EUROPEAN UNION AGENCY FOR RAILWAYS

Moving Europe towards a sustainable and safe railway system without frontiers.

Light Impact Assessment[1]

JNS Normal Procedure

"Consequences of unintended brake applications with LL blocks"

[1] A **light impact assessment** (LIA) provides a mostly qualitative analysis of the main impacts of a change; other IAS outputs are: an **impact note** is a concise analysis that is added to a Recommendation or Opinion in case the expected impacts are negligible or previously adequately assessed, and a **full impact assessment** (FIA) provides a qualitative and quantitative analyses of the impacts of a change. For details on the Agency IA procedure and template see: DECISION n°290 of the Management Board of the European Union Agency for Railways amending annex 1 of MB Decision n° 195 adopting the amended Agency's Impact Assessment Methodology | European Union Agency for Railways (europa.eu); DECISION n° 257 of the Management Board of the European Union Agency for Railways adopting the annex 2 template for the impact assessment methodology | European Union Agency for Railways (europa.eu).

Contents

1. Context and problem definition

1.1. Problem and problem drivers

In rail freight transport, robust and well-proven mechanical and pneumatical brake components are needed. Fixed brakes have occurred since today's air brakes have been invented more than 60 years ago and caused sparks emitted by the cast iron brake blocks and subsequent risk of fires next to the tracks or onboard the wagon. Fixed brakes occur independently of the type of brake blocks. When the LL composite brake blocks were introduced all over the EU in the early 2010's, the consequences differed from fixed cast iron brake blocks:

- Flaming brake blocks (with less high-energetic sparks);
- An increased probability of the occurrence of extraordinary wheel tread deformation.

In 2021 there was a cluster of fixed brakes incidents for freight wagons in Italy. Many of the wagons were equipped with LL brake blocks made of organic composite material. In some events, LL brake blocks did not dissipate sufficiently to avoid secondary damages (e.g. fires along the track and wheel damages).

Pending the identification of shared risk control measures at European level, immediate preventive measures were imposed by the Italian NSA (National Agency for the Safety of Railways and Road and Motorway Infrastructure, ANSFISA).

In November 2021, the JNS launched an urgent procedure relating to the problem statement, with the aim of analysing the recorded incidents and defining short-term risk control measures, to replace the costly and restrictive measures adopted in Italy[2]. Thereafter, a JNS Normal Procedure with the objective to restore/increase the safety level, ensure interoperability, and return to the previous cost base or lower was launched[3]. Within this context, a JNS Task Force (JNS TF)[4] was set up chaired by ERA and composed of European experts in the sector coming from other National Safety Authorities (NSAs) and of the Group of European Representative Bodies (GRB), the associations made up of companies responsible for the design, construction, operation and maintenance of the railway system.

Considering the complex context, the JNS TF elaborated a definition of the risk to be treated at the level of the entire European railway network and proposed proper short-term risk control measures (Figure 1). In particular, the need was identified to deal with the risks associated with: *i)* wheel tread damage, *ii)* damage of the wheel tread, *iii)* flames spreading to load, *iv)* flames spreading to the ground near tracks, and *v)* caused by LL (organic and sintered) brake blocks that behave unexpectedly during unintended brake application.

An additional task was dedicated to analysing the legal framework concerning the requirements for the design of LL composite brake blocks.

Regardless of the measures that will be implemented to reduce the occurrence of a fixed brake, a residual probability of these types of events remains. For this reason the JNS TF clustered the proposed measures as follow:

1. Best practices of risk control measures, based on the analysis of previous case studies,
2. Amendments of the current legislation/standards,
3. Development of research needs[5].

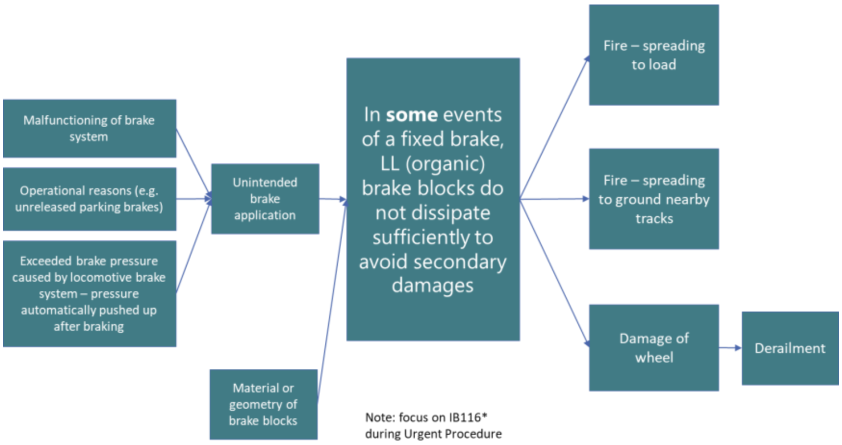
[2] ANSFISA protocol n. 0017573 of 06/08/2021 and protocol n. 0024676 of 02/11/2021.

[3] JNS Normal Procedure "*Consequences of unintended brake applications with LL blocks*" has an overall time frame of 2 years (Joint Network Secretariat (JNS) | European Union Agency for Railways (europa.eu)).

[4] This JNS TF decided also to continue working on this issue within a normal procedure which started in February 2022.

[5] They regarded the block and wheel behavior in a fixed brake situation, and the rolling-stock side detection systems.

Figure 1 – Risk structure (source: JNS TF 2023-2024)



The recall measures (e.g. a well-functioning trackside detection / intervention system and spark plate arresters) are needed to reduce the consequences of fixed brakes. In particular, trackside detection systems monitor the temperatures of wheels and axle boxes of rolling stock; the process of active intervention and warning can reduce the risk of faulty rolling stock.

As preparatory work for the mentioned measures, a recent survey carried out by EIM and CER showed that Hot Wheel Detection (HWD) and Axle Box Detection (HABD) are commonly installed in the European network and an important part of the railway system. To date, full use has not been made of the data gathered through the detection systems currently installed (collecting, using and sharing data with RUs). On this, within the JNS TF, it emerged a lack of harmonisation of these systems both in a technical sense (what do they measure, how do they measure, what thresholds are defined etc.) and an operational sense (what procedures and rules apply in case of a detection, what is done with the data).

1.2. Evidence of the problem

After the incidents in Italy reported in the previous section, other incidents were reported to ERA totalling 19 cases, of which 15 defined as 'relevant'[6]: 6 cases with extraordinary wheel tread deformation and fire, 5 cases with fire only, and 4 cases with extraordinary wheel tread deformation only.

Regarding these cases, the JNS TF pointed out the main observations from the analysis of the 19 cases: all kind of different wagons involved (cases all over Europe); no relation to the season; all incidents occurred with 100 km/h trains; no relation to the geography (gradient, slope, etc.) of the track (braking occurred on level tracks or on slopes and gradients); cases occurred with both manually and automatically operated trains; type of locomotives does not seem relevant, neither the position of the wagon in the train; all kind of brake position (P, long loco and G) are involved, reaction time of the brake has no influence; full brake tests were performed, but no statement of the comparability to the content of brake tests possible.

In addition, concerning the data from data recorders, the analysis showed that they were not available in the vast majority of the mentioned cases, as well as the main information about the outcome of track side detection systems. Moreover, the quality of collected data (especially of the IMs and the RUs), due to problems of collection the operational and trackside data, are not sufficient to analyse cases in depth. This lead to an inability to carry out reliable statistical analyses. However, the cases do provide indicative information about this problem with further data collection permitting additional insights.

[6] The definition is provided at the following link: one-pager-v4_en.pdf (europa.eu).

Analysis of relevant cases of fixed LL composite brake blocks collected in the JNS TF has shown that they have been caused by an unfavorable use of the brakes equipped with LL composite brake blocks.

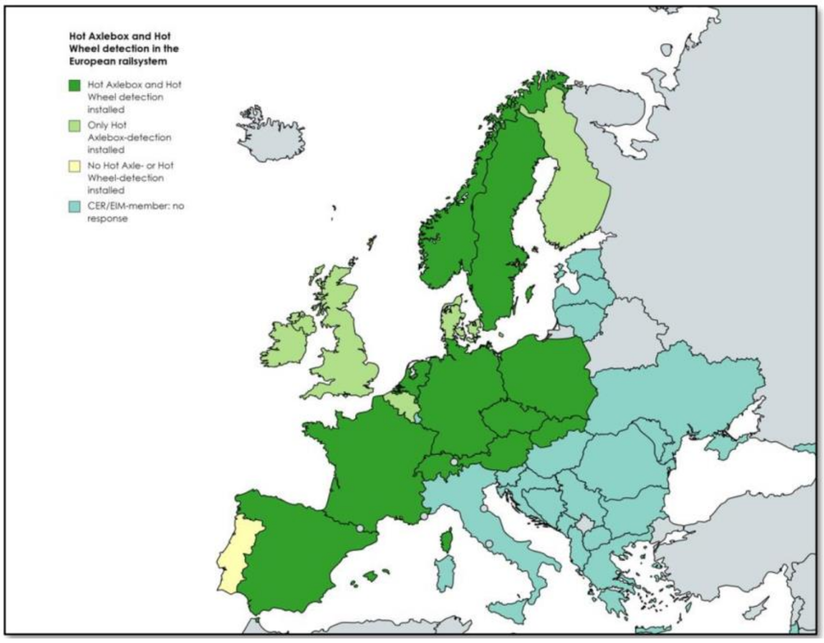
In addition to Italy, these incidents occurred in a number of other Member States such as France, Germany and Hungary, making the geographical scope of the issue broad. This becomes even more important when considering:

- the potential gravity of the consequences of the events which, in some cases, involved trains carrying dangerous goods, and
- the results of a preliminary analysis of the 'oldest' emergency procedure cases, which identify a total of 26 cases showing significant extraordinary deformation of the wheel tread, as well as cases of fire.

The existing technical and operational requirements do not fully cover the risk of the events under analysis in this JNS TF. Moreover, a Fault Tree Analysis has been carried out to verify the completeness of the requirements to reduce the number of fixed brakes, including the implications of driving under Automatic Train Operation (ATO).

Trackside detection systems are commonly installed in the European network, as confirmed by a recent survey carried out by EIM and CER (Figure 2). However, a number of IMs did not answer the survey[7].

Figure 2 – Survey on the availability of trackside detection system (source: EIM, CER)



Currently, the interaction of trackside detection systems with rolling stock is not linked in the European normative environment. Moreover, for other requirements/equipment's quoted in different TSIs there is a correspondence, that is missing for HABD/HWD systems.

The deployment of such systems at European level involves identifying and defining the location of the fixed detection equipment and alarm levels, to be established taking into account the characteristics of the line and the characteristics of the trains allowed to circulate on it. However, requiring that HABD/HWD-systems must be deployed in the rail network (even though limited to the renewal or new installation of infrastructure), before any harmonising activities have taken place does not ensure improved rail safety, also considering the considerable economic costs for their installation for some MSs. It is noted that it

[7] Based on the responses collected, it resulted with a total of approx. 3.000 systems.

would not be proposed to require the installation of these detection systems, but if they are installed it should be implemented in a harmonised way (e.g. on the basis of a risk analysis).

Without the codification of a minimum set of requirements in the TSIs (including coordination between them within the broader legal framework), a risk exists that it would not be possible to anticipate accidents to freight wagons equipped with LL-brake blocks and NSAs would be tempted to adopt different measures in case of incidents and thus a slower process towards the harmonisation of the EU rail network.

1.3. Baseline scenario

If no actions were taken beyond the JNS Urgent Procedure measures this would still lead to the persistence of a relatively unharmonized approach towards LL-brake block issues with the presence of different operational and safety performance characteristics. The problems described in section 1.1 will persist and could potentially increase the number of national rules/standards defined in the EU to the detriment of EU-wide harmonisation of actions taken on LL-brake block issues in the event of accidents/incidents on EU railways.

1.4. Main assumptions

This IA is based on the information provided within the JNS Task Force on the problem statement as well as follow-up analyses.

Within the JNS TF activities, a range of solutions have been discussed and assessed in-depth and, where needed, additional bench tests were performed. Additional data were collected to carry out quantitative evaluations of the potential measures in terms of their effectiveness.

The measures identified are intended both to address the scope of the problem and to offer common solutions. The complexity of the context requires the adoption of multiple potential measures comprising:

- 'Mid-term' measures: improving existing solutions, applicable results after the JNS Normal Procedure resulting in changes of legislative/standards (notably TSI INF, WAG and OPE),
- 'Long-term' measures: research needs to be further explored and developed in-depth.

Further details on the description of the measures are included in the final report of the mentioned TF (e.g. slide 31).

Regarding the legal aspect, a key assumption is that upon the introduction of new solutions (e.g. introduction of TSI requirements or adoption of EN and/or UIC standards), more RUs and keepers would fit locomotives and wagons with derailment detector and prevention functions. IMs can assist RUs to control risks associated with rolling stock regarding improper functioning of LL brake blocks.

Regarding the type of legal solution, the introduction of requirements in WAG and INF TSIs is technically possible[8].

[8] The requirements for the design of brake blocks, fire safety, trackside detection systems and brake air quality have been analysed with the following conclusions: A) The requirements for the design of LL composite brake blocks are sufficiently covered in the current legal framework (Interoperability Directive, including the WAG TSI and the CSM on REA, the EN standard) and related UIC documents. However, the future WAG TSI should refer to only the EN16452 standard, which requires alignment with the UIC leaflet 541-4 and integration of the technical document ERA/TD/2013-02/INT; B) Requirements for spark arresters are missing in the WAG TSI. A respective proposal for a change request has been formulated; C) There are no requirements for hot wheel detection systems in the INF TSI and the EN 15437-1 standard. In addition, there are no requirements on the use of these detection systems in the OPE TSI. Proposals for changes have been formulated.; D) Regarding the air quality, railway-specific harmonized requirements are missing. The Task Force formulated a proposal for a standardization request.

Trackside HABD/HWD systems are a measure that can effectively support regarding rolling stock having faults and thus avoiding accidents but at the same time it needs to be economically sustainable for the concerned stakeholders (e.g. RUs, manufacturers, keepers) where it has not yet been installed.

Furthermore, without EU-wide common requirements, it is assumed that divergent solutions continue to be present each with different operational and safety performance characteristics.

Moreover, the JNS TF looked for research needs and related ongoing projects, focusing mainly on the block and wheel behavior in a fixed brake situation, possible differences of brake block properties caused by deviations in the manufacturing process and on rolling-stock side detection systems[9].

1.5. Stakeholders affected

The **stakeholders affected** by the issue are indicated in the table below.

Railway undertakings (RU)	☒	Third Countries	☐
Infrastructure managers (IM)	☒	National safety authorities (NSA)	☒
Manufacturers	☒	European Commission (EC)	☒
Keepers	☒	European Union Agency for Railways (ERA)	☒
Entity in Charge of Maintenance (ECM)	☒	Persons with reduced mobility (PRM)	☐
Notified Bodies (NoBo)	☒	Passengers	☐
Associations	☐	National Investigation Bodies (NIBs)	☒
Shippers	☐	Loaders/terminals	☒
Ticket vendors	☐	-	-
Member States (MS)	☒	-	-

The envisaged measures would affect many stakeholders. Moreover, there are also significant differences within stakeholder groups. In particular, the complexity of the problem is likely to affect mainly smaller manufacturers, ECMs and operators (IMs and RUs), for which the tracking and compliance with new requirements is relatively more burdensome or with limited availability of staff (as also shown in the Table of slide 31 of the JNS TF final report – Risk control measures by stakeholder type).

As such, geographical and organisational heterogeneity amongst stakeholder groups is of major importance for this evaluation, considering the options proposed.

[9] The ongoing projects are: 1) the development of the coefficient of friction of brake blocks involved in a fixed brake was analyzed in order to determine if such brake blocks present an additional risk after the fixed brake event – this was not the case; 2) the influence from the wheel and track contact force and the conditions under which a fixed brake can lead to unwanted consequences are further investigated in the sector project "brake block-wheel interaction"; 3) the possibility that the deviations in the manufacturing process of composite LL brake blocks cause unwanted consequences of fixed brakes is investigated in the sector project "brake block-wheel interaction"; and 4) a first inventory was made of rolling stock-side detection systems with the potential to detect fixed brakes (at this stage, only test systems exist; the implementation needs further development and can not replace the trackside detection systems on short or medium term).

1.6. Subsidiarity and proportionality

The problem and proposed options fall into the scope of the Safety and Interoperability directives and the TSIs. As concluded within the JNS TF, European action is needed to ensure a coordinated and harmonised solution regarding fixed LL brake events for freight wagons.

Proportionality is an integral part of both the JNS TF as well as the impact assessment in order to ensure that the proposed solutions are not excessive (in line with the EUs Better Regulation Guidelines).

2. Objectives

2.1. Specific objectives

The objectives concern the development of mid and long term measures, to sustainably:

- Restore/increase the safety level,
- Ensure interoperability, and
- Return to the previous cost base or lower.

3. Options

3.1. List of options

The baseline scenario, **Option 0**, implies the status quo in which risk control measures are in place as recommended by the JNS Urgent Procedure[10].

Besides the baseline scenario, 2 options have been considered. Apart from reviewing and improving the the risk control measures included in Option 0[11], **Option 1** includes also the foreseen amendments of the current legislation/standards (e.g. TSIs)[12]. Furthermore, **Option 2** adds on top of Option 1 measures related to the development of research needs[13]. Further details on the description of measures are included in the Task Force report.

4. Impacts of the options

4.1. Qualitative analysis

Stakeholder assessment

An overview of all main impact with the options is provided in this section and in Annexes 1 and 2. In particular, to provide a high-level overview on the expected impacts for different types of stakeholders, the aggregated results are provided in the following Tables, while more detailed analysis results are

[10] For further details please refer the list of measures are reported here: jns_urgent_procedure_part_2_final_v1.0.pdf (europa.eu).

[11] These risk control measures of the JNS Normal Procedure replace the measures from the JNS Urgent Procedure.

[12] For further details please refer to chapter 1 and 2 of the fianl report of the JNS TF.

[13] For further details please refer to chapter 3 of the fianl report of the JNS TF.

reported in Annexes 1 and 2, disaggregating the impacts by the individual stakeholders, being broadly differentiated for the railways and for authorities as well as for assessment bodies.

Option 0 (Baseline) – JNS UP risk control measures			
Category of stakeholder	*Impact type*	*Description*	*Overall Impact*
Sector (IM, RU, manufacturer, ECM etc.)	Positive	Clear and agreed recommendations produced by the JNS UP (e.g. risk control measures).	Neutral
	Negative	It does not improve significantly the ability to prevent accidents . No further harmonisation of the EU rail sector regarding the use of LL brake blocks. Data quality issue and unexploited potential regarding monitoring of the railway system.	
National Authorities and Assessment bodies (MS, NSA, NoBo etc.)	Positive	No need to adjust the legal framework. Limits administrative impacts related to the adjustment of practices and training.	Neutral
	Negative	No contribution is made to further strengthen the harmonisation re. LL Brake Blocks. Data quality issue and unexploited potential regarding monitoring of railway system.	
European Authorities (EC, ERA)	Positive	No need to adjust the legal framework, which limits administrative burden.	Neutral
	Negative	No requirements in TSIs and directives are currently defined, EN 15437 gives general information about HABDS (no specific parameters about distances and thresholds). The voluntary nature of the risk control measure does not prevent the implementation of different methods between countries, making it more difficult to resolve issues re. product design. Possible lack of applicability of measures in all MSs. Data quality issue and unexploited potential regarding monitoring of railway system. Absence of a clear picture of best practices within Europe for thresholds and distances of devices.	

Option 1 – Option 0 + JNS NP risk control measures + Amendments of the current legislation/standards			
Category of stakeholder	*Impact type*	*Description*	*Overall Impact*
Sector (IM, RU, manufacturer etc.)	Positive	Implementation of new requirements ensures alignment across Member States and stakeholders, improving the safety and competitiveness of the railway sector. As the fitting of detection systems shall be voluntary, there are no additional cost implications expected.	Rather positive
	Negative	The TSI revision covers a multitude of changes. For some changes the preferences on discussed solutions differed between sector organisations. The large number of trackside detection systems can limit the smooth provision of rail services at both national and international level.	
Nathional Authorities and Assessment bodies (MS, NSA, NoBo etc.)	Positive	‘Soft’ harmonization of the legal framework (TSIs) at European level of LL brake blocks.	Rather positive
	Negative	Changes to the TSI requirements require an update of knowledge and procedures within the different national authorities and assessment bodies.	

European Authorities (EC, ERA)	Positive	Amending the current TSIs would improve the harmonization of the legal context regarding LL brake blocks.	Rather positive
	Negative	Changes to the TSI requirements require an update of knowledge and procedures within the assessment bodies.	

Option 2 – Option 1 + Development of research needs			
Category of stakeholder	*Impact type*	*Description*	*Overall Impact*
Sector (IM, RU, manufacturer etc.)	Positive	Implementation of new requirements and practices ensures alignment across Member States and stakeholders, improving the safety and competitiveness of the railway sector. Collection of data at EU level and improved sharing supports safety improvements.	Very positive
	Negative	Costs for developing research projects. Output from research might result in changes to TSI requirements/standards which might lead to the need for updating knowledge and procedures within the sector. Issues regarding exchange of data between IMs, RUs and ECMs.	
National Authority and Assessment bodies (MS, NSA, NoBo etc.)	Positive	Further improved basis for the work of national authorities and Assessment bodies regarding the usage of LL brake blocks in the railway sector.	Very positive
	Negative	Output from research might result in changes to TSI requirements/standards which might lead to the need for updating knowledge and procedures among the authorities and assessment bodies.	
European Authorities (EC, ERA)	Positive	The legislative framework would further improve based on the research findings. So, further fine tuning changes to TSI requirements are possible based on the output of the ongoing research projects.	Very positive
	Negative	Fine tuning changes to the TSI requirements require a marginal update of knowledge and procedures.	

Railway system assessment

	Option 0 (baseline): JNS UP risk control measures	*Option 1: Option 0 + JNS NP risk control measures + Amendments of the current legislation/standards*	*Option 2: Option 1 + Development of research needs*
Safety	Current provisions do not ensure further improvements of safety regarding the identified problem. Multiple non-harmonised solutions could generate potentially diverging safety performance.	Harmonised implementation of safety actions regarding the identified problem.	Significant impact on safety to be expected from all the measures including through the further development of research needs (with a long term perspective).
Interoperability	Under this option, there is no further change to the interoperability of the EU rail system.	While this option does not close all open points, it does provide several improvements compared to the baseline.	The adopted measures would further facilitate harmonisation of the EU rail sector and thus interoperability, including

	Risk of diverging implementations of measures.		by further updating the legislative framework.
Competitiveness	No improvements in the competitive situation of the railway system.	Lower administrative burdens, changes to facilitate freight and harmonisation efforts contribute to increased competitiveness of rail.	Lower administrative burdens, changes to facilitate freight and broad harmonisation efforts contribute to increased competitiveness of rail.
Effectiveness	Neutral	Rather high	Very high

Coherency assessment

	Option 0 (baseline)	*Option 1*	*Option 2*
Policy analysis	Risk control mesures resulted from the JNS UP were adopted as recommendations (without TSI's changes)	All TSIs and related legal text have been assessed on their coherence with other relevant legislation. The JNS TF proposes changes of the current legislative provisions.	The development of research projects could lead to future adjustments of TSI's.
Coherence	Neutral	Rather high	Very high

4.2. Quantitative analysis (optional)

The low number of reported cases and lack of related information (e.g. outcome of the track-side detection systems) do not allow for a reasonable statistical evaluation; due to problems of collection of the operational and trackside data, the data quality, especially of the IM and the RUs are insufficient. As a result, it is not possible to carry out reliable statistical analyses. However, as mentioned, the cases do provide indicative information about this problem with further data collection permitting additional insights.

With the the collaboration of JNS TF experts, a few topics have been explored such as the cost consequences of accidents/incidents for fixed brake blocks, time taken for recovery after an accident for fixed brake, deployment and type of information collected by HWD and HABD systems, and statistics (occurrence rate for fixed brake accident and percentage of vehicles equipped with LL blocks).

Monetary quantifications of specific accidents/incidents are estimations and, considering their sensitivity, not often publicly available with detailed elements. However, it is reasonable to assume that they vary depending on the characteristics of the individual event (accident type, with/without derailment, etc.) and the type of cost considered (costs of refurbishing the railway infrastructure, costs of personnel employed in its refurbishment, economic losses resulting from the failure to turn traffic around etc.). Therefore, having a European benchmark would require significant work with a long-term perspective: identifying useful data, collecting the data identified, and carrying out the quantification, either on a European scale or by occurrence/cost category per MS (see section 6).

The time taken for recovery after an accident for fixed brake required also shows similar characteristics to the previous illustrated point, that could be considered a different way to measures occurrence consequences (from passenger point of view).

Regarding the HWD and HABD systems, as resulted from the mentioned survey and further complemented by expert's knowledge, their deployment is broad in the European network. However, due to the lack of information regarding their placement on the network, types of information collected, if/which data are exchanged between IMs and Rus, no detailed quantitative analysis are currently possible. A timely identification of them is desirable.

As emerged from the analysis of the 19 cases of incidents, the quality of data collected and uncertainty about the total number of cases related to the problem statement[14] do not allow the quantification of indicators as those mentioned.

5. Comparison of options and preferred option

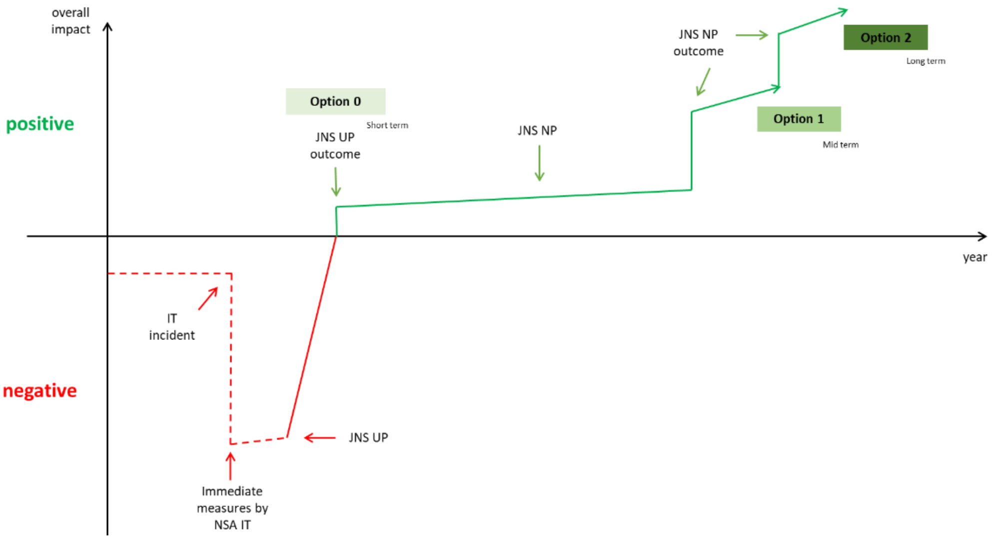
5.1. Comparison of options

	Option 0 (baseline)			*Option 1*			*Option 2*		
Stakeholder impact	Sector org	Nat. Auth & AsBo	EU Auth.	Sector org	Nat.Auth & AsBo	EU Auth.	Sector org	Nat.Auth & AsBo	EU Auth.
Effectiveness	Neutral			Rather high/pos.			Very high/pos.		
Coherence (optional)	Neutral			Rather high/pos.			Very high/pos.		

Colour legend	Very low/neg.	Rather low/neg.	Neutral	Rather high/pos.	Very high/pos.

The overall impact of the measures for the railway sector is shown in Figure 3. While the introduction of national measures - NSA IT - (as shown on the left side of the figure for sake of completeness[15]) marginally reduced the overall negative impact for the railway system, the adoption of measures within the JNS UP lead to a positive balance of the overall impacts of the proposed measures. As a result of the substantial work carried out by the JNS NP, which also sees progressive improvements over time, the outcome of the impacts of the measures improves further (as shown in the right-hand side of the graph).

Figure 3 – Overall assessment of measures for the railway system



Note: Overall impact: Combination of safety and interoperability impacts. Dashed line – measures not included in the overall assessment and reported for the sake of completeness.

[14] The low number of reported cases does not allow for a reasonable statistical evaluation.

[15] This impact assessment analysis does not include the measures adopted by the NSA IT before the JNS UP; For its graphic representation, the information that emerged during the TF activities, summarised in the final report (e.g. slide no. 8), was used.

5.2. Preferred option(s)

Based on the assessment of the measures from the JNS TF, Options 1 and 2 provide both a substantial number of benefits over the baseline (Option 0) at limited costs.

While Option 1 has a more mid term perspective, Option 2 has a more long term perspective, compared with the short term perspective of the Baseline (Option 0).

Overall, **Option 2** would be the preferred one.

5.3. Risk assessment

The measures embedded in Options 1 and 2 have been drafted in close cooperation with industry experts, representative bodies and national authorities over the course of two years withing the JNS NP. Considering the elaborate and iterative discussions of the JNS TF (including subgroups), as well as the detailed analyses underlying each change, there are few risks associated with the implementation of the related measures, further minimised with Option 2 thanks to the ongoing research projects' results.

5.4. Further considerations

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6. Monitoring and evaluation

6.1. Monitoring indicators

Considering that it is the subject of measures that make up Options 1 and 2, monitoring activity is essential for the implementation of the underlying measures because it implies a particular cooperation between actors (IM, RU, wagon keeper, ECM's etc.) in the frame of operations.

Moreover, monitoring scope should cover the following aspects:

- the continued collection and analysis of cases similar to the cases already under analysis (in particular, distinguishing between 'Cases related to flamed brake blocks' and 'Cases of extraordinary deformation of the wheel tread',
- how the limits and conditions of use taking into account current provisions (TSI, EN, UIC) for the application of LL composite brake blocks change over time,
- the HABD/HWD trackside installation availability all over Europe (including in case of incidents), number of detection per year per MS,
- data quality provided and exchanged between stakeholders (e.g. IM, RU) in case of fixed brake,
- the location and temperature measuring principle for HWD (including measuring temperature before/after the accident),
- the alarm level/threshold for HWD,
- the evolution of improvement of the braking system technologies and its operations (including the detection of abnormalities directly on the locomotive).

In addition, more detailed information is expected to be available on cost with the introduction of the CSM ASLP.

The JNS Task Force did not identify further research needs and recommends to observe these developments and to start a review of the JNS Normal Procedure outcome based on the results of this work (see Part II, Chapter 3 of the JNS TF final report). Additional elements could be added to the monitoring activities based on the results from the ongoing research projects.

6.2. Future evaluations

According to the Agency regulation, ERA can undertake ex-post evaluation (Article 8.3). In the future, it could be relevant to undertake ex-post evaluation linked to LL Brake Blocks.

7. Sources and methodology

7.1. Sources

Drafting this impact assessment benefited from inputs received in meetings with both ERA colleagues directly involved in the JNS investigations and JNS TF experts.

The desk research was aimed to collect relevant documentation produced by both participants in the JNS TF, and ANSFISA, also uploaded to the ERA website.

The ERA database used refer to the JNS investigations. Within the context of the JNS TF, section 4.2 benefitted from input from the survey carried out by EIM and CER regarding the benchmarking of trackside HABD/HWD installation availability.

Desk research	☒	Interviews	☐
ERA database	☒	Meetings	☒
External database	☐	Survey	☒

Annex 1. Stakeholders affected disaggregated by potential measure

Stakeholders	Measures									
	1	2	3	4	5	6	7	8	9	10
1- Railway undertakings (RU)	X	X	X	X	X	X	X	X	X	X
2- Infrastructure managers (IM)	X	X	X	X	-	X	X	X	X	-
3 - Manufacturers	-	-	X	X	X	-	-	X	X	X
4 - Keepers	X	X	X	X	X	X	X	X	X	X
5 - Entity in Charge of Maintenance (ECM)	-	X	X	X	X	X	-	X	X	-
6 - Notified Bodies (NoBo)	-	-	X	X	-	-	-	-	-	-
7 - Associations	-	-	-	-	-	-	-	-	-	-
8 - Shippers	-	-	-	-	-	-	-	-	-	-
9 - Ticket vendors	-	-	-	-	-	-	-	-	-	-
10 - Member States (MS)	-	-	-	X	-	-	-	-	-	-
11 - Third Countries	-	-	-	-	-	-	-	-	-	-
12 - National safety authorities (NSA)	X	X	X	X	X	X	X	X	-	-
13 - European Commission (EC)	-	-	X	X	-	X	-	X	X	
14 - European Union Agency for Railways (ERA)	X	X	X	X	X	X	X	X	X	X
15 - Persons with reduced mobility (PRM)	-	-	-	-	-	-	-	-	-	-
16 - Passengers	-	-	-	-	-	-	-	-	-	-
17 - National Investigation Bodies (NIBs)	X	X	X	-	-	-	X	-	-	-
18 – Loaders/terminals	X	X	X	X	-	-	-	-	-	-

Annex 2. Selected measure impacts disaggregated by option and stakeholder

Disaggregated by stakeholder type, the following tables display the impacts of the amendments of the current legislation/standards as resulted from the JNS TF (included in Option 1) and of the development of research projects (included in Option 2).

Measures related to the 'Amendments of the current legislation/standards' (Option 1)			
Category of stakeholder	*Impact type*	*Description*	*Overall Impact*
RU	Positive	Providing an European harmonisation of railway infrastructure regarding the use of composite brake blocks, trackside detection systems and brake air quality. Prevention of potential accidents controlling risks also with the trackside detection systems (already installed on the EU railway infrastructure). Collection of new data from trackside detection systems. As the fitting of detection systems shall be voluntary, there are no additional cost implications expected	Rather positive
	Negative	Marginal implementation costs to adapt rolling stocks to the new TSI requirements in case of purchasing new wagons.	
IM	Positive	Providing a European harmonisation of railway infrastructure regarding the use of composite brake blocks, trackside detection systems and brake air quality. Providing a more safe and innovative services to passengers. Implementation of new requirements ensures alignment with recent technological developments. As the fitting of detection systems shall be voluntary, there are no significant cost implications expected.	Rather positive
	Negative	Marginal implementation costs to adapt rolling stocks to the new TSI requirements in case of new track/upgrading track.	
Manufacturer	Positive	Implementation of new requirements ensures alignment with recent technological developments.	Rather positive
	Negative	Implementation costs for the production of new wagons in compliance with the new requirements.	
Loader/terminal	Positive	Clear and homogeneus conditions defined at European level.	Rather positive
	Negative	-	
Keeper	Positive	Having clear and harmonised features at European level concerning composite brake blocks.	Rather positive
	Negative	Marginal implementation costs to adapt rolling stocks to the new TSI requirements in case of new purchasing new wagons.	
ECM	Positive	Having clear and harmonised features at European level concerning composite brake blocks.	Rather positive
	Negative	No substantial negative impact expected.	
NSA	Positive	Prevention of potential accidents controlling risks also with the trackside detection systems (already installed on the EU railway infrastructure). Changes to the TSI requirements require an update of knowledge and procedures used.	Rather positive
	Negative	-	
EC	Positive	Prevention of potential accidents controlling risks also with the trackside detection systems (already installed on the EU railway infrastructure).	Rather positive

	Negative	-	
MS	Positive	Prevention of potential accidents controlling risks also with the trackside detection systems (already installed on the EU railway infrastructure).	Rather positive
	Negative	-	
ERA	Positive	Prevention of potential accidents controlling risks also with the trackside detection systems (already installed on the EU railway infrastructure). Collection of new data from trackside detection systems.	Rather positive
	Negative	Changes to the TSI requirements require an update of knowledge and procedures, and additional capacity for their monitoring.	
NIB	Positive	The harmonisation of TSI requirements among member states facilitate their independent investigation (when needed).	Rather positive
	Negative	Changes to the TSI requirements require an update of knowledge and procedures.	
NoBo	Positive	Although it increases the number of elements/requirements to be verified, their harmonisation among MSs facilitate their monitoring tasks.	Rather positive
	Negative	Changes to the TSI requirements require an update of knowledge and procedures used.	

Measures related to the 'Research needs' (Option 2)			
Category of stakeholder	*Impact type*	*Description*	*Overall Impact*
RU	Positive	Further/better understanding of the conditions under which the blocks will be flamed and / or plastic deformation of the wheel tread will occur. Fine tuning changes to the TSI requirements leading to an improvement of the safety and competitiveness of the railway sector. Possibility to be proactively involved and contribute to the research project (more efficacy of agreed solution between stakeholders).	Very positive
	Negative	Costs for developing research projects. Inability to provide data concerning the information on the development of flames after fixed brakes.	
IM	Positive	Further/better understanding of the conditions under which the blocks will be flamed and / or plastic deformation of the wheel tread will occur. Fine tuning changes to the TSI requirements leading to an improvement of the safety and competitiveness of the railway sector. Chance to be proactively involved and contribute to the research project (more efficacy of agreed solution between stakeholders).	Very positive
	Negative	Costs for developing research projects. Inability to provide data concerning the information on the development of flames after fixed brakes.	

Manufacturer	Positive	Fine tuning changes to the TSI requirements leading to an improvement of the safety and competitiveness of the railway sector. Possibility to be proactively involved and contribute to the research project (more efficacy of agreed solution between stakeholders).	Very positive
	Negative	Costs for developing research projects.	
Loader/terminal	Positive	Further/better understanding of the conditions under which the blocks will be flamed and / or plastic deformation of the wheel tread will occur.	Very positive
	Negative	-	
Keeper	Positive	Further/better understanding of the conditions under which the blocks will be flamed and / or plastic deformation of the wheel tread will occur.	Very positive
	Negative	-	
ECM	Positive	Having clear features and harmonised at European level concerning composite brake blocks.	Very positive
	Negative	No substantial negative impact expected.	
NSA	Positive	Further improved basis for the work regarding the conditions under which the blocks will be flamed and/or plastic deformation of the wheel tread will occur. Fine tuning changes to the TSI requirements leading to an improvement of the safety and competitiveness of the railway sector.	Very positive
	Negative	Possible marginal changes of training and procedures used linked to future adjustments of TSIs.	
EC	Positive	More in-depth understanding of block and wheel behaviour in a fixed brake situation and rolling-stock side detection systems. Alignment with UIC sector project WP1.2 (regarding the percentage of occurrences of flames on the total number of fixed brake events), and UIC B169 RO 23 (influence of the wheel temperature on mechanical properties and wear development).	Very positive
	Negative	-	
MS	Positive	Further/better understanding of the conditions under which the blocks will be flamed and/or plastic deformation of the wheel tread will occur.	Very positive
	Negative	-	
ERA	Positive	Further/better understanding of the conditions under which the blocks will be flamed and/or plastic deformation of the wheel tread will occur. Fine tuning changes to the TSI requirements leading to an improvement of the safety and competitiveness of the railway sector. Alignment with UIC sector project WP1.2 (regarding the percentage of occurrences of flames on the total number of fixed brake events), and UIC B169 RO 23 (influence of the wheel temperature on mechanical properties and wear development).	Very positive
	Negative	Possible fmarginal changes of training and procedures in case research projects lead to the need for further TSIs changes.	
NIB	Positive	Further/better understanding of the conditions under which the blocks will be flamed and / or plastic deformation of the wheel tread will occur.	Very positive

	Negative	-	
NoBo	Positive	NoBos are likely to be positively impacted.	Very positive
	Negative	No significant negative impacts expected.	