<u>***Alignment Comparison Report (May 9, 2002)***</u>

PARK BRIDGE TO BRAKE CHECK (10 Mile Bridge)

TRANS CANADA HIGHWAY (CCR)

INTRODUCTION

The Ministry of Transportation (MoT), Region 2, Highway Engineering staff were asked to assess the Option 5B alignment done by ND Lea Consultants Ltd., and to improve the alignment wherever feasible, to meet the ministry design standards for a rural arterial highway.

5B Option Alignment;

Option 5B alignment was developed by ND Lea Consultants to improve the existing Trans Canada Highway in the Kicking Horse River valley, about 16 km east of Golden. This section is approximately 5 km in length and runs west to east from the rest area to the brake check. Refer to ND Lea's "Functional Planning Report, Apr. 2001" for more details.

DESCRIPTION:

Option 5B alignment is a split alignment for approximately four kilometers with a small section of 4 lane divided alignment at either end of the split alignment that ties into the existing roadway.

The uphill, eastbound split alignment is mainly located on the existing roadway with a minor improvement to the curves immediately west and east of the existing Park Bridge. The eastbound alignment is essentially designed to 80 km/h design standard with 8% super elevation and maintains a maximum grade of 7.8%.

The downhill, westbound split alignment is located away from the existing roadway on the north side. The westbound alignment is designed to 90 km/h design standard with 6% super elevation and 6% maximum grade.

Region 2, Highway Engineering staff has assessed the **Option 5B** alignment, and the pros and cons of this alignment are presented below;

PROS:

1. Lower cost than Glenogle alignment. Costs will be approximately 126 millions compare to 152 millions for the Glenogle alignment.

2. Easier access to the construction site. The entire project is accessible from the existing highway.

3. Westbound split alignment meets the current standards for 6% superelevation and maximum grade of 6% for a rural arterial highway.

4. The entire alignment is a curvilinear alignment, which will be aesthetically pleasing to the motorists. The new westbound alignment blends into the hillside.

5. Less excavation required than Glenogle alignment and therefore less cost. But it is not feasible to balance quantities for this alignment; approximately 450, 000 m3 of surplus material has to be disposed off. A potential disposal site has been identified on the north side of the existing highway, approximately 1.7 km east of the brake check area. This site has been logged off already. The disposal site identified under ND Lea's report at the base of the mountain would not be feasible due to environmental concerns being adjacent to the Kicking Horse River.

6. Minor intrusion on the valley, a narrow corridor is required to construct the new westbound lanes. Clearing and grubbing of existing trees and vegetation would be minimal.

<u>CONS:</u>

1. Eastbound split alignment only meets 80 km/h design standard with 8% super elevation and maintains existing grade of 7.8%. The current design standard for rural arterial highways is 6% superelevation and 6% maximum grade.

2. Westbound split alignment is designed to 90 km/h design standard with 6% super elevation and 6% maximum grade. The alignment design criteria is not consistent with the adjoining section immediately to the west, which is designed to 100 km/h design standard.

3. This alignment can not avoid two slide areas i.e. Park Bridge Slide and 10 Mile Slide. Sloughing is occurring at the 10 Mile Slide area on both sides of the existing highway. The major concern is the long term stability of the 10 Mile Slide. Geotechnical Engineering has provided estimates of $5 – 7 millions to stabilize the slide area, with no guarantees that the slide would not continue to fail over time.

4. Constructability; most of the construction would be on the existing highway or adjacent to it and therefore would require detours and highway closures constantly. It would result in longer delays during construction.

5. This alignment would experience frequent freezing because 40% of the alignment will be located on the south side of valley. The section west of the existing bridge would be under shade in the wintertime.

6. This alignment goes through 5 avalanche areas and therefore snow-retaining structures and large ditches would be required to retain snow. There would also be higher risk of highway closures due to avalanches.

7. Snow removal; the elevated viaduct (1.2 km long) would require specialized snowplowing operations as it will cross over the eastbound lanes twice. This may result in higher maintenance costs over the life cycle of the highway. Snow plowing on the viaduct could create a severe safety hazards for the eastbound motorists on the lower roadway.

8. Major impact on river rafting operation in the summertime due to frequent highway closures and long delays. It may impact the local commercial economy.

9. There would be nine retaining walls required along this alignment. There is always somewhat risk associated with the retaining walls.

10. Foundation excavation and pile driving for the viaduct pier construction may impact the CPR tracks, east of the existing bridge. Existing fill material east of the bridge was pushed over as a spill pile from the earlier slide in 1950's and may not be compacted properly. Excavation through this 15 m deep fill material would be required for the pier footings.

11. Staging for future alignment upgrade not feasible.

<u>Glenogle Alignment – L11 Option</u>;

Region 2, Highway Engineering staff has investigated numerous alignments to determine an optimum 4 lane alignment based on 100 km/h design speed, which would be consistent with the design standards used for the adjacent sections of Trans Canada Highway. Assessment of eleven different alignments led to the selection of L11 Option as the preferred alignment.

DESCRIPTION:

The alignment for L11 Option begins immediately west of the existing rest area and runs on the south side of the existing highway upto Glenogle Creek, and then crosses the Kicking Horse River on a 379 m long bridge, approximately 100 m upstream of Glenogle Creek convergence point. The alignment then runs on the east side of Glenogle Creek valley and will require 480 m long tunnel through the rock knoll, slightly north of existing Park Bridge crossing. The alignment stays on the upland bench above the existing roadway and connects back into the existing highway at the existing Brake Check area. Refer to attached mosaic and plan drawings (R3-213-1A & R3-213-1B) for more details.

The pros and cons of **L11 Option** alignment are presented below;

<u>PROS:</u>

1. The alignment meets 100 km/h design standards in both directions, which will result in improved running speed and lower travel time.

2. The alignment would be consistent with the design standards used for the adjoining section of the 5 Mile Bridge, which is immediately to the west of this section. The existing alignment to the east of this section is also made of relatively gentle curves with flat grades.

3. Maximum grade will be 5.8% in both directions, which meets the design standards for a rural arterial highway based on mountainous terrain. Lower grades will lower the running cost for large vehicles and trucks.

4. Maximum super elevation will be 5.7%, which meets the current design standards for a rural arterial highway. Lower superelevation will improve the driver's comfort level and would prevent sliding in the wintertime.

5. Ease of Constructability; the new alignment will be located away from the existing highway, which will provide larger separation between new and existing highway. It would be easier to stage construction because of larger separation, which will result in fewer delays and less operating cost during construction.

6. Avoids two slide areas; the new alignment is moved away from the scarp of two slide areas (i.e. Park Bridge Slide and 10 Mile Slide). The new alignment will be located on higher bench, away from both slides and on stable grounds, therefore less maintenance costs and very low risk of highway failure in the future. Sloughing is occurring at the 10 Mile Slide area on both sides of the existing highway.

7. Avoids three avalanche areas; the new alignment avoids 3 avalanche areas, which will result in fewer closures in the wintertime and therefore safer roads. The new alignment will only have a minor impact on the other two avalanche areas because of alignment being on the higher elevation.

8. Less freezing during the wintertime; most of the new alignment will be on the north side of the valley and would have southern exposure all day, which will result in less icing in the wintertime and therefore safer roads.

9. Avoids environmental sensitive areas; the new alignment will avoid the mountain goat habitat area located adjacent to the west end of the existing bridge. There will be no impact on the riverbed and the alignment also avoids two slide areas.

10. Minor impact on River Rafting operation during construction, because of the new alignment will be located away from the riverbed. There may be minor delays for the rafting users during the construction of the west approaches to the bridge.

11. Ease of access during emergencies; the new alignment provides combined 4 lane highway cross section rather than split grades, which will make it easier for accessibility during emergencies.

12. The proposed alignment will be aesthetically pleasing for motorists travelling in both directions.

13. No impact on the existing rest area, west of the existing bridge except a new access will be required. It is feasible to provide a new viewpoint and a rest stop area along the new alignment because of surplus quantities and room.

14. It is anticipated that maintenance will be somewhat easier and less expensive over the life cycle of the highway i.e. reduced icing conditions, wide ditches.

15. No impact on CPR railway tracks because the alignment will be crossing over the railway tracks via a bridge. It may be necessary to upsize few culverts under the tracks due to additional runoff.

16. Alignment improvements can be staged by constructing 2 westbound lanes now and utilize the existing highway for the eastbound lanes. In the future the eastbound lanes could be constructed along side the westbound lanes.

CONS:

1. Costs will be approximately 152 millions compare to 126 millions for 5B Option.

2. Construction access to the west end of tunnel would be a challenge. A tote road approximately 1.1 km long would be required, which will cost additional $400, 000.

3. It will require construction expertise in tunnel construction.

4. Retaining walls approximately 570 m long and 20 m high (average) would be required to place large fills. Shifting the alignment uphill would require very high cuts and produce more surplus material. It is feasible to locate the retaining walls up the hill, off the shoulder of new highway, except more surplus material has to be hauled to the disposal site. There is always somewhat risk associated with the retaining walls.

5. High Cuts (70 to 100 m heights) would be required between stations 129+70 and 132+20 on the north side. It is feasible to construct a snow shed in this area, which would eliminate the high cuts and also reduce the surplus quantity by approximately 700, 000 m3.

6. It is not feasible to balance quantities along this alignment. Surplus quantity in the range of 1.3 million m3 would be available, based on 20% swell factor for the rock. It would be better to construct a snow shed, which will reduce the surplus quantity down to 600, 000 m3 and also offset the cost of snow shed construction. A potential disposal site has been identified on the north side of the existing highway, approximately 1.7 km east of the brake check area. The disposal site has been logged off already.