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# "An Analysis Of The Project Management And Quality Assurance Systems In A High-Rise, Multi-Storey R.C.C. Building" - (A Case Study Of Residential Township, Jamshedpur)

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***Abstract:***
*In high-rise structures, quality control usually includes ensuring that the minimal requirements for materials, equipment, and craftsmanship are met in order to guarantee that the competency is performed in accordance with the design. Standard procedures, numerical techniques, and random samples are typically employed as the first steps in approving or rejecting the work and sets of materials in order to ensure amenability. In addition to improving people's quality of life, high-rise building construction aids in city planning. Any building and facility failures could lead to more costly and unfeasible outcomes.*
*Reconstruction could be necessary to complete the construction facility operations impaired, even in cases of minor flaws or failures. Failures lead to personal grievances in the worst situation. Presenting quality assurance and control in high-rise buildings is the primary goal of this research article. Work quality requirements are a key component of facility designs. The necessary laboratory tests and requirements for the high-rise building are also stated. This chapter also provides an overview of successful and cost-effective method development and highlights the significance of analytical quality assurance throughout the building process.*

***Keywords -*** *High Rise Building, Quality Control, Quality Assurance, Planning, Construction Techniques.*

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## I. Introduction

The Quality is an important factor when it comes to any product or service. With the high market competition, quality has become the market differentiator for almost all products and services. Therefore, all manufacturers and service providers out there constantly look for enhancing their product or the service quality.

Quality inspections on site: -

- Attend progress meetings with contractors.
- Examine and verify the contractor or contractors' strategies.
- Keep an eye on the contractor(s)' QA/QC protocols.
- Examine and observe every field test and inspection. Control of Quality

The operational methods and procedures used to meet quality standards and the several statistical analysis utilised to confirm the system's continuous performance. The contractor is required to uphold a quality system based on globally recognised standards for the execution of the project as a whole. A specialised "Project Quality Plan" that covers topics including project organisation, procedures to be used during engineering, procurement, fabrication, construction, and commissioning, as well as a summary of quality control measures, is how the contractor describes this quality system. It is not an academic endeavour to introduce more creative and efficient project management for the building industry. according to the business's "Construction Industry Cost Effectiveness Project" study. According to general agreement and all available metrics, the country's main industry, construction, no longer provides value for money. The economy as a whole suffers from the steady decline in construction productivity and efficiency. One particularly important industry is construction. The cost of the goods or services produced in or by a factory, office block, hotel, or power plant has an impact on the price that must be charged. Additionally, that effect typically lasts for decades. Due in part to historical divisions and inertia, too much of the industry is still bound to the past. However, these experts can better address the owner's requests for their services if they have a thorough understanding of the

project management process.

Improvement of project management not only can aid the construction industry but may also be the engine for the national and world economy. However, if we are to make meaningful improvements, we must first understand the construction industry, its operating environment and the institutional constraints affecting its activities as well as the nature of project management.

**"Any activities of the overall management function that determine the quality policy, objectives, and responsibilities and implement them by means of quality planning, quality control, quality assurance, and quality improvement" is the definition of a quality management system (QMS).**

**Objectives:**

- Examine how the construction industry is implementing QMS.
- Identify the key elements that have the greatest influence on building quality.
- To raise awareness of quality in building businesses or organisations.
- To cut down on the project's indirect costs and waste of resources, including labour, money, time, and materials.
- Utilisation and comparison of the traditional approach with Primavera and MSP.

## II. Literature Review

The geometry of most constructions is straightforward, consisting of vertical columns and horizontal beams. Any building layout can be created using ETABS version 2009, although in most cases, building geometry can be produced with little effort using a straightforward grid system made up of horizontal floors and vertical column lines. There are several similar floor levels in buildings. The modelling and design time could be halved by taking advantage of this similarities. Our main objectives are to complete a multi-story building, ensure that it is safe and affordable under gravity loading conditions, and satisfy the purpose for which the buildings were intended. When constructing the structure, the dead load and live load are taken into consideration. The structure was analyzed and designed using the ETABS software tool. We used the limit state approach of analysis in this multi-story building project. The design has been approved by IS 456- 2000.

Most Latvians live in multi-story residential complexes built between 1950 and 1992. These structures are now outmoded; also, the durability and dependability standards were projected to be insufficient throughout the construction process. Despite the availability of EU and government support as well as co-financing for building rehabilitation projects, tenants of ordinary multi- story residential structures in Riga do not support and are inactive. The majority of respondents believe that the family's most valuable asset is the residence. Furthermore, 34%–69% of individuals have modified their residence and conserve resources inside their unit borders. Only a few respondents evaluate the technical condition of communal property, but the majority lack information about resource supply and energy accounting, are uninterested in resource-saving opportunities within the building in general, and do not understand the importance of building technical maintenance.

Investigating scheduling methods and construction systems for multi-storey structures is the aim of this project. Additionally, Microsoft project software will be used to plan and schedule the construction of a multi-storey RCC building and determine the project's cost of conformance. To fulfil the goals, a fictitious RCC residential G+7 block is considered. This project's entire planning and scheduling process is examined using traditional methods used by contractors, engineers, and architects, and then compared to modern computerised methods. This method uses Microsoft project software to design and schedule the RCC building. Based on observations, Microsoft Project software is a good tool for constructing Gantt charts for a construction project's schedule. It also uses project crashing and schedule crunching techniques to determine the shortest construction time. Regarding the use of Microsoft project software for scheduling and planning building construction, the current study offers helpful information.

Quality has become a crucial determinant of an organization's success or failure in the era of the open market. Notwithstanding its covert nature, quality has always been a top priority. In the process of being developed. In construction projects, quality, timing, and cost must all be balanced. Quality assurance is necessary, especially in the food business, due to the high rate of negligence and ignorance. The quality of construction is worse for smaller projects. A major concern now is the creation and application of a quality assurance system for the general enhancement of building quality. 30 construction projects from the National Capital Region (NCR) with construction budgets between three and five crores were selected for the current paper, and information on various quality and management aspects was gathered from these projects. Among other buildings, these 30 projects include community centres, hotel blocks, and school buildings. The study was conducted for the construction projects of multiple government entities.

This study concentrated on the elements that are crucial to a structure's quality when it is being built, including the client's dedication to quality, the calibre of the materials, the documentation, the work procedures, the personnel, and so forth. Based on the various factors that either directly or indirectly affect the project's

quality and seamless operation during and after construction, the data analysis revealed that the quality assurance system for these projects was categorised as Excellent, Good, Average and Poor in Quality Grading. It is clear from the process of creating a quality assurance and control system that quality is not something that just happens; it needs to be managed throughout the whole life cycle of the product. A company may achieve, maintain, and improve quality on a budget by organising and managing its resources using a quality system. Examples of quality systems include information technology systems, human management systems, and financial control systems. After all the time and effort spent on the original system, a dangerous point is reached. The system could end up being a neatly packed, inviolate document once it is finished. This is exactly what needs to be avoided, and effective measures need to be taken to stop it. Making procedures more successful in terms of Total Quality and the company's objectives should be the main focus of a well-run quality auditing program. Pre-construction, construction, and post-construction are all phases of the construction process where quality control should be implemented. As much as possible, the use of materials for structural members that are produced under strict supervision and regulated conditions should be promoted. Last but not least, remember that our Quality Assurance and Quality Control System is a living thing that needs information to flow both ways in order to get better.

Quality assurance is one of the characteristics of a quality management system. The Quality Management System pertains to quality assurance, quality control, and quality planning in the construction industry. Quality management systems (QMS) can be used at both the project and business level in the construction industry, and they have several uses. Residents of a residential building or apartment complex were surveyed using a questionnaire by the authors. The study's objective is to pinpoint obstacles to the application of QMS in building projects. preserving the required standard of construction work to satisfy clients, which helps firms remain competitive and survive over the long run (Tan & Abdul-Rahman, 2005). Quality assurance starts with customer happiness.

First, the needs of the client are determined, and quality control is only finished if the client is fully satisfied. In this study, the building's or apartment's occupants after possession are referred to as consumers. Their specifications must be met throughout the building or apartment's construction. In accordance with ISO 9001 standards, customer satisfaction is essential. In order to ascertain client satisfaction in the construction industry, the current study was carried out in the Pimpri district of Maharashtra state, India. "All activities of the overall management function that determine the quality policy, objectives, and responsibilities, and implement them within the quality system by means such as quality planning, quality control, quality assurance, and quality improvement" is how ISO 8402, the quality vocabulary, defines quality management. Meanwhile, "the organisational structure, responsibilities, processes, and resources required to achieve quality management" is how ISO 8402 describes a quality system.

The application of lean principles has been popular in the construction sector recently. The Toyota Production System (TPS), which was developed in the 1950s, served as the foundation for this management approach's production philosophy. Due to the severe shortage of resources following World War II, it was imperative that assembly procedures be as effective as feasible. As a result, emphasis was placed on reducing waste, time, and the need for tangible goods. As a result, preassembly became an essential step in the assembly process. Although there are potential to use the lean concept mindset during the design development phases, engineers in the construction sector are mostly focused on implementing lean strategy for production in shop and field situations.

According to this study, a lean approach can be applied completely throughout the preconstruction and design stages. This study suggests that a lean approach might be applied at both the preconstruction and design stages. To illustrate the use of lean concepts, a case study that integrates the quality assurance and quality control (QAQC) procedures of façade design and manufacturing is developed. The term quality management (QM) refers to a collection of ideas, guidelines, or practices that integrate empirical facts and prescriptive opinions in order to establish and run an industry. to increase the effectiveness the proportion of overall revenue devoted to building maintenance (BM) is rising. The building industry's output has raised awareness of the need for management. Structures in an effective way In the Kingdom of Saudi Arabia, building projects are becoming more and more expensive. The operation and other expenses are included in the approximately SR 181 billion 2014 budget for Riyadh City. The cost of maintenance projects was SR 10 billion in 2014. But in the Kingdom, this sector of the economy suffers a number of difficulties. To guarantee the subsequent gathering of pertinent knowledge and information from the empirical interviews and focus group discussions, the nature of BM is thoroughly studied in the literature review. In order to identify underlying issues and gauge awareness and application of QMCs, the first qualitative exercise involves conducting interviews to gather data for an analysis of the present BM procedures in public departments.

## III. Research Methodology

**Problem Statement**

The building industry is unable to set up even a QMS (Quality Management System), whereas other manufacturing sectors are implementing TQM (Total Quality Management) systems. The cause of this is quality, which is a variable that varies over time and across locations. However, there are numerous standard construction project tasks, such as plastering, waterproofing, bricklaying, and concreting. Concrete work, building detailing and drawings, material quality, workmanship quality, and other important aspects all have an impact on those frequent projects. In construction organisations, quality management systems are more beneficial for raising cost-oriented quality awareness.

Objectives behind this are as follows: -

- Determine the major factors that are mostly affect the quality of construction during the construction particularly during execution phase.
- To create the quality awareness in construction organizations or companies.
- To minimize the indirect cost of the project and also reduce the wastage of wastage of materials, time, money, manpower, etc.
- Investigate the implementation of QMS in the construction industry.

**Methodology**

The work's technique is based on a three-step concept. Quality planning is the initial step, followed by quality control and quality assurance. The writers created the questionnaires in the first step while taking the construction project's quality into consideration. The writers created the questionnaires by considering quality factors found in the Proceedings of the Civil Engineering. Civil Engineering & Technology Advances and Research-Construction Management 324 construction project for builders, contractors, consultants, and building customers/occupants. The study explains how to rate various factors using a five-point rating system in order to analyse the information gathered from builder/contractor interviews. Interviews with building project participants are the second step.

The responders have at least fifteen years of experience working on construction projects as project managers or engineers. They will be asked a number of questions, and there are a variety of possible points for some of the questions. These points must be rated by the respondents using a five-point rating system. "5= Very Strong, 4= Strong, 3= Moderate, 2= Less, 1= Very less" is how the scale is described. Every possible question has been examined in the data analysis, and the results are discussed in the paper's next part.

**Data Collection & Analysis:**

The information was gathered by looking through a variety of online publications, including research journals, project logs, manuals, and news sources. The Internet and its private, corporate Intranet counterparts have been the most striking examples of new technology used in construction. The Internet is frequently used to promote professional teamwork on a project, to exchange bids and results, and to acquire essential products and services. To show interested parties how development is progressing, real-time video from particular construction sites is frequently employed. As a result, procurement, communication, and teamwork have all improved.

**Microsoft Project (MSP):**

The Microsoft organisation created Microsoft Project (MSP), a project management software tool designed to assist a project manager in any kind of project with improving a plan, allocating resources, tracking improvements, completing the budget, and assessing the quantity of work. The cost of resources and the allotted task determine a project's budget. A mutual resource pond can be used to distribute resources, such as labour, materials, and equipment, across the projects. Each resource has a unique calendar that shows the days and times that it is available. Based on resource rates, resource assigned costs are computed. Critical path schedules, which can be resource levelled and depict task networks using Gantt charts, can be created by MSP applications.

**Primavera:**

In general, Primavera P6 uses the dynamic scheduling methodology. which does, in fact, give the Project Management office a clear road map on which to build. The best possible optimized plan of the project by using 'what-if' scenarios risk extenuation methods. Despite, the fact that it exhibits the Project Manager's capability to produce management change possibilities for the Project Management team to select from the when variances by the proposed project Baseline are being noticed. The method of dynamic scheduling frames the base or the platforms for the project scheduling which is designed to support the team of Project

Management with certain official philosophies, policy, guidelines, terminology, templates and procedures which could include the coaching and training tool or platform through which a particular timeline of events, steps, and the project milestones are accomplished.

The following indirect actions, carried out by the various Project Management teams and their stakeholders, form the basis of the dynamic scheduling technique. Because new technology development is expensive, the impact of many new technologies on construction prices has been uneven. It is evident, therefore, that those in the design and construction industries who have failed to adjust to evolving technologies have been pushed out of the mainstream. In the end, implementing new technologies that have been shown to be effective from both a performance and economic perspective can raise construction quality and cost.

**Case study details:**

- Name of the project: "Vijaya Garden" residential project Highrise building
- Location: Phase-1, Vijaya Garden Society, Baridih, Jamshedpur
- Type of the project: Residential apartment
- No of stories: G+10 with basement
- Start of the project: 13 March 2007
- Completion of project: 31 April 2022
- Site Area: 3.4 million Sq. Ft approx.
- Type of construction: RCC Mivan structure.

**Site Observation:**

The following observations are noted in field for the quality control and quality assurance:

**Plain Cement Concrete (P.C.C.):**

In foundations when the earth is soft and yielding, RCC is supported by a solid impervious substrate made of plain cement concrete (PCC). PCC can be used either without or over brick flat soling. "Cement concrete (CC)" or "binding concrete" are other names for plain cement concrete.

- Prior to mixing concrete, verify the PCC form work's dimensions.
- Verify that the polythene covering is placed over the PCC bed.
- Examine the concrete's droop.
- Prior to casting, check the PCC's thickness level by placing steel pegs in the concrete area or levelling fresh concrete pillars at the appropriate distance.
- After casting, check the PCC's final level by using nails to secure the threads in the form work.
- Check to see if the concrete is being laid gently.

**RCC: Reinforced Cement Concrete:**

The following observations assurance Footing, Column Starters Columns, Beams, Slabs, Shear walls, Stair Cases are noted in field for the quality control and quality.

These structural components transfer wall or column loads to the soil beneath the building. In order to minimise differential settlement, avoid sliding and overturning, and prevent excessive settlement of the structure, footings are made to transfer these loads to the soil without going above its safe bearing capacity. In accordance with the proportions specified in the plan, footings are positioned above the PCC to support the structure. Strengthening Footing marking, footing installation, and footing inspection.

**Marking Of Footing**:

The footing is marked using the grid lines that are marked on the PCC laying site. The grids are then transferred to the PPC.

**Footing Layout:**

Footing is laid on PPC, requiring all necessary shuttering and reinforcing work. Examining the photographs: To examine the footings, shuttering and reinforcement checks are necessary.

**Checks For Reinforcement:**

1. Steel Placing: The steel must be positioned correctly in accordance with the designs.
2. Spacing: After the steel is installed, the spacing needs to be carefully examined using the marks to see if it matches the plans or not.
3. Number of Bars: Verify that the specified number of bars is positioned.
4. Diameter of Bars: This is the important factor that will consider mainly while laying of the reinforcement. The diameter of the bars has to be placed in the same direction as given in the drawings.

5. Chair height calculations: Chairs are primarily included to prevent the top and bottom mats from coming into touch. The depth of footing determines how high the chairs are.
6. Alignments: The coverings on all sides of the footing are taken into consideration while performing these reinforcement tests.

**Quiet Checks:**

1. Profile (level): These tests must determine whether or not the footing's top is level.
2. Alignments: If the footings are not put in the same alignments, there may be a possibility that the position will change.
3. Plumb: The plump is used to evaluate the footing's vertical.
4. Measurements: In accordance with the provided designs, the footing's measurements must be the same on the site. For instance, the measurements
5. Diagonal: The PCC must be examined diagonally once the footing dimensions have been marked.
6. Supports: In order to prevent concrete from leaking, some supports must be provided after the shuttering work is completed.
7. When it is poured. For providing this supports the excavations has to be done 1 foot extra excluding the dimension of the footing not in the depth.
   1. Gaps: To prevent leaks when the concrete is poured, the spaces between the shuttering pieces must be kept to a minimum.
   2. Covers: The covers must be inspected following the installation of the reinforcement. If not, there's a potential that one side's cover will increase while the other side's cover will decrease.

**Column Starters:**

As soon as the footing is finished, this work is completed. The sole reason for doing this is to support the column shuttering. The column starts range in height from three to six inches. The benefits of column starters

• It will ensure that the shuttering is supported correctly.
• This starter is used to control concrete leakage.

**Column:**

In structural engineering and architecture, a column or pillar is a structural member that transfers the weight of the structure above to other structural elements below by compression. The columns were checked.

- Checks for Reinforcement
- Checks for shuttering

**Reinforcement Checks:**

• Steel Placing: The steel must be positioned correctly in accordance with the designs.
• Spacing: Following the installation of the steel, the spacing needs to be carefully examined in relation to the marks to see if it matches the drawings or not. Number of Bars Verify that the specified number of bars are positioned.
• Bar diameter: This is the crucial element that will be primarily taken into account when the reinforcement is being laid. The bars' diameter must be positioned in the same direction as shown in the pictures.

**Lapping:**

The typical lengths of steel reinforcement are 6 meters (200 feet) and 12 meters (50 feet). A splice is necessary in situations where the steel reinforcement must be longer than these or other cut lengths. Since there are different bar sizes, the location of the lapsing, and the structural part or element that is being lapped, all affect the lap length, which is what we would call REGULAR.

**Shuttering Checks:**

**Alignments:**

If the footings are not set in the same alignments, there may be a possibility that their position will change. Plumb The plump is used to assess the footing's vertical. Measurements: According to the provided designs, the footing's dimensions must be the same on the site. For that, it is possible to precisely verify the footings' dimensions. Diagonal Dimensions on the PCC must be checked diagonally once the footing supports have been marked. Supports: After the shuttering is installed, it must be supported by something to prevent concrete leaks during pouring. Excavating must be done an additional foot in order to provide this support, omitting the footing's dimensions. voids: Avoiding the spaces between the shuttering projects is necessary to prevent leaks when the concrete is poured. Covers: The covers must be inspected following the installation of

the reinforcement. If not, there's a potential that one side's cover will increase while the other side's cover will decrease.

**Beams:**

A beam is a structural component that extends horizontally between supports and bears loads that are perpendicular to its length. In addition, the beam's depth and width are "small" in relation to its span. The breadth and depth are usually smaller than span/10. Beam types utilised in these structures:

1. Inverted beam
2. Concealed beam
3. T- beams Inverted beam:

The beam whose bottom level is same that of slab called inverted beam, likely to be used only in top slab of the building to give good view for inner face of the building Concealed beam: The Hidden beam is a means to describe the load dispersion on to supporting slab. Hidden beams are generally inserted within the suspended slabs where slab thickness is considerable. The hidden beam is not a beam and the only means to spread the concentrated load of the walls on the slab area. Hidden beam between balcony and room is very common to facilitate easy inclusion of balcony into room space later. It is also known as "Concealed Beam".

**Slab:**

A slab is structural member whose dimensions are small compared to its length. A concrete slab is a common structural element of modern buildings. Horizontal slabs of steel reinforced concrete, typically between 100 and 500 millimeters thick, are most often used to construct floors and ceilings, while thinner slabs are also used for exterior paving.

Types of Slabs: 1. PT Slabs, 2. RCC slab, 3. Flat Slabs, 4. Grade Slabs

## IV. Conclusion:

To ascertain the current site quality management system, field research was carried out on building sites, and the following were examined: No quality management system is in place. businesses, and there's much space for improvement when it comes to implementing quality Work management during the design phase to minimise defects During the building phase, a considerable amount of rework is done. Design and specification errors have caused numerous building projects to fail. Businesses concurred that using a QMS would improve performance due to greater competition among the main justification for not using construction firms.

On-site quality management implementation is few. financial support and knowledge of QMS. Check lists are an excellent tool for construction projects. The on-site quality control measure is the craftsmanship quality of all processes. During the planning and design stages of construction projects, respondents adamantly said that they follow a regular schedule for quality control. One of the things that prevents a project team from doing their best work is inadequate planning. Customer satisfaction was also highly valued by the respondents. Respondents stated that implementing a quality management strategy on-site is equally essential and that supplier test findings should be prioritised over on-site physical testing. According to the poll, client satisfaction is always crucial as long as the satisfaction of the other project participants is also significant. It also highlights the significance of overall quality control in building projects. Following consideration of the aforementioned points, the researcher arrived at the following conclusions, which are listed below.

- Satisfaction of all stakeholders in the industry.
- Better understanding on quality control procedure.
- Satisfaction of Client.
- Suitable quality control method for the project.
- Development of the quality of strength in construction.
- Total Quality Management at construction project.

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