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Cascade Gateway Advanced Border Information System Design Project

Benefit Cost Analysis Technical Memo

FY 2024

Texas A&M Transportation Institute

The Texas A&M University System

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The benefit-cost analysis (BCA) was conducted for the Cascade Gateway Advanced Border Information System Design Project using best practices for transportation planning and reflecting the US DOT 2024 benefit-cost analysis guidance. This analysis focuses on the anticipated benefits and costs associated with at-scale implementation. Narrative documentation of each benefit is brief by design as the Cascade ABIS BCA excel spreadsheet is formatted to provide clear, detailed documentation. Sheet 1 in the file "Notes" describes the content of each sheet in the Excel file. All analyses contain live formulas, clear documentation of assumptions, and assume 2022 constant dollars at a 3.1% discount rate.

Table 1. BCA Summary

Current Status and Problem to be Addressed	Change in Baseline	Type of Impacts	Affected Populations	Economic Benefits
The Cascade Gateway Advanced Border Information System (ABIS) Design Project is designed to provide a modern alternative to the Advanced Traveler Information System. ATIS records traffic flows and estimates wait times for several locations US and Canada border locations. There is a need to calculate more reliable wait times that the current equipment cannot provide	The project will provide Customs and Border Patrol Agents with better delay information, allowing them to open lanes more efficiently and reduce overall delay.	Value of Time Savings	Drivers and commercial truck operators using the POEs.	Benefit 1. Crossing Delay Benefit
		Fuel Cost Savings	Drivers and commercial truck operators using the POEs.	Benefit 1. Crossing Delay Benefit
		Emissions Reductions	Residents living and working the area.	Benefit 2. Environmental Benefit
	The project will provide drivers with better information on current delays, allowing them to plan trips more reliably.	Value of Time Savings	Drivers and commercial truck operators using the POEs.	Benefit 3. Trip Planning Reliability Benefit
	Project components will have useful life remaining after the 11-year analysis period.	Residual Value	Washington State Department of Transportation	Benefit 4. Residual Value
	Project improvements will result in additional maintenance costs.	Maintenance and Operations Costs	Washington State Department of Transportation	(Dis)Benefit 5. Maintenance Costs

Benefit Cost Analysis

The computed benefit-cost ratio for the Cascade Gateway Advanced Border Information System Project was conducted using a 3.1 percent real discount rate recommended by the Benefit-Cost Analysis Guidance for Discretionary Grant Programs[1]. The BCA compares the estimated capital costs to the quantifiable anticipated benefits of the project for an analysis period of 11 years with implementation occurring in the first year. Benefits begin in year 2 and assume a 10-year life cycle.

The quantified benefits are:

1. Crossing Delay Benefit – Value of time savings and fuel cost savings from reduced crossing delay
2. Environmental Benefit – Reduced emissions costs from reduced crossing delay
3. Trip Planning Reliability Benefit – Value of time savings from increased trip planning reliability
4. Residual Value – Remaining useful life of project components
5. Maintenance and Operation Costs

Discount Rates

Federal guidance recommends that applicants discount future benefits and costs to the year 2022 and present discounted rates of both the stream of benefits and the stream of costs. For this analysis, final streams of benefits and costs are presented at a 3.1 percent discounted rate.

Project Description and Cost Estimates

The Cascade Gateway Advanced Border Information System (ABIS) Design Project is intended to provide a modern alternative to the Advanced Traveler Information System (ATIS). Established in 2004, ATIS records traffic flows and estimates wait times for several US and Canada border crossings. Although this system has been in use for several years, there is a need to calculate more reliable wait times than the current equipment can provide. A key to providing the best alternative is to integrate new and old technologies, which minimizes costs while producing more accurate results. Therefore, as part of the project, several design concepts were recommended that utilize a mix of technologies to more thoroughly record the number of vehicle and wait times.

The project area consists of four ports of entry: Peace Arch/Douglas, Pacific Highway, Lynden/Aldergrove, and Sumas/Huntingdon. Combined these crossing experience about 7.98 million passenger vehicle crossings per year and about 1.07 million commercial truck crossings per year. This analysis assumes that the project would reduce delay at the border crossing by giving Customs and Border Patrol better wait time information, and increase the planning time reliability of drivers, decreasing the amount of time they budget for delay at the crossing. Value of time and emissions costs were calculated in a build and no-build scenario, with the difference in costs resulting in a cost-savings or positive project benefit. Because future impacts on delay

[1] https://www.transportation.gov/mission/office-secretary/office-policy/transportation-policy/benefit-cost-analysis-guidance

are unknown but anticipated to be positive, a conservative estimate of a five percent reduction in delay times was used for this analysis. Total project costs were estimated at $8.37 million in 2025 or $7.64 million in 2022 dollars at a 3.1 percent discount rate.

Benefit-Cost Ratios

Table 2 summarizes the estimated project costs and the quantifiable anticipated benefits of the project. With a conservative estimate of a five percent reduction in delay, the project scenario has a net present value of $31.69 million undiscounted and $23.17 million at a 3.1 percent real discount rate. The benefit cost ratio of the project is 4.03:1 discounted at 3.1 percent.

Table 2: Benefit Cost Analysis ($2022)

Category	Undiscounted	Present Value at 3.1%
Construction Costs	**$8,371,000**	**$7,638,382**
Evaluated Benefits		
1. Crossing Delay Benefit	$12,421,251	$9,592,670
2. Environmental Benefit	$615,213	$473,371
3. Planning Reliability Benefit	$26,545,672	$20,500,664
4. Residual Value	$1,316,528	$885,253
5. Maintenance and Operation Costs	-$837,100	-$648,257
Total Evaluated Benefits	**$40,061,564**	**$30,803,701**
NPV[2]	**$31,690,564**	**$23,165,320**
B-C Ratio	**4.79**	**4.50**

Benefit Calculations

The benefits of the project are derived by comparing conditions under a "Build" and "No-Build" scenario. Benefits will accrue over the 10-year operational period of the analysis. Travel impact costs are generated for the "No-Build" baseline scenario and the "Build" project scenario. The difference in costs between the baseline and project scenarios is the cost savings or benefits of the project. The project is anticipated to allow for more efficient crossing operations and reduce crossing delay time by five percent for each trip. This results in a reduction of about 53,000 hours of delay time and about 125,000 hours of planning time, for a total of about 178,000 hours of time in the first year of operation. This reduction in time results in value of time savings for passenger vehicles and trucks, as well as a reduction in fuel consumption and emissions due to idling. Default parameters used in the calculations are included in the spreadsheet accompanying this document.

[2] Net present value (NPV) was calculated by subtracting the total benefit from total cost at 3.1% discount and undiscounted figures.

Benefit 1: Delay Time Reduction Benefit

Benefit one is the value of time benefit generated by reducing crossing delay time in the project scenario. The four border crossings experience about 13.6 million passenger vehicle crossings and about 1.6 million commercial truck crossing per year. In the no-build scenario the average passenger vehicle crossing delay is about 7.24 minutes and the average truck delay about 3.59 minutes. This results in about 994 thousand hours of delay for passenger vehicles and about 66 thousand hours of delay for trucks in the first year of the analysis. With the improvements from the project a 5 percent reduction in these delay times was anticipated. This results in both a value of time savings for each vehicle, as well as a fuel cost reduction since the vehicles are idling for a shorter period of time. The value of delay time is an estimate of the average differential cost of the extra travel time resulting from delay or congestion. These benefits were summed to generate the total Delay Time Reduction Benefit.

Delay Time Reduction Benefit

- Value of Time Cost (Trucks) = Reduced Delay Hours * Truck Driver Hourly Wage
- Value of Time (Passenger Vehicles) = Reduced Delay Hours * Passenger All Purpose Cost Factor
- Fuel Cost Savings = Reduced Hours of Delay * Idle Fuel Consumption * Fuel Price

The total Delay Time Reduction Benefit for the 11-year analysis period was $12.42 million undiscounted, and $9.59 million discounted at 3.1 percent.

Benefit 2: Environmental Benefit

Benefit two is the emissions benefit generated by reducing crossing time delay in the project scenario. Currently, vehicles are idling when they are delayed at the crossing. The build scenario reduces the delay time, thus reducing idling time. The difference in idling time in the build and no-build scenario generates an emissions cost savings. Emissions costs were calculated by multiplying the hours of delay by the idle emission rates for cars and trucks, then by the USDOT Benefit Cost Analysis Guidance emission monetized value.

- Emissions Cost = Vehicle Hours of Delay * Idle Emission Rate per Hour * Emission Monetized Value

The total Environmental Benefit for the 11-year analysis period was $0.62 million undiscounted and $0.47 million discounted at 3.1 percent.

Benefit 3: Trip Planning Reliability Benefit

The third benefit calculated was the value of time savings associated with increased trip planning reliability. The project benefits will give drivers a better understanding of the expected delay times and allow them to better plan their trips, generating a value of time savings. This benefit is based on the Planning Time Reliability Index.[3] This methodology assumes that in order to get to their destination on time, drivers will plan for delays based on the 95th percentile delay. With 20 weekdays in a month this means that drivers plan for the worst day of the month, and 19 out of 20 times will arrive at the destination earlier than necessary. Arriving earlier than necessary means that time has been wasted and generates a value of time cost.

In order to calculate this, delay on the worst day of the month was calculated for each crossing and varied from 12 to 40 minutes depending on the crossing. This means that in order to ensure they arrive on time, in the worst case, drivers must leave 40 minutes earlier than would be necessary if there was no delay. Most of the time drivers will not actually encounter this much delay, meaning they arrive earlier than necessary. The project scenario assumes a five percent reduction in delay times, reducing the delay on the worst day of the month, and allowing drivers to leave slightly later than before. Total planning hours are the difference in hours between the 95th percentile wait time and the average wait time. Reducing these hours saves drivers time, generating a benefit.

Trip Planning Reliability Benefit

- Planning Hours = (95th Percentile Delay Time * Number of Trips) – (Average Delay Time * Number of Trips)
- Reduced Planning Hours = Planning Hours * Percent Reduction in Delay Time
- Value of Time Cost (Trucks) = Reduced Planning Hours * Truck Driver Hourly Wage
- Value of Time (Passenger Vehicles) = Reduced Planning Hours * Passenger All Purpose Cost Factor

The total Trip Planning Reliability Benefit for the 11-year analysis period was $26.55 million undiscounted and $20.50 million discounted at 3.1 percent.

The actual project benefits are likely to be higher than what was estimated here, because in addition to being able to plan for reduced delay, drivers should have a much better understanding of the actual delay they will encounter. Instead of assuming the worst delay, they will be able to see a prediction of crossing delay at their travel time and plan accordingly. This could substantially increase the amount of time saved above the five percent reduction assumed, but currently cannot be calculated.

Benefit 4: Residual Value

The fourth benefit calculated was the residual value of the project. Several of the project components have useful lives beyond the 11-year analysis period. The residual value is the benefit associated with the remaining useful lives of these components. Table 3 shows the useful life and remaining life, after the analysis period, associated with these project components.

[3] https://static.tti.tamu.edu/tti.tamu.edu/documents/mobility-report-2023-appx-a.pdf

Table 3. Project Component Remaining Life

Item Description	Useful Life	Remaining Life
Radar Design, Implementation, Testing	12	2
Wi-fi System Design and Implementation	10	0
Fiber Network	25	15
Cascade Gateway Custom BWT App/Interface	15	5

Residual value was calculated by dividing the estimated cost by the useful life of the component, then multiplying that by the remaining life of the of the component. These values were then summed and discounted to 2022 dollars.

- Residual Value = (Component Cost/Useful life) * Remaining Life

The total residual value was $1.32 million undiscounted and $0.89 million discounted at 3.1 percent.

Benefit 5. Maintenance and Operation Cost

The project includes annual maintenance and operation costs of $84 thousand undiscounted. Over the 11-year analysis period this is $0.84 million undiscounted and $0.65 million discounted at 3.1 percent. This annual cost is presented as a disbenefit.

Qualitative Benefits

Safety and Reliability

The improved detection of traffic at the border crossing will enable a more accurate estimation of wait and delay times. A noticeable benefit of this upgrade will be the reliability of the times produced. Trucks and passenger vehicles crossing will be more confident that the wait and delays times they are receiving will be accurate. Additionally, this new equipment will enable border crossing operators to monitor the movement of people and vehicles in a way that promotes safety. Since this project will give drivers better information about crossing times, it will also help to spread demand across available crossings, maximizing the available infrastructure.

Resiliency

Improving the border information system will draw benefits from a more resilient transportation system. Reliable wait time estimates will inform drivers and operators as to the conditions at the border crossing. Drivers will see benefits in the form of reduced fuel consumption and travel time, extending to health benefits from lower emissions. Furthermore, the installation of modern technology will enable the border crossing to be better prepared against cyber-attacks.

Equity and Access

Improvement to border crossing movements will lead to improved access. Jobs, schools, tourist sites, and other locations will be more accessible for people that travel through border entries. The ease of access will place less of a burden on disadvantaged communities traveling through borders as less time and resources will be needed to cross.

Climate

The improvement in traffic and wait time estimations, and subsequent improvements to operations, will generate climate benefits. The reduction in the amount of time spent at the border crossing will result in reduced congestion, decreased vehicle idling, and improved flow times. Ultimately, the change in traffic conditions will reduce emissions and fuel consumption.

Partnerships

A border crossing is vital for the US and Canadian economies, therefore ensuring smooth ingress and egress from one country to another will promote partnerships between the country's industries. Goods and people will cross the border more efficiently as wait times predictions improve and crossing times become more reliable. This change in operations will stimulate the economies of both countries in several ways. As more people cross the border, the country's respective economy will experience a surge in consumer spending, whether from daily commutes or tourism. For the private sector, reliable crossing times will help the industry make better both informed decisions and enable collaboration between industries. Furthermore, border wait time systems will integrate with connected systems south of the border to better estimate overall travel times across the region.

Integration

Improvements to detection equipment will help integrate different components of border to obtain more robust data. Information gathered by the upgrade includes technologies form Bluetooth and Wi-Fi receptors and radars, which all work together to generate Border Wait Times. This infrastructure picks up information such as traffic, type of vehicle, number of gates open, and others which then generates actual and estimated wait times. With all the gathered information, border crossing operators will help the economy by optimizing the border crossing procedures.

Workforce Development

The installation of new equipment will require the involvement of different areas of the workforce. Not only will new equipment be installed, but the training of personnel will require a different set of skills. Additionally, based on the new information derived from infrastructure updated, border port of entry operators will be able to determine the appropriate level of labor needed to efficiently attend vehicles passing through.