



**Ministry of
Transportation
and Highways**

Conceptual Alignment Study
Sunshine Coast – Sea to Sky Highway

Port Mellon - Squamish

An Engineering Conceptual Alignment Study
and order of magnitude of cost estimate.

Prepared by South Coast Region
Highway & Traffic Engineering

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Attachments:

- A. Estimates, per Ernest Wolski's schedule
- A. Part 1 Plan & Profiles with photos – Sta.100+00 to Sta. 322+50
- B. Part 2 Plan & Profiles with photos – Sta. 322+50 to Sta. 558+00



PROPOSED HIGHWAY PORT MELLON - SQUAMISH

1. Introductory Note:

Highway & Traffic Engineering was instructed by Senior Management of the Ministry, to carry out a Conceptual Alignment Study of a proposed highway that would connect the Sunshine Coast, to the Sea to Sky Highway - from Port Mellon to Highway 99 in the vicinity of Squamish.

A project of this size and complexity over extremely challenging geotechnical, environmental, and topographic features would normally require an appropriate multidisciplinary feasibility study. We would like to caution right from the outset that this exercise is not an alternative or a replacement for such a comprehensive approach. The purpose of this alignment study is aimed at providing very preliminary indications as to whether the geology and the natural topography would allow the building of a highway, and if so at what cost. The geology is similar to the landmass on the eastern coast of Howe Sound, where Highway 99 was built. Hence, with all the challenges of rock stability and the maintenance charges associated thereto we have assumed that it is geotechnically feasible to construct such a highway. This alignment study mainly focussed on the topographic and geometric engineering aspects.

2. Scope:

The scope of the Conceptual Alignment Study is primarily to:

- Explore the technical feasibility of constructing a highway on the mountainous terrain along the western shore of Howe Sound, and
- Indicate an order of magnitude of cost to construct such a highway.

3. Cost Summary:

While technically feasible, the challenge and cost of constructing a highway from Port Mellon to Squamish would be extraordinary. The costs used for this report are very high level, as detailed investigation has not been done. In addition, environmental mitigation costs have been largely assumed based on similar circumstances in such environmental setting.

For the chosen alignment, we have prepared two profiles, as set out in attachments B and C. The black line profile limits the number of tunnels required, but increases the volume of rock excavation tremendously. On the other hand, the alternative red line profiles increase the number of tunnels, improve on the general grade of the alignment and reduce the need for passing lanes. The **most economical overall profile** is a combination of the black line profile in part 1 (attachment B) and the redline profile in part 2 (attachment C).

The following is a rough outline of cost estimates of major cost items for the combined profiles (black line in part 1 and red line in part 2):

| <u>Description</u> | <u>Costs</u> |
|--|-----------------------------|
| ▪ Grade construction (including > 9,000,000 m ³ rockwork) | 282,868,326 |
| ▪ Structural Construction costs | 474,466,994 |
| Including - Tunnels (5 totaling 4700m) | |
| - Bridges (4 major, 12 medium, 28 minor) | |
| - Retaining walls (142,000 m ²) | |
| ▪ Paving | 8,283,160 |
| ▪ Other Construction (primarily Environmental Mitigation) | 21,142,750 |
| ▪ Operational Construction costs | |
| 6,052,136 | |
| ▪ Land Acquisition | |
| 3,727,438 | |
| ▪ Engineering (Design, Geotech) | |
| 75,658,477 | |
| ▪ Construction supervision | |
| 79,220,602 | |
| ▪ Project Management costs | 49,847,755 |
| ▪ Management Reserve | 50,302,797 |
| ▪ Miscellaneous | <u>4,788,296</u> |
| TOTAL Construction Cost | <u>1,056,358,731</u> |

4. General:

The main industrial activity along the entire shore is logging and forest renewal. There are two primary forest license holders. Canfor has the license from Port Mellon to the Potlatch Creek Valley with the Pulp Mill plant in Port Mellon. Interfor is the major forest license holder from Potlatch Creek to Squamish River Valley with its pulp mill at Woodfibre. There are also small log sorting businesses along the shore.

There are three BC Hydro transmission line corridors along the Squamish River Valley heading to Woodfibre, from where the two lines follow a westerly direction towards Sechelt, and the remaining line follows the western coast of Howe Sound to Port Mellon.

In addition to the Squamish River Valley at the north end of the study area, there are four other major valleys (Rainy River, McNab Creek, Potlatch Creek, and

Mill Creek), almost parallel to each other running in a northwest to southeast direction. The logging roads remain within each valley, with no inter-valley connections.

5. Design Criteria:

For the purpose of the study the following design characteristics are assumed:

- 2 lane highway with passing lane/truck lane
- Design Speed 80 km/h
- Maximum grade 9%
- Lane width 3.6 m
- Shoulders 2.0 m
- Ditch on high cut side 2.75 m (to collect rock fall)

6. Available Data and site visits:

At the start of this study, there were vague indications of the possible existence of an alignment study that was done in the seventies/eighties or of ground survey done for such an alignment. We approached surveyors and designers within the ministry and other institutions such as the Forestry Department, if they were aware of the study and if they knew where the information would be available. However, our attempt did not yield any results.

We therefore used the TRIM mapping as the base topographic plan, which we converted into CAICE to create DTM for the study.

Access to most of the alignment is very difficult, and so our visit to the site was limited to the following:

- Visiting the two extreme ends of the study area, at Port Mellon and Squamish;
- Visiting the Engineering Departments at Howe Sound Pulp & Paper Mill and the Canfor office in Port Mellon and discussing the site;
- Viewing the site by means of a boat ride with Mike Bessler of Canfor along the shore from Port Mellon to Potlatch Creek and back;
- Driving on parts of the logging roads in the McNab Valley with Mike Bessler of Canfor;
- Inspecting the alignment from a water-taxi along the entire route from Port Mellon to the mouth of the Squamish River.

7. The Alignment:

The entire landmass and hillside is so rough and rugged that building a highway will not be an easy task. The creeks and watercourses run in the general direction of north-west/south-east, whereas the alignment from Port Mellon to Squamish is almost at right angles to the sense of the valleys. As a result, the alignment traverses deep-water courses and high ridges.

We had looked into the possibility of following the McNab valley and then switching to one of the valleys leading to Woodfibre. But before it is possible to switch to the other valleys the escarpment rises so high that it becomes impossible to maintain a reasonable grade. The other option would be to interconnect the valleys with a tunnel. The latter option would be so much more expensive that we decided to concentrate on the alignment along the shore. The decision was supported by the Canfor staff, who know much of the terrain intimately.

The alignment we have developed follows the coastline along the BC Hydro transmission line. As can be seen from the Plan, Profile, and photos of the site taken from the boat ride, the terrain is extremely rugged, and consists almost entirely of steep, exposed rock. To put it mildly, the construction of such a highway will be extraordinarily difficult. The terrain is more challenging than the terrain over which highway 99 was built.

For most of the alignment, the highway does not impact any residential or other built up areas, except at the Squamish end. It skirts around the two pulp mill plants in Port Mellon and Woodfibre as well as a handful of cabins at McNab Valley and a children's summer camp at the mouth of Potlatch Creek. The connection of the proposed highway to Highway 99 will require thorough investigation and consultation with the community and stakeholders. We have tried to avoid impacting ecological reserves and sensitive estuaries. However, while crossing the Squamish River at the narrowest section, the chosen alignment links to Highway 99 through the Brackendale area either at Judd Rd or Depot Rd. It also passes through Yekwaupsum First Nation lands (IR18).

8. Plan and Profiles:

The alignment is plotted on 1:10,000 scale while the vertical component of the profile is plotted with 10 times magnification.

Also, we have inserted some photos taken from a boat along the alignment. We hope these photos will assist in appreciating the topography of the area.

We have looked at two profiles for the chosen alignment. While the black line profile attempts to minimize the need for tunnels it results in frequent steep grades requiring passing lanes. The volume of rock excavation is extremely high. On the

other hand, the alternative red line profiles increase the number of tunnels, but, improve on the general grade of the alignment and reduce the need for passing lanes, and reduce the overall rock excavation. As can be seen in attachments B and C, the tunnel requirements for each of the profiles is indicated in the same color as the profile (4 for the black line and 7 for the red line profiles).

9. Cost Estimate Schedule: (Attachment A)

For the purpose of extracting quantities and calculating the cost estimates, the alignment was divided into eight distinct sections under the guidance of Ernest Wolski. In fact, we quantified and estimated the first three sections together with Ernest. The rest of the sections were completed following the same process with occasional guidance from Ernest.

The cost estimates for both profiles were analyzed, and as mentioned in Item 8 above, the best combination is the black line profile in Part 1 (sta.100+ 00 to sta. 322+50) and redline profile (sta. 322+50.000 to sta. 558+00.00) in Part 2.

The total construction cost estimate stands at just over \$1.05 Billion. Cost estimate calculation sheets as per E. Wolski's schedule are included in Attachment A

It should be pointed out that the cost estimates might not adequately reflect the sensitivities of historical, environmental and socio-economic concerns of areas traversed by the alignment, and hence the full remedial or mitigation necessary could be substantially more than provided for.