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Engineering Marvel: Pouring 7858 Cum of M40 Grade Concrete in Blast Furnace Proper Raft in 36 HR

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***Abstract*— Industrial construction projects involve time, economy as well as high production output considerations. In this study, an approach to determine a time-optimized solution for speedy construction using a genetic algorithm for a blast furnace proper raft is used to achieve the milestone provided by client. An objective function is formulated for minimizing the reinforced cement concrete (RCC) work duration, subject to certain constraints, ensuring the practicality and safety of the construction. The solution provides the usage of temperature-controlled concrete which reduces the RCC work duration and safe construction. It is found from the study that a well coordination between planning, execution, fleet, resources, supply chain management team have resulted a successful record of achieving 7858 cum of concreting within 36 hours with ensuing all the safety and quality parameters, and thus ensure speedy construction. It is also observed that the M40 grade of temperature concrete provides an acceptable combination for speedy construction with due consideration of safety.**

***Keywords*— Temperature controlled concrete, Speed of construction, Pour plan.**

I. INTRODUCTION

A Blast furnace is a construction designed to convert iron oxide into pure, molten iron through the application of heat and the presence of flux and coke. The furnace itself is a tall stack, often constructed from steel. Raft is an important parameter for the blast furnace operator to judge the thermal state of the hearth. It determines the initial gas temperature of the hearth, thus affecting the heat transfer, reduction, slagging, desulfurization, hot metal temperature, composition, etc. Project is an organized unit dedicated to the attainment of a goal- the successful completion of a developed project on time, within budget, in conformance with pre-determined program specifications. It can be defined as a temporary endeavor which is designed to achieve a set of goals such as a product or service which has a definite beginning and end and is typically undertaken to obtain some benefit or to add value. Recent advancements have made it possible to now undertake complex and technologically intense projects.

II. LITERATURE REVIEW

Temperature differences can cause stress that leads to thermal cracks, as well as loss of structural integrity, thus shortening the life and decreasing the strength of the mass concrete element. If the temperature goes below a certain number, the hydration of water can slow or stop meaning the concrete won't set properly and won't achieve optimal strength. When temperatures are properly monitored, it allows for appropriate adjustments to be made. Therefore, temperature Controlled concrete is prepared by weight & is designed.

A paper states that selecting proper construction equipment is a challenging task in the construction industry due to the broad array of available equipment in the market and many criteria required to be considered during decision making.

A model was developed to address the difficulties experienced during the multifaceted process. The example illustrates how an AHP-based model helps address the multitude of qualitative, intangible factors, both among the factors themselves and then vis-a-vis costs, by means of a systematic and traceable process. The method enables project managers, and their equipment selection teams to exercise their knowledge, intuition, and professional judgment, and at the same time to address the context and specifics of the projects under examination.

A paper reviews the existing research and finds that automation and robotics, innovations, research and developments of newer techniques, prefabricated and modular constructions and use of information technology in this sector are getting popular day by day and conventional construction methods because of their limitations of time consumption and slow progress are becoming out of fashion.

A detailed literature study was carried out to understand the causes of accidents, preventive measures, and development of safe work environment. This paper presents the results of a questionnaire survey, which was distributed among various categories of construction workers.

The Study of Supply Chain Management Strategy and Practices on Supply Chain Performance stated the relationship between supply chain management strategy and chain management practices on supply chain performance.

III. ACTION PLAN

A. Project Execution Plan

A Project Execution Plan (PEP) **is** a crucial document that provides a roadmap for project managers, sponsors, and teams to ensure successful project delivery.

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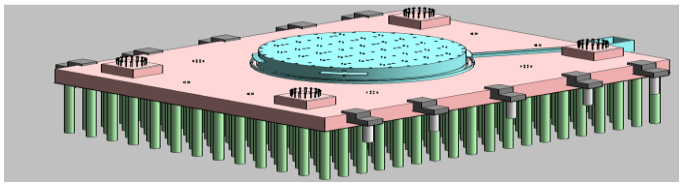

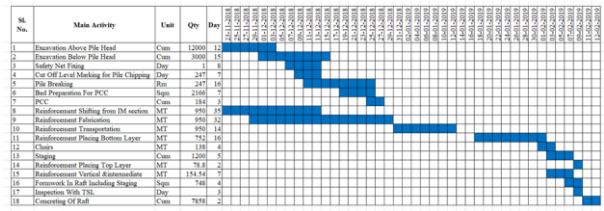

Sl. No.	Main Activity	Unit	Qty	Day
1	Excavation Above Pile Head	Cum	12000	12
2	Excavation Below Pile Head	Cum	3000	15
3	Safety Net Fixing	Day	1	8
4	Cut Off Level Marking for Pile Chipping	Day	247	7
5	Pile Breaking	Rm	247	16
6	Bed Preparation For PCC	Sqm	2166	7
7	PCC	Cum	184	3
8	Reinforcement Shifting from IM section	MT	950	35
9	Reinforcement Fabrication	MT	950	32
10	Reinforcement Transportation	MT	950	14
11	Reinforcement Placing Bottom Layer	MT	752	16
12	Chairs	MT	138	4
13	Staging	Cum	1200	5
14	Reinforcement Placing Top Layer	MT	78.8	2
15	Reinforcement Vertical &intermediate	MT	154.54	7
16	Formwork In Raft Including Staging	Sqm	748	4
17	Inspection With TSL	Day		3
18	Concreting Of Raft	Cum	7850	2

B. Logistic Plan

The circumference of the location has been divided into four approaches, two are for entry purpose and two are for exit purpose. This approach is identified that there will be no overtaking of equipment during transportation.

C. Crew Distribution

The entire team has been divided into 3 crew in three shifts since we have the target to complete the pouring un 36 hours.

D. Resource Mobilization Plan

- The allocation, mobilization, and deployment of 3M resources of the project i.e. Manpower, Machinery and material have been planned with optimization technique followed by safety and quality parameters.

Resource Mobilization Plan		
Manpower	**Machinary**	**Material**
Carpenter-30 No.	Boom Placer-6 No.	Modular Form Work-0.60 M *3.00 M-160 No.
Bar bender-140 No.	Chiller Plant-4 No.	Modular Form Work-0.70 M *3.00 M-130 No.
Welder-6 No.	Diesel Gen Sets-4 No.	Tie Rod16 MM dia-0.4 M-1407 No.
Fitter-6 No.	Transit Mixer-40 No.	Staging – Cup Lock-1 M*1 M-748 Cum
Helper-182 No.	First aid vehicle-1 No.	Cement-3527 Cum
Mason-6 No.	Maintenance workshop for TM-2 No.	20 mm aggregate-8478 Cum
Operator-152 No.	Crane (200 MT, 100 MT & 80 MT)	10 mm aggregate-5945 Cum
Electrician-20 No.	F15 (Material Handling)-2 No.	Sand-7046 Cum
Mechanic-6 No.	Excavator-2 No.	Admixture-43 MT
Flagman-30 No.	Batching Plant-9 No.	Ice-980 MT

E. Quality Plan

- Initial Setting Time-7:40 Hour
- Final Setting Time-10:39 Hour
- There was a no. of check lists which are adopted at site to ensure quality at every step for this mega pour.
- Admixture Used-CICO Plast Super C-711
- Design Mix of M40 grade was finalized as Cement: Fine aggregate: Coarse aggregate=1:1.501:2.625 with Water: Cement ratio of 0.36 and admixture dose of 0.5 %. The slump cone was found out to be 130 mm to 180 mm. The target strength achieved after 28 days was 48.93 N/mm^2

F. Pour Plan

- Pouring Time at site was 45 Min.
- The concrete temperature was maintained at 24 ^{0}c using 420 MT of ice.
- The thickness of each layer was maintained to be 450 mm.
- The concrete quantity per layer of casting was 804 Cum.
- Batching plant production was 1222 Cum in 7 hr by considering 65% productivity.

IV. RESULTS

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- With proper planning and execution, the mega pour was successfully achieved 7858 cum within 36 hours.
- Zero Fatality as with optimum quality standard.
- The total revenue generated against this structure was **5,38,86,724.29.**

V. CONCLUSION

The construction of any civil structure with is subject to industrial based is a very risky, costly, and time-consuming process. A proper coordination of all the 3M i.e manpower, machinery and material make a project less risky, cost effective within safety limit.

A milestone in a project can be achieved with the help of teamwork. In a construction project the team leader is basically a planner. Use of new effective techniques with reference to the construction project plays an important role. With the achievement of milestones, we must give equal attention towards safety and quality parameters also.

During my time spent on this marvelous project, I came to know about all the well co-ordination between different departments and cost effectiveness of speedy industrial construction.

VI. ACKNOWLEDGMENT

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