

# **Efficient management of engineering change - practice and guidance from the United Kingdom**

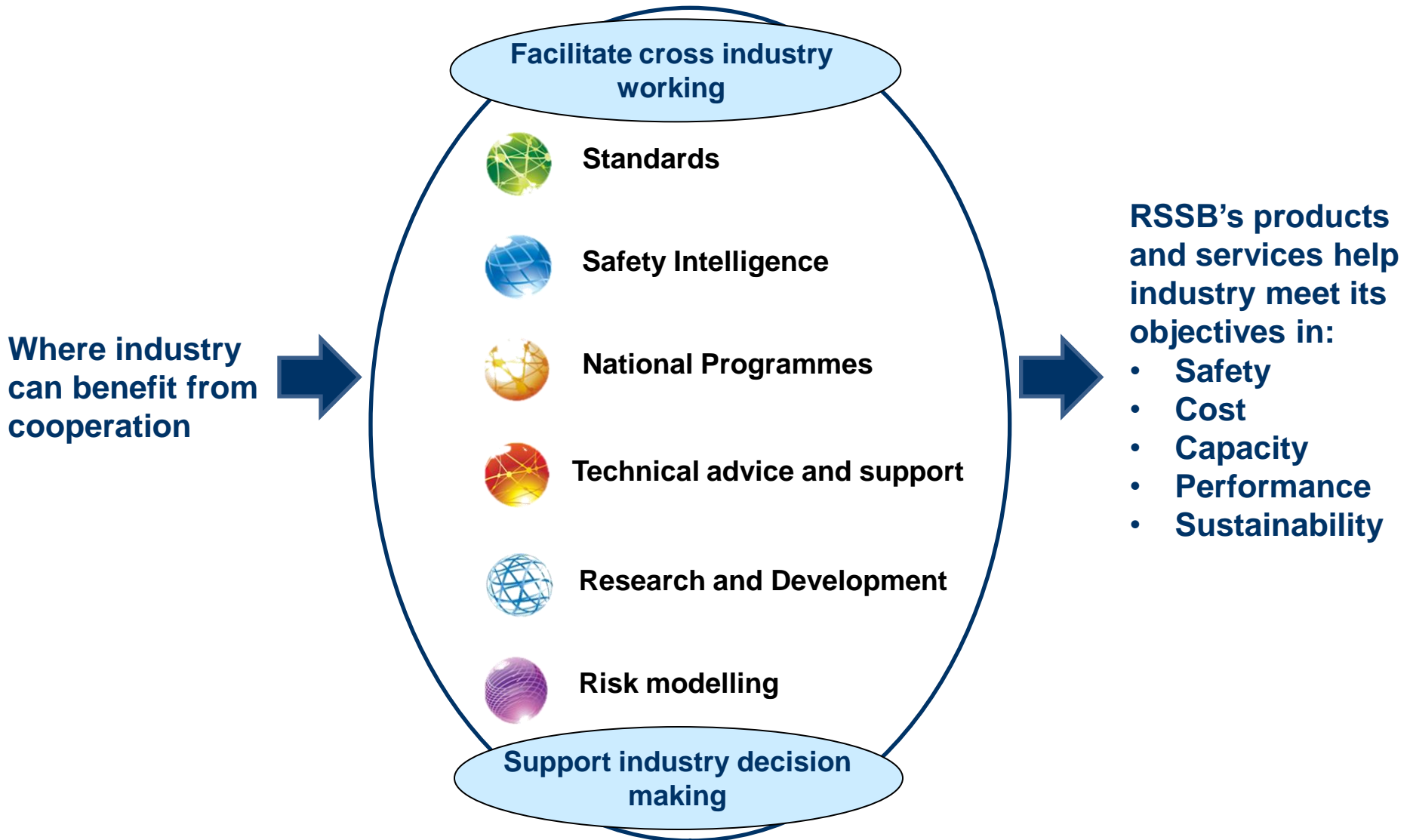
## **RSSB Research Project T955**

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Safety Knowledge and Planning  
RSSB**

**iESM User Group and Launch  
11<sup>th</sup> April 2013**

- Set up in April 2003 as a not-for-profit company
- Approximately 230 employees covering a range of technical and business disciplines
- Owned & funded by major stakeholders in the rail industry
  - Independent of any one party

<b>Categories of Membership</b>	<b>Number</b>	<b>Voting rights (at members' meetings)</b>
Passenger operating companies	25	30%
Freight operating companies	8	10%
Infrastructure manager	1	30%
Rolling stock leasing companies	3	10%
Infrastructure contractors	6	10%
Suppliers	16	10%



## Aim:

To help ensure that engineering safety management work on rail projects is carried out efficiently and effectively

Work is directed by a cross-industry Steering Group

- Infrastructure managers
- Rolling stock owner
- Regulator
- RSSB (Standards, Risk & SMS)
- Railway undertakings
- Supplier
- Major projects

Guidance will be approved by Standards Committee

## Aim:

To help ensure that engineering safety management work on rail projects is carried out efficiently and effectively

## Phase 1 (completed)

Establishing the extent to which a common set of definitions, guidance, processes and tools would benefit the rail industry

## A survey of current practice and opinion:

- Major infrastructure projects
- Rolling stock procurement

- Risk analysis is often carried out late in the project life cycle
  - Focus on safety demonstration rather than safety engineering
  - Problems are expensive to resolve
- Most projects develop a bespoke hazard list
  - Inefficient: difficult to reuse evidence from previous work
  - Hinders good communication through the project lifecycle
- RSSB Safety Risk Model is commonly used for quantified risk assessment but...
  - It is structured around *accidents* not the *conditions* that could lead to them
  - Mapping from hazard lists to SRM structure is time-consuming
- There is a demand for practical guidance on the application of the CSM for Risk Evaluation and Assessment

- Keep your safety engineering process ‘lean and mean’
- Don’t over analyse things – focus on the hazards and causes and common sense ways of addressing their risk.
- Do it as early as possible – flush out risks when you can do something about them.
- The process should be about good safety analysis and engineering – not red tape and ‘passing the buck’



# T955 Phase 2: Project overview



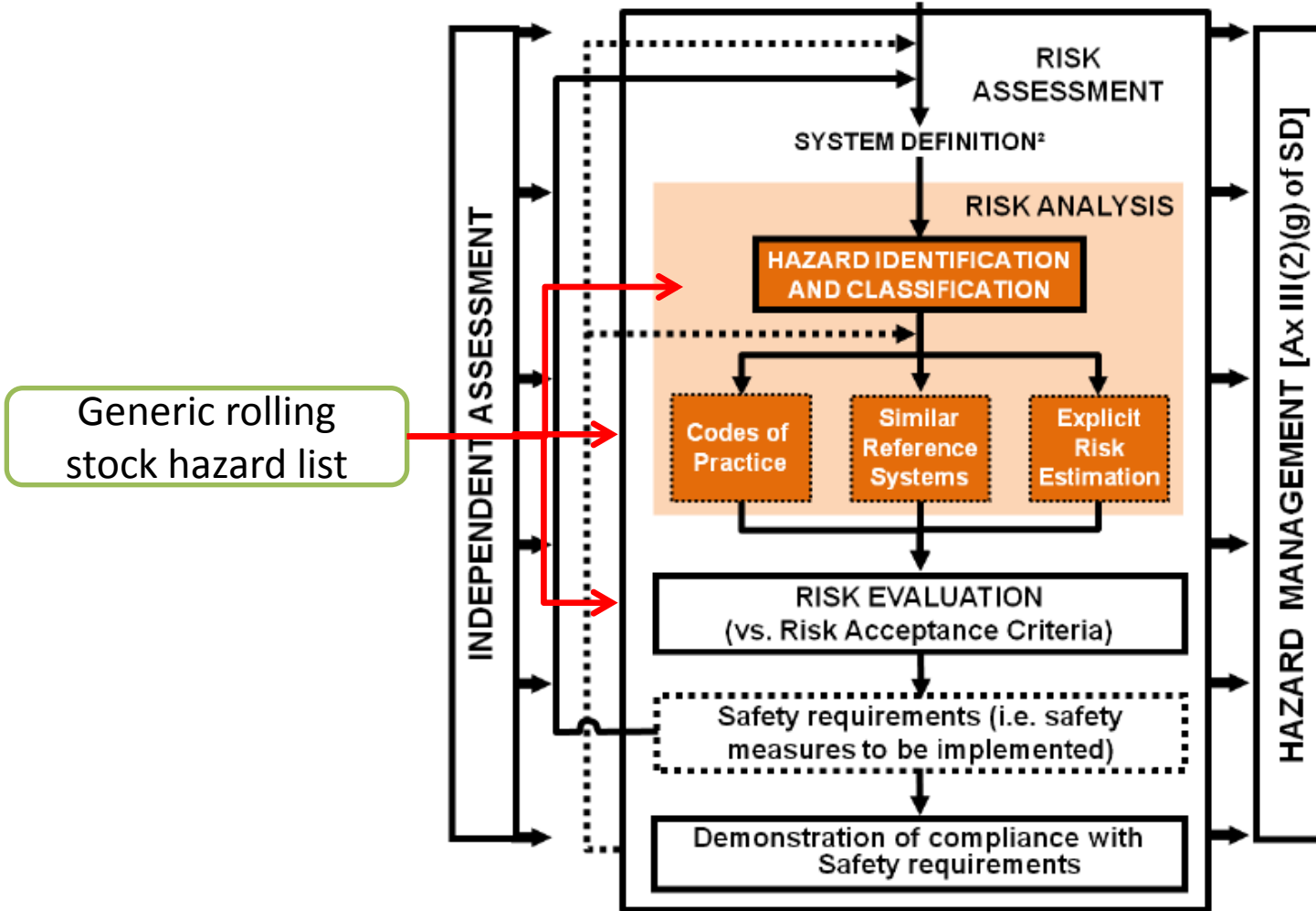
Generic Hazard	Label	Intrinsic	EN15380 Product Group
			B C D E F G H I J K
Detachment of exterior train system or equipment	RS01	Functional	Y N Y Y Y N Y Y
Driver confused or distracted	RS02	Functional	Y Y N N N N N N
Driver incapacitated	RS03	Functional	N Y Y N N N N N
Driver trapped in cab in an emergency	RS04	Functional	Y Y Y N N N N N
Driver too hasty leaving cab	RS05	Functional	Y Y Y N N N N N
Driver between train and non railway systems	RS06	Functional	Y Y Y N N N N N
DMI between train and signalling / telecomms / electrification	RS07	Functional	Y Y Y N N N N N
Excessive platform gap	RS08	Intrinsic	N Y Y N Y Y Y Y
Exposure to arcing / raised electrical potential	RS09	Intrinsic	N Y Y N Y Y Y Y
Exposure to biological / toxic substances	RS10	Intrinsic	N Y Y N Y Y Y Y
Exposure to corrosive / reactive substances	RS11	Intrinsic	N Y Y N Y Y Y Y
Exposure to excessive noise	RS12	Intrinsic	N Y Y N Y Y Y Y
Exposure to hot / cold surface / gas	RS13	Functional	N Y Y N Y Y Y Y
Exposure to pressurised system / explosion	RS14	Functional	N Y Y N Y Y Y Y
Exterior door closes with too much force	RS15	Functional	N Y Y N Y Y Y Y
Exterior door opens when train moving	RS16	Functional	N Y Y N Y Y Y Y
Exterior door opens all platforms	RS17	Functional	N Y Y N Y Y Y Y
Exterior door opens too soon	RS18	Functional	N Y Y N Y Y Y Y
Exterior door opens with step	RS19	Functional	N Y Y N Y Y Y Y

Driver fails to check it is safe to close doors	Driver closes door when not safe to do so	Alarm fails, timer incorrect time
Operations	Operations	System Integrator
System Integrator		Sub Supplier
Maintenance		Maintenance
Requirements in Rule Book Sec 18.05	Requirements in Rule Book Sec 18.05	Alarm requirements in EN14752



# CSM and generic hazard lists



- Progress to date:
  - Focussed on rolling stock hazards
  - Developed using rolling stock manufacturers, operators and European lists.
  - List has set the hazards at the 'railway system' level
  - Discussions with ERA (Agency)
  
  - Case studies underway to define
    - What level of system definition is required
    - How complete is the generic hazard list?
    - Developing indicative causes and controls (by codes of practice, reference system, risk estimation)

- Following the CSM regulation:
  - ‘Hazard’ means a condition that could lead to an accident.
- We have considered this as a failed state of the railway, so example ‘generic hazards’ are:
  - Passenger trapped in exterior door
  - Exterior door open whilst train moving

# Generic Hazard List - examples



Hazard	Ref	Definition	Exclusions	Lifecycle	Affected Groups
Passenger trapped in exterior door	RSH30	Passenger trapped in closed or closing door (includes trapped clothing or apparel and passenger on platform).		Design defect Technical failure Operations issue Maintenance issue	Passengers
Exterior door open whilst train moving	RSH17	Exterior door opens, or remains open, whilst train is moving.	Door opens incorrectly with train stationary (RSH18)	Design defect Technical failure Operations issue Maintenance issue	Staff (train) Passengers

# Generic hazard list (rolling stock)



- Projectile created by passage of train
- Driver confused or distracted
- Driver incapacitated
- Driver or other member of staff trapped in cab in an emergency
- Driver or other staff member trip, slip or fall hazard entering or leaving cab
- Excessive electromagnetic emissions from system
- System has insufficient immunity from electromagnetic interference
- Excessive platform gap
- Excessive access walkway gap
- etc

# Initial analysis – Rolling stock hazards – system definition



## Scenario Description:

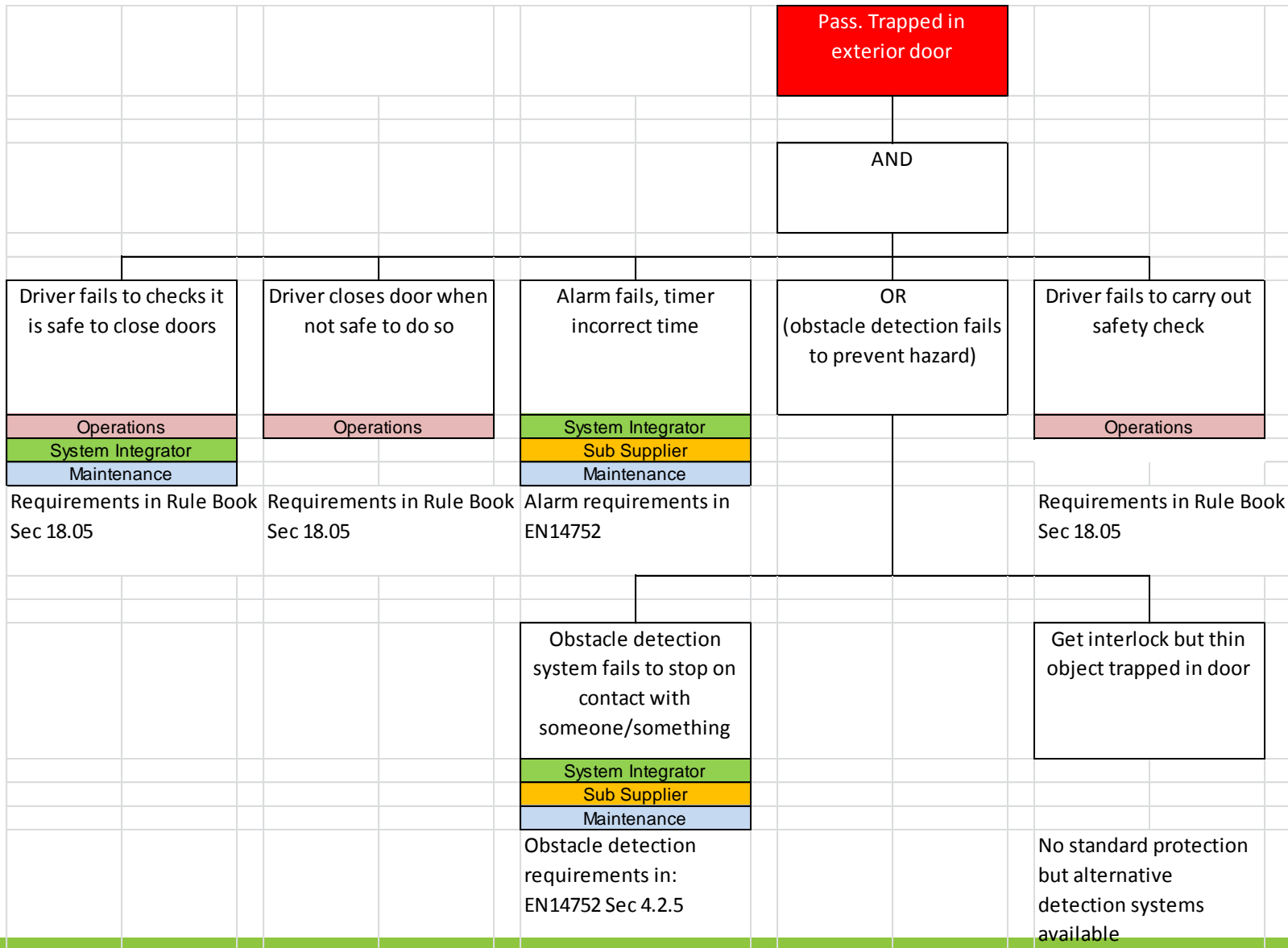
- Considering a scenarios relating to doors in a modern passenger train. The train is arriving at a platform to let passengers on and off.
- Considering hazards relating to door failures and where door relating systems mitigate these hazards.



## System Description:

- The train is being driven manually
- The driver is solely responsible for dispatch (Driver Only Operations - DOO), no platform dispatch staff.
- The platform is the correct length for the train (no selective door opening necessary).
- The driver selects which side of the train to release the doors (no auto-correct side door opening).
- The driver observes the boarding and alighting through in-cab monitors.
- There is no Driver Reminder Appliance (DRA)
- There is a speed interlock at 3 kph which prevents doors being opened above this speed.
- There are no platform edge doors.

# Example output





# Exterior door open whilst train moving



**RSH21**

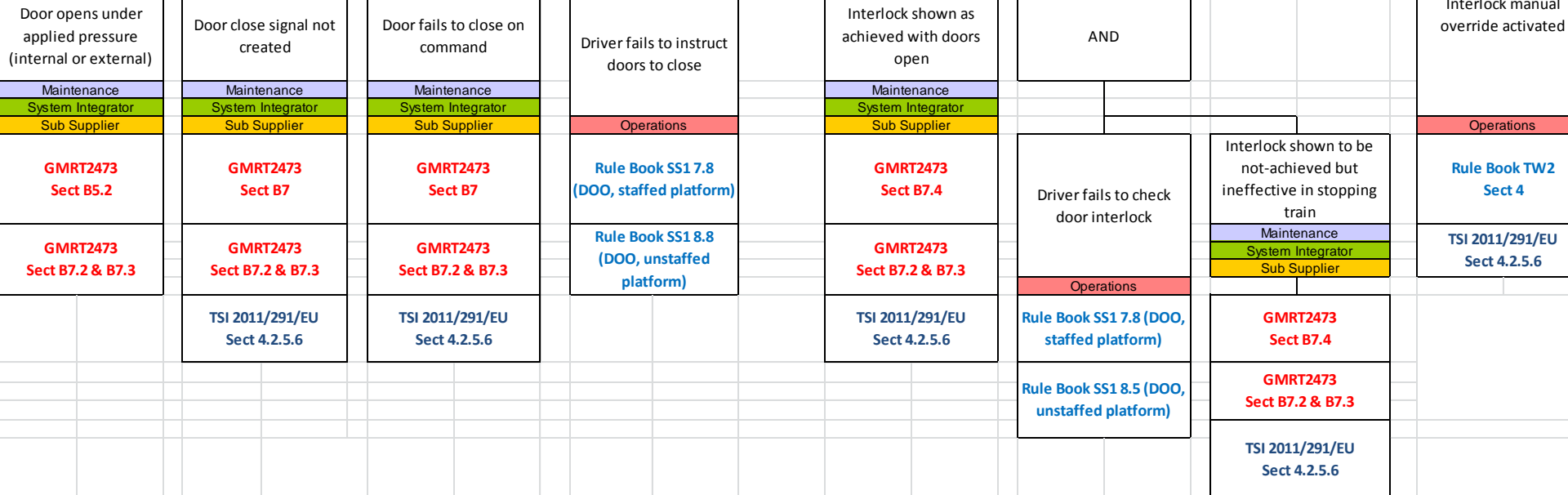
Exterior door open whilst train moving

Note: Moving at over 3 kph

AND

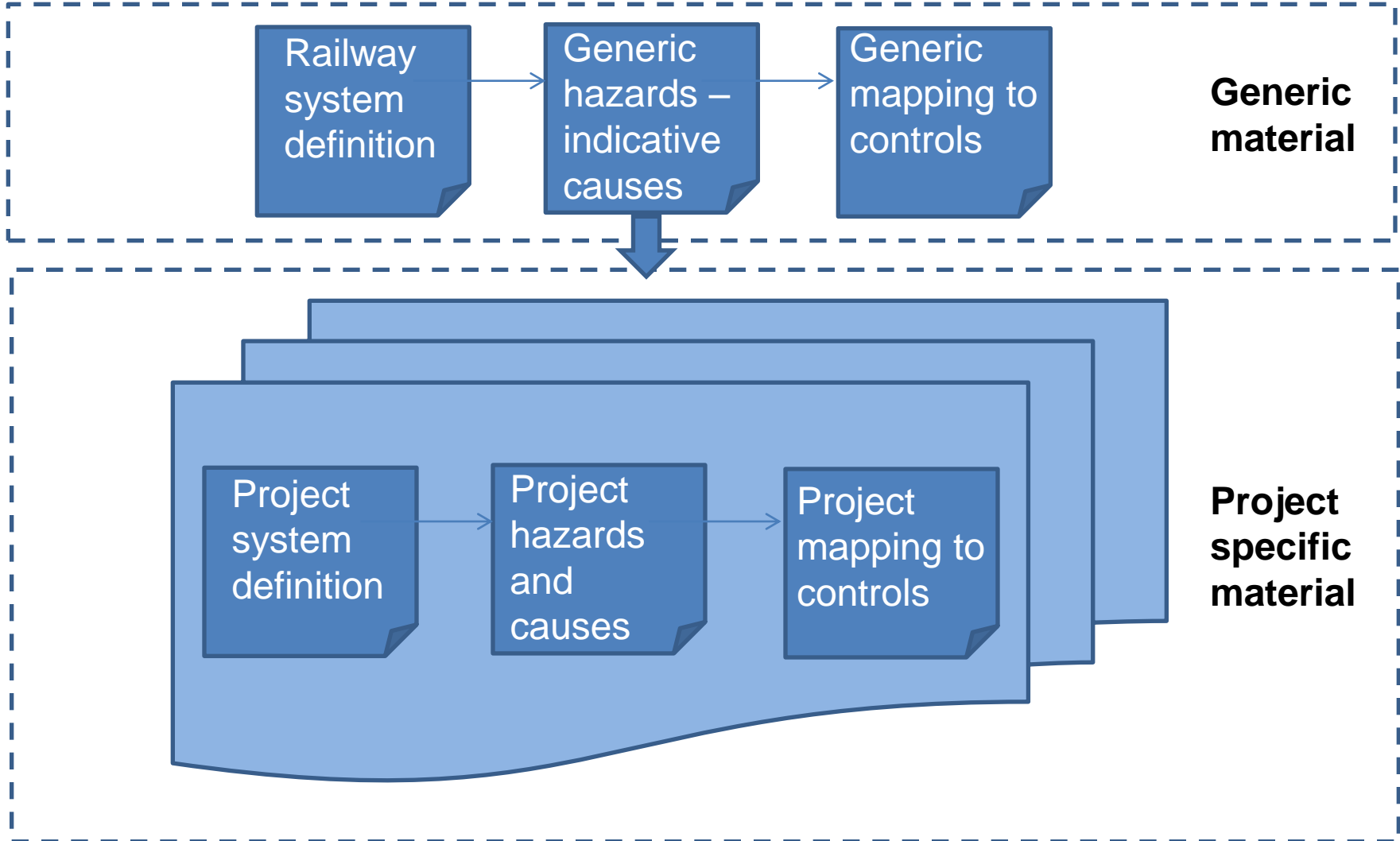
OR

OR



- Using generic mappings
- Applying them to specific projects
- Get a customised mapping of hazards to codes of practice and other evidence.
- These will be published so others can use them.
- Case studies underway
  - Using the list to classify ERTMS hazards
  - Determining the hazards in the rolling stock supply chain and who manages them.
  - Working with a Train operating company looking at a operational change

# Use of the material being developed



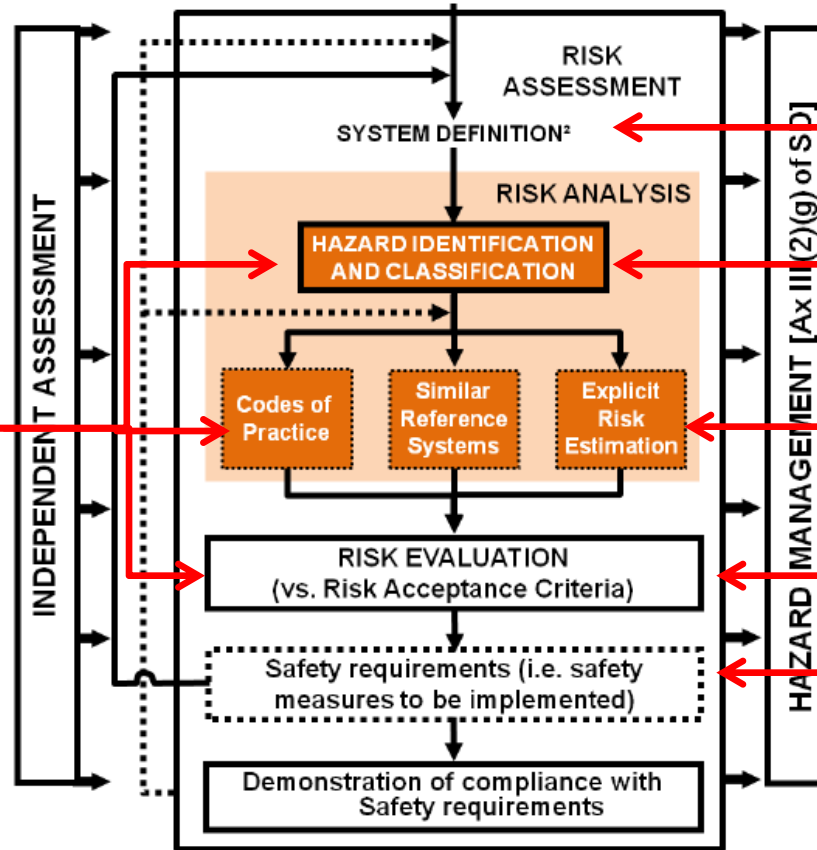
- Guidance on performing CSM risk assessments currently lies in a number of places
  - ORR guidance
  - European Rail Agency guidance
  - CSM regulation
- T955 aims to produce a number of modules supporting application of the CSM on RAE aligned to the process.

# Intended guidance on the CSM process



## ORR guidance on CSM on RA&E

Safety plan  
Guidance



Generic hazard list  
guidance

System definition  
guidance

Risk matrix  
guidance

GN 8642 Hazard ID  
& assessing risk

GN 8643  
Reducing risk

- The guidance is specifically targeted at UK legal framework
- iESM handbook is not specific to any national legal framework.
- RSSB is supporting this iESM initiative with a view to:
  - sharing UK rail experience and practice in the safe management of engineering change
  - to identify good practice from other international companies and organisations
- Our work will be freely available online.
- We would like to distil useful learning and good practice from iESM directly into the UK guidance



**GN**

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**GN**  
 Guidance on the use of Risk Matrices to support the management of

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 Guidance on the use of Risk Matrices to support the management of  
 change  
 Issue x Draft xx: Mmmmm Yyyy  
 Rail Industry Guidance Note

Issue 15: July 2012

			Consequence				
			Average FWI per hazard				
			Class 1 Minor injury/multiple Class 2 injuries	Multiple Class 1 minor injuries/more severe injury	Major injury	Multiple major /single fatality	Multiple fatalities
Frequency			1	2	3	4	5
	Once In	No/year	0.008	0.04	0.2	1	5
5	12 days	31.25	6	7	8	9	10
4	2 months	6.25	5	6	7	8	9
3	9 months	1.25	4	5	6	7	8
2	4 years	0.25	3	4	5	6	7
1	20 years	0.05	2	3	4	5	6

Figure 2 Quantified, calibrated risk matrix.

Questions?

