Phase 1 Feasibility Study

Research Report

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Executive Summary

Project Overview

On July 1, 2005 the governments of the State of Alaska and the Yukon Territory launched an initiative to examine the feasibility of a rail link connecting Alaska and the Yukon with the North American railroad system in British Columbia.

The goal of this study is to provide enough objective information to determine the nature and extent of a business case for investment in an Alaska Canada rail link.

The project was carried out in stages:

- In stage one, expert consultants on shipper markets and railway engineering, maintenance, and operations gathered data on potential traffic and costs for the proposed rail link. At this stage, multiple routes were evaluated.
- In stage two, the most promising route segments were further assessed in terms of financial viability, regulatory issues, and public interests such as economic and social impacts.

  The research was then integrated into an executive report to help the project's sponsors decide whether and how to further advance the rail link concept.

This report contains all of the research and analysis that was carried out prior to writing the executive report.

The work of the stages one and two was divided among a substantial number of expert consultants, who worked on the project in teams:

- The market team analyzed potential markets, traffic, and revenues, and
- The technical team conducted a conceptual engineering analysis of construction requirements and operating costs of rail, as well as the potential capacity at port connections.
- The environmental team conducted a survey of bio-physical, socio-cultural, and economic issues that might arise with the development of a railway.
- The business case team integrated the data from the other packages into a financial model and a cost-benefit analysis that provides economic, commercial, and financial investment viewpoints on potential railway developments.

The work was conducted more or less in the sequence described above. In some cases the research raised issues around work already completed, so on occasion a topic was revisited later in the project. The present report captures all of the research and it is presented in the sequence listed above.

Route Assessment

Ten route segments in B. C., Yukon, and Alaska were selected for study on the basis of contemporary knowledge of the region. They are shown on the map that follows.

The technical research concluded that, in general, engineering constructability and costs do not significantly direct or constrain route selection. The implication of this finding is that the market for transportation will have considerable impact on determining the most desirable route for the rail link.

The market research examined rail traffic opportunities and determined that there are considerable opportunities in export traffic from mineral resource developments. This finding favours a route that provides the best access to prospective resource developments. Furthermore, since most resource products are aimed at export markets, access to ports is an important factor.

Accordingly, a route scenario was sought that provides the shortest rail distance to the most port options for mineral exports, while protecting the potential for bridge traffic between Alaska and the continental rail network, and while avoiding unnecessary construction and operating obstacles.

On this basis, a 1500 mile scenario comprised of the following route segments became the basis for further analysis in stage two of the project. This working scenario is optimal for mineral export traffic and is equivalent to most other routes for bridge traffic.

- Between a southern connection to CN Rail at New Hazelton, B.C. (CN Rail links east to the US rail system and west to nearby ports at Kitimat and Prince Rupert) and Watson Lake, Yukon
- Between Watson Lake and Carmacks, within close proximity to many Yukon mining properties throughout the Tintina Trench.
- Between Carmacks and Delta Junction, Alaska, with connections to ports in Alaska over an Alaska Railroad extension to Delta Junction from its present terminus at Eielson.
- An additional link from Carmacks to future inside passage port facilities at Skagway, Alaska.

Stage two of the project focussed on this routing scenario as the most promising, but this does not preclude further examination of other routes at some other time. If other routes are re-examined at some point, the stage one work will provide baseline data from which that re-examination can start.

Quantitative Assessment

The base construction cost for the selected scenario was estimated at $7 billion. Adding in other costs such as environmental mitigation, engineering, and contingencies brings the full cost to $11 billion, or an average of $7.2 million per mile.

A model for estimating startup costs, operating costs, and capital replacement costs was developed in the course of the technical research. The operating costs were found to be within a range considered normal for North American railways, up to $0.02 per ton-mile.

In the best traffic years, after a start up period, the most conservative market analysis forecasts 8 million tons of freight per year, generating revenue of $240 million per year. Over a 30 year period, it is projected that the railway will carry 174 million tons of freight for total revenue of $5.5 billion.

Other strategic opportunities were examined for rail traffic and a projection that included additional tonnage and revenue was used as the basis for the business case analysis. In particular, the potential for large scale iron ore and coal traffic has lead to development of the "Haines Benchmark" for a phased resource railway investment .

The consultant's reports from which these figures are drawn are included in the body of this report. These reports include explanations of all the assumptions on which these figures are based, and information on their sensitivity to changed assumptions. One of the products of the research is a computer-based model that can be used to reassess evolving traffic and track scenarios.

Route Map


ALASKA
Fairbanks
Delta Junction
Anchorage
YUKON
Carmacks
Whitehorse
Watson Lake
Skagway
Haines
Fort Nelson
BRITISH
COLUMBIA
Minaret
Mackenzie
Prince
Rupert
Hazelton
EXISTING RAIL TRACKS
POTENTIAL RAIL ROUTES

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Background to the Project

A railroad link from Alaska to the rest of the North American rail system has been under consideration since the Alaska Railroad was started in 1914. Today, a renewed interest in resource deposits in Alaska, Yukon, and British Columbia, as well as changing world markets, global trade dynamics and supply chains, has rekindled interest in the link.

On July 1, 2005 the governments of the State of Alaska and the Yukon Territory launched an initiative to determine the feasibility of a rail link connecting Alaska and the Yukon with the North American railroad system.

Objectives of the Study

The goal of this study is to provide enough objective information to determine the nature and extent of the business case for investment in an Alaska Canada rail link.

In the short to mid term, a rail link could be part of a northern transborder corridor that supports mineral resource development, oil & gas development, and other economic activity in Alaska and north western Canada.

In the long term, a rail link could be part of a North pacific trade route bridging both bulk and container traffic between Asia and North America.

If the study shows that the envisioned rail link is not fully feasible at this time, it will help determine how phased investment or alternative routing scenarios might lead to viability in the longer term.

In any case, the study is by no means a definitive and final decision document leading to a go-no-go construction decision. This study should be viewed as documentation for ongoing decision making

History of the Rail Link Idea

The White Pass & Yukon Route Railroad, from the port of Skagway, Alaska to Whitehorse, Yukon was completed in 1900 by private investors. The Alaska Railroad was built by the US federal government in 1914-1923 and taken over by the State of Alaska in 1983. This railroad connects ports near Anchorage with the interior of Alaska around Fairbanks. Neither railway has a link to the North American Rail system, except by sea going barge.

Interest in further railroad development has been maintained from the beginning, and there have been many public and private efforts and schemes to build a link to the south. None have produced any operating railways.

A study was conducted by the US War Department in 1942. It estimated that a rail link could be built in two years with 17,000 men. The project was abandoned primarily because the time was considered too long, and the Alaska Highway was built instead.

A second study was conducted in Canada in the late 1960's, at a time when national interest in development of the Northwest was very high. It was estimated

that a rail route into Yukon could be built for $400 million, without a link to the Alaska Railroad. No construction was funded.

More recently, in 2000 then US Senator Frank H. Murkowski of Alaska introduced the Rails to Resources bill in the US Senate. The bill proposed to fund an international commission to study the possibility of a rail link from B. C. to the existing Alaska Railroad. The bill was passed and authorized $6 million for the study.

The US government then invited Canada to participate in the commission. Canada did not respond immediately, but the Yukon government recognized the importance of the project to its own economy. Yukon commissioned a review to confirm that is was an appropriate time to conduct such a study.

In 2005, Premier Fentie and Governor Murkowski met with Prime Minister Paul Martin to discuss the project. The Prime Minister expressed support on behalf of the Canadian federal government, and the Minister of Transportation concurred.

In March of 2005 Governor Murkowski and Premier Fentie signed a Memorandum of Understanding to initiate the Alaska Canada Rail Link Feasibility study.

Organization of the Feasibility Study

In the 2005 MOU, Yukon and Alaska agreed to:

- establish a multilateral Advisory Committee and a multilateral Management Working Group to oversee the study
- hire a full-time project manager to be based in Whitehorse
- complete a feasibility study by June 30, 2006
- encourage other governments (Canada, USA, and B. C.) to participate in the study

In the initial terms of reference that followed the MOU, Alaska and Yukon agreed:

- that the cost of the study would be shared by USA and Canada
- that the study would look comprehensively at technical, financial, regulatory, and public interest issues surrounding a railway linking Alaska to the North American rail system
- that the study report would include information on what factors would make a rail connection feasible if the financial analysis was not immediately favourable

The two multilateral committees were formed to oversee the project, with representation from Alaska, Yukon, First Nations, British Columbia, and Canada:

- The Advisory Committee, co-chaired by Alaska and Yukon, provides general oversight to the Management Working Group.

- The Management Working Group, chaired by Yukon, carries out the study and delivers the report to the Advisory Committee.

A project manager was hired to lead the project from a project office located in Whitehorse, Yukon. The project manager managed the day-to-day work of the project, which was carried out primarily by contracted consultants and the University of Alaska at Fairbanks.

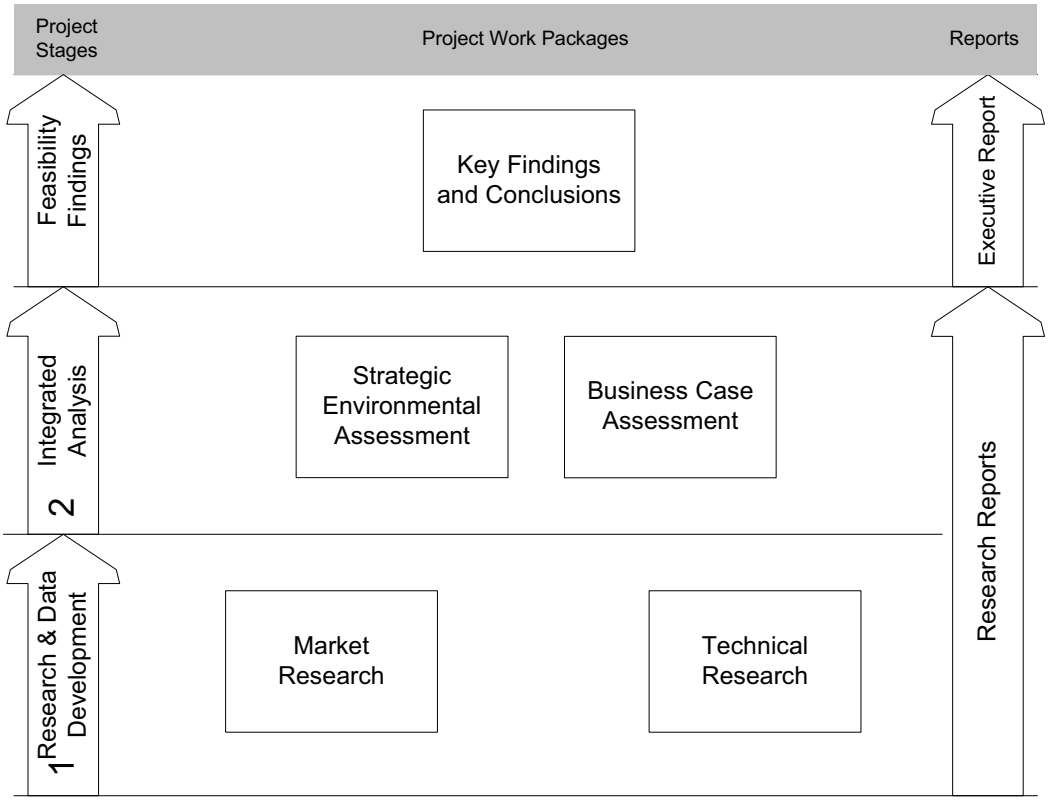
All of the participants in the project are listed in Appendix A.

Outline of the Work Plan

The feasibility study project was carried out in stages:

- Stage 1: A research stage where numerous expert consultants collected data on the market and technical aspects of a rail link,
- Stage 2: An integrated analysis stage where the findings from the market and technical research were used as the basis for preliminary environmental and business case assessments, and

  All the research was then integrated into findings and conclusions to help the project's sponsors decide whether and how to further advance the rail link concept.



The project was generally carried out in the sequence shown in the diagram. In order to achieve tight study time lines, teams sometimes worked in parallel and somewhat independently of each other. Some elements of the market research

continued right up until the end of the project. One of the deliverables of the project was a computer-based tool to allow new market research findings to be integrated into the financial model on an on-going basis.

The present report encompasses the research and integrated analysis stages of the project. The results of this work will, in addition to supporting the feasibility report, provide a body of knowledge that can be used in future by researchers who may pursue the rail link or other regional transportation and economic matters in the future.

Introduction to the Research Report

Purpose of This Report

This report contains the baseline research that was carried out to support the final conclusion of the feasibility study. It is a "stand-alone" report in the sense that the research could be used in other projects. The data could be useful to planners and analysts who may use the data in further work on this project or on other northern infrastructure projects or on other economic development studies

Structure of This Report

This report presents everything that was developed by the consultants during the research and assessment stages of the project, as it was delivered by the consultants. The major sections of the report correspond to the major work modules in the project work plan. Covering material has been written to put the individual consultant reports into the context of the overall project.

The electronic version of this report contains numerous spreadsheets that the consultants developed to support their work.

Research was carried out in both Canada and USA. To provide consistent reporting, quantities are reported in imperial units and US dollars.

The Project Work Plan

The project work that is covered in this report was carried out in two stages:

- In stage one, expert consultants on shipper markets and railway engineering, maintenance, and operations gathered data on potential traffic and costs for the proposed railway. At this stage, several potential routes were evaluated.
- In stage two, the most promising route segments were further assessed in terms of commercial and financial viability, and in terms of potential economic, socio-cultural and bio-physical impacts.

The project work was divided up into work modules or packages that enabled specialized consultants to work within their area of expertise. The four main package groups around which this report is organized are:

- The *market research* packages analyzed potential markets, traffic and revenues.
- The *technical research* conducted a conceptual engineering evaluation of construction requirements, capital and operating costs of rail, as well as the potential capacity at port connections.
- The *strategic environmental assessment* carried out a survey of the bio-physical, socio-cultural, and economic impacts that rail construction and operation could have in the proposed development regions.
- The *business case assessment* integrated the data from the other packages into a financial model and a cost-benefit analysis that provides economic,

commercial, and financial investment viewpoints on potential railway developments.

Methodology: Stage One Data Development

The goal of stage one was to develop market and technical data on several potential routes for the proposed rail link.

The routes for study were selected on the basis of contemporary knowledge of the region, and the following considerations:

- Firstly, it is necessary to connect the Alaska Railroad at Delta Junction, Alaska to an existing railway in British Columbia.
- Secondly, it is necessary to look at transportation links to ports on the expectation that significant proportion of potential traffic for a railway in this region would originate or terminate at a port.
- Thirdly, it is necessary to consider the possibility of building the rail link in stages with links to selected ports being built as they become viable.

With these considerations in mind, nine route segments were examined:

- In British Columbia, there were four possible routes. All brought the rail to Watson Lake, Yukon at the north end, and all joined CN Rail at some point in the south. The southern terminating points for the four routes considered were Hazelton, Minaret, Mackenzie, and Fort Nelson.
- In Yukon, three principal routes were considered to take the rail westward from Watson Lake. One follows the Alaska Highway to the Alaska border near Beaver Creek, and the other two follow the Tintina Trench to Carmacks. Eastward from Carmacks, one possible routes continues eastward to the Alaska Border near Beaver Creek, and the other enters Alaska further north and follows the Ladue River valley to join the Alaska Highway near Tok, Alaska.
- Also in Yukon, an additional segment was considered to join Carmacks or Whitehorse to an inside passage port at Skagway or Haines.
- In Alaska, the route would follow the Alaska Highway from the point where it joins the Yukon segment at either Tok or Beaver Creek, and continues eastward to Delta Junction where it would join the Alaska Railroad.

The constraints under which this work was conducted and the limitations of the data produced are discussed in the body of this report.

Methodology: Stage Two Integrated Analysis

At the end of stage one, it was possible to describe some preferred rail development scenarios. The goal of the stage two assessments was to examine those scenarios in terms of various economic and public interests.

Most of the public interest work was done in a *strategic environmental assessment*. This assessment is best characterized as survey work, intended to identify major issues and to scope out work that will need to be conducted in the future if work on a rail link is to continue. For example, no community consultation was conducted but the research provides base line information on who the community of interests is in order to scope out a future consultation. The assessment included specific modules on bio-physical, socio-cultural, and economic aspects of development and operation of a rail scenario.

In the *business case assessment*, a financial model was developed, based on the preferred development scenarios arising from the first research stage. The assessment then looked at rail development from economic, commercial, and financial investment perspectives. The analysis included suggestions and justifications for public sector involvement in the project, as a means to provide sufficient certainty for private investors.

Summary of Results

Results of the Technical Research

The *technical research* work:

- Assessed the technical feasibility of building and operating a railway over the various routes in Alaska, Yukon, and British Columbia.
- Researched alternative modes of transportation and routes that are or could be available to shippers. This includes a look at potential ports and highway routes.
- Developed life-cycle costs for all of the alternatives

The stage one technical research concluded that in Yukon, engineering constructability and costs marginally favour a northern route following the Tintina trench to the Alaska border. Within Alaska, the only available route would follow the Alaska Highway. In B. C. the partially completed route from Dease Lake to Minaret, B. C. was judged to have significantly higher construction and operating costs than the alternatives. The segment leading to Hazelton was favoured because it brings the rail closest to tidewater.

Options for port access were also examined to provide an understanding of which options would best contribute to an overall development scenario. It was determined that the most accessible port, Skagway, could handle no more than 2 to 3 million tons of exports per year. The market analysis shows that more capacity may be required so further analysis was undertaken and showed that the least cost alternative for adding capacity to the system would likely be Port Mackenzie in Alaska.

The base construction cost for the selected scenario was estimated at $7 billion. Adding in other costs such as environmental mitigation, engineering, and contingencies brings the full cost to $11 billion, or an average of $7.2 million per mile.

A model for estimating startup costs, operating costs, and capital replacement costs was developed in the course of the technical research. The operating costs were found to be within a range considered normal for North American railways, up to $0.02 per ton-mile. Any operating cost is highly dependent on a variety of assumptions about the operation of the railway.

Results of the Market Research

The *market research* work:

- Quantified the existing market for transportation in and out of the region.
- Quantified potential future markets including resource development, pipeline construction, passenger, and inter-modal traffic in the region.
- Estimated potential rail traffic from those markets in the light of current transportation costs.

The stage one market research examined three categories of traffic.

- *terminating traffic* that would flow through the main line between the southern connection point and Alaska, primarily resupply traffic which exists today or would result from increased economic activity in the region, including pipeline construction,
- *originating traffic* that the new transportation infrastructure would generate along the route, primarily export traffic from resource developments,
- *overhead traffic* neither originating nor terminating within the region.

The terminating traffic, because it nearly all terminates in Alaska, and overhead traffic, because by definition it travels the entire route, are not impacted by the route selection. The route options offered no substantial difference in the distance travelled for these types of traffic.

Originating traffic was determined to be a very important component of potential railway revenue, as well as the category most affected by the selection of a route. This finding lends favour to a route that provides the best access to prospective resource developments. Furthermore, since most resource development products are aimed at export markets, access to ports is an important factor.

Based on the results of the stage one research, it was decided to focus on the more market-favourable route scenario in stage two. On this basis, a system comprised of the following route segments was subjected to further analysis:

- From a southern terminus at New Hazelton, B.C., where there are CN Rail links east to the US rail system and west to nearby ports at Kitimat and Prince Rupert, to Watson Lake, Yukon
- From Watson Lake to Carmacks, within close proximity to many Yukon mining properties throughout the Tintina Trench.
- From Carmacks to Delta Junction, Alaska, with connections to ports in Alaska over an Alaska Railroad extension to Delta Junction from its present terminus at Eielson.
- An additional link from Carmacks to future inside passage port facilities at Skagway, Alaska.

This scenario provides for the possibility of building the railway in segments, with the inside passage port providing an access point for inbound and outbound traffic.

It must not be assumed from this that a preferred route has been “selected” for all time. The efforts of stage two of the present project were focussed on this route as the most promising, and sufficient to assess broadly the viability of a rail link. This does not preclude further examination of other routes as the project progresses beyond this study.

Market research turned out to be a very large topic, and the market research was on-going throughout the entire course of the study. There was a constant stream

of new projections as information was analyzed and strategic opportunities uncovered.

One of the conclusions of the study suggests that there is still considerable work to be done to "prove up" some of the traffic projections. Provision has been made to continue to market research beyond the end of this project, pending decisions of the project sponsors on further investments in other aspects of rail development.

The key traffic projections include the following estimates (short tons, annually):

- 1.5 millions tons of traffic from the south into the region, primarily Alaska, that is existing traffic captured from incumbent carriers,
- from 3.5 million to 20 million tons of base metal ores and coal originating at various points along the rail link,
- incoming traffic to supply the mineral development projects in the range of 1.5 to 3 million tons,
- an undetermined amount of bridge container traffic flowing from an Alaska port to central USA and Canada (a nominal figure of 5 million tons was used as a basis for the assessment work), and
- up to 28 million tons of iron ore originating in northern Yukon and travelling to a port.

Results of the Strategic Environmental Assessment

The *environmental assessment* work:

- Conducted a *bio-physical survey* of the proposed routes to identify issues that will require further study and possibly mitigation in future, and summarized overall qualitative and sustainability issues associated with rail development in the area.
- Conducted, at a strategic scoping level, a *socio-cultural survey* to examine how the relationship between local communities and a rail development project might unfold, and identified "rules of engagement" for advancing this relationship.
- Conducted an *economic impact assessment* to identify and quantify the impacts that rail construction and operation might have on the regional and national economies.

The bio-physical survey did not identify any major issues that would change the initial ranking of routes that arose from the stage one work. As would be expected with a project of this scale, there is substantial work to be done to enable the project to pass environmental scrutiny and regulation.

The socio-cultural survey noted that the socio-cultural impact of a rail development project will be very high. All of the proposed routed pass through areas in Canada where aboriginal land claims have not been settled and where, in some cases, there is limited capacity to deal with development initiatives. A

comprehensive and meaningful consultation with affected communities will be a necessary step in a complete feasibility study of rail development.

Long term economic benefits from a railway would arise from a reduction in local transportation costs to consumers and industries, displacement of highway traffic, and new tourism opportunities. As the market researchers discovered, it is difficult to quantify what a reduction in transportation costs might induce in the way of additional industrial and resource development.

The construction of the railway itself would have a major economic impact, which might be difficult to manage in today's environment of labour shortages and strained industrial capacity.

Results of the Business Case Analysis

The *business case analysis*:

- Developed a financial model that aggregates all of the data collected on rail link costs and revenues,
- Interpreted the results of the modelling from economic, commercial, and financial investment perspectives and suggested ways to improve those results,
- Assessed, qualitatively and quantitatively, public interest factors that might enable governments to formulate policies to support a rail development project.

A public cost-benefit analysis identified a positive public benefit in having the rail link in place. All of the analysis indicated that government has a substantial role to play, if not in direct financing then at least in creating a favourable and encouraging environment for private interests to work in.

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Introduction

The purpose of the market research was to forecast the amount of traffic and revenue that might accrue to a railway operating on any of several routes running through BC, Yukon, and Alaska.

The results of the market research, which are reported here, are intended to be used as a source for further economic analyses of the rail project in the present study and in future studies. For that reason, the market research data is accompanied by explanations of its sources, limitations, assumptions, and initial conclusions. Future users can thereby knowledgably interpret, adapt, and enhance the data to suit their requirements.

The fact that the investment planning horizon for a railroad is 30-50 years presents special challenges to a market research. In particular:

- It is necessary not only to look at existing traffic in the region, but also to try to forecast what impact the improved transportation infrastructure would have on the economy of the region, and in turn, what impact that would have on railway traffic.
- The world economy and the patterns of demand for resources and transportation have changed drastically since 2000. There are clearly both risks and opportunities in the next 30-50 years.

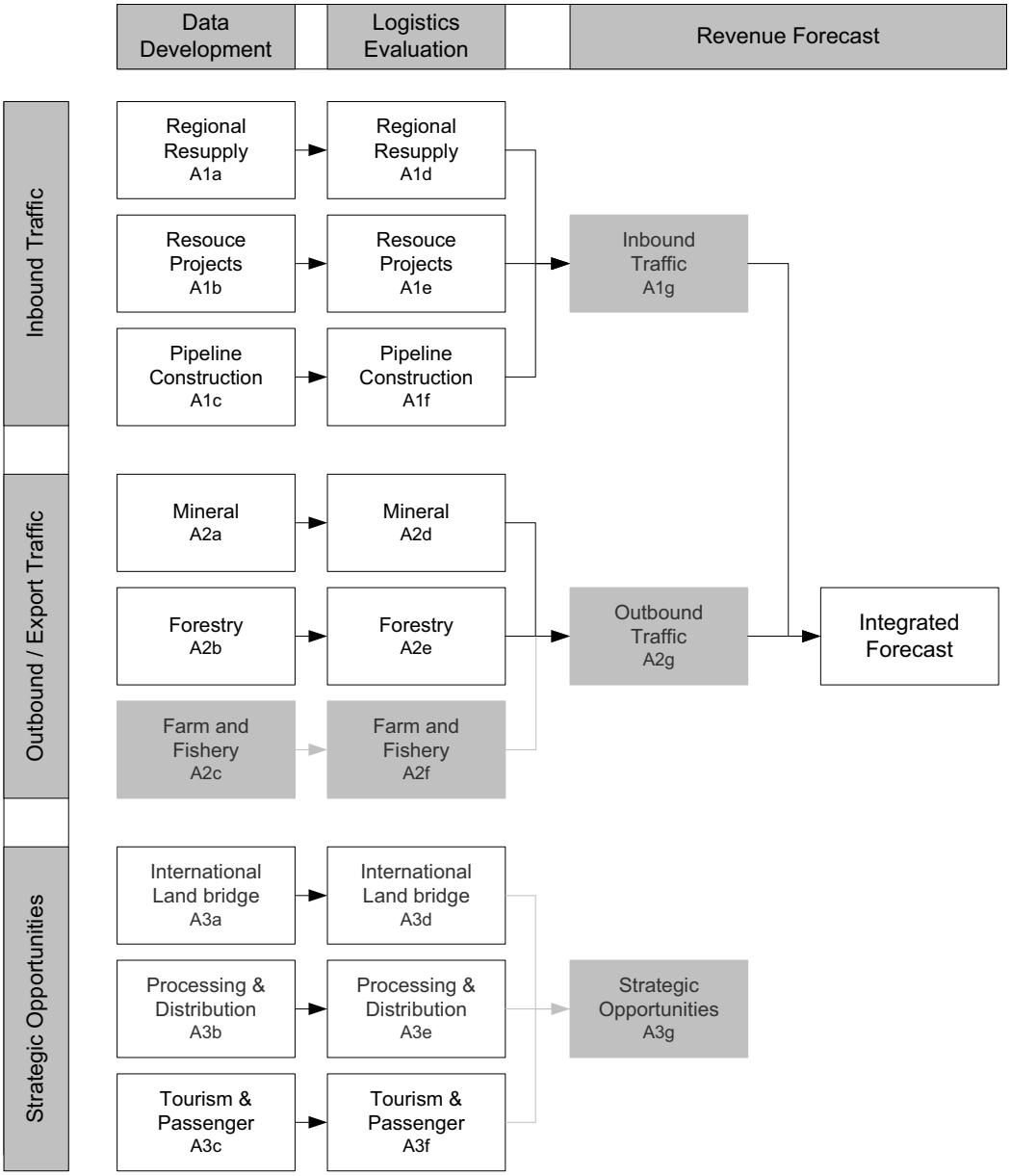
Potential traffic was forecast in three categories:

- *terminating traffic,* which is inbound consumer and industrial goods that are regularly shipped into the region, including shipments relating to pipeline and resource industry construction and operation,
- *originating traffic,* which is primarily the outbound products of the resource industry being shipped to export, and
- *overhead traffic,* which is traffic that neither originates nor terminates in the region, but might use a rail link to pass through the region.

Each of the categories was further broken down and organized around several potential sources of traffic. This breakdown enabled the work to be assigned to specialists most qualified to examine world markets, potential production, and transportation logistics in each market area. This breakdown is shown in the diagram on the next page.

The products of the work are presented in four sections following: an integrated analysis followed by a detailed forecast of each of the three traffic categories.

Market Research Work Breakdown



In each traffic category, the work was broken down into three steps: data development, logistics evaluation, and development of revenue forecasts. The codes shown on the chart are used in the consultants' reports to refer to this work plan.

Integrated Traffic Forecast

In the original project plan, all of the market research was to be rolled up into one integrated forecast of traffic and revenue. As the project unfolded, some of the market research was expanded and was ongoing throughout the project. The integrated traffic forecast report described here was produced at a point where the basic market research was completed, but work was still in progress on some strategic opportunities.

Subsequent market research which is not included in this integrated traffic forecast involved re-examination of the projected mineral traffic, a look at forestry and other resource-based traffic, passenger traffic, and an examination of the potential for land bridge container traffic flowing southward. Individual reports on these topics are included in the *Outbound Traffic* and *Strategic Traffic Opportunities* sections of this Market Research section.

The Integrated Traffic Forecast Report

This report was prepared by QGI Consulting after some conclusions had been reached about the relative values of the rail routes, so it is based on the single working route scenario outlined in the introduction to this report.

Reasonable, and generally conservative, choices were made to come up with the conclusions in this report. The consultant' report contains full coverage of the assumptions and risks associated with this analysis.

This market projection was done year by year over 30 years, starting with the first year of revenue operations. Over the 30 years, it was assumed that:

- Alaska Highway and Mackenzie pipeline construction traffic all occurs in the first two years of revenue operations, with demobilization in the third.
- Resource industry traffic grows to a peak by year 5, and 10 years later starts dropping off. The projection is a mid-range projection selected from a number of mineral traffic projections that were made elsewhere in the study. Refer to the section on mineral export traffic for more information.
- Other inbound resupply traffic (referred to as "bridge" traffic in this consultant's report) grows quickly to a peak and then remains a steady level throughout the forecast period

Over the full 30 year period, it is projected that the railway will carry 174 million tons of freight for a total revenue of $5.5 billion. The following table shows the figures for a representative year from the analysis.

Type of Traffic	Tons	%		Revenue	%
Pipline construction	-	0%			0%
Resource industry (in and out)	7,141,693	82%		123,371,849	51%
Other Inbound resupply	1,577,071	18%		116,648,347	49%
Total	**8,718,764**			**240,020,196**	

Pipeline traffic does not appear in the representative year because it occurs only in the first 2 years of operation, at about 1.1 million tons per year.

This amount of traffic approaches the 10 million revenue ton design limit that was used as the basis for the technical analysis.

This table shows the relationship between incoming and outgoing traffic over the whole 30 years:

		Tons	%		Revenue	%
Inbound		85,478,478	49%		3,731,310,622	68%
Outbound		87,881,507	51%		1,771,582,881	32%
30 year total		173,359,985			5,502,893,503	

The reasons for the lower revenue from the outbound traffic are:

- The inbound traffic is characterized as high value intermodal traffic that travels the whole length of the rail link, and
- The outbound traffic is characterized as low value mineral concentrates that travels from a mine site to the nearest port.

Read the Report

Summary Report (Work Packages A1g A2g)

QGI Consulting: Integrated Traffic Forecast
(34 page report)

QGI Consulting: Integrated Traffic Forecast, Supplement
(17 spreadsheets)

Inbound Traffic Forecast

In this part of the project, rail traffic and revenue forecasts were developed for traffic coming into Alaska, Yukon and Northern B.C. from outside the region. This work included determining what rail rates would be required for competitive cost positioning.

The work was divided into three work packages so that consultants with appropriate knowledge could be assigned to the research:

- Regional Resupply: covers inbound traffic from the lower 48 states and Canada to Alaska, Yukon and Northern BC. This includes construction materials, consumer goods, repair parts, equipment, vehicles, food, and fuel.
- Resource Projects: includes inbound supply to mining and oil and gas developments for construction and operations.
- Pipeline Construction: includes inbound transport of pipe, fuel, and equipment in support of the construction of proposed northern gas pipelines in Alaska and Canada. Outbound demobilization traffic was included in this package.

This table shows the relative importance of each category over 30 years:

Category		Tons	%		Revenue	%
Regional Resupply		44,157,991	52%		3,266,153,717	88%
Resource Projects		39,414,087	46%		425,840,337	11%
Pipeline Construction		1,906,400	2%		39,316,568	1%
30 year total		85,478,478			3,731,310,622	

These figures are taken from the integrated forecast, above. Where they differ from the category-specific forecasts below, this is explained below.

The following sections of the report cover these three categories in turn. For each category there is a logistics evaluation report that summarizes all of the findings in the category, plus multiple supplementary reports detailing the research findings that preceded the evaluation in each of the areas. All of the inbound traffic forecasts are included in the integrated traffic forecast that was presented in the previous section.

Regional Resupply

In this work package, existing inbound traffic was analyzed to determine what part of that traffic could move by rail, and what sort of revenue it would generate for the railway.

The analysis is straightforward as far as it involves existing traffic. The main challenge is to predict what the competitive response of the incumbent carriers would be in the face of rail competition, and what portion of the traffic could be captured by a railway, at what rates. The fact that only 4 carriers handle 90% of the existing traffic increases the risk of a competitive response.

There is presently about 4.1 million tons per year moving into the region, of which about 2.4 million tons is conducive to rail transportation:

	Total Tons	Conducive to Rail
Port of Anchorage	3,247,613	1,587,861
Rail Barge (Anchorage)	309,246	309,246
SE Alaska Ports	360,000	360,000
Highway - Alaska	117,715	117,175
Highway - Yukon	55,193	55,193
Total	4,089,786	2,430,016

The analysis concludes that rail could capture all the truck traffic, but only a portion of the marine traffic. This report estimated that 2.2 million tons could be captured for annual revenue of $201 million. The capture ratio was reduced in the integrated traffic forecast to produce a more conservative peak figure of 1.6 million ton and $116 million annually, after a start up period.

The traffic is not particularly sensitive to the route of the railway, because the travel distances are roughly the same over all routes.

Read the Reports

Summary Report (Work Package A1d)

QGI Consulting: Logistics Evaluation for Regional Resupply
(40 page report)

QGI Consulting: Logistics Evaluation for Regional Resupply, Appendix C
(11 spreadsheets)

Data Development Reports (Work Package A1a)

QGI Consulting: Traffic Data Development for Regional Resupply (Alaska)
(16 page report)

QGI Consulting: Traffic Data Development for Regional Resupply, Supplement
(7 spreadsheets)

Vector Research: Summary Report (Canada)
(9 page report)

Vector Research: Community Inbound Synopsis
(1 spreadsheet)

Vector Research: Haines Highway Freight Flows(1)
(8 page report)

Vector Research: Haines Highway Freight Flows(2)
(3 spreadsheets)

Vector Research: LTL Rate Sheets
(3 pages)

Read the Reports (continued)

Vector Research: Net Alaska Highway Freight Flows
(13 spreadsheets)

Vector Research: Northern BC Community Resupply
(2 spreadsheets)

Vector Research: South Klondike Highway Freight Flows
(6 spreadsheets)

Vector Research: Yukon Highway Traffic Summary
(1 spreadsheet)

Vector Research: Yukon Freight Flows
(4 pages - maps)

Vector Research: Yukon Freight Rates
(1 spreadsheet)

Vector Research: Yukon Liquor Haul Excerpt
(2 pages)

Resource Project Supply

This work package developed forecasts of traffic flow and revenue streams for incoming supplies to the resource industry. It looked at prospective mineral and oil and gas developments, and what these developments would require in the way of incoming freight for construction and operations. Only the one working route scenario was used in this work, based on work that had already been done on projecting the mineral export traffic.

This work involved, first of all, determining what mines would be developed and when. This work on projecting mining activity is reported in the next section on Outbound Traffic. In that section, there are several different projections for mineral traffic. For the present logistics report, QGI used the mineral traffic projections that were contained in the integrated traffic forecast.

The consultant was unable to identify any oil and gas development that would benefit from the railway.

The final projection for a 30 year life cycle was a total of 39 million tons and $425 million in revenue. In peak years, the annual traffic would be 1.8 million tons and $21 million in revenue.

Read the Reports

Summary Report (Work Package A1e)

QGI Consulting: Logistics Evaluation Resource Projects
(17 page report)

QGI Consulting: Logistics Evaluation Resource Projects, Appendix A
(3 spreadsheets)

Data Development Reports (Work Package A1b)

QGI Consulting: Traffic Data Development for Resource Projects
(20 page report)

QGI Consulting: Traffic Data Development for Resource Projects, Appendix A
(7 spreadsheets)

Pipeline Construction

This work package developed forecasts of traffic flow and revenue streams for incoming material to two pipeline construction projects. The two projects are the Alaska Highway gas pipeline and the Mackenzie Valley gas pipeline. It looked at what these developments would require in the way of incoming pipe, fuel and equipment for construction, as well as demobilization after construction. Two route scenarios were used in this work, the one described earlier in this report that is expected to maximize total rail revenue, and another that maximizes revenue from pipeline traffic.

With a good understanding of pipeline construction logistics, this work was fairly straightforward, but limited by current knowledge about when these projects might occur, and when that would be in relation to a rail project.

The final pipeline rail traffic projection over a 3 year period was:

	Inbound and Outbound Revenue $USD		
Route scenario	Alaska Pipeline	Mackenzie Pipeline	Total
For the route scenario that produces the most overall revenue for the rail	40,750,230	8,951,862	49,702,092
For the route scenario that produces the most pipeline traffic revenue	75,496,210	6,172,849	81,669,059

The above figures include revenue from outbound demobilization activity.

Read the Reports

Summary Report (Work Package A1f)

Landspoint Consulting: Traffic Data Development and Evaluation for Pipeline Construction
(48 page report, commissioned by UAF)

Data Development Reports (Work Package A1c)

Landspoint Consulting: Pipeline Granular Memo
(2 page memo)

Landspoint Consulting: Mackenzie Gap Project Overview
(6 page report)

Landspoint Consulting: AHP Freight Volumes
(3 spreadsheets)

Landspoint Consulting: AHP Freight Volumes Summary
(1 spreadsheet)

Landspoint Consulting: AHP Freight Volumes – Short Tons
(3 spreadsheets)

Outbound Traffic Forecast

In this part of the project, rail traffic and revenue forecasts were to be developed for three categories of traffic originating in the Alaska, Yukon, and Northern B. C. region. The work included determining rail rates required for competitive cost positioning.

The work was divided into three work packages so that consultants with appropriate knowledge and skills could be assigned to the research:

- Mineral Resources: examined prospective mine sites, recoverable reserve bases, and corresponding outbound traffic volumes and market destinations for potential exports of base metal concentrates, iron ore, and coal.
- Forestry Resources: examined prospective production areas, traffic volumes and market destinations for forest products in the region.
- Farm/Fishery Resources: considered whether there was any potential for export traffic in farm and fishery production.

Work on the farm/fishery resource was deferred because it was judged that this area would not have a significant impact on the results of the feasibility study at this time.

Mineral Resources Overview

The purpose of this work was to develop volume and revenue projections for mineral resource traffic originating within the study region that may be shipped by rail.

Work on the mineral resource traffic was originally planned to be done in two parts:

- Gartner Lee was engaged to do a detailed analysis of prospective mineral properties in the region and project economic levels of shipments for the rail link, and
- QGI Consulting was engaged to do a logistics analysis on the mineral traffic and determine what revenue might accrue to the rail link.

This work involved projecting traffic that does not presently exist. Very little of this traffic would currently be viable without improved transportation infrastructure. Furthermore, viability of individual projects and the revenue that would accrue to a railway would be very dependent on future market conditions for the various minerals.

In the course of the project, several methodologies on how to make these projections were developed and reported. Consequently, there are several different projections for mineral traffic. A choice from among these was made by the financial and economic consultants that did the integration work later in the project.

Most of the research was based on the original data that Gartner Lee collected, but different consultants used different methods for determining the market viability of the mineral deposits. Some of the work went beyond Gartner Lee's inventory and looked at more extensive inventories of mineral deposits.

The mineral projections ultimately can be put into four groups:

- Group I: Mineral deposits in Gartner Lee's inventory that are likely to be developed within 20 years whether or not a rail link is constructed (base metals and coal).
- Group II: Mineral volumes from deposits in Gartner Lee's inventory that are likely to be shipped by rail within 20-30 years in the presence of a railway (base metals and coal). This projection includes the Group I deposits.
- Group III: Mineral volumes from deposits in Gartner Lee's inventory that are likely to become viable in a longer term scenario (coal and iron ore). These shipments are not includes in any other group.
- Group IV: Mineral volumes that might be shipped in a 50 year scenario, based on a probabilistic assessment of a more extensive inventory of mineral deposits and other factors (base metals). These shipments are not included in any other group.

There are multiple projections within each of these groups because different researchers used different assumptions about how the market will unfold to make deposits viable, when each deposit would be developed, and how long it would be shipping. The University of Alaska produced an additional probabilistic projection that encompasses the base metal shipments in all the above definitions.

Representative figures from these projections are expressed in this table in thousands of short tons annually, in a representative year:

	Base Metals	**Coal**	**Iron Ore**	**Annual Total**
Group I without rail	1,300	1,400		2,700
Group II first 20-30 yr	1,800	11,800		13,600
Group III/IV After 20-30 yr	2,500		23,000	25,500

There is a high level of interest in this work because of the importance of this traffic to a potential railway, because of the Asian concern for supply in mineral commodities, and because of the impacts that mineral development could have on the overall economy of the region. There will be ongoing research and analysis to fix the potential for mineral exports for rail traffic. To facilitate this on-going research, a computer data base with all of the analysis to date has been transferred to Yukon Economic Development so that they can modify the projections and re-run some of the integrated analysis based on evolving projections.

Mineral Resources – Gartner Lee Research

Gartner Lee did the original inventory and assessment of mineral deposits in the region. The initial inventory included only known, quantifiable deposits that were likely to ship by rail as bulk commodities. The initial inventory was then further screened to determine which deposits may become viable within a 30 year scenario. The key screening criteria was based on net ore value exceeding twice the mine's operating cost, based on pessimistic, conservative and optimistic commodity price projections.

Gartner Lee's list of 27 known mineral deposits that passed their initial screening for economic viability in the optimistic scenario includes:

	Number of Deposits	Shippable Tons*
Alaska	4	5
BC	9	111
Yukon	13	66
Subtotal	26	183
Crest Iron Ore	1	1,344
Total	27	1,527

*millions of shippable tons over the life of the mine

At this stage, six different rail routes were analyzed to determine which would produce the most traffic.

A most important conclusion from this analysis is that the route scenario described in the introduction to this report would be the most favourable for maximizing mineral revenue.

Read the Report

Data Development Reports (Work package A2a)

Gartner Lee: Traffic Data Development for Mineral Resources
(171 page report)

Mineral Resources – QGI Logistics Analysis

The second evaluation of mineral traffic started with Gartner Lee's short list of 27 mineral deposits. The challenge at this stage was to determine what revenue the railway might be able to collect from mineral traffic. Among other things, this work required making assumptions about which port the traffic would be carried to.

The list was screened down further to 10 deposits most likely to be viable under the consultant's transportation costing scenario. Peak annual traffic of 3.5 million tons with $62 million of revenue was forecast and it was assumed that the port of Skagway would handle most of the traffic.

While carrying this traffic appears to do little to support the construction of the entire link from Delta Junction to Hazelton, it does contribute traffic to support several of the main route segments.

In the integrated traffic analysis that was described earlier, a more refined screening method was used, and a list of 21 mineral deposits was used as the basis for the mineral component of that traffic projection. In that projection, annual traffic peaks at 5.1 million tons and $106 million of revenue. (The newer screening was based on an assessment of net concentrate value instead of net ore value).

One of the known deposits that was screened out of this work, the Crest iron ore deposit, has the potential to ship at least 17 million tons of ore per year for a long period of time. This one potential development far outweighs everything else included in the present stage one forecasts, so it was generally treated as a distinct scenario in the subsequent integration work.

Read the Report

Summary Report (Work Package A2d)

QGI Consulting: Logistics Evaluation for Mineral Resources
(55 page report)

Mineral Resources – Additional Research (Alaksa)

The University of Alaska at Fairbanks undertook some additional research on mineral deposits and the resource industry.

Read the Reports

Dr. Paul Metz: Energy, Minerals, and Infrastructure in Support of a Petrochemical Industry in Interior Alaska
(14 powerpoint slides UAF)

Dr. Paul Metz: Mineral Occurrences and Potential Sources of Freight for the Alaska Railroad Extensions – Fairbanks to the Canadian Border
(18 powerpoint slides UAF)

Dr. Paul Metz: Alaska, Yukon, and British Columbia Non-ferrous Metal and Petrochemical Freight Forecasts for the Alaska Canada Rail Link (Executive Summary)
(2 page report)

Appendix A Gross Metal Value of Identified Major Mineral Occurrences in ARR Extension Corridor (Alaska)
(Spreadsheet)

Appendix A Gross Metal Value of Identified Major Mineral Occurrences in ARR Extension Corridor (Yukon)
(Spreadsheet)

Read the Resorts, Continued

Appendix A Gross Metal Value of Identified Major Mineral Occurrences in ARR Extension Corridor (BC)
(Spreadsheet)

Lockheed Martin: Analysis of Rail Link Impact on North Slope Development, Current Transportation Risks, and Shared Corridor Synergies
(96 page report, commissioned by UAF)

Mineral Resources – Additional Research (Canada)

The early research on minerals highlighted the difficulty of predicting all of the factors that might affect traffic volumes and rail revenue over a 30 to 50 year horizon. Furthermore, the research highlighted substantial differences of opinion on methodology and on the future of the minerals markets. In light of this, several Yukon Government departments collaborated amongst themselves and with other consultants on a review of the early projections. The resulting report reassessed Gartner Lee's inventory with different criteria to produce some new projections.

This work documented how different methodologies could be used to produce different results, and to compare the results of different methodologies side by side.

Yukon Government commissioned an additional report from Raw Materials Group in Sweden to discuss long term factors in the markets for iron ore, coal, and base metals.

Work by Hatch looks at the prospects for a specific iron ore deposit in Yukon and calculates how much might be available for transportation costs in a plausible market and development scenario.

Read the Reports

Yukon Economic Development: Projected Yukon and British Columbia Mining Sector Activity Arising from the Development of the Alaska-Canada Rail Link
(23 page report)

Accompanying Spreadsheets
(15 spreadsheets)

Accompanying Clarification
(1 page note)

Raw Materials Group: Long Term Metal Prices and Factors Affecting Them
(28 page report)

Forestry Resources

The purpose of this work package was to identify reasonable volume and revenue projections for rail traffic related to the forest industries in the study region.

The analysis suggests that there is very limited opportunity for the railway to handle forest products in the region. The forest industry in Alaska and Yukon is at a competitive cost disadvantage compared to regions to the south, so there is no likelihood of exports from the region. In B. C. it is unlikely that any substantial volumes will be harvested in the north western area for the next 20 years.

Read the Reports

Summary Report (Work Package A2e)

QGI Consulting: Logistics Evaluation for Forestry Resources
(23 page report)

Data Development Reports (Work Package A2b)

Vector Research: Outbound Traffic Data Development – Forestry Resources
(6 page report)

Vector Research: Fort Nelson Overview
(72 slides)

Vector Research: Cassiar TSA Summary
(3 spreadsheets)

Vector Research: Northern BC Forestry Resources
(3 spreadsheets)

Price Waterhouse Coopers: Economic Assessment of Forest Industry in SE Yukon
(31 page report – commissioned by others prior to rail study)

Vector Research: Yukon Forest Resources Summary
(2 spreadsheets)

Parsons & Associates, Inc.: Tanana State Forestry Lands
(20 page report, commissioned by UAF)

Farm and Fishery Resources

These work packages were deferred because it was believed that traffic opportunities in this area would not substantially affect the stage two analysis at this time.

There are no consultant's reports for work packages A2c and A2f.

Strategic Traffic Opportunities

In the initial planning for the feasibility study, three types of strategic opportunities were identified. These were seen as long term opportunities for additional traffic development beyond the obvious areas of inbound resupply and resource export.

The three areas were:

- *International land bridge* was to look at opportunities to bridge container traffic between Alaskan ports and the North American market.
- *Processing and distribution* was to look at value added processing of northern resources that might become feasible with the presence of a railway.
- *Tourism and passenger* was to look at opportunities to develop tourist traffic around a railway.

International Land Bridge

These reports examine the possibility of a new port gateway in the Cook Inlet area near Anchorage that would be connected to inland North American destinations by way of a railway. The idea would be to attract container traffic travelling from Asia to US destinations.

The reports that follow provide an analysis of west cost North American ports and Asian-originating container traffic.

The trade-off in attracting traffic to Alaska instead of other west coast ports is reduced sea distance and increased land distance. Since land transportation is more expensive, this means a higher cost to shippers. One of the Boston Consulting Group's reports points out that "in the realities of competition there are scenarios where high cost capacity is viable". Factors such as reduced sea time, high reliability, or free capacity could have value to shippers.

Boston Consulting Group's "Summary of Operating Characteristics of West Coast Ports" provides a short graphical overview of the present situation and prospects for the future. The remaining reports provide more in-depth analysis and commentary.

Read the Reports

Boston Consulting Group: Summary of Operational Differences Between West Coast Ports
(5 page graphical summary)

GHK International (Canada): Pacific Rim Trade Corridor Study
(132 page report)

GHK Norbridge: Annex 1: Shipping Cost Analysis
(32 page report)

Read the Reports, Continued

Boston Consulting Group: Assessing Demand for Expanding Port in Anchorage
(16 page report)

Boston Consulting Group: Comments on Review of GHK Report
(2 page memo)

Processing and Distribution

No reports wee done specifically on this topic. Some of the work done by University of Alaska on the mineral traffic and by GHK International on the land bridge touches peripherally on this topic.

Tourism and Passenger

This work package evaluated the potential for passenger revenue on the rail link.

The opportunity for train travel is characterized as a tourist market for luxury travel over long distances through rugged regions of Canada and Alaska. The report includes an analysis of rail travel markets around the world to show that a market does exist for this type of travel.

Using the assumptions described in the report, projected passenger revenues, after a start up period, range from $28 million to $38 million per year.

Read the Reports

Summary Report (Work Package A3f)

Klugherz & Associates: Traffic Data Development for Tourism/Passenger Travel – Passenger Revenue Potential
(26 page report, commissioned by UAF)

Klugherz & Associates: Passenger Revenue Model 1
(11 spreadsheets)

Klugherz & Associates: Passenger Revenue Model 2
(11 spreadsheets)

Klugherz & Associates: Passenger Revenue Model 3
(11 spreadsheets)

Data Development Report (Work Package A3c)

Klugherz & Associates: Traffic Data Development for Tourism/Passenger Travel
(25 page report, commissioned by UAF)

Klugherz & Associates: Tourism/Passenger Travel – Draft Results
(57 Powerpoint slides)

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Macleod Institute: Decision Support Document *41*

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Socio-Cultural Impact Assessment **43**
Information Insights, Inc., Dr. Karim-Aly Kassam, Macleod Institute: Strategic Environmental Assessment: Integrated Socio-cultural Assessment *43*
Information Insights, Inc.: Strategic Environmental Assessment: Socio-economic Impact Assessment - Alaska *43*
Dr. Karim-Aly Kassam et al: Strategic level Social Impact Assessment of ACRL *43*

Economic Impact Assessment **44**
Informetrica Limited & Information Insights Inc.: Strategic Environmental Assessment: Overview of Economic Impacts *44*
Informetrica Limited: Strategic Environmental Assessment: Canadian Economic Impacts *44*
Information Insights, Inc.: Strategic Environmental Assessment: Socio-economic Impact Assessment – Alaska (this report is also listed in previous category) *44*
Don Brownie: Alaska Canada Rail Link – World Commodity Markets *44*

Introduction

The purpose of the strategic environmental assessment is to assist public sector decision makers to assess the merits, risks, and impacts associated with public sector support of a rail link project.

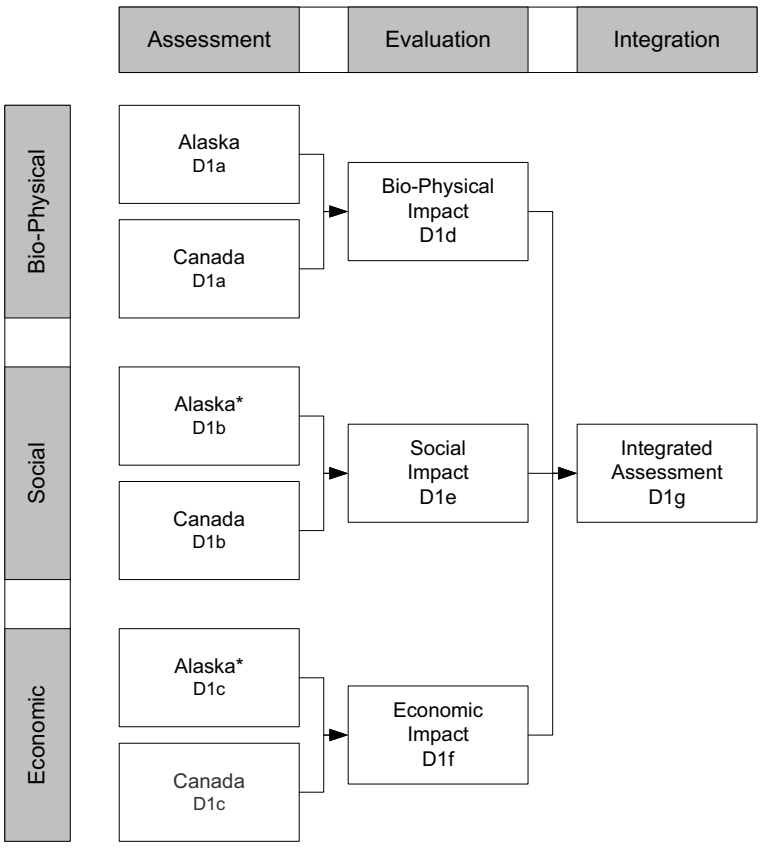
The strategic environmental assessment carried out research to scope out the impacts that rail construction and operation could have on the natural and human environments in the proposed development regions. The assessment was conducted in three topic areas:

- bio-physical impacts,
- socio-cultural impacts, and
- economic impacts.

Reports were delivered by expert consultants in each of these areas, and they are included in the sections that follow.

The Macleod Institute was engaged to lead the assessment, and they completed an integrated overview of the work, referred to in the next section as the decision support document.

The diagram illustrates how the work was broken down for the purpose of assigning work packages to expert consultants.



* The Alaska social and economic reports were combined into one.

The Integrated Assessment

The strategic environmental assessment was designed to assist public sector decision makers to assess the merits, risks, and impacts associated with public sector support of a rail link project. The assessment was done at a high level that will help in planning future environmental assessment work, including the public consultation that will be legally and politically necessary to complete a full feasibility study. It does not contain enough detail to differentiate between the different route options by any quantitative measures.

The proposed rail corridors are almost entirely within wilderness areas that have seen little development. In terms of environmental protection, there are issues with wildlife, endangered species, and extensive bodies of water throughout the region. Extensive curves and grades will increase the risk of accidents and spills. All route segments face seismic and permafrost issues, as well as a substantial number of river crossings. The only substantial differentiating issue identified at this point is that one of the route segments passes along side of Kluane National Park.

There is a significant First Nations presence in the entire rail corridor, with up to 30 First Nations groups affected. The status of land claims negotiations runs from "completed" in the northern parts of the corridor to "just beginning" in the southern parts. The First Nations have rights protected in legislation regardless of the status of land claims negotiations. Furthermore, the various First Nations differ considerably in their organizational capacity to conduct consultations and negotiations. Consultations and right of way negotiations will be a very complex affair.

A rail development project has characteristics that could be attractive to First Nations and other communities in the region. Among them are the prospects of employment and economic development brought about by lower transportation costs. Rail is an attractive transportation option to the extent that it can displace existing or future highway transportation in terms of environmental impact, protection of cultural and wilderness values, and road safety. Whatever the economic attractiveness of rail, environmental protection and protection of cultural traditions will be critical issues in the conduct of a project.

Read the Report

Macleod Institute: Decision Support Document
(32 page report)

Bio-Physical Impact Assessment

The proposed rail corridors are almost entirely within wilderness areas that have seen little development. A major constraint on the study at this stage is a lack of detailed data on these areas. More work needs to be done before there will be sufficient data to differentiate quantitatively between routes in terms of management and mitigation of the bio-physical impacts. The only substantial differentiating issue identified at this point is that one of the route segments passes along side of Kluane National Park.

In terms of construction, all route segments face seismic and permafrost issues, as well as a substantial number of river crossings.

In terms of environmental protection, there are issues with wildlife, endangered species, and extensive bodies of water throughout the region. Extensive curves and grades can increase the risk of accidents and spills.

A positive aspect of rail development is that it is more environmentally favorable that road development, and so is beneficial to the extent that it can displace existing or future road development and highway transportation.

Read the Reports

Integrated Summary

HDR Engineering and IRIS Environmental Systems: Strategic Environmental Assessment: Biophysical Assessment Component
(32 page report commissioned by Macleod Institute)

Assessment Reports

HDR Engineering: Alaskan Bio-Physical Assessment Report: Delta Junction to the International Border
(74 page report commissioned by Macleod Institute)

Accompanying Maps
(35 maps)

HDR Engineering: Overview of Employment Opportunities
(5 page report)

HDR Engineering: Employment Opportunities Matrix
(spreadsheet)

IRIS Environmental Systems: Strategic Environmental Assessment: Biophysical Assessment - Canada
(82 page report commissioned by Macleod Institute)

Socio-Cultural Impact Assessment

The information collected at this stage of the project will help future planners understand the scope of the public consultation that will be necessary to complete a full socio-cultural assessment in the context of a full feasibility study.

There is a significant First Nations presence in the entire rail corridor. The status of land claims negotiations runs from "completed" in the northern parts of the corridor to "just beginning" in the southern parts. The First Nations have rights protected in legislation whether or not land claims negotiations are completed. Furthermore, the various First Nations differ considerable in their organizational capacity to conduct consultations and negotiations. Consultations and right of way negotiations will be a complex affair.

A rail development project has characteristics that could be attractive to First Nations and other communities in the region. Among them are the prospects of employment and economic development brought about by lower transportation costs. Rail is a more attractive development option than roads in terms of environmental impact, protection of cultural and wilderness values, and road safety.

Whatever the economic attractiveness of rail, environmental protection and protection of cultural traditions will be critical issues in the conduct of a project.

At this stage there is very little to differentiate between potential rail routes; all routes face similar issues.

Read the Reports

Integrated Summary

Information Insights, Inc., Dr. Karim-Aly Kassam, Macleod Institute: Strategic Environmental Assessment: Integrated Socio-cultural Assessment
(18 page report)

Assessment Reports

Information Insights, Inc.: Strategic Environmental Assessment: Socio-economic Impact Assessment - Alaska
(114 page report, commissioned by Macleod Institute)

Accompanying Map
(1 map)

Dr. Karim-Aly Kassam et al: Strategic level Social Impact Assessment of ACRL
(172 page report commissioned by Macleod Institute)

Economic Impact Assessment

The economic impacts of a rail link would begin with *direct* employment from rail construction and operations and then ripple through the economy first with *indirect* impacts from the spending on rail construction and operations and then to *induced* impacts arising from having another transportation option in the region.

It is estimated that rail construction will create around 69,000 person-years of direct employment. Indirect and induced employment will bring the total to 209,000 person-years. This is substantially in excess of resources currently available in western Canada, so careful planning will be required to mitigate the influx of temporary workers and of a sharp boom-bust cycle. Rail operations will directly employ around 500 people.

The considerable differences between the economies of Canada and USA made it difficult to assemble a consistently integrated picture of the induced impacts, so there is a lot of detail in each of the regional reports that does not necessarily appear in the integrated report.

Most of the induced impacts will come from the change in transportation economics for the region. Lower freight rates for incoming traffic will lower the cost of living and will lower the cost of operations for resource projects and other economic activity. The availability of rail transportation is expected to make it economically viable to exploit many of the mineral deposits in the region, so much of the induced impact comes from the mining sector.

These economic reports focused mainly on the economic activity arising from investment and employment in the region. A separate report included in the *Business Case Assessment* section examined broader public costs and benefits.

Read the Reports

Integrated Summary

Informetrica Limited & Information Insights Inc.: Strategic Environmental Assessment: Overview of Economic Impacts
(93 page report, commissioned by Macleod Institute)

Assessment Reports

Informetrica Limited: Strategic Environmental Assessment: Canadian Economic Impacts
(page report, commissioned by Macleod Institute)

Information Insights, Inc.: Strategic Environmental Assessment: Socio-economic Impact Assessment – Alaska (this report is also listed in previous category)
(114 page report, commissioned by Macleod Institute)

Accompanying Map
(1 map)

Don Brownie: Alaska Canada Rail Link – World Commodity Markets
(6 page memo, commissioned by Macleod Institute)

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Introduction

The purpose of the technical research was to evaluate several possible rail routes in terms of construction, maintenance and operating costs.

This research was designed to generate data for several alternative routes divided into route segments, so that others could assess the overall feasibility of building a railroad on selected routes either all at once, or in stages over a period of time. Within each of the geographic areas of Alaska, Yukon, and B.C., up to four route segments were examined.

While this research ranks the various route segments on various technical criteria, it does not recommend one route over another. This question is left to other parts of the feasibility study where data from various parts of the study are integrated.

In addition to the land routes, several nearby ports were assessed, on the expectation that much of the originating and terminating traffic would be generated by imports and exports, and possibly by multimodal traffic passing through the region. This work was limited to an assessment of existing capacity, potential for expansion, and order of magnitude costs for expansion. It did not fully assess the feasibility of port upgrades.

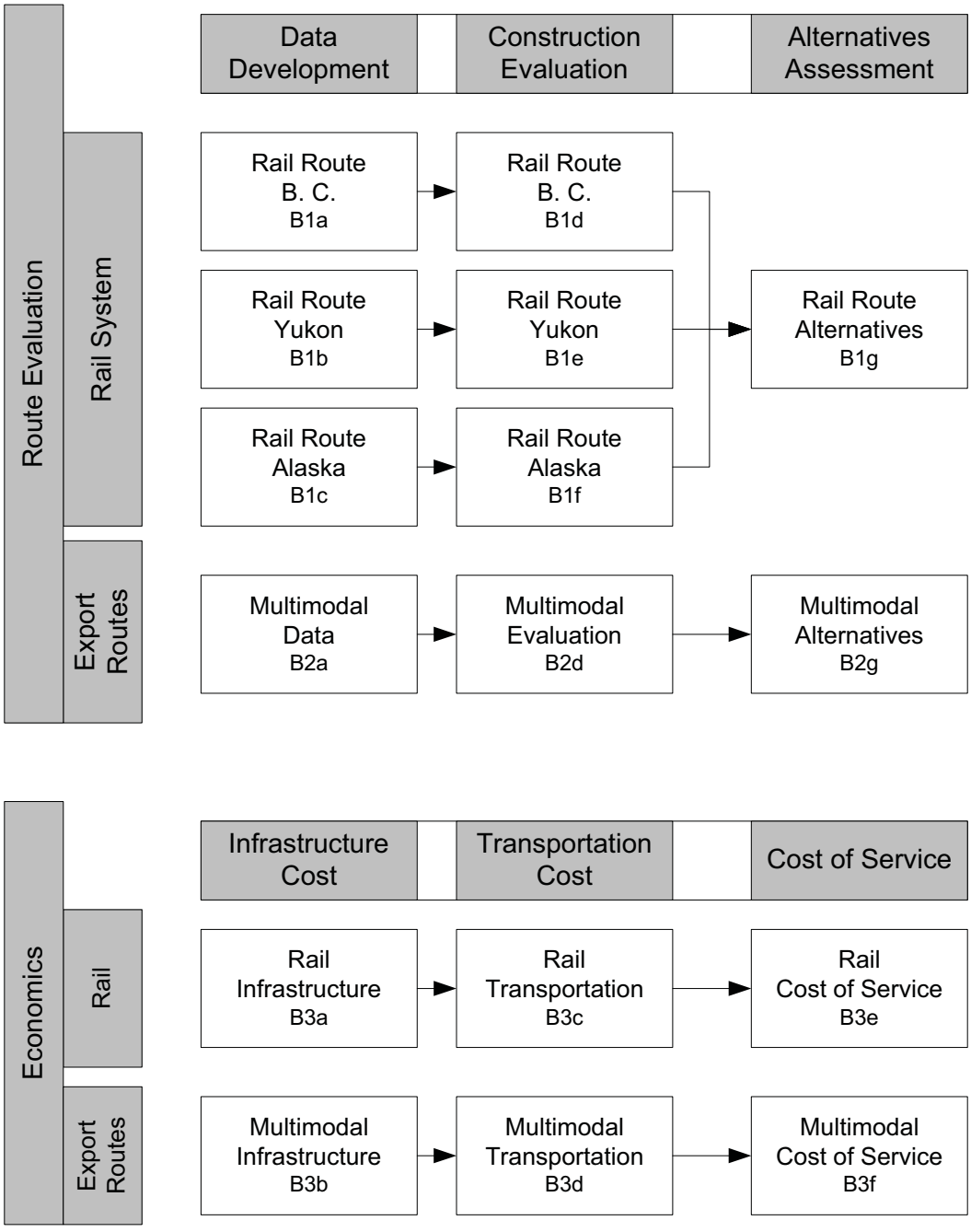
For the purpose of obtaining consulting expertise the work was divided into four major steps:

- *Rail System Evaluation* developed engineering data for a variety of possible routes
- *Export Route Evaluation* developed basic information on nearby ports
- *Rail System Economics* assembled construction, start-up, maintenance, and operating cost information on several rail system scenarios
- *Exports Routes Economics* assembled the corresponding cost information on several rail and port system scenarios

The evaluation work was carried out in parallel with the market analysis. Most of the economics work was carried out after some of the marketing work had been completed and so took advantage of that information.

The products of this work are presented in the four report sections following, corresponding to the four categories above.

Technical Research Work Breakdown



The codes shown on the chart are used in the consultants' reports to refer to the work modules.

Rail System Evaluation

Introduction

In this part of the project, a number of potential rail routes were evaluated from an engineering constructability perspective.

The routes for study were selected on the basis of contemporary knowledge of the region, and the following considerations:

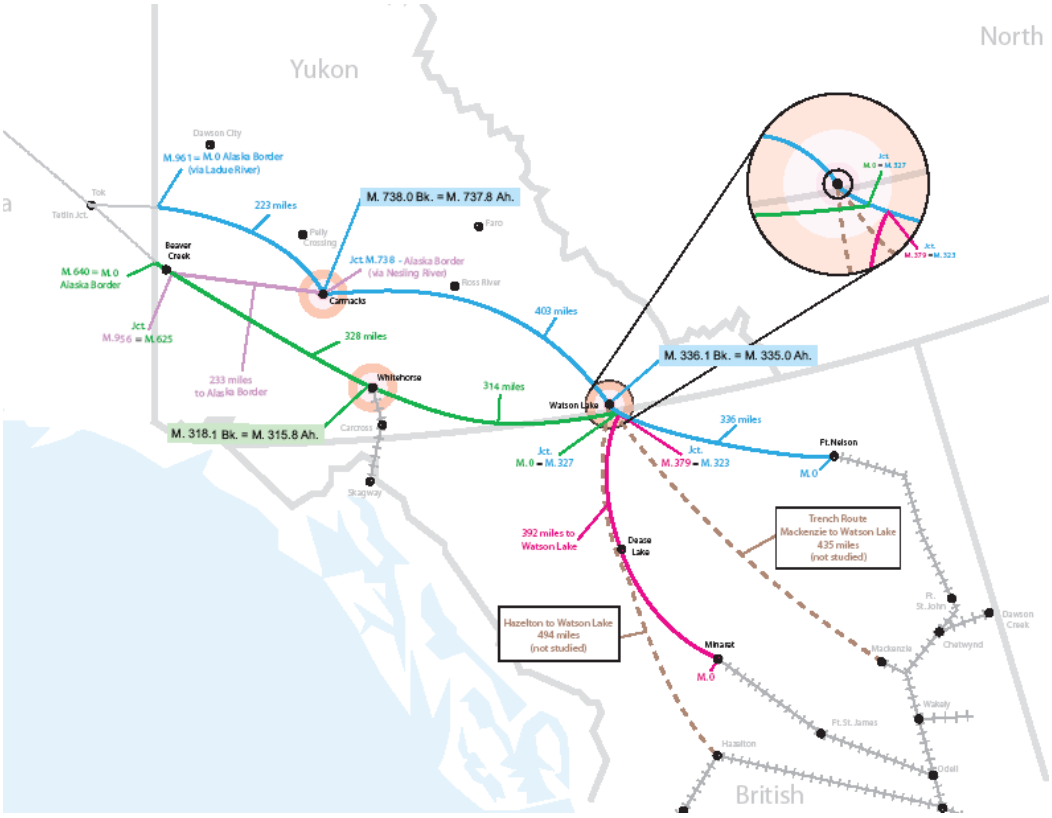
- Firstly, it is necessary to connect the Alaska Railroad at Delta Junction, Alaska to an existing railway in British Columbia.
- Secondly, it is necessary to look at transportation links to ports on the expectation that significant proportion of potential traffic for a railway in this region would originate or terminate at a port.
- Thirdly, it is necessary to consider the possibility of building the rail link in stages with links to selected ports being built as they become viable.

With these considerations in mind, nine route segments were examined:

- In British Columbia, there were four possible routes. All brought the rail to Watson Lake, Yukon at the north end, and all joined CN Rail at some point in the south. The southern terminating points for the four routes considered were Hazelton, Minaret, Mackenzie, and Fort Nelson.
- In Yukon, three principal routes were considered to take the rail westward from Watson Lake. One follows the Alaska Highway to the Alaska border near Beaver Creek, and the other two follow the Tintina Trench to Carmacks. Eastward from Carmacks, two possible routes were considered: one continuing eastward to the Alaska Border near Beaver Creek, and the other entering Alaska further north and following the Ladue River valley to join the Alaska Highway near Tok, Alaska.
- Also in Yukon, an additional segment was considered to join Carmacks or Whitehorse to an inside passage port at Skagway or Haines.
- In Alaska, the route would follow the Alaska Highway from either Tok or Beaver Creek, and continue eastward to Delta Junction where it would join the Alaska Railroad.

These routes are shown in the map on the next page.

The engineering evaluation and construction cost estimate was done as a “desk-top” analysis, using information that was generally available. No field work was done specifically for this study. This information, combined with other analyses of markets and public interests will support future decision making and possibly drive a more detailed technical analysis of the most promising route segments



Route Evaluation Map (From a map by UMA Engineering)

Rail Route Alternatives Assessment

In this report, the construction evaluations from the Yukon and BC regions are brought together and presented in summary form. The summary includes ratings on eight physical criteria of nine route segments. This summary does not include cost information, as that was dealt with in the later rail economics evaluation.

This summary includes two BC route segments from UMA's BC construction evaluation below and five Yukon route segments from UMA's Yukon construction evaluation below. The data on two additional routes in BC was taken from a 1969 study on those routes.

The routes were subjectively ranked for constructability based on mileage, curvature, grade, transit time, track/train dynamics, and seismic risk on nine route segments.

Based on these criteria, the rankings were (1 is best, 5 is worst):

Segment	Miles	Ranking
Fort Nelson to Watson Lake	336	3
Minaret to Watson Lake	392	5
Mackenzie to Watson Lake	435	1
Hazelton to Watson Lake	497	2
Watson Lake to Carmacks	403	1
Carmacks to Ladue Border	223	1
Carmacks to Beaver Creek Border	233	3
Watson Lake to Whitehorse	314	2
Whitehorse to Beaver Creek Border	328	3

This analysis only considered the Canadian route segments. Information on the US route segments is included elsewhere:

- Information on the routes from the Alaska border to Delta Junction can be found in the section Construction Evaluation – Alaska (page 52), below.
- Information on the link from Carmacks to Skagway was developed at other points in the project, and it can be found in two places: in the Operational Evaluation part of the Export Routes Evaluation (page 55), and in the Rail System Economics (page 56) section.

Read the Report

Work Package B1g

UMA Engineering: Alternate Route Segment Assessment (Canada)
(16 page report)

Construction Evaluation – BC

In this part of the project, two rail routes in BC were analyzed using available geologic mapping information to evaluate the difficulty in constructing a rail line along the route.

UMA engineering developed a system to classify the terrain, construction difficulty, and to locate civil structures required to reasonably construct a rail line. The methodology is described in detail in the UMA report.

The information from this work was used to support the alternatives analysis and the preparation of cost estimates for railway construction that are presented in the Rail Economics section of this report.

Read the Reports

Evaluation Reports (Work Package B1d)

UMA Engineering: Rail Route Evaluation Eastern and Western BC
(72 page report)

Data Development Reports (Work Package B1a)

Yukon Engineering Services: BC Bibliography
(spreadsheet)

Yukon Engineering Services: Summary of Data Gaps (BC)
(4 page report)

Construction Evaluation – Yukon

In this part of the project, five rail routes in Yukon were analyzed using available geologic mapping information to evaluate the difficulty in constructing a rail line along the route.

UMA engineering used the same methodology that was used in the BC report, above.

The information in this work was used to support the preparation of cost estimates for railway construction that are presented in the Rail Economics section of this report.

Read the Reports

Evaluation Reports (Work Package B1e)

UMA Engineering: Rail Route Evaluation Northern and Southern Yukon Routes
(109 page report)

Data Development Reports (Work Package B1b)

Yukon Engineering Services: Yukon Bibliography
(spreadsheet)

Yukon Engineering Services: Summary of Data Gaps (Yukon)
(4 page report)

Construction Evaluation – Alaska

The construction evaluation for the Alaska portion of the route was done by the University of Alaska at Fairbanks. This information was integrated with UMA's work in the economics analysis that follows.

Read the Reports

Evaluation Reports (Work Package B1f)

UAF: Risk Opportunity Assessment Sheet
(2 spreadsheets)

Data Development Reports (Work Package B1c)

UAF: Railroad Routes from Delta Junction to Canadian Border
(map A0 1200dpi)

Dr. Scott Huang et al, UAF: Geophysical Exploration
(22 page report)

Bob Thomas, UAF: Ladue Route Spreadsheet
(1 spreadsheet)

Janak Dhungana et al, UAF: Development of GIS Data Base and Analysis of the Alaska Canada Rail Link (Alaska Segment)
(16 page report)

Janak Dhungana et al, UAF: Hydrologic and Hydraulic Features of the Alaska/Canada Railroad Link (Alaska Segment)
(8 page report)

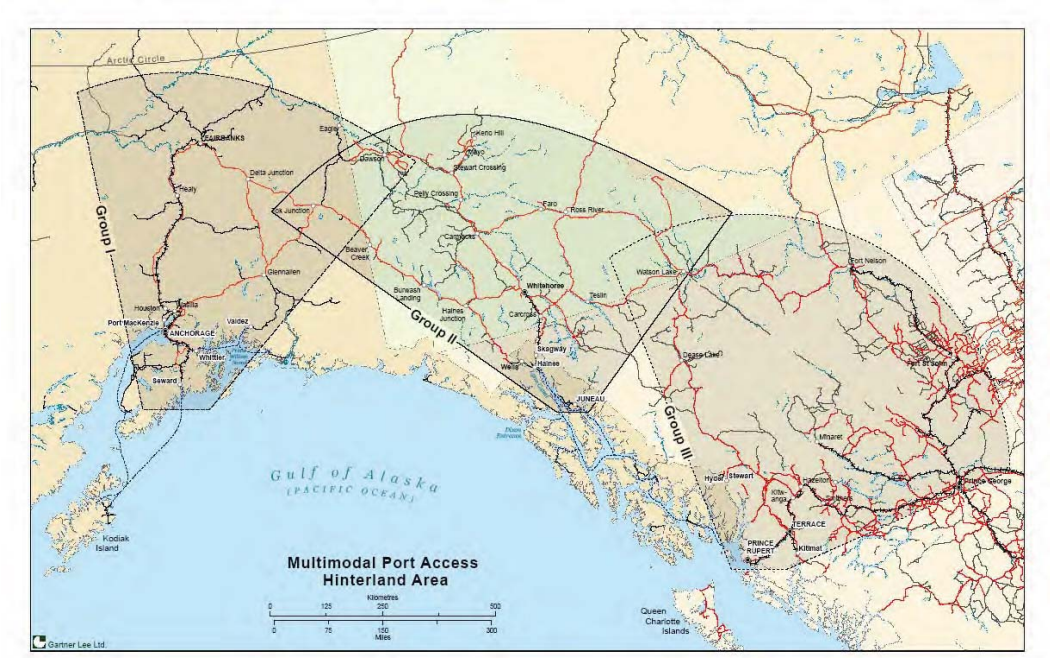
UAF: Technical Report
(20 page report)

Export Routes Evaluation

In this part of the project, a number of ports in the region were evaluated to determine what capability they have, and might be developed to have, to handle traffic that might be generated by a rail system.

This technical work was carried out in anticipation of what the market research would find. In particular, it is expected that a rail system will attract mineral export traffic from the interior regions if that traffic can be carried economically to an export port. Furthermore, the possibility of multimodal bridge traffic from Anchorage to the central US was anticipated.

Ports were selected and grouped according to the regions they might most effectively serve:



Export Routes Hinterland Area Map

Ports in Group I (Alaska) include: Anchorage, Port Mackenzie, Whittier, Seward, and Valdez.

Ports in Group II (SE Alaska) include: Skagway and Haines.

Ports in Group III (SE Alaska and BC) include: Hyder, Stewart, Kitimat, and Prince Rupert.

Alternatives Assessment

This report presents a summary level survey of all of the ports in the region. The information includes a description of the existing capacity, and the prospects for further development.

The summary concludes that Port Mackenzie, Skagway, Haines, Hyder, and Prince Rupert have the most potential to handle bulk resource shipments. There is

potential for increasing multimodal capacity at Anchorage, Hyder, and Prince Rupert. It is noted that Haines, Skagway, and Hyder would require substantial investment in land transportation infrastructure, while the others have existing infrastructure.

Read the Reports

Work Package B2g

Banjar Management & DKA Marketing: Multimodal Port Access – Alternatives Assessment
(25 page report, commissioned by Yukon Engineering Services)

Banjar Management & DKA Marketing: Multimodal Port Access Study
(26 powerpoint slides)

Operational Evaluation

In this part of the project, detailed data on the ports was collected to support the above alternatives summary.

The main reports cover all of the ports identified in the study regions. The Pacific Contracting report covers Skagway specifically, as well as the rail route that would provide access Skagway by way of a branch off the main rail link. Further work on the Skagway rail link is reported in the *Rail Economics* section, following.

Read the Reports

Summary Reports (Work Package B2d)

Banjar Management & DKA Marketing: Multimodal Port Access – Operations Evaluation
(32 page report, commissioned by Yukon Engineering Services)

Pacific Contract Company & HDR Engineering: Southern Yukon and Port of Skagway Analysis
(71 page report, commissioned by UAF)

Data Development (Work Package B2a)

Banjar Management & DKA Marketing: Multimodal Port Access – Data Development
(47 page report, commissioned by Yukon Engineering Services)

Landspoint Consulting: Port of Skagway Re-development Plan
(3 page memo)

Rail System Economics

Rail Infrastructure Cost

This report combines the information generated in the Rail System Evaluations with some benchmark unit costs to come up with total construction costs for the route segments.

The estimate includes basic infrastructure and ancillary facilities based on class 4 track standards (60 mph freight), with a capacity to carry 10 million revenue tons of freight per year. The estimate does not include land acquisition costs. The report also estimates capital replacement costs over 40 years.

These construction estimates are from the UMA report, except where noted:

Segment	Miles	Cost/mile	Total Cost
		$Million USD	$Million USD
Fort Nelson to Watson Lake	336	9.05	3,040
Minaret to Watson Lake	392	14.14	5,542
Mackenzie to Watson Lake	435	7.50	3,262
Hazelton to Watson Lake	497	7.95	3,953
Watson Lake to Carmacks	403	8.19	3,302
Carmacks to Ladue Border	223	9.03	2,015
Carmacks to Beaver Creek Border	233	11.68	2,720
Watson Lake to Whitehorse	314	8.63	2,710
Whitehorse to Beaver Creek Border	328	9.40	3,084
Ladue Border to Delta Junction*	192	5.46	1,048
Beaver Creek Border to Delta Jct*	198	5.90	1,169
Carmacks to Skagway**	217	3.14	681

* from UAF reports, below
** from Pacific Contract Company report in previous section

The report concludes that, with one or two exceptions, there is little reason to differentiate the route segments on cost grounds. Market forces or other considerations should determine the final route selection, except that the route segment from Minaret to Watson Lake should be rejected as an option because of excessively high construction and operating costs.

Read the Reports

Work Package B3a

UMA Engineering: Infrastructure Cost Estimates for Full Rail Route Investment
(20 page report)

UAF: Cost Estimate Alaska Highway Route
(3 spreadsheets)

UAF: Cost Estimate Ladue River Route
(3 spreadsheets)

Cost of Service Model

In this part of the project a full costing model for rail operations was developed. Start-up, operating, and maintenance costs of a railway were added to the construction costs to come up with full costing scenarios for each of the routes. Several iterations of the model were developed to examine different scenarios that were evolving throughout stage 1 and stage 2 of the project. The consultants who were working on stage two collaborated with the cost of service consultant on the final versions of the cost model.

The outcomes of the model are variable, depending on a variety of assumptions that are made about both the technical and market research data. In the initial model, three different traffic levels and three different management strategies were included to produce nine different scenarios for each route. Furthermore, the inclusion of capital costs in the model increases the variability with assumptions about discount rates and amortization periods.

The Phase I Model

The initial model was developed before any consideration was given to the BC route segment that connects at Hazelton.

Early on, the importance of a link to an inside passage port was recognized, so a link from Carmacks to the port at Skagway is included in these models. The costing on this link was broadened to address the tradeoffs of extending the existing narrow gauge link (lower capital and higher operating) vs. upgrading it to standard gauge (higher capital and lower operating). This discussion is included in the Phase I reports and it concludes that the total cost (capital and operating) is essentially the same for both options.

The broad conclusion of the Phase I work is that the operating costs (excluding capital) of the proposed rail link would be within the range of operating costs to be expected from any similar railway, around two cents per ton-mile. If capital costs are assigned to revenue traffic, the total cost on a revenue-ton mile basis could be on the order of ten times the operating cost.

The Phase II Model

Phase II is based on the single working route scenario that was selected for further analysis in stage two of the feasibility study. The Phase II model is designed to be manipulated further in stage two of the project because there was an on-going discussion about how the market forecasts should be evaluated, especially the mineral export forecast. The Phase II model is designed to accommodate that discussion.

Other Models

During stage 2 of the research, it was decided to evaluate the potential iron ore traffic in a stand-alone scenario. A cost model was developed for that scenario.

Read the Reports

"Phase I" Models (Work Package B3e)

Innovative Scheduling: Cost Analysis Report
(45 page report)

Innovative Scheduling: Cost Model
(25 spreadsheets)

Innovative Scheduling: Narrow Gauge Cost Model
(19 spreadsheets)

"Phase II" Models (Work Package B3e)

Innovative Scheduling: Integrated Financial Model
(19 page report)

Innovative Scheduling: Phase II Cost Model
(34 spreadsheets)

Other Models (Work Package B3e)

Innovative Scheduling: Iron Ore Options Cost Model
(38 spreadsheets)

Data Development Reports (Work Package B3c)

Innovative Scheduling: Cost Model Inputs
(3 page memo)

Innovative Scheduling: Operating Cost Model Presentation
(22 powerpoint slides)

Export Routes Economics

The purpose of this work was to validate the selection of ports to be included in the preferred rail routing scenario.

The market research confirmed that port infrastructure is a central requirement for many of the shippers that might use a rail link. Early technical research identified 11 ports in the area that could be included in the development scenarios. The task is to identify which of those best contribute to the viability of the rail scenarios, taking into account potential port capacity and port development costs.

While this work does not go far enough to provide a full feasibility assessment of specific port developments, it does provide some benchmark costs that help complete the rail feasibility assessment by confirming the selection of ports to be included in the preferred scenario.

This examination of port infrastructure was done after all of the market research was done, and after the rail scenarios had been developed and costed. This work therefore takes into account the traffic volumes that the ports may be required to handle. The essential work at this point was to combine the existing traffic and cost information into useful scenarios and add some cost estimates for port infrastructure development and operations.

The work was done in three steps:

- An assessment of capital infrastructure development costs,
- An assessment of rail and port operating costs, and
- A unit cost of service assessment including both operating and capital costs.

The resulting cost reports include both rail and port costs.

Export Routes Infrastructure Cost

This part of the study gathered together infrastructure cost data for ten different rail and port scenarios. The scenarios were designed as alternative ways to handle the traffic volumes that were developed in the market analysis parts of this study.

Rail infrastructure costs were taken from the technical analysis work, and the consultant developed order of magnitude cost estimates for the necessary port development.

The scenarios were built around five ports: Port Mackenzie, Skagway, Haines, Hyder, and Prince Rupert. For those ports potentially large enough to handle iron ore exports, two scenarios were developed, one with iron ore capacity and one without.

Read the Report

Work Package B3b

Banjar Management and CH2M Hill: Phased Multimodal Integration Life Cycle Cost Estimation
(52 page report, commissioned by Yukon Engineering Services)

Export Routes Operating Costs

This work gathered operating cost data for the scenarios that were developed in the previous report. The rail operating cost data was taken from the work done in the present technical analysis. Estimates of port operating costs were added by the consultant.

Read the Report

Work Package B3d

Banjar Management and CH2M Hill: Phased Multimodal Integration Life Cycle Operating Expenses Estimation
(27 page report, commissioned by Yukon Engineering Services)

Export Routes Cost of Service

This report consolidates the information from the previous two reports and develops a unit cost of service for each of the scenarios. The unit cost combines the operating cost with amortized infrastructure cost over a 50 year scenario.

The issue of greatest interest that this work addresses is Haines as a "Benchmark" for phased investment as the least track that can move the most minerals to tidewater export position. For the full potential of very large scale iron ore and coal mines in Yukon, Haines is close to the mineral shippers and has more potential for port capacity development than Skagway. The trade-off is between a considerable capital cost to develop entirely new port and rail access infrastructure at Haines vs. the additional rail operating cost to haul the longer distances to other ports.

Read the Report

Work Package B3f

Banjar Management and CH2M Hill: Phased Multimodal Integration Cost of Service Estimation
(14 page report, commissioned by Yukon Engineering Services)

Part 4: Business Case Assessment

Business Case Assessment 62
Ernst and Young Orenda Corporate Finance Inc., Macquarie North America Limited, Partnerships British Columbia: Alaska Canada Rail Link Business Case Report 62
HDR/HLB Decision Economics Inc. (for UAF): Cost-Benefit Analysis for the Alaska Canada Rail Link 62
Dr. Paul Metz et al: Alaska Canada Rail Link Summary of Benefits to Alaska. 62

Business Case Assessment

The reports commissioned for an ACRL business case reflect two different models for analysis of investment recovery by: (a) commercial revenues and (b) public benefits. A limited number of development scenarios were assessed in these reports in order to provide a sampling of business case scenarios. There are other development scenarios that could be assessed in the future.

The ACRL Business Case Report is a collaborative result of research completed by Ernst & Young Orenda Corporate Finance Inc. (E&Y), Macquarie North American Limited (MNAL), and Partnerships British Columbia (PBC). For a potential Public Private Partnership, E&Y was assigned the public investment perspective, MNAL was assigned the private investment perspective, and PBC was assigned the government oversight perspective.

Under the direction of the University of Alaska Fairbanks, HDR/HLB Decision Economics conducted a Public Benefit/Cost Analysis.

The purpose of the Phase 1 Feasibility Study was to provide a high level assessment of the project's commercial viability based on long range revenue potential. It was not anticipated that the project would at this preliminary stage, be able to meet near-term "bankability" criteria.

Read the Reports

Ernst and Young Orenda Corporate Finance Inc., Macquarie North America Limited, Partnerships British Columbia: Alaska Canada Rail Link Business Case Report
(143 page report)

HDR/HLB Decision Economics Inc. (for UAF): Cost-Benefit Analysis for the Alaska Canada Rail Link
(57 page report, commissioned by University of Alaska)

Dr. Paul Metz et al: Alaska Canada Rail Link Summary of Benefits to Alaska.

Appendices

Appendix A: Project Participants

Advisory Committee

Under the terms of the MOU between Alaska and Yukon, the Advisory Committee was established to serve as an oversight body for the feasibility study. The committee will report the results and recommendations jointly to the respective Canadian and United States project sponsors.

Alaska Members

State of Alaska (Co-chair)	Frank Murkowski, Governor
Alaska Legislature - Senate	John Cowdery, Chair of Rules Committee
Alaska Legislature – House	John Coghill, Representative, North Pole
Alaska Railroad Corporation	Pat Gamble, President
Doyon Limited	Orie Williams, CEO (A First Nation Corp)
Ex-officio	Jeanette James, former representative for North Pole

Canada Members

Government of Yukon (Co-chair)	Dennis Fentie. Premier
Yukon Economic Development	Jim Kenyon, Minister
Council of Yukon First Nations	Andy Carvill, Grand Chief
Kaska Tribal Council	Dave Porter

Management Working Group

Under the terms of the MOU between Alaska and Yukon, the Management Working Group monitored and directed the management of the study. Members were selected from within the public service of each jurisdiction on the basis of their experience, overall project knowledge and/or technical qualifications. The working group met least monthly.

Alaska Members

Department of Transportation	Mike Barton, Commissioner
Alaska Railroad Corporation	Bruce Carr, Director, Strategic Planning
Governor's Office	Rob Corbisier, Special Staff Assistant
Department of Transportation	Mark Taylor, Special Projects Administrator
Ex-officio	Jeanette James, former representative for North Pole

Canada Members

Yukon Economic Development (Chair)	Eugene Lysy, Deputy Minister
Yukon Highways and Public Works	John Stecyk, Deputy Minister
Yukon First Nations representative	Stanley Noel, CEO Yukon Indian Development Corporation
Government of British Columbia Ministry of Transportation	Kathleen Miller, ADM Transportation Planning and Policy
Government of Canada Transport Canada	David W Murray, Regional Director General Prairie and Northern Region

Project Management Team

The Management Working Group hired a full time project manager to conduct the project. He worked out of a project office based in Whitehorse, Yukon with a small support staff.

Project Manager	Kells Boland
Assistant Project Manager	Peter Laight
Project Manager, Ports Access	Roy Matson
Communications Coordinator	Amanda Leslie
University of Alaska Head Investigator	 Dr. Paul Metz

Consultants

Consultant	Work Packages
Banjar Management Inc. Delta, BC	B2 B3
The Boston Consulting Group Toronto, ON	A3
CH2M Hill Canada Ltd. Canada	B3
DKA Marketing Vancouver, BC	B2
Don Brownie Calgary, AB	D1
Gartner Lee Limited Whitehorse, YT	A2
GHK International Vancouver, BC	A3
Hatch Associates Consultants Inc. Mississauga, ON	A2
HDR Engineering Inc.	B2 D1 C
HDR|HLB Decision Economics Inc Ottawa, ON	C
Information Insights, Inc. Fairbanks, AK	D1
Informetrica Limited Canada	D1
Innovative Scheduling Gainesville, FL	B3
IRIS Environmental Systems Inc. Calgary, AB	D1
Dr. Karim-Aly Kassam et al Canada	D1
Klugherz & Associates Seattle, WA	A3
Landspoint Consulting Calgary, AB	A1 B2

Lockheed Martin Anchorage, AK	A2
Macleod Institute Calgary, AB	D
Pacific Contract Company, LLC Alaska	B2
Parsons & Associates, Inc. Alaska	A2
Price Waterhouse Coopers LLP Canada	A2
QGI Consulting Edmonton AB	A1 A2
Raw Materials Group Sweden	A2
UMA Engineering Ltd Edmonton AB	B1 B3
University of Alaska at Fairbanks Dr Paul Metz Dr Scott Huang et al Bob Thomas Janak Dhungana et al	B1 B3 A2 B1 B1 B1
Vector Research Whitehorse, YT	A1 A2
Yukon Economic Development Whitehorse, YT	A2
Yukon Engineering Services Whitehorse, YT	B1 B2 B3