Sea to Sky Highway: Section 1
Summary of Safety Performance Evaluation

Preamble:
A safety evaluation of Section 1 of the Sea to Sky Highway Improvement Project has been completed. The evaluation uses prediction models and collision modification factors to estimate the number of collisions that are expected to occur on the highway. The estimated number of collisions is based on the specific traffic and design characteristics of the highway. It is noted that the collision prediction models were developed in BC, using BC-specific data and as such, are applicable for use on the Sea to Sky Highway.

Summary of Methodology:
Two fundamental inputs are used to apply the collision prediction model: 1) the length of highway and 2) the amount of traffic (e.g., more traffic over a longer section of highway will result in more collisions). The traffic volume and the length of roadway are used by the model to produce a collision frequency estimate that represents "normal" safety performance based on the type of highway (for example, an urban freeway is expected to perform differently than rural two-lane highway).

Once the normal safety performance is determined, a series of collision modification factors are applied. These modification factors quantify the impact that each design parameter has on safety performance, and these are measured relative to a "normal" highway condition. For example, the normal condition for the shoulder width on a two-lane rural highway is 1.8 meters, but if a new facility proposes to have shoulder widths of 2.5 meters, a modification that reflects this improved shoulder width is applied, thereby reducing the predicted number of collisions. Collision modification factors were determined for the eleven design elements listed below and these factors are based on reliable and widely accepted values reported by the Federal Highway Administration (FHWA) and/or the Transportation Association of Canada's (TAC) Geometric Design Guide.

1) Lane width
2) Shoulder width
3) Shoulder type
4) Degree of horizontal curve
5) Super-elevation
6) Highway grade
7) Access density
8) Number of lanes
9) Roadside hazard rating
10) Median treatments
11) Design consistency

The results from the safety analysis produce the expected collision frequency for each design option that is proposed. The expected number of collisions is categorized into the three typical collision severity levels of fatal, injury and property damage only incidents and an average cost for each of these collision types are applied to obtain the annual collision cost associated with each option. The average collision costs are $4.17 million per fatal, $97,000 per injury and $6,000 per property damage incident.

Summary of Results:
Four options for Section 1 of the Sea to Sky Highway Improvement Project were evaluated, with Options B (4-Upslope Lanes) and Option D (2-way, 2-lane tunnel) emerging as options for further discussion. Option B assumed that 90% of the traffic would use the new alignment and 10% would use the old existing alignment. Option D assumed that for the first 20 years of service, that 80% of the traffic would use the tunnel and 20 percent would use the old existing alignment. After 20 years and due to the capacity restrictions, that this split would shift to 70/30.

Using these traffic volume assumptions, it was determined that Option B is expected to have $22.9M in collision costs (present value), while Option B is expected to have $37.8M in collision costs (present value), indicating that Option B is preferable from a safety perspective. The difference in safety performance between Option B and Option D can largely be attributed to the number of lanes, with the four-lane facility expected to perform better than a two-lane facility. In addition, due to the limiting capacity of the two lanes associated with Option D, more traffic uses the existing surface alignment through Horseshoe Bay, and this traffic will be subjected to a road with less desirable road design features (as compared to Option B), which results in an increase the expected number of collisions.

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