INTERNATIONAL RAIL SAFETY COUNCIL
SOUTH AFRICA

Wabtec CORPORATION

23
FETY COUNCIL
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CTOBER 1 - 6, 2023

IRSC 202
INTERNATIONAL RAILWAY SAF
"Reshaping Railway" Reshaping Railway
CAPE TOWN, Oc

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RAILWAY SAFETY REGULATOR
RAIL SAFETY ON THE RIGHT TRACK

Fabrizio Burro
Wabtec Corporation

Advanced Digital Solutions Improving Performances and Workers Safety in Railway Operations

Sub-theme 7 – Worker focused solutions and adaptations

Global Transit Headquarters
PARIS, FRANCE

Corporate Headquarters
PITTSBURGH, PA

Global Freight Headquarters
CHICAGO, IL

27K	50	$8B	FORTUNE 500
EMPLOYEES	COUNTRIES	REVENUE	COMPANY

About Wabtec Corporation

With a strong footprint in railway transportation

An unrivalled portfolio on digital solutions

		SIGNALLING		DISPATCHING	AUTOMATION
+3000	**1B€**	**+22000**	**+90000**	**+30000**	**+11000**
EMPLOYEES ON DIGITAL INTELLIGENCE	1B€ REVENUES IN DIGITAL SOLUTIONS	RADIO BASED ON-BOARD ATP IN OPERATION	KMS OF ATP WAYSIDE IN OPERATION	KM OF NETWORK CONTROLLED BY ONE OPERATION CONTROL CENTER WITH AUTOMATIC ROUTING AND SCHEDULING ALGORITHMS	LOCOMOTIVES EQUIPPED WITH ATO SAVING 10% ENERGY

Wabtec footprint in the Digital railway transportation

Train Automation Benefits

75%
REDUCTION IN ACCIDENTS RELATED TO HUMAN ERRORS

20%
IMPROVEMENT IN ROLLING STOCK UTILIZATION

25%
FUEL SAVINGS ACROSS ENTIRE FLEET

25%
REDUCTION IN TRAIN DELAYS

Potential for
$3.5B*
in annual customer savings

*Estimation for North American Class 1 railroads

Benefit for the improvement of Safety and Performance

Our Strategy…
…to connect and integrate the rail landscape through innovation

…approach to the continuous improvement

Wabtec worldwide presence is a key aspect for the collection of emerging user needs, as driver for products/solutions new developments and upgrading.

In the EMEA area, Wabtec has a leading role in the railway R&D initiatives.

Wabtec is a Funding Member of Europe's Rail

Worldwide collection of safety and performance related users needs

Wabtec is one of the Europe's Rail funding members

ER JU Project

Wabtec is one of the **leading company** in the new ER JU project co-financed by European Commission

Investing **over 47 M€** in digital solution for Railways, a large part focused on <u>Yard Automation</u> and <u>Low Density lines</u>.

Wabtec references and worldwide experience for such applications lines will contribute to **a fast innovation of Yards and Low Density lines**

ER JU project will ensure **European standardization**

Wabtec in the ERJU projects
Sustainable rail systems for improved performance and safety of end users and workers

YARD AUTOMATION

ERJU FA5 – Yard Automation

Wabtec, DB,TRAFIKVERKET, FRET SNCF,FSI,OBB, ProRail, ADIF, Siemens, among the others, are Funding Members of **ER JU Flagship Area 5 - Full Digital Rail Freight Operation** and are actively participating to the definition and standardization of a full automated yard including digital automated coupling.

Among the other goals, this project aims targeting consistent data flow **from operators order to train preparation** along all handover points (yards/borders/recipients). The planning and management of fully **automated shunting operation (ASO)** enables **fully automated marshalling yard operation** and more efficient last mile distribution and collection of wagons.

To this end, it will be developed and tested a solution in 2 demonstrator projects both in Hump and Flat yards where all the know-how and needs of freight yard operators will be considered with a specifically developed system.

Goals of this system will be:
- **Safely** manage basic operation in non signalled yards.
- Increase **productivity** of yard
- Reduce **risky human operations**
- Reduce **costs** while increasing **safety**
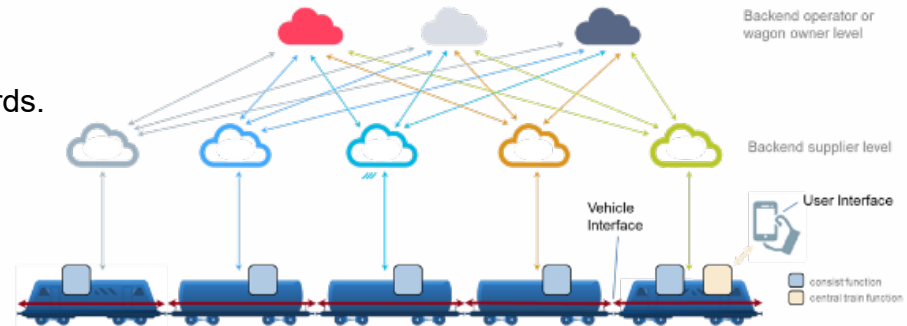
Flat Yard Current Operation Mode

- Current operations in Yards are manually managed with lot of risk for personnel working on the rails to couple/decouple wagons or locos.

- Typical **accidents** in rail yards are due to **crush of the personnel between wagons** or locos for the **low visibility** the loco driver has.

- Still the **low or no visibility** of the loco driver (when pushing wagons) is cause of **accidents with other wagons** parked on the rails.

- These accidents are **not related to Signalling issues and/or operations** that can be managed by the Signalling system

- These accidents are quite severe and causes several injuries and death every year.

ERJU FA5 Yard architecture: from GoA0 to GoA4
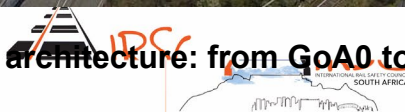
Wabtec Experience in Yard Automation

50 years of operating experience

Systems delivered on six continents

17,000 + systems delivered

Interfaces with most every type of braking system and locomotive control system

LOCOTROL® Remote Control Locomotive (RCL)

Wabtec has been automating remote control technology for 50+ years

- Remote control of locomotives in freight marshaling yard and main line operations.
- **Enable Single Person Crew Segments**
- **Improve Safety**
- Reduced Crew/Improve Efficiency
  - I.   Local Jobs
  - II.   Last Mile Efficiency
  - III. Loading/Unloading Operations
  - IV. Freight Marshaling Yard Movements/Train builds

Single Operator can conduct local pick-ups/ drops offs as well as freight marshaling yard shunting

LOCOTROL® XA equipped locomotive with RCL

Can communicate on 220Mhz/ LTE/ Wi-Fi

Future Design: Handheld Operator Control Unit (OCU) with Video display for train point protection

Improving safety and performance: Remote Control of Locomotive

Wireless controlled YM16 Point Machine

Following the automation requirements

- Level of Automation (Switch Control Methods):

  - *1st Level of Automation:* Push button controlled (manual) by Train driver

  - *2nd Level of Automation:* VHF radio, Dual Tone Multi-frequency codes (DTMF) or smart phone controlled by train driver

  - *3rd Level of Automation:* Computer controlled via PathFinder™ Software using data radio or fibre

  - *4th Level of Automation:* Integrated Yard Control via PathFinder™ Software, setting routes safely, car tracking and locating, and controlling all YM16's

- Communication: Radio (DTMF) controlled by train driver or via DATA Radio by Yard controller, or modem based, WiFi, Internet or Hard wired.

- Sustainable Solar or AC Powered Machine with Battery charger (120VAC 50/60 Hz or 12VDC), 12VDC - 105Ah Battery) – Battery ensures min 200 - max 500 switch movements

- Hydraulic/ spring machine

- All Control and detection components included for monitoring & controlling switch point position, holding force presence, over the switch occupancy and provides the switch condition indications via LED indicators and audible messages.

- The controller logs all event state changes and is displayed in plain text in the language of choice.

- Designed for over 1,000,000 operations virtually maintenance free

Improving safety and performance: wireless controlled point machine

Yard Planner Overview

The Challenge

- 1000's of variables
- Real time changes
- No Network Integration
- Manual decisions
- Constant exceptions

- ✗ Fewer car connections
- ✗ Increased car dwell
- ✗ Fewer blocks made
- ✗ High re-work rate
- ✗ Poor class track utilization

Yard Planner Solution

Receiving/Class

- ✓ Inbound train-to-track assignment
- ✓ Inbound train track-to-dispatch route
- ✓ Switch sequence
- ✓ Block-to-track assignment
- ✓ Block stacking
- ✓ Re-hump/re-switch sequence
- ✓ Bad order processing

Pull-back/Departure

- ✓ Pull-back/build sequence
- ✓ Call track-to-train assignment
- ✓ Outbound train-to-track assignment
- ✓ Departure driven planning
- ✓ Departure time & track-to-route updates
- ✓ Enforces all train building rules

Installed Base & POCs

- ✓ Norfolk Southern (Birmingham hump yard)
- ❑ TASD (Flat yard switching and loading railcar ship)
- ❑ GWI (Buffalo and Pittsburgh Railway flat yard switching)

Outcomes/Benefits

- ✓ Enforces operating plan
- ✓ Significant improvement in car connections
- ✓ Reduced car dwell
- ✓ Reduced car handling
- ✓ Improved asset utilization
- ✓ Additional car blocking in class yard
- ✓ Yardmaster workload reduction

Enforcing the operating plan through real-time classification-yard planning & optimization

Improving performance: Yard Planner

KinetiX: Real-Time Asset Tracking and Inventory Management

Cloud reconciles expected (planned) vs. observed (actual)

Yard Planner decision support

RailConnect inventory

Utilize RCL for Shunting Rosters crew tasks

Wagon ID Tracking & Classification

Dynamic Classification Tracking

Inbound wagon identified with OCR, AI tracks movement

Wagon locations and track "fullness" processed on the edge, reported to cloud to update integrated apps

Outbound wagon confirmed, track availability updated, cloud apps informed

Improvement in safety and in performance are not conflicting requirements

FutuRe in a nutshell – Key highlights

Project motivation

- Regional railway plays a crucial **role in Europe´s regions** and **as feeder lines for or passenger and freight traffic** for the main network and has an essential function **as green transport** as well as **connecting other public transport services** (e.g., bus) and first & last mile services (e.g., bike sharing, cycling, walking or car) to travel from/to railway stations **to remote locations**.

- **But:** many of these lines were given up in the past – due to **high costs**. Thus, these railway **lines need to be revitalized or even rebuilt to make them economically, socially, and environmentally sustainable** and meet the current customer needs but also reduce CO2 emissions of the European transport sector.

A clear project goal

To tackle these challenges and develop solutions the project FutuRe - Future of Regional Rail – has the following goals:

- to ensure long-term viability of regional rail by reducing total cost of ownership (TCO), i.e., cost per kilometer in terms of both OPEX and CAPEX, while ensuring high service quality and operational reliability. In addition, the target is to increase customer satisfaction and become an attractive and preferred mode of transport:

  > **Lowering CAPEX system costs,**
  > **Lowering OPEX,**
  > **Increasing productivity** (unit costs per train kilometer),
  > **Improving customer satisfaction**.

Project key facts

- **Project duration:** 01.12.2022 - 01.12.2026
- **Total Project Costs** (funding+IKOP+IKAA)**: ~35MEUR
- 21 Beneficiaries, >30 Affiliated Entities and Subcontractors

FP6-FutuRe
Cost effective regional lines
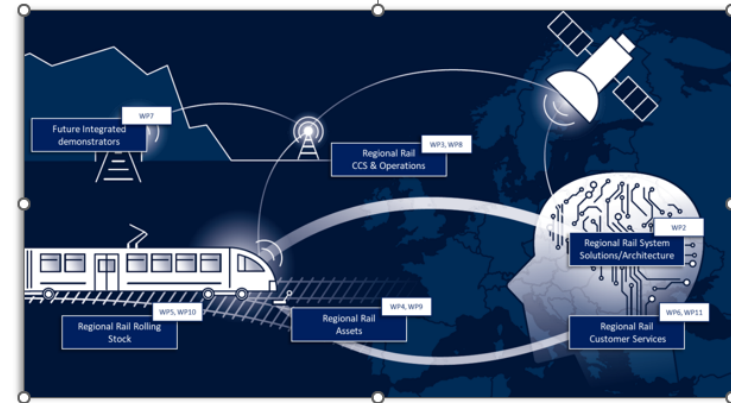
*is the project leading company
and
Project Coordinator*

Old signalling technology:

signals, track circuits, copper cables etc. subject to high failure rate, vandalism, theft etc…

High OPEX

New signalling technology (ETCS):

High CAPEX and OPEX cost.

Too complex and not open to low cost available technologies.

Railway telecom technology (GSM-R):

Too expensive.

Obsolete.

Its planned evolution will be expensive.

Operation Control Room:

too primitive to maximize punctuality & capacity

unable to manage on-demand service & intermodality.

"**Pain points**" of traditional train control and signaling

I-ETMS Positive Train Control *(PTC)*

- ✓ **Designed to prevent** Train to Train to Collisions, over-speed derailments, incursions into work zones, and protect movements through switches left in the wrong position

- ✓ **Interoperable: Over 70 railroad customers** and many combinations of hosts / tenants had to be considered

- ✓ RRs chose **Wabtec's** Interoperable Electronic Train Management System *(I-ETMS)*

- ✓ Today, RRs operate **nearly 2 million km per day** with PTC protection

- ✓ US PTC program was completed in only **12 years**

- ✓ The **scale and speed** of the programme is a world record!

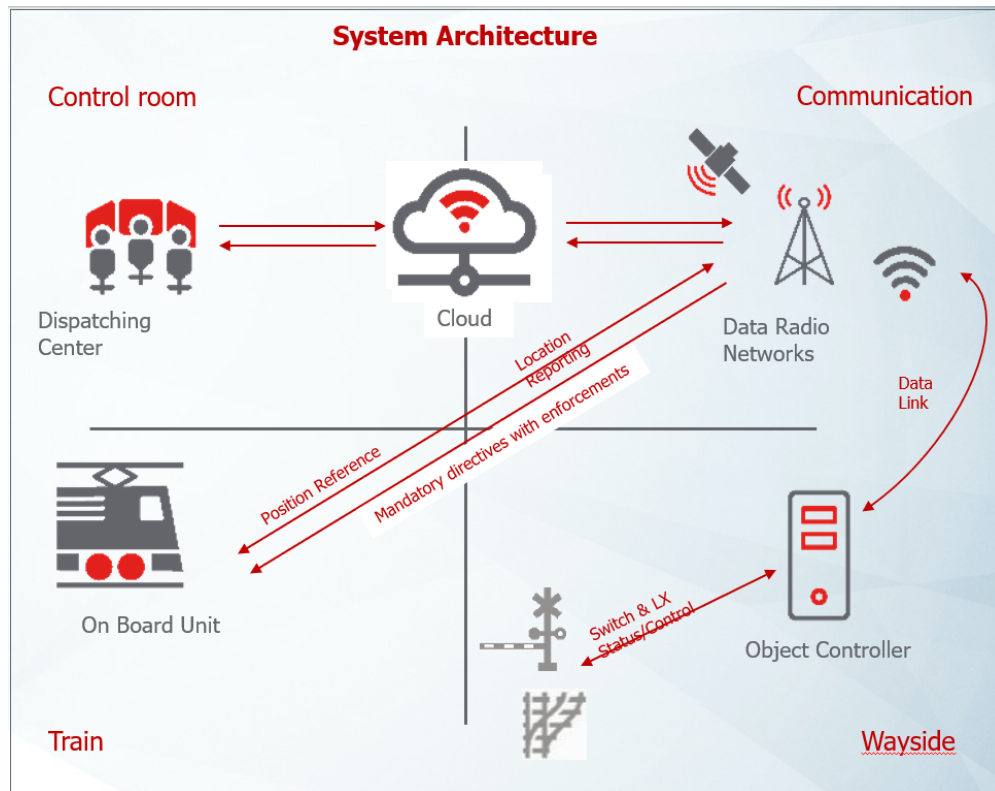Wabtec solutions for Low Density Lines

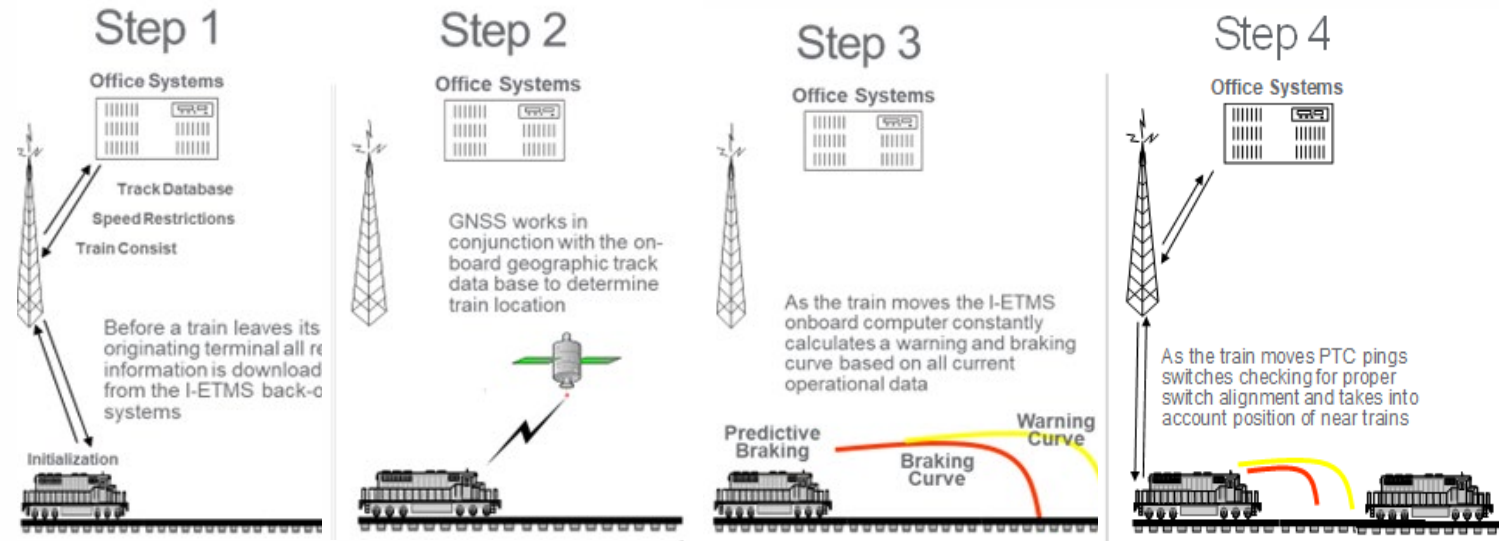# Building blocks and impact on Train Control Operations

- **Train:** precise satellite positioning / simple ATO for energy saving and remote control / radio based moving block ATP

- **Wayside:** self-energized (solar panels) point machines and level crossings remotely controlled via radio

- **Control room:** cloud-based dispatching center integrating:
  - optimization (non safety related) of the real-time routing and scheduling of trains
  - interlocking function controlling point machines and level crossing via radio (SIL4)
  - remote control of rolling stock for shunting

- **Communication:** open interoperability specifications and IP based data radio protocols, applicable on different types of data radio networks.

Public networks: ~**20-30% CAPEX reduction** compared with dedicated radio network.

Zero signals, track circuits, axle counters, eurobalises. **CAPEX: -15% OPEX: -20%**

System Architecture

Control room · Communication

Dispatching Center · Cloud · Data Radio Networks

Location Reporting · Position Reference · Mandatory directives with enforcements · Data Link

On Board Unit · Switch & LX Status/Control · Object Controller

Train · Wayside

Building blocks of Wabtec solution

PTC (I-ETMS) 2.0 Virtual Block

Step 1

Office Systems

Track Database
Speed Restrictions
Train Consist

Before a train leaves its originating terminal all re information is download from the I-ETMS back-o systems

Initialization

Step 2

Office Systems

GNSS works in conjunction with the on-board geographic track data base to determine train location

Step 3

Office Systems

As the train moves the I-ETMS onboard computer constantly calculates a warning and braking curve based on all current operational data

Predictive Braking

Warning Curve

Braking Curve

Step 4

Office Systems

As the train moves PTC pings switches checking for proper switch alignment and takes into account position of near trains

Value for the customers

SAFETY

Prevent Collisions:
Enforce Signals (Home and Intermediate)
Enforce Track Warrants (Non-Signal Territory)

Prevent Overspeeds:
Enforce Signal, Civil, and Temporary Speeds

Protect Track Workers
Enforce Track Permits, Speed Restrictions

Protect Approaches to Switch Machines
Power and Manual Switches/Points

PERFORMANCE

Max Capacity

Optimise Level Crossing management

Energy Management – Fuel Savings

COST

Minimal CAPEX:
Minimal equipment to be installed → min civils, min installation, min disruptions to operations.

Minimal OPEX:
Minimal equipment → min maintenance
Minimal equipment → min failures
No equip in remote areas → no risk of theft/vandalism

UPGRADES

100% Radio based solution:
GNSS for positioning + Data Radio network → infrastructure for other apps.

Optimization & Automation:
Local optimization (TO)
Global optimization (MP)
Analytics

Deployed : 90,000+ Kms | Onboard Units : ~20000 Units in PTC Operation

- 70+ different U.S. railways & operating companies utilizing Wabtec PTC Products and Services.
- Also deployed by MRS Logistica network in Brazil.
- Operational on Cascade tunnel on BNSF, 12.5 km & longest tunnel on MRS logistica network of 8km

Deployed on Both Diesel & Electrified Lines: Freight + Passenger

- **Experience on Electrified Lines:** Several lines with 25kV/60Hz; and with 700 VDC and 1500 VDC metro lines.
- **Freight Lines**: 86,000 kms | Passenger: 6,400 kms (1,500 passenger vehicle equipped). All lines designed support interoperable operation for both freight and passenger trains. E.g. Amtrak passenger trains operate across the U.S. on lines owned by freight railways.
- **Urban Installed Base** : Dallas/Fort Worth, Los Angelis, San Diego, San Francisco, Seattle, Albuquerque, Chicago, Denver, Orlando, Miami
- **High Speed Application :** PTC Designed to take care of extension of the braking algorithms and use of data radio networks capable of supporting high speed operations
- **Non-USA current deployment**: Brazil (RUMO), Guinea (CBG), Liberia (AML)

Overlaid on both relay based & electronic interlocking signaling systems of different types.

Large use of Wayside Interface Units (WIU) to collect wayside signaling status.

Open interoperability specifications and IP based data radio protocols:

Can be applied on different types of data radio networks. LTE & 5G included.

GNSS positioning: Multiple Global Navigation Satellite Systems (GNSS). Modern receivers combine more than one satellite positioning systems to increase accuracy & availability: European (Galileo) | American GPS | Russian (GLONASS) | Indian (NAVIC) etc.

PTC Solution is capable to use modern receiver with many different GNSS systems on same receiver delivering redundancy & increased accuracy.

PTC Facts: Wabtec PTC equipped trains run over 2 Million kms each day!

Secure Smart Mobile Client (SSMC)

Wabtec's TMDS® **Smart Mobile Client** has provided a reliable and **safe way to electronically manage track authorities** to railroad personnel for over 12 years and on over 11000.

By providing a purely **electronic method of authority** delivery the issuance process compared to a typical verbal authorization is significantly **faster and more accurate**.

Railroads which have adopted the TMDS® SMC have experienced operating efficiency gains by **simplifying the process for the maintenance & dispatching employees**.


Cellular
WIFI
Data radio
Satellite

Via the SMC Terminal, mobile workers may:
• View The Current Territory Status
• Request And Receive Electronic Track Authorities
• Place Speed Restrictions & Crossing Protections
• Request Absolute Obstructions
• Instant Message (IM) Train Controller
• Workgroup Tracking
• Switch Position Tracking
• Geofence
• LCP
• Radio Network Backbone (ITCM)
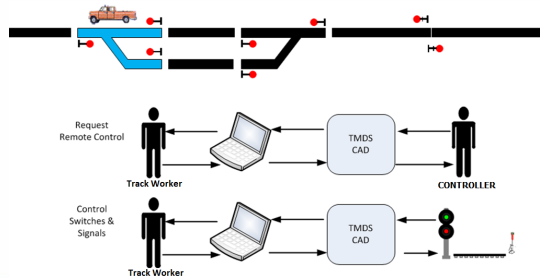
TMDS' Smart Mobile Client (SMC) Terminal allows mobile workers remote access to TMDS allowing them to digitally interact with the Dispatcher and TMDS directly.

Remote Control Panel
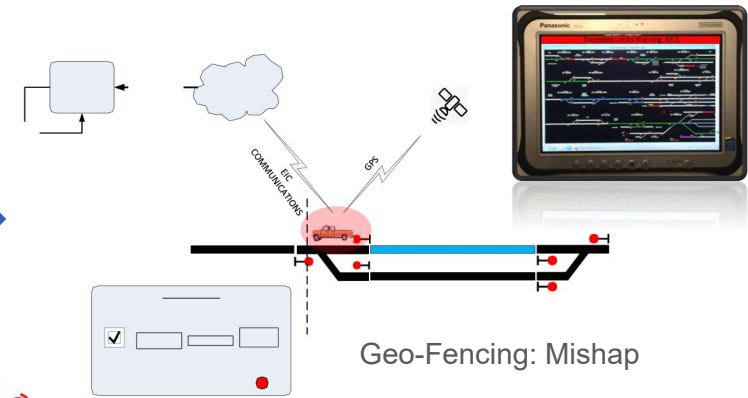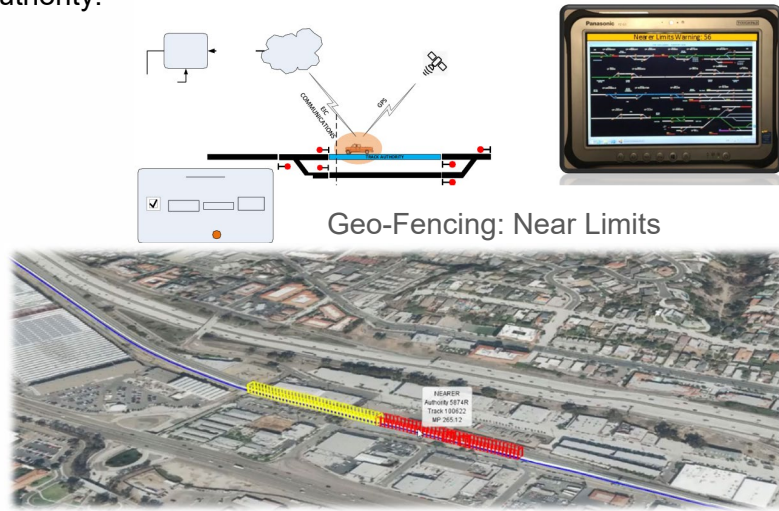
Improvement in safety and performance of trackside workers

Secure Smart Mobile Client (SSMC)

Functions and Features

- **Track Occupancy Authority** ability to request a track authority in non-signalled territory.
- **Switch In Manual Mode** ability to request switches within the limits of the track authority and provide blocking of adjacent routes when switches are placed in hand.
- **Secure Messaging and encryption**, timeout and password rules around the mobile device user as an application.
- **Temporary Speed Restriction** and **Local Possession Authority** ability to request and receive approval from the controller for activation.
- **GPS Integration** tracking of a mobile device user with a GPS transponder mapped to the TMDS track line database to show position and limits compliance within their track authority.
- **Geo-Fencing** monitors the limits given to an "Authority to Track Workers" and alarms if they are approaching or exceed the limits of their authority.
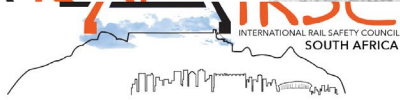

Geo-Fencing: Near Limits

Geo-Fencing: Mishap

Improvement in safety and performance of trackside worker

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