



**RESTRAIL**  
**SCP1-GA-2011-285153**



## **RESTRAIL**

**REduction of Suicides and Trespasses on RAILway property**

**Collaborative project**

**Evaluation of measures, recommendations and  
guidelines for further implementation**

**Pilot test #5**

**A combination of measures at Ayden Station – TCDD**

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No	Beneficiary organisation name	Beneficiary short name	Country
1	Union Internationale des chemins de fer	<b>UIC</b>	<b>FR</b>
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
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<b>Acronym</b>	<b>Meaning</b>
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 A combination of measures at Ayden Station – TCDD

### 1.1.1 Overview of the piloted measure

Our projects aim is to reduce the occurrence of suicides and trespasses on railway property and the costly service disruption these events cause, by providing the rail industry with an analysis and identification of cost-effective prevention and mitigation measures. The Aydin Demonstration has proved to be an excellent example of what could be achieved through research and further investigation on preventive measures and precautions.

The population of the Aydin city is 260 thousand, within the structure of the metropolitan municipality. The geographical position of the railway and station separates the city in the middle. There are schools, hospital, shopping centre and stadium really close to the Aydin Station. State Hospital is also near the station zone and people from nearby towns are coming for treatment to the hospital (Figure 1.1-1).

The measures include physical measures preventing access to the railway area and behavioural measures informing the public about the dangers and illegality of trespassing.



Figure 1.1-1: Location of Aydin Station

As you can see in the picture there are many local centres where passengers and local residents create congestion. Due to this fact Aydin Station has become very vital on trespass issues. There weren't many precautions and measures as regards to this aspect.

### 1.1.2 Methodology to evaluate the piloted measures

The measures will be implemented at the Aydin Station found at 130+012 km of the İzmir-Denizli Line within the Turkish conventional railway line. The station is located in the centre of Aydin, and the railway runs across the city centre (**Figure 1.1-2**).

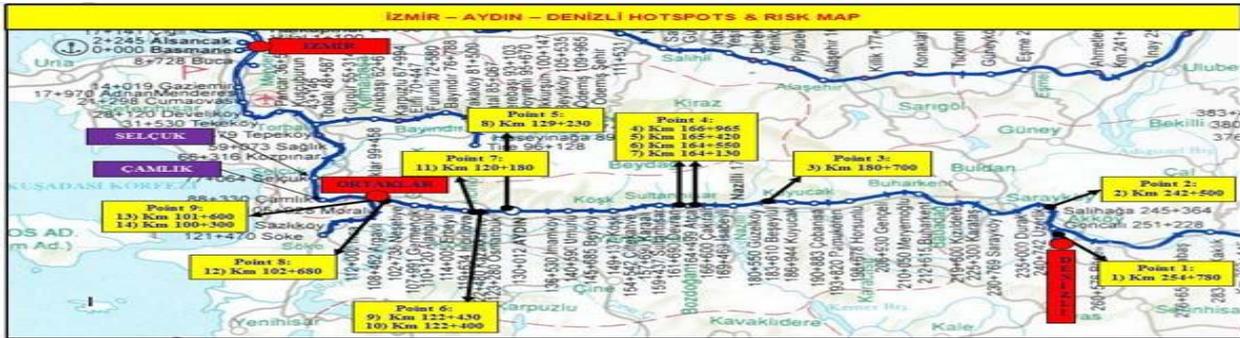


Figure 1.1-2: Aydın Station risk map

The TCDD Accident/Incident Reports related to the last 3 years have been investigated. According to the results the Torbalı-Aydın-Denizli line has been detected as the most frequent trespass area. Consequently:

- 20 risk points are precisely defined.
- On 3 February 2013 TCDD Team has visited these points on site and gathered required data.
- On April 2013 20 risk points have been narrowed down to 9 according to the project members perspective (**Table 1.1-1**).

Table 1.1-1: Descriptions of all measures implemented at Aydın station

Title of measure		Description
1	Cancellation of one of the two gates that has been used for logistics centre and arranging the second gate to be automated and locked.	There were two gates the logistics centre used - one has been cancelled by building 10 metres of wall and the other gate is made into automated gate door. 4 metres fencing is made in addition
2	Fencing to the end platform where there was the main getaway point towards the lines.	11 metres of fence has been built
3	Extending the fence between 1 <sup>st</sup> and 2 <sup>nd</sup> platforms	120 metres of fence extension
4	Fencing the hospital side of the Station Area and rebuilding of fence on top of the short wall that borders the area.	384 metres of fencing +60 metres
5	Fencing towards IZMIR direction from the level crossing.	180 metres of fencing
6	2 IP Cameras in order to collect data.	2 cameras are placed - one at the level crossing and the other at the end of the platform
7	Anti-trespass panels below level crossing and at the end of the platform.	30 square metres at the level crossing and 21 square metres at the end of the platform.

8	Warning Signs and Posters	Non-technical precaution is taken in several spots for directing to safe paths. Approximately 4 different styles of warning sign at related areas and in total 50 sticker signs which are at the ground directing to hospital and city centres.
9	Leaflets	5000 pcs have been printed out and distributed to local citizens and passengers. These leaflets are describing the safety ways via a small map and also indicating the measures that are taken in respect of ensuring correct direction.

## Objectives

The measures are meant to affect the behaviour of individuals living close to the station but also for those using this station for their journey. These measures will address the whole population living in this area as there are schools, a stadium, a hospital and a shopping centre around Aydın Station (Figure 1.1-3).



Figure 1.1-3: Locations of technical measures implemented at Aydın Station

## Effect mechanism

The effect mechanisms of the combination of measures:

**Measure 1:** One of the main people flows is seen at the gates which are frequently used by the logistics centre thus this measure will almost cut this access way.

**Measure 2:** Most of the flow is this area where passengers arrive at the platform and continue walking towards the end of the platform and then pass to the railway lines. This measure will reduce this significantly.

**Measure 3:** This measure effect will be to avoid passing between platforms.

**Measure 4:** This measure is made to avoid access that has been made between hospital and station.

**Measure 5:** This measure is avoiding passing from other local high density areas and diverts passengers to the correct walking path.

Measure 6: Cameras also has an effect from a safety and security perspective.

Measure 7: Anti-trespass panels make walking in treated areas uncomfortable. Therefore people avoid walking on them.

From the technical precautions taken (anti-trespass and fencing), TCDD will be regarded as a reliable firm paying attention to peoples' and passengers` security of life.

Measure 8 and 9: The illegal movement of pedestrians in the future will be prevented via the perception of warning signs and posters. This will help the pedestrians realize that their illegal transition through the railway lines is hazardous. Leaflets will spread the idea of safety concept which is taken into account by the authorities including TCDD.

In addition it is expected that the different measures work together so that the effect of each measure in this combination of measures is greater than it would be if each were implemented alone.

### 1.1.3 Reported costs for measure

Reported costs for this measure implemented are collected in **Table 1.1-2**.

Table 1.1-2: Costs considered in the pilot test named "Combination of measures at Aydin station"

Cost	Nature	Value
Measures 2,3,4,5 all fencing work	Direct	32 943€
Measure 1 for supply of electrics to the gate	Direct	787€
Measure 6 IP camera setup to the PERON	Direct	666€
Measure 6 IP Camera to the logistics entrance gate	Direct	727€
Measure 1 automation of the gate	Direct	908€
Lightning for the logistics area	Direct	917€
Measures 2,3,4,5 additional fencing	Direct	1 939€
Measure 6 Camera link setup	Direct	120€
Measure 6 Camera link setup	Direct	117€
Measure 8 Initial warning signs overall	Direct	333€
Measure 8 Initial warning signs 1st Peron	Direct	333€
Measure 7 anti-trespass	Direct	16 588€
Measure 8,9 Warning signs and leaflets	Direct	1 333€
<b>Total</b>		<b>57 711€</b>

### 1.1.4 Evaluation results

Before and after the demonstration, by using the camera recordings, the analysis of the trespassing is done and evaluations will be made based on these data. The intended method for the evaluation of the effect on the frequency of trespassing is a before-after study (without comparison data) based on field observations. In addition, throughout the application process, the production of the materials, their maintenance, their change, and installations will be fulfilled by TCDD.

As already mentioned, two camera systems were installed in the Aydin Station Area. The aim of these cameras: providing before and after of measurements, by using the camera recordings, enabling an analysis based on these statistical analysis.

The effect of the measures on the frequency of trespassing is evaluated. The variables collected include number of trespassers per day, time of trespassing, gender of trespassers, approximate age of trespassers (children: 12 years; youngsters: 12–20 years; adults and elderly people: over 20 years), group size, if trespassers were carrying or having something with them and the increase of awareness towards the illegality and danger of certain behaviours observed in the railways. Data are evaluated for random periods taking into account public holidays and special occasions. The

evaluation data consists of measurements of the frequency of (different kinds of) trespassing before and after the implementation. Trespasser counts are conducted using video camera at specific locations where most of the flow can be observed.

Table 1.1-3: Results of the camera records in Aydın Station

AGE	WOMEN			MEN			TOTAL		
	BEFORE	AFTER	DIFF.	BEFORE	AFTER	DIFF.	BEFORE	AFTER	DIFF.
CHILD≤12	4	0	4	2	0	2	6	0	6
12 <YOUNG≤20	24	0	24	78	7	71	102	5	97
20< ADULT	116	4	112	282	45	237	398	22	376
<b>TOTAL</b>	<b>144</b>	<b>16</b>	<b>128</b>	<b>362</b>	<b>52</b>	<b>310</b>	<b>506</b>	<b>28</b>	<b>478</b>
<b>PERCENTAGE</b>	<b>-89%</b>			<b>-86%</b>			<b>-94%</b>		

Our primary results at the **Table 1.1-3**. This table collects the trespasses during random periods of time as per weeks of months. Thus we will be able to analyse the effect after measures are taken. Last observation has been made on July 2014.

#### *CBA for a combination of measures at Aydın Station*

The cost effectiveness ratio CER can be calculated given that the detail of costs is known (57 711 €) and that the annual number of prevented trespassers could be estimated. The latter variable can be calculated based on monthly observations before and after the implementation of measures. The variable used for effectiveness is thus primarily the number of trespassers prevented per year. Results and assumptions are provided in **Table 1.1-4**.

Table 1.1-4 CEA of Pilot test 5 " a combination of measures at Aydın station"

<b>Cost</b>	57 711 €
<b>Effectiveness measures</b> Number of trespassers prevented per year	5736 (12* 478 prevented/ month)
<b>Assumption(s)</b>	The reduction in the number of trespassers is considered as constant and representative of the cumulated effect whatever the months in the year
<b>Cost effectiveness ratio (CEA results (E/C))</b>	0,099391797

The resulting CEA ratio can be interpreted in the following way: an investment of 1 euro enable to reduce by 0.1 the number of trespasser per year at the location. 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:

- Number of accidents due to trespassing events per year at the location.
- Distribution of trespass consequences (fatalities, injuries).



- The effect of decreasing the frequency of trespassing on the frequency of fatal trespassing accidents (note that it is assumed at the moment that the effect of a measure is the same on the frequency of trespass and on the frequency of accidents).
- Average delay induced by trespassing events.

#### **1.1.5 Applicability of results to different circumstances**

The following information was used in this study:

- Type of Incident/Accident
- Date of Incident/Accident
- Place of Incident/Accident
- Kilometer of Incident/Accident
- Type of Train
- Casualties
- The number of wounded
- Cause of the event

It is not known whether similar combinations of measures against trespassing in railway area have been implemented before in TCDD. Nor are there results on the frequency of trespassing or trespassing accidents of such approaches.

The variables collected will include the frequency of trespassing, the information of number-age-gender, etc., and the increase of awareness towards the illegality and danger of certain behaviours observed in the railways.

The evaluation data consists of measurements of the frequency of (different kinds of) trespassing before and after the implementation. Trespasser counts will be conducted using video cameras.

Data of the costs of the measures will be collected by TCDD throughout the implementation process, and the cost components include material, installation of these material, maintenance and implementation costs.

#### **1.1.6 Discussion**

Planned technical and non-technical precautions included cancelling the gate used by the logistics centre and controlling the other gate or keeping it locked, installing and manufacturing warning signs and posters, also distributing leaflets to the passengers at the station on certain days. These precautions are not complicated because they are undertaken on a local basis.

However, the installation of fencing can be difficult in hot spots and in relation to rail operations safety depending on the scope of the project, so audit and control should be done during installation.

TCDD will be installing anti-trespass panels for the first time in Aydin Station. Therefore, the technical team of TCDD has started research related to anti-trespass panels.

To be concluded that project, we have identified tangible benefits from the actions taken. Many people have taken notice of the changes and warnings provided resulting in reduced trespassing hence increased safety

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