

# RAILWAY PRO



September 2014 • No. 111

magazine

## Air-rail link **SUSTAINABLE TRANSPORT**

**ALSTOM**



The growing demand for mobility in major cities presents a considerable challenge for public transport services all over the world. In order to be able to operate effectively, they have to make full use of all optimisation possibilities. A modern dispatching and planning system for vehicles and personnel can make a significant contribution towards increasing efficiency. Since 2004 Stockholm's Pendeltåg commuter train service has improved its planning quality with the support of IVU Traffic Technologies AG.

# Moving Stockholm

Efficient dispatching and planning with modern software

## DISPATCHING AND PLANNING FOR 110 TRAIN UNITS

### The Stockholm Pendeltåg system

operates between the Swedish capital city and its outlying communities. A rail network with an overall length of 245 kilometres links 53 stations, providing services for some 270,000 passengers every day. Most of these are commuters travelling to and from their work in Stockholm. Since December 2012 the Arlanda airport has also been accessible with the modern Pendeltåg trains. In view of the fluctuations in the numbers of passengers, the daytime services typically operate with two or four train units, depending on the type of rolling stock, whereas the evening services are operated with only one or two units.

Already in 2004, IVU Traffic Technologies AG won a Europe-wide call for tenders issued by Citypendeln, the operating company at that time. Since then, the integrated software system IVU.rail has been used by Pendeltåg for the planning and dispatching of some 110 train units. The special functions offered for planning multiple-unit trains were a key factor influencing the choice of this software, in addition to the precise modelling of the addition and removal of units. Using the system, the position of each individual train unit can be tracked accurately. Marshalling can also be modelled with precision. This means that the planners of vehicle workings never lose sight of the position of each train unit, so that they are able to put trains together efficiently and flexibly.

## TRACK ALLOCATION PLANNING FOR IMPROVED STABILITY

The daily planning of vehicle workings becomes much more stable if the dispatching and planning system is supported by track allocation planning. Stockholmståg, which has been operating the commuter services since 2006, makes use of the functions of IVU.rail.vehicle to produce detailed station sequences for rolling stock. A graphical display of the sidings helps the Swedish planners to plan shunting activities in advance. A top view of the railway station shows details of the railway tracks, so that planners can immediately



see which tracks are occupied and where shunting is possible. The system automatically issues a warning if a unit is blocking a route or if there are several units on a section of track. The system reduces the burdens of daily routines for the personnel and speeds up the planning of vehicle workings.

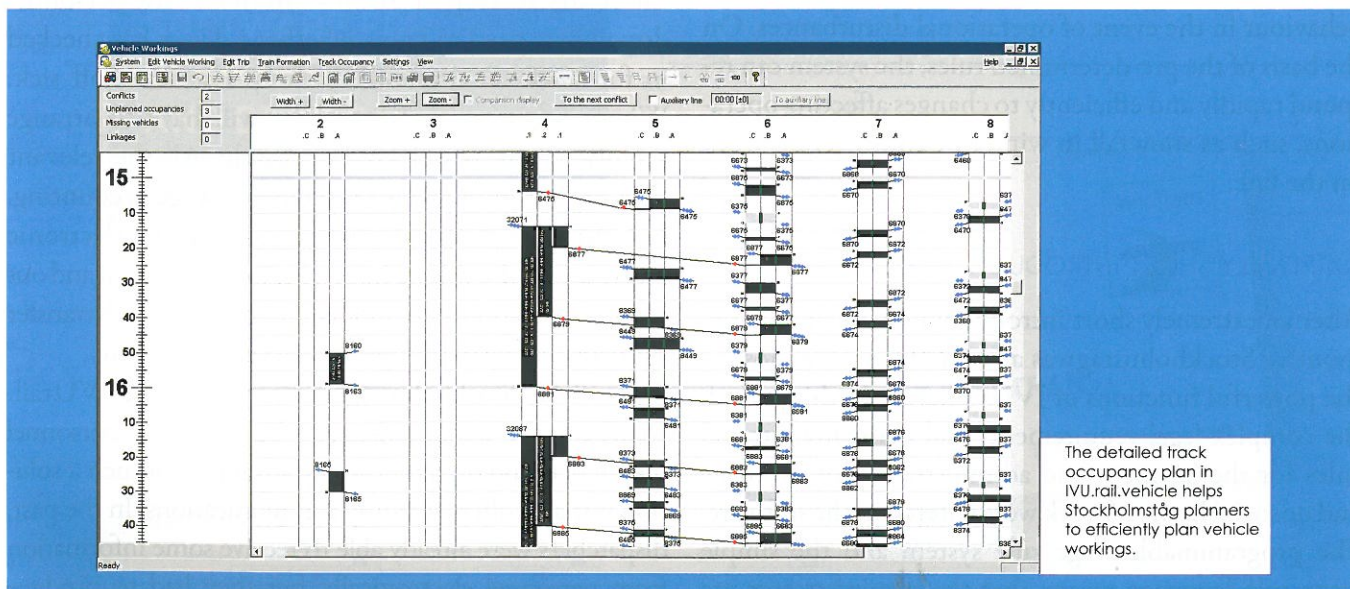
Sweden has a liberalised railway market, so that new calls for tenders regularly go out for the operation of networks, leading to frequent changes of operating companies. Fully interoperable software systems ensure that the network can be handed over without interruptions to services, train cancellations, or inconveniences for the passengers. The planning and dispatching software must be able to operate in heterogeneous system landscapes. IVU.rail therefore supports standard interfaces such as RailML which allow the smooth exchange of data with other internal and external software systems. This is particularly important for the cooperation with sub-contractors. In Stockholm, for example, the provider of maintenance services changed twice in the course of the project. With the IVU solution, Stockholmståg was in a position to integrate the relevant maintenance software seamlessly into the existing configuration.

## DUTY PLANNING FOR 1,500 PERSONNEL

The increasing complexity of vehicle workings and timetables has direct consequences for the duty rosters of the rail personnel. In order to deploy staff as efficiently as possible for the planned vehicle workings it is important to have intelligent systems which are able to take numerous considerations into account – for example where and when can a driver work and on which train? Or whether it is necessary to take working time regulations or holi-

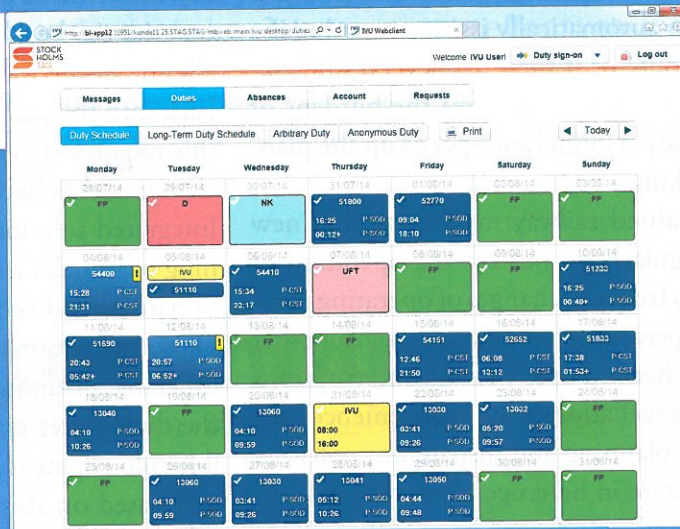
day entitlements into account? In this way the personnel capacity can be adapted to match the requirements. Ideally, the lessons learned from the duty planning can be fed back into the planning of vehicle workings. Once again this requires standardised interfaces for the smooth exchange of data between the individual planning systems. Integrated solutions combine the dispatching and planning of vehicles and personnel for the faster generation of harmonised vehicle workings and duty rosters. Since 2009, in addition to the module for vehicle working and timetable planning Stockholmståg has also been using the duty roster planning functions of IVU.rail. A flexible rule-engine is able to model the complex duty rules and based on this the system makes proposals for the optimised duties for the individual staff members. It not only takes into account the legal and operational requirements and individual preferences for holidays and free time, but also includes details such as supplementary duties, the time taken to get from the rest area to the train, or the walk from one end of the train to the other at an end station. Passage trips and taxi journeys can also be integrated. Stockholmståg draws up duty rosters for some 1,500 personnel. In addition to the mobile personnel, the system also administers the work schedules for the stationary personnel.

Computer-supported personnel deployment is considerably more efficient than manual duty roster planning. By offering proposals it highlights where there is potential for optimisation. This makes it easier to assess the demand for personnel and the scope for reducing costs. In addition, there are fewer sources of error and the dispatchers are able to administer the working hours of hundreds of employees in a very short time.





IVU.rail.crew's web client lets personnel see their duty schedule and allows them to enter times of absence or duty requests.



## AUTOMATIC DUTY OPTIMISATION

Modern software systems go one step further. They not only make proposals about the potential for optimisation but also intervene in the duty roster planning, in order to distribute duties between all personnel fairly and efficiently. Starting in 2012, Stockholmståg gradually began to introduce the IVU.rail.crew module, which provides the duty optimisation functions. In workshops, the project teams of Stockholmståg identified desirable quality criteria and defined the optimisation goals.

Main objective was to ensure operational stability and to speed up planning of personnel. At the same time, the project teams aim to allocate working hours more equally and to avoid fluctuations in working hours. These requirements call for a powerful system – in terms of both software and hardware. The higher initial investments this involves are offset by the much more robust behaviour in the event of operational disturbances. On the basis of the pre-determined rules, the system can respond rapidly and efficiently to changes affecting operations, such as snowfall in winter or construction work on the line.

## EXTREMELY SHORT INTRODUCTION PHASE

After an extremely short introduction phase of only ten months, Stockholmståg was already able to use most of the powerful functions of IVU.rail.crew. In this period, the complex legal requirements and company-internal rules for the payment and administration of overtime and unsocial hours of work were entered in the software. The programmable wage rule system and the simple wage rule language means that the administrators are

able to enter the rules into the system themselves. Tariff changes or similar modifications can easily be taken into account without the involvement of IVU.

In addition, special 'what-if' scenarios have been developed to enable the company management to identify potential cost reductions. The system helps to establish the factors which have the most effect on costs and to determine optimum parameter values. In this way the decision-makers are able to estimate the human resource costs which would result from given changes to timetable and vehicle workings. In addition, this functionality also offers the opportunity to adapt staffing levels proactively to suit anticipated future developments.

## COMMUNICATING WITH PERSONNEL VIA WEBCLIENT

Another important aspect of personnel scheduling is the ability to keep in touch at all times. The personnel dispatchers need to know whether a driver has checked in for work on time, will turn up late, or is off sick. Where necessary the dispatcher will have to arrange a replacement as quickly as possible. All the relevant data must also be made available for wage accounting. IVU.rail.crew supports this process with the electronic registration of working hours. Personnel check in and out of work on stationary or mobile end-devices which transfer the data directly to the operational centre software.

Since 2012, Stockholmståg has been using the IVU.rail.crew webclient for communications between the personnel dispatchers and drivers. The key advantage of such a solution is that it offers two-way communications. In the past, dispatchers were already able to receive some information from personnel electronically, but they had to produce



traditional print-outs of duty schedules to be displayed on pin boards or handed out. This method was error-prone – for example a driver might forget their schedule or mix the days up. The print-outs were also very inflexible, so that short-term changes could not be included.

With the introduction of the webclient, personnel can now inform themselves at any time about their updated duties. The system automatically flags up any changes to the duty schedule. Working hours can also be registered, for example from a mobile enddevice. To make this possible, the client has been integrated in the driver app of Stockholmståg. When they begin work, the personnel check in using their smartphone to notify the operational centre of their presence. The personnel scheduling is further simplified by functions such as a holiday time account and a duty exchange, which allows personnel to swap duties with one another. Each change

is automatically processed in the integrated system and all the relevant positions are notified.

## INCREASED EFFICIENCY BY MEANS OF MODERNISATION

The stepwise modernisation of the dispatching and planning systems for vehicles and personnel by Stockholm's Pendeltåg since 2004 has led to marked improvements in planning quality. Thanks to the modular IVU.rail solution, the operator Stockholmståg was in a position to adapt their system flexibly to the changing requirements. In line with its expansion plans and developments the public transport operator was able to introduce additional functionalities to the software gradually, and in this way to ensure the optimum planning and deployment of the company's resources, personnel and rolling stock.

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