Powerline Pass – B.C. North Coast Mountain The History of Avalanche Damage, Mitigation and a Modern Epic

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ABSTRACT

Scott Flavelle will trace the history of avalanche damage to the Alcan transmission towers and the various mitigation methods recommended by our avalanche forefathers since the powerline was first built in 1953 to two recent tower failures in 1992 & 1993.

Hector MacKenzie will then describe his psychological epic of being trapped by weather in a plywood coffee shack in a large avalanche track with modern linesman while avalanches are running...

INTRODUCTION

The Aluminum Company of Canada (Alcan) has one of Canada's oldest avalanche problems. Since the first winter of operation nine transmission towers have been completely destroyed by avalanches and many others damaged. Several snow avalanche consultants have provided recommendations over the last four decades in regards to the avalanche hazard and implementation of protective measures. The intent of this paper is to provide a historical overview of the consultants input on the perennial avalanche hazard.

PURPOSE OF THE POWERLINE

An extensive lake system was dammed on the east side of the Coast Mountain Range to provide elevated fall for a hydro electric generating facility at the head of a long sea-level fiord. Two single circuit transmission lines conduct the electricity from this site, Kemano, 80 km overland to the aluminum smelter located in the town of Kitimat at the head of another fiord.

TERRAIN

The transmission lines follow the Kemano River Valley near sea level for 15 km before ascending and crossing the 5000' Powerline (or Kildala) Pass through 10 km of alpine before descending the 7 km Hanging Valley to the Kildala Valley, again near sea level. Finally, the lines contour around a bay before crossing a sub-alpine pass to access Kitimat.

The transmission towers in the river valleys are almost all located on the alluvial fans below steep gullies and creek beds, taking advantage of the high spots to maximize the line span. However, given that avalanches on the North Coast frequently reach sea level, many of these towers have been affected by avalanches running out onto the alluvial fans, particularly ones consisting of wet snow mixed with debris. The avalanche terrain traversed in the alpine (3000'-5000') consists of the usual coastal mix of terrain configurations - low angle wide open bowls, steep open slopes, and well defined couloirs and chutes of all aspects and ground roughness.

CONSEQUENCES OF POWER OUTAGE

If power to the aluminum smelter is lost for more than six hours the aluminum "freezes" in the pots requiring a $1 million start up and refurbishing as the aluminum has to be jack-hammered out of the pots. Due to the potential extent of industrial setback, Alcan placed a second transmission circuit alongside the first in the hazardous areas, and on the same towers in safe areas. In this way, as long as only one side of the parallel lines are lost power still gets to the smelter. As the second circuit is not used by the smelter except in emergencies it now conducts surplass power destined for the BC Hydro power grid. So presently, if either of the lines are lost, significant financial loss will be incurred.

AVALANCHE HAZARD TO TOWERS

In the alpine regions it is normal to have a 5 m snowpack, while the depth of snow at sea level may vary dramatically depending on the winter. Storms are usually very severe with strong winds, fluctuating temperatures, and heavy precipitation.

Each tower exposed to an avalanche hazard has its own unique avalanche terrain situation, this combined with the full spectrum of mountain weather and snowpacks over the 42 year life of the line, has produced numerable unusual, rare, and in some cases unprecedented avalanche events causing tower, work camp or forest destruction.

Four reports on the estimated snow avalanche risks to the towers were written during the past 36 years.

In 1955 & 1960, Dr. M.R. de Quervain expressed that there was a "regrettable lack of information on current avalanche activity" and that "systematic observations on snow and avalanches" were needed. Based on avalanche events he concluded that it was the lower elevations which were most at risk due to "wet and muddy avalanches which advance to tower sites taken to be reasonably safe". He further noted that Alcan's previously accepted "1955 calculated risk" was reduced, warranting the construction of additional earth deflectors. All towers were given a rating of the hazard based on an unprotected site.

In 1973 an avalanche destroyed tower 105L which was located mid track of a large moderate angled alpine bowl. This tower had received a reasonably safe rating - "avalanches only in exceptional and unexpected situations." And in 1985 another tower 124L with the same rating was also destroyed along with several hectares of forest.

In 1985, P. Schaerer rated the avalanche hazard to all the towers in the alpine. In using a similar rating criteria as de Quervain he agreed and concluded that there were still many towers at significant risk which should have protective measures taken, as well as many towers which would remain exposed only to rare but large avalanches with low return frequencies and uncertainties in the prediction of their character.

In 1992 one of the towers, 113R which was rated as exposed to rare avalanches was destroyed. After this third event of relatively low risk towers being destroyed in the past 20 years, Alcan was keen to have a further risk assessment undertaken to attempt to determine which tower would be next.

In 1993, C. Stethem & S. Flavelle grappled with the objective of this task and concluded as those before them, that it is not possible to predict when and where the next rare, exceptional, unusual, or unprecedented avalanche would strike an unprotected tower. Instead a risk matrix summary was developed to examine on a larger scale which towers have the most risk from those types of avalanches, what additional risks or difficulties may be encountered during reconstruction, and where the risk of both parallel lines being knocked out simultaneously by a single avalanche event may exist to create the worst economic scenario.

In summary, it appears that originally snow avalancheswere not reckoned with as a hazard to the transmission lines. Though after the five tower disaster in 1954, the caternary suspension was built andprotective measures were emphasized for the accessible and predictable slide paths in the lower valleys. This seemed to solve the problem for the next 20 years. However, each subsequent damaging avalanche incident: 1973, 1985, & 1993, involved the rare and exceptional avalanches that the consultants had recognized as a low but potential risk. This risk of damage to the towers must be an inherent acceptable risk unless major mitigation work is carried out for all 21 exposed towers. As it stands, it is only a matter of time before another tower is hit, but which one, is the million dollar question.

CHRONOLOGY OF AVALANCHE RELATED EVENTS

YEAR	EVENTS
1951	Transmission line surveyed. Dr. M.R. de Quervain commented on emergency sites.
1952-53	Transmission line construction.
1954	Spring Second transmission circuit constructed.
1954	Aug. 1 Transmission lines energized.
1955	Jan. 25 Avalanches in Glacier Cr. destroyed five transmission towers. Power was restored seven days later on a patched left circuit. During summer and fall that year the caternary was rigged to suspend the trans mission lines 500' above the Glacier Cr. valley.(de Quervain rates hazard to towers, recommends protection)
1956	Wood & steel deflector built for Tower 116R,earth deflectors built wherever material and cat access
1957	Dec. 7 Mixed wet snow and rock avalanche destroyed T230 in Kildala Valley. (report by Dr .V. Dolmage)
1958	Tower Reliability Report - protection measures. (M.Parker)
1960	de Quervain evaluates the avalanche risk for towers, appraises protection work being carried out, recommend further improvements and the observations of avalanche occurrence, snow, and wx data.
1960-61	First winter of avalanche occurrence patrols, continued to 1974.
1961	Addendum to Tower Reliability Report (M. Parker)
1973	Dry snow avalanche in Twin Peaks bowl destroyed Tower 105L. de Quervain recommends protection in the form of a steel deflector and splitting wedges for the individual tower legs.
1978	de Quervain site visit. Evaluates avalanche protection on existing lines and avalanche hazard on proposed new coastal route.
1985	Feb. Dry avalanche destroyed Tower 124L. Unprecedented avalanche event. Herb Bleuer provided some avalanche safety during winter reconstruction. Peter Schaerer wrote reports: Rating of hazard exposure to towers and recommended additional protection.
1992	Dec. 27 Dry slab avalanche destroys Tower 113R at Kildala Pass. Damaged deflector at Tower 116R. Colin Zacharias and Scott Flavelle provide avalanche safety during reconstruction to Feb. 8.
1993	Spring Chris Stethem and Scott Flavelle produce avalanche atlas and author a further report on the Avalanche Terrain and Avalanche Hazard to the powerline. Its objective was to estimate the degree of risk to the various towers from avalanches, and the risk encountered during winter repairs, as well as suggesting additional protective measures.
1993	Nov. 21 Strong outflow winds knocked down the replacement Tower 113R.
	Avalanche safety was provided through Stethem & Associates, with Herb Bleuer, Scott Flavelle, and Hector MacKenzie as on site avalanche technicians. Power was restored Feb. 10.

AVALANCHE SAFETY PROGRAMS DURING TOWER 113R RECONSTRUCTION

Tower 113R is located on the SE side of Powerline Pass in the Glacier Creek drainage of the Kemano River in an alpine cirque. The site is threatened by avalanche paths from both valley sides, specifically the track of a SE aspect avalanche path (Gc4) and the runout zone of NE aspect path (Gc3).

Numerous avalanche paths affect the routes approaching Powerline Pass from both the Kemano and Kildala Valleys. Winter access is feasible via helicopter.

The avalanche safety programs during the two winters of tower 113R reconstruction consisted of the following components:

- Preparation of Avalanche Safety & Rescue Systems
- Survival Plan, Equipment and Shelter
- Daily Helicopter Reconnaissance & Site Access
- Daily Weather Forecasts, Base & Field Weather Observations
- Snow Stability Observations
- Daily Avalanche Hazard Evaluations
- Active Avalanche Control - Heli Bombing & Hand Charging

SURVIVAL IN THE PATH OF GC4 - *RECOUNTED BY HECTOR MACKENZIE*

Story narrated by Hector in oral presentation

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