

BENEFIT-COST ANALYSIS SUMMARY

Introduction

A benefit-cost analysis (BCA) for the P&L Shortline Railroad Upgrade & Shuttle Train Loader Facility was completed with the intention of quantifying net benefits generated by the project. The selection criterion transportation, safety, CO₂ and roadway damages were used to calculate the BCA. Long and short term benefits for job creation have been quantified for this application but are not included in the BCA. The supporting documentation for the cost-benefit analysis can be viewed via the following web link: <http://www.pccrail.org/tiger4pl.aspx>.

Methodology

When calculating the BCA, this project is assumed to be fully constructed by 2013 with a 20 year lifecycle. Although lifecycle of rail upgrades and loader facility are greater than 20 years, this was selected so maintenance or rehabilitation cost are not needed in the BCA calculation. This is a conservative approach.

During the first nine years of operation, rail shipments increase from 4400 cars to 6700 cars. This provides an annual growth of 4.78%. From that period on, no growth is calculated into the BCA. All monetary benefits are then discounted back to the present year value using the required 3 and 7 percent discount rates (USDOT – TIGER Guidelines¹).

- **Baselines and Alternatives.** The baseline assumption is that without the project, the P&L branch of shortline rail will eventually close. As a result, an estimated 16,368,000 bushels of grain will be hauled by truck from farm storage and grain terminals to the Whitman County Port of Central Ferry and shipped to Portland, Oregon, in barges. It is unlikely the shortline rail will continue to operate in the future without the project to bring it up to 286K compliance. The result will be increased trucking on the regional highways and a complete dependence on barge transportation of grain.
- **Affected Population.** There are three shipping companies on the P&L: Cooperative Agricultural Producers, Inc. (Co-Ag), Palouse Grain Growers, Inc., and Pacific Northwest Farmers' Cooperative, Inc. These companies will benefit from this project as well as the regional farmers in Stevens, Spokane, and Whitman Counties. The railroad operator, WIR and the BNSF will also benefit from the track improvements.
- **Risk and Uncertainty.** Future fuel prices are uncertain. If environmental concerns were to dominate and the dams along the Snake River were breached, barge shipping options

¹ USDOT Tiger Grants. (2012) "BCA Resource Guide." Retrieved March 5th, 2012 from http://www.dot.gov/tiger/docs/tiger-12_bca-resourceGuide.pdf

would be removed and the ports could close. Other uncertainty includes the assumption of the rail line closure if the improvements are not made. On July 15, 2010, the FRA required lines like the P&L to put together a Bridge Management Program (Ruling 49 CFR Part 237). This program has to be in place and implemented by September 2012. The bridges must be rated. Three years ago, WSDOT went through a cursory evaluation of the bridges on the P&L. The findings showed that many of the bridges were not 286K compatible. Under FRA regulations, without these repairs, the 110-car loader trains that BNSF prefers would not be able to run on this line. The effect would eventually cause closure of the line.

- **Costs.** A total project cost of \$26,660,000 was used to compare the costs of the whole project, including both the TIGER Discretionary Grant funding (\$8,500,000) and the private partner contribution (\$18,160,000).
- **Types of Benefits.** The benefit-cost analysis includes calculations for net benefits in: transportation, road damage, safety, and CO₂ emissions.

Benefit Cost Summary

The analysis resulted in a benefit/cost ratio of 3.53 using a 3% discount rate and 2.45 using a 7% discount rate. The analysis compared two scenarios: continuation of the status quo, eventually resulting in track abandonment due to the state of disrepair and rehabilitation of the track along with a new loading facility.

Figure 1: BCA Results

Impact Matrix Summary of Selection Criteria (All Values are in \$ Millions)	3% Discount Rate	7% Discount Rate
Transportation – Benefit Cost Savings	\$72.3	\$50.2
Road Damage - Benefit Cost Savings	\$13.8	\$9.6
Safety – Benefit Cost Savings	\$7.5	\$5.2
CO ₂ – Benefit Cost Savings	\$0.5	\$0.4
Benefit Cost Analysis Results		
Total Discounted Benefit	\$94.1	\$65.4
Total Cost	\$26.7	\$26.7
Benefit to Cost Ratio	3.53	2.45
Net Present Value	\$67.4	\$38.7

Results

The baseline assumption is that without the project, the shortline rail will close. As a result, an estimated 16,368,000 bushels of grain will be hauled by truck from farm storage and grain terminals to the Whitman County Port of Central Ferry and shipped to Portland, Oregon, in barges. It is unlikely the shortline rail will continue to operate in the future without the project. The result will be increased trucking on the regional highways and a complete dependence on barge transportation of grain.

The project construction costs are \$26,660,000 and assumed to occur in 2013 (Year 0) of the period of analysis. It is assumed that additional yearly costs beyond year zero are negligible for the project. The stream of benefits from the project occurs from reduced grain trucking. The baseline real yearly benefits vary due to increasing yearly shipping until the year 2023. The analysis for this BCA is over a 20-year period. The cumulative real benefits are \$128,666,673. Applying a 7% discount rate, the net benefits are \$38,731,092 and alternatively \$67,402,689 with a 3% discount rate. This yields a BC ratio of 2.45 at 7% discount rate and 3.53 at 3% discount rate.

Transportation Savings

The greatest benefits from the project are the net transportation savings from reduced trucking of grain. Operational benefits are the cost saving associated with shipping by truck to train then train to port as opposed to truck to barge then barge to port.

Build Scenario

- A. Truck-to-Train: 6,500,000 bushels are loaded and shipped directly from storage facilities along the shortline to the loading facility built as a component of this project. The rate is \$.05 per bushel ($6,500,000 * \$0.05 = \$325,000$). The balance of 9,868,000 bushels will be shipped by truck to the loading facility (1,150 bushels per truck) which equals 8,581 truckloads. Conversion to truck miles: $8,581 * 50$ miles (round trip) = 429,043.48 truck miles. Total costs equals: $429,043.48$ truck miles * \$2.645 per truck mile = \$1,134,820.
- B. Train-to-Portland: From this facility the grain will be loaded onto unit trains and shipped to Portland, Oregon. Costs: $16,368,000 * \$0.48/\text{bushel} = \$7,911,200$.

Total 2013 year cost truck-to-train to Portland equals \$ 9,371,020.

No-Build Scenario

- A. Truck-to-Barge: 16,368,000 bushels are shipped to the port at Central Ferry by truck. An average of 1,150 bushels per truck = 14,233 truckloads to ship the grain from farms and grain terminals to the port at Central Ferry (150 miles round trip). Converting to truck miles: $14,233$ truck loads * 150 miles = 2,134,957 truck miles. Total truck cost to port: $2,134,957$ truck miles * \$2.43 per truck mile = \$5,187,944 (Note \$2.43 per truck mile is

used instead of \$2.645 used in the truck-to-train analysis because of less loading-unloading costs/mile).

- B. Barge-to-Portland: Costs: \$6,219,840 (barge rate + FSC)/16,368,000 bushels=\$0.38/bushel. Adding put-through costs: \$0.38/bushel + \$0.10 = \$0.48 per bushel. Total costs = 16,368,000 bushels *\$0.48 per bushels = \$7,856,640.

Total 2013 year cost truck- to-barge to Portland equals \$ 13,044,584.

Net 2013 year transportation savings equals \$3,673,564.

The annual transportation savings with a 4.78% increase in rail shipment are \$4,942,551 and can be seen in Figure 2.

Safety Savings

Safety benefits are the value associated with the reduction of fatalities, injuries and property damage. These benefits are a comparison between the year 2013 no-build scenario and the 2033 build scenario. Network safety was calculated by using vehicle miles traveled (VMT); collision rates and recommended monetized values. VMT's were estimated at 1,705,913. Collision rates were obtained by the 2010 Washington State Collision Data Summary for eastern Washington urban highways². The recommended monetized value for fatal collisions is \$6,200,000³. The value for injury collision is \$652,550⁴ and the value for property damages only is \$3,285⁵. The Injury Collision value was obtained from averaging the cost of a minor, moderate, serious, and severe accident. Those values were \$18,600, \$291,400, \$651,000, and \$1,649,200 respectively.

Total 2013 year safety saving \$378,737

The annual safety savings with a 4.78% increase in rail shipment are \$509,567 and can be seen in Figure 2.

Road Damage Savings

The estimated road damage savings parameters was taken from a 2006 study which estimated the additional road damage from the closure of the shortline railroad⁶:

² 2010 Washington State Collision Data Summary, "2010 Average Collision Rates By Functional Class Eastern Region (State Routes only)," pg 37, July, 2011

³ Treatment of the Economic Value of a Statistical Life in Departmental Analyses (2008 revised guidance and 2011 update), July, 2011

⁴ Treatment of the Economic Value of a Statistical Life in Departmental Analyses (2008 revised guidance and 2011 update), July, 2011

⁵ The Economic Impact of Motor Vehicle Crashes 2000, "Summary of Unit Costs, 2000," pg 62, Table A-1, May, 2002

⁶ Casavant, Ken, and Jessup, Eric, Palouse River and Coulee City Railroad: Market Assessment, Washington State Department of Transportation Office of Freight Strategy and Policy, August 2006, p.8.

The damage costs were estimated in the table below:

Casavant Report Road Damage Costs from P&L abandonment

	<u>Annual</u>	<u>Total</u>
State	\$198,667	\$2,980,000
Local	\$36,667	\$550,000
Total	\$235,334	\$3,530,000

In 2005 an estimated 22% of 19,913,890 bushels of regional wheat was hauled by P&L Rail = 4,381,056 bushels. The \$235,334 annual estimated road damage savings/ 4,382,056 bushels = \$0.0537/bushel in savings.

Converting to bushel-mile: $\$0.053/150 \text{ miles} = \0.000358 bushel-mile savings.

Applying the savings parameters to current estimates: $16,368,000 \text{ bushels} * \$ 0.000358 \text{ per bushel-mile} * 120 \text{ miles (net of truck-to-rail)} = \$ 703,382$.

The 2013 year savings in road damage from the project is \$ 703,382.

The annual roadway damage safety savings with a 4.78% increase in rail shipment are \$946,357.

Savings in CO₂ Emissions

The CO₂ parameters in the analysis were adapted from⁷:

Two analyses were conducted. The emissions created from truck-to-barge to Portland were converted to CO₂ costs. This was compared to truck-to-train to Portland, Oregon in CO₂ costs. The social cost of CO₂ in the literature can reach as high as \$50 per ton. This analysis uses a conservative \$varying price per metric ton year of CO₂ which has been required by DOT.

Truck-to-Barge to Portland

a. Truck-to-Barge

Truckloads conversion: $16,368,000 \text{ bushels}/1,150 \text{ bushel per truck} = 14,233 \text{ truckloads}$.

Metric Tons of CO₂ = 4,795

b. Barge to Portland

Metric Tons of CO₂ = 2,581

Total Metric Tons of CO₂ from Truck-to-Barge to Portland equals 7,375 at the initial year.

Truck-to-Rail to Portland

a. Truck-to-Train

Metric Tons of CO₂ = 964

b. Train to Portland

Metric Tons of CO₂ = 4,679

⁷ A Modal Comparison of Domestic Freight Transportation Effects on the General Public, Texas Transportation Institute, December 2007 (Amended March 2009), p.36.

Total Metric Tons of CO2 from Truck-to-Train to Portland equals 5,643 during the initial year.

The annual CO2 savings with a 4.78% increase in rail shipment are \$34,858 and can be seen in Figure 2.

Total Annual Real Benefits and Costs from Project (Baseline-No Discount Rate)

The annual real benefits by category (undiscounted) are presented in Figure 2. These include an annual growth rate of 4.78% for increased shipping by rail to port for the first nine years. From this period on the growth rate is assumed to be zero because all region wheat is already being shipped by rail. The total undiscounted real benefits are \$128,666,673. They are broken out by net truck savings, road damage savings, safety savings, and CO2 savings.

Figure 2. Yearly and Annual Benefits with Increasing Rail Shipment.

Total B/C with 4.78% rail growth for 9 years						
	Costs		Benefits			
Year		Transportation	Road Damage	Safety	CO2	Total Benefits
2013	\$ 26,660,000					
	\$(26,660,000)					
2014		\$3,673,564	\$703,382	\$378,737	\$39,512	\$4,795,196
2015		\$3,849,161	\$737,004	\$396,841	\$38,449	\$5,021,454
2016		\$4,033,151	\$772,233	\$415,810	\$37,397	\$5,258,590
2017		\$4,225,935	\$809,146	\$435,685	\$36,357	\$5,507,123
2018		\$4,427,935	\$847,823	\$456,511	\$35,332	\$5,767,600
2019		\$4,639,590	\$888,349	\$478,332	\$34,321	\$6,040,592
2020		\$4,861,363	\$930,812	\$501,197	\$33,326	\$6,326,697
2021		\$5,093,736	\$975,305	\$525,154	\$32,348	\$6,626,542
2022		\$5,337,216	\$1,021,924	\$550,256	\$31,622	\$6,941,018
2023		\$5,337,216	\$1,021,924	\$550,256	\$30,779	\$6,940,176
2024		\$5,337,216	\$1,021,924	\$550,256	\$31,560	\$6,940,957
2025		\$5,337,216	\$1,021,924	\$550,256	\$32,229	\$6,941,626
2026		\$5,337,216	\$1,021,924	\$550,256	\$33,010	\$6,942,406
2027		\$5,337,216	\$1,021,924	\$550,256	\$33,679	\$6,943,075
2028		\$5,337,216	\$1,021,924	\$550,256	\$34,460	\$6,943,856
2029		\$5,337,216	\$1,021,924	\$550,256	\$35,129	\$6,944,525
2030		\$5,337,216	\$1,021,924	\$550,256	\$35,798	\$6,945,194
2031		\$5,337,216	\$1,021,924	\$550,256	\$36,579	\$6,945,975
2032		\$5,337,216	\$1,021,924	\$550,256	\$37,248	\$6,946,644
2033		\$5,337,216	\$1,021,924	\$550,256	\$38,028	\$6,947,425
Total	\$(26,660,000)	\$98,851,030	\$18,927,142	\$10,191,338	\$697,162	\$128,666,673
Annual Cost		\$4,942,552	\$946,357	\$	\$34,858	\$6,433,334

Total Annual Real Benefits and Costs from Project (Discount Rate 7%)

The annual real benefits by category (7% discount rate) are presented in Figure 3. The total discounted net benefits are \$38,731,092. They are broken out by net truck savings, road damage savings, safety savings, and CO2 savings.

Figure 3. Annual Cost and Benefits Using a 7% Discount Rate

Total Benefits/Costs ---7% Discount Rate							
Discount 7%							
Costs		Benefits					
Year	\$ 26,660,000	Transportation	Road Damage	Safety	CO2	Total Benefits	Net Benefits
2013	\$(26,660,000)					\$ -	\$(26,660,000)
2014		\$3,433,238	\$657,367	\$353,960	\$36,927	\$4,481,492	\$4,481,492
2015		\$3,362,006	\$643,728	\$346,616	\$33,583	\$4,385,933	\$4,385,933
2016		\$3,292,252	\$630,372	\$339,424	\$30,527	\$4,292,576	\$4,292,576
2017		\$3,223,946	\$617,293	\$332,382	\$27,737	\$4,201,358	\$4,201,358
2018		\$3,157,056	\$604,486	\$325,486	\$25,191	\$4,112,219	\$4,112,219
2019		\$3,091,555	\$591,944	\$318,733	\$22,870	\$4,025,102	\$4,025,102
2020		\$3,027,412	\$579,663	\$312,120	\$20,754	\$3,939,949	\$3,939,949
2021		\$2,964,601	\$567,636	\$305,644	\$18,827	\$3,856,708	\$3,856,708
2022		\$2,903,092	\$555,859	\$299,303	\$17,200	\$3,775,454	\$3,775,454
2023		\$2,713,170	\$519,494	\$279,722	\$15,647	\$3,528,034	\$3,528,034
2024		\$2,535,673	\$485,509	\$261,423	\$14,994	\$3,297,598	\$3,297,598
2025		\$2,369,788	\$453,747	\$244,320	\$14,310	\$3,082,165	\$3,082,165
2026		\$2,214,755	\$424,062	\$228,337	\$13,698	\$2,880,852	\$2,880,852
2027		\$2,069,865	\$396,320	\$213,399	\$13,061	\$2,692,644	\$2,692,644
2028		\$1,934,453	\$370,392	\$199,438	\$12,490	\$2,516,773	\$2,516,773
2029		\$1,807,900	\$346,161	\$186,391	\$11,899	\$2,352,351	\$2,352,351
2030		\$1,689,626	\$323,515	\$174,197	\$11,333	\$2,198,671	\$2,198,671
2031		\$1,579,090	\$302,350	\$162,801	\$10,822	\$2,055,063	\$2,055,063
2032		\$1,475,785	\$282,571	\$152,150	\$10,299	\$1,920,805	\$1,920,805
2033		\$1,379,238	\$264,085	\$142,197	\$9,827	\$1,795,347	\$1,795,347
Total	\$(26,660,000)	\$50,224,500	\$9,616,554	\$5,178,043	\$371,996	\$65,391,092	\$38,731,092

Total Annual Real Benefits and Costs from Project (Discount Rate 3%)

The annual real benefits by category (3% discount rate) are presented in Figure 4. The total discounted net benefits are \$67,402,689. They are broken out by net truck savings, road damage savings, safety savings, and CO₂ savings.

Figure 4. Annual Cost and Benefits Using a 3% Discount Rate.

Total Benefits/Costs ---3% Discount Rate							
		Discount 3%					
Costs		Benefits					
Year	\$ 26,660,000	Transportation	Road Damage	Safety	CO ₂	Total Benefits	Net Benefits
2013	\$(26,660,000)					\$0	\$26,660,000
2014		\$3,566,567	\$682,896	\$367,706	\$38,362	\$4,655,530	\$4,655,530
2015		\$3,628,203	\$694,697	\$374,060	\$36,242	\$4,733,202	\$4,733,202
2016		\$3,690,904	\$706,702	\$380,525	\$34,223	\$4,812,354	\$4,812,354
2017		\$3,754,689	\$718,915	\$387,101	\$32,303	\$4,893,008	\$4,893,008
2018		\$3,819,576	\$731,339	\$393,790	\$30,477	\$4,975,183	\$4,975,183
2019		\$3,885,584	\$743,978	\$400,596	\$28,743	\$5,058,901	\$5,058,901
2020		\$3,952,733	\$756,835	\$407,519	\$27,097	\$5,144,184	\$5,144,184
2021		\$4,021,042	\$769,914	\$414,561	\$25,536	\$5,231,054	\$5,231,054
2022		\$4,090,532	\$783,220	\$421,725	\$24,236	\$5,319,713	\$5,319,713
2023		\$3,971,390	\$760,408	\$409,442	\$22,903	\$5,164,143	\$5,164,143
2024		\$3,855,719	\$738,260	\$397,517	\$22,800	\$5,014,295	\$5,014,295
2025		\$3,743,416	\$716,757	\$385,939	\$22,605	\$4,868,717	\$4,868,717
2026		\$3,634,385	\$695,881	\$374,698	\$22,478	\$4,727,441	\$4,727,441
2027		\$3,528,529	\$675,612	\$363,784	\$22,266	\$4,590,191	\$4,590,191
2028		\$3,425,756	\$655,934	\$353,188	\$22,118	\$4,456,997	\$4,456,997
2029		\$3,325,977	\$636,829	\$342,901	\$21,891	\$4,327,599	\$4,327,599
2030		\$3,229,104	\$618,281	\$332,914	\$21,658	\$4,201,957	\$4,201,957
2031		\$3,135,052	\$600,273	\$323,217	\$21,486	\$4,080,028	\$4,080,028
2032		\$3,043,740	\$582,789	\$313,803	\$21,242	\$3,961,574	\$3,961,574
2033		\$2,955,087	\$565,815	\$304,663	\$21,055	\$3,846,621	\$3,846,621
Total	\$(26,660,000)	\$72,257,983	\$13,835,335	\$7,449,650	\$519,721	\$94,062,689	\$67,402,689

Annual Summary of Real Benefits and Costs from Project (Discount Rate 7% & 3%)

Figure 5 below show the results for each year as the benefits are discounted back at 3 and 7%. A 2.45 benefit/cost ratio was calculated at the prescribed 7% discount, while a 3.53 benefit/cost ratio was found for the 3% discount.

Figure 5. Yearly Summary of Cost and Benefits for 7% and 3% Discounts.

Benefits/Costs Summary Total					
Year	Baseline Costs	Baseline Benefits	Baseline B/C	Discount Rate	
				7%	3%
				7%	3%
2013	(\$26,660,000)	\$0	(\$26,660,000)	(\$26,660,000)	(\$26,660,000)
2014	\$0	\$4,795,196	\$4,795,196	\$4,481,492	\$4,655,530
2015	\$0	\$5,021,454	\$5,021,454	\$4,385,933	\$4,733,202
2016	\$0	\$5,258,590	\$5,258,590	\$4,292,576	\$4,812,354
2017	\$0	\$5,507,123	\$5,507,123	\$4,201,358	\$4,893,008
2018	\$0	\$5,767,600	\$5,767,600	\$4,112,219	\$4,975,183
2019	\$0	\$6,040,592	\$6,040,592	\$4,025,102	\$5,058,901
2020	\$0	\$6,326,697	\$6,326,697	\$3,939,949	\$5,144,184
2021	\$0	\$6,626,542	\$6,626,542	\$3,856,708	\$5,231,054
2022	\$0	\$6,941,018	\$6,941,018	\$3,775,454	\$5,319,713
2023	\$0	\$6,940,176	\$6,940,176	\$3,528,034	\$5,164,143
2024	\$0	\$6,940,957	\$6,940,957	\$3,297,598	\$5,014,295
2025	\$0	\$6,941,626	\$6,941,626	\$3,082,165	\$4,868,717
2026	\$0	\$6,942,406	\$6,942,406	\$2,880,852	\$4,727,441
2027	\$0	\$6,943,075	\$6,943,075	\$2,692,644	\$4,590,191
2028	\$0	\$6,943,856	\$6,943,856	\$2,516,773	\$4,456,997
2029	\$0	\$6,944,525	\$6,944,525	\$2,352,351	\$4,327,599
2030	\$0	\$6,945,194	\$6,945,194	\$2,198,671	\$4,201,957
2031	\$0	\$6,945,975	\$6,945,975	\$2,055,063	\$4,080,028
2032	\$0	\$6,946,644	\$6,946,644	\$1,920,805	\$3,961,574
2033	\$0	\$6,947,425	\$6,947,425	\$1,795,347	\$3,846,621
Total	(\$26,660,000)	\$128,666,673	\$102,006,673	\$65,391,092	\$94,062,689
Benefit Cost Ratios				2.45	3.53