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Opinions on Railway Trespassing of People Living Close to a Railway Line

Abstract

A survey was designed to investigate opinions on railway trespassing of people living close to a railway line. The results showed that 89.2% of the respondents (n=502) recalled that they had seen trespassing in their neighbourhood and, based on their observations, adults are the largest group trespassing. Overall, 68.9% of the respondents had personal experience of trespassing although 83.5% considered trespassing to be fairly or highly dangerous and 81.0% assumed it to be illegal. The respondents supported countermeasures such as building an underpass or fencing off the tracks, and only a few of them indicated that nothing could be done to resolve the problem. In addition, education in schools on the dangers of trespassing was suggested. These results allow practitioners and researchers to see the problem from a local perspective and thus develop a better understanding. This in turn helps design effective countermeasures.

1. Introduction

Train-pedestrian collisions are considered to be one of the most important railway safety issues worldwide. For example, in the European Union, more than half of all fatal injuries (excluding suicides) were sustained by trespassers in 2006 (Lundström 2008). Similar proportions have been reported in the United States (Savage 2007), New Zealand (Patterson 2004) and the Cape Town metropolis in South Africa (Lerer and Matzopoulos 1996). In Finland, of all railway fatalities excluding suicides in 2004–2006, 68% were trespassers (Eurostat 2007).

Trespassers are people who are illegally on railway property (Lobb et al. 2001). They are crossing the railway lines at places not intended for that purpose or

are loitering or walking in the railway area (i.e. using railway property for activities unrelated to railway operations). Most frequently the motive for trespassing is as simple as taking the shortest or most convenient route from one place to another (e.g. Lobb et al. 2001; Rail Safety and Standards Board 2007).

A wide range of initiatives has been launched to counter the trespassing problem. In Canada, a community trespass prevention programme has been set up and a problem-solving model developed as part of the programme C.A.R.E. (Community, Analysis, Response and Evaluation). This model includes a template for the Neighbourhood Trespassing Survey to collect more detailed information about the trespassing problem and its underlying causes through problem analysis (Law 2004).

In New Zealand, two studies included anonymous surveys in an attempt to identify awareness of the illegality of walking across tracks, as well as the perception of risk (Lobb et al. 2001) and trespassers' attitudes (Lobb et al. 2003). The first study evaluated a programme of educational and environmental (access prevention by fences) interventions designed to reduce crossing of the rail corridor at a suburban station in Auckland. The survey was conducted before and after the interventions. The programme slightly increased the awareness of the illegality of walking across the tracks. However, the perception of risk did not change. The results also suggested that, in comparison with other age groups and females, teenagers and males had less safe attitudes and self-stated behaviour with regards to trespassing.

The second study evaluated a programme of interventions designed to reduce the crossing of a rail corridor at a city station (Lobb et al. 2003). These interventions included rail safety education in school, punishment and reinforcement. The surveys were delivered to all the boys at the participating school immediately before and after the interventions. In the after-intervention survey, the boys reported significantly less illegal crossings, greater knowledge of the illegality of trespassing (from 19% to 42%) and some increase in safety attitudes compared to before the survey.

In addition to the interventions introduced in the above studies, several other countermeasures exist to deter trespass. These countermeasures include e.g. limitation of pedestrian access by different means (using signage, attendance of station staff or security personnel and landscaping) and various technical solutions such as warning devices, closed-circuit television with or without a link to audio announcement and/or motion detectors and cameras with motion detectors (see e.g. Rail Safety and Standards Board 2007). Regardless of the large number of proposed countermeasures,

there is little published research evaluating the efficacy of any of these interventions (see Silla and Luoma 2011).

Some studies have investigated issues such as location, time of day, injuries and personal characteristics of trespassers based on reported incidents and fatalities (Centers for Disease Control 1999, Cina et al. 1994, George 2007, Lerer and Matzopoulos 1996, Patterson 2004, Pelletier 1997, Rail Safety and Standards Board 2007). The main findings of these studies suggest that trespassers are usually adults and males (e.g. Centers for Disease Control 1999, George 2007, Patterson 2004). Furthermore, some studies have found that many trespassers who were killed were intoxicated with alcohol or drugs (e.g. Centers for Disease Control 1999, George 2007, Lerer and Matzopoulos 1997, Patterson 2004, Pelletier 1997). Regarding timing, the findings were inconsistent. Specifically, Pelletier (1997) found that fatality accidents typically occurred at night on Friday, Saturday and Sunday, and Lerer and Matzopoulos (1996) found that they occurred at peak commuter times. Furthermore, according to Patterson (2004), the majority of killed and injured trespassers are reasonably evenly spread across the day. However, when assessing only the non-injury trespasser incidents, most of them occurred during the afternoon peak (Patterson 2004) or with observable peaks in the mid-afternoon and mid-to-late evening periods (RSSB 2007). Moreover, compared to other forms of pedestrian accidents, collisions between trains and pedestrians are less common but they are more likely to cause death or irreparable damage such as amputation of limbs (see e.g. Blazar et al. 1997 and Shapiro et al. 1994).

As mentioned by Savage (2007), analysing the reported incidents and accidents gives only a partial picture of the profile of trespassers. Consequently, the investigation of trespassing behaviour (including no accidents) could provide useful information. The first attempt to address this issue in Finland was made by Silla and Luoma (2008), who identified sites of frequent trespassing on Finnish railways and observed trespassing behaviour at selected sites. The information was gathered with the help of a survey directed at engine drivers, trespasser interviews and investigation of trespassing behaviour at three selected sites with the help of cameras equipped with motion detectors. Silla and Luoma (2008) found, for example, that trespassing seems to concentrate near cities where the population density is high and rail traffic is dense. Detailed analysis of trespasser behaviour enabled the characteristics of trespassers at selected sites to be determined.

The present study was designed to obtain complementary information to our earlier study by collecting opinions on railway trespassing from people living close to a railway line. Specifically, this study focused on issues such as whether people assess trespassing as a serious problem (e.g. recollection of frequency and characteristics of trespassers and their behaviour), what sort of countermeasures they assess as effective, the assessment of their own behaviour and overall trespassing safety, and their awareness of the legality of trespassing and trespassing fatalities. The results are important for designing effective countermeasures, as earlier results based on a survey directed at engine drivers and interviews of trespassers covered only limited numbers of relevant aspects of the problem. These aspects include potential needs for information campaigns, preference of various countermeasures and new ideas for prevention based on familiarity with local circumstances.

2. Method

2.1. Subjects

Survey forms were sent to 1,500 households in the city of Lappeenranta in Eastern Finland. The sample size was approximately 2% of the population of the city. Address information for the survey was retrieved from the Population Register Centre. The information was requested for a random sample of households from preselected local districts (10 out of 52) that were assumed to be of interest to the study. Based on the locations of residential areas and other activities, it was assumed that many residents of these areas might have a need to cross the railway, although the distance between the local districts and the railway varied. In addition, one local district was included because some respondents indicated that they were living there rather than the options given on the survey form. Contact information was requested from the Population Register Centre for the oldest person living in each household.

The city of Lappeenranta was selected for survey because our earlier study (Silla and Luoma 2008) showed that the area is very prone to trespassing. Specifically, the tracks divide the city into two parts (Figure 1), which leads to frequent crossing of the tracks. There is a 4 km stretch of track, including 12 identified locations with frequent trespassing.

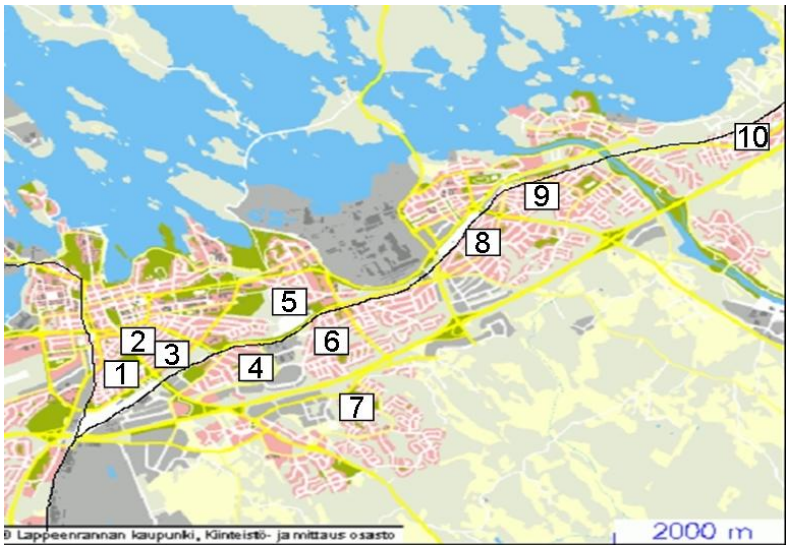

Figure 1. Map of the city of Lappeenranta (City of Lappeenranta 2007). The black line from bottom left to upper right shows the passenger traffic railway. The numbers show the survey locations. The additional local district (11) is located north of local district 2.

2.2. Mailing

The form was mailed with a covering letter requesting voluntary cooperation with the survey. The covering letter provided no specific instruction as to who in the household was expected to answer to the questions. A stamped envelope addressed to VTT was included for the participant to use in returning the form. The survey was anonymous to reduce the tendency of giving socially desirable answers; however, this made it impossible to determine which individuals returned the forms. A separate form enabled respondents to provide their contact information and take part in a raffle. Two gift vouchers were later sent to the winners.

2.3. Survey form and data analysis

The survey form was based on the Neighbourhood Trespassing Survey (Law 2004). The form contained four types of questions: (1) recollection of frequency and characteristics of trespassers and their behaviour, (2) preference of potential means to prevent trespassing, (3) assessment of respondents' own trespassing and the perceived safety of trespassing, and (4) awareness about regulations regarding walking in the railway area and trespassing fatalities. In addition, the respondents could provide additional comments and were asked to indicate their age, gender and the local district where they lived in order to explore potential differences by respondent characteristics.

The words *trespasser* and *trespassing* were not used in the survey. Instead, the questions referred to people who are crossing the railway lines at unofficial/official places. The definitions of official and unofficial places were shown at the beginning of the survey.

The χ^2 test was used to determine the statistical significance of these relationships. The P-value is given where statistical testing has been done. However, no statistical analysis was applied if one or more options could be selected.

Overall, 33.5% of the survey forms were completed, the rate varying from 27% to 40% by local district. The highest return rates were from local districts situated near the tracks on the east side of the railway line (4, 6 and 8 in Figure 1). The number of returned survey forms by local district is shown in Table 1. It must be noted that the small number of returned survey forms, especially in local district 11, might have influenced some of the statistical analysis (such as the inability to find differences in ratings of safety by district).

Table 1. Number of returned survey forms by local district.

Local district	1	2	3	4	5	6	7	8	9	10	11	Missing	Total
No. of answers	93	77	52	36	21	75	29	30	58	10	5	16	502

The sample was somewhat biased for age, probably because the address information was retrieved for the oldest person living in the household. Specifically, 37.5% of respondents were older than 60 years and 31.1% were aged from 45 to 60 years.

3. Results

3.1. Recall of trespassing

Respondents were asked whether they had seen people trespassing, and if so, how often this happened based on their observations. Overall, 40.6% of the respondents answered that trespassing occurs less frequently than once a week, followed by 23.7% who said that it occurs daily, 17.9% who said that it occurs a couple of times a week and 7.4% who said that it occurs once a week. Only 10.8% of the respondents indicated that they had never seen people trespassing. These results suggest that the respondents were quite aware of trespassing.

It was assumed that some of the local districts chosen for the study are more prone to trespassing than others because of their location in relation to the railway lines. This means that people living in these local districts have an obvious need to cross the railway line but the number of legal crossing places is limited (e.g. residential areas 4 and 6 situated on the other side of the railway line from the city centre, or area 1 in the city centre at the junction of two railway lines, see Figure 1). Indeed, when integrating the first three and the last two categories of frequency, the effect of local district on frequency of observed trespassing (once a week or more) was significant ($\chi^2(10)=49.12$, $p < 0.001$), with the most frequent trespassing in local district 4 (75.0%), followed by local district 6 (69.3%), local district 5 (66.7%) local district 11 (60.0%), and local district 1 (59.3%). Among the other local districts the percentages varied between 50.0% and 29.3%.

Respondents were asked whether trespassing occurs at a certain time of day, and if so, what the most frequent times are based on their observations (one or more options could be selected). Forty percent of the respondents answered that they could not define any specific time of day when trespassing is frequent. Other respondents had observed trespassing most frequently in the afternoon (38.7%), followed by morning (35.6%), evening (32.6%), noon (23.0%) and night (10.9%).

Furthermore, the respondents were allowed to define special occasions when they frequently observed trespassers. The most frequent responses included the start and end of ice hockey matches (local districts 5 and 6 are close to an indoor skating rink) and commuting times. Some people also indicated weekends and personal business trips. The answers dealing with seasonal variation were ambiguous: some respondents indicated that trespassing occurs particularly in summer, while others considered it more frequent in winter.

In addition, respondents were asked in which age group the trespassers belong based on their observations (one or more options could be selected). People assessed that most trespassers are adults (21 to 65 years) (85.7%), followed by youngsters (12 to 20 years) (71.5%), the elderly (over 65 years) (30.9%) and children (under 12 years) (21.7%).

3.2. Preference of potential countermeasures

The respondents were asked which countermeasures they preferred to prevent trespassing (one or more options could be selected). The survey form included the alternatives for potential countermeasures listed in Figure 2. The results showed that the respondents most frequently supported building of an over- or underpass (supported by 65.3% of respondents), followed by fencing off the tracks (supported by 44.5% of respondents) and education at school concerning the dangers of walking on or across railway tracks (supported by 36.5% of respondents). Only 6.8% of the respondents indicated that nothing could be done to remove the problem.

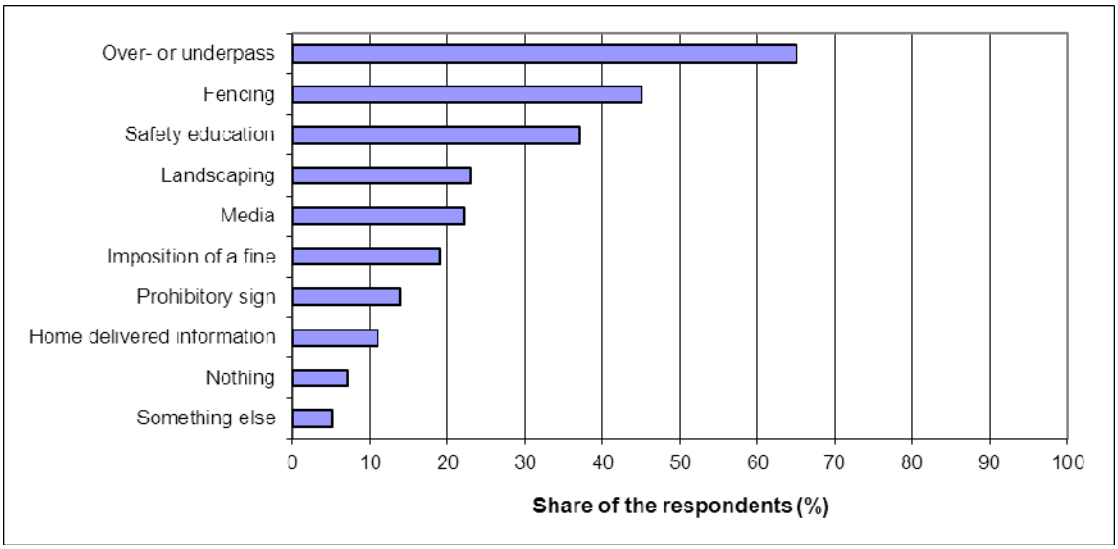

Figure 2. Preference of possible countermeasures (N=501). Respondents were allowed to indicate one or more options.

3.3. Assessment of own trespassing behaviour and perceived safety

The respondents were asked whether they had ever trespassed themselves (yes or no). Overall, 68.9% of the respondents had crossed the railway line at a spot that is not marked for that purpose (N=493). The effect of gender on assessment of own trespassing behaviour was significant ($\chi^2(1)=4.31$, $p < 0.05$), with higher percentages for males (73.1%) than females (64.3%). In addition, younger respondents were more likely than older respondents to indicate that they had trespassed ($\chi^2(4)=10.57$, $p < 0.05$). Specifically, all respondents younger than 20 years had trespassed, followed by age group 20–29 (76% had trespassed), age group 30–44 (70% had trespassed), age group 45–60 (74% had trespassed) and respondents older than 60 years (61% had trespassed).

The effect of local district on own trespassing was significant ($\chi^2(10)=53.98$, $p < 0.001$), with the highest percentage in local district 4 (97.2%) followed by local district 5 (81.0%), local district 6 (81.3%), local district 11 (80.0 %) and local district 3 (78.8%). In other local districts the percentages varied between 39.7% and 70.6%.

Furthermore, the respondents were asked how they assess the safety of trespassing, on a 4-point scale from completely safe to very dangerous. Overall, 83.5% indicated that trespassing is either slightly dangerous (40.2%) or very dangerous (43.3%). Furthermore, 12.4% considered trespassing as fairly safe, 2.7% as safe and 1.4% did not know. The effect of local district on assessment was not significant.

The effect of the perceived safety of trespassing on respondents' own trespassing was significant ($\chi^2(3)=110.15$, $p < 0.001$). Overall, 98.0% of the respondents who indicated that they have not trespassed answered that trespassing is slightly or very dangerous, while the corresponding percentage for respondents who had trespassed was only 76.8% (Figure 3).

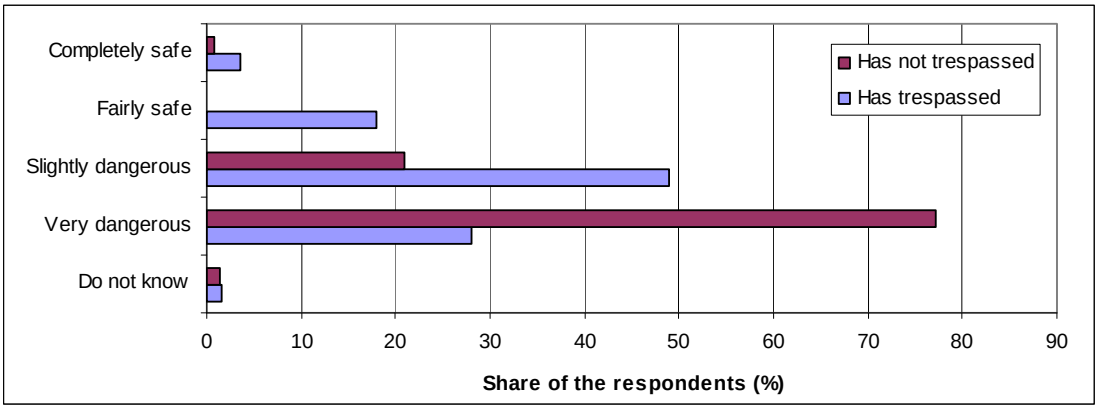

Figure 3. Respondents' perceived safety of trespassing versus their own trespassing.

In addition, the older the respondents were, the smaller was the proportion of respondents who assessed trespassing as completely or fairly safe. Specifically, the average rating for respondents older than 60 years was 3.46, followed by age group 45–60 (3.26), age group 30–44 (3.11), age group 20–29 (2.83) and respondents younger than 20 (2.00).

3.4. Awareness of the legality of trespassing and trespassing fatalities

The respondents were asked whether according to them it was legal to cross the tracks at locations other than sites specifically marked for that purpose. However, this was

somewhat of a leading question because at the top of the survey form it was indicated that *pedestrians should cross the railway only at sites that are specifically marked for that purpose. It is possible to recognise these sites from at least the planking between the rails, which makes it easier to cross over. In practice people cross the tracks also at unofficial sites, which are often formed by regularly used walkways.*

Despite the leading introduction, 18.2% of the respondents indicated that crossing the tracks at an unofficial site is legal. Trespassing was considered to be illegal by 81.0% and 0.8% did not know. Males (22.0%) considered trespassing to be legal more frequently than females (14.2%) ($\chi^2(1)=4.90$, $p < 0.05$). The effect of respondents' age on awareness of legality was also significant ($\chi^2(4)=16.82$, $p < 0.05$), with typically higher percentages of *legal* answers for younger respondents. In addition, the effect of awareness of legality on the respondents' own trespassing was significant ($\chi^2(1)=8.64$, $p < 0.05$), with a more substantial share (82.0%) trespassing among respondents who indicated trespassing to be legal compared with those who considered it illegal (66.1%). Finally, if the respondent considered trespassing legal, it was less likely that he or she would indicate that trespassing is slightly or very dangerous (72.7%) compared to the respondents who considered trespassing illegal (85.7%) ($\chi^2(3)=36.06$, $p < 0.001$).

In addition, the respondents were asked whether they knew of someone who had been killed as a result of trespassing. Overall, 30.3% of the respondents knew of a killed trespasser. The effect of awareness of trespassing fatalities on the assessment of perceived safety was significant ($\chi^2(3)=21.85$, $p < 0.001$). Figure 4 shows that 92.6% of respondents who knew someone who had been killed because of trespassing considered trespassing to be slightly or very dangerous, while the corresponding percentage for those who did not know a killed trespasser was 79.8%.

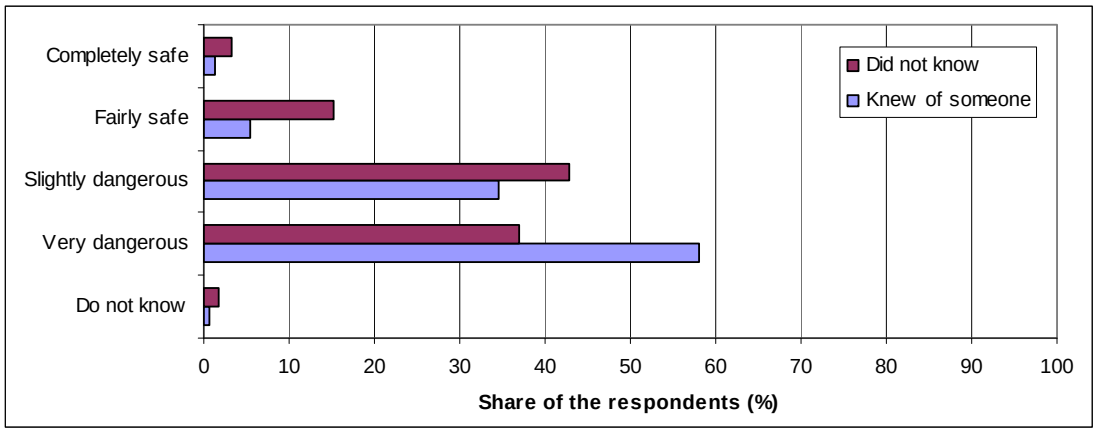

Figure 4. Perceived safety of trespassing versus knowledge of a killed trespasser (N=489).

3.5. Additional comments

At the end of the survey form there was free space for additional observations or opinions on trespassing. In total, 160 comments were received (Table 2).

Table 2. Main content and number of received comments.

Comment	Number of comments	
		Total
Proposition of countermeasures		89
Over- or underpass	45	
Fencing	18	
Safety education	9	
Modification of unofficial crossings to official	7	
Improved enforcement	4	
Landscaping	2	
Other	4	
Information about the observed trespassing site		20
Comments on other people's trespassing behaviour		19
Assessment of implemented measures		13
Reporting own behaviour (with no implications)		12
People should be more cautious		3
Other/unclear		4
Total		160

More than 60% of the comments focused on potential countermeasures. Some of them included a recommendation to introduce a given countermeasure either at the selected site or in general in the city of Lappeenranta. Another group of comments concerned the assessment of implemented measures, including specific improvements of a measure (e.g. fences should be high and strong enough so as not to be easily climbed

or broken) or opinions on the effectiveness of a measure (e.g. several positive comments about the new level crossing built in the Lappeenranta area in 2004). Furthermore, several comments included information about the observed trespassing sites in the city of Lappeenranta, other people's trespassing behaviour (mainly related to their beliefs why people are trespassing) and reports of respondents' own behaviour (e.g. places/situations where they have trespassed).

4. Discussion

This survey was designed to investigate trespassing from the point of view of people living close to a railway line. The data including 502 respondents was collected in a city that is prone to trespassing, especially in local districts close to the railway line. The results showed that the respondents were quite aware that trespassing occurs in their neighbourhood. Only 10.8% of the respondents indicated that they had never seen people trespassing.

According to the respondents' observations, trespassing occurs throughout the day. Specifically, 40.0% of respondents indicated that it is not possible to define any specific time of day when trespassing is frequent. Nevertheless, trespassing seemed to be most popular at those times when people normally move from one place to another, which means normal commuting times and in the evenings when making personal business or leisure trips. According to the trespasser counts, which were carried out at selected sites in the same city as the present survey, trespassing occurred most frequently between 11 a.m. and 7 p.m. (Silla and Luoma 2008). The results of other previous research related to the time when trespassing occurs are inconsistent. However, while earlier results have been based either on the number of fatalities and/or on the number of reported incidents, the present study utilised people's observations and our earlier study information collected by field observations. Consequently, our earlier and present study provided more reliable and consistent results on overall trespassing behaviour compared with many earlier studies.

Overall, 85.7% of respondents in the present study indicated that according to their observations, adults are the largest group trespassing. The other group that clearly stands out is youngsters. The finding that adults are the largest group trespassing is in line with previously obtained results (e.g. Centers for Disease Control

1999, Patterson 2004, Pelletier 1997, Silla and Luoma 2008). Furthermore, there are results supporting the fact that youngsters are also a large group trespassing (Lobb et al. 2003).

The respondents indicated that the most effective countermeasures to prevent trespassing include building an underpass or fencing off the tracks. The respondents also believed that education at school concerning the dangers of walking on or across railway tracks is important. Furthermore, only 6.8% of the respondents indicated that nothing could be done to resolve the problem. The proposed countermeasures are in line with our earlier results from trespasser interviews (Silla and Luoma 2008).

Roughly 69% of the respondents had crossed the railway line at a spot not marked for that purpose. This supports the fact that trespassing occurs a lot in the city of Lappeenranta. Males indicated more frequently than females that they had trespassed, which is in agreement with previously obtained results (e.g. Lobb et al. 2001, RSSB 2007, Silla and Luoma 2008). Men are also predominant among the fatalities in train-pedestrian accidents (e.g. Centers for Disease Control 1999, Cina et al. 1994, Patterson 2004).

Overall, 83.5% of the respondents considered trespassing to be slightly or very dangerous. The corresponding percentage among interviewed trespassers in the same city was much lower (50%) (Silla and Luoma 2008). This difference can be explained by the result showing that the more dangerous people think trespassing is, the more infrequent is their own trespassing. Consequently, these results suggest that those who are trespassing tend to consider trespassing safer on average than those who do not trespass. However, it must be noted that the differences in ratings of perceived safety might also be influenced by different methods used in data collection.

There was a significant effect of awareness of legality on respondents' own trespassing: among the respondents who indicated trespassing to be legal, the more substantial share was trespassing compared to respondents who considered trespassing illegal. Given that 18.2% of the respondents assumed that trespassing is legal, it is worth considering information campaigns as one form of preventing trespassing. The effect of delivered information concerning the dangers of trespassing is also supported by the finding that it appeared to have some effect on the respondents' sense of the danger of trespassing if the respondent knew of a killed trespasser. Even though there are studies stating that public education concerning the danger of railways can be effective (e.g. Lobb et al. 2003, Savage 2006, 2007), it is important to remember that

it is not easy to change the behaviour of trespassers. Pedestrians face risky situations and potential accidents every time they cross the railway tracks. They are faced with the choice between crossing a potentially dangerous railway track from an illegal place and spending more time and effort using an alternative safer route especially meant for that purpose. As mentioned by Lobb (2006), the choice between alternatives is much more sensitive to the probability than to the magnitude of consequences. Even though train-pedestrian collisions are catastrophic and tragic, they are rare events and therefore it is not surprising that some pedestrians evaluate the risk of trespassing as tolerable. This means that the horrible but very unlikely consequence of trespassing on the tracks has less control over behaviour than the smaller but certain benefit of savings in time and effort. Therefore, to have sufficient influence on trespassers' behaviour, it is recommended to reinforce information campaigns by combining them with physical measures (such as prohibitive signs or fencing) or supplementing them by incentives (rewards for safe behaviour) or enforcement procedures (such as punishment or police enforcement) (Lobb et al. 2003, Silla and Luoma 2008).

One of the main areas of the safety education should concentrate on school children, since their ability to perceive and assess the risks related to trespassing is limited. Especially schools near to railway lines should be the primary target group. The Finnish Transport Safety Agency (2009) emphasises correctly that the education at schools should concentrate on issues such as the following: playing or loitering in the railway area is prohibited, railway lines can only be crossed at official crossings, trains and other railway vehicles always have priority, train speeds are high, and trains are heavy and their stopping distance is long.

There are a couple of limitations to this study that should be considered when applying the results. First, due to a somewhat biased sample for age and a relatively low response rate, the results should be viewed with caution. However, it is assumed that these results are useful despite their potential bias, as there is not that much information available about people's perceptions in this domain. The age bias is not considered to have a substantial influence on the results, since based on our earlier study more than half of trespassers in the Lappeenranta area are adults (Silla and Luoma 2008). The response rate could be improved in upcoming surveys by increasing the number of gift vouchers (or other prizes) to be raffled among the respondents. Secondly, the results may have some limitations regarding social desirability (i.e. the tendency to answer self-report items in such a way as to

deliberately or subconsciously represent oneself in a favourable light), which might have biased the results (Edwards 1953). However, as argued by Lajunen and Parker (2001), social desirability should not be seen as a problem due to the anonymity of the respondents.

In conclusion, the opinions and recollections of people living close to the railway line helped to build a relatively extensive picture of the problem. In short, a vast majority of people are aware of trespassing in their neighbourhood, they have their own experience about trespassing although they consider trespassing dangerous and illegal, and they support countermeasures such as building an underpass or fencing off the tracks. These results allow practitioners and researchers to see the problem from the local people's perspective and thus provide an improved understanding of the problem. The increased knowledge helps to design effective countermeasures.

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