Rapid-action cameras cut simulator costs

DRIVERS on the München U-Bahn are to be trained with the help of a newly-developed simulator, writes Ralf Roman Rossberg

Simulators are increasingly being used for driver training by metro and tram operators as they avoid the need to occupy line capacity with 'live' training sessions on the operational network. The workspace on a simulator differs from real life mainly in that the driver's view is not of the track ahead but of a screen showing the line and its features with pictures generated by computer animation. This is an expensive technique, but developments with digital photography at Gießen-Friedberg Technical University suggest that a simulator with pictures true to real life can be supplied for just one-tenth of the cost of a conventional simulator.

Prof Manfred Merkel, who has worked on simulator development for five years, says 'we use the fact that a train is a form of guided transport moving with only one degree of freedom — either forwards or backwards along the track.' As the amount of movement depends only on the length of line that the train is traversing, it is possible with digital photo technology to provide enough pictures to give the driver an impression that it is almost the same as reality.

But obtaining the pictures is no easy task. 'We use a high speed camera able to take up to 1 000 colour pictures/sec with a resolution of 1 280 dpi. The disadvantage is that the large number of pictures limits the exposure time to very short intervals, which means that we can only work in good weather', says Merkel.

The camera can be controlled by sending electronic commands from a wheelslide prevention system, which ensures that the camera is 'triggered' at regular intervals corresponding to a specific length of route; this is a particularly useful feature when the pictures are being processed. To simulate a trip at low or high speed, the computer simply seeks out the relevant pictures.

A prototype simulator is being tested in the München transport museum.

Merkel says that a high-definition camera can be used in bad weather, but this cannot be controlled in the same way with a device activating shots at regular intervals. Instead, location data for each photo have to be input individually — and this type of camera can only provide 30 pictures/sec.

Initial tests with the high speed camera were carried out on the Hessische Landesbahn which made its line from Frankfurt-Höchst to Königstein available for the university. The pictures proved so good that, when they were shown to engineers from München U-Bahn, an initial contract was agreed for a demonstration simulator. This has now been installed in the recently-opened local transport museum, and it quickly proved to be a big draw with the public.

'The contract served to accelerate the development process, but it also set new requirements', says Merkel. 'For the first time we had to cope with taking pictures in tunnels, where drivers do not have lights on in the cab so that they can focus on signals and their instrument panels. We looked at installing lights in the tunnel, some kind of automated system to illuminate the tunnel ahead of the train, or simply working without extra light, but none of these methods was satisfactory.'

The answer was found eventually. 'We mounted a 1 000 W searchlight on a locomotive, which illuminated the tunnel sufficiently to show many details without destroying the illusion of the train running through the tunnel in the normal way', explains Merkel. A full photographic record of Lines U3 and U6 was obtained over several nights, and this also served as a useful way of documenting the condition of the lines in 2007. A section in the open air to the north of the city presented no problems.

The requirements for driver training mean that it must be possible for the trainer to present the driver with real-life situations such as a signal changing from red to green. 'We can do this by incorporating signals into the real pictures as two-dimensional objects', says Merkel, who makes it clear that the simulator development process is by no means complete.

A 'production' simulator will shortly be delivered to München for drivers to use as part of their training, while a second machine will go to Hessische Landesbahn which will use it to familiarise drivers with the latest version of the PZB90 intermittent train protection system.

Recent development work has included co-operation with the University of Bern where Prof Hansjürg Rohrer has been involved in the Locsim simulator project that began in 1995. Using route and vehicle data inputs, this offers precise calculation of a train's running dynamics which can be simulated in a very realistic manner. 'In the meantime we have been able to change signal aspects and alter the points during the simulation by overlaying bitmap files on to video film', says Rohrer, noting that 'we can even add virtual trains running in the opposite direction on double track sections.'

Auxiliary power

Coradia Lirex X61 trainsets being built by Alstom for the Skåne region in Sweden will be equipped with an auxiliary power supply provided by SMA of Niestetal in Germany.

The company is supplying 98 lightweight static converters with multi-level redundancy to be installed in the 49 trainsets being assembled at Alstom's Salzgitter factory. The design of the converters is based on those supplied by SMA for the Coradia Lirex X60 sets already in use in Stockholm.