Capabilities that Connect
Turnkey Solutions for the Rail Sector

LARSEN & TOUBRO
Larsen & Toubro (L&T)

L&T, India’s largest engineering, technology, construction and manufacturing organization has established itself as a unique service provider delivering turnkey solutions for all types of railway projects. The Railway Strategic Business Group of L&T has taken the lead in rail construction by introducing pioneering techniques, resulting in execution of projects with innovation, quality and speed. L&T offers total infrastructure solutions for urban mass transport systems, dedicated rail connectivity projects for both public / private sector developers including construction of railway workshops and modernization/upgradation projects. It also serves as a leading systems integrator for mass transit projects meeting international standards and specifications.

L&T Construction has been engaged in rail infrastructure construction for more than three decades. Commencing the rail track electrification work in 1980, L&T entered the signalling field in 2000 and later diversified into integrated railway construction projects involving comprehensive multi-discipline engineering and construction services. Over the years L&T has developed the overall project management capabilities, improved upon the construction methods by reducing track time occupancy and introduced innovative techniques enabling the railways to enhance the efficiency of their operations.
Achievements

- Commissioning of the country’s first 2x25 kV A.C. railway traction substation executed for South Eastern Railways
- Installation of 47m span overhead equipment portal frames for railway electrification at Mumbai CST Yard
- Erection of 403 OHE steel structures in a day covering 86 km of track on the Beas – Amritsar section of Northern Railways
- Commissioning the rigid catenary traction system for Delhi Metro Underground section of Jawahar Lal Nehru Stadium, the main venue for 2010 Commonwealth Games
- Commissioning of more than 25 traction substations and 220 switching stations

Integrated Railway Projects - Track record

<table>
<thead>
<tr>
<th>Nature of Work</th>
<th>Done</th>
<th>Ongoing</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 kV AC OHE (Track Km)</td>
<td>6,550</td>
<td>3,054</td>
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<tr>
<td>Rigid Overhead Contact (TKm)</td>
<td>40</td>
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<td>Third Rail Electrification (TKm)</td>
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<td>56</td>
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<td>Traction Power Supply</td>
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<td>Traction Sub stations (AC / DC)</td>
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<td>18</td>
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<tr>
<td>Gas Insulated Switching Stations</td>
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<tr>
<td>220</td>
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<tr>
<td>Ballasted Track Work (Track Km)</td>
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<td>1205</td>
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<tr>
<td>Ballastless Track Work (TKM)</td>
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<td>110</td>
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<tr>
<td>Signalling</td>
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<tr>
<td>Centralised Traffic Control (nos)</td>
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<td>-</td>
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<tr>
<td>Electronic Interlocking (Stations)</td>
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<td>17</td>
</tr>
<tr>
<td>Panel / Route Relay Inter. (Stations)</td>
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<td>22</td>
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As a leader in rail construction, L&T offers turnkey Engineering, Procurement and Construction (EPC) solutions encompassing design, engineering, supply, project planning, quality control and field execution. It has on board professionals with varied experience and in-depth knowledge on every aspect of railway construction. The range of services offered includes construction of:

- Integrated / composite railway projects
- Dedicated rail links, internal yards and merry-go-round systems for core sector developers including port connectivity
- Urban mass rail transit systems
- Bridges and tunnels
- Stations (both above / underground)
- Conventional and ballastless tracks
- Railway electrification systems (both Flexible OHE as well as Rigid Catenary System)
- Signalling and telecommunication systems

L&T provides timely delivery of the project with a single point responsibility for varied requirements of complex and integrated railway projects covering the entire gamut of activities from project conceptualization, planning to design engineering, project execution, statutory approvals, testing and commissioning. L&T provides end to end solutions involving:

- Construction of road bed and bridges
- Permanent way works
- Traction system
- Signalling and Telecommunication system
- Associated civil works like station building and platform, staff quarters and passenger amenities.
Permanent Way and Road-bed works

L&T has the expertise to take up construction of rail bed and permanent way works involving construction of embankment, bridges, associated civil works comprising station buildings, passenger amenities and staff quarters. L&T has established the mechanized method for mainline track linking for the first time in Indian Railways, resulting in high quality, speedy execution and improved accuracy. L&T has strategic alliances with leading track fitting manufactures and track system designers for ballastless track fittings. More than 200 km of permanent way works have been executed by L&T and presently it is executing 800 km of work involving road bed, bridges, earthwork, ballastless track, station buildings etc.
L&T holds the unique distinction of energizing major trunk routes in the Indian Railway networks in record time since 1981. It has so far executed over 6500 km of railway track electrification. L&T’s turnkey capabilities in the overhead catenary system include design, supply, erection, testing and commissioning of:

- 25 kV, single phase 50 Hz, traction overhead equipment
- Traction substations, switching stations including 25 kV gas insulated switchgear
- Modification of overhead catenary system
- Rigid overhead conductor system for electrification of underground tunnels with rigid overhead equipment
Signalling and Telecommunication

L&T has the experience and expertise to handle major turnkey projects for railway signalling and telecommunication services. L&T has strategic alliances with leading signalling manufacturers for providing state-of-the-art system engineering for automatic train control system comprising automatic train supervision, protection and operation including electronic interlocking. The range of services offered includes design and commissioning of:

- Panel / Route interlocking
- Solid state interlocking of stations / Interlocking of level crossings
- Block Working and Control Communication
- Fiber Optic Transmission System (FOTS)
- Radio System (GSM-R / TETRA / VHF)
- Public Address System (PAS)
- Passenger Information Display System (PIDS)
- Master Clocks
- Data Networking System (DNS)
- CCTV Surveillance System
- NP-SCADA System

Over 50 stations with relay and solid state interlocking have been commissioned by L&T.
L&T provides comprehensive design and build solutions from concept to commissioning for station buildings and depots, Comprising MEP works, vertical and horizontal transportations, building automation systems, IT systems, system integration etc. It has the capability to deliver structures for mass transit systems including complete E&M installations and services like automated fare collection, passenger information display system and firefighting systems for Railways and Metro operations on a turnkey basis.
Railway Bridges

L&T has pioneered the construction of major steel and concrete bridges and has vast experience in executing a wide range of rail infrastructure development projects. L&T’s comprehensive capabilities in railway bridges includes elevated structures and flyovers, long span and segmental bridges, steel and cable stay bridges.

L&T has the expertise to design special launching and erection techniques, including special systems formwork for concrete deck on top of steel and concrete structures. Jack-down systems are used for accelerated well-sinking. Techniques employed for bridge construction include incremental launching, segmental construction, cables stay, precast and prestressed concrete, steel, concrete composite construction.

The Construction Enabling Services Cell (CESC) complements the execution by providing enabling services such as systemizing, automating and mechanizing the construction process.

State-of-the-art bridges built by L&T include:

- Halladi bridge and Panval Nadi viaduct in the hilly tracts of Western Ghats for Konkan Railway
- Kamshet 1 B twin tube tunnel for Konkan Railway
- Bridges across Gambhir Khad and Jhajjar Khad on Jammu-Udhampur Rail Link (one of the tallest railway bridges in the country) in the northern hill region of the Himalayan ranges
- Yamuna bridge and elevated corridor for Delhi Metro

India’s highest altitude bridge (88m high 308m long) the Jhajjar Khad bridge on Jammu-Udhampur Rail link
Urban Mass Rail Transit Systems

L&T has an impressive track record of executing major metro projects in the country comprising construction of elevated and underground metro rail corridors, monorails, composite railway construction works as well as station buildings and associated systems.

Delhi Metro

L&T has executed the construction of 6.6 km underground corridor from Kashmere Gate and Central Secretariat for Delhi Metro, passing below important areas of Central Delhi and crowded areas of Chawri bazaar. Under phase – 2, L&T executed 5 packages including a pivotal airport expressway link located below the T-3 terminal of Delhi International airport.

The entire rigid overhead catenary system (ROCS) for underground electrification works of Delhi Metro phase – 2 was executed by L&T on design and build basis.

Hyderabad Metro

L&T is the developer for the entire Metro network for the city of Hyderabad, one of world’s most prestigious and the biggest contracts being executed on BOT basis in the metro sector. The project has 3 high density corridors spread over a distance of 71.16 km involving 66 ultra modern station buildings with the state-of-the-art depots and complete infrastructure. The project involves development rights for 18.5 million sq.ft. of transit oriented property and a concession period of 35 years.

Chennai Metro

L&T is also executing the entire track works for Chennai Metro on design and build basis which includes construction of ballastless track in underground tunnels and elevated viaducts as well as ballasted track in depots. The total track length is 110km. The major scope of work includes construction of:

- 9.5 km of elevated viaducts including 6 station viaducts
- Underground stations at Nehru Park, Kilpauk Medical College and Pachaiappa’s College and associated tunnels for a length of 4.4 km along with a consortium partner
- Depot for Chennai Metro Rail involving 22 structures with a built up area of 6,24,150 Sq.ft.

Bengaluru Metro

- 4.8 km of elevated viaducts structures
- 3 elevated metro stations at outer ring road, Peenya Industrial area and Peenya village

Kolkata Metro

- 3 km of elevated viaducts from Barasat to Hridaypur including two stations
- 5.75 km of viaducts from Kavi Subhas (New Garai) to VIP Bazar including station area
India’s first Monorail Transit System

India’s first monorail transit system is currently under execution by L&T on the Jacob Circle-Wadala-Chembur section in Mumbai for MMRDA. This 20 km line is a turnkey design and build project with 17 stations and a maintenance depot, including testing and commissioning with initial operation and maintenance for 3 years.
A well-equipped design facility - Engineering Design and Research Centre (EDRC) at Chennai and Faridabad provides a broad spectrum of Engineering, Design, Research and Consultancy services ranging from concept to commissioning for all types of projects. EDRC provides construction engineering services for overhead equipment including traction substations, signalling and telecommunications, permanent way works, bridges, flyovers, marine structures and other special infrastructure requirements.

EDRC’s comprehensive engineering services cover:
- Assessment of OHE works and preparation of detailed design of OHE including switching stations
- Signalling and Telecommunication: Location drawings, outdoor circuit drawings and track bonding plans
- Feasibility studies
- Project reports and due diligence reports
- Architectural, structural and civil design
- Geo-technical engineering
- Building services
- Mechanical system engineering
- Electrical and instrumentation system engineering
- Hydraulic engineering
- Bridge and elevated structures
- Tunnels and underground structures

Structural Fabrication
L&T’s ISO and OHSAS certified facilities for rolling mill structure fabrication and galvanizing at Puducherry and Pithampur are capable of handling custom-made structures required for railway projects. L&T’s fabrication workshops across India are equipped with sophisticated, heavy duty facilities to take-up intricate fabrication for electrification of masts, bridge decks, structural components, conveyor galleries and transfer towers.

Precast
To enable faster completion of projects, L&T offers state-of-the-art precast technology for various railway projects. Concrete elements such as viaduct segments, tunnel lining rings, armour units and deck elements are prefabricated in custom-made yards.

L&T’s precast production capability includes manufacturing of:
- Railway sleepers
- Prefabricated railway electrification posts
- Precast piles
- Precast superstructure elements
- Concrete armour units

Competency Development Centre (CDC)
Towards fulfilling the demands in rail construction, L&T has established a Competency Development Centre (CDC), a first-of-its-kind training centre for rail construction in the country at Kanchipuram near Chennai for different activities on the integrated project requirements.

The objective of CDC includes:
- To augment the competency of the construction workforce in rail construction
- To familiarize frontline engineers with railway construction concepts, activities and quality working techniques
- To enable middle managers understand activity interfaces and formulate integrated approach on construction of composite railway projects.
- To facilitate training by setting up a modular training school with well-defined infrastructure and curriculum
- To create a talent pool of skilled construction workforce capable of delivering world class standards in rail construction