

Port Improvement Project

Sponsored by

The Port Authority of Guam

EVALUATION OF EXPECTED PROJECT COSTS AND BENEFITS

BST Associates
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Supporting Material for the TIGER Discretionary
Grant Application Submitted by the Port Authority
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Port of Guam Port Improvement Project - Evaluation of Expected Project Costs and Benefits

This report provides a benefit cost evaluation of the Port Improvement Project (the project) of the Port of Guam (PAG) marine terminal. It is based upon the U.S. Department of Transportation’s (USDOT) benefit-cost analysis guidelines for TIGER projects focusing on operational cost savings, reduced inventory carrying costs and the benefits of reduced air emissions.

Benefit Cost Evaluation

The net present value (NPV) of benefits (operational cost savings, reduced inventory carrying costs and benefits from emission reduction) were divided by the cost of the project. The project provides a Benefit/Cost (B/C) ratio significantly greater than 1 under both real discount rates:

- Under the 7% discount rate, the B/C ratio is 2.37.
- Under the 3% discount rate, the B/C ratio is 4.59.

Table 1: Summary of Benefit Cost Analysis Results, 2011 – 2041 2009 \$Millions

Component	NPV (2011-2041 in 1,000s of 2009\$)	
	7.0%	3.0%
Benefits		
Operational Cost Savings	\$143,239	\$260,030
Reduced Inventory Carrying Costs	\$39,303	\$73,184
Benefits from Emission Reduction	\$41,394	\$73,171
Total Benefits	<u>\$223,936</u>	<u>\$406,385</u>
Project Cost	\$94,460	\$88,511
B/C Ratio	2.37	4.59

Source: PBI, BST Associates

It was assumed that the same volume of cargo would be handled each year with and without the improvements. Benefits were estimated to begin in mid-2011 (after construction is partially completed) and extend through the expected 30-year life of the facility (to mid-2041).

Operational Cost Savings

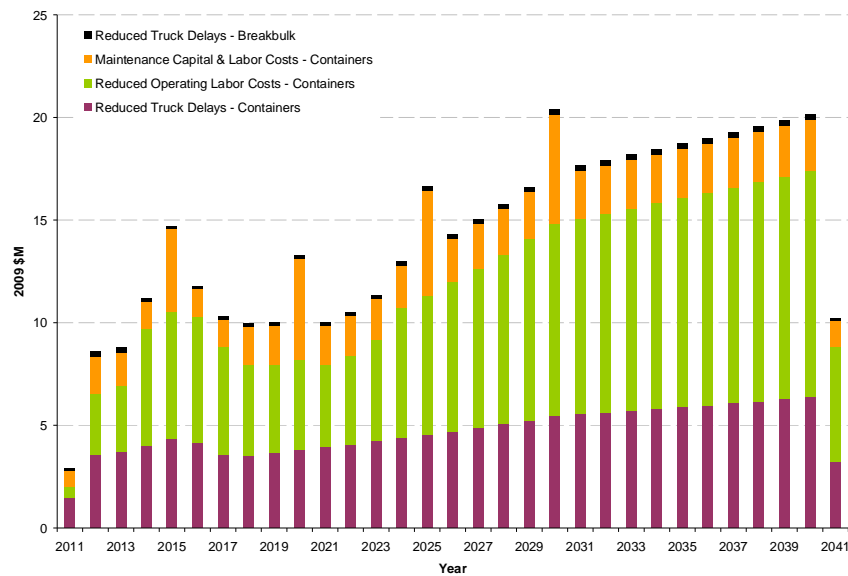
The project will greatly improve the efficiency of the terminal. A detailed model of port operations was developed to assess how cargo operations (containerized and breakbulk) utilize key components of the marine terminal under current conditions as compared with improved conditions. The improvements will facilitate cost savings as follows:

- Reduced Truck Delays within the yard and at the gates – Trucks will be processed faster and will require substantially less service time inside the yard. Important sub-components include:

- Gate Queuing Time,
- Gate Processing Time,
- Yard Service Time.
- Reduced Operating labor Costs – improved gates and computer systems will likewise improve (decrease) the Port’s cost of performing the gate functions. Important sub-components include:
 - Truck Gate Operating hours
 - Container Yard Grounding Service
 - Vessel/Stevedoring Service
- Maintenance Labor and Capital Costs – reductions in equipment operating hours will also lower maintenance costs. Without the proposed Port Improvement Project, increased capital and labor will be required to handle projected cargo volumes.

Figure 1 illustrates the annual flow of operational cost savings by major category.

Figure 1: Port of Guam Operational Cost Savings by Calendar Year, 2011 – 2041, 2009 \$Millions



Note: 2011 and 2041 are partial years since the analysis is from mid-2011 (after construction is partially completed) to mid 2041

Annual real net cost savings were estimated based on the costs associated with existing operations less the cost associated with improved operations. Table 2 summarizes the results of this analysis.

Under the 7% discount rate, the NPV of operational cost savings are estimated to be \$140.8 million and \$2.4 million, for container and breakbulk operations respectively. The combined operational cost savings are estimated at \$143.2 million.

Under the 3% discount rate, the NPV of operational cost savings are estimated to be \$255.9 million and \$4.1 million, for container and breakbulk operations respectively. The combined operational cost savings are estimated at \$260.0 million.

Table 2: Net Present Value of Cost Savings from Operations, 2011 – 2041, 2009 \$Millions

Type	Description	Net Present Value	
Discount Rate		7.0%	3.0%
Container operations - cost savings			
Reduced Truck Delays			
	Gate Queuing Time	\$15.15	\$26.75
	Gate Processing Time	\$7.54	\$13.44
	Yard Service Time	\$25.89	\$46.01
Reduced Operating labor Costs			
	Truck Gate Operating hours	\$7.04	\$12.45
	Container Yard Grounding Service	\$4.18	\$7.38
	Vessel/Stevedoring Service	\$55.26	\$105.20
Maintenance Labor Costs		\$20.34	\$34.21
Maintenance Labor Costs		\$5.47	\$10.52
	SUBTOTAL	\$140.87	\$255.95
Breakbulk operations - cost savings			
Reduced Truck Delays			
	Gate Queuing Time	\$721	\$1.21
	Gate Processing Time	\$551	\$0.93
	Yard Service Time	\$1.10	\$1.94
	SUBTOTAL	\$2.37	\$4.08
Total – Container & Breakbulk		\$143.24	\$260.03

Note: Totals may not add due to rounding
 Source: PBI, BST Associates

Reduced Inventory Carrying Costs

The project will also reduce the inventory carrying costs of shippers in Guam by reducing the time that cargo remains in the marine terminal prior to arriving at the shipper’s warehouse or retail store.

Inventory carrying costs were estimated using the following factors:

- The estimated average value of cargo moving through the Port of Guam was estimated at \$150,000 per loaded inbound container and \$1,500 per revenue ton for breakbulk cargo. These estimates are based on a review of Government of Guam data (Customs and retail sales data) and review of cargo values in other port regions.
- Interest rate for carrying inventory was estimated at 15% per year.
- Additional net hours that cargo remains in the terminal under current conditions relative to improved conditions was an output of the marine terminal model.

Under the 7% discount rate, the NPV of reduced inventory carrying costs is estimated to be \$38.9 million and \$0.4 million, for container and breakbulk respectively. The combined cost savings are estimated at \$39.3 million.

Under the 3% discount rate, the NPV of reduced inventory carrying costs is estimated to be \$72.7 million and \$0.5 million, for container and breakbulk respectively. The combined cost savings are estimated at \$73.1 million.

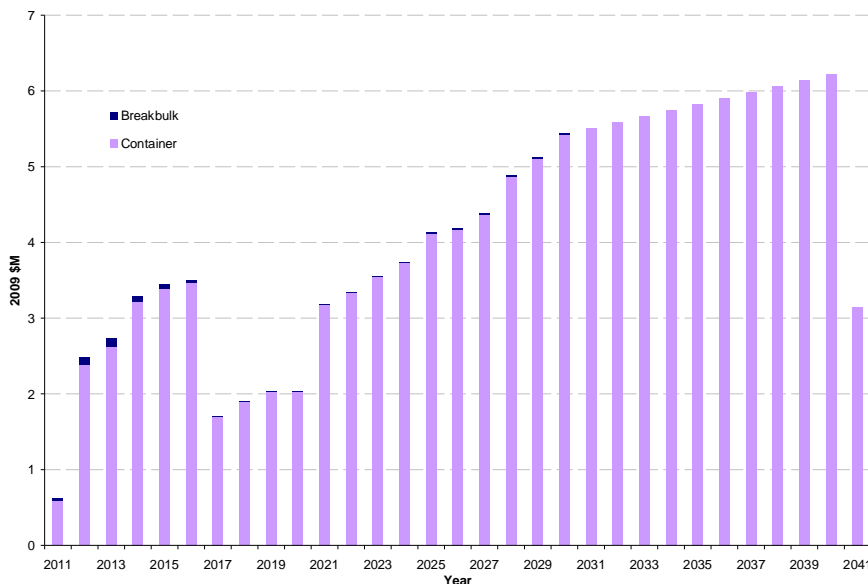
Table 3: Net Present Value of Reduced Inventory Carrying Costs, 2011 – 2041, 2009 \$Millions

Description	Net Present Value	
	7.0%	3.0%
Container Operations	\$38.92	\$72.70
Breakbulk Operations	\$0.38	\$0.49
SUBTOTAL	\$39.30	\$73.18

Note: Totals may not add due to rounding
Source: PBI, BST Associates

Figure 2 illustrates the annual flow of inventory carrying cost savings.

Figure 2: Port of Guam Reduced Inventory Carrying Costs by Calendar Year, 2011 – 2041, 2009 \$Millions



Note: 2011 and 2041 are partial years since the analysis is from mid-2011 (after construction is partially completed) to mid 2041

Benefits from Emission Reductions

The Port Improvement Project will also reduce emission of pollutants by reducing the hours of operations by vessels at berth (on all trade routes) and reduction in hours of use of terminal operating equipment (i.e., crane and top-pick operating hours).

A spreadsheet model was developed to assess the benefits associated with reductions in CO₂, NO_x, SO_x and DPM. The hours of operation came from the marine terminal operation model (net hours of existing less improved operations). The hourly rate of emissions was based upon recent Emissions Inventories for the Port of Los Angeles (2006 and 2007). As shown in the attached table, emissions in tons per hour of operation are reported for vessels while at berth (hotelling) by type and size and equipment under standard terminal operations. The estimated benefit per ton of emission by type came from Office of Regulatory Analysis and Evaluation, National Center for Statistics and Analysis.

Table 4: Benefit inputs from Emission Reduction, Tons of Emissions per Hour while at Berth

Category	CO ₂	NO _x	SO _x	DPM
Container Vessel (1)				
USWC	1.32	0.0176	0.0176	0.00195
CNMI	0.54	0.0047	0.0079	0.00054
FSM	1.08	0.0094	0.0157	0.00107
Asia	1.08	0.0094	0.0157	0.00107
Breakbulk Vessel (1)	1.14	0.0119	0.0180	0.00152
Equipment (1)				
Cranes	0.35	0.000	0.000	0.000
Top picks	0.14	0.001	0.000	0.000
Yard Trucks	0.06	0.000	0.000	0.000
Benefits per ton (2)	\$33¹	\$4,000	\$16,000	\$168,000

Sources: (1) Port of Los Angeles Inventory of Air Emissions 2006 and 2007; (2) Office of Regulatory Analysis and Evaluation, National Center for Statistics and Analysis

As with other benefits, the benefit from emission reductions was estimated annually and estimated net present value based upon the two discount rates. Table 5 shows a summary of these benefits, while Table 6 shows these benefits broken down in more detail by category.

Table 5: Present Value of Emission Reductions, 2011 – 2041, 2009 \$Millions

	7% Discount Rate	3% Discount Rate
CO ₂	\$6.8	\$12.8
NO _x	\$3.6	\$6.3
SO _x	\$15.8	\$27.4
DPM	\$15.3	\$26.7
Total	\$41.4	\$73.2

¹ The benefit from CO₂ reductions were increased at 2.4% per year, as per guidance. Benefit values per tons were not done for the other pollutants.

Table 6: Net Present Value of Emission Reductions, 2011 – 2041, 2009 \$Millions

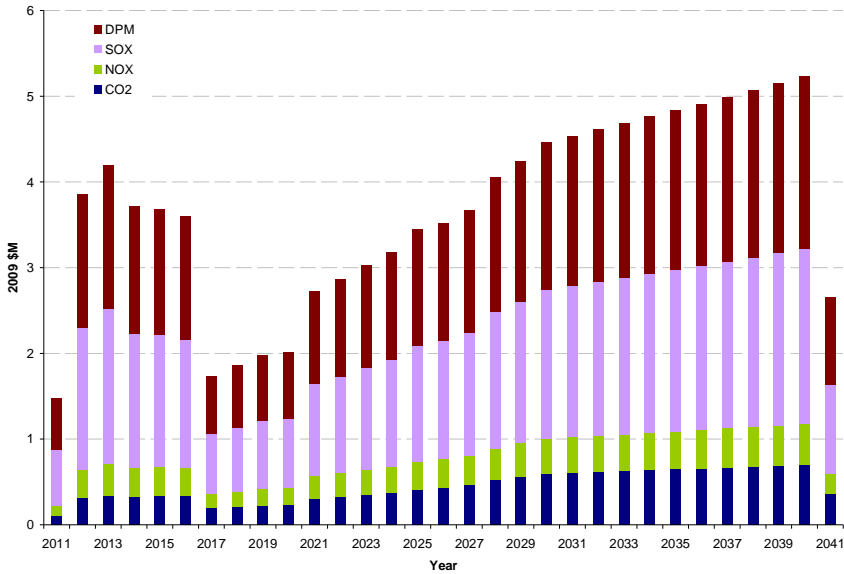
		Net Present Value	
		7.0% discount	3.0% discount
Reduction of CO2 Emissions			
<i>Ocean Vessels</i>	Container	\$2.52	\$4.85
	Breakbulk	\$3.11	\$5.74
	Total	\$5.63	\$10.59
<i>Equipment</i>	Cranes	\$1.14	\$2.19
	Top picks	\$0.04	\$0.07
	Yard Equipment	\$0	\$0
	Total	\$1.15	\$2.20
	Total (Ocean Vessels and Equipment)	\$6.78	\$12.79
Reduction of NOX Emissions			
<i>Ocean Vessels</i>	Container	\$2.47	\$4.56
	Breakbulk	\$0.62	\$0.87
	Total	\$3.09	\$5.43
<i>Equipment</i>	Cranes	\$0.12	\$0.22
	Top picks	\$0.36	\$0.63
	Yard Equipment	\$0	\$0
	Total	\$0.47	\$0.84
	Total (Ocean Vessels and Equipment)	\$3.56	\$6.27
Reduction of SOX Emissions			
<i>Ocean Vessels</i>	Container	\$12.04	\$22.11
	Breakbulk	\$3.73	\$5.28
	Total	\$15.77	\$27.38
<i>Equipment</i>	Cranes	\$0	\$0
	Top picks	\$0.02	\$0.03
	Yard Equipment	\$0	\$0
	Total	\$0.02	\$0.03
	Total (Ocean Vessels and Equipment)	\$15.77	\$27.39
Reduction of DPM Emissions			
<i>Ocean Vessels</i>	Container	\$11.61	\$21.389
	Breakbulk	\$3.31	\$4.69
	Total	\$14.92	\$26.08
<i>Equipment</i>	Cranes	\$0	\$0
	Top picks	\$0.36	\$0.64
	Yard Equipment	\$0	\$0
	Total	\$0.36	\$0.64
	Total (Ocean Vessels and Equipment)	\$15.29	\$26.72

		Net Present Value	
Total Emissions Benefits		7.0% discount	3.0% discount
<i>Ocean Vessels</i>	Container	\$28.64	\$52.90
	Breakbulk	\$10.77	\$16.58
	Total	\$39.41	\$69.48
<i>Equipment</i>	Cranes	\$1.26	\$2.41
	Top picks	\$0.72	\$1.28
	Yard Equipment	\$0	\$0
	Total	\$1.99	\$3.69
Total (Ocean Vessels and Equipment)		\$41.39	\$73.17

Note: Totals may not add due to rounding

Figure 3 illustrates the annual flow of benefits from reduced emissions.

Figure 3 – Port of Guam Reduced Inventory Carrying Costs by Calendar Year, 2011 – 2041, 2009 \$Millions



Note: 2011 and 2041 are partial years since the analysis is from mid-2011 (after construction is partially completed) to mid 2041