

DRAFT FINAL REPORT

August 30, 2019

NAVAL BASE COMMUTER

MULTI-MODAL MOBILITY PLANNING STUDY

Calvert - St. Mary's
METROPOLITAN
PLANNING ORGANIZATION



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Executive Summary

Located at the mouth of the Patuxent River and the Chesapeake Bay, Naval Air Station Patuxent River (NAS/PAX) occupies approximately 6,400 acres of the St. Mary's County landscape. The host of more than 50 tenant activities, including the Naval Air Systems Command (NAVAIR) and the Naval Air Warfare Center Aircraft Division (NAWCAD) headquarters, NAS/PAX provides employment, housing, and vital resources to military personnel and civilians in Southern Maryland and the nearby greater Washington Metropolitan Area.

NAS/PAX is the largest employer in the county and employs over 9,800 civilian employees, 5,700 contractors, and 2,400 active duty military personnel at the Lexington Park facility. Situated along MD 235 just south of the Governor Thomas Johnson Bridge, the location of the facility and limited transportation options present challenges for those commuting to and around the base. While the area and base continue to grow, the limited transportation network and subsequent vehicle congestion along the MD-235 corridor must be addressed. Keeping the region's transportation vision in mind, strategies are needed to decrease the amount of automobile traffic on the major thoroughfares in Calvert and St. Mary's County, thus improving access to NAS/PAX.

The purpose of the Naval Base Multi-Modal Mobility Study is to provide feasible recommendations to the Calvert – St. Mary's Metropolitan Planning Organization that provide methods of reducing the amount of automobile traffic associated with NAS/PAX. NAS/PAX is the nucleus of this study and region; it is the employment center that generates the automobile congestion and must be considered the target focus for recommendations to improve mobility conditions in the area. To achieve this goal, strategies that promote multi-modal mobility are recommended. By encouraging NAS/PAX employees to change their transportation patterns and get out of their vehicle even just one day a week, many of the congestion issues that plague the MD 235 corridor will be lessened.

Recommendations within the Naval Base Multi-Modal Mobility Study are broken down into five main areas of improvements: transit recommendations, bicycle improvements, pedestrian connectivity recommendations, recommended geometric changes, and transportation demand management (TDM) improvements. While the primary focus is on the NAS/PAX base proper, many of the recommendations span outside of base borders and make connections into the

existing roadway infrastructure that spans through this region of Calvert and St. Mary's Counties.

Understanding these five areas of proposed recommendations and how they will interact with one another provided guidance for developing options for short term (0-5 years), medium term (5-10 years) and long term (10+ years) implementation. Planning level cost estimates were developed to help guide an implementation timeframe and provide an overall understanding of what it will take for each term of improvements. This study emphasizes that some recommendations will require extensive coordination with St. Mary's County Government and the State Highway Administration (SHA) as the owner of MD 235. As part of the implementation plan, it is outlined which key agencies that the C-SMMPO should encourage NAS/PAX officials coordinate with as efforts are made to improve multi-modal mobility for the region.

1. Introduction and Project Vision

Located at the mouth of the Patuxent River and the Chesapeake Bay, Naval Air Station Patuxent River (NAS/PAX) occupies approximately 6,400 acres of the St. Mary's County landscape. The host of more than 50 tenant activities, including the Naval Air Systems Command (NAVAIR) and the Naval Air Warfare Center Aircraft Division (NAWCAD) headquarters, NAS/PAX provides employment, housing, and vital resources to military personnel and civilians in Southern Maryland and the nearby greater Washington Metropolitan Area.

NAS/PAX is the largest employer in the county and employs over 9,800 civilian employees, 5,700 contractors, and 2,400 active duty military personnel at the Lexington Park facility. Situated along MD 235 just south of the Governor Thomas Johnson Bridge, the location of the facility and limited transportation options present challenges for those commuting to and around the base. While the area and base continue to grow, the limited transportation network and subsequent vehicle congestion along the MD-235 corridor must be addressed. Keeping the region's transportation vision in mind, strategies are needed to decrease the amount of automobile traffic on the major thoroughfares in Calvert and St. Mary's County, thus improving access to NAS/PAX.

The Naval Base Commuter Multi-Modal Mobility Planning Study was developed keeping in mind the Naval Air Station Patuxent River's Transportation Improvement Plan (TIP), in which specific recommendations were provided to improve NAS/PAX's transportation network. This study aims to expand on one of the major TIP goals that focuses on reducing roadway congestion by recommending ways to promote multi-modal transportation through bus, transit, and pedestrian improvements.

NAS/PAX is the nucleus of this study and region; it is the employment center that generates the automobile congestion and must be considered the target focus for recommendations to improve mobility conditions in the area. To achieve this goal, strategies that promote multi-modal mobility on base are recommended. By encouraging NAS/PAX employees to change their transportation patterns and get out of their vehicle even just one day a week, many of the congestion issues that plague the MD 235 corridor will be lessened. While the primary focus is on the NAS/PAX base proper, many of the recommendations span outside of base borders and make connections into the existing roadway infrastructure that spans through this region of Calvert and St. Mary's Counties.

Initial project steps included touring the base to evaluate existing transportation conditions, including gaining a high-level understanding of the transit, pedestrian, bicycle, and vehicular environment. Recent planning studies that incorporated this region into their work were also reviewed in preparation for this study. Based on these observations and information learned from previous planning study research, it was imperative to get the base community talking about what types of recommendations should be made to fully promote forms of multi-modal mobility as a viable transportation option for their daily commutes. An open-house style workshop was held to present the study to the community, followed by a Transportation Preference Survey that solicited feedback and ideas from base community members. Community comments received and survey responses received then helped to shape many of the recommendations that are included in this report.

Recommendations within the Naval Base Multi-Modal Mobility Study are broken down into five main areas of improvements: transit recommendations, bicycle improvements, pedestrian connectivity recommendations, recommended geometric changes, and transportation demand management (TDM) improvements. Understanding these five areas of proposed recommendations and how they will interact with one another provided guidance for developing options for short term (0-5 years), medium term (5-10 years) and long term (10+ years) implementation. Planning level cost estimates were developed to help guide an implementation timeframe and provide an overall understanding of what it will take for each term of improvements. This study emphasizes that some recommendations will require extensive coordination with St. Mary's County Government and the State Highway Administration (SHA) as the owner of MD 235. As part of the implementation plan, it is outlined which key agencies that the C-SMMPO should encourage NAS/PAX officials coordinate with as efforts are made to improve multi-modal mobility for the region.

2. Previous Planning Studies

The transportation needs and challenges of both NAS/PAX and St. Mary's County have been studied in order to build on or formulate transportation goals, assess existing and future needs, and develop an appropriate course of action to address identified outcomes. These plans have been helpful in understanding the condition of the existing transportation network and the connectivity challenges that are faced on base. A brief synopsis of these plans can be found below.

A. St. Mary's County Transit Development Plan (2013)

The Transit Development Plan (TDP) was developed to serve as a guide for public transportation in St. Mary's County for Fiscal Years 2014-2018. It provides a roadmap for implementing service and/or organizational changes, improvements, and/or potential expansions during the five-year period for which it was wrote.

The TDP provided key background information that elaborates on St. Mary's in-county commuting trends (the highest in the state) and offers projections of population and St. Mary's Transit System (STS) growth. Additionally, the plan reviews existing services which was particularly helpful in understanding what public transit looks like in the areas around the base.

The plan acknowledges that although NAS/PAX is the County's largest employer, STS and NAS/PAX do not coordinate transportation. Through stakeholder feedback and a general public survey that was solicited as part of the TDP, it was emphasized that there is a need to establish a STS-NAS/PAX relationship, especially given the transportation needs of the civilian service industry employees. The TDP also reiterates NAS/PAX's Transportation Improvement Plan's desire to reduce employee single occupancy vehicle commuting and uses that to strengthen the need for improved STS connections.

In its recommendation, it is proposed that STS establish a working relationship with the community and transportation planners at NAS/PAX. STS should ensure that NAS/PAX representatives remain members of the Transportation Advisory Committee (TAC) and are updated of STS service and capital improvements. As a short-term improvement, STS and NAS/PAX should consider how to publicize existing connections between the transit system and the base – for example, better publicizing what buses pass by Gates 1 and 2. The original recommendation in the plan was for the base taxi to regularly serve Tulagi Place, providing a connection between STS and NAS/PAX. The TDP recommends that if the base taxi were to be reinstated that it regularly serves the park and ride on a regular basis.

It is the hope of the established relationship of an increased awareness of STS among NAS/PAX employees and all County residents. In the long-term, coordination between the two could help address issues of congestions and delays on MD 235. The TDP also notes that depending on the funding sources, a STS-NAS/PAX route could provide additional transit service without the need for County-funded operating expenses.

One of the most significant features of the TDP is the recommendation to re-structure STS fixed routes in order to provide more convenient connections for public transit riders and reduce the number of transfers required. This idea could have many beneficial implications

to members of the NAS/PAX community who are looking to use public transit in their commute to work.

B. NAS Patuxent River Transportation Improvement Plan

The Transportation Improvement Plan (TIP) was established to provide specific recommendations to improve NAS/PAX's transportation network. To ensure goals and recommendations align with other initiatives in place, the TIP builds on the Naval District Washington Regionally Integrated Master Program, the Naval Shore Vision 2035, and the NAS/PAX Master Plan.

Many of the goals of the TIP coincide to those of the Naval Base Multi-Modal Mobility Planning Study. These goals include:

- Reducing vehicle congestion
- Decreasing the number of single occupancy vehicles (SOVs) entering NAS/PAX on a daily basis
- Establishing a parking plan in accordance with anti-terrorism/force protection (AT/FP) standards and security constraints
- Avoiding environmental impacts
- Considering transportation impacts related to the implementation of the Red-line (separation between mission critical and non-mission critical)

Additionally, the TIP presents an in-depth analysis of existing conditions as it pertains to roadway operations, parking, the pedestrian environment, and transportation habits. It also presents future traffic forecasts of internal vehicular circulation and related parking demands.

The TIP also presents a set of recommendations that would help advance many of the goals of the Multi-Modal Mobility Planning Study. Many of them are roadway recommendations that will ensure that the installation roadway network continues well into the future, such as upgrading existing intersections, adding a lane to existing roadways, restriping existing lanes at intersections, installing new traffic signals, and monitoring intersections. Additionally, a series of bicycle and pedestrian improvements are suggested. These improvements would form an interconnected bicycle and pedestrian network and would make many of the connections between buildings that the base is currently lacking. Recommendations include adding or improving bicycle facilities, pedestrian paths, or bicycle racks at various locations around the base.

Organizationally, the TIP breaks down the base into Development Centers, which were established as a way to provide a consistent way to geographically break down the evaluation of existing conditions and transportation recommendations. These recommendations are separated by time frame: short, medium, and long-term improvements that prioritize their implementation. Concluding the plan are design standards that identify characteristics of complete streets and complete parking facilities with the intent of transforming NAS/PAX into a more walkable community while being mindful of the environmental consequences of these transformations.

C. Transportation and Traffic Update (Presentation from April 2018)

The Transportation and Traffic Update presentation, delivered by Sabrina Hecht and John Deatrick to NAS/PAX and CSMC, provided an understanding of larger base issues and current transportation initiatives that are being explored.

Key players in the transit system were outlined as well as next steps to operate the taxi and shuttle bus service on base again. Additional progress of other initiatives, such as security procedures for vans and buses and efforts to coordinate light timing with SHA, were explained. The presentation concluded with a discussion of long-term road improvements that would ultimately influence traffic congestion getting to and on base.

D. Joint Land Use Study Report: Naval Air Station (January 2015)

The NAS/PAX Joint Land Use Study (JLUS) was done to mitigate existing and prevent future military compatibility issues by promoting collaboration between the local communities, agencies, and public community that interact with the base. The goal of the study is to protect the viability of current and future military operations while guiding community growth, protecting public health, safety, and welfare, and sustaining the environmental and economic health of the surrounding region.

The JLUS covers an expansive regional study area, including the middle and eastern shore areas, southern Maryland, and Northern Virginia. Context of each sub-area, community growth, and economic trends are explored to give a complete overview of the study area. Most importantly, to appropriately develop and assess compatibility issues for the JLUS, a clear understanding was established surrounding military operations and activities associated with NAS/PAX missions coincide with nearby communities.

As part of this understanding, the JLUS identified compatibility issues, born from the idea that there are numerous factors that influence whether community and military plans, programs, and activities are compatible or in conflict. The compatibility factors that were identified served to influence compatibility issues that currently exist or could exist in the future.

Relating most directly to the Multi-Modal Mobility Planning Study, roadway capacity was a compatibility factor that had issues identified. As noted in the study, roadway capacity can create incompatibilities between military operations and civilian activities when it is not adequately designed to handle the volume. The following were findings from the JLUS regarding roadway capacity in and around NAS/PAX:

- Base Ingress/Egress: MD 235/Three Notch Road is at capacity due to the high volumes approaching NAS/PAX main station entry points. Additional development on- and off- base will likely lead to roadways and intersections with failing level of service.
- Safety/Emergency Access Routes: Congestion on Route 2/4 affects traffic traveling from Calvert County into St. Mary's County in the AM and from St. Mary's County to Calvert County in the PM. The Thomas Johnson Bridge is a vital link between the two counties, is critical to NAS/PAX accessibility, and is part of an emergency access/egress route.

As part of their implementation plan, the JLUS recommended strategies that were designed to address the issues identified during preparation of the study. Each strategy is intended to avoid future actions or operations that would cause a compatibility issue, eliminate an existing issue, and reduce the adversity of an existing issue. Strategies that were recommended in conjunction with the roadway capacity issue include:

- Continue existing efforts and seek additional support to improve flow across the Thomas Johnson Bridge by coordinating with MD DOT and C-SMMPO
- Seek alternative funding sources for transportation improvements: consider Public-Public or Public-Private (P4) funding sources
- Conduct a traffic study to assess community impacts on NAS/PAX and vice versa
- Consider relocation of main gate functions
- Coordinate and budget for gate improvements that affect off-base roadway capacity and level of service
- Consider alternative modes of transportation to access NAS/PAX Main Station

E. FHWA Guidebook for Measuring Multi-Modal Connectivity

The FHWA Guidebook for Measuring Multimodal Network Connectivity builds on the USDOT's *Guidebook for Developing Pedestrian and Bicycle Performance Measures* that presented methods for measuring walking and bicycling performance and activities and embedding them into the transportation planning process. This new resource focuses on pedestrian and bicycle network connectivity and provides information on incorporating connectivity measures into state, metropolitan, and local transportation planning processes.

Analyzing various connectivity measures help transportation practitioners identify high priority network gaps, implement cost-effective solutions that address multiple needs, and measure the long-term impacts of strategic pedestrian and bicycle investments on goals such as improving safety, system efficiency, network performance, and access to key destinations. The Guidebook explains in depth what multimodal network connectivity is and then strategically breaks down key components of pedestrian and bicycle network connectivity: network completeness, network density, route directness, access to destinations, and network quality. It also defends that multimodal network connectivity analyses strongly supports transportation decisions by helping decisionmakers weigh potential outcomes of planned multimodal connectivity investments – particularly helpful in analyzing potential roadway improvements at Gates 1 and 2 at NAS/PAX.

3. General Analysis and Observations

On April 9, 2019, JMT participated in a tour of NAS/PAX in order to assess existing conditions pertaining to the transportation network and gain a better understanding of the transportation challenges that are present on base.

A. Activity Nodes

A drive through of the NAS/PAX facility helped identify key locations within the base that have the largest concentrations of employees daily. These employment and activity nodes could become key components in creating a successful base-wide bus route system. These locations include:

- Carpenter Park Housing: 100 townhomes (enlisted and civilian)
- The Drill Hall: the recreation center and base theater; all hands meeting are also held here
- North Engineering Building: food truck observed here
- South Engineering Building
- Enlisted Barracks: some of which have been turned into administration buildings and are to be demolished
- Atlantic Test Range Complex: facilities that can be rented out for events at the northeast corner of NAS/PAX
- The area at the intersection of Ranch Road and Saufley Road: this is near Hangar 111
- Peary Road near Buildings 3134 and 2370: anticipated new development adjacent from existing buildings.
- River's Edge Conference Center: events and dining
- Buildings 446-447: this is a large employment area where there is also a youth center, and before/after care
- Lovell Cove Housing: newer housing for officers
- Town Center: The Commissary, housing welcome center, and community center are located here. Future on-base redevelopment at the Town Center solidifies the need for improved pedestrian infrastructure at Gate #2.

B. Pedestrian Environment

Review of the pedestrian and bicycle facilities throughout NAS/PAX revealed gaps in sidewalk connections, and few pedestrian amenities such as lighting, shade trees, and site furniture. Although sidewalks do exist, vital pedestrian connections between Development Centers, parking lots, and buildings are missing or are not within an ADA compliant network. For example, Buse Road lacks a complete sidewalk system, both before and after the intersection at Gate #1, where the only pedestrian crossing of MD 235 exists. Cuddihy Road also lacks a complete sidewalk area, particularly around the Commissary, NEX Gas Station, and Navy Lodge. There are also vital pedestrian connections missing along Cedar Point Road, especially between Buse Road and Mandt Road - where the Navy Gateway Inns and Suites are located. Additionally, there are sidewalks missing along Davis Spur Road, where there are designated parallel parking spots along the road for the adjacent NAVAIR facility, to name a few.

Although a bike lane does exist along the outer loop of the facility, not all main roads have bike facilities (for example, parts of Cedar Point Road). Many people were observed running

or biking on base, but lack of proper facilities in key locations has them running or biking in the roadways in various locations.

C. Parking Assessment

Parking is a concern on base. Parking is first come, first serve at all building locations on the installation, with all facilities having ADA-accessible parking spaces. Aside from a designated spot for the CO, ADA-accessible spaces, and those for visitors, other “reserved” spaces are not permitted on base. However, many of these spaces exist creating unusable spots that remain vacant all the time in many situations.

Many vehicles were parked on the side of the road, along medians in parking lots, and in the grass due to insufficient parking. The base has limited space to continue to expand parking (filling in wetlands, etc.) and parking in the grass is damaging to the landscape, particularly in the long term. North Engineering, South Engineering, and the Moffett Building are key employment buildings and have the greatest parking concerns.

D. Roadway Condition and Operation

Many of the roads throughout the base need maintenance and repair to address potholes and lane marking/stripping visibility. Crosswalk markings throughout the base and in parking lots also need to be repainted in order to ensure pedestrian safety. There are no bike lanes on cross streets, and the bike lanes that do exist have faded striping and markings. In efforts to improve roadway condition, the C-SMMPO is coordinating with NAS/PAX to repave the outer loop around the facility.

In terms of roadway operation, significant delays occur at key intersections along MD 235 at Gates #1 and #2. Signal timing and gate operations are the cause of much of the delay.

E. NAS/PAX Gates

Three gates control access to NAS/PAX – Gate #1 along Buse Road, Gate #2 along Cedar Point Road, and Gate #3 along Shaw Road.

Gate #1 is located just east of the MD 235 and Buse Road/Pegg Road intersection. It provides access to the Town Center, the Moffett Building, and the West Basin. There are four lanes at this gate, and all commercial truck traffic must use this gate to enter NAS/PAX.

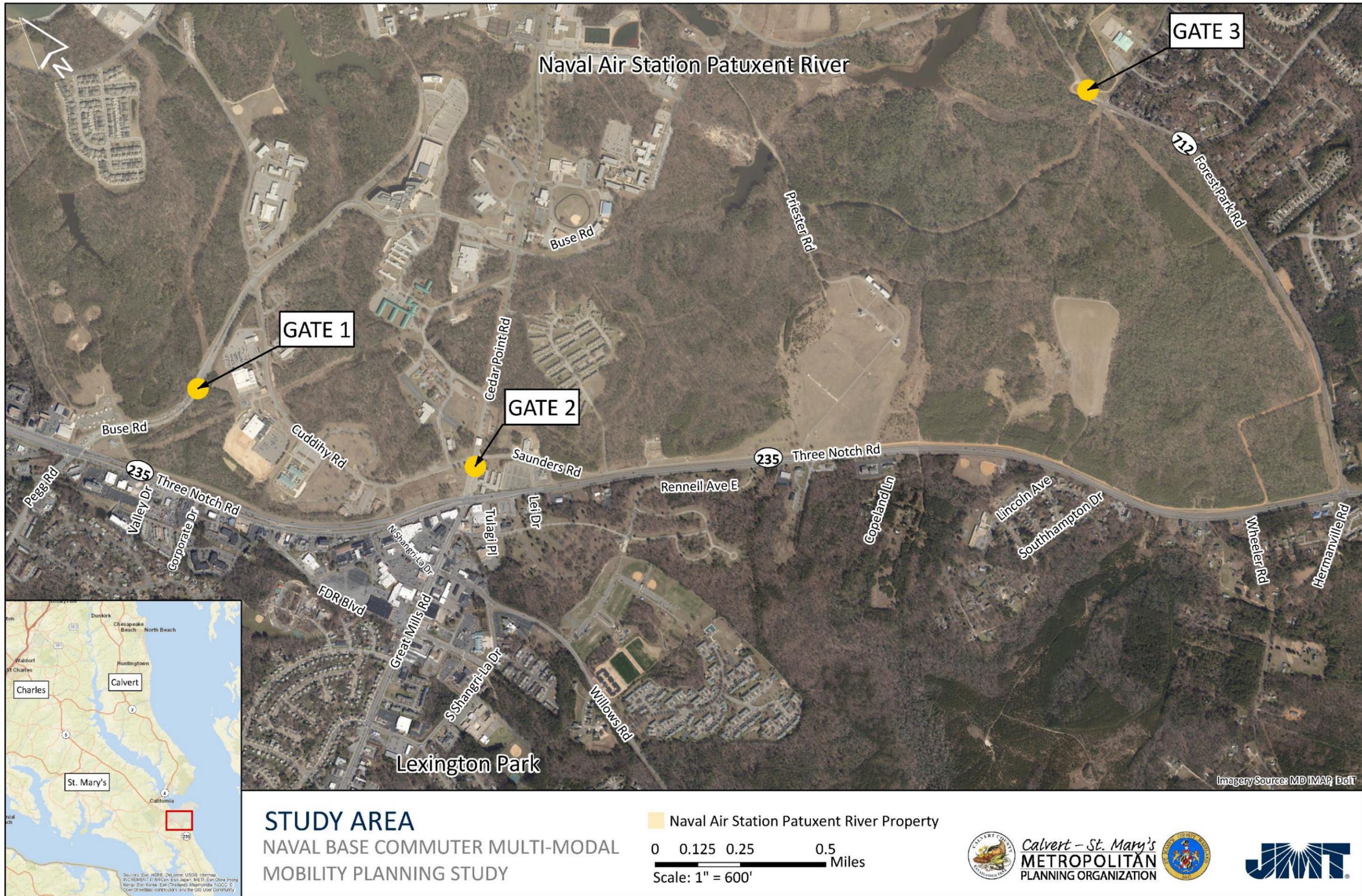
Outbound traffic is not allowed through Gate #1 during the AM period because these lanes are all used for inbound traffic only. Middle of the day operations into the evening hours (9:01 AM – 6:30 PM) have two lanes open in either direction, while all lanes are closed to vehicle traffic overnight into the early morning hours (6:31 PM – 5:29 AM).

Gate #2 is the main gate, located on Cedar Point Road near the intersection of MD 235 and 246 (Great Mills Road). This gate provides access to the North Engineering Center, base support area, Town Center, Rotary Wing, and West Basin. During the AM rush hours (5:30 AM – 9:00 AM) there are three inbound lanes and one outbound lane. Middle of the day operations (9:01 AM – 4:30 PM) have two inbound lanes and two outbound lanes, while during the evening rush/overnight hours (4:31 PM – 5:29 AM) there is only one inbound lane, two outbound lanes, and one lane closed. The visitor center is also located at this gate, where all visitors are required to obtain visitor passes before entering NAS/PAX.

Gate #3 is located on Shaw Road, less than 1.5 miles from MD 235 and the Forest Park/Shaw/Hermanville Roads intersection. This gate provides access to the east side of the facility. During the AM rush hours there are two inbound lanes and one outbound lane operating, while the rest of the workday (9:01 AM – 5:59 PM) there is only one inbound lane, one outbound lane, and one lane closed. During the evening and overnight hours, all lanes are closed to vehicle traffic.

The gates are constraints to the volume of inbound and outbound traffic associated with NAS/PAX. Delays queue at the gate due to the security process during the morning rush hour, while evening rush hour delays queue at the at the three main intersections along MD 235. The timing of signals and intersections at Buse Road/MD 235 (Gate #1) and Cedar Point Road/MD 235 (Gate #2) restrict the outbound flow of traffic significantly during the PM rush. There are no delays at Gate #3 in regard to the evening rush hour, as the gate is located far enough from the intersection of Shaw Road/MD 235 to prevent this from happening. Gate #1 processes the highest volume of traffic and sees the most significant delays throughout the day.

See Figure 1 for a look at the MD 235 corridor and gate locations.



F. Intersection of MD 235 and NAS/PAX

There are two main intersections where NAS/PAX and MD 235 meet. The first one is where Buse Road/Pegg Road meet MD235 at Gate #1, and the other is where Cedar Point Road/Great Mills Road meet MD 235 at Gate #2.

The intersection of MD 235 at Gate #1 is the only intersection where pedestrian facilities exist. There is a crossing adjacent to the Shell Gas Station; however, after crossing MD 235, the sidewalk network ends once crossing into NAS/PAX property. The two dedicated left turn lanes into NAS/PAX experience consistent delays due to signal timing and gate activities, particularly during the AM and PM rush hours. Exiting the facility there are three dedicated right turn lanes, one lane that continues straight onto Pegg Road, and one dedicated left turn only lane onto MD 235.

The intersection of MD 235 at Gate #2 has no pedestrian facilities. Although adjacent to the Tulagi Place Park and Ride and the food/retail services along Great Mills Road, there is no safe way for pedestrians to make the crossing. There are two left turn only lanes off of MD 235 to NAS/PAX, as well as two dedicated left turn only lanes from NAS/PAX back onto MD 235. Two lanes continue straight onto Great Mills Road and one lane is a dedicated merge back onto MD 235. This intersection experiences similar AM and PM rush hour delays as Gate #1.

Together, these two intersections create a lot of traffic congestion throughout the MD 235 corridor along the NAS/PAX facility. Timing of signals at each gate create backups into base and along both directions of MD 235, depending on the time of day.

G. Tulagi Place Park and Ride

The Tulagi Place Park and Ride is approximately a quarter of a mile south from Gate #2 off MD 235. This surface lot is adjacent to the Three Notch Theatre and located across Tulagi Place from Linda's Café and other small shops and services. The Park and Ride has 89 parking spots, 5 of them being ADA accessible.

Although just a short distance away from Gate #2, the Park and Ride sits empty. The lack of pedestrian crossings at the intersection of MD 235 and Cedar Point Road makes it impossible and unsafe for employees or visitors to park at the park and ride or utilize the STS stop located at the park and ride and walk safely to the NAS/PAX facility.

4. Public Workshop

A public workshop was held on Wednesday, May 15, 2019 at the Patuxent River Naval Air Museum from 4:00 pm – 6:00 pm. There was a total of 56 participants in attendance, 34 of which identified themselves as being associated with the base.

At the workshop, participants were able to view presentation boards that summarized the study's purpose, context, and goals, as well as imagery that provided an explanation of what multi-modal mobility is and looks like. Additionally, participants were able to take a paper copy of the Transportation Preference Survey or electronically through tablets that were provided. At the conclusion of the workshop, 13 paper copies of the survey had been collected as well as 18 collected via the tablets (this does not include those who may have scanned the QR code and accessed the survey during the meeting on a personal device.)

Comment cards were also utilized at the workshop to allow for additional feedback to be given about the study. There was a total of six comment cards collected, with participants offering feedback and suggestions regarding a pedestrian crossing at Gate #2 along with improved bike infrastructure, sidewalks, and shoulders along routes to get to that point. Participants who left comment cards also expressed support of a base shuttle or other van pool that might make stops at various locations around St. Mary's and Calvert counties.

As a result of the public workshop, there were also additional suggestions and input gathered from emails to base representatives. This input was forwarded to JMT and has been included in the complete dataset.

Representatives from the C-SMMPO (Margaret Oliver, Kwasi Bosompem), NAS/PAX (Sabrina Hecht, Vanessa Price), and JMT (Jennifer Ray, Sarah Diehl) were on hand to answer any questions that participants might have had regarding the study.

5. Transportation Preference Survey: Summary

A. Summary of Results

The Naval Base Commuter Multi-Modal Planning Study: Transportation Preference Survey's purpose was to gain a better understanding of the transportation patterns and characteristics of the NAS/PAX community. The survey was open from May 10 through June 10, 2019 with 2,516 respondents, of which 2,254 were fully completed. 31 of those

responses were collected at the Public Workshop hosted on May 15, 2019 at the Patuxent Naval Air Museum.

In order to ensure all the data came from individuals who interact with the base, a disqualifying question was included such that if a respondent stated that they did not interact with the base they were thanked for their interest and the survey was concluded.

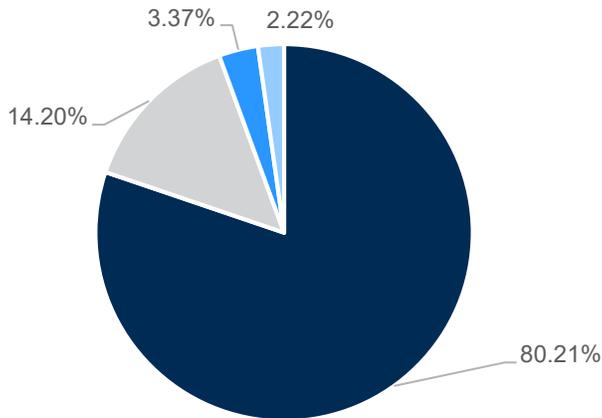
Approximately 80% of respondents are from St. Mary's County and nearly 95% work for NAS/PAX or an associated facility. Most respondents travel to the base daily and use a single occupancy vehicle to do so. Once on the base, most respondents use their personal vehicle to travel around base and about 4% walk/bike. Some identified using their government issued vehicle to travel between buildings while others noted that they try to avoid leaving their building as much as possible due to parking challenges. Challenges facing the walkers and cyclists include the distance between buildings, faded bike lane markings, general upkeep of existing lanes, lack of connected bike lanes, and a lack of bicycle parking.

When asked about carpool options, 54% stated that they would not use carpool even with a monetary incentive. In addition, 62% stated that even if a HOV lane were provided, they would still not carpool. The Drill Hall, Moffett Building, Building 2272, and the NEX were among the most common locations within the base respondents travel to, besides their main place of work. Additional popular locations include lunch spots, South Engineering, and the Post Office. About 30% of respondents leave the base either once a week or once a month and only 12% never leave to use services off base during the workday or lunch hour. However, almost 84% said they would stay on base if more lunch options were available.

About 65% of respondents said they would use a taxi service for on or off base travel for official business if it were available, but a circulator bus service was not as popular. Only 28% said they would use it once a week and 24% said they would use once a month. Finally, about 83% of respondents did not know that there is a public transportation stipend of up to \$265 for federal workers. The following is a detailed report of the results of the survey. See Appendix A for a complete report of all response received and data collected.

B. Results

1. Which county do you live in?

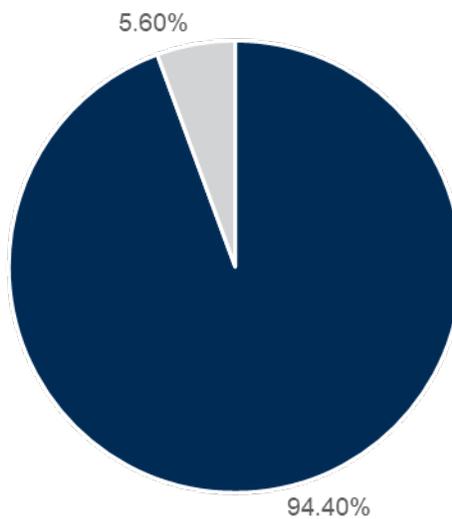


■ St. Mary's ■ Calvert County ■ Charles County ■ Other

“Other” responses included:

- Howard County
- Anne Arundel County
- Prince George’s County
- Virginia
- Pennsylvania

2. Do you work at NAS/PAX or an associated facility?

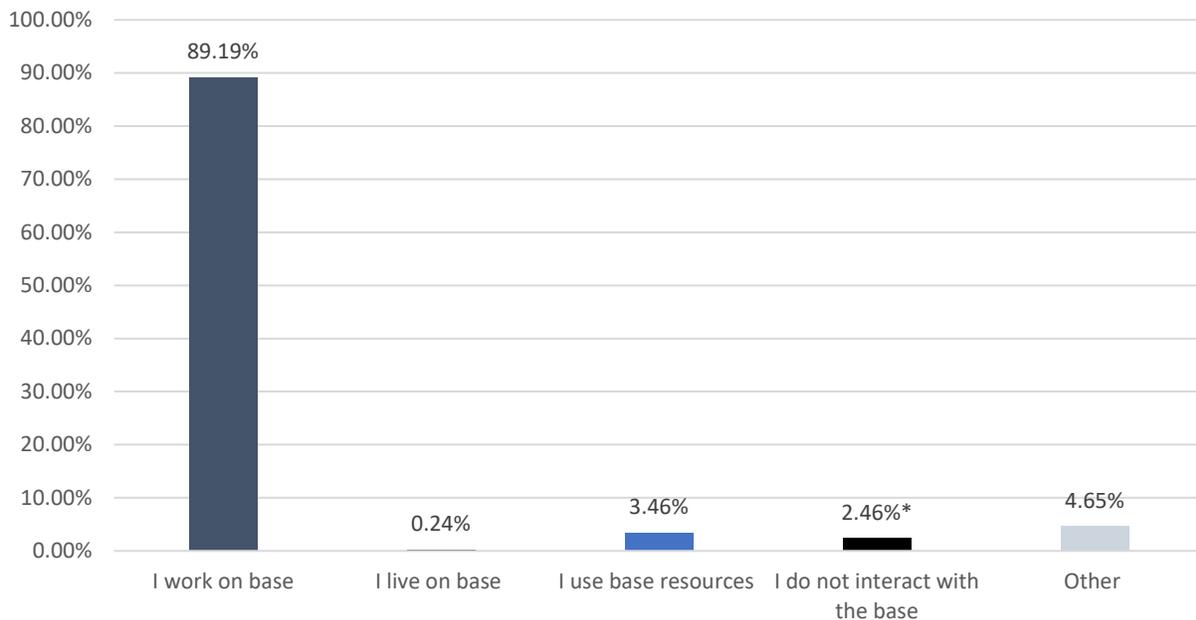


■ Yes ■ No

3. What do you see as your greatest challenge for commuting to work?



4. How do you use the base?

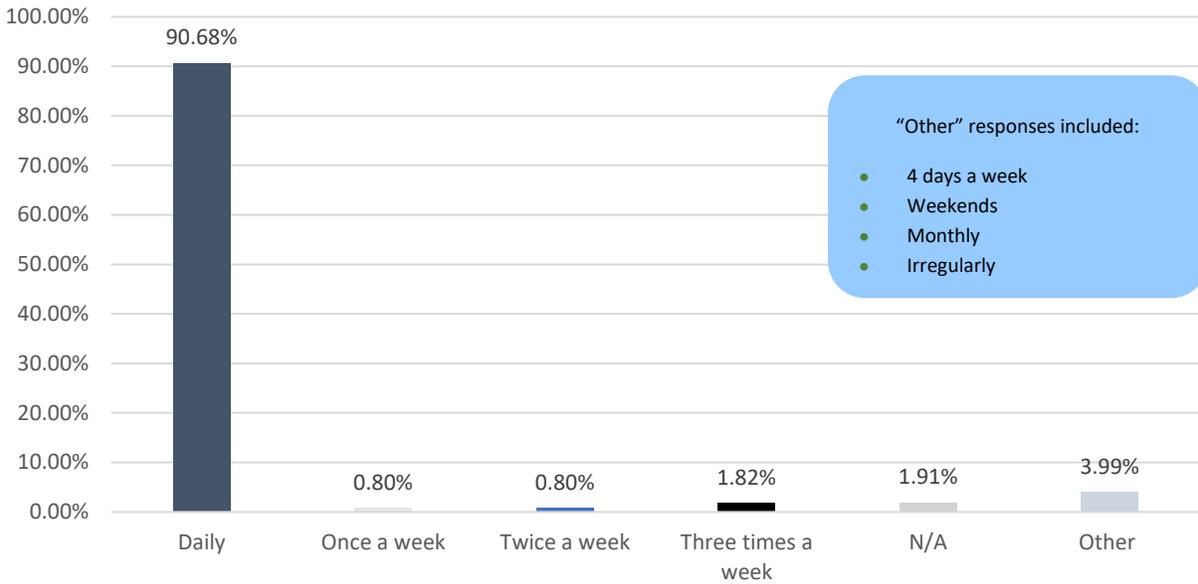


**Respondents who chose this answer were disqualified and unable to complete the survey. Only responses from those who interact with the base were collected.*

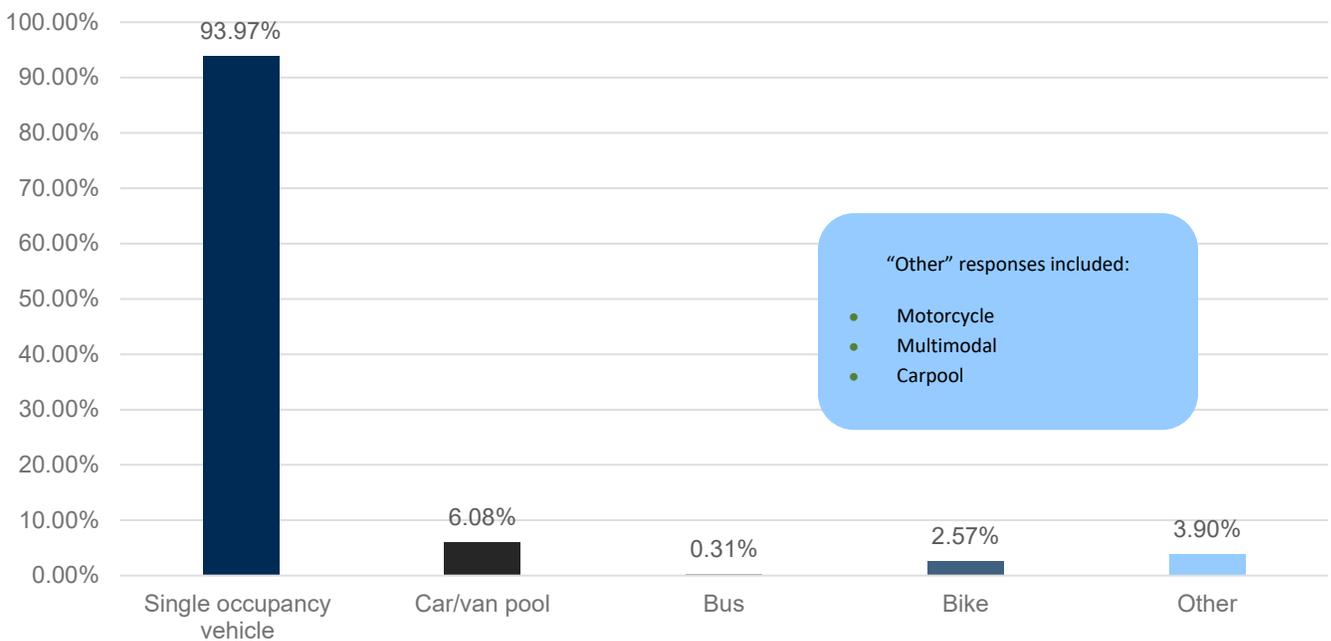
“Other” responses included:

- I support the base from another facility
- I work at the base AND use base resources
- I live on base AND work on base
- Family member works on/uses base
- Retired

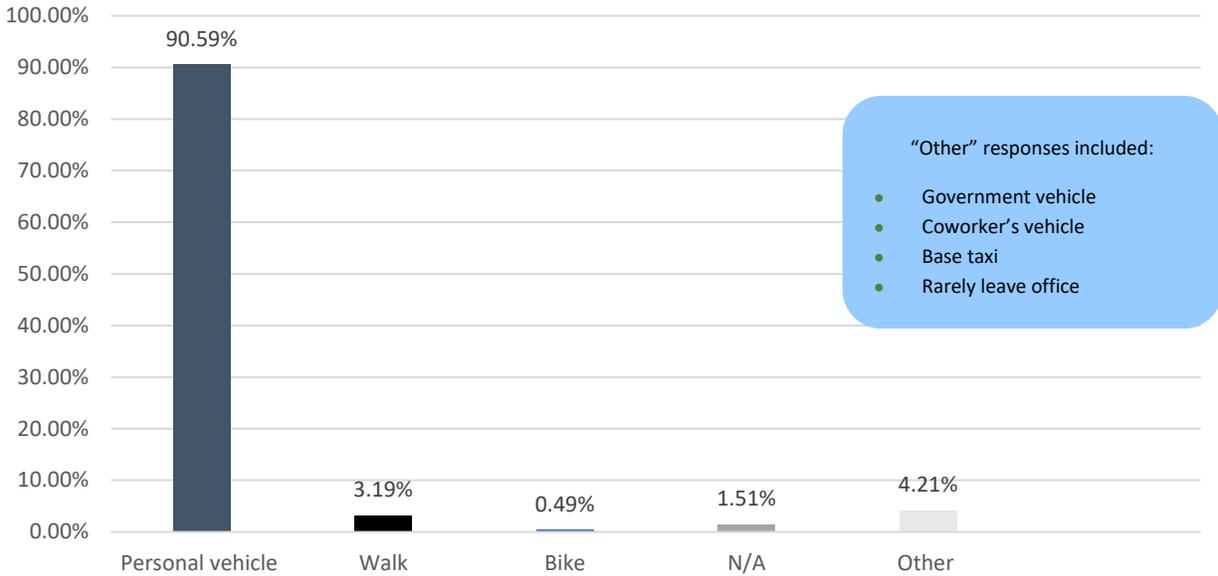
5. If you travel to the base for work, how often do you go to the base?



6. If you travel to the base for work, how do you get there? (Check all that apply)



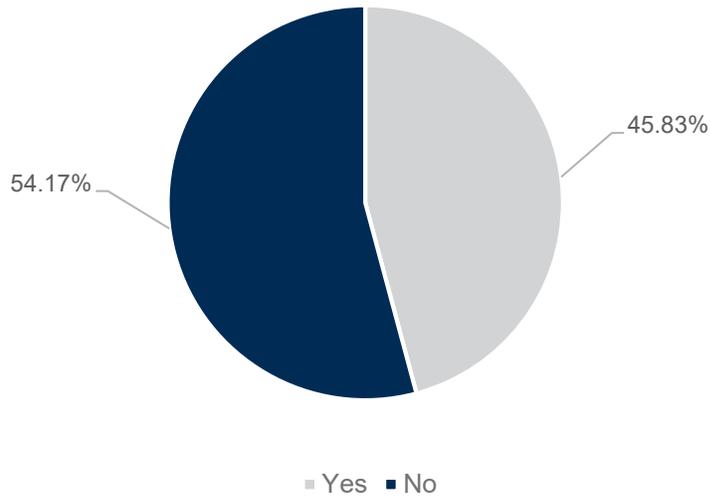
7. Once on base, what is your main mode of transportation to get around (i.e. lunch trips, meetings, etc.)?



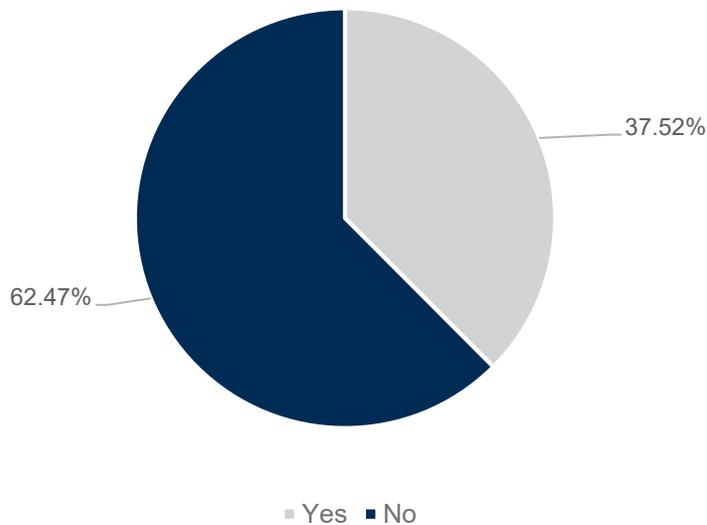
8. If you walk or bike around base, what do you see as the greatest challenge?



9. If there was a monetary incentive provided to you for carpooling to NAS/PAX, would you consider using a car/van pool?



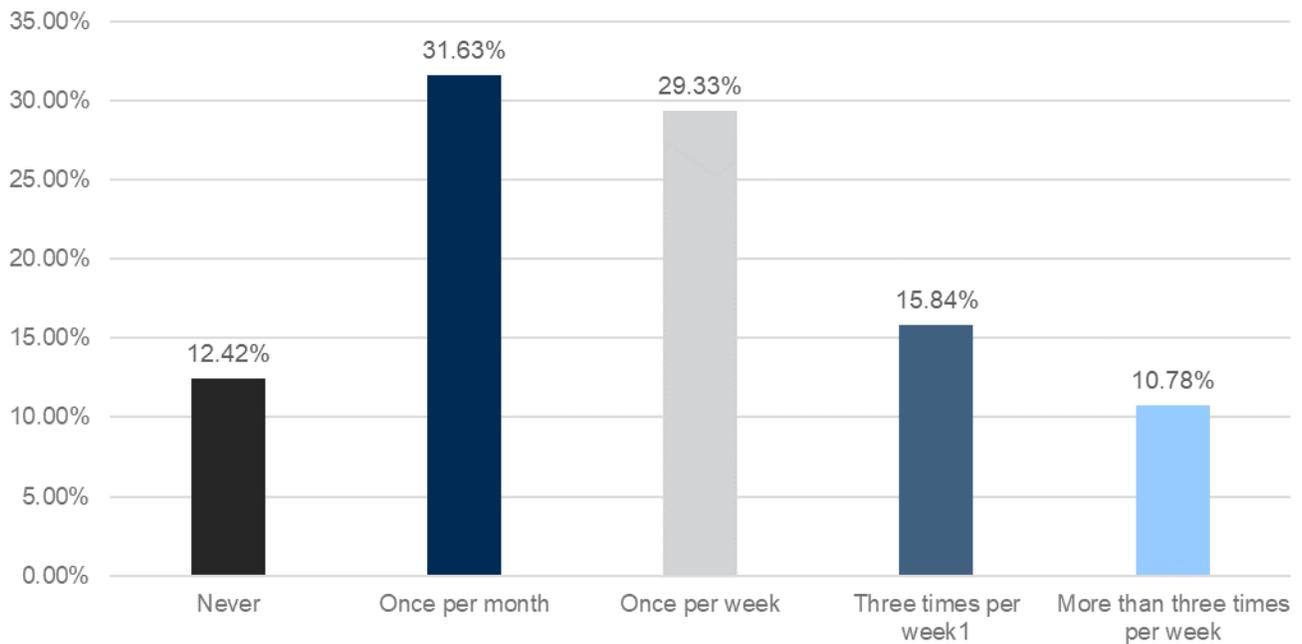
10. If there was a monetary incentive provided to you for carpooling to NAS/PAX, would you consider using a car/van pool?



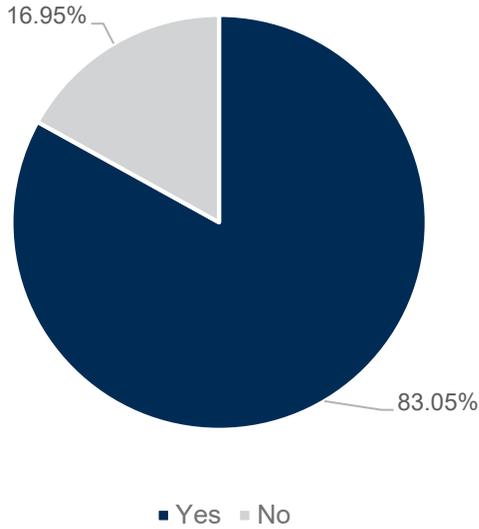
11. Are there particular locations within the base that you travel more frequently, requiring you to leave your main place of work? Please list:



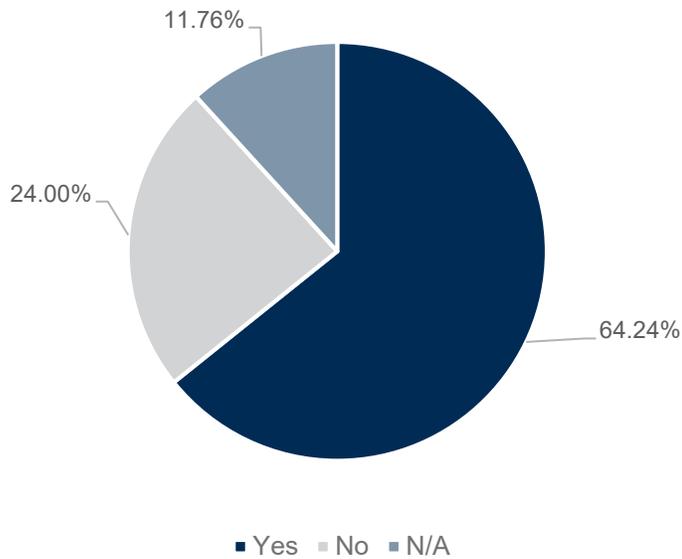
12. How often, if ever, do you use services (restaurants, shops, etc.) off base during the workday or lunch hour?



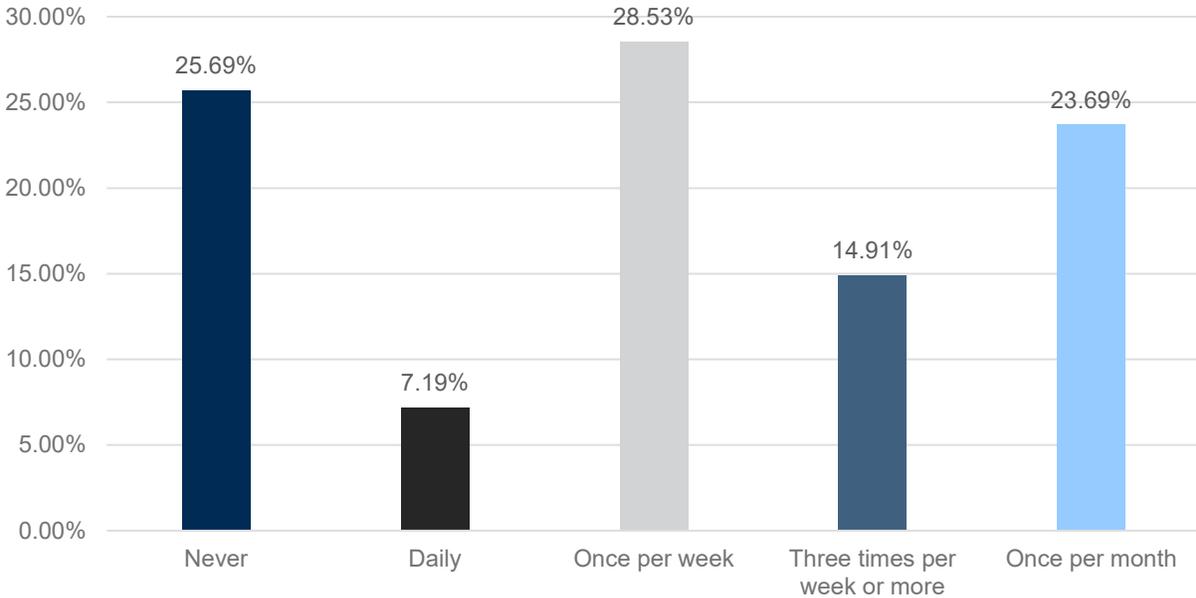
13. If additional and accessible lunch options were provided on base, would you stay on base and frequent them?



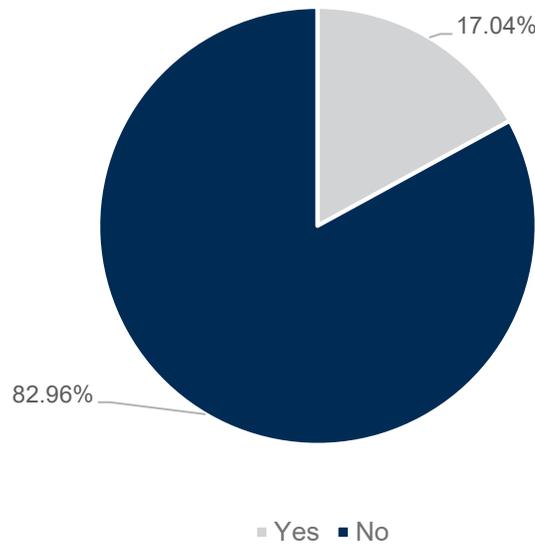
14. If there was a no cost taxi service for on/off base travel for official business, would you use it?



15. If there was a circulator bus route that ran throughout NAS/PAX, would you use it for travel between buildings for meetings, lunch, etc.?



16. Did you know there is a stipend of up to \$265.00 for federal workers for use with approved public transportation?



17. Additional comments and suggestions:

Biking	<ul style="list-style-type: none">• Complete Three Notch Trail• County-wide connectivity• Clear lane markings throughout base• Bike path parallel to Rt. 235• Provide shower facilities on base
Base Improvements	<ul style="list-style-type: none">• More food options• More parking for both vehicles and bicycles• Bike/scooter share program• Publish stipend information• Centralized conference room facility
Congestion	<ul style="list-style-type: none">• Traffic signals need re-sequencing, especially at Gate 2• Reevaluate turn lanes at base entrance• More guards at gates during peak hours• Traffic on base is not the issue, traffic on Rt. 235 is the issue
Modified Work Schedules	<ul style="list-style-type: none">• Telework• Staggering start times• Flexible CWS• Call-in service for meetings
Public Transportation	<ul style="list-style-type: none">• Regular bus service on base• Commuter bus: Leonardtown, Wildewood, Lusby, California, etc.• Bus service could slow base operations, would have to be timely• Bring taxi service back, allow ride sharing services• Ferry service

6. Recommendations

Successful mobility planning ensures that people are easily connected to places. Often, challenges such as congestion and lack of transportation alternatives test the concepts of mobility, therefore making it an obstacle to many individuals. The Naval Base Commuter Multi-Modal Mobility Planning Study strives to improve mobility in and around NAS/PAX and has provided a series of transportation recommendations that will meet the goal of providing choices to individuals to meet their transportation needs.

Improving mobility at a large scale can be a difficult task that often requires a series of smaller changes in order to be effective and measurable. The main goal of this multi-modal mobility planning study largely focuses on the idea of removing people from their cars, even for just one day a week, as part of their daily commuting patterns. This will be accomplished through transit recommendations, bicycle infrastructure improvements, pedestrian connectivity upgrades, geometric changes to infrastructure, and transportation demand management (TDM) strategies. In using these methods, there will be a positive effect on the congestion and parking trends seen throughout the base and along the MD-235 corridor that currently impede mobility.

A. Transit Recommendations

Improving mobility at a large scale can be a difficult task that often requires a series of smaller changes in order to be effective and measurable. The main goal of this multi-modal mobility planning study largely focuses on the idea of removing people from their cars, even for just one day a week, as part of their daily commuting patterns. This will be accomplished through transit recommendations, bicycle infrastructure improvements, pedestrian connectivity upgrades, geometric changes to infrastructure, and transportation demand management (TDM) strategies. In using these methods, there will be a positive effect on the congestion and parking trends seen throughout the base and along the MD-235 corridor that currently impede mobility.

Install Alternative Mobility Hubs and Develop an On-Base Shuttle System

Consistent with the NAS/PAX Transportation Improvement Plan (2013), C-SMMPO should recommend that NAS/PAX implement an on-base shuttle system as an alternative to SOV use. Shuttle use can reduce parking issues and vehicle emissions on base. In conjunction

with a shuttle system, Alternative Mobility Hubs (AMH) should be established as innovative transfer and receiving points that support a multi-modal system.

AMHs provide a focal point in the transportation network that integrate different modes of transportation, multi-modal supportive infrastructure, and place-making strategies to create activity centers that maximize first-mile last-mile connectivity. Amenities that should be included at these hubs include adequate bus stop and layover zones, transit shelters with real-time arrival information, bike share stations, and bicycle storage areas. These nodes must be convenient and comfortable as to make them viable alternative options to SOV use where employees can easily switch modes of travel or gain access to different travel modes, amenities, and information.

A convenient shuttle operating schedule is vital to the success of the system and ridership. Morning and evening rush hours should be prioritized to have the greatest number of buses on the roads with a variety of pick-up and drop-off times to ensure a commuting option that is viable for many employees. Lunchtime and day-long timing should also be provided for lunchtime transportation and inner-base business travel.

Locations of AMHs should be strategically placed to serve the greatest number of employees (Figure 1). The following list of proposed locations of AMHs or bus stops were adapted from the NAS/PAX TIP as well as survey feedback and site visit observations:

1. **Outside of Gate #2 along Cedar Point Rd:** this stop is a key location in making connections to the region's transportation system. It should include a public transportation stop from the St. Mary's Transit System and contain pedestrian amenities. This is also a key connection point between the base and the Tulagi Place Park and Ride.
2. **Town Center:** near the NEX and the Multi-purpose Bowling and Entertainment Center. The new Naval Health Clinic that will be built will also enforce this area as a high trip generating node.
3. **Moffett Building Complex:** large employment center on-base
4. **Tate Road, near Hangars 305 and 306:** This AMH should include links to sidewalk and bicycle connections nearby as well as wayfinding signage to encourage use of these connections.
5. **Gate Rotary Wind and AVMI Center of Excellence (COE):** The limited pedestrian network in this area must be expanded to encourage multi-modal mobility.

6. **South Engineering Center:** a major employment center that attracts high volumes of vehicular trips along Shaw Road. Adequate parking is an issue.
7. **Tactical COE, Old Barn:** Building 132 is an important wayfinding element and landmark. There are several high-volume work locations adjacent to this landmark.
8. **Atlantic Test Range Complex:** Located at Cedar Point at the NE corner of the base. Additionally, there are facilities that can be rented out for events and a beach area.
9. **Carpenter Park Housing:** 100 townhome community for enlisted and civilian use
10. **Lovell Cover Housing Area:** Newer housing for officers
11. **Conference Catering Center:** Particularly important for lunch time access.

The implementation of AMHs at these locations would not necessarily have to wait until a shuttle system is finalized. These hubs can also be developed in conjunction with other alternative modes of transportation, such as the bike share program, on base taxi system, and rideshare pick-up/drop-off locations while funding for the shuttle is being coordinated.

By increasing mobility options for those who do not have a personal vehicle on base every day, many employees may be enticed to carpool or take advantage of the public transportation system to avoid the hassles of parking and congestion in and around base.



Figure 2: Proposed Locations for NAS/PAX Shuttle Stops and Alternative Mobility Hubs

Reinstate the On-Call Taxi Service

As outlined in the Transportation Improvement Plan, C-SMMPO must further encourage base officials to reinstate the on-call base taxi service. This on-call, non-fixed route service was cut in 2012 and allowed employees who carpool to get around base for official business during the work week. The taxi service serviced all three installations on base, off-base leasing, and other approved areas.

According to the *Naval Base Commuter Multi-Modal Planning Study: Transportation Preference Survey*, 64% of respondents agreed that they would use this no cost service if it were to become available again. Implementing this service as part of a multi-modal strategy to reduce congestion on base would provide alternative and reliable means of transportation for those who choose to step away from their personal vehicle.

B. Bicycle Improvements

It is apparent from the Transportation Preference Survey that respondents are interested in using a bicycle to travel within the base or to the base. While only a small percentage of respondents said that they currently bike to work (2.57%) or use a bike to get around base (0.50%), many expressed that biking is an alternative mode of transportation they would consider if the proper safety measures and facilities were put into place. The following are bicycle-focused recommendations that would improve the current state of bicycle infrastructure on base and promote its use.

Implement a Bike Share Program On-Base

Bike share programs supply bicycles for short-term, low-cost use through a network of convenient parking stations, often in conjunction with Alternative Mobility Hubs. This program is a tool to reduce automobile related congestion and parking shortages on base, as well be a convenient alternative means of access to destination locations. Implementing a bike share program would also help to increase the public perception and acceptance of bicycles as a viable mode of transportation.

A bike share program should be provided on base through a series of docked stations only. Implementing a docked system ensures that bikes are picked up and dropped off in approved locations only and allows for easy tracking and maintenance of the system. Docked stations are innovative, allowing for 24/7 pick-up and drop-off, can be run through a smartcard system, often are solar powered, and are modular and movable.

Implementing a bike share program has the potential to decrease daytime traffic congestion on base during the morning/afternoon peak hours as well as the lunchtime rush. Choosing to utilize a bike as part of daily workday travel reduces the number of vehicles on the road as well as further encourages employees to carpool or use transit more efficiently. Strategically placed bike share docks would allow for employees to easily gather at convenient locations to carpool or be able to make the trip from a gate or other commuter transit location. A docked bike share would also allow employees to utilize the system to get to on-base meetings, appointments, errands, and make trips for lunch, rather than getting in their car and losing their parking spot or relying on others if they used transit to get to work.

NAS/PAX should be encouraged to locate bike share docking systems at established bus stops or alternative mobility hubs as part of the shuttle system. This allows for easy and convenient access for NAS/PAX employees. Additional bike share docks can easily be added in areas with high population densities or at parking garages, retail, restaurants, and other entertainment businesses due to their relatively small size and infrastructure requirements.



Figure 3: Capital Bikeshare Docking System

Increased and Improved Bicycle Facilities

One of the most common feedback items received as part of the Transportation Preference Survey was the desire for shower facilities on base for those who bike to work. Many respondents noted that they would be more willing to bike to work if facilities such as showers and lockers were made available. As a short term, high-return effort, C-SMMPO should encourage NAS/PAX to install additional shower facilities around base. These facilities should be in centrally convenient locations: close to major employment centers and alternative mobility hubs/bus stops.

Additionally, increased bicycle storage areas should be provided throughout the base, particularly at major employment centers such as the Moffett Building, North Engineering Center, and South Engineering Center. Increased visibility of bike racks will further support those who already bike from home and perhaps motivate others to do the same.

Implement a Bicycle Subsidy Program

Using the Department of the Interior’s Transportation Subsidy Program as a guide, NAS/PAX (and the Department of Defense) should be encouraged to implement a Bicycle Subsidy Benefits Program to further incentive bicycle usage. The Bicycle Subsidy Benefits Program was added to the DOI’s Transportation Subsidy Program in January 2009 to encourage employees to use means other than SOVs to commute to and from work. The purpose of the program is to meet the mandate of Executive Orders that call for reducing vehicular traffic congestion and air pollution in areas of the country where DOI has a large contingent of employees. At this time, the program has not been adopted by the DOD.

Under this program, NAS/PAX employees would receive a monthly subsidy for commuting by bike at least 20 days in a month. Financial assistance is available for the purchase, improvements, repair, storage, and/or maintenance of a non-motorized vehicle that is used as a primary means of commuting to and from work. To apply, employees must submit an application and complete the required daily or monthly certification logs or statements as part of the guidelines outlined in the Bicycle Subsidy Benefit Program Handbook.

Improve Bicycle Infrastructure On-Base

The above recommendations would be unsuccessful without proper bike infrastructure on base to support them. C-SMMPO should ensure that dedicated bike lanes are established along additional roads throughout base, creating a more continuous road network.

Attention should be paid to the existing bike loop that runs along Buse/Tate/Shaw and Johnson Roads before turning into Cedar Point Road, ensuring that proper bike lane markings, stripping, and signage is visible at all times. Additionally, the following key locations should have bike lanes added, as outlined in the NAS/PAX Transportation Improvement Plan:

- Along Cedar Point Road from MD 235 to the existing bicycle lane that begins near Saufley Road and Taxiway Alpha. This is especially important in creating the necessary connection between MD 235 and the surrounding community and the established bike network on base. Appropriate modifications will need to be made at Gate #2 in order to accommodate bicyclists entering the base. This includes widening Cedar Point Road to accommodate five-foot wide striped bike lanes along both sides of the road from the intersection at MD 235 to the existing bicycle network beginning at the intersection at Cuddihy Road, as outlined in the TIP.
- Along Buse Road, from just before the intersection of Buse Road and Davis Spur Road to the intersection with Cedar Point Road.
- Along Millstone Road.

Additionally, in order to promote bicycling around all parts of the base, appropriate markings for a shared lane (sharrow) should be placed on all secondary and local roads on base (Figure 2).



Figure 4: Roadway with sharrows. *Image source: JMT*

Improve Bicycle Infrastructure Off-Base

Improved external bicycle connections between the base and surrounding communities must be implemented in order to promote safe bicycle commuting to the base. C-SMMPO should coordinate with NAS/PAX to meet with the Maryland State Highway Administration and St. Mary's county officials to discuss where and how these improvements will take place.

Improving bicycle facilities on the MD 235 corridor is crucial to the success of connecting NAS/PAX with the surrounding communities, existing trails and promoting bicycle use. Where feasible, the location of bike infrastructure on MD 235 should be reconsidered. Removing bike lanes from MD 235 and instead creating separated facilities adjacent to the roadway is ideal for safety and comfort. In the short term, existing bike lanes on MD 235 should be re-stripped and widened to be compliant with current SHA design standards. As part of this coordination, the base should also work with SHA to extend existing bicycle lane on MD 235 between Cedar Point Road and Hermanville Road. Currently, the lane ends at Cedar Point Road.

Continued coordination should occur for the completion of the Three Notch Bike Trail. When all nine phases are complete, Three Notch Trail will run approximately 25 continuous miles, from Deborah Drive in Charles County to Pegg Road in Lexington Park. Currently, the trail is completed between the Charlotte Hall to Laurel Park and Chancellors Run Rd. to Wildewood Blvd. (California) portions. This trail will provide a valuable connection for bicyclists looking to commute from the north and should be heavily advertised and encouraged by NAS/PAX once complete.

Additionally, these efforts should include supporting and encouraging the completion of the FDR Boulevard Project. This project, once completed, will help relieve congestion and reduce delays along MD 235 by removing vehicles per day from portions of the highway. An alternative means of access will be provided for residents to travel to and from shopping and work as well as pedestrian and bicyclist amenities such as bike lanes, landscaping, and decorative lighting elements. Bike facilities along FDR Boulevard will provide a crucial link between those neighborhoods and the base, providing a safe and comfortable route for employees to utilize.

It is also important that NAS/PAX stay in contact with the C-SMMPO and county officials to be aware of current and planned transportation improvement projects that will benefit multi-modal commuting at the base. For instance, the C-SMMPO recently advertised an improvement study for St. Andrew's Church Road (MD 4) located north of the base off MD

235. The goal of this study is to analyze all modes of transportation within the study area and prioritize transportation improvements, including stormwater management strategies and complete street components such as traffic calming, sidewalks, and bicycle facilities. Improved facilities throughout this corridor would create valuable connections for communities located north of NAS/PAX.

Create a Bicyclist Education and Safety Campaign

To promote bicycling and the improvements that have been made to the bike network in and around base, it will be necessary to disperse this information to the base community. C-SMMPO should work with NAS/PAX to undertake a public outreach campaign in which information about new bicycle lanes, routes, storage options, shower and locker facilities, and general safety tips for both bicyclists and drivers are made available. Such an effort will promote biking as a viable mode of transportation to work and encourage those who had not considered it to think about the benefits and feasibility.

C. Pedestrian Connectivity Recommendations

Field assessment and Transportation Preference Survey results revealed gaps in the pedestrian environment. Few pedestrian amenities, such as lighting elements, shade trees, and site furniture make walking an unattractive mode of transportation. According to survey results, only 3.19% of respondents cited walking as their main mode of transportation once on base, while others stated that they rarely leave their office perhaps due to challenges that are faced in trying to get around. The following are pedestrian-focused recommendations that will encourage the creation of a healthy walking environment and facilitate walking as a viable mode of transportation for NAS/PAX employees.

General Infrastructure Improvements

Implementation of specific pedestrian infrastructure improvements will connect different parts of the base and form an interconnected pedestrian network. This serves to join major employment centers and encourage employees to walk when traveling for meetings, lunch, etc.

Appropriate sidewalks should be provided between all parking lots/structures and the facilities that they are serving, avoiding the need for pedestrians to walk in the roadway or narrow shoulder to get to their place of work. Primary focus should be on areas that access the most frequented buildings, which according to the Transportation Preference Survey are the North and South Engineering Buildings, the Moffett Building, NEX, Commissary, IPT Work Space, and the Post Office.

Sidewalks must be established in a continuous manner without gaps or dead ends in the system. For example, while Buse and Cuddihy Roads have sidewalks in some areas, gaps between parking facilities and buildings exist. This can be seen along Cuddihy Road, where an incomplete sidewalk network exists between the retail and service amenities. Complete stretches of sidewalk should be provided in all high-volume areas.

Pedestrian crossings and signals should be added to all appropriate intersections, particularly high volume and those that already have existing traffic signals. Locations such as the intersection of Cedar Point Road and Buse Road, as well as Cedar Point Road and Tate Road are vital areas where these improvements should be made. Pedestrian crossings and amenities should also be provided at appropriate intervals throughout the base, to promote safety and comfort of the circulation network. Existing crossings and signals should be repainted and maintained to ensure visibility and functionality.

Bike share programs supply bicycles for short-term, low-cost use through a network of convenient parking stations, often in conjunction with Alternative Mobility Hubs. This program is a tool to reduce automobile related congestion and parking shortages on base, as well be a convenient alternative means of access to destination locations. Implementing a bike share program would also help to increase the public perception and acceptance of bicycles as a viable mode of transportation.

Implement a Pedestrian Crossing of MD 235

C-SMMPO should begin the necessary steps to coordinate with MD SHA to install a pedestrian crossing of MD 235 at the intersection of Cedar Point Road and MD 235 (see Figure 3). There is an existing pedestrian crossing located north on MD 235 at the intersection at Buse Road and MD 235 to meet the needs of that area. However, C-SMMPO and NAS/PAX should continue to monitor the condition of that crossing and make requests for restriping and maintenance as needed.

A crosswalk and necessary crossing infrastructure is recommended to be placed on the southern-most side of the intersection of Cedar Point Road and MD 235. This side is the

most appropriate as it avoids conflict between the high-volume free flow right from the base to MD 235 and reduces the overall number of conflicts between vehicles and pedestrians. Additionally, the majority of the proposed pedestrian generators (food trucks, cafes, and other retail amenities) are located on the south side of the intersection.

The impact of a crosswalk and the associated pedestrians “Walk” and flashing “Do Not Walk” time on vehicular operations at the intersection during the afternoon peak hour was evaluated. This was the only peak hour evaluated since any significant additional pedestrian trip generation is only expected to occur during the afternoon lunch hour.

According to signal timings provided by the Office of Traffic and Safety (OOTs), the intersection currently has split phasing on both MD 246 approaches. It is assumed that the “Walk” indication will be pedestrian activated, meaning there will not be a “Walk” indication unless someone pushes the “Walk” button. Based on the timings from OOTS, the intersection is free running, meaning there is no set signal timing for the intersection. Therefore, signal timings were estimated based on 2017 count. It was determined that the level of service will not be impacted by the installation of a crosswalk on the southeast side of MD 235, as no additional green time will need to be added to the MD 246 northeast movement. The estimated green time for the east leg is 54-66 seconds during the afternoon peak hour. The required flashing “Don’t Walk” time for a crossing distance of 93 feet is 27 seconds and the walk time is 7 seconds. Therefore, the total time required for pedestrians to cross is 34 seconds, which is less than the estimated green time for that approach. A full signal study was not completed at this time and would be required for implementation.

Final recommendations of this crossing will require coordination with MD SHA. However, this should be a priority for both the C-SMMPO and NAS/PAX as a crossing in this area ensures the safety and well-being of employees as well as opens a series of opportunities and connections to be made between the base and retail establishments along the far side of MD 235.

Reimagine Tulagi Place Park and Ride

Tulagi Place Park and Ride is a county-owned underutilized facility located approximately 0.1 mile south of the entrance to Gate #2 (see Figure 3). An STS transit stop is located within the lot and is bordered by a variety of retail services.

Based on the proximity of Tulagi Place to the base, ways to utilize the lot as a destination or lunchtime activity hub, even if it was only once a week/month, should be explored. For example, results of the Transportation Preference Survey indicate that many base

employees frequent the services (restaurants, shops, etc.) off base at least once a week, and that most people are looking for additional accessible lunch options. The Tulagi Place Park and Ride should be considered as an ideal spot to provide a unique food destination in the form of a food truck park during lunch hours a few times a month. Supported by a new pedestrian crossing of MD 235 at Gate #2, base taxi service, and potential shuttle route around base, the park and ride would become an easily accessible destination for NAS/PAX employees.

Additionally, with proper coordination with the county, the park and ride could be utilized as overflow parking for base facilities that are located closer to MD 235. With proper infrastructure to safely deliver pedestrians from one side of MD 235 to the other, this lot has the potential to take some of the strain off parking on base and promote usage of the STS transit stop for base employees.

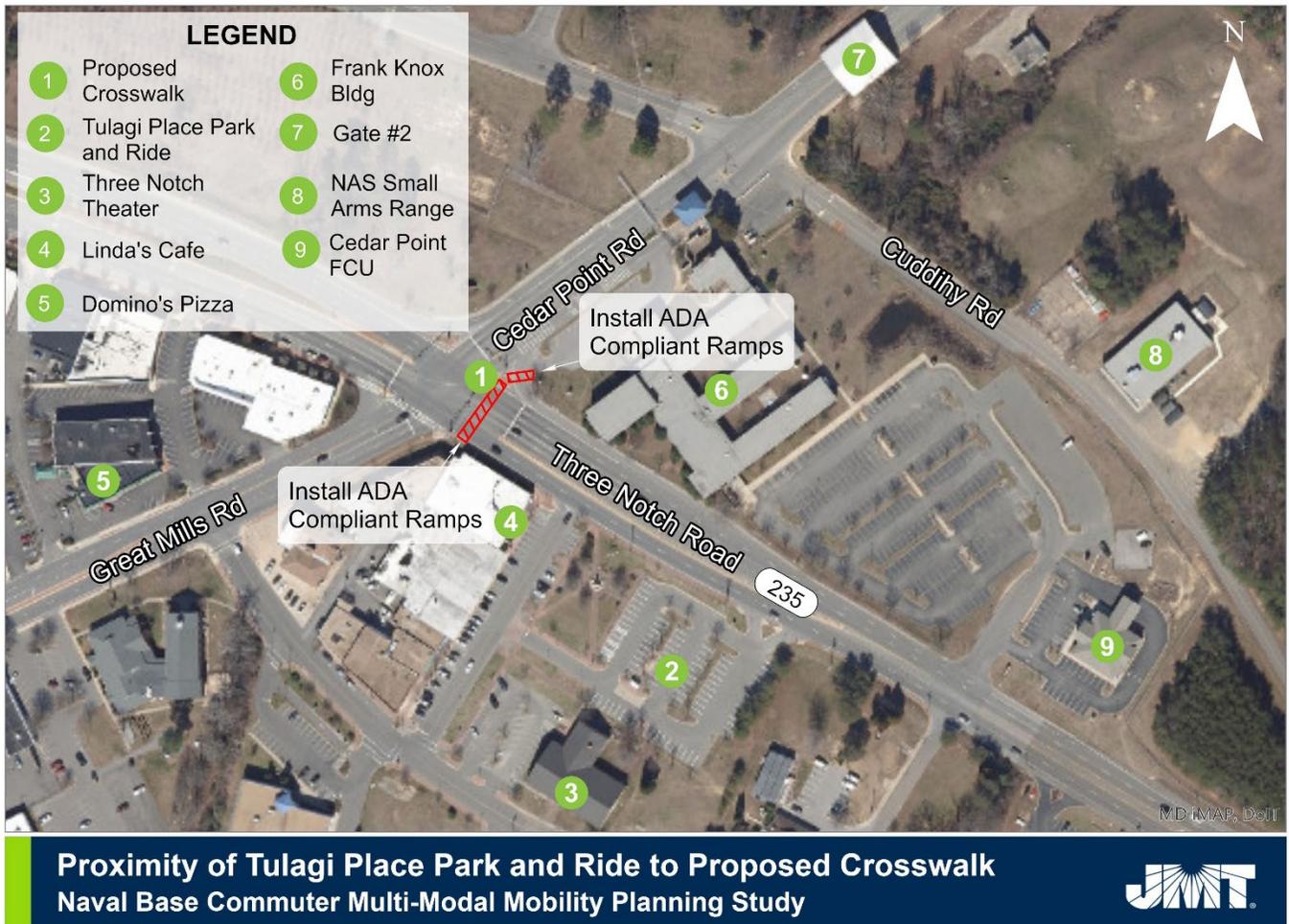


Figure 5: Location of New Proposed Crosswalk in Proximity to Tulagi Place Park and Ride

Increase ADA Compliancy

Maintaining ADA compliancy of all infrastructure on base is vital to ensuring accessibility and walkability for all employees. Site observations at NAS/PAX indicate that the majority of pedestrian infrastructure lacks ADA accessibility.

The C-SMMPO should encourage NAS/PAX to ensure that any new construction complies to ADA guidelines: to include appropriate sidewalk widths, ADA ramps with detectable warning surfaces, appropriate number and location of compliant parking spaces, and accessible ingress and egress for all buildings.

D. Recommended Geometric Changes

To promote multi-modal mobility, a series of geometric changes should occur within existing infrastructure to encourage transit, bicycle, and walking as feasible transportation alternatives.

Location Specific Recommendations

The following recommended geometric changes will improve roadway safety, function, and form. Reference Figure 4 for a location map.

1. Add a bike lane from the intersection of MD 235 and Cedar Point Road to Millstone Road. This would then connect to the existing bike loop around base
2. Implement Cuddihy Road and Buse Road intersection improvements, as outlined in the TIP. Cuddihy Road should have one left turn only lane onto Buse Road from NB Cuddihy Road, while the other lane is a left turn/straight forward lane. Coming south on Cuddihy Road, there should be an optional right turn allowed from the leftmost lane onto Buse Road. With these improvements, the intersection would operate at a more efficient level of service.
3. Install pedestrian crossing signals and crosswalks at the Buse Road/Cuddihy Road intersection.
4. Widen Cedar Point Road to accommodate five-foot wide striped bike lanes along both sides of the road from the intersection at MD 235 to the existing bicycle network beginning at the intersection at Cuddihy Road, as outlined in the TIP.

5. Revise Liljencrantz westbound approach to only allow right turns during the AM peak hours, as outlined in the TIP.
6. Also as outlined in the TIP, NAS/PAX should extend Davis Spur Road to Tate Road. This would also create a new walking connection between the major employment centers in that area as well as connecting Moffett Building to the rest of Mission Critical areas.
7. Install pedestrian signal to existing traffic signal at Cedar Point/Tate Road intersection.
8. Allow for back-in on-street parking only: in instances where angled parking is desired, back-in only parking is required to maximize safety for bicycles sharing the road.
9. Re-strip the entire bike loop around base as well as any other bike lanes to maximize visibility.
10. Improve all taxiway crossings: consistent with recommendations made by the TIP, new signals that would be controlled by the Control Tower should be installed at all crossings of the airfield. Additionally, a new flashing sign should be placed 0.25-mile back from the crossing to alert the driver that the signal is there and that they may have to stop.

Additionally, the implementation of High Occupancy Vehicle (HOV) lanes to encourage carpooling and more efficient gate function was explored. HOV lane implementation has the potential to increase gate efficiency by moving more people through in less vehicles over a period of time.

However, survey results indicate that the intended outcome would not be achieved: approximately 63% of Transportation Preference Survey respondents indicated that even if there was a HOV lane provided at the gates of NAS/PAX, they would not be more likely to carpool. In this case, an empty or underutilized lane at the gate during peak times would cause additional delays and backups to what commuters are already experiencing. For example, a HOV lane at Gate #2 would reduce SOV traffic flow to only two lanes instead of the three that operate during the AM peak period, thus increasing the queue of traffic waiting to get through the gate. Further impairing gate function is counterproductive to this study so therefore HOV lanes are not advised at this time.



Locations of Proposed Geometric Improvements
 Naval Base Commuter Multi-Modal Mobility Planning Study



Figure 6: Locations of Proposed Geometric Improvements

E. Transportation Demand Management (TDM) Improvements

Transportation demand management (TDM) is concerned with ways in which people make optimal use of locally available transportation resources, with a central focus on getting people out of SOVs and into more efficient modes of commuting. It's a program of information and incentives provided by local or regional organizations to make people aware of and how to use all of their transportation options, and can be a combination of traditional and technology-based services to encourage the use of transit, ridesharing, walking, biking, and telework.

The following TDM strategies to decrease SOV usage and congestion in and around the base should be considered.

Staggered Work Hours

Staggered arrival and departure hours for base employees can ease congestion leaving and entering base. A staggered work schedule approach was heavily supported and suggested by many of the respondents in the Transportation Preference Survey looking to make their morning and evening commutes more efficient.

Additionally, it should be encouraged to begin to offer flexibility regarding the Compressed Work Schedule (CWS) program. At this time, the Regular Day Off (RDO) as part of the CWS is regulated to be Friday for most participating base employees. New standards should be set to allow for greater flexibility for each employee to choose their Regular Day Off, for instance Mondays, Wednesdays or Fridays. Based on feedback it appears that NAVFAC currently allows the RDO to be either Monday, Wednesday, or Friday. Granting this flexibility to all eligible employees at NAS/PAX would aid in reducing the volumes of traffic going in and out of the base throughout the week.

Increased Telework Opportunities

In addition to staggered work hours, NAS/PAX should allow eligible employees to take advantage of teleworking days. It is acknowledged that some work units already have teleworking policies in place but expanding the practice base-wide or increasing the number of allowed telework days would have an even larger impact on NAS/PAX transportation patterns.

Teleworking has many benefits, including increasing the quality of life for the employee. The flexibility of working off-site allows the employee to focus on work, without the added stress of how to get there. Encouraging employees to work elsewhere could reduce the parking supply issue on base, where it is common for many buildings to have more employees working in them than available parking spots.

Teleworking and staggered work hours were two concepts heavily favored by respondents of the Transportation Preference Survey. Many respondents referenced either option somewhere in their responses and were hopeful of what the impact on traffic congestion and parking would be.

Transportation Stipend Promotion

According to the Transportation Preference Survey, 83% of respondents did not know that a stipend of up to \$265 was available for federal workers for use with approved public transportation. This is a valuable program that should be advertised more to further encourage the use of public transit. Advertising efforts could include notices in base-wide weekly email blasts, fliers, social media outreach, and better advertisement on frequently used base websites.

Forum Creation for Car/Van Pool Participants

To encourage car or van pool throughout the base, there needs to be a discussion surrounding the creation of a NAS/PAX forum where interested participants can sign up and connect with others who may live in the same area or need a ride. The forum should be accessible by base employees for security purposes, and there is no need for personal information such as addresses to be exchanged over the site- this could be something for a text message or phone call once the initial connection is made via the site. The sole purpose of this forum would be to initiate conversations and connections between employees who may not be aware of others living in their area looking for similar options for their daily commute. This forum would be an appropriate item to advertise along with the transportation stipend program.

Transit Awareness Campaigns

Once any of the above recommendations are put in place, it is important that NAS/PAX promote their existence and encourage their use. Just as the Transportation Stipend

Program is not well known, the base does not want to have gone through the effort of providing transit options only to have no employees use them because they didn't know they existed.

All forms of multi-modal transportation mentioned – biking, taxi, shuttle, walking, etc., should each be highlighted in NAS/PAX publications, email blasts, and social media to ensure that word is getting out about their availability and benefits.

Insert on base recommendation summary map – highlight locations of new and existing bike lanes, infrastructure, and pedestrian connectivity (sidewalk) improvements.

PENDING DEVELOPMENT

Insert off base recommendation summary map – highlight locations of existing trails and infrastructure to connect to, additional bike lanes on MD 235, etc.

PENDING DEVELOPMENT

7. Implementation Plan

One of the most challenging aspects of a multi-modal mobility planning study is the implementation strategy. A large amount of coordination and short, medium, and long-term planning must occur to ensure that key agencies and stakeholders are on the same page and aware of each other's efforts. Several recommendations are provided to assist NAS/PAX with implementation of strategies needed to promote multi-modal mobility on base.

A. General Implementation Guidelines

C-SMMPO and NAS/PAX should make it known to the base community and other agencies (such as SHA, STS, and Calvert County Public Transportation officials) that this study was completed and that the focus is to reduce congestion on MD 235 by promoting multi-modal mobility on base. Additionally, C-SMMPO should encourage NAS/PAX to think about what projects and when coordination with SHA will be necessary. For some of long-term recommendations, it will be imperative that C-SMMPO encourage NAS/PAX and SHA to work together to implement some of the improvements as SHA is the owner and responsible for the maintenance of MD 235.

B. Short Term (0-5) Years

Short term recommendations are defined as opportunities to implement improvements that would advance NAS/PAX multi-modal mobility within the next five years. County projects that are already underway, such as the Three Notch Bike Trail and the FDR Boulevard project are considered as short-term improvements, as C-SMMPO and NAS/PAX should continue to encourage the completion of these projects. Otherwise, all other projects requiring county or state coordination are considered medium- or long-term recommendations.

Recommendations under the short-term timeframe are those that would require minimal coordination, design, and construction time or that should be considered priority projects for the base. These include the installation of alternative mobility hubs (AMHs), where amenities such as a bike share program, bike storage facilities, and shelters for transit are to be placed. It is important to note that these facilities can be constructed before the implementation of the on-base shuttle system because of the numerous benefits they provide for other means of transportation around base. Additionally, it is imperative that

the installation of shower and locker facilities around base be considered a short-term project, as the availability of showers will be the first step in successfully promoting bicycling to and around base as a viable means of transportation.

Transportation Demand Management (TDM) improvements are also all considered short-term coordination efforts as they are concepts that utilize and optimize the existing transportation systems without any capacity and/or construction activities. This is accomplished by reducing the travel demand on existing facilities during the peak traffic times. TDM improvements are also being recommended to promote change in behavior for the way NAS/PAX employees think about transportation. While the installation of additional sidewalk facilities or bike lanes may not garner much attention at first, the inclusion of these new facilities with the promotion of wellness education, transit education campaigns, and other outreach efforts can encourage people to change their behavior.

See the matrix of recommendations and responsibilities for a full list of short-term recommendations.

C. Medium Term (5-10 Years)

Medium term recommendations are defined as opportunities to implement improvements that would advance NAS/PAX multi-modal mobility within the next five to ten years. Many of these projects seek to improve roadway or intersection operations on base as well as off base on MD 235. Medium term recommendations build upon the short-term recommendations and assume that they have been completed.

Recommendations under the medium-term timeframe are those that require greater coordination efforts and potentially a greater design and construction phase. In order to move these projects along, C-SMMPO should encourage NAS/PAX to begin some of the coordination efforts in a short-term timeframe. Examples of these recommendations include expanding the bike lane network on base, constructing sidewalks in a continuous manner, and redesigning some of the intersections on base to maximize efficiency. Off base, a crucial medium-term recommendation is the construction of a new pedestrian crossing of MD-235 (of which coordination should begin as soon as possible) and the extension/ repair of bike lanes along MD 235.

See the matrix of recommendations and responsibilities for a full list of medium-term recommendations.

D. Long Term (10+ Years)

Long term recommendations predominately include opportunities to expand multi-modal mobilities to its “ultimate” condition. These projects will require the most coordination, design and construction time, and financially will be some of the largest projects. Long term projects build off all recommendations to date and assume they have been completed.

Examples of long-term recommendations include creating a fully separated bike facility adjacent to MD 235 and extending roads on base. It is important to note that there is carry-on of medium-term projects into the long-term timeframe; this is to account to the lengthy period of time that coordination and construction activities will require.

See the matrix of recommendations and responsibilities for a full list of long-term recommendations

E. Recommendation Matrix

A matrix has been developed to organize and present a timeline of recommendation implementation in an organized manner. Recommended projects have been organized based on target category consistent with the Naval Base Multi-Modal Mobility Planning Study.

The timeline for each recommended project is broken down into three sections: coordination, design, and construction. It is important to note that many of these recommendations will require coordination throughout the entirety of the implementation cycle; however, for presentation purposes has only been included as in the initial phases of implementation. Each project also has a recommended key agency that C-SMMPO should coordinate efforts with for recommendation implementation.

F. Cost Estimate

A planning level cost estimate has been prepared for all recommendations. The cost summary and cost analysis by recommendation can be found following the recommendation matrix.

Matrix of Recommendations and Responsibilities Naval Base Commuter Multi-Modal Mobility Planning Study							
	Project	Cost*	Timeframe			Key Agencies**	Process to Implement / Remarks
			Short Term 0-5 Years	Medium Term 5-10 Years	Long Term 10+ Years		
Transit Recommendations							
1.1	Install Alternative Mobility Hubs (AMH): to include bike racks, bus shelters, and signage	\$250,00 - \$300,000				NAS/PAX	Secure funding to install AMHs at the 11 key nodes identified in the Naval Base Commuter Multi-Modal Mobility Planning Study.
1.2	Develop an On-Base Shuttle System: NAS/PAX to secure funding for vehicles	No additional cost				NAS/PAX	Secure funding for transit vehicles and develop an operating schedule.
1.3	Reinstate the On-Call Taxi Service	No Cost				NAS/PAX	Futher encourage NAS/PAX officials to implement and fund the service.
Bicycle Improvements							
2.1	Implement a bike share program on-base	\$150,000 - \$200,000				NAS/PAX St. Mary's County	Work with NAS/PAX officials and St. Mary's County to coordinate with bike share providers to bring the infrastructure to base.
2.2	Install shower and locker facilities on base	\$40,000 - \$45,000				NAS/PAX	Install shower and locker facilities at key employment centers.
2.3	Supply additional bicycle storage areas	\$35,000 - \$40,000				NAS/PAX	Install bicycle storage areas at key employment centers.
2.4	Implement a Bicycle Subsidy Benefit Program	No Cost				NAS/PAX DOD DOI	Coordinate with DOD to adopt the DOI's Transportation Subsidy Program.
2.5a	Expand bike lane network on base	Included in cost of 4.9				NAS/PAX	Expand bike lane infrastructure in key locations outlined in the Naval Base Commuter Multi-Modal Mobility Planning Study.
2.5b	Install sharrow markings on secondary and local roads	Included in cost of 4.9				NAS/PAX	Install sharrow markings on all roads without a bike lane.
2.6a	Re-stripe existing bike lanes on MD 235	\$150,000 - \$200,000				MDOT SHA St. Mary's County	Re-stripe bike lanes on MD 235 to ensure visibility and comply with current SHA design standards
2.6b	Create a separated bike path along MD 235	\$7 - \$10 Million				MDOT SHA St. Mary's County	Educate St. Mary's County on the importance of bicycle safety and promote the removal of bike lanes on MD 235 and the creation of separate bicycle facilities that are adjacent to MD 235. Coordinate with the county and SHA to utilize ROW.
2.6c	Extend bike lane on MD 235 between Cedar Point Rd and Hermanville Rd	\$75,000 - \$100,000				MDOT SHA St. Mary's County	Coordinate with St. Mary's County and SHA to utilize ROW to extend the existing bike lane on MD 235.
2.6d	Complete the FDR Boulevard Project	\$12 Million (Currently included in the St. Mary's Capital Budget)				NAS/PAX MDOT SHA St. Mary's County	Encourage St. Mary's County to continue funding for the extension of FDR Boulevard.
2.6e	Complete the Three Notch Bike Trail	Included in completion cost of 2.6d				NAS/PAX MDOT SHA St. Mary's County	Encourage St. Mary's County to continue funding for the completion of the bike trail in order to promote biking as a viable form of transportation to access base.
2.6f	Create a bicyclist education and safety campaign	\$20,000 - \$30,000				NAS/PAX	Coordinate with NAS/PAX to develop a public outreach campaign that will disperse information regarding upgrades and implementation of bike lanes, bike share, new facilities, and general bicyclist safety tips.

*Feasibility level construction cost estimates

**Key Agencies for C-SMMPO to coordinate efforts for recommendation implementation



Matrix of Recommendations and Responsibilities Naval Base Commuter Multi-Modal Mobility Planning Study							
	Project	Cost*	Timeframe			Key Agencies**	Process to Implement / Remarks
			Short Term 0-5 Years	Medium Term 5-10 Years	Long Term 10+ Years		
Pedestrian Connectivity Recommendations							
3.1	Construct sidewalks in a continuous manner throughout base	\$25 - \$30 Million				NAS/PAX	Work with NAS/PAX to identify all locations on base where sidewalks and crosswalk infrastructure is missing. Primary focus should be on areas surrounding the identified key employment nodes and areas around bus stops.
3.2	Install pedestrian crossing signals and crosswalks at all appropriate intersections throughout base	\$300,000 - \$400,000				NAS/PAX	Work with NAS/PAX to inventory intersections on base and install crosswalks. Survey signaled intersections and ensure proper pedestrian crossing signals are active and in proper shape.
3.3	Install a pedestrian crossing of MD 235	\$200,000 - \$250,000				MDOT SHA St. Mary's County	Coordinate with MD SHA to install a signalized pedestrian crossing on the southeast side of the MD 235/Cedar Point Road intersection.
3.4	Reimagine the Tulagi Place Park and Ride	No Cost				NAS/PAX St. Mary's County	Coordinate with St. Mary's County to secure continued usage of the Tulagi Place Park and Ride. Promote the value of the park and ride as a food truck hub and connect with local food trucks to encourage a weekly or monthly gathering.
3.5	Increase ADA compliancy	Included in cost of 3.1				NAS/PAX	Work with NAS/PAX to survey existing pedestrian infrastructure on base and ensure that existing and future entities conform to ADA requirements.
Recommended Geometric Changes							
4.1	Add a bike lane from the intersection of MD 235 and Cedar Point Road to Millstone Road.	\$50,000 - \$75,000				NAS/PAX MDOT SHA	Coordinate with NAS/PAX officials to construct these changes.
4.2	Redesign intersection of Cuddihy Road and Buse Road to realign turn lanes.	\$125,000 - \$175,000				NAS/PAX	Coordinate with NAS/PAX officials to construct these changes.
4.3	Install pedestrian crossing signals and crosswalks at the Buse Road/Cuddihy Road intersection.	Included in cost of 4.2				NAS/PAX	Coordinate with NAS/PAX officials to construct these changes.
4.4	Widen Cedar Point Road from intersection of MD 235 to Cuddihy Road to accommodate bike lane	\$225,000 - \$275,000				NAS/PAX MDOT SHA	Coordinate with NAS/PAX officials to construct these changes.
4.5	Revise Liljencrantz westbound approach to only allow right turns during the AM peak hours.	\$500 - \$1,200				NAS/PAX	Coordinate with NAS/PAX officials to construct these changes.
4.6	Extend Davis Spur Road to Tate Road	\$500,000 - \$600,000				NAS/PAX	Coordinate with NAS/PAX officials to construct these changes.
4.7	Install pedestrian signal to existing traffic signal at Cedar Point/Tate Road intersection.	\$125,000 - \$175,000				NAS/PAX	Coordinate with NAS/PAX officials to construct these changes.
4.8	Implement back-in on-street parking only	No Cost				NAS/PAX	Coordinate with NAS/PAX officials to construct these changes.
4.9	Re-stripe the entire bike loop around base	\$600,000 - \$700,000				NAS/PAX	Coordinate with NAS/PAX officials to construct these changes.
4.10	Improve all taxiway crossings	\$1.0 - \$1.5 Million				NAS/PAX	Coordinate with NAS/PAX officials to construct these changes.

*Feasibility level construction cost estimates

**Key Agencies for C-SMMPO to coordinate efforts for recommendation implementation



Matrix of Recommendations and Responsibilities Naval Base Commuter Multi-Modal Mobility Planning Study							
	Project	Cost*	Timeframe			Key Agencies**	Process to Implement / Remarks
			Short Term 0-5 Years	Medium Term 5-10 Years	Long Term 10+ Years		
Transportation Demand Management Improvements							
5.1	Implement staggered work hours	No Cost				NAS/PAX	Coordinate with different base divisions to create a consistent staggered work schedule among offices and departments.
5.2	Increase telework opportunities	No Cost				NAS/PAX	Work with different base entities to promote consistent telework options.
5.3	Implement Transportation Stipend promotion	No Cost				NAS/PAX	Work with NAS/PAX to include information about the stipend program in weekly e-mail blasts and other social media outreach posts.
5.4	Create a forum for car/van pool participants	No Cost				NAS/PAX	Work with NAS/PAX to develop a secure forum that will allow base employees to easily connect with one another when searching for alternative methods to get to base.
5.5	Implement a Transit Awareness Campaign	\$20,000 - \$30,000				NAS/PAX	Encourage NAS/PAX to develop a media campaign to promote multi-modal mobility on base. A media campaign is ongoing requiring constant updates.

*Feasibility level construction cost estimates

**Key Agencies for C-SMMPO to coordinate efforts for recommendation implementation

Coordination

Design

Construction

Naval Base Commuter Multi-Modal Mobility Planning Study
 Draft Final Report – August 30, 2019

Naval Base Commuter Multi-Modal Mobility Planning Study Cost Estimate Summary		
ID	Recommendation	Infrastructure Improvement Cost
Transit Recommendations		
1.1	Install Alternative Mobility Hubs (AMH)	\$250,000 - \$300,000
1.2	Develop On-Base Shuttle System	No cost
1.3	Re-Instate On-Call Taxi Service	No cost
Bicycle Improvements		
2.1	Implement a Bike Share Program	\$150,00 - \$200,000 Cost taken from Capital Bike Share cost ratio
2.2	Install shower and locker facilities on base	\$40,000 - \$45,000
2.3	Supply additional bicycle storage areas	\$35,000 - \$40,000
2.4	Implement a Bicycle Subsidy Benefit Program	No cost
2.5a	Expand bike lane network on base	Included in cost of 4.9
2.5b	Install sharrow markings on secondary and local roads	Included in cost of 4.9
2.6a	Re-Stripe Existing Bike Lane on MD 235	\$150,000 - \$200,000
2.6b	Create Separated Bike Path along MD 235	\$7 - \$10 Million
2.6c	Extend bike lane on MD 235 to Hermanville Road	\$75,000 - \$100,000
2.6d	Complete the FDR Boulevard Project: Extend FDR Boulevard to Pegg Road	\$12 Million (currently included in the St. Mary's County Capital Budget)
2.6e	Complete the Three Notch Bike Trail	Included in completion cost of 2.6d
2.6f	Create a bicyclist education and safety campaign	\$20,000 - \$30,000
Pedestrian Connectivity Recommendations		
3.1	Construct sidewalks in a continuous manner throughout base	\$25 - \$30 Million
3.2	Install pedestrian crossing signals and crosswalks at all appropriate intersections throughout base	\$300,000 - \$400,000
3.3	Implement a pedestrian crossing of MD 235	\$200,000 - \$250,000
3.4	Re-Imagine Tulagi Place Park and Ride	No cost
3.5	Increase ADA Compliancy	Included in cost of 3.1
Recommended Geometric Changes		
4.1	Add a bike lane on Cedar Point Road to Millstone Road.	\$50,000 - \$75,000
4.2	Implement Cuddihy Road and Buse Road intersection improvements	\$125,000 - \$175,000
4.3	Install ped crossing signals and crosswalks at Buse Road / Cuddihy Road intersection	Included in cost of 4.2
4.4	Widen Cedar Point Road to accommodate bike lanes	\$225,000 - \$275,000
4.5	Buse Road and Liljencratz Road intersection improvements	\$500 - \$1,200
4.6	Extend ped/bike connection from Davis Spur Road to Tate Road	\$500,000 - \$600,000
4.7	Install ped signal to existing signal at Cedar Point / Tate Road intersection	\$125,000 - \$175,000
4.8	Promote back in parking	No cost
4.9	Re-stripe bike facilities for better visibility	\$600,000 - \$700,000
4.10	Improve taxiway crossings	\$1.0 - \$1.5 Million
Transportation Demand Management (TD) Improvements		
5.1	Staggered work hours	No cost
5.2	Increased telework opportunities	No cost
5.3	Transportation Stipend promotion	No cost
5.4	Forum creation for car / van pool participants	No cost
5.5	Transit Awareness Campaign	\$20,000 - \$30,000

Naval Base Commuter Multi-Modal Mobility Planning Study						
Cost Analysis						
Site Option: 1.1 Develop On-Base Shuttle System						
Roadway Costs						
Item No.	Description	Unit	Quantity	Unit Cost	Total Cost	Notes
Preliminary						
	Mobilization	LS	1		\$ 11,010.00	12% of total construction cost
	Construction Stake Out	LS	1		\$ 1,835.00	2% of total construction cost
Roadway						
	Bus Shelter	EA	13	\$ 1,600.00	\$ 20,800.00	13 Buildings - 2 showers each 2016 RS Means - page 291
	Bike Racks	EA	11	\$ 700.00	\$ 7,700.00	2017 RS Means - page 190
	Small Sign on Wood Supports	EA	11	\$ 500.00	\$ 5,500.00	
	Concrete Sidewalk, 5"	SF	3,850	\$ 15.00	\$ 57,750.00	
Subtotal					\$ 91,750.00	
Contingent Categories				Subtotal	\$ 104,595.00	
	Preliminary		40%	\$ 104,595.00	\$ 41,838.00	
	Drainage		30%	\$ 104,595.00	\$ 31,378.50	
	Landscape		6%	\$ 104,595.00	\$ 6,275.70	
Subtotal 2					\$ 171,242.20	
	Contingency		40%		\$ 68,496.88	40% of Subtotal 2
Subtotal 3					\$ 239,739.08	
	Engineering		10%		\$ 23,973.91	
	CM		10%		\$ 23,973.91	
Total					\$ 287,686.90	

Naval Base Commuter Multi-Modal Mobility Planning Study						
Cost Analysis						
Site Option: 2.2 Install Shower and Locker Facilities on Base						
Roadway Costs						
Item No.	Description	Unit	Quantity	Unit Cost	Total Cost	Notes
Preliminary						
	Mobilization	LS	1		\$ 2,495.00	12% of total construction cost
	Construction Stake Out	LS	1		\$ 415.00	2% of total construction cost
Facility						
	Install Showers at Facilities around base	EA	13	\$ 1,600.00	\$ 20,800.00	13 Buildings - 2 showers each 2016 RS Means - page 291
Subtotal					\$ 20,800.00	
Contingent Categories				Subtotal	\$ 23,710.00	
	Preliminary		15%	\$ 23,710.00	\$ 3,556.50	
	Drainage		5%	\$ 23,710.00	\$ 1,185.50	
	Landscape		5%	\$ 23,710.00	\$ 1,185.50	
Subtotal 2					\$ 26,727.50	
	Contingency		40%		\$ 10,691.00	40% of Subtotal 2
Subtotal 3					\$ 37,418.50	
	Engineering		10%		\$ 3,741.85	
	CM		10%		\$ 3,741.85	
Total					\$ 44,902.20	

Naval Base Commuter Multi-Modal Mobility Planning Study						
Cost Analysis						
Site Option: 2.3 Supply Additional Bicycle Storage Areas						
Roadway Costs						
Item No.	Description	Unit	Quantity	Unit Cost	Total Cost	Notes
Preliminary						
	Mobilization	LS	1		\$ 2,100.00	12% of total construction cost
	Construction Stake Out	LS	1		\$ 350.00	2% of total construction cost
Facility						
	Bike Racks	EA	25	\$ 700.00	\$ 17,500.00	2017 RS Means - page 190
	Small Sign on Wood Supports	EA		\$ 500.00	\$ -	
	Curb and Gutter	LF	0	\$ 45.00	\$ -	
	Concrete Sidewalk, 5"	SF	0	\$ 15.00	\$ -	
Subtotal					\$ 17,500.00	
Contingent Categories				Subtotal	\$ 19,950.00	
	Preliminary		15%	\$ 19,950.00	\$ 2,992.50	
	Drainage		5%	\$ 19,950.00	\$ 997.50	
	Landscape		5%	\$ 19,950.00	\$ 997.50	
Subtotal 2					\$ 22,487.50	
	Contingency		40%		\$ 8,995.00	40% of Subtotal 2
Subtotal 3					\$ 31,482.50	
	Engineering		10%		\$ 3,148.25	
	CM		10%		\$ 3,148.25	
Total					\$ 37,779.00	

Naval Base Commuter Multi-Modal Mobility Planning Study Cost Analysis Site Option: 2.6a Re-stripe Existing Bike Lanes on MD 235						
Roadway Costs						
Item No.	Description	Unit	Quantity	Unit Cost	Total Cost	Notes
Preliminary						
	Mobilization	LS	1		\$ 10,245.00	12% of total construction cost
	Construction Stake Out	LS	1		\$ 1,705.00	2% of total construction cost
Roadway						
	5" White Thermoplastic Paint for Edge Line	MI	9.2	\$ 7,920.00	\$ 72,864.00	SHA Cost Estimating Guide
	Pavement Marking Symbols (Bike Markings)	SF	500	\$ 5.00	\$ 2,500.00	Assumed 25 SF per marking, 10 markings January 2019 Price Index
	Small Sign on Wood Supports	EA	20	\$ 500.00	\$ 10,000.00	Assumed 2 SF Signs, 10 new signs. SHA Cost Estimating Manual
	Curb and Gutter	LF	0	\$ 45.00	\$ -	?
	Concrete Sidewalk, 5"	SF	0	\$ 15.00	\$ -	
Subtotal					\$ 85,364.00	
Contingent Categories				Subtotal	\$ 97,314.00	
	Preliminary		15%	\$ 97,314.00	\$ 14,597.10	
	Drainage		5%	\$ 97,314.00	\$ 4,865.70	
	Landscape		5%	\$ 97,314.00	\$ 4,865.70	
Subtotal 2					\$ 109,692.50	
	Contingency		40%		\$ 43,877.00	40% of Subtotal 2
Subtotal 3					\$ 153,569.50	
	Engineering		10%		\$ 15,356.95	
	CM		10%		\$ 15,356.95	
Total					\$ 184,283.40	

Naval Base Commuter Multi-Modal Mobility Planning Study						
Cost Analysis						
Site Option: 2.6b Create a Separated Bike Path Along MD 235						
Roadway Costs						
Item No.	Description	Unit	Quantity	Unit Cost	Total Cost	Notes
Preliminary						
	Mobilization	LS	1		\$ 460,000.00	12% of total construction cost
	Construction Stake Out	LS	1		\$ 76,665.00	2% of total construction cost
Roadway						
	Shared-Use Path	LANE-MI	4	\$ 1,000,000.00	\$ 3,833,333.33	SHA Cost Estimating Guide
Subtotal					\$ 3,833,333.33	
Contingent Categories				Subtotal	\$ 4,369,998.33	
	Preliminary		15%	\$ 4,369,998.33	\$ 655,499.75	
	Drainage		5%	\$ 4,369,998.33	\$ 218,499.92	
	Landscape		5%	\$ 4,369,998.33	\$ 218,499.92	
Subtotal 2					\$ 4,925,832.92	
	Contingency		40%		\$ 1,970,333.17	40% of Subtotal 2
Subtotal 3					\$ 6,896,166.08	
	Engineering		10%		\$ 689,616.61	
	CM		10%		\$ 689,616.61	
Total					\$ 8,275,399.30	

Naval Base Commuter Multi-Modal Mobility Planning Study						
Cost Analysis						
Site Option: 2.6c Extend Bike Lane on MD 235 to Hermanville Rd						
Roadway Costs						
Item No.	Description	Unit	Quantity	Unit Cost	Total Cost	Notes
Preliminary						
	Mobilization	LS	1		\$ 4,645.00	12% of total construction cost
	Construction Stake Out	LS	1		\$ 775.00	2% of total construction cost
Roadway						
	5" White Thermoplastic Paint for Edge Line	MI	4.1	\$ 7,920.00	\$ 32,313.60	SHA Cost Estimating Guide
	Pavement Marking Symbols (Bike Markings)	SF	275	\$ 5.00	\$ 1,375.00	Assumed 25 SF per marking, 10 markings January 2019 Price Index
	Small Sign on Wood Supports	EA	10	\$ 500.00	\$ 5,000.00	Assumed 2 SF Signs, 10 new signs. SHA Cost Estimating Manual
	Curb and Gutter	LF	0	\$ 45.00	\$ -	?
	Concrete Sidewalk, 5"	SF	0	\$ 15.00	\$ -	
Subtotal					\$ 38,688.60	
Contingent Categories				Subtotal	\$ 44,108.60	
	Preliminary		15%	\$ 44,108.60	\$ 6,616.29	
	Drainage		5%	\$ 44,108.60	\$ 2,205.43	
	Landscape		5%	\$ 44,108.60	\$ 2,205.43	
Subtotal 2					\$ 49,715.75	
	Contingency		40%		\$ 19,886.30	40% of Subtotal 2
Subtotal 3					\$ 69,602.05	
	Engineering		10%		\$ 6,960.21	
	CM		10%		\$ 6,960.21	
Total					\$ 83,522.46	

Naval Base Commuter Multi-Modal Mobility Planning Study						
Cost Analysis						
Site Option: 3.1 Construct Sidewalks						
Roadway Costs						
Item No.	Description	Unit	Quantity	Unit Cost	Total Cost	Notes
Preliminary						
	Mobilization	LS	1		\$ 1,021,970.00	12% of total construction cost
	Construction Stake Out	LS	1		\$ 170,330.00	2% of total construction cost
Facility						
	Concrete Sidewalk, 5"	SF	567,760	\$ 15.00	\$ 8,516,400.00	
Subtotal					\$ 8,516,400.00	
Contingent Categories				Subtotal	\$ 9,708,700.00	
	Preliminary		40%	\$ 9,708,700.00	\$ 3,883,480.00	
	Drainage		30%	\$ 9,708,700.00	\$ 2,912,610.00	
	Landscape		6%	\$ 9,708,700.00	\$ 582,522.00	
Subtotal 2					\$ 15,895,012.00	
	Contingency		40%		\$ 6,358,004.80	40% of Subtotal 2
Subtotal 3					\$ 22,253,016.80	
	Engineering		10%		\$ 2,225,301.68	
	CM		10%		\$ 2,225,301.68	
Total					\$ 26,703,620.16	

Naval Base Commuter Multi-Modal Mobility Planning Study						
Cost Analysis						
Site Option: 3.2 Install Pedestrian Crossings and Signals						
Roadway Costs						
Item No.	Description	Unit	Quantity	Unit Cost	Total Cost	Notes
Preliminary						
	Mobilization	LS	1		\$ 12,840.00	12% of total construction cost
	Construction Stake Out	LS	1		\$ 2,140.00	2% of total construction cost
Facility						
	5" White Thermoplastic Paint for Edge Line	MI	0.25	\$ 7,920.00	\$ 1,980.00	
	Install Pedestrian Signal	EA	7	\$ 15,000.00	\$ 105,000.00	
Subtotal					\$ 106,980.00	
Contingent Categories				Subtotal	\$ 121,960.00	
	Preliminary		40%	\$ 121,960.00	\$ 48,784.00	
	Drainage		30%	\$ 121,960.00	\$ 36,588.00	
	Landscape		6%	\$ 121,960.00	\$ 7,317.60	
Subtotal 2					\$ 199,669.60	
	Contingency		40%		\$ 79,867.84	40% of Subtotal 2
Subtotal 3					\$ 279,537.44	
	Engineering		10%		\$ 27,953.74	
	CM		10%		\$ 27,953.74	
Total					\$ 335,444.93	

Naval Base Commuter Multi-Modal Mobility Planning Study						
Cost Analysis						
Site Option: 3.3 Implement Ped Crossing of MD 235						
Roadway Costs						
Item No.	Description	Unit	Quantity	Unit Cost	Total Cost	Notes
Preliminary						
	Mobilization	LS	1		\$ 8,370.00	12% of total construction cost
	Construction Stake Out	LS	1		\$ 1,395.00	2% of total construction cost
Facility						
	5" White Thermoplastic Paint for Edge Line	MI	0.09	\$ 7,920.00	\$ 750.00	
	Install Pedestrian Signal	EA	4	\$ 15,000.00	\$ 60,000.00	
	Concrete Sidewalk, 5"	SF	600	\$ 15.00	\$ 9,000.00	
Subtotal					\$ 69,750.00	
Contingent Categories					Subtotal	\$ 79,515.00
	Preliminary		40%	\$ 79,515.00	\$ 31,806.00	
	Drainage		30%	\$ 79,515.00	\$ 23,854.50	
	Landscape		6%	\$ 79,515.00	\$ 4,779.90	
Subtotal 2					\$ 130,181.40	
	Contingency		40%		\$ 52,072.56	40% of Subtotal 2
Subtotal 3					\$ 182,253.96	
	Engineering		10%		\$ 18,225.40	
	CM		10%		\$ 18,225.40	
Total					\$ 218,704.75	

Naval Base Commuter Multi-Modal Mobility Planning Study						
Cost Analysis						
Site Option: 4.1 Add Bike Lane from Cuddihy Rd to Millstone Rd						
Roadway Costs						
Item No.	Description	Unit	Quantity	Unit Cost	Total Cost	Notes
Preliminary						
	Mobilization	LS	1		\$ 3,560.00	12% of total construction cost
	Construction Stake Out	LS	1		\$ 595.00	2% of total construction cost
Roadway						
	5" White Thermoplastic Paint for Edge Line	MI	2.8	\$ 7,920.00	\$ 22,176.00	SHA Cost Estimating Guide
	Pavement Marking Symbols (Bike Markings)	SF	300	\$ 5.00	\$ 1,500.00	Assumed 25 SF per marking, 12 markings January 2019 Price Index
	Small Sign on Wood Supports	EA	12	\$ 500.00	\$ 6,000.00	Assumed 2 SF Signs, 12 new signs. SHA Cost Estimating Manual
	Curb and Gutter	LF	0	\$ 45.00	\$ -	
	Concrete Sidewalk, 5"	SF	0	\$ 15.00	\$ -	
Subtotal					\$ 29,676.00	
Contingent Categories				Subtotal	\$ 33,831.00	
	Preliminary		15%	\$ 33,831.00	\$ 5,074.65	
	Drainage		5%	\$ 33,831.00	\$ 1,691.55	
	Landscape		5%	\$ 33,831.00	\$ 1,691.55	
Subtotal 2					\$ 38,133.75	
	Contingency		40%		\$ 15,253.50	40% of Subtotal 2
Subtotal 3					\$ 53,387.25	
	Engineering		10%		\$ 5,338.73	
	CM		10%		\$ 5,338.73	
Total					\$ 64,064.70	

Naval Base Commuter Multi-Modal Mobility Planning Study						
Cost Analysis						
Site Option: 4.2 Cuddihy Road and Buse Road Intersection Improvements						
Roadway Costs						
Item No.	Description	Unit	Quantity	Unit Cost	Total Cost	Notes
Preliminary						
	Mobilization	LS	1		\$ 8,395.00	12% of total construction cost
	Construction Stake Out	LS	1		\$ 1,400.00	2% of total construction cost
Roadway						
	5" White Thermoplastic Paint for Lane Line	MI	0.09	\$ 7,920.00	\$ 750.00	SHA Cost Estimating Guide
	5" White Thermoplastic Paint for Crosswalks	MI	0.15	\$ 7,921.00	\$ 1,200.15	SHA Cost Estimating Guide
	Traffic Signal Timing Modification	LS	1	\$ 7,000.00	\$ 7,000.00	
	Install Pedestrian Signal	EA	4	\$ 15,000.00	\$ 60,000.00	
	Small Sign on Wood Supports	SF	2	\$ 500.00	\$ 1,000.00	
	Concrete Sidewalk, 5"	SF	0	\$ 15.00	\$ -	
Subtotal					\$ 69,950.15	
Contingent Categories				Subtotal	\$ 79,745.15	
	Preliminary		15%	\$ 79,745.15	\$ 11,961.77	
	Drainage		5%	\$ 79,745.15	\$ 3,987.26	
	Landscape		5%	\$ 79,745.15	\$ 3,987.26	
Subtotal 2					\$ 89,886.44	
	Contingency		40%		\$ 35,954.58	40% of Subtotal 2
Subtotal 3					\$ 125,841.02	
	Engineering		10%		\$ 12,584.10	
	CM		10%		\$ 12,584.10	
Total					\$ 151,009.22	

Naval Base Commuter Multi-Modal Mobility Planning Study						
Cost Analysis						
Site Option: 4.4 Widen Cedar Point Road for 5' Bike Lanes						
Roadway Costs						
Item No.	Description	Unit	Quantity	Unit Cost	Total Cost	Notes
Preliminary						
	Mobilization	LS	1		\$ 9,470.00	12% of total construction cost
	Construction Stake Out	LS	1		\$ 1,580.00	2% of total construction cost
	Roadway Widening - Collector	LANE-FT	417	\$ 189.39	\$ 78,914.14	SHA Cost Estimating Guide
Subtotal					\$ 78,914.14	
Contingent Categories				Subtotal	\$ 89,964.14	
	Preliminary		40%	\$ 89,964.14	\$ 35,985.66	
	Drainage		30%	\$ 89,964.14	\$ 26,989.24	
	Landscape		6%	\$ 89,964.14	\$ 5,397.85	
Subtotal 2					\$ 147,286.89	
	Contingency		40%		\$ 58,914.76	40% of Subtotal 2
Subtotal 3					\$ 206,201.64	
	Engineering		10%		\$ 20,620.16	
	CM		10%		\$ 20,620.16	
Total					\$ 247,441.97	

Naval Base Commuter Multi-Modal Mobility Planning Study						
Cost Analysis						
Site Option: 4.5 Buse Rd and Liljencrantz Rd Intersection Improvements						
Roadway Costs						
Item No.	Description	Unit	Quantity	Unit Cost	Total Cost	Notes
Preliminary						
	Mobilization	LS	1		\$ 60.00	12% of total construction cost
	Construction Stake Out	LS	1		\$ 10.00	2% of total construction cost
Roadway						
	5" White Thermoplastic Paint for Edge Line	MI		\$ 7,920.00	\$ -	SHA Cost Estimating Guide
	Pavement Marking Symbols (Bike Markings)	SF		\$ 5.00	\$ -	Assumed 25 SF per marking, 12 markings January 2019 Price Index
	Small Sign on Wood Supports	EA	1	\$ 500.00	\$ 500.00	Assumed 2 SF Signs, 12 new signs. January 2019 Price Index
	Curb and Gutter	LF	0	\$ 45.00	\$ -	
	Concrete Sidewalk, 5"	SF	0	\$ 15.00	\$ -	
Subtotal					\$ 500.00	
Contingent Categories				Subtotal	\$ 570.00	
	Preliminary		15%	\$ 570.00	\$ 85.50	
	Drainage		5%	\$ 570.00	\$ 28.50	
	Landscape		5%	\$ 570.00	\$ 28.50	
Subtotal 2					\$ 642.50	
	Contingency		40%		\$ 257.00	40% of Subtotal 2
Subtotal 3					\$ 899.50	
	Engineering		10%		\$ 89.95	
	CM		10%		\$ 89.95	
Total					\$ 1,079.40	

Naval Base Commuter Multi-Modal Mobility Planning Study						
Cost Analysis						
Site Option: 4.6 Extend a Ped/Bike Connection from Davis Spur Rd to Tate Rd						
Roadway Costs						
Item No.	Description	Unit	Quantity	Unit Cost	Total Cost	Notes
Preliminary						
	Mobilization	LS	1		\$ 21,115.00	12% of total construction cost
	Construction Stake Out	LS	1		\$ 3,520.00	2% of total construction cost
	Shared-Use Path	LANE-FT	929	\$ 189.39	\$ 175,978.54	SHA Cost Estimating Guide
Subtotal					\$ 175,978.54	
Contingent Categories				Subtotal	\$ 200,613.54	
	Preliminary		40%	\$ 200,613.54	\$ 80,245.41	
	Drainage		30%	\$ 200,613.54	\$ 60,184.06	
	Landscape		6%	\$ 200,613.54	\$ 12,036.81	
Subtotal 2					\$ 328,444.82	
	Contingency		40%		\$ 131,377.93	40% of Subtotal 2
Subtotal 3					\$ 459,822.75	
	Engineering		10%		\$ 45,982.28	
	CM		10%		\$ 45,982.28	
Total					\$ 551,787.30	

Naval Base Commuter Multi-Modal Mobility Planning Study						
Cost Analysis						
Site Option: 4.7 Install Ped Signal at Cedar Point and Tate Road Intersection						
Roadway Costs						
Item No.	Description	Unit	Quantity	Unit Cost	Total Cost	Notes
Preliminary						
	Mobilization	LS	1		\$ 8,040.00	12% of total construction cost
	Construction Stake Out	LS	1		\$ 1,340.00	2% of total construction cost
Roadway						
	5" White Thermoplastic Paint for Lane Line	MI		\$ 7,920.00	\$ -	SHA Cost Estimating Guide
	5" White Thermoplastic Paint for Crosswalks	MI		\$ 7,921.00	\$ -	SHA Cost Estimating Guide
	Traffic Signal Timing Modification	LS	1	\$ 7,000.00	\$ 7,000.00	
	Install Pedestrian Signal	EA	4	\$ 15,000.00	\$ 60,000.00	
	Sheet Aluminum Sign	SF		\$ 50.00	\$ -	
	Concrete Sidewalk, 5"	SF		\$ 15.00	\$ -	
Subtotal					\$ 67,000.00	
Contingent Categories				Subtotal	\$ 76,380.00	
	Preliminary		15%	\$ 76,380.00	\$ 11,457.00	
	Drainage		5%	\$ 76,380.00	\$ 3,819.00	
	Landscape		5%	\$ 76,380.00	\$ 3,819.00	
Subtotal 2					\$ 86,095.00	
	Contingency		40%		\$ 34,438.00	40% of Subtotal 2
Subtotal 3					\$ 120,533.00	
	Engineering		10%		\$ 12,053.30	
	CM		10%		\$ 12,053.30	
Total					\$ 144,639.60	

Naval Base Commuter Multi-Modal Mobility Planning Study						
Cost Analysis						
Site Option: 4.9 Re-Stripe Bike Loop around Base						
Roadway Costs						
Item No.	Description	Unit	Quantity	Unit Cost	Total Cost	Notes
Preliminary						
	Mobilization	LS	1		\$ 37,110.00	12% of total construction cost
	Construction Stake Out	LS	1		\$ 6,185.00	2% of total construction cost
Roadway						
	5" White Thermoplastic Paint for Edge Line	MI	35.1	\$ 7,920.00	\$ 277,992.00	SHA Cost Estimating Guide
	Pavement Marking Symbols (Bike Markings)	SF	1,250	\$ 5.00	\$ 6,250.00	Assumed 25 SF per marking, 50 markings January 2019 Price Index
	Small Sign on Wood Supports	EA	50	\$ 500.00	\$ 25,000.00	Assumed 2 SF Signs, 50 new signs. SHA Cost Estimating Manual
	Curb and Gutter	LF	0	\$ 45.00	\$ -	
	Concrete Sidewalk, 5"	SF	0	\$ 15.00	\$ -	
Subtotal					\$ 309,242.00	
Contingent Categories				Subtotal	\$ 352,537.00	
	Preliminary		15%	\$ 352,537.00	\$ 52,880.55	
	Drainage		5%	\$ 352,537.00	\$ 17,626.85	
	Landscape		5%	\$ 352,537.00	\$ 17,626.85	
Subtotal 2					\$ 397,376.25	
	Contingency		40%		\$ 158,950.50	40% of Subtotal 2
Subtotal 3					\$ 556,326.75	
	Engineering		10%		\$ 55,632.68	
	CM		10%		\$ 55,632.68	
Total					\$ 667,592.10	

Naval Base Commuter Multi-Modal Mobility Planning Study						
Cost Analysis						
Site Option: 4.10 Improve all Taxiway Crossings						
Roadway Costs						
Item No.	Description	Unit	Quantity	Unit Cost	Total Cost	Notes
Preliminary						
	Mobilization	LS	1		\$ 67,200.00	12% of total construction cost
	Construction Stake Out	LS	1		\$ 11,200.00	2% of total construction cost
Roadway						
	Install Traffic Signals at Taxiway Intersections	EA	8	\$ 60,000.00	\$ 480,000.00	
	Install Flashing Beacon at Taxiway Intersections	EA	8	\$ 10,000.00	\$ 80,000.00	
	Sheet Aluminum Sign	SF		\$ 50.00	\$ -	
	Concrete Sidewalk, 5"	SF		\$ 15.00	\$ -	
Subtotal					\$ 560,000.00	
Contingent Categories						
				Subtotal	\$ 638,400.00	
	Preliminary		15%	\$ 638,400.00	\$ 95,760.00	
	Drainage		5%	\$ 638,400.00	\$ 31,920.00	
	Landscape		5%	\$ 638,400.00	\$ 31,920.00	
Subtotal 2					\$ 719,600.00	
	Contingency		40%		\$ 287,840.00	40% of Subtotal 2
Subtotal 3					\$ 1,007,440.00	
	Engineering		10%		\$ 100,744.00	
	CM		10%		\$ 100,744.00	
Total					\$ 1,208,928.00	

8. Conclusion

In analyzing all aspects of the current NAS/PAX transportation system, the Naval Base Commuter Multi-Modal Mobility Planning Study has laid out a series of recommendations and implementation strategies to successfully promote multi-modal mobility and transform the current conditions along the MD 235 corridor. In moving forward, it will be important for C-SMMPO and NAS/PAX to consider the cost estimates provided and immediate needs of the base community to develop a prioritization plan that will appropriately implement recommendations at a pace to encourage change now.

While implementing change on such a large level is a daunting task, it is important to keep in mind the building blocks that will get the MD 235 corridor to a more efficient future and the impact that changing the behavior of employees even just one day a week can have.

APPENDIX A