

# ONRSR CONSULTATION REGULATORY IMPACT STATEMENT

IN-CAB AUDIO AND VIDEO SAFETY  
RECORDINGS



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## 1 Introduction

This policy options paper (also known as a Consultation Regulation Impact Statement, CRIS) has been prepared for Infrastructure and Transport Ministers to support consideration of regulatory and non-regulatory options for in-cab audio and video recording for the Australian rail industry. Questions for stakeholders are provided at the end of each section. In providing responses to the consultation questions, stakeholders are asked to provide evidence and information references to support their statements.

This paper has been prepared to address key questions identified by the *Council of Australian Governments (COAG) Best Practice Regulation: A Guide for Ministerial Councils and National Standard Setting Bodies*<sup>1</sup>. Responses to the questions will be used to develop a Decision Regulatory Impact Statement (DRIS) with a preferred option to recommend to Ministers who oversee the Rail Safety National Law (RSNL). The paper includes the following sections:

2. Background;
3. Statement of the problem – including the need for government action;
4. Statement of the objectives of the proposal;
5. Statement of the possible options to address the problem; and
6. Impact Analysis (costs and benefits of options identified).

### 1.1 Assumptions and Limitations

This paper discusses a proposal to use in-cab audio and video recording devices for mainline rail transport operators for the purposes of assisting rail incident investigations, determining contributing and causal factors and identifying safety lessons. Consideration is also being given to its potential applicability in light rail operations.

Broadening the use of train safety recordings beyond what is already in the RSNL is out of scope of the proposal. Further, this paper has not assessed the merit of other potential policy options that could improve rail safety outcomes, such as Automatic Train Protection (ATP).

Estimated costs and benefits discussed in this CRIS are indicative. These will be refined through further consultation with key stakeholders and presented in the Decision Regulatory Impact Statement (DRIS).

## 2 Background

### 2.1 Rail investigations in Australia

In 2009, the Council of Australian Governments (COAG) voted to establish one Rail Safety Law overseen by a single National Rail Safety Regulator. The Office of the Rail Safety Regulator (ONRSR) was created to administer and regulate the safety of the Australian railway industry. The Australian Transport Safety Bureau (ATSB) was established in 1999, and its role was expanded to cover national rail safety investigations in 2012. The ATSB's *Transport Safety Investigation Amendment Act 2012* was passed by the Australian Parliament in September 2012 to support the ATSB's expanded role in the conduct of investigations on all metropolitan and freight networks in Australia from 2013. In January 2013, ONRSR began operations with the RSNL being enacted in South Australia, the Northern Territory, Tasmania and New South Wales. The Australian Capital Territory joined in November 2014, Western Australia in November 2015 and Queensland in July 2017. Victoria partially transitioned in May 2014, with the Victorian tram network (and some tourist

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<sup>1</sup> Council of Australian Governments (2007), *Best Practice Regulation: A guide for Ministerial Councils and National Standard Setting Bodies*, available at: <https://www.pmc.gov.au/resource-centre/regulation/best-practice-regulation-guide-ministerial-councils-and-national-standard-setting-bodies>.

and heritage operators) transitioning in December 2019, marking ONRSR achieving national oversight of the Australian railway industry.

Under RSNL, rail transport operators must report all incidents that happen on, or in relation to the operator's railway premises or railway operations to ONRSR<sup>2</sup>. Rail transport operators may conduct investigations into incidents to determine contributing factors and assist in minimising risk in the future. ONRSR can also direct a rail transport operator to undertake an investigation of a rail incident and can require a rail transport operator to provide investigative reports to the regulator<sup>3</sup>.

ONRSR may also conduct incident investigations to fulfil its function and to establish whether a breach of RSNL has occurred. ONRSR's functions include:

- Improve rail safety for the Australian community;
- Decrease the regulatory burden on the rail industry;
- Provide seamless national safety regulation; and
- Enforce regulatory compliance.

The ATSB's rail safety investigation role complements ONRSR's role overseeing rail safety regulation. The ATSB may investigate an accident or incident to determine its circumstances, identify safety issues, and encourage safety action. The aim of all ATSB investigations is to prevent the occurrence of other accidents and incidents, rather than to assign blame or liability. While there are a range of models used to investigate incidents, the Incident Cause Analysis Method<sup>4</sup> (ICAM) is commonly used by rail transport operators to conduct investigations. The ATSB engages their own investigative analysis framework<sup>5</sup>.

State or Territory Coroners may also hold an inquest into a fatal rail incident to better understand the cause of death. If appropriate a Coroner will make recommendations for changes to relevant procedures and practices to prevent similar incidents occurring in the future. The Coronial inquest and the ATSB investigation are separate but they do interact.

Figure 1 below summarises investigative and feedback processes for rail incidents in Australia.

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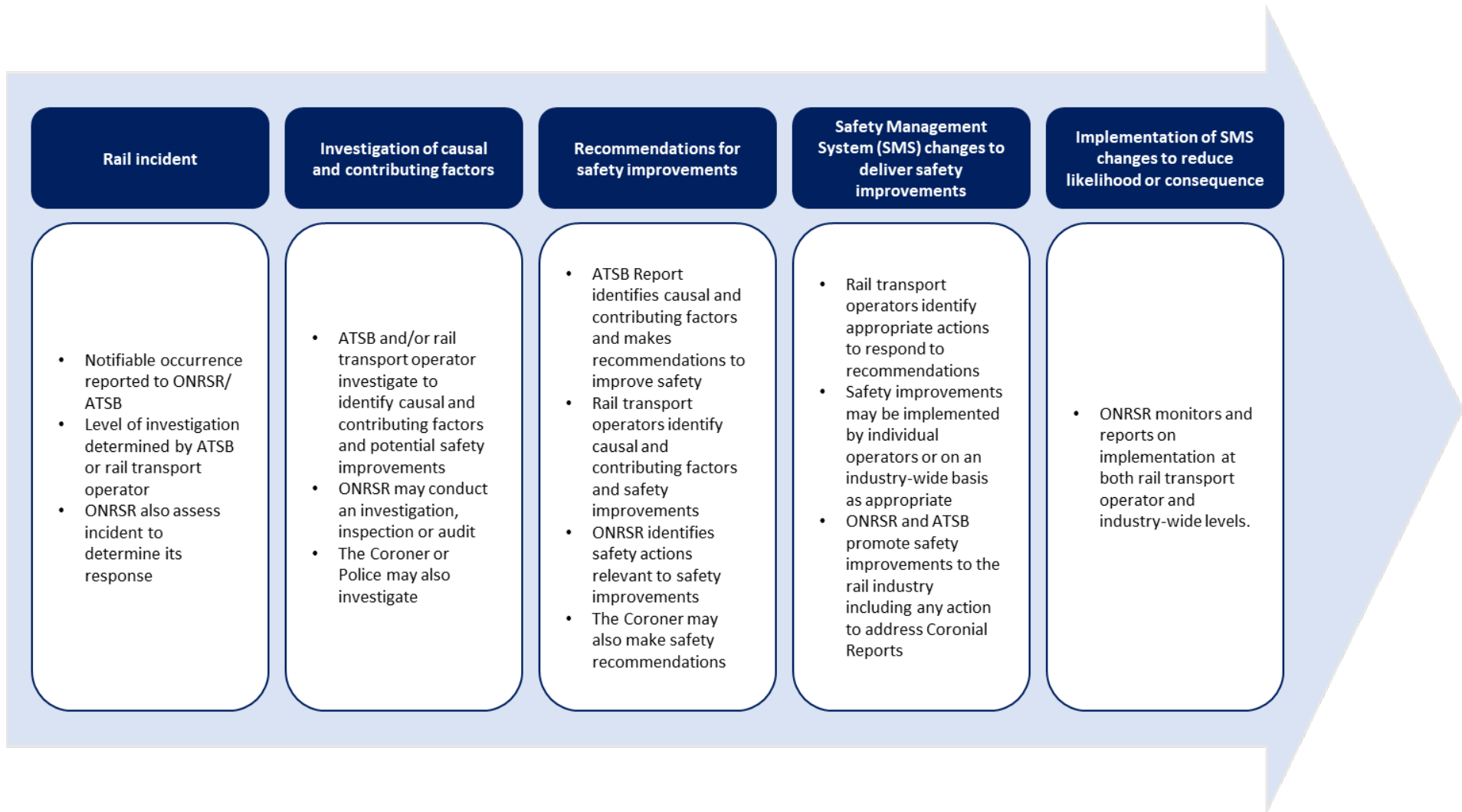
<sup>2</sup> RSNL Part 3, Division 8

<sup>3</sup> In accordance with RSNL section 20 – Power of Regulator to obtain information and section 168A – Power to direct production of documents (note this provision does not apply in Western Australia).

<sup>4</sup> This methodology is further described further in Section 3.

<sup>5</sup> More information at: <https://www.atsb.gov.au/publications/2008/ar2007053/>.

Figure 1: Representative summary of investigative processes



### 2.1.1 Recent events

Information gaps routinely impact on the ability of safety regulators and investigators to understand the causes of, and contributing factors to, rail incidents. This is particularly an issue for situations where in-cab train crew or occurrences within the interior of the train cab were involved. This information can assist greatly in an investigation, determining contributing and causal factors of an incident, identifying safety lessons to be learned and sharing these with the whole of the industry to help in preventing or mitigating similar incidents in the future.

The ATSB has advocated for both in-cab audio and video recording devices in response to some of its investigations into rail incidents involving the train cab and/or crew. For example, an investigation was conducted into the collision of a passenger train with a buffer stop at Richmond Station in NSW in January 2018, in which 16 people were injured (some seriously). In that report, the ATSB outlined a list of previous incidents where in-cab cameras would have aided the investigation to identify contributing and causal factors and safety lessons that may prevent or mitigate similar incidents from occurring (see Table 1 below).

The report notes that the cause of the driver being unresponsive at the controls for approximately 22 seconds leading up to the collision may have been resolved if the driver's cab was fitted with a camera recording the driver's actions. The video may have shown what the driver was doing and his state of consciousness leading up to the collision. The presence of a camera would not have prevented the collision but would have assisted in the post-incident analysis. An audio recording, synchronised with the camera, may have provided additional information about the driver's actions, and possible alarms or sounds inside the cab. Having audio and video recording allows investigators to eliminate, early in the investigation, potential contributory factors such as mobile phone-use or other distraction type events.

Two recent fatal rail incidents investigated by ONRSR have again highlighted this information gap. For the two ONRSR investigations, one incident involved a passenger train, the other a freight train and neither locomotive had image or audio recording of the in-cab environment. While recording of radio transmissions was available, this was collected at limited intervals and relates specifically to communication between train operators and controllers. Had in-cab audio and video recordings been available, significantly more detailed information could have been made available to investigators in relation to the incidents. This could have facilitated a more comprehensive understanding of events within the train cab enabling a more informed safety response while also reducing investigation time.

This technology is currently being applied or considered in Canada and the United States (video only). The application of the technology and its eventual mandating was driven by multiple accidents and fatalities (crew and passengers) involving the train cab and/or crew, with numerous recommendations over a number of years for the installation of these devices for the purposes of investigation and to deter unsafe conduct by train crews.

As a result of recommendations arising from ATSB investigations, gaps in information arising from the ONRSR's own investigations as well as similar developments overseas, ONRSR is examining the feasibility of in-cab recording devices for mainline rail transport operators. The assessment includes consideration for light rail operations, regulatory and non-regulatory options and the costs associated with installing in-cab audio and video recording devices.



Table 1: Rail incidents where in-cab audio and video recording devices may have assisted the investigation

Incident	Date	Title and brief summary
Hurlstone Park, NSW	30 Jan 2013	<b>Multiple SPAD by freight train 9837</b> – train crew, both possibly asleep, passed two signals at stop while track workers were on the track ahead.
Kilbride, NSW	22 May 2014	<b>Near hit with detained passengers on track at Kilbride</b> – the crew of V938 detained passengers onto the track without having arranged the required train protection.
Mt Druitt, NSW	12 Mar 2015	<b>Wrong running direction involving passenger train 165-S</b> – a driver drove an empty cars passenger train in the wrong direction for 761m.
Hornsby, NSW	17 Dec 2015	<b>SPAD and derailment of empty Tangara service 109D</b> – driver was distracted by another driver in the cab and passed two signals.
Muswellbrook, NSW	02 Dec 2016	<b>Disabled Xplorer passenger service NP23</b> – Driver reacted to fire alarm from auxiliary engine and over 200 passengers stranded on board train.
Unanderra, NSW	22 Apr 2017	<b>Runaway of grain train 8960</b> – a fully loaded grain train ran away down Illawarra mountain reaching a speed of 107 km/h.
Petrie, Qld	12 Oct 2017	<b>SPAD by train 2552</b> – a driver, driving an empty suburban passenger train, passed a signal at stop and did not recall acknowledging the onboard Automatic Warning System.
Bowen Hills, Qld	10 Jan 2018	<b>Signal ME45 passed at danger resulting in a near-miss between passenger trains TP43 and TR50</b> – the driver was unaware of the SPAD occurrence and continued to operate the train as if the signal was not displayed at a stop indication.
Wagga Wagga, NSW	01 Mar 2019	<b>Pacific National grain train 5KC3 SPAD</b> – Train passed a series of signals at danger. The train came to a halt approximately 3kmn from train 5BM9 which was travelling in the down direction on the same line.

Source: ATSB

### 3 Statement of the Problem

Investigators from ONRSR, the ATSB, rail transport operators, and the Coroner experience significant challenges in identifying causal and contributing factors<sup>6</sup> arising from rail incidents that involve drivers and other crew in the train cab.

Installing in-cab audio and video recording devices would help investigators to better understand what occurred and allow for the identification of causal and contributing factors including human factors. In turn, this information can provide safety benefits by enabling development of new or improved risk mitigation measures such as technology solutions, train cab design, or driver and crew training and procedures, that can reduce the likelihood and/or consequences of these types of rail incidents.

#### 3.1 Scale of the problem

Rail incidents have significant negative impacts on the community. Rail incidents can result in death and serious injury and can lead to ongoing trauma for those involved in incidents along with their families. Rail incidents can also result in significant direct financial costs through damage to rolling stock, property and impacts on passengers and rail freight operations.

Serious rail incidents are referred to as notifiable occurrences in the RSNL. ONRSR captures data on notifiable occurrences through initial written advice provided by rail transport operators under Section 121 of the RSNL. A notifiable occurrence is defined as an incident associated with railway operations that:

- Has, or could have, caused significant property damage, serious injury or death; or
- Is, or is of a class that is, prescribed by the national regulations to be a notifiable occurrence or class of notifiable occurrence.

Examples of notifiable occurrences include (but are not limited to):

- An accident or incident causing serious injury, death or significant property damage (including suicides/suspected suicides)
- Running line derailments
- Collisions between rolling stock, individuals or motor vehicles

Table 2 below provides an overview of the total number of key occurrences reported to ONRSR on Australian railways between 2015 and 2019.

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<sup>6</sup> such as driver incapacitation, distraction, information or events viewed by drivers and/or train crew, communication within the train cab or factors impacting on the train cab, driver, or crew.

Table 2: Number of key occurrences reported on Australian railways (2015 to 2019)

Category	2015	2016	2017	2018	2019
Fatalities	106	94	112	85	105
Level crossing collisions with person	5	6	3	2	8
Level crossing collisions with road vehicle	33	32	38	32	42
Level crossing near misses with person	224	485	467	517	494
Level crossing near misses with road vehicle	292	525	573	610	534
Light rail/tram authorities exceeded (LRTAEs)	6	9	15	29	112
Running line collisions	10	9	6	6	2
Running line derailments	70	65	90	68	56
Serious injuries	N/A	N/A	110	129	124
Signals Passed at Danger (A1 SPADs – limit of authority missed by train crew)	584	551	552	544	528

Note: (1) the statistics cover railway operations in Australia except tramways operating in Victoria (including the metropolitan tram operator in Melbourne) and several tourist and heritage railways, prior to 2 December 2019.

(2) New LRTAE reporting requirements were introduced in July 2018, which together with testing, commissioning and operation of new light rail networks has led to a significant increase in the number of reported LRTAE incidents

Source: ONRSR National Safety Data

Table 3 and Table 4 below provides a breakdown of fatalities and serious injuries by person type.

Table 3: Fatalities on Australian railways by person type (2015 to 2019)

Category	2015	2016	2017	2018	2019
Passenger	1	3	4	2	3
Public	2	2	3	2	5
Suspected suicide / Trespass	101	88	104	81	96
Worker	2	1	1	0	1
<b>Total</b>	<b>106</b>	<b>94</b>	<b>112</b>	<b>85</b>	<b>105</b>

Source: ONRSR National Safety Data

Table 4: Serious injuries on Australian railways by person type (2017 to 2019)

Category	2017	2018	2019
Passenger	53	75	79
Public	7	6	7
Suspected suicide / Trespass	35	38	28
Worker	15	10	10
<b>Total</b>	<b>110</b>	<b>129</b>	<b>124</b>

Source: ONRSR National Safety Data

As the figures above demonstrate, key challenges to rail safety in Australia are:

- Running line collisions and derailments
- Level crossing collisions and near misses
- Suicides and suspected suicides (including trespassing)

These issues are of particular concern given the potential for fatalities, serious injuries and extensive property damage. Various sources were used to estimate the total costs associated with rail occurrences in Australia including:

- The Office of Best Practice Regulation (OBPR) which publishes estimates of the value of a statistical life (VSL). In 2019, the VSL was equal to \$4.9m.
- Cost per serious and minor injury were estimated using the Rail Industry Safety and Standards Board's (RISSB) Fatalities and Weighted Injuries (FWI) ratios. According to RISSB, the cost per fatality is equal to 10 major injuries.
- Property damage costs associated with running line collisions and derailments, and level crossing collisions have been sourced from the Bureau of Infrastructure, Transport and Regional Economics (BITRE).

All cost estimates have been escalated to 2020 Dollars using the Consumer Price Index (CPI). Estimated costs associated with different types of rail incidents are shown in Table 5 below.

Table 5: Costs associated with rail incidents (AUD \$, 2020 Dollars)

Category	Value	Source
Average cost per fatality (VSL)	\$4,912,883	OBPR (2019)
Average cost per serious injury	\$491,288	OBPR (2019) using RISSB's FWI ratio
Average property damage cost per running line collision	\$673,633	BITRE (2003)
Average property damage cost per running line derailment	\$299,019	BITRE (2003)
Average property damage cost per level crossing collision with a road vehicle	\$23,518	BITRE (2003)

Note: Property Damage costs include the replacement or repair costs of accident-related damages to all fixed structures and rolling stock affected

The cost parameters outlined in Table 5 were multiplied by the number of key occurrences in Table 2 to determine the total annual costs (in 2020 Dollars) associated with rail incidents and accidents in Australia over the period 2015 to 2019. The summary results are presented in Table 6 below.

Table 6: Annual cost of rail accidents and incidents (AUD \$m, 2020 Dollars)

Category	2015	2016	2017	2018	2019
Fatalities	520.8	461.8	550.2	417.6	515.9
Serious Injuries <sup>1</sup>	59.4	59.4	54.0	63.4	60.9
Running line collisions (Property Damage)	3.0	2.7	1.8	1.8	0.6
Running line derailments (Property Damage)	20.9	19.4	26.9	20.3	16.7
Level crossing collisions with road vehicle (Property Damage)	0.8	0.8	0.9	0.8	1.0
<b>Total Costs</b>	<b>604.9</b>	<b>544.1</b>	<b>633.9</b>	<b>503.9</b>	<b>595.1</b>

Note: (1) Serious injury figures were not published for 2015 and 2016 due to a change in the way serious injuries were categorised in mid-2016. An average of the total annual cost of serious injuries between the period 2017-2019 was applied for 2015 and 2016 (\$59.4m).

The figures above indicate that on average, rail incidents cost the Australian economy over \$500 million per year. Rail incidents are low frequency, high consequence events which means that they do not occur often but have significant economic, social and environmental costs when they do. These costs are reflective of:

- Lost workplace productivity
- Lost household productivity
- Medical, ambulance and rehabilitation costs
- Significant damage to property (i.e. rolling stock).

The application of in-cab audio and video recordings is likely to be relevant to some, but not all types of rail incidents. The potential occurrences where in-cab audio and video recordings would greatly assist investigations and likely lead to improved safety outcomes include (but may not be limited to):

- Running line collisions (including any associated fatalities and/or serious injuries)
- Running line derailments (including any associated fatalities and/or serious injuries)
- Light rail/tram authorities exceeded (LRTAEs)
- Signals Passed at Danger (SPADs/PAEs)

Over the period 2015 to 2019, there was one reported fatality in relation to a running line collision (in 2019). There were no fatalities or serious injuries reported for running line derailments over this period. It is noted that whilst SPADs and LRTAEs do not result in fatalities and injuries, they are considered as a pre-cursor to potentially serious incidents.

Applying the cost parameters in Table 5, estimates of the total annual costs of occurrences where in-cab recording devices could assist investigators and lead to improved rail safety outcomes is provided in Table 7 below. This includes estimates of property damage. Because these estimates are based on rail incidents that have occurred over the past 5 years, they could potentially understate the costs of low frequency, high consequence rail incidents that in-cab recording devices may also be relevant to.

Table 7: Annual cost of in-scope notifiable occurrences (AUD \$m, 2020 Dollars)

Category	2015	2016	2017	2018	2019
<b>Running Line Collisions</b>					
Fatalities	0.0	0.0	0.0	0.0	4.9
Property Damage	3.0	2.7	1.8	1.8	0.6
<b>Sub-Total</b>	<b>3.0</b>	<b>2.7</b>	<b>1.8</b>	<b>1.8</b>	<b>5.5</b>
<b>Running Line Derailments</b>					
Property Damage	20.9	19.4	26.9	20.3	16.7
<b>Sub-Total</b>	<b>20.9</b>	<b>19.4</b>	<b>26.9</b>	<b>20.3</b>	<b>16.7</b>
<b>Total</b>	<b>23.9</b>	<b>22.1</b>	<b>28.7</b>	<b>22.1</b>	<b>22.3</b>

Note: In-scope notifiable occurrences include running line collisions, running line derailments, SPADs and LRTAEs.

### 3.2 Available investigative information

To assist in conducting investigations into rail incidents, rail transport operators, ONRSR, ATSB and Coroners use information from available train recording devices. Data provided by recording devices such as data loggers or in-cab video or audio recording devices, is crucial to understanding contributing and causal factors of rail incidents and possible ways to address them. There are many situations where it is difficult to obtain objective information about crew behaviour or activities in the lead-up to an accident or incident. Without complete and detailed data relating to train operations and interactions between the driver and crew, it is considerably more challenging to identify important aspects and failings of current safety performance. This, in turn, can hinder progress towards safety improvements that may reduce the likelihood of similar incidents occurring in the future.

Data loggers (or event recorders) fitted on rolling stock can be used to continuously record a variety of train controls and have been widely adopted across the rail industry. Recordings from these devices can assist in determining causal and contributing factors in rail incidents. Records can include for example train speed, GPS location, data and time, throttle position, brake pipe and cylinder pressures, horns, lights, and vigilance control states. However, they do not provide information about the driver or crew or their interactions. The Australian Standard AS 7527 Event Recorders<sup>7</sup> outlines a set of national industry requirements to ensure that event recorders fitted to rolling stock capture a minimum set of appropriate data for the use of rolling stock operators, rail infrastructure managers, investigators and maintainers for forensic investigations of rail incidents.

<sup>7</sup> Rail Industry Safety and Standards Board (RISSB) (2019), *Australian Standard AS 7527 Event Recorders*.

However, the information is not always available as devices may not be in operation or appropriately calibrated. This means that in some instances specific operational information that may help to identify causal or contributing factors in a rail incident is unavailable.

### 3.3 Limitations on the use of train safety recordings

There are opportunities for data provided by data loggers to be used by rail transport operators to monitor drivers and train crew for compliance with safety procedures, and to assist in incident investigations to further identify and mitigate risk. Under National Regulations<sup>8</sup>, a rail transport operator may publish or communicate a train safety recording for the purpose of analysing or monitoring railway operations or rail safety, or to audit compliance by rail safety workers with any systems, procedures, instructions, orders or notices or undertakings relating to railway operations. Train safety recordings may be shared between transport operators, between employees or contractors within a transport operator, or between a transport operator and its employees or contractors for these purposes.

The RSNL<sup>9</sup> also contains provisions relating to how train safety recordings can be used, referring to any recording consisting of sounds, images or data produced by a device installed in a train, signal box, train control complex or other premises for the purpose of recording activities carried out by rail safety workers in relation to the operation of a train. Under RSNL, train safety recordings must not be published or disclosed other than during an inquiry or investigation into an accident or incident to protect the privacy of rail safety workers. Importantly, a train safety recording is not admissible as evidence in any civil proceedings against a rail safety worker. Part 26 of the National Regulations 2012 also set out guidelines for how train safety information can be used.

Further to RSNL, the *Transport Safety Investigation Act 2003* of the Commonwealth provides for limitations on the disclosure and use of train safety recordings in court proceedings. The Act contains provisions which prevent restricted information, including on-board recordings, from being made freely available for purposes other than transport safety. Importantly, these provisions provide self-incrimination immunity for persons who are required to attend before the ATSB under powers of the Act. Information provided under these circumstances cannot be used against the person in criminal or civil proceedings<sup>10</sup>.

The use of recording devices in the workplace for the purpose of protecting property, monitoring employee performance, or ensuring employee health and safety is legislated under specific workplace surveillance acts. Each State and Territory has its own surveillance device legislation, however this generally only applies to recording or listening to private activities, for example members of the public. The Australian Capital Territory, New South Wales and to some extent Victoria, are the only jurisdictions that specifically legislate workplace surveillance. The requirements in each jurisdiction are described below:

- In the Australian Capital Territory, the *Workplace Privacy Act 2011* applies to optical devices, tracking devices and data surveillance devices, but not to listening devices. The Act requires an employer to provide particular forms of notice to employees if one of these types of surveillance devices is in use in the workplace, and to consult with employees in good faith over a 14-day notice period, before surveillance is introduced.
- In New South Wales, the *Workplace Surveillance Act 2005* similarly applies only to 'optical surveillance', 'computer surveillance' and 'tracking surveillance'. The NSW Act contains similar restrictions to those in the Australian Capital Territory. Surveillance devices must not be used in a workplace without sufficient notice being provided to employees, and must not be used in a change room, toilet, or shower facility.

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<sup>8</sup> Regulation 26 of *Rail Safety National Law National Regulations 2012*.

<sup>9</sup> Part 3, Division 10 of the *Rail Safety National Law, 2012*

<sup>10</sup> For more information relating to the ATSB investigation process under the Act, see:

<https://www.atsb.gov.au/publications/2014/rail-investigations-in-aust/>



- In Victoria, other than specific legislation surrounding the use of an optical or listening devices in toilets, washrooms, change rooms or lactation rooms under the *Surveillance Devices Act 1999*, workplace surveillance is otherwise subject to the same restrictions as general surveillance devices.

### 3.4 Limitations to investigative information

While information provided by devices such as data loggers can assist in identifying causal and contributing factors in rail incident investigations where they are fitted, calibrated and in operation, there are some limitations to the extent of information that can be collected relating to the driver and crew. This is in part due to the range of parameters that can be recorded by data loggers. Data loggers can record a range of information about the train, including speed and train control system inputs, but there is limited data provided relating to the driver, crew, and occurrences in the train cab which can be crucial investigative information.

Some data loggers have features allowing them to record radio transmissions between the driver and crew, and driver and control centre, however these do not record interactions between crew members. In addition, mobile phones are increasingly being used to communicate between the driver and crew, and as a result radios are used less frequently. This means that in many situations, limited or no information that can be obtained from recorded radio transmissions in a rail incident investigation.

### 3.5 Consequences

The collection and analysis of after the event information is crucial to rail incident investigations, allowing investigators to determine causal and contributing factors. Investigative methodologies such as The Incident Cause Analysis Method (ICAM), an internationally recognised safety investigation analysis method, help to identify factors that contribute to rail safety incidents using a structured approach. ICAM aims to identify both local factors and failures within the broader organisation and productive system that contributed to the incident, such as communication, training, or operating procedures. This involves identifying contributing factors including:

- Absent/ failed defences
- Individual/ team actions
- Task/ environmental factors
- Organisational factors

In-cab recording devices have the potential to provide information relating to both task/ environmental factors and individual/ team actions. Unfortunately, the current arrangements and legislative requirements surrounding recording devices in Australian trains mean that there is a significant information gap relating to individual and team actions. Current devices fail to record evidence of human contributing factors such as instances of driver incapacitation or distraction, events or information viewed by drivers and/ or train crew, communication within the train cab, or factors impacting on the train cab, driver or crew. This limits the ability of investigators to gain a complete understanding of factors that contributed to a rail incident.

This important information gap has several consequences, impacting on safety in the Australian rail industry. Greater knowledge of driver and crew communications and in-cab occurrences would help investigators to better understand what occurred in rail incidents, identify causal and contributing factors relating to individual team actions, and better understand communications between crew members in the cab. In turn, this information can provide safety benefits by enabling development of new or improved risk mitigation measures such as technology solutions, train cab design, or driver and crew training and procedures that reduce the likelihood and/or consequences of these types of rail incidents.

### 3.6 Need for government action

Australian transport and infrastructure ministers have responsibility for the RSNL and associated framework for rail safety including for train safety recording devices. Ministers are therefore able to make amendments to current arrangements surrounding train recording devices to support the safe operation of the Australian rail industry. The objective of this proposal is to improve available information relating to what is happening in the train cab in the lead up to a rail incident, enabling a better understanding of causal and contributing factors, and reducing the likelihood or consequence of these incidents.

Three options are being considered that may improve available information relating to causal and contributing factors in rail incidents that involve drivers or crew in the train cab. These are described in detail in Section 5, and summarised below:

- **Option 1:** Retain the status quo and continue to rely on industry discretion regarding the use of devices to monitor train operations. This option would impose no additional costs on rail operators, but current devices provide little or no information relating to the driver, train crew or train cab in the event of a rail incident.
- **Option 2:** Allow voluntary installation of in-cab audio and video safety recording devices in passenger trains and freight locomotives, with supporting advice and promotion from ONRSR and associated bodies. This would involve the development of a Code of Practice outlining performance standards relating to recording devices. Existing RSNL and Workplace Surveillance legislation would apply. This approach would rely on the discretion of rail transport operators as to whether devices are installed. Where in-cab recording devices were installed safety benefits could be derived but there would be no guarantee that crucial information relating to the driver, train crew or train cab would be available in the event of a rail incident.
- **Option 3:** Mandate in-cab audio and video safety recording devices in passenger trains and freight locomotives through RSNL. This option would impose installation and maintenance costs on industry, however, would ensure that information relating to the driver, train crew and train cab is available to investigators in the event of a rail incident. This information would allow rail transport operators to implement preventative safety measures and improve their Safety Management System<sup>11</sup> (SMS) to reduce similar incidents in the future, providing safety benefits for the rail industry and the Australian community.

### 3.7 Consultation questions

This section considered the prevalence and impact of freight and passenger train incidents across Australia involving drivers or train crew in the train cab, and the extent to which knowing information about what was happening in the train cab in the lead up to the incident could have provided investigators with important safety information leading to:

- a better understanding of the causal and contributing factors and
- a reduction in the likelihood or consequence of such incidents.

**Consultation question 1:** Are these appropriate estimates of the type of rail incidents that can involve train drivers or crew in the train cab? Do you have any additional data to support the prevalence or impact of these types of rail incidents? Please specify if your answer relates to mainline freight or passenger rail operations or light rail operations.

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<sup>11</sup> It is a legislative requirement of accreditation that rail transport operators have an appropriate SMS in place. Rail transport operators are legally obliged to implement and comply with their SMS.

Consultation question 2: Are these appropriate estimates of the burden (including financial burden) of these types of rail incidents in Australia? Please provide evidence to support your response.

Consultation question 3: Do similar types of rail incidents occur in light rail operations? Do you have any data or evidence to support that light rail operations are equally affected as mainline operations?

Consultation question 4: Why have in-cab audio and video recording devices not been widely implemented on trains in Australia given their potential to improve safety?

#### 4 Statement of the objectives

The objectives of installing in-cab audio and video safety recording devices in passenger and freight locomotives would be to improve available information relating to causal and contributing factors in rail incidents that involve drivers or crew in the train cab. This would require a reliable method and performance specification to record (both video and audio):

- interactions between the train driver and crew;
- information or events viewed or heard by drivers and/or train crew;
- information on actions taken by the driver and crew; and
- factors impacting on the train cab, driver, or crew in the lead up to an incident.

The following outcomes are sought:

1. Provide better information about the causes and contributing factors of rail incidents, which could include human factors that are not otherwise available
2. Allow ONRSR, ATSB, Coroners and rail transport operators to fulfil their functional responsibilities under the national regulatory framework for rail safety in Australia, by enabling better and more complete incident investigations to be undertaken
3. Enable the making of recommendations for, and sharing of, safety improvements that may reduce the impact of rail incidents
4. Provide data to improve monitoring of rail operations and the effectiveness of risk mitigation measures potentially leading to the development of new rules, policies or procedures
5. Deter conduct that may lead to rail incidents in the future.

Case studies describing the application of this technology in Canada and the United States are presented below.

##### **Case Study: Mandatory installation of in-cab locomotive video and voice recorders in Canada**

Transport Canada (TC) has investigated the use of locomotive video and voice recordings (LVVRs) in cabs of passenger and freight trains since 2012, following a string of high-profile accidents, in particular the Burlington VIA train derailment in February 2012 which resulted in the death of 3 engineers on the locomotive and 46 injuries (43 minor injuries and 3 serious injuries). A LVVR Working Group was established to determine the costs, benefits, uses and privacy issues related to the use of LVVRs. The Working Group established that there are limited benefits associated with outward facing cameras in terms of safety, and inward facing cameras for Transport Safety Board (TSB) investigative use only. The Working Group agreed that installing on-board devices on a voluntary basis was the preferred option and that implementation and operation costs could be justified

only if operators were able to use the devices for ongoing safety and compliance monitoring.<sup>12</sup>

In 2019, TC proposed to implement regulations that mandated the installation of in-cab LVVRs in certain passenger and freight trains. The objectives of the proposed regulations are to:

- Provide data about the causes and contributing factors of accidents or incidents that would otherwise not be available
- Enable better and more complete accident investigations by the TSB, TC and rail operators
- Provide data for proactive use by TC and rail operators to identify safety risks, potentially leading to the development of new regulations, rules, policies or procedures that may mitigate these risks
- Contribute to evidence-based regulatory decision-making.

A cost-benefit analysis was undertaken on the proposed regulation. It was assumed that rail operators would assume costs for purchase and installation, operation and maintenance, testing, and other activities. The total cost to rail operators was estimated to be C\$76.3m (NPV, 7% Discount Rate).

The regulations would enable the TSB to save resources when investigating occurrences. It was assumed that TSB would require 10% less hours per investigation if in-cab LVVRs existed. The total NPV of TSB time savings was estimated to be approximately C\$0.74m. Safety benefits associated with LVVRs were evaluated using a breakeven analysis, which determines the percentage reduction in in-scope occurrences resulting from future safety measures developed using LVVRs. It was estimated that a reduction of 4.32% in in-scope rail occurrences (e.g. accidents or incidents where human actions could be a factor and can be avoided) would be required for benefits of the regulation to offset costs.

Canadian rail operators have praised the measure, with several operators noting they had been working for several years to develop an implementation roadmap for LVVRs. Operators highlighted that “allowing the use of on-board voice and video recordings in the context of proactive safety management will be instrumental in the rail industry’s efforts towards accident prevention.”<sup>13</sup> On 2 September 2020, Transport Canada published the LVVR Regulations that mandate rail operators to install LVVR devices on board their locomotives by 2 September 2022.<sup>14</sup> The regulation requires railroads to install the devices if:

- they earned C\$250 million gross revenues and operate more than 8 km in Canada;
- they have more than 15 employees, operate more than 32 km with at least one train that goes faster than 40 km/h
- they handle more than 10% of its gross ton-miles in Canada;
- they operate a passenger service.

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<sup>12</sup> Transport Canada (2012), *Final Report Advisory Council on Rail Safety Working Group on Locomotive Voice and Video Recorders*, available at: <<https://tc.canada.ca/en/rail-transportation/rail-safety/final-report-advisory-council-rail-safety-working-group-locomotive-voice-video-recorders>>

<sup>13</sup> Marsh, J. (2019), *Transport Canada unveils proposed regulation for recording devices on trains*, FreightWaves, available at: <<https://www.freightwaves.com/news/transport-canada-unveils-proposed-regulation-for-recording-devices-on-trains>>

<sup>14</sup> CBC News (2020), *Federal regulations require most railways to install voice, video recorders by late 2022*, available at: <<https://www.cbc.ca/news/politics/voice-video-recorders-railway-1.5710208>>

Steam locomotives, tourist-only railroads, trains traveling under 40 km/h, yard engines, or equipment to be retired by February 2024 are exempt.<sup>15</sup>

### **Case Study: Support for installation of inward and outward-facing image recording devices in passenger trains in the United States**

In the US, the Federal Railroad Administration (FRA) is proposing to impose regulations that require each rail operator to install inward and outward-facing image recording devices on all lead locomotives in passenger trains.<sup>16</sup> The purpose of the proposal is to supplement existing event recorders and provide Federal and State accident investigators critical information regarding an engineer's manipulation of locomotive controls, other crew actions and other factors prior to an accident.

The proposed regulation will mandate that each image recording device must meet the following criteria:

- A minimum 12-hour continuous recording capability
- Crash and fire protection for any in-cab image recording stored within a locomotive or cab car operating compartment
- Be accessible for review during an accident or incident investigation.

The provisions also allow use of the recordings:

- for an operator to verify that train crew actions are in accordance with safety laws and the railroad carrier's operating rules and procedures;
- for assisting in an investigation into the cause of a reportable accident or incident; and
- for documenting a criminal act or monitoring unauthorised occupancy of the controlling locomotive cab or car operating compartment.

Under the proposal, an in-cab audio or image recording obtained by a rail operator may not be used to retaliate against an employee.

FRA used a cost-benefit analysis (CBA) to estimate the impact of the proposed regulation to install passenger locomotive image recording devices. The estimated quantified net costs to the industry was calculated over a 10-year period, using discount rates of 3% and 7%. The results are summarised in the table below:

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<sup>15</sup> Trains, 2020, *Digest: Canadian government sets rules for locomotive video, voice recorders*, September 4, 2020, <<https://trn.trains.com/news/news-wire/2020/09/04-digest-canadian-government-sets-rules-for-locomotive-video-voice-recorders>>

<sup>16</sup> The Statute gives FRA discretion to similarly require audio-recording devices to be installed on passenger locomotives, however, FRA has not proposed to specifically require audio recording devices, but has requested comment on whether they should be mandated as part of the final ruling.

Table 8: Net costs of FRA's proposal to install inward and outward-facing image recording devices in passenger trains in the United States (USD \$m, 2019 Dollars)

	3% Discount Rate	7% Discount Rate
Net Costs (NPV)	35	32
Annualised Costs (NPV)	4	4.5

Source: Federal Railroad Administration

The FRA identified a number of potential benefits that could arise from this proposal rule including:

- Collection of post-accident data that would help FRA and other Federal and State agencies ascertain causes of accidents and assist in preventing future accidents
- Deterring unsafe behaviours that cause rail accidents (e.g. the use of personal electronic devices which was cited by the National Transport Safety Board as a cause of several railroad accidents).
- Ability to conduct low-cost operational tests that are impractical to perform without the use of cameras
- Improved crew safety and productivity.<sup>17</sup>

FRA is not proposing to make installation of inward- and outward-facing recording devices a mandatory requirement for freight locomotives. This is because the cost of implementing such a requirement for freight locomotives is considered to outweigh any potential benefits. FRA estimates that if freight locomotives were required to have image recording devices, the cost would be approximately \$155 million (NPV, 7%). Further, a number of freight rail operators are already in the process of voluntarily installing image recording devices in their rolling stock.

The National Transportation Safety Board (NTSB) recently released results of an investigation into the August 12, 2019 collision between two freight trains in Ohio<sup>18</sup>. As a result of the collision, the lead locomotive and four railcars of the westbound train were derailed, and the eastbound train derailed 21 railcars. The train crews suffered minor injuries. The probable cause of the train collision was the failure of the westbound train engineer to respond to the signal indications requiring him to slow and stop the train prior to Control Point Springs because of his impairment due to the effects of alcohol. Contributing to the collision was the design of the positive train control (PTC) system which allowed continued operation in restricted mode on the main track. As a result of this investigation, NTSB made new recommendations in the area of impairment and PTC implementation and, called for federal railroad regulators to mandate the use of inward and outward facing cameras on train locomotives. The NTSB has consistently recommended the adoption of inward and outward cameras since 2008 train collision in Chatsworth, California, that killed 25 people and injured 102.

<sup>17</sup> The FRA identified and documented these benefits qualitatively. They reported being unable to identify academic sources to assist in quantifying these benefits.

<sup>18</sup> NTSB Advocacy Update: *Three NTSB MWL Issues Highlighted in Carey, OH, Train Crash Investigation*

## 4.1 Constraints or Barriers

Constraints that could impact on the implementation of the proposal are discussed below.

### 4.1.1 Employee concerns

It is understood that while rail transport operators are supportive of having in-cab audio and video recording devices, the current limited installation in Australia is partly due to union concerns. The Rail, Tram and Bus Union (RTBU) has historically been opposed to in-cab video and voice recordings. Key concerns include<sup>19</sup>:

- privacy breaches,
- day-to-day operations could be undermined and disrupted, and
- loss of trust, increased anxiety and fatigue, low workplace morale.

Applications of this technology in the aviation industry and recent rail-related proposals in Canada and the United States suggest that the safety benefits to crew and passengers, as well as the safety value of definitively identifying the factors inside the cab influencing the driver's actions, can outweigh costs assuming only modest changes in rail incidents.

### 4.1.2 Cost to rail operators

The costs to rail operators of installing in-cab audio and video recording devices on freight and passenger trains could be significant and may act as a barrier to implementation. Costs are described in detail in Section 6, and summarised below, and could include those relating to:

- Installation and maintenance
- Employee training
- Signage
- Data management costs

It is understood that some rail transport operators are already using in-cab video and audio or have provision to install the recording devices. Others have expressed support for the proposal given the potential for information from these devices to improve safety and reduce future rail incidents.

## 4.2 Consultation questions

Consultation question 5: Are these appropriate objectives?

Consultation question 6: Are there additional barriers or constraints to the installation of in-cab audio and video recording devices?

Consultation question 7: Are there any other issues or concerns not mentioned here related to the installation of in-cab audio and video recording devices?

Consultation question 8: Are there alternative initiatives to address the information gap of the factors in the driver's cab that may have contributed to an incident, where it is possible that such factors were influential?

Consultation question 9: What additional measures could be put in place to protect privacy of employees and provide certainty in relation to who can use recordings?

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<sup>19</sup> More information available at: [http://www.rtbu.org.au/safety\\_not\\_surveillance](http://www.rtbu.org.au/safety_not_surveillance).

## 5 Statement of the policy options to address the problem

To improve the availability of information relating to causal and contributing factors in rail incidents that involve drivers or train crew in the train cab, regulatory and non-regulatory options are being considered along with the costs and benefits of each to assess whether they achieve the objectives listed above.

The options include:

- Retaining the status quo.
- Voluntary in-cab audio and video safety recording devices in passenger and freight locomotives.
- Mandatory in-cab audio and video safety recording devices in passenger and freight locomotives.

The section below describes each of the options.

### 5.1 Option 1: Retain the Status Quo

There is currently no legislation mandating in-cab audio and video safety recording devices in passenger and freight locomotives. While industry discretion is permitted as to whether other devices such as data loggers are used to monitor technical components of train operations, there is little if any information collected relating to the driver, train crew or train cab. The status quo is described in Section 3 of the document.

As in-cab audio and video safety recording devices would not be mandated, disclosure and use of recordings would be in accordance with the current provisions for train safety recordings in the RSNL<sup>20</sup>.

Where in-cab audio and video safety recording devices were installed, current workplace surveillance legislation would apply, as described in Section 3 of this paper.

### 5.2 Option 2: Voluntary in-cab audio and video safety recordings in passenger trains and freight locomotives

Under this option, installation of in-cab audio and video safety recording devices in passenger and freight locomotives would be voluntary, as they are currently, however there would be stronger encouragement and support from ONRSR, ATSB and potentially the rail industry itself to fit such devices. The circumstances in which they should be installed and technical specifications would be established through a code of practice or standard developed by the Rail Industry Safety and Standards Board (RISSB) on behalf of the rail industry, or a code of practice approved by Responsible Ministers under the RSNL (Part 10 of RSNL). The standard or code of practice would outline design requirements, storage and systems and systems and procedures for the use of recorded data. Rail transport operators would be responsible for negotiating any industrial relations issues that may arise with relevant unions.

As in-cab audio and video safety recording devices would not be mandated, disclosure and use of recordings would be in accordance with the current provisions for train safety recordings in the RSNL<sup>21</sup>.

Where in-cab audio and video safety recording devices were installed, current workplace surveillance legislation would apply, as described in Section 3 of this paper.

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<sup>21</sup> Part 3 Division 10 of the RSNL and regulation 26 of the National Regulations



### 5.3 Option 3: Mandate in-cab audio and video safety recordings in passenger trains and freight locomotives

In-cab audio and video safety recording devices in passenger trains and freight locomotives would be mandated through the RSNL to apply only to freight and passenger mainline operators. An amendment would be made to the RSNL to make it a specific requirement for freight and passenger rail transport operators operating on the mainline to install these recording devices. There would be penalties for non-compliance which would be enforced by ONRSR.

A number of exclusions to a potential requirement for in-cab audio and video safety recording devices have been proposed for certain lower risk activities and types of operators, recognising that the benefits are unlikely to outweigh the costs. These activities and types are:

- Tourist and heritage (T&H) operators due to their low speeds and minimal passenger movements compared to mainline passenger operators, as well as their operation on mostly isolated lines.
- Driverless trains as human factors are significantly less relevant.
- Maintenance vehicles given they generally operate in a controlled and limited public environment.
- Testing vehicles as this often occurs outside of peak hour times and in remote locations or a controlled/ limited public environment.
- Movements exclusively within a yard (including shunt vehicles) due to their low speeds, short distances and operation in a controlled/ limited public environment.

Consideration is being given to the applicability to light rail, noting operations are generally lower speed and consequences of failures less severe (see consultation question 11).

The RSNL would be amended to allow recording devices to be mandated along with other high-level requirements including for example that:

- In-cab audio and video recording device/s should record continuously while the locomotive is in operation on the running line.
- In-cab audio and video recordings should be able to withstand the impacts of a major accident.
- Recordings should be time and date stamped.
- The device/s should be capable of recording and storing data for a specified minimum time and must be retained for a further specified period<sup>22</sup>.
- Penalties will apply for tampering, misuse of recordings, and failure to comply with the requirements.
- ONRSR may exempt certain vehicles or operations as appropriate (for example, temporary running or testing).

Disclosure and use of in-cab video and audio safety recordings would be in accordance with the current provisions for train safety recordings in the RSNL<sup>23</sup>, which, as previously described would limit their use to:

- ONRSR for an investigation and/ or prosecution.
- ATSB for an investigation.
- Police and/ or Coroner as part of an investigation and/ or prosecution.
- Rail transport operators to monitor rail safety, including training and compliance.

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<sup>22</sup> The current RISSB standard for event recorders requires 7 days for recordings and 2 years for retaining the information

<sup>23</sup> Part 3 Division 10 of the RSNL and regulation 26 of the National Regulations

In addition to these existing RSNL provisions, further requirements for the management of recordings would be pursued, to require rail transport operators to have systems in place to:

- Notify employees that CCTV cameras and audio devices are in operation in the cab, including clear signage on the cab's door.
- Advise employees of the purpose for which the surveillance is conducted.
- Restrict access to, and prevent misuse of, the recordings and keep records of who accessed the recordings, when and for what purpose for a specified period.
- Ensure the recording devices are functioning correctly and recordings are captured, retained and accessible to authorised persons as required.

Table 9: Summary of pros and cons<sup>24</sup>

Option	Pros	Cons
<b>Option 1: Retain the Status Quo</b>	<ul style="list-style-type: none"> <li>No additional installation or maintenance costs.</li> <li>Legislation does not currently prevent the use of in-cab audio and video recording.</li> </ul>	<ul style="list-style-type: none"> <li>Unlikely increase in take up of in-cab recording, meaning little or no information continues to be collected regarding the driver, train crew or train cab.</li> <li>Potential inconsistency in the use of equipment as a result of not setting standards and performance requirements</li> <li>No safety benefits as there continues to be an information gap, limiting ability to improve safety.</li> </ul>
<b>Option 2: Voluntary in-cab audio and video safety recordings</b>	<ul style="list-style-type: none"> <li>Potential improvements in available information regarding the driver, train crew or train cab</li> <li>Potential for significantly improved rail safety outcomes and potential to reduce similar incidents in the future</li> <li>Potential for significant incident investigation time and resource savings</li> </ul>	<ul style="list-style-type: none"> <li>Potential for devices to not be installed and therefore no guaranteed widespread improvement in available information regarding the driver, train crew or train cab.</li> <li>Where devices are installed, significant installation, maintenance, assurance, training, signage and data management costs will be incurred by rail operators.</li> </ul>
<b>Option 3: Mandate in- cab audio and video safety recordings in passenger and freight</b>	<ul style="list-style-type: none"> <li>Guaranteed improvement in available information relating to the driver, train crew and train cab</li> <li>Significantly improved rail safety outcomes and potential to reduce similar incidents in the future</li> <li>Significant incident investigation time and resource savings</li> </ul>	<ul style="list-style-type: none"> <li>Significant installation, maintenance, assurance, training, signage, and data management costs will be incurred by rail operators.</li> </ul>

## 5.4 Consultation questions

Consultation question 10: Are these the appropriate options to be considered? If not, what other options should be included for consideration?

Consultation question 11: Do you support the exclusions? Are there any other circumstances which should also qualify for exclusion from use of in-cab audio and video recording devices?

Consultation question 12: Are in-cab audio and video recording devices applicable to light rail operations? What evidence is there to support the need for these recording devices in trams and under what circumstances?

<sup>24</sup> For a more detailed description of the costs and benefits of each option, see Section 6.

**Consultation question 13:** Are in-cab audio and video recording devices applicable to movements exclusively within a yard, including shunt vehicles (which at this stage are proposed to be excluded)?

## 6 Impact Analysis (Costs and Benefits)

This section provides an overview of the potential costs and approach to benefits of the options described above for the installation of in-cab video and audio recording devices. These estimates will be refined through the consultation process.

### 6.1 Overview of costs

The estimated costs will vary depending on the options. Under the base case (status quo) there would be no requirement for rail operators to install in-cab audio and video recording devices on new and existing rolling stock. Hence, there would be no additional costs imposed on rail operators.

Under Option 2 (voluntary installation of in-cab audio and video recording devices), estimated costs (and benefits) would be dependent upon the voluntary take-up of in-cab recording devices by rail transport operators.

#### 6.1.1 Installation and maintenance costs

Installation and maintenance cost estimates were sourced from Transport Canada's proposal to install in-cab audio and video recording devices on passenger trains. Transport Canada estimates purchase and installation costs to be approximately C\$26,602 per locomotive and C\$375 per locomotive per year for maintenance.<sup>25</sup> Testing costs were estimated at C\$720,000 or C\$260 per locomotive per year which is a 15 min test per year.

Further analysis is required to validate these initial estimates. Preliminary discussions with rail operators have indicated the following costs for locomotives and passenger trains in Australia:

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<sup>25</sup> Government of Canada (2019), *Regulatory Impact Analysis Statement – Locomotive Voice and Video Recorder Regulations*, Part 1, Vol. 153, No. 21, available at: <<http://www.gazette.gc.ca/rp-pr/p1/2019/2019-05-25/html/reg5-eng.html>>

Table 10: Installation and maintenance costs per locomotive (\$A Millions, 2020 Dollars)

Cost Category	Freight Trains (Locomotives)	Passenger Trains (Diesel and Electric)
Purchase and Installation costs (new rolling stock)	\$10,000 - \$15,000	\$12,000
Purchase and Installation costs (retrofit existing rolling stock)	\$30,000 - \$35,000	\$25,000
Maintenance costs	\$500 (per train per annum)	\$500 (per train per annum)
Testing costs	\$1,100 (per train per annum)	\$800 (per train per annum)

Source: Preliminary consultation with rail operators.

Costs may vary significantly based on the level of technology already installed on the train as well as whether it is a retrofit or a new build. Factors that may impact implementation costs are highlighted in the box below. These will be considered further during the consultation process.

#### Factors that affect implementation costs

The costs and complexity of installation of in cab monitoring on passenger trains are likely to vary considerably based on the level of technology already on the train. For example, passenger trains in Australia generally have passenger area cameras and forward-facing cameras and the images are stored for periods up to and exceeding 14 days. Any installation of in-cab monitoring would be an addition to the technology already installed. The installation of the in-cab equipment on new trains under design would have a lower impact on the monitoring equipment already planned for the new trains and minimal additional cost particularly if the trains are at the early design stage.

The video and audio in the crew cab may require separate recording and potentially a different retention time along with additional memory capacity (particularly considering audio recording).

In-cab equipment must be tamper proof with a high level of security and be subject to a higher level crashworthiness requirement than other similar audio and video equipment on the train. The crashworthiness requirements for the locomotive in-cab recording equipment are likely to be similar to other equipment in the crew cab.

### 6.1.2 Auditing/Independent Assurance Costs

The proposed regulations in Canada require regular independent auditing and assurance checks of the operation systems on locomotives. They assume 1 hour per locomotive across 10% of the fleet which is equivalent to C\$580,000 or C\$2,100 per locomotive per year.

Preliminary estimates for auditing and assurance costs to rail operators for both passenger and freight trains is approximately A\$750,000 per year.

### 6.1.3 Miscellaneous Costs

There are a number of additional costs that would be imposed as result of the proposal to implement in-cab audio and video recording devices. These include (but are not limited to):

- **Employee Training** – Rail operators will be required to provide training to authorised employees on the use of the audio and video recording data.
- **Signage** – Should amendments to existing RSNL provisions be required, transport operators will need to ensure that employees are notified that audio and video recording devices are in operation in the cab, including clear signage on the cab's door.
- **Data management costs**, including the monitoring, reporting, creation/retrieval and deletion of audio and video recording data. This cost would likely be imposed on both rail operators (for internal investigative purposes) and on ATSB and ONRSR for their investigations.

Preliminary estimates of miscellaneous costs are approximately A\$300 per locomotive per year for both passenger and freight trains based on similar estimates from Transport Canada. These costs will be further considered during the consultation process.

### 6.1.4 Enforcement and Administration Costs

It is expected that the proposed options would require minor incremental enforcement and regulatory administration time. Advice on administration costs will be sought during the consultation process.

### 6.1.5 Transition Costs

There is the potential for workforce resistance towards installation of in-cab audio and video recording devices on trains. This may result in additional costs associated with delays to installation and other unanticipated transition costs. As these costs are difficult to quantify and monetise as part of a cost-benefit analysis, they could potentially be considered through sensitivity analysis in the DRIS.

## 6.2 Overview of Benefits

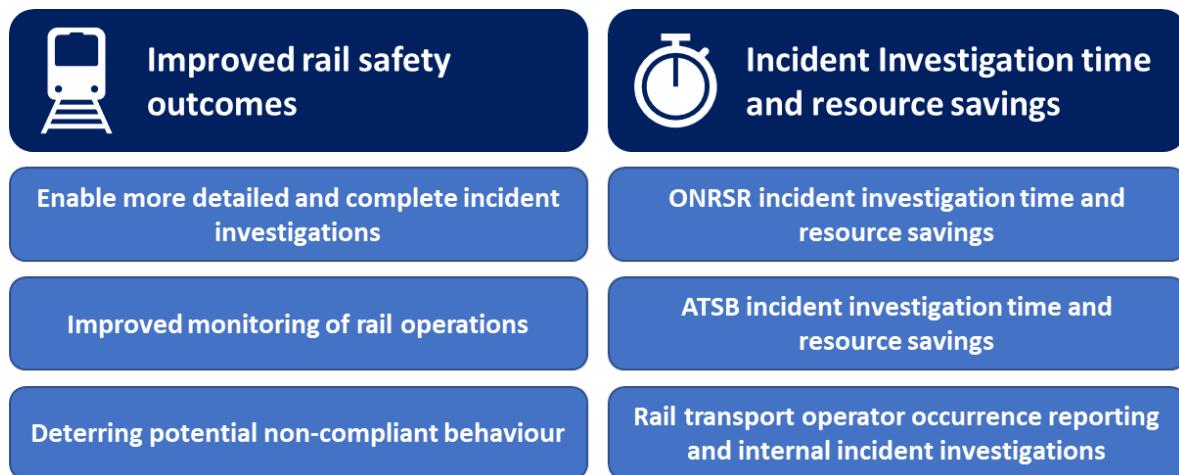
As discussed above, the potential benefits are likely to vary across the options. Under the status quo, there would be no additional benefits to rail transport operators, ONRSR, ATSB and the broader economy. Similarly, benefits under a voluntary approach would be limited to take-up by rail operators.

A literature review was undertaken to determine the potential economic benefits of in-cab audio and video recording devices on passenger and freight trains. It was determined that there are broadly two streams of benefits related to:

- Improved rail safety outcomes, and
- Investigation time and resource savings.

Specific benefits under each of these streams are described in Figure 2 below.

Figure 2: Indicative Benefits Framework



It is noted that there may be potential overlap between these benefits. The benefits framework outlined should be treated as preliminary in nature and will be considered further through the consultation process.

### 6.2.1 Improved rail safety outcomes

In-cab audio and video recording devices provide a high level of detail relating to events occurring inside the train cabin, relating to the driver and crew that would otherwise be unavailable. Whilst in-cab audio and video recording devices themselves do not prevent an accident or incident from occurring, they can assist in delivering improved safety outcomes including:

- Enabling more detailed and complete incident investigations
- Improved monitoring of rail operations
- Deterring potential non-compliant behaviour

In the absence of data on the outcomes of similar reforms in other countries and/or sectors, it is difficult to quantify and monetise these key safety benefits as part of a traditional cost-benefit analysis (CBA). Break-even analysis may be undertaken to determine the percentage reduction in in-scope notifiable occurrences (e.g. SPADs, running line collisions and derailments) that would be required (as a result of improved future safety measures developed using in-cab audio and video recording devices) for the benefits to offset costs (i.e. net cost equal to zero). This approach was used as part of the Regulatory Impact Analysis Statement prepared for the installation of LVVRs in Canada.<sup>26</sup>

### 6.2.2 Enable more detailed and complete incident investigations

The depth of investigation conducted by ONRSR, the ATSB, coroners and rail transport operators is limited by available information relating to the rail incident. In-cab audio and video recording devices significantly improve the availability of data relating to the driver and train cab, and therefore can allow for more detailed and complete investigations to occur. Improved information may allow investigators to identify the root of the problem, and fully understand the series of events that led to the incident, rather than relying on speculation.

<sup>26</sup> Government of Canada (2019), *Regulatory Impact Analysis Statement – Locomotive Voice and Video Recorder Regulations*, Part 1, Vol. 153, No. 21, available at: <<http://www.gazette.gc.ca/rp-pr/p1/2019/2019-05-25/html/reg5-eng.html>>

The installation of in-cab audio and video devices would enable ONRSR and ATSB to make more specific and targeted recommendations for safety actions and improvements to ensure similar incidents do not occur again in the future.

Moreover, recommendations may be directed to the operator involved in the incident or on an industry wide basis where other operators face the same or similar risks. In the case of the latter, ONRSR will distribute safety alerts to the rail industry based on findings and recommendations from their investigations or made by ATSB to advise the rail industry of potential risks to safety so that improvements to their SMS may be made thereby reducing the likelihood and consequence of such incidents.

This approach is underpinned by the RSNL<sup>27</sup> which places obligations on rail transport operators to identify risks to safety arising from their rail operations, to assess those risks and to put measures in place to manage them so far as is reasonably practicable. These measures form a rail operator's safety management system. The obligation to manage risk and to implement a safety management system is a positive one meaning that an operator is obliged to review its risk management practices and their effectiveness in response to new and relevant information and update them if required. Investigations are a key source of such information and so trigger the need for rail transport operators to review and respond to recommendations relevant to their operations.

In some cases, recommendations from investigations may also lead to broader policy and legislative changes, for example, the recommendations made by ATSB as noted above have formed part of the policy consideration for this proposal. This could occur following any investigation but is more typically the case for more complex and systemic investigations.

### **6.2.3 Improved monitoring of rail operations**

In-cab audio and video recording devices can also provide benefits to rail operators without a rail incident occurring. These benefits are already being realised by some rail operators who have the devices installed. The devices can be used proactively to undertake operational and compliance checks of current procedures, processes and technology to assess their effectiveness. The recordings can also be used to identify new risks that may result in a rail incident and/or new information that may help to minimise or better manage them. This could result in improvements to SMSs, for example changes to rules, policies and procedures because of an operator's obligations under the RSNL to continually review risk management practices and their effectiveness.

The use of in-cab recording devices for proactive compliance and monitoring purposes is especially important given the limited number of investigations undertaken by the ATSB and ONRSR each year and the time required to complete an investigation. If in-cab audio and video recording devices are to be used for ATSB and ONRSR investigations only, the benefits are likely to be minimal and may not outweigh the costs associated with implementation and operation. This was a finding of work recently undertaken in Canada (see: *Case Study: Mandatory installation of in-cab locomotive video and voice recorders in Canada*).

### **6.2.4 Deterring potential non-compliant behaviour**

There is the potential for the presence of in-cab audio and video recording devices to act as a deterrent against operators in engaging in non-compliant behaviour (e.g. the use of personal electronic devices which has been cited by the NTSB and TSB as a cause of several railway accidents in North America).<sup>28</sup>

Whilst there is limited academic evidence of a potential deterrent effect, a study by Litschi and Haas in 2013 found that the implementation of onboard video event recorder technology on buses

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<sup>27</sup> Part 3 Division 1 of the RSNL

<sup>28</sup> Transportation Safety Board of Canada (2015), *Railway Safety Issues Investigation Report R16H0002*, available at: <https://www.tsb.gc.ca/eng/rapports-reports/rail/etudes-etudes/r16h0002/r16h0002.html>



in the US appeared to have a positive impact on safety outcomes such as a reduction in collisions and injuries, as well as the risky driving behaviours that contribute to them.<sup>29</sup>

It should be reiterated that in-cab monitoring is to be used as a means to improve safety, processes and procedures and is not as a tool to punish workers (e.g. result in punitive actions). Current law supports and reinforces such use.

### 6.2.5 Incident investigation time and resource savings

In addition to improved safety outcomes, in-cab audio and video recording devices can also deliver time saving outcomes. These include:

- ATSB investigation time and resource savings
- ONRSR investigation time and resource savings
- Rail transport operator occurrence reporting and internal incident investigations

### 6.2.6 ATSB and ONRSR investigation time/resource savings

As highlighted in Section 2, ATSB and ONRSR undertake investigations into rail safety incidents for different purposes. ONRSR conduct investigations for the purpose of establishing a breach of the RSNL whilst the ATSB is responsible for identifying the causes of incident to improve safety (i.e. there is no attribution of blame).

Preliminary discussions with ATSB and ONRSR have revealed that in-cab audio and video recording devices can provide significant time and resource savings for investigations. In particular, ATSB and ONRSR have noted that in-cab recording devices would be particularly useful in eliminating potential factors or causes of the incident at the outset of an investigation.

Further analysis with ATSB and ONRSR will be required to determine:

- The average or median time and resource requirements per investigation and enquiry
- The number and/or type of in-scope notifiable occurrences where having in-cab audio and video recording would assist investigators
- The potential time and/or resource savings that could be achieved as a result of having in-cab audio and video recording devices on trains. In the case of Canada, it was estimated that “the presence of locomotive voice and video data would enable TSB investigators to complete the examination and analysis phases of some rail occurrences with up to 10% fewer investigator hours”.<sup>30</sup>

### 6.2.7 Rail operator reporting and investigation time/resource savings

Under the RSNL, rail transport operators must report all incidents that happen on, or in relation to the operator’s railway premises or railway operations to ONRSR.<sup>31</sup> ONRSR can also direct a rail transport operator to undertake an investigation of a rail incident and can require a rail transport operator to provide investigative reports to the regulator.<sup>32</sup>

The presence of in-cab audio and video recording devices could greatly assist rail operators in their ongoing occurrence reporting obligations to ONRSR in addition to any investigations they may be required to undertake.

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<sup>29</sup> Litschi, M. and Haas, P.J. (2013), *Evaluating Effectiveness of Video-Based Driver Risk Management Systems on Transit Safety*, Transportation Research Board, available at: <<https://trid.trb.org/view/1242370>>

<sup>30</sup> Government of Canada (2019), *Regulatory Impact Analysis Statement – Locomotive Voice and Video Recorder Regulations*, Part 1, Vol. 153, No. 21, available at: <<http://www.gazette.gc.ca/rp-pr/p1/2019/2019-05-25/html/reg5-eng.html>>

<sup>31</sup> RSNL Part 3, Division 8

<sup>32</sup> In accordance with RSNL section 20 – Power of Regulator to obtain information and section 168A – Power to direct production of documents (note this provision does not apply in Western Australia).

## 6.3 Consultation questions

Consultation question 14: Are these preliminary cost estimates for the proposed policy options appropriate? Are there any other potential costs that have not been captured?

Consultation question 15: Are the benefits specified appropriate? Are there any other potential benefits that have not been captured?

## 7 Conclusions

This paper outlines why the installation of audio and video recording devices in train cabs is important for the safety of the community and to the economy. It poses several questions seeking additional information and stakeholder's views on the proposal. Three options are suggested to achieve installation of audio and video recording devices including: the status quo; voluntary installation; and mandatory installation. The paper also canvasses the costs and benefits associated with the installation of these devices.

The main benefits are derived from the information contained in audio and video recordings which would be available to rail transport operators, ONRSR, the ATSB and coroners to assist them to carry out their obligations and functions for rail safety. These recordings enable:

- a better understanding of in-cab interactions between the driver and train crew and potential risks to safety; and
- the development of new or improved risk mitigation measures such as technology solutions, train cab design, or driver and crew training and procedures that support safety improvements.

Delivery of these safety benefits would reduce the likelihood and consequences of future incidents as well as the associated costs from fatalities, injuries and damage to property.

To ensure in-cab audio and video recordings deliver the anticipated benefits, they must be available for use by the appropriate parties. The only option that will deliver this outcome is option three - to mandate installation of these recording devices. Option three is therefore the preferred means of achieving proposal objectives.

### 7.1 Consultation questions

Consultation question 16: Do you agree that option three is the preferred means of achieving proposal objectives?

Term	Description
ATP	Automatic Train Protection
ATSB	Australian Safety Transport Bureau
COAG	Council of Australian Governments
Data loggers (or event recorders)	Devices that can continuously record a variety parameter relating to the operation of rolling stock e.g. train speed, GPS location, data and time, throttle position, brake pipe and cylinder pressures, horns, lights and vigilance control states.
ICAM	Incident Cause Analysis Method
In-cab audio and video recording devices	Devices recording video and audio of the train cab providing information about the driver and crew, and their interactions.
LRTAE	Light Rail or Tram Authority Exceeded – Any incident where rolling stock operating on a light rail or tram network passes a stop indication is referred to as a LRTAE.
Mainline	Principal railway system, including metropolitan passenger networks.
OBPR	Office of Best Practice Regulation
ONRSR	Office of the National Rail Safety Regulator
RISSB	Rail Industry Safety and Standards Board
RSNL	Rail Safety National Law
RTBU	Rail, Tram and Bus Union
SMS	Safety Management System
SPAD	Signals Passed at Danger - An occurrence where a train passes a signal displaying a stop indication without the authority to do so. Only a small percentage of SPADs result in a serious accident but they provide warnings about failures or deficiencies in safety risk controls, including those associated with human factors.