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**COMMISSION STAFF WORKING DOCUMENT**

**Report - Operations with rail wagons equipped with composite brake blocks in Nordic winter conditions**

**Report pursuant to Article 5(e) of Commission Implementing Regulation (EU) 2019/774 of 16 May 2019 amending Regulation (EU) No 1304/2014 as regards application of the technical specification for interoperability relating to the subsystem 'rolling stock - noise' to the existing freight wagons**

The present report fulfils the obligation on the European Commission pursuant to Article 5(e) of Commission Regulation (EU) No 1304/2014 of 26 November 2014<sup>1</sup>, as modified by Implementing Regulation (EU) 2019/774 of 16 May 2019, the ‘TSI Noise’<sup>2</sup>. The report assesses: (i) the safety and braking performance under Nordic winter conditions of freight wagons equipped with ‘silent’ braking technology; and (ii) existing or potential operational and technical measures. For this assessment, the report looks at evidence from work by the European Union Agency for Railways (ERA) on reported safety issues with this braking technology under Nordic winter conditions. The coronavirus outbreak has led to a slight postponement of the original planned publication date of 30 June 2020.

## 1. Why reduction of railway noise is important

European Union transport policies, strengthened by the European Green Deal published in December 2019<sup>3</sup>, aim at shifting traffic to less polluting modes. The European Green Deal Communication (COM(2019) 640 final<sup>4</sup>) states that ‘as a matter of priority, a substantial part of the 75% of inland freight carried today by road should shift onto rail and inland waterways’. The performance of rail on all environmental-impact criteria except noise is extremely good. According to the World Health Organization, environmental noise is an important public health issue with negative impacts on human health and well-being, and is one of the greatest environmental risks to health<sup>5</sup>. The economic costs of noise pollution include devaluations in house prices and productivity losses from health-related impacts.

Figures from the European Environment Agency for 2017, presented in its 2020 report, show that railways are the second largest source of environmental noise in Europe after road transport<sup>6</sup>. Railway noise affects nearly 22 million people (of which, approximately 10.9 million are exposed to railway noise outside urban areas, and approximately 10.7 million are exposed to railway noise within urban areas)<sup>7</sup>. As a result, in some European regions noise is a major reason for public opposition to increases in rail transport.

This means that reducing rail noise is a key objective for the further development of the rail sector, which plays an important role in ensuring sustainable mobility for European businesses and the European public.

## 2. What has been done so far at EU level to reduce rail noise?

The most effective way to mitigate rail noise is by tackling noise at its source, by replacing cast-iron brake blocks (CIBs) on existing freight wagons with composite brake blocks (CBBs)<sup>8</sup>. This technical solution reduces rail noise by up to 10 dB, which equals a 50% reduction in audible noise for humans. Therefore, the EU supports the retrofitting of wagons

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<sup>1</sup> Commission Regulation (EU) No 1304/2014 as regards application of the technical specification for interoperability relating to the subsystem ‘rolling stock — noise’ amending Decision 2008/232/EC and repealing Decision 2011/229/EU (OJ L 356 12.12.2014, p. 421).

<sup>2</sup> Commission Implementing Regulation (EU) 2019/774 of 16 May 2019 amending Regulation (EU) No 1304/2014 as regards application of the technical specification for interoperability relating to the subsystem ‘rolling stock — noise’ to the existing freight wagons (OJ L 1391 27.5.2019, p. 89).

<sup>3</sup> [https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal\\_en](https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en)

<sup>4</sup> [https://ec.europa.eu/info/sites/info/files/european-green-deal-communication\\_en.pdf](https://ec.europa.eu/info/sites/info/files/european-green-deal-communication_en.pdf)

<sup>5</sup> World Health Organization 2018, Regional Office for Europe, *Environmental Noise Guidelines for the European Region*, ISBN 978 92 890 5356 3.

<sup>6</sup> <https://www.eea.europa.eu/publications/environmental-noise-in-europe>

<sup>7</sup> <https://www.eea.europa.eu/data-and-maps/figures/number-of-people-exposed-to>

<sup>8</sup> European Union Agency for Railways, 006REC1072 Impact Assessment Revision of the NOI TSI Final, 2018.

with the most economically viable, low-noise braking technology available. By the end of 2017, some 350 000 wagons still needed to be retrofitted<sup>9</sup>.

This support consists of various instruments, and allows for:

- (i) economic incentives through the track-access charging scheme;
- (ii) financial support to railway operators; and
- (iii) the promulgation of technical standards.

Firstly, Article 31(5) of Directive 2012/34/EU<sup>10</sup> establishing a single European railway area (amended by Directive (EU) 2016/2370<sup>11</sup>) empowers the Commission to adopt implementing measures to charge for the cost of noise effects. These measures can vary in duration and may also allow for differentiated infrastructure charges to take into account, where appropriate:

- (i) the sensitivity of the area affected, in particular the size of population affected; and
- (ii) the train's composition and the effect of this composition on the level of noise emissions.

On this basis, the Commission adopted Implementing Regulation (EU) 2015/429<sup>12</sup>, which provides the legal framework for noise-differentiated track-access charge ('NDTAC') schemes within the EU. Member States are free to decide to introduce a NDTAC scheme, and if they choose to do so, they must follow the Regulation. The Regulation is based on the experience of some of the European countries that had introduced such schemes before the adoption of an EU framework, and has thus harmonised NDTAC schemes across Europe. At present, four Member States have introduced a NDTAC scheme: Austria, Czechia, Germany and the Netherlands.

Secondly, to increase the speed of retrofitting and minimise the risk of possible damage to the competitiveness of the rail sector, wagon keepers<sup>13</sup> can also take advantage of the European public-funding possibilities provided by Regulation (EU) No 1316/2013<sup>14</sup> of the European Parliament and of the Council establishing the Connecting Europe Facility (CEF). The CEF Regulation includes a legal basis for supporting actions in Member States aimed at reducing the level of rail-freight noise through retrofitting existing wagons with CBBs. The first call for proposals, with an available budget of EUR 20 million, took place in 2014. However, only two eligible proposals were submitted, resulting in CEF funding of EUR 6 million. The second call was launched in 2016 and turned out to be a greater success. Given the high demand for this second call, the initial available funding of EUR 20 million was increased to EUR 26 million. The third call, launched in 2019, resulted in funding of EUR 19.5 million (from an available budget of EUR 35 million)<sup>15</sup>. In total, the three calls allowed for the co-financing of retrofitting of some 207 000 noisy wagons.

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<sup>9</sup> European Union Agency for Railways, Full Impact Assessment, Revision of the NOI TSI: Application of NOI TSI requirements to existing freight wagons ([https://www.era.europa.eu/sites/default/files/library/docs/recommendation/006rec1072\\_full\\_impact\\_assessment\\_en.pdf](https://www.era.europa.eu/sites/default/files/library/docs/recommendation/006rec1072_full_impact_assessment_en.pdf))

<sup>10</sup> <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex%3A32012L0034>

<sup>11</sup> <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1588150650001&uri=CELEX:32016L2370>

<sup>12</sup> <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1588150746350&uri=CELEX:32015R0429>

<sup>13</sup> Directive (EU) 2016/797 on the interoperability of the rail system within the European Union provides the following definition: *'keeper' means the natural or legal person that, being the owner of a vehicle or having the right to use it, exploits the vehicle as a means of transport and is registered as such in a vehicle register*. For the purpose of this document, 'wagon keeper' refers to a railway undertaking or a specialised vehicle leasing company.

<sup>14</sup> <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1588150854063&uri=CELEX:32013R1316>

<sup>15</sup> This call included the possibility to co-finance retrofitting freight wagons with disc brakes, as uncertainties have been reported about the brake performance of CBBs under specific Nordic winter conditions.

Thirdly, the first technical specification for interoperability – ‘Noise’ (TSI Noise)<sup>16</sup>, adopted in 2005, sets out noise limit values for new, upgraded and renewed freight wagons. These noise limit values cannot be achieved by the vast majority of freight wagons fitted with CIBs. The most cost-efficient way of making an existing CIB-braked wagon TSI-Noise compliant is to retrofit it with CBBs specifically designed for this purpose. Appendix G of Regulation (EU) No 321/2013 (the rolling stock – ‘Freight wagons’ TSI) lists CBBs that have been authorised by the ERA based on work carried out by the UIC<sup>17</sup>. Appendix G still applies, but has however been frozen since 1 July 2015, because the ERA revised the technical specification for interoperability – ‘Wagon’. Because of this revision, the friction elements for all wheel-thread brakes (i.e. brake blocks) are now defined as an interoperability constituent. And interoperability constituents are covered by the corresponding EC declaration of conformity.

Decision 2011/229/EU was repealed by the TSI Noise of 26 November 2014. In May 2019, the Commission adopted Regulation (EU) 2019/774 of 16 May 2019, amending the TSI Noise. TSI Noise introduces the concept of ‘quieter routes’, defining them as parts of the railway infrastructure with a minimum length of 20 km and with an average number of daily-operated freight trains during night-time of more than 12. From 8 December 2024, only ‘silent’ wagons may be operated on the ‘quieter routes’<sup>18</sup>. There are a number of national exemptions, rooted in technical, operational or economic limitations to retrofitting. However, because the ‘quieter routes’ concern those EU railway lines with the most intense freight traffic, a significant spill-over effect is to be expected, both in geographical terms (to other, less intensively used lines) and over time (the number of ‘quiet’ freight wagons will increase significantly in the ramp-up to December 2024).

When the revised TSI Noise was being drafted, safety alerts were issued about the performance of CBBs under Nordic winter conditions. These safety alerts were submitted to the ERA by the Finnish National Rail Safety Authority (Traficom) on 4 July 2016. The Swedish National Rail Safety Authority (Transportstyrelsen) sent a safety alert supporting the Traficom alert on 16 August 2016. A complementary alert was sent by Transportstyrelsen on 30 August 2017.

To date, no other Member State (nor Switzerland) has reported issues with the use of CBBs in winter conditions.

### **3. Provisions in the revised TSI Noise**

Given the reported concerns about the performance of CBBs under Nordic winter conditions, the revised TSI Noise contains a number of dedicated provisions.

Retrofitting with CBBs is not mandatory, as the revised TSI allows any technology that makes the wagon silent. However, the following two technical solutions can be used to retrofit without assessing the wagon against the revised TSI Noise:

- (i) brake blocks conforming to Appendix G of Regulation (EU) 321/2013; and
- (ii) disc brakes.

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<sup>16</sup> Commission Decision 2006/66/EC.

<sup>17</sup> International Union of Railways.

<sup>18</sup> i.e. freight wagons compliant with TSI Noise (Decision 2006/66/EC, Decision 2011/229/EU or Regulation 1304/2014) or wagons fitted with quieter brake blocks (composite brake blocks of ‘Appendix G’ or ‘Appendix F’, disc brakes or certain types of historic composite brake blocks ‘Appendix E’).

Firstly, taking into consideration the Nordic winter conditions that can affect railway operations in Finland and Sweden, the introduction of ‘quieter’ routes has been postponed to 31 December 2032 for these Member States. To this end, the revised TSI Noise contains a specific case for Finland in Section 7.3.2.1(b) of Annex I<sup>19</sup> and temporary (‘T’) implementation rules for Finland and Sweden in Section 7.4.1(b) of Annex I<sup>20</sup>. Because of the gauge used on the main railway network in Finland (1 524 mm instead of the normal 1 435 gauge used in Sweden, Denmark, Germany and most other Member States), there is almost no exchange of rolling stock between Finland and other Member States.

Secondly, Article 5(e) of the TSI Noise requires the Commission to assess ‘the safety and braking performance of such wagons and existing or potential operational and technical measures applicable in Nordic winter conditions’ and to report by 30 June 2020. At the same time, Article 5(e) states: ‘if the report provides evidence that the use of such wagons in Nordic winter conditions poses safety issues that cannot be addressed by operational and technical measures without severe adverse impact on rail freight operations, the Commission shall propose amendments to this TSI to address those issues while preserving cross border freight traffic to and from affected Nordic regions’.

Article 5(e) stipulates that the above-mentioned Commission assessment must be ‘based on evidence gathered by the Agency [i.e. the ERA], national safety authorities and rail companies’. This Commission staff working document constitutes the reporting by the Commission as stipulated in the first sentence of Article 5(e).

The full texts of Article 5(e) and of the related Recital 10 are provided in the box below.

Article 5(e) of the TSI Noise, states as follows.

*By 30 June 2020, the Commission shall issue a report regarding operations with wagons equipped with composite brake blocks in Nordic winter conditions, based on evidence gathered by the Agency, national safety authorities and rail companies. In particular, this report shall contain an assessment of the safety and braking performance of such wagons and existing or potential operational and technical measures applicable in Nordic winter conditions. The report shall be made public.*

*If the report provides evidence that the use of such wagons in Nordic winter conditions poses safety issues that cannot be addressed by operational and technical measures without severe adverse impact on rail freight operations, the Commission shall propose amendments to this TSI to address those issues while preserving cross-border freight traffic to and from affected Nordic regions. In particular, the proposal may, if necessary, include an exemption permitting the continued operation on quieter routes throughout the Union of a limited number of wagons used frequently in such cross-border freight traffic, and any operational restrictions appropriate to limit the impact of the use of such wagons on quieter routes, which are compatible with the purpose of preserving the above-mentioned cross-border freight traffic.*

<sup>19</sup> (b) *Specific case Finland (‘T’)*  
*Decision 2011/229/EU may continue to apply for freight wagons to be used only on the territory of Finland and until the relevant technical solution in relation to severe winter conditions is found, but in any case not later than until 31 December 2032. This shall not prevent freight wagons from other Member States to operate on the Finnish network.*

<sup>20</sup> (b) *Particular implementation rules for the application of this TSI to existing wagons in Finland and Sweden (‘T’).* *The concept of quieter routes shall not apply on the Finnish and Swedish networks due to uncertainties related to the operation in severe winter conditions with composite brake blocks until 31 December 2032. This shall not prevent freight wagons from other Member States to operate on the Finnish and Swedish network.*

*If the revision set out in the paragraph above takes place, the Commission shall report annually thereafter on the progress on technical and operational solutions for the operation of freight wagons in winter conditions. It shall provide an estimation of the number of wagons equipped with cast-iron brake blocks necessary to ensure continued cross-border traffic to and from such Nordic regions, with a view to ending the exemption in 2028 at the latest.*

Recital 10 of Commission Implementing Regulation (EU) 2019/774, amending the TSI Noise, states the following.

*Given the concerns raised by some stakeholders related to the operations of wagons equipped with composite brake blocks in Nordic winter conditions, the Commission, assisted by the Agency, should continue to analyse the issues and possible solutions. It should assess by June 2020 whether an amendment to this TSI is necessary, possibly in form of an exemption allowing the continued operation of limited numbers of wagons with cast-iron brake blocks on quieter routes, to preserve cross-border rail freight traffic to and from affected Nordic regions. According to the estimates of the Swedish authorities the number of wagons used in such a traffic does in total not exceed 17 500.*

#### **4. Evidence gathered by the ERA**

In accordance with Article 5(e) of the TSI Noise, the ERA has supported the European Commission in gathering evidence on the reported uncertainties related to operations with wagons equipped with CBBs in Nordic winter conditions. To that end, the ERA has set up and chaired a task force with representatives of concerned national safety authorities and rail sector stakeholders, and has issued a dedicated report on the subject<sup>21</sup>.

Since the 1990s, CBBs have been tested and successfully put into operation in a close cooperation between railway undertakings and the rolling-stock manufacturing industry. After extensive testing, various types of CBBs have been found fit for use under severe Nordic winter conditions, complemented with dedicated operational instructions for those brake blocks that fully consist of organic materials<sup>22</sup>. For almost two decades, CBBs have been used extensively and safely in central and southern European countries.

As indicated above, in 2016 and 2017, the Finnish and Swedish rail-safety agencies issued safety alerts for the use of CBBs under winter conditions. These alerts were because of unexpected and significant variation in braking distances reported by various railway undertakings. Subsequently, in the winters 2017/2018, 2018/2019 and 2019/2020 the Finnish and Swedish rail-safety agencies conducted tests to investigate the issue further.

The ERA reached preliminary conclusions after analysing the results of:

- (i) the 2017/2018 winter test in Finland;
- (ii) the preliminary results of the 2018/2019 winter test (Finland, Sweden);
- (iii) the 2019/2020 winter test (Sweden); and
- (iv) the incident reports submitted by railway undertakings in Finland, Sweden and Norway between 2014 and 2020.

<sup>21</sup> [https://www.era.europa.eu/activities/technical-specifications-interoperability\\_en#relatedDocuments](https://www.era.europa.eu/activities/technical-specifications-interoperability_en#relatedDocuments)

<sup>22</sup> Brake blocks fully composed of organic materials have reduced heat conductivity, leading to a higher probability of snow and ice forming around the brake block.

The two main preliminary conclusions by the ERA were:

- incidents related to the winter performance of CBBs occurred in Finland, Norway, and Sweden but not in other Member States or countries;
- the performance of the CBBs during Nordic winter conditions is jeopardised by a complex interplay of, among other factors:
  - (i) meteorological conditions (temperature, snow and humidity);
  - (ii) type of composite brake block;
  - (iii) type of bogie;
  - (iv) loading conditions;
  - (v) required braking performance; and
  - (vi) specific operating conditions.

However, the ERA report also considers that the information resulting from the work carried out so far has not been sufficient to identify:

- (i) the extent of the problem;
- (ii) the precise conditions under which it might arise; or
- (iii) the extent to which it could be addressed by limited operational measures in response to particular conditions.

This lack of information is partially due to the mild winter conditions encountered during the testing period 2019/2020.

Further testing is thus vital to identify possible responses to the issue that are both effective and proportionate. The ERA recommends that testing should include:

- (i) new composite brake-block types that are currently under development;
- (ii) the application of additional technical solutions to strengthen the performance of CBBs; and
- (iii) the application of further operational procedures.

Additional testing is especially important for Sweden (and to a lesser extent Norway). Apart from Swedish domestic freight trains and domestic shuttles (for which the TSI Noise has created an exemption allowing the use of CIBs until 31 December 2032), the extensive Swedish single-wagonload system involves the exchange of significant numbers of freight wagons with the rest of Europe, where wagons are increasingly equipped with CBBs. With the introduction of 'quieter' routes in December 2024, the use of CBB-equipped freight wagons will effectively be mandatory for wagons travelling from Sweden south into Denmark. This means that a solution is needed to the uncertainties in braking performance under Nordic winter conditions of this type of brakes.

The exact combination of conditions that lead to the occurrence of uncertainties in the performance of CBBs under Nordic conditions is unknown. Because of this, the process of identifying appropriate, long-term mitigation measures is only in its initial stage. Pending a more detailed analysis and subsequent conclusions, the ERA has identified five main groups of potential mitigating measures, set out in the bullet points below<sup>23</sup>.

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<sup>23</sup> [https://www.era.europa.eu/activities/technical-specifications-interoperability\\_en#relatedDocuments](https://www.era.europa.eu/activities/technical-specifications-interoperability_en#relatedDocuments)

- **Application of operational measures.** Operational measures can include:
  - (i) speed reductions;
  - (ii) mixed train compositions (mixing CBB-equipped and CIB-equipped wagons);
  - (iii) conditioning braking (regular application of the braking system to keep the brake blocks warm enough to avoid snow and ice forming around the brake block);
  - (iv) more stringent maintenance cycles;
  - (v) operation of shorter trains;
  - (vi) cancellation of trains;
  - (vii) targeted fleet management;
  - (viii) temporary use of road transport;
  - (ix) use of additional de-icing facilities, etc.

These types of measures have the advantage of being flexible (in time and geographically) and restricted in time. They can also be tailored to the current weather conditions, train composition, and train characteristics. However, operational measures can strongly affect reliability and delivery times. Operational measures can also be difficult or expensive to implement and can affect other traffic (domestic block trains and passenger trains).

- **Use of disc brakes.** Initial experiences with freight wagons equipped with disc brakes operating under Nordic winter conditions are positive. Additional operating experience is recommended before the extensive deployment of disc-braked wagons can be actively promoted before December 2024 (when ‘quieter’ routes will be compulsory across the EU). A new freight wagon equipped with disc brakes is about 10% more expensive (approximately EUR 10 000 - EUR 14 000 per wagon) than one equipped with CBBs.
- **Use of locomotive-mounted automatic de-icing devices.** This brake function consists of automatic, light-brake applications without traction cut-off of the locomotive in order to regularly clean the layer of snow and ice between the wheel and the brake block. Such devices would require changes to the freight locomotives only; no changes to the freight wagons are needed. However, these devices are not currently a standard product and exist only in prototype versions for conventional rail-freight locomotives. They therefore need further testing, certification and homologation. This solution also has operational limitations, as it decreases the average speed of the train (thus also reducing infrastructure capacity) and requires sufficient locomotive power, especially when applied up-hill.
- **Development of CBBs tailored for Nordic countries.** Currently, no such targeted developments are expected. Furthermore, the time needed to develop a new brake block, including the required testing, is estimated to be around 7 years. This would also require several million euro in development costs. Nevertheless, the 2017/2018 winter tests in Finland and the preliminary results of the 2019/2020 winter tests in Sweden suggest that, in certain configurations and under a number of preconditions, some types of CBBs have an adequate braking performance under winter conditions.
- **Temporary exemption of wagons from the TSI Noise.** The TSI Noise states that ‘if the use of such wagons in Nordic winter conditions poses safety issues that cannot be addressed by operational and technical measures without severe adverse impact on rail freight operations, the Commission shall propose amendments...’ and ‘...the proposal may if necessary include an exemption permitting the continued operation on quieter



routes throughout the Union of a limited number of wagons used frequently in such cross border freight traffic...' and '...with a view to ending the exemption in 2028 at the latest.'

Given the sensitivity of the issue for public health reasons, this option would require in-depth analysis of its risk, and operational and technical mitigating measures. It would only be feasible if it concerned a very limited number of wagons to allow for a new solution to be deployed rapidly. As of today, there is no supporting evidence for such an exemption.

## **5. Conclusions and next steps**

Under current operational conditions, and under certain severe winter conditions, the braking performance of CBBs can be unpredictable. This can be seen from the number and characteristics of:

- (i) the incident reports from Sweden, Finland and Norway; and
- (ii) the test reports and preliminary test reports of dedicated tests performed in Finland and Sweden in the 2017/2018, 2018/2019 and 2019/2020 winter periods.

This means that railway undertakings must apply mitigating operational measures.

A complex interplay of factors affects braking performance. These factors include:

- (i) geographical location;
- (ii) meteorological conditions;
- (iii) type of composite brake block;
- (iv) type of bogie;
- (v) train loading conditions;
- (vi) required braking performance; and
- (vii) applied operational measures.

Because the exact combination of conditions that lead to the occurrence of uncertainties in the performance of CBBs is unknown, the process of identifying appropriate long-term mitigation measures is only in its initial phase. It is therefore impossible at this stage for the Commission to propose changes to the Noise TSI or other measures to address the problem.

Therefore, the Commission will mandate the ERA:

- to continue collecting additional relevant evidence;
- to continue the work of the task force after the planned winter tests 2020/2021 and to report by 1 June 2021;
- to report by September 2021 to the Commission on:
  - the feasibility of a mix of targeted and tailored operational measures for the Swedish rail network to bridge the period until a long-term solution can be introduced;
  - a global time-schedule for introducing the identified groups of potential long-term mitigating measures, including an analysis of preconditions.

The Commission will report on the basis of this more in-depth analysis and, where appropriate, come forward with a proposal.