Nominees RailTech Innovation Awards 2017

Category: Infrastructure

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1) Name: Nick van den Hurk & Eric van den Bosch

Company: Fugro RailData & BAM Infra Rail BV

Description innovation:
(Semi) automatic generation of tamping information using the advanced RILA application.

The RILA Track sensor is unique in the world and is the only track measurement system that connects to any passenger train and measures at line speed – up to 200 kmh. The operational flexibility, improved safety levels, highly accurate data and very attractive cost level set it apart from traditional track survey methods.

Fugro's RILA system can be mounted to the rear of any scheduled passenger service without the need to alter or affect the train's normal operating performance. The system is connected to the train by a specifically designed coupler adaptor in less than two minutes at any station and supplies absolute track position, gauge and cant at line speed, with data collected in accordance with existing timetables.

The RILA system is made of a lightweight carbon fibre construction containing advanced measurement sensors. It has obtained operating approvals in the Netherlands, United Kingdom, Denmark, France and USA complying with NEN-EN 13848-1 & NEN-EN 13848-2 standards and EMC EN 50121standards.

Track profiles are collected using an integrated laser and imaging system that receives absolute position and orientation from on-board GPS and inertial measurement systems. The system is currently cleared to operate at 200 kmh and at this speed will yield profiles at 10cm intervals relative track geometry accuracies of better than 1 mm. Additionally, the system acquires simultaneous video during collection that can be used as a desktop tool for asset management and condition inspection.

Since the RILA system was first applied in the Netherlands for ProRail, Fugro have continually developed the technology incorporating feedback from clients around the world to improve performance and advance its capabilities launching RILA3 in 2016.

Enhancements include a new application to compute direct tamping information from the RILA dataset, maintaining line and level to design. This increases the life of track components and ensures that track layout stays compliant.

RILA enables the comparison of IST and SOLL data: SOLL being a complete overview of all optimised track alignments held in ProRail's SIGMA database. The high accuracy and repeatability of RILA surveys in respect of location data (IST), makes it possible to compare the SOLL and IST and generate lifts and slews for a tamper in the correct location , an automatic computation that can be adjusted by a track designer. This method has been tested using a Plasser & Theurer tamper owned by one of the Dutch railway contractors using the WIN-ALC guidance computer on-board of the tamper.

The innovativeness and advantages of RILA are clear: no surveyors in the track (safety and cost); tamper can start with its tamping operations as soon as it arrives (higher production rate and lower cost per metre track tamped) and crucially, designed track alignment is and remains compliant,

resulting in a longer lifespan for the total track construction above or below the track surface.

2) Name: Femke van Iterson

Company: Rail Road Systems BV

Description innovation:

Prevent disruption by animals on and around the track

There are regular reports of big animals are affecting rail infrastructure by their presence on or around the track. Wildlife on the track can create collisions or near-collisions and smaller wild animals like rabbits, foxes and badgers dig holes and corridors in the railway embankment. This latter problem can lead to subsidence of track or control cabinets.
Additionally, the presence of mice and rats in cable ducts and housing, leading to gnawing of cables also causes disruption.

These problems are difficult to manage as a number of species of wildlife are protected and cannot be hunted.

Our basic principle for the future is the animal friendly exclusion of large and small wild animals on and around track utilising the highly innovative Tupoleum®, an animal friendly odorant that keeps wild animals away in the area around the track.

Tupoleum® is a natural organic product whose smell is based on an intense threatening observation by wildlife. Tupoleum® is non-toxic, it is completely harmless to health and does not harm the soil and groundwater.

During 2016, ProRail has done an extensive test with Tupoleum® repellent dispensers at three locations.
In the northern part of the Netherlands along 5 km of track, there are placed repellent dispensers to keep deer out of the track. These deer live in an area between the highway and the railway. To forage they want to cross the track in the evening and morning. (Location A)

In the Randstad there are placed repellent dispensers on two level crossings. In this area there are standing fences to keep fallow deer off the track. It happens that the fallow deer comes on the track by the level crossing. (Location B)

In the middle of the Netherlands is a railway embankment equipped with repellent dispenser to repel rabbits and foxes from the embankment. This embankment has suffered from excavation damage and holes. (location C)

At locations A and B there have been no collisions or disruption by animals during the trial period.
At location C excavation damage has been reduced by 85-90%. There are no more depressions in the slope and the collisions with small animals has fallen drastically.

Tupoleum® has already been used in cable trays in the tunnels on the Betuweroute and the rail-brake units on the hump yard Kijfhoek. This prevents that cables are eaten away by rodents. The

number of failures by teeth marks on cables is drastically reduced by this measure. It is no longer necessary to jacket cable additionally.

To summarise, Tupoleum® is proven in trials to offer an innovative, effective and totally safe solution to the problems that animals of all sizes bring to rail infrastructure.
It does so in a humane and environmentally manner and it will reduce disruption costs for all infrastructure providers.

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3) Name: John de Kom

Company: AFT Pneumotion B.V.

Description innovation:
In the current railway industry there is an ongoing struggle when it comes to cleaning of the tracks.
Unclean rail tracks (sleet, ice, rust, compressed leaves etcetera) lead to:

      loss of wheel/ rail adhesion, resulting in wheel spins

      disturbance of the track circuits/ conductivity and rail networks

Consequences are costly rolling stock and track damage, delays and potentially dangerous situations.

The currently available solutions to clean rail tracks are very time consuming (due to their low operating speed), making it impossible to utilized them within normal track schedules. Therefore leaving too little time for proper cleaning of tracks. Operators are forced to minimize the consequences by focusing on the symptoms, instead of effectively dealing with the actual problem. Breaking sand, ABS/ traction control and Sandite are some examples of available measures to reduce symptoms.

AFT Pneumotion is introducing the Rail Brush.
The Rail Brush is a simple rail head conditioning system to clean rail lines. It clears the rail of compressed leaves, ice, sleet, snow, sand, grease, ore, rust and other debris.

The rail Brush comprises an air operated single acting cylinder with a brush head, consisting of steel tines attached to the piston rod. It is bogie mounted with height adjustment to accommodate wear of the brush tines.

In response to a signal (e.g. from the drivers cab, GPS control unit, traction control unit), compressed air enters the cylinder extending the Rail Brush vertically downwards onto the rail. The force and the scraping action of the tines cleans the rail. When the signal is removed the Rail Brush fully spring retracts clear of the rail.

The brush head is designed for quick replacement and adjustable to any kind of bogie, track or environmental conditions. The Rail Brush is mounted to a train/ tram/ metro car in a non-destructive way and can be simply removed when wanted. The brush can be used at a traveling speed of up to 70 kmph. This makes the Rail Brush easily usable within normal track schedules. No special rolling stock and no specific cleaning runs needed. Maintain the contemplated rail condition by mounting the Rail Brush onto a number of regular train/ tram/ metro cars.

The Rail Brush improves:
1.   clean rail tracks and because of that:
a.   Wheel to rail adhesion
b.   Braking efficiency
c.   Acceleration efficiency
2.   cleaning of rail tracks within the normal schedules of a rail network

The Rail Brush helps to avoid:
1. wheel-slide
2. wheel-spin
3. increased stopping distances
4. signals passed at danger (SPADS) and station overruns
5. cost of maintenance of damaged equipment
6. high cost of cleaning itself
7. cleaning of tracks outside (and hindering) the schedules of a rail network
8. delays

Doing so, the Rail Brush does remedy the consequences of polluted rail tracks, by actually removing the pollution. The main innovative power of the Rail Brush is probably its simplicity.
This all makes the Rail Brush a true and welcome innovation for the Railway industry

Category: Rolling stock

1) Name: Werner Filez

Company: FLIR ITS

Description innovation:
The RSX-F is a hybrid thermal wide view angle of 95°and HD imaging sensor with on-board fire detection algorithms for rolling stocks. By using thermal technology, a fire can be detected quicker than with conventional methods as it doesn't require smoke particles to reach a sensor or a change in ambient temperature. The RSX-F uses a small, discrete thermal sensor capable of accurately measuring small temperature difference as small as 50 milli-Kelvin. This accuracy allows not only for the detection of fires in direct line of sight but also concealed fires by looking to the thermal reflection on walls, windows or other objects. Next to a low false alarm rate, the system is also capable of filtering out unwanted events like cigarettes, hairsprays or lighters. Depending on the situation and requirements, these types of events can generate a separate event or be filtered out altogether. Within the RSX-F, the thermal data is converted to a video stream, this video stream can be recorded and saved to be used in case of problems. The sensor can trigger multiple types of events. These types of event can be transmitted separately or can be combined in case this is needed. Upon thermal fire detection and HD video recording the RSX-F is also capable to manage seat occupancy in the same time. The extremely flat design can be flexible mounted in the ceiling or side-wall and can be installed in all kind of environments of the rolling stocks.

2) Name: Arjan Rodenburg

Company: Ricardo Rail

Description innovation:
In the day to day train operations, checking the condition of the pantograph is challenging. The check is often performed by the maintenance crew from the ballast bed, at night with the pantograph seen from below. Imagine trying to decide whether a wear limit of 6 mm has been reached or not under these circumstances. An early replacement of the pantograph means scrapping a perfectly good item with life left in it, whilst not replacing it in time may lead to severe pantograph and overhead line

damage.

Defective pantographs can cause significant damage to overhead wires and associated components of the infrastructure. In extreme cases they can lead to de-wirements, incurring costly and time-consuming repairs and causing significant delays to services. With such consequences at stake it is crucial to perform regular checks on pantograph integrity.

Therefore, Ricardo Nederland B.V. developed with their technology partners Sensys Gatso Group AB, Sioux Group B.V. and DMA s.r.l. the "PanMon" pantograph monitoring system. It is designed to provide easy-to-maintain, contactless, real-time monitoring of both uplift forces and pan-head conditions at full speed (up to 250 km/h). The system consists of 2 innovative solutions using special cameras.

The first camera (Automatic Pantograph Monitoring System – APMS) takes head on photos of pantographs passing the site at full speed. The second camera captures the movement of the overhead contact wire as a train passes and from these images the pantograph uplift is calculated. The APMS is based on the road traffic speed camera and uses a combination of radar, laser and flash technology to secure a high definition image of the pantograph(s) on each passing train at the site. PanMon uses specialist pattern-recognition analysis software to, first, identify the type of pantograph that is passing, and second, automatically interpret the images into full condition assessments of each individual pantograph. On occasions where the system detects any notable damage on the pantograph, an alarm is immediately sent to the control centre for specific attention. PanMon can detect and locate:

• Imperfections, or missing pieces, within the carbon strip;
• Chipping on the edges of the carbon strips;
• End Horns and their status (e.g. broken or bent);
• Defects of the strip holder (e.g. bent, broken, or misaligned);
• The remaining thickness of the carbon strip;
• Contact wire 'uplift' forces.

For infrastructure owners, PanMon can not only identify vehicles that pose a greater risk of inflicting damage to the network's wires, it can also help them to work with operators to take preventative action and, ultimately, extend the life of both wires and onboard pantograph equipment. So besides protecting Infrastructure Assets, PanMon enables Rolling Stock Owners and Maintenance Companies to make the shift from periodic maintenance to condition based maintenance and realise significant costs savings.

3) **Name: Michael Breuer**

Company: RailWatch GmbH & Co. KG

Description innovation: Automatic freight wagon monitoring by RailWatch

Initial situation: expensive repairs, inefficient processes
Downtime of fully loaded freight wagons is expensive and disrupts schedules of clients, railways and infrastructure operators. Regular maintenance is to prevent sudden failures, however, maintenance cycles follow historic rulebooks with high safety margins and great inefficiency. The few existing

details are made available too slowly and inaccurately to the relevant parties (RUs, wagon owners, infrastructure operators, workshops).

Objective: Rail Freight Transport 4.0
Competing with road and inland shipping, rail as the second transport system in Europe needs to become more reliable and efficient.
RailWatch offers: to drive digitisation of railway infrastructure, network the players of rail freight transport and optimise the channels of communication.

RailWatch provides a monitoring system gathering information about the technical condition of freight wagons making this available to relevant parties. Planning maintenance measures long term significantly increases operating safety, cost efficiency and improves availability. Wagon owners benefit as well as RUs and infrastructure/terminal operators.

Potential: about 1 million freight wagons throughout Europe
In Germany, this could include 200,000 wagons a month and 9,900 freight trains per day. In Europe, 970,000 wagons may be inspected per month and approx. 36,000 freight trains per day. For wagon owners and RUs, RailWatch offers different flat-rate cost models, considering information relevant to the respective client.

Innovation: fully automatic registration, reliable forecasts
RailWatch has developed a multi-functional measurement station for wagon monitoring measuring the critical components of each wagon and locomotive during their pass at a speed of 120 kph – fully automatic and without impeding operation. A central analysis and evaluation system processes the data and calculates wear trends to suggest the maintenance interval. The software also translates data into GCU codes. This is summarised in a digital wagon or train file, processed individually and available to the client in real time.

Wear trend analysis represents genuine innovation in freight transport. No other system registers so many details automatically and simultaneously, providing specific interpretation to freight wagon owners! Interesting for the RUs – conclusions may be drawn on the condition of the entire train.

The RailWatch multi-measurement station consists of seven modules compiled individually and a server station. Upon the train passing, the following is registered:
- UIC wagon number
- external condition
- temperature overload
- wheel condition (wheel flange thickness, cross dimension etc.)
- wheel set run
- brake blocks and lining thickness
- axle bearing condition
- wheel flats
- axle loads

Result: greater safety and cost efficiency
The wagon file offers the technical condition of a freight wagon and the specific wear trend at any time. Using this information, maintenance and repairs may be planned according to demand. Advantages are clear: the lifetime of the vehicle is used optimally, offering great economic advantages. Efficient maintenance reduces to a minimum severe accidents and unscheduled downtimes. Availability bottlenecks are avoided and repair costs reduced significantly.

The RailWatch Monitoring System increases reliability and efficiency of the rail and represents a great step towards Rail Transport 4.0!

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1) Name: Daniel Stähli

Company: Amberg Technologies AG

Description innovation:
Create the digital copy of your infrastructure - precise, efficient and labour-saving

Amberg Technologies develops the unique Railway Surveying System IMS 5000 – a revolutionary high-output 3D scanning and track survey system

Fast, exact and cost-efficient: Amberg Technologies is known as the Swiss global leader specialized in user-friendly solutions for railway and tunnel surveying. The implementation of the inertial measurement technology into the well-tried railway scanning system Amberg GRP 5000 leads to the new Amberg IMS 5000 system configuration. This new configuration provides reliable and highly precise track geometry information and a complete 3D-scan of the track-surrounding at an unprecedented new productivity level.

The Amberg IMS Systems measure the relative and absolute track geometry using a new, high-performance sensor – the Inertial Measurement Unit (IMU) AMU 1030. Precise surveying of up to 4000 metres of track and scanning its surrounding per hour, the system's performance is more than twice as high as of any other 3D railway surveying devices available on the market today. The system works completely independent from GPS or Total Stations but nevertheless reaches track positional accuracies of up to ±1mm. "With this system we set a new standard for the speed of hand-pushed measurement trolleys for acquiring track and surrounding objects while nevertheless achieving greatest accuracies", explains Marius Schäuble, Product Manager Rail at Amberg Technologies.

The revolutionary IMU technology replaces the tachymeter or GPS receiver to measure the track geometry. In this way no tachymeter on tripod or on a second trolley is required any more. As a result the number of workers on track is reduced, as only the team operating the one trolley is necessary – a clear safety-benefit (no teams to set up and dislocate total stations on tripods are necessary any more)! Due to higher operational flexibility the output is further increased.

The notorious "line of sight demand" is vanished into thin air. This and the fact that the system works without any restrictions in tunnels make the Amberg IMS 5000 system a unique scanning solution.

Modelling the entire infrastructure or updating parts of it after construction works has never been as easy as with the IMS 5000.

Thanks to the Amberg IMS 5000, Amberg Technologies is further extending its leading position in developing highly performing measurement systems for railway construction and maintenance. "We continuously work on improving the technology and functionality in order to optimally meet the increased market expectations", says Marius Schäuble.

Premiere of the new Amberg IMS 5000: After the announcement at Innotrans 2016, Amberg Technologies presents the system now at the Rail-Tech Europe 2016 from the 28th to the 30th of March in Utrecht (stand 154 H4). The systems will be available for worldwide delivery as of beginning of April 2017.

2) **Name: Marta Desviat**
Company: Amadeus IT Group, SA
Description innovation:

Description innovation:

In recent years, there has been a surge in enthusiasm for rail travel across the globe, driven by expanding high-speed networks and growing consumer awareness of rail as a viable alternative to air. In order to capitalise on this opportunity, rail companies have started to take steps towards modernisation and internationalisation. Yet, there is no easy way to book rail for travel sellers.

As they see an increasing demand for rail, there is a corresponding growth in frustration at the complexity processes involved in booking rail. In an ideal world, travel agents would be able to book and compare rail travel with the same speed and efficiency as they can book air. The challenge lies, therefore, in the rail booking systems and processes. Prior to Amadeus developing Rail Display, there was no easy way for travel agencies to compare rail fares together or with corresponding airline fares. Booking rail in other countries was almost impossible without knowing the operators, their website, and sometimes even the local language.

Rail booking should be made easier; we believe that integrating rail into the overall trip planning process across Europe will significantly increase the number of people shifting to rail as part of their total trip experience.

To tackle this challenge, and make rail booking simple, Amadeus developed Rail Display, an industry-first solution, which allows travel sellers to book rail using one single tool, following the same process for all available railways, anywhere.

With Rail Display the complexity of booking different railways is significantly reduced, as it is fully integrated into travel agencies' tools and processes.

It was also extremely time-consuming to train staff on each of the different rail booking systems. We recently provided Rail Display to a rail specialist who had not seen it before and he was up and running in about 10 minutes. Overall, time spent on training can be reduced by 3, because there is no need to learn railways' specific codes and processes, thanks to its intuitive graphical user interface.

The aftersales process effectively saves 50% of the time when booking with standalone proprietary rail products normally offered by railways or through their website. This increases the productivity of sales agents allowing them to make more sales during the day and it also improves the image of rail being a "specialist" product.

Rail Display is an industry-first solution which has global reach, and the potential to overhaul the way in which rail travel is currently booked. It has responded to the growing demand for a seamless booking model and increasing the desire for rail to be integrated into the travel process.

It will be a key example of the type of innovation needed to allow rail to emerge as a key competitor to the car, bus and airline. This is the way forward in terms of multi-modal connections where rail becomes part of the trip planning process and can be booked with other modes of transport to provide the traveller with a door-to-door offer.

3) **Name: Jillis Mani**
Company: InTraffic
Description innovation:

NaviNABO, the intelligent railway crossing app.
An accident in the Dutch municipality of Winsum, where a train hit a truck and injured 18 people on a non-guarded railway crossing, led to extensive discussions in Dutch politics. Although most of these crossings are on dead end streets or walking trails, ProRail – the Dutch railway operator – is seeking for a solution to actively warn people crossing it. ProRail challenged the market in developing innovative and easy to use warning systems for non-guarded crossings. The InTraffic NaviNABO solution warns people by using their smartphone. It is an innovative solution that makes use of existing data and techniques for warning users with vocal signal and visuals based signals on their current position.

Proof of Concept
The NaviNABO app is a Proof of concept to ProRail to use existing data sources from the "basis beheer kaart" (a GIS platform with rail assets) to actively warn people by using their smartphones. The data is automatically collected adjusted and organised as such that it can be easily integrated into existing navigation systems as TomTom and Google maps or apps as Flitsmeister. The smartphone app combines geofencing technology with GPS satellite position and map API's to warn the user in the most convenient way. The application was recently tested by ProRail and TNO. About 100 users extensively tested the application by car, bike and foot with positive results.

The road ahead
The report by TNO on findings so far is expected soon. In Traffic is planning to develop the app further and to open data sources to other parties so an integrated solution can be provided for all people around these crossings.

Category: Public Transport

1) Name: Claudia Garcia

Company: Infrabel

Description innovation:
During certain works carried out close to or on tracks in service, Infrabel employees are responsible for ensuring the safety of the maintenance teams. Whenever a train approaches, these "lookouts" raise the alarm so that the working area can be cleared immediately. In order to improve their training, Infrabel has developed a tool which is the first of its kind in Europe: a 3D simulator able to replicate their working environment and place them in hazardous situations.
From March 2017, sessions with this tool, which was developed in Belgium, will become an automatic part of the process of training lookouts.
The 3D simulator reproduces the working environment by projecting realistic images onto three walls and the floor. It includes the tracks, the team at work, the trains, the other lookouts and a scenario. The entire reproduction is set to a sophisticated soundtrack. The trainee is also given the equipment carried by a lookout: a horn, cones and flags.
In order to run the simulation, the trainee wears a head tracking system that controls the entire simulated environment in a realistic manner. This is total immersion. Once the simulation starts, depending on the scenario selected, the trainee is faced with ordinary situations as well as disruptive events and "at risk" situations. Their reactions and the correct or incorrect use of the equipment provided are automatically recorded by the central system. The system modifies the progression of the simulation according to the actions recorded.
The 3D simulator therefore allows the trainee to be placed in all kinds of situations, and their performance can be analysed and projected to the class in order to discuss what was good and any errors made.
Initially, new employees recruited will train on the 3D simulator in order to qualify to work as lookouts

as quickly as possible. The 3D simulator will also be a valuable aspect of continuous professional development, with the aim of allowing all lookouts to work on the simulator once every three years. For safety reasons, Infrabel prefers to carry out work on the main tracks of the network when rail traffic can be suspended. In order to minimise the impact on the regularity of the service, work is therefore in practice most often carried out at night.

However, given our obligations with regard to infrastructure availability and punctuality, some maintenance tasks still need to be carried out close to or on tracks in service. In this situation the role of lookout is vital, as it allows Infrabel to deliver part of its maintenance workload with no adverse effect on punctuality and in a way that guarantees the safety of its staff.

2) Name: Pascal de Jong

Company: G4S Cash Solutions

Description innovation:
"G4S PAY-OV: SECURE, CUSTOMER CENTRIC PAYMENT SOLUTIONS FOR PUBLIC TRANSPORT

Violence, threats and abuse are still an issue in today´s Public Transport. A large part of these incidents revolve around robberies on trams and buses. For reasons of safety, Dutch Public Transport companies have jointly decided not to accept cash payments as of 2018, and only allow for card transactions. This decision may cause a lot of inconvenience for travelers who want to pay for tickets in cash, such as incidental travelers, the elderly and tourists. It should not be overlooked that thousands of tickets are still paid for in cash every day. Enforcing cashless payments might even cause violent reactions when certain travelers are being rejected to use transportation services.

Why can travelers not pay for public transport fares how, when and where they want? With this vision, G4S launches a customer centric payment solution for public transport fares. G4S is the world's leading global, integrated security company specialising in the delivery of security and related services. In cooperation with renowned partners, G4S introduces an integrated payment solution that enables public transport companies to safely accept cash payments and simultaneously offer a suite of electronic payments. This solution is being introduced as G4S PAY-OV (OV being the abbreviation of Openbaar Vervoer, which is Dutch for Public Transport).

The technology behind G4S PAY-OV facilitates public transport companies to accept ticket payments by cash, card and common e-commerce payments such as iDeal or PayPal. Any payment results in a hard-copy or digital ticket in the form of a QR-code. These tickets can easily be validated by the driver or ticket inspector. Hard-copy tickets can be paid for in cash or card at assisted or self-service devices in the vehicle or at the platform. Digital tickets can be bought via the transportation company's website or mobile app. G4S PAY-OV is easily integrated with existing websites and apps to ensure a universal brand experience.

Next to offering safe and widely used payment methods to travelers, transportation

companies benefit from G4S PAY-OV in other fields. The solution simplifies the administrative burden of accepting omni-channel payments: the company's bank account is credited for the total of ticket sales the next day, with detailed reports and reconciliation information. This even applies to cash and credit card sales. Also, big data generated from payments will bring new insights into traveler behavior and can be used to the benefit of both transportation companies and travelers. For example, it enables the introduction of tailored loyalty programs and flexible rates.

We believe G4S PAY-OV is a must-have innovation for public transport as it truly allows travelers to pay for tickets how, when and where they want. It addresses the urgent need for a safe environment and prepares for future developments such as new payment methods. The transportation company's administration is simplified and cash flow improved. Big data brings new insights that can be used to improve the company's effectiveness. It comes with a pay-per-use business model."

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3) Name: Martijn Cornelissen

Company: Royal HaskoningDHV

Description innovation:
USING MICRO-SIMULATION ON NATIONAL SCALE FOR TIMETABLE DEVELOPEMENT

Royal HaskoningDHV has developed a sophisticated micro-simulation model to produce fast and accurate rail timetable planning. The model is the largest of its type worldwide.

*The challenge: to develop the best timetable every year while the rail network gets busier

Growing urbanization has a major impact on public transport networks around the world, with more people choosing to travel by train, tram and metro. As a result, our rail networks are becoming busier and more complex.

A knock-on effect of this demand on services is that creating an executable timetable gets even more challenging, not least because they need to facilitate all train paths requested by Train Operating Companies.
Therefore, and enforced by stricter design rules for safety reasons, there is an urgent need in the railway sector to have a detailed view on the possibilities and the limitations for planning train traffic.

*The solution: Micro-simulation of timetables on a nationwide scale

Royal HaskoningDHV has developed an innovative and efficient micro-simulation model operating on a nationwide scale, the NL-model.

Developed over the last ten years, initially with regional studies, we decided to complete the entire Dutch network in 2012. This model is programmed in the Swiss micro-simulation tool OpenTrack and incorporates a network comprising of 9,164 km of track, 6,846 switches and 10,576 signals. To get the model running properly, with approximately 400 passenger and cargo trains running at the same time, was a challenge our simulation

specialists excelled at and we are proud to say it is the largest model of its type in the world.

Our model enables us to simulate one day of train schedule within 45 minutes and produce in-depth output for experts in the form of graphs and data. It has been used by several of our clients in the railway sector during the last three years. The most groundbreaking application of the model is the role as testing device in the annual timetable development. The model enables planners to test timetable variants at any moment between official marking points. As a result, planners are able to design a more accurate timetable with a minimal amount of imperfections.

*Market potential: The Netherlands and beyond

The Dutch rail network is only going to get busier, so we feel that micro-simulation on a nationwide scale will play an increasingly important role in timetable development. This won't just be the case in the Netherlands, but in other countries, so we can seek to export our skills and knowledge to these areas.

Besides timetable development, our micro-simulation model has the potential to serve as a platform for several types of research and design. It can provide nationwide and yet detailed insight into the effects of adaptations in our rail system. For example the introduction of 3kV, ERTMS or new train types. Moreover, side tests can be performed, such as the analysis of robustness, appropriate handling during disruptions, passenger flows on stations and risks regarding red signal approaches.

Category : Rail Cargo

1) Name: Arnout Monster

Company: AeroTrail Solutions

Description innovation:
AeroTrail is a newly established team consisting of six enthusiastic and entrepreneurial students. The team focusses on delivering sustainable solutions for the railway transportation industry and trails towards the future of sustainable railway transport for the coming years.

AeroTrail identified a significant energy loss in freight transportation by trains. The blunt shapes and interrupted volumes of intermodal container freight trains cause a significant increase in aerodynamic drag. AeroTrail developed a retrofit solution that improves the aerodynamic characteristics of intermodal container freight trains. The solution is called "streamliner". Currently there are hardly any other aerodynamic enhancements available for freight trains.

Container freight trains are long trains with multiple gaps. Every interval between containers causes turbulent flows, which results in aerodynamic drag. Closing the gaps decreases the aerodynamic drag of a train significantly. This is done by means of a mechanism that is attached to the already present corner casting on the intermodal containers. A stretched material closes the gap between the containers and reduces aerodynamic drag as a result. The reduction in aerodynamic drag results in a

cost reduction and improves the corporate brand image for the customer.

The drag reduction of 18% to 23% shown by wind tunnel experiments is translated in an energy reduction from 2% up to 7,5%, resulting in a cost saving of multiple hundred thousand euros per year per company. Subsequently, the cost saving is directly related to the social and ecological impact since the European Union made agreements on environmental topics.

Freight train operators and rolling stock owners are the main customer segments that are of interest to AeroTrail. The Streamliner is utilized to decrease their energy costs which relates to an increase in profit and, in addition, a decrease in the price for clients. The market is expected to grow the coming years because of the foreseen growth of freight transportation and increasing market share of railway transportation. This increases the potential of the Streamliner in diverse markets. The business model construction could be based on asset sale or capital lease.

AeroTrail is currently working on the proof of concept. Technical and business feasibility studies are conducted. The concept is further developed in order to determine the costs related to operate the business model. Subsequently, processes as certification, patenting, establishing partnerships, and such are initiated. Extensive searches through patent databases are performed; the concept currently is not patented. Once the concept is developed, a patent request is filed. Furthermore, the Streamliner requires certification for use on railways. All other influences, both internal and external are thoroughly considered in both the feasibility studies, including a SWOT analysis amongst other things.

AeroTrail is founded during the Engineering Entrepreneurship minor of the Aeronautical Engineering course at the Inholland University of Applied Sciences in Delft. During this minor, the team received coaching with respect to scalability and finance of starting a company. Other fields are relatively unknown to the group members and the team could use coaching in starting an enterprise, becoming entrepreneurs and launching actual products.

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2) Name: Simon Bosschieter

Company: Holland Container Innovations

Description innovation:
Rail Cargo Innovation Award – 4FOLD Foldable Container

Despite the standardization and success of containers, the transportation industry still has to deal with inefficiencies, like empty repositioning. The transportation of containers by rail is a big success, but most often one-way. This is mainly due to imbalances which create surplus and deficit areas of containers. Transportation and handling of moving empty containers are inefficient, polluting and cost 25 billion euros a year. On average 40% of the containers transported on land are empty.

Solution
In order to reduce this problem Holland Container Innovations (HCI), a spinoff from the Delft University of Technology, developed a foldable container. 4FOLD is the first ISO certified foldable 40ft high cube container in the world. 4FOLD can be folded when empty and four folded containers can be bundled having the same dimensions as a standard 40ft high cube. A bundle can be transported and handled in the same manner as a standard container. This innovation is the sustainable solution to reduce empty repositioning costs and with it emissions. 4FOLD received a China customs approval for the Chinese Rail and is UIC approved. 4FOLD is already in use on the American, European and

Asian rail.

Benefits Rail
By folding and bundling four 4FOLD containers, one can save 75% on handling, storage and transportation costs. In this way, it becomes more interesting to use rail for empty repositioning and new routes can be provided by rail operators as they have a cheap, sustainable and fast solution to bring back empty containers to deficit areas.

HCI noticed a strong market demand to use 4FOLD foldable containers by rail. Especially when looking at the upcoming "Silk Road", where two additional handling operations are needed because of a gauge change at the border of China with Kazakhstan and again when the train reaches Poland. On the backhaul stretch trains go back with empty containers, a very time consuming process during the gauge change. With the use of 4FOLD 75% savings can be generated on costs and time, this stimulates to use rail for empty repositioning.

4FOLD stimulates multi-modal transportation, making rail a more competitive option compared to trucking. Furthermore, a bundle of four containers creates three revenue generating slots for rail operators. A bundle creates also more flexibility to transportation planners as they only have to book one container instead of four. This flexibility is key when it comes to synchromodality and with it the use of rail transport.

Future
4FOLD is widely accepted in the market, creating new routes and business to rail operators. Current trends such as growing rail transport, shippers' vertical integration into the transportation chain, the shift from transportation of bulk cargo into containers and the growing importance of sustainability, will increase the use of containers by rail. This all will create additional empty repositioning problems and correspondingly, a huge potential for 4FOLD. In the long run HCI's ambition is to replace 70% of all standard containers. This will revolutionize the entire container transport industry.

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3) Name: Tomas Tempelaars

Company: Move Intermodal

Description innovation:
Ultralight 45ft intermodal swapbody

Background:
Because of environmental and congestion issues, Europe strives for a modal shift policy. In the past years intermodal traffic has increased its market share.
Within the continental intermodal traffic there are 3 types of load units:
1. Closed ISO container
2. Curtainside swap bodies (tilt swaps)
3. Crane-able trailers
Each of the 3 units has its own advantages and disadvantages. Tilt swaps serve the same markets as crane-able trailers.
The trailers are put rail on specially build wagons, whereas tilt swaps can use the same wagons as ISO containers. This makes the tilt swap more practical for rail transport because the required wagons are widely available, lighter, cheaper and more efficient in length.
Just as with a truck the total length and weight of a train is limited. By optimizing the length and weight more cargo can be transported at the same cost. Move Intermodal has developed, together with its partner Wecon, an improved and moreover lighter tilt swap to increase the modal shift.

Challenges:
The craneable trailer has a competitive advantage over the tilt swap because its empty weight is lower than the combined weight of a swapbody and the needed container chassis. Therefore a trailer can load upto 800 kg extra. From a cost- and environmental perspective Move Intermodal thinks it is not wise to put the most expensive part of a load unit (axles/wheels/lightning/brakesystem) idle on a wagon.
Moreover the wagons itself are more expensive and more scarse than standard container wagons, which can be used for tilt swaps.
But due to the lower tare weight craneable trailers can be competitive due to the fact that on the road they need only 1 chassis, whilst a swap body in fact needs 2 chassis. (of the swap body itself and the container chassis for on the road)
An optimals solutions from an environmental, cost and wagon availability perspective should therefore reawlize a weight saving of 800 kg on the tilt swap. (15% of the current weight)

Solution:
A transport unit consists of 3 elements:
1. Tractor
2. Container chassis
3. Tilt swap

The craneable trailer and swap body use the same types of tractor units. So besides choosing a light specification, there is no advantage compared to the trailer competition.

In recent years big steps have been taken to lower the tare weight of container chassis. The tare weight is now at a level that further weight savings would impact the lifetime of the chassis.

The weight of the tilt swap was also optimized in the past years, but for the construction of the unit techniques are used which are already decades old.
Tilt swaps have to be approved by by governing bodies before they can be used in rail transport. One of the most important criteria is the bending of the unit under 1,5 times the maximum permitted load weight.
The flexural strength was up to now achieved by heavy steel chassis beam flanges. Move Intermodal has now opted to update the flanges to the actual force lines. This is very expensive to manufacture but the weight gain is significant.
Through the use of advanced computer simulations and alternative construction materials, like plastics, the objective is comfortably achieved, without the strength being affected. Remarkable are the more than 1000 holes which were lasered in the structure without comprimising the strength.

Project approach:
First of all the current swap body was fully analysed, with the objective to find components which could be left out, or alternatively designed. This for example resulted in the replacement of cheap serie produced standard components for specificly designed components for weight optimization.
The computer simulations revealed the places in the construction with useless strength reserves. The design is fully based on the finite element analysis.
Where possible plastics or aluminium was used to reduces weight. After extensive testing of the protoype in mid 2016, a first serie of 10 units was produced for tests in day-to-day operation for several months. The results were so positive that Move Intermodal now ordered the manufacturing of a serie of 150 additional ultralight tilt swap bodies, which will be taken into service before the end of Q2-2017.

NOMINEES YOUNG INNOVATIONS AWARDS

1) **Name: Hoessein Alkisaei**

Company: Delft University of Technology

Description innovation:

Interactive Sound Barriers
Conventional sound barriers along train tracks permanently block the view due to their stiff stature. In addition, they often require an abundant number of parts for construction, which introduces undesired complexity. The aim of this project is to apply interactive and compliant sound barriers along train tracks. The functionality of such sound barriers is that they erect whenever trains enter the scene and flatten to the ground whenever no vehicles are present. This motion should happen in a sustainable manner with little energy. The main objectives during the execution of this project are:
• Reduce complexity and number of parts
• Effortless motion from upright to flat, and vice versa

Monolithic Designs
Compliant mechanisms present the possibility to obtain designs, which consist of a single component. The latter are known as monolithic structures and deal in an adequate way with the abundant number of parts and conventional rigid joints. Such structures and mechanisms gain their motion from the deformation of the material and are able to undergo large displacements. Ultimately, this leads to reduced assembly, weight and lubrication costs.

Static Balancing
A mechanism can be actuated with near zero force whenever the potential energy level of that mechanism is kept constant along the total range of motion. This can be achieved in different ways. The method applied in this project compensates the structural weight by the naturally distributed stiffness or compliance of the structure.

Results
Various cases with different boundary and actuation conditions have been investigated and numerous designs have been obtained by means of numerical optimization procedures. At first planar beams were applied. In a second phase shells were used. The compliant sound barrier prototype consisted of a single monolithic PET-G plastic element. In both cases the shape of the structure was used as design parameter.

Case 1: Planar Beam
The planar beam is clamped at the foundation and exerted to a vertical prescribed displacement at the top, which required approximately 1 Newton to deform the structure from one state to another.

Case 2: Shell Mechanism
The most promising design for this case is a single spatial (3D) shell that is clamped at the foundation and exerted to a prescribed vertical displacement at the top, which requires approximately 20 Newton to deform the structure from one state to another. Due to the curved cross-section this structure is able to withstand wind loads that are generated by trains, for instance.

Scientific Quality of Research
For the first time large statically balanced compliant structures with heights of ±6m are obtained. The structures are monolithic, thus consisting of a single structural element with no hinges or any other complexity.

Impact of Research
This research demonstrates that railway engineering is able to build with nature, instead of against it.

This approach is a great introduction to the world of interactive and shape changing forms within railway engineering fields. In addition, it has application potential in many other fields such as reconfigurable architecture, 4D-printing, and programmable materials.

2) **Name: Marijn van der Zwan**

Company: Movares

Description innovation:
Crowd simulation: A decision-making tool for simulating peak crowd flows and evacuations

Movares' crowd simulation software models dynamic group behaviour in and around stations, in shopping centres, in theme parks and during large-scale events. The software was recently used as a decision-making tool for the GVB (Gemeentelijk Vervoer Bedrijf – the Amsterdam public transport authority) in connection with the renovation of metro stations on the Oostlijn (eastern line) and the design of the Noord-Zuidlijn (the north-south line). Taking the customers' requirements as a starting point, various crowd flow scenarios were examined, including the situations that could arise during peak times and in the event of an evacuation.

Movares' crowd simulation software makes it possible to generate a visually appealing 3D model of a station and its surroundings and to populate it with virtual passengers, as a means of identifying and preventing bottlenecks. The simulation system consists of a 3D model of the location and a user interface with which objects can be inserted. What makes the Movares system unique is that it is faster and more realistic than existing simulation software. The sophistication of the software makes it possible to generate predictions in real time. It is possible to see not only how people will move around a building or area, but also the consequences of an obstacle on a platform or escalator, and to predict how quickly a metro station can be evacuated in case of emergency.

Evacuation time during renovation
The GVB asked Movares to use the crowd simulation software to assess the effect of renovation work on evacuation time at all the stations on the Oostlijn, the oldest of Amsterdam's metro lines. At some stations, renovation work will reduce access capacity by half, which will have a major impact on evacuation time. Simulations were therefore performed to see whether it would still be possible to evacuate each station within the time laid down. The software was also used to predict the effect of setting up temporary bridges to give access to island platforms.

Bikes during rush-hour
Simulation was used to study the effect of passengers' bikes on evacuations from certain underground stations along the Noord/Zuidlijn. The results will enable the customer – Metro en Tram – to assess their evacuation plans and take the necessary measures. Possible scenarios included separating passengers moving in one direction from those moving in the opposite direction, or stopping an escalator temporarily when passengers are unable to move. The simulations enabled Amsterdam City Council to decide whether to allow passengers to take bikes on the metro during rush hour.

New possibilities
The crowd simulator makes it possible to:
• 	generate real-time predictions;
• 	establish a baseline for future studies;
• 	assess different flow patterns;
• 	inform all parties – metro operators, emergency services and station personnel – regarding

the various scenarios, so that they can take the necessary measures in advance;
• take sound decisions during construction or renovation to ensure that evacuation requirements are met.

How the software was developed
The simulation software was developed by Utrecht University. At that time, developer Marijn van der Zwan was doing an internship at Movares as part of his degree. Working closely with Utrecht City Council and the university, he originally developed the software for the Grand Départ of the 2015 Tour de France in Utrecht. Further development has resulted in a software package capable of simulating a range of scenarios for different purposes.

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3) Name: Ingrid Dankers

Company: Jonge Veranderaars

Description innovation:
As one of the teams of SummerChallenge 2016 we designed this idea: OVSmiles. From the moment students have to hand in their student Public Transport travelproduct, use of Public Transport is not free anymore. The difference between free PT and the full amount is big. OVsiles gives them the oppertunity to collect points, by using PT, avoiding rushhour and workactivities on the road and to promote usage of last-mileservices like Abel. After graduation and handing in their travelproduct the graduates can use the points they have been collecting during their study for reduction or free travels. As shortterm rewards they can use collected point for free coffee and others during their study.