SWISS SECTION

Swiss Section Technical Visit
Simplifying Level Crossings for Savings – and Safety
Report by George Raymond

Twenty of us from the IRSE Swiss Section visited Schweizer Electronic (SE) on 14 November to see its solutions for level crossings, railway work-site protection and remote control of locomotives. Founded in 1964 by Margrit and Rudolf Schweizer, in 2002 SE began moving to the modern site in Reiden, Switzerland, where its makes all its products. SE employs 150 and has support offices in 12 countries.

Daniel Berchtold began by presenting the problem of low-volume level crossings, SE's VaMoS solution, its recent success in the UK and the situation in Australia.

LOW-VOLUME CROSSINGS: FEW USERS, MANY DEATHS

The vast majority of the world's level crossings are low-volume, i.e. they each see relatively few road users and pedestrians. Protecting them with conventional systems is prohibitively costly. Available funds gravitate to high-volume crossings. Low-volume crossings remain unprotected and collectively generate many deaths. They call for protection solutions that are safe, cheap and reliable.

UNINTENTIONAL FAILURES AND INTENTIONAL ACTIONS

Most human failures at level crossings are unintentional: they involve distraction by electronic devices, fatigue, habit, a misunderstanding, or an unclear situation or indication. But some failures involve intentional actions like passing danger signals to save time and wrong decisions combined with unawareness of risks.

An as-yet-unpublished study observed user behaviour and attitudes at low-volume crossings equipped with different combinations of user interfaces and lights. The study showed that:

- Level-crossing systems are most effective when they show both red and green lights. Green increases confidence that the system is working;
- If a crossing system offers no green light, just red and dark, dark is ambiguous: is there no train or is the system inoperative;
- A flashing red light is also ambiguous, especially for international users: does it mean stop, be careful, or system inoperative;
- Signs containing text – such as the multiple signs at many UK crossings – are generally ignored and may even create unsafe confusion.

### MORE SAFETY FOR LESS MONEY

A level-crossing system can never be fully "fail-safe". Unlike a train driver, a crossing user cannot be expected to wait indefinitely at a signal that is at danger or dark. Reliability is therefore central to crossing safety.

In designing their Value for Money System (VaMoS) for level crossings, Schweizer Electronic sought both holistic cost reduction and holistic safety maximisation in line with EN 50126. Reliability is central to both. SE has achieved all these goals with a one-word motto: simplify.

NO NEW COMPONENTS

Although procurement processes often focus on purchase price, SE simplified the design of VaMoS to reduce all contributors to life-cycle cost, including design, development, manufacturing, transport, site planning, installation, power consumption and maintenance.

To cut development costs and avoid childhood illnesses, SE used existing principles and technologies, and off-the-shelf components from third parties.
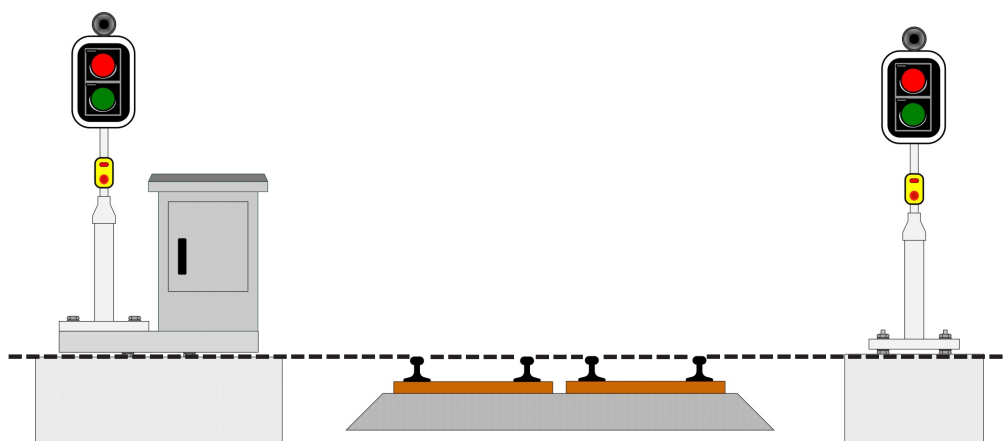
Schematic of a typical VaMoS crossing system for a double-track line
(Schweizer Electronic / G Raymond)

The VaMoS crossing unit: simple by design
(photo G Raymond)

Complexity is the enemy of reliability. In a conventional level-crossing system, what costs the most, fails most often and consumes the most power is the computer. In VaMoS, logic is therefore built into hardware, without a computer or relays.

SE's quest for simplicity and reliability also led them to remove all moving parts and other costly or maintenance-intensive components such as an earth-fault monitor and even paint. Just two wires control both the red and green LED lights. Third parties deliver sub-assemblies, which require just one day for final assembly, verification and shipment from SE's Reiden plant.

SITE PLANNING AND INSTALLATION

To simplify and save money on site planning and installation, Schweizer Electronic designed these features into VaMoS:

- One size fits all. A study is no longer required for each level crossing. (In an EU country, site planning can cost 20 times as much as the device itself.) Because VaMoS does not influence trains, it is not part of the signalling system, so doesn't have to be included in signalling plans;

- The complete kit for a VaMoS unit fits into a standard pallet box, including the two-part mast; this simplifies transport from Switzerland to the installation site;

- VaMoS stands on a standard concrete block, so installers do not need heavy equipment to pour concrete on-site;

- The small footprint of VaMoS keeps it off non-railway land; its proprietary technology minimises work in the danger zone and thus cuts protection costs for the installation crew. Treadles detect train wheels, but do not count axles. A cable connects the treadles to VaMoS today, but SE is developing wireless solutions;

- Off-grid power options, including solar, avoid power lines costing up to 3000 euros per km; Australian crossings can need lines up to 30 km;

- SE checks the VaMoS unit before shipping from its Swiss plant so a local crew can install, test and put the unit into operation in one day.

Mr Berchtold said that SE has reduced the power consumption of VaMoS to 20 W and is aiming for below 10 W. This is 1% of what competitors' conventional crossing systems need. For units on solar power, this shrinks the panel to an A3 sheet size.

MINIMISING MAINTENANCE

Schweizer Electronic has designed VaMoS to require no preventive maintenance or preventive part replacement in a service life exceeding 25 years. Any corrective maintenance is based on remote, automatic diagnostics for a 30-day warning of impending failure that allows repair during "office hours". The system's few components are selected to give the VaMoS unit a

mean time between failures exceeding 10 years and a 15-minute mean repair time. SE's business model is not based on the sale of spare parts.

WORK IN THE UK AND AUSTRALIA

Schweizer Electronic installed VaMoS pilot installations in the UK and Australia in 2014. The UK has over 5000 "user-worked" level crossings devoid of technical protection. Network Rail issued a tender call for over 1000 protection systems requiring no signs. SE won.

In Australia, some 40 people a year die at level crossings. Some 10 railway authorities and 20 operators have a variety of safety targets and policies on risk acceptance. Only about 5%

User-worked crossing on the Stratford to Birmingham line near Newnham, Warwickshire, UK *(photo David P Howard)*

of crossings – including private and pedestrian crossings – are protected. Many are seasonal farm crossings with, for example, no trains for six months and then 10 trains a day. Reliability is particularly critical, as a staff member may need six hours to reach a crossing for repair or a battery check.

PROTECTING TRACK WORKERS

Gerhard Belina presented Schweizer Electronic's system to protect track workers and work sites. Sensors, human sentinels or both trigger wireless sirens and lights. The system also monitors equipment health and sentinel alertness. Features under development include:

- Phased closure as a train runs through a long work site;
- Siren volume that automatically adjusts for ambient noise and warning earphones for workers so trackside residents can sleep;
- Connections with level crossings and interlocking systems, including the ability to hold back a train. This requires new thinking from signal engineers.

REMOTE CONTROL OF LOCOMOTIVES

Thomas Koch presented SE's remote control of locomotives. Applications include shunting in flat and hump yards, adding/removing mainline locomotives, road-rail vehicles, track work machines and rescue trains. The encrypted radio link has a 1000 m range. Adoption of remote control is slow due to discussions of whether one person is safer than two or three and possible job losses.

SWISS SECTION EVENTS IN 2015

IRSE Swiss Section events in 2015 will include a Swiss railway laboratory, a paper session on non-interoperable railways (mostly narrow-gauge) and a two-day weekend event on the Rhaetian Railway's Albula line.