



RAIL CAR IDENTIFICATION AS A KEY ISSUE OF OPERATIONAL HANDLING

Andreas Schöbel

Vienna University of Technology, Institute of Transportation, Research Centre for Railway Engineering, Austria

Abstract

According to European legislation railway companies are divided into railway undertakings and infrastructure manager which causes effects on established processes. A typical example therefore is the long-term issue of automatic rail car identification. The common use of a standard - given by UIC - has failed until now. Due to the liberalization of railway operation an optimization is done within the own cost centre area. Railway undertakings prefer an autarkic technical solution for tracking and tracing of their own rail cars. On the other hand infrastructure manager has to deal with a plurality of isolated technical solutions on the individual car and the issue that the bulk will not be equipped in the foreseeable future. Thus possible fields of application arise for optical practices while entering railway network, in shunting yards and engine stocks which are described in this article.

Keywords: railway operation, rail car identification, operational handling

1 Introduction

For efficient railway operation the collection of rail car numbers is one of the most important tasks to be done in daily operation because all the logistic processes are related to the rail car number [1]. Today's state of the art is the manual collection of rail car numbers at starting station (e.g. shunting yard) during the preparation process of a train and at network border stations between different infrastructure managers. Sometimes this process is supported by technical devices to prevent failures arising from hand writing of rail car numbers at rough environmental conditions. According to the TAF-TSI the train preparation process is located in the responsibility of the railway undertaking. Therefore smaller enterprises have already equipped their vehicles with some technical devices to improve the process of train preparation. Bigger enterprises with a bulk of vehicles are facing economical difficulties when equipping all their cars. Currently, there is no European or worldwide regulation or standard for rail car identification. Only TAF-TSI gives some minimum level of required data during the train preparation process. The basic requirements for any technical device to support the rail car identification process are a high reliability with a high recognition rate at a certain speed level (cargo trains up to 120km/h, high speed trains up to 300km/h). Thereby the costs for installation and maintenance of the identification system shall be low and the data protection must be guaranteed. When talking about rail car identification, two terms have to be distinguished: rail car number identification and rail car type identification. A system for rail car number identification must be able to recognise the car number. This is necessary for all types of allocation of car properties. Only by such a system trend analysis of state parameters are possible. Moreover the efficient maintenance and repair procedures are related to the rail car number. Also the precise localisation of a rail car depends on the quality of such a

system. In comparison to the rail car number identification there are some applications where it is enough to know about the rail car type. This situation can be found at the check of train composition. Here it is easily possible to identify missing cars in a train. The knowledge about the rail car type allows a first optimisation at shunting yards.

2 Technical solutions

Before looking in detail on specific technical solutions table 1 gives an overview on basic arguments for and against vehicle-based and wayside solutions.

Table 1 Overview on arguments for/against vehicle-based and wayside solutions

	Vehicle-based solutions	Wayside solutions
Advantages	Single car can be equipped easily International available when using international standards (GSM, GPS, etc.)	Learn effect due to high numbers of cars Independent from operator (railway undertaking)
Disadvantages	Energy supply on cargo cars Availability of the car shall not be reduced by any additional equipment	Limited to the area of one infrastructure manager Choice of location, Economical feasibility, basic infrastructure in specific location, etc.

Vehicle-based solutions offer the opportunity to easily equip single cars in a short time period. When using international standards for localisation and/or communication the advice can be also used in international traffic. On the other hand there are also some disadvantages like the missing energy supply on cargo cars which must be additionally installed and should guarantee power supply for more than five years (according to the maintenance cycle of a cargo car). Moreover the availability of a cargo car is reduced by any additional device which is mounted on a car because it will need some maintenance too. Even if the single component has a high reliability, the combination of several components leads to a reduction of the overall availability of the cargo car.

Wayside solutions can profit from the so called learn effect because of many cars passing the installation. Therefore the database of existing rail car numbers can be completed during operational application. The most important argument for infrastructure manager is, that this solution is in his responsibility and it is independent from the railway undertakings (or car owner) and their strategies of mounting devices for rail car identification. On the other hand this approach is limited to the mostly national area of an infrastructure manager. Moreover the number of required positions to cover the traffic in a network and therefore the choice of location has to be considered when checking the economical feasibility. There is also the demand for basic infrastructure like power supply, network connection, etc. at the chosen locations in the network.

2.1 Vehicle-based solutions

The first question arising when choosing a vehicle-based solution is if a autonomous or a distributed solution is better fitting. The requirements for both possible solutions are a high quality of information including the potential for automatisisation of data flow and low costs without any additional effort in operation. Most solutions on the market are complete solutions which makes them specific for special applications [2], [3]. Of course, the benefits of a combination of GPS and GSM are used in the design of the system architecture. The problem of shadowing effects is mostly solved by the passed way length. Another key issue in this context is the European system GALILEO [4] which should offer a lot of functionality for rail car identification and localisation [5].

2.2 Wayside solutions

Wayside solutions are limited to optical measurement principles with all the arising problems when using this principle. Under best conditions a unique allocation is possible but weather conditions (fog, snow) and bad writing influence the recognition rate directly in a negative way. The challenge for the optical identification is always the lighting concept (normal light or IR). Additionally, other numbers (or text) located on the car can be read under good conditions. So for container transport it might be also interesting to identify the container number and the name of the owner (and his mobile phone number) [6]. In case of no readable rail car number a combination with other sensors seems to be a promising way to collect the missing information. If only one number is not recognised, the algorithm of check digit allows the calculation of the missing position. Mostly, information on the rail car owner and the procedure for exchange are given as a number and as a text. If the axle numbers are known, the type of the car can be identified and therefore this part of the rail car number can be completed.

2.3 Combined solutions

Combined solutions use tags (active or passive) installed at the cars and wayside readers to identify the cars [8]. The economical benefit is given by the high number of tags needed. Therefore the costs for one single tag are low. The wayside readers work mostly on microwave base and are insensitive against snow and dust. Active tags need some energy supply on the cargo car while passive can be read from wayside readers without any power supply. For this kind of solution a harmonisation of equipment would be necessary but it is not recommended. It is also possible to design wayside readers for different frequencies to deal with different standards and protocols of tags.

3 Wayside applications

This chapter gives an overview about possible wayside applications of rail car identification. Each single application has differences in the technical requirements which make it impossible to use one installation for all different fields of application.

3.1 Engine depot

This application is necessary for the documentation of the time when an engine is provided to the infrastructure manager. Before this point in time the engine is prepared for operation. If there are some technical difficulties, the engine will not be provided in time and therefore there might occur some delay. So for the delay scenario it is very important to have the time documented when the engine was provided. The speed in this area is always low (not more than 40km/h), so the technical requirement is also low. Also the focus is limited because only engines or trainsets enter or pass at the engine depot. Due to liberalisation of the railway market it is also possible to maintain foreign engines or trainsets at engine depots.

3.2 Fault State Monitoring

For several operational fault states sensors were developed in the last years to monitor passing trains [9]. Most of the sensor systems allocate measurements to one axle because this is the most proper way and can be done by any axle counter. The specific task of rail car identification is now to allow an allocation of fault states to a rail car and therefore to a railway undertaking or a rail car owner. Moreover it is also possible to check the order of cars in a train. Sensors used for wayside train monitoring are designed for speeds up to 250km/h. Of course, there are also locations with lower speed limits. Sensors for measuring dynamic Q

forces allow the identification of the rail car type. This allows to complete digits of the rail car number if they are missing. Another benefit of an optical identification of the rail car number is the possibility to use the photo for interpretation of fault states which were recognised by other sensor systems.

3.3 Network entry

In international traffic it is usual practice to inform the border station in advance about on-coming trains. Sometimes the quality of this information is low due to a missing update of information on rail car numbers available in a train. If the train is now approaching at the border station, some personal has to check the rail car numbers during the complete check of the train. Between some countries there is a contract to overtake so called trains of trust at the border without any additional stop. This is now practice between several European countries (especially between EU member states). The manual process at the border station is error-prone and cost intensive (time and personal). Therefore it seems to be suitable to collect rail car numbers automatically.

3.4 Shunting yard

In the reception siding of a shunting yard the comparison of the announced rail car numbers and the really present ones is done [7]. Before departure of a train also the rail car numbers of a train have to be collected. For both tasks automatic rail car identification would be suitable. The specific situation in a shunting yard is given by slow speed limits. Any installation might be only economic feasible at shunting yards with high traffic flow.

4 Outlook

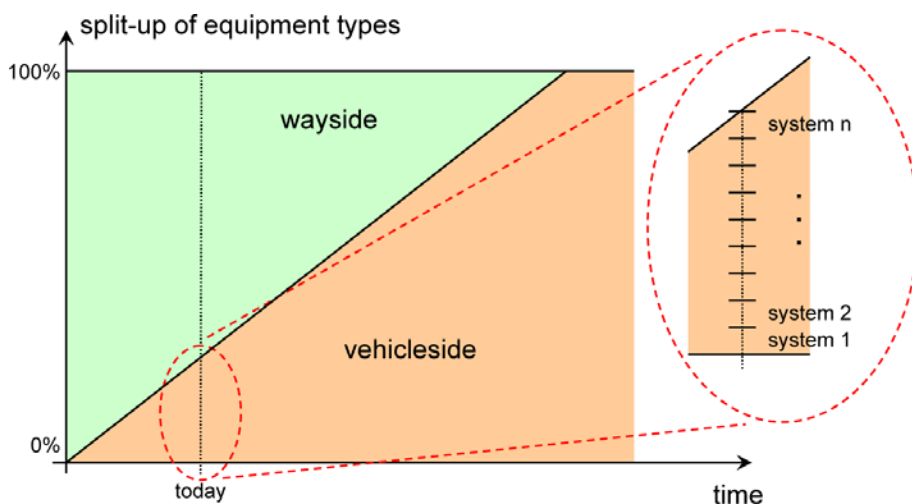


Figure 1 Future trend in rail car identification

Figure 1 expresses the estimation of the authors of the future trend in rail car identification. Today there are several systems available for vehicle-based identification on the market but there is also a market share for wayside solutions due to the missing harmonisation and standardisation in the field of vehicle-based solutions. For the European railway system it would be suitable to look out for this missing task to allow an efficient railway operation along the European freight corridors.

References

- [1] Baranek, M., Käse, G. Online Management und Disposition von Bahnwagen und Ladeeinheiten. Tetzlaff Verlag, Eisenbahningenieur (51), Heft 3, 2000.
- [2] Hauch, w. Einsatz autarker Informationssysteme (AFI-S) im Schienengüterverkehr. Tetzlaff Verlag, Eisenbahningenieur (51), Heft 1, 2000.
- [3] Mietzner, B., Reschke, E. Zuglaufverfolgung mittels automatischer Fahrzeugidentifizierung. Tetzlaff Verlag, Signal+Draht (92), Heft 10, 2000.
- [4] Völkenring, w. GALILEO – Europas neues Satellitennavigationssystem. Tetzlaff Verlag, Eisenbahningenieur (54), Heft 12, 2003.
- [5] Winter, J. Satellitengestützte Ortung im flächendeckenden Einsatz bei der SNCB/NMBS. Tetzlaff Verlag, Eisenbahningenieur (53), Heft 5, 2002.
- [6] AILWS-Automatische Identifikation von Ladeeinheiten und Waggons im Schienenverkehr, Endbericht Version 1.0, März 2005
- [7] Siemens AG Transportation Systems Rail Automation, Das automatische Reihungskontrollsystem ARKOS-Mehr Effizienz und Sicherheit für den Güterverkehr
- [8] Das Mikrowellensystem SICARID der Siemens AG zum automatischen Identifizieren von Eisenbahnfahrzeugen, Ing.-Dr.Kurt Garbrecht, Siemens AG , aci-report 8
- [9] ZEV Rail Glasers Annalen 129 (2005) Sünder, M., Schöbel, A., Pisek, M., Maly, T. Sicherungssystemintegrierte Checkpointanlagen für automatische Zugbeobachtung.

