OCCUPATIONAL SAFETY AND HEALTH IN CONSTRUCTION

OUTLINE OF TOPICS

(1 No. Session at 2 hr)

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Delivery Media: ☑ Oral ☑ Blackboard ☐ Handouts ☐ Slides/Transparencies ☑ Internet ☐ Samples

Equipment: ☐ Slide Projector ☐ Transparency Projector ☐ Computer Projector

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Objective: Introduction to occupational safety and health issues and systems in construction.

Scope/Limitations: OSHA; primary focus on operational issues rather than legal and administrative issues.

Primary Approach: Procedure-Based; Graphics-Based.

TOPICS

1.0 Occupational Safety and Health in Construction
- 1.1 The Need for Safety and Health Sytems
- 1.2 American, British and Local Regulations

2.0 Basic Good Safety Practice
- 2.1 Fundamental OSHA Organisational Requirements
- 2.2 Workforce Safety
- 2.3 Safety of the Structure

1.0 Occupational Safety and Health in Construction[1]

1.1 The Need for Safety and Health Systems

There are many mitigating factors supporting the need for effective construction safety programs today. Generally, they fall into humanitarian and economic categories. The economic factors of safety have forced even the most inhumanitarian management practices into taking a more humanitarian stance on construction safety.

Present-day construction safety programs stress *accountability* for safety throughout the organization. Owners' and contractors' management personnel must initiate the need for safety, and the resulting system must be clear as to who is accountable for carrying out the program. The Contractor is responsible for initiating, maintaining, and supervising accident prevention programs in connection with the work. This translates into a cost to be paid by the Owner. Because Construction Managers have sole responsibility for delivering the project goals, they are typically held accountable for the success or failure of the site-safety performance.

Humanitarian Factors in Safety

The humanitarian factors in safety are quite straightforward. No one connected with the industry wants to see coworkers killed or injured on the job. Everyone working on the job must make a personal commitment to perform in a manner that doesn't endanger the lives and property of others. This is especially true for the various management groups involved in the construction project because they are responsible for managing the safety environment.

Construction Managers are especially sensitive to safety's humanitarian side because they are customarily responsible for delivering the sad news of an accident to the next-of-

[1] Adapted from *Total Construction Project Management* by G. J. Ritz, "*A Comparative Study of Safety Culture in the Construction Industry of Britain and the Caribbean"* by Peckitt, Glendon, and Booth, Proc. CIBW92, *The Contractor's Field Guide* by P.I. Thomas, and *Steel Designer's Manual* by The Steel Construction Institute.

kin. As leaders of their field organizations, most Construction Managers feel a personal responsibility for an accident that happened on their watch.

Economic Factors in Safety

It has been estimated that in the U.S in the 1980s, accidents cost the construction industry approximately US$20 billion per year. Therefore, construction safety and accident reduction programs offer one of the best cost reduction routes towards the goal of reducing overall costs. The costs due to accidents can be sub-divided into direct and indirect costs. It is estimated that the indirect costs are 4 to 17 times larger than the direct costs.

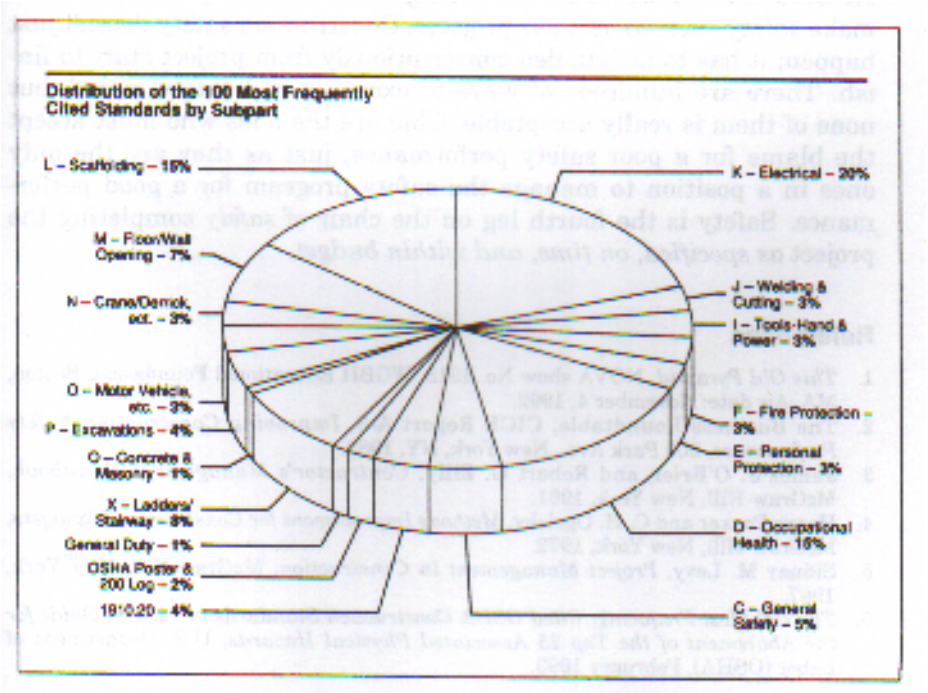
According to a recent study by Peckitt *et al*, the British construction industry is more dangerous than any other land-based industrial activity except mining. Between 1986 and 1992, on average 5 workers were killed every fortnight and a member of the public was killed every month. The rate of fatalities was 6 times greater than in the manufacturing sector and 16 times the rate in the service sector. The number of cases of ill health caused by the British industry annually is reported to be: 48,000 persons with musco-skeletal problems; 23,000 persons with respiratory diseases; 10,000 persons with dermatitis, and 6,000 persons with occupational deafness.

With respect to the Caribbean, the following table (from "*A Comparative Study of Safety Culture in the Construction Industry of Britain and the Caribbean"* by Peckitt, Glendon, and Booth, Proc. CIBW92, pp. 219) indicates accident numbers and incidence rates by country.

Country	Date	Fatal Accidents		Non-Fatal Accidents		Notes
		Number	Rate per 100,000	Number	Incidence rate	
Anguilla	1989 1990 1991	- - -	- - -	- - -	- - -	No industrial accident data available.
Barbados	1989 1990 1991	1 0 1	10.75 0 11.76	70 22 27	642 230 318	Figures from Labour Dept. (>3 day). Employment figures Labour Market Information Report 1990
Guyana	1989 1990 1991	0 1 0	0 1.6 0	15 11 13	165 121 143	Assumes 9,000 construction workers. Reports for greater than one day absences. NIS figures. Total workforce 270,000
Jamaica	1989 1990 1991	0 0 0	0 0 0	68 40 126	224 152 405	Greater than two day absences. Figures from NIS assumed 30,000 construction workers
St. Lucia	1989 1990 1991	0 0 0	0 0 0	- - 36	- - 1663	From National Insurance Figures, not recorded by industry group. (> 3 day)
St. Vincent	1989 1990 1991	0 0 1	0 0 30	23 19 15	675 557 440	Labour Mkt Bulletin Vol 3 1990, (>3 day) Total employees = 37,782 Construction workers = 3,380
Trinidad and Tobago	1989 1990 1991	0 0 0	0 0 0	2 1 0	5.2 2.5 0	CSO Reports Trinidad Labour Dept.Figures. (> three day absences)
Britain	1988/89 1989/90 1990/91	109 108 110	9.9 9.4 9.3	18763 20339 19377	1842.9 1971.4 1876.5	HSE Annual Reports. Employees only RIDDOR Reports

The accident incidence rates for the Caribbean construction industry are generally less than 50% of the British figure. From the available data, it seems that construction accidents occur more frequently in Britain than in the Caribbean though it is difficult to assess the amount of unreported cases in the Caribbean. Electrical, “struck by”, and machinery accidents seem to be more common causes of fatal accidents than falls, in contrast to Britain.

The following diagram (from *The Most Frequently Cited OSHA Construction Standards in 1991*, by the U.S Department of Labour, Feb 1993) shows the distribution of the problem areas for the U.S.



Some of the key direct costs attributable to high accident rates are:

- Higher workers' compensation insurance rates
- Higher liability insurance rates
- Losses not covered by insurance policies
- Depressed craft-labour productivity rates
- Cost of investigating and filing accident accident reports

Some of the key indirect costs are:

- Increased employee turnover
- Lost time of injured workers
- Training cost of replacement workers
- Time lost on the construction schedule with possible liquidated damages
- Lowered worker morale
- Loss of worker efficiency
- Damage to equipment or property
- Litigation support costs
- Loss of new business and damage to corporate image

1.2 American, British, and Local Safety and Health Regulation

U.S

In the U.S, the legal requirements for safety and health in the construction industry are defined by the Occupational Safety and Health Act (OSHA) which was passed by the U.S Congress in 1970. Under this act, no contractor or sub-contractor shall require any labourer or mechanic to work in surroundings that are unsanitary, hazardous, or dangerous to health and safety. The Act covers a variety of fields in addition to construction though Regulations 2207 deal specifically with the construction industry.

OSHA is typically administrated by the State Department of Labour via OSHA Compliance Officials.

U.K

In the U.K, the legal requirements for safety and health in the construction industry were originally under the Factory Act 1961, but is now under the Health and Safety at Work Act 1974, among others, and is administrated by the Health and Safety Executive via Inspectors. In 2007, the Construction (Design and Management) Regulations 2007 came into effect that gives designers particular responsibilities. This is expected to impact the Caribbean in the near to medium term.

Local

The Government of Trinidad and Tobago recently adopted OSHA Regulations by way of an Act of Parliament - the Occupational Safety and Health Act of 2004, amended in 2006. Prior to this, Local health and safety in the construction industry was governed by the Factory Act of the 1930s, based on U.K practice, with amendments made in the 1980s and 1990s. The Occupational Safety and Health Act has15 parts and is based on UK practice and documents. The OSH Authority is a group of persons appointed to enforce the OSH Act and provide information to employers and employees, among other things. The OSH Authority is required to establish the OSH Agency which is the organization responsible for administrating the OSH Act.

2.0 Basics of Good Safety Practice

2.1 Fundamental OSHA Organisational Requirements

OSHA Standards are published in the *Federal Register* that is available in many public libraries, and from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. A summary of some of the more significant rules is given here for your information and further study.

Agreement Between Prime Contractor and Subcontractor

The prime contractor and subcontractor(s) may agree on who shall furnish (for example) toilet facilities, first-aid services, fire protection, or drinking water, but such agreement will not relieve one of legal responsibility.

Machines and Tools

Machines or power tools not in compliance with the regulations must be tagged “unsafe”, locked, or removed from the premises.

Harmful Animals, Plants, Flammable Liquids, and Gases

Employers must instruct employees in avoidance of unsafe conditions to avoid exposure to illness or injury. If harmful animals or plants (ring worm, for example) are present, the employee is to be instructed regarding the hazards and in any first aid procedures. The same rules will apply where employees are required to handle any flammable liquids, gases, or toxic materials.

Medical Attention and First-Aid Supplies

- Employers must insure availability of medical personnel for advice and consultation on matters of occupational health.
- Provisions shall be made for prompt medical attention in cases of serious injury.
- If no infirmary, clinic, hospital, or physician is reasonably accessible, a person certified in first aid shall be available at the work site.
- First-aid supplies shall be easily accessible. The first-aid kit must contain approved materials in a waterproof container, and contents must be checked by the employer before being sent to the job and *at least weekly.*

Transportation to Physician or Hospital

Equipment must be furnished to transport any injured person to a physician or a hospital; or else, communication must be available for ambulance service. Telephone numbers of physicians, hospitals, and ambulances must be conspicuously posted.

Potable Water Supply

An adequate supply of potable water must be supplied in all places of employment. Containers shall be capable of being tightly closed and supplied with a tap (no dipping of water from containers). Container is to be clearly marked. A common drinking cup is prohibited. Where single-service cups are supplied, a sanitary container for unused and one for used cups are to be provided.

Toilets

Toilets are to be provided in accordance with the regulations.

Protection Against Noise Exposure

Protection against the effects of noise exposure shall be provided when sound levels exceed those set forth by OSHA table "Permissible Noise Exposures." The protective devices inserted in the ears must be fitted individually by competent persons. Cotton is not acceptable.

Lighting of Construction Areas

All construction areas must be lighted to minimum intensities listed in a table designating "foot-candles" for specific areas.

Hardhats and Goggles

Hardhats (usually supplied by employer) are to be worn by employees working in areas where there is a possible danger of head injury from impact, falling objects, or electrical shock or burns. Goggles and face protection are to be provided to employees who are engaged in operations where machines or equipment present possible eye or face injury.

Firefighting Equipment and Alarms

Firefighting equipment shall be furnished, maintained, conspicuously located, and periodically inspected. A fire alarm system (telephone, siren, etc.) shall be established so employees and local fire department can be alerted. Alarm code and reporting instructions shall be conspicuously posted at entrance.

Ladders and Scaffolding

Ladders and scaffolding requirements are extensive. They must be equipped with guardrails and toe-boards on all open sides and ends of platforms over 1.8m above ground or floor. If persons are permitted to work or pass under the scaffold, a 12mm mesh screen must be installed between guardrail and toe-board.

2.2 Workforce Safety

The safety of the workforce is the aspect of site safety that is subject to statutory regulation and inspection in a way that the structural safety of a project is not. The object of safety procedures is to ensure that everything possible is done to eliminate the risk of an accident injuring or killing anyone working on the site. In summary, the main methods for achieving workforce safety are:

(1) Communication

Communication of the details of safety procedures to all concerned, with their implementation through the display of the regulations themselves in the form of abstracts, by issuing safety procedure documents and by running of training courses. Individuals must be aware of the location of particularly hazardous areas and the type of protection they have been given, the types of protective clothing and equipment that are available and how to obtain them, the restrictions in force on the site regarding the use of scaffolding or certain items of plant and any access restrictions to certain areas. They should be encouraged to tell someone in authority if they see a potential hazard developing before it causes an accident.

(2) Equipment

Making the necessary equipment available on the site and maintaining it in good order. Equipment includes safety helmets, ladders and working platforms, safety belts and properly selected tools.

(3) Avoidance of working at height

Organization of the task so that the least amount of work possible has to be done at height:

(a) by the use of sub-assembly techniques,

(b) by the fixing of ladders and working platforms as much as possible on the ground before it is lifted into place,

(c) by the early provision of horizontal access walkways,

(d) by the provision of temporary staircases or hoists where appropriate.

All of these measures enable some of the hazards of working at height to be reduced by conferring on that work some of the advantages of ground level working.

(4) Fixing of portable equipment

Ensuring that portable equipment such as gas bottles and welding plant is firmly anchored while it is being used. The horizontal pull on a gas pipe or a welding cable being used at height is considerable, and easily able to dislodge the plant from a working platform, causing it to fall, possibly taking the operator with it. Care should also be taken to ensure that there are no flammable materials below on which sparks could fall.

(5) Design

Thoughtful design makes an important contribution to safety. For example, structural steelwork involves a lot of hoisting of members while the frame is being erected. The positioning of a steel stanchion splice as close as possible to the floor level will reduce the risks in completing the splice on site. Lifting cleats and connections for heavy, complex components should be designed and incorporated in the design drawings as should fixing cleats, brackets, or holes for working platforms and for safety belts or safety net anchorages. They will then be incorporated as part of the fabrication, rather than having to be provided by the erector while working at height.

2.3 Safety of the Structure

The stability of the structure itself is not prescribed by statutory regulations in the way that the safety of those working on it has been protected. Where a collapse of a partly built structure occurs, the loss of life is generally heavy. One of the main indictments of the design process is that where there is a collapse investigation indicates that there have been lapses in the understanding of the behaviour of the incomplete structure, lapses in the detailed consideration of each and every temporary condition, and most important of all, lapses in the communication of information to all involved. A designer must communicate his plan for building the structure to those who will actually have to do the building.

Columns

The effective length, and even the design condition of a column can change during the construction of a building. Each condition must be checked to ensure that the column is adequate for each one and the risks inherent at each stage must be assessed and provided for.

Bracings

Bracing is built into many types of structures to give them capability to withstand horizontal forces produced by wind, temperature, and the movements of cranes and other plant in and on the building. Temporary bracings required at some stages of the work must have properly designed connections. Early or unauthorised removal of temporary bracings is a common cause of collapse in a partially completed building.

Wind Effects

Wind effects can bring a building down if it is not adequately braced and guyed. The wind can have 2 effects: (1) pressure exerted on anything in its path, and (2) vibrations in a member obstructing its path. Bracings, guy ropes and damping weights may all have to

be considered as methods of changing the critical frequencies of vibration and of limiting movements as the job progresses.

Temporary Supports and Conditions

The design of the structure will have had a considerable amount of effort devoted to it. The design of the temporary works, on which that structure may have to depend while it is being built, may not have had so much attention. This has been a source of many collapses in the past. During construction a structure will move as its parts take up their design load. Connections to temporary supports have to be capable of absorbing these movements. Unless the design allows for these movements, eccentricities can result that may trigger a collapse.