ERCI INNOVATION AWARDS 2020

INNOTRANS BUSINESS DAYS — SEPTEMBER 23rd, 2020

ERCI 10 YEARS
EURAILCLUSTERS

ERCI INNOVATION AWARDS WINNERS 2020

This is to certify that

Enekom Enerji Bilisim ve Muhendislik San.Tic.A.S.

won the ERCI Innovation Awards 2020

«COUP DE COEUR OF THE JURY»

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SUCCESSFULLY IN
OPERATION SINCE
2018
RailAcoustic®
High Precision Smart Acoustic
Track-Safety Condition Monitoring System
Patended Methodology in US, EU, Turkey, India, China and Japan
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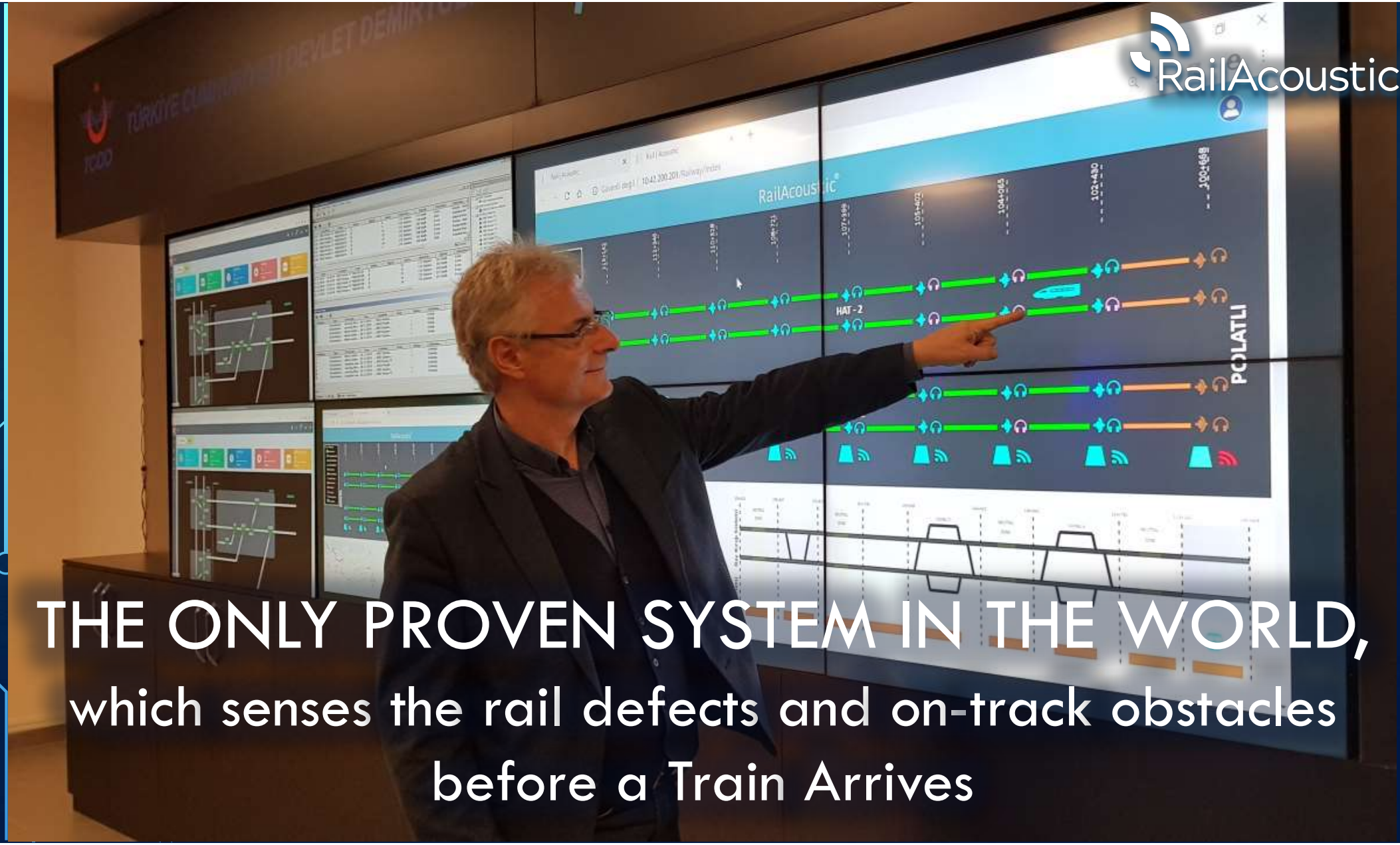


THE ONLY PROVEN SYSTEM IN THE WORLD,

which senses the rail defects and on-track obstacles before a Train Arrives

RAILWAYS SAFETY - GLOBAL STATISTICS

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

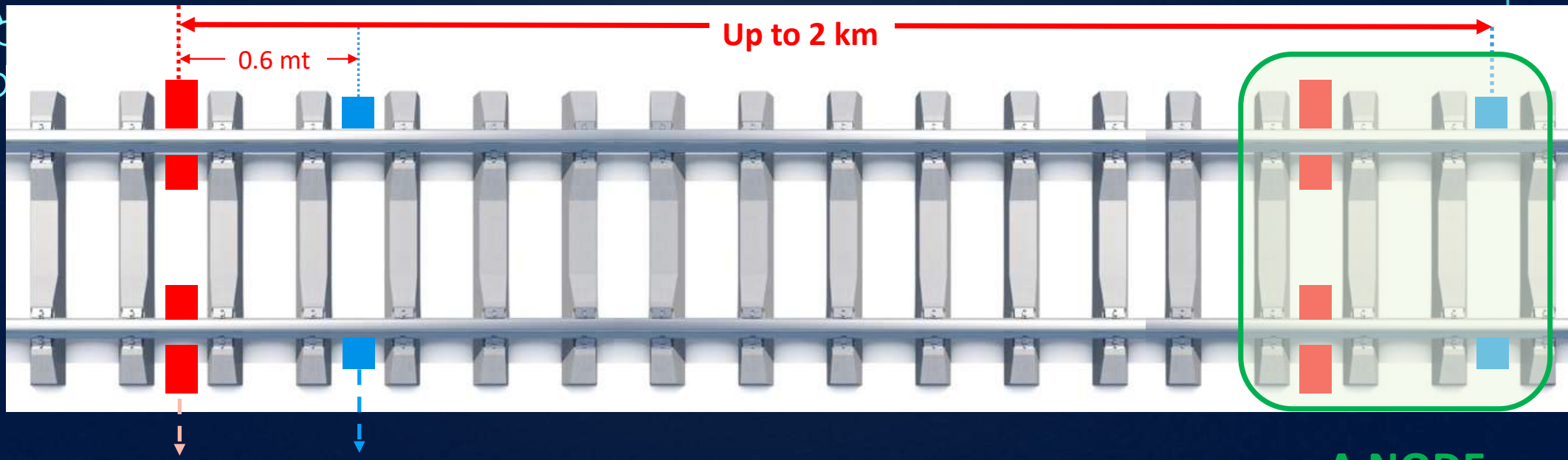
Cause Group	Description	Derailments		Cars Derailed		Average Number of Cars Derailed per Derailment
		Number	Percentage	Number	Percentage	
08T	Broken rails or welds	665	15.3	8,512	22.7	12.8
04T	Track geometry (excluding wide gauge)	317	7.3	2,057	5.5	6.5
10E	Bearing failure (car)	257	5.9	1,739	4.6	6.8
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

BASIC WORKING PRINCIPLES

RailAcoustic®



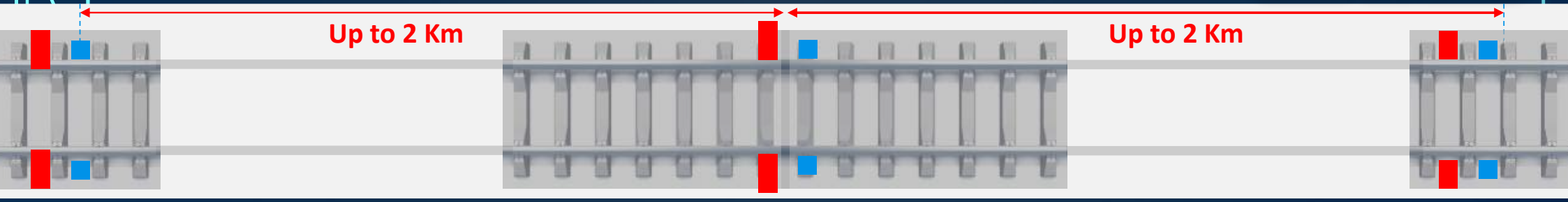
SIGNAL GENERATOR

SIGNAL DETECTOR

RAIL FLAWS and OBSTACLES ARE DETECTED ANYWHERE IN BETWEEN

BASIC WORKING PRINCIPLES

RailAcoustic®



SIGNAL GENERATOR

SIGNAL RECEIVER

SIGNAL PROCESSOR

no need for any welding or putting holes

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

CONTROL CENTER + MOBILE APP

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yaşam için teknoloji

WORKING PHYLOSOPHY OF RAILACOUSTIC®

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

1 BY SENSING THE **CHANGE** IN AMPLITUDE

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

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The RailAcoustic® System continuously performs and improves:

FUNCTIONS IN USE

1. Broken & Cracked Rail Detection (with exact location information)
2. Train Movement & Speed Monitoring
3. Flood, Landslide and Excessive Snow Accumulation Detection
4. Rail & Environmental Temperature Monitoring

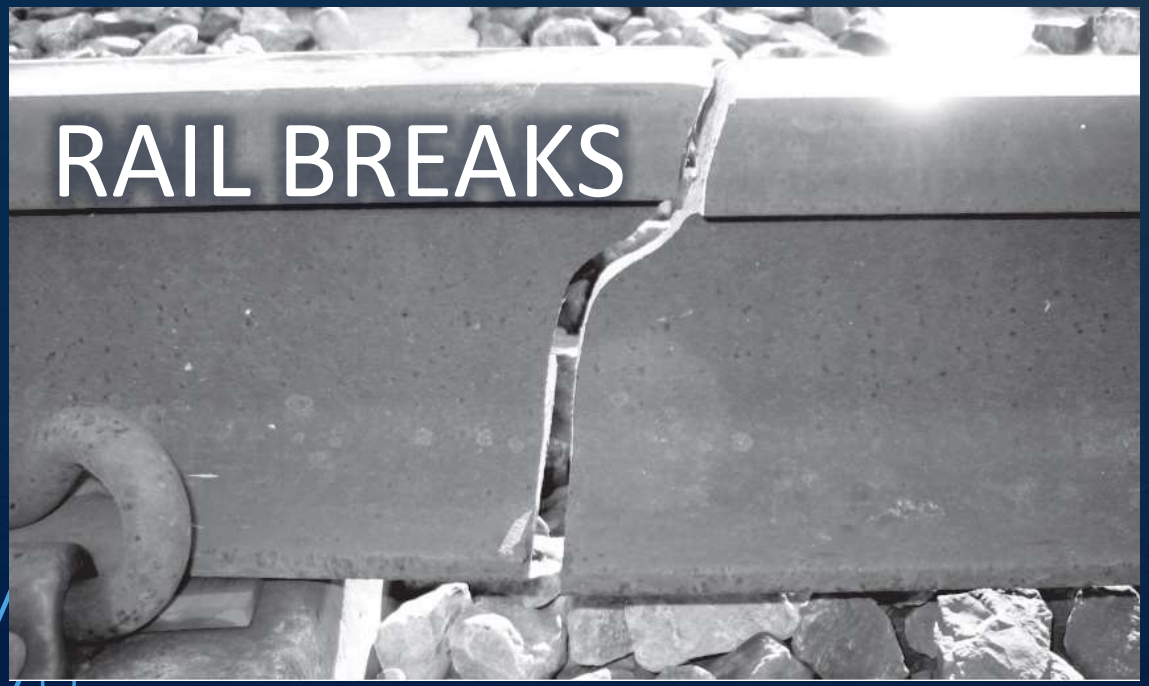
NEW FUNCTIONS UNDER QUALIFICATION TEST

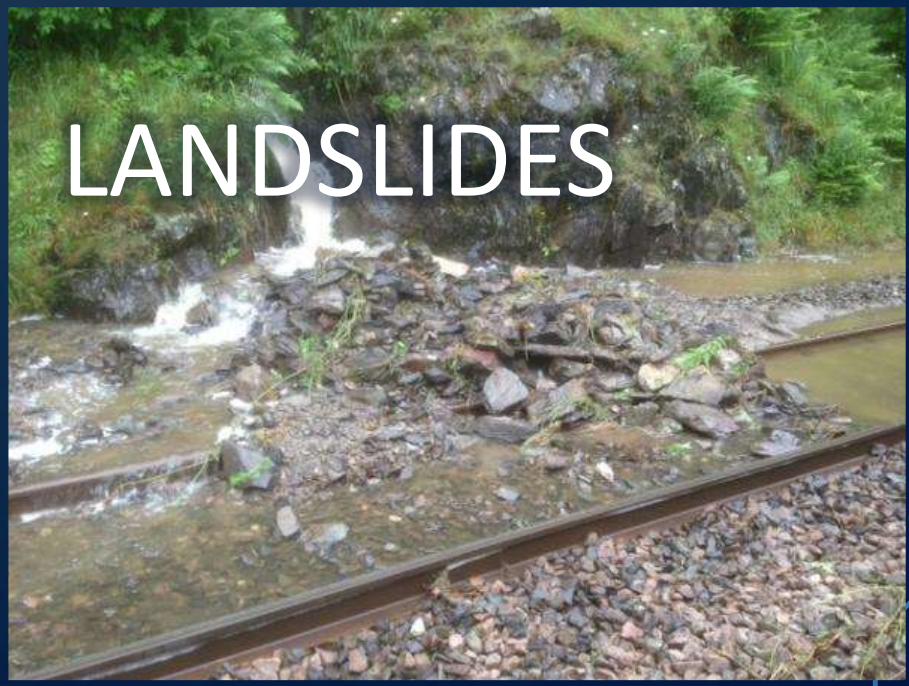
5. Flat Wheel Detection
6. Buckled Rail Detection
7. Major Internal Rail Defect Detection
8. Derailment Detection (for instant emergency brake of the freight rolling stocks)

What is Detected through RailAcoustic® System?

-Long before the train arrives!-

RailAcoustic®





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What is Detected through RailAcoustic® System?

-Long before the train arrives!-

RailAcoustic®

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yaşam için teknolojiler

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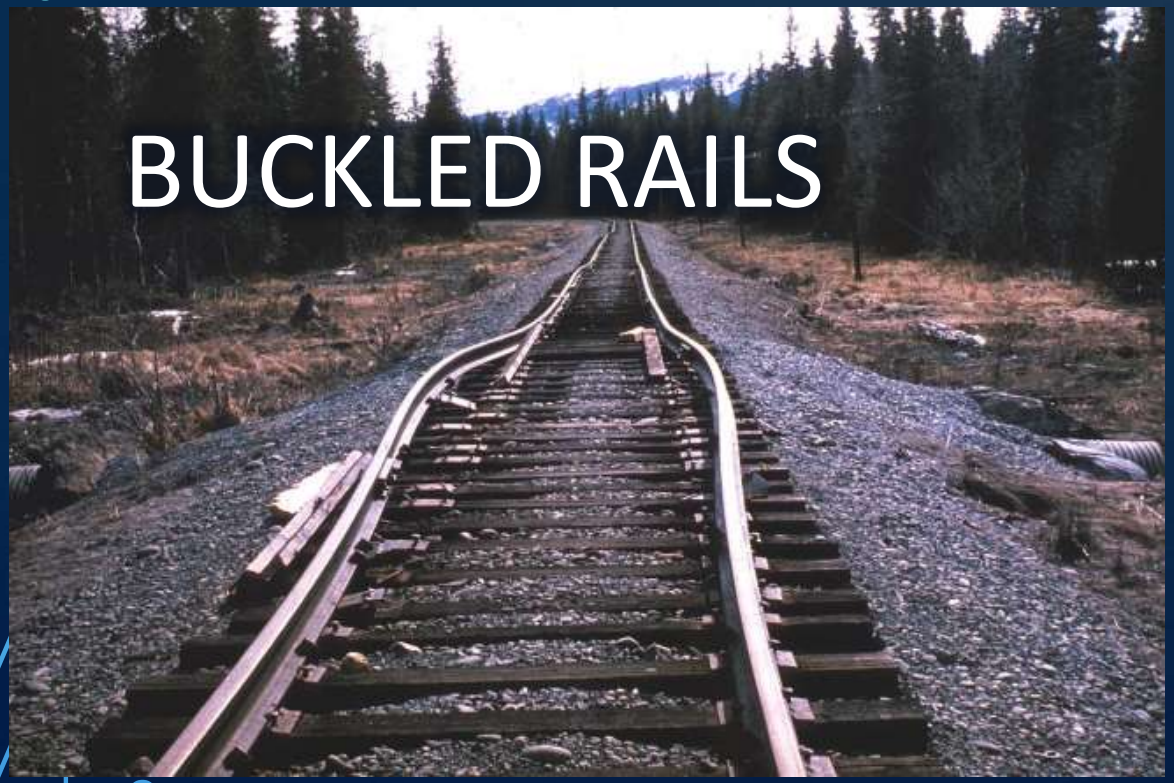

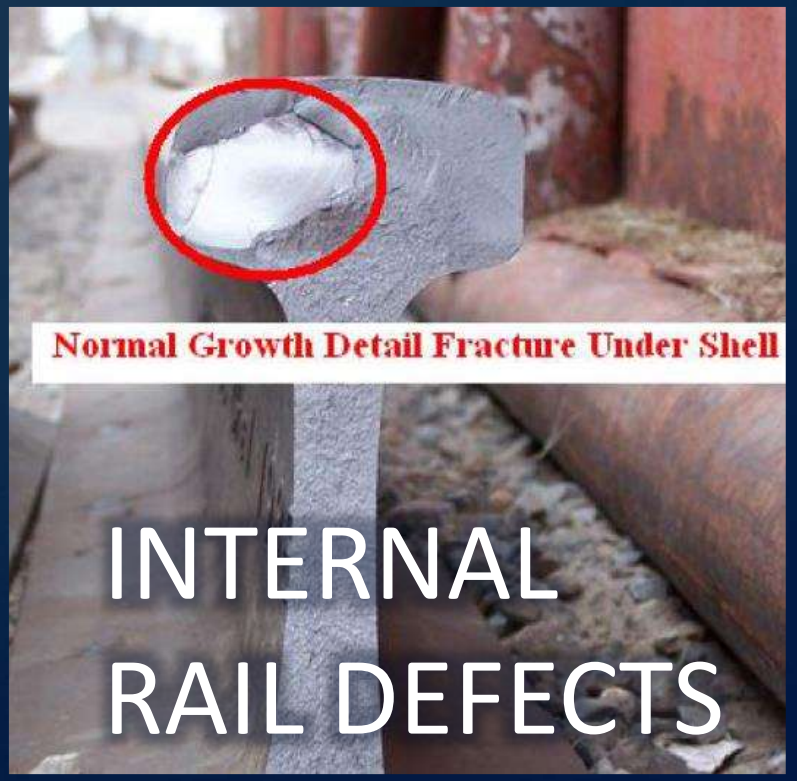

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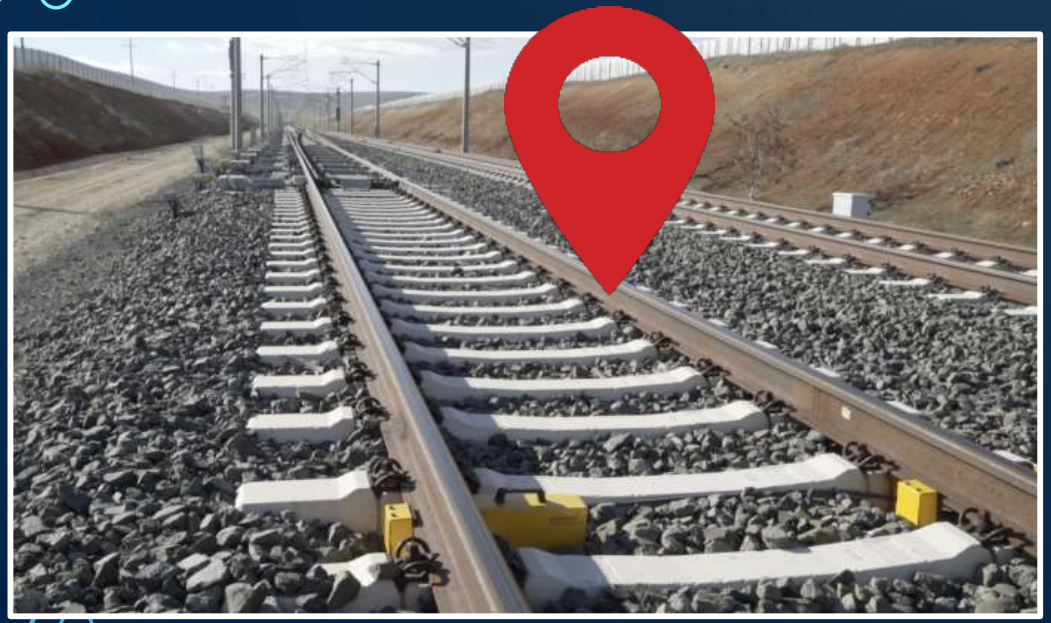
What is Detected through RailAcoustic® System?

-Long before the train arrives!-

RailAcoustic®



EXACT LOCATION OF RAIL FLAWS

PARTIAL RAIL CRACKS

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What is Monitored through RailAcoustic® System?

-In real-time!-

RailAcoustic®

EXACT LOCATION & VELOCITY OF TRAINS

TRAIN WHEEL- FLATS

RAIL TEMPERATURE

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yaşam için teknolojiler

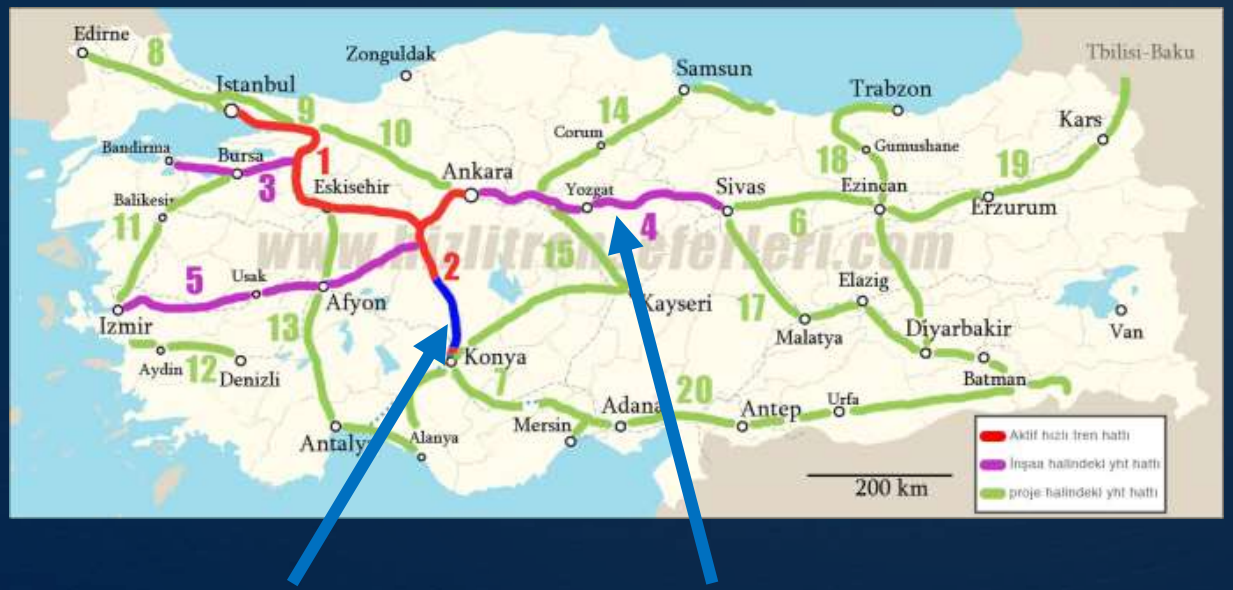
- Successfully in Operation since December 2018 at Konya – Ankara High Speed Railway Line (250Km/Hr Speed, 90 Km Double Track Line)

- 2nd Project in manufacturing & installation phase for total of 37 km long Slab-Track Tunnel Stretch at Ankara – Sivas High Speed Railway Line which is in construction now. (Planned completion date: November 2020)

- 4 Offers of RailAcoustic are in evaluation for international and prestigious Railway Project Tenders in US, EU and Asia through the best-known EU Railway Contractors.

RAILACOUSTIC REFERENCE PROJECTS

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



1st Project in Operation since 2018

2nd Project – Installation Phase (Planned Commissioning in November 2020)

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

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ADVANTAGES OF RAILACOUSTIC® TECHNOLOGY

RailAcoustic®

TECHNOLOGICAL COMPARISON MATRIX	Track Circuits	On-Board Ultrasonic Inspection Systems	Ultrasonic Stationary Inspection Systems	Fiberoptic Peripheral Intrusion Detection Systems	RailAcoustic® Acoustic Stationary Inspection System
Detection of FULL RAIL BREAKS	NOT RELIABLE	✓	NOT RELIABLE	NOT RELIABLE	✓
Detection of PARTIAL RAIL BREAKS	✗	✓	NOT RELIABLE	NOT RELIABLE	✓
DETERMINING THE EXACT LOCATION OF RAIL FLAW	✗	✓	✗	NOT RELIABLE	✓
Detection of rail breaks WITHOUT A NEED OF TRAIN PASSING THROUGH THE DEFECTED ZONE	✓	✗	✓	✗	✓
Detection of LANDSLIDES & FLOODS	✗	✗	NOT RELIABLE	✗	✓
TRAIN SPEED MONITORING	✗	✗	✗	✓	✓
TRAIN MOVEMENT MONITORING	✓	✗	✗	✓	✓
TRACK TEMPERATURE MONITORING	✗	✗	✗	✗	✓
FLAT-WHEEL DETECTION	✗	✗	✗	NOT RELIABLE	✓
DERAILMENT DETECTION	✗	✗	NOT RELIABLE	✓	✓
CONTINUOUS & REAL-TIME MONITORING	✓	✗	NOT RELIABLE	✓	✓
RELIABILITY IN BROKEN RAIL DETECTION	✗	✓	✗	✗	✓
SELF CALIBRATION & ADJUSTMENT	✗	✓	✗	✗	✓

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SYSTEM COMPONENTS OF RAILACOUSTIC

SIGNAL PROCESSING & COMMUNICATION:

This electrical signal processing, control and communication cabinet is located along the track at up to each 2 Km distance, for housing the electronic boards, power supply and the fiber-optical network communication controller.

SIGNAL GENERATOR:

Acoustic signals are injected into the rails thru this unit. The unit is attached onto the rails without any welds or holes.

SIGNAL RECEIVER:

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

SYSTEM COMPONENTS AS APPLIED TO TRACK

RailAcoustic®






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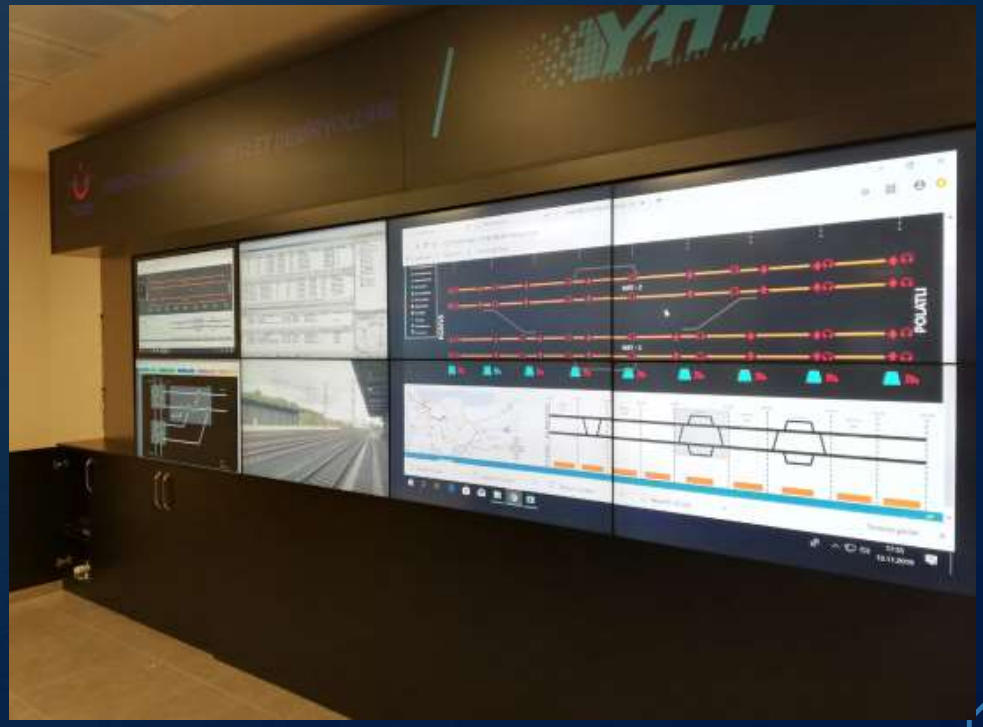
CONTROL CENTER VIEW

HARDWARE & SOFTWARE

RailAcoustic®



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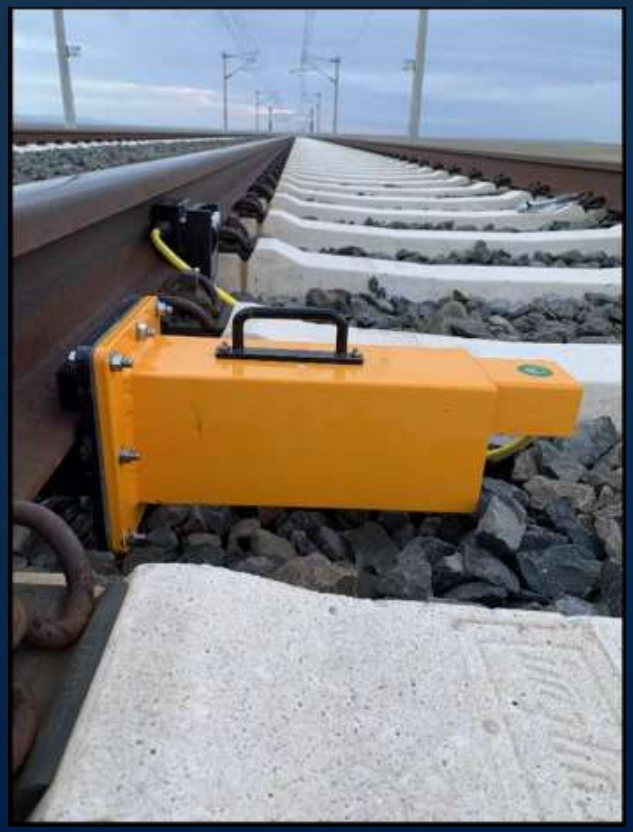
SYSTEM COMPONENTS AS APPLIED TO TRACK

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



RAG and RAR Modules Installed on to the Rails

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.

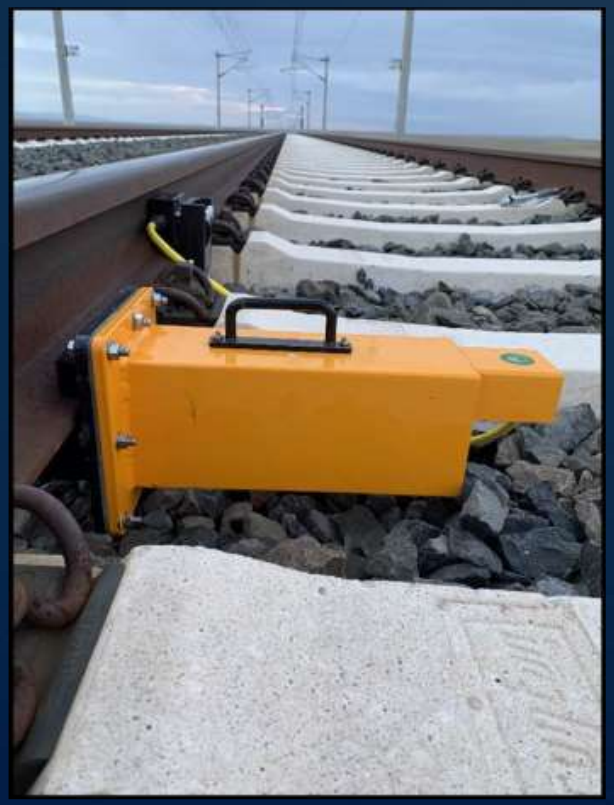
SYSTEM COMPONENTS OF RAILACOUSTIC – RASP

RAILACOUSTIC SIGNAL PROCESSING UNIT (RASP)

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

SYSTEM COMPONENTS AS APPLIED TO TRACK – RAG

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



RAILACOUSTIC GENERATOR (RAG)

- Acoustic signals are injected into the rails thru this unit. The unit is attached onto the rails without any welds or holes but by only using a specially designed clamp mechanism.

SYSTEM COMPONENTS OF RAILACOUSTIC – RAR

RAIL ACOUSTIC RECEIVER (RAR)

- 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.

SYSTEM COMPONENTS 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 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

CONTROL ROOM VIEW

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

CONTROL CENTER HW & SW (CCSM):

CONTROL ROOM VIEW

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.

RAILACOUSTIC SYSTEM CUT TEST

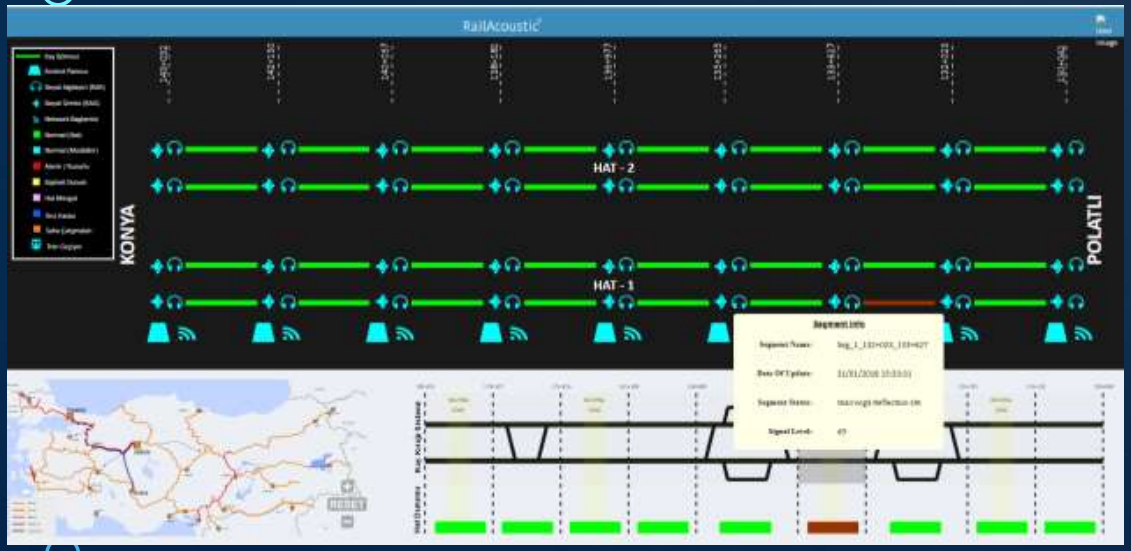
THE SYSTEM HAS BEEN APPLIED to a 90 Km long Double Line and 4 Km long Single Line segment on ANKARA-KONYA High Speed Line (HSL). The system is in use NOW after two times random rail cut tests are performed and accepted by TCDD.

TEST NO : 1 – RAIL HEAD PARTIAL CUT TEST

5 cm deep partial cut. A significant change in the received waveform is observed. Reflection signal has identified the rail fracture and its location. Command center computer has registered the fault as 'Level-1 Insignificant Damage' to the rail.

RAILACOUSTIC SYSTEM CUT TEST

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.

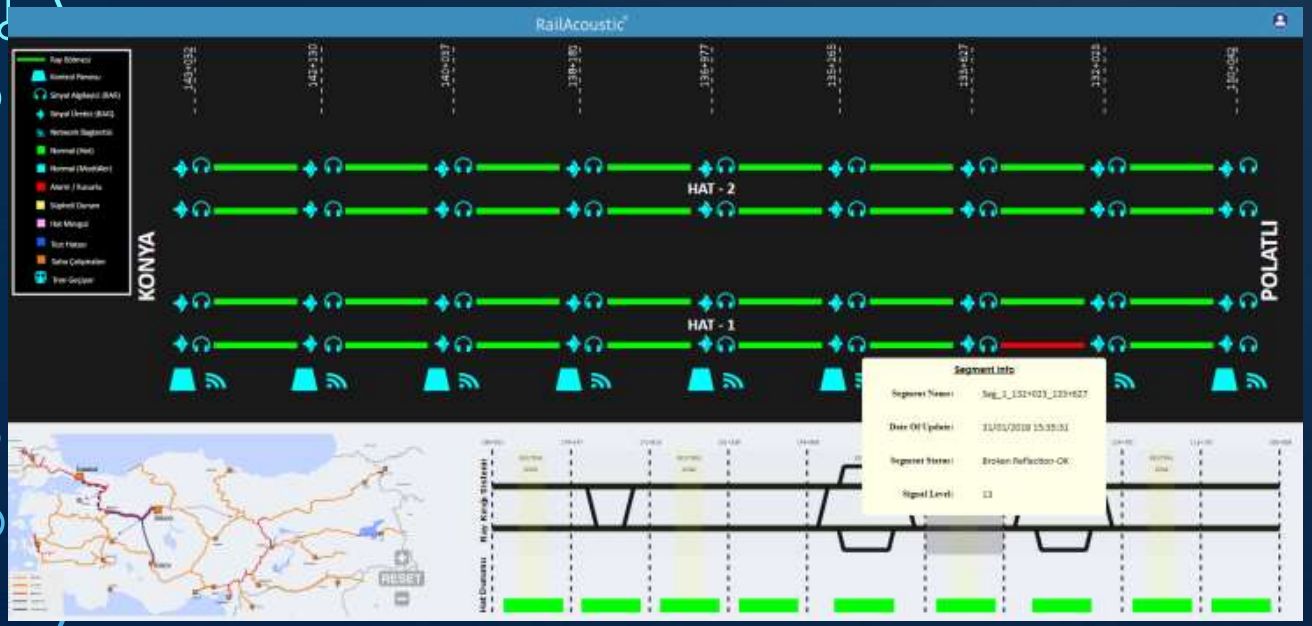


TEST NO : 2 – RAIL HEAD FULL CUT TEST

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. Reflected signal has identified the fault and the location. Command center computer has registered the fault as 'Level-2 Significant Damage' to the rail.

RAILACOUSTIC SYSTEM CUT TEST

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.



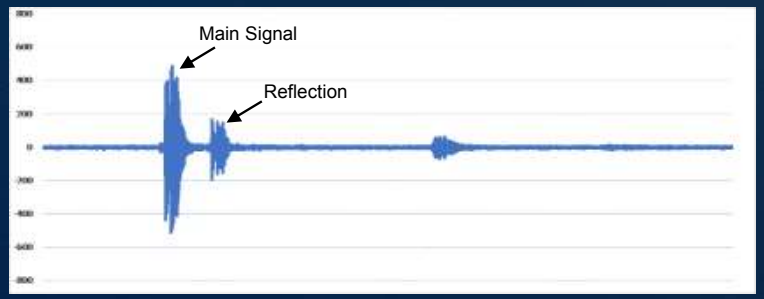
TEST NO : 3 – RAIL WEB HALF WAY THRU CUT

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 Level-3 Significant Damage / Brown Alarm Signal in the form of a critical rail fracture alarm. The damage location has been identified precisely.

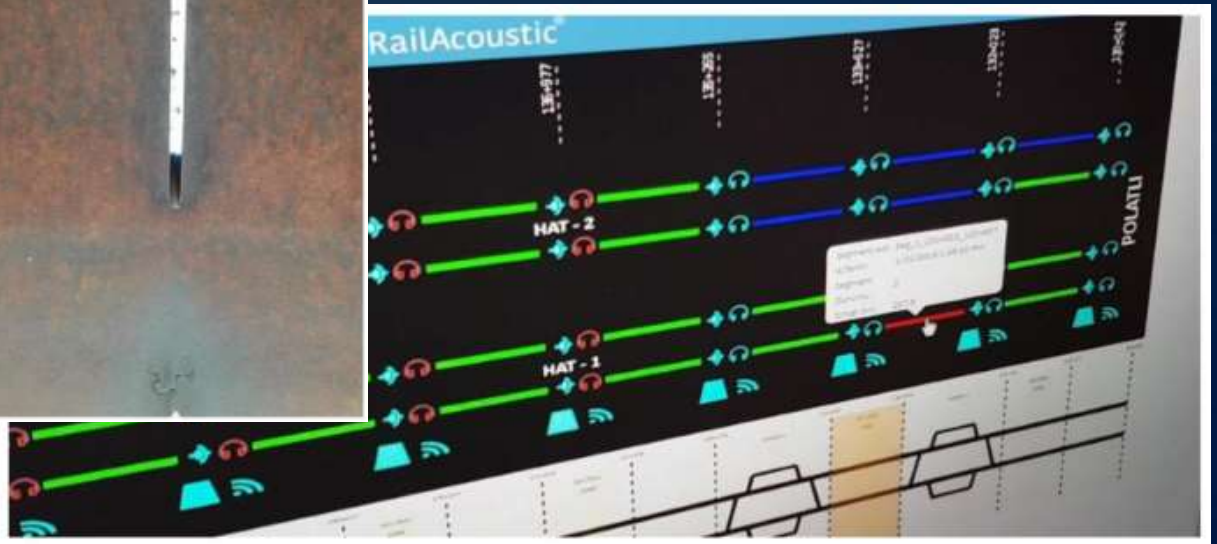
RAILACOUSTIC SYSTEM CUT TEST

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 4 – Rail Web Cut To The Foot Section



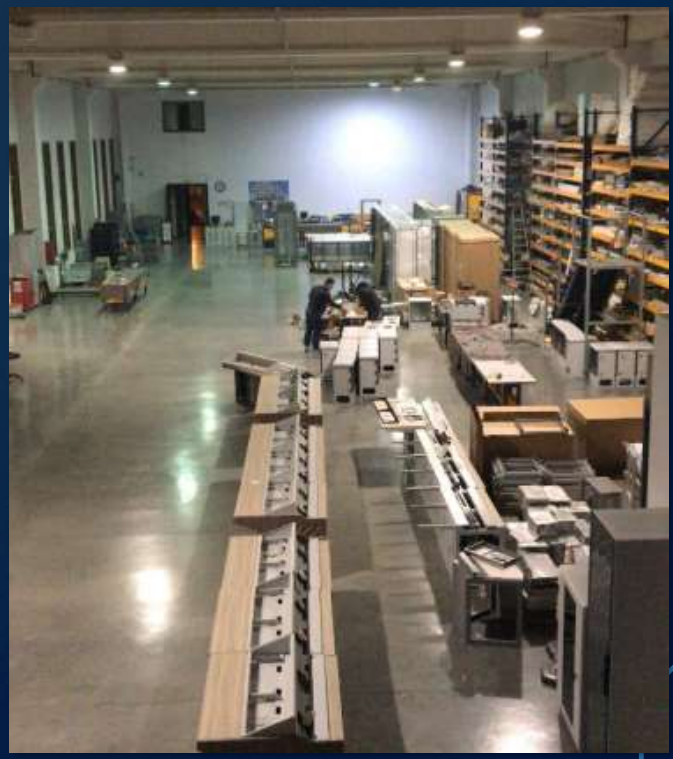
The web of the rail was cut to the foot and the fracture test was performed. The signal level, shape and reflected component has totally changed. At the end, the system generated a Level-4 Significant Damage / Red Alarm Signal. The location of the damaged rail has been identified precisely.



Broken Rail Indication On The Monitoring Screen of Command Center Computer

TEST NO : 4 – CUT TO THE RAIL FOOT TEST

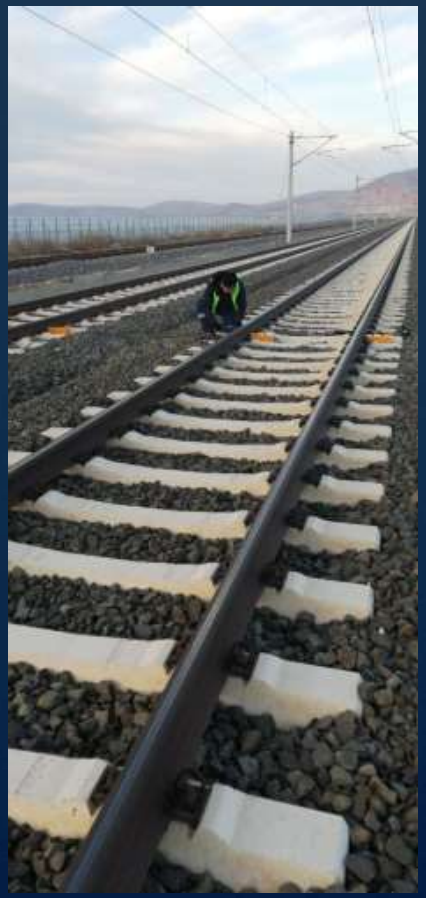
MANUFACTURING PHASE



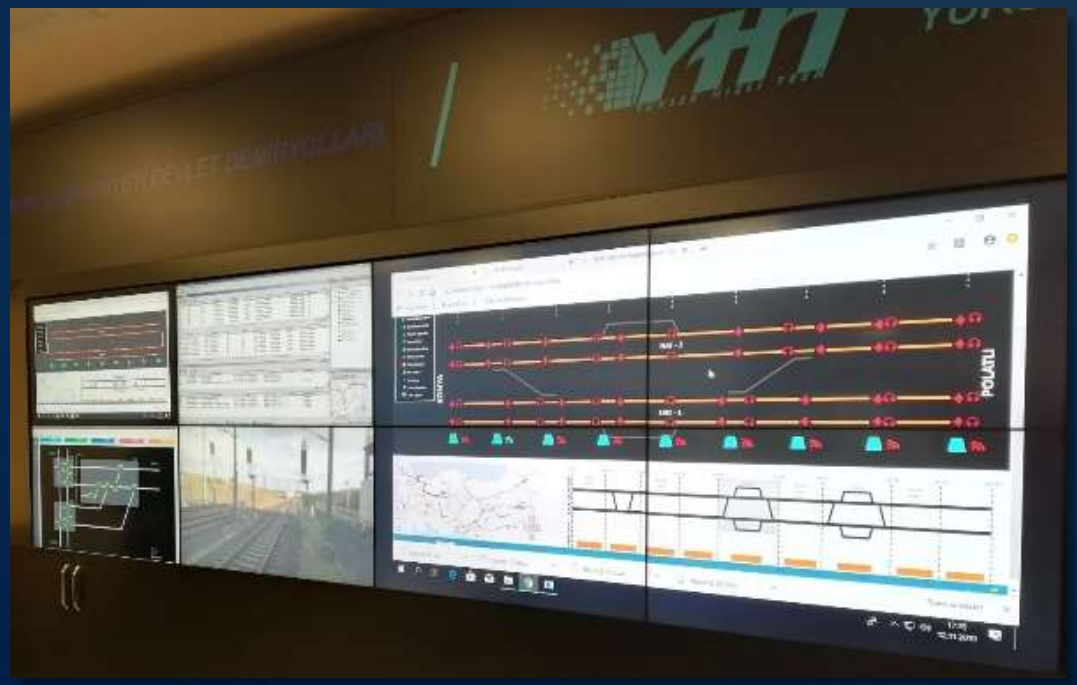
RailAcoustic®

SITE SURVEY BEFORE THE INSTALLATION

INSTALLATION OF THE SYSTEM



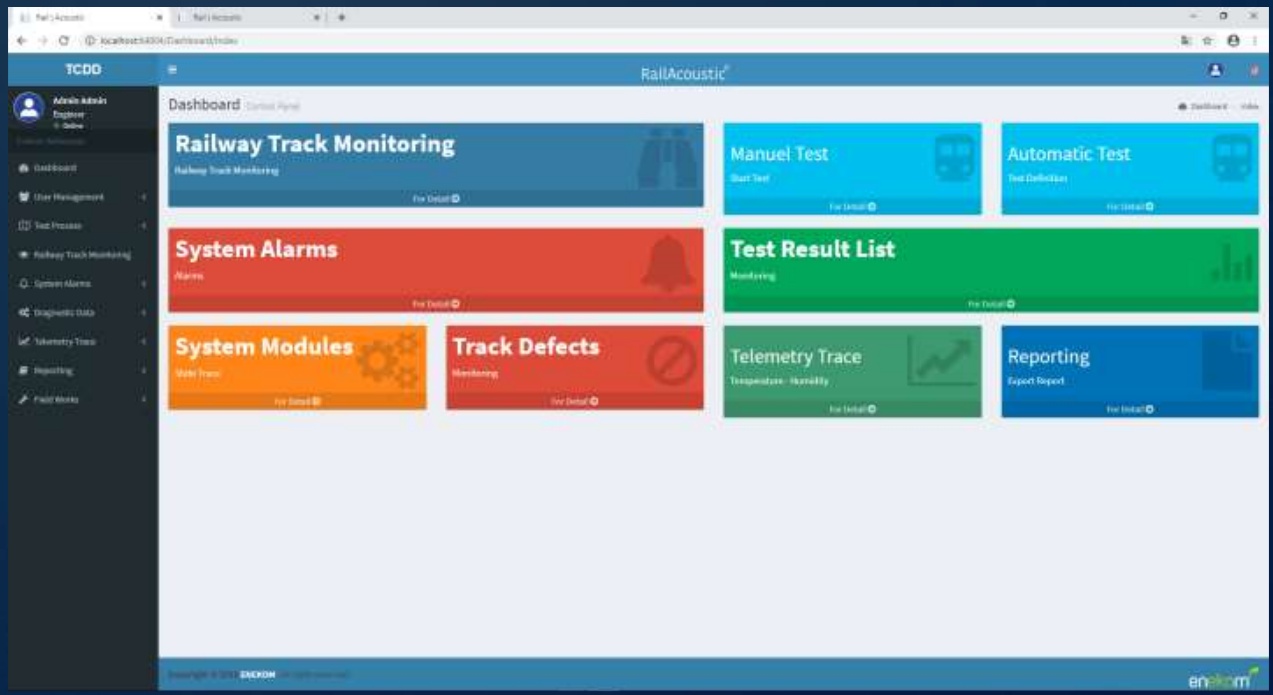
CENTRAL COMMAND MODULE USER SCREENS



- Dashboard
- Tests & Track Condition Monitoring
- System Alarms
- Telemetry
- Traffic Monitoring

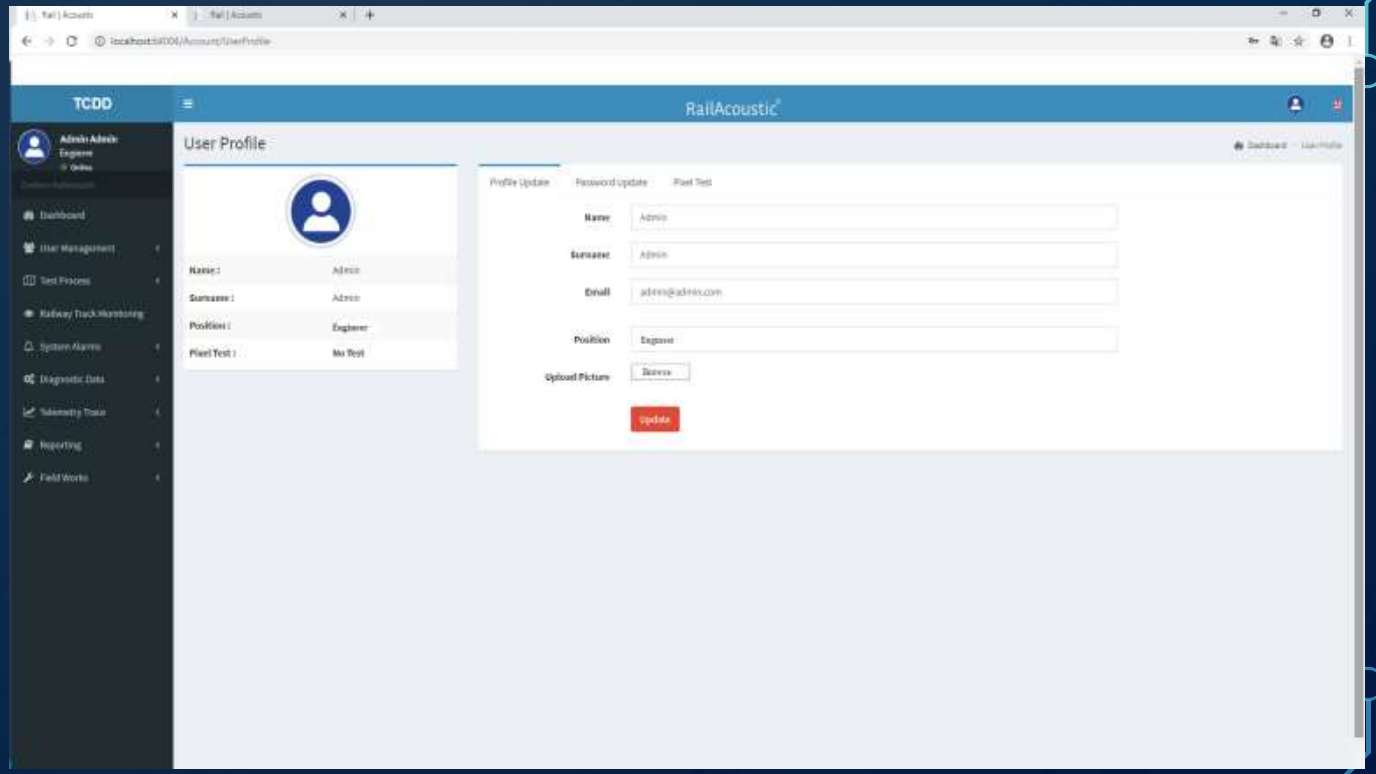
DASHBOARD

- There are mainly two user screen modules inside the RASP program. Dashboard is one of them and it is the passive user interface and control module. It aims to provide the operator with control, over the command center computer, to enter all relevant data including; commands to operate the system such as start an automatic or a manual test , telemetry data collection commands, test result lists, all reports in regards to the historical system data, system components' diagnostic data, current and historical alarm results, user authorization screens etc.
- There are many sub-screens under the dashboard main menu screen, providing access to the operator console functions for further details about the real-time operation and various report generation functions of RailAcoustic system.
- The authorized operator has all the rights to operate the system through this screen. Historical data are only retrieved from the console under authorized access conditions.



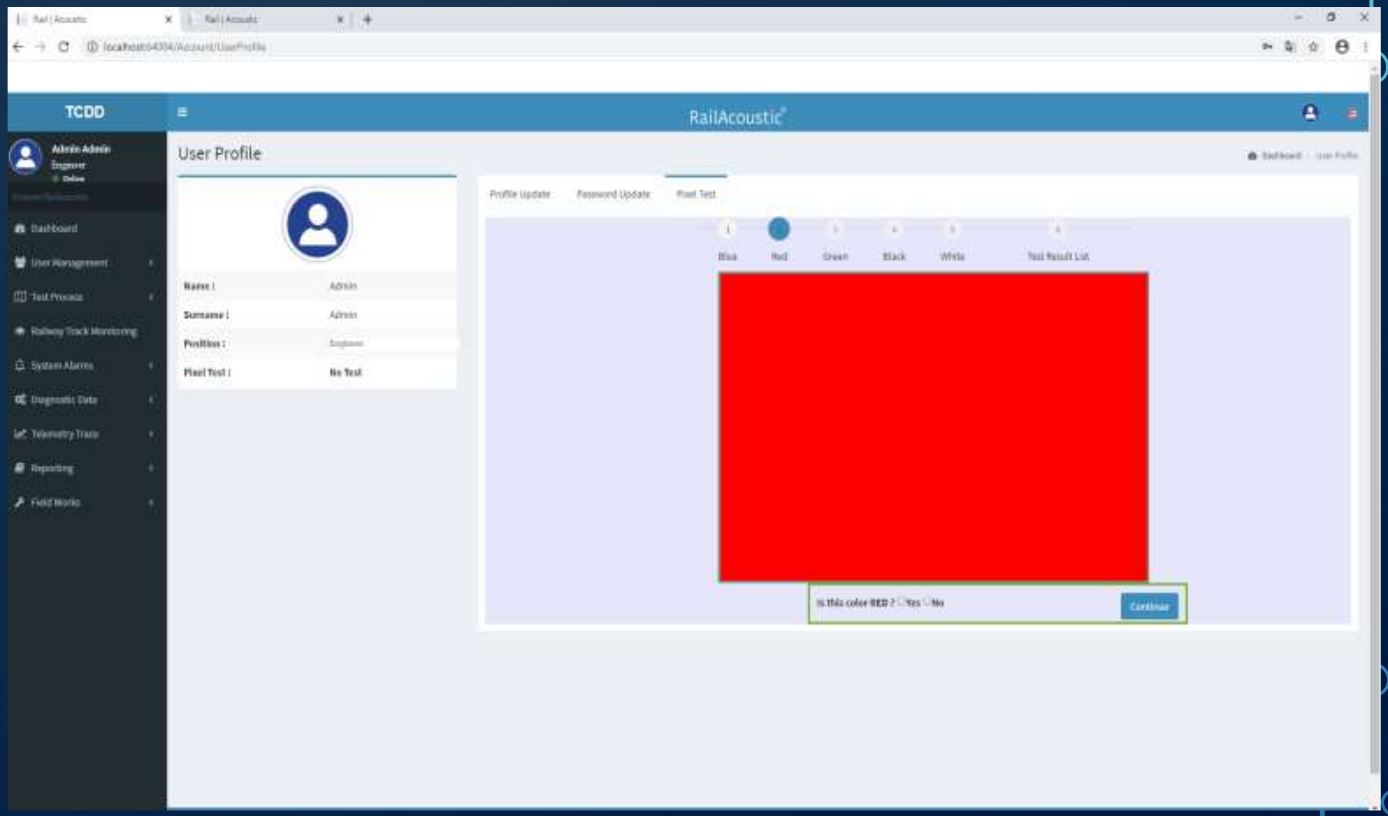
USER MANAGEMENT

- Operators who have rights to access the dashboard functions in different access levels are defined and identified in ‘User Management Screen’ module by the system administer.



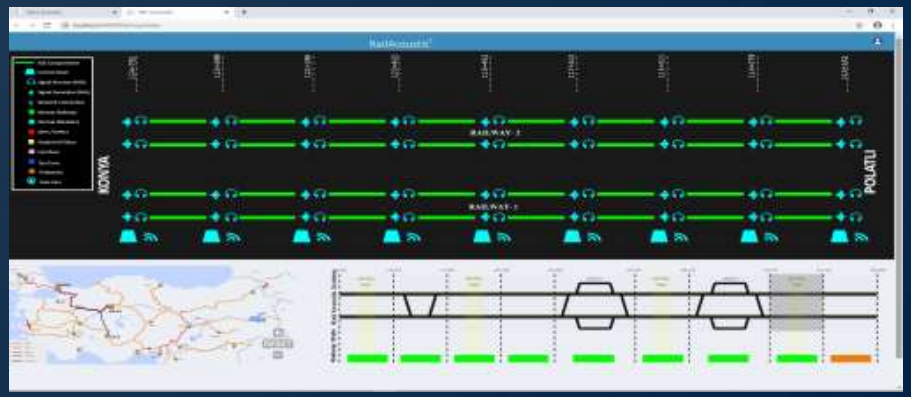
USER MANAGEMENT

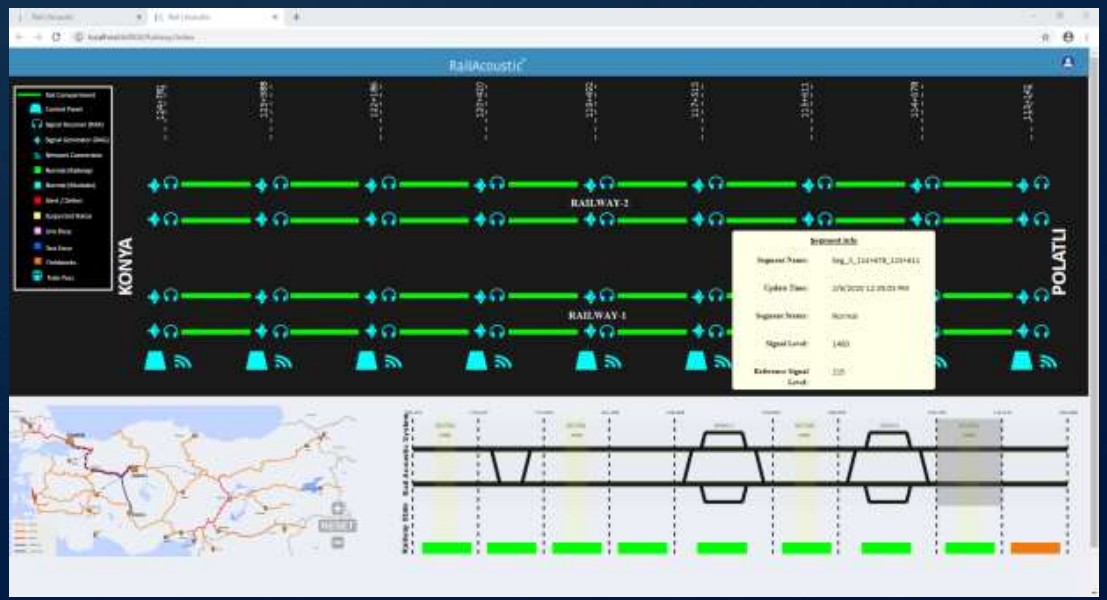
- On the main screen the alarm levels and segments are identified by the colored symbols on the screen. A color identification test was applied to each operator on the entrance to the system.



TESTS & TRACK CONDITION MONITORING

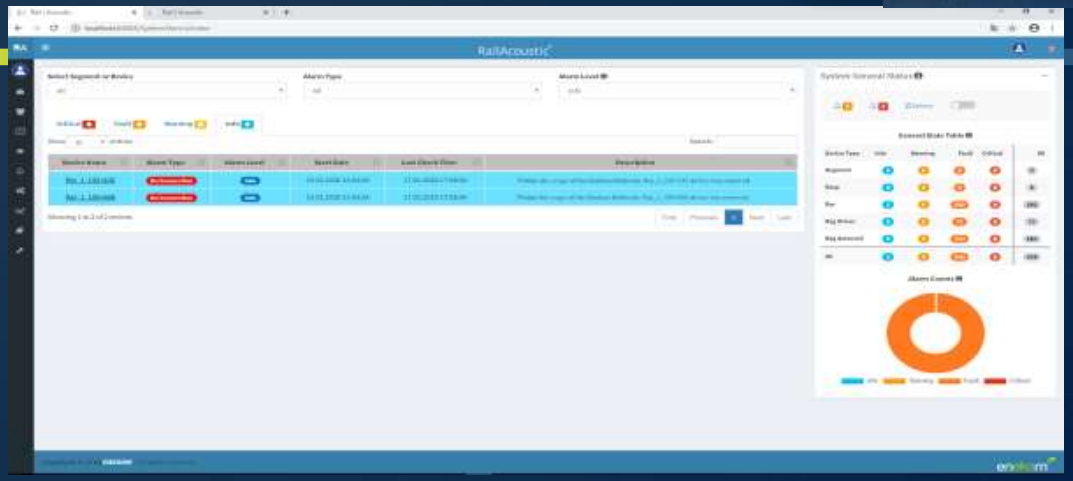
- One of the main RASP screens is Test & Track Monitoring screen which is to show the track condition including system components located on each track segment. Nodes with all system components laid onto the track are indicated on this screen. Track test results, train movements, flat wheels, land slide blocked track segments, system component diagnostic test results are all shown on this screen.

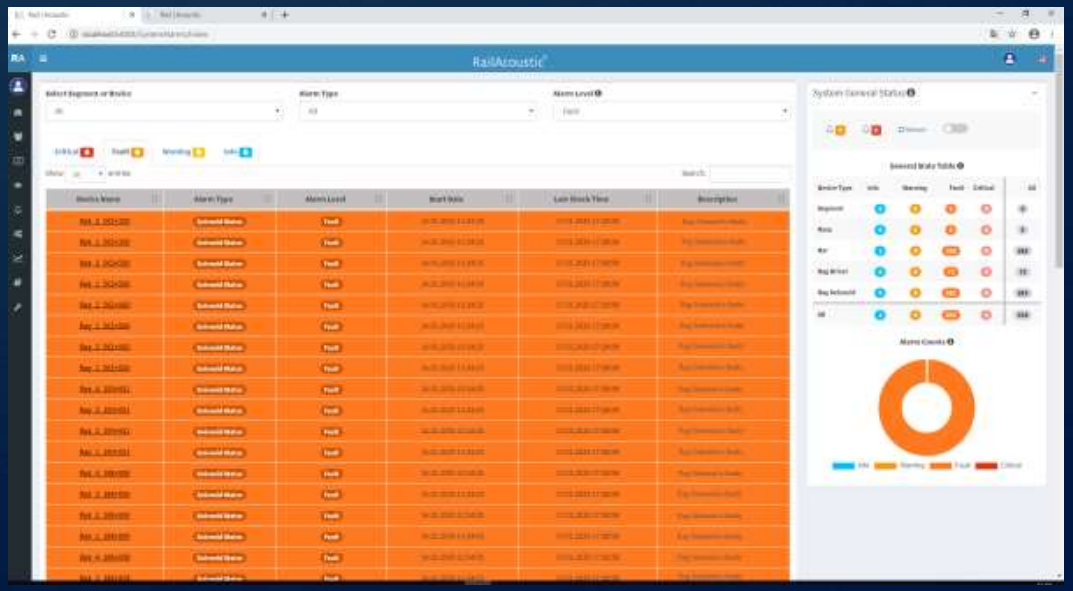




SYSTEM ALARMS

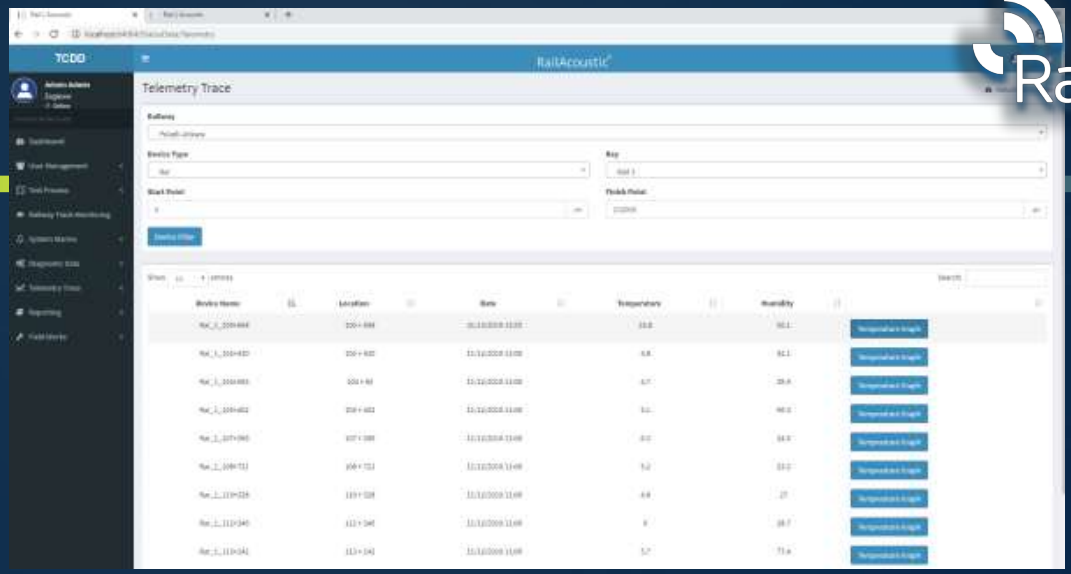
- Alarm screens are essential part of the RASP modules. These screens carry real-time alarm data as well as historical data for all RailAcoustic System components and operations. They are given to the operator in both text and graphical mode. Audio warning option is also available.
- There are a number of operator-controlled list features in Alarm Screens, reflecting the status of track and system maintenance and service conditions. These lists directly affect the Alarm listings on the screen.

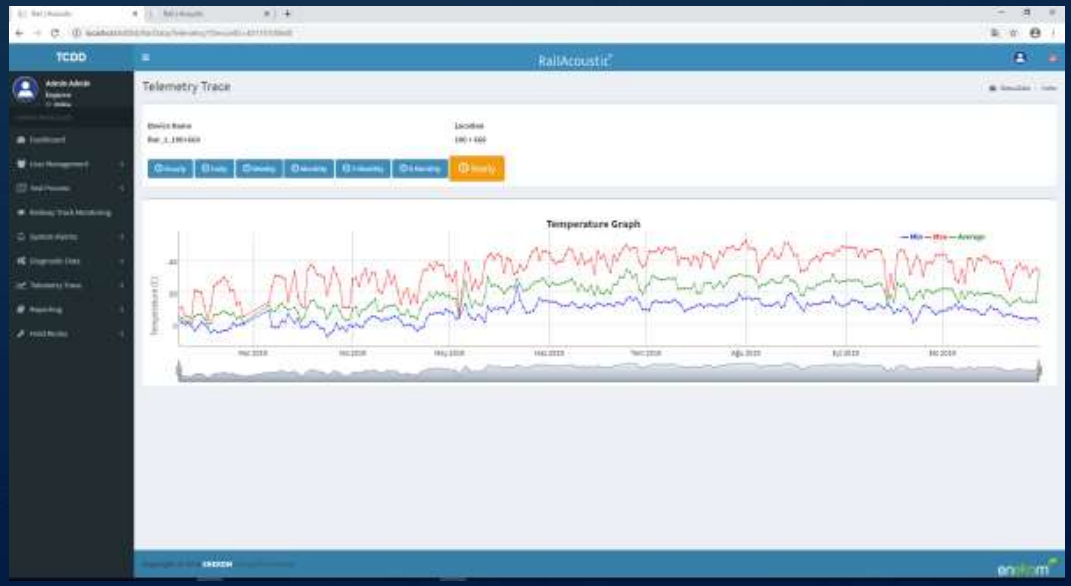




TELEMETRY

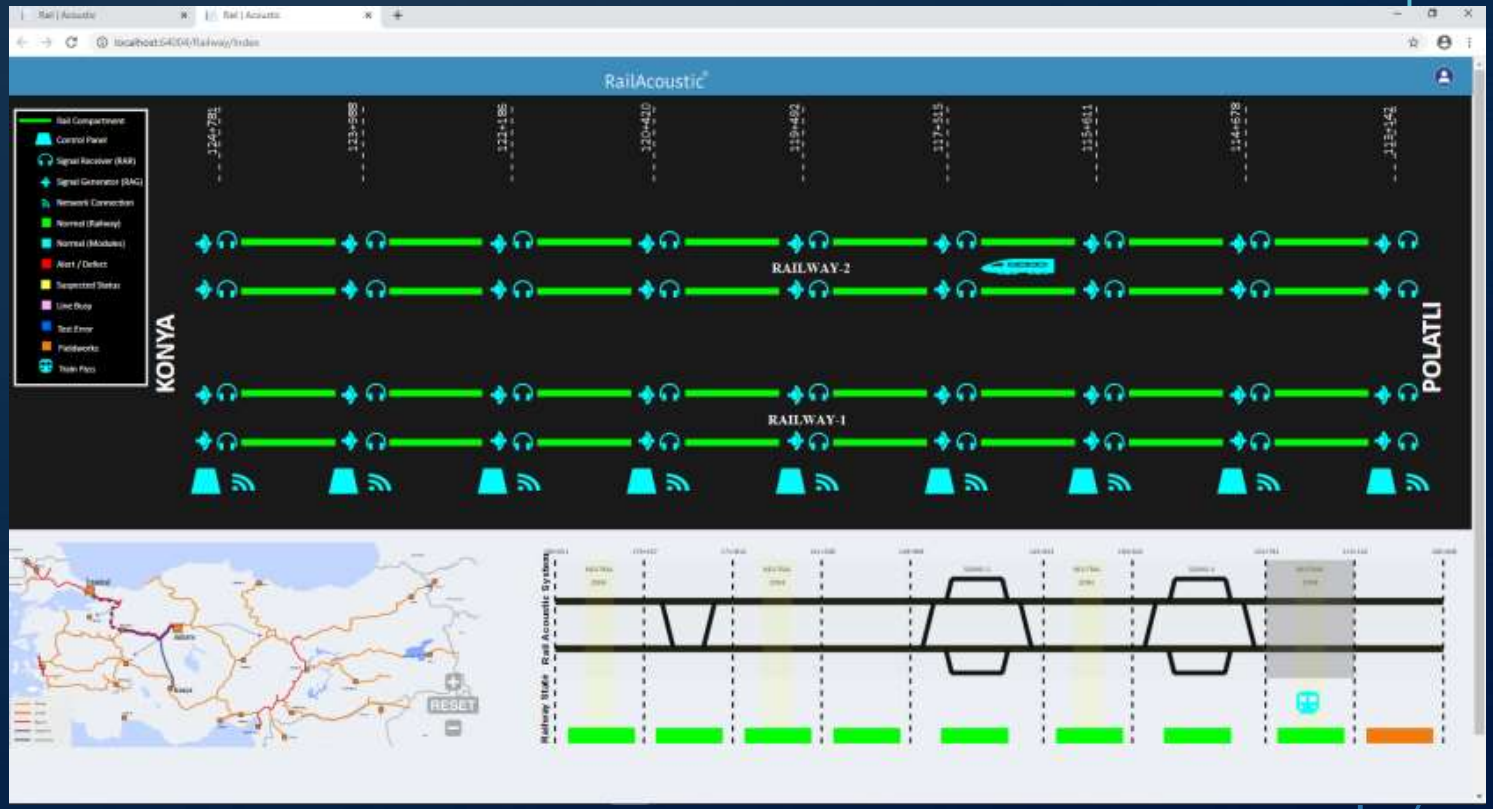
- All nodes measure the rail temperature and outside air temperature and humidity and transmit these data to the remote RASP unit computer. System operators can reach to these telemetry results either at prescheduled times automatically or at any time by pressing a button on the Telemetry Screen.
- Rail temperature and outside the cabin air temperature and relative humidity measurement results are given to the user on the screen under different tabular or graphical format. They can be transferred to outside thru a printer or removable disk, on authorized demand.





TRAFFIC MONITORING

- Train traffic monitoring is performed by the system in real-time. The main Test & Track Monitoring Screen also show the moving train traffic on this graphical screen. Moving train speeds are also indicated on this screen. The track elevation conditions and flat-wheel are also monitored by the system components and those conditions are shown on this screen with different color codes.



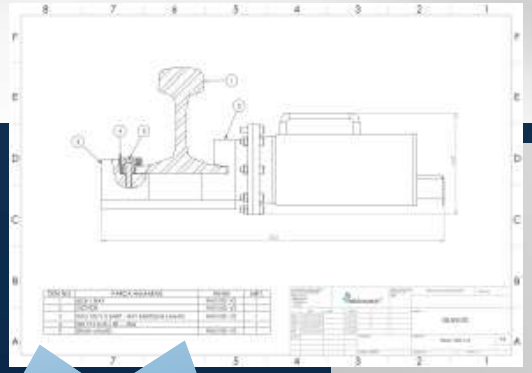
RAIL MOUNTED EQUIPMENT MECHANICAL DETAILS

RailAcoustic®

- Acoustic Signal Generator: RAG
- Acoustic Signal Sensor: RAR
- RAG & RAR Mounted on Rail
- RAG & RAR Installation Method

ACOUSTIC SIGNAL GENERATOR: RAG

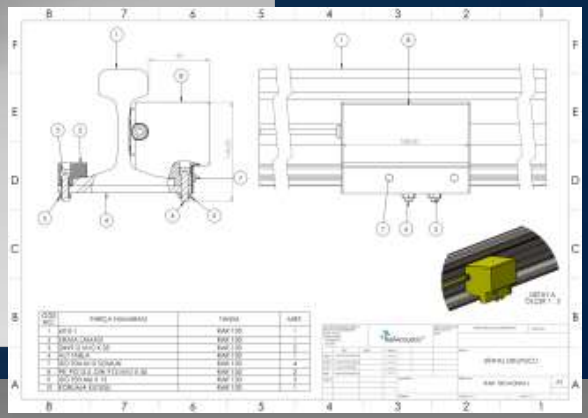
- The acoustic signal generator module of the RailAcoustic technology is called RAG (Rail Acoustic Generator). It is connected to the rail with an easy to mount and remove clamp mechanism as shown below. It is electrically driven by the control cabinet located next to the track.



NEXT GENERATION COMPONENTS

ACOUSTIC SIGNAL SENSOR: RAR

- The acoustic signal sensor module of RailAcoustic is called RAR (Rail Acoustic Receiver) and it is mounted onto the rails with an easy to mount and remove clamp mechanism as shown below. The sensor unit is connected to the track-side control and communication cabinet electronically.



NEXT GENERATION COMPONENTS

RAG & RAR MOUNTED ON RAIL

- RAG and RAR modules are mounted onto the rails side-by-side for each up to 2 Km distance as seen below.
- CLICK FOR VIDEO:

https://youtu.be/ERzhGB95b8s

NEXT GENERATION COMPONENTS

RailAcoustic®

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technologies for a sustainable life

- ERCI – EUROPEAN RAILWAY CLUSTERS INNOVATION AWARD 2020
- INVENTOR AND DEVELOPER OF THE TECHNOLOGY
- 8 PATENTS ON THIS AND OTHER R&D PROJECTS REGISTERED LOCALLY AND INTERNATIONALLY
- LOCATED IN METU (Middle East Technical University) TECHNOPOLIS in Ankara
- GOVERNMENT – UNIVERSITY – INDUSTRY COOPERATION AND CONNECTIONS
- FOCUSED ON OPTIC AND SPECTROMETRIC RAILWAY DETECTION TECHNOLOGIES

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Energy Ecology Informatics Engineering

RailAcoustic®

Railway Technologies in Acoustic Domain

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