

New Methods and Innovative solutions for Speedy Electrification

– L&T Experience



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Presentation Flow

Introduction

L&T Railway Business Introduction – An Overview
L&T's Experience in Mega RE Projects

New Methods & Innovation

- Cylindrical Foundations - Augering
- Cylindrical Foundations - Casting
- Mast Installation and Wiring

RE Contract Restructuring

- Contractual Improvements - from BoQ to EPC Model
- Towards Mechanisation in Rail Electrification

Summary

Conclusion

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Mainline (Railways)

Track | OHE | S&T | Composite

Dedicated Freight Corridor

Civil & Trackwork | 2x25 kV Traction | S&T

Dedicated Rail links

Power | Ports | Coal | Cement



Mass Transit (Metro)

AC | DC Traction

MonoRail

TSS | RSS | ASS | AFC | Integration

Track

Ballastless track - Plinth | Slab | Embedded



Geographies

Business in India
Middle East and
Africa



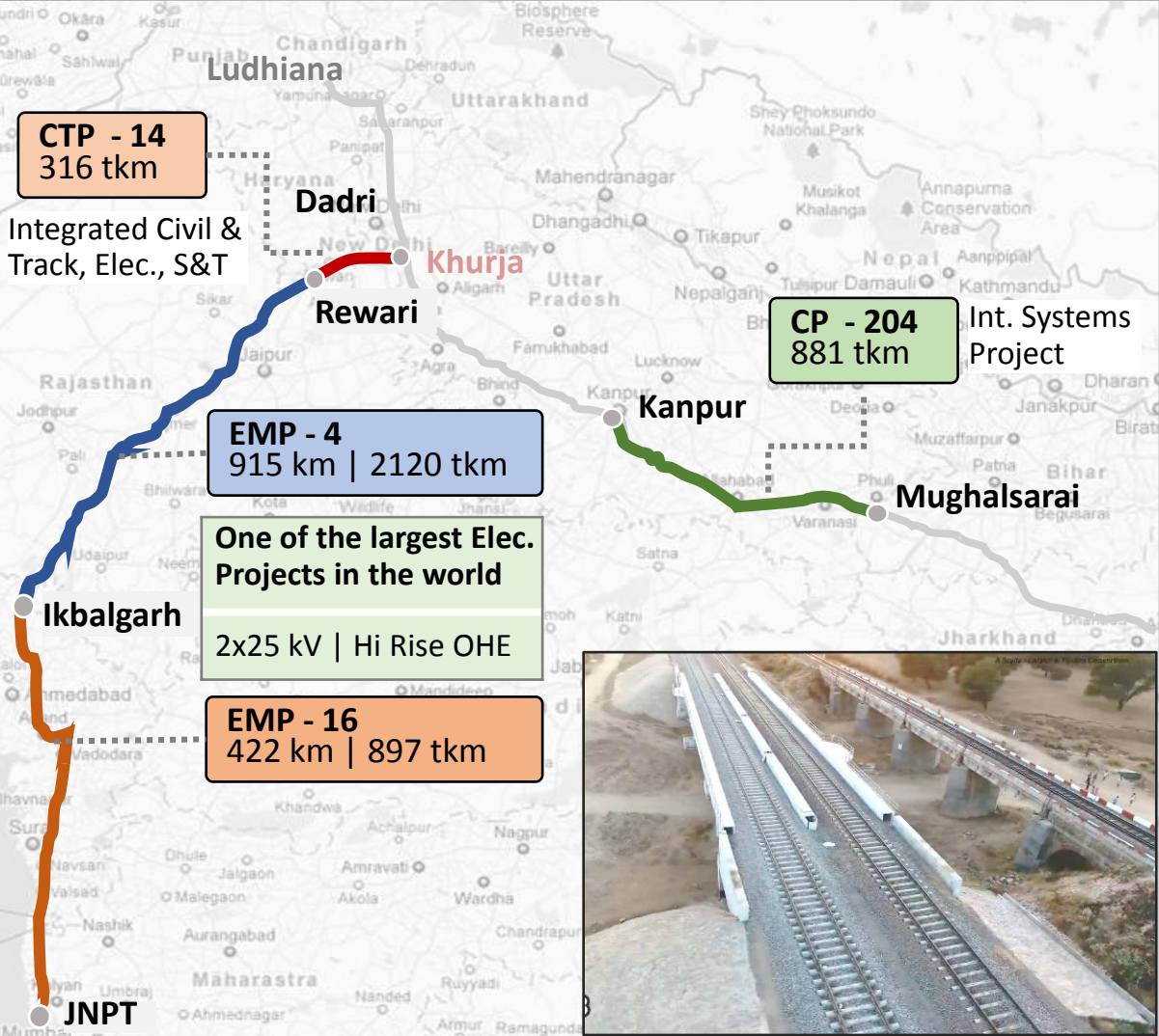
Well Established Track
Record

11250 TKM of Rly. Electrification | **1850 TKM** of Track Construction | **170 Stations** S&T Works
220 TKM of Ballastless Track | **378 TKM** of OHE in Metros | **1st MonoRail** of India

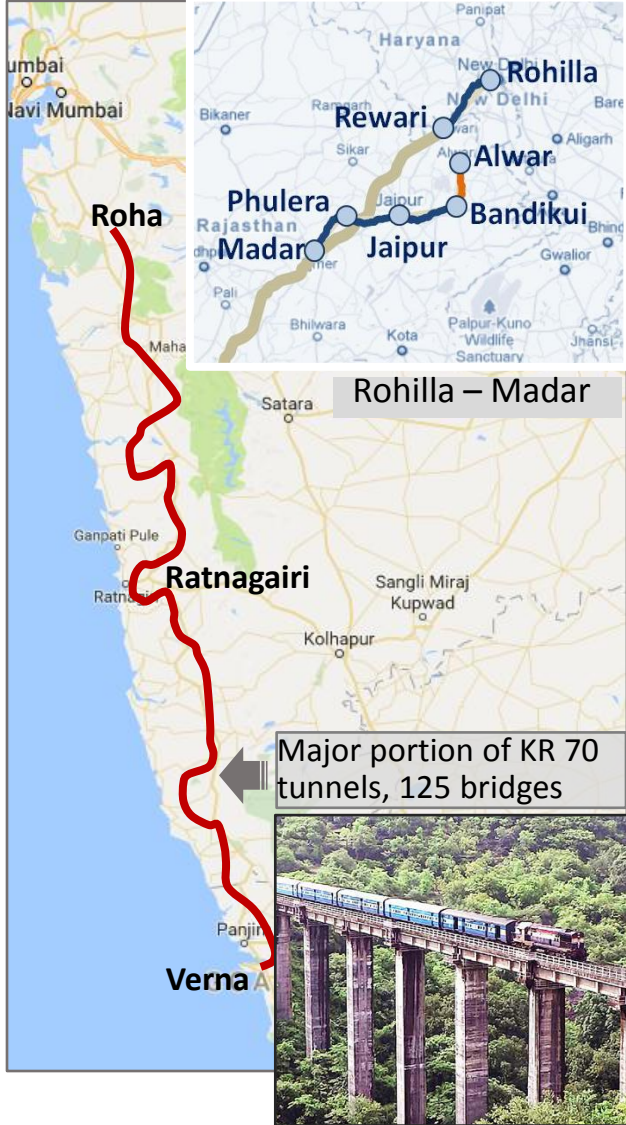
Mega Projects | 100% of Electrification in WDFC (3017 tkm) and Executing IR's first Large Scale EPC Electrification Project



Dedicated Freight Corridor (Western & Eastern)



Large IR EPC Electrification Projects



Executing one of the largest 2x25 kV Electrification Projects in the world

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New Methods and Innovation | Mechanised Methods adopted in Electrification – **Cylindrical Foundations Augering**

1 Auger on Crawler based RRV

At EMP 4 site



- Enables Steep Embankment Climb
- Productivity upto 15nos./day (4m deep)
- Capable of augering in Rocky soil
- Suitable for Implantation greater than 4m

2 Tractor Mounted Auger



- Usability Limited to Pre-Ballast Stage (Green Field)
- Implantation 2.8 – 3.5 m
- Productivity 10 nos. / day

3 Trolley Mounted Auger



- Track based Construction
- Implantation 2.8 – 4 m
- Productivity upto 7nos. /day



Mechanisation increases productivity by 5-6 times

Mix model (Mechanical and Manual) to be adopted in RE works based on site conditions

1

Direct Method



2

Indirect Method

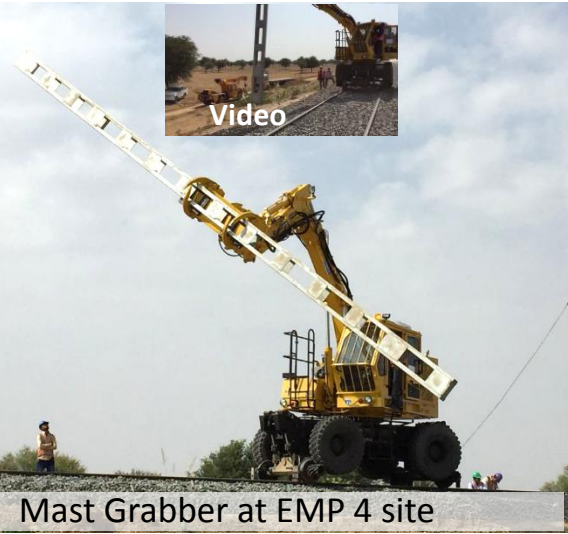


Steps in Casting of Foundation



- Track Formation not disturbed
- No backfilling is required
- Saving in concrete quantity by 40%
- Faster because of low quantity requirement

RRV with Multi axis Mast Grabber



- Safe working while adjacent to Live Track
- High Productivity 10min / Mast
- Faster and Better Precision than conventional Derrick Method
- Better Accessibility for embankment

Fully Mechanised OHE – Simultaneous Stringing of Conductors under tension



- Repetitive Traffic Blocks avoided in the same section owing simultaneous stringing
- 3 times High Productivity

Conventional method of Conductor Stringing



- Repetitive Traffic Blocks required
- Max Productivity 1tkm / hr
- Labor Intensive
- Prone to twisting of contact wires

Typical Sequence | Augering – Concreting - Mast Erection & Cantilever – Stringing – Adjustment - Inspection

Step 1 Cylindrical Auger Boring



Step 2 1st Stage - Concreting of Foundation



Step 3 Mast Erection & Second Stage Concreting (grouting)



Step 4 Cantilever Erection



Step 5 Stringing of Conductors using Wiring Train



Step 6 OHE Adjustment



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Continuous Evolution of Contracting Model |

Critical for Mission Electrification

Parameters	Unit Rate – Schedule of Rates (SOR) Model	EPC Model initiated by CORE in 2017	Further changes recommended
Project Nature & Size	<ul style="list-style-type: none"> Unit Rate-SOR. Value < Rs.100 Cr. Length < 200 RKM 	<ul style="list-style-type: none"> EPC based. Value Rs.500-750 Cr. Length – 300-400 RKM 	<ul style="list-style-type: none"> More Projects in EPC model Value ~ Rs.1000 Cr. Combine smaller adjacent sections. Length - 600 -700 RKM
Design Optimization	Not Applicable	Done at Bid Stage	Approval of Layout Plans & Construction Drawings within 2 weeks of submission
Tendering process	<ul style="list-style-type: none"> Less stringent PQ Delayed finalization 	<ul style="list-style-type: none"> More Stringent PQ Quick award process 	<ul style="list-style-type: none"> Continue with the stringent PQ Minimum 3 months time for bidding. Award OHE projects after completion of track works.
Adopting new methods of Mechanisation	No Scope	More open (eg. Cylindrical Foundation)	<ul style="list-style-type: none"> Adopt more Mechanised Techniques. All Construction Machinery in contractor's scope.
Availability of Traffic Block	Limited and for shorter durations		Minimum 3-4 hrs traffic block per day
Compensation for not providing min. Traffic Block	No Compensation	Rs.1000 / hr. (inadequate)	Compensation need to be in line with the loss incurred due to idling to make it balanced.

Continuous Evolution of Contracting Model |

Critical for Mission Electrification

Parameters	Unit Rate – Schedule of Rates (SOR) Model	EPC Model initiated by CORE in 2017	Further changes recommended
Cash Flow	Cash Flow fairly neutral	Negative cash flow	<ul style="list-style-type: none"> Define a neutral Cash flow. Bidder to propose sub-milestones in Payment Schedule
Interest on Mobilization advance	4.5 % p.a. above SBI base rate (~ 14%).	9.5 % per annum.	Interest free
Variation Order	Issued at the fag end of the project delaying the project completion.		Limited & avoided at the final stages of the project.
Vendor Availability & Customer inspection	<ul style="list-style-type: none"> Limited RDSO approved vendors. Mandatory inspection by RDSO/RITES. 		<ul style="list-style-type: none"> Expedite approvals and add more vendors. Source from approved vendors of SEB`s or other PSU`s Allow 3rd Party Inspection in addition to RDSO/RITES
Land availability for TSS/SP & Readiness of Transmission Line.	<ul style="list-style-type: none"> Land not available for construction of TSS. Transmission line construction delayed. 		<ul style="list-style-type: none"> TSS/SP space to be available before award of contract. Transmission line to be commissioned / in advance stage of completion before commencement of Electrification project.

Continuous Evolution of Contracting Model |

Critical for Mission Electrification

Parameters	Unit Rate – Schedule of Rates (SOR) Model	EPC Model initiated by CORE in 2017	Further changes recommended
Price Variation	Based on : <ul style="list-style-type: none"> ▪ WPI Index ▪ IEEMA Index (for Steel) 	Based on WPI Index for items like Labor, Cement, Structural Steel, Insulators, Copper Wire, Transformer, Electrical Switchgear	In addition to WPI, separate PV formulae for following items : <ul style="list-style-type: none"> ▪ Copper Conductors - Based on LME ▪ Steel Structures - As per IEEMA ▪ Signalling Cables - As per IEEMA ▪ Traction Transformers - As per IEEMA ▪ Any other item for which a separate IEEMA / RBI formulae exists.

Alternative Model for Green Field Electrification

- Combine Trackwork and Electrification (Mast Erection) on formation and not wait till Track laying
- Civil & Electrical Disciplines of IR to discuss feasibility in line with global trends and DFCC

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Critical Actions

- Evolve Design & Build EPC projects of Large Value
- Encourage participation from large professional contractors
- Promote adoption of New Technologies and Mechanisation
- Ensure availability of adequate Traffic block
- Simplifying & Streamlining approval procedures
- Broad basing the vendor sources



Thank You