Position Paper of the Technical Innovation Circle for Rail Freight Transport

Focusing on the rail system

From the innovative freight wagon to the intelligent freight train and a competitive rail freight transportation system

I. The innovative freight wagon

Green light for a new approach to innovation

Low-noise, **L**ightweight, **L**ong-running, **L**ogistics-enabled, **L**ife-cycle-cost-oriented – the freight wagon of the future should meet these five basic criteria. In 2012, the white paper “Innovative Rail Freight Wagon 2030 – The ‘5L’ Future Initiative”, published by the Technical Innovation Circle for Rail Freight Transport (TIS) did more than formulate ambitious goals. It also presented the sector with a new approach for developing fundamental innovations using the concept of a demonstrator train.

The “5L Future Initiative” is now firmly established in the rail freight transportation sector. There is a broad consensus that innovation in accordance with the 5L criteria is a necessity for rail freight wagons. The intensification of innovation activities in the sector is now immediately obvious to any observer. The initiative launched by TIS has made a decisive contribution to promoting the development and implementation of fundamental innovations in freight wagons. This has been achieved through dialogue with the supply industry, definition of functional requirements, and testing in practical demonstrator projects. The most prominent examples are the “5L demonstrator” developed by SBB Cargo AG and the “Innovative Freight Wagon” project initiated by the German Federal Ministry of Transport and Digital Infrastructure (BMVI) and implemented by DB Cargo AG and VTG AG. To a much greater degree than previous research ventures, the projects started by the TIS “5L Future Initiative” now focus on the cost-effectiveness of innovations. These developments should be economically viable for use in freight wagons on the track tomorrow.

So far, all these activities have concentrated on the development potential of the rail freight wagon. The project has stimulated new ideas in the innovation process and is already producing some initial successes. The next step will be to combine these innovative freight wagons into intelligent freight trains. This offers enormous potential for increasing efficiency and thus the cost-effectiveness of rail freight transportation.

II. The intelligent freight train

The automatic coupling as a module for digitisation and automation

Perform the brake test, couple and decouple, record the order of wagons – even in the 21st century, preparing a freight train still involves a lot of manual work. These manual tasks are time-consuming, expensive, and reduce the competitiveness of rail freight traffic compared to other modes of transport. Improving the competitiveness of rail freight transportation will require more than the promotion of isolated innovations in “freight wagon” design. New approaches to innovation must focus on the freight train as a whole.

Serious proponents of rail freight transportation must seize this opportunity and develop digitisation and automation strategies for the entire train. It is the only approach that can pave the way for the numerous innovations required to make rail freight transportation more efficient. These include the introduction of an automatic brake test, the automated registration of wagon orders and the train integrity test, a largely automated technical inspection of the wagons and the switch to condition-based maintenance. The standardisation of freight train handling processes in facilities, nodes and sidings must be started and coordinated at an early stage. This will be essential for every phase of the digitisation and automation process.

The introduction of a digital automatic coupling is one of the most important elements in the process. It is key to delivering leaps in efficiency that will benefit the entire rail system. A sufficient power supply and secure data communication on the train will also be necessary to automate rail operations. Combining these components into an innovative, automatic coupling with integrated power and data bus lines will open up considerable opportunities for rail operators.

The position of TIS is therefore clear: the Europe-wide introduction of a digital automatic coupling (DAC) must be made a top priority.

All past attempts to introduce an automatic coupling (AC) for European rail freight transportation have failed. The companies participating in TIS are all aware of this fact. In the meantime, however, the underlying conditions for the introduction of an AC have changed: Technological advances mean the focus is no longer solely on improving the occupational health and safety of shunting staff or increasing the productivity of shunting operations.

On the contrary, the introduction of a DAC for freight trains could now generate a variety of additional benefits which considerably increase the competitiveness of rail freight transportation.

Simply automating the process of mechanical coupling – standard practice in America and Russia for many years – is no longer enough. To achieve significant increases in productivity,

the AC must also automatically couple the air, power and data bus lines.. This will enable operators to automate many other processes which are currently performed manually. In the future, it may even be possible to develop a DAC that can decouple by remote control.

Setting standards: Migration strategy for the introduction of the automatic coupling

The sector must develop a migration strategy for the aforementioned innovations and implement it in the medium term. This includes the agreement of a uniform, Europe-wide DAC as well as an energy and data management standard for freight trains.

The shippers, wagon owners, railway companies, wagon manufacturers and suppliers participating in TIS have taken up this challenge. Together, they are campaigning for the introduction of a DAC that incorporates further innovations for the digitisation and automation of rail freight operations as well as working on various sub-aspects.

TIS has agreed on five essential technical elements that provide the framework for the definition of a DAC.

- **Definition of different types of automatic coupling** (Types 1 to 5): an AC that only makes a mechanical connection; an AC that integrates automatic connection of the air line; a digital, fully automatic AC which, in addition to the mechanical connection, can automatically couple and decouple the air, power and data bus lines remotely.
- **Integrated coupling of air, power and data bus lines** as the minimum standard for the migration of the DAC into the market. The corresponding DAC Type 4 should aim to achieve maximum impact on the digitisation and automation of rail freight transportation. Important: The digital automatic coupling must be upgradeable and upwardly compatible with a DAC Type 5.
- **No compatibility with the traditional screw coupling (SC).** This should allow the DAC to be adopted quickly and completely throughout in Europe. Although a temporary mixed operation using both DAC and SC could simplify the transition period, the benefits of rapid migration are more significant.
- **Standardised power and data management via a continuous power and data bus line** to ensure reliable telematics applications and automation. The power supply should be sufficient for these functionalities to be expanded in future and provide enough energy to charge a battery. TIS has begun to standardise the data interfaces for today's and tomorrow's telematics applications – from the telematics unit on the freight wagons to the train, the locomotive and all the way to the control unit.

- A **technically robust design** that takes into account the tensile and compressive forces to which the DAC will be subjected by the heavier and longer trains of the future. At the same time, the coupling should remain as light as possible in order to avoid losing payload capacity.

The first automatic couplings with integrated air line connections are currently being used in demonstrator trains operated by companies participating in TIS. These Type 2 couplings are a good entry-level solution and already generate added value for operators. However, the introduction of the fully digitised automatic coupling must remain the ultimate goal. Only a DAC Type 5 will enable companies to take full advantage of the potential offered by digitisation and automation. When companies take the first step of investing in an AC Type 2, manufacturers and users must therefore ensure these couplings are compatible with future upgrades.

A sectoral challenge in need of political support – nationally and throughout Europe

The process of introducing a digital automatic coupling seamlessly across a continent is both complex and financially challenging. Without broad political support at the national and European levels, it will be difficult to accomplish. The high procurement and conversion costs make financial support an absolute necessity.

The introduction of a DAC offers benefits for many stakeholders in the rail freight transportation system – for rail transport and infrastructure companies as well as shippers and wagon owners. However, most of the economic added value will be felt by the railway companies. They stand to increase their productivity significantly by automating operations. By contrast, the burden of investment lies exclusively with the wagon owners. For the migration of a DAC to be successful, it will therefore be crucial to create a monetary incentive for wagon owners. The investment in upgrading freight wagons with a DAC must be made economically viable for them. The challenge for politicians and the sector is to create a pragmatic and fair cost sharing model.

III. The competitive rail freight transportation system

An integrated approach to growth in the rail sector

The sector and the political sphere must address many other improvements that affect the entire rail freight transportation system beyond the innovative freight wagon and the intelligent freight train. The competitiveness of rail freight transportation can only be significantly increased if the necessary innovations are introduced in all three fields.

In addition to promoting and implementing innovations, there is also a need to improve the general conditions for rail freight transportation as well as between modes of transport. These include:

- Efficient and reliable rail freight infrastructure
- Digitisation of rail infrastructure including implementation of ETCS
- Competitive track and facility prices
- Limitation of duties and tax burdens
- Condition monitoring of vehicles on the infrastructure (way-side monitoring systems)
- Standardised data exchange between all participants in rail freight transportation
- Greater emphasis on multimodality
- Intensification of training and professional development in the rail freight sector

Here, too, a first step has been taken. At a round table meeting, the sector and BMVI have jointly developed a master plan for rail freight transportation. The companies participating in TIS support the agreed measures. TIS members are actively involved in the implementation and further development of the measures described in the master plan.

About us

The following companies are currently participating in TIS as part of a practice group: DB Cargo AG, Ermewa SA, GATX Rail Germany GmbH, Knorr-Bremse Systeme für Schienenfahrzeuge GmbH, SBB Cargo AG, VTG AG, Waggonbau Graaff GmbH, WBN Waggonbau Niesky GmbH, Wascosa AG. TIS has the support of a scientific advisory board with Prof. Dr. Hecht (TU Berlin) and Prof. Dr. König (TU Dresden).

TIS – as the sector's practice group – has set itself the goal of initiating and implementing practical innovations for innovative freight wagons and intelligent freight trains. It pursues an integrated approach with a focus on the cost-effectiveness of basic innovations for rail freight wagons. As a result, in addition to wagon owners, TIS brings together rail transportation companies, shippers and companies in the wagon construction and supply industry. The wagon owners in TIS are fundamentally willing to incorporate basic innovations into newbuilds and existing fleets.

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