Abstract

Most of the construction projects are handled by the principal contractor under umbrella package contract and executed through sub-contracting system. Challenge in terms of effective coordination and communication and accountability among participants, inhibits innovation as firms holding umbrella contract is often evaluated based on their specialized fields, and involves a large number of workforces from sub-contractors who are exposed to various hazards of construction sites.

Approaches such as Total Loss Control (TLC), Total Quality Management (TQM), and Supply Chain Management (SCM), which are typically associated with manufacturing industries, are required to be introduced into the construction industry.

The construction of new facilities and maintenance of existing facilities is being carried out in BARC through public tender. These works are mostly carried out by contractors through the labourers, who are from varied background. BARC recognizes the responsibility of ensuring safety of these workers at site. Dynamic nature of works at construction sites invites attention on the adoption of standard procedures and continual supervision during execution. This paper reflects the principle of management of health and safety issues for construction projects in BARC through various engineering practices and safety management techniques.

Introduction

The construction sector in the country employs approximately 32 million people, accounts for about $1/10^{th}$ of GDP and is the largest employment sector after agriculture. The construction industry in general has an annual growth rate of about 10%, primarily due to the increased domestic and international manufacturing activities and industrial growth.

In the years ahead, the construction industry in India has a number of challenges with respect to issues related to protection of environment, transportation, power requirements, natural hazards and occupational safety and health of the work force which are required to be overcome to meet the demands of the industry and public.

Occupational Safety and Health Aspects in Construction Activities

Construction activities include building of new structures, renovation/modification of existing structures, demolition, etc. Normally, large number
of workforces are engaged at construction projects through contractors and sub-contractors. A major portion of construction workers is unskilled while a few of the workers are skilled in trades. Throughout the world, over 90% of construction workers are men while in India- the proportion of women is higher and they tend to be concentrated in unskilled occupations.

Construction works are always associated with occupational risks related to excavation work (use of explosives, earthmoving machines, exposure to chemicals, excavated & deep pits, earth sliding/subsidence); working at heights (use of scaffolding, gangways and ladders; work on fragile roofs, openings); handling of materials (use of cranes, hoists, escalators), and so on, which are specific to the sector. The working conditions at the construction site being dynamic in nature, a systematic approach to manage the occupational safety and health at workplaces is essential.

Safety Management at Construction Site

The work activities in the construction industry are of diversified nature in addition to the problems of employment of unskilled labour. This creates a challenging task for the safety professional to foresee the management of variety of hazards.

The occurrences of unsafe incidents have direct impact on time, cost and legal aspects of supply chain management and therefore it is imperative to ensure that work packages are framed in such a manner and awarded to such contractor, who along with their subcontractors & suppliers, are capable of executing the work in efficient and accident-free manner. Principles of Approaches such as Total Loss Control (TLC), Total Quality Management (TQM), and Supply Chain Management (SCM), which are typically associated with manufacturing industries, have been introduced for application into the construction industry.

Total Loss Control

Total Loss Control (TLC) is a systematic approach to the management of loss, integrating reliability and quality with the reduction of risk to people, the environment, assets and to production. Applications of TLC in construction activity are a growing field that has incorporated tools such as production scheduling, Kaizen, “huddle meetings”, 5S Principles (Sort, Set, Shine, Standardize and Sustain) and visualization to improve all facets of the construction process including safety. Use of visualization techniques includes mobile signs to attract attention to important information, daily huddle meetings address safety issues among other things, use of 5S ensures materials supply and 7 E Principles (Engineering revision, Evaluation, Enforcement, Education, Example setting, Enthusiasm and Employment Practices) ensures workplace safety.

Total Quality Management (TQM)

TQM is a comprehensive management system which (i) Focuses on meeting owners'/customers’ needs by providing quality services at a cost that provides value to the owners/customers (ii) Driven by the quest for continuous improvement in all operations (iii) Views an organization as an internal system with a common aim rather than as individual departments acting to maximize their own performances (iv) Focuses on the way tasks are accomplished rather than simply what tasks are accomplished and (v) Emphasizes teamwork and a high level of participation by all employees. Total Quality Management (TQM) advocates continuous improvement focused on meeting both internal and external customer needs.

Supply Chain management (SCM)

SCM is a network of different organizations, linked upstream and downstream forming a chain, aiming to achieve objectives of delivering quality product in time and value addition in the services and products for the end consumers through integrated processes and
activities. In the context of construction activity, supply chain refers to the end to end “chain” of stakeholders and partners that come together both on individual projects and particularly during the construction phase.

Most of the projects are handled by the principal contractor under umbrella package contract and executed through sub-contracting system. The problems of multi-layered subcontracting practice have long been an issue and a controversial subject in the industry. Recently researchers have suggested having legislation for restricting the subcontracting practice in the construction industry for better safety performance. Although such restrictions may help in improving the safety performance, it would be extremely difficult to implement such restriction in the workplace due to the traditional work practices.

**Construction Safety Management Programme In BARC**

BARC is committed to ensure the highest standard of occupational health, safety and environment in all construction activities undertaken in order to achieve zero-accident working period in all projects and thereby contributing towards enhancement of the safety performance of the centre. The principles of TLC, TQM and SCM are applied during the execution of construction activities thereby site management gets streamlined.

**Construction Safety Management Objectives**

Management intends to execute the construction project without any interruptions either related to supply of materials, equipment, workforce or may be due to undesired events/incidents. To meet this objective the projects are evaluated phase wise which begins with the design, planning, procurement, contracting, workplace monitoring, etc. The process of finalization of design after detailed safety review by experts follows the contract evaluation phase where the records of the bidding contractors with respect to safety management are also reviewed at par with the other executing parameters. The selected contractor needs to meet the requirements of the Construction Safety Manual for Works Contract which also forms a part of contract agreement.

**Work Planning**

Construction activities are mainly divided in four stages viz. Substructure works, RCC and Structural works in Superstructures, Masonry and Waterproofing works and Finishing works. These activities with severe potential hazards require a thorough planning for safe execution at site. Keeping in view of probability of occurrence of accidents/injuries contributing to substantial absence of persons from work and even leading to fatalities, the Job Hazard Analysis (JHA) is carried out prior to beginning of project which helps in integrating accepted safety and health principles and practices into a particular operation.

**Selection of Execution Team**

Departmental as well as Contracting engineers are responsible for the execution of the construction activities as per planned schedule. Ensuring execution of work within the timeframe in a safe manner are the responsibilities of the execution team. This team is supported by Safety Officers/Stewards, Services staff, Stores staff, Paramedical staff, Welfare Officer.

A site level safety organization is formed prior to execution of work at site as per the provisions of BOCW Central Rules, 1996 who regularly meet to discuss the safety issues at site and to improve the safety performance of the project.

**Hazard Communication Mechanism**

**Safety Induction Training:** Each new worker attends initial safety induction training before reporting at
respective place of work. This training is followed by daily training e.g. use of various Personal Protective Equipments (PPEs) and tools, housekeeping, hot job, RCC works, electrical works, etc. The workers are also enlightened with the security requirements to be observed inside BARC premises.

**Walk-through survey:** Members of the safety team carry out a walk through survey every morning at site in order to monitor any unsafe conditions and unsafe acts. The safety related deficiencies are reported immediately for corrective actions and followed up for preventing recurrences.

**Signboards, Posters, Displays:** Signboards (written/painted in photo-luminescent paint) are displayed at various workplaces, movement area of mechanical equipment, diesel store, scaffoldings, first aid post, etc.

**Structured Plan for Execution and Ensuring Safe workplaces**

**System Implementation – Work Permit System:** Aim of work permit system is to identify the unsafe conditions in advance and to take corrective action prior to commencement of work. Work permit system is generated by the concerned site engineer, in quadruplicate. Later, Work Permit is sent to the site safety officer for obtaining the clearance before the work starts. Site Safety Officer then visits the area of work and if working condition is found to be safe and satisfactory, then he clears the work permit for the said work. Copy of work permit is available with engineer, site supervisor, safety officer and departmental representative. The closure of the proposed work, status of incomplete activities, etc. are registered separately.

**System Implementation – Height Pass System:** Aim of the height pass system is to reduce the probability of fall accidents by engaging medically fit people. All new workers, who may work at height, are first sent for a medical check-up, done by a medical practitioner. Those workers who are declared to be medically fit are issued height passes by Safety Officer / Site Medical Attendant after undergoing practical test. The fit workers are instructed to carry their height passes all the time.

**System Implementation – Scaffolding System:** Erection of safe working scaffolding is an important part in the construction activity. A standard checklist [4] is prepared by the site engineer after erection of the scaffolding and submitted to the Safety Officer. Safety Officer visits the site and gives clearance for the scaffolding / issues the observations for rectification.

**Conclusion**

In this paper we have discussed how BARC is committed to ensure the highest standard of OHS in all construction activities undertaken in order to achieve zero-accident working period in all projects. In nutshell following points must be incorporated during construction activities.

- Establishment of clear rules and procedures.
- Significant emphasis on safety during the contract bid and award process
- Establishing a clear understanding of the work process and responsibilities from conceptual design to acceptance of completed work
- Assure that job related hazards have been identified and controlled and are communicated to workers in effective manner
- Vigilance through frequent site visits with a focus on safety helps in prevention of interruptions and thereby maintaining supply chain.
- Continuous training and awareness building process.
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References