

SAFETY AND HEALTH IN CONSTRUCTION OF COMMERCIAL BUILDING

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Abstract: This paper consists of safety and health in construction work. Construction work is dynamic, diverse, and constantly changing in nature. Construction project need a civil engineer who have adequate knowledge on techniques and the conventional practice. Construction is a high-risk activity, which must be managed from procurement, through the design process and to the end of the construction stage. Everyone involved in a building project must appreciate their role, from client, project supervisor design process (PSDP), designer, project supervisor construction stage (PSCS), contractor and employees. We place a high value on the safety and health of our employees. We are committed to providing a safe workplace for all employees and have developed this program for injury prevention to involve management, supervisors and employees in identifying and eliminating hazards that may develop during our work process. If a job represents a potential safety or health threat, every effort will be made to plan a safe way to do the task. Every procedure must be a safe procedure. Shortcuts in safe procedures by either foremen or workers will not be tolerated. If a worker observes any unsafe condition, which may pose a potential threat to their health or safety, it is expected that employees will immediately correct the situation when feasible or inform management. Management will take an active role on the safety and health committee. At least annually the safety and health committee will develop written safety and health goals and track monthly progress. These goals will be communicated to all employees. Committee will be comprised of management and hourly employees.

Keywords: safety and health in construction work, safe workplace, identifying and eliminating hazards.

1. INTRODUCTION

Safety is free from risk and danger. Accidents is an unexpected and desirable event resulting in damage or harm. Hazards is an unsafe condition or activity, that if left uncontrolled can contribute to an accident. Risk is the assessment of 'probability of loss' and 'potential amount of loss'. Construction work is dynamic, diverse, and constantly changing in nature. Construction workers are at risk of exposure to various hazards and risks that can result in injury, illness, permanent disability, or even death.

We place a high value on the safety and health of our employees. We are committed to providing a safe workplace for all employees and have developed this program for injury prevention to involve management, supervisors and employees in identifying and eliminating hazards that may develop during our work process. It is the basic safety and health policy of this company that no task is so important that an employee must violate a safety and health rule or take a risk of injury or illness to get the job done.

Employees are required to comply with all company safety and health rules and are encouraged to actively participate in identifying ways to make our company a safer place to work. Supervisors are responsible for the safety and health of their employees and, as a part of their daily duties, must check the workplace for unsafe conditions, watch employees for unsafe actions and take prompt action to eliminate any hazards.

The leading safety hazards on construction sites include falls, being caught between objects, electrocutions, and being struck by objects. These hazards have caused injuries and deaths on construction sites throughout the world.

2. LITERATURE SURVEY

Building construction projects include design, financial, estimating, environmental consideration, and legal re- view [1]. Building engineering is the application of theory, knowledge, technology, etc. to building construction. Building engineering can be classified into three categories: Structural Engineering, Mechanical, Electrical, and Plumbing

(MEP), and Construction. Structural engineering includes the analysis and design of the structural frame. MEP engineering is a significant component of the building supply system and is the most important part of the building, which must be carefully coordinated before design and installation. In the field of architecture, construction consists of construction technology and construction management. Construction technology includes materials engineering, construction methods, etc. Also, construction management is a process encompassing the planning, coordination, and control of design, financial, and estimation of a project, from starting to completion. Building planning is classified into three categories, which are architectural theory, architectural design, and sustainable architecture design. Architectural theory involves thinking, discussing and writing about architecture [2].

Architectural design is a plan for architecture, i.e. the written documentation and graphical descriptions of building projects. Sustainable architecture refers to eco-friendly design techniques in the field of architecture, and has recently been considered as a priority. Recently, there has been quite a bit of multidisciplinary convergence between research fields. In building construction and planning, there is a tendency to focus research on the fields of construction engineering and architectural planning. But building construction and planning research clearly cannot be separated from each other, and as such, the cooperation between each field in practices of building construction and planning as well as in research is needed. Building construction and planning.

The installation of green-wall systems to block solar radiation and the use of plants with natural cooling properties through evaporation and transpiration can lead to notable reductions in temperature. Furthermore, plants reduce the effects of solar radiation and reduce ambient temperature. The cooling effects of green-wall systems reduce the demand for cooling energy and result in energy efficiency in buildings, namely the ability of the building to operate and function with minimum levels of consumption. These features of green-wall systems offer several environmental and economic benefits. A comparison of related studies reveals that thermal performance is commonly evaluated using small-scale models. Employing this method means that the variables are easier to manage and the results are entirely attributable to the effect of the greenwall systems. Furthermore, there is limited research into the energy-saving capacity of green-wall systems in real-world case studies. Studying the parameters that have the greatest effect on the thermal performance of green-wall systems could help optimise their thermal efficiency.

Temperature reduction and the economic benefits of green-wall systems are not as widely valued as their aesthetic impact, and people generally use these systems for decorative reasons. There need to be greater incentives to use these systems for their economic and environmental benefits, namely to use them more effectively to reduce energy demand. Raising public awareness about the application and benefits of these systems is needed if more green walls are to be used on buildings. The lack of publicly-available information about the economic and environmental benefits is the reason why owners and investors do not request the implementation of green-wall systems due to the initial outlay despite the fact that installing them is actually relatively cheap and offers numerous advantages.

3.PROBLEM IDENTIFICATION

3.1 Major Hazards In Construction Site

There are some common situation in construction area. It was listed in the following,

- Construction work is dynamic, diverse, and constantly changing in nature.
- Constantly changing job site environments and conditions
- Multiple contractors and subcontractors
- High turnover; unskilled laborers
- Constantly changing relationships with other work groups
- Diversity of work activities occurring simultaneously
- Construction workers are at risk of exposure to various hazards and risks that can result in injury, illness, permanent disability, or even death.

3.2 Distribution Of Fatal Accidents In Construction Site

1.	Fall of person	74%
2.	Lifting equipment	7.4%
3.	Fall of material	5.4%
4.	Electrical	3.3
5.	Transport	3.1%
6.	Machinery	1.5%
7.	Excavation	1.3%
8.	Fire and explosion	0.8%
9.	Poisoning and gassing	0.8%
10.	Others	2.4

3.3 Fatal Accidents

- Falls from roof
- Roof edge
- Roof opening
- Skylights
- Through roof surface
- Falls from ladder
- Scaffold
- Girders or structural steel
- Lifts
- Wall openings

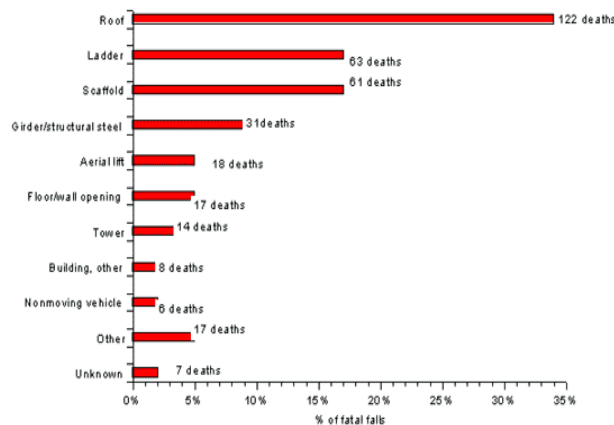


Figure.3.1. Various fatal accident in construction site

4. SAFETY AND HEALTH PROGRAM MANAGEMENT

4.1 Safety and Health Policy

The management should take a high value on the safety and health of our employees and providing a safe workplace for all employees and have to develop the program for injury prevention by involving management, supervisors and employees in identifying and eliminating hazards that may develop during our work process. Employees are required to comply with all company safety and health rules and are encouraged to actively participate in identifying ways to make our company a safer place to work.

4.2 Safety and Health Responsibilities

Employer health and safety responsibilities:

- Carry out risk assessments.
- Identify who needs protecting from potential hazards.
- Implement health and safety procedures.
- Create a health and safety policy.
- Display the health and safety law poster.
- Communicate with employees.
- Provide training and first aid kits.

4.2.1 Manager Responsibilities

- Ensure that sufficient employee time, supervisor support and funds are budgeted for equipment, training and carrying out the safety and health program.
- Evaluate supervisors each year to make sure they carry out their responsibilities as described in this program.
- Ensure that incidents are fully investigated and corrective action is taken to prevent the hazardous conditions or behaviors from happening again.
- Ensure that a record of injuries and illnesses is maintained and posted as described in this program.
- Set a good example by following established safety and health rules and attending required training.
- Report unsafe practices or conditions to the supervisor of the area where the hazard was observed.

4.2.2 Supervisor Responsibilities

- Ensure that each employee has received initial orientation before beginning work.
- Ensure that each employee is competent or has received training on safe operation of equipment or tasks before starting work.
- Ensure that each employee receives required personal protective equipment (PPE) before starting work on a project requiring PPE.
- Perform a daily safety check of the work area. Promptly correct any hazards you find.
- Observe the employees you supervise while they are working. Promptly correct any unsafe behavior. Provide additional training and take corrective action as necessary.
- Document employee evaluations.
- Set a good example for employees by following the safety and health rules and attending required training.
- Investigate all incidents in your area and report findings to management.
- Talk to management about changes to work practices or equipment that will improve employee safety and health.

4.2.3 Employee Responsibilities

- Follow the safety and health rules established by your company, Report unsafe conditions or actions to your supervisor or safety and health committee representative promptly.
- Report all work-related injuries and illnesses to your supervisor promptly, regardless of how minor they may seem.
- Report all near miss incidents to your supervisor promptly.
- Always use personal protective equipment that is in good working condition when it is required.
- Do not remove or bypass any safety device or safeguard provided for your protection.
- Encourage your co-workers to use safe work practices on the job.

Make suggestions to your supervisor, safety and health committee representative, or management about changes that will improve employee safety and health.

5. SAFETY AND HEALTH RESPONSIBILITIES

All contractors performing work will be responsible for conducting daily safety inspections of their work area, tools and equipment. In addition to reviewing injury records and investigating incidents for their causes, management and the safety.

Scaffold Safety

Subcontractors that use scaffolds will have a designated competent person to inspect their scaffolds prior to use each.

Trenches and Excavations

Subcontractors that work in trenches or excavations will have a designated competent person to inspect their excavations prior to beginning work each day.

Cranes

Subcontractors using cranes on the job site will have a designate competent person to inspect each crane prior to use each day.

Forklifts

Subcontractors using forklifts on the job site will have a designated competent person to inspect each forklift prior to use each day.

Manlifts and Scissor Lifts

Subcontractors using manlifts or scissor lifts will have a designated competent person inspect all mechanical parts of such lifts, including all welds for signs of fatigues prior to use each day..

6.MANAGING SAFETY AND HEALTH ON CONSTRUCTION SITES

Construction safety management is a method which is used to control safety activities in order to ensure a safe working environment in the construction site. Safety during the construction project is also influenced to a great part by decisions made during planning and design process.

6.1 Safety Policy

Every employer of 50 or employees shall make a written statement of his policy with respect to the safety and health of his employees and make arrangements to give effect to the policy.

6.2 Risk Assessment

The employer should make a suitable and sufficient assessment of: -

- (a) Any risk to the safety and health to which any employee is exposed whilst he is at work.
- (b) Any risk to the safety and health of any person not in his employment arising out of or in connection with the conduct by him of his undertaking.

6.3 Organising The Site

Make a good planning by gathering as much information about the project and the project site before works begin to ensure safety during construction phase.

Information that could be sought should be: -

- (a) Underground services.
 - (b) Presence of live bare electrical conductors, underground/overhead insulated cables.
- Advice from the authority concerned should be sought prior to start of work.
- (c) Ground conditions.
 - (d) Contract documents.
 - (e) Nearby schools, footpaths and roads.
 - (f) Other activities going on the site.

Responsibilities regarding safety and health between different stakeholders should be clearly allocated: -

- (a) Between client/main contractor/subcontractor.
- (b) By appointment of competent supervisors/safety and health officers.
- (c) By proper coordination on site between parties.

Common facilities to be provided:

Ensure provision of basic facilities to ensure safety, health and welfare of employees.

1. Site access

Adequate, safe and separate pedestrian and vehicular traffic routes should be provided on and around the site.

2 Site boundaries

Fence the construction site to prevent the entry of unauthorised persons on construction sites, which are located in built-up areas and alongside vehicular and pedestrian traffic routes.

3 Public safety

Ensure public safety through appropriate fencing of site or by other means.

4. Lighting

Ensure adequate lighting of all worksite through natural and/or artificial lighting.

5. Site tidiness

- (a) The site should be kept tidy.
- (b) Walkways and stairs should be kept free of slipping and tripping hazards.
- (c) Ensure there are no protruding nails on loose or fixed materials.

6. Storage areas

- (a) Set up storage areas for plants, materials, flammable substances (e.g. flammable liquids and gases) and hazardous substances (e.g. chemicals).
- (b) Store flammable materials away from other materials and protected from accidental ignition.
- (c) Prevent obstruction of access routes/emergency escapes by proper storage of materials.
- (d) Materials to be properly stacked to prevent falls

7. Fire Safety

Ensure fire safety on the construction site by: -

- (a) Providing adequate means for fighting fire.
- (b) Training of personnel in the use of these fire-fighting equipments.

7. WORKING AT HEIGHT

7.1 Guard rails

Guard rails should: -

- be made from any material, provided they are strong and rigid enough to prevent people from falling and be able to withstand other loads likely to be placed on them.
- Be fixed to a structure, or part of a structure capable of supporting them.

Include: -

- a main guard rail at least 900 mm above any edge from which people are liable to fall.
- a toe board at least 150 mm high.
- a sufficient number of intermediate guard rails or suitable alternatives.

- Risks of falls through openings or fragile material (e.g. rooflights), to be reduced by providing appropriate and adequate guard rails or barriers to cover the opening or material.

7.2 Safe Working Platforms

All working platforms should be: -

- Fully boarded and securely fixed to prevent displacement.
- Strong enough to support the load usually placed on it (workers and materials).
- Provided with toe-boards so as to prevent materials and tools from falling over the edges.

7.3 General access scaffolds

All scaffolds should be: -

- Properly designed, constructed, erected and maintained so as to prevent collapse or accidental displacement.
- Based on a firm and level foundation.
- Erected on a firm ground capable of supporting the weight of the scaffold and any load likely to be placed on it.
- Braced and tied into a permanent structure or otherwise stabilized.
- Provided with platforms that are fully boarded and wide enough for the work and for access.
- Provided with scaffold boards that are properly supported and rest on at least three supports.

7.4 Safe use of access ladders

(a) Any ladder should be properly fixed to prevent slipping.

- A good handhold should be provided to the ladder.
- The top of the ladder should rest against a solid surface and not on fragile or other insecure materials such as cement or plastic guttering.
- Both feet of the ladder should rest on a firm footing and cannot slip.
- If the ladder is more than 3 m long, or used as a way to and from a workplace, it should be secured from falling by fixing it at the top or sometimes at base.
- If the ladder cannot be fixed a second person should secure the ladder at the base while it is being used.
- The ladder should extend a sufficient height (about 1 m) above any landing place where workers will get on and off it unless some other adequate handhold is available.

7.5 Stepladders

- Stepladders should be fully opened and both spreader bars should be locked.
- Stepladders should not be used on top of scaffolds, platforms, or other surfaces above the ground.
- Unattended tools, such as hammers, should not be left on top of stepladder.
- Stepladder should be dismantled before being moved.
- Top most rung of a stepladder should not be used.

7.6 Care of ladders

- Ladders should be inspected regularly by a competent person and damaged ladders should be removed from service.
- Ladders should be properly stored on racks under cover and above ground.
- Ladders should not be hung from its rungs.

7.7 Roof works

- All roof-work operations should be pre-planned and properly supervised.
- Roof work should only be undertaken by workers who are physically and psychologically fit and have the necessary knowledge and experience for such work.
- Work on roofs should not be carried on in weather conditions that threaten the safety of workers.

7.8 Moving, Lifting and Handling Loads

Manual handling

- Work site and storage of materials should be planned so that manual handling is reduced to a minimum.
- Manual handling should be done by the kinetic lifting technique and the person involved should be properly trained.

Lifts

Lifts for the carriage of persons need to be especially constructed and installed for the purpose, with such features as mechanical and electrical interlocking devices on the cage and landing gates.

Mobile cranes

- The crane should be able to lift the load on a site.
- It should be of such a size so that it can be used safely on a site.
- Crane's inspection certificates should be up-to-date.
- The crane should be fitted with an automatic Safe Load Indicator, which should be in good working order.
- The employer should ensure that the driver is trained and experienced in the operation of the type of crane being used.

The crane should be sited in a safe place, so that;

- The driver has a clear view of the site.
- It is well away from excavations and overhead power lines.
- It is on level ground which can take its full weight and together with its maximum load.

7.9 Site Vehicles and Mobile Plant

- Provide safe site entry and exit points with adequate turning room and good visibility for vehicle drivers.
- Keep pedestrians separate from vehicles, e.g., by providing separate site entry and exit points.
- Consider a one-way system and avoid needs for vehicles to reverse wherever possible.

8.COST OF ACCIDENTS & WELFARE FACILITIES**8.1 Direct Cost**

The direct costs are insurance. These include medical costs and others workers' compensation insurance benefits as well as liability and property-damage insurance.

8.2 Indirect Cost

- Transportation costs – include the cost of emergency transportation, together with the cost of other personnel that were necessary to get to the injured worker to proper medical facilities
- Wages paid to injured worker for time not worked – include all the time in which the worker was not actually doing his or her job and for the wages paid.
- Extra wage costs, slower returned worker – normally when a worker return to the job site and is partially and/or temporarily disabled, the worker is probably working at a different, less demanding job or less efficient at the former job.
- Costs to reschedule work – include time spent to review and reschedule the project due to investigations or project being temporarily suspended by the authorities.
- Costs of wages for supervision as a result of the accidents – include all time spent on the accident and its results: caring for the worker's medical treatment, investigation, completing forms, disseminating information, visiting the worker, planning to prevent recurrence, appearance in court.

8.3 Welfare Facilities

- Work in the construction industry is arduous; it involves much manual or physical activity. It is also hazardous and dirty. Good welfare facilities not only improve workers' welfare but also enhance efficiency.
- Welfare facilities such as the provision of drinking-water, washing, sanitary and changing accommodation, rest-rooms and shelter, facilities for preparing and eating meals, temporary housing, assistance in transport from place of residence to the worksite and back, all help to reduce fatigue and improve workers' health. The facilities may be provided and maintained by one contractor for all workers or by individual contractors.

8.4 Rest Breaks

- Construction workers begin work early. They start their day alert and productive but their activity level decreases as the day passes. Fatigue develops gradually before it begins to have marked effects. If you rest before you show signs of being really tired, recovery is much faster. Short breaks taken frequently are much better than infrequent long breaks. Productivity improves with frequent rest breaks.
- National law may prescribe the length of a working day which includes a period or periods for rest breaks. At least one ten-minute break in the morning and one in the afternoon, in addition to a longer break for lunch, are essential.
- Workers are not just idle during rest breaks, but are recovering from fatigue and preparing for continued productive work. Getting away from a noisy or polluted workplace helps to relax and recover from fatigue, and an area with seating and out of direct sunlight should be set aside for rest breaks.

8.5 Emergency Action

There are some situations where you cannot wait for a trained first-aider. Doing something at once might save an injured person's life. Here are some things you can do:

- Check breathing; turn an unconscious person from his or her back to the side to prevent choking on the tongue; be cautious, keeping in mind the possibility of a neck injury;
- Provide artificial respiration if breathing has stopped, using the mouth-to-mouth method
- Stop heavy bleeding by direct pressure on the wound and by raising the injured limb (do not try to use a tourniquet);
- Cool a burn with water for some ten minutes, never with anything else – extinguish burning clothing by rolling the person on the ground or wrapping them in a blanket
- Flush a burn from corrosives, or contamination of the eyes from any chemical, with water for at least ten minutes;
- Treat shock by lying the injured person on his or her side; loosen any tight clothing and cover the person with a blanket to keep him or her warm;
- Deep cuts and abrasions carry the risk of tetanus (lockjaw) and need to be treated by a doctor. Abrasions, even minor, carry a greater risk of infection than an open wound. After stopping bleeding, clean cuts and abrasions thoroughly with soap and water before covering them with a bandage. Make sure your hands are clean. Always wash your hands with soap after you have finished.

8.6 Moving an Injured Person

After an accident, leave the site equipment undisturbed as far as it is safe to do so, so that the cause of the accident can be properly investigated. Make sure also that any objects and equipment involved remain untouched. This is important if proper measures are to be taken to prevent a repetition of the accident.

- Where an employee has suffered injury or illness at work necessitating his removal to his home or to a hospital or other similar institution, the employer shall promptly and at his own expense provide an appropriate means of conveyance for the employee.
- The appointed person or first-aider shall accompany the injured or ill employee to a hospital or other similar institution whenever the circumstances so justify.

9.ENVIRONMENTAL HEALTH AND SAFETY

9.1 Building-Related Hazardous Materials

Several kinds of hazardous materials may be present in older existing buildings, including, but not limited to, asbestos-containing materials, lead-based paint, and mercury containing items or PCB-containing transformers and lamp ballasts. All fluorescent bulbs and ballasts are collected for recycling. Contact owner's representative for recycling containers.

To reduce the safety risks associated with such hazardous materials, the general contractor/ construction manager shall assure that only appropriately trained and licensed contractors are permitted to abate, remediate, or otherwise handle or dispose of hazardous materials. In the event that any suspicious materials are identified during the course of work, the general contractor/construction manager must comply with the requirements of its contract with U-M that address the discovery of suspected hazardous materials and shall immediately stop work in the affected area and arrange for additional inspection or analysis by the U-M OSEH Department. The general contractor/construction manager shall immediately stop work and notify the owner's representative.

9.2 Responsibility

Safety is everyone's responsibility. It is a moral and legal obligation of employers to provide a safe working place and of employees to work safely. Employer's duty of care to employees as covering the following areas:

- Safe system of work;
- A safe place of work;
- Plant and machinery that is safe to use;
- Competent supervision and/or suitable training; and
- Care in the selection of fellow employees.

CONCLUSION

Inspection

Equipment for work at height needs regular inspection to ensure that it is fit for use. A marking system is probably required to show when the next inspection is due. Formal inspections should not be a substitute for any pre-use checks

or routine maintenance. Inspection does not necessarily cover the checks that are made during maintenance although there may be some common features.

Inspections need to be recorded but checks do not. Under the Work at Height Regulations weekly inspections are still required for scaffolding used in construction, as required by the Construction (Design and Management) Regulations where a person could fall 2 m or more. The requirements for inspection are set out in the regulations as follows:

- The name and address of the person for whom the inspection was carried out.
- The location of the work equipment inspected
- A description of the work equipment inspected
- The date and time of the inspection
- Details of any matter identified that could give rise to a risk to the health or safety of any person
- Details of any action taken as a result of any matter identified
- Details of any further action considered necessary
- The name and position of the person making the report.

Maintenance

Inspections and even thorough examinations are not substitutes for properly maintaining equipment. The information gained in the maintenance work, inspections and thorough technical examinations should inform one another. A maintenance log should be kept and be up to date. The whole maintenance system will require proper management systems. The frequency will depend on the equipment, the conditions in which it is used and the manufacturers' instructions.

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