RESTRAIL

REduction of Suicides and Trespasses on RAILway property

Collaborative project

Evaluation of measures, recommendations and guidelines for further implementation

Pilot test #3

Education at schools for 8–11 year old children – VTT

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RESTRAIL Consortium

	List of Beneficiaries		
No	**Beneficiary organisation name**	**Beneficiary short name**	**Country**
1	Union Internationale des chemins de fer	**UIC**	**FR**
2	Teknologian Tutkimuskeskus VTT	VTT	FI
3	Trafikverket - TRV	TrV	SE
4	Institut français des sciences et technologies des transports, de l'aménagement et des réseaux	IFSTTAR	FR
5	MTRS3 Solutions and Services LTD	MTR	IL
6	Fundación CIDAUT, Fundación para la investigación y Desarrollo en Transporte y Energia	CIDAUT	ES
7	Helmholtz Zentrum München Deutsches Forschungszentrum für Gesundheit und Umwelt (GmbH)	HMGU	DE
8	Karlstad University	KAU	SE
9	Fundación de los Ferrocarriles Españoles	FFE	ES
10	Turkish State Railway Administration	TCDD	TK
11	Deutsche Bahn AG	DB	DE
12	Instytut Kolejnictwa	IK	PL
13	ProRail B.V	PR	NL
14	Nice Systems Ltd	NICE	IL
15	Ansaldo STS	ASTS	IT
16	University of Nottingham	UNOTT	UK
17	INFRABEL	INFRABEL	BE

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Acronym	Meaning
ADIF	ADministrador de Infraestructuras Ferroviarias
ERA	European Rail Agency
BTP	British Transport Police
CAEX	CAPital Expenditure
CBT	Computer Based Training
CCTV	Close-Circuit TeleVision
CN	Canadian National
DOW	Description Of Work
FFCCTV	Forward Facing Closed-Circuit TeleVision
GDL	German Drivers Leasing
HMTreasury	Her Majesty's Treasury
IM	Infrastructure Manager
IP	Important Point
IT	Information Technology
NPV	Net Present Value
OPEX	OPeration Expenditures
OTDR	On Train Data Recorder
PIER	Program in Interdisciplinary Education Research
2RProtect	Rail and Road Protect
RAILPOL	European Network of RAILway POLice Forces
RSSB	Rail Safety and Standards Board
RU	Railway Undertaking
SMIS	Safety Management Information System
SPSS	Statistical Package for the Social Sciences
STS	SysTemS
SWOV	Institute for Road Safety Research
TCRP	Transit Cooperative Research Programme
VAS	Visual Analogue Scale
VPC	Values of Preventing a Casualty
VT	Value of Time
CBA	Cost Benefit Analysis
CEA	Cost Effectiveness Analysis

1.1 Education at schools for 8–11 year old children – VTT

1.1.1 Overview of the measure

Education in schools included a 45-minute lesson on safe behaviour in a railway environment directed at 8–11 year old schoolchildren. The main message of the lesson was that railway lines are only meant for trains. After the lesson the children should have understood (i) the main characteristics of railway traffic (railway lines are only meant for railway vehicles, trains cannot yield, trains cannot stop fast, trains always have priority etc.), (ii) that trespassing, playing and loitering in the railway areas are forbidden, and (iii) that they have the responsibility to behave safely in a railway environment.

The lessons were held in four schools located near railway lines in the city of Tampere in Finland. The schools were selected by experts at the Finnish Transport Agency on the basis proximity to railway lines but also because the Tampere area has been identified as a problem location for railway vandalism.

1.1.2 Methodology to evaluate the effect

The effect of the school education campaign was evaluated based on a short survey directed at pupils before the lesson (base level) and around 2–3 months later (post-lesson). The survey measured three variables: (i) level of knowledge related to railway trespassing, (ii) reported crossings behaviour, and (iii) pupils' assessment of safety related to crossing railway lines. The questions were linked to three locations (Figure 1.1-1): unofficial path across the tracks (Location A), unofficial path across the tracks with a hole in the fence (Location B), and level crossing (Location C).

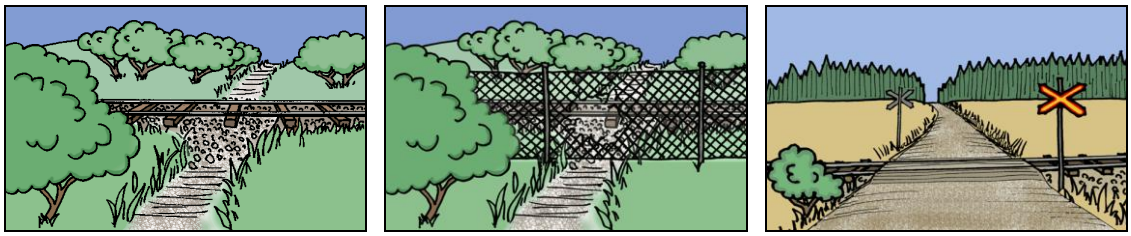

Figure 1.1-1: Locations linked to the questions: location A (picture left), location B (picture middle) and location C (picture right)

The children were allowed to respond anonymously and the answers (base line and post-lesson) were not matched afterwards, since the same students were assumed to have participated in both surveys unless they were sick. However, the results were matched at class level, with only the answers of classes that had participated in both surveys being included in the analysis.

The study was conducted as a before-after study with no control data. The inclusion of a control group was discussed but eventually dismissed, primarily because the short survey included only a few questions and would probably raise discussions among the pupils and their parents, thus informing the control group and creating bias in their answers to the survey.

1.1.3 Reported costs for measure

Reported costs for this measure implemented are given in **Table 1.1-1.**

Table 1.1-1: Costs Education at schools for 8-11 year old children

Cost	Nature	Hours	Value
Cost of measure			
Working of researchers	Preparation of the material for the lesson and the instructions to the teachers	80	8 000 €
	Preparation of the content of the survey (including the preparation of the figures)	40	4 000 €
	Communication with the principals, provision of support to the teachers when needed	20	2 000 €
	Participation in a meeting to plan the material (incl. planning of the meeting)	10	1 000 €
Working time of teachers	Preparation of the lesson (reading the instructions, getting to know the lesson plan)	18	900 €
	Conducting the lesson	18	900 €
Working time of experts of the Finnish Transport Agency	Proposal on possible schools to the included in the study	5	500 €
	Provision of comment to the content of the material which was sent to the principals	6	600 €
	Participation in a meeting to plan the material	4	400 €
	Provision of the material. The material prepared by the Finnish Transport Safety Agency was used as a basis for the material used in this study	4	400 €
	Provision of comments to the content of the material which was sent to the principals	6	600 €
	Participation in a meeting to plan the material	4	400 €
Total		**215**	**19 700 €**
Additional costs related to evaluation			
Working time of researchers	Collection and documentation of survey answers	30	3 000 €
	Analysis of the results	150	15 000 €
Working time of teachers	Conducting the follow-up survey	8	400 €
	Sending the filled surveys to VTT	8	400 €
Total		**196**	**18 800 €**

1.1.4 Evaluation results

Data

In total, 321 schoolchildren in 20 classes participated in the lesson and filled in the base level survey. For unknown reasons the post-lesson survey was not completed by all schoolchildren who took part in the lesson. After the removal of classes, that did not fill in the post-lesson survey, the matched dataset included answers from 248 pupils in 15 classes both in base level and post-lesson surveys.

The results of the base level and post-lesson surveys are presented in the following.

Questions 1–3.

The specific questions were

- Question 1: Would you cross the railway lines at location A (yes/no)?
- Question 2: Would you cross the railway lines at location B (yes/no)?
- Question 3: Would you cross the railway lines at location C (yes/no)?

The results show that for questions 1–3 the share of correct answers was fairly high already in the before phase (72.2%–94.8%), and rose by no more than 3.2 percentage units in the after phase, which in practice is almost negligible (**Table 1.1-2**).

Table 1.1-2: Share of correct answers in base level (before) and post-lesson (after) surveys

	Correct answer	Share of correct answers		Change in proportion of correct answers
		Before	After	
Question 1	No	72.2%	73.7%	+2.1%
Question 2	No	94.8%	97.2%	+2.5%
Question 3	Yes	79.4%	81.9%	+3.2%

Questions 4–6.

The specific questions were

- Question 4: How safe do you think crossing is at location A (completely safe / fairly safe / slightly dangerous / very dangerous)?
- Question 5: How safe do you think crossing is at location B (completely safe / fairly safe / slightly dangerous / very dangerous)?
- Question 6: How safe do you think crossing is at location C (completely safe / fairly safe / slightly dangerous / very dangerous)?

For questions 4–6 the proportion of correct answers (slightly dangerous and very dangerous for Q4 and Q5; completely safe and fairly safe for Q6) in the base line survey varied between 75.4% and 93.9% (**Table 1.1-3**). In the after phase this rose by between 3.2% and 8.8%, the highest change relating to the location with a level crossing (location C).

Table 1.1-3: Share of correct answers in base level (before) and post-lesson (after) surveys

	Correct answer	Share of correct answers		Change in proportion of correct answers
		Before	After	
Question 4	Slightly dangerous + very dangerous	75.4%	77.8%	+3.2%
Question 5	Slightly dangerous + very dangerous	93.9%	98.4%	+4.8%
Question 6	Completely safe + fairly safe	78.5%	85.4%	+8.8%

Questions 7–9.

The specific questions were

- Question 7: Is crossing the railway lines legal at location A (yes/no)?
- Question 8: Is crossing the railway lines legal at location B (yes/no)?
- Question 9: Is crossing the railway lines legal at location C (yes/no)?

For questions 7–9 the share of correct answers in the base line survey varied between 64.2% and 98.4%, the highest share concerning the crossing of railway lines at the location with a hole in the fence (location B) (**Table 1.1-4**). The rise in the share of correct answers varied between -1.1% and 7.0%, with the highest change concerning the location with a level crossing (location C).

Table 1.1-4: Share of correct answers in base level (before) and post-lesson (after) surveys

	Correct answer	Share of correct answers		Change in proportion of correct answers
		Before	After	
Question 7	No	64.2%	66.4%	+3.4%
Question 8	No	98.4%	97.3%	-1.1%
Question 9	Yes	86.0%	92.0%	+7.0%

Statistical tests

The results of the statistical tests (Chi-Square Test) comparing the answers in base level and post-lesson surveys are presented in **Table 1.1-5,** for each question and all pupils, and for each question by school and by grade.

Table 1.1-5: Summary of statistically significant differences between answers in base level and post-lesson surveys

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
All pupils, n=496	–	–	–	–	yes (p<0.05)*	–	–	–	yes (p<0.05)
School A, n= 33	–	np**	np**	–	np**	–	–	np**	np**
School B, n=104	–	–	–	–	–	–	–	_	yes (p<0.05)
School C, n=307	–	–	–	–	yes (p<0.05)*	–	–	–	–
School D, n=52	np**	_	–	np**	np**	–	np**	np**	–
2nd Grade, n=176	–	–	–	–	yes (p<0.05)*	–	–	–	–
3rd Grade, n=141	–	–	–	–	–	–	–	–	–
4th Grade, n=179	–	–	–	–	–	–	–	np**	–

* Due to categories with zero answers in one/more categories the safe and dangerous categories were combined (completely safe + fairly safe = safe and slightly dangerous + very dangerous = dangerous)

** np = statistical analysis was not possible due to categories with zero answers. The combination of categories was not possible or did not help to solve the problem.

For all respondents together, the only statistically significant differences in the share of correct answers between base level and post-lesson surveys were those obtained for question 5 (*How safe do you estimate crossing at location B?*) and question 9 (*Is crossing the railway lines legal at location C?*). Specifically,

- crossing the railway lines at location B (Question 5, hole in the fence) was considered dangerous more often after the lesson than before ($x^2(1)=6.62$ $p < 0.05$)
- crossing the railway lines at location C (Question 9, level crossing) was considered legal more often after the lesson than before ($x^2(1)=4.25$, $p < 0.05$)

For the results by school and by grade, in nine cases significance testing was not possible because of zero answers in the Chi-square tests (marked *np* in **Table 1.1-5**). However, as seen from the distributions of answers to the respective questions, the changes in numbers of answers in the relevant categories between base level and post-level surveys is only one or two. Therefore the effect in these cases, marked *np* in **Table 1.1-5**, was probably negligible.

For the results by school in Table 4, in two cases the effect was statistically significant:

- In school C, education improved understanding of the dangerousness of location B (Question 5, hole in the fence) ($x^2(1)=6.15$, $p < 0.05$) . Specifically, the change in proportion of correct answers improved from 92.9% to 98.7%.
- In school B, education improved understanding of the legality of crossing the railway lines at location C (Question 9, level crossing) ($x^2(1)=4.16$, $p < 0.05$). Specifically, the change in the proportion of correct answers in school B improved from 81.6% to 96.9%.

For the results by grade, in one case the effect was statistically significant:

- 2nd Grade schoolchildren considered crossing the railway lines at location B (Question 5, hole in the fence) to be more often dangerous after the lesson than before ($x^2(1)=5.93$, $p < 0.05$). It should be noted, however, that the proportion of correct answers in the base-level survey was lower (88.4%) for 2nd grade pupils than for 3rd and 4th grade pupils (97.7% and 97.2%).
- We are unable to provide a clear explanation for the variation between schools. However, the teachers constructed the content of their lesson independently based on the lesson plan provided, and they could have weighed the issues differently. In particular, in school B they may have spent more time on the legality of crossing railway lines than in other schools, and in school C they may have paid more attention to the dangers of different crossing points.

In addition to the survey results one filled feedback form was received from one 4th grade teacher. The content of this feedback was:

- The content of the lesson was good and the pictures in the PowerPoint-presentation were clear and illustrative.
- The children were attentive and seemed to be interested in the topic.
- Recommendation: the safe places to cross the railway lines could be more emphasized in the material.

CBA for Education at school for 8-11 years old

Again for this pilot test, cost data are essentially design costs of teaching program and human costs (effort and time). Effectiveness is evaluated through an evaluation of the children's knowledge gained from being exposed to education. Results and assumptions are provided in **Table 1.1-6**.

Table 1.1-6: CEA of Pilot test 3 ": Education at schools for 8–11 year old children"

Cost [C]	**19 600€**
Effectiveness measures (/year) [E] Children's attitude & knowledge changes (questionnaire pre and 2-3 months after)	3,76% (that represents the average increase of knowledge to all children regardless of their grade)
Assumptions	The effect will remain stable at least during one year
CEA [E/C]	0,00019183673469
CBA (same formula as CEA with E monetized)	

As mentioned in the previous CEA section for pilot test 2, the weak measured gain due to the high initial level of success by children before the educational action might explain the low CEA ratio. Beyond the study and validation of an assessment tools for children's attitude and competencies required to predict the adoption of safe behaviours in the railway area, other issues to consider in the future are weighted formula to compute the CEA as well as the CBA taking into account the various impacts of the measure in terms of educational efficiency related to preventing trespass, and assumption should be clarified about the potential impact of such educational measures on the number of incidents and accidents, the size of the potential targeted population, how persistent the effect, etc. It would be also important to know the figures regarding the implication of children in

trespassing accidents, and how these differ depending on where they are living relatively to the railway network location.

1.1.5 Discussion and conclusions

The main aim of this study was to evaluate whether railway safety lessons are effective in increasing schoolchildren's safety knowledge and self-reported behaviour; thus the results provide valuable input to the discussion on the effectiveness of railway safety education campaigns. The effectiveness of this measure was estimated based on three variables: self-reported behaviour, estimated dangerousness of the behaviour, and level of knowledge on the legality of the behaviour. All these variables are considered as strong determinants of actual behaviour.

- *Self-reported behaviour:* The self-reported behaviour is assumed to have a direct link to actual behaviour. Therefore the reduction in self-reported behaviour is assumed to lead to a reduction in the frequency of railway trespassing.
- *Estimated dangerousness of the behaviour:* The assumption is that the higher the children evaluate the risk to be, the smaller the probability of an unsafe crossing of railway lines. This is supported by the findings of Silla (2012), which show that perceived risk has proven to be predictive of trespassing behaviour. Specifically, trespassing was considered dangerous by (i) 98.0% of the respondents in the survey, who indicated that they had not trespassed, followed by (ii) 76.8% of the respondents who indicated that they had trespassed and (iii) 50.0% of the interviewed trespassers.
- *Knowledge of legality of the behaviour:* The assumption is that the higher the knowledge of the illegality of the crossing, the smaller the probability of an unsafe crossing of railway lines. This is supported by the findings of Silla and Luoma (2012), which indicate that the effect of awareness of legality on the respondents' own reported trespassing was significant, with a more substantial proportion trespassing among respondents who indicated trespassing to be legal compared to those who considered it illegal.

The results show that railway safety education in schools has a positive effect for all the measured variables. Specifically, the change in the share of correct answers was positive except for question 8 (*Is crossing the railway lines legal at location B?*). However, upon closer examination the number of *yes* answers was four at base level and six post-lesson, which is not a significant difference. Based on this we can reasonably assume that railway safety education in schools will also have a positive effect on the frequency of trespassing in that area.

The size of the effect depends on the children's base level understanding of the dangers related to railway lines. According to the results of this study, a fairly large majority of the children had a reasonably adequate perception of the dangers related to railways, and their self-reported behaviour reflected their perception even before the lesson. It may well be that the base level knowledge of schoolchildren is better in schools located near railway lines than in schools located farther away. Nonetheless it is always useful to review the topic so that the children maintain their awareness of these dangers.

We can assume from the results that the positive changes in self-reported behaviour, estimation of danger and understanding of legality will have a positive effect on the frequency of trespassing (i.e. fewer unsafe crossings in the future). We can further assume that reduction in the frequency of trespassing could have an effect (i.e. reduction) on the frequency of trespassing accidents. What the results do not do is to answer to the question of how many trespassing accidents could be prevented with this intervention.

1.1.6 Applicability of results to different circumstances

A similar railway safety education programme could be implemented in other European countries, given that the main safety message is valid everywhere. However, the material should be adjusted to comply with local circumstances (e.g. typical environments where trespassing occurs). In addition, it should be noted that this measure is expected to be more effective in raising the level of knowledge when implemented in cities and/or countries in which the children's level of knowledge is not as high in the before phase as in the Tampere region.

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