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PROJECTS EXPERTISE

AN OVERVIEW

Rail Engineering Excellence.
Powering Mobility.

www.barsyl.in

PROJECTS EXPERTISE

ABOUT US

BARSYL
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Commenced operations in **1986.**

Specialized, **Rail Focused**, Indian Multinational

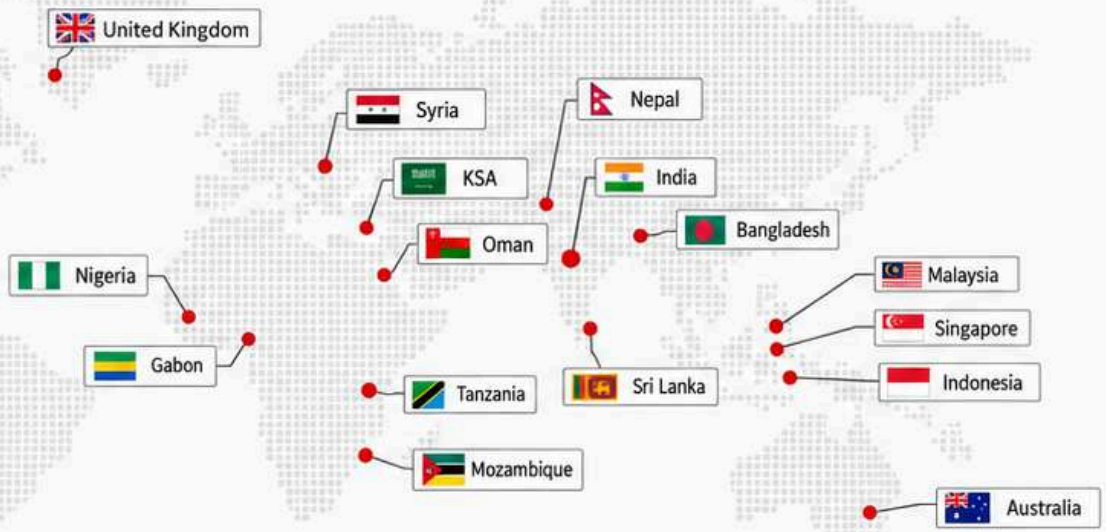
A **Global Consulting** organization with over three decades of specialized Railway experience.

Executed Projects in **18 countries** across **5 Continents.**

Industry Recognition:

- CEAI National Award for Excellence in Project Engineering 2024
- Best Services Company from Industries and Commerce Department - Government of Telangana – 2024
- Iconic Brand of Year – 2023
- National Award for Consumer Insight of the year 2023.
- Winners of 5th edition of Iconic Brand of the year award 2023.
- INDIA 5000 BEST MSME AWARDS – 2023.
- Leaders of Global Magazine as 10 Most successful Consultant Companies of 2022
- SME Empowering India Awards – 2021
- Rail Analysis SME of the Year- 2020
- SIDBI-ET India MSE Best Exporter Award – 2019
- Corporate Excellence Awards, CV Magazine – 2018
- INDIA 5000 Best MSME Awards – 2017
- India Small Giants, MSME's of India – 2013-2014
- BOI India SME 100 SME Award – 2012
- EPC World Award, Best Emerging Consultant – 2011
- EPC World Award, Best Railway Consultant - 2010

GLOBAL EXPERIENCE



1200+ Completed Projects

25+ Urban Transit Assignments

500+ Railway Professionals

ISO 9001
BUREAU VERITAS Certification

UKAS MANAGEMENT SYSTEMS 0008

SIGNALLING EXPERTISE

SPECTRUM OF SERVICES

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- Planning
- Design
- Project Management
- Advisory

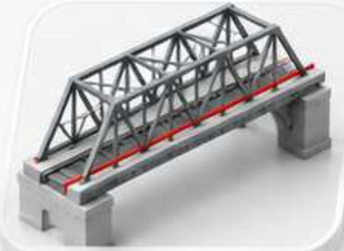
FREIGHT

SUBURBAN

METRO

INTER-CITY

TRACK



STRUCTURES

SIGNALLING & TELE-COMMUNICATION

POWER SUPPLY & TRACTION

ROLLING STOCK

PROJECTS EXPERTISE

THE FOUNDERS

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Late Shri. H.C. Shrivastava

Retd. Dy. Chief Engineer, IR

Late Shri. Arjun Pershad

Retd. General Manager, IR

Late Shri. T.V. Srinivasan

Retd. Chief Commercial Manage.
IR

Late Shri. M.P. Sankarnarayanan

Ex. MD, Ventra Locomotives

Late Shri. M.V. Srinivasan

Retd. Member Traffic, Indian Railway Board

Late Shri. M. Raja Rao

Retd. Chief Engineer, IR

PROJECTS EXPERTISE

BOARD OF DIRECTORS

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M. Ravindra
Non-Exe Chairman

Sunil Srivastava
Managing Director

V. B. Gadgil
Independent Director

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Manoranjan Pershad
Director Corporate Affairs

N. Madhusudhan Rao
Independent Director

V. Ramakrishnan
Director – Strategy

PROJECTS EXPERTISE

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SIGNATURE PROJECTS

Delivering End-to-End Solutions.
Built on Expertise. Driven by Innovation.

PLANNING

- Delhi-Alwar RRTS
- Nacala Corridor, Africa
- Bijwasan Railway Station
- Colombo Suburban Rail
- Madurai Metro
- Bhubaneswar Metro
- Airport Rail, Bangalore
- RRTS Corridors, CMRL

DESIGN

- MMRDA-Monorail Rolling Stock
- GE-Locomotive Maintenance Facility
- Dhaka Metro, Line 6
- Delhi Metro Phase-III
- Kulaura – Shahbapur, Bangladesh
- Major And Minor Bridges, NCR
- KRIDE-Maintenance Depots
- MMRDA-Monorail Evacuation Plan
- Etihad Rail Phase-II , UAE
- Konkan Railway - Self Propelled Car
- Mechi-Mahakali Railway, Nepal

PROJECT MANAGEMENT

- CMRL Phase I
- CMRL Phase II
- DMRC Phase IV
- DFCC Khurja-Dadri
- EMU Factory, Kanpur
- SGR, Tanzania
- Pamban Bridge, RVNL
- Kavach Implementation
- Vande Bharat Factory, Latur

ADVISORY

- Hyderabad Metro
- Mumbai Monorail, MMRDA
- KL Monorail, Malaysia
- O&M Strategy, CMRL
- Capacity Building, Tanzania
- Chennai Monorail

PROJECTS EXPERTISE

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PRE-PROJECT ADVISORY

Strategic foresight. Strong foundations.
Better projects from the start.

- **Feasibility Studies** (Techno-Economic, Demand Forecasting, Route Planning)
- **Master Plans** (Urban Integration, Multimodal Strategies)
- **Procurement Support** (Tender Documentation, Bid Evaluation)
- **Transaction Advisory** (PPP Structuring, Concession Agreements)

Outcome: Informed decision-making & investor confidence

PROJECTS EXPERTISE

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FEASIBILITY AND STUDIES – CONVENTIONAL RAIL

Dhaka-Chittagong Doubling

Client: Bangladesh Railway

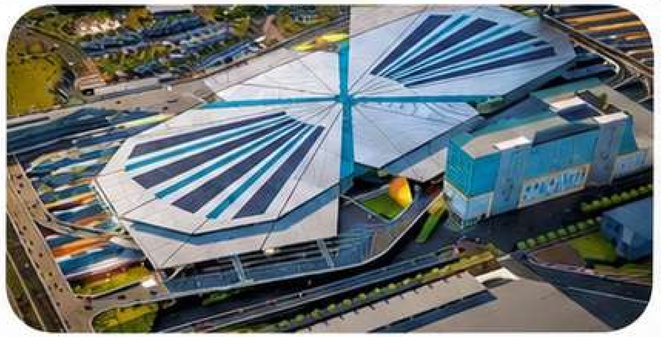
Nacala Corridor

Client: Nacala Logistics, Mozambique

Bintulu Railway Network

Client: Bintulu Development Authority, Malaysia

Bijwasan Station, Delhi



Panvel Station, Mumbai

New Delhi Railway Station

PROJECTS EXPERTISE

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FEASIBILITY AND PLANNING – URBAN RAIL

CSRP
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Colombo Suburban Railway
Client: Sri Lanka Railways

Bengaluru Airport Suburban
Client: Bengaluru International Airport

Bhubaneswar Metro
Client: Govt. Of Odisha

Hosur-Bommasandra
Client: Chennai Metro

Delhi-Alwar RRTS
Client: NCRTC

Thiruvananthapuram – Chengannur RRTS (125km)
Client: Mumbai Rail Vikas Corp

3 RRTS Corridors (500km)
Client: Chennai Metro

PROJECTS EXPERTISE

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DELIVERY SUPPORT

- Multidisciplinary Detailed Design (Structures, Systems, Depot)
- Project Management Consultancy (PMC)
- Contract Management (FIDIC, EPC, etc.)
- Systems Integration & Testing & Commissioning(T&C)
- Quality Management (QA/QC Systems)
- Safety Assurance (RAMS, Safety Cases)

Outcome: On-time, compliant, and integrated delivery

PROJECTS EXPERTISE

DESIGN ENGINEERING

Dhaka Metro Viaduct Design

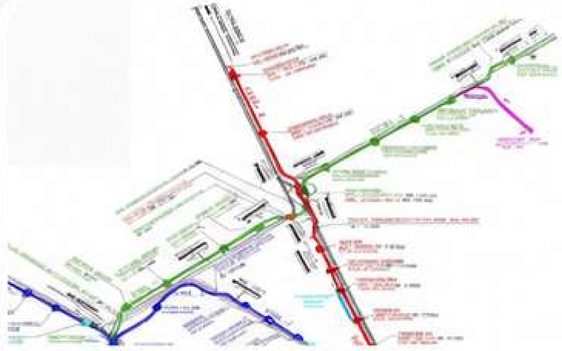
Delhi Metro Phase III – OHE and PST

GE Maintenance Depot - Roza

Bridges of Deen Dyal Upadhyay-Prayagraj 3rd line

Nepal East – West Railway Detailed Design

Detailed Design of Kuluara-Shahbazpur, Bangladesh



K-RIDE Maintenance Depots

PROJECTS EXPERTISE

PROJECT MANAGEMENT & SUPERVISION

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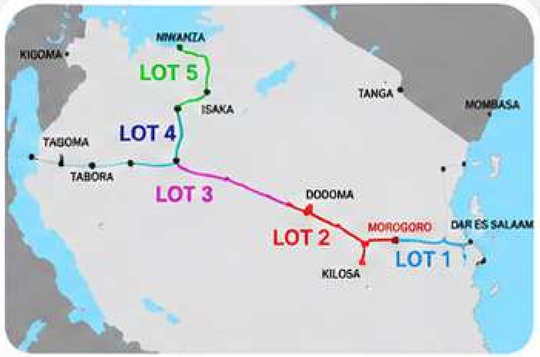
First Kavach Implementation in India – Kota, Rajasthan

Pamban Bridge – Vertical Lift Sea Bridge

Vande Bharat Manufacturing Facility, Latur



900km SGR Network, Tanzania

Chennai Metro Phase 1 and 2

Delhi Metro Phase IV

Dadri-Khurja section, Dedicated Freight Corridor

PROJECTS EXPERTISE

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POST-CONSTRUCTION

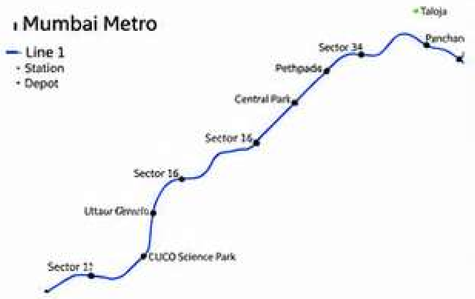
- O&M Advisory (SOPs, Strategy Development, Maintenance Planning)
- Structural & Process Audits
- Capacity Building & Training Programs
- Shadow Operator Support (Pre-commissioning to Stabilization Phase)

Outcome: Operational readiness & sustainable performance

PROJECTS EXPERTISE

ADVISORY AND CAPACITY BUILDING

Lenders' Engineer for
Hyderabad Metro
Client: State Bank of India



Owner's Engineer for
Mumbai Metro Line 1

Lender's Engineer for
Alstom's Madhepura Factory
Client: State Bank of India

Transaction Advisory for
Chennai Monorail
Client: Metropolitan
Transport Corporation

Strategy Development for
Integrated O&M
Client: Chennai Metro

Safety Audit for Kuala
Lumpur Monorail

Business Plan and Asset
Register for Takeover of
Chennai Suburban Rail

Techno Economic Study
for Transportation of Fly
Ash through Indian
Railway.

Quality and Safety
Auditing for Khurja-
Bhaupur of Eastern
Dedicated Freight
Corridor

PROJECTS EXPERTISE

KEY CLIENTS

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INTERNATIONAL

Minconsult
GAMUDA
MRCB
BARCLAY MOWLEM
GKTM
NetworkRail
MTR
ALSTOM
CORYS
SCI /Verkehr
NACALA LOGISTICS
OHI

DOMESTIC

HINDALCO
ncrtc
DRA
L&T Metro Rail Hyderabad
MMRDA
DMICDC
GMR
GVK
adani
Chennai Unified Metropolitan Transport Authority (CUMTA)
JSW
RELIANCE
iLSdc
Bank of Baroda
AXIS BANK
SBI
ADITYA BIRLA GROUP
TATA
K RIDE
Dalmia Bharat Group
AFCONS
SIEMENS
Kempegowda
ALSTOM
Shapoorji Pallonji
ESSAR
RITES
IRCON

PROJECTS EXPERTISE

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KEY PROJECT BRIEFS

PROJECTS EXPERTISE

CMRL PHASE 1 — GENERAL CONSULTANCY | CHENNAI METRO, INDIA

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Client: Chennai Metro Rail Corporation | Period: Apr 2009 – Mar 2021 | Value: USD 9.59 M | Scale: 53.4 km | 40 Stations | TBM + NATM tunnels

SUBSYSTEM DESIGN REVIEW

- Multidisciplinary design review across Track, Rolling Stock, Depot, OHE, Signalling & Telecom (ATP/ATC/ATS), MEP, TVS/VAC — elevated and underground sections of both corridors
- Resolved interface conflicts between UG and elevated sections; verified equipment layouts, cable routes, track alignments and system room compatibility across all contracts
- Coordinated signalling–rolling stock compatibility, traction power distribution checks and PSD–train door interface alignment; DPR reviewed and modifications recommended

TENDER & PROCUREMENT SUPPORT

- Prepared bid designs, pre-qualification documents and ICB tender specifications for all civil and systems packages: Rolling Stock, OHE, Signalling & Telecom, PSD, AFC
- Full assistance in ICB evaluation, negotiation and contract award; selection of contractors, DDCs, equipment manufacturers and suppliers across all packages
- Procurement strategy, BOQ preparation, contract administration and management of timelines; assisted CMRL in putting in place procurement governance across multi-package environment

TESTING, TRIALS & COMMISSIONING

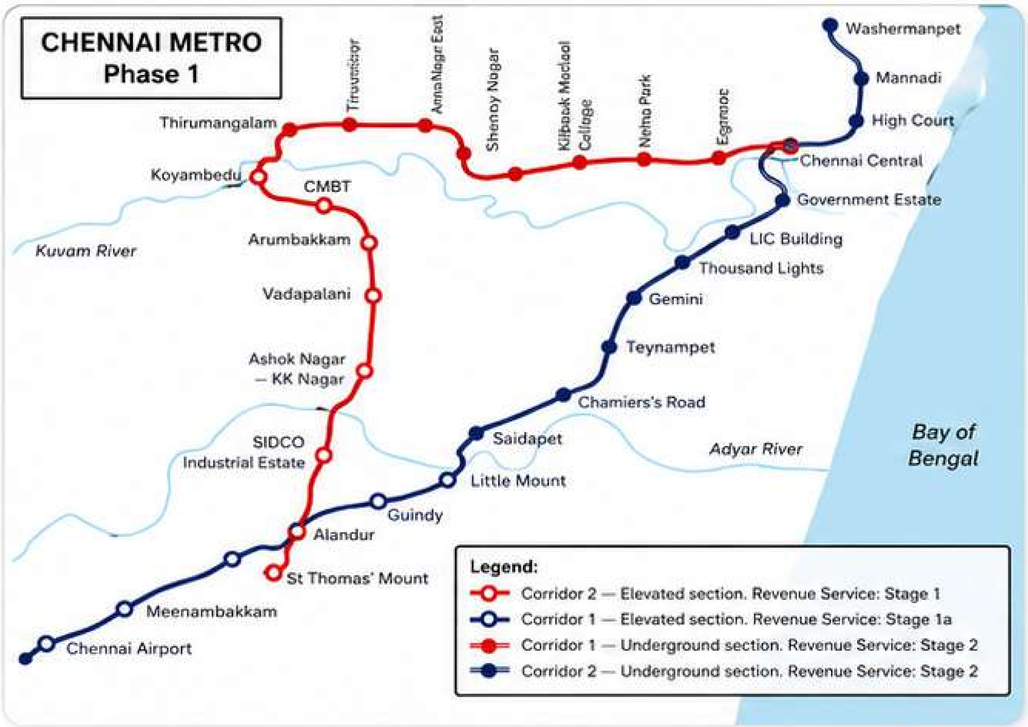
- Planned and executed static and dynamic integration tests verifying functional compatibility, fail-safe behaviour and interoperability between all subsystems prior to revenue operations
- T&C of ATP/ATC/ATS signalling, traction SCADA, OHE, PSDs, AFC and OCC — all verified against RAMS (Reliability, Availability, Maintainability & Safety) standards

SYSTEM INTEGRATION & INTERFACE MANAGEMENT

- Led end-to-end integration of signalling & train control, rolling stock, trackwork, traction power & SCADA, telecom, PSD, AFC, station systems and depot facilities
- Defined and tested all system interfaces (ICDs); resolved technical conflicts; coordinated intra-system functional testing across multi-contractor environment
- RAMS-compliant integration framework: IEC/EN-certified interoperability and fail-safe performance verified across all subsystems

TECH STACK

- GoA2 — ATP / ATC / ATS (Siemens)
- Alstom Metropolis: 42 × 4-car stainless EMUs | 80 km/h
- Standard gauge 1,435 mm | Ballast-free slab track
- 3rd rail 750 V DC | Regenerative braking
- Full-height PSDs — 22 UG stations (48 platforms)
- Siemens OHE, Signalling & SCADA
- AFC: Nippon Signal | Telecom: OCC-integrated multi-functional
- RAMS compliance: IEC 62278 / EN 50126



CMRL PHASE 2 –
GENERAL CONSULTANCY | CHENNAI METRO, INDIA

Client: Chennai Metro Rail Limited | Period: Dec 2019 – Ongoing | Scale: ~119 km | 57 Stations | Lines 3 & 5 | 28 Packages

DDC DESIGN REVIEW & BASIC DESIGN

- DDC document review across Packages 1–28: alignment geometry, TBM tunnels, cut-cover stations, viaducts, bridges, depot, track, TVS/VAC, E&M and signalling systems
- Basic design prepared for Packages 13–28; CBTC–RS compatibility reviews, traction power–train control harmonisation and telecom–signalling interface alignment verified
- System architecture finalised; hazard dentification and ISA review initiated; RAMS compliance framework (EN 50126/128/129) established for GoA4 UTO operation
- 4 km double-decker elevated viaduct, featuring a vehicular flyover on the lower level and metro trains on the upper level.

BID SUPPORT & CONTRACT MANAGEMENT

- Pre-qualification and bid documents prepared for all 28 civil and systems packages covering CBTC, OHE, Rolling Stock, Telecom, PSD and AFC; evaluation, negotiation and contract award supported
- Assisted selection of DDCs, system contractors and equipment suppliers; bid design inputs provided and contract administration maintained across complex multi-package environment
- Interface management across 28+ contracts; contractual obligations tracked and change management applied for inter-package dependencies and scope variations

T&C READINESS & RAMS COMPLIANCE

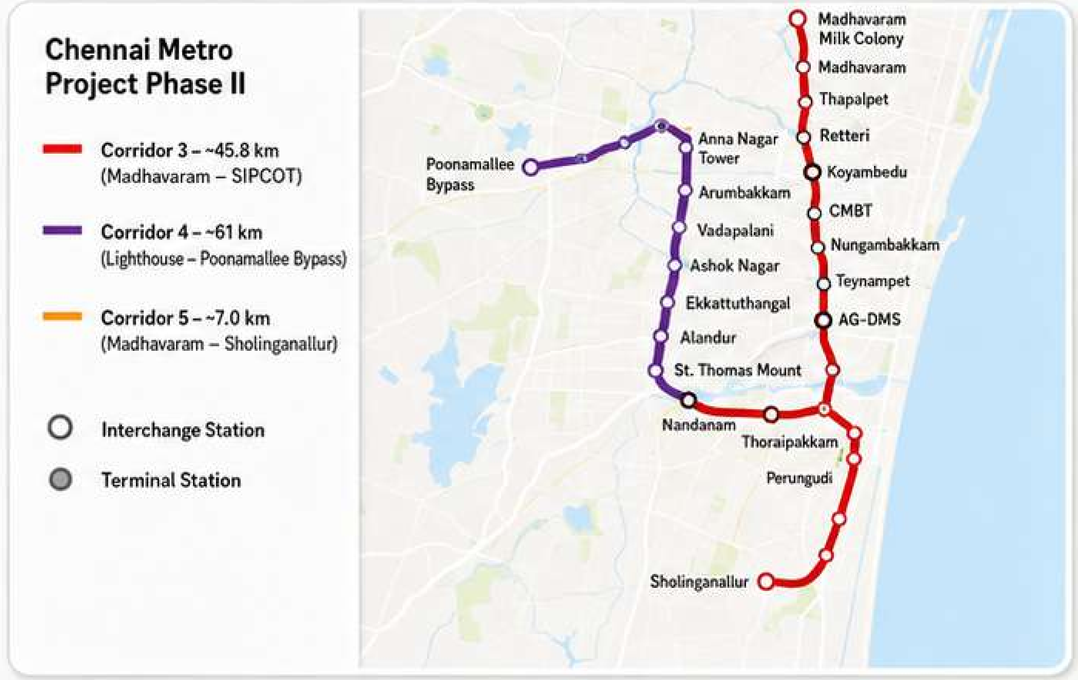
- Hazard log established; ISA review processes initiated to ensure upcoming CBTC commissioning aligns with GoA4 UTO operation norms and EN 50126/128/129 requirements
- Upcoming T&C scope: CBTC equipment, point machines, OHE/TSS, SCADA field interfaces, TETRA radio, telecom fibre backbone and PSD–signalling synchronisation across all 57 stations

CBTC INTEGRATION & GoA4 READINESS

- Inter-package coordination workshops completed; CBTC–RS compatibility, traction power–train control harmonisation and telecom–signalling interface alignment done across all corridors
- ICD management across 28+ packages; civil-system interfaces for TBM tunnels and elevated stretches verified; structural readiness confirmed for systems installation
- GoA4 UTO integration framework: CBTC ↔ RS, CBTC ↔ OCC, PSD ↔ CBTC door interlock, TETRA ↔ OCC voice/data — all verified at design stage ahead of commissioning

TECH STACK

- 138 trains: Alstom Metropolis 6-car driverless sets
- CBTC–RS compatibility: Alstom CBTC ↔ Metropolis 6-car
- 25 kV AC OHE | TBM tunnelling — 33 km underground
- Redesigned UG TVS to reduce UG station length for 50% cost reduction.
- TETRA radio | OFC fibre | SCADA field interfaces
- PSD–signalling sync | Point machines | Track circuits
- RAMS: EN 50126 / 50128 / 50129
- GoA4 CBTC — fully driverless (UTO) across all 3 lines



PROJECTS EXPERTISE

CHENNAI MRTS–METRO INTEGRATION STUDY | CHENNAI, INDIA

Client: Chennai Metro Rail Limited

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TECHNICAL COMPATIBILITY ASSESSMENT

- Gauge conversion study (1,676→1,435 mm): alignment geometry, rolling stock clearances, platform heights, depot track layouts and civil structure compatibility reviewed across MRTS corridor
- Signalling interoperability: migration path from conventional relay-based to CBTC-compatible system assessed; interolocking logic, block workings and fail-safe requirements reviewed
- OCC interfacing design: MRTS control centre functions assessed for absorption into CMRL centralised OCC; control architecture, communication protocols and operational staffing transitions reviewed

PROCUREMENT & UPGRADE COST ADVISORY

- Procurement implications assessed for rolling stock conversion, track re-gauging, signalling system upgrade and AFC replacement across the full MRTS corridor
- Merger cost estimated at ~INR 30 Bn (PwC basis): procurement strategy and contract packaging recommended for gauge conversion civil works, new rolling stock and systems upgrade
- Funding structure advice, phased procurement sequencing and risk allocation between Southern Railway, CMRL and GoTN recommended for merger implementation

PHASED TRANSITION & COMMISSIONING STRATEGY

- Phased commissioning framework recommended: MRTS service continuity maintained during gauge conversion and systems migration; fallback and contingency protocols defined
- Signalling cutover strategy: block-by-block migration from relay to CBTC-compatible system with parallel running provisions and safety interlocks during transition
- AFC cutover plan: unified ticketing implementation with backward-compatible token and smart-card support maintained during transition to full CMRL-operated system

MULTI-SYSTEM INTEGRATION FRAMEWORK

- Integration of two technically incompatible rail systems (BG 25 kV AC conventional vs. SG 3rd rail CBTC) into a single unified network under CMRL operational control
- Seamless travel mechanism: unified AFC, common branding, physical interchange nodes and interoperable journey planning across MRTS and Metro corridors defined
- Governance framework recommended for CMRL takeover: organisational structure, operational transition plan and regulatory approval roadmap for Southern Railway handover

TECH STACK

- **Chennai Metro:** Std gauge 1,435 mm | CBTC
- **Chennai MRTS:** Broad gauge 1,676 mm | 25 kV AC OHE | Relay signalling
- **Gauge conversion required:** 1,676 mm → 1,435 mm
- **Signalling upgrade:** relay-based → CBTC-compatible
- **AFC harmonisation:** unified ticketing across both systems
- **OCC interfacing:** MRTS absorbed into CMRL centralised OCC
- **Southern Railway in-principle approval:** May 2022
- **MRTS extension to St. Thomas Mount completed:** Mar 2026

PROJECTS EXPERTISE

DMRC PHASE 4 — GENERAL CONSULTANCY | DELHI METRO, INDIA

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Client: Delhi Metro Rail Corporation Ltd | Period: Nov 2023 – Jan 2028 | Scale: 65.1 km | 45 Stations | Lines 7 ext., 8 & 10

1. DPR REVIEW & TECHNICAL SUPERVISION

- DPR review across 3 corridors; supervision covering i-CBTC, OHE, Rolling Stock, PSD, AFC, SCADA, TVS, fire detection and ECS
- Reviewed i-CBTC algorithms, speed profiles, comms protocols and failsafe systems against DMRC standards and SIL requirements
- Track–signalling interlocking review, power–traction integration checks and software–hardware interoperability validation

2. SYSTEMS PROCUREMENT & CONTRACT OVERSIGHT

- Technical advice on procurement: i-CBTC signalling, OHE, Rolling Stock (52 × 6-car Alstom Metropolis), Telecom, PSD and AFC
- BOQ verification and contract administration across 45 stations; evaluation support for systems contracts
- First DMRC outsourced OEM maintenance contract (15 yrs, Alstom): KPI framework, performance bonds and lifecycle cost

3. SAFETY ASSURANCE & COMMISSIONING

- Safety and quality assurance across all T&C stages; i-CBTC wayside and onboard unit testing and OCC integration supervised
- Static and dynamic tests supervised across elevated and UG sections; failsafe behaviour and emergency protocols verified

4. i-CBTC INTEGRATION & INTERFACE PLANNING

- Integration framework: i-CBTC ↔ RS, i-CBTC ↔ OCC, OHE/TSS ↔ SCADA, PSD ↔ signalling door interlock, AFC ↔ station systems
- Interface planning: track–signalling interlocking, power–traction integration and OCC synchronisation across all 3 lines
- EMP/EMoP facilitation; coordinating civil, systems and multi-modal contractors across the 65 km expansion

TECH STACK

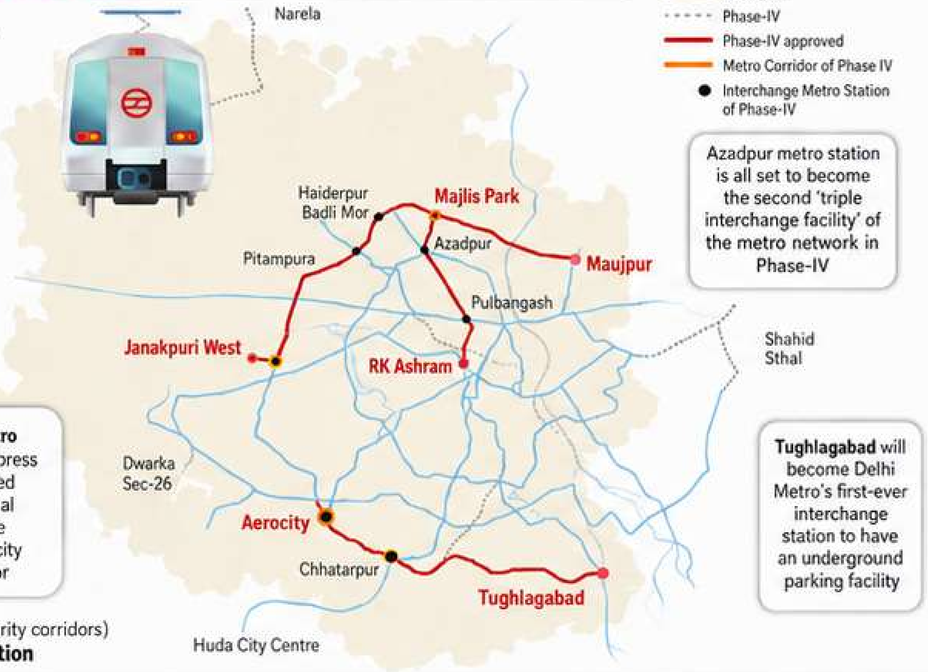
- i-CBTC — India's indigenous CBTC (Make in India, 6th nation globally)
- i-ATS — Indigenous Automatic Train Supervision System
- Alstom Metropolis: 52 × 6-car | CBTC on Lines 7 ext. & 10
- 25 kV AC OHE | Beam-technology TBMs for UG sections
- Integration: i-CBTC, OHE/TSS, PSD, AFC, SCADA, TVS, ECS
- OCC synchronisation | Multi-modal connectivity framework
- 15-yr OEM maintenance by Alstom — first outsourced for DMRC
- Full plan: 103.93 km | 6 corridors | 3 priority corridors active

40 INTERCHANGE STATIONS IN ALL

New interchange stations in **Phase-IV** to bring far-flung areas closer
11

Total number of interchange metro stations to reach
40

Total number of metro stations in Phase I, II and III
254



Phase-IV (Three priority corridors) **under implementation**

PROJECTS EXPERTISE

DMRC PHASE 3 — 25 kV OHE DETAILED DESIGN | DELHI METRO, INDIA

BARSYL weinnovate

Client: Delhi Metro Rail Corporation Ltd | **Period:** *Nov 2011 – Sep 2020* | **Scale:** *69.64 km* | *45 Stations*

1) OHE & POWER SUPPLY DETAILED DESIGN

- Full detailed design of 25 kV OHE and Power Supply & SCADA for elevated sections (41.3 km) and underground (13.9 km)
- RSS design check and 220/66 kV HV cabling review; traction simulation for equipment sizing, voltage drop and power demand
- Auxiliary and traction power distribution fully designed; SCADA architecture for remote control of OHE/TSS assets defined

2) TENDER DOCUMENTS & BID SUPPORT

- Prepared technical specifications, tender drawings, tender design documents and BOQ for OHE, RSS, switching stations and SCADA
- Full assistance in ICB evaluation, negotiation and contract award; selection of OHE manufacturers, RSS contractors and SCADA suppliers
- Revised GFC drawings and design clarifications issued to support DMRC and contractors throughout procurement and construction

3) CONSTRUCTION SUPERVISION & ENERGISATION

- Verified OHE energisation sequences, SCADA commissioning, traction substation bring-up against simulation benchmarks

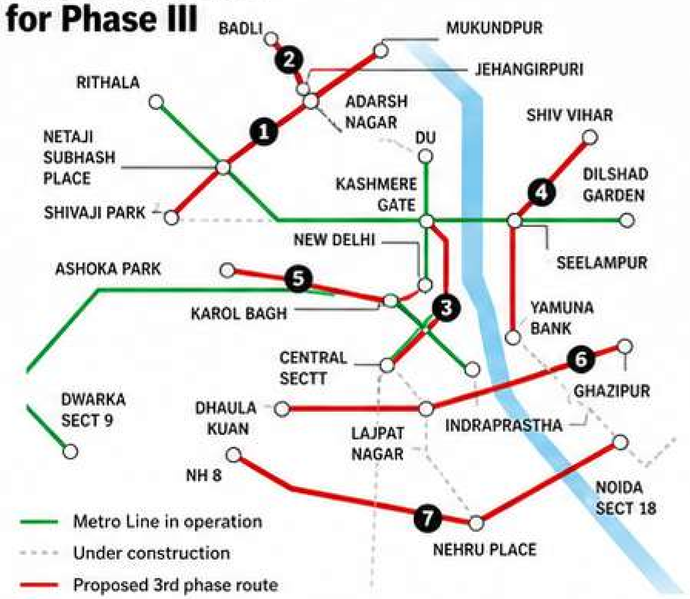
4) TRACTION–SIGNALLING INTERFACE MANAGEMENT

- Interface with signalling contractors: traction power sectioning aligned with train detection zones; neutral sections coordinated
- Auxiliary and traction power compatibility verified with train operations, SCADA and signalling across all sections
- OHE/RSS interfaces coordinated with Phase 1 & 2 infrastructure; live-line operations maintained during phased installation

TECH STACK

- 25 kV AC, 50 Hz single-phase OHE — elevated & underground
- Traction SCADA: remote monitoring & control of OHE/TSS
- Receiving Substations (RSS) at 220 / 66 kV with HV cabling
- Auxiliary Power Supply distribution system design
- Traction Power Supply distribution system design
- Simulation: voltage drop, rail voltage, contact wire temperature
- GFC drawings issued with revisions throughout construction

Proposed routes for Phase III



1. **Mukundpur-Shiv Park** (9 km elevated)
2. **Jehangirpuri-Badli** (3 km elevated)
3. **Central Secretariat – Kashmere Gate** (7km additional route underground)
4. **Shiv Park-Yamuna Bank** (11 km elevated)
5. **Ashok Park-New Delhi Railway Station** (7 km undergroond/ elevated)
6. **Ghazipur-Dhaula Kuan** (25 km elevated)
7. **Noida Sector 18-NH 8** (23 km elevated)

PROJECTS EXPERTISE

MUMBAI MONORAIL — ROLLING STOCK PROCUREMENT CONSULTANCY

BARSYL we innovate

Client: MMRDA | Period: Apr 2022 – Ongoing | Scale: 19.54 km | 17 Elevated Stations

ROLLING STOCK DESIGN REVIEW & RAMS

- Design review: carbody, bogies, propulsion, braking (electrodynamic + pneumatic), HVAC, VMS and vehicle electrical systems
- Verification of design calculations, RAMS documents and SOD — safety and lifecycle performance for 750 V DC straddle monorail
- Review and control of ICDs: RS ↔ signalling (ATP/CBTC), wayside power (750 V DC), OCC, depot equipment and AFC interfaces

PROCUREMENT CONSULTANCY & CONTRACT AWARD

- End-to-end procurement: technical specifications, pre-bid management, technical and financial evaluation of manufacturer bids
- Contract finalization for Rs 700 Cr supply contract (Medha Servo Drives + SMH Rail) — transition from Scomi SUTRA to new fleet
- Vendor qualification audits; manufacturing facility assessments and quality plan review; procurement risk strategy prepared

STATIC, DYNAMIC & INTEGRATION TESTING

- Oversight of static tests (structural, electrical, mechanical interfaces) and dynamic tests (braking, acceleration, ride quality)
- Validated traction performance, braking distances and energy consumption against contract specs and beam geometry constraints
- CBTC retrofit commissioning: wayside installation, onboard unit integration and ATO/ATP functional verification

RS–SYSTEM INTERFACE & CBTC RETROFIT

- Multi-contractor interface: new RS verified against signalling (ATP↔CBTC), SCADA, 750 V DC traction, OCC and depot systems
- Interoperability: new fleet vs. Scomi-era beam, turnouts, switches, depot — contact shoe, clearance and beam curvature checked
- End-to-end ICD sign-off managed with MMRDA; CBTC wayside and RS onboard integration tested and formally accepted

TECH STACK

- Straddle-type monorail on elevated single concrete beam
- Original fleet: Scomi SUTRA 4-car | 750 V DC | ATP
- VVVF propulsion | Electrodynamic regenerative braking
- New fleet: Medha Servo Drives + SMH Rail | 10 × 4-car | Rs 700 Cr
- New fleet: metal body | CBTC upgrade (wayside + onboard retrofit)
- Interfaces: RS ↔ Signalling / SCADA / OCC / Depot / AFC
- ICD review and multi-contractor interface coordination
- ATP ↔ CBTC migration: ATO/ATP functional verification

PROJECTS EXPERTISE

TANZANIA SGR — CENTRAL RAILWAY LINE | DAR ES SALAAM TO MWANZA

Client: Reli Assets Holding Company (RAHCO) | *Period: May 2017 – Ongoing* | *Scale: Phase I: 202 km | Phase II: ~ 1,020 km*

CIVIL, TRACK & SYSTEMS DESIGN REVIEW

- Design review of civil works, CWR track, OHE (25 kV AC), ETCS L2 signalling and GSM-R telecom across all sub-lots
- ETCS Level 2 review: RBC architecture, balise placement, STM interfaces and onboard unit compatibility with locos reviewed
- Depot, freight yard and maintenance facility designs reviewed; OHE/signalling/telecom into depot systems assessed

MULTI-PACKAGE TENDERING & PROCUREMENT

- Pre-qualification and bid documents for all civil and systems packages across 4 Phase II sub-lots
- Technical evaluation of rolling stock, OHE, ETCS signalling and GSM-R telecom contractors; BOQ review and negotiation
- RS performance requirements aligned with ETCS, OHE and depot interface specifications during contractor selection

ETCS L2 & ROLLING STOCK COMMISSIONING

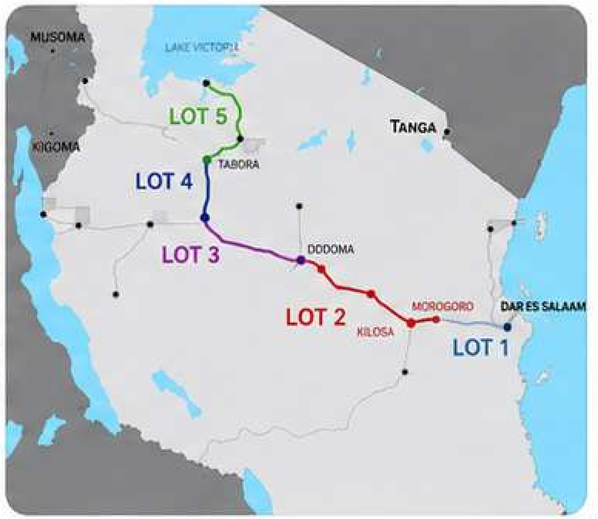
- ETCS Level 2 T&C: *RBC commissioning, balise verification, onboard unit integration and movement authority testing*
- RS commissioning: braking, traction, *GSM-R and pantograph–OHE interfaces verified; depot acceptance at Morogoro and Mwanza*
- *GSM-R network acceptance testing; smart station systems handed over at all 5 major stations*

ETCS–GSM–R–OHE SYSTEM INTEGRATION

- First ETCS Level 2 in Tanzania: *RBC ↔ onboard ETCS ↔ GSM-R — movement authority, emergency stop and degraded mode tested*
- *RS–infrastructure interface: onboard ETCS ↔ RBC, GSM-R ↔ driver comms, OHE ↔ pantograph verified across all stations*
- *Depot systems: OHE depot sections, signalling approach tracks, SCADA and workshop systems integrated for O&M readiness*

TECH STACK

- Standard gauge 1,435 mm | Ballasted CWR | Concrete sleepers | 25T axle
- 160 km/h passenger / 120 km/h freight | Future-ready to 200 km/h
- ETCS Level 2 + Radio Block Centre (RBC) — first in Tanzania
- GSM-R digital comms — full 1,222 km corridor coverage
- 25 kV AC OHE | Traction substations | Regenerative braking
- Onboard ETCS unit ↔ RBC | GSM-R ↔ driver cabs
- Smart stations: digital ticketing, real-time PIS, lifts & escalators
- Depots & freight yards: Morogoro, Dodoma, Tabora, Mwanza



PROJECTS EXPERTISE

KAVACH PMC — NAD–KOTA–MTJ | WEST CENTRAL RAILWAY, INDIA

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Client: West Central Railway | **Period:** April 2023 – Ongoing | **Scale:** 549 Route km | 87 Locomotives

KAVACH SYSTEM DESIGN REVIEW

- KAVACH onboard unit design reviewed: loco brake interface, MU control, cab display and SOS relay integration
- UHF radio coverage design reviewed across 549 RKM; tower placement optimised; EI direct interface validated (v4.0)
- OFC station-to-station KAVACH comms design reviewed; location accuracy and RDSO SIL-4 compliance verified

SUPPLY & INSTALLATION PMC

- PMC oversight of KAVACH onboard fitment in 87 locos; trackside RFID, UHF modems, wayside processors and cab displays
- Supervised UHF tower erection; material inspection, store accountability and site acceptance testing coordinated
- Contract administration, QA/QC, BOQ verification, measurement and payment certification maintained throughout

SIL-4 T&C & CRS CLEARANCE SUPPORT

- T&C: onboard unit testing (brake, SPAD, SOS), wayside testing (RFID accuracy, radio quality) and loco-to-wayside integration
- System commissioning: SPAD prevention, overspeed braking, loco-to-loco collision avoidance and NMS connectivity validated
- RDSO witnessing facilitated; CRS inspection documentation prepared; safety case and commissioning certificate supported

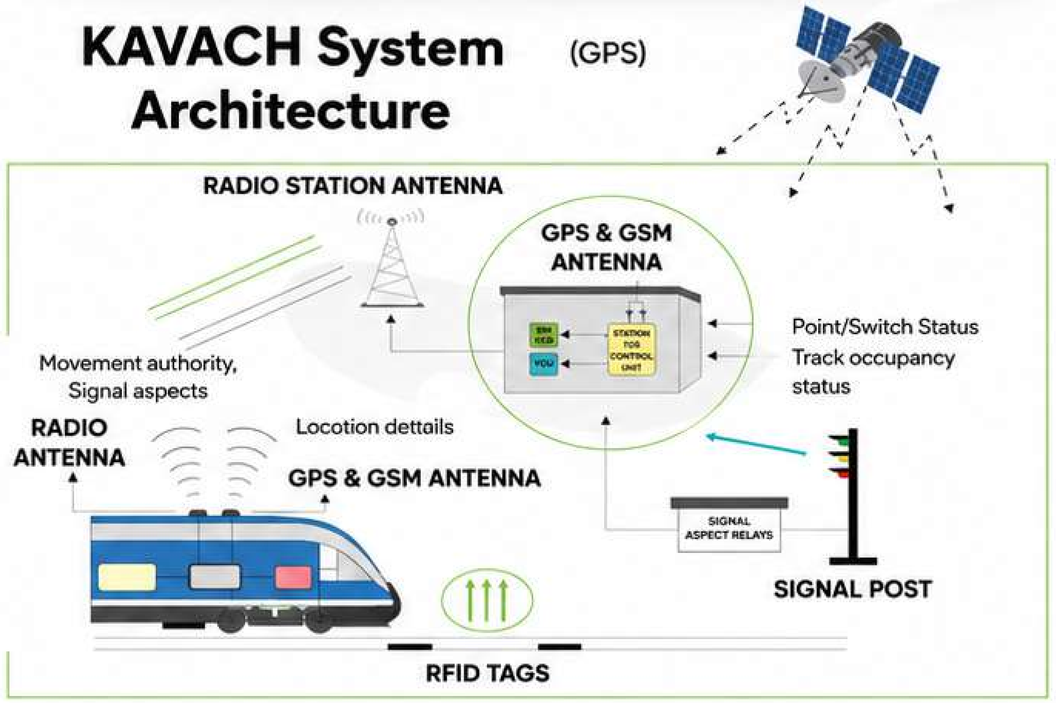
LOCO–WAYSIDE–EI INTEGRATION

- KAVACH onboard integrated with loco brake systems, MU control and cab display; EI interface verified at all stations
- NMS integration: real-time KAVACH status of 87 locos and trackside units; failsafe protocols tested for degraded mode
- PMIS-based project controls | QA/QC across civil, signalling and telecom | Safety, EHS and DLP monitoring

TECH STACK

- **KAVACH: indigenous ATP (RDSO / Make in India) — National ATP**
- **SIL-4 certified: IEC 61508 / EN 50126 / 50128 / 50129**
- **Probability of dangerous failure < 10^{-8} per hour**
- **RFID tags in track + UHF radio: loco-to-loco & loco-to-wayside**
- **Cab signalling | Auto brake on SPAD / overspeed | SOS relay**
- **Network Monitor System (NMS): centralised live train monitoring**
- **v4.0 (RDSO Jul 2024): OFC station link | Direct EI interface**
- **Onboard: 87 locos | Wayside: stations, LC gates, IBS, towers**

KAVACH System Architecture



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PROJECTS EXPERTISE

RAIPUR–TITLAGARH ELECTRIFICATION
PMC | SECR & ECR, INDIA

Client: Rail Vikas Nigam Ltd. (RVNL) | Period: Mar 2015 – Dec 2023 | Scale: 203 RKM / 480 TKM

OHE & TSS DESIGN REVIEW

- Review of DPR, construction drawings and contracts for OHE, TSS, switching stations and associated civil works
- Booster transformer/AT sections, earthing, power line crossings and height gauges reviewed; compliance verified
- Execution supervised simultaneously across Raipur Division (SECR) and Sambalpur Division (ECR) in parallel

SUPPLY CHAIN & CONTRACT ADMINISTRATION

- Supply chain oversight: OHE materials (conductor, masts, insulators), TSS equipment and SCADA hardware
- Contract administration, BOQ verification, measurement and payment certification; material inspection across 203 RKM
- Coordinated utility relocation, power line crossings and forest clearances across Chhattisgarh and Odisha

OHE ENERGISATION & SCADA T&C

- OHE energisation supervised section-by-section; traction substation bring-up and SCADA remote control validated
- SCADA acceptance testing: remote control of sectioning switches, alarm verification and failsafe response testing
- CRS inspection support: as-built drawings, test certifications and close-out documentation prepared

ELECTRIFICATION–S&T SYSTEM INTEGRATION

- OHE track sectioning aligned with signalling block sections; neutral sections coordinated with signal positions
- OHE ↔ S&T interfaces: height gauges at LC gates, signal arm clearances, relay room protection and track circuit bonding
- SCADA ↔ signalling: OHE fault conditions and TSS trips reflected in control centre without interference to block working

TECH STACK

- 25 kV, 50 Hz single-phase AC traction OHE — 203 RKM
- Traction Substations (TSS) + Switching Stations (SS)
- SCADA: remote monitoring & control of OHE and substations
- Booster transformer / auto-transformer (AT) sections
- OHE ↔ S&T: track sectioning aligned with signalling blocks
- Civil: TSS buildings, staff quarters, TW sidings, cross tracks
- OHE mast: stagger, contact wire height and gradient compliance
- Two-zone parallel execution: SECR (Raipur) & ECR (Sambalpur)

NACALA CORRIDOR — ELECTRIFICATION FEASIBILITY & DESIGN | MOZAMBIQUE

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Client: Corredor Logístico Integrado de Nacala (CLIN) | Scale: Moatize (Tete) → Nacala via Malawi | 912 km

PROJECTS EXPERTISE

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DPR & DESIGN BASIS PREPARATION

- DPR prepared for Moatize–Nacala electrification; Design Basis Report covering OHE geometry, loading criteria and interfaces
- 25 kV AC vs 2×25 kV AT options assessed; substation spacing optimised for 912 km corridor across Mozambique and Malawi
- Approximate cost estimates prepared: OHE supply, traction substations, switching stations, SCADA and civil works

TRAIN OPERATION PLAN & SIMULATION STUDIES

- Train Operation Plan for electrified corridor: heavy haul coal operations, headway analysis and energy consumption modelling
- Traction simulation: electric loco sizing, power demand, voltage profile, regenerative braking and contact wire temperature
- Rolling stock analysis: dual-mode vs. pure electric loco options evaluated; fleet size and phased rollout plan defined

TECHNICAL SPECIFICATIONS PREPARATION

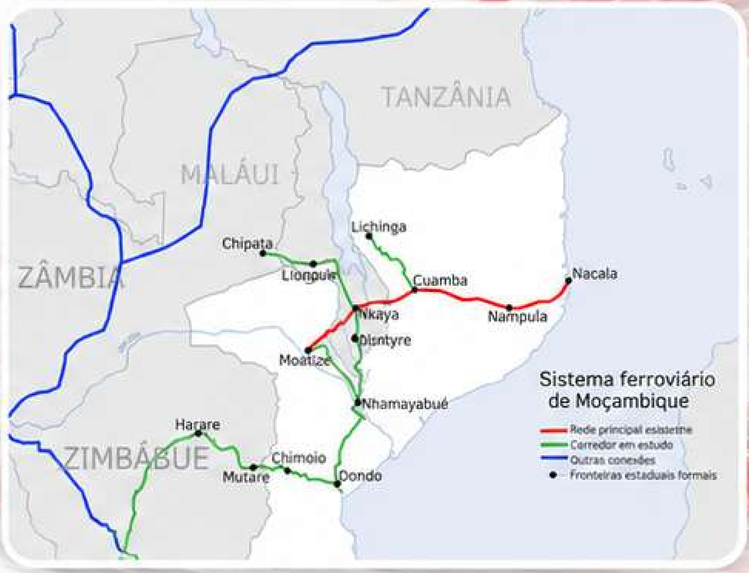
- Technical specifications prepared: 25 kV OHE (masts, wire, catenary, stagger), TSS, switching stations and SCADA
- Interface specs for OHE ↔ Siemens Sentinel PTC: neutral section placement, traction return and earthing/bonding
- RS technical interface specs: pantograph geometry, contact strip, current collection and clearance for electric locos

TENDER DOCUMENTS & BOQ PREPARATION

- Full ICB tender documents prepared: ITB, Conditions of Contract, Employer's Requirements, technical specs and tender designs
- BOQs developed for all electrification packages with quantity take-offs, unit rates and costs for competitive bidding
- Contract packaging strategy defined; cross-border Mozambican (CFM/CLIN) and Malawian (CEAR) jurisdictions addressed

TECH STACK

- **Cape gauge 1,067 mm | Heavy haul coal corridor | ~18 Mtpa design capacity**
- **Electrification scope: Moatize → Nacala — 25 kV AC OHE system**
- **Existing system: diesel traction | Study assessed electrification conversion**
- **Heavy haul: 30T axle load | 1.5–2 km train lengths | 80 km/h freight**
- **Signalling: Siemens Trainguard Sentinel PTC (installed on full corridor)**
- **Route: Moatize (Tete) → Nkaya Junction (Malawi) → Cuamba → Nacala**
- **Coal export terminal at Port of Nacala-a-Velha | Vale + CFM + Mitsui JV**
- **US$4.4 Bn corridor project | 30-year concession**



PROJECTS EXPERTISE

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NCRTC RRTS — FEASIBILITY STUDY & DPR | DELHI–ALWAR CORRIDOR, INDIA

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Client: NCR Planning Board | Period: May 2010 – Aug 2017 | Scale: ~160 km | UG 56 km + Elevated 124.5 km | 20 Stations

DESIGN BASIS REPORT & SYSTEM SPECIFICATIONS

- Route alignment finalised; Design Basis Report prepared summarising ROW, curvature, gradients, building lines and land use
- Technology specs prepared for Rolling Stock, Signalling (ETCS L2 / CBTC-class), Traction (25 kV AC / 2×25 kV AT) and AFC
- Station yard plans and commissioning schedule defined; preliminary viaduct design (loading standards and clearances)

PLANNING, SURVEYS & ALIGNMENT STUDIES

- Alignment selected with topographic and geotechnical surveys; utility mapping, drainage impact and land acquisition planning
- Station locations identified based on catchment, ROW, constructability and integration; depot siting requirements finalised
- Civil aspects: alignment design, UG and elevated section optimisation; construction methodology and schedule prepared

TRAIN OPERATIONS & PROCUREMENT FRAMEWORK

- Train Operation Plan: operation philosophy, hourly plan, phased implementation and rolling stock requirement across 20 stations
- O&M plan including depot maintenance, lifecycle cost optimisation; CAPEX/OPEX estimates with phasing and escalation
- Procurement advisory: recommended system technology options, draft specs for ICB tendering of RS, OHE, signalling and telecom

SYSTEM INTERFACE & INTEGRATION FRAMEWORK

- Multi-modal integration: interchange arrangements with Delhi Metro, IR suburban and feeder bus networks defined
- System interface framework: signalling ↔ RS compatibility, traction ↔ OHE sizing, AFC ↔ OCC and depot ↔ operations defined
- Financial analysis: FIRR, EIRR, sensitivity analysis; PPP/BOT/hybrid structuring, VGF assessment and equity returns evaluated

TECH STACK

- RRTS: semi-high-speed regional rail | Design speed 160–200 km/h
- System technology recommendations: rolling stock, signalling, traction
- Power & Traction: 25 kV AC / 2×25 kV AT — load estimation & SCADA
- Signalling: ETCS Level 2 / CBTC-class system recommended
- Rolling Stock: high acceleration, regenerative braking, stainless body
- AFC: options evaluated; most feasible system recommended for RRTS
- Depot: layout, plant & machinery, OCC within depot complex
- CAPEX/OPEX: abstract cost estimates, FIRR/EIRR, sensitivity analysis

DELHI–ALWAR CORRIDOR

164 km	22	9.1 lakh
Total length	Total no. of stations	Daily Ridership (Projected)

FIRST PHASE
From Sarai Kale Khan in Delhi to SNB Urban Complex (Shahjahapur-Nemrana-Behror) en route Gurugram, Manesar, Panchgaon and Rewari

SECOND PHASE
From SNB to Sotanala via Shahjahapur, Neemrana and Behror

THIRD PHASE
From SNB to Alwar

PROJECTS EXPERTISE

MECHI–MAHAKALI RAILWAY — DETAILED DESIGN & DPR | NEPAL

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Client: Government of Nepal — Dept. of Railways | *Period: Aug 2016 – Ongoing* | *Scale: 139.42 km*

HIGH-SPEED DETAILED SURVEY & DESIGN

- Topographic survey along 139.42 km alignment designed for 200 km/h on challenging Terai terrain with river crossings
- Detailed design: alignment, track geometry, formation, embankments, drainage to 200 km/h standards with ≤25‰ gradient
- Geotechnical surveys: 416 boreholes, 8,436 m drilling; seismic and hydrogeological assessments for high-speed railway

BRIDGE, TUNNEL & STRUCTURE DESIGN

- Detailed design of 61 bridges including 8.12 km Saptakoshi Bridge with hydrodynamic modelling for scour and erosion
- Design of 6,650 m tunnels across hilly terrain; 246 RUBs, ROBs and culverts to 200 km/h loading standards
- 14 station complexes designed: layouts, architectural concepts, utilities, disaster management and maintenance provisions

SYSTEMS SPECIFICATIONS & TENDER PREPARATION

- Power supply & traction, signalling and train control, and comms systems designed for 200 km/h; dual gauge (SG + BG) incorporated
- High-speed EMU specification, passenger capacity, lifecycle cost and maintenance requirements documented in DPR
- *Rate analysis, cost estimation and financing options prepared; tender design documents, BOQs and cost estimates developed*

INTERFACE MANAGEMENT & INTEGRATION

- Cross-border connectivity: SG interface with IR at Nautanwa and Raxaul; dual gauge ensures interoperability with BG IR network
- *Traction ↔ train control ↔ comms: 200 km/h speed profiles, OCS, ETCS-compatible control and GSM-R/LTE-R specified at DPR*
- Implementation and operation schedule: *phased construction, operating costs, maintenance plans and capacity projections*

TECH STACK

- Design speed: 200 km/h — high speed railway standard
- Standard gauge 1,435 mm | Dual gauge provision (SG + BG)
- Electrified railway: traction, train control & comms designed
- Max axle load: 17T (passenger) | Grade: ≤25‰
- 139.42 km survey: 61 bridges incl. 8.12 km Saptakoshi Bridge
- 6,650 m of tunnels | 246 RUBs/ROBs/culverts | 14 stations
- Geotechnical: 416 boreholes | 8,436 m total drilling depth
- Rolling stock: high-speed EMU parameters defined in DPR

PROJECTS EXPERTISE

DFCC EDFC – KHURJA–DADRI PMC | EASTERN DEDICATED FREIGHT CORRIDOR

Client: Dedicated Freight Corridor Corporation of India Ltd (DFCCIL) | Period: Oct 2016 – Ongoing | Scale: 46 Route km | Pkg 302 (Civil) + Pkg 105 (OHE, Signalling & Telecom)

CIVIL & TRACK DESIGN REVIEW

- Review of DPR and construction drawings for Pkg 302: double-line civil works, bridges, track (ballasted, 25T axle load)
- Design review and supervision of civil works and track alignment; track geometry and drainage verified across 46 km
- Works on running lines coordinated within traffic blocks ensuring IR operations not disturbed; grade-separations supervised

OHE, SIGNALLING & TELECOM PROCUREMENT OVERSIGHT

- Pkg 105 scope: 2×25 kV AC OHE, switching stations, TSS, SCADA, ABS and GSM-R telecommunications
- Materials inspected and approved at site; QA plans evolved with contractor for OHE, signalling and telecom equipment
- Conflict and change management; measurement and payment certification; relevant certificates issued

OHE ENERGISATION, ABS & SCADA COMMISSIONING

- Design review, supervision, testing and commissioning of 2×25 kV OHE, switching stations, TSS and SCADA
- ABS commissioning: signal aspect verification, track circuit testing and block section clearance procedures tested
- GSM-R network commissioning; SCADA field interface testing for OHE sections, TSS and freight train movements

FREIGHT SYSTEMS INTEGRATION & INTERFACE MANAGEMENT

- Integration of 2×25 kV OHE, ABS signalling and GSM-R into unified freight corridor framework — coordinated with Prayagraj OCC
- OHE ↔ signalling: 2×25 kV neutral sections aligned with block boundaries; traction return ↔ track circuit coordinated
- SCADA ↔ OCC: real-time train position, OHE health and TSS status relayed to EDFC Operations Control Centre

TECH STACK

- 2×25 kV AC OHE — double-line electrified freight corridor
- Automatic Block Signalling (ABS) — 5-min headway capacity
- Electronic Interlocking deployed on Eastern DFC (Alstom, Prayagraj OCC)
- GSM-R mobile train radio communication across corridor
- SCADA: centralised monitoring of OHE, TSS & train movements
- Broad gauge 1,676 mm | 25T axle load (upgradable to 32.5T)
- Design speed 100 km/h | 1.5 km long freight trains (120 wagons)
- Grade-separated from IR — no level crossings on DFC

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THANK YOU

Engineering Excellence. Powering Mobility.

BALAJI RAILROAD SYSTEMS P. LIMITED

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