The Institution of Engineers (India)
UP State Centre Lucknow

Development of ‘Kavach’ System for Railways

By

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On

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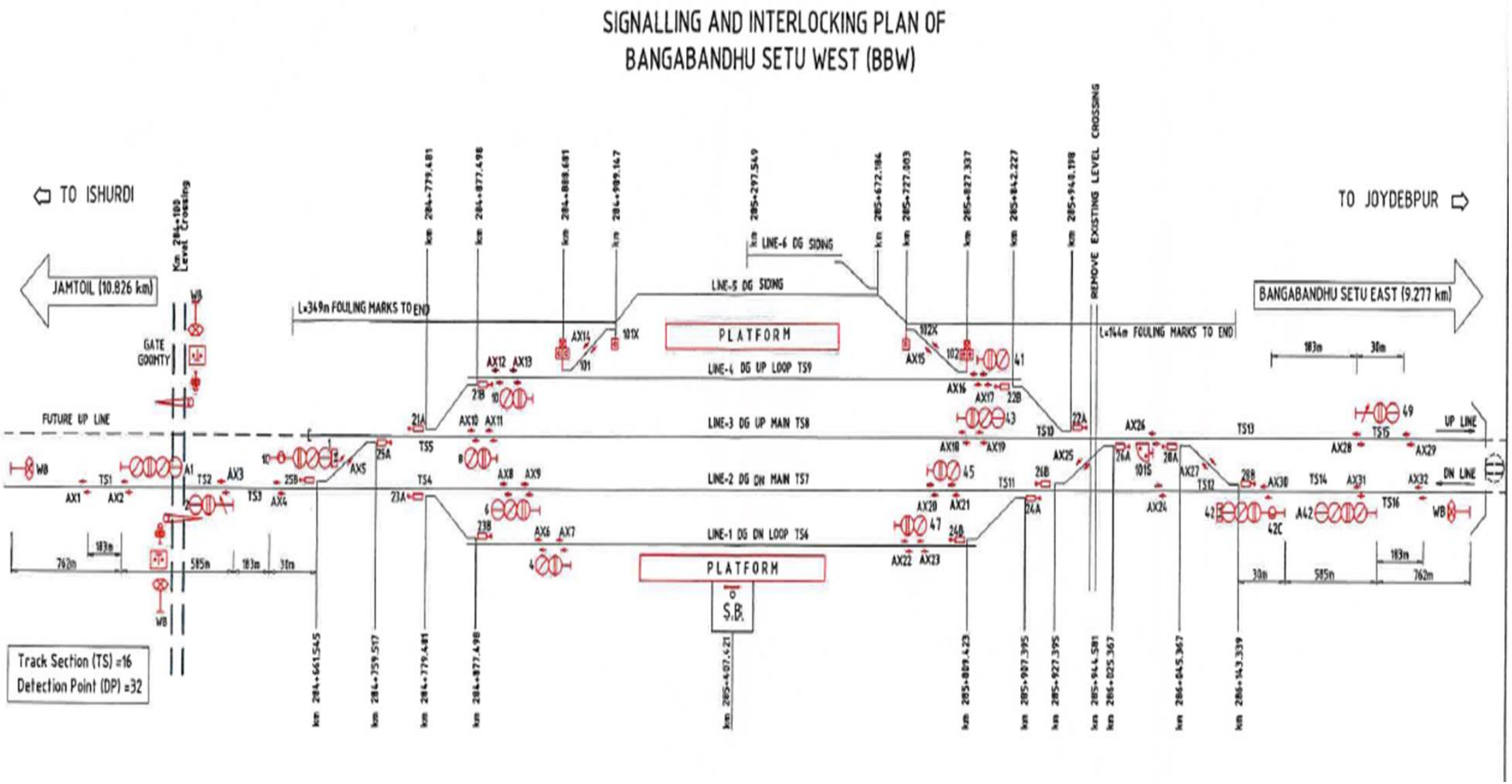
Overview

- Typical Signalling Plan of a station
- Development of Kavach System
- Train Collision Avoidance System (TCAS)
- Kavach System
- Status of Implementation
- Key Features and Functionalities
- Kavach Functions
- Components of Kavach
- Station Kavach
- Loco Kavach
- Photographs of Kavach Equipment
- Question & Answers

Typical Signalling Plan at a Railway Station



Introduction

- At present train do not have any means to apply brake automatically if driver fails to do so
- Driver has to see the Signals in route and act accordingly to control the speed of the train manually
- If driver fails to apply brake, it may create either rear end or head on collision
- Drivers are highly stressed due to long hours of driving, series of Signals and increase in the speed of the trains
- Automatic braking is therefore required and is made mandatory if speed is more than 160 Kmph

Development of Kavach System

- **Train Protection & Warning System (TPWS):**
  - System prevents Signal passing at danger and apply brake at the Stop Signal
  - System is working in Mumbai and Chennai suburban sections
  - It is an imported system and very costly (Approx 2 Cr per Km)
  - Suitable for all type of Signalling and Level Crossing gates

Development of Kavach System

Anti-Collision Device (ACD):

- Developed indigenously by Kernex Hyderabad and approved by RDSO
- Installed in North Frontier Railway (NFR) during 1990-95
- Was discontinued due to reliability issues
- Did not have SIL-4 Safety Certification

Communication Based Train Control (CBTC) System:

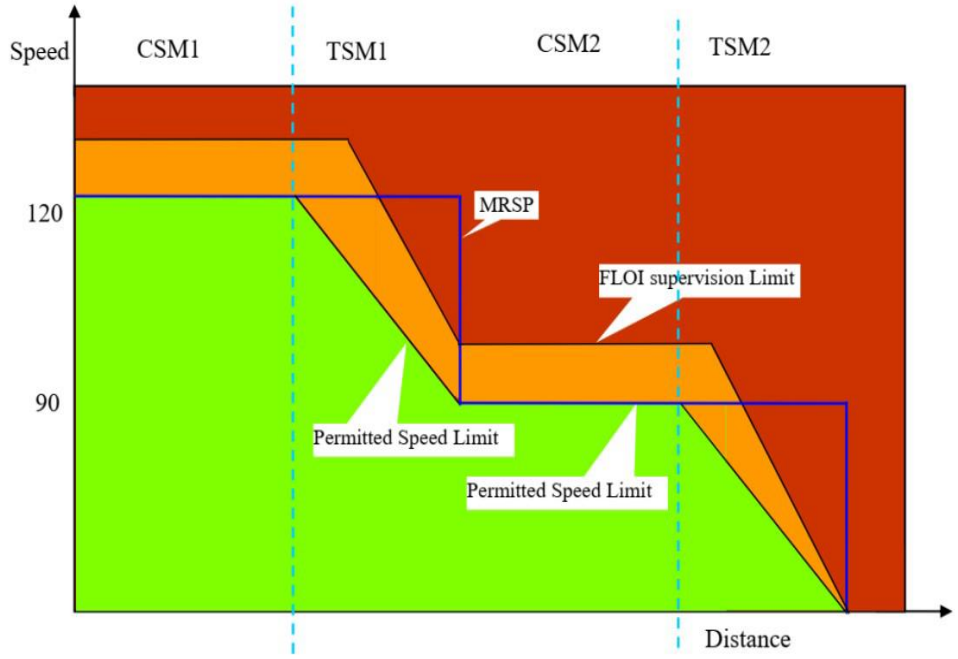
- This is used in Metros. Train run in ATP and ATO mode. Driverless train run is also available.
- Cost: Rs 10 Crore per Km

Kavach System:

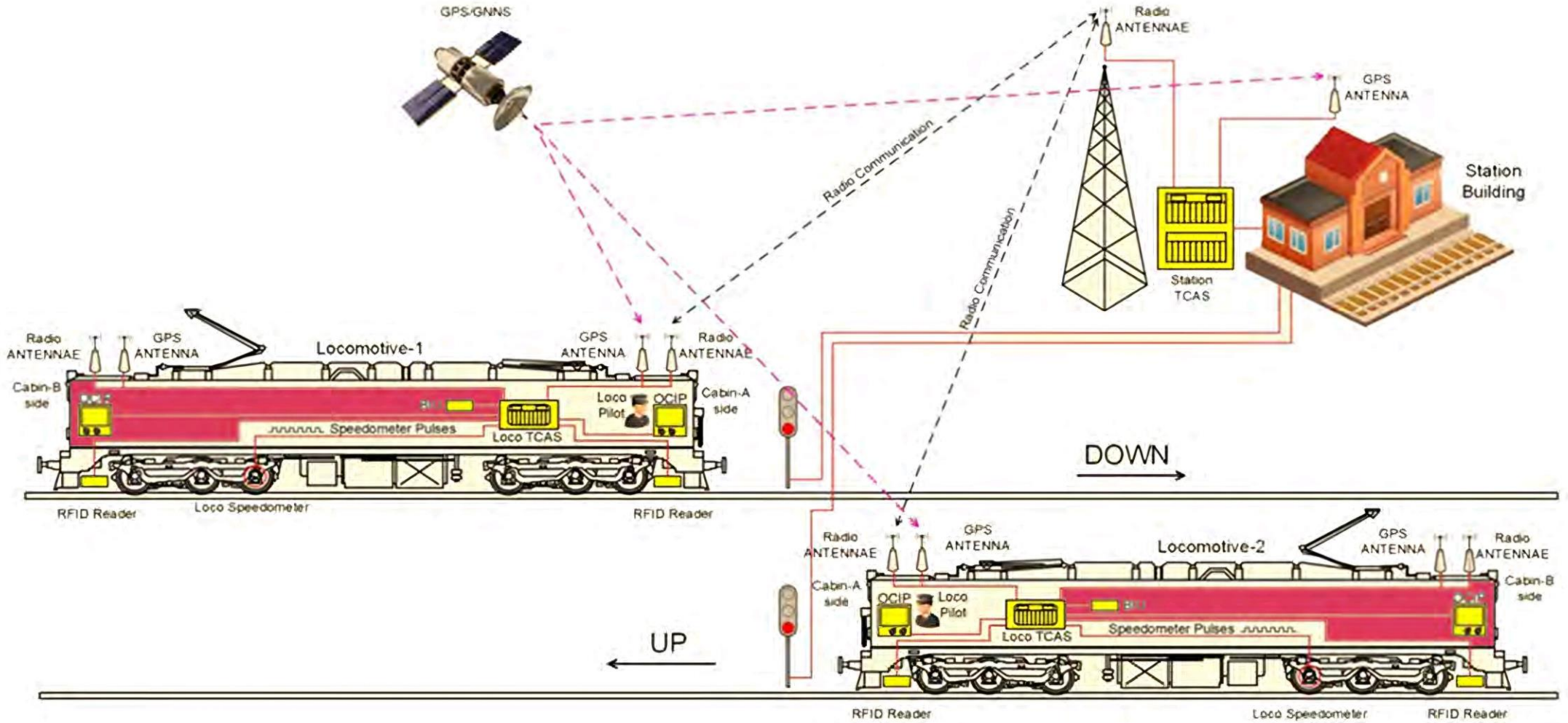
- There was a need to develop indigenous technology of Automatic Train Protection (ATP) to prevent accidents
- Technology was developed by RDSO and 3 firms of Hyderabad
- Has now been certified to meet the Safety requirement of SIL-4

Train Collision Avoidance System (TCAS)-KAVACH

- Designed and developed for Indian Railways
- Standardized by RDSO as per specification RDSO/SPN/196/2012 version 4.0 or latest
- Designed to have additional safety aid to loco pilot to
    - Prevent Signal Passing At Danger (SPAD)
    - Control train speed within specified limits
    - Display Signal Aspect in Loco pilot's cab
    - Prevent the train collisions in block sections / running lines at Stations
- Can be used in electrified as well as non-electrified sections for single or multiple lines



Kavach System



KAVACH – Status of Implementation

- Installed on 1456 Km section & 144 locos of South Central Railway
- To be installed on 44,000 Km section and 10,000 locos in next 5 years
- Approved Source: Medha Servo, HBL Power System and Kernex
- Under Approval: G G Tronics, Quadrant Future Tek, Areca Embedded Systems, Lotus Wireless Technologies, BHEL, KYOSAN and SIEMENS
- Cost: INR 50 Lakhs per Km & INR 70 Lakhs per Loco (INR 2 Cr per Km for imported ATP System)
- Work targeted in Delhi-Howrah and Delhi-Mumbai routes by March 25
- Trial at speed @160 Kmph successful on Mathura-Palwal section
- Railways has allotted a budget of Rs 1.05 Lakh Crore for

Key Features & Functionalities

- Prevents SPAD and all types of train collisions – head-on / rear-end / side
- Temporary & Permanent Speed Restrictions, Prevention of over speed, Loop line speed control
- Blowing of horn ahead of Level Crossing gates
- Provision to log all the system events and faults and communicate them to Network Monitoring System
- Works in Absolute & Automatic blocks; Tested for speeds up to 160 kmph
- In-cab signalling
- Digitally interfaceable with existing signaling equipment and can be seamlessly connected with Centralised Train Control or Passenger Information Systems

Kavach Functions

ATP Functions

- Detection and Prevention of SPAD
- Display of Distance to Signal and Movement Authority
- Loop Line Speed Control
- In-Cab Signaling
- Permanent Speed Restrictions and Temporary Speed Restrictions

Collision Prevention Functions

- Prevention of Head On and Rear End collisions
- Prevention of Collision due to unusual stoppage in Block sections

Other Functions

- Detection and Prevention of Roll Back
- Manual SOS generation in both Loco and Station

Components of Kavach

On Board equipment

- Loco Kavach Controller
- Driver Machine Interface Unit (DMI) for Loco Pilots
- Redundant Radio modems
- GPS and GSM/GPRS interface
- RFID Reader
- Break Interface Unit

Way side equipment

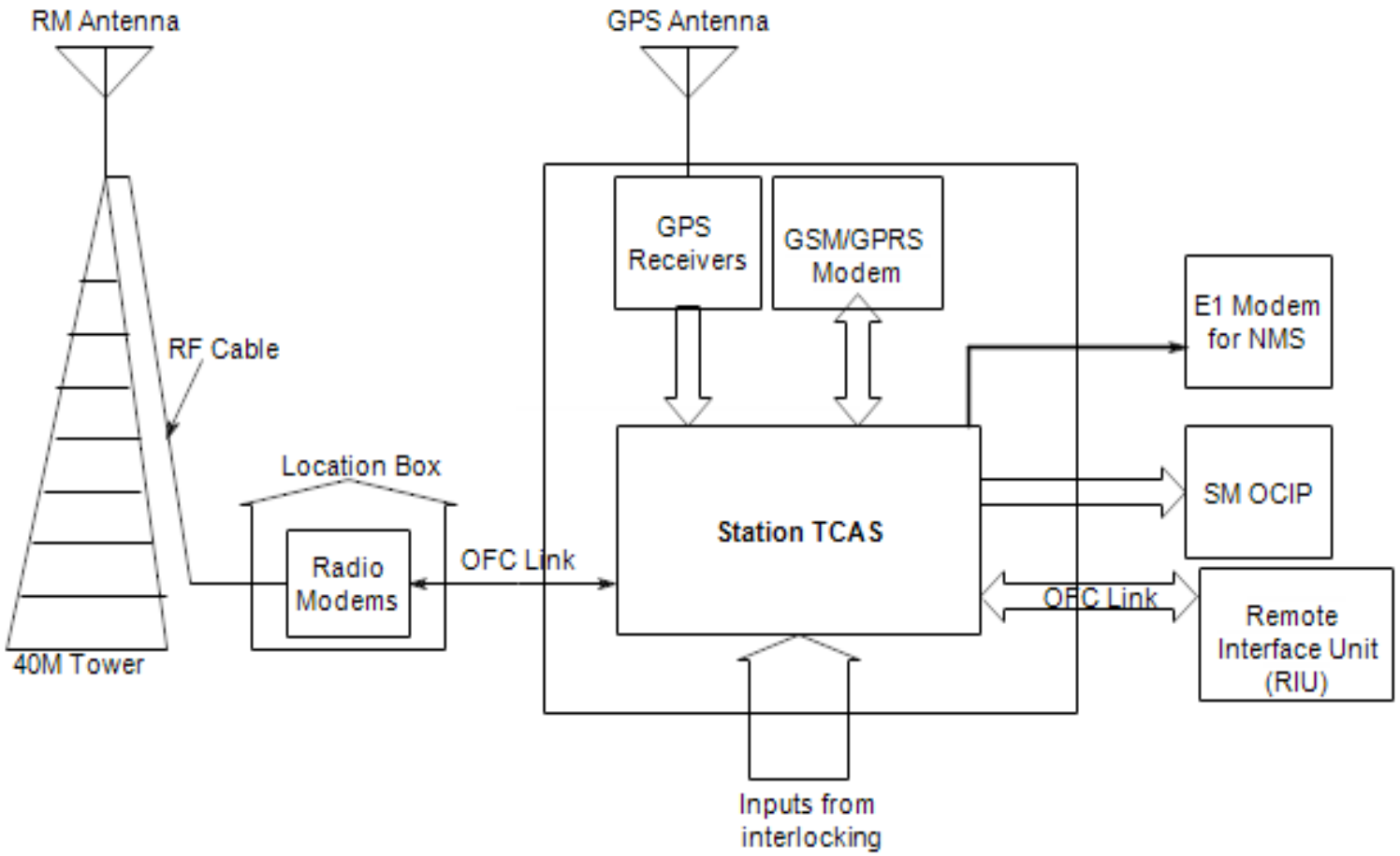
- TCAS Controller in Stations, LC Gates / Intermediate Block sections
- Display unit for Station Master
- Redundant Radio modems
- GPS and GSM/GPRS interface
- Radio Transmission Tower

On track

- RFID tags in the station section
- RFID tags in the block section

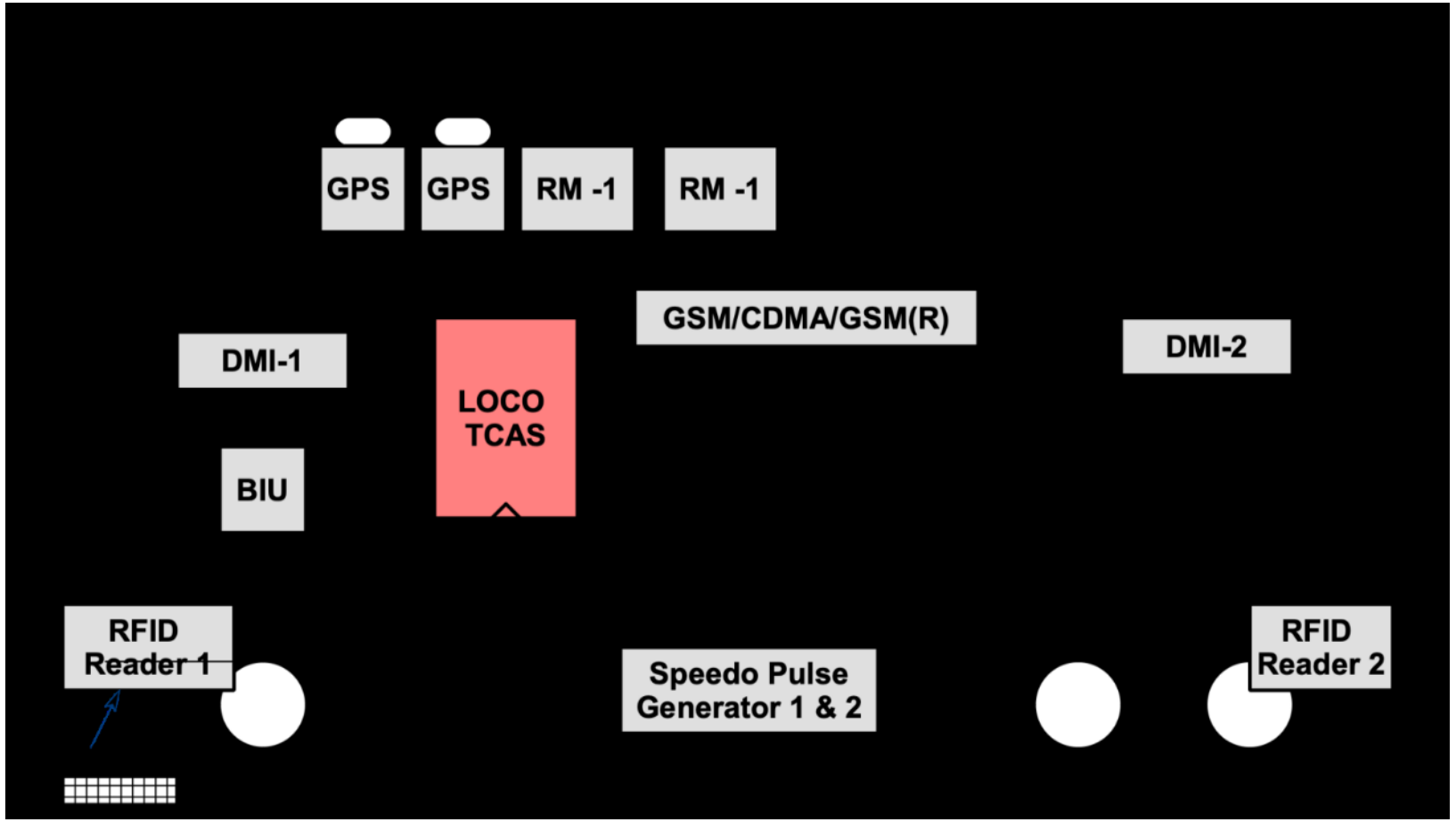
Network Monitoring System

Station Kavach Unit



- ***Station Kavach is Installed inside the Relay room***
- ***Interfaced with Interlocking System to get Signaling and Track Circuit Information***
- ***Interfaced with E1 network for NMS and GSM/GPRS for KMS***
- ***30/40m tower is installed near Relay room with Radio Antennae fixed on it***
- ***GPS Modules are provided for Time Synchronization***
- ***SM-OCIP is installed in Station Master Cabin for Display and provision to generate SOS***

Loco KAVACH System



KAVACH COMPONENTS

Station TCAS
600 x 410 x 1020 mm (L x D x H)

Remote Interface Unit (RIU)
600 x 420 x 410 mm (L x D x H)

Loco TCAS
600 x 375 x 850 mm (L x D x H)

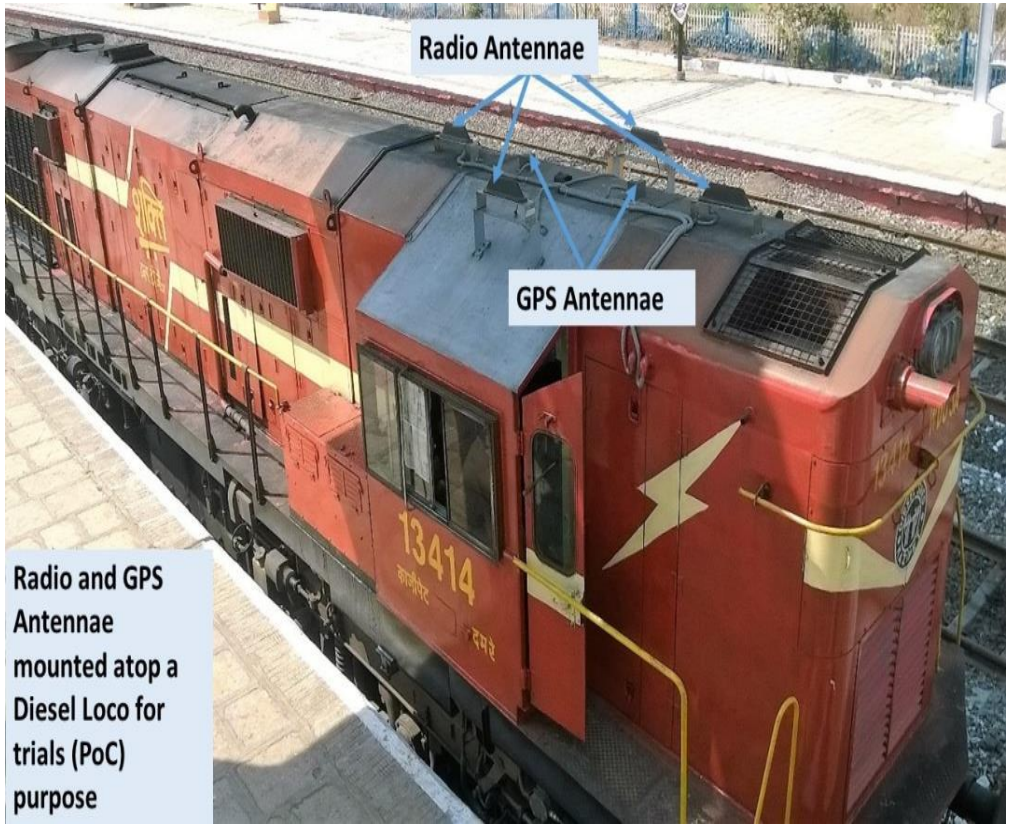
Some pictures of Kavach installation

Station Kavach and Relay Racks

RIU in Location Box

40 meter Tower for Radio Communication

Some pictures of Kavach installation

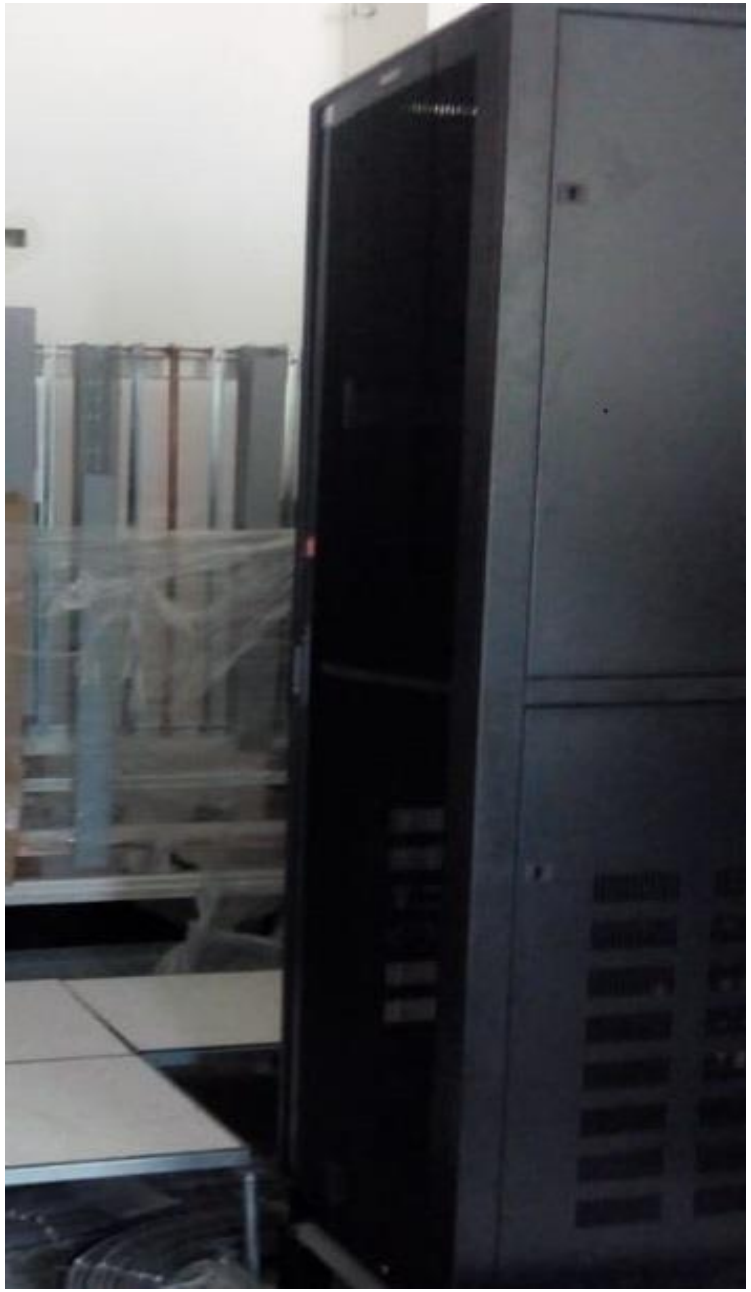


Kavach Installations on Locos

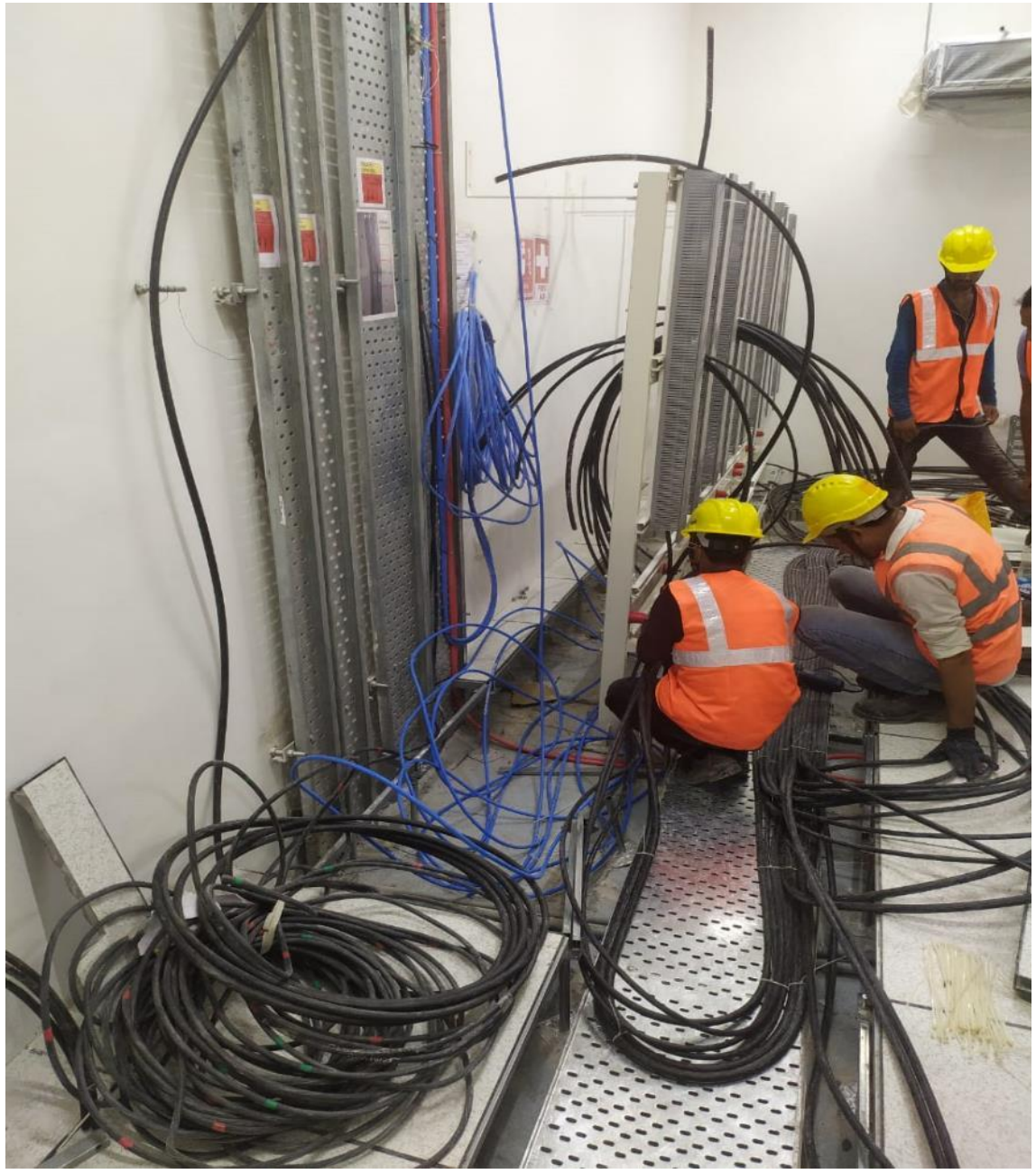
Some pictures of Kavach installation

RFID Tag Reader

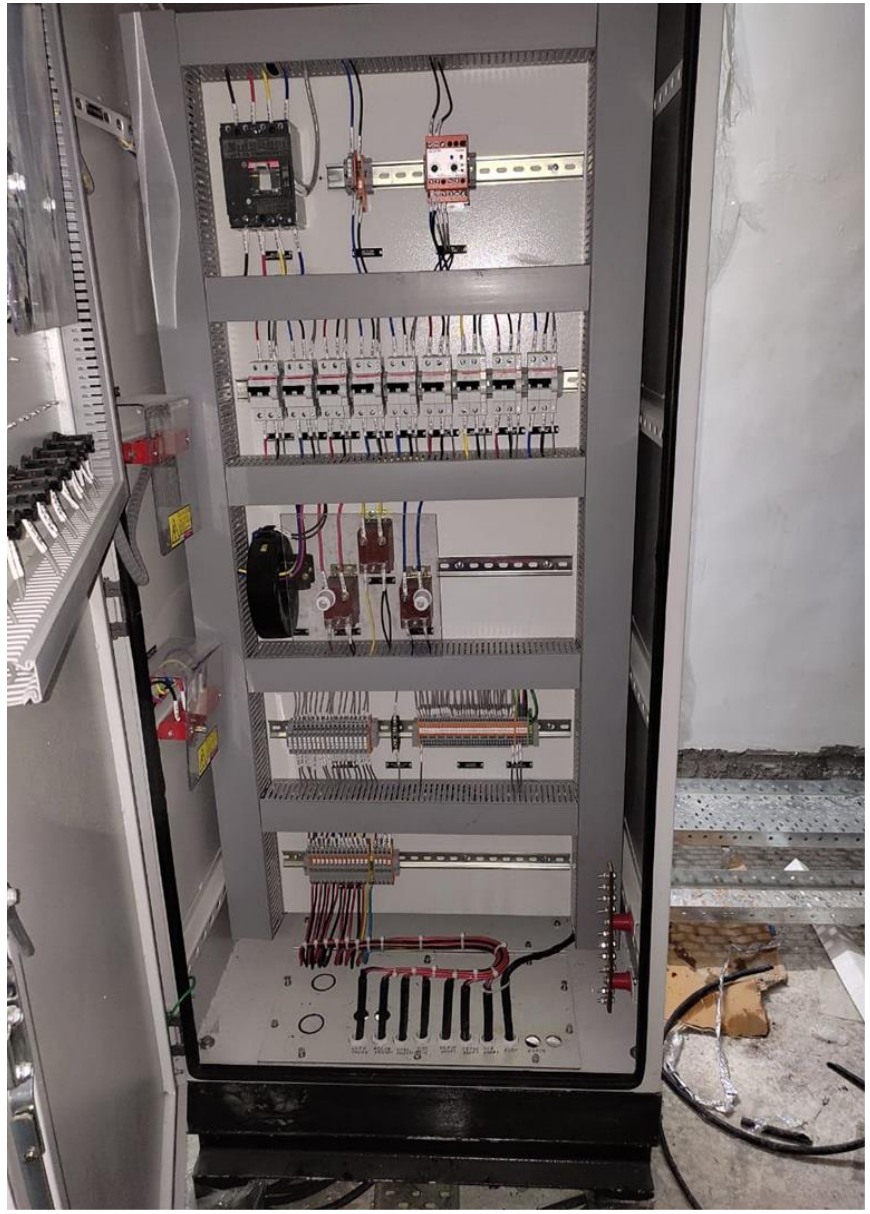
PDC ,CTR and ATS Cabinet in Signal Room

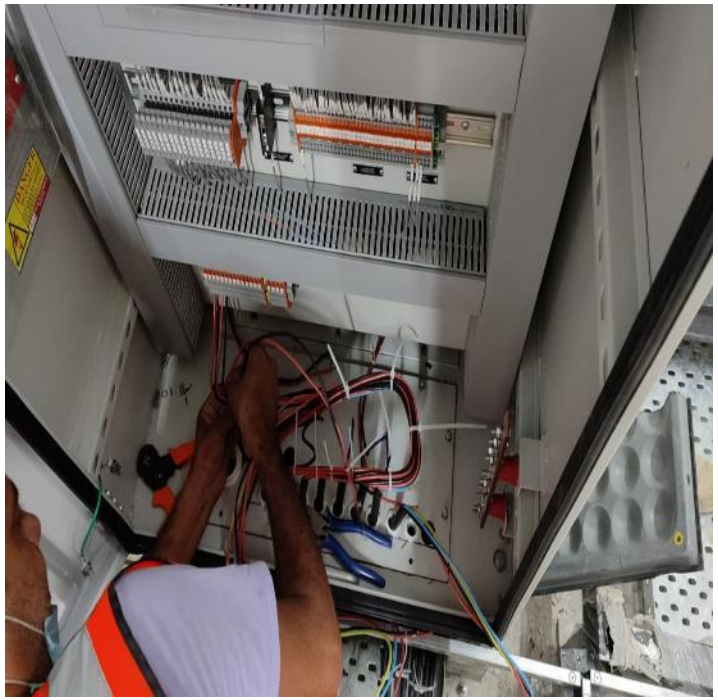


Indoor Signaling Equipment Installation at station



Power Distribution Cabinet (PDC) & Cable termination (CTR)





Outdoor Cable laying and Signal foundation casting

Outdoor Equipment marking

Outdoor Signalling Equipment Installation

Point Machine Type IRS: S-24

Mainline Point Machine 3 Phsae

Balise (Norming Point) - Installation

Question & Answers

Thank You