Feasibility Study on the Use of Spatial Analysis in the Prevention of Train-Trespasser Collisions

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Agenda

• The Problem: Train-trespasser collisions in Finland
• The Idea: Geographic Information Systems and train-trespasser collisions
• Feasibility study:
  • Objectives
  • Starting point
  • Availability and usability of information
  • Modelling risk-levels
• Ideas on next steps
The Problem: Train-Trespasser Collisions in Finland

Data sources: Silla 2011 & Common Safety Indicators
The Problem: Train-Trespasser Collisions in Finland

• Train-trespasser fatalities are widely scattered along the railway network
  • Fencing the whole network is not an option
• RESTRAIL -project summarises dozens of measures to prevent train-trespasser collisions
• Could Geographic Information Systems (GIS) help us to connect the risk-spots and the prevention measures?
The Idea: Geographic Information Systems and Train-Trespasser Collisions

• We could collect all the information related to train-trespasser collisions and combine it with relevant variables
  • Collisions and near-misses
  • Track-related information
  • Socio-economical etc. environment data
  • Authorised and unauthorised routes crossing the railway

• Analyse the data in GIS software:
  • Combine different kinds of datasets
  • Analyse interactions between different types of cases and different variables
  • Vary the perspective between local case studies and the whole network
The Idea: Geographic Information Systems and Train-Trespasser Collisions

• We could:
  • Learn something new about the locations of train-trespasser collisions?
  • Learn more about the regional characteristics of train-trespasser collisions?
  • Find out which factors raise the risk for train-trespasser collisions in the area?
• Would it be possible to estimate the risk-levels of train-trespasser collisions for different parts of the whole network?
  • Then we could prioritise where to locate the prevention measures
  • And the data could help us to choose appropriate measures for different places
• Continuously updated GIS-database for research and risk assessment
Objectives of the feasibility study

• To investigate the potential of spatial analysis:
  i. to enhance the exploitation of information on intentional and unintentional train-trespasser collisions, and
  ii. to produce new and useful information

• The study was divided into three parts:
  • Literature review: identification variables explaining the existence and distribution of train-trespasser collisions
  • Assessment of availability and usability of information; assessment of possibilities to expand the investigation from case study area to whole Finland
  • Discussion on possibilities to apply Tarva LC modelling for the prediction of train-trespasser collisions
Starting point

• Case study: Area near city of Tampere (around 20 km radius)
• ArcGIS software
• Findings from literature review
Availability and usability of information
– Information on victims and collisions

2005–2010

• Information on fatal train-trespasser collisions
• Cases from 2007–2010 included in ArcGIS (good coverage of GPS coordinates); cases from 2005–2006 to be added
• 201 out of 239 (84%) fatal collisions have information on distance between home and accident location

2011–2014

• Fatal train-trespasser collisions: already in ArcGIS
• Injured in train-trespasser collisions: to be added to ArcGIS
• Attempted suicides: to be added to ArcGIS
• Dangerous situations / near misses: to be added to ArcGIS
Availability and usability of information

Unofficial crossing places
• Reported by engine drivers
• Collected during level crossing investigations

Railway network related information
• Level crossings
• Extent of fencing
• Daily number of passenger and freight trains
• Maximum train speed

Speed kmph
- 40
- 70
- 80
- 100
- 120
- 140
- 200
Availability and usability of information

Surroundings
• Bars and nightclubs
• Schools
• Psychiatric clinics and hospitals
• Retail

Socio economic variables
• Statistics Finland – PAAVO
  • Open data by postal code area
  • Key indicators to describe and compare areas
  • Data on population structure, degree of education, income of the inhabitants and households, size of the households and life stage, buildings and dwellings, workplaces and main activities of the inhabitants
Modelling risk-levels
Safety evaluations of level crossings – Tarva LC

- Safety evaluation tool which enables:
  - Review of factors affecting level crossing safety
  - Evaluation of current safety of all the level crossings on the state rail network as reliably as possible
  - Estimation of safety effects of level crossing improvements
  - Study of cost-effectiveness of such improvements
Modelling risk-levels – Tarva LC

• **Prediction**: Number of level crossing accidents in different types of level crossings

• **Unit under investigation**: Level crossing

• **Factors affecting accident numbers**:
  • Number of road and rail vehicles using the level crossing (**exposure**)
  • Warning devices
  • Speed limit on the road and rail
  • Sight conditions after bush removal
  • Type of road surface

• **Exposure** is the main factor affecting the prediction
Modelling risk-levels
Train-trespasser collisions

• Prediction: Number and division of train-trespasser collisions (fatalities + injuries, attempted suicides)

• Unit under investigation: railway kilometre (or combination of them)

• Factors affecting the number of collisions: To be investigated

• Exposure: Reported dangerous situations and near misses; illegal paths across the railway tracks

• Remark: Separation of intentional and unintentional collisions should be done in the beginning
Ideas on next steps

Step 1: Description of data
• Objective: Description of collected data
• Remarks: Additional data collection is needed to complement the already existing dataset

Step 2: Analysis of data
• Objective: Modelling of factors affecting train–trespasser collisions with the help of buffer analysis
• Remarks: Critical analysis of significant factors is needed

Step 3: Prediction
• Objective: Prediction of the number of train-trespasser collisions and identification of high risk locations by applying Tarva LC type of modelling
• Remarks: Information on exposure is needed

All Steps: Primary focus on case study area; after additional data collection possible extension to cover whole Finland
Thank You!

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