

ESTABLISHING QUALITY STANDARDS IN HIGH RISE BUILDING IN ACCORDANCE TO PRE, DURING AND POST CONSTRUCTION

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Abstract - The ideas of proactiveness and generating a win-win situation are essential at every stage of the project life cycle while keeping in mind the needs of the client or customer in mind. Quality has a significant impact on the predicted result. Checklists are the main instrument for assessing quality. Examining the checklists used today for high-rise structures that are at various stages of development, such as pre- construction, Construction, and post- construction , to determine how the quality of a project is trailing is likewise being handled in support of the end user survey. An in-depth knowledge base and experience managing organisations are necessary to manage a project of this nature. Therefore, how a project management consultancy contributes significantly to a project's success will be discussed, as well as the difficulties they encounter and solutions to them is also dealt.

Key Words: Quality, Pre, during and post construction, project management consultant, Checklists.

1. LITERATURE REVIEW

The primary stages of the project:

1. Pre construction
2. During construction
3. Post construction



2. METHODOLOGY

- To understand quality issues in high rise building.
- Review and analyze existing checklist in all phase of the project.
- Comparison of projects with and without Project management consultant.

- To produce an end user survey ensuring quality as key aspect
- To propose checklists to enhance the project output

3. HOW QUALITY IS MEASURED IN HIGH RISE BUILDING :

Inspection and Testing: This involves conducting regular inspections and tests at various stages of the construction process to ensure compliance with design specifications and regulatory requirements. This can include testing the strength of materials used, inspecting structural elements, checking the quality of finishes, and so on.

Quality Control Checklists: These are lists of specific quality criteria that need to be met at different stages of the construction process. These checklists can be used to ensure that all critical elements are checked and that the necessary quality standards are being met

Documentation and Records: This includes keeping track of the construction process, material specifications, design drawings, inspection reports, and any other relevant information.

Compliance with Standards: Compliance with relevant codes, standards, and regulations is critical to ensuring quality in high-rise building construction. These standards may include building codes, fire codes, and environmental regulations, among others.

Feedback from Stakeholders: Feedback from stakeholders, including owners, architects, engineers, and construction workers, can provide valuable insights into the quality of construction. This feedback can be obtained through surveys, interviews, or other methods and can be used to improve future construction projects.

KPIs are performance metrics that evaluate the achievement of goals or benchmarks. In high-rise building construction quality, the following KPIs are commonly used:

The Construction Quality Index (CQI) measures the quality of construction, evaluating aspects such as materials, workmanship, safety, and compliance with standards.

Defect Density is the number of defects per unit of construction, including those in materials, workmanship, or design.

Schedule Variance measures the deviation between the planned and actual progress of a project, with a positive value indicating ahead of schedule and a negative value behind schedule.

Cost Variance measures the difference between the planned budget and actual cost of the project, with a positive value indicating under budget and a negative value over budget.

Safety Incident Rate measures the number of safety incidents per unit of construction work, including accidents, injuries, or other safety-related incidents.

4. QUALITY STANDARDS THAT ARE FOLLOWED IN HIGH RISE BUILDINGS :

ISO 9001: This is a quality management system standard that outlines the requirements for managing and improving quality in all aspects of the construction process.

ASTM Standards: These are standards developed by the American Society for Testing and Materials that cover materials and testing methods for construction.

ACI Standards: These are standards developed by the American Concrete Institute that cover the design, construction, and testing of concrete structures.

ASCE Standards: These are standards developed by the American Society of Civil Engineers that cover various aspects of civil engineering, including building design and construction.

5. ISO 9001 quality standard for high-rise building construction:

Quality Management System: Implement a quality management system that is appropriate for the scope of the construction project.

Leadership: Provide leadership and commitment to the quality management system, and ensure that the necessary resources are available to achieve quality objectives.

Planning: Plan and implement a quality management system that addresses the needs and expectations of stakeholders, including clients, contractors, and regulatory agencies.

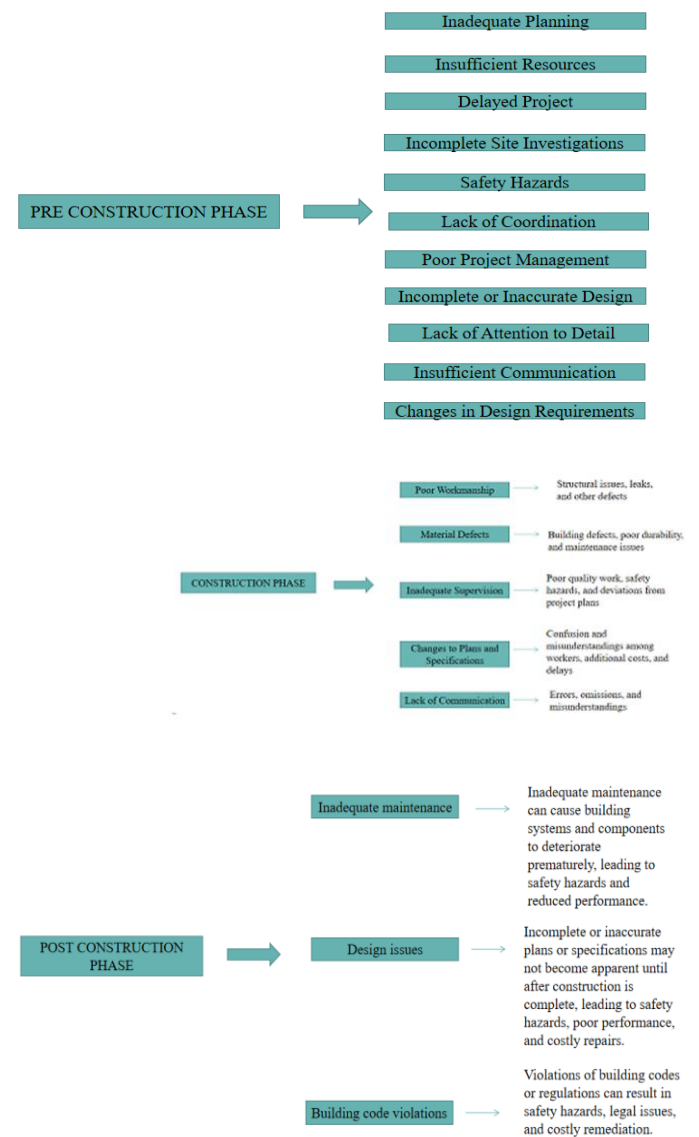
Support: Provide the necessary resources and support to ensure that the quality management system is effective.

Operation: Implement quality control procedures during construction to ensure that work is done in accordance with the design and quality plan.

Performance Evaluation: Monitor and measure the performance of the quality management system, and take corrective action as necessary.

Improvement: Continuously improve the effectiveness of the quality management system through the use of data and feedback from stakeholders.

Compliance with the ISO 9001 quality standard can help to ensure that high-rise building construction projects meet quality objectives, are completed on time and within budget, and are safe and functional for their intended use.



Project management is important because it ensures what is being delivered, is right, and will deliver real value against the business opportunity.

Why is project management important ?

Strategic alignment : Project management is important because it ensures what is being delivered, is right, and will deliver real value against the business opportunity.

Leadership :Project management is important because it brings leadership and direction to projects.

Clear focus & objectives : Project management is important because it ensures there's a proper plan for executing on strategic goals.

Realistic project planning : Project management is important because it ensures proper expectations are set around what can be delivered, by when, and for how much.

Quality control :Project management is important because it ensures the quality of whatever is being delivered, consistently hits the mark.

Risk management : Project management is important because it ensures risks are properly managed and mitigated against to avoid becoming issues.

Orderly process :Project management is important because it ensures the right people do the right things, at the right time – it ensures proper project management process is followed throughout the project life cycle.

Continuous oversight: Project management is important because it ensures a project's progress is tracked and reported properly.

- COLLAPSE OF TRUST MOULIVAKKAM TOWER, PORUR :

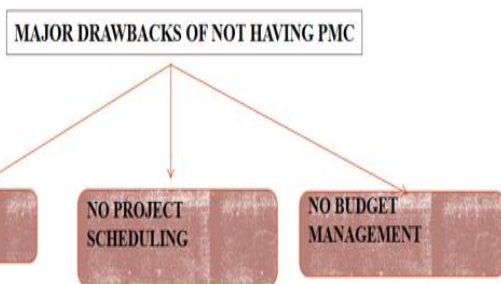
The most common causes attributed for building collapse are:

1. The foundations are too weak
2. The building materials are not strong enough – quality deficiency
3. Human errors
4. The load is heavier than expected &
5. The strength is not tested

Gross Violations only Caused the Collapse

The foundation's structural design, which included a raft and pile, was insufficient to support the combined weight of the basement, stilt, and 11-story building. The building's collapse was mainly due to significant deficiencies in the reinforced concrete columns' structural design, which blatantly disregarded the National Building Code of India's requirements for structural design. Furthermore, the columns were not designed to support the weight of such a massive structure. The accused's foundation design did not consider the soil conditions at the site, and it was woefully inadequate for constructing an 11-story building that would remain stable. Additionally, the improper detailing of the reinforcement, including inadequate anchorage, insufficient reinforcement length, and inadequate column ties, failed to cover the reinforcement.

The improper construction procedures for high-rise buildings, combined with a lackadaisical approach, resulted in numerous issues. The quality of materials used, including bricks and sand, was inadequate for tall constructions, and soil testing was not adequately conducted, especially for plots located near lakes, where the foundation is crucial. The study found that poor construction quality and disregard for soil conditions were the primary reasons for the building's collapse, exacerbated by inadequate structural testing, alterations to the original plans, substandard workmanship, and hasty construction.



6. CASE STUDY

- Collapse of trust moulivakkam tower
- Ganesh Gunjan , Ganesh Astoria
- Shahberi twin building
- SAT Building
- Diamond building

- GANESH GUNJAN, GANESH ASTORIA, NASHIK :

By comparing two buildings, the main quality issue is found and dragged to the conclusion:

PROJECT I:

A. RCC defects

Factors	Honeycombing 33.33%	Steel Exposure 33.33%	Expansion of Beam 33.33%	Total Defect	Defect in %
Management	0	0	1	33.33	12.5%
Material	1	0	0	33.33	12.5%
Equipment	1	0	0	33.33	12.5%
Manpower	1	1	1	99.99	37.5%
Methodology	1	1	0	66.66	25%
				266.64	100%

B. Brickworks

Factors	Uneven Brick size 50%	Breakable Bricks 50%	Total Defect	Defect in %
Management	1	0	50	20%
Material	1	1	100	40%
Equipment	0	0	00	0%
Manpower	0	1	50	20%
Methodology	1	0	50	20%
			250	100%

C. Plastering works

Factors	Cracks 50%	Varying thickness of plaster 50%	Total Defect	Defect in %
Management	1	0	50	20%
Material	0	0	0	0%
Equipment	0	0	0	0%
Manpower	1	1	100	40%
Methodology	1	1	100	40%
			250	100%

PROJECT II

A. For RCC defects

Factors	Cracks 20%	Improper casting of Staircase 20%	Honeycombing 20%	Seaparation of concrete 20%	Total defect	Defect in %
Planning	1	1	1	0	60.00	33.33%
Material	1	0	0	1	40.00	22.22%
Controlling	1	1	1	1	80.00	44.44%
Money	0	0	0	0	0.00	0%
Design	0	0	0	0	00.00	0%
					180.00	100%

B. For brickworks

Factors	Plumb out 20%	Cracks 20%	Uneven Brick Size 20%	No offset in passage 20%	Total defect	Defect in %
Planning	1	1	1	0	60.00	30%
Material	0	0	1	0	20.00	10%
Controlling	1	1	1	0	60.00	30%
Money	0	1	1	0	40.00	20%
Design	0	0	0	1	20.00	10%
					200.00	100%

Therefore we must Work according to two steps:

Proactive steps:- These steps should be carried out before starting the construction work. This consist of strategic planning , sufficient fund available, proper design process, proper management process for materials and labours, adopt training programme and quality control committee at the high rise building site.

Reactive steps :- These steps should be carried out after quality problems arising on the site. This consist of Emergency Preparedness and Response, Monitoring and Measurement, Awareness and Competence, Records Keeping and Repair the Defect.

SHAHBERI TWIN BUILDING, NOIDA

The building collapse incident happened in Shahberi village of Greater Noida on 17th July, 2018 around 9:30 p.m. There were two buildings, 10 storey completely constructed building was two year old, and another was 10 storey under construction. The buildings stood next to each other on the marshy land and were separated by a 5 feet wide road. The land of this area is not hard enough to withstand heavy construction and in absence of proper system of disposal of sewage and garbage the soil has become swampy because of water logging resulting weakening of foundation of building. The other reason for collapse was that the construction is done with the sub-standard building material including fly-ash bricks and pillars developing cracks even before any substantial construction took place.

Therefore it was observed :

- The constructed/under-construction building should be surveyed from hazard and vulnerability point of view.
- A strict action should be taken instantaneously on illegal/unauthorized construction to avoid the incidents.
- Concerned authorities should check the licence and approved plans before any construction take place by builders.

- Structural audit of building should be done by the competent authorities. UNA authorized construction needs to be taken up as a punishable offence.

NAME : SAT,Chennai

WINGS : A, B, C , D, E

WING A : constructed by using mivan technology

WING B,C,D,E : Conventional method (AAC blocks)

No of floors : 19

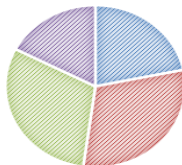
WING A - 114 UNITS

WING B,C,D,E - 334 Units

Checklist for shuttering in mivon technology has to be improved and checked properly at regular intervals . If not checked properly, results in problems in alignment and bulging occurs.Cracks in joints is mostly observed Packing of AAC block must be done properly if not addressed dampness will be formed.Checklist for AAC block dampness must be kept into considerarion. Plumbing quality of pipes must be checked properly Diameter of pipes must be checked properly

CHART

■ Shuttering in mivon ■ packing of AAC block
■ AAC block dampness ■ plumbing and drainage



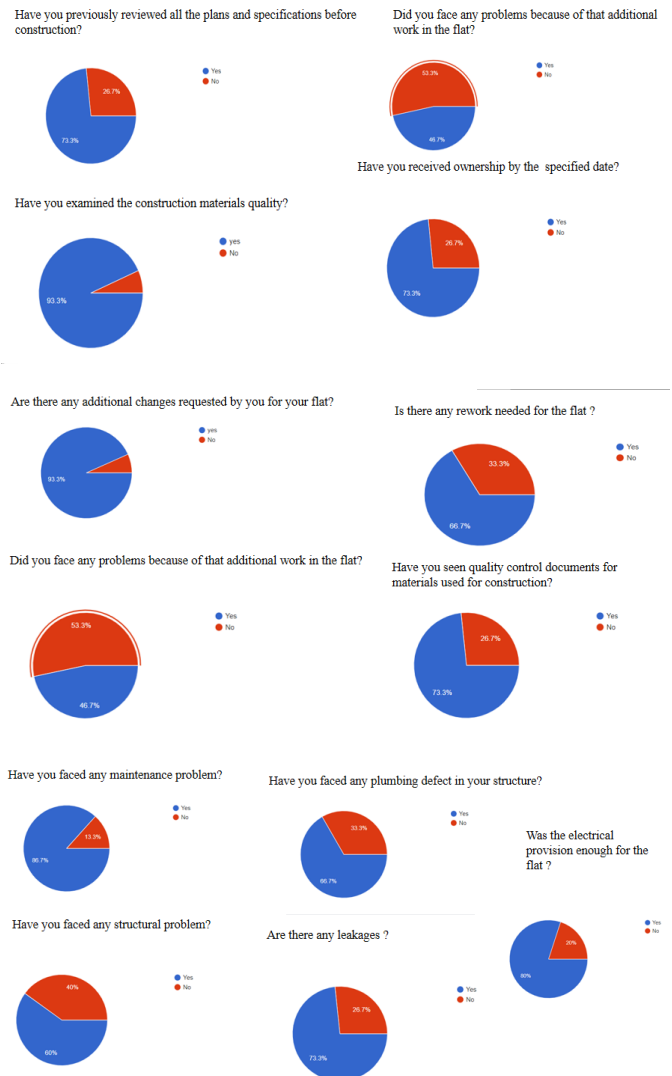
NAME : Diamon, Chennai

FLOORS: 13 (2+3 BHK)

Typology : Highrise residential + commercial

From the above study it was infered that Uneven finishing in many places were found which is due to improper inspection . The works were still pending but handing over to the client is done which will create quality issues.

By infering the above quality issues, End user survey was conducted with high rise occupants



From the above pie charts it is understood that the quality issues in high-rise buildings cannot be resolved easily due to the complex nature of such structures, which involves various factors such as design, materials, workmanship, and construction procedures. Additionally, rectifying quality issues in a high-rise building may require significant time and resources, which may not be feasible or practical. Furthermore, quality issues in high-rise buildings can have severe consequences, such as building collapses, putting lives and property at risk. Hence, ensuring high-quality construction from the beginning is crucial to prevent quality issues in high-rise buildings.

7 FINDINGS

Some common findings related to quality in high-rise buildings include the use of substandard or low-quality materials, poor workmanship, inadequate adherence to construction standards and codes, improper building design and layout, and insufficient attention to safety measures. Quality issues in high-rise buildings can result

in structural weaknesses, safety hazards, and other significant problems that can compromise the building's integrity and stability. Addressing quality issues in high-rise buildings requires careful planning, close attention to detail, and rigorous quality control measures to ensure that the building is constructed to the highest possible standards.

8 CONCLUSION

- From the above study it is inferred that the importance of quality cannot be underestimated.
- Though quality control is critical in construction to ensure that the project meet standards.
- It is necessary to follow proactive and reactive steps to enhance the output of the project
- It is a main factor in establishing project success.
- Maintaining quality throughout the building process requires constant monitoring and attention to detail. Any issues that arise must be addressed promptly to prevent further problems
- A focus on quality in high-rise construction is crucial to ensure the safety and longevity of the building, as well as to protect the investments of stakeholders involved in the project
- <file:///C:/Users/kAMINI%20KOWSALYA%20S/desktop/checklist.html>

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