



RAILACOUSTIC

©

high precision smart acoustic

BROKEN AND DAMAGED RAIL DETECTION SYSTEM

*Designed and Developed by:
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ENEKOM General Manager*



ENEKOM is an Energy Ecology Informatics and Engineering Company

RAILACOUSTIC

‘RKAS-V2’ model

WORKING PRINCIPLES AND CHARACTERISTICS



RAILWAYS SAFETY - GLOBAL STATISTICS

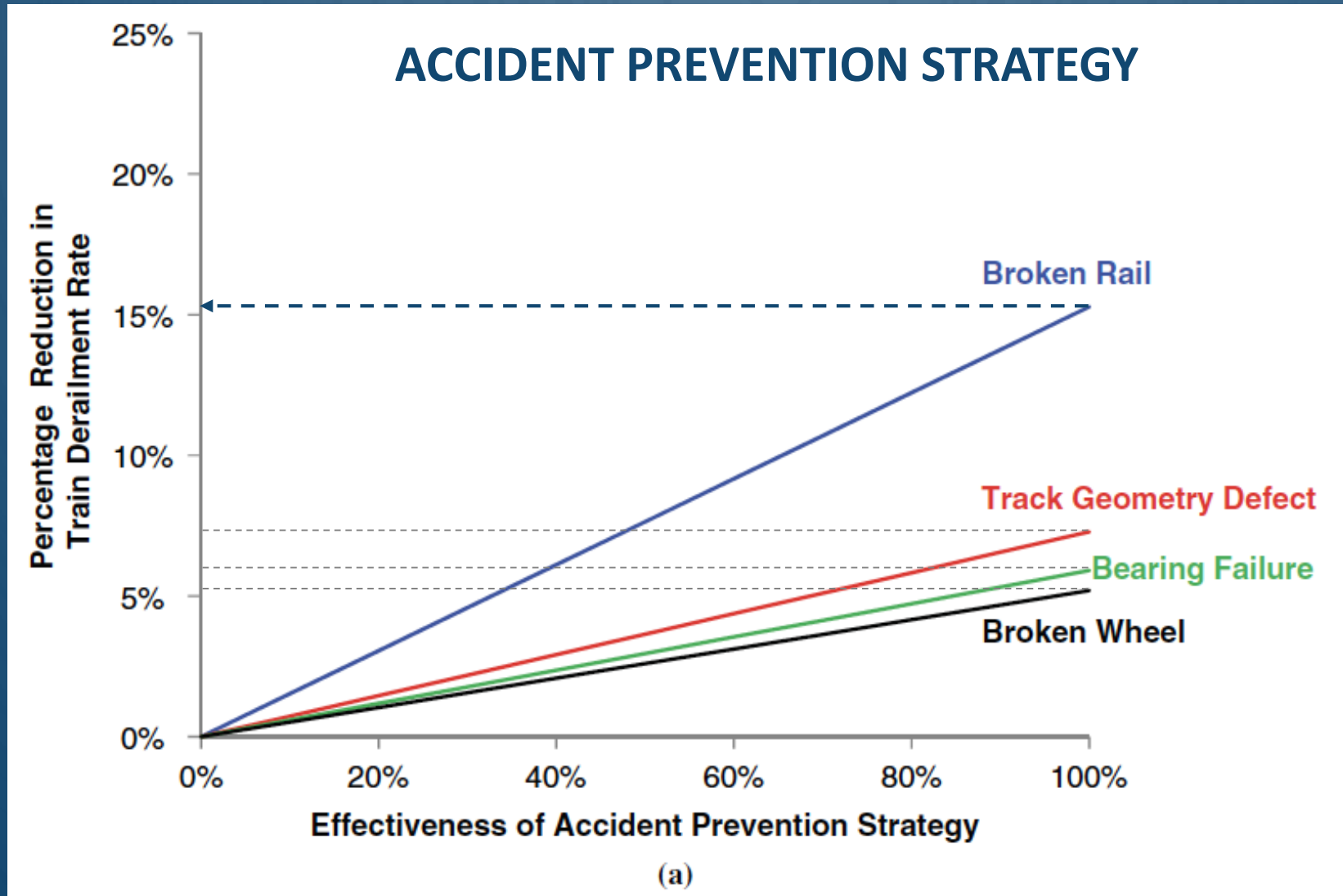
TABLE 2 Derailment Frequency and Severity by Accident Cause on Class I Main Lines, Sorted by Frequency

Cause Group	Description	Derailments		Cars Derailed		Average Number of Cars Derailed per Derailment
		Number	Percentage	Number	Percentage	
08T	Broken rails or welds	665	15.3	8,512	22.7	12.8
04T	Track geometry (excluding wide gauge)	317	7.3	2,057	5.5	6.5
10E	Bearing failure (car)	257	5.9	1,739	4.6	6.8
12E	Broken wheels (car)	226	5.2	1,457	3.9	6.4
09H	Train handling (excluding brakes)	201	4.6	1,553	4.1	7.7
03T	Wide gauge	169	3.9	1,729	4.6	10.2
01M	Obstructions	153	3.5	1,822	4.9	11.9
05T	Buckled track	149	3.4	1,891	5.0	12.7
04M	Track–train interaction	149	3.4	1,110	3.0	7.4
11E	Other axle or journal defects (car)	144	3.3	1,157	3.1	8.0
04H	Employee physical condition	3	0.1	41	0.1	13.7
06H	Radio communications error	3	0.1	13	0.0	4.3
14E	TOFC–COFC defects	2	0.0	2	0.0	1.0
03E	Handbrake defects (car)	1	0.0	2	0.0	2.0
	Total	4,352	100	37,456	100	8.6

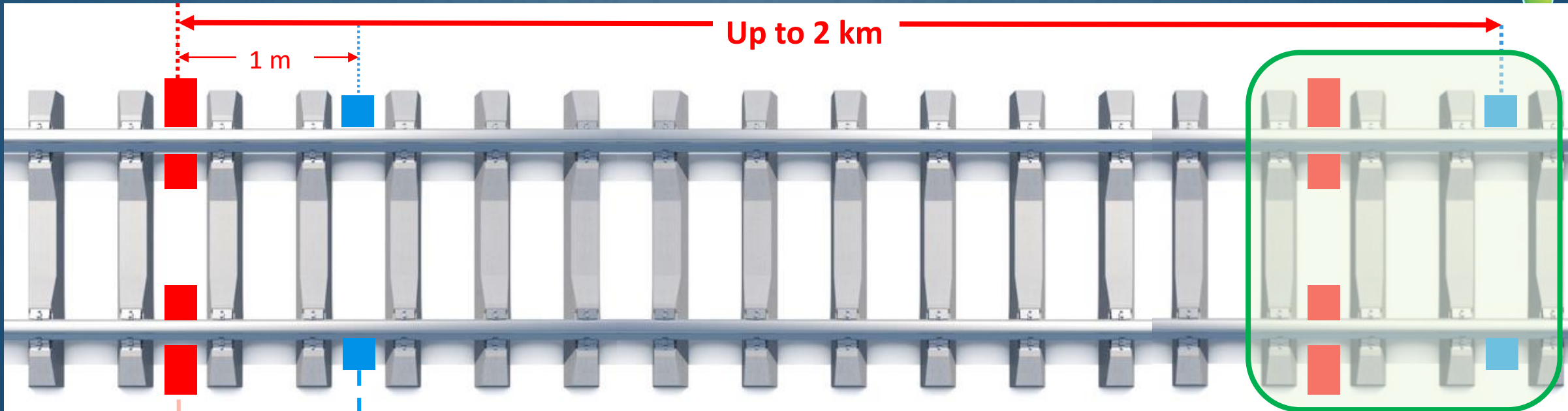
NOTE: UDE = undesired emergency (brake application); TOFC = trailer on flat car; COFC = container on flat car.

NEXTRANS Project (2012) - Analysis of Causes of Major Train Derailment and Their Effect on Accident Rates (2001-2010), University of Illinois

RAILWAYS SAFETY - GLOBAL STATISTICS



BASIC WORKING PRINCIPLES OF RAILACOUSTIC SYSTEM



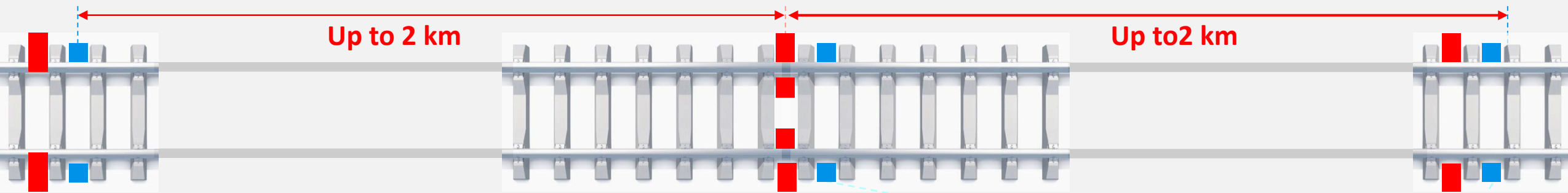
A NODE

**SIGNAL
GENERATOR**

**SIGNAL
DETECTOR**

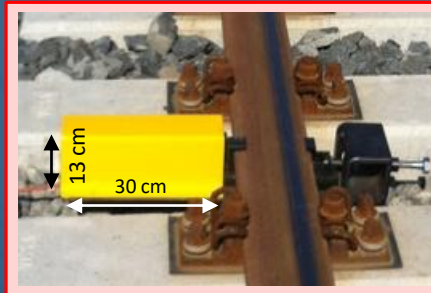
BROKEN OR DAMAGED RAIL SEGMENT IS DETECTED ANYWHERE IN BETWEEN

WORKING PRINCIPLES RAILACOUSTIC SYSTEM



both modules are mounted on to the rail body in a modular way
no need for any welding or putting holes
on the rails for the assembly of modules

51 sensing points for a 100 Km long railway line each
identified with a unique IP address



RAG-100

signal **GENERATOR/INJECTOR**
Smart Acoustic signal

A NODE



RASP-100

Track-Side Sensing Station **RailAcoustic**
System Processor



RAR-100

signal **RECEIVER (Detector)**
sensing the signal from the rails

CCSM-100 (Control Center Software Module)



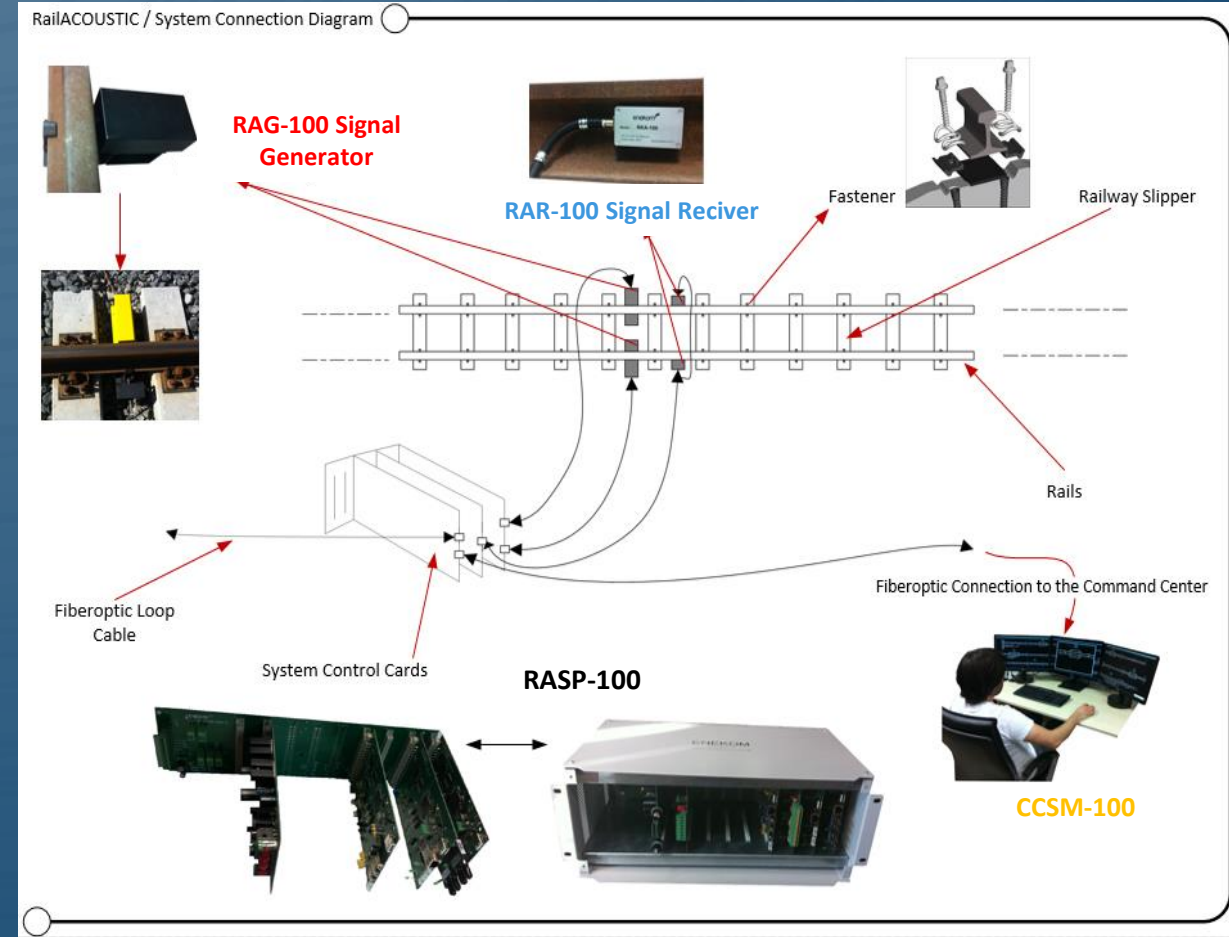
all data are transferred to **THE CONTROL CENTER** via a fiber optic or RF communication

WORKING PRINCIPLES RAILACOUSTIC SYSTEM

1. **RAG-100 (GENERATOR):** a wide band / white noise acoustic signal generator/injector
2. **RAR-100 (RECEIVER):** an acoustic signal receiver
3. **RASP-100 (SYSTEM PROCESS):** a cabinet with communication and signal processing cards and a power supply, distributed along trackside. All equipment is connected to an **IP based fiberoptic or optionally encrypted RF network for communicating** to each other.
4. **CCSM-100 (CENTRAL CENTER SOFTWARE MODULE):** a computer which is connected to the system's communication network, running an operator consol software as an operator's interface module.

DESIGNED FOR EXTREME CLIMATIC CONDITIONS: all system components are designed to operate in extreme climatic conditions such as -40° - $+80^{\circ}$ celsius operational temperature and 95% relative humidity.

THE SYSTEM'S POWER: module is suitable for mains voltages between 90 – 254VAC @ 50 – 60 Hz.



WORKING PHYLOSOPHY OF RAILACOUSTIC “RKA-V1 MODEL”

**HIGH PRECISION - SAFE - SMART
DYNAMIC AND RELIABLE SENSING SYSTEM**
working with 2 methods combined

BY SENSING THE **CHANGE
IN AMPLITUDE**

1

+

2

BY SENSING THE **REFLECTED
SIGNAL FROM BROKEN RAIL**



UNIQUE AND MOST RELIABLE DETECTOR

- An Acoustic Signal with a special characteristic
- Exempt from all sorts of extreme climatic conditions
- Self learning and adapting algorithm to external conditions

SYSTEM COMPONENTS OF RAILACOUSTIC AS APPLIED TO TRACK

THE SYSTEM HAS BEEN APPLIED to ANKARA-KONYA High Speed Line (HSL) in 2018



CONTRACT DATE:

06 April 2018

CONTRACT SCOPE:

Installation of RailAcoustic – Broken Rail Detection and Measuring System At 90 Km Double Track Section of Ankara-Konya High Speed Train Line + 4 Km Conventional Single Track Line (In Ankara)

CONTRACTUAL COMPLETION DATE:

02 December 2018

RASP100 Track Signal Processor and Communication Cabinet

SYSTEM COMPONENTS OF RAILACOUSTIC AS APPLIED TO TRACK

THE SYSTEM HAS BEEN APPLIED to ANKARA-KONYA High Speed Line (HSL) and is in use NOW

TECHNICAL SPEC HIGHLIGHTS:

- High Speed Train Line and Conventional Line Use,
- Broken Rail Detection Without Need of Train Moving,
- Maximum 2 Km Site Installation Intervals,
- Realtime Monitoring of Tracks From a Remote Control Center,
- Data Storage and Customized Reporting With History Records,
- System Hardware, Software, Installations, Trainings and Warranty Period Service.



RAG100 and RAR100 Modules Installed on to the Rails

SYSTEM COMPONENTS OF RAILACOUSTIC AS APPLIED TO TRACK

THE SYSTEM HAS BEEN APPLIED to a 90 Km long Double Line and 4 Km Single Line segment on ANKARA-KONYA High Speed Line (HSL) and it is in use NOW – RKS100 Acoustic Coupler



SYSTEM COMPONENTS OF RAILACOUSTIC AS APPLIED TO TRACK

THE SYSTEM HAS BEEN APPLIED to a 90 Km long Double Line and 4 Km Single Line segment on ANKARA-KONYA High Speed Line (HSL) and it is in use NOW– Open Line View



SYSTEM COMPONENTS OF RAILACOUSTIC AS APPLIED TO TRACK

THE SYSTEM HAS BEEN APPLIED to a 90 Km long Double Line and 4 Km Single Line segment on ANKARA-KONYA High Speed Line (HSL) and it is in use NOW– In the Tunnel



SYSTEM COMPONENTS OF RAILACOUSTIC – RASP100



RAILACOUSTIC SIGNAL PROCESSING UNIT (RASP100):

This electrical signal processing, control and communication cabin is located along the track at each 2 Kms distance along the track for housing the electronic boards, power supply and the fiberoptical network communication controller.

SYSTEM COMPONENTS OF RAILACOUSTIC – RAG100



RAILACOUSTIC SIGNAL GENERATOR (RAG100):

- This signal generator module is an acoustic unit which operates with the commands coming from the central control room computer. Its main task is to apply an acoustic signal on to the rails at certain times.

SYSTEM COMPONENTS OF RAILACOUSTIC – RAR100



RAIL ACOUSTIC RECEIVER (RAR100):

- This signal sensing module is attached to the rail for sensing the acoustic signals generated by the RAG100 unit. It first detects and processes the detected acoustic signal and communicates with the track-side electronic board for additional signal processing and communication.



CONTROL ROOM VIEW OF RAILACOUSTIC SYSTEM

THE SYSTEM HAS BEEN APPLIED to a 90 Km long Double Line and 4 Km Single Line segment on ANKARA-KONYA High Speed Line (HSL) and it is in use NOW – Eryaman Alarm Control Center View

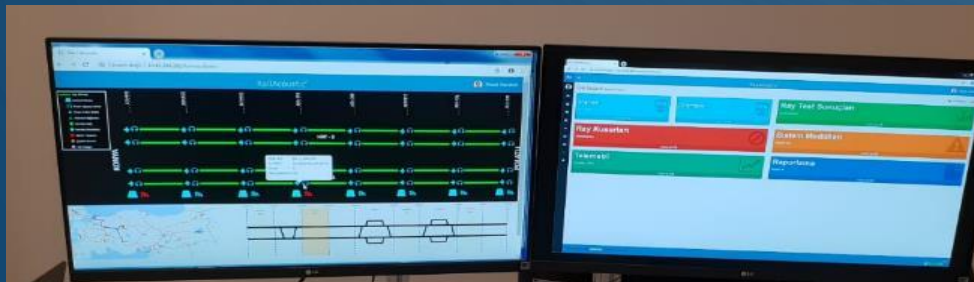


CONTROL ROOM VIEW OF RAILACOUSTIC SYSTEM



ALARM-CONTROL CENTER SOFTWARE MODULE (CCSM-100):

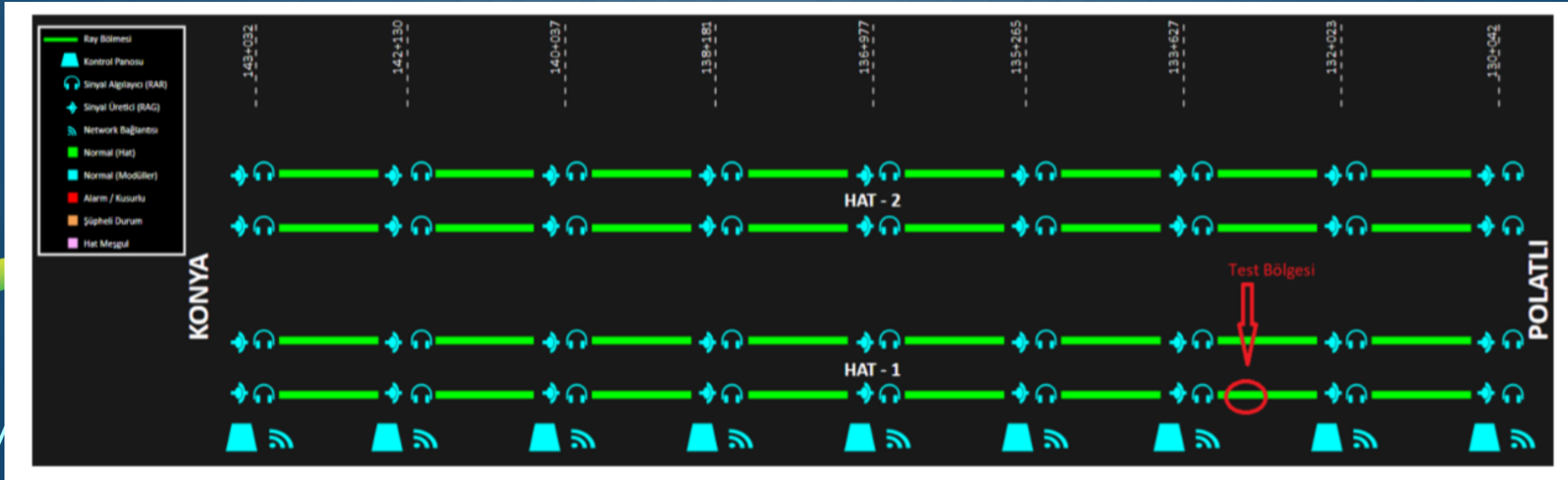
- A central command and monitoring program for operating the system under the supervision of a system operator. The system consists of a computer with a multi screen display, a program running in this computer, a data base operation for controlling, monitoring and remote accessing to each system module in real time.
- The system modules are connected to the alarm-control center computer via a fiber-optical IP network.



CONTROL ROOM VIEW OF RAILACOUSTIC SYSTEM

THE SYSTEM HAS BEEN APPLIED to a 90 Km long Double Line and 4 Km long Single Line segment on ANKARA-KONYA High Speed Line (HSL).

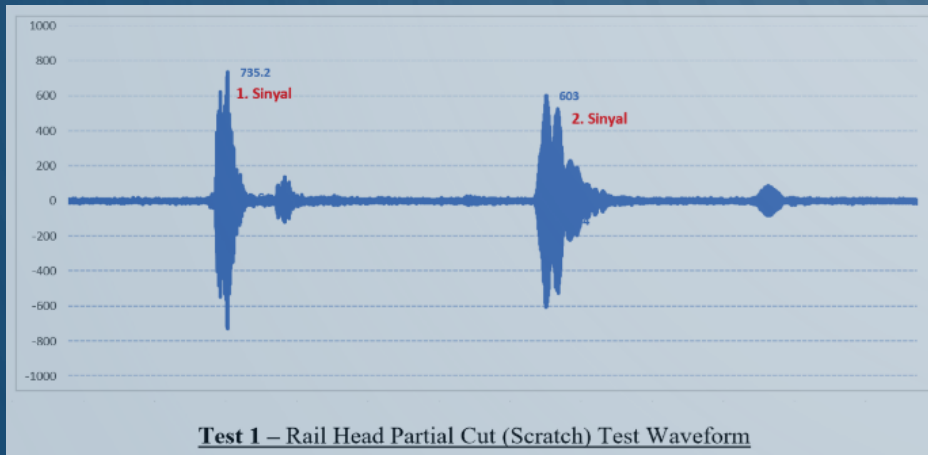
The system is in use NOW after two times random rail cut tests are performed and accepted by TCDD.



CONTROL ROOM VIEW OF RAILACOUSTIC SYSTEM

THE SYSTEM HAS BEEN APPLIED to a 90 Km long Double Line and 4 Km long Single Line segment on ANKARA-KONYA High Speed Line (HSL).

The system is in use NOW after two times random rail cut tests are performed and accepted by TCDD.



TEST NO : 1 – RAIL HEAD PARTIAL CUT

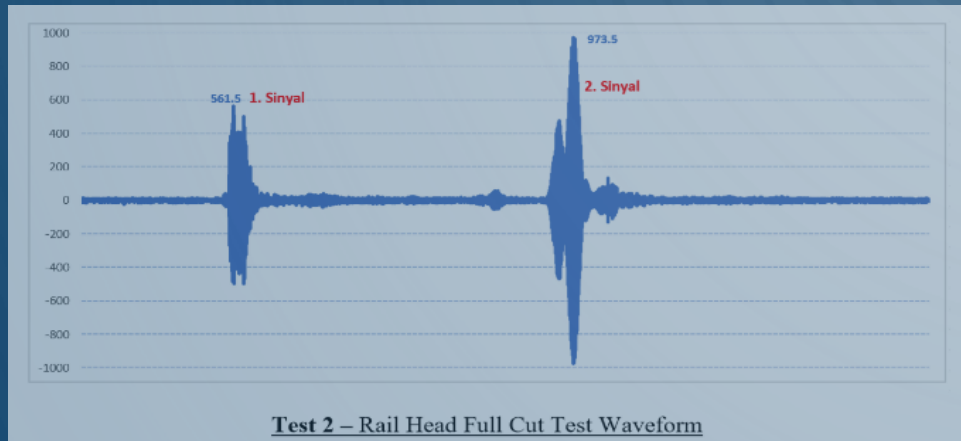
5 cm deep partial cut. A significant change in the received waveform is observed.



CONTROL ROOM VIEW OF RAILACOUSTIC SYSTEM

THE SYSTEM HAS BEEN APPLIED to a 90 Km long Double Line and 4 Km long Single Line segment on ANKARA-KONYA High Speed Line (HSL).

The system is in use NOW after two times random rail cut tests are performed and accepted by TCDD.



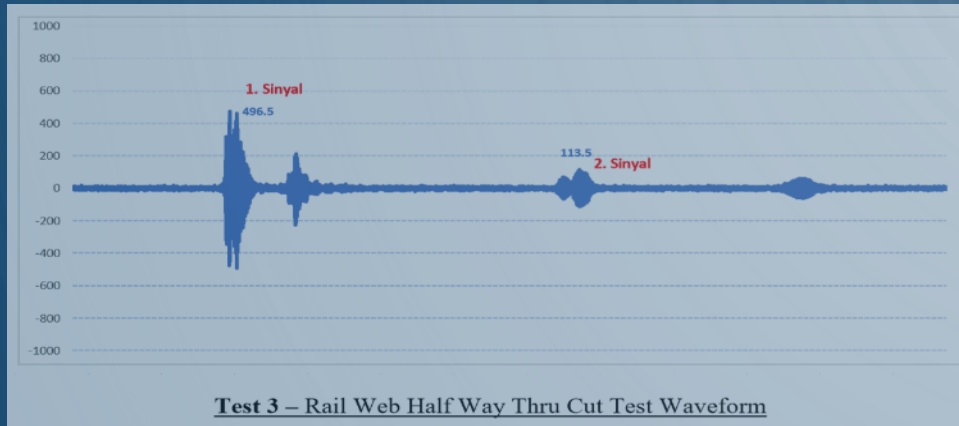
TEST NO : 2 – RAIL HEAD FULL CUT

The head of the rail was completely cut and a fracture test was performed. A typical and significant change in the received waveform is observed.



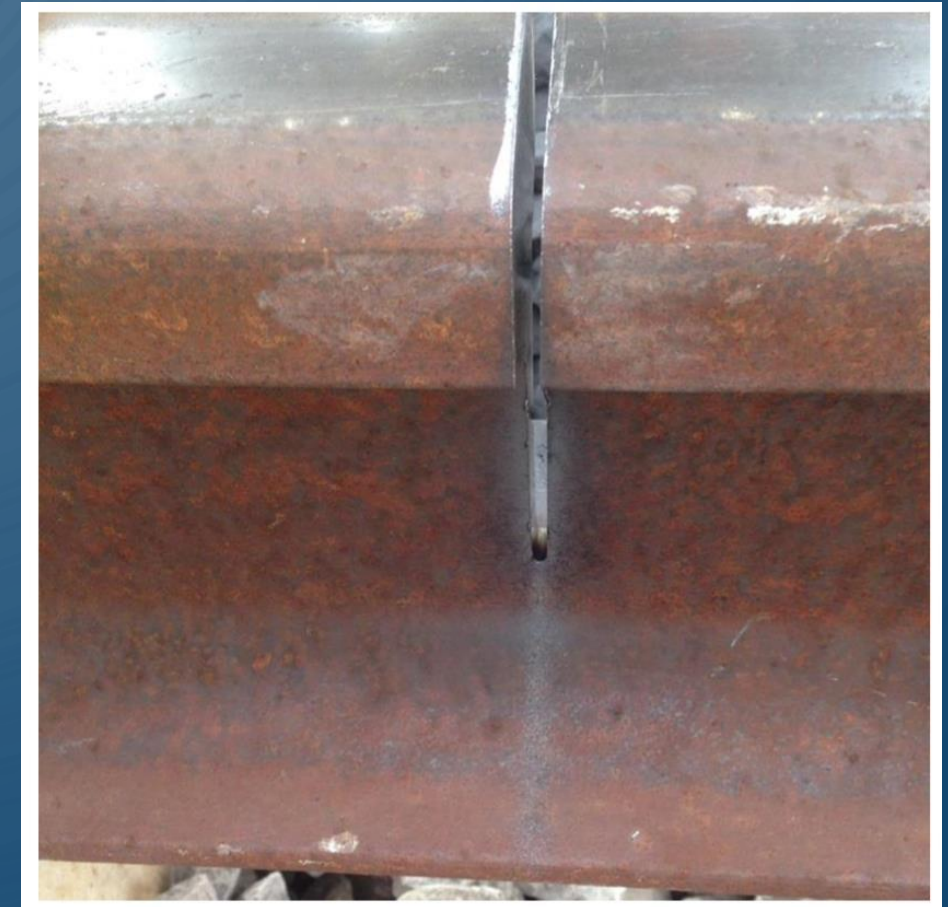
CONTROL ROOM VIEW OF RAILACOUSTIC SYSTEM

THE SYSTEM HAS BEEN APPLIED to a 90 Km long Double Line and 4 Km long Single Line segment on ANKARA-KONYA High Speed Line (HSL).The system is in use NOW after two times random rail cut tests are performed and accepted by TCDD.



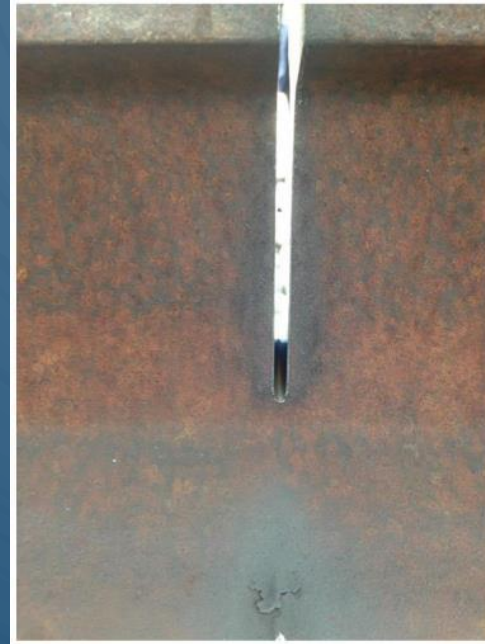
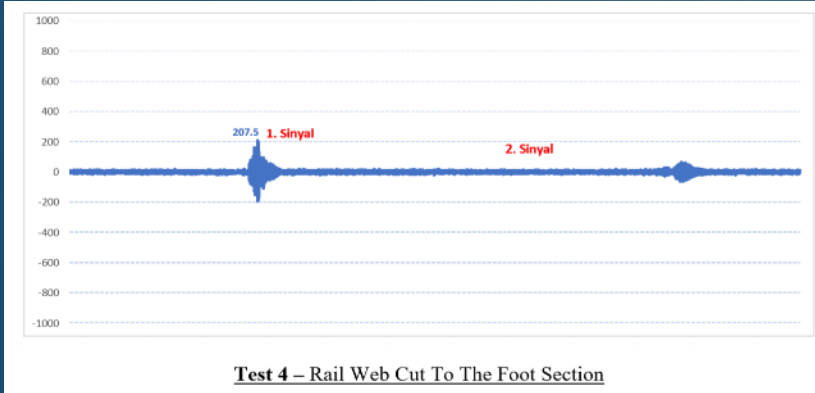
TEST NO : 3 – RAIL WEB HALF WAY THRU CUT

The web of the rail was cut in half and a new fracture test was performed. The result of the test showed that the signal shape and signal levels changed significantly. At the end of the test, the system automatically generated a brown alarm signal in the form of a suspect rail fracture alarm.



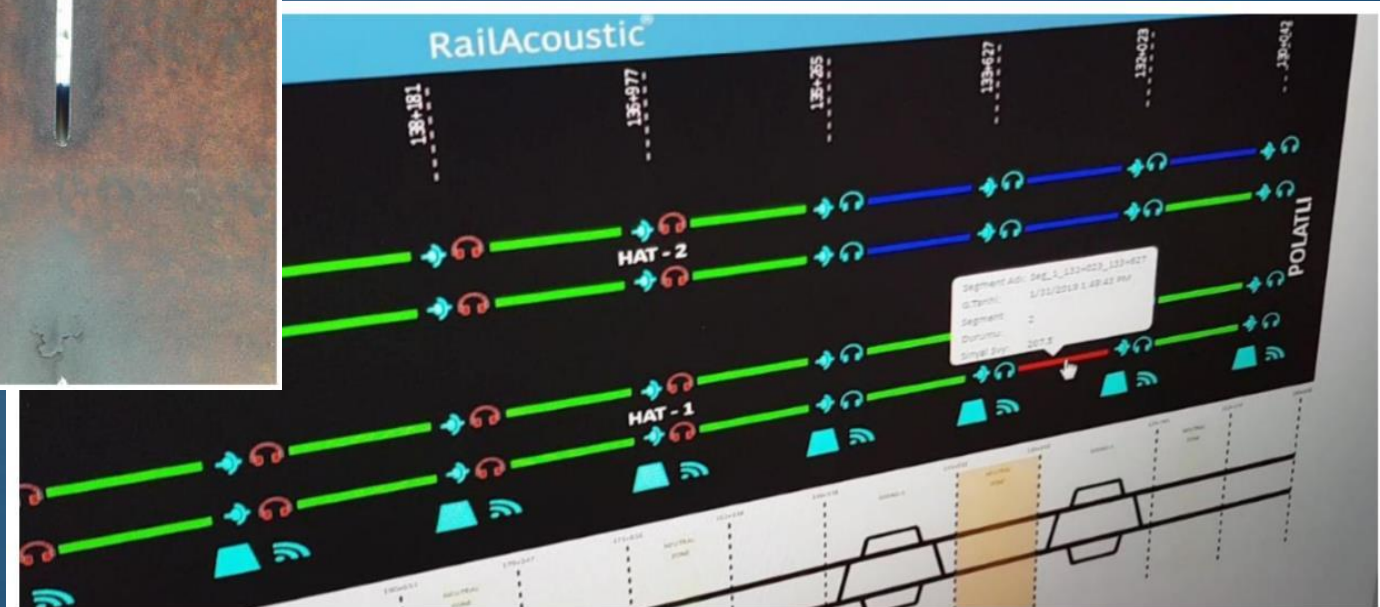
CONTROL ROOM VIEW OF RAILACOUSTIC SYSTEM

THE SYSTEM HAS BEEN APPLIED to a 90 Km long Double Line and 4 Km long Single Line segment on ANKARA-KONYA High Speed Line (HSL). The system is in use NOW after two times random rail cut tests are performed and accepted by TCDD.



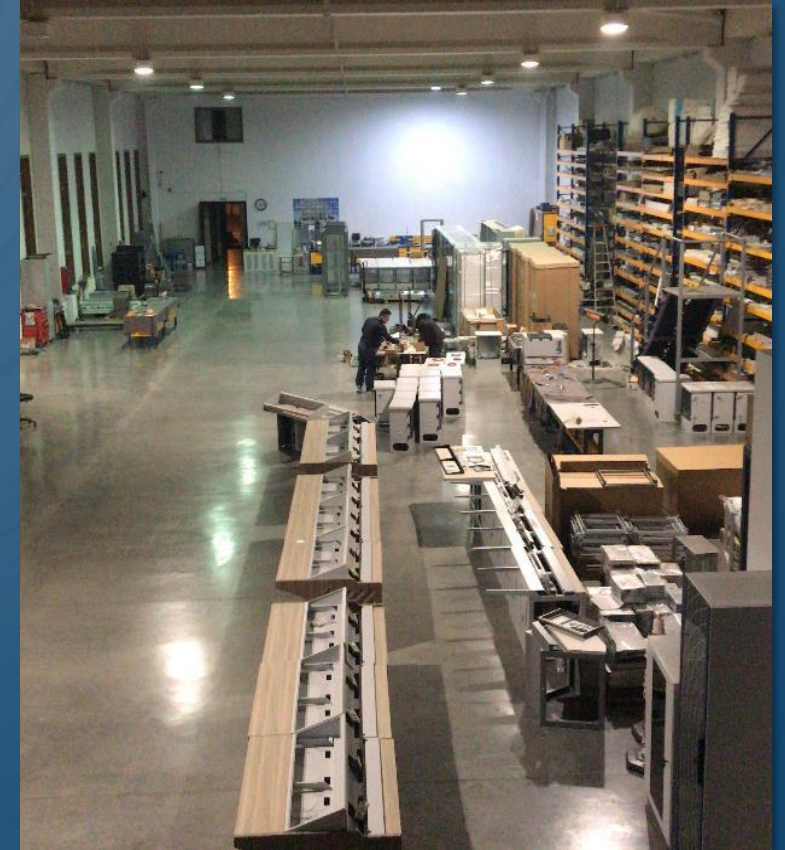
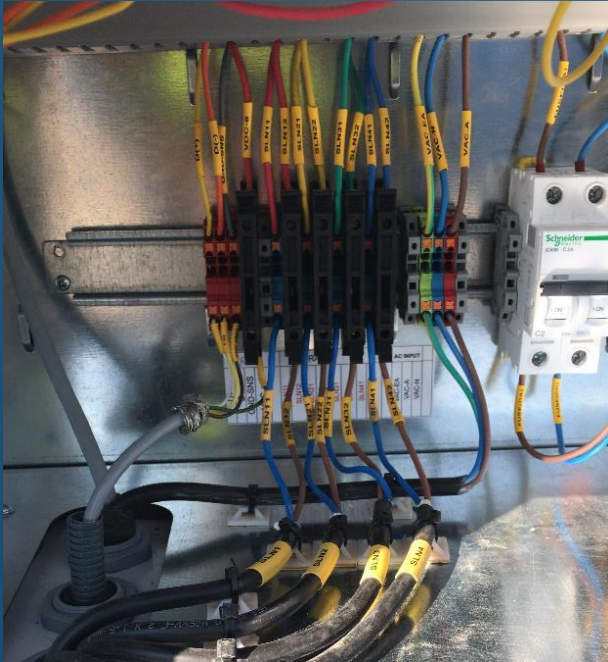
TEST NO : 4 – CUT TO THE RAIL FOOT TEST

The web of the rail was cut to the foot and the fracture test was performed. The signal level, shape and reflected component has totally changed. At the end, the system generated a red alarm signal.



Broken Rail Indication On The Monitoring Screen of Command Center Computer

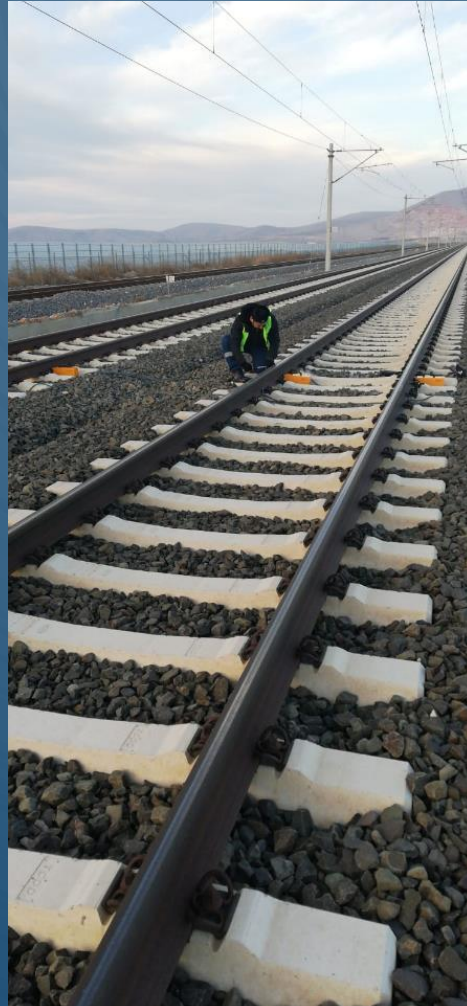
MANUFACTURING PHASE OF RAILACOUSTIC SYSTEM



SITE SURVEY BEFORE THE INSTALLATION OF RAILACOUSTIC SYSTEM



INSTALLATION OF THE RAILACOUSTIC SYSTEM





Energy Ecology Informatics Engineering



technologies for sustainable life

- INVENTOR AND DEVELOPER OF THE TECHNOLOGY
- 8 PATENTS ON SIMILAR R&D PROJECTS REGISTERED LOCALLY AND INTERNATIONALLY
- IN METU (Middle East Technical University) TECHNOPOLIS in Ankara
- GOVERNMENT – UNIVERSITY – INDUSTRY COOPERATION AND CONNECTIONS
- FOCUSED ON OPTIC AND SPECTROMETRIC RAILWAY DETECTION TECHNOLOGIES
- READY TO COOPERATE AND SHARE THE TECHNOLOGY WITH INDIAN PARTNERS



RailAcoustic®

THANK YOU !

INTERNATIONAL

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çevre dostu teknoloji

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