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A Review on “Detailed Study for Feasibility Analysis of Precast Superstructure in Infrastructure Project”

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ABSTRACT:Housing is in high demand as India's urban population expands. The government wants every Indian to have a home by 2022. To attain this purpose, precast concrete is required. Precast technology is adopted in India's construction industry at roughly 2%.

Metro, Monorail, and Bridge projects have all used APC. This project investigated the technique of precast concrete. To improve the use of PCC technology in Indian construction, particularly infrastructure projects, a number of issues must be solved. For both commercial and civic considerations, metro projects must be completed on schedule. Metros can be built along major city roadways by local governments. When creating a Metro, picking the correct construction approach is crucial. To construct in-situ metros, traffic must be diverted or restricted for long periods of time. Casting in situ takes longer and takes up more space. It's not a good idea to cast in place. Precast pieces should be used widely in urban elevated metro projects. Pune Metro's Precast Superstructure Feasibility Study

KEYWORDS:Infrastructure growth, rapid construction, Pune Metro, Precast Super structure

I. INTRODUCTION

The traditional cast in situ method of infrastructure is used in the majority of construction projects in India; however, there is still a significant demand for Infrastructure. As a result, construction must proceed at a significantly faster pace. This is impossible to create using traditional construction methods.

Producing structural elements in the proper or good environment, then transporting them to the project site in the proper or good environment (i.e. on trailers, long trucks), then erecting them with the help of tower cranes. Precast concrete is poured into a reusable mould or form, cured in a controlled environment, then transported to the job site and lifted into position. Precast concrete is created in a controlled environment (precast plant/precast factory) where it can cure properly and be regularly monitored by plant workers. Pre-cast construction is gaining popularity in India, particularly in urban areas. General Pre-Cast, which is industry specific, is scattered across India. Famous actors must also be involved in this field.

To execute such variable works in different phases of project, any big construction company has to keep artillery of various plants and equipment’s supported by an army of skilled and semiskilled manpower. In metro projects, the total project corridor is usually divided into sections and further to sub-sections for the ease of working and resource allocation.



The intent of the project was to minimize time and cost by leveling the resources and this was done by taking three cases to compare the optimized results. In Case 1 the entire project was considered to be done in the same order of WBS without breaking it into parts and the cost incurred by the utilization of resources is calculated. In case 2 the entire project was divided into two parts and the cost sustain by the utilization of resources is calculated. In Case 3 the entire project was divided into three parts and the cost sustain by the utilization of resources is calculated.

This can be done with precast concrete. A number of advantages of precast concrete construction over regular concrete construction. As a result, this study investigates and reviews a variety of literature. Civil engineering is given a new dimension by Precast Engineering's innovative approach to Infrastructure. In fact, it is one of the best construction methods, and it is hoped that it would lead the way in our country's housing growth. This study looks at several aspects of precast construction engineering as well as the financial rewards and drawbacks.

To execute such diverse works in various phases of a project, a large construction company needs an army of skilled and semiskilled workers. For simplicity of labour and resource allocation, metro projects are frequently divided into sections and sub-sections.

The resources are given to the working teams based on their productivity and workload. Any discrepancy between projected and actual output levels can lead to late completion and cost overruns, as well as inaccurate productivity forecasting and production rate estimation. For the reasons stated above, it is vital to examine the productivity of various resources in the metro area. A careful study, categorization, and analysis of resource productivity for diverse activities is required when the same equipment and occasionally even the same labour are employed. Identifying the elements affecting each resource's productivity and creating graphs, formulas, and charts to estimate production are equally important for planning.

Using Project Management Techniques helps reduce costs. Ability to produce is productivity. The input and output might be calculated in physical or monetary terms. Many define productivity as work quantity generated per man-hour of input. Productivity is the output value per man-hour input. Some define productivity as output per rupee input. To control project resources, the productivity concept is employed to calculate resource performance.

Benefits of Mass Rapid Transit Systems

Cities' MRT systems let people move rapidly, but also boost the economy and quality of life. This increased income and societal benefits like reduced external costs due traffic congestion, road and parking costs, transport and per-capita costs travesties MRT tends to reduce per capita vehicle ownership in favour of more compact & walkable development patterns that offer societal development benefits Travel time and cost savings reduce costs production of goods and services that boosts the city's competitiveness. One important contribution is a significant reduction in per capita pollution reducing chronic diseases has huge public health benefits.

Options of Mass Rapid Transit Systems (MRTS)

Mass transit systems in cities/urban agglomerations fall into five categories:

Busways and BRTS: Busways are physical bus lanes along the main carriageway with a separate bus only corridor. Buses may be given priority at intersections via a signaling system. BRTS is a busway with enhanced features for pedestrians, non-motorized vehicles (NMV), and other associated infrastructures such as operations and control. LRT is an at-grade rail-based mass transit system isolated from the main carriageway.

At-grade rail-based systems that are not segregated and often move mixed traffic. An elevated or underground system of fully segregated rail-based mass transit; physical segregation and system technologies.

Metro rail can carry 40,000–80,000 passengers per hour each way (PPHPD). However, monorails have lower capacities and require more maintenance.

Regional Rail: Regional rail connects the city's outskirts to the city's core. The services have more halts at shorter distances than long distance railways but less halts and faster than metro rail. Regional rail is common in large cities and helps decongest the city centre by providing safe, fast access to commuters from less congested suburbs.

II. LITERATURE REVIEW

Bhanu Prakash P.M, T A Srirama Rao “Review On Comparative Study On RCC And Steel Structure For Different Criteria’s”, International Journal of Multi-disciplinary Educational Research 2021

This study explores the rise of composite structures in emerging countries. It is no longer cost effective to build medium and high-rise buildings with RCC due to increased dead weight and unsafe formwork. Steel and concrete composite constructions are getting more popular and safer. Modern buildings are best built with steel and concrete.



This paper discusses the building construction findings for RCC, steel, and composite structures based on numerous studies.

NagarajuKaja, Anupam Jauswal, “Review of Precast Concrete Technology in India”. International Journal of Engineering Research & Technology (IJERT) June-2021

Various technical studies show that the application of precast technology is only 2% (approx.) of the total Indian construction industry. Presently the adaptation of precast concrete construction (PCC) technology is limited to infrastructure projects like Metro, Monorail, Bridges, etc. This research paper studied the different methods and components of precast concrete technology. This paper also reflects the various factors which should be attended for to increase the adaptation of PCC technology in the Indian construction industry. The research suggested that PCC implementation technology is a sustainable method to achieve a high quality along with lesser consumption of resources like cost and time during the construction.

Highlighted the impact of COVID-19 pandemic and how it is supervised. This pandemic being a substantial effect on construction projects; however, the legal implication varies from contract to contract, nations to nations. Although, the pandemic was not rendering projects to incomplete, but was slowing processes causing disruption and delay.

The projects have stopped completely to commence work at a later date. Health and safety risk assessments need to be recognized to be consistent with scientific, medical and government guidelines; for instance, people working in an enclosed environment are at higher risk than people working outside. COVID-19 being an unforeseeable circumstance can be considered to be a force majeure occurrence. Force majeure under any standard form of contract, will usually afford contract extension of time for the delay during the pandemic and not compensation for cost. Nevertheless, any new regulations given by the public authorities may have legal effect and override any contractual position/obligation initially laid down before the commencement of the projects.

Raviraj S. Gaikwad1, Dhananjay S. Patil, THE ECONOMICS OF LANDFILL MINING, IJRETS: International Journal of Research in Engineering, Technology and Science, Volume XIII, Issue VIII, September, 2020

Landfill mining of municipal solid waste combines material recycling and sustainable waste management techniques. This study evaluated the economic feasibility of landfill mining. Initially, a cost-benefit framework was developed with seven cost indicators and seven benefit indicators for landfill mining. The cost-benefit framework was applied to a case study to analyse the economic viability of landfill mining.

Lovneesh Sharma, Nileshwar Taak, A Comparative study between the pre-engineered structures and conventional structure, J.MATPR March 2020,

Pre-engineered buildings are mostly pre-designed and prefabricated. Pre-engineered building construction has evolved in time, cost, structural behaviour, and architectural vision. Pre-engineered buildings are increasingly replacing conventional steel buildings. It provides more advanced cost comparison, construction time, quality factors, and architectural outputs. The current study's major goal is to compare pre-engineered steel buildings to ordinary steel buildings. A pre-engineered building was designed, and then compared to a conventional building of the same size.

An Alternative Method for Traffic Accident Severity Prediction: Using Deep Forests Algorithm, Jing Gan, Linheng Li, Dapeng Zhang, Ziwei Yi, and Qiaojun Xiang”, “ Journal of Advanced Transportation, 21 December 2020

Several alternative machine learning algorithm-based prediction models were constructed to forecast traffic accident severity using the same dataset, and the prediction results demonstrate that the Deep Forests approach has the best stability, less hyper-parameters, and the highest accuracy. The findings of this study may help develop or improve an effective traffic safety system within a sustainable transportation system, which is critical in assisting government managers in establishing timely proactive traffic accident prevention measures and improving road traffic safety.

The role of artificial intelligence in achieving the Sustainable Development Goals, “Madeline Balaam, Virginia Dignum, Sami Domisch, IEEE 2020

The writers' viewpoint is represented in the analysis. The authors may have missed some published information on how AI may harm some SDGs, or such material may not be available yet. Nonetheless, the strategies used attempted to reduce subjectivity. Several writers analyzed and reviewed how AI might affect the delivery of each SDG, and research were reviewed for each inter-linkage. The inters connections were also discussed among a subset of authors until consensus was established on their nature. Finally, this paper examines the SDGs. The SDGs represent a significant improvement over the Millennium Progress Goals in terms of representation of human rights⁶⁹, social sustainability, environmental outcomes, and economic development.

UmamaheswaraRaoTallapalem, et.al “Time History Analysis on Precast Building Connections”, International Journal of Recent Technology and Engineering (IJRTE) November 2019

In present study we consider the three types of Beam-columns connections such as rigid connection, semi-Rigid connection and Hinged connections are established in G+20 High rise building. These High rise building analyzed with help of Time history analysis of High Seismic waves, Moderate Seismic waves and Low seismic waves .It helps to Identify the behaviour of connections and The results of Top Displacements , story Drifts and Inter storey Drifts contrast for the Different connections and Different Seismic waves.

International Conference on Sustainable Engineering Techniques (ICSET 2019), IOP Conf. Series: Materials Science and Engineering 518 (2019), Impact of the Feasibility Study on the Construction Projects, Sawsan Rasheed Mohammed, Hafeth I. Naji, Rouwaida Hussein Ali

A Feasibility studies identify and analyze the project's strengths and weaknesses, as well as the risks and threats it faces in the construction sector. There are several issues with the feasibility study, including the fact that it is often disregarded in the Iraqi building business. Other elements that directly and negatively affect the Iraqi industry such as delay, expense, and other concerns that affect the quality of the construction projects This paper's goal Determine the consequences of feasibility study in the construction industry and the reasons of feasibility study misuse in the construction industry. The paper uses system dynamics to analyze the influence of the factors that lead the feasibility study to fail. The results suggest that the feasibility research is overlooked in Iraqi building projects, resulting in cost and time overruns, and that the system dynamic technique is significant in the impact analysis. Sukhi V. Sendanayake David P. Thambiratnam Nimal Perera Seismic mitigation of steel modular building structures through innovative inter-modular connections, Elsevier, 25 October 2019

The suggested connections contain an extra steel plate and resilient layers for better ductility and energy dissipation during seismic events. To accurately capture their reaction to lateral loads and failure propagations, the suggested connections' three-dimensional numerical models are developed in ABAQUS software. The numerical model is validated using published experimental results and is utilised for parametric research. The suggested connections' seismic dependency is compared to a normal inter-modular connection currently utilised in modular constructions. The results show that the suggested connections outperform the current inter-modular connections in terms of dynamic performance. This study's findings will help improve life safety and dynamic performance of modular buildings under normal and seismic loads.

Anoj Kumar Dubey, Comparative Study on Various Behaviors of an RC Structure with Pre-stressed Concrete Structure, Research Gate January 2019,

This article examines the structural behaviour of a multi-story RC Convention Center with spans of roughly 32 m. Large spans are compared to RC and pre-stressed concrete. The auditorium roof slab is designed with conventional RCC and compared to slabs sitting on pre-stressed post-tensioned girders using Adapt Builder 2016 software. RCC and pre-stressed concrete are also compared. The structure's diaphragm action is evaluated for seismic design to counteract torsion. According to the results of a comparison study, extreme columns and corner columns are more susceptible to failure in greater seismic zones, where torsion is more prevalent. STAAD analyses the structure's response spectrum. We get pro and storey answer plots.

J Prakash Arul Jose, P Rajesh Prasanna, Fleming Prakash“Lean Design Strategy of Waste Minimization in Construction Industries” International Journal of Applied Engineering Research ISSN 0973-4562 Volume 13, Number 6 (2018) pp4593-4598

Regardless of the construction process, construction waste minimization is undertaken to make the system cost effective. This document would solve frequent building waste concerns. A management strategy based on lean construction is presented after analysing the dependability and accuracy of both construction and demolition waste. In lean design, the last planner system is used to identify problems, with resource management and scheduling being the main principles. Thus, analysing the percent of anticipated completion is a great way to reduce waste and increase productivity.

Economic Viability of Construction and Demolition Waste Management in terms of Cost Savings -A Case of UK Construction Industry Article · AbioyeOyenuga, Rao Bhamidimarri, September 2018

The potential cost savings justify the economic viability of controlling C&D waste on construction sites. However, by understanding proper waste management, the total advantages will continue to outweigh the costs. The report examined the issue of construction and demolition waste management in the UK construction industry, and assessed the cost-effectiveness of applying the 3Rs approach to building and demolition trash. The study found out that net benefit of reusing and recycling of C&D waste is estimated at a significant amount of total project budget. In reality, the UK construction industry can save money by applying waste minimization measures based on the 3Rs principles.

Convolutional neural networks: an overview and application in radiology, Rikiya Yamashita, & Mizuho Nishio& Richard Kinh Gian Do, 22 Springer June 2018

Convolutional neural networks (CNNs), popular kind of artificial neural networks in computer vision, are gaining traction in other fields, including radiology. Using convolution layers, pooling layers, and fully linked layers, CNN automatically and adaptively learns spatial hierarchies of features. This paper examines the challenges and future directions of CNN in radiology. This essay will also highlight two issues in applying CNN to radiological tasks: limited datasets and over fitting. Understanding CNN's concepts, benefits, and limitations is critical to maximizing its potential in diagnostic radiology and enhancing patient care.

P.Karthigai Priya, M.Neamitha, A Review of Precast Concrete”. (IRJET) Jan 2018

In India, most construction is done by the traditional cast in situ process. But housing is still in high demand in India. So the construction activities must be significantly faster. No conventional construction method can achieve this. It is achievable with precast concrete. Precast concrete has many advantages over regular concrete. So various literatures are studied and a review of those all has been given in this paper. The benefits and drawbacks of precast construction are also explored.

Analysis of Road Traffic Accident using Causation Theory with Traffic Safety Model and Measures”, “Dr. Neeta Saxena International Journal for Research in Applied Science & Engineering Technology (IJRASET), August 2017

Urbanization and vehicle population growth have increased the number of accidents in India's cities. A number of activity management strategies have been used to reduce traffic congestion and improve travel safety. According to MORTH-2015, India has the most accidents. As the severity of accidents has increased, road safety has become a major concern. Auto accidents have tremendous impact on Indian culture. There is a need to examine the causes of road accidents and security measures must be made to reduce road accidents. This study employs Risk Homeostatic Theory (RHT) and an accident prevention model to reduce road accidents. Risk Homeostatic Theory, Domino's Theory (RHT).

M. Harish, J.D. Chaitanya Kumar, Analysis of multi Storey Building with Precast load bearing walls with and without openings (IJCIET) Jan 2017

Because the population is quickly increasing these days, multi-story buildings with rapid construction are required to suit the needs of the growing population. The current residential building is being investigated. In this project, a

precast structural technology is chosen for quick construction. The sum total Precast load bearing elements, walls, and slabs make up a building. In this research study, a precast building is built using shear walls for earthquake resistance, with and without apertures. Shear walls are mostly utilised in earthquake-resistant structures, which have become more prominent as a result of numerous disasters. The paper is created by examining two buildings, a conventional building and a precast shear wall building, in four separate zones, while taking all of the following factors into account.

Akash Lanke, Dr. D. Venkateswarlu, Design, cost & time analysis of precast & RCC building” (IRJET) June 2016

In this study, we investigated different precast topics in depth, combed through a large amount of literature, and discovered relevant information. We used one building as an example and designed it as both a precast and a traditional cast in-situ structure. On the basis of price and duration, we conducted a cost analysis as well as a feasibility check. For a more practical study, we visited two on-going Precast & cast in-situ construction sites and gathered the necessary information. From this analysis, it is clear that the cost of precast buildings is significantly lower, and the construction time is also significantly shorter than traditional methods. We can conclude from this study that the precast concrete system is more cost effective than the traditional cast-in-place method, but there are some considerations to make when using precast, such as the quantity of construction, the distance between the site and the manufacturing unit, and the type of building.

Hari Prasad M “Comparative Study between Precast and Cast In-Situ Structure Under Combination of Connections between Precast Elements, IJSRD 2016

To meet all of the client's requirements, the precast building system offers a wide range of benefits and advantages to the designer. The increasing popularity of precast systems necessitates the enhancement of their structural behaviour when subjected to dynamic loads. This project involves the research and design of a precast substation building with a crane (5 tonnes capacity) that is subjected to dynamic loads caused by an earthquake. The cast in-situ structure is also evaluated and compared to the precast construction in order to justify its structural behaviour.

Vakas K. Rahman, prof. A.R. Mundhada,” Comparative study of RCC and pre-stressed concrete slab” (IJMER) May 2013

The comparison of R.C.C. and Pre-stressed Concrete Flat Slab is presented in this study. The design and cost estimates for R.C.C. and Pre-stressed Concrete flat slabs of various spans are included in this project. The goal of this project is to develop R.C.C. and pre-stressed concrete flat slabs for different spans and compares the results. Both sorts of flat slabs are designed using MS EXCEL programming. The goal is to come to a definitive judgment that which technique is preferable to the other. For lower spans, the results show that a R.C.C. flat slab is less expensive than a pre-stressed concrete flat slab, while the opposite is true for greater spans.

III. CONCLUSION

Because infrastructure parts are cast in a warehouse and then brought to the job site for final assembly and installation, precast construction technology produces less waste on the job site. The social, economic, and environmental aspects of sustainability may promote precast technology as a viable alternative in the construction business.

It's critical to examine what's preventing infrastructure projects in metro areas from moving forward. Examine how Precast Super Structure can be utilised in various infrastructure projects.

To see if Precast Super Structures can be employed in a real-world case study, such as the Pune Metro, while taking time and money into consideration. To determine whether Precast Super Structures can be employed in a real-world case study, such as the Pune Metro, while maintaining quality

In India, the precast technology is more useful for the development of repaired villages. The cost and time it takes to construct a project using the traditional method is more than using the precast process. The precast process helps to reduce waste on the job site. Precast technology can also be used for low-cost building. Traditional construction techniques will not be able to meet the demand for mass housing, and in the current situation, innovative construction technologies should be used to provide homes quickly with minimal labour and material waste. If the precast technology is employed in India instead of the traditional method, it might be a very beneficial and advantageous way



to solve the housing problem. Precasting allows for a greater number of dwellings to be built with higher quality and in less time than traditional methods.

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