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Cost-Benefit Analysis for the Alaska Canada Rail Link

Final Report

October 27, 2006

HDR | HLB Decision Economics Inc.

Risk Analysis • Investment and Finance
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University of Alaska

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EXECUTIVE SUMMARY

The proposed Alaska-Canada Rail Link (ACRL) would generate economic benefits that exceed the total costs of its construction, operation and maintenance. Although this conclusion is sensitive to the assumed opportunity cost of resources (the “discount rate”), the finding holds for discount rates of 5.9 percent or lower. In other words, the project would yield an economic return on investment of 5.9 percent, a return that makes the project competitive with other economic development investment opportunities available to the State. Economic benefits would exceed $14 billion, and would arise in the form of net new employment in the resource sector; improved industrial productivity (including lower inventory and other logistics costs); improved environmental conditions; greater safety, including reductions in the loss of life, limb and property; military and emergency management benefits; and reduced costs of operating and maintaining transportation systems.

Although the ACRL project is not commercially viable, there is scope for private sector participation in financing the project and operating and maintaining the assets going forward. For example, a co-investment plan of 85 percent public and 15 percent private contribution to capital costs, and 100 percent private financing of on-going operations and maintenance costs would constitute a win-win public-private partnering proposition.

1. INTRODUCTION

HDR|HLB has been retained by the University of Alaska Fairbanks (UAF) to develop a cost-benefit analysis (CBA) of the proposed Alaska-Canada Rail Link (ACRL). This CBA clearly identifies the potential net benefits and costs of the proposed rail link over the life cycle of the project. HDR|HLB's Risk Analysis Process (RAP) has been utilized to fully accommodate risk and uncertainty. The CBA was developed from the perspectives of both the public (Alaska, Yukon, British Columbia, Rest of Canada and Rest of U.S.) and private sectors (rail operator); with risk-adjusted output metrics provided for each sector. The output metrics were then integrated within a P3 analytical framework to determine the optimum cost sharing mechanism for the proposed ACRL.

On July 1, 2005 the governments of the State of Alaska and the Yukon Territory launched an initiative to determine the feasibility of the ACRL. Some of the documents pertaining to this initiative were provided to HDR|HLB. All documents relevant for CBA were leveraged in the development of the CBA framework.

This final report presents the CBA framework and final results. More specifically, it outlines the model logic for P3 analysis, including the benefits, costs and rail revenues of the proposed ACRL. Input values, allocation assumptions for net benefits, results as indicated by the discounted value of the net benefits and costs, and optimal P3 outcomes are reported. The results are based on the assumption that construction of the ACRL starts in 2012 and continues over a period of 5 years. CBA benefits that arise as a result of the ACRL are not realized until after this construction period is complete. The total number of years for CBA analysis is 50 years, which is consistent with the capital and operating costs developed by another consultant as part of the ACRL initiative.

Plan of Report

This final report is organized as follows: Section 2 provides the structure and logic models of the CBA framework (P3 analysis, benefits, costs and rail revenues); Section 3 presents the input values and sources; Section 4 presents the allocation assumptions for net benefits; Section 5 presents the results; Appendix A provides additional input values as referenced in the Section 3; Appendix B reports the *side benefits* as referenced in Section 4; and Appendix C provides a list of ACRL documents provided to HDR|HLB.

2. STRUCTURE AND LOGIC MODELS

This section presents the structure and logic models of the CBA framework. A "structure and logic model" (S&L) depicts the variables and cause and effect relationships that underpin the model logic. Although the structure and logic model is quantified mathematically to facilitate analysis, it is also depicted diagrammatically in order to permit stakeholder scrutiny and modification.

The S&L models of the CBA framework are outlined below. An overview of the P3 analytical framework is presented, followed by the net benefits, costs and rail revenues of the proposed ACRL. Note that the numbers listed in the S&L models are used to identify input variables and are referenced to in Section 3.

2.1 P3 Analytical Framework

The CBA model will be developed and calibrated under the following two scenarios:

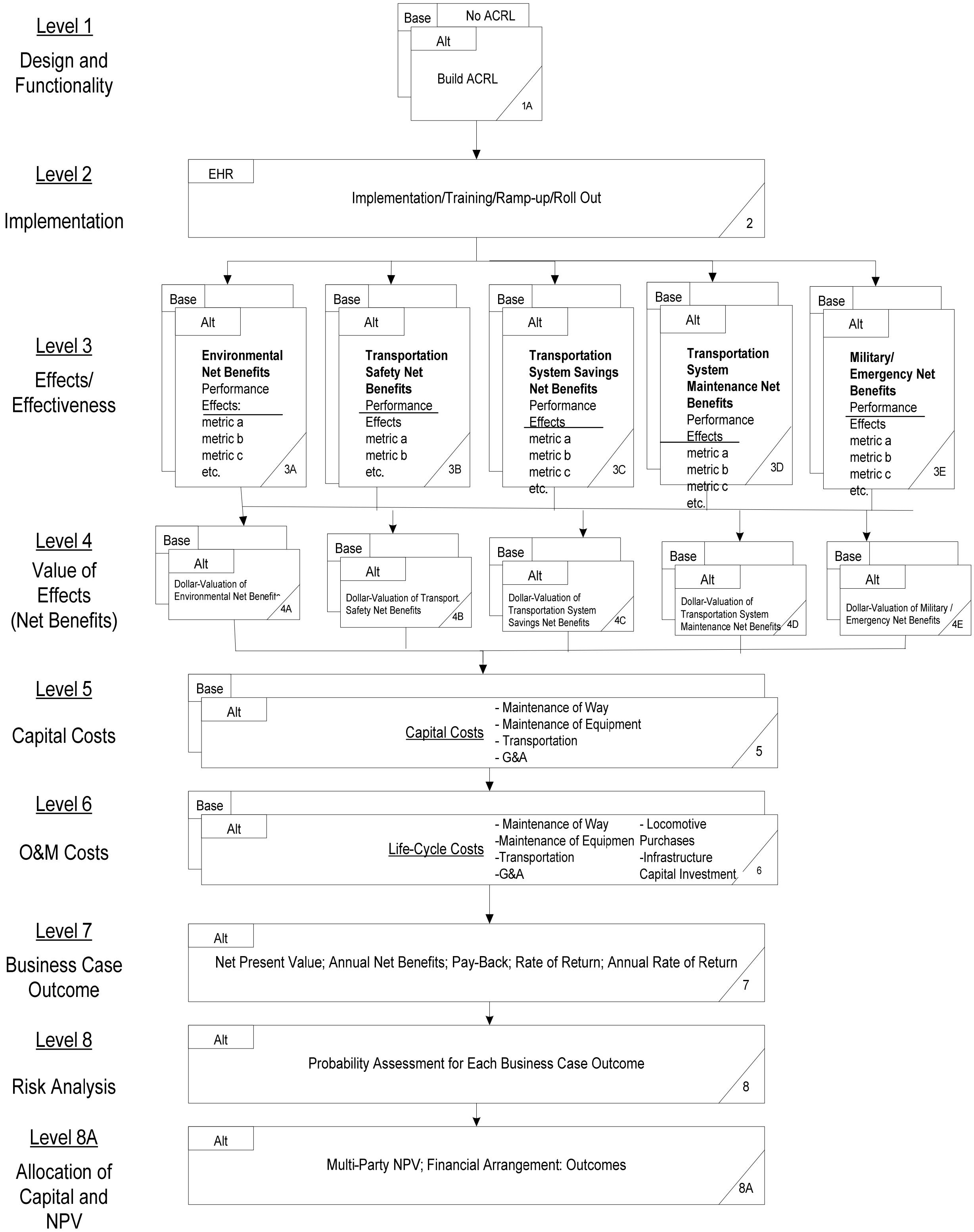
- Baseline Scenario: No ACRL (status quo); and,
- Alternate Scenario: Build ACRL.

The Alternate Scenario (i.e. Build ACRL) assumes a network with a main line from New Hazelton, B.C. to Delta Junction, AK and a second line from Skagway, AK to Carmacks, YT. Between Carmacks and Delta Junction, the railway is built through the Ladue River valley.

Figure 1 presents a high-level overview of the P3 analytical framework. The implementation of the Alternative Scenario (i.e. Build ACRL) results in numerous effects relative to the baseline scenario. These effects, or net benefits, are quantified in order to determine the total dollar value of net benefits. Net benefits will be attributed to five beneficiaries that include Alaska, Yukon, British Columbia, Rest of Canada and Rest of U.S. The net benefits are then compared to the costs to construct and maintain the ACRL over the project life-cycle. The resulting business case outcomes provide the output metrics associated with construction of the ACRL. Since the model is developed within a risk analysis framework, a probability assessment for each output metric is determined. These risk-adjusted output metrics are then used in conjunction with P3 scenario analysis (allocation of capital and multi-party NPV) to determine the optimum cost sharing mechanism for the proposed ACRL.

Note that rail revenues, although not a benefit for CBA purposes, are required to determine the optimal cost sharing mechanism.

Figure 1: High-Level Overview of P3 Analytical Framework



2.2 Net Benefits

The list of net benefits is presented in Table 1 below. Note that economic development impacts are not included in the CBA, with the exception of some Tier 2 and Tier 3 mining-related benefits. Economic development impacts are listed as *side benefits* because they may contain useful information for the state/province, but are not appropriate for CBA analysis because they are considered transfers (as opposed to net benefits to society).

Table 1: List of Net Benefits - CBA Benefits/Side Benefits

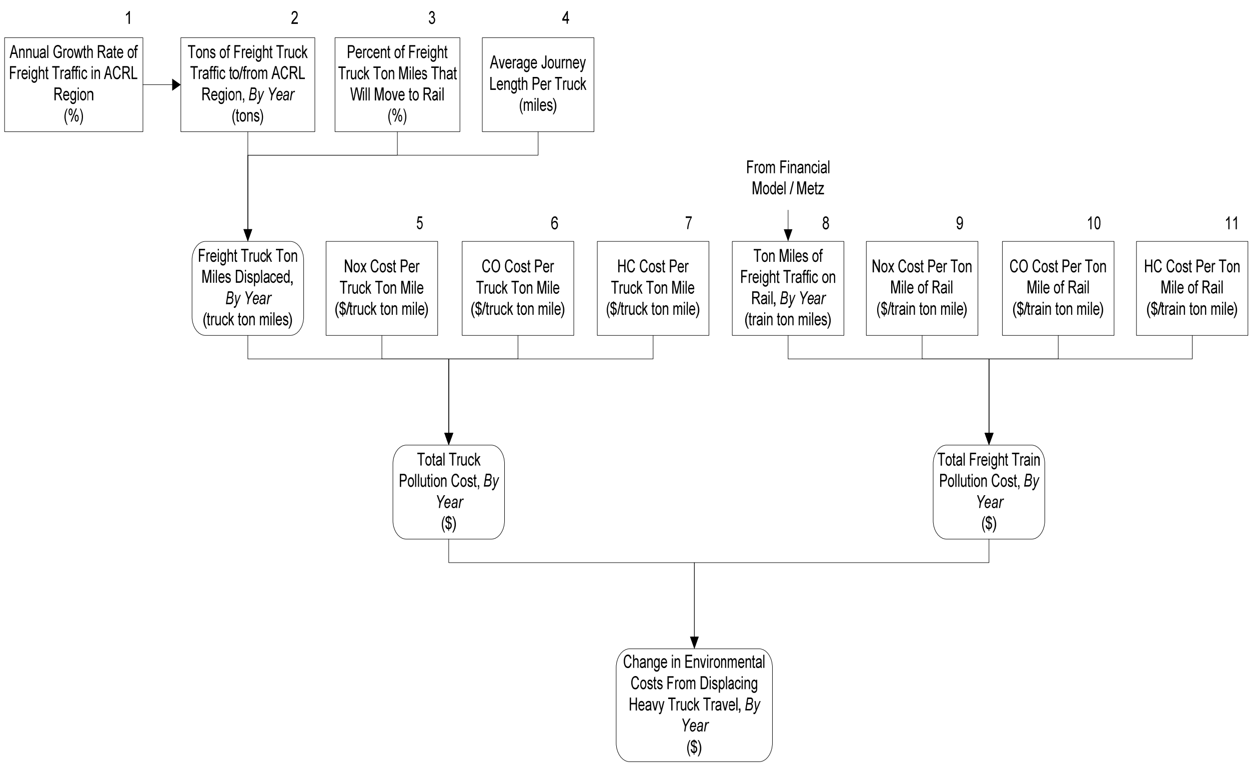
Net Benefit Cat #	Net Benefit Category	Net Benefit #	Net Benefit Name	Benefit Type
1	Environmental	1	Change in Environmental Costs from Displacing Heavy Truck Travel	CBA Benefit
		2	Change in Environmental Costs from Displacing Car/Light Truck Travel	CBA Benefit
2	Transportation Safety	3	Change in Accident Costs from Displacing Heavy Truck Travel	CBA Benefit
		4	Change in Accident Costs from Displacing Car/Light Truck Travel	CBA Benefit
3	Transportation System Savings	5	Change in Inventory Costs	CBA Benefit
		6	Change in Transportation Costs	CBA Benefit
4	Transportation System Maintenance	7	Change in Pavement Maintenance Costs from Displacing Heavy Truck Travel	CBA Benefit
		8	Change in Pavement Maintenance Costs from Displacing Car/Light Truck Travel	CBA Benefit
5	Military/ Emergency	9	Change in Relief and Repair Costs for Natural Disasters / Major Terrorist Attacks	CBA Benefit
		10	Change in War-Time Military Costs	CBA Benefit
6	Economic Development	11	Tier 2 & 3 Mining Related Employment Benefits	CBA Benefit
		N/A	Direct Construction Employment Impacts	*Side Benefit*
		N/A	Ongoing Operations and Maintenance Employment Impacts	*Side Benefit*
		N/A	Indirect and Induced Construction Employment Impacts	*Side Benefit*
		N/A	Tourism Related Employment Impacts	*Side Benefit*

The S&L's for each CBA benefit are depicted in the figures below. A brief explanation of each benefit is provided above each figure. Note that the value of each CBA benefit is allocated to Alaska, Yukon, British Columbia, Rest of Canada and Rest of U.S. (as deemed applicable). The allocation methods are reported in Section 4.

__(Environmental - Benefit #1):__ *Change in Environmental Costs from Displacing Heavy Truck Travel*

Figure 2 below illustrates the change in environmental costs from displacing heavy truck travel. This is the result of a significant amount of freight that is shifted from heavy truck to rail after construction of the ACRL. However, the construction of the ACRL also induces additional rail traffic from Tier 2 and Tier 3 mine development[1]. Nitrogen oxides (NO), carbon monoxide (CO), and hydrocarbons (HC) are harmful pollutants that are emitted from both vehicles and trains. Rail is a more environmentally friendly mode of travel; however, induced rail traffic from Tier 2 and Tier 3 mine development leads to incremental rail emissions. The net impact is the change in environmental costs from displacing heavy truck travel.

Figure 2: [S&L #1] __Benefit #1__ – Change in Environmental Costs from Displacing Heavy Truck Travel



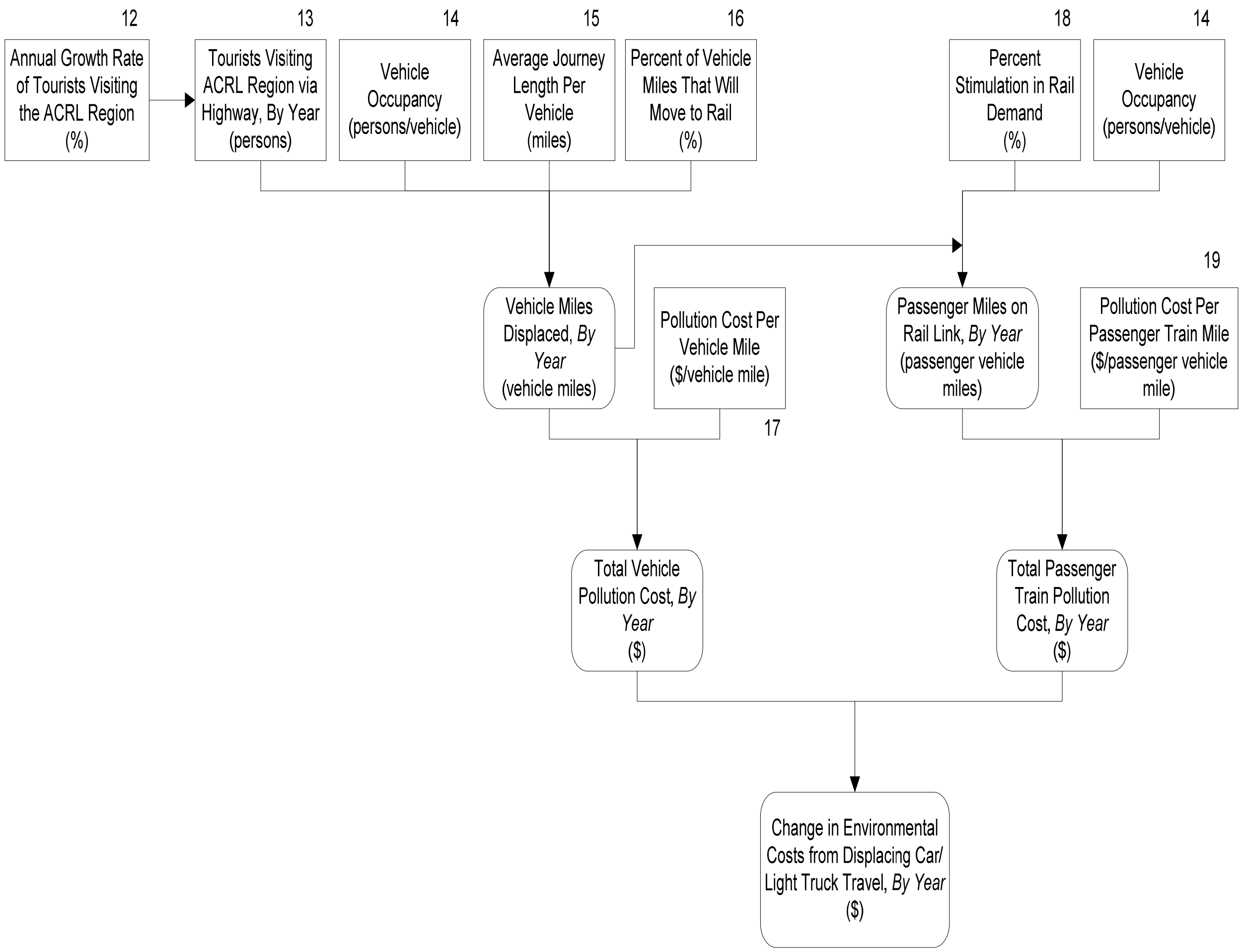
__(Environmental - Benefit #2):__ *Change in Environmental Costs from Displacing Car/Light Truck Travel*

Figure 3 below illustrates the change in environmental costs from displacing car/light truck travel. This is the result of some tourists visiting the ACRL region by car/light truck who would choose to shift their mode of travel to rail. An additional stimulation in rail demand is also

[1] Tier 1 mines are those that are economically viable irrespective of whether the ACRL project goes ahead or not. Tier 2 mines are those that come into operation to take advantage of ACRL as the main transportation mode (i.e., exploit lower transportation costs). Tier 3 mines are new mines that result from induced exploration activities as a result of the ACRL.

expected from rail enthusiasts and locals. Rail is a more environmentally friendly mode of travel; however, induced demand from rail enthusiasts and locals leads to incremental rail emissions. The net impact is the change in environmental costs from displacing car/light truck travel.

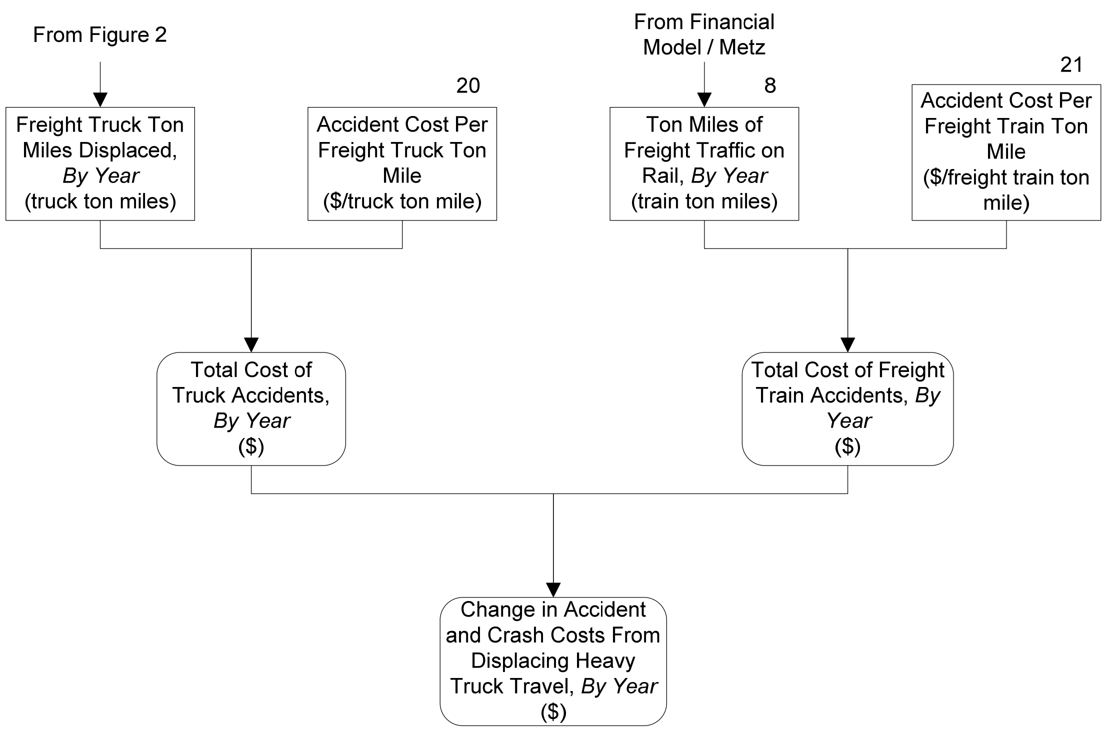
Figure 3: [S&L #2] Benefit #2 – Change in Environmental Costs from Displacing Car/Light Truck Travel



(Transportation Safety - Benefit #3): ***Change in Accident Costs from Displacing Heavy Truck Travel***

Figure 4 below illustrates the change in accident costs from displacing heavy truck travel. This is the result of a significant amount of freight that is shifted from heavy truck to rail after construction of the ACRL. However, the construction of the ACRL also induces additional rail traffic from Tier 2 and Tier 3 mine development. Accidents costs per ton-mile of freight carried by truck are greater than by train; however, induced rail traffic from Tier 2 and Tier 3 mine development leads to incremental rail accident costs. The net impact is the change in accident costs from displacing heavy truck travel.

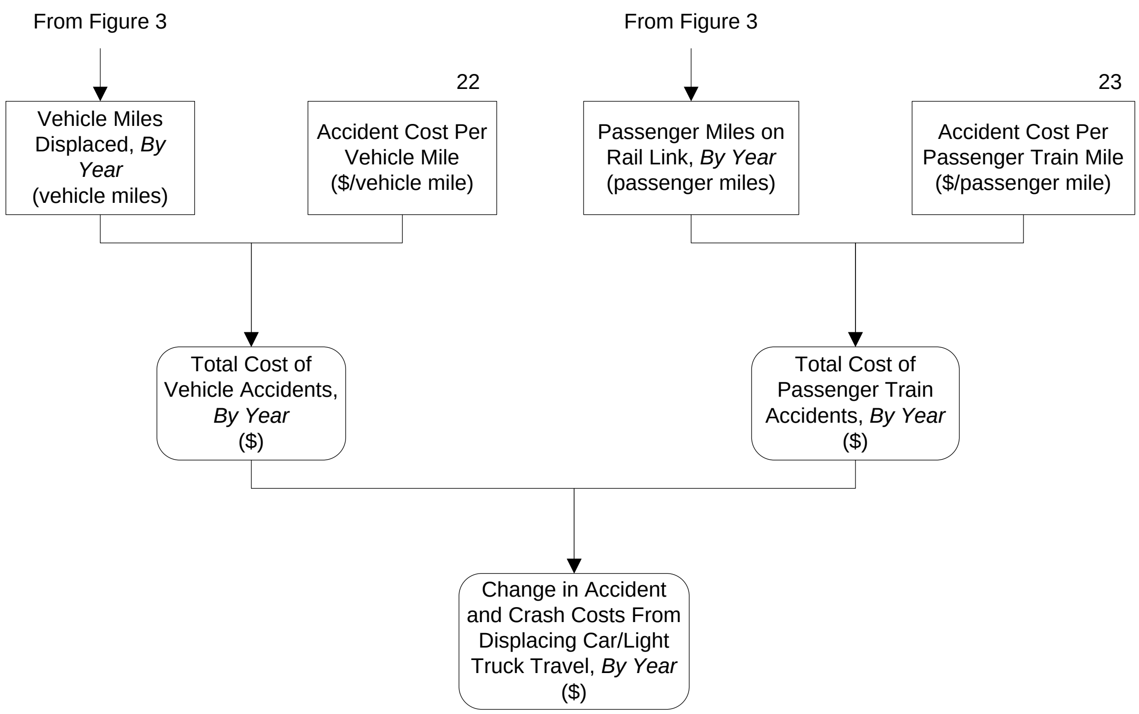
Figure 4: [S&L #3] Benefit #3 – Change in Accident Costs from Displacing Heavy Truck Travel



(Transportation Safety - Benefit #4): ***Change in Accident Costs from Displacing Car/Light Truck Travel***

Figure 5 below illustrates the change in accident costs from displacing car/light truck travel. This is the result of some tourists visiting the ACRL region by car/light truck who would choose to shift their mode of travel to rail. An additional stimulation in rail demand is also expected from rail enthusiasts and locals. Accident costs per passenger-mile by car/light truck are greater than by train; however, induced demand from rail enthusiasts and locals leads to incremental rail accident costs. The net impact is the change in accident costs from displacing car/light truck travel.

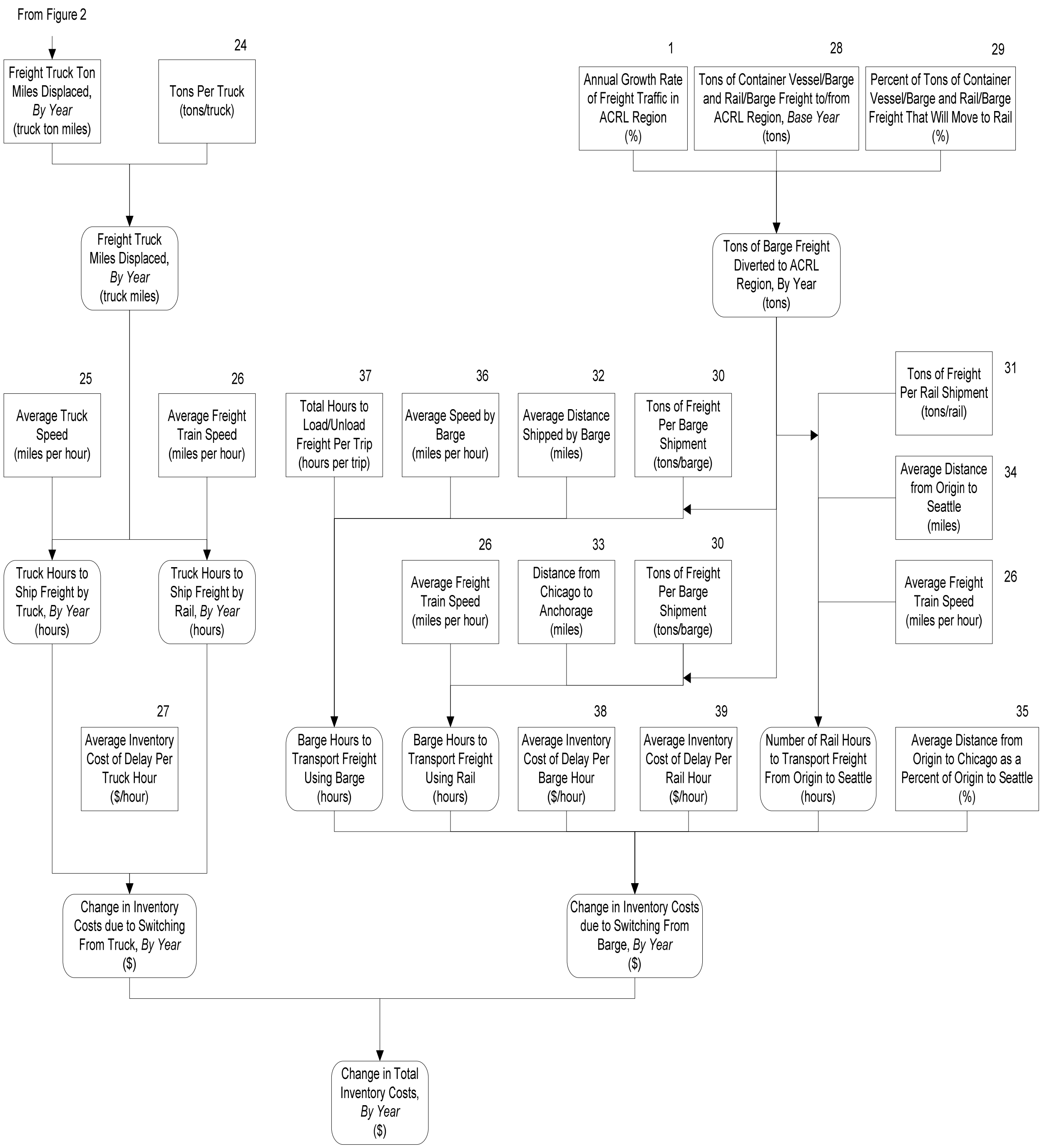
Figure 5: [S&L #4] Benefit #4 – Change in Accident Costs from Displacing Car/Light Truck Travel



(Transportation System Savings - Benefit #5): Change in Inventory Costs

Figure 6 below illustrates the change in inventory costs. This is the result of a significant amount of freight that is shifted from heavy truck to rail and from rail-barge to rail after construction of the ACRL. Average freight train speed is lower than average truck speed; however, time savings are realized from displacing barge traffic to rail. The net impact is the change in inventory costs.

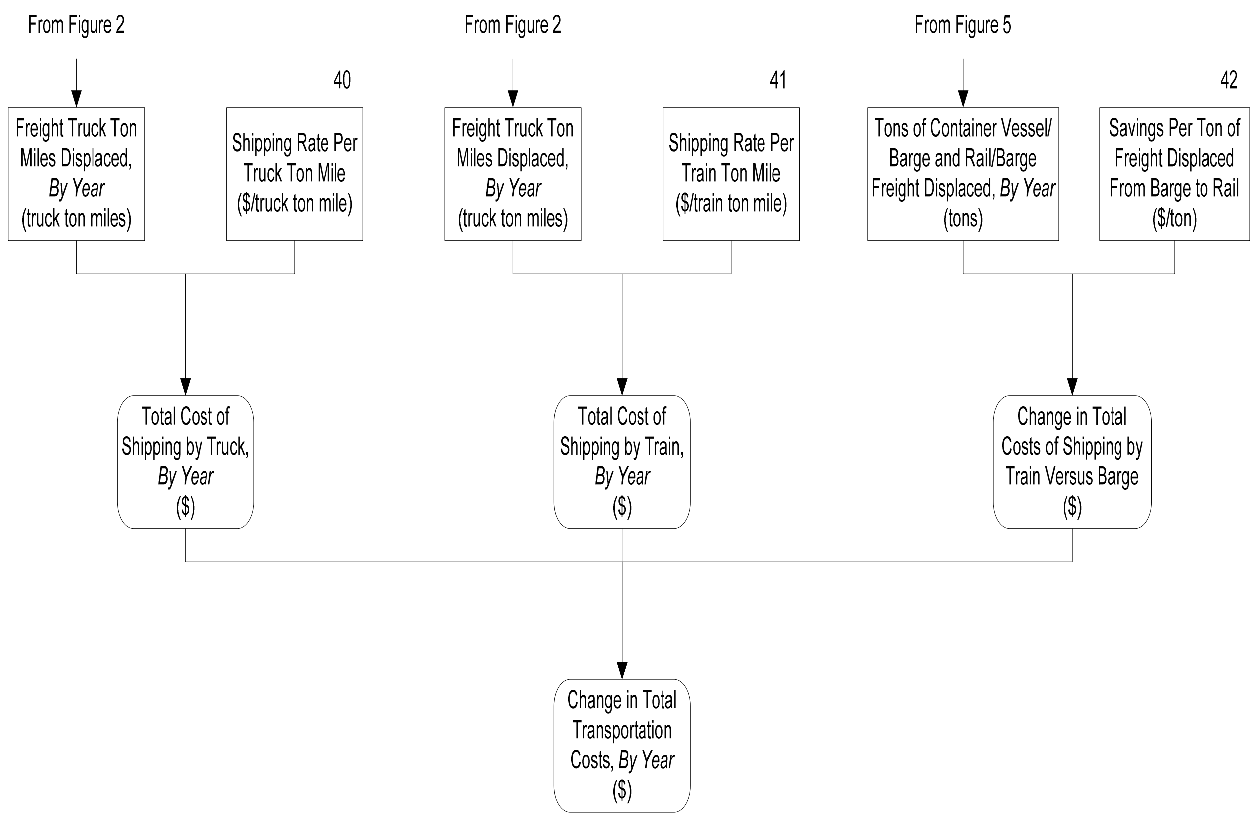
Figure 6: [S&L #5] Benefit #5 – Change in Inventory Costs



(Transportation System Savings - Benefit #6): *Change in Transportation Costs*

Figure 7 below illustrates the change in transportation costs. This is the result of a significant amount of freight that is shifted from heavy truck to rail and from rail-barge to rail after construction of the ACRL. The shipping rate per ton mile is significantly lower by train than by truck, and the displacement of rail barge leads to greater efficiencies. The total impact results in a change in transportation costs.

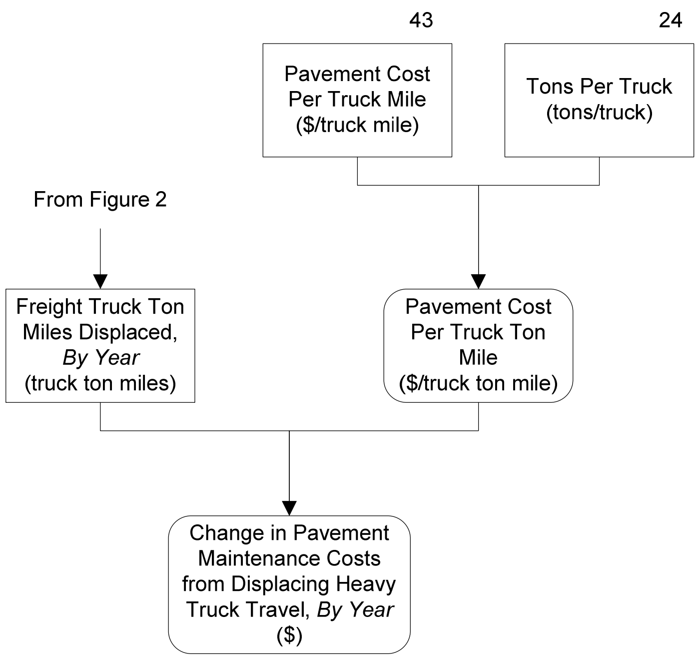
Figure 7: [S&L #6] Benefit #6 - Reduction in Transportation Costs



(Transportation System Maintenance - Benefit #7): ***Change in Pavement Maintenance Costs from Displacing Heavy Truck Travel***

Figure 8 below illustrates the change in pavement maintenance costs from displacing heavy truck travel. This is the result of a significant amount of freight that is shifted from heavy truck to rail after construction of the ACRL. Since fewer trucks are carrying freight on the roadways, a change in pavement maintenance costs is realized.

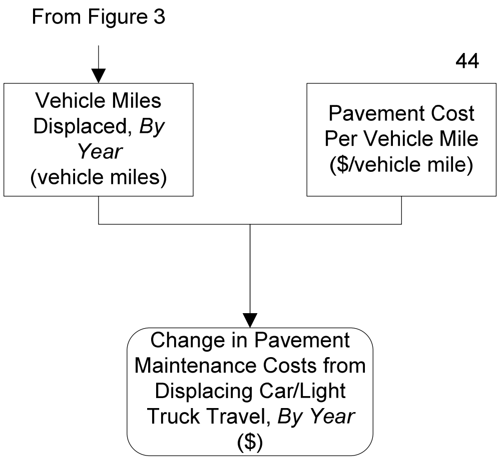
Figure 8: [S&L #7] Benefit #7 – Change in Pavement Maintenance Costs from Displacing Heavy Truck Travel



<u>(Transportation System Maintenance - Benefit #8):</u> *Change in Pavement Maintenance Costs from Displacing Car/Light Truck Travel*

Figure 9 below illustrates the change in pavement maintenance costs from displacing car/light truck travel. This is the result of some tourists visiting the ACRL region by car/light truck who would choose to shift their mode of travel to rail. Since fewer vehicles are on the roadways, a change in pavement maintenance costs is realized.

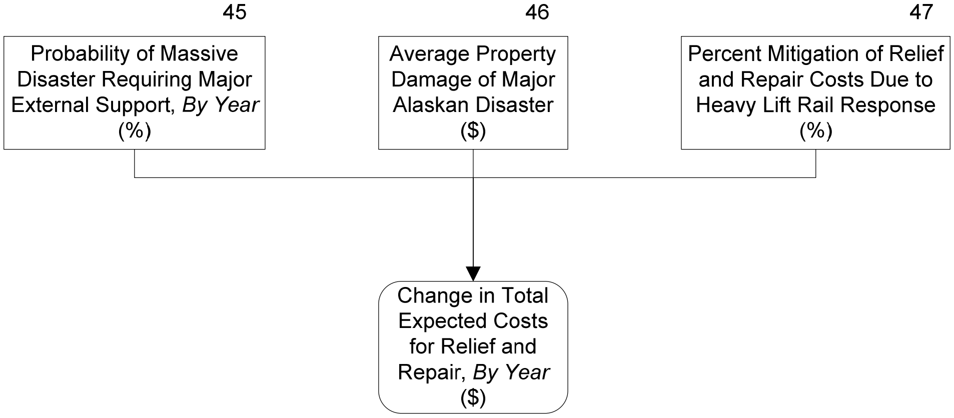
Figure 9: [S&L #8] <u>Benefit #8</u> - Reduction in Pavement Maintenance Costs from Displacing Car/Light Truck Travel



<u>(Military/Emergency - Benefit #9):</u> *Change in Relief and Repair Costs for Natural Disasters/Major Terrorist Attacks*

Figure 10 below illustrates the expected change in relief and repair costs for natural disasters, or major terrorist attacks in the ACRL region. The construction of the rail link would provide the military or emergency personnel with a more efficient mode of moving heavy equipment into the affected area, if such incidents did occur. This would lead to the mitigation of relief and repair costs.

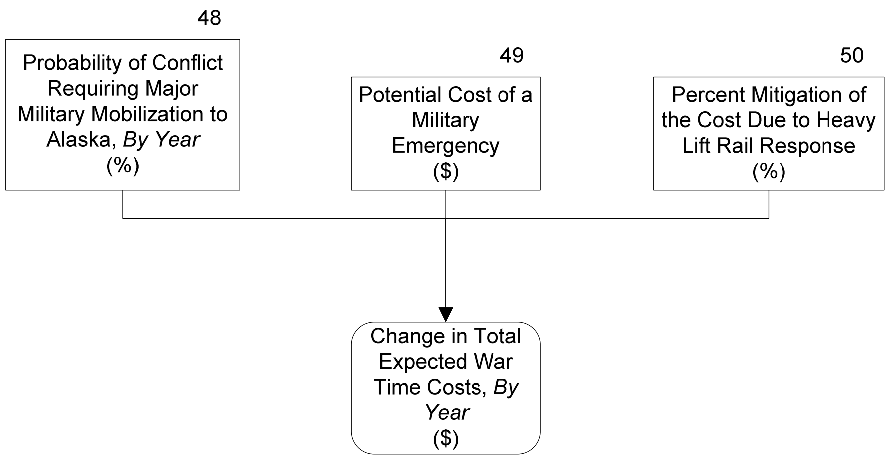
Figure 10: [S&L #9] <u>Benefit #9</u> – Change in Relief and Repair Costs for Natural Disasters / Major Terrorist Attacks



(Military/Emergency - Benefit #10): ***Change in War-Time Military Costs***

Figure 11 below illustrates the expected change in war-time military costs, if the conflict required major military mobilization to Alaska. The construction of the rail link would provide the military with a more efficient mode of moving heavy equipment into the area, if such a conflict did occur. This would lead to mitigation of war-time costs.

Figure 11: [S&L #10] Benefit #10 - Reduction in War-Time Military Costs

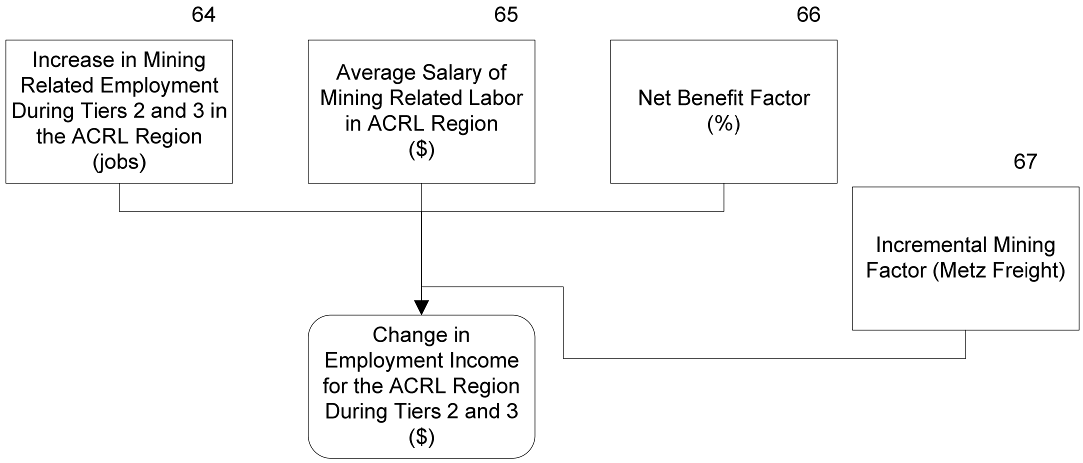


(Economic Development - Benefit #11): ***Tier 2 and 3 Mining Related Employment Benefits***

Figure 12 below illustrates the economic development benefits associated with Tier 2 and Tier 3 mine development. Note that labor income was used to proxy the economic development benefits related to the induced mine activity. However, only a portion of these benefits are deemed appropriate for CBA analysis for the following reasons: a) some of the labor would be "displaced" from less valuable tasks; b) induced mine activity has negative environmental consequences for the region (trucking to the railroad, open pit mining etc.); and, c) costs associated with the safety of mining activities.

It is important to note that the total value of Tier 2 and Tier 3 mining benefits are preliminary and require further analysis. A separate CBA analysis, which was outside of the scope of this study, is required to more appropriately measure the value of this benefit.

Figure 12: [S&L #11] Benefit #11 - Tier 2 and 3 Mining Related Employment Benefits



2.3 Costs

Figure 13 below illustrates the capital expenditures required for the ACRL. The capital expenditures are related to maintenance of way, maintenance of equipment, transportation, general and administrative, locomotives, and infrastructure capital investments. Capital costs were extracted from a financial model developed by another consultant as part of the ACRL initiative.

Figure 13: [S&L #12] ACRL - Capital Expenditures

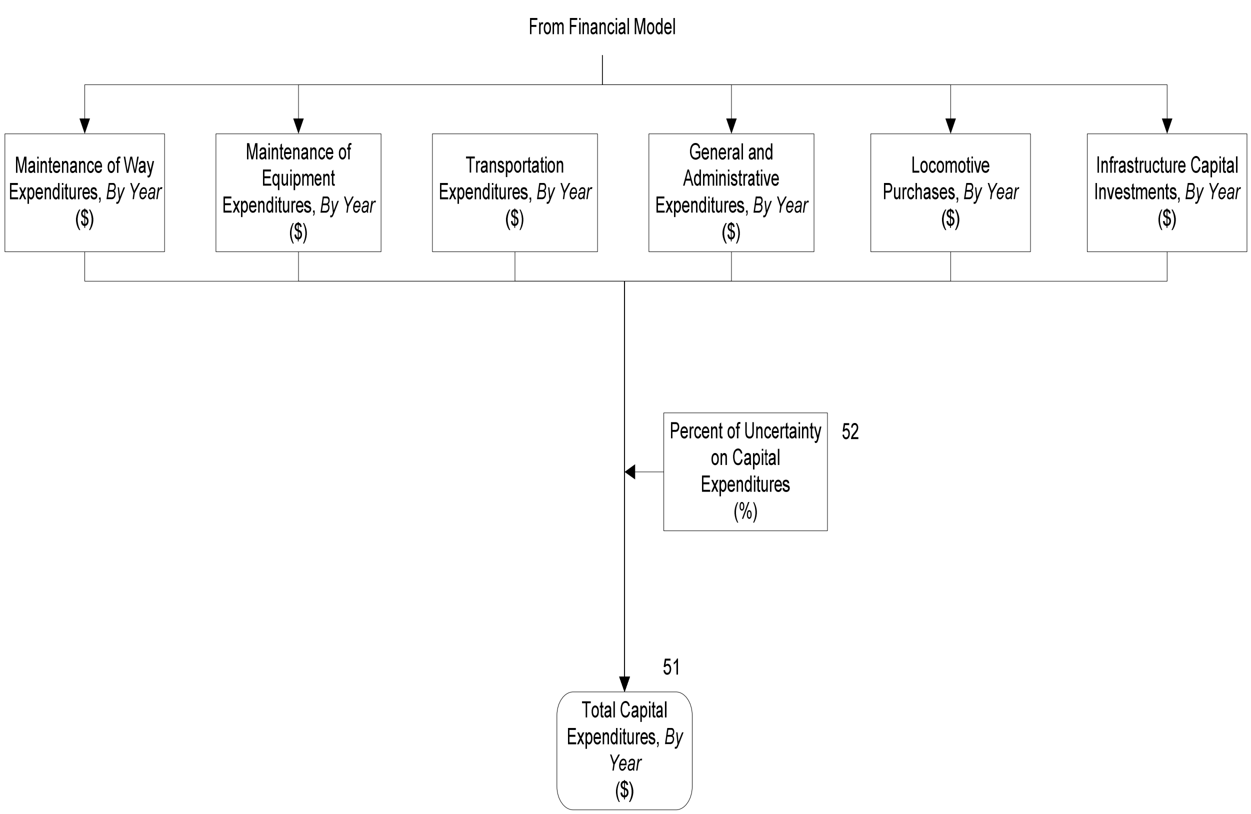
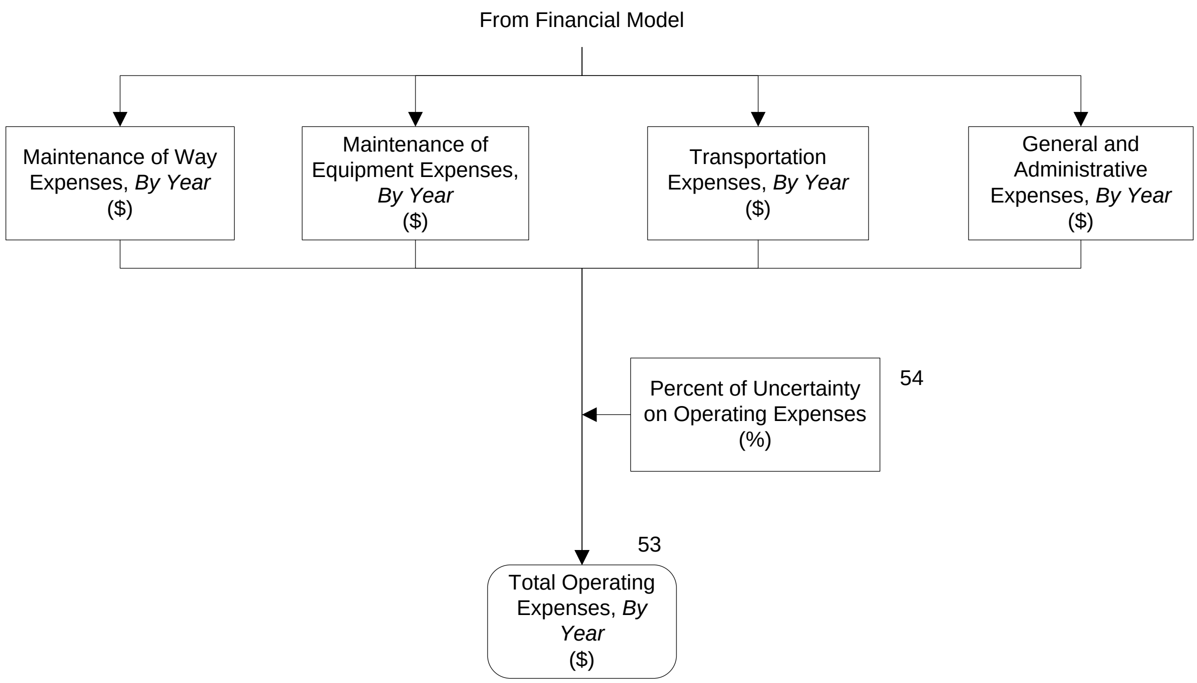


Figure 14 below illustrates the operating expenditures required for the ACRL. The operating expenditures are related to maintenance of way, maintenance of equipment, transportation, and general and administrative. Operating costs were extracted from a financial model developed by another consultant as part of the ACRL initiative.

Figure 14: [S&L #13]   ACRL – Operating Expenditures



Note: All operating and capital costs reflect Management Strategy #1, which identifies operations typical of a drag tonnage/low cost railroad.

2.4 Rail Revenue

Rail revenues, although not a benefit for CBA purposes, are required to determine the optimum cost sharing mechanism. Figure 15 below illustrates the rail revenues from operating the ACRL. The rail revenues are from intermodal freight, mineral freight, coal freight, pipe freight, industrial product freight, passengers and autorail, and track. All revenues were extracted from models developed by other consultants as part of the ACRL initiative. Cost factors were applied to passenger, autorail and track revenues to account for the costs of providing these services[2].

[2] The financial model did not include costs for passenger rail services.

Figure 15: [S&L #14] ACRL – Rail Revenue

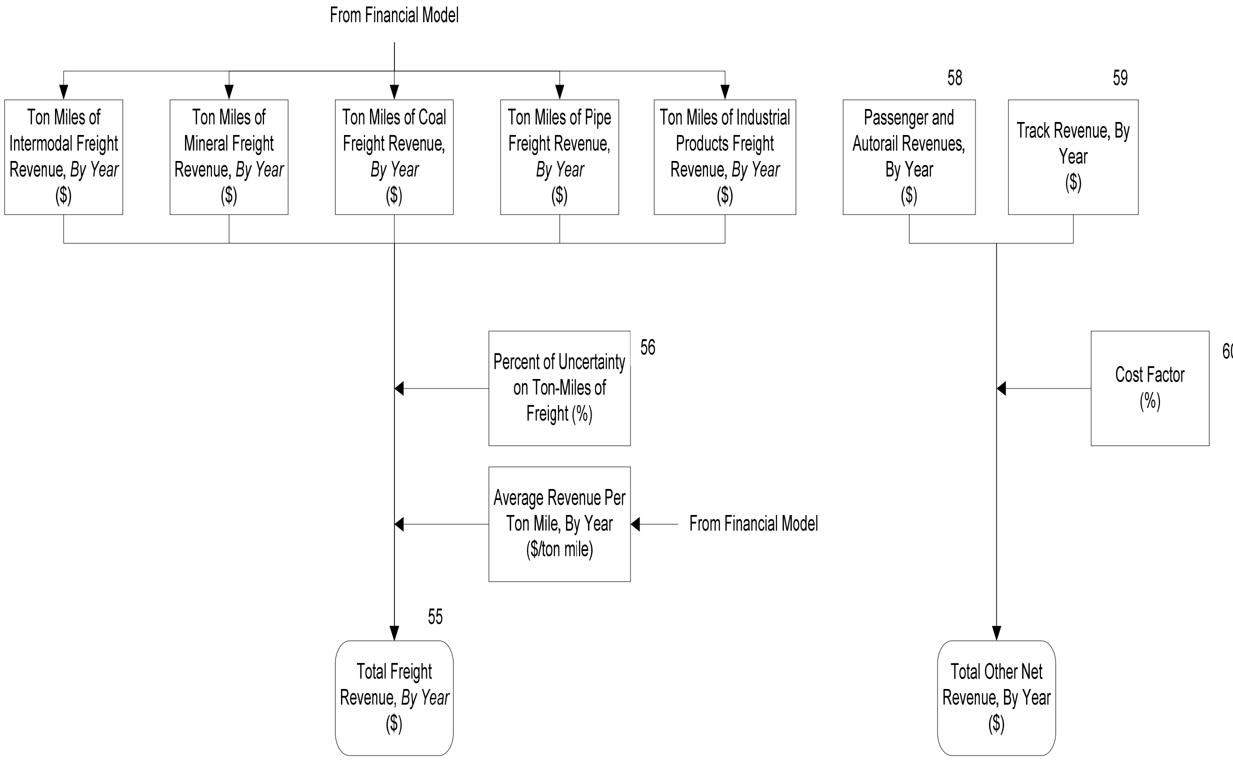
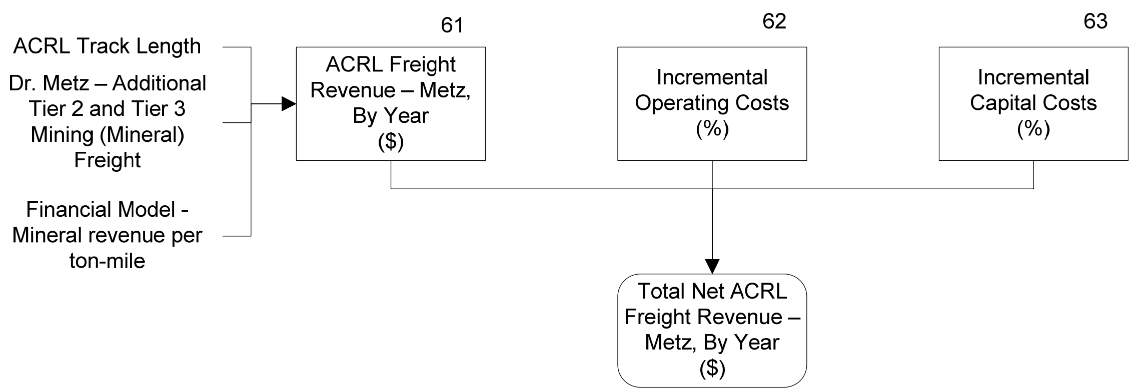


Figure 16 below illustrates the incremental Tier 2 and Tier 3 freight revenue for the ACRL. This freight revenue was calculated using estimates of incremental Tier 2 and Tier 3 mining freight (as per Dr. Metz). These estimates were used in conjunction with ACRL track length, and mineral revenue per ton-mile, to determine the incremental freight revenue for the ACRL. Factors to account for incremental operating and capital costs were then applied to account for the additional costs of transporting the freight[3].

Figure 16: ACRL – Incremental Rail Freight Revenue (Dr. Metz)



[3] The financial model did not account for all costs needed to transport this freight.

3. INPUT VALUES AND SOURCES

Table 2 presents a comprehensive listing of all input values and sources. For reference, the input numbers listed correspond to those that identify input variables in the structure and logic models. Note that some of the variables in the structure and logic models are intermediate outputs (not assumptions), and hence are not reported. The 10 percent lower and upper values define an uncertainty range representing an 80 percent confidence interval. This is the range within which there exists an 80 percent probability of finding the actual outcome.

Table 2: Input Values and Sources (2006 US$)

INPUT #	S&L #	BENEFIT NAME	VALUE OF INPUT			SOURCE FOR MEDIAN VALUE / COMMENT
			MEDIAN	10 PERCENT LOWER	10 PERCENT UPPER	
1	1,3,5,6,7	Annual Growth Rate in Freight Traffic in ACRL Region (2003-2010)	0.12%	0.09%	0.15%	Federal Highway Administration, Freight Analysis Framework - Freight Projections for Alaska (Domestic Market)
1	1,3,5,6,7	Annual Growth Rate in Freight Traffic in ACRL Region (2011-2020)	2.1%	1.6%	2.7%	Federal Highway Administration, Freight Analysis Framework - Freight Projections for Alaska (Domestic Market)
1	1,3,5,6,7	Annual Growth Rate in Freight Traffic in ACRL Region (2021-2061)	1.1%	0.8%	1.4%	HLB Estimate based on 2003-2020 FAF Projections.
2	1,3,5,6,7	Tons of truck freight to and from Alaska in tons (base year - 2002)	2,097,475	1,887,655	2,307,217	Federal Highway Administration, Freight Analysis Framework (2002). Domestic/Canada shipments only.
2	1,3,5,6,7	Tons of truck freight to and from Yukon in tons (base year -2002)	109,400	82,050	136,750	Informetrica Limited, Alaska-Canada Rail Link Strategic Environmental Assessment: Canadian Economic Impacts Final Report D1.c (August 2006) – Resupply of 54,700. HLB assumed 2x this value for total tonnage.
2	1,3,5,6,7	Tons of truck freight to and from Northern BC in tons (base year -2002)	6,356	4,767	7,945	HLB Estimate – Tons of freight to/from Alaska adjusted by population share of N BC to Alaska.
3	1,3,5,6,7	Percent of those truck freight ton-miles that will be moved to rail due to ACRL (Alaska)	50%	33%	68%	HLB Estimate
3	1,3,5,6,7	Percent of those truck freight ton-miles that will be moved to rail due to ACRL (Yukon)	50%	33%	68%	HLB Estimate

Table 3: Input Values and Sources (2006 US$) (Cont'd)

INPUT #	S&L #	BENEFIT NAME	VALUE OF INPUT			SOURCE FOR MEDIAN VALUE / COMMENT
			MEDIAN	10 PERCENT LOWER	10 PERCENT UPPER	
3	1,3,5,6,7	Percent of those truck freight ton-miles that will be moved to rail due to ACRL (BC)	50%	33%	68%	HLB Estimate
4	1,3,5,6,7	Average journey length per truck (Alaska)	3,901	2,926	4,877	Derived using Federal Highway Administration, Freight Analysis Framework (2002) database.
4	1,3,5,6,7	Average journey length per truck (Yukon)	2,695	2,021	3,369	HLB Estimate - Alaska average journey length per truck less distance from Anchorage to Whitehorse. Further reduced by 500 to account for BC traffic.
4	1,3,5,6,7	Average journey length per truck (BC)	2,163	1,622	2,704	HLB Estimate - Yukon average journey length per truck less track miles in BC.
5	1	Nox cost per thousand ton-miles truck	$52.63	$39.47	$65.78	Environmental Protection Agency / Business Case for the Northern Rail Extension (February 2006).
6	1	CO cost per thousand ton-miles truck	$0.98	$0.74	$1.23	Environmental Protection Agency / Business Case for the Northern Rail Extension (February 2006).
7	1	HC cost per thousand ton-miles truck	$3.26	$2.45	$4.08	Environmental Protection Agency / Business Case for the Northern Rail Extension (February 2006).
8	1	Thousands of ton miles of freight traffic ACRL - Financial Model	Refer to Appendix for a complete list of values (Table A-1)			Financial Model. Crest_200607020901_AMG.xls
8	1	Percent of uncertainty on thousands of tons miles of freight on ACRL	100%	80%	120%	HLB Estimate
8	1	Thousands of ton miles of freight traffic ACRL - Metz	Refer to Appendix A for a complete list of values (Table A-1)			Derived using Dr. Metz incremental Tier 2 and Tier 3 mining freight and ACRL track distance.
8	1	Thousand of ton miles of freight traffic ACRL other rail - Metz	Refer to Appendix A for a complete list of values (Table A-1)			Derived using Dr. Metz incremental Tier 2 and Tier 3 mining freight, ACRL track distance, and assumed rail distance from ACRL regions to Chicago.
9	1	Nox cost per thousand ton-miles rail	$9.47	$7.58	$11.36	Environmental Protection Agency / Business Case for the Northern Rail Extension (February 2006).

Table 4: Input Values and Sources (2006 US$) (Cont'd)

INPUT #	S&L #	BENEFIT NAME	VALUE OF INPUT			SOURCE FOR MEDIAN VALUE / COMMENT
			MEDIAN	10 PERCENT LOWER	10 PERCENT UPPER	
10	1	CO cost per thousand ton-miles rail	$0.33	$0.26	$0.40	Environmental Protection Agency / Business Case for the Northern Rail Extension (February 2006).
11	1	HC cost per thousand ton-miles rail	$2.38	$1.90	$2.86	Environmental Protection Agency / Business Case for the Northern Rail Extension (February 2006).
12	2,4,8	Annual Growth Rate of Tourists Visiting the ACRL Region via Highway	0%	-.05%	.05%	Klugherz & Associates, Alaska Canada Rail Link Project Feasibility Study Report: Traffic Data Development for Tourism/Passenger Travel - Work Package A3(c). This report shows actual tourists visiting Alaska via highway has been declining. HLB Estimate - assume tourists visiting region remain constant (rate of decline in K&A would not continue in the long run)
13	2,4,8	Tourists visiting Alaska via Highway (base year - 2003/2004)	101,600	71,120	132,080	Klugherz & Associates, Alaska Canada Rail Link Project Feasibility Study Report: Traffic Data Development for Tourism/Passenger Travel - Work Package A3(c).
13	2,4,8	Tourists visiting Yukon via Highway (base year - 2003/2004)	214,489	150,142	278,836	Klugherz & Associates, Alaska Canada Rail Link Project Feasibility Study Report: Traffic Data Development for Tourism/Passenger Travel - Work Package A3(c).
13	2,4,8	Tourists visiting N. BC via Highway (base year - 2003/2004)	195,298	136,708	253,887	Klugherz & Associates, Alaska Canada Rail Link Project Feasibility Study Report: Traffic Data Development for Tourism/Passenger Travel - Work Package A3(c).
14	2,4,8	Passengers per vehicle	2.25	1.80	2.70	Klugherz & Associates, Alaska Canada Rail Link Project Feasibility Study Report: Traffic Data Development for Tourism/Passenger Travel - Work Package A3(c). Note: Based on 2005 value.

Table 5: Input Values and Sources (2006 US$)

INPUT #	S&L #	BENEFIT NAME	VALUE OF INPUT			SOURCE FOR MEDIAN VALUE / COMMENT
			MEDIAN	10 PERCENT LOWER	10 PERCENT UPPER	
15	2,4,8	Average journey length per vehicle (Alaska)	4,574	3,888	5,260	HLB Estimate - Driving distance from Anchorage to Vancouver. x2 to account for return trips.
15	2,4,8	Average journey length per vehicle (Yukon)	3,170	2,695	3,646	HLB Estimate - Driving distance from Whitehorse to Vancouver. x2 to account for return trips.
15	2,4,8	Average journey length per vehicle (BC)	2,176	1,850	2,502	HLB Estimate - Driving distance from Dease Lake to Vancouver. X2 to account for return trips.
16	2,4,8	Percent of those vehicle-miles that will be moved to rail due to ACRL (Alaska)	15%	8%	23%	HLB Estimate
16	2,4,8	Percent of those vehicle-miles that will be moved to rail due to ACRL (Yukon)	20%	10%	30%	HLB Estimate
16	2,4,8	Percent of those vehicle-miles that will be moved to rail due to ACRL (BC)	15%	8%	23%	HLB Estimate
17	2	Pollution cost per vehicle mile for cars/light trucks in thousands	$5.69	$4.27	$7.11	Victoria Transport Policy Institute, Transportation Cost and Benefit Analysis (March 2005).
18	2,4	Percentage stimulation in rail demand (rail enthusiasts)	20%	10%	30%	HLB Estimate
19	2	Pollution cost per passenger mile for train in thousands	$1.16	$0.93	$1.39	Virginia Department of Rail and Public Transportation Model (August 2006). Revised DRPT BCA Model - Final Draft (Proj 06-001).xls
20	3	Accident cost per truck ton-mile	$0.00792	$0.00594	$0.00990	Virginia Department of Rail and Public Transportation Model (August 2006). Revised DRPT BCA Model - Final Draft (Proj 06-001).xls
21	3	Train accident costs per freight ton-mile	$0.00228	$0.00171	$0.00285	Virginia Department of Rail and Public Transportation Model (August 2006). Revised DRPT BCA Model - Final Draft (Proj 06-001).xls
22	4	Accident costs per vehicle mile	$0.02371	$0.01778	$0.02964	Virginia Department of Rail and Public Transportation Model (August 2006). Revised DRPT BCA Model - Final Draft (Proj 06-001).xls

Table 6: Input Values and Sources (2006 US$) (Cont'd)

INPUT #	S&L #	BENEFIT NAME	VALUE OF INPUT			SOURCE FOR MEDIAN VALUE / COMMENT
			MEDIAN	10 PERCENT LOWER	10 PERCENT UPPER	
23	4	Accident cost per passenger train-mile	$0.00492	$0.00369	$0.00615	HLB Estimate based on data from Federal Railroad Administration Office of Safety Analysis. Assume 500 passengers per train. Available at: http://safetydata.fra.dot.gov/OfficeofSafety
24	5,7	Tons Per Truck	30	22	37	Virginia Department of Rail and Public Transportation Model (August 2006) and Business Case for the Northern Rail Extension (February 2006).
25	5	Average Truck Speed (m/h/day)	27.5	20.6	34.4	HLB Estimate. Assume 55 miles per hour, and 12 hours of driving per day.
26	5	Average Freight Train Speed (m/h/d)	22.4	20.2	24.6	Financial Model. Crest_200607020901_AMG.xls
27	5	Average Inventory Cost of Delay Per Truck Hour	$2.07	$1.55	$2.58	Virginia Department of Rail and Public Transportation Model (August 2006). Revised DRPT BCA Model - Final Draft (Proj 06-001).xls
28	5,6	Tons of container vessel/barge freight from Seattle to Anchorage/other ports in Alaska	1,947,719	1,460,879	2,434,649	Informetrica Limited, Alaska-Canada Rail Link Strategic Environmental Assessment: Overview of Economic Impacts (August 2006). Includes the 360,000 tons of container freight and trailers shipped to ports other than Anchorage.
28	5,6	Tons of rail/barge freight from Seattle to Whittier per year	167,000	125,250	208,750	Informetrica Limited, Alaska-Canada Rail Link Strategic Environmental Assessment: Overview of Economic Impacts (August 2006)
29	5,6	Percent of container vessel/barge freight from Seattle to Anchorage diverted to ACRL	82%	73%	90%	Informetrica Limited, Alaska-Canada Rail Link Strategic Environmental Assessment: Overview of Economic Impacts (August 2006)
29	5,6	Percent of rail/barge from Seattle to Whittier diverted to ACRL	1.2%	0.9%	1.5%	Informetrica Limited, Alaska-Canada Rail Link Strategic Environmental Assessment: Overview of Economic Impacts (August 2006)

Table 2: Input Values and Sources (Cont'd)

INPUT #	S&L #	BENEFIT NAME	VALUE OF INPUT			SOURCE FOR MEDIAN VALUE / COMMENT
			MEDIAN	10 PERCENT LOWER	10 PERCENT UPPER	
30	5	Tons of freight per barge shipment	3,700	2,960	4,440	Environmental Defense, Investing In Mobility (2004) – 50-56 railcars per barge shipment. US Bureau of Transportation Statistics - 69.7 tons of freight per railcar.
31	5	Tons of freight per rail shipment	3,485	3,137	3,834	US Bureau of Transportation Statistics - 69.7 tons of freight per railcar. Assume 50 railcars per locomotive.
32	5	Average distance shipped by barge	1,250	1,000	1,500	HLB Estimate – based on other similar Origin-Destination pairs provided in Environmental Defense, Investing In Mobility (2004)
33	5	Distance from Chicago to Anchorage	3,614	3,433	3,795	MapQuest.com – Assume driving distance as proxy for rail.
34	5	Average distance from origin to Seattle (miles)	2,000	1,600	2,400	HLB Estimate
35	5	Average distance from origin to Chicago as a percent of origin to Seattle	25%	18%	33%	HLB Estimate – Assume most shipments diverted to Chicago would be much closer to Chicago than Seattle. This is the reason why they would no longer use rail/barge as travel mode.
36	5	Average speed by barge	5.4	4	7	Derived using data in Environmental Defense, Investing In Mobility (2004). Available at: http://www.environmentaldefense.org/documents/3601_InvestingMobility_Hudson.pdf.
37	5	Number of hours to load/unload container vessel freight (per trip)	8	6	10	Connecticut Department of Transportation: The Office of Intermodal Planning, Container Barge Feeder Service Study (2001).
38	5	Average inventory cost of delay per barge hour	$254.94	$203.96	$305.93	Derived based on inventory cost per truck hour, adjusted for total tonnage carried per truck/barge.
39	5	Average inventory cost of delay per rail hour	$240.13	$180.10	$300.16	Derived based on inventory cost per truck hour, adjusted for total tonnage carried per truck/rail.

Table 2: Input Values and Sources (Cont'd)

INPUT #	S&L #	BENEFIT NAME	VALUE OF INPUT			SOURCE FOR MEDIAN VALUE / COMMENT
			MEDIAN	10 PERCENT LOWER	10 PERCENT UPPER	
40	6	Shipping rate per thousand truck-ton miles	$82.49	$70.12	$94.87	Virginia Department of Rail and Public Transportation Model (August 2006). Revised DRPT BCA Model - Final Draft (Proj 06-001).xls
41	6	Shipping Rate per thousand train-ton miles	$44.60	$37.94	$51.33	Based on data from Financial Model. Crest_200607020901_AMG.xls
42	6	Savings per ton of freight diverted to ACRL for Seattle to Alaska shipments	$47.99	$35.99	$59.99	Informetrica Limited, Alaska-Canada Rail Link Strategic Environmental Assessment: Overview of Economic Impacts (August 2006)
42	6	Savings per ton of freight diverted to ACRL for Seattle to Whittier shipments	$6.86	$5.14	$8.57	Informetrica Limited, Alaska-Canada Rail Link Strategic Environmental Assessment: Overview of Economic Impacts (August 2006)
42	6	Savings per ton of freight diverted to ACRL for Prince Rupert to Whittier shipments	$16.45	$12.34	$20.56	Informetrica Limited, Alaska-Canada Rail Link Strategic Environmental Assessment: Overview of Economic Impacts (August 2006)
43	7	Pavement cost per truck mile	$0.1736	$0.1389	$0.2083	Virginia Department of Rail and Public Transportation Model (August 2006). Revised DRPT BCA Model - Final Draft (Proj 06-001).xls
44	8	Pavement cost per car mile	$0.00181	$0.00145	$0.00218	Virginia Department of Rail and Public Transportation Model (August 2006). Revised DRPT BCA Model - Final Draft (Proj 06-001).xls
45	9	Probability of massive disaster requiring major external support	2%	1%	3%	HLB Estimate – Twice per century. Note: 8.0+ earthquake occurs approx. every 13 years.
46	9	Average property damage of a massive Alaskan disaster in $M	$1,000	$500	$1,500	HLB Estimate – property damage of 1964 Tsunami, and value of 125 lives lost. Adjust values to account for greater redevelopment over last forty+ years.

Table 2: Input Values and Sources (Cont'd)

INPUT #	S&L #	BENEFIT NAME	VALUE OF INPUT			SOURCE FOR MEDIAN VALUE / COMMENT
			MEDIAN	10 PERCENT LOWER	10 PERCENT UPPER	
47	9	Percent mitigation of relief & repair cost due to heavy lift rail response	15%	8%	23%	HLB Estimate
48	10	Probability of conflict requiring major military mobilization to Alaska	2%	1%	3%	HLB Estimate – Twice per century (can include any Northern Pacific war).
49	10	Potential cost of Military emergency in millions of $	$5,000	$2,500	$7,500	HLB Estimate
50	10	Percent mitigation of the cost due to heavy lift rail response	25%	13%	38%	HLB Estimate
51	12	Total capital expenditures by year	Refer to Appendix A for a complete list of values (Table A-2)			Financial Model. Crest_200607020901_AMG.xls
52	12	Percent of uncertainty on total capital expenditures	100%	75%	125%	HLB Estimate
53	13	Total operating expenses by year	Refer to Appendix A for a complete list of values (Table A-2)			Financial Model. Crest_200607020901_AMG.xls
54	13	Percent of uncertainty on total operating expenses	100%	75%	125%	HLB Estimate
55	14	Rail freight revenue (Financial Model)	Refer to Appendix A for a complete list of values (Table A-2)			Financial Model. Crest_200607020901_AMG.xls
56	14	Percent of uncertainty on ton-miles estimates	100%	80%	120%	HLB Estimate
58	14	Passenger and Autorail Revenues	See Appendix for a complete list of values (Table A-3)			WP A3(f) - Passenger Revenue Model - Mgmt Strategy 1.xls (Klughertz & Associates). Note: Low, base and high values were incorporated into the model. No growth of passenger volume was assumed.
59	14	Track Revenue	Refer to Appendix A for a complete list of values (Table A-4)			WP A3(f) - Passenger Revenue Model - Mgmt Strategy 1.xls (Klughertz & Associates). Note: Low, base and high values were incorporated into the model. No growth of passenger volume was assumed.

Table 2: Input Values and Sources (Cont'd)

INPUT #	S&L #	BENEFIT NAME	VALUE OF INPUT			SOURCE FOR MEDIAN VALUE / COMMENT
			MEDIAN	10 PERCENT LOWER	10 PERCENT UPPER	
60	14	Cost Factor	81%	77%	85%	Railcan.ca – 2004 Operating Profit Margin for total industry was 19%. 1-19%=81% Cost Factor.
61	15	ACRL Freight revenue – Metz	Refer to Appendix A for a complete list of values (Table A-5)			
62	15	Incremental operating costs	46%	41%	50%	Financial Model. Crest_200607020901_AMG.xls Incremental O&M costs are assumed to be 46% of ACRL Freight Revenue – Metz. (this was the average over the project life-cycle in the financial model)
63	15	Incremental capital costs	73%	-	-	73% increase in revenue-ton miles on ACRL if include Metz freight (relative to financial model). Assume that capital expenditures increase by the same rate (excluding track capital excluded).
64	11	Increase in mining related employment Alaska	699	559	839	HLB Estimate based on Informetrica.
64	11	Increase in mining related employment Yukon	4,000	3,200	4,800	Informetrica Limited, Alaska-Canada Rail Link Strategic Environmental Assessment: Canadian Economic Impacts Final Report D1.c (August 2006)
64	11	Increase in mining related employment BC	2,322	1,858	2,786	Informetrica Limited, Alaska-Canada Rail Link Strategic Environmental Assessment: Canadian Economic Impacts Final Report D1.c (August 2006)
65	11	Average salary of mining related labor (Alaska)	$73,230	$65,907	$80,553	US Bureau of Labor Statistics. National Mining Association (average salary)
65	11	Average salary of mining related labor (Yukon/BC)	$65,907	$59,316	$72,497	HLB Estimate (assumed 90 percent of Alaska)
66	11	Net benefit factor	50%	30%	70%	HLB Estimate
67	11	Incremental Mining Factor (Metz Freight)	161%	100%	224%	Increase in Mineral Tons shipped on ACRL. Based on freight estimates from Dr. Metz and maximum value from financial model.

4. ALLOCATION ASSUMPTIONS FOR NET BENEFITS

The CBA model quantifies each net benefit according to the S&L models and input values as presented in Section 2 and Section 3 respectively. Table 3 presents HDR|HLB's methodology for allocating the net benefits between Alaska, Yukon, British Columbia, Rest of Canada and Rest of U.S.

Table 7: HDR|HLB Allocation Assumptions for Net Benefits

#	BENEFIT NAME	SUB-CATEGORY	PERCENT ALLOCATED TO:					HDR|HLB – ALLOCATION METHODOLOGY
			Alaska	Yukon	BC	Canada	USA	
1	Environmental - Change in Environmental Costs from Displacing Heavy Truck Travel	Impact of Freight on ACRL	13%	1%	86%	0%	0%	Since the environmental cost is based on the effect of pollution on the populace, the split is by state/provincial population for traffic on ACRL and by national population for traffic carried on rail beyond the ACRL.
		Impact of Freight on other RRs	0%	0%	0%	10%	90%	
2	Environmental - Change in Environmental Costs from Displacing Car/Light Truck Travel	N/A	13%	1%	86%	0%	0%	Since the environmental cost is based on the effect of pollution on the populace, the split is by state/provincial population.
3	Transportation Safety - Change in Accident Costs from Displacing Heavy Truck Travel	Impact of Freight on ACRL	33%	33%	33%	0%	0%	The freight traffic on the ACRL is traveling roughly the same distance in each state/province and therefore there is an equal likelihood of an accident in each region, traffic beyond the ACRL is primarily traveling in the US.
		Impact of Freight on other RRs	0%	0%	0%	8%	92%	
4	Transportation Safety - Change in Accident Costs from Displacing Car/Light Truck Travel	N/A	9%	36%	54%	0%	0%	The safety savings are split by the percentage of tourist traffic that was traveling in each region, few people actually travel all the way to Alaska by car.
5	Transportation System Savings - Change in Inventory Costs	From Truck	90%	1%	3%	1%	5%	Savings from reduced inventory costs are assumed to be passed on to consumers, virtually all ACRL region truck traffic is inbound to Alaska, and all rail barge traffic goes to the continental US from Alaska.
		From Rail Barge	0%	0%	0%	0%	100%	

Table 3: HDR|HLB Allocation Assumptions for Net Benefits (Cont'd)

#	BENEFIT NAME	SUB-CATEGORY	PERCENT ALLOCATED TO:					HDR|HLB – ALLOCATION METHODOLOGY
			Alaska	Yukon	BC	Canada	USA	
6	Transportation System Savings -Change in Transportation Costs	From Truck	90%	1%	3%	1%	5%	Savings from reduced transportation costs are assumed to be passed on to consumers, virtually all ACRL region truck traffic is inbound to Alaska, and all rail barge traffic goes to the continental US from Alaska.
		From Rail Barge	0%	0%	0%	0%	100%	
7	Transportation System Maintenance - Change in Pavement Maintenance Costs from Displacing Heavy Truck Travel	Impact of Freight on ACRL	33%	33%	33%	0%	0%	The freight traffic on the ACRL is traveling roughly the same distance in each state/province and therefore there is an equal share of maintenance in each region, traffic beyond the ACRL is primarily traveling in the US.
		Impact of Freight on other RRs	0%	0%	0%	8%	92%	
8	Transportation System Maintenance - Change in Pavement Maintenance Costs from Displacing Car/Light Truck Travel	N/A	9%	36%	54%	0%	0%	The maintenance savings are split by the percentage of tourist traffic that was traveling in each region, few people actually travel all the way to Alaska by car.
9	Military/Emergency - Change in Relief and Repair Costs of Natural Disasters/Major Terrorist Attacks	N/A	50%	0%	0%	0%	50%	The federal government would pick up the major portion of the relief tab, while the major beneficiaries of the effort would be the people of Alaska therefore the benefit was split equally
10	Military/Emergency - Change in War-time Military Costs	N/A	0%	0%	0%	0%	100%	The defense of the United States in all theatres is entirely a federal mandate.
11	Economic Development - Tier 2 & 3 Mining Related Employment Benefits	Tier 2 & 3 Mining in Alaska	75%	0%	0%	0%	25%	Assumes most wages are spent in territory, with some flow back to other parts of the same country where the development occurs. This is caused by migrant labor which would be lowest in BC and highest in Yukon.
		Tier 2 & 3 Mining in Yukon	0%	50%	0%	50%	0%	
		Tier 2 & 3 Mining in BC	0%	0%	85%	15%	0%	

5. RESULTS

This section presents the final results of the BCA analysis based on the structure and logic models and input values presented in Section 2 and Section 3 respectively. The allocation assumptions presented in Section 4 are utilized to breakdown the net benefits by region. The results presented in this section are based on the assumption that construction of the ACRL starts in 2012 and continues over a period of 5 years. CBA benefits that arise as a result of the ACRL are not realized until after this construction period is complete. The total number of years for CBA analysis is 50 years, which is consistent with the capital and operating costs extracted from the financial model.

Note that in order to meaningfully compare benefit and cost dollar streams over the project lifecycle, the changing value of a dollar is accounted for by expressing all future costs and benefits in base-year 2006 dollars, and further, by discounting them with the "real discount rate" factor.

In the results presented below, the ACRL operating costs are assumed to be paid by the rail operator, however, the capital costs are allocated to the public and private sector as determined by the optimal P3 outcome. This outcome represents the minimum amount of public funding such that the ACRL rail operator breaks even, that is recovers its opportunity cost of capital.

The Choice of Discount Rates

A real discount rate of 10.1 percent was used to discount the value of future revenues and costs for the ACRL rail operator. This is based on the average opportunity cost of capital for Canadian Pacific Rail (9.9 percent) and the Canadian National Railway (10.3 percent)[4].

The choice of discount rate for the public sector is not as clear. In its guidelines on the conduct of Cost-Benefit Analysis[5], the federal Office of Management and Budget (OMB) recommends the use of 7 percent as the real (after inflation) rate at which to discount the value of future costs and benefits. This is the rate of return that OMB believes to represent the opportunity cost of capital resources when they are employed for public rather than private investment. Deeming analysis based on the 7 percent discount rate the "base case," the OMB guidelines recognize that other discount rates will be appropriate in various circumstances, and invites project sponsors to employ such other discount rates, as appropriate, as alternatives to the base case.

Defining the Base Case

The base case analysis given in this report reflects a discount rate of 7 percent as recommended in federal OMB guidelines.

[4] Real Cost of Capital as of July 28, 2006 (extracted from http://www.fpinfomart.ca/).
[5] OMB Circular A-94, updated January, 2006

Defining the Alternative Case

Circumstances surrounding the investment under examination here justify an alternative discount rate that is lower than the 7 percent base case level. Economically less developed regions necessarily place a smaller discount on the value of future benefits than do developed regions. This reflects the reality that economic development is a long-term process and that under-developed regions must be prepared to "wait longer" for development initiatives to pay-off. Another reason why the discount rate is appropriately lower in under-developed regions is that the rate of return on opportunities foregone are lower; were it not so, the region would not be underdeveloped. While there is no consensus as to exactly how much lower than 7 percent the discount rate should be for under-developed regions, expert opinion appear to cluster around the 3 to 5 percent level. In conducting sensitivity analysis to the base case, we present two alternate scenarios. One scenario examines project outcomes at the break-even discount rate, and the other examines project outcomes at a 5 percent discount rate.

5.1 The Base Case: 7 Percent Real Discount Rate

Net Benefits

Table 4 presents the total discounted value of benefits. Note that the negative numbers in the table represent reductions in costs, which are a benefit. The expected (mean) value of benefits is almost $9.5 billion (all 2006 U.S $). The risk analysis identifies a 90 percent probability that benefits exceed $6.4 billion and a 10 percent probability that benefits exceed $12.7 billion. At the mean, Tier 2 and Tier 3 mining related employment is the single largest benefit contributor. This benefit represents $5.4 billion, or 57 percent of the total benefits. Reduced transportation costs is the next largest benefit contributor at $3.2 billion, or 34 percent of total benefits. In total, these two benefits represent approximately 91 percent of total benefits. Note that there is only one category which is a net dis-benefit; the expected change in accidents costs from displacing heavy truck travel increases by $133 million. This is the result of induced rail traffic from Tier 2 and Tier 3 mine development which only occurs if the ACRL is built.

Figure 17 shows the total discounted value of benefits by region. Alaska is the primary beneficiary, receiving 48 percent of the total benefits. British Columbia is the next largest beneficiary at 30 percent, followed by the Rest of Canada (11 percent), Yukon (9 percent), and Rest of U.S. (2 percent). This percentage breakdown is consistent for both alternative scenarios (Section 5.2 and Section 5.3), and hence this allocation is not produced for those scenarios.

Table 8: Total Discounted Value of Net Benefits (Base Case)

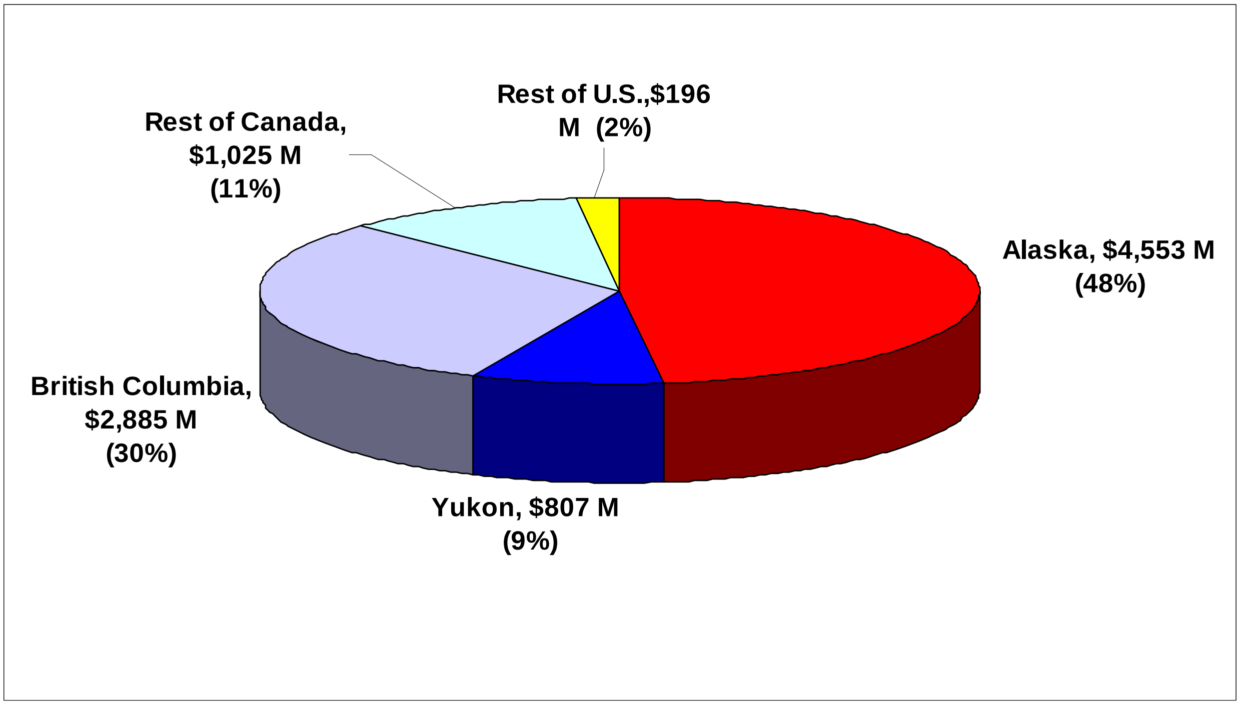
Net Benefit Cat #	Net Benefit Cat #	Net Benefit #	Net Benefit Name	Total Discounted Value (2006 US$ M)		
				Mean	Probability of (Not) Exceeding	
					(10%) / 90%	(90%) / 10%
1	Environmental	1	Change in Environmental Costs from Displacing Heavy Truck Travel	($133)	($1,892)[1]	$1,473[1]
	Environmental	2	Change in Environmental Costs from Displacing Car/Light Truck Travel	($3)	($6)[2]	($1)[2]
2	Transportation Safety	3	Change in Accident Costs from Displacing Heavy Truck Travel	$133	($139)	$401
	Transportation Safety	4	Change in Accident Costs from Displacing Car/Light Truck Travel	($13)	($22)	($5)
	Transportation System Savings	5	Change in Inventory Costs	($211)	($396)	($57)
	Transportation System Savings	6	Change in Transportation Costs	($3,218)	($4,590)	($2,027)
4	Transportation System Maintenance	7	Change in Pavement Maintenance Costs from Displacing Heavy Truck Travel	($333)	($523)	($169)
	Transportation System Maintenance	8	Change in Pavement Maintenance Costs from Displacing Car/Light Truck Travel	($2)	($3)	($1)
5	Military / Emergency	9	Change in Relief and Repair Costs for Natural Disasters / Major Terrorist Attacks	($30)	($58)	($7)
	Military / Emergency	10	Change in War-Time Military Costs	($245)	($481)	($60)
6	Economic Development	11	Tier 2 & 3 Mining Related Employment Benefits	$5,411	$3,451[3]	$7,644[3]
Total Discounted Value of Net Benefits				**$9,467**	**$6,412**	**$12,753**

[1]A 10 percent probability that the reduction in environmental costs exceeds -$1,892M (benefit), and a 10 percent probability that the increase in environmental costs exceeds $1,473M (dis-benefit).

[2] A 10 percent probability that the reduction in environmental costs exceeds -$6M (benefit), and a 90 percent probability that the reduction in environmental costs exceeds -$1M (benefit)

[3] A 90 percent probability that the economic development benefits exceed $3,451M (benefit), and a 10 percent probability that they exceed $7,644M (benefit).

Figure 17: Total Discounted Value of Net Benefits – By Region (Mean Estimates, Base Case)



Costs

There is no optimal P3 outcome for the base case since the expected value of net benefits does not exceed ACRL costs. As a result, for the purposes of valuing the cost of the project, it was assumed that the public sector contributed 90 percent of the capital costs, and the rail operator contributed 10 percent. Table 5 presents the total discounted value of costs based on this assumption. The expected (mean) value of costs is $11.3 billion, with capital costs representing approximately 89 percent of total costs. There is a 90 percent probability that costs exceed $8.8 billion, and a 10 percent probability that costs exceed $13.8 billion.

Table 9: Total Discounted Value of Costs (Base Case)

Cost Category	Total Discounted Value (2006 US$ M)		
	Mean	Probability of Exceeding	
		90%	10%
Capital	$10,046	$7,549	$12,546
Operating	$1,266	$1,008	$1,526
Total	**$11,312**	**$8,814**	**$13,805**

Surplus/Shortfall

Table 6 reports the surplus/shortfall as measured by the discounted value of net benefits less costs. The expected (mean) value is a shortfall of $1.8 billion. There is a 10 percent probability of a shortfall that exceeds $5.8 billion, and a 10 percent probability of a surplus that exceeds $2.1 billion.

Table 10: Total Discounted Value of Surplus/Shortfall (Base Case)

	Total Discounted Value (2006 US$ M)		
	Mean	Probability of Exceeding	
		10%	10%
Surplus / Shortfall (Net Benefits - Costs)	**-$1,845**	**-$5,797**	**$2,143**

5.2 Alternate Case #1: Break-Even Real Discount Rate

Alternative Case #1 was run using the break-even real discount rate. This represents the discount rate at which the public sector net benefits exactly cover its costs, with the rail operator receiving an amount equivalent to their opportunity cost of capital (i.e. 10.1 percent). The discount rate and corresponding P3 outcome that produced this result was determined using an iterative solve algorithm.

A discount rate of 5.9 percent, with public contribution of capital costs at 85 percent and rail operator contribution at 15 percent was found to produce a break-even outcome. Note that this solve algorithm is an approximation external to the risk analysis. Hence, when incorporated within the risk framework, it produces a very "close" approximation of the P3 outcome at the break-even level.

Net Benefits

Table 7 presents the total discounted value of benefits. Note that the negative numbers in the table represent reductions in costs, which are a benefit. The expected (mean) value of benefits is $11.6 billion (all 2006 U.S $). The risk analysis identifies a 90 percent probability that benefits exceed $7.9 billion and a 10 percent probability that benefits exceed $15.6 billion. At the mean, Tier 2 and Tier 3 mining related employment is the single largest benefit contributor. This benefit represents $6.5 billion, or 57 percent of the total benefits. Reduced transportation costs is the next largest benefit contributor at $3.9 billion, or 34 percent of total benefits. In total, these two benefits represent approximately 90 percent of total benefits. Note that there is only one category which is a net dis-benefit; the expected change in accidents costs from displacing heavy truck travel increases by $149 million. This is the result of induced rail traffic from Tier 2 and Tier 3 mine development that occurs only if the ACRL is built.

Table 11: Total Discounted Value of Net Benefits (Alternative Case - Break-Even Real Discount Rate)

Net Benefit Cat #	Net Benefit Cat #	Net Benefit #	Net Benefit Name	Total Discounted Value (2006 US$ M)		
				Mean	Probability of Exceeding	
					(10%) / 90%	(90%) / 10%
1	Environmental	1	Change in Environmental Costs from Displacing Heavy Truck Travel	($234)	($2,376)[1]	$1,722 [1]
	Environmental	2	Change in Environmental Costs from Displacing Car/Light Truck Travel	($4)	($7)[2]	($1) [2]
2	Transportation Safety	3	Change in Accident Costs from Displacing Heavy Truck Travel	$149	($180)	$473
	Transportation Safety	4	Change in Accident Costs from Displacing Car/Light Truck Travel	($16)	($27)	($6)
	Transportation System Savings	5	Change in Inventory Costs	($259)	($485)	($70)
	Transportation System Savings	6	Change in Transportation Costs	($3,944)	($5,624)	($2,484)
4	Transportation System Maintenance	7	Change in Pavement Maintenance Costs from Displacing Heavy Truck Travel	($408)	($641)	($207)
	Transportation System Maintenance	8	Change in Pavement Maintenance Costs from Displacing Car/Light Truck Travel	($3)	($4)	($1)
5	Military / Emergency	9	Change in Relief and Repair Costs for Natural Disasters / Major Terrorist Attacks	($36)	($70)	($9)
	Military / Emergency	10	Change in War-Time Military Costs	($296)	($580)	($73)
6	Economic Development	11	Tier 2 & 3 Mining Related Employment Benefits	$6,564	$4,197 [3]	$9,258 [3]
Total Discounted Value of Net Benefits				**$11,612**	**$7,892**	**$15,631**

[1] A 10 percent probability that the reduction in environmental costs exceeds -$2,376M (benefit), and a 10 percent probability that the increase in environmental costs exceeds $1,722M (dis-benefit).

[2] A 10 percent probability that the reduction in environmental costs exceeds -$7M (benefit), and a 90 percent probability that the reduction in environmental costs exceeds -$1M (benefit)

[3] A 90% probability that the economic development benefits exceed $4,197M (benefit), and a 10 percent probability that they exceed $9,258M (benefit).

Costs/P3 Analysis

The optimal P3 scenario assumes public contribution of capital costs at 85 percent and rail operator contribution at 15 percent. Table 8 presents the total expected (mean) discounted value of net benefits and costs for the public sector. The total CBA net benefits total $11.6 billion; however, $2.6 billion is paid to the rail operator as revenue. The total value of benefits net of transfers is $8.97 billion, while the total costs are $8.92 billion. This results in a net present value of $48 million for the public sector (approximately break-even).

Table 12: Costs/P3 Analysis – Public Sector (Mean Estimates, Alternative Case - Break-Even Real Discount Rate)

Total CBA Net Benefits (PV, $M)	Reduction for Revenue Transfer (PV, $M)	Benefits Net of Transfers (PV, $M)	Capital Costs (PV, $M)	Operating Costs (PV, $M)	Capital & Operating Costs (PV, $M)	Net Present Value ($M)
$11,612	$2,641	$8,972	$8,924	$0	$8,924	$48

Note: PV = Present Value.

Table 9 presents the total expected (mean) discounted value of revenues and costs for the private rail operator. Rail revenues total $2.641 billion, while the total costs are $2.640 billion (approximate values). This results in a net present value of $0.3 million for the private rail operator (approximately break-even). A net present value of zero would indicate that the private rail operator receives an amount equivalent to their opportunity cost of capital.

Table 13: Costs/P3 Analysis – Private Rail Operator (Mean Estimates, Alternative Case - Break-Even Real Discount Rate)

Revenue (PV, $M)	Capital Costs (PV, $M)	Operating Costs (PV, $M)	Capital & Operating Costs (PV, $M)	Net Present Value ($M)
$2,640.75	$1,375	$1,266	$2,640.44	$0.3

Surplus/Shortfall

Table 10 reports the surplus/shortfall as measured by the discounted value of net benefits less costs. The expected (mean) value is a surplus of $48 million. There is a 10 percent probability of a shortfall that exceeds $4.5 billion, and a 10 percent probability of a surplus that exceeds $4.6 billion.

Table 14: Total Discounted Value of Surplus/Shortfall (Alternative Case - Break-Even Real Discount Rate)

	Total Discounted Value (2006 US$ M)		
	Mean	Probability of Exceeding 10%	Probability of Exceeding 10%
Surplus / Shortfall (Net Benefits - Costs)	**$48**	**-$4,498**	**$4,651**

5.3 Alternate Case #2: 5 Percent Real Discount Rate

To illustrate the impact of using a lower discount rate than 5.9 percent, Alternative Case #2 reports the outcomes at 5 percent discount rate. The results are presented below.

Net Benefits

Table 11 presents the total discounted value of benefits. Note that the negative numbers in the table represent reductions in costs, which are a benefit. The expected (mean) value of benefits is $14 billion (all 2006 U.S $). The risk analysis identifies a 90 percent probability that benefits exceed $9.5 billion and a 10 percent probability that benefits exceed $18.8 billion. At the mean, Tier 2 and Tier 3 mining related employment is the single largest benefit contributor. This benefit represents $7.8 billion, or 56 percent of the total benefits. Reduced transportation costs is the next largest benefit contributor at $4.7 billion, or 34 percent of total benefits. In total, these two benefits represent approximately 90 percent of total benefits. Note that there is only one category which is a net dis-benefit; the expected change in accidents costs from displacing heavy truck travel increases by $164 million. This is the result of induced rail traffic from Tier 2 and Tier 3 mine development which only occurs if the ACRL is built.

Table 15: Total Discounted Value of Net Benefits (Alternative Case – 5 Percent Real Discount Rate)

Net Benefit Cat #	Net Benefit Cat #	Net Benefit #	Net Benefit Name	Total Discounted Value (2006 US$ M)		
				Mean	Probability of (Not) Exceeding	
					(10%) / 90%	(90%) / 10%
1	Environmental	1	Change in Environmental Costs from Displacing Heavy Truck Travel	($365)	($2,933)[1]	$1,985[1]
	Environmental	2	Change in Environmental Costs from Displacing Car/Light Truck Travel	($5)	($8)[2]	($1)[2]
2	Transportation Safety	3	Change in Accident Costs from Displacing Heavy Truck Travel	$164	($229)	$552
	Transportation Safety	4	Change in Accident Costs from Displacing Car/Light Truck Travel	($18)	($32)	($7)
	Transportation System Savings	5	Change in Inventory Costs	($312)	($584)	($84)
	Transportation System Savings	6	Change in Transportation Costs	($4,753)	($6,777)	($2,993)
4	Transportation System Maintenance	7	Change in Pavement Maintenance Costs from Displacing Heavy Truck Travel	($491)	($773)	($249)
	Transportation System Maintenance	8	Change in Pavement Maintenance Costs from Displacing Car/Light Truck Travel	($3)	($5)	($2)
5	Military / Emergency	9	Change in Relief and Repair Costs for Natural Disasters / Major Terrorist Attacks	($42)	($83)	($10)
	Military / Emergency	10	Change in War-Time Military Costs	($352)	($690)	($87)
6	Economic Development	11	Tier 2 & 3 Mining Related Employment Benefits	$7,822	$5,007[3]	$11,014[3]
Total Discounted Value of Net Benefits				**$14,000**	**$9,528**	**$18,814**

[1] A 10 percent probability that the reduction in environmental costs exceeds -$2,933M (benefit), and a 10 percent probability that the increase in environmental costs exceeds $1,98M (dis-benefit).

[2] A 10 percent probability that the reduction in environmental costs exceeds -$8M (benefit), and a 90 percent probability that the reduction in environmental costs exceeds -$1M (benefit)

[3] A 90 percent probability that the economic development benefits exceed $5,007M (benefit), and a 10 percent probability that they exceed $11,014M (benefit).

Costs/P3 Analysis

The optimal P3 scenario assumes public contribution of capital costs at 85 percent and rail operator contribution at 15 percent. Table 12 presents the total expected (mean) discounted value of net benefits and costs for the public sector. The total CBA net benefits total $14 billion; however, $2.6 billion is paid to the rail operator as revenue. The total value of benefits net of transfers is $11.4 billion, while the total costs are $9.2 billion. This results in a net present value of almost $2.2 billion for the public sector.

Table 16: Costs/P3 Analysis – Public Sector (Mean Estimates, Alternative Case – 5 Percent Real Discount Rate)

Total CBA Net Benefits (PV, $M)	Reduction for Revenue Transfer (PV, $M)	Benefits Net of Transfers (PV, $M)	Capital Costs (PV, $M)	Operating Costs (PV, $M)	Capital & Operating Costs (PV, $M)	Net Present Value ($M)
$14,000	$2,641	$11,359	$9,194	$0	$9,194	$2,165

Note: PV = Present Value.

Table 13 presents the total expected (mean) discounted value of revenues and costs for the private rail operator. Rail revenues total $2.641 billion, while the total costs are $2.640 billion (approximate values). This results in a net present value of $0.3 million for the private rail operator. A net present value of zero would indicate that the private rail operator receives an amount equivalent to their opportunity cost of capital.

Table 17: Costs/P3 Analysis – Private Rail Operator (Mean Estimates, Alternative Case – 5 Percent Real Discount Rate)

Revenue (PV, $M)	Capital Costs (PV, $M)	Operating Costs (PV, $M)	Capital & Operating Costs (PV, $M)	Net Present Value ($M)
$2,640.75	$1,375	$1,266	$2,640.44	$0.3

Surplus/Shortfall

Table 14 reports the surplus/shortfall as measured by the discounted value of net benefits less costs. The expected (mean) value is a surplus of almost $2.2 billion. There is a 10% probability of a shortfall that exceeds $3.1 billion, and a 10% probability of a surplus that exceeds $7.5 billion.

Table 18: Total Discounted Value of Surplus/Shortfall (Alternative Case – 5 Percent Real Discount Rate)

	Total Discounted Value (2006 US$ M)		
	Mean	Probability of Exceeding	Probability of Exceeding
		10%	10%
Surplus/Shortfall (Net Benefits - Costs)	**$2,165**	**-$3,079**	**$7,483**

5.4 Conclusion

The proposed Alaska-Canada Rail Link (ACRL) would generate economic benefits that exceed the total costs of its construction, operation and maintenance. Although this conclusion is sensitive to the assumed opportunity cost of resources (the "discount rate"), the finding holds for discount rates of 5.9 percent or lower. In other words, the project would yield an economic return on investment of 5.9 percent, a return that makes the project competitive with other economic development investment opportunities available to the State. Economic benefits would exceed $14 billion, and would arise in the form of net new employment in the resource sector; improved industrial productivity (including lower inventory and other logistics costs); improved environmental conditions; greater safety, including reductions in the loss of life, limb and property; military and emergency management benefits; and reduced costs of operating and maintaining transportation systems.

Although the ACRL project is not commercially viable, there is scope for private sector participation in financing the project and operating and maintaining the assets going forward. For example, a co-investment plan of 85 percent public and 15 percent private contribution to capital costs, and 100 percent private financing of on-going operations and maintenance costs would constitute a win-win public-private partnering proposition.

APPENDIX A

This appendix contains data inputs as referenced in Section 3.

Table A1: Ton-Miles of Freight (000s)

Year #	Fiscal Year	ACRL - Financial Model	Incremental ACRL -Metz (Mean Value)	Incremental Other Rail – Metz (Mean Value)
1	2012	-	-	-
2	2013	-	-	-
3	2014	-	-	-
4	2015	-	-	-
5	2016	-	-	-
6	2017	3,755,254	4,717,873	12,007,276
7	2018	4,792,001	4,717,873	12,007,276
8	2019	4,824,416	4,717,873	12,007,276
9	2020	5,242,430	4,717,873	12,007,276
10	2021	7,916,547	4,717,873	12,007,276
11	2022	8,240,215	4,717,873	12,007,276
12	2023	8,240,215	4,717,873	12,007,276
13	2024	8,240,215	4,717,873	12,007,276
14	2025	8,240,215	4,717,873	12,007,276
15	2026	7,799,815	4,717,873	12,007,276
16	2027	7,799,815	4,717,873	12,007,276
17	2028	7,748,193	4,717,873	12,007,276
18	2029	7,526,308	4,717,873	12,007,276
19	2030	7,526,308	4,717,873	12,007,276
20	2031	7,369,606	4,717,873	12,007,276
21	2032	7,085,201	4,717,873	12,007,276
22	2033	7,085,201	4,717,873	12,007,276
23	2034	7,085,201	4,717,873	12,007,276
24	2035	6,969,530	4,717,873	12,007,276
25	2036	6,708,535	4,717,873	12,007,276
26	2037	6,708,535	4,717,873	12,007,276
27	2038	6,708,535	4,717,873	12,007,276
28	2039	6,663,062	4,717,873	12,007,276
29	2040	6,663,062	4,717,873	12,007,276
30	2041	5,777,271	4,717,873	12,007,276
31	2042	5,401,440	4,717,873	12,007,276
32	2043	5,152,023	4,717,873	12,007,276
33	2044	4,554,992	4,717,873	12,007,276
34	2045	4,554,992	4,717,873	12,007,276
35	2046	4,361,728	4,717,873	12,007,276

Table A1: Ton-Miles of Freight (000s) (Cont'd)

Year #	Fiscal Year	ACRL - Financial Model	Incremental ACRL -Metz (Mean Value)	Incremental Other Rail – Metz (Mean Value)
36	2047	4,361,728	4,717,873	12,007,276
37	2048	4,361,728	4,717,873	12,007,276
38	2049	4,361,728	4,717,873	12,007,276
39	2050	4,361,728	4,717,873	12,007,276
40	2051	4,042,115	4,717,873	12,007,276
41	2052	4,042,115	4,717,873	12,007,276
42	2053	4,042,115	4,717,873	12,007,276
43	2054	4,042,115	4,717,873	12,007,276
44	2055	4,042,115	4,717,873	12,007,276
45	2056	4,042,115	4,717,873	12,007,276
46	2057	4,042,115	-	-
47	2058	4,042,115	-	-
48	2059	4,042,115	-	-
49	2060	4,042,115	-	-
50	2061	4,042,115	-	-

Source: Financial Model, Dr. Metz.

Note: HDR|HLB allocated Dr. Metz's estimates of incremental freight to the ACRL and other rail systems. This allocation was done using ACRL track length, and average distance from Alaska, Yukon, and Northern B.C. to Chicago.

Table A-2: Capital Expenditures, Operating Expenses and Rail Freight Revenue, By Year (2006 $US Millions)

Year #	Fiscal Year	Capital Expenditures	Operating Expenses	Rail Freight Revenue (Mean Value)
1	2012	$2,404.1	$7.2	$0.0
2	2013	$2,388.6	$7.2	$0.0
3	2014	$2,388.6	$7.2	$0.0
4	2015	$2,388.6	$7.2	$0.0
5	2016	$2,388.6	$7.2	$0.0
6	2017	$38.5	$93.1	$170.8
7	2018	$14.9	$102.7	$218.2
8	2019	$13.2	$102.9	$219.7
9	2020	$26.4	$106.6	$227.9
10	2021	$94.8	$135.5	$328.5
11	2022	$40.5	$138.4	$335.1
12	2023	$17.9	$138.4	$335.1
13	2024	$17.9	$138.4	$335.1
14	2025	$17.9	$138.4	$335.1
15	2026	$17.3	$134.2	$321.5
16	2027	$23.9	$134.2	$321.5
17	2028	$17.2	$133.5	$318.8
18	2029	$16.9	$131.5	$314.8
19	2030	$16.9	$131.5	$314.8
20	2031	$16.7	$130.0	$309.6
21	2032	$31.8	$127.3	$301.3
22	2033	$16.3	$127.3	$301.3
23	2034	$16.3	$127.3	$301.3
24	2035	$16.1	$125.9	$295.7
25	2036	$15.7	$123.8	$290.7
26	2037	$22.3	$123.8	$290.7
27	2038	$15.7	$123.8	$290.7
28	2039	$15.7	$123.5	$289.4
29	2040	$15.7	$123.5	$289.4
30	2041	$14.3	$114.5	$264.2
31	2042	$29.2	$110.1	$246.8
32	2043	$13.7	$105.8	$223.8
33	2044	$12.6	$101.4	$207.7
34	2045	$12.6	$101.4	$207.7
35	2046	$12.3	$99.4	$202.3
36	2047	$40.5	$99.4	$202.3
37	2048	$14.1	$99.4	$202.3
38	2049	$12.3	$99.4	$202.3

Table A-2: Capital Expenditures, Operating Expenses and Rail Freight Revenue, By Year (2006 $US Millions) (Cont'd)

Year #	Fiscal Year	Capital Expenditures	Operating Expenses	Rail Freight Revenue (Mean Value)
39	2050	$24.9	$99.4	$202.3
40	2051	$89.2	$97.5	$194.8
41	2052	$34.5	$97.5	$194.8
42	2053	$11.8	$97.5	$194.8
43	2054	$11.8	$97.5	$194.8
44	2055	$11.8	$97.5	$194.8
45	2056	$11.8	$97.5	$194.8
46	2057	$18.3	$97.5	$194.8
47	2058	$11.8	$97.5	$194.8
48	2059	$11.8	$97.5	$194.8
49	2060	$11.8	$97.5	$194.8
50	2061	$11.8	$97.5	$194.8
Total		**$12,937.6**	**$5,154.3**	**$11,361.7**

Source: Financial Model (Crest_200607020901_AMG.xls)

Table A-3: Passenger and Autorail Revenues, By Year (2006 $US Millions)*

Year #	Fiscal Year	Most Likely Value	10% Lower Value	10% Upper Value
1	2012	$0.0	$0.0	$0.0
2	2013	$0.0	$0.0	$0.0
3	2014	$0.0	$0.0	$0.0
4	2015	$0.0	$0.0	$0.0
5	2016	$0.0	$0.0	$0.0
6	2017	$16.5	$8.9	$20.2
7	2018	$24.7	$11.5	$30.3
8	2019	$33.0	$14.2	$40.4
9	2020	$33.0	$15.9	$40.4
10	2021	$33.0	$17.7	$40.4
11	2022	$33.0	$17.7	$40.4
12	2023	$33.0	$17.7	$40.4
13	2024	$33.0	$17.7	$40.4
14	2025	$33.0	$17.7	$40.4
15	2026	$33.0	$17.7	$40.4
16	2027	$33.0	$17.7	$40.4
17	2028	$33.0	$17.7	$40.4
18	2029	$33.0	$17.7	$40.4
19	2030	$33.0	$17.7	$40.4
20	2031	$33.0	$17.7	$40.4
21	2032	$33.0	$17.7	$40.4
22	2033	$33.0	$17.7	$40.4
23	2034	$33.0	$17.7	$40.4

Table A-3: Passenger and Autorail Revenues, By Year (2006 $US Millions)* (Cont'd)

Year #	Fiscal Year	Most Likely Value	10% Lower Value	10% Upper Value
24	2035	$33.0	$17.7	$40.4
25	2036	$33.0	$17.7	$40.4
26	2037	$33.0	$17.7	$40.4
27	2038	$33.0	$17.7	$40.4
28	2039	$33.0	$17.7	$40.4
29	2040	$33.0	$17.7	$40.4
30	2041	$33.0	$17.7	$40.4
31	2042	$33.0	$17.7	$40.4
32	2043	$33.0	$17.7	$40.4
33	2044	$33.0	$17.7	$40.4
34	2045	$33.0	$17.7	$40.4
35	2046	$33.0	$17.7	$40.4
36	2047	$33.0	$17.7	$40.4
37	2048	$33.0	$17.7	$40.4
38	2049	$33.0	$17.7	$40.4
39	2050	$33.0	$17.7	$40.4
40	2051	$33.0	$17.7	$40.4
41	2052	$33.0	$17.7	$40.4
42	2053	$33.0	$17.7	$40.4
43	2054	$33.0	$17.7	$40.4
44	2055	$33.0	$17.7	$40.4
45	2056	$33.0	$17.7	$40.4
46	2057	$33.0	$17.7	$40.4
47	2058	$33.0	$17.7	$40.4
48	2059	$33.0	$17.7	$40.4
49	2060	$33.0	$17.7	$40.4
50	2061	$33.0	$17.7	$40.4
Total		**$1,459**	**$776**	**$1,790**

*Assumes summer service between Vancouver/Fairbanks/Vancouver and winter service between Prince George/Fairbanks/Prince George

Source: WP A3(f) - Passenger Revenue Model - Mgmt Strategy 1.xls (Klughertz & Associates)

Table A-4: Track Revenues, By Year (2006 $US Millions)*

Year #	Fiscal Year	Most Likely Value	10% Lower Value	10% Upper Value
1	2012	$0.0	$0.0	$0.0
2	2013	$0.0	$0.0	$0.0
3	2014	$0.0	$0.0	$0.0
4	2015	$0.0	$0.0	$0.0
5	2016	$0.0	$0.0	$0.0
6	2017	$1.4	$1.1	$1.8
7	2018	$1.6	$1.2	$2.0
8	2019	$1.8	$1.3	$2.2
9	2020	$1.8	$1.3	$2.2
10	2021	$1.8	$1.3	$2.2
11	2022	$1.8	$1.3	$2.2
12	2023	$1.8	$1.3	$2.2
13	2024	$1.8	$1.3	$2.2
14	2025	$1.8	$1.3	$2.2
15	2026	$1.8	$1.3	$2.2
16	2027	$1.8	$1.3	$2.2
17	2028	$1.8	$1.3	$2.2
18	2029	$1.8	$1.3	$2.2
19	2030	$1.8	$1.3	$2.2
20	2031	$1.8	$1.3	$2.2
21	2032	$1.8	$1.3	$2.2
22	2033	$1.8	$1.3	$2.2
23	2034	$1.8	$1.3	$2.2
24	2035	$1.8	$1.3	$2.2
25	2036	$1.8	$1.3	$2.2
26	2037	$1.8	$1.3	$2.2
27	2038	$1.8	$1.3	$2.2
28	2039	$1.8	$1.3	$2.2
29	2040	$1.8	$1.3	$2.2
30	2041	$1.8	$1.3	$2.2
31	2042	$1.8	$1.3	$2.2
32	2043	$1.8	$1.3	$2.2
33	2044	$1.8	$1.3	$2.2
34	2045	$1.8	$1.3	$2.2
35	2046	$1.8	$1.3	$2.2
36	2047	$1.8	$1.3	$2.2
37	2048	$1.8	$1.3	$2.2
38	2049	$1.8	$1.3	$2.2
39	2050	$1.8	$1.3	$2.2
40	2051	$1.8	$1.3	$2.2
41	2052	$1.8	$1.3	$2.2
42	2053	$1.8	$1.3	$2.2
43	2054	$1.8	$1.3	$2.2

Table A-4: Track Revenues, By Year (2006 $US Millions)* (Cont'd)

Year #	Fiscal Year	Most Likely Value	10% Lower Value	10% Upper Value
44	2055	$1.8	$1.3	$2.2
45	2056	$1.8	$1.3	$2.2
46	2057	$1.8	$1.3	$2.2
47	2058	$1.8	$1.3	$2.2
48	2059	$1.8	$1.3	$2.2
49	2060	$1.8	$1.3	$2.2
50	2061	$1.8	$1.3	$2.2
Total		**$80.3**	**$60.2**	**$100.4**

*Assumes summer service between Whitehorse/Fairbanks/Whitehorse

Source: WP A3(f) - Passenger Revenue Model - Mgmt Strategy 1.xls (Klughertz & Associates)

Table A-5: Incremental ACRL Freight Revenue (Metz) – By Year (2006 $US Millions)

Year #	Fiscal Year	Mean	10% Lower	10% Upper
1	2012	$0.0	$0.0	$0.0
2	2013	$0.0	$0.0	$0.0
3	2014	$0.0	$0.0	$0.0
4	2015	$0.0	$0.0	$0.0
5	2016	$0.0	$0.0	$0.0
6	2017	$123.1	$61.5	$187.8
7	2018	$123.1	$61.5	$187.8
8	2019	$123.1	$61.5	$187.8
9	2020	$123.1	$61.5	$187.8
10	2021	$123.1	$61.5	$187.8
11	2022	$123.1	$61.5	$187.8
12	2023	$123.1	$61.5	$187.8
13	2024	$123.1	$61.5	$187.8
14	2025	$123.1	$61.5	$187.8
15	2026	$123.1	$61.5	$187.8
16	2027	$123.1	$61.5	$187.8
17	2028	$123.1	$61.5	$187.8
18	2029	$123.1	$61.5	$187.8
19	2030	$123.1	$61.5	$187.8
20	2031	$123.1	$61.5	$187.8
21	2032	$123.1	$61.5	$187.8
22	2033	$123.1	$61.5	$187.8
23	2034	$123.1	$61.5	$187.8
24	2035	$123.1	$61.5	$187.8
25	2036	$123.1	$61.5	$187.8
26	2037	$123.1	$61.5	$187.8

Table A-5: Incremental ACRL Freight Revenue (Metz) – By Year (2006 $US Millions) (Cont'd)

Year #	Fiscal Year	Mean	10% Lower	10% Upper
27	2038	$123.1	$61.5	$187.8
28	2039	$123.1	$61.5	$187.8
29	2040	$123.1	$61.5	$187.8
30	2041	$123.1	$61.5	$187.8
31	2042	$123.1	$61.5	$187.8
32	2043	$123.1	$61.5	$187.8
33	2044	$123.1	$61.5	$187.8
34	2045	$123.1	$61.5	$187.8
35	2046	$123.1	$61.5	$187.8
36	2047	$123.1	$61.5	$187.8
37	2048	$123.1	$61.5	$187.8
38	2049	$123.1	$61.5	$187.8
39	2050	$123.1	$61.5	$187.8
40	2051	$123.1	$61.5	$187.8
41	2052	$123.1	$61.5	$187.8
42	2053	$123.1	$61.5	$187.8
43	2054	$123.1	$61.5	$187.8
44	2055	$123.1	$61.5	$187.8
45	2056	$123.1	$61.5	$187.8
46	2057	$0.0	$0.0	$0.0
47	2058	$0.0	$0.0	$0.0
48	2059	$0.0	$0.0	$0.0
49	2060	$0.0	$0.0	$0.0
50	2061	$0.0	$0.0	$0.0
Total		**$4,922.7**	**$2,459**	**$7,512**

Source: Dr. Metz

Note: HDR|HLB allocated Dr. Metz's estimates of incremental freight to the ACRL and other rail systems. This allocation was done using ACRL track length, and average distance from Alaska, Yukon, and Northern B.C. to Chicago. The revenue per ton-mile of mineral freight came from the financial model.

APPENDIX B

Table B-1 below lists the economic development impacts (side benefits) as reported by Informetrica. These economic development impacts are listed as side benefits because they may contain useful information for the state/province, but are not appropriate for CBA analysis because they are considered transfers (as opposed to net benefits to society).

Table B-1 shows that direct construction employment impacts from the ACRL project would result in 67,200 person-years of jobs. Of that, 58,000 would be in Canada shifting approximately US$2.4 Billion to direct construction labor income. Total ongoing operations and maintenance employment for the ACRL would be 490 FTE's, resulting in a total wage bill of approximately US$ 44.1 Million per year. Indirect and induced construction employment would yield 152,300 person-years of jobs. Of that, 133,600 would be in Canada shifting approximately $9.4 Billion to indirect and induced construction labor income. The amount of tourism revenue related to the ACRL is expected to be about US $30 Million per year.

Table B-1: Economic Development Impacts (Side Benefits)

Benefit Category	Side Benefit Name	Benefit Name	Total Project	Alaska	Rest of US	Canada	Yukon	British Columbia	Rest of Canada
Economic Development	Direct Construction Employment Impacts	Increase in Direct Construction Jobs	67,200	9,200	-	58,000	33,000	25,000	-
		Increase in Direct Construction Labor Income over 5 Years	-	-	-	$2.4 B[1]	-	-	-
	Ongoing Operations and Maintenance Employment Impacts	Number of FTE's	490	-	-	-	-	-	-
		Total Wage Bill	$44.1 M						
	Indirect and Induced Construction Employment Impacts	Increase in Indirect and Induced Construction Jobs	152,300	5,700	13,000	133,600	21,800	35,700	76,100
		Increase in Indirect and Induced Construction Labor Income over 10 Years	-	-	-	$9.4 B[1]	-	-	-
	Tourism Related Employment Impacts	Tourism Revenue Per Year	$30.0 M	-	-	-	-	-	-

[1] These figures were multiplied by 0.85 to convert from Canadian to US dollars.

Source: Informetrica Limited, Alaska-Canada Rail Link Strategic Environmental Assessment: Canadian Economic Impacts Final Report D1.c (August 2006).

APPENDIX C

Table C-1 provides a list of ACRL documents provided to HDR|HLB. All documents relevant for CBA were leveraged in the development of the CBA framework.

Table C-1: List of ACRL Documents Provided to HDR|HLB

#	Document Filename	Document Title	Document Date	Author(s)
1	ACRL Feasibility Analysis Outlook 082406.pdf	Financial Analysis Workshop - Project Update	July 6, 2006	Ernst & Young Orenda/ Macquarie/Partnerships BC
2	ACRL Financial Analysis Stage 1 082406.pdf	Financial Analysis Workshop - Project Update	July 6, 2006	Ernst & Young Orenda
3	ACRL Financial Analysis Stage 2 082406.pdf	Stage 2 Financial Analysis Workshop - Management Working Group	August 24, 2006	Macquarie
4	Alaska Canada Rail Link Benefits Summary 080806.doc	Alaska Canada Rail Link - Summary of Benefits to Alaska	July 26, 2006	Paul Metz
5	Alaska Canada Rail Link Refined Metal Freight.doc	Alaska Canada Rail Link Project: Metallic Mineral Resources in Alaska, Yukon, and British Columbia And Railroad Freight Estimates for the Connection Between Alaska and the Contiguous States.	August 8, 2006	Paul Metz
6	Cost of Service Estimation. Pdf	Alaska Canada Rail Link Study: Phased Multimodal Integration - Work Package B3(f) - Cost of Service Estimation	August 2006	Banjar Management Inc., CH2M Hill Canada Ltd.
7	Life Cycle Capital Cost Estimation.pdf	Alaska Canada Rail Link Study: Phased Multimodal Integration - Work Package B3(b) - Life Cycle Capital Cost Estimation	August 2006	Banjar Management Inc., CH2M Hill Canada Ltd.

Table C-1 (Cont'd): List of ACRL Documents Provided to HDR|HLB

#	Document Filename	Document Title	Document Date	Author(s)
8	Life Cycle Operating Expenses Estimation.pdf	Alaska Canada Rail Link Study: Phased Multimodal Integration - Work Package B3(d) - Life Cycle Operating Expense Estimation	August 2006	Banjar Management Inc., CH2M Hill Canada Ltd.
9	Strategic Environmental Assessment - Canadian Economic Impact .pdf	Alaska Canada Rail Link - Strategic Environmental Assessment: Canadian Economic Impacts - Final Report D1.c	August 2006	Informetrica (M.C. McCracken, Charles Saunders, Abeer Reza)
10	Strategic Environmental Assessment - Overview of Economic Impacts.pdf	Alaska Canada Rail Link - Strategic Environmental Assessment: Overview of Economic Impacts - Final Report D1.c	August 2006	Informetrica Ltd.(M.C. McCracken, Charles Saunders, Abeer Reza), and Information Insights (Brian Rogers, Jana Peirce, Charles Ermer)
11	Traffic Data Development for Resource Projects.pdf	Alaska Canada Rail Link: Traffic Data Development for Resource Projects - Work Package: A-1(B)	January 30, 2006	QGI Consulting
12	YK and BC Mining Sector Activity.pdf	Projected Yukon and BC Mining Sector Activity arising from the Development of the Alaska-Canada Rail Link	August 4, 2006	Yukon Economic Development (Geoff Bradshaw, Mike Burke, Ken Galambos, Derek Parker)
13	WP#6_EconDevYukon.doc	Economic Development Opportunities arising in Yukon from ACRL: Working Paper #6	July 2006	Informetrica (Mike McCracken, Charles Saunders)
14	ACRL Risk Opportunity Sheets 041406.xls	Risk/Opportunities Assessment - Market Analysis, Environmental Regulatory Approvals & Technical	April 14, 2006	N/A
15	Copy of EcDev Tier II and III Final Aug 9.xls	Tier 2 and Tier 3 Mining	August 9, 2006	Yukon Economic Development?
16	Copy of Phase2_Financial_ Model_Base_Case_DRAFT.xls	Financial Model (includes cost and freight revenues)	N/A	Innovative Scheduling?

Table C-1 (Cont'd): List of ACRL Documents Provided to HDR|HLB

#	Document Filename	Document Title	Document Date	Author(s)
17	Traffic Data Development for YK Resource Projects.xls	Traffic Data Development for YK Resource Projects	N/A	N/A
18	Yukon_impact_EcDev.xls	Reallocate some of the "Rest-of-Canada" impact to the Yukon (GDP, Employment)	N/A	Informetrica (Charles Saunders)
19	Crest_200607020901_AMG.xls	Updated financial model with Crest (includes cost and freight revenues)	N/A	Innovative Scheduling? / Ernst & Young?
20	PetrochemicalIndustry.pdf	Petrochemical industry would have big economic impact on Alaska	July 18, 2004	Paul Metz, Gang Chen, Scott Huang, Tao Zhu
21	RailroadExtensionMineralConcentrates.ppt	Mineral Occurrences and Potential Sources of Freight for Alaska Railroad Extensions - Fairbanks to the Canadian Border	N/A	Paul Metz
22	Energy Minerals and Infrastructure in Support.ppt	Energy Minerals and Infrastructure in Support of Petrochemical Industry in Interior Alaska	N/A	Paul Metz
23	ACRL_LockheedMartinReport_June2006.pdf	Alaska Canada Rail Link Feasibility Study, Phase 1: Analysis of Rail Link Impact on North Slope Development, Current Transportation Risks, and Shared Corridor Synergies	June 2006	Lockheed Martin
24	British Columbia Major Mineral 080806.xls	Gross Metal Value of Identified Major Mineral Occurrences in ARR Extension Corridor in BC	August 8, 2006	Paul Metz
25	MAGORMINRailExten090706.xls	Gross Metal Value of Identified Major Mineral Occurrences in ARR Extension Corridor in Alaska	September 7, 2006	Paul Metz
26	YukonMajorMin090806.xls	Gross Metal Value of Identified Major Mineral Occurrences in ARR Extension Corridor in Yukon	September 8, 2006	Paul Metz