in part to slower than expected increases at the Mark Center. In response to community concerns, personnel were added to the Mark Center at a slower rate than initially proposed. Personnel were relocated in phases, with relocation of all 6,400 personnel not completed until the end of 2012.

Transportation Demand

- At the Main Post and Mark Center, AADT trends were generally consistent with nationwide VMT trends.
- Peak hour traffic volumes were predicted to increase significantly around the Mark Center as a result of BRAC 2005 implementation. However, based on current available data, the predicted increase has not occurred. According to VDOT, this is likely because background traffic in the area has decreased during the period coinciding with the Mark

Center realignment. Even though the Mark Center generated new traffic from the BRAC 2005 implementation, that traffic accounts for only a small share of the total vehicles using the surrounding roadways.

- At the Main Post, AM peak hour gate volumes increased by 38 percent, with the largest increase seen at gates located along or near U.S. Route 1. Personnel at the Main Post increased by approximately 3,400, or 13 percent above the baseline of 26,000. Considering that the share of employees driving alone also dropped from 81.0 percent to 76.5 percent, the rise in gate volumes may be the result of additional personnel, patients, and visitors accessing the new medical center.
- New travel options were added at the Main Post and Fort Belvoir North, resulting in a small increase in transit mode share from 6.7 percent to 8.8 percent, while carpool and vanpool mode share also increased from 7.2 percent to 8.4 percent. Nevertheless, public transit remains a less convenient mode for most personnel because transit travel time is much greater than driving, and peak hour transit service is variable.
- At the Mark Center, transit mode share dropped well below the level achieved at predecessor worksites, which generally had much better transit access. About 59 percent of Mark Center employees had ridden transit for at least a portion of their commute to the predecessor worksites, but only 17 percent used transit to the Mark Center. Achieving even this level of transit ridership is attributable to new shuttles connecting nearby Metrorail stops, expanded bus options, and a new on-site bus transit station.

Mitigation Measures

- Most mitigation projects have focused on roadway improvements such as widening roadways or adding new access points. Because these projects are often costly, securing enough resources prior to BRAC implementation in 2011 was difficult. As a result, most mitigation projects were completed after 2011 or are still underway.
- The most successful TDM strategy implemented has been the addition of shuttle service to the Mark Center from nearby Metrorail stations. The service has made it possible for personnel who previously commuted via Metrorail to continue to use public transit.
- While parking restrictions were part of TDM strategies at each site, they did little to reduce the share of personnel driving alone. This is likely because the restrictions did not substantially limit parking for single-occupancy vehicle travel. Discussions with various stakeholders indicated that further revisions to parking restrictions are not currently under consideration. Instead, despite an initial cap of 2,000 spaces, the Mark Center has increased its parking supply to 3,200 to be closer to what was initially planned.[215]
- Approximately 40 percent of Mark Center staff have reported that they take advantage of opportunities to telework or work off-site, although most do so infrequently (generally one or two times per month).[216]

Transportation Impacts

- At all of Fort Belvoir's three sites, LOS at key intersections improved more than expected. Congestion is still an issue in some areas, but predictions that overall LOS would worsen were not realized.
- The difference between actual and predicted LOS was most evident at the Mark Center. Compared to predicted impacts—that none of the seven intersections would experience improved LOS—nearly 60 percent of intersections saw a reduction in overall delay even though several mitigation projects are incomplete. The improvements in LOS are likely related to the declines in overall general peak traffic volume in the study area observed by VDOT for their 2014 report.
- At the Mark Center, the shuttles and the transit center have likely made it possible to maintain some transit mode share despite a move to a less transit-accessible location.

Data and Analysis Issues

- Since predicted mode splits were not available at the Main Post and Fort Belvoir North, analysis of the effectiveness of TDM strategies relative to predictions was limited.
- Because multiple projects are underway or have recently been completed, additional data is needed to understand their impact. This is already underway in Alexandria, Virginia, where the Mark Center is located, as the local department of transportation is currently working on a traffic study of the area.
- Data on peak hour traffic volumes around the Main Post and Fort Belvoir North was unavailable. As a result, transportation impacts beyond vehicular LOS could not be assessed.
- Walking and biking volumes were not available at any of the three Fort Belvoir sites. Judging from the walking and biking mode splits, it is likely that these volumes are small. Nevertheless, additional data would provide a more comprehensive understanding of the surrounding transportation network.

3.3. FORT MEADE

Fort Meade is located in Anne Arundel County, Maryland, roughly halfway between Washington, D.C. and Baltimore. The 5,500-acre facility is in a suburban area, and it accommodates 117 units from the U.S. Army, Navy, Air Force, Marines, and Coast Guard. Fort Meade is a center for federal cyber-security operations in the United States and hosts several federal agencies including the National Security Agency (NSA), United States Cyber Command, Defense Information School (DINFOS), and the Defense Information Systems Agency (DISA). [217] This combination of units means that Fort Meade essentially functions as both an active duty military base and a civilian employment center.

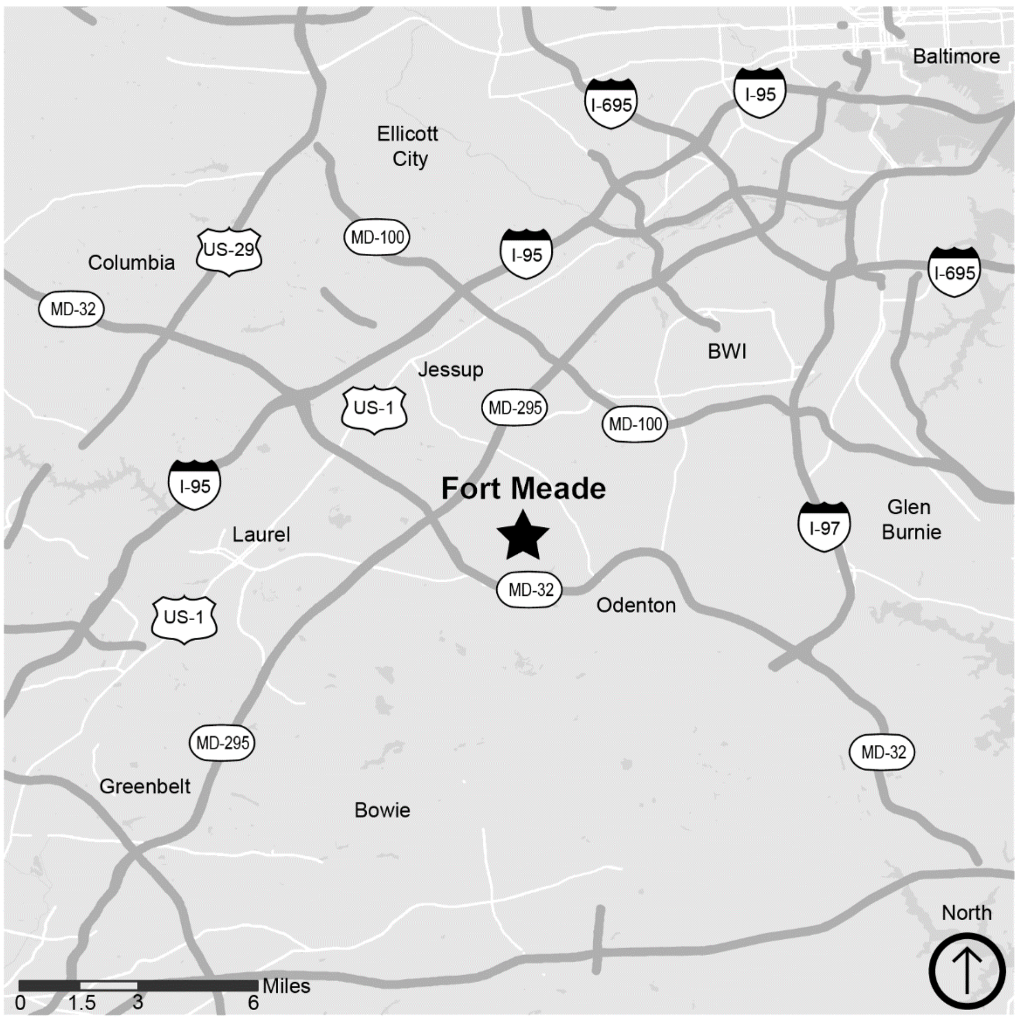


Figure 38: Regional map, Fort Meade

With nearly 57,000 personnel, Fort Meade is the largest employer in Maryland, the third largest workforce of any U.S. Army installation, and contributes an estimated $17 billion per year to local, state, and regional economies. [218] The population of Anne Arundel County was approximately 540,000 in 2010;[219] the Maryland Department of Planning predicted that it would grow by about 15 percent to nearly 630,000 by 2040.[220] Owing largely to the presence of multiple federal agencies at Fort Meade, the federal government and the defense industry are major employers and a significant part of Anne Arundel County's local economy.

3.3.A. Case Study Update

Baseline Condition – Existing condition prior to BRAC implementation

This section outlines baseline conditions at Fort Meade prior to the 2011 implementation of BRAC 2005. Some of conditions described still exist and others, discussed in later sections, have changed.

Facility Profile

Prior to implementation of BRAC 2005, Fort Meade hosted approximately 80 partner organizations from the U.S. Army, Navy, Air Force, Marines, and Coast Guard, as well as several federal agencies, such as the NSA and DINFOS. Approximately 40,000 military and civilian personnel were employed across all partner organizations on the 5,500-acre campus.[221]

Transportation System Condition and Performance

Roadway Access and Traffic Conditions

Fort Meade is located in western Anne Arundel County approximately 17 miles southwest of Baltimore, Maryland and 24 miles northeast of Washington, D.C. The facility is bounded by Patuxent Freeway (MD 32) and Fort Meade Road (MD 198) to the southwest, Annapolis Road (MD 175) to the northeast, and Baltimore-Washington Parkway (MD 295) to the north. Primary highway access is provided by I-95, MD 32, and MD 295. Several access roads connected the regional highway network though Fort Meade, including Rockenbach Road and Mapes Road.[222]

Nearby highway, local, and state roads were at or exceeding capacity prior to BRAC 2005. According to the 2005 *Fort Meade Comprehensive Expansion Master Plan*, MD 175, which provided access to the main gate at Reece Road, was the facility's most significant congestion issue, with peak hour traffic volumes ranging from 500 to just over 1,100.[223] Peak period congestion was also an issue on MD 295 and MD 32 near I-95.[224]

Level of Service (LOS) measures from a 2004 Anne Arundel County study of MD 175 and the 2007 FEIS found that most intersections near the facility operated at LOS C or better during peak hours (see Table B14). Only two intersections, one on MD 175 and one on Ridge Road operated at LOS E or worse during the PM peak hour. Table B15 shows LOS at 11 intersections near Fort Meade.

Gates/Entry Points to the Facility

Fort Meade could be accessed by eight gates. Three of these access points were for NSA personnel only. On average, just over 37,500 vehicles entered the gates each weekday in 2006.

Table 20 shows the average weekday inbound gate volume as well as the AM peak hour inbound volume. Two NSA gates, one at MD 295 and one at MD32 and Samford Road, had the highest entering volumes.

Table 20: Inbound gate volumes at Fort Meade[225]

Gate	Baseline (2006)	
	Weekday Average Traffic	AM Peak Hour (8 to 9 AM) Volume
MD 295 Baltimore-Washington Parkway (NSA)	8,459	1,398
MD 32 (Patuxent Freeway) and Canine Road (NSA)	4,401	793
MD 32 (Patuxent Freeway) and Samford Road (NSA)	6,246	1,565
MD 32 (Patuxent Freeway) and Mapes Road	4,609	558
MD 32 (Patuxent Freeway) Truck Gate	1,359	139
MD 175 (Annapolis Road) and Rockenbach Road	4,722	601
MD 175 (Annapolis Road) and Reece Road (Main Gate)	3,430	489
MD 175 (Annapolis Road) and Mapes Road	4,345	692
TOTAL	**37,571**	**6,235**

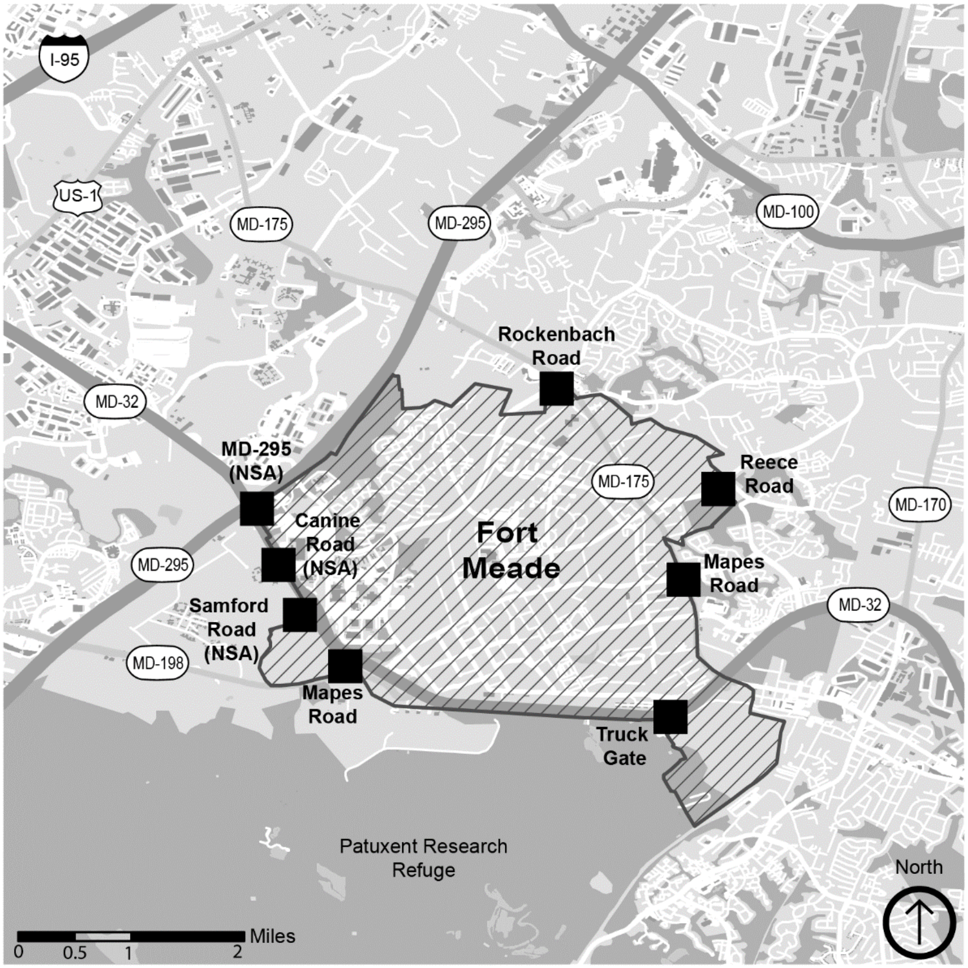


Figure 39: Gate locations, Fort Meade

Public Transit

Prior to implementation of BRAC 2005, public transit access options directly to Fort Meade were limited. Rail transit did not directly serve the facility and personnel needed to transfer to buses to reach the facility. Because of Fort Meade's suburban location, large size, distance from transit, and lack of pedestrian infrastructure, less than one percent of personnel used transit to reach the facility in 2010.[226]

There were several commuter rail stations within 10 miles of Fort Meade. Maryland Commuter Rail (MARC) stations at Odenton and Baltimore Washington International – Thurgood Marshall Airport (BWI) on the Penn Line and Savage, Laurel, and Jessup on the Camden Line were located two to eight miles away. Maryland Transit Administration's (MTA) Central Light Rail was available at the Cromwell/Glen Burnie or BWI Business District stations approximately eight miles to the north. Amtrak service was available 10 miles away at BWI. WMATA's Metrorail stations were located further away – New Carrollton Station on the Orange Line was nearly 20 miles away and the Greenbelt Station on Green Line was approximately 25 miles away.[227]

Because of Fort Meade's distance from rail transit stations, any personnel riding rail transit needed to make a transfer to a bus to complete the last miles of their commute. MTA, WMATA, Howard

County Transit, and Central Maryland Regional Transit (CMRT) provided a total of 11 bus routes near Fort Meade. However, only two routes, CMRT's K and F Routes, directly served Fort Meade and the NSA. Fort Meade was also served by private shuttles, including the LINK shuttle between BWI and NSA, NSA shuttles from the Odenton and Savage MARC stations, a pilot shuttle program connecting Fort Meade to the Odenton and Savage MARC stations, and the DINFOS shuttle that circulated within the facility.[228]

Pedestrian and Bicycle

Prior to implementation of BRAC 2005, there were limited pedestrian and bicycle facilities both within and around Fort Meade. Outside the facility, few roadways were served by sidewalks or dedicated bicycle lanes. Jogging paths were available within the facility but sidewalks were extremely limited and not connected throughout the facility.[229] The lower-density, suburban character of the facility and the surrounding area, coupled with limited pedestrian and bicycle facilities, resulted in a very low share, less than one percent, of personnel walking or bicycling to and from Fort Meade.

Parking

Meeting parking demands was a challenge prior to implementation of BRAC 2005. Personnel relied on surface parking lots, which often did not meet demand. While information on the total amount of parking was not available from the U.S. Army, external sources estimated the number of spaces at approximately 22,000, to serve an estimated 40,000 military and civilian personnel.[230]

Travel Behavior

Before BRAC 2005 was implemented, nearly all personnel (approximately 90 percent), lived in Maryland. Most personnel, just under 60 percent, lived in Anne Arundel County.[231] Approximately 30 percent of personnel arrived from west of the facility via MD 32, 20 percent from the east, and 35 percent from the north via MD 295. The average commute length was about 20 miles in each direction.[232] Because of Fort Meade's suburban location and its poor multimodal access, nearly 90 percent of personnel commuted to the facility by driving alone.[233] Baseline mode split is shown in Table 21, based on both a travel survey of Fort Meade personnel and U.S. Census American Community Survey (ACS) data for personnel who live on-base.

Table 21: Baseline mode split at Fort Meade, based on personnel survey and ACS

Mode	Survey (2007) [234]	ACS (2006-2010)[235]
Drive alone	89%	72%
Carpool/Vanpool	9%	12%
Transit	1%	3%
Walk/Bike	1%	11%
Telework		3%

Safety Record

Comprehensive crash data for the Fort Meade study area was unavailable for the period immediately prior to BRAC 2005 implementation. Crash data was available, however, for the MD 175 corridor for the years 2002-2004; during this period, crash rates along MD 175 from

Telegraph Road to MD 295 were higher than Maryland's statewide average. Specifically, left turn and injury crashes were significantly higher than the state average between Reece Road and MD 295. Table 22 shows the three-year average total crash rates compared to statewide averages.[236]

Table 22: Crashes along MD 175 from MD 170 to MD 205, January 1st, 2002 through December 31st, 2004[237]

Roadway Segments	2004	
	3-Year Average Total Crash Rate (per 100 million vehicle miles)	Statewide Average Total Crash Rate for Similar Roadways (per 100 million vehicle miles)
MD 175 (Annapolis Road) between MD 10 (Arundel Expressway) and MD 32 (Patuxent Freeway)	265.4	307.8
MD 175 (Annapolis Road) between MD 32 (Patuxent Freeway) and Reece Road	282.7	343.1
MD175 (Annapolis Road) between Reece Road and Rockenbach Road	252.5	218.5
MD 175 (Annapolis Road) between Rockenbach Road and MD 295 (Baltimore-Washington Parkway)	252.3	195.3

Predicted Condition – Projected Future Conditions

Facility Realignment Plan

The BRAC 2005 realignment plan for Fort Meade entailed the relocation of three defense agencies, Defense Information Systems Agency (DISA), Defense Media Activity (DMA), and Defense Adjudication Activities, to Fort Meade. As a result of these relocations, Fort Meade was expected to gain 5,700 personnel by 2013. Most new personnel, approximately 75 percent, were affiliated with DISA.[238]

In addition to BRAC 2005, other expansion efforts were expected to be implemented concurrently at Fort Meade, including an NSA staff expansion of approximately 800 personnel per year between 2008 and 2015, development associated with the U.S. Army's enhanced use lease (EUL) program, and the creation of the U.S. Cyber Command. The U.S. Army's EUL program leases underused land to private developers to fund construction on federal property. At Fort Meade, EUL actions would allow private companies to lease and develop 173 acres of land on the eastern side of the facility; these actions were expected to add up to two million square feet of private development to Fort Meade.[239] In 2009, plans were announced to create the U.S. Cyber Command. The command, charged with consolidating existing cyber resources, was established at Fort Meade in 2010. It was estimated that U.S. Cyber Command would employ approximately 2,800 personnel by the end of 2016.[240]

Considering all BRAC and non-BRAC actions, personnel levels at Fort Meade were expected to grow by over 50 percent. The number of personnel at Fort Meade was expected to grow by approximately 22,000 between 2009 and 2015, with the facility exceeding 60,000 total personnel by the end of 2015.[241]

Predicted Transportation System Performance – Future Build Conditions

This section describes the predicted impacts of BRAC 2005 on the areas surrounding Fort Meade. Because of the similar timeline and the significant effects expected from the NSA expansion and EUL program, these are included in the future predictions along with the BRAC 2005 impacts. The creation of the U.S. Cyber Command, however, is not included in the predicted conditions because it was not proposed until 2010, well after the completion of the major documents predicting future impacts.

Traffic Impacts and Mitigation

According to Maryland State Highway Administration (SHA), the number of cars using MD 175 each day was expected to increase dramatically during the period coinciding with the BRAC 2005 realignment and proposed EUL actions.[242] rease by as much as 80 percent.

Table 23 shows predicted peak hour roadway volumes along the individual segments of MD 175 that pass in front of Fort Meade. Along these segments, SHA predicted that roadway volumes would increase by as much as 80 percent.

Table 23: Baseline vs. predicted future build peak hour traffic volumes along MD 175[243]

Roadway Segment		Baseline (2005)		Predicted Future Build (2011)			
		AM Peak Hour (8 to 9 AM) Volume	PM Peak Hour (5 to 6 PM) Volume	AM Peak Hour (8 to 9 AM) Volume	PM Peak Hour (5 to 6 PM) Volume	% Change	
MD 175 (Annapolis Road) and Rockenbach Road	Northbound	1,130	860	1,405	1,260	24%	47%
	Southbound	680	980	1,145	1,460	68%	49%
MD 175 (Annapolis Road) and Reece Road	Northbound	655	825	965	1,490	47%	81%
	Southbound	690	665	955	1,000	38%	50%
MD 175 (Annapolis Road) and Mapes Road	Northbound	750	850	1,110	1,565	48%	84%
	Southbound	500	760	850	1,030	70%	36%

Predicted increases in volume were expected to cause roadways to reach or exceed capacity. The U.S. Army Corps of Engineers' 2007 FEIS predicted significant worsening in LOS after implementation of BRAC and the proposed EUL actions. Table B17 compares baseline LOS to predicted future build LOS based on the predicted impacts of BRAC and the proposed EUL actions. LOS at all 11 intersections was expected to deteriorate during at least one peak hour. Ten out of 11 intersections were expected to operate at LOS E or below during at least one peak hour.

A 2009 study commissioned by the U.S. Army for the BRAC 2005 implementation at Fort Meade determined that roadway improvements were necessary to prepare surrounding roads to carry increased volumes.[244] To address these needs from the expected growth at Fort Meade, SHA proposed the following program of short and long-term roadway improvement projects.

MD 175 Corridor Improvements

SHA conducted a planning study in 2010 to identify roadway and traffic operations improvements on MD 175 between MD 295 and Telegraph Road (MD 170). The project was designed to accommodate future transportation needs in and around Fort Meade and improve connectivity between Odenton and MD 295. It was expected to improve roadway capacity, traffic operations, intermodal connectivity, and pedestrian safety.[245]

MD 175 Intersection Improvements

SHA developed intersection improvements for three intersections along MD 175 near Fort Meade. The improvements, described in

Table 24, were expected to improve the flow of traffic into and out of Fort Meade by providing additional lanes for critical intersection movements.

Table 24: Proposed intersection improvements along MD 175[246]

Intersection	Improvements
MD 175 at Rockenbach/Ridge Roads to Disney Road/26th Street	• Widen MD 175 to accommodate double left turn and exclusive right turn lanes in eastbound and westbound direction • Widen Ridge Road by one lane to accommodate a second through lane onto Rockenbach Road • At 26th Street/Disney Road, widen MD 175 to accommodate double left turn lane in eastbound direction and double through lanes in both directions
MD 175 at Mapes Road/Charter Oaks Boulevard	• Widen MD 175 to add exclusive left and right turn lanes and a 4-foot bike compatible shoulder • Adjacent to Fort Meade, add second left-turn lane from westbound MD 175, an exclusive right-turn lane from eastbound 175, and a free right-turn lane exiting the facility from Mapes Road onto eastbound MD 175
MD 175 at Reece Road	• Widen each leg of intersection to include exclusive left and right turn lanes on MD 175 and a 4-foot bike compatible shoulder • On Reece Road, add an exclusive right-turn lane from eastbound MD 175 to the facility entrance

MD 198 Corridor

SHA proposed widening MD 198 between MD 295 and MD 32 from a two-lane roadway to a four-lane divided roadway with a bicycle lane and a shared-use pedestrian/bicycle path. The project was expected to improve roadway capacity and traffic operations, enhance access to Fort Meade, and increase the safety of drivers, bicyclists, and pedestrians.[247]

Transit Impacts and Mitigation

A 2010 study conducted by WMATA showed that less than one percent of personnel commuted to Fort Meade by transit prior to implementation of BRAC 2005. In the absence of transit system improvements as part of a mitigation program, no significant increases in transit ridership were anticipated fin the future build scenario.[248] If transit services were improved as part of a mitigation program, however, WMATA estimated that mode share could increase by one to five percentage points.[249] In their TDM plans, officials from Fort Meade predicted a similar increase, with a transit mode share target of three percent assuming improvements are made.[250] To accommodate growth at Fort Meade and encourage a larger share of personnel to use transit, the following service changes were proposed by WMATA:

- Increase frequency of CMRT Route F, add a route variant that better serves Fort Meade
- Implement direct local bus service to and from Piney Orchard and Columbia Gateway
- Restructure and extend CMRT Route K
- Implement express bus service to/from Annapolis, to/from Greenbelt Metrorail Station, to/from Gaithersburg via Intercity Connector, and to/from Brooklyn Park and Glen Burnie
- Improve connections to Odenton MARC station with new public shuttle service and new local service to and from Crofton, Severna Park, and Piney Orchard
- Improve connection to Savage MARC station with new public shuttle service
- Improve Greenbelt Metrorail Station connection with BWI Business Partnership shuttle[251]

Because of Fort Meade's size, WMATA also recommended creating a transit center at the Reece Road gate. Public transit buses were not expected to operate within Fort Meade because of security concerns, so personnel using transit would need to transfer to on-base shuttles to reach their destinations.

Pedestrian and Bicycle Impacts and Mitigation

Like the transit system predictions, pedestrian and bicycle travel to and from Fort Meade was not expected to change significantly from its very low baseline level in the absence of any pedestrian and bicycle system improvements. While some improvements to pedestrian and bicycle facilities were proposed as part of implementing BRAC 2005, they were not expected to have a significant impact on mode split. Some proposed roadway projects, such as improvements to MD 175 and MD 198, included new facilities for pedestrians and bicyclists. Within Fort Meade, the U.S. Army noted that it intended to improve pedestrian and bicycle facilities along base's internal roadways by creating a network of interconnected sidewalks, shared use paths, and bicycle routes.[252] These improvements were intended to expand pedestrian and bicycle access, especially internally, but were not expected to significantly affect commuting modes.

Travel Demand Management Strategies

To minimize the impacts of BRAC 2005 actions on surrounding communities and preserve roadway capacity, the U.S. Army at Fort Meade aimed to reduce private vehicle trips from 90 percent to approximately 73 percent. Travel demand strategies to meet the goals included:

- *Adding shuttle services* to encourage a larger share of personnel to use transit. In 2009, non-NSA Fort Meade personnel were given permission to use NSA shuttles. It was expected that more shuttle service would be needed, and proposals have been made to add shuttles connecting the facility to nearby rail stations. [253]
- *Limiting parking*, with space for only 60 percent of building occupants. [254]
- *Continuing to offer voluntary commuter programs for personnel* to encourage alternatives to private vehicles.[255]
- *Launching subscription bus service* that will provide point to point service based on user needs and allow personnel to use their travel time productively.[256]

Because Fort Meade lies outside of the National Capital Planning Commission's (NCPC) jurisdiction, the U.S. Army was not required to create a transportation demand management (TDM) plan. Instead, each organizational unit at Fort Meade was tasked with developing and implementing their own TDM plans consistent with the goal of reducing private vehicle trips.[257]

Travel Behavior

Many of Fort Meade's incoming personnel previously lived and worked in northern Virginia. According to a survey conducted as part of Howard County's Transit Demand Plan, nearly 60 percent of commuting personnel said they would commute to Fort Meade from their current homes rather than moving closer.[258] Although the TDM recognized the challenges of getting personnel to switch from private drive-alone vehicles to a different commuting mode, target mode splits aimed to reduce the share of personnel driving alone to approximately 73 percent, from its baseline level of nearly 90 percent. Table 25 shows Fort Meade's predicted mode split.

Table 25: Predicted mode splits at Fort Meade, predicted future build conditions[259]

Mode	Predicted (2011)
Drive alone	73%
Carpool/Vanpool	9%
Subscription Bus	7%
Local Transit	2%
Rail Shuttle	1%
Telework	9%

To achieve this shift, personnel were encouraged to join a carpool or vanpool or to try a new subscription bus service. Where possible, personnel were also encouraged to telework. While Fort Meade's mitigation program included investments in local transit, such as the addition of shuttles from rail stations, the rail and local transit mode share was expected to remain low.

Actual Condition – Measured post-BRAC implementation conditions

The following section discusses actual post-BRAC measured conditions in and around Fort Meade. Most of the projections in the previous section were made for 2011, and many of the conditions described in the following section document conditions between 2011 and 2016. Actual post-BRAC data and performance measures as close as possible to 2011 have been used.

Actual Post-BRAC Facility Profile

As of 2016, Fort Meade employed approximately 57,000 personnel, and the military units have generally grown as predicted.[260] The Defense Information Systems Agency (DISA), Defense Media Activity (DMA), and Defense Adjudication Activities units all relocated to Fort Meade in 2011 as part of BRAC 2005 implementation. Relocation of these three organizations added approximately 5,600 personnel: DISA brought 4,300 personnel to a new 1.1 million square foot headquarters, DMA added 600 personnel and constructed a new 185,000 square foot headquarters, and Defense Adjudication Activities relocated 760 personnel to a new 150,000 square foot facility.[261]

Other facility expansion initiatives have also increased employment at Fort Meade. Growth at the NSA added approximately 6,700 personnel as of 2016. In 2010, the U.S. Cyber Command was established at Fort Meade and, while not included in many BRAC studies, the organization added approximately 1,800 jobs to Fort Meade between 2010 and 2014. In the coming years, growth at U.S. Cyber Command is expected to add another 3,000 personnel (4,800 total) to Fort Meade.[262]

EUL development, which allows private sector entities to lease underutilized land on the facility, has been delayed. Initial predictions estimated that up to 10,000 non-federal private sector personnel could be added, but delays in negotiating leases mean this growth has not yet occurred.[263] With negotiations still in progress, it is unclear how much personnel growth should be expected to result from EUL development.[264]

Actual Transportation Mitigation

Roadway Network Improvements

Roadway network improvements were necessary to accommodate growth in personnel at Fort Meade. While only 5,600 personnel relocated to Fort Meade as a direct result of BRAC, growth due to the expansion of the NSA and the establishment of U.S. Cyber Command began at the same time as BRAC 2005 and continues today. Because of the extended and overlapping timeframes for growth at Fort Meade, many of the roadway improvements were developed to address both BRAC and non-BRAC related growth, and have entailed long planning and project development schedules.

Due to the high levels of peak period congestion on MD 175 and its importance for access to Fort Meade, most of the major roadway improvements focused on increasing the capacity of MD 175, especially at base access points. In 2014, U.S. DOT awarded SHA a $10 million TIGER grant to help complete a program of roadway capacity and multimodal access improvements along MD 175. Because of the large scope of the improvements, many are still under construction.

Projects Completed After 2011

1. **Widen MD 175 from MD 295 to Rockenbach Road.** In 2012, SHA completed a $6 million project to widen of MD 175 from MD 295 to Rockenbach Road (Project 1, Figure 40). SHA received supplemental private funding from the developer of the nearby Parkside project, who agreed to fund must of the project as part of their own traffic mitigation efforts.[265]
2. **MD 175 Intersection Improvements from Ridge/Rockenbach Roads to Disney Road/26th Street.** SHA's proposed improvements to the intersections at Ridge Road/Rockenbach Road and Disney Road/26th Street were completed in 2014 (Project 2, Figure 40).[266]
3. **Odenton Town Center Master Plan.** Odenton, adjacent to the southeast side of Fort Meade, was named a BRAC Revitalization and Incentive Zone in 2008 by the state of Maryland (Project 3, Figure 40). In April 2016, Odenton adopted the Odenton Town Center Master Plan, which was developed partly in response to the growth of Fort Meade. The plan prioritizes development around the Odenton MARC Station and aims to create development conditions that will promote the use of transit by both residents and workers commuting into the area.[267]

In Progress

4. **Rockenbach Road Access Control Point.** In 2015, the U.S. Army, FHWA, and SHA began work to expand the capacity of the gate at Rockenbach Road (Project 4, Figure 40). The project entails a modernized, bullet-proof gate house and expanding the roadway capacity to four inbound lanes and two outbound lanes.[268]
5. **Widen MD 175 between MD 295 to MD 170.** The project to increase the capacity of MD 175 between MD 295 and MD 170 has been in the works since 2007; it is currently in the design engineering phase (Project 5, Figure 40).[269] The project will improve access to Fort Meade by widening 5.2 miles of MD 175 to six lanes and adding sidewalks, on-road bicycle facilities, and a trail.[270] This project, as well as the others involving MD 175, is part of SHA's Fort Meade Multimodal Accessibility Project that was awarded a $10 million TIGER grant in 2014.[271]
6. **MD 175 Intersection Improvements from Reece Road to Mapes Road/ Charter Oaks Boulevard.** SHA's proposed intersection improvements to Reece

Road and Mapes Road/Charter Oaks Boulevard were combined into one project expected to be completed in spring 2018 (Project 6, Figure 40). The project will entail intersection capacity improvements along 0.6 miles of MD 175 between Reece Road and Mapes Road/Charter Oaks Boulevard. A new security fence and tree buffer alongside Fort Meade's property will also be implemented as part of the project.[272]

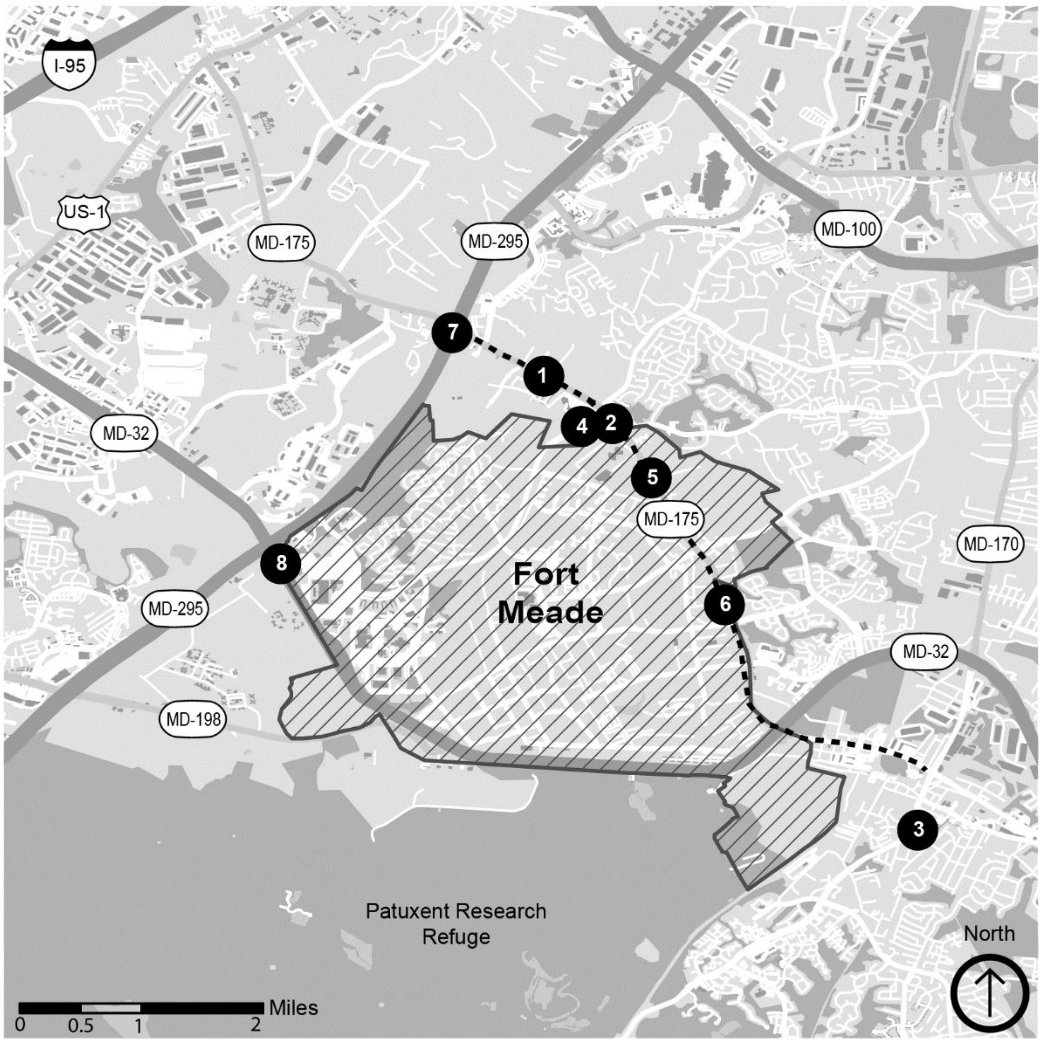


Figure 40: Project map, Fort Meade

7. **Improve Interchange at MD 175 and MD 295.** The interchange at MD 175 and MD 295 will be reconstructed. Portions of MD 175 will be widened from two to six lanes and ramps will be reconfigured to create signalized left-turns at MD 175 (Project 7, Figure 40). The project is currently in the design engineering phase, with construction planned to begin in 2019.[273]
8. **Increase Capacity of MD 198.** SHA is leading a project, currently in development, to increase roadway capacity and improve intersection operations at MD 198 and MD 295 (Project 8, Figure 40). Proposed improvements include roadway widening, ramp

widening, bicycle lanes, sidewalks, and a shared-use path along westbound MD 198. The project is currently in the design engineering phase.[274]

Travel Demand Management Strategies

At Fort Meade, officials developed a wide variety of travel demand management strategies to reduce the percentage of personnel commuting by private vehicle from 89 percent to the predicted target of 73 percent. In 2011, Fort Meade implemented several programs and initiatives designed to reach this goal. Fort Meade launched a website, MeadeRide, with comprehensive information on the base's broad range of TDM measures, including an internal shuttle available for all personnel; a shuttle to and from the Odenton MARC Station; guaranteed no-cost emergency ride home transportation; a mass transit fringe benefits program that offsets commuting costs (parking fees excluded); subscription bus service; and programs to incentive carpools and vanpools.[275]

An interagency group (comprising MTA, Regional Transportation Agency of Central Maryland, City of Laurel, Howard County, Prince George's County, and Anne Arundel County) is developing a Central Maryland Transit Development Plan. The plan will serve as a guide for developing public transit services over the next five years and is expected to recommend improvements in transit service that will benefit Fort Meade personnel.[276]

Community Involvement Process

As part of the environmental impact statement (EIS) process, the U.S. Army Corps of Engineers invited the public to participate in the scoping process and provide comments on the draft EIS through meetings, mailings, and email.[277] In addition to engaging with the community during the environmental review process, representatives from Fort Meade created the Fort Meade Regional Management Committee in March 2007 to enable ongoing coordination on BRAC 2005 implementation. The Committee includes representatives from local jurisdictions and oversees growth and development at and around Fort Meade. The Committee has continued to meet even though BRAC 2005 has been completed, and continues to work with local stakeholders to respond to the regional impacts and opportunities create by Fort Meade's growth.

In 2014, Fort Meade Alliance (FMA) worked with local stakeholders and SHA to secure a $10 million federal TIGER grant to widen MD 175. Currently, FMA is exploring options to transfer ownership of the MD 295 from the National Park Service to the State of Maryland to enable better management of the roadway.[278] Officials from Fort Meade have engaged with the BWI Business Partnership, the leading transportation management association in the region, to develop and improve shuttle service between regional transit centers.

Actual Transportation System Performance

Traffic Operations

Compared with baseline pre-BRAC conditions, overall traffic volumes have declined on MD 175. Table B18 shows baseline, predicted, and actual post-BRAC traffic volumes along MD 175. Some of the declines may be because construction at Rockenbach Road and MD 175 has caused vehicles to avoid that stretch of roadway. Decreases may also be the result of effective travel demand management strategies. Lower actual volumes compared to predicted volumes may be due to the fact that the most comprehensive data was available for 2012, a time that does not reflect the full magnitude of growth at Fort Meade.

Table B19 compares baseline, predicted, and actual post-BRAC LOS at intersections along MD 175. Compared to baseline pre-BRAC conditions, four intersections along MD 175 showed worse LOS in 2012. However, three of the four intersections had actual post-BRAC LOS that were the same as or better than the predicted LOS. Of these four intersections, three operated at LOS E or worse during at least one peak hour.

Congestion at surrounding intersections has remained the same or worsened, and roadways around Fort Made are still at or exceeding capacity. The actual measured LOS at many of the study area intersections, however, is better than the predicted. In part, this may be due to the fact that the predicted condition included EUL development, which has not yet been completed.

Transit Operations

Since implementation of BRAC 2005, transit agencies in the region have expanded the transit options serving Fort Meade. New shuttle services are running within Fort Meade and to nearby rail stations, bus service has expanded, and more MARC trains are running. Currently, four shuttles directly serve Fort Meade (see

Table 26). In 2011, MTA launched a new bus service, the Intercounty Connector (ICC). ICC's Route 202 provides service between the Gaithersburg Park and Ride Lot in Montgomery County, Maryland and Fort Meade. Transit agencies have increased train and bus frequencies, partly in response to expected growth at Fort Meade.[279]

Table 26: Shuttle service at Fort Meade

Shuttle	Route	Frequency
Fort Meade Internal Shuttle[280]	Internal	Hourly from 9 AM to 4PM
Fort Meade MARC Shuttle[281]	Fort Meade to Odenton MARC Station	Monday through Friday, hourly from 6 to 9 AM and 2 to 5:30 PM
DINFOS Shuttle[282]	Internal	Monday through Friday, hourly from 9 AM to 8 PM; Saturdays, hourly from 10 AM to 5 PM
BWI LINK Shuttle[283]	BWI Amtrak Station to NSA	Monday through Friday, every 30 minutes from 5:45 AM to 5:30 PM

Pedestrian and Bicycle Access Impacts

Because planned pedestrian and bicycle improvements have not yet been implemented, it is too early to tell if demand has been significantly affected by the changes associated with BRAC 2005.

Safety Impacts

Baseline and actual post-BRAC 2005 crash data was unavailable for the Fort Meade study area. However, in Anne Arundel County, approximately 8,144 crashes occurred in 2010, including 2,892 injury crashes, and 32 fatal crashes. This is a 10 percent reduction in overall crashes from 2009 figures (9,002 crashes).[284] Between 2011 and 2013, an average of 8,500 crashes occurred in

Anne Arundel County per year. This number is slightly higher than 2011 levels. An average of 3,000 crashes per year resulted in injury with an average of 38 fatal crashes during this period.[285]

3.3.B. Evaluation of Actual Versus Predicted Conditions

Facility Changes – Baseline v. Proposed Build v. Actual

Prior to implementation of BRAC 2005 actions, Fort Meade employed approximately 40,000 military and civilian personnel on the 5,500-acre campus. Under predicted conditions, which included both BRAC and concurrent non-BRAC actions, personnel levels were expected to grow by approximately 22,000 personnel between 2009 and 2015. As of 2016, Fort Meade has grown by nearly 17,000 to approximately 57,000 employees; this increase was about 24 percent lower than the 22,000 person increase that was predicted.

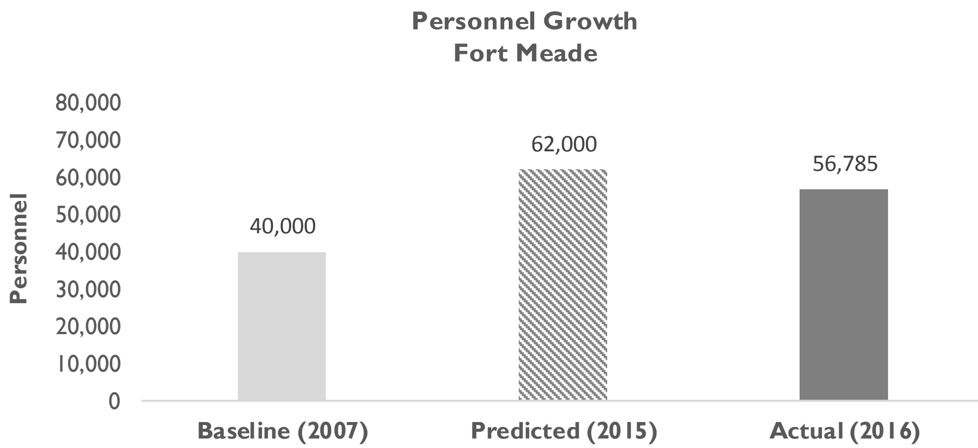


Figure 41: Personnel growth at Fort Meade[286]

Transportation Demand – Baseline v. Proposed Build v. Actual

Between 2005, when BRAC actions were first proposed, and 2014, when the latest AADT volumes are available, AADT declined along MD 175 and MD 32, two critical arterials serving Fort Meade. Traffic volumes were higher on MD 32 than on MD 175; each roadway experienced AADT reductions that were similar in magnitude. From 2005 to 2014, AADT declined by just over five percent on MD 175 near MD 295 and by approximately seven percent on MD 32 and Mapes Road. While MD 175 experienced a steady, gradual decline in volume between 2005 and 2014, MD 32 experienced a sharp reduction from 2006 to 2007, followed by a constant volume until 2012, then a sharp increase from 2012 to 2013. Figure 42 shows AADT from 2005 to 2014.

MD 175 near MD 295 is a five-lane major arterial with traffic signal spacing at more than ½ mile. According to FDOT's 2013 Quality/Level of Service Handbook, a four-lane divided major arterial reaches LOS D at an AADT of approximately 39,800. With AADT of approximately 25,000 vehicles per day, MD 175 was operating with volumes under this capacity, and operations better than LOS D. MD 32 around Mapes Road is a four-lane divided freeway. A four-lane divided freeway in an urbanized area reaches LOS D at an AADT of 74,400 vehicles per day. Therefore, MD 32 is currently under its LOS D capacity, and likely operates between LOS B and C.

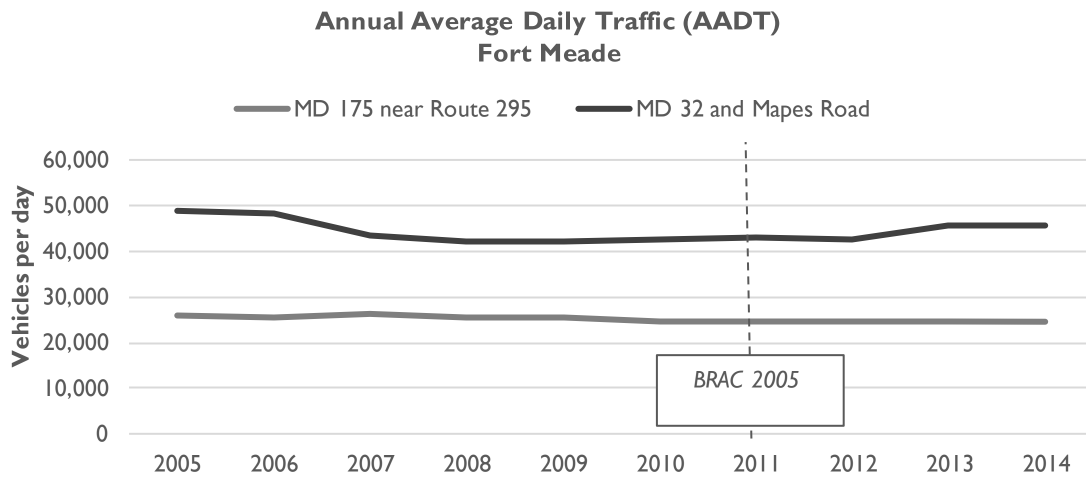


Figure 42: AADT from 2005 through 2014 around Fort Meade

Peak hour traffic data was available for all three conditions – baseline, predicted, and actual – at three locations along MD 175. Traffic volumes at these locations were predicted to increase by 40 to 56 percent during the AM peak and 52 to 67 percent during the PM peak. However, the data showed decreases in volume when comparing baseline and actual conditions (see Figure 43). Based on traffic counts from 2012, volumes decreased by 15 to 23 percent during the AM peak and one to nine percent during the PM peak.

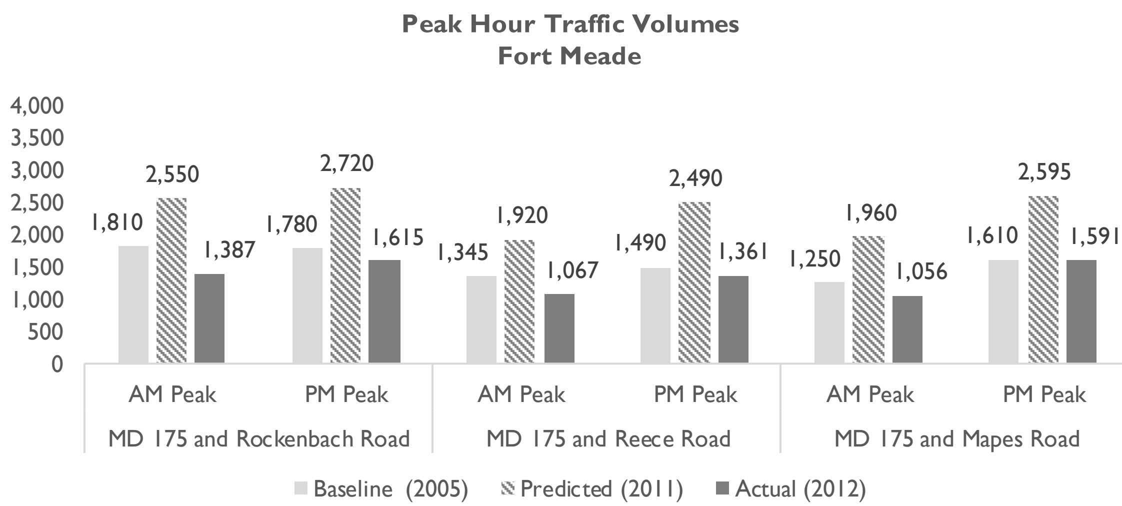


Figure 43: AM and PM peak hour traffic volumes on MD 175 near Fort Meade[287]

Historically, transit demand has been very low at Fort Meade (see Figure 44). Prior to implementation of BRAC 2005, less than one percent of personnel used transit to reach campus. Predictions for transit demand after implementation of BRAC 2005 were ambitious and demand was estimated to increase to six percent. However, despite the addition of shuttles and a subscription bus service, transit demand remained low under actual conditions due to Fort Meade's suburban location and the strong preference among personnel for using private vehicles.

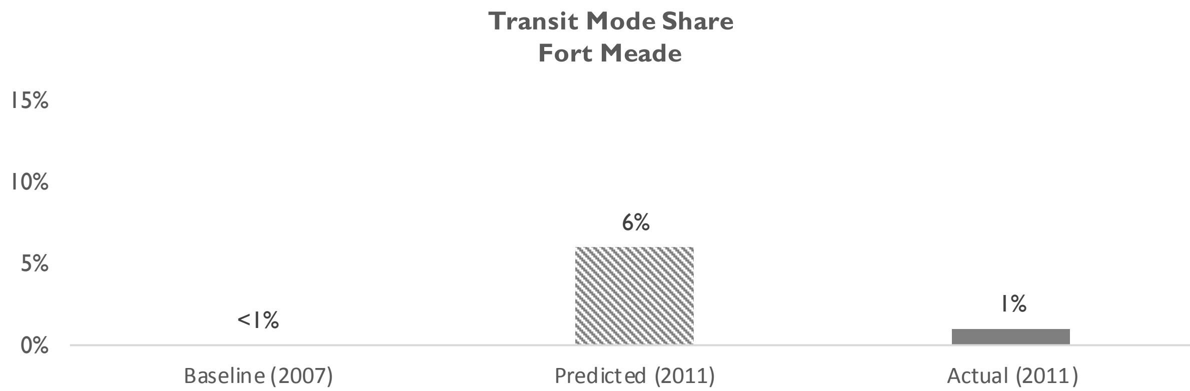


Figure 44: Transit mode share at Fort Meade[288]

Mitigation Measures – Proposed Build v. Actual

Multiple TDM strategies were employed by Fort Meade to reduce the percentage of personnel commuting by private vehicle. Strategies included following the U.S. Army's guideline to only provide enough parking for 60 percent of personnel, offering a transit pass subsidy, adding shuttles to and from nearby rail station, creating a subscription bus service, aiding in the creation of carpools, and launching a website called "MeadeRide" to educate personnel on alternatives to private vehicle commuting. Fort Meade also implemented efforts to encourage telework and the use of flextime.

Mitigation projects at Fort Meade were focused on roadway improvements. Of the seven major projects described in

Table 27, all improved roadways, none directly addressed transit, and two had a pedestrian or bicycle component. Additionally, most projects were focused on improving the capacity of MD 175. Improvements to MD 175 have been funded in part by a 2010 federal TIGER grant. This grant was awarded not only for vehicle capacity but also for bicycle and pedestrian facilities. Due in part to funding constraints, none of the projects were completed prior to 2011, three were completed after 2011, and four are currently underway.

Table 27: Mitigation projects at Fort Meade

	Project Type			Improvement	Project Status			Project Cost
	Roadway	Transit	Ped/Bike		Completed Before 2011	Completed After 2011	Under-way	
Widen MD 175 from MD 295 to Rockenbach Road	X			Widen MD 175 from MD 295 to Rockenbach Road to five lanes		X		$6,000,000[289]
MD 175 Intersection Improvements from Ridge/Rockenbach Road to Disney Road/26th Street	X			Widen MD 175 for double left-turn and exclusive right-turn lanes, widen Ridge Road. At 26th Street/Disney Road, widen MD 175.		X		*Missing data*
Rockenbach Road Access Control Point	X			Add modernized, bullet-proof gate house and increase roadway capacity to four inbound and two outbound lanes at the Rockenbach Road gate.		X		$10,000,000[290]
Widen MD 175 between MD 295 to MD 170	X		X	Widen 5.2 miles of MD 175 to six lanes and add sidewalks, on-road bicycle facilities, and a trail.			X	$49,823,000[291]
MD 175 Intersection Improvements from Reece Road to Mapes Road/Charter Oaks Boulevard	X			Construct intersection capacity improvements along 0.6 miles of MD 175 between Reece Road and Mapes Road/Charter Oaks Boulevard. Add new security fence and tree buffer alongside Fort Meade's property.			X	$18,917,000[292]
Improve Interchange at MD 175 and MD 295	X			Reconstruct interchange, widen portions of MD 175 from two to six lanes, and reconfigure ramps to create signalized left-turns at MD 175.			X	$111,389,000[293]
Increase Capacity of MD 198	X		X	Widen MD 198 to provide on-road bicycle lanes. Widen ramps to and from south MD 295 to provide second ramp lane. Add sidewalks and shared-use path.			X	$5,500,000[294]
TOTAL	**7**	**0**	**2**		**0**	**3**	**4**	**$201.6 million**

Transportation Impacts – Baseline v. Proposed Build v. Actual

Data that compared LOS under baseline, predicted, and actual conditions were limited – only four intersections around Fort Meade could be analyzed under all three conditions. At baseline, one of the four intersections operated at LOS E or worse during at least one peak hour. Figure 45 and Figure 46 show available LOS data. Under predicted conditions, LOS at all four intersections was expected to worsen and increase congestion. As of 2011, predicted conditions matched actual conditions almost exactly. Consistent with the predicted condition, LOS at all four intersections worsened in the actual condition. As shown in Figure 46, LOS levels under actual conditions matched those in predicted conditions.

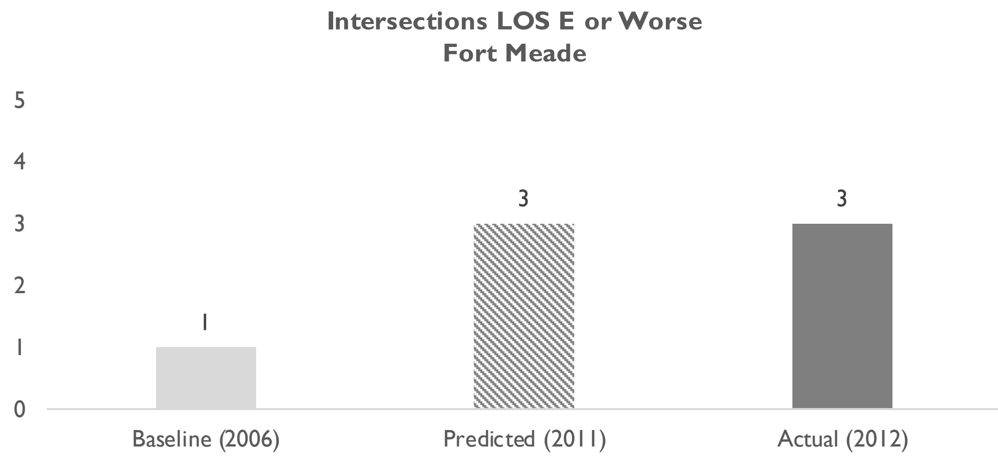


Figure 45: Intersections LOS E or worse near Fort Meade[295]

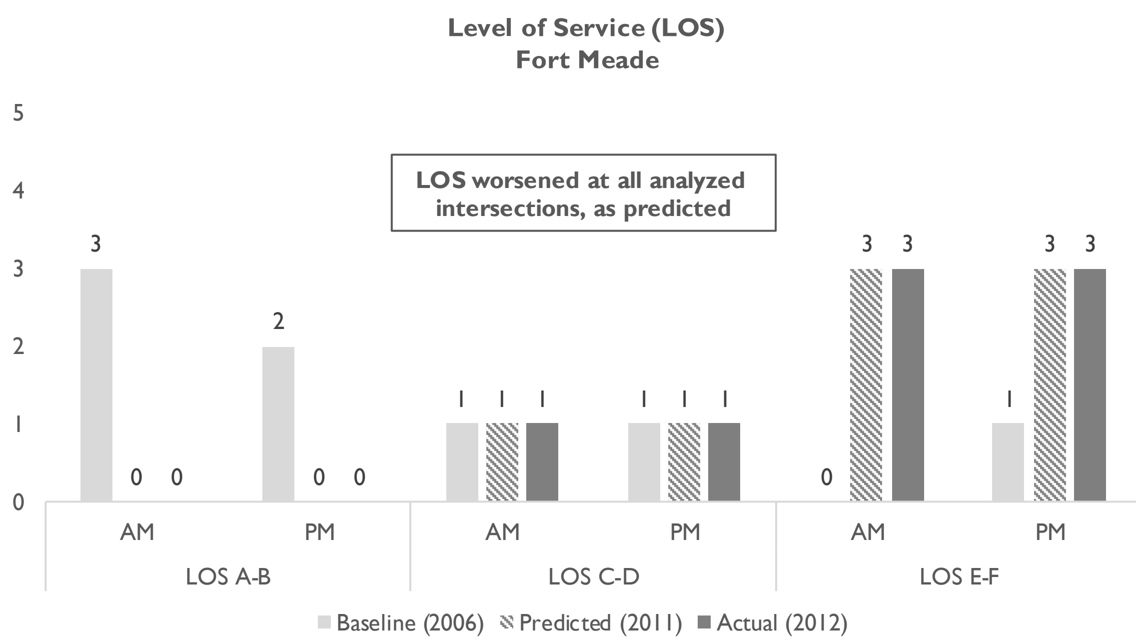


Figure 46: LOS at study area intersections near Fort Meade[296]

Mode splits at Fort Meade were available from two sources: a survey of personnel and through the U.S. Census American Community Survey (ACS), as shown in

Table 29,

Figure 48, and Figure 47. Both sources indicate that a large majority of personnel commuted via private vehicle. The utility of the personnel survey results is limited by the absence of mode split information for post-BRAC actual conditions. However, the survey provides information about personnel who reside both on-base and off-base, while the ACS provides information only about those living on-base.

Table 28: Mode splits at Fort Meade, personnel survey[297]

Mode Splits	Baseline (2007)	Predicted (2011)	Actual
Drive Alone	89%	73%	*Missing data*
Carpool/Vanpool	9%	9%	
Subscription Bus	*Missing data*	6%	
Transit	1%	2%	
Rail Shuttle	*Missing data*	1%	
Walk, Bike, Drop Off	1%	*Missing data*	
Telework	*Missing data*	9%	

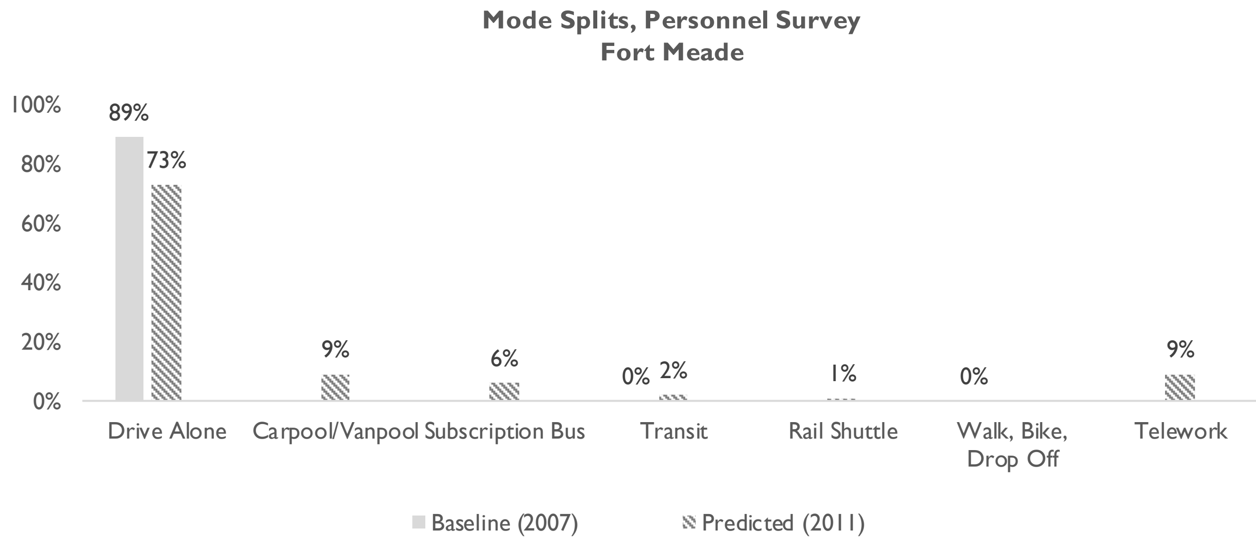


Figure 47: Mode splits at Fort Meade, personnel survey[298]

The personnel survey indicates that at baseline, an estimated 89 percent of personnel drove alone to their work sites. To reach the predicted level of a 73 percent drive alone mode share, the drive-alone mode share would need to fall by 16 percent. Because of absence of actual post-BRAC 2005 survey data for mode split, it is difficult to judge the success of TDM strategies at Fort Meade based on the personnel survey alone.

Table 29: Mode splits at Fort Meade, American Community Survey (ACS)[299]

Mode Split	Baseline (2006-2010)	Predicted	Actual (2011-2015)
Drive Alone	71.6%	73.0%	72.0%
Carpool/Vanpool	12.4%	9.0%	7.6%
Transit	2.5%	2.0%	1.1%
Walk	9.4%	*Missing data*	10.1%
Bike and other	1.6%		2.9%
Telework	2.5%	9.0%	6.3%

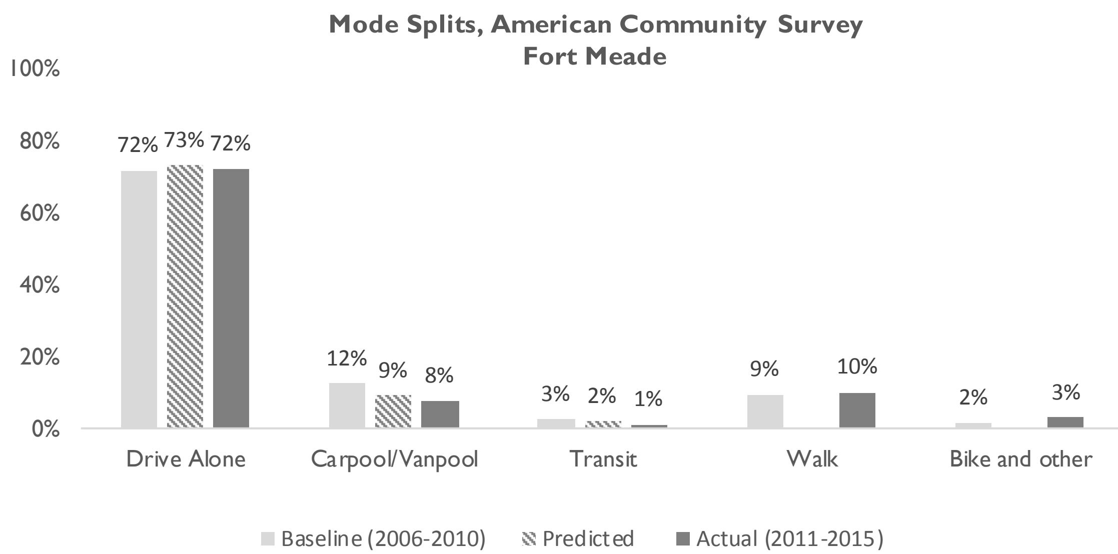


Figure 48: Mode splits at Fort Meade, ACS[300]

According to the ACS, which provides information only about on-base residents' travel behavior, the share of travel by each mode remained similar under all conditions. Drive-alone share was almost unchanged. While carpool/vanpool and transit shares decreased, increases were seen in the shares of personnel walking, biking, and teleworking. The increase in the teleworking share, from 2.5 percent to just over six percent, was the largest observed. Walking increased only modestly, but still represented a significant share of travel under both baseline and actual conditions. Bicycling increased significantly, nearly doubling, but still accounted for a small share of travel. Because the ACS results apply only to on-base residents, walking and bicycling are much more feasible modes of travel than for off-base residents.

While these results indicate that TDM strategies had little effect on discouraging personnel from using private vehicles, improvements to the telework policy may have encouraged more personnel to take advantage of this option. Although the ACS data is not directly applicable to all personnel working at Fort Meade, the consistency of drive-alone mode share may suggest that TDM measures did not have a major effect on drivers' travel choices, while the increase in telework may be indicative of increased openness to employees working off-site, at least periodically.

3.3.C. Findings

Overview

Growth at Fort Meade has added nearly 20,000 personnel since 2011. A minority of this growth, approximately 5,600 or nearly 39 percent, was the direct result of BRAC 2005 actions. The rest was the result of expansion of the NSA and the establishment of the U.S. Cyber Command. To absorb this rapid growth, Fort Meade and local stakeholders worked together to devise effective TDM strategies and develop funding sources for transportation system improvements.

Because Fort Meade's suburban location is far from rail stations, most personnel drive alone. While TDM plans at Fort Meade aimed to reduce the share of personnel using drive alone private vehicles by approximately 15 percent, the facility's location, infrastructure, and history encourage most personnel to continue to drive alone. Actual traffic volumes measured in 2012 were lower than the predicted volumes. During peak hours at key intersections along MD 175, actual post-BRAC LOS was better than predicted at some intersections and worse at others. Fort Meade is still growing, and significant roadway improvements are in progress.

Evaluation of transportation impacts and development of mitigation programs has been a continuing process at Fort Meade. Proposed transportation system improvements and TDM programs often evolved over time based on supplemental planning processes and ongoing coordination among military and civilian authorities. These partnering relationships among military and civilian authorities at Fort Meade developed and improved over the course of coordination on BRAC 2005 impacts and mitigation. In many cases, the coordination that was initiated through planning for BRAC 2005 and implementation of mitigation projects has resulted in ongoing partnerships that have improved communication and cooperation.

Facility Changes

- Actual BRAC 2005 growth, which represents only 39 percent of total personnel growth during the period evaluated, roughly met predicted growth levels.
- The concurrent growth at other agencies headquartered at Fort Meade, namely the growth of NSA personnel at this location and creation of the U.S. Cyber Command, made it challenging to isolate BRAC-related growth and its impacts.
- It was difficult to identify appropriate individuals knowledgeable about transportation issues related to the Fort Meade facilities, in particular about pre-BRAC 2005 conditions or effects of the BRAC 2005 implementation.

Transportation Demand

- At Fort Meade, actual AADT measurements were consistent with national VMT trends and showed declines around 2007 and a slight increase around 2012.
- At all locations analyzed, actual post-BRAC peak hour traffic volumes along MD 175 were lower than predicted volumes. Additionally, under actual conditions, traffic volume declines were observed from baseline levels.
- Given Fort Meade's suburban location, its lack of parking restrictions, and the significant travel time penalty for riding public transit, this mode has not been truly competitive with

driving alone. Transit demand has generally been quite low at Fort Meade. The six percent transit mode share target under predicted conditions was ambitious and was not met. Rather, transit demand roughly remained the same, at approximately one percent.

Mitigation Measures

- Multiple TDM strategies were employed, but they appeared to have little effect. Their effectiveness was likely diminished by the suburban, auto-oriented location of Fort Meade and the lack of parking restrictions.
- Based on discussions with stakeholders, very few personnel took MARC to get to Fort Meade, and the implementation of shuttles connecting to the Odenton MARC station had only a minor effect. Additionally, it was difficult to facilitate the efficient flow of shuttles in and out of Fort Meade due to security concerns.[301]
- Capacity improvements to roadways were the focus of mitigation projects at Fort Meade. Work is still underway given difficulties in securing funds and the long lead time required to plan, design, procure, and build such large-scale projects.

Transportation Impacts

- There is uncertainty about benefits and impacts of transportation system improvements, including those intended to mitigate BRAC 2005 impacts, which were under construction or not implemented at the time of post-BRAC data collection.
- While traffic volume data and LOS performance measures for Fort Meade are sparse for all conditions, available performance measures indicate that delays at nearby intersections have generally worsened. Congestion was expected to increase and LOS was expected to worsen at all analyzed intersections; it appears that this has occurred.
- Mode splits indicate that TDM strategies have had little effect. The share of personnel driving alone has remained constant, and use of transit and carpools/vanpools has not increased as predicted.
- Shares of walking and biking have increased and more personnel are choosing to telework. While these increases are promising, more resources would be required to reduce the share of driving alone and make transit more attractive.

Data and Analysis Issues

- There is a lack of available information on a wide range of topics, including facility characteristics, nature of the military activities at the facilities, land use, mitigation programs, and effects of transportation system improvements.
- There is inconsistency in data, information, and analysis at Fort Meade, as well as for different time periods (i.e. pre-BRAC implementation versus post-BRAC implementation).
- Since survey-based mode splits were not available for the actual post-BRAC 2005 condition, analysis of the effectiveness of TDM strategies was limited. Mode splits from the ACS could not be directly compared to Fort Meade's predicted mode splits due to the divergent populations.

- Because multiple mitigation projects are under construction or have recently been completed, additional data and information is needed to better understand their impact.
- Walking and bicycling volumes are not available for any of the conditions at Fort Meade. While it is likely that these volumes are small, the increase observed when comparing ACS mode splits indicates that additional data could provide a more comprehensive understanding of the local transportation network.

3.4. JOINT BASE LEWIS-MCCHORD

On February 1, 2010, the BRAC 2005 process merged U.S. Army Fort Lewis with adjacent McChord Air Force Base (AFB) to create a single facility Joint Base Lewis–McChord (JBLM). JBLM is the home of the U.S. Army's I Corps and the Air Force's 62nd Airlift wing, as well as many reserve components; it is the largest operational active duty joint base in the United States. Along with Camp Pendleton in California, JBLM is one of only two West Coast-based "power projection platforms," which are U.S. Army installations that can quickly mobilize and deploy large, high-priority active and reserve units.

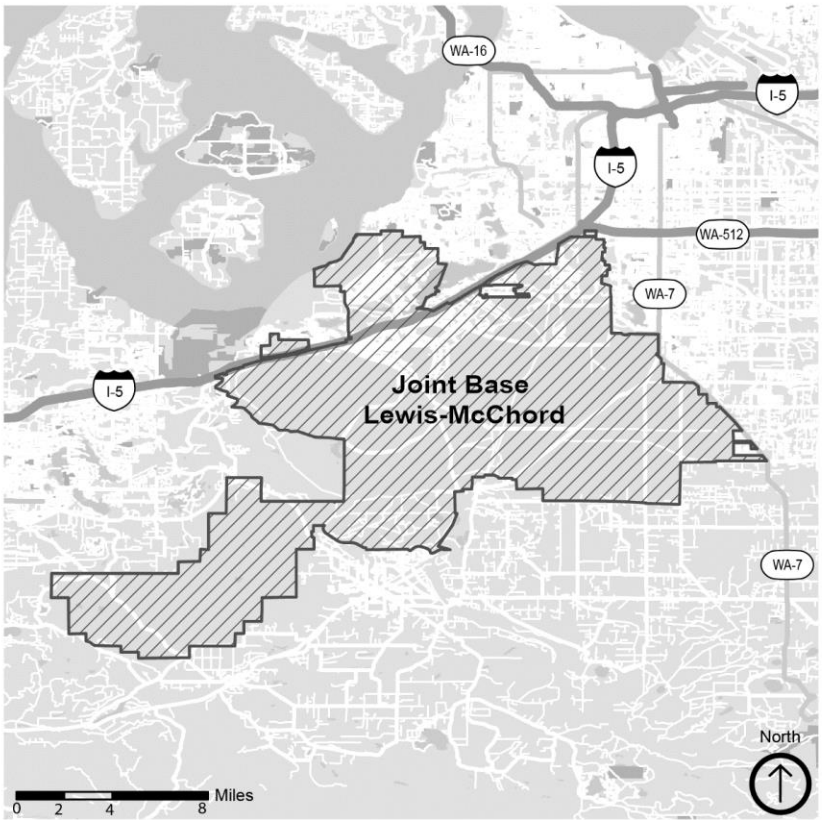


Figure 49: Regional map, Joint Base Lewis-McChord

JBLM, which occupies 87,000 acres of flat prairie land, is in Pierce County, Washington. The facility is approximately nine miles southwest of Tacoma, a mid-sized port city, and 23 miles east of Olympia, Washington's state capital. JBLM is bounded by the suburbs of these cities, with Tacoma's suburbs to the east and northeast, and Olympia's suburbs to the west, beyond conservation land and the Nisqually Reservation. JBLM is bounded by more rural land to the south, and by Interstate 5 to the north.

The population of Pierce County was approximately 795,000 in 2010.[302] The State of Washington predicts that the county's population will grow by 48 percent to nearly 1.2 million by 2040.[303] JBLM is the largest employer in Pierce County and the second largest in the state. The facility is a major population and employment center with multiple civilian and non-civilian functions.

Camp Murray, located adjacent to JBLM, is home to several Air and Army National Guard units. JBLM also serves as the home of the Madigan Army Medical Center, one of only two designated Level II trauma centers in Army Medicine and one of only four Level II trauma centers in Washington. Madigan Army Medical Center maintains approximately 220 beds for inpatient care and an outpatient "medical mall" that handles approximately one million visitors annually.

3.4.A. Case Study Update

Baseline Condition – Existing condition prior to BRAC implementation

This section summarizes the baseline conditions at Fort Lewis and McChord AFB prior to implementation of the BRAC 2005 actions.

Facility Profile

Fort Lewis was founded 1917 for use as a military training camp for soldiers entering World War I. In 1930, McChord AFB was established as an airfield to support Fort Lewis. Between 2003 and 2009, prior to the BRAC 2005 consolidation, these facilities' military-related population (including active duty military personnel and their families, DoD contractors, and civilian workforce) increased by 43 percent from approximately 92,000 to 131,000. In 2009, the bases employed nearly 30,000 full-time military personnel, 6,000 DoD civilian personnel, and 10,000 non-DoD civilian contractors. [304]

Transportation System Condition and Performance

Roadway Access and Traffic Conditions

Fort Lewis and McChord AFB were served directly by Interstate 5 (I-5), which provided connections to Seattle-Tacoma International Airport (Sea-Tac) and to the deep-water ports of Tacoma and Seattle. I-5, an early Interstate highway last widened in 1975, was the principal highway serving the bases. State Routes 507 and 510 provided access to the bases along the western and southern edges of the bases, respectively.

Within Fort Lewis, primary roadways included the four- to five-lane 41st Division Drive and primary east-west thoroughfare Pendleton Avenue. [305] Within McChord AFB, primary roads included the north-south Barnes Avenue and east-west Lincoln Boulevard. No direct connection was available between the two facilities, so travelers needed to use one of the boundary roadways as a connection between facilities. Due to the design of the transportation network and the concentration of most major land uses in the northern areas of the bases, I-5 was the most direct and fastest connection between the two facilities.

Therefore, in the baseline condition, I-5 was the principal roadway connection between Fort Lewis and McChord AFB, a situation that contributed to traffic congestion on the highway. Increased growth in Pierce and Thurston Counties, combined with expanding populations at the bases, strained the capacity of I-5 and other roadways serving Fort Lewis and McChord AFB. The I-5 interchanges, where congestion was often the worst, were built in 1950; due to physical constraints, they had not been widened from their original three-lane configuration. In 2009, sections of the corridor north of Berkeley Street and at Center Drive operated at LOS E or worse (see Table B20). [306]

During peak periods, vehicles entering the facility often backed up onto I-5, causing congestion and safety concerns on the interstate. Increased congestion was observed at the North Thorne Lane interchanges during PM peak hours; this congestion was in part due to the four-to-three lane transition that occurs here and at other interchanges. Between 2003 and 2006, volumes increased by nearly 17 percent during AM peak hours and 22 percent during PM peak hours. Congestion was also an issue at Berkeley Avenue, just south of North Thorne Avenue, and near Madigan Army Medical Center.[307]

Public Transit Access

Prior to implementation of BRAC 2005, transit access was limited. Bus service was available from Pierce Transit, but the service frequency and coverage was limited. Table 30 illustrates available bus routes and their frequency prior to the BRAC 2005 realignment.

Table 30: Bus routes serving Fort Lewis and McChord Air Force Base[308]

Bus		Route	Frequency
Pierce Transit	206	Lakewood Transit Center and Madigan Hospital	Weekdays, every 30 minutes; Weekends, every 30 to 60 minutes
	300	Tacoma Mall to McChord Commissary	Weekdays, every 30 minutes; Weekends, every 60 minutes

A very small share of personnel used transit to reach Fort Lewis and McChord AFB. Public transit was generally not an attractive or efficient option because there were few and infrequent transit options, along with the spread-out development patterns of the bases and the fact that both facilities were secure active duty military bases with security requirements that kept buses outside the gates.

Pedestrian and Bicycle Access

Within Fort Lewis and McChord AFB and in the surrounding area, bicycle and pedestrian facilities were limited. Few major internal or external roadways had sidewalks or bicycle lanes, and there were no continuous pedestrian or bicycle routes that provided a reasonable non-motorized alternative to I-5.[309] Some parts of each base had closely-spaced land uses with sidewalks, making walking practical for trips in the immediate vicinity.

As a whole, however, both Fort Lewis and McChord AFB were large facilities not well-suited to walking and biking. In addition, I-5 ran along the northern edge of both bases and divided them from JBLM North, a component of the base to the north of I-5, as well as adjacent off-base areas. This meant that pedestrian and bicycle connections across this barrier were restricted to those locations with roadway crossings of the highway, and also limited the opportunities for creating new pedestrian and bicycle facilities.

Parking

Prior to implementation of BRAC 2005, no restrictions were placed on private vehicle parking at Fort Lewis and McChord Air Force Base. Data and information on baseline parking conditions were not available.

Gates/Entry Points to the Facility

There were 15 gates used to access Fort Lewis and McChord Air Force Base. Four gates were used to access McChord Air Force Base and 11 were used to access Fort Lewis.[310] Five of these access points were located along I-5.[311] The Liberty (Main) Gate, located at 41st Divisions Drive, and Madigan Gate, located at Berkeley Avenue/Jackson Avenue, experienced the heaviest congestion, with vehicle queues often backing up onto I-5.[312]

Travel Behavior

Most soldiers, family members, and civilian personnel associated with Fort Lewis and McChord AFB lived in local communities surrounding the bases, although some personnel lived on-base. As with most large military installations, single-occupancy private vehicle commuting was the dominant travel mode. Because of the location of the bases, their large base areas with spread-out land use patterns, infrequent transit that did not connect through secure gates, limited pedestrian and bicycle facilities, and ample free parking, single-occupancy private vehicle commuting was the most convenient and attractive mode for the clear majority of personnel.[313]

However, no quantitative data is available on travel behavior or mode choice for all Fort Lewis or McChord AFB personnel. Table 31 shows the ACS mode split results only for on-base personnel at Fort Lewis and McChord AFB. These results indicate high walking share at both Fort Lewis and McChord AFB; it is important to remember that this is only for on-base residents, who reside close enough to their work sites to walk. The results also indicate a high telework/off-site work share at Fort Lewis prior to BRAC 2005.

Table 31: Baseline mode splits at Fort Lewis and McChord AFB, ACS[314]

Mode Splits (Baseline, 2006-2010)	Fort Lewis	McChord AFB
Drive Alone	43.3%	69.3%
Carpool/Vanpool	6.4%	7.6%
Transit	1.3%	0.0%
Walk	25.3%	19.8%
Bike and other	1.5%	3.2%
Telework	22.1%	0.0%

Safety Record

The Washington Department of Transportation (WSDOT) provides an annual collision data summary for use in safety related performance measures. Since specific data on crashes near Fort Lewis and McChord AFB was not available for baseline conditions, WSDOT's data on Pierce County was analyzed. In 2009, Pierce County had a crash rate of 1.97 crashes per million vehicle miles traveled (CPMVMT) on a countywide level, which is higher than the statewide crash rate (all roadways) of 1.37 CPMVMT. On interstates (i.e. roadways comparable to I-5), the crash rate was lower, at 1.04 CPMVMT statewide.[315]

Table 32 shows the total number of crashes in Pierce County (2009) listed by the jurisdiction of the roadway and the severity of the crash.

Table 32: Crashes by county (2009), Pierce County, Washington[316]

Crash History and Severity					
Jurisdiction	**Total Crashes**	**Fatal Crashes**	**Serious Injury Crashes**	**Minor Injury Crashes**	**Property Damage Only Crashes**
State Route	5,535	18	85	1,968	3,464
City Street	5,274	8	91	1,605	3,570
County Road	1,515	19	85	568	843
Misc. Trafficway	7	0	0	4	3
Total	12,331	45	261	4,145	7,880

Of more than 12,000 crashes that occurred in Pierce County in 2009, 180 involved a pedestrian. Five of the pedestrian crashes resulted in fatalities and 30 resulted in a serious injury. Just over 100 crashes involved a bicyclist; while none of those involved a fatality, six involved serious injuries.[317]

Predicted Condition – Projected Future Conditions

Facility Realignment Plan

For Fort Lewis and McChord AFB, the changes mandated by BRAC 2005 merged the two facilities to streamline administration, services, and operations. The merger to create JBLM was focused on administrative consolidation of two adjacent facilities, and it would not in itself add any new units, personnel, or travel demand. Nevertheless, the merger's administrative effects would necessitate greater integration of operations and administrative functions, which was predicted to require changes to the location of certain personnel and more travel between the formerly distinct and separate bases.

In addition to the BRAC 2005 actions, JBLM was expected to grow by approximately four percent from 131,000 to just over 136,000 between 2010 and 2016 as the result of other military growth initiatives, including transforming the Army to Modular Forces and the Integrated Global Presence and Basing Strategy. The JBLM "Growth Coordination Plan" predicted that approximately 1,900 full-time military personnel, 150 DoD civilian personnel, and 3,000 military family members would be added by 2016. This growth was expected to have indirect effects on the region's population that would add over 33,000 people, 62 percent of whom were expected to live in Pierce County.[318] The predictions included in this case study update account for this expected growth.

Predicted Transportation System Performance and Mitigation

Traffic Impacts and Mitigation

Although predicted growth at JBLM and greater demand for travel between the formerly separate bases was expected to increase travel demand and roadway congestion along portions of I-5, major increases in traffic volume were not anticipated as a result of BRAC 2005. Traffic volumes along I-5 in the JBLM corridor were predicted to increase by about one percent per year between 2013 and 2040. The increasing volumes were expected to cause increased congestion during peak hours, which would cause trips to be diverted outside of peak hours eventually expanding peak hours.[319] Without a direct connection between the two facilities, base personnel would continue to rely on congested segments of I-5, and the expected increase in travel between the two bases would increase the congestion in these areas.

Proposed roadway improvements generally focused on improving connectivity between the two bases and increasing the capacity of I-5 along the 13-mile JBLM corridor. Increasing congestion on I-5 had long been an issue in the area, and the predicted growth at JBLM highlighted the importance of improving the roadway and increasing its capacity.

Proposed short-term improvements included reconfiguring and improving signalized ramp terminals at selected interchanges along I-5, as well as roadway access improvements at entry/exit gates. Proposed longer term improvements entailed adding lanes on I-5, rebuilding interchanges, building a new connector road and bridge to connect the two bases, and implementing Intelligent Transportation System (ITS) strategies such as metered on-ramps and variable message signs displaying real time traffic information.

Transit Impacts

The JBLM "Growth Coordination Plan" recognized JBLM's lack of public transit options, and suggested ways of improving transit service for the facility. Nevertheless, neither JBLM nor regional transit agencies provided funding for transit improvements to JBLM in advance of BRAC 2005 implementation. The "Growth Coordination Plan" also recognized significant constraints and obstacles to enhancing transit service for JBLM, such as the security requirements that would limit the ability of local buses to directly service JBLM. As a result, there were no changes to the local public transit network anticipated for the post-BRAC predicted condition at JBLM.[320]

Pedestrian and Bicycle Impacts

Proposed improvements to I-5, discussed in subsequent sections, were expected to include enhanced pedestrian and bicycle facilities, and it was anticipated that these improvements would increase the share of personnel traveling by foot or by bicycle as part of their commute. As Fort Lewis and McChord AFB were both large facilities not well suited to walking and biking, no significant improvements to pedestrian or bicycle facilities were proposed for the internal roadway network.

Travel Behavior

Between 2010 and 2016, direct and indirect growth in the population at JBLM was predicted to add more than 33,000 residents to Pierce and Thurston Counties. This growth was estimated to account for as much as 22 percent of project population growth in the two counties.[321]

Apart from proportional increases in the number of trips due to personnel growth, travel behavior was not predicted to change significantly in the post BRAC 2005 condition. The location and land use patterns of JBLM were obstacles to implementing viable alternate commuting modes; therefore, drive alone private vehicles were expected to remain the dominant commuting mode.

Travel Demand Management Strategies

While BRAC 2005 actions were administrative in nature and not expected to directly result in personnel growth, the BRAC 2005 realignment was expected to change travel patterns to and within JBLM, while concurrent non-BRAC initiatives were predicted to increase personnel and travel demand. TDM proposals focused on the development of an internal shuttle service and on encouraging personnel to commute via vanpool, carpool, or bicycle.

Actual Condition – Measured post-BRAC implementation conditions

The following section discusses actual (2010 and after) conditions at JBLM. The actual conditions described in this section are then compared to baseline and predicted conditions to evaluate the effects this growth had on the region and how the area around JBLM has adapted.

Actual Post-BRAC Facility Profile

Implementation of BRAC 2005 occurred as expected. In February 2010, Fort Lewis merged with McChord AFB to create an active duty joint base (JBLM). The merger streamlined services and created a single supervising authority for the joint base. As predicted, the direct effects of BRAC 2005 were administrative and generally related to consolidation of facility management and operations. Personnel growth at JBLM was the result of other military initiatives, as well as the late 2010 drawdown of troops in Afghanistan and Iraq. Approximately 18,000 troops returned to JBLM from overseas deployment between February and September 2010, resulting in a significant increase in personnel and travel demand.[322]

As a result of these changes, JBLM experienced a 36 percent increase in personnel between 2010 and 2015 and has expanded its role as a regional population and employment center. JBLM is an active duty military base; about 80 percent of personnel are active duty and 20 percent are civilian.[323] In 2015, JBLM employed, housed, and provided services to an average of over 150,000 people daily, which includes nearly 41,000 military service members, 18,000 DoD civilians, 47,000 military family members, and 32,000 local retirees.

Actual Transportation Mitigation

Roadway Network Improvements

State, local, and military organizations have completed several roadway improvement projects to address transportation issues, including issues resulting from growth and changes at JBLM. The project most closely associated with BRAC 2005 implementation was the construction of a bridge over railroad tracks connecting the former Fort Lewis and McChord Air Force Base facilities. Prior to construction of this bridge, which was completed in 2015, there was no direct connection between the two campuses. Personnel traveling between the two components of JBLM had to drive in and out of the base, get on I-5, and submit to another security gate clearance process.[324]

Other recently completed projects include the Madigan Access Improvements, a $5.7 million effort in the city of Lakewood to improve traffic circulation to and from JBLM's Madigan Army Medical Center; implementation of numerous intelligent transportation systems (ITS) measures in Thurston and Pierce Counties; reconstruction of the I-5/Center Drive interchange in DuPont to allow for continued use by JBLM commuters; and a new traffic signal at the I-5/Nisqually Road SW/JBLM Mounts Road Gate designed to allow motorists to exit JBLM from this gate. Another major regional project with significant benefits for JBLM is the interstate improvement project in the I-5 corridor adjacent to JBLM. Given the scope and complexity of the proposed changes to I-5, and the fact that BRAC 2005 implementation was not expected to directly affect travel demand at JBLM, work on this project did not begin until after implementation of BRAC 2005.

Projects Completed After 2011

1/5. Implementation of Intelligent Transportation Systems (ITS) Measures. Between 2013 and 2015, WSDOT worked with JBLM, Washington State Patrol, and local municipalities to implement numerous ITS measures around Thurston and Pierce Counties. WSDOT installed 18 new ramp meters on I-5, which helped manage congestion by controlling the number of cars merging onto I-5 when traffic is heavy (Projects 1 and 5 and, Figure 50). WSDOT also provided commuters with better quality information about road conditions in the corridor. In 2015, WSDOT began offering a new traffic flow map showing I-5 and arterial roads for drivers who travel through the JBLM corridor; this now allows commuters in the corridor to make more informed route decisions.[325] These systems have helped WSDOT manage traffic and communicate real-time traffic conditions to the public. The implementation of the systems improved traffic flow along I-5; [326] between 2013 and 2015, I-5 through JBLM witnessed a significant decrease in congestion.[327]

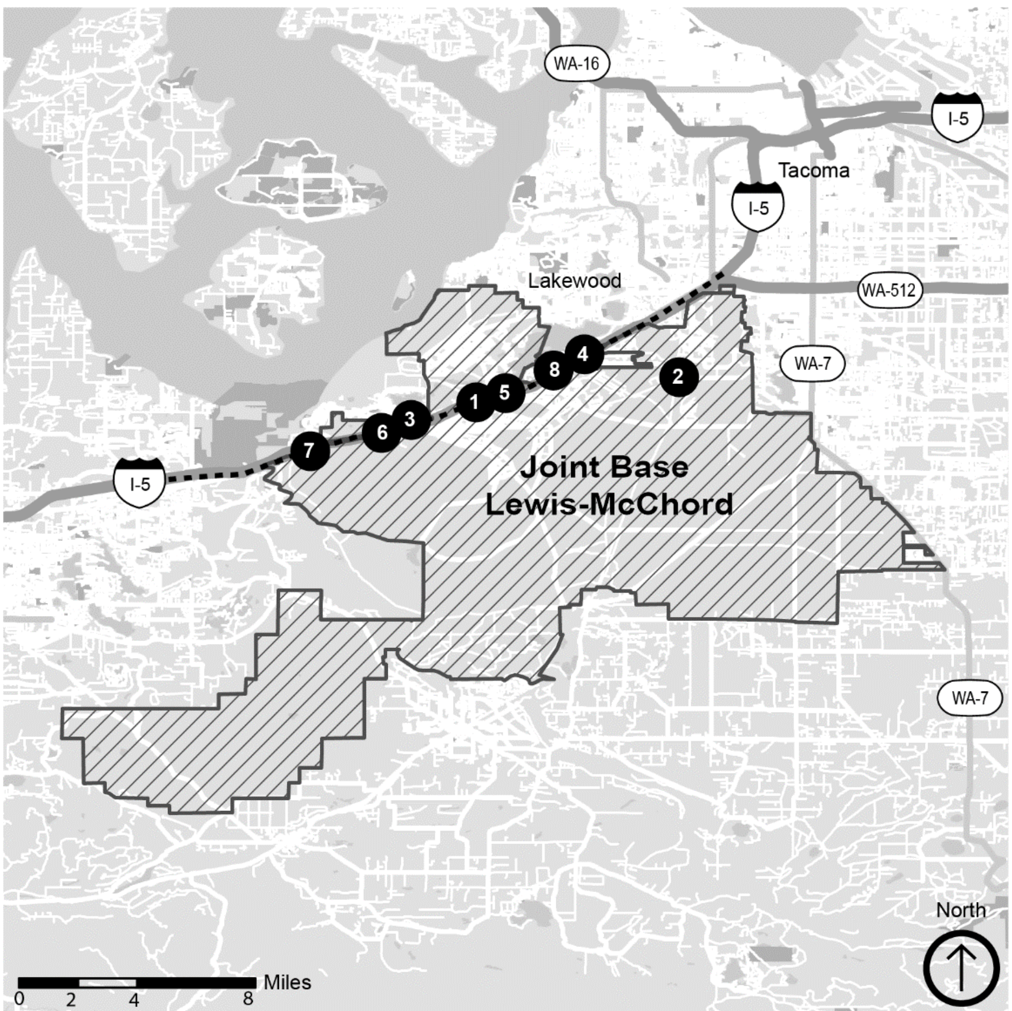


Figure 50: Project map, Joint Base Lewis-McChord

2. **Construction of Joint Base Access Road Connecting JBLM Lewis Main to JBLM McChord Field.** Joint Base Access Road (Project 2, Figure 50) is intended to provide users with a more direct connection between the two components of JBLM and to reduce military base-related traffic on I-5. Prior to construction of this connection, users had to use I-5 to go from JBLM Lewis Main (formerly Fort Lewis) and JBLM McChord Field (formerly McChord AFB).[328] In May 2015, construction of Joint Base Access Road between the former Fort Lewis and McChord AFB facilities was completed.[329]

3. **Gate Improvements.** In March 2015, Integrity Gate serving JBLM North in DuPont opened. WSDOT's plan to move the Steilacoom-DuPont Road overpass 1,000 feet to the north will eventually require a new DuPont Gate into JBLM because of security concerns related to high speed vehicle approaches (Project 3, Figure 50). Construction of this new DuPont Gate is expected to occur between 2020 and 2023.[330] Additionally, the opening of the Joint Base Access Road meant that users could now access by JBLM Lewis Main by entering Barnes Gate at Perimeter Road; the opening of the bridge also led to the closing of the Lincoln-Rainier Gate at East Lincoln Road and Rainier Drive.[331]

4. **Madigan Access Improvements.** In 2015, DoD awarded the City of Lakewood a $5.7 million grant to improve traffic circulation to and from JBLM's Madigan Army Medical Center (Project 4, Figure 50). To help reduce congestion, the project added one travel lane to the I-5 Berkeley Street overpass and widened the southbound I-5 exit to create a second left-turn lane. Construction was completed in the summer of 2016.[332]

6. **Improvements to I-5 Center Drive Interchange.** When it was constructed initially, the I-5 Center Drive interchange was built as an emergency access road not intended for regular use (Project 6, Figure 50). As part of overall improvements to I-5, WSDOT redesigned the I-5/Center Drive interchange in DuPont to allow for continued use by JBLM commuters. A new roadway and an HOV bypass lane were added to streamline the roadway geometry for regular use by commuters.[333]

7. **I-5 Nisqually Road SW/JBLM Mounts Round Gate Signal Improvements.** WSDOT worked with Pierce County, JBLM, DoD, and the Nisqually Indian Tribe on roadway improvements at the I-5 Nisqually Road SW and JBLM Mounts Road Gate interchange. Improvements included the addition of new turn lanes and a new traffic signal on Old Nisqually Road at the JBLM Mounts Road Gate (Project 7, Figure 50). Completed in June 2014, the improvements allow motorists to now exit JBLM from this gate providing an alternative to the often-congested DuPont Gate.[334]

In Progress

8. **I-5 JBLM Area Improvements.** WSDOT is implementing a $494 million, nine-year upgrade and expansion of I-5 in the JBLM corridor (Project 8, Figure 50). The freeway will be widened and two interchanges at Berkeley Street and Thorne Lane will be rebuilt. Funding will be provided by an 11.9-cent-per-gallon gas-tax increase approved by the Washington State Legislature and signed by Governor Jay Inslee in July 2015. The planned changes will reduce chronic traffic congestion through the JBLM corridor by incorporating the following elements:

- Adding one lane to I-5 SB from Thorne Lane to the DuPont area
- Adding one lane to I-5 NB from Mounts Road to Thorne Lane
- Adding auxiliary lanes to mitigate weaving between interchanges
- Rebuilding the signalized I-5 interchanges at Thorne Lane and Berkeley Street with unsignalized modern roundabouts, which have been demonstrated to generally improve traffic flow, reduce speeds, and reduce crash incidence relative to signalized intersections
- Building a new local connector road between Gravelly Lake Drive and Thorne Lane alongside I-5 to provide a needed parallel link between population centers
- Building a shared use path adjacent to the I-5 corridor between Lewis North and Camp Murray[335]

These roadway improvements may have had some effects on traffic congestion in the I-5 corridor through JBLM. Between 2013 and 2015, average daily traffic volumes along the I-5 corridor near JBLM increased by an average of two percent.[336] The new Joint Base Access Road may have had some effect in keeping traffic volumes relatively constant despite recent personnel growth, while recent reconfiguration of interchanges and improvements to signal operations on the I-5 ramps have helped to mitigate congestion.

Even with the improvements, however, daily congestion is common along the I-5 corridor. During the morning peak period, traffic congestion can last for two hours or more and travel times are four to six percent higher than off-peak hours. Evening peak period congestion is much more severe. During the evening peak period, traffic congestion can last up to three hours, with travel times 75 percent higher than off-peak travel times.[337] In 2014, I-5 through the 13-mile JBLM corridor several segments operated at LOS D or worse (see Table B21).[338]

Travel Demand Management Strategies

JBLM and WSDOT have implemented several travel demand management (TDM) strategies for improving access via alternative modes to, from, and within JBLM. As part of the ongoing I-5 improvements, WSDOT is building a shared use bicycle and pedestrian path along the I-5 corridor. JBLM's core TDM program, GO Lewis-McChord, entails transit system improvements (discussed below), along with a free bicycle share system for JBLM personnel, and service that connects commuters with vanpools and an emergency ride home service.[339] In addition to the services provided by GO Lewis McChord, all personnel were eligible to receive a monthly subsidy

Transit Operations

Neither JBLM nor the region's transit agencies proposed significant transit improvements as a means of mitigating BRAC 2005 transportation impacts. However, some transit system improvements and expansion have been put in place since BRAC 2005 implementation to improve transit services in and around JBLM. In October 2013, Intercity Transit added Route 609 to provide bi-directional service along I-5 between Olympia and Lakewood.

Additionally, a joint initiative of JBLM, WSDOT, Pierce Transit, Intercity Transit, and Thurston Regional Planning Council launched GO Lewis McChord in July 2015. The service consists of three programs – GO Transit, GO Bike, and GO Vanpool – and is available to all personnel. GO

Transit and GO Vanpool are discussed here, while GO Bike is discussed in the pedestrian and bicycle access impacts section below.

GO Transit, the internal JBLM shuttle service, operates with five new transit vans and 28 stops around the installation and connects to local bus service. This new shuttle service offers shorter wait times than previous shuttle services, which operated with only two vans and just nine stops. GO Transit also connects with local public transit, including Pierce Transit Route 206 (Madigan Army Medical Center–Lakewood Mall Town Center) and Route 300 (McChord Commissary–Tacoma Mall). In July 2015, the internal GO Transit shuttle transported 500 to 700 riders each day. To help manage wait times, a smartphone app, OneBusAway, provides users with real time transit information.[340] GO Vanpool connects commuters with vanpools and offers an emergency ride home service. GO Vanpool allows five to 15 people to share a passenger van whose trip origin is within the county which operates the vanpool. There are currently 20 vanpools that serve JBLM.[341]

Over the longer term, substantial region-wide investments in passenger rail may shift some Pierce County and JBLM commuters away from single-occupancy private vehicles. In November 2016, voters in the urbanized areas of Pierce County approved the Sound Transit 3 ballot measure (ST3), which will extend Link light rail from Sea-Tac Airport to Tacoma and Sounder commuter rail from the current terminus in Lakewood (adjacent to McChord AFB) to Tillicum (adjacent to Camp Murray) and DuPont (near Fort Lewis). The planned extension of Sounder to Tillicum and DuPont is expected to attract up to 3,000 riders a day when completed in 2036.[342]

In addition, the Point Defiance Bypass project will relocate Amtrak's popular Cascades passenger rail service to an existing, upgraded line through JBLM, providing more direct and rapid service. This project was completed in 2017; on December 18, 2017, an Amtrak train on this line derailed, killing three passengers and injuring more than 80 people, including people in cars below on I-5. The train service has been relocated back to the original line; it will be restored to the new line when positive train control is implemented on the line.[343] This relocation could allow for additional passenger service at Lakewood, Tillicum, and DuPont at some point in the future, although no Amtrak stops in the corridor are currently proposed.[344]

Pedestrian and Bicycle Access Impacts

While pedestrian and bicycle facilities in and around JBLM continue to be modest, many of the completed and ongoing roadway projects entail improvements to pedestrian and bicycle facilities. For example, as part of the I-5 – Mounts Road to Thorne Lane Interchange project, WSDOT is building a bicycle and pedestrian path along the I-5 corridor. JBLM's GO Bike program, introduced in 2015, is a bike-share system that is available free to service members, DoD civilians, and contractors at five locations. Despite these efforts, the share of personnel commuting via walking or biking remains low.

Community Involvement Process

To plan for growth in the region, JBLM officials have worked with stakeholders including WSDOT, Pierce Transit, Sound Transit, Intercity Transit, Thurston Regional Planning Council, the Cities of Lakewood, Tacoma, Lacey, and Yelm, the Town of Steilacoom, the Nisqually Indian Tribe, and Pierce and Thurston Counties. In 2011, with the participation of these stakeholders, the South Sound Military and Communities Partnership (SSMCP) was created.

The SSMCP allows these regional stakeholders to coordinate efforts in areas such as military relations, transportation and land use planning, environmental protection, emergency preparedness, population forecasting workforce development, housing, and economic development. Members of SSMCP partnered to develop the GO Lewis McChord transit services, worked to develop strategies for dealing with population growth, and drafted the 2010 *JBLM Growth Coordination Plan* and 2015 *JBLM Joint Land Use Study*.[345] Additionally, stakeholders were involved in the development of WSDOT and FHWA's plans to relieve congestion along I-5.

Community members were also engaged. While BRAC 2005 had mainly administrative effects, officials from JBLM prepared environmental impact statements for all subsequent military growth initiatives. As part of those processes, community members were invited to participate in the scoping phase and provide comments on drafts. Outreach to the local community was also a large component of drafting the 2010 *JBLM Growth Coordination Plan* and 2015 *JBLM Joint Land Use Study*. When planning the I-5 improvements, WSDOT, FHWA, and JBLM worked with stakeholders and local planners to transmit information to the wider public through a project website, radio and television reports, email, and printed mailings. Potentially affected residents were invited to attend open houses and neighborhood meetings where they could give feedback on project alternatives and express any concerns.[346]

3.4.B. Evaluation of Actual Versus Predicted Conditions

Facility Changes – Baseline v. Proposed Build v. Actual

The merger of U.S. Army Fort Lewis and McChord AFB to create JBLM was principally an administrative merger that streamlined services to create a single supervising authority. Before BRAC 2005 actions, the population of Fort Lewis and McChord AFB, which included military personnel and their families, DoD contractors, and civilian workforce, was approximately 131,000 personnel; this number was expected to grow by 5,000 over the following decade, largely as a function of organic growth at the facility. As a result of this growth, JBLM has expanded its role as a regional population and employment center. In 2016, the population of JBLM was approximately 138,000, including nearly 41,000 military service members, 18,000 DoD civilians, 47,000 military family members, and 32,000 local military retirees.

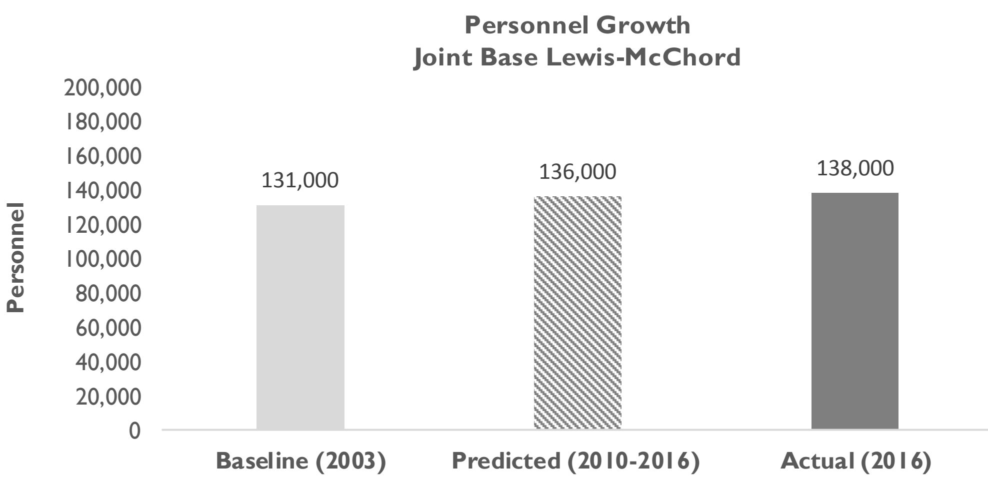


Figure 51: Population growth at Joint Base Lewis-McChord[347]

Transportation Demand – Baseline v. Proposed Build v. Actual

To evaluate transportation demand trends and patterns under baseline, predicted, and actual conditions at JBLM, AADT along I-5, the major interstate highway used to access the facility, was reviewed. Between 2005, when BRAC actions were proposed, and 2014, AADT on I-5 near JBLM remained fairly constant at just over 120,000 vehicles per day (see Figure 52).

I-5 near JBLM includes sections of six-lane and eight-lane divided urban freeway. According to FDOT's 2013 Quality/Level of Service Handbook, a six-lane divided urban (core) freeway reaches LOS D at an AADT of 116,600 vehicles per day and 154,300 vehicles per day for an eight-lane divided facility. Based on this, I-5 would be expected to operate at between LOS C and D in the eight-lane section and between D and F in the six-lane section during peak hour conditions. The consistent level of AADT along this section of I-5 each year between 2005 and 2014 may be the result of a roadway system that is operating at or near capacity.

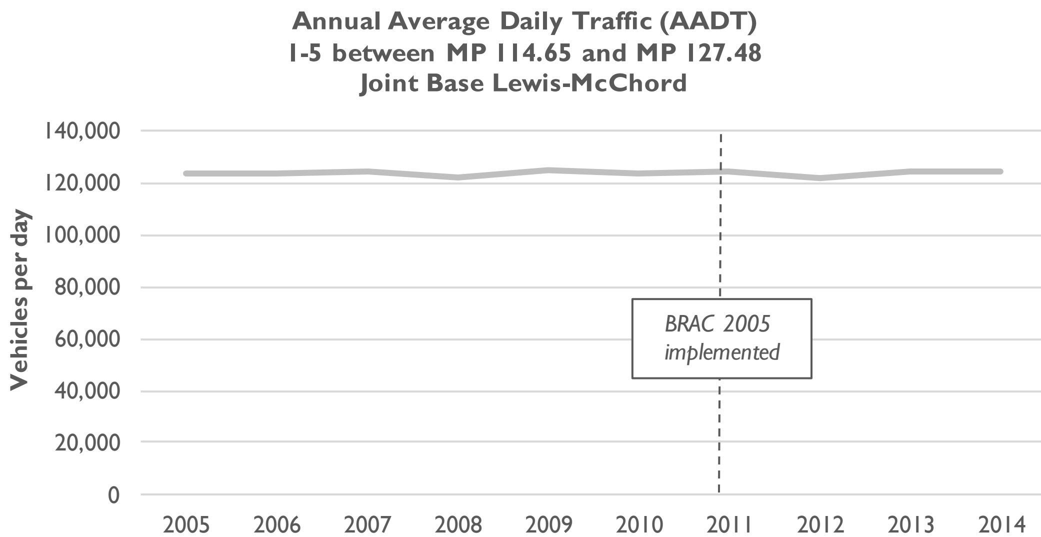


Figure 52: AADT from 2005 through 2014 near Joint Base Lewis-McChord[348]

Mitigation Measures – Proposed Build v. Actual

TDM strategies were employed by JBLM to reduce the percentage of personnel commuting by private vehicle. Strategies included encouraging commuting via carpool/vanpool and bicycle as well as developing an internal shuttle service.

Mitigation projects at JBLM were focused on roadway improvements, as listed in Table 33. Of the six major projects, all were focused on improved roadways, one addressed transit improvement, and one addressed accommodations for pedestrians and bicyclists by constructing a shared-use path adjacent to the I-5 corridor. Additionally, a new roadway and a High Occupancy Vehicle (HOV) bypass lane were added to improve traffic flow. None of the projects were completed prior to 2011. Five of the projects were completed after 2011 and one, the I-5 JBLM Area Improvements Project, is currently underway due to the large scope and resource constraints.

Table 33: Mitigation projects at Joint Base Lewis-McChord

	Project Type			Improvements	Project Status			Project Cost
	Roadway	**Transit**	**Ped/ Bike**		**Completed Before 2011**	**Completed After 2011**	**Under-way**	
Intelligent Transportation Systems (ITS) Measures	X			Installation of 18 new ramp meters on I-5, provision of better information including traffic flow map and real-time traffic cameras.		X		*Missing data*
Joint Base Access Road	X			New bridge to connect the two previously separate military bases.		X		*Missing data*
Gate Improvements	X			Construction of new Integrity Gate; construction of new DuPont Gate 2020 – 2023.		X		*Missing data*
Madigan Access Improvements	X			One travel lane added to I-5 Berkeley Street overpass and southbound I-5 exit widened.		X		$5,400,000[349]
Improvements to I-5 Center Drive Interchange	X	X		I-5/Center Drive interchange in DuPont redesigned to allow continued use by JBLM commuters. A new roadway and an HOV bypass lane were added to streamline the roadway geometry for regular use by commuters.		X		*Missing data*
I-5 Nisqually Road SW/JBLM Mounts Round Gate Signal Improvements	X			New turn lanes and a new traffic signal on Old Nisqually Road at the JBLM Mounts Road Gate		X		$728,000[350]
I-5 Mounts Road to Thorne Lane Interchange, Corridor Improvements	X		X	One lane added to I-5 SB from Thorne Lane to the DuPont area. One lane added to I-5 NB from Mounts Road to Thorne Lane. Auxiliary lanes added to improve weaving between interchanges. Reconstruction of signalized I-5 interchanges at Thorne Lane and Berkeley Street with unsignalized modern roundabouts to improve traffic flow, reduce speeds, and reduce crash severity. Construction of a new local connector road between Gravelly Lake Drive and Thorne Lane alongside I-5. Construction of a shared use path adjacent to the I-5 corridor between Lewis North and Camp Murray.			X	$494,000,000[351]
TOTAL	**6**	**1**	**1**		**0**	**6**	**1**	**$500.1 million**

Transportation Impacts – Baseline v. Proposed Build v. Actual

Because the BRAC 2005 actions to create JBLM was largely an administrative change, BRAC 2005 was not expected to have major transportation system impacts, so JBLM did not undertake a significant transportation impact evaluation. As a result, comparison of transportation impacts, including peak hour traffic volumes or LOS, was not possible due to the lack of data and inconsistency of data across baseline, predicted, and actual conditions.

Mode split data for JBLM was calculated by adding together the U.S. Census American Community Survey (ACS) mode split data for Fort Lewis Census Designated Place (CDP) and McChord AFB CDP, as shown in Table 34 and Figure 53. It is important to recognize that these ACS results provide mode split information for residents of the Fort Lewis CDP and McChord AFB CDP, and do not include personnel who live off-base and commute to and from JBLM.

According to the ACS, the share of personnel who live on-base and drive alone was fairly low in the baseline condition, and it increased significantly between baseline and actual conditions, from about 48 percent to nearly 73 percent. The walking mode share dropped from nearly 25 percent to just over 10 percent, while the carpool/vanpool share and bike/other share increased slightly.

Table 34: Mode splits at Joint Base Lewis-McChord ACS[352]

Mode Splits	Baseline (2006-2010)	Predicted	Actual (2011-2015)
Drive Alone	48.4%	*Missing data*	72.9%
Carpool/Vanpool	6.6%		8.5%
Transit	1.1%		0.3%
Walk	24.3%		10.6%
Bike and other	1.9%		2.6%
Telework	17.8%		5.2%

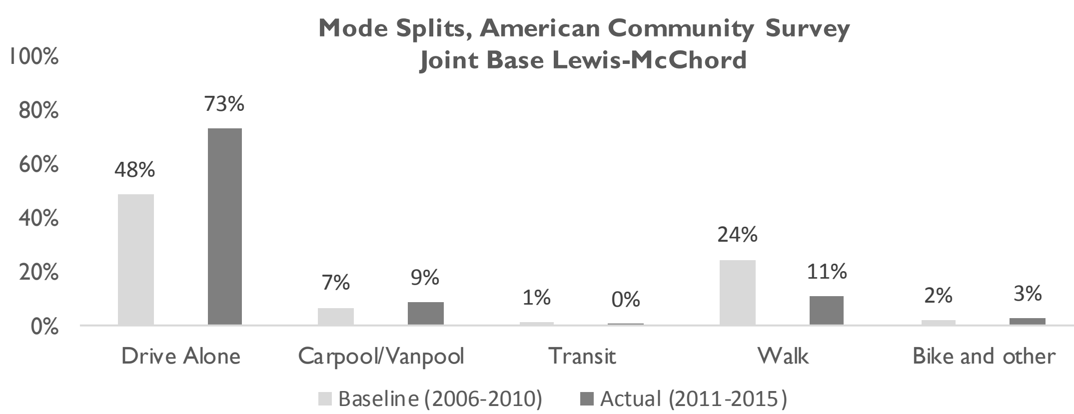


Figure 53: Mode splits at Joint Base Lewis-McChord, ACS[353]

The active duty personnel who reside on the base would be more likely to walk to their duties than personnel who live off-base. Nevertheless, these ACS results for mode split are difficult to interpret, and they raise several questions:

- Why was the percentage of walk commuters so high in the baseline condition? Is this a realistic representation of on-base personnel travel behavior on a large, spread-out military base?

- Why did the percentage of walk commuters drop so much between the baseline and the actual condition? Did the merger of the facilities or the redeployment of large numbers of personnel from overseas contribute?
- Who are the personnel telecommuting in the baseline condition, and why did their share of commuting drop so much between the baseline and the actual condition? Active duty military activities at JBLM do not appear to be well-suited to telecommuting, especially on a regular basis. Is there a different interpretation of "Worked at home" that explains the high percentage, and the variability, of that mode share?
- Why did the percentage of drive-alone commuters increase so significantly?

There were no surveys of JBLM personnel travel behavior, so the ACS data are the only quantitative measures for travel behavior at JBLM. However, the variability of the data and the disparities between the ACS data and expected travel behavior, as evidenced by the questions above, make it difficult to draw useful conclusions from the ACS data.

3.4.C. Findings

Overview

Since the merger of Fort Lewis and McChord AFB that created Joint Base Lewis–McChord (JBLM), the facility has grown by approximately 36 percent. It now accommodates over 150,000 military service members and their families, local retirees, and Department of Defense (DoD) civilian personnel. While it is important to note that this growth was not a direct result of BRAC 2005 actions, it is impossible to have any discussion of conditions at JBLM without addressing the facility's growth. Managing growth at JBLM and understanding its effects on the surrounding counties and roadway networks has shaped regional planning efforts and influenced infrastructure investments.

To cope with increased traffic, the WSDOT, JBLM, Pierce County, and other local stakeholders have taken on numerous projects to reduce congestion along I-5, the main freeway serving JBLM. An internal access roadway connecting the newly consolidated facilities opened in 2015; this new direct connection has removed auto trips from I-5. A long-term project to overhaul and expand I-5 has just begun and its effects will not be seen for quite some time.

Facility Changes

- Actual personnel growth at JBLM was higher than predicted. Personnel at JBLM increased from approximately 131,000 in 2009 to approximately 138,000 in 2016, which is higher than the 136,000 personnel predicted by 2016.
- Personnel growth was mostly the result of redeployment of overseas troops and other military initiatives, and not directly related to the BRAC 2005 realignment, which was an administrative merger of the existing adjacent Fort Lewis (U.S. Army) and McChord AFB.

Transportation Demand

- On roadways adjacent to JBLM, AADT remained very consistent between 2005 and 2014, with a total increase of only 0.8 percent.

- Because the BRAC 2005 actions to create JBLM were principally an administrative consolidation rather than a physical relocation of forces or personnel, BRAC 2005 was not expected to increase transportation demand.

Mitigation Measures

- The principal focus of TDM strategies at JBLM was encouraging personnel to try commuting via vanpool, carpool, or bicycle and developing an internal shuttle service.
- JBLM has several characteristics – active duty military operations, a large area with spread out development patterns, and secure boundaries with controlled access points – that make travel modes such as transit, walking, bicycling, and teleworking difficult or infeasible.
- Because JBLM is a secure facility limited-access entry points, transit demand was low due to requirements for buses to drop passengers off outside entry gates.
- The opening of Joint Base Access Road improved connectivity for many trips between the two components of the previously separated facility, which likely removed trips from I-5.
- Most major transportation system improvements to mitigate impacts of BRAC 2005 and other transportation issues were completed after 2011 or are still underway. Therefore, their impacts are not fully reflected in the actual conditions.

Transportation Impacts

- While data on baseline, predicted, and actual LOS measures were limited, available analysis indicated that LOS at nearby intersections has worsened.
- Congestion was predicted to increase and LOS was expected to worsen at all study intersections. Actual counts and analysis of current conditions support this prediction.

Data and Analysis Issues

- Since actual surveyed mode splits were not available, analysis of the effectiveness of TDM strategies was limited.
- Predicted mode splits for post-BRAC JBLM travel were unavailable.
- In the absence of any other data on mode split, the only available information on mode split was for base residents from the American Community Survey (ACS). This data, however, produced a few questionable results, especially for the baseline condition. Therefore, it does not appear to be a reliable measure of baseline v. actual travel behavior.
- Available baseline, predicted, and actual condition intersection LOS data are not for the same intersections; this limits the ability to draw clear conclusions about changes in traffic and congestion.
- Because multiple projects are underway or have recently been completed, additional data is required to understand their impact.
- Walking and biking volumes were not available for JBLM for any analysis conditions. Mode splits available from the ACS suggest there has been a decrease in walking.

3.5. EGLIN AIR FORCE BASE

Eglin Air Force Base is the largest air force base in the world. It encompasses three military installations, collectively known as the Eglin Military Complex, and includes: Eglin Air Force Base (AFB), the host unit for the 96th Air Base Wing; Hurlburt Field, headquarters to Air Force Special Operations Command; and Duke Field, which houses the 919th Special Operations Wing, the only special operations unit in the Air Force Reserve. Eglin AFB stretches across three counties in northwest Florida: Santa Rosa, Okaloosa, and Walton; this area is defined as the Region of Influence (ROI) in this case study update.

Eglin AFB comprises 463,360 acres of land area, often referred to as the Eglin Reservation. The facility also includes nearly 83.2 million acres of airspace overlying the land directly above Eglin AFB and extending to the east, south, and north into Alabama; approximately 2.5 percent of the airspace is over land and the remaining 97.5 percent is over water. Contained within the 463,360 acres of the Eglin Reservation are 17 miles of barrier island coastline on Santa Rosa Island in Okaloosa and Santa Rosa Counties, of which 13 miles are closed to the public.[354]

The primary function of Eglin AFB is to support test and training activities for numerous development programs, operational military units, military schools, and various federal agencies.[355] Assigned to the 96th Test Wing and Air Force Materiel Command, Eglin Air Force Base is a joint-service installation supporting more than 62 organizations from the U.S. Air Force. Army, and Navy including the 7th Special Forces Group (Airborne), 6th Ranger Training Battalion, the Navy Explosive Ordnance School, the 20th Space Control Squadron, and the F-35 Joint Strike Fighter Initial Training Center. Eglin AFB also hosts the Joint Gulf of Mexico Range Complex.[356]

Three main actions affecting Eglin AFB were proposed in the BRAC 2005 commission report. These include:

- Relocating the Army 7SFG(A) to Eglin AFB from Fort Bragg, North Carolina;
- Establishing Joint Strike Fighter (JSF) Initial Joint Training Site (IJTS) by realigning Luke Air Force Base in Arizona, Marine Corps Air Station in Miramar, California, Naval Air Station in Oceana, Virginia, Sheppard Air Force Base in Texas, and Naval Air Station in Pensacola, Florida and relocating them to Eglin AFB; and,
- Creating an Air Integrated Weapons and Armaments Research, Development and Acquisition, Test, and Evaluation Center[357]

The first two actions were evaluated in the 2008 Final Environmental Impact Statement (FEIS) for the BRAC 2005 realignment at Eglin AFB, while the third recommendation was completed in 2005 before the BRAC 2005 commission report became law. Implementation of BRAC 2005 at Eglin AFB began in 2011 and all actions were expected to be completed by 2016. Implementation of BRAC 2005 at Eglin AFB was anticipated to result in an increase of approximately 11,000 personnel in the ROI and create a new series of installations.

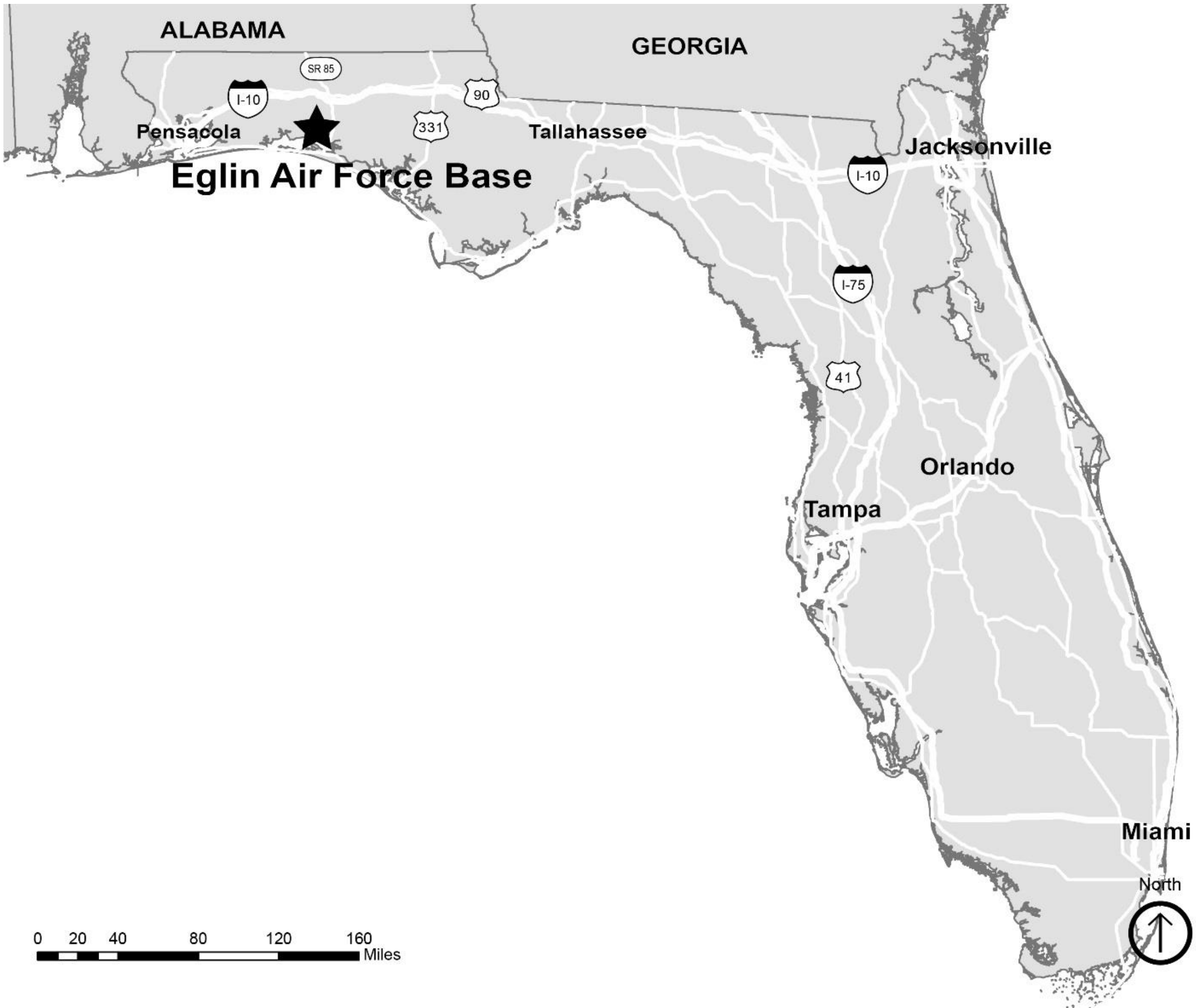


Figure 54: Regional map, Eglin Air Force Base

3.5.A. Case Study Update

Baseline Conditions – Existing condition prior to BRAC Implementation

This section outlines baseline conditions at Eglin AFB prior to the 2011 implementation of BRAC 2005. Some of conditions described still exist and others, discussed in later sections, have changed.

Facility Profile

Prior to BRAC 2005 implementation, the total land area of the Eglin Reservation encompassed nearly half of Okaloosa County, as well as significant parts of the adjacent Santa Rosa and Walton Counties. Eglin Air Force Base and Hurlburt Field were staffed by approximately 16,500 military personnel and 4,500 civilian workers. The three surrounding counties had a combined population of approximately 353,000 by 2009. The Eglin Reservation accounted for more than 34 percent of the economy in northwest Florida and more than 70 percent of the economy in Okaloosa County.[358]

As mentioned previously, the creation of the Air Integrated Weapons and Armaments Research, Development and Acquisition, Test, and Evaluation Center, part of the BRAC 2005 actions, was completed in 2005. Due to the timing and limited data availability, the impacts of this initiative are included in the baseline condition.

Transportation System Condition and Performance

Roadway Access and Traffic Conditions

The major transportation facilities in the Eglin Reservation area included State Roads (SR) 85, 20, 123, 188, 393, 189, 397, and 285 and U.S. Highways (U.S.) 98/SR 30 and 331 as well as the local roadways within Eglin Main Base. Several of the study area roadways were designated as part of the Strategic Intermodal System (SIS), a statewide network of transportation facilities designated by the Florida Department of Transportation (FDOT) as high priority facilities. Also, included in SIS were the state's largest and most significant commercial service airports, the spaceport, deep-water seaports, freight rail terminals, passenger rail and intercity bus terminals, rail corridors, waterways, and highways. SIS facilities in the study area included Interstate 10 (I-10), SR 123, SR 85 (from SR 123 to the Okaloosa Regional Airport entrance and I-10 to SR 123), U.S. 331, and U.S. 98 through Walton County. [359]

Prior to BRAC 2005, several segments of the roadway network within the Eglin Air Force Base ROI were considered deficient and operated worse than the LOS standard adopted by the Florida Department of Transportation (FDOT) for the PM peak-hour. Deficient segments included portions of SR 85, Mary Esther Boulevard, U.S. 98, SR 189, and SR 123. [360]

Since BRAC 2005 actions have the potential to affect specific areas of the Eglin Reservation ROI differently, traffic operations are discussed across three general regions: the areas surrounding and leading to Eglin AFB, Duke Field, and the area near DeFuniak Springs in Walton County.

Eglin Air Force Base Region

In the Eglin AFB region, nine roadway segments were deficient with respect to the FDOT LOS standard. Eight of these segments operated at LOS F in the PM peak-hour in the peak-direction. Deficient segments are marked in gray in Table B22. None of these deficiencies identified were located within the Eglin Main Base.[361]

Duke Field Region

For roadways in the Duke Field Region, two segments of SR 85 operated worse than FDOT's LOS standard; these are marked in gray in Table B23. This was of particular concern as the deficient segments were expected to be directly impacted by BRAC 2005 actions. There was concern that scheduled improvements of these segments would not completely address the existing deficiency and additional mitigation measures would be required.[362]

DeFuniak Springs Region

For roadways in the the DeFuniak Springs Region, three segments, including portions of U.S. 90, U.S. 331 and SR 285, were deficient with respect to FDOT's LOS standard. These segments are marked in gray in Table B24.

Gates/Entry Points to the Facility

Under the baseline condition, Eglin AFB had two 24-hour gates. The West Gate was just off SR 85 (also called Eglin Parkway) and was closest to the city of Fort Walton Beach. The East Gate was on the Valparaiso side, off SR 397. Two other gates, North Gate and ACC Gate, were open during peak hours Monday through Friday from 6 AM to 8 PM and 4 PM to 6 PM. The ACC Gate was located at the intersection of SR 397 and SR 189, close to the West Gate, and the North Gate was located on SR 85.[363]

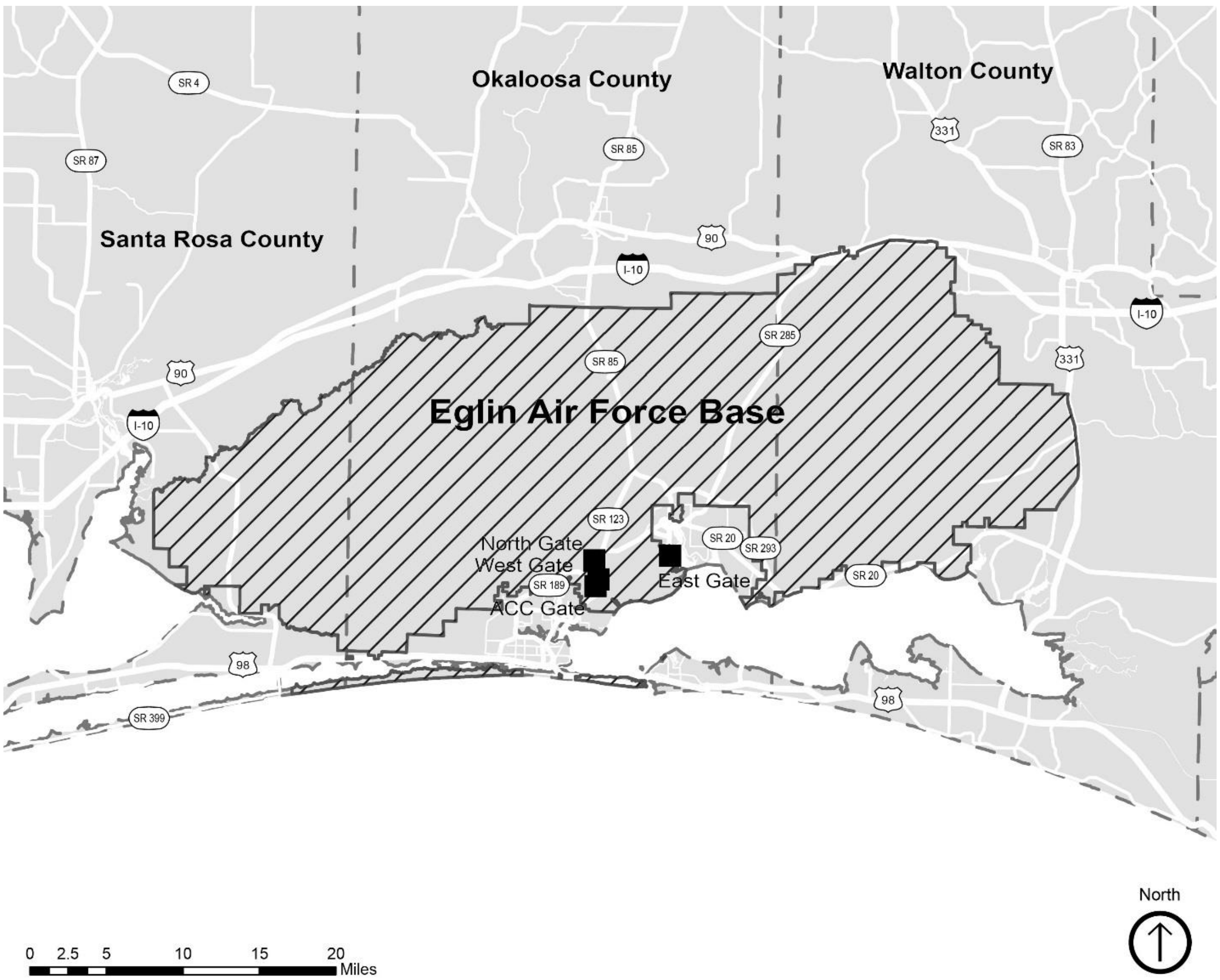


Figure 55: Gate locations, Eglin Air Force Base

Public Transit

Two of the three counties in the Eglin Reservation ROI, Walton County and Santa Rosa County, did not provide public transportation. Okaloosa County did provide public transit, but it was mostly in or near Fort Walton Beach.

The transit system in Okaloosa County, Okaloosa County Transit (OCT), started offering fixed route bus service in 2000. In 2006, OCT offered three routes serving Fort Walton Beach, two Crestview routes, one Okaloosa Island routes, and three Destin and South Walton routes. An

Express line was added to the system in 2006 and provided service between Crestview and Fort Walton Beach running through the Eglin Reservation. [364]

Between 2005 and 2008, a large increase in OCT ridership was observed. This increase may correspond to the sharp rise in oil prices during the same period. In 2005, passenger trips totaled 71,193 and increased steadily until peaking at 211,330 in 2008.[365]

Based on public feedback from the Okaloosa-Walton Transportation Planning Organization's Transit Development Plan, OCT was not seen as a good option for military personnel accessing Eglin Air Force Base despite the recent increases in users. Eglin Air Force Base had limited transit options inside the facility and was considered "not walkable".[366]

Pedestrian and Bicycle

Prior to BRAC 2005 implementation, pedestrian and bicycle infrastructure was not comprehensive around Eglin Reservation. Very few people walked or biked to the facility for their daily commute, since the system of sidewalks was not comprehensive or interconnected. Sidewalks were provided around some major general use buildings to reach nearby buildings and parking areas as well as along some residential streets. Additionally, the roadway network was organized with large blocks and limited connectivity making it difficult to add sidewalks. Given this environment, the Okaloosa-Walton Transportation Planning Organization noted that the interior of Eglin AFB was considered "not walkable."[367] Due to the limited pedestrian and bicycle facilities to and from Eglin AFB and an inadequate walking environment inside the facility, very few personnel commuted by walking or bicycling.

Parking

Information regarding parking facilities in the pre-BRAC 2005 baseline condition was not provided in the 2008 FEIS and was not available in any other planning or reference documents.

Travel Behavior

Prior to the implementation of BRAC 2005, most personnel (86.7 percent) reached AFB by driving alone. Approximately 8.2 percent of personnel were part of a carpool or vanpool.[368] The baseline mode split for the Eglin Air Force Base census-designated place (CDP) is shown in Table 35. The U.S. Census American Community Survey (ACS) failed to capture any travel by the public transit system or bicycle for their commute to work.

Table 35: Baseline mode split for Eglin Air Force Base[369]

Mode	Baseline (2006-2010, ACS)
Drive alone	86.7%
Carpool/Vanpool	8.2%
Public Transit	0.0%
Walked	3.0%
Bicycle	0.0%
Taxicab, motorcycle, or other	0.4%
Worked at home	1.7%

Safety Record

Before crash data was unavailable within the specific Eglin AFB study area. The annual total number crashes in Okaloosa County, Santa Rosa County, and Walton County are shown in Table 36. The number of crashes within each of these three counties remained consistent apart from the 15% decrease in Okaloosa County (2008) and 20% decrease in Santa Rosa County, versus the previous four-year (2004 – 2007) averages.

Table 36: Annual crashes in Okaloosa, Santa Rosa, and Walton Counties[370]

Year	Okaloosa	Santa Rosa	Walton
2004	2174	1402	628
2005	2190	1543	684
2006	2050	1541	654
2007	2026	1419	671
2008	1779	1186	602

Predicted Condition – Projected Future Conditions

Facility Realignment Plan

BRAC 2005 legislation recommended relocating the Army 7th Special Forces Group (airborne) and the Joint Strike Fighter (JSF) Initial Joint Training Site (IJTS) to Okaloosa County. Relocation of the Army 7th Special Forces Group was expected to increase the population of the Eglin Reservation by an estimated 6,100 (2,200 military personnel, 1,500 spouses, and 2,400 children) and relocation of Joint Strike Fighter (JSF) Initial Joint Training Site (IJTS) was expected to increase the population by 4,900 (2,300 personnel and contractors, 1,200 spouses, and 1,400 children).[371] By 2015, estimates indicated that the total (direct, indirect, and induced) impact of the arrival of the Army 7 SFG(A) and JSF would total 16,000. With the expected concurrent departure of the 33rd Fighter Wing, which would decrease the population by 5,000 individuals, the net population impact of the BRAC 2005 actions was expected to be 11,000 in the ROI, of which nearly 10,000 individuals would reside in Okaloosa County.[372]

The BRAC 2005 realignment plan called for realignment activities to begin in 2011, with relocation of all personnel completed by 2016. These activities are forecast to create more than 10,000 jobs in the professional technical services, construction, healthcare, and social assistance sectors in the tri-county region by 2015.[373] Given this timeline, all predictions in this section have been made for a 2016 future horizon.

Predicted Transportation Systems Outcomes

This section describes the projected impacts of BRAC 2005 actions on the areas surrounding Eglin AFB in a future build scenario. All projected impacts included in this section were developed prior to implementation of BRAC 2005 recommendations.

Traffic Impacts and Mitigation

The 2008 FEIS predicted declines in LOS after implementation of the BRAC 2005 actions. Table B28 compares baseline LOS to the predicted future build LOS in the Duke Field region. According to the analysis, the Duke Field region was expected to be the only area directly influenced by

BRAC 2005 implementations; the other regions were projected to experience the same level of impacts as described in the predicted future no-build condition. Three roadway segments were projected to operate at deficient LOS compared to FDOT's LOS standard for the peak-hour, peak-direction analysis (marked in gray in Table B28). These three segments include portions of SR 85 directly adjacent to the proposed new access point and will provide the connection from the Cantonment Area/Duke Field to I-10.[374]

Road improvements were expected to occur on Range Roads (RRs) 211, 213, 215, and 237. These roads would be widened and paved, with graveled shoulders. Roadway right-of-way width was to be expanded to 80 feet for RR 211 and the section of RR 237 north of the new Cantonment Area. Roadway right-of-way width in section of RR 237 south of new Cantonment Area and the sections of RR 215 and RR 213 from RR 237 to SR 85 would be widened to 200 feet. A new 200-foot-wide connecting road segment was expected to link RR 213 to the Duke Field entrance. A new access control point would be located at the intersection of RR 237 and RR 215.

The proposed new access to the new 7th SFG(A) Cantonment Area was proposed to from a new signalized intersection at the existing Duke Field entrance at SR 85. The new access road would extend southwest from the intersection to RR 213 with access continuing to be available on RR 213 to RR 215, and then north onto RR 237.[375]

Congestion Management System (CMS) and Transportation System Management (TSM) projects, which are typically intersection and operational improvements to preserve or act as minor capacity improvements, were also proposed as part of the future mitigation program. These projects were proposed along with access/corridor management plans and/or transit improvements.

Transit Impacts and Mitigation

The increase in population and employment resulting from the realignment was expected to create additional demand on the local public transportation system. Demand was expected to be especially high along the SR 85 and SR 123 corridors, which provided access between Eglin AFB and the Crestview as well as Fort Walton Beach/Niceville areas.[376] Expansion of the transit system, discussed in subsequent sections and led by OCT, was recommended as mitigation for anticipated congestion from projected impacts to the roadway system.

Pedestrian and Bicycle Impacts and Mitigation

Few improvements to pedestrian and bicycle facilities were proposed as part of implementing BRAC 2005. Some of the proposed roadway projects, like the SR 85 improvement project, included widening the roadway shoulder for bicyclists.

Safety Impacts

Specific conclusions predicting how implementation of BRAC 2005 would affect safety were not available. However, many of anticipated roadway improvements, some of which were proposed to enhance facilities for pedestrians and bicyclists, were expected to improve safety and decrease the number of and severity of crashes. The use of Intelligent Transportation System (ITS) technologies that have been shown to increase transportation safety, such as automatic road enforcement and emergency vehicle notifications systems, were also recommended.[377]

Travel Demand Management Strategies

To reduce congestion and energy consumption, Okaloosa County and Walton County established several supporting policies in the Okaloosa-Walton 2035 Long Range Transportation Plan, including:

- Providing multi-modal linkages to increase the range of modal choices available and connection between modes to motorized and non- motorized users;
- Reducing energy consumption by promoting actions to increase the occupancy of vehicles (e.g. ridesharing, rail transportation, mass transit, and High Occupancy Vehicle (HOV) Lanes).[378]

Travel Behavior

Adding approximately 11,000 personnel to the Eglin Reservation was expected to affect the existing roadway system, especially within the segments already experiencing capacity issues. Daily congestion was expected to cause travelers to re-evaluate their travel mode and potentially encourage a shift to carpools, vanpools, or public transit rather than drive alone travel. With the recommended expansion of the transit system and the addition of more robust carpool/vanpool services, discussed in subsequent sections, the share of commuters using public transit, carpool, or vanpools was expected to increase.

Actual Condition – Measured post-BRAC implementation conditions

The following section discusses actual (2016) conditions in and around the Eglin Reservation. Where possible, comparisons to the 2016 actual conditions will be made to predicted 2016 future build conditions.

Actual Post-BRAC Facility Profile

Completion of the BRAC 2005 actions at Eglin AFB were planned to be completed in 2016. To date, the BRAC 2005 relocation of personnel was substantially complete, although redeployment of aircraft, in particular F-35s, is ongoing.

The Eglin Military Complex currently accounts for about 35 percent of the economy in Northwest Florida and about 73 percent of the economy in Okaloosa County. Defense activities in Northwest Florida generate an estimated 192,000 jobs, mostly as a direct result of the Eglin Military Complex.[379]

Actual Transportation Mitigation

Roadway Network Improvements

Early in the BRAC 2005 implementation process, multiple projects were proposed and programmed to improve the roadway network around the Eglin Reservation. By 2006, projects programmed for construction within the next three years included improvements to SR 85 (John Sims Parkway) from SR 397 (Government Avenue) to SR 85 (junction of SR 85 with SR 20), SR 85 at the Okaloosa Regional Airport entrance, SR 85 at SR 123 (South of General Bond Boulevard to north of Okaloosa Airport), and SR 189 at General Bond. To date, all of these roadway projects had been completed.

Additional projects were proposed in the 2008 FEIS as part of suggested mitigation measures. These projects, described below, are still under construction and expected to be completed in 2017 and 2018.

In Progress

1. **SR 85 Improvement Projects.** Given its proximity to Eglin AFB, SR 85 was prioritized for improvement to accommodate future traffic growth (Project 1, Figure 56). Two improvement projects along SR 85 are currently in progress: SR 85 from College Boulevard to south of SR123 Bridge and SR 85 from north of SR 190 (Valparaiso Parkway) to south of SR 397 (John Sims Parkway). Improvements along these segments include resurfacing the roadway, repairing curbs and gutters, adding drainage improvement signing, and completing guardrail work, signing and pavement markings, and sidewalk and pedestrian ramp reconstruction. These improvements are expected to be completed in 2017.[380]
2. **SR 83 Improvement Project.** The SR 83 improvement project from north of SR 20 to SR 8/I-10 began in August 2013 and is ongoing (Project 2, Figure 56). Extra through lanes were added as part of the reconstruction of SR 83 at a cost of approximately $50.7 million.

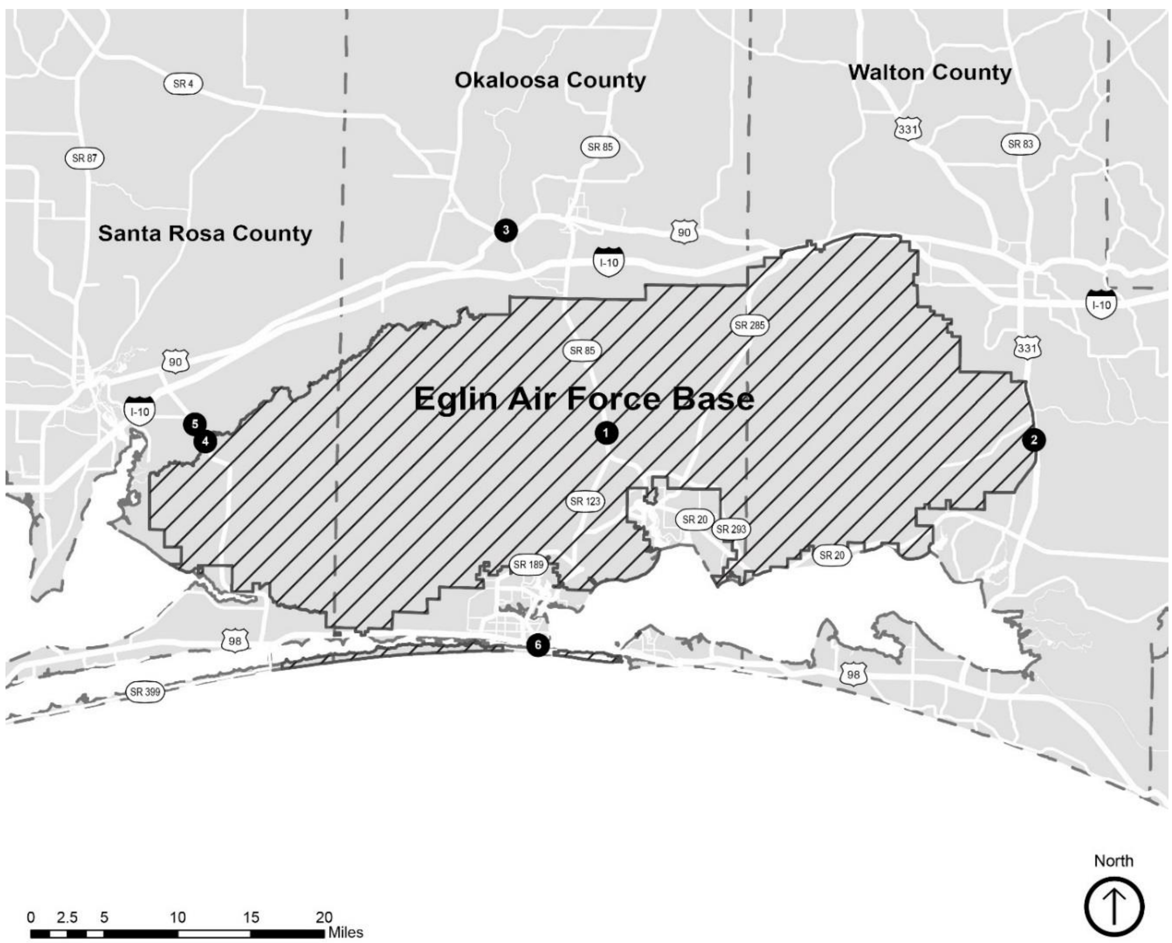


Figure 56: Project map, Eglin Air Force Base

3. **SR 10 (U.S. 90) Yellow River Bridge Replacement.** The replacement of the Yellow River Bridge on SR 10/U.S. 90 began in August of 2014 and is ongoing. The project has an estimated construction cost of $15.1 million (Project 3, Figure 56).
4. **SR 87 from Eglin Air Force Base Boundary to two miles south of Yellow River Bridge.** The SR 87 reconstruction project includes widening the roadway from two to four lanes from Eglin AFB Boundary to two miles south of Yellow River Bridge (Project 4, Figure 56). The roadway will include two 12-foot travel lanes in each direction separated by a 40-foot median and 10-foot outside shoulder. Storm water ponds and drainage improvements are also part of the multi-lane reconstruction project. The project began in the fall of 2015, and is estimated to be completed in the summer of 2017 at a cost of $18 million.[381]
5. **SR 87 from two miles south of Yellow River Bridge to County Route 184 (Hickory Hammock Road).** This SR 87 reconstruction project includes adding lanes from two miles south of Yellow River Bridge to CR 184 (Hickory Hammock Road) (Project 5, Figure 56). The $29.6 million project will widen the four-mile segment of SR 87 from two to four travel lanes and construct a new bridge across the Yellow River. Other additions include resurfacing existing travel lanes, new roadway striping, signage improvements, storm water retention ponds, and drainage upgrades. Along with the other project on SR 87, the entire corridor is slated for completion fall 2018.[382]
6. **Santa Rosa Sound Alternate Crossing Study.** The Santa Rosa Sound Alternate Crossing Study is a high-level planning study that focuses on the feasibility of creating an alternate road and bridge corridor between Fort Walton Beach and Okaloosa Island. An additional crossing is being considered to relieve regional traffic congestion. When the study is completed, FDOT will decide whether or not to proceed to a Project Development & Environment Study for this project.

Travel Demand Management Strategies

Eglin AFB is served by the 'Ride On' carpool/vanpool program, also known as the West Florida Commuter Assistance Program. This program is funded by FDOT and staffed by the West Florida Regional Planning Council. Ride On offers employer-based programs to assist in reducing single occupant vehicle travel to work sites. The Commuter Assistance Program matches commuters to assist in forming carpools and vanpools. In response to the BRAC 2005 actions, Ride-On staff worked with Eglin AFB to establish a vanpool program with four vans commuting to Eglin AFB every day.[383]

Community Involvement Process

Community outreach related to implementation of BRAC 2005 began with the drafting of an environmental impact statement (EIS). As part of the process, the U.S. Air Force invited the public to participate in the scoping process and provide comments through meetings, mailings, and email. The Air Force published a Notice of Intent to prepare an EIS on August 1, 2006. Eglin AFB then held two public scoping meetings in Fort Walton Beach and Crestview, Florida in August 2006.

After the initial scoping period, the U.S. Air Force identified new potential alternatives for the JSF flight training. A supplemental Notice of Intent to the EIS was published in October 2007. The alternatives were presented at two public scoping meetings in Navarre, Florida, and Niceville, Florida in November 2007. The public scoping period was extended until December 2007. Public concerns and comments were used to develop the document and were noted in relevant sections of the 2008 FEIS. [384]

Actual Transportation System Performance

Travel Behavior

As BRAC actions are still occurring, a full set of data on travel behavior and mode split is not yet available. Examining the most recent data available, the 2015 transportation mode split at Eglin Air Force Base from the U.S. Census American Community Survey (see Table 37), can lend some insight into the current conditions. Compared to baseline, driving alone remains the major mode of commuting to work, and very few people used public transit. A similar trend was observed within greater Okaloosa County as less than one percent of the population used the public transit system in 2015. Nearly eight percent of commuters to Eglin Air Force Base used a carpool or vanpool.[385] Between baseline and actual conditions, the mode split for personnel walking to work decreased from three to one percent, while the mode split for bicycling increased from zero to nearly three percent. With BRAC 2005 actions expected to be implemented through 2016, and transportation improvement projects being completed through 2017 and 2018, travel mode splits may shift and should be continuously monitored.

Table 37: Actual mode split at Eglin Air Force Base[386]

Mode	Baseline (2006-2010, ACS)	Actual (2011-2015, ACS)
Drive alone	86.7%	82.6%
Carpool/Vanpool	8.2%	7.8%
Public Transit	0.0%	0.0%
Walked	3.0%	1.0%
Bicycle	0.0%	2.7%
Taxicab, motorcycle, or other means	0.4%	3.7%
Worked at home	1.7%	2.3%

Traffic Operations

As BRAC actions are still occurring, a full set of data on current traffic operations is not yet available. A comparison of traffic operations under the baseline (2006) condition with available data from 2011 and the predicted (2016) condition is discussed below. More data collection is needed to evaluate post-BRAC 2005 transportation conditions at Eglin Air Force Base.

Eglin Main Base Region

The LOS for most of the road segments of Eglin Main Base region in 2011 are the same as or better than the 2016 prediction, although in 2011 some road segments had traffic operations worse than the LOS standard adopted by FDOT as shown in Table B29.

Duke Field Region

Several of the road segments in the Duke Field region operated with worse LOS in 2011 than what was predicted for 2016. This may be due to the fact that several roadway improvements intended to mitigate the effects of the BRAC 2005 recommendations are still under construction.

DeFuniak Springs Region

The LOS for most of the road segments of DeFuniak Springs region in 2011 are the same as or better than the 2016 prediction, although in 2011 some road segments had traffic operations worse than the LOS standard adopted by FDOT as shown in Table B31.

Transit Operations

Since implementation of BRAC 2005, the transit system around Eglin Air Force Base has expanded. The transit system serving Okaloosa County has changed its name to the 'Emerald Coast Rider.' There are now 10 bus routes serving the area, including five routes in Fort Walton Beach, one express bus connecting Crestview and Fort Walton Beach, one on Okaloosa Island, and three in Destin.

Annual passenger trips on the Emerald Coast Rider system (see Table 38) have been steadily increasing since 2010. In 2015, annual ridership across all routes was 137,736 (see Table 39). Route 14, known as the WAVE Express, runs across the Eglin Air Force Base Reservation along SR 85 every four hours. As mentioned in previous sections, this express line was established in late 2006. Annual ridership data on each route in 2015, the most recent data available as of this writing, indicates that Route 14 accounted for nearly seven percent of Emerald Coast Rider's annual ridership (see Table 39).

Table 38: Emerald Coast Rider passenger trips (2008-2012)[387]

Year	Total Passenger Trips (2008-2012)
2005	71,193
2006	108,404
2007	169,389
2008	211,330
2009	172,122
2010	162,820
2011	175,595
2012	179,921
2013	182,584

Table 39: Emerald Coast Rider annual ridership by route (2015)[388]

Route	Annual Ridership (2015)	% of Annual Ridership
1	27,406	19.9%
2	14,045	10.2%
3	5,962	4.3%
4	17,598	12.8%
5	1,870	1.4%
14	9,044	6.6%
20	21,449	15.6%
30	17,678	12.8%
32	13,362	9.7%
33	9,322	6.8%
TOTAL	**137,736**	**100%**

Several other transit strategies have been established for Eglin AFB. The 'Ride On' carpool/ vanpool program has four vans commuting to Eglin AFB every day.[389] The Florida Transportation Plan also proposes to provide transportation connectivity to Florida's military facilities to support their national security and emergency management functions.[390]

Pedestrian and Bicycle Access Impacts

Pedestrian and bicycle facilities around Eglin AFB and within the facility remain minimal. In most areas of Eglin AFB, bicyclists can use paved shoulders or ride within the traffic lane. Sidewalks or shared-use paths are still available in some areas, but not consistently, and they do not form a true consistent or reliable network.[391]

Safety Impacts

Baseline and actual post-BRAC crash data was unavailable for the specific Eglin AFB study area. However, the total number of crashes per year in Okaloosa County, Santa Rosa County, and Walton County increased from 2011 to 2015.

Table 40: Annual traffic crashes in Okaloosa County, Santa Rosa County and Walton County[392]

Year	Okaloosa	Santa Rosa	Walton
2008	1779	1186	602
2009	1924	1363	597
2010	1867	1318	597
2011	2084	1501	700
2012	2512	1666	909
2013	2914	1688	1088
2014	3007	1605	1127
2015	3362	1944	1248

New strategies have been implemented for using technology to improve transportation safety, security, and emergency management in the region.[393] The Okaloosa/Walton TPO Congestion Management Process Plan supports improving pedestrian and bicycle safety through the creation of sidewalks, bicycle lanes, and shared use paths.[394]

3.5.B. Evaluation of Actual Versus Predicted Conditions

Facility Changes – Baseline v. Proposed Build v. Actual

As a part of BRAC 2005, Army 7SFG(A) was relocated to Eglin AFB from Fort Bragg, North Carolina. Joint Strike Fighter (JSF) Initial Joint Training Site (IJTS) was established by relocating forces from several other facilities to Eglin AFB. Before implementation of BRAC 2005 actions, Eglin AFB and Hurlburt Field were staffed by approximately 16,500 military personnel and 4,500 civilian workers across 463,360 acres.

The proposed relocations resulting from BRAC 2005 actions were estimated to add approximately 11,000 personnel to Eglin AFB. Unlike the other BRAC 2005 actions described in this report, implementation of BRAC 2005 at Eglin Air Force Base was not completed until 2016. Due to this longer schedule, most relocations to Eglin Air Force Base are more recent or still underway; personnel estimates are not yet available for the actual (2016) condition.

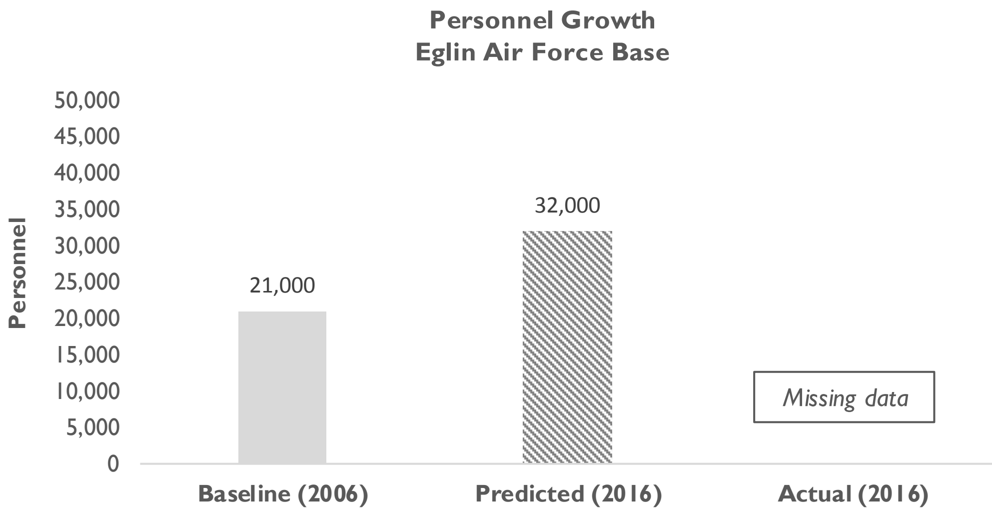


Figure 57: Personnel growth of Eglin Air Force Base

Transportation Demand – Baseline v. Proposed Build v. Actual

To determine transportation demand trends and patterns under baseline, predicted, and actual conditions, multiple metrics were reviewed. Between 2005, when BRAC actions were proposed, and 2015, AADT remained constant along Florida State Road (SR) 85 and SR 189, two major state routes serving Eglin Air Force Base. Traffic volume on SR 85 decreased by 11 percent between 2005 and 2010, followed by an increase of 14 percent between 2010 and 2015. SR 189 steadily declined by approximately 17 percent between 2005 and 2015. Traffic volumes on SR 285 were essentially constant during this period. Figure 58 shows AADT on SR 85, SR 189, and SR 285 from 2005 to 2015.

SR 85 between P J Adams Parkway and SR 123 is a four-lane divided expressway. SR 189 between Mooney Road and General Robert Bond Boulevard is also a four-lane divided expressway. FDOT's 2013 Quality/Level of Service Handbook shows that a four-lane divided rural expressway (uninterrupted flow) reaches LOS C at an AADT of 40,300 vehicles per day. Both SR 85 and SR 189 are estimated to be operating between LOS B and C with 2015 traffic volumes.

SR 285 between College Boulevard and Bob Sikes Road is a rural two-lane highway. FDOT's 2013 Quality/Level of Service Handbook shows that a two-lane undivided rural highway (uninterrupted flow) reaches LOS C at an AADT of 8,400 vehicles per day. SR 285 is estimated to be operating between LOS B and C with 2015 traffic volumes.

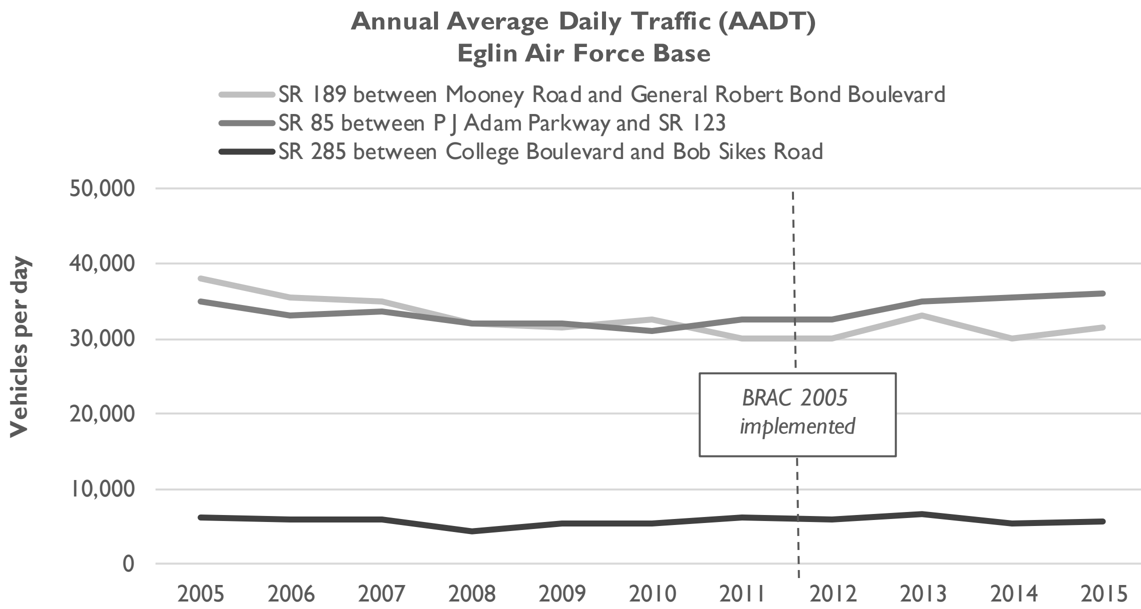


Figure 58: AADT from 2005 through 2015 around Eglin Air Force Base

Mitigation Measures – Proposed Build v. Actual

TDM strategies used by Eglin AFB to reduce the percentage of personnel commuting by private vehicle were relatively limited. Strategies centered on programmatic assistance in the creation of carpools and vanpools.

Mitigation projects at Eglin AFB were focused on roadway improvements. The six major projects described in

Table 41 focused primarily on improving roadways. One project, the SR 85 improvement project, addressed pedestrian facilities and included sidewalk and pedestrian ramp reconstruction. All six mitigation projects are currently underway.

Table 41: Mitigation projects at Eglin Air Force Base

	Project Type			Improvement	Project Status			Project Cost
	Roadway	Transit	Ped/Bike		Completed Before 2011	Completed After 2011	Under-way	
SR 85 Improvement projects	X		X	Rehabilitation and multimodal improvements for SR 85 from College Boulevard to south of State Road 123 Bridge; and S.R. 85 from North of SR 190 (Valparaiso Pkwy) to South of SR397 (John Sims Pkwy).			X	$2,830,000[395]
SR 83 Improvement Project	X			Reconstruction and addition of extra through lanes.			X	$50,700,000[396]
SR 10 Yellow River Bridge	X			Yellow River Bridge Replacement			X	$15,100,000[397]
SR 87 from Eglin AFB Boundary South	X			Roadway widening from two to four lanes, implementation of stormwater ponds and drainage improvements from Eglin AFB boundary to 2 miles south of Yellow River Bridge.			X	$18,000,000[398]
SR 87 Improvements to County Route 184	X			Rehabilitate and widen a four-mile segment of SR 87 between southern terminus of previous project to County Route 184 (Hickory Hammock Road)			X	$29,600,000[399]
Santa Rosa Sound Alternate Crossing Study	X			Feasibility study for a new roadway and bridge corridor between Fort Walton Beach and Okaloosa Island to relieve regional traffic congestion.			X	*Missing data*
TOTAL	**6**	**0**	**1**				**6**	**$116.2 million**

Transportation Impacts – Baseline v. Proposed Build v. Actual

Figure 59 and Figure 60 compare LOS at intersections around Eglin Air Force Base under baseline, predicted, and actual conditions. In the baseline condition, 10 out of 39 intersections operated at LOS E or worse during peak hour. Under predicted conditions, several intersections were expected to worsen and become more congested, with a total of 16 intersections expected to operate at LOS E or worse. As of 2011, actual conditions were better than predicted, with only six of the intersections operating at LOS E or worse.

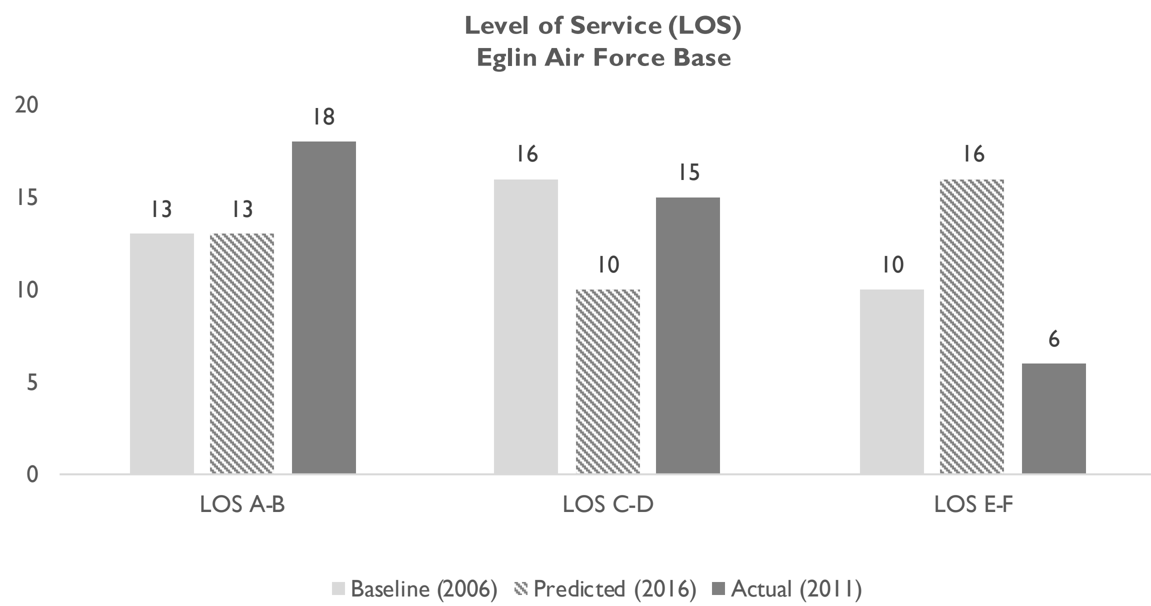


Figure 59: LOS at study area intersections near Eglin Air Force Base

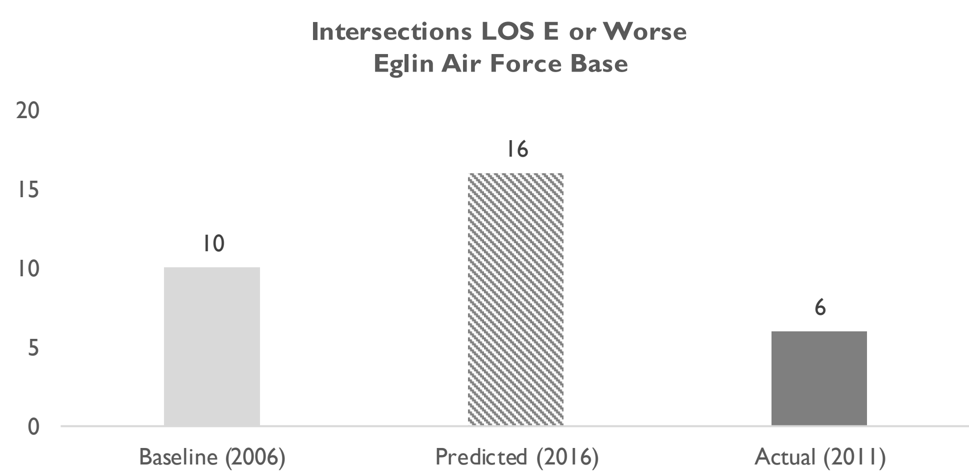


Figure 60: Intersections LOS E or worse near Eglin Air Force Base

Mode splits at Eglin Air Force Base were only available through the U.S. Census American Community Survey (ACS). Mode splits from these sources are outlined in Table 42 and Figure 61. As indicated in the ACS data, the clear majority of personnel commute via private vehicle. Although the share of personnel driving dropped by about four percent from baseline to actual conditions, it remained very high at nearly 83 percent. The share of personnel reporting that they walked dropped from three percent to one percent, while the carpool/vanpool share dropped slightly, by 0.4 percent, despite the promotion of a rideshare program.

Somewhat unexpectedly, transit mode share remained constant at zero. Under both baseline and actual conditions, no Eglin AFB personnel sampled for the ACS indicated that they took public transit, despite the availability of transit service within the facility. The decreases in drive alone and walking mode shares were balanced by a modest 0.6 percent increase in the share of personnel working at home and a six percent increase in the share of personnel traveling by taxi, motorcycle, or bicycle. ACS data does not break this category down, so it is impossible to know whether this increase represents increased bicycle ridership (despite the fact that none of the mitigation projects addressed bicycle facilities), more motorcycle ridership, or increased use of taxi or ride-hailing services.

Table 42: Mode splits at Eglin Air Force Base, ACS[400]

Mode Splits	Baseline (2006-2010)	Predicted	Actual (2011-2015)
Drive Alone	86.7%	*Missing data*	82.6%
Carpool/Vanpool	8.2%		7.8%
Transit	0.0%		0.0%
Walk	3.0%		1.0%
Taxi, motorcycle, bike	0.4%		6.4%
Work at home	1.7%		2.3%

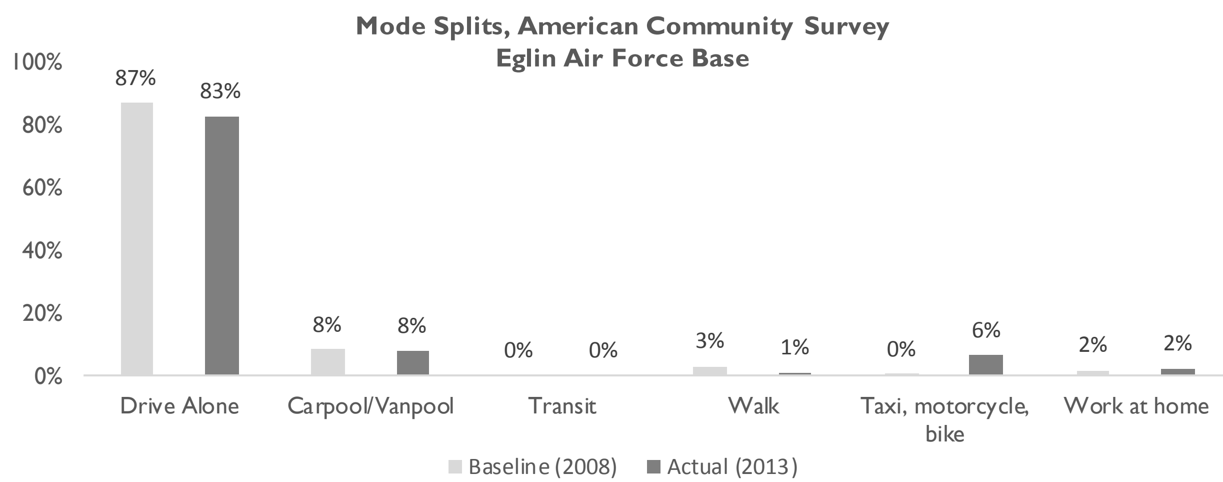


Figure 61: Mode splits at Eglin Air Force Base, ACS[401]

3.5.C. Findings

Overview

As a result of BRAC 2005, the total number of personnel at Eglin AFB was expected to increase by approximately 50 percent. To manage increased traffic from the BRAC 2005 realignment and address traffic congestion, Eglin AFB, Okaloosa County, and other local stakeholders took on numerous projects to reduce congestion along the major arterial roadways serving the Eglin Reservation. Congestion on SR 85 decreased by 2011, but increased on several other arterial routes in the area. Because infrastructure improvement projects are still underway, final conditions and operations of study area roadways and intersections are uncertain.

Evaluation of transportation impacts and development of mitigation programs was an ongoing process at Eglin AFB. Proposed transportation system improvements and TDM programs often evolved over time based on supplemental planning processes and ongoing coordination among military and civilian authorities.

These partnering relationships among military and civilian authorities at Eglin AFB developed and improved over the course of coordination on BRAC 2005 impacts and mitigation. In many cases, the coordination that was initiated through planning for BRAC 2005 and implementation of mitigation projects has resulted in ongoing partnerships that have improved communication and cooperation.

Facility Changes

- Personnel at Eglin Air Force Base was predicted to increase 50 percent by 2016.
- Detailed information on actual personnel growth of Eglin Air Force Base could not be obtained.
- It was difficult to identify appropriate individuals knowledgeable about transportation issues related to the Eglin Air Force Base facilities; it was particularly difficult to identify individuals with a knowledge of pre-BRAC 2005 conditions or effects of the BRAC 2005 implementation.

Transportation Demand

- At Eglin Air Force Base, AADT of several arterial roads showed a moderate decrease after 2005 followed by an increased after 2010.
- Other secondary routes showed more consistent traffic volumes between 2005 and 2015.
- Considering the increase in demand associated with the BRAC realignment, these patterns in general traffic volumes near Eglin Air Force Base most likely reflect national VMT trends.

Mitigation Measures

- TDM strategies at Eglin Air Force Base included a subsidy for public transit fares and encouragement of carpooling/vanpooling among base personnel.
- Mitigation projects at Eglin Air Force Base focused on roadway network improvements, with one project addressing improvements for pedestrian/bike.
- Construction projects initiated to help mitigate the effects of the BRAC 2005 actions at Eglin Air Force Base realignment are still underway.

Transportation Impacts

- There is uncertainty about benefits and impacts of transportation system improvements, including those intended to mitigate BRAC 2005 impacts, which were under construction or not implemented at the time of post-BRAC data collection.

- Overall, predicted congestion was expect to increase and LOS was expected to worsen in the area. While data on actual traffic volumes and LOS was limited, available information indicated that LOS at several intersections has worsened, while improvements were observed along SR 85.
- Because of Eglin AFB's large area, lack of well-connected public transit service, and work force that lives primarily off-base, the majority of personnel drive single-occupancy vehicles (SOV). Note that Eglin Air Force Base is an active duty military base, so most personnel cannot telework.
- Despite predicted decreases in drive-alone mode share and increases in carpool/vanpool mode share, actual mode split showed minimal changes.
- Walking mode shares decreased, while the mode share for taxi, motorcycle and bicycling increased.

Data and Analysis Issues

- There is a lack of available information on a wide range of topics, including facility characteristics, nature of the military activities at the facilities, land use, mitigation programs, and effects of transportation system improvements.
- There is inconsistency in data, information, and analysis at Eglin Air Force Base, as well as for different time periods (i.e. pre-BRAC implementation versus post-BRAC implementation).
- Since actual surveyed mode splits were not available, analysis of the effectiveness of TDM strategies was limited.
- Predicted mode split for post-BRAC Eglin Air Force Base travel was unavailable.
- Available baseline, predicted and actual condition intersection LOS data are not for the same intersections; this limits the ability to draw clear conclusions about changes in traffic and congestion.
- Because construction projects are still underway, additional data is required to understand their impact.
- Walking and biking volumes were not available for Eglin Air Force Base for any analysis conditions.

3.6. FORT BLISS

Fort Bliss is the U.S. Army's second-largest installation by geographic area, with approximately 1.12 million acres of land in Texas and New Mexico, as well as multiple civilian and non-civilian functions. It consists of the Cantonment Area and the Fort Bliss Training 12 Complex (FBTC). The Cantonment Area comprises the Main Post, William Beaumont Army 13 Medical Center (WBAMC), and Logan Heights. The FBTC is comprised of three large geographic areas: the South Training Areas, the Doña Ana Range-North Training Areas, and McGregor Range.

The Fort Bliss Cantonment Area is in El Paso, Texas. All other training lands and several base camps are in New Mexico. The Cantonment Area is home to a range of military entities, including the 1st Armored Division, the 32nd Army Air and Missile Defense Command, the Future Force Integration Directorate, the William Beaumont Army Medical Center, the U.S. Army Sergeants Major Academy, and the German Air Force Command Air Defense Center.

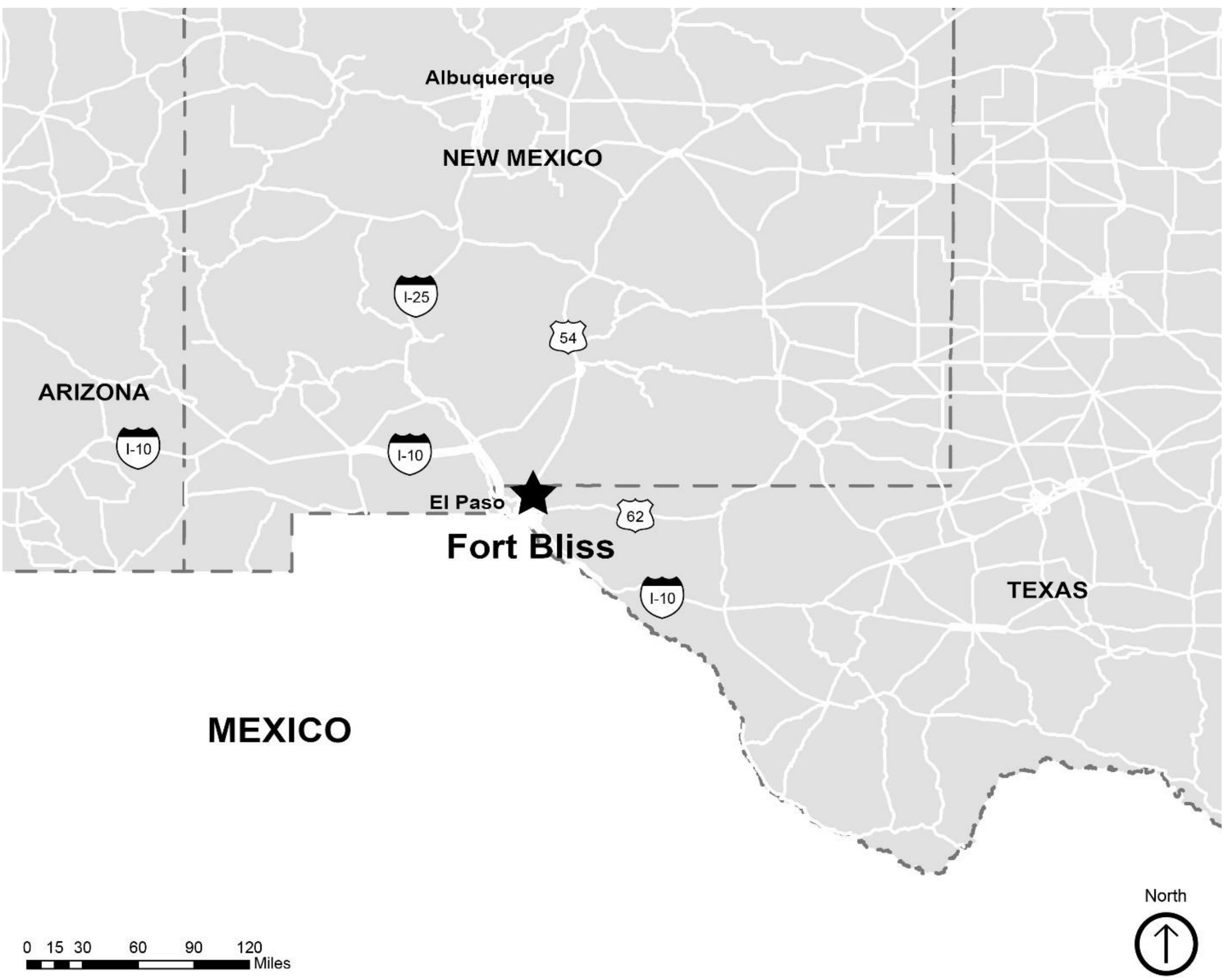


Figure 62: Regional map, Fort Bliss

BRAC 2005 actions represent the biggest transformation in history of Fort Bliss. Due to BRAC 2005, the number of active duty soldiers at Fort Bliss increased from under 10,000 in 2005 to more than 32,000.[402] This action realigned Fort Bliss by relocating air defense artillery units to Fort Sill in Lawton, Oklahoma and relocating the 1st Armored Division and various echelons above division units from Germany and Korea to Fort Bliss. Maneuver battalions, a support battalion, and aviation units from Fort Hood, Texas were also relocated to Fort Bliss.[403] As of this writing, four air-defense brigades have been assigned to the U.S. Army Forces Command (FORSCOM) at Fort Bliss.

These realignment actions present a challenge to the communities adjacent to Fort Bliss regarding housing, schools, health care, and transportation. The realignment of forces from Fort Hood to Fort Bliss took this into account and was made possible in part due to anticipated improvements across the adjacent communities.[404]

3.6.A. Case Study Update

Baseline Condition – Existing condition prior to BRAC implementation

This section outlines baseline conditions at Fort Bliss prior to the 2011 implementation of BRAC 2005 actions. Some of conditions described still exist and others, discussed in later sections, have changed.

Facility Profile

In 2006, the total population of Fort Bliss, which includes active duty personnel, civilian personnel, and their dependents, was more than 68,200. Retirees, annuitants, and their dependents comprised nearly 80,000 additional people, increasing the overall population associated with Fort Bliss to an estimated 147,875.[405] Prior to the BRAC 2005 realignment, Fort Bliss was composed of the Cantonment Area, comprising 24,000 acres, and the Fort Bliss Training Complex (FBTC), comprising 1.09 million acres. The Cantonment Area is adjacent to the most populated areas of the City and County of El Paso, Texas. The training areas are surrounded primarily by undeveloped, publicly-owned lands.[406]

Transportation System Condition and Performance

Roadway Access and Traffic Conditions

The Fort Bliss Cantonment Area, located near downtown El Paso, was served by multiple roadways. East-west access was provided by I-10, which runs through downtown El Paso just south of the Cantonment Area. Prior to implementation of BRAC 2005, I-10 was the most heavily traveled roadway in El Paso; it connected the metropolitan area to western and central Texas to the east, and southern New Mexico and Arizona to the west. Approximately 44 miles northwest of El Paso in New Mexico, I-10 connected with I-25 to provide access to Fort Bliss from the north. U.S. 54 (Patriot Freeway) also provided access to Alamogordo, New Mexico and Holloman Air Force Base/White Sands approximately 90 miles north of Fort Bliss. Montana Avenue (U.S. 62/180), located immediately south of Fort Bliss, was another major connection route to the facility and provided access to locations east of El Paso.

Besides access provided by major interstates and U.S. highway routes, Fort Bliss was also served by multiple state highway corridors. Texas' Loop 375 crossed the Fort Bliss installation between

Montana Avenue and U.S. 54, connecting the northeast and eastern portions of the facility and helped reduce traffic congestion along U.S. 54. Overpasses, constructed to allow military vehicles and equipment to pass under Loop 375, were also available and reduced civilian traffic interference with military operations.

The Fort Bliss Cantonment Area was served by major arterial city streets as well. These included Fred Wilson Avenue to the north, Airport Road to the east, U.S. 54 to the west, and Montana Avenue (U.S.-62/180) on the south. Other major roadways in the area included Railroad Drive and Dyer Street.

As previously discussed, the Cantonment Area of Fort Bliss is surrounded by major arterial city streets. The primary arterials providing access to the facility included Jeb Stuart Road, Ricker Road, Forrest Street, Marshall Road, Sheridan Road, Haan Road, and Robert E. Lee Road. This roadway network had heavy traffic volumes and high levels of congestion before implementation of BRAC 2005 because of the City of El Paso's rapid growth. This congestion was exacerbated by the fact that Fort Bliss itself created a large barrier. Because traffic could not pass through the facility, it was funneled onto the roadways along the facility perimeter rather than being distributed over a network.

The transportation network serving Fort Bliss under the baseline condition had segments of highways that were operating at LOS F. Minor delays and congestion occurred during the morning and afternoon peak travel periods.[407] In 2006, vehicles exiting the Main Post to reach the training areas need to cross Fred Wilson Boulevard at Chaffee Road or Airport Road at Haan Road, both locations that had significant congestion. Access to training ranges for most tracked vehicles and truck convoys was provided by the Chaffee Road /Fred Wilson Road intersection. Vehicle access to Biggs AAF was provided along Sergeant Major Boulevard east of Airport Road.

The capacity analysis of area roadways in 2006 is shown in Table B32:. Portions of I-10 and Montana Avenue operated at LOS F during peak periods due to limited capacity and high hourly traffic volumes; these are both major routes connecting to the downtown area of El Paso. In 2006, both U.S. 54 and Loop 375 provided ample capacity during peak travel times.

Gates/Entry Points to the Facility

In the baseline condition, 12 gates provided access to and from the Fort Bliss Cantonment Area. Eight gates provided access to the Cantonment Area's Main Post: Cassidy Gate, Chaffee Gate, Jeb Stuart Gate, Marshall Gate, Pershing Gate, Remagen Gate, Robert E. Lee Gate, and Sheridan Gate. Two gates, Biggs Gate and Global Reach Gate, provided access to Biggs Army Airfield (AAF) and two gates, Fred Wilson Gate and Alabama Gate, provided access to WBAMC.

A few of these gates were closed occasionally due to construction activities or operational needs. All vehicles entering Fort Bliss were required to have an occupant with a government identification card, display an installation decal, or be issued a vehicle pass. For those persons without a government identification card or decals, vehicle passes were only issued at the Cassidy Gate, Robert E. Lee Gate, Chaffee Gate, Biggs Gate, and Fred Wilson Gate.

The gates with highest observed traffic volume were Cassidy, Sheridan, Biggs AAF, and Robert E. Lee. The highest volume of entering vehicles was observed during the morning rush hour between 7:00 AM and 9:00 AM.[408]

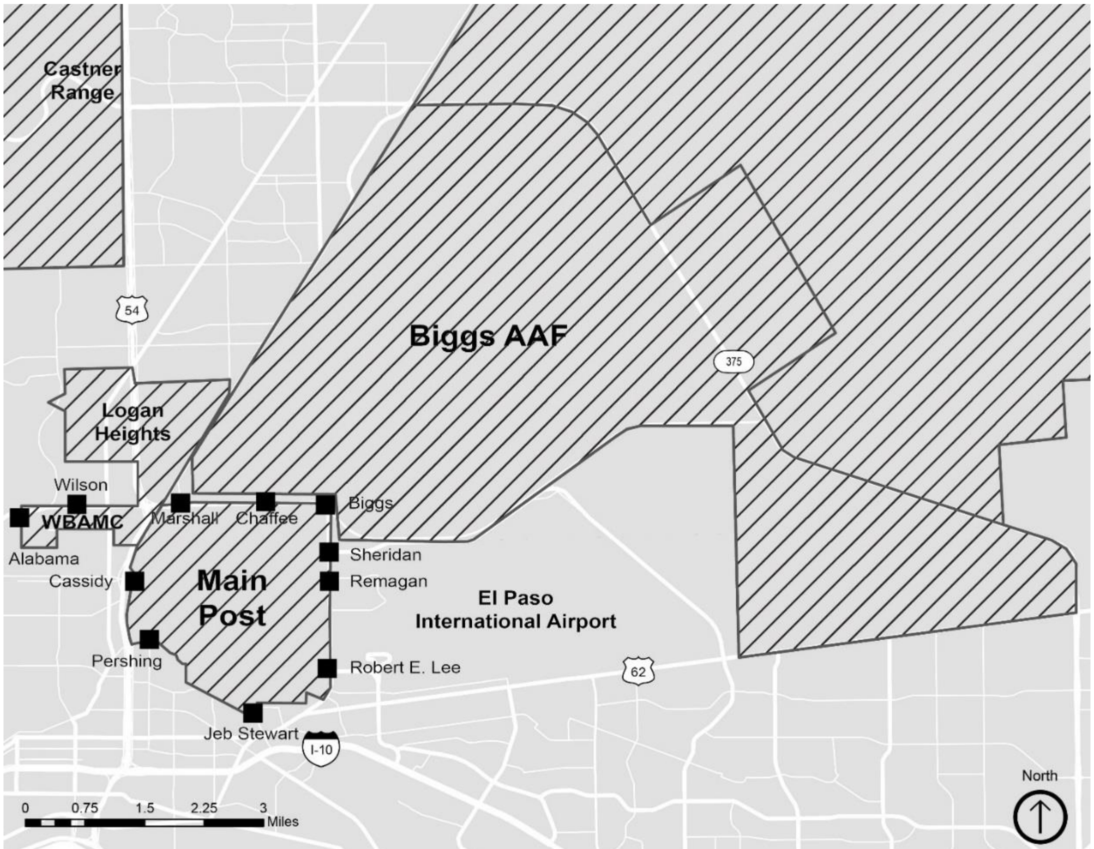


Figure 63: Gate locations, Fort Bliss

Table 43: Baseline traffic volume at gates in the Cantonment Area[409]

Gate	Baseline Daily Entry Volumes
Cassidy	7,160
Sheridan	6,282
Biggs	5,182
Lee	5,034
Wilson	4,436
Remagen	3,638
Pershing	1,962
Alabama	2,380
Jeb S.	1,613
Chaffee	1,079
TOTAL	**38,766**

Public Transit Access and Operations

Prior to BRAC 2005 implementation, transit services around Fort Bliss were minimal. The local transit authority, Sun Metro Mass Transit Department (Sun Metro), provided service only to the edges of the facility. Fort Bliss encompasses a large geographic area, with long distances between the entry gates and major base employment and activity areas. The facility did not have a shuttle service to transport transit users from the gates to their on-base destinations. Thus, public transit access and operations were not a significant element of the transportation system for Fort Bliss. In fact, the major BRAC 2005 planning documents, the 2007 Supplemental Programmatic Environmental Impact Statement (SEIS) and the 2010 Final Environmental Impact Statement (FEIS), did not provide any specific information on public transit services or usage before or after the BRAC 2005 realignment.

Prior to BRAC 2005 implementation, public transit use accounted for an estimated two percent of the total travel mode share.[410] Other than shuttle service connecting the airport and the base area, primarily used by new soldiers, single-occupancy private vehicle travel was the primary mode used to reach the facility (about 41.6 percent).[411] This was likely the result of the large area of the facility, the lack of transit connections with the facility, and the ready availability of parking.

Pedestrian and Bicycle Access

More than 20 percent of people at Fort Bliss walked to work before the BRAC 2005 implementation, likely due to the on-base housing facilities provided. An estimated 2.8 percent of personnel used taxi, motorcycles, or bicycles.[412]

Pedestrian and bicycle access to Fort Bliss made up a minimal share of travel to and from the facility under the baseline conditions. As with public transit access, the 2007 SEIS and the 2010 FEIS did not provide specific information on pedestrian and bicycle access or travel behavior.

Parking

Parking capacity was not identified as an issue prior to the implementation of BRAC 2005. Vehicles were parked in parking garages, lots, and other authorized parking areas.[413]

Travel Behavior

A large portion of the military housing at Fort Bliss was located off-post in the adjacent community, which resulted in a high volume of commuting traffic. Table 44 shows the travel mode splits before implementation of BRAC 2005 at Fort Bliss.

Table 44: Baseline mode splits at Fort Bliss[414]

Mode	Baseline (2006-2010, ACS)
Drive alone	41.6%
Carpool/Vanpool	9.9%
Public Transit	2.0%
Walked	20.7%
Taxi, motorcycle, bicycle	2.8%
Worked at home	23.0%

Safety Record

Crash statistics were not available exclusively for Fort Bliss, and neither the 2007 SEIS nor the 2010 FEIS addressed roadway safety; safety issues addressed in those documents related more to on-base military operations safety. Examining the surrounding city of El Paso, the number and severity of crashes increased significantly between 2006 and 2008 (Table 45). The total number of crashes in El Paso increased by over 70 percent, rising from 6,846 in 2006 to 11,724 in 2008 prior to full implementation of the BRAC 2005 realignment. The number of fatal car crashes in El Paso more than doubled between 2006 (19 fatal crashes) and 2008 (43 fatal crashes).

Table 45: Annual crashes in El Paso, TX (Total, Injury and Fatality)[415]

Year	Total Crashes	Injury Crashes	Fatality Crashes
2006	6846	2389	19
2007	9727	3438	41
2008	11724	4069	43
2009	11950	4337	47
2010	11665	3887	50

Predicted Condition – Projected Future Conditions

Facility Realignment Plan

Fort Bliss was one of the military facilities most significantly affected by realignments of forces and personnel. BRAC 2005 and other parallel military expansion efforts brought major changes to Fort Bliss's mission, personnel, associated population, and its impact on the regional transportation system. BRAC 2005 actions were expected to add approximately 11,000 military and civilian personnel to Fort Bliss. Other U.S. Army expansion and realignment initiatives, such as Grow the Army, Army Campaign Plan, and Army Modularity Force, were expected to occur in parallel and add about 28,000 military and civilian personnel and approximately 41,700 dependents to the Fort Bliss community by 2012. In total, accounting for BRAC 2005 and other parallel actions, the active duty military population stationed at Fort Bliss was predicted to triple between 2005 and 2012.[416]

Predicted Transportation Systems Performance – Future Build Conditions

This section describes impacts of a predicted future build scenario with BRAC 2005 actions and other expansion initiatives in place. Data on predicted impacts of BRAC 2005 only was not available; these projections include impacts of both BRAC 2005 and parallel expansion activities.

Traffic Impacts and Mitigation

Table 46 shows trip generation estimates for each geographic area of the Main Cantonment Area.

Table 46: Trip generation of the Main Cantonment Area under predicted future build condition[417]

	Main Post and Biggs AFF		Logan Heights		WBAMC		Total Trips	
	AM	PM	AM	PM	AM	PM	AM	PM

Predicted Future Build	24,000	28,000	1,500	1,500	8,200	8,600	33,300	38,100

Under the predicted future build condition, two more BCTs were expected to be added at Fort Bliss east of Biggs AAF. This was expected to add another source of traffic to the local roads and highway network (Loop 375 and Sergeants Major Boulevard). The projected LOS under a predicted future build conditions is shown in Table B34. Compared to the baseline condition, multiple roadway segments were expected to become more congested and experience worsening LOS. Airport Road was expected to worsen from LOS D to LOS F, segments of U.S. Route 54 were expected to worsen to LOS C and D immediately around the facility, and Loop 375 was expected to decline from LOS A to LOS D. A total of nine segments were expected to operate at LOS D by 2016, and another four at LOS E or F; these segments included I-10 from U.S. Route 54 (Patriot Freeway) to Paisano Drive (U.S. 62), Paisano Drive (U.S. 62) to McRae Boulevard, Fred Wilson Boulevard from U.S. Route 54 to Airport Drive, and Airport Road from Fred Wilson Boulevard to Haan Road. The road segments with a degradation in LOS are marked gray in Table B34.

The traffic improvement projects discussed under the predicted future no-build condition would also be completed under the predicted future build condition. Because of these improvements, several roadway segments of I-10 and Montana Ave were expected to operate with improved LOS. However, the 2007 SEIS noted that future transportation planning would need to consider the concentrated development in the Main Cantonment Area and these proposed projects would not provide enough capacity to handle the additional expected traffic.

To accommodate expected growth at Fort Bliss, several roadway improvement projects were proposed. This section discusses proposed improvements and their possible impacts. Spur 601 was a primary project and was proposed to accommodate the transportation needs of BRAC 2005 prior to 2011.

Spur 601

Prior to 2011, Spur 601 in Texas was proposed to link U.S. 54 and Loop 375. The 7.4-mile project was proposed to connect U.S. 54 (Patriot Freeway) at Fred Wilson Avenue to the west and at Loop 375 to the east. The project was expected to provide a direct route for trucks in the area to U.S. Route 54 and Loop 375 and would relieve traffic congestion on Airport Road, Airway Boulevard, U.S. 62/180, and Paisano Drive. The route would also provide additional access to Fort Bliss, El Paso International Airport (EPIA), and Butterfield Trail Industrial Park. Key intersections along Fred Wilson Avenue were expected to improve, including the interchange with U.S. Route 54, Airport Road/Sergeant Major Boulevard, and the Loop 375 interchange. The Spur 601 project was proposed to be funded through a public-private partnership making use of "pass-through" tolling.[418] Under this plan, the initial capital cost would be funded by a private firm, which would be reimbursed by the TxDOT based on the volume of traffic using the roadway.[419]

Northeast Parkway

The Northeast Parkway was planned to provide a limited access roadway for trucks and other traffic to bypass I-10 through El Paso and a more efficient and direct access to regional industrial parks. This 20-mile long, limited-access four-lane freeway would include a corridor between

Anthony, New Mexico at the I-10/NM 404 Interchange and Loop 375 near the Railroad Drive overpass in northeast El Paso.[420]

Internal Roadway Improvements

Some roadway segments were expected to be improved within the Fort Bliss Main Cantonment Area to alleviate traffic congestion, provide access to new facilities, and provide tank vehicle access to the training areas. Entry gates to the Fort Bliss Main Cantonment Area were anticipated to be upgraded to meet new anti-terrorism and force protection standards and to accommodate additional traffic. Two new U.S. 54 overpasses (North Overpass and South Overpass) were planned to provide safer access to the Doña Ana Range-North Training Areas. New gates would also need to be constructed to provide access off Loop 375 to the BCT enclaves. A new gate between Biggs AAF and EPIA was also proposed. An additional new vehicle overpass, constructed by TxDOT, would provide access to tank trails along the perimeter of Biggs AAF and connect to the South Training Areas. Other improvements were to include widening roads and constructing tank trails. Other proposed infrastructure projects included widening Haan Road as well as upgrading and repairing Main Post facilities and roads.

Transit Improvements

No improvements to public transit facilities were proposed as part of BRAC 2005 planning. During the period leading up to the realignment and expansion actions, Fort Bliss attempted to establish an on-base bus service but discontinued the effort because of low demand.[421]

Pedestrian and Bicycle Impacts

One of the planning goals of the 2007 SEIS was to improve "traffic circulation and functional effectiveness to reduce intra-cantonment travel and encourage pedestrian circulation."[422] However, no specific improvements to pedestrian and bicycle facilities were proposed as part of implementing BRAC 2005.

Travel Behavior

Since the BRAC 2005 realignment actions and other expansion activities did not address access by non-single-occupancy vehicle modes, changes to travel behavior and mode split were not addressed by predictions for future build conditions.

Travel Demand Management Strategies

The planning and environmental documents completed in response to BRAC 2005, and the other realignment/expansion initiatives, did not address multimodal transportation issues or demand management strategies such as parking limitations.

Actual Condition – Measured Post-BRAC Implementation Conditions

Actual Post-BRAC Facility Profile

Fort Bliss's growth after BRAC 2005 has been consistent with projections and the unit assignment went as planned. Currently, the population of Fort Bliss is comprised of 38,589 active duty soldiers, 39,422 family members, 13,079 civilians, and 1,253 reservists.[423] The increase in active duty soldiers is higher than predicted, while the increase in the number of dependents is lower than predicted. Because a large portion of the military housing of Fort Bliss is located off-post in the surrounding community, there is a large volume of commuting traffic and this has exacerbated congestion in El Paso's rapidly growing city center.

In parallel to these changes at Fort Bliss, El Paso was also growing. *Plan El Paso*, El Paso's 2016 plan, anticipated the creation of new employment and commuting demand in the Fort Bliss area due to two projects. The first project involves building a new William Beaumont U.S. Army Medical Center in the southwest quadrant of Loop 375 near the Liberty Expressway. The second project involves construction of an El Paso Community College campus immediately south of the new William Beaumont U.S. Army Medical Center. Without improvements to public transit, these new projects were expected to add additional congestion to the regional roadway network.

The impacts of BRAC 2005 and the other military expansion initiatives at Fort Bliss are not the only contributors to growing congestion on the transportation system in El Paso. A major challenge is the continuously growing population of Texas and the El Paso region. The population of El Paso County has grown substantially since 2000. Per the U.S. Census, the total population was 679,622 in 2000, 800,647 in 2011, and estimated at 831,095 in 2015. County employment also increased, from 244,464 in 2000 to 338,952 in 2015. More than 93 percent of this population and employment growth has been focused in and around the city of El Paso, greatly increasing pressure on the local transportation network.

Actual Transportation Mitigation

Roadway Network Improvements

A wide range of major roadway network improvements have been implemented to accommodate the growth in personnel at Fort Bliss. While approximately 22,000 military personnel and dependents were relocated to Fort Bliss directly because of BRAC 2005 actions, the El Paso Metropolitan Planning Organization (El Paso MPO) also developed projects during the years of BRAC 2005 implementation to address population growth. Because of the extended and overlapping timeframes for growth at Fort Bliss, many of the regional roadway improvements proposed addressed both BRAC 2005 and non-BRAC related growth.

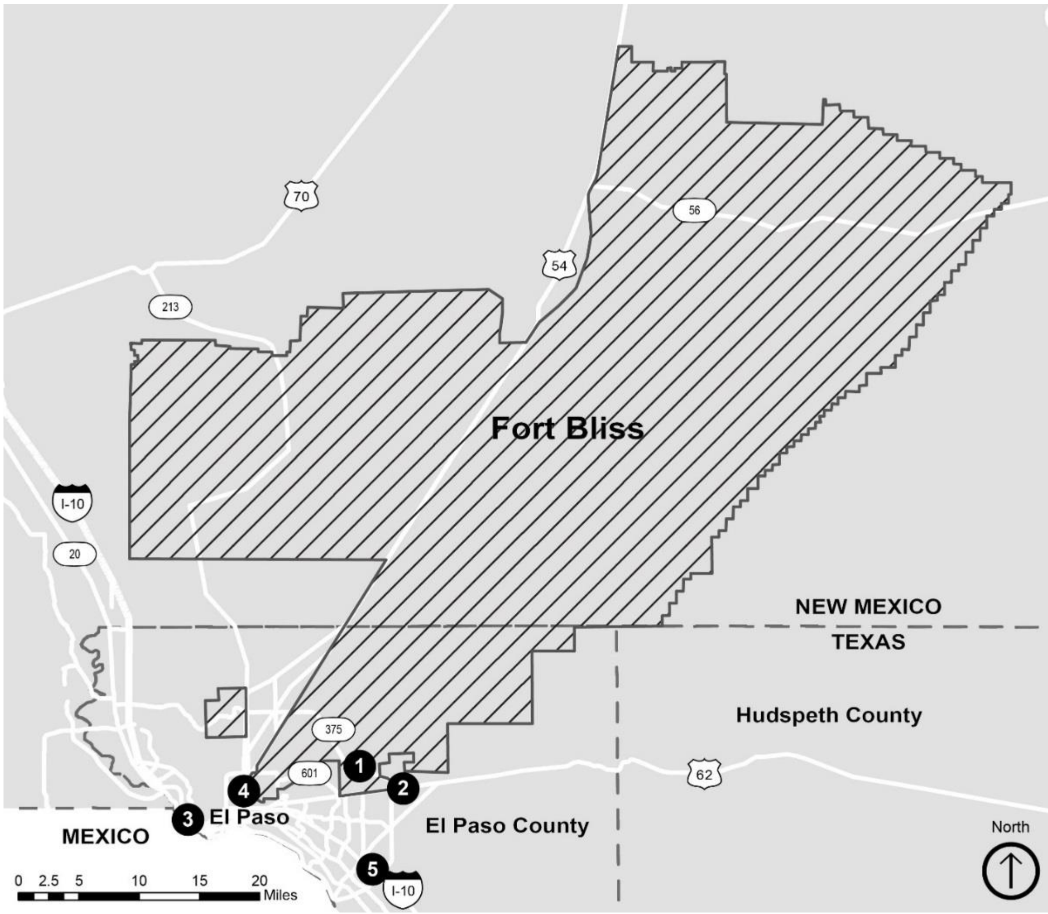
Projects Completed

1. **Spur 601.** Texas State Highway Spur 601 (officially known as the Liberty Expressway) is a 7.4-mile (11.9 km), six-lane, controlled access elevated freeway spur route stretching from U.S. Route 54 in El Paso eastward to Loop 375 within the Fort Bliss Military Reservation (Project 1, Figure 64). Construction of Spur 601 was completed in January 2011, at a cost of $364 million.[424] Spur 601 serves the Cantonment Area, Biggs Army Airfield and the El Paso International Airport. The roadway includes a 6,000-foot viaduct bridge spanning an existing service road, a new entrance to nearby Fort Bliss, and a traffic management system. The construction of Spur 601 significantly improved access to Biggs AAF and Fort Bliss. Spur 601 is a Pass-Through Toll Agreement between JD Abrams and the TxDOT.

In Progress

2. **Loop 375 Border Highway West Extension.** The Loop 375 Border Highway West Extension project originally entailed widening Loop 375 from Montana Avenue to Bob Hope Drive. However, in 2014 the project was expanded to include the

widening of Loop 375 from Montana Avenue to Spur 601 and the inclusion of frontage roads along the route (Project 2, Figure 64).[425] This includes reconstructing the inside shoulders and accommodating one additional 12-foot-wide travel lane in each



direction at a cost of $22 million. Construction began in March 2016 and is expected to be completed in December 2017.

Figure 64: Project map, Fort Bliss

3. **U.S. 62/180 (Montana Avenue) Project.** TxDOT proposed upgrading U.S. 62/180 (Montana Avenue) from 0.5 miles west of Global Reach to 0.5 miles east of Zaragoza Road (Project 3, Figure 64). The proposed improvements include widening U.S. 62/180 (Montana Avenue) and upgrading it to an access-controlled facility with frontage roads, sidewalks, and a bike lane. In addition, the project will add three through-lanes in each direction between Global Reach and Loop 375 as well as two or three through-lanes in each direction between Loop 375 and Zaragoza Road. The length of the proposed project is approximately 7.6 miles. To complete the project, additional right-of-way is required.[426] Additional right-of-way is needed on the segment of road located on the east side of the Fort Bliss headquarter area, one of the main entrances to the facility.
4. **Border West Expressway Project.** The Border West Expressway project is a new expressway to be located west of downtown El Paso and south of I-10. The new expressway will provide an alternate route for I-10. It extends approximately 7.4 miles

from Racetrack Drive near Doniphan Road and New Mexico 273 East to U.S. Route 54 (Project 4, Figure 64). The Border West Expressway project adds more lane miles and improves access to multiple destinations in El Paso, border crossings, international bridges, and medical centers. Construction of the project began in 2015, and is scheduled to be completed by 2018.[427]

5. **Northeast Parkway Project.** The Northeast Parkway project was proposed by TxDOT to add a new roadway in Northeast El Paso to reduce traffic on Transmountain Drive, U.S. Route 54, and I-10 (Project 5, Figure 64). The project is in the Final EIS stage and does not yet have an identified source of funding.[428]
6. **I-10 Connect Project.** The I-10 Connect Project will provide improved access from I-10 to Loop 375 and improve mobility in the surrounding area; it is located where U.S. Route 54 and I-10 converge. The project is currently in the environmental review process.

Several other infrastructure improvement projects are being implemented. These include:

- Realignment and extension of Global Reach Drive from Montana Avenue to the Liberty Expressway;
- Construction of full interchanges along Liberty Expressway at Global Reach Drive, Loop 375, and Sergeant Major Boulevard; and,
- Widening of North Zaragoza Road from Loop 375 to Montana Avenue. [429]

Travel Demand Management Strategies

Travel demand management strategies at Fort Bliss are limited to support for travel by carpool or vanpool. However, a recent report, *Alternative Transportation Modes and Technology Applications for Multimodal Transportation Planning in the El Paso Region,* was completed by the Texas Transportation Institute (TTI) in June 2016 for the El Paso MPO. The report recommends that El Paso MPO use TDM to "balance the need for transportation improvements with management of the demand on the transportation system," noting that "improving the management and utilization of the existing system becomes a priority when cost, community, or environmental impact limits expansion of the transportation system."[430]

Community Involvement Process

Community outreach related to implementation of BRAC 2005 actions began with the scoping of an environmental impact statement (EIS). As part of the process, the U.S. Army invited the public to participate in the scoping process. Input from the public was solicited through meetings, mailings, and email; public meetings were at key milestones in Las Cruces, Chaparral, and Alamogordo, New Mexico and El Paso, Texas.[431]

Throughout BRAC 2005 planning and implementation, post commander Major General Stan Green partnered with elected officials, local governments, and other groups to address transportation concerns from new troops to be stationed at Fort Bliss. [432] To support the partnerships established by the post commander, the El Paso City Council created the Camino Real Regional Mobility Authority (CRRMA) in March 2007. The CRRMA then worked with the Texas Department of Transportation (TxDOT), the El Paso Metropolitan Planning Organization, and the City of El Paso to identify future transportation projects to accommodate BRAC 2005 recommendations.

Actual Transportation System Performance

Travel Behavior

Despite the expansion of public transit network and regional shuttle service around Fort Bliss, the share of personnel driving alone to work increased by nearly 11 percent. Similarly, the share of personnel using public transit dropped from two to 0.6 percent. The share of personnel walking to work increased from approximately 21 to 25 percent; this may be the result of the Residential Community Initiative (RCI) program, which demolished new housing units as well as renovated 1,331 existing homes for military families in the Fort Bliss Main Cantonment Area. The share of personnel using taxi, motorcycle, or bicycle also increased between 2010 and 2015. The Travel Mode Split of 2015 is shown in Table 47.

Table 47: Actual condition mode splits at Fort Bliss[433]

Mode	Baseline (2006-2010, ACS)	Actual (2011-2015, ACS)
Drive alone	41.6%	52.3%
Carpooled	9.9%	8.9%
Public transit	2.0%	0.6%
Walked	20.7%	24.5%
Taxi, motorcycle, bicycle	2.8%	6.2%
Worked at home	23.0%	7.6%

Traffic Operations

Per the 2013 El Paso MPO *Congestion Management Process*, several street segments surrounding Fort Bliss are among the most congested areas of El Paso. These include Airport Road (east side), Montana Avenue (U.S. 62/180) (south/east sides), and Fred Wilson Boulevard (north side) of the base area. Although multiple road improvement projects will likely be completed in the area, more severe congestion is anticipated based on regional travel demand model projections.

LOS in 2012, after BRAC 2005 realignment, is shown in Table B35. There is significant worsening of LOS on most of the surrounding road network. I-10, U.S. Route 54, Loop 375, Fred Wilson Boulevard, and Airport Road all operate at LOS E or lower under actual conditions. Roadway segments where LOS has worsened are marked gray in Table B35.

Transit Operations

Since BRAC 2005 implementation, the transit system around Fort Bliss has expanded, and Fort Bliss itself is served by four shuttle lines. Shuttle services are provided between the U.S. Army Sergeants Major Academy area, Sage Hall, and Center Chapel of the Fort Bliss Main Cantonment Area in the living area of the facility.[434]

Bus service has also been improved. Route 90-Westside/Eastside Express was established in 2014 and provides express bus service between the Westside Transfer Center and the Eastside Transfer Center. In 2013, Route 31 was extended to the east of Loop 375.

Table 48: Bus routes serving Fort Bliss[435]

Bus		Route	Frequency
Sun Metro	7	Mission Valley Transfer Center to Walmart on Transmountain	Every 60 minutes
	30	Ft. Bliss PX to Five Points Terminal	Every 70 minutes
	31	Torch at Medic to Eastside Terminal	Every 60 minutes
	90	Eastside Transfer Center to Westside Transfer Center	Weekday only, every 45 minutes

Besides the bus services, Sun Metro also introduced Bus Rapid Transit (BRT) to El Paso. The new system is known as the Sun Metro Brio. The first line of the Mesa corridor began running in 2014. In 2018, two additional corridors will begin providing services near Fort Bliss (Alameda Corridor and Dyer Corridor). Circulator routes are expected to be added upon completion of the Range Target System (RTS) which connects to Fort Bliss' major transit generators.[436]

Despite these transit improvements to and within Fort Bliss, there are still less than 0.5 percent people utilizing public transportation for daily commute to Fort Bliss CDP.

Pedestrian and Bicycle Access Impacts

Since the start of the planning process for BRAC 2005 and the other military expansion initiatives, the City of El Paso has greatly enhanced its planning for and commitment to multimodal transportation, such as walking and bicycling. El Paso's 2009 sustainability plan proposed strategies for transitioning into a "walkable" community, which included extending the bike lane system and developing a bike trail system.[437] In *Plan El Paso*, the City declared "decreasing auto-dependence is a primary goal of the City of El Paso". The most effective way to achieve this goal, per *Plan El Paso*, is to improve walkability.

El Paso has also been working to become a more bicycle-friendly city in the recent years. In the last three years, El Paso and its regional agencies have made several efforts to expand bicycling options. In May 2014, the El Paso City Council approved a resolution establishing a Bicycle Advisory Committee to advise the City of El Paso on matters related to bicycle planning and infrastructure. In August 2014, the El Paso City Council approved four new bike lanes in the city, pending the approval of El Paso MPO and funding. The 2016 *City of El Paso Bike Plan* went on to propose a comprehensive set of policy, programmatic, and infrastructure enhancements to promote bicycling; suggestions included adding a network of bike lanes and shared-use paths within Fort Bliss.

Additionally, the Camino Real Regional Mobility Authority is in the process of initiating a bike share program. The agency needs approval to access federal funding to begin the procurement process. The bike share program will have five stations downtown, two stations at the University of Texas at El Paso (UTEP), and one station at El Paso Community College's downtown campus. The program will have a fleet of 80 bikes in its first phase. After implementation of the first phase, the agency will pursue sponsorship and funding to add additional stations in the following phases. In the current 2013-2016 Transportation Improvement Program (TIP), which is based on the regional Horizon 2040 MTP, total funding programmed for bicycle infrastructure and programs is over $2.9 million.[438]

Safety Impacts

Crash statistics were not available exclusively for Fort Bliss, and neither the 2007 SEIS nor the 2010 FEIS addressed roadway safety; safety issues addressed in those documents related more to on-base military operations safety. In 2011, there were 12,200 total crashes with 3,959 injury crashes and 55 fatal crashes in the City of El Paso. Total crashes remained consistent between 2011 and 2014 with fatality crashes trending downward and injury crashes trending upward. In 2015, total crashes increased by 30% to 16,345 and fatal crashes rose in 2016 to a high of 60.

Table 49: Annual crashes in El Paso, TX (Total, Injury and Fatality)[439]

Year	Total Crashes	Injury Crashes	Fatality Crashes
2011	12200	3959	55
2012	13035	4363	48
2013	12228	4171	45
2014	12588	4150	46
2015	16345	4377	47
2016	17172	4526	60

3.6.B. Evaluation of Actual Versus Predicted Conditions

Facility Changes – Baseline v. Proposed Build v. Actual

BRAC 2005 actions at Fort Bliss relocated air defense artillery units to Fort Sill (located in Lawton, Oklahoma) and moved the 1st Armored Division as well as various echelons above division units from Germany and Korea to Fort Bliss. Maneuver battalions, a support battalion, and aviation units from Fort Hood, Texas were also relocated to Fort Bliss.[440] Currently, four air-defense brigades assigned to the U.S. Army Forces Command (FORSCOM) are also stationed at Fort Bliss. Before the implementation of BRAC 2005 actions, Fort Bliss had 10,000 active duty soldiers and 68,200 personnel in 2007. BRAC 2005 actions were expected to increase the total personnel to 96,200 in 2015. The actual personnel after implementation was 92,300 in 2016, somewhat less than the predicted.

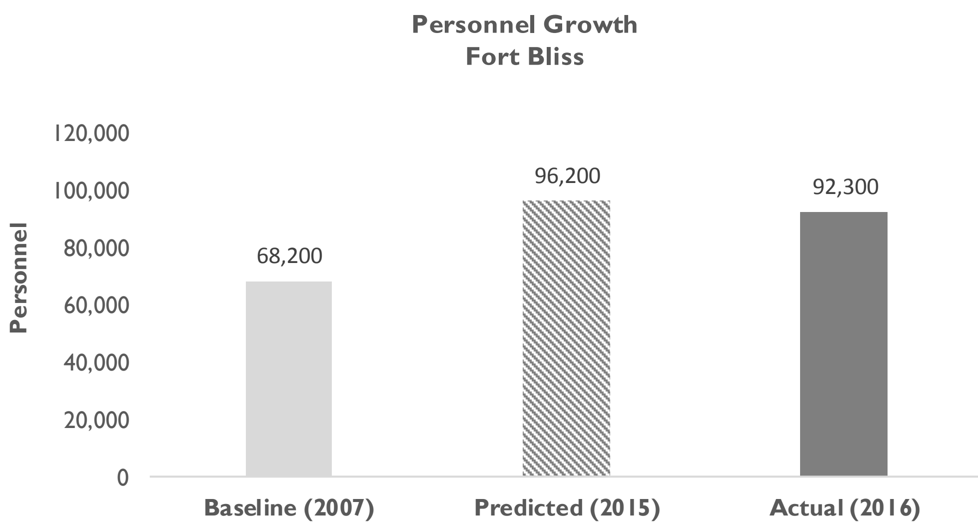


Figure 65: Personnel growth at Fort Bliss

Transportation Demand – Baseline v. Proposed Build v. Actual

To evaluate transportation demand trends and patterns under baseline, predicted, and actual conditions at Fort Bliss, a few different transportation metrics were reviewed. These included overall traffic levels along major routes near Fort Bliss. Between 2007 and 2015, combined AADT declined along I-10. For Loop 375, U.S. Route 62, and U.S. Route 54, AADT declined and then rose between 2011 and 2015. Figure 66 shows AADT from 2007 through 2015.

I-10 between U.S. Route 54 and U.S. Route 62 is an eight-lane divided urban freeway in the urban core. FDOT's 2013 Quality/Level of Service Handbook shows that an eight-lane divided urban core freeway (uninterrupted flow) reaches LOS E at an AADT of 176,600 vehicles per day. I-10 should be operating at LOS F with actual traffic volumes. U.S. Route 62 near Airway Boulevard is a six-lane signalized urban arterial roadway. FDOT's 2013 Quality/Level of Service Handbook shows that a six-lane signalized urban arterial (interrupted flow) reaches LOS D at an AADT of 59,900 vehicles per day. U.S. Route 62 near Airway Boulevard should be operating between LOS A and B with actual traffic volumes.

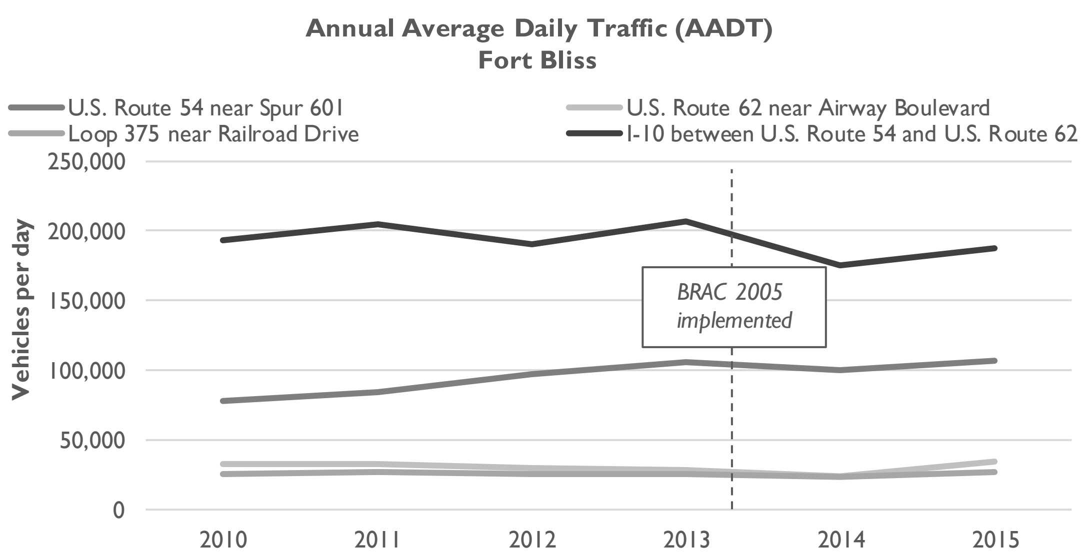


Figure 66: AADT from 2010 to 2015 at Fort Bliss

U.S. Route 54 near Spur 601 is a six-lane urbanized freeway. FDOT's 2013 Quality/Level of Service Handbook shows that a six-lane divided urbanized freeway (uninterrupted flow) reaches LOS D at an AADT of 111,800 vehicles per day. U.S. Route 54 should be operating between at LOS C and LOS D with actual traffic volumes.

Loop 375 near Railroad Drive is a four-lane urbanized freeway. FDOT's 2013 Quality/Level of Service Handbook shows that a four-lane divided urbanized freeway (uninterrupted flow) reaches LOS D at an AADT of 74,400 vehicles per day. Loop 375 should be operating between at LOS A with actual traffic volumes.

Mitigation Measures – Proposed Build v. Actual

Fort Bliss has implemented minimal TDM measures to reduce the share of personnel commuting by private vehicle. The only such strategy is encouraging personnel to use carpools and shuttles.

Mitigation projects at Fort Bliss generally focused on improving the roadway network. As shown in
Table 50, all six major projects had a roadway improvement component. Three of the projects entail construction of new roadways and three are widenings of existing roadways. All projects were completed after implementation of BRAC 2005 or are still underway; specifically, construction of Spur 601 was completed after 2011, while the other five are still underway.

Table 50: Mitigation projects at Fort Bliss

	Project Type			Improvement	Project Status			Project Cost
	Road way	Transit	Ped/ Bike		Completed Before 2011	Completed After 2011	Under -way	
Spur 601	X			Construction of the new Texas State Highway Spur 601 to improve access to Biggs Army Airfield and Fort Bliss.		X		$364,000,000[441]
Loop 375 Border Highway West Extension	X			Widen Loop 375 from Bob Hope Drive to Spur 601.			X	$22,000,000[442]
The U.S. Route 62/180 (Montana Avenue) Project	X		X	Widen U.S. Route 62/180 (Montana Avenue) and upgrade it to an access-controlled facility with frontage roads, sidewalks, and a bike lane, with two to three lanes in each direction.			X	$36,000,000[443]
The Border West Expressway Project	X			New expressway located west of downtown El Paso and south of I-10, providing an alternate route for I-10.			X	$639,500,000[444]
Northeast Parkway Project	X			New roadway in Northeast El Paso to reduce traffic on Transmountain Drive, U.S. Route 54 and I-10.			X	*Missing data*
I-10 Connect Project	X			Connector road to improve access from I-10 to Loop 375.			X	*Missing data*
TOTAL	**6**	**0**	**1**		**0**	**1**	**5**	**$1.1 billion**

Transportation Impacts – Baseline v. Proposed Build v. Actual

Figure 67 compares LOS for study area intersections near Fort Bliss under baseline, predicted, and actual conditions. Under baseline conditions, seven intersections operated at LOS E or below. Under predicted conditions, 21 intersections were expected to operate between LOS A and D and four were expected to operate at LOS E or worse. LOS under actual conditions was worse than predicted and a significant drop was observed. Twenty intersections operate at LOS E or below, indicating that congestion is more severe than expected.

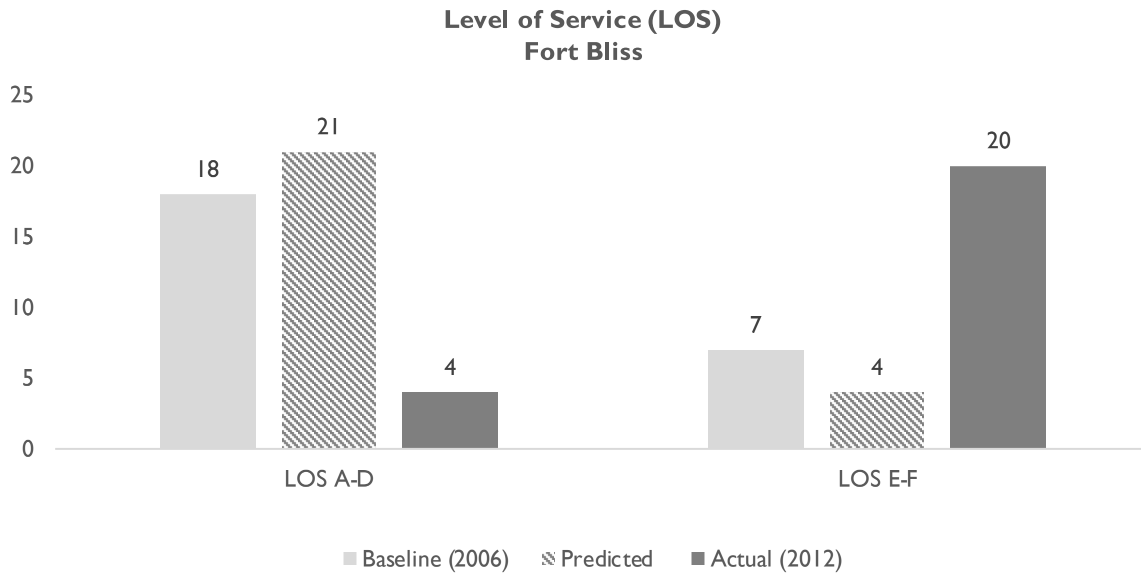


Figure 67: LOS at study area intersections near Fort Bliss

Mode splits at Fort Bliss are available through the U.S. Census American Community Survey (ACS) and are shown in Table 51 and Figure 68. The drive alone mode share increased from about 42 percent before implementation of BRAC 2005 actions to just over 52 percent in 2015. The share of personnel working from home decreased drastically from 23 percent to nearly eight percent; this was accompanied by a slight drop in the shares of personnel using carpool/vanpool and transit and a three percent increase in the share of personnel using taxi, motorcycle and bike. Fort Bliss has a high mode share of personnel walking, increasing by nearly five percent after the implementation of BRAC 2005, to include nearly one quarter of personnel.

These mode split results show a high degree of variability between the baseline condition and the actual post-BRAC condition. These results raise questions about Fort Bliss travel behavior that are similar to those raised for JBLM, such as the identity of the walking commuters and the nature of their trips, the reason for the high baseline share of "worked at home," and the explanation for the sharp drop in "worked at home" mode.

Table 51: Mode splits at Fort Bliss, ACS

Mode Splits	Baseline (2006-2010)	Predicted	Actual (2011-2015
Drive Alone	41.6%	*Missing data*	52.3%
Carpool/Vanpool	9.9%		8.9%
Transit	2.0%		0.6%
Walk	20.7%		24.5%
Taxi, motorcycle, bike	2.8%		6.2%
Work at home	23.0%		7.6%

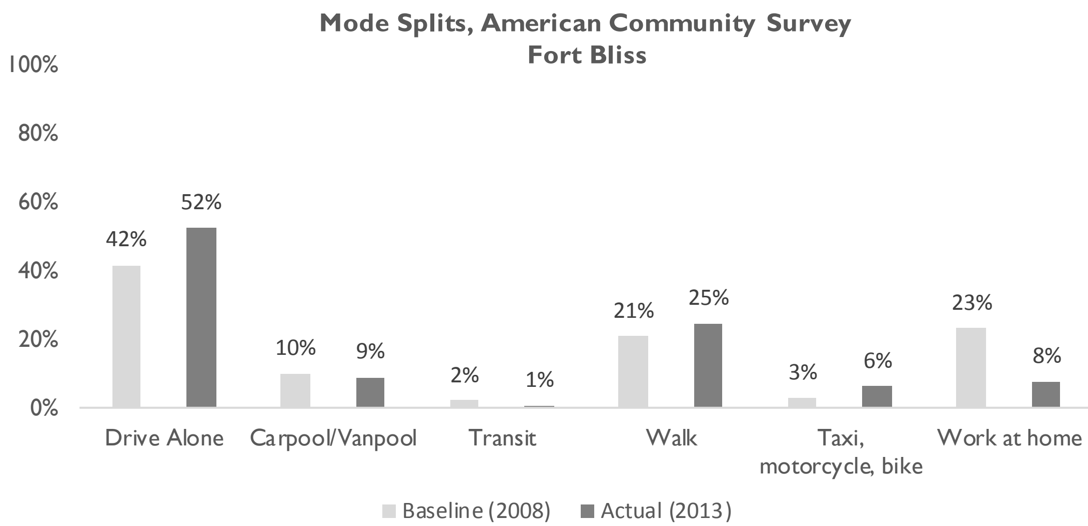


Figure 68: Mode splits at Fort Bliss, ACS

3.6.C. Findings

Overview

The BRAC 2005 realignment at Fort Bliss entailed relocating air defense artillery units to Fort Sill and relocating the 1st Armored Division and various echelons above division units from Germany and Korea to Fort Bliss. These changes resulted in a net gain of 11,501 soldiers at Fort Bliss.[445] In addition, the City of El Paso experienced rapid growth which continues to add to the number of daily trips on the area transportation system. To absorb this rapid growth, Fort Bliss and local stakeholders worked together to construct roadway improvements, increase transit opportunities, and implement TDM strategies.

Evaluation of transportation impacts and development of mitigation programs was an ongoing process at Fort Bliss. Proposed transportation system improvements and TDM programs often evolved over time based on supplemental planning processes and ongoing coordination among military and civilian authorities.

These partnering relationships among military and civilian authorities at Fort Bliss developed and improved over the course of coordination on BRAC 2005 impacts and mitigation. In many cases, the coordination that was initiated through planning for BRAC 2005 and implementation of mitigation projects has resulted in ongoing partnerships that have improved communication and cooperation.

Facility Changes

- Actual personnel growth at Fort Bliss resulting from the BRAC 2005 realignment was lower than predicted levels. Personnel increased by 35 percent from 2007 to 2015, about six percent lower than predicted.

- Approximately 92,300 military service members and their families, local retirees, and DoD civilian personnel were in Fort Bliss in 2015. This growth was mostly the result of the BRAC 2005 realignment.
- It was difficult to identify appropriate individuals knowledgeable about transportation issues related to the Fort Bliss facilities; it was particularly difficult to identify individuals with a knowledge of pre-BRAC 2005 conditions or effects of the BRAC 2005 implementation.

Transportation Demand

- Actual measured AADT on U.S. Route 54 and U.S. Route 62 near Fort Bliss between 2007 and 2015 are consistent with national trends.
- AADT of I-10 near Fort Bliss remained constant at approximately 200,000 vehicles per day from 2007 until 2013, when it began to decrease.
- About half of personnel at Fort Bliss drove to work in single-occupancy vehicles (SOV) while one-quarter walked based on ACS data.
- Actual post-BRAC 2005 traffic volumes have exceeded predicted volumes.

Mitigation Measures

- While there are some preliminary proposals to extend public transit services and improve pedestrian and bicycle access to enhance the connection between the facility and local area, Fort Bliss expects that driving will continue to be the most convenient travel mode for most personnel.
- There have been no parking restrictions implemented at Fort Bliss.
- Mitigation projects at Fort Bliss are predominantly focused on improving the roadway network.
- All mitigation projects were either completed after implementation of the BRAC 2005 realignment or are still underway.

Transportation Impacts

- There is uncertainty about benefits and impacts of transportation system improvements, including those intended to mitigate BRAC 2005 impacts, which were under construction or not implemented at the time of post-BRAC data collection.
- Actual LOS at intersections near Fort Bliss worsened after implementation of the BRAC 2005 realignment. Predicted LOS was expected to improve because of implementing mitigation measures; however, actual data and analysis shows a significant increase in the number of intersections operating at LOS E or worse.
- Total crashes have continued to rise within the City of El Paso resulting from increased population, traffic and congestion.
- ACS mode split data indicates that walking remains an important commuting mode at Fort Bliss due to a significant number of employees who live on-base.

- The teleworking mode share decreased significantly after the BRAC 2005 realignment.
- Actual mode shares of carpool/vanpool and transit have decreased since the BRAC 2005 realignment.

Data and Analysis Issues

- There is a lack of available information on a wide range of topics, including facility characteristics, nature of the military activities at the facilities, land use, mitigation programs, and effects of transportation system improvements.
- There is inconsistency in data, information, and analysis at Fort Bliss, as well as for different time periods (i.e. pre-BRAC implementation versus post-BRAC implementation).
- Since actual surveyed mode splits were not available, analysis of the effectiveness of TDM strategies was limited.
- Predicted mode split for post-BRAC Fort Bliss travel was unavailable.
- Because multiple projects are underway or have recently been completed, additional data is required to understand their impact.

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4. FINDINGS AND RECOMMENDATIONS

Chapter 4 summarizes quantitative analysis of the data and information compiled in Chapter 3 and overall trends and patterns related to predicted versus actual impacts of the 2005 BRAC process based upon review of the six case study facilities. Chapter 4 builds upon the case study-specific reviews in Chapter 3 with a detailed quantitative evaluation of the data and performance measures to assess how well predicted conditions align with actual measured post-BRAC 2005 conditions. The research team also identified impacts, factors, and issues that are common and/or different across the case studies. Lastly, Chapter 4 proposes areas of research and review that could enable improved planning and transportation impact analysis for future military base realignment initiatives.

4.1. OVERALL TRENDS

Facility Changes – Baseline v. Proposed Build v. Actual

Actions resulting from BRAC 2005 included administrative mergers and consolidations, relocations of agencies and/or service units, and the expansion of personnel, services, and/or facilities. Of the six military facilities analyzed as part of this report, two involved a merger or consolidation, five involved a relocation of agencies and/or services, and three involved an expansion of personnel, services, and/or facilities (see Table 52). In several cases, more than one type of action occurred at a given facility.

Table 52: Types of actions mandated by BRAC 2005

	BRAC Action		
	Merger and/or consolidation	**Relocation of agencies and/or services**	**Expansion of personnel, services, and/or facilities**
Walter Reed National Military Medical Center	X	X	X
Fort Belvoir/Mark Center		X	X
Fort Meade		X	
Joint Base Lewis-McChord	X		
Eglin Air Force Base		X	X
Fort Bliss		X	
TOTAL	**2**	**5**	**3**

Despite the personnel growth at the facilities, BRAC 2005 actions did not generally expand the site footprints of the six military facilities evaluated in this report. As shown in

Table 53, only two facilities (Fort Belvoir/Mark Center and Fort Bliss) expanded their site footprint because of BRAC 2005 actions. As shown in Table 53, personnel growth exceeded predictions at WRNMMC (56 percent higher increase than predicted), Fort Belvoir/Mark Center (19 percent higher than predicted), and JBLM (40 percent higher than predicted); personnel growth fell short of predictions at Fort Meade (15 percent lower than predicted) and Fort Bliss (14 percent lower than predicted). Actual post-BRAC 2005 personnel headcount was not available for Eglin AFB.

Table 53: Site and personnel growth during BRAC 2005 implementation

	Site Growth (acres)			Personnel Growth		
	Baseline	Predicted	Actual	Baseline	Predicted	Actual
Walter Reed National Military Medical Center	243			4,600	7,100	8,500
Fort Belvoir/Mark Center	8,500	8,516	8,516	26,000	46,200	50,000
Fort Meade	5,500			40,000	62,000	56,785
Joint Base Lewis-McChord	87,000			131,000	136,000	138,000
Eglin Air Force Base	463,360			21,000	32,000	*Missing data*
Fort Bliss	133,000	137,900	*Missing data*	68,200	96,200	92,300

Transportation Demand – Baseline v. Proposed Build v. Actual

To assess patterns in actual versus predicted conditions related to transportation demand across the six military facilities included in this report, peak hour traffic volumes on major roadways adjacent to the facility were reviewed. Unfortunately, this data was not available for most of the facilities; data was only available for National Capital Region facilities: WRNMMC, Mark Center, and Fort Meade (see Table 54).

Generally, peak hour volumes were expected to increase between baseline and predicted conditions. However, in multiple cases, specifically at WRNMMC and Fort Meade, volumes under actual conditions were lower than under predicted conditions. At Fort Meade, available data shows that volumes under actual conditions were even lower than in the baseline condition. These traffic volumes reflect general regional traffic conditions, not just impacts of the BRAC realignments, which account for a minority of traffic near the facilities for which data was available. This decrease in traffic volume may be due to national travel patterns; during the period of BRAC 2005 implementation, traffic volumes nationally were decreasing or flat, a trend that is attributed principally to the Great Recession.

Table 54: Trends in peak hour traffic volumes

	Peak Hour Traffic Volumes		
	Predicted vs. Baseline	Actual vs. Predicted	Actual vs. Baseline
Walter Reed National Military Medical Center	*Missing data*	Actual volumes lower than predicted by 17% in the AM peak and 18% in the PM peak	*Missing data*
Main Post and Fort Belvoir North	*Missing data*		
Mark Center	Predicted volumes higher than baseline by 17% in the AM peak and 25% in the PM peak	*Missing data*	*Missing data*
Fort Meade	Predicted volumes higher	Actual volumes lower than predicted	Actual volumes lower than baseline
Joint Base Lewis- McChord	*Missing data*		
Eglin Air Force Base	*Missing data*		

Fort Bliss	*Missing data*

Table 55: Transit demand under baseline, predicted, and actual conditions

	Transit Demand		
	Baseline	**Predicted**	**Actual**
Walter Reed National Military Medical Center	11%	30%	40%
Main Post/Fort Belvoir North	4%	18%	6%
Mark Center	76%	28%	17%
Fort Meade	<1%	6%	1%
Joint Base Lewis-McChord	1%	*Missing data*	0%
Eglin Air Force Base	0%	*Missing data*	0%
Fort Bliss	2%	*Missing data*	1%

Mitigation Measures – Proposed Build v. Actual

The six bases analyzed as part of this report employed a variety of TDM strategies.

Table 56 summarizes the main TDM strategies used at each facility. Parking restrictions, generally one of the most effective TDM strategies, were implemented at three out of six facilities; all three facilities were in the National Capital Region. Transit pass subsidies, another effective measure, were only used at the three facilities in the National Capital Region, likely the result of participation in the DoD's Mass Transportation Benefit Program, which offers all eligible civilian and military personnel in the National Capital Region a subsidized transit pass. Strategies to enhance multimodal connections, such as improving transit access, adding shuttles, or improving pedestrian and bicycle networks, were used at four facilities. Efforts to promote carpooling and vanpooling were more popular and were used at all facilities. Due to the varying nature of each facility, flexible scheduling was not always feasible, and was only employed as a strategy at three facilities.

Table 56: Travel demand management strategies used across bases

	Parking Restrictions	Transit Pass Subsidy	Enhance Multimodal Access	Promote Carpooling/ Vanpooling	Flextime and/or Telework
Walter Reed National Military Medical Center	X	X	X	X	X
Fort Belvoir/Mark Center	X	X	X	X	X
Fort Meade	X	X	X	X	X
Joint Base Lewis-McChord			X	X	
Eglin Air Force Base				X	
Fort Bliss				X	
TOTAL	**3**	**3**	**4**	**6**	**3**

Most mitigation projects involved improvements to the surrounding roadway networks. Of the 45 projects analyzed, 41had a roadway component while only five involved transit and 13 made improvements to pedestrian and bicycle networks (see Table 57). Additionally, since most projects involved improvements to roadways, which can be costly and time-consuming, only five projects were completed prior to the 2011 BRAC 2005 implementation deadline. Indeed, most projects were completed after 2011or are still underway.

Table 57: Mitigation project by type and status

	Project Type			Project Status		
	Roadway	Transit	Pedestrian/ Bicycle	Completed Prior to 2011	Completed After 2011	Underway
Walter Reed National Military Medical Center	5	2	3	3	0	4
Fort Belvoir/Mark Center	11	3	5	2	8	3
Fort Meade	7	0	2	0	3	4
Joint Base Lewis-McChord	6	1	1	0	5	1
Eglin Air Force Base	6	0	1	0	0	6
Fort Bliss	6	0	1	0	1	5
TOTAL	**41**	**6**	**13**	**5**	**17**	**23**

The cost of mitigation projects associated with BRAC 2005 actions is high. However, as complete cost data is not available for all projects, we cannot make any specific judgements on total costs. Examining available cost data, as shown in r accessing these facilities.

Table 58, confirms that most funds went toward roadway projects. Much less was spent on multimodal, transit, and pedestrian and bicycle improvements, which is consistent with the mode split for accessing these facilities.

Table 58: Cost of mitigation projects by type

	Project Cost				
	All	Multimodal	Roadway	Transit	Pedestrian/ Bicycle
Walter Reed National Military Medical Center	$554,300,000	$94,200,000	$32,700,000	$422,000,000	$5,400,000
Fort Belvoir/Mark Center	$1,431,400,000	$326,000,000	$1,105,400,000	$0	$0
Fort Meade	$201,629,000	$55,323,000	$146,306,000	$0	$0
Joint Base Lewis-McChord	$500,128,000	$0	$500,128,000	$0	$0
Eglin Air Force Base	$116,230,000	$0	$116,230,000	$0	$0
Fort Bliss	$1,061,500,000	$0	$1,061,500,000	$0	$0
TOTAL	**$3,865,187,000**	**$475,523,000**	**$2,962,264,000**	**$422,000,000**	**$5,400,000**

Transportation Impacts – Baseline v. Proposed Build v. Actual

This section summarizes the transportation impacts across the case study bases. This review relies heavily upon commuting mode split for these facilities. Some of these facilities conducted surveys of personnel, which are more reliable compared to the U.S. Census American Community Survey (ACS), which is based on a sample of on-base residents only and does not reflect the travel behavior of all personnel.

Under predicted conditions, available level of service (LOS) results indicate that more intersections were expected to worsen than improve (see Table 59). In most cases, LOS improved more than expected under actual conditions. This was true at all bases except for Fort Meade and Fort Bliss. At Fort Meade, LOS worsened as expected, while at Fort Bliss, LOS worsened more than expected. The largest differences between predicted and actual conditions were observed at the Mark Center. While about 71 percent of intersections near the Mark Center were expected to worsen and none were expected to improve, 43 percent worsened and 57 percent improved under actual conditions.

Table 59: Trends in LOS at nearby intersections

	Level of Service (LOS) at Nearby Intersections			
	Predicted vs. Baseline		Actual vs. Baseline	
	Improve	Worsen	Improve	Worsen
Walter Reed National Military Medical Center	7%	73%	46%	23%
Main Post and Fort Belvoir North	24%	50%	56%	38%
Mark Center	0%	71%	57%	43%
Fort Meade	0%	100%	0%	100%
Joint Base Lewis-McChord	*Missing data*			
Eglin Air Force Base	1%	22%	13%	12%
Fort Bliss	32%	44%	8%	56%

In general, where consistent and comparable data were available, the targets outlined in predicted mode splits aimed to reduce the share of personnel driving alone. In most cases, however, predicted target mode splits were not met. While declines in the share of personnel driving alone were observed, such as at WRNMMC and Main Post/Fort Belvoir North, mode splits under actual conditions did not meet the predicted targets.

Table 60: Trends in drive alone mode split

	Baseline	Predicted	Actual
Walter Reed National Military Medical Center (personnel survey)	72.4%	28.0%	36.1%
Main Post and Fort Belvoir North (personnel survey)	84.8%	60.0%	83.3%
Main Post and Fort Belvoir North (ACS)	81%	60%	76.5%
Mark Center (personnel survey)	41%	57%	66%
Fort Meade (ACS)	71.6%	73.0%	72.0%
Joint Base Lewis-McChord (ACS)	48.4%	*Missing data*	72.9%
Eglin Air Force Base (ACS)	86.7%		82.6%
Fort Bliss (ACS)	41.6%		52.3%

All six facilities aimed to encourage carpool and vanpool as part of their TDM strategies. Where consistent and comparable data were available, predicted carpool/vanpool shares were expected to rise. At the Mark Center and JBLM, increases in the share of personnel using carpool/vanpool were observed. Somewhat unexpectedly, declines were observed at Fort Meade, Eglin Air Force Base, and Fort Bliss. Data was inconclusive at the Main Post and Fort Belvoir North,

Table 61: Trends in carpool/vanpool mode split

	Baseline	Predicted	Actual
Walter Reed National Military Medical Center (personnel survey)	13.5%	24.0%	10.3%
Main Post and Fort Belvoir North (personnel survey)	9.9%	*Missing data*	8.0%
Main Post and Fort Belvoir North (ACS)	7.2%		8.4%
Mark Center (personnel survey)	9.0%	11.0%	15.0%
Fort Meade (ACS)	12.4%	9.0%	7.6%
Joint Base Lewis-McChord (ACS)	6.6%	*Missing data*	8.5%
Eglin Air Force Base (ACS)	8.2%		7.8%
Fort Bliss (ACS)	9.9%		8.9%

As shown in Table 62, public transit is a significant access mode for WRNMMC and the Mark Center, but these facilities are unusual among military installations in that they are more like civilian employment sites. Transit mode share rose significantly at WRNMMC compared to both baseline and predicted conditions, most likely due to very strict parking constraints coupled with an urban setting, multimodal access options, and a comprehensive TDM program. The Mark Center, in contrast, was a new work site with poor transit access that replaced several predecessor sites with much better transit access; transit use at the new site was much lower than the baseline, but was still able to achieve a significant share due to aggressive TDM measures that include a new transit center and shuttles to remote rapid transit stations.

Because transit demand was very low at the other case study military facilities, available BRAC 2005 impact assessments did not conduct thorough data collection or analysis relative to public transit at most locations. Therefore, transit data for comparing baseline, predicted, and actual conditions was limited. The transit mode shares in Table 62 Table 55for Fort Meade, JBLM, Eglin AFB, and Fort Bliss are based on the ACS. Although the utility of this data is limited, for transit mode share it likely represents an upper bound of transit use for these facilities. The low levels of transit ridership, even for on-base residents, in both baseline and actual conditions, demonstrate that transit is not a significant mode for personnel at these facilities.

Table 62: Trends in transit mode split

	Baseline	Predicted	Actual
Walter Reed National Military Medical Center (personnel survey)	11.3%	30.0%	40.3%
Main Post and Fort Belvoir North (personnel survey)	4.0%	*Missing data*	6.0%
Main Post and Fort Belvoir North (ACS)	6.7%		8.8%
Mark Center (personnel survey)	17.0%	28.0%	17.0%
Fort Meade (ACS)	2.5%	2.0%	1.1%
Joint Base Lewis-McChord (ACS)	1.1%	*Missing data*	0.3%
Eglin Air Force Base (ACS)	0.0%		0.0%
Fort Bliss (ACS)	2.0%		0.6%

Promoting teleworking is another TDM strategy that employers can use to decrease driving demand. Data on use of telework was inconsistent among the different case study bases. ACS data was the most commonly available source of data on teleworking (i.e. "worked at home," per the ACS), but the ACS results on teleworking mode share raise questions. At Fort Meade and Eglin AFB, the share of personnel working at home increased significantly, but the shares were still fairly low. In contrast, teleworking mode shares dropped sharply at some other facilities: at JBLM, the teleworking share dropped from 17.8 percent to 5.2 percent, while it dropped from 23.0 percent at Fort Bliss to 7.6 percent.

Table 63: Trends in flextime or telework mode split

	Baseline	Predicted	Actual
Walter Reed National Military Medical Center (personnel survey)	*Missing data*	8.0%	8.6%
Main Post and Fort Belvoir North (personnel survey)	*Missing data*		
Main Post and Fort Belvoir North (ACS)	1.8%	*Missing data*	1.3%
Mark Center (personnel survey)	*Missing data*		
Fort Meade (ACS)	2.5%	9.0%	6.3%
Joint Base Lewis-McChord (ACS)	17.8%	*Missing data*	5.2%
Eglin Air Force Base (ACS)	1.7%		2.3%
Fort Bliss (ACS)	23.0%		7.6%

4.2. OVERALL FINDINGS

The following is a summary of overall findings of the research report. The data collected as part of this research report enabled the research team to draw conclusions and develop a meaningful understanding of the actual impacts of the BRAC 2005 process, how those impacts compare to what was predicted, and the ways they can inform future military facility planning.

Facility Changes

- Personnel growth at the case study facilities generally differed from that predicted to result from BRAC 2005 implementation. Total post-BRAC personnel was higher at three of the case study facilities: WRNMMC, Fort Belvoir/Mark Center, and Joint Base Lewis – McChord; at Fort Belvoir/Mark Center, the post-BRAC increase was only about 19 percent higher, while the increase at WRNMMC was 56 percent higher than predicted, and near four times as high for Joint Base Lewis – McChord. Post-BRAC personnel growth at Fort Meade was about 24 percent lower than predicted, and about 14 percent lower at Fort Bliss. Post-BRAC personnel levels at Eglin Air Force Base were not available.
- These changes in personnel levels, however, were not exclusively attributable to BRAC 2005. Several facilities, notably Fort Meade, were undergoing parallel growth and expansion initiatives that were not directly related to the BRAC 2005 process. However, many of these changes were implemented at the same time as BRAC 2005, and were often integrated into the transportation impact analysis and mitigation planning undertaken for BRAC 2005. As a result, it has proven difficult in some cases to separate

the transportation demand and system impacts of BRAC 2005 from the impacts of other realignment/expansion projects, and they must be considered as part of an overall realignment program.

Mitigation Measures

- Case study facilities located in areas with reliable transit options were more successful implementing additional/improved transit alternatives to accommodate personnel needs resulting from the base realignment.
- Case study facilities with limited transit options showed minimal increases in transit mode share, despite predictions and targets. In some cases, transit mode share decreased.
- Case study facilities with aggressive parking restrictions showed the greatest reductions in single-occupancy vehicle (SOV) trips and the greatest increase in other travel modes.
- Evaluation of transportation impacts and development of mitigation programs was an ongoing process at many of the case study facilities. Proposed transportation system improvements and TDM programs often evolved over time based on supplemental planning processes and ongoing coordination among military and civilian authorities.

Transportation Impacts

- For case study facilities with available predicted transportation impacts, the actual impacts were generally lower than originally predicted.
- There were other trends and issues that likely influenced background traffic patterns and volumes, and therefore affected the congestion levels near the case study facilities. There may have been non-military growth in the vicinity of these facilities that contributed to congestion on the roadway system. An even greater factor may have been the effects of the Great Recession on economic activity and travel behavior. Between 2007 and 2014, a period that coincides with most of the BRAC-related activities and data monitoring, national vehicles miles traveled (VMT) dropped and then remained at a lower level. This may have contributed to actual conditions that were less congested than predicted in some areas.
- In many cases, the predicted impacts of BRAC 2005 realignments highlighted and threatened to exacerbate existing transportation issues.
- The roughly six-year schedule for planning and implementing the BRAC 2005 realignments did not provide adequate time to complete major infrastructure improvement projects, which require a longer time to plan, permit, design, and build. Therefore, many of those projects that are intended to address BRAC 2005 realignment impacts are not yet complete.
- Public transit, walking, and bicycling generally received greater attention in post-BRAC 2005 analyses and evaluation of actual impacts than they did in pre-BRAC planning and mitigation programs. However, the lack of baseline and predicted performance measures for these modes made before-and-after data comparison more difficult.

Data and Analysis Issues

- The availability of data and analytical reports varied widely among the case studies.
  - For the three case study facilities in the National Capital Region—WRNMMC, Fort Belvoir/Mark Center, and Fort Meade—there was a larger quantity of data and information available. However, the data was frequently inconsistent, and quantitative comparisons across these three conditions proved difficult for many performance measures.
  - Data and quantitative analysis were significantly sparser and less comprehensive for the remaining three case study facilities—JBLM, Eglin Air Force Base, and Fort Bliss.
  - Data and analysis were focused principally on automobile volumes and traffic operations for all facilities except WRNMMC, which has good transit, pedestrian, and bicycle access. Multimodal volumes, analysis, and discussion were lacking, especially for JBLM, Eglin AFB, and Fort Bliss.
  - Inconsistency of data and performance measures between different time periods was also an issue. Consistent transportation performance measures should be established for future changes to military facilities so that baseline, predicted, and actual comparisons can be made before, after, and during the implementation process.
- There was a lack of readily available information on a wide range of topics, including facility characteristics, nature of the military activities at the facilities, land use, mitigation programs, and effects of transportation system improvements.
- It was difficult to determine the benefits and impacts of transportation system improvement projects that were not yet complete at the time of post-BRAC data collection.
- It was difficult to identify and contact individuals knowledgeable about transportation issues related to the case study facilities; it was particularly difficult to identify individuals with a knowledge of pre-BRAC 2005 conditions or effects of the BRAC 2005 implementation.
- Case study facilities that required completion of Traffic Impact Studies (TIS), either as part of an environmental review/mitigation process or in parallel with such a process, had more comprehensive data and performance measures. As a result, these case study facilities were better prepared to predict the potential impacts of base realignment on their transportation system, and better able to mitigate impacts through such measures as TDM strategies and mode share goals.
- Multimodal gate entry volume measures are a basic and important measure for the actual vs. predicted impact evaluation, since many proposed and implemented improvements focused on how to accommodate peak volumes of traffic from their point of origin to one or more entry gates. However, in many cases, these volumes were not counted in a consistent manner before and after BRAC 2005, nor predicted in a manner consistent with baseline or actual counts.

Stakeholder and Community Engagement

- Case study facilities that established "partnering" relationships with key personnel from the specific branch of the U.S. military, Department of Transportation, metropolitan planning organization (MPO), host city/county, and Federal Highway Administration (FHWA) were well prepared to establish and implement successful transportation mitigation strategies.
- These partnering relationships among military and civilian authorities often developed and improved over the course of coordination on BRAC 2005 impacts and mitigation. In many cases, the coordination that was initiated through planning for BRAC 2005 and implementation of mitigation projects has resulted in ongoing partnerships that have improved communication and cooperation.

4.3. SUGGESTIONS FOR FUTURE RESEARCH

This research project has produced a considerable amount of data, analysis, and information that focuses principally on transportation impacts and transportation performance measures. It has also yielded insights on the transportation impact assessment processes undertaken for the six case study military facilities, the data and analysis produced, and the limitations of that data and analysis for assessing transportation impact.

The research project has also highlighted related areas of inquiry and research that might prove useful in addressing issues identified above, and planning for future military base expansions and realignments. The following are preliminary suggestions for potential future research topics that are designed to address the key issues identified in Section 4.2:

- Best practices for evaluating transportation impacts at military facilities. A significant challenge in conducting this research project has been lack of data, inconsistency of data for evaluating transportation impacts, and inconsistent tracking of mitigation programs and the effectiveness of various mitigation approaches. A research project could develop a guidebook or best practices manual for evaluating the transportation impacts of military facility expansions or realignments, and the outcomes of mitigation measures. Key elements may include standards for appropriate study areas and transportation facilities for evaluation; data collection procedures; evaluation conditions; predictions for traffic and multimodal transportation impacts; performance measures and evaluation criteria appropriate to the facility context; and post-implementation monitoring.
- Review of Department of Defense smart growth land use strategies and review of their impact on military transportation behavior. Evaluation of land use patterns and land use-related strategies for mitigating transportation impacts from BRAC 2005 was not a component of this research project. However, land use is an important issue for consideration in military base planning and future BRAC initiatives. Since the BRAC 2005 process began, DoD has undertaken initiatives to promote sustainability and smart growth development. Beginning in 2006, DoD reviewed its fossil fuel dependency and began work to reduce it.446 Building upon these efforts, as well as the 2009 federal Executive Order 13514 that set federal sustainability goals and guidelines, DoD revised its military base planning and development guidelines. The resulting Unified Facilities Criteria (UFC) for

Installation Master Planning strongly promotes compact and infill development, transit-oriented development, mixed land uses, connected transportation networks, and other sustainable infrastructure strategies. 447 These goals are also supported by the Department of Defense's Healthy Base Initiative, promotes a range of strategies to reduce obesity and encourage healthy lifestyles. This includes promotion of walking and bicycling not just for recreation, but for transportation and mobility, as well as encouragement of infrastructure and development strategies that will support more active transportation.448 Implementation of these initiatives would vary significantly depending on the form and function of a given military facility; smart growth and sustainable development would mean something very different for a large, spread out rural base like Eglin AFB than it would for an urban/suburban military office worksite like the Mark Center. Therefore, an evaluation of effects of these initiatives should include a review of transportation impacts at military facilities with different land use contexts. Such a review could help to enable better understanding of the military smart growth and sustainability initiatives, and facilitate consideration during future BRAC processes of smart growth land use and transportation strategies that are appropriate to military facility context.

- Toolkit of transportation mitigation measures. A toolkit of transportation mitigation measures and strategies, including both infrastructure improvement and travel demand management (TDM) strategies, could be useful for managing military facility operations, expansions, and realignments. Such a toolkit should offer a range of options that could be tailored to the facility's geographic context and its functional mission. For larger, more spread out facilities, multimodal infrastructure improvements and automobile trip reduction strategies would likely be concentrated in clustered activity centers.
    - Infrastructure improvements, including Complete Streets roadway improvements that address not only traffic needs, but also the needs of pedestrians, bicyclists, and public transit riders.
    - Parking reductions, restrictions, and fees.
    - Improved transit service.
    - Free shuttles/on-base transit and/or subsidies for transit fares for facilities that are served by civilian transit.
    - Encouragement of ridesharing, vanpooling, and potentially innovative transportation modes such as connected and automated vehicles (CAV) and transportation network companies (TNCs).
    - Encouragement of and/or incentives for alternate travel schedules, flextime for appropriate facility personnel.
    - Promotion of telework (frequent or occasional, as appropriate) for personnel who are not essential to have on-base.
- Best practices for military/civilian transportation coordination. As noted in TRB Special Report 302, coordination about transportation impacts and issues was not well-established among military facility officials, civilian authorities, and the general public at the start of the BRAC 2005 implementation process. As planning for the BRAC 2005

realignments proceeded and transportation impact and mitigation plans were developed, this coordination generally improved. Research on approaches to this coordination, outcomes, and best practices could help to facilitate improved early coordination for future BRAC processes.

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APPENDIX A: LEVELS OF SERVICE, HIGHWAY CAPACITY MANUAL 2010

The Highway Capacity Manual (HCM) focuses on evaluating the capacity and quality of transportation service of various facilities and modes. One of the most widely-used of the quality of service is known as the Level of Service (LOS).

The LOS of a roadway facility relates the quality of traffic service to a given flow rate by denoting the level of quality under different operation characteristics and traffic volumes. LOS is based on different Measures of Effectiveness (MOE) of a facility such as speed, travel-time, density, delay etc. The HCM reports LOS using letters that designate a range of operating conditions on a particular type of facility. The letters are defined as A, B, C, D, E, and F where ‘A’ denotes the best quality of service and ‘F’ denotes the worst.

LEVEL OF SERVICE AT SIGNALIZED INTERSECTIONS

The LOS at signalized intersections is based on the amount of delay experienced by drivers traveling along the roadway through an intersection. The LOS criteria for signalized intersections as provided in chapter 18 of the 2010 Highway Capacity Manual, are given in Table A1.

Table A1: Level of Service for signalized intersections based on control delay

Level of Service	Description	Average Control Delay Per Vehicle (seconds)
A	Operations with very low control delay occurring with favorable progression and/or short cycle lengths.	≤ 10.0
B	Operations with low control delay occurring with good progression and/or short cycle lengths.	> 10.0 and ≤ 20.0
C	Operations with average control delays resulting from fair progression and/or longer cycle lengths. Individual cycle failures begin to appear.	> 20.0 and ≤ 35.0
D	Operations with longer control delays due to a combination of unfavorable progression, long cycle lengths, or high V/C ratios. Many vehicles stop and individual cycle failures are noticeable.	> 35.0 and ≤ 55.0
E	Operations with high control delay values indicating poor progression, long cycle lengths, and high V/C ratios. Individual cycle failures are frequent occurrences. This is considered the limit of acceptable delay.	> 55.0 and ≤ 80.0
F	Operation with control delays unacceptable to most drivers occurring due to oversaturation, poor progression, or very long cycle lengths.	> 80.0

Source: 2010 Highway Capacity Manual

LEVEL OF SERVICE ON FREEWAY FACILITIES

Freeways are defined as divided highway facilities with two or more lanes in each direction and full control of access. Since speed is constant through a broad range of flows, the LOS on basic freeway segments is based on the density of vehicles. Density describes the proximity to other vehicles and is related to the freedom to maneuver within the traffic stream. Unlike speed, density is sensitive to flow rates throughout the range of flows. The service measures for freeways facilities as defined in chapter 10 of the HSM are shown in Table A2.

Table A2: Level of Service for basic freeway segments based on density

Level of Service	Description	Density (pc/mi/ln)
A	Free flow operations and speeds. Unimpeded maneuver. Incidents are easily absorbed	≤ 11.0
B	Reasonably free flow operations and speeds. Slight restrictions to traffic stream. Minor incidents are easily absorbed	> 11.0 - 18.0
C	Flow with speeds near the free flow speeds. Lane changes require more vigilance. Minor incidents may be absorbed but deterioration in service quality is notable.	> 18.0 - 26.0
D	Declining speeds with increasing flows. Maneuver within traffic stream is limited. Minor incidents can be expected to create queues.	> 26.0 - 35.0
E	Operations at freeway capacity and no useable gaps within the traffic stream. Incidents can be expected to produce substantial queues.	> 35.0 - 45.0
F	Demand exceeds Capacity. These conditions exist within queues forming behind bottlenecks.	> 45.0

Source: 2010 Highway Capacity Manual

LEVEL OF SERVICE FOR MULTI-LANE HIGHWAYS

Multilane highways generally have posted speed limits between 40 to 55 mph with four or six lanes. Multi lane highways may be undivided or have physical medians or two way left turn lane medians. These highways are often interrupted by intersections or driveways.

LOS criteria A through D for multilane highways are generally similar to those of the freeway facilities. However, LOS E and F represent capacity which occur at varying densities on Multilane highways ranging from 40pc/mi/ln for 60 mi/h Free Flow Speeds to 45 pc/mi/ln for 45 mi/h Free Flow Speeds. LOS F is determined when demand flow rate exceeds capacity. ays per chapter 14 of the HCM.

Table A3 shows the service measures for multilane highways per chapter 14 of the HCM.

Table A3: Level of Service for multilane highways based on density

Level of Service	Description	FFS (mi/h)	Density (pc/mi/ln)
A	Free flow multilane operations and speeds. Unimpeded maneuver. Incidents are easily absorbed	All	>0 - 11
B	Reasonably free flow multilane operations and speeds. Slight restrictions to traffic stream. Minor incidents are easily absorbed	All	>11 - 18
C	Flow with speeds near the multilane free flow speeds. Lane changes require more vigilance. Minor incidents may be absorbed but deterioration in service quality is notable.	All	>18 - 26
D	Declining multilane speeds with increasing flows. Maneuver within traffic stream is limited. Minor incidents can be expected to create queues.	All	>26 - 35
E	Operations at multilane freeway capacity and no useable gaps within the traffic stream. Incidents can be expected to produce substantial queues.	60 55 50 45	>35 – 40 >35 – 41 >35 – 43 >35 – 45
F	Demand flow rate exceeds Capacity. These conditions exist within queues forming behind bottlenecks.	60 55 50 45	>40 >41 >43 >45

Source: 2010 Highway Capacity Manual

LEVEL OF SERVICE FOR TWO-LANE HIGHWAYS

Two lane highways are defined as highways that have one lane of traffic use in each direction whereby passing maneuvers take place in the opposing lane of traffic. The HCM 2010 manual uses three measures to assess the highways operations:

1. Average Travel Speed (ATS) which reflects mobility on a two-lane highway (Highway segment length divided by average travel time.),
2. Percent Time Following (PTSF) which reflects the freedom to maneuver and the comfort and convenience of travel (Average percentage of time that vehicles must travel in platoons behind slower vehicles due to inability to pass.),
3. Percent Free Flow Speed (PFFS) which represents the ability of vehicles to travel at or near the posted speed limit.
4. Two-lane highways are classified into Class I, Class II and Class III highways based on wide range of functions. Per the HCM, arterials are considered Class I highways, and most collectors and local roads are considered to be Class II. Class III highways are a special case and may be any functional class. Definitions of the three classes based on the 2010 HCM are:
5. Class I – Two-lane rural highways where motorists expect to travel at relatively high speeds. Mostly serve long distance trips or provide the connections between facilities that serve long distance trips.
6. Class II – Two lane rural highways where motorists do not necessarily expect to travel at high speeds. Mostly serve short trips and as access routes to Class I facilities. Sometimes scenic or recreational routes.
7. Class III – Two lane rural highways in moderately developed areas. Local traffic often mixes with through traffic and density of un-signalized access points is noticeably higher. Often reduced speeds limit that reflect higher activity levels.

On Class I highways, both ATS and PTSF represents quality of service. While, PTSF defines LOS on Class II highways and PFFS is used to define LOS on Class III highways. LOS criteria for two-lane highways as defined in chapter 15 of the HCM are shown in Table A4.

Table A4: Level of Service for two-lane highways

Level of Service	Class I Highways		Class II Highways	Class III Highways
	ATS (mi/h)	PTSF (%)	PTSF (%)	PFFS (%)
A	>55	≤35	≤35	>91.7
B	>50 – 55	>50 – 55	>40 – 55	>83.3 – 91.7
C	>45– 50	>50 – 55	>55 – 70	>75.0 – 83.3
D	>40 – 45	>50 – 55	>70 – 85	>66.7 – 75.0
E	≤40	>50 – 55	>85	≤66.7

Source: 2010 Highway Capacity Manual

APPENDIX B: TRAFFIC VOLUME AND OPERATIONS TABLES

WALTER REED NATIONAL MILITARY MEDICAL CENTER

Baseline

Table B1: Baseline LOS near NNMC from Maryland SHA[449]

Intersection	Baseline (2008)	
	AM	PM
Rockville Pike (MD 355) and Grosvenor Lane	E	C
Rockville Pike (MD 355) and Cedar Lane*	F	F
Old Georgetown Road (MD 187) and West Cedar Lane/Oakmont Avenue*	C	C
Rockville Pike (MD 355) and North Drive	F	D
Rockville Pike (MD 355) and North Wood Road	C	E
Rockville Pike (MD355)/Wisconsin Avenue and Center Drive/Jones Bridge Road*	E	F
Connecticut Avenue (MD 185) and Jones Bridge Road/Kensington Parkway*	F	F

Table B2: Baseline LOS near NNMC from the U.S. Navy's 2008 FEIS[450]

Intersection	Baseline (2008)	
	AM	PM
Rockville Pike (MD 355) and Grosvenor Lane	C	A/B
Rockville Pike (MD 355) and Pooks Hill Road	E	D
Rockville Pike (MD 355) and Cedar Lane	F	F
Rockville Pike (MD 355) and North Drive	E	C
Rockville Pike (MD 355) and North Wood Road	B/C	D
Rockville Pike (MD 355) and Wilson Drive	D	E
Rockville Pike (MD 355) and South Drive/South Wood Road	B/C	B/C
Rockville Pike (MD 355) and Center Drive/Jones Bridge Road	D	E/F
Gunnell Road and Jones Bridge Road	A	A
Grier Road and Jones Bridge Road	A	B
University Road and Jones Bridge Road	A	A/B
Connecticut Avenue (MD 185) and Jones Bridge Road	F	F

Intersection	Baseline (2008)	
	AM	PM
Manor Road and Jones Bridge Road	A	A
Jones Bridge Road and Jones Mill Road	C	A
Wisconsin Avenue and Woodmont Avenue	B	B

Predicted

Table B3: Baseline and predicted future no-build LOS[451]

Intersection	Baseline (2008)		Predicted Future No-Build (2011)	
	AM	PM	AM	PM
Rockville Pike (MD 355) and Grosvenor Lane	C	A/B	C/D	B
Rockville Pike (MD 355) and Pooks Hill Road	E	D	E	D
Rockville Pike (MD 355) and Cedar Lane	F	F	F	F
Rockville Pike (MD 355) and North Drive	E	C	E	C
Rockville Pike (MD 355) and North Wood Road	B/C	D	B/C	D
Rockville Pike (MD 355) and Wilson Drive	D	E	D/E	E
Rockville Pike (MD 355) and South Drive/South Wood Road	B/C	B/C	B/C	B/C
Rockville Pike (MD 355) and Center Drive/Jones Bridge Road	D	E/F	D	F
Gunnell Road and Jones Bridge Road	A	A	A	A
Grier Road and Jones Bridge Road	A	B	A	B
University Road and Jones Bridge Road	A	A/B	A	B
Connecticut Avenue (MD 185) and Jones Bridge Road	F	F	F	F
Manor Road and Jones Bridge Road	A	A	A	A
Jones Bridge Road and Jones Mill Road	C	A	C/D	A
Wisconsin Avenue and Woodmont Avenue	B	B	D	B

Table B4: Baseline and predicted future build LOS[452]

Intersection	Baseline (2008)		Predicted Future Build (2011)	
	AM	**PM**	**AM**	**PM**
Rockville Pike (MD 355) and Grosvenor Lane	C	A/B	D	B
Rockville Pike (MD 355) and Pooks Hill Road	E	D	E	D/E
Rockville Pike (MD 355) and Cedar Lane	F	F	F	F
Rockville Pike (MD 355) and North Drive	E	C	F	D
Rockville Pike (MD 355) and North Wood Road	B/C	D	D	E
Rockville Pike (MD 355) and Wilson Drive	D	E	D/E	E/F
Rockville Pike (MD 355) and South Drive/South Wood Road	B/C	B/C	C	C
Rockville Pike (MD 355) and Center Drive/Jones Bridge Road	D	E/F	D	F
Gunnell Road and Jones Bridge Road	A	A	B	B/C
Grier Road and Jones Bridge Road	A	B	A	C/D
University Road and Jones Bridge Road	A	A/B	A	B/C
Connecticut Avenue (MD 185) and Jones Bridge Road	F	F	F	F
Manor Road and Jones Bridge Road	A	A	A	A
Jones Bridge Road and Jones Mill Road	C	A	D	A
Wisconsin Avenue and Woodmont Avenue	B	B	B	B

Actual

Table B5: Predicted future build 2008 BRAC FEIS traffic volumes vs. actual traffic volumes[453]

Count Location	Direction	2008 BRAC FEIS Predicted Future Build Traffic Volumes		Actual Traffic Volumes (2011)	
		AM Peak (7:45 to 8:45 AM)	PM Peak (4;45 to 5:45 PM)	AM Peak (7:45 to 8:45 AM)	PM Peak (4:45 to 5:45 PM)
Rockville Pike (MD 355) between Pooks Hill Road and Cedar Lane	Northbound	1,728	3,383	1,699	3,646
	Southbound	3,539	2,134	2,911	2,011
Rockville Pike (MD 355) between Wilson Drive and Gate 2	Northbound	1,657	2,790	1,096	1,824
	Southbound	2,732	2,216	2,346	1,726
Rockville Pike (MD 355) between Gate 2 and Jones Bridge Road	Northbound	1,353	2,250	1,197	1,854
	Southbound	2,567	2,185	2,093	1,770
Rockville Pike (MD 355) between Jones Bridge Road and Woodmont Avenue	Northbound	1,663	2,592	1,400	2,082
	Southbound	3,289	1,686	2,650	1,911
	Northbound	**1,600**	**2,754**	**1,348**	**2,352**

Count Location	Direction	2008 BRAC FEIS Predicted Future Build Traffic Volumes		Actual Traffic Volumes (2011)	
		AM Peak (7:45 to 8:45 AM)	PM Peak (4;45 to 5:45 PM)	AM Peak (7:45 to 8:45 AM)	PM Peak (4:45 to 5:45 PM)
Average of Rockville Pike (MD 355) Corridor	**Southbound**	**3,032**	**2,055**	**2,500**	**1,855**
Jones Bridge Road between Gate 5 and Connecticut Avenue (MD 185)	Eastbound	675	2,068	528	-
	Westbound	1,664	656	-	-
Jones Bridge Road between Gate 3 and Rockville Pike (MD 355)	Eastbound	848	1,373	508	-
	Westbound	1,365	772	-	-
Average of Jones Bridge Corridor	**Eastbound**	**762**	**1,721**	**518**	-
	Westbound	**1,515**	**714**	-	-

Table B6: WRNMMC actual inbound gate volumes[454]

		Baseline (2009)		Actual (2011)	
Gate	**Gate #**	**AM Peak Hour Volume**	**PM Peak Hour Volume**	**AM Peak Hour Volume**	**PM Peak Hour Volume**
North (North Wood Road)	1	913	29	2,104	303
South (South Wood Road)	2	200	194	1,058	414
Navy Exchange (Jones Bridge Road)	3	360	90	1,125	374
Navy Lodge (Jones Bridge Road)	4	21	0	156	-
USU (Jones Bridge Road)	5	310	0	807	31
TOTAL		2,004	313	5,250	1,122

FORT BELVOIR/MARK CENTER

Table B7: Baseline LOS at AM and PM peak hours around Fort Belvoir Main Post and EPG[455]

	Intersection	Baseline (2006)	
		AM Peak Hour (7:15 to 8:15 AM) LOS	PM Peak Hour (4:30 to 5:30 PM) LOS
Engineer Proving Ground (EPG)	Franconia-Springfield Parkway and Spring Village Drive	E	E
	Franconia-Springfield Parkway Eastbound Ramp/Backlick Road	E	D
	Franconia Springfield Parkway Westbound Ramp and Backlick Road	B	B
	Franconia Springfield Parkway and I-95 HOV Ramps	D	F
	Franconia Springfield Parkway Eastbound Ramp and Frontier Drive	C	D
	Franconia Springfield Parkway Westbound Ramp and Frontier Drive	C	F
	Franconia Springfield Parkway and Beulah Street	F	F
	VA 286 (Fairfax County Parkway) and Fullerton Road	F	F
Main Post	VA 286 (Fairfax County Parkway) and Terminal Road	D	C
	VA 286 (Fairfax County Parkway) Southbound Ramps and Telegraph Road	B	D
	VA 286 (Fairfax County Parkway) Northbound Ramps/Telegraph Road	B	C
	VA 286 (Fairfax County Parkway) and John J. Kingman Road	D	F
	Telegraph Road and Beulah Street	D	C
	U.S. Route 1 and Telegraph Road-Old Colchester Road	D	D
	U.S. Route 1 and VA 286 (Fairfax County Parkway)	D	C
	U.S. Route 1 and Backlick Road-Pohick Road	C	F
	U.S. Route 1 and Belvoir Road	B	B
	U.S. Route 1 and Woodlawn Road	A	B
	U.S. Route 1 and Old Mill Road	F	F

Predicted

Table B8: Baseline vs. predicted future no-build LOS at AM and PM peak hours around Main Post and EPG[456]

	Intersection	Baseline (2006)		Predicted Future No-Build	
		AM Peak Hour (7:15 to 8:15 AM) LOS	PM Peak Hour (4:30 to 5:30 PM) LOS	AM Peak Hour (7:15 to 8:15 AM) LOS	PM Peak Hour (4:30 to 5:30 PM) LOS
Engineer Proving Ground (EPG)	Franconia-Springfield Parkway and Spring Village Drive	E	E	F	F
	Franconia-Springfield Parkway Eastbound Ramp/Backlick Road	E	D	E	D
	Franconia Springfield Parkway Westbound Ramp and Backlick Road	B	B	B	C
	Franconia Springfield Parkway and I-95 HOV Ramps	D	F	E	F
	Franconia Springfield Parkway Eastbound Ramp and Frontier Drive	C	D	C	D
	Franconia Springfield Parkway Westbound Ramp and Frontier Drive	C	F	C	F
	Franconia Springfield Parkway and Beulah Street	F	F	F	F
	VA 286 (Fairfax County Parkway) and Fullerton Road	F	F	F	F
Main Post	VA 286 (Fairfax County Parkway) and Terminal Road	D	C	C	C
	VA 286 (Fairfax County Parkway) Southbound Ramps and Telegraph Road	B	D	C	C
	VA 286 (Fairfax County Parkway) Northbound Ramps/Telegraph Road	B	C	B	C
	VA 286 (Fairfax County Parkway) and John J. Kingman Road	D	F	D	F
	Telegraph Road and Beulah Street	D	C	D	C
	U.S. Route 1 and Telegraph Road-Old Colchester Road	D	D	D	E
	U.S. Route 1 and VA 286 (Fairfax County Parkway)	D	C	D	D
	U.S. Route 1 and Backlick Road-Pohick Road	C	F	D	F
	U.S. Route 1 and Belvoir Road	B	B	C	D
	U.S. Route 1 and Old Mill Road	F	F	E	E

Table B9: Baseline vs. predicted future-build LOS at AM and PM peak hours around Main Post and Fort Belvoir North[457]

	Intersection	Baseline (2006)		Predicted Future Build	
		AM Peak Hour (7:15 to 8:15 AM) LOS	PM Peak Hour (4:30 to 5:30 PM) LOS	AM Peak Hour (7:15 to 8:15 AM) LOS	PM Peak Hour (4:30 to 5:30 PM) LOS
Fort Belvoir North	Franconia-Springfield Parkway and Spring Village Drive	E	E	F	F
	Franconia-Springfield Parkway Eastbound Ramp/Backlick Road	E	D	E	D
	Franconia Springfield Parkway Westbound Ramp and Backlick Road	B	B	B	C
	Franconia Springfield Parkway and I-95 HOV Ramps	D	F	F	F
	Franconia Springfield Parkway Eastbound Ramp and Frontier Drive	C	D	C	E
	Franconia Springfield Parkway Westbound Ramp and Frontier Drive	C	F	D	F
	Franconia Springfield Parkway and Beulah Street	F	F	F	F
Main Post	VA 286 (Fairfax County Parkway) and Terminal Road	D	C	C	C
	VA 286 (Fairfax County Parkway) Southbound Ramps and Telegraph Road	B	D	C	C
	VA 286 (Fairfax County Parkway) Northbound Ramps/Telegraph Road	B	C	B	B
	VA 286 (Fairfax County Parkway) and John J. Kingman Road	D	F	D	F
	Telegraph Road and Beulah Street	D	C	D	C
	U.S. Route I and Telegraph Road-Old Colchester Road	D	D	E	E
	U.S. Route I and VA 286 (Fairfax County Parkway)	D	C	E	D
	U.S. Route I and Backlick Road-Pohick Road	C	F	F	F
	U.S. Route I and Belvoir Road	B	B	F	F
	U.S. Route I and Old Mill Road	F	F	F	E

Table B10: Baseline vs. predicted future build LOS at AM and PM peak hours around Mark Center

Intersection	Baseline (2009)[458]		Predicted Future Build (2010 TMP)[459]		Predicted Future Build (2009 VHB)[460]		Predicted Future Build (2009 PB)[461]	
	AM Peak Hour LOS	PM Peak Hour LOS	AM Peak Hour LOS	PM Peak Hour LOS	AM Peak Hour LOS	PM Peak Hour LOS	AM Peak Hour LOS	PM Peak Hour LOS
Seminary Road and North Beauregard Street	C	D	E	E	F	D	D	E
North Beauregard Street and Mark Center Drive	B	B	D	C	F	C	C	D
Seminary Road and Mark Center Avenue	C	C	D	D	C	F	C	F
I-395 Southbound Off-Ramp and Seminary Road	B	C	B	B	B	C	B	D
I-395 Southbound On-Ramp and Seminary Road	C	B	D	A	C	C	D	E
I-395 Northbound Off-Ramp and Seminary Road	B	C	E	B	C	D	E	D
I-395 Northbound On-Ramp and Seminary Road	B	B	C	A	B	B	B	B

Note: AM peak hour is 7:15 to 8:15 AM and PM peak hour is 4:30 to 5:30 PM

Actual

Table B11: AM Peak Hour (6:15 to 7:15AM) gate volumes, baseline vs. actual

Gate	Gate Serves	AM Peak Hour Baseline Volume (2006)[462]	AM Peak Hour Actual Volume (2013)[463]	% Change
Tully	Main Post	1,519	1,211	-20%
Pence	Main Post	585	869	49%
Walker	Main Post	301	612	103%
Kingman	Main Post	651	1,782	173%
Telegraph	Main Post	597	880	47%
Farrar	Main Post	40	-	-
Woodlawn	Main Post	200	-	-
TOTAL		**3,893**	**5,354**	**-**

Table B12: Baseline vs. actual LOS at AM and PM peak hours around Main Post and Fort Belvoir North

	Intersection	Baseline (2006)[464]		Predicted Future Build *(compared to Baseline)*[465]		Actual 2012-2013 *(compared to Baseline)*[466]	
		AM Peak Hour (7:15 to 8:15 AM) LOS	PM Peak Hour (4:30 to 5:30 PM) LOS	AM Peak Hour (7:15 to 8:15 AM) LOS	PM Peak Hour (4:30 to 5:30 PM) LOS	AM Peak Hour (7:15 to 8:15 AM) LOS	PM Peak Hour (4:30 to 5:30 PM) LOS
Engineer Proving Ground (EPG)/ Fort Belvoir North	Franconia-Springfield Parkway and Spring Village Drive	E	E	F	F	C	C
	Franconia-Springfield Parkway Eastbound Ramp/Backlick Road	E	D	E	D	D	C
	Franconia Springfield Parkway Westbound Ramp and Backlick Road	B	B	B	C	C	B
	Franconia Springfield Parkway and I-95 HOV Ramps	D	F	F	F	B	D
	Franconia Springfield Parkway Eastbound Ramp and Frontier Drive	C	D	C	E	C	C
	Franconia Springfield Parkway Westbound Ramp and Frontier Drive	C	F	D	F	B	C
	Franconia Springfield Parkway and Beulah Street	F	F	F	F	E	E
Main Post	VA 286 (Fairfax County Parkway) and Terminal Road	D	C	C	C	D	D
	VA 286 (Fairfax County Parkway) Southbound Ramps and Telegraph Road	B	D	C	C	B	B
	VA 286 (Fairfax County Parkway) Northbound Ramps/Telegraph Road	B	C	B	B	B	B
	Telegraph Road and Beulah Street	D	C	D	C	D	D
	U.S. Route 1 and Telegraph Road-Old Colchester Road	D	D	E	E	D	D
	U.S. Route 1 and VA 286 (Fairfax County Parkway)	D	C	E	D	D	E
	U.S. Route 1 and Backlick Road-Pohick Road	C	F	F	F	D	F
	U.S. Route 1 and Belvoir Road	B	B	F	F	C	D
	U.S. Route 1 and Woodlawn Road	A	B	-	-	A	A

Table B13: Baseline vs. actual LOS at AM and PM peak hours

Intersection	Baseline (2009)[467]		Predicted Future Build (2010 TMP) *(compared to Baseline)*[468]		Predicted Future Build (2009 VHB) *(compared to Baseline)*[469]		Predicted Future Build (2009 PB) *(compared to Baseline)*[470]		Actual (2014 VDOT) *(compared to Baseline)*[471]	
	AM Peak Hour LOS	AM Peak Hour LOS	AM Peak Hour LOS	PM Peak Hour LOS	AM Peak Hour LOS	PM Peak Hour LOS	AM Peak Hour LOS	PM Peak Hour LOS	AM Peak Hour LOS	PM Peak Hour LOS
Seminary Road and North Beauregard Street	C	E	E	E	F	D	D	E	D	E
North Beauregard Street and Mark Center Drive	B	D	D	C	F	C	C	D	B	B
Seminary Road and Mark Center Avenue	C	D	D	D	C	F	C	F	C	C
I-395 Southbound Off-Ramp and Seminary Road	B	B	B	B	B	C	B	D	B	C
I-395 Southbound On-Ramp and Seminary Road	C	D	D	A	C	C	D	E	C	C
I-395 Northbound Off-Ramp and Seminary Road	B	E	E	B	C	D	E	D	E	E
I-395 Northbound On-Ramp and Seminary Road	B	C	C	A	B	B	B	B	B	B

Note: AM peak hour is 7:15 to 8:15 AM and PM peak hour is 4:30 to 5:30 PM

FORT MEADE

Baseline

Table B14: Baseline peak hour traffic volumes along MD 175[472]

Roadway Segment		Baseline (2005) AM Peak Hour (8 to 9 AM) Volume	Baseline (2005) PM Peak Hour (5 to 6 PM) Volume
MD 175 (Annapolis Road) and Rockenbach Road	Northbound	1,130	860
	Southbound	680	980
MD 175 (Annapolis Road) and Reece Road	Northbound	655	825
	Southbound	690	665
MD 175 (Annapolis Road) and Mapes Road	Northbound	750	850
	Southbound	500	760

Table B15: Baseline LOS at AM and PM peak hours around Fort Meade[473]

Intersection	Baseline (2006) AM Peak Hour (8 to 9 AM) LOS	Baseline (2006) PM Peak Hour (5 to 6 PM) LOS
MD 175 (Annapolis Road) and Mapes Road	C	B
MD 175 (Annapolis Road) and Llewellyn Road	B	A
MD 175 (Annapolis Road) and Reece Road	B	C
MD 175 (Annapolis Road) and Rockenbach Road	B	E
MD 175 (Annapolis Road) and Disney Road	A	C
MD 32 (Patuxent Freeway) and Mapes Road (Northbound)	B	A
MD 32 (Patuxent Freeway) and Mapes Road (Southbound)	A	A
Jacobs Road and Reece Road	C	D
Pioneer Drive and Reece Road	A	A
Severn Road and Reece Road	B	B
Severn Road and Ridge Road	B	F

Predicted

Table B16: Baseline vs. predicted future no-build LOS at AM and PM peak hours around Fort Meade[474]

Intersection	Baseline (2006)		Predicted Future No-Build (2011)	
	AM Peak Hour (8 to 9 AM) LOS	PM Peak Hour (5 to 6 PM) LOS	AM Peak Hour (8 to 9 AM) LOS	PM Peak Hour (5 to 6 PM) LOS
MD175 (Annapolis Road) and Mapes Road	C	B	D	D
MD 175 (Annapolis Road) and Llewellyn Road	B	A	B	A
MD 175 (Annapolis Road) and Reece Road	B	C	B	D
MD 175 (Annapolis Road) and Rockenbach Road	B	E	C	F
MD 175 (Annapolis Road) and Disney Road	A	C	A	E
MD 32 (Patuxent Freeway) and Mapes Road (Northbound)	B	A	C	B
MD 32 (Patuxent Freeway) and Mapes Road (Southbound)	A	A	A	A
Jacobs Road and Reece Road	C	D	D	F
Pioneer Drive and Reece Road	A	A	A	A
Severn Road and Reece Road	B	B	B	C
Severn Road and Ridge Road	B	F	B	F

Table B17: Baseline vs. predicted future build LOS at AM and PM peak hours around Fort Meade[475]

Intersection	Baseline (2006)		Predicted Future Build (2011)	
	AM Peak Hour (8 to 9 AM) LOS	PM Peak Hour (5 to 6 PM) LOS	AM Peak Hour (8 to 9 AM) LOS	PM Peak Hour (5 to 6 PM) LOS
MD175 (Annapolis Road) and Mapes Road	C	B	F	F
MD 175 (Annapolis Road) and Llewellyn Road	B	A	D	C
MD 175 (Annapolis Road) and Reece Road	B	C	F	F
MD 175 (Annapolis Road) and Rockenbach Road	B	E	E	F
MD 175 (Annapolis Road) and Disney Road	A	C	E	F
MD 32 (Patuxent Freeway) and Mapes Road (Northbound)	B	A	F	B
MD 32 (Patuxent Freeway) and Mapes Road (Southbound)	A	A	E	A
Jacobs Road and Reece Road	C	D	F	F
Pioneer Drive and Reece Road	A	A	F	F
Severn Road and Reece Road	B	B	F	F
Severn Road and Ridge Road	B	F	E	F

Actual

Table B18: Baseline, predicted, and actual peak hour traffic volumes along MD 175

Roadway Segment		Baseline (2005)[476]		Predicted Future Build (2011)[477]		Actual (2012)[478]			
		AM Peak Hour (8 to 9 AM) Volume	PM Peak Hour (5 to 6 PM) Volume	AM Peak Hour (8 to 9 AM) Volume	PM Peak Hour (5 to 6 PM) Volume	AM Peak Hour (7:30 to 8:30 AM) Volume	PM Peak Hour (4:30 to 5:30 PM) Volume	% Change *(compared to baseline)*	
MD 175 and Rockenbach Road	Northbound	1,130	860	1,405	1,260	856	752	-24%	-12%
	Southbound	680	980	1,145	1,460	531	863	-22%	-12%
MD 175 and Reece Road	Northbound	655	825	965	1,490	598	668	-9%	-19%
	Southbound	690	665	955	1,000	469	693	-32%	4%
MD 175 and Mapes Road	Northbound	750	850	1,110	1,565	686	744	-9%	-12%
	Southbound	500	760	850	1,030	400	847	-20%	11%

Table B19: Baseline, predicted future build, and actual LOS at AM and PM peak hours around Fort Meade

Intersection	Baseline (2006)[479]		Predicted Future Build[480]		Actual (2012)[481] *(compared to baseline)*	
	AM Peak Hour (8 to 9 AM) LOS	PM Peak Hour (5 to 6 PM) LOS	AM Peak Hour (8 to 9 AM) LOS	PM Peak Hour (5 to 6 PM) LOS	AM Peak Hour (7:30 to 8:30 AM) LOS	PM Peak Hour (4:30 to 5:30 PM) LOS
MD 175 and Mapes Road	C	B	F	F	E	E
MD 175 and Llewellyn Road	B	A	D	C	F	F
MD 175 and Reece Road	B	C	F	F	C	C
MD 175 and Rockenbach Road	B	E	E	F	E	E

JOINT BASE LEWIS-MCCHORD

Baseline

Table B20: Baseline LOS at AM and PM peak hours around Fort Lewis[482]

Intersection	Baseline (2009)	
	AM Peak Hour LOS	PM Peak Hour LOS
I–5 Northbound Ramps/Barksdale Avenue/Clark Road (Exit 119)	C	D
I–5 Southbound Ramps/Barksdale Avenue/Clark Road (Exit 119)	B	D
DuPont Steilacoom Road/Barksdale Avenue/Wilmington Drive	A	F
DuPont Steilacoom Road/East Drive	A	F
North Gate Road/East Drive	B	D

Actual

Table B21: Actual LOS at AM and PM peak hours around Fort Lewis[483]

Intersection	Actual (2013)	
	AM Peak Hour LOS	PM Peak Hour LOS
I–5 Northbound Ramps and Berkeley Street	C	C
I–5 Southbound Ramps and Berkeley Street	E	D
Berkeley Street and Union Avenue	B	B
I–5 Northbound Ramps and Thorne Lane	E	E
I–5 Southbound Ramps and Thorne Lane	E	D
Thorne Lane and Union Avenue	B	B
Center Drive and Wilmington Drive	B	B
I–5 Northbound Ramps and DuPont Steilacoom Road	C	D
I–5 Southbound Ramps and DuPont Steilacoom Road	B	C
DuPont Steilacoom Road/Barksdale Avenue/Wilmington Drive	D	D
I–5 Northbound Ramps and Gravelly Lake Drive	D	E
I–5 Southbound Ramps and Gravelly Lake Drive	D	D
Gravelly Lake Drive and Pacific Highway	C	C

EGLIN AIR FORCE BASE

Baseline

Table B22: Baseline LOS of Eglin Main Base Roadways[484]

Route	Segment	FDOT Adopted LOS Standard	Baseline (2006) PM Peak Hour
3rd Street	Between Van Matre Ave & SR 397 (Eglin Blvd/John Sims Pkwy)	E	C
4th Street	Between F Ave & Magnolia St	E	C
5th Street	Between F Ave & Eglin Blvd	E	C
7th Street	Between Daytona Ave & Eglin Blvd	E	C
8th Street	Between Daytona Ave & Eglin Blvd	E	C
8th Street	Between Eglin Blvd & Biscayne Rd	E	C
Barrancas Avenue	Between Choctawhatchee Rd & F Ave	E	C
	Between F Ave & 2nd St/Eglin Blvd	E	C
Boatner Road	Between Hatchee Rd & Hospital	E	D
	Between Hospital & Ash Dr	E	C
Chinquapin Drive	Between Eglin Blvd & Memorial Dr	E	C
	Between Memorial Tr & Wakulla Rd	E	C
Choctawhatchee Road	Between 7th St & Barrancas Ave	E	C
Cypress Road	Between Lido Rd & Kissimmee Rd	E	C
Daytona Avenue	Between 10th St & 8th St	E	C
	Between 8th St & 7th St	E	C
General Bond Boulevard	Between SR 85 & SR 189	D	D
Hatchee Road	Between Choctaw Rd & Eglin Blvd	E	C
	Between Eglin Blvd & Choctaw Rd	E	C
Inverness Road	Between Cypress Rd & De Leon Rd	E	C
Kissimmee Road	Between Biscayne Rd & Cypress Rd	E	C
Magnolia Street	Between Eglin Blvd & F Ave	E	C
May Road	Between Eglin Blvd & Gaffney Rd	E	C
Memorial Trail	Between Eglin Blvd & Commissary/Exchange	E	C
	Between Commissary/Exchange & Chinquapin Dr	E	C
Museum Drive	Between Eglin Blvd & Minor Dr	E	D
Nomad Way	Between SR 85 & Pumphouse	E	C
	Between Pumphouse and Eglin Blvd	E	C
North Gate Road	Between SR 85 & Perimeter Rd	E	C
Perimeter Road	Between Daytona Rd & TWS	E	C
	Between TWS & North Gate Rd	E	C
	Between North Gate Rd & ACC Munitions (west end)	E	C
	Between ACC Munitions (west end) & ACC Munitions (south end)	E	C
	Between ACC Munitions (south end) & TWC	E	C
	Between TWC & Nomad Way	E	C
State Road 20	Between SR 85N & SR 285	D	C
	Between SR 285 & Rocky Bayou Bridge	D	C
	Between Rocky Bayou Bridge & White Point Road	D	C

	Between White Point Road & Walton County Line	D	C
State Road 30 (U.S. 98)	Between SR 85 & SR 393 (Mary Esther Boulevard)	D	D
	Between SR 393 (Mary Esther Boulevard) & Hurlburt Field Gate	D	F
State Road 85	Between College Blvd & SR 20	D	B
	Between SR 20 & SR 397	D	F
	Between SR 397 & North Gate at Perimeter Rd	D	B
	Between North Gate at Perimeter Rd & SR 123	D	B
	Between SR 123 & Nomad Way/ACC Gate	D	F
	Between ACC Gate at Nomad Way & SR 189 (Lewis Turner Blvd)	D	F
	Between SR 189 (Lewis Turner Blvd) & Eglin Blvd	D	B
	Between Eglin Blvd & 12th Ave	Constrained*	F
	Between 12th Ave & SR 188 (Racetrack Rd)	Constrained*	C
	Between SR 188 (Racetrack Rd) & SR 30 (U.S. 98)	Constrained*	D
State Road 123	Between SR 85 & SR 85N	D	E
State Road 188 (Racetrack Road)	Between Beal Parkway & SR 85	D	C
State Road 189	Between Eglin Blvd & SR 85	E	B
	Between SR 85 & General Bond Blvd	E	B
	Between General Bond Blvd & Mooney Rd	E	F
	Between Mooney Rd & SR 188 (Racetrack Rd)	D	D
	Between SR 188 (Racetrack Rd) & SR 393 (Mary Esther Blvd)	D	F
	Between SR 393 (Mary Esther Blvd) & Yacht Club Dr	D	B
State Road 285	Between Swift Creek & SR 20	E	C
State Road 393 (Mary Esther Blvd)	Between SR 189 & SR 30 (U.S. 98)	D	F
State Road 397	Between SR 190 & SR 85	D	B
	Between SR 190 & East Gate	D	B
	Between East Gate & 8th St	D	C
	Between 8th St & 7th St	D	C
	Between 7th St & 5th St	D	B
	Between 5th St & Memorial Tr (northbound/eastbound)	D	B
	Between 5th St & Memorial Tr (southbound/westbound)	D	B
	Between Memorial Tr & Eglin Blvd South End Split (eastbound)	D	B
	Between Memorial Tr & Eglin Blvd South End Split (westbound)	D	B
	Between Eglin Blvd South End Split & Museum Dr/Nomad Way	D	B
	Between Museum Dr/Nomad Way & SR 189 (Lewis Turner Blvd)/West Gate	D	B
	Between SR 189 (Lewis Turner Blvd)/West Gate & SR 85	D	B

*Note: * refers to case were roadway was not able to be widened due to environmental, physical or political constraints.*

Table B23: Baseline LOS of Duke Field Region Roadways[485]

Route	Segment	FDOT Adopted LOS Standard	Baseline (2006) PM Peak Hour
State Road 8 (I-10)	Between Antioch Road & SR 85	C	A
	Between SR 85 & Walton/Okaloosa County Line	C	A
State Road 10 (U.S. 90)	Between Fairchild Road & SR 85	D	A
	Between SR 85 & Antioch Road	D	C
State Road 85	Between Old Bethel Rd & SR 10 (U.S. 90)	D	B
	Between SR 10 (U.S. 90) & RS 8 (I-10)	D	E
	Between SR 8 (I-10) & PJ Adams Pkwy	C	F
	Between PJ Adams Pkwy & Duke Field	C	C
	Between Duke Field & College Blvd	C	C

Table B24: Baseline LOS of DeFuniak Springs Region Roadways[486]

Route	Segment	FDOT Adopted LOS Standard	Baseline (2006) PM Peak Hour
State Road 8 (I-10)	Between Walton/Okaloosa County Line & SR 83 (U.S. 331)	C	A
State Road 10 (U.S. 90)	Between SR 83 (U.S. 331) & SR 187 (U.S. 331)	C	C
	Between SR 187 (U.S. 331) & SR 285	C	D
State Road 83 (U.S. 331)	Between SR 10 (U.S. 90) & SR 8 (I-10)	C	B
	Between SR 8 (I-10) & Freeport City Limits	C	F
	Between Freeport City Limits & SR 20	C	E
State Road 285	Between SR 10 (U.S. 90) & Okaloosa/Walton County Line	C	C
	Between Okaloosa/Walton County Line & Swift Creek	C	C

Predicted

Table B25: Baseline vs. predicted future no-build condition LOS in Eglin Main Base Region[487]

Route	Segment	FDOT Adopted LOS Standard	Baseline (2006) PM Peak Hour	Predicted Future No-Build (2016) PM Peak Hour
3rd Street	Between Van Matre Ave & SR 397 (Eglin Blvd/John Sims Pkwy)	E	C	C
4th Street	Between F Ave & Magnolia St	E	C	C
5th Street	Between F Ave & Eglin Blvd	E	C	C
7th Street	Between Daytona Ave & Eglin Blvd	E	C	C
8th Street	Between Daytona Ave & Eglin Blvd	E	C	C
	Between Eglin Blvd & Biscayne Rd	E	C	C
Barrancas Avenue	Between Choctawhatchee Rd & F Ave	E	C	C
	Between F Ave & 2nd St/Eglin Blvd	E	C	C
Boatner Road	Between Hatchee Rd & Hospital	E	D	D
	Between Hospital & Ash Dr	E	C	C
Chinquapin Drive	Between Eglin Blvd & Memorial Tr+	E	C	D
	Between Memorial Tr & Wakulla Rd	E	C	C
Choctawhatchee Road	Between 7th St & Barrancas Ave	E	C	C
Cypress Road	Between Lido Rd & Kissimmee Rd	E	C	C
Daytona Avenue*	Between 10th St & 8th St	E	C	C
	Between 8th St & 7th St	E	C	C
General Bond Boulevard	Between SR 85 & SR 189	D	D	D
Hatchee Road	Between Choctaw Rd & Eglin Blvd	E	C	C
	Between Eglin Blvd & Choctaw Rd	E	C	C
Inverness Road	Between Cypress Rd & De Leon Rd	E	C	C
Memorial Trail	Between Biscayne Rd & Cypress Rd	E	C	C
Magnolia Street	Between Eglin Blvd & Gaffney Rd	E	C	C
May Road	Between Eglin Blvd & F Ave	E	C	C
Kissimmee Road	Between Eglin Blvd & Commissary/Exchange	E	C	C
	Between Commissary/Exchange & Chinquapin Dr	E	C	C
Museum Drive	Between Eglin Blvd & Minor Dr	E	D	D
Nomad Way	Between SR 85 & Pumphouse	E	C	C
	Between Pumphouse and Eglin Blvd	E	C	B
North Gate Road	Between SR 85 & Perimeter Rd	E	C	C
Perimeter Road	Between Daytona Rd & TWS	E	C	C
	Between TWS & North Gate Rd	E	C	C
	Between North Gate Rd & ACC Munitions (west end)	E	C	C
	Between ACC Munitions (west end) & ACC Munitions (south end)	E	C	C
	Between ACC Munitions (south end) & TWC	E	C	C
	Between TWC & Nomad Way	E	C	C
State Road 20	Between SR 85N & SR 285	D	C	F
	Between SR 285 & Rocky Bayou Bridge	D	C	F
	Between Rocky Bayou Bridge & White Point Road	D	C	F
	Between White Point Road & Walton County Line	D	C	D

State Road 30 (U.S. 98)	Between SR 85 & SR 393 (Mary Esther Boulevard)	D	D	F
	Between SR 393 (Mary Esther Boulevard) & Hurlburt Field Gate	D	F	F
State Road 85	Between College Blvd & SR 20	C	B	B
	Between SR 20 & SR 397	D	F	F
	Between SR 397 & North Gate at Perimeter Rd	D	B	B
	Between North Gate at Perimeter Rd & SR 123	D	B	C
	Between SR 123 & Nomad Way/ACC Gate	D	F	F
	Between ACC Gate at Nomad Way & SR 189 (Lewis Turner Blvd)	D	F	F
	Between SR 189 (Lewis Turner Blvd) & Eglin Blvd	D	B	B
	Between Eglin Blvd & 12th Ave	Constrained*	F	F
	Between 12th Ave & SR 188 (Racetrack Rd)	Constrained*	C	D
	Between SR 188 (Racetrack Rd) & SR 30 (U.S. 98)	Constrained*	D	F
State Road 123	Between SR 85 & SR 85N	D	E	E
State Road 188 (Racetrack Road)	Between Beal Parkway & SR 85	D	C	F
State Road 189	Between Eglin Blvd & SR 85	E	B	B
	Between SR 85 & General Bond Blvd	E	B	B
	Between General Bond Blvd & Mooney Rd	E	F	F
	Between Mooney Rd & SR 188 (Racetrack Rd)	D	D	F
	Between SR 188 (Racetrack Rd) & SR 393 (Mary Esther Blvd)	D	F	F
	Between SR 393 (Mary Esther Blvd) & Yacht Club Dr	D	B	B
State Road 285	Between Swift Creek & SR 20	E	C	C
State Road 393 (Mary Esther Blvd)	Between SR 189 & SR 30 (U.S. 98)	D	F	F
State Road 397	Between SR 190 & SR 85	D	B	C
	Between SR 190 & East Gate	D	B	B
	Between East Gate & 8th St	D	C	C
	Between 8th St & 7th St	D	C	C
	Between 7th St & 5th St	D	B	B
	Between 5th St & Memorial Tr (northbound/eastbound)	D	B	B
	Between 5th St & Memorial Tr (southbound/westbound)**	D	B	B
	Between Memorial Tr & Eglin Blvd South End Split (eastbound)	D	B	B
	Between Memorial Tr & Eglin Blvd South End Split (westbound)	D	B	B
	Between Eglin Blvd South End Split & Museum Dr/Nomad Way	D	B	B
	Between Museum Dr/Nomad Way & SR 189 (Lewis Turner Blvd)/West Gate	D	B	B
	Between SR 189 (Lewis Turner Blvd)/West Gate & SR 85	D	B	B

Table B26: Baseline vs. predicted future no-build condition LOS in Duke Field Region[488]

Route	Segment	FDOT Adopted LOS Standard	Baseline (2006) PM Peak Hour	Predicted Future No-Build (2016) PM Peak Hour
State Road 8 (I-10)	Between Antioch Road & SR 85	C	A	B
	Between SR 85 & Walton/Okaloosa County Line	C	A	B
State Road 10 (U.S. 90)	Between Fairchild Road & SR 85	D	A	A
	Between SR 85 & Antioch Road	D	C	C
State Road 85	Between Old Bethel Rd & SR 10 (U.S. 90)	D	B	C
	Between SR 10 (U.S. 90) & SR 8 (I-10)	D	E	F
	Between SR 8 (I-10) & PJ Adams Pkwy	C	F	F
	Between PJ Adams Pkwy & Duke Field	C	C	C
	Between Duke Field & College Blvd	C	C	C

Table B27: Baseline vs. predicted future no-build condition LOS in DeFuniak Springs Region[489]

Route	Segment	FDOT Adopted LOS Standard	Baseline (2006) PM Peak Hour	Predicted Future No-Build (2016) PM Peak Hour
State Road 8 (I-10)	Between Walton/Okaloosa County Line & SR 83 (U.S. 331)	C	A	B
State Road 10 (U.S. 90)	Between SR 83 (U.S. 331) & SR 187 (U.S. 331)	C	C	C
	Between SR 187 (U.S. 331) & SR 285	C	D	D
State Road 83 (U.S. 331)	Between SR 10 (U.S. 90) & SR 8 (I-10)	C	B	B
	Between SR 8 (I-10) & Freeport City Limits	C	F	F
	Between Freeport City Limits & SR 20	C	E	E
State Road 285	Between SR 10 (U.S. 90) & Okaloosa/Walton County Line	C	C	D
	Between Okaloosa/Walton County Line & Swift Creek	C	C	D

Table B28: Baseline vs. predicted future build condition LOS in Duke Field Region[490]

Route	Segment	FDOT Adopted LOS Standard	Baseline (2006)	Predicted Future-Build (2016)
SR 85/I-10	Between Antioch Road & SR 85	C	A	B
	Between SR 85 & Walton/Okaloosa County Line	C	A	B
SR 10/U.S. 90	Between Fairchild Road & SR 85	D	A	A
	Between SR 85 & Antioch Road	D	C	C
SR 85	Between Old Bethel Rd & SR 10 (U.S. 90)	D	B	C
	Between SR 10 (U.S. 90) & SR 85 (I-10)	D	E	F
	Between SR 85 (I-10) & PJ Adams Pkwy	C	F	F
	Between PJ Adams Rd & Duke Field	C	C	D
	Between Duke Field & CR 190 (College Blvd)	C	C	C

Actual

Table B29: Road segment LOS (2011) for Eglin Main Base Region[491]

Route	Segment	FDOT Adopted LOS Standard	Baseline (2006)	2011	Predicted Future Build (2016)
State Road 20	Between SR 85N & SR 285	D	C	B	F
	Between SR 285 & Rocky Bayou Bridge	D	C	F	F
	Between Rocky Bayou Bridge & White Point Road	D	C	F	F
	Between White Point Road & Walton County Line	D	C	C	D
State Road 30 (U.S. 98)	Between SR 85 & SR 393 (Mary Esther Boulevard)	D	D	B	F
	Between SR 393 (Mary Esther Boulevard) & Hurlburt Field Gate	D	F	C	F
State Road 85	Between College Blvd & SR 20	C	B	B	B
	Between SR 20 & SR 397	D	F	B	F
	Between SR 397 & North Gate at Perimeter Rd	D	B	-	B
	Between North Gate at Perimeter Rd & SR 123	D	B	-	C
	Between SR 123 & Nomad Way/ACC Gate	D	F	-	F
	Between ACC Gate at Nomad Way & SR 189 (Lewis Turner Blvd)	D	F	-	F
	Between SR 189 (Lewis Turner Blvd) & Eglin Blvd	D	B	B	B
	Between Eglin Blvd & 12th Ave	Constrained *	F	B	F
	Between 12th Ave & SR 188 (Racetrack Rd)	Constrained *	C	D	D
	Between SR 188 (Racetrack Rd) & SR 30 (U.S. 98)	Constrained *	D	C	F
State Road 123	Between SR 85 & SR 85N	D	E	D	E
State Road 188 (Racetrack Road)	Between Beal Parkway & SR 85	D	C	B	F
State Road 189	Between Eglin Blvd & SR 85	E	B	C	B
	Between SR 85 & General Bond Blvd	E	B	B	B
	Between General Bond Blvd & Mooney Rd	E	F	-	F
	Between Mooney Rd & SR 188 (Racetrack Rd)	D	D	C	F
	Between SR 188 (Racetrack Rd) & SR 393 (Mary Esther Blvd)	D	F	F	F
	Between SR 393 (Mary Esther Blvd) & Yacht Club Dr	D	B	B	B
State Road 285	Between Swift Creek & SR 20	E	C	B	C
State Road 393 (Mary Esther Blvd)	Between SR 189 & SR 30 (U.S. 98)	D	F	E	F
State Road 397	Between SR 190 & SR 85	D	B	C	C
	Between SR 190 & East Gate	D	B	B	B
	Between East Gate & 8th St	D	C	-	C
	Between 8th St & 7th St	D	C	-	C
	Between 7th St & 5th St	D	B	-	B
	Between 5th St & Memorial Tr (northbound/eastbound)	D	B	-	B
	Between 5th St & Memorial Tr (southbound/westbound)**	D	B	-	B
	Between Memorial Tr & Eglin Blvd South End Split (eastbound)	D	B	-	B

	Between Memorial Tr & Eglin Blvd South End Split (westbound)	D	B	-	B
	Between Eglin Blvd South End Split & Museum Dr/Nomad Way	D	B	-	B
	Between Museum Dr/Nomad Way & SR 189 (Lewis Turner Blvd)/West Gate	D	B	-	B
	Between SR 189 (Lewis Turner Blvd)/West Gate & SR 85	D	B	-	B

Note: "/" depicts data that was unavailable for 2011

Table B30: 2011 Road segment LOS (2011) for Duke Field Region[492] [493]

Route	Segment	FDOT Adopted LOS Standard	Baseline (2006)	2011	Predicted Future Build (2016)
State Road 8 (I-10)	Between Antioch Road & SR 85	C	A	B	A
	Between SR 85 & Walton/Okaloosa County Line	C	A	B	A
State Road 10 (U.S. 90)	Between Fairchild Road & SR 85	D	A	A	A
	Between SR 85 & Antioch Road	D	C	C	C
State Road 85	Between Old Bethel Rd & SR 10 (U.S. 90)	D	B	C	B
	Between SR 10 (U.S. 90) & RS 8 (I-10)	D	E	F	E
	Between SR 8 (I-10) & PJ Adams Pkwy	C	F	F	F
	Between PJ Adams Pkwy & Duke Field	C	C	C	C
	Between Duke Field & College Blvd	C	C	C	C

Table B31: 2011 Road segment LOS (2011) for DeFuniak Springs Region[494]

Route	Segment	FDOT Adopted LOS Standard	Baseline (2006)	2011	Predicted Future Build (2016)
State Road 8 (I-10)	Between Walton/Okaloosa County Line & SR 83 (U.S. 331)	C	A	B	B
State Road 10 (U.S. 90)	Between SR 83 (U.S. 331) & SR 187	C	C	-	C
	Between SR 83 (U.S. 331) & SR 285	C	D	B	D
State Road 83 (U.S. 331)	Between SR 10 (U.S. 90) & SR 8 (I-10)	C	B	C	B
	Between SR 8 (I-10) & Freeport City Limits	C	F	D	F
	Between Freeport City Limits & SR 20	C	E	C	E
State Road 285	Between SR 10 (U.S. 90) & Okaloosa/Walton County Line	C	C	B	D
	Between Okaloosa/Walton County Line & Swift Creek	C	C	B	D

Note: "/" depicts data that was unavailable for 2011

FORT BLISS

Baseline

Table B32: Baseline LOS around Fort Bliss[495]

Route	Segment	Vehicle per Hour (vph)	Capacity	LOS
I-10	U.S. Route 54 (Patriot Fwy) to Paisano Dr (U.S. 62)	8,446	8,280	F
I-10	Paisano Dr (U.S. 62) to McRae Blvd	8,528	8,280	F
I-10	McRae Blvd to Yarbrough Dr	6,334	6,210	F
I-10	Yarbrough Dr to Lee Trevino Dr	6,272	6,210	F
I-10	Lee Trevino Dr to Zaragoza Rd	4,720	6,210	D
I-10	Zaragoza Rd to Loop 375 (Americas Ave)	3,353	4,140	D
I-10	Loop 375 (Americas Ave) to Horizon Blvd	2,939	4,140	C
Montana Ave	U.S. Route 54 (Patriot Fwy) to Paisano Dr (U.S. 62/180)	1,445	1,980	C
Montana Ave	Paisano Dr (U.S. 62/180) to Hawkins Blvd	2,376	2,970	C
Montana Ave	Hawkins Blvd to McRae Blvd	3,267	2,970	F
Montana Ave	McRae Blvd to Yarbrough Dr	2,435	2,970	C
Montana Ave	Yarbrough Dr to Lee Trevino Dr	2,138	1,980	F
Montana Ave	Lee Trevino Dr to Loop 375 (Joe Battle Blvd)	1,742	1,980	D
Montana Ave	Loop 375 (Joe Battle Blvd) to Hueco Club Rd	2,257	1,980	F
U.S. Route 54	I-10 to Trowbridge Ave	4,720	12,420	B
U.S. Route 54	Trowbridge Ave to Pershing Dr	4,595	12,420	B
U.S. Route 54	Pershing Dr to Van Buren Ave	4,130	7,245	B
U.S. Route 54	Van Buren Ave to Fred Wilson Ave	3,105	4,140	C
U.S. Route 54	Fred Wilson Ave to Hondo Pass	2,360	4,140	B
U.S. Route 54	Hondo Pass to Loop 375 (Transmountain Dr) to Kenworth St	1,780	4,140	A
Loop 375	Route 659 to Montana Avenue	1,449	4,140	A
Loop 375	Montana Avenue to BR 54	1,242	4,140	A
Loop 375	BR 54 to U.S. Route 54	1,863	4,140	A
Fred Wilson Blvd	U.S. Route 54 to Airport Drive	1,980	2,430	C
Airport Rd	Fred Wilson Blvd to Haan Rd	2,284	2,430	D

Predicted

Table B33: Baseline vs. predicted future no-build condition LOS around the Main Cantonment Area[496]

Route	Segment	Baseline (2006)	Predicted Future No-Build (2016)
I-10	U.S. Route 54 (Patriot Fwy) to Paisano Dr (U.S. 62)	F	E
I-10	Paisano Dr (U.S. 62) to McRae Blvd	F	F
I-10	McRae Blvd to Yarbrough Dr	F	D
I-10	Yarbrough Dr to Lee Trevino Dr	F	D
I-10	Lee Trevino Dr to Zaragoza Rd	D	C
I-10	Zaragoza Rd to Loop 375 (Americas Ave)	D	C
I-10	Loop 375 (Americas Ave) to Horizon Blvd	C	C
Montana Ave	U.S. Route 54 (Patriot Fwy) to Paisano Dr (U.S. 62/180)	C	B
Montana Ave	Paisano Dr (U.S. 62/180) to Hawkins Blvd	C	C
Montana Ave	Hawkins Blvd to McRae Blvd	F	C
Montana Ave	McRae Blvd to Yarbrough Dr	C	C
Montana Ave	Yarbrough Dr to Lee Trevino Dr	F	B
Montana Ave	Lee Trevino Dr to Loop 375 (Joe Battle Blvd)	D	B
Montana Ave	Loop 375 (Joe Battle Blvd) to Hueco Club Rd	F	B
U.S. Route 54	I-10 to Trowbridge Ave	B	B
U.S. Route 54	Trowbridge Ave to Pershing Dr	B	B
U.S. Route 54	Pershing Dr to Van Buren Ave	B	D
U.S. Route 54	Van Buren Ave to Fred Wilson Ave	C	C
U.S. Route 54	Fred Wilson Ave to Hondo Pass	B	C
U.S. Route 54	Hondo Pass to Loop 375 (Transmountain Dr) to Kenworth St	A	C
Loop 375	Route 659 to Montana Avenue	A	C
Loop 375	Montana Avenue to BR 54	A	C
Loop 375	BR 54 to U.S. Route 54	A	C
Fred Wilson Blvd	U.S. Route 54 to Airport Drive	C	C
Airport Rd	Fred Wilson Blvd to Haan Rd	D	F

Table B34: Baseline vs. predicted future build condition LOS around the Main Cantonment Area[497]

Route	Segment	Baseline (2006)	Predicted Future Build (2016)
I-10	U.S. Route 54 (Patriot Fwy) to Paisano Dr (U.S. 62)	F	F
I-10	Paisano Dr (U.S. 62) to McRae Blvd	F	F
I-10	McRae Blvd to Yarbrough Dr	F	D
I-10	Yarbrough Dr to Lee Trevino Dr	F	D
I-10	Lee Trevino Dr to Zaragoza Rd	D	C
I-10	Zaragoza Rd to Loop 375 (Americas Ave)	D	C
I-10	Loop 375 (Americas Ave) to Horizon Blvd	C	C
Montana Ave	U.S. Route 54 (Patriot Fwy) to Paisano Dr (U.S. 62/180)	C	C
Montana Ave	Paisano Dr (U.S. 62/180) to Hawkins Blvd	C	C
Montana Ave	Hawkins Blvd to McRae Blvd	F	D
Montana Ave	McRae Blvd to Yarbrough Dr	C	C
Montana Ave	Yarbrough Dr to Lee Trevino Dr	F	C
Montana Ave	Lee Trevino Dr to Loop 375 (Joe Battle Blvd)	D	C
Montana Ave	Loop 375 (Joe Battle Blvd) to Hueco Club Rd	F	C
U.S. Route 54	I-10 to Trowbridge Ave	B	C
U.S. Route 54	Trowbridge Ave to Pershing Dr	B	C
U.S. Route 54	Pershing Dr to Van Buren Ave	B	D
U.S. Route 54	Van Buren Ave to Fred Wilson Ave	C	D
U.S. Route 54	Fred Wilson Ave to Hondo Pass	B	C
U.S. Route 54	Hondo Pass to Loop 375 (Transmountain Dr) to Kenworth St	A	D
Loop 375	Route 659 to Montana Avenue	A	D
Loop 375	Montana Avenue to BR 54	A	D
Loop 375	BR 54 to U.S. Route 54	A	D
Fred Wilson Blvd	U.S. Route 54 to Airport Drive	C	E
Airport Rd	Fred Wilson Blvd to Haan Rd	D	F

Actual

Table B35: Built condition LOS around the Main Cantonment Area

Route	Segment	Baseline (2006)[498]	Built Condition Projection[499]	Built Condition 2012[500]
I-10	U.S. Route 54 (Patriot Fwy) to Paisano Dr (U.S. 62)	F	F	E
I-10	Paisano Dr (U.S. 62) to McRae Blvd	F	F	F
I-10	McRae Blvd to Yarbrough Dr	F	D	F
I-10	Yarbrough Dr to Lee Trevino Dr	F	D	F
I-10	Lee Trevino Dr to Zaragoza Rd	D	C	F
I-10	Zaragoza Rd to Loop 375 (Americas Ave)	D	C	F
I-10	Loop 375 (Americas Ave) to Horizon Blvd	C	C	/
Montana Ave	U.S. Route 54 (Patriot Fwy) to Paisano Dr (U.S. 62/180)	C	C	E
Montana Ave	Paisano Dr (U.S. 62/180) to Hawkins Blvd	C	C	D and above
Montana Ave	Hawkins Blvd to McRae Blvd	F	D	E
Montana Ave	McRae Blvd to Yarbrough Dr	C	C	E
Montana Ave	Yarbrough Dr to Lee Trevino Dr	F	C	F
Montana Ave	Lee Trevino Dr to Loop 375 (Joe Battle Blvd)	D	C	F
Montana Ave	Loop 375 (Joe Battle Blvd) to Hueco Club Rd	F	C	F
U.S. Route 54	I-10 to Trowbridge Ave	B	C	D and above
U.S. Route 54	Trowbridge Ave to Pershing Dr	B	C	D and above
U.S. Route 54	Pershing Dr to Van Buren Ave	B	D	E
U.S. Route 54	Van Buren Ave to Fred Wilson Ave	C	D	F
U.S. Route 54	Fred Wilson Ave to Hondo Pass	B	C	F
U.S. Route 54	Hondo Pass to Loop 375 (Transmountain Dr) to Kenworth St	A	D	F
Loop 375	Route 659 to Montana Avenue	A	D	F
Loop 375	Montana Avenue to BR 54	A	D	F
Loop 375	BR 54 to U.S. Route 54	A	D	D and above
Fred Wilson Blvd	U.S. Route 54 to Airport Drive	C	E	F
Airport Rd	Fred Wilson Blvd to Haan Rd	D	F	F

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