Common Safety Indicators

Assessment of achievement of safety targets for 2020
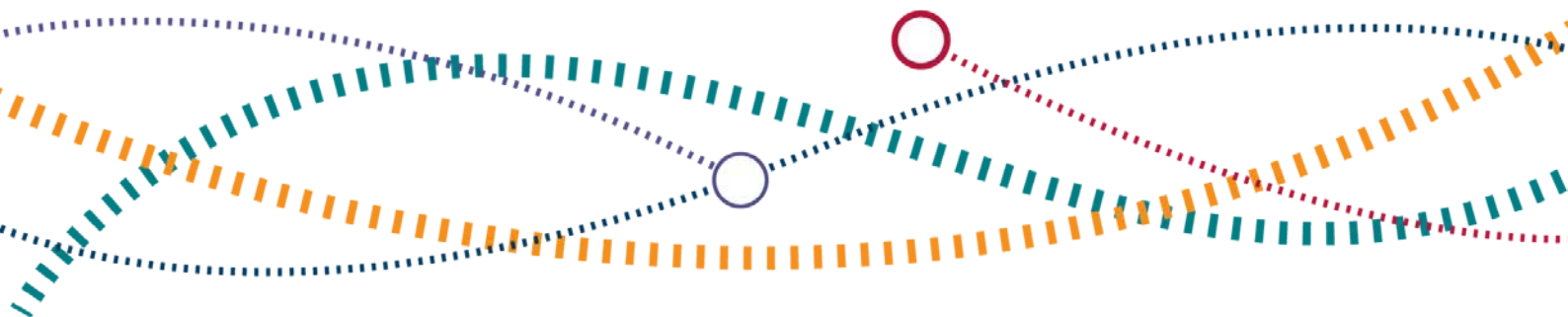
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1. Introduction

1.1   Safety targets are imposed to ensure a minimum level of safety is achieved.

1.2   The assessment of achievement of safety targets is undertaken using a common set of railway safety data, the Common Safety Indicators (CSI). CSI help assess whether railway systems comply with safety targets and facilitate the monitoring of railway safety performance. CSI include but are not limited to:

- Significant accidents

- Fatalities and serious injuries

- Accident precursors

- Suicides

1.3   This report assesses safety performance of Great Britain's mainline railway and the achievement of safety targets for the calendar year 2020. This uses CSI data to assess the level of safety associated with six risk categories:

- Passengers

- Employees

- Level crossing users

- Others

- Trespassers

- Whole society (collective risk to all categories of persons above)

1.4   This assessment must be carried out annually by the Office of Rail and Road (ORR), in accordance with The Railways and Other Guided Transport Systems (Safety) Regulations 2006 (the 'ROGs') as amended by The Rail Safety (Amendments etc.) (EU Exit) Regulations 2019 (the 'EU Exit Regulations'), taking into account the five most recent reporting years (2016 to 2020).

1.5   Prior to the UK leaving the European Union (EU), this assessment was conducted by the European Union Agency for Railways (ERA), who are responsible for assessing safety performance for the 25 EU Member States that have a railway

system plus Norway. ERA publishes the results of this assessment annually. ERA's latest assessment for 2020 was published in March 2022.

1.6   This is the first time ORR has conducted this assessment and published this report. This is a statistical assessment and does not include wider commentary about safety performance.

1.7   A set of data tables accompanying this report are published on the ORR data portal. Key definitions are in Annex A of this report.

2. Method for assessing achievement of safety targets

Data

2.1   This assessment is conducted annually and takes into consideration CSI data for the five most recent reporting years. Therefore, the current assessment covers the calendar years 2016 to 2020.

2.2   The data that underpins this assessment is supplied to ORR by the Rail Safety and Standards Board (RSSB) and Network Rail and is available in Table 5300 on the ORR data portal. Data since 2006 are published by ERA which covers the years in which the assessment of achievement for the UK was conducted by ERA.

Assessment process

2.3   The procedure for assessing the achievement of safety targets is applied to six risk categories (see Annex B for additional information on each category):

- Passengers

- Employees

- Level crossing users

- Others

- Trespassers

- Whole society

2.4   There is a National Reference Value (NRV) and Common Safety Target (CST) associated with each of the risk categories (see Annex B). These values and the process for assessing the achievement of them are set out in the ROGs.[1]

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[1] In carrying out our assessment, it has become clear that that there are differences between the NRV scaling bases within the measurement units column of the table set out at Schedule 11, paragraph 14 of the ROGs in relation to the passenger (1.2) and employee (2) risk categories and the scaling bases within the scaling bases column of the same table. For the purposes of our assessment, we have used those set out in the scaling bases column as to do otherwise would mean the number of fatalities and weighted serious injuries would be normalised using the incorrect scaling base.

Assessment of achievement of National Reference Values

2.5   The procedure for assessing the achievement of NRVs consists of four steps. These are depicted in the flowchart below (see Figure 2.1), where positive and negative decisional arrows correspond respectively to a 'pass' or 'fail' at each stage. The outcome of the assessment sees each of the risk categories classified as having: (a) acceptable safety performance; (b) possible deterioration of safety performance; or (c) probable deterioration of safety performance.

2.6   The **first step** of the assessment involves verifying whether the observed safety performance for each risk category complies with the NRV. Observed safety performance must be expressed in terms of the most recent observation (OBS) and the moving weighted average (MWA) for the five most recent reporting years. If one or both of these values does not exceed the NRV, safety performance is considered acceptable. If the most recent observation and the MWA both exceed the NRV, then the procedure must continue to the second step of the assessment.

2.7   The **second step** involves evaluating whether the MWA exceeds the NRV plus a 20% tolerance range. If this is not satisfied, the single highest consequence accident (in terms of fatalities and weighted serious injuries (FWSI)) in the five most recent reporting years is identified. If this single accident is more severe, in terms of consequence, than the most severe single accident included in the data used for setting the NRV, it is excluded from the calculations. The MWA is then recalculated to assess whether it lies within the abovementioned tolerance range. If this is the case, safety performance is considered acceptable. If not, the procedure must continue with the third step.

2.8   The **third step** must verify whether this is the first time in the last three years that the second assessment step did not return evidence of acceptable safety performance. If this is the case, the outcome of the third step can be classified as passed. However, the procedure continues to the fourth step of the assessment, regardless of the outcome at the third step.

2.9   The **fourth step** must verify whether the number of significant accidents per train-kilometre, has remained stable or decreased relative to previous years. This depends on whether there was a statistically significant increase in the number of relevant significant accidents per train-kilometre. This is evaluated using an upper Poisson tolerance bound which determines the acceptable variability based on the number of accidents that occurred in the member States of the European Union. If the number of significant accidents per train-kilometre does not exceed the tolerance bound, it is assumed that there has not been a statistically significant increase, and the outcome of the assessment is classified as passed.

Figure 2.1   Decision flowchart for assessing achievement of NRVs
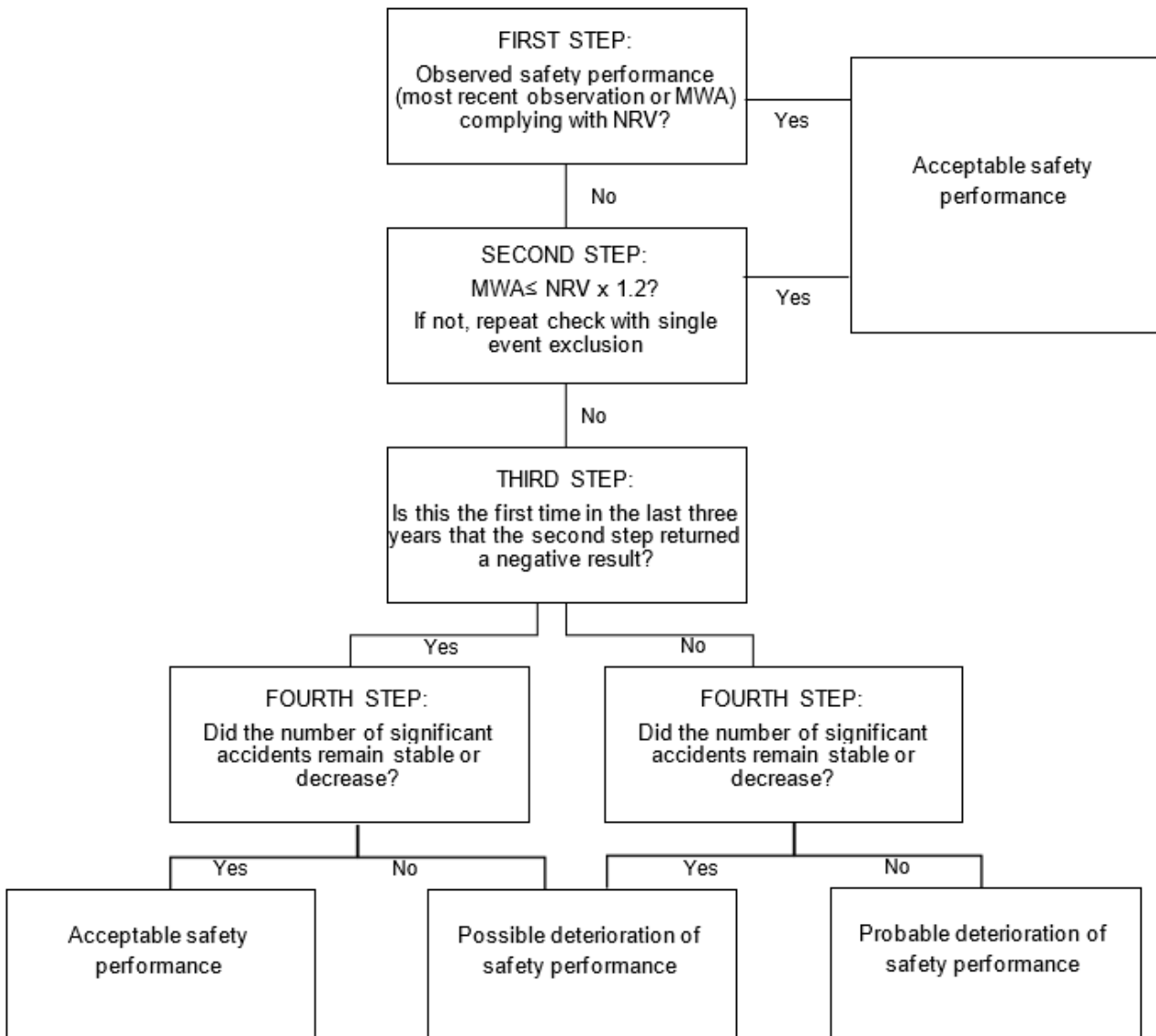
Assessment of achievement of Common Safety Targets

2.10   In addition to assessing compliance with NRVs, achievement of CSTs must also be assessed. For each risk category for which the NRV is equal to or lower than the corresponding CST, the achievement of the NRV automatically implies the achievement of the CST. For each category for which the NRV is higher than the corresponding CST, the CST represents the maximum tolerable level of risk to which it refers. For Great Britain, the NRV is less than the corresponding CST for each of the risk categories, therefore achievement of CSTs mirrors the achievement of NRVs.

3. Results of the assessment

Results

3.1 At the **first step** of the assessment process, five of the six risk categories[2] complied with the NRVs. This indicates that there is acceptable safety performance for passengers, employees, level crossing users, trespassers and whole society. The only risk category that did not pass the first step was Others, as the most recent observation and MWA exceeded the NRV. The procedure therefore continued to the next step.

Table 3.1   First step assessment results

All values in this table are multiplied by 10 to the power of negative nine. This means the values are divided by 10 nine times.

Risk category and scaling base	Annual observation (OBS) (2020)	MWA (2016 to 2020)	NRV (2004 to 2009)	OBS ≤ NRV	MWA ≤ NRV
Passengers (passenger train-km)	2.22	2.27	2.73	Yes	Yes
Passengers (passenger-km)	0.04	0.02	0.028	No	Yes
Employees (train-km)	6.24	2.36	5.17	No	Yes
Level crossing users[3] (train-km)	4.57	8.20	23.5	Yes	Yes
Others (train-km)	8.32	7.16	7.00	No	No
Trespassers (train-km)	16.84	30.46	84.5	Yes	Yes
Whole society (train-km)	38.05	49.03	120.0	Yes	Yes

[2] There are two passenger risk categories using different scaling bases (passenger train-km and passenger-km). For this assessment, compliance with one (or both) of the NRVs is considered acceptable.

[3] Under the legislation, there is no NRV for Level crossing users with the scaling base of (Train-km per year x Number of level crossings)/Track-km. Therefore, this has not been assessed and is excluded from Table 3.1.

3.2   At the **second step** of the assessment, Others risk category passed as the MWA does not exceed the NRV with the additional 20% range of tolerance. It can therefore be determined that there was acceptable safety performance for Others. Safety performance is therefore considered acceptable for each of the risk categories, and it was not necessary to proceed to the third and fourth step of the assessment.

Table 3.2   Second step assessment results

All values in this table are multiplied by 10 to the power of negative nine. This means the values are divided by 10 nine times.

Risk category and scaling base	MWA (2016 to 2020)	NRV (2004 to 2009)	MWA ≤ NRV*1.2
Others (train-km)	7.16	7.00	Yes

3.3   As explained in paragraph 2.10, achievement of the NRVs automatically implies achievement of the CSTs associated with each risk category.

4. Further analysis

Comparisons with other European countries

4.1   The rail industry measures safety performance and risk using the FWSI measure. This measures the consequences of significant accidents by combining the number of fatalities and serious injuries.

4.1   Using data published by ERA in March 2022, the average number of FWSI in Great Britain was compared against other European countries for each of the six risk categories. Data on common safety indicators since 2006 is available from the European Railway Accident Information Links (ERAIL) database.

4.2   For **passenger safety risk**, Great Britain ranks eighth (both per passenger train-km and passenger-km) compared with other European countries (see Annex A for a list of country codes). Great Britain performs favourably in comparison to countries with similarly large railway networks.

Figure 4.1   Passenger safety risk (FWSI for passengers per passenger train-km) by European country, 2016 to 2020 average

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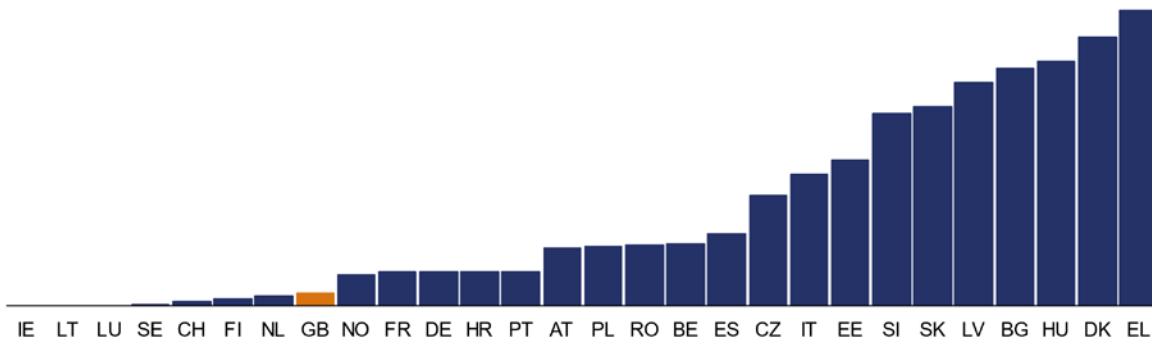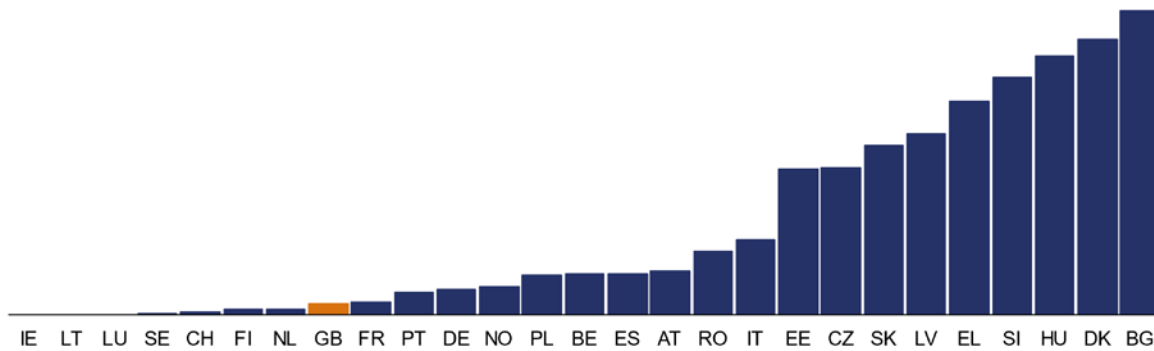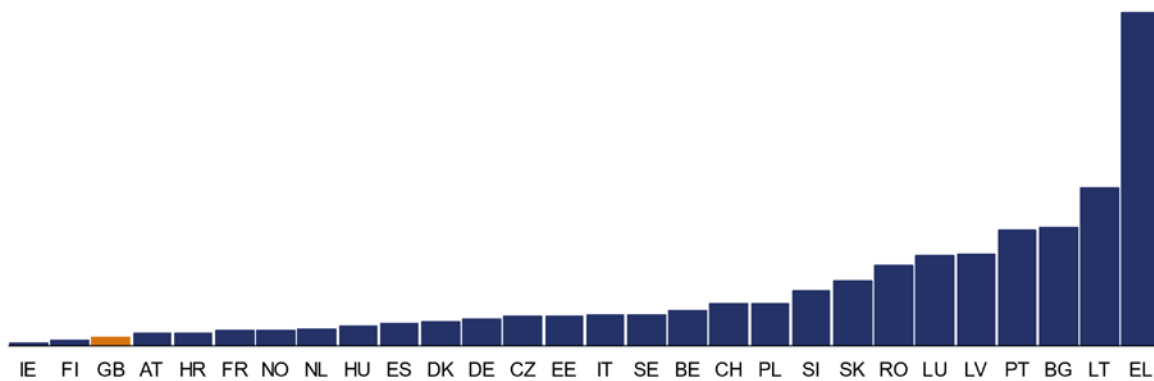
Figure 4.2   Passenger safety risk (FWSI for passengers per passenger-km) by European country, 2016 to 2020 average
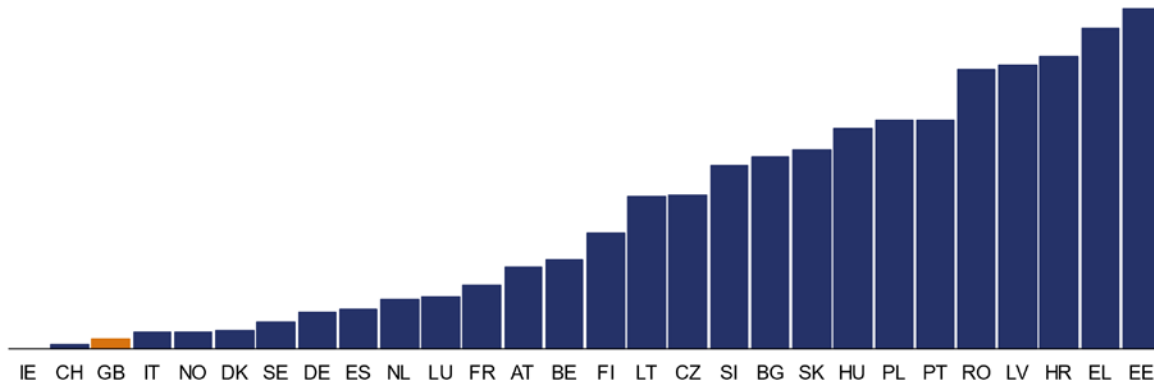

4.3   For **employee safety risk**, Great Britain is third compared with other European countries. The only countries with a lower average number of FWSI for employees were Ireland and Finland.

Figure 4.3   Employee safety risk (FWSI for employees per train-km) by European country, 2016 to 2020 average
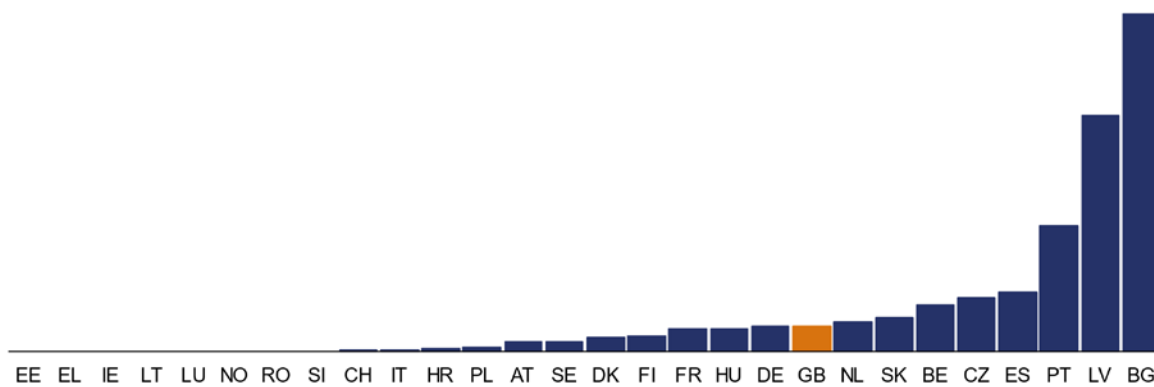
4.4   For **level crossing user safety risk**, Great Britain is third compared with other European countries. The only countries with a lower average number of FWSI for level crossing users were Ireland and Switzerland.

Figure 4.4   Level crossing user safety risk (FWSI for level crossing users per train-km) by European country, 2016 to 2020 average
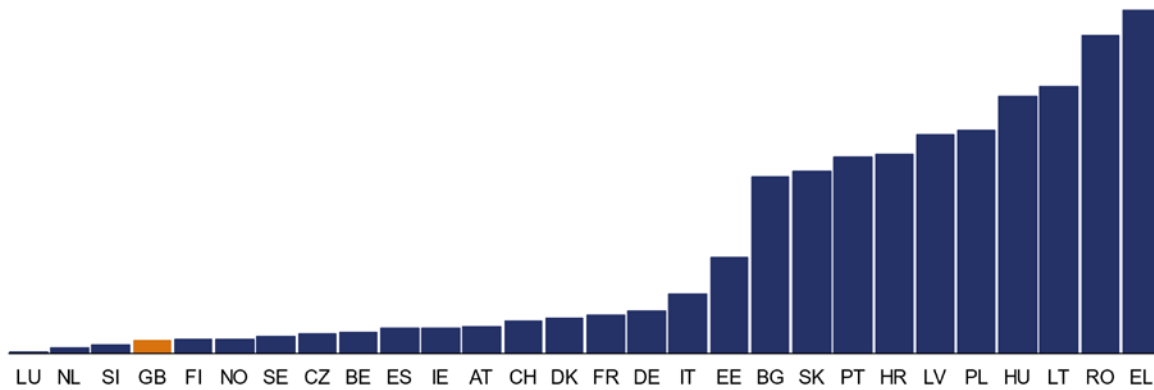

4.5   For **risk to others**, Great Britain is 20th compared with other European countries.

Figure 4.5   Other safety risk (FWSI for others per train-km) by European country, 2016 to 2020 average

4.6   For **trespasser safety risk**, Great Britain is fourth compared with other European countries. The only countries with a lower number of FWSI for trespassers were Luxembourg, the Netherlands and Slovenia.

Figure 4.6   Trespasser safety risk (FWSI for trespassers per train-km) by European country, 2016 to 2020 average

4.7   For **whole society safety risk**, Great Britain ranks first compared with other European countries. This means the average number of FWSI across each of the five risk categories combined is lower than any other European country for which there is available data.

Figure 4.7   Whole society safety risk (FWSI for whole society per train-km) by European country, 2016 to 2020 average
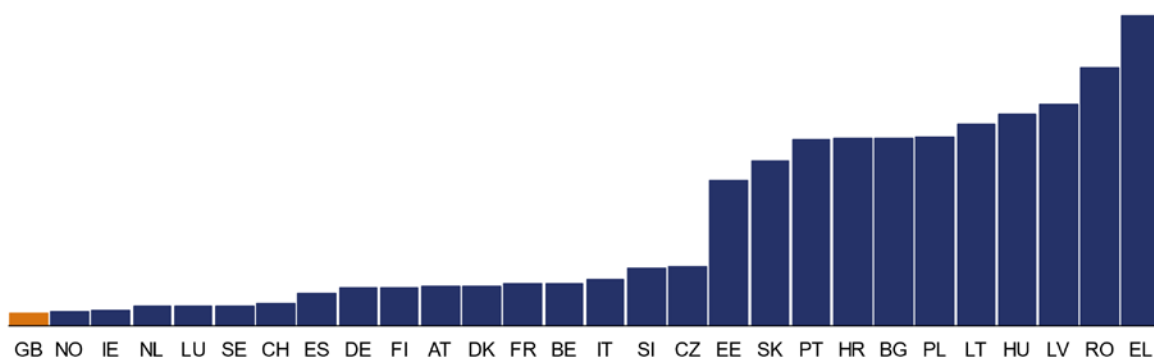
5. Conclusions

5.1   The results of the assessment for 2020 indicate acceptable safety performance for Great Britain's mainline railways in each of the six risk categories.

5.2   Analysing data published for other European countries by ERA, Great Britain also performs well in terms of the average number of FWSI over the most recent five years.

5.3   Great Britain has the lowest average number of FWSI for whole society (all risk categories combined). Great Britain also ranks favourably compared to other European countries in terms of employee safety, level crossing user safety and trespasser safety.

Annex A: Definitions

The following terms have been commonly used in our assessment. Unless otherwise stated please refer to the ROGs for full details.

- The **annual observation (OBS)** is the safety performance in the single most recent reported year.

- **Common safety indicators (CSI)** are a set of rail safety data used to assess whether railway systems comply with safety targets and facilitate the monitoring of railway safety performance.

- A **Common safety target (CST)** means the minimum safety level that must be reached by the mainline railway systems, expressed in the risk categories as defined in paragraph 2 of Schedule 11 to the ROGs.

- **Directive** means Directive 2004/49/EC of the European Parliament and of the Council on safety on the Community's railways as amended.

- **Fatalities and weighted serious injuries (FWSI)** means a measure of the consequences of significant accidents combining fatalities and serious injuries, where 1 serious injury is considered statistically equivalent to 0.1 fatalities.

- **National reference value (NRV)** means a reference measure indicating the maximum tolerable level for a railway risk category.

- **Risk category** means one of the railway risk categories specified under Article 7(4)(a) and (b) of the Directive. These six railway risk categories are:

  - **Passengers** (as defined by ERA) means all persons, excluding members of traincrew, who make a trip by rail, including passengers trying to embark or disembark from a moving train.

  - **Employees** (staff or employees including the staff of contractors) means any persons whose employment is in connection with a railway and is at work at the moment of the accident; it includes the crew of the train and persons handling rolling stock and infrastructure installations.

  - **Level crossing users** means all persons using a level crossing to cross a railway line by any means of transportation or by foot.

- **Others** means all persons who are not passengers, staff or employees including the staff of contractors, level crossing users or unauthorised persons on railway premises.

- **Trespassers (unauthorised persons on the railway premises)** means any persons present on railway premises where such presence is forbidden (trespassing), with the exception of level crossing users.

- **Whole society** means the collective risk to all categories of persons listed under Article 7(4)(a) of the Directive.

● **Moving weighted average (MWA)** is the average safety performance over the five most recent reporting years. Further information on how this is calculated is outlined in the ROGs.

● **Accident precursor** means an incident that occurs in the causal chain of train accidents and can be used to indicate the risk of accidents happening.

● **Passenger-kilometre (km)** means the unit of measure representing the transport of one passenger by rail over a distance of one kilometre.

● **Passenger train-kilometre (km)** means the unit of measure representing the movement of a passenger train over one kilometre.

● **Train-kilometre (km)** means the unit of measure representing the movement of a train over one kilometre; the distance used is the distance actually run, if available, otherwise the standard network distance between the origin and destination must be used.

● **Track-kilometre (km)** means the length measured in kilometres of the railway network where each track of a multiple track railway is to be counted.

Country codes

- Belgium (BE)
- Bulgaria (BG)
- Czechia (CZ)
- Denmark (DK)
- Germany (DE)
- Estonia (EE)
- Ireland (IE)
- Greece (EL)
- Spain (ES)
- France (FR)
- Croatia (HR)
- Italy (IT)
- Latvia (LV)
- Lithuania (LT)
- Luxembourg (LU)
- Hungary (HU)
- Netherlands (NL)
- Austria (AT)
- Poland (PL)
- Portugal (PT)
- Romania (RO)
- Slovenia (SI)
- Slovakia (SK)
- Finland (FI)
- Sweden (SE)
- Norway (NO) – not an EU Member State but assessed by ERA
- Switzerland (CH) – not an EU Member State or assessed by ERA but data included in ERAIL database

Annex B: National reference values and Common safety targets

Measurement units for NRVs and CSTs

The following table sets out the measurement units for NRVs and CSTs used for this assessment.

Table B.1   Measurement units and scaling bases for each risk category

Risk category	Measurement units	Scaling base
Passengers	1.1 Number of passenger FWSI per year arising from significant accidents/Number of passenger train-km per year	Passenger train-km per year
	1.2 Number of passenger FWSI per year arising from significant accidents/Number of passenger-km per year[4]	Passenger-km per year
Employees	2. Number of employee FWSI per year arising from significant accidents/Number of train-km per year[5]	Train-km per year
Level crossing users	3.1 Number of level crossing user FWSI per year arising from significant accidents/Number of train-km per year	Train-km per year
	3.2 Number of level crossing user FWSI per year arising from significant accidents/[(Number of Train-km per year x Number of level crossings)/Track-km] per year	(Train-km per year x Number of level crossings)/Track-km
Others	4. Yearly number of FWSI to persons belonging to the category 'others' arising from significant accidents/Number of train-km per year	Train-km per year
Trespassers (unauthorised persons on railway premises)	5. Number of FWSI to unauthorised persons on railway premises per year arising from significant accidents/Number of train-km per year	Train-km per year
Whole society	6. Total number of FWSI per year arising from significant accidents/Number of train-km per year	Train-km per year

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[4] This differs from the incorrect measurement units as set out in Schedule 11, paragraph 14 to the ROGs.
[5] This differs from the incorrect measurement units as set out in Schedule 11, paragraph 14 to the ROGs.

Values for NRVs and CSTs

The following table sets out the values of the NRVs and CSTs. These are from the ROGs. There are two NRVs and CSTs for the passenger risk category. This is because it is calculated twice using different scaling bases (passenger train-kilometres and passenger-kilometres).

Table B.2   NRV and CST for each risk category

Risk category and scaling base	NRV (*10^{-9})	CST (*10^{-6})	NRV ≤ CST
Passengers (Passenger train-km)	2.73	0.17	Yes
Passengers (Passenger-km)	0.028	0.00165	Yes
Employees (train-km)	5.17	0.0779	Yes
Level crossing users (train-km)	23.5	0.710	Yes
Others (train-km)	7.00	0.0145	Yes
Trespassers (train-km)	84.5	2.05	Yes
Whole society (train-km)	120.0	2.59	Yes

The NRV is less than or equal to the corresponding CST for each of the risk categories. Therefore, the achievement of the NRV automatically implies achievement of the CST.

Annex C: List of data tables and other related statistics

Data tables

All data tables can be accessed on the ORR data portal free of charge in OpenDocument Spreadsheet (.ods) format. We can also provide data in csv format on request.

All tables associated with this report are in one file and can be found under the Data tables heading at the bottom of the Common safety indicators page.

Common safety indicators – Table 5300

(a) Assessment of achievement of safety targets

(b) Significant accidents by accident type

(c) Fatalities by accident type

(d) Persons seriously injured by accident type

(e) Indicators relating to precursors to accidents

(f) Level crossings

(g) Indicators relating to suicide or suspected suicide

Other related statistics

Rail Safety: Annual safety statistics for Great Britain's mainline networks, London Underground and other non-mainline networks. It includes the number of fatalities and injuries affecting workforce and non-workforce (passengers and other members of the public) on the different rail networks. It also covers incidents and misuse at level crossings, and information on train accidents and the severity. A statistical release, data tables and interactive dashboard are published on the Rail safety page on the data portal.

Signals passed at danger (SPADs): Quarterly statistics on the number of signals passed at danger on the mainline railway. A data table is published on the Rail safety page on the data portal.

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Safety data and commentary about specific incidents, trends and background information can also be found in the following two publications:

- [RSSB - Annual Health and Safety Report](#) (published July 2021)

- [ORR - Annual Health and Safety Report](#) (published July 2021)

Common Safety Indicators for other European countries are published annually by ERA in a report and database:

- [ERA - Assessment of achievement of safety targets Safety data](#) (published March 2022)

- [ERAIL database - Common safety indicators data reported by National Safety Authorities](#) (published January 2022)