

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

# Light Impact Assessment<sup>1</sup>

## *JNS Normal Procedure*

### *“Accident in the Gotthard base tunnel with focus on broken wheels”*

---

<sup>1</sup> 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 analysis 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** .....3
- 1.1. Problem and problem drivers.....3
- 1.2. Evidence of the problem .....4
- 1.3. Baseline scenario .....5
- 1.4. Main assumptions .....6
- 1.5. Stakeholders affected.....6
- 1.6. Subsidiarity and proportionality.....6
- 2. **Objectives** .....6
- 2.1. Specific objectives .....6
- 3. **Options** .....7
- 3.1. List of options .....7
- 4. **Impacts of the options** .....7
- 4.1. Qualitative analysis.....7
- 4.2. Quantitative analysis (optional) .....9
- 5. **Comparison of options and preferred option** .....11
- 5.1. Comparison of options .....11
- 5.2. Preferred option(s) .....11
- 5.3. Risk assessment .....11
- 5.4. Further considerations .....11
- 6. **Monitoring and evaluation** .....11
- 6.1. Monitoring indicators .....11
- 6.2. Future evaluations.....12
- 7. **Sources and methodology** .....12
- 7.1. Sources .....12

# 1. Context and problem definition

## 1.1. Problem and problem drivers

In December 2023, the JNS launched a Normal Procedure (NP) after the accident in the Gotthard base tunnel occurred in August of the same year. Thereafter, a JNS NP with the objective to restore/increase the safety level, ensure interoperability, and return to the previous cost base or lower was launched. Within this context, a JNS Task Force (JNS TF) 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.

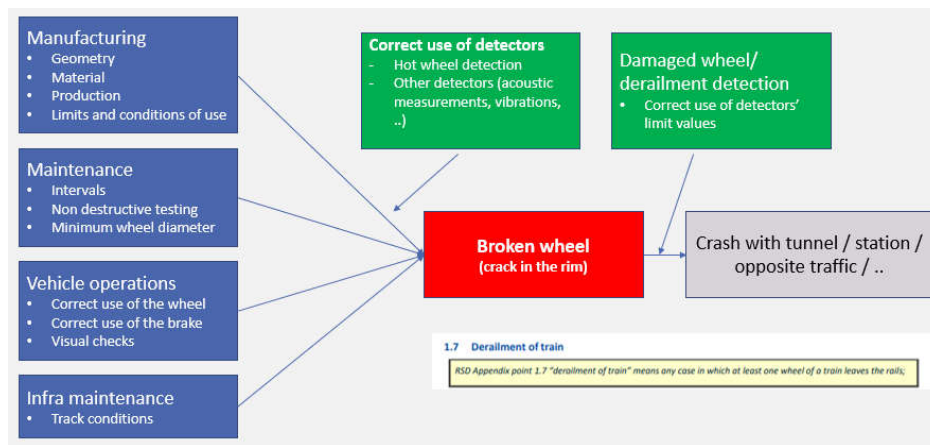
With regard to broken wheels, two JNS procedures had been completed in the past:

- *JNS Urgent Procedure “Broken Wheels” (May-July 2017),*
- *JNS Normal Procedure: “Broken Wheels” (2017-2019)<sup>2</sup>.*

Results of the last mentioned JNS procedure (e.g. short and long mitigation measures, proposals for amendments in standards/regulation and complementary investigation and activities) are currently in force. Risk control measures (RCMs) of the current JNS NP will replace the measures abovementioned. All actors are obliged to implement either these recommended risk control measures or alternative measures stemming from a risk assessment that guarantee at least the same level of safety.

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 RCMs (Figure 1). Risk analysis is based on the Fault Tree Analysis produced within the 2019 JNS NP that was verified and confirmed by TF members to be still valid nowadays.

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



Within this JNS procedure, the following tasks were defined and elaborated by the TF members:

1. *Analysis of the accident in the St. Gotthard tunnel,*
2. *Further elaboration of the risk to be tackled,*
3. *Identification of wheel types comparable to BA 004,*
4. *Application of RCMs for BA 004 to all identified comparable wheel types,*
5. *Check of the effectiveness of the RCMs for the wheel type BA 004 and identified comparable wheel types and possible further developments, if any.*

<sup>2</sup> [Short Term measures agreed und proposed by UIC, ERFA, UIP dated 13/07/2017 \(europa.eu\).](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32017R0371)

The identification of wheel types comparable to BA 004 included among others the description of wheel type BA 004, main features and the definition of criteria (linked to 5 relevant parameters<sup>3</sup>) / procedures for the identification of comparable wheels to BA 004. Using the overview of wheel types in the European freight sector provided by the VPI European Maintenance Guide (EMG)<sup>4</sup>, complemented with information from the original designer and the JNS TF members, a reduced list of wheel types with a low residual rim thickness has been selected and further analysed in addition to the BA 004 (used also in some versions of Wheelset VRV):

- *Db-004sa;*
- *BA 390;*
- *RI 025;*
- *R 32,*
- *BA 304<sup>5</sup>.*

Within task 5, the JNS TF collected accident cases started in the previous JNS procedures on Broken Wheels and analysed only the cases gathered after the implementation of the JNS measures focused to identify similarities concerning for instance the rim as the crack initiation location, wheel material type, mileage since last reprofiling etc.

The current JNS procedure carried out an in-depth analysis of the recalled 2019 JNS UP measures envisaging adjustments were needed and added additional RCMs structured as reported below:

- *Operation and wagon maintenance<sup>6</sup>;*
- *Off vehicle maintenance<sup>7</sup>;*
- *General requirements in operation, wagon and wheelset maintenance<sup>8</sup>.*

In addition, improvements in standards, regulation and company rules were also proposed by the JNS TF members (e.g. GCU amendments)<sup>9</sup>. Concerning other JNS activities, the JNS NP “Consequences of unintended brake applications with LL blocks” (2024) and the Sector Project “Brake Blocks/Wheel Interaction” were identified as relevant.

## 1.2. Evidence of the problem

The subject of broken wheels has been the subject of several JNS procedures since 2017. An graphical overview of the current and previous JNS procedures with additional details is provided in Figure 2.

A total of 23 accident cases were identified by the JNS TF members with wheel type BA 004 and comparable ones as defined within the current JNS procedure. On this regard, within the 23 cases:

- *there are 15 cases before the implementation of the JNS measures (2019), and*
- *8 cases after the implementation of the JNS measures (2019).*

<sup>3</sup> The 5 parameters are: position of the web in the middle of rim; radii in the transition between rim and web, nominal thickness of the web near the rim = 20 mm; design of the contour of the wheel web in the transition rim – web; relevant in combination with geometry comparable to BA 004 (wheels with geometry of the rim with residual rim thickness in worn conditions acc. prEN13979-1 - Criteria: 0,23 dm<sup>2</sup>).

<sup>4</sup> [The VPI-EMG \(vpihamburg.de\)](https://vpi-hamburg.de) - VPI EMG 04 – 04.02 has been used for analysis.

<sup>5</sup> Additional wheel types were considered but not included (e.g. BA 005, BA 303, BA 304, RI101).

<sup>6</sup> For the full list of related RCMs see from slide 38 of the Final Report of the current JNS procedure.

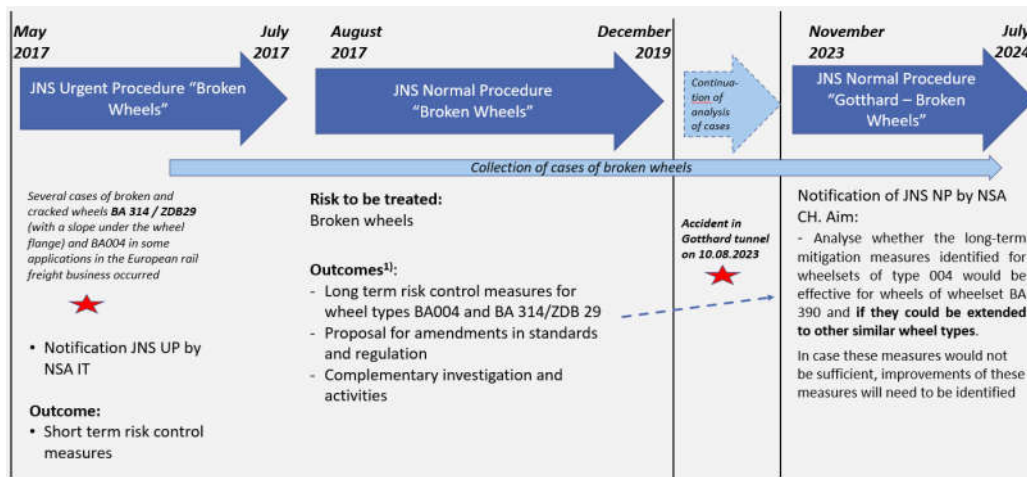
<sup>7</sup> For the full list of related RCMs see from slide 40 of the Final Report of the current JNS procedure.

<sup>8</sup> For the full list of related RCMs see from slide 41 of the Final Report of the current JNS procedure.

<sup>9</sup> For the full list of related RCMs see from slide 52 of the Final Report of the current JNS procedure.

Concerning the cases collected after the implementation of the mentioned JNS measures, the analysis on the implementation status of the 2019 JNS measures in the event of a rail accident showed some cases where information was not available or measures seemed not implemented.

Figure 2 – Overview of JNS procedures on Broken Wheels (source: JNS TF Dec. 2023- Jun. 2024)



Withing the JNS procedure, a survey was designed aimed to collect data (via questionnaire) from TF members regarding the owned number of wheel sets and a cost estimation of the potential impact of the RCMs. With specific reference to the estimated economic impact of the RCMs from this JNS procedure, it is worth to mention the rough cost estimation provided within the 2019 JNS UP was considered as a starting point of the evaluation (Figure 3). Results of the ERA survey and the comparison with the previous cost estimation are reported in section 4.2.

Figure 3 – Aggregated financial impact of 2019 JNS measures (source: JNS TF 2019<sup>10</sup>)

Responsible	Measures	Assumption for estimation (depends on ECM and application)	Cost estimation in the whole sector
RU	No additional measures	5.000 additional wagons (wheelsets) to sort out from service a 100€	500.000 €
For ECM/Keeper	Risk assessment	20.000 € per ECM Number of ECM: 50	1.000.000 €
For affected ECM/ Keeper	Additional measures	100 € per wheelset / year 200.000 affected wheelsets	20.000.000 €
For affected application	Diameter reduction in affected application	75 € per 1 mm => 20 mm reduction => 1.500 € per wheelset 50.000 affected wheelsets	75.000.000 €

### 1.3. Baseline scenario

If no actions were taken beyond the current JNS NP measures this would still lead to the persistence of less effective RCMs with the presence of different operational and safety performance characteristics. So, problems described in section 1.1 will persist and could potentially increase.

<sup>10</sup> [Short Term measures agreed und proposed by UIC, ERFA, UIP dated 13/07/2017 \(europa.eu\)](#) – slide 45.

**1.4. Main assumptions**

This IA is based on the information provided within the JNS TF exchanges (including subgroups’ meetings) on the problem statement as well as follow-up analyses and exchanges with also TF members.

Within the JNS TF activities, a range of solutions have been discussed and assessed in-depth. Additional data were collected via survey to carry out simplified quantitative evaluations to contextualise the potential impact of the RCMs.

**1.5. Stakeholders affected**

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

The envisaged measures would affect a range of stakeholders. Moreover, there are also significant differences within stakeholder groups. In particular, the complexity of the problem is likely to affect mainly smaller ECMs, RUs and manufacturers which deal with wheel types BA 004 and comparable wheels, for which the tracking and compliance with new requirements is relatively more burdensome or with limited availability of staff.

Railway undertakings (RU)	<input checked="" type="checkbox"/>	Member States (MS)	<input checked="" type="checkbox"/>
Infrastructure managers (IM)	<input checked="" type="checkbox"/>	Third Countries	<input type="checkbox"/>
Manufacturers	<input checked="" type="checkbox"/>	National safety authorities (NSA)	<input checked="" type="checkbox"/>
Keepers	<input checked="" type="checkbox"/>	European Commission (EC)	<input checked="" type="checkbox"/>
Entity in Charge of Maintenance (ECM), including ECM Certification Bodies (CB)	<input checked="" type="checkbox"/>	European Union Agency for Railways (ERA)	<input checked="" type="checkbox"/>
Notified Bodies (NoBo)	<input checked="" type="checkbox"/>	Citizens living nearby railway tracks	<input type="checkbox"/>
Associations	<input type="checkbox"/>	Persons with reduced mobility (PRM)	<input type="checkbox"/>
Shippers	<input type="checkbox"/>	Passengers	<input type="checkbox"/>
Ticket vendors	<input type="checkbox"/>	National Investigation Bodies (NIB)	<input checked="" type="checkbox"/>

**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 broken wheel sets’ 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.

<b>3. Options</b>
<b>3.1. List of options</b>
<p>The baseline scenario, <b>Option 0</b>, implies the status quo in which RCMs are in place as recommended by the 2019 JNS Urgent Procedure (which included also proposals for amendments in standards and regulation and complementary investigation and activities)<sup>11</sup>.</p> <p>Besides the baseline scenario, an additional option has been considered. Apart from reviewing and improving the RCMs included in Option 0<sup>12</sup>, <b>Option 1</b> includes also supplementary RCMs and foreseen amendments of the current legislation/standards and company rules (e.g. GCU).</p>

<b>4. Impacts of the options</b>			
<b>4.1. Qualitative analysis</b>			
<i>Stakeholder assessment</i>			
A high-level overview on the expected impacts for clusters of stakeholders and aggregated results are provided in the following Tables.			
<i>Option 0 (Baseline) – JNS NP risk control measures (2019)</i> <i>[including proposals for amendments in standards / regulation &amp; complementary investigation and activities]</i>			
<i>Category of stakeholder</i>	<i>Impact type</i>	<i>Description</i>	<i>Overall Impact</i>
Sector (IM, RU, manufacturer, ECM etc.)	Positive	No need to adapt to changing legislation, which limits administrative burden on existing projects.	Rather positive
	Negative	Costs for developing research projects. Output from research might result in changes to regulation or standards.	
National Authorities and Assessment bodies (MS, NSA, NoBo etc.)	Positive	No need to adapt to changing legislation <sup>13</sup> . The two previous JNS procedures implemented a ‘soft’ harmonisation of the measures concerning broken wheels. Limited administrative impacts related to the adjustment of practices and training. Further improved basis for the work of national authorities and AsBos concerning the broken wheels’ usage.	Rather positive
	Negative	Persistence of lack of applicability of measures across MSs.	
European Authorities (EC, ERA)	Positive	No contribution is made to further facilitate the growth of rail transport toward a more harmonisation. The legislative framework would further improve based on the research findings.	Rather positive
	Negative	Persistence of a possible different implementation of the RCMs across MSs.	

<sup>11</sup> [Short Term measures agreed und proposed by UIC, ERFA, UIP dated 13/07/2017 \(europa.eu\)](#).

<sup>12</sup> These risk control measures of the 2019 JNS Normal Procedure replace the measures from the 2017 JNS Urgent Procedure.

<sup>13</sup> Since this option does not involve the adoption of any new RCMs, but rather the continuation of measures already adopted in the past, no additional legislative changes are expected.

<i>Option 1 – Option 0 + JNS NP risk control measures (2024)</i> <i>[including proposals for amendments in standards / regulation and company rules]</i>			
<i>Category of stakeholder</i>	<i>Impact type</i>	<i>Description</i>	<i>Overall Impact</i>
Sector (IM, RU, manufacturer etc.)	Positive	Agreed on updated RCMs which ensure alignment across stakeholders, improving safety and interoperability, contributing also to the prevention of accidents due to the problem in question. No significant increase in the implementation costs for the RCMs as defined within the current JNS procedure <sup>14</sup> .	Very positive
	Negative	Fine tuning changes to the GCU requirements require a marginal update of knowledge and procedures for the interested stakeholders.	
National Authorities and Assessment bodies (MS, NSA, NoBo etc.)	Positive	Further and updated harmonization of the legal framework (GCU) at European level for broken wheels.	Very positive
	Negative	Fine tuning changes to the GCU requirements require a marginal update of knowledge and procedures for the interested stakeholders.	
European Authorities (EC, ERA)	Positive	Implementation of updated RCMs and practices ensures improved alignment and harmonisation across stakeholders, improving safety and interoperability levels.	Very positive
	Negative	Fine tuning changes to the legislative framework requires a marginal update of knowledge and procedures.	

**Railway system assessment**

	<i>Option 0 (baseline)</i>	<i>Option 1</i>
<i>Safety</i>	Harmonised implementation of safety actions regarding the identified problem.	Significant improvement and update of the harmonised implementation of the safety actions.
<i>Interoperability</i>	Several improvements were obtained concerning the interoperability of the EU railway system.	The adopted measures would further facilitate harmonisation of the EU railway sector and thus interoperability, including by further updating the legislative framework.
<i>Competitiveness</i>	No change in the competitive situation of railway.	Lower administrative burdens, changes to facilitate freight, and harmonisation efforts contribute to the greater competitiveness of railway.
<i>Effectiveness</i>	Rather high	Very high

**Coherency assessment**

	<i>Option 0 (baseline)</i>	<i>Option 1</i>
<i>Policy analysis</i>	The 2019 JNS NP proposed changes of the legislative Provisions and replaced measures resulted from the 2017 JNS UP.	The present JN NP proposed a further update of the legislative provisions recalled in the Option 0.
<i>Coherence</i>	Rather high	Very high

<sup>14</sup> It is worth to mention that indications on the economic impact of the RCMs are aggregated estimates and they might differ from the actual costs incurred by stakeholders.



## 4.2. Quantitative analysis (optional)

In Europe there are currently a total of around 500,000 freight wagons (ERA EVR, 2023)<sup>15</sup>.

Within the current JNS procedure, a survey was designed and implemented to gather information from TF members concerning the:

- *Number of owned wheel sets, and*
- *Cost estimation of the potential impact of the RCMs.*

We obtained a total of 10 completed questionnaires. Although this figure does not have robust statistical significance or representativeness, some indicative evaluations follow.

Regarding the first point, it was asked to TF members to provide the number of wheel sets for specific types of wheels, including those selected as comparable ones to the BA004 (see \* in Table 1); 3 additional wheel sets, discussed in the TF meetings, were also included. An overview of the results is provided in Table 1, where the size and type of wheels vary across actors.

Table 1 – N. of wheel sets by stakeholders (source: selected JNS TF members, 2024)

JNS TF members	BA004*	Db-004sa*	BA 390*	RI 025*	BA304*	R32*	BA005	BA303	RI101
Actor 1	28,345	-	-	481	-	-	114	35,949	-
Actor 2	-	560	-	-	-	-	-	-	-
Actor 3	2,369	-	78	-	102	10	n.a.	n.a.	n.a.
Actor 4	412	-	-	-	-	-	-	-	-
Actor 5	31,027	431	-	9	5	-	80	12,516	-
Actor 6	70,000	-	-	-	8,500	-	23,500	12,600	-
Actor 7	100	-	-	-	-	-	2,300	2,500	-
Actor 8	1,434	-	-	-	-	-	-	239	559
Actor 9	53,500	41	-	11,351	272	594	1,675	14,331	4
Actor 10	800	-	-	-	-	-	-	-	-

Concerning the economic impact of the RCMs, it is important to recall the analysis carried out within the 2019 JNS NP where a rough estimation was provided (Figure 3). Excluding a reply which did not provide the information related to this topic, around half of the sample confirmed that values included in Figure 3 are all still valid, while the other half is expecting an increase in costs (Table 2). Multiple actors indicate changes with regards to diameter reduction in affected application. Among the costs not covered by the mentioned table, wagon repair, wheel sets’ transport and loss of wagon availability were mentioned by actors.

Only the cost related to the risk assessment of the measure for ECM or vehicle keeper (see line 2 of Table 2 below) are one-time type of costs.

With reference to the cost consequences of accidents/incidents for Gotthard broken wheels’ case, although the investigation is not concluded, SBB claimed that a property damage amount, including loss of income<sup>16</sup>, of around 155 M€ (of which around 140 M€ are insured)<sup>17</sup>. Always according to SBB, it is

<sup>15</sup> Data source: [ERA Railway Factsheet - Italy \(europa.eu\)](https://era.europa.eu/era-railway-factsheet-italy).

<sup>16</sup> These take into account ‘losses’ for SBB Cargo, SBB Infra, SBB Passenger Traffic and SBB International.

<sup>17</sup> The estimation accuracy for both figures is +/- 20%; [Gotthard Base Tunnel in operation on 2 September | SBB News](https://www.sbb.ch/en/press-releases/2024/06/27/gotthard-base-tunnel-in-operation-on-2-september) (27.06.2024).

important to recall that since August 10<sup>th</sup> 2023, the traffic will be fully resumed after the summer holiday on September 2<sup>nd</sup> 2024 (after around 1 year)<sup>18</sup>.

Table 2 – Estimation of the aggregated economic impact of the 2024 JNS procedure (source: selected JNS TF members, 2024)

#	Responsible	Measures	Assumption for estimation (2024 calculation)	Cost estimation (Million euro) - 2019 JNS procedure	Cost estimation (Million euro) - 2024 JNS procedure
1	RU	No additional measures	5,000 additional wagons (wheelsets) to sort out from service a 100 €	0,5 M€	-
1.1	RU	No additional measures but additional number of wheelsets: Case " K + R1 (isolate brake)" (e.g.: paint burns of at connection rim\web - GCU 1.2.2 )	10,000 additional wagons (wheelsets) to sort out from service a 60 €	-	0,6 M€
1.2	RU	No additional measures but additional number of wheelsets: Case " Detach wagon " (e.g.: cracks on the rim surface - GCU 1.3.6)	5,000 † additional wagons (wheelsets) to sort out from service a 200€	-	1 M€
2	For ECM/ Keeper	Risk assessment	From 10.000 to 20.000 € per ECM (only freight) Number of ECM (only freight): 500	1 M€	From 5 M€ To 10 M€ §
3	For affected ECM/ Keeper	Additional measures	From 110€ to 120€ per wheelset / year from 200.000 to 300.000 affected wheelsets	20 M€	From 22 M€ To 36 M€
4	For affected application	Diameter reduction in affected application	75€ per 1 mm => 24 mm reduction => 1.800€ per wheelset from 200.000 to 300.000 affected wheelsets	75 M€	From 360 M€ To 540 M€

Notes: Values = order of magnitude provided by around half of the sample. / ● - In the 2024 JNS Gotthard BW procedure, measures for RUs are disaggregated – see lines 1.1 & 1.2. / † - value underestimated. / § - No AsBos' costs included.

Tunnel closure as a consequence of an accident is prejudicial not only to the regional economy but also to the national and in some cases even to the whole European economy, increasing transport costs, reducing competitiveness and safety of the affected areas<sup>19</sup>. Also the literature have been demonstrated that accidents/incidents in tunnels might be very costly<sup>20</sup> as in some railway accidents (e.g. Rastatt tunnel<sup>21</sup>).

The impact evaluation of the RCMs should consider also the ability of the recalled measures to avoid these kinds of accidents with huge economic impacts that could more than offset the cost of the measures themselves.

<sup>18</sup> [Gotthard-Basistunnel am 2. September in Betrieb | SBB News; Gotthard Base Tunnel: Speed reduction and detectors for more safety \(nzz.ch\).](#)

<sup>19</sup> Haukur Ingason, 2023, Proceedings of the International Symposium on Catastrophic Tunnel Fire, 20-21 November 2003.

<sup>20</sup> OECD (2006), OECD Studies in Risk Management – tunnel safety, Paris.

<sup>21</sup> [Rastatt Tunnel - Wikipedia, the free encyclopedia.](#)

5. Comparison of options and preferred option						
5.1. Comparison of options						
	Option 0 (baseline)			Option 1		
<i>Stakeholder impact</i>	Sector org	Nat. Auth & AsBo	EU Auth.	Sector org	Nat.Auth & AsBo	EU Auth.
<i>Effectiveness</i>	Rather high/pos.			Very high/pos.		
<i>Coherence (optional)</i>	Rather high/pos.			Very high/pos.		
Colour legend	Very low/neg.	Rather low/neg.	Neutral	Rather high/pos.	Very high/pos.	
5.2. Preferred option(s)						
Based on the assessment of the measures from the JNS TF, Options 1 provides both a substantial number of benefits over the baseline (Option 0) at limited costs for which it is the preferred one.						
5.3. Risk assessment						
The measures embedded in Options 1 have been drafted in close cooperation with industry experts, representative bodies and national authorities over the course of six months within the JNS NP which also benefits from previous JNS procedures as described in section 1. Considering the elaborated and iterative discussions of the JNS TF (including subgroup), as well as the detailed analyses underlying each change, there are only limited risks associated with the implementation of the related measures.						
5.4. Further considerations						
Regarding the detection devices, it is important to highlight for future activities to explore the comparison in terms of costs and risks between rolling stock (on-board) and trackside systems not included in this LIA. In particular, the topic of trackside systems (availability and location) has already been considered in the impact assessment carried out for the JNS Procedure “Consequences of unintended brake applications with LL blocks”, closed on March 5 <sup>th</sup> 2024 (especially, sections 1.2, 4.2 and 6.1) <sup>22</sup> . With specific reference to the costs for the risk assessment for ECMs, investigations revealed the need to be further explored in order to have more evidence not only for risk assessment but other activities within the railway system with the aim to better determine: a) what are the typical costs, and b) possible variations between entities.						

6. Monitoring and evaluation
6.1. Monitoring indicators
<p>Considering that it is the subject of measures that make up Options 1, monitoring activity is essential for the implementation of the underlying measures because it implies a particular cooperation between actors (IMs, RUs, ECMs etc.) in the frame of operations.</p> <p>Moreover, <b>monitoring scope</b> should cover the following aspects:</p> <ul style="list-style-type: none"> <li>the continued collection and analysis of cases similar to the cases already under analysis,</li> </ul>

<sup>22</sup> It did not include the quantification in monetary terms of these devices; it is indeed an issue emerged within the current JNS procedure.

- the monitoring of the implementation status of the RCMs produced by this JNS procedure,
- the HADB/HWD trackside installation availability all over Europe (including in case of incidents), number of detection per year per MS (and related deployment costs),
- the collection of the incurred implementation costs of measures by stakeholder type.

**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 broken wheels.

**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 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 data gathered via dedicated survey / questionnaire from JNS TF members regarding both the cost estimation of measure and the number of wheel sets disaggregated by selected type of wheels and follow-up bilateral meetings.

Desk research	<input checked="" type="checkbox"/>	Interviews	<input checked="" type="checkbox"/>
ERA database	<input checked="" type="checkbox"/>	Meetings	<input checked="" type="checkbox"/>
External database	<input type="checkbox"/>	Survey	<input checked="" type="checkbox"/>