SWISS SECTION

Sorting wagons and interfacing the interlockings near Lausanne

George Raymond

On 13 November 2015, at the Lausanne marshalling yard of Swiss Federal Railways (SBB), six speakers presented technology for sorting wagons by destination and for creating interfaces between interlockings of different makers and generations. In their audience were 24 members and three guests of the IRSE Swiss Section.

René Julmy of Siemens told us that operating Lausanne marshalling yard involves interactions among the following components:

- **SBB's Cargo Information System (CIS)**, which contains the current consists (train formation details) of trains moving over the main line.
- **SBB's Train Number (ZN) system**, which allows each train to transmit its number to trackside readers for automatic routing on the main-line network.
- **The consist-checking system ARKOS**, which checks that each inbound train contains the wagons that CIS thinks it does, in the right order, on the basis of axle weights and spacing. ARKOS replaced the employee who would walk along the train with a dictating machine.
- **A Siemens CM100 yard control system**, which takes a verified inbound consist and assigns each wagon to a yard track corresponding to the wagon's destination. The system also takes account of placement rules for dangerous goods within outbound trains. The CM100 then prints a list telling an employee which wagons in the inbound train to uncouple as they approach the hump.
- **A Siemens Trackguard MSR32 hump-control system**, which uses the track assignment plan from the CM100 to guide the driver of the locomotive that pushes the train over the hump. (At SBB's Limmattal marshalling yard near Zurich, which sorts about 3,000 wagons a day compared to Lausanne's 1,000, the hump system controls the locomotive directly.)

As wagons approach the hump, the MRS32 again checks axle weights and spacing, and verifies uncoupling. Some hump-yard systems also check the wind speed. The MRS32 then calculates how long and how hard to apply the yard's retarders (track brakes) to the wheels of each wagon as it descends the hump. The safety integrity level of the MRS32 is SIL 2, not SIL 4.

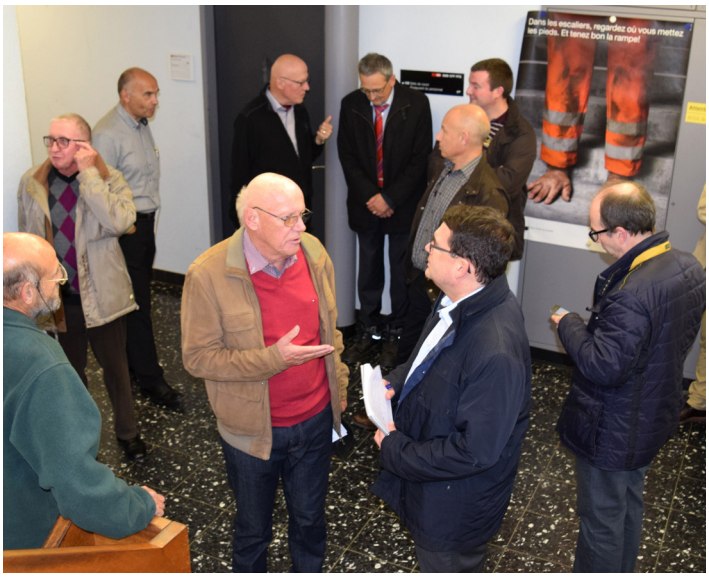
Point reversal in 0.8 seconds

In Lausanne, retarders on five primary tracks slow the progress of wagons as they roll toward one of 38 destination tracks. As each wagon or group descends the hump, the MSR32 monitors wagon speed and position and recalculates retarder application. As they descend the hump, wagons must roll at the right speed. Once a wagon group has cleared a set of points, the MRS32 can reverse their position within about 0.8 seconds. But if wagons roll too fast or too slowly, the MRS32 may not have time to reverse points between two wagon groups. In this case, the MRS32 freezes the points. This sends the second wagon group onto the same track as its predecessor. A locomotive must then re-shunt it onto the correct track.

On a wagon's destination track, a field worker manually places a 'skate' on the rail to stop the wagon in the right place. Wagons rolling too fast could cause wagon or cargo damage or continue

Below, the Lausanne yard sorts most wagons at night.
Photo Bob de Graffenried, surlevif.ch

Christian Elfeber of Sigdata was the afternoon's lead organiser. *Photo Pierre-Noël Rietsch.*



Between segments of the technical visit. *Photo Pierre-Noël Rietsch.*

past the far end of the destination track. (Some European yards have installed additional retarders in these positions to prevent wagons from fouling exit points.)

SBB's busier yards in Limmattal (Zurich) and Muttenz (Basel) have additional devices that Lausanne lacks. They replace the manual placement of skates:

- A retarder at the entry of each destination track slows each wagon, so that it stops just short of other wagons already on the track;
- When wagons stop too soon, low carts running between the rails pull wagons to group them.

Mr Julmy said that on a destination track in a Russian or North American yard, wagons' automatic couplers attach arriving wagons to those already there, whereas in a European yard, wagons' buffers push them apart. But on the approach to the hump, uncoupling European wagons is easier.

Interfaces between interlockings: operator requirements

Patrick Sonderegger of Thales described the Swiss network's heavy traffic levels and the resulting need for reliability in interlockings. On some lines, they must also integrate ETCS Level 2 functionality. Heavy traffic also leaves ever-smaller windows of opportunity for testing new interlockings and their interfaces. This requires fast switching back and forth between the new and old system. Operators also require that any changes in interlocking technology entail minimal down time for the re-training of dispatchers.

Marc Pellaton, also from Thales, described the implementation of an Elektra electronic interlocking for the Denges main-line junction, which lies parallel to the Lausanne marshalling yard on SBB's Geneva–Lausanne line. Due to enter service in April 2016, it will interface with four neighbouring Siemens interlockings of three different generations. Unlike on other parts of the Swiss network, trains have no alternative route between Geneva and Lausanne if there's a problem. Operators are consequently concerned whether the interlockings can deal with disturbances and ask questions such as: *"Can a train be signalled through an occupied block?"*

Interfaces between interlockings: technical requirements

Mr Pellaton noted that SBB's procurement policy allows mixing interlockings of various generations and suppliers along a line. Replacing several small interlockings with a bigger one is difficult whenever adjacent interlockings have not reached the end of their economic life. Mr Sonderegger said that keeping older interlockings in service is sometimes cheaper than replacing them. But SBB then strives to modify them as little as possible.

This creates a need for intelligent interfaces between interlockings of different makers and different generations, based on 'quasi-standards'. The design of such interfaces must follow CENELEC standards, but can take advantage of TCP/IP technology. An interface system must also be as generic and pre-tested as possible. Simplifying and standardising the implementation process makes errors less likely.

Relay coils at 56° C

Christian Elfeber of Sigdata presented one of his company's specialties: its *eLogic* interfaces that link Thales and Siemens interlockings. Since August 2014, Sigdata has worked on such projects at ten places in Switzerland, in all three main language zones. At Denges junction, which links two main-line routes and provides access to the parallel Lausanne marshalling yard, Sigdata is implementing interfaces between Denges's new Thales Elektra interlocking and three generations of Siemens interlockings.

Mr Elfeber said that the more complex an interlocking, the greater the potential savings from using electronic technology instead of relays for its interfaces. An electronic interface also avoids the energy use and unproductive heat generated by relays, whose coils can reach 56° C.

Parameters instead of programming

Sigdata's *eLogic* interfaces have separate cards for generic and specific parts. To adapt *eLogic* to a specific interlocking, the developer mostly uses a graphical interface to set parameters instead of programming.

In its role as an intelligent link between interlockings, the *eLogic* interface duplicates all processing steps in two independent strings of complex programmable logic devices (CPLDs) and uses a patented method to compare and combine the resulting instructions at the last moment before forwarding them to the neighbouring interlocking.

"We are just the postal service," Mr Elfeber said, *"but we do check the information in each letter to make sure it doesn't give the recipient a heart attack."*

Five principal tracks and their retarders (track brakes) lead to Lausanne marshalling yard's 38 destination tracks. *Photo copyright Google Earth, used with permission.*

Just two Ethernet cables

Mr Sonderegger of Thales said that whereas conventional interfaces between Siemens and Thales interlockings require up to 36 wires, the *eLogic* interface needs only two Ethernet cables, one of which is intentionally redundant. To take advantage of ever-shorter testing windows, *eLogic* can be unplugged and plugged easily.

Mr Pellaton of Thales said that Denges junction's Elektra interlocking governs 41 signals, 42 ground signals and 17 sets of points. It will enter service in April 2016; installation and testing began a year earlier. It replaces an SpDrS60-SBB dating from 1974. The *eLogic* interfaces correspond to the following 11 tracks, which link the Elektra with Siemens interlockings of three generations.

Number of tracks	Siemens interlocking generation	Zone	Direction from Denges junction
2	SIMIS-C	Morges	Southwest towards Geneva
3	Domino 67	Renens	East towards Lausanne
1	SpDrS60-SBB	Bussigny	North towards Yverdon
5	SpDrS60-SBB	Lausanne marshalling yard	Parallel to and southeast of Denges junction

Dispatchers in the Lausanne regional centre control all these interlockings via a Siemens ILTIS system.

Most of these tracks have *eBlock* interfaces, which essentially just say the track is clear but transmit no route information. But four of the tracks into the Lausanne yard have *eFAP* interfaces, which also transmit route information for both through trains and shunting. Both the *eBlock* and *eFAP* units use the *eLogic* system.

The SpDrS60 interlockings are the oldest. Mr Julmy said that Siemens still has models of all generations of interlocking systems running at their development centre in Braunschweig, Germany. Computer generations are shortening from ten to five years.

Dieter Kaupp, former lead developer of hump-yard control for Siemens in Switzerland, presented the Lausanne yard's five retarders. The main-line tracks of Denges junction are in the far background. *Photo George Raymond.*

A lively discussion. *Photo George Raymond.*

Linking solid and stranded wire

As we toured the equipment room, all displays were on flat screens except an old schematic board over the door, whose lights show the status of the current Denges interlocking.

In designing its interface, Sigdata also faced the challenge of linking solid and stranded wire. Siemens' standards for the SpDrS60 require that interface wires be solid copper and soldered to the interlocking. But Sigdata's *eLogic* system needed stranded wire, which is more supple than solid wire when many wires are combined in a cable. We saw Sigdata's solution: a board lined with crimp receptacles for both the solid and stranded wires. It provides one-to-one and one-to-many connections as needed and obeys SpDrS60 rules for wire numbering.

President's remarks

President Daniel Pixley said that the Swiss Section now has 56 individual and nine corporate members, and asked us to check the IRSE website for the Section's 2016 events:

- 11 March, Sargans: Visit to a historic mine and tunnel railway and the Swiss Section's annual meeting;
- 3 June, Olten: Paper session on international signalling;
- 21 September, Berlin: Swiss Section evening at InnoTrans;
- 11 November, Zurich: Visit to cable-worked airport people mover.