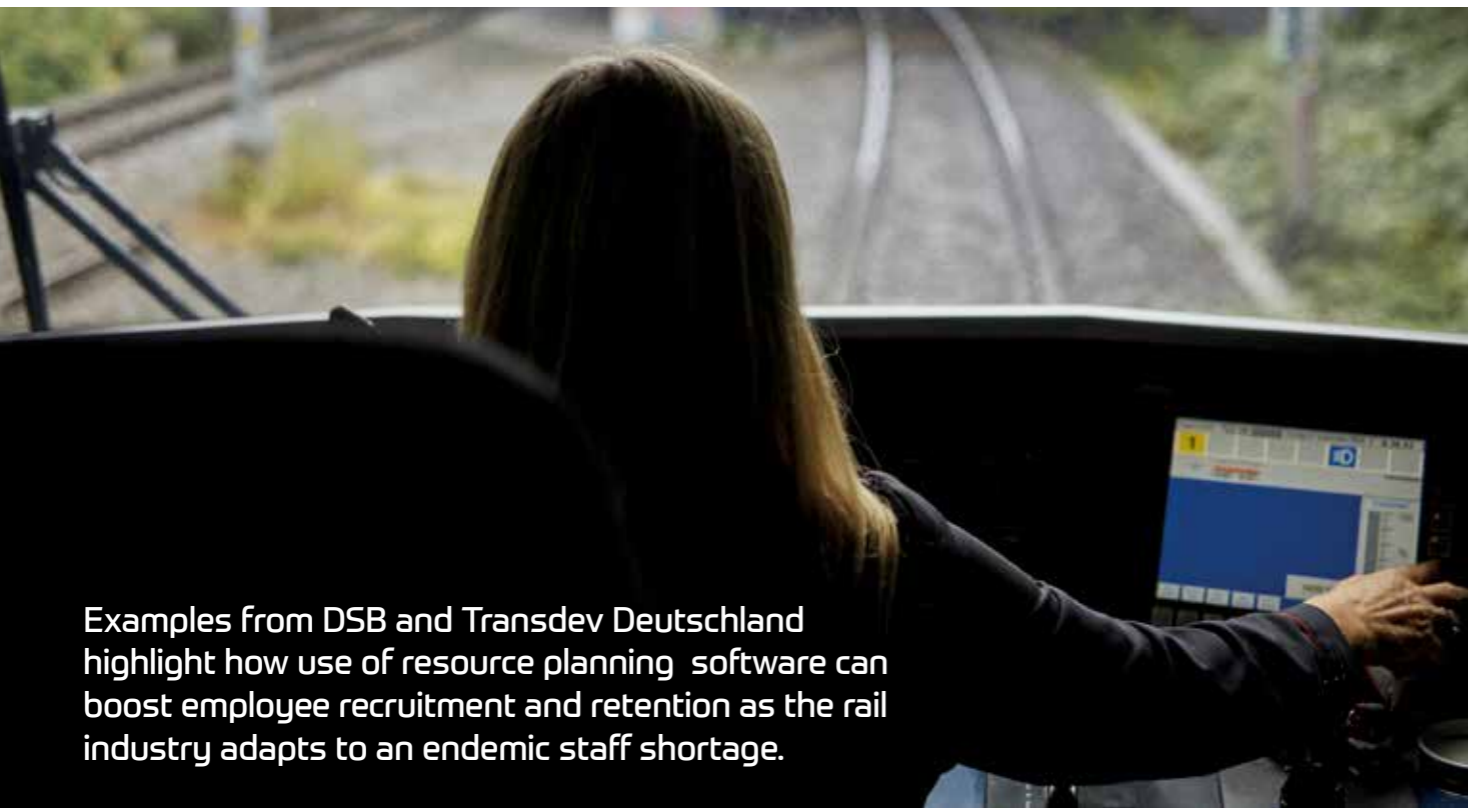


Software tools can mitigate demographic crisis



Examples from DSB and Transdev Deutschland highlight how use of resource planning software can boost employee recruitment and retention as the rail industry adapts to an endemic staff shortage.

Dr Mareike Massow
Head of Product Management
IVU Traffic Technologies AG

The roll-out of CBTC on suburban services run by DSB has helped the Danish operator to recruit drivers more easily.

resource allocation. However, there is also now scope to investigate how far technology could be used to mitigate some of the worst effects of this demographic crisis.

Recruitment in the railway sector has become increasingly fraught because of the sector's rapidly ageing workforce and competition railways face with other sectors for limited talent. The industry struggles to attract young professionals, who often view other careers choices as more innovative. A major issue in rail is the frequent need for shift work; this is generally less

attractive to prospective recruits and has often been shown to be damaging to health.

Nevertheless, expanding the railway's pool of candidates must be a key sectoral goal. The data on the need for recruitment is stark: in Germany alone, 2000 drivers retire every year, whereas the number of trainees completing their driving qualifications is hovering at around 1400 per year; these numbers pose a serious barrier to expanding rail provision, achieving modal shift and realising policymakers' green goals.



Fig 1. The IVUcrew Personnel Dispatching System can manage staff working hours based on individual contracts.

Solving the problem

One potential answer is to hire staff internationally, while the other is to make the job more accessible for people already in the country. Hiring people internationally comes with its own set of challenges, starting with the need for a professional language level — especially important in safety-critical jobs — and raising other issues, such as which international qualifications can be recognised in the country. However, many companies in the rail sector have by now become proficient in dealing with these challenges, for example by offering language courses and adapting training schemes to suit recruits from abroad.

Meanwhile, to enlarge the pool of candidates of people already in the country, companies are increasingly analysing how work time models can become more flexible so that more people with limits on their time can join the workforce. Here, digitalisation of the crew planning and dispatching tasks is a prerequisite for quickly calculating and validating different models. Modern dispatching tools like IVU.crew can incorporate any working time model and calculate optimal duty schedules and rosters automatically.

This is the approach being adopted at Transdev Deutschland. 'The flexibility of worktime models is a big topic in our companies,' says Director Andreas Melzig. 'We are using optimisation to test scenarios whereby we can cover our trips with different working hours models. We are currently examining the feasibility of shift models fitting childcare hours. If we can recruit more parents, especially mothers, we would potentially gain a lot of job candidates.'

He explains that success 'depends on the flexibility that the workload offers. In small companies, the trips that need to be allocated to staff tightly limit the models which fit the demand. In larger

companies, for example at big municipal public transport operators, where there are many options for changing drivers, also the shift models can be much more flexible.'

Improving training

The demographic challenges in rail and public transport extend beyond operational crews like drivers and guards. Many companies are also struggling to source qualified technicians and engineers, and as result they are having to think in a more agile manner about how to alleviate the amount of 'on the job' training needed.

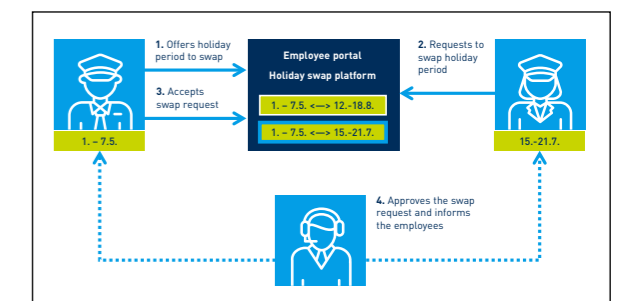
Danish national operator DSB is a case in point, where the roll-out of CBTC on the S-bane network around København has given the company the chance to rethink how it hires and trains its staff.

'The new signalling system has allowed us to shorten the training to become a suburban train driver from 11 months to three. Now we are recruiting from a much broader pool of candidates; among others, hiring students and other part time workers,' says Jesper Rosholt Bremholm, Vice President for Traincrew at DSB. 'To start with, we made the application super easy. We also worked on shifting the image of the job: we used to hire classic craftsmen, and it used to be a very male job. Now we are hiring a lot of women.'

But not every operator could easily adopt such a short training period. Important parameters inhibiting change include the heterogeneity of the vehicle pool and the network; a standard platform length, a single train type and a limited 'closed loop' route network makes training operational staff quicker and easier, as does the use of a single signalling system throughout. While many metros around the world fit the bill, most main line rail operations would not.

45%
of Europe's train drivers could retire over the next decade

Fig 2. Digital rostering software can make it easy for crew to swap holiday dates while still ensuring diagrams can be fulfilled by appropriately qualified staff.



Retaining staff

Employees need not only to be recruited, but also retained, and in an era of staff shortages, that makes employee satisfaction more important than ever. Many operators are therefore undertaking detailed staff surveys, and making concrete steps to bridge any gaps that can appear between the management teams and frontline crews.

While organisational issues like mess room or canteen ambience have been understood for many years, operators can now turn to other options to boost morale, including developing much more individualised staff rostering techniques. Again, this should appeal to staff seeking more flexibility from their employer.

'We asked about preferred shift times and the time it takes to travel from people's home to their depot,' says Transdev's Melzig. 'Especially interesting were the results about best-liked and least-liked routes [for staff to work]. It turns out that there are two to three favourite lines and one particularly disliked line. With this information, we will try to create more balanced rosters. Another result was that many drivers prefer long shifts of up to 10 h, where they get more days off in return. We want to take this into account more in both duty scheduling and rostering,' Melzig adds.

Employee portals

Management teams are also seeking ways to boost engagement among their staff, especially in traditionally blue collar roles like traincrew. Digital tools like the IVU.pad employee portal are therefore gaining popularity; these tools allow staff to request functions, days off, extra duties or particular working times at the tap of an app. Newer features include shift swap tools and functionality to enter personalised preferences, for example for late or early shift time.

Most management teams go a long way to incorporate requests and preferences into their operating models, but again this depends to an extent on how big the operator is and how many staff it has to deploy. 'We have run pilot projects to introduce online requests for shifts and off days in

some of our independent subsidiaries in Germany’, Melzig continues. ‘One outcome is clearly visible: the satisfaction of the employees with the model depends largely on the fulfilment ratio of their requests. This makes it difficult for small companies, where there is just not a big enough mass of duties to provide flexibility. If the fulfilment rate is high, the model is very positively received by the crew.’

Limiting rules

Another factor limiting crew flexibility is the roster rules, which determine whether a shift plan is valid. This can be a particular problem in periods of negotiation between companies and labour representatives, for example, when the resulting rules can be so tight that there are no degrees of freedom to adjust schedules.

Holiday planning is another issue that significantly influences employee satisfaction. Besides the holiday request function, the IVU.pad platform offers companies and their staff a ‘holiday swap’ tool. Clearly, such swaps are only offered within the tool if the altered schedules are still compliant with the relevant rostering rules. This takes workload off the operator’s control teams — another discipline in the industry which facing staff shortfalls.

Plan your communication

Train driving jobs are well-suited to people who like being alone for the majority of their shift. To keep a strong bond with employees, management teams need to plan their communication with staff effectively, especially because it usually happens mainly when things do not go as planned.

According to DSB, best practice is to maintain an appreciative communication style in the control centre towards the crew. ‘Our whole control centre staff receives a



DSB says positive communication between control centre and traincrew can drive employee satisfaction, highlighting its importance to staff in roles where they must work alone for long periods.

communication training’, emphasises Bremholm. ‘Our goal is to always convey the sense that we are building a solution together, instead of telling people what to do. And we explicitly value it when colleagues are showing flexibility. We have a digital high five that control centre agents send to crew members when they have helped out with something. The ‘high five’ is sent to the driver and to their manager, so there is immediate positive feedback.’

Schedule optimally

While recruiting and retaining staff are mid-term actions, the quotidian problem of covering every diagram with the staff available on that day remains. To achieve this, optimisation tools like those in the IVU.rail software platform can help operators to manage vehicle diagrams, duty schedules and employee dispatch.

Developing such digital tools is no easy task; the core mathematics is among the hardest problems in computer science. The rostering problem needs powerful models like multi-layer hypergraph-based mixed-integer programming to be solved. To find the best choice in a multidimensional space, the models are attuned to the characteristics of public transport and use booster methods such as

Lagrangean relaxation and column generation to find options quickly.

The end goal is to deliver the timetable with the (few) people that are available for the job. Duty optimisation and personnel dispatch optimisation are the most effective means of reaching this target, and solid rolling stock diagramming is the base.

Unsurprisingly, operators who face a staff shortage are increasingly seeing a chance to review all of their planning and dispatching steps. This usually needs a deep dive into the written and unwritten rules of the company; one main ingredient for success is to bring rules specialists and decision-makers as close together as possible to ensure rapid progress.

Contract bids

Resource optimisation tools are seeing increasing use to calculate scenarios before or during ongoing negotiations, whether this is with labour unions or for renewal of a tendered operating contract. They make it possible to see exactly how much a revised working hours model would cost. The same benefits apply when operators bid to launch new services; an optimal vehicle and duty schedule can be defined upfront, providing certainty about operating costs once the services launch.

Similar challenges exist for short-term alterations to services, for example when planning for a major engineering blockade on a core route. This can necessitate multiple interim timetables over a long period, each lasting perhaps a week. The burden of planning the necessary resources would stretch even the most capable control centre team; IVU.consult helps with Planning-as-a-Service to navigate those challenges. In North America, the IVU team has delivered new baseline schedules and temporary crew diagrams for multiple interim timetables.

Get everyone involved

The railway sector’s staff shortage is a pervasive issue, and the strategies to address it will involve all parts of a given operator’s business.

Operations teams must maintain good communication and respond to employee needs; training teams can reassess qualifications; HR departments could focus on revised contract models and recruitment strategies.


Digitalisation is at the heart of these new models, making the IT department crucial when introducing tools and ensuring employee adoption. The demographic problem will stay with the sector for years to come — so it is time to get everyone involved. 

Fig 3. A multidimensional mathematical model for a weekly optimisation in the IVU.rail tool.

