A Study on Repetitive Scheduling Techniques in Large Construction Project

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doi.org/10.64643/IJIRTV12I11-201240-459

***Abstract*—Construction contractors often encounter projects that contain several identical or similar units, such as floors in multistory building, houses in housing developments, meters in pipelines, or stations in highways. These multi projects are characterized by repeating activities, which in most instances arise from the sub division of a generalized activity into specific activities associated with particular units. For example, a paint wall activity for a multistory building may be broken into paint first floor wall, paint second floor wall, etc. Activities repeating from unit to unit create a very important need for a construction schedule that facilitates the uninterrupted flow of resources (work crew) from one unit to the next, because it is often this requirement that establishes activity starting times and determines the overall project duration. Hence, uninterrupted resource utilization becomes an extremely important issue. The objective of this work is to integrate these methods into a generalized and simplified model, the Repetitive Scheduling Method (RSM), which ensures continuous resource utilization and is applicable to both vertical and horizontal construction. Two new concepts that emerge from development of RSM are control point and controlling sequence. RSM is not a complicated technique. It is a simple and easily applied scheduling methodology that follows naturally from the concepts and relationships found in Critical Path Method (CPM) precedence network.**

***Index Terms*—Repetitive Scheduling Method (RSM); Critical path method (CPM).**

I. INTRODUCTION

Construction projects often involve complex processes that must be completed within limited time, cost, and resource constraints. In many cases, particularly in large-scale developments, projects contain repetitive or identical units, such as the floors in multistory buildings, houses in housing colonies, sections of highways, or segments of pipelines.

These types of projects are known as repetitive or linear construction projects, characterized by the repetition of similar activities in multiple locations or units.

II. LITERATURE REVIEW

Moreno, 2020 – "A Fixed Start Scheduling Approach for Repetitive Construction Projects" Moreno (2020) develop a unique scheduling framework specifically designed to manage uncertainties in repetitive construction environments. Unlike traditional Critical Path Method (CPM) or Program Evaluation and Review Technique (PERT), the fixed start scheduling model focuses on minimizing project. variability through probabilistic time analysis.

Tomczak & Jaśkowski, 2022 – "Scheduling Repetitive Construction Projects: A Structured Literature Review"Tomczak a Jaśkowski (2022) conducted a comprehensive literature review on various repetitive project scheduling techniques and their evolution over the years. Their study classified methodologies such as the Repetitive Scheduling Method (RSM), Line of Balance (LOB), and Repetitive Critical Path Method (RCPM), analyzing their strengths and limitations. The review emphasized the significance of maintaining resource continuity, managing risks, and adopting multi-objective optimization techniques for effective scheduling.

Lazari et al., 2024 – "Multi-Objective Resource-Constrained Scheduling in Large and Repetitive Construction Projects" Lazari et al. (2024) introduced a multi-objective optimization model using Genetic Algorithms (GA) for repetitive projects involving

large-scale operations. The model considered factors such as crew transportation costs, idle times, and resource movement penalties. By analyzing 16 case studies, the research demonstrated how an intelligent optimization system could effectively balance project cost, time, and resource utilization.

Mohamed et al., 2025 – "Integrated Decision Support System for Optimizing Time and Cost Trade-offs in Linear Repetitive Construction Projects" The findings indicated that the hybrid approach outperforms traditional CPM methods, leading to improved project scheduling accuracy and better overall performance in repetitive construction environments.

Hu, 2023 – "Scenario-Oriented Repetitive Project Scheduling Optimization" This study demonstrated how advanced optimization tools can help planners make better decisions under uncertain and changing site conditions.

Shin & Suh, 2021 – "Dynamic Resource Optimization for Repetitive Scheduling Using BIM Integration" The integration allows real-time updates and analysis of project progress, enabling planners to visualize crew activities across repetitive units. This research highlighted the potential of digital technologies in achieving effective coordination, communication, and control in repetitive construction projects.

Patel & Mehta, 2020 – "Comparison of CPM and Repetitive Scheduling Method in High-Rise Projects" Patel and Mehta (2020) carried out a comparative study between CPM and RSM for a 15-storey residential project. The study demonstrated that RSM better accommodates repetitive construction conditions, as it maintains steady crew flows and minimizes idle periods. Unlike CPM, which often causes disruptions between successive units, RSM provides a more practical and visually interpretable schedule suitable for high-rise building projects.

Arash & Zhang, 2021 – "Hybrid Simulation Model for Repetitive Construction Activities "rash and Zhang (2021) developed a hybrid simulation framework integrating discrete-event simulation with repetitive scheduling techniques The study concluded that combining simulation with repetitive scheduling provides a more flexible and responsive approach to managing complex, large-scale construction projects.

Lin & Lee, 2022 – "Repetitive Construction Scheduling Under Resource Constraints Using Machine Learning" Their model utilized historical scheduling data to learn patterns and improve predictive accuracy in activity duration and sequencing. The study demonstrated that machine learning systems could adapt dynamically to project uncertainties and minimize interruptions in crew movement.

Singh et al., 2023 – "Crew Continuity Optimization in Linear Construction Projects" The study concluded that implementing crew continuity optimization could improve efficiency by up to 15% and significantly reduce overall project costs. This research provided a valuable quantitative framework for enhancing the performance of large linear repetitive projects.

Chen & Wang, 2024 – "Adaptive Scheduling Framework for Repetitive Bridge Construction Projects" Chen and Wang (2024) developed an adaptive scheduling system for bridge construction projects composed of multiple repeating spans. The inclusion of uncertainty analysis and visualized outputs helped project managers make informed scheduling adjustments. The results showed that the adaptive model improved schedule flexibility and reduced disruptions, making it particularly effective for complex infrastructure projects.

Ahmed & Farouk, 2020 – "Use of Repetitive Scheduling Method in Residential Development Projects" Ahmed and Farouk (2020) conducted a case study on large-scale residential housing developments, demonstrating the advantages of applying the Repetitive Scheduling Method (RSM) The research highlighted that RSM is ideal for housing projects involving multiple identical units, as it simplifies resource allocation and ensures consistent productivity across all construction phases.

Ofori & Mensah, 2022 – "Integration of GIS and RSM for Linear Infrastructure Scheduling"
The study concluded that combining GIS with RSM significantly increases scheduling precision and resource efficiency in pipeline and highway projects.

Al-Fadhli et al., 2023 – "Genetic Algorithm Optimization for Resource Continuity in Repetitive

Projects" Results showed a notable reduction in project duration and idle costs compared to conventional scheduling techniques. The study confirmed that GA-based optimization can effectively generate resource-efficient schedules for large repetitive construction projects.

Li & Park, 2025 – "Automated Line-of-Balance Scheduling Using AI-Driven Optimization"
The study concluded that AI-enabled automation in scheduling could revolutionize project management by improving accuracy, efficiency, and coordination in large-scale repetitive construction projects.

III. RESEARCH METHODOLOGY

The methodology adopted for the study titled "The Study on Repetitive Scheduling Techniques in Large Construction Projects." The main objective of this research is to analyze and understand the effectiveness of repetitive scheduling methods such as the Repetitive Scheduling Method (RSM), Line of Balance (LOB), and Repetitive Critical Path Method (RCPM). The methodology involves several sequential steps—beginning with the site visit, followed by data collection, data analysis, preparation of a Work Breakdown Structure (WBS), graphical representation, and result interpretation. Each step plays a vital role in achieving the research objectives and ensuring that the study is carried out in a systematic and logical manner.

IV. DATA COLLECTION

The Data Collection phase involves gathering information from both primary and secondary sources to support the research.
Primary data were collected through field visits, direct observations, and interviews with engineers, site supervisors, and project managers involved in ongoing construction projects. Secondary data were obtained from journals, reports, books, online articles, and previous studies related to repetitive scheduling and project management.

Primary Data

Primary sources provide data and information from using questionnaire survey for the research. A total number of 20 closed-ended questionnaires send out by email and distributing in construction site.

Questionnaire Survey

The Questionnaire stage is essential to gather professional opinions and real- world experiences from construction experts. A structured questionnaire was prepared and distributed among engineers, planners, and contractors to collect data regarding the scheduling techniques currently used in their projects. The responses helped to understand how repetitive scheduling can solve practical issues faced in the construction field, such as resource idleness, delays, and cost overruns.

Secondary Data

Secondary data is written or collected by other researcher such as journal, academic book, newspaper and report. Secondary data is saving time to analyze as well as providing larger database and understanding to researcher before researcher plan to collect primary data. These data are basically second-hand pieces of information and are already collected. So, these are comparatively less reliable than the primary data.

Data Analysis

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Ranking of questionnaire

The ranking question asks respondents to compare items to each other by placing them in order of preference. In the Analyze Results section, an average ranking is calculated for each answer choice, allowing to quickly evaluate the most preferred answer choice. It involves determining which answer choice is most preferred overall by finding the average of all responses with respect to the values assigned to each rank. The answer choice with the largest average ranking is the most preferred.

Average Ranking

Ranking questions calculate the average ranking for each answer choice so we can determine which answer

choice was most preferred. The answer choice with the largest average ranking is the most preferred choice. The average ranking is analyzed using MS Excel.

V. CONCLUSION

Repetitive scheduling techniques like RSM, LOB, and RCPM are more effective than traditional CPM in managing large construction projects with repetitive tasks, as they improve workflow, reduce idle time, and ensure better resource utilization. Modern technologies such as AI, BIM, GIS, and Genetic Algorithms further enhance scheduling accuracy and decision-making. The study establishes a strong base for developing intelligent, optimization-based scheduling systems. Future work will focus on practical implementation using tools like Primavera or MS Project to create cost-effective and time-efficient project schedules.

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