



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)

DEC 2021 TO JAN 2022

Name of the Student : Nivedhaa.B

Semester :III

Reg No. :40840011

Batch : 2020-2022



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SCHOOL OF BUILDING AND ENVIRONMENT

DEPARTMENT OF ARCHITECTURE

M. Arch (Building management)

VIVA-VOCE EXAMINATION

This is to certify that the Professional Training Report (S84APT) is the work of **NIVEDHAA.B (40840011)** who had undergone training in **EPMCR PVT .LTD , CHENNAI** and has been monitored by the continuous assessment during December 2021 to January 2022.

Dr.Devyani Gangopadhyay
HOD AND DEAN

Submitted for Viva voce Examination held on **01.02.2022**

Internal Examiner

(Ar.Sukirtha Suresh)

External Examiner

(Ar. Hena Damodharan)



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DECLARATION

I **NIVEDHAA.B(40840011)** hereby declare that this Professional Training Report for the period of **36 days** from **1st Dec2021 to 13th Jan 2022** done by me under the guidance of **Mr.Kavinkumar** is submitted in partial fulfilment of the requirements for the completion of practical training session.

DATE : 01.02.2022

PLACE : CHENNAI

A handwritten signature in blue ink, appearing to read 'Nivedhaa B', is written over the signature line.

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 like to express my sincere and deep sense of gratitude to **Mr.Kavinkumar , Director – EPMCR PVT LTD** for his valuable guidance, suggestions and constant encouragement paved way for the successful completion of my Training.

I would also like to express my sincere thanks to **Ar. Sukirtha Suresh (Internal Co-Ordinator)** for her valuable guidance, during the entire Professional Training period.

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.

I would also like to extend my gratitude to Mr. Vinodh , Mr.Prakash, Mr. Nithyanandham , Mr. Prakash Raja , Mr. Sekar , Ar.Priya , Ar. Kiruthika and Mr. Ranjith of EPMCR PVT LTD, for their valuable criticism and guidance all through my internship period .

CONFIRMATION LETTER



Ref. No. EPMCR/Internship/2021-22/09/02
Date: 03rd December 2021

To

The Head of the Department
Department of Architecture, School of Building and Environment
Sathyabama Institute of Science and Technology
Rajiv Gandhi Salai
Jeppiar Nagar
Chennai – 600 119
TamilNadu

Subject: Confirmation letter for Internship in our organization for Ms. Nivedhaa B. Reg. No. 40840011 – reg.

Dear Sir,

This is to confirm you that, we would like to induct **Ms. Nivedhaa. B, (Reg. No. 40840011)** M.Arch in Building Management (Sathyabama Institute of Science And Technology) as a project management trainee in our organization will commence from the following period.

1 st Internship	-	07.07.2021 to 13.10.2021
2 nd Internship	-	01.12.2021 to 13.01.2022

Thanks & regards,
for Engineering Project Management Consultancy & Research Pvt. Ltd.,


(S Sekar Mahalingam)
HR & Admin.



Engineering Project Management Consultancy and Research Private Limited



Regd. Office: #15, Rajamanickam Street, New Perungalathur, Chennai-600 063.
Tel : 044-4282 4759 | email : epmcr@epmcr.co.in | Web : www.epmcr.co.in



COMPLETION CERTIFICATE



Ref. No. EPMCR/Internship/2021-22/01/09
Date: 25th January 2022

To

The Head of the Department
Sathyabama Institute of Science & Technology
Rajiv Gandhi Salai, Jeppiar Nagar
Chennai – 600 119

Sub: Completion Letter for Professional Training – reg.

Respected Sir,

This is to certify that **Ms. Nivedhaa. B (Reg. No. 40840011)** has undergone project management student professional training with us from the following periods and has successfully completed the **112 days** period training.

Period 1	-	07.07.2021 to 30.07.2021 - 19 days
Period 2	-	01.08.2021 to 31.08.2021 - 25 days
Period 3	-	01.09.2021 to 13.10.2021 - 32 days
Period 4	-	01.12.2021 to 13.01.2022 - 36 days

During her tenure as a trainee with us, we found her to be diligent, intelligent and hard working. We wish her all the best & success for the future endeavors.

Thanks & regards,

for Engineering Project Management Consultancy & Research Pvt. Ltd.,


(S Sekar Mahalingam)
HR & Admin.



Engineering Project Management Consultancy and Research Private Limited



Regd. Office: #15, Rajamanickam Street, New Perungalathur, Chennai-600 063.
Tel : 044-4282 4759 | email : epmcr@epmcr.co.in | Web : www.epmcr.co.in



MONTHLY REPORT


SATHYABAMA
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SCHOOL OF BUILDING & ENVIRONMENT, DEPARTMENT OF ARCHITECTURE
M. Arch (Building management) Batch 2020-2022
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 :	EPMCR PVT LTD				
2. Address & Contact Number	: PERUNGALATHUR , 9444039796				
3. Name of the student	: NIVEDHAA .B				
4. Duration	: From 07.07.2021 To 30.07.2021				
5. Total No. of days	: 19 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 - 8.0, B - 7.0, C - 6.0, D - 5.5, E - 5.0, F - <5)

7. Any other Remarks : A

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




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(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 :	EPMCR PVT LTD				
2. Address & Contact Number	: PERUNGALATHUR , 9444039796				
3. Name of the student	: NIVEDHAA .B				
4. Duration	: From 01.08.2021 To 31.08.2021				
5. Total No. of days	: 25 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 - 8.0, B - 7.0, C - 6.0, D - 5.5, E - 5.0, F - <5)

7. Any other Remarks : A

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





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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 :	EPMCR PVT LTD
2. Address & Contact Number :	PERUNGALATHUR
3. Name of the student :	NIVEDHAA B
4. Duration :	From 01.09.2021 To 13.10.2021
5. Total No. of days :	32 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 - 8.0, B - 7.0, C - 6.0, D - 5.5, E - 5.0, F - <5)

7. Any other Remarks : A

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

S. Sankar



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M. Arch (Building management) Batch 2020-2022
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 :	EPMCR PVT LTD
2. Address & Contact Number :	PERUNGALATHUR
3. Name of the student :	NIVEDHAA B
4. Duration :	From 01.12.2021 To 13.01.2022
5. Total No. of days :	36 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 - 8.0, B - 7.0, C - 6.0, D - 5.5, E - 5.0, F - <5)

7. Any other Remarks : A

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

S. Sankar



WORK DIARY

DAILY PROGRESS REPORT			DATE	PROJECT NAME	WORK DONE
DATE	PROJECT NAME	WORK DONE			
07.07.2021	DESIGN THINKING	STUDY ON A3 JAPANESE SHEETS	02.08.2021	DESIGN THINKING - PRECAST	A3- IDEATE REVIEW
			03.08.2021	DESIGN THINKING - PRECAST	RISK ANALYSIS - ERECTION
			04.08.2021	DESIGN THINKING - PRECAST	RISK ANALYSIS - ERECTION
			05.08.2021	DESIGN THINKING - PRECAST	REVIEW - RISK ANALYSIS
08.07.2021	DESIGN THINKING	STUDY ON MIND MAPPING TECHNIQUES	06.08.2021	DESIGN THINKING - PRECAST	WORK SEQUENCE AND DURATION
09.07.2021	DESIGN THINKING	INTRODUCTION TO AYO	07.08.2021	DESIGN THINKING - PRECAST	WORK SEQUENCE AND DURATION
10.07.2021	DESIGN THINKING	PRE-CAST DESIGN THINKING - INTRO	08.08.2021	DESIGN THINKING - PRECAST	WORK SEQUENCE AND DURATION
12.07.2021	DESIGN THINKING	UNDERSTAND - MIND MAPPING	09.08.2021	DESIGN THINKING - PRECAST	REVIEW
			10.08.2021	DESIGN THINKING - PRECAST	A3 - IDEATE AND SOLUTION
13.07.2021	DESIGN THINKING	UNDERSTAND - MIND MAPPING - REVIEW	11.08.2021	DESIGN THINKING - PRECAST	A3 - IDEATE AND SOLUTION
			12.08.2021	DESIGN THINKING - PRECAST	A3 - IDEATE AND SOLUTION
14.07.2021	DESIGN THINKING - PRECAST	A3 - UNDERSTAND	13.08.2021	DESIGN THINKING - PRECAST	REVIEW
17.07.2021	DESIGN THINKING - PRECAST	A3- UNDERSTAND - REVIEW	16.08.2021	DESIGN THINKING - PRECAST	LEAN - PRECAST WORK FLOW INTRO
18.07.2021	DESIGN THINKING - PRECAST	FABRICATOR - INTERVIEW	17.08.2021	DESIGN THINKING - PRECAST	LEAN - PRECAST WORK FLOW
19.07.2021	DESIGN THINKING - PRECAST	BREIFING ABOUT EMPATHISE	18.08.2021	SITE VISIT	MIT-M SITE VISIT - LEAN (INTRO)
20.07.2021	DESIGN THINKING - PRECAST	FABRICATOR - INTERVIEW	19.08.2021	SITE VISIT	MIT-M SITE VISIT -PROJECT MANAGEMENT ISSEU (INTRO)
23.07.2021	DESIGN THINKING - PRECAST	A3- DEFINE BREIFING	20.08.2021	DESIGN THINKI - PMC	PMC - TRENDS AND TECHNOLOGIES
24.07.2021	DESIGN THINKING - PRECAST	FABRICATOR - INTERVIEW	21.08.2021	DESIGN THINKI - PMC	TREND + QUALITY TOOLS
25.07.2021	DESIGN THINKING - PRECAST	A3 - DEFINE PROGRESS DISCUSSION	23.08.2021	DESIGN THINKI - PMC	A3 - UNDERSTAND
26.07.2021	DESIGN THINKING - PRECAST	A3- DEFINE REVIEW	24.08.2021	DESIGN THINKI - PMC	STUDY - PMC INVOLVEMENT AT DIFFERENT STAGES
27.07.2021	DESIGN THINKING - PRECAST	A3- IDEATE BRIEFING	25.08.2021	DESIGN THINKI - PMC	CHALLENGES AND PROBLEM STATEMENT
28.07.2021	DESIGN THINKING - PRECAST	A3- IDEATE MIND MAPPING	26.08.2021	DESIGN THINKI - PMC	CHALLENGES AND PROBLEM STATEMENT
29.07.2021	DESIGN THINKING - PRECAST	A3- IDEATE MIND MAPPING	27.08.2021	DESIGN THINKI - PMC	CHALLENGES AND PROBLEM STATEMENT
30.07.2021	DESIGN THINKING - PRECAST	A3- IDEATE	30.08.2021	DESIGN THINKI - PMC	SRM - SITE VISIT
			31.08.2021	DESIGN THINKI - PMC	A3 -SOLUTION

DATE	PROJECT NAME	WORK DONE
01.09.2021	DESIGN THINKI - PMC	A3 - SOLUTION
02.09.2021	DESIGN THINKI - PMC	FLOW CHART - PMC - INTIATION PHASE
03.09.2021	DESIGN THINKI - PMC	FLOW CHART - INTIATION
06.09.2021	DESIGN THINKI - PMC	FLOW CHART - EXECUTION
07.09.2021	DESIGN THINKI - PMC	FLOW CHART - EXECUTION
08.09.2021	DESIGN THINKI - PMC	FLOW CHART - MONITOR AND CONTROL
09.09.2021	DESIGN THINKI - PMC	FLOW CHART - MONITOR AND CONTROL
10.09.2021	DESIGN THINKI - PMC	FLOW CHART - CLOSE OUT
13.09.2021	DESIGN THINKI - PMC	FLOW CHART - CLOSE OUT
14.09.2021	DESIGN THINKI - PMC	PMC MANAGEMENT PLAN - STUDY
15.09.2021	DESIGN THINKI - PMC	MANAGEMENT PLAN - STUDY
16.09.2021	DESIGN THINKI - PMC	FLOW CHART - MANAGEMENT PLAN
17.09.2021	DESIGN THINKI - PMC	QUALITY MANAGEMENT - STUDY
20.09.2021	DESIGN THINKI - PMC	FLOW CHART
21.09.2021	DESIGN THINKI - PMC	CHANGE CONTROL - STUDY
22.09.2021	DESIGN THINKI - PMC	FLOW CHART
23.09.2021	DESIGN THINKI - PMC	ISSUE CONTROL - STUDY
24.09.2021	DESIGN THINKI - PMC	FLOW CHART
27.09.2021	CHITRAKOOTA SCHOOL	CONSTRAINTS IN CONSTRUCTION
28.09.2021	CHITRAKOOTA SCHOOL	CONSTRAINTS IN CONSTRUCTION
29.09.2021	CHITRAKOOTA SCHOOL	CONSTRAINTS IN CONSTRUCTION
30.09.2021	CHITRAKOOTA SCHOOL	MANAGEMENT PLAN
31.09.2021	CHITRAKOOTA SCHOOL	MANAGEMENT PLAN
01.10.2021	PMC	DAILY TRACKING SCHEME
04.10.2021	LEAN TECHNIQUES	LEAN TOOLS AND TECHNIQUES
05.10.2021	LEAN TECHNIQUES	LEAN TOOLS AND TECHNIQUES
06.10.2021	LEAN TECHNIQUES	LEAN TOOLS AND TECHNIQUES
07.10.2021	LEAN TECHNIQUES	JOURNAL STUDY
08.10.2021	LEAN TECHNIQUES	JOURNAL STUDY
11.10.2021	LEAN TECHNIQUES	FRAME WORK DEVELOPMENT
12.10.2021	LEAN TECHNIQUES	FRAME WORK DEVELOPMENT
13.10.2021	LEAN TECHNIQUES	FRAME WORK DEVELOPMENT

01.12.2021	GT.ELECTRICALS	INTRODUCTION TO THE PROJECT
02.12.2021	GT.ELECTRICALS	STUDY OF ALL THE DRAWINGS
03.12.2021	GT.ELECTRICALS	STUDY OF ALL THE DRAWINGS
04.12.2021	GT.ELECTRICALS	PRE-FAB CONSTRUCTION - STUDY
06.12.2021	GT.ELECTRICALS	DEVELOPMENT OF ACTIVITY SEQUENCE
07.12.2021	GT.ELECTRICALS	DEVELOPMENT OF ACTIVITY SEQUENCE , WATERPROOFING WORKS
08.12.2021	GT.ELECTRICALS	GENERATION OF DOCUMENTS NEEDED , CONSTRAINTS STUDY
09.12.2021	GT.ELECTRICALS	WBS , WORK FLOW CHART
10.12.2021	GT.ELECTRICALS	WBS -REVISION , WORK FLOW CHART
11.12.2021	GT.ELECTRICALS	WBS -REVISION
13.12.2021	GT.ELECTRICALS	WBS -REVISION
14.12.2021	GT.ELECTRICALS	PRELIMINARY CHECKLIST - VISUAL INSPECTION
15.12.2021	GT.ELECTRICALS	EQUIPMENT ANALYSIS , QUALITY CHECKLIST FOR PRE-FAB CONSTRUCTION
16.12.2021	GT.ELECTRICALS	EQUIPMENT ANALYSIS , QUALITY CHECKLIST FOR PRE-FAB CONSTRUCTION
17.12.2021	GT.ELECTRICALS	EXCAVATION - CALCULATION
18.12.2021	GT.ELECTRICALS	SHUTTERING CALCULATION , BBS
20.12.2021	GT.ELECTRICALS	ADMIN BLOCK - CASH FLOW
21.12.2021	GT.ELECTRICALS	EQUIPMENT ANALYSIS (REVISION) , SECURITY BLOCK ESTIMATE
22.12.2021	GT.ELECTRICALS	SECURITY BLOCK CASH FLOW
23.12.2021	GT.ELECTRICALS	JAPANESE A3 SHEETS
24.12.2021	GT.ELECTRICALS	JAPANESE A3 SHEETS
27.12.2021	GT.ELECTRICALS	JAPANESE A3 SHEETS
28.12.2021	GT.ELECTRICALS	JAPANESE A3 SHEETS
29.12.2021	BIAL PROJECT	CONTRACT STUDY
30.12.2021	BIAL PROJECT	CONTRACT STUDY
31.12.2021	BIAL PROJECT	PRELIMINARY REPORT
02.01.2021	BIAL PROJECT	SPECIFICATIONS
03.01.2021	BIAL PROJECT	SPECIFICATIONS
04.01.2021	BIAL PROJECT	WBS
05.01.2021	BIAL PROJECT	WBS
06.01.2021	BIAL PROJECT	WBS
07.01.2021	BIAL PROJECT	EQUIPMENT ANALYSIS
08.01.2021	BIAL PROJECT	TENDER PRESENTATION
10.01.2021	BIAL PROJECT	TENDER PRESENTATION
11.01.2021	BIAL PROJECT	TENDER PRESENTATION
12.01.2021	BIAL PROJECT	TENDER PRESENTATION

S. Ram Kumar



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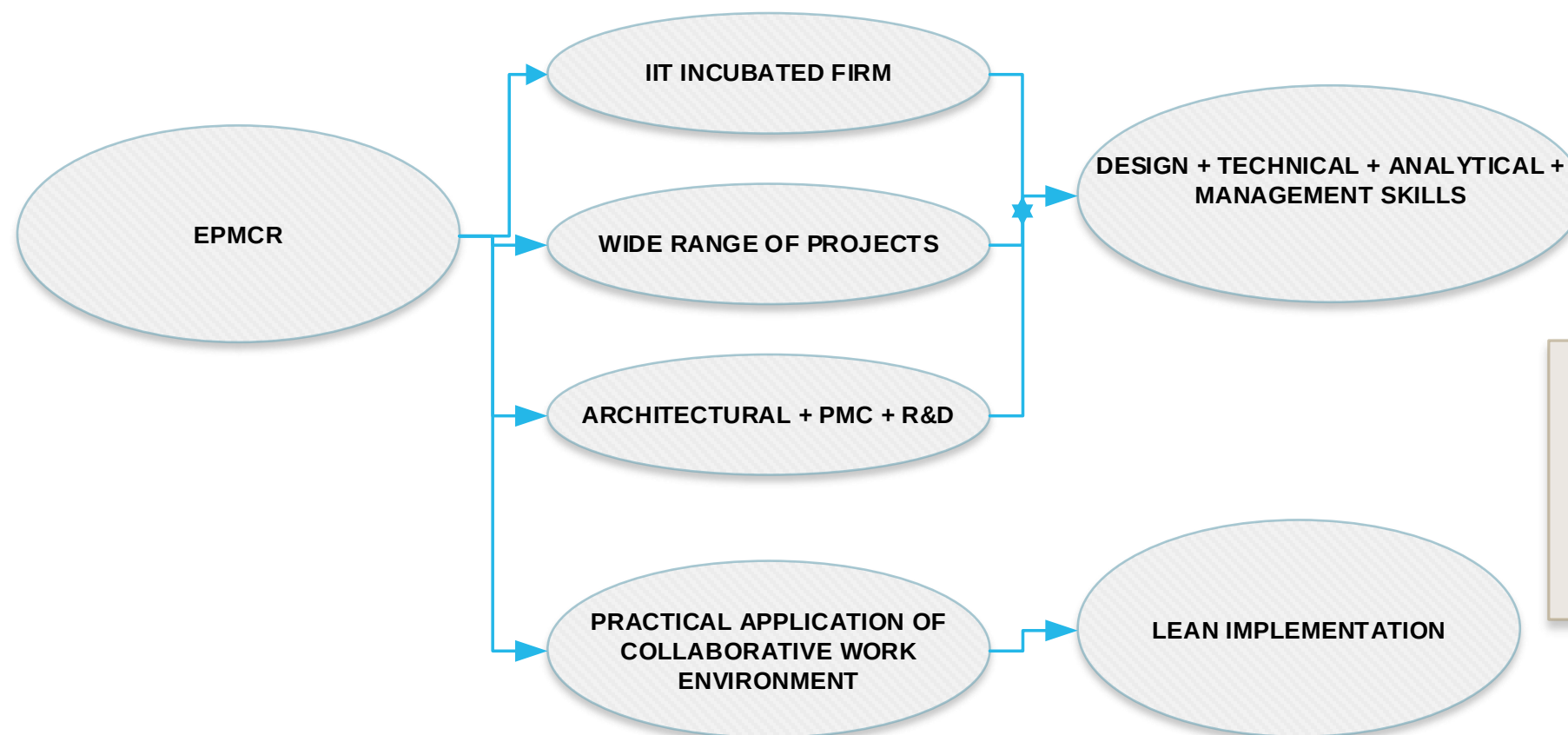
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EPMCR PVT LTD , CHENNAI

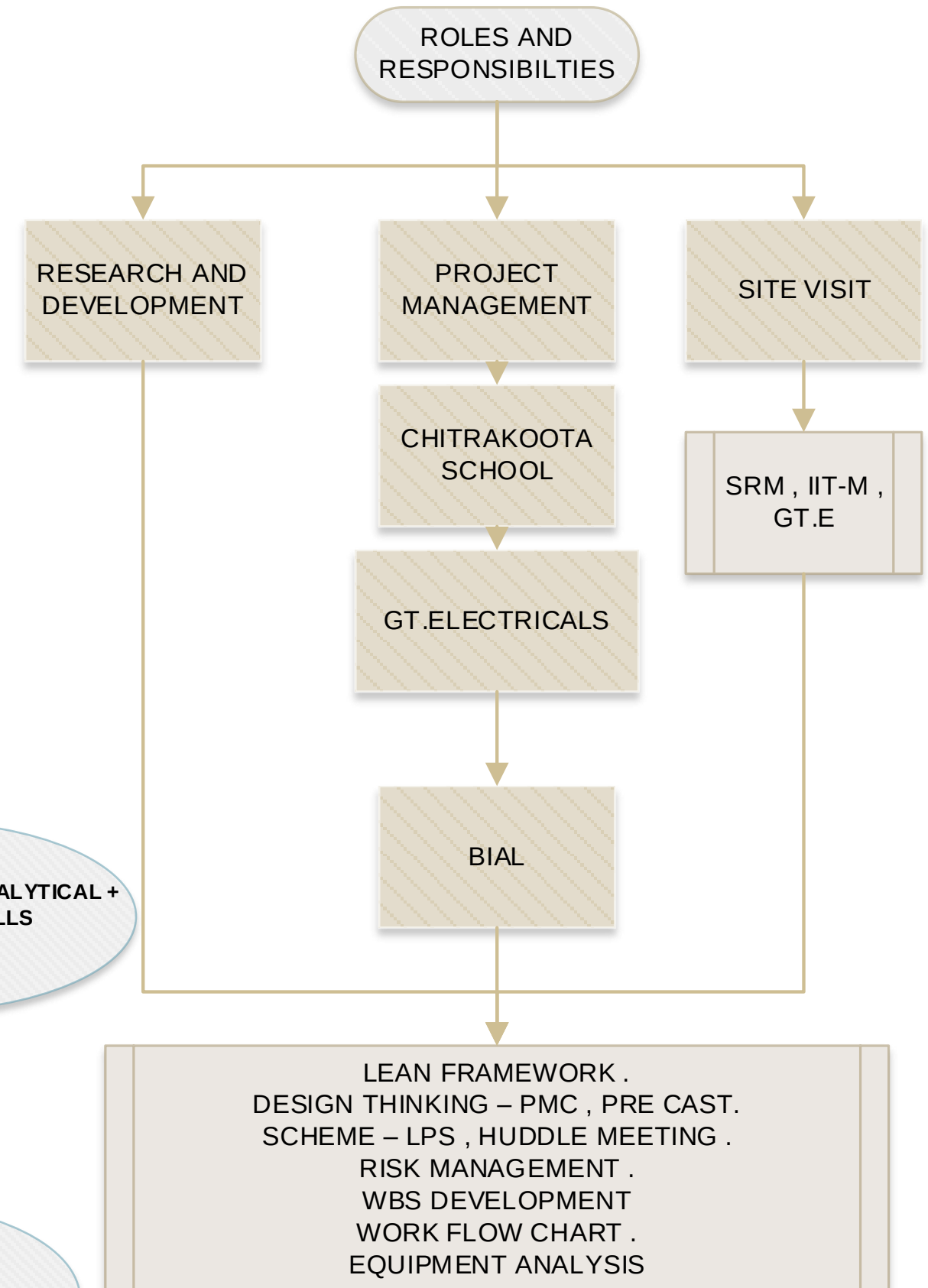
INTERNSHIP OBJECTIVE

As a fresher Architect entering into the Construction Management domain was a little bit tedious than expected. The significant objective of the internship was to benefit from the experience . This is my first experience working for a big company . The internship will allow me to learn and develop new set of skills that is much needed for project management . From my learning I would be able to reflect them when I join a large work force after my graduation .

REASON TO CHOOSE EPMCR



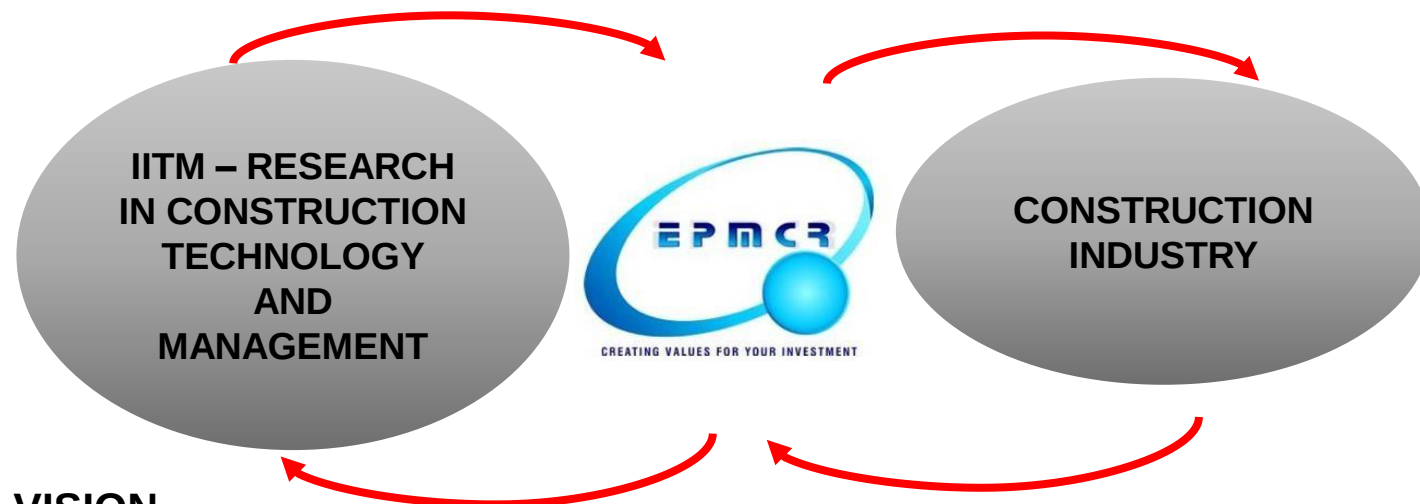
ROLES AND RESPONSIBILITIES



ORGANISATION'S DETAILS

ABOUT THE ESTABLISHMENT

EPMCR(P)LTD is an IIT Madras incubated Engineering and Project Management consulting company offering civil engineering solutions ranging from Architecture to Infrastructure facilities to the client. The company offers one point solution for planning, design and construction. The company's strength lies with the expert consultants. EPMCR acts as a bridge between IITM and construction industry by inculcating modern technologies developed by IITM.



VISION

- To become world class Engineering & Project Management consultants and professional trainers.
- Enabling high quality Indian infrastructure development within time and budget. Create innovation in construction technology and Management techniques through our continuous research.
- Strengthen Indian construction work force through our skill training.

MISSION

- Provide Value creation for our client's Infrastructure Investment through our Engineering, Project Management Consultancy, Research and Training services.

OBJECTIVES

- To help our client to realize the optimum value & quality for their investment in infrastructure projects within the time and budget.
- Bring innovative & cost-effective solution to improve productivity through waste reduction and other new technologies.
- Offer professional training to young engineers on construction management.



CONSULTING



CONSTRUCTION MANAGEMENT – CONTRACTORS



BUSINESS CONSULTANCY



CONSTRUCTION AUDITS



MASTER PLANNING, ARCHITECTURAL AND DETAILED DRAWINGS



TRAINING



PROJECT MANAGEMENT

BUILDING INFRASTRUCTURE

Residential Buildings & townships
Institutional Buildings
Commercial Buildings
Industrial Buildings
Retail Buildings
Healthcare Buildings
Hospitality Buildings



WATER INFRASTRUCTURE

Drinking water supply
Storm water management
Sewage water management



TRANSPORTATION INFRASTRUCTURE

Roads
Bridges and Flyovers
Elevated Corridors



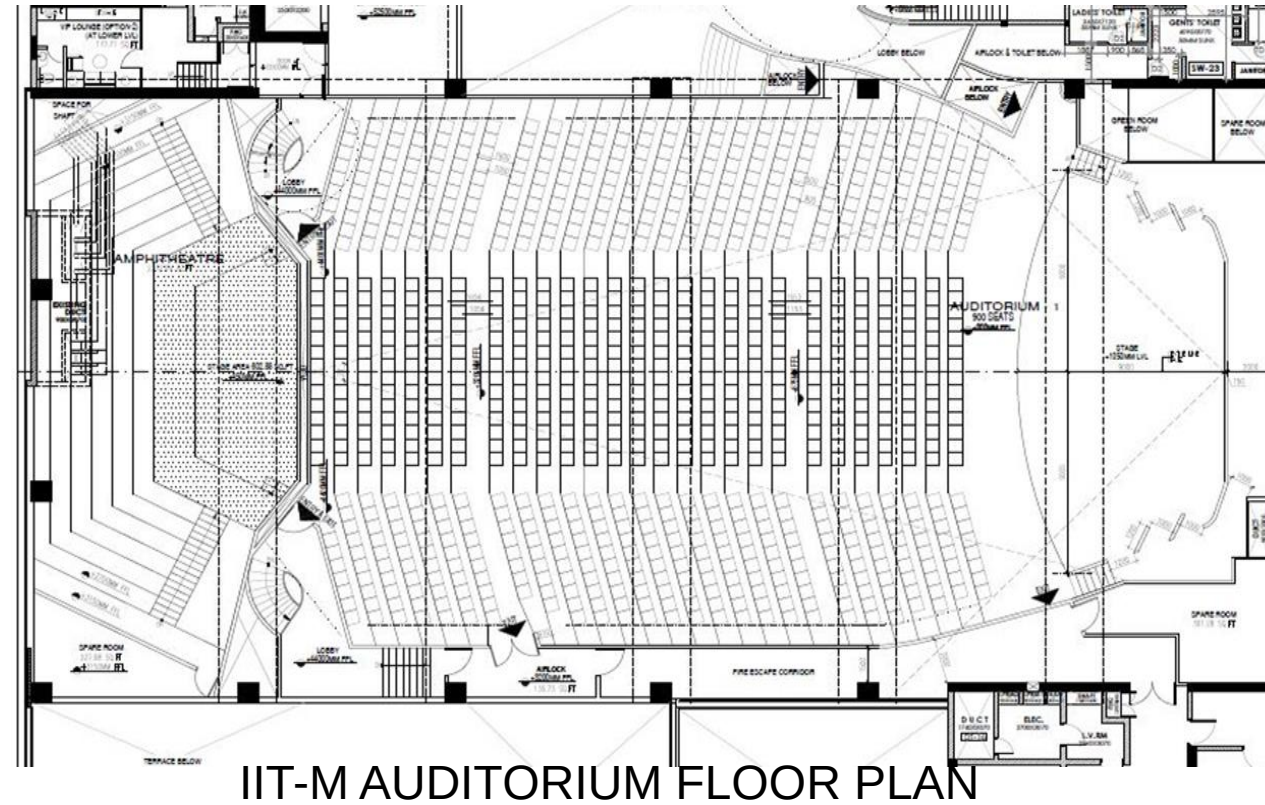
INTERNSHIP REPORT

ENGINEERING PROJECT MANAGEMENT CONSULTANCY AND RESEARCH PRIVATE LIMITED
- AN IIT MADRAS INCUBATED COMPANY

NIVEDHAA B
40840011-III SEM – II YR
M.ARCH-BUILDING MANAGEMENT
SATHYABAMA INSTITUTE OF SCIENCE AND TECHNOLOGY

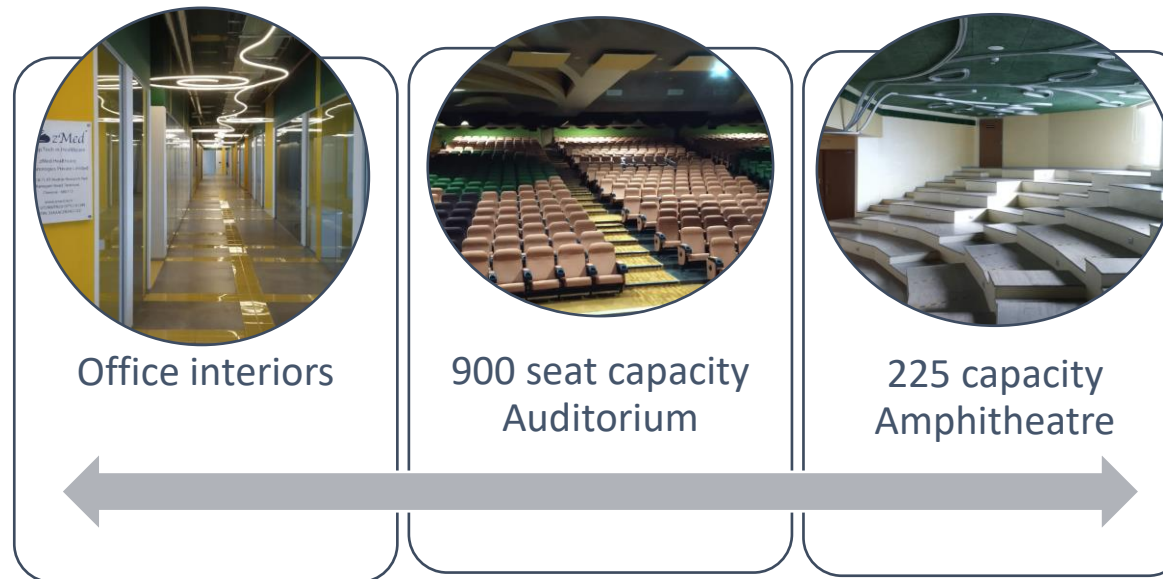
IIT - RESEARCH PARK AUDITORIUM AND OFFICE INTERIORS

IITM – RESEARCH PARK

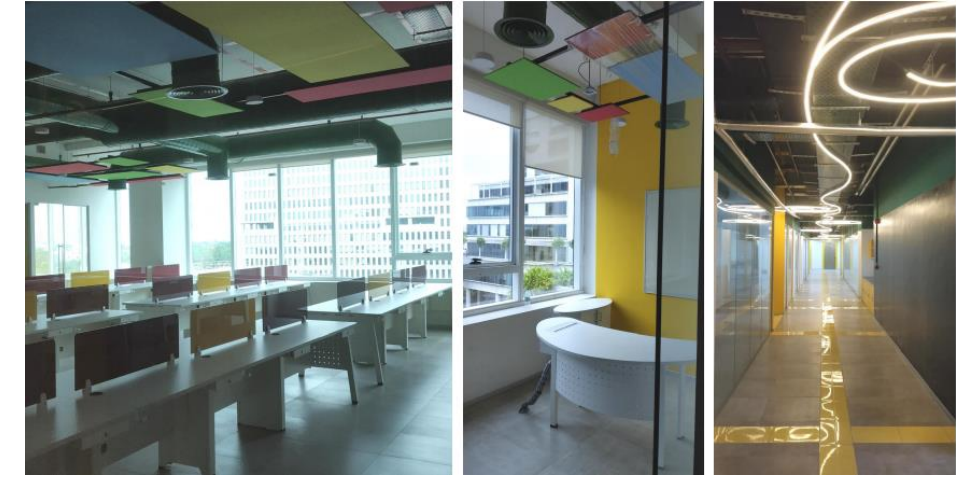


Location : Kanagam road ,
Taramani ,Chennai .

IIT Madras Research Park endeavor to enable companies with a research focus to set up a base in the Park and leverage the expertise of IIT Madras. It is modeled in the lines of successful Research Parks such as Stanford, MIT and Harvard.



Ar. Priyadharshini and Er.Ranjith



A Stretch Ceiling is a **suspended ceiling system consisting of two basic components** – a perimeter track and lightweight fabric membrane which stretches and clips into the track. In addition to ceilings the system can be used for wall coverings, light diffusers, floating panels, exhibitions and creative shapes.

LEAN CONSTRUCTION PRACTICES

TRENDS AND TECHNOLOGIES

- Agile
- Kanban
- Scrum
- Lean
- Waterfall
- SDLC

MANAGEMENT



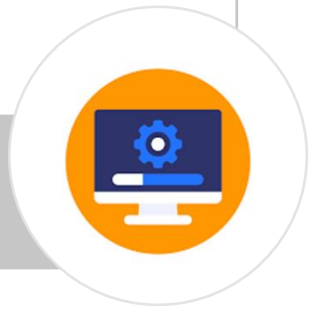
- Gantt
- Pert
- Bar charts
- CPM
- Leads and lags
- Lone of balance technique
- Q scheduling
- Network diagram

TRACKING AND SCHEDULING



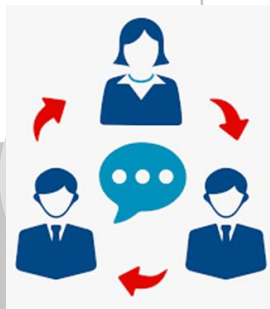
- MSP
- Primavera
- Ms Office
- Visilean

SOFTWARE



- Interviews
- Workshops
- Mind maps
- Brainstorm
- Affinity diagram
- Delphi
- Fish bowling
- Expert judgement
- Questionnaire and survey
- Observation
- Devil's advocacy

COMMUNICATION TOOLS



QUALITY TOOLS

BASIC TOOLS

- Cause effect diagram
- Pareto chart
- Control charts
- Histogram
- Check sheet
- Flow chart
- Scatter diagram

PLANNING TOOLS

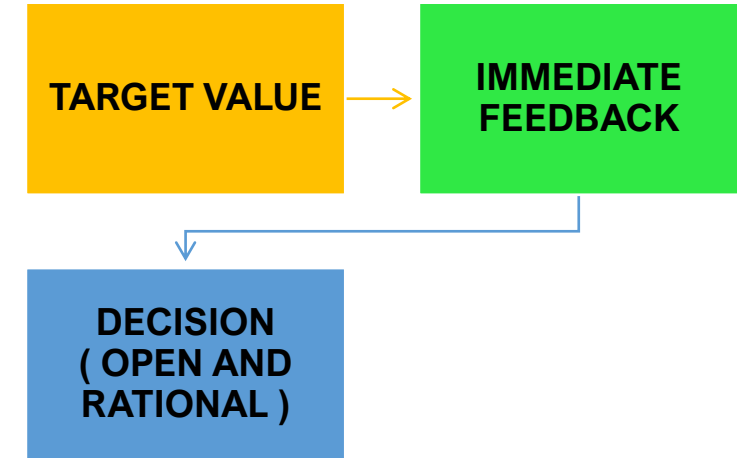
- CPM
- Affinity diagram
- Matrix
- Tree diagram
- PDCA Cycle

ANALYSIS TOOLS

- Benchmarking
- Cause and effect
- Critical to quality
- FEMA
- 5 WHY Analysis
- Flow chart
- KPI
- Visual management
- DMAIC Roadmap

LEAN TOOLS

- Just in time
- Kanban
- Gemba walk
- A3 reports
- 5s analysis
- Co-Location
- BIM
- Daily hurdles
- Choosing by advantage
- Six sigma
- ERP
- Target Value design
- Value stream mapping
- LCA
- LCCA
- Look – ahead schedule



TECHNICAL ANALYSIS

- BIM
- GIS
- IoT
- Block chain
- Augmented reality
- Virtual reality
- Quantum computers

INTERNAL / EXTERNAL	LOCAL	SUPPLIERS	NATIONAL	INTERNATIONAL	MEDIA
	WEBSITE				
		SITE REPORTS			
	SITE VISIT				SITE VISIT
			NEWSLETTERS		
			MEETINGS		
COMMITTEE MEETINGS					
			CORPORATE REPORTS		
BRIEFING					PRESS RELEASES
FOCUS GROUPS					

STAKEHOLDERS CLASSIFICATION

INTERNAL STAKEHOLDERS

CLASS –I

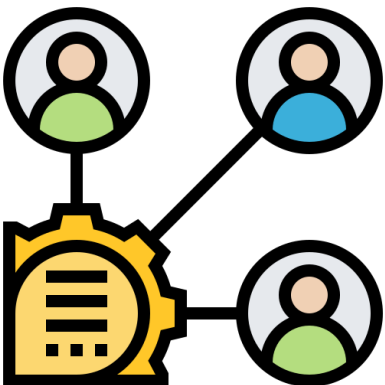
Client / owner
End user
Client – organisation
Financial body
Directors , managers

CLASS –II

Architect
Project managers
Design team
HR
Structural engineers / consultants
MEP consultants
Project coordinator
Engineers
Surveyors
Contractors
Managers
Labours
Business head
Environmental and health safety team

CLASS – III

Suppliers
Manufacturers
Vendors
Security and other
assistant labours
Operators
Drivers



EXTERNAL STAKEHOLDERS

CLASS- IV

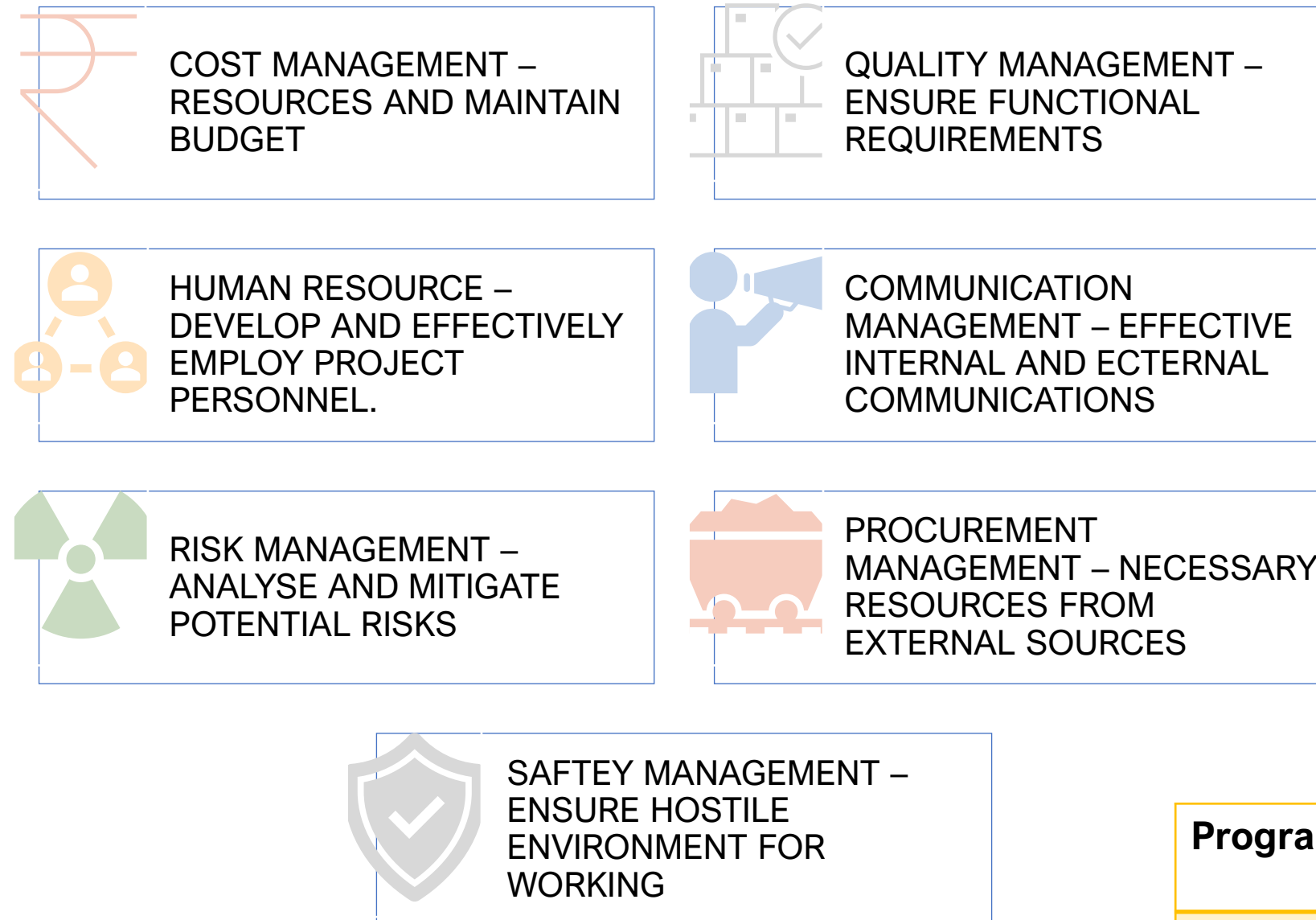
Environmental authority
Planning board
Approval committee
Financial bodies
Media
Neighbours
Other industries
Media
Customers and visitors

PLACES

CLIENT Office In-house location	SITE Security Co-location Labs Temporary units Loading and unloading bay Material storage Visitor room Washrooms Workshops Yards Mock-ups	MATERIAL SUPPLY Supplier's yard and storage Warehouse Shops Manufacturing plant Temporary facilities Transportation
PMC / DESIGNER Office Co-location Other consultants office		R&D E-Access Knowledge centres Research centres and labs

FACTS

- Integration of various project elements that are effectively coordinated.



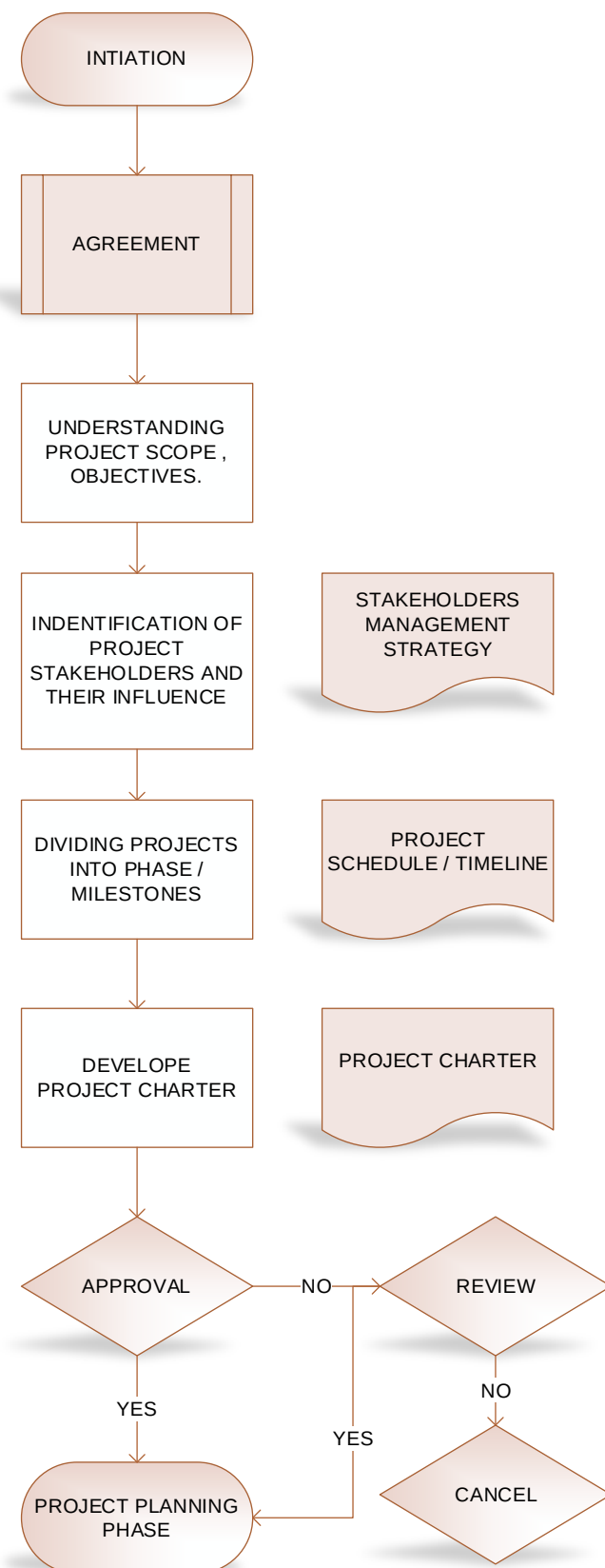
- There is an increase in percentage of women in PMC from 5.9 % to 16% between 2003 -2018.
- Problem solving can be done with in- depth analysis and mitigation plan .
- Artificial intelligence will act as an aid to over come lags .
- More collaborative workspaces have emerged since COVID – 19 .
- Hybrid approach to face all size problems . Waterfall methodologies is tweaked with modern strategies.

- High demand and inflation of all the materials and labour price after COVID -19.
- Regular monitoring and tracking all the activities will ensure safety and help us achieve milestones.
- Several method for scheduling and tracking of all the activities . They also help to find out the reasons for fall back .
- Proper communication and impromptu conversation will result in a collaborative team and growth in terms of productivity.
- BIM , lot will provide us with real time visibility and information accessibility .
- Preventive maintenance will help in an optimized usage of all the resources.
- Checklists will assist in evaluation .
- Smart technologies applications will lead to proper energy management .
- TQM , PDCA and other assessment will make communication easy and help to maintain an equilibrium between all the stakeholders.

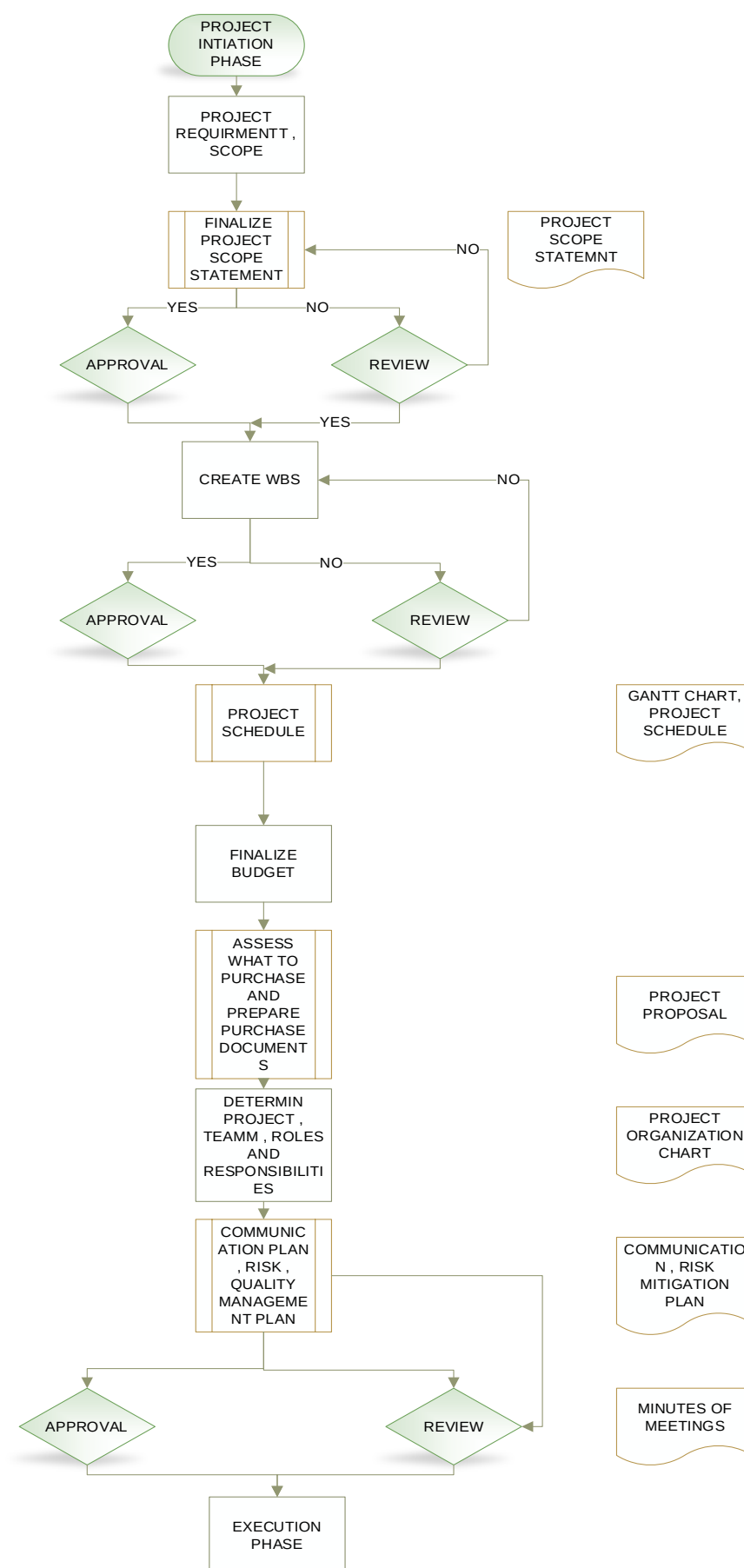
Program Manager	Construction Manager	Project Manager
Based at Headquarters , Visits site .	Job site	Headquarters or job site .
Multiple projects , multiple sites.	One project , one site	Typically one project
Budget , schedule , masterplans and leadership	Leaders on project , central point of communication , overseeing quality , cost and schedule	Cradle to grave : Design process , Bid / award , construction , close – out .

ACTIVITY FLOW CHART

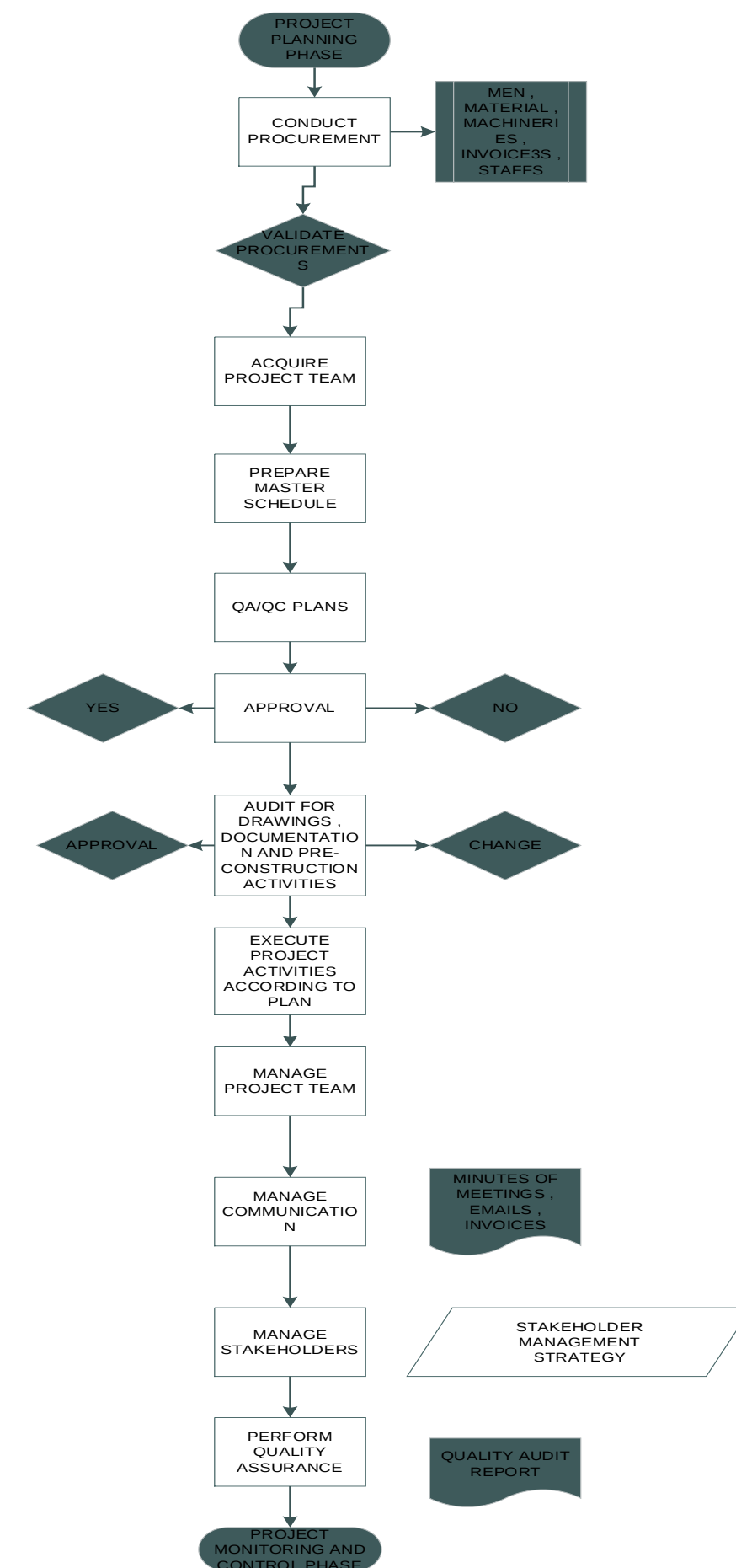
INITIATION PHASE



PLANNING PHASE

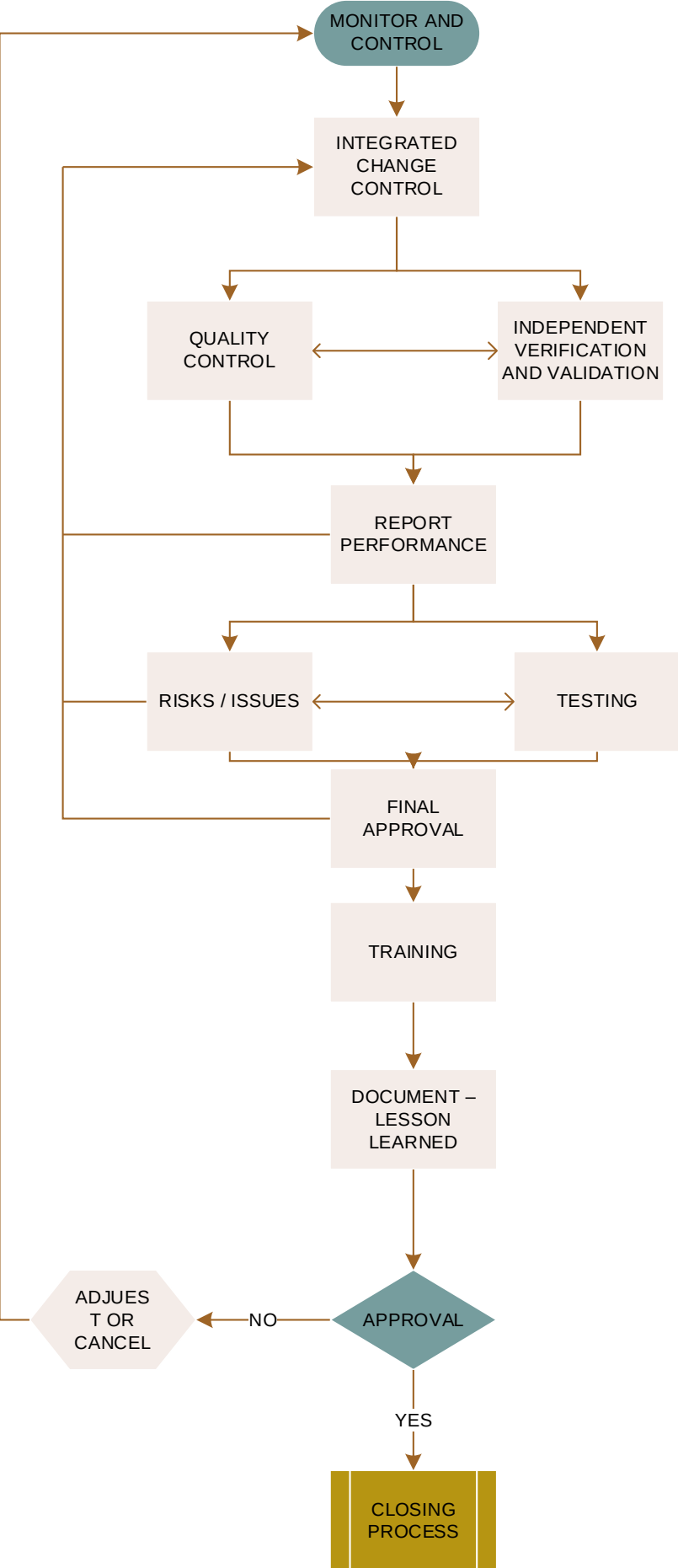


EXECUTION PHASE

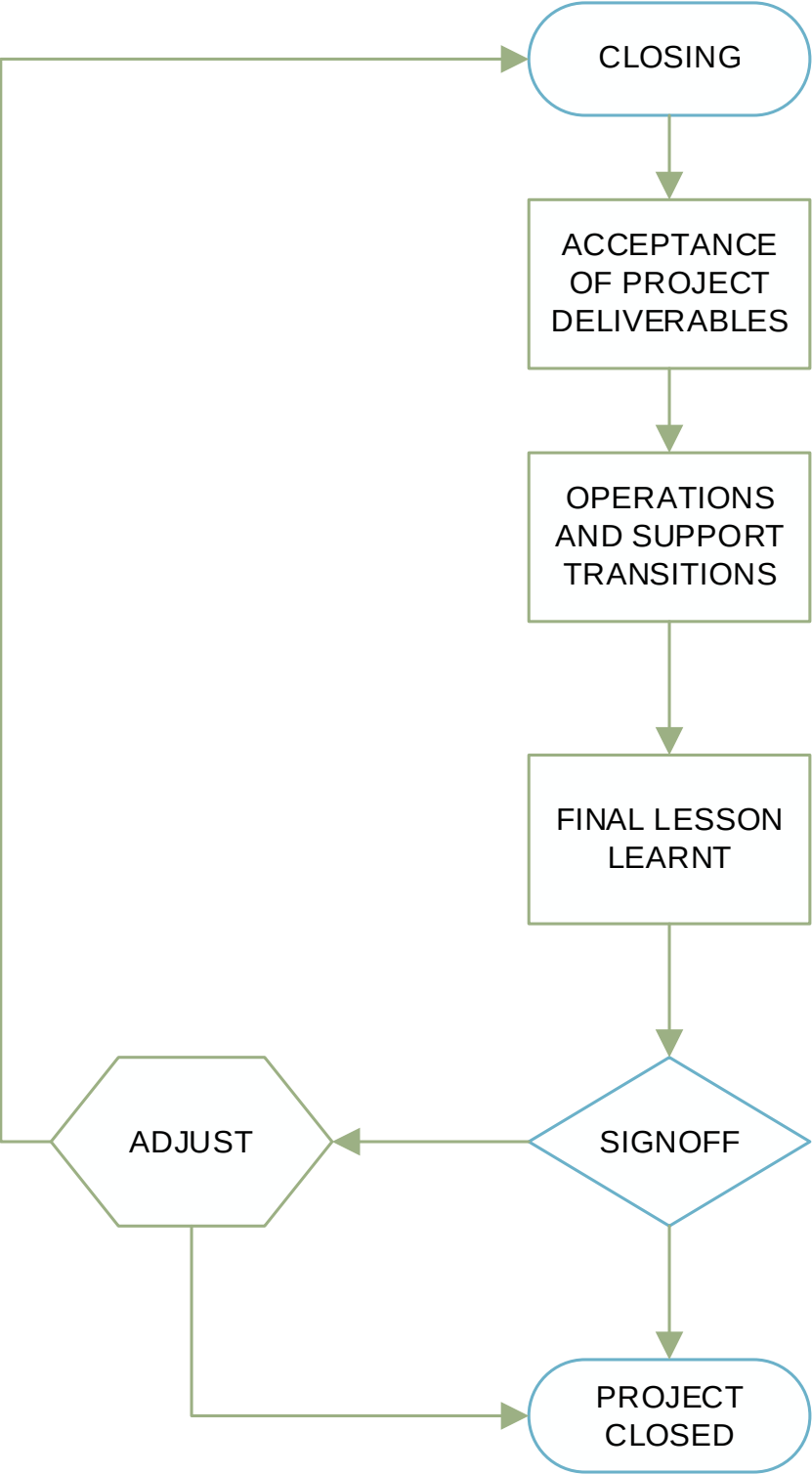


ACTIVITY FLOW CHART

MONITOR AND CONTROL PHASE



CLOSE-OUT PHASE



CHALLENGES AND PROBLEMS

STAKEHOLDERS MANAGEMENT

- NOT UNDERSTANDING THE ROLES AND RESPONSIBILITIES.
- LACK OF COMMUNICATION AND INTERACTION .
- NO LEADERSHIP AND COMMITMENT.
- IMPROPER INFLUENCE AND LESS INTEREST .
- NO ALIGNED VALUES AND MOTIVATIONS

I WONDER IF THAT MEANS :
NO PROPER INTEGRATION OF ALL THE
STAKEHOLDERS .

SCOPE AND OBJECTIVES DEVELOPMENT

- NO REALISTIC GOALS.
- LESS INVOLVEMENT OF STAKEHOLDERS .
- NO UTILISATION OF PROPER SOFTWARE.
- IN-EFFECTIVE USAGE OF PROJECT MANAGEMENT PRACTICES .
- IMPROPER BUSINESS DEVELOPMENT.
- NOT UNDERSTANDING THE REQUIREMENT.
- CONTRACTUAL PROBLEMS

I WONDER IF THAT MEANS :
• IN-EFFECTIVE COMMUNICATION.
• NO PROPER DEFINITION OF SCOPE AND
DECISION MAKING.

CHALLENGES



PROBLEM STATEMENT

DESIGN DEVELOPMENT

- CHANGE ORDERS .
- CONTRACTUAL PROBLEMS .
- NO CLEAR SCOPE .
- SUBSEQUENT DELAYS OF ALL THE ACTIVITIES

I WONDER IF THAT MEANS :
• NO PROPER SITE DOCUMENTATION .
• INVOLVEMENT OF STAKEHOLDERS IS LESS .
• NO PROPER DEVELOPMENT OF
REQUIREMENTS.
• DELAY .
• IN-EFFECTIVE SCHEDULE AND COST
DEVELOPMENT AND MANAGEMENT.

CHALLENGES AND PROBLEMS



COMMUNICATION

LACK OF TRUST AMONG MEMBERS.
RESISTANCE OF SHARING INFORMATION.
PROJECT ENVIRONMENT.
DIFFERENCE BETWEEN SYSTEMS AND BUSINESS.
DIFFERENCE IN PERCEPTION.
LACK OF PROJECT PLAN COMMUNICATION.

NO PROPER PLAN.
MISUNDERSTANDING BETWEEN STAKEHOLDERS.
NO INTEGRATED PLATFORM TO SHARE DATA .
NO CO-ORDINATION WITHIN THE TEAM MEMBERS.
DOCUMENTATION IS NOT PROPER

DOCUMENTATION

CHANGE OF ORDERS.
NO PROPER WAY / PERSONNEL TO MAIN ALL THE
MEDIUM OF COMMUNICATION.

NO TRANSPARENT CHANGE OF INFORMATION.
NO PROPER SOFTWARE /SYSTEM TO MAINTAIN
DATA.
NO STANDARD PROTOCOLS TO MAINTAIN TO
COAGULATE ALL THE SUBMITALS, DRAWINGS AND
OTHER MEDIUM OF DATA.



REPORTING

NO PROPER DOCUMENTS TO REPORT.
NO HIEARCHY .
NO CLEAR UNDERTANDING /
MISUNDERSTANDING.
MISSING DETAILS / DOCUMENTS .
NO PROPER FOLLOW-UP / CO-ORDINATION.
NO PRECISE INFROMATION .

LACK OF DATA .
NO PROPER PRESENTATION .
IRREGULAR MEETINGS .
LACK OF FOLLOW-UP.



SCHEDULE MANAGEMENT

NO PROPER BREAKDOWN OF ACTIVITIES.
LACK OF RESOURCE ALLOCATION.
NO PROPER TRACKING SYSTEM.
SHORT DURATION FOR LARGE COMPLEX ACTIVITIES.
LACK OF QUALITY / PERFROMANCE ASSESSMENT

NO PROPER UNDERSTANDING OF OBJECTIVES.
IMPROPER ORGANISATION OF ACTIVITIES.
NO QUALITY WBS .
POOR DECISION MAKING .
NO FEASIBLE DEADLINES.
LACK OF RESOURCES.



CHALLENGES AND PROBLEMS

COST MANAGEMENT

NO PROPER FINANCIAL DECISION MAKING .
ALLOCATION .
ON-TIME PAYMENTS .
BUDGETING PROBLEMS .

NO CLEAR FINANCIAL DECISIONS.
NOT ACCOUNTING UNCERTAINTIES.
NOT UNDERSTANDING THE REQUIREMENT .
COST OF NON – CONFORMANCE ACTIVITIES .



MEN , MATERIAL, MACHINERIES

NO PROPER ALLOCATION .
COST –OVER RUN
SHORTAGE .
BREAKDOWN .
CONTROL OF INVENTORIES .
UNIFORM FLOW OF MATERIALS.
RIGHT QF QUALITY .

IMPROPER HANDLING EQUIPMENTS .
NO PROPER STORAGE .
SUPPLY CHAIN PROBLEMS.
MATERIALS NOT ARRIVED ON TIME .
NO PROPER UNDERSTANDING OF ACTIVITIES.
NO PROPER PLANNING .



QUALITY –MONITORING AND CONTROL

LACK OF QUALITY IN WORK .
MORE RE-WORK
NO PROPER COORDINATION .

NO PROPER QUALITY MANAGEMENT PLAN.
LACK OF TEST AND COMMISSIONING .
NO PROPER PERSONNEL .
LACK OF KNOWLEDGE .



INTIATION PHASE	• LACK OF STAKEHOLDERS MANAGEMENT . • NO PROPER DOCUMENTATION . • NO PROPER UNDERSTANDING OF SCOPE AND OBJECTIVES.	• SITE RELATIOSHIP BUBBLE. • CIRCULATION DIAGRAM. • MIND MAPPING . • INTEGRATED COMMUNICATION PLATFORM. • A3 DESIGN THINKING . • REGULAR UPDATES . • PROPER FEASIBILITY STUDY . • DISCUSS CONCEPT DEVELOPMENT . • ESTABLISH GOALS. • COLLECT FACTS. • DETERMINE NEEDS. • DEFINE THE PROBLEM . • ESTABLISH COMMUNICATION PLAN.
CONCEPTUAL DESIGN DEVELOPMENT	• GENERATION OF IDEAS TOO EARLY. • SKEWED OPINIONS ON CONCEPTS . • FORGETTING THE TECHNICAL APPLICATION. • ESTABLISH BASIC LOGIC. • PROPER VERBAL IDEATION . • SYSTEMMATIC DOCUMENTATION.	BRAINSTROM . DELPHI METHODS. EXPERT OPINIONS. USAGE OF SOFTWARE. SIMPLIFY THE REQUIRMENTS. WBS . LPS . MoM. A3 JAPANESE SHEETS. DETAILED PRESENTATIONS. SIMULATIONS, 3D MODELS. EFFECTIVE DOCUMENTATION OF CHANGE ORDERS. CLEAR SIT LAYOUT AND UNDERSTANDING .

DESIGN DEVELOPMENT

- INSSUFFICIENT SUPPORT FROM MANAGEMENT.
- NOT CLEARLY DEFINED AND UNDERSTANDABLE STRATEGY.
- NO RESULT AND COMNTINUOUS IMPROVEMENT.
- NOT PRECISE IDENTIFICATION OF RELEVANT KEY PERFROMANCE INDICATORS.
- GOALS ARE NOT LINKED WITH LOWER LEVELS OF THE ORGANISATIONS.
- INSUFFICIENTEXPERTISE AND PROFESSIONAL SKILLS.
- NO STRATEGIC OBJECTIVES AND INDICATORS .
- CONTRACTUAL PROBLEMS.

- INTEGRATED COMMUNICATION.
- MoM.
- PDCA ANALYSIS.
- PRIORITIZATION MATRIX.
- LPS
- EFFECTIVE DOCUMENTATION.
- BRAINSTROM
- CONTINOUS FEEDBACK.
- INVOLVE EXPERTISE .
- TESTING AND OPTIMIZATION.
- FEED .
- TASK BOARDS
- 5 WHY'S AND 5'S .
- PARTNERING SESSIONS.
- INTERNAL DISPUTE RESOLUTION .
- SET MILESTONES

IMPLEMENTATION PHASE

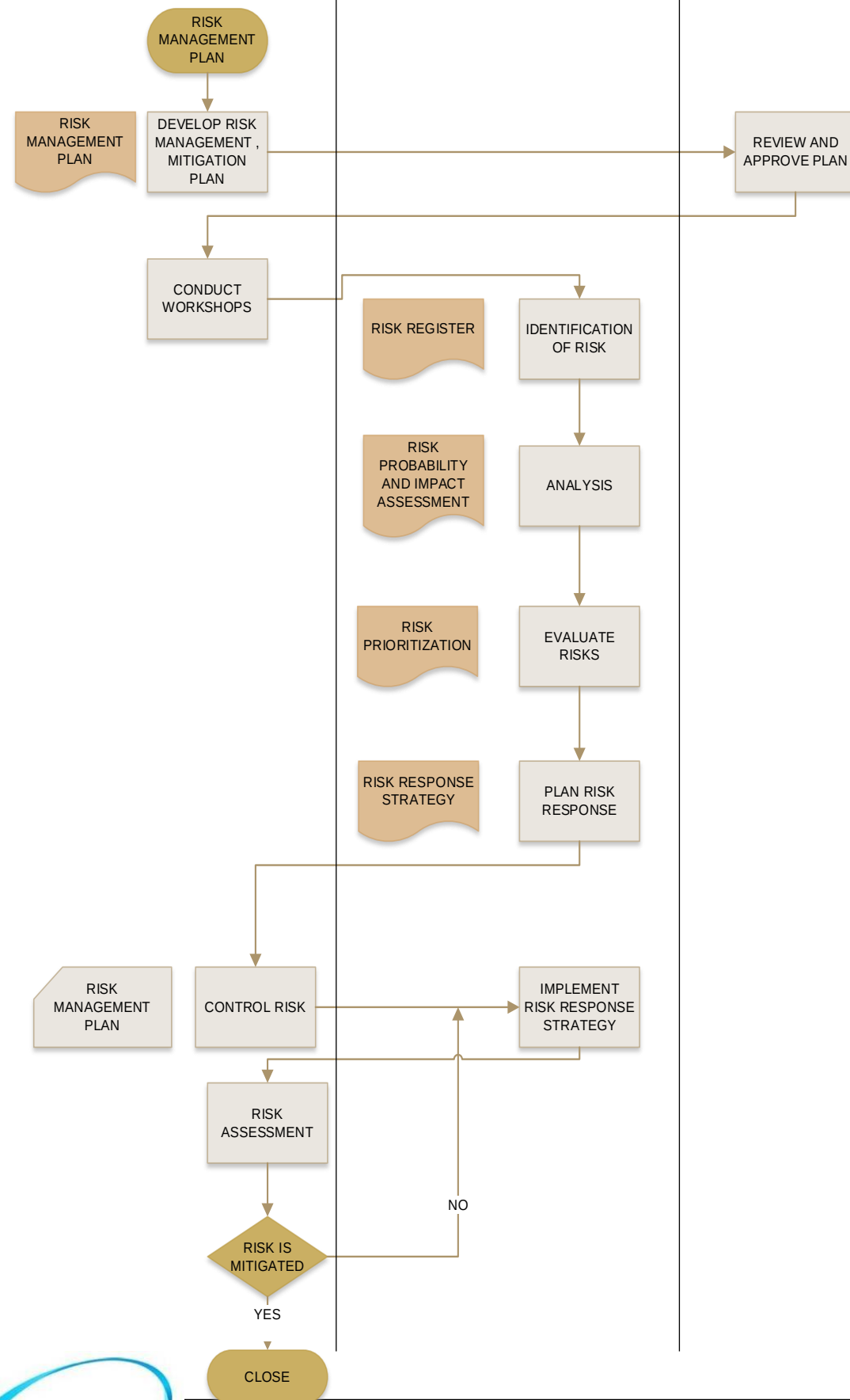
- LACK OF COMMITMENT FROM MANAGEMNT .
- NO PROPER EVALUATION OF RISKS.
- LACK OF UNDERSTANDING OF THE ROLES AND RESPONSIBILITIES.
- LACK OF STRATEGY .
- CONFLICTING PROJECT OBJECTIVES.
- FINACIAL CONSTRAINTS.
- DELAY .
- NO COORDINATION WITH THE TEAM .
- LACK OF CROSS-FUNCTIONAL WORKING .
- NO PROPER DEPLOMENT OF MACHINERIES AND MEN.
- RESISTANCE TO ORGANISATIONAL CHANGE .
- LACK OF ALINGMENT OF SCOPE.
- REPEATED CHANGE ORDERS.
- NO PROPER TENDERING PROCESS .
- PAYMENT / INVOICE PROBLEMS .
- APPROVALS – DELAY.

- CO-LOCATION
- BIG ROOMS
- TASK BORDS
- CONTINOUS EVALUATION.
- PROPER PROCUREMENT OF MATERIALS.
- EFFECTIVE CONTRACT LANGUAGE.
- INTEGRATED COMMUNICATIONS.
- COORDINATION WITH PMC
- PROPER QUALITY MONITORING .
- DAILY HURDLES.
- GEMBA WALK .
- LOOK AHEAD PLAN .
- CLEAR DRAWINGS AND SPECIFICATION.
- DEVELOPMENT OF WORK METHODLOGY .
- OPTIMIZED PLANNING OF MACHINERIES AND MEN.
- PROPER CASH FLOW PLANNING .

MANAGEMENT PLAN

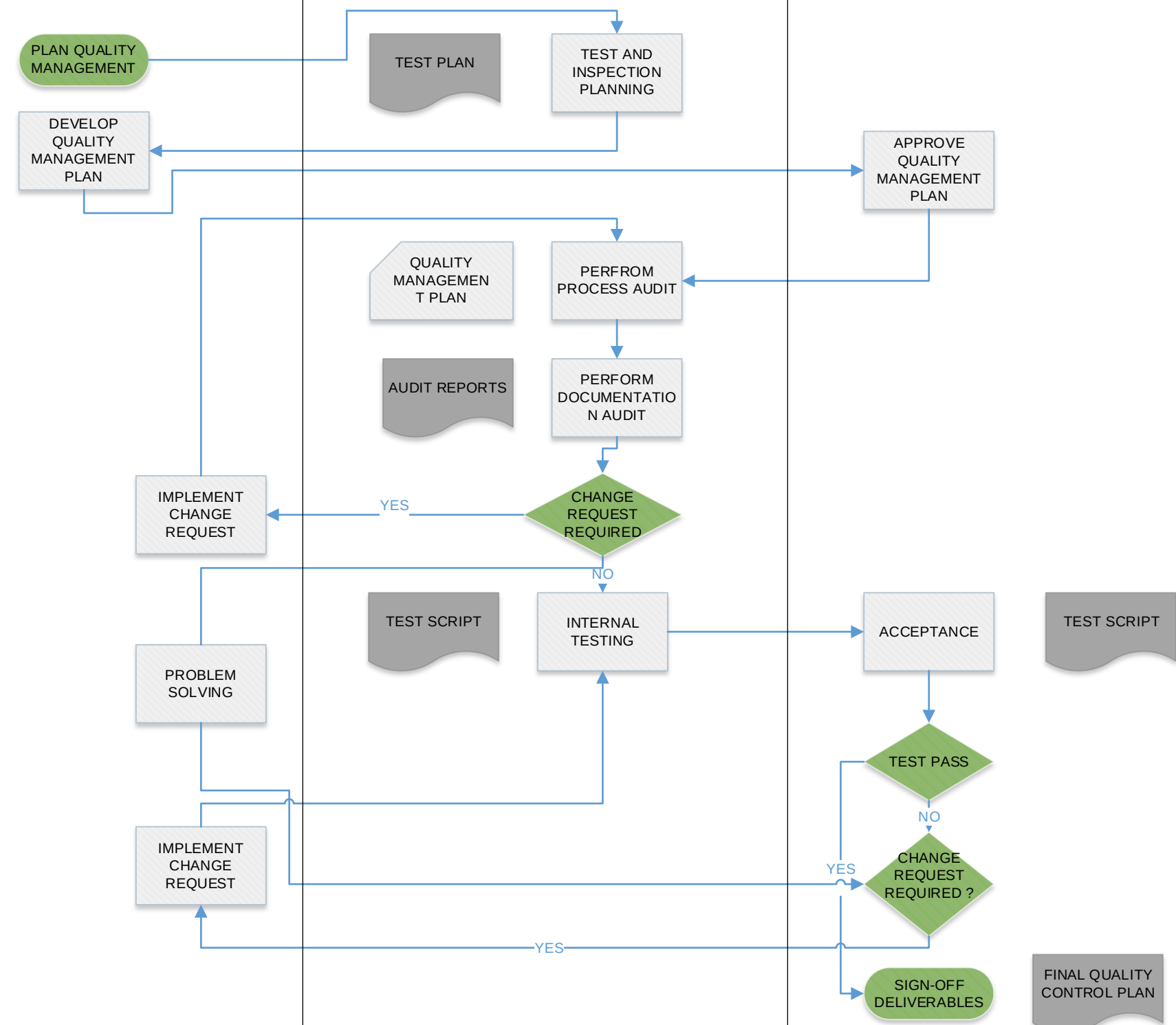
RISK MANAGEMENT PROCESS

PROJECT MANAGER PROJECT TEAM CLIENT



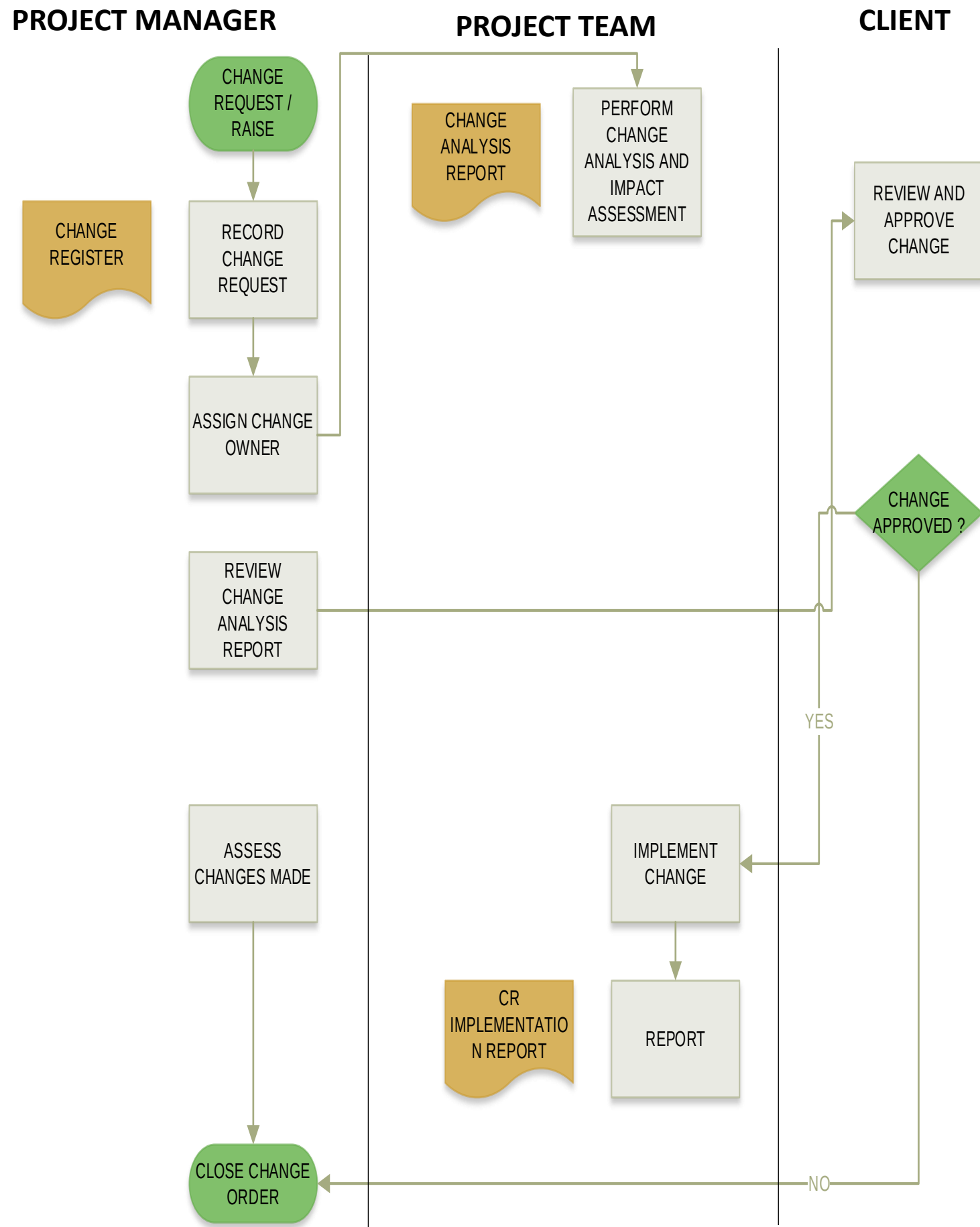
QUALITY MANAGEMENT PROCESS

PROJECT MANAGER PROJECT TEAM CLIENT

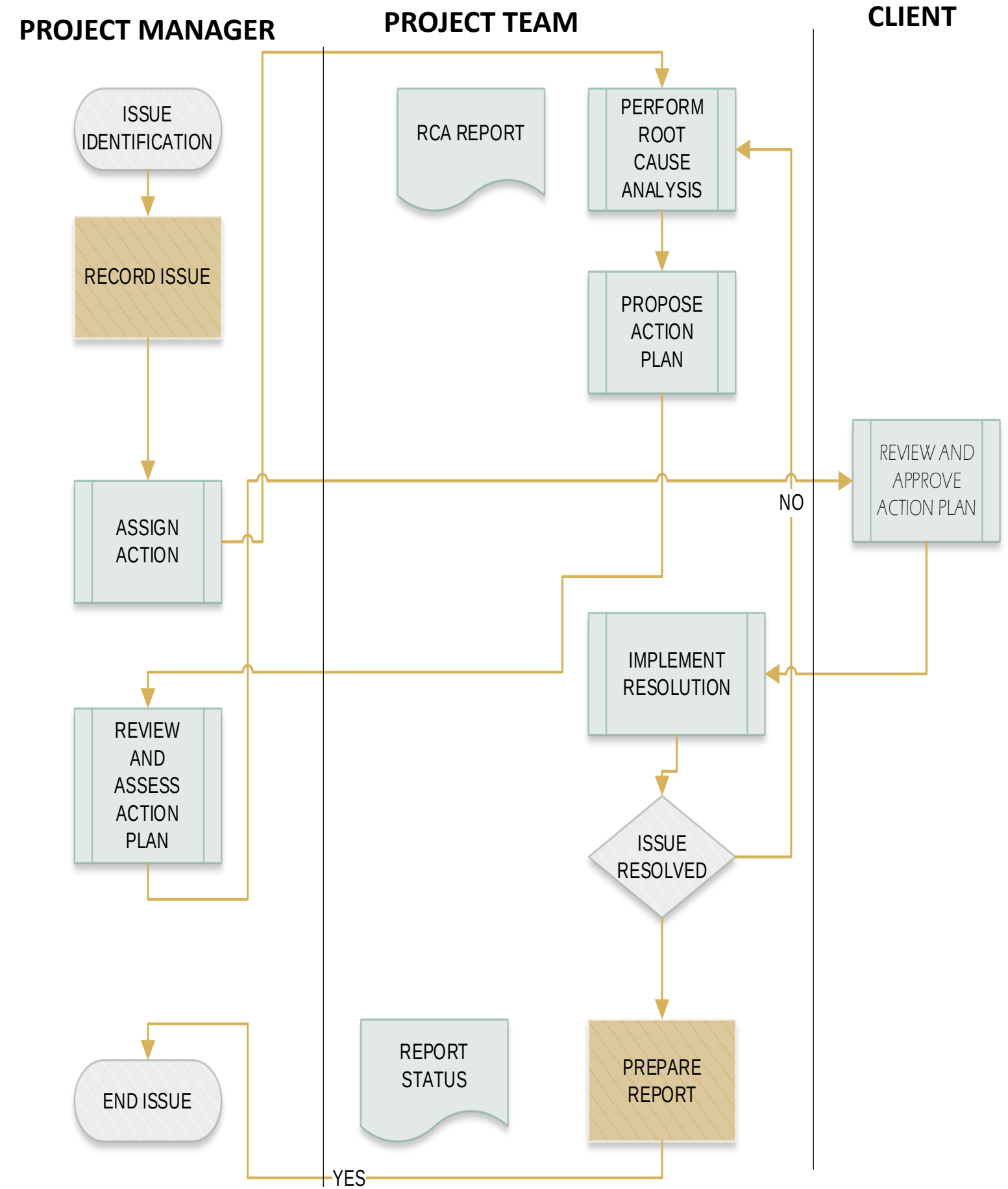


MANAGEMENT PLAN

CHANGE CONTROL PROCESS



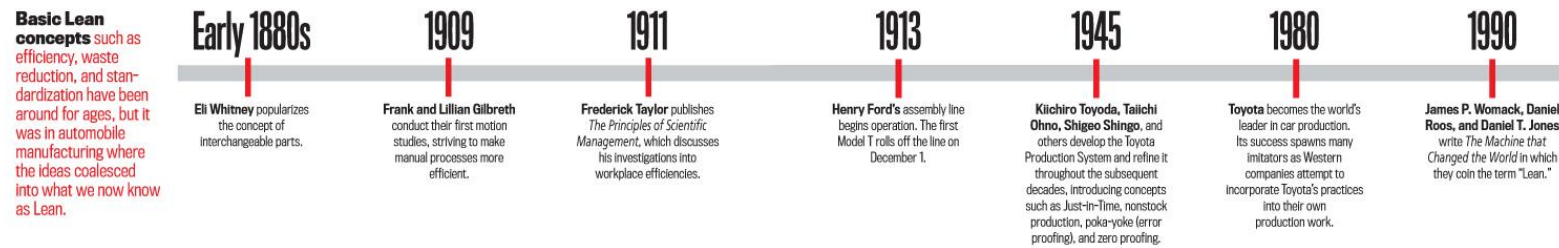
ISSUE MANAGEMENT PROCESS



LEAN CONSTRUCTION

Lean construction is a set of principles and tools to facilitate planning and control , **maximize value and minimize waste** throughout the construction process.

THE BEGINNING OF LEAN



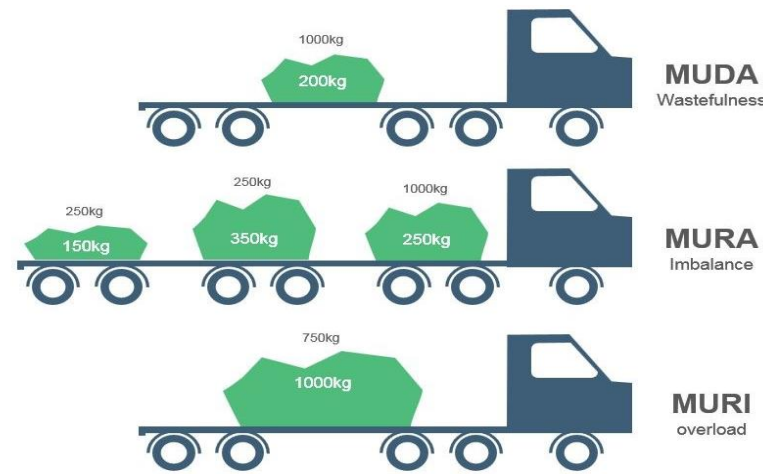
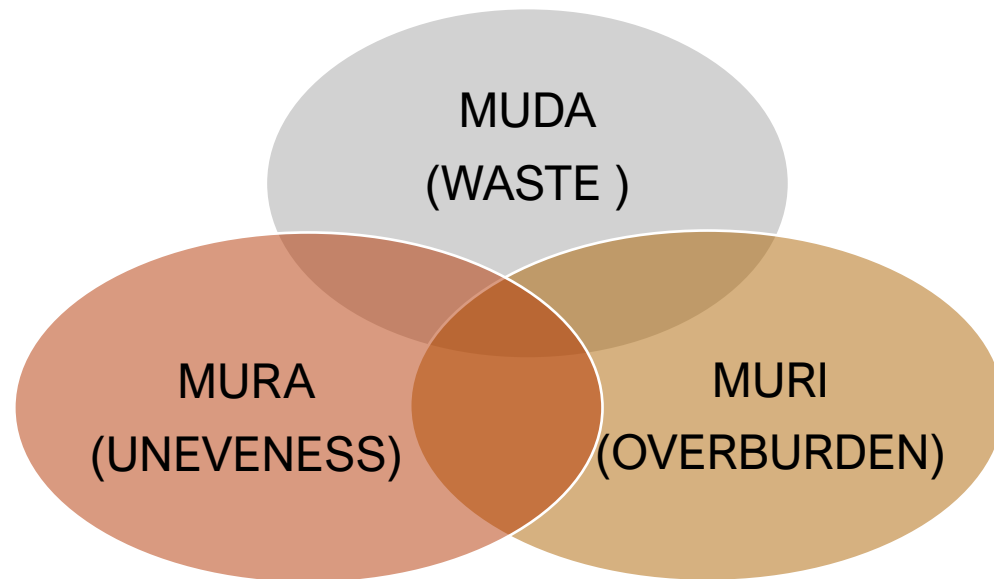
MURA:

Mura is the waste of unevenness or inconsistency. Depending on your context, it can have more than one manifestation. Mura is the conjunction of overburdening some resources while others wait or alternating over time between overburdening and underutilizing the same resources.

MURI :

Overburden resulting from Mura and from removing too much Muda .

Lean waste types :



PRINCIPLES OF LEAN :

- 1.IDENTIFY VALUE :** Add value defined by customer needs. Value lies in the problem you are trying to solve .
- 2.MAP THE VALUE STREAM :** Map the workflow of the company . Identify the part of the process that does not yield no value . Eliminate them .

MUDA :

Activities that do not add any customer value .

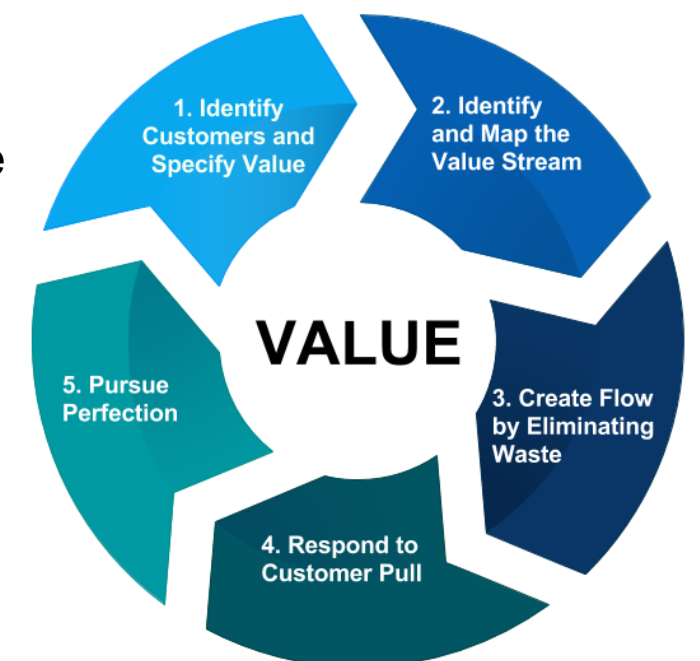


3.CREATE FLOW : Cross functional teamwork .Remove process that block the process.

4.ESTABLISH PULL: Work is pulled only if there is a demand for it .

Optimize resources capacity and deliver products.

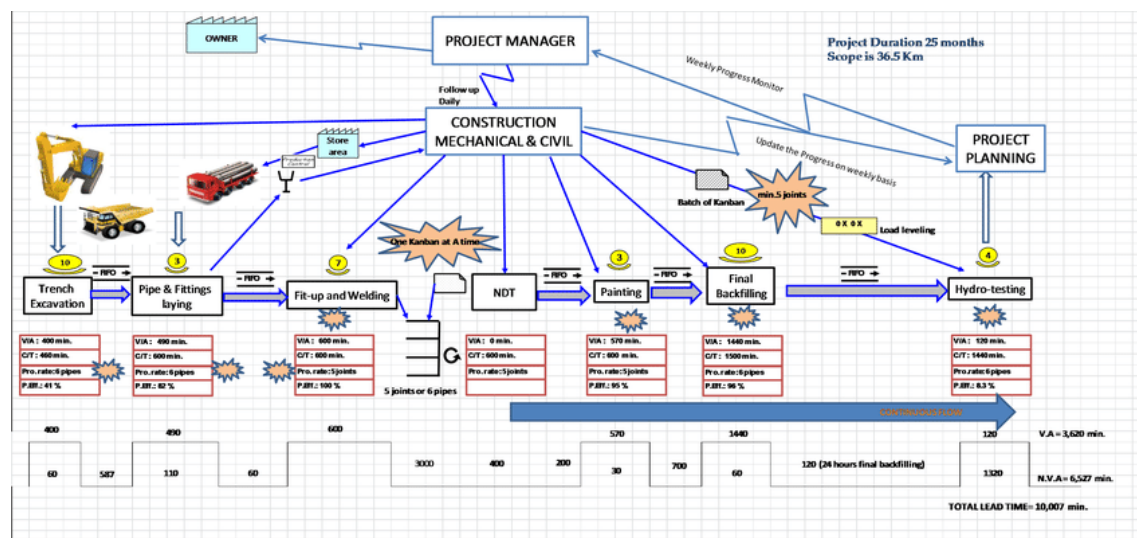
5. CONTINUOUS IMPROVEMENT: Encourage continuous improvement all through the process.



TOOLS AND TECHNIQUES

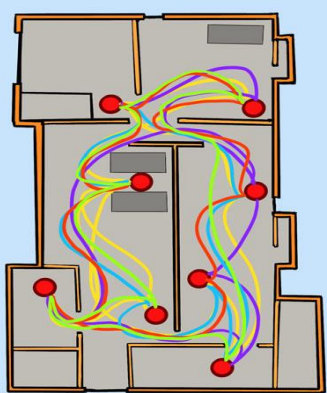
VALUE STREAM MAPPING :Technique which uses visual guide all the components necessary to deliver a product or service, with the goal of analyzing and optimizing the entire process.

The process of creating a value stream map takes all the necessary people, processes, information and inventory, and displays them in a flowchart format. By visualizing all elements that go into creating a product or service, organizations can apply lean principles to reduce waste in specific areas of their processes.



SPAGHETTI DIAGRAM

A spaghetti diagram is defined as a visual representation using a continuous flow line tracing the path of an item or activity through a process. As a process analysis tool, the continuous flow line enables process teams to identify redundancies in the workflow and opportunities to expedite process flow.



- Assembly Process 1
- Assembly Process 2
- Assembly Process 3
- Assembly Process 4
- Assembly Process 5

PDCA CYCLE: An improvement cycle based on the scientific method of proposing a change in a process, implementing the change, measuring the results, and taking appropriate actions.

Plan: Determine goals for a process and needed changes to achieve them.

Do: Implement the changes.

Check: Evaluate the results in terms of performance.

Act: Standardize and stabilize the change or begin the cycle again, depending on the results.

GEMBA WALKS: Gemba walks are an increasingly popular management technique. By visiting the place where work is done, leaders gain valuable insight into the flow of value through the organization and often uncover opportunities for improvement and learn new ways to support employees. The approach is a collaborative one, with employees providing details about what is done and why.

Key elements of a gemba walk



observe, don't correct
Not meant to be a corrective exercise

value add activities
What is working about this process?



innovate and improve conditions, tools, and procedures
Remove the elements that are detrimental to production

seek to understand
Why is it this way?

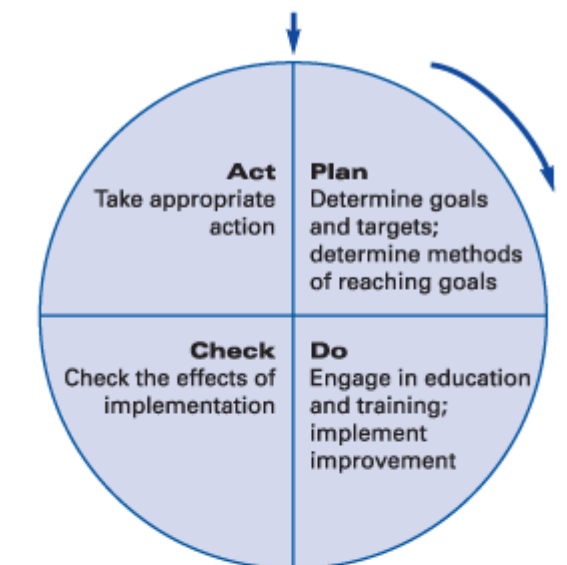


subtracting value
Where are you losing value in the existing process? Why?

5WHY ANALYSIS:

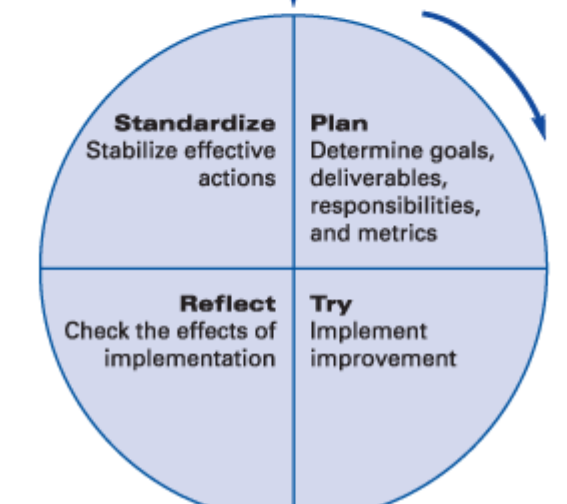
The 5 Whys method is part of the Toyota Production System. Developed by **Sakichi Toyoda**, a Japanese inventor and industrialist, the technique became an integral part of the Lean philosophy.

A Common Version of the PDCA Wheel



Toyota frequently employs PDCA, but changes the terminology slightly:

Grasp the Situation or "Go See"



Define the Problem

Why is it happening?

Why is that?

Why is that?

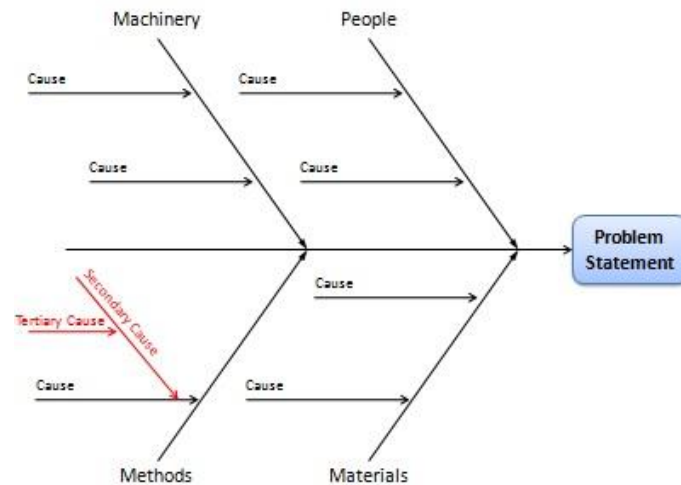
Why is that?

Why is that?

TOOLS AND TECHNIQUES

FISHBONE STRUCTURE:

fishbone diagram is a visualization tool for categorizing the potential causes of a problem. This tool is used in order to identify a problem's root causes. Typically used for root cause analysis, a fishbone diagram combines the practice of brainstorming.



5S ANALYSIS:

It's a workplace organisation technique composed of five phases .

SORT- Keep only necessary items

SET IN ORDER – Arrange items to promote efficient workflow.

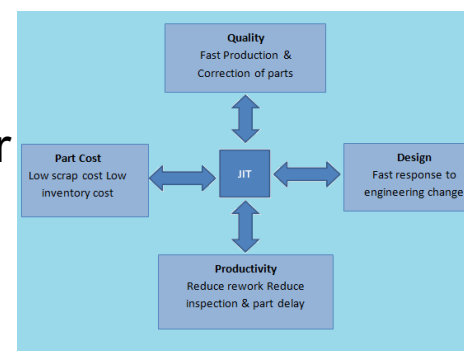
SHINE-Clean the work area so its neat and tidy.

STANDARDIZE – Set standards for consistently organized workplace.

SYSTEMATIZE – Maintain and review standards.

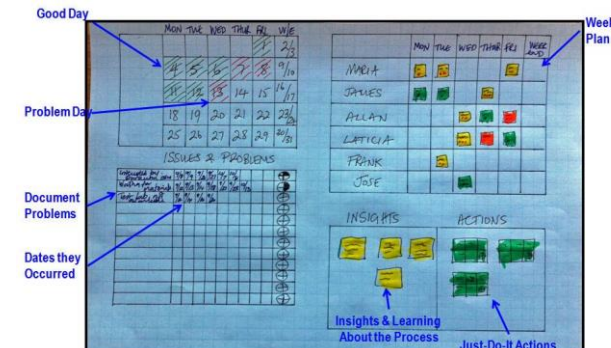
JIT:

Just in Time (JIT), as the name suggests, is a management philosophy that calls to produce what the customer wants, when they want it, in the quantities requested, where they want it, without it being delayed in inventory.



VISUAL MANAGEMENT :

Visual management is fundamentally all about communication. Effective visual management uses instinctive visual cues to communicate key information about a workplace 'at a glance'. Visual management is a way to communicate all information possible, but you will most commonly find it to display information about expectations, performance, standards and warnings.



CO-LOCATION

Colocation is a concept of placing all resources of a project _within a single location. This project management term is also called as “tight matrix” and it is strategically important during the implementation of the project so that all resources are in the same location.

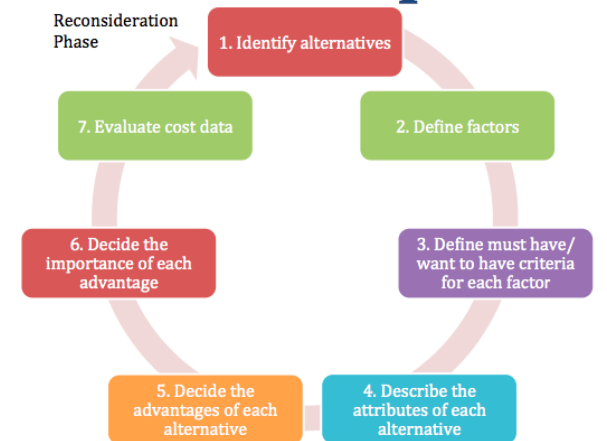


BIG ROOMS

The Big Room is an on-site co-location space that physically brings together designers, builders, and often facility operators to work together.



CBA Steps

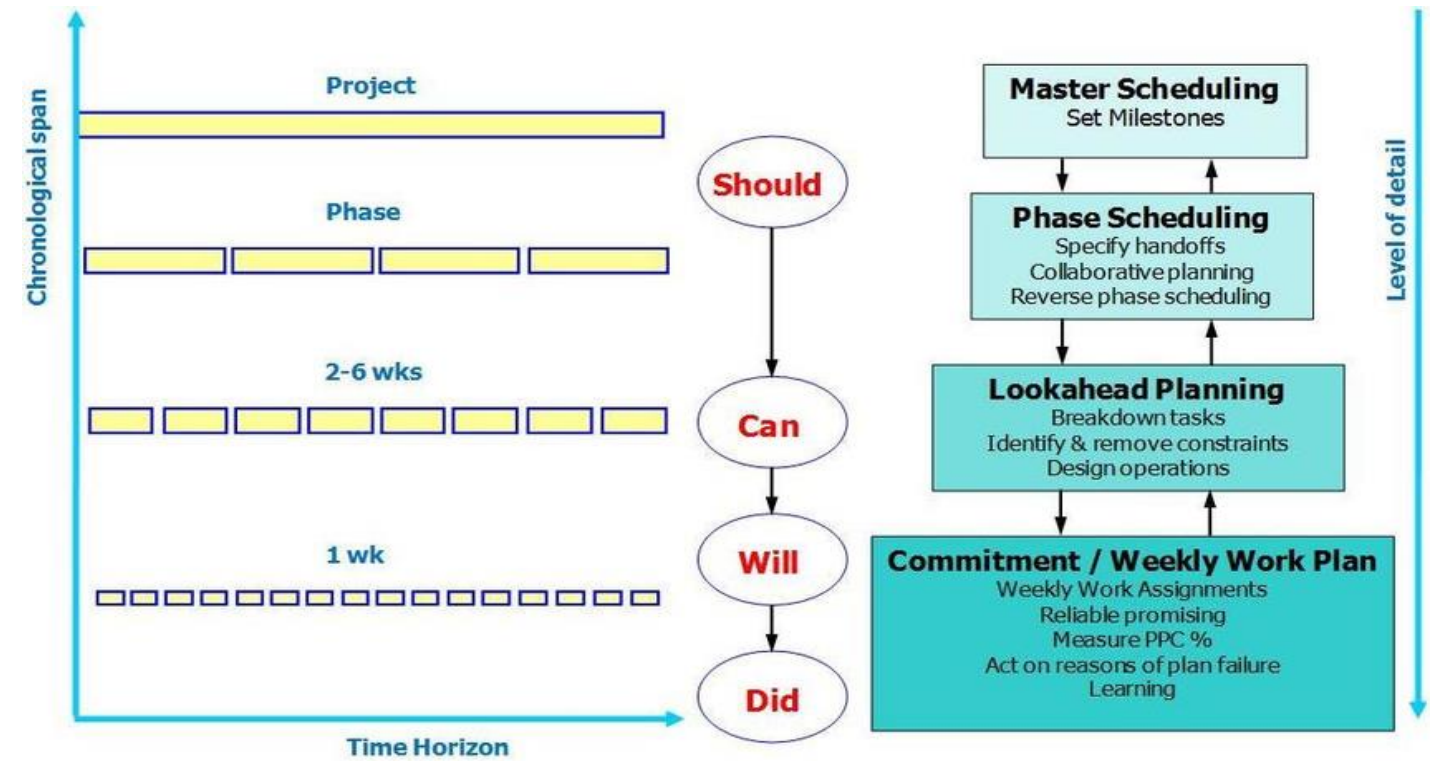
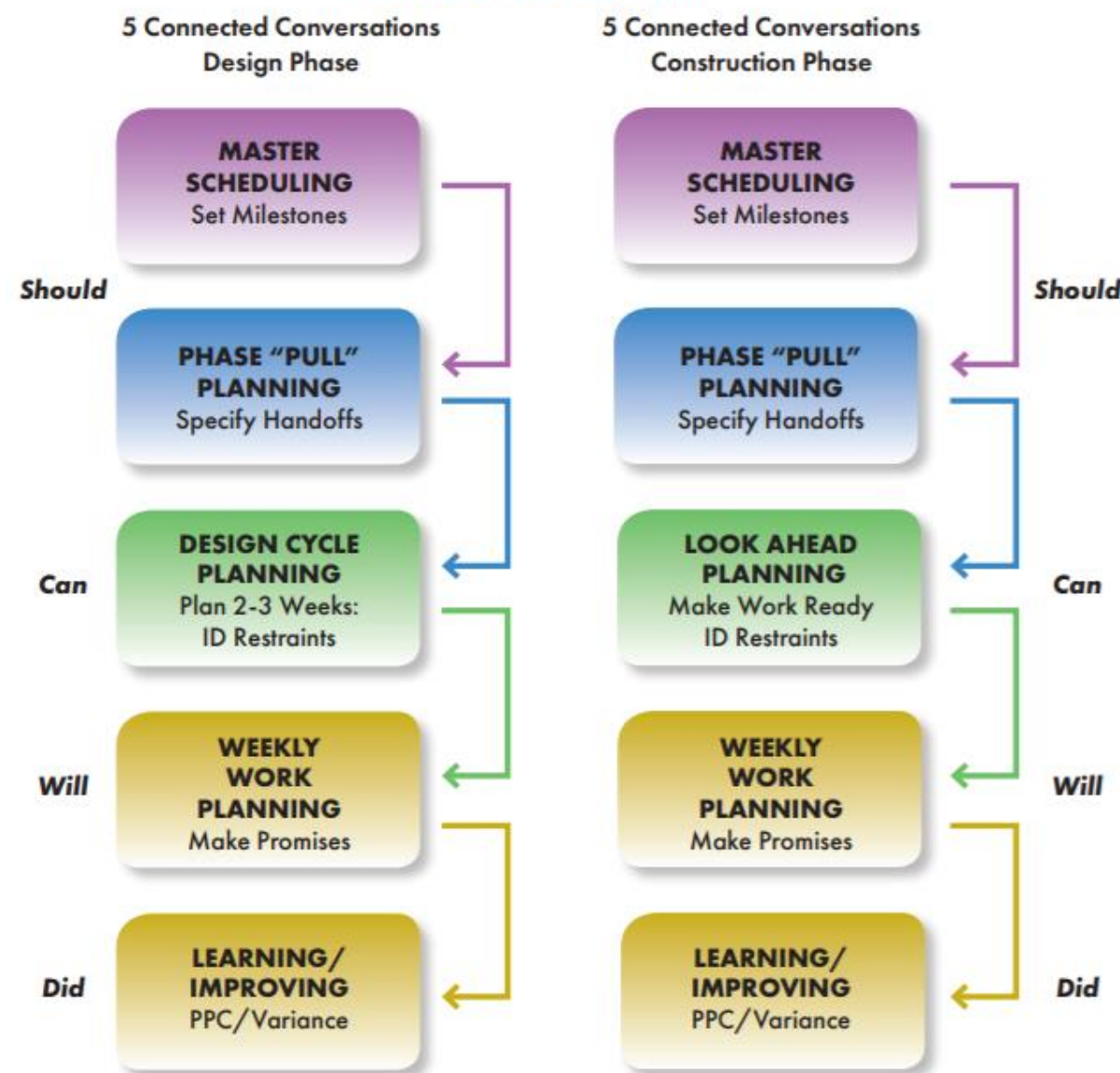


CBA : Choosing By Advantages (CBA) enables decision makers to concentrate on what is important: the advantages (beneficial differences) that each alternative could deliver to stakeholders and basing the decision on the total importance of those advantages.

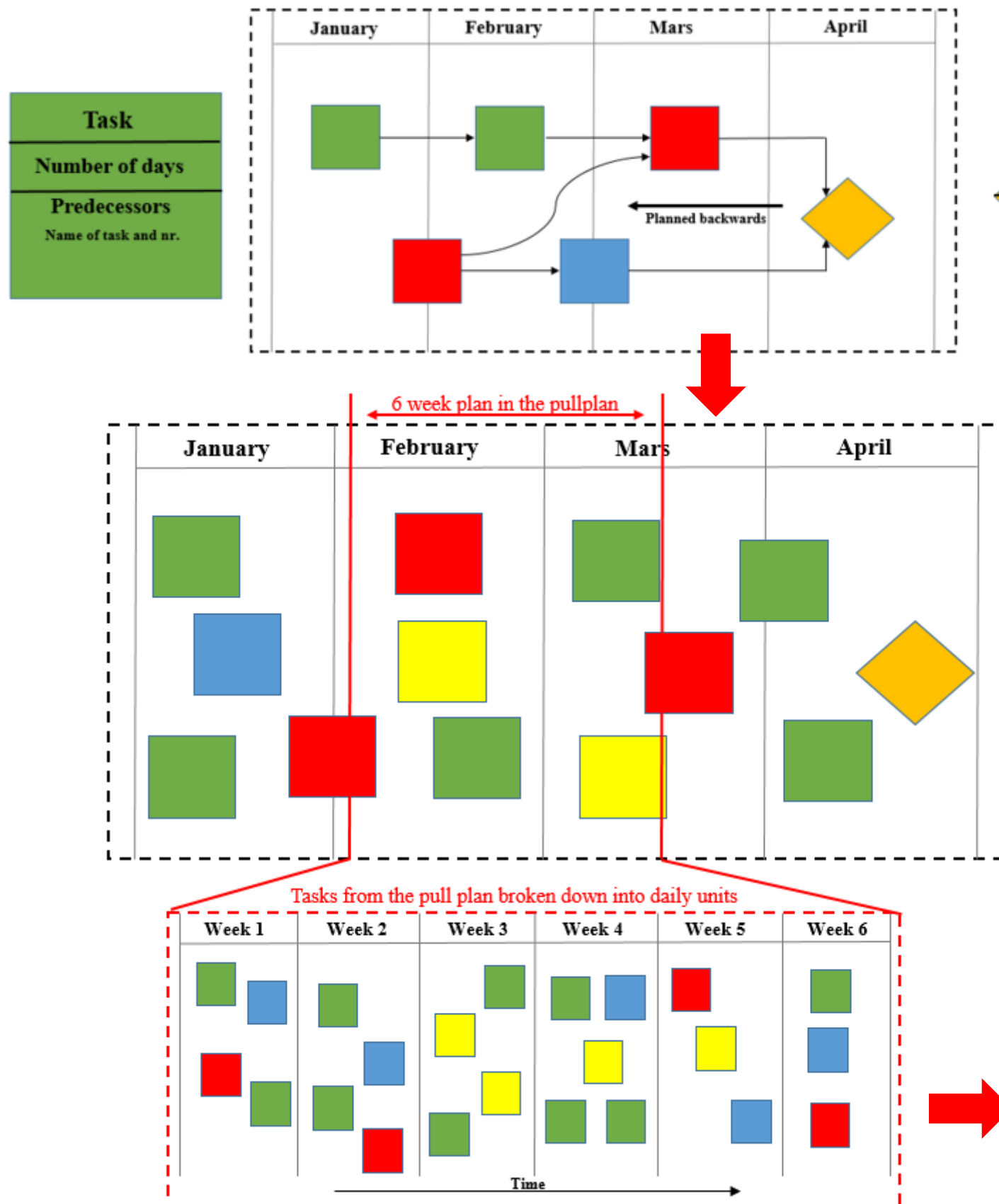
LAST PLANNER SYSTEM

The **Last Planner System (LPS)** is a collaborative, commitment-based planning system that integrates SHOULD-CAN-WILL-DID planning by “Last Planners” (the people who will do the work). In general terms, the LPS focuses on identifying those tasks that can be done to move along a planned production path, and when that becomes constrained or not possible, determine alternative paths that accomplish the desired goals. LPS involves action by multiple team members at many different levels, starting with the master schedule, followed by a detailed phase planning session, and carried out through look-ahead and weekly work planning efforts.

Last Planner® System



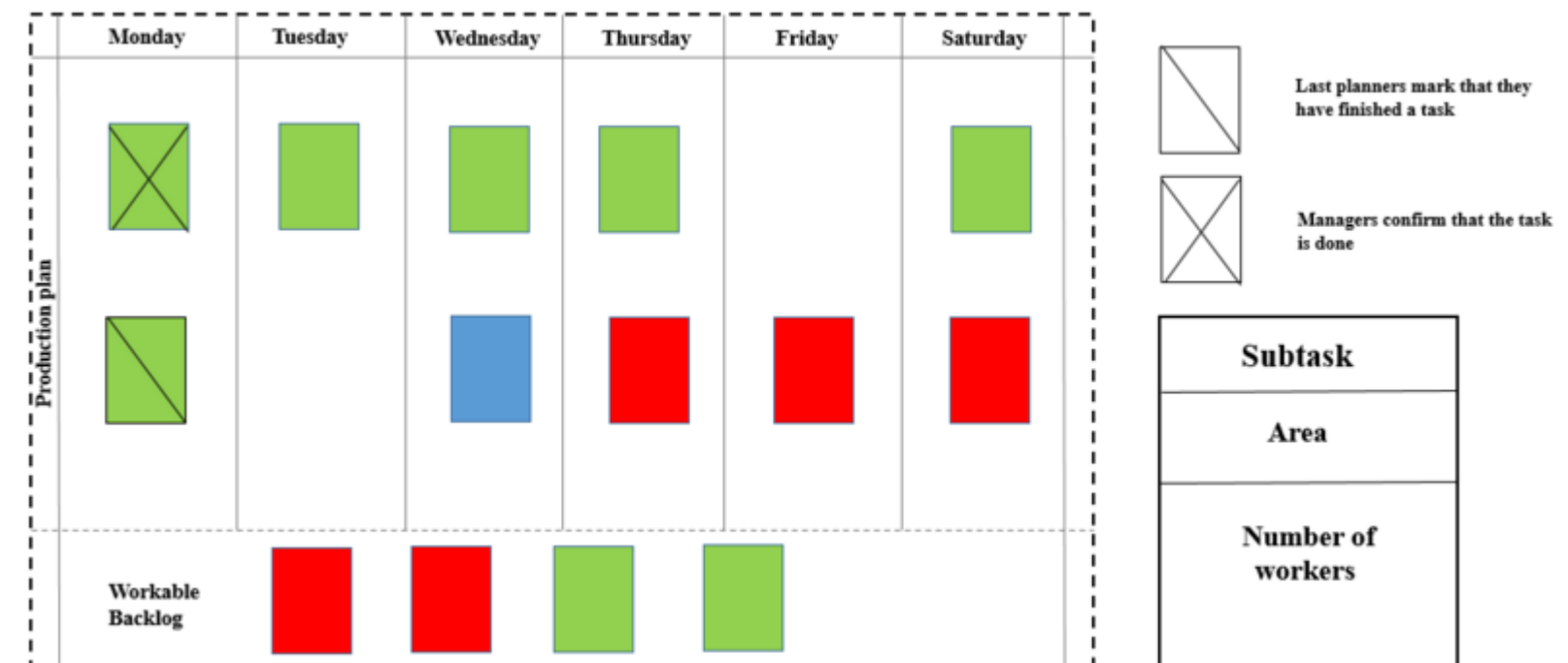
LAST PLANNER SYSTEM



IMPLEMENTATION OF LAST PLANNER SYSTEM :

The main objectives of a production control system like the Last Planner System are as follows □ Manage and mitigate the variability.

- Assignments and schedules should be sound regarding their prerequisites.
- The completed assignments should be monitored.
- Causes for failure to complete the planned work should be investigated and removed.
- The prerequisites of upcoming assignments should be made ready.
- The traditional push-based construction process model should be incorporated with pull techniques.
- Traditional project control focuses on hierarchical decision making and thus the decision-making process lies in the hands of few and often decision makers are unaware of the ground realities. Decision making powers should be well distributed among the project team.



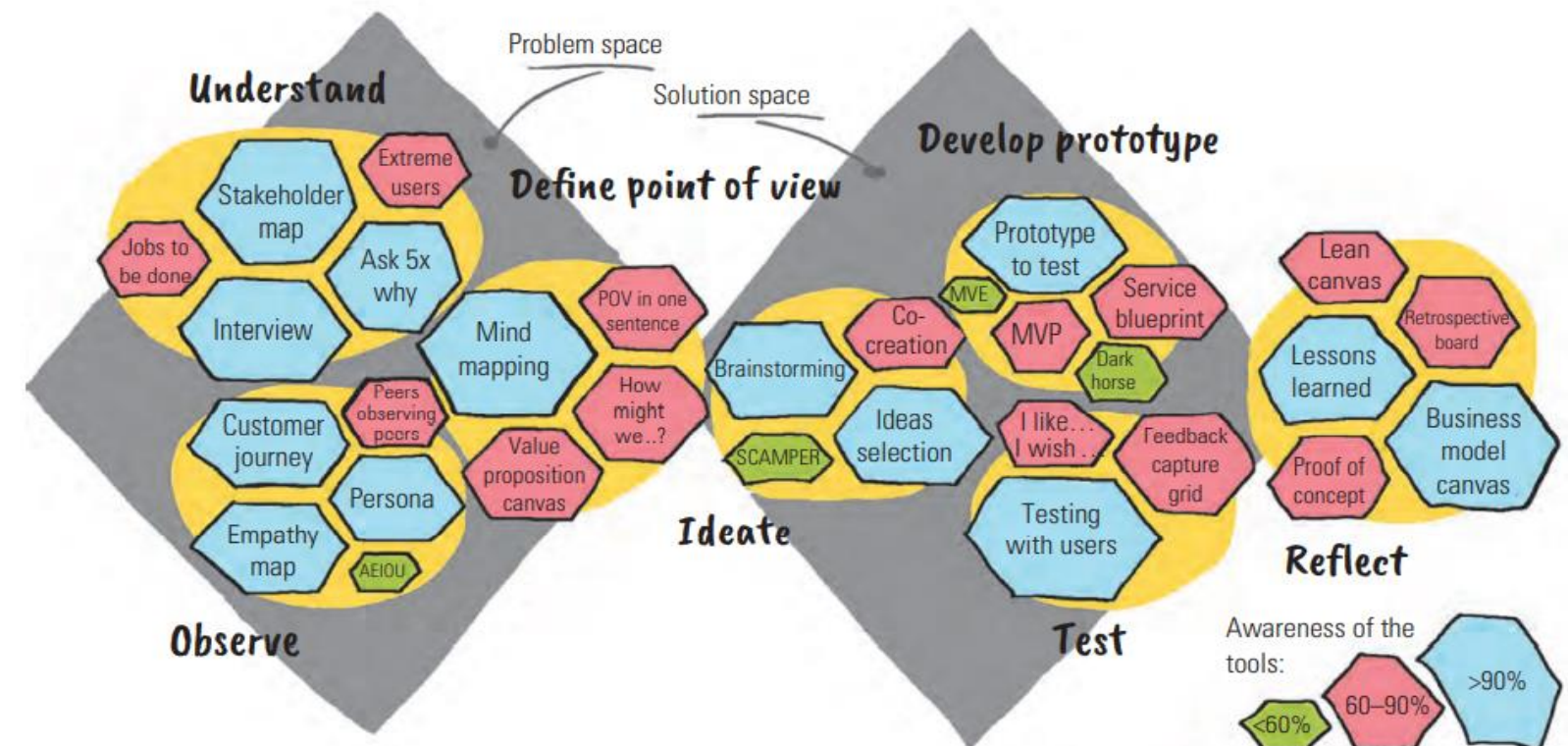
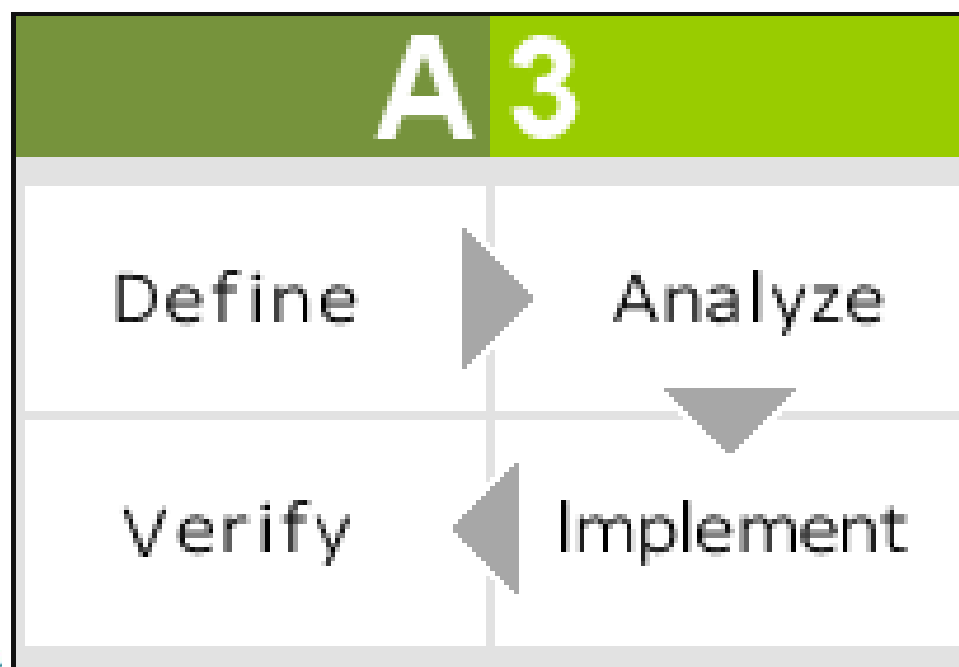
A3 JAPANESE SHEETS

The method of A3, which originated in the framework of the Toyota Production System, is used for collaborative problem solving, status reporting, and presenting proposals. It is now widely used as a part of the implementation of lean in different industries.

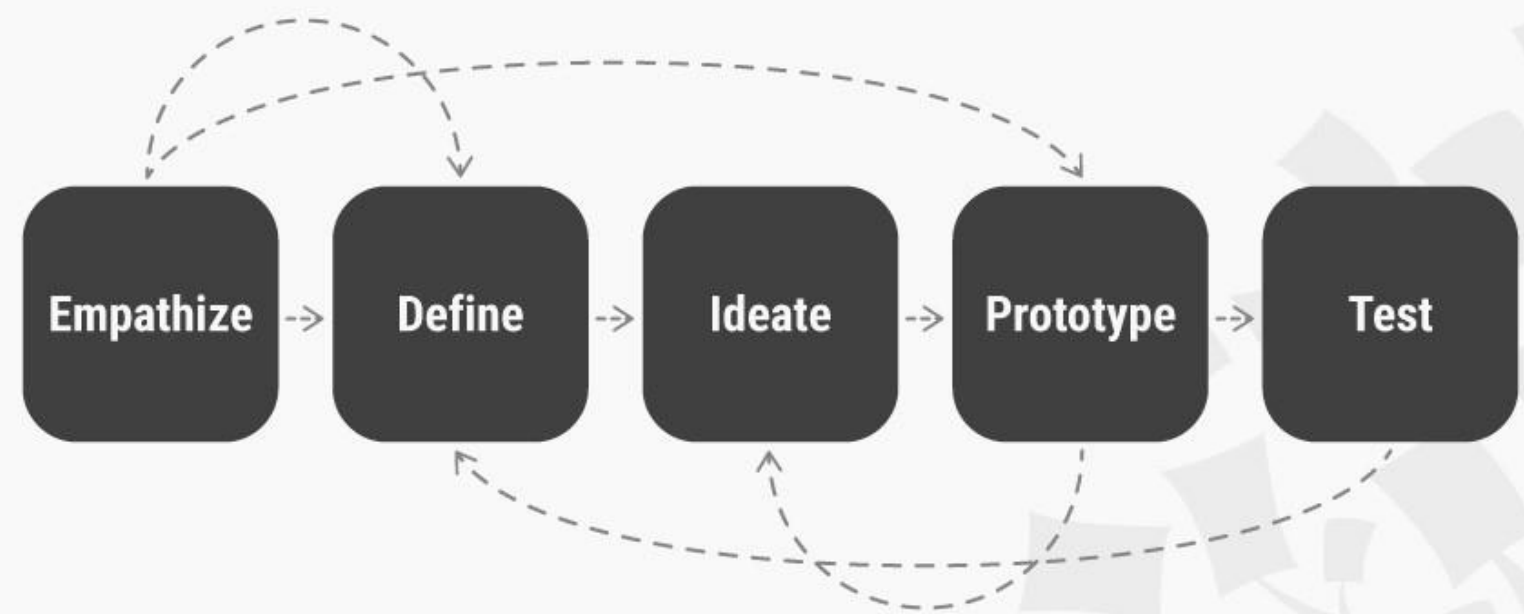
BENEFITS :

Teams should use an A3 to improve collaboration, outcomes and the problem solving of specific issues. Due to the size of an A3 (typically displayed on an 11 x 17 sheet of paper), teams are required to focus each A3 on a complicated or broadly compelling decision or a single small to mid-size problem.

- Identifying root causes
- Creating a dashboard of useful information to reference throughout the project;
- Sharing information and knowledge among team members
- Reaching consensus among team members
- Promoting deliberative, thoughtful decision making.



Design Thinking: A 5-Stage Process



DESCRIPTION OF PROJECT / WORK / ACTIVIYTY / TASK	AUTHOR:	SUPPORT TEAM	DATE:	TITLE
WORK SCOPE /METHODS / TECHNOLOGIES / TRENDS			REV.NO:	
	STAKEHOLDERS			
IMPORTANT FACTS TIME/COST/QUALITY/RESOURCES/PRODUCTIVITY/CONSTRAINTS	PLACES			

[illegible][illegible]

[illegible]

AUTHOR:	SUPPORT TEAM		DATE:	TITLE
REV.NO:				
DEFINE				
<i>I WONDER IF THAT MEANS....(I DENTIFY CHALLENGES)</i>				
CREATE A POINT OF VIEW ==> WE MET WE DISCOVERED				
IT WOULD BE HELPFUL TO...				

DESCRIPTION OF PROJECT / WORK / ACTIVIYTY / TASK
--

HOW MIGHT WE..?
(IDEAS FOR OVERCOMING CHALLENGES)

AUTHOR:	SUPPORT TEAM		DATE:	TITLE
			REV.NO:	

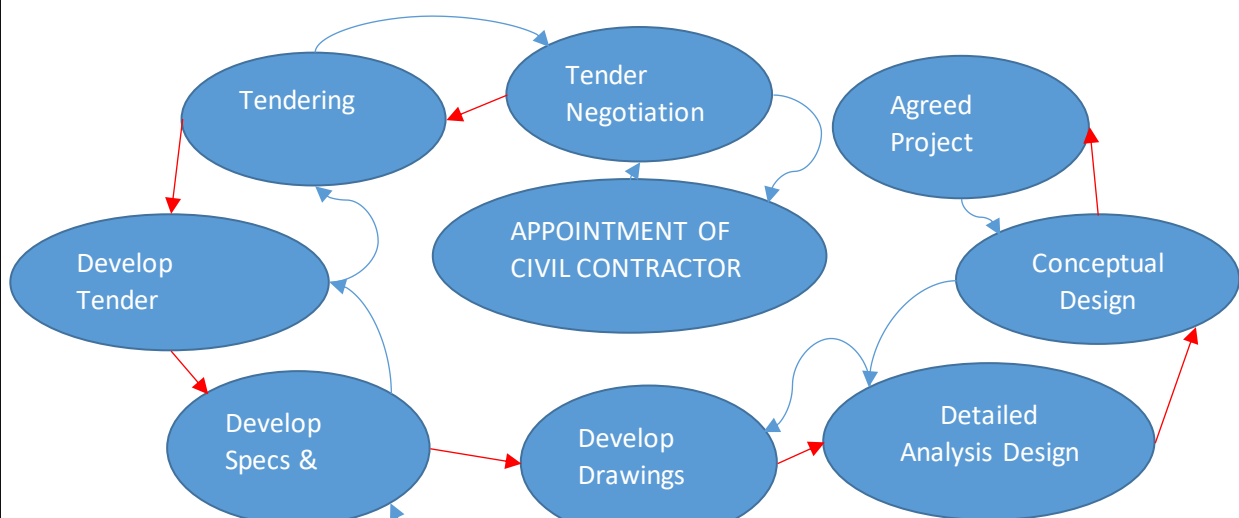
HOW MIGHT WE
(IDEAS FOR OVERCOMING CHALLENGES)

DESCRIPTION OF PROJECT / WORK / ACTIVIYTY / TASK		
THE PROBLEM (TO BE SOLVED) HOW MIGHT WE..		
THE USER PAIN POINTS THE USER PAIN POINTS / NEEDS ARE		
THE IMPACT THE BENEFITS OF THE SOLUTION IS		THE ACTORS OUR SOLUTION INVOLVES

AUTHOR:	SUPPORT TEAM		DATE:	TITLE
			REV.NO:	
THE USERS THE USERS THAT WE ARE TARGETING ARE				
THE SOLUTION OUR SOLUTION WORKS LIKE THIS				
THE COST THE SOLUTION NEEDS INVESTMENT FOR			THE REVENUE OUR SOLUTION GENERATES PROFIT BY	

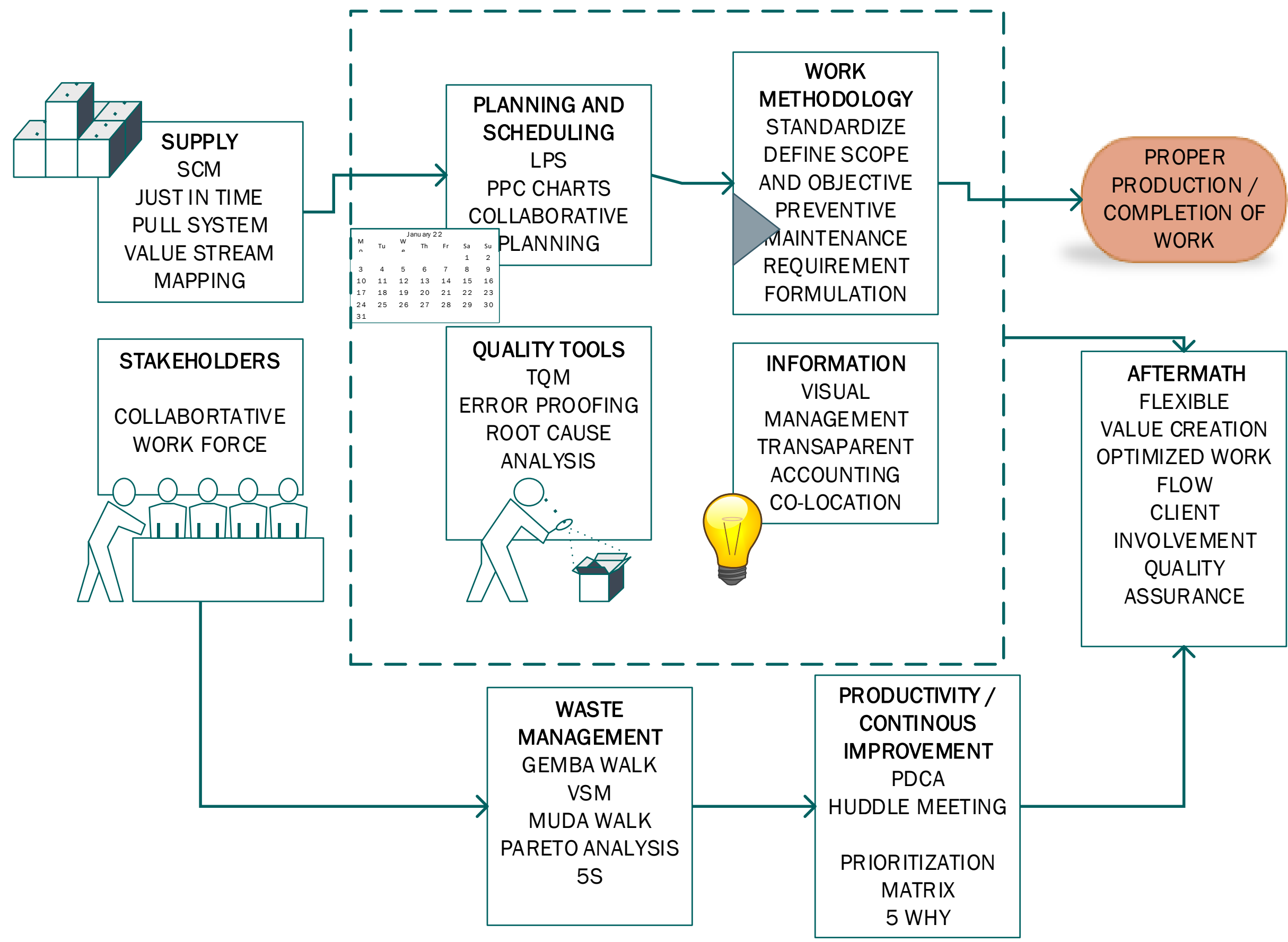
STAKEHOLDERS			
BACKGROUND			
CURRENT CONDITIONS		CHALLENGES / ASPIRATIONS / IDEAS	
PROBLEM			
GOALS / TARGETS	DEPENDENCIES	RESOURCES	
	CONSTRAINTS	PRODUCTIVITY	
	CO M MITMENT		
REASON ANALYSIS			

AUTHOR:	SUPPORT TEAM		DATE:	TITLE
			REV.NO:	
COUNTER MEASURE	DESCRIPTION		BENEFIT	SUPPORT
DELIVERABLE	TIMELINE		RESPONSIBILITY	REVIEW
CHECK				
ACT - LEARN - IMPROVE				

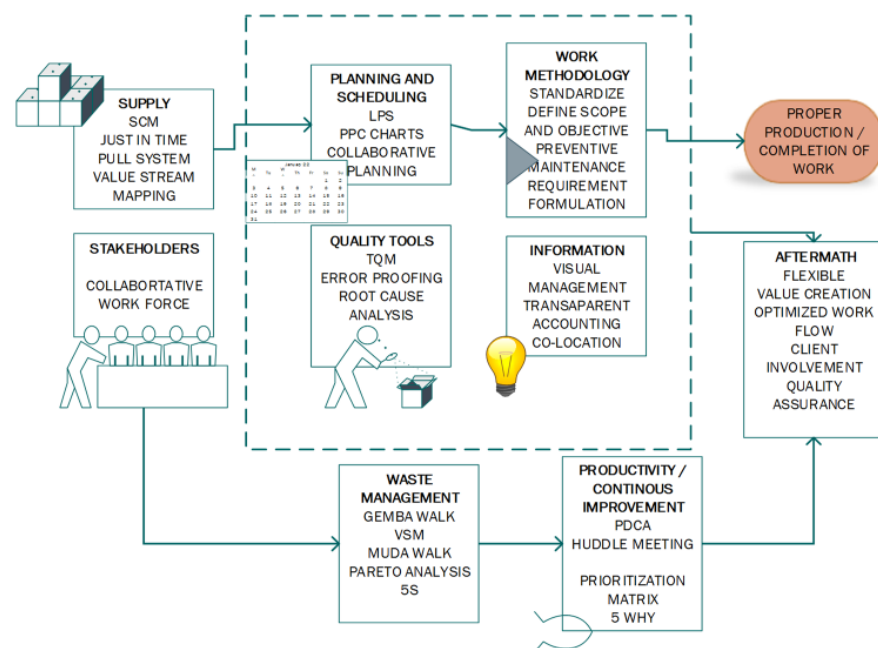
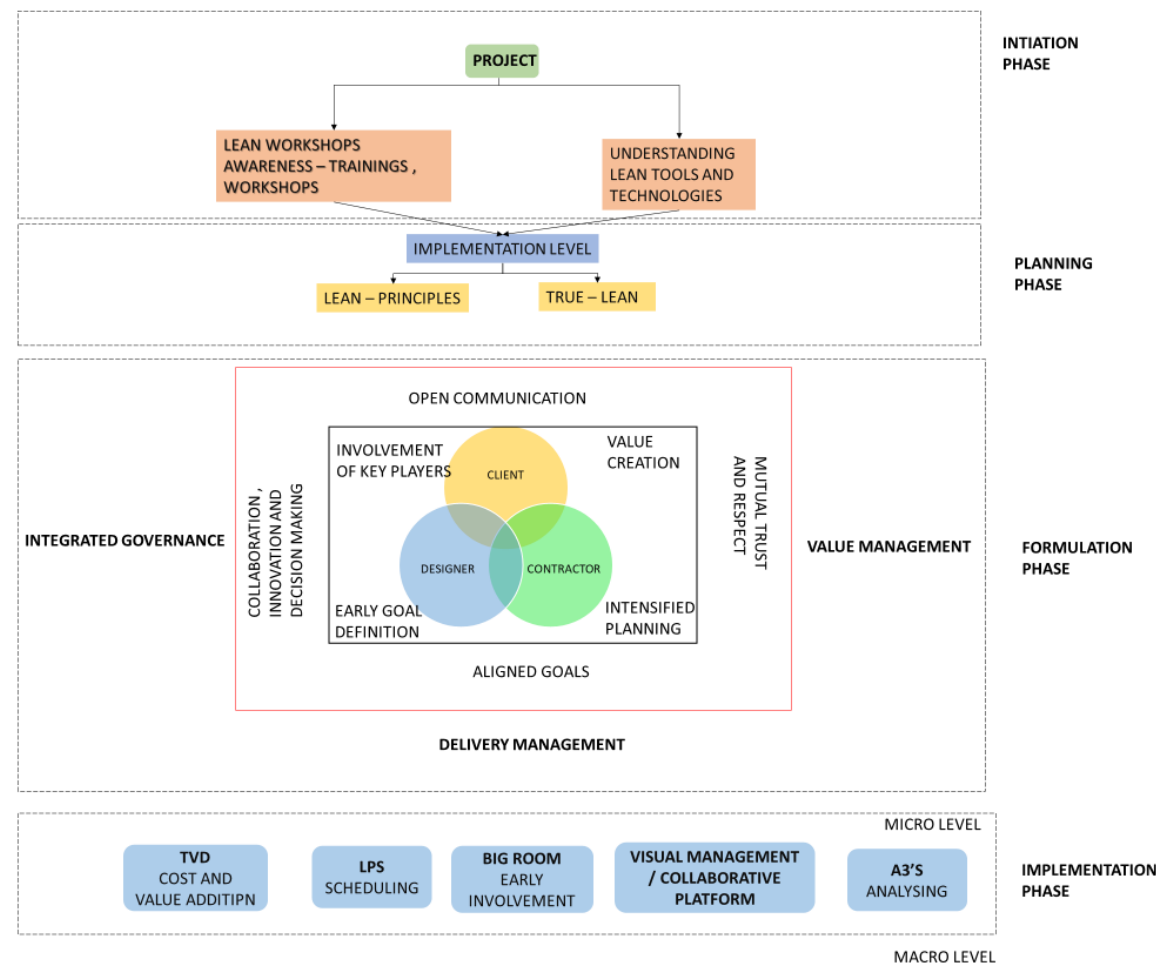
STAKEHOLDERS	
BACKGROUND	
THE BIG PICTURE AT THE END OF DELIVERY	
ACTIVITY	
PLACE	STAKEHOLDERS AT THE SCENE
DELIVERY	
DELIVERY ANALYSIS (Logical steps leading to the Big Picture)	
	

AUTHOR:	SUPPORT TEAM		DATE:	
MILESTONES	PROBLEM	STAKEHOLDERS	PLACE	

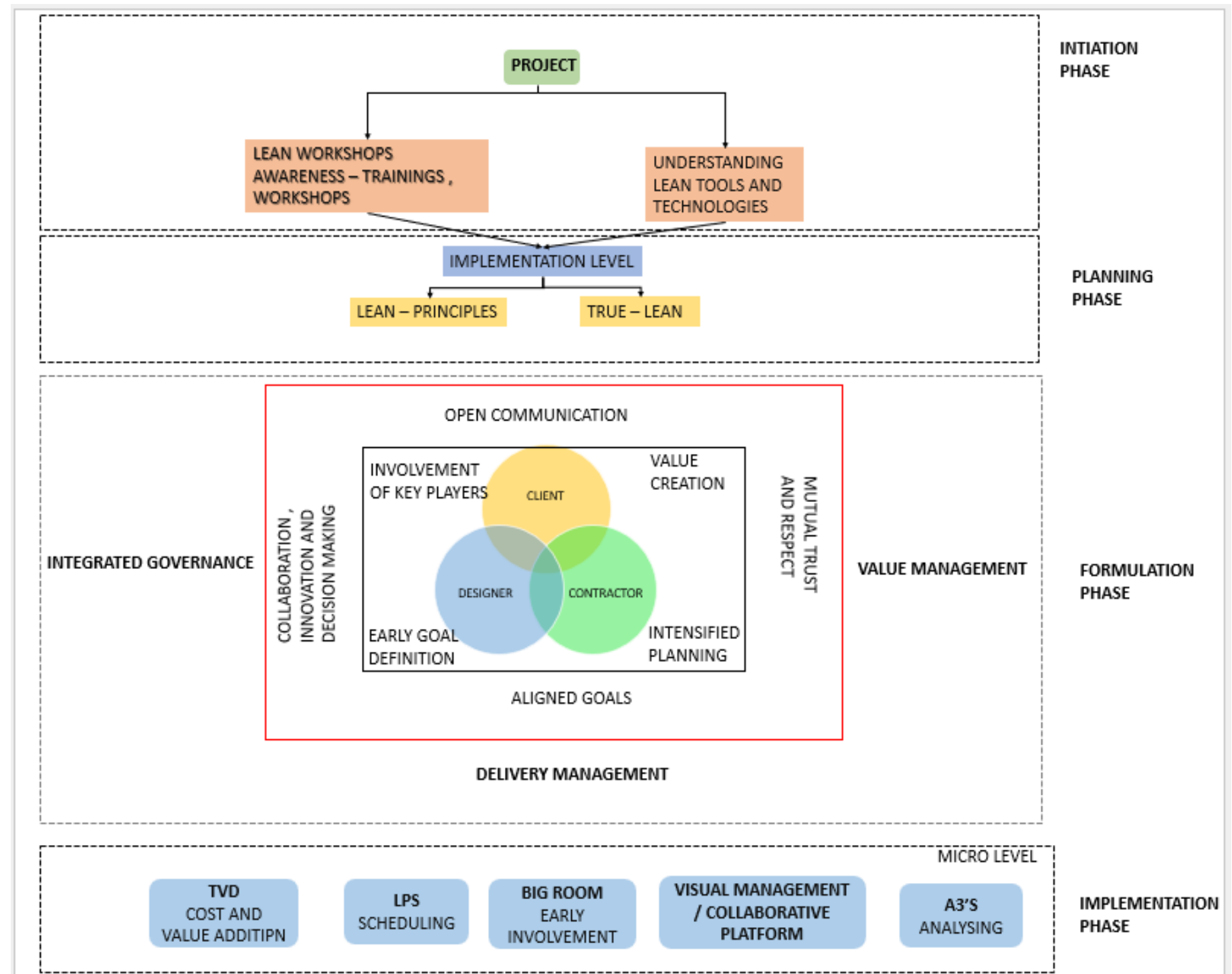
MICRO FRAMEWORK - LEAN TOOLS AND TECHNIQUES



FRAMEWORK



LEAN FRAMEWORK



SCHEME DEVELOPMENT

HUDDLE BOARD

PROJECT TITLE :		FROM :	TO :	SUPERVISOR/ INCHARGE		
DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7

HURDLE BOARD – 1 WEEK
A2 BOARD :
574mm x 420mm
A3 BOARD :
420mm x 297 MM

FORMAT : Landscape
STICKY NOTE SIZE

- 1. 35mm X 50 mm
- 2. 50mm x 50mm
- 3. 75mm x 75mm
- 4. 101mm x 101mm
- 5. 75mm x 127mm
- 6. 101mm x 152 mm

1 x 20
(5 x 3.5)

20 Each

20 Each

20 Each

20 Each

1 x 20
(5 x 3.5)

1 x 25
(7.5 x 5)

1 x 20
(7.5 x 7.5)

1 x 20
(5 x 3.5)

1 x 20
(12 x 7.5)

1 x 20
(7.5 x 5)



OVER ALL REMARKS :

WEEK PLAN

ACTIVITY	
LOCATION	
INCHARGE	
PREDECESSOR	
SUCCESSOR	
PLANNED ACTIVITY	
COMPLETED ACTIVITY	
RESOURCE PERSON	
MATERIALS REQUIRED	
CONSTRAINTS (IF ANY)	
REMARKS	

DAY 1

PROJECT TITLE :		FROM :		TO :		SUPERVISOR/ INCHARGE																																																																																																																																																																	
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MATERIALS REQUIRED	
CONSTRAINTS (IF ANY)	
REMARKS	

DAY 2

ACTIVITY	
LOCATION	
INCHARGE	
PREDECESSOR	
SUCCESSOR	
PLANNED ACTIVITY	
COMPLETED ACTIVITY	
RESOURCE PERSON	
MATERIALS REQUIRED	
CONSTRAINTS (IF ANY)	
REMARKS	

DAY 3

ACTIVITY	
LOCATION	
INCHARGE	
PREDECESSOR	
SUCCESSOR	
PLANNED ACTIVITY	
COMPLETED ACTIVITY	
RESOURCE PERSON	
MATERIALS REQUIRED	
CONSTRAINTS (IF ANY)	
REMARKS	

DAY 4

ACTIVITY	
LOCATION	
INCHARGE	
PREDECESSOR	
SUCCESSOR	
PLANNED ACTIVITY	
COMPLETED ACTIVITY	
RESOURCE PERSON	
MATERIALS REQUIRED	
CONSTRAINTS (IF ANY)	
REMARKS	

DAY 5

ACTIVITY	
LOCATION	
INCHARGE	
PREDECESSOR	
SUCCESSOR	
PLANNED ACTIVITY	
COMPLETED ACTIVITY	
RESOURCE PERSON	
MATERIALS REQUIRED	
CONSTRAINTS (IF ANY)	
REMARKS	

DAY 6

ACTIVITY	
LOCATION	
INCHARGE	
PREDECESSOR	
SUCCESSOR	
PLANNED ACTIVITY	
COMPLETED ACTIVITY	
RESOURCE PERSON	
MATERIALS REQUIRED	
CONSTRAINTS (IF ANY)	
REMARKS	

DAY 7

DAILY PROGRESS REPORT													
PROJECT NAME										DATE			
LOCATION										INCHARGE			
ACTIVITY CODE	DESCRIPTION	UOM	OUTSTANDING SCOPE	QUANTITY OF THE DAY		LABOUR		MATERIAL		TYPE OF MACHINE	MACHINE		REMARKS
				PLANNED	ACTUAL	TYPE	NO'S	TYPE	QTY		IN	OUT	

A2 BOARD TEMPLATE

- 1. A2 X 1 = 1 WEEK SCHEDULE
- 2. A2 X 2 = 2 WEEKS/ 15DAYS SCHEDULE = 1 A1 SHEET
- 3. A2 X 4 = 4 WEEKS / 1 MONTH SCHEDULE = 1 A0 SHEET
- 4. A2 X 6 = 6 WEEK SCHEDULE = 1 A0 PLUS

A3 BOARD TEMPLATE

- 1. A3 X 1 = 1 WEEK SCHEDULE
- 2. A3 X 2 = 2 WEEKS/ FORTNIGHT SCHEDULE = 1 A2 SHEET
- 3. A3 X 4 = 4 WEEKS / 1 MONTH SCHEDULE = 1 A1 SHEET
- 4. A3 X 6 = 6 WEEK SCHEDULE = 1 A1 PLUS



	MONTH -01	MONTH-02	MONTH-03	MONTH-04	MONTH-05	MONTH-06																																
DESIGN	<table><tr><td colspan="2">TASK: COMPANY:</td><td colspan="2">TASK: COMPANY:</td></tr><tr><td colspan="2">COMMITMENT</td><td colspan="2">COMMITMENT</td></tr><tr><td colspan="2">REQUEST</td><td colspan="2">REQUEST</td></tr><tr><td>WHAT</td><td>FROM</td><td>WHAT</td><td>FROM</td></tr></table>	TASK: COMPANY:		TASK: COMPANY:		COMMITMENT		COMMITMENT		REQUEST		REQUEST		WHAT	FROM	WHAT	FROM																					
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MINUTES OF MEETINGS

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Engineering Project Management Consultancy and Research (EPMCR) Private Limited
An IIT Madras incubated company

PROJECT : G.T.Electronics	LOCATION : Thindivanam - Site office
FACILITATOR : EPMCR	MINUTE TAKER :
ATTENDEES: G.T Electronics - Managing Partners , Finance Officer , EPMCR , Contractor team ,	
DATE : 14.12.2021	TIME: 10 :00 am
AGENDA	ACTION
1.Erection methodology to be finalised .	1.Method statement - Contractor
2.Fabrication and production dates to be discussed.	2.Hinderance report - Contractor
3.Fabrication site testing .	3.Survey
4.Delay analysis	4.Pump cycle time
5.Water discharge time - should be calculated.	5.Workfront - division - site utility planning .
6.Crane movement to be planned.	6. Revision of costing and cash flow .
7.Utility planning.	7.Lean board - Weather forecast , PPC , Work plan .
8.Electrical installations .	8.Mock-up
9.Quality check - soil filling .	9.Finalise dates for primary members production.
10.Check flood levels .	10.Co-ordinate with MEP consultants.
11.Excavation planning.	11.15 Days ahead plan .
12.Revision of schedule.	
13.Final costing	

MINUTES OF MEETINGS

1.G.T.Electronics

2.Precast manufacturers –
Precon structures, Kanchipuram
Velan concast, Coimbatore .

- 1.Precast production and erection sequence .
- 2.Advantages of Precast construction .
- 3.Marketing strategies
- 4.Workmanship
- 5.Crane requirement
- 6.Supply chain management

3.BIAL – Contractor and EPMCR team



INTERNSHIP REPORT

ENGINEERING PROJECT MANAGEMENT CONSULTANCY AND RESEARCH PRIVATE LIMITED
- AN IIT IMADRAS INCUBATED COMPANY

NIVEDHAA B
40840011-III SEM – II YR
M.ARCH-BUILDING MANAGEMENT
SATHYABAMA INSTITUTE OF SCIENCE AND TECHNOLOGY

RISK MANAGEMENT PLAN

CHITRAKOOTA SCHOOL , BANGALORE

RISK MANAGEMENT

CLIENT : CHITRAKOOTA SCHOOL , BANGALORE
AREA : 9952 SQ.M
EPMCR CONTRIBUTION : PMC

CHITRAKOOT DELAY ANALYSIS					
S.NO	1	2	3	4	5
CONTRACT DURATION FOR ACTIVITIES IF NOT FEASIBLE					PROJECT CONTRACT
LEGAL DISPUTES BETWEEN PARTIES					
NO SUBSTANTIAL SCOPE DEFINITION					
PAYMENT DELAY					CLIENT
CHANGE ORDER					
APPROVAL OF PLANS / STRATEGIES					
DELAY IN APPROVAL OF MATERIALS / PLANS					
LACK OF COMMUNICATION BETWEEN OWNER AND CONTRACTOR					
LACK OF COMMUNICATION BETWEEN OWNER AND PROJEC MANAGEMENT TEAM					
SLOWNESS IN DECISION MAKING					
CONFLICTS WITHIN THE TEAM					
SUSPENSION OF WORK BY OWNER					
DIFFICULTIES IN FINANCING THE PROJECT					
DIFFICULTIES IN FINANCING THE PROJECT					CONTRACTOR
CONFLICT IN SUB-CONTRACT					
SU-CONTRACT EXECUTION CONFLICTS					
REWORK					
CONFLICT BETWEEN CONTRACT AND OTHER PARTIES					
POOR CO-ORDINATION					
IMPOTENT PROJECT TEAM					
POOR SITE MANAGEMENT AND SUPERVISION					
NO CLEAR UNDERSTANDING ABOUT THE PROJECT					
COMMUNICATION PROBLEM BETWEEN LABOUR AND SUBCONTRACTOR					
INEFFECTIVE PLANNING AND SCHEDULING OF PROJECT					
IMPROPER CONSTRUCTION METHOD IMPLEMENTED.					
LACK OF EXPERTISE					
FREQUENT CHANGES IN WORK					
UNSKILLED LABOUR					
DELAY IN MOBILIZATION					

DELAY IN RESTING AND INSPECTION						PMC
DELAY IN APPROVING CHANGES IN PLAN / SCOPE						
RESISTANCE TO CHANGE / ADOPT						
POOR COMMUNICATION BETWEEN PMC AND CONTRACTOR/ CLIENT						
SLOW REVIEW of DOCUMENTS/ PLAN						
INDAEQUATE EXPERIENCE						
NO PROPER METHODOLOGY						DESIGN TEAM
DELAY IN PRODUCING DESIGNS						
UNCLEAR REQUIREMENTS						
NO CLEAR UNDERSTANDING OF SCOPE						
INSUFFICIENT DATA COLLECTION						
NO PROPER SURVEY						
MISUNDERSTANDING OF SCOPE						
NO PROPER USAGE OF SOFTWARE						
CHANGE ORDERS						MATERIAL
CHANGE IN MATERIAL SEPCIFICATIONS						
DELAY IN MATERIAL DELIVERY						
DAMAGED MATERIAL						
LOW GRADE MATERIALS						
COST VARIATION						
DELAY IN MANUFACTURING OF MATERIALS						
LATE PROCUREMENT						
AVAILABILITY OF MATERIAL						EQUIPMENT
SHORTAGE OF EQUIPMENT						
EQUIPMENT ALLOCATION						
SLOW DEPLOYMENT						
BREAKDOWN						
LOW LEVEL OPERATOR SKILL						
LOW EFFICIENCY AND PRODUCTIVITY OF THE EQUIPMENT						
LACK OF ADVANCED EQUIPMENT						
SHORTAGE OF SKILLED LABOUR						LABOUR
LOW PRODUCTIVITY OF LABOUR						
CONFLICT WITHIN LABOUR						
LACK OF COMMUNICATION						
SOIL CONDITION						MISC
CLIMATE FACTORS						
APPROVAL DELAYS						
UNAVAILABILITY OF UTILITIES						
ACCIDENTS DURING CONSTRUCTION						
GOVERNMENT REGULATIONS						
THIRD PARTY INVOLVEMENT						

RISK MANAGEMENT

STAGE	INPUT	OUTPUT	ACTIVITIES
RISK ANALYSIS	PROJECT STUDY	•PROJECT RISK MANAGEMENT PLAN	•STRATEGIC PLANNING - RISKS •PROJECT LIFE CYCLE STUDY •STUDY OF THE IMPLEMENTATION METHOD •CONTRACTOR TEAM AND CONSULTANTS - ANALYSIS •SELECTION OF DESIRED RISK LEVELS (STAKEHOLDER)
RE-WORK ON OBJECTIVES AND SCOPE	RISK FESABILITY	•SPECIFICATIONS AND REQUIRMENT ANALYSIS ACCORDING TO THE RISK MANAGEMENT APPROACH	•IDENTIFICATION- WHAT IS NEEDED BY THE CLIENT .
STANDARDIZATION	RISK FESABILITY AND REQUIRMENT ANALYSIS	•RISK MANAGEMENT FRAMEWORK	•DETERMINATION OF OBJECTIVES AND FORMING THE MISSIONS. •RISK MANAGEMENT TEAM - FORMATION •DEFINING ALL THE TECHNIQUES AND METHODS THAT ARE TO BE USED . •PREPARATION OF RISK BREAK DOWN STRUCTURE

PLANNING		PROPER SCHEDULE AND COST PLAN IN CONCERN WITH RISK PROCESS	
RISK IDENTIFICATION AND RISK MITIGATION	SCHEDULE , RBS AND RISK MITIGATION FRAMEWORK	•PRIORITIZATION OF RISKS •IDENTIFICATION OF UNCERTAIN RISKS	•RISK IDENTIFICATION •RISK REFINEMENT
QUALITATIVE RISK ANALYSIS	•PRIORITIZATION OF RISKS •IDENTIFICATION OF UNCERTAIN RISKS	PLANNING OF THE WHOLE WBS (RISK)	RISK COST ANALYSIS AND TIME ANALYSIS
RESPONSE PLAN	•RISK PLANNING •RISK MANAGEMENT	•RISK PLAN BEFORE AND AFTER RESPONSE •ANALYSE COST OF RESPONSE TO THE RISK •RISK RESPONSE PLAN	•PROCEDURE FOR DIFFERENT PHASES •FINALIZE AND APPROVE RISK RESPONSE PLAN
RISK MONITORING , CONTROLLING AND TRACKING	•RISK PLAN BEFORE AND AFTER RESPONSE •ANALYSE COST OF RESPONSE TO THE RISK •RISK RESPONSE PLAN	•UPDATED RISK PLAN	•EXECUTION OF RISK RESPONSE PLAN •PERIODICAL UPDATE OF RISK LIST AND RISK PLAN •RECORDING THE LESSON LEARNT DURING IMPLEMENTATION .

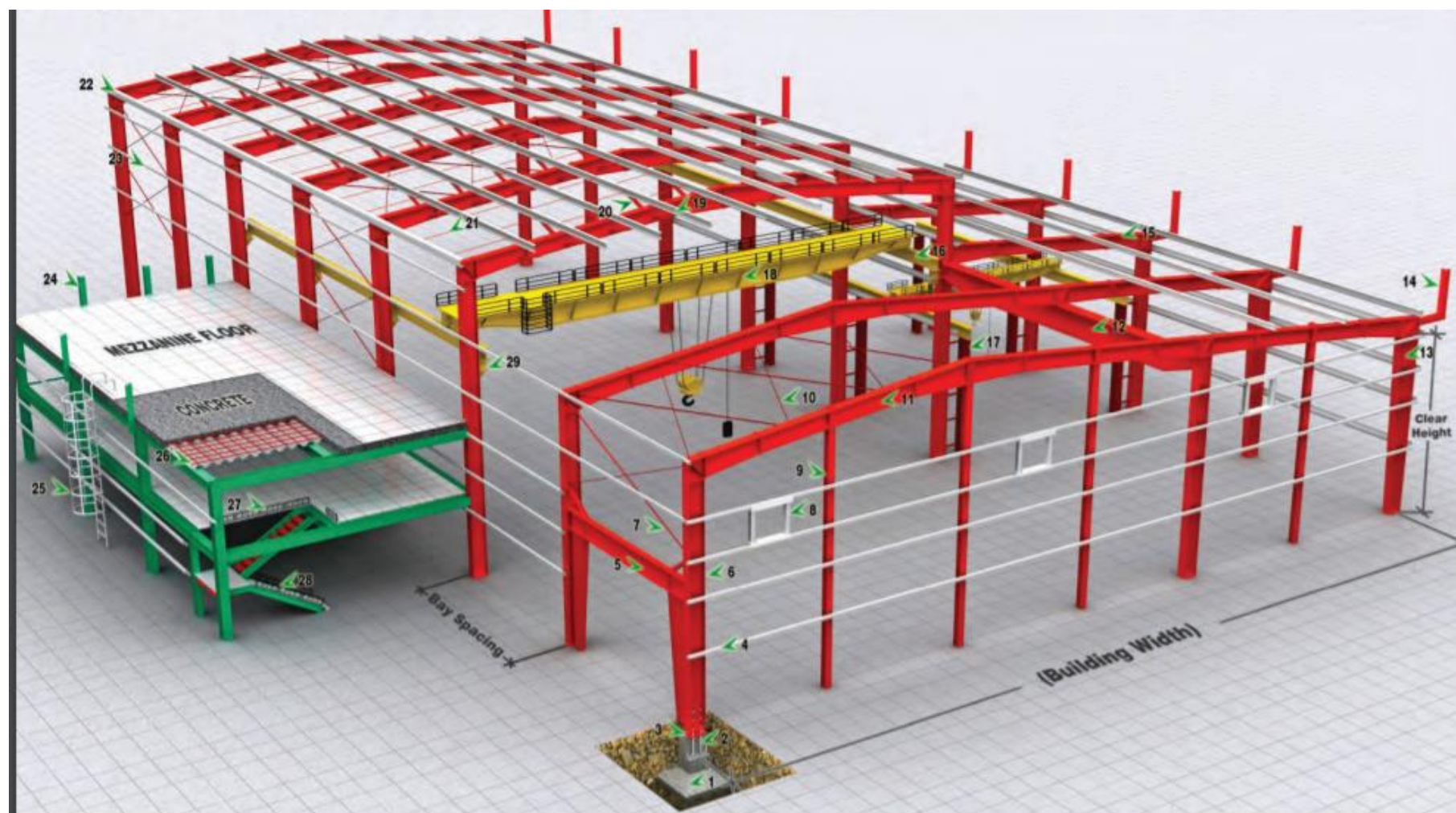
GT.ELECTRICALS

PRE-FABRICATION

Prefabrication is the method of construction which includes assembling components of a structure in a manufacturing or production site, transporting complete assemblies or partial assemblies to the site where the structure is to be located. It is combination of good design with modern high performance components and quality controlled manufacturing procedures. This work is carried out in two stages, manufacturing of components in a place other than final location and their erection in position.

Advantages:

- Saving in cost, material, time & manpower.
- Shuttering and scaffolding is not necessary.
- Installation of building services and finishes can be done immediately.
- Independent of weather condition.
- Components produced at close supervision .so quality is good
- Clean and dry work at site.
- Possibility of alterations and reuse
- Correct shape and dimensions and sharp edges are maintained.
- Very thin sections can be entirely precast with precision



- | | | | |
|-----------------------------------|------------------------------------|-------------------|---|
| 1. Concrete Footing | 8. Framed Opening (Window/Louver) | 15. Lean To Frame | 22. Eave Strut |
| 2. Anchor Bolts | 9. End Wall Wind Column | 16. Crane Beam | 23. Side wall Girt |
| 3. Base Plate | 10. Roof Bracing (Angle/Rod/Cable) | 17. Crane Column | 24. Flush Fascia Frame |
| 4. End Wall Girt | 11. Main Frame Rafter | 18. EOT Crane | 25. Cage Ladder |
| 5. Portal Bracing | 12. Jack Beam | 19. Roof Purlin | 26. Deck Panel with Steel Mesh |
| 6. Main Frame Straight Column | 13. Main Frame Tapered Column | 20. Flange Brace | 27. Hand Rail (Steel) |
| 7. Wall Bracing (Angle/Rod/Cable) | 14. Cantilevered Fascia Frame | 21. Sag Rod | 28. Staircase (Checker Plate/C Channel) |
| | | | 29. Crane Bracket |

Disadvantages:

- Handling and transportation may cause breakages of members during the transit and extra provision is to be made.
- Difficulty in connecting precast units so as to produce same effect as monolithic. This leads to non-monolithic construction.
- They are to be exactly placed in position, otherwise the loads coming on them are likely to get changed and the member may be affected.

Disadvantages:

- High transport cost
- Need of erection equipment
- Skilled labour and supervision is required

PRE-FAB CONSTRAINTS	
CONSTRAINTS	CATEGORY
INCOMPLETE SHOP DRAWINGS	INFORMATION -DOCUMENT
INCOMPLETE SPECIFICATIONS / BOQ	INFORMATION -DOCUMENT
LACK OF PERMITS / APPROVALS	INFORMATION -DOCUMENT
UNAVAILABLE OF RESOURCES	INFORMATION QUALITY
UNPREDICTABLE WEATHER	INFORMATION QUALITY
PRODUCTION AND TRANSPORTATION SCHEDULE	INFORMATION QUALITY
TRACKING OF MEMBERS	INFORMATION SAFTEY
TRANSPORTATION (ROUTE / DAMAGE)	INFORMATION SAFTEY
UNAVAILABLE QUALITY CONTROL HOLD POINTS	INFORMATION SCHEDULE
UNAVAILABLE CONNECTION POINTS FOR HANDLING	INFORMATION SCHEDULE
LACK OF TESTING INSTRUCTIONS	INFORMATION SCHEDULE
IDENTIFICATION OF INSTALLATION PRODUCTS	INFORMATION SCHEDULE
LACK OF LIFTING LOAD CAPACITY	INFORMATION SCHEDULE
LACK OF COLLISION FREE PATH PLANNING	PHYSICAL ENVIRONMENT
STORAGE / LIFTING AND PLACING LOCATION FOR ASSEMBLY MEMBERS	PHYSICAL ENVIRONMENT
INADEQUATE CRANE MOVEMENT / LOCATION PLANNING	PHYSICAL PRE-REQUISITE WORK
UNAVAILABLE EQUIPMENT AND DEVICES	PHYSICAL PRE-REQUISITE WORK
LACK OF VISIBLE AND AUDIBLE COMMUNICATION MECHANISM	PHYSICAL PRE-REQUISITE WORK
BUFFER LAYOUT	PHYSICAL PRE-REQUISITE WORK
INSTALLATION SEQUENCE	PHYSICAL PRE-REQUISITE WORK
UNAVAILABILITY OF PREFABRICATED ELEMENTS	PHYSICAL RESOURCE
LACK OF UNDERSTANDIUNG OF PREFAB CONSTRUCTION SEQUENCE	PHYSICAL RESOURCE
LACK OF RELATIVE POLICIES , LAWS AND STANDARS	PHYSICAL RESOURCE
HIGH EMPLOYEE TRAINING COST	PHYSICAL RESOURCE
POTENTIAL DELAYS - MANUFACTURERE'S SIDE	PHYSICAL RESOURCE
DURABILITY , LEAKAGE , CRACKS	PHYSICAL RESOURCE
LACK OF R&D INPUT	PHYSICAL RESOURCE
LACK OF PRACTICE AND EXPEREINCE	PHYSICAL RESOURCE
LACK OF MANAGEMENT FOR PREFACBRICATED CONSTRUCTION	PHYSICAL RESOURCE
LACK OF SYNERGETIC INFORMATION PLATFORM	PHYSICAL RESOURCE
UNAVAILABLE TEMPORARY STRUCTURE	PHYSICAL RESOURCE
UNAVAILABLE INSTALLATION INSTRUCTION	PHYSICAL SAFTEY
INADEQUATE WORKFORCE	PLANNING / SCHEDULE
INADEQUATE SAFTEY TRAINING	PHYSICAL SAFTEY

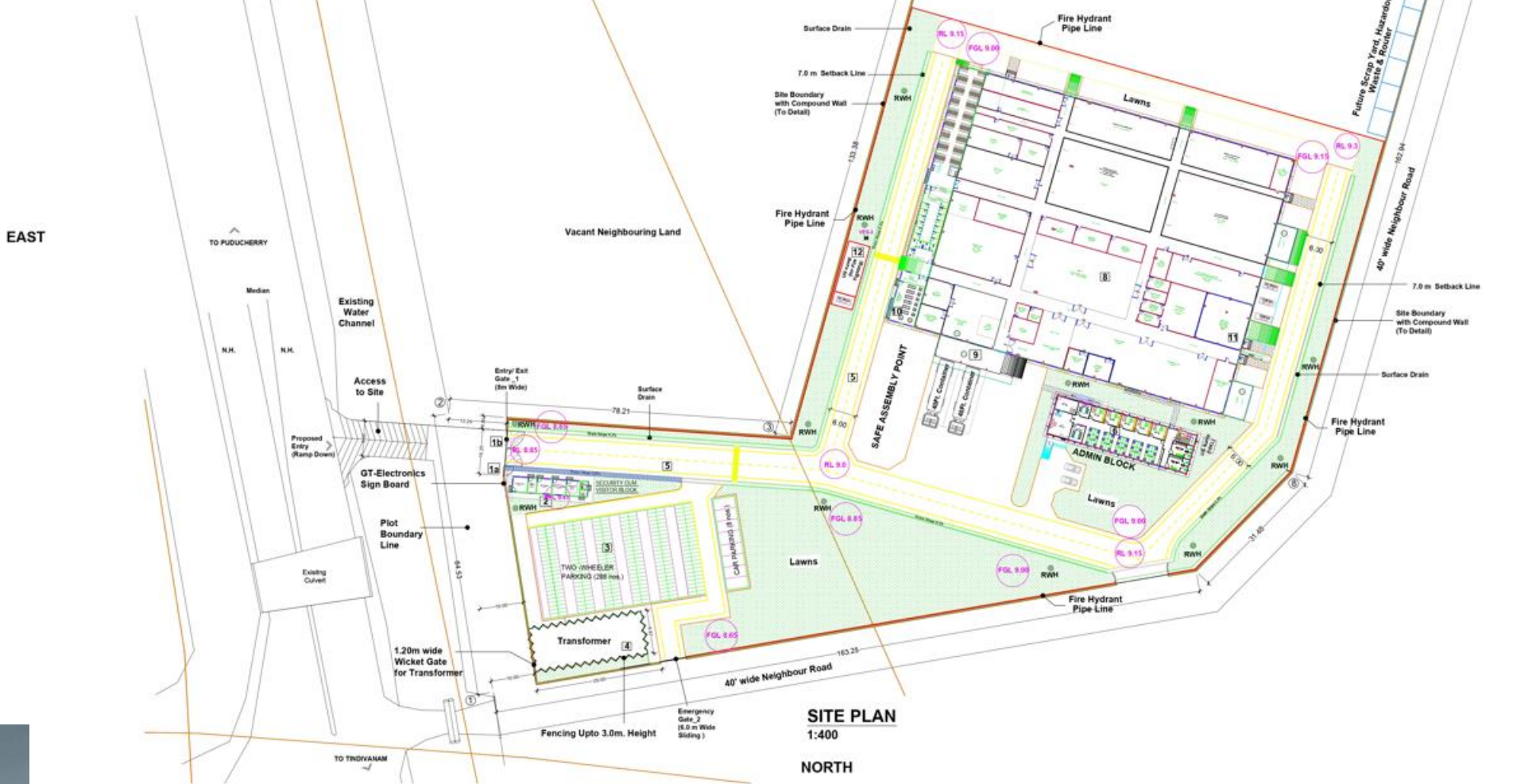
CLIENT : GT.ELECTRICALS.

CONTRACTOR:TARMAKER , PONDYCHERRY.

PLOT AREA : 6.26 ACRES

TOTAL BUILT-UP AREA 6,755.352 SQ.M

DESCRIPTION	AREA (Sq.m)
ADMIN	622736
PRODUCTION BUILDING	4464.45
CANTEEN , REST ROOMS & HEALTH CENTER	318.058
COMPRESSOR ROOM	59.521
LOADING BAY	101.208
GAS BANK	38.848
GENERATOR YARD	69.594
OIL STORAGE YARD	38.775
SECURITY BLOCK	65.837
STAFF & VISITORS PARKING	976.32
Total	6,755.352



OVERALL LAYOUT



RACI MATRIX

	GT.ELECTRICALS	EPMCR	CONTRACTOR	STRUCTURAL CONSULTANTS	MEP CONSULTANTS	ESTIMATION TEAM	SITE INCHARGE	SAFETY / QUALITY	MANUFACTURER	SUPPLIERS	ERECTION TEAM	OPERATORS	WORKERS	SECURITY	LEGAL ADVISORY TEAM	GOVT. BODIES	FINANCIAL INSTITUTIONS
DEVELOPMENT OF WORK METHODOLOGY	C	R/A	C/I	C	C		C/A	I	C		C				C		
APPROVALS AND CLEARANCES		C	C													R/A	
ASSIGNING ROLES AND RESPONSIBILITIES	C/I	R/A	R/A				R										
DEFINING SCOPE , OBJECTIVES	I	R/A	C	C	C			I	I						C		
CONTRACT DOCUMENTS PREPARATION	C	R/A	C	C	C	C									C		
FEASABILITY STUDY & REPORT	C/I	R/A	C					C							C		
ARCHITECTURAL DRAWINGS	I	R/A	I	C/I	C/I												
STRUCTURAL DRAWINGS	I	C	I	A/R	I												
PARTITION / INTERIOR DRAWINGS	I	R/A	I	C/I	C/I												
BOQ GENERATION	C	R/A	C	I	I	R/A			C	C					C		C/A
SCHEDULING - MACRO , LOOK AHEAD /LPS	C/I	R/A	C/I	C/I	C/I	C			C/I	C/I	C/I						
BUDGETARY CONTROLS AND APPROVALS	R/A	R/A	A	I	I	A			I	I							
QUALITY ASSESSMENT CHECKLIST AND REPORTS		R/A	C	I	I			R/A									
SURVEY AND SET LEVELS AS PER DRAWINGS		A	R/A				R/A						A				
MANUFACTURE ORDER PLACEMENT	C	R/A	A/R						I/A		I/A						
FABRICATION QUALITY CHECK		R/A	A/C					R	R/A	R/A							
TRANSPORTATION OF MATERIALS									R/A			R/A					

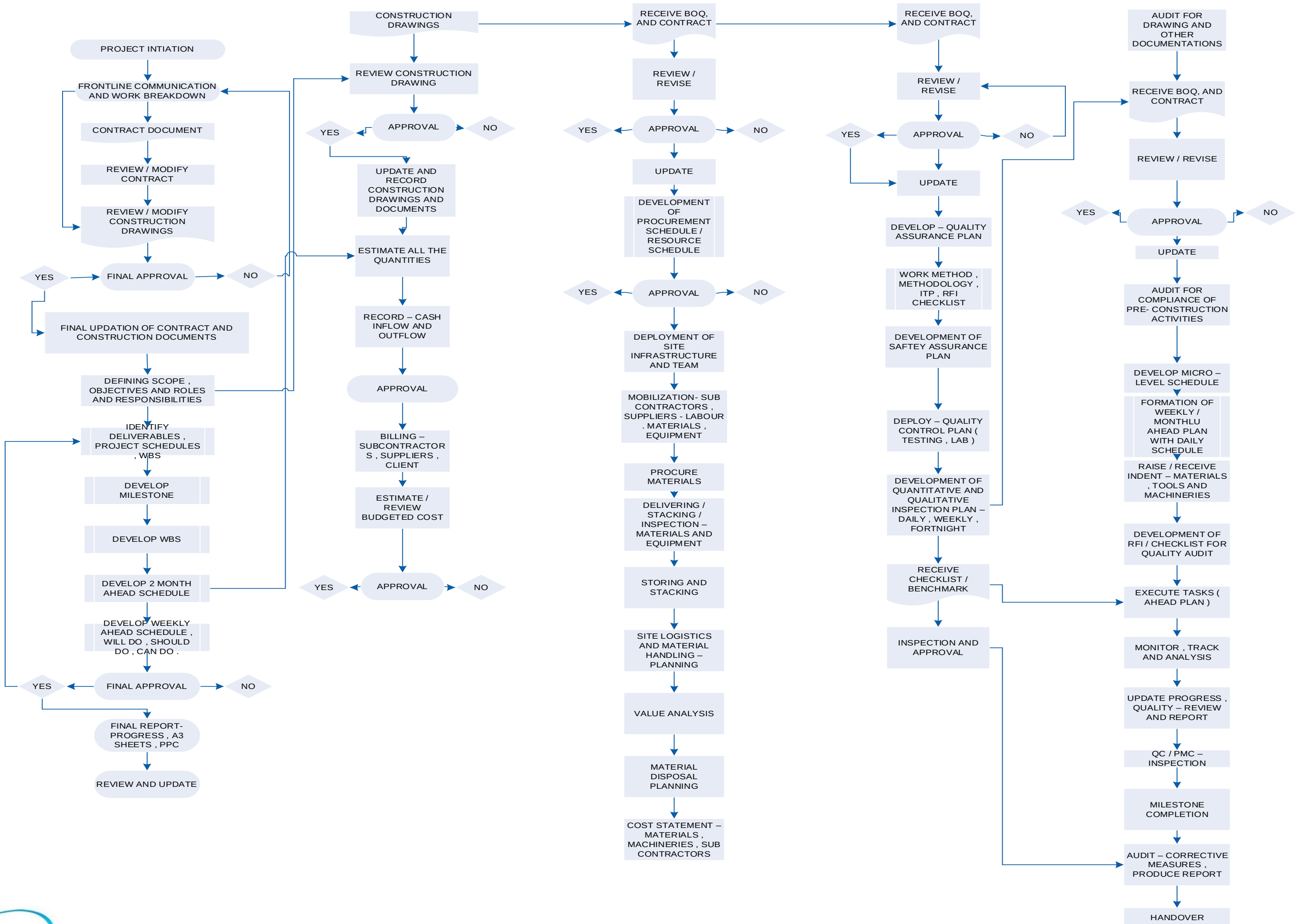
R	Responsible The person assigned to do the work
A	Accountable The person who makes the final decision and has the ultimate ownership
C	Consulted The person who must be consulted before a decision or action is taken
I	Informed The person who must be informed that a decision or action has been taken

RACI MATRIX

	GT.ELECTRICALS	EPMCR	CONTRACTOR	STRUCTURAL CONSULTANTS	MEP CONSULTANTS	ESTIMATION TEAM	SITE INCHARGE	SAFTEY / QUALITY TEAM	MANUFACTURER	SUPPLIERS	ERECTION TEAM	OPERATORS	WORKERS	SECURITY	LEGAL ADVISORY TEAM	GOVT . BODIES	FINANCIAL INSTITUTIONS
STORAGE OF MEMBERS		C/I	R/A/C				R/A							R/A			
TASK COMPLETION ACCORDING TO SCHEDULE		C/I	R/A				R/A										
SITE INCHARGE , MONITORING , IMPLEMENTATION		C/A	R/A	C/A	C/A		R/A	C/A			R/A	R/A	R/A				
ERECTION WORK METHODOLOGY	I	C	R/A						C		R/A/C	R/A	R/A				
RESPONISIBLE FOR QUALITY CHECK - PREFAB MEMBERS AND OTHER MATERIALS		A					R/A	R/A	R/A								
SAFTEY PRECAUTIONS AND PREVENTIVE MEASURES	I	C	R/A	C/A	C/A		C/A/R	R/A									
RISK MITIGATION AND MANAGEMENT PLAN	I	R/A	C/A	I	I			R/A									
ERECTION AND ASSEMBLY OF MEMBERS ACCORDING TO THE PLAN	I	A	R	C			R/A				R/A		R/A				
CO-ORDINATION OF ALL OPERATIONS		A/C	R/A	C	C		R/A										
WEEKLY STATUS / PROGRESS UPDATE	I	I/C	R/A	A	A		R/A										
DAILY PROGRESS REPORT	I	R/A/I	I				R/A										
PROJECT STATUS	I	I/A/C	R/A				R/A										
A3 SHEET REPORT		R/A/C	I				I/C										
LESSON LEARNT RECORD AND OTHER DOCUMENTS	I	R/A	R/A				R/A										

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WORK FLOW AT EPMCR



MILESTONE ACTIVITY		MONTH -1							
		WEEK 1		WEEK 2		WEEK 3		WEEK 4	
ACTIVITY - A	ACTIVITY NAME			ACTIVITY NAME		ACTIVITY NAME		ACTIVITY NAME	
	DATE			DATE		DATE		DATE	
	ID			ID		ID		ID	
	LOCATION			LOCATION		LOCATION		LOCATION	
	PLANNED AMT . OF WORK			PLANNED AMT . OF WORK		PLANNED AMT . OF WORK		PLANNED AMT . OF WORK	
	RESOURCE PERSON			RESOURCE PERSON		RESOURCE PERSON		RESOURCE PERSON	
	MACHINERIES/ MATERIALS			MACHINERIES/ MATERIALS		MACHINERIES/ MATERIALS		MACHINERIES/ MATERIALS	
	INCHARGE			INCHARGE		INCHARGE		INCHARGE	
	PREDECESSOR			PREDECESSOR		PREDECESSOR		PREDECESSOR	
SUCCESSOR			SUCCESSOR		SUCCESSOR		SUCCESSOR		
ACTIVITY - B	ACTIVITY NAME			ACTIVITY NAME		ACTIVITY NAME		ACTIVITY NAME	
	DATE			DATE		DATE		DATE	
	ID			ID		ID		ID	
	LOCATION			LOCATION		LOCATION		LOCATION	
	PLANNED AMT . OF WORK			PLANNED AMT . OF WORK		PLANNED AMT . OF WORK		PLANNED AMT . OF WORK	
	RESOURCE PERSON			RESOURCE PERSON		RESOURCE PERSON		RESOURCE PERSON	
	MACHINERIES/ MATERIALS			MACHINERIES/ MATERIALS		MACHINERIES/ MATERIALS		MACHINERIES/ MATERIALS	
	INCHARGE			INCHARGE		INCHARGE		INCHARGE	
	PREDECESSOR			PREDECESSOR		PREDECESSOR		PREDECESSOR	
SUCCESSOR			SUCCESSOR		SUCCESSOR		SUCCESSOR		
MONTH -2									
		WEEK 5		WEEK 6		WEEK 7		WEEK 8	
ACTIVITY - A	ACTIVITY NAME			ACTIVITY NAME		ACTIVITY NAME		ACTIVITY NAME	
	DATE			DATE		DATE		DATE	
	ID			ID		ID		ID	
	LOCATION			LOCATION		LOCATION		LOCATION	
	PLANNED AMT . OF WORK			PLANNED AMT . OF WORK		PLANNED AMT . OF WORK		PLANNED AMT . OF WORK	
	RESOURCE PERSON			RESOURCE PERSON		RESOURCE PERSON		RESOURCE PERSON	
	MACHINERIES/ MATERIALS			MACHINERIES/ MATERIALS		MACHINERIES/ MATERIALS		MACHINERIES/ MATERIALS	
	INCHARGE			INCHARGE		INCHARGE		INCHARGE	
	PREDECESSOR			PREDECESSOR		PREDECESSOR		PREDECESSOR	
SUCCESSOR			SUCCESSOR		SUCCESSOR		SUCCESSOR		
ACTIVITY - B	ACTIVITY NAME			ACTIVITY NAME		ACTIVITY NAME		ACTIVITY NAME	
	DATE			DATE		DATE		DATE	
	ID			ID		ID		ID	
	LOCATION			LOCATION		LOCATION		LOCATION	
	PLANNED AMT . OF WORK			PLANNED AMT . OF WORK		PLANNED AMT . OF WORK		PLANNED AMT . OF WORK	
	RESOURCE PERSON			RESOURCE PERSON		RESOURCE PERSON		RESOURCE PERSON	
	MACHINERIES/ MATERIALS			MACHINERIES/ MATERIALS		MACHINERIES/ MATERIALS		MACHINERIES/ MATERIALS	
	INCHARGE			INCHARGE		INCHARGE		INCHARGE	
	PREDECESSOR			PREDECESSOR		PREDECESSOR		PREDECESSOR	
SUCCESSOR			SUCCESSOR		SUCCESSOR		SUCCESSOR		

WEEKLY PLAN

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WEEKLY PLAN

	MONTH-02							
	WEEK 5		WEEK 6		WEEK 7		WEEK 8	
SURVEYING , MARKING , SURFACE PREPARATION	ACTIVITY NAME: LOCATION SCOPE QTY RESOURCES: PREDECESSOR ACTIVITY		ACTIVITY NAME: LOCATION SCOPE QTY RESOURCES: PREDECESSOR ACTIVITY		ACTIVITY NAME: LOCATION SCOPE QTY RESOURCES: PREDECESSOR ACTIVITY		ACTIVITY NAME: LOCATION SCOPE QTY RESOURCES: PREDECESSOR ACTIVITY	
PRODUCTION BLOCK - FOOTING	ACTIVITY NAME:EXCAVATION LOCATION SCOPE QTY RESOURCES: PREDECESSOR ACTIVITY		ACTIVITY NAME:EXCAVATION LOCATION SCOPE QTY RESOURCES: PREDECESSOR ACTIVITY		ACTIVITY NAME:EXCAVATION LOCATION SCOPE QTY RESOURCES: PREDECESSOR ACTIVITY		ACTIVITY NAME: LOCATION SCOPE QTY RESOURCES: PREDECESSOR ACTIVITY	
PRODUCTION BLOCK - PREFAB	ACTIVITY NAME: LOCATION SCOPE QTY RESOURCES: PREDECESSOR ACTIVITY		ACTIVITY NAME:FABRICATION ORDER - LOCATION SCOPE QTY RESOURCES: PREDECESSOR ACTIVITY		ACTIVITY NAME: LOCATION SCOPE QTY RESOURCES: PREDECESSOR ACTIVITY		ACTIVITY NAME:RECEIVING ANCHOR LOCATION SCOPE QTY RESOURCES: PREDECESSOR ACTIVITY	
FOOTING	ACTIVITY NAME:REINFORCEMENT , PCC LOCATION SCOPE RESOURCES: PREDECESSOR ACTIVITY		ACTIVITY NAME:REINFORCEMENT , PCC LOCATION SCOPE QTY RESOURCES: PREDECESSOR ACTIVITY		ACTIVITY NAME:REINFORCEMENT , PCC LOCATION SCOPE QTY RESOURCES: PREDECESSOR ACTIVITY		ACTIVITY NAME: LOCATION SCOPE QTY RESOURCES: PREDECESSOR ACTIVITY	
PEDESTAL	ACTIVITY NAME:REINFORCEMENT AND LOCATION SCOPE QTY RESOURCES: PREDECESSOR ACTIVITY		ACTIVITY NAME:REINFORCEMENT AND STARTER CONCRETE , PEDESTAL LOCATION SCOPE QTY RESOURCES: PREDECESSOR ACTIVITY		ACTIVITY NAME:REINFORCEMENT AND LOCATION SCOPE QTY RESOURCES: PREDECESSOR ACTIVITY		ACTIVITY NAME:REINFORCEMENT AND LOCATION SCOPE QTY RESOURCES: PREDECESSOR ACTIVITY	
PEDESTAL CONCRETING	ACTIVITY NAME:CONCRETING - 1ST LIFT LOCATION SCOPE QTY RESOURCES: PREDECESSOR ACTIVITY		ACTIVITY NAME:CONCRETING - 1ST LIFT ANCHOR BOLT FIXING , 2ND LIFT LOCATION SCOPE QTY: 324 RESOURCES: PREDECESSOR ACTIVITY		ACTIVITY NAME:ANCHOR BOLT FIXING , LOCATION SCOPE QTY RESOURCES: PREDECESSOR ACTIVITY		ACTIVITY NAME:ANCHOR BOLT FIXING , LOCATION SCOPE QTY RESOURCES: PREDECESSOR ACTIVITY	
GRADE BEAM	ACTIVITY NAME: LOCATION SCOPE QTY RESOURCES: PREDECESSOR ACTIVITY		ACTIVITY NAME: LOCATION SCOPE QTY RESOURCES: PREDECESSOR ACTIVITY		ACTIVITY NAME: LOCATION SCOPE QTY RESOURCES: PREDECESSOR ACTIVITY		ACTIVITY NAME:GRADE BEAM LOCATION SCOPE QTY:707 RESOURCES: PREDECESSOR ACTIVITY	

WEEKLY PLAN

	MONTH - 03											
	WEEK 9			WEEK 10			WEEK 11			WEEK 12		
SURVEYING , MARKING , SURFACE PREPARATION	ACTIVITY NAME:			ACTIVITY NAME:			ACTIVITY NAME:			ACTIVITY NAME:		
	LOCATION		SCOPE QTY	LOCATION		SCOPE QTY	LOCATION		SCOPE QTY	LOCATION		SCOPE QTY
	RESOURCES:			RESOURCES:			RESOURCES:			RESOURCES:		
	PREDECESSOR ACTIVITY			PREDECESSOR ACTIVITY			PREDECESSOR ACTIVITY			PREDECESSOR ACTIVITY		
PRODUCTION BLOCK - FOOTING	ACTIVITY NAME:			ACTIVITY NAME:			ACTIVITY NAME:			ACTIVITY NAME:		
	LOCATION		SCOPE QTY	LOCATION		SCOPE QTY	LOCATION		SCOPE QTY	LOCATION		SCOPE QTY
	RESOURCES:			RESOURCES:			RESOURCES:			RESOURCES:		
	PREDECESSOR ACTIVITY			PREDECESSOR ACTIVITY			PREDECESSOR ACTIVITY			PREDECESSOR ACTIVITY		
PRODUCTION BLOCK - PREFAB	ACTIVITY NAME:			ACTIVITY NAME:			ACTIVITY NAME:			ACTIVITY NAME:		
	LOCATION		SCOPE QTY	LOCATION		SCOPE QTY	LOCATION		SCOPE QTY	LOCATION		SCOPE QTY
	RESOURCES:			RESOURCES:			RESOURCES:			RESOURCES:		
	PREDECESSOR ACTIVITY			PREDECESSOR ACTIVITY			PREDECESSOR ACTIVITY			PREDECESSOR ACTIVITY		
FOOTING	ACTIVITY NAME:			ACTIVITY NAME:			ACTIVITY NAME:			ACTIVITY NAME:		
	LOCATION		SCOPE QTY	LOCATION		SCOPE QTY	LOCATION		SCOPE QTY	LOCATION		SCOPE QTY
	RESOURCES:			RESOURCES:			RESOURCES:			RESOURCES:		
	PREDECESSOR ACTIVITY			PREDECESSOR ACTIVITY			PREDECESSOR ACTIVITY			PREDECESSOR ACTIVITY		
PEDESTAL	ACTIVITY NAME:REINFORCEMENT AND			ACTIVITY NAME:			ACTIVITY NAME:			ACTIVITY NAME:		
	LOCATION		SCOPE QTY	LOCATION		SCOPE QTY	LOCATION		SCOPE QTY	LOCATION		SCOPE QTY
	RESOURCES:			RESOURCES:			RESOURCES:			RESOURCES:		
	PREDECESSOR ACTIVITY			PREDECESSOR ACTIVITY			PREDECESSOR ACTIVITY			PREDECESSOR ACTIVITY		
PEDESTAL CONCRETING	ACTIVITY NAME:ANCHOR BOLT FIXING ,			ACTIVITY NAME:ANCHOR BOLT FIXING ,			ACTIVITY NAME:			ACTIVITY NAME:		
	LOCATION		SCOPE QTY	LOCATION		SCOPE QTY	LOCATION		SCOPE QTY	LOCATION		SCOPE QTY
	RESOURCES:			RESOURCES:			RESOURCES:			RESOURCES:		
	PREDECESSOR ACTIVITY			PREDECESSOR ACTIVITY			PREDECESSOR ACTIVITY			PREDECESSOR ACTIVITY		
GRADE BEAM	ACTIVITY NAME::GRADE BEAM			ACTIVITY NAME:GRADE BEAM			ACTIVITY NAME:PCC LAYING, BEAM			ACTIVITY NAME:		
	LOCATION		SCOPE QTY	LOCATION		SCOPE QTY	LOCATION		SCOPE QTY	LOCATION		SCOPE QTY
	RESOURCES:			RESOURCES:			RESOURCES:			RESOURCES:		
	PREDECESSOR ACTIVITY			PREDECESSOR ACTIVITY			PREDECESSOR ACTIVITY			PREDECESSOR ACTIVITY		

WEEKLY PLAN

MONTH- 01 , WEEK 3

SURVEYING ,
MARKING , SURFACE
PREPARATION

ACTIVITY NAME:SURFACE PREPARATION . MOBILIZATION	
LOCATION	SCOPE QTY
RESOURCES:COMPA	
PREDECESSOR ACTIVITY	

MONTH – 02 , WEEK 5,6,7

PRODUCTIO
N BLOCK -
FOOTING

ACTIVITY NAME:EXCAVATION	
LOCATION	SCOPE QTY
RESOURCES:	
PREDECESSOR ACTIVITY	

MONTH – 02 , WEEK 6

PRODUCTIO
N BLOCK -
PREFAB

ACTIVITY NAME:FABRICATION ORDER - PRIMARY MEMBERS	
LOCATION	SCOPE QTY
RESOURCES:	
PREDECESSOR ACTIVITY	

WEEK 8

ACTIVITY NAME:RECEIVING ANCHOR BOLTS	
LOCATION	SCOPE QTY
RESOURCES:	
PREDECESSOR ACTIVITY	

MONTH – 02 , WEEK 5,6,7

FOOTING

ACTIVITY NAME:REINFORCEMENT , PCC ,	
LOCATION	SCOPE QTY:68.NOS
RESOURCES:	
PREDECESSOR ACTIVITY:EXCAVATION	

MONTH – 02 , WEEK 5

PEDESTAL

ACTIVITY NAME:REINFORCEMENT AND	
LOCATION	SCOPE QTY
RESOURCES:	
PREDECESSOR ACTIVITY	

WEEK 6, 7

ACTIVITY NAME:REINFORCEMENT AND	
LOCATION	SCOPE QTY
RESOURCES:	
PREDECESSOR ACTIVITY	

WEEK 5,6,7 :
REINFORCEMENT , PCC ,
CONCRETING , SHUTTERING , DE-
SHUTTERING.

**WEEK 5- REINFORCEMENT AND
STARTER CONCRETE**
**WEEK 6, 7- REINFORCEMENT AND
STARTER CONCRETE , PEDESTAL
SHUTTERING**

MONTH 02-WEEK 5

MONTH 02 -WEEK 6

MONTH – 02, WEEK 7,8 MONTH 03-9,10

PEDESTAL CONCRETING

ACTIVITY NAME:CONCRETING - 1ST LIFT	
LOCATION	SCOPE QTY
RESOURCES:	
PREDECESSOR ACTIVITY	

ACTIVITY NAME:CONCRETING - 1ST LIFT , ANCHOR BOLT FIXING , 2ND LIFT	
LOCATION	SCOPE QTY: 324 BOLTS
RESOURCES:	
PREDECESSOR ACTIVITY	

ACTIVITY NAME:ANCHOR BOLT FIXING , 2ND LIFT SHUTTERING ,CONCRETING	
LOCATION	SCOPE QTY
RESOURCES:	
PREDECESSOR ACTIVITY	

WORK PACKAGE -

WEEK 5 -CONCRETING - 1ST LIFT

WEEK 6 -1ST LIFT , ANCHOR BOLT FIXING , 2ND LIFT SHUTTERING , CONCRETING.

WEEK 7,8,9,10 -ANCHOR BOLT FIXING , 2ND LIFT SHUTTERING ,CONCRETING

MONTH 02-WEEK 8 MONTH 03- 9,10

MONTH 03 –WEEK 11

GRADE BEAM

ACTIVITY NAME:GRADE BEAM EXCAVATION , GSB LAYING , PCC LAYING	
LOCATION	SCOPE QTY:707 RMT
RESOURCES:	
PREDECESSOR ACTIVITY	

ACTIVITY NAME:PCC LAYING, BEAM RNFCMNET , BEAM SHUTTERING ,	
LOCATION	SCOPE QTY
RESOURCES:	
PREDECESSOR ACTIVITY	

WORK PACKAGE
WEEK 8,9,10 -GRADE BEAM EXCAVATION , GSB LAYING , PCC LAYING.

WEEK 11 -PCC LAYING, BEAM RNFCMNET , BEAM SHUTTERING , CONCRETING

TASKS	ASSESSMENT CRITERIA
DESIGN PHASE	• Contractor to inform the design team and identify any procurement constraints. • Project constraints such as limitations on plant and equipment due to ground conditions or existing structures, restrictions associated with logistics to and around the site, or working in or around an operating environment . • Assessment of adjacent structures when required to connect to, or when required to work around . • Sizes, lengths and weights of members and assemblies for both transport and erection. Connection types, if welded and/or bolted including if Snug (S), Tension Friction (TF) or Tension Bearing (TB) and assessment of connections in both the temporary and permanent condition. • Steel, fasteners and consumables procurement sources and quality assurance and quality control requirements to ensure compliance to contractual documentation . • Safety in design risk register/report.
CONSTRUCTION PHASE	
ENGINEERING PHASE	Site conditions including topography, prevailing weather and boundary conditions. Geotechnical assessment to determine if ground conditions are suitable for storage and erection of structural steel including safe operation of associated plant (eg. cranes, elevated work platforms) . Structural engineering assessment to determine the capability of existing structures to support temporary loads associated with storage and erection of structural steel including safe operation of associated plant . Structural engineering assessment of column base plate and hold down bolt assembly designs for temporary condition . Lifting strategy for inclusion of required connection points .

PRE-ERECTION	PMC to identify any time constraints for key activities. Identification and locating of existing services including power lines and service pits particularly in the areas where major plant will be operated. Sequential erection of steel members indicating nature and extent of temporary works required during the sequence with witness and hold points . Critical props and/or bracing and/or connections required for the erection sequence, when they are required to be installed, when they are required to be completed if permanent, or when they can be removed and how they are removed if temporary . Development of a scope specific WBS in consultation with all relevant parties. Detailed work instructions to be developed .
ACCESS	Access to all work faces including connections (scaffold, plant and sequencing) for installation, inspection, testing and painting. Working at heights including edge and/or perimeter protection. Assessment of adjacent activities and interaction . Barrier free environment .
MATERIAL HANDLING	Lifting methodology including crane selection, major plant set-up areas, expected loads including size, weight and geometry, lifting point locations with associated certification and any specialized rigging equipment required. Erection methodology for large and/or complex lifts and assess if any additional specific lift engineering assessment is needed. Laydown and storage zones – location, size and load capacity.

Delivery	Delivery schedule to suit steel erection sequence . Method and type of transportation to site including delivery route and traffic management . Safety Issues with transportation and unloading of containerized loads.
Erection	Induction of all relevant stakeholders into WBS. Expected weather conditions and identification of alternate activities that can be undertaken during inclement weather events . Physical marking of critical props and/or bracing including identifying whether temporary or permanent, and physical protection of same if in a location where there is risk of impact/damage. Progressive survey of installed members for tolerance and verticality and include what survey is a witness or hold point based on member criticality as determined by the TWE in consultation with the PWE . Identification of what connections require completion (full bolting or welding versus partial) and when baseplates require full grouting as erection progresses .

EXCAVATION VOLUME

GRID NUMBER	COLUMN	FOOTING SIZE			NO.OF.FOOTINGS				VOLUME (SQUARE)	LONG SIDE	SHORT SIDE	VOLUME	TOTAL VOLUME (m^3)
		L (m)	B (m)	D (m)		L	B	D					
F1	A2,A11	1.2	1	0.35	2	2.2	2	2	8.8	4	2.4	15.2	30.4
F2	B2,B11,R2,R11	1.4	1.3	0.35	4	2.4	2.3	2	11.04	4.6	2.8	18.44	73.76
F3	C2,C11,D2,D11,E2,E11,G2,G11,H2,H11,J2,J11,L2,L11,M2,M11,P2,P11												
		1.4	1	0.35	18	2.4	2	2	9.6	4	2.8	16.4	295.2
F4	F2,F11,K2,K11	1.6	1.4	0.35	4	2.6	2.4	2	12.48	4.8	3.2	20.48	81.92
F5	A3,A4,A5,A7,A8,A9,A10	1.15	1.05	0.35	7	2.15	2.05	2	8.815	4.1	2.3	15.215	106.505
F6	B3,B4,B5,B7,B8,B9,B10,R3,R4,R5,R7,R8,R9,R10	1.75	1.4	0.375	14	2.75	2.4	2	13.2	4.8	3.5	21.5	301
F7	F4,F7,F9,K4,K7,K9	2.65	2.2	1.9	6	3.65	3.2	2	23.36	6.4	5.3	35.06	210.36
F8	N4,N5,N6,Q4,Q7,Q6,R6	1.4	1.4	0.375	7	2.4	2.4	2	11.52	4.8	2.8	19.12	133.84
F9	C1,D1,E1,F1	2.3	2.3	1.9	4	3.3	3.3	2	21.78	6.6	4.6	32.98	131.92
	FOOTING SCHEDULE (M25:Fe550)											TOTAL EXCAVATION VOLUME (M^3)	1364.905
		FOOTING	GRID	FOOTING	PERCENT	FOOTING DIMENSION							

FOOTING NUMBERS	GRID NUMBERS	FOOTING TYPE	PEDESTAL SIZE (L X B)	FOOTING DIMENSION		
				L	B	D
F1	A2,A11	Pad	600X400	1200	1000	350
F2	B2,B11,R2,R11	Pad	735X630	1400	1300	350
F3	C2,C11,D2,D11,E2,E11,G2,G11,H2,H11,J2,J11,L2,L11,M2,M11,P2,P11	Pad	655X300	1400	1000	350
F4	F2,F11,K2,K11	Pad	850X630	1600	1400	350
F5	A3,A4,A5,A7,A8,A9,A10	Pad	400X300	1150	1050	350
F6	B3,B4,B5,B7,B8,B9,B10,R3,R4,R5,R7,R8,R9,R10	Pad	735X400	1750	1400	375
F7	F4,F7,F9,K4,K7,K9	Pad	850X400	2650	2200	1900
F8	N4,N5,N6,Q4,Q7,Q6,R6	Pad	400X400 / 675X400	1400	1400	375
F9	C1,D1,E1,F1	Pad	450X450	2300	2300	1900

INTERNSHIP REPORT

ENGINEERING PROJECT MANAGEMENT CONSULTANCY AND RESEARCH PRIVATE LIMITED
- AN IIT IMADRAS INCUBATED COMPANY

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M.ARCH-BUILDING MANAGEMENT
SATHYABAMA INSTITUTE OF SCIENCE AND TECHNOLOGY



SHUTTERING

GRID NUMBER	COLUMN	FOOTING SIZE			PEDESTAL SIZE		VOLUME OF CONCRETE		SHUTTERING AREA (2 (L+B)xD	BITUMEN PAINT AREA (SHUTTERING AREA + (TOP AREA OF FOOTING - COLUMN AREA)	NO.OF.FOOTINGS	TOTAL SHUTTERING AREA	NUMBERS
		L (m)	B (m)	D (m)	L	B							
F1	A2,A11	1.2	1	0.35	0.6	0.4	1.2	0.42	1.54	2.74	2	3.08	1.54
F2	B2,B11,R2,R11	1.4	1.3	0.35	0.73	0.63	1.82	0.637	1.89	3.9781	4	7.56	1.89
F3	C2,C11,D2,D11,E2,E11,G2,G11,H2,H11,J2,J11,L2,L11,M2,M11,P2,P11	1.4	1	0.35	0.65	0.3	1.4	0.49	1.68	3.445	18	30.24	1.68
F4	F2,F11,K2,K11	1.6	1.4	0.35	0.85	0.63	2.24	0.784	2.1	5.1485	4	8.4	2.1
F5	A3,A4,A5,A7,A8,A9,A10	1.15	1.05	0.35	0.4	0.3	1.2075	0.422625	1.54	2.808625	7	10.78	1.54
F6	B3,B4,B5,B7,B8,B9,B10,R3,R4,R5,R7,R8,R9,R10	1.75	1.4	0.375	0.73	0.4	2.45	0.91875	2.3625	6.358	14	33.075	2.3625
F7	F4,F7,F9,K4,K7,K9	2.65	2.2	1.9	0.85	0.4	5.83	11.077	18.43	33.5395	6	110.58	18.43

BARBENDING SCHEDULE

[illegible]

INTERNSHIP REPORT

ENGINEERING PROJECT MANAGEMENT CONSULTANCY AND RESEARCH PRIVATE LIMITED
- AN IIT IMADRAS INCUBATED COMPANY

NIVEDHAA B
40840011-III SEM – II YR
M.ARCH-BUILDING MANAGEMENT
SATHYABAMA INSTITUTE OF SCIENCE AND TECHNOLOGY

EQUIPMENT ANALYSIS

EXCAVATOR			
No. of Excavator		1	Nos
Bucket capacity		0.35	Cum
Time Taken For one Bucket Excavation			
Digging Time		7	Sec
Scrubbing/ Scooping Time		10	Sec
Swinging time		12	Sec
Loading		5	Sec
Moving and Position		5	Sec
Total Time		0.70	Min
Working hours for Excavator		8	hrs
Effective work of Excavator		75%	
Effective work of Excavator in "min"		360	min
Production Per day		180	Cum/day
DUMPER ANALYSIS			
Capacity of Dumper		5.00	Cum
NET CAPACITY			
Dumper Avg. Speed (Km/h)		30	Km/h
Leading distance(Two way travel)		1.00	Km
Loading Time		10	min
Unloading Time		2	min
Travel Time		2	min
Position Time		2	min
Total Time/Dumper		16	Min
Working hours for Dumper		8	hrs
Effective work of Dumper		75%	
Effective work of Dumper in "min"		360	min
No of trips required/Dumper		23	Nos
Productivity Per day per Dumper		115	Cum/day
Total dumper required/day (Theoretically)		2	Nos
Total dumper required/day (Practically)		2	Nos

EQUIPMENT ANALYSIS

PLANNED OUTPUT = IDEAL OUTPUT X TOTAL FACTOR					126.48	CUM		
IDEAL OUTPUT					31 CUM @6 hrs for a cycle time of 35 sec	186	CUM	
TOTAL FACTOR=PERFORMANCE FACTORXCORRECTION FACTOR						0.68		
PERFORMANCE FACTOR					FOR 60 MIN	1		
CORRECTION FACTOR= SOIL FACTORX LOAD FACTOR X SWINGING FACTOR						0.68	(REFER FOR 75%	
SOIL FACTOR					0.85			
LOAD FACTOR					0.8	(FACTOR)		
SWINGING FACTOR					1			
SUMMARY OF CALCULATIONS								
TOTAL FACTOR					0.68			
CORRECTION FACT					0.68			
IDEAL OUTPUT					186			
PLANNED OUTPUT					126.48			

Load Factor :

- 1) Side Casting - Open Area : 1.0
- Restrict Area : 0.80
- 2) Loading in Vehicle - Open Area : 0.80
- Restrict Area : 0.60

Soil Factor (Digging factor) :

- 1) For Loom, Sandy , Gravel Soil : 1.0
- 2) For Common earth : 0.85
- 3) For Stiff clay, Soft rock : 0.67

Cubic Meters per 60 Minute Hour*

ESTIMATED CYCLE TIMES		ESTIMATED BUCKET PAYLOAD** — LOOSE CUBIC METERS																			ESTIMATED CYCLE TIMES	
Cycle Time		0.2	0.3	0.5	0.7	0.9	1.1	1.3	1.5	1.7	1.9	2.1	2.3	2.5	2.7	2.9	3.1	3.3	3.5	4.0	Cycles Per Min.	Cycles Per Hr.
Seconds	Min.																					
10.0	0.17																				6.0	360
11.0	0.18																				5.5	330
12.0	0.20	60	90	150	210	270															5.0	300
13.3	0.22	54	81	135	189	243	297	351	405	459	513	567	621	675	729	783	837	891	945	1080	4.5	270
15.0	0.25	48	72	120	168	216	264	312	360	408	456	504	552	600	648	696	744	792	840	960	4.0	240
17.1	0.29	42	63	105	147	189	231	273	315	357	399	441	483	525	567	609	651	693	735	840	3.5	210
20.0	0.33	36	54	90	126	162	198	234	270	306	342	378	414	450	486	522	558	544	630	720	3.0	180
24.0	0.40	30	45	75	105	135	165	195	225	255	285	315	345	375	405	435	465	495	525	600	2.5	150
30.0	0.50	24	36	60	84	108	132	156	180	204	228	252	276	300	324	348	372	396	420	480	2.0	120
35.0	0.58	20	31	51	71	92	112	133	153	173	194	214	235	255	275	296	316	337	357	408	1.7	102
40.0	0.67					81	99	177	135	153	171	189	207	225	243	261	279	297	315	360	1.5	90
45.0	0.75									133	148	164	179	195	211	226	242	257	273	312	1.3	78
50.0	0.83																				1.2	72

Performance Factor :

- 1) 60 Min / Hr : 1.00
- 2) 55 Min / Hr : 0.92
- 3) 50 Min / Hr : 0.83
- 4) 45 Min / Hr : 0.75
- 5) 40 Min / Hr : 0.67

Swing Factor :

- 1) Angle of swing - 45 Degree : 1.20
- 2) Angle of swing - 60 Degree : 1.16
- 3) Angle of swing - 75 Degree : 1.07
- 4) Angle of swing - 90 Degree : 1.00
- 5) Angle of swing - 120 Degree : 0.88
- 6) Angle of swing - 150 Degree : 0.79
- 7) Angle of swing - 180 Degree : 0.71

A3 – DESIGN THINKING

PROJECT G.T.ELECTRONICS , THINDIVANAM.		ACTIVITY : A3 - DESIGN THINKING			DATE :21.12.2021		REVISION		AUTHOR																																																																																																																																																																											
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PROJECT GT.ELECTRICALS,THIDIVANAM		ACTIVITY FOOTING		DATE :22.12.2021	REVISION	AUTHOR
GOALS EARTH WORK EXCAVATION	STAKEHOLDERS		ACTION PLAN		OBSERVE	
EARTH WORK EXCAVATION FOOTING EXCAVATION NO.S- 5 / DAY	PMC- MONITORING OF ALL THE ACTIVITIES . ENSURING QUALITY . CONTRACTOR - INCHARGE FOR EXECUTION . LABOURS OPERATORS - DUMPER , JCB, EXCAVATOR		YET TO DEVELOP		•LAG WHILE USING THE EQUIPMENTS . •SAFETY PROTOCOLS WERE NOT FOLLOWED . •NO PROPER SITE MARKING WERE DONE . •INADEQUATE EQUIPMENT PLANNING .	
CONSTRAINTS			OPPORTUNITIES			
•CHANGES - SITE MARKINGS . •INADEQUATE EQUIPMENT PLANNING AND OPTIMIZATION . •DELAY - FOLLOWING AND PARALLEL ACTIVITIES . •CAVE -IN PROPABILITIES . •UNPREDICTABLE SITE CONDITIONS . •EQUIPMENT AND LABOURS AROUND THE EDGES OF THE EXCAVATED PIT . (DAMAGE / INJURY) IMPACT 1 2 4,5 3 PROBABILITY OF OCCUREE			SCHEDULE DELAYS CAN BE SOLVED . EFFICIENT USAGE OF EQUIPMENTS . INCREASE IN PRODUCTIVITY . COST BENEFITS.			

A3- DEFINE AND IDEATE

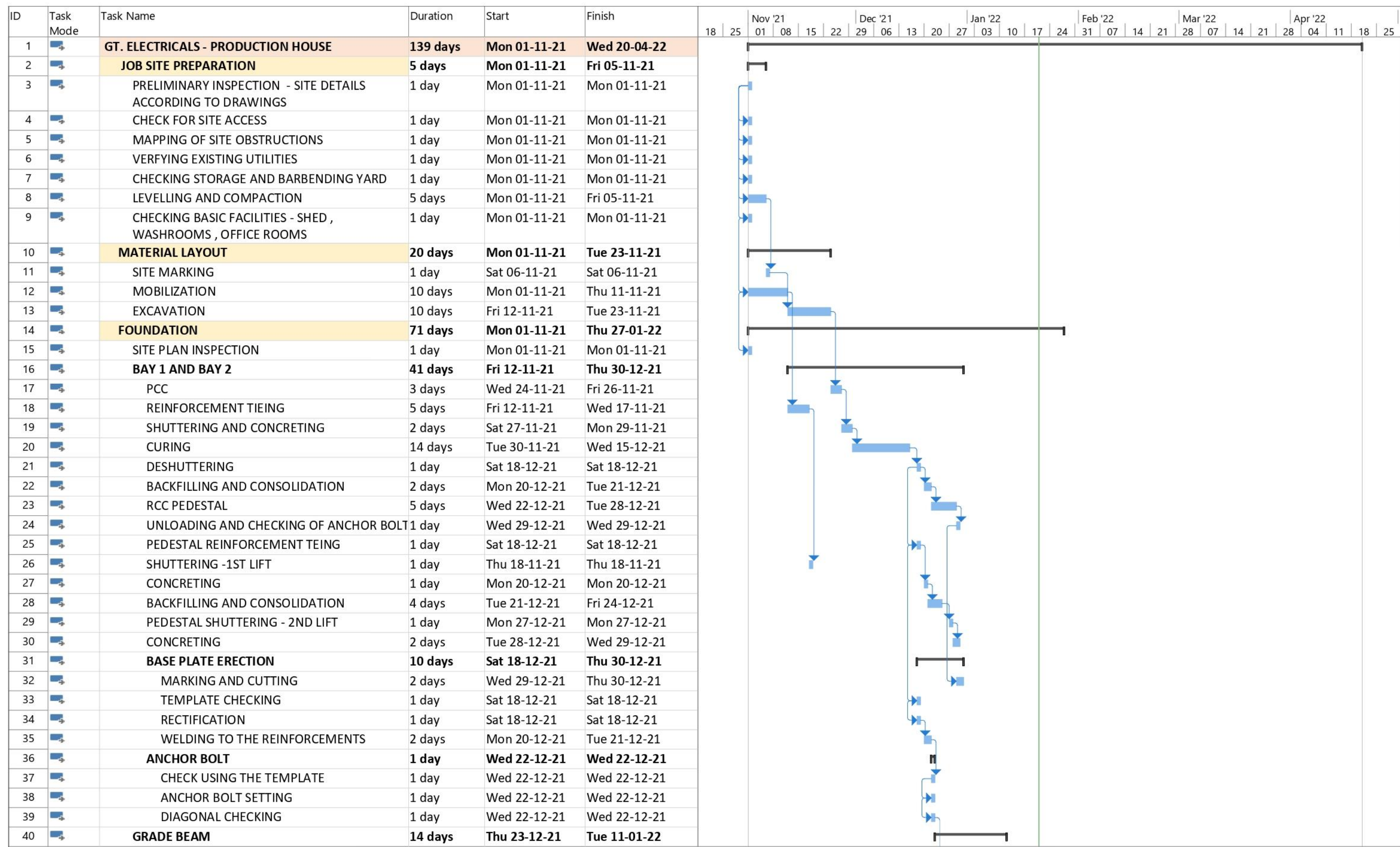
PROJECT GT.ELECTRICALS, THINDIVANAM				ACTIVITY :EXCAVATION				DATE :21.12.2021		REVISION		AUTHOR			
KEY PROBLEMS CAVE IN . EQUIPMENT AND SCHEDULE OPTIMIZATION . SITE MARKINGS								PROBLEM STATEMENT DELAY IN EARTHWORK EXCAVATION ACTIVITIES . THERE IS NO PROPER PREVENTIVE MEASURES . THERE IS NO PROPER PLANNING / METHODOLOGY FOR EXCAVATION . THERE IS LACK OF CLARITY IN SITE LEVELS AND MARKINGS . THERE IS A COMMUNICATION FALLBACK BETWEEN THE CONTRACTOR AND THE PLANNING TEAM .							
RESPONSIBILITIES PMC CONTRACTOR LABOURS OPERATORS - DUMPER , JCB, EXCAVATOR				MATERIALS AND MACHINERIES SAFTEY BOARDS , GUIDERAILS . EXCAVATOR DUMPER				DOCUMENTS SITE LEVEL DRAWINGS . SOIL REPORT . WEATHER FORECAST. DPR				PAIN POINTS NO PROPER MICRO - CLIMATE DATA . UNPREDICTABLE SITE CONDITIONS . WATER RUNOFF. STAGNANT WATER . STORAGE OF EXCAVATED SOIL .		CHANGE ORDERS . - SITE MARKINGS . SCHEDULE LAG BUDGET REVISIONS DELAY IN PLACEMENT OF ORDERS (ELEMENTS AND MEMBERS) .	
IDEATION								SOLUTION (WE MIGHT ..) •DEVELOPE PROPER METHODOLOGY FOR EXCAVATION . •PLANNING OF UTILIZATION AND DEPLOYMENT OF EQUIPMENTS . •INITIATE SAFTEY PROTOCOLS . •USE PLAN AHEAD SYSTEM TO OVER COME SCHEDULE DELAYS .							
IMPACT SCHEDULE DELAY - SORTED . EQUIPMENT BUDGETS - NOMINAL . PROPER UTILISATION OF EQUIPMENT AND LABOUR				ACTIONS PLAN AHEAD SCHEDULE . PLANNING OF WBS IN CONCERN WITH PRE FAB ORDERS . EFFECTIVE PLANNING OF EQUIPMENT AND ACTIVITIES ASSOCIATED WITH IT . PREVENTIVE SAFTEY MEASURES											
MITIGATE	ADAPT	REDUCE	DISABLE	IMPROVE	AUGMENT	ENABLE	ENHANCE	WORK METHOD EXCAVATION METHOD - SLOPED / STEPPED . SAFTEY GEARS TO BE WORN . PROPER SURVEYING OF THE SITE LEVELS . DAILY HURDLES CAN BE INTIATED .							
															
AVOID	REFOCUS	COUNTERACT	ELIMINATE	REFOCUS	CAPTUER	ENSURE	EXPLOIT								
															
TRANSFER	REASSIGN	SHIFT	OUTSOURCE	REASSIGN	PARTNER	OUTSOURCE	SHARE	REMARKS							
															

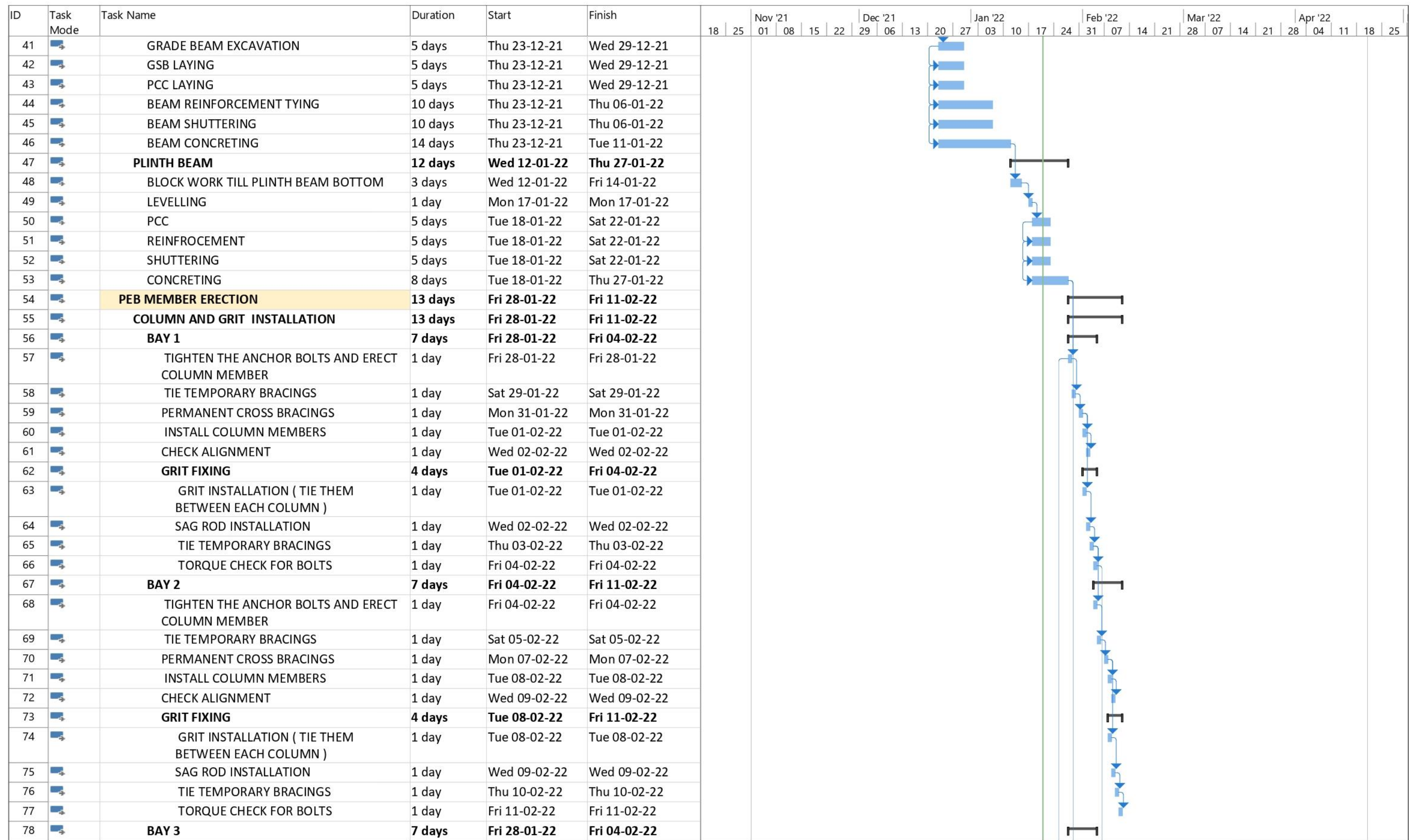
BACKGROUND				COUNTER MEASURES									
DATE: 21.12.2021		INCHARGE:											
ACTIVITY: FOOTING EXCAVATION		PREDECESSOR: MARKING AND LEVELLING		CATEGORY	ISSUES	CORRECTIVE MEASURES	RESPONSIBILITY	DUE	STATUS				
LOCATION: GT.ELECTRICALS		SUCCESSOR:PCC AND REINFORCEMENT											
CURRENT CONDITIONS DELAY IN THE EXCAVATION SCHEDULE	ROLE AND RESPONSIBILITIES	MACHINERIES	MATERIALS	MANAGEMENT - CONTRACTOR	SITE LEVEL MARKINGS	SURVEY AND REWORKING OF SITE LEVELS .	CONTRACTOR / SURVEY TEAM						
				RESOURCES-EQUIPMENT	NO PROPER PLANNING OF ACCESS .	EFFICIENT PLANNING OF THE TRAIL .	CONTRACTOR AND PMC						
GOALS / TARGETS TO OVERCOME SCHEDULE DELAY AND COMPLETE THE FOOTING ACTIVITIES WITHIN THE STIPULATED TIME.	KEY METRICS/ CONSTRAINTS CONTRACTOR - SITE MARKING AND CO-ORDINATION . PMC - EXECUTION OF ACTIVITIES OPERATORS - NOT CLEAR WITH THE ROUTES CLIENT - COST AND SCHEDULE IMPACT	IDEA	RESOURCES - LABOURS	SAFTEY PROTOCOLS ARE NOT FOLLOWED	ADHERE TO SAFTEY NORMS	CONTRACTOR AND PMC							
			ACTIVITY - EARTHWORK EXCAVATION	NO PROPER METHODOLOGY FOR EXCAVATION - CAVE IN .	DEFINE THE METHODOLOGY - SLOPE / STEP EXCAVATION .	CONTRACTOR AND PMC							
PLANNED			ACTIVITY - EARTHWORK EXCAVATION	DELAY IN SCHEDULE	PLANNING OF PARALLEL AND SUCCESSOR ACTIVITIES	CONTRACTOR AND PMC							
COMPLETED	REASONS FOR DELAY	REMARKS / LESSON LEARNT	ACTIVITY - EARTHWORK EXCAVATION.	WATER RUNOFF AND ACCUMULATIO N	PROPER DE-WATERING SYSTEMS	CONTRACTOR AND PMC							
ANALYSIS				FOLLOW-UP									
<pre> graph TD A[SCHEDULE DELAY - EARTHWORK] --> B[IN-EEFFECTIVE USAGE OF] B --> C[NO PROPER PLANNING AND CO-ORDINATION] C --> D[ACCESS ROAD ARE NOT PLANNED] C --> E[MARKINGS ARE NOT PROPER] </pre>				ACTIONS LPS EQUIPMENT PLANNING DAILY HURDLES GEMBA WALK VISUAL MANAGEMENT SPAGHETTI DIAGRAMS - EQUIPMENT PLANNING		<table border="1"> <tr> <td>VERY HIGHLY AFFECTIVE</td> <td>HIGHLY EFFECTIVE</td> </tr> <tr> <td>EFFECTIVE</td> <td>LESS EFFECTIVE</td> </tr> </table>		VERY HIGHLY AFFECTIVE	HIGHLY EFFECTIVE	EFFECTIVE	LESS EFFECTIVE		
VERY HIGHLY AFFECTIVE	HIGHLY EFFECTIVE												
EFFECTIVE	LESS EFFECTIVE												
				OUTCOMES		EVALUATE							

MILESTONE

	Task Mode ▾	Task Name ▾	Duration ▾	Start ▾	Finish ▾
1	→	GT. ELECTRICALS - PRODUCTION HOUSE	139 days	Mon 01-11-21	Wed 20-04-22
2	→	▷ JOB SITE PREPARATION	5 days	Mon 01-11-21	Fri 05-11-21
10	→	▷ MATERIAL LAYOUT	20 days	Mon 01-11-21	Tue 23-11-21
14	→	▷ FOUNDATION	71 days	Mon 01-11-21	Thu 27-01-22
54	→	▷ PEB MEMBER ERECTION	13 days	Fri 28-01-22	Fri 11-02-22
89	→	▷ BLOCK WORK	1 day	Sat 05-02-22	Sat 05-02-22
91	→	▷ ROOF AND WALL ERECTION	16 days	Sat 05-02-22	Wed 23-02-22
104	→	▷ LINTEL BEAM AND SUNSHADE	16 days	Mon 07-02-22	Thu 24-02-22
108	→	▷ FLOORING	23 days	Fri 28-01-22	Wed 23-02-22
119	→	▷ MEZZANINE FLOOR WORK	13 days	Sat 05-02-22	Sat 19-02-22
123	→	▷ JOINERY WORK	9 days	Wed 06-04-22	Tue 19-04-22
128	→	▷ ELECTRICAL	12 days	Mon 21-02-22	Sat 05-03-22
131	→	▷ PLUMBING	45 days	Wed 09-02-22	Fri 01-04-22
137	→	▷ INTERIOR WORKS	38 days	Tue 22-02-22	Wed 06-04-22
143	→	▷ FIRE FIGHTING AND PROTECTION	24 days	Mon 21-02-22	Sat 19-03-22
148	→	▷ PLASTERING	28 days	Mon 07-03-22	Thu 07-04-22
152	→	▷ PAINTING	14 days	Mon 21-03-22	Tue 05-04-22
155	→	▷ POST ERECTION AND COMPLETION	7 days	Sat 09-04-22	Wed 20-04-22

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WBS – GT . ELECTRICALS

ID	Task Mode	Task Name	Duration	Start	Finish	18	25	Nov '21	01	08	15	22	29	06	13	20	27	03	10	17	24	31	07	14	21	28	07	14	21	28	04	11	18	25
79		TIGHTEN THE ANCHOR BOLTS AND ERECT COLUMN MEMBER	1 day	Fri 28-01-22	Fri 28-01-22																													
80		TIE TEMPORARY BRACINGS	1 day	Sat 29-01-22	Sat 29-01-22																													
81		PERMANENT CROSS BRACINGS	1 day	Mon 31-01-22	Mon 31-01-22																													
82		INSTALL COLUMN MEMBERS	1 day	Tue 01-02-22	Tue 01-02-22																													
83		CHECK ALIGNMENT	1 day	Wed 02-02-22	Wed 02-02-22																													
84		GRIT FIXING	4 days	Tue 01-02-22	Fri 04-02-22																													
85		GRIT INSTALLATION (TIE THEM BETWEEN EACH COLUMN)	1 day	Tue 01-02-22	Tue 01-02-22																													
86		SAG ROD INSTALLATION	1 day	Wed 02-02-22	Wed 02-02-22																													
87		TIE TEMPORARY BRACINGS	1 day	Thu 03-02-22	Thu 03-02-22																													
88		TORQUE CHECK FOR BOLTS	1 day	Fri 04-02-22	Fri 04-02-22																													
89		BLOCK WORK	1 day	Sat 05-02-22	Sat 05-02-22																													
90		BRICK WORK TILL 3M	1 day	Sat 05-02-22	Sat 05-02-22																													
91		ROOF AND WALL ERECTION	16 days	Sat 05-02-22	Wed 23-02-22																													
92		BAY 1	16 days	Sat 05-02-22	Wed 23-02-22																													
93		CHALK MARKING FOR DRILLING	1 day	Sat 05-02-22	Sat 05-02-22																													
94		IDENTIFICATION OF BAY PLACEMENTS	1 day	Sat 05-02-22	Sat 05-02-22																													
95		PLACEMENT OF CLADDING -WALL	5 days	Mon 07-02-22	Fri 11-02-22																													
96		EAVE FLASHING	1 day	Sat 12-02-22	Sat 12-02-22																													
97		PLACEMENT OF CLADDING - ROOF	5 days	Mon 14-02-22	Fri 18-02-22																													
98		RIDGE FLASHING	2 days	Sat 19-02-22	Mon 21-02-22																													
99		LAP AND SEAL FLASHING	1 day	Mon 21-02-22	Mon 21-02-22																													
100		GUTTER AND DOWNSPROUT INSTALLATION	1 day	Tue 22-02-22	Tue 22-02-22																													
101		VENTILATOR , CURBS INSTALLATION	1 day	Tue 22-02-22	Tue 22-02-22																													
102		FASCIA FIXING	1 day	Wed 23-02-22	Wed 23-02-22																													
103		FIXING CORNERS AND EAVE TRIMS	1 day	Wed 23-02-22	Wed 23-02-22																													
104		LINTEL BEAM AND SUNSHADE	16 days	Mon 07-02-22	Thu 24-02-22																													
105		BEAM & SUNSHADE REINFORCEMENT TYING	1 day	Mon 07-02-22	Mon 07-02-22																													
106		BEAM & SUNSHADE SHUTTERING	1 day	Tue 08-02-22	Tue 08-02-22																													
107		CONCRETING AND CURING	14 days	Wed 09-02-22	Thu 24-02-22																													
108		FLOORING	23 days	Fri 28-01-22	Wed 23-02-22																													
109		GOOD EARTH FILLING	2 days	Fri 28-01-22	Sat 29-01-22																													
110		GSB	1 day	Mon 31-01-22	Mon 31-01-22																													
111		PCC	1 day	Tue 01-02-22	Tue 01-02-22																													
112		HDPE SHEET LAYING	1 day	Wed 02-02-22	Wed 02-02-22																													
113		REINFORCEMENT TYING	1 day	Thu 03-02-22	Thu 03-02-22																													
114		FLOOR CONCRETING	1 day	Fri 04-02-22	Fri 04-02-22																													
115		CURING AND EPOXY COATING	10 days	Sat 05-02-22	Wed 16-02-22																													
116		GROOVE CUTTING AND SEALANT FILLING	2 days	Thu 17-02-22	Fri 18-02-22																													
117		INDUSTRIAL FLOOR TILE LAYING INCLD PARTITION BEAM	2 days	Sat 19-02-22	Mon 21-02-22																													

WBS – GT . ELECTRICALS

ID	Task Mode	Task Name	Duration	Start	Finish	18	25	Nov '21	01	08	15	22	29	06	13	20	27	03	10	17	24	31	07	14	21	28	07	14	21	28	04	11	18
118		TOILET & DINING AREA FLOOR TILE LAYING	2 days	Tue 22-02-22	Wed 23-02-22																												
119		MEZZANINE FLOOR WORK	13 days	Sat 05-02-22	Sat 19-02-22																												
120		G.I DECK SHEET FIXING	5 days	Sat 05-02-22	Thu 10-02-22																												
121		REINFORCEMENT TYING	7 days	Fri 11-02-22	Fri 18-02-22																												
122		FLOOR CONCRETING	1 day	Sat 19-02-22	Sat 19-02-22																												
123		JOINERY WORK	9 days	Wed 06-04-22	Tue 19-04-22																												
124		FLASHING WINDOWS AND DOORS	2 days	Wed 06-04-22	Thu 07-04-22																												
125		INSTALLATION OF ROLLING SHUTTERS	4 days	Fri 08-04-22	Tue 12-04-22																												
126		INSTALLATION OF DOORS AND WINDOWS	7 days	Fri 08-04-22	Tue 19-04-22																												
127		SEALING JOINTS	1 day	Fri 08-04-22	Fri 08-04-22																												
128		ELECTRICAL	12 days	Mon 21-02-22	Sat 05-03-22																												
129		MARKING , INSTALLATION	10 days	Mon 21-02-22	Thu 03-03-22																												
130		CHECK FOR CONTINUITY	2 days	Fri 04-03-22	Sat 05-03-22																												
131		PLUMBING	45 days	Wed 09-02-22	Fri 01-04-22																												
132		LINE WORK	14 days	Wed 09-02-22	Thu 24-02-22																												
133		INSTALLATION OF IWC AND EWC	14 days	Fri 25-02-22	Sat 12-03-22																												
134		WASH BASIN FIXING	5 days	Mon 14-03-22	Fri 18-03-22																												
135		SS HAND WASH BASIN FIXING	5 days	Sat 19-03-22	Thu 24-03-22																												
136		URINAL AND GRANITE FIXING	7 days	Fri 25-03-22	Fri 01-04-22																												
137		INTERIOR WORKS	38 days	Tue 22-02-22	Wed 06-04-22																												
138		DRY WALL INSTALLATION	10 days	Tue 22-02-22	Fri 04-03-22																												
139		ALUMINIUM PARTITION INSTALLATION	7 days	Sat 05-03-22	Sat 12-03-22																												
140		METAL FENCING	4 days	Mon 14-03-22	Thu 17-03-22																												
141		FALSE CEILING - 600 X 600 TILE FIXING	7 days	Fri 18-03-22	Fri 25-03-22																												
142		FALSE CEILING -8mm BISON BOARD SUSPENDED CEILING	7 days	Wed 30-03-22	Wed 06-04-22																												
143		FIRE FIGHTING AND PROTECTION	24 days	Mon 21-02-22	Sat 19-03-22																												
144		EXTINGUISHER PLACEMENTS	2 days	Mon 21-02-22	Tue 22-02-22																												
145		CHECK FOR SPRINKLER LINES	1 day	Mon 21-02-22	Mon 21-02-22																												
146		SPRINKLER INSTALLATION	14 days	Thu 24-02-22	Fri 11-03-22																												
147		HOSE REEL INSTALLATION	7 days	Sat 12-03-22	Sat 19-03-22																												
148		PLASTERING	28 days	Mon 07-03-22	Thu 07-04-22																												
149		INTERNAL PLASTERING	12 days	Mon 07-03-22	Sat 19-03-22																												
150		EXTERNAL PLASTERING	12 days	Mon 21-03-22	Sat 02-04-22																												
151		WALL DADOING	14 days	Wed 23-03-22	Thu 07-04-22																												
152		PAINTING	14 days	Mon 21-03-22	Tue 05-04-22																												
153		INTERNAL PAINTING	7 days	Mon 21-03-22	Mon 28-03-22																												
154		EXTERNAL PAINTING	7 days	Tue 29-03-22	Tue 05-04-22																												
155		POST ERECTION AND COMPLETION	7 days	Sat 09-04-22	Wed 20-04-22																												
156		FINAL FINISHING WORKS	3 days	Sat 09-04-22	Tue 12-04-22																												
157		CHECK FOR DEFECTS	2 days	Sat 16-04-22	Mon 18-04-22																												

ID	Task Mode	Task Name	Duration	Start	Finish																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
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158		CLEAN UP OF SITE	4 days	Sat 16-04-22	Wed 20-04-22																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															

DOCUMENTS CHECKLIST

DOCUMENTS CHECKLIST					
S.NO	DOCUMENTS		AVAILABLE	NOT AVAILABLE	REMARKS
1	PRE - DESIGN	CONTRACT DOCUMENTS			
		SITE BOUNDARING USING SURVEY			
		SOIL REPORT			
		LOCATION OF EXISTING FEATURES			
		DISTANCE / ACCESS			
		FLOOD HAZARD AREAS AND FLOODWAYS			
		FLOOD ELEVATION			
		LOCATION OF EXISTING SYSTEM			
2	POST DESIGN				
		SUPPLIER DETAILS			
		SHIPPERS LIST			
3	ERECTION	CONTRACT DOCUMENTS			
		PROPER SITE LAYOUT			
		3 SETS OF DRAWINGS ALONG WITH PERMITS			
		TECHNICAL DRAWINGS			
4	TECHNICAL DRAWINGS				
		APPROVAL DRAWINGS			
		DESIGN , FABRICATION AND ERECTION PLAN			
		ELECTRICAL , PLUMBING OTHER SERVICE			
		GENERAL ARRANGEMENT DRAWINGS			
		RAFTER DRAWINGS			

DOCUMENTS CHECKLIST

DOCUMENTS CHECKLIST						
S.NO	DOCUMENTS			AVAILABLE	NOT AVAILABLE	REMARKS
5	DESIGN , FABRICATION AND ERECTION					
		LOCATION OF MEMBERS				
		SIZE AND SECTIONS				
		COLUMN LOCATIONS AND DIMENSIONS				
		LOAD CALCULATIONS				
		ANCHOR BOLT SETTING PLAN	LAYOUT OF ALL BOLTS			
		ROOF FRAMING PLAN	INDICATION OF PURLINS , BRACINGS , SAG RODS , STRUT TUBES			
		CROSS SECTIONS	COLUMNS, RAFTER REFERENCES, PURLINS, GIRTS, VERTICAL AND ROOF BRACINGS, CONNECTION DETAILS, BOLT SCHEDULES, FLANGE BRACE SCHEDULES AND OTHER DETAILS AS APPLICABLE, SUCH AS STRUT TUBES, FLASHING ETC.			
		ROOF SHEETING LAYOUT	ROOF PANELS WITH DIMENSIONS , PANEL LAP DETAILS , SKYLIGHT POSITIONS , DOWNSPOUT POSITIONS , STANDARD DETAILS OF FASTNERS , TRIMS , INSULLATIONS			
		SIDEWALL SHEETING AND FRAMING	NUMBER OF GRITS , EAVES STRUTS , BRACINGS AND SAG RODS NEEDED TO FIND THE POSITION OF PANELS			
		RAFTER DRAWINGS				
		OTHER DRAWINGS	DOOR DETAILS , MEZZANINE LAYOUTS			
		SHIPPERS LIST	BILL OF MATERIAL .			
6	SCHEDULE	WBS , LPS				
7	QUALITY ASSURANCE CHECKLIST	QA/QC PLANS AND CHECKLISTS				

PRE- FAB QUALITY ASSURANCE CHECKLIST				
S.NO	DESCRIPTION	SATISFACTORY	NOT SATISFACTORY	REMARKS
	FABRICATION			
A	DRAWINGS			
1	SHOP DRAWINGS WITH DETAILED CONNECTIONS			
2	MEMBERS SHOULD BE NUMBERED			
3	STEEL GRADE AND SIZE			
4	CERIFICATIONS AND FACILITIES			
5	CHECK FOR NECESSARY FACILITIES FOR WELDING AND SHELTER FABRICATION YARD			
6	VALID CERTIFICATIONS FOR WELDERS			
B	MARKING AND CUTTING			
1	TOLERANCE LEVEL FOR STEEL MEMBERS			
2	MARKINGS			
C	FASTENINGS			
1	BOLT TYPES			
2	BOLT DIMENSIONNS			
3	POSITION OF BOLTS ACCORDING TO THE DRAWINGS			
4	DRILLING SIZEE VERIFICATION			
5	DRILLING ACCORDING TO THE DRAWINGS			
6	WASHER GRADE AND TYPE			
7	THREAD OF THE BOLT SHOULD BE 1.5MM BEYOND THE THREAD			
8	EMBEDMENT LENGTH AND HOLDING ARRANGEMENT OF THE BOLTS			

QUALITY ASSURANCE

PRE- FAB QUALITY ASSURANCE CHECKLIST

S.NO	DESCRIPTION	SATISFACTORY	NOT SATISFACTORY	REMARKS
D	WELDING CONNECTIONS			
1	SIZE AND POSITION ACCORDING TO THE PLAN			
2	SURFACE SHOULD BE FREE FROM DUST AND RUST			
3	VERIFY THE WELDER			
4	APPROVED WELDING PROCEDURE			
5	CHECK FOR WELDING DEFECTS SUCH AS UNDERCUTS , PITS CRACKS , LACK OF FUSION			
E	SURFACE			
1	SHOULD BE CLEANED AND WIRE BRUSHED			
2	SPECIFICATIONS ACCORDING TO THE DRAWINGS			
F	PRE - ERECTION			
1	BASEPLATE CHECKING AND RECTIFICATION			
2	ANCHOR BOLT CHECK			
3	PROPER LAYOUT			
4	TWO CIVIL , ONE WELDER			
5	WEILDING MACHINE , MEASUREMENT TAPE , WATER LEVEL TUBE , ALL TEMPLATES (TO FIX COLUMNS OF PEB)			
G	POST ERECTION			
1	CENTER - CENTER MEASUREMENTS			
2	CENTER - CENTER MEASUREMENTS			
3	LEVEL OF TMT BARS - BASE PLATE PLACEMENET			
4	ANCHOR BOLT THREADS SHOULD BE ABOVE THE TEMPLATE LEVL			
5	ANCHOR BOLTS SHOULD BE WELDED WITH COLUMN BARS AND COVERED WITH SHUTTERS			
6	POST COLUMN CONSTRUCTION			
7	RE-CHECK (BECAUSE OF VIBRATIONS THERE CAN BE BENDING OF COLUMN 5MM - TOLERANCE)			

QUALITY ASSURANCE

PRE- FAB QUALITY ASSURANCE CHECKLIST				
S.NO	DESCRIPTION	SATISFACTORY	NOT SATISFACTORY	REMARKS
H	PRE - SETTING OF ANCHOR BOLTS			
1	CHECK THE FFL			
2	CONCRETING SHOULD BE 25MM BELOW THE FFL			
I	COLUMN INSTALLATION			
1	PRE - COLUMN INSTALLATION			
2	CHECK THE BOLT TIGHTNESS			
3	TEMPORARY BRACINGS - SHOULD BE ON THE TWO SIDES OF THE COLUMN			
J	ROPES			
1	PP ROPES - 20MM DIA			
2	WIRE ROPE - 12MM DIA			
3	POST CONSTRUCTION			
4	CHECK THE PLUMB OF THE COLUMN ON EITHER SIDES			
5	CHECK THE STABILITY OF THE SLINGS AFTER THE RELEASE OF THE LOAD			
K	FIXING OF THE GRITS			
1	GRITS SHOULD BE TIED WITH ROPE WITH SAFTEY LOCK HOOK TO LIFT GRITS			
2	CHECK NORMAL TORQUE			

QUALITY ASSURANCE

PRE- FAB QUALITY ASSURANCE CHECKLIST

S.NO	DESCRIPTION	SATISFACTORY	NOT SATISFACTORY	REMARKS
L	RAFTER INSTALLATIONS			
1	ID MARKING ON RAFTERS			
2	ASSEMBLY SHOULD BE DONE ON THE GROUND			
3	TORQUE CHECK FOR HIGH STRENGTH BOLTS			
4	TEMPORARY BRACINGS (AT EVERY 6M)			
5	CHECK FOR RAFTER PLATE CONNECTIONS			
M	BAY CHECKING			
1	CHECK FOR CALIBRATION			
2	VERTICALITY CHECK FOR COLUMN AND PLUM OF THE COLUMN			
3	RAFTER ALIGNMENT			
N	ROOF			
1	CHECK FOR LEAKAGES FROM ROOF SHEETING			
2	ALIGNMENT OF GUTTER			
3	SAG RODS INSTALLED ACCORDING TO DRAWINGS			
O	PURLINGS , GRITS AND EAVES			
1	CHECK FOR STRAIGHTNESS			
2	TIGHTENED WITH RAFTERS			
P	POST CONSTRUCTION			
1	CHECK FOR DEFECTS			
2	CLEAN UP OF SITE			
3	PREPARATION OF PUNCH LIST			
4	HANDING OVER			

SECURITY cum VISITOR BLOCK							SECURITY cum VISITOR BLOCK				
Sl. No.	Description of Item	Tender					Additional			Total Amount	Remarks
		Unit	Qty.	Rate	Amount	Remarks	Rate	Qty	Amount		
	A. CIVIL WORKS										
	EARTH WORK EXCAVATION										
1	Earthwork excavation by mechanical means (Hydraulic excavator) for foundations, trenches, etc., not exceeding 1.5m in width or 10 Sqm on plan in hard gravelly soil and other types of soil excluding hard rocks require blasting including bailing of water if necessary, dressing of sides, shoring, benching, levelling and ramming the bottom of trenches etc., all complete										
a	All kinds of soil upto 1.5 metre depth from GL	56.00	113.00	270.00	30,510.00					30 510	
b	For depth greater than 1.50 Mtrs up to 3.00 Mtrs from GL	Cu.m	56.00	300.00	16,800.00					16 800	
	BACK FILLING				-						
2	Filling available selected excavated earth within project premises (excluding rock) in and around basement, plinth, sides of foundation etc.,for all leads and lifts (lead upto 50m and lift upto 2.5m.) in layers not more than 300mm in depth including breaking clods, consolidating each deposited layer by ramming and watering etc., all complete	Cu.m.	169.00	141.00	23,829.00					23 829	
	BASEMENT FILLING				-						
3	Supplying and Filling with good quality selected earth (MURRUM /Hill earth/ Approved soil minimum CBR value of 8%;) brought from outside source in and around basement, plinth, sides of foundation etc., for all leads and lifts in layers not more than 300mm in depth including conveyance by lorry load, breaking clods, consolidating each deposited layer by ramming (Vibratory rollers/ Mechanical earth rammers) and watering etc., all complete.(Minimum density of compaction 95% proctor density).(Compaction test / 500sqm in each layer).The filling materials shall be test for minimum CBR before collection.	Cu.m.	-	1,050.00			1050	52.01202	54 613	54 613	
4	Supplying and Filling with crusher powder around basement, plinth, sides of foundation etc., for all leads and lifts in layers not more than 300mm in depth including conveyance by lorry load, each deposited layer by ramming (Vibratory rollers/ Mechanical earth rammers) and watering etc., all complete.	Cu.m.	-	2,658.00							

ESTIMATION

5	Providing and laying Hard core/ Granular sub base with minimum CBR value of 50%; in layers not more than 150mm with stone aggregate 63mm to 45mm size including stone screening 11.2mm size complete including mechanical rolling (Vibratory rollers/ Mechanical earth rammers)and consolidation.(Minimum density of compaction 95% proctor density).(Compaction test / 500sqm in each layer).The filling materials shall be test for minimum CBR before collection.	Cu.m	20.00	1,800.00	36,000.00					36 000	
	PRE - CONSTRUCTION ANTI -TERMITE				-						
6	Providing Pre-Construction Anti-termite Treatment using Chloropyriphos E.C. 20% with 1% concentration as detailed below including cost of chemicals, labour, tools & plants and all other incidental charges for entire ground floor area of building and injecting termicide emulsion to the soil in contact with the foundation along the perimeter of both internal and external walls, etc., (Plinth area of the building at ground floor only shall be measured for payment).	Sq.m.	66.00	75.00	4,950.00					4 950	
	1) Top surface of consolidated earth within plinth walls shall be treated with chemical emulsion @ 5 Ltr / Sqm of the surface before the PCC is laid.				-						
	2) Treatment along the external perimeter of the building shall be treated with chemical emulsion @ 5 Ltr / Sqm to facilitate this holes shall be provided upto 300mm below GL & 600mm apart for external perimeter.				-						
	PLAIN CEMENT CONCRETE				-						
7	Providing and laying in position of Plain Cement Concrete 1:4:8 (One Cement, Four M.Sand and Eight hard broken stone jelly) using 40 mm gauge hard broken granite stone jelly for foundation, trenches etc., including mechanical mixing, ramming, compaction, levelling, curing, dewatering, if any including the cost of formwork etc., all complete.	Cu.m	20.00	5,172.00	1,03,440.00					1 03 440	
8	Providing and laying in position of M7.5 (Cement content 170kg/cum) or Plain Cement Concrete 1:4:8 (One Cement, Four M.Sand and Eight hard broken stone jelly) using 20 mm gauge hard broken granite stone jelly for foundation, trenches etc., including mechanical mixing, ramming, compaction, levelling, curing, dewatering, if any including the cost of formwork etc., all complete.	Cu.m	-	5,271.00							

ESTIMATION

9	Providing and laying M10 (Cement content 220kg/cum) or Plain Cement Concrete P.C.C 1:3:6 using (1Cement :3 M.Sand:6 Aggregate) 20 mm size hard broken stone including mechanical mixing, ramming, compaction, levelling, curing, dewatering, if any including the cost of formwork etc., all complete	Cu.m	-	5,892.00						
	REINFORCED CEMENT CONCRETE				-					
10	Providing and casting Reinforced Cement Concrete of the following grades and locations as per approved design mix by Weigh batching using OPC cement and Using manufactured sand conforming to IS 383 and 20mm and down grade size hard granite broken stones including all charges for designing the mix, in situ weigh batching or RMC from outside source, mixing concrete, cost of adding concrete admixtures as required, transporting, dewatering if any ,laying, vibrating, consolidating, curing with minimal use of water subject to provision of IS 456, etc. all complete but excluding cost of form work (steel, silver wood planks & plywood and reinforcement etc., all complete as per drawings in items like Footings, Pedestals, columns, floor, roof beams and slabs, lintels, sun-shades, Stair-cases, Balcony , water tanks, etc., as per drawings and specifications.)				-					
i	M25 GRADE - upto floor finish level with minimum cement content of 360kg/cum				-					
a	Footings	Cu.m	12.00	7,491.00	89,892.00				89 892	
b	Column & Pedestal upto Grade beam level	Cu.m	3.00	7,767.00	23,301.00		7767	0.8625	6 699	30 000
c	Grade beam /Plinth beam	Cu.m	9.00	7,656.00	68,904.00				68 904	
ii	M25 GRADE - Above floor finish Level upto Ground floor roof level with minimum cement content of 360kg/cum				-					
a	Columns	Cu.m	3.00	8,043.00	24,129.00				24 129	
b	Sill slabs	Cu.m	1.00	8,343.00	8,343.00				8 343	
c	Lintel & Sunshade	Cu.m	6.00	8,208.00	49,248.00				49 248	
d	Roof & stairs Beam	Cu.m	3.00	8,043.00	24,129.00				24 129	
e	Roof slab	Cu.m	9.00	8,043.00	72,387.00				72 387	
	SHUTTERING & CENTERING WORKS				-					

ESTIMATION

11	Shuttering & Centering Works: Shuttering and centering for foundation, columns, beams, slabs, shear walls, retaining walls and similar concrete structural components including nails, spans, props, scaffolding and staging require for the safe execution of work. Shuttering for shear walls, retaining walls and similar members shall be carried out using plywood. Shuttering for footings, columns, grade beams, plinth beams shall be with plywood or steel box, shuttering for roof slabs shall be with steel or plywood, shuttering for roof beams shall be with plywood or finished silver wood planks.									
a	Footing & Raft	Sqm	29.00	375.00	10,875.00					10 875
b	Pedastal	Sqm	6.00	450.00	2,700.00		450	13.25	5 963	8 663
c	Coloumn upto basement	Sqm	26.00	450.00	11,700.00					11 700
d	Coloumn upto GF roof level	Sqm	44.00	450.00	19,800.00					19 800
e	Grade beam /Plinth beam	Sqm	68.00	420.00	28,560.00					28 560
f	Lintel & Sunshade in GF	Sqm	73.00	525.00	38,325.00					38 325
g	GF Roof beam	Sqm	45.00	600.00	27,000.00					27 000
h	GF Roof slab	Sqm	66.00	600.00	39,600.00					39 600
i	Sill slab in GF	Sqm	9.00	450.00	4,050.00					4 050
	STEEL REINFORCEMENT				-					
12	Providing, cutting, bending, placing and binding Steel reinforcement using ISI -TMT bars of Fe-500 grade or above in all reinforced cement concrete works including transporting from Steel yard, preparation of bar bending schedules, cutting, bending, fixing, tying in position with 20G soft drawn annealed binding wire, cost of cover blocks etc., complete as per specifications and drawings.	MT	5.00	89,700.00	4,48,500.00		89,700.00	0.129615	11 626	4 60 126
	MASONRY WORK				-					
13	Providing and constructing Brick masonry at all lifts with well burnt country bricks class designation 5 in Cement Mortar 1:5 (1 cement : 5 M.sand) in sub structure including curing, raking out joints, etc., all complete .				-					
	Upto Ground floor finish Level	Cu.m.	7.00	8,340.00	58,380.00		8340	14.651	1 22 189	1 80 569
14	Providing and constructing Brick masonry at all lifts with well burnt country bricks class designation 5 in Cement Mortar 1:5 (1 cement : 5 M.sand) in super structure including scaffolding, curing, raking out joints, etc., all complete .				-					
a	Ground floor finish Level upto Ground floor roof level	Cu.m.	41.00	8,565.00	3,51,165.00					3 51 165
d	Staircase steps.	Cu.m.		9,300.00	-					
	HALF BRICK MASONRY WORK				-					

ESTIMATION

15	Providing and constructing Brick masonry 115 mm tk.at all lifts with well burnt country bricks class designation 5 in Cement Mortar 1:4 (1 cement : 4 M.sand) in super structure including scaffolding, curing, raking out joints,providing Hoop iron at every third layer etc., all complete.			-							
	Ground floor finish Level upto Ground floor roof level	Sq.m.	5.00	1,071.00	5,355.00					5 355	
	INTERNAL PLASTERING			27,276.00	-						
16	Plastering with Cement mortar 1:5, (One cement and Five P.sand) 15mm thick over brickwork. block work / Concrete on internal faces including Lead & lift, hacking of concrete surfaces with pointed tool, scaffolding, curing and forming grooves wherever necessary all complete.			-							
a	Ground floor finish Level upto Ground floor roof level	Sq.m.	246.00	450.00	1,10,700.00					1 10 700	
	EXTERNAL PLASTERING				-						
17	Plastering with Cement mortar 1:4, (One cement and Five P.sand) 20mm thick for brickwork, block work, concrete on its external faces including Lead & lift, hacking of concrete surfaces with pointed tool, scaffolding, curing and forming grooves wherever necessary all complete.			-							
a	Ground floor finish Level upto Ground floor roof level	Sq.m.	252.00	480.00	1,20,960.00		480	45.1125	21 654	1 42 614	-
	CEILING PLASTERING				-						
18	Plastering with Cement mortar 1:4, (One cement and Five P.sand) 15mm thick for Rcc slab ceiling upto 3.6m height from FFL including Lead & lift, hacking of concrete surfaces with pointed tool, scaffolding, curing and forming grooves wherever necessary all complete.			-							
a	Ground floor roof ceiling	Sq.m.	110.00	465.00	51,150.00					51 150	
19	Supply and fixing of GI chicken mesh 15mm x 28G wherever the rcc and masonary joints, scaffolding curing etc complete as instruction of engineering -in charge.	Sq.m.	60.00	60.00	3,600.00					3 600	
20	Cornice work	RM	43.00	2,100.00	90,300.00					90 300	
	INTERNAL PAINTING				-						
21	Painting all internal facesof newly plastered wall surface two coats of ready mixed interior Acrylic emulsion of approved colour and brand (Asian, Berger, Nerolac, MRF) over a priming coat including thorough scrapping, clean removal of dirt and including two coats of wall putty complete .	Sq.m.	356.00	390.00	1,38,840					1 38 840	
	EXTERNAL & CEILING PAINTING				-						

ESTIMATION

22	Painting two coats of newly plastered all External faces wall surface with Weather Proof Exterior paint of approved colour and brand (Asian, Berger, Nerolac, MRF) over a priming coat including thorough scrapping, clean removal of dirt and including two coats of external wall putty, wherever required etc., complete complying with standard specification.	Sq.m.	252.00	405.00	1,02,060.00		405	45.1125	18 271	1 20 331
	TILES FOR REST ROOM WALLS									
24	Providing and fixing Premium Quality dadoing walls with glazed tiles of approved design & colour in SOMANY/KAJARIA or approved equivalent make. Tile set in Cement Mortar 1:4 (One Cement and Three M.sand) 12mm thick and pointing the joints with coloured tile grout in complete.. The basic cost of Tile Rate shall be maximum of Rs 50/Sqft.	Sq.m.	26.00	1,674.00	43,524.00					43 524
	TILES FOR REST ROOM FLOOR				-					
25	Providing and laying Premium quality flooring with vitrified/ Ceramic tiles of approved design & colour in SOMANY / KAJARIA or approved equivalent laid over 20 mm thick cement mortar 1:4 (One Cement and Four M.Sand) base mortar over the existing slab / floor including cutting the tiles to the required size with special cutter wherever necessary, laying in position and pointing with coloured tile grout etc., complete . The basic cost of Tile Rate shall maximum of Rs50/Sqft.	Sq.m	5.00	1,590.00	7,950.00					7 950
	OFFICE FLOOR TILES				-					
26	Providing and laying Premium quality flooring with Double charge vitrified tiles of approved design & colour in SOMANY / KAJARIA or approved equivalent laid over 20 mm thick cement mortar 1:4 (One Cement and Four M.Sand) base mortar over the existing slab / floor including cutting the tiles to the required size with special cutter wherever necessary, laying in position and pointing with coloured tile grout etc., complete . The basic cost of Tile Rate shall maximum of Rs60/Sqft.	Sq.m	48.00	1,840.00	88,320.00					88 320
27	Above in Shirting 100mm high	RM	62.00	270.00	16,740.00					16 740
	WEATHER PROOF CERAMIC TILE				-					

ESTIMATION

28	Providing and laying Premium quality weather proof ceramic tiles in SOMANY / KAJARIA or approved equivalent laid over 20 mm thick cement mortar 1:4 (One Cement and Four M.Sand) base mortar over the existing slab / floor including cutting the tiles to the required size with special cutter wherever necessary, laying in position and pointing with coloured tile grout etc., complete . The basic cost of Tile Rate shall maximum of Rs60/Sqft.	Sq.m	65.00	1,800.00	1,17,000.00						1 17 000
29	Above in Skirting 100mm high	RM	42.00	255.00	10,710.00						10 710
	GRANITE FLOORING FOR STAIRS				-						
30	Providing and laying good quality mirror polished Granite stone Slabs of 18mm thick +/- 2mm laid over 20 mm thick cement mortar 1:4 (One Cement and Four M.Sand) base mortar over the existing slab / floor including cutting the slabs to the required size , laying in position and edge polishing etc., complete .for . The basic cost of Granite Rate shall be maximum of Rs.100/Sqft.	Sq.m	20.00	3,342.00	66,840.00						66 840
	GRANITE COUNTERTOPS				-						
31	Providing and laying good quality mirror polished Black Granite stone Slabs of 18mm thick +/- 2mm for kitchen platforms, vanity counters and similar locations in Extra for providing opening of required size & shape for wash basin/kitchen sink in kitchen platform, vanity counter and similar location in complete . The basic cost of Granite Rate shall be maximum of Rs 120/Sqft.	Sq.m.	6.00	3,750.00	22,500.00						22 500
	TERRACING				-						
32	Providing and laying water proofing treatment in sunken portion of terrace by applying two coats of cement slurry mixed with tapcrete or equivalent water proofing compound. The first layer will be allowed to air cure for 4 hours. Second layer will be allowed to air cure for 4 hours followed with water curing for 48 hours. The rate includes preparation of surface, treatment and sealing of all joints, corners, junctions of pipes and masonry with polymer mixed slurry.	Sqm	77.00	450.00	34,650.00						34 650
33	Providing Pressure grouting to stop the water leaks through the construction joints including the cost of drilling ,fixing nozzle ,admixture and completion of the same with renderoc plug of Fosroc make ,all complete.	No	-	180.00	-						
	JOINERS				-						
	DOORS				-						
	WINDOWS				-						

ESTIMATION

34	from roll formed sections made of galvanized steel Color Coated / Powder Coated (Base steel as per IS 513 'D' quality, galvanized as per IS 277 with zinc of 120 GM / Sq. Mtr.) with total coated thickness of 0.6mm. Coated Sections should be with Primer Coat of Epoxy Primer of 5-7 microns thick, finish painted with a polyester paint of 12-16 microns thick and back coated with Alkyd backer of 5-7 microns or powder coated with pure polyester powder up to 50- 60 microns thick. Sections for shutter should be of 47 x 20mm and external frame should be of 48 x 50mm. Section for glass beading should be of 12 x 12mm and center mullion should be of 48mm x 50mm. The Frame & Shutter Sections should be cut to length and miter joined with Corner Bracket made of CRCA electroplated. Mullion Section should be joined with Frame / Mullion using Nylon Mullion Cap Ethyl Propylene Diamine Monomer (EPDM) Gasket should be used all around glass in shutter, between frame and glazed shutter and both sides of fixed glass. Handle, Stay 2 no of stainless steel heavy duty pivot hinges Gaskets made of Ethyl Propylene Diamine Monomer (EPDM). Corner brackets made of CRCA with zinc phosphate. Mullion caps made of glass filled nylon. Glass: Glass shutter and fixing glass portions should be provided with a glass of 4mm Plain Glass. Grill : Windows should be provided with Grill made of 10mm sq. MS Bars welded to, at 5" intervals centre to centre, 5mm x 12mm MS flat. Total grill unit should be powder coated and fixed to window frame with screws.	Sqm	15.00	6,450.00	96,750.00					96 750	
35	Above in Fixed ventilators without grills	Sqm	2.00	5,550.00	11,100.00					11 100	
	Aluminium DOORS				-						
37	Supplying, Providing and fixing in position powder coated anodised Aluminium work in Doors fabricated with Aluminium extruded sections including necessary hold fasts, all fixtures and fastenings of 5mm thick glass at top and 8mm thick bison laminated board at bottom fixed with special gasket felt and Aluminium beading, door handle 6", door closer, door stopper all in complete	sqm	11.00	5,250.00	57,750.00					57 750	
	Solid PVC Doors:				-						

ESTIMATION

38	Providing & erecting Solid PVC doors made out of EXTRUDED PROFILE with wall thickness 5mm. The Frame shall be made of profile of size 55 x 65mm. The Door's rails & stiles shall be made of PVC PROFILE 35mm x 80mm and the inner panel shall be of 5mm colored PVC Grade sheet. Necessary lock rail made of 85mm wide PVC taper extruded Strip will be pasted using PVC solvent cement adhesive on middle of inner panel of the door. The door shall be provided stainless steel hinges & Alumium powder coated hardwares.	Sqm	4.00	3,900.00	15,600.00					15 600	
	DOWN TAKE PIPES				-						
39	Providing and fixing of 110 mm dia PVC rain water down take pipes with necessary, shoes, bends, door bends, offset pieces etc (6 kg/cm2) including scaffolding.	RM	20.00	840.00	16,800.00					16 800	
40	M25 or 1:1.5:3 mix in levelling coarse	CUM	5.00	7,491.00	37,455.00					37 455	
41	Providing and laying 50mm thick grano flooring over 100mm thick PCC 1:4:8 and 100mm thick GSB including cost of earth work & sectioning for Plinth Protection	Sqm	35.00	480.00	16,800.00					16 800	
	A. CIVIL WORKS				28,99,971.00				2,41,014.48	31,40,985.48	
	B.Sanitary & Cp fittings & Plumbing										
47	Indian Type Water Closet with Accessories (Parryware Orissa Pan White): Providing and fixing vitreous China white glazed Indian Type Water Closet (Orissa Pan) with "P" or "S" trap, Parryware slimline PVCcistern , PVC flush pipe 32/40 mm, PVC brided hose connection pipe with CP brass coupling (15mm), Jaguar Continental model CP brass angle valve (15mm) all of approved make complete	No	1.00	7,200.00	7,200.00					7 200	
51	Parryware Wall Fixed Wash Basin :Supply and fixing of white glazed vitreous china wall Fixed Wash Basin Circular 450mm x 300mm dia CP brass waste coupling fittings, PVC brided hose connection pipe with CP brass angle valve all of approved make and quality complete CP items - Jaguar Continental model	No	1.00	5,400.00	5,400.00					5 400	
	Parryware white Maganum Urinal with accessories Manual Flush type: Providing and fixing white glazed vitreous China Parryware white Maganum Urinal , Jaguar Continental modelCP brass angle cock, CP brass flush pipe (15 mm), CP brass spreaders with CP brass union and clamp , PVC waste pipe with CP brass coupling, etc with all bye-works	No	1.00	8,760.00	8,760.00					8 760	

ESTIMATION

	Supplying and fixing 16 mm thick Granite Double side polished urinal Partition to fix with the inbetween urinals with edge polishing including SS clamps etc complete.The maximum basic price of granite Rs.120 / SFT	No	1.00	4,800.00	4,800.00					4 800	
52	Supplying and fixing Following chromium plated bath room & kitchen C.P fittings (JAQUAR Continental model)				-						
a	Pillar cock	No	1.00	2,100.00	2,100.00					2 100	
b	Long body bib cock	No	-	1,872.00	-						
c	Two in one bib cock	No	1.00	1,872.00	1,872.00					1 872	
d	Health fausecut	No	1.00	1,590.00	1,590.00					1 590	
e	Angle valve	No	-	1,131.00	-						
f	Urinal Push Valve	No	1.00	2,970.00	2,970.00					2 970	
53	Supplying and fixing Following PVC bath room & kitchen C.P fittings (Water tech brand)				-						
a	Double coat hook	No	2.00	600.00	1,200.00					1 200	
b	Mirror 500mmx700mm (Water tec brand)	No	1.00	1,800.00	1,800.00					1 800	
c	Liquid soap dispenser	No	1.00	900.00	900.00					900	
54	Supplying and fixing 16 mm thick Granite Double side polished urinal Partition to fix with the inbetween urinals with edge polishing including SS clamps etc complete.The maximum basic price of granite Rs.120 / SFT	No	1.00	4,800.00	4,800.00					4 800	
	WATER SUPPLY				-						
55	S. I. T. & C. in position Chlorinated Polyvinyl Chloride (Jain/Finolex/ Astral/ Ashirwad make CPVC pipes) SDR-11/13.5 pipes as per ASTM D-2846 standard, having thermal stability for hot & cold water supply, including all CPVC plain & brass threaded fittings, including concealing the pipes in walls or under floors, including making chases in the walls, fixing in the wall with M.S. clamps and making good the wall surface fixing the pipe with support clamps at 1.00 m spacing, includes jointing of pipes & fittings with one step CPVC solvent cement and testing of joints at pressure 7Kg/Cm ² , etc. complete				-						
a	40 mm dia	RM	-	534.00	-						
b	32 mm dia	RM	6.00	390.00	2,340.00					2 340	
c	25 mm dia	RM	6.00	252.00	1,512.00					1 512	
d	20 mm dia	RM	4.00	159.00	636.00					636	
e	15 mm dia	RM		105.00	-						

ESTIMATION

56	Supply and fixing Leader/Equ Make Basic Ball Valve, Pressure/Class Rating: PN-25, Body Material Cum Std.: Forged Brass (EN:12165 Gr. CW617N), Nickel Plated, Port Opening: Full Bore, Product Description: Two Piece Design, Lever Operated, Type of Seat: Renewable PTFE Seat, Ball: Machined Brass, Cr.Plated Stem: Machined Brass, End Details: Screwed Female BSP Parallel, Threads, Test Pressure: B.T.P. - 30 Bar Hyd.; S.T.P.- 22 Bar Hyd.									
a	40 mm dia	No			-					
b	32 mm dia	No	1.00	1,857.00	1,857.00				1 857	
c	25 mm dia	No		1,359.00	-					
d	20 mm dia	No		927.00	-					
e	15 mm dia	No		618.00	-					
57	S. I. T. & C. in position ASTM Polyvinyl Chloride (ASTM-PVC) SCH 40 pipes as per ASTM including all ASTM PVC plain & brass threaded fittings, including fixing in the wall / Supports with GI clamps at 1.00 m spacing, includes jointing of pipes & fittings with one step PVC solvent cementetc. complete				-					
a	40 mm dia	RM		498.00	-					
b	32 mm dia	RM		291.00	-					
c	25 mm dia	RM		219.00	-					
d	DRAINAGE			150.00	-					
58	Supplying and fixing 6kg PVC pipes of Jain/Finolex/ Bhavani/Truebore and pipe specials of Prince/ star make, cutting, fixing the pipe specials, making joints using solvent cement solution, fixing pipes in position to a perfect alignment, providing and fixing PVC GI pipe clams to vertical and exposed pipe work, making holes in masonry, restoring the damaged portions to original condition, cutting grooves in walls to conceal the pipe wherever required, providing cement mortar 1:4 mix to the concealed portions of pipe conducting leak test to pipe work etc. complete				-					
a	40 mm dia	RM	6.00	108.00	648.00				648	
b	75 mm dia	RM	6.00	356.00	2,136.00				2 136	
c	110 mm dia	RM	6.00	741.00	4,446.00				4 446	
59	Supplying and fixing 6kg PVC pipes of Jain/Finolex/ Bhavani/Truebore and pipe specials of Prince/ star make, cutting, fixing the pipe specials, making joints using solvent cement solution for underground drainage and sewerage systems - pipe in trenches to required gradients etc., complete.				-					
a	160 mm dia	RM		1,566.00	-					

b	200 mm dia	RM		2,472.00	-						
c	300mm dia	RM		8,280.00	-						
60	Providing and fixing in position FRP cover of size in levels etc complete(medium duty)				-						
a	300X300	No		1,359.00	-						
b	450X450	No		2,475.00	-						
c	600X600	No		4,954.00	-						
d	900X900	No		10,560.00	-						
61	Providing and erecting 110mm dia PVC Floor traps in position laying cement concrete to 75mm alround in 1:3:6 mix.	No	3.00	300.00	900.00					900	
62	Providing and erecting 300 x 300mm Internal Size gully trap chamber in position laying cement concrete to 75mm alround in 1:3:6 mix.	No	1.00	1,200.00	1,200.00					1 200	
63	Providing and fixing SS Grating	No	3.00	750.00	2,250.00					2 250	
64	Providing Inspection Chamber of inner size 600mm x600 mm upto 1000mm deapth-Hardcore 100mmTHK , Raft 150mmTHK, , BrickWall 230mmTHK, Cover slab 100mmTHK including Earth wrk, plaster with CM1:4 inner & exposed outer surface.	No	1.00	13,500.00	13,500.00					13 500	
65	Supply, instalation and delivery of OCEAN Ready made septic tank (Length x Dia -2440mmx 790mm) 20 flush /day capacity inculding soak pit	No	1.00	48,000.00	48,000.00					48 000	
	B.Sanitary & Cp fittings & Plumbing				1,22,817.00					1 22 817	
	SECURITY GROUND FLOOR & TERRACE.				30 22 788				2 41 014	32 63 802	

CASH FLOW

SL NO.	DESCRIPTION	UNIT	RATE	QTY			AMOUNT	COMPLETION MONTH	CASH FLOW											
									1 Month	2 Month	3 Month	4 Month	5 Month	6 Month	7 Month	8 Month	9 Month	10 Month	11 Month	12 Month
				TENDER	ADDITIONAL	TOTAL			Amount	Amount	Amount	Amount	Amount	Amount	Amount	Amount	Amount	Amount	Amount	
1	UPTO GRADE BEAM																			
	EARTHWORK EXCAVATION UPTO 1.5M DEPTH	Cum	270	113.000		113.000	30510	3	-	-	30510	-	-	-	-	-	-	-	-	-
	EARTHWORK EXCAVATION ABOVE 1.5M - 3M DEPTH	Cum	300	56.000		56.000	16800	3	-	-	16800	-	-	-	-	-	-	-	-	-
	GSB FILLING - FOUNDATION AND GRADE BEAM	Cum	1800	9.887		9.887	17796.51	3	-	-	17796.51	-	-	-	-	-	-	-	-	-
	PRE- CONSTRUCTIONAL ANTI TERMITE	Sqm	75	66.000		66.000	4950	3	-	-	4950	-	-	-	-	-	-	-	-	-
	PLAIN CEMENT CONCRETE (1:4:8) - FOUNDATION AND GRADE BEAM	Cum	5172	9.898		9.898	51193.4904	3	-	-	51193.49	-	-	-	-	-	-	-	-	-
	AVAILABLE EARTH FILLING - FOUNDATION AND GRADE BEAM	Cum	141	169.000		169.000	23829	3	-	-	23829	-	-	-	-	-	-	-	-	-
	RCC								-	-	-	-	-	-	-	-	-	-	-	-
	FOOTING	Cum	7491	12.000		12.000	89892	3	-	-	89892	-	-	-	-	-	-	-	-	-
	PEDESTAL	Cum	7767	1.000		1.000	7767	3	-	-	7767	-	-	-	-	-	-	-	-	-
	COLUMN	Cum	7767	1.123		1.123	8723.686848	3	-	-	8723.687	-	-	-	-	-	-	-	-	-
	GRADE BEAM	Cum	7656	3.500		3.500	26796	3	-	-	26796	-	-	-	-	-	-	-	-	-
	SHUTTERING								-	-	-	-	-	-	-	-	-	-	-	-
	FOOTING	Sqm	375.00	29.000		29.000	10875	3	-	-	10875	-	-	-	-	-	-	-	-	-
	PEDESTAL	Sqm	450.00	6.000		6.000	2700	3	-	-	2700	-	-	-	-	-	-	-	-	-
	COLUMN	Sqm	450.00	14.571		14.571	6556.875	3	-	-	6556.875	-	-	-	-	-	-	-	-	-
	GRADE BEAM	Sqm	420.00	36.000		36.000	15120	3	-	-	15120	-	-	-	-	-	-	-	-	-
	REINFORCEMENT								-	-	-	-	-	-	-	-	-	-	-	-
	FOOTING	MT	89,700.00	0.327		0.327	29331.9	3	-	-	29331.9	-	-	-	-	-	-	-	-	-
	PEDESTAL	MT	89,700.00	0.000		0.000		3	-	-		-	-	-	-	-	-	-	-	-
	COLUMN	MT	89,700.00	0.201		0.201	17993.82	3	-	-	17993.82	-	-	-	-	-	-	-	-	-
	GRADE BEAM	MT	89,700.00	0.431		0.431	38660.7	3	-	-	38660.7	-	-	-	-	-	-	-	-	-
									-	-	-	-	-	-	-	-	-	-	-	-
2	ABOVE GRADE BEAM UPTO BASEMENT								-	-	-	-	-	-	-	-	-	-	-	-
	BASEMENT BRICKWORK	Cum	8340	7.000	14.651	21.651	180569.34	3	-	-	180569.3	-	-	-	-	-	-	-	-	-
	HILL EARTH FILLING	Cum	1050		52.01202	52.012	54612.621	3	-	-	54612.62	-	-	-	-	-	-	-	-	-
	GSB FILLING	Cum	1800	10.113		10.113	18203.49	3	-	-	18203.49	-	-	-	-	-	-	-	-	-
	PCC	Cum	5172	10.102		10.102	52246.5096	3	-	-	52246.51	-	-	-	-	-	-	-	-	-
	RCC								-	-	-	-	-	-	-	-	-	-	-	-
	COLUMN UPTO BASEMENT LEVEL	Cum	7767	0.877	0.86	1.739	13509.35065	3	-	-	13509.35	-	-	-	-	-	-	-	-	-
	PLINTH BEAM	Cum	7,656.00	3.500		3.500	26796	3	-	-	26796	-	-	-	-	-	-	-	-	-
	STEPS	Cum	7,656.00	2.000		2.000	15312	3	-	-	15312	-	-	-	-	-	-	-	-	-
	SHUTTERING								-	-	-	-	-	-	-	-	-	-	-	-
	COLUMN UPTO BASEMENT LEVEL	Sqm	450.00	11.429	13.25	24.679	11105.625	3	-	-	11105.63	-	-	-	-	-	-	-	-	-
	PLINTH BEAM	Sqm	420.00	32.000		32.000	13440	3	-	-	13440	-	-	-	-	-	-	-	-	-
	REINFORCEMENT								-	-	-	-	-	-	-	-	-	-	-	-
	COLUMN UPTO BASEMENT LEVEL	MT	89,700.00	0.201	0.129614507	0.330	29620.24127	3	-	-	29620.24	-	-	-	-	-	-	-	-	-
	PLINTH BEAM	MT	89,700.00	0.347		0.347	31125.9	3	-	-	31125.9	-	-	-	-	-	-	-	-	-
									-	-	-	-	-	-	-	-	-	-	-	-
3	GROUND FLOOR								-	-	-	-	-	-	-	-	-	-	-	-
	MASONRY WORKS								-	-	-	-	-	-	-	-	-	-	-	-
	BRICK WORK	Cum	8,565.00	41.000		41.000	351165	4	-	-	-	351165	-	-	-	-	-	-	-	-
	HALF BRICK WORK	Sqm	1,071.00	5.000		5.000	5355	4	-	-	-	5355	-	-	-	-	-	-	-	-
	RCC								-	-	-	-	-	-	-	-	-	-	-	-
	COLUMN	Cum	8043	3.000		3.000	24129	4	-	-	-	24129	-	-	-	-	-	-	-	-
	ROOF AND STAIRS BEAM	Cum	8043	3.000		3.000	24129	4	-	-	-	24129	-	-	-	-	-	-	-	-
	ROOF SLAB	Cum	8043	9.000		9.000	72387	4	-	-	-	72387	-	-	-	-	-	-	-	-
	LINTEL BEAM & SUNSHADE	Cum	8,208.00	6.000		6.000	49248	4	-	-	-	49248	-	-	-	-	-	-	-	-
	SILL SLAB	Cum	8343	1.000		1.000	8343	4	-	-	-	8343	-	-	-	-	-	-	-	-
	SHUTTERING								-	-	-	-	-	-	-	-	-	-	-	-
	COLUMN	Sqm	450	44.000		44.000	19800	4	-	-	-	19800	-	-	-	-	-	-	-	-
	ROOF BEAM	Sqm	600	45.000		45.000	27000	4	-	-	-	27000	-	-	-	-	-	-	-	-
	ROOF SLAB	Sqm	600	66.000		66.000	39600	4	-	-	-	39600	-	-	-	-	-	-	-	-
	LINTEL BEAM & SUNSHADE	Sqm	525	73.000		73.000	38325	4	-	-	-	38325	-	-	-	-	-	-	-	-
	SILL SLAB	Sqm	450	9.000		9.000	4050	4	-	-	-	4050	-	-	-	-	-	-	-	-
	REINFORCEMENT								-	-	-	-	-	-	-	-	-	-	-	-
	COLUMN	MT	89,700.00	0.602		0.602	53981.46	4	-	-	-	53981.46	-	-	-	-	-	-	-	-
	ROOF BEAM	MT	89,700.00	1.108		1.108	99387.6	4	-	-	-	99387.6	-	-	-	-	-	-	-	-
	ROOF SLAB	MT	89,700.00	0.710		0.710	63687	4	-	-	-	63687	-	-	-	-	-	-	-	-
	LINTEL BEAM & SUNSHADE	MT	89,700.00	0.789		0.789	70773.3	4	-	-	-	70773.3	-	-	-	-	-	-	-	-
	SILL SLAB	MT	89,700.00	0.069		0.069	6189.3	4	-	-	-	6189.3	-	-	-	-	-	-	-	-
	STAIRCASE WAIST SLAB	MT	89,700.00	0.216		0.216	19375.2	4	-	-	-	19375.2	-	-	-	-	-	-	-	-

CASH FLOW

	PLASTERING							-	-	-	-	-	-	-	-	-	-	-	-
	CEILING PLASTERING	Sqm	465	110.000		110.000	51150	5	-	-	-	-	51150	-	-	-	-	-	-
	INNER PLASTERING	Sqm	450	246.000		246.000	110700	5	-	-	-	-	110700	-	-	-	-	-	-
	OUTER PLASTERING	Sqm	480	252.000	45.1125	297.113	142614	5	-	-	-	-	142614	-	-	-	-	-	-
	GI CHICKEN MESH	Sqm	60	60.000		60.000	3600	5	-	-	-	-	3600	-	-	-	-	-	-
	CORNICE	RM	2100	43.000		43.000	90300	5	-	-	-	-	90300	-	-	-	-	-	-
	TILE WORK								-	-	-	-		-	-	-	-	-	-
	RESTROOM FLOOR	Sqm	1590	5.000		5.000	7950	5	-	-	-	-	7950	-	-	-	-	-	-
	RESTROOM WALL	Sqm	1674	26.000		26.000	43524	5	-	-	-	-	43524	-	-	-	-	-	-
	OFFICE FLOOR TILE	Sqm	1840	48.000		48.000	88320	5	-	-	-	-	88320	-	-	-	-	-	-
	SKIRTING - OFFICE	RM	270	62.000		62.000	16740	5	-	-	-	-	16740	-	-	-	-	-	-
	STAIRCASE- GRANITE	Sqm	3342	20.000		20.000	66840	5	-	-	-	-	66840	-	-	-	-	-	-
	GRANITE COUNTERTOPS	Sqm	3750	6.000		6.000	22500	5	-	-	-	-	22500	-	-	-	-	-	-
	PAINTING								-	-	-	-		-	-	-	-	-	-
	EXTERIOR PAINTING AND CEILING	Sqm	405	252.000	45.1125	297.113	120330.5625	5	-	-	-	-	120330.563	-	-	-	-	-	-
	INTERIOR PAINTING	Sqm	390	356.000		356.000	138840	5	-	-	-	-	138840	-	-	-	-	-	-
									-	-	-	-		-	-	-	-	-	-
	JOINERS								-	-	-	-		-	-	-	-	-	-
	1000 SERIES WINDOWS (UPVC)	Sqm	6450	15.000		15.000	96750	5	-	-	-	-	96750	-	-	-	-	-	-
	VENTILATORS WITHOUT GRILLS	Sqm	5550	2.000		2.000	11100	5	-	-	-	-	11100	-	-	-	-	-	-
	DOOR D	Sqm	5250	11.000		11.000	57750	5	-	-	-	-	57750	-	-	-	-	-	-
	SOLID PVC DOORS	Sqm	3900	4.000		4.000	15600	5	-	-	-	-	15600	-	-	-	-	-	-
	SANITARY WORKS																		
	TOTAL SANITARY WORKS	EACH	122817	1.000		1.000	122817	5	-	-	-	-	122817	-	-	-	-	-	-
									-	-	-	-		-	-	-	-	-	-
	MISCELLANOUS								-	-	-	-		-	-	-	-	-	-
	PLINTH PROTECTION	Sqm	480	35.000		35.000	16800	5	-	-	-	-	16800	-	-	-	-	-	-
									-	-	-	-	-	-	-	-	-	-	-
6	TERRACE								-	-	-	-	-	-	-	-	-	-	-
	WEATHER PROOF TILE	Sqm	1800	65.000		65.000	117000	4	-	-	-	117000	-	-	-	-	-	-	-
	SKIRTING	Sqm	255	42.000		42.000	10710	4	-	-	-	10710	-	-	-	-	-	-	-
	WATER PROOFING	Sqm	450	77.000		77.000	34650	4	-	-	-	34650	-	-	-	-	-	-	-
	RAINWATER PIPE	RM	840	20.000		20.000	16800	4	-	-	-	16800	-	-	-	-	-	-	-
	LEVLLING COURSE	Cum	7491	5.000		5.000	37455	4	-	-	-	37455	-	-	-	-	-	-	-
						TOTAL COST	32 63 802		0	0	846037.1	1193539.86	1224225.56	0	0	0	0	0	0
						CUMILATIVE COST					846037.1	2039576.92	3263802.48						
						END MONTH													



INTERNSHIP REPORT
ENGINEERING PROJECT MANAGEMENT CONSULTANCY AND RESEARCH PRIVATE LIMITED
- AN IIT IMADRAS INCUBATED COMPANY

NIVEDHAA B
40840011-III SEM – II YR
M.ARCH-BUILDING MANAGEMENT
SATHYABAMA INSTITUTE OF SCIENCE AND TECHNOLOGY

BASKET BALL COURT, BASEMENT - SRM UNIVERSITY, CHENNAI .



POOR EXECUTION OF THE WORK DONE BY THE PREVIOUS CONTRACTOR .



- MISALIGNMENT OF THREADS.
- INAPPROPRIATE LENGTH OF THE THREADS ABOVE THE SLAB.



DESIGN FAILURE

16 OUT OF 80 COLUMNS DID NOT MEET THE DESIGN ED LOAD BEARING CAPACITY IN THE BASEMENT .

COLUMN JACKETING

Jacketing is the process of strengthening weak RCC columns which have deteriorated over some time due to adverse atmospheric conditions or due to poor maintenance of the structure. Other reasons during the construction phase include design errors, deficient concrete productions, bad execution process. During the service life, the need may arise due to an earthquake; an accident, such as collisions, fire, explosions; situations involving changes in the structure functionality; the development of more demanding code requirements. In these following cases, Jacketing is needed:

- The load carried by the column is increased.
- When there is an error in design.
- Deterioration of column due to weathering action.
- Heavy damage due to other causes like earthquake and fire.



SRM – SITE VISIT

Advantages of jacketing

- It increases the seismic capacity of columns.
- Amount of work is less as foundation strengthening is not required.
- It increases the shear strength of the column.
- It also increases the confinement of concrete in circular columns.
- Does not increase the significant weight of the column and also saves construction time (curing).
- Concrete jacketing or micro concrete jacketing technique increases existing strength of structural components like a beam, column.
- Concrete jacketing shields the concrete against deterioration and nourishes its strength capacity.
- High early and ultimate strength, durability, appearance, protection of steel, increase the column's shear capacity, preventing shrinkage in the plastic stage due to gaseous properties and increases its flexural strength.



Hacking of column



Placing of reinforcement



Drilling of Column – hook fixing .



Concreting of column starter



Applying of Fosroc Nitobond bonding agent using brush



Fixing of shutters



Removal of shuttering



Facilitating microcrete pouring from the top



Materials for Microcrete - Fosrac
Renderoc RG, 8 - 10 mm of
Aggregates & water



Mixing



Microcrete pouring



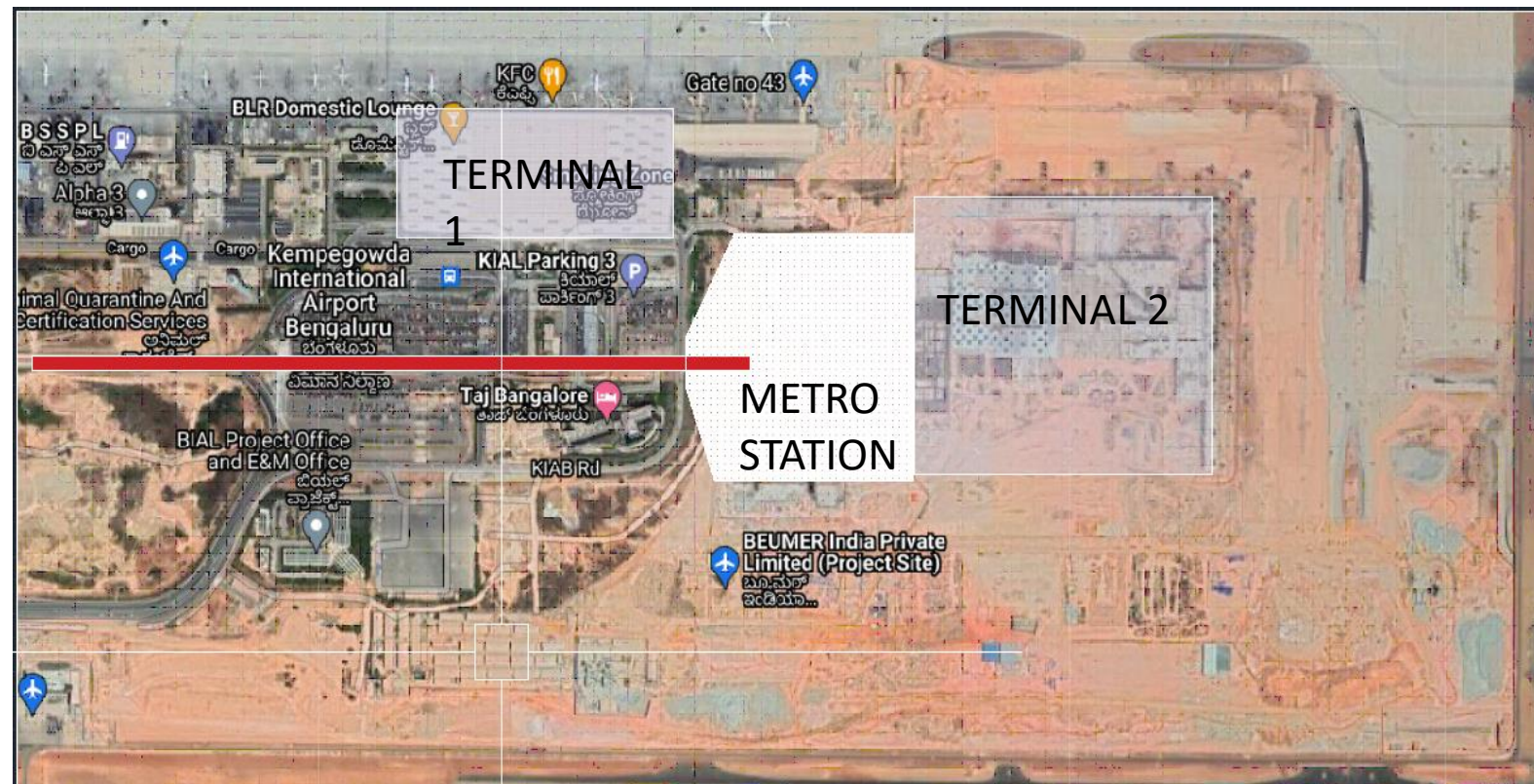
Compaction using wooden hammer



Removal of shuttering after 12 hours



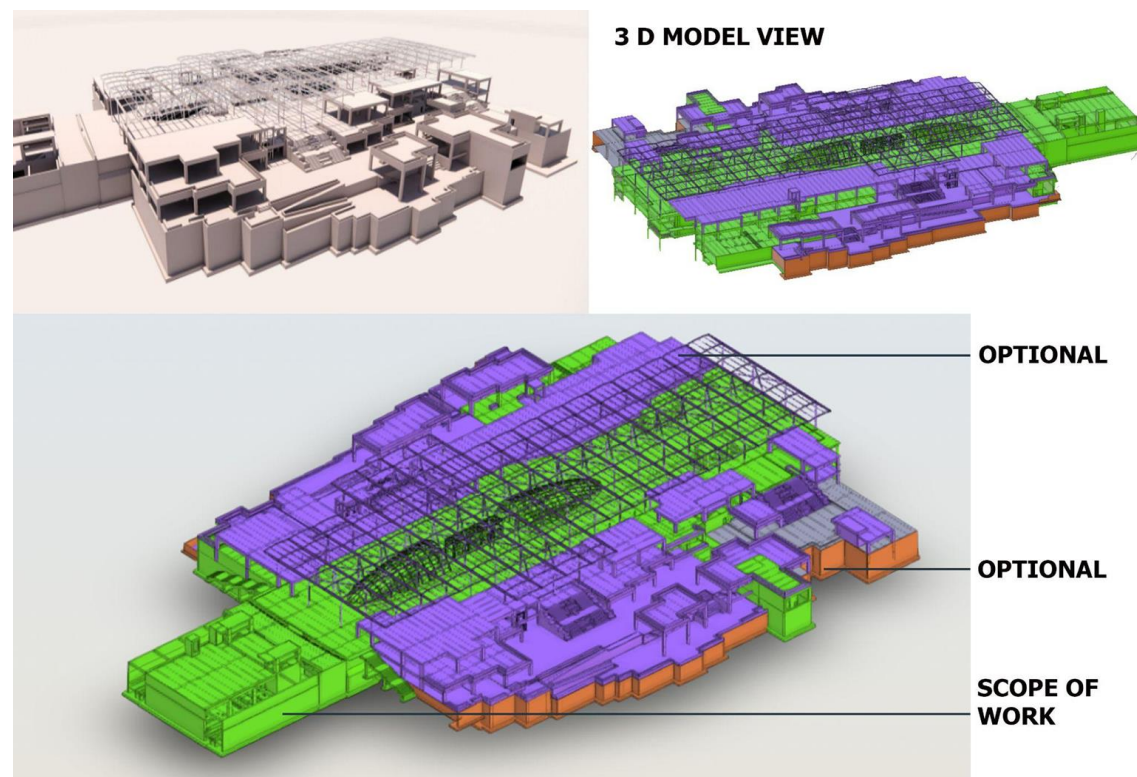
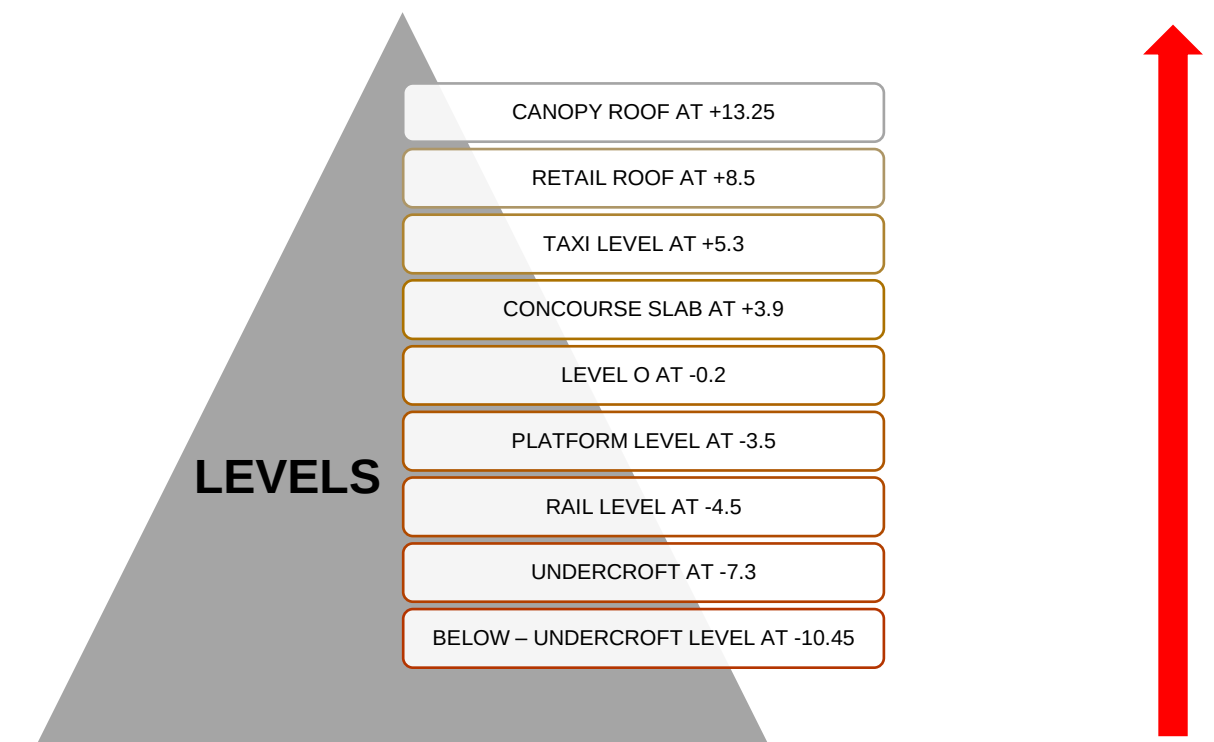
Curing for 3 days



Metro station proposal within the Bangalore International Airport .

SCOPE :

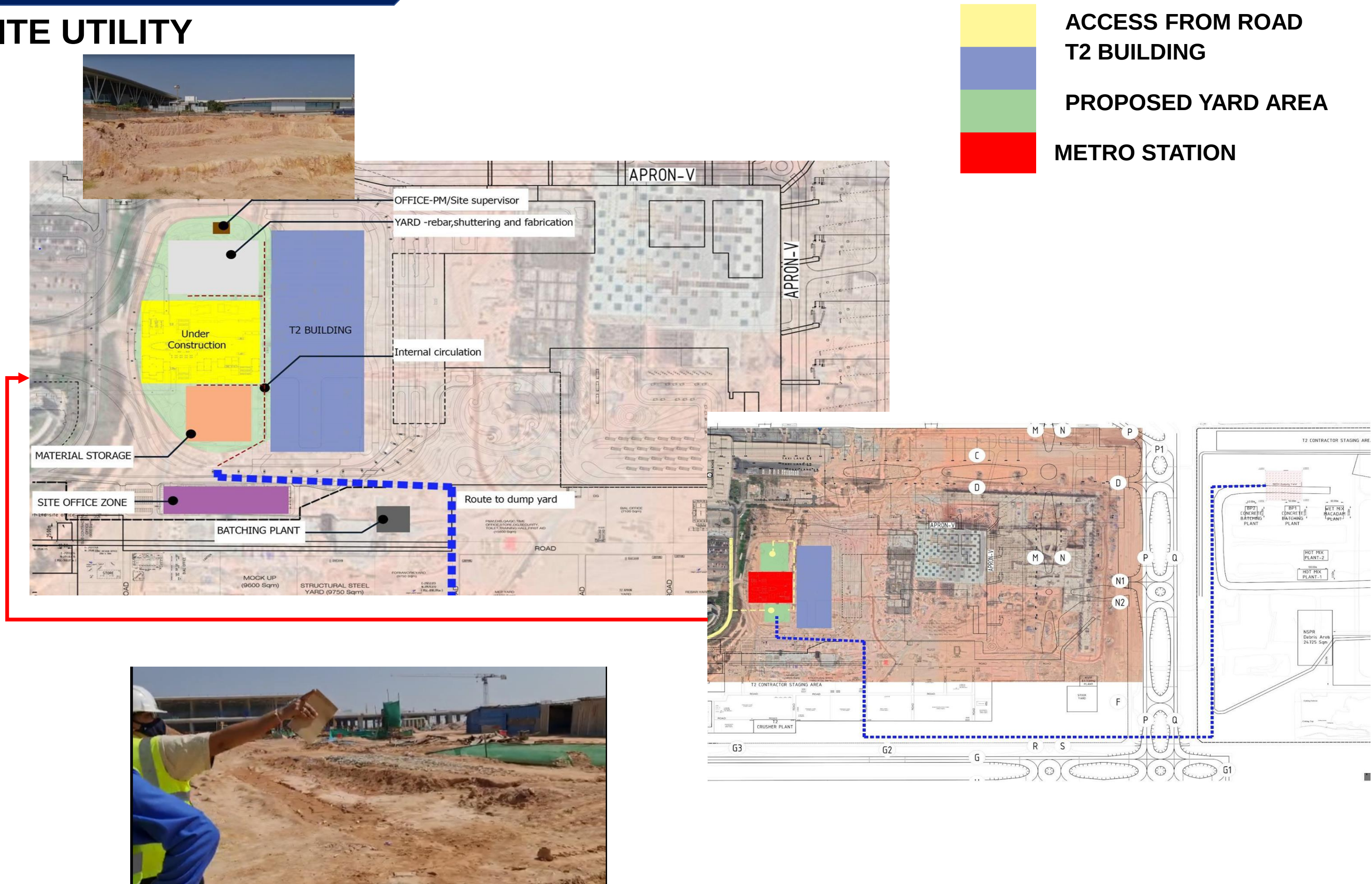
- Below Undercroft Level with a built- up area of approx. 300 sqm.
- Undercroft Level with a built-up area of approx 9212 sqm.
- Platform Level with a built-up area of approx 10331 sqm.
- Recirculation road bridge with a built-up area of approx 352 sqm.

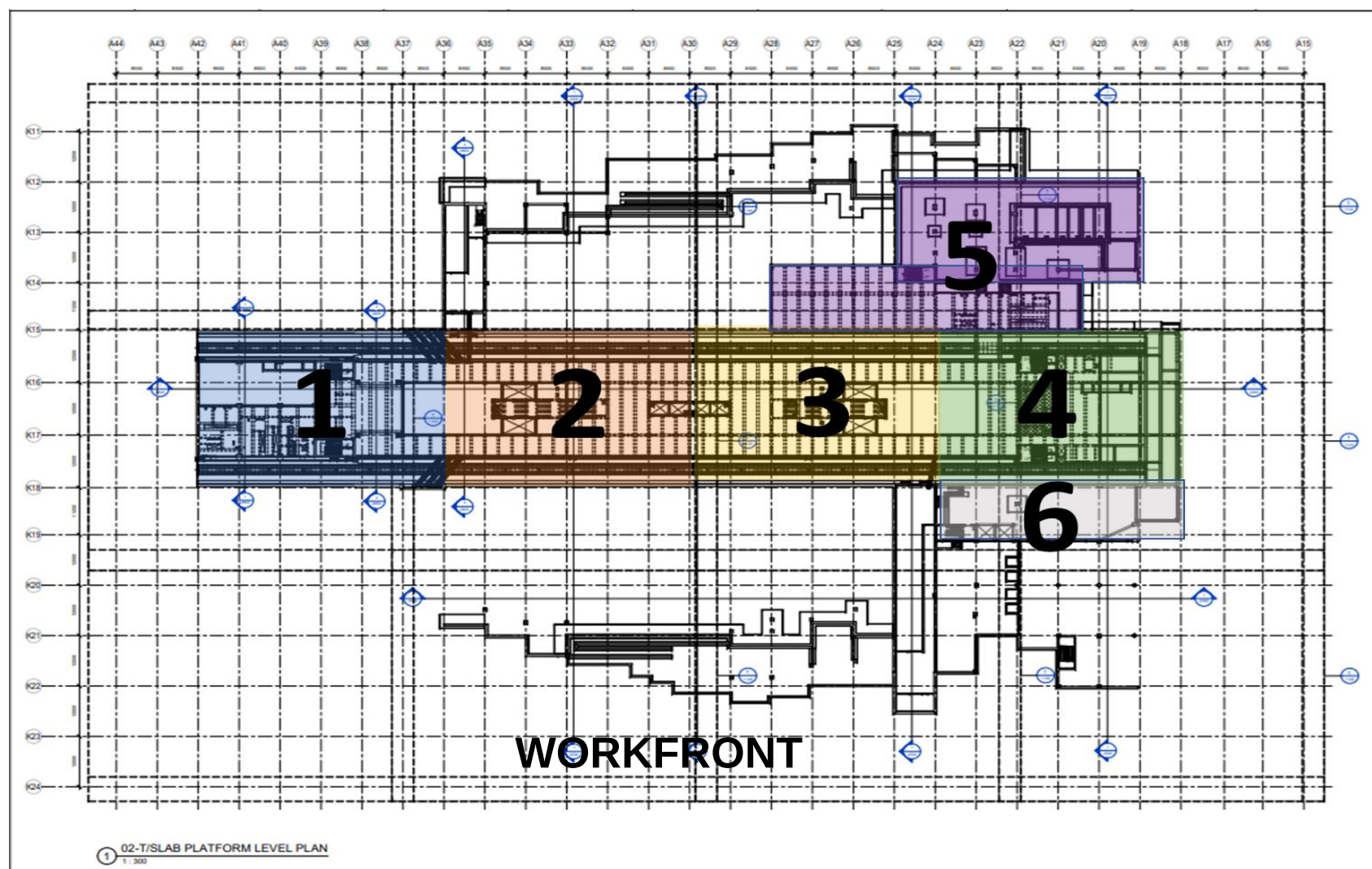


SCOPE OF WORK

- TVF rooms at Undercroft/Platform Level @ -7.15M from level 0 with a built up area of approx 900 sqm Level 0.
- OTE Shaft with a built-up area of approx 2427 Sqm Concourse Level @ +4.1M from level 0 with a built-up area of approx 12053 sqm.
- Loading dock Level @ -7.15M from Level 0 with a built-up area of approx 1226 sqm.
- Lagoon retaining wall length north side approx 163 m and south approx 236 m, these walls shall be priced separately for north and south walls accordingly.
- North and South of ATMS Retail zones with pedestrian Streets and retail spaces @ Level 0 with an overall area of approx 10947 sqm (Not part of the optional items scope, only dowels to be left for future construction as per the design)
- Interface with the recirculation road crossing metro station beyond metro station battery limits.

SITE UTILITY

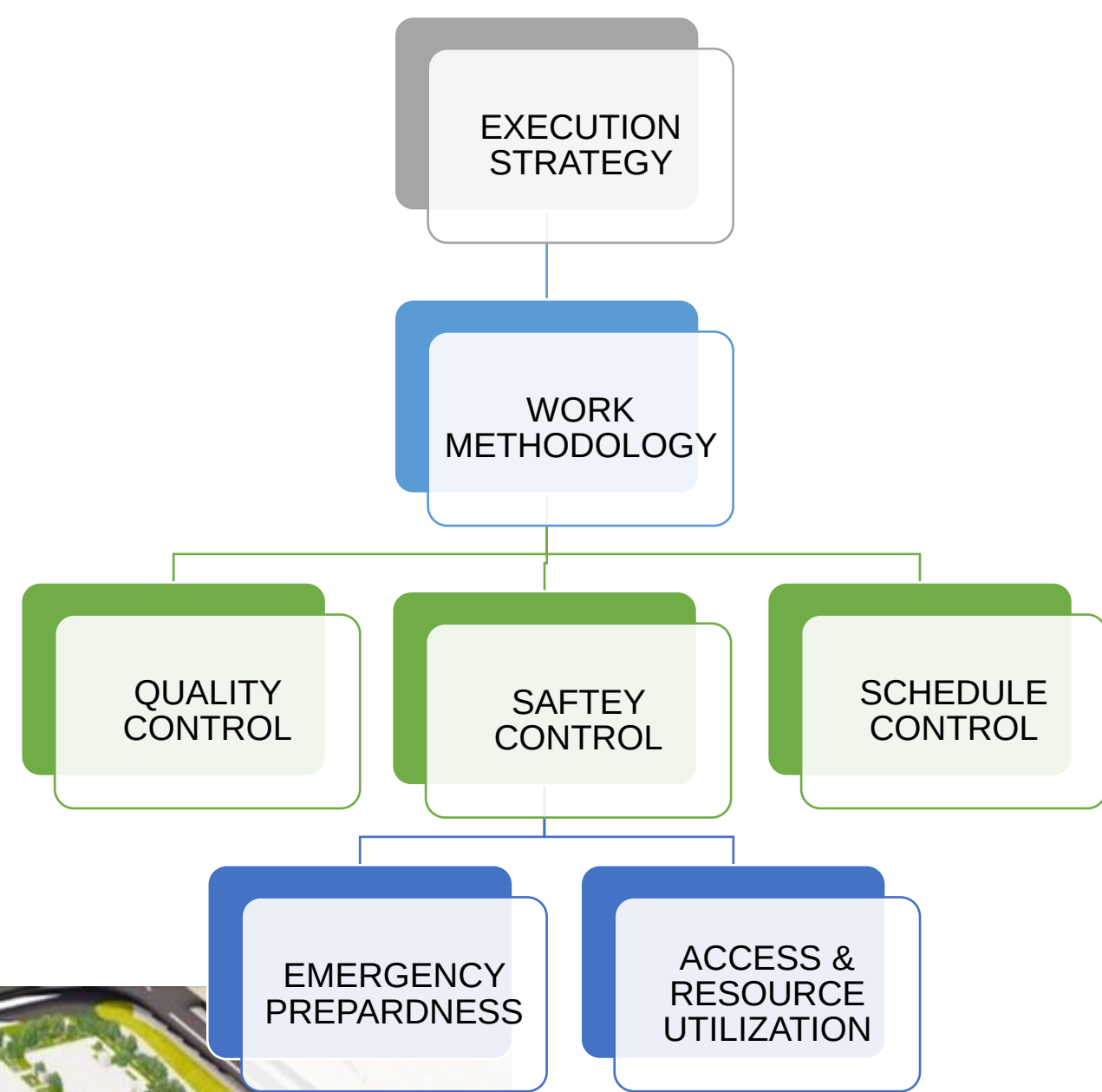




Zone	Grid Reference
01	K15 to K18 (A42 To A36)
02	K15 to K18 (A36 To A30)
03	K15 to K18 (A30 To A24)
04	K15 to K18 (A24 To A18)
05	K15 to K12 (A36 To A19)
06	K18 to K19 (A24 To A18)



EPMCR SCOPE

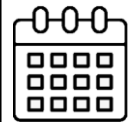


EXCAVATION

Total Volume : **109698 cu.m.** | Productivity per day : **3300 cu.m.**

Number of workfront : **Workfront : Zone 1, Zone 2, Zone 5**

Workfront : Zone 3, Zone 4, Zone 6



28th January 2022 - 01st March 2022



32 Days



Proposed Machinery:



- Excavators : 7 nos of 1.1cu.m bucket capacity ;
- Dumpers : 42 nos. @ 6 dumpers (9 cum) per excavator
- Breaker
- Grader
- Compressor
- Dewatering pumps

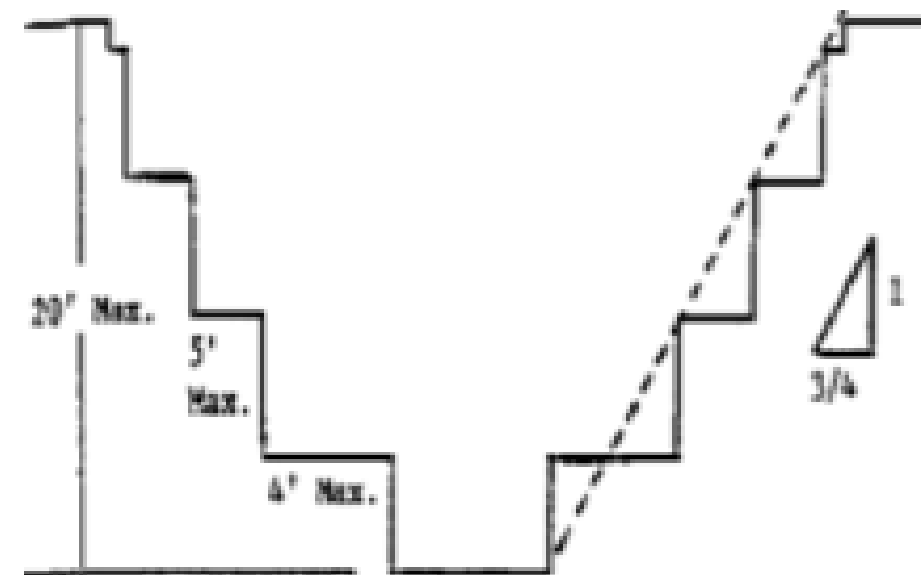
• TYPE OF EXCAVATION METHODOLOGY ADOPTED:

- All benched excavations 20ft (6Mt) or less in depth will have a maximum

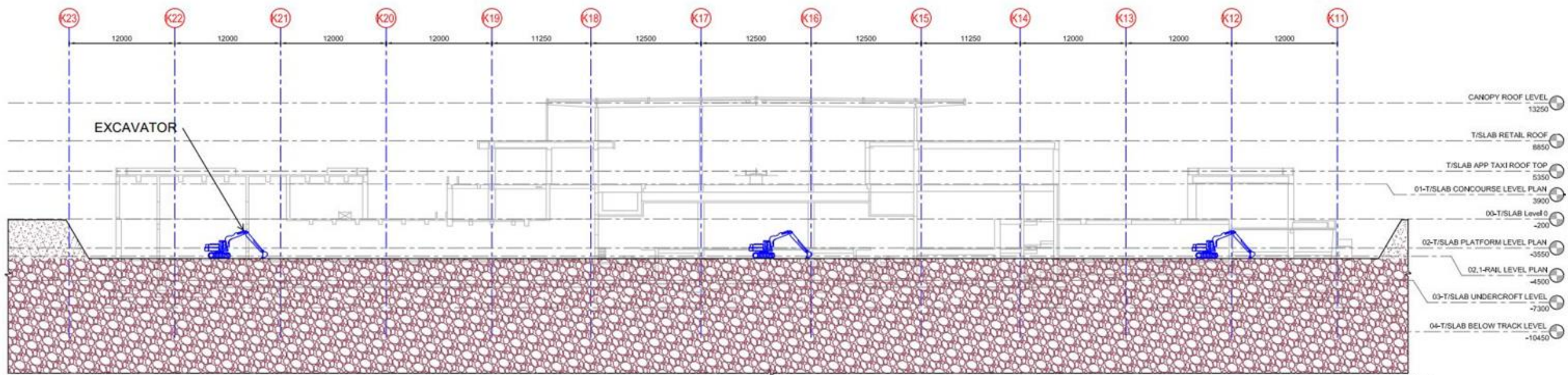
allowable slope of $\frac{3}{4}$ to 1 and maximum bench dimensions as indicated

WORK SAFETY MEASURES:

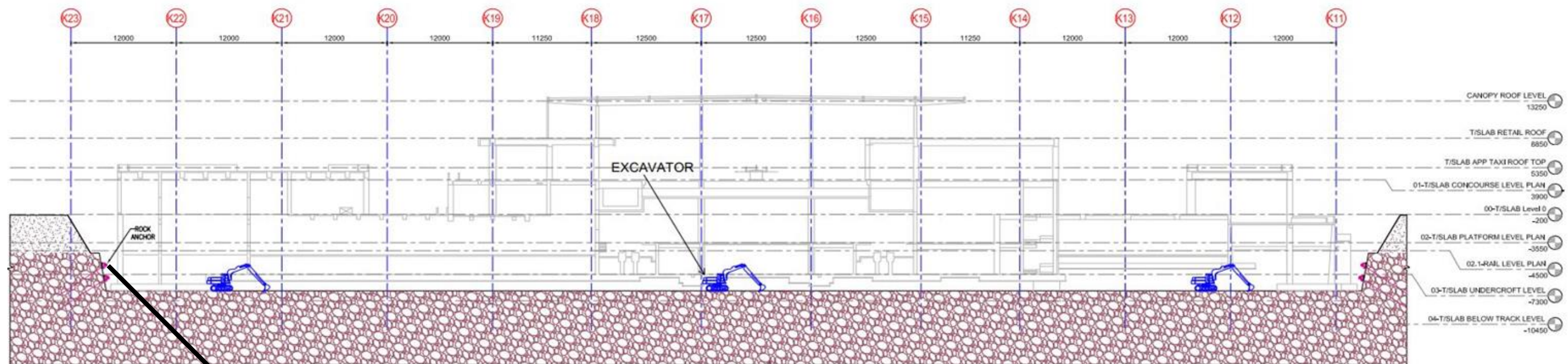
- Where any construction building worker engaged in excavation is exposed to hazard of falling or sliding material or article from any bank or side of such excavation which is more than one 1.2 m above his footing, such worker is protected by adequate piling and bracing against such bank or side.
- Where banks of an excavation are undercut, adequate shoring is provided to support the material or article overhanging such bank.
- Excavated material should not be stacked within $\frac{1}{3}$ rd of depth of the pit or 1.5 m whichever is more from the edge of an open excavation or trench and banks of such excavation or trench are stripped of loose rocks and the banks of such excavation or trench are stripped of loose rocks and other materials which may slide, roll or fall upon a construction building worker working below such bank.



EXCAVATION SEQUENCE 1-EXCAVATION OF TOPSOIL LAYER USING EXCAVATORS



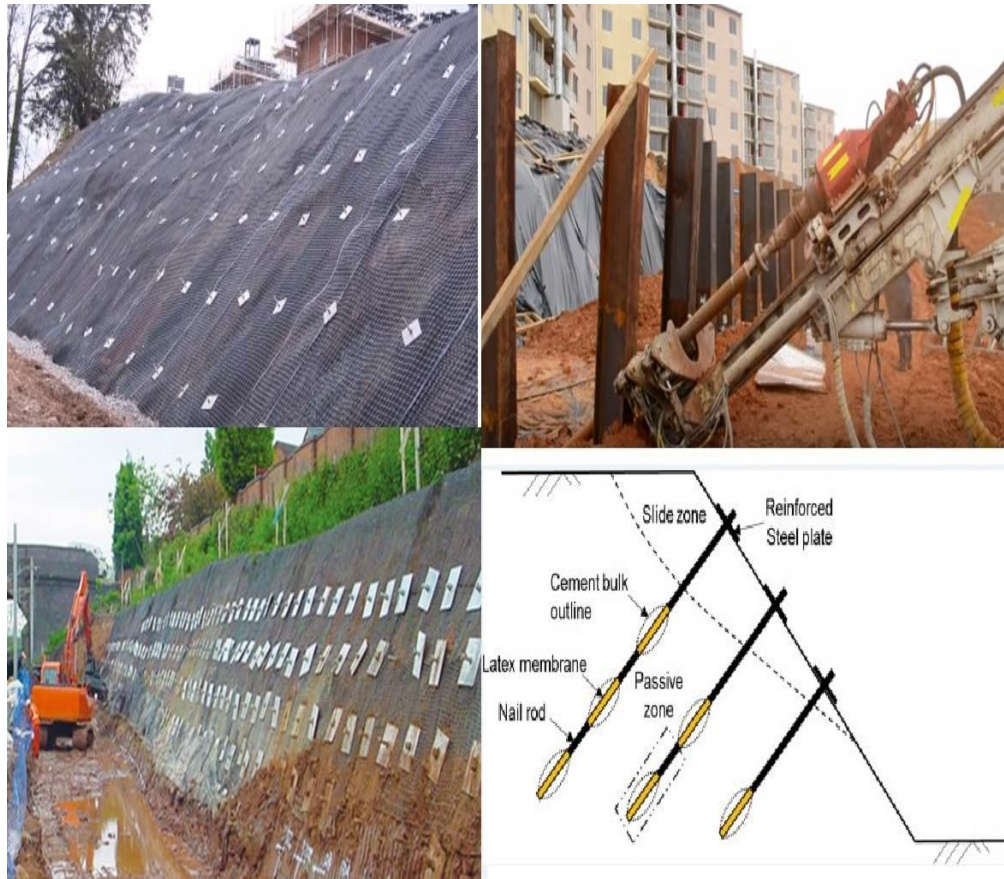
SEQUENCE 2 -EXCAVATION OF soft ROCK USING EXCAVATORS



Rock Anchoring for slope protection

SLOPE PROTECTION - SOIL NAILING

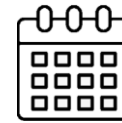
- Soil nailing is a ground stabilization technique where steel bars are drilled into a slope face and then grouted in place.
- A mesh is attached to the bar ends to hold the slope face in position.
- The soil should be capable of standing – without supports – to a height of 1-2 m for no less than 2 days when cut vertical or near-vertical.
- It is suitable for clayey , silty clays, glacial soils, sandy silts, sand, gravels and weathered rocks.



QUARRY DUST SAND FILLING - 100 mm thick



Total Volume : **1042 cu.m.** | Productivity per day : **75 cu.m.**
Volume per workfront : **174 cu.m.**



15th March 2022 - 19th March 2022



4 Days



Proposed Machinery:

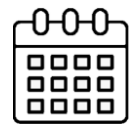
- Dumpers
- Grader
- Vibro-Roller



HDPE SHEET LAYING



Total Area : **10419 sq.m.** | Area per workfront : **1737 sq.m.**



Productivity per day : **5210 sq.m.**

04th April 2022 - 06th April 2022



2 Days



Flat coil construction process cleaning base layer—>base layer elastic line—> laying non-asphalt-based self-adhesive film waterproofing membrane coil lap joint—> detail node processing —> self-inspection, repair, acceptance—>Binding steel bar pouring concrete.



REINFORCEMENT WORK FOR RAFT/FOOTING:



Total Tonnage : **555MT** | Tonnage per workfront : **93MT**

Productivity per day : **70MT**

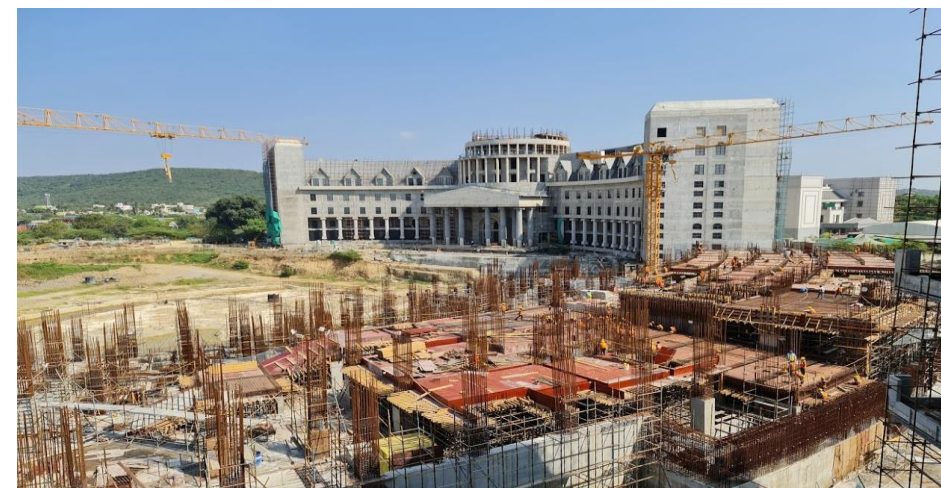


07th April 2022 - 15th April 2022

8 Days



The foundation slabs are **reinforced** with two wire meshes, one placed at the lower fibers and one at the upper fibers. Since the most intense stresses appear along the columns' axis, their surrounding areas are usually reinforced with stronger or double grates.



FORMWORKS FOR RAFTS



Total shuttering length of raft : **680 Rmt.** | Shuttering per workfront : **115 Rmt.**

Productivity per day : **97 Rmt.**



16th April 2022 - 23rd April 2022



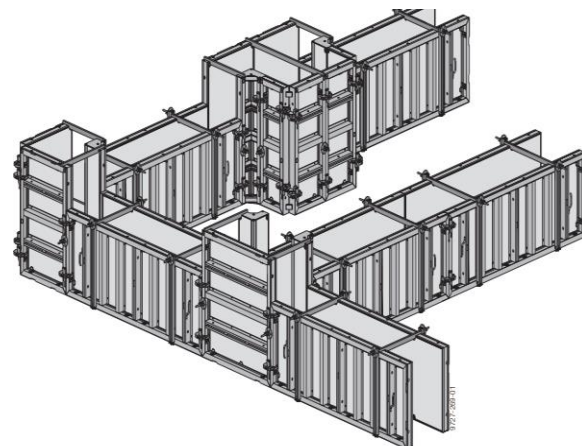
7 Days



Tie rod is held above panel (not in the concrete).
Tension bracing and compression bracing using just one tool.

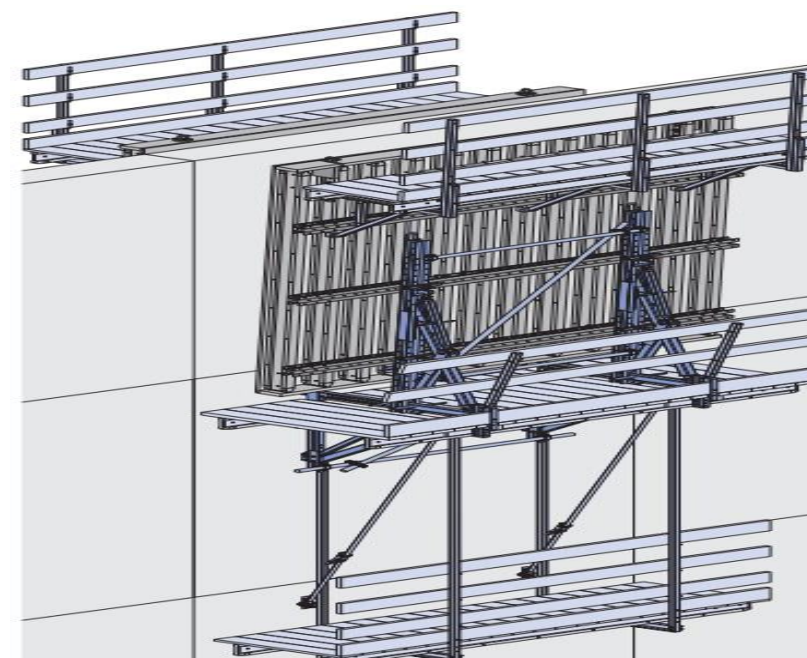
Wall thickness adjustable in 5-mm grid.

For foundation formwork of up to 1.35 m in height.



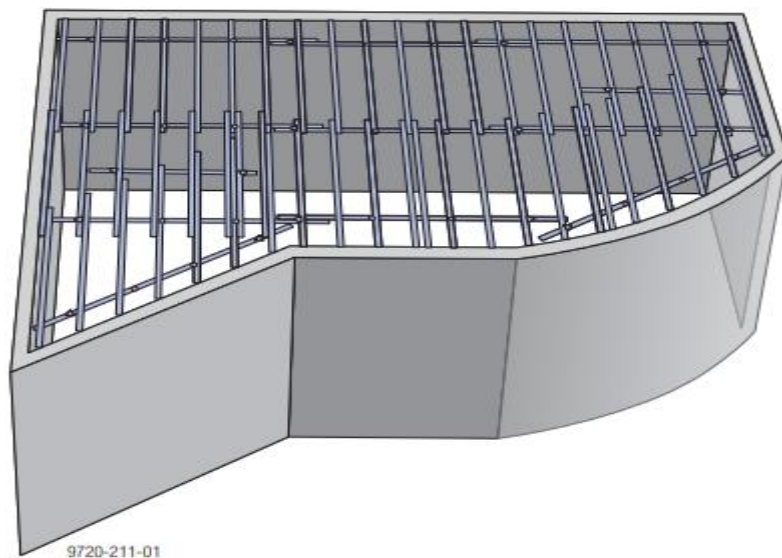
CLIMBING FORMWORK

- Allows easy adaptation to construction projects with vertical walls.
- Provides 1.65 m wide working platforms with an up to 70 cm roll-back for the formwork.
- Allows fast set-up and stripping of the formwork without crane assistance.
- It has a high load-bearing capacity (35 kN per Climbing bracket).
- Used for formwork heights of up to 6.0 m.



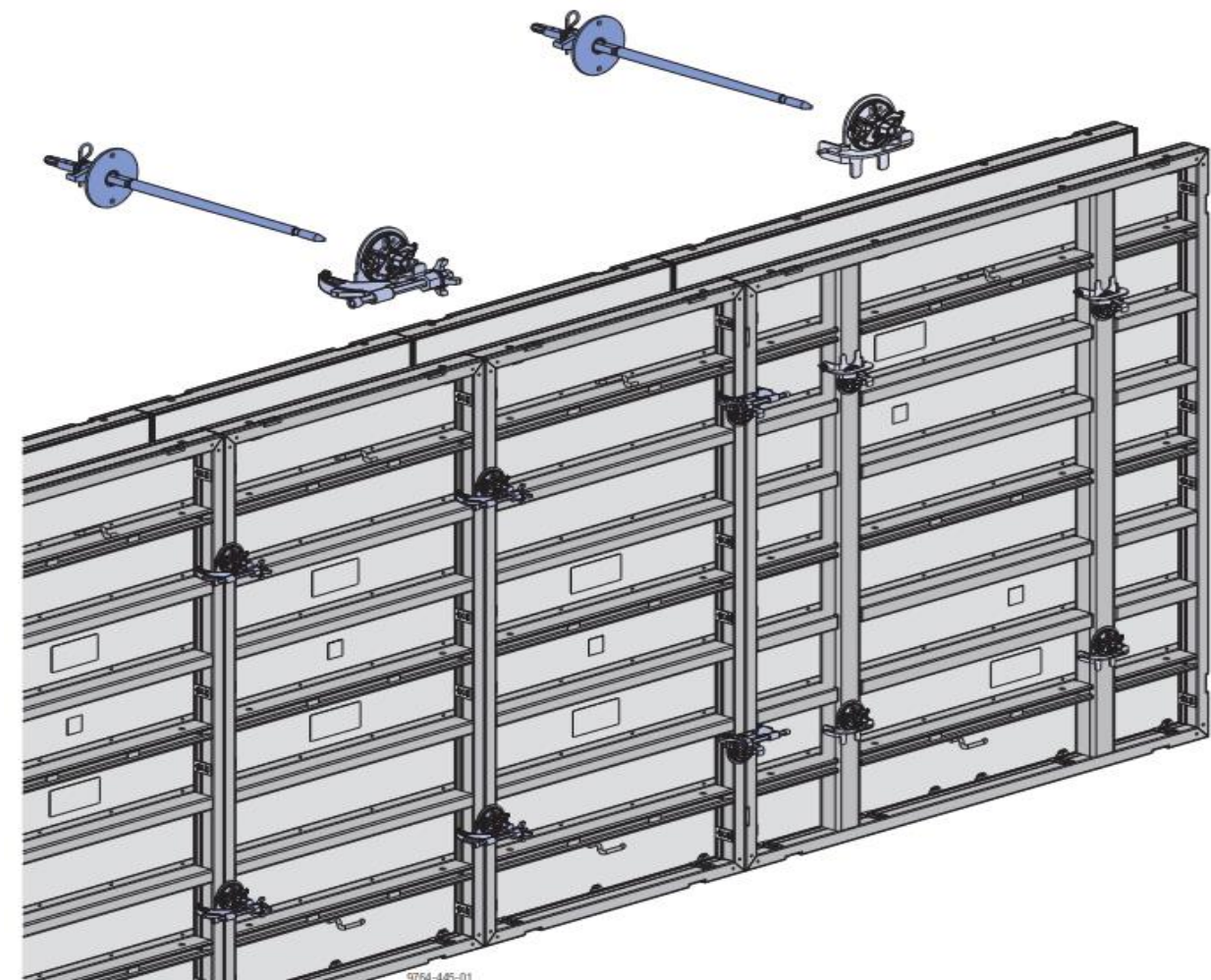
BEAM - FLOOR FORMWORK

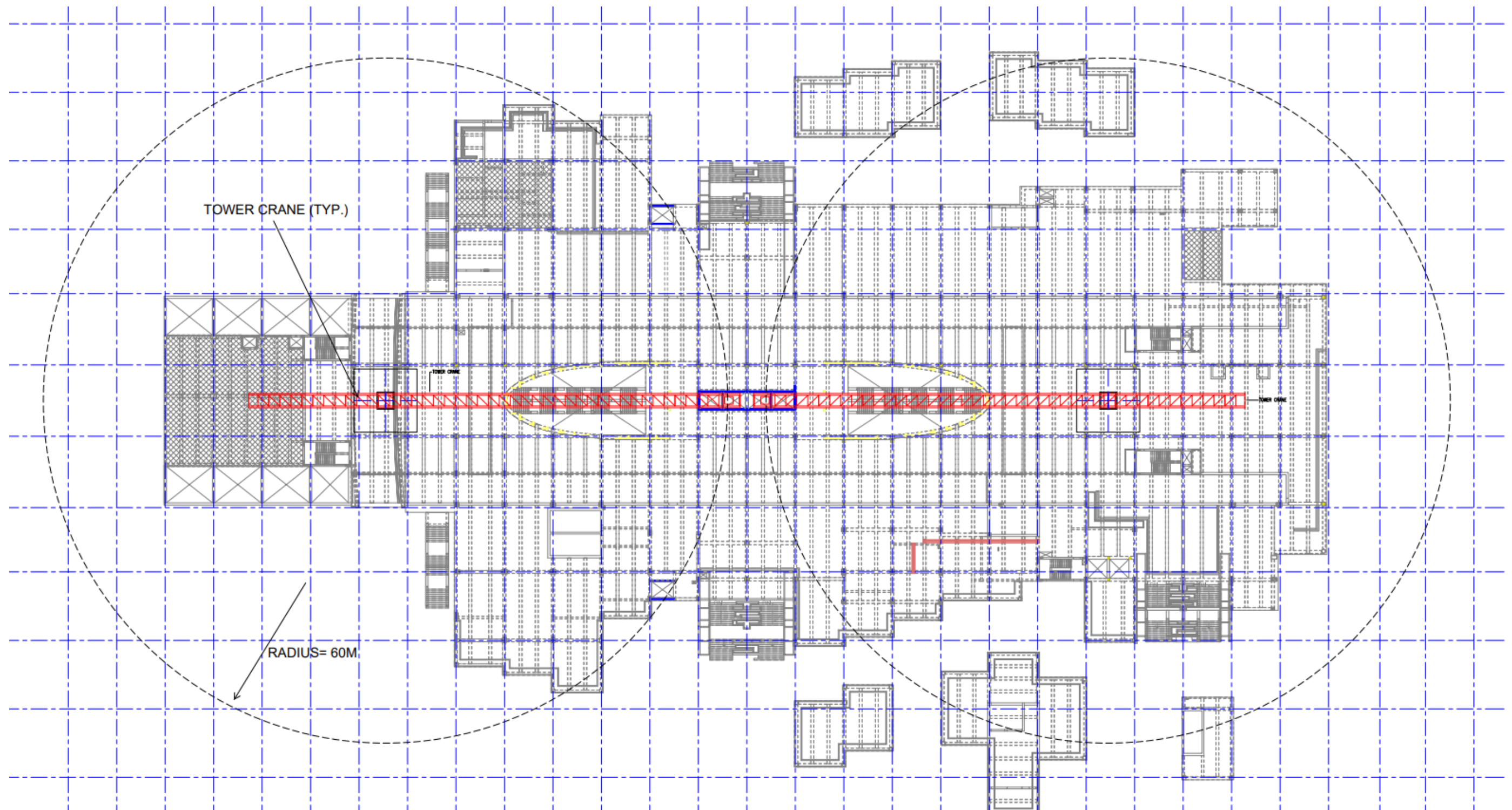
- The system is ideal for enclosed spaces where the form work superstructure can rest up against walls on all sides.
- Infill zones are managed within the system, making it easy to adapt to walls and columns.
- They are used for shoring heights of up to 5.50 m and can use any type of form facing.
- The form work adapts to difficult shapes.



TIE ROD SYSTEM

- This form work can be tied by just 1 man working from one side only.
- There are no time-consuming fitting of jacket tubes.
- It has a long lifespan, as the tie is operated using a ratchet, minimizing wear-and-tear on the equipment .
- The ties are easy to unscrew, so the formwork can be stripped out faster.





RESPONSIBILITY TABLE

Process	Responsibility	Remarks
Project Initiation Phase		
Developing Quality Management Plan	Quality Manager	
Guidelines for developing contractors QAP & ITP	Quality Manager	
Guidelines for developing contractors WMS	Construction Manager	
Checklists for Tests and Audits	Quality Manager	
Checklists for Field Inspections	Site works Manager & Site Quality Manager	
Criteria for review of contractor’s quality related documents submittal	Quality Manager &Construction Manager	
Review of Technical specifications	Design Manager, Package Manager & Quality Manager	Functional & performance
		Constructability
		Quality specifications & standards
Procurement Phase		
Assessment of contractor’s quality competencies	Quality Manager	Quality Manager will provide the inputs to Procurement Manager & project manager for evaluation
Pre-Construction Phase		
Evaluation of contractors submissions related to quality function (QAP, material source approval, mix design, approval of lab facilities & 3 rd party labs)	Quality Manager	
Work method statements	Construction Manager	Sections related to QA/QC to be reviewed by Quality Manager
Inspection and Test Plans	Quality Manager	
Material Approvals	Design Manager	Architectural elements
	Quality Manager	Checking of test reports & compliances

Construction Phase		
Factory Inspections (Manufacturing)	Package Manager &/or Quality Manager	
Incoming Material inspections	Quality Manager / Construction Manager	
Field/stage Inspections (Site works)	Works Area Manager	Random inspections by Quality inspection Engineers
Batching/Fabrication & Hot mix plants monitoring	Quality Inspectors & Construction site Engineers	
Field Deficiency reports	Site Engineer/Quality Engineer	- Construction Manager/Quality Manager to approve correction measures. - Site Manager to Close
Non Conformance reports	Design Non Conformance: Design Manager Material non-conformance: Quality Manager Workmanship & Installation: Construction Manager & Quality Manager	Contract violation report is to be issued by contract manager for not attending NCR's or repeated NCR's based on Quality Manager report. Construction Manager: follow up for closure of NCRs.
Conducting Audits	Quality Manager	Works Area In charge: Participate
Audit reports	Quality Manager	Construction Manager: follow up for closure of Audit findings
Punch list/Snag List	Construction site manager & Quality site Manager	Construction Manager: follow up for closure of punch points & De-snagging
Defect Liability Phase		
Defect notice	Construction Manager/Quality Manager	Issues related to Design defects to be addressed by Design Manager Construction Manager: follow up for closure of Defect Notices.

EXCAVATOR			
No. of Excavator		1	Nos
Bucket capacity		1.10	Cum
Time Taken For one Bucket Excavation			
Digging Time		7	Sec
Scrubbing/ Scooping Time		10	Sec
Swinging time		12	Sec
Loading		5	Sec
Moving and Position		5	Sec
Total Time		0.70	Min
Working hours for Excavator		10	hrs
Effective work of Excavator		65%	
Effective work of Excavator in "min"		390	min
Production Per day		613	Cum/day
DUMPER ANALYSIS			
Capacity of Dumper		9.00	Cum
Dumper Avg. Speed (Km/h)		30	Km/h
Leading distance(Two way travel)		10.00	Km
Loading Time		6	min
Unloading Time		2	min
Travel Time		20	min
Position Time		2	min
Total Time/Dumper		30	Min
Working hours for Dumper		10	hrs
Effective work of Dumper		65%	
Effective work of Dumper in "min"		390	min
No of trips required/Dumper		13	Nos
Productivity Per day per Dumper		117	Cum/day
Total dumper required/day (Theoretically)		6	Nos

PLANNED OUTPUT =IDEAL OUTPUT X TOTAL FACTOR		530.64	CUM
IDEAL OUTPUT	99 CUM @ 10 hrs for a cycle time of 40 sec		
TOTAL FACTOR=PERFORMANCE FACTORXCORRECTION FACTOR		0.536	CUM
PERFORMANCE FACTOR	FOR 60 MIN 1		
CORRECTION FACTOR= SOIL FACTORX LOAD FACTOR X SWINGING FACTOR		0.536	
SOIL FACTOR		0.67	
LOAD FACTOR		0.8	
SWINGING FACTOR		1	
SUMMARY OF CALCULATIONS			
TOTAL FACTOR	0.536		
CORRECTION FACTOR	0.536		
IDEAL OUTPUT	990		
PLANNED OUTPUT	530.64		

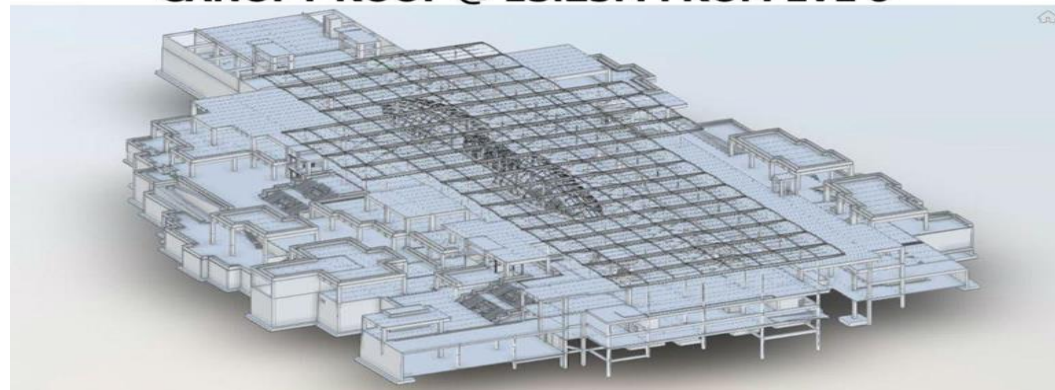
LEVELS	WIDTH (m)	DEPTH (m)	DIAMETER (m)	HEIGHT	NO.S	ZONE	END LEVEL	VOLUME (m3)		
BELOW TRACK LEVEL										
M24-CR16	0.65	0.65		5.3		24	UNDERCROFT	2.24		
M24-C53	0.65	0.65		6.2		24	UNDERCROFT	2.62		
M25-CC18			0.7	6.2		25	UNDERCROFT	2.38		
M25-CC19			0.7	6.2		25	UNDERCROFT	2.38		
M25-CC19A			0.7	4.725		25	UNDERCROFT	1.82		
M25-CR35	0.6	1		4.725		25	UNDERCROFT	2.84		
M25-CR35A	0.6	1		4.725		25	UNDERCROFT	2.84		
M26-CC22			0.7	2.85		26	UNDERCROFT	1.10		
M34-CR05	0.6	0.6		6.15		34	PLATFORM	2.21		
M35-CC10B			0.7	3.15		35	UNDERCROFT	1.21		
									21.64	21.64
UNDERCROFT VOLUME										
M24-CR02	0.65	0.65		5.7	3	24	LEVEL 0	7.22475		
M24-SCR15	0.65	0.65		5.45		24	PLATFORM	2.302625		
M24-SCR16	0.65	0.65		3.75		24	PLATFORM	1.584375		
M24-CR53	0.65	0.65		3.75		24	PLATFORM	1.584375	12.69613	
M2-CC10			0.7	3.75	4	25	PLATFORM	5.77		
M25-CC10A			0.7	3.75	4	25	PLATFORM	5.77		
M25-CC18			0.7	3.75	2	25	PLATFORM	2.88		
M25-CC19			0.7	3.75	2	25	PLATFORM	2.88		
M25-CC19A			0.7	3.75		25	PLATFORM	1.44		
M25-CR01	0.6	1		3.75	3	25	PLATFORM	4.33		
M25-CR5A	0.65	0.65		5.8		25	LEVEL 0	2.4505		
M25-CR06	0.65	0.65		3.75		25	PLATFORM	1.584375		
M25-CR34	0.6	1		3.75		25	PLATFORM	2.25		
M25-CR35	0.6	1		3.75		25	PLATFORM	2.25		
M25-CR35A	0.6	1		3.75		25	PLATFORM	2.25		
M25-CR43	0.65	0.65		3.75		25	PLATFORM	1.584375	35.44825	
M26-C22			0.7	3.75	2	26	PLATFORM	2.88		
M26-CC23			0.7	3.75	2	26	PLATFORM	2.88		
M26-CC24			0.7	3.75		26	PLATFORM	1.44		
M26-CR03	0.65	0.65		3.75	2	26	PLATFORM	3.16875		
M26-CR3A	0.65	0.65		3.75	2	26	PLATFORM	3.16875	13.54969	
M34-CR02	0.65	0.65		7	3	34	LEVEL 0	8.8725		
M34-CR2A	0.65	0.65		3.75		34	PLATFORM	1.584375		
M34-CR04	0.65	0.65		3.75	3	34	PLATFORM	4.753125		
M34-CR09	0.65	0.65		7	2	34	LEVEL 0	5.915		
M34-CR21B	0.6	1		3.75	2	34	PLATFORM	4.5		
M34-CR37	0.6	1		3.75		34	PLATFORM	2.25		
M34-CR38	0.6	0.8		3.75	2	34	PLATFORM	3.6		
M34-CR39	0.6	1		3.75	2	34	PLATFORM	4.5		
M34-CR45	0.65	0.65		3.75	8	34	PLATFORM	12.675	48.65	
M35-CC10			0.7	3.75	12	35	PLATFORM	17.31		
M35-CC10B			0.7	3.75	2	35	PLATFORM	2.88		
M35-CR42	0.45	0.45		3.75	6	35	PLATFORM	4.55625		
M35-CR42A	0.45	0.45		3.75	2	35	PLATFORM	1.51875		
M35-42B	0.45	0.45		3.75	4	35	PLATFORM	3.0375		
M35-44	0.65	0.65		3.75		35	PLATFORM	1.584375		

BIAL , T2 CONNECTIVITY

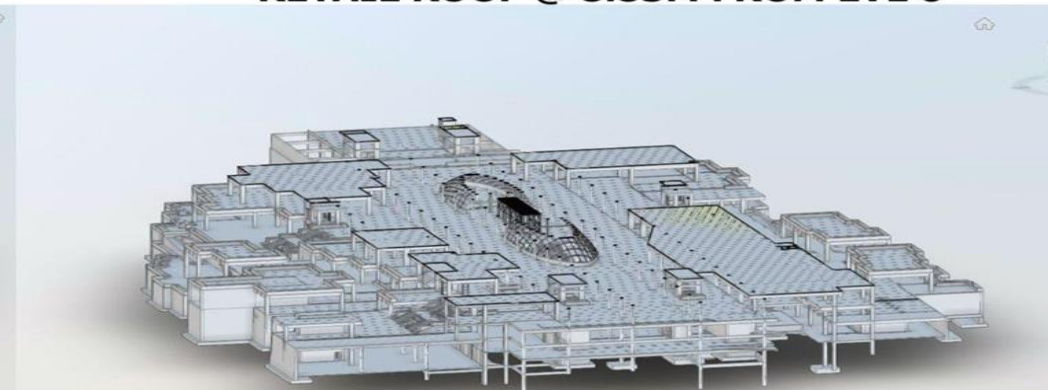
M35-62	0.6	0.6		3.75		35	PLATFORM	1.35	32.24	
M36-CR41	0.65	0.65		3.75	3	36	PLATFORM	4.753125		
M36-CR46	0.65	0.65		3.75	2	36	PLATFORM	3.16875		
M36-CR46A	0.65	0.65		3.75		36	PLATFORM	1.584375		
M36-CR48	0.65	0.65		3.75		36	PLATFORM	1.584375	11.09063	
M44-CR27B	0.6	1		3.75	2	44	PLATFORM	4.5		
M44-CR52	0.65	0.65		3.75	2	44	PLATFORM	3.16875		
M44-CR55	0.65	0.65		3.75	3	44	PLATFORM	4.753125	12.42188	
M45-CC10			0.7	3.75	14	45	PLATFORM	20.19		
M45-CR42	0.45	0.45		3.75	6	45	PLATFORM	4.55625		
M45-CR42A	0.45	0.45		3.75	2	45	PLATFORM	1.51875		
M45-CR42B	0.45	0.45		3.75	4	45	PLATFORM	3.0375	29.31	
M46-CR52	0.65	0.65		3.75	3	45	PLATFORM	4.753125	4.753125	200.1573
PLATFORM										
M24-CR15	0.65	0.65		3.35		24	LEVEL 0	1.415375		
M24-CR16	0.65	0.65		3.35		24	LEVEL 0	1.415375		
M24-CR21	0.65	0.65		3.35		24	LEVEL 0	1.415375		
M24-CR21	0.65	0.65		3.35		24	LEVEL 0	1.415375		
M24-CR53	0.65	0.65		3.35		24	LEVEL 0	1.415375	7.076875	
M25-CC10			0.7	3.35	4	25	LEVEL 0	5.15431		
M25-CC10A			0.7	3.35	4	25	LEVEL 0	5.15431		
M25-CC18			0.7	3.35	2	25	LEVEL 0	1.2885775		
M25-CC19			0.7	3.35	2	25	LEVEL 0	2.577155		
M25-CC19A			0.7	3.35		25	LEVEL 0	1.2885775		
M25-CR01	0.6	1		3.35	3	25	LEVEL 0	6.03		
M25-CR34	0.6	1		3.35		25	LEVEL 0	2.01		
M25-CR06	0.65	0.65		3.35		25	LEVEL 0	1.415375		
M25-CR35	0.6	1		3.35		25	LEVEL 0	2.01		
M25-CR35A	0.6	1		3.35		25	LEVEL 0	2.01		
M25-CR43	0.65	0.65		3.35		25	LEVEL 0	1.415375		
M25-SCR18	0.4	0.4		3.35		25	LEVEL 0	0.536	30.88968	
M26-CC22			0.7	3.35	2	26	LEVEL 0	2.577155		
M26-CC23			0.7	3.35	2	26	LEVEL 0	2.577155		
M26-CC24			0.7	3.35		26	LEVEL 0	1.2885775		
M26-CR03	0.65	0.65		3.35	2	26	LEVEL 0	2.83075		
M26-CR3A	0.65	0.65		3.35	2	26	LEVEL 0	2.83075	12.10439	
M34-CR2A	0.65	0.65		3.35		34	LEVEL 0	1.415375		
M34-CR04	0.65	0.65		3.35	3	34	LEVEL 0	4.246125		
M34-CR05	0.65	0.65		3.35		34	LEVEL 0	1.415375		
M34-CR8C	0.65	0.65		3.35		34	LEVEL 0	1.415375		
M34-CR14	0.65	0.65		3.35		34	LEVEL 0	1.415375		
M34-CR21A	1.2	0.6		3.35		34	LEVEL 0	2.412		
M34-CR21C	0.6	1		3.35		34	LEVEL 0	2.01		
M34-CR37	0.6	1		3.35		34	LEVEL 0	2.01		
M34-CR38	0.6	0.8		3.35	2	34	LEVEL 0	3.216		
M34-CR39	0.6	1		3.35	2	34	LEVEL 0	4.02		

M34-CR45	0.65	0.65		3.35	8	34	LEVEL 0	11.323	34.89863	
M35-CC10			0.7	3.35	12	35	LEVEL 0	15.46293		
M35-CC10B			0.7	3.35	2	35	LEVEL 0	2.577155		
M35-CR42	0.45	0.45		3.35	4	35	LEVEL 0	2.7135		
M35-CR42A	0.45	0.45		3.35	2	35	LEVEL 0	1.35675		
M35-CR42B	0.45	0.45		3.35	4	35	LEVEL 0	2.7135		
M35-CR44	0.65	0.65		3.35		35	LEVEL 0	1.415375	26.23921	
M36-CR62	0.6	0.6		3.35		36	LEVEL 0	1.206		
M36-CR1A	0.65	0.65		3.35	4	36	LEVEL 0	5.6615		

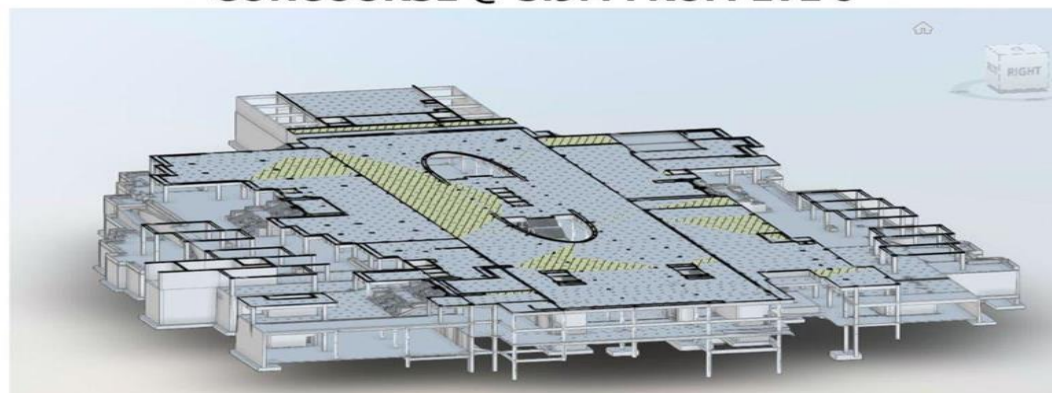
CANOPY ROOF @ 13.25M FROM LVL 0



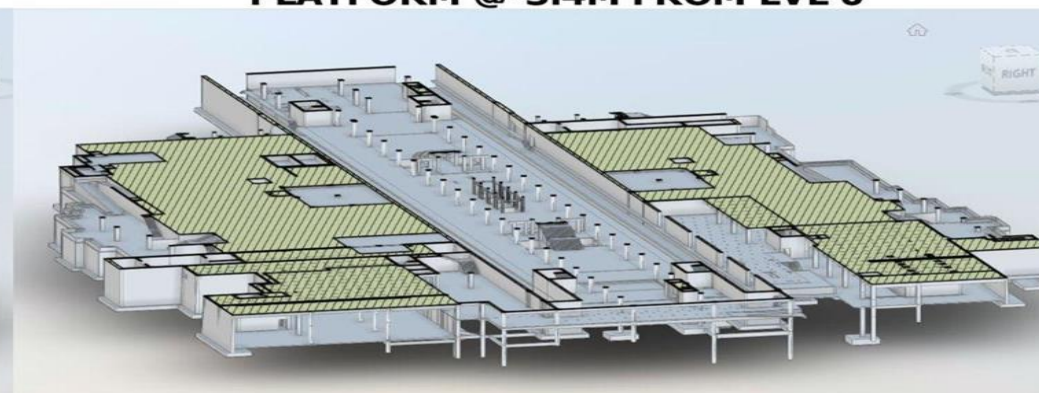
RETAIL ROOF @ 8.85M FROM LVL 0



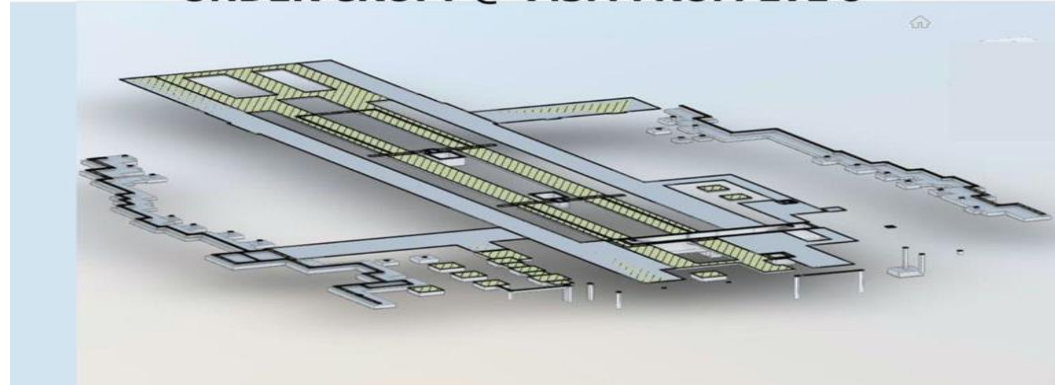
CONCOURSE @ 3.9M FROM LVL 0



PLATFORM @ -3.4M FROM LVL 0



UNDER CROFT @ -7.3M FROM LVL 0



BELOW TRACK @ -10.45M FROM LVL 0



PRE –CAST

Precast construction Technology is a system of casting concrete in a reusable mould or “form” which is then treated in a controlled environment, conveyed to the construction site and lifted to the place. Precast Construction Technology consists of various precast elements such as walls, beams, slabs, columns, staircase, landing and some customized elements that are standardized and designed for stability, durability and structural integrity of the building. Precast residential building construction involves design, strategic yard planning, lifting, handling and transportation of precast elements. This technology is suitable for construction of high-rise buildings resisting seismic, and wind induced lateral loads along with gravity loads. The building framing is planned in such a way that maximum number of repetitions of molds is obtained. These elements are cast in a controlled factory condition. The factory is developed at or near the site which provides an economical solution in terms of storage and transportation.

Precast concrete elements Concrete components of a building prefabricated in precast yard or site and shall be installed in the building during construction.

- Precast reinforced concrete elements These shall consist of reinforcement bars and/or welded wire meshes within the elements to provide the structural strength as per requirement of the component such as facade walls, beams, columns, slabs, staircases and parapet wall.
- Precast pre-stressed concrete elements These shall consist of pre-stressing tendons within the elements to provide a predetermined force needed to resist external loadings and cracks such as hollow core slabs, beams and planks.



Wall Panels



Parapet Beams



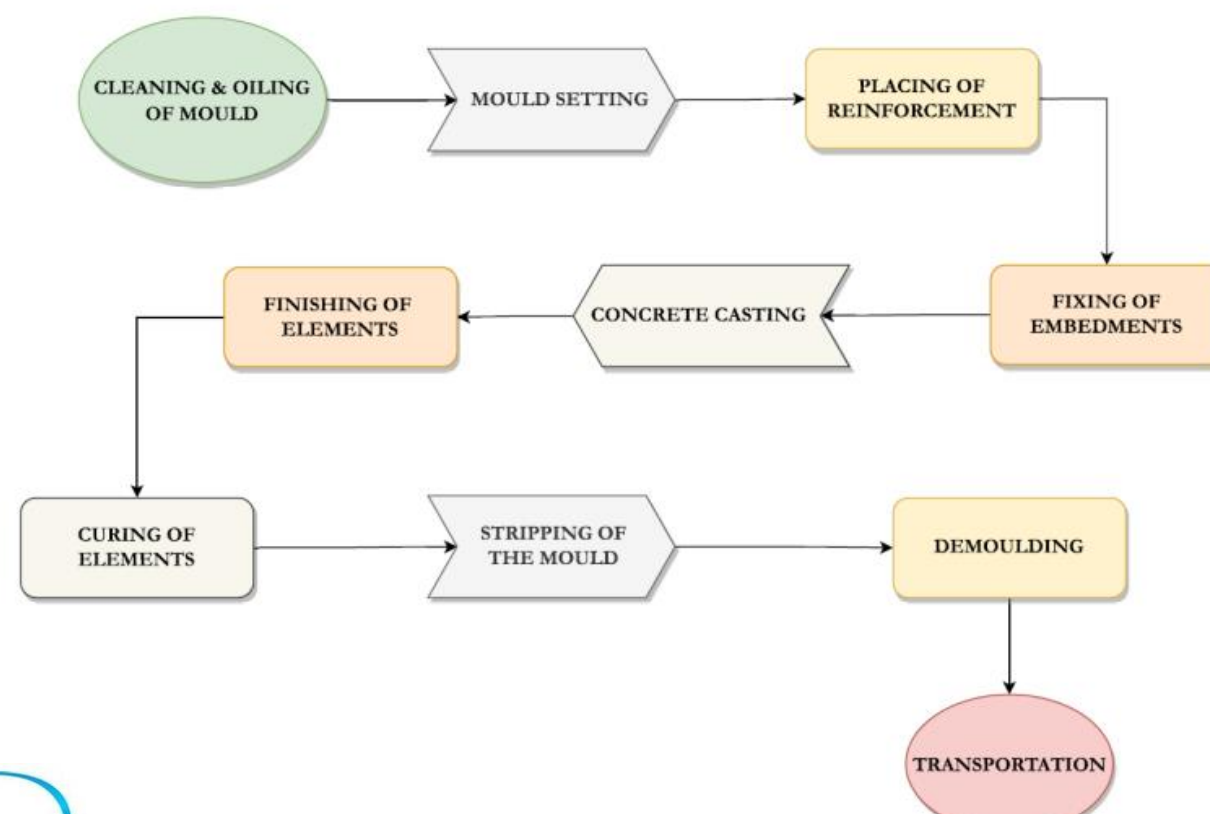
Staircase



Hollow core slab



Pod Element





Pre-stressed Hollow Core Slab



Pre-stressed Beam



Tilting Tables for Wall Panels

S. No.	Mould type	Uses
1.	Conventional moulds	Ribbed slabs, beams, window panels, box type units and special elements
2.	Tilting moulds	Exterior wall panels where special finishes are required on one face or for sandwich panels
3.	Long line prestressing beds	Double tees, ribbed slabs, piles and beams
4.	Prestressing bed with Extrusion machine	Hollow core slabs and hollow core non load bearing wall



Conventional Mould



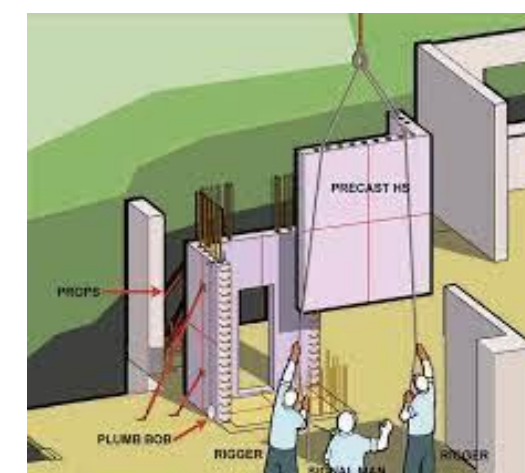
Tilting Mould



Extrusion Machine

Proper planning and preparatory works shall be required before the actual installation of precast concrete elements in order to ensure quality installation. The following items shall be planned:

- i. **Method of sequence of assembly and installation:** Precast elements should be identified based on their location number and the tag.
- ii. **Method of providing temporary support:** Elements should be supported temporarily before these get stabilized. Generally structural members with adjustable ends shall be used for securing the panels. Shims should be used to adjust the panels to ensure dimensional correctness.
- iii. **Installation tolerances:** Installation tolerances should be based on codal provisions and design considerations should be clearly indicated.
- iv. **Handling and rigging requirements:**
 - Elements should be checked for handling stresses before lifting and the cranes should have sufficient capacity to handle the precast panels.
 - At least 10% impact should be considered while calculating the lifting capacity of the crane.
 - At site locations, panels shall be first unloaded and stacked or directly lifted by the crane.
 - The element shall then be installed on the site and supported by temporary jacks.
 - The cranes shall be released for next lifting once the temporary supports are in place.
 - Shims shall be used to carefully align the element before grouting.
 - The panels shall be grouted after the final adjustments are done.



PRECAST CONCRETE MARKET : COVID 19 MARKET :

Since , December 2019 the market for precast has decreased .

China being the major exporter the global market has seen a negative curve owing to lockdown .

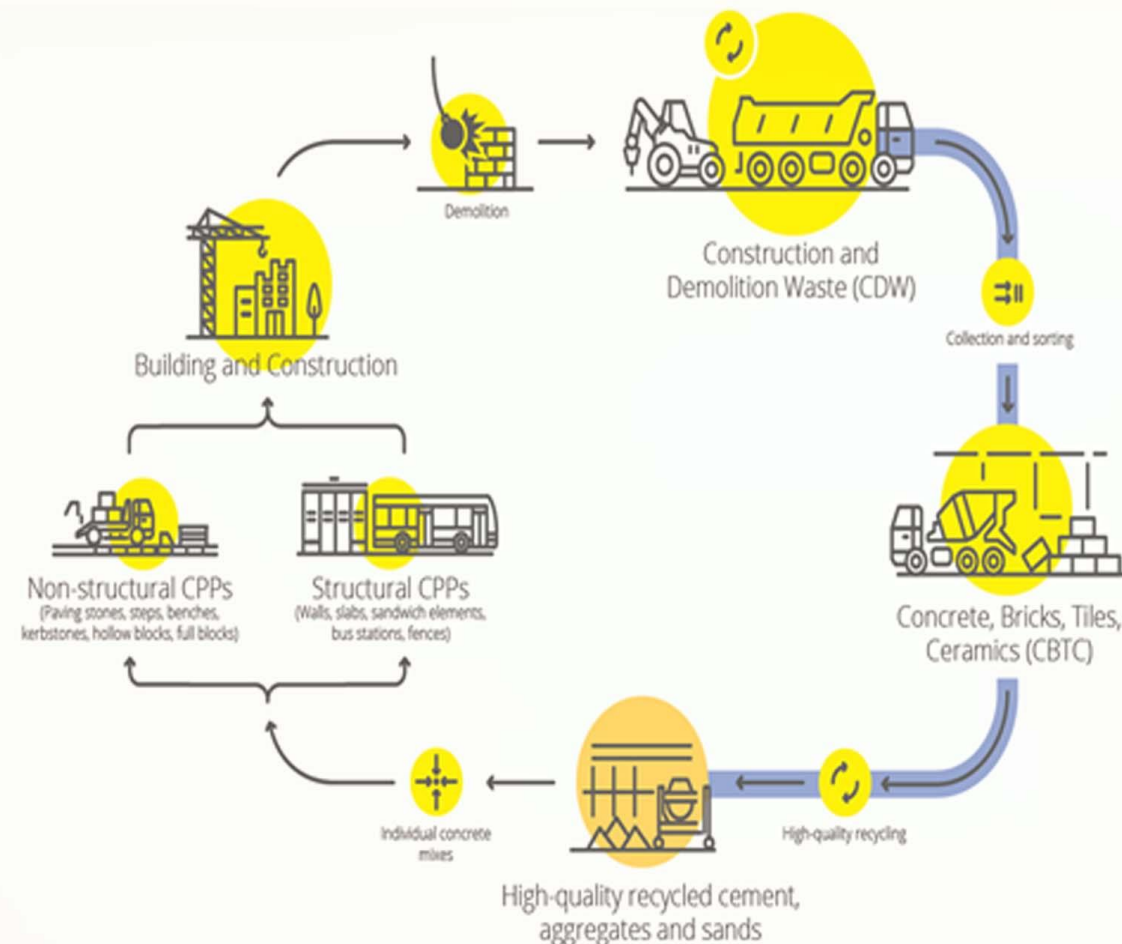
PRECAST INDUSTRY GROWTH -



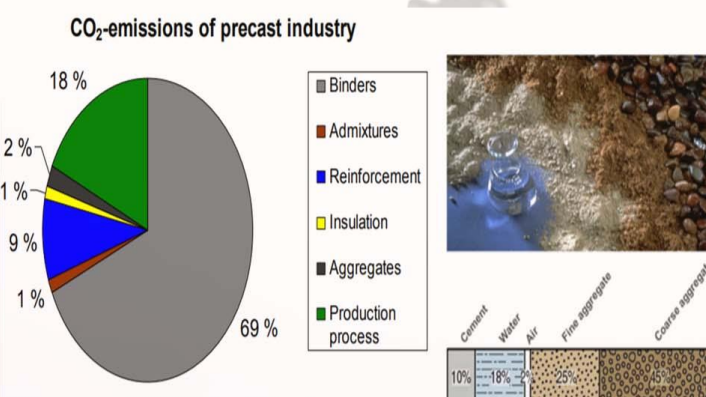
ANNUAL GROWTH - 4.4 % (NEW)

ASIA LEADS WITH REVENUE SHARE OF 38.5%

EMERGING TREND :

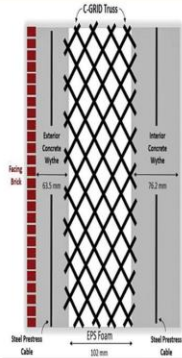


Precast concrete products manufactured from the construction and demolition waste has been an emerging technology in North - Western Europe



Reduction of CO₂ emission by 50%

Trends in Precast concrete technology:



Carbon cast : Usage of carbong fibre grid (C- Grid) - Act as shear connccetor .
Ex: Innovation center, Bloomington



Self consolidating concrete : Eliminates need for mechanical consolidation .
Initiated by : Center for transportation , Texas .

Insulated Concrete Forms Market | Global Industry Report, 2031

Insulated concrete form walls :
Insulating concrete forms (ICFs) result in cast-in-place concrete walls that are sandwiched between two layers of insulation material.

Polystyrene Foam
Polyurethane Foam
Cement-bonded Wood Fiber
Cement-bonded Polystyrene



Stakeholders :

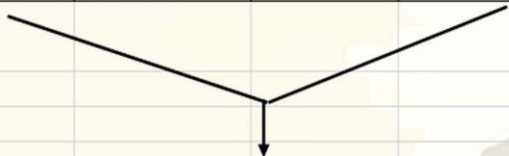
Internal Employees Contractors	Local Financial institutions Suppliers Customers Service suppliers Governing bodies	National Industrial customers Investors Governing bodies MISC : Media
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PMC	LEGAL
FACILITIES MANAGER	R&D
SALES AND COMMERCIAL	IT
DESIGNERS	ACC
OWNER	
PURCHASING AND SUPPLY CHAIN	
HUMAN RESOURCE	
TECHNICAL AND NON TECHNICAL STAFFS	

LEGAL ADVISORY BODIES
R&D
IT
ACCOUNTING

Places involved :

RAW MATERIAL STAGE	CEMENT	AGGREGATE	WATER	CHEMICAL ADMIXTURES	REBARS
					PRODUCTION COMPANY
	BATCHING PLANT				
TRANSPORTATION			TRUCK , CONVEYORS		
MANUFACTURING STAGE	STOCK IN FIELD / SILOS				
	CONCRETE PLACEMENT - REMOVAL OF MOLD - PRODUCTION COMPANY				
	STORAGE YARD				
	IN HOUSE OFFICE				
TRANSPORTATION	TO SITE				
INSTALLATION	TEMPORARY FACILITY				

Facts:



Pantheon is one of the earliest example for precast concrete technology .

Water cement ratio :
Exposed to fressing and thawing - 0.45 or less
Not exposed to freezing and thawing : 0.48 or less



Manuvering equipment : Minimum turning radius for extensive trucks and cranes - 8m - 14m .

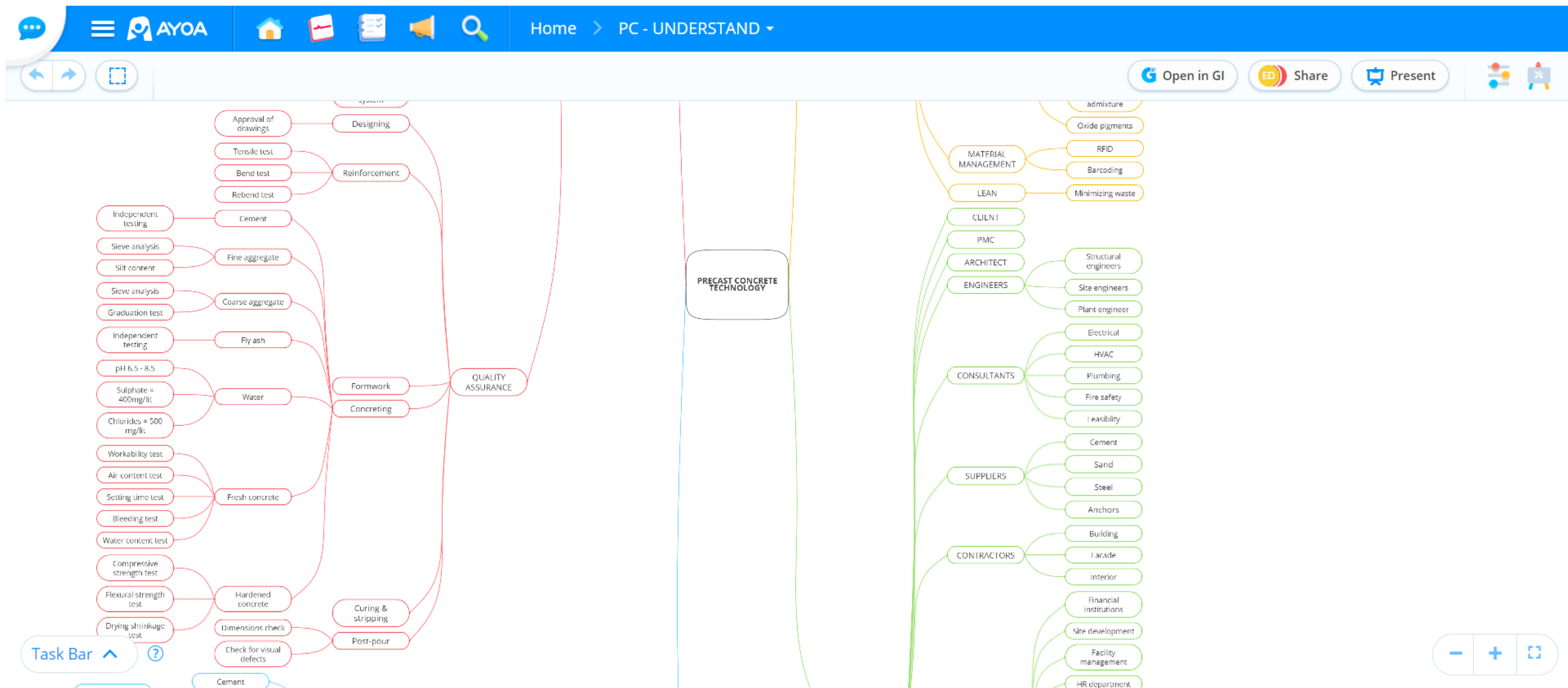
Temporary facilities : Storage of components- atleast 150 sq.m



Crane lifting capacity should be calculated at least with 10% impact

WORK SCOPE / METHODS / TECHNOLOGIES / TRENDS			STAKEHOLDERS	
Workscopes	Methods	Trends & Technologies		
Manufacturing Process	Making Of Hollow Concrete Slab	GPS - For topographic survey		Client
	Making of precast concrete slab	GIS - Geographic survey, weather forecast		PMC
Erection Process		RFID - Tracking of manual activity, coding bar identification, automatic monitoring of vehicle movement		Architects
	Strip or Regular Foundation laid	Drone - Monitoring of construction activity		Engineers (Structural, Site, Plant, Electrical)
	Insert vertical bar for panel fit	Blockchain - Construction site measurement automatically send to IT department		Consultant (HVAC, Plumbing, Fire Fighting, Design, Execution, Liaison)
	Filing tube and lock reinforcement bar	IOT - Real time measurement, curing invention for construction quality control		Contractor (Building, Facade, Interior)
	Laying hollow concrete block toward vertical erect panel	SAP - Material purchasing documents, Prerequisite of material analysis		Material Supplier (steel, cement, sand, aggregate)
	Door, window fitting	Barcoding		Equipment Supplier
Mould Making	Conventional, Tilting mould making	Cloud - All construction and tender documents keeps in one data file		Quality Control Team
Transport and Storage	Proper planning of operation system	FSC technologies		Planning and execution team
Installation	Follow tagged numbers in precast block			Operation and maintenance team
	Codal provision wise tolerance check			Precast element manufacturer
Water proofing	In external joint waterproofing material fill			Storekeeper
Mechanical Electrical Plumbing	Concealed fitting, fire fighting system installed			Driver and operator
Surveying	Proper level check of foundation, beam, column, wall	Drone survey		Barbender
Demould	Follow identification mark, All side shuttering check			Labours
	Compressive strength check			Research & Development Team
Batching Plant Operation	Arrange stacking area for cement, sand, aggregate, Fly Ash			Specialized IT department
	Available space of movement for loader, transit mixer			software developer
QC Machinery	Testing of compression machine			
	Follow proper reading in weighing gauge, flakiness gauge			
	Check aggregate crushing value, aggregate impact value			

IMPORTANT FACTS (TIME / COST / QUALITY / RESOURCES / PRODUCTIVITY / CONSTRAINTS)				PLACES	
Time	Constraints	Quality and Resource	Productivity		Manufacturing
Manufacturing & supply of construction Material	Proper working boom radius	Quality of grade of steel, sand, aggregate, fly ash as per schedule	Supplying of construction element should be proper and sufficient		Raw material storage - Steel, Cement, Water, Anchor
Maintaining transportation time of precast element from plant to site	Ensure correct panel before hoisting	Production of good concrete in batching plant	Production Of concrete blocks sufficient as per erection		Material testing Lab
Batching plant setup	Small road in front of site may not allow crane or heavy vehicle	Bar bending should be proper	Batching plant capacity more		Material storage
Concrete operation to plant	Material resource affect production	Regular testing of concrete materials in lab	Carrying capacity of concrete blocks more		Formwork yard
Quality control department checking at site	Equipment Availability delays construction work	Workability of concrete check at site	New technologies in manufacturing plants		Concrete batching plant
Supplying of materials	Non-availability of trained workmanship	Outer surface of precast building check	New technologies apply in site for increase work efficiency		Material stacking area
Issues related to design, specification - inform to client & consultant	additional costs with highly skilled workers, design changes, extra labor costs (for checking, counting, and sorting raw materials)	Joints of elements check	Maintain proper work schedule		Site office
Labour daily work schedule	The conventional monitoring process is not suited to prefabricated construction since it assumes the construction stage is fully separate from the design stage	Proper curing	Continuous training and development programme		Batching plant
Payment for stakeholders		Facade quality	Apply lean construction method		Equipment stacking area
Proper planning & scheduling of all activities		Electric and plumbing work quality			Loading and unloading
Project close out		Safety equipments quality			Crane movement
		Resources of construction material always available			Labour and staff Hutment
		Resource of material as per IS code maintain and client instruction			carousel plants
		More involvement of local manpower			



<https://app.ayoa.com/mindmaps/0bd9548e-6c14-4be3-ad5f-d725e14d5410>

A3-EMPATHIZE

- Engineers (10-15 -year experience) - 11
- Architect (more than 15-year experience) – 1
- Project manager (more than 15-year experience) - 1
- Contractors (south TN) - 2
- Client/owner (south TN) - 2
- PC Manufacturer – 2
- Labors - 2

MERITS

- Time saving
- Cost saving
- Does not affect by natural calamities
- Made in controlled environment - Proper safety
- Less labour-intensive
- Less wastage of materials

DEMERITS

- Heavy lifting equipment - site constraints, special permissions
- Transportation - cost, permissions, restrictions (horizontal & vertical clearance of roads)
- Proper road facility needed, maximum load carrying capacity of bridges
- Stock yard required at site
- Lack of coordination among various stakeholders
- Moisture penetrations & leakages
- Lack of precast yard near to site
- Proper planning needed for incorporate MEP services
- Uneconomical for small projects

STAKEHOLDER NAME	WHAT DID YOU HEAR	WHAT DID YOU OBSERVE	KEY CHALLENGES / EXPECTATIONS
SOCIAL			
Client	Resistance to change over conventional methods	Negative perception about PC	Lack of awareness
Client	High initial investment, no skilled labours	belief - conventional method is good	lack of skilled labour , lack of awareness, high transportation costs
Precast manufacturer	Major marketing points - Quality & Durability	In TN, maximum client does not consider the speedy construction	Convince the client & designer
Client/ Architect/ Precast manufacturer	Lack of guidelines & standardisation	Few Codes available but book format	Process flow is important including stakeholders
MANUFACTURING			
Architect	Does not affect by natural calamities	Made in a controlled environment	Proper promotions needed
Project Manager	Supplying rate of particular steel grade not mention	Steel supply delay due to decision of rate, delay in manufacture of precast components	Quick decision of steel rates, Setting of existing precast blocks
Project Manager	Availability of specific grade of sand	Not able to achieve the concrete quality	To find proper resource for sand
Project Manager	No proper mixing of concrete in batching plant	Quality department not check the quality & workability of concrete properly	Selection of good quality of materials & suppliers
Plant Engineer	Leakage of concrete from mould	Defects in formwork	Good quality of formworks with proper joints
Site engineer	Delay in getting raw materials	Supplying shortage, cost hike, monsoon issues, logistics problem	Maintain proper supply chain for resources, preplanning for monsoon, cost estimation as per recent market rates
Precast manufacturer	Improper coding/ numbering of PC elements leads to confusion during execution	Coding/ numbering is not standardized	Proper coding/ numbering system have to follow
Precast manufacturer	Open yards reduce productivity	Has effect due to weather conditions	Budgeting to include PEB shed captive plants
Precast manufacturer	Delays due to reworks	Lack of strict supervision & planning	Strict supervision, Flow process to be planned
Plant engineer	Surface defects - pinholes, surface blemishes etc	Avoidable by downstreaming, patchwork, adding additional resource	How to avoid surface defects
Precast manufacturer	Housekeeping & safety issues	Cleanliness, Safety aspects lacking	Admin need to supervise closely & plan properly
Precast manufacturer	Lack of space & standardised layout	Cause congestion	Proper & efficient layout planning essential
Precast manufacturer	Repairing & cleaning of moulds take time	time consuming	Use of time efficient measure/ use of technology
Precast manufacturer	Overproduction/ wastage	Identification of wastes etc to be done at regular intervals	implementing lean methods would be useful

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STAKEHOLDER NAME	WHAT DID YOU HEAR	WHAT DID YOU OBSERVE	KEY CHALLENGES / EXPECTATIONS
Plant engineer	Grooves for conduits etc not clean/ clogged or lugs not fixed properly	Improper manufacturing method, issues during transportation	Training & supervision needed
Plant engineer	Proper record keeping lacking	Test results etc need to be recorded for corrective measures & identifying issues	Technology based real time tracking essential
Precast manufacturer	damages to finished goods	Improper stacking	Training & supervision needed
Precast manufacturer	Improper planning	Late start/ early finish, lack of proper supply chain management, waiting of materials & equipments	Proper planning & process flow essentials
Site engineer	Waiting/ idle time among labours	lack of production plan with targets	Give targets & have a proper production plan
Site engineer	Negative attitude of workers	Cultural differences, communication barriers, absentees/ strikes, poor working attitude	Training, incentives, timely payment, Shift system etc
engineer	Lack of comprehensive understanding		
DESIGN			
Architect	Difficult to implement sudden design changes	Frequent change of design is not possible	Design has to finalize in the pre planning stage
Architect	Issues in integrating all the MEP input at earlier stage, client changes	Changes not easy to handle, cause delay & errors	Coordinating requirements & integration of MEP at pre planning stage
Architect	Cantilevers not possible	Columns at periphery	Limiting cantilever spans
Architect	Manufacturing problem of precast element to manufacturer due to intermediate design change	Specifications as per BOQ had not maintain, Durability and quality of works affected	Maintain quality, service period, Proper discussion with consultant and client before design change
Site engineer	leakage in joints	no proper execution	lack of knowledge about joints
EQUIPMENTS			
Architect	Lack of advanced technologies	Delay in manufacturing precast elements	Use of new technologies leads to decrease in production time and reduction in cost
Architect	no skilled labour to operate	skilled labour is less	educate more labour
Architect	more hiring charge for machine - crane	suitable for high rise building	improve good resource planning
Precast manufacturer	varying in crane lifting capacity and working boom radius	cost and location issues	Ensure availability of machineries near to the site in pre planning stage
Site engineer	ensure correct panel before hoisting	proper planning and responsibility of workers	ensure proper planning and scheduling
Plant engineer	Machineries are not in proper working conditions while manufacturing	Affects the overall progress in manufacturing	Lack of maintenance
Precast manufacturer	Gantry not properly moved	Lifting Capacity Reduce	Properly checked ISO certification, Exchange Of new gantry

A3-EMPATHIZE

Stakeholder Name	What did you hear	What did you observe	Key Challenges / Expectations
Site engineer	Unavailability of essential materials in store, Records of material are not properly maintained, Delay in ABC analysis, Late material Purchase	Shortage of essential material in store, Lack of knowledge among storekeeping employees	Quick requisition of material purchase, continuous contact to supplier, training given to storekeeping employees, Use of SAP software for proper documentation
TRANSPORTATION			
Precast manufacturer	Proper road facility needed	Other than main roads, restrictions are more	Major issue, without proper access PC is not possible
Precast manufacturer	Restrictions like overhead lines & other infrastructure		
Plant engineer	Improper condition & less capacity of transit mixers	Less capacity of concrete in transit mixer, Sometimes service problem in transit mixer	Should reach proper time for casting, Increase the carrying capacity of concrete to the manufacturing plant
WORKMANSHIP			
Client	Moisture penetration & leakages	Negative perception	Proper workmanship needed
Contractor	Less labour intensive	Unskilled labours, less labour safety	Skilled labours required with proper training, more attention towards safety
Project manager	Lack of coordination between various stakeholders	Construction delays due to lack of delay in decisions	Proper coordination needed, quick decisions for construction activities
Project manager	Review of rescheduling of activities from execution team	Execution work not as per previous schedule, Project cost increases	Project cost and duration properly maintain, Sanction the bill from client
QUALITY			
Structural consultant	No proper maintenance of quality of materials & documentation of lab results	No good quality of material supplied, lack of testing data in documents	Proper testing in lab and site, maintaining all testing documents and DPR
Plant engineer	No proper storage of reinforcement bars in plant	Risk of internal structural failure & corrosion	Proper stockyard required
Project manager	Use of inferior quality raw materials	Not procured from good sources/ not stored properly	Good testing facilities & invest in proper storage, identify good suppliers
Project manager	Lack of engineers & architects with sufficient PC experience	Lack of experience & knowledge in PC	Increase awareness & training , share experiences etc
EXECUTION			
Labour	Fall from height and vehicular accidents	No proper provision of PPE suits	Lack of safety management
Project manager	Proper planning of cranes placement , logistics, temp braces essential in tight sites	Lack of pre planning	Pre planning essential, checklists
Contractor	No proper payment release according to the contract	Affects quality of works, labour shortage, delay in overall progress	Project cost increases. Release payment as per contract

STAKEHOLDER NAME	WHAT DID YOU HEAR	WHAT DID YOU OBSERVE	KEY CHALLENGES / EXPECTATIONS
TOTAL QUALITY MANAGEMENT			
Quality Manager	No proper tools use for quality improvement	Lack of training, less use of modern tools & technologies, lack of implementation of lean construction technology	Use of proper tools for increase quality of work, reduce waste generation from construction activities
Project manager	PDCA cycle not properly maintained	Lack of coordination and work efficiency is less	Proper monitoring, control and take action quickly to increase work efficiency
CONTRACT			
Client	Contractor can negotiate the cost of material	Price hike of materials	Provides the quality work at the price mentioned in the contract. Contract have to be clear
Project Manager	Material specifications not per contract	Affects quality	Strictly have to follow the BOQ in the contract document
Project Manager	Improper cost escalation formula in bid	Some extra cost not as per escalation formula	Maintain proper project cost as per cost escalation clause in bid
ENVIRONMENT			
Precast manufacturer	Pollution in locality of manufacturing and batching plant	Dust pollution, Air pollution due to transportation	Location of manufacturing plant should be select properly
Precast manufacturer	No maintenance of proper environmental impact assessment documents	No proper EIA reports	Follow & document all the environmental safety guidelines

The slide displays a mind map for 'Production Manufacturing' under the 'PC - EMPATHIZE' section. The mind map is structured as follows:

- Approach of internal**
 - Planning of construction knowledge
 - Process start (start time)
 - Lack of construction knowledge
 - Should transfer the planning knowledge step by step
 - Process start (start time)
 - Cost of design knowledge and design cost will be reduced
 - It can prevent the errors of design manufacturing
 - Application software
 - App professional knowledge, it can be a complete and easy to learn to use
 - Application software
 - Start time (development authority)
 - App professional knowledge, it can be a complete and easy to learn to use
 - Specification of application
 - It can be used in a more authority in BOM
 - Manufacture analysis
 - It can be used in a more authority in BOM
- Preparation of BOM**
 - It can be used in a more authority in BOM
 - It can be used in a more authority in BOM
 - It can be used in a more authority in BOM
 - It can be used in a more authority in BOM
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- Creating of user manuals**
 - It can be used in a more authority in BOM
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- Maintenance of user manuals**
 - It can be used in a more authority in BOM
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The slide also includes navigation icons at the top (Home, PC - EMPATHIZE) and a footer with 'Open in Gl', 'Share', and 'Present' buttons.

▼ AWARENESS

1. Architect/ precast manufacturer - Clients had resistance to change over conventional methods
2. Client - Negative perception about precast
3. Client - Lack of trust
4. Architect/ precast manufacturer - Convince the client to adopt precast technology
5. Precast manufacturer - Lack of specialized knowledge about PC for designers & structural engineers

Add new item here

I wonder there is no proper exposure about PC among people & even among most of the stakeholders in const. field

▼ DESIGN COORDINATION

1. Precast manufacturer - No proper consultation with us
2. Structural engineer - Lack of coordination from architect
3. Precast manufacturer - No coding/ numbering system followed in drawings
4. Precast manufacturer - Lack of coordination among various stakeholders
5. Precast manufacturer - Lack of complete knowledge about PC for architect

Add new item here

I wonder there is no proper design delivery management system

I wonder there is lack of guidelines & standards for precast concrete technology

▼ MATERIAL MANAGEMENT

1. Plant engineer - Late material order delays the whole process
2. Store keeper - Unavailability of storage space for raw materials
3. Plant engineer - No daily update of material stock from the storekeeper
4. Plant engineer - Delay/ Unavailability of materials - No proactiveness
5. Purchase manager - Location of the suppliers is far away from the manufacturing plant

Add new item here

I wonder there is no proper pre-planning for ordering, procuring & storing of raw materials

I wonder there is no proper material management system

▼ ENVIRONMENT

1. Localites - No dust & noise reduction in site
2. Local authorities - Stacking of materials & parking/ movement of vehicles disturbs the public
3. Site supervisor - No proper fencing of site
4. PCB - No EIA report

Add new item here

I wonder there is no environmental norms followed in site

▼ ERECTION

1. site engineer - difficult to modify the structure
2. site supervisor - fault connection in joints may leads to water leakage and fail in sound insul:
3. project manager - insufficient industrial training and education
4. site supervisor - failure of connection during lifting
5. quality manager - lack of technology to test the quality of connection
6. structural engineer - failure because of load

Add new item here

I wonder there is no proper preplanning

I wonder there is lack of knowledge in erect precast elements in site

▼ WORKMANSHIP

1. Project manager - Less availability of skilled labours
2. Site engineer - Poor workmanship - moisture penetration & water leakage in joints
3. Site engineer - Lack of knowledge about tools & techniques among labours

Add new item here

I wonder there is lack of appropriate training for labours

I wonder there is no proper work methodology followed in site

DEFINE

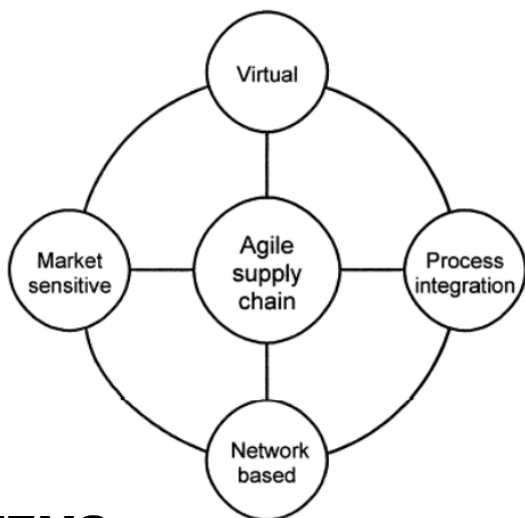
AWARENESS.
 DESIGN CO-ORDINATION
 MATERIAL MANAGEMENT
 ENVIRONMENT
 WORKMEN SFATEY
 SAFTEY
 MACHINERIES AND EQUIPMENT
 DOCUMENT MANAGEMENT
 QUALITY MANAGEMENT
 COST MANAGEMENT
 CONCRETE DISTRIBUTION
 POST POUR DISTIRBUTION
 RAW MATERIALS PROCUREMENT
 RAW MATERIAL STORAGE
 CONNECTIONS
 SUPPLY CHAIN
 TRANSPORTATION
 ERECTION

<https://app.ayoa.com/whiteboards/c5883b85-d56c-412d-94a7-bb40e3b3fa10>

A3- IDEATE AND SOLUTION

SUPPLY CHAIN MANAGEMENT FROM COLGATE,

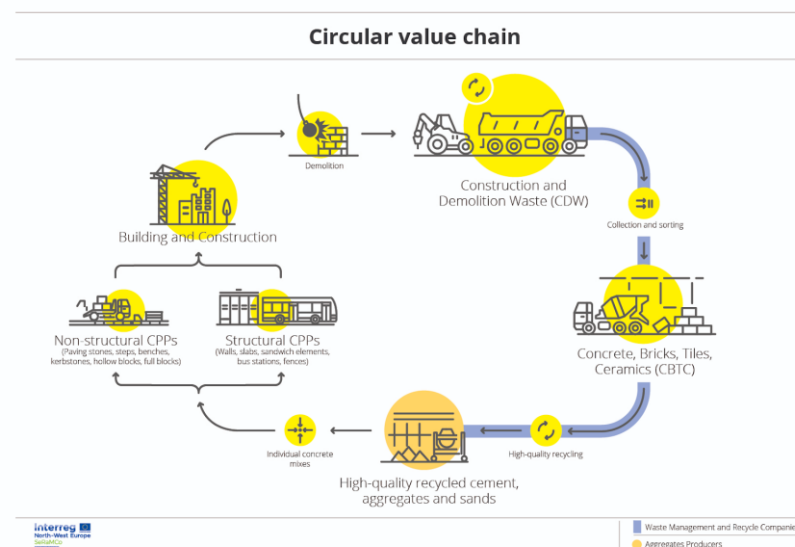
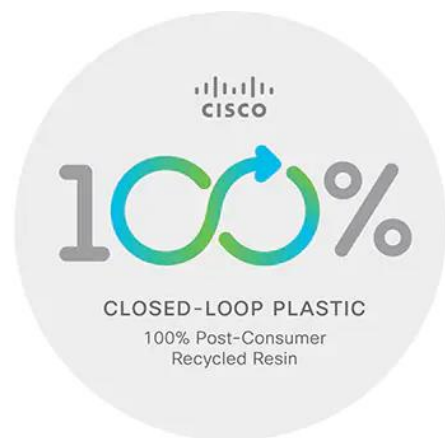
- Colgate-Palmolive has started to transform its supply chain operations with Smart manufacturing.
- Smart manufacturing supports the 2020 strategy in which the organization plans to design more agile supply chains, improve end-to-end planning and execution, and make greater use of analytics to address complex problems and further achieve operational excellence.



CISCO SYSTEMS

CIRCULAR ECONOMY :

- Reuse of old , e- waste products into new products .
- Simple, secure, and sustainable takeback and reuse.
- CONFIGURE - TO - ORDER



STARBUCKS :

ORGANISATIONAL STRUCTURE :

•Plan, source, make, and deliver.

•With the reorganization accomplished, each functional group was tasked with finding improvements. The sourcing group, for example, worked on identifying the factors that were causing price increases. Through research, it better understood what products should cost, and as a result, could negotiate better contracts. For its part, the manufacturing group determined that it could reduce cost as well as delivery time by opening a fifth U.S. roasting plant. Another important aspect of the transformation was the introduction of weekly scorecards with very clear service, cost, and productivity metrics

SCORE CARDS :

The use of scorecards can help you track the most crucial metrics or key performance indicators for organizational success. Scorecards provide a powerful method to align activities within your company and among third-party relationships, as they did in the case of Starbucks

Strategy tree and scorecard details:					
Perspective	Goal	Weight (x of 10)	Description	Performance (%)	Target Values
Manufacturing		1		92,19%	
	Manufacturing Cycle Time	6	The time period from the firm planned order until the final production is reported.	4	3
	Defects Per Million Opportunities	4	The total number of defects divided by the total number of opportunities for a defect, multiplied by 1 Million (Six Sigma calculation).	200	150
	Total Performance in group		Manufacturing	92,19%	
Warehousing		1		82,53%	
	Inventory Months of Supply	6	The total inventory units on hand divided by the average monthly usage.	80%	95%
	Number of Inventory Turns	4	The annual cost of sales divided by the average inventory cost level.	20%	15%
	Total Performance in group		Warehousing	82,53%	
Transportation		3		91,74%	
	Freight cost per unit shipped	3	Total freight costs divided by the number of units shipped per period.	100	85
	Claims percentage for freight costs	3	Total loss and damage claims divided by total freight costs, multiplied by 100.	6%	5%

COCA COLA :

•Common Innovation Framework:

- Using the Innovation Framework, anyone from any of the operating units worldwide can search for, find, and apply concepts, strategies, development successes, and marketing approaches that have been used elsewhere in the organization.
- For example, when introducing Georgia teas in Australia, the Coke people Down Under can research what marketing strategies worked well in related countries such as New Zealand.



TEREX :

RFID TAGS :

- Terex decided to replace the outdated manual yard management process with a new, digital solution using RFID tracking.
- Decision-makers chose a yard management software (YMS) product, and then had the transfer centre surveyed before initiating a pilot project covering a small portion of the yard.
- RFID-based unit identification and location processes have saved the company around 70 weeks per year in labour costs, by cutting the process-time down from six minutes, to a mere 30 seconds per unit.



QUALITY MANAGEMENT : HONDA :

Training curricula content

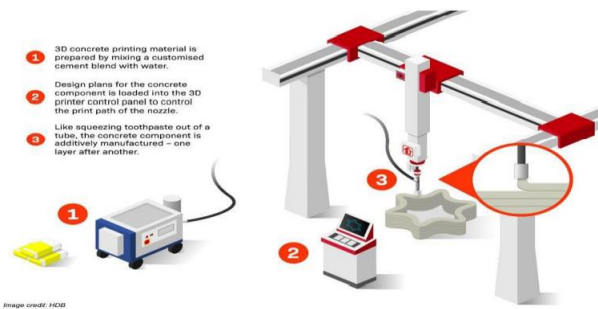
Category	Course name	Course content	Period
Basic training	QC Junior (QC J) Course	Targets associates six months to one year after joining Honda to learn the basics of quality control techniques.	1 day
	QC Foreman (QC F) Course	Targets associates engaged in production and quality duties to learn the quality control techniques and approaches required for quality assurance activities.	Total of 2 days
Specialized training	Statistical Quality Control (SQC) Course	Targets associates whose principal responsibility is quality control and quality improvement activities to learn professional quality control techniques and approaches.	Total of 2 days
	Honda QC Basic Course (HBC)	Targets associates who are responsible for the core of quality control activities to learn skills that allow them to resolve difficult problems/issues with the aim of becoming quality control experts.	Total of 22 days

*SQC Course and HBC are held in Japan.



Training and workshop sessions

- For standard quality production in manufacturing plant, digital technology like 3D precast can be implement for exact shape and size.
- Statistical process control chart tools can be used where the total dimensions workforce can be utilized for better quality production can be understood by putting mean median value.
 - Six sigma concept can be applied.



WORKMANSHIP

- Proper training and development programmed for each work of manufacturing plant and site activities applying black belt, green belt and yellow belt six sigma process where from top management, middle management and lower management line manpower for smooth work process.
- RFID trackers and Scanner system should be implemented for knowing how much manpower available and tracking all their activities.

. Environment

- During the planning phase of the project, all EIA related documents must submit to local authorities.
- All the environmental safety related data should be proper from contractor side.
- In GCC of tender documents, all environmental related norms and clauses should be clear.
- Follow all the OSHA related guidelines and properly implement in manufacturing plant and at site.

TOWER CRANE - PROCUREMENT, INSTALLATION & OPERATION PROBLEMS DEFINED,

- No proper planning
- No procurement guidelines followed
- Unaware of type of crane needed & installation methods
 - Operational constraints - No working clearance, collision etc.,
- Outdated guidelines
- Lack of safety guidelines
- Lack of safety equipment in crane



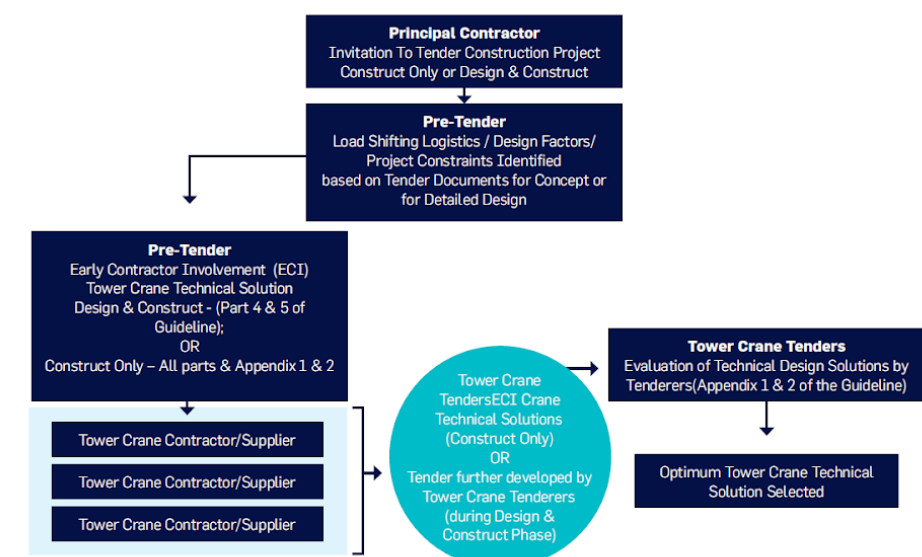
MODEL TOWER CRANE PROCUREMENT GUIDELINE

For the Australian Construction Industry

June 2021

Tower cranes can expose persons to a risk of serious injury or death from a variety of hazards and related risks including:

- structural or mechanical failure and collapse;
- contact or collision with other plant, structures or people;
- arcing or flashover when a tower crane boom, hook or rope comes near an energized overhead power line;
- lightning strike and damage to major components of the tower crane or its rigging equipment;
- falling materials/objects being load shifted by the tower crane;
- fall of objects used in the erection, alteration, dismantling, operations, service and maintenance of a tower crane;
- persons falling from height when accessing, inspecting or maintaining a tower crane;
- fires and related damage or collapse;
- extreme weather and related damage or collapse; and
- fatigue of those workers involved in tower crane operations or related slinging and lifting and load shifting operations.



Factors to be consider while procurement of tower cranes

•
Tower crane procurement decisions are primarily based on tower crane design aligned with the type, design and layout of a building and construction project for which load shifting operations are required.

•**Early contractor involvement (ECI)** between the Principal Contractor and the tower crane supplier is a key element in achieving industry leading practices for tower crane design, procurement and related safe operations.

Tower Crane Design and Procurement Considerations:

- Building design and the height of the structure to be erected;
- Adjacent properties/buildings or structures;
- Construction type and typical materials that require load shifting by the tower crane;
- Construction site layout, area and the foundation for the crane including inspection and test plans along with an independent structural engineer check to verify compliance of the foundation (crane base) to the original structural engineer's design standard;
- Site location and any adjoining constraints or no-go areas;
- Height and operating radius of the tower crane and any Obstacle Limitation Surfaces (airspace) factors or occupied building tenancies within the crane operational envelope;
- Overhead power lines or other obstructions in the vicinity of lifting operations;
- Independent third-party inspection of the tower crane and its major components at the supplier's premises;

Specification for procurement of tower cranes

Age of Cranes

- Structural Components, Non Destructive Testing and Reports
- Access Ladders
- Wind Measurement
- Aircraft Warning Lights
- Zoning and Anti-collision Systems
- Rated Capacity Indicator
- New Wire Ropes
- Electrical Bonding to Earth
- Crane Erection Method
- Duty Board and Signage
- Painting
- Emergency Equipment
- Machine History File

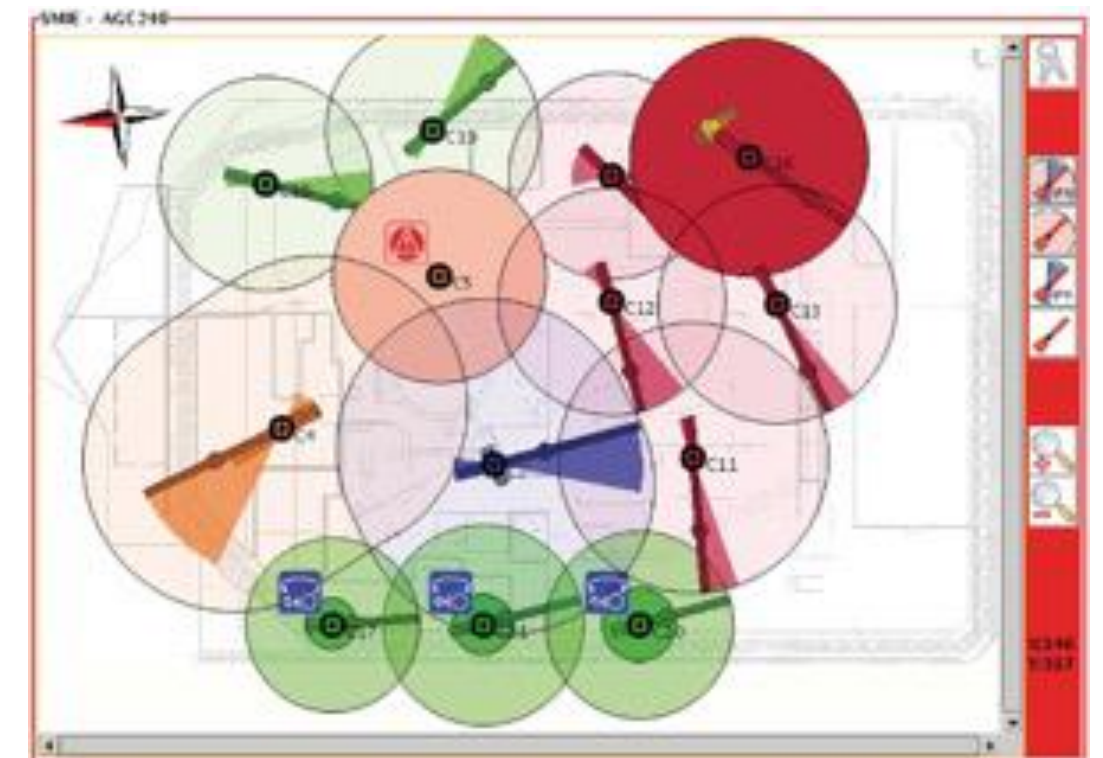
Additional operational aids (Latest advancements)

Anti-collision - Anti-collision technology prevents collision between crane jibs where multiple tower cranes are in operation on a construction project. The system allows tower cranes to track each other automatically at an optimum speed and maintain a pre-set separation by calculating in real time the risk of collision with regard to the breaking capacity of the crane; thereby eliminating potential for tower crane jib clashes and increasing the productivity of tower crane operations.

Zoning - Zoning prevents oversailing by the tower crane of critical exclusion zones such as public areas/ rail corridor interfaces / site boundaries or schools that are precoded into the tower crane's computer. The tower crane can therefore work in proximity of the zone or follow its boundary in complete safety. Zoning technology is normally a component of the anti collision system of a tower crane.

Key features

- load parameters, hook height.
- automatic clash detection and braking.
- communications between tower crane systems and operators.
- override bypass/deactivation real time detection.
- real time operator/driver assist graphic design.
- protection and monitoring of zoned areas



Additional operational aids (Latest advancements)

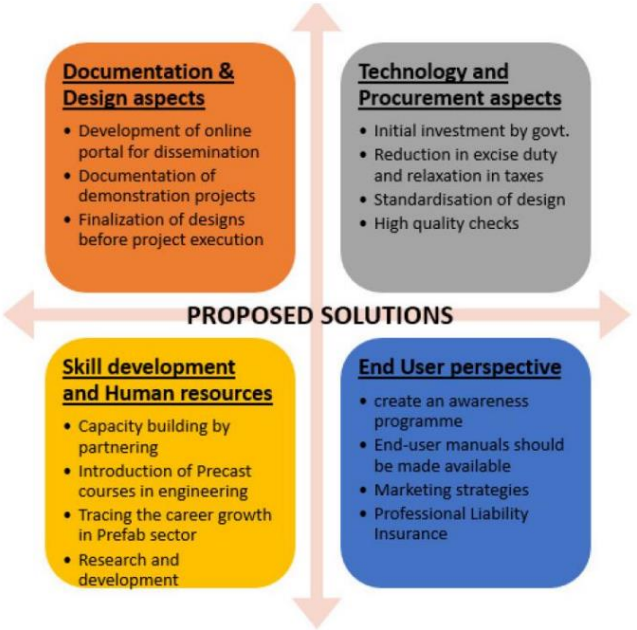
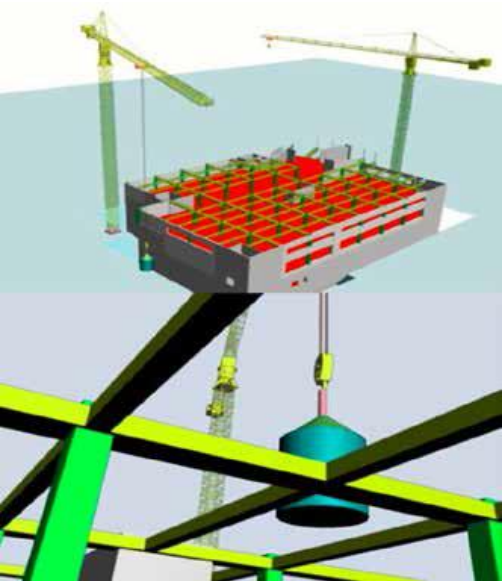
Building Information Modelling - Effective modelling of complex construction projects and related building and logistics operations using three 3D BIM can significantly assist construction planning and scheduling. This can include the identification of the optimum location for the placement of a tower crane(s) with related elements and inputs such as building type and configuration, work hours, no go zones, delivery and unloading zones, crane capacity and type, landing platforms, construction scheduling of major components and sub component activities and vertical building complexities.

Data monitoring - Modern tower cranes have remote data communication via radio, cellular or satellite networks which enable log of fleet or individual tower crane operations to maintain oversight of key parameters related to operations, including safety and optimise productive use of the tower crane asset.

Fire Suppression System (Diesel Tower Cranes)

Jib Tip Hook Camera Assist - Cameras can be attached either to the jib tip hook and/or the winch drums for viewing the load in flight, lift/landing of the load, winches and the work site. This feature helps the tower crane operator/driver to eliminate blind spots and view areas clear of obstruction. It assists the operator/driver to verify that the load is properly attached to the hook.

Increased accuracy of load placements; Increased vision of the load lifting or load landing zone; Remote monitoring of the job site with an aerial view.



RISK MANAGEMENT

RISK MANAGEMENT - PRECAST ASSEMBLY									
S.NO	ACTIVITY	CONSTRAINTS	PROBABILITY	SEVERITY	RISK	CONTROL MEASURE	PROBABILITY	SEVERITY	RISK
1	Transfer of equipment	•Transfer device collide with other things. •Oil leakage	4	3	12	Choose a qualified driver . Check the calibration . Check for barrier free space / planning .	2	1	3
2	Locating the crane	Hitting injury . Inadequate space .	4	3	12	Ground check . Reinforce the pads . Create a barrier free space.	2	1	2
3	Transportation of materials	Traffic. Collision with person / device / materials.	3	3	9	Operate with limited speed . Proper usage of circulation signs. Plan the circulation path	2	3	6
4	Movement of crane / equipments	Slip / trip / all	3	3	9	All hose/ropes/cables in use shall be secured to the side of walkways and handrails. All unnecessary materials and equipment to be immediately removed from site . All exits and walkways to be kept clear for use of personnel . High standard of housekeeping to be always maintained.	2	2	4
5	Lifting	Fall from height and injury / damage. Material damage. Collision . Poor visibility of the driver. Crane tilt.	4	4	16	Crane wires should be regularly calibrated . Should work with safe working load and speed. Dedicated personnel only should work . Barricade the lifting area . Proper safety gears should be worn . Proper lifting tools . Clear and mark the area of operation before lifting . Check the safety catch hook of the slings . Pre-define the radius of the crane . Ensure proper light during lifting at nights. Stop the lifting operation in strong winds exceed the 50km/h and during heavy rain .	2	3	6

RISK MANAGEMENT

6	Working at height	Fall from height . Object damage . Physical injury.	4	4	16	Prohibition to work at heights of night. Prohibit work at height if the weather affected the safety of persons. Protection of persons with safety harnesses. The scaffolding should be based on graded soil with good foundation. Protect a guard with a height of 1.15M protect with an end-board 10 to 15 cm high. All gaps in scaffolding structure shall be highlighted by tiger tape. The scaffolding boards shall be well secured. Use of Scaff tag. Removal of garnet from boards to avoid stress on the scaffolding. Tools put into the tools pocket their capacity. Erection in accordance with the requirement. It is forbidden to exceed the prescribed load on the Man basket. All man baskets will be load tested and certified. All man baskets will not be overloaded and will be used inside.	2	3	6
7	Welding	Burn /sting/ glare . Gas and smock Fire and /or explosion of the gas cyclinder	4	4	16	Port PPE: Face shield or goggles, gloves, aprons and leggings. Respiratory protection. Aeration of the workspace. Dilution of gas and smoke with ventilation. Cleanliness of welding at risk of abrasive particles. Check valve and Pressure of gas cylinder. Leak Detection Gas cylinders and hoses	2	3	6

RISK MANAGEMENT

8	Communication	Miscommunication during the operation .	3	3	9	Only the designated riggers who are allowed to communicate with the crane operators. Operators and riggers will use handheld radios always and will be sure that they use the same frequency prior to lifting.	2	2	4
9	Electricity	Electrocution	3	4	12	Protect electrical equipment from ingress of water. Identify equipment risk. Warning notices . Verification of electric cables before the start of work by an electrician.	2	3	6
10	Fire	Abrasive materials / particles	3	3	9	Check the cleanliness of the workplace. Site emergency plan to be followed in event fire or explosion. All personnel to be inducted and aware of emergency procedures. Installation of fire extinguishers visible and accessible. No smoking or naked light.			
11	Environmental	Exhaust gas, dust. Leaking oil or diesel machines on soil.	3	3	9	Ventilated working station . Check environmental compliance before the operation.	2	2	4

FURTHER STUDY :

PREPARATION OF QUALITY CHECKLIST FROM THE PROCESS OF MANUFACTURING (RAW MATERIAL) TILL POST CONSTRUCTION .
DEVELOPMENT OF STAKEHOLDERS MANAGEMENT .
QUALITY TOOLS AND COLLABORATIVE PLATFORM .
RISK ANALYSIS AND FRAMEWORK FOR MITIGATION.



WATERPROOFING CONCRETE FOR LIFE

RADCRETE

RADMYX™ crystalline waterproofing provides a cost effective and environmentally friendly system which gives total waterproofing protection for the life of a concrete structure.

RADMYX™ reacts with the hydration products of cement to form crystals within the cracks, pores and capillaries of concrete structures – thereby effectively blocking the passage of water. RADMYX™ can be added to fresh concrete as an admixture or applied onto an existing surface as a slurry.

Not only does RADMYX™ enhance the quality and durability of the concrete, but it also causes the concrete to become permanently self-sealing and water pressure resistant: thereby effecting great cost savings in labour and maintenance during construction and for the life of the structure.

APPLICATION

Basements
Ground Slabs
Tunnels
Roof slabs (in certain conditions)
Foundations
Diaphragm Walls

Water Holding Vessels
Wastewater Structures
Retaining Walls
Dams
Canals
Swimming Pools



Comparing RADMYX untreated concrete (top) with a treated sample (bottom) in an immersion test

WATER PROOFING

RADMYX achieves its self-sealing capability through a unique formula utilizing the capacity for regenerative crystal growth.

RADMYX can be added to the concrete as an admixture or applied onto an existing surface as a slurry. The active chemicals in RADMYX™ react with the cement particles in the concrete (in a similar way to cement hydration itself) to form insoluble, fiber-like crystals. These crystals fill the cracks, pores and capillaries in the concrete to stop the flow of water and resultant leakage through the concrete.

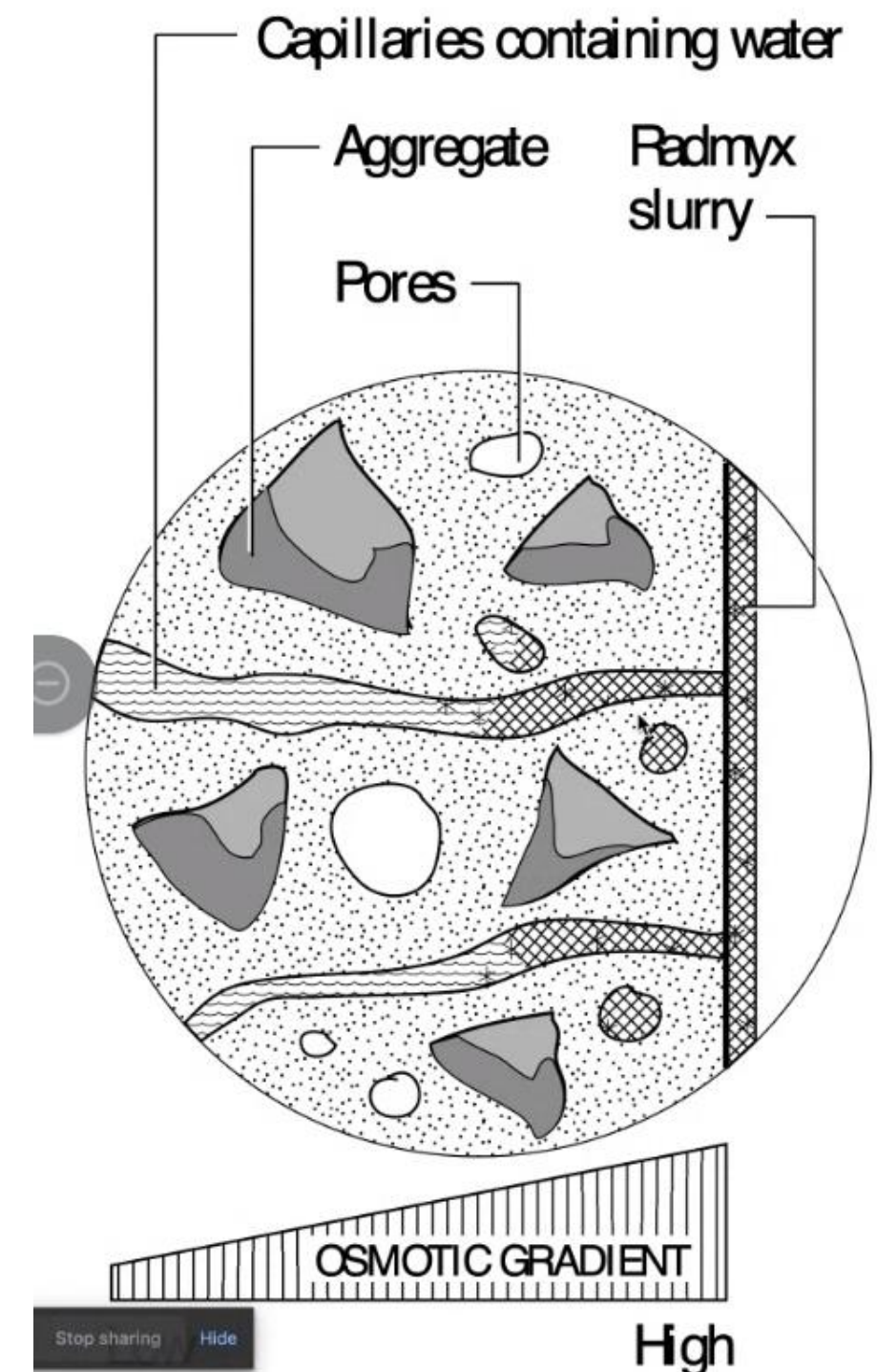
The active chemicals within RADMYX remain dormant in the concrete indefinitely. Once these chemicals again come into contact with water – for example, if there is a crack which allows water into the concrete – the chemical process is re-activated and continues to grow crystals through the concrete, sometimes reaching many centimeters in length.

This ability to constantly re-activate in the presence of moisture guarantees the concrete will achieve 100% waterproof capability for the life of the structure, as the concrete now has the capacity to self-seal on a continuous basis.

HOW DOES RADMYX™ DO IT?

It is the process of osmosis that enables the **Radmyx™** crystals to migrate through the concrete. Osmosis is where compounds of higher concentration move through a semi permeable barrier (concrete) to areas of low concentration.

The crystals produced by the reaction of **Radmyx™** move from their highest concentration — i.e. as applied to the surface (slurry) or distributed through the matrix (admixture) — to where they are needed most, that being where the water is present to reactivate and stop the leakage.



LESSON LEARNT



DESIGN THINKING
PROCESS



LEAN TOOLS AND
TECHNIQUES



SWIMLANE , WORK
FLOW DIAGRAMS



CASH FLOW AND
ESTIMATION



OPTIMIZATION OF
EQUIPMENTS



STAKEHOLDER,
ISSUE , RISK ,
QUALITY
MANAGEMENT .



DPR , LPS , DAILY
TRACKING



WORK BREAK
DOWN STRUCTURE



FEASABILITY
STUDY .



QUALITY
CHECKLISTS



SOFTWARE : RIVET

WORD OF EXTENSIVE EXPERIENCE :

The key aspect of academics is to gain hands – on – experience . And I was fortunate to gain work experience from EPMCR PVT LTD , Chennai. As a Project Management Intern , I was introduced to practical realities and was able to reinforce the lessons learnt. The groundwork gave us a brief approach regarding the delivery method along with value adding solutions . I was able to visualise my growth in concern with analytical , technical , research skills addendum to the managerial skill.

I was provided with opportunities to expose myself with different phases of construction with different requirements . The Design Thinking process has enabled me to analyse any constrain with more forward perspective which has resulted in a positive and successful aftermath of mitigation . Several different tasks have been gone through , have been completed , and have been understood and will be taken into use in the future work situations. The internship has made me more knowledgeable more ready to join the workforce. Apart form the academic inputs , I was able to understand the work ethics office culture and management . I was inspired by the people around me about their outlook towards project management . The whole 4-month internship provided me with a wide spectrum of experience and professional exposure .

I would like to express my sincere gratitude to Mr.Kavinkumar , Director – EPMCR and all the members of the office who have helped me to shape up my Project Management skills.

