IRSE Swiss Section International Technical Visit

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The IRSE Swiss Section's first International Technical Visit on 14-16 March featured the control and safety systems for the new Gotthard base tunnel, wine making and towns in the homeland of Switzerland's beloved Heidi, operations control and signalling for Rhaetian Railway's 384 km metre-gauge network, a surprising annual meeting and a ride in Pullman carriages up the 6% grade of the Arosa branch.

14 MARCH: ZURICH AND THE NEW GOTTHARD TUNNEL.

We met in the great hall of Zurich main station. The cold was compensated by the welcome of Melanie of Systransis at the check-in desk. A road vehicle had somehow gained permission to enter this holy hall of the Swiss Federal Railways and took our luggage. We found ourselves in an illustrious group of 69 members from China and Japan – some of whom flew in just for this event – and from all over Europe, including Latvia and of course Switzerland. Twelve partners (at this event, all ladies) accompanied us, at times joining the technical tours or exploring the vicinity.

At our first stop, at Thales' Zurich offices, we were welcomed by Swiss Section President Markus Montigel and IRSE Vice President David Weedon. Peter von Rotz had orchestrated a rich programme in which experts from Alcatel Lucent, Siemens, Systransis and Thales presented their contributions to reliability and safety in the Gotthard base tunnel.

The world's longest. When the 57 km, twin-bore tunnel enters service in 2016, it will be the world's longest railway tunnel. Up to 300 trains per day in each direction will traverse the Alps at up to 250 km/h at an altitude 500 m lower than the legacy Gotthard route. The tunnel will be a vital link on Corridor 1/A from Rotterdam to Genoa and save an hour of travel time.

The central focus of the tunnel's design is safety. Equipment will detect train faults such as fire or hot parts before the train enters the tunnel. Accident scenarios include a lineside or train fire, or a train crash or derailment, with or without dangerous goods. In an emergency, the only exits and access points will be the tunnel portals. The access shafts built for construction, including the 800m Sedrun lift, will help ventilate the tunnel but not serve as exits.

Reliability critical for safety. With the nearest exit up to 29 km away, fail-safe isn't enough: like an airplane, the tunnel must continue to function in an emergency. This makes reliability critical for safety. A common feature of all the tunnel's systems is redundancy for reliability, which is critical given the difficult access to components for repair and their importance in an emergency. Also critical are the filtering and cross-checking of alarms.

The tunnel contains two sets of 110 km/h double crossovers. Cross-shafts also connect the two tubes every 300 m. In the presence of smoke or hazardous gas, doors will help maintain higher-pressure, breathable air in the second tube, where passengers will await a rescue train.

Testing for emergencies. Thales is responsible for the Gotthard base tunnel's signalling concept. Their G-LAB is testing the train control systems to be installed in the tunnel, in trains and in control centres. The test platform simulates trains and radio links for the tunnel's ETCS Level 2 signalling. Several train drivers and signallers can work in the lab in their respective roles and deal with simulated faults and emergencies. The focus of the tests is safety, not functionality or capacity. About 90% of tests will be done in the lab and only 10% in the field. Nonetheless, test running in one tunnel section will start in January 2014.

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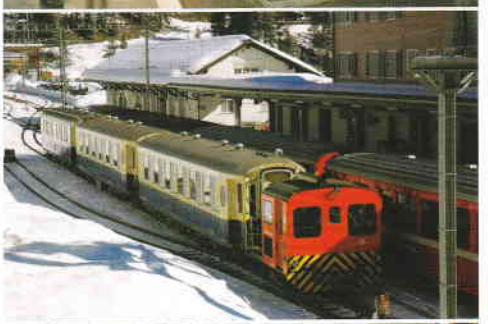
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1. Melanie of Systransis in Zurich main station
2. RhB's Landquart shops
3. Shunting our carriages in Arosa
4. Keeping a watchful eye on RhB's north end
5. Zurich test lab for the new Gotthard tunnel

A Systransis system monitors and predicts train movements. It alerts controllers to conditions such as low train speed, which may indicate that something is wrong, and prevents a train from driving into an unpowered section unless it can coast to the next powered section. With one click, controllers can keep trains from entering the tunnel, stop trains at evacuation points and get trains out the tunnel, if need be by backing out. The objective in an emergency is to get the system into a "calm" state, then proceed with further evaluations and actions.

A Siemens system enables a user to monitor and control some 20 different tunnel systems, from a variety of suppliers. In the event of a general alarm, the user can drill down to displays of individual components, such as doors, ventilators and lights.

Maienfeld and Heidi

As we returned to Zurich main station on the Uetliberg railway, we admired the Uetliberg's laterally offset catenary and were recognisable as railway devotees because we mostly took pictures of signals, level crossings and locomotives. Our two reserved coaches were waiting at the main station. But doesn't a train also have a locomotive? Not to worry: a regular train soon entered the station and was coupled to our coaches.

We headed south to Maienfeld, hometown of the very likable character of Johanna Spyrig's renowned 1880 novel *Heidi*. During the trip and over a finger-food dinner of local specialities, we were able to renew old acquaintances and make interesting new ones.

After dinner, a short walk in cold air brought us to the Pola winery, where we tasted the products of the winery's local and exotic grapevines and perused its historical book collection, including plans for one of the few Swiss railways that were never built. One connoisseur reported that the Blauburgunder (Pinot Noir) brought him deep and restful sleep.

15 MARCH: RhB LANDQUART

We awoke to bright sunshine but bitter, windy cold. A few minutes' train ride brought us to Landquart, where Marco Lüthi and his colleagues of the Rhaetian Railway (RhB) presented their on-train customer service, control centre, signalling and workshop.

Infrastructure and its environment. The RhB's metre-gauge network comprises 384 route-km, of which 58 km are tunnels and 15 km bridges. The Bernina route starts at Chur at 580 m, culminates at Hospizia Bernina at 2253 m, and then descends to Tirano in Italy at 420 m. Maximum grade is 7%. Weather on Bernina Pass changes fast and differs entirely from that in the lowlands. Dispatchers get information from both weather stations and drivers, who can for example say when to activate turnout heaters.

The RhB spends about 83 million euros yearly to maintain and modernise its infrastructure. High in the Alps, the RhB must be ready for heavy snow, but also for avalanches and rock slides. Detectors warn of trouble; repair crews are always on call. At the cramped sites of some stations, turnouts may extend into tunnels or onto bridges. Nevertheless, some trains are too long for some passing loops. At several locations, the meter-gauge RhB and standard-gauge SBB cross each other or share three-rail track.

Customers. RhB has a strongly symbiotic relationship with tourists, who comprise some 40% of RhB's 11 million annual passengers but supply about 80% of revenue. We were able to talk with a real-life Heidi who is an enthusiastic RhB train attendant. She diplomatically deals with people who lack the right ticket, answers questions ranging from scenery to connecting trains, tests brakes, checks doors, helps with prams and bicycles and signals the driver to depart. In summer, riding in RhB's open carriages at up to 33 km/h requires "strong hair spray" and tolerance of wind and tunnel noise.

Other main RhB customers are commuters and freight shippers. RhB hauls some 800 000 tonnes of freight per year, which is said to save 100 000 truck trips. The Vereina tunnel opened in 1999 and offers an 18-minute ride for some 500 000 road vehicles yearly.

Dispatching. Dispatchers manage some 550 trains per day over single-track routes. In the dispatching centre, trains are colour-coded on time-space graphs by degree of tardiness. If an SBB train from Zurich is late, the RhB dispatcher faces a dilemma: If the dispatcher holds the RhB train, it produces knock-on delays, whereas if he or she doesn't, not everyone may fit in the next train an hour later. Although guidelines exist, each dispatcher is responsible for sorting out whatever situation they create.

The dispatchers control station displays and announcements and send messages to crews so they can tell passengers about connections. A button at each unmanned station lets passengers ask a dispatcher about delay reasons and bus replacements. As many stations have no road access, reaching the replacement bus can mean a half hour's walk.

Signalling. Of particular interest to the IRSE members was naturally RhB's signalling. The railway's 103 stations and stops are protected by 99 interlockings. By 2024, RhB plans to replace ten Domino 55 interlockings, aged 43 to 53, and the 58-year-old electro-mechanical *Schalterwerk* interlocking at St. Moritz. The following table shows the pros and cons of relay and electronic interlockings from RhB's viewpoint.

	Relay Interlockings	Electronic Interlockings
Advantages	Well-proven technology High availability Uniform functionality Maintenance personal and users trained and spare parts available Multiple suppliers	Somewhat smaller investment than for relay interlockings Lower maintenance costs (fewer relays) Centralisation of several stations along a line allows savings
Disadvantages	Supply industry seeks to replace relay technology long-term Need to pay licence fees to secure supplier know-how Long-term availability of spare parts uncertain	Availability Non-uniform functionality (requiring additional training) Costly system maintenance (software versions) Life expectancy beyond 25 years hard to evaluate (life-cycle cost) Dependency on just one supplier Long-term availability of spare parts uncertain

Based on a case-by-case evaluation, some of the new RhB interlockings will be relay and some electronic. RhB is also seeking a replacement for their ZS190 automatic train protection.

Workshops. Some 120 people work at RhB's Landquart workshops. Carriages are refurbished every 10 years, including toilets and air conditioning, and are now migrating from vacuum to air brakes. Equipment under the workshop's care includes three steam locomotives, a 1929 "crocodile", 1950-era electric locomotives still in regular service and ultra-modern Allegra trainsets.

Heidi's Homeland.

We returned to Maienfeld via a short sightseeing tour of Heidi's storybook homeland. Special training had given our Swiss postal bus driver an astounding ability to manoeuver through narrow village streets.

A Hong Kong perspective. Although the Swiss Section's annual meeting in Maienfeld was mostly in German, a surprising number of non-Swiss-section IRSE members sat in on it. In expressing his appreciation for the three-day programme, Charles Lung of Hong Kong compared IRSE to a 101-year-old mum, the Hong Kong section to a 17-year-old teenager trying to prove she was an adult and the Swiss Section to a two-year-old Heidi.

MARCH 16: THE CLIMB TO AROSA

The day was cold and windy at 07:00 in Maienfeld, but the weather improved as we journeyed from Chur in vintage Pullman carriages on the 26km RhB line to Arosa, which opened in 1914. Climbing at a maximum of 6%, our train clung to mountainsides and crossed a number of hair-raising bridges, including the Langwieser Viaduct, RhB's longest (284 m), which runs 62 m over the Plessur River. An aerial cable car then brought us to the Aroser Weisshorn at 2,653 m and perfect visibility over the snowy Alps. *[We were lucky in several ways: just 13 days later, on Good Friday, a major rockslide that hit the Chur-Arosa line was expected to keep it closed for weeks.]*

Later, as we began our descent from Arosa, young accordionists played in both our upholstered Pullmans. Thanks to the exceptional efforts of the IRSE Swiss Section and the sponsoring companies, we could look back on three fascinating and very enjoyable days. In the words of Philippe Barthel of France: "Very great moments, very great people, splendid sightseeing, delightful. Thank you for all, and hope to visit you again."

Editor's Note: As the Uetlibergbahn approaches its terminus under the Zurich main line station it shares tracks with the Sihltalbahn (both now under the same management). Whilst the Sihltalbahn uses the standard Swiss 15 kV 16.7 Hz traction system, the Uetlibergbahn uses a 1200 V d.c. system. To avoid the complications, the contact wire for the Sihltalbahn is in the normal position on the centre line of the track, whilst the contact wire for the Uetlibergbahn is offset to one side, using special narrow pantographs.

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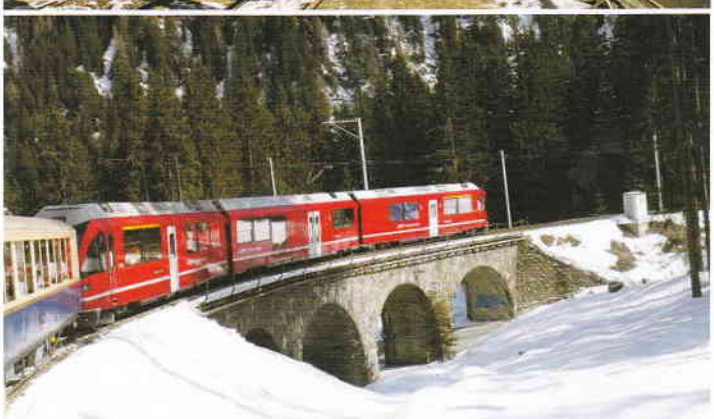

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6. Bus and non-centred train catenary on Zurich's Uetliberg line
7. Swiss section president Markus Montigel and Claire Porter in Maienfeld
8. In Arosa, after alighting from our Alpine Classic Pullmans
9. Descending from Arosa

Photos: P-N Rietsch and H Uebel