

Construction Cost Estimates

We are not construction professionals, but we have had tremendous help from a wide variety of engineers, surveyors, experienced road contractors and many others. The estimates assembled here have often been made from incomplete information, from which we have made certain assumptions that may prove incorrect.

Our current estimate for completing a link between Highways 99 and 101 is \$500 to \$600 million. This estimate is not complete. Work is ongoing. Here's a summary (details follow):

•Land acquisition - nominal	\$	500,000
•Enviromental impact study		1,000,000
•Surveying		
LIDAR		70,000
Three new sections		500,000
•Tunnel (\$108,600,000 - \$192,000,000)		151,000,000
•Bridges		60,000,000
•Paving		44,000,000
•All other costs		<u>224,380,000</u>
		481,000,000
	Contingencies - 24.6%	<u>118,550,000</u>
TOTAL		600,000,000

Land acquisition costs

Virtually all of the required land is Crown Land. There may be some legal and other soft costs, but compared to many other road projects these costs, for this road, will be nominal, say \$500,000.

Environmental impact

Most of the road exists today. However the volume of traffic will increase. Evaluation will continue in 2016. A preliminary provision is \$1,000,000.

Surveying

It is reasonably obvious where the necessary widening will most easily be achieved. Curves may be reduced and blasting may be minimized. As a prelude to surveying, LIDAR may be used. Cost estimate is \$60,000 to \$80,000. Full surveying services will be required for three sections of new road.

We are currently working on updating our surveying estimate, which is now out of date. Our preliminary provision is \$500,000.

Tunnel

Building a tunnel 11.2 m wide and 14.3m high for 3200 m would call for excavation of 51,200 cubic metres of what appears to be basalt, a hard igneous rock.

Our first estimates were based on published statistics using Norway's Laerdahl Tunnel as our reference. That 24.5 km tunnel was completed in November 2000 at a Canadian dollar equivalent of \$185 million, or \$7.6 million per kilometre. We adjusted to 2012 dollars in making our estimate of \$10 million per km. At 3.2 km our then estimate was \$32 million.

Closer to home, the Robertson Tunnel is a twin bore light rail tunnel through the Tualatin Mountains west of Portland, Oregon. The Robertson is 4.7 km long and consists of twin 6.4 m (21 foot) diameter tunnels. There is one station inside. Trains are in the tunnel for about 5 minutes. It was placed into service on September 12, 1998. Construction began in 1993 using drilling and blasting for about one mile into the west side of the hill and boring thereafter. East end construction began in 1994 with a customized tunnel boring machine. The north tunnel borers met after 16 months. The south tunnel borers met after only 4 months. The original estimate for the tunnel was US\$103.7 million. The formal price tag was US\$184 million, largely due to challenges posed by unexpected "loose layers of silt and gravel, and crumbling basalt". On a kilometre basis those costs suggest a per km cost of US\$22 million to \$39 million, being \$70.4 million to \$124.8 million for our 3.2 km tunnel. Converting to Cdn \$ (\$0.88) and factoring inflation (1998 to 2014 or 125.8/91.3) brings this to Cdn\$108.6 million to 192.6 million. Obviously, significant estimation differences can arise because of variations in rock makeup and significant time variations can occur. There are several different sub-types of basalt as well. Based on the forgoing calculations we have chosen the mid-point – \$151 million – as our estimate at this time.

Estimating the cost of the Casement Mountain tunnel is thus a work in progress.

Bridges

A road building company obtained estimates from a leading engineering firm on our behalf. Cost estimates for bridges of varying lengths were estimated as:

100 metres	\$4.8 million
70 metres	2.9 million
50 metres	1.8 million

We learned that bridge building costs are primarily a function of the area of the bridges. since all of the above estimates are for 12 m wide bridges, the cost per square metre can be calculated as:

100 m bridge	$\$4.8/100 \times 12 = \$4,000/\text{m}^2$
70 m bridge	$2.9/70 \times 12 = 3,452/\text{m}^2$
50 m bridge	$1.8/50 \times 12 = 3,000/\text{m}^2$

Obviously, the cost per metre declines as the bridge gets shorter. Based on the above declines, we hypothesized that a 25 m bridge would be $\$2000/m^2$ or \$600,000. Most of the needed bridges are less than 25 m. We estimate 100 bridges for a total of \$60,000,000.

Additional site investigation is needed to more accurately determine the number and size of the bridges required.

Paving

We obtained a rough estimate from a major supplier of asphalt. Including taxes, the total estimate is \$44 million.

All other costs

Existing roads are approximately 3 to 5m wide. These widths will have to be expanded to 10.2m of paving plus 1.0m of gravel shoulder plus about 2m for ditching for a total of 13.2m or 43.3 feet.

Our provisional estimate is based on consultations with experienced road building contractors and former contractors. LIDAR applications, continuing consultations and surveying, will refine this estimate. At \$1.3 million per kilometre, the provisional estimate for the 172.6 km route is \$224.38 million.

-- Third Crossing Society, 2015