

Highway 29

Bear Flat / Cache Creek

Summary of Design Work – 1981 Through 2017

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1981 – Highway 29 Hudson’s Hope to Charlie Lake Environmental Impact and Engineering Study of Highway 29 Relocation Section 1 – Graeme & Murray Consultants Ltd.

- **Content:** The study investigated feasible alternative relocation alignments of Highway 29 at Attachie (Halfway River) and Bear Flat. The report was requested by and prepared for the Ministry of Transportation & Highways.
- **Background:** The report references preliminary investigations that had identified two possible general alignments – one at the toe of the steep plateau slope and the other adjacent to the proposed reservoir – but there is no mention of the date or source of those investigations. This 1981 investigated those alignments in detail.
- **Methodology:**
 - The study investigated two alignments at Bear Flat considered feasible from an engineering standpoint and sympathetic to the terrain, to 90km/h geometry with two traffic lanes.
 - Alignment D is the northern most route, running along the open toe of the slope, skirting the edge of the cultivated land and through some wooded areas. Three alternative alignments were then examined for climbing east out of Bear Flat.
 - Alignment E is the southern most route and attempts to make as much use of the existing highway as possible, running above and parallel to the proposed reservoir. Two alternative alignments were then examined for climbing east out of Bear Flat.
 - The comparison of alignments included construction cost, construction maintenance, standard of alignment, drainage, landscape and visual resources, heritage and archaeology, fish and wildlife, agriculture, forestry, environmental hazards and economic rate of return.
- **Conclusion:**
 - The potential for wholesale realignment of Highway 29 along the plateau (north of and above the valley) involving 60 km of new highway between Hudson Hope and Fort St. John, was considered, but was not considered further on the basis of high costs per kilometre.
 - Alignment E, is the preferred alternative given that it could be staged, had better geometry, and features best in the overall comparison.

2009 – Highway 29 Relocations Report – KCB/SNC with USL

- **Content:** Report presents results of updated Highway 29 realignment options and river crossing designs developed during Stage 2, including adopted design standards and design criteria.
- **Background:** Alignment options were originally identified and studied in 1981 by *Graeme & Murray Consultants* and were updated by USL to meet current MoTI design standards.
- **Methodology:**
 - The conceptual design alternatives were developed for Bear Flat Section – Alignment “Option E Altered” (and alignments within other Hwy 29 realignment segments).
 - 3 alternatives were considered at Bear Flat / Cache Creek, each with varying lengths of bridge and causeway across Cache Creek.
- **Conclusion:**
 - A 410m long six span bridge with no causeway is most economical solution, along yellow line illustrated in figure below.
 - The potential for wholesale realignment of the highway along the plateau, involving 60 km of new road construction, was discounted in the 1981 study on basis of high cost and impacts. This was revisited in 2009 but was not pursued further, as the rationale for the previous decision was still considered valid.



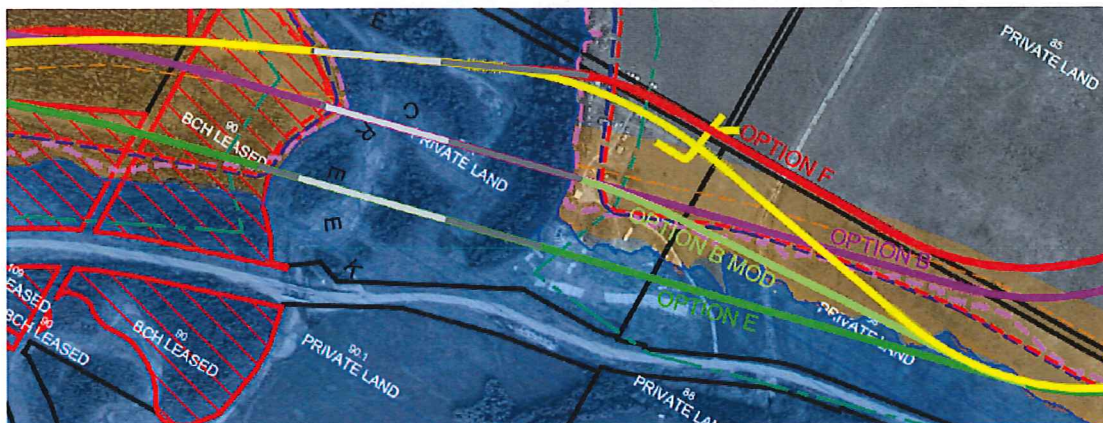
April 2012 – Options Analysis for Highway 29 Realignment – BC Hydro

- **Content:** Report summarises the Multiple Account Evaluation process and the criteria used for evaluating three segments (Lynx Creek, Halfway River and Cache Creek), and describes re-alignment alternatives and preferences selected at each segment.
- **Background:** Definition Design information available in 2011 was used in undertaking the MAE.
- **Methodology:**
 - The MAE included the accounts engineering, environment, archaeology, property and agriculture, along with indicators within each account.
 - Consensus on the preferred alignment within each segment was reached, and included representatives from BC Hydro, MoTI, Site C Integrated Engineering Team and design consultant RF Binnie and Associates.
- **Conclusion:**
 - Alignment 1 with a short bridge (yellow line illustrated below) was selected as preferred alignment over Alignment 2 (red line illustrated below) given unstable escarpment and associated technical challenges on Alignment 2; resulting in substantially higher costs and construction risks.
 - Alignment 1 also has:
 - Less area of private land impacted;
 - Significantly less length of actively farmed land severed; and
 - Less area of Agricultural Land Reserve land needed for the right-of-way.
 - Several routing refinements are possible with alignment 1, and participants selected it as a preferred 'corridor'.



April 2012 – Highway 29 Definition Design Report – R.F. Binnie & Associates

- **Content:** Definition Design Report documents engineering assessment of six Highway 29 realignment segments including Bear Flat / Cache Creek, and includes existing condition information, design criteria, options analysis and discussion on preferred options.
- **Background:** Alignment work from 1981 and 2009 was used as input to Definition Design, and was updated to reflect current design guidelines and feedback from 2008 public consultation.
- **Methodology:**
 - 2011 MAE led to consensus on the preferred corridor at Bear Flat / Cache Creek.
 - Additional alignments crossing Cache Creek were then developed, each of which had various creek-crossing lengths.
- **Conclusion:**
 - Alignment Option F Modified (yellow line illustrated below) was selected as preferred alignment on basis of relatively-lower construction cost estimate.
 - Option F Modified also largely stayed north of preliminary landslide generated wave impact line (orange shading in illustration below).
 - Revised landslide generated wave impact line was received in January 2012 toward end of Definition Design development, which was incorporated into a corridor across Cache Creek for purposes of Environmental Impact Statement.
 - Future design work was required to confirm final optimisation and alignment across Cache Creek.



Oct. 2015 to Mar. 2016 – Design Development – BCH, IET, MoTI and RF Binnie

- **Scope:** Design optimisation:
 - Optimise grade of Highway 29 toward its east limit; and
 - Optimise crossing of Cache Creek.

- **Methodology:**
 - Final alignment refinement and optimisation within corridor
 - MoTI was involved through the design process, and accepted the refined design alignment.

- **Conclusion:**
 - The orange, cyan and magenta alignments provide improved stability over the yellow alignment at the west side of Cache Creek (where the bridge would 'land').
 - The orange alignment (and cyan) resulted in a crossing length 20m shorter than the Definition Design alignment.
 - The orange alignment had the lowest estimated construction cost, and was selected as the basis for Functional Design work in 2016.
 - The current design alignment follows this orange alignment.

