



TECHNICAL MEMORANDUM

TO: Mark Davis/Jeff San Juan, AIDEA
FROM: Maryellen Tuttell, AICP/Rich Pribyl, PE, DOWL
DATE: February 26, 2018
PROJECT: Ambler Access Project, Cost Estimates

AMBLER ACCESS COST ESTIMATES

Thank you for your inquiry about the road cost estimates for the proposed Ambler Access Project. We recently provided similar information to a person asking questions about how these estimates compare to cost estimates used by the Alaska Department of Transportation & Public Facilities on a different project, the Western Alaska Access Planning Study (WAAPS).

Estimating costs for constructing roads in undeveloped parts of Alaska is difficult as there are many details that can affect construction costs and little comparable data for similar projects. This paper describes some of the factors affecting road construction costs.

Level of Field Data and Engineering Design

Costs can be estimated using many different assumptions for factors that affect pricing, such as road profile details, the level of environmental and geotechnical information available, and even the regulatory review processes that can affect the cost of design and construction. When estimating road costs with limited LiDAR/survey data and field information, such as on WAAPS, costs are estimated very conservatively. As you refine alignments and gather relevant field information, cost estimates can be refined and are generally lower.

By way of background, the WAAPS estimates were prepared without field investigations and used a 20% contingency given the level of data available. AIDEA's recent cost estimates for the Ambler Access project included extensive field reconnaissance, use a 10% contingency factor, and are based on a much different level of data.

The Ambler Access project cost estimates included in the SF299 application are done on a 20% design (plan and profile) using LiDAR and topographic survey data, which enabled us to more accurately estimate material needs. The 20% design supported with a substantial amount of field work, including geotechnical investigations and aerial alignment revisions. This level of detail was not available for WAAPS estimates.

Due to this higher level of detail in computing estimates, we were able to take advantage of good soils where we could cut and generate material for use in fill portions of the embankment. Through balancing of cut and fill quantities, we were able to identify 11.5 million cubic yards of cut material usable as fill; this resulted in a \$28.2 million cost savings alone (based on difference in cut and fill unit costs). We are also able to align the road along better soils and avoid wetlands and poor soils, which allowed for use of a reduced road thickness and further reduced material costs.

TECHNICAL MEMORANDUM

In contrast, the road to Nome was a very conceptual estimate; no design work was done and cost estimates assumed a consistent road thickness for the entire corridor. As noted in the Executive Summary of the WAAPS 2011 report:

Initial planning of access between Fairbanks to Nome relied on existing crude topographic mapping and no field verification of engineering and environmental conditions. The expansive study area required use of readily available data, such as United States Geological Survey mapping, that was often imprecise. Now that a final corridor has been selected, next steps should focus on a more precise review of the initial stage between Manley Hot Springs and Tanana, with better mapping, in-field investigations, and more stakeholder involvement, particularly by those most directly affected by the first stage between Manley Hot Springs and Tanana.

This caveat proved true in construction of the first phase in WAAPS, the road to Tanana. The WAAPS report conservatively estimated a single-lane road at \$69 million (54 miles at \$1.3 million/mile). As additional information was gathered and the route refined, DOT&PF constructed a single-lane pioneer road to Tanana for \$13.1 million for 35 miles, or \$0.37 million/mile.

Bridge Cost Estimates

Similar to the discussion above, bridge cost estimates in the WAAPS study were also very conservative and based on available desktop information. The WAAPS study estimate included the cost for 2-lane, concrete-girder bridges based on a conservative \$375/square-foot unit cost and include 45% in markups for various contingencies and assumed separate mobilization efforts. As noted in the WAAPS report, changing the width assumptions for bridges along the road to Nome would result in a reduction of \$100 million, and using Bailey bridges for river and stream crossings would have reduced costs by almost \$200 million; these potential reductions were not incorporated into the cost estimates for the project. Bridges required for the road to Nome are also generally much larger than required for the Ambler Access project and include five bridges with spans estimated greater than 1,000 feet, including the Yukon River bridge estimated at 5,000 feet. Comparatively, all large bridges required for the Ambler Access project have estimated spans less than 1,000 feet, with all but two of the large bridges having estimated spans less than 500 feet.

The bridge cost estimates for the Ambler Access project included in the SF299 are based on much better data. As additional field and design work was completed on the Ambler Access project, proposed bridge widths were reduced to 1-lane, and field survey and alignment investigations allowed for reduction in the originally assumed bridge lengths. Many of the small bridges were also eliminated and replaced with more cost-effective culverts. Bridge costs only account for 12% of the total project cost in the SF299 full-build cost estimate.

TECHNICAL MEMORANDUM

Ambler Access Cost Estimates

The cost estimate for each phase of the Ambler Access project are listed in the table below and attached.

AIDEA 2017 Cost Estimates With Bridges/10% Contingency		
Option	Total Cost (million \$)	Cost/Mile (million \$)
Phase 1: 1-Lane Pioneer Road	\$281.7	\$1.33
Phase 2: 1-Lane Full Embankment	\$313.2	\$1.48
Phase 3: 2-Lane Full Embankment	\$379.0	\$1.80

Note: One-lane bridges.

To make this more directly comparable to the WAAPS estimates, we have provided a revised cost with bridge costs removed and a 20% contingency used so that the costs per mile for road construction are more comparable to the roadway costs estimated for WAAPS.

Revised/Comparable AIDEA 2017 Cost Estimates Without Bridges/20% Contingency (Similar to WAAPS Estimates)		
Option	Total Cost (million \$)	Cost/Mile (million \$)
Phase 1: 1-Lane Pioneer Road	\$245.5	\$1.16
Phase 2: 1-Lane Full Embankment	\$279.9	\$1.33
Phase 3: 2-Lane Full Embankment	\$364.0	\$1.73

As you can see, the full buildout estimate for a 2-lane road comes in at \$1.73 to \$1.80 million per mile. We believe that these construction cost estimates for Ambler Access are reasonable and conservative when compared to other remote road studies and with the road to Tanana and other remote road construction projects.

For comparison, WAAPS estimates from the 2010 Corridor Planning Report and 2011 Corridor Staging and Alternatives Report are summarized below. As discussed above, bridges make up a larger portion of the overall cost estimate (21% of the 2011 cost estimate) compared to the Ambler Access estimate due to more and larger water bodies, more expensive bridge types assumed, 2-lane bridges versus 1-lane bridges, and a lower level of actual field environmental and design information.

TECHNICAL MEMORANDUM

WAAPS Cost Estimates (revised to 2017\$) With Bridges/20% Contingency		
Option	Total Cost (million \$)	Cost/Mile (million \$)
2010 Original Estimate, Route 2b	\$1,951	\$4.34
2010 Refined Estimate, Route 2b	\$2,060	\$4.12
2011 Costs Minimized Estimate*	\$1,042	\$2.11

Note: Two-lane bridges. *Excludes Stage 1 where primitive road exists.

WAAPS Cost Estimates (revised to 2017\$) Without Bridges/20% Contingency		
Option	Total Cost (million \$)	Cost/Mile (million \$)
2010 Original Estimate, Route 2b	\$1,566	\$3.48
2010 Refined Estimate, Route 2b	\$1,661	\$3.32
2011 Costs Minimized Estimate*	\$821	\$1.66

Note: *Excludes Stage 1 where primitive road exists.

Summary

This technical memorandum compares AIDEA's 2017 cost estimate for the Ambler Access project to previous WAAPS cost estimates and to recent costs for rural pioneer road construction in interior Alaska. Considering the level of information available to base cost estimates on, the differences in the river crossings between the two projects, and the other information discussed above, the Ambler Access cost estimates appear to be reasonable and consistent with other cost estimates for remote road construction.

Enclosures: Phase I – III Cost Estimates
Cross Sections for Phase I – III
Cost Estimate Technical Memorandum

AMBLER MINING DISTRICT INDUSTRIAL ACCESS PROJECT				
Preferred Corridor, Phase 1				
1-Lane Pioneer, 1-Lane Bridges				
ITEM DESCRIPTION	UNIT	QUANTITY	UNIT COST	AMOUNT
CLEARING	ACRE	2,080	\$4,400	\$9,152,000
EXCAVATION (CUT)	CY	5,116,000	\$6.00	\$30,696,000
EMBANKMENT (FILL)	CY	8,014,000	\$8.45	\$67,719,000
AGGREGATE SURFACE COURSE (D1)	CY	383,000	\$11.45	\$4,386,000
TURNOUTS	EACH	19	\$8,700	\$166,000
LARGE BRIDGES	LF	4,400	\$6,400	\$28,160,000
MEDIUM BRIDGES	EACH	13	\$649,000	\$8,437,000
SMALL BRIDGES	EACH	2	\$335,000	\$670,000
MAJOR CULVERT (10'-20')	EACH	10	\$219,000	\$2,190,000
MODERATE CULVERT (4'-10')	EACH	13	\$92,000	\$1,196,000
MINOR CULVERT (36")	EACH	2,637	\$23,000	\$60,651,000
LANDING STRIPS	EACH	3	\$754,000	\$2,262,000
MAINTENANCE STATIONS	EACH	3	\$13,452,000	\$40,356,000
			SUBTOTAL	\$256,041,000
			10% CONTINGENCY	\$25,605,000
			TOTAL COST	\$281,646,000
MATERIAL ROYALTIES		FILL \$/CY		
State-owned/conveyed land:	61%	\$6.50		
BLM/NPS/Native-owned/conveyed land:	39%	\$11.50		

Assumptions:

- Estimate is for the Preferred Corridor option through Gates of the Arctic National Park and Preserve as proposed for the SF299 permit application.
- Western termini is Kogoluktuk River; total length of road is 196 miles and quantities are reduced accordingly from full build-out estimate.
- Maintenance station and landing strip proposed near Ambler River would be relocated to western end of corridor at a location to be determined.
- Blended unit cost of \$8.45/CY used for embankment assumes 61% of material will come from State land with a unit price of \$6.50/CY and 39% will come from non-State Land with a unit price of \$11.50/CY, including a \$5/CY royalty; percentages based on land ownership of identified material sites.
- Embankment fill quantity reduced by the amount of estimated cut generation, assuming all cut is usable material.
- Embankment fill cost includes material produced and in-place.
- Embankment excavation includes excavated material placed as fill.
- Currently have material sites identified for >40 million CY of fill.
- Estimate assumes only 50% of total roadway area will need to be cleared.
- Embankment surface is 16-feet wide, including one 12-foot lane and 2-foot shoulders.
- Bridges are 1-lane wide with a 23-foot deck width.
- Costs for right-of-way acquisition not included.
- Includes 10% contingency as shown.
- All costs are in 2017 dollars.

AMBLER MINING DISTRICT INDUSTRIAL ACCESS PROJECT				
Preferred Corridor, Phase 2				
1-Lane Full-Embankment, 1-Lane Bridges				
ITEM DESCRIPTION	UNIT	QUANTITY	UNIT COST	AMOUNT
CLEARING	ACRE	2,080	\$4,400	\$9,152,000
EXCAVATION (CUT)	CY	5,116,000	\$6.00	\$30,696,000
EMBANKMENT (FILL)	CY	11,404,000	\$8.45	\$96,364,000
AGGREGATE SURFACE COURSE (DI)	CY	383,000	\$11.45	\$4,386,000
TURNOUTS	EACH	19	\$8,700	\$166,000
LARGE BRIDGES	LF	4,400	\$6,400	\$28,160,000
MEDIUM BRIDGES	EACH	13	\$649,000	\$8,437,000
SMALL BRIDGES	EACH	2	\$335,000	\$670,000
MAJOR CULVERT (10'-20')	EACH	10	\$219,000	\$2,190,000
MODERATE CULVERT (4'-10')	EACH	13	\$92,000	\$1,196,000
MINOR CULVERT (36")	EACH	2,637	\$23,000	\$60,651,000
LANDING STRIPS	EACH	3	\$754,000	\$2,262,000
MAINTENANCE STATIONS	EACH	3	\$13,452,000	\$40,356,000
			SUBTOTAL	\$284,686,000
			10% CONTINGENCY	\$28,469,000
			TOTAL COST	\$313,155,000
MATERIAL ROYALTIES		FILL \$/CY		
State-owned/conveyed land:	61%	\$6.50		
BLM/NPS/Native-owned/conveyed land:	39%	\$11.50		

Assumptions:

- Estimate is for the Preferred Corridor option through Gates of the Arctic National Park and Preserve as proposed for the SF299 permit application.
- Western termini is Kogoluktuk River; total length of road is 196 miles and quantities are reduced accordingly from full build-out estimate.
- Maintenance station and landing strip proposed near Ambler River would be relocated to western end of corridor at a location to be determined.
- Blended unit cost of \$8.45/CY used for embankment assumes 61% of material will come from State land with a unit price of \$6.50/CY and 39% will come from non-State Land with a unit price of \$11.50/CY, including a \$5/CY royalty; percentages based on land ownership of identified material sites.
- Embankment fill quantity reduced by the amount of estimated cut generation, assuming all cut is usable material.
- Embankment fill cost includes material produced and in-place.
- Embankment excavation includes excavated material placed as fill.
- Currently have material sites identified for >40 million CY of fill.
- Estimate assumes only 50% of total roadway area will need to be cleared.
- Embankment surface is 20-feet wide, including one 12-foot lane and 4-foot shoulders.
- Bridges are 1-lane wide with a 23-foot deck width.
- Costs for right-of-way acquisition not included.
- Includes 10% contingency as shown.
- All costs are in 2017 dollars.

AMBLER MINING DISTRICT INDUSTRIAL ACCESS PROJECT				
Preferred Corridor, Phase 3				
2-Lane Full-Embankment, 1-Lane Bridges				
ITEM DESCRIPTION	UNIT	QUANTITY	UNIT COST	AMOUNT
CLEARING	ACRE	2,240	\$4,400	\$9,856,000
EXCAVATION (CUT)	CY	11,519,000	\$6.00	\$69,114,000
EMBANKMENT (FILL)	CY	12,332,000	\$8.45	\$104,206,000
AGGREGATE SURFACE COURSE (DI)	CY	662,000	\$11.45	\$7,580,000
TURNOUTS	EACH	20	\$8,700	\$174,000
LARGE BRIDGES	LF	4,760	\$6,400	\$30,464,000
MEDIUM BRIDGES	EACH	15	\$649,000	\$9,735,000
SMALL BRIDGES	EACH	3	\$335,000	\$1,005,000
MAJOR CULVERT (10'-20')	EACH	11	\$219,000	\$2,409,000
MODERATE CULVERT (4'-10')	EACH	15	\$92,000	\$1,380,000
MINOR CULVERT (36")	EACH	2,869	\$23,000	\$65,987,000
LANDING STRIPS	EACH	3	\$754,000	\$2,262,000
MAINTENANCE STATIONS	EACH	3	\$13,452,000	\$40,356,000
			SUBTOTAL	\$344,528,000
			10% CONTINGENCY	\$34,453,000
			TOTAL COST	\$378,981,000
MATERIAL ROYALTIES		FILL \$/CY		
State-owned/conveyed land:		61%	\$6.50	
BLM/NPS/Native-owned/conveyed land:		39%	\$11.50	

Assumptions:

- Estimate is for the Preferred Corridor option through Gates of the Arctic National Park and Preserve as proposed for the SF299 permit application.
- Western termini is Ambler River; total length of road is 211 miles.
- Blended unit cost of \$8.45/CY used for embankment assumes 61% of material will come from State land with a unit price of \$6.50/CY and 39% will come from non-State Land with a unit price of \$11.50/CY, including a \$5/CY royalty; percentages based on land ownership of identified material sites.
- Embankment fill quantity reduced by the amount of estimated cut generation, assuming all cut is usable material.
- Embankment fill cost includes material produced and in-place.
- Embankment excavation includes excavated material placed as fill.
- Currently have material sites identified for >40 million CY of fill.
- Estimate assumes only 50% of total roadway area will need to be cleared.
- Embankment surface is 32-feet wide, including two 12-foot lanes and 4-foot shoulders.
- Bridges are 1-lane wide with a 23-foot deck width.
- Costs for right-of-way acquisition not included.
- Includes 10% contingency as shown.
- All costs are in 2017 dollars.