Final report

on the activities of the

Task Force Freight Wagon Maintenance

Version: 1.0
Date: 05/10/2010
Status: Final document
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Change Control

Version No	Changed Section	Date	Description of Change
0.1	All new	16/07/2010	
0.2 and 0.3	All revised	27/07/2010	
0.4	All revised	28/09/2010	After consultation of participating NSAs, JSG and ERA services (participants to the TF)
1.0	Final version	05/10/2010	

Contents

1 Introduction

Following the accident in Viareggio (Italy) and the Agency's Preparatory Meeting on 20th August for the EC Conference on "Railway Safety: the way forward" held on 8th September in Brussels, the Agency agreed with the European Commission to set up a Task Force (TF) to discuss issues and propose measures on maintenance of freight wagons and in particular of wheelsets. The Task force should be made up of experts in the field of freight wagon maintenance and railway axles and coming from all stakeholders: Railway Undertakings (RU), keepers, Entities in Charge of Maintenance (ECMs), suppliers of railway components, National Safety Authorities (NSA), etc. The idea was supported and accepted by the NSAs and representatives of the sector organisations (CER, ERFA, ETF, UIP, UNIFE).

The TF had 7 meetings (18 September 2009, 27 October 2009, 24 November 2009, 16-17 December 2009, 2 February 2010, 20 April 2010 and 22 June 2010), of these only the December 2009 meeting was held in Viareggio (Italy), all the others were held in the Agency's premises in Lille.

An intermediate report was addressed to the European Commission in January 2010.

The objective of the task force was to address and develop maintenance and if necessary design measures as a follow-up to information on problems with broken axles of freight wagons (cases in AT, DE, IT).
The detailed objectives as stated in the terms of Reference are to:

- discuss relevant actions/information resulting from the EC Conference;
- exchange and analyse information relating problems with broken axles/fatigue and relevant testing methods;
- assist the sector and NSAs to establish sound evidence and advice on the causes of the
- problems with broken axles;
- propose/develop appropriate controls and monitoring tools;
- propose measures to review the different maintenance regimes existing across Europe and draw up a programme for further harmonization; and
- evaluate the role of standards for wheel-sets in the different countries.

For this purpose the sector set up a Joint Sector Group (JSG) composed of representatives of sector organisations and experts in standardisation (CEN) and focused on the following tasks:

- Establishing a risk assessment of the situation of problems with broken axles/fatigue
- Developing an inspection scheme of axles valid for the European Union
- Proposing an harmonised solution for overloaded UIC type A axles
- Harmonising the exchange of relevant data of wheelsets
- Harmonising the maintenance plans regarding the types of inspections and used NDTs

Nine NSAs joined also the Task Force: Austria, Belgium, France, Germany, Italy, Latvia, The Netherlands, Sweden and United Kingdom.

This final report on the activities of the Task Force focuses on the following results:

- The risk assessment performed by the JSG
- The Survey on the situation of broken axles in the European Union performed by the Agency
- The continued High Performance Operation of UIC type A wheelsets (Axle load above the nominal design load of 20 T)
- The European Visual Inspection Catalogue of axles including the sampling initiative
- The European Wheelset Traceability Catalogue
- The European Common Criteria for Maintenance
- The conclusions and continuation proposals.

2 Risk assessment

The current population of freight wagon axles is estimated by JSG to be 1.6 million in service, running 50 billion kilometres/year (average of 30.000 km/year/wagon).
The experts of the JSG studied 16 cases of broken axles that occurred between 1994 and 2009 for which they could gather accurate and sufficient detailed information.

Based on this study, no evidence of correlation has been found between broken axles and:

- UIC types A and B axle.
- Mechanical design:
  - Axle: no cracks in critical regions[1] have ever been observed and number of accidents remains too limited to have doubts on the design methods.
  - Running gear: design more or less equivalent on the Continent. The bogies Y 25 have been mounted for more than 50 years on the great majority of wagons. It will remain the standard bogie for lots of years.
- Age of axles: It means the age of the axle calculated since its manufacturing. The age of broken axles varies greatly.
- Maintenance plan.
  - Wheel wear: high mileage vehicles are more often in maintenance.
- Methods for non-destructive testing (NDT method).
- High Performance Operation (permanent overloading)

Nevertheless, the following conditions are still considered to have a possible impact on the state of an axle:

- Specific transport and operational regimes:
  - Dangerous goods: even if no correlation has been observed, wagons transporting dangerous goods are concerned because of the potential huge impact of an accident.
  - Wagons used in corrosive environment: transport of salt, potash, fertilizers,...

[1] Critical region is a term of mechanical engineering and means here areas of the axle where concentration of mechanical stresses may appear. Basically these areas are the transition between two different diameters (e.g. transition axle –wheel seat) or the junction wheel-axle

  - High loading factors such as bulk transport or High Performance Operation (permanent overloading)[2]
  - Impact due to drop loading (transport of containers, clay or scrap).
- Surface conditions: corrosion should be considered
- Derailment
- wheel tread damage caused for instance by vibrations caused by the state of the rails.
- Lack of traceability of wheelsets that may have as consequences the use of wheelsets that are not fit, out of maintenance or damaged.

The JSG was not capable to address more in detail the risks due to lack of time and resources and availability of additional accurate and sufficient information. Nevertheless, even if these observations have not been verified by the participating NSAs, they provided valuable information for the development of other activities within the Task Force.

In addition, the Agency made a survey on broken axles with the collaboration of the sector, of the NSAs and of the National Investigation Bodies that confirms the results of the risk assessment performed by the JSG.

3 Survey: situation of broken axles in the European Union

The Agency launched a survey to collect information on cases of broken axles through questionnaires addressed to NSAs. The NIBs were not addressed directly but it was asked to the NSAs to collect the national information and by the way to request to NIBs and national RUs (see details in annex 2).

The first part of the survey considered the period 2006-2009 to make possible the comparison between the values of the Common Safety Indicators provided by NSAs in annual reports. The second part of the survey considered the period 1990-2005.

Design standards are now commonly used for new wheelsets. Applicable standards vary from national standards such as in Poland to EN 13103/4 in many western and central European countries and specific industry standards in UK.

Regarding traceability of maintenance of wheelsets only 9 Member states have centralised databases.

Regarding the axles failures, 38 cases were reported between 2006 and 2009. Failures caused/due to hot axle boxes represent 80% of all failures (30/38). Fatigue is the other identified cause but always in conjunction with other factors such as metallurgic default or corrosion.

In the second part of the survey it was asked to NSAs to provide information on broken axles related to causes other than hot axle box between 1990 and 2005. 29 cases have been identified where corrosion appears 10 times[3].

[2] Even if no correlation has been found with broken axles.

Therefore corrosion may be seen as certainly not the main factor but requires further clarifications. The data collected during the second phase were transferred to the JSG after Agency's suggestion to analyse them in details. The Agency suggested also that research activities should be performed to define in detail and accurately the real role of corrosion in failures of axles.

4 The deliverables

The following sections report briefly on the developments of the JSG as part of this Task Force and the way they have been implemented.
These developments concern:

- Continued High Performance Operation (axle load above the nominal load of 20 T) of UIC type A wheelsets
- The European Visual Inspection Catalogue (EVIC)
- The European Wheelset Traceability catalogue (EWT)
- The European Common Criteria for Maintenance (ECCM)

4.1. Continued High Performance Operation of UIC type A wheelsets

A first possible cause of problems that has been investigated by JSG was related to the overloading of UIC type A axles. It appears that many operators/keepers have allowed these types of axles to be loaded above the nominal load of 20 tons, i.e. from 20,6 tons (e.g. France and Belgium since 1990) up to 22,5 tons (Sweden) without experiencing problems.
This overloading remains in conformity with the former design rules, so still within the design limits of the axles. For new axles, new rules were introduced in 1979 (ERRI B 136 RP 11)

No evidence of correlation has been found between broken axles and:

- the allowed minimum diameter of the wheel-seat which varies widely from country to country; or
- the design specifications (UIC type A design or older national rules).

Nevertheless, to increase operational safety further and in anticipation of new, more accurate calculation methods, the JSG proposed to the members of the respective sector associations to commit to continuously reduce loading of the type A I+II and A III-(1) axles from 21t to 20t axle load.

Additionally, when changing wheels and if the wheelset is operated at 20 tons axle load, the worn diameter of the wheel-seat will be limited to 182 mm, this will also mean the continuous phasing out of axles with wheel-seat diameters of 180 mm (mainly belonging to Trenitalia, ÖBB, SBB) and a greater harmonisation and interchangeability of wheels and axles.

[3] In 14 of 17 cases that are known by NSA Germany, corrosion was identified at least partially as potential cause together with other reasons.

4.2. The European Visual Inspection Catalogue (EVIC) for freight wagon axles

The EVIC is a harmonised maintenance program of inspection of axles that was developed by the JSG in 2009 and has been in force since April 2010.

The EVIC provides to maintenance staff the criteria to visually inspect axles against corrosion and mechanical damages.

EVIC inspections are carried out in maintenance workshops during wagon light maintenance (i.e. without dismounting the wheelsets from the wagon). Only the section between the wheels is concerned as the only easily visible. Nevertheless provisions for the area between wheel and bearing are given if the area can be inspected.

An axle which doesn't meet the EVIC-criteria will be removed from service and handed over to medium or heavy wheelset maintenance to undergo non-destructive tests (NDTs) on axle surface after surface treatment according to the existing heavy maintenance rules. This will be extended to the full axle surface after full implementation of the European Common Criteria for maintenance

Additionally, a sampling process has been put in place. See further details in section 4.2.1.of this report

The TF agreed in December 2009 to start the EVIC campaign in April 2010.

It covers all wagons including the wagons for which specific transport or specific loading conditions may have an impact according to section 2 of this report.
For two of the four different operational regimes defined afterwards, in 4.2.1., (i.e. wagons used in corrosive environments and wagons transporting dangerous goods), inspections of all axles against the EVIC rules have to be completed within 4 years delay.
The delay is extended to 6 years for the other wagons. These delays were defined taking into account the availability of resources in maintenance workshops.

As a result of the implementation of the EVIC programme, overall, the JSG estimates that there will be a 30-40% increase of NDT checks during maintenance operations of reprofiling wheels and in medium and heavy wheelset maintenance in the next years.

The JSG has also set up a centralized logging of performed inspections, follow-up and documentation of the EVIC and intends to report and discuss as soon as possible the results with the Agency, the participants to the task force and all NSAs through the NSA network.

The consolidated version of the EVIC may be found in annex 3

4.2.1. The sampling initiative

As part of the EVIC programme, the JSG has also set up a sampling initiative. The objective of this sampling is to check the efficiency of the EVIC through comparisons of the NDT results of "EVIC failed" and "EVIC passed" axles.

According to the risk assessment performed by the JSG the sampling considers specifically the operational regimes that are considered as potential high risk domain for development of corrosion and damages:

- Wagons transporting dangerous goods
- Wagons used in operations in corrosive environment
- Wagons with a high loading factor (mainly full loaded in service, e.g. bulk traffic)
- Wagons for which drop load is current

24.000 axles are involved in the sampling, 6.000 for each potential high risk domain

Axles which fulfil the EVIC-criteria will also be subject to NDT.
The results will also be compared to the results obtained from heavy maintenance currently undertaken.

The sampling will take place over a 12 month period from June 2010 onwards.

The Agency, the JSG and the participating NSAs in the TF will evaluate jointly in November 2010 the intermediate results of the sampling program. For the case that an analysis of the „normal operation" domain should be necessary, the JSG will prepare in advance the checking of 3000 additional axles (1/2 share of a potential high risk domain) within the foreseen timeframe for the sampling. The „normal operation" domain considers the wagons not belonging to the four potential high risk domains.

The intermediate results will then be presented to the NSA Network.

4.2.2. Implementation

The JSG started the implementation of EVIC beginning of 2010. EVIC bodies are established in each Member states[4] and in Switzerland. They are the national central points for supporting the implementation of EVIC.

By May 2010, more than 52 training sessions had been organised with the documentation translated in 11 languages.

By the end of June 2010, more than 130.000 axles had been checked by 86 keepers in 11 Member states and in Switzerland. According to the first results 2.3 % of the axles were immediately removed from service. Nevertheless the results of NDTs will be gathered from the sampling.

[4] End of June 2010 EVIC bodies were established in 21 Member States AT, BE, CZ, DE, DK, ES, FR, HU, IE, IT, LU, LT, LV, NL,PL, SK, SL, RO, PT, SE, UK and in Switzerland

The EVIC rules will be implemented in the General Contract of Use[5] (GCU) from October 2010 onwards.

4.3. The European Wheelset traceability catalogue (EWT) for freight wagon axles

Lack of traceability has been seen as having a potential impact on safety in particular when wagons are continuously exchanged between RUs. Exchanges of wheelsets under wagons are mainly performed by maintenance services of RUs with wheelsets belonging or not to keepers. This situation leads also to important exchanges of wheelsets between railway actors. Therefore lack of traceability leads to a loss of control and by the way may impair safety.

Traceability of relevant information is today available by physical marking on the wheelset and in the documentation of the production and the maintenance in case of necessity.

To improve and to harmonize traceability further, and to reduce the time for analyzing in case of incidents/accidents, the JSG proposed and the Task Force agreed to identify the data that needs to be collected in a European Wheelset Traceability Catalogue (EWT).

The objectives of the EWT are to:

- Trace wheelsets involved in incidents/accidents and therefore to reduce the risk for further incidents/accidents due to similar reasons.
- Trace in case of incidents/accidents the service conditions of an involved wheelset in the past and also its core item, the axle.
- Trace the applied maintenance regime and which non destructive tests have been done on the wheelset.

In case wheelset defects are detected, the EWT facilitates the keepers to select concerned wheelsets and allows them to carry out appropriate measures.

The EWT contains (details in annex 4):

- identification data of wheelset;
- manufacturing data of axle, wheels and bearings.; and
- data of maintenance performed.

The Task Force agreed on the content of the EWT and supported its implementation in autumn 2010.

4.4. The European Common Criteria for Maintenance (ECCM) for freight wagon axles

The JSG presented the elements to be harmonized. Nevertheless more restrictive requirements may be used based on return on experience or existing national rules.

[5] The General Contract of Use (GCU) is a harmonised contract between keepers and RUs regulating the exchange of wagons in Europe. 640 keepers and RUs apply the GCU. It covers 90% of the commercial wagons

The maintenance system of freight wagons is divided in two parts:

- Light maintenance of freight wagons
- Heavy maintenance of freight wagons

The maintenance system of wheelsets is divided in three levels:

- Operations of reprofiling (wheels)
- Medium wheelset maintenance with/without changing wheels with bearing overhaul
- Heavy wheelset maintenance, including changing wheels

In light wagon maintenance the JSG decided to introduce the EVIC as common visual inspection means. In heavy wagon maintenance all axles with EVIC defects cases A, B or C will be removed from wagons.

In reprofiling the JSG imposes the treatment and withdrawal of axles with:

- all EVIC defect cases A, B and C;
- local and severe defects according to UIC category 4 (roughness aspect).

In medium maintenance the JSG has proposed to impose the treatment and withdrawal of axles with:

- all EVIC defects A, B and C;
- local and severe defects according to UIC category 4; or
- large and heavily corroded areas, strongly and uniformly pitted surface.

The treatment will necessitate confirming NDT.
It was also agreed that NDT will apply to the full axle through ultrasonic test (automatic or manual) and magnetic particles test.

In heavy maintenance the JSG decided to apply the same harmonized rules as in medium maintenance but:

- the minimum wheel seat diameter for all UIC type A axles operated at 20 T will be limited at 182 mm (see section 4.1.);and
- magnetic particles test is imposed for the full axle.

The harmonization of NDT methods has not been undertaken by the JSG as it is in the scope of several international projects of research programs such as the program EURAXLE that is now under negotiation for European funding. These programs are not in the scope of the JSG nor the TF. But they should include at least studies on ultrasonic, magnetic particles and eddy current tests. Other new methods will also certainly be studied. They should also consider painted axles as well as non painted axles as an alternative solution.
The JSG will start also an investigation project on the effects on wheelsets and axles caused by severe events such as derailments. No program has been provided up to now.

The JSG introduced also common rules for wheelsets operated above the nominal axle load.

The Task Force agreed in June 2010 on the content of the ECCM but then the Agency considers that the work is not fully accomplished because research studies should be developed and NDTs should also be harmonised.

The details of this ECCM programme may be found in annex 5

4.5. Adaptation of EN standards for wheelset design and maintenance

Two standards were considered in the development of the activities of the Task force:

- EN 13103:2009 Railway applications. Wheelsets and bogies. Non-powered axles. Design method
- EN15313:2010 Railway applications. In-service wheelset operation requirements - In-service and off-vehicle wheelset maintenance

The JSG considers that the results presented here above in section 4.1. to 4.4. should be integrated in both above relevant standards. This will provide them greater visibility and may avoid through self commitment that NSAs or the European legislation impose too prescriptive design and maintenance rules that must be kept in the hands of railway actors for enhanced flexibility and cost efficiency.

As consequences of the proposal regarding the Continued High Performance Operation (axle load above the nominal design load of 20 T) of UIC type A axles (section 4.1) the JSG proposes to reflect on an a revision of the EN 13103:2009 to include a new calculation method that would be closer to the lived experience of the last 40 years.

The EVIC, the EWT and the ECCM will be proposed to be included in the EN 15313:2010 at a next revision.

5 Challenges faced by the Task Force

An important achievement of the task force is that for the first time the institutional representatives and all stakeholders from the freight transport business were represented and constructively worked together around the same table to discuss common measures for the European freight wagon fleet.

It was also not easy to unify the resources of sector organisations whose members are often in competition. The JSG put in place by sector organisations performed with success the necessary works and discussions to listen and understand concerns of participating NSAs and to provide the results presented in this report. The efforts developed must certainly not be neglected.

But the activities and the positive and constructive mood of the TF have been partly irritated by unilateral, independent initiatives (request for detailed information on vehicle maintenance) of some National Safety Authorities, namely Italy and Germany, towards their freight actors (railway undertakings as well as keepers).
In the case of Italy the request to freight operators was addressed through a letter from the Italian NSA to operators in Italy. After negotiations between Italy and sector organisations, a consensus was found.

In the case of Germany the request for information was published by the German NSA (EBA) through an "Allgemeinverfügung" (Public announcement).
In both cases the Agency has received requests from the Commission to deliver an opinion. Therefore the Agency will not comment on it in this report.

A challenge for ERA has been the additional, unplanned increased workload for the Safety Unit/SafeCert Sector as well as other Units and Sectors.

6 Conclusions

A general agreement was reached and the conclusions of the activities of the TF were unanimously adopted.

Given the expectations and short deadline to deliver these results The Agency can conclude that the work for the TF has been very intense, productive and with high motivation and encourages the sector to continue to work together for the development of optimal harmonisation in the area of freight transport.

The Agency supports the commitment of the JSG to introduce results in EN standards to let full responsibility in the hands of railway actors. The Agency is now reflecting on how to help the sector through the introduction of general requirements in the TSI freight wagons and through the possible request to develop/revise EN standards.

The survey made by the Agency shows that the main cause of broken axles is hot axle boxes. The Agency considers that this should be investigated in the future with high priority.

Nevertheless corrosion seems to remain a non negligible risk factor. Future research programs should focus on the real importance and effects of different types of corrosion associated and not associated to other risk factors before developing improvements and harmonisation of the design methods, systems of protections of axles and NDTs.
Non painted axles should also be more considered in research programs and in harmonisation activities than today as it seems from the survey that their safety performance may be better than the ones of painted axles.
The European program EURAXLE should take into account the results of the TF and should in particular consider better understanding of the role of fatigue and corrosion, harmonisation of NDTs and development of innovative technical solutions for painted and non painted axles.

In the meantime before research results are available, the results of the EVIC and of the sampling will be the basis for the reflection about necessary future measures.

7 Continuation

In short term it was agreed to have two meetings end of 2010 and in 2011 to assure follow-up of the Task force.

On the long term the sector organisations and the participating NSAs expressed the explicit wish to create a permanent structure to deal with future optimal harmonisation in the area of freight transport. Harmonisation must be considered here as in addition to the development of TSIs.
In particular the working process of the task force should be continued.

The Agency fully supports the sector organisations and the participating NSAs in this view.

Today the railway freight transport is changing following opening of markets and implementation of railway interoperability and safety directives,TSIs, ECM certifications,...
As railway freight transport is mainly international, there is also strong need to avoid new national rules that could impair interoperability by interrupting movement of freight wagons at the borders.
Innovations find their way with enormous difficulties. Research programs and immediate or middle term needs are disconnected or seem to be.
Finally the system is mainly working in reactive mode: for instance all actions put in place after the Viareggio accident aimed at avoiding unilateral local measures that could harm badly the competitiveness of freight transport.
The Agency considers that a better connection and coordination of different initiatives is crucial and proposes the setting up of a Freight Platform that aims to connect railway actors including research bodies and NSAs, and also to coordinate freight transport developments on a pro-active way, with a long term view (target system) and while promoting and supporting innovation.

The scope of the freight platform will certainly not be limited to maintenance of freight wagons but must be extended to all necessary aspects relevant to railway freight transport.

The Agency is reflecting on the best way to organise this Freight Platform.