

Mineral Occurrence Revenue Estimation and Visualization Tool A cooperative project between the University of Alaska – Fairbanks (UAF) and the Michigan Tech Research Institute (MTRI)



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Under a cooperative project between MTRI and UAF, we have created a flexible and mapbased Mineral Occurrence Revenue Estimation and Visualization (MOREV) tool for existing and planned Alaska and Canadian railroads, including the proposed Alaska-Canada Rail Link. Estimates of carbon emissions for multimodal shipping of mineral commodities are included in a flexible tool module.

MOREV uses existing high-quality geospatial data on metallic and non-metallic mineral resources, and other commodities for Alaska, Yukon, and British Columbia to estimate potential future revenues under pre-defined and user-generated scenarios within the existing and future railroad corridors in the region.



Fig. 2 (above): The Alaska Railroad, part of the network, along with proposed ACRL routes, that the tool uses for a multi-modal shipping network for mineral and related freight.

Uccurence: Comeback; Gray cagle				Selected Occurrences (fid name model)	Deposit	Model Summary				
Uepost Model	Hevenue Parameters		Summary	27: Independence: 36a +	DM	Model Name		EGMV 10%	EGMV 50%	EGMV 90%
Model number: • 36a	Change commodily prices Reca	curate	 Base production values 	28: Lucky Shot: Willow Creek Mines Inc.: 36a						
Model name: LOW-SULFIDE Au-QUARTZ VEINS	GMV (\$USD): \$24,3	000,08	Mina He facard 0	23: Wat Baby; Willow Creek Mines Inc.: 36a	36a	LOW-SULFIDE AU-QUARTZ VEINS	104	\$32,214	\$2,577,120	\$105,165,
Commodition: /field Shar	Development Factors		Destados esta (e T idea)	30. Gold Builder, New Builder, Neady Builder, V 31: Eem: Eem Gold Mining Co.: Eem Gold Lea	39a	PLACER Au-PGE	88	\$6,397	\$999,460	\$54,596,
	Control optimiter in a control		Production rate (m17/day);	32: Martin: Alaska Free Gold Mining Co.: 36a	NA	Not available	45	\$0	\$0	
Manuficketter	Mine Juny Small Ones Dk		Concentrate tonnage (m1): 0.	33: Gold Cord; Gold Cord Mining, Milling, and F	23	BASALTIC Cu	23	\$0	\$0	
	Sing Oper-k		Freight volume (mT/day): 0.	34: Mabel: 36a	20c	PORPHYRY Cu-Au	8	\$6,965,000	\$44,510,000	\$149,980,
Percentile: 50 -	Mine recovery rate:	0.90		 High Brade; Kloss and Associates; Kloss a 20. March 20. 	22c	POLYMETALLIC VEINS	8	\$469	\$67,613	\$5,126
Reserve tormage (mT) 27.216	Mill pre puero saler	0.90		 Wei dukri 338 Grüchtake Brüch and Willow Dreek area." 	8a	PODIFORM CHROMITE	6	\$22	\$479	\$4
			Scenario length adjusted using	38. Wolverine: 36a	17	PORPHYRY Cu	3	\$1,236,900	\$15,876,000	\$161,373
Transportation Cost parameters			Scenario lenger aquato valua	39: Panhandle: 36a	24a	CYPRUS MASSIVE SULFIDE	2	\$8,820	\$380,800	\$7,684
Character Daniel	CODMING MART COM	40	Scenario length (vears): 10	40: Golden Top; Gold Top; Gold Top Mining C	21a	PORPHYRY Cu-Mo	2	\$5,001,852	\$35,883,500	\$136,403
Cristole Model	Continue (hum conti		Processed in the I 27,21	41: Loneback: Gray Lage: 36a 42: Dischart NA	6a	KOMATIITIC NI-Cu	2	\$49,904	\$865,856	\$11,556
Distance Rep) MiniTain C.02 Emissi	inter ImTi Madal Total Co	at 121	Processed tomoge (iii) 27,21	43 Golden Light NA	21b	PORPHYRY Mo. LOW-F	2	\$510,400	\$4,634,200	\$21,112
Rail			Shipped tonnage (mT)	44: Ryan: NA	27d	Simple Sb	2	\$31	\$1,600	\$41
	. 🗖			45 Crainie Creek: Ná	18a	PORPHYRY CU. SKARN-RELATED	1	\$714.000	\$5,569,600	\$31,115
0 10.0177	0	10	Gross revenue \$20.071.00	·	39c	SHORELINE PLACE TI	1	\$0	\$0	
Read				Remove from List	15b	Sn VEINS	1	\$2,822	\$104,832	\$1,738
0 \$0.0340	0 2	\$0	Show/baloulate Camm costs	2	15c	Sn GREISEN	1	\$45.696	\$677,376	\$5,132
				∠00fh10	39b	PLACER PGE-Au	1	\$219	\$14.021	\$300
Inland Waters	_		,	Evaluate Individual Occurrence	25a	HOT-SPRING Au-AG	1	\$129,062	\$3,489,850	\$25,812,
0 \$0.0320	0 🗉	\$0	Trans. costs \$		18b	Cu SKARN	1	\$1,666	\$66,640	\$2,121,
Ocean Going Vessel			Miss: adjustment (+/-)	Change Commodity Prices Recoloutere	24b	BESSHE MASSIVE SULFIDE	1	\$538	\$23,100	\$548.
4				the get of the second sec	26a	CARBONATE-HOSTED Au-Ag	1	\$39,183	\$658,219	\$4,891.
40.0015	0	*0	Balance \$20.071.00	EGMV refers to estimated GMV, which is GMV/multiplied by Probability of Davalisement. For the 10th and 50th parcentiles.	28a	KUROKO MASSIVE SULFIDE	1	\$3,780	\$235,980	\$6,371
Intermodal Transfers			620,071,00	Ptobability of Development is 0.001. For 10th percentile, it is	27b	ALMADEN Ho	1	\$0	\$0	
Rail O Road # 0 SimT \$45000		\$0	,	0.0005.		TOTAL:	306	\$14,749,054	\$116,636,246	\$731.078
Ind College I In Start \$10000		10	Show graphs >>							

Fig. 1 (above): Example of the MOREV tool input tables, used to calculate revenue scenarios and transportation carbon emissions.



Within the tool, users are able to select particular resource types and locations to retrieve what the estimated extractable resource amounts, rail freight, and associated revenue would be if an operational railroad existed nearby. Potential railroad routes can be displayed and customized by users to quickly evaluate the enhanced economic feasibility of currently stranded resources.

Fig. 3 (left): The GIS interface to the MOREV tool, showing mineral deposit locations in Alaska, Yukon, and B.C.



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The revenue estimation equations and relationships underlying the tool are based on expert input from a wide variety of stakeholders in the Alaska-northwest Canada region. Present military and future national security usage, including natural disaster preparedness, of a trans-continental railroad system will also be also modeled. A web-mapping version of the tool to help users understand the tool's functionality is being developed. A site-specific desktop GIS version, for detailed, in-depth analysis, is now available by contacting Colin Brooks, Dr. Paul Metz, or Dr. Robert Shuchman (see below).



Fig. 4 (above): Examples of the detailed emissions tables used to calculate potential carbon emissions related to mineral freight shipping.

This project is part of a larger cooperative international investigation linking Alaska and Canada rail systems involving the University of Alaska, Michigan Technological University, and the University of Calgary.

Collaborators:

UAF - Dr. Paul Metz, Mark Taylor, P.E. MTRI - Dr. Robert Shuchman, Colin Brooks, Helen Kourous-Harrigan, Eric Keefauver, Michael Billmire, Richard Dobson, Nathaniel Jessee, and Michelle Wienert Project Consultant - Leon Van Wyhe



Fig. 5 (above): An example of displaying a revenue & shipping scenario in Google Earth using the tool's visualization capabilities.

Transportation Carbon Accounting Module (TCAM): With the recent increased focus on energy efficiency and carbon accountability, the revenue estimation tool also incorporates carbon accounting to help users minimize carbon footprints. This includes calculating carbon footprints of user-selected multi-modal networks to ship mineral and supporting freight to continental and international destinations.

Fig. 6 (right): The Fort Knox Gold mine near Fairbanks, AK - the potential revenue impacts of developing new resources such as these will be easier to calculate with the MOREV tool.



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