Motivations for trespass on the GB rail network

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ABSTRACT

This paper reports on an RSSB and Department for Transport funded research project to consider the effectiveness of Trespass Detection and Prevention methodologies. The paper focuses on work to identify the prevalence of trespass, understand why it happens and identify the types of interventions that can be used to try and prevent it from occurring. The work involved a literature review and analysis of trespass data between 2017 and 2020. The output of the work has led to a range of guidance materials, such as how to conduct trespass risk assessment, how to select interventions and then how to measure their effectiveness. This guidance is available on the RSSB website <u>https://www.rssb.co.uk/safety-and-health/improving-safety-health-andwellbeing/trespass/tackling-trespass-risk</u>

KEYWORDS

Trespass, motivation, behaviour, interventions, GB rail network

Introduction

This paper reports on a project conducted to better understand the motivation for trespass on the rail network and how this differs geographically and temporally across the GB network. The work was conducted by a team of HF specialists and encompassed a literature and data review. The aim of the project was to develop guidance to enable industry selection of the best approaches to prevent trespass at specific locations and support effective measurement of intervention effectiveness.

Trespass is a complex issue and there are many inter-related reasons that can lead to trespass. Identifying an effective method of prevention can therefore be difficult. For example, one solution, such as fencing applied at one location, may displace trespass to another location.

Definitions and project focus

In the context of the project and as defined by the Trespass Risk Group, trespass is defined as: "*Any case of a person in an area in which they are not permitted to be at that time.*" A person in an area in which they are not permitted covers a range of circumstances, such as a person jumping from platform to track or trespassing on a running line from a level crossing.

It should be noted that the work focused on trespass events and not suicidal or pre-suicidal behaviour. The two areas are closely linked as people often trespass on the rail network in prohibited areas to enact suicide which means it is not always possible to clearly separate these types of acts. The review therefore identified suicidal or pre-suicidal behaviour but did not seek to explore these events in more depth.

Approach

Eight research questions (as follows) were used to guide the research team in their approach to ensure the research aims, set out within the client's statement of requirement, were met.

- R1 What are the number of trespass events?
- R2 When do trespass events occur?
- R3 Where do trespass events occur?
- R4 Who is involved in trespass events?
- R5 What are the motivations for trespass events (crime, convenience etc.)?
- R6 What are the observable types of trespass behaviours?
- R7 What other factors contribute to trespass events (socio-demographic, station usage)?
- R8 Which interventions work best in preventing trespass?

These questions were used to identify relevant material for inclusion in the literature review and to inform the analysis of rail trespass data provided by the National Disruption Fusion Unit (NDFU), hereafter termed Fusion Data (FD). The NDFU combines Network Rail (NR) and British Transport Police (BTP) expertise to offer insight in causes of disruption on the rail network. A key use of the FD data is to identify rail trespass hotspots which are defined as locations (i.e. stations) or routes (length of track) where more than 12 Trespass events occur annually.

The review of literature was conducted in accordance with principles presented by the Temple University libraries (Systematic Reviews & Other Review Types, 2020) for an effective 'Scoping Review'. The review focused on understanding trespass in the rail domain but also considered knowledge from other sectors (e.g., road, criminology) and academic papers on subjects such as delinquency and risk taking in adolescents. Pre-approved search terms were used to identify relevant materials from databases, such as 'Science Direct'. Online searches were made of relevant websites, such as the Office of Rail and Road, Rail Accident Investigation Branch and the RSSB SPARK research database. Exclusion criteria, such as year of publication, direct relevance to research questions & duplication) were applied to screen materials. In total 93 publications were identified and reviewed in depth¹.

In addition to the literature review analysis was also conducted of FD, which represents approximately 68,000 instances of trespass incidents for GB railways between 2017 and 2020. This data comes from Trains Running Under System Tops (TRUST) and/or Safety Management Intelligence System (SMIS) sources. This data was analysed in two ways. Qualitative data analysis sought to identify themes with respect to the reasons why trespass events were occurring. Quantitative data analysis then sought to explore statistical trends in the data. For example, correlations were run to test for a relationship between socio-demographic variables, such as the English Index of Multiple Deprivation (IMD) and the location of trespass related events. A review was also carried out of seven NDFU Trespass Insight Assessment (TIA) reports produced nationally and regionally.

The project team were supported by input from a steering group and stakeholders such as NR route crime managers (RCM).

Findings

Research findings have been synthesised per research question and presented below.

R1 What are the number of trespass events?

¹Only a small number of materials reviewed have been cited in this paper.

According to RSSB, reporting of trespass events rose by about 40% to 50% between 2014/15 and 2018/19, rising to over 13,000 events in 2018/19, (RSSB Annual health and safety report. A reference guide to trends on GB railways. 2018/19, 2020) Reporting of trespass from other sources, such as BTP and NR, also indicate the number of trespass events have increased. Passenger numbers have risen by approximately 6% over this period (2014 - 2019), indicating that the rise in trespass events far exceeds the rise in passenger numbers. The reasons for this rise are unknown.

R2 When do trespass events occur?

According to 2019 data, there is a seasonal trend towards Spring and Early summer. Broadly these events are evenly spread across the days of the week, peaking between 16.00 and 17.00 (as illustrated within Figure 1 below).



Figure 1: Numbers of trespass events nationally during the day (all data and excluding level crossing, fatalities, and theft)

R3 Where do trespass events occur?

The review of the National TIA (Unger et al, 2019) reports of locations with high numbers of trespass incidents was compared with stations ranked by cost of disruption (Schedule 8 payments – the monies paid by Network Rail to compensate train operators for unplanned service disruption) due to trespass.

The two approaches provide very different rankings. Indeed, only one of the most frequent hotspots cited in the TIA report comes within the top 21 when ranked by value of Schedule 8 payments. This is because Schedule 8 payments are based on the number of delayed passenger journeys and the duration of delay which is higher for incidents at terminus and major connecting stations. A small number of incidents at a major station may incur a very high cost. There may be a higher risk to life at other stations where there are more trespass incidents but with a lower impact on passengers and associated delay costs. This has an implication for the criteria used for targeting areas, namely that a safety led strategy may focus on the frequency of trespass and the potential for harm whereas a rail operations led strategy might focus on minimising delay costs. A related sister project for RSSB (RRSB project reference T1183) found that train speed, accessibility of electrical hazards (e.g. overhead electrical lines) and high structures (e.g. bridges) were the main factors in the severity of harm in trespass incidents.

Both approaches indicate that, unsurprisingly, trespass occurs in mostly urban areas and near or at train stations. Train stations range in terms of size and include major stations such as Euston but also stations with lower fare usage such as Pitsea. It can be noted that many of the stations that rank high for trespass incidents are staffed and/or have a security such as CCTV. The throughput of passengers was not found to be related to the frequency of trespass. The frequency of trespass incidents was related to adjacent land use, particularly residential / urban uses, local population density, local rates of crime, deprivation and the opportunity to trespass. Most trespass instances were found to occur at stations and station related infrastructure, with a small minority occurring over 250m from a station.

It is perhaps surprising that only 13% of incidents occur in what are termed "hotspots", locations with more than 12 incidents per year. This means that most incidents occur across a very large number of dispersed locations. This has an implication for strategy, in that focusing exclusively on "hotspots" may not address locations where 87% of incidents occur.

R4 Who is involved in trespass events?

The FD indicated that adult men are far more likely to be involved in trespass events (78% of incidents). This was supported by findings from the literature which also indicated males were more likely to be involved in incidents on the rail network (75% to 84%). Evidence suggests that males of all ages are more likely to engage in risk taking behaviour across all domains of life (e.g., gambling, recreation, social, health and safety) and are more likely to knowingly break rules Freeman, McMaster & Rakotonirainy, 2015).

Whilst adults are the most common trespassers, younger groups tended to be more vulnerable to injury or serious outcomes. In general, adolescents and young adults are more likely than adults over 25 to engage in a range of other activities linked with risk taking such as binge drinking, smoking cigarettes, and engaging in violent and other criminal behaviour (Waterson et al, 2015). This would suggest that heightened risk-taking during adolescence is likely to be normative, biologically driven, and, to some extent, inevitable (Waterson et al, 2015). Other factors that may exacerbate a higher propensity for adolescents to take risks, were identified from the literature review to include: control inhibition; impulsivity and sensation seeking (Romer, Reyna, & Satterthwaite, 2017; Willoughby et al., 2017); perceived invulnerability; less developed decisionmaking skills (e.g. to adequately judge risk) and poorer inhibitory control (Waterson et al., 2015). Adolescents are seemingly at a "cross-road" where they are still in a period of cognitive and behavioural development but at the same time subject to different experiences and situations, as well being given greater freedom as they move into adulthood (e.g. travelling to school or meeting friends unaccompanied (Waterson et al., 2015)). This makes them uniquely vulnerable to expose themselves to more hazardous situations and then have poorer judgement on the likelihood and consequence of harm occurring.

R5-R7 What are the observed behaviour, motivations and other influencing factors leading to trespass events (crime, convenience etc.)?

Motivations are not directly observable but can be inferred through observations of behaviour and through interviews that seek to ask people why they behave or act in a particular way. It is also possible to gain insight from theories on motivation and behaviour. The literature review and analysis of the FD identified the following trespass event types:

- 1. Unintentional (lost/walking in depot, retrieving dropped item such as a phone);
- 2. Convenience (walking off a platform end to engage in short-cutting);
- 3. Fare evasion (walking off a platform end to avoid fare payment);
- 4. Theft (stealing items from the rail track);

- 5. Anti-social behaviour (damage to property, placing obstacles on track);
- 6. Graffiti paint graffiti or 'tag name' onto fences, trains and property;
- 7. 'Hangout' people congregating and socialising (e.g. to use and deal drugs);
- 8. Recreation engaging in acts for entertainment such as dangling legs over the platform edge, running across of jumping down onto the track or train surfing.

Socio-demographic factors (e.g. deprivation, population density, station usage and distance to the nearest railway station) were explored through in-depth statistical analysis to see if certain factors were correlated more strongly with trespass events. Trespass incidents were mapped to 3,867 small geographic areas (termed Lower layer Super Output Areas designed to improve the reporting of small area statistics). and aligned to data on local crime etc. Factors such as deprivation, crime, a younger population and population density were all correlated. Therefore, a multivariate analysis was completed between a range of socio-demographic factors and the frequency of trespass. There were low but significant correlations between factors such as local crime and the number of trespass events. However, the socio-demographic factors accounted for only a small part of the variance in the number of trespass incidents, partly due to many areas having few incidents. It was also thought that other factors (e.g. ease of access, level of surveillance or existence of short cuts etc) probably influence trespass but the available data did not allow for modelling through statistical analysis. Socio demographic and other factors were also identified from the literature review, review of TIA reports and qualitative analysis of the FD. In summary the prominent factors influencing trespass occurrence were: a) ease of access (design of the station and crossing points); b) population age and density, crime and deprivation and c) intoxicants and individual characteristics (e.g. age and gender).

A typology of trespass behaviour was developed for all of the eight trespass event types identified above. Two examples, for 'convenience' and 'anti-social behaviour', are provided in Table 1 below.

Trespass	Observable	Trespasser	Group	Gender	Motivations	Other factors
event	behaviour	type	activity			
Convenience (short cutting)	Exiting the platform end via a level crossing or other access point (gap in boundary fence).	Regular commuters – age neutral.	No.	Males more likely to be less rule compliant	To shorten distance. To catch a train Seeking to reach destination in less time.	Layout and design of the station Lack of convenient official crossing points
Anti-social behaviour	Damage to facilities or equipment; large items being laid on track (sleeper, shopping trolley); Items (stones) thrown at train, damage to fencing.	Children and young persons.	Yes.	Mainly male but female as well.	Self- expression and boredom. Low or immature moral judgement and reasoning. Lack of self- control. Peer pressure Anti-societal feelings.	Poor social cohesion. Urban decay and deprivation. Exclusion from normal social groups

Table 1: Typology of trespass behaviour

The typology reveals insights into trespass events showing who are involved and different forms of motivations and influencing factors. Only with this enhanced understanding of why trespass occurs will the selection and design of interventions be truly effective. The type of intervention applied will depend on the trespass type and who is involved.

For example, if a person or persons is observed near line side equipment, then this could be for reasons of 'theft', 'anti-social behaviour' – to vandalise or damage property or for the purposes of 'recreation' – playing with equipment for entertainment. If it is for 'recreation' or 'anti-social behaviour' then in addition to physical barriers, outreach programmes might be effective in helping to dissuade younger people (typically involved in this form of trespass) by changing attitudes (i.e. making them aware of the dangers to self and others). However, if it is for purposes of 'theft' then outreach programmes will have limited or no impact. Understanding the motivators behind the visible human behaviour will also help in the design of an intervention. For example, if the reasons for trespass is 'theft', then a physical barrier or fence will need to be designed not just to deter but prevent access - such a high palisade fence topped with barbs.

R8 Which interventions work best for each trespass motivation and circumstance?

The literature review helped to identify 24 interventions, grouped into seven types (listed in Table 2 below). The project team produced one to two pages of information for each intervention to describe the intervention, its applicability, cost, effectiveness and considerations for implementation. The rating of effectiveness (included within Table 2) refers to the reduction in the number of trespass incidents where 'High' is typically preventing around 80 percent of incidents, 'Medium' may be preventing about half of incidents and 'Low' may be preventing around 20 per cent of incidents or less. Although based on current evidence, these ratings also involved the subjective judgment of the expert research team. Intervention effectiveness will also be influenced by other factors (e.g. context, location and whether the intervention has been combined with other measures). They may also not be relevant in all circumstances and contexts.

It should be noted that further work was also done to comprehensively map interventions to trespass types and observed behaviour, although this work is not presented here.

Education and	School education	(medium effectiveness)
awareness	Media campaigns	(medium effectiveness)
	Education through community	(medium effectiveness)
	Edutainment	(low/medium effectiveness)
	Posters	(low/medium effectiveness)
	Information and warning signs	(low/medium effectiveness)
Community	Community activity	(medium effectiveness)
engagement	Counselling and support	(low effectiveness)
	Outreach programmes and targeting of at-risk groups	(low/medium effectiveness)
Environmental	Lighting	(low/medium effectiveness)
design	Layout	(high effectiveness)
	Landscaping	(high effectiveness)
	Creating an environment less conducive to trespass	(medium effectiveness)
Physical barriers	Platform end gates / fences	(medium effectiveness)
	Anti-trespass grids	(high effectiveness)
	Fencing	(high effectiveness)

Table 2: Summary of interventions to prevent or reduce trespass

	Mid-platform fencing	(high effectiveness)
Monitor /	Static and dynamic CCTV	(medium effectiveness)
surveillance	Automatic technological surveillance	(medium effectiveness)
Staffing and	Station staff	(medium effectiveness)
Patrols	BTP patrols (overt and covert)	(medium/high effectiveness)
Sanctions	Restitution	(medium effectiveness)
	Rewards	(low effectiveness)
	Fines	(low effectiveness)

In general terms physical barriers and landscaping can reduce all forms and motivations of trespass by the prevention of access; Deterrence in the form of overt British Transport Police patrols may also reduce all forms and motivations of trespass. Monitoring and surveillance may be advocated where physical barriers and overt patrols are not possible, especially with respect to motivations such as fare evasion, anti-social behaviour, and convenience. Providing safe alternative routes such as bridges may be particularly applicable where trespass is motivated by convenience and individuals taking short cuts. Unintentional trespass and trespass during recovery of lost items may be addressed by signage and education. Education and outreach programmes can reduce some forms of trespass such as anti-social behaviour and convenience.

Discussion

The motivations for trespass may be innate (shaped by a person's personality and upbringing) and can also be inspired by others or influenced by external events, situations or the wider environment. Greater understanding of this complex area was sought by the rail industry to support consideration of next steps and selecting and implementing interventions to reduce trespass occurrence.

The guidance developed from this research provides this greater understanding. It gives advice on how to select the most appropriate intervention(s). It does this by encouraging a systematic approach to explore important features of trespass events in a particular context, before considering the merits of different interventions and how well these interventions will work in practice (e.g. what are the local factors that could impact on successful implementation?).

Conclusion/impact



Tackling rail trespass requires a holistic and joined up approach. In addition to the research into motivations for trespass and interventions to reduce trespass, additional guidance was also developed for RSSB. This focused on how to use risk assessment to inform the selection of interventions and how to evaluate whether interventions and intervention strategies are effective.

The resource of information and guidance on tackling trespass risk (see Figure 2 for a screenshot) is available for free on the RSSB website: <u>https://www.rssb.co.uk/safety-and-health/improving-safety-health-and-wellbeing/trespass/tackling-trespass-risk</u>

Figure 2: RSSB website with information on steps to tackle trespass risk

References

- Freeman, J., McMaster, M. & Rakotonirainy, A. (2015) An Exploration into Younger and Older Pedestrians' Risky Behaviours at Train Level Crossings. Safety. 1(1), 16-27.
- Waterson, P., Kendrick, V., Biggin, M., Foulkes, F & Briz, S. (2015). How Can We Improve the Communication of Railway Safety Information to Teenagers and Young Adults? The Fifth International Rail Human Factors Conference, 14th-17th September 2015. Viewed March 2020. < https://rhf2015.exordo.com/files/papers/40/final_draft/040.pdf>
- Romer, D., Reyna, V. & Satterthwaite, T. (2017) Beyond stereotypes of adolescent risk taking: Placing the adolescent brain in developmental context. Developmental Cognitive Neuroscience. 27, 19-34.
- Author not cited (2020) SMIS trespass events: Rail Safety and Standards Board. Annual health and safety report. A reference guide to trends on GB railways. 2018/19. (page 40). www.rssb.co.uk. [March 2020]
- Author not cited (2020). Systematic Reviews & Other Review Types. Temple University libraries. Viewed March 2020. https://guides.temple.edu/c.php?g=78618&p=3879604>
- Unger, C., Burgess, A., Minnis, G., Lampadariou, A., & Chan, H. (2019) Trespass Insight Assessment. National Disruption Fusion Unit. Internal report.
- Willoughby, T., Good, M., Adachi, P., Hamza, C. & Tavernier, R. (2013). Examining the link between adolescent brain development and risk taking from a social–developmental perspective. Brain and Cognition. 83(3), 315-323.