

RESEARCH REPORT

Trespass/“Self-Harm”

Investigating current international practices in prevention of trespass and suicide/“self-harm” incidents on urban rail systems: Literature Review

Revision 3.41 (18/12/2018)



Document Control Sheet

111 Alinga Street, Canberra City ACT 2601 PO Box 238 Civic Square ACT 2608 Australia Phone: 02 6274 7525 www.acri.net.au	Document Title:	Literature Review – <i>PF14 – Trespass/“Self-Harm”</i>
	Document No.:	3.41
	Project Number:	PF14
	Project Name:	Current international practices in prevention of trespass and suicide/“self-harm” incidents on urban rail systems
	Proposed Project Participants:	<ul style="list-style-type: none"> Central Queensland University University of Wollongong Queensland University of Technology

Amendment Record

Version	Change Record	Section(s)	Author	Date
1.0		ALL	Janet E Jackson Anjum Naweed Alison Bell Lesley Cooper Janine Chapman	07/09/2018
1.1	Minor edits and comments	ALL	A Larsson	11/09/2018
2.0	Edits to address comments Additional modifications and enhancements	ALL	Janet E Jackson Anjum Naweed	17/09/2018
3.0	Accepted changes and minor edit	3.2.3	A Larsson	17/09/2018
3.1	Check and minor edit	3.2.3 References	Anjum Naweed	17/09/2018
3.2	Feedback from ACRI following Working Group review	ALL	N/A	30/10/2018
3.3	Edits following ACRI/Working Group review	Exec Summary, 3.2.1	Janet E Jackson	28/11/2018
3.4	Global edits following ACRI responses/Working Group review	ALL	Anjum Naweed	14/12/2018
3.41	Accepted changed and minor edits	ALL	Paul Murray	18/12/2018

Document Distribution History

Version	Date	Recipients
1.0	07/09/2018	Ankie Larsson, Andrew Meier
2.0	17/09/2018	Ankie Larsson

Definitions

ACRI	Australasian Centre for Rail Innovation
CCTV	Closed circuit television
PSD	Platform Screen Door
RESTRAIL	REduction of Suicides and Trespasses on RAILway property project
UK	United Kingdom

Disclosure Restrictions

All disclosure restrictions relating to the Intellectual Property contained within this report should be documented here:

- Any release to a third party to be approved by ACRI.
- Redistribution outside ACRI Participant Organisations is prohibited without permission in writing.

Table of Contents

Document Control Sheet	2
Document Distribution History	2
Definitions	3
Disclosure Restrictions	3
Executive Summary	5
1 Introduction	6
1.1 Project Objectives	7
1.2 Project Scope.....	7
1.2.1 In Scope.....	7
1.2.2 Out of Scope	7
2 Methodology	8
2.1 Approach.....	8
2.1.1 Literature Search Criteria.....	8
2.2 Review Framework.....	8
2.2.1 Limitations of Approach.....	9
3 Results.....	10
3.1 Overview	10
3.2 International Practices in the Prevention of Trespass and Suicide Incidents	12
3.2.1 Physical Design.....	12
3.2.2 Media Guidelines	13
3.2.3 General Education Programs for the Community, Schools and Non-Rail Workplaces.....	13
3.2.4 Identification of ‘Hotspots’ and Introduction of Controls at ‘Hotspot’ Locations.....	14
3.2.5 Control Systems Framework/Approach for Organisational Management.....	15
3.2.6 Signage.....	15
3.2.7 Collaboration with Other Stakeholders/Entities	15
3.2.8 Education for Rail Staff	16
3.2.9 Monitoring and/or Detection Systems in Specific Locations.....	16
3.2.10 Engaging with Lived Experience Individuals.....	17
3.2.11 Community Survey	17
4 Discussion	18
5 Conclusions	19
6 Acknowledgements	20
7 References	20
8 Appendix A – Summary of Documents	23
8.1 Physical Design	23
8.2 Media Guidelines	27
8.3 General Education Programs for the Community, Schools and Non-rail Workplaces.....	29
8.4 Control Systems Framework/Approach for Organisational Management	31
8.5 Identification of ‘Hotspots’ and Introduction of Controls at ‘Hotspots’	34
8.6 Signage	36
8.7 Collaboration with Other Stakeholders/Entities.....	37
8.8 Specific Education for Rail Staff	38
8.9 Monitoring and/or Detection Systems in Specific Locations	39
8.10 Engaging with Lived Experience Individuals.....	40
8.11 Community Survey	41

Executive Summary

This study reviews current international practices in the prevention of trespass and suicide on urban rail systems. In addition to this report, the findings will be disseminated to ACRI participants via a series of presentations, providing a platform to discuss application for their specific rail environment and also narrow the scope for further research in this area.

The implications of train-pedestrian collisions leading to fatalities are very apparent. Beyond the tragic loss of human life, they impact the health and wellbeing of those affected, causing trauma and work-related stress to rail and recovery staff, as well as vicarious trauma to others. For drivers, such events almost always necessitate sick leave and increased risk of acute and chronic health and wellness issues that affect return to work. The impact on rail customers and the general community can be extensive and include the disruption to services and areas near the incident. This disruption may continue for several hours post incident. In Australia, these experiences have been well-documented. Trauma resulting from the work environment is a known risk to the rail industry and needs to be managed effectively. The immediate cost of train-pedestrian collisions extends to emergency services, insurance administration and others. For rail operators, such events result in substantial costs from time lost and delays as a result of network disruption.

This report documents the findings of the review examining the strategies that rail networks around the world currently use to manage and prevent train-pedestrian collision potential in the context of trespass and suicide-related incidents.

The study reviewed documents published in the ten-year period from 2008-2018. In total, 42 documents were reviewed including published literature as well as documents sourced from within the rail industry. Of the 42 reviewed documents, 54% dealt with suicide, 14% with trespass and 32% of the documents were related to both suicide and trespass.

The approach used to review the documents was based on the Hierarchy of Risk Control whilst considering the individual and the community involved in terms of prevention, intervention and recovery post-incident. The documents were grouped into eleven categories according to the recommended control measure: physical design; media guidelines; general education programs; identification of hotspots; framework for organisational management; signage; collaboration with other stakeholders and entities; education programs for rail staff; monitoring and detection systems; engaging with lived experience individuals and community surveys.

The management of trespass and suicide in the rail environment is a complex issue and a multifaceted approach is required in order to manage it effectively. The literature reviewed in this study highlights that a “one size fits all” approach is often not the most appropriate method to deal with the issue. Taking the time to deeply understand the problem, and what motivates people to trespass, suicide (or “self-harm”) in the rail environment, is a powerful starting point for a rail organisation to develop an effective management strategy.

1 Introduction

Railways offer rapid land transportation with extremely high levels of passenger/cargo utilisation due to low friction resistance characteristics which optimise energy efficiency. However, this also means that rolling stock has very lengthy stopping distances and may not be able to stop in time to avoid potential collisions. In many parts of the world, railways exist as an “open system”, meaning that despite fences and barriers, it is still relatively easy for non-authorised persons to access the track. The rail environment is designed to permit pedestrian access where needed, for example using level/pedestrian crossings. Train-pedestrian collisions have always been a critical issue for safe rail operations in this environment, but the risk has invariably grown in concert with the intensification of services and network traffic. Train-pedestrian collisions are now the leading cause of fatalities in rail accidents. In the EU, for example, ~3800 trespassing-related fatalities occur annually, ~3000 of which are suspected suicide incidents representing 88% of all fatalities in the system (European Railway Agency 2014). In Australia, ~200 trespassing-related fatalities occur annually, ~150 of which are suspected suicide incidents (Jackson et al. 2017).

The impacts and implications of train-pedestrian collision leading to fatalities are far reaching. Beyond the human loss, they can cause trauma and work-related stress to the rail and recovery staff directly involved with the incident. Such events almost always necessitate sick leave and risk of acute and chronic health and wellness issues for train drivers and affect their return to work. The potential impact to the train driver and the importance of the provision of psychological support post-incident has been acknowledged (Cothereau et al. 2004), and in Australia, these experiences are well-documented (French 2016). Such is the severity of the issue that Safe Work Australia (Safe Work Australia 2017ba) have now grouped rail drivers with 1st responders, police services, paramedics, fire-fighters, etc., as one of the most at-risk occupations for work-related mental disorders.¹ Incidents of trespass and suicide may also cause trauma and discomfort vicariously to those who do not have to deal with it directly, for example passengers and eye witnesses. Trauma resulting from the work environment is a known risk of the rail industry and therefore needs to be managed effectively. However, in terms of financial costs to the business and impact on the customer experience, the disruption and ensuing delays from such events have far-reaching consequences and plummet rail operators into the nadir of service delivery.

Train-pedestrian collisions are typically understood in terms of underlying intent of the fatally or non-fatally injured party. Trespass can be predicated by individuals with intent to suicide or by those with intentional nonfatal self-harm. In contrast, trespass incidents can also impact those who do not desire to harm themselves but who have created a situation where injury could easily come to them by entering into unauthorised sections of track. Trespassing is characterised by crossing the track in illegal places (Silla and Luoma, 2009), and walking or loitering along the tracks (Lobb et al., 2001), largely for the sake of taking shorter routes. The distinction between the intent of the trespasser in the context of train-pedestrian collisions is important for advancing and developing preventative measures. Other reviews have also explored the socio-environmental determinants of railway suicide (Too et al. 2014), with recent research seeking to understand the behaviours of those involved in railway suicide, in order to develop frameworks to inform prospective mitigation efforts (Ryan 2017).

In Australia, the size of the country and federated states has served to engender a bespoke and highly diverse rail industry with many contrasts. Unfortunately, this also means that train-pedestrian collision prevention practices may vary enormously between states; learnings may not be shared between organisations very readily, and operators may not be readily aware of international best practice.

¹ Note that pedestrian collision-risk is only one contributing factor for work-related mental disorders in rail drivers.

1.1 Project Objectives

The objective of this project was to undertake a review of current international practices in the prevention of trespass and suicide/“self-harm” incidents on urban rail systems and disseminate the findings to ACRI participants. This review, and the accompanying methodology, may then help define or narrow a scope for further research in this area.

1.2 Project Scope

1.2.1 In Scope

This research, endorsed by rail organisations throughout Australasia, undertook a review of international literature. The primary aim of the review was to consolidate current international practices in the prevention of trespass and suicide/“self-harm” on urban rail systems and to disseminate it to ACRI participants. While this report is one dissemination pathway, the review will form the basis for a follow-up presentation series to ACRI participants, providing the opportunity to broach distances between organisations and determine the applicability of preventative practices to the local rail system through audience discussion. ACRI participants to be included are:

- Queensland Transport & Main Roads, Queensland
- Queensland Rail, Queensland
- KiwiRail, New Zealand
- PTV, Victoria
- VicTrack, Victoria
- Transport for NSW, New South Wales
- PTA-WA, Western Australia
- DPTI-SA, South Australia

1.2.2 Out of Scope

This report presents reviewed and synthesised literature for current international practices in prevention of trespass and suicide-related incidents on rail. Extensive review of practices that seek to manage incidence of non-fatal self-harm (i.e. someone deliberately hurting themselves without wanting to die) were not covered, though it was acknowledged from review of selected rail industry risk registers, that there was a tendency to use the terms suicide and “self-harm” interchangeably in the Australian rail industry. This is also acknowledged by inverted commas around the words “self-harm” in the project title.

Specific recommendations or assessment of best “fit” for Australia and New Zealand is not included but will be discussed during the planned industry presentations.

2 Methodology

2.1 Approach

2.1.1 Literature Search Criteria

Two main academic databases were used to search for relevant literature - *Scopus* and *Google Scholar*. The search covered the ten-year period from 2008 to 2018 and search terms used were “suicide*OR trespass*”, “prevent* OR control*” and “rail*” in the Title, Abstract, and Keyword sections. While not necessarily the best term to describe those with suicidal ideation, the term “self-harm” was also used in these search terms in recognition of its use in risk registers, though it returned fewer documents. Documents that were published in the English language were considered for this review and material published in languages other than English were excluded. Duplicate results and articles that were not peer-reviewed were excluded. The abstract of each article that satisfied these criteria was read to assess relevance to the prevention of trespass and suicide incidents on rail systems. If deemed relevant, the full article was read and examined for potential inclusion. Grey literature was also sought from international rail organisations, conference proceedings and rail bodies, for example Rail Safety and Standards Board UK. In addition, key references of the data-base searched articles were also reviewed.

2.2 Review Framework

This review followed the Hierarchy of Risk Control (Safe Work Australia 2017ab) approach, which is the most commonly adopted model of risk management used by rail practitioners in the Australian rail industry. The Hierarchy of Risk Control ranks the controls from the highest, most effective control, to the lowest, least effective control (see Figure 1).

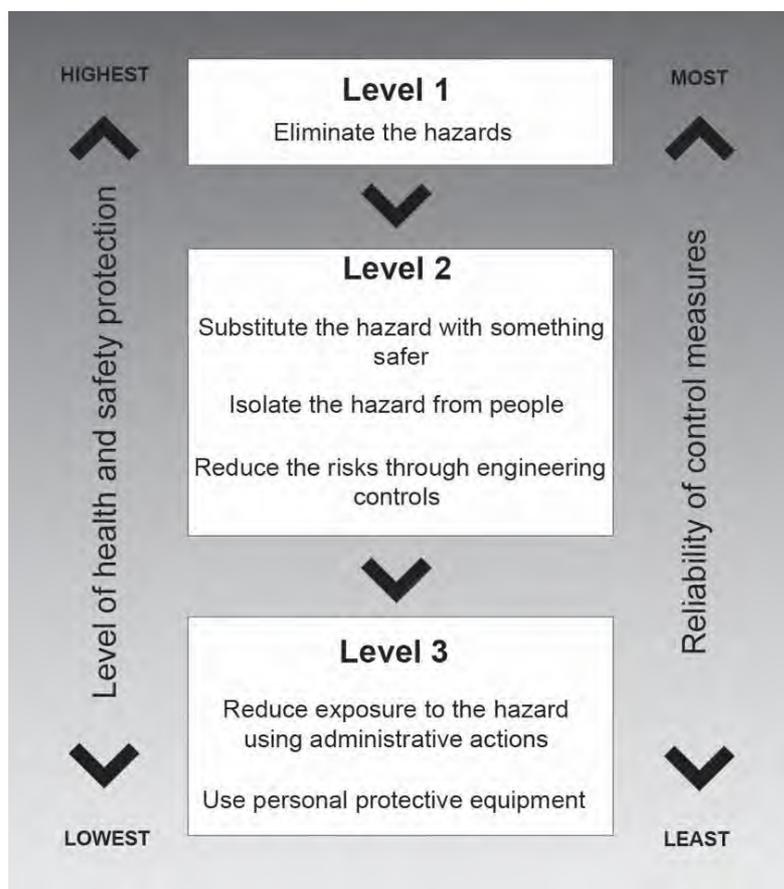


Figure 1: The Hierarchy of Risk Control
Source: (Safe Work Australia 2017ab)

In the context of rail, the “hazard” in the Hierarchy of Risk Control is the rolling stock itself—that is, if a train does not run, then there would be no risk for trespassers or those attempting suicide as the hazard would be eliminated. Needless to say, elimination of the train as a hazard is impractical, as is substitution; therefore, most initiatives are implemented at the isolation level. While useful, the Hierarchy of Risk Control does not readily consider the individual or community in terms of prevention, intervention and recovery post-incident in the trespass/suicide context. This is, however, key to this review, with prevention including early identification of those who are likely to be at risk; intervention including the strategies in place to prepare the individual and to support them and, recovery focusing on what support is provided post-incident at a system, organisational and local level.

For this reason, this review implemented a combined inductive—deductive method to group and categorise practices in the prevention of trespass and suicide incidents. This means that while researchers followed the overarching hierarchy of risk control structure when examining practices, the categories themselves were not predefined and emerged based on the literature. This approach goes further and incorporates an orientation to individuals and community as partners in a problem-solving process.

The relevant characteristics of each publication that satisfied the criteria were recorded, including details of the recommended control measure and if it sought to proactively manage the risk (i.e. before a trespass or suicide incident occurred) or whether it was reactive and occurred after related activity. This control strategy was further examined to determine if the prevention mechanism occurred at the systemic, organisational, or the local/individual control level, and if the control was a current (at time of incident), early (before injury/incident), or long-term (impact not immediately evident) intervention. This particular approach was adopted in order to look at prevention, intervention and recovery at a system, organisational and at a local level, with a focus on the individual involved.

2.2.1 Limitations of Approach

The review primarily considered academic literature, however, where accessible and relevant, grey literature was also incorporated and rail organisations from around the world were contacted. Several organisations responded (internationally as well as nationally) and willingly shared information which was much appreciated by the research team. Hence, the findings of this review reflect a good account of current practices in the prevention of trespass and suicide but are not exhaustive.

3 Results

3.1 Overview

The search yielded a total of 179 documents and after removal of duplicates and studies which were not relevant to this project, a total of 42 publications were reviewed. In all, 52% of the publications fulfilling the selection criteria were published in 2012, 2014 and 2016, 31% were published in 2011, 2013 and 2017, and the remaining 17% were published in 2008, 2009, 2015 and 2018. See Figure 2 for a detailed distribution of year publication of documents included in review.

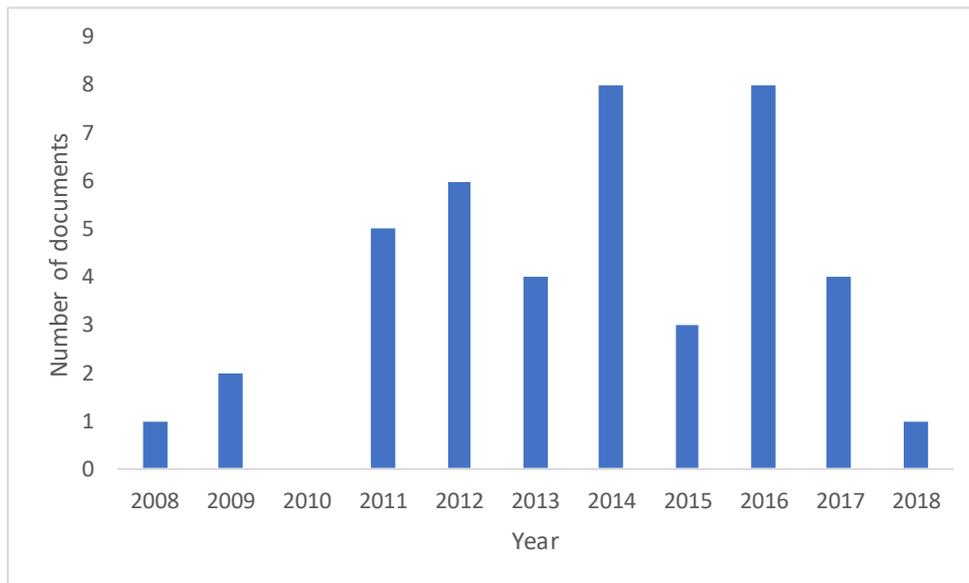


Figure 2: Year of publication of documents reviewed

Just over half of the documents reviewed (54%) included control measures applicable to suicide, a third (32%) were related to both trespass and suicide, and just under a fifth (17%) included control measures for trespass in the rail corridor (see Table 1).

Table 1: Number of documents and the focus of the recommended control measure

Topic	Number of documents	%
Suicide	22	52
Trespass	7	17
Suicide + trespass	13	31
Total number of documents	42	100

The 42 documents reviewed were subsequently grouped into eleven categories based on the recommended control measure (Table 2). The categories used, including their definitions, were as follows:

- Physical design: included physical barriers (e.g. gates, fences, landscaping including planting of shrubs, placing of large rocks etc.), design of rolling stock (e.g. skirts on front of trains), infrastructure including buildings, access to bridges/designated walkways, lighting at stations etc.
- Media guidelines: guidelines for the reporting and communication of suicide incidents.
- General education programs: included educational campaigns that encompass rail safety presentations at schools, railway stations or with community groups, public service announcements, workplaces (non-rail) and the distribution of leaflets in the community etc. Programs to raise awareness of depression and to promote help seeking behaviour were also included.

- Identification of ‘hotspots’/introduction of controls at ‘hotspots’: included locations identified as highest densities of trespass and suicide (including attempted suicide) and the installation of interventions at the identified location.
- Control systems framework/approach for organisational management: included framework developed to serve as a reference for rail organisations in the control of trespass and suicide risk.
- Signage: included installation of warning and prohibitive signs, posters advertising helpline numbers.
- Collaboration with other stakeholders/entities: included partnering with law enforcement agencies, local leaders, medical service providers, including mental health support agencies etc.
- Education programs for rail staff: included education to raise awareness of suicidal behaviours and post-traumatic stress, identify and report signs of trespass etc.
- Monitoring and/or detection systems: included systems that detect trespass or violation of a boundary.
- Engaging with lived experience individuals: involvement with persons who have attempted or considered railway suicide or an individual who has experience of another person’s suicide, for example family member or friend.
- Community survey: where a survey was conducted to investigate opinions of the local community or to engage with individuals with lived experience to understand why people take their lives on the railway.

A number of documents reviewed included more than one control measure and were therefore included in more than one category. The type of control measure most frequently cited across the literature was physical design and the least cited was survey methods to inform effective prevention strategies. Over 65% of documents, i.e. 28 of the 42 documents reviewed, recommended physical design or media guidelines as an effective control measure for trespass or suicide.

Table 2: Number of documents in each category of control measure

Control Measure	Number of documents	% of documents including the control measure	Suicide (%)	Trespass (%)	Suicide + Trespass (%)
Physical design	19	45	42	11	47
Media guidelines	9	21	89	11	0
General education programs for the community, schools and non-rail workplaces	8	19	37.5	37.5	25
Identification of ‘hotspots’ and introduction of controls at ‘hotspots’	7	17	100	0	0
Control systems framework/approach for organisational management	6	14	67	0	33
Signage	4	10	25	25	50
Collaboration with other entities	3	7	33	0	67
Education programs for rail staff	2	5	50	0	50
Monitoring and/or detection systems in specific locations	2	5	0	50	50
Engaging with lived experience individuals	1	2	100	0	0
Community survey	1	2	0	100	0

Note: Table arranged in descending order of number of documents (highest to lowest)

The first column in Table 2 shows the category of the control measure recommended in the reviewed document. The second column contains the number of documents reviewed that included each control measure. The percentage of documents that include each control measure is included in the third column, e.g. 19/42=45%. The remaining columns include the percentage of the documents including the control measure

as an intervention for suicide, trespass, or both suicide and trespass, e.g. 42% of the 19 documents that included physical design were applicable to suicide, 11% were applicable to trespass and 47% of the 19 documents included physical design for suicide and trespass.

Each publication was reviewed and categorised based on the recommended control measure/s determined by the author of the article and/or organisation (in the case of grey literature). The findings for each category are detailed below and a decomposed summary of the characteristics of each document is presented in Appendix A.²

3.2 International Practices in the Prevention of Trespass and Suicide Incidents

3.2.1 Physical Design

Restricting access to the rail corridor is considered one of the most effective measures to prevent railway suicide, however there is limited evidence regarding the effectiveness of this intervention (Krysinska & De Leo 2008). The installation of physical barriers at railway stations, or at locations of elevated levels of reported trespass or suicide activity, is a common control measure (Pirkis et al. 2013). Beautrais et al. (2009) noted a fivefold increase in the number of suicide incidents after the removal of barriers on a bridge in New Zealand. Full-height platform screen doors (PSDs) have been effective in reducing the number of rail suicide incidents at railway stations as they reduce the accessibility of the tracks from a platform. Half-height PSDs have also been used as a barrier at some metropolitan railway stations, however, they are not as effective as full-height screens as individuals may gain access to the track by climbing over the PSD (Chung et al. 2016; Ueda et al. 2015). There is no evidence to confirm if the installation of physical barriers, including PSDs, move potential suicide attempters to another unsealed, easily accessible location of rail track (Law & Yip 2011; Law et al. 2009; Too et al. 2014).

Efforts to reduce access to the rail corridor on the open track can decrease the number of trespassers and those attempting suicide (Krysinska & De Leo 2008; Silla & Luoma 2011; Stewart & Colwill 2012). Fencing and landscaping, such as planting bushes and installing large rocks, appear to reduce the ease with which an individual can access the rail tracks (daSilva & Ngamdung 2014). This includes situations where an individual chooses to take a short cut across running lines rather than use the designated path/bridge to cross the rail corridor. Silla and Louma (2011) observed a 94.6% reduction of trespass following the installation of fencing and a 91.3% reduction with the removal of an existing illegal pathway and landscaping at 12 locations of known frequent trespassing in Eastern Finland, demonstrating the potential utility of this control.

The installation of ‘suicide pits’ have been shown to be effective in reducing suicide mortality on the London Underground. Originally constructed to aid drainage, these are located under the rail tracks and increase the distance between the individual, who may have fallen or jumped onto the rail tracks or been struck by a train, and the train itself. These pits also enable access for medical assistance to be provided for the injured individual (Kolves et al. 2012; Krysinska & De Leo 2008).

Redesigning rolling stock has been proposed as an effective intervention for train-pedestrian collisions leading to fatalities. The suggested redesign includes the installation of an airbag which inflates when the train driver applies the emergency brake, or a rigid skirt to prevent a body from rolling under the train. However, no data is available to support the design changes suggested (Krysinska & De Leo 2008). There has also been work undertaken in the United States which proposes that a different emergency warning signal for trains would increase the sense of urgency and improve the ability of an individual to detect an approaching train (Ross et al. 2015). An initial study has indicated that it is possible to create an emergency warning signal which may be effective for use on the railway and warn of the approach of an oncoming train. This may be a useful measure

² Reading the Appendix in conjunction with each of the Results subsections is recommended

to alert individuals who are trespassing in the rail corridor. Further work is needed to determine the effectiveness of the new warning signal on a moving train.

The installation of blue lights is a control measure that has been used to reduce crime rates in Japan by having a ‘calming effect’ on potential criminals. They are considered a cost-effective intervention and have been installed on the end of station platforms with the intention to calm those with suicidal ideation. While the exact proportion of suicide attempts that occurred at the end of platforms at night is difficult to calculate (Ichikawa et al. 2014), they are turned on from sunset to sunrise only, therefore it would only be possible to influence individuals during this period; for this reason, they may have limited impact on the overall prevention of railway suicide incidents. However, the effectiveness of blue lights on the occurrence of suicide incidents at railway stations remains uncertain in the literature reviewed (Ichikawa et al. 2014; Matsubayashi et al. 2013).

Nineteen of the documents reviewed recommended physical design as a control measure, with the majority using it to target suicide over trespassing. In most cases, these control measures were designed and implemented in response to the number of reported incidents of trespass and/or suicide. It is evident that physical design is most often a reactive control measure. While it may be effective for some, the utilisation of physical design as a control measure does not consider the best way to support the individual involved, particularly given that it is a prevalent approach to prevent suicide.

3.2.2 Media Guidelines

Media guidelines are used to provide guidance regarding the reporting and representation of suicide in the media. The guidance may include a range of considerations, for example: minimising the prominence of the suicide story; reduction of the details included in media reports, including location and method used; and controlled reporting of celebrity suicide incidents. In some cases, the detailed reporting of a suicide may result in an increase in suicide attempts and by the same means which were utilised in the event in the report i.e. “copycat” suicide (Kolves et al. 2012; Yang et al. 2013). Media guidelines discourage the publicising of suicides and also provide guidance of details to include in reports of suicide on the railway (Mishara & Bardon 2014).

Media guidelines can reportedly reduce the number of occurrences of suicide (Kunrath et al. 2011). Following the introduction of media guidelines there have been reports of a reduction in suicide incidents. A decrease of greater than 80% of suicide incidents annually was observed in the first six months in Vienna following the introduction of media guidelines in Austria in 1987 (Niederkrotenthaler & Sonneck 2007). The guidelines contained guidance for the reporting on suicide incidents, including factors which may influence the probability of a “copycat” incident and suggested ways to lower the possible imitation effect. The guidelines also suggested that if options for self-help were encouraged in media reports, the potential impact of the reporting of a suicide incident may be reduced (Kolves et al. 2012). An 84% decrease of suicide attempts was also observed in Vienna following a campaign to raise awareness of journalists of the potential impacts of intense reporting in the media (Barker et al. 2017). Despite media guidelines playing a role in the reporting and incidence of railway suicide, there have been a limited number of studies undertaken involving large sample sizes of data.

3.2.3 General Education Programs for the Community, Schools and Non-Rail Workplaces

Education programs include community-based public awareness campaigns about suicide and mental health, the warning signs of suicidal behaviour and how to respond, as well as non-rail workplace and school programs (daSilva & Ngamdung 2014; Matsubayashi et al. 2014; Teo et al. 2016). Programs involving members of the general community targeting rail safety have been seen to reduce trespass rates with the rates reducing even further over the following 3 months after the program (Kolves et al. 2012). Increasing community awareness that a train-pedestrian collision is not always fatal may encourage individuals who are contemplating suicide to re-think their approach (Mishara & Bardon 2014). In Australia, Metro Trains Melbourne launched a campaign to improve rail safety in November 2012 which involved a series of cartoon characters in a video, song, game, outdoor advertising, posters, social media (Tumblr), children’s books, toys and other

merchandise. Focused on trespass prevention as well as general danger awareness, a consistent safety message, using the same characters, was used across all media associated with the campaign, which enabled the audience to interact and engage at different levels. While the campaign has reportedly contributed to some decrease in train station incidents (Metro Trains 2016), there has to date been no exhaustive study of the full impact of the campaign.

Education programs have also been used to increase the understanding of mental health and suicidal behaviour in the community. These types of proactive programs can encourage help-seeking behaviour of individuals who may need mental health support and have resulted in a reduction in suicide of middle-aged men in Japan (Matsubayashi et al. 2014).

The RESTRAIL project included trials in Spain and Finland of an education program highlighting the dangers of trespassing in the rail corridor. This program was held both in schools and in the general community and helped raise the awareness of the participants in regard to railways, including the hazards of playing near the tracks (Havârneanu 2017; Silla & Kallberg 2016). Raising the awareness of staff in mental health facilities can assist with staff identifying individuals that may be at risk of suicide and then appropriate assistance can be provided. This approach is useful for suicide in general, not just for suicide on the rail network (Mishara & Bardon 2014).

General education programs for the community are a proactive intervention which are focussed on long term impact and not limited to a particular location or group of people based on suicide and/or trespass data. Describing the dangers of being in the rail corridor and the possible consequences may also be an effective control and raise risk awareness at a range of locations close to the railway (e.g. hotels and pubs). There is no evidence that education used as a standalone intervention, i.e. not used in conjunction with another control measure, is an effective intervention for trespass or suicide. However, general community education is a valuable addition to any campaign when used in addition to other controls (Havârneanu et al. 2017; Kolves et al. 2012).

3.2.4 Identification of ‘Hotspots’ and Introduction of Controls at ‘Hotspot’ Locations

Introducing control measures at identified ‘hotspots’ is a common approach taken by rail organisations across the globe. This is a reactive measure, usually in response to the number of suicide or trespass incidents reported at specific locations. Recent research undertaken in Austria considered 15 ‘hotspot’ locations with identified predictors of railway suicide. These included the density of beds in nearby mental health facilities; population density; infrastructure design (i.e. multitrack structure with more than one rail track, this is usually associated with a higher volume of rail traffic); and socio-economic factors, for example unemployment rate, mean yearly gross income and level of education completed (Strauss et al. 2017). However, the influence of these factors was not consistent across the identified ‘hotspots’. A study in Belgium found that three major common characteristics of 43 ‘hotspots’ were that they provided anonymity to the individual, they were easily accessible and almost half of them were obscured from the train driver’s vision, due to physical design of the track curvature or vegetation (Debbaut et al. 2014).

Organisations respond to the number of incidents reported and focus on introducing control measures at identified ‘hotspots’ or a location of “elevated incidence of suicide” (Debbaut et al. 2014) or trespass incidents (Andriessen & Kryszynska 2012; Cox et al. 2013; Pirkis et al. 2013). The control measure most often implemented is to restrict access by the use of physical barriers (see Section 3.2.1). The installation of signage advertising the contact numbers of help lines at identified ‘hotspot’ locations have also been used to encourage individuals in the area with the intention of suicide to seek help (see section 3.2.6, (Mishara & Bardon 2014). There is limited evidence confirming that this approach prevents, or does not lead to increases in, suicide or trespass incidents at other nearby locations.

3.2.5 Control Systems Framework/Approach for Organisational Management

Several rail organisations were found to have produced documents that serve as a reference or guide to assist in the understanding of control measures for trespass and suicide on the railway. The documents include recommendations of control measures and provide a framework or suggested approach to mitigate risk. In many cases the most valuable mitigation may be a combination of control measures, for example a rail organisation would install physical barricades and signage at a specific location and then introduce a school education program and initiate a community focus group to work with members of the local neighbourhood to find ways to reduce trespass activity in the rail corridor (Gabree et al. 2014; Network Rail Network Rail UK 2016). The introduced interventions may focus on deterring an individual from considering suicide, preventing access to the rail corridor or ways to lessen the severity of a train-pedestrian collision.

Within the frameworks, some organisations view railway suicide as an issue that is not owned by the rail industry, but a societal problem that requires a community approach. The approach used is to partner with other stakeholders, such as the police force, mental health services, voluntary organisations and local authorities, to try to assist the rail industry in managing the risk of train-pedestrian interactions (Brown et al. 2012).

The literature generally points to the requirement of a proactive, long term strategy for sustainability in prevention of train-pedestrian collisions leading to fatalities, with the focus on business continuity and the health and wellbeing of all individuals involved. Recommended approaches for organisational management include the acknowledgement that the train driver and other rail staff are also affected by critical incidents which occur on the rail network (Lifeline Foundation 2012).

3.2.6 Signage

The installation of signage, for example ‘No trespassing’ signs, in order to manage trespass and/or attempted suicide is a commonly reactive control measure. Prohibitive and warning signs, stating possible fines or prosecution, have been effective in reducing the number of trespassers in some studies by over 30% (Havârneanu 2017; Silla & Luoma 2011). However, signage may only be an effective control during daylight hours if the sign is not illuminated or located in a well-lit area after dark (Silla & Luoma 2011).

A substantial decrease in trespass has also been observed when warning signs and posters were installed near factories and on billboards in the vicinity of the railway station, along with the introduction of other measures, e.g. physical barriers and education programs. The researcher noted that “...the potential of signs to change behaviour in absence of any other activity is limited, therefore they should be included in wider interventions and in conjunction with other measures” (Havârneanu 2017, p. 7).

Posters advertising telephone numbers of help lines have also been installed, along with telephones at identified locations, with the intention of encouraging individuals having suicidal thoughts to seek help and possibly prevent them entering the rail corridor. This control measure may be considered costly for an organisation; however, this expense may not be significant considering the financial and non-financial costs of train-pedestrian collision which result in a fatality to an organisation and to society in general (Mishara & Bardon 2014). To date, there is no evidence of the effectiveness of this type of control measure and whether individuals contemplating suicide would call the help lines advertised.

3.2.7 Collaboration with Other Stakeholders/Entities

Suicide is a community concern as well as an issue for the rail industry, and it would be beneficial for rail organisations to work collaboratively with other entities to enable a coordinated approach on this issue. Collaboration may include working with police coordinated projects focussing on trespass in the rail corridor, working with other rail organisations and infrastructure managers to gather accurate data, partnering with local health providers and local authorities in order to develop joint suicide prevention plans, and so on.

Consulting with mental health care providers located near railway lines can assist with raising awareness of railway suicide and the field of impact following an incident of this type, including the effect on the train crew (Havârneanu et al. 2015). Working in partnership with law enforcement agencies such as the police force and security firms, has been identified as successfully reducing the number of train-pedestrian collisions. Working collaboratively with the local police force personnel can also assist with identifying high risk locations and identifying trespassers (Havârneanu 2017; Havârneanu et al. 2015; Lukaschek et al. 2011).

The development of a national suicide prevention strategy is another recommended intervention which relies on working together with other agencies in order to be effective (Havârneanu et al. 2015). The introduction of such a strategy has been noted in several European countries with a decrease in the number of suicide incidents post implementation. The introduction of a national railway suicide prevention strategy in Germany resulted in a reduction in suicide incidents on the railway network by almost 14%. The strategy included restricting access to the rail corridor, introduction of a media strategy and working collaboratively with other agencies. In the Netherlands, the national prevention strategy resulted in an online suicide prevention service being launched offering support to individuals considering suicide, and individuals who may be concerned about another person or who have been impacted by another person’s suicidal behaviour.

Collaborating with other stakeholders and entities is a proactive, long term intervention that seeks to consider the wider impacts and influence of railway suicide incidents. However, in the documents reviewed, few studies identified the effectiveness of collaborating with other entities in reducing railway trespass or suicide or describe which mechanism for collaboration is most effective.

3.2.8 Education for Rail Staff

Educating rail staff may involve ‘gatekeeper training’ or general raising of awareness of railway suicide and the importance of reporting incidents of trespass or any signs or indications of trespass, for examples damaged boundary fences or access gates. ‘Gatekeeper training’ involves developing an understanding of the warning signs and how to appropriately respond to a suicide or attempted suicide emergency. This type of training can assist in increasing the confidence of rail staff when they interact with individuals having thoughts of suicide in or near their workplace (Havârneanu et al. 2015; Mishara & Bardon 2014).

Among the documents reviewed, one study included a 1-day ‘gatekeeper training’ course for rail staff. The participants reported feeling positive about the course and more confident to be able to deal with a situation in the workplace if needed. The effect of this type of control measure on railway suicide is unclear, however, upskilling staff to deal with an identified risk in the workplace is reportedly worth considering and may contribute to controlling the risk (Havârneanu et al. 2015).

3.2.9 Monitoring and/or Detection Systems in Specific Locations

The introduction of detection systems may be useful to monitor trespassing activity, or when a boundary or barrier has been transgressed. Detection systems include the installation of a device to monitor activity and to react if a transgression occurs; for example, an audible alarm or recorded message may sound when a person crosses a barrier. This type of intervention is suitable for trespass and suicide activity, and the use of an automatic warning system may be a suitable alternative when the installation of a physical barrier, e.g. a fence, is not a cost-effective option (Kallberg & Silla 2017).

Ketcham et al. (2014) propose the use of an intruder detection system on a station platform to detect individuals encroaching on the yellow line when a train is not on the platform. Another detection system used involves an automatic warning system being activated when trespassers in the rail corridor are detected by an infrared sensor. Upon detection, an automatic and audible message plays advising the individuals that they are trespassing and requesting that they leave the rail corridor. This system was trialled at 2 locations in Finland, resulting in a reduction of trespass activity at both locations, by 18% and 44% respectively (Kallberg & Silla 2017).

In Australia, researchers from Australian National University (Canberra) are currently working on a project with Sydney Trains (New South Wales) to develop an automated risk detection system using open-systems theory. This approach considers the interaction between different rail service functions to monitor and respond to at-risk behaviour and recognises that rail operation is a complex system aiming to provide a reliable service for customers. Consequently, the unpredictability of trespass and suicide requires a flexible organisational response. This project involves the development of an approach for monitoring at-risk suicidal behaviour using automated video analysis and a real-time warning system which will provide rail operators with the opportunity to respond and analyse the interaction and effectiveness between different interventions (Keating & Gordon 2018).

3.2.10 Engaging with Lived Experience Individuals

Effective suicide prevention measures can be informed by: “..the wisdom gained by those with lived experience of suicide”(Suicide Prevention Australia 2018). Engaging with individuals who have attempted or considered suicide on the rail network, or who have experience with another person’s suicide, can provide further understanding of the issue. These individuals may also be able to assist with the design and development of effective interventions. Focussing on the person who is considering railway suicide, and the best way to support them, has the potential to reduce the attractiveness of the railway environment for suicide and reduce the frequency of suicide on the rail network.

A study was conducted in the UK with the aim of understanding why the rail network is a chosen method for individuals considering suicide. The study involved online surveys, in-depth interviews with individuals who had contemplated or attempted suicide at or near a railway station, and also those who had attempted suicide using other methods near the railway (Marzano et al. 2016). The participants in this study indicated that the attractiveness of the railway was due to the perceived certain and quick lethality, ease of access to the rail tracks and the ability to avoid intervention. This was the only rail-related study involving individuals with lived experience encountered as part of this review and although the information is insightful, further studies would be of benefit to investigate and evaluate possible effective suicide prevention measures.

3.2.11 Community Survey

Considering trespass and suicide as a community issue requires involving the local community in a participative way to be part of the solution. Conducting a survey to understand local opinions can also provide an insight into what motivates individuals to trespass into the rail corridor. There can be a range of reasons why people trespass: possibly to take a shorter route rather than using the dedicated, longer walkway to the desired destination, or maybe it is a common, accepted route in the local neighbourhood and is not perceived to be dangerous (Silla & Luoma 2011). Engaging with local residents can also be worthwhile to seek opinions on possible control measures and their perceived effectiveness. However, the use of a self-reported survey may be a limitation, as people will often respond to represent themselves favourably and may not honestly reflect their actual behaviour (i.e. social desirability).

Only one document in this review involved engaging with the local community in order to gain an understanding of trespass from the perspective of people living near a railway (Silla & Luoma 2012). The study involved surveying individuals who live near a railway line about their opinions and observations of trespassers, and their preference of interventions to manage this issue. The survey participants supported control measures involving the installation of physical barriers or constructing an alternate route to cross the tracks in order to manage people taking a short cut via the rail corridor.

4 Discussion

Fatalities resulting from a train-pedestrian collision are a risk to the rail industry and need to be managed effectively. A range of practices are used internationally for the prevention of trespass and suicide on urban rail networks. The most frequently cited control measure is physical design and often involves the installation of physical barriers at identified ‘hotspot’ locations of frequent trespass or suicide activity. While it must intuitively result in a baseline reduction in risk, there is limited evidence of the effectiveness of physical design in controlling trespass or suicide on rail networks when installed in isolation. However, when implemented in combination with other control measures, physical design can be a promising intervention for managing rail trespass and suicide.

Several of the documents reviewed considered the cost of the intervention. All organisations need to consider costs; including costs to reputation, business continuity, return on investment, and so on. In the Australian context, the cost of a human life has been calculated to be \$5.7m (Australian Safety & Compensation Council 2008), which invariably exceeds the sort of expenditure required to implement an effective control measure in most circumstances. This is in addition to the personal cost of the family and friends of the individual involved in the incident.

General education programs in the community, at schools and at workplaces, support the raising of awareness and understanding of depression, suicide and rail safety in society. They also provide an opportunity for rail operators to explain to the local community the widespread impact of a train-pedestrian collision. Programs of this type can also encourage individuals experiencing suicidal thoughts and behaviours to consider seeking help, which in turn has the potential to result in the reduction of suicide (Mishara & Bardon 2014). While lasting sustainability associated with individual behaviour change is not always achievable, education campaigns that engage widely among members of the community are more likely to make a positive impact on baseline levels of risk. An example is the Metro Trains Melbourne campaign, which focussed on general rail safety in train station trespass incidents (Metro Trains 2016).

The way in which railway suicide incidents are reported in the media also contributes to community understanding of rail safety. When the explicit details of incidents are included in media reports this can potentially influence “copycat” behaviour of individuals contemplating suicide (Barker et al. 2017; Kolves et al. 2012; Mindframe Media 2014; Too et al. 2014).

Identification of ‘hotspot’ locations for trespassing and/or suicide requires reliable and accurate reporting of incidents. However, elevated levels of incidents may be reported at some locations for a variety of reasons. For example, the location may be well-staffed, visible, and under constant CCTV surveillance such that all incidents are observed and reported (i.e. not obscured by vegetation or buildings). There may also be many reasons why rail staff are hesitant to report trespass incidents. They may have reported incidents in the past and felt that they were not taken seriously, or that their reports were not followed up by management. These factors can lead to a workforce believing that trespass in the rail corridor is a normative feature of their workplace, and reporting is unnecessary unless a person is directly in the path of the rail vehicle. All of these factors can impact the accurate identification of ‘hotspots’, or lead to erroneous identification of ‘hotspots’ to the detriment of more significant locations (Pharoah & Dark 2017).

Perhaps a more robust approach to managing the risk of trespass and suicide at specific locations, would be to determine the characteristics at locations with elevated reported incidents and identify other locations across the network which share these characteristics. Pharoah and Dark (2017) suggest that “the only common characteristic of hotspots that truly marks them as being different to other potential sites that are not hotspots... is the elevated incidence of suicide” (p. 5). This may also be true for trespass in the rail corridor. When an organisation considers suicide or trespass ‘hotspots’ they may often channel resources into that location. These may include increased staff presence, installation of signage, improved fencing, introduction of monitoring systems, and so on. However, the only thing which makes the location unique is elevated

reporting of incidents, which may result from a range of factors rather than the characteristics of the location itself.

Through this study it is apparent that the most effective method to control trespass and suicide on rail networks is to implement a range of control measures. There is no one, single intervention that appears to be effective and reliable in the prevention of individuals illegally entering the rail corridor. Some rail organisations have developed and implemented a program of work involving a range of control measures introduced in combination to manage this issue. For example, restricting access to tracks along with installing signs at identified locations and CCTV monitoring. This is in addition to partnering with the local community, and other local entities, to raise awareness of safety around the railway and the impact of train-pedestrian collisions (Network Rail 2016).

The consideration of culturally specific beliefs, values and practices in programs designed to prevent train-pedestrian collisions cannot be overlooked. Understanding the cultural context is key to the success of any intervention as not all control measures will be effective in all cultures. For example, the use of blue lights to calm potential criminals in Japan have also been used to calm individuals possibly contemplating suicide on railway stations and may not be an effective intervention in other countries (Ichikawa et al. 2014). The use of media guidelines also needs to respect cultural differences. Guidelines that have been effective in one country or culture may not always be successful when applied in another cultural setting or may need an altogether different form of engagement to establish partnerships.

Involving lived experience individuals in the quest for an appropriate and effective control may bring a different dimension; one that is more focussed on the people involved whilst gaining a deeper understanding of their views and experiences. This perspective needs to be considered when designing and piloting interventions for railway suicide prevention (Marzano et al. 2016; Suicide Prevention Australia 2018). It would be beneficial for future research to investigate what factors influence a person to suicide or attempt suicide in the Australian and New Zealand rail environment.

5 Conclusions

The impact field of a fatality resulting from a train-pedestrian interaction extends beyond the family and friends of the individual involved to rail staff, customers and other members of the community. This review investigated the strategies currently adopted across international urban rail networks to manage and prevent trespass and suicide. It has highlighted that this is a complex issue which needs a multi-layered approach for an effective, sustainable solution.

A range of control measures are currently in place across global urban rail networks with reactive use of physical barriers being the most frequently adopted intervention among the documents reviewed in this study. Reducing accessibility to rail tracks is often considered to be one of the most successful control measures to counteract suicide and trespass on the railway. There is a lack of evidence regarding whether controlling access to some parts of the railway did actually mitigate the issue, as opposed to simply moving those at risk of suicide to other more accessible locations of open, unfenced track elsewhere.

Overall, there were numerous gaps in the literature regarding the effectiveness of interventions adopted for the prevention of trespass and suicide in the rail corridor, including the impact of education programs for rail staff and members of the community; the redesign of rolling stock; installation of blue lights on railway station platforms; installation of signage promoting self-help contact numbers; and organisational focus on locations of increased reported trespass and suicide (“hotspots”).

In general, the control measures described in the documents reviewed were selected by following the Hierarchy of Risk Control, which categorises controls by those that aim to: (1) eliminate the hazard; (2)

substitute or isolate the hazard from people; and (3) reduce the risks through engineering or administrative controls. However, an adaptation was required to the Hierarchy of Risk Control approach as a prospective framework for this review, in order to include additional dimensions and practices. During the review, the researchers also considered whether those intending to trespass or suicide could be considered a “hazard” (i.e. to the wellbeing of rail drivers and rail staff), in which case the framework would seek to eliminate them. However, this was found to be problematic (e.g. it is not possible to eliminate people from railways, or to substitute them), and had the effect of misrepresenting the problem (i.e. people as system actors that need to be controlled/blamed rather than supported/helped). In short, the hierarchy of risk controls approach is somewhat intractable as a framework to manage trespass and suicide, and may not be the most appropriate approach to manage it on the railways. The issue is multifaceted and would benefit from a participative approach focussing on the individual involved: the person who is trespassing or who is contemplating suicide. There is no simple fix to resolve the issue of railway trespass and suicide and the use of a combination of control measures was recommended in several studies reviewed.

6 Acknowledgements

A number of people were consulted and shared documents, and provided generous time and input in this study. We would like to thank Ian Stevens from Network Rail, Scott Gabree from Volpe Center, Naomi Frauenfelder from TrackSafe Foundation, Cameron Gordon from Australian National University and Daniel Blais from Transport Canada.

7 References

- Andriessen, K & Kryszynska, K 2012, ‘Railway suicide in Belgium 1998–2009: Incidence and prevention’, *Crisis: The Journal of Crisis Intervention and Suicide Prevention*, vol. 33, no. 1, pp. 39-45.
- Barker, E, Kolves, K & De Leo, D 2017, ‘Rail - suicide prevention: Systematic literature review of evidence - based activities’, *Asia - Pacific Psychiatry*, vol. 9, no. 3, p. e12246.
- Beautrais, AL, Gibb, SJ, Fergusson, DM, Horwood, LJ & Larkin, GL 2009, ‘Removing bridge barriers stimulates suicides: an unfortunate natural experiment’, *Australian & New Zealand Journal of Psychiatry*, vol. 43, no. 6, pp. 495-7.
- Brown, R, Evans, E & Webb, S 2012, *Improving suicide prevention methods on the rail network in Great Britain Annual Report 2011*, Rail Safety and Standards Board Ltd, London, UK.
- Chung, YW, Kang, SJ, Matsubayashi, T, Yasuyuki, S & Ueda, M 2016, ‘The effectiveness of platform screen doors for the prevention of subway suicides in South Korea’, *Journal of Affective Disorders*, vol. 194, pp. 80-3.
- Cothreau, C, De Beaurepaire, C, Payan, C, Cambou, JP, Rouillon, F & Conso, F 2004, ‘Professional and medical outcomes for French train drivers after "person under train" accidents: Three year follow up study’, *Occupational and Environmental Medicine*, vol. 61, no. 6, pp. 488-94.
- Council, ASaC 2008, *The health of nations: The value of a statistical life*, Commonwealth of Australia, Canberra.
- Cox, GR, Owens, C, Robinson, J, Nicholas, A, Lockley, A, Williamson, M, Yee Tak Derek, C & Pirkis, J 2013, ‘Interventions to reduce suicides at suicide hotspots: a systematic review’, *BMC Public Health*, vol. 13, no. 1, pp. 1-12.
- daSilva, M & Ngamdung, T 2014, *Trespass Prevention Research Study – West Palm Beach*, FL DOT-VNTSC-FRA-14-0, U.S. Department of Transportation, Research and Innovative Technology Administration, John A. Volpe National Transportation Systems Center
- Debbaut, K, Kryszynska, K & Andriessen, K 2014, ‘Characteristics of suicide hotspots on the Belgian railway network’, *International Journal of Injury Control and Safety Promotion*, vol. 21, no. 3, pp. 274-7.
- European Railway Agency 2014, *Railway Safety Performance in the European Union*.
- French, R 2016, ‘Train drivers, suicide and tracks of tears’, *The Australian*.

- Gabree, S, H., Chase, S, Doucette, A & Martino, M 2014, *Countermeasures to Mitigate Intentional Deaths on Railroad Rights-of-Way: Lessons Learned and Next Steps*
- Havârneanu, G, M. 2017, 'Behavioural and organisational interventions to prevent trespass and graffiti vandalism on railway property', *Proceedings of the Institution of Mechanical Engineers, Part F: Journal of Rail and Rapid Transit*, vol. 231, no. 10, pp. 1078-87.
- Havârneanu, GM, Burkhardt, J-M & Paran, F 2015, 'A systematic review of the literature on safety measures to prevent railway suicides and trespassing accidents', *Accident Analysis & Prevention*, vol. 81, pp. 30-50.
- Havârneanu, GM, Burkhardt, JM & Silla, A 2017, 'Optimizing suicide and trespass prevention on railways: a problem-solving model from the RESTRAIL project', *International Journal of Injury Control and Safety Promotion*, vol. 24, no. 4, pp. 469-86.
- Ichikawa, M, Inada, H & Kumeji, M 2014, 'Reconsidering the effects of blue-light installation for prevention of railway suicides', *Journal of Affective Disorders*, vol. 152-154, pp. 183-5.
- Jackson, JE, Cooper, L, Bell, A, & Naweed, A 2017, 'Exploring organisational responses to railway suicide', paper presented to 2017 Human Factors & Ergonomics Conference, Wollongong, NSW, Australia, 27-29 November.
- Kallberg, VP & Silla, A 2017, 'Prevention of railway trespassing by automatic sound warning—A pilot study', *Traffic Injury Prevention*, vol. 18, no. 3, pp. 330-5.
- Keating, B & Gordon, C 2018, 'Preventing railway suicide: An opensystems perspective and application ', Australian National University.
- Ketcham, M, Ganokratanaa, T & Srinichaarnum, S 2014, 'The intruder detection system for rapid transit using CCTV surveillance based on histogram shapes', in pp. 1-6.
- Kolves, K, Barker, E & De Leo, D 2012, *Suicide prevention strategies for the reduction of rail-related suicides and suicide attempts Report to Lifeline Foundation.*, Australian Institute for Suicide Research and Prevention, Brisbane.
- Krysinska, K & De Leo, D 2008, 'Suicide on railway networks: epidemiology, risk factors and prevention', *Australian and New Zealand Journal of Psychiatry*, vol. 42, no. 9, pp. 763-71.
- Kunrath, S, Baumert, J & Ladwig, K-H 2011, 'Increasing railway suicide acts after media coverage of a fatal railway accident? An ecological study of 747 suicidal acts', *Journal of Epidemiology and Community Health (1979-)*, no. 9, p. 825.
- Law, CK & Yip, PSF 2011, 'An economic evaluation of setting up physical barriers in railway stations for preventing railway injury: evidence from Hong Kong', *Journal of Epidemiology and Community Health (1979-)*, no. 10, p. 915.
- Law, CK, Yip, PSF, Chan, WSC, Fu, K-W, Wong, PWC & Law, YW 2009, 'Evaluating the effectiveness of barrier installation for preventing railway suicides in Hong Kong', *Journal of Affective Disorders*, vol. 114, no. 1, pp. 254-62.
- Lifeline Foundation 2012, *Proposals for a National Rail Suicide Prevention Strategy.*
- Lukaschek, K, Baumert, J & Ladwig, K-H 2011, 'Behaviour patterns preceding a railway suicide: explorative study of German Federal Police officers' experiences', *BMC Public Health*, vol. 11, pp. 620-.
- Marzano, L, Borrill, J, Mackenzie, J, Fields, B & Kruger, I 2016, *Why do people take their lives on the Railways in Great Britain? A research study* Coimmissioned by Samaratans, funded by Network Rail, London.
- Matsubayashi, T, Sawada, Y & Ueda, M 2013, 'Does the installation of blue lights on train platforms prevent suicide? A before-and-after observational study from Japan', *Journal of Affective Disorders*, vol. 147, no. 1, pp. 385-8.
- Matsubayashi, T, Ueda, M & Sawada, Y 2014, 'The effect of public awareness campaigns on suicides: Evidence from Nagoya, Japan', *Journal of Affective Disorders*, vol. 152-154, pp. 526-9.
- Metro Trains, Melbourne, 2016, *Dumb Ways to Die*, viewed 03/09/2018 2018, <<https://dumbwaystodiecasestudy.wordpress.com>>.
- Mindframe Media 2014, *Mindframe media guidelines*, Australian Government Department of Health, viewed 12/08/18 2018, <<http://www.mindframe-media.info/for-media/reporting-suicide#b>>.

- Mishara, BL & Bardon, CftCTDC 2014, 'Research and Countermeasures to Prevent Suicide in Railway Rights of Way'.
- Network Rail 2016, *Measures Employed By the Rail Industry to Prevent Suicides on The Network*, Network Rail, UK.
- Niederkrotenthaler, T & Sonneck, G 2007, 'Assessing the impact of media guidelines for reporting on suicides in Austria: interrupted time series analysis', *Australian & New Zealand Journal of Psychiatry*, vol. 41, no. 5, pp. 419-28.
- Pharoah, R & Dark, A 2017, *Suicide Prevention on the Railway - An Anthropological and Ethnographic Approach* Rail Industry Suicide Stakeholder Group, UK.
- Pirkis, J, Spittal, MJ, Cox, GR, Robinson, J, Cheung, YTD & Studdert, D 2013, 'The effectiveness of structural interventions at suicide hotspots: a meta-analysis', *International journal of epidemiology*, vol. 42, no. 2, pp. 541-8.
- Ross, JC, Johnson, TM, Campbell, T, Parida, BK, Zaouk, AK & Omar, T 2015, 'Development of a new emergency warning signal for trains to improve detectability of pedestrians wearing headphones', in *INTER-NOISE and NOISE-CON Congress and Conference Proceedings*, vol. 250, pp. 3409-20.
- Ryan, B 2017, 'Developing a framework of behaviours before suicides at railway locations', *Ergonomics*, pp. 1-22.
- Safe Work Australia 2017a, *Identify, assess and control hazards*, Safe work Australia, viewed 17/08/18, <<https://www.safeworkaustralia.gov.au/risk#the-hierarchy-of-risk-control>>.
- 2017b, *National Data Set for Compensation-based Statistics Workers Compensation claims for the period 2007-2008 to 2011-2012*, <<https://www.safeworkaustralia.gov.au>>.
- Silla, A & Kallberg, V-P 2016, 'Effect of railway safety education on the safety knowledge and behaviour intention of schoolchildren', *Evaluation and Program Planning*, vol. 55, pp. 9-16.
- Silla, A & Luoma, J 2011, 'Effect of three countermeasures against the illegal crossing of railway tracks', *Accident Analysis & Prevention*, vol. 43, no. 3, pp. 1089-94.
- 2012, 'Opinions on railway trespassing of people living close to a railway line', *Safety Science*, vol. 50, no. 1, pp. 62-7.
- Stewart, R & Colwill, MftCTDC 2012, 'Rail Trespassing Occurrences and Countermeasure Strategies'.
- Strauss, MJ, Klimek, P, Sonneck, G & Niederkrotenthaler, T 2017, 'Suicides on the Austrian railway network: hotspot analysis and effect of proximity to psychiatric institutions', *Royal Society open science*, vol. 4, no. 3.
- Suicide Prevention Australia 2018, viewed 1/08/18, <<https://www.suicidepreventionaust.org/projects>>.
- Teo, AR, Andrea, SB, Sakakibara, R, Satoko, M, Matthieu, MM & Fetters, MD 2016, 'Brief gatekeeper training for suicide prevention in an ethnic minority population: a controlled intervention', *BMC Psychiatry*, vol. 16, pp. 1-9.
- Too, LS, Milner, A, Bugeja, L & McClure, R 2014, 'The socio-environmental determinants of railway suicide: a systematic review', *BMC Public Health*, vol. 14, no. 20, p. 10.
- Ueda, M, Sawada, Y & Matsubayashi, T 2015, 'The effectiveness of installing physical barriers for preventing railway suicides and accidents: Evidence from Japan', *Journal of Affective Disorders*, vol. 178, pp. 1-4.
- Yang, AC, Tsai, S-J, Yang, C-H, Shia, B-C, Fuh, J-L, Wang, S-J, Peng, C-K & Huang, NE 2013, 'Suicide and media reporting: a longitudinal and spatial analysis', *Social Psychiatry and Psychiatric Epidemiology*, vol. 48, no. 3, pp. 427-35.

8 Appendix A – Summary of Documents

8.1 Physical Design

Reference	Sample/Data	Proactive or Reactive Early/Now/Long Term intervention	Description	Key Findings	Applicability		
					SH	T	T + SH
Silla and Luoma (2011)	Landscaping 10 days n=200 Fencing 11 days n=407 12 locations of known trespass	Reactive Organisational Now	Countermeasures tested: landscaping, building a fence and prohibitive signs	Landscaping 91.3% reduction Benefits-cost ratio 3.6 Fencing 94.6% reduction Benefits-cost ratio 4.5			✓
Too et al. (2014)	11 studies based in 6 countries. 4 studies examined metro, subway or underground suicide, 7 studies considered suicide occurring in railway systems Most of the studies were 2006-2013; 2 studies were prior to 2000	Proactive Organisational Long term	1 study examined physical barriers and 1 compared station with blue lights installed to stations without blue lights	59% decrease in rail suicide after installation of platform screen door; 84% decrease after installation of blue lights Impact of physical barriers was strong without substitution effect to unsealed platforms; installation of barriers effective to decrease suicide at 'hotspots'	✓		
Havârneanu et al. (2015)	n=139 in review, 12 studies involving design	Proactive Organisational Long term	Installation of physical barriers, other design considerations including environmental, technology, lighting, train design, design and aesthetics of stations, monitoring	Installation of physical barriers most common measure against trespass and suicide			✓
Ueda et al. (2015)	Tokyo Suicides April 2004 -March 2014; Accidents April 2005 - March 2014 Stations included n=168 Total suicides n=144, accidents n=1821	Proactive Systemic Long term	Half height platform screen doors (PSDs) installed	7 suicides at stations with PSDs; Nil fall accidents at stations with PSDs; Average of 185 accidents/year at stations without PSDs			✓

Research PF14 – Trespass/“Self-Harm”

Pirkis et al. (2013)	9 independent intervention studies	Reactive Systemic Long term	6 studies examined effect of barriers installed on bridges/viaducts; 2 studies considered fencing off road access to cliffs; 1 study examined effectiveness of installing a safety net below the top of a cliff	Pre-intervention - mean of 5.7 deaths/year; post-intervention mean of 0.5 deaths/year 44% increase in the number of jumping suicides per year at nearby sites. Net overall effect was reduction of 28% in number of deaths/year	✓		
daSilva & Ngamdung (2014)	4 years duration (2009-2013) Two railway lines in West Palm Beach, Florida based on fatal incident history	Reactive Systemic Long term	Enhanced channelization using fencing, platform fence end extenders, inter-track fence extension and landscaping	Evaluation incomplete			✓
Krysinska and DeLeo (2008)	30 original studies (1966-2007) on epidemiology and peer-reviewed articles on risk factors and prevention of rail suicides	Reactive Systemic Long term	Physical design at stations and of rolling stock	Data to support suicide pits and sliding doors at platforms limiting access to tracks Indirect evidence supporting potential effectiveness of airbags or skirts on front of trains	✓		
Barker et al. (2017)	8 papers - 3 studies analysed effectiveness of platform screen doors, 3 analysed installation of blue lights and 2 papers analysed effectiveness of suicide pits	Reactive Systemic Long term	Systematic review	Strong indications that physical barriers can prevent suicidal behaviour from occurring despite initial costs of implementation.			✓
Ross et al. (2015)	US Injury data 2004-2011 of train-pedestrian accidents	Proactive Systemic Long term	Literature review on emergency warning signals and their effectiveness	116 reports of death or injury to pedestrian wearing headphones 74% of cases reported involving trains victims were wearing headphones at time of incident It is possible to create a more effective emergency warning signal		✓	
Kolves et al. (2012)	6 studies - including 1 focus group which evaluated rail and safety workers opinions and 1 general safety program focussed on limiting illegal crossing of train tracks	Reactive Systemic Long term	Systematic review	The installation of PSDs has resulted in reduction in annual average of suicide incidents in Hong Kong. No significant displacement to other platforms was observed. Reduction in fatality of attempted suicide at stations where 'suicide pits' were installed in London- 44% as opposed to 76% Repair of holes in fences and installation of			✓

Research PF14 – Trespass/“Self-Harm”

				stronger fence resulted in reduction in illegal crossing of tracks			
Stewart and Colwill (2012)	Known trespass location in Mississauga Before implementation n= 84/day Data collected for 54 days post implementation	Proactive Systemic Long term	Analyse trespass occurrences and identify and evaluate effectiveness of potential countermeasures Pilot study using high security and standard chain-link fencing installed as right-of-way protection	90% reduction in average number of daily trespassing incidents (from 84 to 8/day)		✓	
Havârneanu (2017)	2 projects - RESTRAIL (Reduction of Suicides and Trespasses on RAILway property, 3-year project ending in Sept 2014) and GRAFFOLUTION (2 year project ending in Feb 2016)	Proactive Systemic Long term	Both projects employed systematic review of literature, collection of data from railway organisations and infrastructure managers, identification and evaluation of most promising measures	Design of stations, platforms, carriages, public walkways and the terrain near the railway should be reviewed. Authorised walk routes and enclosed footbridge to be installed; improve lighting on stations and at high risk locations; remove abandoned buildings close to tracks			✓
Beautrais et al. (2009)	Suicide deaths from bridge in Auckland were compared for: 1991-1995 (old barrier in place); 1997-2002 (no barriers in place); 2003-2006 (post reinstatement of barriers)	Reactive local Long term	Safety barriers were removed in 1996. Study compared number of suicide incidents due to jumping from bridge after reinstatement of safety barriers.	5 x increase in number and rate of suicides after removal of barriers. Safety barriers of an improved design reinstated	✓		
Mishara and Bardon (2014)	Proposal of suicide prevention interventions	Reactive Systemic Now	Literature review of suicide prevention measures	Few scientific studies of effectiveness of these interventions, except for blue lighting which one study claimed as promising intervention	✓		
Matsubayashi et al. (2013)	71 stations using data from 2000-2010 from one railway company in Tokyo Control group n= 60 stations treatment group n= 11 stations.	Reactive Organisational Long term	Blue lights were introduced at 1 station in 2008, 4 stations in 2009 and at 6 stations in 2010 and illuminated from sunset to sunrise. Blue lights were installed at stations where suicide rates were high.	84% decrease in the number of suicide incidents	✓		
Chung et al. (2016)	Monthly data for 121 subway stations. 2003-2012 in Seoul - 119 with full-height, 2 with half-height Platform screen doors (PSDs)	Proactive Organisational Long term	Effect of half and full-height PSDs on the number of suicide incidents after installation	PSDs decrease fatal suicide cases by 89% Installation of full-height PSDs eliminated subway suicides, half-height were not as effective			✓

Research PF14 – Trespass/“Self-Harm”

Ichikawa et al. (2014)	Data of rail suicide attempts in Japan from April 2002 - March 2012	Reactive Organisational Long term	Blue lights installed at the ends of platforms.	Installation of blue lights have less impact than previously estimated	✓		
Law and Yip (2011)	Data on railway injuries 1997-2007 in Hong Kong, n=397	Proactive Systemic Long term	Investigate effectiveness and cost-effectiveness of platform screen doors (PSDs)	PSD installation has reduced railway injuries by 68.8%, with no observed substitution effect to other platforms; 78.9% reduction in fatal suicidal falls, 67.9% decrease in accidental falls			✓
Law et al. (2009)	Cases of railway suicide 1997-2007 (n=76) with pre-installation of platform screen doors (PSD) 1997-2001 and post-installation being 2003-2007	Proactive Organisational Long term	Effectiveness of installing PSDs at underground railway stations was assessed through a quasi-experimental setting	59.9% reduction after PSD installation; no significant sign of substitution by displacing potential suicide attempters to unsealed platforms	✓		

8.2 Media Guidelines

Reference	Sample/Data	Proactive or Reactive Early/Now/Long Term intervention	Description	Key Findings	Applicability		
					SH	T	T + SH
Krysinska and De Diego (2008)	Searches for period 1966-2007 performed 30 original studies on epidemiology and peer-reviewed articles on risk factors and prevention of rail suicide incidents included	Proactive Systemic Long term	Responsible reporting of suicide incidents in the media introduced and community media campaigns	80% reduction of rail suicide incidents in Vienna following implementation of media reporting guidelines indirect evidence that community media campaigns advertising local crisis intervention centres and hotlines at railway stations are effective	✓		
Mishara and Bardon (2014)	Results from research studies on the nature of railway suicide incidents in Canada over 10-year period	Proactive Systemic Long term	Guidelines developed discouraging media from publishing suicide incidents and limiting reporting on railway suicide	Media guidelines have had positive impact in Canada	✓		
Niederkroten haler and Sonneck (2007)	Media guidelines were introduced in Austria in 1987. Viennese subway suicide data was examined 1982/83 - 2004/05	Proactive Systemic Long term	Media guidelines for the reporting on suicide introduces. Newspapers reaching approx. 50% of the Austrian population were collaborated with.	Decrease of approx. 10 subway suicide incidents post implementation of media guidelines.	✓		
Havârneau et al. (2015)	n=139 in review, 6 studies involving appropriate reporting or broadcast of critical incidents	Proactive Organisational Long term	Provision of media guidelines and tips to avoid a 'copycat' effect.	Announcement to passengers on trains and at stations should inform but avoid promotion - the message should be neutral about the nature of the incident. Death memorials should be removed.	✓		
Barker et al. (2017)	8 papers -1 paper included the influence of media reporting guidelines	Reactive Systemic Long term	Systematic review	84.2% decrease in suicide incidents on Viennese subways following introduction of media guidelines for reporting of suicide incidents. Reduction sustained over time.	✓		
Kolves et al. (2012)	6 studies - including 1 focus group which evaluated rail and safety workers opinions and 1 general safety program focussed on limiting illegal crossing of train tracks	Proactive Systemic Long term	Systematic review	Introduction of media campaign was coupled with a decrease of 84.2% in suicide attempts			✓

Research PF14 – Trespass/“Self-Harm”

Too et al. (2014)	11 studies based in 6 countries. 4 studies examined metro, subway or underground suicide, 7 studies considered suicide occurring in railway systems 9 studies were 2006-2013; 2 studies were prior to 2000	Proactive Systemic Long term	8 studies examined non-intervention studies on railway suicide	Increase of 44% of daily suicide behaviours following extensive media coverage of railway suicide incident in one study	✓		
Yang et al. (2013)	All suicide incidents 2003-2010 in Taiwan, n=31364	Proactive Systemic Long term	Major and minor suicide events and time-dependent correlation was used to quantify the temporal correlation between suicide deaths and suicide news.	Media reporting of suicide was synchronized with increased suicide deaths during major suicide events, such as celebrity deaths, and lagged behind the suicide death for 1 month in other periods without celebrity suicide. Media reports of suicide had a higher association with suicide deaths in urban than in rural areas.	✓		
Kunrath et al. (2011)	Suicidal acts occurring the first 2 months following a highly publicised (TV, radio, newspapers, internet) railway accident on 29/12/06 which killed 3 people in Austria ('index period') were compared to 2 control periods (12/04-03/05 and 12/05-03/06). n=747 fatal and non-fatal railway suicide incidents were observed during the index and the 2 control periods.	Proactive Systemic Long term	Poisson regression analysis was undertaken to model number of suicide incidents/day - different models including day of week, month, period, av monthly temperature and unemployment rate.	During the index period the mean number of railway suicide incidents increased to 2.66, compared to 1.94/day on the control periods - leading to almost 5 more suicide incidents on average/week. A daily max of 8 railway suicide incidents was reached ~ 1-week post event. Railway suicide incidence figures returned to baseline level of the control periods 3 months post event. Effects of media on suicide incidents prevailed for 2 months post incident.	✓		

8.3 General Education Programs for the Community, Schools and Non-rail Workplaces

Reference	Sample/Data	Proactive/Response Early/Now/Long Term intervention	Description	Key Findings	Applicability		
					SH	T	T + SH
Teo et al. (2016)	106 community members in a high-risk Asian community in the United States; intervention participants n=85; control group n=48	Proactive Systemic Long term	Intervention and control events entitled 'Saving 10,000' were held. Intervention included gatekeeper training involving screening of documentary, interactive Q&A session, 15 min lecture by psychiatrist and Q&A session. Pre-post survey Open-ended, written qualitative comments	Intervention participants showed significant increases in all 3 types of intended gatekeeper behaviour, all four measures of self-efficacy and both measures of social norms relevant to suicide prevention	✓		
daSilva & Ngamdung (2014)	Education campaigns targeting businesses and customers, passengers and pedestrians Two railway lines in West Palm Beach, Florida	Reactive Systemic Long term	Before and after analysis of trespass data at specific locations	Evaluation incomplete			✓
Kolves et al. (2012)	6 studies - including 1 focus group which evaluated rail and safety workers opinions and 1 general safety program focussed on limiting illegal crossing of train tracks	Proactive Systemic Long term	Systematic review Safety programme targeted illegal railway crossing at a station and included presentations to school children and rail workers, distribution of leaflets to community, larger warning signs and media coverage. Self-reported surveys utilised. Fences were also repaired/replaced as needed.	Reduction in number of people observed walking across tracks from 59% to 40% 2 weeks post intervention and 36% 3 months later. Self-report surveys indicated that 25% respondents walked across the tracks 25% less		✓	
Mishara and Bardon (2014)	Results from research studies on the nature of railway suicide incidents in Canada over 10-year period	Reactive Systemic Long term	Raising awareness in community about railway suicide and that it is not guaranteed death and is often neither quick or painless	Trial recommended - community awareness campaign	✓		

Research PF14 – Trespass/“Self-Harm”

Silla and Kallberg (2016)	248 students 8-11-year-old 15 classes at 4 schools located near railway lines in Finland in September - November 2013	Proactive Systemic Long term	45-minute lessons held by teachers Short survey before and 2-3 months post lesson Main messages: railway lines are for trains; trespassing, playing, loitering in railway areas is forbidden; they have responsibility to behave safely in rail environment Part of RESTRAIL project	Effectiveness based on 3 variables: behaviour intention, estimated dangerousness of behaviour, knowledge of legality of behaviour. Results show railway safety education in schools has positive effect for all variables.		✓	
Havârneanu (2017)	2 projects - RESTRAIL (Reduction of Suicides and Trespasses on RAILway property, 3-year project ending in Sept 2014) and GRAFFOLUTION (2-year project ending in Feb 2016)	Proactive Systemic Long term	Both projects employed systematic review of literature, collection of data from railway organisations and infrastructure managers, identification and evaluation of most promising measures	Educational measures showed positive results and were highly recommended in both projects Risk awareness should be raised at locations close to tracks, e.g. bars, schools etc Broader public awareness campaigns targeted at high-risk audiences			✓
Matsubayashi et al. (2014)	Suicide data before and after campaign in Nagoya during 2010-2012	Proactive Organisational Long term	Promotional material distributed aimed at raising public awareness of depression and promote care seeking behaviour. Determine the association between number suicide and frequency of distributions post-distribution of material.	More frequent distribution of campaign material is associated with decrease in number suicide incidents in subsequent months. Especially effective for male residents.		✓	
Metro Trains Melbourne (2016)	Target audience – children and young adults (18-29 year olds). Launched November 2012; <i>Dumb Ways to Die2:The Game</i> released in November 2014	Proactive Organisational Long term	Public Service Announcement promoting rail safety – involving video on television and YouTube , song (on iTunes and played at railway stations), game, Smartphone App, social media blog, children’s books, toys and other merchandise including clothing. Video used as informational/teaching tool in schools	Reported reduction in train station incidents following campaign reported, however difficult to determine actual contribution of campaign in the reduction of incidents Broad delivery of consistent safety message Reported as ‘most shared public service campaign in history’			✓

8.4 Control Systems Framework/Approach for Organisational Management

Reference	Sample/Data	Proactive/Response Current/Early/Long Term intervention	Description	Key Findings	Applicability		
					SH	T	T + SH
Measures Employed by the Rail Industry to Prevent Suicides on The Network Network Rail UK (2016)	Network Rail Involves internal and external resources in the community	Proactive Organisational Long term	Mitigation measures include: reducing accessibility, CCTV cameras with communication means, lighting, platform hatching/marketing, motion activated voice messages, visual screens, enhancing security and patrols, removal of memorials. 'Data collection Framework' developed. Training of rail. Prominent display of stickers, posters, signs and digital display material encouraging help seeking behaviour. Provision of post incident support to locations following a traumatic event.		✓		
Countermeasures to Mitigate Intentional Deaths on Railroad Rights-of-Way: Lessons Learned and Next Steps Gabree et al. (2014) Volpe National Transportation Systems Center http://www.fra.dot.gov	Review of information re trespasser fatalities and the countermeasures at intervention points along the path to complete suicide on railroad right-of-way	Proactive Organisational Long term	Intervention points include: preventing individuals reaching suicidal state, making the railroad less attractive, reduce accessibility to railroad, avoiding collisions with trespassers, reducing lethality of train-person collision, improving quality of data and reporting	Document serves as a reference to assist rail companies understand each countermeasure and its effectiveness on reducing suicide incidents at rights-of-way. In many cases a combination of countermeasures may be most effective.			✓

Research PF14 – Trespass/“Self-Harm”

<p>Proposals for a National Rail Suicide Prevention Strategy Lifeline Foundation (2012) Australia</p>	<p>Rail operators in Australia</p>	<p>Proactive Organisational Long term</p>	<p>Identified priorities: media and communication guidelines; promotion of help seeking behaviour to people in personal crisis; identify and implement best practice technique to support rail personnel; surveillance and monitoring on open track areas; site specific initiatives for 'hotspot' locations; training rail staff to identify suicide risk alert; protocols with health/police on post release support for individuals identified with mental illness</p>		<p>✓</p>		
<p>Improving suicide and prevention methods on the rail network in Great Britain Annual Report 2011 Rail Safety and Standards Board Ltd Brown et al. (2012)</p>	<p>Study of rail suicide in Great Britain commissioned in June 2010 Literature review, quantitative analysis, qualitative research and evaluation of existing Network Rail/Samaritans programme</p>	<p>Proactive Organisational Long term</p>	<p>Review what is currently known and inform the RSSB and rail industry of recommended future action</p>	<p>Communication: issues identified between train operating companies (TOCs) and Network Rail, between TOCs etc; Partnerships: with British Transport Police, other police forces, mental health services, voluntary organisations and local authorities; challenge misconceptions about suicide and ensuring the same message is disseminated to all staff; focus on men: lit review and quantitative analysis demonstrated increased risk of rail suicide among men; focus on stations.</p>	<p>✓</p>		
<p>Rail Industry Suicide Stakeholder Group (RISSG) Suicide Prevention on The Railway An Anthropological & Ethnographic Approach Pharoah et al. (2017)</p>	<p>Theoretical and practical work carried out between September 2016 and April 2017 Fieldwork was carried out at 4 locations which were identified by the rail industry for the study - Wimbledon and Raynes Park, Dronfield, Clapham Junction and Romford 10 full days at each site, using 2 researchers. Participants included individuals who had made previous attempts to take their own life (both on railway and other methods), individuals who had thought about taking their own life, local residents familiar with suicide at the station but had never been suicidal themselves, residents who had lost a loved one to</p>	<p>Proactive Organisational Long term</p>	<p>Literature review: including existing anthropological work on suicide to determine framework, collating local statistical and strategic reports pertaining to each location and 'grey literature' At each location - 8x4 hour tours and unstructured interviews with local residents, visit local stakeholders, informal station staff interviews, station tours, mapping and observation of local spaces and informal interviews with local residents</p>	<p>Three concepts: the 'ideation menu', 'hotspots' and railway suicide discourses Several recommendations including: standardised data collection to detect 'hotspots'; rapid initial responses to single events and/or certain numbers of staff interventions with rail users that do not end in suicide; influencing the wider narrative around railway suicide; consider 'mental barrier ' design options (lower cost than physical barriers); local mitigation strategies; introduction of suicide prevention innovation hub/s; monitoring of social media and public forums for discussions of suicide; exploring further the presence of the railway in 'ideation menu'; establish a clear set of policies around the level of transparency for media and local announcements at stations/on trains</p>	<p>✓</p>		

Research PF14 – Trespass/“Self-Harm”

	suicide, residents who had experienced depression/other mental health difficulty but did not self-identify as being at risk of suicide.						
Lessons learned from the collaborative European project RESTRAIL:Reduction of suicides and trespasses on RAILway property Havârneanu et al. (2016)	A 3-year research project, coordinated by the International Union of Railways (UIC) 25 recommended measures, 11 field tests	Proactive Organisational Long term	Project covered 5 issues: collection and analysis of data; assessment of preventative measures to reduce rail suicide and trespass; assessment of measures to mitigate consequences; pilot testing to evaluate some measures in the field; practical recommendations and guidelines	Training about rail suicide/attitude toward rail suicide/competence of staff; Collaboration among emergency/health services; Mid-platform fencing - increasing perception of safety on platforms /prevention of unsociable behaviour and controls access to areas. Educational program had a positive effect on trespassing; Warning signs/posters - discouraged pedestrians using illegal crossings, effective used in combination with other wider targeted campaigns; Video enforcement & sound warning system - reduction in trespass by 18% &44% at 2 pilot test sites; Combination of different resulted in 95% immediate reduction of trespass Forward Facing CCTV - provides real time remote access to images to key decision makers on the details of rail incidents (suicide/trespass/homicide) Development of RESTRAIL toolbox			✓

8.5 Identification of ‘Hotspots’ and Introduction of Controls at ‘Hotspots’

Reference	Sample/Data	Proactive/Reactive Current/Early/Long Term intervention	Description	Key Findings	Applicability		
					SH	T	T + SH
Mishara and Bardon (2014)	Results from research studies on the nature of railway suicide incidents in Canada over 10-year period	Reactive Organisational Long term	Installation of telephones, posters with helpline number in areas and along open track where suicide incidents have occurred	Focussing on ‘hotspots’ may prevent suicide incidents	✓		
Havârneanu et al. (2015)	n=139 in review	Reactive Organisational Long term	Aims to encourage help-seeking behaviour of individuals contemplating suicide Include: installing signs; posters to promote hotlines, crisis intervention and mental health services; crisis phones; electronic billboards with emergency button; communication poles on platforms for commuter to report if they notice a possible suicide candidate; trained outreach support staff available on-call	Unclear	✓		
Andriessen and Kryszynska (2012)	1092 railway suicide incidents (1998-2009) and 557 suicide attempts (1998-2009) in Belgium	Reactive Organisational Long term	Prevention measures applied at ‘hotspots’. Installation of electronic info billboards with emergency button to contact emergency services. Closing some level crossings and increasing safety at others	34 ‘hotspots’ identified accounting for 35% of cases; prevention measures installed at ‘hotspots’ by Infrabel (Belgium Railway Infrastructure Manager)	✓		
Strauss et al. (2017)	Data on location of suicide incidents on Austrian rail network 1998-2009 n=1170	Reactive Organisational Long term	Identify locations with highest densities of suicide incidents per railroad km Calculate psychiatric institution size (av. dept size for psychiatric department/unit of each medical centre/hospital) Determine possible influence of psychiatric institutions on railway suicide incidents	15 ‘hotspots’ identified corresponding to 9.8-16.8% of all suicide incidents in observation period Density of psychiatric beds is a significant predictor of railway suicide, other predictors include population density, multitrack structure and socio-economic factors. Structural separation of rail tracks from nearby psychiatric institutions is recommended	✓		

Research PF14 – Trespass/“Self-Harm”

<p>Debbaut et al. (2014)</p>	<p>Fatal and non-fatal suicidal incidents on Belgian rail network 2003-2009</p> <p>19 semi-structured interviews conducted</p>	<p>Reactive Organisational Long term</p>	<p>Analyse data over 5-year period, identify ‘hotspots’ (at least 2 suicide incidents recorded in a 2km section in the 5-year period)</p> <p>Visit ‘hotspot’ locations and identify characteristics</p> <p>Conduct semi-structured interviews with staff and management of mental facilities located near identified hotspots</p>	<p>43 ‘hotspots’ identified</p> <p>Risk and protective factors for rail suicide identified - training of staff, introduction of suicide prevention policy and the role of the media</p>	<p>✓</p>		
<p>Cox et al. (2013)</p>	<p>19 papers describing 14 studies at 13 locations worldwide met inclusion criteria</p>	<p>Reactive Organisational Long term</p>	<p>Search databases for systematic reviews and meta-analyses</p>	<p>4 main approaches: physical barriers; encouraging help-seeking; increasing likelihood of intervention by third party; responsible media reporting</p> <p>Reducing access to means can avert suicide incidents at ‘hotspots’ without substitution effects.</p>	<p>✓</p>		
<p>Pirkis et al. (2013)</p>	<p>9 independent intervention studies</p>	<p>Reactive Systemic Long term</p>	<p>6 studies examined effect of barriers installed on bridges/viaducts; 2 studies considered the effect of fencing off road access to cliffs; 1 study examined effectiveness of installing a safety net below the top of a cliff</p>	<p>Pre-intervention - mean of 5.7 deaths/year; post-intervention mean of 0.5 deaths/year</p> <p>44% increase in the number of jumping suicide incidents per year at nearby sites.</p> <p>Net overall effect was reduction of 28% in number of deaths/year</p>	<p>✓</p>		

8.6 Signage

Reference	Sample/Data	Proactive/Reactive Current/Early/Long Term intervention	Description	Key Findings	Applicability		
					SH	T	T + SH
Silla and Luoma (2011)	12 locations with frequent trespass in Finland n=17 days	Reactive Organisational Now	Prohibitive 'No trespassing' signs	30.7% reduction of trespass in daylight only Benefits-cost ratio 5.7			✓
Havârneanu et al. (2015)	n=139 in review, 3 studies involving signage	Proactive Organisational Long term	Before and after analysis of trespass data at specific locations	Prohibitive signs reduced trespass frequency		✓	
Mishara and Bardon (2014)	Studies over 10-year period in Canada - open track where suicide incidents have occurred and in stations	Response Organisational Long term	Installation of telephones and posters at identified 'hotspots' advertising helpline numbers	Focussing on 'hotspots' and introducing signage may prevent suicide incidents	✓		
Havârneanu (2017)	2 projects - RESTRAIL (Reduction of Suicides and Trespasses on RAILway property, 3-year project ending in Sept 2014) and GRAFFOLUTION (2-year project ending in Feb 2016)	Proactive Systemic Long term	Both projects employed systematic review of literature, collection of data from railway organisations and infrastructure managers, identification and evaluation of most promising measures	Prohibitive signs regarded as highly effective in both projects; Signs in combination with new fences and surveillance cameras were effective.			✓

8.7 Collaboration with Other Stakeholders/Entities

Reference	Sample/Data	Proactive/Reactive Current/Early/Long Term intervention	Description	Key Findings	Applicability		
					SH	T	T + SH
Havârneanu et al. (2015)	n=139 in review, 2 studies involving enforcement and patrols; 1978-2014	Proactive Organisational Long term	Identify past and current trends in prevention of suicide and trespassing	Consultation and collaboration with other entities recommended, including psychiatric hospitals in proximity to railway lines and implement a national suicide prevention strategy.			✓
Lukaschek et al. (2011)	202 German Federal Police officers completed questionnaire on intranet (mean age 41 years, 84.9% male)	Proactive Organisational Long term	Regression analyses performed to predict prevention of suicide incidents (first model) or demand for counselling as outcomes (second outcome).	Behavioural patterns preceding suicide provide important clues on suicidal intention	✓		
Havârneanu (2017)	2 projects - RESTRAIL (Reduction of Suicides and Trespasses on RAILway property, 3-year project ending in Sept 2014) and GRAFFOLUTION (2-year project ending in Feb 2016)	Proactive Systemic Long term	Both projects employed systematic review of literature, collection of data from railway organisations and infrastructure managers, identification and evaluation of most promising measures	Law enforcement measures identified as effective in both projects. Targeted visible security patrols and fine illegal and unsafe behaviour. Rail staff can work with other entities to identify trespassers, e.g. police.			✓

8.8 Specific Education for Rail Staff

Reference	Sample/Data	Proactive/Reactive Current/Early/Long Term intervention	Description	Key Findings	Applicability		
					SH	T	T + SH
Havârneanu et al. (2015)	n=139 in review, 1 study involved training of rail staff	Proactive Organisational Long term	Gatekeeper training for staff, police, security guards etc; staff trained to manage suicidal contacts, to understand the behavioural patterns of individuals at risk and vulnerable time windows of excess risk for railway suicide incidents, identify and report signs of trespass, raising awareness of post-traumatic events and the prevention of post-traumatic stress	Training programmes have led to staff intercepting possible suicide attempts			✓
Mishara and Bardon (2014)	Results from research studies on the nature of railway suicide incidents in Canada over 10 year period	Reactive Organisational Now	Training railway personnel to recognise behaviours identified as suicidal	Trial recommended - community awareness campaign	✓		

8.9 Monitoring and/or Detection Systems in Specific Locations

Reference	Sample/Data	Proactive/Reactive Current/Early/Long Term intervention	Description	Key Findings	Applicability		
					SH	T	T + SH
Ketcham et al. (2014)	CCTV footage at stations	Proactive Local Now	Intruder detection of yellow line located on the ground near platform edge at stations	95.52% accuracy of detection of intrusion of yellow line			✓
Kallberg and Silla (2017)	2 test sites in southern Finland where an illegal footpath crossed a railway line Frequent trespassers Data collected before and after installation of system.	Reactive Local Now	System installed to provide sound warning to trespassers. Persons who crossed the tracks/ were about to cross the tracks detected by infrared sensor, which triggered a pre-recorded voice message.	Trespassing reduced at both sites by 44% and 18% respectively Frequency of average daily trespassing reduced at both locations		✓	
Preventing railway suicide: An open systems perspective and application Keating and Gordon (2018)	Team of researchers based out of ANU and Sydney Trains Sydney Trains data	Systemic Long	Development of new approach for monitoring at-risk suicide behaviour using automated video analysis Development of real-time early warning system to provide rail operator the ability to respond Analysis of interplay among different interventions and the effect of situational factors on efficacy of interventions	Preliminary work partially completed which includes lit review and analysis of different situational data			✓

8.10 Engaging with Lived Experience Individuals

Reference	Sample/Data	Proactive/Response Early/Now/Long Term intervention	Description	Key Findings	Applicability		
					SH	T	T + SH
Marzano et al. (2016)	Online survey - n=1804 In-depth qualitative interviews- n=34 Analysis of CCTV footage - 15 railway suicide incidents Analysis of news/online content - 21810 news reports of suicide, 240 internet sites, 61000 rail-related tweets	Proactive Systemic Long term	Aim: to understand why people take their own lives on the rail network and what factors may influence theory decision Studies conducted: online survey, in-depth qualitative interviews, analysis of CCTV footage, analysis of news and online content Suggestions from participants sought for suicide prevention	What is attractive about railway methods? Certain and quick lethality, influence of media announcements (reinforcing perception of high, 'automatic' lethality), accessibility/avoiding intervention What deters people from railway methods? Lack of fast trains, likelihood of intervention, not wanting to hurt other people, including the driver (common theme in survey respondents, interviews, online blogs and discussion forums) Participants' suggestions - restricting access, addressing perceptions of lethality, having someone to talk to (in person, text, email to avoid being overheard) or outreach teams at stations, making the environment feel more positive and friendly, training to help rail staff/community identify people in distress and respond	✓		

8.11 Community Survey

Reference	Sample/Data	Proactive/Reactive Current/Early/Long Term intervention	Description	Key Findings	Applicability		
					SH	T	T + SH
Silla et al. (2012)	East Finland, n=502 The rail track divides the city into two parts, leading to frequent crossing of track. Response rate was 33.5%	Reactive Systemic Long term	Survey to investigate opinions of local community on railway trespassing.	89.2% had seen people trespassing; 68.9% of respondents had personal experience of trespassing; 83.5% considered trespassing to be fairly or highly dangerous. Respondents supported counter measure and education in schools on the dangers of trespassing was suggested, especially schools near railway lines		✓	



E acri@infrastructure.gov.au
T +61 2 6274 7149 **W** www.acri.net.au
A 111 Alinga Street, Canberra City, ACT 2600
P PO Box 238, Civic Square, ACT 2608, Australia

CONTACT US

