OITAF Seminar in Innsbruck

OITAF On April 11, 2013 – the second day of the Interalpin trade show – Congress Innsbruck hosted a seminar organized by OITAF Committee no. 6 on the subject of "The operation of ropeway installations in exceptional operating conditions – experiences and measures".

OITAF President Martin Leitner and seminar chairman Mauro Joyeusaz (from the left)

The 2013 OITAF Seminar, for which 184 participants had registered, was officially opened by OITAF President **Martin Leitner**. He started off with thanks to the organizers of Interalpin for supporting the seminar before requesting one minute's silence for two recently deceased members of the international ropeway community, namely Jean-Pierre Cartiard, long-serving President of the international Association of Ropeway Manufacturers, who died in February of this year, and Hannes Steinlechner, Technical Director of Arlberger Bergbahnen, who was due to make the second presentation at the seminar but regrettably passed away on 29 March shortly before his retirement. Martin Leitner then expressed his gratitude to OITAF Committee no. 6 (Optimization of Ropeway and Ski-Tow Operations) for organizing this year's seminar and passed the floor to committee chairman **Mauro Joyeusaz**, who then chaired the further proceedings. The program included six presentations devoted to various aspects of the seminar topic "Operation of ropeway installations in exceptional conditions".

In a paper entitled "Humidity and icing: past experience with the ropeways of Sierra Nevada", **Eduardo Valenzuela** and **Alejandro Madrid**, Director and Technical Director respectively of the Sierra Nevada Ski Area, made a presentation of their ski area and reported on the measures adopted there to cope with serious problems of ice buildup. A combination of humidity and temperature patterns in the Sierra Nevada causes a degree of ice formation on the line works that is hard to imagine in the Alpine region (see photo).

Problems with ice buildup affect various ropeway system components:

- the stations,
- the ropes,
- the sheave trains,
- the grips and
- the carriers.

In the stations, ice can accumulate in the runways and on the rails. An effective solution is to fit covers over the openings in the ceiling enclosure during the night. Ice on the haul rope can lead to problems with various station components and can be prevented in a number of ways. One solution is to temporarily increase sheave pressure in the carrier conveyor system; another is to fit brushes to keep the rope free of ice, and a third is to spray the rope with a deicing agent.

Ice on the rope is not only a problem in the stations; it can also lead to deropement on the line. One commonly adopted solution is to maintain movement in the rope during the night. To avoid rope operation throughout the night and thus reduce power consumption and wear in the components, an ice sensor system has been developed that sets the rope in motion only when necessary. Other solutions shown by the speakers included the addition of auxiliary rollers to the sheave trains that serve to either increase the sheave loads or remove the ice from the rope.

Massive ice buildup on the sheaves can immobilize them completely. The problem can be mitigated by fitting lateral sheave covers made of plastic, but the best answer is doubtless to have a good team for deicing the tower heads.

With regard to the grips, the speakers expressed a clear preference for grips with torsion springs located inside the body where they are protected from the elements rather than grips with open helical springs. Ice on the friction plates that are engaged by the tire banks can be tackled with special brushes.

For the speakers, the best way to prevent ice buildup on the carriers on detachable installations is to

Ice on the line in the Sierra Nevada Ski Area

PHOTOS: J. NEJEZ, SIERRA NEVADA (2), R. GRIC

Tower head completely enclosed in ice

provide carrier parking in the terminal, a feature that is now standard in the Alps but not always in Spain.

The gentlemen from the Sierra Nevada closed their presentation with the hope that ropeway manufacturers will pay more attention to problems of ice formation in the design of future installations.

As mentioned above, Hannes Steinlechner, who was due to present the second paper on the subject of "Wind and thunderstorm: the enemies of ropeway installations", died shortly before the seminar. In view of the work he had put into the preparations for his presentation, **Professor Josef Nejez** kindly agreed to share the experience of the Technical Director of Arlbergbahnen with attendees with the help of the two-page outline previously submitted. Unfortunately, the Powerpoint file already prepared by Hannes Steinlechner was not available, so that the audience had to manage without the visuals and rely on their own imagination.

Hannes Steinlechner had prepared a concise outline of his presentation:

- hazards outside of operating hours (rope throw-over, derope-ment, direct lightning strike, overvoltage): no danger to passengers but possible damage to the installation and downtime;
- hazards outside of operating hours (partial or complete deropement, carrier swing on the line, carrier impact with solid objects, rope overthrow, direct lightning strike, overvoltage): danger to passengers and operating personnel, possible damage to system components and downtime.

With regard to possible solutions, Hannes Steinlechner distinguished between

- organizational,
- operational and
- structural measures.

The main organizational measures include due attention to weather forecasts and wind warnings, especially for the one or two days ahead. Current meteorological reports and weather radar maps – with a radius of 200 km – are a valuable source of information. Personal contact with ropeway operators in the surrounding areas can also be helpful.

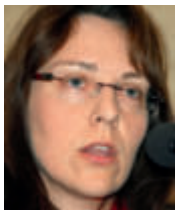
As the most important operational measure according to Hannes Steinlechner's draft outline, operations managers must be sure to provide employees with the relevant instructions in good time. Depending on the situation in the individual case, a reduction in line speed is often a logical measure, as there is empirical evidence correlating line speed with frequency of deropement. Where strong side winds are expected, it may make sense to add ballast to the carriers. Chairs with hinged canopies left in the open position offer a significant wind contact area. The canopies on unoccupied chairs should not therefore be opened in the stations.

In terms of structural measures, the choice of line and the location of the terminals relative to local topographic features are particularly important. Terminals should not be built on summits and ridges except where essential to ensure full slope access and efficient utilization of the ski area. Where terminals are constructed in exposed locations, various structures can be placed so as to offer maximum protection from the wind (office, control room, stores, etc.). In the case of detachable chairlifts, 90° unloading can improve the situation with regard to wind. For the rope, the rule must be to maintain the necessary ground clearance but otherwise keep it as low as possible. The sheave loads on the towers should be as high as possible in exposed locations, and additional design solutions may be required (e.g. counter-pressure sheaves). Rope position detection systems provide effective monitoring of the position of the rope in the grooves of the sheaves. Any deviation from correct alignment in the groove generates a fault message and rope speed is automatically reduced, while deropement triggers a complete system shutdown.

Mauro Joyeusaz thanked Professor Nejez for agreeing to stand in and outline Hannes Steinlechner's paper. He saw that as a mark of respect for a deceased colleague.

Prof. Dr. Josef Nejez

"Operation at the limit of normally permissible operating conditions: the viewpoint of the super-



Mag. Marianne Fritz, BMVIT

visory authority and its legal consequences" – That was the title of the presentation made by **Mag. Marianne Fritz** of the Austrian Ministry of Transport, Innovation and Technology (BMVIT), and Dipl.-Ing. Richard Dietzsch, head of the Ropeway Department at TÜV SÜD Industrie Service GmbH (D).

Dipl.-Ing. Dietzsch, TÜV SÜD Industrie Service GmbH

Richard Dietzsch started off by defining normal operations in terms of the following factors:

- operation using the main or auxiliary drive,
- system readiness, and
- weather conditions and visibility that do not necessitate any special measures.

For such normal operating conditions, the measures to be taken are described in the operating instructions provided by the ropeway manufacturer, and the provisions of product liability law apply. In the case of abnormal operating conditions, on the other hand, alternative or additional measures are required, for which the operator or the operator's personnel has full responsibility and legal liability. That applies in the case of malfunctions and also to the delicate subject of safety system overrides. The motivation for overriding safety systems is clear: maintaining operations or evacuating the line using the main or auxiliary drive instead of the lengthier process of evacuation using the emergency drive.

Activation of a safety system can have one of two causes: a fault in the component or system monitored or a fault in the monitoring system or sensor itself. In either case, overriding the safety system involves certain risks:

- inability to distinguish between a monitoring fault and a real problem,
- incorrect evaluation of the real problem and its impacts on the installation, and
- failure to take (adequate) counter measures.

As already pointed out, the decision to override the system and the responsibility for that decision rest with the operator or the operator's personnel. Such decisions are often taken in a state of stress: financial considerations, rarity of the occurrence, the pressures of handling queues of passengers. In the interest of sound decision-making, the speaker proposed measures in three areas to help operating personnel to cope with such stressful situations:

- training (regular realistic training, fault simulation, definition of time windows),
- processes (giving clearly structured instructions, emergency procedure cards, decision diagrams, legally compliant organization), and
- knowledge (training in basic functions, system knowhow – especially for the mechanical-electrical interfaces).

For consistently structured procedures, Richard Dietzsch recommends the use of decision trees, ideally with one tree diagram for every safety function that can be overridden. (See graphic).

Mauro Joyeusaz, Chief Engineer on Mont Blanc

Mag. Marianne Fritz, a legal expert at the Austrian ropeway supervisory authority (BMVIT), said that even the most conscientious operating personnel cannot always prevent the – usually sudden – development of an abnormal operating state. In all cases, however, a strict duty of care applies to ropeway operating personnel. The speaker explained the relevant codes and legal provisions in Austria and went into particular detail on the legal consequences of any infringement of the duty of care in civil, criminal and administrative law. She also spoke of the considerable differences that exist with regard to liability for ropeway operators in the various countries of the Alps.

In the discussion session following the first half of the program, Professor Gabor Oplatka pointed out that wind hazard involves not only such factors as wind speed and direction but also the possible effects of induced oscillations, and Dipl.-Ing. Michael Manhart from Lech am Arlberg spoke of positive results obtained by spraying glycol to deice a track rope.

"Development of constructive solutions for the problems of ropeway operation in difficult operating conditions" was the title of the paper presented by **Ing. Josef Sutter** of the Doppelmayr company, in which he discussed the measures and technical solutions developed to improve system availability in marginal operating conditions in response to increased expectations on the part of both operators and passengers. He discussed the operating characteristics of the various ropeway systems and drew attention to the relationships between the system and crosswind stability of the carriers (see graphic).

Many of the developments introduced to improve system availability in marginal operating conditions had already been mentioned by previous speakers. With the help of some good photographs and drawings, Josef Sutter provided a clear overview of the various options.

Problems with wind:

- higher rope pressures on the sheaves,
- deeper grooves on the rope sheaves,
- higher sheave side plates,
- sprung-mounted counter sheaves on the sheave trains,
- combination sheave assemblies,
- carriers designed for minimum drag,
- chairs with reduced wind contact areas,
- additional weight in/on cabins and chairs,
- swing dampers on chairs,
- automatic canopy closing and locking on empty chairs,
- design of (un)loading areas to take account of prevailing winds, e.g. 90° unloading,
- provision of wind breaks,
- automatic reduction of line speed at a certain wind speed,

PHOTOS: J. NEIEZ

- rope monitoring with RPDs,
- rope-securing devices on stationary installations.

Problems with snow and ice:
- appropriate dimensions for station and line components,
- appropriate component design,
- enclosed grip design,
- carrier parking (detachable systems),
- continuous station enclosures,
- weather doors for the stations,
- removal of carriers from the line at night.

The speaker also dealt with lightning protection, avoiding problems with damp, safety system failure, and conditions for evacuation with the various ropeway systems, focussing in particular on the integrated evacuation system. In his summary, Josef Sutter said that the technical and operational means were available to cater to a very large extent for today's user expectations of ropeways operating in challenging weather conditions.

Enric Barbier, Technical Director in Andorra, and **Manel Salsas,** Technical Director of Baqueira Beret (E), then presented their "Computer aided model for the determination of the necessary rescue team". This is an Excel software program in five languages that generates an optimized deployment plan for the rescue team taking account of the existing evacuation plan and the relevant parameters in the individual case (carrier position, tower heights, rope spans, terrain, number of towers to be crossed, possible uphill/downhill operation, etc). The process relates to rescue by abseiling and not to evacuation along the rope. One of the foundations for the work was OITAF Guideline no. 26 on the subject of rescue from ropeways produced by Committee no. 6.

Seminar chairman Mauro Joyeusaz is in charge of one of the world's biggest current ropeway projects involving the construction of a new aerial tram serving Mont Blanc from the Italian side. He began his presentation, which was entitled "The new Mont Blanc Ropeway – construction and operation in extreme working and operating conditions" with a presentation of the history of the Mont Blanc ropeway and the local topography before going into detail on the new project for a jigback to be built in three stages, namely
- La Palud (1,370 m) – Pavillon (2,178 m),
- Pavillon (2,181 m) – Rifugio Torino (3,329 m) and
- Rifugio Torino (3,320 m) – Punta Helbronner (3,452 m)

From the photographs and the renderings of the terminals shown by Mauro Joyeusaz, it is clear that a very special feat of ropeway engineering is in the offing, and ISR will be reporting in full following the planned completion of the project in 2015.

Enric Barbier, Andorra, and Manuel Salsas, (from the left)

The construction site photos, complete with shear rock faces at over 3,000 meters above sea-level, were impressive. But perhaps not everyone will envy Mauro Joyeusaz his job as chief engineer of this exciting project!

Josef Nejez

Rendering of the Helbronner upper terminal

Rendering of the Pavillon mid-station

PHOTOS: J. NEJEZ, INGENIERIA PERLA MONTAGNA