Railway Gazette

INTERNATIONAL

GERMANY

Stuttgart 21

Seven more years to complete deep level hub

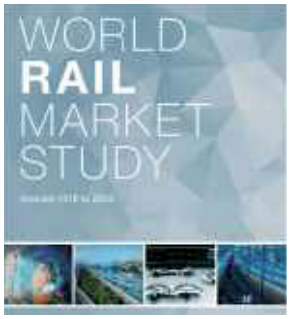
PAGE 46

NEXT GENERATION

Bridging the skills gap

The UK's National Skills Academy for Rail develops a long-term strategy

PAGE 79



IN FOCUS

Industry trends

World Rail Market Study points to steady global growth

PAGE 115

www.railwaygazette.com September 2018

Prototype wagons promise a **quieter** future

A dedicated test train with prototype low-noise wagons is clocking up the kilometres thanks to federal funding for a research programme that also targets energy-efficiency and lower life-cycle costs. **Murray Hughes** reports.

One of many initiatives to revive Germany's rail freight industry is the development of quieter freight wagons. Noise from freight trains in areas such as the Rhein valley has long been a contentious political issue, and measures taken to date include retrofitting composite 'whisper brakes' to the DB Cargo wagon fleet — about two-thirds of the active fleet had been equipped by the end of 2017. Installation of sound barriers alongside busy lines has progressed steadily for years, and around 50 km of barrier were erected in 2017, but noise emissions can be further reduced if quieter wagons are used.

In autumn 2016 the Federal Ministry for Transport & Digital Infrastructure decided to explore the possibilities offered by novel wagon designs. It awarded DB Cargo and private wagon fleet owner VTG a research contract to develop wagon technology that would offer lower life-cycle costs, reduced noise emissions and better energy efficiency. With funding for the work available from the federal government's Future Investment Programme, the two organisations joined forces and set out to design four types of wagon. Three prototypes of each type were ordered, and all 12 vehicles were ready for testing by March 2018.

The principal objective was to determine what options there may be for adopting low-noise and energy-saving technologies at acceptable cost. The programme promoters were conscious that similar initiatives in the past have foundered because of high costs, and lower operating and maintenance costs were identified as fundamental aims. Whatever the outcome of the project, it looks certain to influence the design of tomorrow's freight trains.

Dedicated test train

After laboratory tests, the wagons were taken to the Wegberg-Wildenrath facility for initial running trials during which noise measurements and energy consumption data were collected. The 12 wagons were then assembled into a dedicated test train for field trials on the German network, specific objectives being to reveal wear characteristics and the costs of maintenance. Five circuits or out-and-back routes were selected: Dresden – Leipzig – Berlin – Dresden; Dortmund – Neuss – Bochum – Dortmund; Nürnberg – Donauwörth – München – Nürnberg; Minden – Hamm – Paderborn – Hameln – Hannover – Göttingen – Minden; and Köln – Mainz – Mannheim – Frankfurt.

The train consists of 23 wagons: three of each new design, eight reference wagons of conventional design and three existing wagons with centre couplers. With each type of new wagon, one is run empty, one fully loaded and one half loaded.

The objective is to accumulate at least 150 000 km of test running over 10 months, with the programme wrapping up by the end of the year. By October the project team expected to have approval for the wagons to operate under TSI rules, allowing the test train to run across the German border and into neighbouring countries for further evaluation from November onwards. Four routes have been identified, all starting from Minden: to Kiruna in Sweden via Padborg, Malmö and Gävle; to Bellinzona and Brig in Switzerland via Basel; to Wien in Austria via Salzburg; and to Bari in Italy via Chiasso and Milano.

A second phase of trials at Wegberg-Wildenrath is envisaged in October, during which further measurements will be taken and compared with the results from the field trials.

The Federal Railway Office was involved at an early stage in the project, ensuring that the necessary approvals and documentation for the wagons was available in good time for the test programme. Four wagons will be displayed at InnoTrans this month.

Higher capacity and flexibility

In designing the new wagons the emphasis was on increasing capacity and attaining greater flexibility. VTG and DB Cargo each worked on two designs,

The 'BraCoil' six-axle wagon is intended primarily to carry steel coils but is also designed to handle containers.

The car carrier is designed to carry SUVs and small vans as well as other types of car.

The container wagon features a lightweight skeletal frame and can accommodate combinations of containers of different sizes.

The tank cars are fitted with RC25NT bogies supplied by ELH Eisenbahnlaufwerke Halle.

GERMANY Wagons

collaborating with various wagon builders. DB Cargo developed the 16·4 m long Saghmmns-ty 'BraCoil' six-axle wagon able to carry up to 100 tonnes of steel coils or slabs as well as containers.

DB Cargo was also responsible for the design of the Laaeffrs 561 four-axle double-deck twin-section car transporter; both the upper and lower decks of this 33 m long wagon are high enough to accommodate SUVs and vans.

VTG developed the Sggnss 'weight-optimised' 80 ft container wagon and the Zacens tank car. The container wagon offers the longest continuous load surface of any European container wagon design and hence considerable flexibility in terms of the combination of different length containers. The tank car retains the capacity of earlier designs but is 2 m shorter thanks to the use of a larger tank made possible through the use of a specialised type of stainless steel with thinner tank walls.

Before any new components were chosen for the programme they underwent detailed evaluation to ensure that they met cost requirements and other criteria.

New bogie designs

Both the container wagon and the tank car are mounted on bogies of a new design. The RC25NT bogies for the tank car were supplied by ELH Eisenbahnlaufwerke Halle and the DRRS25L bogies for the container wagon came from WBN Waggonbau Niesky. Both have radial-steering axles and rubber suspension which are expected to reduce noise, energy consumption and wear.

The tank car and container wagon have also been fitted with disc brakes. Supplied by Faiveley Transport, these are lighter than other types of disc brake.

Different combinations of wheelsets, noise-absorbing wheels and wheelset coatings were applied to the wagons for the noise measurements. Six types of wheelset were fitted: three from Bonatrans, two from Lucchini RS and one from GHH-Radsatz.

All the prototypes are fitted with electro-pneumatic brakes using a 'light' design from either Faiveley Transport or Knorr-Bremse which does not require a second air pipe. EP brakes require an on-train power supply, which may one day become the norm as digitisation advances. On the prototypes this consists of a 110 V trainline plus a data bus from Aspöck Systems. This makes use of standard components as applied in the road transport business. Further development of an on-board power supply is envisaged after the research programme ends, the objective being to develop a cost-effective 48 V power line and CAN bus.

Telematics devices for location and data collection have been supplied by Siemens and Nexiot, while a digital brake status indicator from Asto Telematics is also being tested; this shows whether the handbrake is applied and whether the brake is set to G or P mode. RFID and NFC tags have been mounted on the wagons to permit rapid identification and download of the vehicle's history from a mobile device.

Manual greasing of wagon buffers is a costly process, and the prototypes feature an automatic buffer greasing apparatus developed by Faiveley Transport Schwab.

Conventional screw couplings rather than automatic couplers were fitted to the prototypes, as automatic couplers would alter the wagon dynamics and potentially affect wear patterns. However, three of the reference wagons have

1·4 dB(A)

REDUCTION IN NOISE EMISSION TESTS ACHIEVED BY FITTING SOUND-ABSORBING SKIRTS TO THE BOGIES OF THE TANK CAR

Recording and monitoring functions are performed by solar-powered telematics devices from Nexiot.

Table I. Component suppliers and partners, innovative wagon development programme

Aspöck GmbH	power and data bus lines
Asto Telematics GmbH	brake monitoring system
Astra Rail Industries	container wagons
CE Cideon Engineering GmbH	car transporters
DB Cargowerk Oberhausen	fitment of automatic couplers
DB Systemtechnik GmbH	component installation and testing
Eisenbahnlaufwerke Halle GmbH & Co KG	RC25NT bogie
Faiveley Transport SA	disc brakes, ep brake valves, couplers, buffer lubricators
GHH Bonatrans	wheelsets, coatings, wheel noise absorbers
Gutehoffnungshütte Radsatz GmbH	wheelsets, coatings, wheel noise absorbers
Hwh Gesellschaft für Transport und Unternehmensberatung	project co-ordination
Knorr-Bremse Systeme für Schienenfahrzeuge GmbH	ep brake valves
Lucchini RS spa	wheelsets, coatings, wheel noise absorbers
Nexiot AG	telematics devices
PVFS Schienenfahrzeuge sro	container wagons
RWTH Aachen Institute for Rail Vehicles & Transport Systems	technology screening, noise skirts, consultancy
RWTH Aachen, Institute for Technical Acoustics	acoustic design of noise skirts, noise control studies
SCI Verkehr	technology screening, feasibility study, life-cycle cost model
Siemens	telematics devices, use of test facility
Tatravagonka as Poprad	flat wagons, BraCoils, car transporters
TU Berlin	Fachgebiet für Schienenfahrzeuge technology screening, noise skirt design, consultancy
TU Berlin Hermann-Föttinger Institute	aerodynamic optimisation
TÜV Rheinland Rail Certification BV	test
Voith Turbo GmbH & Co KG	autocouplers, Scharfenberg couplers
Waggonbau Graaf GmbH	tank wagons
WBN Waggonbau Niesky GmbH	DRRS25L bogies

Table II. Technical data for prototype freight wagons

	BraCoil	Container wagon	Car transporter	Tank car
Designation	Saghmmns-ty	Sggnss	Laaeffrs 561	Zacens
Length over buffers *mm*	16400	25940	33000	14400
Load length *mm*	15160	24700	32180[1]	12560
Load width *mm*	2400	2500	1990[2]	2850[3]
Distance between bogie centres *mm*	9400	19300	N/A	9360
Wheel diameter *mm*	920	920	N/A	N/A
Axles	6	4	4	4
Axleload *tonnes*	22·5	22·5	N/A	22·5
Unladen weight *tonnes*	35·0	22·3	N/A	23·6
Maximum load *tonnes*	100	67·7	36·0	66·4
Loaded weight *tonnes*	135	90·0	N/A	90·0

1. 32550 on upper deck 2. Maximum car height 3. Tank diameter

been equipped with two types of automatic coupler from Voith Turbo Scharfenberg and Faiveley Transport Schwab that incorporate air connections.

Independent noise assessment

The Federal Ministry for Transport & Digital Infrastructure wanted to ensure that noise measurements were carried out independently, and the contract for this work went to Prose. Measurements were conducted according to the TSI Noise requirements at a distance of 7·5 m from the track centre, with further measurements taken at a distance of 3 m to give better differentiation of bogies and wheelsets. Lineside microphone arrays were used to identify the location of noise sources on the wagons and bogies.

Initial results from the noise tests revealed that in all three cases a substantial improvement over the 83 dB(A) noise limit in the TSI had been achieved, with a reduction of more than 6 db(A). Especially strong results were reported for the container wagon and the tank car, not least because they were fitted with disc brakes. Good results were also obtained for the six-axle coil wagon, mainly as a result of the wheelset design. For the car transporter the best result was 78·9 dB(A), probably because there are noise sources located higher up on the wagon structure. Further testing is expected to confirm the results.

Above left: Several types of wheelset with different sound absorbing properties are being tested. This is the car transporter with Lucchini wheelsets.

Above: Sound absorbing rings feature on some of the Bonatrans wheelsets.

Skirts

A number of trials were conducted with bespoke noise-absorbing skirts fitted to three of the wagon types. These were developed by Berlin Technical University and Aachen Technical University. No significant noise reduction was evident on the container wagons and the car transporters, but a further reduction of 1·4 dB(A) was attained with skirts fitted to the tank car bogies.

The bespoke skirt designs were not approved for use on the national network, so they were not fitted during the field trials.

Tests conducted at Wegberg-Wildenrath suggested that the prototypes have the potential to reduce energy consumption by about 3% when running unladen, although this will depend on the characteristics of the routes on which the wagons run. Tests in loaded condition are planned when the wagons return to the test track in October.

Consumption of energy by the use of electro-pneumatic brakes is being measured during the field trials. ■

Some material in the text is drawn from an article by Dr Jens Klocksin and Ralf Turge from the Federal Ministry for Transport & Digital Infrastructure, Dipl-Ing Andreas Eckel and Dip-Ing Jürgen Frenzel of TÜV Rheinland Consulting GmbH, published in our sister DVV Media Group journal *ETR*.