CHAPTER 4
TOTAL CONSTRUCTION SAFETY
MANAGEMENT MODEL SYSTEM

4.1 INTRODUCTION

In the previous Chapter 3 analysis of factors affecting safety in construction site is done so as to form a basis for development of the new total construction safety management model system. In this Chapter 4 the newly developed total construction safety management model system is presented.

Construction safety is of grave concern around the world due to its unique nature (Behm 2005, Fang et al 2004 and Kartam et al 2000). To improve it, some countries such as Australia, Singapore and United Kingdom have enacted legislations regulating safe working practices on site (Low and Pong 2003). Owing to the advocacy of self-management approach, some construction firms have actively begun to seek effective safety management systems (Herrero et al 2002, Jannadi and Bu-Khamsin 2002, McVittie et al 1997, Tam et al 2001).

In developing countries, like India it has been grown in terms of its infrastructure and the construction industry constitutes the major role in construction business. As rapid is the growth of the construction industry, so fast is the shortfall in terms of safety and health aspects of the workers. This is mainly because of lack of formal organizations and standard legislations with
perfect implementation. So it is necessary to develop a safety management model for construction industry.

4.2 TOTAL CONSTRUCTION SAFETY MANAGEMENT SYSTEM (TCSMS) MODEL

In the present work, a new Total Construction Safety Management System model has been developed (Figure 4.1). This approach consists of three phases;
1) Planning and Preparation Phase,
2) Implementation and operation Phase and
3) Checking and corrective action Phase.

Health Safety Environment (HSE) Policy

Top level management sets the policy on safety aspects which covers objective, scope, legal requirements, requirements of each employee in the organisation to implement safety and continual improvement. All staff and employees shall be made aware of the existence of this policy by discussing in HSE meetings, displaying at project offices, notice boards, workmen camp, canteen and conspicuous locations.

Customer requirements

It is a set of requirement given by the client before placing an order to contractor.

Legal requirements

The following legal requirements should be considered and followed at site, if any other statutory requirement specified by customer then that also should be taken into account.
List of Applicable Legal Requirements

- Building and Other Construction Workers’ (Regulation of Employment and Conditions of Service) Act, 1996 and Rules
- Petroleum Act 1934 and Petroleum Rules, 2002
- Motor Vehicles Act, 1988
- Explosives Act, 1884
- Gas Cylinder Rules, 2004
- Indian Electricity Act, 2003 and Rules, 1956
- Air (Prevention and Control of Pollution) Act, 1981
- Water (Prevention and Control of Pollution) Act, 1974, Rules, 1975
- The Noise Pollution (Regulation and Control) Rules, 2000
- Batteries (Management and Handling) Rules, 2001
- Environment Protection Act, 1986 and Rules, 1986
- Bio-Medical Waste (Management and Handling) Rules, 1998 etc,

Management review

Management should review the safety implementation status on work place, safety performance, accident statistics, compliance to legal requirement and customer requirement at frequent interval for continuous improvement.

4.2.1 Phase 1 - Planning and Preparation Phase (Figure 4.1)

In this phase, construction organizations must first initiate the safety program through an effective pre-planning and resource development process. During this period, organizations must establish a vision, develop strong commitment from senior management, develop an employee-training plan, and must verify that all operational resources are in place to accommodate the program change. In summary the newly developed total
construction safety management model in the present work is shown in Figure 4.1.

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**Figure 4.1 Total Construction Safety Management Model**

The important things to consider on the planning phase are:

**i. Project Health Safety Environment (HSE) Plan**

A site HSE plan is prepared as soon as a new job is received. In contains following broad parameters of safety management to be followed at site.
● Project highlights.
● Organisation chart.
● Roles and responsibilities.
● Applicable statutory requirement, standards and codes.
● General site safety rules and regulations.
● Identification of high risk/hazardous operations and appropriate safety measures.
● Work permit system.
● Checklist and reports.
● Contingency plan for emergency situations.
● List of job specific personal protective equipments to be used at site.
● Training plan.

ii. Job Hazard Analysis (JHA)

Site engineers in consultation with safety engineer and supervisor prepare the job hazard analysis. Critical jobs with hazards and risks are identified. Such jobs are broken down into various steps (i.e., sub activities). Risks / Hazards involved in each step are identified and appropriate precautionary measures are integrated. Job hazard analysis is circulated to all concerned for implementation. This helps in foreseeing risks and hazards involved in a job and taking precautionary measures for doing it safely. The format for the present work is shown in Table 4.1. The checklist should contain important precautionary steps to be observed before execution of job.

Table 4.1 Job Hazard analysis format

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Activity</th>
<th>Hazards associated with that activity</th>
<th>Precautionary measure to be taken</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
iii. Health Safety Environment (HSE) site based objectives

Site based objectives should be framed by the HSE committee after consultation with contractor representatives which should be in line with the safety policy set by the top level management. The objective should be framed based on the below guidelines:

a. To determine broad parameters of Health Safety and Environment (HSE) management at site.

b. Establish and define individual responsibilities, hazard prevention and safety promotion responsibility at each level of the construction team.

c. Identify highly hazardous operations within the scope of work and specify integrated preventive measures to mitigate the same.

d. To ensure compliance with relevant applicable legislation.

e. Continual HSE performance improvement by directing focus on the key areas for improvement in a consistent manner.

4.2.2 Phase 2 – Implementation and operation Phase (Figure 4.1)

This phase consists of developing safety goals and objectives, management training and strategic decision making on safety management techniques.

The important things considered on this phase are listed below:

i. Health Safety Environment (HSE) Ownership

There should be procedure of defining the roles, responsibility and authority for performing work on safety aspect. The procedure is suggested for senior management and other employees in the organisation are given below. Senior management provides demonstrable management leadership and commitment through active participation in HSE activities. Their leadership and commitments translate into necessary resources to develop,
operate and maintain HSE management system and to attain HSE Policy and legal requirements. Management is committed to manage all its activities, risks to ‘As Low As Reasonably Practicable’ (ALARP).

a. Visibility

The management will provide strong demonstrable visible leadership and commitments towards HSE by personal example and action in the present work is shown in Table 4.2. The management will participate in HSE meetings, conduct site Inspections and HSE Audits, to encourage a positive attitude towards HSE.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>TASK</th>
<th>ACTION BY</th>
<th>TARGET</th>
<th>VERIFICATION DOCUMENT</th>
</tr>
</thead>
</table>
| 1.      | Project HSE Committee Meeting  
(Review performance against HSE plans, HSE Objectives and targets and any HSE issues) | Project Manager (PM) | Min Frequency : 1 month | Minutes of Project HSE Committee Meeting |
| 2.      | Project HSE Committee Inspection | HSE Committee Members | Min Frequency : 1 month | HSE Inspection Report |
| 3.      | Internal HSE Audit | Project Manager (PM) | Once in two Months | Audit Report Including Non Compliance reports, and Site Observation |
| 4.      | Motivation: Giving Safety Certificates, with token gift to the “Best safety conscious personnel” of the month to recognise good HSE practices. | Project Manager (PM) | Monthly | Copies of Certificates |

b. Proactive in target setting

The project management demonstrates pro-activeness in target setting in the present work is shown in Table 4.3.
Table 4.3 Proactive target setting

<table>
<thead>
<tr>
<th>No.</th>
<th>TASK</th>
<th>ACTION BY</th>
<th>TARGET</th>
<th>VERIFICATION DOCUMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Jointly develop and discuss improvement targets and indicators for each location with Construction Managers and Safety Officer. (e.g. Training of Workmen – Coverage, Inspection Compliance etc)</td>
<td>Project Manager (PM)</td>
<td>Every Quarter</td>
<td>Minutes of meeting (MOM) of Project HSE Committee Meeting</td>
</tr>
<tr>
<td>2</td>
<td>Jointly review the Incidence rate of First Aid Cases/ dangerous occurrence/ lost time injuries and set a target for reduction.</td>
<td>Project Manager (PM)</td>
<td>Every Quarter</td>
<td>MOM of Project HSE Committee Meeting</td>
</tr>
<tr>
<td>3</td>
<td>Management involvement in Accident review and target setting.</td>
<td>Project Manager (PM)</td>
<td>As required / Monthly</td>
<td>Investigation Report</td>
</tr>
</tbody>
</table>

c. Company Safety Culture

The management should seek to create and sustain a Company culture in which employee’s share a commitment to Health, Safety and Environment in the present work is shown in Table 4.4.

Table 4.4 Company safety culture

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>TASK</th>
<th>ACTION BY</th>
<th>TARGET</th>
<th>VERIFICATION DOCUMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Put HSE as the “First agenda” of all review meetings at Head quarters and projects</td>
<td>Project Manager (PM)</td>
<td>All time</td>
<td>MOM</td>
</tr>
<tr>
<td>2</td>
<td>Empowerment to Stop Work: Employees are empowered to stop work when the situation warrants immediate action in view of imminent danger to life / property / environment.</td>
<td>All</td>
<td>All time</td>
<td>Verbal Verification</td>
</tr>
<tr>
<td>3</td>
<td>PM must appreciate and reward those employees whose prompt action helps avoid potential incident.</td>
<td>All</td>
<td>All time</td>
<td>Verbal Verification</td>
</tr>
</tbody>
</table>

d. Involvement of Senior Management

Senior management demonstrates its involvement in Health Safety Environment issues in the present work is shown in Table 4.5.
Table 4.5 Involvement of senior management in safety

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>TASK</th>
<th>ACTION BY</th>
<th>TARGET</th>
<th>VERIFICATION DOCUMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Review Project HSE Performance and HSE plan implementation in consultation with Project Manager and Safety officer.</td>
<td>Senior Management</td>
<td>Project Duration</td>
<td>-</td>
</tr>
<tr>
<td>2.</td>
<td>Ensure adequate professional HSE support is available for effectively implementing the HSE plan, fulfilling HSE targets and attaining HSE objectives.</td>
<td>Head of Department – HSE</td>
<td>Project Duration</td>
<td>No evidence of HSE discrepancy due to lack of resources</td>
</tr>
<tr>
<td>3.</td>
<td>Ensure sufficient support and resources are available to meet HSE targets (e.g., Infrastructure, vehicle, HSE steward, communication etc.)</td>
<td>Project Manager (PM)</td>
<td>Project Duration</td>
<td>No evidence of HSE discrepancy due to lack of resources</td>
</tr>
<tr>
<td>4.</td>
<td>Impart necessary HSE training for Staff and workmen of the project.</td>
<td>Project Manager (PM)</td>
<td>As required</td>
<td>HSE Training record</td>
</tr>
</tbody>
</table>

e. Responsibilities

HSE management is a line responsibility requiring active participation of all levels of management and supervision.

Individual HSE roles and responsibilities, along with task and target shall be distributed to the individuals for action, as described below. The responsibilities of the safety manager in the present work is shown in Table 4.6.

Table 4.6 Responsibility of project manager on safety

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>TASK</th>
<th>TARGET</th>
<th>VERIFICATION DOCUMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Responsible for completion of the project with total implementation of the company’s HSE policy requirement, HSE Management System and requirements of this plan and comply with the relevant legislations.</td>
<td>Project Duration</td>
<td>-</td>
</tr>
<tr>
<td>2.</td>
<td>Ensure sufficient resources are available at project. He shall ensure through:</td>
<td>Project Duration</td>
<td>1) MOM – Project HSE Committee</td>
</tr>
</tbody>
</table>
Table 4.6 (continued)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>TASK</th>
<th>TARGET</th>
<th>VERIFICATION DOCUMENT</th>
</tr>
</thead>
</table>
| 3.     | Ensure that all staff and workmen are competent to perform their tasks safely in compliance with HSE Management System and this plan requirement. He shall do so by ensuring:  
  – Screening of workmen is effectively implemented by the time office and site execution engineers.  
  – HSE Induction provided for all staff and workmen by Safety officer before deployment.  
  – Regular monitoring and organise continuous in-house HSE trainings.  
  – Establishing adequate control measures for the employees fitness in order to avoid fatigue, stress, extended working etc. | Project Duration | Project Duration |
| 4.     | Project HSE Inspection and HSE Plan implementation monitoring | Project Duration | Inspection report |
| 5.     | Investigate all high potential incidents and non-compliance and ensure immediate remedial action to stop recurrence. | As and when notified | Investigation Reports and action plans |

**Safety Officer**

The responsibilities of the safety officer in the present work are shown in Table 4.7.

**Table 4.7 Responsibility of safety officer**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>TASK</th>
<th>TARGET</th>
<th>VERIFICATION DOCUMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Disseminate and Communicate HSE Policy, HSE Management System requirements to project personnel.</td>
<td>Project Duration</td>
<td>-</td>
</tr>
<tr>
<td>2.</td>
<td>Provide necessary advice, information and support in the effective implementation of the HSE Management System requirements and this HSE plan.</td>
<td>Project Duration</td>
<td>-</td>
</tr>
<tr>
<td>3.</td>
<td>Update the HSE Plan to the requirements of the activities being carried out when there is a revision.</td>
<td>Project Duration</td>
<td>HSE Plan</td>
</tr>
<tr>
<td></td>
<td>Plan and conduct Internal HSE training programs, initiate drive to promote HSE awareness and performance.</td>
<td>Project Duration</td>
<td>HSE Training Records</td>
</tr>
<tr>
<td>---</td>
<td>--------------------------------------------------------------------------------------------------</td>
<td>------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>5.</td>
<td>Carry out HSE inspection of Work Area, P&amp;M Equipments and Machineries, etc.</td>
<td>As per Monthly Activity Plan</td>
<td>Inspection Reports</td>
</tr>
<tr>
<td>6.</td>
<td>Creating HSE awareness through Tool Box talks.</td>
<td>Every day</td>
<td>Tool box talk Report</td>
</tr>
<tr>
<td>7.</td>
<td>Advice and co-ordinate with line management in preparing HSE Risk Assessment (i.e, Job Hazard Analysis) for new activities.</td>
<td>Project Duration</td>
<td>HSE Risk assessment Records (Job Hazard Analysis with checklist)</td>
</tr>
<tr>
<td>8.</td>
<td>Conduct investigation of all incidents and recommend appropriate corrective measures.</td>
<td>When reported</td>
<td>Investigation Report</td>
</tr>
<tr>
<td>9.</td>
<td>Convene HSE Committee meeting and minute the proceedings for circulation and follow-up action.</td>
<td>Min Frequency – Once in a month</td>
<td>MOM – Project HSE Committee Meeting</td>
</tr>
<tr>
<td>10.</td>
<td>Advise and co-ordinate for implementation of Work Permit Systems.</td>
<td>Whenever work requiring WPS is executed</td>
<td>Completed Work Permit</td>
</tr>
<tr>
<td>11.</td>
<td>Plan procurement of PPE and safety devices and inspect before use as per laid down norms.</td>
<td>Project Duration</td>
<td>Requirement and Release of Safety Materials, Delivery Challan Records</td>
</tr>
<tr>
<td>12.</td>
<td>Facilitate screening of workmen and conduct HSE induction.</td>
<td>Project Duration</td>
<td>Screening and Induction Records</td>
</tr>
<tr>
<td>13.</td>
<td>Monitor administration of First Aid.</td>
<td>Project Duration</td>
<td>First Aid Register</td>
</tr>
<tr>
<td>14.</td>
<td>Conduct Fire Drill, Procure, inspect and arrange to maintain Fire Extinguishers.</td>
<td>As scheduled in the monthly activity plan</td>
<td>Fire Drill Register, Fire extinguishers inspection register</td>
</tr>
<tr>
<td>15.</td>
<td>Organise campaigns, competitions and other special emphasis programmes to promote HSE in the workplace.</td>
<td>As and when required</td>
<td>Record of HSE Campaigns and Competitions</td>
</tr>
<tr>
<td>16.</td>
<td>Register Customer complaints and take corrective action.</td>
<td>Project Duration</td>
<td>Customer Complaint Register</td>
</tr>
<tr>
<td>17.</td>
<td>Record, analyse and cascade lateral learning points from First Aid Cases, Near Miss Cases and Accidents to all project personnel and analyse the trends and effectiveness.</td>
<td>Monthly</td>
<td>First Aid Register; Incident Investigation Report</td>
</tr>
<tr>
<td>18.</td>
<td>Maintain all HSE related documents Update HSE training records</td>
<td>Continuous</td>
<td>HSE related Documents</td>
</tr>
</tbody>
</table>
Section / Area In-charges

The responsibilities of the section/Area In-charges in the present work are shown in Table 4.8.

Table 4.8 Responsibility of section / area in-charges on safety

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>TASK</th>
<th>TARGET</th>
<th>VERIFICATION DOCUMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Ensure that all the workmen engaged under him are selected through the screening system and have undergone HSE Induction before assigning any task at site.</td>
<td>Project duration</td>
<td>Screening and HSE induction records</td>
</tr>
</tbody>
</table>
| 2.      | Ensuring compliance of organisation HSE rules and applicable specifications by  
          – Taking prompt action of project inspection and hazard findings.  
          – Closing all the points identified in inspection reports  
          – Ensure Job Hazard analysis with checklist is done for all the jobs under him and implementation in the field. | Project duration | HSE Inspection report, Job Hazard Analysis records |
| 3.      | Ensure that all near miss cases / Reportable LTI / Dangerous Occurrence / Fatality are reported promptly. | As and when notified | Reports                                |
| 4.      | Participate regularly in HSE meetings.                                | As scheduled  | MOM                                               |

All Employees

The responsibilities of all the employees in the present work are shown in Table 4.9.

Table 4.9 Responsibility of all employees in organisation on Safety

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>TASK</th>
<th>TARGET</th>
<th>VERIFICATION DOCUMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Report all unsafe acts and condition to the immediate supervisor.</td>
<td>Continuous</td>
<td>-</td>
</tr>
<tr>
<td>2.</td>
<td>Start work only when conditions are safe and stop work when it is unsafe.</td>
<td>Continuous</td>
<td>-</td>
</tr>
<tr>
<td>3.</td>
<td>Operate equipment only when authorised and in prescribed manner. (If applicable)</td>
<td>Continuous</td>
<td>Inspection records</td>
</tr>
<tr>
<td>4.</td>
<td>Report any incident immediately.</td>
<td>Continuous</td>
<td>Reports</td>
</tr>
</tbody>
</table>
Site Engineers

The responsibilities of the site engineer in the present work are shown in Table 4.10.

Table 4.10 Responsibility of site engineer on safety

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>TASK</th>
<th>TARGET</th>
<th>VERIFICATION DOCUMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Understand the HSE requirements of the Project from this Plan, HSE Management Systems, HSE Manual and follow the same in work execution.</td>
<td>Continuous</td>
<td>No. of findings in the HSE Inspection</td>
</tr>
<tr>
<td>2.</td>
<td>Give Tool box talk to the workmen under him.</td>
<td>Daily</td>
<td>Tool box Report</td>
</tr>
<tr>
<td>3.</td>
<td>Ensure the workmen under him wear the necessary personal protective equipments relevant to the job.</td>
<td>Continuous</td>
<td>Subcontractor Evaluation Report</td>
</tr>
<tr>
<td>4.</td>
<td>Eliminating all unsafe conditions in the workplace.</td>
<td>Continuous</td>
<td>HSE Inspection Report</td>
</tr>
<tr>
<td>5.</td>
<td>Keeping the workplace neat and clean</td>
<td>Continuous</td>
<td>HSE Inspection Report</td>
</tr>
<tr>
<td>6.</td>
<td>Know the critical activities of his job based on HSE Risk Assessment and ensure implementation of the control measures.</td>
<td>Project Duration</td>
<td>Job Hazard Analysis and Safe work method</td>
</tr>
<tr>
<td>7.</td>
<td>Participating with the Safety officer or the committee Members in the Project HSE Inspection.</td>
<td>As per schedule</td>
<td>HSE Inspection Report</td>
</tr>
<tr>
<td>8.</td>
<td>Follow all work permit system as per HSE Management System before starting of work.</td>
<td>As and when required</td>
<td>Work Permit System</td>
</tr>
<tr>
<td>9.</td>
<td>Report all near miss cases / reportable Lost Time Injuries /dangerous occurrences / fatality to safety officer immediately verbally and submitting the preliminary incident report within 12 hours.</td>
<td>As and when required</td>
<td>Preliminary Incident Report</td>
</tr>
<tr>
<td>10.</td>
<td>Inform the concerned authority as per the emergency response plan.</td>
<td>As and when required</td>
<td>Emergency Response Plan</td>
</tr>
</tbody>
</table>

Project HSE Committee Members

The responsibilities of the Project HSE committee members in the present work are shown in Table 4.11.
Table 4.11 Responsibility of project HSE committee members on safety

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>TASK</th>
<th>TARGET</th>
<th>VERIFICATION DOCUMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Attend meeting regularly as per schedule to discuss and decide the ways and means of eliminating the factors affecting HSE.</td>
<td>Minimum once in a month</td>
<td>MOM – HSE Committee Meeting</td>
</tr>
<tr>
<td>2.</td>
<td>Analyse all the activities of the forthcoming period and identify the possible hazards and finalizing the precaution to be taken.</td>
<td>Minimum once in a month</td>
<td>MOM – HSE Committee Meeting</td>
</tr>
<tr>
<td>3.</td>
<td>Monitor the HSE Performance of the project and suggesting improvements whenever needed.</td>
<td>Minimum once in a month</td>
<td>MOM – HSE Committee Meeting</td>
</tr>
<tr>
<td>4.</td>
<td>Actively participate in the HSE Committee Inspections and assess Key Safety Performance Indicators (KSPI) on Health, Safety and Environment.</td>
<td>As per Schedule</td>
<td>HSE Inspection Report, KSPI report</td>
</tr>
</tbody>
</table>

Sub-Contractors

All Subcontractors / Vendor / Supplier / Third Party performing services at the Project shall be subject to this plan requirement. The responsibilities of the Project Sub-Contractors in the present work are shown in Table 4.12.

Table 4.12 Responsibility of subcontractors on safety

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>TASK</th>
<th>TARGET</th>
<th>VERIFICATION DOCUMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Understand the HSE code of practice for subcontractors and sign the same as a token of acceptance before starting the activity.</td>
<td>Before starting the activity</td>
<td>HSE Code for Sub contractors</td>
</tr>
<tr>
<td>2.</td>
<td>Subcontractor, his Supervisor and his workmen shall adhere all the laid down HSE rules and regulations while working at site, follow the instruction / advice of Site engineer and safety officer from time to time.</td>
<td>Continuous</td>
<td>Key Safety Performance indicator (KSPI)</td>
</tr>
</tbody>
</table>

ii. Safe work method

A Safe Work Method (SWM) is documents that contain:
- List the types of high risk construction work being done
- States the health and safety hazards and risk arising from that work
- Describes how the risk will be controlled, and
- Describes how the risk control measures will be put in place.
iii. Work permit system

The work permit systems are designed and intended to specify adequate safety measures in advance against identified hazards and stipulate implementation of the said safety measures by the permittee to ensure safe execution of work in the designated workplace. The following work permit systems are to be used.

- Working in confined space.
- Carrying out hot work in specified location.
- Giving clearance for excavation work.
- Blasting permit.
- Carrying out Industrial Radiography.
- Working on overhead traction line.
- Working on P & M and other power driven equipment.
- Carrying out electrical work (High tension (HT)/ Low tension (LT)).
- Removal of covers from manholes/ openings/ barricading.

iv. Screening and induction of workmen

All new workmen should undergo (i.e., Medical Test, Physical Ability Test) before they are engaged on the job. Their fitness and previous experience is verified to find his suitability for a particular job. Safety engineer gives safety induction to the new workmen including knowledge on common hazards and relevant precautionary measures. This ensures right man for right job and safe working.

v. Equipment fitness certification

During mobilisation of any equipment, the equipments should have history card and necessary third part competent certificate (if needed).
Inspection should be carried out on the aspect of safety features before deploying into present site.

**vi. Training**

Training is an important aspect of safety management function. Training needs of staff members are identified and Training matrix is prepared as shown in Appendix -2. Following training programmes are to be conducted regularly or as per the training calendar.

- Safety while working at height.
- Safety in civil work (i.e., excavation, blasting, concreting etc.).
- Safe erection methods and rigging practices.
- Safety in operation of plant and machinery.
- Safety in gas cutting and welding operations.
- Safety in scaffolding.
- Prevention and control of fires.
- First aid.
- Electrical safety.
- Safety management and up-gradation of safety systems.

**vii. Pep talk**

Before commencing any job the workmen are made aware of potential hazards involved in the job through pep talks. Work methods and various safety precautions are explained to them. This cautions them on the associated risk and prepares them to take adequate precautions. Site engineers and safety engineers conduct pep talks.

**viii. Communication, participation and consultation**

Always proper communication should be available in the organisation, to transfer the information from one level to another level. Top
level management should participate in all the promotional activities on safety aspect. Whenever Job hazard analysis or safe work method is prepared for critical activities, engineers should consult the supervisor, workers also to get their ideas for performing job. Cascading any HSE messages down the line is vital for the success of any HSE management system and to ensure that all personnel are aware of HSE issues the following technique shall be adopted. The effective communication strategies on safety are shown in Table 4.13.

**Table 4.13 Effective communication strategies on safety**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>TASK</th>
<th>ACTION BY</th>
<th>TARGET</th>
<th>VERIFICATION DOCUMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>HSE NOTICE BOARD: Fix HSE Notice board at project office and other conspicuous locations for cascading HSE messages such as HSE Notices, Safety Alerts, Posters and incident evaluation etc., and regularly update. Install and maintain HSE performance board showing Safety statistics i.e. days without Lost time injuries etc.</td>
<td>Safety Officer</td>
<td>Daily / Weekly update</td>
<td>HSE Notice Board</td>
</tr>
<tr>
<td>2</td>
<td>PROMOTION: Monthly Incentive Select “Safe Man of the month” on the basis of HSE performance evaluation and award certificate of commendation along with a token gift.</td>
<td>PM / Safety Officer</td>
<td>Monthly</td>
<td>--</td>
</tr>
</tbody>
</table>

**ix. Sub-contractor management**

Key Safety Performance Indicator (KSPI) is the tools which can give clear picture of the sub-contractor status on safety aspect. Key safety
performance indicator is dealt in details on chapter 5. A monitoring of sub-contractor on the safety is evaluated by key safety performance indicator.

x. Emergency response plan

A plan developed for different scenario’s like fire emergencies, medical emergencies, collapse of structure, natural disaster etc., which will bring the action plan and responsibility of personnel during emergency situation.

xi. Personal protective equipments (PPE) and safety devices

Personal protective equipment (PPE) is often referred to as the least desirable way to protect workers from hazard. It is the "last line of defence" against harmful substances or sources of energy, to be used only when other controls have failed to eliminate or isolate the hazard.

xii. HSE reward and reprimand

It is important to acknowledge and encourage good health and safety performance and suitably reprimand repeated violations, non-conformances and poor health and safety performances.

a. Reward for good health and safety performance

To motivate the employees and organization to work safely the following measures can be implemented based on the suitability. Selection and rewarding on a monthly basis a) Safest workmen, b) Safest supervisor, c) Safest area and d) Safest sub-contractor, etc.

Subcontractors and employees may be rewarded when the project achieves significant million man-hours without any lost time injury. Poor health and safety performance in the form of repeated violations, frequent adverse incidents and accidents shall be dealt with firmly. Depending on the
seriousness of the violation the following options shall be considered:
a) Issue of violation memorandum and obtaining written commitment for safe
working, b) Suspension or termination of the employee, c) Suspension or
termination of contract in case of construction agency / subcontractor and d) 
Imposition of penalty. When penalties are imposed due records shall be
maintained in a transparent manner. The funds thus accrued can be
transparently spent in the form of rewarding employees for their sincere
efforts towards improving the health and safety performance.

4.2.3 Phase 3 – Checking and Corrective Action Phase (Figure 4.1)

The final phase of the TCSM implementation model is the
execution and improvement phase. At this stage, the new culture must be
incorporated in the mix, employee-training programs must be launched, and
all safety performance closely monitored to promote continuous
improvement.

i. Internal Health Safety Environment (HSE) audit

Systematic, independent and documented process for obtaining
“audit evidence” and evaluating it objectively to determine the extent to
which audit criteria are fulfilled.

ii. Key Safety Performance Indicator (KSPI) on health safety
environment (HSE) inspection

Key safety performance indicator is a tool to measure safety
performance measurement, subcontractor’s performance measurement,
develops an effective feedback mechanism at site. The chapter 5 deals in
detail on Key safety performance indicator.
iii. Health Safety Environment (HSE) committee

A committee is framed to look after the general hazard present at site. The committee will go through the entire site once in a month to see the level of safety culture developed at site. A meeting will be convened to address all the safety issues. The representation will be from worker side also in the meeting to give a feedback and address the issue faced at the site.

The committee shall discussion as per following agenda 1) review of minutes of meeting of previous meeting, 2) suggestions and complaints received from clients and corrective and preventive action, 3) non confirmatory reports (NCR’s)/observation from external parties, 4) evaluation of compliance to legal requirements, 5) Status of implementation of objectives and programmes, 6) analysis of reportable cases/ reportable accident case and discussion on other site accidents details, 7) two month look ahead plan and safety specific requirements, 8) status of implementation of Safety management systems and plan, 9) critical compliance and action plan for compliance, 10) analysis of key safety performance indicator and contractor safety performance based on monthly evaluation, 11) specific inputs from last subcontractor safety meeting and representation of any issues by subcontractors on safety aspects, 12) critical observation noted at site and recurring observations at site and 13) need of any specific system/training / personal protective equipments / resources.

iv. Health Safety Environment (HSE) inspection

All Equipment, Plant and Machinery, Vehicles, Tools & Tackles, Electrical Installations, Work areas, Scaffolds are inspected periodically as per standard guideline/ checklist. Compliance with site safety rules is checked during inspection. Corrective and Preventive actions are promptly
taken on points observed during inspection. Safety engineer carries out these inspections along with concerned site engineer and plant and machinery engineers. The following inspection checklists are developed based on Indian construction industry scenarios.

The Inspections to be carried out with checklist at sites include:

a) General HSE Safety inspection  
b) Housekeeping inspection  
c) Vehicle and earth moving equipment inspection  
d) Scaffolding inspection  
e) Diesel generator inspection  
f) Lifting tools and tackles inspection  
g) Canteen and labour camp inspection  
h) Electrical Safety Inspection and EL CB inspection (dealt in Chapter 6).

v. Health Safety Environment (HSE) statistics

It is one of the performance indicators, which shows how much accidents happened at site and Safe man hours worked. The indicators are frequency rate and severity rate.

vi. Incident investigation

Incident investigations determine how and why these failures occur. By using the information gained through an investigation, a similar or perhaps more disastrous accident may be prevented.

vii. Management of first aid

Medical management should have good facility at construction site. So that when a person gets injured, he can be treated with utmost care.
viii. Evaluation of compliance to legal and other requirements

Legal requirement applicable can be selected by the site and prepared the registers which are required to be complied. The format of legal register and evaluation of legal register format in the present work is shown in Appendix- 3.

ix. Corrective and preventive action

Site should take corrective action whenever safety related deficiencies exist, if any lesson learnt accident is known then preventive action should be taken.

4.3 DISCUSSION

Owing to increase in complexity of operations, the construction industry has become more dangerous than ever before. Construction organizations are faced with the challenge of having too closely to monitor their safety management systems to minimize occupational hazards, while simultaneously trying to sustain profits in a competitive marketplace. In the United States, government agencies such as OSHA have done their part to promote a zero injury environment. However, in India effective safety construction management is not available. Moreover, the key to proper safety execution is not necessarily through strict guidelines and standards, but through an effective total safety management initiative, first it should be supported by an organizations senior management, then integrated via specific safety management implementation tools/ systems, and finally by continuous follow up and monitoring to ensure safety and continuous improvement in implementation of the systems. Construction organizations interested in maximizing safety and competitiveness must look to Total Quality Management (TQM) initiatives for inspiration. Quality focus, total commitment, and continual improvement must be the mantra of choice. Only
those companies that take on an aggressive total construction safety management approach will sustain profit margins and achieve world-class competitiveness.

The proposed Total Construction Safety Management (TCSMS) system acts as a catalyst for maintaining a safe project. Contractor top management should formulate strategies and develop policies that nurture a safe culture. This research would like to conclude that the single most important determinant of the success of an organization in implementing TCSMS is its ability to translate, integrate, and ultimately institutionalize into everyday practice on the job.

4.4 SUMMARY

In this chapter, the generic model for site based safety management system (i.e., Total Construction Safety Management System) is defined. The systematic management requires that organisations have a clear purpose or policy with regard to health and safety of the employees, and that safety is incorporated in planning at all levels. The companies implementing this total safety management system will have following benefits 1) no accidents or zero level accidents, 2) increase in operational efficiencies, 3) reduction in lost time injuries and medical claims and 4) recognition by insurers and regulators and improvement worker’s retention and satisfaction. The organisation with effective total safety management system earns positive returns and benefits on their health and safety investment.