Final Report

Naval Air Station Alameda Multimodal Regional Connections Project TIGER Grant Application: Benefit-Cost Analysis

Prepared for

City of Alameda, Alameda Contra-Costa Transit District & Water Emergency Transportation Authority, Co-Applicants

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I. Executive Summary

The following Benefit-Cost Analysis (BCA) demonstrates that the proposed Naval Air Station Alameda Multimodal Regional Connections (NAS Alameda) project is estimated to yield a benefit ratio of between 1.30 (conservative case) to 2.16 (aggressive case) and significant non-monetary livability and environmental benefits.

The NAS Alameda project provides significant measurable benefits primarily in the categories of safety (via reductions in collisions and injuries), environmental benefits (via greenhouse gas emissions reductions), and economic competitiveness (via travel time savings). Additional significant non-monetized social benefits of the project include improved public health (via increased bicycling and walking) and roadway state of good repair (via reduction in the need for development at the urban fringe).

Federal TIGER guidance recommends that applicants discount future benefits and costs to 2016 present values using a real discount rate of 7% to represent the opportunity cost of money in the private sector. TIGER guidance also allows for present value analysis using a 3% discount rate when the funds currently dedicated to the project would be other public expenditures. This is the case for this project, where 21% of project costs are to be funded by the Alameda County Transportation Commission transportation sales tax (Measure BB).

Various aspects of safety benefits were researched and monetized for this analysis, and two scenarios of the BCA were calculated: conservative case (7% discount rate) and aggressive case (3% discount rate).

Summary of Results

Under the conservative case, the estimated BCA ratio is 1.30, and is calculated by dividing the total estimated 20-year benefit ($50.44 million) by the total project cost ($38.7 million). Based on DOT BCA guidelines, project costs do not need to be escalated for the 20-year period to perform this calculation. Using the same methodology described above, under the aggressive case, the estimated BCA ratio is 2.16 with a 20-year total benefit of $ 33.1 million.

A comparative overview of the relationship between total project costs and benefits is illustrated in Table 1: Summary of Results, which summarizes monetized benefits, project costs and potentially significant categories of un-quantified benefits. This summary indicates that the largest benefit is derived from reductions in travel time savings, followed by reductions in injuries from accidents and emissions reductions. It should be noted that the benefit-cost ratio for this analysis is considered highly conservative for several reasons. One of the primary transportation improvements that will result from the proposed plan relates to bicycle lane expansions. While these benefits are treated as qualitative in nature, it is anticipated that the City of Alameda's aggressive focus on behavior change goals to shift vehicle passengers to ferry riders and bicyclists will drive tangible quantitative benefits over time not captured in the benefit-cost ratio presented in this application such as health and recreational benefits.

Table 1: Summary of Results

Project Component	Project Costs	Project Benefits (7% discount rate)[1]	Project Benefits (3% discount rate)
Seaplane Lagoon Ferry Terminal			
(a) Travel Time Savings - Ferry		$33,150,240	$59,762,943
(b) Collision Reductions at Webster Street/RAMP		$174,383	$278,897
(c) Greenhouse Gas Emissions Reductions		$93,752	$-
Subtotal	**$18,200,000**	**$33,418,375**	**$60,041,840**
Ralph Appezzato Memorial Parkway (RAMP) BRT Lanes			
(d) Collision Reductions - Multi-Use Path		$5,668,963	$8,727,643
(e) Travel Time Savings - Bus		$325,176	$564,310
(f) Travel Time Savings - Automobile		$887,727	$1,540,558
(g) Greenhouse Gas Emissions Reductions		$1,250,532	$-
Subtotal	**$12,027,000**	**$8,132,398**	**$10,832,511**
Willie Stargell Avenue			
(h) Travel Time Savings - Queue Jump Lanes		$495,436	$859,779
(i) Collision Reductions - Multi-Use Path		$3,619,939	$5,573,072
(j) Greenhouse Gas Emissions Reductions		$712,872	$-
Subtotal	**$3,237,000**	**$4,828,247**	**$6,432,851**
Central Avenue			
(k) Collision Reductions - Main St/Pacific Ave Intersection Realignment		$4,063,886	$6,256,549
(l) Greenhouse Gas Emissions Reductions		$-	$-
Subtotal	**$5,250,000**	**$4,063,886**	**$6,256,549**
Total	**$38,714,000**	**$50,442,906**	**$83,563,750**
Ratio (Benefit to Cost)		**1.30**	**2.16**
Net Benefit		**$11,728,906**	**$33,120,844**

1/Project benefits include the monetized value of time savings, collision reductions, and greenhouse gas emission reductions.

Source: 2016 Benefit-Cost Analysis Guidance for Tiger Grant Applicants, US Department of Transportation; Kittelson & Associates, Inc.; Willdan, 2016.

The detailed assumptions and calculations supporting the calculation of benefits are provided in Table 7: Monetized Value of Travel Time Savings through **Error! Reference source not found.** later in this report.

Project Background

The City of Alameda is home to 900 acres of the former NAS Alameda, which when closed in 1997 resulted in the loss of over 18,000 local jobs. It now offers one of the largest infill redevelopment opportunities in the San Francisco Bay Area, with the potential to create thousands of new housing units and close to 9,000 jobs within the region, not the outskirts. The large-scale transit-oriented development planned for the NAS Alameda property will result in reduced commute times and vehicular miles travelled, and fewer greenhouse gas emissions.

However, overcoming Alameda's isolation is a major hurdle. The Army Corps of Engineers dredged the Oakland Estuary in 1902, separating Alameda from the mainland. There are limited crossings on and off the island, which are already at capacity today, and Alameda is the only major city in Alameda County without a Bay Area Rapid Transit station or direct freeway access.

The only way that the City of Alameda can accommodate significant growth at the former NAS Alameda is if Alameda can be effectively stitched into the regional multimodal transportation network. A new ferry terminal and multimodal complete streets in Alameda, including dedicated lanes for bus rapid transit, queue jump lanes for buses, protected bikeways, bike lanes and pedestrian walkways, are crucial to re-connecting Alameda with the regional transit system and facilitating successful transit-oriented development at the former military property.

There are other regional assets in and around the NAS Alameda property that need better access to the regional transportation network that will also benefit directly from multimodal complete streets, including a new Veteran's Administration outpatient clinic and columbarium; the College of Alameda (a public community college); 200 units of supportive housing for formerly homeless veterans, survivors of domestic violence, and families; and a new transit hub for buses and ferries.

Connecting the substantial existing and planned jobs and housing throughout the Bay Area with the housing, employment centers and other regional assets in and around the former NAS Alameda via multimodal streets is crucial to preventing growth from clogging local and regional streets with cars and ultimately, to the success of this unparalleled infill development opportunity. To address this need, the City is implementing the NAS Alameda project to create multimodal streets along key corridors leading into the tubes that connect west Alameda (and the former NAS Alameda) with the region.

Phase 1 of the Project consists of major elements, such as queue jump lanes and dedicated bike and pedestrian paths along primary transportation corridors, which are either in the design or construction stages with completion expected by the end of 2017. The Final Phase of the Project, including a new ferry terminal at the Seaplane Lagoon, over a mile of dedicated bus rapid transit lanes, creation of queue jumps at two key intersections and 3.5 miles of protected cycle paths, will be funded primarily (53 percent) through regional transportation sales tax dollars and private funding from developers. The City is seeking a TIGER grant to provide the last funding for completion of the Final Phase of the Project.

This BCA provides the detailed calculations and assumptions related to key transportation infrastructure improvements that will serve to revitalize NAS Alameda by reconnecting to the community and to the regional economy. The total estimated cost of these proposed infrastructure improvements is $38.7 million. The City of Alameda, the Alameda Contra-Costa Transit District (AC Transit) and the Water Emergency Transportation Authority (WETA) are jointly applying for TIGER Grant funding to ensure that the needed infrastructure improvements are in place to support the proposed residential and commercial development envisioned by the former NAS Alameda military base. Together, the proposed public infrastructure improvements and private redevelopment and reuse activity will:

- Construct a new Seaplane Lagoon ferry terminal at the heart of NAS Alameda, which will connect to San Francisco and Alameda's proposed BRT and will improve the region's ability to respond to emergencies and transportation disruptions
- Provide safe alternate paths for bicycles and pedestrians along Main Street, Central Avenue, Willie Stargell Avenue, and the portion of Ralph Appezzato Memorial Parkway (RAMP) west of Main Street for travelers to reach and travel within NAS Alameda from elsewhere in the City of Alameda and the region, preventing accidents and injuries
- Create dedicated bus lanes along RAMP, reducing transit times and saving energy
- Create queue jump lanes for transit along Willie Stargell Avenue, reducing transit times and saving energy
- Increase connectivity to, and reduce the isolation of, the former NAS Alameda and the City of Alameda as a whole

- Create or improve regional connections between people and centers of employment, education, and services, especially for transbay commuters who are experiencing delays and congestion due to the capacity issues of the Bay Bridge, BART transbay tube and the existing ferry system
- Promote workforce development
- Revitalize the community with a model sustainable development on a present-day brownfield site
- Construct the foundation of a Transit Oriented Development (TOD) in the heart of the San Francisco Bay area through new strategic partnerships and extensive multi-jurisdictional cooperation
- Provide access to affordable housing choices with a 25% affordable requirement as well as employment and recreational opportunities totaling over 250 acres of parks and open space in a high-quality waterfront community that also includes land set aside for endangered species
- Reduce air and water pollution, and create green development at a former Superfund site using the latest low-impact development techniques
- Leverage Federal funding through innovative local and regional funding aligned with private investment

A summary of project's baseline assumptions along with the types of impacts, populations to be affected, economic benefits, and potentially significant categories of unquantifiable benefits is provided in the following Table 2 and Table 3.

Table 2: Detailed NAS Alameda MRCP Benefit Matrix

Current Status/Baseline & Problem to be Addressed	Change to Baseline/ Alternatives	Type of Impacts	Population Affected by Impacts	Economic Benefit	Summary of Total Benefits (7% discount rate)
Seaplane Lagoon Ferry Terminal					
▪ Existing ferry system is close to capacity	▪ Constructs a new ferry terminal at NAS Alameda	▪ Reduced travel time for transit vehicles and reduced travel time for automobile traffic	▪ 1,124,250 transit passengers annually ▪ 4,374,000 automobile passengers annually	▪ Monetized value of reduced transit and automobile travel times ▪ Monetized value of greenhouse gas emissions	**$33.42 M**
Ralph Appezzato Memorial Parkway (RAMP) Dedicated Bus Lanes /1,2					
▪ Projected Year 2035 traffic congestion for transit vehicles increases travel time ▪ Existing roadway facility creates safety hazard for bicyclists	▪ Bus-only lanes along Appezzato Pkwy between Webster Street and Ferry Terminal[1]	▪ Reduced travel time for transit vehicles and reduced travel time for automobile traffic[2] ▪ Reduced collisions and greenhouse gas emissions	▪ 1,124,250 transit passengers annually ▪ 4,374,000 automobile passengers annually ▪ Number of drivers/bicyclists injured	▪ Monetized value of reduced transit and automobile travel times ▪ Monetized value of safety benefits and greenhouse gas emissions	**$8.13 M**
Willie Stargell Avenue /3					
▪ Projected Year 2035 traffic congestion for transit vehicles increases travel time ▪ Existing roadway facility creates safety hazard for bicyclists	▪ Queue jump lanes along Willie Stargell Avenue at Main Street and Fifth Street intersections[1] ▪ Multi-use path along Willie Stargell Avenue	▪ Reduced travel time for transit vehicles and reduced travel time for automobile traffic[1] ▪ Reduced greenhouse gas emissions ▪ Reduced collisions	▪ 1,627,500 transit passengers annually ▪ Number of drivers/ bicyclists injured	▪ Monetized value of reduced transit and automobile travel times ▪ Monetized value of greenhouse gas emissions ▪ Estimated dollar value of safety benefits	**$4.83 M**
Central Avenue/Main Street/Pacific Avenue Intersection					
▪ Existing roadway facility creates safety hazard for bicyclists	▪ Main Street and Central Avenue: protected bikeways, bus stop islands/upgrades, safer pedestrian crossings and rain gardens	▪ Reduced collisions and greenhouse gas emissions	▪ Number of drivers/ bicyclists injured	▪ Estimated dollar value of safety benefits and greenhouse gas emissions	**$4.06 M**

1/Annual transit passenger count for RAMP are based on 4,497 average weekday trips forecast for 2035, multiplied by 250 days (to exclude weekends and holidays)
2/Annual vehicle passenger count for RAMP based on17,496 average weekday person trips forecast for 2035, multiplied by 250 days (to exclude weekends and holidays).
3/Annual transit passenger count for Willie Stargell Avenue queue jump lanes based on 6,510 average weekday trips forecast for 2035, multiplied by 250 days (to exclude weekends and holidays).

Source: 2016 Benefit-Cost Analysis Guidance for Tiger Grant Applicants, US Department of Transportation; Kittelson & Associates, Inc.; Willdan, 2016.

Table 3: Summary of Potentially Significant Categories of Unquantifiable Benefits

Project Component	Potentially Significant Categories of Unquantifiable Benefits
Seaplane Lagoon Ferry Terminal	
Travel Time Savings – Ferry Travel Time Savings – Automobile Greenhouse Gas Emissions Reductions	▪ Improved regional access to jobs within the former NAS Alameda ▪ Property value increases ▪ Connection to RAMP Dedicated Bus Lanes ▪ Future TOD transit spine
Ralph Appezzato Memorial Parkway (RAMP) Dedicated Bus Lanes	
Travel Time Savings - Bus Travel Time Savings - Automobile Greenhouse Gas Emissions Reductions Collision Reductions – RAMP/Webster Street Intersection	▪ Improved regional access to jobs within the former NAS Alameda ▪ Property value increases ▪ Connection to future ferry terminal in Seaplane Lagoon ▪ Future TOD transit spine ▪ Improved health and recreation from bicycle and pedestrian lanes west of Main Street
Willie Stargell Avenue	
Travel Time Savings - Queue Jump Lanes Collision Reductions - Multi-Use Path Greenhouse Gas Emissions Reductions	▪ Improved regional access to jobs within the former NAS Alameda ▪ Improved health and recreation associated with bicycling and walking
Central Avenue/Main Street/Pacific Avenue	
Collision Reductions - Bicycle Lanes Collision Reductions - Main St/Pacific Ave Intersection Realignment Greenhouse Gas Emissions Reductions	▪ Improved health and recreation associated with bicycling and walking ▪ Improved transportation options

[1]Project benefits include the monetized value of time savings, collision reductions, and greenhouse gas emission reductions.

Source: 2016 Benefit-Cost Analysis Guidance for Tiger Grant Applicants, US Department of Transportation; Kittelson & Associates, Inc.; Willdan, 2016.

I. Introduction

This Appendix presents the key findings and describes the methodology and assumptions behind the BCA for the NAS Alameda MRCP TIGER Grant Application. The analysis and findings are based on research and analysis conducted by a team of technical consultants with input and direction from the City of Alameda, AC Transit, WETA and other stakeholders.

As illustrated on the next page in Table 5, the factors evaluated in this BCA specifically address the key selection criteria identified in the DOT's Notice of Funding Availability (NOFA) for the TIGER Discretionary grant program (Table 4). For example, the net economic benefits associated with reduced travel time directly address the "economic competitiveness" criterion. Issues related to Economic Competitiveness are also further addressed in this analysis. Likewise, the expected reductions in collisions and carbon emissions contribute directly to the "safety" and "environmental sustainability" criteria, respectively.

Table 4: Primary TIGER Grant Benefit Categories

Long-Term Outcome	Types of Societal Benefits
Livability	Land Use Changes that Reduce VMT Increased Accessibility Property Value Increases Improved Public Health and Recreation
Economic Competitiveness	Travel Time Savings Operating Costs Savings
Safety	Prevented Accidents (Property Damage), Injuries and Fatalities
State of Good Repair	Deferral of Complete Replacement Maintenance & Repair Savings
Environmental Sustainability	Reduced VMT Environmental Benefits from Reduced Emissions

Source: 2016 Benefit-Cost Analysis Guidance for Tiger Grant Applicants, US Department of Transportation, 2016.

As directed by the NOFA, this analysis acknowledges that several of the benefits analyzed fall into more than one of the selection criteria, and focuses on quantifying the benefit itself instead of attempting to precisely place each benefit under specific criteria.

We also analyze the full spectrum of benefits, and attempt to quantify those that can reasonably be quantified, but we start with a very focused analysis in which we specifically monetize only those benefits which 1) the proposed Project improvements are specifically intended to generate, 2) does not double count any of the other monetized benefits, and 3) is easily quantified based on best practices. A summary of the former NAS Alameda BCA benefits relative to the NOFA criteria follows.

Table 5: Summary of NAS Alameda MRCP BCA Benefits Relative to NOFA Criteria

Factors Analyzed	State of Good Repair	Economic Competitiveness	Livability	Environmental Sustainability	Safety	Monetized in BCA
Travel Time Savings	**X**	**X**				**Yes**
Greenhouse Gas Emissions Reductions			**X**	**X**		**Yes**
Collision Reductions					**X**	**Yes**
Improved Transportation Options and Mode Shift			**X**	**X**		**No**
Improved Public Health and Recreation			**X**			**No**
Lower Road Maintenance Costs	**X**					**No**
Energy Savings from Heat-Island Reductions				**X**		**No**
CO2 Sequestration by Trees				**X**		**No**

Source: 2016 Benefit-Cost Analysis Guidance for Tiger Grant Applicants, US Department of Transportation, Kittelson & Associates; Willdan, 2016.

This Appendix consists of the following key sections:

I. Project Summary: As a starting point for the analysis and pursuant to the DOT's Notice of Funding Availability, this section summarizes the nature and purpose of the proposed infrastructure project relative to the existing baseline.

II. Analytical Framework: This section describes the overall framework and methodology for the BCA, including a definition of the analytical assumptions both "with" and "without" the proposed infrastructure improvements.

III. Summary of Results: This section presents the key findings of the BCA, specifying those results that have been quantified and those that, although potentially significant, cannot be effectively quantified due to data limitations.

IV. Estimation of Social Costs: This section describes and estimates the "social" costs included in the BCA that are necessary to achieve the associated benefits

V. Estimation of Social Benefits: This section describes and estimates the "social" benefits included in the BCA that are the offset to the associated costs described above.

VI. Additional Social Benefits: This section evaluates, and to the extent possible quantifies, additional social benefits that, although excluded from the more conservative BCA quantification, are nevertheless expected to result from the TIGER Project investments.

II. Project Summary

Definition of the Baseline and Proposed Project Scenarios

The NAS Alameda Multimodal Regional Connections Project BCA is structured to measure costs and benefits of the proposed project against a baseline (also called a "base case" or a "no build" case). According to the guidelines defined by the Notice of Funding Availability (NOFA) for this TIGER grant, the baseline should be an assessment conditions if the project did not receive the requested TIGER Discretionary Grant funding.

In the baseline scenario, assuming no TIGER funding is granted to the former NAS Alameda, both local and regional travel must rely on the existing travel network. In this case, it is reasonable to forecast that the existing conditions baseline case resembles the present state. This assumption factors in completion of already planned and funded projects that would occur even in the absence of the requested project. For future conditions, a year 2035 baseline was used, consistent with the buildout year for the former NAS Alameda development as approved and documented in the former NAS Alameda Environmental Impact Report (EIR). From a land use standpoint, the future conditions baseline assumes the buildout of the former NAS Alameda, in addition to other planned development within Alameda as documented in the Year 2035 Cumulative Plus Project scenario.

The future conditions baseline also assumes future traffic growth per the traffic forecasts from the EIR. From a transportation infrastructure standpoint, the future conditions baseline assumes that high-frequency bus service will have been implemented to connect the former NAS Alameda to the BART stations at Oakland City Center/12th Street and Fruitvale. However, this service will operate without the bus-only lanes and queue jumps identified as part of the requested project.

The proposed project scenario assumes that the following improvements will take place:

- Seaplane Lagoon Ferry Terminal
- Ralph Appezzato Memorial Parkway Bus Rapid Transit Lanes/Multimodal Street Conversion
- Stargell Avenue Queue Jump Lanes and Bicycle and Pedestrian Paths
- Main Street and Central Avenue Bicycle Lanes and Realignment

Thus, the difference between the base case and project scenarios is the construction of the proposed projects.

Consideration of Project Alternatives

DOT directs applicants to present and consider reasonable alternatives in the analysis. The projects represent the final portion of a larger project to connect the former NAS Alameda to key locations such as San Francisco, BART stations and the City of Oakland. The applicant, therefore, has not identified any reasonable alternatives to the proposed project, other than the base case.

Categories of Benefits and Costs Included in the BCA

The NAS Alameda Multimodal Regional Connections Project BCA takes into consideration the following categories of benefits and costs:

- Vehicle miles traveled
- Greenhouse gases
- Pedestrian and bicyclist safety

- Resilience of existing transportation networks
- Economic opportunities for small businesses
- Cultural shift away from single-occupant vehicles and toward healthier lifestyles

Current Infrastructure Baseline

The existing transportation conditions within the proposed NAS Alameda project are as follows:

- **Existing Conditions Baseline** – The existing conditions baseline represents on-the-ground conditions as of April 2016. The former NAS Alameda development has not commenced, but will begin later in 2016 and will continue through completion in 2035.
- **Future Conditions Baseline –** The future conditions baseline represents the year 2035 with buildout of the former NAS Alameda redevelopment. For the year 2035, high-frequency bus routes are assumed to be in place connecting the former NAS Alameda to BART stations at Oakland City Center/12th Street and Fruitvale. However, the infrastructure improvements requested through the TIGER grant are assumed not to be in place.

Proposed Project and Project Justification

The Project is comprised of four components, their purpose and summary description as follows:

- Seaplane Lagoon Ferry Terminal
- Ralph Appezzato Memorial Parkway (RAMP) dedicated bus lanes and pedestrian and bicycle paths west of Main Street
- Willie Stargell Avenue Queue Jump Lanes and Bicycle/Pedestrian Paths
- Central Avenue and Main Street Multimodal Complete Street and Intersection Realignment at Main Street and Pacific Avenue

Seaplane Lagoon Ferry Terminal

- **Project Description:** Regional ferry service is a low-risk transbay alternative with proven high demand. The new Seaplane Lagoon ferry terminal will create a transbay transit hub at the heart of NAS Alameda, which will be well located for Alamedans to access by all modes, and especially by bicycle, in a community that is flat and with a temperate climate. For the San Francisco Bay Area, the ferry service plays an important role in coordinating transportation response for natural disasters and emergencies or network disruptions such as scheduled and unscheduled road/bridge or BART closures. The ferry terminal waterside improvements include pier, abutment, gangway and boarding float additions. The ferry terminal landside improvements include shoreline repairs, parking facilities for 400 vehicles, passenger drop-off and pick-up, a public waterfront access path, bikeway access, bike parking and a bus stop at the ferry plaza entrance.

- **Justification:** This transportation access will allow residents of the area far easier access to the job centers of San Francisco, Oakland, and beyond. This project will cut the peak-hour commute transit time to downtown Oakland and offer additional ferry options for reaching downtown San Francisco from west Alameda. This new ferry terminal will improve transbay transportation redundancy to supplement BART and the Bay Bridge corridors, which are at capacity and causing delays for commuters. Furthermore, Alameda's Main Street ferry terminal is reaching capacity, and the ferry service increased 71% between 2012 and 2015, which is causing crowding and parking issues. This new ferry terminal will help relieve the ferry access issues.

Ralph Appezzato Memorial Parkway (RAMP) Dedicated Bus Lanes

- **Project Description:** Dedicated bus lanes are proposed on Ralph Appezzato Memorial Parkway between Webster Avenue and Seaplane Lagoon in the former NAS Alameda. Bicycle lanes and pedestrian facilities are also proposed for the section of RAMP from Main Street west to Seaplane Lagoon. As part of this project, AC Transit is committing to offering service as soon as residents move in to the redeveloped NAS Alameda and to operating high-frequency service to meet demand up to 8-minute intervals.

- **Justification:** The dedicated bus lanes will improve transit travel times between the former NAS Alameda and the City of Oakland. The transit lanes are part of the planned bus route between the former NAS Alameda and the Oakland City Center/12th Street BART station. As traffic growth occurs along RAMP due to the development of the former NAS Alameda, traffic operating conditions and travel speeds are expected to deteriorate. The addition of dedicated bus lanes will allow transit vehicles to avoid queued traffic. The lanes will also result in time savings for automobile traffic, as bus stop boardings and alightings will not occur within the automobile travel lane. Bicycle and pedestrian facilities will further improve multimodal access to the ferry terminal by providing safe accommodations that separate users from moving traffic.

Willie Stargell Avenue Bus Queue Jump Lanes

- **Project Description:** Transit queue jump lanes are proposed along Willie Stargell Avenue at the intersections of Main Street and Fifth Street.

- **Justification:** The queue jump lanes will improve transit travel times between the former NAS Alameda and the City of Oakland. The transit lanes are part of the planned bus route between the former NAS Alameda and Oakland BART stations. As traffic growth occurs along Willie Stargell Avenue due to the development of the former NAS Alameda, traffic operating conditions and travel speeds are expected to deteriorate. The addition of bus queue jump lanes will allow transit vehicles to avoid queued traffic.

Willie Stargell Avenue Shared Use Path

- **Project Description:** A multi-use path for pedestrians and bicyclists is proposed along Willie Stargell Avenue between the former NAS Alameda and Webster Avenue.

- **Justification:** The proposed path will allow for safer pedestrian and bicycle circulation between the former NAS Alameda and the rest of the City of Alameda, consistent with the adopted multimodal policies for both the former NAS Alameda and the City of Alameda as a whole. By providing an off-street facility for bicyclists, the project will reduce the potential for bicycle-related collisions along the corridor.

Central Avenue/Main Street/Pacific Avenue Intersection Realignment

- **Project Description:** The south leg of the intersection is proposed to be realigned to address the existing offset between the northbound and southbound approaches.

- **Justification:** The proposed intersection realignment will improve safety at the intersection and reduce the risk of collisions. Currently, the north leg (Main Street and Main Street Frontage) and the south leg (Central Avenue) are offset by more than 50 feet. This causes safety problems related to sight distance and driver paths through the intersection. The Central Avenue/Main Street/Pacific Avenue intersection is one of the gateways to the former NAS Alameda development. As the development is completed, increases in traffic volumes at this intersection will result in increased traffic that is exposed to the existing condition.

Main Street and Central Avenue Bicycle Path

- **Project Description:** The project creates a multimodal complete street along Main Street and Central Avenue with protected and physically separated bikeways, Class II bike lanes, safer pedestrian crossings, bus stop islands and rain gardens. The project is proposed along Main Street from RAMP south to Pacific Avenue/Central Avenue, continuing south along Central Avenue to Lincoln Avenue and the existing San Francisco Bay Trail on Boat Ramp Road.

- **Justification:** Main Street and Central Avenue serve as one of the primary routes between the former NAS Alameda and the remainder of the City of Alameda and also connect directly to the San Francisco Bay Trail. The NAS Alameda project offers access to the Main Street Soccer Field and Encinal High School and a connection to the Bay Trail. Consistent with the adopted multimodal policies for both the former NAS Alameda and the City of Alameda as a whole, the bicycle path will increase the safety and comfort of bicyclists while offering a direct commuting route for cyclists approaching the former NAS Alameda property, including the existing and proposed ferry terminals, from eastern Alameda.

III. Summary of Results and Discussion of Alternatives

This BCA compares the "social" costs associated with TIGER Project components with the "social" benefits and, to the extent possible, monetizes the net impact based on a "net present value"[1] calculation. "Social" costs and benefits refer to the actual gains or losses to society as a whole as opposed to transfers of goods and resources from one group or region to another. The BCA calculation only includes factors where both costs and benefits can be effectively monetized based on best practices defined by DOT's internal guidance and the U.S. Office of Management and Budget's (OMB) Circular A-4. Project related costs or benefits that cannot be monetized have been excluded from the formal BCA calculation but quantified in other ways, as outlined in Section VI. In addition, potential productivity gains associated with the increased economic output from the land uses served by the TIGER infrastructure (e.g. due to improved mobility and access) have also been excluded from the formal BCA.

DOT directs applicants to measure costs and benefits of the proposed Project against a "baseline," defined as the way the world would look if the Project did not receive the requested TIGER funding. The formal BCA compares two alternative scenarios that are designed to reflect costs and benefits in a world "with" and a world "without" the proposed TIGER funding. The definition and key analytical assumptions of the buildout scenario is described below.

Baseline Scenario

Assuming no TIGER funding is granted to the former NAS Alameda, both local and regional travel must rely on the existing and planned the former NAS Alameda transportation network absent the specific projects included in this application. For the future conditions baseline, a dedicated bus route is assumed

[1] A net present value calculation accounts for the economic effects associated with differences in the timing of gains and losses (e.g. delayed costs or accelerated benefits are more valuable). Specifically, this analysis applies an annual discount rate of 7 percent to costs and benefits that accrue over time (as required by DOT, a 3 percent discount rate is also included to test the sensitivity of our results to the selected rate).

to be in place along RAMP, connecting the former NAS Alameda to the BART station at Oakland City Center/12th Street. A bus route is assumed to be in place along Willie Stargell Avenue, connecting the former NAS Alameda to the Fruitvale BART station.

However, no transit-only lanes, new ferry terminal or queue jumps are present. The future conditions baseline scenario assumes no multiuse path exists along Willie Stargell Avenue. Similarly, the baseline scenario assumes existing conditions remain at the Central Avenue/Main Street/Pacific Avenue intersection, and that no bicycle facility is completed along Main Street or Central Avenue. The baseline scenario does assume that traffic growth and transit ridership growth associated with the former NAS Alameda project occur.

Future transit ridership forecasts for the year 2035 were developed by Kittelson & Associates as part of the BART Alameda Regional Transit Access Study. Future roadway volumes for the year 2035 were estimated by Kittelson & Associates as part of the former NAS Alameda Environmental Impact Report (EIR); this study utilized the transit assumptions from the BART study.

The transportation forecasts assume gradual absorption of the former NAS Alameda development over time, with buildout in the year 2035. The forecasts also include regional growth (growth external to the former NAS Alameda) from approved and planned development. The forecasts suggest that anticipated regional growth will result in congestion and increases in the need for improvements to enhance safety and mobility.

Proposed Project Scenario (With TIGER Funding)

Under this scenario, the TIGER grant is awarded to the former NAS Alameda Project with construction of the transportation improvements commencing in 2018 and completing by 2020. These transportation improvements become fully operative in 2020 and serve both local (e.g. the former NAS Alameda) and regional travel.

Under this scenario, both local and regional travel volumes (demand) are assumed to be the same as those in the "Baseline Scenario." Thus, the primary difference between the two scenarios is travel time savings associated with the improvements, in addition to safety benefits and reduced emissions.

The proposed improvements to Ralph Appezzato Memorial Parkway and Willie Stargell Avenue and the ferry terminal will be built outside of existing travel lanes. Therefore, there is no opportunity cost estimate associated with construction-related delay. For Main Street and Central Avenue, the proposed bicycle facilities would be separated from existing travel lanes, allowing for minimal disruption to existing traffic flow during construction.

We identified the buildout scenario as the best means to assess the potential costs and benefits of the proposed Project for the following reasons:

- The buildout scenario accounts for full utilization of the transit and bicycle improvements by the former NAS Alameda trips as well as background regional traffic.
- The buildout scenario captures the increased safety risk associated with bicyclists and pedestrians utilizing substandard roadways that are experiencing long-term increases in traffic volumes.

In this BCA, we focus on the opportunity cost to society of spending resources on the proposed transportation Project components. Costs include the capital costs of building each improvement and the operations and maintenance costs of each improvement, including costs experienced by users inconvenienced during construction.

IV. Estimation of Social Costs

This section describes the approach, data, and assumptions used to estimate the social costs resulting from the award of TIGER funds to the NAS Alameda. As discussed in the Analytical Framework section above, this analysis assumes that absent TIGER funding, the proposed transportation improvements will eventually be implemented, but only once alternate funds become available, creating an approximately 20-year lag in delivery of the Project.

However, the timing of the transportation improvements will be accelerated if TIGER funds are made available. From a societal perspective, the cost of awarding the TIGER funds is the opportunity cost of spending resources immediately on the improvements, rather than later in time. Given the time value of money and all other things being equal, consumers generally prefer to incur costs later, rather than earlier.

The total capital costs of each Project, including the amount of TIGER funding requested as well as local funding obligated to the Project, are presented in Table 6. Costs are allocated across the years shown in the detailed calculations and assumptions based on a detailed construction and financial schedule prepared by the City of Alameda.

Table 6: Capital Cost of Proposed Improvements (2016$)

Project Component	Project Costs
Ralph Appezzato Memorial Parkway (RAMP) Dedicated Bus Lanes	$(12,027,000)
Willie Stargell Avenue	$(3,237,000)
Central Avenue/Main Street/Pacific Avenue Intersections	$(5,250,000)
Seaplane Lagoon Ferry Terminal	$18,200,000
Total	**$(38,714,000)**

Source: Kittelson & Associates, Inc.; Willdan, 2016.

V. Estimation of Social Benefits

V.1 Time Savings Benefits

The project is expected to result in travel time savings for transit users along Ralph Appezzato Memorial Parkway (RAMP) by allowing buses to have dedicated lanes and avoid vehicle queues. The RAMP project component will also result in travel time savings for automobile traffic by removing the wait times associated with buses loading and unloading passengers at bus stops. For Willie Stargell Avenue, the queue jump lanes will result in travel time savings for transit users by allowing transit vehicles to bypass vehicle queues at intersections. For the Seaplane Lagoon ferry terminal, travel time savings will result from increased service and decreased wait times for ferry users. The following Table 7: Monetized Value of Travel Time Savings summarizes the calculations of monetized benefits for travel time savings for each of these three project components.

The number of transit users affected is based on model forecasts developed as part of the City of Alameda Regional Transit Access Study. This study evaluated dedicated bus lane service between the former NAS Alameda and the BART stations at Oakland City Center/12th Street and Fruitvale. Based upon land use projections for buildout of the former NAS Alameda, coupled with future increases in traffic congestion, approximately 4,500 daily transit trips were forecast for RAMP, as part of the route between the former NAS Alameda and Oakland City Center/12th Street BART. Approximately 6,500 daily transit trips were forecast for Willie Stargell Avenue as part of the route between the former NAS Alameda and Fruitvale BART. For the Seaplane Lagoon ferry terminal, the number of transit users is based on ridership forecasts developed by Kittelson and Associates in March 2016 for the City of Alameda.

Table 7: Monetized Value of Travel Time Savings

Project	Year 2035 Persons Affected /1	Travel Time Savings per Person (sec)	Daily Travel Time Savings (person hrs) /6	Yearly Travel Time Savings (person hrs) /7	Value per person-hour ($2014) /8	Transit Operating Cost Savings	Annual Monetized Value ($2015)
Seaplane Lagoon Ferry Terminal	987	3,000	822.50	205625	$13.45	$0	$2,765,656
RAMP Transit Lanes (transit users) /2	4,497	17.10	21.36	5,341	$13.45	$30,964	$102,801
RAMP Transit Lanes (automobile traffic) /3,4	17,497	12.00	58.32	14,581	$13.45	$0	$196,112
Willie Stargell Avenue Queue Jump Lanes (transit users) /2, 5	6,510	18	32.55	8,138	$13.45	$32,589	$142,038
Total							**$3,206,607**

1/ Year 2035 persons affected consider transit users for the RAMP transit lanes and Willie Stargell queue jump lanes, as well as automobile occupants for the RAMP transit lanes.

2/ Year 2035 daily transit ridership estimates are from Alameda BRT forecasts developed as part of the City of Alameda Regional Transit Access Study.

3/ Assumed travel time savings for automobile traffic is due to the removal of stopping buses from automobile travel lanes.

4/ Savings is calculated as (20 seconds dwell time per bus) x (3 stops along the RAMP corridor) x 20% to account for bus frequencies.

5/Maximum queue jump travel time savings of 9 seconds per bus per intersection without transit signal priority.

6/For transit users, daily travel time savings = (year 2035 daily transit riders x travel time savings per rider) / 3600 seconds per hour.

7/Annual monetized value assumes 250 days of travel per year.

8/ Value of travel time savings shown is for local travel as $13.45 for all purposes, per 2016 USDOT BCA reference.

Source: Queue Jump Lane, Transit Signal Priority and Stop Location: Evaluation of Transit Preferential Treatments Using Microsimulation; Kittelson; Willdan, 2016

Travel time savings for each of the three components were estimated as follows:

- Seaplane Lagoon Ferry travel time savings are calculated as the reduction in average wait time for ferry service to and from Alameda Point. For this analysis, the wait time is assumed to equal half of the service headway. The baseline conditions assume a headway of 65 minutes, equating to an average wait time of 32.5 minutes. With the project, headways are reduced to 15 minutes, equating to an average wait time of 7.5 minutes.
- For the RAMP bus lanes, the transit travel time savings were calculated based on congested and uncongested speeds from the Year 2035 Alameda Countywide Model. For RAMP between Webster Street and the Ferry Terminal, the analysis showed a total travel time of 136 seconds for congested conditions (which would be experienced by transit vehicles in mixed traffic). For uncongested conditions, a travel time of 120 seconds was calculated, based upon a posted speed limit of 35 miles per hour.
- Automobile travel time savings for the RAMP bus lanes were estimated based upon the average dwell time for buses and the expected transit headways along the corridor. For an average dwell time of 20 seconds and an average transit headway of 12 minutes, an automobile travel time savings of 12 seconds per vehicle was calculated.
- Travel time savings for the queue jump lanes were calculated using an assumption of 9 seconds per bus per intersection, per a 2014 study that evaluated the maximum benefits for queue jumps.

Using these travel time savings and the value per person-hour standards provided by USDOT, annual monetized values were calculated for each transit component related to the proposed project.

The following Table 8 provides the detailed calculations and assumptions in support of the travel time savings for the Seaplane Lagoon Ferry improvements.

Table 8: Travel Time Savings – Seaplane Lagoon Ferry

Calendar Year	Project Year	% of Maximum Value Based on Forecast Year /1	Number of Affected Persons (Transit)	Daily Travel Time Savings (person hrs)	Yearly Travel Time Savings (person hrs)	Willingness to Pay for Time Savings (undiscounted)	Present Value (discounted at 7%)	Present Value (discounted at 3%)
							7%	3%
2020	1	16.67%	165	137.08	34,271	$460,943	$351,651	$409,542
2021	2	33.33%	329	274.17	68,542	$921,885	$657,292	$795,226
2022	3	50.00%	494	411.25	102,813	$1,382,828	$921,437	$1,158,097
2023	4	66.67%	658	548.33	137,083	$1,843,771	$1,148,208	$1,499,154
2024	5	83.33%	823	685.42	171,354	$2,304,714	$1,341,364	$1,819,362
2025	6	100.00%	987	822.50	205,625	$2,765,656	$1,504,334	$2,119,645
2026	7	116.67%	1,152	959.58	239,896	$3,226,599	$1,640,239	$2,400,893
2027	8	133.33%	1,316	1096.67	274,167	$3,687,542	$1,751,924	$2,663,959
2028	9	150.00%	1,481	1233.75	308,438	$4,148,484	$1,841,977	$2,909,663
2029	10	166.67%	1,645	1370.83	342,708	$4,609,427	$1,912,748	$3,138,796
2030	11	183.33%	1,810	1507.92	376,979	$5,070,370	$1,966,377	$3,352,112
2031	12	200.00%	1,974	1645.00	411,250	$5,531,313	$2,004,802	$3,550,339
2032	13	216.67%	2,139	1782.08	445,521	$5,992,255	$2,029,784	$3,734,175
2033	14	233.33%	2,303	1919.17	479,792	$6,453,198	$2,042,917	$3,904,291
2034	15	250.00%	2,468	2056.25	514,063	$6,914,141	$2,045,645	$4,061,329
2035	16	266.67%	2,632	2193.33	548,333	$7,375,083	$2,039,272	$4,205,907
2036	17	283.33%	2,797	2330.42	582,604	$7,836,026	$2,024,978	$4,338,618
2037	18	300.00%	2,961	2467.50	616,875	$8,296,969	$2,003,827	$4,460,030
2038	19	316.67%	3,126	2604.58	651,146	$8,757,911	$1,976,776	$4,570,688
2039	20	333.33%	3,290	2741.67	685,417	$9,218,854	$1,944,689	$4,671,117
Total						**$96,797,969**	**$33,150,240**	**$59,762,943**

1/ Number of affected persons assumes a straight-line interpolation between construction of the project in 2019 and buildout in 2035.

2/ Yearly travel time savings assumes 250 travel days per year.

3/ Willingness to pay for time savings based on $13.45 value per 2016 USDOT BCA guidance.

4/ Ferry Terminal Construction Costs = *$18,200,000*

Source: 2015 Benefit-Cost Analysis Guidance for Tiger Grant Applicants, US Department of Transportation; Kittelson & Associates, Inc.; Willdan, 2016.

The following Table provides the detailed calculations supporting the estimate of transit travel time savings related to the RAMP dedicated bus lanes.

Table 9: Travel Time Savings - RAMP Dedicated Bus Lanes

Segment	Length (feet)	AM Peak Hour /1	PM Peak Hour /1	Peak Hour Travel Speeds (mph) Baseline /2	Peak Hour Travel Speeds (mph) With Project /3
Webster Street to Coral Sea Street	2,300	1,781	2,006	29.70	35
Coral Sea Street to Main Street	1,960	1,333	1,623	30.10	35
Main Street to Ferry Terminal	1,370	592	805	23.95	25
Total	**5,630**			28.44	**32.57**

1/ AM and PM peak hour volumes are from the year 2035 Alameda Point Environmental Impact Report (EIR) traffic forecasts.
2/ Baseline travel speeds are from the year 2035 Alameda Point EIR traffic forecasts. Speeds are the same for AM Peak and PM Peak hours.
3/ Travel speeds with project are based on current posted speed limits.

Source: Kittelson & Associates; Willdan, 2016.

The following Table 10 provides the detailed calculations supporting the estimate of persons affected (automobile passengers).

Table 10: Persons Affected (Automobile Passengers) -RAMP Dedicated Bus Lanes

Segment	Distance (ft)	Year 2035 Traffic Volumes AM Peak /1	Year 2035 Traffic Volumes PM Peak /1	Conversion factor from Peak Hr to Daily	Year 2035 Daily Volumes /2
Webster Street to Coral Sea Street	2,300	1,781	2,006	5	18,935
Coral Sea Street to Main Street	1,960	1,333	1,623	5	14,780
Main Street to Ferry Terminal	1,370	592	805	5	6,985
Overall /3	5,630				14,581
Automobile Passengers (Persons Affected) /4					**17,497**

1/ AM and PM peak hour volumes are from the year 2035 Alameda Point EIR traffic forecasts.
2/ Daily volumes are calculated as (AM peak volumes x 5) + (PM peak volumes x 5)
3/ The daily volume used for travel time savings is a weighted average for volumes along the length of the corridor.
4/ Automobile passengers are calculated as (daily traffic volumes) x 1.2 passengers per vehicle.

Source: Kittelson; Willdan, 2016

The following Table 11 provides the detailed calculations supporting the estimate of travel time savings resulting from RAMP dedicated bus lanes. Table 12 provides the detailed calculations and assumptions supporting the estimate of automobile travel time savings expected to result from RAMP dedicated bus lanes. Table 13 provides the detailed calculations and assumptions supporting the combined estimate of automobile and travel time savings expected to result from installation of Willie Stargell Avenue Queue Jump Lanes.

Table 11: Travel Time Savings Benefits - RAMP Dedicated Bus Lanes

Calendar Year	Project Year	% of Maximum Value Based on Forecast Year /1	Number of Affected Persons (Transit)	Daily Travel Time Savings (person hrs)	Yearly Travel Time Savings (person hrs)	Willingness to Pay for Time Savings (undiscounted)	Present Value (discounted at 7%)	Present Value (discounted at 3%)
							7%	3%
2019	1	5.88%	265	1.26	314	$4,226	$3,449	$3,867
2020	2	11.76%	529	2.51	628	$8,451	$6,447	$7,509
2021	3	17.65%	794	3.77	943	$12,677	$9,039	$10,935
2022	4	23.53%	1,058	5.03	1,257	$16,903	$11,263	$14,156
2023	5	29.41%	1,323	6.28	1,571	$21,128	$13,158	$17,179
2024	6	35.29%	1,587	7.54	1,885	$25,354	$14,756	$20,015
2025	7	41.18%	1,852	8.80	2,199	$29,580	$16,089	$22,670
2026	8	47.06%	2,116	10.05	2,513	$33,805	$17,185	$25,154
2027	9	52.94%	2,381	11.31	2,828	$38,031	$18,068	$27,474
2028	10	58.82%	2,645	12.57	3,142	$42,257	$18,762	$29,638
2029	11	64.71%	2,910	13.82	3,456	$46,482	$19,289	$31,652
2030	12	70.59%	3,174	15.08	3,770	$50,708	$19,665	$33,524
2031	13	76.47%	3,439	16.34	4,084	$54,934	$19,910	$35,260
2032	14	82.35%	3,703	17.59	4,398	$59,159	$20,039	$36,866
2033	15	88.24%	3,968	18.85	4,713	$63,385	$20,066	$38,349
2034	16	94.12%	4,232	20.11	5,027	$67,611	$20,004	$39,714
2035	17	100.00%	4,497	21.36	5,341	$71,836	$19,863	$40,967
2036	18	105.88%	4,762	22.62	5,655	$76,062	$19,656	$42,114
2037	19	111.76%	5,026	23.88	5,969	$80,288	$19,391	$43,159
2038	20	117.65%	5,291	25.13	6,284	$84,513	$19,076	$44,107
Total						**$887,390**	**$325,176**	**$564,310**

1/ Number of affected persons assumes a straight-line interpolation between construction of the project in 2019 and buildout in 2035.

2/ Yearly travel time savings assumes 250 travel days per year.

3/ Willingness to pay for time savings based on $13.45 value per 2016 USDOT BCA guidance.

Source: 2015 Benefit-Cost Analysis Guidance for Tiger Grant Applicants, US Department of Transportation; Kittelson & Associates, Inc.; Willdan, 2016.

Table 12: Automobile Travel Time Savings Benefits - RAMP Dedicated Bus Lanes

Calendar Year	Project Year	% of Maximum Value Based on Forecast Year /1	Number of Affected Persons (Auto)	Daily Travel Time Savings (person hrs)	Yearly Travel Time Savings (person hrs)	Willingness to Pay for Time Savings (undiscounted)	Present Value (dis-counted at 7%)	Present Value (dis-counted at 3%)
							7%	3%
2019	1	5.88%	1,029	3.43	858	$11,536	$9,417	$10,557
2020	2	11.76%	2,058	6.86	1,715	$23,072	$17,602	$20,499
2021	3	17.65%	3,088	10.29	2,573	$34,608	$24,675	$29,853
2022	4	23.53%	4,117	13.72	3,431	$46,144	$30,748	$38,645
2023	5	29.41%	5,146	17.15	4,288	$57,680	$35,920	$46,899
2024	6	35.29%	6,175	20.58	5,146	$69,216	$40,284	$54,640
2025	7	41.18%	7,205	24.02	6,004	$80,752	$43,924	$61,890
2026	8	47.06%	8,234	27.45	6,862	$92,288	$46,915	$68,671
2027	9	52.94%	9,263	30.88	7,719	$103,824	$49,326	$75,005
2028	10	58.82%	10,292	34.31	8,577	$115,360	$51,221	$80,911
2029	11	64.71%	11,322	37.74	9,435	$126,896	$52,657	$86,410
2030	12	70.59%	12,351	41.17	10,292	$138,432	$53,686	$91,520
2031	13	76.47%	13,380	44.60	11,150	$149,968	$54,355	$96,259
2032	14	82.35%	14,409	48.03	12,008	$161,504	$54,707	$100,644
2033	15	88.24%	15,439	51.46	12,865	$173,040	$54,780	$104,692
2034	16	94.12%	16,468	54.89	13,723	$184,576	$54,609	$108,419
2035	17	100.00%	17,497	58.32	14,581	$196,112	$54,227	$111,840
2036	18	105.88%	18,526	61.75	15,439	$207,648	$53,660	$114,970
2037	19	111.76%	19,555	65.18	16,296	$219,184	$52,936	$117,822
2038	20	117.65%	20,585	68.62	17,154	$230,720	$52,077	$120,411
Total						**$2,422,563**	**$887,727**	**$1,540,558**

1/ Number of affected persons assumes a straight-line interpolation between construction of the project in 2019 and buildout in 2035.

2/ Yearly travel time savings assumes 250 travel days per year.

3/ Willingness to pay for time savings based on $13.45 value per 2016 USDOT BCA guidance.

Source: 2015 Benefit-Cost Analysis Guidance for Tiger Grant Applicants, US Department of Transportation; Kittelson & Associates, Inc.; Willdan, 2016.

Table 13: Travel Time Savings Benefit Summary - Willie Stargell Avenue Queue Jump Lanes

Calendar Year	Project Year	% of Maximum Value Based on Forecast Year /1	Number of Affected Persons	Daily Travel Time Savings (person hrs)	Yearly Travel Time Savings (person hrs)	Willingness to Pay for Time Savings (undiscounted)	Present Value (discounted at 7%)	Present Value (discounted at 3%)
							7%	3%
2019	1	5.88%	383	1.91	479	$6,438	$5,255	$5,892
2020	2	11.76%	766	3.83	957	$12,876	$9,823	$11,441
2021	3	17.65%	1,149	5.74	1,436	$19,315	$13,771	$16,661
2022	4	23.53%	1,532	7.66	1,915	$25,753	$17,160	$21,568
2023	5	29.41%	1,915	9.57	2,393	$32,191	$20,047	$26,174
2024	6	35.29%	2,298	11.49	2,872	$38,629	$22,483	$30,494
2025	7	41.18%	2,681	13.40	3,351	$45,067	$24,514	$34,540
2026	8	47.06%	3,064	15.32	3,829	$51,506	$26,183	$38,325
2027	9	52.94%	3,446	17.23	4,308	$57,944	$27,529	$41,860
2028	10	58.82%	3,829	19.15	4,787	$64,382	$28,586	$45,156
2029	11	64.71%	4,212	21.06	5,265	$70,820	$29,388	$48,225
2030	12	70.59%	4,595	22.98	5,744	$77,258	$29,962	$51,077
2031	13	76.47%	4,978	24.89	6,223	$83,697	$30,335	$53,722
2032	14	82.35%	5,361	26.81	6,701	$90,135	$30,532	$56,169
2033	15	88.24%	5,744	28.72	7,180	$96,573	$30,573	$58,428
2034	16	94.12%	6,127	30.64	7,659	$103,011	$30,477	$60,508
2035	17	100.00%	6,510	32.55	8,138	$109,449	$30,264	$62,417
2036	18	105.88%	6,893	34.46	8,616	$115,888	$29,948	$64,164
2037	19	111.76%	7,276	36.38	9,095	$122,326	$29,543	$65,756
2038	20	117.65%	7,659	38.29	9,574	$128,764	$29,064	$67,201
Total							**$495,436**	**$859,779**

1/ Number of affected persons assumes a straight-line interpolation between construction of the project in 2019 and buildout in 2035.

2/ Yearly travel time savings assumes 250 travel days per year.

3/ Willingness to pay for time savings based on $13.45 value per 2016 USDOT BCA guidance.

Source: 2015 Benefit-Cost Analysis Guidance for Tiger Grant Applicants, US Department of Transportation; Kittelson & Associates, Inc.; Willdan, 2016.

Table 13: Travel Time Savings Benefit Summary - Willie Stargell Avenue Queue Jump Lanes

Calendar Year	Project Year	% of Maximum Value Based on Forecast Year /1	Number of Affected Persons	Daily Travel Time Savings (person hrs)	Yearly Travel Time Savings (person hrs)	Willingness to Pay for Time Savings (undiscounted)	Present Value (discounted at 7%)	Present Value (discounted at 3%)
							7%	3%
2019	1	5.88%	383	1.91	479	$6,438	$5,255	$5,892
2020	2	11.76%	766	3.83	957	$12,876	$9,823	$11,441
2021	3	17.65%	1,149	5.74	1,436	$19,315	$13,771	$16,661
2022	4	23.53%	1,532	7.66	1,915	$25,753	$17,160	$21,568
2023	5	29.41%	1,915	9.57	2,393	$32,191	$20,047	$26,174
2024	6	35.29%	2,298	11.49	2,872	$38,629	$22,483	$30,494
2025	7	41.18%	2,681	13.40	3,351	$45,067	$24,514	$34,540
2026	8	47.06%	3,064	15.32	3,829	$51,506	$26,183	$38,325
2027	9	52.94%	3,446	17.23	4,308	$57,944	$27,529	$41,860
2028	10	58.82%	3,829	19.15	4,787	$64,382	$28,586	$45,156
2029	11	64.71%	4,212	21.06	5,265	$70,820	$29,388	$48,225
2030	12	70.59%	4,595	22.98	5,744	$77,258	$29,962	$51,077
2031	13	76.47%	4,978	24.89	6,223	$83,697	$30,335	$53,722
2032	14	82.35%	5,361	26.81	6,701	$90,135	$30,532	$56,169
2033	15	88.24%	5,744	28.72	7,180	$96,573	$30,573	$58,428
2034	16	94.12%	6,127	30.64	7,659	$103,011	$30,477	$60,508
2035	17	100.00%	6,510	32.55	8,138	$109,449	$30,264	$62,417
2036	18	105.88%	6,893	34.46	8,616	$115,888	$29,948	$64,164
2037	19	111.76%	7,276	36.38	9,095	$122,326	$29,543	$65,756
2038	20	117.65%	7,659	38.29	9,574	$128,764	$29,064	$67,201
Total							**$495,436**	**$859,779**

1/ Number of affected persons assumes a straight-line interpolation between construction of the project in 2019 and buildout in 2035.

2/ Yearly travel time savings assumes 250 travel days per year.

3/ Willingness to pay for time savings based on $13.45 value per 2016 USDOT BCA guidance.

Source: 2015 Benefit-Cost Analysis Guidance for Tiger Grant Applicants, US Department of Transportation; Kittelson & Associates, Inc.; Willdan, 2016.

VI.2 Collision Reductions – Avoiding Injuries and Fatalities

For each of the project components, collision data for the years 2011 through 2015 was collected through the California Statewide Integrated Traffic Records System (SWITRS).

For the Seaplane Lagoon Ferry, collision data relates to the Webster Street and Ralph Appezzato Memorial Parkway intersection, as increases in ferry ridership would remove motorists from this location and decrease their exposure to potential collisions. The collision data for the Central Avenue/Main Street and Willie Stargell Avenue project limits focused on bicycle-related collisions. Additionally, automobile-related collision data for the Central Avenue/Main Street/Pacific Avenue intersection was collected, since this intersection will be realigned as part of the proposed project.

Table 14 through Table 17 summarize the collisions at each of these locations for the years 2011 through 2015. These data represent the collision reduction potential anticipated from the proposed Alameda Multimodal Regional Connections Project improvements including:

- Bike and Pedestrian Paths on Willie Stargell Avenue
- Central/Main/Pacific Intersection Realignment
- Webster Ave/Ralph Appezzato Intersection

As illustrated by the detailed assumptions regarding collisions, there were five bicycle collisions and 21 other automobile collisions within the project area. These figures reflect a Crash Reductions Factor (CRF) estimate of 36% to 56% according to Report No. FHWA-SA-08-011, September 2008.

Table 14: Collision Reductions Potential at Ralph Appezzato Memorial Parkway (RAMP) Multimodal Street Conversion (2011 through 2015)

Primary Street	Cross Street	Date	Description	SWITRS Category	AIS Category	Unit Value ($2015)
Ralph Appezzato Pkwy	Main St	5/22/2012	Bicycle/Moving Vehicle	Other Visible Injury	3	$1,008,000
Atlantic Ave/RAMP	Orion St	9/11/2012	Bicycle/Fixed Object	Other Visible Injury	3	$1,008,000
Atlantic Ave/RAMP	Main St	7/11/2013	Bicycle/Moving Vehicle	Other Visible Injury	3	$1,008,000
Main St	Ralph Appezzato Pkwy	8/12/2014	Pedestrian/Moving Vehicle	Severe	4	$2,553,600
Subtotal - Ralph Appezzato						$5,577,600
Crash Reduction Factor (CRF) for Bike Lanes						36%
Benefit Subtotal						$2,007,936
Number of Years for Crash Data						5
Average Annual Value ($2015)						**$401,587**

Table 15: Collision Reductions Potential - Bike and Pedestrian Path on Willie Stargell Avenue (2011 through 2015)

Primary Street	Cross Street	Date	Description	SWITRS Category	AIS Category	Unit Value ($2015)
Webster St	Willie Stargell Ave	1/13/2013	Bicycle/Moving Vehicle	Other Visible Injury	3	$1,008,000
Willie Stargell Ave	Main St	12/10/2014	Bicycle/Moving Vehicle	Severe	4	$2,553,600
Subtotal - Willie Stargell Ave						$3,561,600
Crash Reduction Factor (CRF) for Bike Lanes						36%
Benefit Subtotal						$1,282,176
Number of Years for Crash Data						5
Average Annual Value ($2015)						**$256,435**

Table 16: Collision Reductions Potential from Central/Main/Pacific Intersection Realignment (2011 through 2015)

Primary Street	Cross Street	Date	Description	SWITRS Category	AIS Category	Unit Value ($2015)
Central Ave/Main St	Pacific Ave	2/11/2012	Fixed Object/Moving Vehicle	Property Damage Only	PDO	$4,198
Central Ave/Main St	Pacific Ave	1/30/2013	Fixed Object/Moving Vehicle	Property Damage Only	PDO	$4,198
Central Ave/Main St	Pacific Ave	11/23/2013	Fixed Object/Moving Vehicle	Severe	4	$2,553,600
Central Ave/Main St	Pacific Ave	3/3/2015	Pedestrian/Moving Vehicle	Property Damage Only	PDO	$4,198
Central Ave/Main St	Pacific Ave	6/28/2015	Fixed Object/Moving Vehicle	Property Damage Only	PDO	$4,198
Subtotal - Central/Main/Pacific Intersection						*$2,570,392*
Crash Reduction Factor (CRF) for Improving Horizontal and Vertical Alignments						56%
Benefit Subtotal						$1,439,420
Number of Years for Crash Data						5
Average Annual Value ($2015)						**$287,884**

Table 17: Collision Reductions Potential at the Webster Ave/Ralph Appezzato Intersection (2011 through 2015) /1

Primary Street	Cross Street	Date	Description	SWITRS Category	AIS Category	Unit Value ($2015)
Webster St	Ralph Appezzato	4/11/2011	Rear End	Complaint of Pain	1	$28,800
Webster St	Atlantic Ave/ RAMP	4/25/2011	Fixed Object/Moving Vehicle	Property Damage Only	PDO	$4,198
Atlantic Ave/ RAMP	Webster St	5/21/2011	Broadside	Property Damage Only	PDO	$4,198
Atlantic Ave/ RAMP	Webster St	7/26/2011		Complaint of Pain	1	$28,800
Webster St	Atlantic Ave/ RAMP	8/1/2011	Rear End	Complaint of Pain	1	$28,800
Webster St	Ralph Appezzato	10/6/2011	Rear End	Complaint of Pain	1	$28,800
Webster St	Ralph Appezzato	10/9/2011	Rear End	Property Damage Only	PDO	$4,198
Ralph Appezzato	Webster St	6/23/2012	Fixed Object/Moving Vehicle	Other Visible Injury	3	$1,008,000
Webster St	Atlantic Ave/ RAMP	8/7/2012	Fixed Object/Moving Vehicle	Other Visible Injury	3	$1,008,000
Ralph Appezzato	Webster St	4/16/2013	Rear End	Property Damage Only	PDO	$4,198
Atlantic Ave/ RAMP	Webster St	4/18/2013	Broadside	Property Damage Only	PDO	$4,198
Webster St	Ralph Appezzato	11/10/2013	Pedestrian/Moving Vehicle	Other Visible Injury	3	$1,008,000
Atlantic Ave/ RAMP	Webster St	5/8/2014	Fixed Object/Moving Vehicle	Property Damage Only	PDO	$4,198
Atlantic Ave/ RAMP	Webster St	4/13/2015	Rear End	Property Damage Only	PDO	$4,198
Atlantic Ave/ RAMP	Webster St	9/30/2015	Broadside	Complaint of Pain	1	$28,800
Subtotal - Webster St/ Ralph Appezzato Intersection						*$3,197,386*
Ferry Ridership						*987*
Share of Ferry Ridership Using Webster/Ralph Appezzato Intersection						*18%*
Potential Vehicle Trips Removed from Webster/Ralph Appezzato Intersection						*144*
Potential Reduction in Vehicle Trips (and Collisions) due to Mode Shift to Ferry						2%
Benefit Subtotal						$63,363
Number of Years for Crash Data						5
Average Annual Value ($2015)						**$12,673**

Source: California Statewide Integrated Traffic Records System (SWITRS); Guidance on Treatment of the Economic Value of a Statistical Life in US Department of Transportation Analyses (2016);
http://www.dot.gov/office-policy/transportation-policy/guidance-treatment-economic-value-statistical-life
The Economic and Societal Impact of Motor Vehicle Crashes, 2010; Desktop Reference for Crash Reduction Factors, Report No. FHWA-SA-08-011, September 2008.
http://safety.fhwa.dot.gov/tools/crf/resources/fhwasa08011/fhwasa08011.pdf

Source: 2015 Benefit-Cost Analysis Guidance for Tiger Grant Applicants, US Department of Transportation; Kittelson & Associates, Inc.; Willdan, 2016.

Following are key assumptions employed in the approach to estimating the collision reductions potential at the Webster Ave/Ralph Appezzato Intersection:

1. **Share of Ferry Ridership Using Webster/Ralph Appezzato Intersection:** Estimated as the same proportion of project trips that use the intersection.
2. **Potential Vehicle Trips Removed from Webster/Ralph Appezzato Intersection:** Calculated as the ridership multiplied by the percentage using the intersection and divided by the average vehicle occupancy. The value is an average of the AM Peak and PM Peak values.
3. **Potential Reduction in Vehicle Trips (and Collisions) due to Mode Shift to Ferry:** The reduction in collisions is estimated based on reduced traffic volumes between the "Baseline" and "With Project" scenarios. The reduction in traffic volumes results from the shift in mode from automobile to ferry (peak values).

Using USDOT guidance for unit values of collisions by severity, these collisions were monetized in 2016 dollars. To estimate the benefit for each of each of the project components, a Crash Reduction Factor (CRF) was applied based on the collision type; these factors are from FHWA-SA-011 (2008), Desktop Reference for Crash Reduction Factors.

Based on this reference, a CRF of 36 percent was applied to the monetized value for collisions that would be affected by the multiuse paths along Central Avenue, Main Street and Willie Stargell Avenue. A CRF of 56.2 percent was applied to the monetized value for collisions that would be affected by the realignment of the Central/Main/Pacific Intersection.

To estimate the present value for the safety benefits, a 20-year benefit horizon was assumed. For the baseline, bicycle traffic and collisions were assumed to grow at the same rate as automobile traffic, calculated as 7.1 percent. This approach assumes that the former NAS Alameda will generate bicycle and transit trips that will use RAMP, Willie Stargell Avenue and Central Avenue, in part due to on-site land use strategies and project transportation demand management (TDM) program requirements. Without the project improvements to these corridors, there will be increased exposure to adverse conditions, resulting in more collisions over time.

The following Table 18 through Table 21 provide the detailed calculations supporting the estimated net present value of benefits associated with reductions in collisions and injuries.

Table 18: Collision Reductions Benefits Summary - Webster Street and Ralph Appezzato Memorial Parkway (Seaplane Lagoon Ferry Terminal Improvements)

Calendar Year	Project Year	Years of Traffic Growth Escalation	Traffic Growth Escalation Factor	Value of Collisions (undiscounted)	Present Value (discounted at 7%)	Present Value (discounted at 3%)
					7%	**3%**
2020	1	5	1.23	$15,642	$11,933	$13,898
2021	2	6	1.29	$16,315	$11,632	$14,073
2022	3	7	1.34	$17,016	$11,339	$14,251
2023	4	8	1.40	$17,748	$11,053	$14,431
2024	5	9	1.46	$18,511	$10,774	$14,613
2025	6	10	1.52	$19,307	$10,502	$14,797
2026	7	11	1.59	$20,138	$10,237	$14,984
2027	8	12	1.66	$21,003	$9,979	$15,173
2028	9	13	1.73	$21,907	$9,727	$15,365
2029	10	14	1.80	$22,849	$9,481	$15,559
2030	11	15	1.88	$23,831	$9,242	$15,755
2031	12	16	1.96	$24,856	$9,009	$15,954
2032	13	17	2.05	$25,925	$8,782	$16,155
2033	14	18	2.13	$27,039	$8,560	$16,359
2034	15	19	2.23	$28,202	$8,344	$16,566
2035	16	20	2.32	$29,415	$8,133	$16,775
2036	17	21	2.42	$30,680	$7,928	$16,987
2037	18	22	2.52	$31,999	$7,728	$17,201
2038	19	23	2.63	$33,375	$7,533	$17,418
2039	20	24	2.75	$34,810	$7,343	$17,638
Total					**$174,383**	**$278,897**

1/ Value of collisions reflects a base Year 2015 value of $12,643, with an annual increase of 4.3% corresponding to projected traffic growth.

Source: 2016 Benefit-Cost Analysis Guidance for Tiger Grant Applicants, US Department of Transportation; Kittelson & Associates, Inc.; Willdan, 2016.

Table 19: Collision Reductions Benefits Summary: RAMP Multimodal Improvements

Calendar Year	Project Year	Years of Traffic Growth Escalation	Traffic Growth Escalation Factor	Value of Collisions (undiscounted)	Present Value (discounted at 7%)	Present Value (discounted at 3%)
					7%	3%
2019	1	4	1.18	$475,244	$387,941	$434,916
2020	2	5	1.23	$495,680	$378,152	$440,405
2021	3	6	1.29	$516,994	$368,610	$445,964
2022	4	7	1.34	$539,225	$359,308	$451,592
2023	5	8	1.40	$562,411	$350,242	$457,292
2024	6	9	1.46	$586,595	$341,404	$463,064
2025	7	10	1.52	$611,819	$332,789	$468,908
2026	8	11	1.59	$638,127	$324,391	$474,826
2027	9	12	1.66	$665,566	$316,206	$480,819
2028	10	13	1.73	$694,186	$308,227	$486,888
2029	11	14	1.80	$724,036	$300,449	$493,033
2030	12	15	1.88	$755,169	$292,868	$499,256
2031	13	16	1.96	$787,641	$285,478	$505,557
2032	14	17	2.05	$821,510	$278,274	$511,938
2033	15	18	2.13	$856,835	$271,252	$518,399
2034	16	19	2.23	$893,679	$264,407	$524,942
2035	17	20	2.32	$932,107	$257,735	$531,568
2036	18	21	2.42	$972,188	$251,232	$538,277
2037	19	22	2.52	$1,013,992	$244,892	$545,071
2038	20	23	2.63	$1,057,593	$238,713	$551,950
Total					**$5,668,963**	**$8,727,643**

1/ Value of collisions reflects a base Year 2015 value of $401,587, with an annual increase of 4.3% corresponding to projected traffic growth.

2/ RAMP Construction Cost estimates = $12,027,000

Source: 2016 Benefit-Cost Analysis Guidance for Tiger Grant Applicants, US Department of Transportation; Kittelson & Associates, Inc.; Willdan, 2016.

Table 20: Collision Reductions Benefits Summary: Willie Stargell Avenue Multi-Use Path

Calendar Year	Project Year	Years of Traffic Growth Escalation	Traffic Growth Escalation Factor	Value of Collisions (undiscounted)	Present Value (discounted at 7%)	Present Value (discounted at 3%)
					7%	**3%**
2019	1	4	1.18	$303,469	$247,721	$277,717
2020	2	5	1.23	$316,518	$241,470	$281,222
2021	3	6	1.29	$330,129	$235,377	$284,772
2022	4	7	1.34	$344,324	$229,438	$288,366
2023	5	8	1.40	$359,130	$223,648	$292,006
2024	6	9	1.46	$374,573	$218,005	$295,691
2025	7	10	1.52	$390,679	$212,504	$299,423
2026	8	11	1.59	$407,478	$207,141	$303,202
2027	9	12	1.66	$425,000	$201,914	$307,029
2028	10	13	1.73	$443,275	$196,819	$310,904
2029	11	14	1.80	$462,336	$191,853	$314,828
2030	12	15	1.88	$482,216	$187,012	$318,802
2031	13	16	1.96	$502,952	$182,293	$322,826
2032	14	17	2.05	$524,579	$177,693	$326,900
2033	15	18	2.13	$547,135	$173,209	$331,026
2034	16	19	2.23	$570,662	$168,838	$335,204
2035	17	20	2.32	$595,201	$164,578	$339,435
2036	18	21	2.42	$620,794	$160,425	$343,719
2037	19	22	2.52	$647,489	$156,377	$348,057
2038	20	23	2.63	$675,331	$152,431	$352,450
Total					**$3,619,939**	**$5,573,072**

1/ Value of collisions reflects a base Year 2015 value of $256,435, with an annual increase of 4.3% corresponding to projected traffic growth.

Source: 2016 Benefit-Cost Analysis Guidance for Tiger Grant Applicants, US Department of Transportation; Kittelson & Associates, Inc.; Willdan, 2016.

Table 21: Collision Reductions Benefits Summary: Central Avenue/Main Street/Pacific Avenue Intersection Realignment

Calendar Year	Project Year	Years of Traffic Growth Escalation	Traffic Growth Escalation Factor	Value of Collisions (undiscounted)	Present Value (discounted at 7%)	Present Value (discounted at 3%)
					7%	3%
2019	1	4	1.18	$340,686	$278,102	$311,776
2020	2	5	1.23	$355,336	$271,084	$315,711
2021	3	6	1.29	$370,615	$264,244	$319,696
2022	4	7	1.34	$386,552	$257,576	$323,731
2023	5	8	1.40	$403,174	$251,076	$327,817
2024	6	9	1.46	$420,510	$244,741	$331,954
2025	7	10	1.52	$438,592	$238,565	$336,144
2026	8	11	1.59	$457,451	$232,545	$340,387
2027	9	12	1.66	$477,122	$226,677	$344,683
2028	10	13	1.73	$497,638	$220,957	$349,033
2029	11	14	1.80	$519,036	$215,382	$353,439
2030	12	15	1.88	$541,355	$209,947	$357,899
2031	13	16	1.96	$564,633	$204,649	$362,417
2032	14	17	2.05	$588,912	$199,485	$366,991
2033	15	18	2.13	$614,236	$194,451	$371,623
2034	16	19	2.23	$640,648	$189,545	$376,313
2035	17	20	2.32	$668,196	$184,762	$381,063
2036	18	21	2.42	$696,928	$180,099	$385,872
2037	19	22	2.52	$726,896	$175,555	$390,742
2038	20	23	2.63	$758,153	$171,125	$395,674
Total					**$4,063,886**	**$6,256,549**

1/ Value of collisions reflects a base Year 2015 value of $287,884, with an annual increase of 4.3% corresponding to projected traffic growth.

2/ Central Avenue construction cost = *$5,250,000*

Source: 2016 Benefit-Cost Analysis Guidance for Tiger Grant Applicants, US Department of Transportation; Kittelson & Associates, Inc.; Willdan, 2016.

VI.3 Improved Transportation Options and Effect on Air Quality

The RAMP transit lanes and queue jumps are expected to support a shift to transit use, consistent with the transit ridership forecasts described earlier. Using the transit forecasts for the travel along RAMP and Willie Stargell Avenue, annual VMT reductions were estimated. For the RAMP improvements, the trip length is based upon a trip from the former NAS Alameda to the City Center/12th Street BART station, the terminus of the future high-frequency transit route serving that corridor. For Willie Stargell Avenue improvements, the trip length is based upon a trip from the former NAS Alameda to the Fruitvale BART station, the terminus of the future high-frequency route serving that corridor.

Using the annual VMT reduction for each component as detailed in the following Table 22, the greenhouse gas emissions were then calculated using EPA standard conversion factors.

Table 22: Pollutant/Fuel Benefits (Emission Reductions & Fuel Savings)

Pollutant/Fuel	Emission Factor	Reductions in VMT	Benefit (Emission Reductions and Fuel Savings)	
CO2	368.4 g/mi	15,000 mi	12172	lb CO2
VOC	1.034 g/mi	15,000 mi	34.2	lb VOC
CO	9.400 g/mi	15,000 mi	311	lb CO
Nox	.693 g/mi	15,000 mi	22.9	lb Nox
PM10	.0044 g/mi	15,000 mi	0.14	lb PM10
PM25	.0041 g/mi	15,000 mi	0.14	lb PM25
Gasoline Consumption	0.042 gal/mi	15,000 mi	630	gallons gasoline

Source: Statewide Integrated Traffic Records System; Kittelson & Associates; Willdan, 2016.

Note that for carbon dioxide, the social cost of carbon was calculated separately, assuming a project start of 2017 and a 20-year benefit horizon. The gasoline savings was also calculated based on the reduction in VMT, and then converted to an equivalent savings in carbon dioxide.

Table 23 summarizes the monetized value for emissions reductions. Taking all the preceding assumptions and estimates, Table 24 through Table 26 provide the detailed calculations supporting the estimated net present value of benefits associated with reductions in greenhouse gas emissions for the Seaplane Lagoon Ferry Terminal, RAMP and Willie Stargell Avenue.

Table 23: Monetized Value of Emissions – Detailed Assumptions & Calculations

Project	Year 2035 Person Trips (Daily)	Year 2035 Person Trips (Annually) 2/	Average Vehicle Occupancy	Trip Length (mi) 3/	Annual VMT Reduction	Carbon Dioxide (metric tons)	Volatile Organic Compounds (short tons)	Nitrogen Oxides (short tons)	Particulate Matter (short tons)	Gasoline (gallons)
Seaplane Lagoon Ferry Terminal /1					640,375	235.7	0.7	0.5	0.01	13
RAMP Transit Lanes (transit users)	4,497	1,124,250	1.2	2.7	2,529,563	930.9	2.9	1.9	0.02	53
RAMP Transit Lanes (automobile traffic)	17,497	4,374,250	1.2	2.7	9,842,063	3,622.0	11.2	7.5	0.09	207
Willie Stargell Ave Queue Jump Lanes (transit users)	6,510	1,627,500	1.2	5.2	7,052,500	2,595.4	8.0	5.4	0.07	148
Subtotal					20,064,500	7,384.0	22.9	15.3	0.19	421
Conversion of gasoline to metric tons of CO2						3.74				
Total					**20,064,500**	**7,387.7**	**22.9**	**15.3**	**0.19**	
Value per ton ($2015)							$1,844	$7,266	$332,405	
Total Cost Savings ($2015)						**$0**	**$42,179**	**$111,285**	**$62,249**	

Table 24: Greenhouse Gas Emission Reductions Benefits - Seaplane Lagoon Ferry Terminal

Calendar Year	Project Year	% of Maximum Value Based on Forecast Year /1	Reduced Emissions (metric tons of carbon)	Social Cost of Carbon (per metric ton, 3% discount rate, 2015$)	Total Costs (undiscounted)	Present Value (7%)
				3%		7%
2020	1	16.67%	39.30	47	$1,847	$1,409
2021	2	33.33%	78.60	47	$3,694	$2,634
2022	3	50.00%	117.89	48	$5,659	$3,771
2023	4	66.67%	157.19	50	$7,860	$4,895
2024	5	83.33%	196.49	51	$10,021	$5,832
2025	6	100.00%	235.79	52	$12,261	$6,669
2026	7	100.00%	235.79	53	$12,497	$6,353
2027	8	100.00%	235.79	54	$12,732	$6,049
2028	9	100.00%	235.79	55	$12,968	$5,758
2029	10	100.00%	235.79	55	$12,968	$5,381
2030	11	100.00%	235.79	56	$13,204	$5,121
2031	12	100.00%	235.79	58	$13,676	$4,957
2032	13	100.00%	235.79	59	$13,911	$4,712
2033	14	100.00%	235.79	60	$14,147	$4,479
2034	15	100.00%	235.79	61	$14,383	$4,255
2035	16	100.00%	235.79	62	$14,619	$4,042
2036	17	100.00%	235.79	63	$14,854	$3,839
2037	18	100.00%	235.79	64	$15,090	$3,644
2038	19	100.00%	235.79	65	$15,326	$3,459
2039	20	100.00%	235.79	67	$15,798	$3,332
2040	21	100.00%	235.79	68	$16,033	$3,161
Total						**$93,752**

1/ CO_2 values for Ferry Terminal reflect maximum ridership values that are reached in year 2025 values and are capped thereafter due to the capacity of the ferry boat.

Source: 2015 Benefit-Cost Analysis Guidance for Tiger Grant Applicants, US Department of Transportation; Kittelson & Associates, Inc.; Willdan, 2016.

Table 25: Greenhouse Gas Emissions Reductions Benefits - RAMP BRT Lanes

Calendar Year	Project Year	% of Maximum Value Based on Forecast Year /1	Reduced Emissions (metric tons of carbon)	Social Cost of Carbon (per metric ton, 3% discount rate, 2015$)	Total Costs (undiscounted)	Present Value (7%)
				3%		7%
2019	1	5.88%	268.0	46	$12,326	$10,062
2020	2	11.76%	535.9	47	$25,188	$19,216
2021	3	17.65%	803.9	47	$37,782	$26,938
2022	4	23.53%	1,071.8	48	$51,447	$34,281
2023	5	29.41%	1,339.8	50	$66,988	$41,717
2024	6	35.29%	1,607.7	51	$81,994	$47,721
2025	7	41.18%	1,875.7	52	$97,535	$53,053
2026	8	47.06%	2,143.6	53	$113,612	$57,755
2027	9	52.94%	2,411.6	54	$130,226	$61,869
2028	10	58.82%	2,679.5	55	$147,375	$65,436
2029	11	64.71%	2,947.5	55	$162,112	$67,271
2030	12	70.59%	3,215.4	56	$180,065	$69,832
2031	13	76.47%	3,483.4	58	$202,037	$73,228
2032	14	82.35%	3,751.4	59	$221,330	$74,972
2033	15	88.24%	4,019.3	60	$241,159	$76,345
2034	16	94.12%	4,287.3	61	$261,523	$77,375
2035	17	100.00%	4,555.2	62	$282,423	$78,092
2036	18	105.88%	4,823.2	63	$303,860	$78,523
2037	19	111.76%	5,091.1	64	$325,832	$78,693
2038	20	117.65%	5,359.1	65	$348,340	$78,625
2039	21	123.53%	5,627.0	67	$377,011	$79,529
Total						**$1,250,532**

1/ CO2 values for RAMP BRT lanes reflect year 2035 ridership forecast values that continue to increase at a constant rate thereafter.

Source: 2015 Benefit-Cost Analysis Guidance for Tiger Grant Applicants, US Department of Transportation; Kittelson & Associates, Inc.; Willdan, 2016.

Table 26: Greenhouse Gas Emissions Reductions Benefits – Willie Stargell Avenue

Calendar Year	Project Year	% of Maximum Value Based on Forecast Year /1	Reduced Emissions (metric tons of carbon)	Social Cost of Carbon (per metric ton, 3% discount rate, 2013$)	Total Costs (undiscounted)	Present Value (7%)
				3%		7%
2019	1	5.88%	152.7	46	$7,026	$5,736
2020	2	11.76%	305.5	47	$14,358	$10,954
2021	3	17.65%	458.2	47	$21,538	$15,356
2022	4	23.53%	611.0	48	$29,328	$19,542
2023	5	29.41%	763.7	50	$38,187	$23,781
2024	6	35.29%	916.5	51	$46,741	$27,204
2025	7	41.18%	1,069.2	52	$55,600	$30,243
2026	8	47.06%	1,222.0	53	$64,765	$32,923
2027	9	52.94%	1,374.7	54	$74,236	$35,269
2028	10	58.82%	1,527.5	55	$84,012	$37,302
2029	11	64.71%	1,680.2	55	$92,413	$38,348
2030	12	70.59%	1,833.0	56	$102,647	$39,808
2031	13	76.47%	1,985.7	58	$115,172	$41,744
2032	14	82.35%	2,138.5	59	$126,170	$42,738
2033	15	88.24%	2,291.2	60	$137,473	$43,521
2034	16	94.12%	2,444.0	61	$149,082	$44,108
2035	17	100.00%	2,596.7	62	$160,997	$44,517
2036	18	105.88%	2,749.5	63	$173,217	$44,762
2037	19	111.76%	2,902.2	64	$185,742	$44,859
2038	20	117.65%	3,055.0	65	$198,573	$44,820
2039	21	123.53%	3,207.7	67	$214,917	$45,336
Total						**$712,872**

1/ CO_2 values for Stargell queue jump lanes reflect year 2035 ridership forecast values that continue to increase at a constant rate thereafter.

Source: 2015 Benefit-Cost Analysis Guidance for Tiger Grant Applicants, US Department of Transportation; Kittelson & Associates, Inc.; Willdan, 2016.

VI. Additional Non-Monetized Social Benefits

VI.1 Productivity and Agglomeration Benefits

The proposed Project will support the development of the former NAS Alameda, which is slated to contain 1,425 residential units and 5.5 million square feet of commercial development. Although these benefits are significant and assisted by the Project, it is possible that they would occur even without the project and therefore the benefits of this development have not been included in the BCA.

VI.2 Improved Public Health

A major benefit of the project is the reduction in injuries from the separation of bicycle traffic from vehicles. Another potential benefit is the health effects of greater bicycle ridership by the public. The proposed facilities allow for both recreational and non-recreational trips throughout the Alameda community, especially since the Central Avenue bicycle path connects to the San Francisco Bay Trail – a major bicycle commuting route - and provides direct access to multiple parks and two public schools: Ruby Bridges Elementary and Encinal High School.

VI.3 Roadway State of Good Repair

By creating a TOD on the NAS Alameda property, the project reduces the transportation impacts of development on the local system and reduces the need for development further afield, which in turn results in reduced impact to the regional transportation network.

VI.4 Other Livability and Environmental Sustainability Benefits

The reduction in fossil fuel consumption will contribute to improved air quality in Alameda and surrounding areas and reduced greenhouse gas emissions.

Appendix A: Key Assumptions & Data Sources

Naval Air Station Alameda Multimodal Regional Connections Project TIGER Grant Application:
Benefit-Cost Analysis

APPENDIX A: Key Assumptions & Data Sources

COLLISIONS REDUCTIONS ANALYSIS ASSUMPTIONS

Value of Statistical Life ($2015) $9,600,000

Source: Guidance on Treatment of the Economic Value of a Statistical Life in US Department of Transportation Analyses (2016)
http://www.dot.gov/office-policy/transportation-policy/guidance-treatment-economic-value-statistical-life

Value of Injuries and Property Damage Only Crashes ($2015)

AIS Level	Description	Value
1	Minor	$28,800
2	Moderate	$451,200
3	Serious	$1,008,000
4	Severe	$2,553,600
5	Critical	$5,692,800
6	Not survivable	$9,600,000
PDO	Property damage only	$4,198

Sources:
1/ http://www.dot.gov/office-policy/transportation-policy/guidance-treatment-economic-value-statistical-life
2/ The Economic and Societal Impact of Motor Vehicle Crashes, 2010

Assumptions for Converting CA SWITRS Crash Data Categories to AIS Categories

SWITRS Category	AIS Category	Value ($2015)
Complaint of Pain	1	$28,800
Other Visible Injury	3	$1,008,000
Severe	4	$2,553,600
Fatal	6	$9,600,000
Property Damage Only	PDO	$4,198

Source: California Statewide Integrated Traffic Records System (SWITRS)

Crash Reduction Factors (CRF)

Safety Countermeasure	Study 1	Study 2	Study 3	Study 4	Study 5	CRF Average
Provide bike lanes	36%					**36%**
Install a traffic signal	74%					**74%**
Improve horizontal and vertical alignments /1	58%	50%	50%	50%	73%	**56%**
Narrow Cross Section (4 to 3 lanes with two way left-turn lane) /2	37%	26%	29%			**31%**
Narrow Cross Section (4 to 3 lanes), pedestrian crashes	29%					**29%**

Source: Desktop Reference for Crash Reduction Factors, Report No. FHWA-SA-08-011, September 2008.
http://safety.fhwa.dot.gov/tools/crf/resources/fhwasa08011/fhwasa08011.pdf
1/ CRF is an average of values presented for five separate studies.
2/ CRF is an average of values presented for three separate studies.

Assumptions Regarding Increase in Collisions over Time

	PM Peak Hour Volume by Year /1, 2, 3		Traffic Growth		Annual Increase
Street	**2012**	**2035**	**Cumulative**	**Annual**	**in Collisions**
Central Avenue	332	877	264%	104.3%	4.3%
Willie Stargell Ave	679	1786	263%	104.3%	4.3%

1/ Year 2012 volumes and Year 2035 peak hour forecasts are from the Alameda Point Environmental Impact Report, Appendix G.
2/ Central Avenue volumes are from the intersection of Central Ave/Main St/Pacific Ave.
3/ Willie Stargell Avenue volumes are from the intersection of Willie Stargell Avenue/Fifth Street.

Naval Air Station Alameda Multimodal Regional Connections Project TIGER Grant Application:
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APPENDIX A: Key Assumptions & Data Sources

TRAVEL TIME ANALYSIS ASSUMPTIONS

Forecast Year Assumptions

Project Component	Forecast Year
Seaplane Lagoon Ferry Terminal /1	2025
RAMP Transit Lanes (transit users) /2	2035
RAMP Transit Lanes (automobile traffic) /2	2035
Willie Stargell Avenue Queue Jump Lanes (transit users) /2	2035

1/ Values for the Ferry Terminal reflect estimated year 2025 forecasts that are based on one ferry boat. Following the year 2025, ridership is assumed to continue linear growth as the City of Alameda acquires additional ferry boats.
2/ Forecast values for RAMP BRT lanes and Willie Stargell queue jump lanes reflect year 2035 ridership forecasts that continue to increase at a constant rate thereafter.

Number of Persons Affected

Project Component	**Persons Affected /1,2,3**
Seaplane Lagoon Ferry Terminal (transit users)	987
Ralph Appezzato Transit Lanes (transit users)	4,497
Willie Stargell Avenue Queue Jump Lanes (transit users)	6,510

1/ Daily transit ridership estimates for the Ferry Terminal are from Kittelson & Associates' Alameda Point Seaplane Lagoon Ferry Terminal technical memo, March 2016. The transit ridership is the midpoint of the low and high forecast values.
2/ Daily transit ridership estimates for RAMP and Willie Stargell are from Alameda BRT forecasts developed as part of the City of Alameda Regional Transit Access Study.

3/ Values for the Ferry Terminal reflect estimated year 2025 forecasts that are based on one ferry boat. Following the year 2025, ridership is assumed to continue linear growth as the City of Alameda acquires additional ferry boats.
4/ Year 2035 persons affected consider transit users for the RAMP transit lanes and Willie Stargell queue jump lanes, as well as automobile occupants for the RAMP transit lanes.

Seaplane Lagoon Ferry Terminal Assumptions	**Baseline**	**With Project**
Service Headway, in minutes /1	65	15
Average Wait Time, in minutes /2	32.5	7.5

1/ Service headways from 2012 WETA Ridership Forecasting Model Report.
2/ Baseline based on 2035 Constrained scenario and assumes service is limited to the existing Main Street terminal.
3/ With Project scenario assumes the addition of the Seaplane Lagoon terminal, served by one ferry boat.
4/ Average wait time assumed as half of service headway.

Webster Ave/Ralph Appezzato Intersection Assumptions /1	AM Peak	PM Peak
Year 2035 Volumes with Alameda Point buildout	3,652	3,634
Change in Volumes due to Alameda Point	620	459
Alameda Point Trip Generation	2,928	3,294
Change in Volumes as a Percentage of Alameda Point Trip Generation /2	21%	14%

1/ All traffic volume forecasts and trip generation assumptions are from the Alameda Point Environmental Impact Report.
2/ Calculated as Change in Volumes divided by Alameda Point Trip Generation

Queue Jump Travel Time Savings (transit users), in seconds /1	**9**

1/Maximum queue jump travel time savings of 9 seconds per bus per intersection without transit signal priority.
Source: Queue Jump Lane, Transit Signal Priority and Stop Location: Evaluation of Transit Preferential Treatments Using Microsimulation

Naval Air Station Alameda Multimodal Regional Connections Project TIGER Grant Application:
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APPENDIX A: Key Assumptions & Data Sources

Ralph Appezzato Memorial Parkway Segment Lengths, Traffic Volumes and Travel Speeds

Segment	Length (feet)	AM Peak Hour /1	PM Peak Hour /1	**Peak Hour Travel Speeds (mph)**	
				Baseline /2	With Project /3
Webster Street to Coral Sea Street	2,300	1,781	2,006	29.70	35
Coral Sea Street to Main Street	1,960	1,333	1,623	30.10	35
Main Street to Ferry Terminal	1,370	592	805	23.95	25
Total	**5,630**			28.44	32.57

1/ AM and PM peak hour volumes are from the year 2035 Alameda Point Environmental Impact Report (EIR) traffic forecasts.
2/ Baseline travel speeds are from the year 2035 Alameda Point EIR traffic forecasts. Speeds are the same for AM Peak and PM Peak hours.
3/ Travel speeds with project are based on current posted speed limits.

BRT Lanes Travel Time Savings (Automobile Traffic) /1

Dwell Time per Bus (seconds)	20
Number of Bus Stops along Ralph Appezzato	3
Adjustment for Bus Frequency	20%
Travel Time Savings /2	**12**

1/Assumed travel time savings for automobile traffic is due to the removal of stopping buses from automobile travel lanes.
2/Savings is calculated as (20 seconds dwell time per bus) x (3 stops along the RAMP corridor) x 20% to account for bus frequencies.

Automobile Passengers per Vehicle	**1.2**
Conversion Factor from Miles to Feet	**5,280**
Conversion Factor from Minutes to Seconds	**60**
Conversion Factor from Hours to Seconds	**3,600**

Value of Travel Time Savings ($2014 per person-hour)

Category	**Value**
Transit Passengers	$13.45
Automobile Passengers	$13.45
Bus Drivers	$27.60

Source: Revised Departmental Guidance on Valuation of Travel Time in Economic Analysis (Revision 2 - corrected)
http://www.dot.gov/office-policy/transportation-policy/guidance-value-time

Days of Travel per Year	**250**

AC Transit Operating Cost Assumptions

Transit Operating Expense per Vehicle Revenue Hour	$181.05

Source: 2013 National Transit Database

Number of Transit Trips per Day /1	**144**

1/ Number of trips assumes a 15-minute headway in each direction, with 18 hours of operation per day.

Naval Air Station Alameda Multimodal Regional Connections Project TIGER Grant Application:
Benefit-Cost Analysis

APPENDIX A: Key Assumptions & Data Sources

EMISSIONS ANALYSIS ASSUMPTIONS

Value per Short Ton	(2015$)
Volatile Organic Compounds (short tons)	$1,844
Nitrogen Oxides (short tons)	$7,266
Particulate Matter (short tons)	$332,405
Sulfur Dioxide (short tons)	$42,947

Source: Corporate Average Fuel Economy for MY2017-2025 Passenger Cars and Light Trucks (August 2012), page 922, Table VIII-16
http://www.nhtsa.gov/staticfiles/rulemaking/pdf/cafe/FRIA_2017-2025.pdf

Trip Lengths	Trip Length (mi) /1
Ralph Appezzato Transit Lanes (transit users) /1	2.7
Ralph Appezzato Transit Lanes (automobile traffic)	2.7
Willie Stargell Avenue Queue Jump Lanes (transit users) /2	5.2

1/ Trip lengths for Ralph Appezzato based on distance from Alameda Point to 12th St./City Center BART station in Oakland.
2/ Trip length for Willie Stargell based on distance from Alameda Point to Fruitvale BART station in Oakland.

Average Emission Reductions and Fuel Savings Per Day Per Vehicle for Gasoline Passenger Cars

Pollutant/Fuel	Emission Factor (grams per mi)	Reduction in VMT (miles)	Benefit (Emission Reduction and Fuel Savings)	
CO_2	368.4	15,000	12,172	lb CO_2
VOC	1.034	15,000	34.2	lb VOC
CO	9.4	15,000	311	lb CO
NOx	0.693	15,000	22.9	lb NOx
PM_{10}	0.0044	15,000	0.14	lb PM_{10}
$PM_{2.5}$	0.0041	15,000	0.14	lb PM_{25}
Gasoline Consumption /1	0.042	15,000	630	gallons gasoline

1/ Emissions factor for gasoline consumption expressed in gallons per mile.
Source: US EPA Emissions Facts, 2008

Conversion from Short Tons to lb	**2,000**
Conversion from Metric Tons to lb	**2,205**
Conversion from Gallons of Gasoline to Metric Tons of CO2	**0.008887**

Source: Federal Register (2010). Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards; Final Rule, page 25, page 30

Daily VMT Reduction for Seaplane Lagoon Ferry Terminal	
High Estimate /1	1,343
Low Estimate /1	3,780
Average	2,562

1/ Daily VMT reduction for Ferry Terminal is from March 17, 2016 technical memorandum from Kittelson & Associates. Value is an average of the year 2025 low and high estimates.

Naval Air Station Alameda Multimodal Regional Connections Project TIGER Grant Application:
Benefit-Cost Analysis

APPENDIX A: Key Assumptions & Data Sources
Social Cost of Carbon (per metric ton, 3% discount rate, $2015)

Year	Value, in dollars
2018	45
2019	46
2020	47
2021	47
2022	48
2023	50
2024	51
2025	52
2026	53
2027	54
2028	55
2029	55
2030	56
2031	58
2032	59
2033	60
2034	61
2035	62
2036	63
2037	64
2038	65
2039	67
2040	68

Source: Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866 (May 2013; revised July 2015)
https://www.whitehouse.gov/sites/default/files/omb/inforeg/scc-tsd-final-july-2015.pdf

Appendix B: Travel Time Savings Benefits Assumptions & Calculations

Naval Air Station Alameda Multimodal Regional Connections Project TIGER Grant Application:
Benefit-Cost Analysis

APPENDIX B: Monetized Value of Travel Time Savings - Detailed Calculations

Project	Year 2035 Persons Affected /1	Travel Time Savings per Person (sec)	Daily Travel Time Savings (person hrs) /6	Yearly Travel Time Savings (person hrs) /7	Value per person-hour ($2014) /8	Transit Operating Cost Savings	Annual Monetized Value ($2015)
Seaplane Lagoon Ferry Terminal	987	3,000	822.50	205625	$13.45	$0	$2,765,656
RAMP Transit Lanes (transit users) /2	4,497	17.10	21.36	5,341	$13.45	$30,964	$102,801
RAMP Transit Lanes (automobile traffic) /3,4	17,497	12.00	58.32	14,581	$13.45	$0	$196,112
Willie Stargell Avenue Queue Jump Lanes (transit users) /2, 5	6,510	18	32.55	8,138	$13.45	$32,589	$142,038
Total							**$3,206,607**

1/ Year 2035 persons affected consider transit users for the RAMP transit lanes and Willie Stargell queue jump lanes, as well as automobile occupants for the RAMP transit lanes.
2/ Year 2035 daily transit ridership estimates are from Alameda BRT forecasts developed as part of the City of Alameda Regional Transit Access Study.
3/ Assumed travel time savings for automobile traffic is due to the removal of stopping buses from automobile travel lanes.
4/ Savings is calculated as (20 seconds dwell time per bus) x (3 stops along the RAMP corridor) x 20% to account for bus frequencies.
5/Maximum queue jump travel time savings of 9 seconds per bus per intersection without transit signal priority.
6/For transit users, daily travel time savings = (year 2035 daily transit riders x travel time savings per rider) / 3600 seconds per hour.
7/Annual monetized value assumes 250 days of travel per year.
8/ Value of travel time savings shown is for local travel as $13.45 for all purposes, per 2016 USDOT BCA reference.
Source: Queue Jump Lane, Transit Signal Priority and Stop Location: Evaluation of Transit Preferential Treatments Using Microsimulation

Transit Operating Cost Savings

Project	Operating Time Savings per Trip (sec)	Number of Buses per Day	Operating Cost per Revenue Hour	Daily Operating Cost Savings	Annual Monetized Value ($2015)
Seaplane Lagoon Ferry Terminal	N/A	N/A	N/A	N/A	$0
RAMP Transit Lanes (transit users) /2	17.10	144.00	$181.05	$123.86	$30,964
Willie Stargell Avenue Queue Jump Lanes (transit users) /2, 5	18.00	144	$181.05	$130.36	$32,589
Total					**$63,553**

1/ No transit operating time savings is assumed for the ferry terminal, as the ferry travel time remains unchanged.

Transit Travel Time Savings
Seaplane Lagoon Ferry Terminal

Direction	Transit Wait Time (sec) /1		Travel Time Savings (sec)
	Baseline /2	With Project /3	
Outbound from Alameda to San Francisco	1,950	450	1,500
Inbound from San Francisco to Alameda	1,950	450	1,500
Total	3,900	900	**3,000**

1/ Average wait time assumed as half of service headway.
2/ Baseline based on 2035 Constrained scenario and assumes service is limited to the existing Main Street terminal.
3/ With Project scenario assumes the addition of the Seaplane Lagoon terminal.

Naval Air Station Alameda Multimodal Regional Connections Project TIGER Grant Application:
Benefit-Cost Analysis

APPENDIX B: Monetized Value of Travel Time Savings - Detailed Calculations

Transit Travel Time Savings
Ralph Appezzato BRT Lanes

	Segment Length (ft)	Travel Speed (mph)	Travel Time (sec)
Baseline /1	5,630	28	135.0
With Project /2	5,630	33	117.9
Travel Time Savings, seconds			**17.1**
Travel Time Savings, percent			13%

1/ Baseline travel speeds are from the year 2035 Alameda Point EIR traffic forecasts. Speeds are the same for AM Peak and PM Peak hours.
2/ Travel speeds with project are based on current posted speed limits.

Automobile Travel Time Savings
Ralph Appezzato BRT Lanes /1

Travel Time Savings, seconds /2	12

1/Assumed travel time savings for automobile traffic is due to the removal of stopping buses from automobile travel lanes.
2/Savings is calculated as (20 seconds dwell time per bus) x (3 stops along the RAMP corridor) x 20% to account for bus frequencies.

Persons Affected (Automobile Passengers)
RAMP BRT Lanes

Segment	Distance (ft)	Year 2035 Traffic Volumes AM Peak /1	Year 2035 Traffic Volumes PM Peak /1	Conversion factor from Peak Hr to Daily	Year 2035 Daily Volumes /2
Webster Street to Coral Sea Street	2,300	1,781	2,006	5	18,935
Coral Sea Street to Main Street	1,960	1,333	1,623	5	14,780
Main Street to Ferry Terminal	1,370	592	805	5	6,985
Overall /3	5,630				14,581
Automobile Passengers (Persons Affected) /4					**17,497**

1/ AM and PM peak hour volumes are from the year 2035 Alameda Point EIR traffic forecasts.
2/ Daily volumes are calculated as (AM peak volumes x 5) + (PM peak volumes x 5)
3/ The daily volume used for travel time savings is a weighted average for volumes along the length of the corridor.
4/ Automobile passengers are calculated as (daily traffic volumes) x 1.2 passengers per vehicle.
Source: Kittelson; Willdan, 2016

Transit Travel Time Savings
Willie Stargell Queue Jumps

Number of Queue Jumps (per direction)	2
Travel Time Savings per Queue Jump, seconds /1	9
Transit Travel Time Savings, seconds	18

1/Maximum queue jump travel time savings of 9 seconds per bus per intersection without transit signal priority.
Source: Queue Jump Lane, Transit Signal Priority and Stop Location: Evaluation of Transit Preferential Treatments Using Microsimulation

Appendix C: Emissions Reductions Benefits Assumptions & Calculations

Naval Air Station Alameda Multimodal Regional Connections Project TIGER Grant Application:
Benefit-Cost Analysis

APPENDIX C: Greenhouse Gas Emission Reductions - Detailed Calculations

(1) Monetized Value of Emissions

Project	Year 2035 Person Trips (Daily)	Year 2035 Person Trips (Annually) 2/	Average Vehicle Occupancy	Trip Length (mi) 3/	Annual VMT Reduction	Carbon Dioxide (metric tons)	Volatile Organic Compounds (short tons)	Nitrogen Oxides (short tons)	Particulate Matter (short tons)	Gasoline (gallons)
Seaplane Lagoon Ferry Terminal /1					640,375	235.7	0.7	0.5	0.01	13
RAMP Transit Lanes (transit users)	4,497	1,124,250	1.2	2.7	2,529,563	930.9	2.9	1.9	0.02	53
RAMP Transit Lanes (automobile traffic)	17,497	4,374,250	1.2	2.7	9,842,063	3,622.0	11.2	7.5	0.09	207
Willie Stargell Ave Queue Jump Lanes (transit users)	6,510	1,627,500	1.2	5.2	7,052,500	2,595.4	8.0	5.4	0.07	148
Subtotal					20,064,500	7,384.0	22.9	15.3	0.19	421
Conversion of gasoline to metric tons of CO2						3.74				
Total					**20,064,500**	**7,387.7**	**22.9**	**15.3**	**0.19**	
Value per ton ($2015)							$1,844	$7,266	$332,405	
Total Cost Savings ($2015)						**$0**	**$42,179**	**$111,285**	**$62,249**	

(2) Conversion of Benefit to Tons per Vehicle Miles Travelled

Pollutant/Fuel	Conversion of Benefit to Tons per VMT /7
CO_2	0.0003680121
VOC	0.0000011400
CO	0.0000103667
NOx	0.0000007633
PM_{10}	0.0000000047
$PM_{2.5}$	0.0000000047
Gasoline Consumption	0.0000210000

(3) Breakdown of CO2 Reduction by Project Component

Project Component	% of Total	Tons of CO2
Seaplane Lagoon Ferry Terminal	3.19%	235.79
RAMP Transit Lanes	61.66%	4,555.22
Willie Stargell Avenue Queue Jump Lanes	35.15%	2,596.72
Total	**100.00%**	**7,387.72**

1/ VMT values for Ferry Terminal reflect maximum values that are reached in year 2025 values and are capped thereafter due to the capacity of the ferry boat.

2/ Annual person trips assume 250 days of travel per year (excluding weekends and holidays).

3/ For RAMP improvements, the estimated trip length is from Alameda Point to the City Center/12th Street BART station in Oakland.

3/ For Willie Stargell improvements, the estimated trip length is from Alameda Point to the Fruitvale BART station in Oakland.

5/ A short ton is 2000 lbs and a metric ton is 2205 lbs.

6/ Values per ton are from 2016 TIGER BCA Guidance.

7/ Calculated using metric tons for CO2 and short tons for all others.