

Simulators for training of drivers

Simulation on the original cab

For training of drivers, different options are available.

- During a trip on the track
- On the locomotive at a standstill,
- On a simulator.

Each of these three methods has advantages and disadvantages. Because of ever-growing schedule density, there is less time for driving instruction on the track and the practice of occupational specific cases (behaviour disordered systems or vehicles) is practically impossible, or only feasible during night breaks. It is impossible to realistically portray many common accidents while training in a stationary vehicle.

Training in a simulator allows replication of all possible situations - even emergency operations. Unfortunately, a replica of the vehicle itself (the cab and on-board computer) is very expensive, so that accurate representations are affordable only for large series of vehicles. If only operational situations - and not vehicle breakdowns - are to be practiced, a simplified vehicle model (e.g. with a standard driver's desk) can be used. Examples are the exact models of several large locomotive series by SBB Login and the RAILplus simulator with a multifunctional control panel, contains all the necessary controls of the involved railways (rack operation, train control).

To avoid the aforementioned disadvantages, it is therefore necessary to use the cab of the vehicle itself for operational simulation. The vehicle for this purpose must be blocked and the powertrain disabled. Since the onboard computer (electronic control) and auxiliaries are interlocked, the simulation can reproduce an exact image of the vehicle.

The view of the line ahead is shown on a large screen in the cab. The development and investment costs are very low: it needs several modifications to the vehicle's software and the procurement of a large screen and a standard PC monitor for the instructor. The representation of the line is done with the same methods as in conventional simulation systems.

With early planning, additional on-board computer programs may be installed even during the vehicle development, so that the development expenditure is very small. The great advantage of this method of simulation is that when there are changes in vehicle hardware and software the simulator is automatically updated. The simulator is not tied to a particular vehicle, but can be used without restriction on all vehicles in the series.

Initial tests on vehicles of Aare-Seeland-mobil (GTW) and Chemins de fer du Jura showed promising results. In the summer of 2008, the historic locomotive Ae 4/4 251 of BLS Lötschberg Railway and the FLIRT train 108 of the Algerian National Railways SNTF were modified to fulfil this purpose. Both were shown in late August in Biel Station as part of the diploma exhibition of the Berner Fachhochschule (Berne Institute of Technology), which was followed by the highly regarded presentation of the FLIRT train 101 at Innotrans 08 in Berlin. Several railway companies have decided to introduce this method of instruction for new types of vehicles.

Track representation in cab driving simulations using video

Normally, the line ahead is represented in the simulator cabs with a virtual 3D landscape. This landscape can be real or fabricated.

In the case of a virtual line, station facilities can be made in a sequence and at distances that can be determined without restrictions. For this reason, the line should not present too steep grades and no tunnels. For the RAILplus simulator was chosen a line from a previous work of the already existing S-Bahn Zug. Despite initial concerns, the integration of the station Malans overlooking Lake Zug or view Rigi when passing through the station of Zollikofen have created no problems for operators. It is possible to place along a virtual line any signals or signs of traffic regulations of Swiss or foreign origin. Objects (buildings and vegetation, as well as trains travelling in opposite directions) can be installed without problems. Through an interface of the data format of Microsoft Train Simulator, these objects are fairly easy to create with the editors available for that purpose.

The track plan to scale, complete with all its signs and signals, level crossings, platform simulation, the simulated train and trains traveling in opposite direction is depicted on the screen of the instructor. The position of fixed signals and lighting in front of trains travelling in opposite direction can be changed simply by clicking.

The creation of such virtual models is extremely time consuming.

An alternative to virtual representation is the projection of a video film. A video film must be played at any speed forwards or backwards. The signals appear in a video journey usually in an open position. If the instructor wishes to test the driver's reactions to other situations, he can change the position of the signals. This is made possible by a digitally superimposed image over the signal on the video film. Since the videos are comprised of single frames, it is also possible to include different routes with this method. With virtual 3D techniques, objects such as trains travelling in the opposite direction can also be displayed on the film, which in reality (during the video) were not present.

To display smooth video, the computer must be equipped with a large capacity hard disk with a fast access rate (one hour of video recording is equivalent to more than 20 GB). The frame refresh rate of current computers is about 25 frames per second.

A video representation costs significantly less and can be completed more quickly than a 3D virtual representation. Thus, for example, at Innotrans 08 on 15th September 2008 the entire Thenia-Alger route of the Algerian National Railways (47 km) was filmed, then edited and synchronised, including virtual trains moving in the opposite direction on the simulator and was presented on 23 September in Berlin. The introduction of new situations (eg worksites) on a simulator is thus made possible within a few days.

The exact reproduction of real courses, coupled with the easy identification of sites in the video also allows drivers to be trained in the most energy efficient style.

Abstract

The Berner Fachhochschule BFH has developed together with various railway companies (RAILplus AG, Aare Seeland-mobil, Chemins de fer du Jura, BLS) and Stadler Rail, a new concept of vehicle simulation for training simulators. In addition, a new way of presenting the route in such simulators was developed.

With the aforementioned two methods of vehicle and route simulation, simulators can be developed at a fraction of the cost of a conventional simulator.