

Review on Early Occupancy Stage of Residential Building

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Abstract: This is a review paper on the quality of residential construction in India. The Construction in India is important indicator of development's of a country. It includes infrastructure, residential and commercial construction i.e. it ensures travelling, health care, housing and job opportunities. The construction alone contributes to about 19% of India's GDP that is around US\$ 38 billion. Residential Construction is an important part of not only GDP but also of social progress in standard of living. Although many aspects of *quality control have been studied but one of major part of this process is neglected, i.e. the Occupant or Buyers.*

Keywords: Post handover Evaluation, residential building, defect, defect analysis

I. INTRODUCTION

Construction sector is old very old. Almost of the same age as it is of human civilization. It creates opportunities for employment of around 33 million people and there are various sectors which are deeply dependent on this industry such as steel, cement, aggregate, technology etc. The industry has been sub classed into hospitality, housing, retail, and commercial. Housing is the huge contributor of the construction sector. It contributes to about 6% GDP of the country. Housing is huge sector that provides employment as well as income.

There are many players involved in a project: Client, Builder, Contractor, Consultant and Architect. And everyone has their own goals.

Since no proper technical knowledge of procedure and repetitive work causes negligence of importance steps by the labours, foreman and supervisor. This negligence result in deterioration of building condition and also reduces the service life of a structure.

These flaws in structure are generally termed as defects or construction defects. Defects are been defined in different was by different researches one of which is: Defect is been defined as non-fulfillment of a requirement related to an intended or specified use. This definition states that defect is also a state of mind which gives a feeling of dissatisfaction.

There are various classifications done by different researchers but the most common one is

- **Structural Defects**
The defects occurring in the structural elements: beams, column.
- **Non Structural Defects**
The defects observed in non structural element such as wall, Plaster.
- **Other**

These are not in dwelling directly but in secondary necessities. For example leakages or improper working of doors and windows

Few of the previous study show that few of major reasons for these defects to occur were lack of knowledge or the quality of material or negligence in workmanship. The study the prospective of residents influences hugely to the outcome of research; as the residents are the ones identifying defects and mentioning its severity.

The severities of these defects have also been given ubiquitous attention by Zuber R. Thaddi et al [2015] in his literature. He classified the defects into two sub class: Major defects and minor defects. He also defined them as follows.

- **Minor Defects-** Those arising from poor workmanship or defective materials used during erection or construction of the building but there does not render the building unsafe, uninhabitable or unusable for the objective for which the building was designed or intended.

- **Major Defects-** These defects render the building unsafe, uninhabitable or unusable for the objective for which the building was designed or intended.

To fix these defects we need to operate or work on these defects. This process was referred to as “rework”. It was defined as follows “the unnecessary effort of redoing an activity or process that was incorrectly implemented the first time.”

According to the study conducted most common defects were the incompleteness of tile grouting, incorrect fixtures and toilet fittings. Moreover defects like waterproofing issues, cracks, soil settlements, wall finishing problems, staining, lack of knowledge and expertise on maintenance aspects. He also proposed that defect repairs should focus on impact of weather, environmental conditions, soil, poor design, chemical attacks, structural movements, installation methods, workmanship, and maintenance and on site working conditions. In his review he has stated that Building management is done in the Operational phase of building’s life cycle. These involve various management activities amongst which Technical Maintenance is the most crucial. In case of abandonment these may limit the functional ability of structure further in extreme cases; there could be shortening of overall building’s life cycle.

Real estate owners often insist more on saving resources than expenses of a long term sustainable life cycle of a building. The quality determines the usefulness of service to user and commercial success to its service provider

Iman Shirkavand et. al. did a defect survey in Norwegian. The research was concentrated on design build type contracts; it is the most common type of contract in Norwegian public sector. The study was carried out on medium level complexity (i.e. having HVAC system). The researchers did a POE to collect data. A general literature review from previous study mentions 37.1% of missing item or track, surface appearance with 19.5% and 16.0% inappropriate installation. The research was a combination of qualitative and quantitative research method similar to that described by Yin (2014).

They also studied the protocol of handover inspection lists of defects on completion, project description and contract. In all seven cases where studied. These were public buildings mostly. All the defects at handover stage were noted; and later were classified into building, technical and electrical categories.

Building- internal and external wall, slab, roofs.

Electrical- high and low voltage, light and electric heating.

Technical- sanitation, heat, fire, gas, and compressed air and water treatment.

Other defects were neglected considering them general ones. Computing the result shows most number of defects in building, while technical defects are most difficult to detect and fix. Economic loss is most common loss for all stakeholders. There isn’t a lot of documentation on defects and causes. Delay is also a major reason for defects.

The defects which are related to buildings are surface or cosmetic related are the most frequent ones. Second is the inappropriate installation and missing item. Human errors like fall of tool or locating of heavy material are main reason for construction related defect. Poor planning, scheduling and changes lead to time pressure. Therefore internal control through proper planning and minimum changes can help in minimising construction defect. Performance failure is generally due to poor design. A flawless handover requires experienced, well organised and knowledgeable project management. Few defects during handover represent good project process.

Marcel Macarulla et. al. did a study to standardise the defect. Defect is accepted as a part of building process. According to a research defect is approximately 4% of contract value of any new dwelling on renovation. And money used in defect rectification is at most 0.11% of Spanish GDP i.e. US\$ 1.5 billion. HGF database was sorted and each defect was given an individual code, there are 11,652 records which were analysed. Understanding and knowledge of local construction practices is very important. This research was carried out to develop a classification until occupancy stage. Defect can also be stated as non fulfilment of requirement which were intended. Georgia et. al. (1999) they divided/ classified into two parts major and minor categories, classifying based on technical, aesthetic or functional severity. They carried out several workshops with panel of experts to discuss and improve the proposed system. The panel included practitioner, professors, managing directors of construction companies and quality coordinators. Using these members a classification system was developed. And during validation stage eight structural interviews were taken. The person interviewed included site managers and quality inspectors having experience of minimum 10 years. The

interviews were told to classify 20 defects using the proposed classification system supporting it with comments.

In the case study they studied three building and found out total of 1,138 defects. They used SPSS (version 19.00) to perform chi square test in it. They organised the classification system into 15 categories as per its functionality and to facilitate statistical analysis. These were affected functionality, Inappropriate installation, Detoriation, Biological action, chemical action, Detachment, soiled, flatness and levelness, misaligned, stability, surface appearance, water appearance, tolerance error and other. This system which was proposed would enable companies to implement their tracking system and understanding defects.

Watt (1999) gave a definition of defect as “A defect is short coming or failing in function, performance, statutory or user requirement of building, fabric, services, might itself within structure or other facilities of affected building”. Latent defect is used to describe imperfection in construction buildings or defects that appear during occupancy stage. The researchers observed few defect after the handover was complete. Most client/ customer does not visit dwelling until the handover was completed. Therefore client may be disappointed as expectations may differ with what was received. Defects are reduced when they are not visible to clients and are considered as absorbed by main contractor or trade contractor.

Firstly they tried to identify the data that they wished to track, which included building type, gross floor area etc. They started to collect, analyse and evaluate data which they collected from forms given to client following handover of 95 dwelling from several Spanish contractors. The data they collected was:

- Find the number of defect and the building type.
- To analyse the influence of dwelling's building characteristics on defects that were detected and compare the findings.
- Identify problem area in dwelling which would be most likely same in each building type.
- Identify specific element in dwelling which would be most likely observed by end user.
- Find area of supervisor to satisfy the final user.

The collected data were analysed in Minitab (version 16) and SPSS (version 17). Minitab was used to perform Anderson – Darling test and normal probability plot correlation coefficient (r). They also determine the mean, standard deviation, standard error mean and confidence interval at 95% using Minitab and performed chi square test to test dependence between building type and affect element or area.

They studied a total of 95 dwelling which included both flats and detached houses. Pearson's correlation was completed to find significant relationship between defect and construction parameter (construction cost, gross floor area etc.). It was observed higher construction cost resulted in fewer defect; as there are lot of quality check and inspection. The workers are working under high pressure led to more defect in finished work. The correlation analysis of flats didn't show any significant relationship between floor area and number of defect. While in detached houses having larger area but had fewer defects. These studies prove that client is not aware of quality of a lot of non-visible structural element or latent defect. And the observed/ noticed defects are malfunctioning element, omission and aesthetic defects; many such defects can still be observed in new residential building.

The difference in clients and contractors perception of quality notwithstanding, contractors observe the final user's need more accurately in detached houses than in flats. The quality of material used in flat are of lower standard and performing repetitive work result in loss of motivation of workers. Cost remains a very important factor, but a holistic approach is required to be taken so that service quality and cost of defect in product is also taken in account.

II. SUMMARY

Customer satisfaction in any field is important for growth and improvement of firm and industry. But, in construction sector review of customer is hardly ever collected during the operational phase. The only emphasis of construction has been on attaining economy and completion of project in least possible time. One of the major reasons of this in general cases could be that a particular customer generally buys home once in his life time and if he buys second home it is rarely from the same developer/ builder.

Secondly, middle class individual books a dwelling during the construction phase and being such a huge investment for him and negligible knowledge of construction practices. They seldom point or object to defects that he observes because of mental barriers. Moreover the defects are easily superficial during the stage of handover; and these appear after few months or years of occupancy. By this time handover of complex is done to the committee and the builder/ developer has no loyalty. There has been almost no study on this topic in India. Post handover evaluation is very important for the growth of construction industry.

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