



SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

Accredited "A" Grade by NAAC | 12B Status by UGC | Approved by AICTE

www.sathyabama.ac.in

**SCHOOL OF BUILDING AND ENVIRONMENT
DEPARTMENT OF ARCHITECTURE
M. Arch (Building Management)**

**PROFESSIONAL TRAINING (S84APT)
JUL 2022 - AUG 2022**

Name of the Student : A.THAMARAI SELVI

Semester : III

Reg No. : 41840018

Batch : 2021-2023



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DEPARTMENT OF ARCHITECTURE

M. Arch (Building Management)

VIVA-VOCE EXAMINATION

This is to certify that the Professional Training Report (S89APT) is the work of **A.THAMARAI SELVI** who had undergone training in **LARSEN AND TOUBRO CONSTRUCTION** has been monitored by the continuous assessment during Jul 2022 to Aug 2022.

Dr. Devyani Gangopadhyay
HOD AND DEAN

Submitted for Viva voce Examination held on 20.12.22

Internal Examiner

External Examiner



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DECLARATION

I **A.THAMARAI SELVI** hereby declare that this Professional Training Report done by me under the guidance of **Mr.V.SWAMINATHAN** is submitted in partial fulfillment of the requirements for the completion of practical training session.

DATE : 12-20-22

PLACE : CHENNAI

A.THAMARAI SELVI

SIGNATURE OF CANDIDATE

ACKNOWLEDGEMENT

I am pleased to acknowledge my sincere thanks to Board of Management of **SATHYABAMA INSTITUTE OF SCIENCE & TECHNOLOGY** for their kind encouragement in doing this project and for completing it successfully. I am grateful to them.

I convey my thanks to **Dr. Devyani Gangopadhyay Dean, School of building and Environment** for providing me necessary support and details at the right time during the progressive reviews.

I would also like to express my sincere thanks to **AR. SURYA RAJKUMAR** Internal coordinator for her valuable guidance, during the entire Professional Training period.

I would like to express my special thanks to **L&T CONSTRUCTION - BUILDINGS AND FACTORIES** for this wonderful opportunity. Secondly, I, sincerely, express my gratitude to **Mr.V.SWAMINATHAN, Mr.JAIGANESH, Mr.ARUN, Mr. UMAR BELAL, and Mr. VISHNU VARTHAN** for accepting and providing me the opportunity to work under their expert guidance and close supervision.

I wish to express my thanks to all Teaching and Non-teaching staff members of the Department of Architecture who were helpful in many ways for the completion of the project.



Date: 11.05.2022

TO WHOMSOEVER IT MAY CONCERN

THAMARAI SELVI A (Reg No- 41840018) is a bonafide student of our institution pursuing Masters in Architecture in Building Management (Batch 2021-2023). As part of the curriculum the students are required to undergo Professional Training for a minimum period of 30 working days. Kindly grant permission for the same in your esteemed organization. We also assure that information collected about any project will be used for academic purpose only.

Thanking You,


Dr. Devyani Gangopadhyay
Dean, School of Building & Environment

JEAN
SCHOOL OF BUILDING & ENVIRONMENT
SATHYABAMA
INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)
Jenpally Nagar, Rajiv Gandhi Salai,
Chennai - 600 119.



Larsen & Toubro Limited,
Construction
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P. B. No. 979, Mount Poonamallee Road,
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Chennai - 600 089, INDIA
Tel : +91-44-2252 6000, 2252 8000
Fax : +91-44-2259 7288
www.Lntecc.com

B&F IC/EDRC-HR/Training/599-2022

08 July 2022

Head of the Department
Sathyabama Institute of Science & Technology
Kamaraj Nagar, Semmancheri, Chennai - 600119

Dear Sir/Madam,

Sub: Project Training

This has reference to your letter dated **11-May-2022** regarding Project Training for your student, **Ms. Thamarai Selvi A (41840018)**. As a special case, we agree to admit her for Project Training from **11-July-22 to 19-Aug-22**.

Please advise her to carry 3 Passport size photographs, copy of her College ID card and Adhaar card copy while reporting for the project training.

Please note that:

- She has to undergo the training without any financial commitment to our Company and fully at her own risk and responsibility.
- She must strictly comply with safety & other rules applicable at the project site/Office.
- She will be awarded her Project Training completion certificate on submission of the Project Report.

Thanking You,

Yours faithfully,
For **LARSEN & TOUBRO LIMITED**



SUNEET KUMAR
DGM - HUMAN RESOURCES

Registered Office: L&T House, N. M. Marg, Ballard Estate, Mumbai - 400 001, INDIA
Licence No.: CIN - L99999MH1946PLC004768

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Tel : +91-44-2259 6000
Fax : +91-44-2249 3317
www.lntec.com

B&F IC/HQ-HR/Training/2022-23/34
August 18, 2022

TO WHOMSOEVER IT MAY CONCERN

This is to certify that **Ms. Thamarai Selvi A** student from Sathyabama Institute of Science & Technology Chennai has completed her Internship in the Corporate Strategy Department at our Head Quarters, Chennai, during July 11, 2022 – August 18, 2022.

We wish her all success in her professional career.

Yours faithfully,
for LARSEN & TOUBRO LIMITED

(S VIJAYARAGHAVAN)
MANAGER - HR



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SCHOOL OF BUILDING & ENVIRONMENT, DEPARTMENT OF ARCHITECTURE
M. Arch (Building management) Batch 2021-2023
Continuous Assessment Report for Professional training

(Continuous progress report of the trainee architect/Project Manager for the period of 15 working days in the office to be submitted to HOD)

1. Name of the office / organization :	LARSEN AND TOUBRO CONSTRUCTION
2. Address & Contact Number :	MANAPAKKAM, CHENNAI
3. Name of the student :	A. THAMARAI SELVI
4. Duration :	From 11.07.2022 To 08.07.2022
5. Total No. of days :	15 working days
6. Evaluation of Performance criteria shall be on	

* Note: Kindly grade the student as per his/her overall performance in the office during the assessment month;

Description of works	Excellent	Good	Fair	Poor	NA
Understanding of office culture		✓			
Skillsets related to project management		✓			
Design Management		✓			
Understanding the Triple Constraints	✓				
Observation during Site Visits		✓			
Understanding of construction details		✓			
Understanding of Construction sequences		✓			
Site Supervision / Discussion with clients		✓			
Adherence to Time schedule	✓				
Quantitative aptitude		✓			
Documentation skills		✓			
Coordination with other consultants		✓			

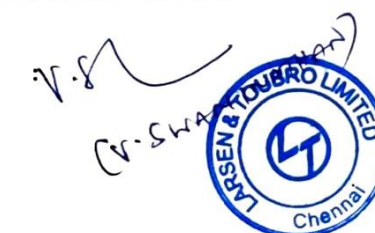
Overall Grading*

(A) Good

(A – 8.0, B – 7.0, C – 6.0, D – 5.5, E – 5.0, F – <5)

7. Any other Remarks

8. Signature of the
Head of the Office /
Organization (With Seal)





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1. Name of the office / organization :	LARSEN AND TOUBRO CONSTRUCTION
2. Address & Contact Number :	MANAPAKKAM, CHENNAI
3. Name of the student :	A. THAMARAI SELV
4. Duration :	From 29.07.2022 To 18.08.2022
5. Total No. of days :	15 WORKING DAYS
6. Evaluation of Performance criteria shall be on	

* Note: Kindly grade the student as per his/her overall performance in the office during the assessment month;

Description of works	Excellent	Good	Fair	Poor	NA
Understanding of office culture	✓				
Skillsets related to project management		✓			
Design Management		✓			
Understanding the Triple Constraints		✓			
Observation during Site Visits		✓			
Understanding of construction details		✓			
Understanding of Construction sequences		✓			
Site Supervision / Discussion with clients		✓			
Adherence to Time schedule	✓				
Quantitative aptitude		✓			
Documentation skills		✓			
Coordination with other consultants		✓			

Overall Grading*

Good

(A – 8.0, B – 7.0, C – 6.0, D – 5.5, E – 5.0, F – <5)

7. Any other Remarks

8. Signature of the
Head of the Office /
Organization (With Seal)

(V. S. SATHYANARAYAN)



WORK DIARY

DAY	PROJECT NAME	WORK DONE	DAY	PROJECT NAME	WORK DONE
1.	Introduction	Lean construction	16	Innovation centre	Site visit
2.	ILCC 2022 conference	Lean construction	17	Innovation centre	FHS (Induction programme)
3.	ILCC 2022 conference	Lean construction	18	Innovation centre	Time office & 3d printing
4.	Prestige Finsbury park	Lean construction (SS)	19	Innovation centre	Lean construction (constraint analysis)
5.	Prestige Finsbury park	Lean construction (SS)	20	Innovation centre	Lean construction (constraint analysis)
6.	Prestige Finsbury park	Lean construction	21	Innovation centre	Quality Assurance and Quality Control
7.	Data centre project	contract document	22	Innovation centre	Plant and machinery
8.	Data centre project	contract document	23	Innovation centre	Planning
9.	Data centre project	contract document	24	Innovation centre	Formwork
10.	Data centre project	contract document	25	Innovation centre	Stores & batching plant
11.	Data centre project	contract document	26	Innovation centre	Presentation
12.	Data centre project	contract document	27	Innovation centre	Presentation
13.	Data centre project	contract document	28	Innovation centre	Scheduling
14.	Data centre project	contract document	29	Innovation centre	Scheduling
15.	Data centre project	contract document	30	Innovation centre	Scheduling

Project manager Signature: 
(V. Srinivasan)

Office seal:



FIRM HISTORY

- L&T CONSTRUCTION are India's largest construction organization and ranked among the world's top contractors.
- They contribute significantly to build the image and stature of L&T across the world and drive L&T's reputation as 'the builder of the India of the 21st century' by offering EPC solutions to execute large industrial and infrastructure projects from concept to commissioning on a turnkey basis with single-source responsibility.
- Their multiple businesses encompass distinct but complementary capabilities that address different segments of infrastructure and industry.
- L&T Construction is a division of Larsen & Toubro (L&T) a major Indian technology, engineering, construction, manufacturing and financial services conglomerate, with global operations.
- L&T addresses critical needs in key sectors - Hydrocarbon, Infrastructure, Power, Process Industries and Defense - for customers in over 30 countries around the world.
- L&T is engaged in core high impact sectors of the economy and our integrated capabilities span the entire spectrum of 'design to deliver'.

Some of the iconic projects done by L&T:

- Mumbai International Airport
- The Bahai's temple
- Statue of unity
- Mumbai Surveillance project
- Pellet and sinter plants Tata steel limited – Jamshedpur & Kalinganagar
- Motera cricket stadium

L&T are pioneers at doing

• Airports	• Hydel Projects	• Water infrastructure
• Bridges	• Railways	
• Factories	• Office spaces	
• Hospital	• Nuclear plants	
• Housing	• Transportation infrastructure	

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1. PROJECT BRIEF

Name Of The project	L&T INNOVATION CAMPUS
location	Chennai
Client	L&T Realty
Contractor	L&T Construction (Buildings &Factories)
Consultant	Architect Consultant R Chakrapani & Sons
	Structural consultant Vastech Consultant and Engineers LLP
	MEP Consultant QDC India Consulting Pvt Ltd
Types Of contract	Item Rate Contract
Total project cost	475 CRORES
Project Timeline	29 Months
Plot Area	22 Acres
Built up area	16, 10,334 Sq.m (4.6 Acres)

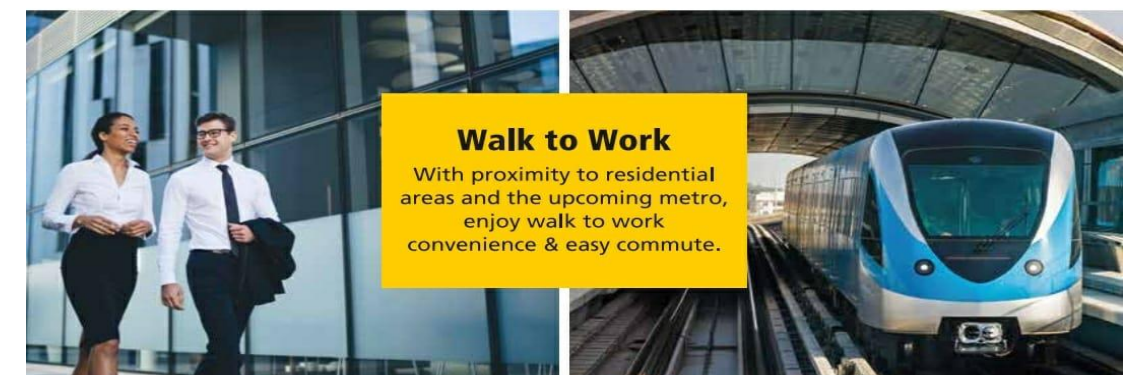
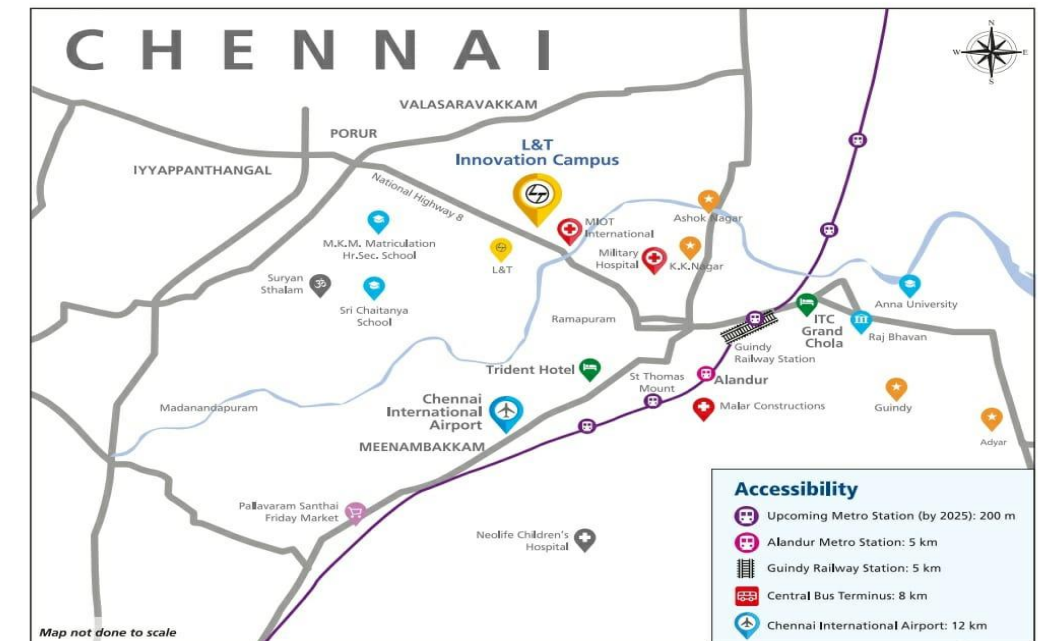
1.1 L&T INNOVATION CAMPUS

L&T Innovation campus, Chennai brings together world class IT/ITES office spaces, Contemporary residences, the best of amenities and a lush

Well-connected Destination

L&T Innovation Campus, Chennai is ideally located in Mount Poonamallee Road, Manapakkam - the city's fastest-growing, in-demand locality today owing to its proximity to IT / ITeS hubs & SEZs, industrial parks and good residential projects.

With excellent connectivity, ease of public transportation and within a 10-minute radius of social infrastructure like hotels, hospitals, schools, shopping malls, etc, you will also have access to a rich talent pool.



central parkland, right in the heart of the city's emergent growth corridor.

Designed to be future –ready, wellness centered and sustainable, with plenty of green open spaces to spur innovation and growth, its where you unravel the future.

1.2 NEIGHBORHOOD CONTEXT

The L & T Head Quarters, and **DLF IT park** is located direct opposite to the site and the development of various IT, ITES buildings are under development in ponnamalee high road acting as IT Corridor.

1.3 SITE PLAN

L&T Innovation campus has two towers. Towers of Phase 1 is on under Construction, which is located on southwest corner of the plot with an abutting road. The Site is accessed through a temporary internal road, which is connected to the Ponnamalle high road.

The project is developed in two phases. The Phase 1 Development consists of 3 basements with the Total Built up area of 16, 27,400 Sq. Ft with a building height of 12 storey including 3 basement area.

The Phase 2 is yet to be planned and developed.

1.4 SPATIAL PLANNING

- Ground Floor and 12 Office Floors in each tower.

There will be 2 towers with a combined basement.



- Parking and Services infrastructure are provided at basements.
- The building has a Raft foundation, a diaphragm wall, and a top-down flat slab construction system.
- The Core has been planned with a prominent location at the centre of the structure such as staircase, lobby, toilets and services to adhere safety requirements
- Elegant entrance lobby with double storey height for an exciting drop off experience and Amenities spaces are planned in the ground and first floor.

- Separate landscaped jogging track at the terrace and outdoor activities like gym/yoga with shading elements such as pergolas/louvers.

1.5 INFRASTRUCTURE FACILITIES

Infrastructure facilities like

- roads, power, water, storm water and sewer management system,

waste management system (solid & sewage), high-tech optical fiber connectivity, etc., are expected to be seamlessly integrated into the development.

1.6 SUSTAINABILITY AND WELLNESS BENEFIT

- Optimal natural daylight and ventilation.
- Treated water for landscaping and flushing
- High performance double glazed façade
- Rainwater harvesting
- Low VOC material for better indoor air quality
- Space optimization and energy efficient
- Health and safety of building occupants

1.7 SMART TECHNOLOGY

- Touch less Access/IOT (Built To Suit)
- 100% POWER BACKUP
- Smart Parking and air quality control
- Facility Management and BMS
- High speed elevators
- Intelligent Lighting control
- Multi-Tier security and surveillance
- Campus Visitor Management

1.8 SCOPE OF THE PROJECT

BY OWNER - Land, Specifications and Drawings, Permissions, Approval for construction Payment for initial connection for obtaining electricity on a single point .

BY CONTRACTOR – Materials ,Plant and Machinery, tools with resources , Water supply for initial connection , consumption of electricity and water for usage and for drinking including testing , site office and provide major site infrastructure for other contractors e.g. Tower crane, Material hoist, labour, Passenger hoist.

1.9 KEY CLAUSES OF THE CONTRACT

Approvals	Statutory approvals in employer's scope
	Construction related approvals in contractor's scope
Performance guarantee	5% of Total order Value within 7 days
Mobilization Advance	10% of Total order value
Retention Money	5% of the value of order within seven days of issue of the work order
DLP Period	24 months from the date of issue of LOA
Liquidated Damages	0.5% of the total ordered value

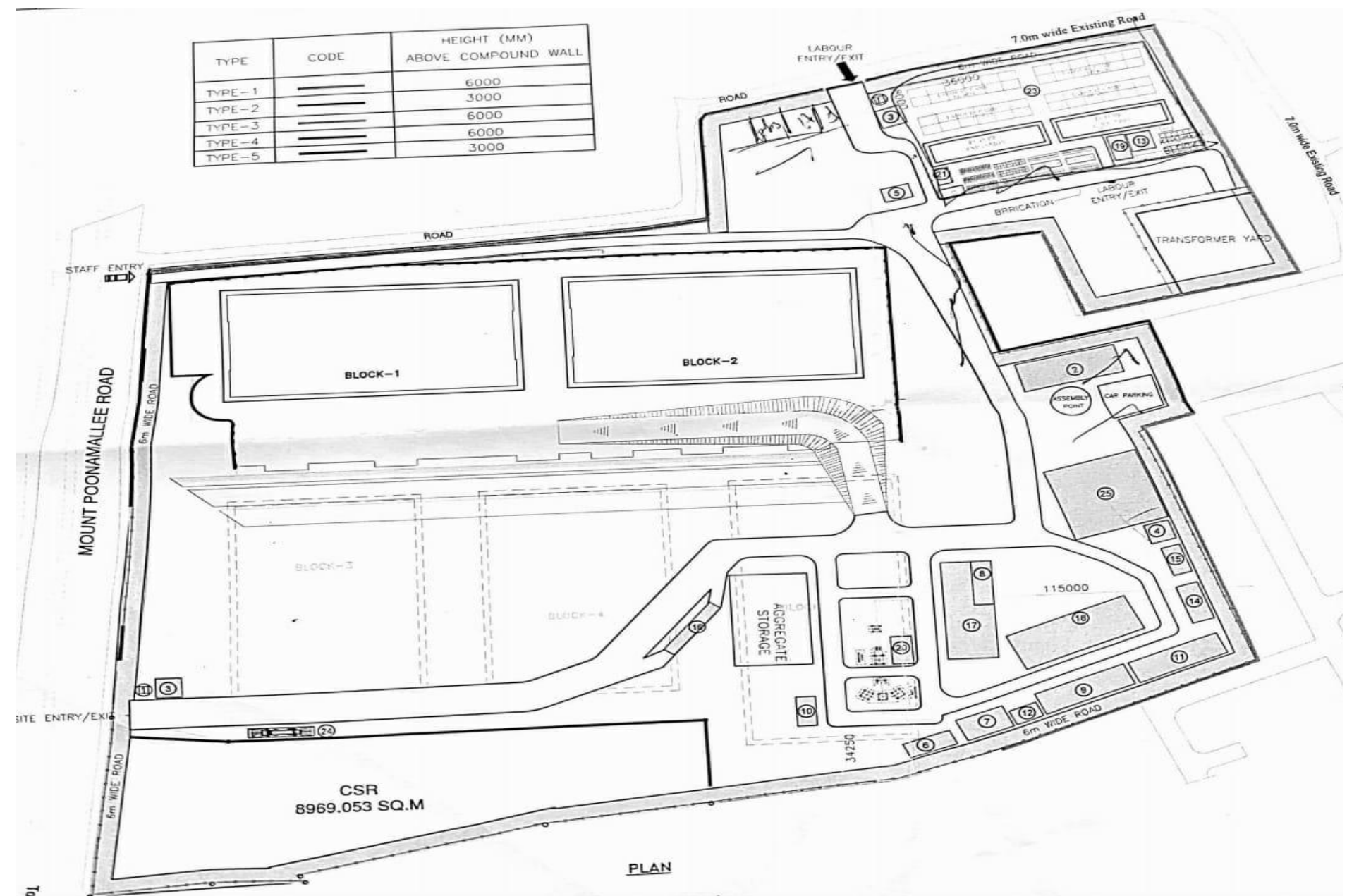
Payment term	Stage 1- 75% of RA bill shall be paid within 10 days
	Stage 2 - Balance of RA shall be made within 30 days after its certification
Variation	Owner has right to make any variation in quality or quantity of the work
Order of precedence	Special condition of contract General condition of contract General guidelines towards workmanship and contract condition. Technical Specification
Insurance	Workmen's compensation insurance, Group personal accident policy, Third party liability insurance, Contractor plant and machinery insurance

Termination	Owner liability will be limited to work already executed	Closure/Suspension	The owner shall have rights to temporarily suspend and reinstate the execution .
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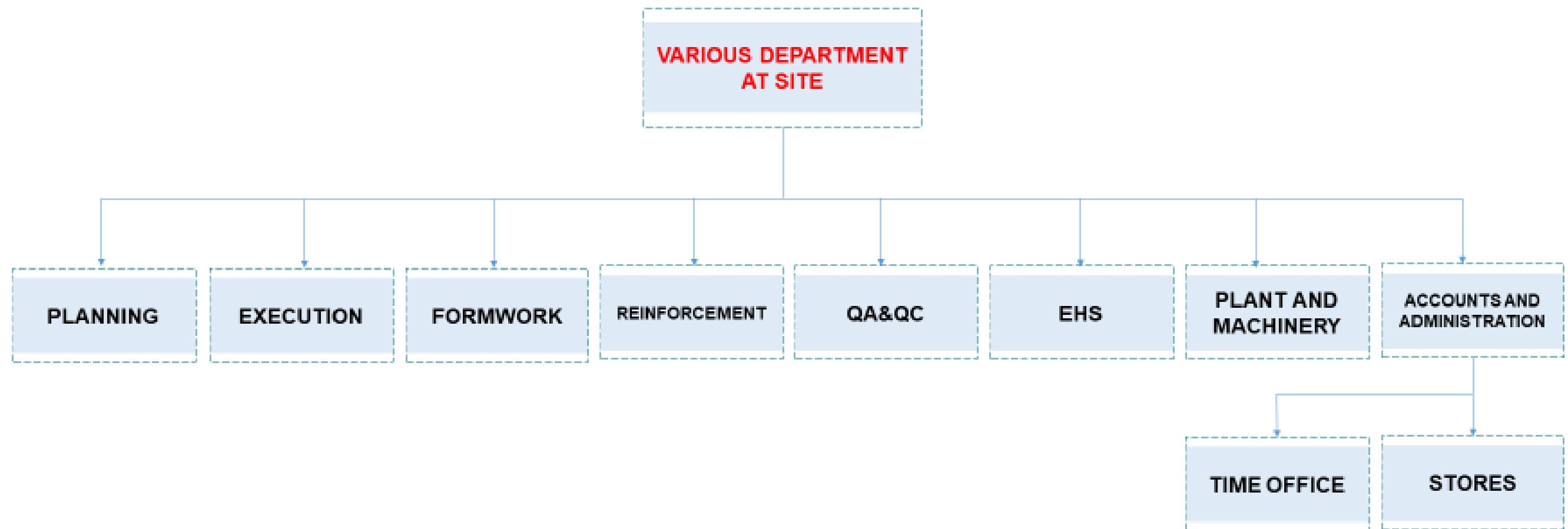
1.10 TEMPORARY INFRASTRUCTURE FACILITIES AT SITE

TEMPORARY INFRASTRUCTURE FACILITIES		
ITEM CODE	DESCRIPTION	QTY
1	SECURITY CABIN	2
2	PROJECT OFFICE	1
3	TIME OFFICE	2
4	EHS OFFICE & INDUCTION ROOM	1
5	STORE OFFICE	1
6	QA / QC LAB & OFFICE	1
7	P&M WORKSHOP	1
8	FORMWORK WORKSHOP	1
9	MAIN STORES	1
10	CEMENT GODOWN	1
11	MEP GODOWN	1
12	DIESEL YARD	1
13	WORKERS TOILET	1
14	CANTEEN STAFF	1
15	DG SHED	1
16	WEIGH BRIDGE	1
17	FORMWORK YARD	1
18	REINFORCEMENT YARD	1
19	WATER TANK (BELOW GROUND LEVEL)	1
20	WATER TANK (BELOW GROUND LEVEL)	1
21	SEPTIC TANK (12 KL EACH)	1
22	M1 BATCHING PLANT	1
23	WORKMEN COLONY (G+2)	4
24	TYRE WASH	1
25	CSTI	1

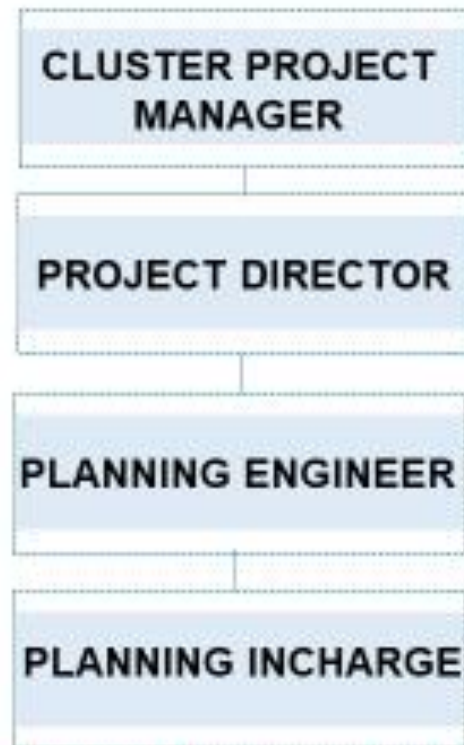
PRO



SITE PLAN DURING EXECUTION STAGE



3.0 PLANNING DEPARTMENT AT PROJECT SITE



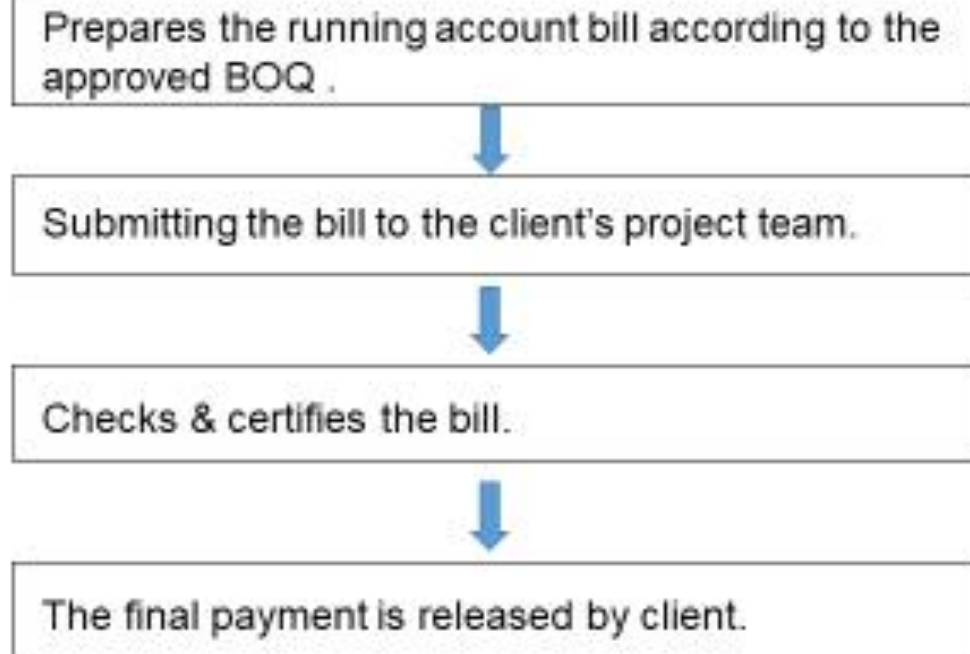
ORGANIZATION CHART OF PLANNING

VARIOUS FUNCTIONS

- Preparing master schedule
- Creating a Work schedule Monthly and Weekly
- Approval of schedule
- Tracking of schedule
- Updating master construction schedule.
- Monitoring the construction work.

Scheduling (using software such as primavera, MS Project)

CLIENT BILLING



ROLES AND RESPONSIBILITIES

- Client billing
- Subcontractor billing
- Procurement
- Resource Management
- Costing based on BOQ (bill of quantities).

3D PRINTING MACHINE

It is an emerging technology, which is being tested in L&T by doing sample 3D structure using 3D printer by COBOD



4.0 DIAPHRAGM WALL CONSTRUCTION | L&T INNOVATION CAMPUS

4.1 GUIDEWALL CONSTRUCTION

Constructed to set out the position of diaphragm wall.

Guide walls provide

- Template for wall excavation panel layout
- Serves as platform to hang reinforcement provide reference elevation for inserts.

Equipment: clamshell, Excavator

4.2 EXCAVATION

Excavation using trencher/grabber.

Depth: 16m

The Excavation is stabilized by filling it with bentonite slurry to support the wall of the excavation.

INSTALLATION OF REBAR CAGE

The crane lifts up the reinforcement bar cage and places it within the panel.

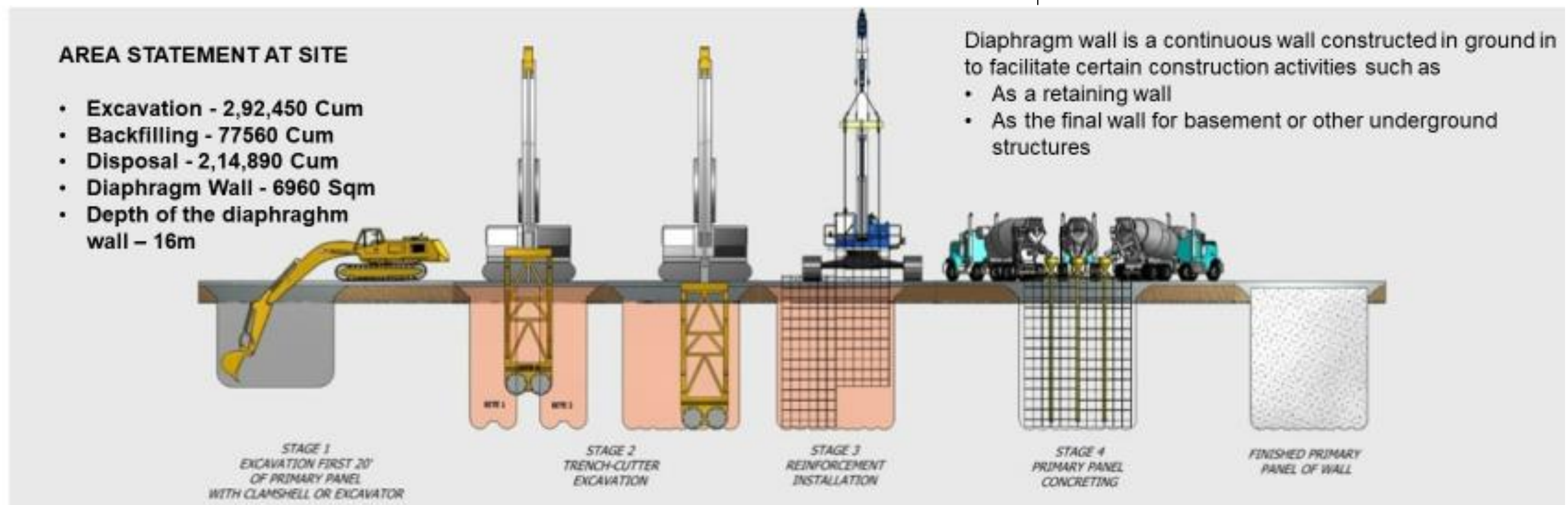
Equipment: Tower crane

4.3 CONCRETING OF PANEL

Tremie pipe lowering

Concrete is poured into the panel to form the panel wall.

Transit mixer, Tremie pipe



4.1.1 GUIDE WALL CONSTRUCTION

- Guide walls are two temporary parallel beams constructed along the side of the wall in order to guide the excavation tool and stabilize the top portion.
- The implementation of guide walls prior to diaphragm-wall construction helps to maintain the horizontal alignment and continuity of the diaphragm walls constructed.
- Guide walls also:
 - Avoid Soil collapse
 - Help mark the panel positions
 - Support the reinforcement steel cages

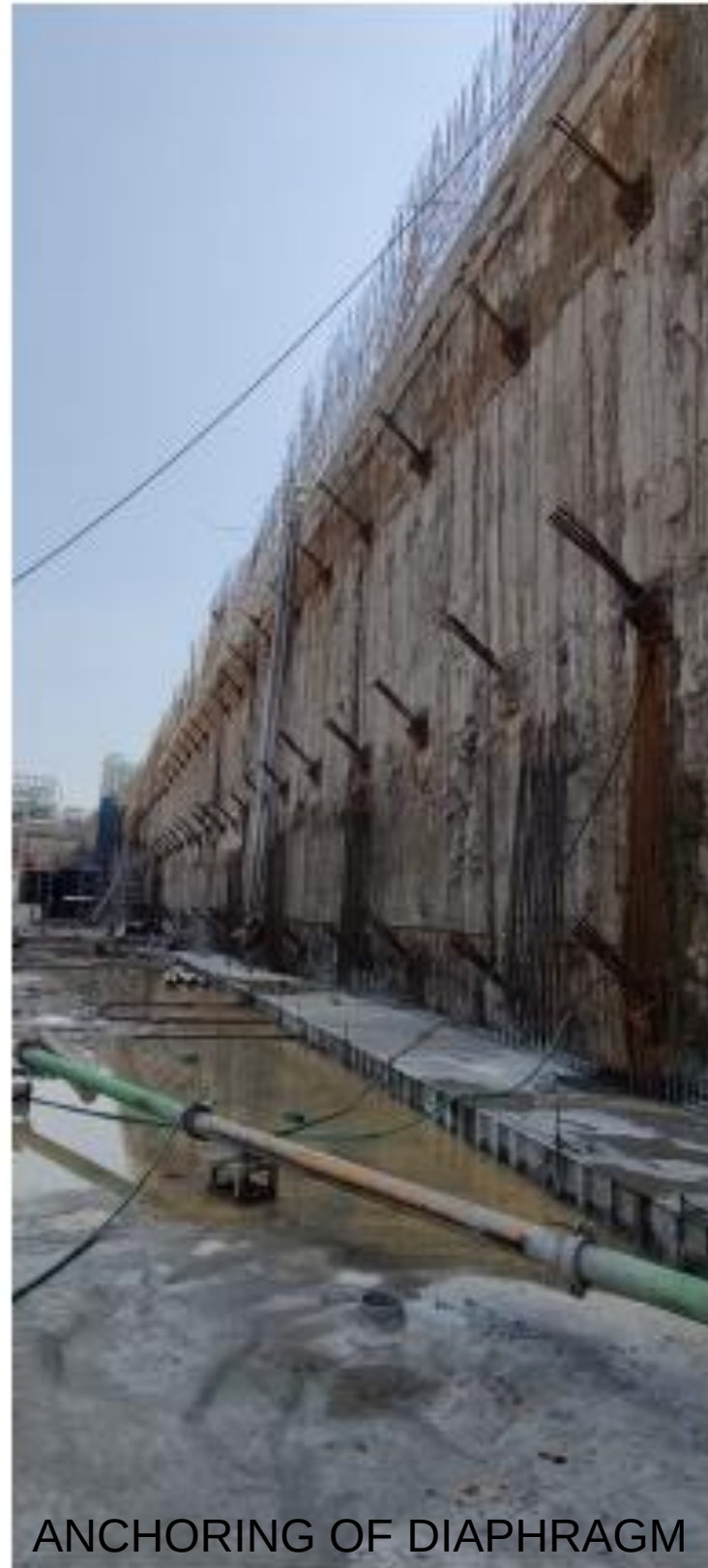
4.1.2 EXCAVATION OF PANEL

- This stage includes soil-removal and stabilization. A rectangular excavation tool is used to excavate the panel section.
- A grabber is used to excavate the trench in normal soil.
- Grab suspended by a crane or cable easily moves into the soil.
- The above procedure carried with adequate excavation support, otherwise, the sides of the excavated trench can collapse.
- To protect the sides, bentonite slurry is used.
- The slurry helps in producing lateral pressure that is sufficient to retain the vertical soil.

4.1.3 WALL CONCRETING

- This stage involves the concreting of the panel excavated. Initially, the reinforcement cage is inserted into the trench.
- These steel reinforcement cages have to be inserted to cover the depth and these cages are lapped.
- Once the reinforcement is placed, the concrete is poured into the trench with the help of tremie pipes.
- The use of tremie pipes helps to avoid segregation of concrete.
- The poured concrete replaces the bentonite clay in the trench. The density of bentonite is low compared to concrete hence is replaced during the concreting.
- The bentonite clay displaced is collected and reused.

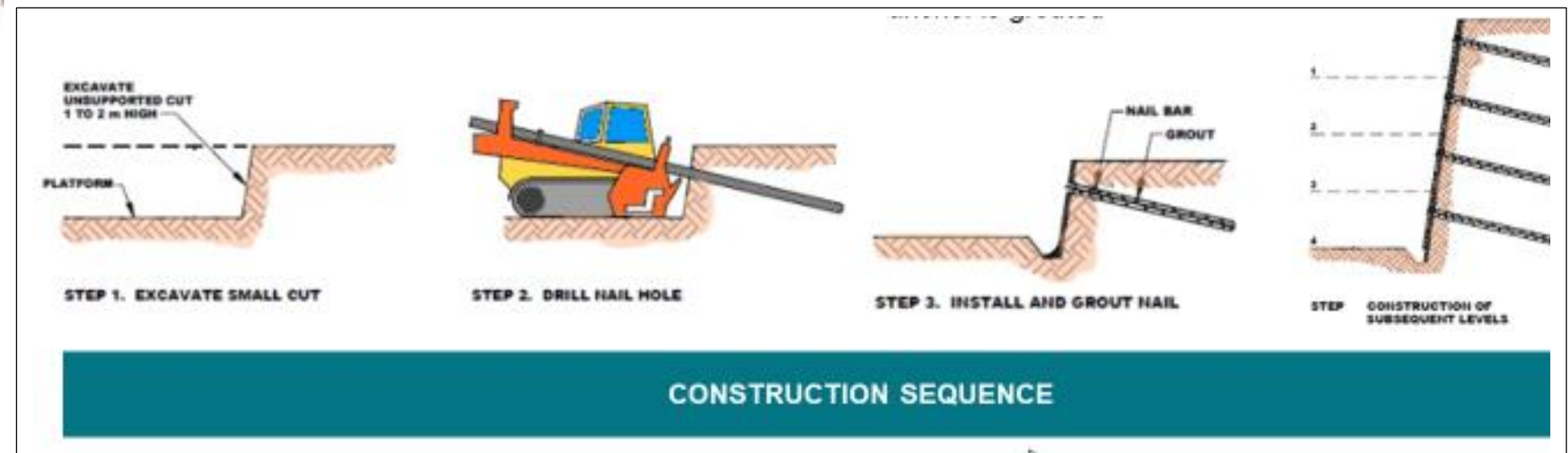
4.4 DIAPHRAGM WALL CONSTRUCTION | L&T INNOVATION CAMPUS



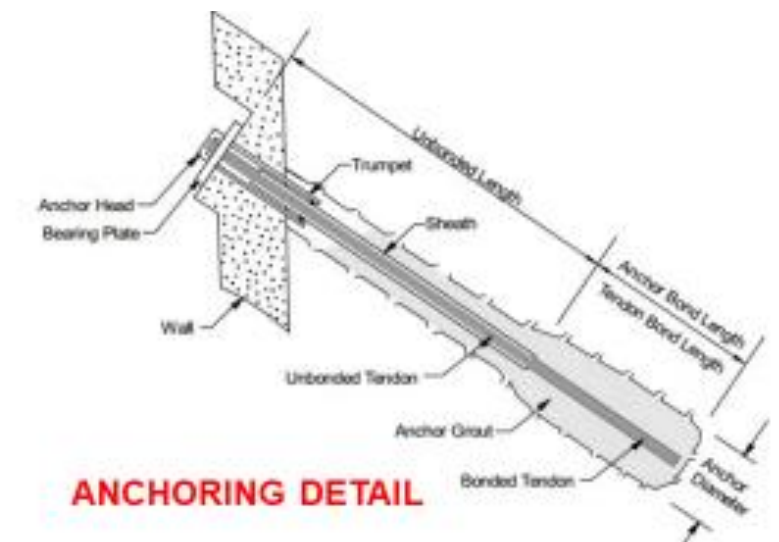
ANCHORING OF DIAPHRAGM

5.1 ANCHORING OF DIAPHRAGM WALL

- Landslide stabilizations.
 - Stabilization of existing structures such as retaining walls.
 - Protection works for deep excavation for underground purposes.
- A drill rig is used to drill boreholes.
 - anchor tendon is put into the hole in the center.
 - Strand is inserted into the bore and the anchor is grouted.
 - The anchor head is then pre-tensioned by jacking after 7 to 10 days.



ANCHORING AT SITE



ANCHORING DETAIL

SITE PHOTOS

EXCAVATION



REBAR CAGE



CONCRETING



DRILLING BOREHOLES



ANCHORING



DIAPHRAGM WALL CONSTRUCTION

ANCHORING OF DIAPHRAGM WALL

5.0 POST TENSIONING OF SLAB | L&T INNOVATION CAMPUS

1. Shuttering
2. Bottom reinforcements
3. Ducting
4. Top Reinforcement

5. A post-tensioning tendon is made up of one or more pieces of prestressing steel are housed inside a duct or sheathing.

6. One end of the tendons are anchored with the help of anchor and the other end is left open with plastic pocket former, where the tendons are stressed.

7. Couplers are used in between if any construction joint is formed.



POST TENSIONING OF TENDONS AT SITE

8. Placing of the Concrete
9. These tendons are stressed with the help of stressing jacks.

10. The steel gets elongated, and the concrete is compressed.

11. The extra tendons that are left out at one end are trimmed and non shrink grouting is put in the anchor pocket.

6.0 RAFT FOUNDATION | L&T INNOVATION CAMPUS



WATER PROOFING MEMBRANE – HDPE



REINFORCEMENT AND SHUTTERING OF
RAFT FOUNDATION



COLUMN SHUTTERING AND
REINFORCEMENT

HIGH DENSITY POLY ETHYLENE (HDPE SHEETS)

It is fully bonded waterproofing membrane that bonds directly to structural concrete, thus sealing the concrete and prevent any ingress of water around the concrete structure.

To prevent the building's basement from water penetration

- Cleaning and Dewatering
- Cutting the membrane as per required length.
- Align the membrane and roll it out
- Overlaps between sheets to be rolled to ensure good adhesion.
- End joint and cut edges should be sealed with tape.

Types of Foundation: **RAFT FOUNDATION**
SEQUENCE OF ACTIVITIES

RAFT

- PCC
- Water proofing
- Reinforcement
- Shuttering
- RCC

FOOTING

- Shuttering
- RCC

PEDESTAL

- Shuttering
- RCC

7.0 FORM WORK | L&T INNOVATION CAMPUS



→ Plywood

→ H beam

→ Scaffolding

**HORIZONTAL
FORMWORK**

CONCRETING

HUTTERING

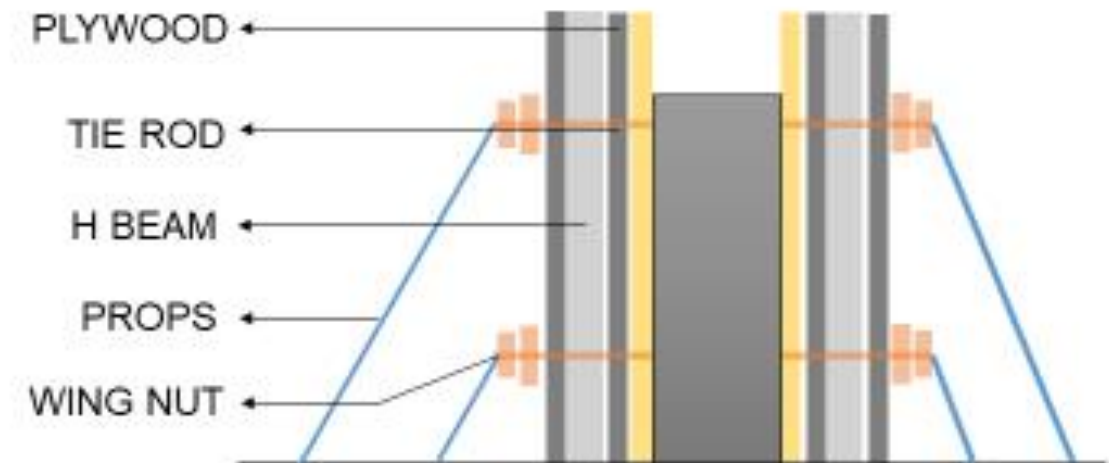
REINFORCEMENT

SYSTEM SELECTION

- Floor to Floor height of the structure.
- Type of Slab
- Tower crane availability
- Repetition of the activities.

TYPES OF SYSTEM

- Flex system
- Table form work system
- Cup lock system



VERTICAL FORMWORK



7.0 FORM WORK | L&T INNOVATION CAMPUS



10. Joint bar

Weight (kg)	0.68
Used to joint the prop heads with the beams (Middle beam and/or End beam)	



11. Special prop head

Dependent upon each structure
Used to joint the beams together (Middle beam and/or End beam), this special prop head will be placed where a normal prop head cannot be installed



12. AL - (A/G) Release

Size	63.5 x 63.5	Weight (kg/m)	1.931
Used to join panels together around the corners			

16. Pipe support

Type	Length	Weight (kg)
V-1	1,800mm ~ 3,200mm	10.9
V-2	2,000mm ~ 3,400mm	11.5
V-3	2,400mm ~ 3,800mm	12.5
V-4	2,600mm ~ 4,000mm	13.0

The pipe support is used to support the weight of the slab during concrete pouring and casting. It will remain under the prop head until 2 levels of casting.



TYPES OF SYSTEM

- Flex system
- Table form work system
- Cup lock system

MATERIAL USED

Aluminium Form work

WHY IT IS OPTED?

No welding required

Easier and faster to build and remove the cup lock.

- **Stability** - Reliable self-locking mechanism and can withstand significant amounts of load at times.
- **Repetitive utilization:** Being easy to use, quick to operate, durability and requirement of low maintenance
- **Low maintenance and Cost effective**
- **Reduces Manual Efforts** – It can be made for variable height &
- Can be used for various floors of building simultaneously.
- It tremendously reduces the labour required for the construction task.
- **Easy To Transport**

8.0 QUALITY ASSURANCE AND QUALITY CONTROL (QA&QC)

Various Quality test for material is been tested in QA/QC lab with the proper approval from client the material will be used for various activities on the site.

DETERMINATION OF COMBINED FLAKINESS AND ELONGATION INDEX	
CODE OF PRACTICE	IS 2386
OBJECTIVE	To determine the particle shape distribution of Coarse aggregate

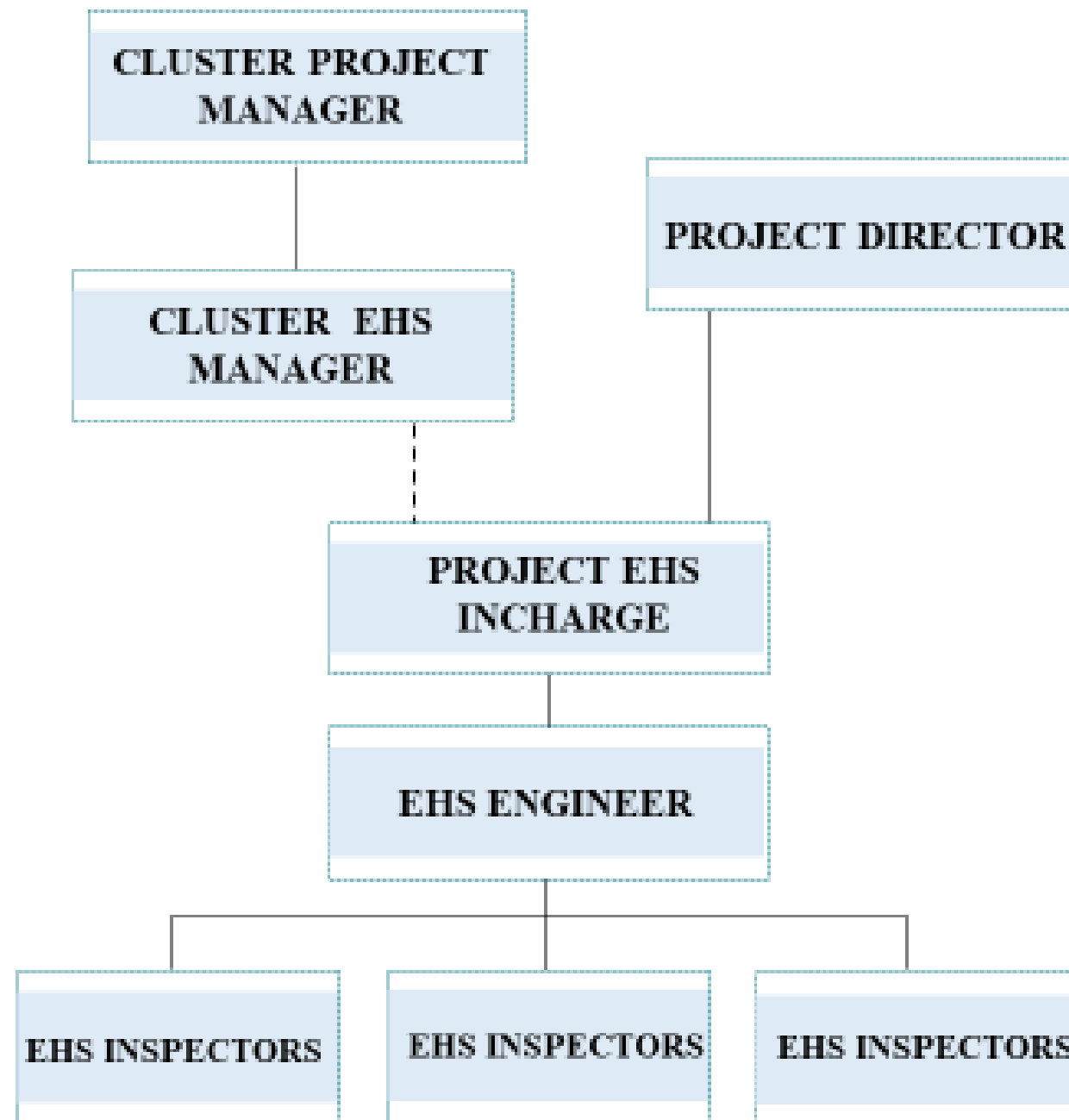
DETERMINATION OF SIEVE ANALYSIS OF AGGREGATE	
CODE OF PRACTICE	IS2386 (PART 1) – 1993
OBJECTIVE	To determine the particle size distribution of fine and coarse aggregate.

DETERMINATION OF CONSISTENCY OF CEMENT PASTE	
CODE OF PRACTICE	IS 4031 (PART 4) -1993
OBJECTIVE	To determine the quantity of water required producing a cement paste of standard consistency.
APPARATUS	Vicat's apparatus with plunger

SLUMP CONE TEST	
CODE OF PRACTICE	
OBJECTIVE	TO determine the workability or consistency of concrete mix
APPARATUS	



9.0 ENVIRONMENTAL HEALTH AND SAFETY (EHS)



ORGANIZATION CHART OF ENVIRONMENTAL, HEALTH AND SAFETY DEPARTMENT

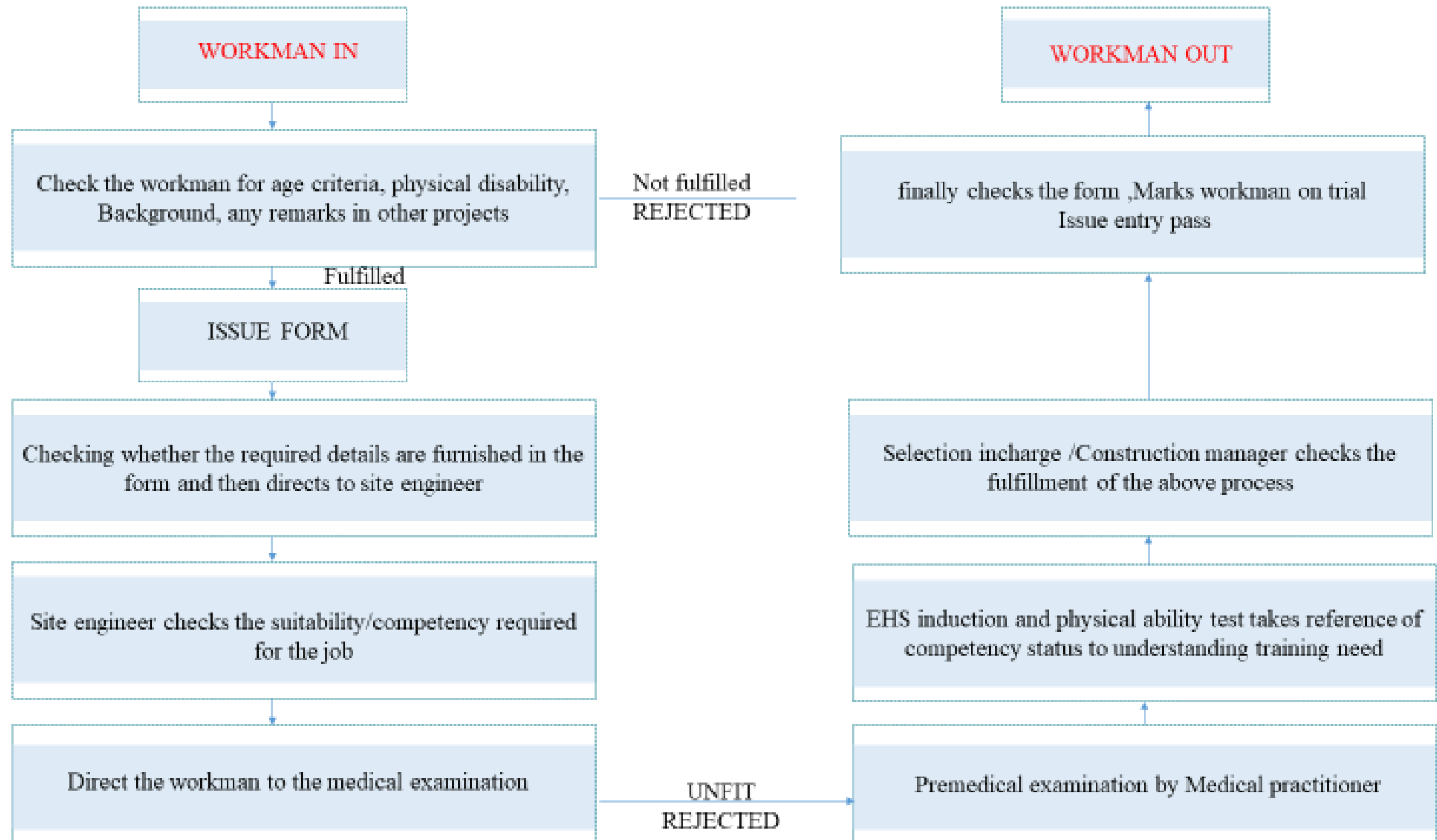
OBJECTIVES OF EHS :

- Responsible & accountable for the implementation of EHS policy at his workplace.
- Review and monitoring EHS performance of the project and proactive EHS performance of employees at all levels.
- Identify the training needs, imparting training for staff, visitor, subcontractor and workmen.

CONTRACTUAL REQUIREMENTS

Personal protection	Personal Protective Equipment, periodic environment monitoring, and health surveillance .
Inspection	Inspection to detect and correct unsafe practices and conditions .
Education and Training	To develop skills that are required to perform, supervise and manage assigned tasks without mishap .
Standards and Instructions	Must conform to relevant standards and XXX realty's general instructions
Indian Government Regulations	BOCW act. Environment protection act, Rules of municipal corporation on health & hygienic etc.

9.1 SCREENING PROCESS IN ENVIRONMENTAL HEALTH AND SAFETY (EHS)



9.0 ENVIRONMENTAL HEALTH AND SAFETY (EHS)

Corporate Environment, Health & Safety (EHS) Policy

We remain committed to safeguarding the health and safety of our employees and other stakeholders and preserving the environment.

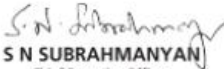
To fulfil the above commitment, we will ensure the following:

- Incorporate applicable EHS requirements across all processes, right from tendering, planning, design, recruitment and procurement, production, execution, operation and maintenance to align with their respective business objectives
- Meet or exceed all applicable legal and other compliance obligations, irrespective of the stipulations of the enforcement authorities in the country of operation
- Pay serious attention to workmen welfare, especially to their habitat, to improve morale, retention and thereby productivity
- Impart structured training and augment resources for effective EHS performance
- Prevent adverse environmental impact and occupational health and safety risks
- Conserve natural resources, minimize waste generation, environmental emissions and reduce carbon footprint
- Encourage communication, consultation and collaboration with all stakeholders
- Establish SMART EHS objectives to permanently reduce EHS risks by eliminating hazards or substituting with less harmful equipment, material, methods and review implementation to achieve continual improvement.

This policy to be communicated to all our stakeholders and reviewed periodically to ensure that it remains relevant to our business and effective to improve performance.

Date: 1st April, 2021


LARSEN & TOUBRO
It's all about Imagineering


S N SUBRAHMANYAM
Chief Executive Officer
& Managing Director

**L&T Construction**
Buildings & Factories

Innovation Campus Project,
Chennai

Environment, Health & Safety Policy (EHS)

The L&T Management of **NPCI Data Center Project** is committed to conserve the environment and to provide safe and healthy workplace to its employees and stakeholders, who are involved in the project. We are committed for continual improvement in EHS Management System by reviewing the suitability, adequacy and effectiveness through various processes. Prevention of injury, ill health and adverse environmental impacts are our motto.

This shall be achieved by,

- Assessing risks & opportunities arising out of work and identify necessary controls for mitigation through Risk assessment. Implementation of controls referred in Risk assessments and verification through safe-to-start work cards / work permits. Ensuring effective administration, work instruction and monitoring of work activities for EHS enforcement.
- Fulfilling Standard Operating Procedures (SOPs), which are integrated with EHS requirements and other management directions to bring standardized work culture.
- Complying with applicable legal and other requirements.
- Establishing Operational EHS objectives to bring permanent risk reduction, improving operational efficiency, presenting comfortable work environment and development of culture.
- Ensuring deployment of appropriate Plant, Machinery, equipment and materials in accordance with accepted EHS norms.
- Providing adequate resources, deployment of employees with relevant competency involved in various tasks and imparting structured training for effective EHS performance.
- Assigning specific roles and responsibilities for implementing and maintaining the EHS requirements at their respective workplace to personnel. Monitoring the achievement of these responsibilities through Proactive EHS performance monitoring system (PPMS).
- Encouraging consultation and participation with Stakeholders in all our processes.
- Establishing substantial arrangements to enhance the wellbeing of employees thereby morale and retention.

All sub-contractors & specialized agencies, who are deployed by us shall abide to our EHS requirements. Vendors, Suppliers and Transporters shall support the Project team by adhering the workplace & transportation norms and submit appropriate documents for vehicles & drivers as per applicable rules.

Everyone, who are associated with the project construction, has the responsibility to observe safe system of work at the workplace and to protect the natural environment from harm.

10th Oct 2021

S Vadivazagan
Project Manager

Next Review: 1st week of Jan 2022

**DNV**

MANAGEMENT SYSTEM CERTIFICATE

Certificate no.: 287669 2019-AHSO-IND-RvA Initial certification date: 07 June 2019 Valid: 11 February 2021 – 10 February 2024

This is to certify that the management system of
Larsen & Toubro Limited
Buildings & Factories Independent Company, Mount Poonamallee Road, Manapakkam, Chennai - 600089, Tamil Nadu, India

has been found to conform to the Occupational Health and Safety Management System standard:
ISO 45001:2018

This certificate is valid for the following scope:
EHS Management (including managing, controlling and handling) of Environmental, Occupational Health and Safety Requirements at Project Sites and Offices of L&T Construction, Buildings & Factories Independent Company

Place and date:
Barendrecht, 03 May 2021

For the issuing office:
DNV - Business Assurance
Zeedijkweg 1, 2384 LB Barendrecht, Netherlands


DNV - Business Assurance
RvA C 004
Site Representative

Lack of fulfilment of conditions as set out in the Certification Agreement may render this Certificate invalid.
ACCREDITED UNIT: DNV GL Business Assurance B.V., Zeedijkweg 1, 2384 LB Barendrecht, Netherlands • TEL: +31(0)105522669 • www.dnv.com/certification

9.0 ENVIRONMENTAL HEALTH AND SAFETY (EHS)

9.2 HAZARD IDENTIFICATION AND RISK ASSESSMENT

Hazard Identification & Risk Assessment (HIRA) shall be done for

- Routine & non-routine activities.
- Activities of all personnel having access to the workplace (including contractors & visitors)
- Facilities at the workplace.
- Equipment / substances

PARTICIPANTS: a team of persons who have a thorough knowledge of the work to be assessed shall conduct H&S Risk assessment. Team members may include CPM, CEHSM, Project Manager, Area / Section In charges & Execution Engineer, EHSO, Subcontractors, Workmen.

9.3 TYPE OF RISK ASSESSMENTS

- Routine activities Risk assessments.
- Non routine activities Risk assessments (breakdown maintenance, site visit by visitors/suppliers, extreme weather conditions, dismantling of tower crane etc.)

Facility based risk assessments (office premises, carpentry yard, stores etc.)(Fire detection & fighting requirements, space requirements, exit requirements, location etc. shall be considered in this.)

Equipment based risk assessments (only installation parameters shall be considered, operational parameters shall be considered in activity based risk assessments.

However few envisaged hazards during operation shall be included, for e.g.. Tower crane rotation limitation (due to other structure existence during operation) shall be considered).

9.4 EMERGENCY RESPONSE MANAGEMENT

The Emergency Response Plan is prepared as per the guideline provided in the EHS Manual. This plan lays down the Code of conduct of personnel and the procedures to be adopted by them in the event of an” Emergency”.

9.5 OBJECTIVES:

Preserving the life, property and environment from the consequences of emergencies arising within the site.

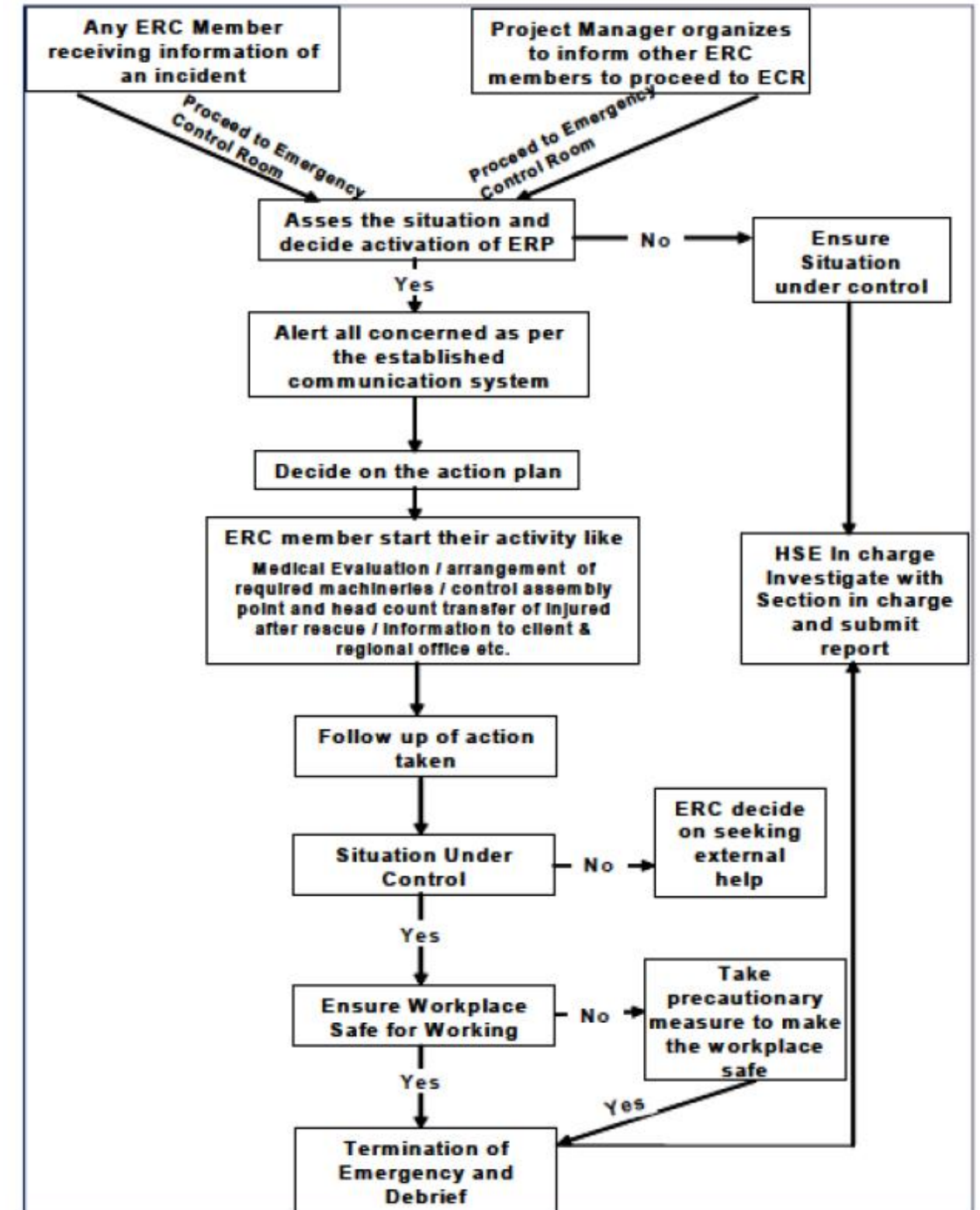
- Systematic coordination of emergency control action to arrest escalation of emergency, to evacuate personnel within or outside the site where necessary and to rehabilitate them.

9.6 RESPONSIBILITIES OF EMERGENCY ACTION TEAM:

- | | | |
|-----------------------------|-----------------------|-----|
| 1. 1) Emergency Task Force | 2) Security Team | 1) |
| Communication Team | 4) Rescue Team | 5) |
| Medical Team | 6) Evacuation Team | 7) |
| Transportation Team | 8) Firefighting Team | |

9.0 ENVIRONMENTAL HEALTH AND SAFETY (EHS)

Sl. No	PPE	Details	Specifications	Remarks
1	Safety Helmet	- Helmet is mandatory PPE and to be always used within site premises. - Helmet with adjustable chin strap to be used. - Colour Coding of Helmet - White : For Staff - Yellow : For Workers - Green : Safety Staff - Red : Electricians - Purple : Visitors	IS 2925 : 1984 or EN 397	Test certificate to be produced whenever asked by L&T Realty
2	Safety Shoes	- Safety shoes are mandatory PPE and to be always used within the site premises. - With steel toe and black in colour. - Meet requirement of IS:10667:1983 titled "Guide for selection of Industrial safety equipment for protection of foot and leg".	IS 15298 : 2002 or EN ISO 20345 or EN 345	For monsoon gumboots with steel toe should be used.
3	Safety Harness	- Safety belt is mandatory PPE for any work above 2m height. - Full body harness with 1.8m lanyard and auto snap spring hook to be used. - Fall arrests shall consists of full-body harness, lanyards with shock absorbers, lifeline, rope grabs and associated hardware.	IS 3521 : 1999 IS 4912 : 1978 IS 11972 : 1987 IS 8519 : 1977 or EN 361 : 2002	For working above 2m height. Test certificate to be produced
4	Dust Mask	< 10 micron size to avoid respirable particles. - SCBA for areas where gases such as carbon monoxide, methane, chlorine, etc are present. - SCBA as per IS 9623:1980 titled "Selection, use and maintenance of respiratory protective devices". # Periodic drills on use and care.	IS 8522 : 1977 or EN 149 : 2001 FFP2	For working in dusty atmosphere
5	Ear Plugs	- Disposable foam ear plugs. - Periodic hearing acuity tests shall be conducted on persons exposed to high noise levels to ensure that they do not suffer any hearing impairment as per requirements of IS 8520 : 1977.	IS 6229 : 1980 or EN 352 - 2	For working in high noise area above 85 dB(A)
6	Cotton Hand Gloves	- Fast Grip Dotted Gloves. - Appropriate hand gloves as per IS 8870:1978 titled "Safety equipment for protection of arms and hands".	IS 6994 : 1973 BS EN 388 : 2003	For working with sharp objects
7	Electrical Hand Gloves	Seamless gloves for minimum working voltage of 11KV	IS 4770	For working on electrical panels
8	Face Shield	Polypropylene impact resistant shell with high strength nylon ratchet headgear.	IS 8521 BS EN 166 or ANSO Z 87.1	For doing welding work in site premises.
9	Safety Goggles	- Plain goggles for grinding and chipping and dark goggles for gas cutting work. # Meet the requirement of IS: 8540:1978 titled "Guide for selection of Industrial safety equipment for eye and face protection.	IS 1179:1967 BS EN 166 : 2001	For Grinding, Chipping and gas cutting work in site premises.
10	Safety Hi-Vis Jacket	Green for Staff and Orange for contractors.	Reflective tape to confirm EN471 Class 3.	It is a part of mandatory PPE to be always used at construction site.



9.7 SITE SPECIFIC OPERATIONAL CONTROLS

This section shall detail the general EHS Rules & Regulations to be adopted in the site for the following areas. All activities shall be commenced after received approved risk assessment and safety work method statement.

EXCAVATION AND FILLING WORKS	DIAPHRAGM WALL	STEEL REINFORCEMENT	GENERAL HOUSEKEEPING & STACKING OF MATERIALS
IS: 3764-1998 Safety code	IS: 5121-1969 - piling and other deep foundations	Reinforcement crew shall be provided with cut Resistance hand gloves for handling the rebars.	Stacking height shall be restricted with 5feet
Excavated earth should be kept at least 1.5 M or half the depth of the pit, whichever is more, away from the edge of the pit.	Leading edge protection (Hard barrication) shall be provided away from guide wall excavation and over the guide wall.	Accumulation of shifted rods at a single place to be avoided in the shuttered area to avoid overload in particular area	Toxic & hazardous materials are labelled and kept at secluded place. Material Safety Data Sheet (MSDS)
There should not be any vehicle movement close to the edge of the excavation pit .	Workmen's movement shall be restricted in the rigging area swing radius		The materials shall be stacked with clear passageways to reach them. Care shall be taken so that the materials do not protrude beyond the marked area posing tripping hazard.
Gumboots, Safety Helmets and hand gloves should be provided to the workmen.	During Working all workmen should wear required PPE"s for the specific job.		

9.8 BUSINESS CONTINUITY PLAN

Objectives of this Plan

- The objectives of this business continuity plan are to:
- Identify advanced arrangements and procedures that will enable the agency to respond quickly to an emergency event and ensure continuous performance of critical business functions.
- Reduce employee injury or loss of life and minimize damage and losses.
- Protect essential facilities, equipment, vital records, and other assets.
- Reduce and mitigate disruptions to business operations.

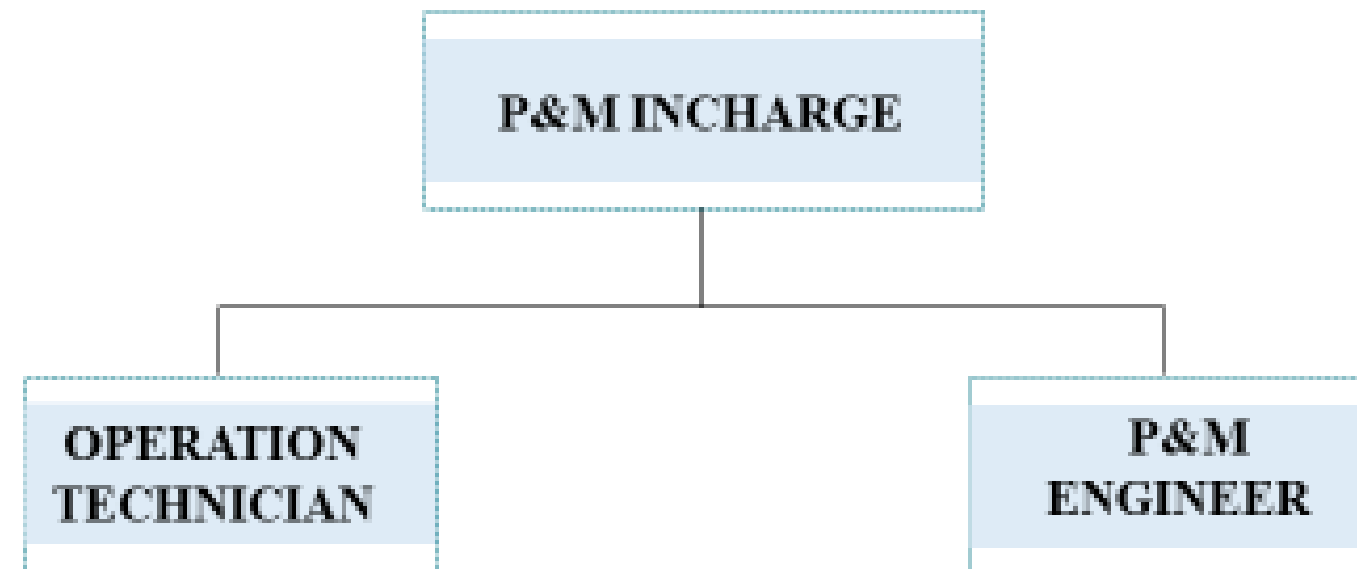
11.10 EMERGENCY RECOVERY MANAGEMENT

The function of the team is;

- 1) Review the emergency investigation and recommendation.
- 2) Recommend the proposal to top management.
- 3) Execute the proposal to recover in time.
- 4) Emergency recovery core management team contains.
- 5) Planning team.
- 6) Resource & supporting team.
- 7) Execution Team.
- 8) Monitoring and review team.

Sr. No.	Potential Scenario	Source (Internal/ External)	Potential cause/ source for the incident	Existing Control Measures	ERP Procedure	BCP Procedure
1	Fire	Internal	Electrical	Fire detection system, Fire-Extinguishers	evacuate the area, use Fire Extinguisher	Work can be done from other cabins
		Internal	Flammable liquids (HSD...etc.)	Fire-Extinguishers	evacuate the area, use Fire Extinguisher, External help may be needed.	In case of large area damage, work can be resumed from home/office
		Internal	Flammable Gases	Fire-Extinguishers	evacuate the area, use Fire-Extinguisher, External help may be needed	In case of large area damage, work can be resumed from home/office
		Internal	Chemicals	Spill control procedures	Limited evacuation.	Work can be done from other cabins
2	Medical Emergency	Site	Burn Injury	Minor injury to be treated at site Medical Center	All medium injuries to be sent for expert treatment to the concerned Hospital.	Work to continue unless there is unrest.
		Site	Crush Injury	Minor injury to be treated at site Medical Center	All medium injuries to be sent for expert treatment to the concerned Hospital.	
		Workmen Habitat	Food Poisoning	Food hygiene to be followed- Certified vendor to be approved	Send patient to hospital if uncontrolled	
		Site	Fracture & Cut (Bleeding)	Cut may be treated at Medical Center	Fractured person to be hospitalized	
3	Public Unrest	Site Internal	Regional Group conflict / Injury to workmen	Security Personnel	Persons to be deployed to pacify workers and villagers identification.	Till situation is restored owners team to work from client office. L&T staff to work from their local office.
		External	Local villagers/ Communal riot	Security Personnel	Police & Administration help sought	Till situation is restored owners team to work

10.0 PLANT AND MACHINERY | (P&M)



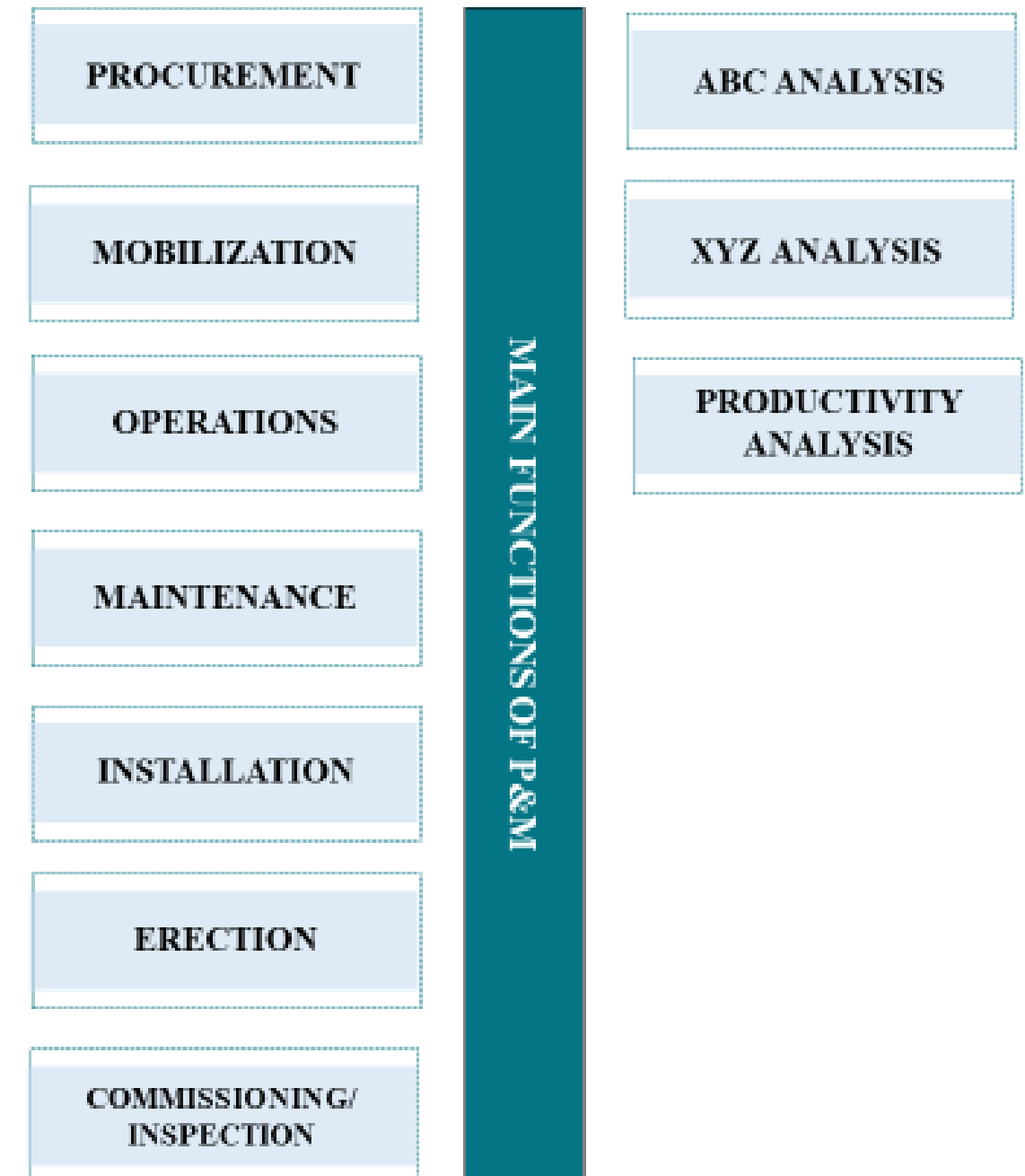
ORGANIZATION CHART OF PLANT AND MACHINARIES

10.1 OBJECTIVES OF PLANT AND MACHINERY

- Procuring The equipment based on the needs.
- Review and monitoring the performance of the equipment .
- Adherence to rules and guidelines pertaining to use of plant and machinery
- Planning the work schedule for plant and machinery

10.2 CONSIDERATION IN SELECTING THE CRANE

1. Capability of lifting the load site.
2. Placement of the equipment at site.



10.0 PLANT AND MACHINERY (P&M) | L&T INNOVATION CAMPUS

PLANT & EQUIPMENT	ACTIVITIES AT SITE
EXCAVATORS	Digging , lifting and carrying the Earth
BACKHOE LOADER	Excavating the Earth
HYDRALIC DRILLING RIG	To makes holes in the earth's surface
MATERIAL HANDLING EQUIPMENT	
TIPPERS	Loading and unloading of the excavated earth.
BULKER	To carry and unload the cement to the silos
TOWER CRANE	To lift, and move heavy or bulk construction materials around the site.
CONCRETE HANDLING EQUIPMENT	
TRANSIT MIXER	Carry the concrete from the batching plant to the site.
BATCHING PLANT	Combines the various ingredients to make up concrete.



STATIC BOOM PLACER

Pouring large amounts of concrete quickly from height.

10.0 PLANT AND MACHINERY (P&M) | L&T INNOVATION CAMPUS



Filling of silos with cement



Aggregates storage yard



JCB Carries the aggregates



Conveyer belt carrying the aggregates



Aggregates gets collected in the tank



Cement from silos, Aggregates, Admixtures, water are mixed together to form a concrete



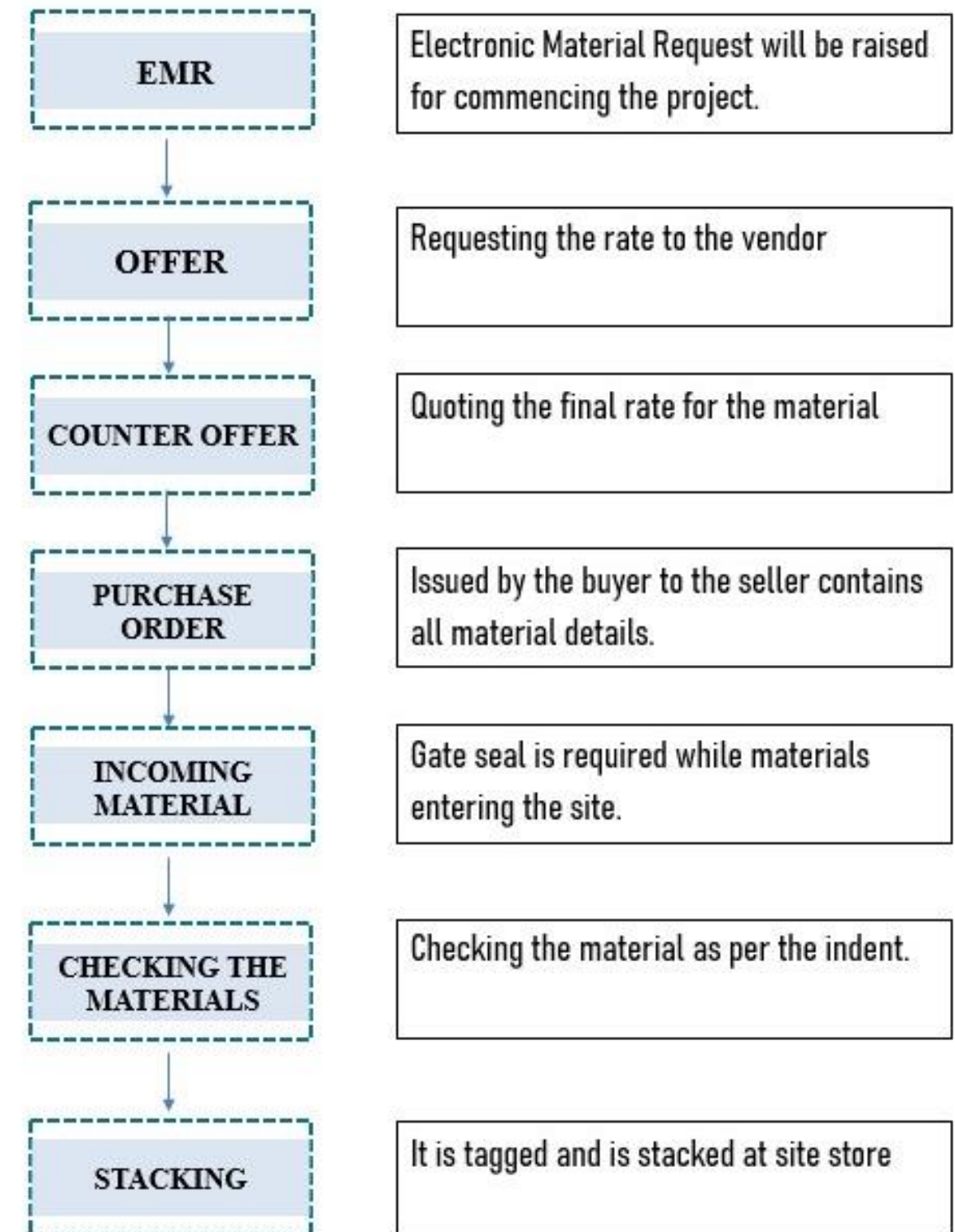
11.0 ACCOUNTS AND ADMINISTRATION | L&T INNOVATION CAMPUS

ORGANIZATION CHART:

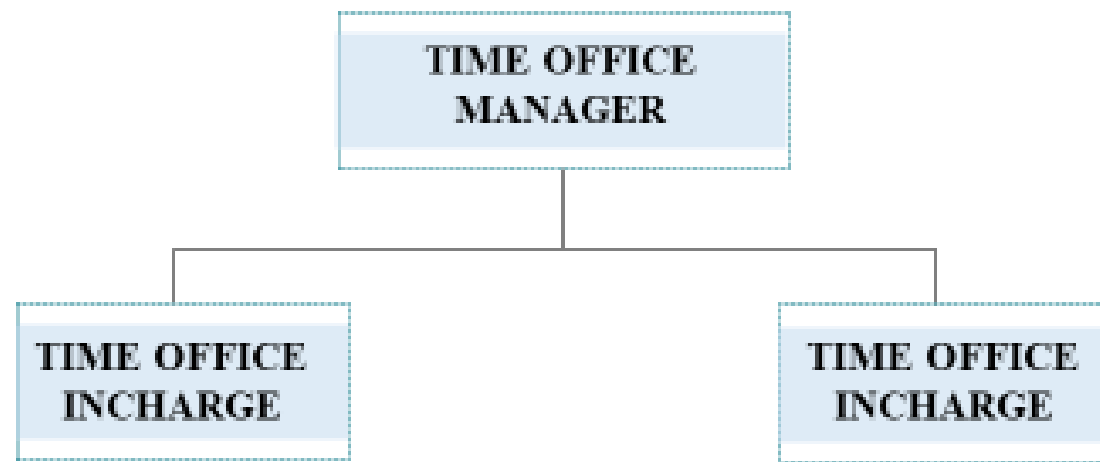


RESPONSIBILITY OF THE STOREKEEPER:

- Issue materials as per the indent for different works.
- Receiving material, stocking and recording of receipts.
- Record the store material receipt and consumption on daily basis.
- Checking the stocks as per records.
- Follow up with the material suppliers with prior consent from purchase department to ensure timely supply.



11.0 ACCOUNTS AND ADMINISTRATION | TIME OFFICE | L&T INNOVATION CAMPUS



11.1 TIME OFFICE

Time office is responsible for documenting the information about the labour and taking care of every Labour related activities till the handover of the project.

11.2 FUNCTIONS OF TIME OFFICE

- Procuring the manpower from the vendor
- Categorizing the workers.
- Registering License for the workers under **CONTRACT LABOUR ACT 1970 AND MINIMUM WAGES ACT 1948.**
- Training will be provided for the Labour.
- Evaluating and categorizing the labour based on their skills.
- Handing over them to the Engineer In Charge.

An app is maintaining at L&T Company to track the details of the labour.

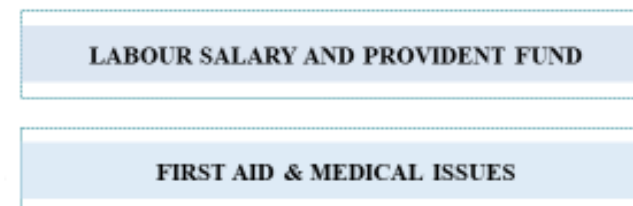
FORM 1: Registering the work of the client.

FORM 2: Given by the Government to the contractor for accepting the work.

FORM 3: Given by the contractor for registering the license of the labour.

FORM 4: Given by the contractor for registering the license of the migrant labour.

FORM 5: The Acknowledgement to the Government that the work had done properly.



LEAN INITIATIVE IMPLEMENTATION GUIDELINES CONSTRAINT ANALYSIS WORKSHEET									
Name of Project :IT COMMERCIAL Campus (Tower 01)					Reference :				
Weekly Review - Constraint Meeting 01									
Month - August									
S. No.	Activity	Constraints / Points discussed	Constraints	Remedial action	Responsibility & Signature	Target date	Follow up	Closure Signature	Remarks
Date : 04 Aug'22 Time : 18:00-18:40									
Name of Attendee					Mr.	Mr.	Mr.	Mr.	Mr.
1	Excavation	Delay due to hard rock	Permission to blast the rock						
2	PCC	Dewatering system is less productive	Pumping has to be done and it is time consuming						
3	Foundation	Not receiving the drawings on time							
		Water seepage in basement due to anchorage bolts							
4	Reinforcement	Delay due to issues during loading and unloading	Lack of coordination between SSC and Site Issues in transportation vehicle						
			Mobile crane breakdown or operator unavailability						
		Placement of materials at site is not in order							
5	Concreting	Pump productivity is less	Time consumed for dismantled and fixing due to placement of concrete						
6	Formwork	Delay in arrival of materials							
7	Issue with manpower	Insufficient Manpower for Concreting, Shuttering and Reinforcement works							
8	Issue with materials	Delay in arrival of materials							
		Materials not kept in order	Difficulty to access the materials						
9	Workmen habits	Time spent on water breaks and washroom breaks, tea breaks							
10	Working at height								

LEAN INITIATIVE IMPLEMENTATION GUIDELINES CONSTRAINT ANALYSIS WORKSHEET									
Name of Project : IT Commercial Campus (Tower 02)					Reference :				
Weekly Review - Constraint Meeting 01									
Month - August									
S. No.	Activity	Constraints / Points discussed	Constraints	Remedial action	Responsibility & Signature	Target date	Follow up	Closure Signature	Remarks
Date : 04 Aug'22 Time : 17:15 - 18:00									
Name of Attendee									
1	Excavation	Delay due to hard rock	Permission to blast the rock		Mr.				
2	PCC	Dewatering system is less productive	Pumping has to be done and it is time consuming		Mr.				
3	Reinforcement	Delay due to issues during loading and unloading	Lack of coordination between SSC and Site						
			Issues in transportation vehicle						
			Mobile crane breakdown or operator unavailability						
4	Concreting	Pump productivity is less	Time consumed for dismantled and fixing due to placement of concrete						
5	Formwork	Delay in arrival of materials							
6	Issue of manpower	Insufficient Manpower for Concreting, Shuttering and Reinforcement works							

12.0 LEAN IMPLEMENTATION

12.1 CONSTRAINT ANALYSIS

- **Big room meetings** helps to discuss the constraints faced by them to achieve target cycle time.
- All constraints/issues faced should be recorded and remedial action should be taken using the **constraint analysis** to resolve it within target date.
- **The theory of constraints is a way to solve problems inherent in the project that are preventing from achieving more of company's goals.**

PROJECT NAME	L&T INNOVATION CAMPUS
location	Chennai
Client	L&T Realty
Contractor	L&T Construction (Buildings &Factories)
Contract Value	475 CRORES

12.2 VALUE ADDED ACTIVITY AND NON VALUE ADDED ACTIVITY

Activity Type				
(The following are typical suggestions & need to be prepared for each site according to the context)				
S.No	Activity Head	Value Adding (VA)	Non-Value Adding But Necessary (NVAN)	Non Value Adding (NVA)
0	General			Late start/ Early quit Personal break Waiting / Idle time Overprocessing Rework Movement for arranging tools, equipment, materials
1	Earthwork			
	Excavation	Excavation	Setting out work, profiles etc	Shifting of backfill material
		Shifting of excavated material	Site clearance for vegetation	
		Planking, Shoring, Strutting for deep excavation	Battering or Benching for excavation	
		levelling of excavated area	Forming tell tales in borrow pits and removal	
			Forming steps for deep excavation & removal	
			Excavation for insertion of planking and strutting	
			Bailing out or pumping of water from rain in pits	
	Backfilling	Spreading, levelling of backfill	Watering, Ramming of backfill	
			Taking samples for lab tests	
2	Concrete Work			
	PCC & RCC	Mixing Concrete	Curing/ applying curing compound for concrete	Shifting of material for mixing concrete
		Pumping & Pouring Concrete	Levelling & finishing surface	chipping & removal for making new sleeves, cavities
		Vibrating & levelling of poured concrete (NVA in case)	Removing slush or rain water	Grouting & other repairs
			Making bunds with PCC	Grouting of pipes, fittings, bolts, base plates
			Fixing of pipes, fittings, bolts, base plates	Grouting for new reinforcement
			chipping of surface for bonding/finishing	
			taking samples for slump, cube moulds & other lab tests	
			Formwork, staging	
			Expansion joint & construction joint treatment	
			waterproofing	
	Piling	Boring & placing steel encasing	Mixing and pumping of bentonite slurry	
		Mixing Concrete	recirculation, removal & disposal of bentonite slurry	
		Pumping & Pouring Concrete	breaking of pile heads	
	Precast Concrete	Precasting of concrete	Curing of concrete	Shifting of material for making precast members
		Placing of precast members	shifting & lifting of precast members	
		Grouting of joints		
3	Brickwork			
		Laying of Brickwork	Raking out joints for plastering & pointing	
			preparing top of existing walls for raising	
			chasing & cutting for fixing plumbing & like	
			Shifting of material	
			staging	
1	Gypsum Plaster			
		Marking tikki-dhada	Cleaning, chipping, chiseling	Late Start / Early quit
		Application of bonding coat	Shifting of material	Break
		Mixing	Treating hairline cracks	Personal
		Application of gypsum	Read instructions / plans	Waiting
			Tool and material	
2	Plumbing Works			
2.1	Water Supply Line			
		Marking of levels as per architectural drawing	Shifting of materials/tools from godown/place of assembly	Late Start / Early quit
		Cutting of copper pipes to specified length	Checking of the soldered joints and cleaning of excess flux	Unscheduled Break
		Piping framework prepared with necessary fittings and mounted on wall	Checking alignment (shower & spout points should be in line)	Personal
		Copper tubes joints preparation prior to soldering	Read instructions / plans for fixing of mixer diverter	Waiting
		Soldering of joints	Reworking in case of leakage observed at joints during pressure testing	
		Clamping of mounted frame		

2.2	Drainage Line			
		Cutting of HDPE pipes to specified length	Shifting of materials/tools from godown/place of assembly	
		Preparing Framework with necessary fittings	Physical Checking of joints	
		Filing of cut surface of pipes to be jointed prior to welding	Checking plumb of the outlets with respect to outlets at lower floor	
		Aligning of welding machine	Plugging of pipes / multi trap opening to prevent clogging	
		Pipes joints welding		
		Checking of level & slope		
		Testing for leakages - Remains filled with water for 4-6 hrs		
		Cement mortar supports		
3	Tiling			
		Baking Plaster	Cutting the material	Late Start / Early quit
		Hard bedding	Shifting of material	Break
		Curing	Cleaning the surface	Personal
		Layout of flooring	Read instructions / plans	Waiting
		Fixing of tiles, bekar rod & skirting	Tool and material	
		Polishing	Mixing of adhesives	
		Laying of tiles	Level marking	
		Counter fixing	Bund wall fixing	
		Stainless steel fixing		
4	Waterproofing			
		Surface Preparation		
		Opeaning up cracks	Shifting of Tools required for cleaning	Late Start / Early quit
		Treating hairline cracks with approved chemicals	Clearing off the debris from slab	Break
			Washing the slab	Personal
				Waiting
		Applying chemical coating		
		Treating the wall-slab junction	Shifting of Materials	
		Applying two coats of approved chemical coats	Shifting of Tools	
			Ponding to test the chemical coating	
		Applying protective screed		
		Preparing plaster coat or 2:20 cement mortar of 10mm thickness made rich with Good sand	Shifting of Materials	
			Shifting of Tools	
			Ponding to test the protective screed	
5	Subframe Installation			
		Fixing of subframe	Shifting of subframes	Late Start / Early quit
		Anchoring	Adjusting tools and tackles	Break
		Levelling	Taking out Measurements	Personal
		Aligning		Waiting

Work sampling is a statistical tool used for calculating the amount of time spent by workers under different work categories

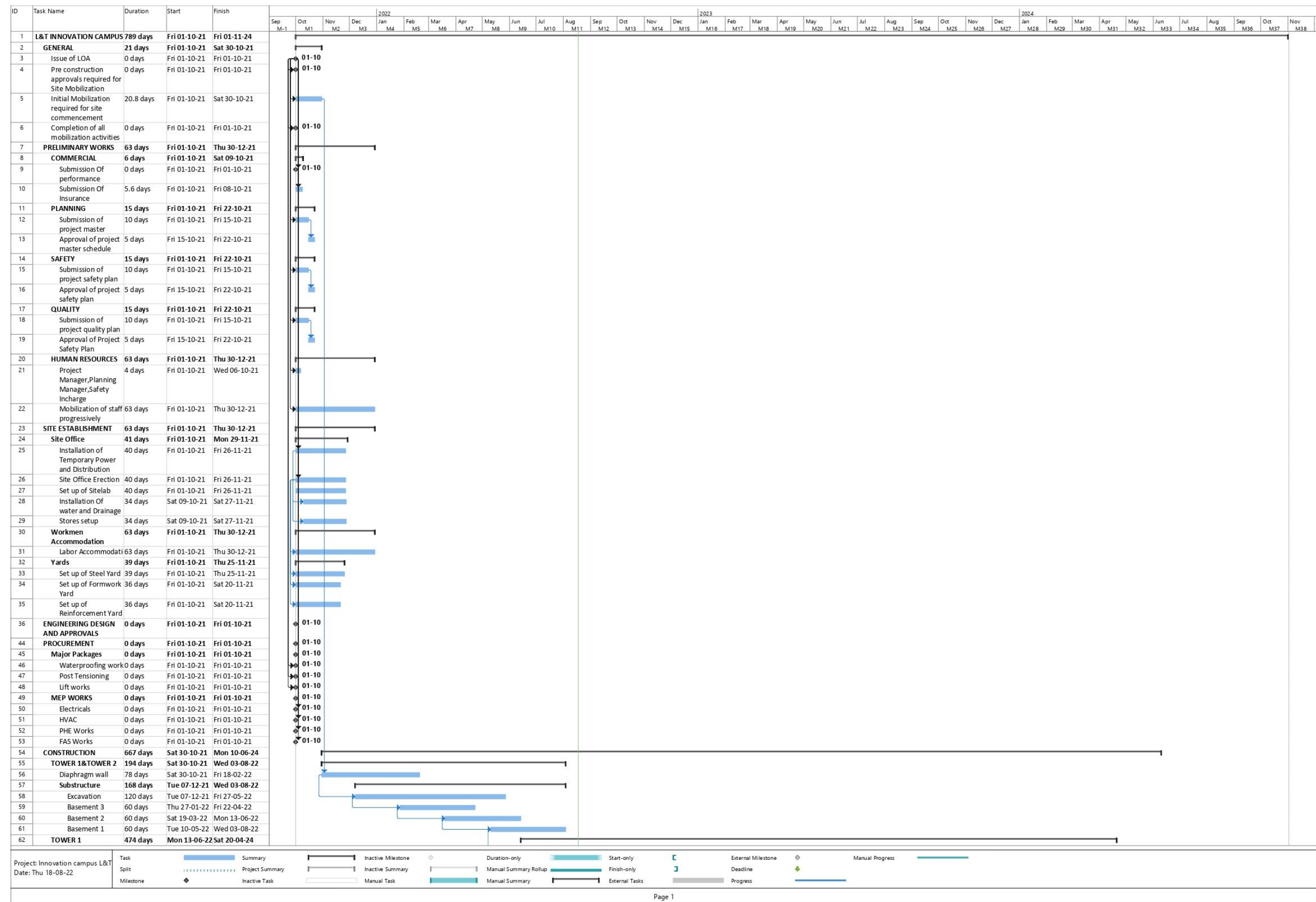
All the samples observed were classified under three heads:

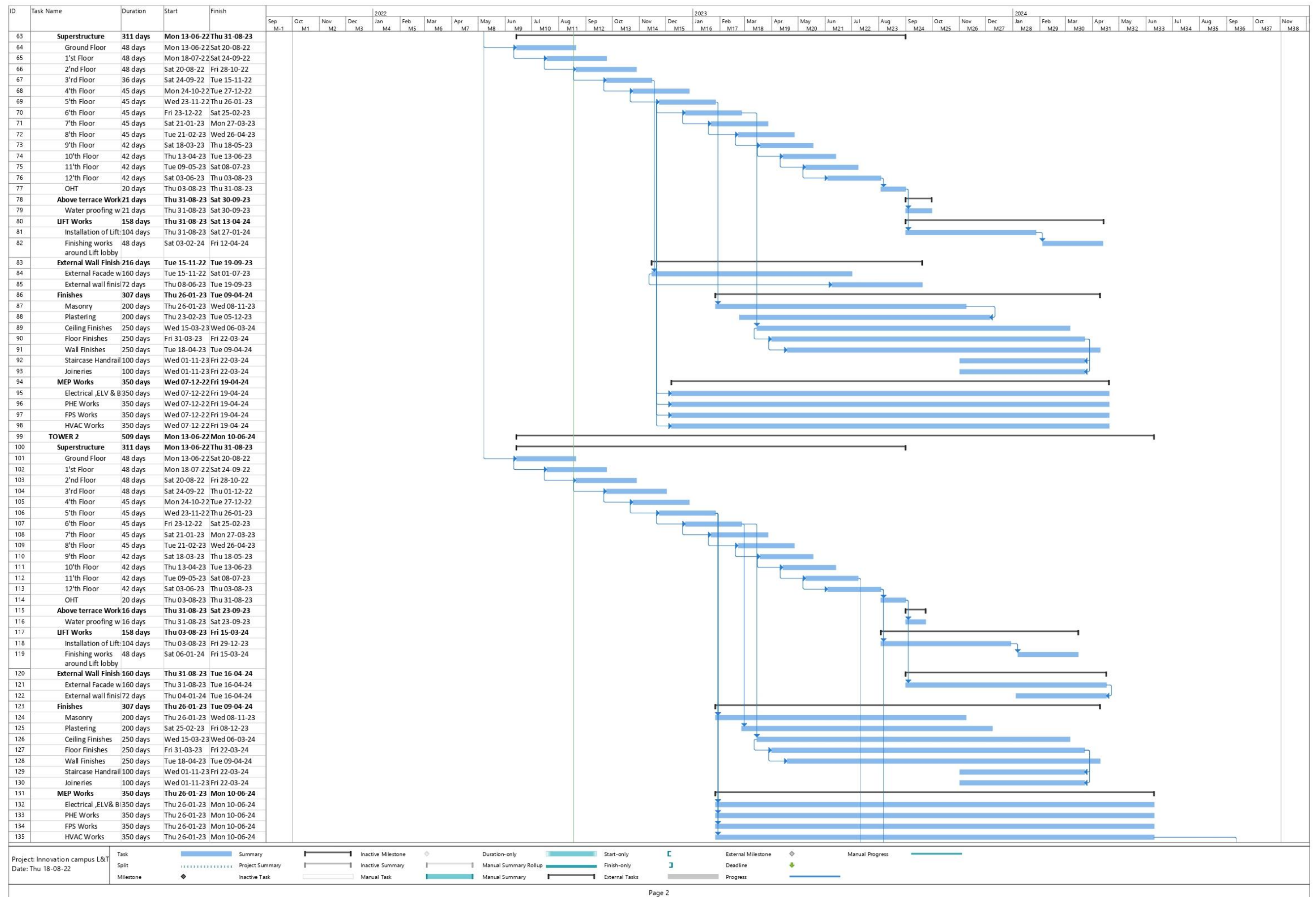
- (i) Value Adding
- (ii) Essential Contributory (Necessary non value added waste)

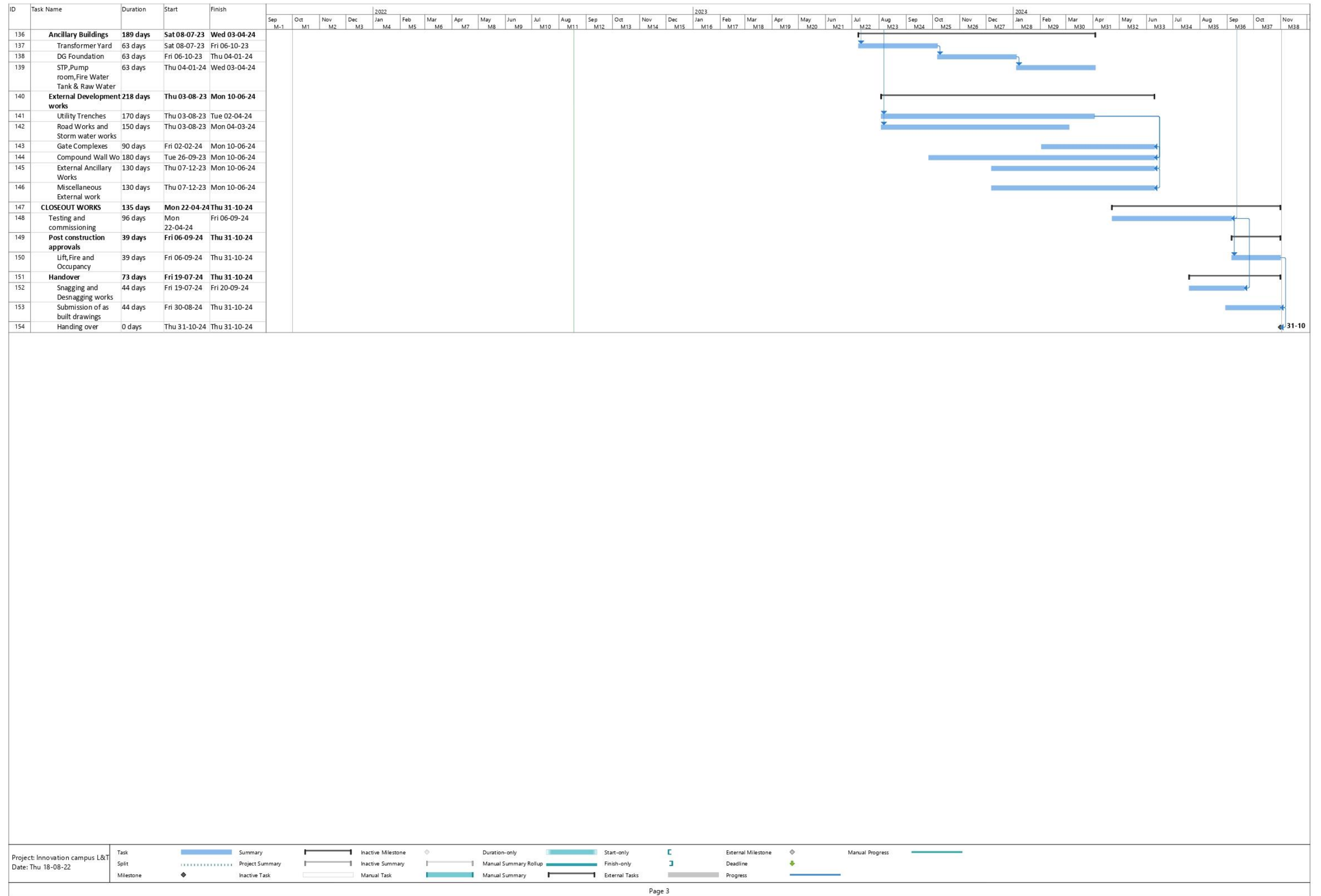
The number of workers who perform effective work and essential contributory work respectively

- (iii) Non Value Adding

13.0 SCHEDULING







13.0 5S CONCEPTS IN LEAN

LEAN Implementation Guideline

5S Audit Checklist

Name of Project:

Area Audited:

Audit Date:

Reference : PQP/8.1-C/GL-01/F-07

Auditor(s):

Auditee :

Scoring Legend

Green >=70%

Yellow 50%-69%

Red <=49%

<10% Compliance

<10% Compliance

<10% Compliance

<10% Compliance

<10% Compliance

Determine what is needed and remove the rest		0	1	2	3	4	5	Comments/Actions to be taken	Action Taken	Verified Signature
SORT	Have all the unnecessary items (tools, machines, boxes, etc.) been removed from site?							Improvement seen at work location all the unnecessary items removed but not completely.		
	Does the inventory or in-production inventory include any materials that are not required?							The materials which are not required is partially incorporated in the inventory		
	Are tools and equipment located in the most convenient location?							Improvement required in this area		
	Do cupboards, storage cabinets and shelves only contain essential items?							Cupboards, storage cabinets & shelves which is available in store & office contains necessary items		
	Is the work area properly managed? - (fully up to date?)							During handover & takeover proper care is not taken & not managed		
Sub Total				12		20				
A place for everything and everything in its place.....No Searching!		0	1	2	3	4		Comments/Actions to be taken	Action Taken	Verified Signature
SET IN ORDER	Are shelves and other storage areas clearly defined with location indicators and all footprints clearly marked?							Storage map displayed & Rack Numbering done		
	Are shadow boards and other storage systems used where possible?							Toolbox maintained in P&M Workshop		
	Are walkways and work areas clearly defined and unobstructed?							Improvement seen as per the last audit		
	Are personal belongings and Safety PPEs stored in designated areas?							PPE's left at the work area, So more improvement required		
	Safety Equipments - Are all safety equipment in place and up to date?							Safety Equipment is not taken care by downline Supervisor		
Sub Total				11		20				
Cleaning and looking for ways to keep it clean.		0	1	2	3	4		Comments/Actions to be taken	Action Taken	Verified Signature
SHINE	Work Areas - Are they kept clean, tidy and neat?							Sign of improvement seen.		
	Machines & Tools - Are they free from dirt, visible leaks and spillages?							Periodic preventive maintenance regime shall be established		
	Bins - Are the properly maintained and emptied on regular basis?							Segregation of waste is not done & not emptied on regular basis		
	Is anyone responsible for routine inspection/maintenance?							No evidence found, Name shall be displayed		

Audit Date:

Reference : PQP/8.1-C/GL-01/F-07

Auditor(s):

Auditee :

Scoring Legend

Green >=70%

Yellow 50%-69%

Red <=49%

<10% Compliance

<10% Compliance

<10% Compliance

<10% Compliance

<10% Compliance

Determine what is needed and remove the rest		0	1	2	3	4	Comments/Actions to be taken	Action Taken	Verified Signature	
STANDARDISE	Is stock control established, obvious and in use?						Stock control is established but monitoring level shall be improved & immediate action shall be taken			
	Is everyone aware of their responsibilities and department flow with ease?						Section wise responsibility defined & improvement seen			
	Is information to carry out daily work routine clear and in use?						Information is clarified at certain level			
	Are improvement ideas being generated and regularly acted on?						Ideas for stacking materials are implemented			
	Are the standards for the first 35's clear and up to date?						Not Satisfactory			
Sub Total				10		20				
Maintain high standards and constantly seek to improve.		0	1	2	3	4	Comments/Actions to be taken	Action Taken	Verified Signature	
SUSTAIN	Are checklists available and being used?						Specific Check-List shall be developed			
	5S Board - Is this up to date and regularly reviewed?						No			
	Have improvement suggestions from last month been acted upon?						Improvement seen from last audit			
	Training - Is everyone adequately trained to carry out their job role?						Some level of training conducted for new workers			
	Education - Can everyone in the area explain the benefits of 5S?						Awareness training conducted			
Sub Total				5		20	Score	Difference (+/-)		
Q25. Education - Ask 4 employees benefits of 5S (-1 point for each person that cannot explain)							(Week1) 38 out of 96 (Week2) 47 out of 100	0		
Difference (+/-) - Compare this months score to previous month to see if improvements are being made								8% Improvement seen		
Auditors Signature -							Auditee Signature -			

5S is a system to reduce waste and optimize productivity through maintaining an orderly workplace and using visual cues to achieve more consistent operational results.

- Workflow becomes smoother and more systematic
- Non-value added activities are reduced
- Consumables and material wastage are minimized
- The productivity of the office and project improves
- Enhances quality of project

PROJECT NAME	Prestige Finsbury park project, Bangalore
Broad Scope of Works	Design and Build contract for civil works for Tower and Non - Tower Areas at Prestige Finsbury Park (18 Towers –2B+G+19/20/21)
Revised Contract Value	491 Cr



5S IMPLEMENTATION AT SITE



14.0 CONTRACT DOCUMENT

- DD/BG against EMD
- DD Towards cost of tender document
- Enlistment letter
- Integrity pact
- Letter of acceptance of tender condition
- Affidavit certificate
- Power of Attorney
- Corrigendum
- Tax registration
- EPF Registration
- VAT Registration
- Sales tax registration

TENDER DOCUMENTS

- Notice inviting e-tender
- Quoting sheet for tenderer
- Instruction to tenderers
- General condition of contract
- Technical specification
- Bill of quantities
- Tender drawing
- Acceptance of tender condition
- Integrity pact
- Corrigendum

Notifying the contractor that his bid has been accepted



LETTER OF INTENT

LETTER OF ACCEPTANCE



Formal acceptance signed by the contractor

Commitments of the principal

- To treat all Contractor(s)/Bidder(s) with equity and reason.
- Should not do criminal offence under the IPC/PC Act

Commitments of the bidders/contractors

- Should not enter into any undisclosed agreement between other bidders

Disqualification from tender process

Exclusion period
6 months to 3 years

Compensation for damages

- Termination of contract
- Forfeiture of Earnest money and security deposit

Duration of the integrity pact

- 3 months after the last payment under the Contract is made.
- 2 months after the contract for the project has been awarded.

DESCRIPTION	CLAUSES OF CONTRACT	VALUES/DESCRIPTION TO BE APPLICABLE FOR RELEVANT CLAUSE
Type of Tender		Percentage rate tender
Earnest Money Deposit	NIT	Rs.1,18,79,000.00
Estimated cost	NIT	Rs.59,39,17,923.00
Time allowed for completion of work	NIT	15 MONTHS
Mobilization Advance	CC/4.0	10% Of contract value
Interest rate of Mobilization advance	CC/4.0	13%
Validity of tender	ITT/9.0	90 Days
Performance Guarantee	CC/2.0	5% of contract value
Security Deposit/Retention money	CC/3.0	5% of gross value of the running bill
Time allowed for starting the work	ITT/16.0	The date of start of contract shall be reckoned from 10 days from the issue of Letter of Award
Schedule Of Rates applicable		Civil works , Electrical works, Sanitary works : DSR 2012

Escalation	CC/7.0	No escalation shall be applicable on this contract.
Defects liability period	CC/39.0	Twelve months
Deviations/Variations	6.1	The original tender value plus 25% of the time calculated
Compensation for delay	8.0	1.5%per month delay to be computed on per day basis
		Total amount should not exceed 10% of tendered value of work
Carrying out part work at risk & cost of contractor	13.0	It should not exceed 10% of the tendered value of the work.
Suspension of works	14.0	Extension of time equal to the period of every such suspension plus 25% for completion period.
Time essence of contract & extension for delay	16.2	Total amount of compensation for delay to be paid under this condition shall not exceed 10% of the Tendered value of work.
Service Tax	21.0	Quote his rates inclusive of service tax along with other tax.
Third Party Insurance	23.3	5% of contract value

Measurement Of works	25.0	CPWD, Bureau of Indian standards
Materials and samples	30.1	CPWD/MORTH/ISI/BIS specification
Materials procured with the assistance of NBCC	31.0	The price allowed to the contractor, however, shall not exceed the amount charged to him excluding the element of storage charges which shall be 10% of the cost charged to contractor
Mobilization of men, materials and machinery	33.5	The cost of the above equipments/ gadgets are deemed to be included in the rates quoted by the contractor for the items & works as per BOQ
Quality assurance programme	34.0	To prepare and finalize within 15 days from date of issue Letter of Award
Completion certificate and completion plans	36.0	Liable to pay a sum equivalent to 2.5% of the value of the work
Prohibition of unauthorized construction & occupation	37.0	a levy of compensation upto 5% of tendered value of work
Observance of labour laws	74.4.2	Withhold payment to the extent of 4.70% (Four point Seven Zero percent) of the value of the Running Account bill

Labour records	74.6	The contractor shall be liable to pay to NBCC, a sum not exceeding Rs.200/- for each default or materially incorrect statement
Labour cess	75.0	1% of each RA bill of the contractor
Contract Agreement	82.0	Within 45 days from the letter of award
Order of precedence of documents	ITT/26.0	• Letter of Award along with statement of agreed variations and its enclosures • Description of bill of quantity • Special Conditions of contract • Technical specifications • General conditions of contract, • Drawings • CPWD/MORTH specifications • Relevant BIS Codes
SPECIAL CCONDITIONS OF CONTRACT		
Payment condition	SCC/1.4	40% - Delivery of equipment at site 30% - Installation and commissioning of equipment at site.

		30% - Total equipment for the data centre and completion of the project
Service Tax		The contractor will submit regular invoice/bill fulfilling all conditions of service tax rule 4A,12994 amended from time to time and shall produce proof of deposit of service tax ,to the corporation as contained in the GCC
Cement		If the contractor brings the RMC from outside of the project,no extra cost is payable on account of lead against RMC.