

THE TEN COMMANDMENTS TO MANAGE SUSTAINABLE DEVELOPMENT

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ABSTRACT

The effective approach to management of construction projects can lead to enormous benefits in terms of saving resources and environment. This paper focuses on the issues of management of building construction during planning and execution stage. Ten areas of construction management, having huge potential for achieving sustainable development have been identified and discussed in detail after thorough study of literature. These commandments can certainly lead to saving environment from huge losses.

Keywords: Coordination, Life cycle, Recycling, Sustainable development, Team integration

I. INTRODUCTION

The construction projects in India are an important component for rating the economic growth of country. On the other hand, they are also the contributors for environmental degradation. There is an emergent need to manage and control the construction projects and add to sustainable development, which is the need of time. Sustainable development has been an issue of major concern for the world and it is the responsibility of stakeholders in the construction industry to focus on the issues and contribute in this direction. It is the development which fulfils current needs without compromising the capacity of future generations to fulfil theirs. The depletion in the natural resources and increase in global warming are an alarming situation for all to be concerned.

II. NEED OF STUDY

Various researches are being carried out world-wide to conclude appropriate solutions to environmental problems, because the degradation of environment is taking place at a very fast pace. Construction industry is one of the important sources of degrading environment and needs special concern as the industry is growing fast. The dynamic changes taking place in the technological advancements everyday are adding to the problems. Construction management has a very important role to play in such a changing scenario. Every project needs to be examined on the management grounds and sustainability of projects can be increased by concentrating on various issues, which are probably ignored in the long run by the managers.

III. LITERATURE REVIEW

The concept of Sustainable development was introduced during the Rio Earth Summit in 1992, and the heads of state committed that they shall explore "Development which fulfils current needs without compromising the

capacity of future generations to fulfil theirs” [1]. The key components of sustainable development, based on the recommendations of all the major conferences including Brundtland’s Report can be classified in the following way: (1) economic growth generated by sustainable patterns of production and consumption of resources, to enable; (2) the social wellbeing of all humanity and equitable access to resources now and in future, while; (3) protecting the environment and the services it provides for humanity [2]. Sustainability can be defined as “the continued ability of a society, an ecosystem or any such interactive system to function without exhausting key resources and without adversely affecting the environment” [3] (

Fig.1). Maughtin defined sustainable development as, “development that is non damaging to the environment and which contributes to the city’s ability to sustain its social and economic structure” [4].

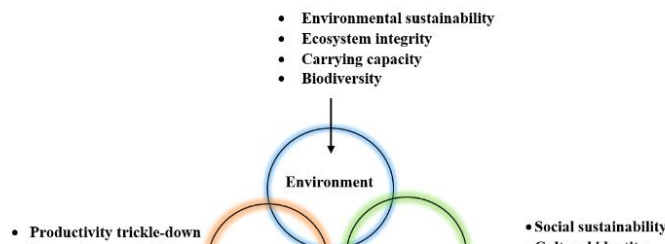
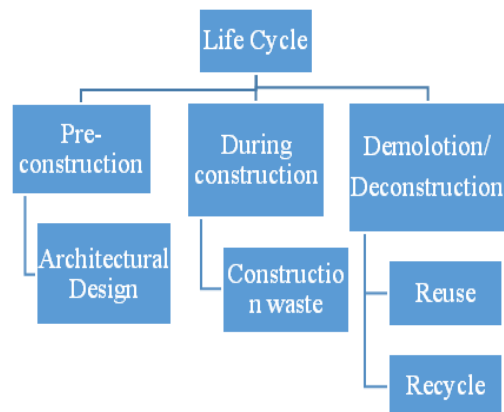


Fig.1. Three issues of sustainability (Source:TERI)

A sustainable building is also defined as a building that [5];

1. minimizes the use of natural resources during construction and operation
2. uses efficient building material
3. optimizes the use of on-site sources
4. uses minimum energy for its working
5. maximizes use of renewable sources of energy
6. uses efficient waste and water management practices
7. provides comfortable and hygienic indoor working conditions

The efficient management of construction projects can lead to sustainable development and gain enormous benefits. Various researches have been carried out to identify these principles of management and incorporate them at various stages in projects. Every construction project can be broadly classified into three stages, in terms of its life cycle [6]. These stages are; Pre-construction, Construction and Demolition/Deconstruction stage (**Error! Reference source not found.**). Every project can further be subdivided into three stages, during its construction period. These are identified as; Conceptual Design stage, Design Development stage and Field Operations stage [7].



Among various other principles the involvement of construction knowledge in conceptual planning stage is the most important and basic principle. CII Australia proposed twelve principles for execution of the constructability programme. These principles are Integration, Construction knowledge, Team skills, Corporate objectives, Available resources, External factors, Programmer, Construction methodology, Accessibility, Specifications, Construction innovation and Feedback [8]. In 1990's, some studies were conducted at Singapore under first assessment system for buildability of designs and the results proved that the lack of integration of construction knowledge into the design process resulted in the exceeding budgets and scheduled deadlines of projects [9] [10].

VI. THE TEN COMMANDMENTS

A thorough study and analysis of various management principles leads to identification ten basic commandments, which can be applied at various stages of construction of a project to lead to sustainable development. These can be enlisted as follows:

1. Integration&Coordination
2. Construction Driven Schedules
3. Simplification of Design & Standardization of elements
4. Accessibility to site
5. Adverse weather conditions
6. Technical specifications & availability of resources
7. Encouragement to innovation
8. Regular review meetings
9. Recording of lessons learned
10. Recycling & Waste management

Following these commandants can lead to sustainable development. Hence it becomes essential to understand them in totality and adopt them during project design and execution.

V. INTEGRATION & COORDINATION

The discussion on how to make construction process easier is to be conducted amongst the team members of the project, i.e., the Client, the Architect, the Project Manager, the Contractor, and the Consultant. This discussion

largely depends on the Architect's capabilities and the experiences of the shortlisted Contractors. Their valuable inputs can make the construction process more workable and hence affecting the whole life cycle cost. The discussion for making construction process easier also depends on the review and implementation of past lessons learned. The profits and loss, the construction equipment and methods adopted, the experience with building materials and technology etc. from previous projects can be utilized as lessons learned for future projects. This shall result in financial benefits and time saving by not committing the same errors again. Such discussions have an impact on selection of construction methods, discussion on recycling and working out the construction schedule also. The benefits may not be countable immediately but they shall prove themselves in the course of smooth project execution and operation of the building. The selection of construction method depends on the Architect, the Contractor, and discussion on how to make construction process easier. Suitable construction methods are selected by team members on recommendations from Contractors and after scrutinizing the site conditions with a vision of making the construction process easier.

5.1 Construction Driven Schedules

Working out Construction Schedule depends on the Architect, the Contractor, the discussions for making construction process easier and selection of construction methods. The design prepared by Architect influences the time that shall be taken for completion of the project. The Contractor's resources and capabilities to handle the project shall have an impact on the working and execution of the project. The discussions amongst the team members for making the construction process easier and their experience and exposure to the similar projects shall guide in preparation of construction schedules. The advance equipment and latest technology available with the Contractor can be an aid in time management. Besides this the preparation of construction schedule does not have any major impact on any other activity during conceptual planning stage.

5.2 Simplification of Design & Standardization of elements

The simplification of technical specification depends on Architect, the shortlisted Contractors and the selection of construction methods. It is very clear that the knowledge of Architect and experience of Contractor regarding building materials, their fixing details, availability of workmanship, their properties, positive and negative impacts, performance etc. shall help and guide them in finalization of technical specifications. Also the construction methods adopted shall guide in selection or rejection of certain specifications. The standardization of design elements refers to fixing of the sizes of various components in a building. It is an exclusive part of design and extremely useful for lean construction. Standardization helps in reducing wastage of building materials and can stimulate the process of construction by use of repetitive sizes. The standardization is also driving factor for prefabrication of building components. The buildings can be constructed more efficiently, accurately, and timely. The standardization of design elements depends on concern to reduce scaffolding. This activity also depends on preference of methods and materials for renovation and deconstruction. The maintenance and extraction of materials shall be easier for the standardized elements as compared to the building components with large number of components in variable sizes. The standardization of design elements influence the scaffolding requirements of the project.

5.3 Accessibility to site

The exercise of laying out site efficiently depends on Architect and the surveys conducted. The Architect is

responsible for site planning as well as building design. This activity can be efficiently performed after conducting proper surveys, especially those related to site. However efficient lay out of site has an impact on selection of construction methods. There can be major problems related to execution of the project and delays in the project if the site layout did not consider the ease of working and movement of various equipment on the site, at the planning stage.

5.3 Adverse weather conditions

The use and application of preassembly in case of adverse weather conditions depend on the use of temporary material and system on site, and on the condition that the Contractors are given freedom for technical inputs to improve the construction process.

5.4 Technical specifications & Availability of resources

The simplification of technical specification depends on Architect, the shortlisted Contractors and the selection of construction methods. It is very clear that the knowledge of Architect and experience of Contractor regarding building materials, their fixing details, availability of workmanship, their properties, positive and negative impacts, performance etc. shall help and guide them in finalization of technical specifications. Also the construction methods adopted shall guide in selection or rejection of certain specifications. It is also essential to opt for locally available resources, which saves enormous embodied energy.

5.4 Encouragement to innovation

Innovation in available equipment depends on freedom to Contractors for technical inputs to improve the construction process and waste management on site. As it has been known, "Need is the mother of all invention". The requirement and concern for waste generation promotes the innovation in the available equipment but it is possible only when the Contractors are given freedom to give technical inputs. Innovation in available equipment also influences the use of temporary material. Freedom to Contractor for technical inputs has an impact on the innovation in available equipment, use of preassembly in case of adverse weather conditions, and waste management on site. The Contractors can actively participate in these activities and display their best abilities only if, they are encouraged, promoted, motivated and given freedom to express themselves and exhibit their ideas.

5.5 Regular review meetings

The review of design by other team members is an independent activity. It should be adopted and practiced as a regular tradition or policy. The suggestions should be invited from all team members and incorporated, if jointly agreed upon by them. This practice shall help reduce rework at later stage of design and execution of project. This practice has an influence on the construction methodology and materials to be adopted for project especially from the point of view of renovation work or deconstruction after the useful life of building is over. General discussions regarding these important aspects can take place in such meetings and important and influential decisions taken.

Regular inspections and meetings on/off site by Consultants should ideally take place in every construction project for efficient project management. This has a major impact on the waste management of the site also. The segregation, disposal and various other factors can be discussed and important decisions can be taken for environmental safety.

5.6 Recording of lessons learned

The review and implementation of past lessons learned can be of great help and make project successful. They can be initiated at any stage of work and the experiences can be applied for any issue. The past lessons learned experience can even guide the Client in selection of team members for the project. The review and implementation of past lessons learned has impact on various other activities like discussions for making construction process easier. The information regarding their past lessons learned can help in making the future project's D&C process smoother and easier. For example: there may be certain equipment, method or building material which would have been difficult to handle in their past projects. If such information is shared and suitable measures are taken in advance, the probability of failures and risk of delays are reduced. Documentation work of the lessons learned during the project execution stage is an important activity which should be performed as an integral part of the project.

5.7 Recycling & Waste management

Recycling in a project largely depends on the Architect, the Contractors and discussion which takes place amongst the team members for making construction process easier. The experience and knowledge of team members regarding building materials shall help in selection of proper methods for their reusability and recycling. Proper discussions among participants of project shall lead to working and feasible solutions for various resources that can be recycled. Waste management on site depends on regular inspections and meetings on/off site by Consultants. Such meetings keep a check on the site activities and suitable suggestions and measures can be taken from time to time for management of site. Waste management on site influences the use of temporary material and system on site and also the innovation in available equipment by the Contractor.

VI. CONCLUSION

This paper discusses the concept of sustainable development in detail and also the issues of management. The ten issues have been identified and referred as TEN COMMANDMENTS, to be followed by the team members for any construction project. The ten commandments are; Integration & Coordination, Construction Driven Schedules, Simplification of Design & Standardization of elements, Accessibility to site, Adverse weather conditions, Technical specifications & availability of resources, Encouragement to innovation, Regular review meetings, Recording of lessons learned, and Recycling & waste management. It is expected that integration and adoption of these parameters can lead to sustainable development in future.

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