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Construction Management Issues for Architects in Indian Construction Industry

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ABSTRACT: The increasing advancement in technology has introduced multi-players in the construction industry. The role of an Architect has become multifaceted in context to increase in the complexity of construction projects. On the other hand, the degradation of environment has created challenges for him, especially for large scale projects. The responsibility for an environment friendly design and construction largely lies on his shoulders. This study is based on analysis of the role of Architects in the present scenario and the challenges before him. A qualitative as well as quantitative data collection and analysis methodology leads to the conclusion that Architects today shall have to maximise focus on various issues such as team integration, efficient layout of site, and regular review meetings especially at initial stage of design, recycling and deconstruction. Also, there is a need to concern more for making construction process easier and plan to reduce scaffolding.

I. THE CONSTRUCTION INDUSTRY

The advancements in technology and degrading environmental conditions demand for a specific and targeted approach to deal with the situation. There is a need to handle the problem in a very specialized manner. This paper aims at studying the present scenario in the Indian construction industry and identify areas of design and construction which are in need of special concern and attention of architects, in order to manage and maintain environment.

Indian construction industry is a significant donor towards environmental degradation. It is one of the largest in terms of economic expenditure, volume of raw materials, products manufactured, and employment generated etc. (Reddy, 2004). It is estimated that Indian construction industry generates about 22% of GHG (greenhouse gases). Approximately 12 to 14.7% million tonnes/year of construction and demolition waste is generated in India (TIFAC, 2000). There is a lack of proper waste handling techniques in India and it is generally disposed off without proper segregation (Thomas and Wileson, 2013).

The industry is currently facing many issues which can be enlisted as lack of awareness among project participants, Client's lack of interest in environmental protection techniques, lack of skilled labour for the kind of specification proposed, waste minimization and management techniques and many others. This paper identifies some of the important issues in the present scenario and attempts to bring forward the areas of design and construction that need special concern, especially from architect's purview.

II. ISSUES BEFORE AN ARCHITECT

The process of design and construction has been broadly categorised into three different stages, namely; Conceptual planning stage, Design development stage and Field operations stage. An architect plays crucial role in all the stages of work because of which he is the major contributor towards the consequences of construction and built environment. The duties and responsibilities are multiplied, in case the project is Design and Build or Architect is the Project manager for the same project. The issues faced by the Architect are classified in two categories; General issues and Special issues.

General Issues

Team integration and coordination are the most critical issues in construction management. The integration refers to the combination of all the project participants; Client, Architect, Project Manager, Consultant and Contractor. It is important that the team formation takes place at initial stage of design so that the expertise of all the participants can be taken advantage of and the best design solutions are evolved. The ability to control cost is high at initial stage of design and decreases as the stages of design and construction proceed. The integration and inputs at this stage lead to enormous cost savings of the project (Business, 1982).

Team integration results in many benefits such as improved project cost, effectiveness in schedule, increased safety, prevention of claims and improved logistics management and cash flow (Mitropoulous and Tatum, 2000). Many researchers have identified the importance of contractors involvement, so that they can give inputs to design team, identify potential areas for standardization, minimize accessibility problems on site to improve the working (O'Conner et al. , 1987). The construction personnel can also can also play important role in preparation of schedules and budget, selection of major building materials, construction methods, structural systems (Uhlik and Lores, 1998).Integration requires joint decision making. In spite of the researches conducted, the involvement of construction personnel or contractor at initial stage of design, i.e. conceptual planning stage, is generally not accepted because of certain barriers such as contractual practices and culture and faces resistance (O'Conner and Miller, 1994).

Conducting surveys prevents delays during the field operations stage. These include site surveys (topography, vegetation, services across and along the site), visual surveys, feasibility surveys, materials availability etc. depending upon the nature of project. An ignorance can lead to unexpected crisis. The team integration also plays an important role here because the inputs from all the participants are incorporated at initial stage of design.

The efficient site layout has a major impact on the execution of the project as well as during the life time of the building. The accessibility to site largely depends on the site layout, which in turn depends on the surveys conducted. The design and layout should promote accessibility of manpower and equipment (O'Conner, 1987).

Regular review meetings and inspections should be an integral part of project working, through all the stages. All team members have to work in close coordination, which is the backbone of efficient project management system. Crichton (1966) mentioned in Tavistock studies that the activity of coordination is carried out in an informal manner in the building industry and it is not generally spoken off on record. It does not appear in the handbooks or formal reports. O'Connor et al. (1987) further suggested that inter organizational communication should be encouraged and planned for, particularly between designers and contractors. Saram and Ahmad (2001) identified that one of the most important coordination activities is maintaining proper relationship with client, consultant and contractor. It was also observed that conducting regular meetings and project reviews consumes most of the time.

Preparation of construction schedules should be done before the design and procurement schedules because they have to be regulated and driven by construction schedules (O'Conner et al. , 1987). Glavinich (1995) highlights further, that the schedules should be updated as the design proceeds.

Reduction in scaffolding helps in making construction process simpler and faster. , O'Connor et al. (1987) identified that ease of construction enhances if preassembly work is thought off in advance and preassembly/module designs are incorporated in advance to facilitate the process of fabrication, transport and installation. It should be take care off at the conceptual planning stage.

Inviting contractors for technical inputs and innovations is a positive initiative by architects and it helps improve the inadequacies of current technology. Such projects have higher project objectives (Foster, 1986). O' Connor et al. (1987) identified that good management practices should include practices like challenging of past practices and rewarding innovative ideas. He also emphasised that inputs should be invited from the construction personnel in finalizing of preferred specifications and methods but that should not be constraining design configuration. In case the views of construction personnel vary, specifications should allow for cost effective alternatives. Glavinich (1995) adds that the specification of special or custom equipment or material should be avoided. Also the specification of obsolete materials, equipment and construction techniques should be avoided.

O'Connor (1988) explored that documentation of the preferences and innovative ideas of the constructors can help in future for increasing the working and efficiency at field operations stage. Proper information management systems should be taken care off by the designers as well as the constructors.

The application of advance information technology helps in hurdle free planning. The prospects of problems can be reduced to a considerable extent by adoption of latest and modern technology. O'Conner *et al*. (1988) observed that CAD overlay techniques are helpful in studying the accessibility problems, which might occur during the field operations stage. Companies in India are mostly using "MS Project" to plan out the quantities of materials to be used (Kansara *et al.,* 2007). Russell *et al.* (1994) writes that maintaining a lessons learned database allows communication of positive and negative activities and experiences from one project to the future project. Glavinich (1995) made a mention of the term Design Phase Constructability Review and discussed that the design reviews should be conducted by senior design and field personnel prior to the start of the work.

The benefits of such reviews are increased client goodwill, greater design constructability and continuous scrutiny of the firm's design policies and standards. Another paper by Fisher and Tatum (1997) concluded that often the corporate lessons learned are overlooked. Generally there are no formal systems of keeping the feedbacks.

Special Issues

The building material should be non-polluting, local and appropriate for future deconstruction. The environmental impacts can be enormous because of the uncontrolled extraction process and transformation of materials. The important strategies can be stated as: reduction in the amount of material consumption, reuse, recycling, minimization and management of wastes. Another important methodology can be substitution of building materials with those materials that have lesser environmental impact.

It is observed that 5% of water consumption is for hygienic purposes and 95% is because of evacuation of wastes. It becomes important to improve the efficiency of appliances, recycle and recover water from rain. There are three categories of water. Rainwater, Grey water and Black water. Rainwater is a good quality water as compared to other waste water. It can be stored or conserved and reused for flushing, washing machines and landscaping purposes. Landscaping with native species shall also reduce the demand for water. An area covered with grass and trees absorbs almost all the rain water falling on it. It also helps in preventing soil erosion. Thus permeable surfaces are of extreme importance as they help maintain the natural water cycle. Recycling of grey water has great potential in saving water, as this water is less contaminated.

Hemalatha *et al.* (2008) discussed construction and demolition waste and highlighted the importance of recycling. The construction and demolition waste is 10-20% of municipal waste. Such wastes are heavy, bulky and need huge amount of space for storage. The authors have made a mention in their paper that according to Technology Information Forecasting and Assessment Council (TIFAC), New Delhi, 70% of the construction industry is not aware of the recycling techniques. The construction and demolition waste management has been categorised in 4 stages: (1) storage and segregation, (2) collection and transportation, (3) recycling and reuse, (4) disposal. Othman (2011) has recommended for design firms to integrate construction knowledge and contractors experience in design process as approach to reduce construction waste and improve building performance. Deconstruction is referred to as dismantlement of building to retrieve its components for reuse, recycling or waste management. The waste produced at different stages of construction and after deconstruction is a matter of concern. Proper segregation on site and recycling and reuse of waste materials is essential. The waste generated on site can have huge environmental impacts. The process of reuse and recycling of waste can save environment and create employment also at the same time.

Fisher and Tatum (1996) identified some of the preliminary design variables, like dimension of elements, distances between elements, their repetition and modularity of layout. It is also suggested that the efficiency can be improved at preliminary design stage in three types of design decisions: the horizontal layouts, vertical layouts and the dimensioning of structural elements. Precast systems can save energy involved in transportation, thus saving time and energy (Ritchie and Thomas, 2009). It is important to preserve the existing features on site and incorporate them into design. These can be either the vegetation or natural existing topography and other features on site.

III. DATA COLLECTION AND ANALYSIS

Thorough literature study and qualitative data collection was conducted to identify important issues that have an impact on environment and are related to architectural design and construction. The role of architect in 70% of the cases identified was that of a project manager also. It was interesting that such projects did not face major delays and hurdles. Ten such issues were identified as general and ten issues were categorised as special issues after study. A quantitative data was later collected through online survey and responses of one hundred and six architects were recorded and were used for data analysis to conclude the critical issues that need concern. The general issues identified can be listed as: (1) Team integration, (2) Conducting surveys, (3) Efficient layout of site, (4) Regular review meetings, (5) Preparation of schedules, (6) Concern to reduce scaffolding, (7) Inviting contractors input, (8) Simplification of technical specifications, (9) Use of advance information technology, and (10) Documentation work on site.

On close observation it is found that the contractors are not invited for giving inputs for design improvements, these is less concern to reduce scaffolding, and the layout of site is not generally planned to make construction process easier. These issues scored less than 50% and hence need more concern by Architects, as they are important construction management issues. The team is formed at the beginning of project but it excludes the inclusion of Contractor.

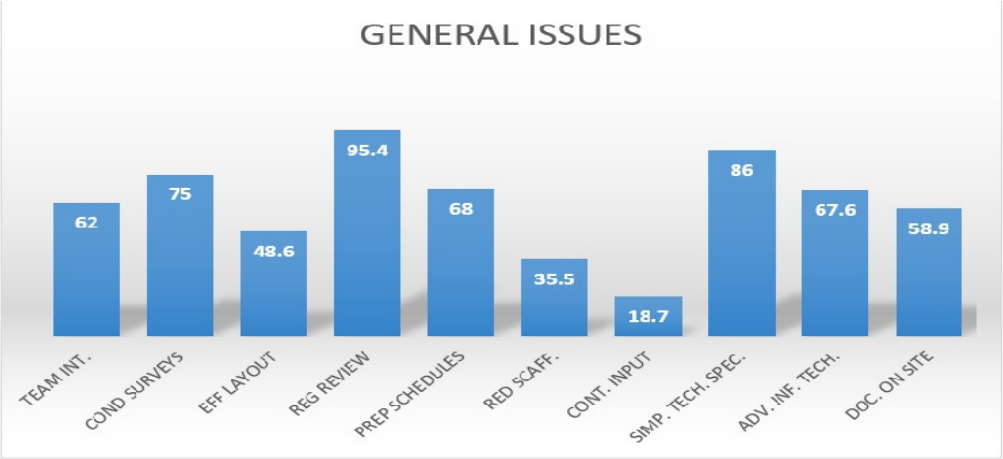

Fig. 1. General issues of construction management.

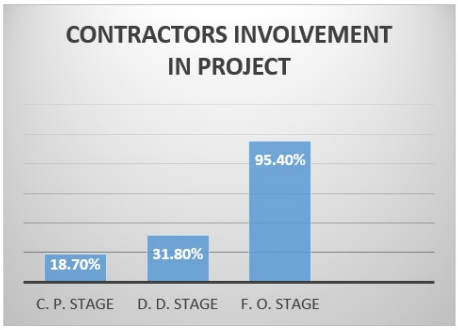

Fig. 2. The contractors involvement at different stages.

The Contractors were involvement in the design team at conceptual planning stage is 18.7%, at design development stage is 31.8% and at field operations stage is 95.4%. This data clearly states that the Contractors are not invited for any inputs at design stages, as a practice. Their contribution in design is not very widely accepted and invited, although it may lead to savings in terms of cost and time during the field operations.

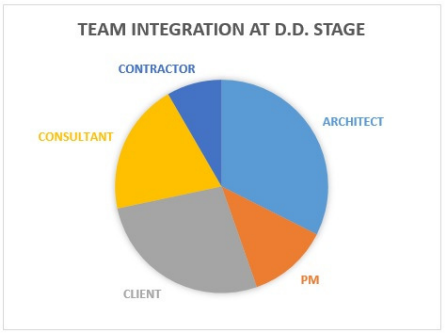

Fig. 3. Composition of team members.

It was also observed that during the design development stage, the team formulation read as; Architect - 95.3%, Project Manager – 35.8%, Client – 79.2%, Consultant – 58.5%, and Contractors – 24.5%. This clearly explains that Project Managers and Contractors are not included in majority of the cases, at design development stage. Hence, the probability of possible delays at later stage of design increases as inputs are not invited from all members of the team not only at initial conceptual planning stage but also at design development stage.

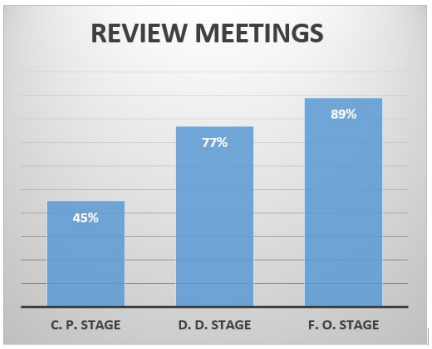

Fig. 4. Different types of schedules.

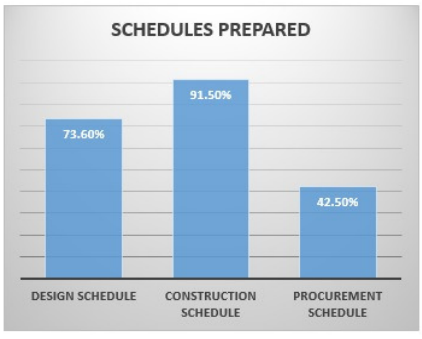

Fig. 5. Regular review meetings at different work stages.

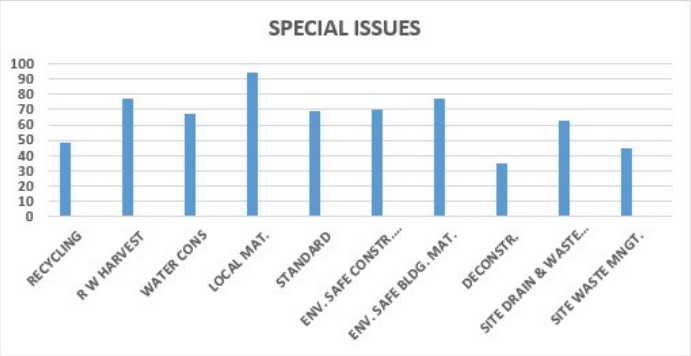

Fig. 2. Special issues of construction management.

The preparation of procurement schedules is not in good practice as it scored only 42.5%, whereas it was observed that design schedules are prepared in 73.6% of the responses and construction schedules were prepared by 91.5% of the respondents Regular review meetings are conducted at conceptual planning stage in 45% of the responses, whereas they are conducted in 77% cases at design development stage and in 89% of the responses, review meetings are conducted at field operations stage. This elaborates further that still there is 11% of the probability that review meetings are not even conducted at field operations stage also and in 55% of the cases, such meetings are not conducted at conceptual planning stage.

The Special issues have been identified as: (1) Recycling of building materials, (2) Rain water harvesting, (3) Water conservation on site, (4) Locally available materials, (5) Standardization of building components, (6) Environmentally safe construction methods, (7) Environmentally safe building materials, (8) Considering deconstruction for building components, (9) Site drainage and waste water management, (10) Waste management on site during construction.

The analysis of data determines that deconstruction and reuse of building materials and components is not considered at design stage, in majority of the cases. The other issues that need special concern are waste management of building materials on site, recycling considerations at design stage, site drainage, waste water management on site and water conservation techniques.

CONCLUSION

The study undertaken brings forward an overview of construction industry and identifies twenty issues (general and special), which were further examined with the help of questionnaire survey among architects. The responses of one hundred and six architects were recorded, analysed and it was observed that although team integration is recognised, the contractors are not accepted widely as an integral part of team at conceptual planning stage and design development stage. This restricts their inputs and contribution in terms of saving cost and time. There is less concern for reducing scaffolding and laying out site efficiently for site management and ease of construction. Regular review meetings are not encouraged at initial stages. Procurement schedules are not generally prepared. Regular review meetings should be promoted by all team participants. Some of the special issues that need more concern from team are waste management of building materials on site, recycling considerations, site drainage, waste water management on site and water conservation techniques.

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