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Measuring and upgrading the clearance gauge of railway lines:

Assessment of information systems and procedures

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1. INTRODUCTION

The current document is part of the final report for the Study on Measuring and Enlarging Railway Clearance Gauges. This study has been mandated by the European Commission, Directorate-General for Mobility and Transport, with the following primary objectives in mind:

- Create transparency on the access conditions of railway lines
- Attract additional freight traffic for rail according to real markets
- Open the rail freight market by removing unnecessary clearance gauge restrictions, and exploit economies of scale by giving wider network access to vehicles built to standard gauges
- Strengthen demand-oriented infrastructure development
- Identify the most profitable bottlenecks to act on
- Identify how current practice and standards with regards to gauge could be simplified/ revised for increase efficiency in solving gauge questions

The study works toward these objectives via the development of a best-practice guide with procedures for the revision of line codifications, with a view to upgrade line characteristics in a pilot program

The study activities are broken up into 6 distinct work packages (WP), as illustrated in the figure below.

	Description	WP Deliverables (integrated into contractual deliverables)
WP 1	Assessment of existing clearance gauge information systems	• Information on current data and procedures • Recommendations for EU policy makers
WP 2	Assessment of procedures to measure and enhance clearance gauge information	• Report including the state of the art and current rules and procedures to measure railway gauge, enlarge railway gauge, to revise the codification of railway
WP 3	Market study, resulting in selection of 2 to 6 gauge enlargement links	• Market study including the identification of flows and line sections where gauge is particularly problematic, the definition of the target commercial gauge for operators, and traffic forecasts
WP 4	Measurement campaign	• Report including the description of the tests conducted, the data collected and its analysis, the validation of the procedures to measure and enlarge railway gauge
WP 5	New gauge standard and Best practice guide	• Definition of new kinematic reference contour & infrastructure gauge • Best Practice Guide and report with the results of the previous tasks, proposed structures and harmonized rules • Identification of necessary modifications to UIC standards
WP 6	Feasibility study and cost benefit analysis (CBA)	• A report including a feasibility study and a Cost Benefit Analysis to prepare for the civil engineering works for enhancing the gauge on 2-3 selected sections identified in the market study

Figure 1 – Breakdown of the 6 work packages

The results of all the work produced within these 6 packages can presented in three major parts:

- An opportunity and feasibility of gauge enlargement operations, which corresponds to the WP 3, 4, 5 and 6
- Assessment of existing information systems and procedures for gauge measurement and enhancement, which corresponds to the WP 1 and 2
- A Best Practice Guide, which presents recommendations stemming from this whole study

The final report of this study consists of three documents, each of which is related to one of the parts above.

This document presents the results of the second part: assessment of existing information systems and procedures.

2. ABSTRACT AND EXECUTIVE SUMMARY

2.1. Abstract

NB: The following abstract covers the whole study.

2.1.1. English

This study deals with the question of rail freight clearance gauges in several ways.

A feasibility study identifies the bottlenecks of the European network where an enhancement in the gauge would make it possible to develop combined transport in the medium term, by increasing the modal share of rail in traffics. The appropriateness of such work has been studied through economic and financial evaluations. An increase in the permissible gauge on the Rhone Valley and on Perpignan-Barcelona then seems to present a very interesting potential in terms of development of rail freight activity.

An assessment also presents the practices of the infrastructure managers concerning their management of the clearance gauge: knowledge of the actual gauge using measurements, procedures implemented in response to requests from railway undertakings, monitoring of the infrastructure information and communication of this information to customers, in particular via the Network Statements.

Finally, a Best Practice Guide presents recommendations in terms of regulations, based on these assessments, in order to smoothen interactions between the different stakeholders, to facilitate access to the rail network by customers and ultimately to develop rail freight business.

2.1.2. French

Cette étude sur la question des gabarits pour le fret ferroviaire aborde le sujet sous plusieurs aspects.

Une étude de faisabilité identifie les points du réseau européen où une amélioration du gabarit permettrait de développer le transport combiné à moyen terme, en augmentant la part du rail dans les trafics. L'opportunité de tels travaux a été étudiée au moyen d'évaluations socio-économique et financière. Une augmentation du gabarit admissible sur la Vallée du Rhône et sur Perpignan-Barcelone semble alors présenter un potentiel très intéressant en termes de développement du fret ferroviaire.

Un état des lieux présente également les pratiques des gestionnaires d'infrastructure à propos de leur gestion du gabarit sur leurs réseaux : la connaissance du gabarit via des mesures, les procédures mises en œuvre en cas de sollicitation par une entreprise ferroviaire, la conservation de l'information et la communication de cette information aux clients, notamment via les Documents de Référence du Réseau.

Enfin, un Guide des Bonnes Pratiques présente des préconisations en termes de règlementation, partant des observations réalisées, afin de fluidifier les interactions entre les différents acteurs, faciliter l'accès au réseau ferré par les clients, et à terme développer le transport de marchandises sur rail.

2.2. Executive summary

NB: The following executive summary only covers this document.

2.2.1. English

The management of the track clearance gauge information by the infrastructure managers is a crucial process all along its different steps, from physical measurement of infrastructure characteristics to the delivery of the right up-to-date and reliable information to the stakeholders.

Technical difficulties, communication deficiencies between infrastructure managers and their customers, unsuitable standards or inadequate practice about clearance gauge management contribute altogether to a current non-satisfactory situation that could be improved through the generalization of good practices.

In the present Study, WP1 "Assessment of clearance gauge information and enhancement" and WP2 "Statement of current rules and procedures to measure and enlarge railway gauge" aimed at providing a picture of the difficulties actually met by the stakeholders, highlighting their expectation, and describe some practice in order to provide recommendations in the different fields of clearance gauge management. The work was developed through the analysis of questionnaires sent to the different Infrastructure Managers (IMs) and Railway Undertakings (RUs), the complementary interviews conducted, a Seminar held in September 2015 and the study of a large bibliography.

In relation with the acquisition of gauge data, accuracy of clearance gauge measurement remains costly and capacity-consuming. High-output measurement techniques used for regular measurements are generally less accurate than local on-demand measurements. The cost is not only related to the measurement train, but also to the software development allowing to use the data. IMs carry out the measures by laser telemetry technologies boarded on railway vehicles. These techniques coexist with hand-held trolley systems. The frequency of the clearance gauge monitoring is subject to high variability. For on-board techniques, the frequency is often aligned with the other missions of the carrying vehicle.

A common approach or even a harmonization of the measurement systems between IMs would be a possible answer to the need for wider accessibility to the data. To guarantee the quality of data, the question of external certification or control of the measured data is still open. The recourse to external entities to measure and manage the data could be part of a solution. Although some experts claim that it could face cultural resistance, subcontracting of the measurement process is already a reality for several infrastructure managers.

The publication of the data engages the responsibility of the IM who publishes it. A question is raised about how much and how often the IM should run measurements to ensure the quality and the update of the data. Each IM is obliged to publish a Network Statement (NS). These NSs aim to provide all applicants, the RUs wishing to operate services on a given rail network with a single source of up-to-date, relevant information on a fair and non-discriminatory basis. Gauge information is also included in the NSs.

The reality is that although RailNetEurope has provided guidelines that define a Network Statement Common Structure, the format of the displayed data has not been harmonised, thus resulting in a very large variety of situations, in particular regarding the publication of clearance gauge data by the IMs. However, the issue is made more complex for IMs by the fact that the wishes of RUs might be themselves diverse: some request tables or raw data, to be able to proceed with their own studies, some other request for more synthetic information. It is anyway a strong request from the RUs that all needed information should be available on internet, due to the necessity for IM to be reactive in answering urgent demands from the market.

It is also important to identify for the IMs what is the information that can be provided instantly via a web platform, and which information necessitates further treatment. GIS display of data appears as one of the most attractive and easy-to-access way to provide data.

On corridors, the ECCO project conducted by UIC has demonstrated the wish of most RUs for a harmonization of infrastructure data and higher level of integration and coordination, with their enhanced involvement in the decision process. The process towards harmonization and integration is progressing through several initiatives at the corridor level.

In spite of the definition of a series of reference profiles applicable to both infrastructure and rolling stock, RUs and IMs often seem not to speak the same language. In absence of a universal codification system, defining at least a standardized measurement/codification method is crucial and wished by all, in the current complexity and variety of gauging and line or wagon codification systems, which are currently mostly accessible to experts.

2.2.2. French

La gestion des informations concernant le gabarit par les gestionnaires d'infrastructure est un processus crucial tout au long de ses différentes étapes, de la mesure physique des caractéristiques de l'infrastructure à la communication d’une information à jour et fiable aux intervenants.

Les difficultés techniques, les manques de communication entre les gestionnaires d'infrastructure et leurs clients, les normes ou pratiques inadéquates en matière de gestion des gabarits contribuent à une situation actuelle non satisfaisante qui pourrait être améliorée par la généralisation des bonnes pratiques.

Dans la présente étude, le WP1 «Évaluation de l'information concernant les gabarits et éléments d'amélioration» et le WP2 «Énoncé des règles et procédures actuelles de mesure et d'agrandissement du gabarit ferroviaire» présentent les difficultés rencontrées par les parties prenantes, en prenant en compte leurs attentes, et décrivent certaines pratiques afin de formuler des recommandations dans les différents domaines de la gestion de la question du gabarit. Le travail a été réalisé à travers l'analyse de questionnaires envoyés aux différents gestionnaires d'infrastructure et aux entreprises ferroviaires, des entretiens complémentaires, un séminaire organisé en septembre 2015 et l'étude de nombreux documents.

En ce qui concerne l'acquisition de données de gabarit, une mesure très précise du gabarit reste coûteuse et mobilise une capacité importante. Les techniques de mesure à rendement élevé utilisées pour les mesures régulières sont généralement moins précises que les mesures locales, à la demande. Le coût n'est pas seulement lié au train de mesure, mais aussi au développement logiciel permettant l'utilisation des données. Les GI réalisent les mesures grâce à un outil de télémétrie laser embarqué sur wagon. Ces techniques coexistent avec les systèmes de « chariots poussés main ». La fréquence de ces mesures est soumise à une grande variabilité. Pour les techniques embarquées, la fréquence est souvent liée aux autres missions du véhicule porteur.

Une approche commune voire une harmonisation des systèmes de mesure entre les gestionnaires d’infrastructure serait une réponse possible à la nécessité d'une meilleure accessibilité aux données. Pour garantir la qualité des données, la question d’une certification ou d’un contrôle externe des données mesurées est toujours ouverte. Le recours à des entités externes pour mesurer et gérer les données pourrait faire partie d'une solution. Bien que certains experts prétendent qu'elle pourrait faire face à la résistance culturelle, la sous-traitance du processus de mesure est déjà une réalité pour plusieurs gestionnaires d'infrastructure.

La publication des données engage la responsabilité du gestionnaire d’infrastructure qui la publie. Une question est soulevée quant à la quantité et la fréquence des mesures à réaliser pour assurer la qualité et la mise à jour des données. Chaque GI doit publier un Document de Référence du Réseau (DRR). Ces DRR visent à renseigner les demandeurs, les EF désireux d'exploiter de circuler sur un réseau ferroviaire donné, avec une source unique d'informations pertinentes et actualisées, sur une base équitable et non discriminatoire. Les informations relatives au gabarit sont également incluses dans les DRR.

En pratique, même si RailNetEurope a fourni des lignes directrices qui définissent une structure commune du Document de Référence du Réseau, le format des données affichées n'a pas été harmonisé, ce qui donne lieu à une très grande variété de situations, en particulier concernant les informations relatives au gabarit. Cependant, la question est rendue plus complexe pour les GI par le fait que les doléances des EF peuvent être elles-mêmes diverses : certains demandent des tableaux ou des données brutes, pour pouvoir poursuivre leurs propres études, d'autres des informations plus synthétiques. Il y a de toutes façons une forte demande des EF que toutes les informations nécessaires soient disponibles sur Internet, en raison d'impératifs de réactivité pour répondre aux demandes urgentes du marché.

Il est également important pour les GI d'identifier quelles sont les informations qui peuvent être fournies instantanément via une plate-forme Web, et quelles informations nécessitent un traitement préliminaire. L'affichage des données SIG apparaît comme l'un des moyens les plus attrayants et faciles d'accès pour fournir des données.

Sur les corridors, le projet ECCO mené par l'UIC a démontré le souhait de la plupart des EF d'harmoniser les données d'infrastructure et de renforcer leur intégration et leur coordination, en les associant davantage au processus décisionnel. Le processus d'harmonisation et d'intégration progresse à travers plusieurs initiatives, au niveau des corridors.

Malgré la définition de profils de référence pouvant faire référence à la fois à l'infrastructure et au matériel roulant, les EF et les GI semblent souvent ne pas parler le même langage. En l'absence d'un système de codification universel, la définition d'au moins une méthode normalisée de mesure/codification est cruciale et souhaitée par tous, face à la complexité et la variété des systèmes de codage des lignes ou des wagons, actuellement compréhensibles seulement par les experts.

3. CONTEXT

On the European Railway Network, and especially on freight corridors, insufficient track clearance gauge might on some lines generate bottlenecks and constitute a barrier to a potential increase of traffic, and poor knowledge of the track clearance gauge conditions or inadequate management of the information could even lead to neglect some traffic opportunities that could be physically possible.

Therefore, it appears that the management of the track clearance gauge information by the infrastructure managers is a crucial process all along its different steps, from physical measurement of infrastructure characteristics to the delivery of the right up-to-date and reliable information to the stakeholders.

It is suspected that technical difficulties, communication deficiencies between infrastructure managers and their customers, unsuitable standards or inadequate practice about clearance gauge management contribute altogether to a current non-satisfactory situation that could be improved through the generalization of good practices.

Through the analysis of questionnaires, interviews, seminar and bibliography, this report aims at providing a picture of the difficulties actually met by the stakeholders, highlighting their expectation, and describe some practice in order to provide recommendations in the different fields of clearance gauge management.

4. METHODOLOGY

The work presented here is resulting from diverse actions to collect information from the main stakeholders of the rail freight transport.

In particular, three main sources have been used:

4.1. Questionnaires and interviews

Questionnaires have been elaborated within the work team, and sent out to a large panel of stakeholders, including infrastructure managers and railway undertakings. To each of these two populations, was addressed a specifically designed questionnaire.

After analysing the received answers, UIC conducted complementary interviews in order to clarify or give additional details to the responses.

The questionnaire to IMs intended to draw up a picture of the European situation and to possibly highlight best practices regarding clearance gauge management. It included the following topics:

- monitoring practice and measurement methods,
- clearance gauge maintenance,
- enlargement practice,
- gauge studies and transport authorizations,
- information given to customers
- Data management

A sample questionnaire is given in appendix A.

It has been sent to 44 different European infrastructure managers,

Country	Company	Country	Company	Country	Company
Austria	ÖBB	Hungary	GYSEV	Russia	RZD
Belarus	BC		MAV	Serbia	ZS
Belgium	INFRABEL	Ireland	CIE	Slovakia	ZSR
Bosnia-Herzegowina	ZFBH	Israel	ISR	Slovenia	SZ
	ZRS	Italy	FS	Spain	ADIF
Bulgaria	NRIC	Latvia	LDZ		FGC
Croatia	HZ-Infrastruktura	Lithuania	LG	Sweden	TRAFIKVERKET
Czech Rep	SZDC	Luxembourg	CFL	Switzerland	BLS
Estonia	EVR	Moldova	CFM		RhB
Finland	FTA	Montenegro	ZICG		SBB CFF FFS
France	EUROTUNNEL	Nederland	PRORAIL	Turkey	TCDD
	LISEA	Norway	JBV	UK	HS1
	SNCF Reseau	Poland	PKP		NETWORK RAIL
Germany	DB AG	Portugal	REFER	Ukraine	UZ
Greece	OSE	Romania	CFR-SA		

The questionnaire to RUs, was mostly focusing on their appreciation of the accessibility of the clearance gauge data provided by the IMs. RUs were also questioned about their perspectives and their possible requests for enlargements.

A sample of the questionnaire to RUs is shown in annexe B.

About 180 companies operating in 27 countries were questioned through this questionnaire (list in annexe B).

A low level of answering was however deplored to these questionnaire. Poor competences in English, lack of available experts and little awareness of the questionnaire recipients about the gauge topic are probably some of the reasons for this.

4.2. Workshop

In order to examine the early answers to the questionnaire, and motivate active discussion between all parties, a workshop was organised by UIC on 25 September 2015.

After an introductive speech by the Project Officer, high level speakers introduced a series of topics that were discussed afterwards within small groups, allowing cross presentations of their conclusions.

The topics and speakers were the followings:

- Current state and limits of the European Register of Infrastructure (RINF)
    - Speaker : Rémy Dayez (EUAR)
- The production, reliability and quality of available data on clearance gauge
    - Speaker : Paul Godard (Infrabel)
- Clearance gauge codification
    - Speaker: Kristof van Londersele (Infrabel)
- Improving tools to publish information
    - Speaker : Alexis Robin, UIC
- Requests for measurement and enhancement of railway clearance gauge
    - Speaker : Alvaro Mascaraque (ADIF)
- Feedback from questionnaires on clearance gauge management
    - Presenter : Laurent Schmitt (UIC)

50 experts representing Infrastructure Managers, railway undertakings, rail freight corridors, professional associations, manufacturers and service providers actively exchanged on the four main topics proposed.

The presentations and complete synthesis of the seminar are given in a specific report.

4.3. Analysis of Network Statements

A systematic review of the Network Statements provided by the European Infrastructure Managers was conducted to identify and highlight the best practices proposed by the IMs, for making the clearance gauge information available for their customers.

38 documents (28 network statements and 10 corridor information documents) were scrutinized to compare the service offered to the customers looking for gauge information.

5. ACQUISITION AND PROCESS OF THE GAUGE DATA

5.1. The measurement of line clearance gauge

5.1.1. As a regular maintenance process

Periodic measurement of the line clearance gauge is for all IMs a regular maintenance process that meets the mandatory mission of guaranteeing the safety of running trains.

The process is generally ruled by internal regulations, and funded on regular maintenance budget.

From the responses of the contributing IMs, the periodicity of periodic gauge measurement is characterized by a very large variability, ranging from every 6 months (Infrabel) to 6 years (SNCF). Trafikverket report that their measurement are currently not depending on any periodicity, but upon needs. They are however targeting a 4 year periodicity.

In most of the cases, the periodicity is reinforced in particular sensitive areas (tunnels, bridges) or when elements infringe the gauge or are likely to, up to an alert level.

The line category appears to be a governing parameter of the measurement frequency for one IM only (ADIF), while this frequency is depending on the type of structure for a majority of IMs, as stated above.

5.1.2. After infrastructure works

Measurement after infrastructure works which are aiming or likely to impact the gauge are systematically carried out by the responding IMs, either to check that the nominal gauge is not infringed (after track levelling, or construction in the vicinity of track, for example) or to control that the targeted gauge improvement has been achieved after infrastructure upgrading works.

5.1.3. Before introducing new rolling stock

Operations of new rolling stock are submitted to the homologation delivered by the national safety authorities.

Although designing a rolling stock that fits into the available gauge is of the responsibility of the manufacturer, the admittance is also submitted by an assessment of compatibility with the infrastructure, carried out by the Infrastructure manager. Two of our respondents mentioned this case, as requesting a specific gauge measurement.

In France, the new Bombardier Regio 2N double deck EMUs introduced in 2014, has shorter articulated vehicles that allows a wider body on curves. The non-driving vehicles are made up of alternate15.445 metre double deck seating coaches and 10.020 single deck coaches that contain the doors, toilets and other facilities. While the longer vehicles are 2.99 metre wide the shorter single deck vehicles are 3.05 metres wide. These meet the loading gauge for the current platform specification, but the platform edges that had not been replaced in the last 20 years were likely to be a few centimetres too wide. With the Alstom Regiolis units a similar problem was relates to the step or palette that comes out when the doors open to improve access for disabled passengers.

Consequently, a complete network measurement has being undertaken and a database of platform dimensions has been completed. About 1300 platforms are to be moved back to gain the missing few centimetres, for an approximate cost of 50 M€ taken in charge by SNCF.

In Spain, ADIF reported the assessment for compatibility of new low wagon, upon the request of COMSA Transport on the TP Ferro and Barcelona Can Tunis line sections, to extend the rail motorway to harbour of Barcelona.

Three particular sites justified physical measurements of the gauge and were carried out in the three tunnels of Rubi, Castellbisbal and Cantunis (illustration 1).

Illustration 1. The three tunnels of Rubi, Castellbisal and Cantunis, on the route to Barcelona harbour.

The cost of the measurement campaign was taken in charge by ADIF, their customer paying for safety measures of their own staff, ensured by ADIF.

5.2. Measurement techniques

All measurement techniques used by the responding partners are laser based. The devices are either vehicle-borne or mounted on trolleys.

Infrabel has one of the most efficient and complementary set of devices, combining two fast-check tools and a two detailed-check devices.

In the mid-90s, tools were developed in-house by SNCB, using laser-profile bars and scanners mounted on trolleys (illustration 2), the use of which was quite time consuming.

Illustration 2. Infrabel mobile laser-profile bar (left) and L-Kopia scanner on trolley (right) (photo Infrabel)

Since 2011, a Riegl scanner is mounted on a EM 130 track geometry recording car (ill. 3), allowing a simultaneous control of track, over-head lines and clearance gauge. The periodicity of measurement is therefore aligned to the 6 month periodicity required for geometry monitoring. The laser scanner is able to take 1001 points at 100 HZ. The 120 km/h running speed of the EM 130 vehicle allows capturing a laser profile every 20 to 30 cm, thus providing a quick view of the situation. A simultaneous video recording makes it possible to compare results with the existing knowledge of the obstacles.

Illustration 3. Riegl laser system mounted on the EM 130 vehicle (Infrabel)

The laser system was bought for about 500 k€. It was then mounted on the EM 130 measurement car by the Infrabel staff, and was therefore not very expensive.

When local anomalies are detected with the on-board laser, or in order to answer a specific question, hand-held systems Amberg GRP 3000 or Amberg GRP 5000) can complete the dataset with detailed local measurements (ill. 4)

The GRP 3000 profiler system is able to measure the obstacle point-by-point in one single cross section.

The GRP 5000 laser scanner system results in a point cloud from scans at min. 100 Hz and 1 000 000 points.

Improvements are planned in the future, especially to enhance the use of video and image recognition systems.

Illustration 4. GPR system with profiler or scanner, relative or absolute (photo Infrabel)

SNCF currently uses two hand-held trolleys equipped with laser scanner, to control the railway gauge.

The Geismar Mephisto (ill. 5) and the ELISE (Engin Léger Informatisé pour la Simulation des Engagements) tool are laser scanners mounted on mono-rail trolleys, allowing a sub-centimetre accurate measurement of the distance to obstacle, with a range of about 30 m, at low speed (1.8 km/h).

Within 3 years, SNCF plans to put into regular service a high output vehicle-borne system running at 80 km/h, based on two Riegl VMX 450 scanners at 400Hz, allowing capturing the gauge at an up to 140 m distance, with a 5 mm accuracy.

Illustration 5. Mephisto trolley (picture Geismar)

MAV

The Hungarian railways entrust their dedicated branch MAV KFV Ltd with the mission of measurement and monitoring of track parameters.

A solution of laser telemeter has been used for nearly two years, that can be mounted on the MAV KFV Ltd owned FMK004 track geometry recording car.[1]

The rotating frequency of the laser source is 100 Hz. At the maximum vehicle speed of 100 km/h, the measured data are served like a spiral with a thread of 278 mm (similar to Infrabel). Therefore only those objects can surely be detected that are wider than this value.

In order to detect narrower obstacles, a speed reduction is necessary in front of them. The information about the required places of speed-reducing is served for the engine-driver by the system automatically. The system deals with the data of the mechanical track geometry system so that the clearance system receives the radius data, which is essential for the calculation of curve supplement, that are necessary at the curves with R≤4000 m radius. [1]

For detailed measurements at walking speed, the same laser telemeter can be easily transferred to a trolley.

Illustration 6. MAV KFV Ltd Laser telemeter mounted on FMK004 track recording car and hand-driven lorry

[1] MAV Central Rail and Track Inspection Ltd website http://www.mavkfv.hu/

MAV KFV Ltd sells and performs several kind of track monitoring service on the neighbouring networks (Slovenia, Croatia, Bosnia and Herzegovina, Greece, etc.) allowing these countries to benefit from performing monitoring technologies.

ADIF

In Spain, is subcontracting gauge measurement and processing to external companies.

After a preliminary analysis of the available gauge information, the selected sections are inspected with laser-scanner technology.

The measurement-equipment is installed on a vehicle specially prepared for this purpose, running at speeds between **10 and 80km/h**, allowing great precision data in the acquisition at the minimum speed and high-performance in both data collection and commuting to different work areas.

With a **frequency of rotation of 300Hz**, a cloud of points is acquired, obtaining a representation of the entire section where the fundamental elements (such as the catenary, rails, cables, hectometers, signaling balises, overpasses, tunnels sections, platforms in stations, etc) can be identified.

This system obtains measurements in high resolution, collecting digital images containing a massive amount of data about the infrastructure environment studied.

In the case of railway lines in operation, where time access to infrastructure is very limited, these inspection systems dynamic are used because they allow the capture of multiple data of the 360 ° of the platform in a single pass.

In potential conflict areas, in-situ tests are performed to check the free-passing of loaded wagons, simulated by a metallic frame mounted behind a rail-road vehicle (Illustration 7).

The vehicle circulates through the conflicting sections, at different speeds so that the viability and safety of the potential freight traffics are checked.

Illustration 7. ADIF clearance gauge frame behind rail-road vehicle

In Portugal (Infraestructuras de Portugal, IP) the periodic measurement of tunnels is executed using laser scan technology to obtaining various information necessary to the control and inspection works. In the case of maintenance and investment works, the control is executed using classic topography and the construction and passage of a model of clearance gauge through this structures.

The inspection system property of IP, which is also able to inspection the catenary geometry, is a laser system installed in one end of IP's main inspection vehicle, and is systematically rotating a laser emission/reception to get the full coverage of the infrastructure. As it's on the move, the laser emission gets an helicoidal shape that is then transferred in to transverse infrastructure profiles, with 25cm constant distance

Newly equipped with this laser inspection system, it is one of IP's intention for the near future to systematically analyze and report all potential anomalies in terms of localized gauge exceedances.

Trafikverket, in Sweden, is also subcontracting the measurements to a specialized company which carries out clearance measurement using on-board laser system. Benchmarking of new measurement methods is planned in the near future.

5.3. Internal data management

In-house developed data management tools are generally the most efficient and used solutions to centralize, handle and share the clearance gauge data internally, with the staff which needs them. These generally simple solutions, based on Excel sheets or in-house database application or event paper prints, ensure the continuity of the process through long periods of times. Moreover, they are adapted to handle and mix data coming from the variety of measurement sources and tools that were used in the past. With a low update frequency, but allowing to implement new data quickly and easily when needed, such more or less sophisticated tools are still in use by most of the IMs. In their diversity, the data management systems generally meet the internal needs of the infrastructure managers and ensure the safety of standard-profile traffic.

But the upcoming on-board laser measurement systems generate a big volume of data which are frequently updated. More powerful data management systems are therefore required.

The example of Infrabel's system appears as a good example of such evolution: all assets are identified in a central database. A part of it, named ORBE, is dedicated to clearance gauge information.

Due to the small size of the Belgian network, all measurements are carried out by Central Services, making the clearance gauge information centralized and immediately available for everyone.

With much more efficient measurement systems, the collected data are processed by a unique software program, making data from different sources compatible and exchangeable in a single database, and allowing good communication with Network Management (ill. 8). Data from all sources are processed to detect all intrusions into the clearance gauge and send alerts to relevant staff. From the central data server, accessible through web-based interface, the clearance gauges can be defined for each line section (ill. 9).

This solution allows good data quality as well as significant cost savings.

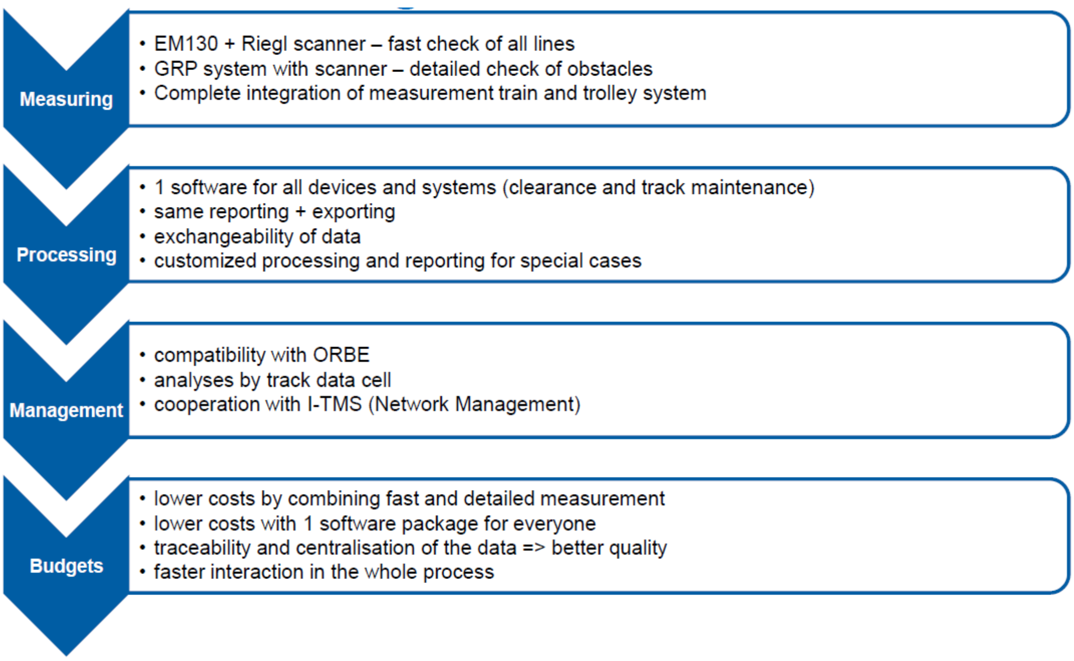


Illustration 8. Infrabel Obstacle Management Tools – Process principles (P. Godard, Infrabel)

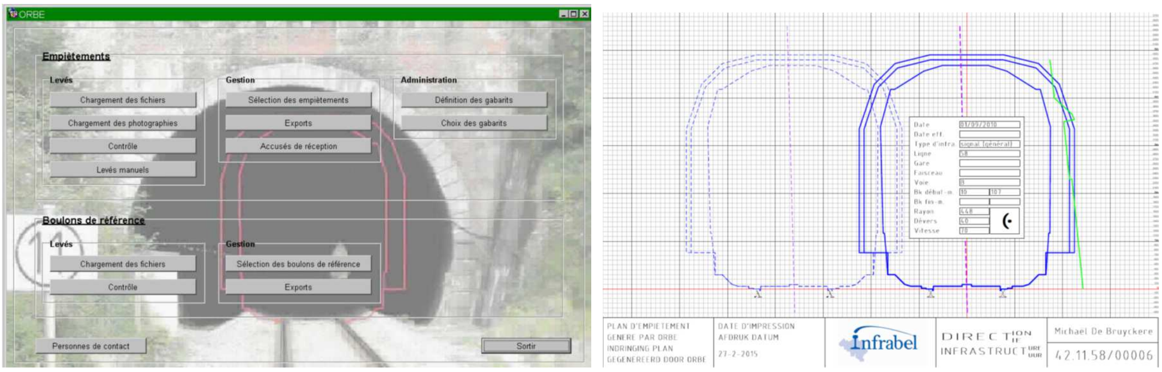


Illustration 9. ORBE management tool : obstacle management screen shot (left) and automatically generated cross section of infringed gauge profile (right) – (P. Godard, Infrabel)

In the near future, Infrabel expects improving the procedure to check the quality of the obstacle database, every time there are available results from the measurement train.

SNCF: Operated by the application BINOD (Base Informatisée Nationale des Obstacles et Débouchés), a centralised database has been put into service from 2014 by SNCF-Réseau for the management at national level of all obstacles clearance reductions. Data are made available to all experts and concerned users in the different local infrastructure establishments of SNCF.

Traffic management depends on the effective update of the database. All IMs report having a satisfactory updating process of their obstacle database, whether the information is transmitted simply by mail or through sophisticated automatic ways. When an obstacle is no reported in the database, it makes it very difficult to use. The reliability of the database is crucial to make it useful.

After infrastructure works, a systematic clearance gauge measurement should be necessary to keep the database updated.

The Romanian railways CFR are expecting to have a dedicated "AVI-Gabarite" application soon developed by their Information System branch.

5.4. Maintenance

Maintenance of the clearance gauge is a crucial condition for the efficiency of the management process and for the reliability of the data.

There exist a variety of situations regarding the existence of alert limit values or intervention limit values systems or procedures when a discrepancy is observed. All respondents but one report applying alert system, based on TSI limits or ruled by specific national regulations. The delay before action depends on the line category, the speed of evolution of the obstacle intrusion and/or its absolute value. Immediate action, being imposed when the obstacle infringe the limit profile, where no intrusion is allowed. When there is no immediate danger for the traffic, the intervention is generally undertaken by the local maintenance staff, at the next maintenance shift (SNCF) and at least within the measurement cycle (Infrabel). MAV reports an average delay of 4 weeks before intervention. Depending on the situation (nature of the problem, speed of evolution) a speed restriction and possibly traffic restrictions can be imposed until the correction is completed.

Works likely to impact the gauge and during which a particular care is to be taken to maintain the gauge are well known, and track aligning, constructions in the vicinity of track, works in tunnels are generally reported by our respondents. Some IMs (Infrabel, SNCF, Trafikverket, ADIF) report having specific documents identifying the concerned work types and providing good practice to manage the gauge issue (SNCF). Contractors can also be particularly sensibilized to the gauge conservation issue through specific documents (Infrabel).

All gauge modifications (temporary reduction and their starting and end dates, restoration or completed enlargement) are reported by the means and in the shortest delays allowed by the gauge data management systems (e.g. directly into the ORBE database system for Infrabel; or the BINOD obstacle database at SNCF). In Portugal, the IP internal Security department informs the railway national authority (IMT) which issues instructions to the railway operators.

In Hungary, temporary gauge limitations due to infrastructure works have to be notified in advance by the contractor in charge of the works. The infrastructure manager then decides on the restriction (in speed or in traffic).

5.5. Conclusion

The emergence of laser telemetry technology, combined with the capabilities of numerical processing of data offers efficient solutions for high-output clearance monitoring techniques on board railway vehicles. Most of the infrastructure managers already acquired, are in their way to acquire such technology, or can at least benefit from it. Accurate but hand-held trolley systems, developed earlier (from the mid 90s), are still co-existing and are an efficient ways to answer specific local needs.

With these techniques a cloud of points is acquired, obtaining a representation of the entire section where the fundamental elements (such as the catenary, rails, cables, hectometers, signaling beacons, overpasses, tunnels sections, platforms in stations, etc) can be identified.

Accuracy of clearance gauge measurement remains costly and capacity-consuming. High-output measurement techniques used for regular measurements are generally less accurate than local on-demand measurements.

Indeed, with a 27 cm space resolution (for a 100 Hz laser rotating speed, running at 100 km/h), on-board monitoring is of limited accuracy that needs to be compensated by higher measurement train running frequency, to statistically improve the detection of smaller obstacles. The solution proposed by MAV KFV ltd to automatically adjust the running speed depending on the area is a response to this issue, but with direct impact on the capacity consumption. Moreover, this solution is no longer suitable when the measuring device is mounted on revenue trains or on some multi-purpose measurement trains.

Low cost solutions on-board service trains could be a choice, and such tools exist. But the cost is not only that of measurement train, but also of software development allowing to use the data. This development and integration into the global maintenance routine and system (if any) can take a very long time and the requirement is very high. According to our seminar attendees, alternative to low-cost tools to measure quickly could be to organize the project step-by-step and divide the project into different steps, starting with less accurate solution, then improving the system.

It is agreed that technical improvements still have to be made however to bring the quality of on-board measurements at the level offered by trolley-type devices.

Although generally ruled by internal directives, the frequency of the clearance gauge monitoring is subject to high variability. The cost of manual measurement (in terms of capacity consumption) makes this technique mostly used for specific needs and for specific locations. For high output on-board techniques, the frequency is often aligned with the other missions of the carrying vehicle (e.g. track geometry recording in Belgium and in Romania) or with other simultaneously measured parameters (e.g. over-head line control cycles in Portugal). In the first case, this generates a extremely big volume of data to be handled, requesting a high performance data processing chain.

The balance between regular less accurate fast measurements and local on-demand measurement, is for a large part a question of cost.

It also depends on the two dominant cultures regarding clearance gauge:

- Culture by exception, where the gauge is the definition of a limit, but one has to make studies by exception
- Management by nominal gauge, where no exception is possible and where work on the infrastructure is needed when the nominal gauge is not respected.

Ensuring reliability

The publication of the data engages the responsibility of the IM who publishes it. A question is raised about how much the IM should do to ensure the quality of the data, which partly depends on the nature and openness of the market they are dealing with.

A common approach or even a harmonization of the measurement systems between IMs would be a possible answer to the need for wider accessibility to the data.

To guarantee the quality of data, the question of external certification or control of the measured data is still open. The recourse to external entities to measure and manage the data could be part of a solution. Although some experts claim that it could face cultural resistance, subcontracting of the measurement process is already a reality for several infrastructure managers.

The reliability of gauge data mainly depends on

- The accuracy and efficiency of measurement tools. High speed on-board devices now allow to assess the gauge along complete routes, potentially revealing unlisted obstacles or areas where the clearance gauge is to be regularly assessed. The lower resolution of these high output measurements need to be completed by hand-held methods or compensated by higher monitoring frequencies.
- A rigorous management of the clearance gauge during infrastructure maintenance operations, in order to guarantee the preservation of the clearance or its controlled modification.
- A permanently updated gauge and obstacle database: immediate reporting of any obstacle or gauge change is crucial, as one missing obstacle might jeopardize the usability of the whole database. To ensure reliability, the data management system must be simple and of high quality.

6. PROVIDING INFORMATION TO CUSTOMERS: THE NETWORK STATEMENTS

Planned by the provisions of the directive 2012/34/UE of the European Parliament and of the Council of 21 November 2012 establishing the single European railway area, Network Statements (NS) are mandatory documents published by each Infrastructure Manager that describe the practical, technical, administrative and price conditions and arrangements for a fair and non-discriminatory access to the railway network. It particularly give the useful contacts, describe the access conditions, describe the infrastructure, explain the process of capacity allocation for train paths and maintenance works, presents the provided services and their price.

In addition, and in a similar way, the Rail Freight Corridors publish the Corridor Information Documents (CID) which make direct references to each network statements of the IM managing the Corridor. See point 6.3.

The "Network Statement Common Structure" describing the basic content and structure of all documents states that information about "gauge" (including track gauge, loading gauges and access conditions referred to Exceptional Transports) should be stated in the Network Statement.

This point document analyses how the clearance gauge information is presented on the Network Statements by the different Infrastructure Managers (and Rail Freight Corridors).

For the present assessment:

- 28 NS from different IMs and 10 CIDs have been studied.
- Additionally, an extensive collection of experiences on gauge information systems has been gathered through the open seminar (Seminar on measuring and enhancing railway clearance gauge; September 2015), the questionnaires sent to the different IMs and RUs and the complementary interviews with relevant stakeholders.
- From the knowledge received, **the information and facilities (concerning "gauge") provided by 8 IMs and 3 Corridors** (from the 28 + 10 previously analyzed) **have been scrutinized.** These experiences are the real core of the study conducted.

The completeness of the clearance gauge information given in the Network Statements has been analyzed and also the **relation between Network Statements and Register of Infrastructure.**

The main objectives of this analysis have been:

- To quote and highlight the good practices found in the way of presenting the clearance-gauge information in the Network Statements studied (and other associated documents).
- To establish the recommendations on how information on clearance-gauge must be made available to the RUs and the potential clients/users of the Infrastructure.

6.1. The Network Statement Common Structure

The legal framework that regulates the publication of infrastructure data includes:

- Council Regulation (EC) No 2236/95 of 18 September 1995 creating TEN-T
- Decision No 1692/96/EC on Community guidelines for the development of the trans-European transport network.
- Directive 2001/14/EC of 26 February 2001 on the allocation of railway infrastructure capacity and the levying of charges for the use of railway infrastructure defined in Article 3 the requirements for the publication of the Network Statement.
- Directive 2012/34/EU of 21 November 2012 establishing a single European Railway Area reviewed the Network Statement requisites.

- Decisions n°2011/633 and 2014/880 for the creation and implementation of RINF.

European Directive 2012/34 describes the obligation for each rail Infrastructure Manager to publish a Network Statement. These NSs present information on rail networks, in particular on commercial and legal access conditions. They aim to provide all Applicants wishing to operate services on a given rail network with a single source of up-to-date, relevant information on a fair and non-discriminatory basis.

This legal framework has been supplemented by initiative taken at UIC or other international bodies:

- EurailDataMap GIS, initiated by UIC in 1998.
- RailNetEurope, setup in 2004.
- The UIC project European Rail Infrastructure Masterplan (ERIM).

RailNetEurope (RNE) is an association set up on the initiative of a number of European Rail Infrastructure Managers and Allocation Bodies created to *"facilitate the International Rail Traffic on the European Rail Infrastructure".* At present, 35 active members compose the association.

6.1.1. Objectives and Implementation

Among other tasks, RailNetEurope has promoted the harmonisation and publication of user-friendly, customer-oriented Network Statements designed to enable the RUs to easily find the information needed. In fact, the Network Statement WG was established in 2001 under the UIC umbrella and was fully transferred to RNE in 2004. The main scope of this WG has been the development of the Network Statement specification and making all efforts to *guarantee its implementation on national level.*

To this end, the Members of RailNetEurope have agreed a common structure and an implementation guide for drafting Network Statements in accordance with Article 27 of Directive 2012/34/EU.

The Network Statement Common Structure (CS) developed by the Network Statement WG offers guidelines for the expected content, organization and other information useful for the production of the NS.

The CS aims at facilitating the production process of the NS and also to allow the adoption of a common structure throughout Europe that leads to comparable and structured information.

The RNE Corridor Information Document (CID), developed by the Rail Freight Corridors should replicate the structure of the NS, making direct references to each national NS involved in the Corridor. See point 6.3.

6.1.2. General requirements about Network Statements

Directive 2012/34/EU of the European Parliament and of the Council of 21 November and the Network Statement Common Structure document[2] of RailNetEurope (RNE) specify the Network Statement Requisites in terms of minimum content and format:

[2] Network Statement Common Structure, RailNetEurope, 10 March 2015

- the Network Statements shall be published in at least two official languages of the European Union in order to favor free competition and access to information of the possible clients/RUs.
- It is recommended that the Network Statements and its annexes are updated and made available in various languages. It is strongly recommended that at least one of these language shall be English.
- The Network Statements should be made available free of charge in electronic format on the web portal of the infrastructure manager or, in any case, should be easily available.
- Complementary contents to the Network Statements should be identified in the main document, specifying how to reach them and the department or contact person responsible of the content. It is recommended that these additional content are easily accessible and are updated.

6.1.3. Clearance Gauge and related information requested by the NS Common Structure

In the Network Statement Common Structure document, RailNetEurope (RNE) specifies the minimum content and format of the NS documents.

Indications about information to be provided on clearance gauge, loading gauge, exceptional transport process and other related issues are given in the different chapters of the document.

In particular, the following specifications can be highlighted:

Exceptional Transports

The IM are requested to specify whether they use or not the UIC definition of "Exceptional Transports" given in UIC leaflet 502 Annex 1. They should state which body is in charge of the rules for exceptional transports and give their contact names and address (Chapter 2 – Access conditions).

When requesting for capacity allocation (chapter 4**),** the Network Statements should specifies whether the RU needs to notify the IM (or any other body) about its Exceptional transport or Dangerous Goods when applying for train paths, and any deadlines that need to be met.

Infrastructure Data and Infrastructure Register

The IMs are invited to provide available documents including **detailed infrastructure data** and give contact details for further information.

All the information is provided by the individual IM according to availability and relevance of the data.

Where "relevant", maps or lists should be produced, or reference should be made to documents containing the required information, ideally by means of GIS allowing the customers to quickly access infrastructure information on the specific line.

The NS shall also contain information setting out the conditions for access to service facilities connected to the network. Besides, the IM should state how the information on the Network Statement is consistent with the rail infrastructure register, including how the register can be accessed.

When describing the infrastructure (Chapter 3), it is requested that the Network Statements shall

- Indicate the loading gauge applicable to each route section.
- Refer to UIC leaflet 506 or to Combined Traffic Codes, and
- Refer to UIC leaflet 502, namely indicating where the 'Directory of routes of the permissible profile numbers' can be found.

6.2. *Assessment of the clearance gauge information in the Network Statements*

6.2.1. First approach. General Overview

28 Network Statements (NS) from different IMs and 10 Corridor Information Documents (CID) have been studied. In the table below are shown the main characteristics of the information related to "clearance gauge" found in the scrutinized documentation.

To complete the information, UIC has also conducted complementary interviews with relevant stakeholders and taking an in-depth look **a**t a selected number of Network Statements (published by 8 IMs and 3 Corridor), in order to:

- Analyze the transparency and accessibility to published information relative to infrastructure data and, in particular, clearance gauge information.
- Study the completeness of the Network Statements (Corridor Information and Documents) detecting gaps and requirements defined in the Network Statement CS that need better definition.
- Indicate the cases of good practices in publishing railway gauge information.
- Establishing the conclusions / recommendations for publishing railway clearance gauge data on a transparent and accessible method to RU.

These selected networks were :

- ÖBB (Austria)
- Infrabel (Belgium)
- SNCF Réseau (France)
- DB Netz (Germany)
- RFI (Italy)
- PKP (Poland)
- ADIF (Spain)
- ADIF Alta Velocidad (Spain)
- TP-Ferro (France / Spain)
- Rhine Alpine Rail Freight Corridor (RFC 1)
- Mediterranean Rail Freight Corridor (RFC 6)
- The Orient/East-Med Rail Freight Corridor (RFC 7)

A first overview of the 38 documents shows that:

- Clearance gauge data are generally provided as annexes in local languages.
- 21% do not follow UIC 506 standard for interoperable gauge.
- 21% present data for combined transport.
- About 50% do not provide any clearance gauge map.
- 7 IMs offer GIS access to infrastructure data.

	Country	Infrastructure Manager	1st EU official language	2nd language	Available maps?	Identification of the line?	Characteristics of the line?	Type of clearance gauge?
1	AUSTRIA	OBB	german	english	yes	yes	yes	UIC standard + national clearance gauge
2	AUSTRIA/HUNGARY	GYSEV	english		no	yes	yes	UIC standard
3	BELGIUM	INFRABEL	french-dutch-german	english	yes	yes	yes	UIC standard (page 35) + map of the combined transport
4	BULGARIA	NRIC	bulgarian	english	yes	no	no	-
5	CROATIA	HZ INFRASTRUCTURA	croatian	english	yes, for combined transport but no for clearance gauge	yes	yes	UIC standard
6	CZECH REPUBLIC	SZDC	czech	english	yes but none for the clearance gauge	yes	yes	UIC standard + national clearance gauge
7	DENMARK	BANEDANMARK	danish	english	yes but none for the clearance gauge	yes	yes	UIC standard + national clearance gauge
8	FRANCE	SNCF RESEAU	french	english	yes	yes	no	UIC standard
9	GERMANY	DB NETZ	german	english	yes, DB application, register of infrastructure	yes, DB application, register of infrastructure	yes, DB application, register of infrastructure	UIC standard + combined transport
10	HUNGARY	VPE	hungarian	english	no	yes	yes	UIC standard + national clearance gauge
11	ITALY	RFI	italian	english	yes but none for the clearance gauge	yes	yes	combined transport none for the clearance gauge
12	LUX	CFL	french	english	yes	yes	yes	UIC standard + combined transport
13	NETHERLANDS	PRORAIL	dutch	english	yes	no	yes, IT system	UIC standard + national clearance gauge
14		KEYRAIL	dutch		no	no	no	
15	NORWAY	JERNBANEVERKET	norwegian	english	yes	no	yes	UIC standard + national clearance gauge
16	POLAND	PKP	polish	english	no	yes	yes	-
17	PORTUGAL	IP INFRAESTRUTURAS DE PORTUGAL	portuguese	english	yes	yes	yes	UIC standard + national clearance gauge
18	ROMANIA	CFR	romanian	english	yes but none for the clearance gauge	no	no	UIC standard + national clearance gauge
19	SLOVAKIA	ZSR	slovakian	english	yes but none for the clearance gauge	yes	yes	UIC standard + national clearance gauge
20	SLOVENIA	SLOVENSKE ZELEZNICE	slovenian	english	yes, for combined transport but no for clearance gauge	yes	yes	UIC standard + combined transport
21		AZP	slovenian	english	yes, for combined transport but no for clearance gauge	yes	yes	UIC standard + combined transport
22	SPAIN	ADIF	spanish	english	yes but none for the clearance gauge	yes	yes	UIC standard + national clearance gauge
23	SPAIN/FRANCE	TP FERRO	french-spanish-english	french-spanish-english	yes	no	no	UIC standard + TSI 2002/735/CE
24	SWEDEN	TRAFIKVERKET	swedish	english	yes	no	yes	UIC standard
25	SWITZERLAND	BLS	german	english	yes	no	yes	UIC standard + combined transport
26		TRASSE.CH	german		yes	no	yes	-
27		SBB CFF FFS	german-french-italian	english	yes but none for the clearance gauge	no	yes	UIC standard + national clearance gauge
28	UK	NETWORK RAIL	english	french	yes, NESA application	yes, NESA application	yes, NESA application	UK classification
C1		FREIGHT CORRIDOR 1 (RHINE-ALPINE)	english		yes	no	yes	UIC standard
C2		FREIGHT CORRIDOR 2 (NORTH SEA-MEDITERRANEAN)	english	french	yes	no	no	following the Corridor Member's Network statement
C3		FREIGHT CORRIDOR 3 (SCANMED)	english	danish	yes	no	no	following the Corridor Member's Network statement
C4		FREIGHT CORRIDOR 4 (ATLANTIC)	portuguese-spanish-french	english	yes	no	yes	following the Corridor Member's Network statement
C5		FREIGHT CORRIDOR 5 (BALTIC-ADRIATIC)	english		yes	no	yes	following the Corridor Member's Network statement
C6		FREIGHT CORRIDOR 6 (MEDITERRANEAN)	english		yes	no	no	following the Corridor Member's Network statement
C7		FREIGHT CORRIDOR 7 (ORIENT)	english		yes	no	yes	UIC standard
C8		FREIGHT CORRIDOR 8 (NORTH SEA BALTIC)	english		yes	no	no	-
C9		FREIGHT CORRIDOR 9 (CZECH-SLOVAK)	english	czech	yes but none for the clearance gauge	no	yes	-

6.2.2. User friendliness of the network statements

In general, the NS sections are easily reachable from the main page of the IMs websites. But, this situation can differ from one IM to another.

Normally, network statements are updated in their "national" version, in the official language of each IM. All documents analyzed are also available in English, but these English versions are not systematically updated.

In several cases, the annexes to the NS, where the information concerning clearance gauge are published, are only available in the local language, which makes their content incomprehensible to a non-native speaker.

Moreover, the Network Statement can refer to other applications, databases, procedures… starting a spiral of successive stages to find the desired information.

Once arrived to the correct step, the access to information (applications, information systems) may require a user registration.

Sometimes this information is only available in the local language, but not in English.

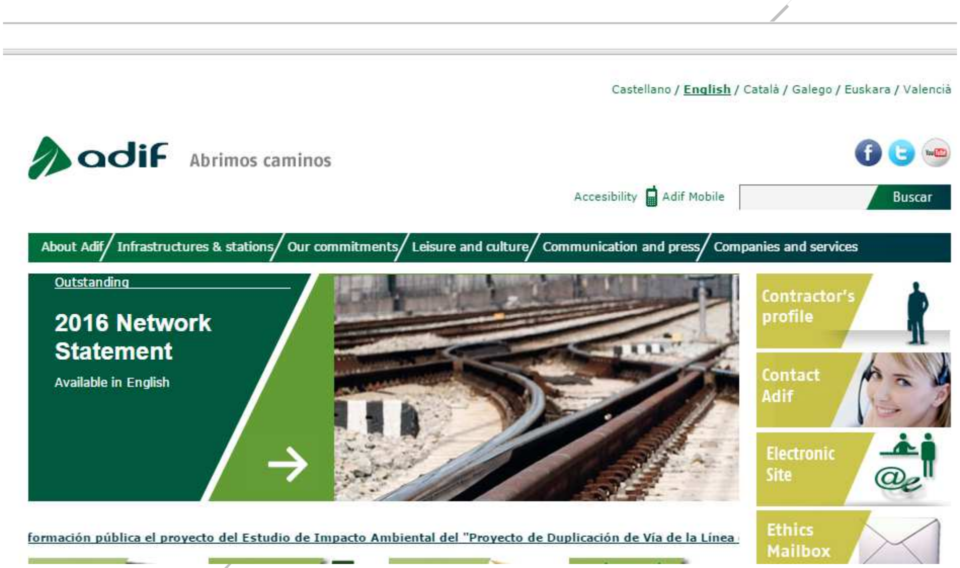


Illustration 10. ADIF Network Statement accessible from the main website

Illustration 11. Although RFI Network Statement is available in Italian and English, the technical annexes, provided as an efficient multi-layer GIS, in only available upon registration on a private area.

Illustration 12. Despite a presentation in English, PKP PLK documents on infrastructure parameters are in Polish only.

6.2.3. Clearance/loading gauge information; Good practices

As mentioned earlier, it is recommended that the Network Statements indicates the loading gauge applicable to each route section referring to the UIC leaflets, EN standard or any other normative document applicable (from Network Statements Common Structure).

Practice in this area is quite diverse from one IM to another. Some NS diffusely express the information relative to "loading gauge", referring to national legislation or internal procedures, the access of which or contact to obtain them is not indicated. Others do not include references to UIC leaflets, EN standard or any other normative applicable document. At last, it is sometimes very difficult or impossible to find the roster of loading gauge applicable to each section referring to UIC codes (or any other normative document applicable).

In the following section, examples of good practices found in the different NS analyzed are listed.

6.2.3.1.SNCF Réseau (France)

http://www.sncf-reseau.fr/en/national-rail-network-statement

The network statement refers to the types of structure gauge, for both passenger and freight traffic, linking each gauge with the UIC leaflet associated and identifying the characteristics of each profile.

The document also refers to the series of standards EN 15273.

The Network Statement is also complemented with complete graphical information, annexed to the main document, such as:

- 6.1 - Maximum clearance gauges by sections of lines on the national rail network and by type of activity (for freights and for passengers).
- 6.9 - Network accessible to exceptional Consignments
- 6.10. - Lines accessible to passengers transport and lines reserved for freight transport
- 6.11 - Consignments With Network accessible to contour M and maximum permissible load D4

Other complementary information:

- 6.10. Lines accessible to passengers transport and lines reserved for freight transport
- 6.14. Map of European freight corridors passing through France

Some of these documents are available as annexes to the main document.

3.3.2.1. Loading gauge

Trains operated by railway undertakings must comply with the most restrictive gauge of all the lines on which they run, according to the maximum loading gauge defined as:

- the clearance gauge indicated for each specific route, in relation to the various installations encountered on the way (civil engineering structures, platform shelters, signals, etc.);
- the limit not to be fouled by the maximum loading gauge of vehicles standing or moving on adjacent tracks.

When the vehicle gauge of the train exceeds the limits defined above on one section of its route, it has to be operated as an exceptional consignment only acceptable on the national rail network subject to the provisions stated in **§ 4.7** and on network lines accessible for this purpose (**Appendix 6.9**):

There are also exceptional consignments:

- exceptionally large and bulky JUMBO consignments which must be subject to a case-by-case analysis. The required studies are invoiced under the conditions defined in Chapter 6.
- trains in envelope M and with the maximum permissible load D4 (**Appendix 6.11**).

Each gauge is classified on the basis of a cinematic reference contour and, after application of the associated rules, in compliance with the provisions of **UIC Leaflets 505-4 and 506**.

The International Union of Railways (UIC) has classified structure gauges, ranking them as in the following tables:

- **For freight traffic**

Gauge	UIC Leaflet	Characteristic
G1	505-4	Minimum guaranteed on lines with standard European track gauge
GA	506	Reference gauge of the national rail network
GB	506	Exists on several main trunk routes on the national rail network
GB1	506	Transport services for high cube containers
GC	506	High speed lines

- **For passenger traffic**

Gauge	UIC Leaflet	Characteristic
G1	505-4	Minimum guaranteed on lines with standard European track gauge
FR3.3		For running certain types of double-decker passenger rolling stock
G2	505-1	Certain cross-border traffic (Germany, Switzerland, Luxembourg)

These gauges are also described in European standard EN 15 273.

For combined freight traffic, the gauge of the wagon/intermodal transport unit combination is obtained from the indications marked via a system of codes, themselves obtained by combining the overall dimensions of the wagon and its ITU thereby establishing the gauge requirement.

Generally speaking, the reference gauge of the national rail network is GA.

The maps in **Appendix 6.1** indicate the maximum clearance gauges by sections of lines on the national rail network and by type of activity (page 1 for freight and page 2 for passenger).

Illustration 13. Example from SNCF Réseau Network Statement. References to UIC leaflets and EN standards applicable.

6.2.3.2.DB NETZ AG (Germany)

Network Statement

http://fahrweg.dbnetze.com/fahrweg-en/network_access/network_statement/

Infrastructure Register

http://fahrweg.dbnetze.com/fahrweg-en/network_access/infrastructure_register/

Infrastructure Register – Interactive Map

http://fahrweg.dbnetze.com/fahrweg-en/network_access/infrastructure_register/map.html

It is a representative example of how the NS contains the information strictly necessary, according to the Network Statement Common Structure and how each chapter or section, if necessary, refers to the link or document where the additional information is available.

In the case of DB, there is a close **correlation between the Network Statement and the Register of Infrastructure** RINF.

The register of infrastructure published by DB Netz AG contains the characteristics of all relevant routes for all subsystems with fixed installations. DB Netz AG Network is illustrated in cartographic representations based on defined infrastructure features.

In the **Register of Infrastructure – Interactive Map,** DB Netz AG provides detailed information about the route characteristics named in the Network Statement.

The RINF is being continuously updated and the data can be consulted in the interactive map.

In the case of gauge, data for both clearance and loading gauges are available in the register and can be visualize in the map for any section of line.

The Infrastructure gauges are set out on the basis of kinematic reference profiles GC, GB and GA or national profiles G1 and G2. The interactive map shows the minimum infrastructure gauge for the corresponding route section.

For each route section of the network, detailed information are given, including infrastructure codification and P/C codification. If the information is not available, the data can be known "upon request".

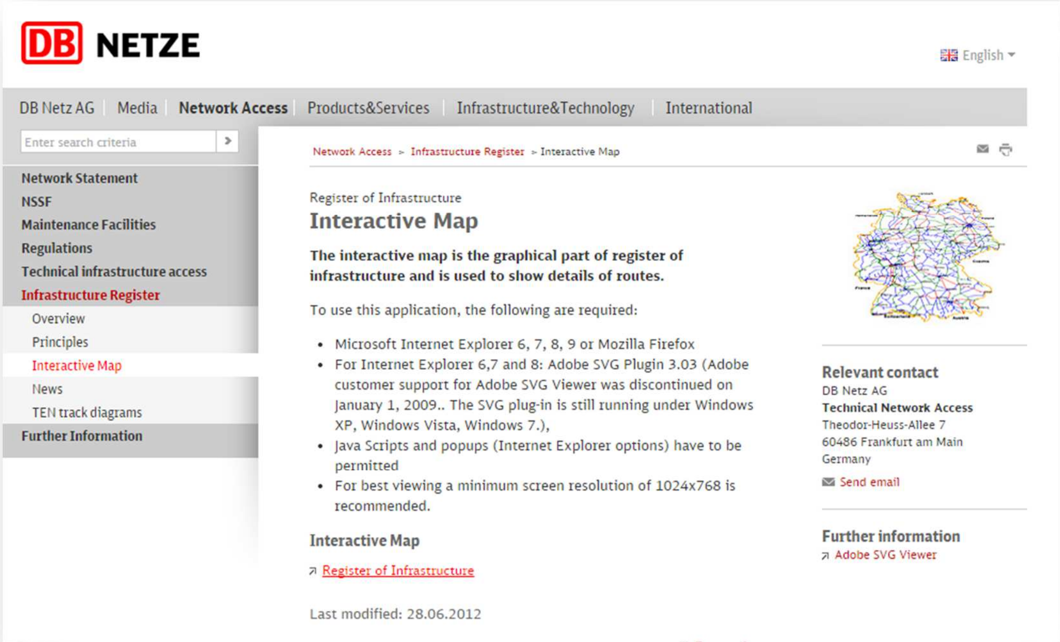


Illustration 14. DB Network Statement. Access to the Register Of Infrastructure - Interactive Map.

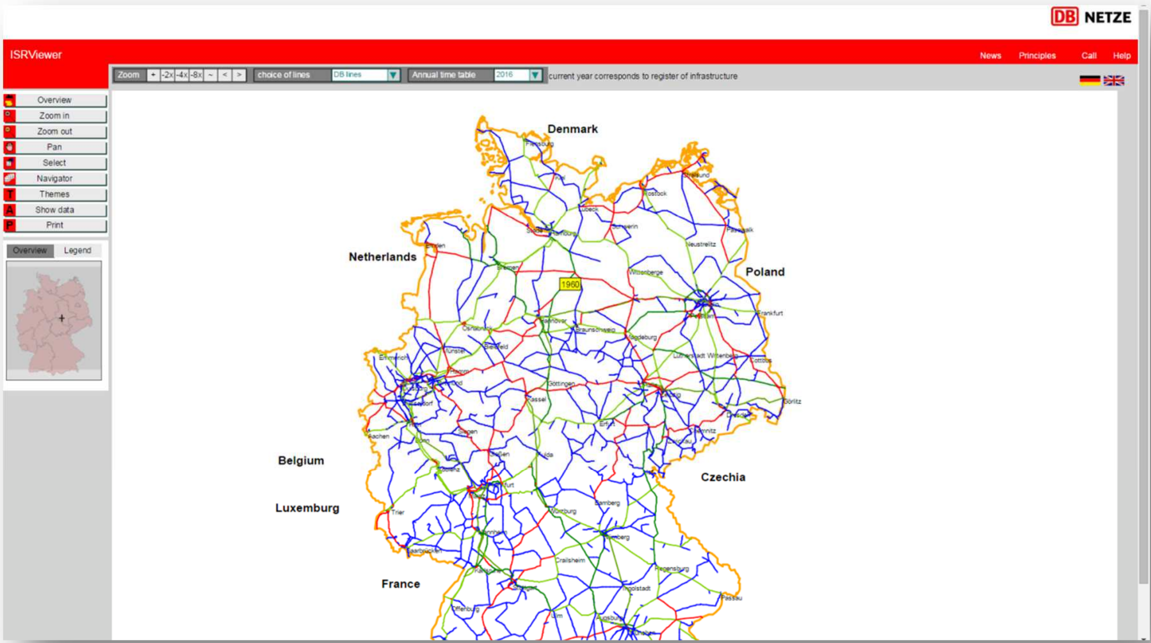


Illustration 15. DB Register Of Infrastructure - Interactive Map. Overview.

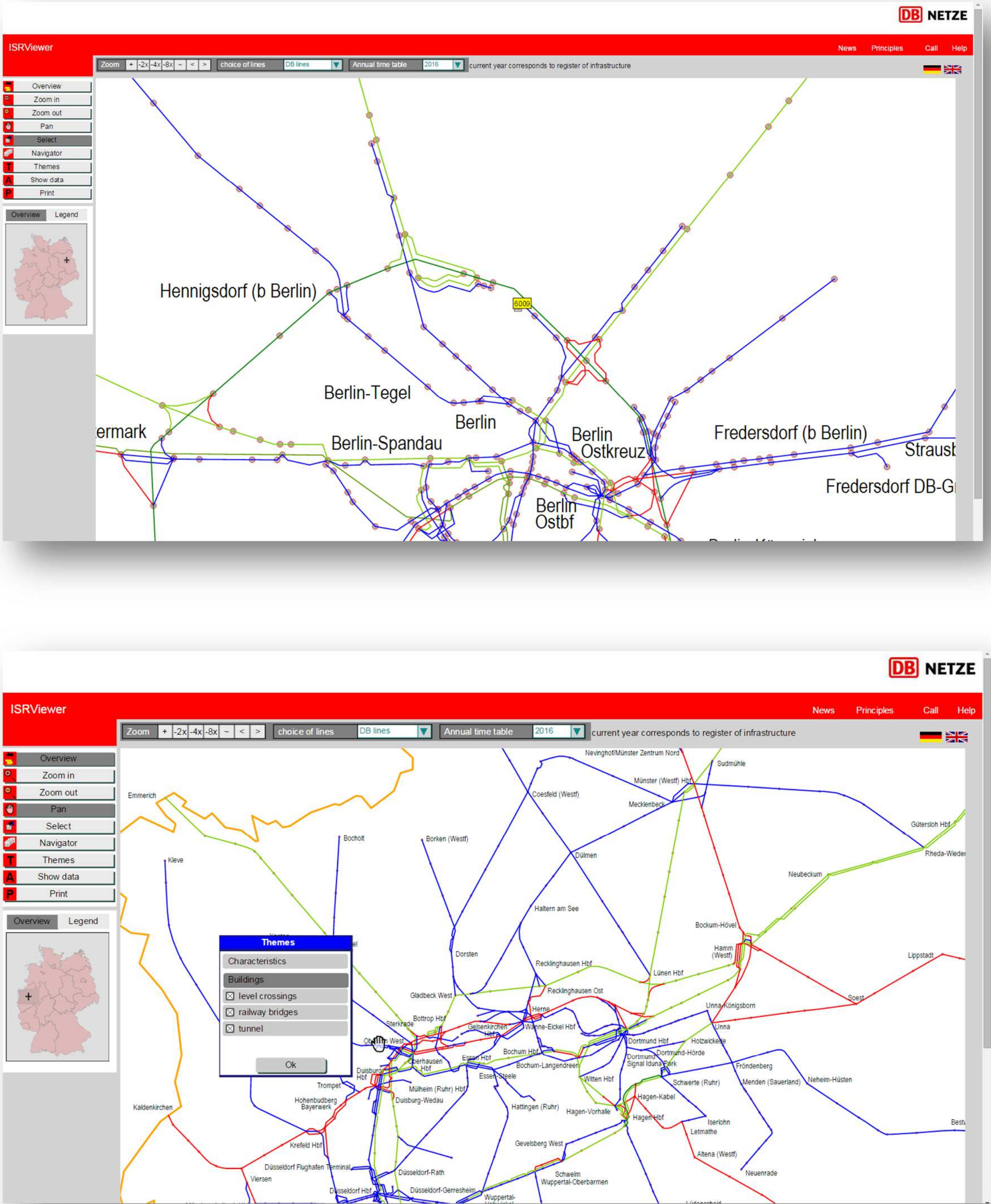
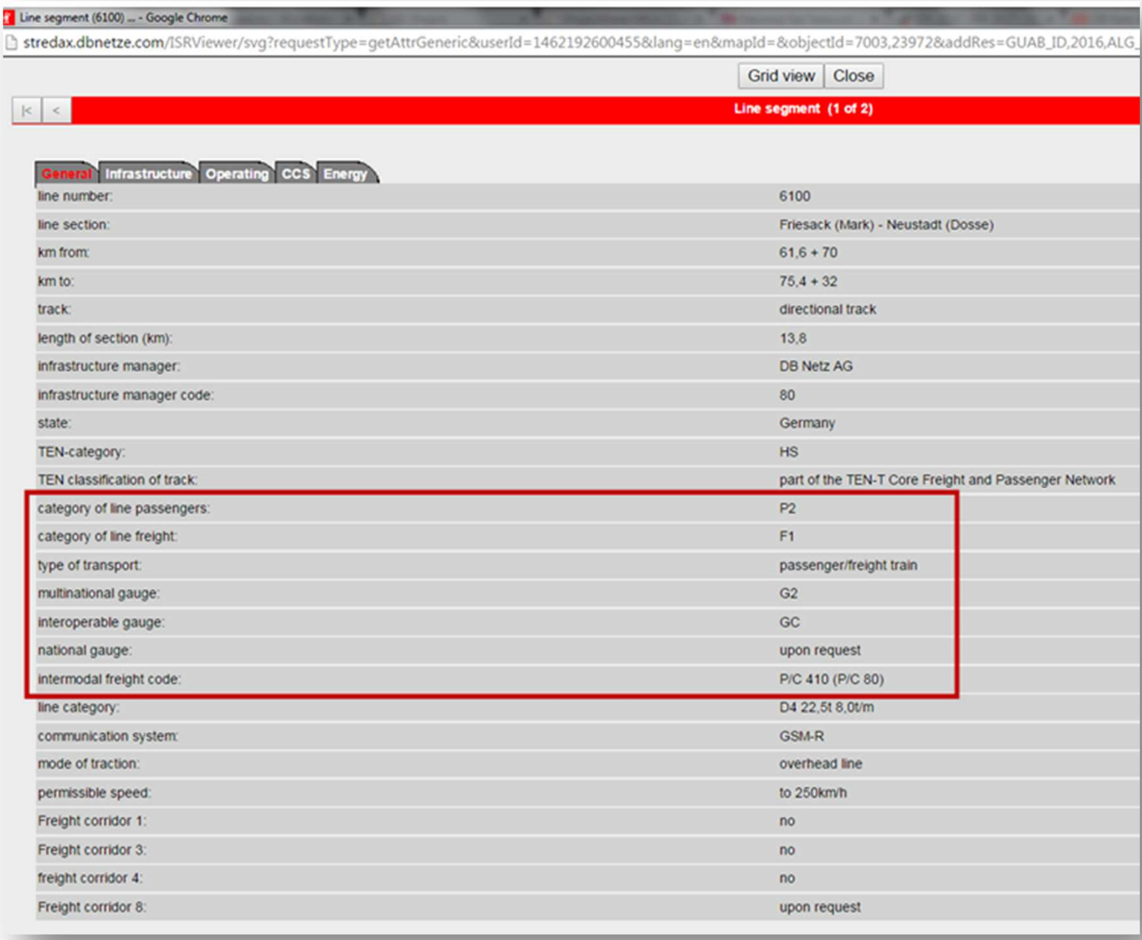


Illustration 16. DB Register of Infrastructure - Interactive Map. GIS-based. Practical, friendly and easy to use



line number:	6100
line section:	Friesack (Mark) - Neustadt (Dosse)
km from:	61,6 + 70
km to:	75,4 + 32
track:	directional track
length of section (km):	13,8
infrastructure manager:	DB Netz AG
infrastructure manager code:	80
state:	Germany
TEN-category:	HS
TEN classification of track:	part of the TEN-T Core Freight and Passenger Network
category of line passengers:	P2
category of line freight:	F1
type of transport:	passenger/freight train
multinational gauge:	G2
interoperable gauge:	GC
national gauge:	upon request
intermodal freight code:	P/C 410 (P/C 80)
line category:	D4 22,5t 8,0t/m
communication system:	GSM-R
mode of traction:	overhead line
permissible speed:	to 250km/h
Freight corridor 1:	no
Freight corridor 3:	no
freight corridor 4:	no
Freight corridor 8:	upon request

Illustration 17. DB Register of Infrastructure - Interactive Map. Infrastructure Data.

For each section in the Network, detailed information is given, including:

- Category of the line (passenger and/or freight) and type of transport.
- Multinational Gauge codification
- Interoperable Gauge Codification, Infrastructure codification.
- Intermodal Freight Code, P/C codification.

If the information is not available, the data can be known "upon request".

6.2.3.3.OBB (Austria)

Network Statement

http://www.oebb.at/infrastruktur/en/_p_Network_Access/NetworkStatement/index.jsp

Profile Catalogue

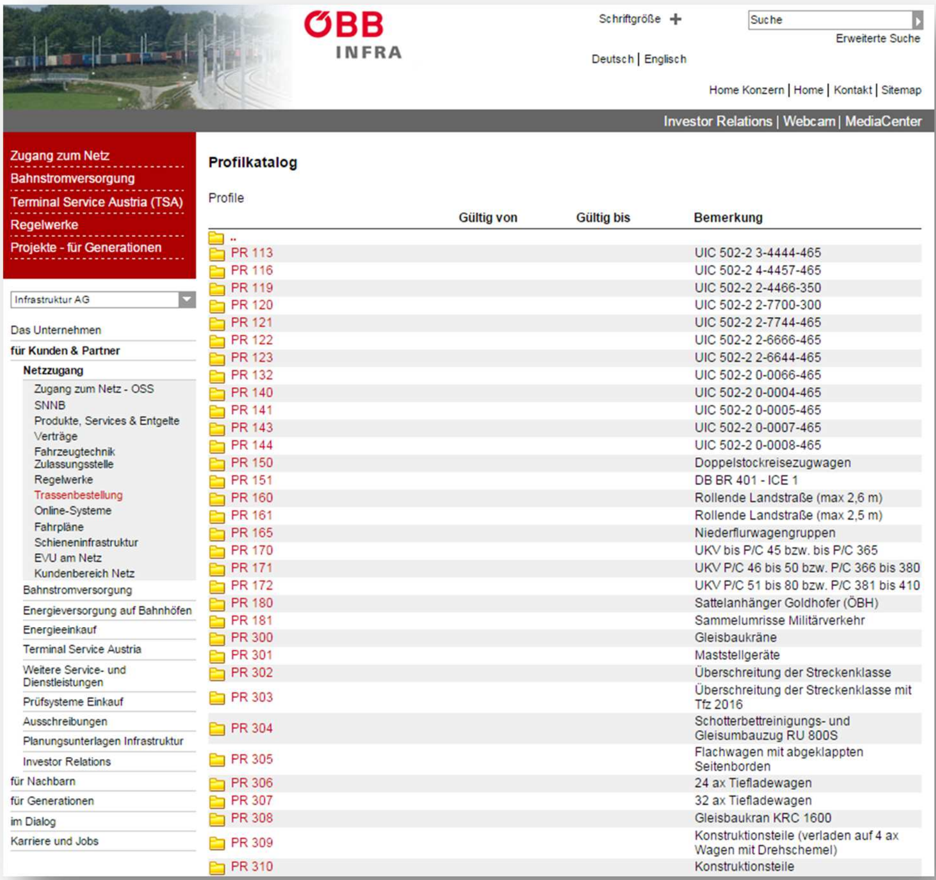
http://www.oebb.at/infrastruktur/de/_p_3_0_fuer_Kunden_Partner/3_2_Schienennutzung/3_2_8_Trassenbestellung/Aussergewoehnliche_Sendungen/02_DMS_Dateien/_Profilkatalog.jsp

ÖBB Profile Catalogue "Profilkatalog"

Austria has been pioneer in the implementation of the "Profile Catalogue", currently further developed and extended by the UIC 502-2 working group, led by Rail Cargo Austria.

ÖBB Network Statement provides the "Profile Catalogue" in force for the Austrian network, allowing any RU or potential client to know the compatibility between a line and a gauge profile allowed.

The Network Statement openly provides a number of gauge profiles, accessible to any RU able to check on which line which profile is allowed.



Profile	Gültig von	Gültig bis	Bemerkung
..			
PR 113			UIC 502-2 3-4444-465
PR 116			UIC 502-2 4-4457-465
PR 119			UIC 502-2 2-4466-350
PR 120			UIC 502-2 2-7700-300
PR 121			UIC 502-2 2-7744-465
PR 122			UIC 502-2 2-6666-465
PR 123			UIC 502-2 2-6644-465
PR 132			UIC 502-2 0-0066-465
PR 140			UIC 502-2 0-0004-465
PR 141			UIC 502-2 0-0005-465
PR 143			UIC 502-2 0-0007-465
PR 144			UIC 502-2 0-0008-465
PR 150			Doppelstockreisezugwagen
PR 151			DB BR 401 - ICE 1
PR 160			Rollende Landstraße (max 2,6 m)
PR 161			Rollende Landstraße (max 2,5 m)
PR 165			Niederflurwagengruppen
PR 170			UKV bis P/C 45 bzw. bis P/C 365
PR 171			UKV P/C 46 bis 50 bzw. P/C 366 bis 380
PR 172			UKV P/C 51 bis 80 bzw. P/C 381 bis 410
PR 180			Sattelanhänger Goldhofer (ÖBH)
PR 181			Sammelumrisse Militärverkehr
PR 300			Gleisbaukräne
PR 301			Maststellgeräte
PR 302			Überschreitung der Streckenklasse
PR 303			Überschreitung der Streckenklasse mit Tfz 2016
PR 304			Schotterbettreinigungs- und Gleisumbauzug RU 800S
PR 305			Flachwagen mit abgeklappten Seitenborden
PR 306			24 ax Tiefladewagen
PR 307			32 ax Tiefladewagen
PR 308			Gleisbaukran KRC 1600
PR 309			Konstruktionsteile (verladen auf 4 ax Wagen mit Drehschemel)
PR 310			Konstruktionsteile

Illustration 18. OBB-Network Statement. Access to the profile catalogue.

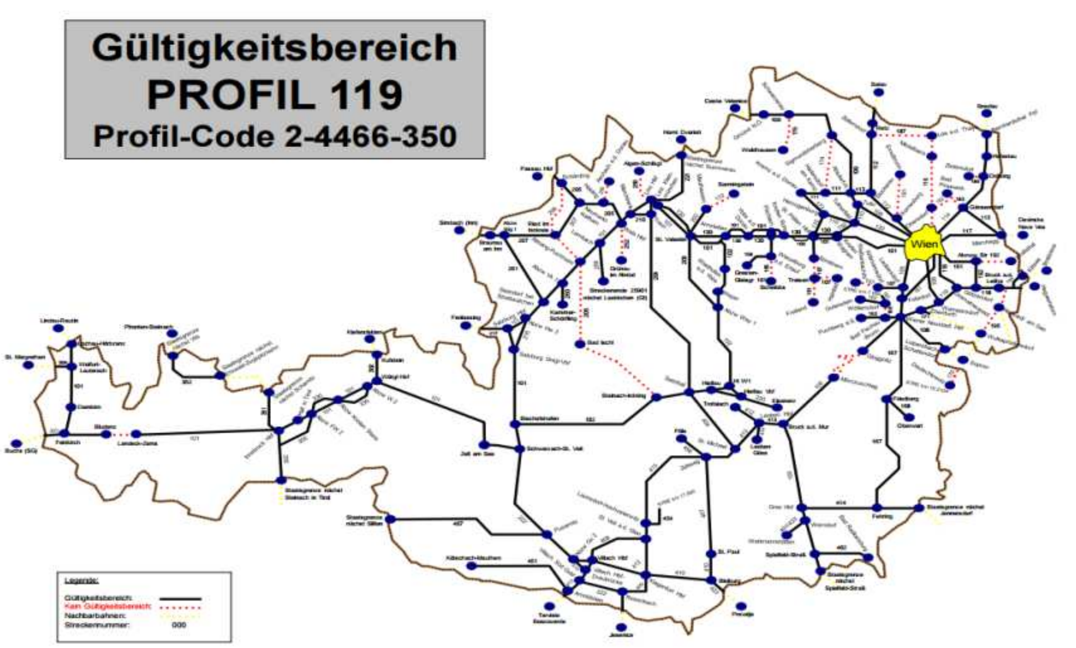


Illustration 19. OBB-Network Statement, Profile Catalogue. Extract of the information given for one profile type.

1.1.1.1 Infrabel, Belgium

Network Statement: http://www.infrabel.be/en/professionals/rail-operators/network-statement

The Belgian Network Statement refers to the Infrastructure Codification, the gauge considered in the Belgian Network are the BE1, BE2, BE3 and BE4.

But the documentation available is a map indicating the classification of the lines for combined transport according to P/C codification.

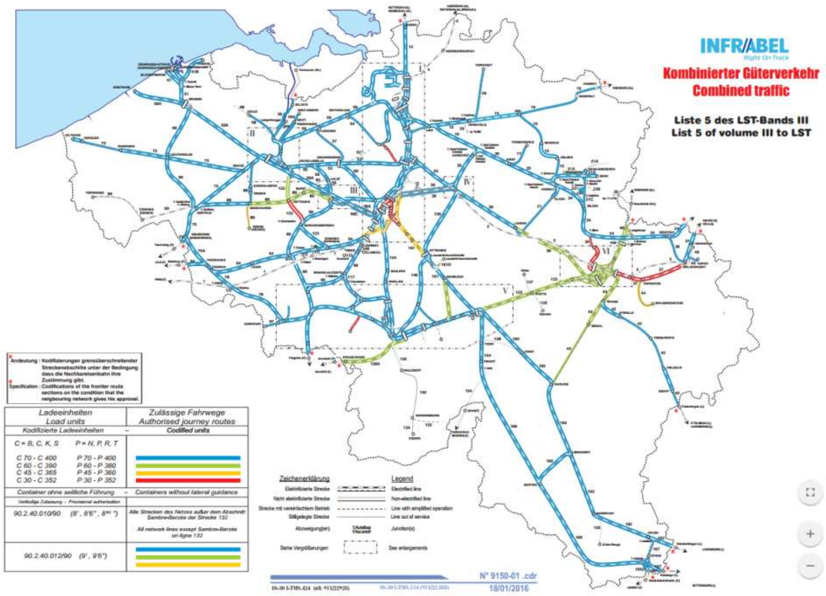


Illustration 20. Infrabel line accessibility to combined transport map

As indicated in the NS Common Structure, **where "relevant", maps or lists should be produced, or reference should be made** to documents containing the required information, ideally by **means of GIS** allowing the customers to quickly access infrastructure information on the specific line.

It has been illustrated with the above examples that all graphic documentation accompanying a NS, enriches the knowledge of the network in service, and is basically language independent.

From our analysis of various Network Statement, it can be noticed that:

- Cases remain where no plan is included. Line characteristics are listed in tables, often in local language.
- Others include descriptive plans of line types, without specifying the loading gauge or gauge clearance available.
- In some cases, network statements incorporate plans indicating routes accessible to combined transport specifying intermodal freight codification.
- In the most complete cases, i**nformation systems, based on GIS technologies are available.** For a selected section in the Network, detailed information is given, including (it depends on the case) category of the line and type of transport, interoperable gauge codification or intermodal freight code.

According to the different actors consulted, **GIS tools are recognized as the most efficient and user-friendly** ways of displaying the information, as long as it does not impose duplication and multiple updating of the data by the IMs.

For example, DB Netz (Germany) and Trafikverket (Sweden) present their infrastructure data at a public level, with no request to be addressed. Additionally, these data are accessible on GIS-tools.

These tools should allow operators to know if they can pass a train through a given itinerary by comparing the rolling stock characteristics with the infrastructure clearance gauge.

This tools would additionally allow the user to identify the best route to go from one point to another by introducing the characteristics and parameters of a train.

These applications must be updated, be easy to use and should represent gauge data under uniform criteria (national codifications systems and the infrastructure and-or P/C codes according to European standards and UIC leaflets).

As well as the RINF software application is a web-based application facilitating access to the data of national registers of infrastructure at European level, **the graphical representation of these data could be managed in a centralized mode in a single tool**. **In the case of clearance gauge data, their update and representation under uniform coding systems should be ensured.**

Given the large amount of data from different IMs and the disparity of coding systems used, this possible unified GIS tool could focus, in a first moment, on a limited number or data, on a limited number or typical or most used gauges. For example P400 (as it has been analyzed in the WP3 Market Study at the present Study) seems to be the most convenient and desired gauge by the rail users.

6.2.4. Line codifications in the Network Statements

Although RNE provide guidelines that define a NS CS, additional requirements are needed to better specify the necessary information that should be delivered, in order to reach a better harmonization of the published information**.**

The nomenclatures used to describe the gauges are not the same for the description of the infrastructure and for the profile of the rolling stock, and may also vary in some countries that do not follow the international standards recommended by the UIC.

As it has been shown, there is a wide disparity of criteria when publishing data concerning railway clearance gauge. **The information is expressed under different regulated codifications.**

6.3. CIDs Corridor Information Documents and Clearance gauge information

Regulation (EU) No 913/2010 of the European Parliament and of the Council concerning a European rail network for competitive freight was adopted on 22 September 2010. In Article 18, the Regulation refers to a document that should be drawn up, published and regularly updated by the Management Board of the given Rail Freight Corridor.

This document should contain *"all the information in relation with the Rail Freight Corridor contained in the national network statements"*

In a similar way than with the networks statements, RailNetEurope issued a **"Corridor Information Document Common Structure".** The objective of this specification is to offer guidelines for the expected content, organisation and other information useful for the production of the Corridor Information Document (CID).

The aim is for Applicants to get access to similar documents along different corridors and in principle, as in the case of the national Network Statements, to find the same information at the same place in each one.

Regulation 913/2010 leaves some degree of flexibility for the corridor organisations to select the level of information included in the CID. It follows the logic of the Network Statement Common Structure, which is largely respected but not all IMs choose to use the totality of the described chapters.

As with the experience of the Network Statement production, it is likely that the first versions of the CID will include basic information, while later versions will gradually become more detailed.

The "Corridor Information Document Common Structure" proposes to divide the CID into several books in order to facilitate the organisation and updating of the information. The book 2 is the **"Network Statement Excerpts".**

Several references relative to clearance gauge or related issues, such as loading gauge or exceptional transports have been found in the Corridor Information Document Common Structure and, specifically, in the contents recommended for the Book 2.

Between them, the following references can be highlighted:

Chapter 2. Access Conditions.

2.5. Exceptional Transports: *List the Exceptional Transport conditions by IM NS in the form of a link/cross-reference.*

Chapter 3. Infrastructure

3.3. Network description

Whenever possible, maps or similar solutions (e.g. GIS applications) should be used.

Track gauges

Compile the information from all NSs into a single detailed description relevant for the Corridor or refer to a link/cross-reference to relevant documents.

Loading gauge

Compile the information from all NSs into a single detailed description relevant for the Corridor or refer to a link/cross-reference to relevant documents.

From the documents analyzed it can be seen that the CIDs, through the respective Book 2, only make direct references (link-cross references) to the different national NS involved in the Corridor when they describe the Infrastructure characteristics, in general, and the data concerning the clearance gauge information, in particular.

6.4. Suggestions from RUs

The responding RUs are used with the facilities offered by the IMs network statements on the networks where they are operating and can generally make it with the provided data. However, In spite a low level of answering to the questionnaires, some suggestion have been expressed regarding enhanced facilities that could be expected:

- the possibility of offering optimised route solutions with a chosen gauge (BLS Cargo, CH),
- the possibility to visualise the maximum gauges of all sections (BLS Cargo, CH) or specific sectors (Servtrans, RO)
- the possibility to visualise IM's expected plans several years ahead, in addition to current data (BLS Cargo, CH)
- The provision of more detailed technical and track characteristics of the railway infrastructure, restrictions, and gauge characteristics (Servtrans, RO)
- an extra financial resources (EU/national) for the system development (Servtrans, RO).
- Provision of more technical data on a easy-to-use GIS system (Esxpress Group, SK; COMSA RT, SP).
- Provision of pulling possibilities (admissible weight of trains) for any type of locomotive.
- The usable length of a specific railway sector (Servtrans, RO).
- Need for standardisation and unification of gauge codification (COMSA RT, SP)

6.5. The UIC ECCO project for Rail Freight Corridors

With the coming into force of the European regulation 913/2010 concerning a European rail network for competitive freight, corridors are being established at their own pace with no obligation of coordination between them. According to the regulation, Railway Undertakings only play a consultative role in activities to improve the corridors, within corridor-specific "advisory boards" (RAG). In their consultative capacity, European railway freight operators wish to underline that, while each corridor may require specific action to improve its own freight operations, a coordinated approach to corridor improvements should be pursued across Europe.

With a view to strengthening the Railway Undertakings' message in the European Corridor structures as defined by Regulation 913/2010, UIC has initiated the ECCO project designed to streamline processes across all railway undertakings and across all corridors.

The project was aiming at:

- providing the necessary coordination and exchange of information between the advisory boards which will ensure Railway Undertakings' needs are promoted efficiently
- setting up a structure to monitor progress and designed to provide regular feedback which will help put in place the necessary improvement measures whenever required.

In the UIC publication "Requirements of Railway Undertakings for the Implementation of European Rail Freight Corridors" resulting from this project, the following Railway Undertakings (RU), DBSR, BLS, Trenitalia, SNCF, CFLMM, Captrain, RCA, RC Hungaria, B Logistics, SBB, CP, PKP, in cooperation with the International Union of Railways (UIC), have proposed a list of priority topics which need to be progressed on all corridors. These topics are analysed in terms of their importance for developing rail freight traffic and implementation proposals are identified for each.

These requirements expressed by the RUs are covering a list of priority topics/recommendations which need to **be progressed**:

- Transport market studies
- Infrastructure bottlenecks
- Regulatory and operational interoperability (cross border)
- Coordination of infrastructure works
- Traffic management procedures
- Use of Path Coordination system
- Definition of the role of the C-OSS
- Organisational issues
- Train parameters
- Harmonised corridor documents
- Other

In the Train parameters section, related to the clearance gauge, the Railway Undertakings recommend to harmonise minimum technical standards along and across borders, in consultation with RUs. Together with setting 740 m as the minimum train length and increasing axle load from 22.5 to 25 tonnes, they pointed out that a PC70/P400 loading gauge on all route, to accommodate high cube semi-trailers on piggyback wagons and high cube containers on standard intermodal wagons, would significantly boost the competitiveness of rail over road.

Further than this first step requirements, Railway Undertakings point out that the evolving weights and dimensions in different modes such as road and sea, such as high cube trailers and containers should be taken into account.

In terms of documents, RUs are underlining that multiple network statements of each infrastructure manager restricts the movements towards an interoperable pan-European railway network. Consequently, RUs wishing to operate on a RFC must refer to the individual Network Statements for each of the infrastructures making up the RFC. They request the development of a harmonised Network Statement structure for all RFCs end to end and the implementation unique public documents for the whole RFC, including diversionary routes. This would strongly stimulate rail freight traffic, by providing easy access to the information.

RUs have the direct interface with the customers, and they consider that their input into the governance structure in the RFCs is fundamental to the efficient development of the Freight Corridors. Their deep understanding and knowledge of the end user customer requirements is necessary in order to ensure that the correct information is available and in the right format in Network Statements (and Corridor Information Documents) to enable

RUs to collate and provide the relevant information customers to make commercial decisions on choice of mode.

More generally, RUs are requesting a higher level of technical and operational integration and coordination along corridors, with a "close involvement of the RUs who have a deep understanding of the end user customers' requirements [...][3]".

6.6. Conclusion

Although RailNetEurope has provided guidelines that define a *Network Statement Common Structure*, the format of the displayed data has not been harmonised, thus resulting in a very large variety of situations, in particular regarding the publication of clearance gauge data by the infrastructure managers.

GIS display of data appears as one of the most attractive and easy-to-access way to provide data, and the UIC has been working on a GIS prototype built on a "Google transit" model, allowing the user to identify the best route, the cost, energy consumption, etc., to get from point A to point B, by introducing the characteristics and parameters of the train.

However, the issue is made more complex for IMs by the fact that the wishes of RUs might be themselves diverse: some request tables or raw data, to be able to proceed with their own studies, some other request for more synthetic information. Network statements should be able to propose both types of data.

It is anyway a strong request from the RUs that all needed information should be available on internet, due to the necessity for IM to be reactive in answering urgent demands from the market.

Several possible approaches can be therefore considered to reach a higher level of harmonisation:

- Describing railway infrastructures uniformly:
  The RailTopoModel developed by a large group of experts (UIC, ADIF, BLS, DB Netze, Infrabel, Jernbanverket, ÖBB, ProRail, SBB/CFF/FFS, SNCF Réseau, VR Track and RailML) under the patronage of UIC is a logical object model to standardise the representation of railway infrastructure-related data. RailTopoModel is described in the UIC IRS 30100 document.
- allowing RUs (with a safety license of the concerned network) to directly access the data they need from the IM's own system, possibly through a standardized tool offering a common interface
- centralizing information into a RINF-based data system, assuming an appropriate enrichment of the RINF data and an evolution of its scope, purpose and capabilities.

Duplicating and providing data to too many destination by the IM is not acceptable as there would be a risk of giving out-of-date information. It is however important for the IMs to identify what is the information that can be provided instantly via a web platform, and which information necessitates further treatment.

On corridors, the ECCO project conducted by UIC has demonstrated the wish of most RUs for a harmonisation of infrastructure data and higher level of integration and coordination, with their enhanced involvement in the decision process. The process towards

[3] Requirements of Railway Undertakings for the Implementation of Rail Freight Corridors. International Union of Railways, Paris, 2014.

harmonisation and integration is progressing through several initiatives at the corridor level.

7. GAUGING AND CODIFICATION: TOWARDS HARMONISATION

7.1. Principles of gauge codification

7.1.1. From reference profile to limit gauges

Structure gauge is is defined on the basis of the reference contour by application of the associated rules[4]

Three gauging methods are currently in use in Europe.

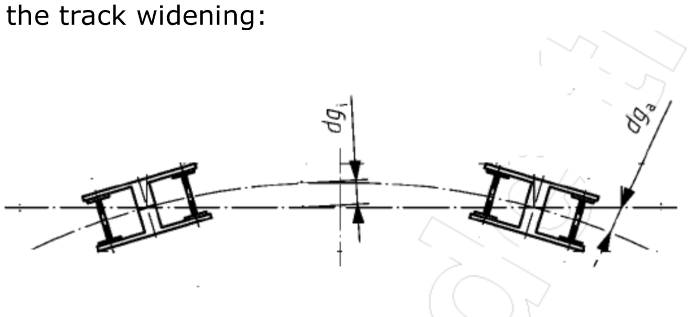
- Defined gauging
- Absolute gauging
- Comparative gauging

Defined gauging is the UIC method, whereas absolute and comparative methods are used in UK. Defined gauges are characterized by an association of a reference profile and associated rules. Therefore, comparing gauges only by their profiles is not relevant because every gauge has its own associated rules.

Gauging is a convention between the infrastructure and the rolling stock. The IM needs a reference profile to know where obstacles can be put, and the rolling stock needs to know the reference profile to load or build new vehicles.

An infrastructure limit gauge is built up from a reference profile, to which are successively added:

- The static effect S, corresponding to the geometrical overthrow of reference vehicles in curves and the track widening:



- The quasi-static q_s effect of the suspensions of the loading on a canted track, over 50 mm cant (the first 50 mm being taken into account in the rolling stock « E » part).
- Allowances, defined by UIC and EU Standards and calculated in a statistical way, assuming that not all allowances occur at the same time (track displacement, cross level error, dissymmetry, vehicle oscillations).

The infrastructure nominal gauge is built up in the same way, but considering the arithmetic sum of allowances, assuming all allowances have to be taken into account at the same time.

[4] Commission Regulation (EU) No 1299/2014 of 18 November 2014 on the technical specifications for interoperability relating to the 'infrastructure' subsystem of the rail system in the European Union

Most of the IMs define the limit gauge by adding a fixed value to the nominal profile. No obstacle is allowed inside this limit gauge. Although allowances are recommended by UIC leaflet 505-3 and EN 15273 series, they remain the choice of each Infrastructure Manager.

On the rolling stock side, the maximal construction or loading profile is derived from the reference profile reduced by a quantity E depending on:

- The play/clearance in the bogie
- The geometrical overthrow
- The inclination of the vehicle
- The projection S

Consequently, a couple of corresponding loading and infrastructure gauges is defined as the combination of a common reference profile with associated rules to be applied from one side by the rolling stock manufacturer or operator (reduction formulae), and by the Infrastructure manager (by addition of margins) on the other side.

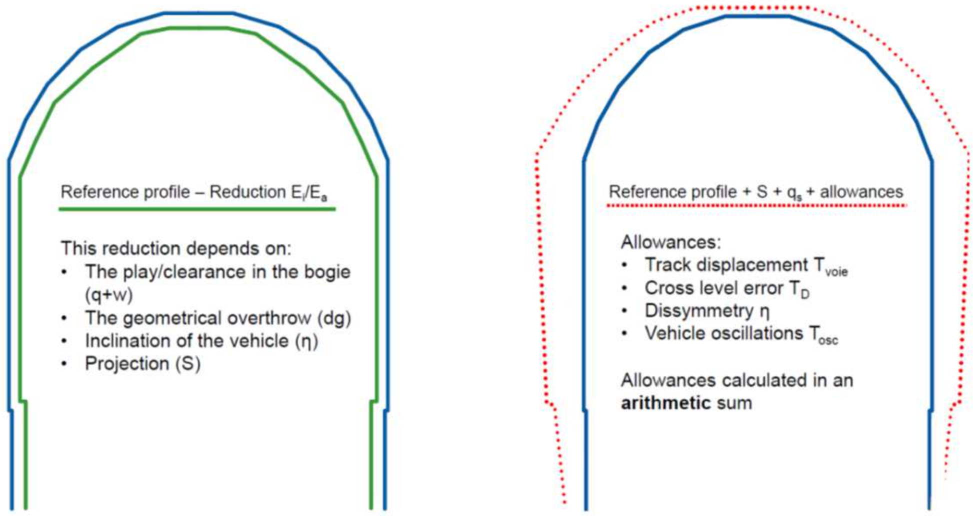


Illustration 21. Determination of rolling stock maximum construction gauge (A) and infrastructure installation nominal gauge (B) from the common reference profile in blue (from K. Van Londersele[5]).

Each time the reference profile is exceeded by the load profile the transport is to be considered as exceptional.

Due to the complexity of the associated rules on both sides, few specialists have the full expertise for conducting such calculations. The splitting of historical integrated railways between infrastructure management and operation, added with the segmentation of the market into small or middle-size railway undertakings, makes the issue of lacking of gauging specialist particularly true for these companies.

It is therefore not surprising that it is a common claim from many interviewed and questioned RUs, that IMs should deliver the information in terms of a codification of train profiles that can go through the infrastructure clearance, in a language that RU do understand.

[5] Kristof Van Londersele : Gauging and Codification, presentation at the UIC Seminar "*Measuring & Upgrading the clearance gauges of railway line*", Paris, 29 September 2015

In consequence, such codification of infrastructure would no longer describe the actual structure clearance gauge, but would express a permission given to a particular rolling stock to go through.

The specific codification system for combined transport, described in following chapter 5.2, and the current standardization of a loading profile catalogue described in chapter 5.3 are the two main examples of progress toward this kind of codification.

7.2. The treatment of RU's requests for the carriage of exceptional consignments

7.2.1. UIC leaflet 502-1

According to the terms of UIC leaflet 502-1, a consignment is considered as exceptional if "its external dimensions, its weight or its properties give rise to particular difficulties in relation to the fixed equipment or wagon for anyone involved in the carriage of the consignment, and it can therefore only be accepted under special technical or operating conditions which must be agreed in advance between all RUs/railways involved in the carriage thereof" [1].

These parameters that makes a consignment exceptional can thus be related to the loading dimensions, to the cargo securing, to the loading of a single unit of two consecutive wagons, to the bulk mass, to the axle load or to any non-suitable marking of the loaded vehicle.

The study, authorization and operation of exceptional transportations are in most of the case subject to the provisions of UIC leaflet 502-1. Although internal organisations and means of communication might vary locally, the procedure described in UIC 502-1 remains the reference procedure, mandatory for all Railway Undertakings members of the UIC and contributing to operate exceptional transportation in international traffic.

UIC leaflet 502-1 defines the concept of exceptional consignment, indicates the respective roles of the client, of the main operator and of the infrastructure manager, set up their responsibilities and proposes templates of data forms allowing an accurate and complete examination of the request, setting a maximum delay of 15 days to answer a request.

It stipulates the conditions for transportation allowance, set the time framework for its validity (3 months), specifies the conditions for loading and preparation to carriage, as well as the needed marking.

The documents also governs the operating conditions and there possible modifications, between the different railway undertakings and the relevant infrastructure managers.

Appendix A - Form for written communications

A.1 - Numerical code for approval applications/ handover approvals between RU/IM GECs

Code No.	Subject	Unit	Used in AA	Used in HA (RU)	Used in HA (IM)
1a	Type of goods and NHM-code (see List of abbreviations)		X	X	X
1b	Number of the same consignment		X	X	X
1c	Outline code of consignment		X	X	X
2a	Type of wagon: *In general, class of wagon and type number as specified in the standard marking. Number of carrying wagons, match wagons, buffer wagons etc.*		X	X	X
2b	International usability: *RIV, RIC, TEN, derogation plate or "none"*		X	X	X
3	Wheelbase, bogie pivot pin pitch (a):	mm	X	X	X
4	Bogie wheelbase (p), (p_1), (p_2), (p_a), (p_i)	mm	X	X	X
5	Number of wheelsets		X	X	X
6a	Length over buffers	mm	X	X	X
6b	Floor height above top of rail	mm	X	X	X
7	Tare weight of wagon	t	X	X	X
8	Weight of payload	t	X	X	X
7 + 8	Total weight	t	X	X	X
9	Load per metre	t/m	X	X	X
10	Greatest axle load	t	X	X	X
11	Length of payload	mm	X	X	X

Critical points where the loading gauge is fouled:

Points	12a	12b	13	14	15	16	17		18	
	Transverse distance from the wagon longitudinal axis on		Height above top of rail	Longitudinal distance from wheelset or bogie pin		Dimensions for service irregularities	Gauge widening D_i or D_a in the track curve radius of		Total width of track centre (columns 12+16+17) in the track radius of	
	one	the other								
	Side			n_i	n_a		∞ m	250 m	∞ m	250 m
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
	Half width including any loading tolerance			*Including any loading tolerance in the length*		*In international traffic columns 16, 17 and 18 need not be filled in*				
A										
B										
C										
D										
E										

Code No.	Subject	Unit	Used in AA	Used in HA (RU)	Used in HA (IM)
19	Comments on the critical points *- No fouling of the loading gauge* *- Connect critical points with a straight line or curve* *- Dimensions of payload* *- Centre of gravity (as specified in point 4.3.6 - page 8)* *- Peculiarities of payload (load securing)*		X*	X*	X*
20a	Consignor (name and address)		X	X	
20b	RU executing the carriage e. g. RU .... from.................. to		X	X	X
21	Dispatch station		X	X	X
22	Destination station *If there are several stations at the destination, the destination station must be clearly defined*		X	X	X
23a	Route requested by consignor		X		
23b	Specific forwarding route			X	X
24	Carriage in normal freight train, special freight train, with own power equipment	V_{max} km/h	X	X	X
25	Customs station *Only required if customs are dealt with at neither the frontier station nor the destination station*		X*	X*	
26	Harbour loading quay		X*	X*	X*
27a	Consignee (name and address)		X	X	
27b	Freight payer (name and address)		X*	X*	
28	Other matters a) Indicate regular line class[a], heavy wagon class [b], b) Reason why the wagon has no RIV/RIC or TEN marking c) Dimensions of the wheelsets and type of suspension if these differ from the GCU, TSI (etc.) regulations d) Properties and class of the brakes if they are not permitted in international traffic e) Other technical details of the vehicle, operating conditions f) Speed for the loaded and empty wagon g) Indicate the values s, hc, and q + w where these deviate from the standard values of s = 0,1, hc = 500 mm, q + w=25[c]		X*	X	X
29	Forwarding conditions - Must the load be earthed? - Journey: (hauled, with own power equipment and pilotman) - Position: (behind the locomotive, last vehicle) - Propelling, hump shunting, passing over humps forbidden - Wagon groups not separated -..		X*	X	X

7.2.2. Questionnaire on infrastructure managers' practice

A questionnaire was issued to a panel of infrastructure managers on several aspects of railway gauge management. The following series of questions were related to gauge studies and transport authorizations:

- Is there a special department of the infrastructure Manager in charge of the gauge topic and exceptional transport authorization?
- How is the request for specific study received and transmitted to this department (or subcontractor)?
- What is the average delay to answer a specific demand?
- Is the study carried out internally or externally, by a contractor?
- In any case, whom is the study verified by?
- How is this department informed of temporary or permanent clearance gauge changes?

Answers where received by eight partners: Infrabel (Belgium), DB (Germany), MAV (Hungary), SNCF (France), IP (Portugal), ADIF (Spain), Trafikverket (Sweden), CFR (Romania).

Answers can be summarised in the table 1.

Structures set up by the responding IMs show that the examination of requests are carried out internally and submitted to internal control. Central and regional technical department (track, structures, catenary) are involved according the needs of the study.

A large variability is observed in terms of delays indicated by the responding IMs, reaching up to several weeks for highly complex requests.

A few RUs questioned on this particular point report sometimes longer delays to obtain a complementary information on the railway gauge.

Apart from some variable interpretations of the questionnaire, the followed procedures are in line with the recommendations of the UIC 502-1 leaflet.

Respondent	Department in charge of studies and E.T. authorization	Transmission of T.E. request	Average delay	Information of gauge change
Infrabel	Internal	According to UIC 502.1	5 days	Department in charge of the study received a message after any change in the central obstacle database.
MAV	Internal	e-mail	1 to 6 working days, up to 15-20 for difficult consignment such as electrical transformers	Immediate transmission of data after works causing restrictions in clearance gauge. No data received for small changes (< 10 mm).
SNCF	Internal study and verification	According to UIC 502.1		En principe, études et travaux réalisés sur la base d'un gabarit d'implantation limite. En cas de réalisation non-conforme à l'étude, la mise en exploitation est autorisée tant que le gabarit

				d'alerte est dégagé.
DB	Internal specialised services.	e-mail	None	Regular update of database
IP	De-centralized, regional Request received by the security department which communicates the request to operation/circulation, engineering and maintenance departments. Verification by Security Department		Depends on each situation/Type of request, studies and verification needed.	
ADIF	Internal Exceptional Transport Group. If needed, the ETG asks for analysis of the request to Rolling Stock Department and Infra Department which propose restrictions or new route.	According to UIC 502.1	Limited to 15 days.	A formal document expedited by the Operational Safety Department is formally agreed between the Maintenance and Operation Departments involved.
Trafikverket	Internal. Shared between different services, e.g.	Data system	5 days	National rules for measureme

	Planning (for authorization for exceptional transport) and Maintenance (for gauge issues).			nt and reporting
CFR	Internal, with contribution of branch and regional agencies	According to UIC 502.1	5 days + 2 days for traffic advisory	According to internal regulations, after infrastructure works impacting the clearance gauge. Local managers are due to communicate new data in the shortest delays.

Table 1 – Responses to the questionnaire to IMs on the item « Authorisation of exceptional consignments ».

7.2.3. Exemple of practice

During the seminar «*Measuring and upgrading the Clearance Gauge of Railway Lines*", held at UIC on 29 September 2015, Alvaro Mascaraque, from ADIF International Department, described the procedure in use on the Spanish network.

Three main documents constitute the basis of the regulation:

- The network statement, according to RailNet guidelines
- The Gauge technical instruction, updated in 2015 by the Ministry of Transport of Spain, defining the rolling stock gauge, the infrastructure gauge and the wagon and loading gauge. This instruction is aligned with EN 15273:2013 as well as TSI Infra, RS and Energy.
- ADIF general instructions n°66 (defining exceptional consignment) and n°2 (regulating exceptional consignment), based on UIC leaflet 502-1

The technical instruction for gauges specifies the main gauges: the Iberian gauge GHE16, international gauge GC. Rule C-47 sets up profiles for combined transport C33 and C352 inside gauge GHE16. In many lines, C45 and C364 profiles can be operated without applying specific prescriptions, although considered as exceptional consignments.

The commission for loading rules and exceptional consignment gathers together ADIF departments of Safety, Training, Infrastructure and of Logistics Services, railway undertakings and the Spanish Railways Safety Agency, with the mission of agreeing on ADIF technical instructions and plays an important role in the Exceptional Consignment procedure.

ADIF has 15 days to respond to client request for exceptional transport.

From the client's demand, the RU undertakes a preliminary study and request for an exceptional consignment to the Commission. The Commission reviews the preliminary study and reviews the past exceptional consignment against the last known changes in the infrastructure.

When agreed, the Commission sets the possible transport restrictions and release the transport authorization to the RU who reports to the client and asks for a running plan to the traffic department.

An authorization for exceptional transport are valid for a 1 year period.

ADIF entertains about 150 applications per year, 100 of which are renewed each year. It is estimated that 99,5% of the requests for exceptional consignment are answered positively without any additional measure.

Feasibility studies, as well as all actions concerning the measurements of clearance railway gauge are financed by ADIF and conducted by ADIF Infrastructure and Safety departments. In some cases, they can be subcontracted to engineering companies. They might require track auscultation, field test or other additional assessments.

These studies are undertaken in the following cases:

- When no similar transport has been previously recorded
- When changes have affected the infrastructure,
- When the gauge data provided by the RU study are close to the infrastructure limit gauge.

From the client's demand, the RU undertakes a preliminary study and request for an exceptional consignment to the "Commission for loading rules and exceptional consignment" (CPCTE Comisión de Prescripciones de Cargamento y Transportes Excepcionales). This Commission gathers together ADIF departments of Safety, Training, Infrastructure and Logistics Services, railway undertakings and the Spanish Railways Safety Agency, with the mission of agreeing on ADIF technical instructions and plays an important role in the Exceptional Consignment procedure.

The group of exceptional consignment (GTE-Grupo de Transportes Excepcionales) of the Commission will conduct the studies needed to determine whether the consignment is feasible and, where appropriate, the transport conditions and traffic requirements that must be taken into account.

Extra measurements are carried out when possibly affected by maintenance or civil works and upon specific demands of RUs. LIDAR and Laser 3D techniques are used.

Alternative solutions

- ✓ When the exceptional consignment cannot be granted on the requested route, **alternative routes** can be proposed to avoid the identified bottlenecks (certain tunnels or bridges), or operational restrictions setup (use a specific track or speed restriction).
- ✓ A request can be addressed to the RU to consider making use of more suitable wagons (with a lower height of loading plane or a lower distance between bogies).
- ✓ Loading procedures can eventually be altered to modify the positioning of loads, possibly during transport.
- ✓ Infrastructure works can be undertaken to allow the traffic to go through. They can be local and temporary, like a limited re-alignment of the track, a lowering of the cant or the removal of catenary, or can fall under the case of investments (change for lower slab track, bridge deck substitution, enlargement of tunnels, platform rearrangements, etc.).

No case of a gauge enlargement investment (in the medium-long term), **due to a request of transport by an external RU, has been identified in the last years.**

7.3. Combined transport: a special case of exceptional transport

Combined transport (TC) represents a major element of the European freight market. The European Council Directive 98/106/EEC defines the combined transport as follow:

Combined transport means the transport of goods

- Between Member States where the lorry, trailer, semi-trailer, with or without tractor unit, swap body or container of 20 feet or more uses he road on the initial or final leg of the journey and, on the other leg, rail or inland waterway or maritime services where this section exceeds 100 km as the crow flies and make the initial or final road transport leg of the journey.
- Between the point where the goods are loaded and the nearest suitable rail loading station for the initial leg, and between the nearest suitable rail unloading station and the point where the foods are unloaded for the final leg, or
- Within a radius not exceeding 150 km as the crow flies from the inland waterway port or sea-port of loading or unloading

During the last decade, with the exception of the 2008-2009 period when economic crisis severely impacted the rail freight activity, a continuous growth of intermodal transport has been observed, while the overall rail freight performance was slowly declining, both in terms of tonnes and of t.km (ill. 23). Compared to the base year 2005, a 41 % growth in weight and a 27 % growth in terms of tonnes.kilometres has been achieved by 2013, with a total CT volume of 213.8 million tonnes.

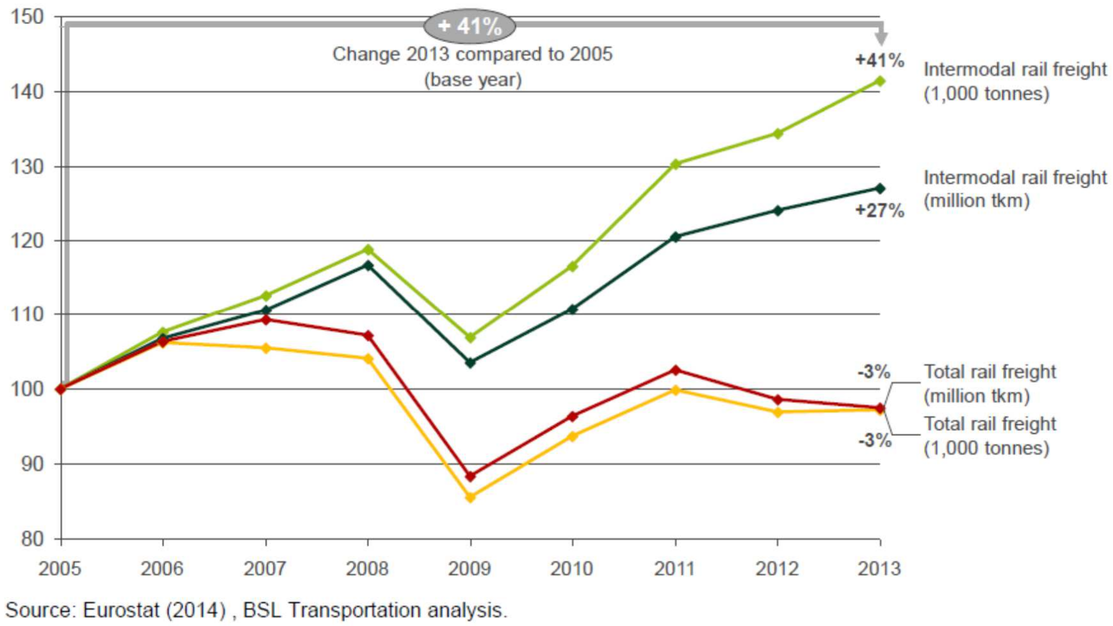
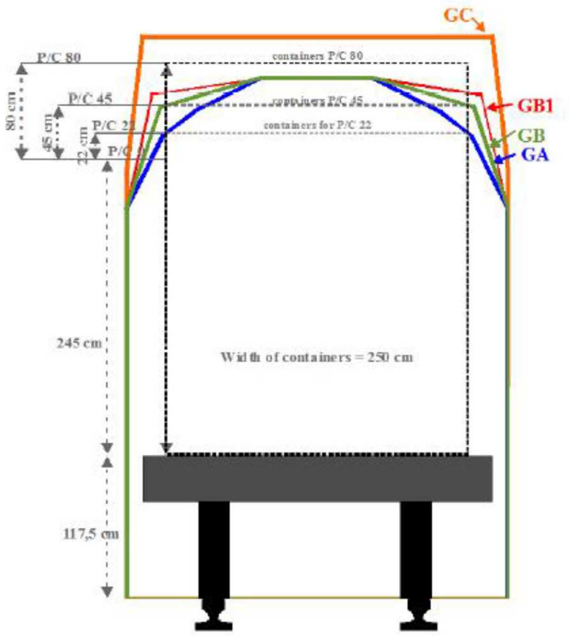


Illustration 22. Evolution of total and intermodal rail freight performance in Europe (Index 2005 = 100) - From Eurostat (2014), BLS Transportation Analysis – quoted by UIC 2014

Need for a specific codification for combined transport



In most of the European countries, the authorized dimensions of CT carrier wagons and their loads lead to fouling the upper part of the infrastructure refence profiles of the different networks. The transport must consequently be operated under the exceptional consignment procedure.

In order to facilitate and make this CT traffic smoother, the complexity and requirements of the UIC 502.1 procedure has been overcome by introducing the specific codification system of the constitutive elements of the combined traffic, including ITUs, wagons and railway lines, indicating their respective dimensions, with the basic rule to be respected by the railway undertaking, that the codification of units and wagons should of course remain lower than the line codification.

Illustration 23. Inclusion of P/C loading gauges into the reference infrastructure gauges

The P codification (applicable for semi-trailers) and C codification (for containers and swap bodies) are prescribed in the UIC leaflet 596-6.

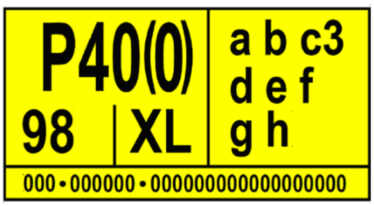
ITU codification is materialised by codification plates added on both sides of the ILU.

Wagons for combined transport are mixed-use, specialised of flat wagons. They differ by the height of the loading plan (between 0,95 and 1,30 m) or the height of the pocket of trailer carriers (from 0,22 to 0,33 m) above the reference plan of the rail surface.

The maximal loading gauge of the ILU is determined using the concept of "reference wagon". The reference wagon is characterised by UIC leaflet 596-6 [2] for each ILU type and is used [3]:

- For the codification of combined transport railway lines
- For the codification of ILUs
- For the determination of the correction number of wagons that differ from the reference wagon

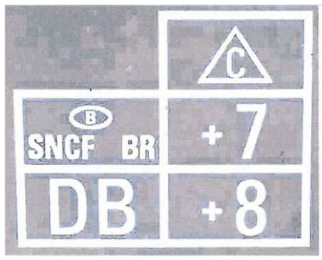
Wagon codification is based on reference wagons, characterised by the distance between the boggy centers and the floor height. When new wagons came up to the market in the recent years, it became necessary to introduce positive or negative correction numbers, which reflect their difference from the reference. This number is valid for the indicated network and modifies the ILU codification. An harmonisation of the ILU and wagon codification between the different networks should be recommended.



ILU plate

Applicable for semi-trailers (P)

When width < 2500 mm (P40) or



Wagon plate.

An ILU codified C45 placed

on this wagon becomes C45-7 = C38

Width > 2500 mm (P400)

Illustration 24. ILU and wagon marking plates for combined transport

Line codification is carried out by the Infrastructure Manager, using one of the two existing main methodologies.

- The reference profile method does not allow vehicles to exceed the kinematic profile, and to use all the available space, since vehicles remain within the reference profile.
- The available space method allows vehicles to exceed the reference profile, and thus to use all available space; but therefore this method requires a detailed assessment of the allowances (exact position of obstacles, cants, etc.). This accurate and permanent knowledge of the infrastructure clearance is only affordable when high performance measurement and gauge data management techniques are used by the Infrastructure Manager.

Infrabel in Belgium uses the available space method, requiring the Orbe database to be kept permanently up to date.

It is to be noted that the codification of a line according to the intermodal codification system, expresses the ability of the line to be ran by certain categories of intermodal trains, but is not describing the reference profile of the infrastructure. However, practically, some correspondence can be assumed (GA ≈ C22; GB ≈ C45).

Documents such as published by EPSF[6] indicated the ability of inscription of 8' wide containers into loading gauges GIC, GA and GB, as a function of the wagon floor height, thus allowing an easy first check by the RU of the ability of lines to accommodate combined transport.

7.4. Extension of a codification system to other exceptional transports: UIC leaflet 502-2 and the Outline Procedure.

Some Railway Undertakings suggest that Infrastructure Managers should not deliver the railway gauge information in terms of a codification that describe the infrastructure (GA, GB, GC..) but according to the codification of train profiles that can go through, in a language that RU do understand.

The use of a single universal codification system to codify a line appears however difficult to achieve, since it should reflect the variety of wagon load configurations. If a P/C code can be attributed to the main lines, as stated in the UIRR map, the P/C system remains a codification for allowance of combined transport. It mostly addresses the height capabilities but does not describe the overall shape of the infrastructure clearance. Other types of traffic with other lateral or low clearance requirements are not concerned with the P/C codification. Therefore, several codification system seem needed to address several types of consignments, not to mention the recent approval of the European Commission for new trailers and new lories, higher than 4 meters, longer than 18 meters and probably wider than currently, for the transport of which railways have no available equipment yet.

In an attempt to propose a codification system that extends the principles of defining standard loading profiles, the UIC 502 working group is developing and implementing into the UIC leaflet 502-2 a catalogue of harmonised profiles[7], defined for different consignments, including commercial market as well as military materials. In Austria, 15 profiles are covering more than 80% of the over-sized transport. UIC 502 extends this system to other countries (including France, Germany, Slovakia, Hungary, Switzerland and Netherland).

The work first consisted in deciding which oversize transport profiles (loaded on regular wagons) are the most needed by RUs, and which profiles each IM can provide.

Knowing the weight, width and height requirements, 45 profiles have thus been determined to fit the needs of the RUs. On their side, IMs have to check which of the profiles needed by RUs operating on their networks are possible.

Each profile is characterized by an 8-digit code. A four-digit basic code describes the loading profile in a cross section divided into four sectors (ill. 26), while a 3-digit additional code indicates the maximum height of the profile, from the top of the rail.

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[6] Etablissement Public de Sécurité Ferroviaire (EPSF). Conditions d'admission et d'acheminement des Unités de Transport Intermodal. Référentiel RC A 7d n°2, version du 6 mars 2014.

[7] UIC leaflet 502-2 : « Exceptional consignments – outline procedure ». 1st edition, Nov. 2009

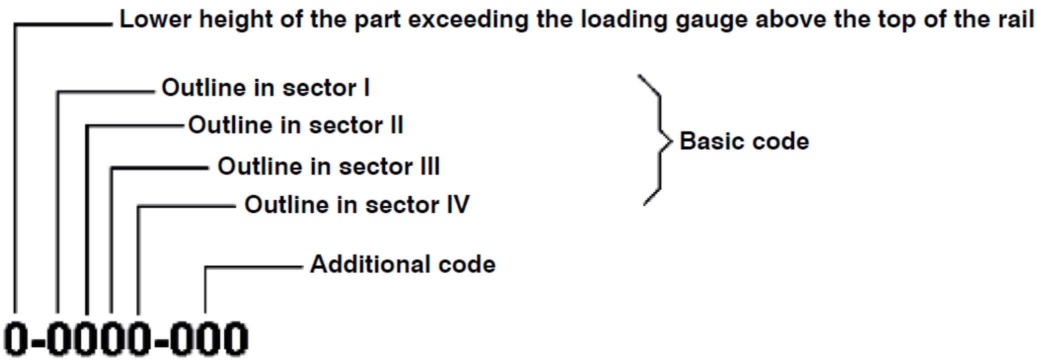


Illustration 25. Principle of codification using the outline procedure

Route sections are codified by the Infrastructure Manager according to the same system, describing the usable space for the carriage of consignment exceeding the loading gauge (UIC 502-2) taking into account additional dimensions for operational irregularities and curve supplements.

The comparison of the outline code of the consignment with the outline code of the route indicates the ability of the exceptional transport on the specified route, if each digit of the route basic code and the additional code as a whole are higher than the consignment code (ill. 27).

Example 1: (carriage possible)

Outline code for the route	3 – 3 5 4 4 – 465
Outline code for the consignment	0 – 0 4 4 3 – 425
Lowest number from each column	0 – 0 4 4 3 – 425

(0<3 – 0<3, 4<5, 4=4, 3<4, – 425<465)

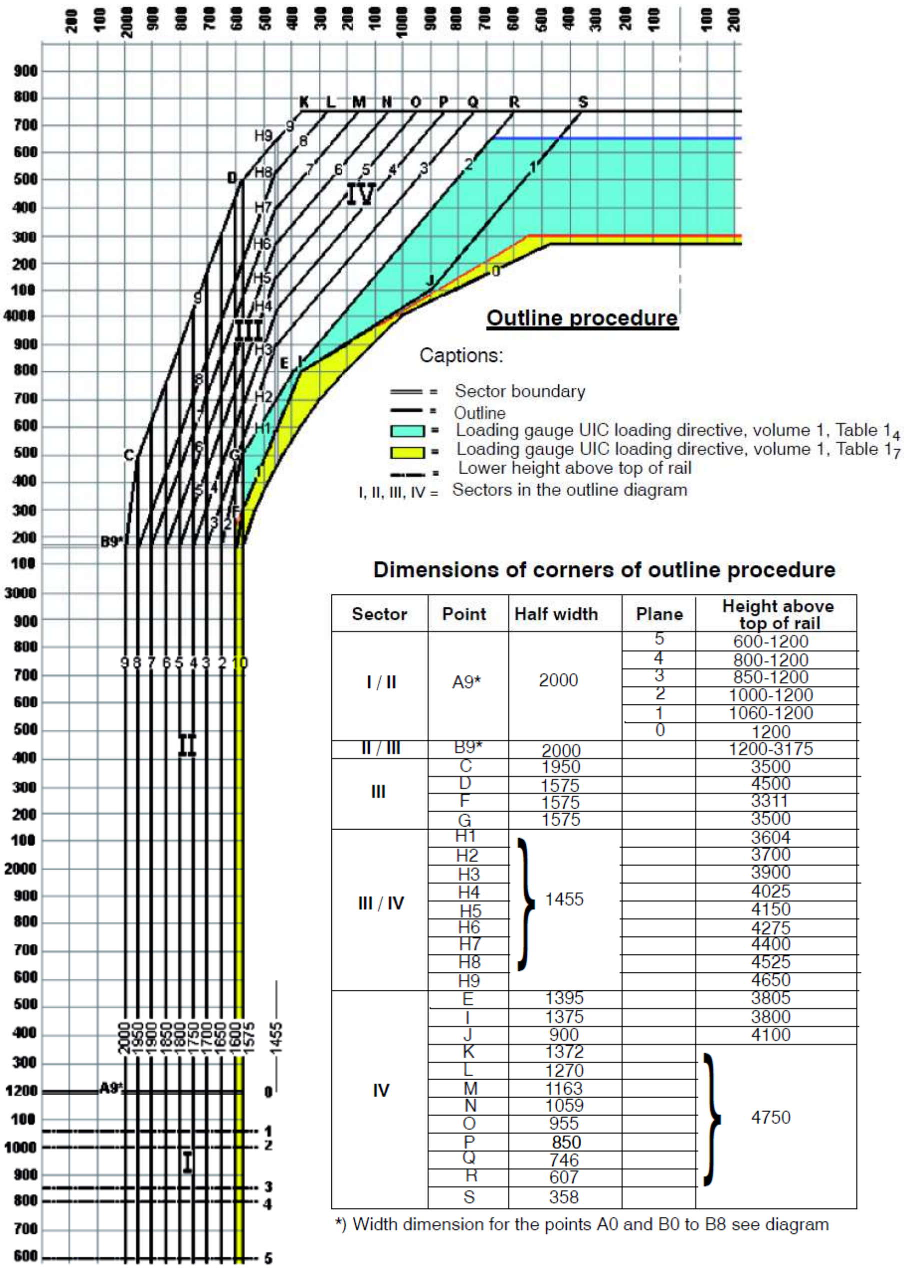
Example 2: (carriage not possible)

Outline code for the route	3 – 3 5 4 4 – 465
Outline code for the consignment	0 – 0 4 6 6 – 425
Lowest number from each column	0 – 0 4 6 6 – 425

(0<3 – 0<3, 4<5, 6>4, 6>4, – 425<465)

Illustration 26. Two examples of route/consignment codification using the outline procedure[8]

8



Sector	Point	Half width	Plane	Height above top of rail
I / II	A9*	2000	5	600-1200
			4	800-1200
			3	850-1200
			2	1000-1200
			1	1060-1200
			0	1200
II / III	B9*	2000		1200-3175
III	C	1950		3500
	D	1575		4500
	F	1575		3311
	G	1575		3500
III / IV	H1	1455		3604
	H2			3700
	H3			3900
	H4			4025
	H5			4150
	H6			4275
	H7			4400
	H8			4525
	H9			4650
IV	E	1395		3805
	I	1375		3800
	J	900		4100
	K	1372		4750
	L	1270		
	M	1163		
	N	1059		
	O	955		
	P	850		
	Q	746		
	R	607		
	S	358		

*) Width dimension for the points A0 and B0 to B8 see diagram

Illustration 27. The outline procedure of UIC leaflet 502-2

This profile system has been successfully in used in Austria since 2008. In Austria, 15 profiles have been so defined for different consignments, including the commercial market as well as military materials, covering about 80% of the needs. This “Profilkatalog” is provided in the Austrian network statement, so that everyone is able to check on which line which profile is allowed.

In a similar way than the P/C system, this codification saves a lot of time and avoids waiting days for an exceptional transport request to be answered, which generally generates an unacceptable delay for the RU.

Although this “Profile Procedure” is now being recognized by an increasing number of actors among UIC members, some IMs point out that the optimal balance between the use of UIC 502-1 and 502-2 procedures is different for each network, and that there might be some obstacles in terms of national procedures.

7.5. Conclusion

In spite of the definition of a series of reference profiles applicable to both infrastructure and rolling stock, it is often deplored that when it comes to clearance gauge, Railway Undertakings and Infrastructure Managers seem not to speak the same language and each one seems to be waiting for the right information from the other. In absence of a universal codification system, defining at least a standardised codification method is crucial and wished by all, in the current complexity and variety of gauging and line or wagon codification systems, which are currently mostly accessible to experts.

For infrastructure managers, a single and well defined gauging method should be adopted.

The P/C codification system applied to combined transport has proven its efficiency for several decades, to enhance the communication and understanding between IMs and RU on a common basis. Design for the standardisation of loading gauges for combine transport operators, this codification has been progressively adopted by infrastructure managers who, in addition to delivering structure gauge information, express the capability of their lines to operate different categories of combined transport.

This progressively reverses the notion of route-compatibility of trains into train-compatibility of routes.

Anyway, this good communication trough a common language is an essential condition for the IMs to properly understand the needs of their clients and to adapt the infrastructure in an appropriate way. Therefore, and although combined transport remain a limited (yet expanding) part of the freight exchanges, it is not surprising that railway gauge enlargement is mostly focusing on catering the needs of this transport category.

The codification of ILUs for combined transport

It is to be noted that the French Safety Authority EPSF has issued guidelines for the inscription of 8' wide containers into the standard loading gauges, depending on the bogie spacing and the wagon floor height.

INSCRIPTION DES CONTENEURS DE 8' DE LARGE DANS LES GABARITS DE CHARGEMENT

Empattement maxi	Gabarit de Chargement	Hauteur maxi du plan de chargement (*)										
		1100 mm	1120 mm	1140 mm	1160 mm	1180 mm	1200 mm	1220 mm	1240 mm	1260 mm	1280 mm	1300 mm
10 m	GIC	8'6"1/2	8'6"1/2	8'	8'	8'	8'	8'	8'	8'	8'	8'
	GA	9'	9'	9'	8'6"1/2	8'6"1/2	8'6"1/2	8'6"1/2	8'6"1/2	8'6"1/2	8'6"1/2	8'
	GB	9'6"	9'6"	9'6"	9'6"	9'6"	9'	9'	9'	9'	9'	9'
12 m	GIC	8'6"1/2	8'	8'	8'	8'	8'	8'	8'	8'	8'	-
	GA	9'	9'	9'	8'6"1/2	8'6"1/2	8'6"1/2	8'6"1/2	8'6"1/2	8'6"1/2	8'6"1/2	8'
	GB	9'6"	9'6"	9'6"	9'6"	9'6"	9'	9'	9'	9'	9'	9'
13 m	GIC	8'6"1/2	8'	8'	8'	8'	8'	8'	8'	8'	-	-
	GA	9'	9'	9'	8'6"1/2	8'6"1/2	8'6"1/2	8'6"1/2	8'6"1/2	8'6"1/2	8'6"1/2	8'
	GB	9'6"	9'6"	9'6"	9'6"	9'6"	9'	9'	9'	9'	9'	9'
14 m	GIC	8'	8'	8'	8'	8'	8'	8'	8'	-	-	-
	GA	9'	9'	8'6"1/2	8'6"1/2	8'6"1/2	8'6"1/2	8'6"1/2	8'6"1/2	8'6"1/2	8'	8'
	GB	9'6"	9'6"	9'6"	9'6"	9'6"	9'	9'	9'	9'	9'	9'
15 m	GIC	8'	8'	8'	8'	8'	8'	8'	-	-	-	-
	GA	9'	9'	8'6"1/2	8'6"1/2	8'6"1/2	8'6"1/2	8'6"1/2	8'6"1/2	8'6"1/2	8'	8'
	GB	9'6"	9'6"	9'6"	9'6"	9'6"	9'	9'	9'	9'	9'	9'
16 m	GIC	8'	8'	8'	8'	8'	8'	8'	-	-	-	-
	GA	9'	8'6"1/2	8'6"1/2	8'6"1/2	8'6"1/2	8'6"1/2	8'6"1/2	8'6"1/2	8'	8'	8'
	GB	9'6"	9'6"	9'6"	9'6"	9'6"	9'	9'	9'	9'	9'	9'

Nota : Les conteneurs de 2,600 m de haut des classes 2 et 3 sont assimilés à des conteneurs de 8' de large et 8'6"1/2 de haut

(*) Signe pour les wagons porte-conteneurs indiquant la hauteur du plan de chargement: ▼OOOO

8. BENCHMARK ON GAUGE ENLARGEMENT PROCEDURES

8.1. SNCF (France)

In the past, when SNCF was at the same time the Infrastructure Manager and the only RU, decisions for enlargements were made as a response to clearly expressed needs (e.g. : carrying 4m semi-trailers on a 23 cm height wagon).

Up to now, in the current organisation, no example is available of clearance gauge enlargement in response to a precise RU demand. In such case, it can be expected that SNCF-Réseau (IM) would requests some guarantees from the RU: financial contribution, commitment on minimum traffic level, etc.

SNCF Long term strategy for clearance gauge

Recognizing some gaps in the accurate knowledge of the actual status of clearance gauges on the network, and a lack of long term vision for their evolution, resulting in the inability to provide an integrated response to the customers' needs, SNCF-Réseau initiated in 2016 the definition and implementation of a strategic plan on clearance gauge policy.

Through regular communications with the stakeholders of combined transport operating on the network (HUPAC, VIIA, CargoBeamer, Ambrogio, Kombiverkehr, Naviland Cargo,...) SNCF is of course aware of the insufficient clearance gauge offered to combined traffic by the GA (reference), GB and GB1 profiles on most of the network (ill. 29).

This strategy is being built from the needs expressed by the customers, and mostly focuses on:

- Combined transport
- Autoroute ferroviaire
- Double-deck rolling stock for passenger traffic
- Particularly bulky exceptional consignments
- Military convoys

The question of the first three traffic is currently being addressed.

Three level of priority have been identified:

- Priority 1: the French part of the North Sea – Mediterranean Corridor (Corridor 2).
- Priority 2: Atlantic Rail Motorway and corridor 6
- Priority 3: East-West link of the 4^{th} corridor

The route of Corridor 2 appears as a natural link connecting the North Sea main ports (Rotterdam, Antwerpen) or Channel tunnel and Marseille on the Mediterranean Sea and joining the Rhine-Alpine corridor (Corridor 1) in Basel. Gauge limitations on this corridor lead to near-to-saturation traffic on the Corridor 1 through Netherlands, Belgium and Germany.

While, in 2013, 56% of the freight traffic is intermodal on RFC1 and 25% on RFC2[9], market studies show that rebalancing the traffic between RFC 1 and RFC 2 by upgrading the Calais-Basel route is a necessity to relieve RFC 1 and achieve substantial modal shift.

[9] 2014 Report on Combined Transport in Europe, International Union of Railways, 2015.

Technical studies carried out by SNCF end of 2015 have specified the works and estimated the costs for the enlargement of 14 tunnels on the Calais-Metz-Strasbourg-Basel, to enable 4 meters loads to be carried on 27 cm wagons.

Depending on technical options (arch raising or platform lowering), a minimal amount of 60 M€ should be necessary to finance the whole line upgrading works. SNCF is not in position to finance these works, since the expected incomes from infrastructure access charges will not make the upgrading economically profitable. The project and technical options, their operational consequences and costs have been presented to the railway undertakings operating on the corridor, at several Railway Undertakings Advisory Group (RAG) meetings of the Corridor, with a request for a still unidentified "external funding".

Although the technical needs of the CT operators is getting clearer (mostly focusing on GB1 and AFM 427), the quantification of the commercial and economical benefit is still missing to properly evaluate the economical feasibility of gauge enhancement. The Corridor 2 management invited the RAG Members to build a business case to estimate the market that could be generated by the enhancement of the loading gauge in the Metz-Basel segment. It is expected that the submission of such a business case to the concerned IM and Member States would give additional arguments to get the projects funded. The opportunity to include RUs not operating yet on this corridor segment (but which potentially could) would be worth considering.

In the absence of external funding, SNCF-Réseau is constrained to find technical solutions to combine the tunnel enlargement works with the periodical maintenance and renewal operations on the concerned lines and therefore to align the timetable of clearance gauge upgrading with the infrastructure maintenance schedule, sometimes spreading out tunnel enlargements over several maintenance time periods. This solution allows gauge upgrading at minimal cost, but generates extended delays that may not match the market needs.

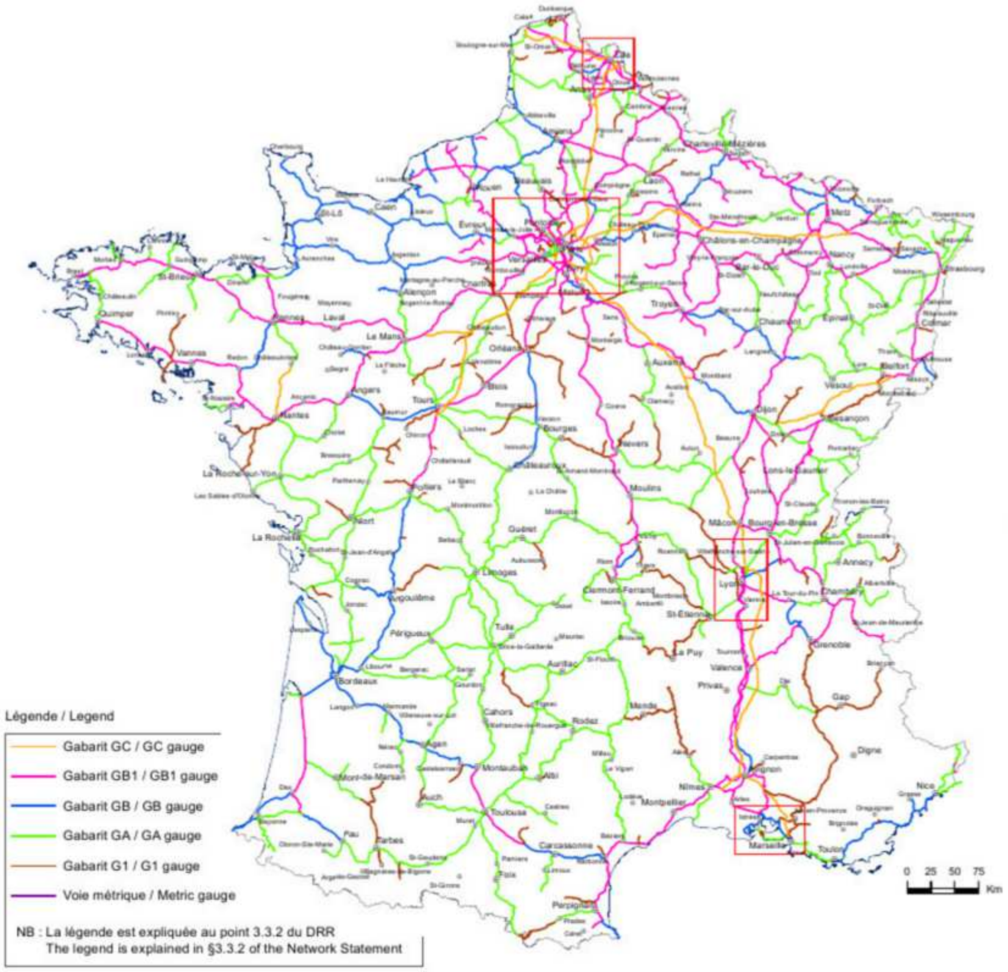


Illustration 28. Clearance gauge map of the French network

In principle, enlargement studies and works are carried out on the basis of a limit structure gauge. In case the result is not in conformity with the initial study, commissioning is however allowed as far as the alert gauge is not infringed.

The French NSA Etablissement Public de Sécurité Ferroviaire (EPSF) participates to Steering committees. In addition, before operating any new rolling stock, the concerned routes have to be checked and the results communicated to the NSA in charge of delivering a recognition of compatibility to allow the trains to circulate.

8.2. MAV (Hungary)

No case of gauge enlargement on an RU's request is reported by the Hungarian Infrastructure Manager, and no gauge enlargement project is planned. MAV considers that their railway clearance are basically all right. Occasionally, some over-head line poles are removed farther from the track during reconstruction works.

In case of new line construction, the Hungarian NSA decides the height and lateral distance (from track axis) of the platform. At handing over, the NSA checks the conformity of the achievement.

8.3. ADIF (Spain)

Decisions for gauge enlargement in Spain are mostly based on experience and on strategic decision. NSA sets gauge goals for new infrastructures, and is in charge of normative and homologation. When a gauge enlargement is carried out, the study is based on nominal gauge.

Several experiences of measurements of railway clearance gauge were identified in the last years. The cases analyzed mainly refer to railway sections or corridors with existing or potential freight-traffics.

Clearance gauge monitoring, in the railway network managed by Adif (Adif and Adif-Alta Velocidad; Spanish Railway Administration), is a usual **process carried out on a periodic basis as a maintenance operation.** The periodicity of the measures may depend on the line category and on local particular situations. This periodic monitoring can cover strategic corridors or be limited to selected obstacles such as bridges as tunnel.

Besides, measurement of clearance railway gauge can be due to additional **feasibility studies related to a request of exceptional consignment**. (The procedure applied is described afterwards).

No case of gauge enhancement at the request of RUs has been reported in the last years.

Furthermore, Adif is collaborating, through punctual advice and answering specific questions, in the design of two lower-wagons (developed by different manufacturers) for the transportation of trailers.

The development of the wagons is very advanced and it is expected that numerical simulations and measurements track will be made for the analysis of rail gauge in certain singular points (tunnels) in the corridors required by manufacturers as future receiver of their freight traffic.

During the last years, certain corridors, with Iberian Gauge (1668 mm), were selected in the conventional network to evaluate the existing gauges and analyze the expected passage of freight transport with excess dimensions with respect to kinematic gauge of different profiles collected in the series of UNE-EN-15273 (from EN *15273* Railway Applications – Gauges) and other profiles specifically detailed for the studies (P400 and P450).

The aim of providing such comprehensive information arises from the growing demands of freight traffic (tracks, semi-trailer and swap bodies to be transported by rail) with the objectives of:

- Transferring the freight traffic from the road to the railway
- Reducing the freight traffic by road
- Minimizing the long-journeys of truck-drivers.

A special attention was made on tunnels, overpasses, platforms, bridges, height of the overhead contact line and any other element that could also be considered as singular point with the possibility of interfering with the kinematic gauge.

Measurements and analysis were performed on sections with partial correspondence with the corridors belonging to the TEN-T (Trans-European Transport Network), corridor 4 (Atlantic) and 6 (Mediterranean). The information obtained has to be transferred to the National Register of Infrastructure (RINF) according to the common specifications of the register of railway infrastructure, current Decision 2014/880/EU.

All the actions concerning the clearance gauge analysis are financed by the Railway Administration (Adif).

It is a long process, from the planning of the work, to the implementation of the measures, analysis of results and redaction of deliverables. Therefore, this procedure does not answer to specific demands of freight traffic.

Future actions arising from measures

At present, from all the information gathered in the various corridors, it is being quantified the possible intervention in the singular points detected to adapt them to the standards required and the desirable conditions of service.

From the results, it should be analyzed the feasibility and capacity to act on a set of "bottlenecks" in a corridor, or establish priorities for action on the network and in a medium-long period of time.

It would be ADIF (through investment budget, or other national or EU funding programs) who will finance the possible enhancement in the infrastructure.

So far, enhancement in the infrastructure, in existing sections in service, have been developed from a located-based point of view, punctually, and taking advantage of improvement works in certain infrastructure (such as tunnels or bridges) or the renewal of track at the end of the useful life of the superstructure.

8.4. IP (Portugal)

In Portugal, IP decides for gauge enlargement mainly for technical reasons, e.g. the renewal of an existing tunnel to allow the railway line electrification.

In this case of tunnels renewal or excavation, the Portuguese NSA (ANPC – National Authority of Civil Protection) is only involved in the development of evacuation plans. They provide help for the observance of the compliance of security and safety rules, in terms of access and rescue.

When a gauge enlargement is carried out, they are mostly based on the installation gauge study of which, in turn, the calculation is based on the reference profile (PTb+ or PTc). It is intended that projects for new lines consider the reference profile PTc+, higher than Ptb+ and PTb.

8.5. Trafikverket (Sweden)

The rail share of the land based freight transports is much higher for Sweden (2008: 35%) than for Europe EU27 (18 %) [10]. A considerable increase of the combined transports has been observed during the last 20 years, largely explained by the development of the shuttle trains to/from the port of Gothenburg.

The Swedish network is characterised by three national gauge reference profiles: SEa, SEb and Sec (ill. 30).

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[10] 15 years deregulated rail freight market – lessons from Sweden, Inge Vierth, Swedish National Road and Transport Research Institute, VTI

The entire railway network can be operated by vehicles that fulfil the requirements for dynamic reference profile SEa and static reference profile A (maximum width 3,400 mm and maximum height 4,650 mm), which includes the European GA and GB profiles.

Dynamic reference profile SEc (maximum width 3,600 mm and maximum height 4,830 mm) is an extended profile that is being implemented on all new lines. Reference profile SEc may only be shipped as an exceptional transports at the moment. [11]

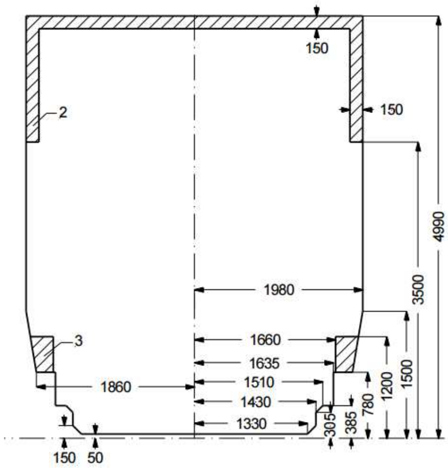

Illustration 29. Swedish dynamic reference profile SEc

Through market studies, monitoring of the road traffic volumes and on the basis of various dialogues with the operators, Trafikverket has undertaken an evaluation of the opportunities and potential benefits of gauge enlargement on modal shift and increase of rail market share.

Based on demand from market, policy decision (at government or IM level) and on studies (technical, economical and on traffic) to identify the priorities and set up the financing structures. This lead to a gauge enlargement plan on different routes that mostly focuses on combined traffic.

On the main lines of the Scan-Med corridor, Trafikverket is investigating the economical feasibility of larger clearance gauge and the social-economical feasibility of gauge enlargement.

The funding of the removal of obstacles is based on the line upgrading funds budgeted by the Infrastructure Manager. No request for financial contribution from the railway undertakings is considered up to now.

The National Safety Authority is not involved in the process.

8.6. CFR (Romania)

In Romania, the reference profile is defined by the Romanian standard STAS 4392/86 and railway regulation 328/2008 on allowance and operation of exceptional transportation on the public railway infrastructure. From 31 May 2010, the Romanian Standard Association (ASRO) has transcribed as a national standard the European Norm EN 15273-3 "*Railway application. Gauges. Structure gauges*"[12].

The gauge enlargement plan on the Romanian CFR network is targeting an expansion to the UIC GC profile whenever major modernisation works and structure renewals are undertaken, mostly on the routes of the 4th Railway Freight Corridor as well as some major lines outside the corridor.

These works include path corrections, tunnel enlargements and more rarely bridge heightening.

Undertaken under the responsibility of CFR infrastructure bodies (track National Department, Regional Divisions and local track establishments), these modernisation

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[11] Trafikverket, Network Statement 2016 – Edition 2014-12-12

[12] EN 15273-3:2013 "*Railway application. Gauges. Structure gauges*"

works are funded for 25% on State budget and 75% on European Cohesion Funds for the 4th RFC and fully on State budget for other lines.

These investments are mostly motivated by the engagement of the Romanian State Railways and the Romanian government to comply the AGC and AGTC agreements[13,14] , to which the state is committed through the Romanian 8/1993 law.

8.7. Rail Freight Corridor 1 – Enlarging the gauge to P400 in Switzerland and Italy.

Whereas the route sections of the Rhine-Alpine corridor in Netherlands, Germany and Belgium are already open to P400 operation, the Saint-Gothard and Ceneri (between Bellinzona and Lugano) in the near future will soon open an alternative route to the Loetschberg-Simplon large gauge section.

In Switzerland, the law for transport of goods modal shift (Loi de Transfert du Transport de Marchandises, LTTM) came into force on 1st of January 2010 and set up the objective of shifting a yearly volume of 650 000 transalpine journeys of heavy good transports from road to rail. This objective must be achieved within two years after the opening of the Saint-Gothard base tunnel, i.e. by June 2008. The Saint-Gothard route becomes an essential element of the corridor. However, although the commissioning of the GBT is expected to provide a very positive impact on the desired modal shift, its start of operation will not be sufficient by itself to reach the objectives, and the Federal Council acknowledged the necessity of enlarging the whole route to a 4m gauge.

Switzerland is planning to complete a further project aimed at delivering efficient rail services by 2020 – a continuous, four-metre railway corridor from Basel through the Gotthard and Ceneri Base Tunnel to northern Italy. Switzerland is also investing CHF 990 million (EUR 900 million) in upgrading the existing railway infrastructure on the approach routes to the Gotthard.

In addition, a clearance gauge limitation remains south of the Alps, on the Italian routes of Chiasso and Luino.

In the framework of a general land use planning and development of the Region of Lombardy, and especially in view of the Universal Exhibition in Milano and in connection with the opening, in June 2016 of the GBT, the Italian Infrastructure Manager RFI started a program for enhancement of the railway infrastructure of a global amount of 3.8 G€. This programme was mainly aiming at solving the rail bottlenecks in the Milanese area for the benefit of commuting traffic, of average and long distance passenger traffic and for an increase of freight transport capacity on the North-South (corridor 1) and East-West (corridor 4) axis.

[13] European Agreement on Important International Combined Transport Lines and Related Installations (AGTC), Geneva 1 February 1991. United Nations, 2010.

[14] European Agreement on Main Railway Lines (AGC), Geneva 31 May 1985, United Nations.

The planned works include in particular an enhancement to P/C 80 gauge of the two lines connecting the Saint-Gothard tunnel to Milano via Chiasso and to Novara via Luino. The tunnels of these two lines need to be enlarged, and the tracks upgraded to axle load category D4. In 2020, once the improvements have been completed on both the Italian and Swiss sides, a capacity of 390 trains per day is expected, compared to the current 290, 170 of which to the Chiasso pass, 90 to the Luino pass and 130 to the Domodossola pass.

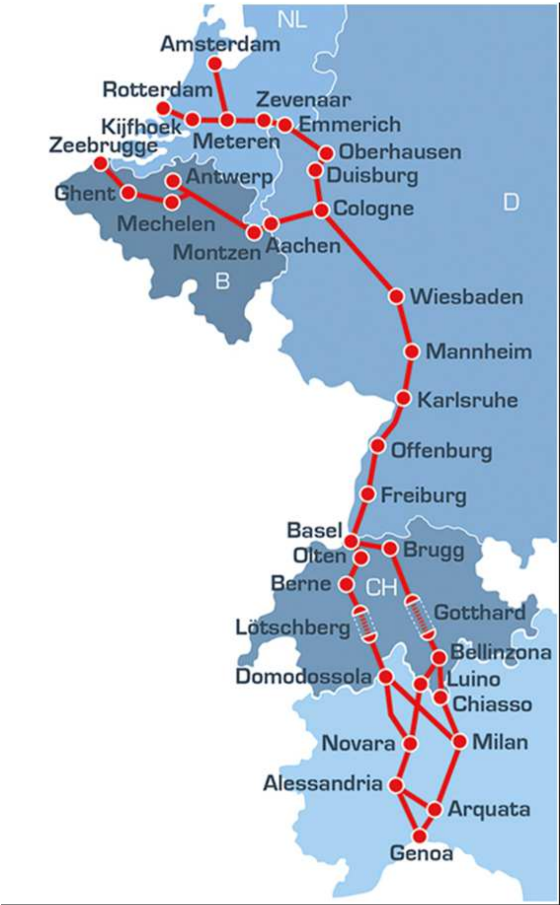


Illustration 30. Map of the Rhine-Alpine corridor

The financing of these works was agreed through a memorandum of understanding between the Italian government and the federal government of Switzerland, this latter taking financially in charge the costs on the Luino line.

As soon as year 2012, an interest group associating the operators RALPIN, VAP and HUPAC, supported by the UIRR, the UTP and the ERFA have signed a position paper to denounce what they consider as an unbalanced investment between the two lines, with a excessive focus given on the Chiasso line and under-investment on the Luino line, while this latter is currently supporting about 80% of the unaccomapiend combined transport (UCT) between the St-Gothard tunnel and the Genova terminals.

Switzerland and Italy signed an agreement in 2014 to secure the required expansion work on the Italian side. The Swiss Parliament provided credit of CHF 280 million (EUR 255 million) for investment in Italy, such as on the Luino line.

Italy has a priority interest in the development of the railway infrastructures that form part of the Rhine-Alpine Corridor, and in the European Corridors in general, due to their strategic contribution to the country's competitiveness and economic and employment growth.

8.8. Conclusion

Knowing the needs

During decades, the adjustment of the infrastructure to the operation needs were permitted by close and natural contacts within the integrated national companies. The arrival of new market players and the separation between historical operators and infrastructure managers have disrupted these natural links, and impose to find new ways to reconnect and harmonise procedures.

Up to now, their apparently exists no formal procedure through which an operator would request a gauge enlargement to an IM.

However, a large number of active exchanges between the infrastructure managers and their clients are of course existing and regularly make the IMs aware of the operational needs of their customers. Either through direct individual business contacts, at the first level, or through the Corridors' Railway Undertaking Advisory Groups (RAG) where RU can voice their requirements. The ECCO project gave the Railway Undertakings an opportunity to express their recommendations at the earliest stage of RFC implementation. In the field of clearance gauge, they clearly claimed for a P400 as an overall standard.

At the highest level, the annual "High Level Freight" meetings held jointly by UIC and CER, that brings together the railway freight undertakings' CEO, and the initiative of nine of them to implement a "CEO task force", brings a high level support to discussions related with the increase of railway competitiveness and provides help for a purely RU position to be developed and voiced. The discussions cover 17 items, including "train parameters" which is mostly dealing with longer and heavier trains but which has not addressed the clearance gauge yet.

From a technical point of view, defining a technical target for gauge enlarging requires an accurate and harmonised codification, both for the load and for the line. This partly explains (together with the growth of this particular market) why combined transport and its associated P/C codification are mainly focused and successful.

Attempts towards further harmonisation for other exceptional consignments are being made, for example with the UIC 502 working group and UIC leaflet 502-2. However, the issue of harmonised and easy codification is still an obstacle to achieve substantial progress for the following reasons:

- RUs and IMs complain about not speaking the same language, due to the lack of harmonised and integrated infra/load codification system
- RUs have often a low understanding of the meaning, principles and constraints of infrastructure codification
- IMs themselves not always have the sufficient expertise (and/or information) to codify their own lines.

It is a strong demand from the RUs that information on clearance gauge should be given in terms they easily understand.

Gauge measurement

Clearance gauge measurement is not by itself a request from railway undertakings, and there is no clear example of such.

Clearance gauge measurement might be needed by infrastructure managers to check the codification or capability of their lines, when the available measurement database do not provide sufficient reliability.

Therefore, there is no identified procedure for a RU to request a measurement, except that this measurement is a consequence, upon the IM's needs and decision, of a request for exceptional consignment, generally presented according to the UIC 502-1 leaflet.

IM's plans

There is an expressed need from railway undertakings, to have a better vision of the expected evolution of the networks where they operate, planned by the infrastructure managers in the coming years.

The increasing involvement of the RUs in the discussion, through the corridor RAGs makes it easier and for them to specify their needs and to be effectively aware of the IM's plans.

In general, a more systematic display of the expected modification of the network parameters is wished by the customers. It however faces the reluctance of some IMs to provide non-contractual information on some development intentions that could finally not come true.

Deciding and financing

It results from all questionnaires, interviews and discussions with all parties that no case of a clearance gauge enlargement decided by an IM upon the request of a single RU can be reported.

The above examples of gauge enlargements show that clearance gauge upgrading works throughout Europe are undertaken upon several grounds and under several financing conditions:

- In France, a concern to rebalance the traffic on corridor 2 and develop an alternative and natural route from the North Sea ports to the Mediterranean sea
- In Switzerland, the Federal commitment to shift a major part of road traffic to rail
- In Italy, the will to develop the Lombardy region and the need to channel the traffic coming down from Switzerland,
- In Sweden, a will to increase the rail market share and remove trucks from the road.
- In Romania, a legal commitment to increase the standards of the main lines and corridor routes.

To each of these motivations correspond particular ways of funding. Public funding is of course mobilised each time legal grounds are dictating the infrastructure upgrading (Switzerland, Romania, Italy). In some cases, railway undertakings can intervene into the debate and express their concern for an appropriate (re)allocation of public funds (Italy).

When only market considerations are involved, the infrastructure managers are facing a more problematic question, as the economical profitability of the enlargement is often insufficient for them to finance on their own. Three non-exclusive solutions can then be considered:

- A call for public funding, that generally needs the support of an in-depth business case study,
- A call for the contribution of the railway undertakings which are operating (or likely to operate) on the considered route, requesting transparency and good will from all parties
- Recourse to low-cost but long-term technical solutions, taking benefit of regular maintenance or investment operations on tracks to progressively tackle at the same time the gauge issue.

Establishing an adequate funding requires conducting detailed market analysis that need to be systematised, standardised and extended to all potentially interested RUs. In this respect, the current role of UIC is of major importance, with the monitoring of market trends in combined transport by its Combined Transport group, and the biennial issue of the "Combined Transport Report".[15]

In any case, it is reported that

- financing from the only IM is rarely possible, as the expected incomes hardly cover the costs induced by the traffic growth,
- financing from individual RUs is neither possible since the benefit that results from the enlargement is collective.

At technical or decision level, appears the urgent need for an international coordination that is currently missing.

[15] Report on Combined Transport in Europe, International Union of Railways, Paris, biennial edition.

ANNEX I. LIST OF ABBREVIATIONS.

List of abbreviations used in the document.

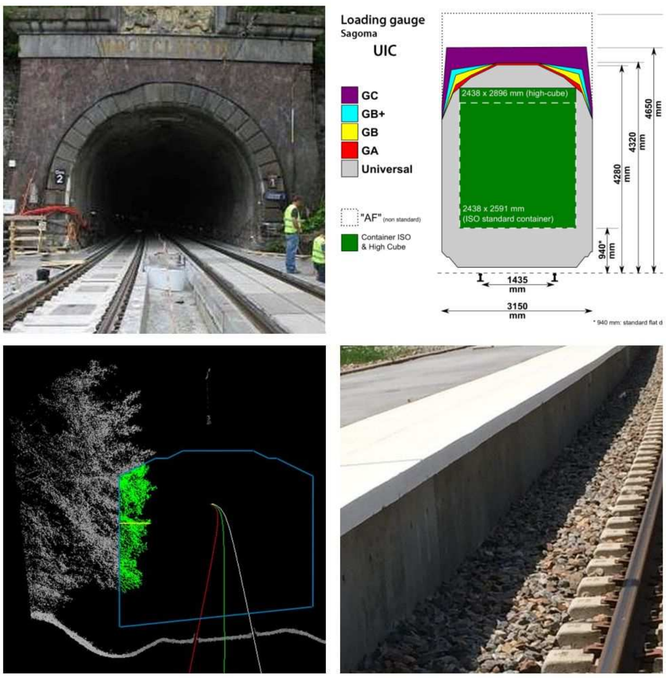
CID	Corridor Information Document
CT	Combined Transport
EMU	Electric Multiple Unit
EUAR	European Union Agency for Railways
GIS	Geographical Information System
IM	Infrastructure Manager
ILU	Intermodal Loading Unit
ITU	Intermodal Transport Unit
NS	Network Statement
NS-CS	RailNetEurope Network Statement Common Structure
NSA	National Safety Authority
RAG	Railway Undertakings Advisory Group
RFC	Rail Freight Corridor
RNE	RailNetEurope
RU	Railway Undertaking
RINF	European Register of Infrastructure
TSI	Technical Specification for Interoperability
UIC	International Union of Railways
WG	Working Group

ANNEX II – QUESTIONNAIRE TO IMS

European Commission

Study on Measuring and Upgrading the Clearance Gauges of Railway Lines

Contract number – MOVE/B2/SER/2013-825



Questionnaire to Infrastructure Managers

DOCUMENT IDENTIFICATION	
Client	European Commission – Directorate General for Mobility and Transport
Study	Measuring and upgrading the clearance gauges of railway lines
Document title	Questionnaire to Infrastructure Managers
Date	02/04/2015
Document name	RW_Gauge-OUTPUT-Final Report_WP1-2_2016-11-24.docx
Number of pages	15

ABOUT THIS QUESTIONNAIRE

On the European Railway Network, and especially on freight corridors, insufficient track clearance gauge might on some lines generate bottlenecks and constitute a major barrier to a potential increase of traffic. The *European Railway Gauge* project, funded by the European Commission, aims at investigating and demonstrating how targeted and appropriate increase of track clearance can aid in capturing some new market opportunities and initiate a modal shift from road to rail.

One risk is that poor knowledge of the track clearance gauge conditions or inadequate management of the information could even lead to neglect some traffic opportunities that could be physically possible.

Therefore, it appears that the management of the track clearance gauge information by the infrastructure managers is a crucial process all along its different steps, from the physical measurement of infrastructure characteristics to the delivery of the right up-to-date and reliable information to the stakeholders.

In view of enhanced cooperation and interoperability, this questionnaire is intended to highlight best practices in clearance gauge data management by Infrastructure Managers.

On the 29th of September, a Seminar will be held at UIC Head Quarters, in Paris. This will be the occasion to discuss this issue with other stakeholders, get initial feedback on this questionnaire, clarify some points if needed and exchange on various practices and experience.

You are of course cordially invited to attend this event (registration is open here) and to propose a presentation if you think relevant.

Do not hesitate to add any documentation or information available that could be of interest.

We thank you for your interest and for your time.

The Project Team.

YOUR IDENTIFICATION

Network /
Company:

....

Name of contact person:

....

Department /
Division:

....

....

....

Position:

....

Telephone
number:

....

E-mail address:

....

Confidentiality of the questionnaire:

Information collected through this questionnaire will be compiled anonymously, with the only inx Please, indicate if your answers to this questionnaire can be disclosed:

- O Freely
- O Anonymously

Any remark:

....

....

....

....

....

....

1. Clearance Gauge Monitoring

1.1 - When and how is the measurement/monitoring of the line gauge decided and launched (several answers are possible).

☐ Periodic measurement as part of infrastructure maintenance (if yes at what frequency is the monitoring carried out)?

☐ Measurement / control after infrastructure works

☐ After maintenance works likely to impact the gauge

☐ After investment works, such as infrastructure or structure renewal, line upgrade

☐ Measurement before infrastructure works. Please describe (e.g. line upgrade, infrastructure renewal, …)

☐ Measurement before introducing new rolling stock

☐ On specific demands, e.g. in prevision of exceptional traffic

Any comments:

⇨ ....

....

....

....

1.2 Depending on the above situations, how is the gauge measurement budgeted/funded (maintenance budget, investment budget, payment from customer)

⇨ ....

1.3 Depending on the above situations, with which delay/notice is this measurement completed? How long in advance has it to be planned?

⇨ ....

1.4 With which periodicity(ies) are the clearance gauges controlled?

⇨ ....

1.5 On what criteria/factors do these periodicities depend on?

⇨ ....

1.6 Does your network manager have written regulations ruling the clearance gauge control process?

⇨ ....

2. Measurement method

2.1 Please describe the principles and tool used for the gauge measurement. Any additional documentation is welcome.

⇨ ....

2.2 Who does the device belong to (infrastructure manager, external company)?

⇨ ....

2.3 By whom has this device been developed (internal development, external purchase)

⇨ ....

2.4 By whom is the measurement carried out?

☐ Internally, by the infrastructure manager staff and tools

☐ by the infrastructure manager staff operating external tools

☐ by an external company

☐ other

3. Clearance Gauge maintenance

3.1 Is there any intervention/alert limits system applying when a discrepancy is observed?

⇨ ……

3.2 What are the average delays before intervention? What do they depend on?

⇨ ……

3.3 Who is in charge?

⇨ ……

3.4 How are maintenance works and possible clearance gauge modifications documented and reported for database management?

⇨ ……

3.5 What if maintenance cannot be carried out in due time? Temporary speed restriction? Traffic restriction?

⇨ ……

3.6 Are infrastructure maintenance works likely to impact the gauge identified and are there regulations to describe how to take care of the gauge?

⇨ ……

3.7 When undertaken infrastructure works temporarily reduce the available clearance, how is this anticipated and managed? How is the information documented and shared?

⇨ ……

3.8 Are you planning any technological or policy changes in the near future, regarding monitoring and maintenance of clearance gauge?

⇨ ……

4. Gauge enlargement

4.1 Decision-making: based on case studies, please describe how gauge enlargement decisions are made (reason and analysis leading to enlargement decision, delay, financing, technical studies, contractor…)

⇨ ……

4.2 How is your National Safety Authority (NSA) involved in this process?

⇨ ……

4.3 How would you qualify/describe your relationship with the NSA, regarding their agreement for gauge enlargement projects? Delay? Obstacles and difficulties?

⇨ ……

4.4 When a gauge enlargement is carried out, which gauge type (verification, installation or nominal gauge) is the study based on?

⇨ ……

5. Gauge studies and transport authorizations

Is there a special department of the Infrastructure Manager in charge of the gauge topic and exceptional transports authorization?

⇨ ……

5.1 How is the request for specific study received and transmitted to this department (or subcontractor)? Please describe

⇨ ……

5.2 What is the average delay to answer a specific demand?

⇨ ……

5.3 Is the study carried out internally or externally, by a contractor?

⇨ ……

5.4 In any case, whom is the study verified by?

⇨ ……

5.5 How is this department informed of temporary or permanent clearance gauge change?

⇨ ……

6. Information given to other stakeholders

RINF and Decision 2011 633/EU – Specification for the infrastructure register under Directive 2008/57)

6.1 What is the role of your Company in the fulfillment of National obligations regarding RINF and Decision 2011 633/EU – Specification for the infrastructure register under Directive 2008/57 on interoperability)?

☐ In charge of setting up and maintaining the RINF at National level

☐ Contributor to the National Infrastructure Register, maintained by another entity (specify which one)?

☐ Other:

6.2 What data format(s) are you using to exchange/manage infrastructure data at National level (XML, other…)?

⇨ ……

6.3 Have you identified obstacles to the implementation of the Decision 2011 633/EU requirements?

⇨ ……

Information on clearance gauge given to Railway operators

6.4 How are the gauge data made available to Railway Operators?

- Full availability on a website or server
- Periodic publication of network data (e.g. Network Reference Document) including available gauges and limitations
- On demand
- Other ………

6.5 How are the operators aware of planned, temporary or accidental gauge modifications? Channel, delay

⇨ ……

6.6 Is the information given for free or upon payment?

⇨ ……

6.7 Which is the format of the line characteristic descriptions? (e.g. Tabs, Maps or both) If possible annex to the questionnaire a sample.

⇨ ....

6.8 Which is the IT format of the file?

⇨ ....

6.9 What is the mesh of provided data (e.g. for the whole line, between nodes, every x meters…)?

⇨ ....

6.10 Is there any specific communication given about bottlenecks?

⇨ ....

6.11 Is the data available for the whole network or only parts of it? Which ones? Why?

⇨ ....

6.12 Do you inform the operator(s) about future development of the network permitting them to develop new traffics?

⇨ ....

6.13 Do you offer an IM IT system that allow operators to check if the desired characteristics of a train are allowed on the lines? (If Yes briefly describe the functionalities)

⇨ ....

7. Data management and databases

7.1 Organisation of the railway gauge data governance

Data governance is considered here as the set of procedures and organisations implemented to follow up the data life cycle. What is the data update cycle? How is the update triggered? Who are the information managers? Who is responsible for data validation? Upon which criteria? A which moment?

⇨ ....

7.2 How are the data accessible for the staff in need of it (for creation, consultation, update)?

☐ In a centralized information system?

☐ In an intranet-borne database?

☐ Shared Excel sheet?

☐ Paper data?

☐ Other?

7.3 What are the rules and procedures for updating clearance gauge data? (when, who, how?)

⇨ ....

7.4 How are the quality and reliability of the information controlled?

⇨ ....

7.5 What kind of tools are you using for railway gauge data management?

☐ In-house developed tools, (database, dedicated applications, Excel sheet…)

☐ Purchased applications

☐ Other

7.6 If several tools are used at the same time (e.g. for different applications), how are they linked and coordinated together to ensure the reliability and quality of data?

⇨ ....

7.7 Do you currently face difficulties in the management of clearance gauge data?

⇨ ....

7.8 Are you planning any technological or policy evolution in the near future, regarding management of clearance gauge data management?

⇨ ....

4. Suggestions and expectations

Do you have any suggestion or expectation from the European Commission to support you in an easier and more efficient management and sharing of Railway clearance gauge data?

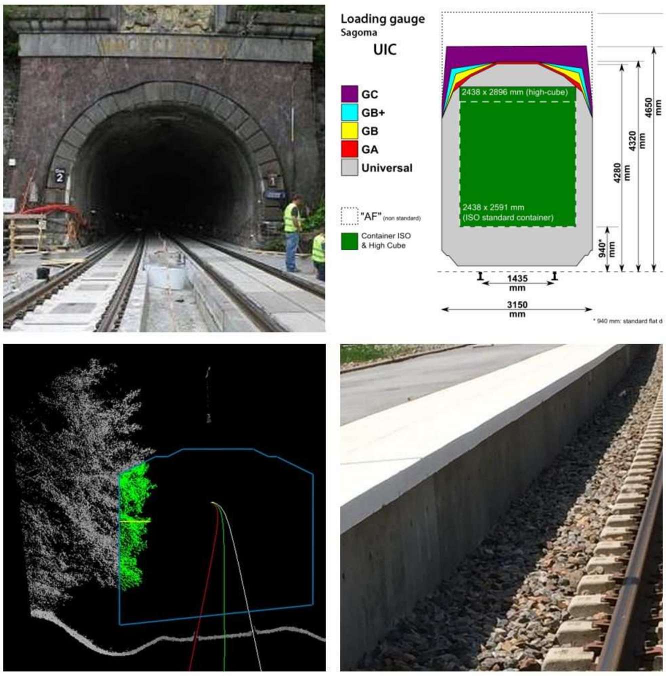
⇨ ....

ANNEX IIa – QUESTIONNAIRE TO RUs

European
Commission

Study on Measuring and Upgrading the Clearance Gauges of Railway Lines

Contract number – MOVE/B2/SER/2013-825



Questionnaire to Railway Undertakings

MEASURING AND UPGRADING THE CLEARANCE GAUGES OF RAILWAY LINES

DOCUMENT IDENTIFICATION	
Client	European Commission – Directorate General for Mobility and Transport
Study	Measuring and upgrading the clearance gauges of railway lines
Document title	Questionnaire to Railway Undertakings
Date	20/07/2015
Document name	RW_Gauge-OUTPUT-Final Report_WP1-2_2016-11-24.docx

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The Project Team.

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Company:

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Name of contact person:

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Department / Division:

……

……

……

Position:

……

Telephone number:

……

E-mail address:

……

Confidentiality of the questionnaire:

Please, indicate if your answers to this questionnaire can be disclosed:

- ○ Freely
- ○ Anonymously

Any remark:

……

……

……

....

COMPANY INFORMATION

Country:

....

N. Employees:

....

Train - km x Year

total:

....

....

% in combined

traffic:

....

% in international

traffic:

....

What kind of wagons do you use for combined transport and how high is the floor level above the top of the rail in cm?

....

1. Information accessibility

1.1 On which Networks are you operating?

⇨ ……………………………………………………………………………………………………

1.2 Do the network statement, register of infrastructure and corridor document of the networks where you operate provide information that is complete and sufficient for your needs?

⇨ ……………………………………………………………………………………………………

1.3 What is the time to response when you must request additional clearance gauge data from the infrastructure manager (that is, when the documents listed in 5.2 above are not sufficient)?

⇨ ……………………………………………………………………………………………………

1.4 Is the clearance gauge data provided easy to use and understand?

……………………………………………………………………………………………………

1.5 Does the Infrastructure Manager levy charges from users for getting clearance gauge information?

⇨ ……………………………………………………………………………………………………

1.6 Does the Infrastructure Manager have a Website? (If Yes insert the link)

⇨ ……………………………………………………………………………………………………

1.7 Which languages are available on the website?

⇨ ……………………………………………………………………………………………………

1.8 Are the technical line specifications available and accessible? If Yes, are they public or in a restricted area?

⇨ ……………………………………………………………………………………………………

1.9 Are the gauge details available for the whole network?

⇨ ……………………………………………………………………………………………………

1.10 How would you qualify the user friendliness of the website interfaces, in particular for the part concerning clearance gauge information? (Is the website

easy to understand and use? Is the information provided easy to understand and use? Etc.)

⇨ ....

1.11 Which codes are used to define the clearance gauge characteristics? (e.g. National Code, UIC Standard, Detailed measures, P/C code)

⇨ ....

1.12 Are line codifications the only data provided regarding clearance gauge, or is supplementary information also provided?

⇨ ....

1.31 Is there an infrastructure manager-side IT system that allows operators to check if the desired technical characteristics of a train are allowed on the lines? (If Yes briefly describe the functionalities)

⇨ ....

1.14 Would you be interested in the open source availability of a geographic system that allows you to check the technical characteristics of the rail network all over Europe? (Which kind of expectations you would have from this system?)

⇨ ....

2. Proposals to improve information accessibility

Do you have any suggestion or expectation from the European Commission to support you in an easier and more efficient management and sharing of railway clearance gauge data?

3. Network development

3.1 Does the Infrastructure Manager inform you about future development of the network permitting you to develop new traffic in time? (Detail your answer)

⇨ ....

3.2 have you requested in the last five years measurements and/or enlargements of railway clearance gauge?

⇨ ....

3.3 What would be the ideal loading gauge enhancements to develop your business (nature and location)? (Detail for existing or new route)

⇨ ....

3.4 What impact do you expect these enhancements will have on the traffic? (If PXX or CXX is available on this route, we may offer XX additional roundtrips per day or week)

⇨ ....

3.5 Does clearance gauge pose a problem to the development of your business in your target countries?

⇨ ....

3.6 Do you often have to use low wagons to have the possibility to transport your freight?

⇨ ....

ANNEX III – LIST OF CONTACTED RUs

Country	RU Name
Austria	Cargo Service GmbH
	ecco-rail GmbH
	FLOYD Szolgáltató Zrt.
	LTE Logistik- und Transport-GmbH
	PKP Cargo S.A.
	Raaberbahn Cargo GmbH
	Rail Cargo Austria AG
	RTS Rail Transport Service GmbH
	Steiermarkbahn Transport und Logistik GmbH
	TX Logistik Austria GmbH
	Wiener Lokalbahnen Cargo GmbH
Belgium	CapTrain Belgium
	CFL cargo S.A
	Crossrail
Bulgaria	BDZ Cargo
	Bulgarian railway company AD
	CARGO TRANS VAGON BULGARIA
	EXPRESS SERVICE LTD
	GASTRADE S.A.
	Rail Cargo Austria AG
Croatia	ADRIA TRANSPORT
	RCC Kft.
	RTS Rail Transport Service GmbH
Czech Republic	Advanced World Transport a.s
	BF Logistics s.r.o.
	ČD Cargo, a.s.
	IDS CARGO a.s.
	LOKO TRANS s.r.o.
	LTE Logistik a transport Czechia s.r.o.
	METRANS Rail s.r.o
	Ostravská dopravní společnost, a.s.
	PKP Cargo S.A.
	RCC Kft.
	RM LINES, a.s.
	UNIPETROL DOPRAVA, s.r.o.
Denmark	Captrain Sweden AB
	CFL Cargo Danmark
	Hector Rail AB
	TX Logistik AB
Estonia	AS E.R.S.
	AS EVR Cargo
	AS Sillamäe Sadam
	Edelaraudtee AS
	LEONHARD WEISS RTE AS
	Maardu Raudtee AS
	OÜ Dekoil
Finland	Destia Rail Ltd
	Komsor Oy
	KTI-Urakointi Ay
	Proxion Train Oy
	VR Track Oy
France	EuroCargoRail
	Europorte France
	TX Logistik AG
	VFLI
Germany	EBM Cargo GmbH
	ecco-rail GmbH
	ERS Railways

Country	RU Name
Germany	Freightliner DE GmbH
	Hector Rail AB
	KombiRail Europe B.V.
	Lokomotion GmbH
	RheinCargo GmbH & Co. KG
	RTS Rail Transport Service GmbH
	SBB Cargo Deutschland GmbH
	TX Logistik AG
	Wiener Lokalbahnen Cargo GmbH
Grece	TRAINOSE
Hungary	AWT Rail HU Zrt.
	BILK
	GySEV CARGO Zrt.
	HUNGRAIL
	Rail Cargo Hungaria Zrt.
	RCC Kft.
Italy	Captrain Italia S.r.l.
	CFI SpA
	Crossrail Italia S.r.l.
	DB Schenker Rail Italia S.r.l.
	FUORIMURO Servizi portuali e ferroviari S.r.l.
	GTS RAIL Srl
	Impresa Ferroviaria HUPAC SpA
	InRail S.p.A.
	Interporto Servizi Cargo S.p.A
	Rail Cargo Carrier - Italy srl
	RTC SpA
	SBB Cargo Italia srl
	Serfer - Servizi Ferriovari S.r.l.
	TX Logistik AG - Filiale Italia
Latvia	Joint-stock company "BALTIJAS TRANZĪTA SERVISS"
	Limited company "LDZ CARGO"
Lithuania	AB "Lifosa"
	AB "ORLEN Lietuva"
	AB "Vilniaus gelzbetoniniu konstrukciju gamykla Nr. 3"
	Joint-stock company "Lietuvos gelezinkeliai"
	LKAB "Klaipedos Smelte"
Luxemburg	CFL cargo S.A
Norway	CargoLink AS
	Hector Rail AB
	LKAB Malmtrafik
	Tågåkeriet i Bergslagen AB
	TX Logistik AB
Poland	Advanced World Transport a.s.
	BARTER SPÓŁKA AKCYJNA
	Bronisław Plata P.H.U. „LOKOMOTIV" Bronisław Plata
	CEMET S.A.
	CTL Express Sp. z o.o.
	DB Schenker Rail Polska S.A.
	ECCO RAIL SPÓŁKA Z O.O.
	FREIGHTLINER PL Sp. z o.o.
	Grupa Azoty "KOLTAR" spółka z ograniczoną odpowiedzialnością
	Inter Cargo Spółka z ograniczoną odpowiedzialnością
	LOTOS Kolej sp. z o.o.
	PCC INTERMODAL S.A.
	TORPOL S.A.
	ZAKŁAD INŻYNIERII KOLEJOWEJ LEŚKIEWICZ, KOSMALA Spółka jawna
	ZUE Spółka Akcyjna

Country	RU Name
Portugal	CP Carga - Logística e Transportes Ferroviários de Mercadorias, S.A.
Romania	RAIL CARGO CARRIER-ROMANIA
	S.C. VEST TRANS RAIL S.R.L.
	SERVTRANS INVEST
	SOCIETATEA NATIONALA DE TRANSPORT FEROVIAR DE MARFA "CFR-MARFA" S.A.
	TEHNOTRANS FEROVIAR
	TRANS RAIL
	TRANSFEROVIAR GRUP
	UNICOM TRANZIT
Slovak Republic	CENTRAL RAILWAYS, a.s.
	CER Slovakia a.s.
	Express Group
	LOKORAIL
	LTE Logistik a Transport Slovakia s.r.o.
	METRANS /Danubia/
	Petrolsped Slovakia, s.r.o.
	PRVÁ SLOVENSKÁ ŽELEZNIČNÁ, a.s.
	Železničná spoločnosť Cargo Slovakia, a.s.
Slovenia	Adria Transport d.o.o.
	Rail Cargo Austria AG
	SŽ - Tovorni promet d.o.o.
Spain	ACCIONA RAIL SERVICES, SA
	COMSA RAIL TRANSPORT, S.A.
	CONTINENTAL RAIL
	LOGITREN FERROVIARIA,S.A.U.
	TRACCIÓN RAIL, S.A.
	TRANSFESA RAIL, S.A.U.
Sweden	BS Skandinavia
	Captrain Sweden AB
	CFL cargo Sverige
	DB Schenker Rail Scandinavia A/S
	Green Cargo AB
	Hector Rail AB
	LKAB Malmtrafik
	Rushrail
	Tågåkeriet i Bergslagen AB
	TMRail AB
	TX Logistik AB
Switzerland	BLS Cargo AG
	Crossrail
	DB Schenker Rail Schweiz GmbH
	railCare AG
	Transalpin Eisenbahn AG
	TX Logistik GmbH
The Netherlands	CapTrain Belgium
	Crossrail Benelux
	ERS Railways
	KombiRail Europe B.V.
	Locon Benelux B.V.
	Railtraxx
	RheinCargo GmbH & Co. KG
	Rotterdam Rail Feeding BV
	Rurtalbahn Benelux B.V.
	TX Logistik
United Kingdom	COLAS RAIL
	DB Schenker Rail International Limited
	Devon and Cornwall Railways Limited
	Direct Rail Services
	Freightliner Heavy Haul Ltd