OFFICE OF THE national rail safety regulator

ONRSR Cost Recovery Model

Consultation Paper

safe railways for Australia

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1 Introduction

ONRSR was tasked by Infrastructure and Transport Ministers with developing a national cost recovery model based on risk and regulatory effort.

In doing so, ONRSR has reviewed the current cost recovery arrangements and looked to other costing models nationally and internationally for learnings in shaping development of the proposed new model.

Stakeholder input will be considered in progressing the resultant cost recovery model for consideration by the Infrastructure and Transport Ministers in 2021.

2 Scope

In 2016, Infrastructure and Transport Ministers agreed to the recommendations from the first stage of the cost recovery review and tasked ONRSR with further developing a national model.

The Council of Australian Government (COAG) principles for cost recovery have guided the scope of this model's development, encompassing a nationally consistent model based on risk and regulatory effort and 100 percent cost recovered from industry. These principles focus on efficiency and effectiveness; transparency; and stakeholder engagement.

The following set of principles have guided development of a cost recovery model:

- The model will be transparent
- Fees should be based on a national model
- Fees should be reflective of and proportionate to RTO risk classification
- Fees should be aligned with ONRSR's regulatory effort
- Cross-subsidisation should be avoided; however, if cross-subsidisation is used, it must be transparent
- The model should be simple to administer.

The following matters are out of scope for the project:

- Penalty and infringement fees under the Rail Safety National Law
- The national cost of regulation.

Cost recovery for tourist and heritage operations will be considered separately by governments. The extent to which they are addressed in this paper relates specifically to current cross-subsidisation and addressing this imbalance.

3 How information you provide will be used

Your response to this consultation paper will inform the cost recovery model to be progressed to Ministers.

Your responses will be treated as confidential. ONRSR may use concepts and ideas to progress the cost recovery model proposal but will not identify the specific proponent of the material presented. ONRSR may however identify the broader class of the proponent if this does not identify the specific individual. ONRSR will not share information that may identify a particular respondent unless explicit permission is sought by ONRSR and permission is granted by the respondent.

4 Existing cost recovery arrangements

The current cost recovery arrangements are based on the following fee types:

- Application fees
- Annual fixed fees
- Annual variable track and train km fees
- Major project fees.

Fees to be recovered are based on the agreed cost of regulation in each jurisdiction at the time of transition to ONRSR, adjusted by CPI each year.

Application, annual fixed and major project fees are nationally consistent (with the exception of major project fees which do not yet apply in Western Australia).

Variable track and train km fees form the main cost recovery input. However, different fee rates apply in each jurisdiction – as a result of the cost of regulation in each jurisdiction at the time of transition to ONRSR, the number of operators, the volume of track and train km respectively in that jurisdiction (which are apportioned at a ratio of 30 percent track km : 70 percent train km), and any government funding currently contributed (with government funding currently reducing by five percent per annum). Attachment A outlines the process for the current fee rate calculation in a given jurisdiction.

The table below identifies the 2020-21 cost of regulation, any government contributions and track and train km fee rates.

Table 1: 2020-21 cost of regulation, government contributions and track and train km fee rates

	ACT/NSW	NT	QLD	SA	TAS	VIC	WA
2020-21 cost of regulation	$17,681,032	$473,232	$5,518,220	$2,212,756	$397,494	$9,446,979	$4,008,967
Government contribution	$7,618,962	$118,818	$0	$0	$68,663	$5,124,207	$0
Rate per track km	$260.71	$57.92	$138.05	$123.89	$88.47	$175.74	$91.66
Rate per train km	$0.079	$0.162	$0.078	$0.102	$0.245	$0.039	$0.045

5 Cost recovery model development approach

The cost recovery project has taken a thorough, comprehensive and consultative approach to the development of a risk and regulatory effort-based cost recovery model. The process has been one of iterative engagement with industry via a reference group and workshops, as well as governments over the past three years.

This has included:

- A review of cost recovery models in other industries and rail internationally to identify any learnings for a model based on a risk and regulatory effort
- Development of a risk profiling tool for use in cost recovery
- Collection of regulatory effort data for use in cost recovery
- Fee modelling
- Consideration of policy issues associated with any change to ONRSR's cost recovery model.

ONRSR was unable to find any other models nationally or internationally that were based on risk and regulatory effort and others are now following closely the development of this model.

A number of key policy issues have been identified as the project progressed, including current areas of cross-subsidisation and the treatment of tourist and heritage operations.

This consultation paper has also been informed by recent industry consultation activities. This is the third stage of industry consultation, following on from Chief Executive briefings in September and October 2020, and consultation workshops in October and November 2020. These workshops focussed on the risk profiling tool in detail, which is central to the model's design. Where face-to-face workshops were not possible due to COVID-19 arrangements, videoconference information sessions were held.

The cost recovery development process is described in further detail below.

6 Model design

6.1 Review of other cost recovery models

In 2016, ONRSR examined cost recovery models from other safety regulators in Australia and regulators internationally to assist in shaping options for discussion and exploration with stakeholders.

In 2018, a further review was undertaken which examined a wider range of regulators' cost recovery regimes specifically in relation to risk and regulatory effort, which included the following regulators:

- Civil Aviation Safety Authority (CASA)
- Australian Maritime Safety Authority (AMSA)
- Australian Prudential Regulation Authority (APRA)
- Australian Securities and Investments Commission (ASIC)
- National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA)
- ComCare
- National Heavy Vehicle Regulator (NHVR)
- Victorian Competition and Efficiency Commission
- Office of Rail and Road (UK)
- Technical Safety British Columbia (Canada)

Although there were a number of examples of risk-based regulation, there are few examples of risk-based cost recovery, and no regulators grouped the organisations that they regulate by risk profile.

Overall, the supplementary review of other cost recovery models revealed that few regulators have risk-based cost recovery regimes for regulatory activities and that funding sources vary depending on circumstances. APRA's approach appeared to have some alignment in terms of a focus on regulated parties' inherent risk and those parties' management and control of risk.

6.2 Development of a model based on risk and regulatory effort

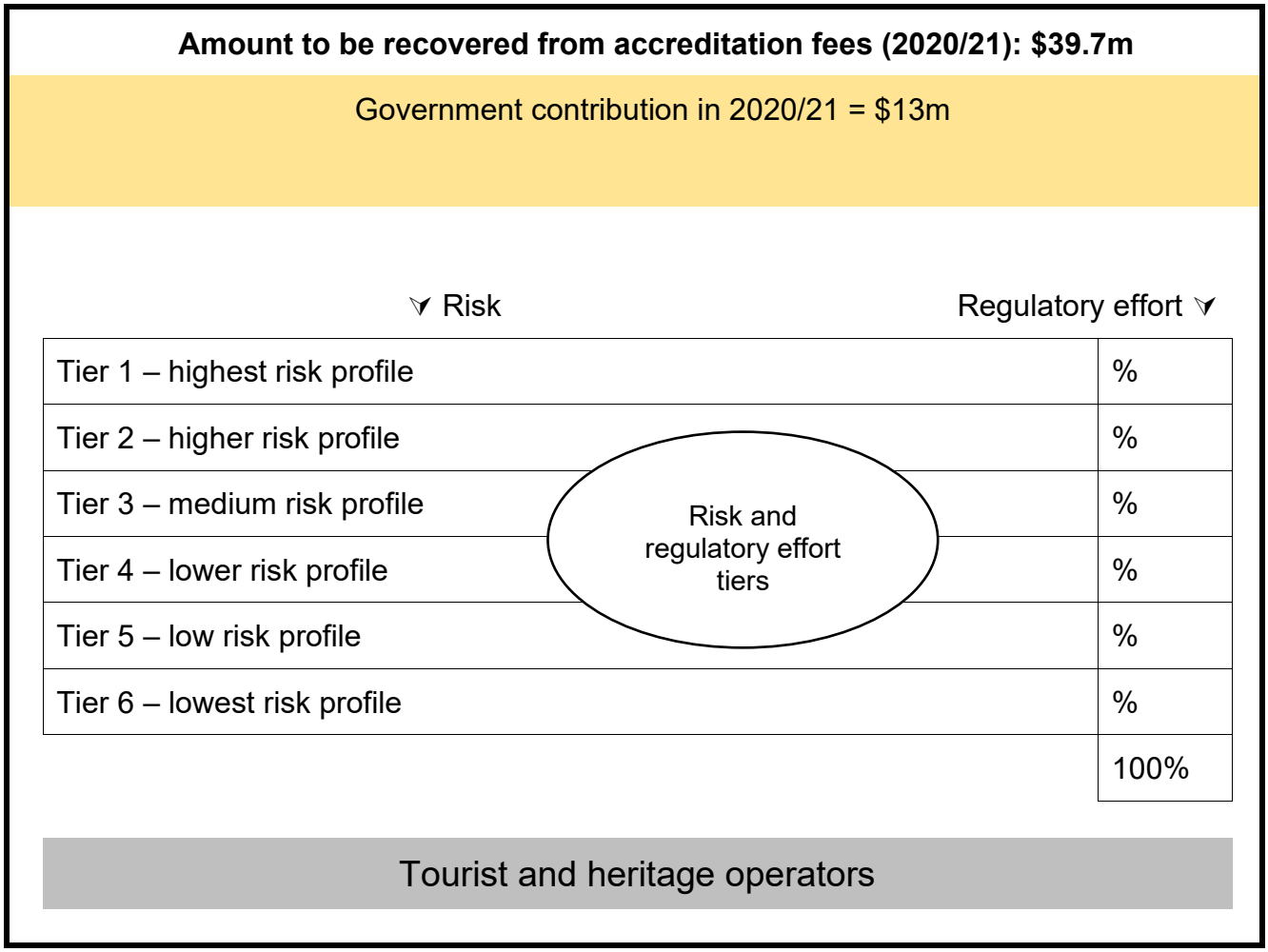
Given the limited comparative options, ONRSR commenced conceptualisation of a proposed model. At that stage, consideration was given to the two primary inputs – risk and regulatory effort – and their method of appropriate interaction in a cost recovery model. ONRSR proposed the framework outlined in Figure 1 below, and following significant socialisation with stakeholders, this has formed the basis for the overarching model design.

At the time of deciding to have a national rail safety regulator, heavy vehicle regulator and maritime regulator COAG also agreed that all three regulators would progress towards 100% cost recovery from industry. Hence, it was included in the COAG Intergovernmental Agreement in 2011 that

those jurisdictions not yet fully recovering costs from industry would progressively move towards full cost recovery.

This means governments will no longer contribute to the cost of regulation for commercial operators. In 2020/21, government funding was $13m as identified in Table 1 above. The regulatory costs for the tourist and heritage sector do not form part of this consultation paper.

Figure 1: Proposed national cost recovery model based on risk and regulatory effort



6.3 Assessment of options for profiling operators' risk

Ministers' direction that ONRSR develop a risk and regulatory effort-based cost recovery model results from risk being recognised as the driver that has the greatest effect on ONRSR's level of activity[1,2]. The use of a transparent tool for profiling operators' risk is therefore paramount to any risk and regulatory effort-based cost recovery model.

6.3.1 Review of industry risk model

In 2016, ONRSR's recommendations to Infrastructure and Transport Ministers about a prospective stage II of the cost recovery project were premised on the development of an industry risk model. Although not designed for the purpose, it was thought that the industry risk model might serve as

[1] Victorian Government (2013) *Cost recovery guidelines,* January, accessed from website

[2] Government of Western Australia (2015) *Costing and Pricing Government Services: Guidelines for use by agencies in Western Australian Public Sector*, June, accessed from website

the basis for cost recovery. Since that time, the Rail Industry Safety and Standards Board (RISSB) has developed an industry risk model, launched in late 2017, known as the Australian Rail Risk Model[3] (ARRM). Although a valuable tool for industry, the risk model was built for a different purpose than for cost recovery risk profiling and its scope does not extend to all operators, therefore it is not appropriate as the basis for a cost recovery model.

6.3.2 Other options for a risk profiling tool

Having determined that RISSB's ARRM would not be used for cost recovery purposes, ONRSR reviewed other options for profiling operator risk:

- **Using another regulator's model**. there is no readily identifiable model already in use which ONRSR can adopt as the basis for its risk-based cost recovery model. In 2018, the supplementary review of other regulators' cost recovery regimes identified that APRA and ONRSR's approaches to risk assessment have in common a focus on regulated parties' inherent risk and those parties' management and control of risk. However, while APRA uses aggregate regulatory effort data as the basis for the levies charged to different groups of financial providers, these groupings are not based on similar risk profiles.
- **Using a proxy for risk.** The current cost recovery model uses track and train kilometres (passenger and freight) as indicators of activity and proxies for risk. While these represent a proxy, it is recognised that no single proxy captures the breadth of the Australian rail industry, from T&H, terminals, freight, heavy haul, light rail, heavy passenger rail, regional and metropolitan operations.
- **Developing ONRSR's own approach.** ONRSR could develop a model from first principles, using qualitative and quantitative factors for which there is evidence and/or appropriate stakeholder consensus that these factors relate to rail safety risk. It is important to note that while some risk factors may distinguish one operator's risk profile from another's, they may not make a material difference to regulatory effort expended.

After surveying the options available, ONRSR decided to develop its own risk profiling tool for cost recovery purposes.

7 Risk profiling tool

ONRSR undertook a comprehensive process to develop the proposed risk profiling tool for cost recovery purposes. The tool is a "composite indicator" model formed when individual indicators are compiled into a single index, on the basis of an underlying model of the multi-dimensional concept that is being measured.

In applying this composite indicator approach, ONRSR has aligned with the construction process outlined by the Organisation for Economic Cooperation and Development (OECD).

A composite indicator measures multi-dimensional concepts (e.g. competitiveness, e-trade, environmental quality or risk) which cannot be captured by a single indicator. Ideally, a composite indicator should be based on a theoretical framework/ definition, which allows individual indicators/ variables to be selected, combined and weighted in a manner which reflects the dimensions or structure of the phenomena being measured.[4]

[3] https://www.rissb.com.au/safety-tools/arrm/

[4] OECD (2008), *Handbook on Constructing Composite Indicators: methodology and user guide*, available from http://www.oecd.org/sdd/42495745.pdf

7.1 Development process

The below timeline outlines the risk profiling tool development process:

March 2018	Industry reference group: primary and sub-risk factor identification
April – May 2018	Industry focus groups: evaluation of sub-risk factors
May 2018	Focus group: initial weighting of risk factors
June 2018	Industry reference group: review initial risk factor weightings
December 2018	Industry workshops: consultation on risk factor weightings
Q1 2019	Independent review of risk factors and weightings
Q2 & Q3 2019	ONRSR: iterative modelling
Q4 2019 – Q1 2020	Government socialisation
January 2020	Industry reference group: input to outstanding issues
Q2 – Q3 2020	Outstanding components developed
August 2020	Risk profiling tool developed for consultation
September 2020	Consultation delayed due to COVID-19: first on-line sessions commence

The proposed risk profiling tool is premised on three primary components:

- **Inherent risk**: risks to safety associated with the specific scope and nature of the operation(s) for which the entity is accredited
- **Management and control**: processes and systems used by the accredited entity to manage safety risks associated with their railway operation(s)
- **Safety performance**: Remaining safety risk (residual) after taking into account the effect of management and control.

ONRSR worked with the industry reference group to identify sub-factors for each component that are appropriate for use in a cost recovery context, without additional reporting burden. This encompassed identification of sub-factors that may be relevant to rail infrastructure managers (RIMs) or rolling stock operators (RSOs) or both.

A range of sub-factors were identified by the group, which were then evaluated against the following criteria:

- **Accessible**: data is accessible in an appropriate form, in a timely manner from a suitably governed and secure system
- **Relevant**: the factor is directly relevant to the aspect of the risk being measured for cost recovery purposes
- **Reliable**: the systems and processes governing the definition, capture, coding and estimation of data are established and rigorous to ensure consistent and correct measurement
- **Sensitive**: the measured value changes as the state of the system changes
- **Specific**: the concept or factor is defined with sufficient precision to be easily understood and is sufficiently bounded to ensure any measured difference is not due to misinterpretation.

This resulted in the shortlisted set of sub-factors being agreed by the industry reference group for use in the risk profiling tool. If data is not currently collected by ONRSR for these sub factors this would be addressed through the joint project between the ARA and ONRSR – National Rail Safety Data Strategy.

Appropriate weightings for these were then discussed with the industry reference group. ONRSR used two methods to consult with the group on these:

- Pairwise comparisons: respondents identify a position between two variables on an 'importance' continuum – refer Figure 2 below for a pairwise comparison example
- Direct weighting: respondents allocate 100 points across the available variables, again reflecting their perceived 'importance' – refer Figure 3 below for a direct weighting example.

Figure 2: Pairwise comparison example

Instructions: which factor do you consider to be more important in estimating the risk profile of an operator for the purpose of risk-based cost recovery? Indicate the relative importance by placing a circle along the importance scale.

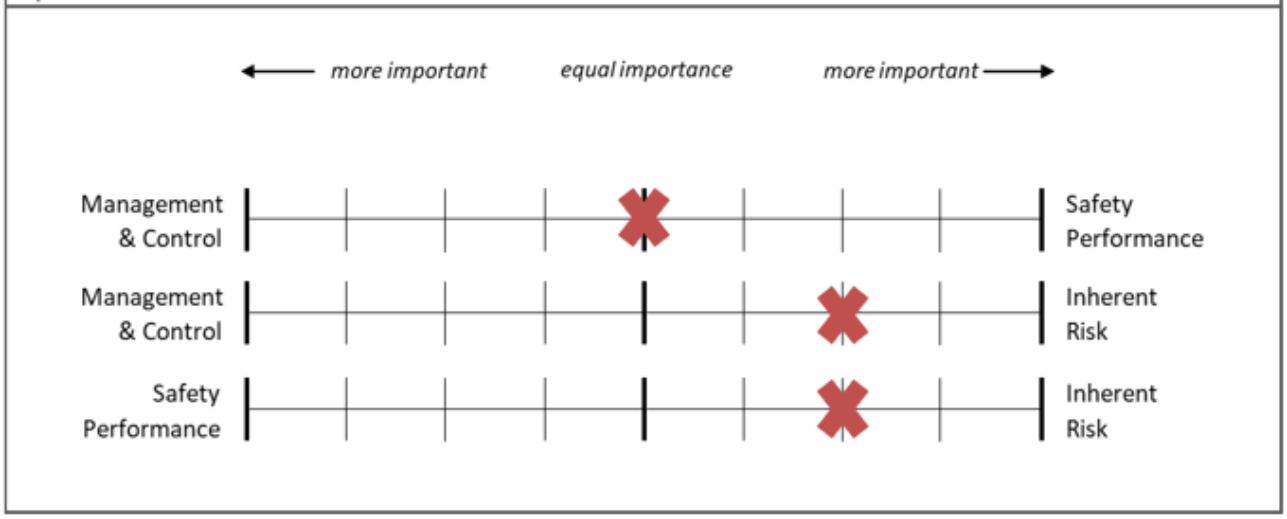


Figure 3: Direct weighting example

Instructions: allocate 100 points across two of the primary risk factors based on the level of importance you consider each factor has in determining the safety risk profile of an operator, for the purpose of cost recovery (sum to equal 100)

Cost Recovery Factor	Description	Score	Comments
Inherent Risk	*Scope and nature of the accredited entity's rail operations*	/ 100	
Management and Control	*The anticipated impact the processes and systems used by the accredited entity to manage safety risks associated with their railway operation(s) has on the inherent risk measure.*	/ 100	
Safety Performance	*The effectiveness of the accredited entity's safety management system in terms of the realisation of significant notifiable occurrences.*	/ 100	

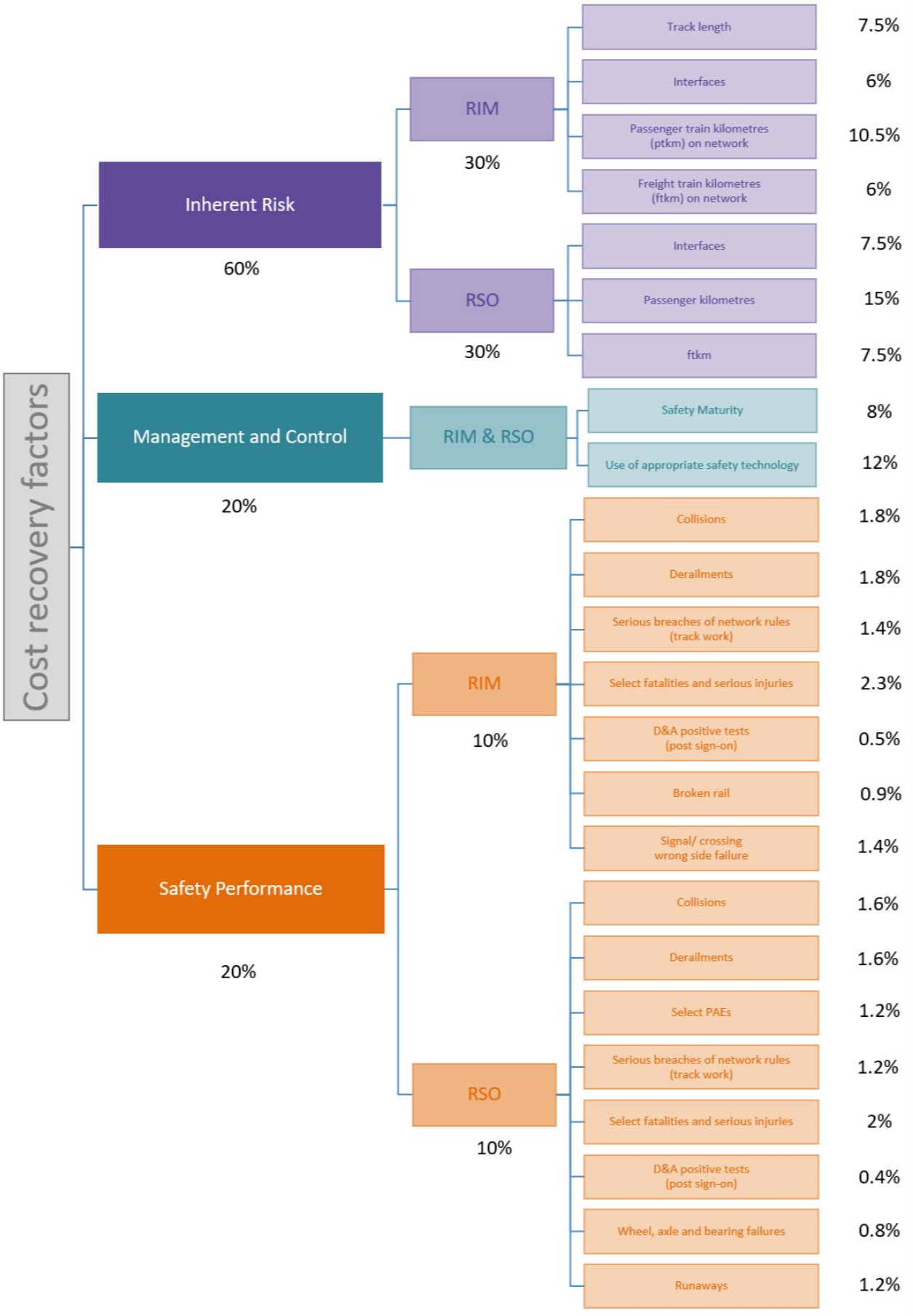
The results of both methods were generally consistent. On this basis, ONRSR then conducted broader consultation on the weightings, using the direct weighting method only. Three industry workshops with safety risk specialists were conducted, with participants asked to consider appropriate weightings for a national cost recovery model when providing their input. ONRSR's Senior Manager, Risk and Analysis facilitated these workshops and was involved in the development of the model.

The resultant proposed risk profiling tool for cost recovery is illustrated below in Figure 4. The primary factors are assigned the following weightings: inherent risk 60%; management and control 20%; and safety performance 20%. Inherent risk attracts the largest weighting as it is the key driver of rail safety risks overall based on size and scope of operation.

However, because a composite indicator model has been used, which results in the aggregation of all sub-factors, it is the sub-factor weightings that carry impact in terms of risk profiling outcomes. The four sub-factors that are notably the highest weighted are the passenger measure 15% (RSO inherent risk); *passenger train kilometres on network* 10.5% (RIM inherent risk); and the two management and control sub-factors – *use of appropriate safety technology* 12% and *safety maturity* 8%.

The sub-factor scores for each operator are added together to give an overall risk profile score. If an operator scores highly against the inherent risk sub-factors, this indicates that the size and scope of its operations are significant. If an operator scores highly against the safety performance sub-factors, this indicates a relatively high incident rate. However, if an operator scores highly against management and control sub-factors, indicating strong performance, the scores are 'inverted' to contribute to a lower overall risk profile score.

Figure 4: Conceptual representation of the risk profiling tool



The sub-factors are described in further detail below.

7.2 Inherent risk

As identified above, inherent risk is assigned 60% of the risk profiling tool's weighting. Its sub-factors are separated into those that apply to RIMs (30%) and those that apply to RSOs (30%), with those operators that are both attracting all inherent risk sub-factors.

7.2.1 RIM sub-factors

The following inherent risk sub-factors apply to RIMs:

Track length – 7.5%

- Includes all track within the scope of an operator's accreditation (including track that is only used occasionally, ie. seasonal activities)

Exclusions: non-operational lines that will not be used by revenue services at any stage throughout the year

Interfaces – 6%

- The number of networks the RIM connects with and the number of RSOs operating on the RIM's network; and
- the number of level crossings
  - note an exponential model is applied on a scale of 0-20 for the number of level crossings to control for skewness/outliers ie. operators are placed into one of 20 bands that equates to the number of level crossings they manage, with the size of the bands growing exponentially

Exclusions: private level crossings and level crossings on non-operational lines

Passenger train kilometres on network – 10.5%

- The sum of passenger train kilometres operated on the network. This indicates the intensity of operations on the network.

Freight train kilometres on network – 6%

- The sum of freight train kilometres operated on the network. This indicates the intensity of operations on the network.

7.2.2 RSO sub-factors

The following inherent risk sub-factors apply to RSOs:

Interfaces – 7.5%

- The number of networks on which the RSO operates; and
- the number of stations (heavy metro and heavy regional) and/or the number of light rail stops that a RSO's passenger services stop at (as relevant to type of operation)
  - note an exponential model is applied on a scale of 0-20 for the number of stations/stops to control for skewness/outliers ie. operators are placed into one of 20 bands that equates to the number of stations/stops that their passenger services stop at, with the size of the bands growing exponentially

Passenger kilometres – 15%

- A passenger kilometre represents the transport of one passenger by rail over one kilometre

Initial consultation workshop feedback indicated it may not be possible for all operators to provide this data. Passenger kilometres are recognised internationally as a contemporary measure for passenger risk exposure, so ONRSR is seeking broader input as to whether this measure is feasible or not.

If an alternative option is required, a combination of passenger train kilometres (10%) and passenger journeys (5%) has been put forward as an alternative representative passenger measure.

Freight train kilometres – 7.5%

- The number of kilometres travelled by freight trains over which the reporting organisation has effective management and control.

Consultation questions: Inherent risk

1. Do you consider that the sub-factors for RIMs and RSO appropriate?
2. Do you consider that the sub-factor weightings are appropriate?
3. If the collection of data is challenging to provide or not available for any of the sub-factor, can you identify these sub-factors and provide alternative measures that would reflect the risk input for this sub-factor measure?
4. If you undertake passenger operations, are you able to provide passenger kilometres?
5. If passenger kilometres are unable to be provided, an alternative measure being considered is passenger train kilometres (10%) and passenger journeys (5%).
   (a) Do you consider this as an appropriate alternative?
   (b) What measurer(s) would you consider appropriate to reflect the risk input for this measure?

7.3 Management and Control

Management and control is assigned 20% of the risk profiling tool's weighting. Its sub-factors of use of appropriate safety technology (12%) and safety maturity (8%) apply to both RIMS and RSOs.

7.3.1 Use of appropriate safety technology

ONRSR engaged an external consultant to develop the use of appropriate safety technology (or 'technology maturity') measure in consultation with ONRSR and the industry reference group. This measure is intended to recognise investment in engineering controls. It follows a five step assessment process, which involves both the operator and ONRSR.

The first time this technology maturity assessment process is undertaken, ONRSR will work with operators in undertaking the assessment to assist with understanding of the assessment tool and to promote a consistent approach nationally.

Step 1: Hazard allocation

ONRSR will allocate the hazards applicable to an operator (ie. those hazards to which an operator is exposed) for technology maturity assessment. Figure 5 below is the hazardous events matrix against which this allocation will be made. While some operators will have fewer hazards to assess than others, all operators will have at least one applicable hazard to assess.

Figure 5: Hazardous events matrix

	Heavy Rail			Light Rail		Other		
	RSO - Passenger	RSO - Freight	RIM	Light Rail - RSO	Light Rail RIM	Track Maintainers	Rolling Stock Maintainers / Constructors	Terminal Managers / Yard Operators / Siding Operators
Running Line Collision with Rolling Stock/Work Vehicle	1	1	1	2	2	1		
Running Line Collision with Worker			3		3	3		
Collision with Person at Station/Platform	4							
Level Crossing Collision			5		5			
Fire on Train	6	6		6				
Fire at Station/Platform	7							
Derailment - Track/Infrastructure			8		8	8		
Derailment - Rolling Stock	9	9		9			9	
Depot or Siding Operations	10	10	10				10	10
Light Rail - Collision with Vehicle on Roadway				11				
Light Rail - Acceleration/Deceleration on Roadway				12				

Note: Numbering in the matrix above refers to the relevant scoring template.

Step 2: Technology selection

The operator uses hazard scoring templates to identify relevant technologies and associated maturity levels. Refer Attachment B for the 12 scoring templates. The operator will identify the technology in place to mitigate risk. Each technology type corresponds to a maturity level ranging from 1 – 5; where 1 is 'ad-hoc' and 5 is 'optimised'. Multiple technologies can be listed per hazard.

Step 3: Technology coverage

The operator estimates technology coverage across the network and records the basis for this estimation.

Note: The first time this process is used across the rail industry, ONRSR will work with operators to streamline the assessment process and ensure it is completed consistently across industry.

Step 4: Score and submit

The operator populates the templates and the technology maturity score is calculated and submitted to ONRSR.

The score is automatically calculated by the template:

Score = sum of (technology maturity level x coverage)

This process is repeated for all applicable hazards and the average score is used in the risk profiling tool.

Step 5: Review and validate

ONRSR reviews assessment and validates the technology maturity score for use in the risk profiling tool.

It is proposed that this process be subject to a three year review, but that operators can trigger a review if required in the interim using the annual safety performance reporting mechanism. Scoring templates will reviewed prior to the three year assessment and updated to reflect new technologies and any new hazardous events.

7.3.2 Safety maturity

ONRSR also worked with the same consultant to develop the safety maturity measure in consultation with the industry reference group. The key aim in developing this measure was to ensure it was appropriate *for cost recovery modelling purposes*. While there are a range of safety maturity models used across industry (for example, the Risk Management Maturity Model (RM3)), no one model is used ubiquitously, and they have been designed with a very different purpose and application.

As part of the development process, industry and ONRSR together identified six key factors as appropriate to be measured for this purpose:

- Leadership
- Communication
- Continual improvement
- Control assurance
- Consultation and engagement
- Change management.

Of note, these include elements from each primary maturity element in RM3, as well as reflecting the Rail Safety National Law National Regulation requirements for safety culture.

The assessment follows a five step process, again involving both the operator and ONRSR. The first time this safety maturity assessment process is completed, ONRSR will work with operators to provide assistance and promote a consistent approach nationally.

Step 1: Assessment questionnaire

The operator completes the assessment questionnaire – refer Attachment C. This includes 30 questions, with responses on a five point scale relating to the six safety maturity factors. There is an opportunity to note 'evidence' to support the rating for each question.

Step 2: Review and confirm maturity results

The operator reviews results for each safety maturity factor. If they believe there are any inaccuracies, the operator can provide additional explanation and evidence.

Step 3: Results validation

ONRSR reviews the outcomes of the maturity assessment, including any safety maturity factor the operator believes does not accurately reflect their operations, or identifies any area where ONRSR may require further evidence to be provided.

Step 4: Scoring

An average score across all questions is calculated, which determines the operator's final summative maturity score.

Step 5: Management and control impact

The safety maturity score is applied in the risk profiling tool.

It is proposed that this process also be subject to a joint three year review, but that operators can trigger a review if required in the interim using the annual safety performance reporting mechanism.

Consultation questions: Management and control

6. Do you consider the sub-factors to be appropriate? If not, please provide further information and alternative options.
7. Do you consider the sub-factor weightings to be appropriate? If not, please provide further information and alternative options.
8. Do you consider the hazardous events in the technology maturity assessment to be representative and appropriate? If not, please provide further information and alternative options.
9. Do you consider the questions in the safety maturity questionnaire to be appropriate? If not, please provide further information and any alternative options

7.4 Safety Performance

As identified above, safety performance is assigned 20% of the risk profiling tool's weighting. Its sub-factors are separated into those that apply to RIMs (10%) and those that apply to RSOs (10%), with those operators that are both attracting all safety performance sub-factors.

The weightings of individual sub-risk factors are commensurate with their position in the accident sequence.

7.4.1 RIM sub-factors

The following safety performance sub-factors apply to RIMs.

Select fatality and serious injury rate (1:3) 2.3%

- Fatalities and serious injuries per train kilometre on the network.
- Fatalities have been weighted three times more heavily than serious injuries. This weighting is based on the ratio of fatalities and serious injuries reported to ONRSR over a five year period, which were of an occurrences category within scope of this measure. The weighting is not intended to represent the relative difference in severity and/or cost of the two outcomes.

Exclusions: Fatalities and serious injuries as a result of:

- Trespass
- Suspected suicide/attempted suicide
- Collision with person/vehicle at a level crossing where not as a result of a wrong side failure
- Running line collision between tram and person/vehicle
- Assault
- Slips/Trips/Falls not directly associated with train movement or interaction

Normaliser: Train kilometres on the network

Running Line Collision rate **1.8%**

- Running line collisions between rolling stock per train kilometre on the network.

Exclusions: Collisions with people, road vehicles, obstruction (unless railway-related object) or fixed railway infrastructure; yard collisions.

Normaliser: Train kilometres on the network

Running Line Derailment rate **1.8%**

- Derailments of rolling stock on a running line per train kilometre on the network

Exclusions: Yard derailments and road-rail vehicle derailments

Normaliser: Train kilometres on the network

Serious safe working rule breach rate **1.4%**

- Rate of incidents in which a failure, breach or omission of a system, process or procedure had the potential to threaten the safety of people or railway operations.

Normaliser: $\frac{\text{Train kilometres on the network}}{\text{Track kilometres}}$

Broken rail and rail defect rate **0.9%**

- Rate of rail irregularities that cause a stoppage of rolling stock, or a speed restriction being imposed that is lower than that currently in force.

Normaliser: $\frac{\text{Train kilometres on the network}}{\text{Track kilometres}}$

Wrong side failure rate **1.4%**

- Failure where vital equipment, circuits or signals, including at level crossings, do not fail-safe in accordance with the design specifications to provide the intended protection for train movements, endangering or having the potential to endanger the safety of railway operations

Normaliser: $\frac{\text{Train kilometres on the network}}{\text{Track kilometres}}$

Drug and alcohol positives (post sign-on) **0.5%**

- Rate of positive post sign-on drug or alcohol tests conducted by an operator, including refusals.

Exclusions: pre-sign on testing

Normaliser: Number of tests conducted

When considering normalisers for RIM-related safety performance sub-factors, stakeholders expressed mixed views and a number of options are listed below for your consideration:

- Train kilometres on the network
- $\frac{\text{Train kilometres on the network}}{\text{Track kilometres}}$
- Gross or net tonne kilometres.

Following the consultation workshop feedback, ONRSR reviewed the proposed normalisers for RIM safety performance sub-factors. As a result, it is proposed to use the following as normalisers where relevant:

- Train kilometres on the network
- Train kilometres on the network / Track kilometres

No changes are proposed to the drug and alcohol positive normaliser.

7.4.2 RSO sub-factors

The following safety performance sub-factors apply to RSOs. When these sub-factors were identified, normaliser options were discussed with stakeholders and it was agreed that for RSO-related sub-factors, the continued use of train kilometres (including maintenance train kilometres) as a normaliser would be the most appropriate, with the exception of drug and alcohol positives.

Select fatalities and serious injuries / train km (1:3) 2.0%

- Fatalities and serious injuries per train kilometre.
- Fatalities have been weighted three times more heavily than serious injuries. This weighting is based on the ratio of fatalities and serious injuries reported to ONRSR over a five year period, which were of an occurrences category within scope of this measure. The weighting is not intended to represent the relative difference in severity and/or cost of the two.

Exclusions: Fatalities and serious injuries as a result of:

- Trespass
- Suspected suicide/attempted suicide
- Collision with person/vehicle at a level crossing where not as a result of a wrong side failure
- Running line collision between tram and person/vehicle
- Assault
- Slips/Trips/Falls not directly associated with train movement or interaction

Normaliser: Train kilometres

Running Line Collision rate 1.6%

- Running line collisions between rolling stock per train kilometre.

Exclusions: Collisions with people, road vehicles, obstruction (unless railway-related object) or fixed railway infrastructure; yard collisions.

Normaliser: Train kilometres

Running Line Derailment rate 1.6%

- Derailments of rolling stock (other than a road-rail vehicle) on a running line per train or track kilometres

Exclusions: Yard derailments

Normaliser: Train kilometres

Select Proceed Authority Exceeded 1.2%

Currently reported as:

- SPAD A1 / LRTAE A4 (LOA missed by train/tram crew)
- LRTAE A1 (Road traffic light passed w/out authority)
- LRTAE A2 (Tram signal passed w/out authority)

Under the National Rail Safety Data Strategy, that these will be captured as Category A occurrences – Proceed Authority Exceeded.

Exclusions: all other types of SPAD/LRTAE.

Normaliser: Train kilometres

Serious safe working breaches / train km 1.2%

- Rate of incidents in which a failure, breach or omission of a system, process or procedure that had the potential to threaten the safety of people or railway operations.

  Normaliser: Train kilometres

Runaways & uncontrolled movements / train km 1.2%

- Uncontrolled movements of an unattended train or item of rolling stock that endangers or has the potential to endanger the safety of railway operations per train kilometre.

Normaliser: Train kilometres

Wheel, axle and bearing failures / train km 0.8%

- Rate of wheel, axle and bearing failures which occur while the vehicle is in service that results in the vehicle being taken out of service, either immediately or at the end of its run, or a speed restriction being imposed, including but not limited to:
  - Breaks or cracks within any part of a wheel.
  - Axle breaks or shears due to flaws or cracks within the axle.
  - Axle that is bent or out of alignment within its housing.
  - Seized bearings and screwed journals
  - Bearing defect detected by trackside monitoring equipment.

Normaliser: Train kilometres

Drug and alcohol positives (post sign-on) – 0.4%

- Rate of positive post sign-on drug or alcohol tests conducted by an operator including refusals.

Exclusions: pre-sign on testing

Normaliser: Number of tests conducted

Consultation questions: Safety performance

10. Do you consider the sub-factor weightings to be appropriate? If not, please provide further information and alternative options.
11. Do you consider the sub-factors for RIMs and RSO to be appropriate? If not, please provide further information and alternative options.
12. Do you consider he normalisers for RIMs to be appropriate? If not, please provide further information and alternative options.
13. Are you aware of any issues / impacts with providing the RIM normaliser data?
14. Do you consider the normalisers for RSOs appropriate? If not, please provide further information and alternative options.

7.5 Risk Profile Score

To formulate an operator's risk profile score, the individual weighted scores against each sub-factor are summed to calculate a raw score, which is then re-scaled between 0-100 for use in the tiered cost recovery model.

The operator with the highest raw risk profiling score is assigned a rescaled score of 100; the operator with the lowest raw risk profiling score is assigned a rescaled score of zero; and all other operators are assigned a proportional score based on where their raw scores sit within these two.

Consultation questions: Risk profiling tool

15. Do you consider the risk profiling tool approach appropriate for cost recovery purposes?
16. Have you identified any limitations or opportunities that have not been addressed?

7.6 Regulatory effort

Regulatory effort is the second key component of the cost recovery model.

ONRSR collects data on regulatory effort (hours) allocated to operators, which enables analysis of the amount of regulatory effort allocated on an annual basis to individual operators and to groups of operators.

Regulatory effort data used for cost recovery modelling includes effort spent on the following ONRSR activities focused on individual operators:

- Variation of accreditation
- Audit and inspection
- Investigations
- Education.

Regulatory effort relating to operations which attract a Major Project Fee are excluded. All other regulatory and non-regulatory activities are also excluded.

From the modelling undertaken to date the relationship between risk profile scoring and regulatory effort shows a strong correlation.

Regulatory effort for each operator is identified, both in terms of hours and as a percentage of the total regulatory effort.

It is proposed that a rolling three year average be used in applying the regulatory effort data which will even out periodic fluctuations due to operational changes and regulatory task scheduling.

7.7 Fee modelling: tiered approach

The cost recovery model then pulls together these two key inputs: risk profile scores and regulatory effort. As mentioned above, when these are compared a strong correlation between the two is generally apparent.

Operators are then grouped into six cost recovery 'tiers', with tier one being those that have the highest risk profile (and attract the most regulatory effort); and tier six being the lowest.

While it will be rare, there may be occasions where through further analysis of the data ONRSR may adjust the tier in which an operator is placed. This could be, for example, if a small operator's risk profile score is inappropriately affected by a single occurrence for which they attracted a disproportionate score (eg, a fatality for which they were an involved party but not responsible).

This would be a Regulator decision, but any adjustments would be discussed with the operator/s involved.

7.7.1 Determining the fee amounts

Fee amounts for each fee tier are determined by summing the regulatory effort for every operator in a tier, then using the overall percentages to determine how much to recover from each tier. The amount to recover from each tier is divided by the number of operators in the tier to determine the fee amount as per the following relationship:

$$\frac{\text{Total amount of regulatory effort in the tier}}{\text{number of operators in the tier}} \Rightarrow \text{Annual accreditation fee per operator in the tier}$$

The following table provides an example of how this approach is given effect across six tiers.

Table 6: Tier fee rate calculation

Tier	Number of Operators	Tier RE %	Amount to Recover for Tier	Fee per Operator
1	4	26%	= 26% of Amount to Recover	= Tier cost / 4
2	11	33%	= 33% of Amount to Recover	= Tier cost / 11
3	8	7%	= 7% of Amount to Recover	= Tier cost / 8
4	21	14%	= 14% of Amount to Recover	= Tier cost / 21
5	18	7%	= 7% of Amount to Recover	= Tier cost / 18
6	52	13%	= 13% of Amount to Recover	= Tier cost / 52

The result is that each operator is assigned a fee based on the tier in which their risk score places them and the regulatory effort expended on operators within that tier. **Each operator within that tier pays the same amount of fees**.

7.7.2 Appeal provisions

ONRSR will advise operators of the fee they have been assigned and appeal provisions will be put in place for an operator to appeal if they believe they are not in an appropriate tier.

Discussion points: Risk and regulatory effort model: tiered approach

17. Do you consider that the proposed method of ascribing regulatory effort to a tier is appropriate for cost recovery purposes? If not, please provide further information and alternative options.
18. Do you consider that this approach has achieved the intent of developing a cost recovery model based on risk and regulatory effort? If not, please explain the limitations and suggest improvements.

8 Other opportunities to reduce cross-subsidisation

The regulatory effort allocated to processing applications and the regulatory effort allocated to registered operators is in no way commensurate with current fees charged for these activities. While application fees are transactional, they are not a 'fee for service' as the outcome of the application process is dependent on the assessment. However, fees should recover costs for undertaking these regulatory activities, based on average regulatory effort costs.

It is proposed to revise the following fees:

- application for accreditation fee (currently $10,000)
- application for registration fee (currently $1,000)
- annual registration fee (currently $500).

These fees have been static since ONRSR commenced operation. At that time, it was acknowledged that they were not representative of the effort involved, but it was agreed that they would also be reviewed in future years as part of the cost recovery review.

It is proposed to revise these fees to the following amounts:

- application for accreditation fee: $25,000
- application for registration fee: $1,000
- annual registration fee: $5,500.

Further, as ONRSR actively encourages industry to continue to focus on safety improvement, and operators are already paying an annual fee, it is proposed to remove the current application for variation of accreditation fee altogether.

Another area of significant cross-subsidisation that has been addressed in the proposed risk and regulatory effort model is that of accredited maintenance operations. Currently, they generally only pay the fixed $15,000 annual accreditation fee, as they do not attract a variable fee for track or train kilometres (maintenance train kilometres are not included under the current model) regardless of risk or the amount of regulatory effort they attract. Moving forward, they will be treated as per all other accredited operators and will attract fees based on risk and regulatory effort, thus reducing the level of cross-subsidisation from other operators.

Discussion points: Other opportunities to reduce cross-subsidisation

19. Do you consider the proposed revised and withdrawn fees to be appropriate?
20. If not, please explain the limitations and suggest alternatives for cross-subsidisation be addressed.

Example: Annual variable fee setting for Victoria – 2020/21

Amount to recover from industry, adjusted by National CPI and major project fees; and increased by 5% of the overall cost of regulation (if not at 100%) = **$4,037,452**

Deduct fixed fees

Calculate fixed fees by the number of operators principally accredited in that jurisdiction e.g:

14 Commercial operators principally accredited X $15,000

17 Tourist & heritage operators X $2,000

18 registered operators X $500

Total fixed fees = **$253,000** (including pro-rata)

Determine amount to recover through variable fees

Deduct total fixed fees from total cost of recovery

$4,037,452- $253,000 = $3,784,452

Total variable amount to be recovered = **$3,784,452**

Divide variable amount into track and train at a ratio of 30:70

Track portion

$3,784,452 x 30%

= **$1,135,336**

Divide by state / territory total track

$1,135,336/ 6,399 kms = $179.11/km

Reduced by estimated over-recovery

$179.11 - 1.88%

Track Fee

$175.74/km

Train portion

$3,784,452 x 70%

= **$2,649,116**

Divide by state / territory total train

$2,649,116/ 66,189,497 kms = $0.040/ km

Reduced by estimated over-recovery

$0.040 - 1.88%

Train Fee

$0.039/km

NB: Figures have been rounded for the purposes of this document. The rates are as published in Schedule 3 of the Rail Safety National Law National Regulations 2012 at 18 December 2020.

Control Technology Maturity Assessment Template 1

This template is to be used to assess the level of technical maturity used by the RTO to mitigate the following hazardous event:

Hazardous Event	Train to Train or other rail vehicle collision on a main / running line.
Description	A collision between a train and other rail vehicle on any main running line. Examples: • Head-on or nose-to-tail collision on main line • Side-on collision when train crossing points • Collision due to kinematic envelope breach • Collision between main-line running train and train in siding / depot that remains foul of main-line • Collision between train travelling on mainline and work vehicle within a works zone This event excludes collisions that occur in sidings or depots only. This event also excludes collision between works vehicles in a work zone. Light rail collisions are addressed in a separate template.

1 Directions

On the following page you will be asked to identify the specific technologies that are applied across your network that mitigate the hazardous event.

For the purposes of this assessment, technology is defined as: *Machinery or equipment (mechanical or software) that mitigates a hazardous event in part or full.*

In completing this:

- There may be multiple types of technologies in place for different circumstances / contexts / scenarios, and it is expected that you consider these as best you can.
- Technologies may be integrated to provide improved mitigation. Where this is the case, include the range of technologies that, combined, mitigate the risk.
  - Using a rail operations example: Conventional signalling systems in conjunction with fatigue monitoring technology (e.g. eye tracking) mitigate train to train collision.
- For each technology (or group of technology), *estimate* the percentage of use across the network or operations.
  - The estimate is intended to be just that - a reasoned estimate. It does not assume that the precise value is known. (Of course, if it is known feel free to use that).
- For each technology, you will be asked to define the level of maturity. A technical maturity table, tailored for this hazardous event, is at the end of the template along with examples of technology that are commensurate with that level. Use reasoned judgement to identify the level of technical maturity.

IMPORTANT: technical maturity does not imply the risk is being managed (or not managed) safe, so far as is reasonably practical.

2 Technology Identification

2.1 Listing of Technologies

What technology, or combination of technologies, are in place to address the hazardous event?

Add rows to this table as necessary to include all relevant technologies.

Technology (ies)	Maturity[1]

2.2 Scope of Application

For the technologies identified, it is now necessary to understand the degree of mitigation provided by the technology (i.e. percentage of hazardous event covered).

Maturity	Technology (ies)	% of services protected by the technology[2]
5 – Optimized	•	
4 – Targeted	•	
3 – Tailored	•	
2 – Implemented	•	
1 – Ad-Hoc	•	

2.3 Application Percentage

Briefly describe how the percentage values were determined?

2.4 Justification and Notes

Please enter any details that may support the assessment above if you feel necessary

[1] Refer to last page for maturity descriptions.

[2] Note that this is not the percentage of network covered by the technology, but rather percentage of services run on the network.

3 Technology Maturity Definitions – Train to Train Collision (Heavy Rail)

Technology maturity relates to the level of protection that a specific technology provides for a specific hazardous event. It does not mean the 'newest' technology, though frequently newer technology will improve on older technology.

Maturity	Score	General Description	Event Specific Description	Technology Examples

Optimized	5	Technology directly addresses the hazardous events that lead to the risk. There is no opportunity to improve the technology effectiveness (irrespective of cost).	Technology ensures the separation of trains with other rail vehicles.	• ATP, examples include:
				  • Fully automated (driverless) train system
				  • ATC with ATP, ATO
				  • CBTC operations
				  • Positive Train Control
				  • ETCS

Targeted	4	Technology is well designed specifically addresses the hazardous events that lead to the risk. There remain potential failure modes (including human error and degraded mode operations).	Technology ensures the separation of trains with other rail vehicles, but where some hazards still exist (including human error or where the operator may undertake steps to manually override the system).	• TPWS, TPWS+, or train stops in conjunction with braked overlap in combination with 'Human error' mitigation technologies • Any of the 'optimized' technologies but where infrastructure / works vehicles are not covered (E.g. RRV) OR where an individual may override the system without confirmation.
Tailored	3	The technology addresses the majority of source events that can lead to the risk arising, but: • Fails to address all hazards; or • There is a high reliance on human performance; or • The technology only addresses the hazard in part.	Technology provides a good level of protection against collision events, but also rely on other processes or systems to mitigate the risk (e.g. verbal authorisation from train control to proceed after an intervention).	• Stop enforcement technologies (e.g. TPWS, TPWS+, train stops) where fully braked overlap is not ensured. • Conventional signalling system in combination with 'human error' mitigation systems plus crashworthiness standards.
Implemented	2	The technology provides a degree of risk mitigation but is not targeted to the specific risk events or precursors, and there is reliance on administrative controls to mitigate the risk.	Technologies are in place to mitigate some of the risk events (or precursors to these), but there remains reliance on administrative controls (such as obeying signal aspects).	• Conventional signalling system • 'Human error' mitigation systems (e.g. vigilance, fatigue)

				• Rollingstock designed to meet contemporary crashworthiness standards (e.g. RISSB standard) • Availability of Monuments (track position identifiers) • LED signals / lanterns • Co-Actors to improve signal sighting • Slippage prevention / recovery systems (e.g. sanding)
Ad-Hoc	1	No technology applied, or where technology has very indirect effect on the risk. Reliance on administrative style controls.	Rail traffic is coordinated through administrative systems.	• Manual safeworking systems (e.g. token systems, some train order systems) • Dark territory operations

Control Technology Maturity Assessment Template 2

This template is to be used to assess the level of technical maturity used by the RTO to mitigate the following hazardous event:

Hazardous Event	Light Rail / Tram to Light Rail / Tram or other rail vehicle collision on a main / running line.
Description	A collision between a train and other rail vehicle on any main running line. Examples: • Collision on shared roadway • Collision on segregated rail • Collision at intersection due to kinematic envelope breach This risk excludes collisions that occur in sidings or depots only. This risk also excludes collision between works vehicles in a work zone. Heavy rail collisions are addressed in a separate template.

1 Directions

On the following page you will be asked to identify the specific technologies that are applied across your network that mitigate the hazardous event.

For the purposes of this assessment, technology is defined as: *Machinery or equipment (mechanical or software) that mitigates a hazardous event in part or full.*

In completing this:

- There may be multiple types of technologies in place for different circumstances / contexts / scenarios, and it is expected that you consider these as best you can.
- Technologies may be integrated to provide improved mitigation. Where this is the case, include the range of technologies that, combined, mitigate the risk.
  - Using a rail operations example: Conventional signalling systems in conjunction with fatigue monitoring technology (e.g. eye tracking) mitigate train to train collision.
- For each technology (or group of technology), *estimate* the percentage of use across the network or operations.
  - The estimate is intended to be just that - a reasoned estimate. It does not assume that the precise value is known. (Of course, if it is known feel free to use that).
- For each technology, you will be asked to define the level of maturity. A technical maturity table, tailored for this hazardous event, is at the end of the template along with examples of technology that are commensurate with that level. Use reasoned judgement to identify the level of technical maturity.

IMPORTANT: technical maturity does not imply the risk is being managed (or not managed) safe, so far as is reasonably practical.

2 Technology Identification

2.1 Listing of Technologies

What technology, or combination of technologies, are in place to address the hazardous event?

Add rows to this table as necessary to include all relevant technologies.

Technology (ies)	**Maturity**[1]

2.2 Scope of Application

For the technologies identified, it is now necessary to understand the degree of mitigation provided by the technology (i.e. percentage of hazardous event covered).

Maturity	**Technology (ies)**	**% of services protected by the technology**[2]
5 – Optimized		
4 – Targeted		
3 – Tailored		
2 – Implemented		
1 – Ad-Hoc		

2.3 Application Percentage

Briefly describe how the percentage values were determined?

2.4 Justification and Notes

Please enter any details that may support the assessment above if you feel necessary

[1] Refer to last page for maturity descriptions.

[2] Note that this is not the percentage of network covered by the technology, but rather percentage of services run on the network.

3 Technology Maturity Definitions - Light Rail / Tram to Light Rail / Tram or other rail vehicle collision on a main / running line.

Technology maturity relates to the level of protection that a specific technology provides for a specific hazardous event. It does not mean the 'newest' technology, though frequently newer technology will improve on older technology.

Maturity	Score	General Description	Event Specific Description	Technology Examples
Optimized	5	Technology directly addresses the hazardous events that lead to the risk. There is no opportunity to improve the technology effectiveness (irrespective of cost).	Technology ensures the separation of light rail vehicles with other rail vehicles.	• Communication based technologies (ensuring separation is maintained through speed and distance)
Targeted	4	Technology is well designed specifically addresses the hazardous events that lead to the risk. There remain potential failure modes (including human error and degraded mode operations).	Technology ensures the separation of trams with other rail vehicles, but where some hazards still exist (including human error or where the operator may undertake steps to manually override the system).	• Obstacle detection and avoidance systems which actively intervene when potential hazards are identified.
Tailored	3	The technology addresses the majority of source events that can lead to the risk arising, but: Fails to address all hazards; or There is a high reliance on human performance; or The technology only addresses the hazard in part.	Technology provides a good level of protection against collision events, but also rely on other processes or systems to mitigate the risk (e.g. verbal authorisation from train control to proceed after an intervention).	• Conventional signalling and / or vigilance systems in combination with a human monitoring system (e.g. eye tracking, fatigue monitoring) plus contemporary crashworthiness standards • Obstacle detection identification systems, requiring driver intervention.
Implemented	2	The technology provides a degree of risk mitigation, but is not targeted to the specific risk events or precursors, and there is reliance on administrative controls to mitigate the risk.	Technologies are in place to mitigate some of the risk events (or precursors to these), but there remains reliance on administrative controls and error avoidance strategies.	• Conventional Signalling system • Vigilance devices • Fatigue monitoring systems • Rollingstock designed to meet contemporary crashworthiness standards (e.g. RISSB standard)
Ad-Hoc	1	No technology applied, or where technology has very indirect effect on the risk. Reliance on administrative style controls.	Rail traffic is coordinated through administrative systems.	• Vehicles separated from other rail traffic relying on line of sight only

Control Technology Maturity Assessment Template 3

This template is to be used to assess the level of technical maturity used by the RTO to mitigate the following hazardous event:

Hazardous Event	Authorised person performing work in corridor struck by train on running line.
Description	Any person who is performing work within the rail corridor, including track workers, engineering staff, drivers, shunters, and is struck by train. Examples: • Track worker conducting maintenance duties (repairs, routine inspections, emergency works, etc.) • Driver who steps off train into corridor to inspect or troubleshoot train • Track worker enters corridor without permission to do work This event excludes: • Persons intent on self-harm / suicide. • Person who enter corridor without permission for purposes other than performing track related work (i.e. shortcut). • Person being struck by vehicles that are operating within a defined / protected work zone. • Light rail infrastructure works

1 Directions

On the following page you will be asked to identify the specific technologies that are applied across your network that mitigate the hazardous event.

For the purposes of this assessment, technology is defined as: *Machinery or equipment (mechanical or software) that mitigates a hazardous event in part or full.*

In completing this:

- There may be multiple types of technologies in place for different circumstances / contexts / scenarios, and it is expected that you consider these as best you can.
- Technologies may be integrated to provide improved mitigation. Where this is the case, include the range of technologies that, combined, mitigate the risk.
  - Using a rail operations example: Conventional signalling systems in conjunction with fatigue monitoring technology (e.g. eye tracking) mitigate train to train collision.
- For each technology (or group of technology), *estimate* the percentage of use across the network or operations.
  - The estimate is intended to be just that - a reasoned estimate. It does not assume that the precise value is known. (Of course, if it is known feel free to use that).
- For each technology, you will be asked to define the level of maturity. A technical maturity table, tailored for this hazardous event, is at the end of the template along with examples of technology that are commensurate with that level. Use reasoned judgement to identify the level of technical maturity.

IMPORTANT: technical maturity does not imply the risk is being managed (or not managed) safe, so far as is reasonably practical.

2 Technology Identification

2.1 Listing of Technologies

What technology, or combination of technologies, are in place to address the hazardous event?

Add rows to this table as necessary to include all relevant technologies.

Technology (ies)	Maturity[1]

2.2 Scope of Application

For the technologies identified, it is now necessary to understand the degree of mitigation provided by the technology (i.e. percentage of hazardous event covered).

Maturity	Technology (ies)	% of work protected by the technology[2]
5 – Optimized	•	
4 – Targeted	•	
3 – Tailored	•	
2 – Implemented	•	
1 – Ad-Hoc	•	

2.3 Application Percentage

Briefly describe how the percentage values were determined?

2.4 Justification and Notes

Please enter any details that may support the assessment above if you feel necessary

[1] Refer to last page for maturity descriptions.

[2] Note that this is not the percentage of network covered by the technology, but rather percentage of work performed.

3 Technology Maturity Definitions – Authorised person struck by train

Technology maturity relates to the level of protection that a specific technology provides for a specific hazardous event. It does not mean the 'newest' technology, though frequently newer technology will improve on older technology.

Maturity	Score	General Description	Event Specific Description	Technology Examples
Optimized	5	Technology directly addresses the hazardous events that lead to the risk. There is no opportunity to improve the technology effectiveness (irrespective of cost).	Persons authorised to work on track are fully protected through technology, and there is no opportunity for a train to collide with a person.	• Signalling based protection arrangements with full protection (e.g. ATP established track protection along with adjacent lines also protected.) • Rail corridor fully protected by fencing (or similar) - any access is monitored, and unauthorised access results in rail traffic stopping.
Targeted	4	Technology is well designed specifically addresses the hazardous events that lead to the risk. There remain potential failure modes (including human error and degraded mode operations).	Persons authorised to work on track are well protected by the technology in place. However, incidents / near misses have occurred, or human error may lead to technology failure.	• Signalling based protection arrangements (ATP established track protection, but adjacent line running) • Absolute signal-blocking with train stop enforcement, overlap accounted for, and all adjacent lines also blocked) • Track shunt devices in combination with train stop enforcement (e.g. Zollner) and app linkages to ensure blocks have been implemented correctly.
Tailored	3	The technology addresses the majority of source events that can lead to the risk arising, but: • Fails to address all hazards; or • There is a high reliance on human performance; or • The technology only addresses the hazard in part.	The technology provides good level of protection to authorised persons on track, but must be used alongside additional processes or systems to mitigate the risk. The technology is reliant on human operator to set-up and implement each time.	• Advanced warning systems for train approaches. • Track shunt devices in combination with train stop enforcement (e.g. Zollner) • Absolute signal blocking • CCTV related systems with analytics identifying incursion into unprotected areas

				• App developed to ensure appropriate form of protection is selected based on site context. • 4TeL WorkSite Protection usage in regional areas. • Bombardier TrackSafe • Electronic Track Work Application (JHR)
Implemented	2	The technology provides a degree of risk mitigation, but is not targeted to the specific risk events or precursors, and there is reliance on administrative controls to mitigate the risk.	Technology was not specifically designed to address the safety of persons authorised to work on track, but does provide a degree of protection on top of other controls in place.	• End of work zone warning lights • Train approaching warning systems (e.g. TASS – ARTC; Zone Guard; Inventis SafeZone) • App to walk through site – to ensure knowledge of site is known and to brief track workers.
Ad-Hoc	1	No technology applied, or where technology has very indirect effect on the risk. Reliance on administrative style controls.	Persons authorised to work on track do so under administrative processes only.	• Manual safeworking methods • Standard or augmented PPE (e.g. 'halo' light)

Control Technology Maturity Assessment Template 4

This template is to be used to assess the level of technical maturity used by the RTO to mitigate the following hazardous event:

Hazardous Event	Person being struck by a train at a station.
Description	Any person who is at a station being struck by a train, including staff, public, or passengers. Examples: • Person too close to edge being struck by mirror or similar. • Person purposely entering the rail corridor and being struck by train. • Person inadvertently entering the rail corridor and being struck by train. • Pram or wheelchair rolling into the and struck by train. This event excludes persons intent on self-harm / suicide.

1 Directions

On the following page you will be asked to identify the specific technologies that are applied across your network that mitigate the hazardous event.

For the purposes of this assessment, technology is defined as: *Machinery or equipment (mechanical or software) that mitigates a hazardous event in part or full.*

In completing this:

- There may be multiple types of technologies in place for different circumstances / contexts / scenarios, and it is expected that you consider these as best you can.
- Technologies may be integrated to provide improved mitigation. Where this is the case, include the range of technologies that, combined, mitigate the risk.
  - Using a rail operations example: Conventional signalling systems in conjunction with fatigue monitoring technology (e.g. eye tracking) mitigate train to train collision.
- For each technology (or group of technology), *estimate* the percentage of use across the network or operations.
  - The estimate is intended to be just that - a reasoned estimate. It does not assume that the precise value is known. (Of course, if it is known feel free to use that).
- For each technology, you will be asked to define the level of maturity. A technical maturity table, tailored for this hazardous event, is at the end of the template along with examples of technology that are commensurate with that level. Use reasoned judgement to identify the level of technical maturity.

IMPORTANT: technical maturity does not imply the risk is being managed (or not managed) safe, so far as is reasonably practical.

2 Technology Identification

2.1 Listing of Technologies

What technology, or combination of technologies, are in place to address the hazardous event?

Add rows to this table as necessary to include all relevant technologies.

Technology (ies)	Maturity[1]

2.2 Scope of Application

For the technologies identified, it is now necessary to understand the degree of mitigation provided by the technology (i.e. percentage of hazardous event covered).

Maturity	Technology (ies)	% of persons at stations protected by the technology[2]
5 – Optimized	•	
4 – Targeted	•	
3 – Tailored	•	
2 – Implemented	•	
1 – Ad-Hoc	•	

2.3 Application Percentage

Briefly describe how the percentage values were determined?

2.4 Justification and Notes

Please enter any details that may support the assessment above if you feel necessary

[1] Refer to last page for maturity descriptions.

[2] Note that this is not the percentage of network covered by the technology, but rather percentage of persons.

3 Technology Maturity Definitions - Person being struck by a train at a station.

Technology maturity relates to the level of protection that a specific technology provides for a specific hazardous event. It does not mean the 'newest' technology, though frequently newer technology will improve on older technology.

Maturity	Score	General Description	Event Specific Description	Technology Examples
Optimized	5	Technology directly addresses the hazardous events that lead to the risk. There is no opportunity to improve the technology effectiveness (irrespective of cost).	People at stations and platforms are fully protected from the danger zone through technology.	• Full height platform screen doors or gates
Targeted	4	Technology is well designed specifically addresses the hazardous events that lead to the risk. There remain potential failure modes (including human error and degraded mode operations).	Technologies are provided that actively monitor the danger zone. If a person infringes on the corridor the system will automatically stop train running.	• CCTV combined with rail zone incursion alarms which automatically stops approaching trains. • Half height platform screen doors or gates
Tailored	3	The technology addresses the majority of source events that can lead to the risk arising, but: • Fails to address all hazards; or • There is a high reliance on human performance; or • The technology only addresses the hazard in part.	Technologies are provided that address events such as crowding or identification of at-risk behaviours (including intentional access to the danger zone) but require a human controller to decide on the response (e.g. stop trains or similar).	• CCTV combined with rail zone incursion alarms • Platform congestion monitoring systems with alerts made to station controllers • Door obstacle detection systems interlocked with traction control • Anti-drag interlocking • Door closure detection systems (degree of sensitivity – mechanical vs. sensor based) • CCTV with video analytics (to identify incursions into corridor) • Narrow gaps / straight platforms. • Engineered gap reduction technologies (e.g. raised platforms) in conjunction with gap fillers.
Implemented	2	The technology provides a degree of risk mitigation but is not targeted to the specific risk events or precursors, and there is reliance on administrative controls to mitigate the risk.	There is a degree of technology provided but is highly dependent on person behaviours.	• Platform / train gap fillers • Platform end height adjustments (to reduce gap at specific locations)

				• Emergency button on platform – to inform controllers that incident at station. • CCTV monitors (to support authorised person observing down train) • Passenger emergency door release (if someone stuck) • Paddles (demonstrating to driver platform is clear prior to departure) • Fixed door threshold extensions • Bellows between cars
Ad-Hoc	1	No technology applied, or where technology has very indirect effect on the risk. Reliance on administrative style controls.	No technology of any sort applied to ensure a person does not enter (intentionally or unintentional) the danger zone.	• No indications of platform edge. • Mirrors to support platform sighting • Yellow / white line to stand behind. • Tactiles in place

Control Technology Maturity Assessment Template 5

This template is to be used to assess the level of technical maturity used by the RTO to mitigate the following hazardous event:

Hazardous Event	Road vehicle and train / light rail collision at level crossing.
Description	Any accredited road vehicle and train or light rail collision at a defined level crossing. Examples: • Road vehicle incorrectly enters level crossing in front of train. • Road vehicle stuck in level crossing. • Road vehicle driving around boom barriers • Signalling system fails leading to unprotected level crossing or degraded protection. • Road vehicle entering occupation crossing in front of train due to sighting issues • Adjacent rail works incorrectly de-activates the crossing on train approach. • Adjacent rail works where the crossing is placed into manual activation and it fails to be activated This event excludes scenarios where the road vehicle driver is intent on self-harm / suicide. This event excludes 'unauthorised' crossings (i.e. not registered in ALCAM or on the RTO asset management system).

1 Directions

On the following page you will be asked to identify the specific technologies that are applied across your network that mitigate the hazardous event.

For the purposes of this assessment, technology is defined as: *Machinery or equipment (mechanical or software) that mitigates a hazardous event in part or full.*

In completing this:

- There may be multiple types of technologies in place for different circumstances / contexts / scenarios, and it is expected that you consider these as best you can.
- Technologies may be integrated to provide improved mitigation. Where this is the case, include the range of technologies that, combined, mitigate the risk.
  - Using a rail operations example: Conventional signalling systems in conjunction with fatigue monitoring technology (e.g. eye tracking) mitigate train to train collision.
- For each technology (or group of technology), *estimate* the percentage of use across the network or operations.
  - The estimate is intended to be just that - a reasoned estimate. It does not assume that the precise value is known. (Of course, if it is known feel free to use that).
- For each technology, you will be asked to define the level of maturity. A technical maturity table, tailored for this hazardous event, is at the end of the template along with examples of technology that are commensurate with that level. Use reasoned judgement to identify the level of technical maturity.

IMPORTANT: technical maturity does not imply the risk is being managed (or not managed) safe, so far as is reasonably practical.

2 Technology Identification

2.1 Listing of Technologies

What technology, or combination of technologies, are in place to address the hazardous event?

Add rows to this table as necessary to include all relevant technologies.

Technology (ies)	Maturity[1]

2.2 Scope of Application

For the technologies identified, it is now necessary to understand the degree of mitigation provided by the technology (i.e. percentage of hazardous event covered).

Maturity	Technology (ies)	% of level crossings protected by the technology
5 – Optimized	•	
4 – Targeted	•	
3 – Tailored	•	
2 – Implemented	•	
1 – Ad-Hoc	•	

2.3 Application Percentage

Briefly describe how the percentage values were determined?

2.4 Justification and Notes

Please enter any details that may support the assessment above if you feel necessary

[1] Refer to last page for maturity descriptions.

3 Technology Maturity Definitions - Road vehicle and train / light rail collision at level crossing.

Technology maturity relates to the level of protection that a specific technology provides for a specific event. It does not mean the 'newest' technology, though frequently newer technology will improve on older technology.

Maturity	Score	General Description	Event Specific Description	Technology Examples
Optimized	5	Technology directly addresses the hazardous events that lead to the risk. There is no opportunity to improve the technology effectiveness (irrespective of cost).	The technology in place provides the maximum protection available, and actively ensures that the crossing is clear and stops vehicles from entering the crossing. The only improvement being removal of the crossing (closure or separation).	• Bells, lights, booms and in-crossing obstacle (vehicle) detection • Obstacle detection systems – automatic (prevent rail approach if object detected)
Targeted	4	Technology is well designed specifically addresses the hazardous events that lead to the risk. There remain potential failure modes (including human error and degraded mode operations).	Technology will address the primary hazardous event of drivers entering the level crossing, and also provides road users with additional awareness of level crossing activation.	• Bells / lights / booms (interlocked) in association with other systems such as active advanced warnings for road vehicles • Obstacle detection systems (in lower speed environments – e.g. light rail) • Obstacle detection systems – manual detection. (e.g. Signaller direct observations, via CCTV)
Tailored	3	The technology addresses the majority of source events that can lead to the risk arising, but: • Fails to address all hazards; or • There is a high reliance on human performance; or • The technology only addresses the hazard in part.	Technology will address the primary hazardous event of drivers entering the level crossing only.	• Bells / lights / booms interlocked with signalling system, and prior signal at stop until proven protected. • Passive protected crossings where it is associated with good sight lines, quality signage (and advanced warnings).
Implemented	2	The technology provides a degree of risk mitigation, but is not targeted to the specific risk events or precursors, and there is reliance on administrative controls to mitigate the risk.	Technology will make road users aware of a level crossing with a train approaching, however there is no barrier of any sort to prevent entry to the level crossing.	• Bells / lights interlocked with signalling system (including axle counters if used) • Train Horns • Lights / strobes on rollingstock • Trap track circuits • Gated passive crossings

Ad-Hoc	1	No technology applied, or where technology has very indirect effect on the risk. Reliance on administrative style controls.	There is no technology to make a user actively aware that a train is approaching.	• Passive protected crossings • Rollingstock fitted with track circuit assistors (considered ad-hoc as this is compensating for a weak control)

Control Technology Maturity Assessment Template 6

This template is to be used to assess the level of technical maturity used by the RTO to mitigate the following hazardous event:

Hazardous Event	Fire on-board train or light rail / tram while in running
Description	A fire on-board a train while the train is operating on a mainline. Examples: • Fire occurring in a freight wagon • Fire occurring in a passenger saloon • Fire occurring in the cab of any train This event excludes fires that may occur while the train or light rail is in a siding or depot.

1 Directions

On the following page you will be asked to identify the specific technologies that are applied across your network that mitigate the hazardous event.

For the purposes of this assessment, technology is defined as: *Machinery or equipment (mechanical or software) that mitigates a hazardous event in part or full.*

In completing this:

- There may be multiple types of technologies in place for different circumstances / contexts / scenarios, and it is expected that you consider these as best you can.
- Technologies may be integrated to provide improved mitigation. Where this is the case, include the range of technologies that, combined, mitigate the risk.
  - Using a rail operations example: Conventional signalling systems in conjunction with fatigue monitoring technology (e.g. eye tracking) mitigate train to train collision.
- For each technology (or group of technology), *estimate* the percentage of use across the network or operations.
  - The estimate is intended to be just that - a reasoned estimate. It does not assume that the precise value is known. (Of course, if it is known feel free to use that).
- For each technology, you will be asked to define the level of maturity. A technical maturity table, tailored for this hazardous event, is at the end of the template along with examples of technology that are commensurate with that level. Use reasoned judgement to identify the level of technical maturity.

IMPORTANT: technical maturity does not imply the risk is being managed (or not managed) safe, so far as is reasonably practical.

2 Technology Identification

2.1 Listing of Technologies

What technology, or combination of technologies, are in place to address the hazardous event?

Add rows to this table as necessary to include all relevant technologies.

Technology (ies)	Maturity[1]

2.2 Scope of Application

For the technologies identified, it is now necessary to understand the degree of mitigation provided by the technology (i.e. percentage of hazardous event covered).

Maturity	Technology (ies)	% of rollingtock protected by the technology
5 – Optimized	•	
4 – Targeted	•	
3 – Tailored	•	
2 – Implemented	•	
1 – Ad-Hoc	•	

2.3 Application Percentage

Briefly describe how the percentage values were determined?

2.4 Justification and Notes

Please enter any details that may support the assessment above if you feel necessary

[1] Refer to last page for maturity descriptions.

3 Technology Maturity Definitions – Fire on Train or Light Rail / Tram

Technology maturity relates to the level of protection that a specific technology provides for a specific risk. It does not mean the 'newest' technology, though frequently newer technology will improve on older technology.

Maturity	Score	General Description	Event Specific Description	Technology Examples
Optimized	5	Technology directly addresses the hazardous events that lead to the risk. There is no opportunity to improve the technology effectiveness (irrespective of cost).	Technology is in place which will minimise spread of fire, and also actively detect and respond to a fire without external intervention.	• Fire retardant seats and panelling, in combination with active fire detection and suppression systems.
Targeted	4	Technology is well designed specifically addresses the hazardous events that lead to the risk. There remain potential failure modes (including human error and degraded mode operations).	Technology is in place which may minimise the consequence or spread of a fire, and there will also be active detection / alarms to indicate fire presence which alerts an authorised person (i.e. driver) who can then decide on the appropriate response.	• Fire retardant seats and panelling, in combination with active fire detection systems that alert an authorised person such as a driver (who must then respond). • Freight flammable goods / fuels – containers comply with relevant design standards plus active fire detection systems alerting authorised person.
Tailored	3	The technology addresses the majority of source events that can lead to the risk arising, but: • Fails to address all hazards; or • There is a high reliance on human performance; or • The technology only addresses the hazard in part.	Technology is in place which may minimise the consequence or spread of a fire, and there will also be active detection / alarms to indicate fire presence.	• Fire retardant materials throughout the train (e.g. seats and panelling), in combination with active fire detection systems that alert locally (i.e. within the single carriage), plus extinguishers or similar available. (include hot box detection) • Emergency escape doors (end of train / emergency release) • Freight flammable goods / fuels – containers comply with relevant design standards • Tunnel based fire systems (applicable when operations are in tunnels)

Implemented	2	The technology provides a degree of risk mitigation, but is not targeted to the specific risk events or precursors, and there is reliance on administrative controls to mitigate the risk.	Technology is in place which may minimise the consequence or spread of a fire, but there is no active system monitoring for fire events.	• Fire retardant materials throughout train (e.g. seats and panelling). • Fire retardant materials of track components (particularly in tunnels) • Provision of extinguishers as appropriate (e.g. in passenger saloons; readily accessible on freight trains) • Breathing apparatus available (e.g. tunnels) • Fire / heat emission standards (spark arresters, exhausts / mufflers)
Ad-Hoc	1	No technology applied, or where technology has very indirect effect on the risk. Reliance on administrative style controls.	No technology to raise awareness or mitigate the consequences in the event of a fire.	• No fire alarms or suppression systems.

Control Technology Maturity Assessment Template 7

This template is to be used to assess the level of technical maturity used by the RTO to mitigate the following hazardous event:

Hazardous Event	Fire at station.
Description	A fire at a train station which may have passengers or public. Examples: • Fire within station buildings • Fire in bins • Sleeper fires This event excludes stations that have no services scheduled to stop at the station (i.e. station is closed). This event only applies to enclosed stations (i.e. not simply a platform), and may apply to light rail if they operate directly at a station.

1 Directions

On the following page you will be asked to identify the specific technologies that are applied across your network that mitigate the hazardous event.

For the purposes of this assessment, technology is defined as: *Machinery or equipment (mechanical or software) that mitigates a hazardous event in part or full.*

In completing this:

- There may be multiple types of technologies in place for different circumstances / contexts / scenarios, and it is expected that you consider these as best you can.
- Technologies may be integrated to provide improved mitigation. Where this is the case, include the range of technologies that, combined, mitigate the risk.
  - Using a rail operations example: Conventional signalling systems in conjunction with fatigue monitoring technology (e.g. eye tracking) mitigate train to train collision.
- For each technology (or group of technology), *estimate* the percentage of use across the network or operations.
  - The estimate is intended to be just that - a reasoned estimate. It does not assume that the precise value is known. (Of course, if it is known feel free to use that).
- For each technology, you will be asked to define the level of maturity. A technical maturity table, tailored for this hazardous event, is at the end of the template along with examples of technology that are commensurate with that level. Use reasoned judgement to identify the level of technical maturity.

IMPORTANT: technical maturity does not imply the risk is being managed (or not managed) safe, so far as is reasonably practical.

2 Technology Identification

2.1 Listing of Technologies

What technology, or combination of technologies, are in place to address the hazardous event?

Add rows to this table as necessary to include all relevant technologies.

Technology (ies)	Maturity[1]

2.2 Scope of Application

For the technologies identified, it is now necessary to understand the degree of mitigation provided by the technology (i.e. percentage of hazardous event covered).

Maturity	Technology (ies)	% of persons at stations protected by the technology[2]
5 – Optimized	•	
4 – Targeted	•	
3 – Tailored	•	
2 – Implemented	•	
1 – Ad-Hoc	•	

2.3 Application Percentage

Briefly describe how the percentage values were determined?

2.4 Justification and Notes

Please enter any details that may support the assessment above if you feel necessary

[1] Refer to last page for maturity descriptions.

[2] Note that this is not the percentage of network covered by the technology, but rather percentage of persons.

3 Technology Maturity Definitions – Fire at station

Technology maturity relates to the level of protection that a specific technology provides for a specific hazardous event. It does not mean the 'newest' technology, though frequently newer technology will improve on older technology.

Maturity	Score	General Description	Event Specific Description	Technology Examples
Optimized	5	Technology directly addresses the hazardous events that lead to the risk. There is no opportunity to improve the technology effectiveness (irrespective of cost).	Technology is in place which will minimise spread of fire, and also actively detect and respond to a fire without external intervention.	• Fire retardant materials within the building (and no flammable), active fire detection and suppression systems, semi-automatic support for passenger management.
Targeted	4	Technology is well designed specifically addresses the hazardous events that lead to the risk. There remain potential failure modes (including human error and degraded mode operations).	Technology is in place which may minimise the consequence or spread of a fire, and there will also be active detection / alarms to indicate fire presence which alerts an authorised person (i.e. driver) who can then decide on the appropriate response.	• Fire retardant materials throughout the building (and no flammable), in combination with active fire detection and suppression systems, and alerts to an authorised person who will then provide passenger response.
Tailored	3	The technology addresses the majority of source events that can lead to the risk arising, but: • Fails to address all hazards; or • There is a high reliance on human performance; or • The technology only addresses the hazard in part.	Technology is in place which may minimise the consequence or spread of a fire, and there will also be active detection / alarms to indicate fire presence.	• Fire retardant materials (e.g. panelling, equipment) throughout, in combination with active fire detection systems that alert locally (i.e. to the one platform), plus extinguishers or fire hoses locally available. • Tunnel ventilation systems (in underground stations) • Train emergency stop systems / buttons at stations
Implemented	2	The technology provides a degree of risk mitigation, but is not targeted to the specific risk events or precursors, and there is reliance on administrative controls to mitigate the risk.	Technology is in place which may minimise the consequence or spread of a fire, but there is no active system monitoring for fire events.	• Fire retardant materials (e.g. panelling; advertising and related must meet fire standards, non-combustible track components etc.) used in some parts of the station • Provision of extinguishers and / or hoses throughout station • Localised fire alarms

				• Fire retardant materials of track components (particularly in tunnels)
Ad-Hoc	1	No technology applied, or where technology has very indirect effect on the risk. Reliance on administrative style controls.	No technology to raise awareness or mitigate the consequences in the event of a fire.	• No fire alarms or suppression systems.

Control Technology Maturity Assessment Template 8

This template is to be used to assess the level of technical maturity used by the RTO to mitigate the following hazardous event:

Hazardous Event	Train or light rail / tram derailment on mainline due to infrastructure.
Description	A derailment due to infrastructure failure or defect, and applies to any rollingstock operator who derails on a mainline. Examples: • Derailment due to broken rail. • Derailment due to points reverting under train This excludes scenarios where a driver does not adhere to speed restrictions or similar. It also excludes derailments due to direct vandalism or malicious intent. This also excludes RRV operations and derailments.

1 Directions

On the following page you will be asked to identify the specific technologies that are applied across your network that mitigate the hazardous event.

For the purposes of this assessment, technology is defined as: *Machinery or equipment (mechanical or software) that mitigates a hazardous event in part or full.*

In completing this:

- There may be multiple types of technologies in place for different circumstances / contexts / scenarios, and it is expected that you consider these as best you can.
- Technologies may be integrated to provide improved mitigation. Where this is the case, include the range of technologies that, combined, mitigate the risk.
  - Using a rail operations example: Conventional signalling systems in conjunction with fatigue monitoring technology (e.g. eye tracking) mitigate train to train collision.
- For each technology (or group of technology), *estimate* the percentage of use across the network or operations.
  - The estimate is intended to be just that - a reasoned estimate. It does not assume that the precise value is known. (Of course, if it is known feel free to use that).
- For each technology, you will be asked to define the level of maturity. A technical maturity table, tailored for this hazardous event, is at the end of the template along with examples of technology that are commensurate with that level. Use reasoned judgement to identify the level of technical maturity.

IMPORTANT: technical maturity does not imply the risk is being managed (or not managed) safe, so far as is reasonably practical.

2 Technology Identification

2.1 Listing of Technologies

What technology, or combination of technologies, are in place to address the hazardous event?

Add rows to this table as necessary to include all relevant technologies.

Technology (ies)	**Maturity**[1]

2.2 Scope of Application

For the technologies identified, it is now necessary to understand the degree of mitigation provided by the technology (i.e. percentage of hazardous event covered).

Maturity	**Technology (ies)**	**% of network assessments conducted using he technology**
5 – Optimized	•	
4 – Targeted	•	
3 – Tailored	•	
2 – Implemented	•	
1 – Ad-Hoc	•	

2.3 Application Percentage

Briefly describe how the percentage values were determined?

2.4 Justification and Notes

Please enter any details that may support the assessment above if you feel necessary

[1] Refer to last page for maturity descriptions.

3 Technology Maturity Definitions – Derailment due to infrastructure

Technology maturity relates to the level of protection that a specific technology provides for a specific hazardous event. It does not mean the 'newest' technology, though frequently newer technology will improve on older technology.

Maturity	Score	General Description	Event Specific Description	Technology Examples
Optimized	5	Technology directly addresses the hazardous events that lead to the risk. There is no opportunity to improve the technology effectiveness (irrespective of cost).	Track quality is actively (and near continuous) monitored and data processed to pro-actively identify any potential defects, with pre-identified responses identified and flagged for implementation.	• Rail inspection (integrity, geometry, stability) - Rollingstock mounted track monitoring systems and • Crossing work: ATP controlled crossing work / turn-outs.
Targeted	4	Technology is well designed specifically addresses the hazardous events that lead to the risk. There remain potential failure modes (including human error and degraded mode operations).	Track quality is frequently monitored and data automatically analysed, with alerts made when track is out of set parameters.	• Rail inspection (integrity, geometry, stability) inspection vehicles have limited / no false negatives. and • Crossing work: Actively controlled crossing work / turn-outs (i.e. where train will be forced to stop prior to crossing if not proven).
Tailored	3	The technology addresses the majority of source events that can lead to the risk arising, but: • Fails to address all hazards; or • There is a high reliance on human performance; or • The technology only addresses the hazard in part.	Technology is used on a regular basis across the network which has the capability of finding the primary faults.	• Rail inspection (integrity, geometry, stability) inspection vehicles have some false negatives. and • Crossing work: Signal interlocking – ensuring that points / route is set.
Implemented	2	The technology provides a degree of risk mitigation, but is not targeted to the specific risk events or precursors, and there is reliance on administrative controls to mitigate the risk.	Visual inspections and similar provide the primary means of monitoring track quality, though some technology is in place allowing for indirect monitoring.	• Rail inspection is manual / visual (integrity, geometry, stability) – informed by risk / RAMS / etc. approach. and • Crossing work: Track circuit integrity / monitoring

Ad-Hoc	1	No technology applied, or where technology has very indirect effect on the risk. Reliance on administrative style controls.	Track quality is completed through manual inspection with the aid of some tools.	• Rail inspection is manual / visual (integrity, geometry, stability) – standard approach across whole of network. and • Crossing work: Undetected manual / hand points.

Control Technology Maturity Assessment Template 9

This template is to be used to assess the level of technical maturity used by the RTO to mitigate the following hazardous event:

Hazardous Event	Train or light rail / tram derailment due to rollingstock technical failure or issue.
Description	A derailment due to rollingstock failure or defect where the train or light rail vehicle is being operated by an RTO. Examples: • Wheel bearing seizure. • 'Hot-box' • Axle failure • Wheel crack or flange failure It excludes derailments due to direct vandalism or malicious intent. It also excludes events where a derailment occurs under controlled conditions (e.g. a known defective train being moved). This also excludes RRV operations and derailments. It excludes derailments occurring in sidings / depots.

1 Directions

On the following page you will be asked to identify the specific technologies that are applied across your network that mitigate the hazardous event.

For the purposes of this assessment, technology is defined as: *Machinery or equipment (mechanical or software) that mitigates a hazardous event in part or full.*

In completing this:

- There may be multiple types of technologies in place for different circumstances / contexts / scenarios, and it is expected that you consider these as best you can.
- Technologies may be integrated to provide improved mitigation. Where this is the case, include the range of technologies that, combined, mitigate the risk.
  - Using a rail operations example: Conventional signalling systems in conjunction with fatigue monitoring technology (e.g. eye tracking) mitigate train to train collision.
- For each technology (or group of technology), *estimate* the percentage of use across the network or operations.
  - The estimate is intended to be just that - a reasoned estimate. It does not assume that the precise value is known. (Of course, if it is known feel free to use that).
- For each technology, you will be asked to define the level of maturity. A technical maturity table, tailored for this hazardous event, is at the end of the template along with examples of technology that are commensurate with that level. Use reasoned judgement to identify the level of technical maturity.

IMPORTANT: technical maturity does not imply the risk is being managed (or not managed) safe, so far as is reasonably practical.

2 Technology Identification

2.1 Listing of Technologies

What technology, or combination of technologies, are in place to address the hazardous event?

Add rows to this table as necessary to include all relevant technologies.

Technology (ies)	Maturity[1]

2.2 Scope of Application

For the technologies identified, it is now necessary to understand the degree of mitigation provided by the technology (i.e. percentage of hazardous event covered).

Maturity	Technology (ies)	% of rollingstock operated with the technology[2]
5 – Optimized	•	
4 – Targeted	•	
3 – Tailored	•	
2 – Implemented	•	
1 – Ad-Hoc	•	

2.3 Application Percentage

Briefly describe how the percentage values were determined?

2.4 Justification and Notes

Please enter any details that may support the assessment above if you feel necessary

[1] Refer to last page for maturity descriptions.

[2] Note that this only applies to the rollingstock operated under the RTO accreditation.

3 Technology Maturity Definitions – Derailment due to rollingstock

Technology maturity relates to the level of protection that a specific technology provides for a specific risk. It does not mean the 'newest' technology, though frequently newer technology will improve on older technology.

Maturity	Score	General Description	Event Specific Description	Technology Examples
Optimized	5	Technology directly addresses the hazardous events that lead to the risk. There is no opportunity to improve the technology effectiveness (irrespective of cost).	The technology on board the rollingstock actively monitors bogies and related, and the system adjusts rollingstock performance to suit.	• Full rollingstock condition monitoring and automatic response system.
Targeted	4	Technology is well designed specifically addresses the hazardous events that lead to the risk. There remain potential failure modes (including human error and degraded mode operations).	The technology on board the rollingstock actively monitors bogies and related, and informs an operator of status. Some automated responses may be present in high-risk scenarios.	• Full rollingstock condition monitoring, with alerts to operator (driver, train controller) for reaction.
Tailored	3	The technology addresses the majority of source events that can lead to the risk arising, but: • Fails to address all hazards; or • There is a high reliance on human performance; or • The technology only addresses the hazard in part.	Technology is implemented and evaluates rollingstock in running that will identify key / common failure modes.	• Hot box detection (rollingstock or line-side mounted) • Wayside monitoring by infrastructure manager • Loading management systems (monitoring weight / distribution through hopper car). • Rollingstock component technology (e.g. suspension systems etc.) to address specific hazards
Implemented	2	The technology provides a degree of risk mitigation, but is not targeted to the specific risk events or precursors, and there is reliance on administrative controls to mitigate the risk.	Technology is implemented that will identify key / common failure modes at defined frequencies.	• Bogie assessment systems on entry / exit of depots. • Advanced computer diagnostic systems during maintenance.
Ad-Hoc	1	No technology applied, or where technology has very indirect effect on the risk. Reliance on administrative style controls.	Routine maintenance and monitoring of rollingstock done through visual examinations and associated testing.	• Routine maintenance and monitoring; no on-track monitoring.

Control Technology Maturity Assessment Template 10

This template is to be used to assess the level of technical maturity used by the RTO to mitigate the following hazardous event:

Hazardous Event	Train derailment or collision with other train or person in a siding or depot during yard operations.
Description	A derailment or collision with train or person that occurs during rollingstock movements within a yard. This event only applies to the RTO responsible for the movement of trains. Examples: • Derailment over points due to points reverting under train • Train hitting shunter due to marshalling / safeworking failures • Train colliding with other train due to being foul of points • Train colliding with other train due to human error This excludes: • Events where the rollingstock operator (e.g. driver, shunter, etc.) fails to adhere with degraded mode workings (e.g. TSRs). • RRV operations and derailments. • Derailments involving known defective rollingstock that is being moved. • Light rail depot operations • Suicide or self-harm intent

1 Directions

On the following page you will be asked to identify the specific technologies that are applied across your network that mitigate the hazardous event.

For the purposes of this assessment, technology is defined as: *Machinery or equipment (mechanical or software) that mitigates a hazardous event in part or full.*

In completing this:

- There may be multiple types of technologies in place for different circumstances / contexts / scenarios, and it is expected that you consider these as best you can.
- Technologies may be integrated to provide improved mitigation. Where this is the case, include the range of technologies that, combined, mitigate the risk.
  - Using a rail operations example: Conventional signalling systems in conjunction with fatigue monitoring technology (e.g. eye tracking) mitigate train to train collision.
- For each technology (or group of technology), *estimate* the percentage of use across the network or operations.
  - The estimate is intended to be just that - a reasoned estimate. It does not assume that the precise value is known. (Of course, if it is known feel free to use that).
- For each technology, you will be asked to define the level of maturity. A technical maturity table, tailored for this hazardous event, is at the end of the template along with examples of technology that are commensurate with that level. Use reasoned judgement to identify the level of technical maturity.

IMPORTANT: technical maturity does not imply the risk is being managed (or not managed) safe, so far as is reasonably practical.

2 Technology Identification

2.1 Listing of Technologies

What technology, or combination of technologies, are in place to address the hazardous event?

Add rows to this table as necessary to include all relevant technologies.

Technology (ies)	Maturity[1]

2.2 Scope of Application

For the technologies identified, it is now necessary to understand the degree of mitigation provided by the technology (i.e. percentage of hazardous event covered).

Maturity	Technology (ies)	% of yard movements controlled by the technology
5 – Optimized	•	
4 – Targeted	•	
3 – Tailored	•	
2 – Implemented	•	
1 – Ad-Hoc	•	

2.3 Application Percentage

Briefly describe how the percentage values were determined?

2.4 Justification and Notes

Please enter any details that may support the assessment above if you feel necessary

[1] Refer to last page for maturity descriptions.

3 Technology Maturity Definitions – Yard / Depot Incident

Technology maturity relates to the level of protection that a specific technology provides for a specific hazardous event. It does not mean the 'newest' technology, though frequently newer technology will improve on older technology.

Maturity	Score	General Description	Event Specific Description	Technology Examples
Optimized	5	Technology directly addresses the hazardous events that lead to the risk. There is no opportunity to improve the technology effectiveness (irrespective of cost).	Depot and siding operations are fully controlled through technology.	• Fully automated (driverless) train system in yard • ATC operations within yard environment.
Targeted	4	Technology is well designed specifically addresses the hazardous events that lead to the risk. There remain potential failure modes (including human error and degraded mode operations).	Depot and siding operations are controlled through technology, though there remain some hazards which could lead to a derailment or collision (including human error)	• Fully signalled yard with train stop enforcement.
Tailored	3	The technology addresses the majority of source events that can lead to the risk arising, but: • Fails to address all hazards; or • There is a high reliance on human performance; or • The technology only addresses the hazard in part.	Technology is available and support the safe operations within the depot or siding but does not provide full control and protection within the yard.	• Fully signalled yard, automatic points.
Implemented	2	The technology provides a degree of risk mitigation, but is not targeted to the specific risk events or precursors, and there is reliance on administrative controls to mitigate the risk.	There is some technology that mitigates risk of derailment, but where yard / siding operations are heavily reliant on administrative controls.	• Conventional signalling in place in yards, with support of on-ground operators / shunters (who may manually operate points etc).
Ad-Hoc	1	No technology applied, or where technology has very indirect effect on the risk. Reliance on administrative style controls.	Yard and siding operations are based on administrative controls and operational rules.	• Manual safeworking systems / yard operations (e.g. driver authority yards)

Control Technology Maturity Assessment Template 11

This template is to be used to assess the level of technical maturity used by the RTO to mitigate the following hazardous event:

Hazardous Event	Light Rail / Tram to Road Vehicle collision on a main / running line.
Description	A collision between a train road vehicle. Examples: • Collision with vehicle on shared roadway • Collision with a road vehicle standing on the tracks waiting to move off (given sufficient warning) • Collision with a road vehicle at a defined traffic intersection This event excludes: • Collisions where a road vehicle undertakes a U-Turn immediately in front of the tram. • Events where the road vehicle turns into the side of a tram. • Events where a road vehicle collide with the rear of a tram. • Collisions at defined level crossings.

1 Directions

On the following page you will be asked to identify the specific technologies that are applied across your network that mitigate the hazardous event.

For the purposes of this assessment, technology is defined as: *Machinery or equipment (mechanical or software) that mitigates a hazardous event in part or full.*

In completing this:

- There may be multiple types of technologies in place for different circumstances / contexts / scenarios, and it is expected that you consider these as best you can.
- Technologies may be integrated to provide improved mitigation. Where this is the case, include the range of technologies that, combined, mitigate the risk.
  - Using a rail operations example: Conventional signalling systems in conjunction with fatigue monitoring technology (e.g. eye tracking) mitigate train to train collision.
- For each technology (or group of technology), *estimate* the percentage of use across the network or operations.
  - The estimate is intended to be just that - a reasoned estimate. It does not assume that the precise value is known. (Of course, if it is known feel free to use that).
- For each technology, you will be asked to define the level of maturity. A technical maturity table, tailored for this hazardous event, is at the end of the template along with examples of technology that are commensurate with that level. Use reasoned judgement to identify the level of technical maturity.

IMPORTANT: technical maturity does not imply the risk is being managed (or not managed) safe, so far as is reasonably practical.

2 Technology Identification

2.1 Listing of Technologies

What technology, or combination of technologies, are in place to address the hazardous event?

Add rows to this table as necessary to include all relevant technologies.

Technology (ies)	Maturity[1]

2.2 Scope of Application

For the technologies identified, it is now necessary to understand the degree of mitigation provided by the technology (i.e. percentage of hazardous event covered).

Maturity	Technology (ies)	% of services protected by the technology
5 – Optimized	•	
4 – Targeted	•	
3 – Tailored	•	
2 – Implemented	•	
1 – Ad-Hoc	•	

2.3 Application Percentage

Briefly describe how the percentage values were determined?

2.4 Justification and Notes

Please enter any details that may support the assessment above if you feel necessary

[1] Refer to last page for maturity descriptions.

3 Technology Maturity Definitions – Light Rail to Road Vehicle Collision

Technology maturity relates to the level of protection that a specific technology provides for a specific hazardous event. It does not mean the 'newest' technology, though frequently newer technology will improve on older technology.

Maturity	Score	General Description	Event Specific Description	Technology Examples
Optimized	5	Technology directly addresses the hazardous events that lead to the risk. There is no opportunity to improve the technology effectiveness (irrespective of cost).	Technology ensures that light rail vehicles do not contribute to a collision with a road vehicle.	• Obstacle detection and avoidance systems which actively intervene when potential hazards are identified. • Separation of light rail vs. road vehicles through barriers (curbs, fencing) except for defined level crossing points.
Targeted	4	Technology is well designed specifically addresses the hazardous events that lead to the risk. There remain potential failure modes (including human error and degraded mode operations).	Technology ensures the separation of trams with other rail vehicles, but where some hazards still exist (including human error or where the operator may undertake steps to manually override the system).	• Obstacle detection identification systems, requiring driver intervention. • Separation of light rail vs. road vehicles, but where road intersections or other road vehicle crossings exist (excluding defined level crossings).
Tailored	3	The technology addresses the majority of source events that can lead to the risk arising, but: • Fails to address all hazards; or • There is a high reliance on human performance; or • The technology only addresses the hazard in part.	Technology provides a good level of protection against collision events, but also rely on other processes or systems to mitigate the risk (e.g. verbal authorisation from train control to proceed after an intervention).	• Vigilance systems in combination with a human monitoring system (e.g. eye tracking, fatigue monitoring) • Rollingstock designed to meet contemporary crashworthiness standards (e.g. RISSB standard) • Vigilance devices • Fatigue monitoring systems
Implemented	2	The technology provides a degree of risk mitigation, but is not targeted to the specific risk events or precursors, and there is reliance on administrative controls to mitigate the risk.	Technologies are in place to mitigate some of the risk events (or precursors to these), but there remains reliance on administrative controls and error avoidance strategies.	• No technologies in place to minimise road collisions.
Ad-Hoc	1	No technology applied, or where technology has very indirect effect on the risk. Reliance on administrative style controls.	Rail traffic is coordinated through administrative systems.	• No technologies in place.

Control Technology Maturity Assessment Template 12

This template is to be used to assess the level of technical maturity used by the RTO to mitigate the following hazardous event:

Hazardous Event	Light Rail / Tram rapid acceleration or deceleration leading to passenger injuries.
Description	A sudden acceleration of a light rail vehicle leading to on-board passenger injuries (e.g. slips, trips, falls). Examples: • Late braking for a tram stop. • Sudden braking due to vigilance or similar system activation. • Application of significant power from stand-still. This event excludes: • Sudden braking which occurs to avoid a more significant collision (e.g. road vehicle or tram to tram or pedestrian), or where acceleration is due to another event such as collision or derailment.

1 Directions

On the following page you will be asked to identify the specific technologies that are applied across your network that mitigate the hazardous event.

For the purposes of this assessment, technology is defined as: *Machinery or equipment (mechanical or software) that mitigates a hazardous event in part or full.*

In completing this:

- There may be multiple types of technologies in place for different circumstances / contexts / scenarios, and it is expected that you consider these as best you can.
- Technologies may be integrated to provide improved mitigation. Where this is the case, include the range of technologies that, combined, mitigate the risk.
  - Using a rail operations example: Conventional signalling systems in conjunction with fatigue monitoring technology (e.g. eye tracking) mitigate train to train collision.
- For each technology (or group of technology), *estimate* the percentage of use across the network or operations.
  - The estimate is intended to be just that - a reasoned estimate. It does not assume that the precise value is known. (Of course, if it is known feel free to use that).
- For each technology, you will be asked to define the level of maturity. A technical maturity table, tailored for this hazardous event, is at the end of the template along with examples of technology that are commensurate with that level. Use reasoned judgement to identify the level of technical maturity.

IMPORTANT: technical maturity does not imply the risk is being managed (or not managed) safe, so far as is reasonably practical.

2 Technology Identification

2.1 Listing of Technologies

What technology, or combination of technologies, are in place to address the hazardous event?

Add rows to this table as necessary to include all relevant technologies.

Technology (ies)	Maturity[1]

2.2 Scope of Application

For the technologies identified, it is now necessary to understand the degree of mitigation provided by the technology (i.e. percentage of hazardous event covered).

Maturity	Technology (ies)	% of services protected by the technology
5 – Optimized	•	
4 – Targeted	•	
3 – Tailored	•	
2 – Implemented	•	
1 – Ad-Hoc	•	

2.3 Application Percentage

Briefly describe how the percentage values were determined?

2.4 Justification and Notes

Please enter any details that may support the assessment above if you feel necessary

[1] Refer to last page for maturity descriptions.

3 Technology Maturity Definitions – Light Rail / Tram sudden acceleration / deceleration leading to passenger injuries.

Technology maturity relates to the level of protection that a specific technology provides for a specific hazardous event. It does not mean the 'newest' technology, though frequently newer technology will improve on older technology.

Maturity	Score	General Description	Event Specific Description	Technology Examples
Optimized	5	Technology directly addresses the hazardous events that lead to the risk. There is no opportunity to improve the technology effectiveness (irrespective of cost).	Technology ensures acceleration / deceleration is limited within a defined curve or rate (except in emergency scenarios)	• Active acceleration and deceleration management system.
Targeted	4	Technology is well designed specifically addresses the hazardous events that lead to the risk. There remain potential failure modes (including human error and degraded mode operations).	Technology provides a driver with tools to use to ensure appropriate acceleration / deceleration in certain scenarios. These technologies are to be activated by the driver at the appropriate times.	• Acceleration and deceleration management systems activated by driver (in specific scenarios – e.g. hill starts).
Tailored	3	The technology addresses the majority of source events that can lead to the risk arising, but: • Fails to address all hazards; or • There is a high reliance on human performance; or • The technology only addresses the hazard in part.	Technology provides tools which addresses common factors leading to acceleration / deceleration related injuries (such as wheel slip), but primary control remains with the driver.	• Sanding systems • Combination of 'implemented' examples.
Implemented	2	The technology provides a degree of risk mitigation but is not targeted to the specific risk events or precursors, and there is reliance on administrative controls to mitigate the risk.	Technologies are in place to mitigate some of the risk events (or precursors to these), but there remains reliance on administrative controls and error avoidance strategies.	• Routine off-line monitoring of driver performance characteristics to determine if driver is operating within expected acceleration / deceleration profiles. • Hand-holds on board • Interior design – no sharp edges, cushioned materials, secured fittings, etc. • Rollingstock adherence to a defined standard for acceleration / deceleration.

Ad-Hoc	1	No technology applied, or where technology has very indirect effect on the risk. Reliance on administrative style controls.	Rail traffic is coordinated through administrative systems.	• No technologies in place.

Safety Maturity Assessment

Organisation		**Completed By**	

Background

The questions below focus on 6 elements of safety maturity, which are:
* Leadership
* Communication
* Continual Improvement
* Control Assurance
* Consultation and Engagement
* Change Management

These 6 elements are arepresentative subset of factors that relate to the overall safety maturity of an organisation.

Directions

1. To complete the survey, enter a score for every question in the 'orange' box.
2. Enter relevant evidence that helps justify this scoring (if available / applicable) in the blue box.
3. Once all questions are completed the score against the 6 factors above will be generated and presented on the next tab.
4. Compare the score for each factor against relevant maturity description to ensure it is applicable to the organisation being assessed.
5. If there is a disparity (i.e. the description doesn't accurately match the organisation), state which level you beleive the organisation to be at and provide justification in the blue box beside each factor.

1	1	2	3	4	5		Example Evidence: Multiple feedback systems; improvements made based on feedback; leader site visits / observations
Safety Feedback	The organisation doesn't seek feedback from their employees.		The organisation may have a limited set of feedback opportunities (e.g. an annual engagement survey). Feedback is delayed or limited.		The organisation uses a variety of approaches to engage and gain feedback from their employees. This includes surveys, workshops, direct meetings, safety tours, etc. Feedback and improvements arising from these are provided in a timely manner.		
2	1	2	3	4	5		Example Evidence: Change plans including human factors; documented change processes; human impacts in change registers; RTBNAs conducted
Human Impacts of Change	There is little or no consideration of human factors or the impacts on human performance and error during the change process.		Change management is primarily technical, but established processes and risk assessments require a focus on human performance impacts.		It is recognised that the 'human element' of change is critical to a successful change, and as such the organisation clearly plans for, engages, and seeks to optimise the system for the human user.		
3	1	2	3	4	5		Example Evidence: correction action closure / extension rate and overdues
Action Timeliness	Corrective actions are frequently overdue, remain open, or have their timeframes extended for various reasons. Completion of these are at the discretion of the action owner.		There is an established process for management of corrective actions. This process ensures that open actions are followed up on, and reasons for deviation from established dates are documented and provided.		Corrective actions are completed on or ahead of schedule. These are monitored and reported on regularly, and delays in implementation must be addressed as soon as possible.		
4	1	2	3	4	5		Example Evidence: Opportunities implemented outside audit / investigation findings; risk-based safety improvement programs; business strategy
Encouraging Improvements	Safety improvements are done only following an incident.		There are instances of safety improvements being delivered on independent of incidents or change drivers, but this is by exception.		Senior leaders support their employees / teams to come up with safety solutions, providing resources to deliver on these, and helping address 'hurdles'.		
5	1	2	3	4	5		Example Evidence: Example of lead or behavioural indicators; safety or executive reports showing indicators used; actions arising from adverse trends
Safety Indicators	The organisation monitors lag safety incident indicators only (e.g. LTI trends).		The organisation monitors safety incident indicators, some precursor indicators, and is seeking to move towards outcome and activity based indicators (lead indicators).		The organisation has outcome and activity based indicators which demonstrate that risk controls remain effective. There is clear demonstration of action taken where indicators suggest otherwise.		

Safety Maturity Assessment

6	1	2	3	4	5		Example Evidence: Positive / constructive inputs into safety improvements; improvements implemented with union support
Perception of Change Drivers	Employees do not trust that change is being done to improve their safety or wellbeing, and as a result they are not included in change planning or delivery by the organisation.		Employees recognise that change and continual improvement will occur, and engage in these activities. They may remain cautious and / or they may place an emphasis on matters other than improving safety (e.g. increase pay or similar)		Employees understand the need for continual improvement, and engage in change activities in a constructive and positive manner to improve safety.		
7	1	2	3	4	5		Example Evidence: Change Process are in place requiring management sign off; The level of change is determined based on complexity of the change and the level of risk associated with the change.
Change Process	Every change is individually managed. There is no consistent underlying approach or methodology.		There is an established process / standard which describe how changes are to be undertaken, and this is uniformly applied.		The organisation has an established process / standard which is uniformly applied for change, and this is regularly reviewed to integrate improved ideas and learnings from prior changes.		
8	1	2	3	4	5		Example Evidence: Process for safety innovations to be identified; allocated funding for safety innovation and improvements; feedback between managers / employees regarding ideas
Safety Innovation	Safety innovation is not encouraged within the organisation.		Safety innovation is encouraged where it will also have an operational performance benefit.		The identification of innovative safety solutions is encouraged and rewarded.		
9	1	2	3	4	5		Example Evidence: Risk process describing control review requirements; evidence of control reviews undertaken; lead indicators for control monitoring performance
Control Monitoring	The organisation doesn't have an approach to monitor risk controls apart from those that are considered 'routine maintenance'.		All risk controls are monitored in a systematic and consistent way across the organisation.		The degree of monitoring of a risk control is directly associated with the criticality of the control. Data trends or other 'flags' are used to trigger additional oversight or review.		
10	1	2	3	4	5		Example Evidence: Communication is tailored to work groups; division / department responsibility for local
Safety Sharing	The organisation may present 'basic' safety information, but not targetted to any specific employee group.		The organisation conventionally presents safety information targetted towards specific employee groups on issues that matter to them.		The organisation seeks out new opportunities and ideas on how to effectively communicate safety information.		
11	1	2	3	4	5		Example Evidence: SMS updates made; human error / violation trending in incidents; SMS changes communicated; training / instruction provided to support changes pro-actively.
SMS Application	The SMS is available, but there are routine accepted deviations to established systems and processes - normally to 'get the job done' faster / easier.		The SMS is established, and clear standards drawn. There is little innovation explored, and improvements tend to be incrememental only (large changes are rare, and potentially discouraged).		The SMS is regularly updated to reflect new ideas and opportunities raised by the workforce, to ensure it remains 'fit for purpose' and to keep people safe.		
12	1	2	3	4	5		Example Evidence: findings must have corrective and preventative actions; risk register updated post-corrective action implemented; actions focus on non-administrative controls; specific action examples showing 'systemic' focus
Action Scope	Corrective actions are 'quick and simple' to implement, and only address the immediate cause of an incident or finding.		Corrective actions address the immediate cause of an incident / finding, and sometimes the systemic cause.		Corrective actions target the systemic causes, and have led to organisation wide changes when required (e.g. when a similar issue exists in other parts of the organisation). There is clear linkage with risk profile improvements.		
13	1	2	3	4	5		Example Evidence: Investigation process documented including discussion on depth to be based on findings; independent investigors assigned to key incidents; appropriately trained investigators; human factor specialists involved in investigations
Investigation Scope	The investigation focuses on the actions of the individual and potential errors / violations ('blame').		Investigations seek to understand the underlying causes of an incident, and recognise the importance of human factors as part of this.		Investigations regularly produce recommendations that address the 'systemic factors', and have impacts across the organisation (not only the area that had the incident).		
14	1	2	3	4	5		Example Evidence: human factor training provided to managers / supervisors; human factors specialists in attendance at risk reviews and workshops (attendance sheets); risk controls focus on supporting people / minimising error.
Human Risks	Risks arising from human factor issues do not appear to be considered during risk assessment.		There is a consistent approach to considering human and organisational factors during the risk process, with potential to draw on relevant SMEs.		Human and organisational risks are thoroughly understood, considered and appropriately mitigated.		

Safety Maturity Assessment

15	1	2	3	4	5		Example Evidence: safety policy; risk decision tools 'weights' safety significantly; examples of operational changes rejected due to safety
Safety Priority	Safety is regularly talked about, but other factors (financial, performance) are the key decision drivers and drive change. Any safety improvement is a benefit.		Safety is always considered when making operational decisions, though is not necessarily the primary factor. Some changes where safety is worsened may be accepted if there are significant other benefits.		Safety is clearly stated as the primary aim, and leaders will always prioritise safety when making operational decisions. Safety will never be compromised as a result of a change.		
16	1	2	3	4	5		Example Evidence: ARA / RISSB / state based forum attendance; chair of industry groups; conference attendance; conference presentations
Industry Leadership	The organisation does not actively participate in cross-industry improvement programs unless required.		The organisation participates in cross-industry improvement programs, and may play a leadership role in a small number.		The organisation is recognised as an industry leader in safety, and leads cross-industry safety improvement programs.		
17	1	2	3	4	5		Example Evidence: rail resource management programs; non-technical skills training program outline; non-technical skills training attendance sheets; position descriptions include non-technical skills
Non-Technical Skills	Non-technical skills are not considered or developed. Employee performance are based on their technical capabilities only.		Non-technical skills are specified in PDs, and staff receive the relevant training when first moving into a role.		Non-technical skills are part of everyone's role, and these skills are routinely refreshed and further developed.		
18	1	2	3	4	5		Example Evidence: executive / board reports with relevant information
Action Governance	There is no oversight of audits or corrective actions.		Senior leadership and the Board receive some advice as to the status of audit outcomes, investigation findings, and corrective actions but there is no systematic approach to highlight key concerns.		Audit outcomes, investigation findings, and corrective action status are appropriately communicated to senior leadership and the Board as appropriate to provide the relevant assurance. This includes relevant KPIs, identification of critical issues, etc.		
19	1	2	3	4	5		Example Evidence: change process; change communication briefings / posters etc.; change training (where
Change Communication	Staff are not alerted to the presence of a new or changed system, process, or operations.		Communication of changes to systems, processes or operations is reliably done in a conventional manner.		Communication of changes to processes, instructions, etc. is viewed as integral to successful change, and is subject to planning and review to ensure optimal effectiveness.		
20	1	2	3	4	5		Example Evidence: staff engagement survey; leadership 'roadshows'; evidence of employee feedback on ideas
Manager / Staff Engagement	Managers do not talk to non-managerial staff, or do so ineffectively about safety.		Managers give instructions and guidance which reinforces processes to help achieve safety objectives.		Managers provide instruction and guidance, and also listen and act on feedback received to continally imrpvoe safety. A key focus of conversation is on human factors.		
21	1	2	3	4	5		Example Evidence: change control boards; change plans; change process; change examples - particularly organisational / personnel changes managed to process
Recognition of Change	Technical / asset changes are subject to management (e.g. type approval).		Technical / asset changes are primarily considered, though significant operational process / rule changes are also recognised.		The organisation recognises that any change may impact on (or provide an opportunity to improve) safety. This includes organisational changes, personnel changes, system changes, technical / asset changes, etc.		
22	1	2	3	4	5		Example Evidence: investigation team composition; investigation interview participation; near-miss / error reporting; just culture process
Investigation Engagement	Investigations do not engage with individuals involved.		Staff engage in investigations when necessary, and are often supported by union officials to ensure the investigation is conducted fairly.		Staff, unions, and others freely and actively engage in investigations recognising that the outcomes are to improve safety for all.		
23	1	2	3	4	5		Example Evidence: change process; change reviews conducted; audit program includes changes; managerial inspection of changes over time
Change Review	Once a change is implemented there is no formal monitoring to ensure it was successful.		Once a change is implemented, incidents or issues arising are monitored to ensure it is successful.		A clear review process is in place that analyses the effectiveness of the change that occurred - particularly for 'higher risk' changes, and contrasts these to planned outcomes. This includes technical, organisational, and process changes.		

Safety Maturity Assessment

24	1	2	3	4	5		Example Evidence: Safety issue reviews; external investigation reviews; peer sharing forum participation; standards adoption; integration of ideas into corrective action process
Fostering Learning	There is limited or no pro-active pursuit of safety learnings.		Safety learnings, when identified through audit, incident investigations, etc. , are considered constructively. Standards are adopted over time.		The organisation monitors reports (and similar) from the rail and other industries to identify potential improvements to safety and risk control. The organisation is an 'early adopter' of new standards improving safety.		
25	1	2	3	4	5		Example Evidence: safety reports; safety performance monitoring process; KPI monitoring; safety data system
Safety Data	There is no process to establish or track safety targets.		There is a defined process to monitor established safety KPIs.		The organisation using data analytics to support its monitoring of all safety data in addition to the established KPIs normally reported.		
26	1	2	3	4	5		Example Evidence: articulated just culture policy; examples of people speaking up; just culture training; constructive actions (no blame / punitive actions due to error or incident)
Trust	Employees do not want to speak up about safety as this is responded to by blame or ridicule.		Employees are supported and encouraged to speak up about safety in some areas of the organisation.		Leaders have created an environment of trust, allowing people to speak up, share opportunities and ideas, and to discuss safety errors.		
27	1	2	3	4	5		Example Evidence: interface agreements in place; external stakeholder consultation in changes; external stakeholder participation in workshops; expert participation in forums and workshops
Change Scope	Changes are implemented in isolation. No consideration of other stakeholders or wider risk impacts.		There is a consistent approach to managing change, including understanding the risks directly associated with that change. Impacts on external stakeholders (e.g. other operators) is sometimes considered.		It is understood that a change can affect other aspects of an organisation or external stakeholders (e.g. other operators). The organisation ensures that the full scope of impacts of a change are understood, and that all risks are considered.		
28	1	2	3	4	5		Example Evidence: risk based audit schedule; allocation of appropriate audit resources given topic; audit program response to changes; audit process
Audit Program	There is no defined audit program, and audits are either 'as desired' or not carried out.		The audit program is coordinated, provides effective coverage of the organisation risks, and is up-to-date.		The audit program is based on risk, and is also flexible to allow for issues / concerns arising to be proactively explored (i.e. before an incident occurs) and provide confidence that controls are in place and effective.		
29	1	2	3	4	5		Example Evidence: risk process including stakeholder inputs; data and research to inform risk
Risk Inputs	No intelligence is collected (or shared) to better understand risks or available controls.		Risk assessments include inputs from employees and other groups as specified in processes.		Ensuring the appropriate information regarding a risk is known is fundamental to managing the risk and making related decisions, and this includes leveraging internal and external knowledge and experience.		
30	1	2	3	4	5		Example Evidence: Opportunities implemented outside audit / investigation findings; risk-based safety improvement programs; business strategy
Engagement Process	There is no process to involve staff on safety matters.		The organisation has a set processes to ensure consultation and participation occurs at all levels on safety matters.		The organisation makes full use of it's employees experiences and skills in managing safety, and actively develops these further.		