RESTRAIL

REduction of Suicides and Trespasses on RAILway property

Collaborative project

Evaluation of measures, recommendations and guidelines for further implementation

Pilot test #1

Warning signs and posters – CIDAUT

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RESTRAIL Consortium

	List of Beneficiaries		
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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
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Table of contents

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 Warning signs and posters – CIDAUT

1.1.1 Overview of the piloted measure

Warning signs and posters are aimed to deliver information concerning dangers and punishments associated with trespassing. The warning signs selected (trespassing and breaking the fence) for this pilot test, consist of a range of images and texts aiming to convey information about punishments associated with illegally crossing the rails, targeted at preventing trespasses in the railway property. These signs are especially based on the facts of trespassing and breaking the fence. On the other hand, the informative poster aims to increase the level of knowledge about the railway culture in order to avoid the most frequent risks. See in **Figure 1.1-1** an example of a warning sign (other signs can be found in D5.1. Selection of measures and their implementation in pilot test planning and execution; Kallberg, Plaza, Silla, García et al, 2014).¡

Figure 1.1-1: Spanish warning sign referring to the fine for trespassing.

The place selected in order to implement this preventive measure was the stopping place named "Valladolid-Universidad" located at the conventional gauge railway, L Madrid-Irún, PK-25+600, in Valladolid, Spain. This stopping place has been identified as a hotspot with a high number of trespassing and real pedestrian-train fatalities. In addition, a large number of vandalism acts and graffiti actions have been detected at this stopping place. In this rail area, there are a high number of users who usually go across this stopping place to pass from the one area of the city to another side by walking over the tracks instead of taking the underpass.

1.1.2 Methodology to evaluate the piloted measure

The main hypothesis of this evaluation was that potential trespassers who became more aware of the illegality and punishments associated with their behaviours would, after reading the warning signs at the poster located at the site, avoid crossing illegally in the railway area in the future, avoiding, thus, being fined as well. For this purpose, a before and after study was carried out, based on comparison of frequency of trespassing as well as unsafe behaviours before and after the warning signs and the posters were set up. As it was pointed out in D5.1.Selection of measures and their implementation in pilot test planning and execution (Kallberg, Plaza, Silla, García et al, 2014), it is assumed that changes in the frequency of trespassing reflect the effects on the frequency of trespassing accidents and positive attitudes towards avoiding risky behaviours (Korve, Farran, mansel, Levinson, Chira-Chavala and Ragland, 1996).

In order to carry out this comparison an observation study was carried out, consisting of two phases: (1) pre-intervention (baseline) and (2) post-intervention (short-term effects).

Observations

The days of observation were established on the basis of the user profiles for the stopping place and their usual behaviour. For this purpose, a pre-study was carried out in order to detect the usual behaviours and the times of increased presence of passengers and users. As result of this, observations were established from 9.00 to 19.00 on four consecutive days, from Wednesday to Saturday, when the main type of illegal and unsafe behaviours at this stopping place were registered.

One inconspicuous and trained observer was located at each platform during the four days of observation. Each observation day was divided into seven observation hours on the basis of the pre-study, except the observation time from 09.00 to 10.00 on Friday and from 16.00h to 17.00 on Saturday because ADIF workers were on the track, and thereby, this situation could affect the actual behaviours of the users. The observers collected separately the legal and illegal behaviours carried out in the stopping place. To check the reliability of the observations after each period of observation, the recordings were checked out among both observers.

Furthermore, every day during the second evaluation (post-intervention), the repaired fence was checked in order to know if it had been broken or not. The fence broken by users to take a short cut was mended during the implementation of the measure with the aim of knowing the effect of one of the warning signs that identified the punishment for breaking the fence.

The second hypothesis was that people, who became more aware of the dangers of crossing illegally after reading the posters set up at the stopping place, would pay the greatest attention in the future when they cross by using the authorised places and would acquire positive attitudes towards avoiding risk behaviours.

In order to know if users were aware of the dangers of crossing illegally as well as the illegality of some behaviour, a before and after study was carried out, comparing the knowledge acquired between (1) pre-intervention (baseline) and (2) post-intervention (short-term effects).

Surveys

The questions of the survey concentrated on perceptions of safety and illegality, frequency of walking across the tracks and using the level crossing and underpass. These surveys were conducted from 09.00 to 19.00 the following week after the observations in both periods of the study. On the one hand, the surveys were carried out at the stopping place and on the other hand, in one community centre near the stopping place. A total of 162 forms were issued prior to the intervention and 142 after the intervention. Concerning the interviewees, people from the community centre were the same for both the before and after surveys and most people interviewed at the stopping place were also the same (around 88%).

Furthermore, one question about the illegality of breaking fences and punishment associated was also asked. At the end, three questions concerning the railway culture were carried out as well to know basically if during the study period the warning and educational signals have been read.

The sample was taken from two places during the before and after study. These places were at the stopping place and a community centre close to the rail station. The number of subjects that filled the surveys in the pre-study was 107 at the stopping place and 55 in the community centre. On the other hand, 106 people at the stopping place in the after-study and 37 in the community centre (**Table 1.1-1**).

Table 1.1-1: Total number of participants

		Surveys		Total
		Before	After	
Place	**Stopping place**	107	106	213
	Community centre	55	37	92
Total		162	143	305

The subjects were divided into four groups according to their age. As it could be observed (**Table 1.1-2**), the number of participants in these groups was quite similar before and after the study.

Table 1.1-2: Group of participants

		Surveys		Total
		Before	After	
Group of participants	**Teenagers**	1	0	1
	Youth	35	27	62
	Adults	80	53	133
	Elderly	46	63	109
Total		162	143	305

As it can be observed in **Table 1.1-3,** the number of females and males who participated was similar before and after the study.

Table 1.1-3: Gender

		Surveys		Total
		Before	After	
Gender	**F**	99	83	182
	M	63	60	123
Total		162	143	305

Finally, another characteristic was taken into account was the occupation of the participants. Thus, four groups were created: students, retired, unemployed and workers. As described in the table, no big differences were found according the occupation before and after the study (**Table 1.1-4**).

Table 1.1-4: Occupation of the participants

		Surveys		Total
		Before	After	
Professional situation	**Student**	22	24	46
	Retired	53	62	115
	Unemployed	44	27	71
	Worker	43	30	73
Total		162	143	305

1.1.3 Reported costs for measure

Reported costs for the measure implemented in this pilot test are collected in the **Table 1.1-5.**

Table 1.1-5: Reported costs for Warning signs and posters

Cost	Nature	Value
Costs of production for posters and signs	warning sign 1 (X2)	1166,24
	warning sign 2 (X2)	494,98
	poster 1 (X2)	1086,92
	poster 2 (X2)	m.v.
Maintenance costs		m.v.
Total		**2748,14**

1.1.4 Evaluation results

Observation study

Focusing on the main hypothesis, the table, collected in **Annex 1: Groups combination** shows that the trespassers have been reduced from 128 to 77 after the implementation of the warning signs that indicated the possibility of being fined for trespassing. Furthermore, it should also be highlighted the reduction in numbers of people using the broken fence areas in order to access or leave the stopping place. As also collected in the same table, this illegal behaviour has decreased from 26 to 4. In addition to this, after the installation of the warning sign, the broken fence area was repaired, impeding through it. After post-intervention, it was checked out that the fence has not been broken again, so an effect of the warning sign indicating the possibility to be fined for breaking the fence could have occurred as well. Concerning this, it was indicated by ADIF that before carrying out this study, when the fence was repaired, people broke it immediately again.

On the other hand, the number of people using the stopping place for running, jogging and walking using the cross-platform interchange in order to cross from one area of the city to other one, increased from 200 to 248. In this context, it is important to remember that the cross-platform is intended for users who have to change the platform in order to take the train at the opposite side. In the same way, the number of cyclists through stopping place and using the cross-platform to cross over has increased from 158 to 282 after being implemented the poster indicating that riding bikes is prohibited along the stopping place. However, the number of motorcyclists riding through stopping place and using the cross-platform to cross over has decreased from 3 to 0.

In order to know whether these differences were significant, Chi Square tests (**Table 1.1-6**) were performed and they indicated that all these differences were significant (p=0.025). Consequently, the null hypothesis can be refused and we can say that the number of trespassers has been decreased considerably after the implementation of the warning signs indicating that trespassing is an illegal behaviour and the possibility of being fined if you were caught by Police/Railway Security. As result of this, the trespassers who have read the warning signs are aware of the illegality and punishments of this behaviour and they have avoided trespassing at the stopping place named University-Valladolid.

Furthermore, the number of people using the broken fence areas to cross also has been reduced significantly (p=0.025). Furthermore, the repaired fence has not been broken by people after the repairs. Hence, we can say that after the implementation of warning sign indicating the possibility of being fined for breaking the fences, nobody broke the fence and people could not use this short cut, so the warning sign that indicated the punishment for breaking the fence could have had an effect.

Table 1.1-6: Chi Square tests for the significance of the results

Chi-Square Tests			
	Value	**Df**	**Asymp. Sig. (2-sided)**
Pearson Chi-Square	138,927[a]	8	,000
Likelihood Ratio	163,335	8	,000
Linear-by-Linear Association	38,449	1	,000
N of Valid Cases	1758		
a. 6 cells (33,3%) have expected count less than 5. The minimum expected count is 1,50.			

All these variables supports our main hypothesis stating that people after reading the warning signals would reduce their illegal and unsafe behaviours.

However, the number of people using the stopping place for running, jogging and walking, who cross from one area of the city to other one through the cross-platform interchange, has increased from 200 to 248. As it has just said in the paragraph above is important to remember that the cross-platform is intended for passengers who have to change platforms in order to take the train in the opposite side/platform or to leave the stopping place. In the same way, number of cyclists using the stopping place in order to access the green park through the cross-platform has increased from 158 to 282, despite the poster indicating that riding bike is prohibited along the stopping place. All these unsafe behaviours have increased significantly (p=0.025).

Although the likely explanation for the increase of these types of unsafe actions seems to be the weather conditions, since it is spring and people usually go to run, jog, biking more often than winter, it is certain too, that no information was gathered from the warning signs at the stopping place referring to these behaviours. An exception is that whilst biking is forbidden through the stopping place, this information was provided on the poster located in the underpass and thus, not accessible for bikers to read.

Survey study

The main variables that were measured in the survey in order to know the effectiveness of the piloted measures were the following ones:

- The perception of illegality about crossing over the tracks when a train is not approaching.
- Awareness about the sanction applied in case of crossing over the tracks when a train is not approaching.
- Perceived illegality about crossing the tracks when a train is approaching.
- Sanction for crossing over the tracks when a train is not approaching.
- Awareness about the illegality about breaking/painting the fence.
- Sanction for breaking/painting the fence
- Time taken for a train to stop in comparison to a car.
- Knowledge about the trains that stop at this station.
- Knowledge about the speed of the trains at the station.
- Perceived prohibited behaviours.

1. - The perception of illegality about crossing over the tracks when a train is not approaching.

As observed below (**Figure 1.1-2**), it has been an increase in the number of people that has denominated this action as illegal. This will support our hypothesis and the effectiveness of the informative warning which notifies about the illegality of trespassing.

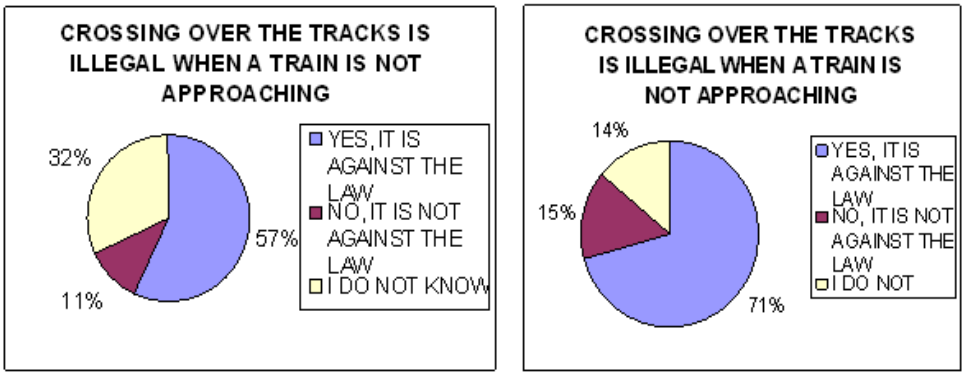

Figure 1.1-2: Perception of illegality crossing over the tracks, when train is not approaching

2. - Awareness about the sanction applied in case of crossing over the tracks when a train is not approaching.

The results showed a larger amount of people that have chosen the correct answer after the implementation of the warning. 9% more respondents chose that the fine can be up to 6000 €. It is remarkable that the "none" option has fallen from 49% to 26%. It can be interpreted that although the amount is not accurately known, the fact that there is some kind of fine has reached users (**Figure 1.1-3**).

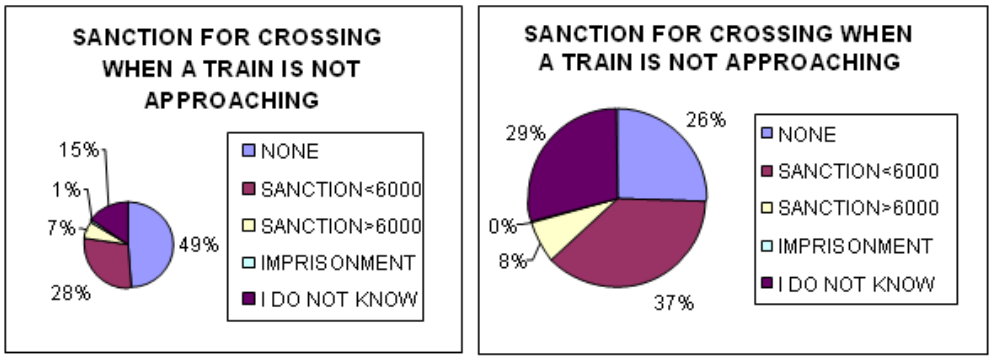

Figure 1.1-3: Awareness about the sanction applied in case of crossing over the tracks, when train is not approaching

3. - Perceived illegality about crossing the tracks when a train is approaching

As noted below the grade of people's awareness about this behaviour has increased (**Figure 1.1-4**), although most participants had already indicated that this behaviour is illegal (69%).

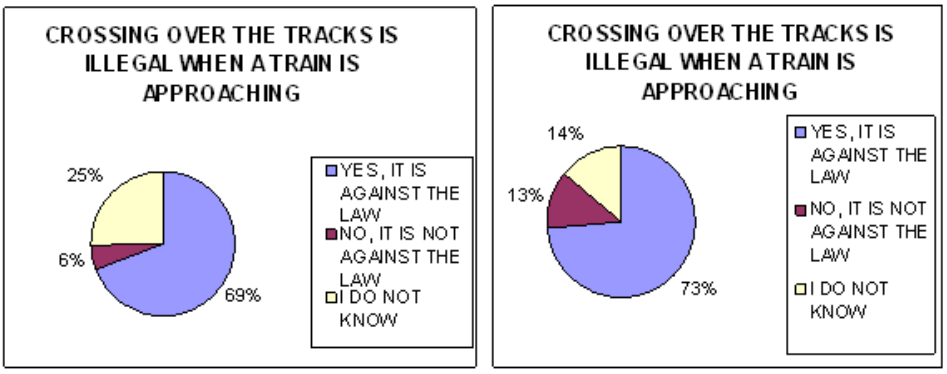

Figure 1.1-4: Perception of illegality crossing over the tracks, when train is not approaching

4. - Sanction for crossing over the tracks when a train is approaching

In this case, a decrease has been found in the after-phase of the study about the sanction associated with crossing through the tracks, since less people have answered correctly. In fact, the number of participants who answered 'Do not know' has increased as well (**Figure 1.1-5**).

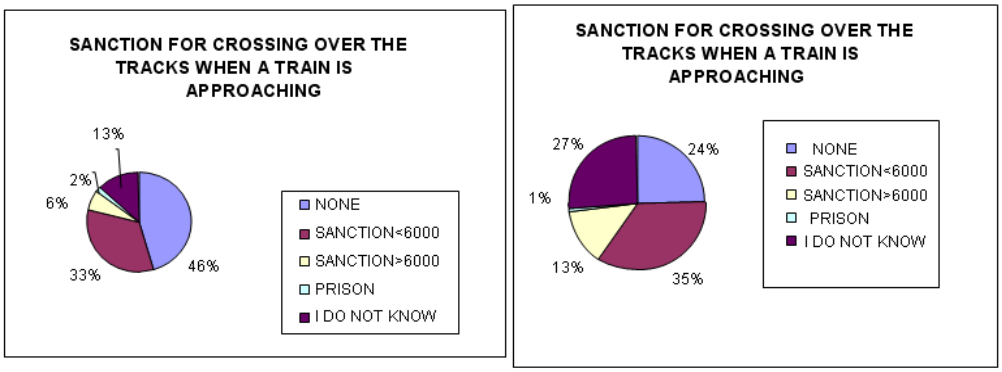

Figure 1.1-5: Percentage of responses about sanctions for crossing over the tracks when train is approaching

5. - Awareness about the illegality about painting/breaking the fence

As shows below, the people's awareness about the illegality relating to painting/breaking the fence has increased, although before-study already a high number of right answers. When there are small percentages unaware of a particular measure, it becomes exponentially difficult to reach them. However, this measure has achieved a 99% informed users about the illegality of this practice (**Figure 1.1-6**).

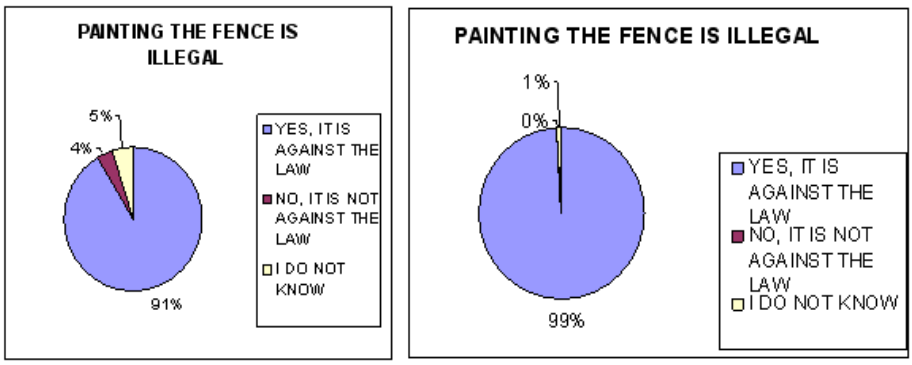

Figure 1.1-6: Awareness about illegality about breaking/painting the fence

6. - Sanction for painting/breaking the fence

It has been demonstrated that people have answered more correctly after the implementation of the piloted measures. It has gone from 19% to 33% who are aware that penalties may be greater than 6,000€, although in general terms, despite being well known that it is illegal, similar percentages between the two options show that users do not know exactly the amount of the fine (**Figure 1.1-7**).

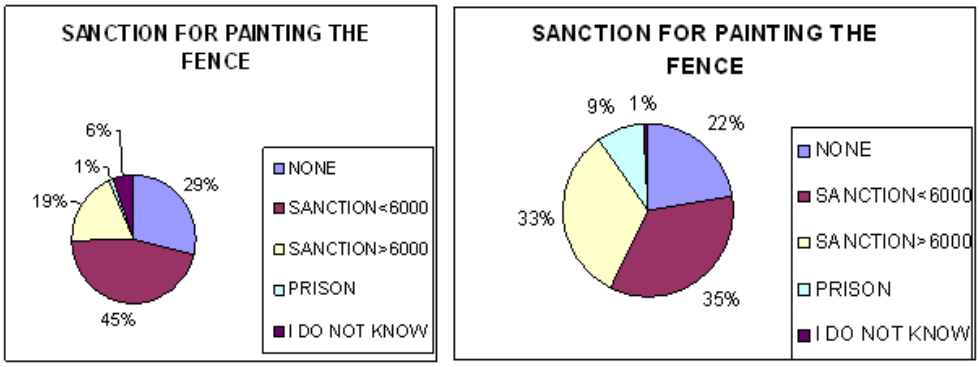

Figure 1.1-7: Percentage of answer about sanction for painting/breaking the fence

7. - Time taken for a train to stop in comparison to a car

It is clear that people have answered more correctly than in the before- phase of study. The posters have improved markedly users' train knowledge, which is represented by an 8% increase on the correct answer. The "20 times more" option has decreased by 16%, even though the "twice more" option has increased by 13 % (**Figure 1.1-8**).

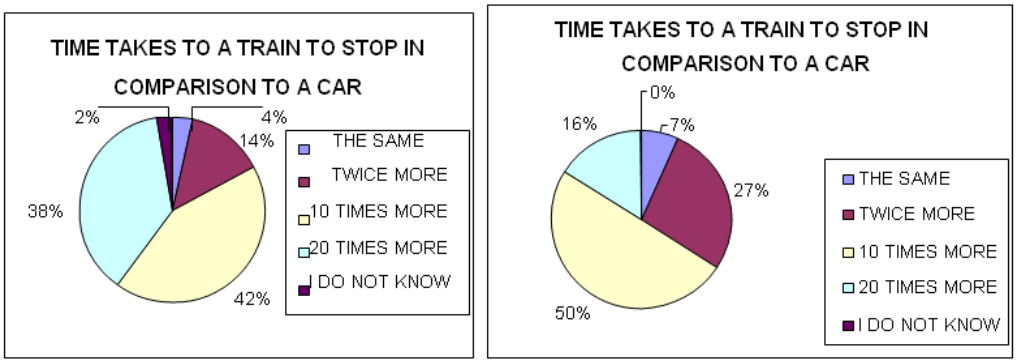

Figure 1.1-8: Percentage of answers concerning the time takes to stop a train

8. - Knowledge about the trains that stops at this station

A number of right answers (with/without stop, at any time and in both ways) has increased considerably from 36% to 69%, being the option that has suffered a major decrease is that the trains can only stop in one way (**Figure 1.1-9**).

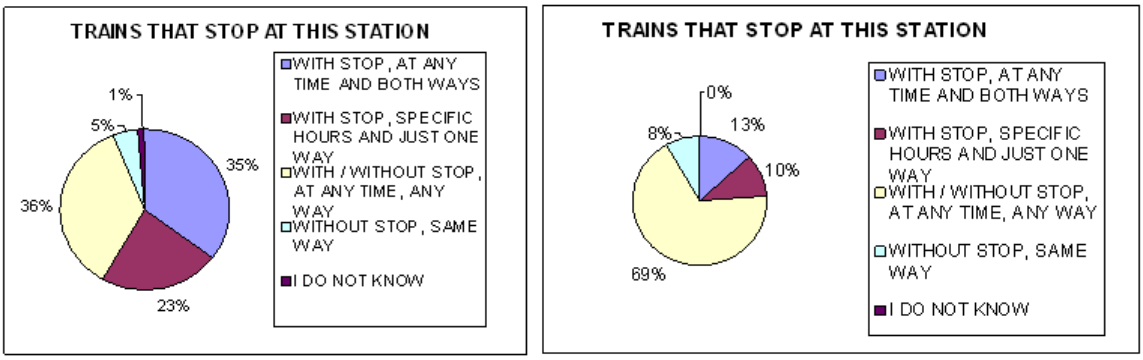

Figure 1.1-9: Knowledge about the trains that stop at this station.

9. - Knowledge about the speed of the trains at the station

The correct information has slightly decreased in favour of the option “up to 160 km/h same way”. Interestingly, the option “more than 200 km/h same way” has also increased (**Figure 1.1-10**).

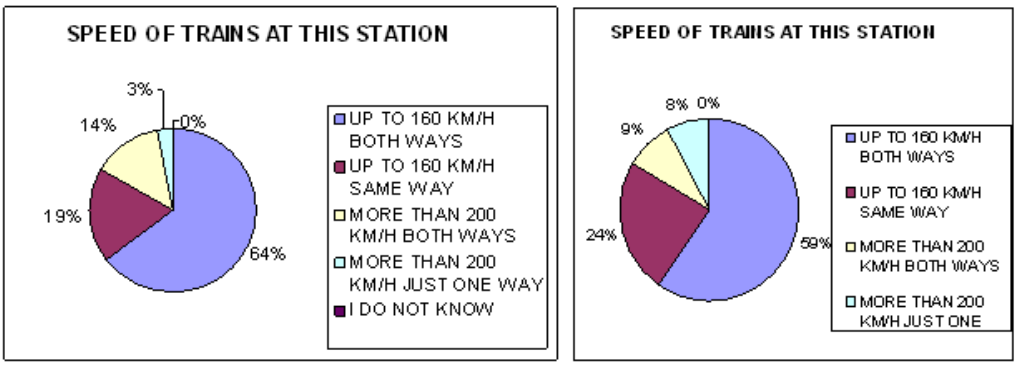

Figure 1.1-10 Knowledge about the speed of the trains at the stations

10. - Perceived prohibited behaviours

The correct answer that was “cycling through platforms and authorised passes” has been increased significantly (**Figure 1.1-11**). So this information posted in the informative panel seems to have been very effective.

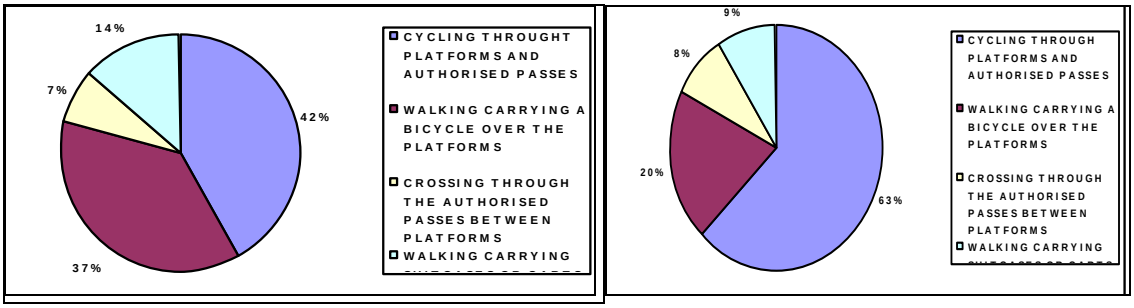

Figure 1.1-11: Percentage of answers concerning the prohibited behaviour

Below, it is collected the table of decision-making that shows which differences were or not significant for each one of the variables studied in the comparison between the punctuation in the before-phase and after-phase (**Figure 1.1-12**).

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of cruce_vias_NOILEGAL is the same across categories of Obs_temp.	Independent-Samples Mann-Whitney U Test	,160	Retain the null hypothesis.
2	The distribution of sancion_cruce_NOtren is the same across categories of Obs_temp.	Independent-Samples Mann-Whitney U Test	,000	Reject the null hypothesis.
3	The distribution of cruce_SItren is the same across categories of Obs_temp.	Independent-Samples Mann-Whitney U Test	,672	Retain the null hypothesis.
4	The distribution of sancion_cruce_SItren is the same across categories of Obs_temp.	Independent-Samples Mann-Whitney U Test	,000	Reject the null hypothesis.
5	The distribution of pintar_vallado is the same across categories of Obs_temp.	Independent-Samples Mann-Whitney U Test	,061	Retain the null hypothesis.
6	The distribution of sancion_pintar_vallado is the same across categories of Obs_temp.	Independent-Samples Mann-Whitney U Test	,733	Retain the null hypothesis.
7	The distribution of frenar_tren is the same across categories of Obs_temp.	Independent-Samples Mann-Whitney U Test	,000	Reject the null hypothesis.
8	The distribution of paradas_tren is the same across categories of Obs_temp.	Independent-Samples Mann-Whitney U Test	,000	Reject the null hypothesis.
9	The distribution of velocidad_tren is the same across categories of Obs_temp.	Independent-Samples Mann-Whitney U Test	,001	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Figure 1.1-12: Asymptotic significance for the variables studied in the survey.

CBA for warning signs and poster

For this pilot test, only costs related to the design and implementation were available, and no maintenance costs were provided. The costs are therefore incomplete. We performed a CEA however, as a first indicative evaluation. It will be possible to compute an updated CEA and/or a CBA when full costs and more long-terms data will be available.

Effectiveness was measured essentially by comparing the number of trespassers before and after implementation during four consecutive days in the week. Due to the short timeframe, only a short-

term evaluation was done, but it is planned to collect data on effectiveness in the future to have a more long-term evaluation of the effect of the measure. A survey was also performed in order to evaluate the knowledge acquired about the dangers of trespassing as well as attitude about some risky behaviour. It was not possible to use these results as a measure of effectiveness given that no standard calculation formula was available to transform responses to each item into a global quantitative score to be used in CEA or CBA. Results and assumptions are provided in **Table 1.1-7**. Bearing in mind the limits of the current calculation, the observed ratio could be interpreted in the following way: an investment of 1 euro reduces by 0.96 the number of trespassers per year. Alternately, it can be also understood as an investment of 1,04 Euros (1/0.96) will reduce by 1 the number of trespassers in one year at the considered location.

Table 1.1-7: CEA of Pilot test 1: "Warning signs and posters"

Cost [C]	2 748€
Effectiveness measures **Number of trespassers prevented per year**	2652 (51 decrease/ week * 52 weeks)
Assumption(s)	The reduction in the number of trespassers is considered as constant and representative of the cumulated effect whatever the period in the year
Cost effectiveness ratio (CEA results (E/C)	0,96501

It should be noted that a mini CBA could be calculated given that an estimation of the following parameters could be obtained or assumptions made in the future:

- Number of accidents due to trespassing events per year.
- Distribution of trespass consequences (fatalities, injuries).
- The effect of decreasing the frequency of trespassing on the frequency of fatal trespassing accidents.
- Average delay induced by trespassing events.

1.1.4 Applicability of results to different circumstances

Existence of empirical evidence from other studies makes clear and supports the fact of signals and posters' effectiveness. Some years ago, Silla and Luoma (2011) obtained a reduction of 30.7 % in trespassing in a specific Finnish location. In this paper, authors suggest, as improvement and future line, that posters are aimed only to deliver information about dangers related to trespassing and they highlight that they should have just an informative purpose and should not prohibit or dictate behaviours. These points have been successfully collected in the poster and signs applied in the University of Valladolid stopping place where information about economic charges have been provided.

Even though a general effectiveness seems to be clear, the characteristic of these signs and posters should be adapted depends on the context and country; especially, it should be flexible regarding three main points: content, amount of signs and posters and period of time.

The design of the signs/posters should be carefully planned. It might be that the same design is not effective in all cultures. For example some train operators could disagree with the message shown as they might not like the depiction of a (recognizable, their company) train on a poster. In addition, it is important that the posters have a language such that everyone can understand its content (i.e. removing old posters and replacing them with posters in a modern language). Finally, it is crucial to be careful with the message "trespassing is dangerous" this could attract potentially suicidal persons to the tracks. It is better to address to "the delays caused by trespassers" and "the number of people that are deceived by those delays".

The amount of signs presented is another important factor to be considered. It should be made sure that there is no unnecessary signing. Otherwise, people could look at the posters without taking much notice of them. On the other hand, paying attention depends on the amount of posters that are installed, in this way, it should be study carefully how many and where the posters are allocated.

Thirdly, it is important to take into account the period of time the signs and posters are exposed in a determinate area. The effect of posters is likely to be reduced over time. However, this effect could be maintained by replacing the old and 'grungy' posters by new ones. Their effectiveness could be increased also by changing the content / design of the posters from time to time (e.g. every year or twice a year a new poster).

As a general idea, the optimal measure would be to combine these signs with targeted campaigns. Furthermore, another successful resource could be to combine these measures with prohibitive signs. Placing signs with the same message next to each other (e.g. one is an icon, the other a picture with text, the other is a prohibitive sign). Finally, it is crucial to receive support from station owners etc. for space to place posters as these may compete with others for space (e.g. displacing advertising revenue). After all, one of the most important factors is government involvement. Budget and political will would be the main paths in order to generalize those methodologies.

1.1.5 Discussion

As it collected above, the warning signs had a significant effect on the reduction of trespassing. It seems to be an effective measure in order to reduce trespassing incidents as also indicated in some previous studies (Silla and Luoma, 2011). In addition at the trial location, warning about the possibility of being fined by breaking the fences located at the stopping place has had an effect on avoiding this behaviour in the future. Consequently, after the implementation of this type of warning, the stopping place users have not again broken the fence, reducing significantly the use of an illegal area in order to cross to the stopping place.

1.2 References

Bickel, P., Friederich, R., Burgess, A et al.(2006). *"Proposal for Harmonised Guidelines"*, Deliverable 5, HEATCO *"Developing Harmonised European Approaches for Transport Costing and Project Assessment"*, 2nd Revision, February 2006. Available at: http://heatco.ier.uni-stuttgart.de/HEATCO_D5.pdf

Burkhardt, J.-M, Radbo H., Silla, A. and Paran F. (2014). A model of suicide and trespassing processes to support the analysis and decision related to preventive railway suicides and

trespassing accidents. *Transport Research Arena*, 14-17 Apr 2014 Paris La Défense (France).

Burkhardt, J-M; Beurskens, E.; Ryan, B.; Hedqvist, M. et al (2013). RESTRAIL (Reduction of Suicides and Trespasses on RAILway property) project. Assessment of suitable measures (Technical and soft measures) for the prevention of suicides and trespasses. Merged Deliverable D5.3. and D3.2. ; 28/02/2013.

CGSP (2013). L'évaluation socioéconomique des investissements publics (tome 1). Commissariat general à la stratégie et la prospective, septembre 2013.

Commonwealth of Australia (2006). *Introduction to Cost-Benefits analysis and other alternative evaluation methodologies.* Dpt of finance and administration, January 2006. Available at: http://www.ag.gov.au/cca

Cross, W., Matthieu, M.M., Lezine, D., and Knox, K.L. (2010) Does a brief suicide prevention gatekeeper training program enhance observed skills? *Crisis, 31*(3):149-159.

Elvik, R., Høye, A., Vaa, T. & Sørensen, M. 2009. *The Handbook of Road Safety Measures*. Second Edition. Emerald.

Erazo N, Baumert J, Ladwig KH (2005). Factors associated with failed and completed railway suicides. *J Affect Disord 88, 137-43.*

Erazo NS, Baumert J, Ladwig KH (2004). Sex specific time patterns of suicidal acts on the German railway system. An analysis of 4003 cases*. J Affect Disord 83: 1-9).*

European Railway Agency (2013). *Implementation guidance for CSIs*, Annex I of directive 2004/49/EC as amended by directive 2009/149/EC. Report ERA/GUI/09-2013 v 2.3.

Florio, M. et al. (2008) "Guide to cost-benefit analysis of investment projects: structural funds and instrument for pre-accession." (2008). *EUROPEAN COMMISSION Directorate General Regional Policy*. Available at: http://ec.europa.eu/regional_policy/sources/docgener/guides/cost/guide2008_en.pdf

Hauer, E. (1997). *Observational Before-After Studies in Road Safety*. Pergamon.

Hills, D, Junge, K. (2010) *Guidance for transport impact evaluations*. The Tavistock Institute, London. Available from http://www.roadsafetyevaluation.com/evaluationguides/index.html.

Hills, D. (2010) *Logic mapping: hints and tips guide*, Department for Transport, UK.

HM Treasury (2011). *The Magenta Book. Guidance for evaluation.* HM Treasury. Downloaded from http://www.hm-treasury.gov.uk/data_magentabook_index.htm, 1 February 2013.

Hsieh, H–F., Shannon, S.E., 2005. Three Approaches to Quantitative Analysis. *Qualitative health research 15* No 9, 1277–1288.

Kallberg, Plaza, Silla, García et al (2014). RESTRAIL (Reduction of Suicides and Trespasses on RAILway property) project. D5.1. Selection of measures and their implementation in pilot tests planning and execution, 31/07/2014

Karoline, L., Baumert, J., Erazo, N. And Ladwig, K-H (2014). Stable time patterns of railway suicides in Germany: comparative analysis of 7,187 cases across two observation periods (1995–1998; 2005–2008). *BMC Public Health* 2014, 14:124.

Korve, H.W., Farran, J.I., Mansel, D.M., Levinson, H.S., Chira-Chavala, T., & Ragland, D.R. (1996). *TCRP Report 17: Integration of Light Rail Transit into City Streets*. Washington, D.C.: TRB, National Research Council.

Lukaschek K, Baumert J, Ladwig KH (2011). Behavioural patterns preceding a railway suicide: Explorative study of German Federal Police officers' experiences. *BMC Public Health* 11: 620; Gaylord MS, Lester D: Suicide in the Hong Kong subway. Soc Sci Med1994, 38:427-430.

Mann, JJ; Apter, A; Bertolote, J; Beautrais A, Currier D, Haas A, et al (2005): Suicide prevention strategies: a systematic review. JAMA, 294:2064-2074

Meunier, V (2009). Analyse coût-bénéfices : guide méthodologique. Cahiers de la Sécurité Industrielle, 2009-06: Institute for an Industrial Safety Culture, Toulouse, France (ISSN 2100-3874) at http://www.icsi-eu.org/français/dev_cs/cahiers/.

O'Donnell I, Farmer R, Tranah T (1994): Suicide on railways. *Soc Sci Med*, 39:399-400

Rådbo, H., Renck, B., & Andersson, R. (2012). Feasibility of railway suicide prevention strategies; a focus group study. In C. Bérenguer, A. Grall & C. Soares (Eds.), Advances in safety, reliability and risk management. London: Taylor & Francis Group.

Randles, R.H. and Wolfe, D.A. Introduction to the theory of nonparametric statistics, John Wiley & Sons, New York etc (1979).

RESTRAIL. 2014. Deliverable 5.1. Selection of measures and their implementation in pilot test planning and execution.

RSSB. (2006). T555 Improving the Content and Placement of Anti-trespass Signs (Final Report No. T555): Halcrow Group Limited in partnership with Human Engineering Limited.

Silla A. and Luoma, J. (2012). Opinions on railway trespassing of people living close to a railway line. Safety Science 50, 62–67.

Silla, A. (2012). Improving safety on Finnish railways by prevention of trespassing. Espoo 2012. VTT Science 27. 49 p. + app. 43 p.

Trafikverket (2012). http://www.trafikverket.se/PageFiles/73641/samhallsekonomiska_principer_och_kalkylvarden_for_transportsektorn_asek_5_kapitel_9_trafiksakerhet_2.pdf

Trafikverket (2012). http://www.trafikverket.se/PageFiles/73641/samhallsekonomiska_principer_och_kalkylvarden_for_transportsektorn_asek_5_kapitel_9_trafiksakerhet_2.pdf

Transport Note TRN- 6, 33927 (2005) "When and How to use NPV, IRR2 and modified IRR", ,The World Bank, Washington D.C. 2005.

Van Houwelingen CA and Beersma DG (2001): Seasonal changes in 24-h patterns of suicide rates: a study on train suicides in The Netherlands. *J Affect Disord, 66:215-223.*

World road association, Technical committee C2, safer road operations (2012). *State of the practice for Cost-effectiveness analysis (CEA), cost-benefit analysis (CBA) and resource allocation*