

Taseko Mine – Potential Costs to Public Road System from Truck Transport of Mine Concentrate



Introduction and Purpose of Road Review

EIS did not include costs or impacts of year-round transport of mine concentrate on existing public roads

B-train trucks (7 or 8 axles) loaded with 40 tonnes of mine concentrate travelling from mine site to Macalistar

An estimated 15 truck/trailers per day for the life of mine

The public road system to be used was described as consisting of “all-weather roads”

Road maintenance cost appears to be responsibility of the Province of BC and its taxpayers

Existing Forestry Standard Roads

Typical appearance of existing forestry standard road network (4500 Road located near Fish Lake)

Road has been upgraded in sections over many years from original trails

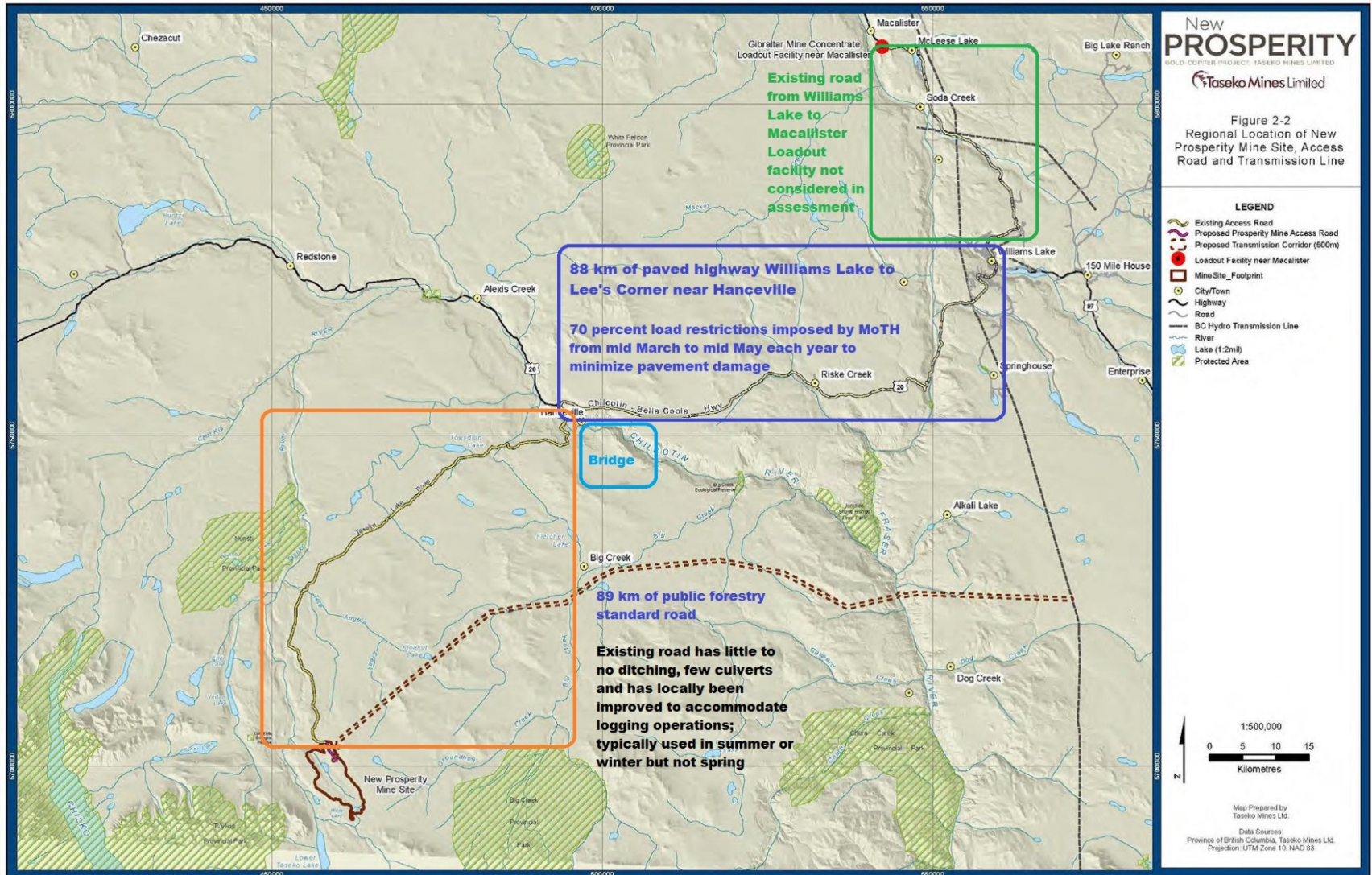
Gravel sources in area are limited

Road alignment crosses through terrain with bog areas and high water table

Few culverts or ditches are in place



Road Upgrade Review – New Prosperity Mine



Road Upgrade Review - Summary

Improvements to the Forestry Standard Roads

- **improve road drainage**
- **increase strength of the road to accommodate heavy loads during “spring thaw”**

Improvements to the paved Highway 20

- **pavement overlay to preserve the strength of the existing road structure**

Annual maintenance

- **manage dust and vegetation (for visibility around corners)**
- **road grading the gravel-surfaced road and snow removal**

Bridge Improvement at Chilcotin River crossing

Road Upgrade Review - Summary

Improvements to Forestry Standard Road

Road width 7m at top with ditching one side

Gravel road structure consisting of

- **300mm (12 inches) thick 25mm sized crushed gravel (WGB) base**
- **600mm (24 inches) thick pit run gravel (200mm size maximum SGSB) subbase**

Culverts at stream crossings or low spots (bogs) or convey water under road



Road Upgrade Review - Summary

Improvements to Forestry Standard Road – 89 km

Drainage - \$0.6 Million

41 km of ditching

47 culverts (600mm diameter)

17 arch culverts (1200mm opening)

1 of 6m long bridge

Road Structure - \$21.2 Million

0.52 million tonnes of WGB

1.30 million tonnes of SGSB

Camp cost for 12 workers (1000 days)



Road Upgrade Review - Summary

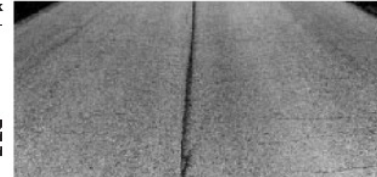
Improvements to paved Highway 20 – 88km

In August 2012 pavement from Williams Lake to Lee's Corner was visually assessed

Two sections of pavement were in poor condition

- from 39km to 42km south of Williams Lake
- from 54km to 70km south of Williams Lake

Centerline crack (still tight).



Edge cracking from weakened subbase and traffic loads.



First stage of wheel path cracking caused by heavy traffic loads.



Load-related cracks in wheel path plus centerline cracking.



Longitudinal cracks

Cracks running in the direction of traffic are longitudinal cracks. Center line or lane cracks are caused by inadequate bonding during construction or reflect cracks in underlying pavement. Longitudinal cracks in the wheel path indicate fatigue failure from heavy vehicle loads. Cracks within one foot of the edge are caused by insufficient shoulder support, poor drainage, or frost action. Cracks usually start as hairline or very narrow and widen and erode with age. Without crack filling, they can ravel, develop multiple cracks, and become wide enough to require patching.

Filling and sealing cracks will reduce moisture penetration and prevent further subgrade weakening. Multiple longitudinal cracks in the wheel path or pavement edge indicate a need for strengthening with an overlay or reconstruction.

Multiple open cracks at center line, wheel paths and lane center.



Road Upgrade Review - Summary

**Improvements to paved
Highway 20 – 88 km**

25mm Overlay \$4.45 Million

**38km of one-lane overlay with 15
year life expectancy**

**Hot mix asphaltic concrete with
minimal base repair**

**2 sections of 2 lanes x 19km at
\$117,000/km (2011/2012 dollars)**

**Source: Ministry of Transportation and
Infrastructure Construction and
Rehabilitation Cost Guide, July 2012**



Road Upgrade Review - Summary

Annual Maintenance Costs

Gravel Surfaced Road \$0.38 Million

- **2 graders operating year round to shape road surface, remove washboard sections and potholes (snow as required)**
- **Vegetation removal for sight lines**
- **Ditch maintenance / cleaning**

Calcium Application \$0.34 Million

- **Liquid calcium delivered by rail to Williams Lake then trucked to apply on gravel surfaced road once per year at rate 1.5-2.0 litres/sq.m. for Dust Control**



Road Upgrade Review - Summary

Annual Maintenance Costs

Pavement Crack Sealing \$0.06 Million

- **500 lineal metres of sealing product/km**
- **Product applied in 20km sections of Highway 20 (Lee's Corner to Williams Lake) in a rotation over the estimated 20 year life of the mine**
- **Crack sealing cost estimated based on \$4.50 to \$5.50/lineal metre with 25% increase in material and labour costs every 5 years.**



Road Upgrade Review - Summary

Initial Road Upgrade Construction Cost

\$26.2 Million

Annual Road Maintenance over mine life

\$0.8 Million/year

Consider cost together with “normal” road maintenance costs that Province of BC would apply against similar projects that develop its resources.

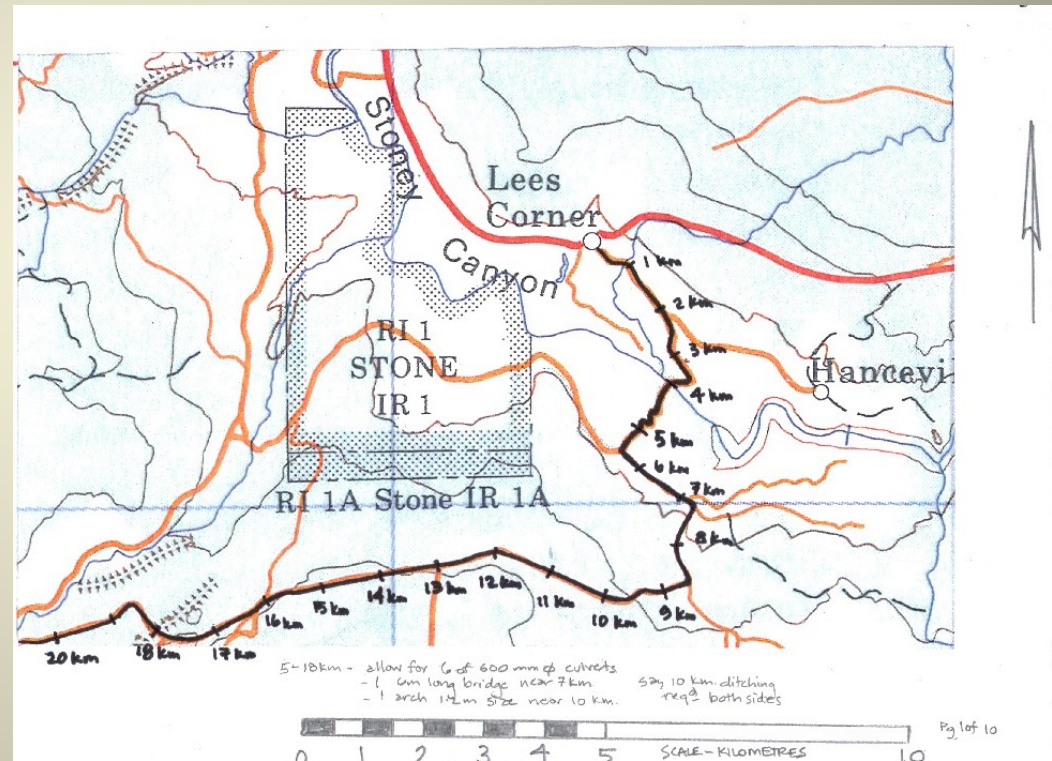
Would these costs be paid through taxation?



Road Upgrade Review - Details

Review was based on

- Observed road conditions
- Review of surficial geology mapping
- Review of topographic maps and Google Earth images
- Stereographic interpretation of aerial photos



Road Upgrade Review - Details

Assumption:

Public Roads would be upgraded to avoid seasonal road bans from mid March to mid May each year

The existing Highway 20 was constructed to a “medium-volume” highway standard consisting of

- **75mm of asphaltic concrete over**
- **150mm of 25mm crushed gravel (WGB) over**
- **150mm of 75mm crushed gravel (WGB) over**
- **300mm of Select Granular Subbase (SGSB) gravel**

It is understood Highway 20 has 70% axle load restrictions placed during spring thaw (ie. Seasonal road bans)

Road Upgrade Review - Details

A gravel pavement structure equivalent to the Highway 20 medium volume pavement structure would consist of

- **300mm layer of 25mm crushed gravel (WGB) base over**
- **600mm layer of pit run gravel (SGSB – 200mm maximum size)**

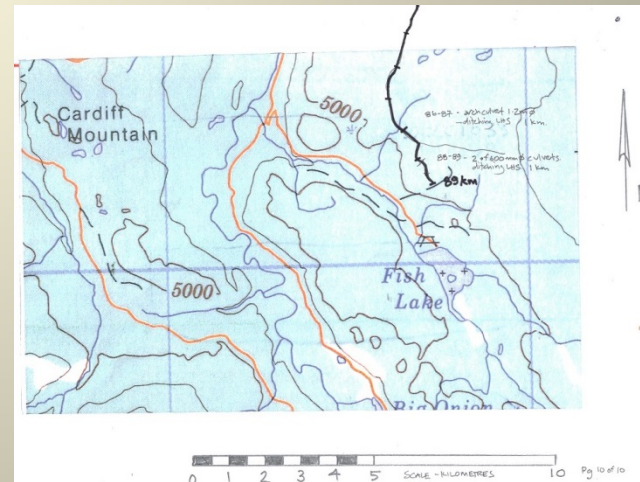
Ditching would be completed to maintain the gravel pavement structure in a fully drained condition year-round (groundwater table at 1.2m below the finished road surface)

It is possible that detailed pavement design taking local soil conditions into account would result in a thinner gravel pavement structure. Intent of this review is to bring attention to the potential magnitude of road improvement costs.

Road Upgrade Review - Details

Gravel Products for WGB and SGSB would be obtained from two sources

- A gravel source near Yunesit'in IR 1 (Stone Reserve) at north end of the project
- Non-PAG (acid-generating) mine overburden material that would be crushed and screened at the mine site



Road Upgrade Review - Details

Highway 20 at Lee's Corner was built on unstable ground and subject to on-going maintenance costs

Some road sections along the Chilcotin River valley, at Vaden Creek and other incised stream road crossings may cross unstable ground or slopes that are susceptible to erosion. Cutslope buttressing may be required as part of road upgrade/maintenance activities.



Road Upgrade Review - Details



Vedan Creek Bridge crossing appears to have been improved to carry B-train tractor-trailer combinations (60 km south of Lee's Corner)



Road Upgrade Review - Details

Chilcotin River bridge replacement cost is estimated at approximately \$1.0 Million

- **No detailed assessment was completed**
- **107m long bridge 8 m wide**
- **\$1200-\$1500 / sq. m for L165 loading capable, steel girder with concrete deck**
- **MoTH estimate = \$2.0 Million (July 2012 Costs)**



Road Upgrade Review - Details

Estimated Cost of Aggregate Production/Transport/Placement

- Cost of developing approximately 1.2 to 1.3 million tonnes of SGSB or 75mm crushed rock suitable for use as SGSB, including stripping of the pit area, would amount to \$3.00/tonne loaded into trucks
- Cost of developing approximately 0.52 million tonnes of 25mm crushed/screened gravel meeting WGB gradation/quality specifications, would amount to \$3.00/tonne loaded into trucks with an estimated crushing cost of \$4.00/tonne.
- Cost of hauling the rock products based on an average speed of 50 km/hour and an average distance of 25 km from respective pit areas, 1 trip/hour, using off-highway trucks and 30 tonne payload would amount to \$4.50/tonne.
- Cost of placing and compacting the rock products would be estimated at \$2.00/tonne
- Estimated cost, therefore, of making and placing SGSB gravel would total \$9.50/tonne
- Estimated cost, therefore, of making and placing WGB gravel would total \$13.50/tonne

Road Upgrade Review - Details

Estimated Associated Road Construction Costs

- Estimated camp costs of \$120.00 - \$150.00/day/person.
- Estimated duration of project using 12 workers, moving 200 tonnes/hour, would total 9100 hours. Assuming average 10 hour days, this would require 1000 days accommodation in a construction camp or equivalent.
- Annual road maintenance would be undertaken by grader(s), requiring minimum 12 hours/day for snow removal and/or grading for an estimated 3 months annually plus a sanding truck for an estimated total of 2600 hours/year at an estimated rate of \$145/hour
- Cost of installing a culvert up to 600mm diameter would be \$500 delivered, would take 2 hours to install using an EX300 excavator at \$185.00/hour for estimated “installed” cost of \$850 /culvert
- Cost of installing a bridge would take between 1 week and 2 weeks at \$5000/day and for 6 m long span, an estimated “installed” cost of \$70,000 /bridge.
- Cost of installing an arch culvert of 1.2m opening would take about 3 days at \$5000/day, an estimated “installed” cost of \$20,000 /arch culvert.
- Cost of ditching or similar road improvement is estimated at \$3700 /km

Road Upgrade Review - Details

Initial Construction Cost

The cost estimate developed to improve the existing forest road to accommodate un-interrupted 40 tonne B-train trucks is based upon constructing the road to a 7 m wide surface. The existing road system contains many vertical and horizontal curves and a narrower road would not enable use of low-bed trucks or the axle turning capabilities of B-train trucks. To estimate the volume of WGB gravel, an average width of 8 m was assumed accounting for the sideslopes of the 300mm thick layer at 3 horizontal to 1 vertical. To estimate the volume of the SGSB gravel, an average width of 10 m was assumed accounting for the sideslopes of the 600mm thick layer at 2 horizontal to 1 vertical.

The volume of WGB gravel required to upgrade the 89 km of existing road as a gravel surfacing layer is estimated at 213,600 m³ or 0.52 Million tonnes at an estimated in-place cost of \$7.02 Million dollars.

The volume of SGSB gravel required as granular subbase (underlying the gravel surfacing layer) is estimated at 534,000 m³ or 1.30 Million tonnes at an estimated in-place cost of \$12.35 Million dollars.

Accommodation cost for 12 workers over the estimated 3 year (1000 days) construction period is estimated at \$1.80 Million dollars.

It is estimated that 41 km of ditching, 47 culverts of 600mm diameter size, 17 arch culverts of 1.2m opening size, and a 6m long bridge span would cost an estimated \$0.6 Million dollars.

It is estimated that a total of 38 km of one-lane pavement overlay would be required along Highway 20 to accommodate the 40 tonne B-train truck traffic. This overlay would be undertaken within two sections (from 39km to 42km south of Williams Lake, then from 54km to 70km south of Williams Lake). These overlays would cost an estimated \$4.45 Million dollars.
(2 lanes x 19km x \$117,000/km = \$4.45 Million)