Reporting methods within the railway sector

IPA Training | 12.09.2023 | Belgrade, Serbia

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- Aim of this part of the presentation
  - Provide a general overview of the EU legal framework on railway safety
  - Explain concepts safety performance and safety levels
  - Explain current reporting requirements
  - Explain the future Common Safety Methods
    - Taxonomy
    - Reporting

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European Railway Market Opening
Common approach for management and supervision of railway safety

EU railway legislation

- EU legislation defines “Roles & Responsibilities“
- [RUs, IMs, Vehicle Keepers, ECMs, NSAs, NoBos, DeBos, CSM Assessment Bodies, Manufacturers, etc.]

Safety Regulation → WHO shall do WHAT? (**CSMs**)

Safety Management →

- Responsibility for safety of railway system put on those who OPERATE and MAINTAIN railways:
  - RUs, IMs must manage and monitor safely their activities through a **Safety Management System**
  - ECMs must manage and monitor maintenance activities through a “System of Maintenance”

Safety Supervision → **NSAs** & other bodies (e.g. ECM Certification Body, NoBo, DeBo, CSM Assessment Body, etc.) guarantee RUs, IMs and ECMs comply with their obligations

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Overview of legislation concerning railway safety

Directive 2016/798
Safety Directive

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Regulation 2019/773
TSI"Operation and traffic Management"

+

Regulation 402/2013
CSM REA

+

Regulation 1078/2012
CSM Monitoring

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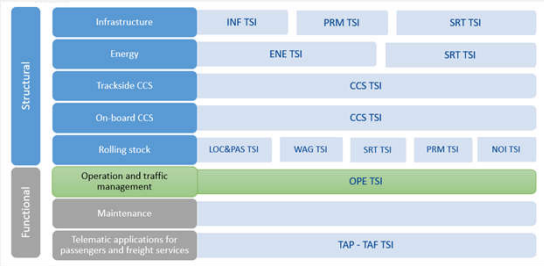
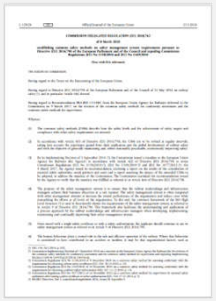
Practical Arrangements
Practical arrangements for issuing SSC

TSIs
INF, PRM, SRT, ENE, CCS, LOC&PAS, WAG, NOI, TAF&TAP



Regulation 2018/762
CSM on SMS requirements



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Directive 2007/59/EC
Train drivers

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Directive 2008/68/EC
TDG

Consolidated version

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Regulation 2018/545
Vehicle authorisation / vehicle type

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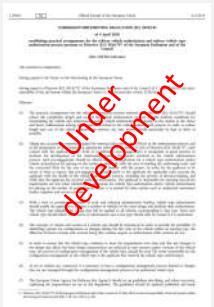
Regulation xxxx/xx
CSM ASLP



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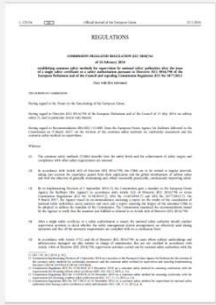
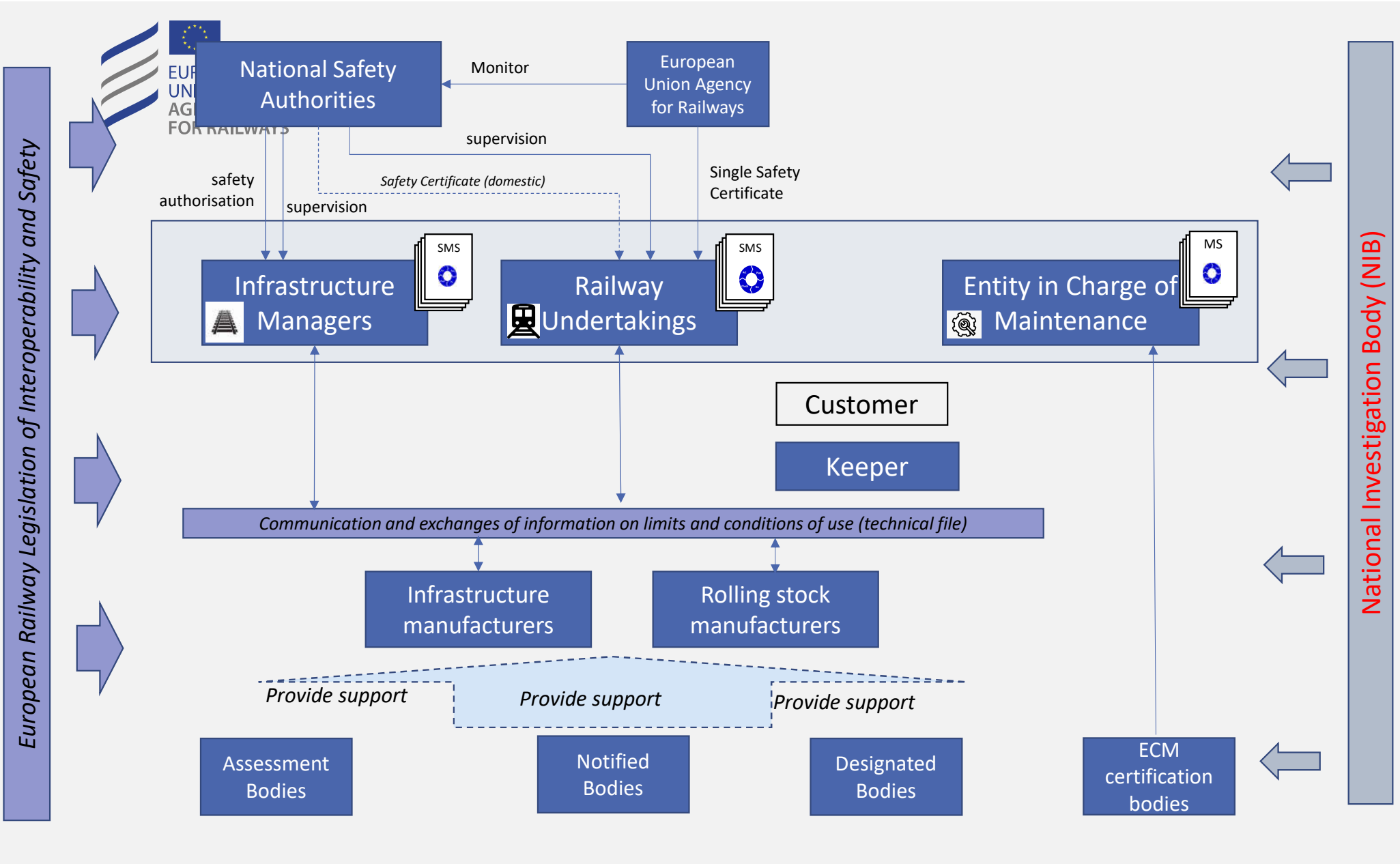
Regulation 2018/761
CSM on supervision




European Railway Legislation of Interoperability and Safety
National Safety Authorities
Monitor
European Union Agency for Railways
supervision
safety authorisation
supervision
Safety Certificate (domestic)
Single Safety Certificate
SMS
SMS
MS
Infrastructure Managers
Railway Undertakings
Entity in Charge of Maintenance
Customer
Keeper
Communication and exchanges of information on limits and conditions of use (technical file)
Infrastructure manufacturers
Rolling stock manufacturers
Provide support
Provide support
Provide support
Assessment Bodies
Notified Bodies
Designated Bodies
ECM certification bodies
National Investigation Body (NIB)

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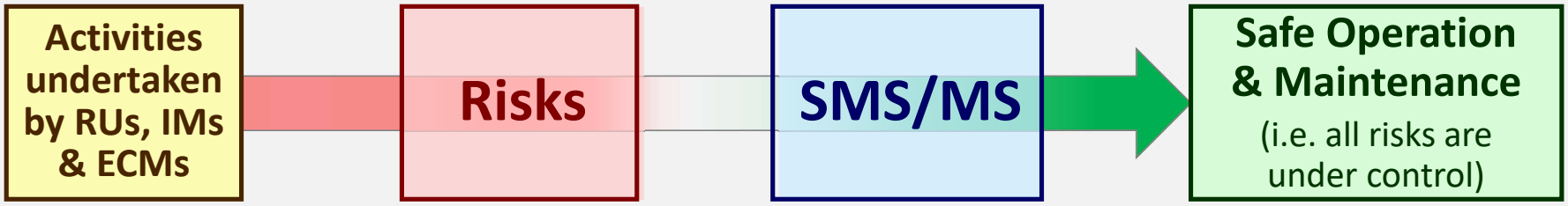
Harmonised way of thinking in terms of «risk»
«Risk based approach» and proactive Management of Safety

- Instead of «reacting and fixing» only the events that occurred in past, Directive 2004/49 requires RUs, IMs & ECMs putting in place:
  - (Safety) Management System (SMS/MS), and;
  - proactive way of thinking in «**predicting and preventing**» possible unwanted events (risks) that may happen;

- → to ensure safe Operation & Maintenance of railway system, SMS/MS shall look both **FORWARD and RETROSPECTIVE** in order to control (all) risks associated with RU, IM & ECM activities. This implies to:
  - «**predict**» unwanted events that can happen during operation & maintenance of railway system;
  - «**prevent**» them to happen or «protect» against their consequences;



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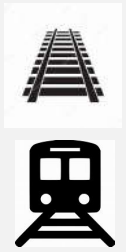
Current existing legislation

Roles and responsibilities → Art 4 Directive 2016/798 → Risk control measures



Article 4.1:
"*The **responsibility for the safe operation** of the Union rail system and the control of risks associated with it is laid upon the **infrastructure managers and railway undertakings**, each **for its part of the system**, obliging them to implement necessary risk control measures as referred to in point (a) of Article 6(1), where appropriate in cooperation with each other*".

- Implement → Risk control Measures
- Monitor → Risk control Measures
- Contract → Contractors, partners and suppliers
  - Implement → Risk control measures
  - Monitor → Risk control measures

Article 4.4:
All other actors of the railway system *having a potential impact*

- Implement → Risk control measures
- Compliance → Specified requirements and conditions for use

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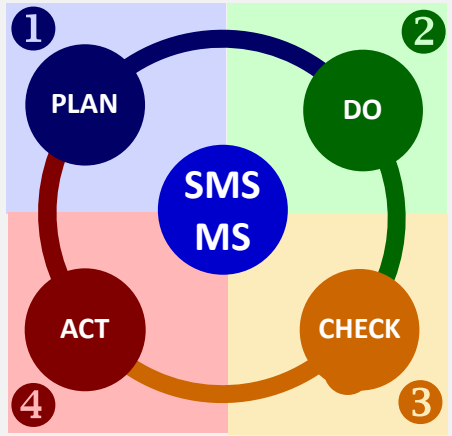
What is an SMS/MS?



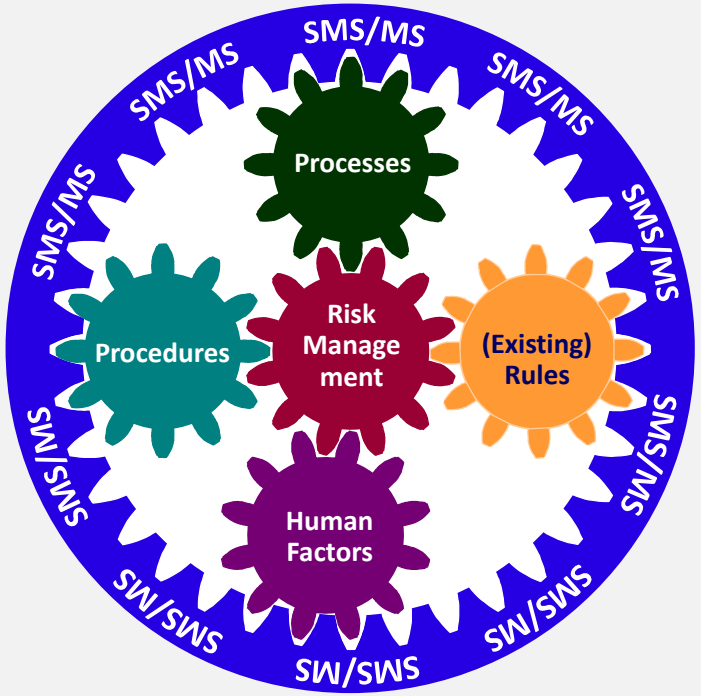
SMS/MS is **a structured & documented set of tools,** specific to activities of every RU-IM-ECM, used for safe management of company risks. It ensures that:

1) **PLAN**: the company is organised (designed) to deliver safely the operation through appropriate **processes, procedures & rules**

2) **DO**: the company actually deploys the operational and supporting processes

3) **CHECK**: the company measures the effectiveness of the processes (monitoring)

4) **ACT/ADJUST**: the company takes preventive or corrective measures on detection of non-compliances *(→ i.e. continuous management of company risks with aim of preventing accidents)*



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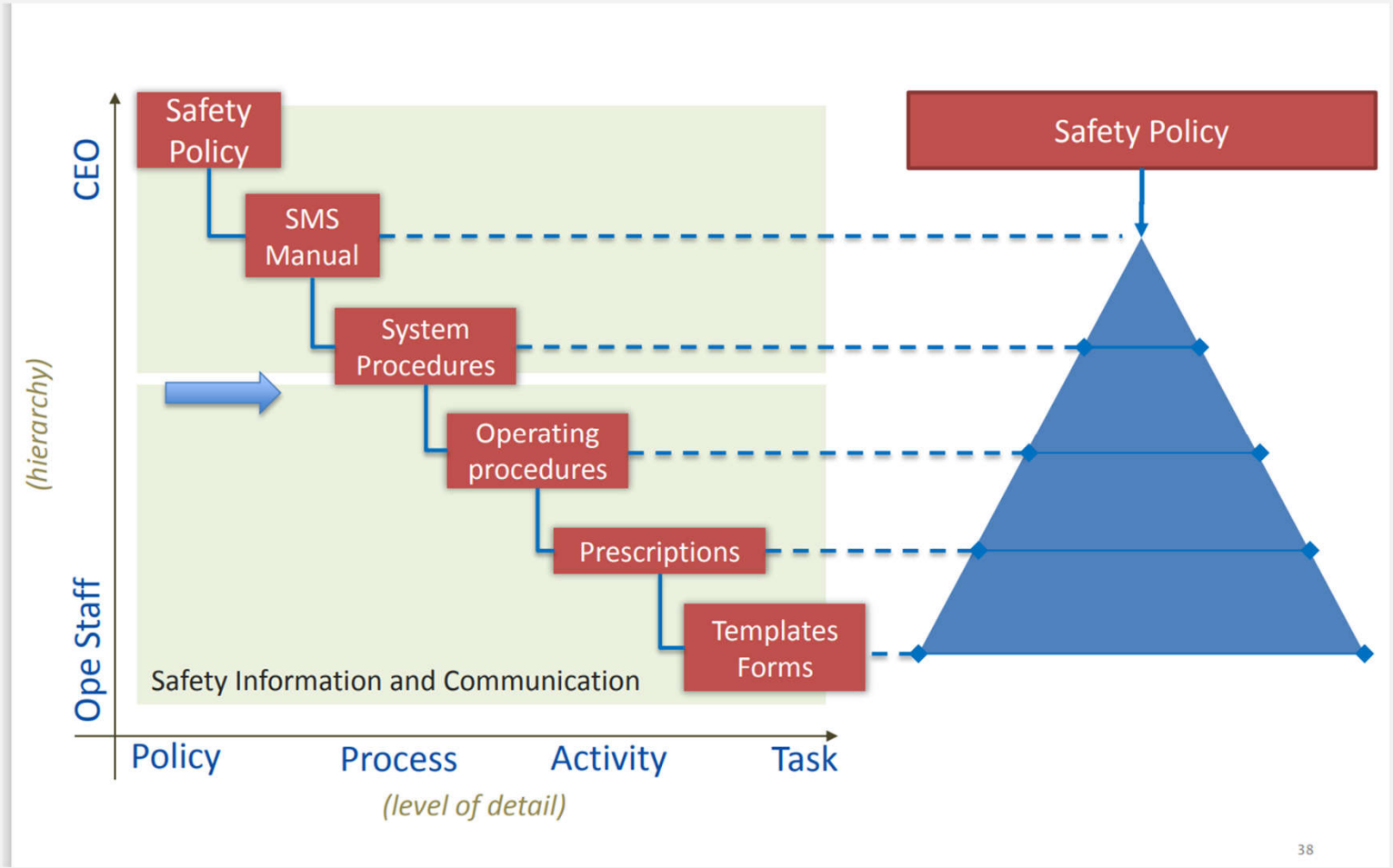
SMS requirements (Common Safety Methods on SMS Requirements Regulation 2018/762)



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SMS

The purpose of the SMS is to ensure that the organisation controls risks that arise as a consequence of business objectives in a safe manner and complies with all of the safety obligations that apply to it.

Adopting a structured approach enables the identification of hazards and the continuous management of risks related to an organisation's own activities, with the aim of preventing accidents.

This approach takes into account shared risks at the interfaces with other actors in the railway system (mainly railway undertakings, infrastructure managers and entities in charge of maintenance but also any other actors having a potential impact on the safe operation of the rail system, such as manufacturers, maintenance suppliers, keepers, service providers, contracting entities, carriers, consignors, consignees, loaders, unloaders, training centres, as well as passengers and other people interacting with the rail system etc). Implementing all relevant elements of a SMS in an adequate way can provide an organisation with the necessary trust that it controls and will continue to control all the risks associated with its activities, under all conditions

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Risk assessment – why

Why?

"Implementing all relevant elements of an SMS in an adequate way can provide an organisation with the necessary trust that it controls and will continue to **control all the risks associated with its activities, under all conditions**."

"An SMS is a unique system of **documented information**, providing an indication of the specific **risk control measures** and systems in place within an individual organisation which evolves over time as the organisation changes."

An organisation should at least:
- Know and document all risks associated to its activities;
- Know and document the control measures in place to control the risks;

A risk register is the document collecting all the organisation's risks and risk control measures

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SMS – reporting and exchange of information

Requirement 4.4.2 :
Basic requirements for the purposes of the exchange of information (4.4.2) are identified in the TSI OPE between the railway undertaking and the infrastructure manager, in the ECM Regulation between the railway undertaking and the ECM, in the CSM on Safety Management System Requirements between the railway undertaking/infrastructure manager and the authorities (the Agency, NSA).

Requirement 7.1.1 :
7.1. Learning from accidents and incidents
7.1.1. Accidents and incidents related to the organisation’s railway operations shall be: (a) reported, logged, investigated and analysed to determine their causes; (b) reported to national bodies as appropriate.

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- The assessment of achievement of CSTs is facilitated by the collection and use of a common set of rail safety data, the Common Safety Indicators (CSIs).
- National safety authorities use CSIs to gather information from railway undertakings and infrastructure managers, which combined with other relevant data, makes a comparative analysis possible, and serves as basis for policy recommendations at EU level.
- CSIs are based on common definitions and calculation methods, the data set is structured as follows:
  - Significant accidents;
  - Deaths and serious injuries;
  - Suicides;
  - Precursors of accidents;
  - Economic impact of accidents;
  - Technical aspects (level crossings by type and automatic train protection systems).

NUMBERS

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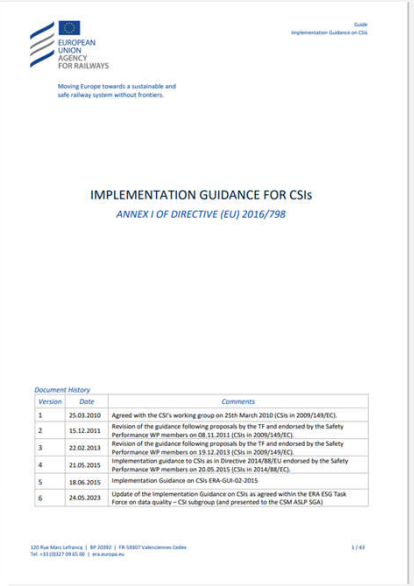
- CSIs primarily concern significant accidents as opposed to the serious accidents reported by National Investigation Bodies (NIBs). Significant accident covers a wider range of events than serious accidents.

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

IMPLEMENTATION GUIDANCE FOR CSIs

ANNEX I OF DIRECTIVE (EU) 2016/798

Document History

Version	*Date*	*Comments*
1	25.03.2010	Agreed with the CSI's working group on 25th March 2010 (CSIs in 2009/149/EC).
2	15.12.2011	Revision of the guidance following proposals by the TF and endorsed by the Safety Performance WP members on 08.11.2011 (CSIs in 2009/149/EC).
3	22.02.2013	Revision of the guidance following proposals by the TF and endorsed by the Safety Performance WP members on 19.12.2013 (CSIs in 2009/149/EC).
4	21.05.2015	Implementation guidance to CSIs as in Directive 2014/88/EU endorsed by the Safety Performance WP members on 20.05.2015 (CSIs in 2014/88/EC).
5	18.06.2015	Implementation Guidance on CSIs ERA-GUI-02-2015
6	24.05.2023	Update of the Implementation Guidance on CSIs as agreed within the ERA ESG Task Force on data quality – CSI subgroup (and presented to the CSM-ASLP SGA)

Note: For the CSIs, the classification of an event may depend on whether the train or other rail vehicle is involved, as summarized in the table below.

Where a train is involved	Where the accident involves other rail vehicles
Derailment	Other
Collision	Other
Level crossing accident	Level crossing accident
Person hit by rolling stock in motion	Person hit by rolling stock in motion
Fire	Fire
Other	Other
SPAD	(not reported)

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Pre-cursors

- Broken rail
- Track buckles and other track misalignment
- Wrong side signalling failure
- Signal passed at danger (SPAD) when passing a danger point
- Signal passed at danger (SPAD) without passing a danger point
- Broken wheel on rolling stock in service
- Broken axle on rolling stock in service

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Current reporting of safety information

NIB

Can investigate serious accidents

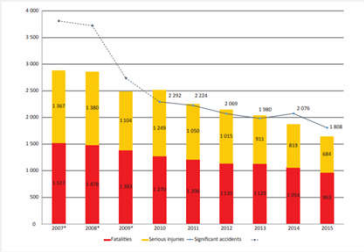
CST

- *Annual safety report*
- *Information on accidents/incidents*

Operators → NSA → ERA

CSIs

Reports



Provides expertise (Operators)

Provides expertise (NSA)

Provides secretariat (ERA)

Joint Network Secretariat

JNS reports: short/long term risk control measures
+ proposals to change legislation

Urgent / Normal procedures to investigate issues (accidents, incidents, ..) with EU wide impact

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Strengths / weaknesses of this system?

Strengths?

Weaknesses?

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Under development : CSM ASLP

- Common Safety Methods for assessing the safety level and the safety performance of railway operators at national and Union level
  - Development started : mid-2019
  - Discussion started with first a Big Picture document (2019), followed by a Working Party in which the NSAs and Representative Bodies participated (2019 – 2021)
  - Resulted in a Recommendation sent to the European Commission

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Importance of reporting and sharing of information

- Ensure that accidents that occurred are prevented by other operators
- Identify and monitor trends in Safety Level and Safety Performance scores
- Identify common causes that indicate risks are not under control
- Identify opportunities of improving risk control measures
- Identify best practices in the management of risk control measures
- Identify opportunities for improving cost-efficiency in risk control measures

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- Support the users of the Information Sharing System (training/updates/..)
- Identify gaps in data set (missing causes, missing RCM or RCM information, missing links..)
- Provide input to improve the legal framework in a broader sense
- Identify correlations between measured parameters and risk levels
- Identify correlations between maturity of operators and accident/risk levels

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Aim CSM ASLP

- “provide assistance to the railway undertakings and infrastructure managers for improving their safety management and, in particular to ensure that they can achieve their business objectives in a continuously improved safe manner. The methods should also support decision making of Member States regarding the achievement of common safety targets referred to in Article 7 of Directive (EU) 2016/798, by providing evidence and information on the evolution of safety performance and safety levels at national and Union level.”

- “enable railway operators, national safety authorities and the Agency to collectively ensure a broader visibility of the current safety level and safety performance of the railway operators for the different types of operations defined in Article 3(31) of Directive (EU) 2016/798 and should provide the necessary system-wide data and information for efficient continuous improvements, taking into account technical and scientific progress.”

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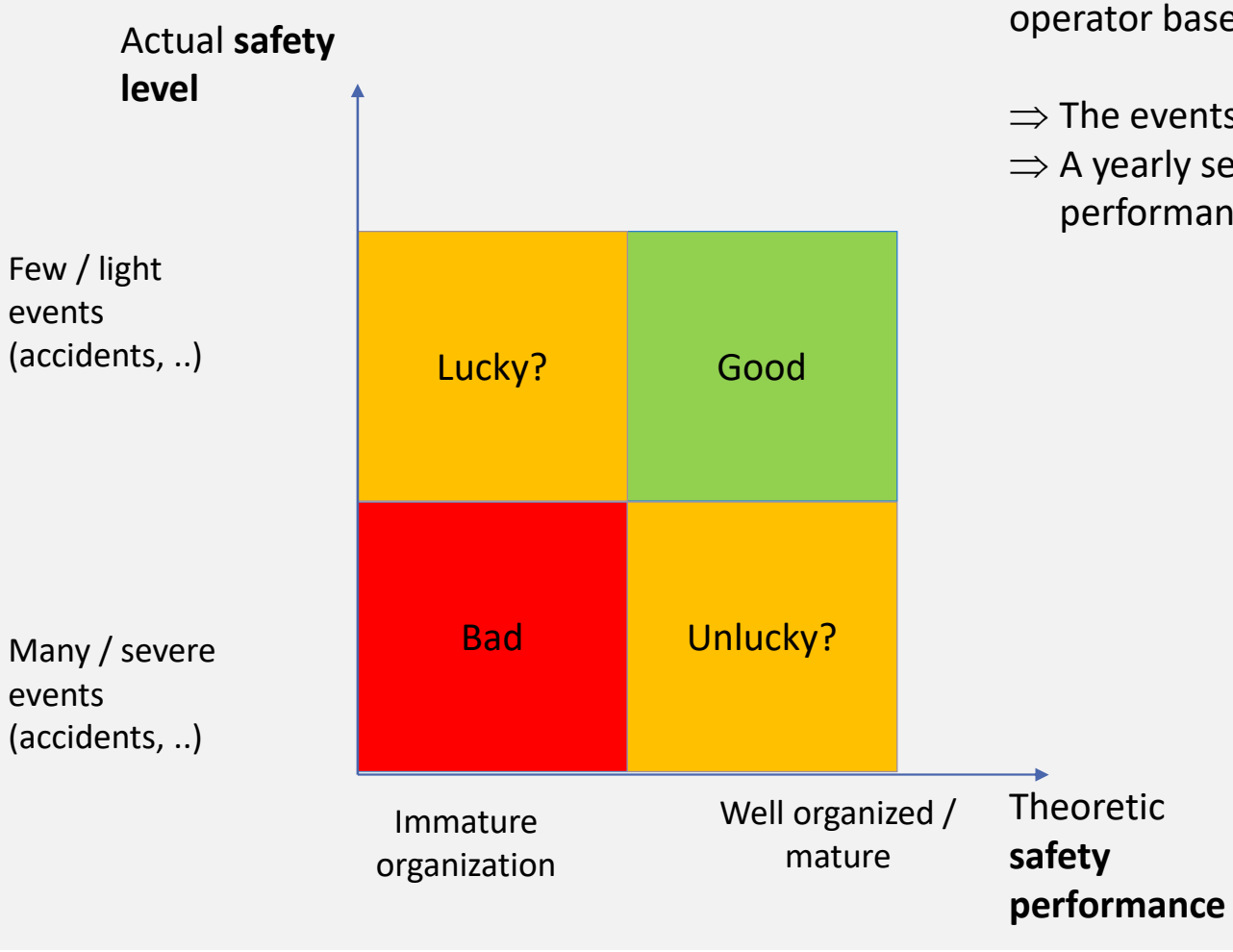
Safety **level** and safety **performance** will be calculated on a yearly basis for each operator based on:

⇒ The events reported (safety level)
⇒ A yearly self assessment (safety performance)



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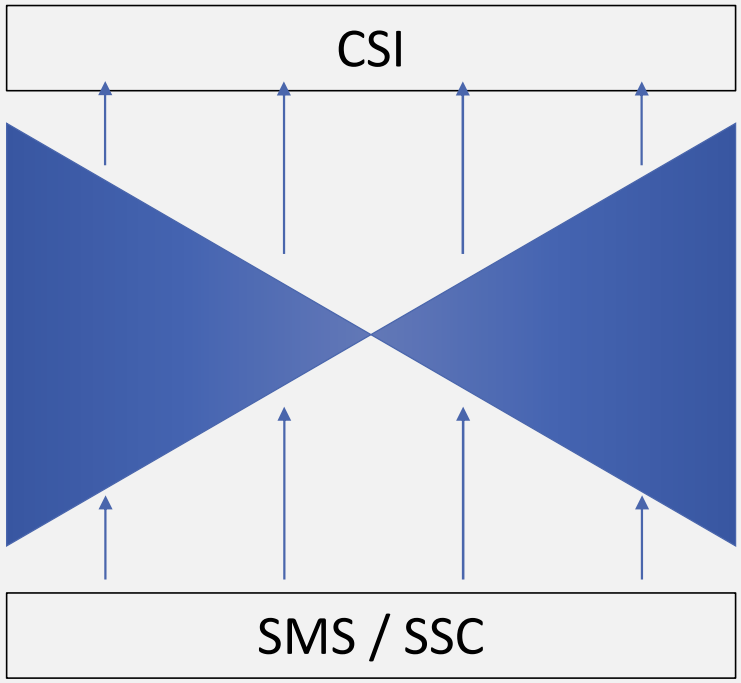

Actual safety **level**

Theoretic safety **performance**

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- Explain reporting of events : now
- Explain the safety performance : later in training

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- What? Type A event | Type B event | Type C event
- Why? Contributing factors | Systemic factors
- Mitigation strategies? RCM functions

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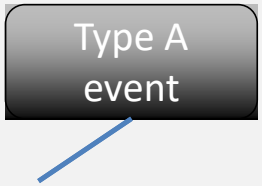
Taxonomy elements to enable reporting of risk scenarios



"Accident types closely related to CSI"

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CSM ASLP taxonomy: Type A events

- **Collisions (A1):**
  Includes train collisions with another train/rail vehicle, obstacles, or other rail vehicles not forming a train.
- **Derailments (A2):**
  Involves scenarios where at least one wheel of a train or rail vehicles not forming a train leaves the rails.
- **Level Crossing Accidents (A3):**
  Accidents at level crossings involving trains, rail vehicles, pedestrians, and crossing vehicles or objects temporarily present on or near the track.
- **Accidents to Persons Involving Rolling Stock in Motion (A4):**
  Accidents to persons hit by a train or rail vehicle, objects attached or detached from the train or vehicle, persons falling from trains or vehicles, or hit by loose objects while onboard.
- **Fire or Explosion in Rolling Stock (A5):**
  Fire or explosion occurring in a train, rail vehicle, or its load.
- **Other Accidents (A0):**
  Includes electric shocks, cargo/freight falling from a height, dangerous goods accidents not related to another type A event, and other accidents not covered in the above categories.
- **Suicides and Attempted Suicides (A6 - Voluntary Reporting):**
  Acts to deliberately injure oneself resulting in death or serious injury.

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Reference list for Category A events

Reference list for Category A events, in accordance with Article 3 (e) definition			
Code of event type	Name of the event type	Definitions	Allocation of related occurrences
A1	**Collisions**		Section 5.1.3 of Appendix C Part A apply
A1.1	**Collision of train with rail vehicle**	A front to front, front to end or a side collision between a part of a train and a part of another train or rail vehicle, or with shunting rolling stock	Section 5.1.3 of Appendix C Part A apply
A1.2	**Collision of train with obstacle within the clearance gauge**	A collision between a part of a train and objects fixed or temporarily present on or near the track (except at level crossings if lost by a crossing vehicle or user), including collision with overhead contact lines	Section 5.1.3 of Appendix C Part A apply
A1.3	**Collision of one or more rail vehicle with another rail vehicle**	Same as A1.1 but concerning one or more rail vehicle not forming a train.	Section 5.1.3 of Appendix C Part A apply
A1.4	**Collision of one or more rail vehicle with obstacle within the clearance gauge**	Same as A1.2 but concerning one or more rail vehicle not forming a train.	Section 5.1.3 of Appendix C Part A apply

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Reference list for Category A events

A1.5	**Other**	A reporting of information in accordance with section 3.3 of Appendix A - Part C shall apply.	Section 5.1.3 of Appendix C Part A apply
A2	**Derailments**		Section 5.1.3 of Appendix C Part A apply
A2.1	**Derailment of train**	Any case in which at least one wheel of a train leaves the rails	Section 5.1.3 of Appendix C Part A apply
A2.2	**Derailment of one or more rail vehicle**	Same as A2.1 but concerning one or more rail vehicle not forming a train.	Section 5.1.3 of Appendix C Part A apply
A2.3	**Other**	A reporting of information in accordance with section 3.3 of Appendix A - Part C shall apply.	Section 5.1.3 of Appendix C Part A apply
A3	**Level Crossing Accident**	Any accident at level crossings involving at least one railway vehicle and one or more crossing vehicles, other crossing users such as pedestrians or other objects temporarily present on or near the track if lost by a crossing vehicle or user	Section 5.1.3 of Appendix C Part A apply
A3.1	**Level Crossing Accident involving a train**	Same as A3 but concerning a train.	Section 5.1.3 of Appendix C Part A apply
A3.2	**Level Crossing Accident involving one or more rail vehicles**	Same as A3 but concerning one or more rail vehicle not forming a train.	Section 5.1.3 of Appendix C Part A apply

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Reference list for Category A events

A3.3	**Other**	A reporting of information in accordance with section 3.3 of Appendix A - Part C shall apply.	Section 5.1.3 of Appendix C Part A apply
A4	**Accidents to persons involving rolling stock in motion**	Accidents to one or more persons who are either hit by a railway vehicle or by an object attached to, or that has become detached from, the vehicle, this includes persons who fall from railway vehicles as well as persons who fall or are hit by loose objects when travelling on board vehicles	Section 5.1.3 of Appendix C Part A apply
A4.1	**Accidents to persons involving a train in motion**	Same as A4 but concerning rolling stock in motion forming a train.	Section 5.1.3 of Appendix C Part A apply
A4.2	**Accidents to persons involving rail vehicle in motion**	Same as A4 but concerning one or more rail vehicle not forming a train.	Section 5.1.3 of Appendix C Part A apply
A4.3	**Other**	A reporting of information in accordance with section 3.3 of Appendix A - Part C shall apply.	Section 5.1.3 of Appendix C Part A apply
A5	**Fire (or explosion) in rolling stock**	A fire or explosion that occurs in a railway vehicle (including its load) when it is running between the departure station and the destination, including when stopped at the departure station, the destination or intermediate stops, as well as during re-marshalling operations	Section 5.1.3 of Appendix C Part A apply
A5.1	**Fire (or explosion) in Rolling Stock involving a train**	Same as A5 but concerning rolling stock in motion forming a train.	Section 5.1.3 of Appendix C Part A apply
A5.2	**Fire (or explosion) involving one or more rail vehicle**	Same as A5 but concerning one or more rail vehicle not forming a train.	Section 5.1.3 of Appendix C Part A apply

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Reference list for Category A events

A5.3	**Others**	A reporting of information in accordance with section 3.3 of Appendix A - Part C shall apply.	Section 5.1.3 of Appendix C Part A apply
A6	**Other accident**	any accident other than a collision of train with rail vehicle, collision of train with obstacle within the clearance gauge, derailment of train, level crossing accident, an accident to person involving rolling stock in motion or a fire in rolling stock	Section 5.1.3 of Appendix C Part A apply
A6.1	**Electrocution**	(reserved)	Section 5.1.3 of Appendix C Part A apply
A6.2	**Cargo falling from a height**	(reserved) Note: here it is referred to cargo(es) falling from a height during the process of applicable types of railway operations	Section 5.1.3 of Appendix C Part A apply
A6.3	**Dangerous goods occurrence not related to another type A event**	A reporting of information in accordance with section 1.8.5 of 'RID' (as referred to in Annex II.1 to Directive 2008/68/EC, as amended) shall apply.	Section 5.1.3 of Appendix C Part A apply
A6.4	**Other**	A reporting of information in accordance with section 3.3 of Appendix A - Part C shall apply.	Section 5.1.3 of Appendix C Part A apply
A7	**Suicides and attempted suicides (voluntary reporting)**	Definition applied consistently with Annex I to Directive (EU) 2016/798	Not applicable
A7.1	**Suicide (voluntary reporting)**	An act to deliberately injure oneself resulting in death, as recorded and classified by the competent national authority	Not applicable
A7.2	**Attempted suicide (voluntary reporting)**	An act to deliberately injure oneself resulting in serious injury	Not applicable

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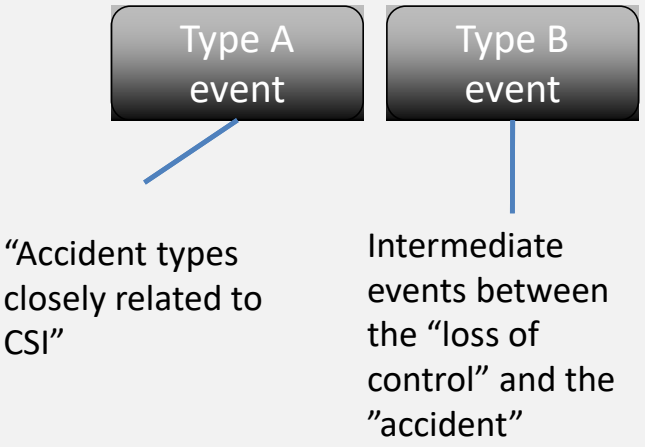
Taxonomy elements to enable reporting of risk scenarios



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CSM ASLP taxonomy: Type B events

- **Operation Failures (B.1):**
  This includes all operation failures, whether they are due to infrastructure or train or rail vehicle operation. Examples are improper routing, signal passed at danger, over-speeding, etc. It involves sections B.1, B.1.1, B.1.2, and their subcategories.
- **Technical Failure of the Rolling Stock (B.2):**
  This involves all technical failures related to the rolling stock, such as failure of the wheelset, braking system, and other rolling stock failures like on-board signalling failure, odometry error, etc. It involves sections B.2, B.2.1, B.2.2, B.2.0, and their subcategories.
- **Technical Failure of the Infrastructure (B.3):**
  This includes all the technical failures of the infrastructure, for instance, track failure, structures failure, and other infrastructure failures like power supply equipment failure, overhead contact line failure, etc. It involves sections B.3, B.3.1, B.3.2, B.3.0, and their subcategories.
- **Other category B event types (B.0):**
  This includes other category B events that do not fall under the categories mentioned above, such as fire in proximity of rail infrastructure, unauthorized presence of staff/employees or other third parties on the railway system. It involves section B.0 and its subcategories.

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Reference list for Category B events

Reference list for Category B events, in accordance with Article 3 (f) definition			
Code of event type	Name of the event type	Definitions	By default allocation of related occurrences
B.1	**Operation failures**		Section 5.1.3(c) of Appendix C Part A apply
B.1.1	**Failure to operate the infrastructure**		Section 5.1.3(c) of Appendix C Part A apply
B.1.1.1	Improper routing	Any occasion when a train/vehicle is directed on an inappropriate track.	IM or RU if responsible of the routing
B.1.1.2	On track plant incorrectly outside possession	Note: on track plant refers to on track machine(s) or other object(s) used during infrastructure works.	IM
B.1.1.3	Pushed switch	Any occasion when a switch is run over in a wrong setting unintentionally	Section 5.1.3(c) of Appendix C Part A apply
B.1.1.4	Other	A reporting of information in accordance with section 3.3 of Appendix A - Part C shall apply.	Section 5.1.3(c) of Appendix C Part A apply
B.1.2	**Failure to operate a train or rail vehicle(s)**		RU

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Reference list for Category B events

B.1.2.1	Signal passed at danger when passing a danger point	Any occasion when any part of a train proceeds beyond its authorised movement and travels beyond the danger point.	RU
B.1.2.2	Signal passed at danger without passing a danger point	Any occasion when any part of a train proceeds beyond its authorised movement but does not travel beyond the danger point	RU
B.1.2.3	Runaway	Any uncontrolled movement of a rail vehicle over a distance of at least one meter.	RU
B.1.2.4	Over-speeding	Any occasion when a train runs with a speed higher than the maximum authorized speed or design speed.	RU
B.1.2.5	Loading irregularity	Any situation in which an improperly loaded goods creates an imminent risk of an accident.	RU
B.1.2.6	Train composition Failure		RU
B.1.2.7	Train available for boarding or alignment outside platform	When this situation is taking place unintentionally or without specific RU procedure to be followed	RU
B.1.2.8	Passenger entrapment in door		RU
B.1.2.9	Train departure with open door		RU
B.1.2.10	Long stop in tunnel	Any occasion when a passenger train is stopped in a tunnel for more than 10 minutes.	RU
B.1.2.11	Severe brake/snatch		RU
B.1.2.12	Brake not correctly set for load		RU
B.1.2.13	Brake not checked		RU
B.1.2.14	Other	A reporting of information in accordance with section 3.3 of Appendix A - Part C shall apply.	RU
B.1.3	**Other <u>un-coded operation failure</u>**	A reporting of information in accordance with section 3.3 of Appendix A - Part C shall apply.	RU

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Reference list for Category B events

B.2	**Technical Failure of the vehicles**		**RU**
B.2.1	**Failure of the wheelset**		RU
B.2.1.1	Broken wheel on rolling stock in service	A break affecting the wheel and creating a risk of accident (derailment or collision)	RU
B.2.1.2	Broken axle on rolling stock in service	A break affecting the axle and creating a risk of accident (derailment or collision) Note: this category excludes broken axles resulting from hot axles boxes.	RU
B.2.1.3	Hot axle box	Any situation in which the axle suffers structural failure due to friction-induced overheat.	RU
B.2.1.4	Suspension system failure		RU
B.2.1.5	Other	A reporting of information in accordance with section 3.3 of Appendix A - Part C shall apply.	RU
B.2.2	**Failure of the braking system**	A failure in breaking system significantly reducing the braking capacity.	RU
B.2.2.1	Brake not operating with the expected performance		RU
B.2.2.2	Other	A reporting of information in accordance with section 3.3 of Appendix A - Part C shall apply.	RU
B.2.3	**Other failures of the vehicle**		RU
B.2.3.1	Wrong side signaling (vehicle) failure	any technical failure of a signalling system (either to infrastructure or to rolling stock), resulting in signalling information less restrictive than that demanded	RU
B.2.3.2	Losing of vehicle parts	Any situation when a part of a rail vehicle detach and falls on ground.	RU
B.2.3.3	Traction motor failure (electrical)		RU
B.2.3.4	Diesel engine failure		RU
B.2.3.5	Coupling failure	Any situation in which the railway vehicles detach as a result of a structural component failure.	RU
B.2.3.6	Doors failure		RU

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Reference list for Category B events

B.2.3.7	Loss of ventilation	Note: for example, a loss of ventilation in railway vehicle compromising fire management plan, potentially leading to victims or damage	RU
B.2.3.8	ERTMS/ATP/APC odometry error		RU
B.2.3.9	Twisted underframe		RU
B.2.3.10	Train detection equipment failure		RU
B.2.3.11	Other	A reporting of information in accordance with section 3.3 of Appendix A - Part C shall apply.	RU
B.2.4	**Other un-coded technical failure of the vehicle**	A reporting of information in accordance with section 3.3 of Appendix A - Part C shall apply.	RU
B.3	**Technical Failure of the infrastructure**		**IM**
B.3.1	**Failure of the track**		IM
B.3.1.1	Broken rail	any rail which is separated in two or more pieces, or any rail from which a piece of metal becomes detached, causing a gap of more than 50 mm in length and more than 10 mm in depth on the running surface	IM
B.3.1.2	Track buckle and other track misalignment	any fault related to the continuum and the geometry of track, requiring track to be placed out of service or immediate restriction of permitted speed	IM
B.3.1.2.1	Gauge spread		IM
B.3.1.2.1	Track twist		IM
B.3.1.2.3	Improper rail fastening and joints		IM
B.3.1.2.4	Other		IM
B.3.1.3	Wrong side signaling (infrastructure) failure	any technical failure of a signalling system (either to infrastructure or to rolling stock), resulting in signalling information less restrictive than that demanded	IM

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Reference list for Category B events

B.3.1.4	Switch and crossing failure		IM
B.3.1.5	Failure of the level crossing equipment	Any occasion when a train passes over a level crossing with lower protection level than required.	IM
B.3.1.6	Disorder of earthworks/embankment failure		IM
B.3.1.7	Other	A reporting of information in accordance with section 3.3 of Appendix A - Part C shall apply.	IM
B.3.2	**Structures failure**	Any collapse, including partial, distortion or break affecting the clearance gauge and stability of the superstructure.	IM
B.3.2.1	Tunnel failure		IM
B.3.2.2	Viaduct failure		IM
B.3.2.3	Culvert failures		IM
B.3.2.4	Rail bridge structural failure		IM
B.3.2.5	Over line bridge (e.g. pedestrian) failure		IM
B.3.2.6	Station (building) Structure failure		IM
B.3.2.7	Platform failure		IM
B.3.2.8	Other	A reporting of information in accordance with section 3.3 of Appendix A - Part C shall apply.	IM
B.3.3	**Other failures of the infrastructure**		IM
B.3.3.1	Power supply equipment failure		IM
B.3.3.2	Train detection equipment failure		IM

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Reference list for Category B events

B.3.3.3	Overhead contact line failure		IM
B.3.3.4	Loss of ventilation	Note: for example, a loss of tunnel ventilation compromising fire management plan, potentially leading to victims or damage	IM
B.3.3.5	Other	A reporting of information in accordance with section 3.3 of Appendix A - Part C shall apply.	IM
B.3.4	**Other un-coded technical failure of the infrastructure**	A reporting of information in accordance with section 3.3 of Appendix A - Part C shall apply.	IM

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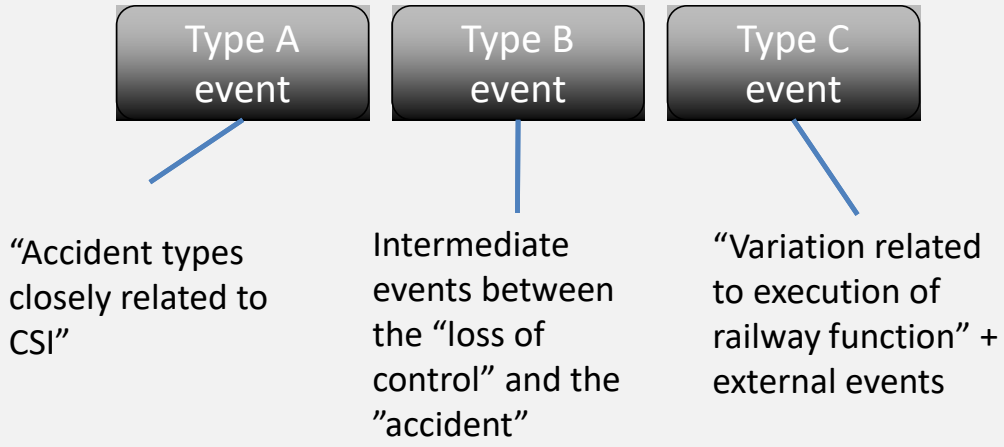
Taxonomy elements to enable reporting of risk scenarios



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CSM ASLP taxonomy: Type C events

- **C.1. - Railway system performance**
  - C.1.1 - To provide power for train (or vehicle) operations
  - C.1.2 - To respond to incidents and occurrences
  - C.1.3 - To maintain, repair and extend the infrastructureC.1.4 - To operate a train in normal operational situations
  - C.1.5 - To control train movements in all operational circumstances
  - C.1.6 - To prepare trains for service
  - C.1.7 - To support passenger movements and well-being at stations
  - C.1.8 - To check, inspect, maintain and repair rolling stock for service
  - C.1.9 - To design a structural subsystem
  - C.1.10 - To Install a structural subsystem

C.2 - External events - Environmental

  - C.2.1 - Earthquake
  - C.2.2 - Flooding
  - ... (and other sub-categories)

- **C.3 - External events - Security**
  - C.3.1 - Terrorism
  - C.3.2 – Assault

C.0 - Other un-coded category C event types

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Reference list for Category C events

Reference list for Category C events, in accordance with Article 3 (g) definition

Note: In this table, the Category C event type are mainly formulated as a variation in the performance of a railway function or the action of external events with the potential to directly or indirectly cause a category B event

Code of event type	Name of the event type	Definitions	By default allocation of related occurrences
C.1	**Human Performance**		
C.1.1	**To provide power for train (or vehicle) operations in normal operations, or situations where there are disruptions or engineering work**		
C.1.1.1	Variation in function 'Take up power control duties'		
C.1.1.2	Variation in function 'Monitor power'		
C.1.1.3	Variation in function 'Provision of traction supply'		
C.1.1.4	Variation in function 'Detect irregularity'		
C.1.1.5	Variation in function 'Agreement of isolation'		
C.1.1.6	Variation in function 'Formal agreement for control of the line'		
C.1.1.7	Variation in function 'Apply isolation'		
C.1.1.8	Variation in function 'Return of power / remove isolation'		
C.1.1.9	Other	A reporting of information in accordance with section 3.3 of Appendix A - Part C shall apply.	
C.1.2	**To respond to incidents and occurrences, including arrangements for safety and initiation of remedial actions**		
C.1.2.1	Variation in function 'Detect irregularity'		
C.1.2.2	Variation in function 'Conduct immediate mitigation, containment'		

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Reference list for Category C events

C.1.2.3	Variation in function 'Gather and communicate incident information'		
C.1.2.4	Variation in function 'Protect work area'		
C.1.2.5	Variation in function 'Verify work arrangements'		
C.1.2.6	Variation in function 'Ensure status of infrastructure'		
C.1.2.7	Variation in function 'Formal agreement for control of the line'		
C.1.2.8	Variation in function 'Coordinating failure and incident response'		
C.1.2.9	Variation in function 'Anticipate delay'		
C.1.2.10	Variation in function 'Re-planning train service'		
C.1.2.11	Variation in function 'Ensure passenger and personnel safety'		
C.1.2.12	Variation in function 'Rectifying the incident'		
C.1.2.13	Variation in function 'Protect evidence'		
C.1.2.14	Other	A reporting of information in accordance with section 3.3 of Appendix A - Part C shall apply.	
C.1.3	**To maintain, repair and extend the infrastructure**		IM

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Reference list for Category C events

C.1.3.1	Variation in function 'Identify engineering work requirements'		IM
C.1.3.2	Variation in function 'Establish network access'		IM
C.1.3.3	Variation in function 'Formulate work plans'		IM
C.1.3.4	Variation in function 'Allocate resources'		IM
C.1.3.5	Variation in function 'Formal agreement for control of the line'		IM
C.1.3.6	Variation in function 'Verify work arrangements'		IM
C.1.3.7	Variation in function 'Protect work area'		IM
C.1.3.8	Variation in function 'Supply of resources to site work'		IM
C.1.3.9	Variation in function 'Establish safe working environment'		IM
C.1.3.10	Variation in function 'Using trains, plant and machinery for engineering work'		IM
C.1.3.11	Variation in function 'Close down site on completion of work'		IM
C.1.3.12	Variation in function 'Supervision of teams and individuals'		IM

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Reference list for Category C events

C.1.3.13	Variation in function 'Carrying out trackside work'		IM
C.1.3.14	Other	A reporting of information in accordance with section 3.3 of Appendix A - Part C shall apply.	IM
C.1.4	**To operate a train in normal operational situations and situations where disruption or problems occur**		RU
C.1.4.1	Variation in function 'Ensure authority'		RU
C.1.4.2	Variation in function 'Maintain appropriate speed'		RU
C.1.4.3	Variation in function 'Ensure train integrity and load integrity on journey'		RU
C.1.4.4	Variation in function 'Stopping train'		RU
C.1.4.5	Variation in function 'Management of train control systems'		RU
C.1.4.6	Variation in function 'Ensure status of infrastructure'		RU
C.1.4.7	Variation in function 'Operate level crossing'		RU
C.1.4.8	Variation in function 'Warnings to other rail users'		RU
C.1.4.9	Variation in function 'Stabling of vehicles'		RU

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Reference list for Category C events

C.1.4.10	Variation in function 'Provide information and support to passengers'		RU
C.1.4.11	Other	A reporting of information in accordance with section 3.3 of Appendix A - Part C shall apply.	RU
C.1.5	**To control train movements in all operational circumstances**		IM
C.1.5.1	Variation in function 'Take up control of train movement duties'		IM
C.1.5.2	Variation in function 'Handover of responsibility'		IM
C.1.5.3	Variation in function 'Monitor rail network'		IM
C.1.5.4	Variation in function 'Authorise train movements'		IM
C.1.5.5	Variation in function 'Route / re-route passenger or freight service'		IM
C.1.5.6	Variation in function 'Record train movements'		IM
C.1.5.7	Variation in function 'Anticipate delays or poor traffic flow'		IM
C.1.5.8	Variation in function 'Deal with irregular train movements'		IM
C.1.5.9	Variation in function 'Provide train identification'		IM

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Reference list for Category C events

C.1.5.10	Variation in function 'Manage implementation of emergency / temporary speed restrictions'		IM
C.1.5.11	Variation in function 'Gather and communicate information'		IM
C.1.5.12	Variation in function 'Control level crossing'		IM
C.1.5.13	Variation in function 'Dispatch train'		IM
C.1.5.14	Variation in function 'Supervision of teams and individuals'		IM
C.1.5.15	Other	A reporting of information in accordance with section 3.3 of Appendix A - Part C shall apply.	IM
C.1.6	**To prepare trains for service**		RU
C.1.6.1	Variation in function 'Assembling vehicle formation'		RU
C.1.6.2	Variation in function 'Preparation of vehicles'		RU
C.1.6.3	Variation in function 'Take up driving duties'		RU
C.1.6.4	Variation in function 'Loading of freight'		RU
C.1.6.5	Other	A reporting of information in accordance with section 3.3 of Appendix A - Part C shall apply.	RU
C.1.7	**Support passenger movements and well-being at stations**		RU
C.1.7.1	Variation in function 'Preparing stations for use by passengers'		RU

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Reference list for Category C events

C.1.7.2	Variation in function 'Assisting passengers'		RU
C.1.7.3	Variation in function 'Control of crowds'		RU
C.1.7.4	Other	A reporting of information in accordance with section 3.3 of Appendix A - Part C shall apply.	RU
C.1.8	**To check, inspect maintain and repair rolling stock for service**		
C.1.8.1	Variation in function 'Identify rolling stock maintenance requirements'		
C.1.8.2	Variation in function 'Allocate resources'		
C.1.8.3	Variation in function 'Prepare rolling stock for inspection'		
C.1.8.4	Variation in function 'Inspect rolling stock'		
C.1.8.5	Variation in function 'Handover of responsibility'		
C.1.8.6	Variation in function 'Installation of components onto vehicles normally in service'		
C.1.8.7	Variation in function 'Maintenance of components on vehicles normally in service'		
C.1.8.8	Variation in function 'Servicing of rolling stock'		
C.1.8.9	Other	A reporting of information in accordance with section 3.3 of Appendix A - Part C shall apply.	

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Reference list for Category C events

C.1.9	**To design a structural subsystem**		
C.1.9.1	Variation in function 'Define scope and purpose'		
C.1.9.2	Variation in function 'Establish system definition and application conditions '		
C.1.9.3	Variation in function 'Identify risks'		
C.1.9.4	Variation in function 'Specify system requirements'		
C.1.9.5	Variation in function 'Apportion system requirements (sub-system and compoment level)'		
C.1.9.6	Other	A reporting of information in accordance with section 3.3 of Appendix A - Part C shall apply.	
C.1.10	**To Install a structural subsystem**		
C.1.10.1	Variation in function 'Manufacture'		
C.1.10.2	Variation in function 'Assemble and install'		
C.1.10.3	Variation in function 'Validate (incl. safety acceptance and commissioning)'		
C.1.10.4	Variation in function 'Accept system (incl. entry in service)'		
C.1.10.5	Other	A reporting of information in accordance with section 3.3 of Appendix A - Part C shall apply.	

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Reference list for Category C events

C.1.11	**To Maintain a structural subsystem**		
C.1.11.1	Variation in function 'Coordinating/managing of maintenance (of below 3 activities) '		
C.1.11.2	Variation in function 'Identifying of maintenance needs '		
C.1.11.3	Variation in function 'Organizing maintenance activities '		
C.1.11.4	Variation in function 'Executing maintenance '		
C.1.11.5	Variation in function 'To Decommission a structural subsystem'		
C.1.11.6	Other	A reporting of information in accordance with section 3.3 of Appendix A - Part C shall apply.	
C.1.12	**External events - Environmental**	Note: This category of event and its subtypes are allowed to be used as Category B events in the case there is no other possibility to describe properly the scenario which took place.	
C.1.12.1	Earthquake		
C.1.12.2	Flooding		
C.1.12.3	Landslide		
C.1.12.4	Vegetation		
C.1.12.5	Other	A reporting of information in accordance with section 3.3 of Appendix A - Part C shall apply.	
C.1.13	**External events - Security**	Note: This category of event and its subtypes are allowed to be used as Category B events in the case there is no other possibility to describe properly the scenario which took place.	

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Reference list for Category C events

C.1.13.1	Terrorism		
C.1.13.2	Assault		
C.1.13.3	Theft		
C.1.13.4	Arson		
C.1.13.5	Vandalism		
C.1.13.6	Cyber attack		
C.1.13.7	Other	A reporting of information in accordance with section 3.3 of Appendix A - Part C shall apply.	
C.2	**Other**	A reporting of information in accordance with section 3.3 of Appendix A - Part C shall apply.	

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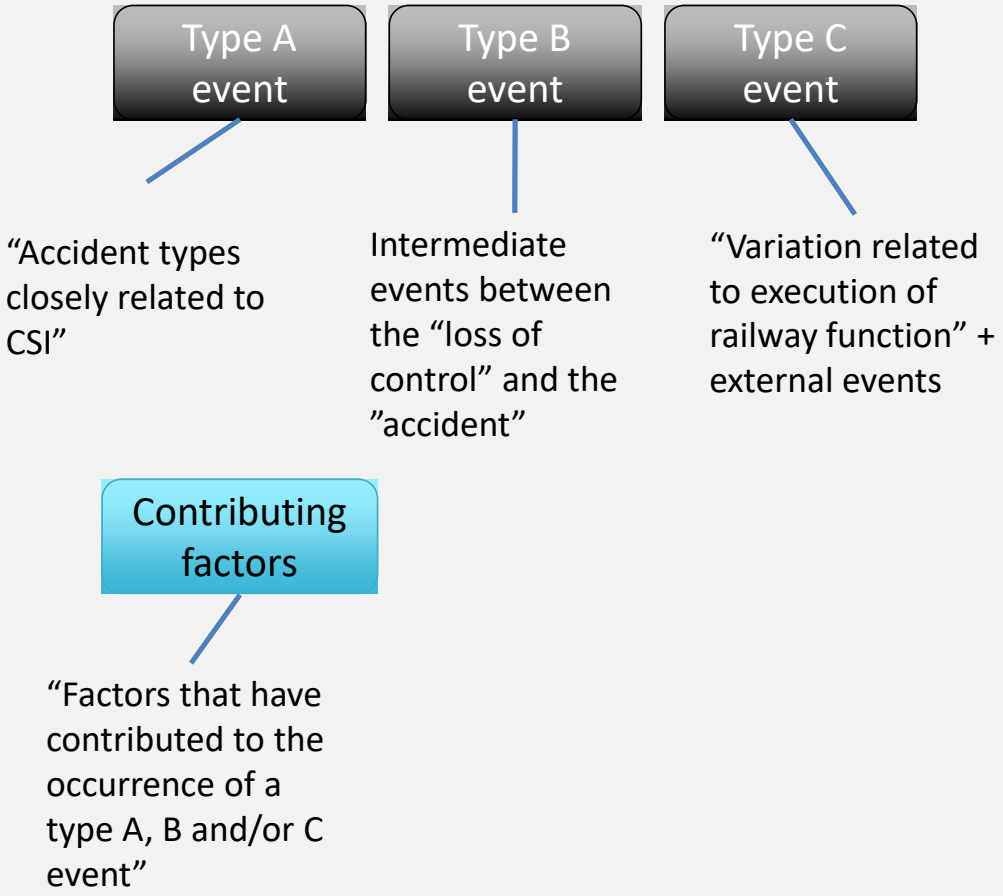
Taxonomy elements to enable reporting of risk scenarios



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CSM ASLP taxonomy: Contributing factors

- **CF.1 Performance Relevant Factor**
  - CF.1.1 Dynamic Situational Factors: Temporary characteristics influencing situations.
    Examples: Pressure, Complexity, Monotony, Work-rhythms, Environment.
  - CF.1.2 Dynamic Staff Factors: Temporary characteristics of individuals/teams influencing situations.
    Examples: Intentions, Attention, Fatigue, Stress, Awareness.
  - CF.1.3 Static Situational Factors: Lasting or repetitive situational elements.
    Examples: Design, Instructions, Communication Means, Tools, Context.
  - CF.1.4 Static Staff Factors: Lasting or repetitive individual/team characteristics.
    Examples: Experience, Personal traits, Motivation, Competencies, Decision-making.
  - CF.1.5 Relational Factors: Factors between staff or staff groups influencing situations.
    Examples: Communication, Relationships, Trust, Reinforcement, Involvement.

CF.0 Other Contributing Factors: Factors not covered by the above categories.

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Reference list for contributing factors

Note: In accordance with Article 2 of Regulation (EU) 2020/573, 'contributing factor' means any action, omission, event or condition that affects an occurrence by increasing its likelihood, accelerating the effect in time or increasing the severity of the consequences, but the elimination of which would not have prevented the occurrence.

Code of event type	Name of the event type	Definitions
F.1	**Performance relevant factor**	
F.1.1	**Dynamic staff factors**	
F.1.1.1	Intention: Expectation / Intention while acting / Decision model / Error type	
F.1.1.2	Attention / Vigilance/ Concentration	
F.1.1.3	Fatigue	
F.1.1.4	Stress (incl. emotions & psychosocial factors)	
F.1.1.5	Situational awareness (incl. self-awareness - situational self-knowledge)	
F.1.1.6	Other	A reporting of information in accordance with section 3.3 of Appendix A - Part C shall apply.
F.1.2	**Dynamic tasks factors**	
F.1.2.1	Uncertainty-Volatility / Time pressure / Time to respond	
F.1.2.2	Complexity-Ambiguity / Autonomy	
F.1.2.3	Monotony / Routine; habits	
F.1.2.4	Work rythms (working hours, breaks, manning)	
F.1.2.5	Working environment (visibility, noise, vibrations, weather,…)	
F.1.2.6	Other	A reporting of information in accordance with section 3.3 of Appendix A - Part C shall apply.
F.1.3	**Static Staff Factors**	

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Reference list for contributing factors

F.1.3.1	Experience: Familiarity / Individual experiences - job history	
F.1.3.2	Individual characteristics (incl. self-trust, openness (and others aspects of personality,...))	
F.1.3.3	Motivation / Commitment (to goal (priorities, risks), to organisation, to rules)	
F.1.3.4	Fit to work (matching to the requirements of the tasks/activities, health)	
F.1.3.5	Decision making skills	
F.1.3.6	Other	A reporting of information in accordance with section 3.3 of Appendix A - Part C shall apply.
F.1.4	**Static Task Factors**	
F.1.4.1	Communication Means	
F.1.4.2	Task instructions - Quality of procedures and rules	
F.1.4.3	User-centered design / Human Machine Interfaces / Levels of automation	
F.1.4.4	Tools - Preventive dispositions and devices	
F.1.4.5	Societal & Institutional context (regulation, economy, politics, medias, trespassing, sabotage, terrorism…)	
F.1.4.6	Other	A reporting of information in accordance with section 3.3 of Appendix A - Part C shall apply.

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Reference list for contributing factors

F.1.5	**Interactional Factors**	
F.1.5.1	Communication (between employees, within organisation)	
F.1.5.2	Relationships (within team, with team-leader, within organisation) - power issues	
F.1.5.3	Trust in information - in others (management, colleagues, technical means,…)	
F.1.5.4	Positive - negative reinforcement	
F.1.5.5	Involvement in decision making	
F.1.5.6	Other	A reporting of information in accordance with section 3.3 of Appendix A - Part C shall apply.
F.2	**Other**	A reporting of information in accordance with section 3.3 of Appendix A - Part C shall apply.

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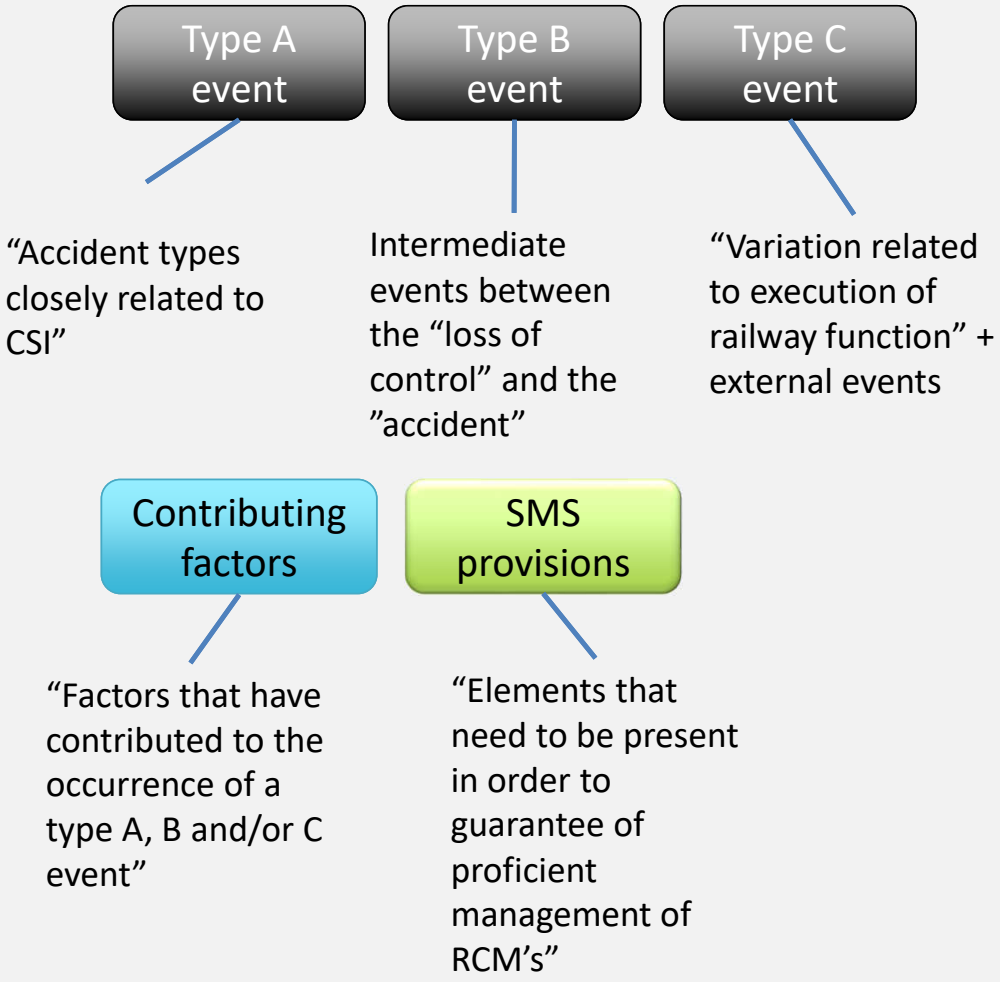
Taxonomy elements to enable reporting of risk scenarios



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CSM ASLP taxonomy: Systemic factors

- **SF.1 Leadership:**
  Factors that guide staff towards organizational objectives.
  Examples: Leadership and commitment, Safety Policy, Organizational roles and responsibilities, Consultation of staff, and other leadership aspects.
- **SF.2 Planning:**
  Factors that identify risks and establish safety objectives.
  Examples: Actions to address risks, Safety objectives and planning, and other planning aspects.
- **SF.3 Support:**
  Provides support for the safety management system.
  Examples: Resources, Competence, Awareness, Information and communication, Documented information, Integration of human and organizational factors, and other support aspects.
- **SF.4 Operation:**
  Develops and implements processes as per organizational safety policy.
  Examples: Operational planning and control, Asset Management, Contractors and suppliers management, Management of change, Emergency management, and other operational aspects.
- **SF.5 Performance Evaluation:**
  Monitors and audits processes in relation to objectives and resources.
  Examples: Monitoring, Internal auditing, Management review, and other performance evaluation aspects.
- **SF.6 Improvement:**
  Enhances safety performance and the safety management system.
  Examples: Learning from accidents and incidents, Continual improvement, and other improvement aspects.

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Reference list for systemic factors

Note: In accordance with Article 2 of Regulation (EU) 2020/573, 'Systemic factor' means any causal or contributing factor of an organisational, managerial, societal or regulatory nature that is likely to affect similar and related occurrences in the future, including, in particular the regulatory framework conditions, the design and application of the safety management system, skills of the staff, procedures and maintenance

Code of event type	Name of the event type	Definitions
S.1	**Leadership**	
S.1.1	Leadership and commitment	
S.1.2	Safety Policy	
S.1.3	Organizational roles, responsibilities, accountabilities and authorities	
S.1.4	Consultation of staff and other parties	
S.1.5	Other	A reporting of information in accordance with section 3.3 of Appendix A - Part C shall apply.
S.2	**Planning**	
S.2.1	Actions to address risks	

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Reference list for systemic factors

S.2.2	Safety objectives and planning	
S.2.3	Other	A reporting of information in accordance with section 3.3 of Appendix A - Part C shall apply.
S.3	**Support**	
S.3.1	Resources	
S.3.2	Competence	
S.3.3	Awareness	
S.3.4	Information and communication	
S.3.5	Documented information	
S.3.6	Integration of human and organizational factors	
S.3.7	Other	A reporting of information in accordance with section 3.3 of Appendix A - Part C shall apply.
S.4	**Operation**	
S.4.1	Operational planning and control	
S.4.2	Asset Management	
S.4.3	Contractors, partners and suppliers	
S.4.4	Management of change	
S.4.5	Emergency management	
S.4.6	Other	A reporting of information in accordance with section 3.3 of Appendix A - Part C shall apply.

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Reference list for systemic factors

S.5	**Performance evaluation**	
S.5.1	Monitoring	
S.5.2	Internal auditing	
S.5.3	Management review	
S.5.4	Other	A reporting of information in accordance with section 3.3 of Appendix A - Part C shall apply.
S.6	**Improvement**	
S.6.1	Learning from accidents and incidents	
S.6.2	Continual improvement	
S.6.3	Other	A reporting of information in accordance with section 3.3 of Appendix A - Part C shall apply.

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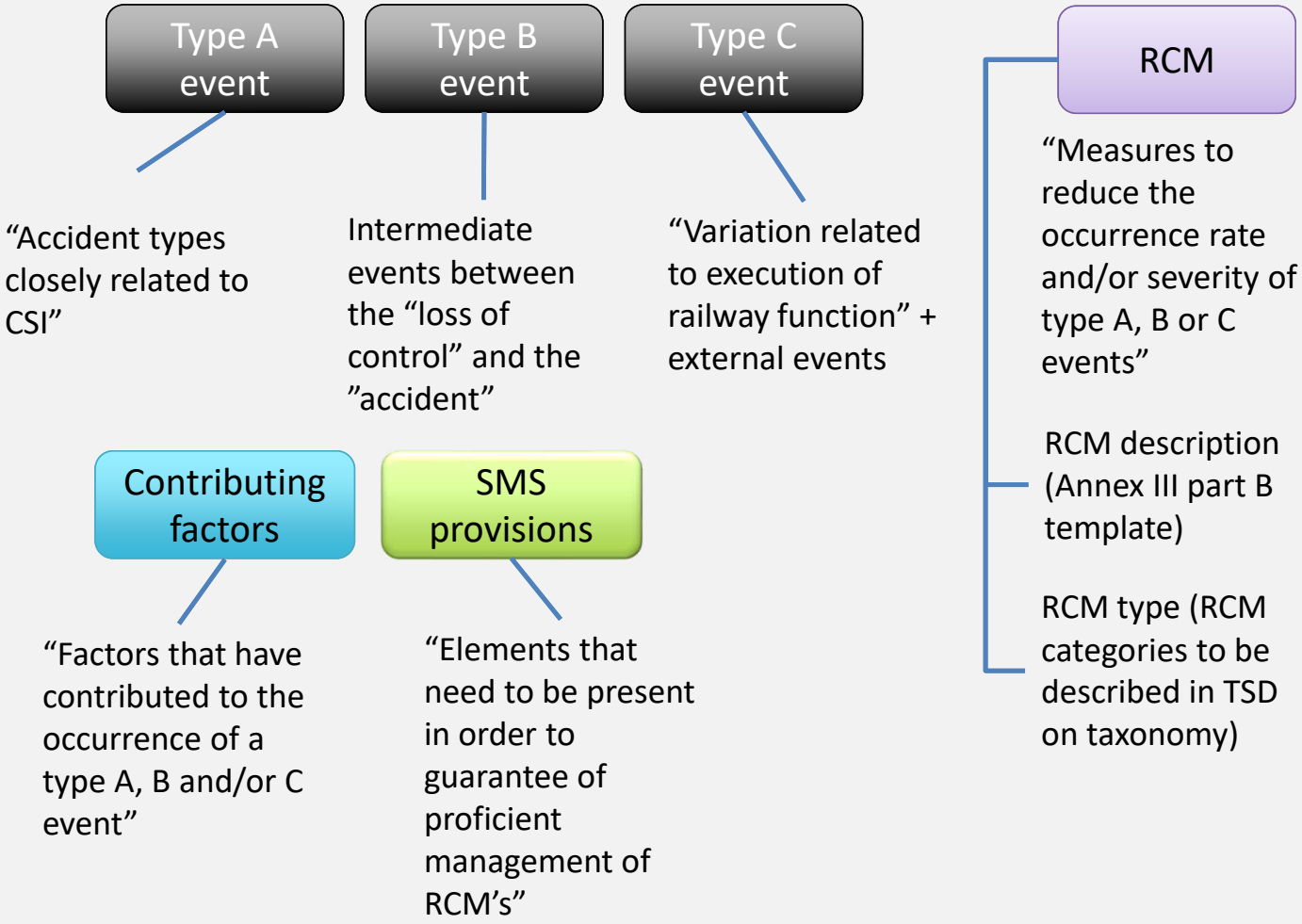
Taxonomy elements to enable reporting of risk scenarios



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APPENDIX A – PART D

RISK CONTROL MEASURE FUNCTIONS AND REFERENCE LIST

1. Definitions

The following definitions are applicable to describe the functions of a Risk Control Measure:

(a) "Risk Control Measure function" or "RCMF" means a function designed to contribute to the reduction of risks.

(b) "Detect function" means a function detecting a specified undesirable situation applicable to the linked event types.

(c) "Diagnose function" means a function evaluating the detected undesirable situation, taking into account its context, and deciding whether or not an action should be performed.

(d) "Act function" means a function that is designed to avoid the occurrence of the linked event types, or will directly reduce its consequences, or both.

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2. Risk Control Measure functions

Risk Control Measures shall consist of one or more of the functions described in this section.

2.1. Detect function

Code	Name	Definition
RCMF.1.0.	None	The RCM does not incorporate a detect function.
RCMF.1.1.	Technical system	The RCM incorporates a detect function. The detect function consists of an automated system that does not require human intervention in order to operate.
RCMF.1.2.	Human	The RCM incorporates a detect function. The detect function consists of an activity to be performed by a human.

Note: If a Risk Control Measure does not contain a "Detect" function, the operator shall confirm this by reporting "RCMF.1.1. – None" in the required dataset.

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Reference for Risk Control Measures

2.2. Diagnose function

Code	Name	Definition
RCMF.2.0.	None	The RCM does not incorporate a diagnose function.
RCMF.2.1.	Technical system	The RCM incorporates a decision-taking process, to be handled by a technical system.
RCMF.2.2.	Human	The RCM incorporates a decision-taking process, to be handled by a human.

Note: If a Risk Control Measure does not contain a "Diagnose" function, the operator shall confirm this by reporting "RCMF.2.1. – None" in the required dataset.

2.3. Act function

Code	Name	Definition
RCMF.3.0.	*(Not applicable)*	*(Not applicable)*
RCMF.3.1.	Technical system	Risk reduction is the direct result of a function assured by a technical system. This should not always involve an initiated action. It could also be the case that the mere presence of the technical system results in a risk reduction.
RCMF.3.2.	Human	Risk reduction is the direct result of a function assured by a human.

Note: The category "None" is not applicable for the "Act" function, since it is assumed that any RCM should at least contain a function acting on the event(s) to which the RCM is linked.

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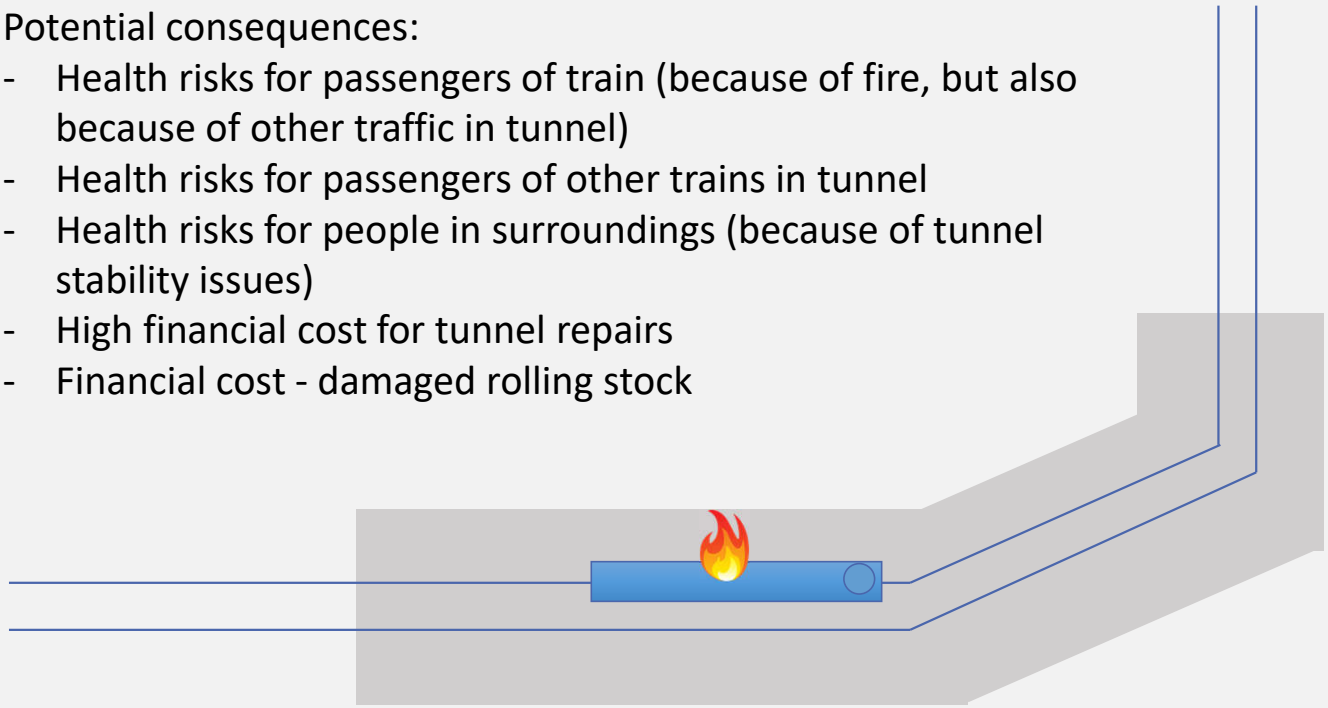
Example of a risk scenario to be managed by railway operators

A fire starts on board of a moving train. This train comes to a halt in a tunnel.

Potential consequences:

- Health risks for passengers of train (because of fire, but also because of other traffic in tunnel)
- Health risks for passengers of other trains in tunnel
- Health risks for people in surroundings (because of tunnel stability issues)
- High financial cost for tunnel repairs
- Financial cost - damaged rolling stock



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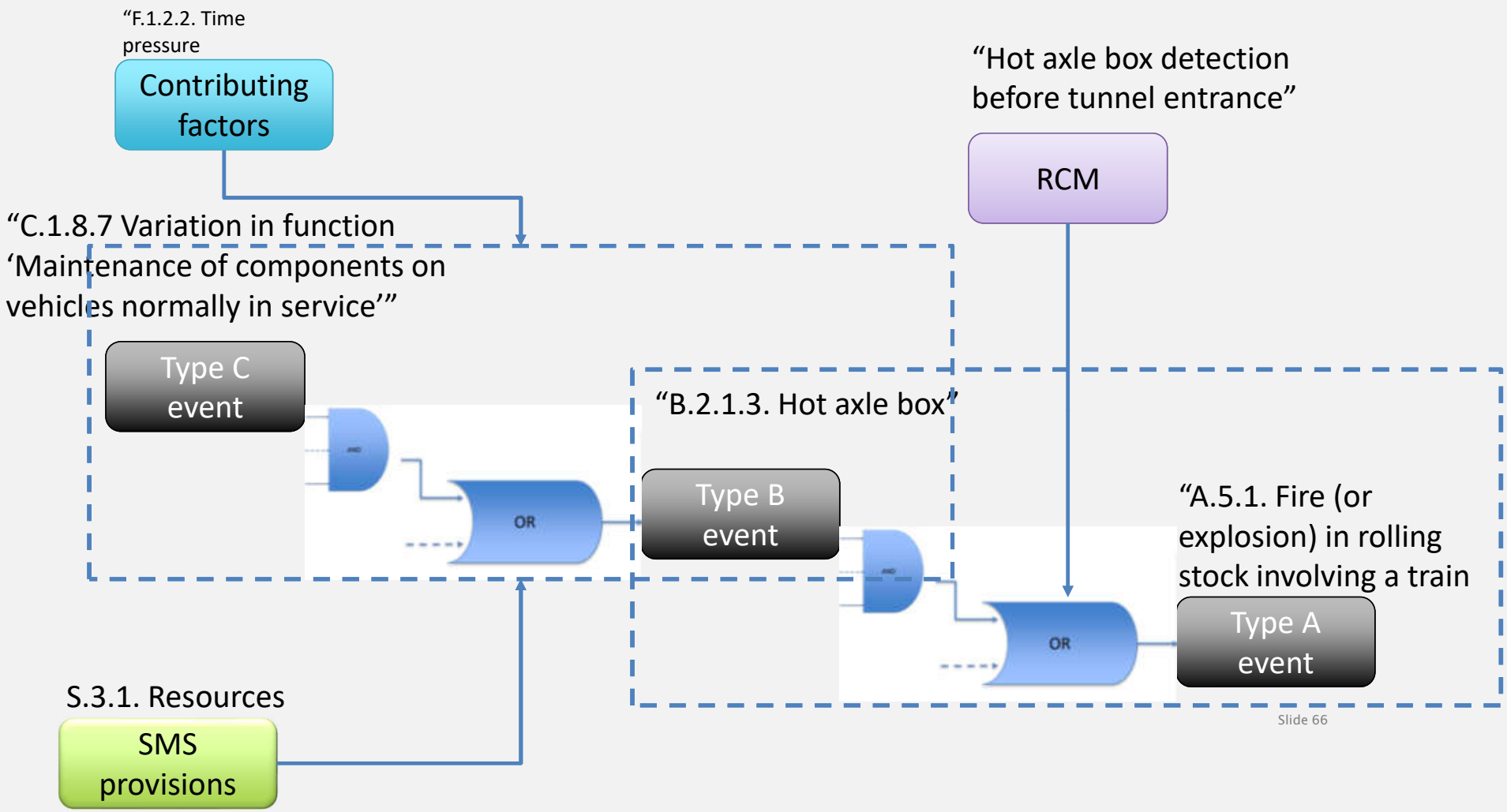

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Some examples:

Tunnel fire detection system

Detect
None
Machine
Human

Diagnose
None
Software
Hardware
Human – Skill base
Human – Knowledge based
Human – Rule based

Act
None
Hardware
Human
Remote-control

Primary

Secundary

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Some examples:

Continuous supervision of tunnel status (Tunnel control room)

Detect
None
Machine
Human

Diagnose
None
Software
Hardware
Human – Skill base
Human – Knowledge based
Human – Rule based

Act
None
Hardware
Human
Remote-control

Primary

Secundary

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Some examples:

Tunnel wall fire protection layer

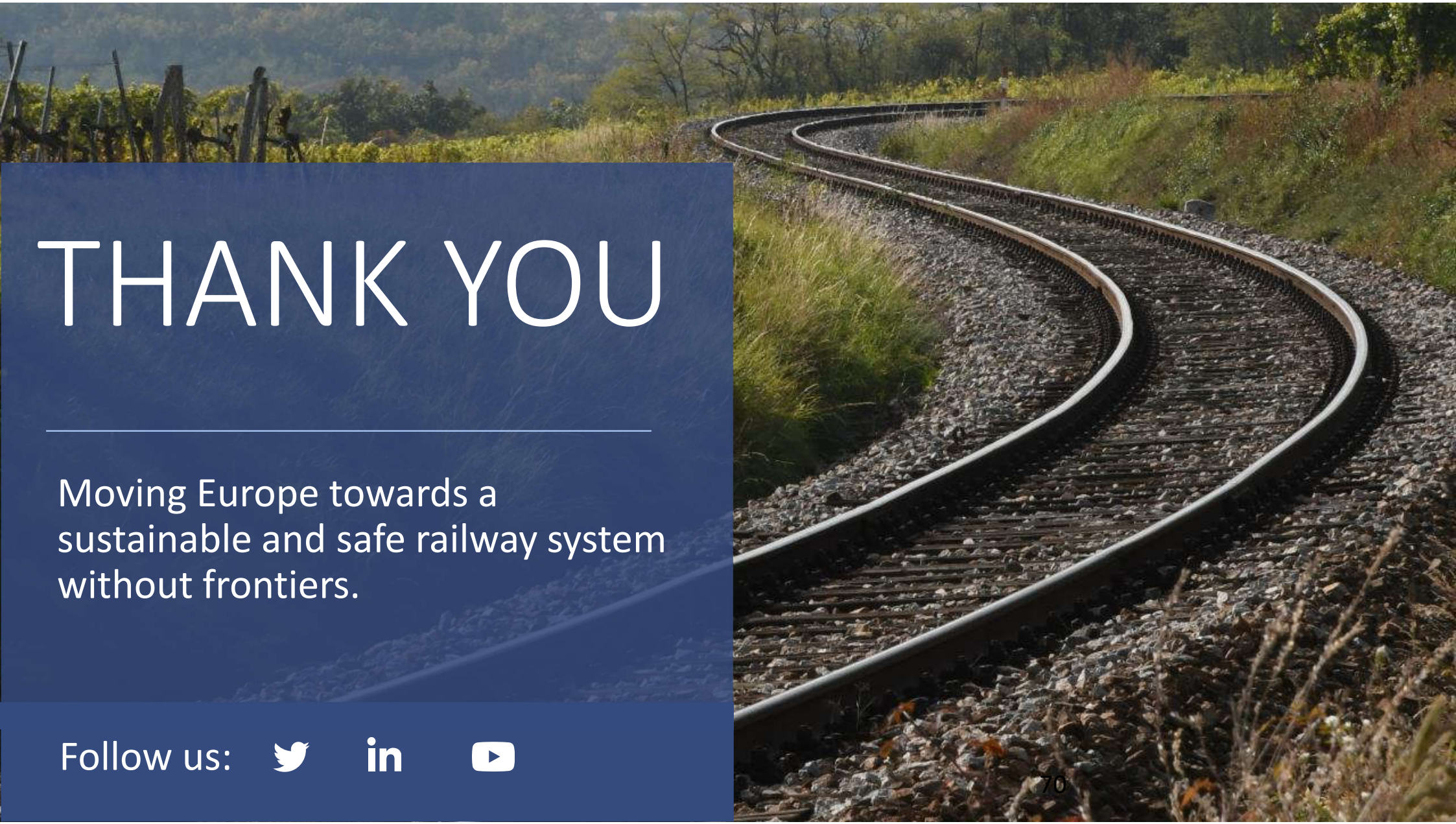
Detect
None
Machine
Human

Diagnose
None
Software
Hardware
Human – Skill base
Human – Knowledge based
Human – Rule based

Act
None
Hardware
Human
Remote-control

Primary

Secundary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