ECC CONCORD

In-house Journal of L&T Construction | Volume - 39, Issue - 4 | Special issue on Digitalization

INTERNET OF CONSTRUCTION

DIGITALIZATION:
it is about embracing technology for change

Dear Colleagues,

Recently, I have used every forum and platform available to me to drive the message of digitalization because I am convinced that this is the springboard that can launch us to the next level. The objective of 'DIGITRANS' or 'Digital Transformation at L&T Construction' is neither an attempt to showcase just any technology nor is it a fascination with frontier technology and new gadgets; our objective is to utilize the power of new and emerging technologies to make very significant improvements to our business – to our core operations that utilize man, machine and material, to save costs, improve productivity and efficiency and reduce execution time. It will open up new ways of working and move business operations from tedious, manual compilations of data to acting on data captured in real time, provide insights and be available online in visually rich and intuitive dashboards.

Needless to say, we are committing significant investments of money and talent into this Digital effort and the savings we expect to generate from the various Digital implementations will be substantial, multiple times the investment that we make and show in our performance numbers and thereby make us a far more profitable and hugely more efficient organization. This is a serious commitment that we are making to transform ourselves using technology. Several other Industry sectors have already been transformed by Digital and leaders are reaping the benefits while the laggards are either catching up or are in the danger of falling by the wayside.

The construction Industry has been late to catch the Digital Wave but we have an amazing opportunity to lead the charge. Research shows that some leaders in other parts of the world are also embarking on this journey now. The opportunity for change and utilization of the many digital technologies in our Industry is actually even bigger than in other Industry sectors because of two reasons:

1: Technology penetration in our Industry has been traditionally low and...

2: The areas of utilization for us are so many: machinery, design and engineering, geographical surveys, materials, logistics, maintenance, field execution, labor workforce, safety, customer relationships, documentation and so on.

3: It will bring in transparency – we will be able to take decisions objectively based on online data and will improve customer relationship based on facts.

While we master the technology and design and develop solutions, the key to realize their true potential lies in implementation and embracing the changes it will bring. Many of the digital solutions will provide information and insights, some in real time about the status of activity, some as alerts, some will emerge from analytics, trends, patterns and statistical measures that point to possibilities. Managers and executives will need to look at this information from dashboards and reports and ACT on them. It is important that the operations people get to know the initiatives closely, involve themselves during the implementations to improve their ability to see and use the information.

This issue of ECC Concord is about how those initiatives are being deployed at various sites across ICs. It is heartening to see that there is far greater understanding of these initiatives and increasing acceptance of them but I would like to see far more traction. To embrace this new order, we need to have a fresh outlook and a new mindset to welcome this change because in many ways the spread of digitalization in the organization is also about managing change.

THIS IS A SERIOUS COMMITMENT THAT WE ARE MAKING TO TRANSFORM OURSELVES USING TECHNOLOGY.

As we go deeper into the digital world, the old paradigm of finding a needle in a haystack is fast changing because all you now need to search for the needle is to use a magnet!

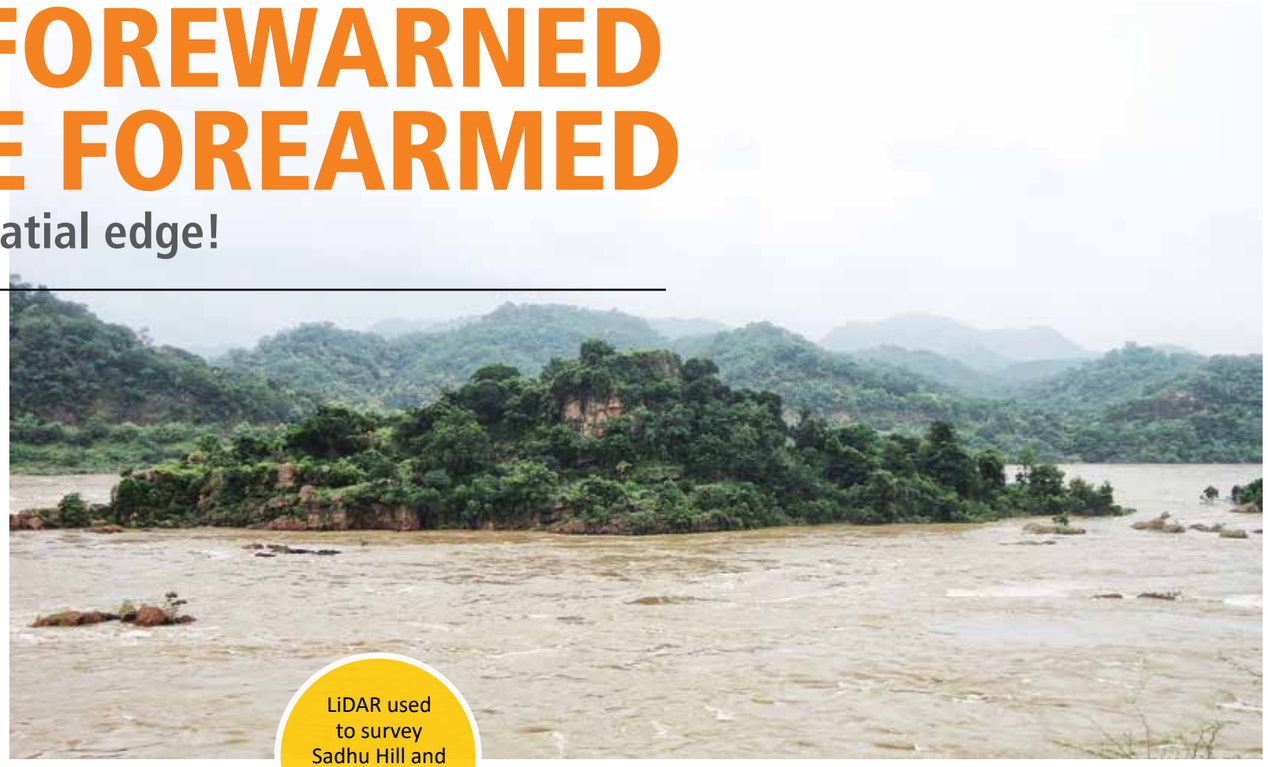
Let's go digital!

All the best!

S.N. Subrahmanyan
Deputy Managing Director & President
Larsen & Toubro

BEING FOREWARNED IS TO BE FOREARMED

Getting the geospatial edge!



LiDAR used to survey Sadhu Hill and Narmada dam surrounding

One look at the original site for the Statue of Unity would have broken the heart of the hardiest geological surveyor. A steep hill that dropped down to a road from where a steep descent landed one on the rock-strewn river bed where each rock was a potential ankle breaker and being the same color of the crocodiles that infested the area, meant that one had to doubly careful. There in the middle of the Narmada river bed, some 5 km downstream from the Narmada Dam, arose Sadhu Hill on which will stand Sardar Vallabhai Patel's statue. However, the same surveyor's heart would have leapt with joy when he found what the digital team had in store for him in the form of geospatial technologies.

"Terrestrial LiDAR (Light Detection and Ranging) was a huge boon for us and made the task of surveying both easy and accurate," shares Gopinath Virassamy, Chief Architect, working on the SoU project. "With it, we were able to understand the topography of the river bed and ascertain the quantity of landfill that had been used at the time of constructing the dam for it had a critical bearing on the statue's foundation. Further, we used satellites to survey 7-8 km of the river bed and an area of around 9 sq. km which would have been very difficult if we had to resort to conventional surveying methods. Importantly, we could also study the wind tunnel and hydrodynamic model effect as the statue is going to reach a height of 182 meters." GeoSpatial analytics came in handy to effectively estimate catchment areas and assess runoff flow directions for a sustainable storm water drainage design too.

Gopinath Virassamy
Chief Architect

Terrestrial LiDAR (Light Detection and Ranging) was a huge boon for us and made the task of surveying both easy and accurate

Geospatial technologies have not only made life easier for Gopinath and his team and others like them but have equipped them with quicker and accurate data, with far less effort much more economically. It saved them innumerable visits to the site, it removed rework, there was continuous flow of data without interpolation and the data was accurate enough for quantity estimations. It is no surprise therefore that geospatial technologies such as GPS/GNSS, LiDAR, Photogrammetry, satellite remote sensing and the like are already rendering traditional forms of surveying redundant and obsolete. Data can now be acquired, manipulated, stored, analyzed and presented as one desires and project sites across ICs of L&T Construction have started to enjoy the geospatial edge.

"It is about creating digital geography and the advantages of geospatial technologies are huge though we have only just started our journey at L&T," smiles Dr. Y Pari, Head – Geospatial Technologies and quickly adds, "but we are really pushing the pedal on it but as is the case with the adoption of any new technology, there is a learning curve only in this case it has to be a steep one!" But Dr. Pari's misgivings seem to be unfounded as several projects sites across L&T Construction have gladly espoused the new technologies.

LiDAR is an active remote sensing technology, using its own source of energy to emit millions of laser point clouds and based on their reflection, measures co-ordinates of objects in 3D. LiDARs can be terrestrial when placed on a tripod or stand on the ground as in the case of SoU or mobile when placed on a vehicle as used at such sites like the Bar-Bilara-Jodhpur road project for TI IC, the Sri Ganganagar project for the WET IC and the smart city projects in Nagpur, the surveillance system in Mumbai and the CSITMS in Hyderabad.

Dr. Y Pari,
Head – Geospatial Technologies

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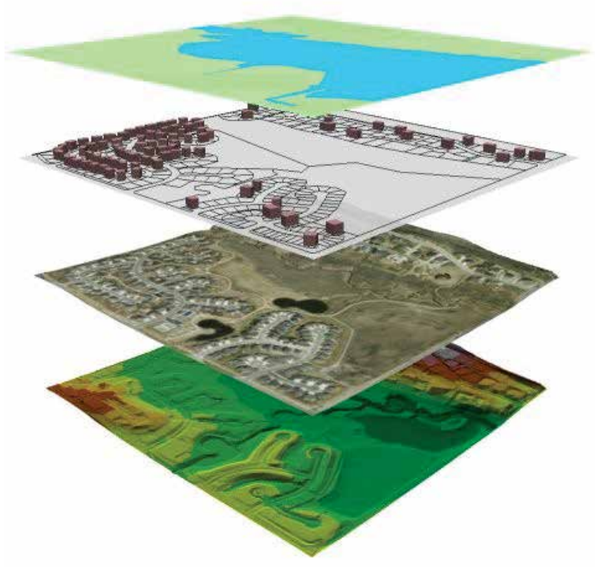
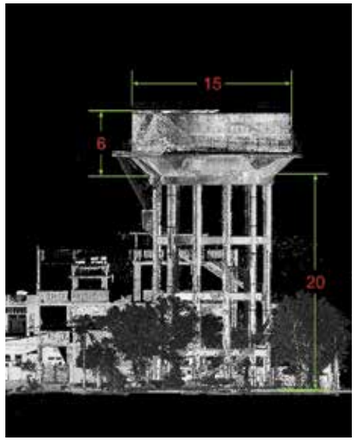




The use of Drone-based Photogrammetry is equally advantageous and works best especially on road projects as the team on the Dasna-Meerut road project is discovering. In linear road projects, large tracts of the terrain can be quickly, accurately and 'painlessly' surveyed with the added advantage of extrapolation and reuse of data. Drone-based Photogrammetry has also been used in the Dholera SIR (Special Investment Region) site in Gujarat and the DFCC Projects for the Eastern and Western corridors.

Stereo satellite imaging processing is the method employed at the Koppal (MP) water supply and the Statue of Unity projects sites while Real-time Kinematic GNSS and Integrated GNSS-based Positioning & Monitoring Solutions are being used at the dedicated freight corridor sites. Real-time surveying does not require post processing and its popularity lies in its simplicity, quickness, accuracy and elimination of all human error. It is most handy when executing locations near the sea for it enables automatic stakeout of pile locations on the coast like in the case of the L&T Geostructure IOCL project in Ennore, near Chennai.

GIS-based Radar Elevation Data processing is another geospatial technology that has been employed at some PT&D sites in Kenya (400 kV Menegai-Rongai transmission line project), the 275kV D/C OHL for the Lambir - Bunut line for Sarawak Energy Berhad in Malaysia and the 400 kV Transmission Line in Botswana from Letlhakane to Mawana.

"Our pre-bid engineering for the Lake Victoria pipeline project in Tanzania was helped to a great extent by the GIS portal developed by our digital team," enthuses C V Mahadev, Chief Engineering Manager (Civil), WET. "The client furnished us the alignment of the proposed pipeline which we plotted into the portal that facilitates five types of base maps i.e., National Geographic, Oceans, Imagery, Streets and Topographic. The option to switch between the base maps helped us access information on terrain conditions and features along the route like highways, railway crossings, water-bodies, etc. The facility to include markups in the portal environment was also available and the Digital Elevation Models (DEMs) provided better visualization of the hill top reservoir sites."

We, at WET IC, have quickly understood the inherent advantages of digitalization in our business and have readily espoused it

S Rajavel - Senior Vice President & Head – WSW&C.

"We, at WET IC, have quickly understood the inherent advantages of digitalization in our business and have readily espoused it," assures S Rajavel (SRV), Senior Vice President & Head – WSW&C. "Digitalization can play a vital role in areas such as supply, treatment, distribution and conservation. Much of our work involves trenching and often we have to literally dig 'blind' because there are no records available of the existing underground utilities. Geospatial technologies have literally given us an x-ray vision to see what lies beneath the surface before we start work as was done in the case of the integrated sewer and water distribution system that we are developing in Pali, Rajasthan where GNSS-based surveys has helped us immensely."

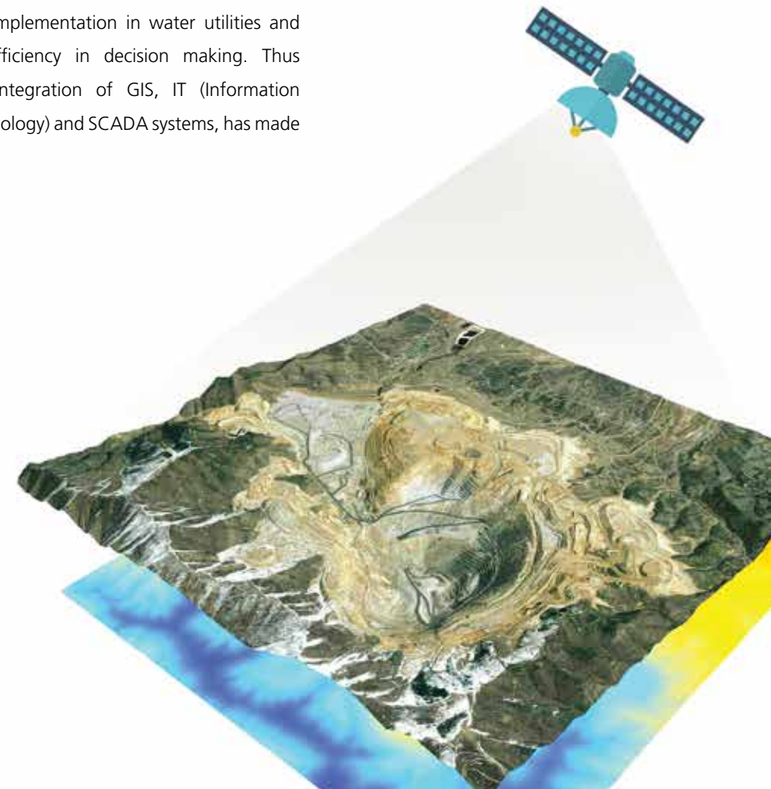
The topography of Pali was captured, a GIS database was built and a GIS solution was developed to view, analyze and utilize the geographical data. Thereafter, the GIS solution was interlinked with GIS-based data of property, consumer and pipeline network of water utilities. DGNSS (Differential Global Navigation Satellite System) and Total Station-based Traverse Network surveys were executed to connect all forms of survey data into a common coordinated system. After the survey, the topographic and GPR data, originally in CAD format, was converted into a shapefile and the GIS database was built using GIS software. The satellite imagery of Pali with 0.5 m resolution was georeferenced and the Topo & GPR data superimposed onto it thereby building footprints of the city based on which the water and sewer networks were designed using the WaterGEMS software. Pali was divided into 19 Zones comprising of 50 DMAs (District Metering Area) and 6 Zones for Sewer Network.

"Apart from the Pali project, we have found geospatial technologies of great help even in our BWSSB project in Bengaluru," adds SRV, referring to a project that is being developed to save hitherto 'Unaccounted For Water'. "It is quite evident that these technologies are set to change the rules of the game and by being early adopters we are already steeling a march over competition," he sums up confidently.

Water utilities recognize GIS as an authoritative repository of asset information that can be shared throughout the entire utility and integrated with other enterprise utility embedded systems like SCADA. The application has been developed with the concept of web based enterprise level GIS implementation in water utilities and its efficiency in decision making. Thus the integration of GIS, IT (Information Technology) and SCADA systems, has made a significant impact on the information dissemination, by means of mapping the information resources on to real world visualizations, resulting in the development of integrated enterprise level Geographical Information Systems for Water Utilities Management.

To build the world's largest cricket stadium in Motera, near Ahmedabad (Gujarat), the team is fusing virtual geography with engineering design and dimensions.

Longitudinal and cross-sectional profile analysis, optimum route analysis, mapping of land use and land cover, terrain undulations, settlements, river/road/railway crossings are all possible to be efficiently surveyed with the Optimum Route Analysis technology that MMH has used at Kalinganagar.

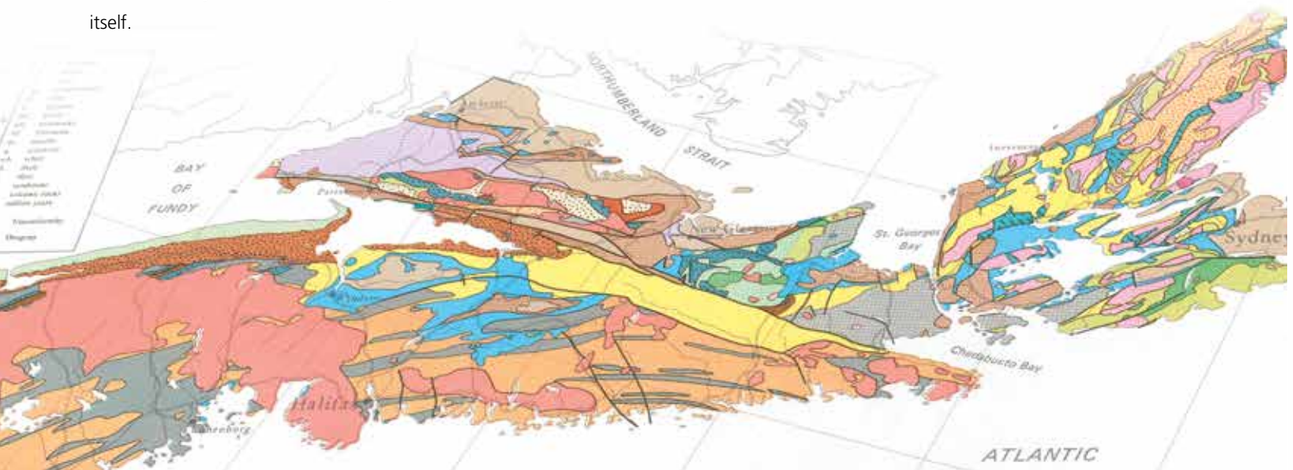


In the realm of smart world solutions, asset management of CCTV implementation is now possible using web-based GIS like it is in the Gujarat intelligent traffic management system which is by integrating the NMS (Network Management System) and the VTMS (Vehicle Tracking Management System) with asset information of the cameras. All the camera locations are mapped using GIS technology and the asset information pertaining to every camera is fed into GIS. By integrating NMS with GIS systems, faulty cameras can be identified as they get displayed on GIS maps with geographic perspectives along with the details of fault information. Likewise, integration of VTMS with GIS will support the dispatching team to rectify the faulty cameras and other assets by implementing routing analysis and Geo-fencing concepts.

Reusability of data from the Geospatial data bank is another huge asset. Normally, conventional surveying methods provide only project-related information whereas geospatial technologies provide data of the whole geography in the form of point cloud data which can be reused. Presently, spatial data which is bought like Satellite images, Survey of India Toposheet, Forest Department and Geological maps, etc. will soon be readily available within our system itself.

GeoData bank is a blend of geographic understanding, management practices, engineering & information technology that help to effectively re-usage spatial data that has been captured / bought for earlier projects. This spatial and aspatial data with spatial dimensions can be effectively re-used at various stages of design, execution and contract. This centralized GeoData bank is developed using GIS server technology and all the spatial data isstored in a centralized database server located at the L&T Headquarters consisting of satellite images, topo sheets, Cadastral maps digitized for various projects, geotechnical investigation data, thematic maps of Indian & International Standard Codes, Geological Survey of India (GSI), National Bureau of Soil Survey and Land use Planning (NBSS & LUP), Indian Metrological Department (IMD), Census of India, etc.

"The whole digitalization exercise only starts to make sense when the initiatives are able to pay back to the organization which will happen when adoption is more widespread," explains S Anantha Sayana, Head – Digital. "Our objective is to have fully connected construction sites and geospatial technologies form an important component in it!"



DiGi SPEAK

P S RajKumar
Digital Officer – B&F IC

We are positive that our digital initiatives will bring a new dimension to the way our projects function because there's a lot we are already achieving. We first connected our site engineers – the front line warriors - with our planning and project managers through mobile apps for daily project monitoring and EHS reporting. Most of our machines are now connected; especially batching plants, helping us measure productivity or even diagnose issues. With RFID based technology we have started monitoring fuel consumption for assets and can track vehicles apart from getting an insight on how many workmen are deployed at the project site on real-time basis.

FOR ONCE, TALKING IS ACTUALLY PROVING TO BE BENEFICIAL!

AssetInsight is already streaming data from P&M across 284 project sites

The Unnao-Lucknow Expressway has earned its fame on several counts. Firstly, it is a project that has been completed by L&T in double quick time well ahead of schedule. Then, the expressway made news in the very unique way it was launched with fighter jets landing on sections of it which, according to the then UP Chief Minister, Akhilesh Yadav, could be used as an operational runway in emergency situations. The road project has also been making waves within L&T Construction by driving a very significant digital initiative: several equipment, primarily, motor graders, equipped with sensors have started to 'talk' and stream important data.

The digital initiative, christened 'AssetInsight', has 'hooked up' several equipment of 51 asset types across 284 projects sites pan-India cutting across ICs to stream data primarily on utilization and geo location. Telematics devices installed on these assets stream data through a digital gateway to a defined source for storage and analytics based on which, information with regard to hours of usage, location of the asset, fuel consumption and the like can be extracted and made available on a dashboard. Armed with this information, planners can evolve strategies to improve production, enhance productivity and thereby make significant savings for the organization. 'Talking' pays, at least in this case!

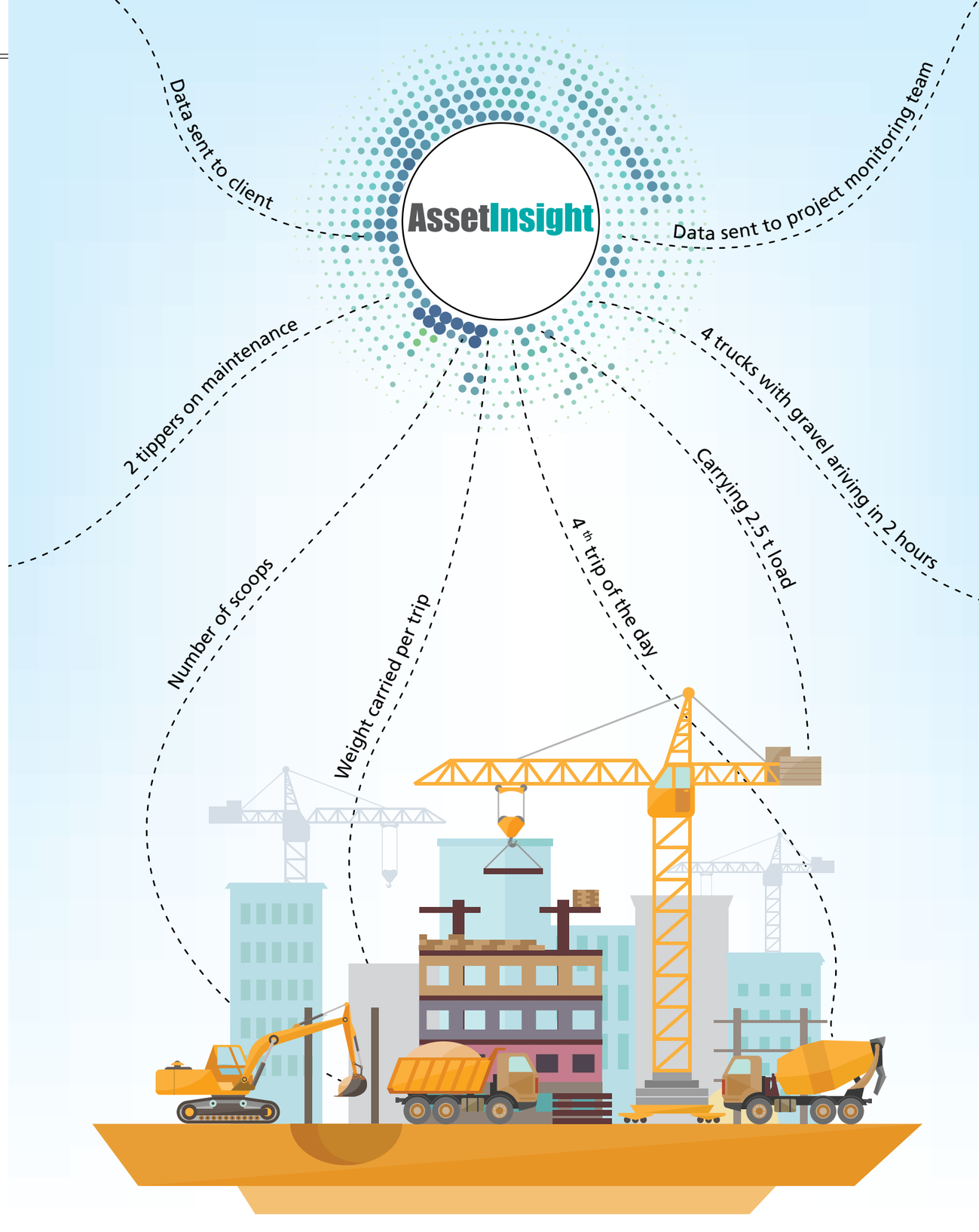
"With some 35,000 odd assets of various types and vintage that were likely candidates for 'sensoring', you can well imagine the magnitude of what we are trying to do," laughs S Anantha Sayana, Head – Digital. "In fact, the task was so huge that it was almost like standing at the foot of Mount Everest and wondering how we were going to scale it. So we set about using various criteria and applying multiple filters to break this huge task into a more manageable level. At the same time, the accent was always on hooking up assets that would give us good, intelligent data that we could work on for better understanding of the assets and later draw conclusions and inferences through analytics." This is why equipment like motor graders, batching plants, cranes, wheel loaders, excavators, concrete pumps, power generators, etc. were 'chosen' while assets like welding generators, total stations, cars, motor bikes were struck off the list.

Motor graders form the most important equipment in projects undertaken by the Transportation IC and as S P Rajan, Head – P&M, TI IC informs, "The profitability of a road project hinges heavily on how efficiently we can utilize our motor graders. Moreover, because of the huge length of road projects, not only are our resources stretched but very often we lose sight of available assets and therefore 'AssetInsight' is a real boon for us." 104 motor graders across 25 road projects have started to stream data and although the data collected is still in its nascent

DiGi SPEAK

Aritra Mandal
Digital Officer – PT&D IC

Real-time project and P&M asset monitoring, setting up time lapse cameras and mapping workmen skillsets have already started delivering amazing benefits to PT&D IC. Our digital journey is sure to open up more vistas to reach our desired goal of efficiency.



stage, several interesting aspects are being highlighted and some serious questions are being raised on usage against assumptions made in the original project plan.

Digital initiatives on Plant & Machinery is now set to go beyond remote monitoring and analytics to core automation. "The 3D Grade Control system on the Motor Grader is the construction industry's equivalent of the Driverless Car," gushes Utkarsh Desai, Digital Officer, TI IC. "This system measures real time blade position through GPS and controls the blade movement by referring to the 3D design model of the road preloaded on the Grade Control system to achieve precise accuracy levels. To implement the 3D Grade Control System, you have to practice on a 2D system which is a 3D system minus GPS controls wherein the sensors control the blade levels by referring to a physical reference like a sensor string line or an existing surface," he explains. Currently 2D Grade Control systems are being installed at a couple of road projects and this system will significantly improve the accuracy and reduce time and effort for grading.

"Road projects are linear in nature and therefore the challenges we face are unique that demand smart solutions," says D K Sen, Whole Time Director & Senior Executive Vice President (Infrastructure) and Head – Transportation IC. "Also, since our projects normally stretch over huge distances, management of plant, machinery and material becomes extremely difficult but I am delighted that with some of our digital initiatives, we are better armed to lick several of these problems. Time and therefore cost overruns really hit both our bottom line and our credibility for timely delivery. Hopefully with real time monitoring and using advanced technologies we should start delivering better. We are faced with a number of extraneous issues like RoW (Right of Way), approvals, client clearances, etc. but if we are on top of those factors that are within our control, there will be huge improvements in our efficiencies. In fact, the numbers are already beginning to show!"

SINCE OUR PROJECTS NORMALLY STRETCH OVER HUGE DISTANCES, MANAGEMENT OF PLANT, MACHINERY AND MATERIAL BECOMES EXTREMELY DIFFICULT BUT I AM DELIGHTED THAT WITH SOME OF OUR DIGITAL INITIATIVES WE ARE BETTER ARMED TO LICK SEVERAL OF THESE PROBLEMS.

D K Sen,
Whole Time Director & Senior Executive Vice President (Infrastructure) and Head – Transportation IC.

If batching plants can be made to talk more, they can provide a goldmine of information that can have a serious bearing on the profitability of the B&F IC, the prime users of this equipment. B&F owns a large fleet of P&M close to Rs. 1,200 Crores in worth across some 150 project locations and monitoring their deployment, effective and efficient operation and utilization will undoubtedly contribute handsomely to ROI. "34 batching plants and 761 major P&M have already been connected and have started to stream data on to the dashboard," states Ganesh Prasath V Viswanathan, DGM, P&M, RB&F SBG. "Thankfully, the dependence on manual reports is eliminated and with this connectivity, we are now able to view the working details on a virtual basis. The dashboard is proving to be very useful for us as it gives insights into the status of equipment, its working details, fuel consumption, vital parameters related to safety, health and maintenance of the equipment on a continuous basis." By being able to extract data and monitor fuel consumption on a real time basis, any anomaly can be instantly detected and corrective action initiated can translate into considerable cost saving.

A complete convert about the success of digitalization, Ganesh elaborates about batching plants that "We are now able to monitor and reconcile the consumption of material very accurately which minimizes wastage. We have data as to which mixes work better and by being able to continuously study loading time, we are able to improve performance in relation to other concreting logistics and thereby reduce slab cycle time." Looking forward, he hopes that "All historical and reliable data captured by the system will enhance our capabilities to calibrate our bidding parameters and thereby be more successful in our projects."

Not to be left behind, the Heavy Civil Infrastructure IC has installed almost 300 gateways across various assets at major ongoing projects. "We have installed 82 gateways in various capacity power generators across the 75 km stretch of the Hyderabad Metro," says Sadanand Nayak, Head-P&M, HC IC "which feeds us electrical load data in KW that helps us to monitor the loading of the DG sets and equalize load distribution across the three phases. This optimizes fuel consumption and reduces maintenance cost. In fact, it also helps us choose an optimum sized genset for a particular location." DG set engine parameters under development can drastically reduce manpower and enable centralized monitoring of engine parameters. "Of course, knowing the location of critical assets like truck cranes, mobile cranes and boom placers that are always in demand will help us plan their allocation and deployment more efficiently especially in projects that are of a linear nature. Asset commissioning time is being reduced significantly which can translate into huge savings!" he points out.

What is obvious is that making P&M 'talk' from across sites is ushering in a new cost efficient dawn in the organization and as the chatter from more and more equipment increases, the sound of savings will also increase multifold!

DiGi SPEAK

U Udhayakumar
Digital Officer - SWC

With digitalization, we have entered a world of dashboards! Even the projects under O&M are monitored on real-time basis using GIS applications. Predictive analysis, barcode based inventory management, enhanced CRM for prospect management, mobile based attendance systems, and procurement schedule tracking systems are some of areas under various stages of implementation.

Building Information Modelling

FUNDAMENTALLY DIFFERENT

"Building Information Modelling (BIM) is a collaborative way of working underpinned by digital technologies. These technologies allow for more efficient methods of designing, delivering and maintaining physical built assets throughout their entire lifecycle."

– UK Government Level 2 BIM

Of all the various digital technologies that are capturing people's imagination in recent times is Building Information Modelling or BIM as its huge potential to shift the paradigm in the construction process becomes increasingly apparent. By driving design, cost and schedule optimization and integrated solutions through BIM, project management can become smarter and significantly more economical. All the information of a particular project can be created and managed before, during and after its completion; BIM can carry a digital description of every aspect of the built asset. In other words, BIM is a digital repository.

Surprisingly, BIM is not a new concept dating back to references in the 1960s, but it is only in recent times that BIM, which at its core is a 3D design and modeling software, has made its presence felt significantly. The reasons are not hard to find as BIM facilitates 3D visualization, intelligent engineering,

BIM can carry a digital description of every aspect of the built asset. In other words, BIM is a digital repository

BOM qualification, constructability assessment, clash resolution, integrated planning and monitoring, control on material, cost and quantity and document management.

Hitherto, construction has relied heavily on drawings; hundreds of separate and, at times, inconsistent designs - often lacking vital information such as Bills of Materials, specifications, cable lists, timelines, costs – produced in silos and exchanged between the design and execution teams as a project progresses.

"BIM will break down these silos and transform project management from a largely disconnected into a fully integrated exercise in a complex ecosystem," informs P R Surendhrababu, Head – Digital Engineering, who drives this futuristic digital initiative at L&T Construction. "It will dramatically change the lives of designers, architects and engineers. In the new scheme of things, designers can create a shared building project with integrated information in a format that models both the structure and the entire timeline of the project from inception right through to completion and even beyond. BIM also acts as a platform for architects and engineers to collaborate across geographies by condensing a plethora of information about every detail of a project into a workable format. It makes design superior, coordination easier and construction simpler and since BIM forms the foundation of the data in a project,

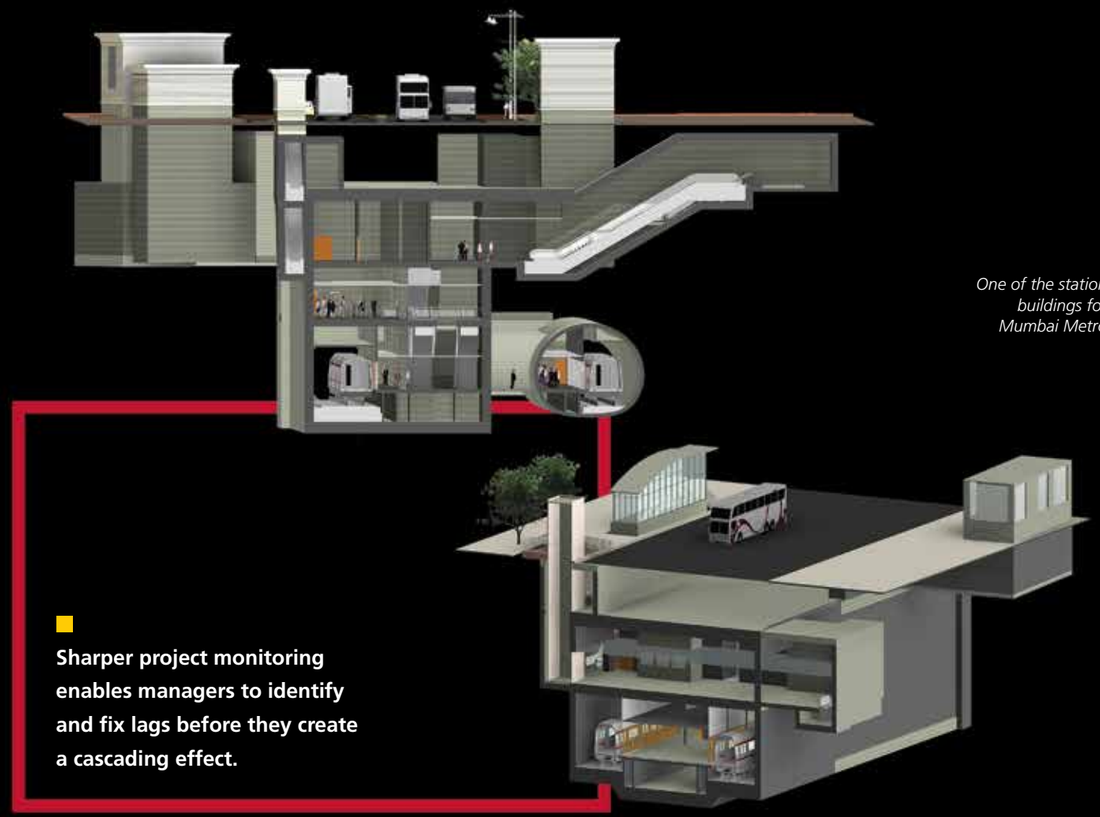
Ford, Chennai

it provides answers to innumerable 'what if' scenarios which would have been impossible with the conventional 2D approach," shares P R Surendhrababu.

While the system sounds perfect from a theoretical perspective, he quickly explains how it will work in the real world. "When you are designing a building, there are both physical and functional characteristics of their actual counterparts such as columns, walls, doors, windows and stairs which when integrated provide a simulated experience that helps us understand the building much before it is actual constructed thus giving us the flexibility to modify elements either to save resources or enhance efficiencies." Presently, 27 projects across ICs including Mumbai Metro, Apollo Hospitals, Ford factory, Dholera SIR and a substation in Qatar have been identified for BIM implementation in a phased manner.

Mumbai Metro is one of the most challenging of metro jobs that we have won in the country because our packages are almost entirely underground and BIM will surely play a key role in our success

S V Desai
Executive Vice President & Head – Heavy Civil Infrastructure IC.



One of the station buildings for Mumbai Metro

Sharper project monitoring enables managers to identify and fix lags before they create a cascading effect.

Apollo Hospital, Chennai

"Mumbai Metro is one of the most challenging of metro jobs that we have won in the country because our packages are almost entirely underground and BIM will surely play a key role in our success," opines S V Desai (SVD), Executive Vice President & Head – Heavy Civil Infrastructure IC. "We have already prepared the 3D rendition and are now developing the 4D BIM by overlaying the time factor. There are tough deadlines and the initial delays haven't helped us but by precisely plotting the schedule we will be far better placed to deliver the project on time. We will also be doing a 5D BIM which will include the cost factor because ultimately even if we are able to deliver on time, we need to do it by safeguarding our profitability," adds SVD.

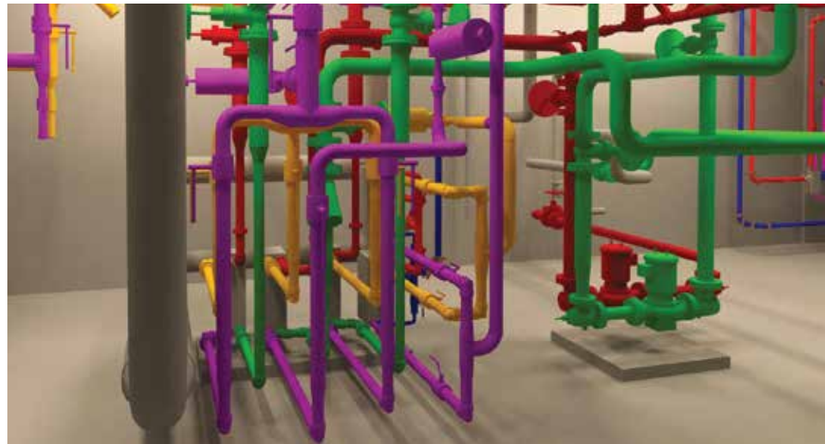
To move towards a model-based design process, information has to be fed into BIM seamlessly. P R Surendhrababu takes over again: "In fact, at the initial stages of a project, the designer and scheduler should ideally sit together and input all the necessary data which forms the foundation of the collaborative planning process. Once finalized, the planning manager at the site keys in the actual progress periodically that reflects across the BIM module. It really does not matter what software is used by the planning people. There are several smart integration tools or interface programs that allow data flow into the BIM module making 'up-to-the-minute' progress monitoring possible" he assures.

Evolving a collaborative culture, using a collaborative platform and CAD tools for creating integrated design in 3D is, however, only the tip of the BIM iceberg!

Once the design is frozen, the next critical consideration for both the client and contractor is the time required to execute followed closely by how much the project would cost. Hence, time, technical aspects and budgetary considerations form the vital 4th and 5th dimensions of BIM.

"Time is always of the essence in projects as clients increasingly demanding project completion at never before speeds. To push the pace of construction to a higher gear and still maintain safety for our workforce, there is a need to crash certain areas of the project." And as P R Surendhrababu adds, there is always great debate and uncertainty at site level as to which activity at what stage can be crashed. With the 360 degree perspective that BIM offers covering design, schedule, material requirement and cost on an element to element basis, project managers have a sound system to choose the optimum area to crash.

Operation & Maintenance, real estate facilities management and sustainability are the 6th and 7th dimensions of BIM that involve creating an energy saving culture, driving focus on asset performance, integration with HVAC control systems, integration with ERP for asset maintenance, etc. There more dimensions that involve



Clash analysis with BIM

EHS and asset decommissioning, lean construction management, security, emergency & disaster management, but that is way into the future.

Using BIM, data can be furnished on demand, visits and design rework is avoided translating into significant savings on time and cost. Sharper project monitoring enables managers to identify and fix lags before they create a cascading effect and, perhaps of more critical relevance, change is easier to execute. If a client seeks a change, it can be carried out in the design which is then reflected across all platforms, be it scheduling, pricing, resource or execution. Better risk identification and management is also possible with BIM.

Perhaps, one of the most vexing causes for delay in the progress of a project are 'clashes' and managing and resolving them at site. With BIM, clash analyses are possible prior to going on-site as any geometric interference of the elements can be immediately identified and resolved at just the click of a button in a virtual environment. Armed thus, Project Heads can get more proactive and get things right first time at site, improving the quality of the final product. Advanced clash analyses software which are still evolving will be equipped to detect clashes at a very early stage again resulting in huge savings for the organization.

"With the advent of mobile technologies, utilization of BIM will not just be restricted to computers. We are in the process of creating paperless operations and everything right from project scheduling, quality, safety, daily reports and live model measuring can now be done from mobile phones! At the Apollo hospital project for instance, queries by the execution team can be pinned on the BIM model for resolution by the engineering team. With data being cloud based, even the clients and other stakeholders can access these BIM models through their hand held devices even without the need to install a BIM application. Such will be the rapid rate at which this domain will expand," projects P R Surendhrababu.

DiGi SPEAK

Karthik
Digital Officer –
L&T GeoStructure

Primarily a mechanized business operating a large fleet of foundation equipment, we at L&T GeoStructure, aim to leverage digitalization by creating 'Internet of Things' so that our equipment can communicate with us on logistics, fuel consumption and productivity helping us make informed decisions and optimize resource mobilization.

PROJECT MONITORING... AT YOUR FINGERTIPS!

Procube – the real-time score board

For a diehard cricket fan, the surfeit of statistics that keep popping up on TV screens during a cricket telecast is fodder for his mental archive. In fact, many fans vouch that watching a match live at a stadium, offers a world of a difference, thanks to the heated and animated discussions among the spectators on data analytics and stats making it far more exciting than the real action on the pitch! While the sporting world and several industries have already adopted and adapted to a digitalized way of reporting data, the construction industry has only just entered the fray. Being a late adopter, however, has its own advantages, one of which is to be able to benefit from the cumulative learning from other industries and leapfrog into a digital world where data rich managers can make informed decisions that can alter the course of a project.

With performance increasingly interpreted as progress, it is vital to be armed with information, the single most powerful tool, which can make or break a project. In a globalized scenario where construction tasks are increasingly sub-contracted to experts in their respective domains, a mega project often has several teams from various organizations working in unison towards a single goal. This makes monitoring progress and evolving meaningful data for necessary course corrections increasingly challenging. Apart from ensuring that the project is on schedule, proper monitoring can detect snags early-on and throw up accurate information on areas such as engineering, supply chain, interface management, execution, quality and even safety.

Future ready with just your device

If one thought conventional programs on project management worked wonders, a re-think is recommended and a look at what the modern tools, developed as part of the digitalization drive at L&T Construction, are capable of! Simply put, the whole world of project monitoring is alive on a hand held device!

The transition began with the widespread use of Whatsapp for monitoring project progress and instant trouble shooting across ICs and sites. When visiting one of the Delhi Metro sites a few months ago, the Project Manager accompanying us suddenly noticed some corrective measures on the 'U' girder that had not yet been carried out. He immediately got out of the vehicle, photographed the location and sent it to the section head by Whatsapp. Even as we stood there, workmen had been reassigned to set things right. With digitalization, action and reaction can only become faster!

"I can now say good bye to the tedious daily progress reports that I had to fill out at the end of a long and exhausting day," shares Manjunath, a young execution engineer at a hi-rise residential project in Mumbai. "I am so happy that I don't have to return to office in search of a computer system from the thick of action at the site because I can now update progress with just three clicks on the Procube App right from my mobile phone."

With an easy to use interface, the Procube project monitoring app has indeed revolutionized the way construction projects are monitored and managed. With simplicity and brevity as the core objectives, the development team has created a simple interface to the innumerable processes and myriad systems that get camouflaged behind it.

I no longer conduct review meetings at my project because every action performed at every moment can now be reviewed in detail anytime, thanks to Procube

K. Gurusamy
Project Director of Chennai Metro Rail Project

DiGi SPEAK

M. Anton Jayanth
Digital Officer – MMH IC

On job trainings can make our transition to a digital world more seamless. At MMH, over 45% of our equipment are now connected so as 97 % of the workforce whose details have been captured. We are really excited to explore implementation of other breakthrough technologies such as BIM and AR/VR.

"I no longer conduct review meetings at my project because every action performed at every moment can now be reviewed in detail anytime, thanks to Procube," declares K. Gurusamy, Project Director of Chennai Metro Rail Project, pointing to his mobile screen flipping between the lists for engineers and tasks. The screen throws at the user, easy-to-chew data in simple and graphically represented charts that's easy to grasp at just a glance. "The execution team is now truly liberated and will have more time to put their noses to the grinding wheel rather than create reports for the sake of monitoring. This will have a cascading effect on enhancing productivity and quality that is guaranteed to delight the customer which anyway is our ultimate goal," asserts Gurusamy.

MMH's new HSM project at SAIL-RSP is also implementing Procube, informs, Digital Officer, M Anton Jayanth. "Frontline engineers are now able to mobilize resources based on the daily plan for the month. These engineers enter the achieved the quantity in the smartphone app. With real-time project progress data loaded to Procube, micro level root cause analysis are done and necessary corrective actions can be initiated immediately. In a nutshell, Procube is an excellent project monitoring tool and the L&T-ites at NEW HSM SAIL RSP is proud to be front runners in implementing it," declares Jayanth.

A major initiative taken up in the WSD BU is the planning and daily monitoring of progress of projects through a system created on EIP, aptly christened PRAGATI. "This system enables the project team to review and track activities based on criticality," says WET IC's Digital Officer, Shaktivel. "PRAGATI has an

PROCUBE
What gets measured, gets improved!
PROJECT PRODUCTIVITY PROGRESS

In a nutshell, Procube is an excellent project monitoring tool and the L&T-ites at NEW HSM SAIL RSP is proud to be front runners in implementing it

added functionality of escalating and enabling management intervention at the appropriate level and at the appropriate time. It records daily progress, measures & benchmarks productivity and forecasts resource requirements on an ongoing basis. It is also synced with a mobile application, using which the site engineers can directly update progress and manpower details into the system," he shares.

"We were early adapters of digitalized project management at L&T Construction," informs T. Madhavadas (TMD), Head – PT&D IC, a strong proponent of this project management tool. "With linear projects such as Transmission Line erection that involve numerous elements and processes, only efficient project monitoring can bring in the desired results," and it is this pressing need that forced the PT&D team to develop Allign, a forerunner to Procube which is active and widely used across sites. TMD elaborates, "A site engineer only has to fill out his area of achievement on a daily basis, be it foundation, tower erection or stringing right from his/her mobile. This individual data will have the innate nature to cumulatively provide real-time data that can be filtered at various levels and activities from which meaningful data can be mined to plan and perform better."

CoDeS or Construction Decision Support System is another ambitious GIS initiative to digitally monitor progress and operations. "Anytime online information about construction activities and status like Actual Start and End date, reason for delay, NCR, Quantities and many more are available," smiles K Bhavani, Head – Procurement, Heavy Civil IC. "Dashboards display accurate analytical data and one can get a thematic representation of what's

WITH LINEAR PROJECTS SUCH AS TRANSMISSION LINE ERECTION THAT INVOLVES NUMEROUS ELEMENTS AND PROCESSES, ONLY EFFICIENT PROJECT MONITORING CAN BRING IN THE DESIRED RESULTS

T. Madhavadas
Head – PT&D IC

K Bhavani
Head – Procurement, Heavy Civil IC.

CoDeS will also assist in effective decision making, resource allocation and mitigation of risks by providing a transparent and single source of truth making it a very powerful and effective tool to aid construction progress monitoring. This tool is also capable of visualizing site geography

been actually completed and what's under-progress. CoDeS will also assist in effective decision making, resource allocation and mitigation of risks by providing a transparent and single source of truth making it a very powerful and effective tool to aid construction progress monitoring. This tool is also capable of visualizing site geography, says Bhavani, fully appreciating the decided advantages of CoDeS.

"Take a closer look at the various screens of Procube and you can derive invaluable data by applying perception and logic to these figures," enlightens S. Anantha Sayana, Head – Digital. "For instance, when you find a steep curve of productivity for reinforcement activity at a particular floor level of a hi-rise, it is only logical that formwork and concreting will follow shortly in the next couple of days, the absence of which indicates some snag at the site." He guarantees that with this new age monitoring, transparency at the sites will be a given resulting in far greater cost savings and better realization of profits.

DiGi SPEAK

Sakthivel
Digital Officer – WET IC

Our digital initiatives cut across our value chain and every business function. Through digitalisation we are trying to address areas like business prospect tracking, risk management system, HR analytics, centralized O&M monitoring and conveyance vehicle tracking. We aim to reach down to the grass root levels and make digitalisation all-pervasive.

TAKE A CLOSER LOOK AT THE VARIOUS SCREENS OF PROCUBE AND YOU CAN DERIVE INVALUABLE DATA BY APPLYING PERCEPTION AND LOGIC TO THESE FIGURES

- S. Anantha Sayana,
Head – Digital.

TWO MS FROM THE 3MS
IN CONSTRUCTION

Like the 4Ps in Marketing, Construction too has its own share of 3Ms – Machinery, Material and Men of which, quite predictably, Men are the most important. There can be no construction without workmen and hence their sustained wellbeing is very high on the priority list of construction organizations. Giving them a safe work environment, ensuring their personal safety, providing them with all the appropriate tools and protective gear, equipping them with the necessary training and methods to enable them to do the tasks assigned to them are carried out systematically across all L&T Construction project sites.

Needless to say, optimizing labor, ensuring their safety and improving their productivity can make a significant positive impact on projects and go a long way towards achieving timely completion and better cost management. Digital technologies have now started to play an increasingly important role in realizing these objectives.

Yoking the power of Aadhaar cards and Jan Dhan accounts

The vital first step in our digital strategy to manage workmen is to ascertain proper identification. The introduction of finger printing and biometrics for workmen have been major steps in this space; taking advantage of the government's initiatives of issuing Aadhaar cards and opening Jan Dhan accounts have been other important steps.

More than a billion Aadhaar cards have been issued in the country and hence it did not require any rocket science to consider Aadhaar numbers of workmen as a sure method to establish their identities and ensure security. Once uniquely identified, it is possible to maintain a database of workmen with respect to their skills, qualifications, levels of expertise, training attended, record of all the sites they have worked at and the special works they have been involved in. Records of those having been trained at any of the eight CSTIs are also maintained. With this wealth of information, it is possible to nurture the workmen, enhance their skills and consequently, improve their productivity.

A vital aspect of the drive towards a Digital India and to make growth and development more inclusive is the country-wide effort to bring more and more of the population within the banking system with the opening of Jan Dhan accounts. The fact that nearly 30 crore Jan Dhan accounts have been opened till date is reflective of its success and spread. Wages payment to workmen has always been a difficult task, which reached critical levels during the early days of demonetization. Jan Dhan accounts have come as a boon because subcontractors can directly credit wages into the accounts of workmen through the available digital channels. This opens a huge vista of opportunities and could well dramatically change the rules of the game in the near future. All of these form the foundation for making business process changes and engagement models that can result in quantum improvements in efficiencies.

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Ushering in a new dimension of safety

Safety of workmen is another critical aspect and several measures are being taken in that direction.

One of the fundamental applications of digitalization at construction sites is the use of tracking systems such as bar codes and RFIDs. Workmen at select sites of L&T Construction now wear helmets that are RFID-tagged whereby the project safety team can ensure that workmen are confined to their designated areas of operation. Straying into other areas could be hazardous for all concerned and thus this ensures that they are kept away from 'no go zones.' Workmen, wired thus, can only work at heights with the proper protective equipment and necessary permits.

Digital harnessing

Another important safety-related digital initiative has been the introduction of bar codes to the full body harness which not only accounts for each and every life saving device, but also makes its periodic inspection certain and more efficient. Only equipment that is cleared can be used which improves the safety quotient immeasurably. It also puts the onus on the subcontractors to ensure that only properly kitted workmen are allowed to the work site.

A safety app is available about safety guidance and carries videos on safety; it can also record all safety compliance processes like safe to start, incidents and so on. Further, a variety of technologies are being evaluated to ensure safety and security which will be implemented in the coming year.

Introducing the 'connected' workman

At the zenith of the digital pyramid is the 'connected workman' who, with 'wearables' can be 'sensed' which can play a vital role in ensuring his safety. This is very much in its developmental stage at L&T Construction. At times, workmen are forced to work in places where they are uncomfortable or even scared like at heights or in confined spaces. These sensors and beacons on the workmen will immediately reveal if there are undesirable fluctuations in heartbeat, pulse rate, blood pressure and the like that can in turn alert the supervisors to take corrective action and thereby prevent an incident. These 'wearables' can also detect fatigue and other behavior aspects that are deterrents to performance.

Dashboards providing all information and insights about workmen allocation, work done and safety records are being made available to supervisors and managers to drive improvements and better monitoring.

The other M – Material

Material management at a construction site is a completely different kettle of fish. It has historically been extremely complicated and arduous not just because of the numerous types, volumes and value of the material involved, but also because of the tedious stages a material has to pass through both virtually, as a purchase order, and physically to the yard/stores, to fabrication and finally to the site. Construction managers now seek real time data from vendors to track material movement from dispatch to delivery and even within the site before installation and post installation for Operation and Maintenance purposes.

Material-related issues are aplenty: traceability within the site, inefficient use of reusable materials, need to improve efficiency to accurately gauge requirements and place timely orders; and the overarching problem of reconciling between purchase and consumption.

In the new scenario, every single piece of material arriving at the site will 'carry' technology in the form of bar codes, RFID, or sensors that will constantly communicate on what it is and where is it being stored along with data on expiry dates, if any. This data is available to the stores in-charge and the execution team who have visibility of the material within the site on a real-time and paperless basis and can thus ensure its availability at the right time and right location with notification to the right person. The technology also tracks some material even after commissioning which comes handy for the O&M team. While the possibility of this scenario is being explored at every single site of L&T Construction, no efforts are being spared to closely study the pilot sites to sharpen processes and create a seamless system that is sure to transform procurement and supply chain management.

Digitalization in material management at L&T Construction aims to ensure the availability of the right material in the right quantity at the right place and time and to streamline matters the digital team has created four buckets into which all the material can be classified:

Reusable
- Heavy Tools
- Small Tools and Equipment
- PPE
- Electrical Consumables
- Formwork

Commodities
- Personal Protection Equipment
- Trolleys
- P&M Spares

Consumables
- Oil & Fuel
- Coolants & Lubricants
- Electrical Consumables
- Abrasives

Construction Materials
- Bulk – Steel, Cement, Sand, Aggregates, Boulders, Bricks, etc.
- Non-Bulk – Electrical Items, Tiles, Cables, Pipes, Plywood, etc.

Likewise, four domains of technology have been identified to digitalize material management.

RFID

A combination of Active and Passive RFID technology can identify, track and assess the utilization of high-value material and expensive equipment that includes formwork, rebar, heavy tools and conductors.

GPS tracking

Movement of select high value equipment and material which will be largely reused across sites and projects, such as plant and machinery and other vital equipment will be GPS tracked.

Bar / QR coding

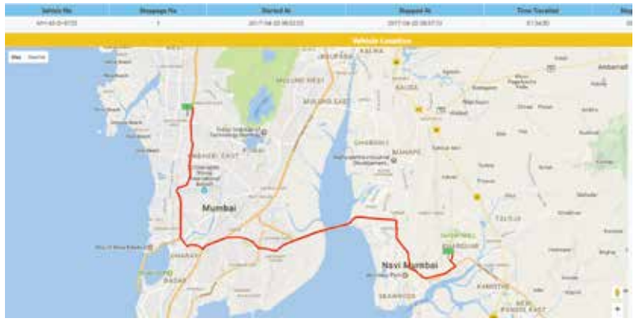
Low value but high quantity items such as small tools, tackles, spares and electrical items will be barcoded or QR coded that also include material arriving at a site in packaged form with the vendor's barcode.

Supply Chain Management Solution

A dedicated system will streamline supply chain management to make demand and supply planning seamless which will include store management and inventory control apart from sharpening transportation and logistics strategies.

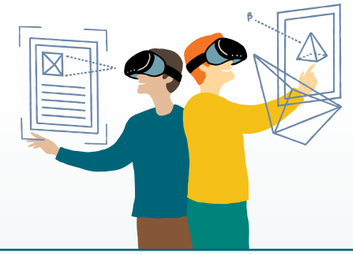
A construction site faces a unique set of asset managerial and operational challenges: procuring material on time, tracking, monitoring and documenting that the material is secure and being utilized to its fullest potential. Further, with the ever-changing environment at site, issues such as pilferage, theft, misplacement and unauthorized use of equipment cannot be ruled out.

One of the quickest and most efficient ways to address this issue is to monitor and track materials on a real time basis. Data automation on material management helps easily locate material at large construction sites, be it in the stores or at the points of utilization. This crucial data avoids wasteful expenditure in terms of duplication of orders, material lost / misplaced and unsuitable material owing to specs or material crossing expiry dates due to non-use. Data automation can also help generate management information reports which capture the exact quantity of material utilized and verify if the consumption has been as per the specs planned.



With material management rapidly getting digitalized, project sites will become more equipped to focus on execution, safety, quality and timely completion which will make all the difference to enhance productivity and profitability.

VIRTUAL WORLDS CAN HELP BUILD THE REAL WORLD



You feel you are inside a building – the one that you are planning to construct! You see the patterns on the floor, you can almost feel the texture of the walls, you look up at the HVAC ducts, the piping and the cable trays; you move forward and walk into another room and then on to another floor. You can see all the intricate details.

The lights come on and when you remove your special glasses, you suddenly realize that you have been touring a building that is yet to be built at Shristhi, the 3D studio at the Chennai campus and what you were experiencing was Virtual Reality (VR)!

Design and engineering has evolved from the days of the draftsmen and their drafting boards to today's digital avatar. Engineering is now on CAD (Computer Aided Design) software on powerful workstations with huge computing and graphics power. From drawings in 2D CAD, the world has evolved to 3D models that truly represent what is being planned to be built. 3D CAD

DiGi SPEAK

Mohanbabu. S
Digital Office – HCI IC

Being one of the least digitalized, the construction industry offers great avenues for implementation but it's the initial change management that can pose teething issues. Backed by the drive from the top management and leveraging on the tech-savviness of our young colleagues, going digital at HCI IC will surely be faster than we anticipate.

software has further evolved to integrate elements like structure, MEP, HVAC and finishes into one single model, which when put through some additional rendering software and projected onto a screen using a special projector and viewed with special spectacles, one experiences VR.

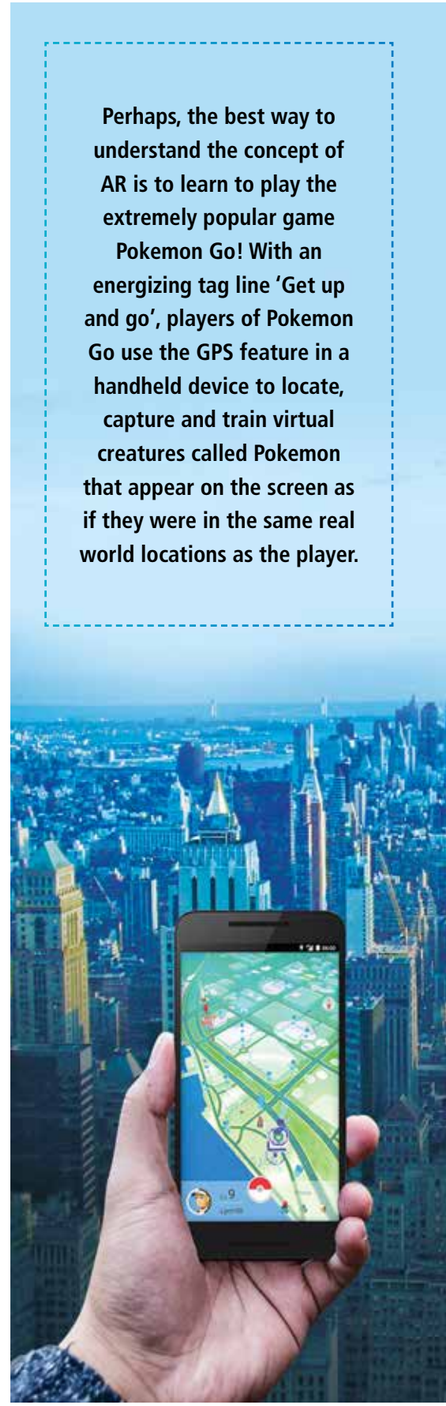
Shristhi therefore is a studio where design engineers, the execution team and the client can 'virtually' walk through every nook and cranny of the structure to be built. The Statue of Unity team jocularly mentions the client's astonishment at the virtual size of Sardar Vallabhai Patel's toe - a case of Gulliver and the Lilliputians in reverse! One can already virtually walk through the Statue of Unity project site or the Hyderabad Metro or even the Shell project in Bengaluru. Literally, a commuter's experience at a station of the Hyderabad Metro has been recreated – the entry, the ticket vending machine, the ride up the stairs or elevator to the platform and then entry into the metro rake. "This is so good and informative that our projects should ideally be error-free in its design and execution," declares Sthaladipti Saha, Head - EDRC (Commercial Buildings & Airports).

The only drawback if any, is that this experience can only be had at Shristhi. The Digital Engineering team is working to achieve the next milestone: of developing a facility whereby 3D models in Virtual Reality can also be viewed at construction sites using new digital technologies from various vendors using special headsets and a combination of devices and software. Imagine how useful it would be for a Construction Engineer to actually visualize, experience and walk through what he is going to construct rather than seeing a 2D drawing on a sheet of paper!

A few pilots are in progress and this facility should be rolled out at a majority of sites across L&T Construction during the year.

Augmented Reality (AR), on the other hand, is a reality that keeps the real world and adds a digital layer to it or amplifies it thereby giving one actual information without changing or displacing the real world that one is experiencing. AR uses laptops, smartphones and tablets to change the real world with digital images and graphics that intersect and interact with one another.

Perhaps, the best way to understand the concept of AR is to learn to play the extremely popular game Pokemon Go! With an energizing tag line 'Get up and go', players of Pokemon Go use the GPS feature in a handheld device to locate, capture and train virtual creatures called Pokemon that appear on the screen as if they were in the same real world locations as the player.



Sthaladipti Saha
Head - EDRC (Commercial Buildings & Airports).

I call this Mixed Reality, and this is what we are planning to do at the Apollo site in Chennai where with the use of Microsoft Holo Lens we can, from different locations, study the same model and collaborate virtually. The day when reality and virtual may actually merge is not very far away!

AR comes in handy for construction teams on the field to understand how various systems and components fit together. Instead of generating an entirely virtual environment, AR takes the 3D model, of the metro in this case, and places it directly into the site in real time enabling the user to see exactly how a design fits into the construction site, including how parts and systems that have yet to be constructed will fit in comparison to those which have already been constructed.

With AR, a project manager or contractor can walk through a construction site and easily view an overlay of a BIM model on top of an as-built construction and compare the two while also accessing up-to-date change orders or other project documentation. The project manager can instantly click pictures or video record the AR walkthrough and send it back to the design team for clarification as and when issues arise for speedy resolution. One can even walk through a full-scale BIM model to create the most efficient construction schedule possible and develop a logistics plan for the site for material and supply deliveries, equipment storage.

"The potential for AR for our industry is enormous because if design and construction can be error-free our savings will be mind-boggling with no reworks," enthuses Saha, "though even from a technology perspective we have just begun to scratch the surface." There is, however, no denying the huge potential of VR and AR for the construction industry and we dare say it will only be a matter of time before all resolutions can be settled … virtually!

THE POTENTIAL FOR AR FOR OUR INDUSTRY IS ENORMOUS BECAUSE IF DESIGN AND CONSTRUCTION CAN BE ERROR-FREE OUR SAVINGS WILL BE MIND-BOGGLING WITH NO REWORKS

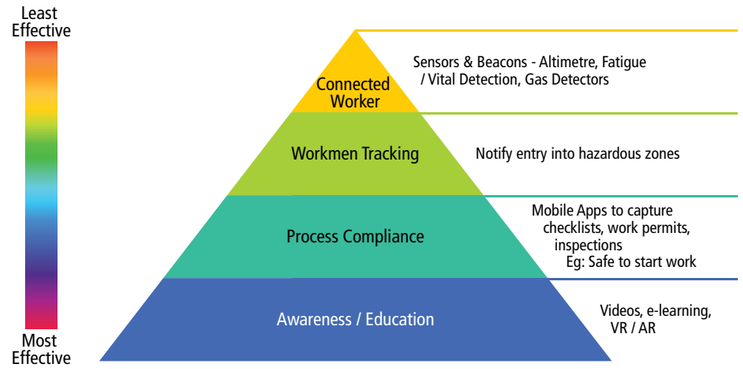
- Sthaladipti Saha,
Head - EDRC (Commercial Buildings & Airports).

MAKING SAFETY LIVE

Even as recently as a couple of decades ago, EHS, or more specifically safety, was not a planned activity and incidents were handled as and when they occurred. As organizations realized the criticality of safety, structured systems were developed and what was merely a reactive incident management system evolved into a proactive and planned programme that along with environment and health emerged as the EHS system which is now an integral function of any organization, especially at construction projects. Digital technology is rapidly rewriting the rules of the game by offering innumerable opportunities to improve work place safety and allowing safety managers to develop and implement actionable safety plans.

The digital pyramid

The digital team at L&T Construction has devised a four-pronged approach to implement digital initiatives which will impact the EHS function positively. The primary focus is on creating awareness and educating stakeholders about the importance of digitalization for a positive buy-in and thereby help create a safer work environment. Next comes process compliance aimed at creating a paperless work environment by capturing all checklists, reports and permits as mobile apps. The vital third area of implementation will be tracking of workmen to prevent from entering unsafe work zones. The 4th and perhaps a lofty objective is to create a 'Connected Workman' –who is 'connected' by all the necessary lifesaving sensors such as beacons, altimeters and fatigue and gas detectors.



Zoning the presence

One of the fundamental applications of digitalization at construction sites is the use of tracking systems such as bar codes and RFIDs. Workmen at L&T Construction now wear helmets that are RFID-tagged whereby the project safety team can ensure workmen keep away from 'no go zones' or do not enter higher levels of structures without the necessary permits. "Whenever we on-boarded fresh workmen to a project, we used to allot them different colored helmets irrespective of their work experience during their first month of induction. This was to ensure that they do not stray into hazardous zones without permits or work alone in areas where they are not permitted. The introduction of RFID tags has made all this easier as we can monitor a large project right on our computer screens and ensure safety to the workforce," says Arun Kumar, an EHS engineer at Shell project site, Bengaluru.

"The recent initiative of adding bar codes to the full body harness not only accounts for each and every life saving device, but also makes its periodic inspection certain and more efficient. With this, the subcontractors too are made accountable and it will certainly translate into huge cost savings," asserts Amitabh Pandey, the cluster EHS manager.

A time to save

"We developed what we call the 'safety clock' which is a tracker with a trigger mechanism on incident reporting as a predecessor to the safety app," shares Gabriel Fenandez, HQ based EHS co-ordinator for B&F IC. "The earlier avatar was entirely manual and therefore tedious both to fill out and analyze, but with this portal based incident reporting system, all a site engineer has to do is to feed in the incident on the EIP portal and based on its severity from fatal to three-day Lost Time Injury, SMSs are generated to the project, cluster and HQ based management team. This helps in augmenting the actionable areas and greatly improves reaction time resulting

in a safer work environment across sites." The safety clock also integrates the feature of pushing monthly reports through SMS on safe man hours achievement and as a future option, the team aims at stacking the present performance against the past data to create trend analysis too.

"Safety is always in your hands and the best way to prevent incidents is to ensure that there is 100% process compliance," stresses M V Satish, Whole Time Director & Senior Executive Vice President, Buildings, Minerals & Metals. "If everyone at a site is constantly aware of his/her responsibilities and carries them out well, I am certain that zero harm is a very achievable goal! The safety app is very active in some 130 sites with close to 4,000 users and this app is really helping us raise the safety ante: everything is real time and transparent and with the kind of audit trail we can now create, there is no place to hide!" He smiles and then adds, "It is indeed heartening to see that many of our digital initiatives are gaining ground in L&T Construction – initiatives like the use of RFIDs that we first experimented with and successfully implemented about 3-4 years ago at HMRL and some of our residential building projects. And, of course, digitalization also means going paperless which is a great step forward in the right direction and with even performance monitoring online, we can refocus our energies on performing and delivering to our clients!"

SAFETY IS ALWAYS IN YOUR HANDS AND THE BEST WAY TO PREVENT INCIDENTS AND ENSURE SAFETY AT SITES IS TO UNSURE THAT THERE IS 100% PROCESS COMPLIANCE

M V Satish
Whole Time Director & Senior Executive Vice President, Buildings, Minerals & Metals.

DiGi SPEAK

Utkarsh Desai
Digital Officer – TI IC

Aiming at deeper penetration even at the induction process at TI IC integrates digitalization for our new joiners. We are now focusing on capturing OEM and third party gateway data onto our portal. With most projects being linear in nature, digitalization can offer great savings through project control. The automation of grader machines have given great results and we are excited to spread such benefits of digitalization across the P&M range at TI IC.

Making safety self-appraisals a reality

The EHS team of B&F IC were keen to bring safety to hand held devices much before the digitalization drive gathered steam at L&T Construction. Based on strong fundamentals, the team devised plans, schemes, analytics and the communication architecture well in advance to evolve a well laid out blue print which when laced with technology became both functional and feature rich.

"We planned the whole Safety App on a scoring basis so that everybody gets self-appraised on his/her activity on a continual basis," shares M. Kamarajan (MK), Head - EHS, B&F IC. "Managers, engineers and even supervisors are given scores based on safety performance and other activities on the Mobile App. Individuals who do not fare well are given greater focus in terms of training and counselling to improve his/her responsiveness to EHS. We ensure that this scoring system is not viewed upon as a method of penalization and encourage

We planned the whole Safety App on a scoring basis so that everybody gets self-appraised on his/her activity on a continual basis.

M. Kamarajan
Head – EHS, B&F IC,

We plan to integrate fish bone analysis into the safety app and aim to reduce the burden of the execution team by lifting the run of the mill areas of safety off their shoulders and make it so efficient that the system takes care of itself offering a totally safe and positive work environment where every day is a safe working day

- S. Anantha Sayana, Head – Digital

active participation for creating a positive EHS culture that is based on transparency." MK claims that he has started refusing to accept power point presentations as reports and insists on live, app based data for meetings which is bringing about the desired results with several clusters migrating completely to an app based reporting system allowing for review from practically any place in the world. "I no longer ask for EHS data, I take it from the safety app at whatever level I want," beams Kamarajan.

The safety app allows execution teams to log in 'Safety Improvement Slips' should they notice anything amiss or anybody violating norms, irrespective of their position or hierarchy. In fact, persons logging in such slips are rewarded with points. "The safety app allows for easy reporting of near miss cases on the spot when the memory is still fresh," shares Sudarsan, a senior engineer at a mixed development project at Delhi. Another great feature is the area for suggestions on improving EHS performance that allows open-ended proposals that can make a huge difference. The 'safe to start card' too is now live on the app vastly improving efficiency at the site level.

Facilitating upward communication and triggering incident based alert systems, the safety app ensures action on a war-footing if the situation so warrants it. What's more, the app can get smarter by the day and eventually evolve into one that is active and questions rather than merely a passive app that accepts input data. Such a system can narrow down to the actual cause of the event while the conventional system can only report along with a skimmed level of investigation. "We plan to integrate fish bone analysis into the safety app and aim to reduce the burden of the execution team by lifting the run of the mill areas of safety off their shoulders and make it so efficient that the system takes care of itself offering a totally safe and positive work environment where every day is a safe working day," forecasts S.Anantha Sayana, Head – Digital.

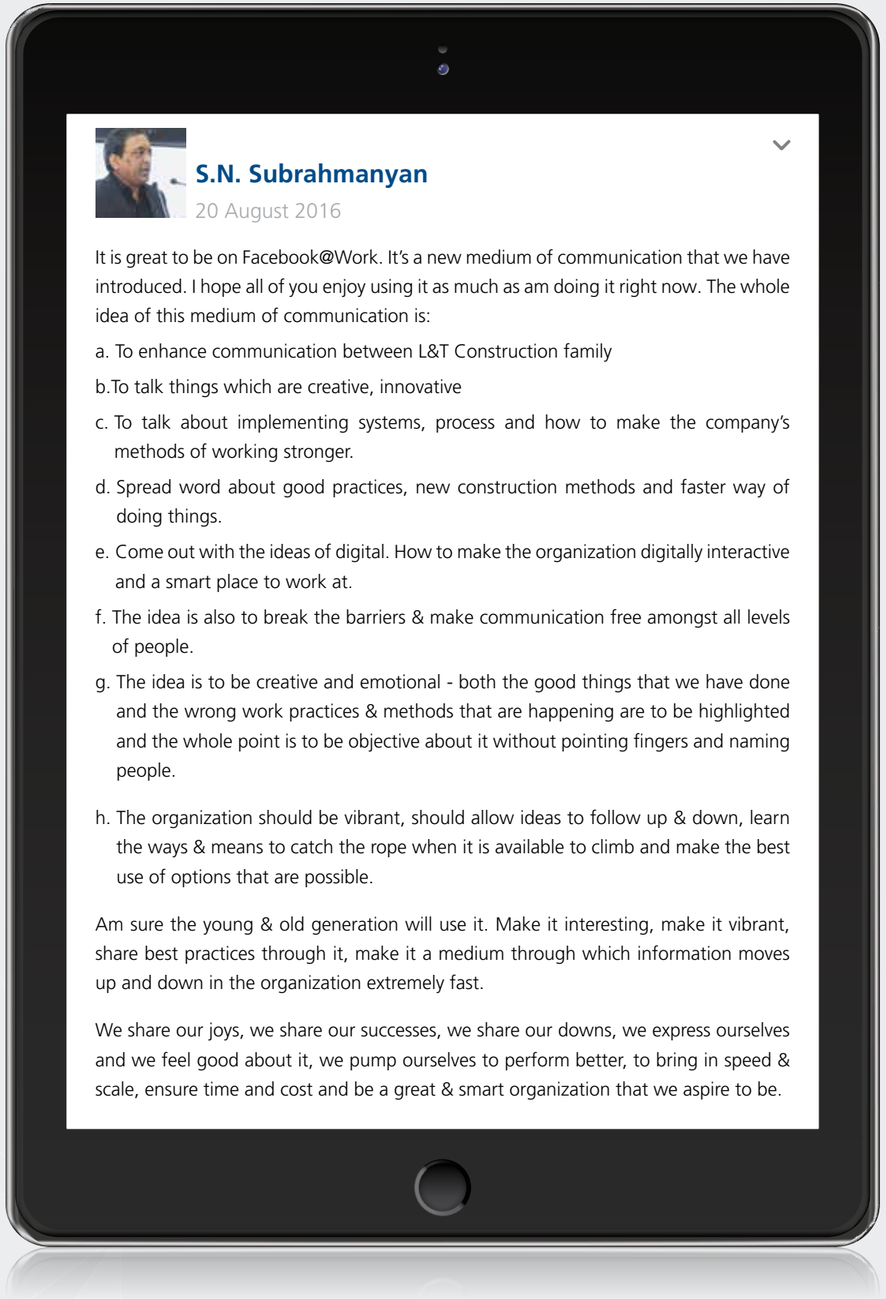
The digitalization initiative also includes a proposal to draw heavily from the Artificial and Virtual reality realms in the way of creating six modules of simulation to begin with. While three modules will be dedicated to presenting to the viewer hazardous situations to monitor how the individual acts under duress, the other three would be exclusively for gauging the reaction of participants

@Workplace

1973
Groups

30,000+
members

Over 15,000 registrations on the day of launch!



S.N. Subrahmanyan
20 August 2016

It is great to be on Facebook@Work. It's a new medium of communication that we have introduced. I hope all of you enjoy using it as much as am doing it right now. The whole idea of this medium of communication is:

a. To enhance communication between L&T Construction family

b.To talk things which are creative, innovative

c. To talk about implementing systems, process and how to make the company's methods of working stronger.

d. Spread word about good practices, new construction methods and faster way of doing things.

e. Come out with the ideas of digital. How to make the organization digitally interactive and a smart place to work at.

f. The idea is also to break the barriers & make communication free amongst all levels of people.

g. The idea is to be creative and emotional - both the good things that we have done and the wrong work practices & methods that are happening are to be highlighted and the whole point is to be objective about it without pointing fingers and naming people.

h. The organization should be vibrant, should allow ideas to follow up & down, learn the ways & means to catch the rope when it is available to climb and make the best use of options that are possible.

Am sure the young & old generation will use it. Make it interesting, make it vibrant, share best practices through it, make it a medium through which information moves up and down in the organization extremely fast.

We share our joys, we share our successes, we share our downs, we express ourselves and we feel good about it, we pump ourselves to perform better, to bring in speed & scale, ensure time and cost and be a great & smart organization that we aspire to be.

A L Sekar
Sr. V.P – Special Projects

Cr(azy)eativity

We are so creative with ideas in construction. They vanish into thin air because of pressure at work. In my , many crazy ideas have been converted to workable solutions enhancing productivity. I hope this forum can serve the purpose of recording crazy ideas, allowing them to spark in the hearts of L&T Construction family, paving the way for some excellent solutions.

Mr. T. Kumaresan, VP & Head, Minerals & Metals BU uses L&T@ work innovatively by connecting and collaborating with his colleagues across the globe through a 'go live' event at the beginning of every month. He presents the month that has been and shares the plans for the future briefly putting the entire team on the same map in an instant.

Jayapriya
HR Dept. – HCI IC

L&T Workplace is a fantastic engagement tool. To connect, communicate, collaborate and commit was our four pronged goal at HCI IC:

- **To connect.** Claim the account, network with colleagues, keep the channel on.
- **To communicate.** Share information. Learn happenings in the IC.
- **To collaborate.** Knowledge development. Best practices exchange. Resources-sharing.
- **To commit.** Be a part of a team, self-improvement, higher motivation to success.

To proliferate these goals at the sites, we came up with an innovative idea of 'special feature edition' which is sustaining the action on workplace!

For a period of 10 days, the chosen project team gets to anchor the Heavy Civil page. The team starts posting energetically using a hashtag.

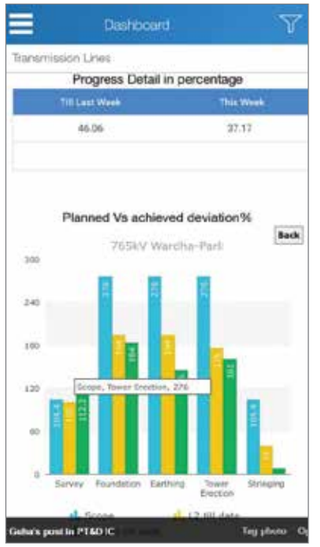
These posts can be on best practices, cost saving methods adopted, voices from the site, motivational messages, awards/recognition, long service award/special mention and training program/celebrations/CSR/Welfare.

This initiative has made L&T@work more exciting and has led many of our people post with enthusiasm

Amit Guha
Head – Corporate Centre (PT&D)

The power of monitoring and collaborating

'Good evening Wardha Parli 765kV TL Project Team! Just reviewed the real time progress of our Project on the mobile App "Align". Heartening to see that we are close to L2 in most areas. Keep progressing faster and finish Ahead of Time. Good Luck!'



L R K Krishnan

Head HR – SWC

To me L&T@work is an excellent engagement tool and right from its introduction, the HR team at Smart World Communication has used this platform to connect and receive feedback as well. All our HR communique is now through this amazing tool and we are simply loving the responsiveness and interactivity which was not possible earlier!

Sonia Shalom

HR Dept. PT&D IC

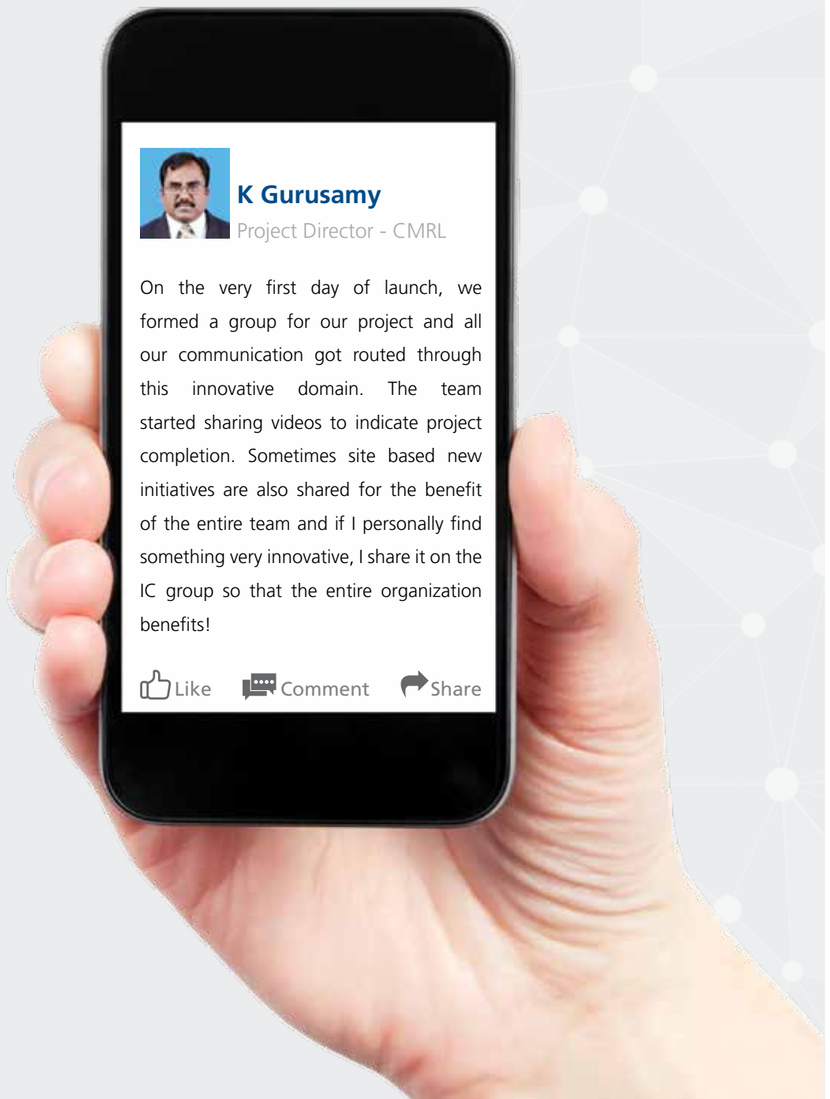
On occasions when we are commissioning projects or even trying to find innovative solutions to complex situations, the PT&D team puts it all there on L&T@work! Apart from feeling elated about the congratulatory notes, many project managers claim their colleagues even sharing videos on the platform to explain easy solutions that can enhance efficiencies. On the whole, L&T@work, really works!

S. Rajavel

Sr. VP & Head - WSW&C

Keeping motivation high

Hi Colleagues, Recently I paid a visit to Greater Colombo Rehab Works project, Sri Lanka along with K Asok Kumar, S Jagannathan, G. Balasubramanian. I appreciate the efforts put in by the project team led by K. Sivaramakrishnan on the progress of the job and I have encouraged the team to complete the project on time.



ORDERS THAT AUGER WELL FOR A ROBUST GROWTH

L&T wins madate to build a 4-lane extradosed road bridge across the Durgam Cheruvu Lake at Hyderabad

108 km of pipeline for the Narmada River Basin based Bulk Water Pipeline Scheme

Electrification works under Integrated Power Development Scheme (IPDS) and Deen Dayal Upadhyay Gram Jyoti Yojana

Primary substations, extra high voltage cabling, and overhead transmission lines across various locations in the Middle East.

Cement plant in Andhra Pradesh

High voltage substations at Oman and UAE consolidates L&T leadership position in the segment in the Middle East.

More orders for commercial and residential towers in Mumbai

4 laning of the Wadpale to Bhogaon Khurd section of NH-17 in Maharashtra

L&T Construction Wins a Major Composite Railway Project of the Dedicated Freight Corridor that includes Civil, Track, Electrification and S&T systems

L&T to re-develop Mumbai's century-old BDD Chawls for Maharashtra Housing and Area Development Authority

Prestigious orders to build transmission lines at voltage levels of 765 kV and 400 kV across different states of India

L&T bags EPC order from the Ministry of Water and Irrigation of the United Republic of Tanzania for the extension of the water transmission pipeline from the Lake Victoria Water Supply scheme to Tabora, Nzega and Igunga Towns.

L&T Construction Signs Contract with Maharashtra Government for Nagpur Smart City Project

L&T to build a part of Ahmedabad Metro

Turnkey construction of solar PV plants in the states of Uttarakhand and Rajasthan

Medical college and a 500-bed hospital for Bihar Medical Services & Infrastructure Corporation Limited

L&T to execute project that aims to quench the thirst of rural villages of Odisha

A navigational lock at Farakka, West Bengal

WE ARE TEAM DIGITAL!

We are a startup within an almost 8-decade-old solid brick and mortar company. Our job is all about taming new and emerging technologies to work for us.

The white board is our most precious asset. Once we gather in front of it and start talking about problems, our creative juices flow out of the marker pen to sketch solutions.

We think and work like a startup; at our sites we meet, listen, talk, understand, think, conceptualize, solve and build fast.

We are an energetic team built from scratch, talented, diverse, creative, passionate, gregarious, fun loving.

Our challenges are many; nascent technology, emerging ecosystems, people and change management. The opportunities are however, tremendous! Excitedly, we stand at the threshold of transforming our Industry and leading the pack.

We are a startup with SNS our boss who inspires us, supports us, eggs us, 'pushes' us, demanding speed and scale, backing us solidly in all our efforts. He is our angel investor and we owe him a good valuation and great dividends on investments made. Our valuation is surely rising with each solution that we implement, and surely as our users embrace our solutions and reap its benefits, we will deliver!

Team members who were busy at the sites on the day of the shoot.

Edited by Vinod Jacob Chacko for L&T Construction from L&T Construction Headquarters, Manapakkam, Chennai - 600 089.
Associate Editor: Gopi Kannan. S, Editorial team: Ashwin Chand, Photography: V. S. Natanavelu | R. Vijay Kumar
Design & layout: Venture Media Works