Reducing suicide and trespass in rail

Brendan Ryan, University of Nottingham

Abstract— Suicide and trespass are major contributors to risk on the railway, resulting in around 250-300 fatalities per year in Great Britain, as well as associated major disruption to the rail network. The EU project (RESTRAIL), with good coverage of experts and rail operators from across Europe, is attempting to tackle these important issues. This paper outlines two parts of the project that are being led by the University of Nottingham in the UK, namely the understanding of behaviours prior to suicide and trespass incidents and the evaluation of preventative measures for suicide and trespass.

Keywords— behaviour, evaluation, prevention, railway suicide and trespass.

I. INTRODUCTION
Suicide and trespass result in more than 250 fatalities each year on the Great Britain (GB) rail network, with obvious impacts on the people involved (and their families) and the associated major disruption to the rail network. Whilst the numbers of fatalities linked to railway accidents have generally fallen over the years [1], the suicide and trespass fatalities have not been reducing. The numbers of suicide fatalities have fluctuated around 220 (approximately 0.3 per 100000 population, accounting for 3.4-4.0% of the national total of all suicides, [2,3]). Approximately 40% of these occur at stations, 7-14% at railway crossings and 45% at other locations [4]. There may even be an increase in railway suicide, based on recent monthly counts of events, in spite of efforts in GB to reduce these [5]. Trespass fatalities have been in the region of 50 each year [4]. These can include incidents involving people taking short cuts (to get from one side of the line to other, crossing to other platforms at stations by unauthorised routes), children playing on the railway, people committing crimes (e.g. graffiti, stealing copper), or recovering lost property (e.g. at stations). Death and serious injuries can occur largely through being struck by trains, with smaller numbers of fatalities occurring through contact with live electrical conductors. In these situations, those involved do not generally perceive the risk in accessing the railway.

This situation is not unique to GB, with over 850 railway suicide and trespass fatalities each year in Germany (approximately 0.7 per 100000 of population, 6.0% of annual suicides) and around 200 suicide fatalities each year in the Netherlands (1.14 per 100000 population, 13.0% of annual suicides) [2].

II. OVERVIEW OF THE RESTRAIL PROJECT
RESTRAIL (www.restrail.eu) is a 3 year, 3.9m Euro European Union FP7 project that is aiming to reduce suicide and trespass in rail. The University of Nottingham is the only UK representative in a consortium of 17 European partners, though is working with strong support from RSSB, Network Rail, the British Transport Police (BTP) and the Samaritans to provide data and expert input from Great Britain to the project.

The RESTRAIL project includes:
- the collation of statistics on incidents and practices and processes for prevention, mitigation and management of incidents across Europe
- evaluation of known preventative measures for suicide and trespass and development of new measures
- development of methods and tools to integrate with existing procedures and technologies to mitigate the potential consequences of incidents
- piloting and demonstration of promising measures.

This paper has a particular focus on two areas of the project which are led by the University of Nottingham:
- the behaviours of people in the period leading up to an incident
- the development and use of methodology to evaluate preventative measures for suicide and trespass in rail.

III. PREVENTING RAILWAY SUICIDE AND TRESPASS
Efforts to prevent suicide and trespass on the railway are not futile. There are a number of commonly heard statements,

"...you can’t stop people doing this”,

".... if you stop people they will try again somewhere else”,

"...this is not a railway issue”.

There are elements of truth in these statements. However, there is evidence from other contexts that supports the potential effectiveness of preventative measures [6]. For example, restricting easy access to a means of suicide is a major factor in prevention and there is generally thought to be a low risk of substitution to another method or location [7, 8]. Suicide can be transitory and impulsive in some circumstances and successful interventions do not necessarily lead to later attempts [7]. Furthermore, railway suicide and trespass have major impacts on the industry, on staff and general performance [3, 9].

Railway organisations, among others, have important roles to play in tackling these problems. Nevertheless, there are great challenges for prevention. There is access to the railway (e.g. at stations and crossings) and some (but certainly not all) incidents occur with very little warning. The remaining sections of this paper contain a brief overview of two parts of the RESTRAIL project that the University of Nottingham are
leading. These pieces of work contribute to the understanding of how the early identification of suspicious behaviour could lead to better interventions to prevent incidents.

IV. UNDERSTANDING OF BEHAVIOURS LEADING UP TO SUICIDE AND TRESPASS INCIDENTS

There is currently little information in the literature on the behaviours of people in the period leading up to these types of incidents. There are references to some behavioural patterns prior to railway suicide events (e.g. dropping or leaving behind personal possessions, taking off clothing, wearing unusual clothing or carrying personal items [10, 11, 12]) but these offer limited scope for the early identification of opportunities for intervention. The work in RESTRAIL has attempted to broaden the understanding of the behaviours of people prior to incidents. In this context, behaviour can include the physical, observable actions of the people involved, how people interact with their environment (such as how they get access to the railway), but also linked to this is what can be inferred about their choices and decisions and the strategies that they employ (e.g. in concealing themselves to avoid being disturbed). In terms of prevention, the time window for intervention can be very short or much longer (depending on the point at which the behaviours are observed) and this can influence the choice of different types of interventions that are needed.

The work in this part of the project aimed to build on the limited detail within existing literature. Preliminary plans were put in place to explore the collection of the information in a series of stages. These included the following:

- Analysis of what is already documented in railway or other sources, such as the narrative content of databases, to identify pre-recorded historical details of behaviours (i.e. based on reports from witnesses) (e.g. in Great Britain, Germany)
- Interviews and/or workshops with expert staff from rail organisations and transport police, to collect their expert knowledge and experience of behaviour in these contexts (GB, Spain)
- Structured observations of behaviours leading up to trespass events (using data from CCTV), to collect specific data on behaviours (Finland).

This work has therefore included new studies in four countries, as well as additional analyses of contents of historical reports and databases. The work that has been carried out in Great Britain is outlined below.

A. Workshops with expert staff from the British Transport Police, Network Rail and the Samaritans

The aim of the workshops was to bring together people with specific experience of dealing with incidents involving railway suicide and trespass, with the primary goal of collecting information and exchanging ideas to understand more about the behaviours of people in the period prior to an incident.

Two workshops were conducted with a total of 12 expert staff in mixed groups from the participating organisations. The workshops included a series of different exercises to collect information from the experts in a semi-structured format. In the second workshop, some of the preliminary findings from the first workshop were fed back to staff, as a means of validating some of the points that had been made and in order to prompt additional discussion of similar or differing viewpoints.

Forms that were filled in by the participants and handwritten notes that were prepared by the researcher during the workshop exercises were typed as a record of the workshop. A similar process was used for analysis of the content from the different exercises in the workshop. The transcriptions were read and coded, using labels which the researcher produced, to summarise the content of relevant phrases from the text (e.g. to identify phrases which related to similar types of behaviours). The codes and the data which were linked to the codes were reviewed and compared, revising the groupings of relevant parts of the data or refining the coding as necessary. Findings from the analyses were presented in a series of tables, which summarised the findings from the different parts of the workshop. These tables included the codes or themes which described the groupings of different aspects of the findings (such as types of behaviours or interventions), as well as examples of specific comments which were useful in illustrating the content of these groupings. For the purpose of this paper, only brief summary findings are presented. Table I presents a summary of the content and findings from the workshops with the twelve experts.

The discussion focussed more on behaviours linked to suicide than behaviours linked to trespass. Generally, it was felt by the experts that there are patterns of behaviour that can be used to identify those at risk of suicide. People who do get stopped from committing suicide do have positive outcomes and can return to normal activities. The experts explained how identifiable behaviours can be traced back much earlier than those that can be observed at a station, though even these are sometimes only evident with hindsight. There was thought to be a need for more learning in front line staff, and more systematic ways of achieving this. Additional efforts may be needed to develop the observational skills of staff in these railway situations. It was suggested that the current Samaritans course for railway staff makes you more observant ("you know what to look for"), but this needs to be evaluated. This current research has taken further steps to answering some important questions - What are the characteristic things that can be observed? What is unusual in the railway environment? However, clear answers are not yet available. Some of the immediate behaviours that have been identified are commonplace in passengers in railway stations (such as waiting for periods of time on the station). A better understanding of the observable behaviours at stations could potentially be obtained through better analysis of the information that is available (e.g. through additional analysis of CCTV footage).
The workshop included a variety of exercises aimed at helping participants to better understand and implement interventions aimed at preventing suicide and trespass. These exercises included:

- **A written exercise which collected accounts of an occasion when someone was acting suspiciously, and details of any actions or interventions that were made**
  - This exercise identified a range of different types of behaviours and examples of interventions that were made in these circumstances, some of the challenges that the experts faced in doing so.

- **Discussion within groups to identify and write down different types of behaviours of people in the period of time leading up to suicide / attempted suicide and trespass**
  - Produced a classification of:
    - some of the short term behaviours (e.g. at stations, such as loitering or letting trains pass by), though it could be difficult to identify some of the more immediate behaviours, from amongst those that would be common place at many railway stations.
    - longer term behaviours (that could be observable in the home or community, such as taking less care of personal appearance).
    - For trespass, distinctions were made between accident, criminal and cultural and medical aspects of behaviour.

- **An exercise that was designed to give the expert participants a new perspective from which to consider the problem, using a series of questions to help them to consider how they would help a junior colleague in conducting their duties**
  - These questions were designed to lead participants in a series of steps to explore how they determine risk in a situation, how they developed their knowledge, what cues alert them to a problem, which factors influence their intervention, what types of interventions can be made and which type of support that they think that they need to do their job better.
  - Experts reported on the need to share personal experiences, use formal sources of support (e.g. through policies), make compassionate interventions, however small, especially where there was an indication of vulnerability or threats to safety.
  - In terms of cues which alerted the experts to problems, there were a number of commonly mentioned examples (e.g. loitering, indications of being upset). Several participants raised the concept of “gut feeling”, which alerted them to the fact that someone may be at risk.
  - There was thought to be a need for various developments (better collaboration, more knowledge and training in what to look for and how to intervene), as well as a change in attitudes of people in general, with greater confidence to do something and be more compassionate to people involved.

- **An exercise to produce sketches and annotate relevant details, to illustrate how aspects of design of the railway environment can influence behaviours of people.**
  - This resulted in suggestions of:
    - need to restrict access to fast lines that run close to platforms and could encourage suicide attempts,
    - need to discourage access to the track where it is easy to do so (such as from the ramps at platform ends)
    - need to remove places of concealment (e.g. dark places in stations),
    - a general fear of using underpasses,
    - need to avoid convenient short-cuts (such as to get home from the pub on a night out) or temptations of a location (e.g. for graffiti),
    - the condition at the railway locations (e.g. making sure that lighting is working and vegetation is cut back, so that places look like they are in use and are visited daily by people).

- **An exercise to get the participants to bring together all that they had considered in discussions, giving their top ten “rules of thumb” for the early identification of those at risk, producing written lists.**
  - This highlighted:
    - making it easier for people (and families) to ask for help (e.g. reducing stigma of mental illness and raising the awareness of sources of help in people),
    - better coordination between organisations and need for organisations to act where they have responsibilities,
    - carrying out better analysis of information held by organisations (e.g. CCTV, demographic information) and using existing knowledge better (e.g. sharing of information)
    - reacting to some specific short term behaviours (e.g. lack of eye contact, staring or no interaction with others, unusual behaviour (for the location), waiting for periods of time) and longer term behaviours.

### TABLE 1

**Summaries of analyses of responses from experts**

<table>
<thead>
<tr>
<th>Outline of the exercises in the workshop</th>
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<tr>
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| Discussion within groups to identify and write down different types of behaviours of people in the period of time leading up to suicide / attempted suicide and trespass | Produced a classification of:
  - some of the short term behaviours (e.g. at stations, such as loitering or letting trains pass by), though it could be difficult to identify some of the more immediate behaviours, from amongst those that would be common place at many railway stations.
  - longer term behaviours (that could be observable in the home or community, such as taking less care of personal appearance).
  - For trespass, distinctions were made between accident, criminal and cultural and medical aspects of behaviour. |
| An exercise that was designed to give the expert participants a new perspective from which to consider the problem, using a series of questions to help them to consider how they would help a junior colleague in conducting their duties | These questions were designed to lead participants in a series of steps to explore how they determine risk in a situation, how they developed their knowledge, what cues alert them to a problem, which factors influence their intervention, what types of interventions can be made and which type of support that they think that they need to do their job better.
  - Experts reported on the need to share personal experiences, use formal sources of support (e.g. through policies), make compassionate interventions, however small, especially where there was an indication of vulnerability or threats to safety.
  - In terms of cues which alerted the experts to problems, there were a number of commonly mentioned examples (e.g. loitering, indications of being upset). Several participants raised the concept of “gut feeling”, which alerted them to the fact that someone may be at risk.
  - There was thought to be a need for various developments (better collaboration, more knowledge and training in what to look for and how to intervene), as well as a change in attitudes of people in general, with greater confidence to do something and be more compassionate to people involved. |
| An exercise to produce sketches and annotate relevant details, to illustrate how aspects of design of the railway environment can influence behaviours of people. | This resulted in suggestions of:
  - need to restrict access to fast lines that run close to platforms and could encourage suicide attempts,
  - need to discourage access to the track where it is easy to do so (such as from the ramps at platform ends)
  - need to remove places of concealment (e.g. dark places in stations),
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  - need to avoid convenient short-cuts (such as to get home from the pub on a night out) or temptations of a location (e.g. for graffiti),
  - the condition at the railway locations (e.g. making sure that lighting is working and vegetation is cut back, so that places look like they are in use and are visited daily by people). |

Some of the discussion focused on how the experts identified people at risk through “gut feeling”. This was explained as “something not right... it uses a combination of the senses”. The responses from workshops do not contain the underlying detail that is needed to understand the nature of “gut feeling” in this context, though this is a concept that is worthy of further investigation and is being considered in on-going research [13].

How people lead up to suicide on the railway can be very variable. For example, people involved may have health or social issues and the need for inter-agency working and sharing of information was mentioned frequently. It will be important to consider how any lessons that can be learned can be applied in railway contexts. Things are being done. For example, the British Transport Police are doing a lot on prevention, changing the attitudes of officers and helping them to be aware of the potential impacts of their actions and their approach to dealing with these situations when people are vulnerable. It may be possible to broaden this type of approach to encourage more interaction between people (including the public and other professionals that become involved in these incidents). The experts gave examples of instances in which abnormal, suspicious behaviour may be recognised, but people did not generally challenge this or intervene. This could be effective, but difficult to develop in practice. How do we empower people to intervene and offer support in the different situations in which they encounter people in need of assistance?

### B. Analysis of existing sources of information on behaviours

This part of the analysis included analysis of a number of existing data sources. The process of analysis of the qualitative data was similar to that described above. Brief findings from these analyses of different sources are summarised in Table 2.
TABLE 2
SUMMARY OF ANALYSES OF DIFFERENT DATA SOURCES ON BEHAVIOUR

<table>
<thead>
<tr>
<th>Type of data source</th>
<th>Summary of findings from the analysis</th>
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<tr>
<td>Narrative data on</td>
<td>These are largely based on witness reports by the driver or other sources (e.g. from brief reports of CCTV evidence) and therefore include details of some of the behaviours that have been observable in the final moments leading up to an incident. Analysis was carried out for a sample of the descriptive data for 66 fatalities (almost all thought to be suicide) in a three month period. Relevant sections of the narrative accounts were classified according to 3 typical pre-suicide behaviours (lyeing, jumping, wandering), in a similar manner to that carried out by Guggenheim and Weisman (1972) and Dinkel et al (2011), determining the modes of access to the track. Some additional findings from this analysis are summarised below. The analysis gives indications of the following:</td>
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<td>reports of behaviours of people, as recorded in the industry SMIS database (the industry safety management information system database).</td>
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<tr>
<td>Analysis of a small sample (11 extracts) of the descriptions of behaviours from CCTV footage, by the Coroner Liaison Officer for the BTP</td>
<td>The findings provide details of the longer term, medium term and short term behaviours. These include:</td>
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<tr>
<td>Analysis of examples of testimony or case studies that are collected by the Samaritans, which contain free text descriptions and describe details of observed behaviours and interventions</td>
<td>These testimonies include:</td>
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</table>

There is much information that is already available to the industry, with the potential for understanding more about behaviours in the period prior to incidents. In this review in RESTRAIL, small samples from a number of different sources have been examined to consider the potential for use of these data to understand more about the behaviours of people leading up to incidents. The different data sources cover a number of different timeframes. For example, the observations from drivers in the SMIS data focus on the very short term behaviours, immediately before an impact, whereas the observations of CCTV by the Coroner Liaison Officer extend back to a period of around 30 minutes in a number of instances. These analyses add to what is known currently (e.g. adding some relevant descriptive characteristics to the existing knowledge of modes of access to the track). Suggestions for additional analyses have been made in a number of circumstances.

V. EVALUATION OF MEASURES FOR THE PREVENTION OF SUICIDE AND TRESPASS

The improved understanding of behaviours leading up to incidents contributes to a second area of work where the University of Nottingham has a major contribution to the RESTRAIL project. There are many known preventative measures, with different modes of operation (e.g. physical barriers to prevent access to the track, surveillance based technologies for early warning of events, and station design or campaigns to influence the behaviour of people in the vicinity of the railway). However, the effectiveness of these and other types of measures is not known.

A. Identification of known preventative measures for railway suicide and trespass

Work within RESTRAIL has collected details of all known preventative measures for railway suicide and trespass, through consultation with partners across Europe. This produced a list of 67 preventative measures and these have been grouped into 38 “families of measures”, based on their mode operation. Examples of the families of measures are included in Table 3.

Rådbo and colleagues have already begun to develop a classification of different prevention strategies for railway suicides [14] and a number of these classes can be seen in the examples in Table 3. Several of the measures attempt to reduce the attractiveness of the railway as a means of suicide or for trespass, or dissuade people from accessing the railway. Others use design to influence movements of people away from high risk locations at stations. Fences or barriers prevent the means of access to the railway (for suicide and trespass), though the circumstances in which these are used are different at stations and beyond stations. Some of the measures are based around early interventions when a person is in a high risk area. Some measures could also help to mitigate the consequences of a collision.
TABLE 3
EXAMPLES OF PREVENTATIVE MEASURES

| Surveillance to deter: CCTV and sound warnings | Increased visibility by lighting at railway crossings, tunnels and hotspots |
| Design of stations and other locations to influence the movements of people |
| Fences and barriers at specific parts of stations |
| Fences and barriers at high risk locations outside stations where people take shortcuts across tracks |
| Design of trains to reduce the effects of impact |
| Mass media campaigns |
| Training of staff at stations - Gatekeeper training |

B. Development and use of evaluation criteria

The 38 families of measures are being evaluated using fourteen different criteria which have been developed from earlier work by Elvik and colleagues [15] on the EU SUPREME road safety evaluation project. Supplementary criteria have been developed for use in this rail context. The criteria that are being used for evaluation are outlined in Table 4.

TABLE 4
CRITERIA THAT HAVE BEEN USED IN THE ANALYSIS

| 1. Description of the measure |
| 2. Definition of target incidents |
| 3. Size of the problem (e.g. number of target incidents per year) |
| 4. Effect on incidents (%) |
| 5. Durability of effects |
| 6. Costs and benefits |
| 7. Integration with other policy measures |
| 8. Impact on railway operations |
| 9. Impact on people and jobs |
| 10. Technological issues |
| 11. Environmental issues |
| 12. Acceptance |
| 13. Transferability issues |
| 14. Additional information |

C. The process of evaluating preventative measures for suicide and trespass

A process has been developed for the evaluation of the measures, including the following stages:

- Collecting together evidence for each of the families of measures, using a specially designed form which includes the evaluation criteria.
- Consulting more widely with EU partners (including rail operators and relevant experts) for more information on application of the measures and details of any existing evaluations of the measures.
- Expert review of the evidence for the potential success of the measures, to identify those that are promising and suitable for further development and use within RESTRAIL.
- Additional analysis of the more promising measures, including cost-benefit analysis.
- Development of recommendations for pilot testing of the better measures in a later work package in RESTRAIL.

Further details of the process of evaluation in RESTRAIL and the development and use of the evaluation criteria are available [16].

D. Intermediate findings from the evaluation

This evaluation is on-going. An expert group meeting is scheduled for mid-October 2012 and the project will produce recommendations for pilot testing of a selection of measures for suicide and trespass by the end of the year. Some of the intermediate findings are discussed.

The preventative measures have been classified according to whether they can target suicide, trespass or both suicide and trespass incidents. In the case of the latter group, the majority of measures that have an impact on suicide and trespass (e.g. fencing as one example) would be expected to have a positive influence (i.e. reducing suicide and trespass incidents). For a small number of preventative measures, there may be an opposing effect on suicide and trespass. For example, a measure to warn of the danger of trains in a specific location would be expected to have a positive effect on trespass (reducing the numbers of trespass), but a negative effect on suicides (potentially increasing the numbers of suicides) in this location. The process of evaluation will account for these types of anomalies.

The early part of the evaluation process has involved the collation of relevant information on each of the families of preventative measures, using the evaluation criteria as a structure for searching for and recording relevant information. This is the first exercise that we are aware of that has attempted to collect together such a wide body evidence about this range of measures. Generally there is a lack of relevant information on both the use and the evaluation of preventative measures, either in literature or documented within industry. Whilst there are many preventative measures in operation, few, if any have been evaluated. This is a problem that is common in this type of context. Efforts are in progress in other work in GB to evaluate the success of the Samaritans’ initiatives [5]. Evaluation in this type of context will be considered in greater detail in a special session at Fourth International Rail Human Factors Conference in London in 2013.

There are likely to be different effects of preventative measures in different European contexts. The evaluation process that has been developed accounts for this, collecting relevant detail on contexts in which measures are applied, to develop a clearer idea of the circumstances in which measures may work or not work.

The process has been developed to harness the expertise (in suicide, trespass or other technical areas) and operational rail experience of our partners and their contacts within the industry. Experience has suggested that it will probably be necessary to consider the application of preventative measures in combination, in relation to specific railway locations (e.g. stations, crossings).

VI. CONCLUSIONS - WHAT DO WE KNOW ABOUT BEHAVIOURS AND HOW DOES THIS CONTRIBUTE TO OUR UNDERSTANDING OF REQUIREMENTS FOR PREVENTION?

The workshop studies have collected information on behaviours of people at risk of suicide or trespass incidents and opportunities for interventions, using experts from a range of organisations working in this area. This information was supplemented with the analysis of a number of pre-existing sources of data, partly to collect behavioural related data and partly to explore the potential for using these types of pre-existing sources of information.
The findings add to what is known currently about behaviours and is reported in the literature. The classifications that have emerged of different types of behaviour, provide the basis of a preliminary framework that could be used and developed in future analyses of this kind.

There are opportunities for prevention, based on understanding of some of the behaviours of those involved in trespass and suicide incidents, and a number of examples of interventions have been outlined. These opportunities are more difficult in response to some behaviours (often seemingly normal behaviours, or hidden from view), and in particular because of the limited time period in which to react and initiate an intervention. In the future, there may be technologies (e.g. linked to video analytics) that can be used to help to make much faster and effective interventions, as well as better interventions by railway staff and others in the vicinity. However, the effectiveness of these interventions will be dependent on being able to identify the types of behaviours that are known to put a person at increased risk of being involved in an incident. The findings from this work therefore help to contribute to development of requirements for prevention.

Some of the examples of the longer term behaviours (e.g. observable in the home or community) might offer greater opportunities for intervention, though these could be beyond the normal scope of work for rail organisations. Findings from the workshops with experts refer to the need for changes within organisations, better interactions between organisations, and more broadly to changes in society. The industry may need to consider how it can engage more effectively with external organisations and the public who are using the railway, in further efforts to understand and respond to these complex issues of railway suicide and trespass.

The analysis of pre-existing data sources has looked at small samples, though demonstrated that analyses of this type can be fruitful. Some of the findings will not be new to railway related staff, who will be aware of many anecdotal reports of these types of behaviours. It is likely that there are additional sources of more detailed descriptive information that will be held by various organisations (e.g. police, coroner or rail organisations) and there is scope for more in-depth analysis. The value in this piece of work at this time is in bringing together and trying to articulate the range of behaviours that are evident in the period leading up to incidents of these types.

The research that has been reported here is also contributing to understanding of the range of preventative measures for railway suicide and trespass. This is the first study that has attempted to collate this type of evidence for the success (or not), of such a wide range of measures. The process that has been developed uses a broad range of evaluation criteria to collect and record the evidence for the evaluation. Difficulties have been experienced (e.g. evidence that is needed for evaluation of the effectiveness of measures is limited). However, the evaluation is based on a structured, transparent process and draws on technical and operational expertise from across Europe, in selecting a shorter list of measures that are appropriate for further testing in RESTRAIL. At this stage of the project, there will be additional opportunities to define an evaluation strategy and collect relevant data for evaluation of the selected measures within the demonstration phase of the RESTRAIL project.

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