Measure Name Identify and monitor hotspots

Definition Review past trespass and suicide incidents, including close calls, to identify locations on the rail system where trespass and/or suicide incidents are occurring at unexpectedly high rates.

Tags

Incident Type	Both trespass and suicide
Location	Both station and right-of-way
Intervention Strategy	Data: application and planning
Measure Group	Risk assessment

Description

Hotspots are generally thought of as locations where incidents occur at a higher rate than expected. It is often beneficial to use mathematical modeling [1], geospatial data, and/or visualization software to help identify hotspots. These locations should then be monitored regularly, including before and after mitigations are implemented to see if the problem is reduced or moves to another location within the rail system. Hotspots can also be called suicide clusters, which refers to a series of suicides or attempts that happen closer together in time, space or both than would typically be anticipated in a community. The two main types of clusters are point clusters, occurring in a specific geographic area (such as school, institution, county) and mass clusters. Mass clusters can be geographically dispersed over long distances (for example following a celebrity suicide) [2].

Hotspot data is useful for prioritizing locations for allocating resources to support the implementation of countermeasures [3]. Research also shows value in identifying the common characteristics and risk factors of hotspots in preventing future incidents [4]. These characteristics can include many different types of information (but are not limited to):

- Location – Station, platform or open track, presence of a shortcut, landscape, accessibility to the tracks, etc.
- Community information – Distance from the hotspots to schools, elder care facilities, mental health facilities, or other areas with populations potentially at risk, etc.
- Timing – Time of day, season, etc.
- Train and rail system information – Passenger/freight train, train frequency, train speed, track length, number of crossings, number of stations, number of passengers, passenger distance traveled, etc.
- Information about the individuals involved – Age, intent (i.e., suicide, non-suicide), gender, distraction, intoxication, socioeconomic status, familiarity with the rail system, past suicide attempts, etc.
- Census information – Population density, unemployment rate, average income, etc.

Additional search terms: *analysis, cluster, copycat, data, risk*

Advantages

- Identifying and monitoring hotspots can be a low-cost effort.
- Commercial off-the-shelf software can assist in visualizing hotspots.
- Maximizes effective allocation of resources by focusing mitigation strategies on hotspot locations.
- Identifying common incident characteristics can help to mitigate future hotspots.
- National suicide and trespass data starting from June 2011 is readily available from the FRA safety website and dashboard (see Additional Resources). This can be useful for communities and others interested in identifying problem areas or implementing mitigations.

Drawbacks

- Some data are highly sensitive and not easily shared between stakeholders without collaboration.
- FRA incident data includes less detail for suicide incidents than for trespass incidents, potentially limiting the utility of the dataset.

Notable Practices

- When collecting data, include a variety of factors related to rail suicide and trespassing both with and without incident in order to gain a more comprehensive understanding of hotspot characteristics. Examples include train frequency, trespasser exposure, train speed, proximity of the right-of-way to areas with foot traffic, etc. (e.g., 1).
- Consider including close-call data when identifying future and developing hotspots, if available. This can provide important information about safety risks, allowing rail carriers to act before an incident occurs.
- Include a variety of data sources for analysis of hotspots in order to better understand the factors that contribute to trespassing [5] and suicide, for example trespass violation data reported by local law enforcement, locomotive crew observations, video recording of specific locations, and interviews with everyday onlookers (railway employees, people living in the immediate vicinity) can also be collected [6].
- If a hotspot is identified, there is evidence that actions can be taken to help reduce events. A 2015 meta-analysis assessed the effects of interventions on hotspots, and found that restricting access to means, encouraging help-seeking, and increasing the likelihood of intervention by a third party can reduce deaths by suicide at suicide hotspots [7].

- Continue to monitor and track hotspot data before and after the implementation of mitigations to assess the impacts and changes over the short and long term.

References:

[1] Stanchak, K. and daSilva, M. (2014). *Trespass Event Risk Factors*. Technical Report No. DOT/FRA/ORD-14/32. Washington, DC: U.S. Department of Transportation, Federal Railroad Administration.

> Abstract: The Volpe Center has used three sources of data—the Federal Railroad Administration's required accident reports, locomotive video, and U.S. Census data—to investigate common risk factors for railroad trespassing incidents, the leading cause of rail related deaths in the U.S. Risk factors found include (1) a disregard for grade crossing warning signs, (2) trespasser intoxication, (3) use of distracting electronic devices, and (4) right-of-way proximity to stations, bridges, and rail yards. This research report offers several suggestions for improved data availability to support future studies.

[2] Trinh, E., Ivey-Stephenson, A. Z., Ballesteros, M. F., Idaikkadar, N., Wang, J., & Stone, D. M. (2024). CDC guidance for Community Assessment and investigation of suspected suicide clusters, United States, 2024. MMWR Supplements, 73(2), 8–16.

> Summary: This report is the second of three reports in the MMWR supplement updating CDC's guidance for investigating and responding to suicide clusters. The first report, Background and Rationale — CDC Guidance for Assessing, Investigating, and Responding to Suicide Clusters, United States, 2024, describes an overview of suicide clusters, methods used to develop the supplement guidance, and intended use of the supplement reports. The final report, CDC Guidance for Community Response to Suicide Clusters, United States, 2024, describes how local public health and community leaders can develop a response plan for suicide clusters. This report provides updated guidance for the approach to assessing and investigating suspected suicide clusters. Specifically, this approach will guide lead agencies in determining whether a confirmed suicide cluster exists, what concerns are in the community, and what the specific characteristics are of the suspected or confirmed suicide cluster. The guidance in this report is intended to support and assist lead agencies and their community prepare for, assess, and investigate suicide clusters. The steps provided in this report can be adapted to the local context, culture, capacity, circumstances, and needs for each suspected suicide cluster.

[3] Chaudhary, M., Hellman, A., and Ngamdung, T. (2011). *Railroad Right-of-Way Incident Analysis Research*. Technical Report No. DOT/FRA/ORD-11/09. Washington, DC: U.S. Department of Transportation, Federal Railroad Administration.

> Abstract: Locations of railroad right-of-way incidents in this research were identified as hotspots. These can be defined as highway-rail grade crossings or locations along the railroad right-of-way where collision or trespassing risk is unacceptably high and intervention is justified because the potential safety benefits exceed the cost of intervention. This project categorizes the hotspots as grade crossing and trespass incident hotspots. Mathematical models and theories are researched to see which ones may be used in identifying the hotspots. For the analysis of grade crossing incident hotspots, the Transport Canada model is modified to accommodate U.S. data and is applied to a sample of grade crossing incidents from 2003 to 2007 in the San Joaquin corridor in California. In analyzing trespass incident hotspots, the theory of cluster analysis, a type of spatial analysis, was researched. It appears that cluster analysis, used in conjunction with a geographic information system platform, would be a beneficial way of analyzing and predicting trespass hotspots.

[4] Chase, S. and Hiltunen, D. (2020). *Fatal Trespasser Strikes in the United States: 2012-2017*. Research Results, RR 20-01. Washington, DC: U.S. Department of Transportation, Federal Railroad Administration.

Abstract: The results of the analysis show that California, New York, Florida, and Texas consistently had the highest number of fatal trespasser strikes, regardless of intent. Fatal suicide strikes most often occur during the spring, while non-suicides occur most often in the summer. Suicides tend to take place during later evening hours (8:00 p.m. to 12:00 a.m.) on both weekdays and weekends, while non-suicides tend to occur during weekday evening commute hours (4:00 p.m. to 8:00 p.m.), and during early morning hours on weekends (12:00 a.m. to 4:00 a.m.). Individuals are most likely to be between age 15 and 34 for all fatal strikes. At the time of the strike, fatal suicides most often involve an individual lying down, while for non-suicides, individuals are most often walking/stepping. Suicides and non-suicide strikes both involve freight trains more often than passenger trains.

[5] Federal Railroad Administration. (2018). *National Strategy to Prevent Trespassing on Railroad Property*. Washington, DC: U.S. Department of Transportation, Federal Railroad Administration.

Description: This report is in response to U.S. House of Representatives Committee on Appropriations request for FRA to study and identify the causal factors that lead to trespassing incidents on railroad property. The report defined four strategic areas for its national strategy; Data Gathering and Analysis, Community Site Visits, Funding, and Partnerships with Stakeholders. The report list top 10 counties in the United States where most pedestrian trespasser casualties occurred between November 2013 and October 2017. The report also analyzed trespass incident in relation to its distance from a grade crossing. The finding showed that approximately 73 percent of trespassing suicides and attempted suicide casualties and 74 percent of trespassing casualties excluding suicides occur within 1,000 feet (less than ¼ of 1 mile) of a highway-rail grade crossing.

[6] Skládaná, P., Skládaný, P., Tučka, P., Bidovský, M., & Sulíková, B. (2016). Trespassing railway property – typology of risk localities. Transportation Research Procedia, 14, 2091–2100.

Abstract: Number of train-person crashes in the CR remains constantly very high. Many of these accidents concentrate at localities with frequent occurrence of trespassing. In frame of research project AMELIA (Trespassing railway property – research of situation and proposal of measures for prevention and mitigation of consequences), the localities with high risk of accidents resulting from trespassing were characterized and classified into six basic categories. The typology is supposed to serve as one of the tools facilitating formulation of preventive measures in further stage of the project.

[7] Pirkis, J., Too, L. S., Spittal, M. J., Krysinska, K., Robinson, J., & Cheung, Y. T. (2015). Interventions to reduce suicides at suicide hotspots: A systematic review and meta-analysis. The Lancet Psychiatry, 2(11), 994–1001.

Interpretation: The key approaches that are currently used as interventions at suicide hotspots seem to be effective. Priority should be given to ongoing implementation and assessment of initiatives at suicide hotspots, not only to prevent so-called copycat events, but also because of the effect that suicides at these sites have on people who work at them, live near them, or frequent them for other reasons.

Additional Resources

FRA Office of Safety Data – Website

Description: FRA database that contain railroad safety information including accidents and incidents, inventory and highway-rail crossing data.

FRA Trespass Dashboard – Website

Description: Presents an interactive map that displays all railroad trespasser-related injuries and fatalities dating back to June 2011. FRA started requiring railroad to submit precise location (lat/long) of trespass incident starting in June 2011. It allows user the ability to view maps in multiple forms, as well as add layers, including Class I railroads, Main Line Rail, and colleges/universities.

Confidential Close Call Reporting System (C^3RS) – Website

Description: The Confidential Close Call Reporting System (C^3RS) is a partnership between the National Aeronautics and Space Administration (NASA), the Federal Railroad Administration (FRA), in conjunction with participating railroad carriers and labor organizations. The program is designed to improve railroad safety by collecting and analyzing reports which describe unsafe conditions and events in the railroad industry. Employees will be able to report safety issues or "close calls" voluntarily and confidentially.

Long Island Rail Road (LIRR). *Hazardous Assessment Approach to Trespass Management – High Security Fence*.

Description: Presentation describes an algorithm used for prioritizing the implementation of high security fencing.

Debbaut, K., Krysinska, K., & Andriessen, K. (2014). Characteristics of suicide hotspots on the Belgian railway network. *International Journal of Injury Control and Safety Promotion*, *21*(3), 274-277.

Abstract: In 2004, railway suicide accounted for 5.3% of all suicides in Belgium. In 2008, Infrabel (Manager of the Belgian Railway Infrastructure) introduced a railway suicide prevention programme, including identification of suicide hotspots, i.e., areas of the railway network with an elevated incidence of suicide. The study presents an analysis of 43 suicide hotspots based on Infrabel data collected during field visits and semi-structured interviews conducted in mental health facilities in the vicinity of the hotspots. Three major characteristics of the hotspots were accessibility, anonymity, and vicinity of a mental health institution. The interviews identified several risk and protective factors for railway suicide, including the training of staff, introduction of a suicide prevention policy, and the role of the media. In conclusion, a comprehensive railway suicide prevention programme should continuously safeguard and monitor hotspots, and should be embedded in a comprehensive suicide prevention programme in the community.

Lockley, A., Williamson, M., Robinson, J., Cox, G., Cheung, Y. T., Grant, L., & Pirkis, J. (2012). *Preventing suicide at suicide hotspots: A case study from Australia*. Canberra, Australia: Australian Government Department of Health and Ageing.

Document Excerpt: This resource provides a summary of available evidence, and a more detailed indication of tasks for key steps in the process of establishing actions at suicide hotspots. Actions should be considered in the context of longer term suicide prevention initiatives including public education, community based programs and clinical services.

National Institute for Mental Health in England. (2006). *Guidance on action to be taken at suicide hotspots*.

Document Excerpt: There are two parts to the guidance. The first part deals with the definition of 'suicide hotspot', outlines the range of measures that can be taken to improve safety at such locations and summarises the evidence of effectiveness. Part two describes a process for identifying and managing

suicide hotspots at local level based on interagency collaboration. The model has been developed by means of 'action learning', using the county of Devon as a pilot site.

Oswald Beiler, M. R., Miller, G., & Varley, D. (2018). Railway Trespass Prevention: Spatial Analysis of Incidents to Connect to Countermeasures. *Journal of Transportation Engineering, Part A: Systems*, *145*(2), 04018086.

Abstract: Railway incidents continue to be a safety concern for transportation agencies throughout the United States. In particular, trespasser incidents, which are the most frequent cause of railway fatalities in the United States, are those that involve a person whose presence is prohibited or actions are unlawful involving railway property. By analyzing past data on trespassing incidents, recommendations for future improvement through countermeasures can be made. This research investigates historical trespasser incidents throughout national Amtrak data from 2011–2017. The data were analyzed at the national as well as megaregional levels in order to determine trends using 14 factors, including both incident (such as time of day, precrash activity, and gender) as well as geographic (such as population density and average income based on the census level in which the incident occurred) factors. A case study on a segment of Amtrak's northeast corridor alignment is provided in order to serve as an example of connecting to countermeasure recommendations.

Savage, I. (2014). Analysis of Fatal Train Pedestrian Collisions in Metropolitan Chicago 2004-2012. In *Proceedings of the 2014 Global Level Crossing Symposium*, 4-8 August 2014, Urbana, IL.

Abstract: This paper analyses the 338 pedestrian fatalities on railroads that occurred in the Chicago metropolitan area between 2004 and 2012. On average there was one such fatality every ten days, and they comprised the vast majority (84%) of all deaths on the railroad. Almost half (47%) of the pedestrian fatalities are apparent suicides. Non-suicidal fatalities at stations and crossings represent 21% of the total, while the remaining 32% are non-suicidal incidents at other places along the right of way. The decedents are predominantly male (72%) and of working age (83% between the ages of 18 and 65). There are very few minors or senior citizens. Chicago has harsh winters, so incidents are much more common during the warmer months. There does not seem to be any pattern to how fatalities are distributed across the days of the week, but they are concentrated during peak travel times of day, with an additional spike late at night. A spatial analysis shows that while there is a general randomness in incident location, there are some common patterns, and also some notable outliers or "hot spots." The frequency of fatalities at stations and crossings and from trespassing in different municipalities within the region is strongly related to the density of public access points to the right of way. Consequently, grade separation is effective in reducing fatalities. But fatalities of these types do not increase with train volume suggesting that pedestrians may exercise more care around busier lines. The distribution of apparent suicides is less strongly related to the density of public access points suggesting that those intending self-harm will seek out a point of access. Apparent suicides are also more prevalent where there is a higher train frequency and a greater proportion of passenger trains that run to a published schedule. They are also more prevalent in municipalities with higher incomes and lower population density. While most of the apparent suicides (70%) are not associated with any copycat activities, the dataset contains 20 clusters of suicides. These clusters contain incidents that are proximate in both time and space and are unlikely to have occurred randomly. There was also a highly-publicized suicide that led to a 95% increase in apparent suicides throughout the region in the 18 weeks following the incident.

Related Measures

- Collaboration with local governments and communities
- Identify access points for potential trespassers
- Identify funding opportunities
- Improved data collection after an incident
- Incident cost estimation
- Lighting at hotspots
- Rail corridor risk assessment
- Risk assessment using forward facing CCTV
- Safety patrols to deter suicide and trespassing
- Training to identify and assist those at risk for suicide and trespassing