Keeping Our Lines and Towers In Good Service

GEOTECHNICAL HAZARD REVIEWS HELP TO ENSURE ELECTRICAL RELIABILITY

By Tonia Jurbin, P. Eng

With over 18,000 kilometres of high voltage transmission lines crossing through some of the roughest terrain in Canada, the job of maintaining these lines involves a significant chunk of BC Hydro's resources. Dozens of power line technicians (PLTs), area managers, vegetation coordinators, engineers and technologists inspect the lines looking at hardware, structural and electrical parts, corrosion, danger and hazard trees, encroachment of the rights-of-way (ROW) by development, and natural hazards.

The geotechnical hazard reviews are carried out by a small group of geological professionals in the Transmission Maintenance Services group. One civil engineer, and the manager of Transmission Maintenance Group, Barry Anderson, two geological engineers and one civil technologist are the only geo-types in BC Hydro that work outside of the dam safety and power generation groups.

Prior to the early 1980s, Transmission's geotechnical group was primarily responsible for carrying out hazard and stability assessments before construction. Today the hazards are monitored and tracked on a sophisticated tracking system known as STARR, the System for Transmission Asset Recording and Reporting, administered by the BC Transmission Corporation (BCTC). The inspections boil down to the corporation demonstrating due diligence, which is becoming increasingly important as utilities become more interdependent.

"These reviews started in the late 1970s and early 1980s. We started doing reviews on the 5L71/72 circuits in the Vernon area at the request of then manager Blake Tweddle, because the alignment crossed some unstable areas that were also susceptible to damage from snow avalanches," explains Blain Good, Senior Geotechnical Design engineer. "It started with the Vernon area, later Lower Mainland Transmission (LMT) began requesting reviews, then we started getting requests from the North Coast. The reviews were funded by the requester because the attitude at the time was that it was their plant to look after."

Most of the time the inspections were done on an ad hoc basis or after a major storm or flooding event. Areas that were known to be particularly prone to slides (Vernon area) or erosion (North Coast) started to be inspected regularly. Other areas were inspected as needed or as requested.

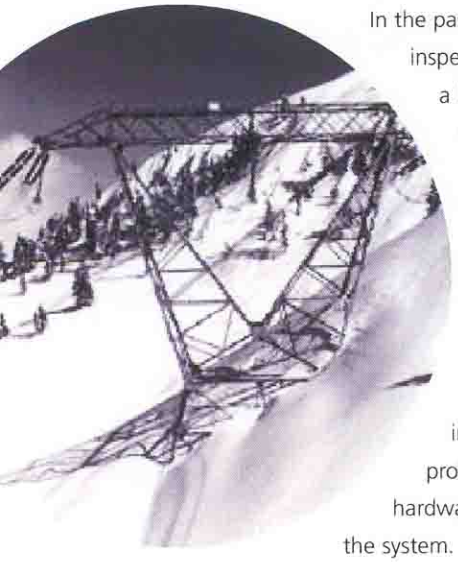
"We weren't calling them hazard reviews at that time," explains Barry Anderson, managing engineer for the Transmission Maintenance Group. "We were calling them soils inspections until about the mid 1990s. The key lines that we have been inspecting regularly for decades are 5L71/72, 5L76/77 and 5L75/77, a major slow-moving slide on 5L63 near Telkwa, 2L101 along the Skeena River, and 2L99, and 1L387 also along the North Coast."

Though his reviewers are not assigned to specific areas, over the years, Barry's staff have mostly inspected the same lines, and have become familiar with the areas. This has enabled them to do a better job at tracking specific sites, or even to predict when a particular site needs erosion protection, or a debris deflector. "After many years of inspecting a line you sort of feel a personal responsibility for it," explains Barry.

continued on page 17

Keeping Our Lines and Towers In Good Service

– Continued from page 16



5L30 engulfed by snow.

In the past the emphasis was on inspecting specific structure sites, a hold over from the days when the group was performing pre-construction assessments. Today, the inspectors look at the whole rights-of-way including access roads (bad roads are a financial risk and subject to instability), and noting problems that they see with hardware, or other components of the system. The reviews are a joint effort between the engineering staff and the local transmission line technologists or area managers who know the lines and the terrain intimately. It is great to have a second set of eyes along, and it gives the local staff a chance to look at the lines for forestry, wildlife and fisheries management issues.

The reviews are done as early in the season as possible, ideally when the spring runoff water is on the ground. This gives the staff in the regions a chance to plan for repairs that may be needed later that season. The reviewers fly the circuits with pilots who have had training and experience doing this type of patrolling. A pilot with regional knowledge and transmission experience is critical to collecting useful data and photographs, and landing in challenging spots sometimes under challenging weather conditions. BC Hydro employees fly with pilots that have at least 2,500 hours of experience.

In addition to the technical training the remote nature of the work requires training in helicopter safety, hover exit training, field check-in procedures, winter survival, four by four (4X4) vehicles, winter driving and working around wildlife, particularly cougars and bears. Some of the work also requires them to take river soundings for assessing scour at erosion prone sites. They have even assembled their own overnight shelter kit.

During the inspections, the group identifies hazards that may have occurred as a result of the past winter or spring runoff, or they may be monitoring a long-term potentially large-scale stability or erosion problem.

"Any protection placed near a structure is a trade off between the amount of risk we can take at that structure, the consequences of that structure failing, and the cost to protect it. So we try to spread the money out over several years and stage the protection work so that the line can survive an event," says Barry. "It is not economical to do full protection on several towers in one year where the risk is actually quite low."

Often for the larger potential problems, the group will issue a report that will outline the problem, the risk and offer several options. Often the low risk events have very high consequences. Of course, the more security the client wants, the more expensive the fix. Options can range from the 'do nothing' option which will generally require a detailed monitoring program, to an expensive fix or structure relocation that might be funded as a capital project.

By the mid 1990s, the Maintain group took over the financing and responsibility for funding these reviews in an effort to make the system more consistent. About $235,000 a year is budgeted for the reviews. $50,000 to $60,000 of that is for helicopters, the rest is for the inspections, reporting, and any design work that comes out of the recommendations. Most of the work is carried out by the small group, but occasionally, consultants are brought in to help with specific events that cause a lot of damage in a localized area, such as the slides that occurred along the 5L30/32 this past winter.

Since about the year 2000, the task of deciding what lines have to be inspected has fallen to Barry's group, in cooperation with the Field Services manager and the BCTC. In fact, the BCTC has identified this as the most important work Transmission Maintenance does for them.

Blain has taken the lead role in deciding what is to be inspected, when, and how often. "In the last two or three years, we have started to carefully review our inventory of lines from a geotechnical viewpoint, especially some of the lower voltage (60kV) T/L in areas of low geotechnical risk that may have never been looked at (geotechnically) since construction," he explains.

The target is to inspect every line every five to 10 years, but as the program evolves it may become clear that it is not efficient to inspect each line as frequently. Clearly, these lines have been inspected regularly from an operational viewpoint and have been

continued on page 18

well maintained. The PLTs note many site-specific geotechnical problems, but the geotechnical reviewers look beyond the immediate vicinity of the structure.

Inside of D-Leg, Structure 8015 circuit 2L101 in 2000.

"When we fly the lines, we are looking at the plant from a high level, we are looking for logging activity that could cause instability, where we see a slide we follow the slide or a debris flow path to its source to assess future hazards," says Blain. "I am currently ranking the less commonly reviewed lines based on geotechnical risk, voltage and importance, For example, is it a radial line? Or is there some duplication in that area?"

Some of the critical 500kV lines that are in areas of high risk may be inspected monthly, or even weekly, as was done with the 5L30/32 lines along the Sunshine Coast. The reviews are carried out to identify any natural hazard that can impact the line including floods, snow avalanches, river erosion, rock falls, debris flows, instability and landslides, individual rock or boulder hazards. Even ice on a river can impact a crossing tower or cause bank erosion.

"We will note property or development issues, we may comment on log piles under our structures (fire hazards), or material extraction that is too close to the towers, or dumping on the ROW, but we are not primarily responsible for these issues," says Barry.

The STARR program database has just over 96,000 structures in it, since it was introduced in 2001 to capture the results of the inspections by the PLTs. The database has expanded in 2002 to include the engineering hazard reviews and schedule inspections, Since its inception, STARR has captured over 500,000 inspections. Not bad for two years worth of work, using a program that is constantly evolving.

Bryan Hooper, manager, Transmission and Vegetation program management department talks about the current function of the program and compares it with other products. "STARR is unique to BC Hydro, but other utilities are using similar data base products to record inspection results," he says. "Our system is a little more comprehensive then some in that it captures four things: when the inspections are due, when the inspections are done, observations of the risks and hazards, and when they are corrected. The area managers also use the system to prioritize the work that the inspectors identify. Depending on the scale and the nature of the work required, it will either become part of the work program and be handled locally by the Field Services group, or, larger jobs may go through the project management process and be tendered as an external contract."

What does the future hold for the hazard inspection program? With many of the problems identified and repaired, will this group eventually run of work?

Barry says that the work they do will actually never be finished, as each year brings new problems, potential hazards and length of service repairs or upgrades to complete.

"Although there are areas where we are not doing as much work as we used to because we've stabilized those areas, the rivers will keep moving, and the slides will keep coming down," he says. "There will always be new slides, higher snow falls, avalanches that will present new challenges. As long as the towers are there, we will have to keep watching them."