ECC CONCORD

In-house Journal of L&T Construction

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Acknowledgements

All that we do, our end goal is a delighted client and this issue of ECC Concord celebrates several projects across businesses that have stretched the extra miles to delight their customers. To showcase their sterling efforts, we are thankful to several of our colleagues for their coordination, inputs, guidance, patience & support. Here are some of them in no particular order: Santosh Subramanian, K Arunkumar Vignesh, Anirudh Bharadwaj, K Rahul, Sushrut Thakre, Y Phanindra, P T Selvam, Akshara Asok (who helped us till the day she moved) & Harshvardhan, who took up from where Akshara left off, Moinudeen Akbar, Vineet, Dinesh Soni, G Srinivas, Rajshekhar Pingala, B. Vineeth, several of our Project Directors & Managers who jumped in to contribute and many more. Much appreciated, guys!

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EVERYTHING WE DO, WE DO IT FOR THE CUSTOMER.

If our ultimate business objective is to maximize shareholder value, then for a project-based organization like ours, wowing the customer is critical for success. Understanding what customers are thinking, feeling, saying, demanding, expecting is the first critical step towards delivering to their satisfaction. In today's world of cut throat competition, it is obvious that winning and retaining customer loyalty is imperative for our continued success. There are several businesses across L&T Construction that have successfully nurtured and built long term associations with customers, winning repeat projects, and delivering handsomely. Kudos to all of them. However, this must be the mantra for every business leader, every project leader and everyone down the line.

Understanding what customers are thinking, feeling, saying, demanding, expecting is the first critical step towards delivering to their satisfaction.

Recently, the Hon'ble Prime Minister of India inaugurated the Integrated Transit Corridor Development, at Pragati Maidan in New Delhi and expressed his delight at the tunnel we have constructed, more specifically the murals that adorn the walls of the tunnel, who also inaugurated Phase 1 of the Ahmedabad Metro that we have constructed for the Gujarat Metro Rail Corporation. One of our teams from WET IC delivered a state-of-the-art sewage treatment plant to our client, ASHGHAL, ahead of time and a team from RREC is readying the Madhya Pradesh Expressway project for delivery to NHAI, again ahead of schedule. The futuristic-looking Terminal 2 at the Bangalore International Airport is almost ready for on time commissioning; by recently setting a world record in tunnelling at the Mumbai Coastal Road project we delighted the client, MCGB, for whom it meant speedy progress. Our PT&D teams have been consistently delivering on time to a variety of customers, while at M&M, we have been winning fresh repeat mandates from long-standing clients like Tata Steel & JSW. With 'Customer First' as one of our core values, we can and must certainly keep this good thing going.

Be a partner for your customer

Customers love a partner. It is therefore imperative for all you, business leaders, to be 'partners' rather than mere 'executors' to our customers for which it is important to understand their business, their challenges, their goals, and ambitions that will strengthen your position to understand their requirements, anticipate their demands, manage their expectations. It will keep you a step ahead in the game.

No customer is unreasonable. Their demands may seem so at times, but they are not for they too are answerable to someone above them, they too have their own compulsions, their own targets to meet, their own KRAs to achieve. Our focus should unwaveringly be to 'perform' and not merely 'please' a customer. Often, in our anxiety to please the customer, we tend to over promise and, considering all the risks and challenges involved at site, under deliver. By being aware both of our strengths and shortcomings, we are better prepared to deliver as promised.

Today's reality is that we are still having to deal with the impact of the several disruptions caused by the pandemic and other geopolitical happenings. Unfortunately, most of our customers have moved on. Continuing to cite these as reasons for non-delivery will not be accepted. In fact, these could put us on the back foot. We must be sharp, resilient, and resourceful to work around these road blocks and continue to deliver.

Be mindful that we always deliver value, and it is important for customers to acknowledge the value that we create for them.

Keep reminding customers of our value

Be mindful that we always deliver value, and it is important for customers to acknowledge the value that we create for them. This calls for a balanced approach, to deal with customers firmly but fairly and always being on top of all your deliverables. There is no better way to build a bridge with your customer. First impressions still make the best impressions so try and start new client relationships on the right foot. Never, however, take your customer for granted. Be sensitive to them, listen to both what they are saying and implying, avoid being confrontationist, and once you have agreed to deliver, do your best to make it happen. That is how successful business associations are forged.

Customers feel more secure when they know that there is a team that is working for them and, more so, if the team has people with the ability to ensure progress.

Empower your teams to excel

Customers feel more secure when they know that there is a team that is working for them and, more so, if the team has people with the ability to ensure progress. By projecting your team to customers, allowing them to present their points of view and participating in decision making, you are not only impressing the customer, but you are, at the same time, strengthening our leadership pipeline. Lead from the front but always make sure that your back is covered.

With a huge order backlog to cover, we need to be on the best wicket with our clients to deliver and keep the order inflow intact. We have delivered in the past and there is no reason why we cannot now.

Here's wishing you all the very best! Let's together seize the day!

S N Subrahmanyan
CEO & Managing Director, L&T

TEAM BIAL, BEATING ALL ODDS TO THE FINISH LINE!

Amidst the scissor and spider lifts, the BIAL Terminal 2 project site is a beehive of activity. Even as workmen scurry around, engineers shout instructions, materials get loaded and unloaded, Project Director, J K Shivaraj, and Deputy Project Director, K P Maheswarappa, can be spotted having an animated discussion with the team. In the background, are the golden hues of the engineered bamboo ceiling and the bells and veils section distinctive of the new Terminal 2. The duo exudes an air of purpose, confident in the knowledge that their team will deliver the mandate comfortably. They wouldn't have it any other way, in any case.

"Things, however, were dramatically different to start with for us," comments Shivaraj. "As a team we have had to go through a lot. Ours is really a story of struggle and triumph, overcoming disruptions to bring to reality what is conceived as an 'airport terminal inside a garden'."

Green Terminal – an integration of natural elements

Pivoted on the concept of 'a terminal in a garden', the architecture of Terminal 2 integrates several natural elements such as clay, bricks, bamboo, rattan, and extensive landscape. A lagoon with a big artificial forest belt around it, a multimodal transport hub, including the Metro, provisions for solar panels on the roof, artificial waterfalls, elevated walkways, and green seating areas are among its standout features.

Embracing innovation to overcome execution challenges

While the structural system of the passenger terminal building is a conventional RC beam slab system supported by non-ductile RC columns, its envelope is designed with a standing seam metal roof system resting on steel beams and tapering girders supported on built-up cruciform steel columns raising

VOICES FROM
GROUND ZERO

"Things, however, were dramatically different to start with for us. As a team we have had to go through a lot. Ours is really a story of struggle and triumph, overcoming disruptions to bring to reality what is conceived as an 'airport terminal inside a garden.'

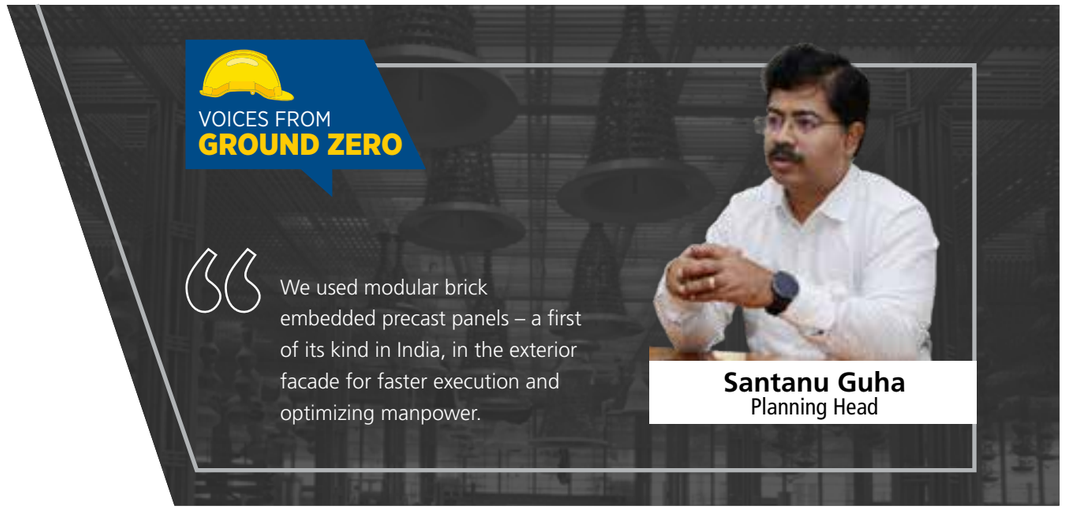
J K Shivaraj
Project Director

above the departure & retail mezzanine levels (levels 3 & 4). The 18 m main steel beam spans connect the steel columns and secondary steel beams with intervals at 6 m, bifurcating the spans into 3 segments.

K P Maheshwarappa speaks of several innovative methods adopted to overcome challenges, save cost, and speed up execution. "We realized that on the Departure level RCC slab, heavy cranes could not be mounted. An option would have been to use 750 tonne cranes at the ground level which were not viable in terms of cost, time, availability and so on. We came up with a solution of having a supporting structure or an enabling platform on top of the RCC slab supported on main beams from which we could use much smaller 50/60 tonne cranes to do the structural steel erection. This out of the box thinking helped us complete all the structural steel works above the departure level of the terminal and that, in turn, greatly helped in hastening the works in the piers, forecourt, elevated corridors, multi modal transport hub facility and structural steel work for all pavilions, terminals and ancillary structures."

Erection of bells and veils in the Departure level ceiling amidst the intricately spaced engineered bamboo ceiling has been a big challenge. The conventional chain-pulley system adopted initially was very time consuming. "We overcame the challenge by an innovative erection scheme involving a 25 T capacity crane with an additional jib," recalls Maheswarappa, with a sense of satisfaction. Another innovation was to replace the combination of blockwork cladded with wire cut brick cladding in the building façade by brick-embedded precast panels.

"All our MEP & Airport systems are equipped with seismic resistant supports, that have all been commissioned on time," remarks Head – MEP, Anne Sriram Kumar. The systems comprise HVAC (with a unique feature of Photo-Catalytic and Gas-phased filtration system), Fire Fighting system, Electrical, PHE, VHT (Lifts, Escalators & Travelators), ICT systems (Automated Flight Announcement including regional language



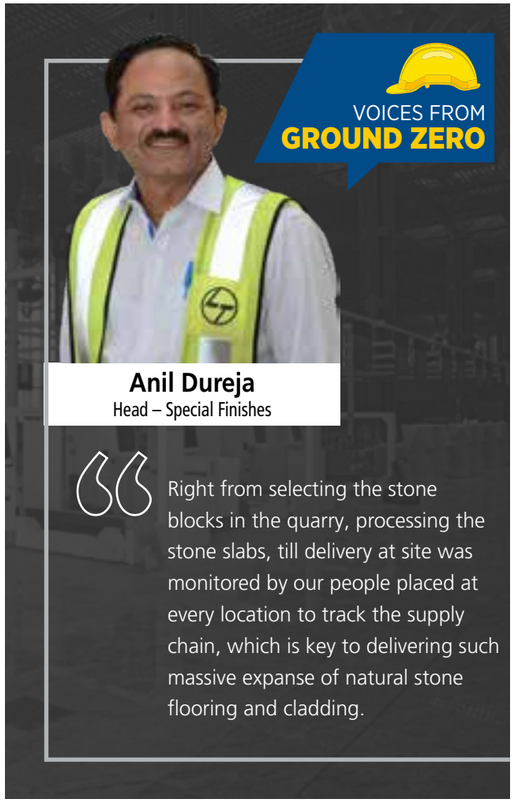
systems have been installed with complete mechanization (duct lifters, pipe lifters, etc.) with prefabrications to expedite process and progress," he says, proud of his team's efforts.

Planning Head, Santanu Guha mentions, "Procuring the right material to meet the architectural intent, many of which are first-of-their-kind was tough as was procuring about 16 lakh architectural bricks for the internal brick cladding as well as for the external brick façade as the readily available wire cut bricks in the market were neither meeting the client's aesthetic expectations nor that of our EDRC architects. We used modular brick embedded precast panels – a first of its kind in India, in the exterior facade for faster execution and optimizing manpower," adds Santanu, sharing the team's insightful solution.

"In the initial phase of the project, we completed all the RCC works for the terminal as per the project milestones," shares S Kaliyan - Head Construction (Terminal), with a sense

announcement) systems integrated with Public Address System, Networking - active & passive with software designed access (SDA), 5G-compatible Distributed Antenna Systems, Trunk Mobile Radio Systems, ELV Systems, and Airport Systems like Baggage Handling System with unique tilt-tray sorters, Self-Baggage Drops, Passenger Boarding Bridges, Security Screening systems - all with end-to-end integrated testing and commissioning.

"There are several firsts," remarks Anne like conducting an Integrated Test and having simulation labs at site for testing, simulating the IT systems, BHS HLC and LLC (high- and low level controls), combined wash & dry faucets in rest rooms with ADA compliance, LOD 400 (clash free shop drawings developed in BIM 360 Cloud) & Cobie (asset management system integrated with BIM platform). "We conducted Virtual FATs (factory acceptance tests) along with the customer for both imported and indigenous equipment and our MEP

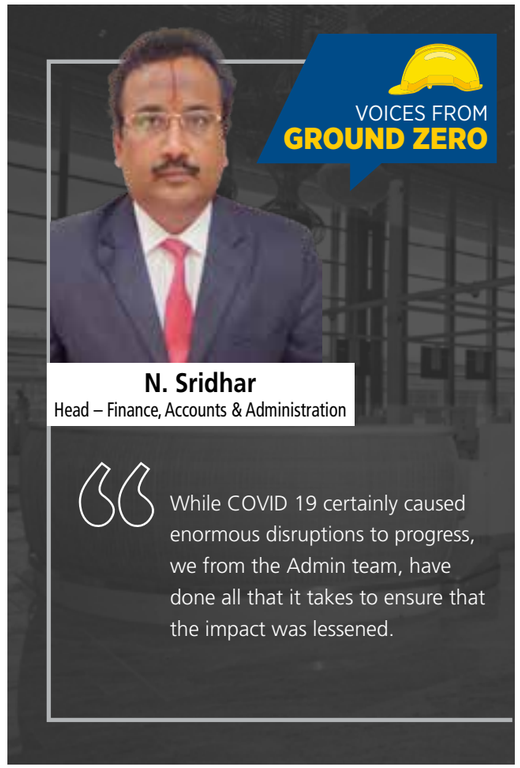


of purpose. Post COVID, the team faced the challenge of mobilizing workmen and vendors to execute the finishing works for which they rigorously followed up and re-mobilized the entire workforce. "We realigned our strategy and prepared a detailed plan for 750+ Back of House Rooms which were required for the operations team. In addition, we created a separate team to focus on the passenger movement areas" informs Kaliyan. "Detailed interface plan with all trades were prepared and works were monitored daily to complete all the rooms and passenger movement areas."

The elevated corridor with the Departure Forecourt and the road network, were logistically constrained in all sides with the MMTH, metro tunnel, lagoon, air-side boundary, and the CUP building. "The elevated corridor consists of Void Form Slabs, PT Slabs, a signature bridge (connecting the existing Terminal 1 to the main exit road)," informs Pranab Krishna De – Head Construction (Elevated Corridor, Forecourt & At-Grade Roadworks). The bridge bearings of this elevated network (of varying load bearing capacity), had to be tested 100% as a stringent quality assurance measure by EDRC as against one of each type as per codal provision prior to installation. "With very few test facilities available in the country to test such higher capacity bearings, we proactively engaged with stakeholders, identified the facility, and ensured that the bearing testing was not an impediment to site progress and completed the bridge as per the project timelines." Pranab's triumphant expression says it all. "The signature bridge was the project's first major milestone (related to operation readiness) to be completed, that was inaugurated on April 25th, 2022, in the presence of our senior management and BIAL senior management," he adds proudly.

"Executing about 1.35 lakh sqm of granite flooring and cladding selected from various quarries from across India was a huge task," remarks Anil Dureja, Head – Special Finishes. "Right from selecting the stone blocks in the quarry, processing the stone slabs, till delivery at site was monitored by our people placed at every location to track the supply chain, which is key to delivering such massive expanse of natural stone flooring and cladding."

"While COVID 19 certainly caused enormous disruptions to progress, we from the Admin team, have done all that it takes



to ensure that the impact was lessened," recalls N. Sridhar, Head – Finance, Accounts & Administration. "Be it liaising with the Railway Ministry to allocate dedicated trains for workmen to travel to Bengaluru, obtaining special approvals from the Health Minister of Karnataka to reduce the quarantine period for workmen who tested negative in Rapid Antigen Tests, and more."

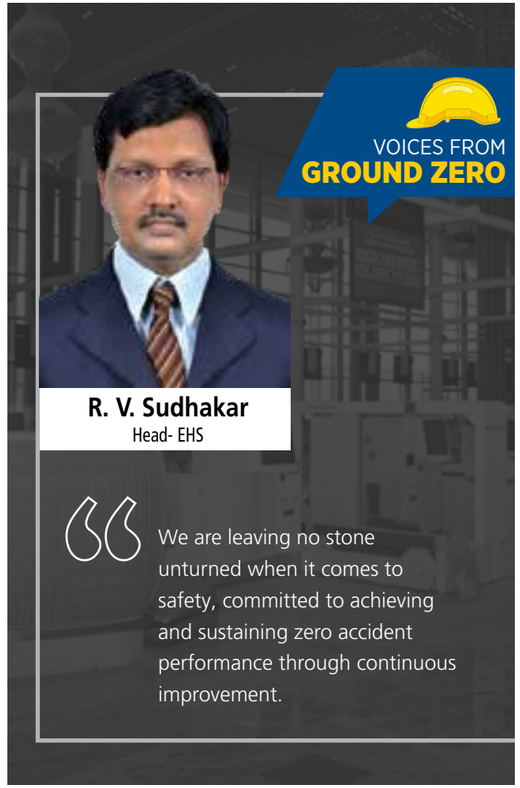
Safety, the No. 1 priority

"We are leaving no stone unturned when it comes to safety, committed to achieving and sustaining zero accident performance through continuous improvement," affirms R. V. Sudhakar, Head- EHS. 'Visual Impact Training' is helping engineers and workmen understand real life safety scenarios, while safe material is being used instead of mastic asphalt which is hazardous to workmen.

All lifts including the critical ones, using 60 T crane over the RCC slab at 12 m levels, were carried out in consultation with the CMPC Department. MEWP – mobile elevated working platforms - have been used extensively instead of scaffoldings, another unique safety feature while 110v hand-held power tools make operations safer for workmen. Roof works, a critical activity was completed efficiently and safely.

No compromise on Quality

The Terminal 2 is spread over about 20 acres of footprint area with a basement and 4 upper levels which will typically take a person about 3 days to visit every nook and corner of the terminal in detail. For former Quality Head, V. Yegappan,



VOICES FROM
GROUND ZERO

V Yegappan
Former Head - Quality

> We achieved many exciting milestones simply because we didn't quit when faced with challenges and worked together as a team to give the best output.

who retired recently, the project was his best shot in terms of quality adherence. Not only did the project win the internal rolling B&F Quality Trophy in 2019-20 but has also consistently won the client's appreciation, which was no mean achievement, he grins. "We achieved many exciting milestones simply because we didn't quit when faced with challenges and worked together as a team to give the best output."

The 4 lakh cum concrete required was entirely produced in house, managed and supplied by the project's Quality & P&M teams. About 1.5 lakh sqm of screed floor was executed meeting the stringent requirements from the client for pull out tests on screed, soundness testing for the screed by a methodology as per British Standard with the BRE test procedure. A third-party inspector was appointed to inspect the work along with the in-house quality team as an additional quality assurance to the client. This first of its kind activity of pull-out and BRE tests on screed were completed much to the client's delight.

Around 13,000 MT of structural steel having AESS (Architecturally Exposed Structural Steel) was fabricated externally and brought to site with two dedicated QA/QC Engineers deployed at factory for strict inspection & adherence.

"Another big challenge was casting the circular columns of 1.2 & 1.8 m diameter of 12 m height in a single pour without intermediate lifts," shares PL Alagappan – Head-Formwork, with the hint of a frown. "By devising a proper methodology and through our dedicated team, we cast 400 plus columns in a single lift that saved us time and cost. Generally, we construct such long columns in multiple lifts."

Digital Transformation through BIM, COBie

"Being the country's first project to integrate a full BIM lifecycle for the entire project cycle meant that we had to hand hold the teams through the process as our vendors were used to 2D," shares Narin Gobindranath, Design Head.

Today the entire team can access all information and take informed decisions. "We are leveraging the full extent of

VOICES FROM
GROUND ZERO

PL Alagappan
Head-Formwork

> By devising a proper methodology and through our dedicated team, we cast 400 plus columns in a single lift that saved us time and cost. Generally, we construct such long columns in multiple lifts.

digital design under the Autodesk suite from design to on-site construction, asset and facilities management and are extensively using COBie (Construction Operation and Building information exchange) which is a framework for collecting and storing information within the elements during the design and construction stages to utilize during operations and maintenance. The BIM model is the complete source of information, and we are proud to be early adopters," enthuses Narin.

The BIAL project site looks like a giant pitstop with every person playing a key role. Senior Principal Architect, Nandedkar Suchita walks energetically and points at the granite flooring and says, "All the dry lay inspections of granites have been carried out by me personally day in and day out to meticulously ensure that the extensive granite flooring at various levels of the terminal are of the best quality and aesthetics."

Meanwhile, at another section, K. P. Maheswarappa is having a sunset huddle with the team. He easily walks about 20,000 steps everyday around the site, and you can sense the fire in his belly as they plan their day's work. "Hats off to our execution team and the various service departments for their tremendous dedication, with most of them voluntarily coming on Sundays and other holidays in rotation to ensure that the project is completed on time which has earned the appreciation of the client," remarks Maheswarappa, with a sense of gratitude.

"My team has done an excellent job against all odds," says Shivaraj proudly. And as they march closer to the finish line together, of late he has been asking them only one thing, "How is the josh?" "High Sir", they roar in unison.

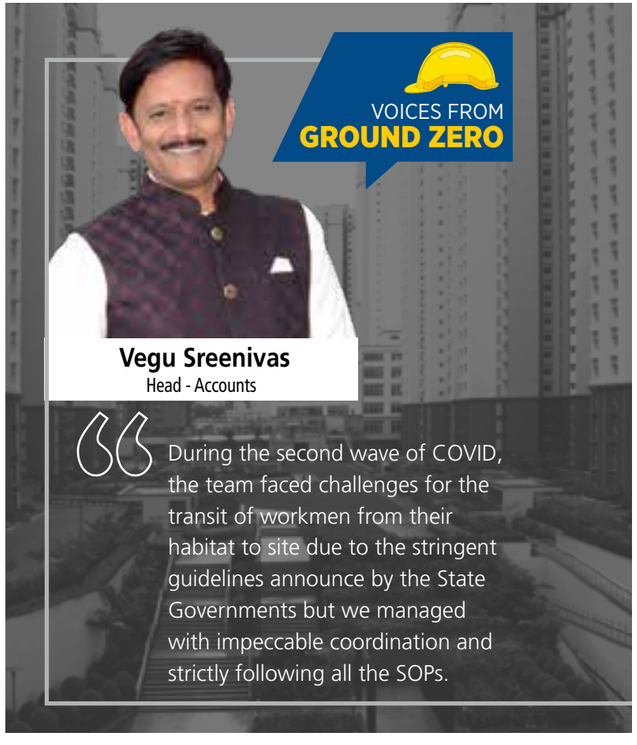
A MATTER OF PRESTIGE!

Spread over 32 acres with 5 Buildings & 15 Towers, 3571 flats with each tower having 2 to 3 Basements + Ground Floor +30 Floors, the Prestige Jindal City residential project paints a majestic picture in the dense residential area of Bengaluru. For Project Director, K Ravichandran and team, it was time to celebrate, entering the last leg of completing a project which was initially marred by several disruptions. As the team cheered in tailormade sherwanis made for the occasion, Ravichandran remarks, "the timely completion and commendable progress of the project are only because the team stood by each other undeterred by challenges. An indication of the quality of our work, is that we have bagged more high value projects from Prestige."

Every challenge is an opportunity to excel

Located in a residential area, the team only had a restricted 7 am – 7 pm window for construction activities during which they had to complete 500 – 750 cum of concrete in 12 hours and maintain equipment at the highest levels of efficiency and availability, with zero breakdowns. Elaborating, Head Finishing- A Subramanian shares, "Our challenges were not to create any noise after 7 pm and take extreme care to minimize dust by using vacuum grinding machines, and sprinkling water around the clock. I am equally thrilled that we have been able to maintain the highest levels of quality and consistency even while working with multiple agencies and workmen."

"During the second wave of COVID, the team faced challenges for the transit of workmen from their habitat to site due to the stringent guidelines announced by the State Governments," informs Vegu Sreenivas, Head Accounts, "but we managed with impeccable co-ordination and strictly following all SOPS."



Triumphing the COVID phase

COVID-19 and the subsequent lockdown saw the workmen of the site stuck in their colony at a different location. The local villagers demanded the workmen be vacated and almost took siege of the colony. It took constant reassurance and negotiation from the project team to appease the villagers and convince them that there were no infected workmen in the colony. In addition, they reached out to them with initiatives such as arranging medical camps and conducting tests.

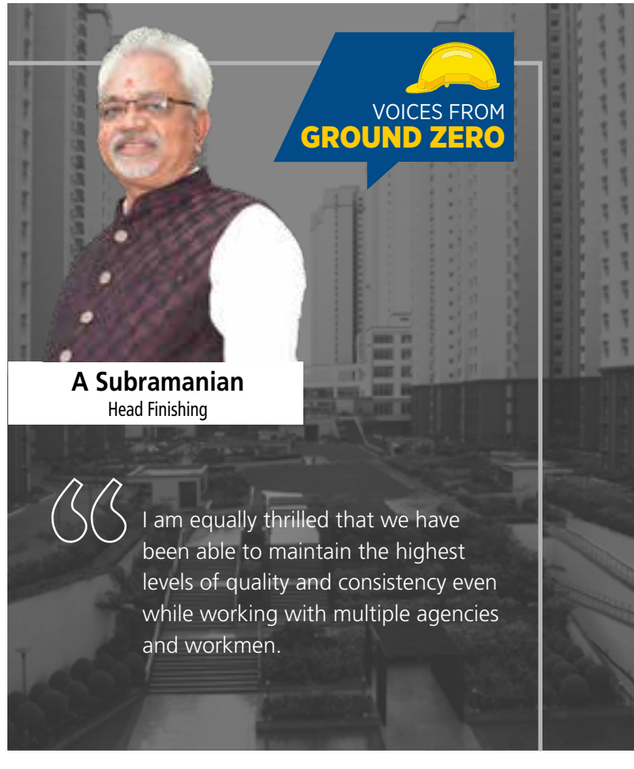
Vadivelu Rajendran, Head EHS shares "Post lockdown, through our excellent planning and coordination, we have successfully mobilized the required workforce to achieve and, in some cases, exceed our targets with Safety and Quality."

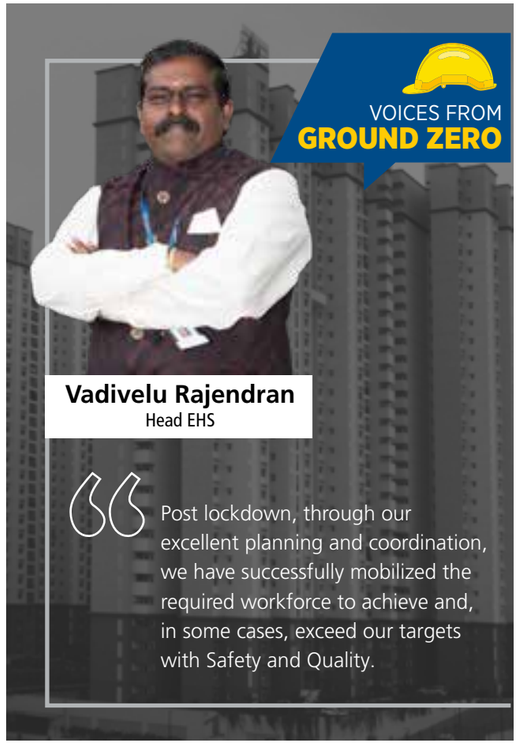
Some of the team's prime challenges were to sustain the increasing prices of transportation despite the spike in fuel prices, steel prices and all consumables, retain and timely re-mobilize vendors and sub-contractors for all the activities.

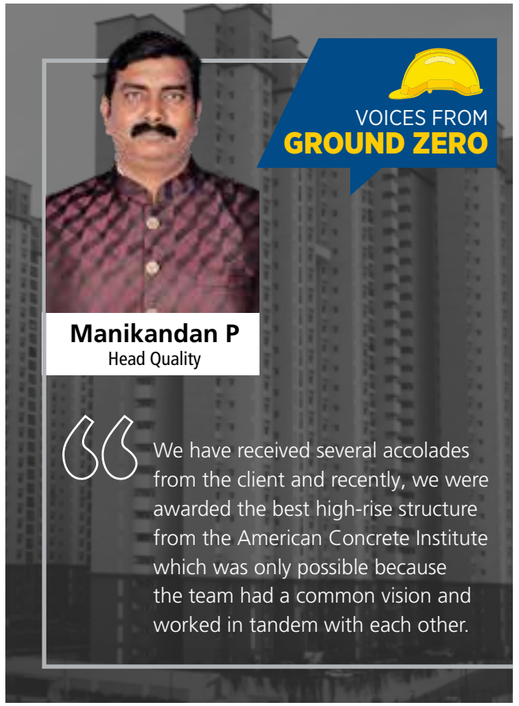
"With stringent planning at task level, active resource mobilization, workmen and P&M allocation, and strict monitoring of site progress, we achieved several milestones, well ahead of time," happily grins Head - Planning, Ms. V Ramani.

Achieving milestones galore

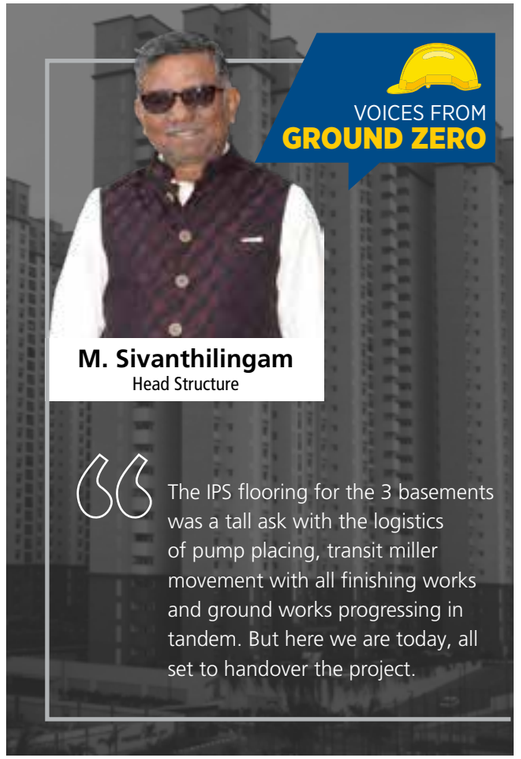
"Completing 63, 68, 546 lakh sq ft of built up area of a residential development of this scale in the span of 40 months







by working only 12 hours a day is not an easy task," shares Ravichandran, who is proud of his team's several timely milestones: 3,32,401 cum concrete, 5,71,871 sqm of tiling works, 23,900 MT of TMT works, 650 MT of structural steel works. The team achieved 250 flats of tiling, 250 flats of gypsum and 200 flats of waterproofing in a single month which is a new benchmark for residential projects in Bengaluru.



Another huge challenge for M. Sivanthilingam, Head Structure, "was to complete the 19 Lakh sq ft of non-tower area structure with almost 9 ancillary building structures of STP, UG Sump, DG rooms at the 3rd & 2nd basement levels." he huffs with relief. "The IPS flooring for the 3 basements was a tall ask with the logistics of pump placing, transit miller movement with all finishing works and ground works progressing in tandem. But here we are today, all set to handover the project," he says with a quick smile.

"I am proud that the team effectively implemented QMS systems and digital checklists at site. We have received several accolades from the client and recently, we were awarded the best high-rise structure from the American Concrete Institute which was only possible because the team had a common vision and worked in tandem with each other," states Manikandan P - Head Quality.

Ensuring On time delivery through BIM

Building Information Modelling (BIM) has been extensively used in the project especially for the school building. One of the most valuable benefits of BIM is its ability to improve the coordination between multiple design disciplines, thus reducing errors and improving outcomes. Using BIM, the team could effectively visualize the final design model, share information, quantify key building elements, plan monthly activities, monitor schedules, progress & cost for on-time project delivery.

Ravichandran or "Captain" as the team affectionately calls him looks proudly as they rally around each other in easy camaraderie, knowing that in a few weeks, they will congratulate each other on their latest triumph and move on to other projects to do what they do best – changing cityscapes together! ■

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In August 2022, the iconic Mumbai Coastal Road project of Heavy Civil IC thrust its way into the record books by setting a world record in tunnel boring. The 12.18 dia Slurry TBM, named 'Mavala', the largest deployed in the country at Package 4, excavated 456.72 m in the calendar month of July beating the previous record of 455.4 m set by a Turkish company for monthly tunnelling by a 13 m single shield EPB (Earth Pressure Balance) TBM. While the entire organization is celebrating the record, achieved thanks to an experienced & well-qualified team helped in no small measure by a benign geology, for the client, the Municipal Corporation of Greater Mumbai (MCGM), the pace of boring is good news as it translates into accelerated progress and quicker project completion.

While Project Director, Sandeep Singh, cannot stop smiling, this is sweet respite for the several issues he and his team have had to face starting with the environmental clearances, the pandemic, the Mumbai traffic and monsoon, nature's fury, the list is seemingly endless.

The 7.87 km stretch that falls within L&T's ambit of the total 10.58 km long Phase 1 of the project will have four interchanges at Amarsons Garden (Breach Candy), Worli, Haji Ali & Marine Lines.

"The TBM was delivered when the pandemic was at its height," he recalls, "and neither could the experts travel to help us, nor did we have any knowledge how to assemble it." Realizing that often the best help is at the end of one's own hand, the team took it upon themselves to assemble it on the ground. "Lowering a fully assembled TBM, weighing some 2,500 tonnes, into the launching shaft was attempted perhaps for the first time in India and we succeeded but then that's what you call innovation," grins Sandeep.

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VOICES FROM
GROUND ZERO

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Sandeep Singh
Project Director

ADDRESSING DISRUPTIONS AND CONVERTING THE SOLUTIONS INTO SOPS

Massive reclamation

"We have reclaimed 111 Ha of land from the Arabian Sea that is as big as 274 football fields," remarks Planning Head, Raj Kumar, referring to the massive extent of reclamation in the inter-tidal zone that placed extra onus on the team to both keep the environment clean and preserve the marine life in the region. "To diffuse the tidal force, we have used core rocks overlaid with armour rocks that allow for the sea to move in unhindered, under the reclaimed land and also preserves aquatic life," he points out. "Some corals along the Amarsons Garden – Haji Ali stretch have been relocated to Navy Nagar in Colaba and are doing well," he smiles, perhaps in relief. The new reclamation will feature a 1 km cantilever promenade from Princess Street to Girgaon Chowpatti for the citizens of Mumbai to enjoy.

Monopile technology

Constantly seeking new technologies to speed up construction, the team opted for monopile construction for the bridge pillars that has thus far been used successfully only in Scotland & South Korea. Deployed in India for the first time, with raw material sourced from Europe, the monopiles are environmentally friendly, significantly reduces work, time, and cost and is aesthetically more attractive. "By adopting monopiles that are in a range of 2.5 – 3.2 m in dia, we have reduced the number of piles from 704 to just 176," flags off Raj. "This also means that we are putting up less piles on the seabed and thus disrupting the marine life less to that extent."

The pandemic cleared the Mumbai roads for free movement

Considering the strategic importance of the project, MCGM was keen that construction was not disrupted by the pandemic so with special permissions, the project team continued work even during the lockdowns. "The lockdowns were a boon for us," says Raj, with relief, gesturing towards the road outside the site that is choc-a-bloc with traffic in the early afternoon, that was previously considered a non-peak hour. "With the roads cleared of traffic, we could bring in material, move equipment and take away debris from the reclamation without any hinderances." The Mavala TBM was delivered at site on 273 vehicles in quick time that would otherwise have taken months to transport on the normal Mumbai roads.

Deployed in India for the first time, with raw material sourced from Europe, the monopiles are environmentally friendly, significantly reduces work, time, and cost and is aesthetically more attractive.

Gasping for oxygen

With oxygen supplies being diverted almost entirely for medical purposes to treat COVID patients, the team switched to plasma cutting that has now been adopted as a SOP even after oxygen supplies have been restored.

Accommodating workmen at site

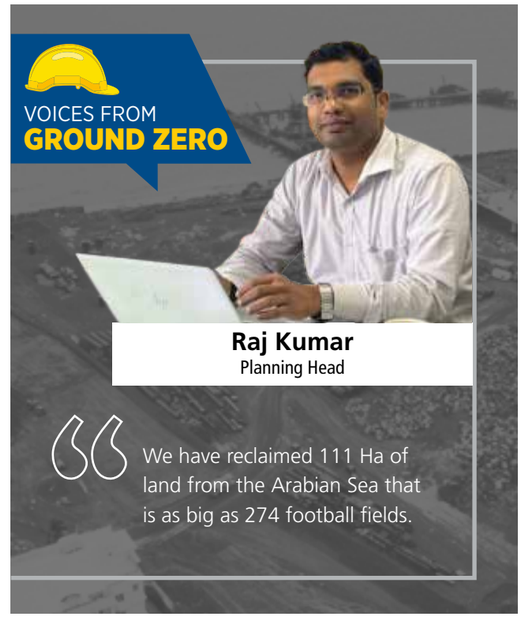
With Mumbai reeling under the COVID scare, mobilizing workmen was an extremely difficult task and with so many restrictions on movement, transporting them was a nightmare. The team therefore developed a labour camp at site, equipped with all facilities, to address all these issues.

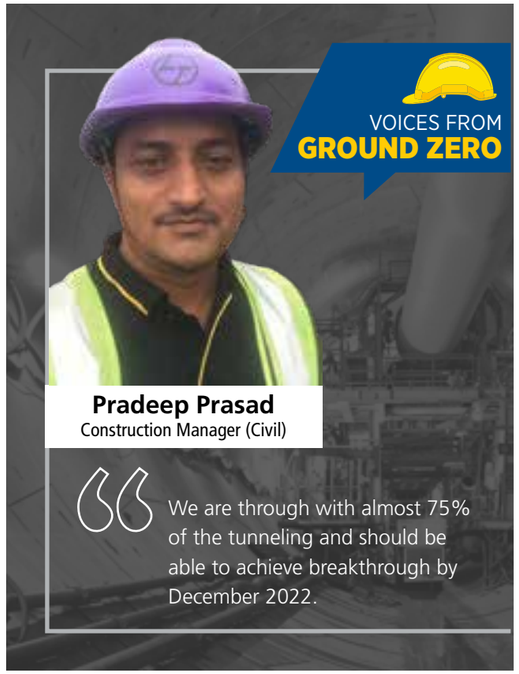
Managing the TBM

The arrival of 'Mavala' at site was the opening chapter of an entire saga of first assembling it and then the bold decision to lower the fully assembled TBM to the launch ramp with three backup gantry parts, weighing 350 MT and three freshly assembled shields, weighing 1,500 MT, using a 200-wheel self-propelled modular transporter. The team is using the TBM to construct two 12 m wide tunnels of 2.072 km each running at depths of 5 – 68 m under the Malabar Hills and 25 m below Girgaum Chowpatty between Priyadarshini Park and Marine Drive.

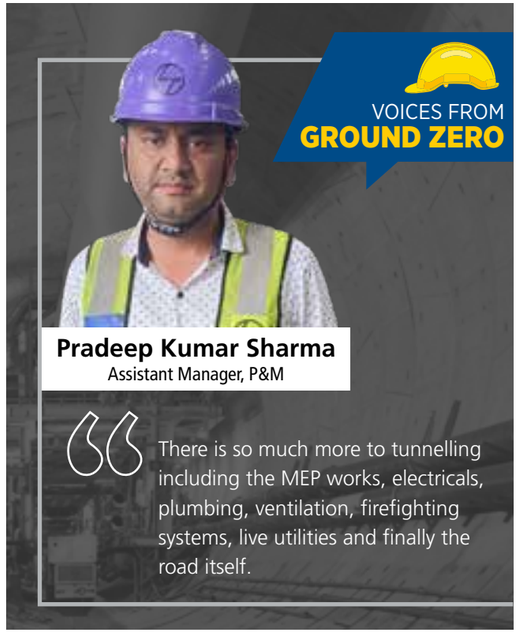
With 11 strategically placed cross passages for fast evacuation, the tunnels will be equipped with heat sensors, CCTV-based advanced traffic controls, Saccrado ventilation systems to pump in fresh air to main air parameters while work is in progress. The 2,072 rings in the tunnel consist of 16,576 precast concrete elements each weighing some 9 tonnes, equivalent to an empty truck.

Once work started, the TBM smoothly burrowed its way to the end of the tunnel and then the team was faced with the arduous task of dismantling the TBM underground, lifting it part by part to the surface, transporting it to the new location where the second tunnel was to be launched, reassembling and lowering it to start boring. "All this would have taken several months and that is when our brainstorming gave us an absolutely out-of-this-world idea," Sandeep pauses, perhaps thinking back to the moment when he had to take that call to go ahead with their plan. Their idea was to rotate the TBM in the tunnel itself and revise the TBM construction sequence. As per the earlier plan the 2nd tunnel was to be constructed from Priyadarshini Park to Girgaon Chowpatty site like the 1st drive which would have involved 6 months of work to dismantle the TBM, transport and re-assemble it at Priyadarshini Park. "We rotated the TBM inside the shaft and started the second tunnel from Girgaon Chowpatty within 3 months and saved us some 6 months of execution time in the process," says an elated Sandeep. This will not only help in reducing the tunnelling activity but will also facilitate the other successive activities like MEP works to be started earlier.





To execute such a massive project involving so many facets of construction, calls for deep understanding of all the deliverables, meticulous planning, and picture-perfect execution capabilities.



"We are through with almost 75% of the tunneling and should be able to achieve breakthrough by December 2022," says a confident sounding Pradeep Prasad, Construction Manager (Civil), Heavy Civil IC.

His colleague, Pradeep Kumar Sharma, Assistant Manager, P&M, Heavy Civil IC, reminds us that tunnelling is not only about TBM activity. "There is so much more to tunnelling including the MEP works, electricals, plumbing, ventilation, firefighting systems, live utilities and finally the road itself."

Both are unanimous that perhaps the most difficult aspect of MCRP is having to work and construct in the congested city of Mumbai. "In most places, we have very little space to maneuver," laments Sharma, "Constructing on Marine Drive is particularly challenging, not just because of the density of traffic but being one of the city's most important roads, very often our work is disrupted by VIP movement. This stop-and-start kind of work plays havoc with our delivery schedules and sometimes we have just 2–3-hour windows to work," he points out with a long face.

Considering its sheer magnitude and complexity, MCRP is a dream project for any civil engineer, opines A H Khan, Vice President & Head – Operations, Mumbai. "It involves tunnel cut and cover sections, huge reclamation, sea front protection with rocks of various sizes, underpasses, road works, large diameter monopiles, underground car park, viaducts with cast-in-situ, segmental launching involving girders and many more." To execute such a massive project involving so many facets of construction, calls for deep understanding of all the deliverables, meticulous planning, and picture-perfect execution capabilities. "The teams at both packages have been constantly deliberating with project consultants, designers, and the Employer to improvise upon the deliverables, for them to be aesthetically pleasing and sustainable, with sharp emphasis on digitalization particularly BIM implementation, on-line monitoring of resources and data validation for operation excellence."

November 2023 is fast approaching for Sandeep Singh and his hardy foot soldiers. They have already completed a large section of the seawall, almost the entire reclamation and a fair number of the land piles, monopiles and superstructure jobs. There is still a mountain waiting to be climbed but the team is ready and raring to summit it. ■

RREC PROJECTS MAINTAIN BUSINESS CONTINUITY DESPITE DISRUPTIONS

Even as the country awaits the arrival of India's first Bullet Train, several L&T teams are striving muscle and sinew, night and day, to build this extremely difficult infrastructure in challenging conditions and terrains at a speed unheard of in the Indian construction industry. At the MAHSR Package C-6, Task Force Leader, Mohan Ramesh, and team faces the challenge of working on the River Mahi to sink twelve wells and build the first of its kind large dia Shinso Pile of 7.2 m diameter on a National Highway. "We have to liaise with over 30 government authorities to construct the viaduct and bridges so that the services, roads, pipelines and telecommunication networks of these utility agencies remain uninterrupted," he shares the enormity of their mandate. "We also have to work closely with State and Central government authorities for the permissions for the crossings and the availability of work fronts."

Testing the ground

Soil testing and preparation of the foundation recommendation reports were the initial deliverables that involved government testing agencies, laboratories, and academic institutes. When matters started to stick in the mud, the project team established three state-of-art testing laboratories, compliant to ISO and NABL standards at site to undertake tri-axial and consolidation tests with renowned testing equipment. "Quicker testing meant speedier reports and recommendations on the deep foundations for the viaduct and bridges," quips Rajesh Srinivasan, Head – Technical Services. Special testing like Cross Hole Sonic Logging (CHSL) that confirms pile integrity to withstand loads were conducted on a large scale for the first time in India; special material approval committees and policies ensured that the product and services procured were compliant to meet the Employer's requirements.

VOICES FROM
GROUND ZERO

"The availability of moulds, launching equipment, and skilled craftsmen are inherent requirements and critical to deliver the project on time to quality. Now, with a supply chain within India aware of the construction technology we have adopted, a pool of talented engineers and other skilled human resources, and future-ready manufacturing set-ups, we are well placed to deliver to our Client's requirements.

Mohan Ramesh
Task Force Leader

The first set of Straddle Carrier, Girder Transporter & Launching Girder was commissioned in January 2022. All sixteen sets of the moulds are now being manufactured in India, for which vendors possessing adequate skills to adopt the technology and produce fit for purpose moulds and other necessary construction equipment have been developed.

Timely availability of material & machinery

Ready availability of heavy equipment was an issue since deliveries from China were severely affected due to the pandemic, port congestions and power cuts. "With project delivery on the line, we choose to look inward rather than outward," remarks Mohan. With the timely availability of the full span and segment moulds remaining top priority to commence round the clock operations of the casting yards, the team decided to manufacture the equipment within India, as a great example of the 'Make in India' spirit. As a result, the first set of Straddle Carrier, Girder Transporter & Launching Girder was commissioned in January 2022. All sixteen sets of the moulds are now being manufactured in India, for which vendors possessing adequate skills to adopt the technology and produce fit for purpose moulds and other necessary construction equipment have been developed.

Global situations including the Russian aggression in Ukraine and the Beirut blast sent the price of Ammonium Nitrate skyrocketing by 80%. Yet, the team maintained 24x7 operations of the five quarries and crushers to ensure non-stop supply of aggregates.

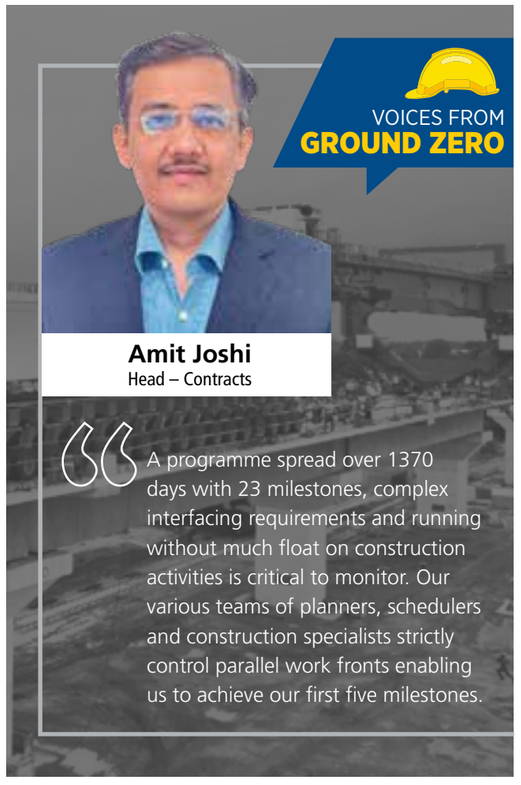
Speed is of the essence

The project's first 500 piles were completed in 135 days with the plan to complete 5,000 piles in 309 days. "We are gearing up to reduce the cycle time," affirms a confident Rajesh, "as shown by performing two full span castings in one day in our casting yard at Ch 434. The River Mahi foundation works cover twelve well sinking and our teams have attained to reach up to the scour depths for each of the wells before the peak of monsoon." With two casting yards fully operational with 16 sets of full span moulds, the full span girders are being casted rapidly to feed the viaduct construction. "Our fastest cycle time of Pile cap to Pier cap is 14 days at C6," Rajesh reveals. The shortest Pier with Pier Cap is 4.1 m and the tallest, 22 m; the tallest Pier over River Mahi is 32.9 m.

Digitalization is further improving the speed of construction. Presently, the team is performing time and motion studies over the casting yard operations involving the movement of inner moulds, straddle carriers, productivity of rebar fixing and concreting to reduce idling time, loss of production and thereby enhance value for the Client. "We have undertaken measures such as bar coding, RFIDs on the movable assets, forms, moulds to track and measure performance to reduce production cycle time," elaborates Mohan, "while our P&M is equipped with mechanisms to avoid down time, ensure preventive maintenance, avoid downtime and idling."

Maintaining stringent timelines & monitoring

"A programme spread over 1370 days with 23 milestones, complex interfacing requirements and running without much float on construction activities is critical to monitor," points out Amit Joshi, Head – Contracts. "Our various teams of planners, schedulers and construction specialists strictly control parallel work fronts enabling us to achieve our first five milestones." The activities are planned well in advance to gather the required resources to avoid slippages to the best extent possible.



A team of schedulers are controlling and monitoring resources through a three-week look ahead and reporting mechanism and working round the clock to fulfil the Client's requirement to have an online reporting Project Management Information System [PMIS] using Oracle's Primavera Unifier platform, which is presently running as a pilot project. The information is keyed in real time to formulate dashboards and enable high level monitoring to overcome challenges and remove site constraints.

Harnessing manpower & combatting bad weather

As the Project progressed, there was scarcity of skilled manpower, especially for pre-casting full span girders, being cast for the first time in India. With the pandemic depleting the workforce, the CSTI played a vital role to train 600 personnel in welding, steel fixing, masonry, and land survey. "Our craftsmen have successfully completed training in rebar fixing, formworks, concreting and have been absorbed into the project," remarks Mohan.

The Cyclone Tauktae and some exceptionally heavy rains have threatened to severely disrupt operations, but the team is holding its own and pushing progress.

"The availability of moulds, launching equipment, and skilled craftsmen are inherent requirements and critical to deliver the project on time to quality," sums up Ramesh. "Now, with a supply chain within India aware of the construction technology we have adopted, a pool of talented engineers and other skilled human resources, and future-ready manufacturing set-ups, we are well placed to deliver to our Client's requirements." He is happy that the site has already clocked 6.4 million safe man hours and measuring up to the immense interfacing requirements.

MADHYA PRADESH EXPRESSWAY - DRIVING FOR A TOUGH DEADLINE

The Madhya Pradesh Expressway, Package no 22 was awarded by NHAI with the clear understanding that it had be completed in 2 years. Situated near Ratlam, the team has to construct 25 km of perpetual flexible pavement, 33 Bridges, 48 Culverts, 16 Underpasses, 1 ROB and 2 interchanges involving 60 lakh cum of earthwork, 7.5 LMT of asphalt and 2.5 lakh cum of concrete. Once completed, the Delhi Vadodara Expressway, of which the MPE is a segment, will be the country's longest under the flagship Bharat Mala programme.

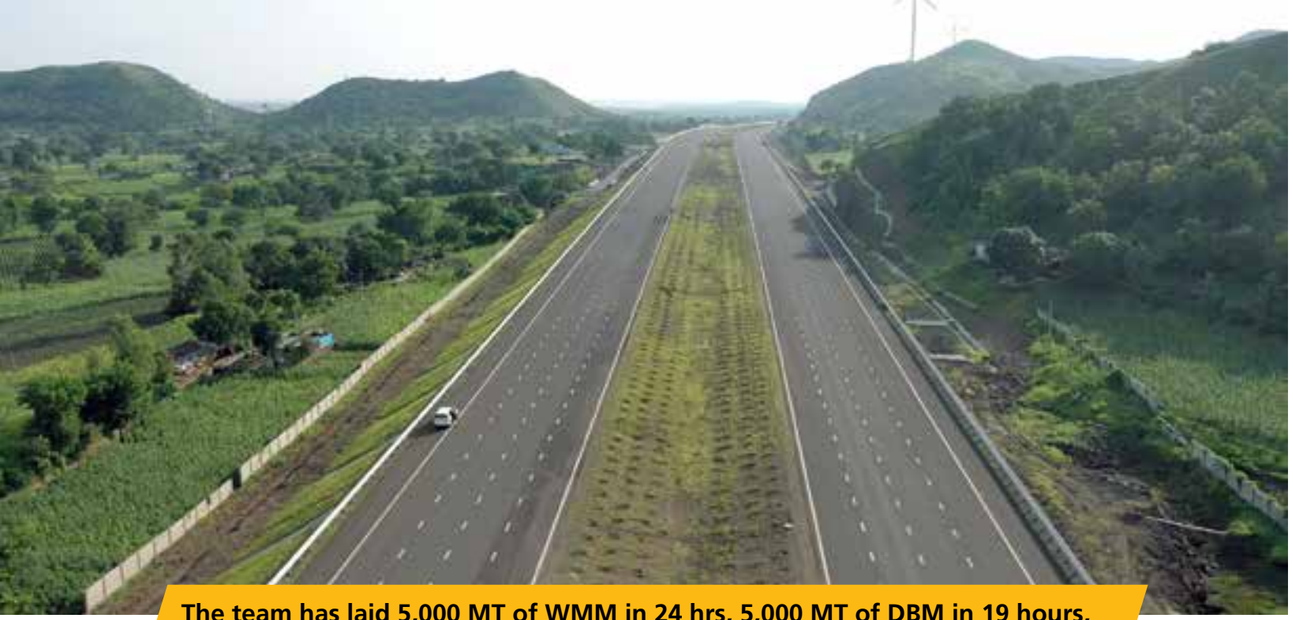
Firing on all cylinders

Mobilization began in July 2020, almost 4 months before the appointed date, right in the middle of the monsoon and the pandemic storm. "Soon all the plants and precast yards were set up and the statutory approvals were obtained within two months," informs Project Director, Jeeva David, who seems to be on top of things. "Our effective liaising and relationship building with the Authority, CALA and other local authorities helped to resolve local issues and obtain nearly 90% of the land on the appointed date."

Post the RREC conclave, it was decided that 95% of the critical designs and drawings would be approved at the preconstruction stage, which was a huge head start. The team planned and ensured to run all the plants with EB power instead of DGs and installed solar plants that significantly reduced costs. "With this massive 'push', we commenced the WMM works in the third month and asphalt paving works in the fourth month from the Appointed Date," informs Project Manager, Anil Kumar Sachan.

Micro-planning, strict monitoring and tireless efforts helped the team achieve their first milestone of 10% of invoice 168 days ahead of schedule, the second milestone (35% of invoice) 218 days ahead of schedule and third milestone (70% of invoice) 155 days ahead of the schedule.

Micro-planning, strict monitoring and tireless efforts helped the team achieve their first milestone of 10% of invoice 168 days ahead of schedule, the second milestone (35% of invoice) 218 days ahead of schedule and third milestone (70% of invoice) 155 days ahead of the schedule. "Our success is thanks to several new initiatives like using 100% crusher sand instead of river sand, constructing a Gabion wall in place of a RCC retaining wall, utilizing 4 lakh cum of rock cut materials as rock filling in the high embankment stretches and opening up fronts by talking all activities in parallel," flags off Planning In-charge, N V Dhananjaya.



The team has laid 5,000 MT of WMM in 24 hrs, 5,000 MT of DBM in 19 hours, continuously laying 15,000 MT of DBM within a stipulated time of 69 hours and more than 80,000 MT of asphalt in the months of May and June 2022.

Overcoming disruptions

Although the pandemic proved to be a huge speed-breaker, the project team have stuck to their guns and in their concerted effort to make up for lost time, have created several records along the way. The team has laid 5,000 MT of WMM in 24 hrs, 5,000 MT of DBM in 19 hours, continuously laying 15,000 MT of DBM within a stipulated time of 69 hours and "more than 7.50 lakh MT asphalt produced and laid within a period of 15 months is the highest for any road project till date in L&T," enthuses Anil, "and our quarry and crusher teams completed 25 LMT of crushing in a span of 15 months and crushed 17,000 MT of aggregates / GSB in a day."

Anil is delighted that the project has not received a single customer complaint throughout the year, it has been appreciated by NHAI and won several awards including The Best Contactor Award, the award for achieving targets within the timeline, and appreciation awards for both the Project and Liaising Managers. "It has been our constant endeavour from the word 'go' to never lose sight of our various milestones and to deliver a project in time to quality and safety," sums up Project Director, Jeeva David J, visibly proud of his team's progress till date. "All projects have their own set of unique challenges and the MPEP is no exception but the difference is in how we, as a team, are standing shoulder-to-shoulder to overcome the roadblocks and forge ahead. That our client is cognizant of our effort, appreciates our work and trusts in our capabilities are a huge bonus for us."

INTEGRATED TRANSIT CORRIDOR - CONSTRUCTING IN THE HEART OF BUSTLING NEW DELHI

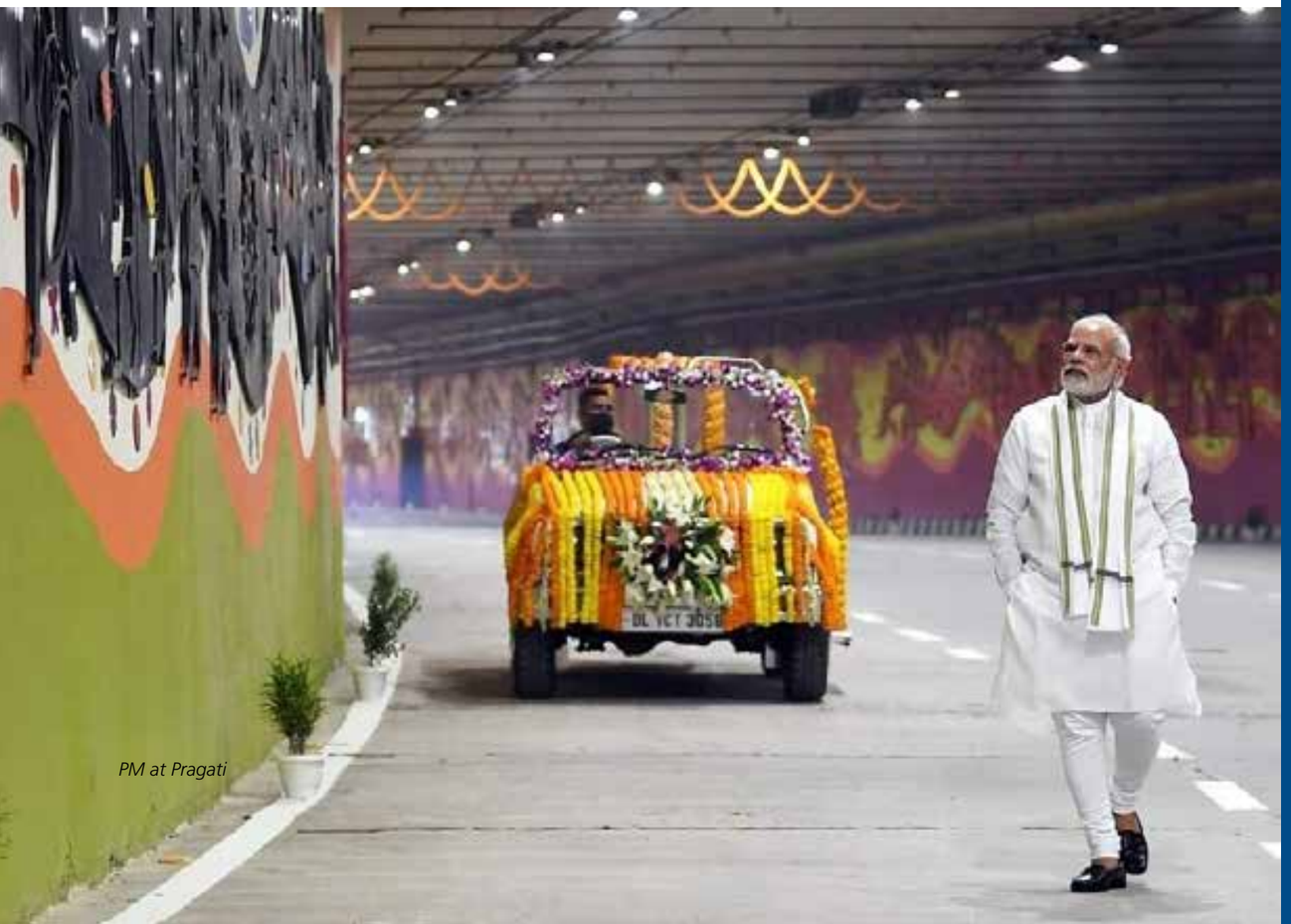
The Integrated Transit Corridor, part of the redevelopment of Pragati Maidan, was planned by the Central Government to tackle the traffic woes due to a perpetually clogged Mathura Road and a choked Ring Road-Bhairon Road. An elaborate traffic solution has been designed to ensure that all the road crossings would be signal free, and capacities augmented. RREC is constructing a 1.6 km tunnel and 5 underpasses as part of the Pragati Maidan Project that was inaugurated on June 19th, 2022, by the Prime Minister of India.

However, when work kicked off in November 2017, Project Director, Ajay Asthana, and team were greeted by various challenges. "Shifting live utilities in an urban environment meant coordinating with different government utility agencies and despite utility shifting being in the client's scope, we deployed our Utility Shifting coordination team to speed things up," notes Ajay. The result was that all the major utilities were timely and quickly shifted that won PWD's appreciation.

How unique is the project!

- Construction involved the longest box pushing (460 m inside the tunnel; 220 m in the underpass) and the widest (each box of 14.8 m) below a trailway track in India
- India's widest (varying from 25.2 – 35.2 m) urban tunnel for traffic (6 lanes with 4 branch tunnels & 2 cross tunnels plus a cross sewer tunnel)
- The only tunnel in India where a building tower sits on top of a tunnel slab
- Ground water table stabilization by a well point system – maximum lowering depth of 20 m; average of 10 m

Traffic is an ever-present hazard for road projects but in this case diverting thick traffic yet maintaining a smooth flow and proceeding with construction was a huge balancing act. The team skilfully planned the diversions and ensured that the structures could be completed without issues that again won accolades from the Government bodies and daily commuters.



PM at Pragati

An Indian record: 70,000 sq. meters of artworks based on traditional Indian concepts

The project required excavation of up to an average depth of 8-10 m below the ground level. De-watering was a major challenge with the River Yamuna flowing close by and high ground water tables. Construction was carried out by lowering the ground water table using an elaborate Wellpoint dewatering system. Planning Manager, Ms. Sweta Chaturvedi, refers to the box pushing method that the team adopted. "This is one of the longest & widest box-pushed tunnels below 7 railway tracks (280m length) and built such that it will not hinder future railway expansions," she says. An exhibition Hall No.6 is being built on the slab of the tunnel resulting in a few columns resting on the tunnel with each column's vertical load being around 3,000 tons.

"Managing the complexity of a high ground water table, the critical challenge of box pushing below 'live' railways tracks, constructing below major Delhi roads with 'live' traffic above and, most importantly, the extreme weather conditions that varied from 50 degrees in summer to 1 degree in winter were challenges," points out Subhash Singh,Senior Manager-QA/QC, "but the PM's appreciation and achieving the final COD from client gave me immense satisfaction."

Stunning murals floors the PM

This project boasts of the longest artwork of around 70,000 sqm representing various forms of Indian culture – festivals, rituals, seasons and more. During his inauguration address, the Prime Minister of India quipped that he was a little late for the event as he abandoned his buggy and walked to study and enjoy the murals. The 1.36 km long wall starts on Purana Qila Road, passes under Pragati Maidan, terminating on Ring Road. The tunnel that features an artery and four branches, slashes travel time between central and east Delhi and the satellite towns of Noida & Ghaziabad by about 15 minutes. Although ranging in width from 28.2 m to 42 m, the Pragati Maidan tunnel is India's widest urban road tunnel.

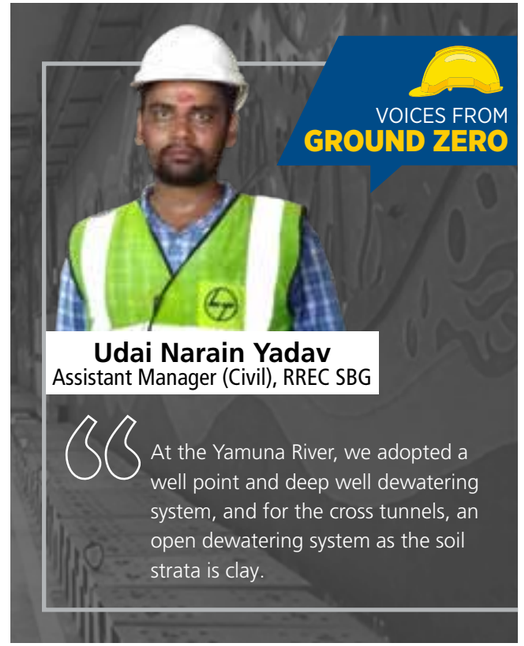
The project team's challenges ran both high and low! Structures had to be constructed near the Yamuna River at 5.69 m below the water table, with two cross tunnels 8–9 m below the water table. "At the Yamuna River, we adopted a well point and deep well dewatering system, and for the cross tunnels, an open dewatering system as the soil strata is clay," informs Udai Narain Yadav – Assistant Manager (Civil), RREC SBG. The box pushing at the Underpass 05 embankment was at a height of 19 m above ground with the team's major challenge being the railway track that was skewed at 40 degrees. They pushed the box from a single end with the help of hydraulic jacks and power packs and have thus far successfully completed 175 m of the total 215 m.

"The tunnel will be equipped with the latest smart MEP features like smart lighting, active firefighting systems, passive heat sensing systems, mechanical ventilation & automatic pumping systems, a digital traffic management system with CCTV security, telephones, and public announcement systems," informs Ajay. 28 bidirectional German-made jet fans ensure ventilation, while sensors continually measure carbon dioxide and visibility levels, and an optical-fibre-based linear mechanism will detect heat levels that will trigger sprinklers if the temperature rises above permissible levels.

The project will create a distinct 'green' advantage as it is estimated to help reduce CO2 by approximately 13k Tons/Year, an average saving of 8 min/vehicle of waiting time and an average fuel saving of around 55 lakhs liters per year. Besides this, 15,688 trees have been planted on the Yamuna Belt.

"Apart from the extremely complex location of the project in the heart of Delhi, we successfully overcame the several challenges of NGT/Central Pollution Control Board/various law enforcing government departments, the lengthy farmers' agitation, CAA and Covid restrictions," mentions a relieved Subrat Kumar Parida, Manager - FA&A. "We, however, kept up our untiring efforts under the guidance of our Project Director to successfully complete our project," he rounds off jubilantly. ■

The Pragati Maidan tunnel is India's widest urban road tunnel.



PT&D IC DELIGHTS CLIENTS BY ENERGIZING THEIR PROJECTS!

TUNNEL ELECTRIFICATION AT THE UDHAMPUR–SRINAGAR–BARAMULLA RAIL LINK PROJECT, JAMMU & KASHMIR

The Government of India has planned a 272 km long railway line from Udhampur to Baramulla under the Udhampur–Srinagar–Baramulla Rail Link (USBRL) Project as an alternative and reliable transportation system for the people of Jammu & Kashmir. The 112 km long Katra–Banihal section is the missing link that will connect the Kashmir Valley to the rest of India. Declared a 'national project' in 2002, this is perhaps the most challenging project undertaken by the Indian Railways post-independence that involves the construction of several tunnels and bridges across extremely rugged and mountainous terrain.

Apart from 38 tunnels, including what will be the country's longest transportation tunnel, the project also comprises a whopping 927 bridges, among them the iconic Chenab Bridge, the highest railway bridge in the world, and the Indian Railways' first cable-stayed bridge on Anji Khad, supported by 96 cables. The entire electrical and mechanical (E&M) scope of the project has been divided into multiple packages.

KRCL Power Distribution Package for Tunnels T1, T2, T8/9, and T10

The package comprises Tunnels T1, T2, T8/9, and T10, with 11 km of main tunnels and 5 km of escape tunnels, located at an altitude of 980 m, and the scope for PT&D IC includes the construction of five 33/11 kV gas insulated substations, eight 11/0.430 kV substations, six of which are inside the tunnel, and HV cabling at the under-construction Anji Khad Bridge.

Obstructions make for a treacherous, uphill climb

Much like the project's location, the disruptions have been mountainous too. To start with, the handover of the tunnels

VOICES FROM
GROUND ZERO

Dileep Kumar Verma
Project Manager

We have achieved 40% of project progress and are targeting completion by June 2023 through micro-planning, constant reviews, and training engineers to execute multidisciplinary activities by deploying the available digital tools.

in workable condition was delayed. In fact, even today, Tunnel T1 is yet to be handed over, and work on the Anji Bridge is still under progress. Limited availability of space is another issue, with the team having to literally break rocks to forge ahead! "We developed land by hill-cutting and constructing retaining walls ranging from 1.5 m to 8 m height," reveals Project Manager Dileep Kumar Verma. Access to the site is challenging due to frequent landslides and stone shooting.

Deploying and retaining manpower is tricky due to, among other issues, the local vs. non-local rift and militancy movements. "Skilled migrant workers are reluctant to work in this region," explains Planning Manager Sunil Kumar Maurya with a serious look. "To retain them, the labour colony is equipped with facilities such as room heaters & blankets for the winter and false ceilings to reduce the summer heat, with police night patrolling, organized with the help of the local administration. We have also encouraged localization by asking subcontractors to engage more than 50% of local labour to avoid unrest."

Complications of all shapes and sizes

To add to the space constraints, the tunnels are of varying sizes and non-uniform shapes: some D-shaped, some elliptical, some modified horseshoe, and so on. Various agencies are involved, with the engineering, interface, and installation of equipment inside tunnels requiring precision to avoid any infringement with the schedule of dimension (SOD) of the train. But thanks to careful collaboration with the agencies, the process has been smooth. "We closely coordinate with the detail design consultants (DDCs) and other agencies for timely resolution of any infringements to avoid rework," confirms Construction Manager Arvind Singh Panwar. "Before the start of every activity inside the tunnels, we perform a mock-up to ensure suitability for fitment."

Laying the 33 kV cable weighing 20 kg/m at a height of 6 m inside the tunnel was a tall ask, for which customized scaffolding was used. "We have established a full-fledged fabrication yard for TMT and fire protection pipe for cutting, bending, grooving, and painting to ensure better quality, safety, speed and to minimize scrap," remarks Sunil.

The USBRL is a complex project with various systems and two DDCs to verify engineering drawings and vendor documents. "The digital tool 'Align' has worked wonders for us to micro-plan and monitor the progress of engineering, procurement,

CLIENT ACCOLADES

The L&T team has made an outstanding contribution in implementing labour laws and statutory compliances despite several unfavourable conditions, particularly during the COVID-19 pandemic.

- Regional Labour Commissioner of Jammu

Tray and cabling work inside Tunnels T8/9

VOICES FROM
GROUND ZERO

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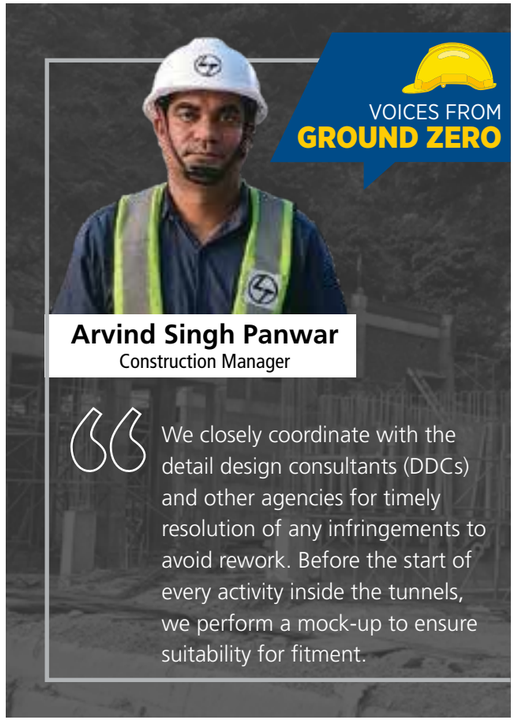
Sunil Kumar Maurya
Planning Manager

T5P1 33/11 kV GIS Portal Substation and Firefighting Pump House under construction



and construction," mentions Arvind with a smile. Other digital solutions include M-power, WISA, QIR, and Shield apps.

The hilly terrain and tunnels call for special attention towards workmen safety. "We provide regular onsite activity-specific training on different aspects of safety while working near hilly areas and inside tunnels," elaborates EHS In-charge Sanjeev Kumar. "Two-wheeler movement at site is banned and monitored meticulously. We also regularly monitor oxygen levels inside tunnels to ensure safe working conditions that has won us a RoSPA Gold in 2022!" His delight is obvious.

Efforts well recognized

"From the beginning, we have maintained positive cash flow and negative working capital by timely invoice certification and collection from the customer," beams Project Accountant Gopi Marripudi.

The client has been lavish in their appreciation for the team's efforts to tackle the difficult obstructions. "The L&T team has made an outstanding contribution in implementing labour laws and statutory compliances despite several unfavourable conditions, particularly during the COVID-19 pandemic," the Regional Labour Commissioner of Jammu had applauded when presenting the team with an Appreciation Certificate.

"We have achieved 40% of project progress and are targeting completion by June 2023 through micro-planning, constant reviews, and training engineers to execute multidisciplinary activities by deploying the available digital tools," Dileep says, signing off with a confident thumbs-up.

KRCL Power Distribution Package for Tunnels T3 and T5

The E&M work for this package includes the supply, erection, testing, and commissioning of 33 kV and 11 kV HT power cable network, GIS substation, DG sets, tunnel ventilation system, tunnel lighting, SCADA, and firefighting systems for Tunnels T3 and T5, between kms 39 to 52 on the Katra–Dharam section of the USBRL.

Meticulous measures employed

The project team began their survey jointly with the Konkan Railway Corporation Limited (KRCL) to identify locations for the substation and firefighting buildings. "We finalized the design after several visits considering the space constraints and seismic zone-V," explains Planning Head Tanmay Dwivedi. "551 detailed design/engineering drawings were prepared with each minute detail captured, checked, and approved by the client."

Automation is propelling project progress: STAAD.Pro for building designing, DIALux for lighting, and Acoustic Study for designing the public address system. "The entire system is so designed that all the tunnel utilities and substation equipment can be controlled through a SCADA system from anywhere, be it a SCADA control room, a railway station control room, or the J&K railway HQ," clarifies Project Manager Nandalal Chandra.

A well-strategized plan

Owing to the tough terrain, Tanmay and team have planned the material on a stagewise basis, monitored as per the execution schedule. "By coordinating with all the stakeholders and ensuring positive cashflow throughout the project cycle, we have managed to meet all project deliverables on time," explains Tanmay.

The unavailability of skilled labour in Jammu & Kashmir has been addressed by arranging a labour colony with all basic facilities to retain workmen, which has also helped maintain quality standards. "We have ensured that the materials delivered at site are as per approved designs and the GPRS Tunnelling Protocol (GTP) and have implemented quality standards as per the client's approved field quality plan and method statements," says Quality Head Vishnu Kumar emphatically.

A Hazard Identification and Risk Assessment (HIRA) workshop was conducted at the beginning. EHS Head Nishant Kumar and team, through continuous monitoring, ensure that all identified risks are mitigated well ahead of time. "From the word 'go', all SOPs related to COVID-19 were implemented at each level," elaborates Nishant. "Hence, we were able to continue the project work even during peak COVID waves." Nishant and team regularly monitor all PTPs and related observations through the Shield app. A safety culture has been inculcated at site through periodic physical training as well as VR training.

CLIENT ACCOLADES

Resonating with their brand image, we find that despite the tough terrain, adverse weather conditions, and the tough geology of J&K, L&T's performance, quality of work, and project management have greatly contributed to the esteemed project of connecting Kashmir to the rest of India. L&T is rightly labelled as nation-builders.

– Jitendra Kane, Assistant Electrical Engineer (Project), Konkan Railway, Reasi

On the digital front, project progress is being tracked using the Align tool, QIR, Shield apps and WISA and the project has migrated to PROnTo for centralizing the planning module.

Providing value for the client

"The client has appreciated us for maintaining excellent safety and quality standards in the project," signs off Nandalal. "By maintaining good relationships, we have met all our financial targets including settlement of price variation claims."

Speaking of client delight, Jitendra Kane, Assistant Electrical Engineer (Project), Konkan Railway, Reasi, said it best when appreciating L&T's work at the project: "Resonating with their brand image, we find that despite the tough terrain, adverse weather conditions, and the tough geology of J&K, L&T's performance, quality of work, and project management have greatly contributed to the esteemed project of connecting Kashmir to the rest of India. L&T is rightly labelled as nation-builders!".


T3P2 33/11 kV GIS Portal Substation under construction

REPLACEMENT OF OLD AND OBSOLETE SUBSTATIONS IN MAA REFINERY, KNPC, KUWAIT

The Kuwait National Petroleum Company's (KNPC's) Mina Al Ahmadi (MAA) refinery was built in 1949 with a capacity of 25,000 barrels per day (bpd) to cater to local demands. After two phases of modernization over the years, its processing capacity has increased to 466,000 bpd. In 2020, PT&D IC was awarded the project to provide a new network of distribution substations with the latest technology by replacing the 9 existing substations at the MAA refinery and the North Pier area operating with old/obsolete switchgears and systems that were built in 1981.

The scope of work and new facilities includes the construction of 3 blast-resistant and 2 non-blast-resistant buildings; supply, installation, and commissioning of 11 kV switchgear of 50 KA fault level with Is-limiter and Ultra-Fast Earthing Switches; real-time study of the electrical network using E-TAP online; sequential load transfer of 1,500 active loads from old to new substations; and electrical and instrumentation cable laying of over 350 km, among others.

An area rife with difficulties

To begin with, the site location was challenging. Being the largest in Kuwait contributing significantly to the national economy, the refinery is a strategic asset situated in a high-security zone with restricted access. In addition to the presence of several hydrocarbon processing units and off-site facilities, the refinery is prone to hydrocarbons and H2S gases exposure and the salt-laden sea air is corrosive. There were other severe constructability restrictions caused by cables, fire hydrants, and other process unit facilities in and around the site.

The critical load-shifting activities had to be carried out without shutting down the plant, and the work at the North Pier was 1.5 km offshore. With commodity prices sky-rocketing and a global shortage of electronic components, containers, and vessels, the project team was severely tested to manage costs and timely deliveries.

Tackling issues prudently

Taking one thing at a time, the project team started by negotiating the schedule to begin from September 2020, against the original schedule of May. "This helped us gain an advantage to identify resources early," says Project Manager Ashwani Kumar Tyagi. "We got a head start to carry out survey activities, fulfil advance prerequisites, and ensure availability of key personnel right from Day One."

For manpower mobilization, the team was well prepared. The Kuwait government had stopped issuing visas to contractors to prevent the spread of the pandemic therefore the team took the client's help to mobilize L&T manpower. "We were able to utilize several positions like Procurement, Planning, and Costing Engineers from other L&T projects, saving indirect cost," reveals Planning Lead Vishal Nandkumar Raje. "This continued until December 2021 when Kuwait and India lifted their travel bans by which time, we had already completed 50% with minimal resources!. Delays were inevitable during the pandemic, and the team proactively conducted a workshop with KNPC to reduce the customer approval cycle time. "We merged the approval processes for RFQ and TBE," explains Vishal. "All documents relating to a particular equipment were submitted together, which significantly reduced the approval time." To tackle the high commodity prices and logistics challenges, the team adopted special approvals from the client:


HV Switchgear

- DG (change in COO): The client accepted material from component manufacturers in the approved CEC/VEC list where the assembly was happening outside the component manufacturer's location.
- Cables (change in insulation material): The client was briefed about the benefits of a new material, Hyperon, over lead, the material prescribed in the specification.
- DC UPS (change in battery rating): A deep dive by the technical committee revealed that the initial specifications of an 8-hour backup would waste natural resources and money. The client accepted the reduction of battery backup to 1 hour, sufficient for the smooth running of the system.
- HVAC (change in SC methodology): The contractual requirement was to order HVAC as a single package, but the client allowed L&T to integrate HVAC components.

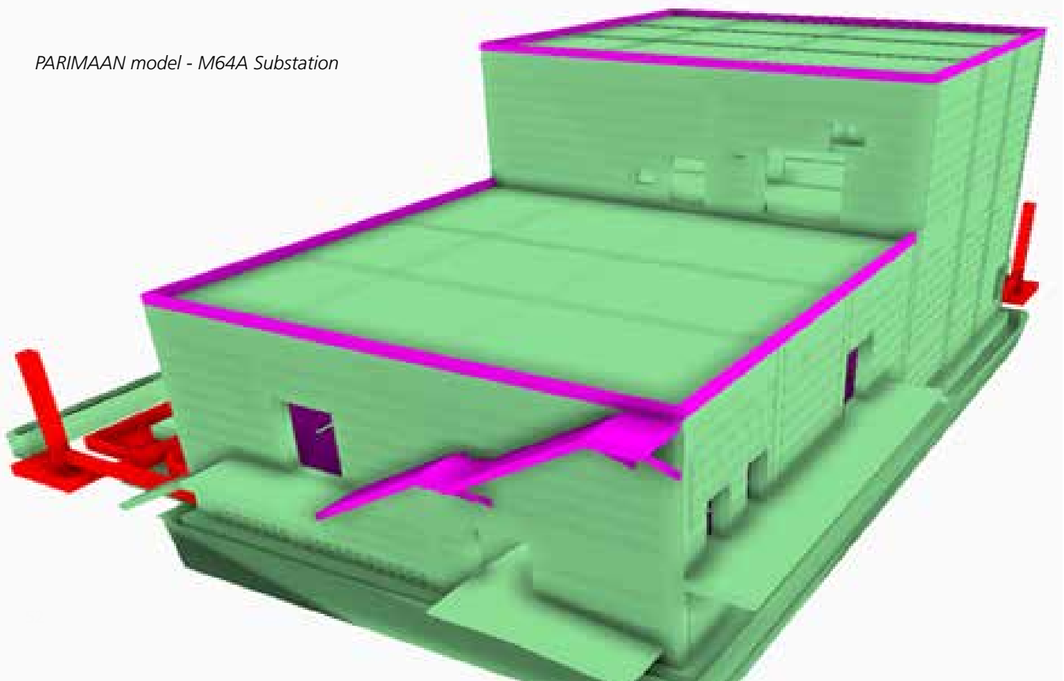
These changes helped the project get lower vendor quotes and order placement. "We solicited and obtained unit-rate validities for extended periods," adds Vishal, "and expedited orders by following up directly with the sub-vendors when needed." The team took the support of L&T offices in nearby countries for manufacturing and conducting stage-wise inspections. The client too helped mount necessary pressure on vendors whenever required.

On the subcontracting front, the building work was broken down into blast-proof and non-blast-proof buildings to ensure sufficient availability of manpower and resources. Vishal throws light on their plan: "We specifically targeted companies that were not already overloaded with orders with idle resources in Kuwait. It also helped us obtain special rates from subcontractors that were lower than our in-house working rates," he says triumphantly.

A strategic approach

The project commenced with SMART goals defined and dedicated teams deployed for critical path activities. Adequate funding was ensured to avoid slippages in activities owing to budget constraints. "We conducted a risk analysis at initiation to identify issues early and resolve them immediately before they could affect the project," says Quality Head Vasudevan Jayaraman, "and continually monitored subcontractor productivity through daily progress reports (DPRs)." A Critical Task Risk Assessment (CTRA) was conducted for critical activities to identify risks and brainstorm over feasible resolutions.

In terms of material management, Ashwani Kumar and team have implemented technologies such as connected drums, "to reconcile cable drum lengths and minimize cable scrap," he explains. "Similarly, cross-docking project equipment directly on their designated foundations has helped avoid double handling of material. We also link monthly reconciliation statements with progress measurements of subcontractors." The team has managed to get the central storage yard allocated within the MAA refinery premises, even though it was not a contractual obligation.



PARIMAAN model - M64A Substation

Night view of the M61A/M62A/M63A Substation

The Align tool monitors real-time monitoring, and with the Quality and Safety apps, learnings from one location help implement corrective measures in others. "Project data is stored on a shared server with access control," EHS Head Sameer Dawood Gangrekar says. "We have developed 3D, 4D, and 5D models for clash checking and monitoring, and virtual reality for HSE training."

A happy client, a happy project

"Our client, KNPC, has recommended us for the HSE Rolling Trophy, which is currently under management approval," Sameer shares proudly. The project has achieved one million safe manhours without LTI and has successfully completed a 'SAFOP' workshop.

The client is regularly apprised on progress updates. "At weekly review meetings, the customer can record their concerns and hear our plan to address routine issues," spells out Vasudevan. "From time to time, additions/deletions to the project's scope are highlighted through Change Order Requests and amicably agreed upon."

Over the course of the project, the team has maintained positive cash flow and reduced the collection cycle from the contractual 30 days to 10–15 days. "We have improved profitability and job margin and have maintained negative sales over invoice from commencement, which shall continue till completion," remarks Ashwani Kumar with a confident grin. ■

DELIVERING ON PROMISES, THE WET IC WAY

June 16th, 2022, will forever be etched in the minds of Project Manager Rajesh Madhaian and his team as the Hon'ble Chief Minister of Gujarat inaugurated the 100 MLD desalination plant, the first one constructed by L&T in partnership with Tecton, to provide water for industrial use to various industries of the PCPIR region of Dahej in Gujarat's Bharuch district, apart from providing water to the existing Galenda reservoir. Completed three months ahead of time, which released fronts for electromagnetic works, the Gujarat Industrial Development Corporation is a happy client with their vision realized.

CM inauguration

100 MLD WSRO Desalination Plant, Dahej

Realizing a vision

The '100 MLD WSRO Desalination Plant' project was awarded on July 31st, 2019, to the L&T-Tecton JV on an EPC-DBO (Design Build & Operate) basis with the scope comprising procuring the necessary statutory permissions, constructing and operating the plant for 10 years, located at the confluence of the River Narmada estuary at Rahiyad village.

"Typical desalination plants handle only salinity (TDS-Total Dissolved Salts) as they draw water from the sea," points out Rajesh, "but our unique plant draws a mix of river and sea water and has to handle varying tide levels. The project is based on SWRO (Sea Water Reverse Osmosis) membrane technology and houses robust pre-treatment units and the

Some of the project team's initiatives

External glazing: For building the RO and other structures, high-end external glazing was preferred to Galvalume sheets & masonry walls, which reduced both work at height and manhours by eliminating staging works, quicker release of structure for the subsequent electromechanical works and reduced daylight requirements leading to significant savings in power cost.

Precast cable trenches: Hastened the process and, by shifting the production to factory units, resulted in better product finish and significantly faster execution.

Precast boundary wall: Understanding the project requirements for unhindered access for transit mixers, mechanical equipment, piping works and such activities, the construction of the boundary wall was strategically delayed. However, the idea to process a 3 m boundary wall was a fallback plan to catch up with the schedule and, by fabricating it at a reputed vendor's premises, ensured that the material was ready while site preparations were underway.

latest filtration technologies." It has a unique energy recovery device too that salvages the energy of the rejected water to reduce overall power consumption; the resultant lowered power cost directly benefits the industries. Presently, 67 MLD has been booked by 22 industries with an additional 10 MLD reserved for GIDC.

For Planning Manager Madhup Sharma, the novelty was handling a sea-facing project. "Not only for me, but it was also the first time for the entire team," he grins, though procuring the statutory permissions & CRZ clearances was no laughing matter. "Our initial application was processed through the Gujarat Pollution Control Board, the Gujarat Maritime Board, the Gujarat state-level Technical Advisory Committee and the Gujarat Coastal Zone Management Authority," he ticks off the bodies involved on his fingers, "and the file was presented at the Ministry of Environment, Forest and Climate Change (MoEF&CC) meeting of August 27th, 2020. The technical proposal required modifications and the entire process had to be redone," he says, throwing his hands up in the air. In coordination with the Environmental Consultant, MoEF officials and, for several inter-departmental clearances, the design team, the CRZ clearance was finally given on September 30th, 2020.

All systems go

Rajesh led his team from the front, pushing vigorously for approvals, organizing & coordinating with representatives from the consultants & client for factory visits, optimizing quantity requirements with vendors, selecting premium vendors and, most importantly, adhering to execution requirements. In the process, they had some initiatives to write home about.

The huge task of handling, joining & laying humongous pipes

Another 'first' for the team was to handle the huge intake and outfall pipeline: 1,800 mm (wall thickness 114 mm) and 1,200 mm (wall thickness 49 mm). These were specialized pipes owing to their size with only a select few worldwide capable of manufacturing them. "The pipes delivered at site were approximately 12 m sticks that required to be joined by butt fusion welding," says Madhup. "Normal working sizes range between 300 and 600 mm, but these were far bigger." Closely interacting with fusion technology machine vendors and agencies (Mcelroy, Ritmo), by using various international code references and with the help of Vikas Kumar (CQM) and N. Nirapandian, Head QC, the site QC team was able to establish the WPS and PQR requirements for both the pipe

sizes. The test pieces were passed and accordingly both the machine and operator were permitted to join the pipes. Both 1,200 mm and 1,800 mm HDPE pipes were hydrotested and passed all consultant evaluations without comments.

Building the critical intake structures

The project's intake structures were on the critical path with several inherent challenges and risks that called for meticulous planning, engaging specialized agencies, handling heavy reinforcement cage lifts, deep excavations at 39 m, mud excavation through bucket and crane systems and managing huge water ingress requiring continuous dewatering works.

The intake pump house, travelling band screen and the inlet pipe chamber were constructed by the Diaphragm Wall method. Rajesh explains, "Normally, once the side walls are cast, the soil nailing is done to hold the walls in position along with the anchorage. In our case, the proximity to a water body on the southside, an existing ONGC well on the east side, a newly constructed earthen reservoir to the north side and a maintenance bay on the west side necessitated alternate methods for anchorage. The design team proposed interconnecting cross tie beams to hold the walls in position at four different elevations."

The challenge was that after excavating to a certain depth, one layer of beam had to be concretized and the next stage of excavation could only be started after the first beam achieved its necessary strength and, added to the congestion due to the network of beams, the team was staring at the prospect of five months of construction time for 5 levels that they could ill-afford. Quality Manager Dani Nirmal picks up the story: "The excavation, shuttering, reinforcement works, and concrete placement activities require a minimum duration, but the 'strength gaining' or stripping time can be altered; accordingly we decided to try out quick strength concrete." After discussions with Ultratech's cement expert team, two variants among OPC Gr 53 type cement were frozen, aptly branded RAPID (48 hours full strength) & FAST (5-7 days M35 strength). "We reduced cycle time by at least 15 days across 5 levels and achieved an overall period reduction of 85 days," sums up Rajesh jubilantly.

ALIRAJPUR LIFT IRRIGATION SCHEME – ANOTHER WATERSHED PROJECT

"Being an EPC project, we arranged for all the statutory permissions beginning with the environment & forest clearances, land acquisitions for permanent structures, electrical works, Railway, NH & other roads & river crossings to execute the work without local and political hindrances at site," describes Project Manager Sunil Thakre, giving an overview of the project. In terms of land acquisition, the project team's biggest challenge was to get 15 Ha at a stretch, which was well-nigh impossible as individual land holdings were often less than 0.5 Ha. "With a clear strategy and a time-bound plan, we completed the process of land acquisition for the factory, storage yards and various permanent structures within 9 months," says a relieved Sunil.

VOICES FROM
GROUND ZERO

"With a clear strategy and a time-bound plan, we completed the process of land acquisition for the factory, storage yards and various permanent structures within 9 months.

Sunil Thakre
Project Manager

Negotiating an uphill struggle

All pump houses and distribution chambers are on hilly terrains ranging from 15 m to 80 m in height.
"The Pumphouse-1 required 40 m deep excavation in weathered and hard rock strata," informs Planning Manager Abhishek Kumar Pandey."We completed the earthwork of 72,000 cum. safely within 98 days. Further, being in a submergence zone, we deployed the slipform technique to construct it in 18 months."

The 26 km Rising Mains (of 2,770 mm & 1,860 mm dia.) run through hills, valleys, and forest areas for 8 km, which called for special methods for safe earthwork. "The challenge was to transport the pipes in these hilly terrains, where P&M came in handy by deploying double axle trailers," remarks Sunil. "On an average, we had to develop new roads for every 500–800 m as the ROU couldn't be developed across hills." GPS systems tracked the transport vehicles as breakdowns in such terrains were common, with no proper mobile communication signals.

For the Rising Main Pipeline of 2,770 mm that passes through three hills of 20–30 m height across 650 RM, conventional methods were impossible as the limited ROU was in a forest area. The team therefore developed a Winch & Trolley method to lay the pipe safely without using a crane, which was recognized as the 'Best Innovative Practice' for 2019–20.

MS Pipelines of 400–2,770 mm dia. were laid along a 280 km stretch and HDPE ranging from 63 mm to 280 mm along 2,531 km to irrigate 35,000 Ha. Totally, 1,742 OMS boxes have been fixed to cover approximately 20 Ha with PFCMD controllers to control/regulate the water flow, discharge, and pressure and deliver water to eight 2.5 Ha chaks with minimum residual head of 20 m from each OMS box. These OMS boxes have antennas to send and receive signals from the Master Scada room housed at PH3 by means of LORA technology. The electrical 132 kV transmission lines for 30 km and 33 kV for 10 km were laid in hilly terrains to meet the demand of 35 MW to power all the pumphouses to pump water with mammoth pumps and motors of discharges varying from 6,870 cum./hour to 7,560 cum./hour.

Abhishek is delighted that the project won the 'Digitally Enabled' award in 2019 for the slew of digital solutions employed at site including View EHS, QIR, PQI, ePragati, GIS Progress Monitoring, EDMS, BIM Progress for Pump House-1, VPR (Vendor Performance Rating), P&M IoT & WISA.

Alirajpur LIS Site

Alirajpur LIS Site 2

For the Rising Main Pipeline of 2,770 mm that passes through three hills of 20–30 m height across 650 RM, conventional methods were impossible as the limited ROU was in a forest area. The team therefore developed a Winch & Trolley method to lay the pipe safely without using a crane, which was recognized as the 'Best Innovative Practice' for 2019–20.

Automation to the fore

A major decision the team took was to establish a spiral factory at site that manufactured more than 350,000 RMT of pipeline of thickness varying from 3.15 mm to 7 mm in a span of 22 months, catering to three different projects within a radius of 250 km. Sunil reminds that established spiral mills run by reputed organizations in the country had ruled out the possibility of manufacturing pipes of 3.15 mm thickness. "Our QA/QC and site teams under the able leadership of K Prabakaran put up the factory in 4.5 months replete with a BIS license." Similarly, other processes like painting and guniting were mechanized with the latest technology plants for mass production of finished MS Pipe to meet the laying & joining targets, going a long way in winning the client's confidence.

The 28,500 MT of MS bare pipes (2,770 mm to 1,300 mm dia.) and around 14,500 MT of MS pipes (1,200 mm to 400 mm dia.) that were fabricated at site required the Gunniting & Epoxy coating before transporting them, for which automated Gunniting & Coating plants were established at site. Other than the pipes, huge pumps & HT motors, transformers, flow meters, butterfly valves, electrical panels, VFD panels, etc. were moved through hilly and uneven routes using heavy duty trailers and expert teams to the pumphouses and erected successfully.

Other challenges included mobilizing manpower & skilled labour in an area like Alirajpur district, with 99% population being tribal adivasis. The team, however, managed to retain 90% of their workforce. More than 200 subcontractors have been engaged at site for different site works and about 20-25 local subcontractors developed for the HDPE Pipeline, inline civil works, etc. All the workmen and employees have been adequately trained in EHS & Quality, and various training sessions on self-development of employees were organized through the segment and HQ for the team to improve their technical and management skills.

VOICES FROM GROUND ZERO

"The Pumphouse-1 required 40 m deep excavation in weathered and hard rock strata. We completed the earthwork of 72,000 cum. safely within 98 days. Further, being in a submergence zone, we deployed the slipform technique to construct it in 18 months.

Abhishek Kumar Pandey
Planning Manager

16 SCHEMES. 21,300 HA. 115 VILLAGES. 21,684 BENEFICIARIES.

Cluster XII Site

Project Manager S S Mani and his team at the Mega Lift Irrigation Project, Cluster XII, in Odisha have been mandated to construct 16 pumphouses & MCC rooms and eight 33/11 kV substations, lay 260 km of DI pipelines & 909 km of HDPE pipelines, create 5,276 total outlet systems, lay 76 km of transmission lines, and put up 53 VT pumps to achieve a total discharge of 77,737 cum. per hour. Mani's focus is on the client, and his approach is clear: to keep them on his side. "Anticipate their needs and objectives, communicate regularly, perform exceptional work to their satisfaction, take regular feedback from them and the PMCs, and maintain good relationships to build long-time associations and thereby delight the customer."

As with most water infrastructure projects, initial survey, finalizing the cultivable command area, land acquisition and RoW were their initial challenges. "To identify and finalise 21,300 Ha of cultivable area, we conducted a topographical survey for around 1,000 sq. km area covering 115 villages in 7 blocks," informs Planning Manager T Arulgnanam, "to determine the locations for the pumphouses & substations, route of the pipeline network, and power connectivity." The survey had to be conducted across various terrains, dense forests, habitations, canals, nallas, the works. Since most of the schemes are in Sundergarh, which is considered a scheduled district, land acquisition involved an SIA (Social Impact Assessment). Political inferences were addressed with the help of the local district administration.

VOICES FROM
GROUND ZERO

Anticipate their needs and objectives, communicate regularly, perform exceptional works to their satisfaction, take regular feedback from them and the PMCs and maintain good relationships to build long time associations and thereby delight the customer.

S S Mani
Project Manager

Automating SCADA – another 'first'

The Megalift Irrigation Project, Cluster XII is the first project in Odisha to use the SCADA (Supervisory Control and Data Acquisition) and Automation concept. The 21,300 Ha of irrigation land is operated through 5,325 Outlet Management Systems (OMSs) installed at every 4 Ha chak. Network connectivity towers have been strategically installed for seamless communication through the LORA network system from the central control room to the OMS installed on agriculture land. All the 5,325 OMSs are operated and monitored from a central control room situated at one of the Pumphouses, Semina-II, with the help of SCADA to monitor and control the equipment and gather and analyse real-time data for enhancements.

RoW was another thorn in their flesh as the major scope involves DI & HDPE pipeline network of 1,169 km covering 115 villages and 76 km of transmission lines that pass through several villages and reserve forest areas where the team faced severe resistance from the local farmers. The IR team did their bit by procuring approvals from the various District & State headquarters to construct on forest lands.

Supply, resource & contract management

"Optimizing the design and locations of the pumphouse & command area during detailed engineering helped to reduce the distribution network's HDPE pipe length & electromechanical items, saving cost as compared to the prebid stage," informs Mani. All the electromechanical items (DI & HDPE pipes, pump, motors, electrical panels, transformers, etc.) were procured efficiently to minimize the working capital cycle for conversion to cash. Resource mobilization of subcontractors, materials and P&M was planned well in advance, and contractors were engaged immediately after the monsoon to achieve maximum progress in the 6-month working season.

The team strategically focused on submission, certification & collection of running bills from the client within the stipulated time, which helped them maintain a positive cash flow and a negative working capital throughout the project period. Digitalization is through e-Pragathi, View EHS, Power BI, QIR, P&M IoT & WISA.

Cluster XII, Prtoject Team

IASTW – PHASE 3A: SIMPLY DELIVERED ON TIME


Industrial Area STP, Qatar

The Industrial Area Sewage Treatment Works (IASTW) project is located in the southwest part of Doha, Qatar's capital, and the client – the Public Works Authority – popularly known as ASHGHAL, visioned to achieve the world's highest quality to treat sewage effluent to be used for the city's irrigation network. L&T was awarded the 'concept to commissioning' project in November 2018 and successfully completed it in November 2021, well within the allocated time frame for project execution, clocking around 4 million safe manhours in the process, much to EHS Manager Saif Saeed Bagdadi's delight.

The project has modern Sequential Batch Reactor (SBR) technology followed by ultra filtration & UV disinfection, and the sludge generated from the SBR is treated within the plant to achieve the required dry solid content for further disposal. Currently the project is being successfully operated, meeting all the required performance guarantee parameters.

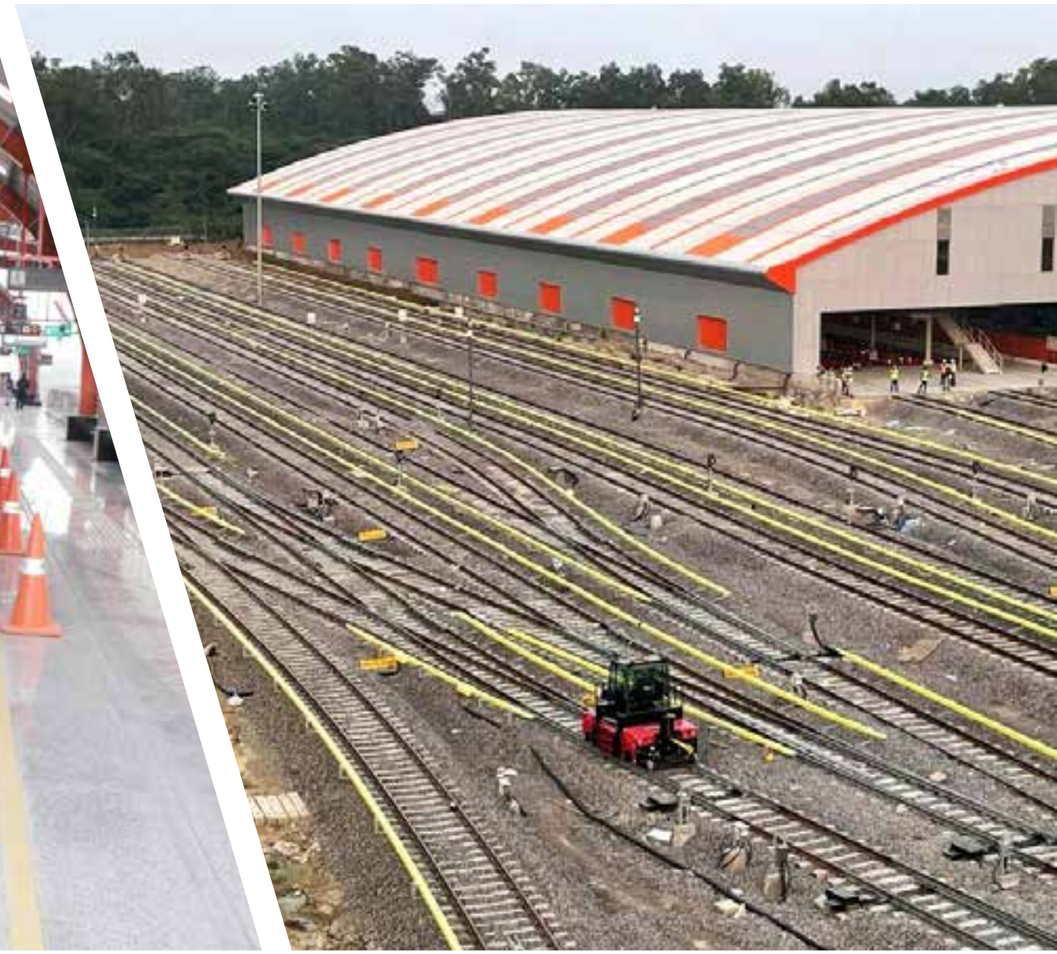
Project Manager, S Vishal is all praise for his team having achieved almost zero solid contamination and using the split backlash concept for ultra-filtration, saving almost 50% of energy in comparison to using conventional methods. "We did zero harm to the environment and to personnel during execution and that is key to our success," he declares proudly. "A robust design using BioWin software strengthened our TSE standard, which helped us achieve <5 ppm Total Nitrogen, which is unique for sewage treatment plants the world over."

"We carried out AERMOD, an Odour Disappearance Model, at the beginning of the project, which resulted in zero odour emission from the STP," remarks Planning Manager Hariom Kumar. "And by carrying our CFD (Computational Fluid Dynamic) for the deep inlet pump station, we achieved the best operation efficiency."

4 projects. 4 jubilant project teams. 4 delighted clients. That's the way they do it at WET IC! ■

RAILWAYS SBG PROJECTS ACHIEVE MILESTONES TO MEET CLIENT DEMANDS

Kanpur is one of India's most populous cities, the largest in the state of Uttar Pradesh and one of the oldest industrial townships in North India. Agra, on the other hand, is synonymous with the Taj Mahal, UP's 3rd most populous city, the administrative headquarters of the Agra district and a major tourist hub.
To take commute in these two cities to a new level, the Uttar Pradesh Metro Rail Corporation Ltd. (UPMRCL) awarded the Kanpur & Agra Metro track work project to the Railways SBG on February 2nd, 2021. Being the first such project for both cities, the client had a strict deadline for the Kanpur Metro priority section of 18.892 T-km to be completed by December 2021. Despite several challenges, the team led by Project Manager, Venigalla Venkata Ramana successfully met the client's milestone on December 28th and the client is doubly happy because the inaugurated section has already started to generate revenue.



The Kanpur Agra MRTS project contours

The project involves the construction of a ballast-less track for a length of approximately 29.4 Rkms in Agra and 32 Rkms in Kanpur with a third rail DC traction on elevated and underground structures. L&T's scope involves design, supply, installation, testing and commissioning of the ballast-less track of standard gauge in 4 elevated corridors & underground sections in Kanpur & Agra along with supply of fastening and associated ballasted/ballast-less track in four depots to be completed in 48 months with a target delivery date of January 31st, 2025.

Small beginnings

"We started small," smiles Venigalla, "for when the project began in February 2021, we had just three employees: a Project Manager, a Planning Manager, and one FLS and a team from another project was requested to commence the survey work. Things have improved since and with resources gradually increasing, we now have 24 L&T employees and their families in Kanpur and Agra." The initial stage of mobilisation involved preparation and contractual submittals to Client, online discussions with the

Kanpur Metro

a. Corridor 1 - IIT Kalyanpur to Naubasta (23.5 RKM)
b. Corridor 2 - Agriculture University to Barra (8.9 RKM)
c. Depots – (i) Polytechnic Depot and (ii) Agriculture University

Agra Metro

d. Corridor 1 - Sikandara to Taj East Gate (13.9 RKM)
e. Corridor 2 - Agra Cantt to Kalinda Vihar (15.4 RKM)
f. Depots – (i) Fatehabad Depot and (ii) Kalindi Vihar

VOICES FROM
GROUND ZERO

Emamul Pavel
Planning Manager

> The interfacing contractors expected us to provide immediate solutions and our technical experts, with their inherent knowledge of the subsystems, did a good job of providing information on time, and the Employer was pleased too with the project's rapid pace of involvement.

HQ team and vendors for finalisation and mobilisation of equipment, ballast-less fastening, identifying & finalising staff deployment, project scheduling and planning an effective work execution strategy.

COVID strikes

The pandemic waves and the subsequent lockdowns hit when the project was well on track. "Due to the state-imposed lockdown, 70% of trackwork workers from West Bengal, Jharkhand, and Madhya Pradesh left the sites and returned home," laments Planning Manager, Emamul Pavel, "and with no local resources from Kanpur or the surrounding area available for the specialised track work, progress at the Polytechnic Depot slowed substantially." If the first wave depleted the labour force, the second completely disrupted the supply chain cycle from May 2021 to September 2021. While the lack of oxygen brought operations to a halt, the strict lockdown meant that all the vendors experienced delays in material production and delivery timelines.

Emamul explains a case in point. "With the closure of the sleeper plant in Haryana, our delivery of tension clamps from China was pushed back from July to August, severely affecting our execution target. The lack of required tension clamps from Vossloh, Germany & China-PR, and base plates from Nellore, among other things, had a further negative impact on our track plinth casting."

Kanpur - Agra depot entry line

Desperate situations require desperate solutions, and to make up for lost time, the team took transport material on loan from Kochi Metro and UPMRCL, Lucknow, to meet the desired per day casting target.

VOICES FROM
GROUND ZERO

Venigalla Venkata Ramana
Project Manager

“Despite having a skeleton project team during the initial period, we have successfully achieved all the key dates and have been receiving continuous appreciation from the Employer and Engineer.

The order for Ballast-less Fastening was placed with Vossloh as soon as the order was approved in May 2021. “The Kanpur Metro project’s first priority section included imports from Germany and China-PR and despite the effects of the second pandemic wave and a typhoon, our logistic experts did an excellent job in obtaining clearances from the customs department for our products,” praises Venigalla. The arrival of the tension clamp and elastic pad was delayed too, forcing the the team to airlift the first lot of 21,600 numbers.

Desperate situations require desperate solutions, and to make up for lost time, the team took transport material on loan from Kochi Metro and UPMRCL, Lucknow, to meet the desired per day casting target. From June 21 to October 21, activities were planned and carried out round the clock to meet their initial deadline of commissioning the 18.892 TKM section, emphasizing on completing activities such as Flash Butt Welding, AT Welding, Plinth Casting, and Rear Works.

“At the same time, we had continuous discussions with the client (GC & UPMRCL) to agree on the list of designs & drawings, and closely coordinated with all the relevant stakeholders – EDRC, BU, SBG – to push progress,” comments Venigalla.

Work with other contractors on civil packages and rolling stock was, however, difficult as none of the equipment manufacturers agreed to participate at such an early stage. Further, the civil, rolling stock, and electrical contracts were awarded by contractors much earlier and their projects were well underway. “The interfacing contractors expected us to provide immediate solutions and our technical experts, with their inherent knowledge of the subsystems, did a good job of providing information on time, and the Employer was pleased too with the project’s rapid pace of involvement,” points out Emamul.

Project planning and scheduling were comprehensive, and although access was phased, the access to the viaduct, stations, and depot is updated in real time in the project schedule and translated into a prominent lookahead plan that keeps the team on track for resource and manpower engagement. “As a result, our organisation is lean and project management is asset-light,” points out Venigalla. Furthermore, the real-time schedule serves as a good trigger for material requirements and since most of the materials are from India, this early indication has proven useful to maximize project progress.

“The design and installation of the plinth ballast-less tracks have been in practice for over two decades and now extremely commoditized with strong competition from unequal players,” grimaces Venigalla; however, he brightens up about the state of his project: “Despite having a skeleton project team during the initial period, we have successfully achieved all the key dates and have been receiving continuous appreciation from the Employer and Engineer,” he sums up with a winning smile.

SET TO CHANGE HOW THE CITY OF AHMEDABAD COMMUTES

Although the LOA was issued for the Ahmedabad Metro Phase 1 project on June 28th, 2017, the project team gained access to site only in February 2018, the actual physical installation of track work began on March 1st, 2018, with rail lifting and flash butt welding activities and the first concrete pour for track plinth was on June 13th. The criticality of the project is reflected in two PMO directives, the first in August 2018 to the Employer, Gujarat Metro Rail Corporation (GMRC), to commission the 12.9 TKM stretch from Apparel Park to Vastral Gam including Apparel Park Depot and make ready for the people of Ahmedabad by March 2019. The second directive was to complete the entire 40 TKM length of the project within a limited time frame by August 2022.

The team under Project Manager Venigalla Venkata Ramana's leadership took the challenge to successfully complete the installation of the track, the highlight being to achieve track plinth casting of 5.6 TKM by December 2018, the highest in metro projects in India at that point of time. The section was inaugurated by the Hon'ble Prime Minister of India, commissioned on March 3rd, 2019, and revenue operations started from March 6th, 2019, much to the client's delight. Even with several hindrances, the team surpassed their earlier benchmark to cast 28 TKM in a record 4 months, which is approximately 40% of total scope of work, with a highest track plinth/slab casting of 8.263 TKM and 8 Turnouts (all over India) in February 2022. The necessary casting activities were completed in April 2022, and all works have been handed over to the other system contractors, meeting the expectations of the Customer and still retaining the project's profitability.

The scope, early days & challenges

The project will connect the four corners of Ahmedabad city with two corridors and 32 stations and involves design, supply, installation, testing and commissioning of ballast-less track of standard gauge: the North–South elevated corridor from APMC to Motera Stadium, the East–West corridor from Thaltej Gam to Vastral Gam in elevated and underground sections, along with ballasted/ballast-less tracks in depots at Gyaspur and Apparel Park. The total length of the Ahmedabad Metro Rail Project Phase-I is about 40.03 km, out of which approximately 6.5 km is underground and the rest elevated, and is expected to be completed in 156 weeks from LOA, tentatively April 2023.

After the initial kick-off on August 10th, 2017, a team of 4 including the Project Manager landed in Ahmedabad and initially tied up with the regional office for basic support with the focus on contractual deliverables like submission of plans, project scheduling, spotting best fit personnel for the job & resource availability in existing / closing jobs, discussions with HO team and vendors to finalize project deliverables. Subsequently, the focus shifted to other key areas like design, interface, procurement, & construction.

One huge challenge was the complexity of doing business with multiple stakeholders as L&T was the solitary contractor for the complete track construction, having to interface simultaneously for Civil & Systems works. Venigalla is all praise for the design coordinator, Ramakrishna, who managed all the interface requirements accurately and timely with multiple contractors. "The Employer was satisfied with our rapid pace too," smiles Venigalla.

Procurement is key for 40% of project value is for the supply of both indigenous and imported components, including from Germany, Austria, UK, China, and Poland. “We received all the necessary technical approvals from the customer well in advance and the delivery requirements were clearly communicated and coordinated with the concerned SCM/HO team by the Project Planning Team, led by me, supported by Manikandan,” flags off Planning Manager H R Shashitheja “Despite the pandemic, the logistics teams did an appreciable job to timely procure the materials for execution.” As a back-up, the team developed local vendors & sub-contractors to reduce delays.

The pandemic took its toll too, causing a labour exodus, throwing the supply chain into disarray, and infecting several personnel at site.

Innovations to drive efficiencies

- **3rd Rail Template Fixture Adaptation:** To start with, the Client insisted on the high-precision vertical fixing. We initially followed the concreting with a two-pour system as implemented in Kochi Metro by leaving a cavity in track plinths from the top of the derailment guard to the bottom of the plinth at the location specified by Traction, which was a tedious job to maintain quality, progress and schedules. With one of Venigalla’s innovative ideas, the project team implemented distinct prefabricated third rail dowel holding **Template**, which is precise, labor friendly, easy, and factory-made along with modifying the **Steel Shuttering plates to Ply shutters.** “This was a key initiative for our success which increased the progress with quality and precision as well as proved cost efficient to the project,” Venigalla proudly explains.
- **Installing a Mass Spring System:** The team was awarded a variation order to supply and install a Mass Spring System (MSS) in the underground section, being implemented for the first time in GMRC as well as for L&T. Steel Spring MSS is a specialized system for vibration attenuation technique which is precision work and requires lots of time and resources. “The Employer believed in our capabilities, and we accomplished this job of installing a Mass Spring System in the underground section brilliantly within the stipulated time through meticulous planning and optimizing the required resources,” says Shashitheja jubilantly.

The team even surpassed their earlier benchmark to cast 28 TKM in a record 4 months, which is approximately 40% of total scope of work, with a highest track plinth/slab casting of 8.263 TKM and 8 Turnouts (all over India) in February 2022.

Yet another deadline to meet

The Employer fixed an objective with the PMO to complete the remaining section of Phase I by August 2022 to coincide with the country’s 75th Independence Day. However, due to the pandemic, access was delayed from Civil and only 26% of total access was provided till the completion of the contractual period.

The team still took up the challenge, guided by HO, and a central team comprising Venigalla, Shashitheja, Stalin Ramar (DPM), and Ramakrishna was set up to coordinate with the Customer as well as the HO and vendors for early decisions and speedy implementation. Cluster Head Brij Mohan Sharma and BU Head Sunil Khattar effectively supported in strategizing execution to achieve benchmarking progress by assisting to arrange the necessary supervisory staff and resources. “We had initially forecasted the requirements for man, material and P&M wherein We had initially forecast the requirements for man, material, and P&M wherein we had deployed and managed 3 Flash Butt Welding Machines and 10 Track Linking teams, compared to 2–3 teams normally and 37 equipment at one point of time and other necessary tools,” adds Venigalla, who is all praise for the DPM, Stalin, for managing all the resources accurately and timely in achieving the desired task.

Further trail runs are underway in both the corridors, and the Customer is planning to commission the whole of the Ahmedabad Phase I in August 2022 and commence revenue operations by September 2022. ■

M&M PROJECTS OVERCOME DISRUPTIONS TO TAKE CLIENT RELATIONSHIPS TO THE NEXT LEVEL

The project to construct the Blast Furnace #5 and Steel Melting Shop #4 for JVML Ballari Project began in April 2021 when the world was still reeling under the impact of the pandemic. Apart from that major challenge, Project Director R. Umasathiyan and his team had to face other major issues including delayed receipt of drawings and non-availability of workmen. Refusing to be overawed, they put up a solid front, went about meeting the client's requirements of establishing the required infrastructure like the labour camp, two large fabrication yards, site setup, a rolling yard and networking with vendors. Their quick decision making and swift action on ground have been prime reasons why JVML is singing their praises.

Quickly off the blocks

To meet the monthly demand of 5,000 MT of fabricated materials, the team begin by quickly developing a green field fabrication yard, with the support of the JVML project team. As the fabrication was ramping up, Umasathiyan's next task was to handle the huge quantum of fabricated items. "We introduced a digital tool, EPC Proman, to monitor work progress, material management, dispatch, unloading and storage of material," he says, revealing his faith in the benefits of digitalization. "Later, as the quantum of work increased with several new work fronts opening, and to eliminate the long route of data flow to the planning department, we digitally integrated scheduling and progress monitoring upfront to the central servers via the WRENCH platform." The direct entry of data to the servers from the site officers eliminated delays and provided streaming data to review and monitor.

Arranging the required steel within a short time frame to feed the fabrication team was another challenge for which a cross-functional project team comprising representatives from L&T, the procurement team and JSW was formed to discuss the supply chain issues on a weekly basis and take immediate action.

Innovations push progress

Planning Manager Srinivas Pabolu is excited about the Semi-Automated Welding they have introduced at site. "It is an efficient methodology where the welding locus is Planar, and the machine movement path is simple," he explains. "We initially utilized it for the modular doubling of the Blast

Furnace Shells achieving significantly less cycle time for the bed level doubling." The Hot Blast Stoves that were initially scheduled for 12 months was squeezed to 8 months as per the Client's requirement that had initially looked too tall a mountain to climb. Not leaving any stone unturned, the team conducted meetings with expert blast furnace in-charges and understood that increasing welders would decrease cycle-time, but expert welders were scarce. "To address this issue, the number of fabrication beds was increased and with the semi-automated welding methodology, we achieved a cycle-time that was significantly lesser that the manual welding cycle," adds Srinivas.

Managing the workmen

Owing to the remote location of the site, workmen accommodation had to be set up next to the fabrication yard to house 5,000 people during Stage 1 of development, scalable to accommodate up to 7,000 during Stage 2. To keep the pace of progress intact, Umasathiyan requires a strong workforce and when attrition started to outstrip mobilization, quick action was warranted to retain labour. "We reduced the workmen commuting time to site by establishing alternate entry and exit gates and introduced additional amenities at their camp to improve their quality of life especially for those who did not prefer to stay in after travelling from various distant parts of North India," he shares. Other amenities they set up included a volleyball court, a football ground, an open-air theatre, proper bus parking and boarding points, canteens, and RO plants for drinking water. "We revamped the induction and screening process to reduce it from 6 days to just 2 days and set up a Medical Center too."

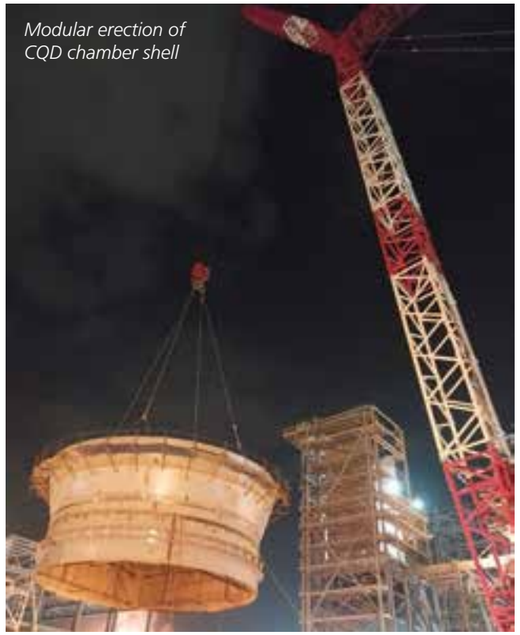
The challenges remain but Umasathiyan, Srinivas and their charged project team are keen to overcome them and deliver the project to the client's complete satisfaction.


Steel Melt Shop at JVML Ballari


Semi-automatic welding process for shells

DELIVERING ON THE TRUST REPOSED BY TATA STEEL

M&M is presently executing two projects for Tata Steel: the 1.5 MTPA Coke Oven plant and the Steel Melt Shop both at Kalinga Nagar. In both cases, project teams have been punching above their weight to delight the client with their consistent, and often before-time, delivery.



Modular erection of CQD chamber shell

Tata Steel Limited is augmenting the capacity of their integrated steel plant at Kalinga Nagar, Odisha from 3 MTPA to 8 MTPA under the Phase II Expansion project in which L&T has been mandated to construct the 1.5 MTPA Coke Oven plant. The scope includes refractory works, supply & erection of building & technological structures, equipment, piping, E&I, and commissioning assistance of the plant within 24 months. The major units of delivery being two blocks of Coke Oven batteries each with 62 ovens (6.25 m height), by-product plant & utility, two Coke Dry Quenching (CDQ) units of 200 TPH capacity each and an associated raw material handling system.

As per the contract, the supply of major structural items/ equipment for the two CDQ units were in Tata Steel's scope for which they issued free issue materials along with the work fronts at start of the contract. "By mobilizing from word go, we started structural erection work on 21st January 2022 i.e. within 70 days from start of contract on November 11th 2021," informs a determined Prasanta Tikadar, Project Manager. "We completed major erection in the module and around 550 MT (light weight & tall structures) was erected within 2 months. During a site visit, higher officials of Tata Steel expressed their admiration for such significant progress in such a short span of time," he says with a beaming victory smile.

Good work brings more and considering the rapid progress in execution, Tata Steel offered L&T to execute another critical structure (TOPR – 3B battery) after another agency had failed.

VOICES FROM
GROUND ZERO

By mobilizing from word go, we started structural erection work on 21st January 2022 i.e. within 70 days from start of contract. We completed major erection in the module and around 550 MT (light weight & tall structures) was erected within 2 months. During a site visit, higher officials of Tata Steel expressed their admiration for such significant progress in such a short span of time.

Prasanta Tikadar
Project Manager

VOICES FROM
GROUND ZERO

The entire process from receipt of 17.5 lakhs of 783 different types of brick and mortar, unloading and storage in different locations and feeding the matching bricks layer wise to site as per requirement was digitized.

Subhasish Sarkar
Planning Manager

"We completed the structural erection works within the stipulated time and handed it over to a delighted customer who is all praise for our efforts for timely completion of a job which is in the critical path of the entire Coke Oven project." Prasanta is visibly proud of his team's delivery.

Delivery on the back of automation & digitalization

Refractory Works: Considering the huge volume of bricks & complexity, the team digitalized materials management for seamless execution. "The entire process from receipt of 17.5 lakhs of 783 different types of brick and mortar, unloading and storage in different locations and feeding the matching bricks layer wise to site as per requirement was digitized," informs Planning Manager Subhasish Sarkar. The entire refractory installation work of one battery was planned to be completed in 250 days and the entire materials availability and progress is being monitoring on a 3D platform. For easy tracking and identification, each packet of bricks are QR coded and GPS tracked as per site requirement. "For record

CDQ 2 & 3

& reconciliation, we use EPC Proman for entry and issue of materials," adds Subhasish.

To enhance productivity and speed up progress, the team plans to move from a conventional execution style to more mechanization & automations with minimum workmen strength. Here are a few of them:

- Refractory 4D modelling: 3D Model developed in REVIT & Navisworks software and 4D progress monitoring in Synchro-Pro software to monitor planned v/s actual progress each brick layer wise.
- By-product Plant Model: 3D Model developed in REVIT & Navisworks software to visualize the entire plant/facility to ease execution planning.
- Modular erection specially for heavy & critical structural lifts like tanks, structures, conveyors, heavy weight equipment like scrubbers, primary gas cooling units resulting in huge savings of labour & time, improved quality of job and reduced safety hazards.
- EPC PROMAN: Piping work planning involves a lot of interfaces, identifying lines with specifications, processes that SPOOLMAN makes easier & faster with the isometric view it affords. Material is tracked with MATCONTRK for different dia/types of pipes & pipe fittings.
- Orbit pipe cutting & welding machines reduce time for pipe fabrication, especially for the higher dia. pipes.

Addressing the issues of procurement & workmen

The team soon realized that delivery depended on the supply of building structures for timely generation of fronts for subsequent activities like equipment, piping & E&I. "Accordingly we finalized as many as 5-6 fabrication vendors at different locations to speed up fabrication of the building structures," shares Pradeep Kumar Das, Assistant Construction Manager – Structural Fabrication, "with special emphasis on procurement of raw steel, and delivery at fabrication shops as per priority items. Within 3 months from the start of the project, we had procured 46% of the raw steel, and started delivering the fabricated building structures."


Refractory top layer – Corbel Zone (Battery 3A)


C 207 - 208 Conveyor (COB area)

"As we mobilized early, we started structural erection work at various critical units like CDQ Chamber, Boiler Structure, that boosted our client's confidence in us," says Saroj Kumar Maity, Construction Manager – Structural. Saroj is a happy man for their action also insulated the project from the highly volatile steel market and disruptions caused by various global geopolitical issues.

"To counter the higher price trends, we tightened our planning and started to order minimum quantities of raw steel closely monitoring site requirements / completion of critical units," adds Subhasish. "In some cases, we even directed the vendor to defer supplies and delayed placing fresh orders to minimize the impact of material cost." The orders for pipes were delayed a trifle, only minimum quantities of pipe fittings were ordered considering immediate front readiness of pipelines. "Altogether, we made substantial operating cost savings in this unavoidable global market scenario," sums up Prasanta.

Realizing how critical workmen are for project progress, the location finalization, construction of the workmen colony and associate infrastructure were taken up on top priority despite persisting local issues. At the same time, local agencies were engaged to identify and mobilize competent workmen. When finalizing the sub-contractors, special attention was given to bring workmen groups in the right combination & skill levels. With all the basic amenities in place, timely wages payment, etc., workforce attrition was significantly controlled.

"Overall, the initial resource mobilization was completed at least a month ahead to start the execution at site by meticulous planning, monitoring, and coordination with the customer, internal departments & the BU team," points out Prasanta. "Our customer appreciated our efforts for prompt mobilization at site with required manpower, plant and machineries."

ONE MORE FOR TATA STEEL

M&M is helping Tata Steel to augment their 'Steel Melt Shop' from its existing capacity of 3 MTPA to 8 MTPA with the scope of work involving supply & erection of building & technological structures, equipment, piping, E&I and commissioning of the plant. The project that kicked off on 24th January 2022 must be delivered in 28 months.

Apart from the challenges of executing inside an operational plant, timely resource mobilization was key in a highly volatile global scenario. "We had three months for mobilization as per the contractual schedule but with meticulous planning and drawing on our strong relationships with vendors from earlier projects, we mobilized the site one month ahead of the schedule that delighted the client," says an equally delighted R Sivanesan, Project Manager.

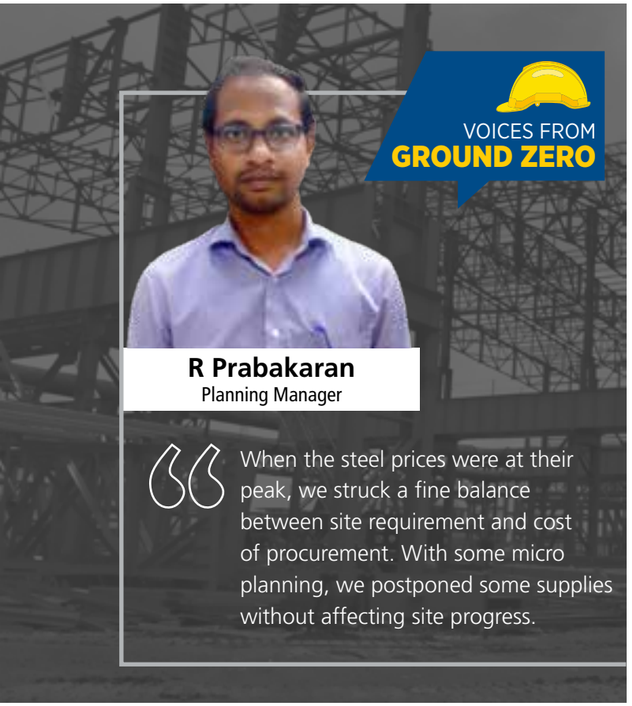
"When the steel prices were at their peak, we struck a fine balance between site requirement and cost of procurement,"

shares an astute R Prabakaran, Planning Manager. "With some micro planning, we postponed some supplies without affecting site progress and schedule and after minutely studying the BOQ issued by the customer for pipes & pipe fittings, ordered bare minimum quantities to facilitate the site erection and make huge savings in the bargain."

WISA, Safety app and WRENCH are being implemented at site. "In fact, we have done away with manual DPRs, and all drawing approvals & communications are through WRENCH," points out Shubhranshu Mohapatra, who is spearheading the digital initiatives. "Progress monitoring is through chatbots since the beginning of the project; all supply items are QR coded and we even bar code client supplied material to identify and retrieve them easily." He is happy that the client is extremely appreciative of the team's digital efforts. On the automation front, the focus is to reduce dependency on manpower as the customer is keen to reduce human footprint inside the site to avert any potential safety hazard due to operating units and, increase modularization. "Avenues like Bevel cutting of pipes, orbital duct welding and electric chain blocks have been identified," informs Jiten Dutta, Senior Construction Manager.

Site administration is key to keep the morale of the employees & workmen high while labour attrition has been controlled by redressing their genuine grievances. "We received an appreciation mail from our SBGH for the timely processing of subcontractor bills and 100% workmen payment before the 7th of the succeeding month," says a proud Satish Patnaik, Site Accounts & Admin Head, which he adds also won the customer's appreciation.

No stone is left unturned at all these three M&M sites to overcome every disruption and push progress to delight their customers. ■



'PQR Bay area' at SMS expansion project, Kalinga Nagar

L&T GEOSTRUCTURE NRL PROJECT OFF TO A GREAT START

Numaligarh Refinery Limited (NRL), Assam, intends to expand its crude oil processing capacity from the present 3 MMTPA to 9 MMTPA, as part of India's Hydrocarbon Vision 2030 to help meet the growing demand for petroleum products. The project offers huge scope for piling and ground improvement works. After extensive risk assessment to quell the initial skepticism of venturing into business in the North-East, L&T GeoStructure (LTGS) took up the mandate for piling and GI works at Numaligarh. The project that was awarded on December 12th 2021 involves 2,989 piles of 750 mm dia, 20 m and 25 m in length, 12 initial load tests, 17 routine load tests each for both vertical & lateral and a further 17 pull out tests and 8,000 stone columns, 900 mm in dia and 12 m in depth.

A job well begun is half done

Off to a good start, the project has made significant headway having achieved the milestone of 1,000 piles in August 2022. The 750 mm diameter piles, averaging 25 m in depth, were cast in a short span of 5 months hitting a maximum of up to 16 piles per day, with 4 hydraulic piling rigs and 3 cranes deployed for the piling works.

Despite being in a remote location, Project Manager, Nowshath Hussain is happy that the entire site mobilization was completed within a month. "This area experiences rains throughout the year with heavy rainfall during the monsoon

Nikhil Pasari
Planning Manager

VOICES FROM
GROUND ZERO

"The design team demonstrated their technical prowess with all site load tests. All the initial pile load tests were successfully completed to the complete satisfaction of our client, that enabled us to conclude the design quickly and ensured continuation of working piles without any delays.

period," he informs. "To ensure uninterrupted access for the movement of machinery, especially transit mixers and dumpers, we have used fiber-type Porta Mats. Such methods and proper coordination with the local concrete supplier, have ensured that our supply of concrete has never been affected," he adds.

The good news for Planning Manager, Nikhil Pasari has been that the design team set the ball rolling with some quick GTI and test pile designs. "They demonstrated their technical prowess with all site load tests," he remarks."All the initial pile load tests were successfully completed to the complete satisfaction of our client, that enabled us to conclude the design quickly and ensured continuation of working piles without any delays," he says, with an air of achievement.

Addressing local issues to ensure progress

Harmonizing with the locals is a key differentiator for progress because the area has a strong presence of unions."We formed a co-ordination committee to address all concerns of the unions," shares Construction Manager, Subrata Ray. "Sub-contracting works like reinforcements and piling were distributed among the locals to meet their employment needs, thus contributing to their livelihood and overall development."

"In fact, LTGS has engaged several budding small contractors to give them the opportunity to do pile cage fabrication works," interjects Nowshath, "and this inclusiveness of external agencies has ensured unhindered work progress."

Planning & executing to succeed

A strict monthly material procurement plan has been followed for continuous tracking of basic piling consumables to ensure uninterrupted supply and steady progress. The spiral bending machine has been deployed for making the pile cage master rings, with 16 mm dia TMT, that reduces the time required to bend one master ring from 10 mins to 40 seconds. "Such practices have improved our productivity and ensured that we always have sufficient stock of pile cages," reminds Nikhil. To ensure a smaller ecological footprint, polymer fluid has been used as drilling fluid to stabilize the boring, that is economical to dispose of and helps keep the site tidy.

All the piles are installed by taking utmost care of pile quality. "We have already conducted 21 pile load tests (7 each of vertical, lateral and pull-out tests) within 4 months and the results have been extremely satisfactory," shares a pleased QA QC Lead - Ritabrata Roy. More than 11,000 cum of concrete has been completed till the date, and all concreting is completed within 6 hours of boring completion, although there are many entry and exit security protocols to be followed in the refinery premises. "Till date, we have not received any NC or major observation from the client, and they are extremely satisfied with the quality of product delivered by LTGS," adds Ritabrata for good measure.

EHS Lead, V Naresh Chakradhar is following the tradition at LTGS of maintaining a high standard of safety, having already

VOICES FROM
GROUND ZERO

Nowshath Hussain
Project Manager

“We have been appreciated by our client (NRL), the consultant ThyssenKrupp Industrial Solutions (TKIS) and the PMO (Deloitte) for our meticulous planning, thanks to which we completed 1,000 piles faster in comparison to the other competitors working with NRL. By keeping a good thing going, we are certain that we will be able to open doors for new project avenues with NRL.

achieved more than 5 lakh safe manhours at the project. “On the first day of every month, we conduct a theme-based safety awareness programme with prize distribution among the workmen to motivate and encourage them to follow safe working practices,” he shares. Special emphasis is laid on conducting regular safety training to infuse the LTGS safety culture among all stakeholders.

Hard work and an innovative approach have been key to Nowshath’s and his team’s success that comprise mostly young engineers, especially in execution, who have a quick learning aptitude and the grit to push progress to the next level. “We have been appreciated by our client (NRL), the consultant ThyssenKrupp Industrial Solutions (TKIS) and the PMO (Deloitte) for our meticulous planning, thanks to which we completed 1,000 piles faster in comparison to the other competitors working with NRL. By keeping a good thing going, we are certain that we will be able to open doors for new project avenues with NRL,” his smile is big for LTGS has already secured additional works on a client nomination basis, a first time in NRL. ■

VOICES FROM
GROUND ZERO

Ritabrata Roy
QA QC Lead

“We have already conducted 21 pile load tests (7 each of vertical, lateral and pull-out tests) within 4 months and the results have been extremely satisfactory, Till date, we have not received any NC or major observation from the client, and they are extremely satisfied with the quality of product delivered by LTGS

GEOTECHNICAL LABORATORY AT SURAT ENTERS ASIA BOOK OF RECORDS AND INDIA BOOK OF RECORDS AS ASIA'S LARGEST GEOTECHNICAL TESTING LABORATORY IN TERMS OF SOIL TEST TYPES AND VOLUME

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