

Benefits of the Southcentral Rail Extension to the Municipality of Anchorage

prepared for:

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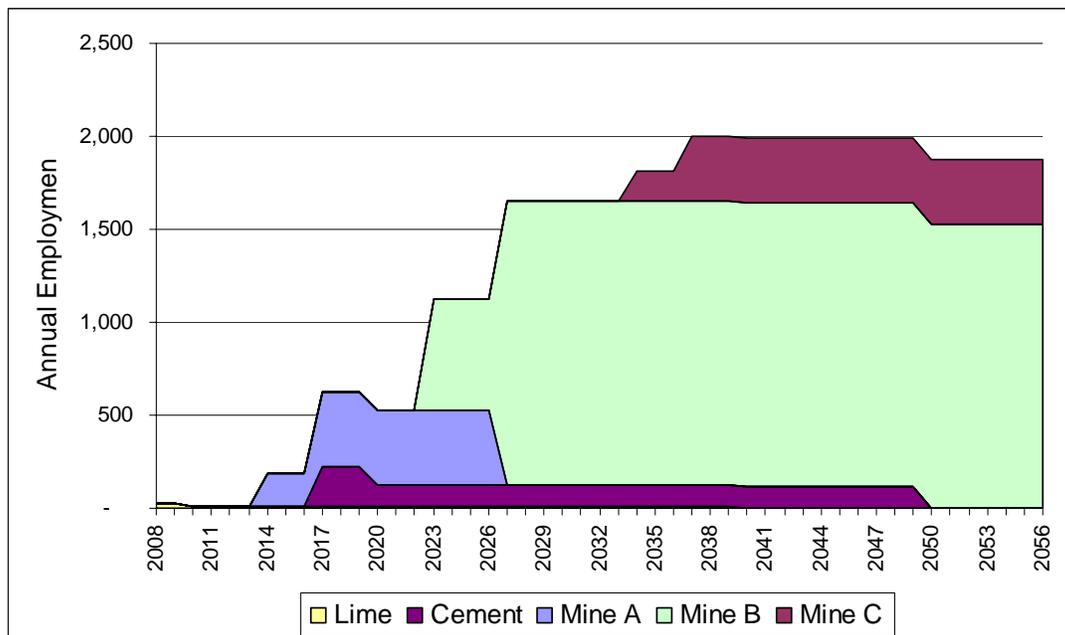
Summary of Findings

The proposed Southcentral rail extension to Port MacKenzie is likely to generate significant economic benefits for the residents of Anchorage. These benefits are due to a combination of reduced transport costs, the ability to ship bulk commodities over shorter distances, and economical access to industrial land. We considered and analyzed these benefits under a set of assumptions about job creation, transportation costs, land use considerations and future mineral development. Our major findings include the following:

Jobs

- Port MacKenzie.** The rail extension will generate new jobs for Anchorage workers by stimulating industrial development and jobs at Port MacKenzie. Under a base case scenario with a rail extension and ferry service, Anchorage residents would gain 730 average annual jobs and \$50 million of annual income during the period of 2013 -2017 from industrial development at Port MacKenzie. Hundreds more jobs would be gained after 2017. The rail extension will play an important role in this process. For example, it will allow coal exports through the port as early as 2013, generating more than 100 jobs.
- New Mines.** Major new mines shipping concentrate via the rail extension would generate thousands of new jobs, and a significant fraction of these jobs would be held by Anchorage residents. Our detailed analysis of the potential employment from five specific mining projects indicates that more than 2,000 average annual jobs would be created in Anchorage or held by Anchorage residents once the mines are fully developed. Most of these jobs would be in mining and in professional sectors that pay good wages. Also, during initial mine development, many of the jobs would be in construction and fabrication.

Projected average annual employment of Anchorage residents due to new mining activity and multiplier effects, by mining project



- **Rail Construction.** The construction of the rail extension would generate up to 3,000 total jobs, and ongoing operations would generate up to 150 total jobs. It is likely that many of these jobs would be held by Anchorage residents.
- **State Revenues.** State mining taxes generated from new mines will boost the Anchorage economy. Estimated tax revenues and royalties would grow steadily, reaching \$267 million per year by 2040. A large share of these potential tax revenues, roughly proportional to Anchorage's share of state population, would likely flow into the Anchorage economy, sustaining hundreds of direct jobs and reducing property tax burdens that would otherwise stifle private sector job creation.

Regional Competitiveness

- **New Economic Opportunities.** Port MacKenzie and the rail extension, operating together, are a significant new strategic asset for the entire regional economy. This infrastructure will create expanded opportunities for mineral, timber, and energy resource development, and the export of bulk commodities by rail through Port MacKenzie constitutes a new economic sector for the Southcentral regional economy. As the region's commercial and financial hub, Anchorage will gain jobs and income from all of this activity.
- **More Efficient Land Use.** The rail extension allows for higher-valued use of land in Anchorage. The rail extension will allow for railroad-dependent industrial development to take place at Port MacKenzie. This development would allow limited existing industrial-zoned land throughout Anchorage to be used for other, higher-value uses such as commercial development, while still meeting the regional economy's need for industrial land.

Fiscal Benefits

- **New State Revenues.** As noted above, revenues to the State of Alaska from new resource development would grow steadily, reaching \$267 million per year by 2040. These revenues will reduce the need for other taxes, stimulating capital formation and job creation by the private sector.
- **Higher Local Tax Base.** Local governments will also see higher tax revenues from a higher-valued property tax base. The stimulated new development will increase the tax base and reduce the need to raise taxes on homeowners or existing businesses.

Other Benefits

- **Port of Anchorage.** The industrial and mineral development stimulated by the rail extension to Port MacKenzie will likely increase both the volume and the value of cargo going through the Port of Anchorage. For example, if large mines are developed, the goods and equipment used by the mines for development and operations will flow through Anchorage.
- **Rail Shipping Costs.** The unit cost of shipping on the Alaska Railroad is likely to fall as fixed costs of roadbed maintenance and administration are spread over a higher volume of shipments.

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1. Introduction

The purpose of this study is to examine the economic benefits to the Municipality of Anchorage of a rail extension from the existing Alaska Railroad south to Port MacKenzie. The Matanuska-Susitna Borough (Mat-Su) and the Alaska Railroad Corporation are jointly proposing this new rail line. The rail extension is expected to significantly lower the cost of transporting both manufactured goods and bulk commodities into and out of Interior Alaska, stimulating economic development. In particular, one or more new large mines could be rendered economically attractive with the rail extension. Because of strong economic linkages between regions, the economic activity associated with Southcentral rail extension is expected to generate significant economic benefits to the Municipality of Anchorage.

2. Two Municipalities, One Regional Economy

The Matanuska-Susitna Borough and the Municipality of Anchorage have always had strong economic ties. The Mat-Su Borough has historically served as a “bedroom community” for Anchorage. Relatively higher wages in Anchorage and lower-cost housing in the Mat-Su Borough are largely responsible for this economic relationship. In 2008, 32 percent of employed Mat-Su residents worked in Anchorage.¹ Recently, there has been a noticeable “deepening” of the Mat-Su economy as many industrial operations, business services, and health care facilities have located in the Borough. These businesses now have a larger local market, better communications, and a larger labor pool, in addition to inexpensive land. This maturing of the Mat-Su economy has contributed significantly to the regional economy.

The Southcentral rail extension has the potential to further enhance the economic ties between the Mat-Su Borough and Anchorage. The rail extension is expected to significantly lower the cost of transporting both manufactured goods and bulk commodities into and out of Interior Alaska, stimulating economic development. In particular, one or more new large mines could be rendered economically attractive. Anchorage can expect increased levels of economic activity as a result of any new development, no matter what form it takes.

When thinking about the rail extension, it is helpful to consider the distinct strengths of the Anchorage and Mat-Su economies. These strengths complement and reinforce each other, making the entire region economically stronger. The rail extension may be able to simultaneously stimulate the development of Mat-Su’s more industrial, land-intensive sectors and Anchorage’s professional and retail sectors. The rail extension, together with Port MacKenzie, presents an opportunity for both Anchorage and the Mat-Su to exploit their “comparative advantages” – meaning, play to their respective strengths – so as to increase the overall level of economic activity in the region.

¹ Fried, Neal, Alaska Department of Labor and Workforce Development, *The Latest Valley Numbers*, Presentation to Palmer Greater Chamber of Commerce. March 18, 2009.

3. Overview of Potential Benefits to Anchorage from the Rail Extension

In this section, we discuss the overall range of benefits that Anchorage could expect with the extension of the railroad to Port MacKenzie. While many of these benefits cannot be readily quantified, they are all likely to be significant for both Anchorage and Mat-Su residents. In the sections following this one, we provide quantitative estimates of the benefits from three major sources: construction and operation of the rail extension, industrial development at Port MacKenzie, and railroad-dependent mineral development.

Port MacKenzie, the new ferry, and the rail extension, operating together, are a significant new strategic asset for the entire regional economy. This infrastructure will allow railroad-dependent industrial development to take place at Port MacKenzie. It will also create expanded opportunities for mineral, timber, and energy resource development. Indeed, the export of bulk commodities by rail through Port MacKenzie constitutes a new economic sector for the Anchorage-Mat-Su regional economy. As the region's commercial and financial hub, Anchorage will gain jobs and income from all of this activity. In addition Anchorage residents will likely hold many of the jobs building and operating the rail extension itself. More detailed projections of these job gains from industrial development and from mineral development are provided below, in sections 5 and 6.

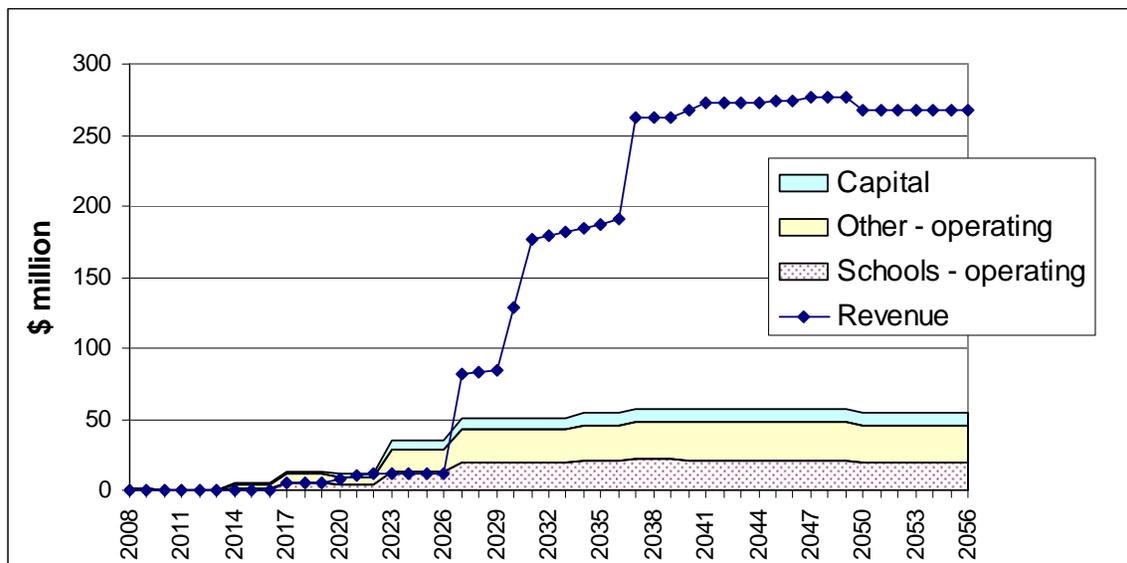
In addition to being a direct new source of jobs, industrial development at Port MacKenzie would allow limited existing industrial-zoned land throughout Anchorage to be used for other, higher-value uses such as commercial development, while still meeting the regional economy's need for industrial land. According to a study released by the Anchorage Economic Development Corporation, Anchorage is expected to have a significant shortage of industrial land in the coming years. The study asserts that "Anchorage will continue to have a resource and logistics driven economy for the foreseeable future. It is necessary to protect land to facilitate industrial development in the MOA supporting these key industries."² Similarly, the Municipality of Anchorage's land use plan, the *Anchorage 2020 Comprehensive Plan*, recognizes the importance of rail access for industrial development and recommends limiting non-industrial land use near the railroad to ensure that regional industrial development has a sufficient supply of industrial land with rail access. However, government land use restrictions are likely to stifle the most profitable and beneficial business developments that would otherwise take place. Over time, these restrictions reduce economic competitiveness and growth. In addition, lower-value uses of land will also directly reduce the Anchorage property tax base, requiring the Municipality to increase tax rates to maintain the same level of revenue. The Southcentral rail extension will help Anchorage avoid this inefficient and burdensome outcome.

Significant fiscal benefits can be expected for both state and local governments from the rail extension and Port Mackenzie infrastructure. State mining taxes generated from new mines will boost the Anchorage economy. In a previous analysis, we estimated that up to 13,000 additional people could move to Alaska (or not leave the state) as a result of these new mines (and rail

² Economic and Planning Systems Inc. *Anchorage Industrial Land Assessment*. Prepared for Anchorage Economic Development Corporation, Municipality of Anchorage. March 2009.

extension).³ Additional education expenditures on about 3,300 additional students would be about \$21 million per year, and total additional annual state expenditures could reach \$57 million based on historical norms. After 2025, however, estimated tax revenues and royalties greatly exceed expenditures, reaching \$267 million per year by 2040. The expected fiscal impact on the State of Alaska is shown in Figure 1. A large share of these potential tax revenues, roughly proportional to Anchorage’s share of state population, would likely flow into the Anchorage economy, sustaining hundreds of direct jobs and reducing property tax burdens that would otherwise stifle private sector job creation. Local governments will also see higher tax revenues from a higher-valued property tax base. The stimulated new development will increase the tax base and reduce the need to raise taxes on homeowners or existing businesses.

Figure 1. State of Alaska revenues and expenditures associated with new mining activity in Interior Alaska



Source: Colt, S., and Nick Szymoniak. *Port MacKenzie Rail Extension: Fiscal and Economic Impacts of Associated New Mineral Development. Preliminary Draft Results*. Anchorage: Institute of Social and Economic Research. October 2008.

The Port of Anchorage is likely to also benefit from the new development associated with the rail extension. Large mines developed in the Interior region will be supplied with goods traveling through the Port of Anchorage. Indeed, any large economic development project in Alaska will likely result in some increase in the amount of cargo handled by the Port of Anchorage. Shipping bulk commodities through Port MacKenzie will allow the Port of Anchorage to handle these increased, higher-value cargo shipments – mostly commercial and residential goods in containers.

³ Colt, S., and Nick Szymoniak. *Port MacKenzie Rail Extension: Fiscal and Economic Impacts of Associated New Mineral Development. Preliminary Draft Results*. Anchorage: Institute of Social and Economic Research. October 2008.

The neighborhoods surrounding the Port of Anchorage may also benefit. As Port MacKenzie handles more volume, the pressure to create large amounts of additional storage space at or near the Port of Anchorage – beyond the current expansion -- should abate.

Another benefit of the rail extension is that the unit cost of shipping on the Alaska Railroad is likely to fall as fixed costs are spread over a higher volume of shipments. The Railroad has significant fixed costs, such as roadbed maintenance and administration, that will not change when the total volume of shipments increases. With more shipments of bulk commodities, these fixed costs can be spread over the increased volume, lowering the unit cost of all cargo shipped. Lower unit railroad shipping costs will benefit Anchorage residents by decreasing the cost of goods shipped to Anchorage by rail (e.g., fuel from North Pole refineries or containers from Whittier). The unit cost of providing passenger or commuter rail service might also be reduced.

4. Benefits from Construction and Operation of the Rail Extension

The construction and operation of the Southcentral rail extension will create economic activity in Anchorage and jobs for Anchorage residents. Northern Economics estimated the statewide economic impacts of the construction and operation of the rail extension, a new dock at Port MacKenzie, the loading and unloading facilities from the rail terminal to the dock, and the expansion of coal production at Usibelli Coal Mine.⁴ Although Northern Economics did not allocate the statewide benefits specifically to Anchorage (or other places), they are clearly significant. We did not perform additional analysis related to the Northern Economics study, so this section merely discusses Northern Economics' findings about the economic benefits to Anchorage of the rail extension. The Northern Economics report largely focuses on the use of the rail extension to transport coal to Nikiski for coal gasification. While this specific project is not currently underway, this is a useful example of the economic benefits that are expected from any increased activity at Port MacKenzie resulting from the rail extension.

According to the Northern Economics report:

- The rail extension is estimated to cost \$276 million, including construction management, right-of-way costs, subgrade construction, track construction, and bridges/other structures.
- Maintenance of the rail extension track, bridge structures, rail bed, locomotives, and other facilities is expected to cost between \$1.5 and \$2.0 million annually.
- Major upland development associated with the rail extension and coal movement will involve facilities associated with unloading, stacking, reclaiming, and conveying of the coal to barges.⁵ These facilities are expected to cost approximately \$25 million.

The statewide employment impacts of the construction and annual operation activity as estimated by Northern Economics are shown in Table 1. Northern Economics also estimated the impacts of the associated expansion of the Usibelli coal mine, but these are not included in the table.

⁴ Northern Economics, Inc. *Economic Effects of the Southcentral Rail Extension*. Prepared for the Matanuska-Susitna Borough. March 2007.

⁵ While the NE report focused on regional transport by barge, any future coal exports from Alaska would be transported by ocean-going vessel.

Table 1. Estimated direct, indirect, and induced jobs associated with the proposed Southcentral rail extension and associated port developments^{6,7}

Facility	Direct	Indirect + Induced	Total
Rail Extension			
Construction	1,700 to 1,900	1,500	3,200 to 3,400
Operations (annual)	10 to 20	10 to 15	20 to 35
Uplands Development			
Construction	80	45	125
Operations (annual)	25 to 35	80	105 to 115
Port MacKenzie Dock			
Construction	230 to 260	145 to 165	375 to 425
Operations (annual)	10	<10	<20
Total Construction			3,600 to 3,950
Total Operations			145 to 170

Our analysis of the economic benefits to Anchorage of industrial development at Port MacKenzie (discussed in the following section) indicates that Anchorage residents are likely to hold a significant share of the indirect and induced jobs. If the Cook Inlet Ferry is operating, Anchorage residents are also expected to hold many direct jobs as well as an increased share of the indirect and induced jobs.⁸ The Cook Inlet Ferry will give Anchorage workers increased access to the jobs at Port MacKenzie. In addition, the Ferry will give Port MacKenzie workers living in the Mat-Su increased opportunity to spend their wages in Anchorage.

5. Benefits from Industrial Development at Port MacKenzie

As discussed above, Anchorage's economic growth is increasingly constrained by lack of industrial land. The Southcentral rail extension will relieve some of this pressure and generate more economic growth in Anchorage by increasing industrial development at Port MacKenzie. We recently investigated the benefits of the Cook Inlet Ferry to the Municipality of Anchorage⁹ and estimated the potential economic benefits to Anchorage of industrial development at Port MacKenzie. Much of the potential industrial development is largely dependent on the Cook Inlet Ferry and railroad extension, although the extent and allocation of the dependency is uncertain. Neither this study, nor the Ferry study, allocates a particular share of the benefits of the industrial development to the Ferry or to the rail extension though both are expected to be vital components of supporting infrastructure.

⁶ Northern Economics, Inc. *Economic Effects of the Southcentral Rail Extension*. Prepared for the Matanuska-Susitna Borough. March 2007.

⁷ ISER calculations (the total fields do not include Usibelli).

⁸ Institute of Social and Economic Research, *Benefits of the Cook Inlet Ferry to the Municipality of Anchorage*. 2009. Available at <http://www.iser.uaa.alaska.edu/Publications/BenefitsCookInletFerry2MOA.pdf>.

⁹ Szymoniak, N., and S. Colt. *Benefits of the Cook Inlet Ferry to the Municipality of Anchorage*. 2009. Anchorage: Institute of Social and Economic Research. Available at <http://www.iser.uaa.alaska.edu/Publications/BenefitsCookInletFerry2MOA.pdf>.

Our study of the Cook Inlet Ferry benefits estimates the economic impacts on Anchorage of industrial development at Port MacKenzie. We estimated near-term economic impacts under three scenarios (base, low, and high cases). The results from this analysis are reported in Table 2. Under the base case scenario Anchorage residents would gain 730 average annual jobs and \$50 million of annual income during the near term period from 2013-2017 as a result of industrial development at Port MacKenzie. Production and sales¹⁰ occurring within Anchorage, a broad measure of economic activity, would increase by \$68 million. The number of jobs would likely continue to grow after 2017.

Table 2. Economic impact of Port MacKenzie industrial development, 2013-2017

	Anchorage			Total (Anchorage + Mat-Su)			Mat-Su		
	Low	Base	High	Low	Base	High	Low	Base	High
Employment (annual avg)	474	730	1,271	1,737	2,674	4,628	1,264	1,944	3,357
Labor Income (\$ million per yr)	32	50	87	123	190	329	91	140	242
Production & Sales (\$million per yr)	43	68	125	355	554	1,051	312	487	925

Note: Employment and labor income are by place of residence: Anchorage employment means employment of Anchorage residents. Production and sales are by location of economic activity.

The rail extension is particularly important for the near-term benefits of industrial development at Port MacKenzie. The Mat-Su Borough expects that the rail extension will be used to export coal out of Port MacKenzie beginning in 2013.¹¹ According to our model and analysis, these coal exports are estimated to create 111 direct, indirect and induced jobs with 33 of these jobs held by Anchorage residents.

6. Benefits from Employment of Anchorage Residents due to Railroad-Dependent Mineral Development

The Southcentral rail extension to Port MacKenzie is expected to significantly decrease the cost of transporting mineral concentrate to tidewater for export. The reduced cost results in large part because the distance to tidewater at Port MacKenzie would be reduced by 147 miles compared to shipping from the current bulk commodities Port in Seward. The decreased cost of exporting goods from Interior Alaska is expected to stimulate large amounts of economic development in that region.¹²

¹⁰ The technical term for production and sales is “value of shipments.” The value of shipments associated with a particular item can go up or down depending on how many times the components of that item are bought and sold before it reaches the final consumer. Hence, this measure of economic activity, while useful, is not as precise as employment or income. In our model, “Anchorage production and sales” means production and sales occurring within Anchorage.

¹¹ Northern Economics Inc. *Port MacKenzie Industrial Lease Forecast*. Produced for Matanuska-Susitna Borough. Not yet published.

¹² Metz, P. A. 2007a. *Economic Analysis of Rail Link Port MacKenzie to Willow, Alaska*. Prepared for Matanuska-Susitna Borough. February.

The economic development resulting from new mines in Interior Alaska generates benefits to Anchorage because Anchorage is the state's commercial and financial hub. Specifically, benefits from new mines flow to Anchorage because:

- A significant fraction of mine employees are likely to live in Anchorage and spend their paychecks there.
- Anchorage serves as a headquarters for many businesses – such as banks and insurance firms -- with operations located elsewhere in the state.
- The mining industry's professional support personnel often live and work in Anchorage.
- Much of the income earned throughout Alaska is spent in Anchorage.

For these reasons, any large economic developments that occur in Interior Alaska will result in significant economic benefits to Anchorage.

Our analysis uses the development of three mines and two limestone-related operations in Interior Alaska as a case study to discuss how the rail extension could generate flows of economic activity into Anchorage. We estimated the economic benefits to Anchorage of the hypothetical mining projects. We assumed for purposes of our analysis that the development of these projects is stimulated by the significant transportation cost savings stemming from access to tidewater via the railroad extension. Obviously, there are many interacting factors that determine the feasibility of any particular large mine.

With the proposed extension in place, the rail distance from Interior Alaska to Port MacKenzie will be 26.4 miles shorter than the rail distance to the Port of Anchorage and 147 miles shorter than the rail distance to the Port of Seward.¹³ This difference results in lower rail transportation costs because trains burn less fuel and crews work fewer hours. The shorter distance may also allow for fewer crew changes, further lowering costs. Wharfage tariffs are charged for the loading or unloading of goods from a ship or barge at port. Wharfage rates are different for different commodities and are usually charged on a dollars per ton basis. Dockage charges relate to the vessel and are usually determined by the length of the vessel being docked and the number of days docked. The Mat-Su Borough expects wharfage tariffs and dockage charges to be lower at Port MacKenzie than at the ports in Anchorage and Seward.

Dr. Paul Metz, Professor of Geological Engineering and director of the Mining Industry Research Lab at the University of Alaska Fairbanks, predicts that the rail extension will lower the cost of exporting mineral concentrate to the point that it will directly stimulate the development of three new mineral deposits within a 120-mile-wide corridor surrounding the existing railroad in Interior Alaska.¹⁴ Mat-Su Borough officials also assume that a cement and lime mining and production operation would be developed as a result of the railroad extension.¹⁵ We have used these five mining projects as a case study to calculate the resulting expected benefits to Anchorage from the rail extension.

¹³ Northern Economics, Inc. *Economic Effects of the Southcentral Rail Extension*. Prepared for the Matanuska-Susitna Borough. March 2007.

¹⁴ Metz, Paul. *Economic Analysis of Rail Link Port McKenzie to Willow, Alaska*. Prepared for the Matanuska-Susitna Borough. November 2007.

¹⁵ Mat-Su Borough, personal communication. September 2008.

We developed a quantitative model that estimates the overall economic benefits of the mineral developments in Interior Alaska and the share of the impacts that would occur in Anchorage. The inputs of the model were taken directly from Metz’s report and assumptions supplied to ISER by the Mat-Su Borough regarding the proposed Globe Creek lime and cement production operation. Our model uses the IMPLAN input-output modeling system.¹⁶ More discussion of the methodology is provided in the appendix to this report.

Based on Metz’s analysis we assumed the following: Three new mines are developed with the first mine beginning production in 2017. The total gross metal value of the three mines is estimated to be \$173 billion. These mines are projected to export a cumulative total of 64 million tons of mineral concentrate over the course of their lives. Table 3 shows a summary of the characteristics of these three mines. In order to be consistent with Metz’s scenario, we have assumed production occurs only through year 2056, although it is certainly plausible that these or other mines would continue to produce after that year.

Table 3. Description of mine characteristics¹⁷

	Mine A	Mine B	Mine C
First year of mine production	2017	2027	2037
Mine life (years)	10	30	20
Annual employment	250	480	350
Mineral concentrate (million tonnes)			
Annual	0.4	1.7	0.2
Total	4	50	4
Gross metal value (millions)			
Annual	\$ 580	\$ 5,153	\$ 620
Total	\$ 5,800	\$ 154,600	\$ 12,400

For this case study, the Mat-Su Borough also expects a limestone resource to be developed in Interior Alaska that will produce lime and cement products. Much of the lime and cement will be used instate for other mining and construction projects but a significant share of production will need to be exported in order to make the enterprise financially viable. For that reason, all of the economic benefits of the cement and lime production are attributed to the railroad extension. Table 4 describes the Globe Creek cement and lime operations.

¹⁶ MIG, Inc. IMPLAN™ Professional Version 2.0.1001 Social Accounting and Impact Analysis Software. Minnesota Implan Group. Stillwater, MN.

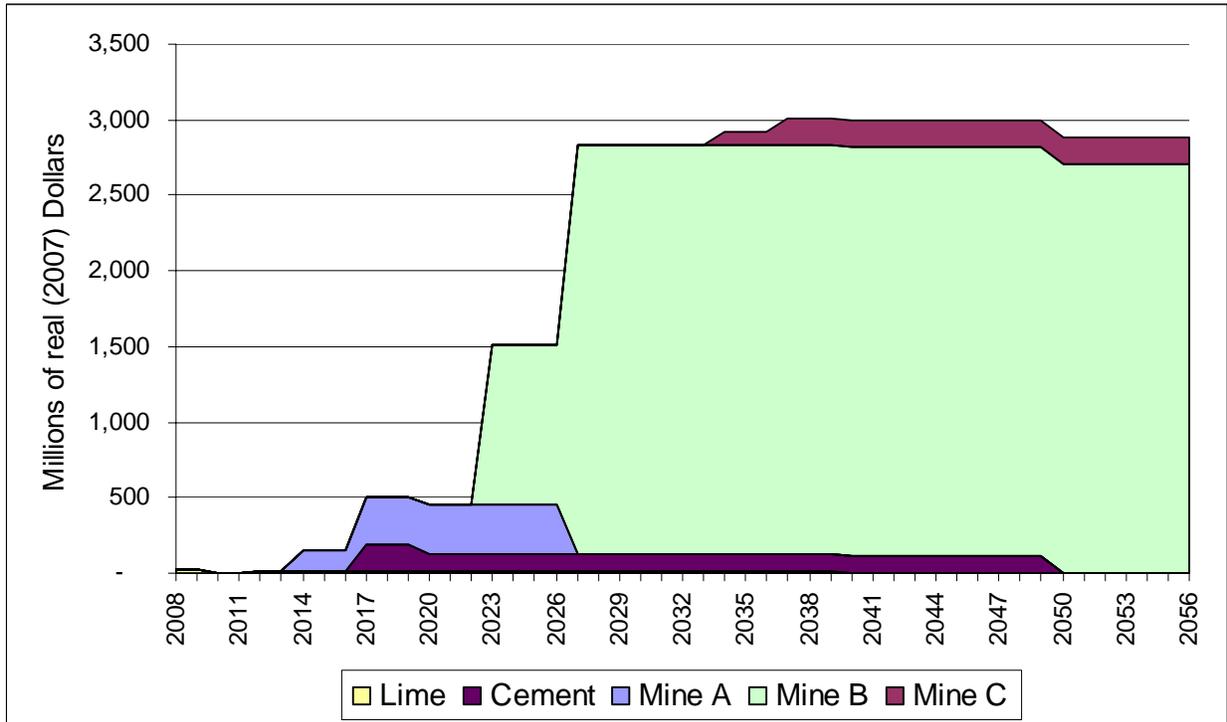
¹⁷ Paul Metz, Economic Analysis of Rail Link Port McKenzie to Willow, Alaska. February 2007.

Table 4. Description of Globe Creek Mining Operations¹⁸

	Lime	Cement
First year of mine production	2010	2020
Mine life (years)	30	30
Annual employment	21	200
Mineral production (million tonnes)		
Annual	0.5	1.2
Total	15	36
Gross value of production (millions)		
Annual	\$ 12	\$ 120
Total	\$ 354	\$ 3,600

We used the annual spending within Alaska on mine development and mine operations for each mine as inputs to our economic impact model. These spending amounts are shown in Figure 2.

Figure 2. Annual spending in Alaska on assumed mining operations



In our analysis, the mines generate both direct and indirect employment and income for Anchorage residents. Because the mines would be isolated enclaves, we assume that 50% of mine employees would live in Anchorage. This fraction is consistent with employment patterns at other isolated mines for which we have some data, such as Red Dog. In addition, the mines will generate major indirect and induced jobs and income in Anchorage because of economic multiplier effects. The mines and their employees will purchase goods and services from

¹⁸ Mat-Su Borough, personal communication, September 2008; author calculations.

Anchorage businesses. In turn, these businesses and their employees will purchase a share of their goods and services in Anchorage. The process continues with some money “leaking” out of the Anchorage economy during each round of spending.

Based on the above assumptions and projected spending amounts, our analysis indicates that more than 500 jobs for Anchorage residents would be created by 2017, and between 1,500 and 2,000 jobs would be created after 2027. Figure 3 shows the total employment of Anchorage residents associated with each mine.

Figure 3. Projected average annual employment of Anchorage residents due to new mining activity and multiplier effects, by mining project

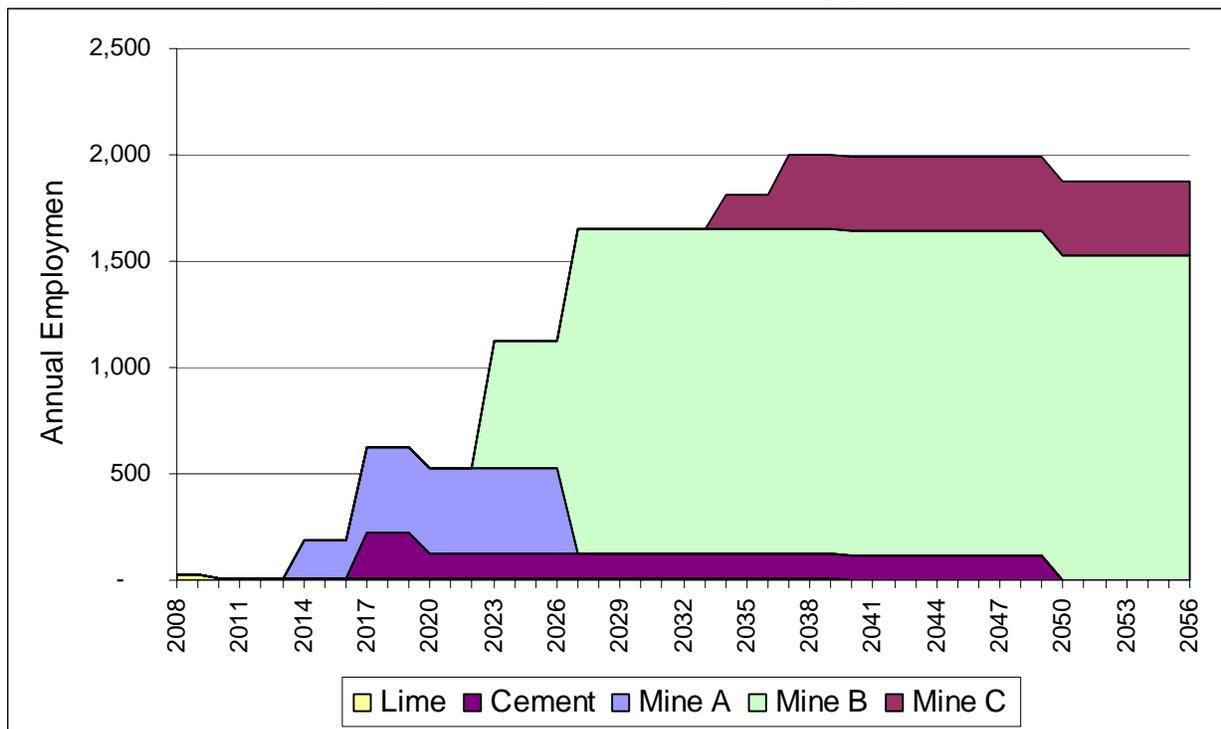


Table 5 shows how the total person-years of employment during the life of the mine projects would be distributed among industries. The industry categories are defined by the North American Industrial Classification System (NAICS).¹⁹ Most of the projected new jobs that would be held by Anchorage residents are in two economic sectors: mining itself, and “professional, scientific, and technical services” (PST). These PST jobs include engineers, accountants, lawyers, computer systems designers, public relations people, and several other categories of professionals.²⁰ Other industry sectors with significant numbers of jobs include management, finance, and health care – all of which are substantially “based” in Anchorage. All of the above industry sectors provide relatively high-wage jobs.

¹⁹ See <http://www.census.gov/eos/www/naics/index.html> for detailed explanations of NAICS industry categories.

²⁰ The PST category is code 54 in the North American Industry Classification System (NAICS). A full listing of all jobs in this sector can be found at <http://www.census.gov/cgi-bin/sssd/naics/naicsrch?chart=2007>

Table 5. Projected cumulative person-years employment of Anchorage residents due to new mining activity and multiplier effects, by industry

NAICS Code and Sector Name	Mine A	Mine B	Mine C	Lime	Cement	Total
72 Accommodation and Food Services	122	1,247	166	9	102	1,646
56 Admin, Support, Waste Mgmt Svcs	147	2,310	162	18	213	2,850
11 Agriculture, Forestry, Fishing and Hunting	5	92	6	0	5	109
71 Arts, Entertainment, and Recreation	62	898	84	6	59	1,109
23 Construction	15	281	17	0	4	317
61 Educational Services	18	175	30	2	18	243
52 Finance and Insurance	149	2,772	175	9	97	3,202
62 Health Care and Social Assistance	211	2,135	345	20	210	2,921
51 Information	40	665	48	4	34	790
55 Management of Companies and Enterprises	133	4,751	127	8	66	5,084
31-33 Manufacturing	19	530	29	4	79	661
21 Mining, Quarrying, Oil & Gas Extraction	1,475	10,612	3,870	225	2,089	18,271
81 Other Services (except Public Administration)	141	1,864	205	14	150	2,373
54 Professional, Scientific, and Technical Services	1,317	8,543	1,247	23	297	11,428
92 Public Administration	130	2,431	137	9	109	2,817
53 Real Estate and Rental and Leasing	136	1,786	167	12	112	2,213
44-45 Retail Trade	147	1,406	249	15	154	1,970
48-49 Transportation and Warehousing	67	1,414	83	18	92	1,673
22 Utilities	138	2,210	130	11	119	2,608
42 Wholesale Trade	64	2,056	83	10	103	2,316
Total	4,535	48,179	7,359	416	4,113	64,601

To help make these figures more understandable, Table 6 shows the same numbers on an average annual basis. On average, over the several decades of the study period, our analysis indicates that almost 1,500 jobs would be created and could be held by Anchorage residents. It is important to remember that the actual number of projected jobs varies greatly over time, as shown in Figure 3, above.

**Table 6. Projected average annual employment of Anchorage residents
due to new mining activity and multiplier effects, by industry**

NAICS Code and Sector Name	Mine A	Mine B	Mine C	Lime	Cement	All five Combined
72 Accommodation and Food Services	9	37	7	0	3	37
56 Admin, Support, Waste Mgmt Svcs	11	68	7	1	6	65
11 Agriculture, Forestry, Fishing and Hunting	0	3	0	0	0	2
71 Arts, Entertainment, and Recreation	5	26	4	0	2	25
23 Construction	1	8	1	0	0	7
61 Educational Services	1	5	1	0	1	6
52 Finance and Insurance	11	82	8	0	3	73
62 Health Care and Social Assistance	16	63	15	1	6	66
51 Information	3	20	2	0	1	18
55 Management of Companies and Enterprises	10	140	6	0	2	116
31-33 Manufacturing	1	16	1	0	2	15
21 Mining, Quarrying, Oil & Gas Extraction	113	312	168	7	63	415
81 Other Services (except Public Administration)	11	55	9	0	5	54
54 Professional, Scientific, and Technical Services	101	251	54	1	9	260
92 Public Administration	10	71	6	0	3	64
53 Real Estate and Rental and Leasing	10	53	7	0	3	50
44-45 Retail Trade	11	41	11	0	5	45
48-49 Transportation and Warehousing	5	42	4	1	3	38
22 Utilities	11	65	6	0	4	59
42 Wholesale Trade	5	60	4	0	3	53
Total	349	1,417	320	13	125	1,468

Note to table: “average annual employment” for each mine reflects the employment during years when that mine is operating. The number for the “All five Combined” column does not equal the simple arithmetic sum of the numbers for each mine because during some years not all mines are operating.

Appendix: Notes on Methodology

The benefits to Anchorage from the potential mines described by Metz were estimated using IMPLAN economic impact software. IMPLAN is not designed to estimate the impacts on one region of an economic activity in another but because of the economic structure of Alaska we were able to use IMPLAN to perform this type of analysis.

Specifically, Anchorage's role as the economic hub allows us to estimate the flows from the interior region to Anchorage because other Alaska regions would supply a negligible amount of support for mines in the interior. This assumption allows us to estimate the economic impact on Anchorage as the economic impact on the entire state minus the economic impact on the interior region. For this analysis the interior region is defined as an aggregation of the Fairbanks North Star Borough, the Denali Borough, and the Matanuska-Susitna Borough.

This approach is useful at getting a rough idea of the magnitude of impacts on Anchorage but has two notable flaws:

- Not all economic impacts occurring inside Alaska and outside the Interior occur in Anchorage. These impacts are likely small, but still cause the impacts to Anchorage to be slightly overstated.
- IMPLAN averages characteristics of industries within a region meaning the characteristics of the industries in the Alaska model are different than in the Interior model. This matters because the economic impacts of an industry's output will be different for the two regions' models. It is uncertain whether this effect will cause the economic impacts on Anchorage to be over or under estimated. This error is expected to be most significant in the analysis of which Anchorage industries are most impacted but the error is expected to be relatively minor compared to the overall magnitude of the impact on Anchorage.

This analysis investigated five mining operations. Three were predicted by Metz and two were assumed by the Mat-Su Borough. Metz's three mines are coded MM1, MM2 and MM3. An expanded discussion of the mines and Metz's methodology can be found in his report. The Mat-Su Borough asked us to assume a Globe Creek lime production and a Globe Creek cement production. These are coded GCL and GCC respectively.

Metz estimated and itemized the costs associated with his three mines. Economic impact is driven by the inputs to an economic activity which can be measured by its costs. For this reason the economic impact of the three mines is estimated with the cost of the mines as the "output" of the activity in the IMPLAN model. The associated rents and profits are left out of this economic impact analysis because the magnitude of the associated impacts is completely dependent on volatile mineral prices and the allocation of the rents and profits is dependent on the corporate structure, land ownership and local taxes.

Metz provided basic information on the operating cost of each mine as well as the expected annual production and life of the mine. Table 7 shows the production characteristics and costs of each of the Metz mines.

Table 7. Characteristics of Metz's Mines

Mine Name	MM1	MM2	MM3
Mine Type	Sedimentary	Kuroko	Porphyry
Mineral	Zn-Pb	Cu-Zn-Pb-Ag-Au	Cu-Mo-Au-Ag
First Year of Mine Production	2017	2037	2027
Years to Develop	3	3	4
Mine Life (years)	10	20	30
Mining Rate (mt/day)	6,100	2,500	200,000
Mining Rate (mt/year)	2,226,500	912,500	73,000,000
Concentrate Production (mt/day)	1,000	550	5,150
Concentrate Production (mt/year)	365,000	200,750	1,879,750
Gross Metal Value (year)	\$ 580,000,000	\$ 620,000,000	\$ 5,500,000,000
Annual Gross Revenue (year)	\$ 489,833,919	\$ 497,130,048	\$ 5,522,825,950
Annual Gross Revenue (price adjusted) (year)	\$ 277,128,774	\$ 281,256,637	\$ 3,124,597,795
Employment	250	350	480
Operating Costs			
Mining Costs (\$/mt)	\$ 38.26	\$ 66.02	\$ 10.51
Milling Costs (\$/mt)	\$ 19.03	\$ 31.50	\$ 8.47
Infrastructure Costs (\$/mt)	\$ 21.66	\$ 13.49	\$ 3.94
Total Costs (\$/mt)	\$ 78.95	\$ 111.01	\$ 22.92
Mine Capital Costs			
Mine Working Capital	\$ 18,631,043	\$ 13,174,188	\$ 167,750,580
Heavy Equipment (fixed life)	\$ 37,626,190	\$ 8,616,619	\$ 722,246,307
Mine Rehabilitation	\$ 13,630,572	\$ 2,791,215	\$ 71,581,501
Engineering and Management	\$ 6,023,926	\$ 8,966,973	\$ 43,029,093
Remaining mine Capital	\$ 44,872,273	\$ 40,215,946	\$ 370,255,849
Total Mine Capital	\$ 120,784,000	\$ 79,764,941	\$ 1,374,860,330
Mill Capital Costs			
Mill Working Capital	\$ 9,265,396	\$ 5,454,357	\$ 135,251,710
Light Vehicles (short life)	\$ 2,701,192	\$ 1,978,592	\$ 9,134,026
Remaining Mill Capital	\$ 43,075,727	\$ 30,084,762	\$ 684,233,508
Total Mill Capital	\$ 55,042,315	\$ 37,517,712	\$ 828,619,244
Infrastructure Capital Costs			
Buildings and Structures	\$ 28,590,754	\$ 16,530,036	\$ 176,531,836
Remaining Infrastructure Capital	\$ 51,234,025	\$ 28,636,151	\$ 593,680,311
Total Infrastructure Capital	\$ 79,824,779	\$ 45,166,187	\$ 770,212,147
Condensed Capital Costs			
Sum of Working Capital	\$ 27,096,439	\$ 18,628,545	\$ 303,002,290
Sum of Remaining Mine, Mill and Infrastructure Costs	\$ 139,182,020	\$ 98,939,860	\$ 1,648,169,484
Sum of Total Mine, Mill and Infrastructure Costs	\$ 255,651,090	\$ 156,448,840	\$ 2,973,691,721
Exploration Costs	\$ 25,565,109	\$ 15,644,889	\$ 297,370,416
Overall Capital Cost	\$ 281,216,199	\$ 172,093,729	\$ 3,271,074,576

Changes were made to the IMPLAN model to reflect the structure of each individual mine. First, all rents for the associated IMPLAN sectors were eliminated because the output put value being used is based on mine costs, not sales. Second, the ratios of mine output, employment and employee compensation were altered in IMPLAN to reflect the cost and employment structure predicted by Metz. These ratios were altered for both the Alaska model and the Interior model. Each of Metz's mines had a separate Alaska and Interior IMPLAN run.

The analysis was done in a manner that would allow for estimating the economic impact a mine with variable annual output. This was done by estimating the economic impact of \$1 million of output/cost for each mine to establish a rate of economic impact. This rate of economic impact per \$1 million of output/cost is then multiplied by the actual estimated annual mine output/cost measured in millions of dollars to generate the economic impact of the mine at an level of output.

The economic impact of \$1 million of output/cost was estimated for both the Alaska and Interior regions. The difference of the economic impact in Alaska and the economic impact in the Interior region was used as an estimate of the economic impact in Anchorage per \$1 million of output/cost for each mine. This value was multiplied by the amount of mine output/cost for each mine over the study period to estimate the future economic impacts of the Metz's mines on Anchorage.

The economic impact of the Globe Creek lime and cement production was estimated in a slightly different manner for two reasons. First, no information on the cost of operation was available. Instead, the output of the operations was measured by multiplying the expect prices of the productions (lime and cement) by their respective outputs. Unlike the Metz mines, this method of measuring output includes profits and rents. Second, no lime or cement industry currently exists in Alaska meaning that the industries needed to be created in IMPLAN. This was done by using the national ratios of output, employees, employee compensation, profits and economic rents and the expected output of the Globe Creek productions. Once the IMPLAN model was modified by creating the lime and cement manufacturing industries the economic impact was estimated the same way as it was for Metz's mines.

The Anchorage industries with the largest economic impacts were measured by those industries with the greatest amount of expect associated employment. The increase in Anchorage employment by industry was estimated in a similar manner that the overall economic benefits were estimated; the expected employment by industry in the Interior was subtracted from the expected employment by industry in Anchorage.

The employment by industry was estimated for every \$1 billion in output for each industry. This allows for estimating the employment by industry by year associated with each mine. It is reported in total "man-years" of employment by industry and by average annual employment during each mines operating life.