ILO CONSTRUCTION OS&H

A free, comprehensive, international, digital training package in occupational safety and health for the construction industry

THEME SUMMARY 3: SAFE AND HEALTHY WORKING ENVIRONMENT



(Photo by Fiona Murie, BWI)

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PREFACE

"Preventing injuries and ill health in construction"

"You might think that the active, outdoor life in the construction sector would keep you fit and healthy. Quite the reverse is true and the construction industry has a deservedly notorious reputation as being dirty, difficult and dangerous.

More than 100, 000 people suffer fatal injuries on building sites every year. That means that one person is killed in a site accident every five minutes. Many hundreds of thousands more people suffer serious injuries and ill health because of bad, and often illegal, working conditions.

The fragmentation of the industry and the widespread use of flexible employment practices seriously undermine trade union capacity to organise in the sector. Downsizing, outsourcing, the use of labour-only sub contracting and the so-called self-employed has a negative impact on the management of health and safety. Responsibilities for planning and coordination of health and safety are often unclear, and compliance with health and safety law is generally poor.

Informal contractual conditions in the sector make it difficult for workers to exercise their rights, and to push for more progressive and effective prevention initiatives based on workers participation, collective bargaining and training on skills and health and safety. The consequence of poor management standards in the sector is the deterioration of working and living conditions and an alarmingly high incidence of injuries.

To make matters worse, many governments do not have a coherent legislative and policy framework for prevention. Self-regulation in construction is increasingly widespread, and the relevant administrations frequently have a permissive, passive attitude towards employers who ignore health and safety laws, even when this leads to the death of a worker."

"Deaths on Site - Predictable but not Prevented"

"The real tragedy behind the statistics is that deaths are preventable. Most people are killed whilst carrying out perfectly routine work, where the hazards are well known. Deaths from these causes can and should be avoided by the use of collective prevention measures."

These passages are taken from the "BWI Construction Hazards Fact Sheet" on the BWI web site (See Appendix, Section 7 below). They set the scene for this Theme, which is summarized under the headings given in the table above.

The Summary begins with an analysis of the causes of 'accidents' and injuries, which gives the **Construction OS&H** assessment of this important subject. Since this is an international training package, the diversity of the human workforce worldwide is discussed, making the point that a 'one size fits all' approach cannot work in practice. Specific guidance is then given on the need to make all workplaces safe and ways of reducing health hazards. The Theme Summary concludes with recommendations for inspection and maintenance.

This Theme Summary is based mainly on the following sources of information:

- ILO C167 Safety and Health in Construction Convention, 1988 ('C167')
- The BWI web site: http://www.bwint.org ('BWI')
- ILO Code of Practice: Safety & health in construction ('ILO Code')
- ILO Safety, health and welfare on construction sites: a training manual ('ILO Manual')
- ILO Managing international construction projects: an overview ('ILO Overview')

For further information on these sources see relevant extracts from the Knowledge Base, Section 7 below.

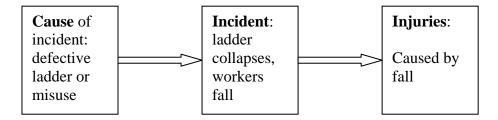
2 CAUSES OF OS&H INCIDENTS ('ACCIDENTS') AND INJURIES

The word 'accident' has at the root of its meaning an understanding that it is unexpected and unpredictable, that it occurs entirely by chance and that there is no apparent cause. Construction OS&H is based on the belief, as stated by BWI above, that most 'accidents' are in fact preventable and so are not in fact 'accidents' but 'preventable OS&H incidents'. True 'accidents' are in fact rare occurrences. This is the basis for the 'zero incident' philosophy.

In OS&H literature, the term 'causes of accidents' is used in different ways, so its meaning has to be clarified for **Construction OS&H**. To illustrate this point through a simple example, imagine that some workers were injured because the ladder that they were climbing broke, so they fell to the ground and were injured. The safety officer reported the incident using the standard form, and entered the cause of the 'accident' using common terminology as a 'fall from height'. In fact, the fall was the incident not the cause, because the cause was a defective ladder, or perhaps misuse or overloading of the ladder.

The following diagram illustrates the use of the terms in **Construction OS&H**, based on this simple example.

Causes, OS&H incidents and injuries



But note also:

"Accident prevention is often misunderstood, for most people believe wrongly that the word "accident" is synonymous with "injury". This assumes that no accident is of importance unless it results in an injury. Construction managers are obviously concerned with injuries to the workers, but their prime concern should be with the dangerous conditions that produced the injury — with the "incident" rather than the "injury". On a construction site there are many more "incidents" than injuries. A dangerous act can be performed hundreds of times before it results in an injury, and it is to eliminate these potential dangers that managers' efforts must be directed. They cannot afford to wait for human or material damage before doing anything. So safety management means applying safety measures before accidents happen."

(ILO Manual)

Some typical and common forms of incident are listed below:

Falls from heights	Falls from scaffolding, maintenance cradles, mobile access towers, ladders, roofs, etc.
Slips	Slips from roofs, into trenches, over handrails, on oil. Include trips over materials, badly fitting scaffold boards, etc.
Being struck by moving objects	Materials falling from a height (e.g.: off scaffolds) Materials being handled by cranes, etc.
Electrical hazards	Excavating live cables, misuse of electrical power tools, demolition, etc.
Confined spaces – Asphyxiation	Drainage works especially maintenance, basement excava- tions, large diameter piles (inspection), underground storage tanks, etc.
Machinery	Excavation plant, cranes, hoists, etc.

(ILO Overview)

A comprehensive and persuasive review by BWI of OS&H incidents in construction is given in the Appendix.

There is a number of reasons to study the causes of incidents. These include:

- Legal investigations to apportion blame and assess compensation for those injured
- To determine the adequacy of the plant and equipment used and to improve its performance if found to be defective
- To investigate the materials and components used, to review their suitability for future use and, if defective, to determine how they may be improved
- To review the management and OS&H systems to determine where they were deficient, with the aim of 'continuous improvement'.

Within the 'systems approach' explained in the Theme Summary 7: "Processes and systems", comprehensive and purposeful studies of the causes of incidents should be an integral part of the normal OS&H processes of review and audit.

Simple example of hazards and risks: erection of scaffolding

The picture below shows workers erecting a scaffold. No safety measures appear to be visible, so this is highly dangerous. Following the systematic construction OS&H process advocated in Theme 7: "Processes and systems" would provide the following analysis.



Workers erect scaffolding in Shenyang in NE China (From The Guardian 24 March 2009)

The general hazard is 'working at height'; specific hazards include

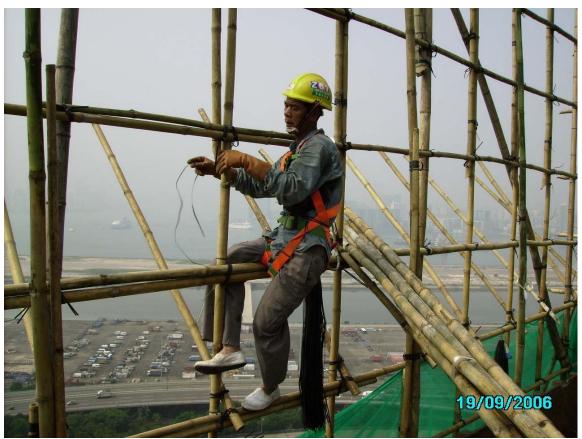
- Potential to fall from the scaffold
- Collapse of the un-braced scaffold

The **risk** is obviously very high, because this is clearly a very dangerous activity; but it is also severe, because a fall would almost certainly be fatal.

If a worker is killed or injured as a result of working on this scaffold, the **cause** will be a failure to control the hazard and risks, it **will not be a 'fall'**

A **risk assessment** should endeavour to reduce the risks. This would include:

- Completing the scaffold as it is erected, lift-by-lift, by installing bracing, decking, handrails, toe-boards, ladders etc. In this way, each lift will provide a solid basis for the erection of the next.
- Providing personal protective equipment (PPE). An example is the hard hat, gloves and safety harness shown in the picture below (note also from this picture the positive effects of government action to protect workers).



"Hong Kong's bamboo scaffolders continue to work at ever-increasing heights – but they now have to follow government safety codes and design guidelines"

[From the paper "Hong Kong-bastion of bamboo scaffolding", by M Ramanathan, Proceedings of ICE- Civil Engineering, Volume: 161, Issue: 4, November 2008.

Photograph by the author of the paper, Muthukaruppan Ramanathan}

The Construction OS&H systems approach to eliminating the causes of 'preventable OS&H incidents'

Thorough implementation of the recommendations advocated in the elements of Construction OS&H are designed to prevent 'preventable OS&H incidents'. The principal elements are as follows:

- Senior management commitment
- Strong policies
- Comprehensive participatory processes and procedures
- A systematic way of assessing and managing hazards and risks
- Well-developed preventative safety culture
- Good project briefing
- Strong contract clauses in all contracts
- Effective OS&H plans by all parties involved
- Effective OS&H processes and procedures
- Safety through design of the permanent works
- OS&H as a central part of project planning and organisation
- Design of the temporary works
- Competent management and supervision
- Safe materials and components
- Safe plant and equipment
- Good workplace design
- Good welfare facilities

3 DIVERSITY OF THE WORKFORCE

One of the key requirements of good OS&H practice is to 'match the task to the person'. Human beings range widely in physical and mental characteristics, and to take a 'one size fits all' approach to allocating tasks to workers will cause problems.



(Photo: Fiona Murie, BWI)

The ILO Code of Practice states:

"2.2.7. Employers should provide such supervision as will ensure that workers perform their work with due regard to their safety and health."

And

"2.2.8. Employers should assign workers only to employment for which they are suited by their age, physique, state of health and skill."

The need to recognise this diversity is discussed further in Theme Summary 8: "Welfare and project site".

The ILO Code also refers to 'ergonomics':

"2.2.6. When acquiring plant, equipment or machinery, employers should ensure that it takes account of ergonomic principles in its design and conforms to relevant national laws, regulations, standards or codes of practice and, if there are none, that it is so designed or protected that it can be operated safely and without risk to health."

This topic is explained clearly in the ILO Manual:

"10.1 Fitting work to people: Ergonomics

The technical development of the construction industry has led to reliance on machines and technical equipment for much heavy work previously done by hand. Although there are still many tasks on site which are carried out using manual labour, it is difficult to envisage high-rise building construction without cranes, excavators, concrete mixers or pile drivers. Mechanization has, however, brought new problems to the workplace.

Technology changes faster than people and technological change often exceeds people's ability to adapt. As a construction worker, you know the difference between a tool that is well suited for you and for the job, and one that is not. You also soon become aware of the difference between a comfortable working posture and one that is uncomfortable. Ergonomics or human engineering is a multidisciplinary way of looking at the interrelationship between the worker, the workstation and the working environment. Ergonomics plays a key role in the humanization of work, in increasing productivity, and in improving safety and health.

Even with new and modern technologies a lot of heavy work is still done by hand. Tools, machines and equipment are in many cases old-fashioned, poorly designed or badly maintained. Many operatives on construction sites are unskilled. Heavy loads frequently have to be carried up and down stairs, ladders and scaffolds, and people working on construction sites often suffer from low back pain or injury to muscles and joints.

The construction industry has a wide range of jobs and processes. These change according to the stage of the project. They involve consideration of:

- working positions, both standing and sitting;
- work which is especially strenuous;
- the use of hand tools and equipment."

An illustration of the use of new technology to protect workers is shown in the photos below. The first shows a mechanical lifting device. The second shows two workers are using the device for lifting the heavy paving slabs, all of which is ergonomically very sound.



(Photo: Richard Neale. Skanska project, Cardiff, Wales, UK)



(Photo: Richard Neale Skanska project, Cardiff, Wales, UK)

4 SAFETY OF WORKPLACES



(Photo: Fiona Murie, BWI)

The 'workplace' above is chaotic, disorganised and really unsafe. There is no 'edge protection' to prevent falls from the edge of the workplace, there is a lot of material lying around that can cause workers to trip and fall, and there is no safe means of access or egress for the beam soffit formwork carpenters. The workers are wearing no personal protective equipment - helmets, boots etc.

The important subject of safety of workplaces is explained comprehensively in the ILO Code, which is summarized below.

Generally

All appropriate precautions should be taken: to ensure that all workplaces are safe and without risk of injury to the safety and health of workers; and to protect persons present at or in the vicinity of a construction site.

Means of access and egress

Adequate and safe means of access to and egress from all workplaces must be provided, indicated where appropriate and maintained in a safe condition.

Housekeeping

Should include provisions for the proper storage of materials and equipment and the removal of waste. Loose materials obstruct means of access and egress. Causes of slips or trips should be avoided.

Precautions against the fall of materials and persons

Adequate precautions should be taken to protect any person who might be injured by the fall of materials, tools or equipment.

All openings through which workers are liable to fall should be kept effectively covered or fenced.

"Edge protection": guard-rails and toe-boards should be provided to protect workers from falling from elevated work places. Wherever the guard-rails and toe-boards cannot be provided adequate safety nets or safety sheets should be erected and maintained or adequate safety harnesses should be provided and used."

The photo below shows a 'protective fan' projecting from the building to catch falling objects, good edge protection and a securely fenced site to exclude the public and protect the workforce from road traffic.



(Photo: Richard Neale. 'Old Town', Geneva, Switzerland)

More 'fans' are shown in more detail below, together with a metal edge protection system.

(Photo: Richard Neale. St David's 2 project, Cardiff, Wales, UK)

Prevention of unauthorised entry

Construction sites in built-up areas and alongside vehicular and pedestrian traffic routes should be fenced to prevent the entry of unauthorised persons.



(Photo: Richard Neale. St David's 2 project, Cardiff, Wales, UK)

Visitors should not be allowed access to construction sites unless accompanied by a competent person, or receive effective site induction training and be provided with the appropriate personal protective equipment.

Fire prevention and fire fighting

All appropriate measures should be taken by the employer to avoid the risk of fire; control quickly and efficiently any outbreak of fire; and bring about a quick and safe evacuation of persons.

Sufficient, secure and suitable storage must be provided for flammable liquids, solids and gases. Precautions must be taken to avoid ignition of all combustible materials and regular inspections should be made of places where there are fire risks.

Welding, flame cutting and other hot work should only be done on the orders of a competent supervisor after appropriate precautions, as required, are taken to reduce the risk of fire.

Places where workers are employed should be provided with suitable and sufficient fireextinguishing equipment, which should be easily visible and accessible, which must be properly maintained and inspected at suitable intervals by a competent person. Access to fireextinguishing equipment such as hydrants, portable extinguishers and connections for hoses should be kept clear at all times.

All supervisors and a sufficient number of workers must be trained in the use of fireextinguishing equipment, so that adequate trained personnel are readily available during all working periods and workers must be suitably trained in the action to be taken in the event of fire, including the use of means of escape. Suitable visual signs should be provided to indicate clearly the direction of escape in case of fire.

Sufficient and suitable means to give warning in case of fire should be provided and such warning should be clearly audible in all parts of the site where persons are liable to work. There should be an effective evacuation plan so that all persons are evacuated speedily without panic and accounted for and all plant and processes shut down.

Notices should be posted at conspicuous places indicating the nearest fire alarm and how to contact the nearest emergency services.

Lighting

Where natural lighting is not adequate to ensure safe working conditions, adequate and suitable lighting, including portable lighting where appropriate, should be provided at every workplace and any other place on the construction site where a employee may have to pass."

5 HEALTH HAZARDS

Article 28 of the ILO Convention 167 states:

HEALTH HAZARDS

- 1. Where a worker is liable to be exposed to any chemical, physical or biological hazard to such an extent as is liable to be dangerous to health, appropriate preventive measures shall be taken against such exposure.
- 2. The preventive measures referred to in paragraph 1 above shall comprise-
- (a) the replacement of hazardous substances by harmless or less hazardous substances wherever possible; or
- (b) technical measures applied to the plant, machinery, equipment or process; or
- (c) where it is not possible to comply with subparagraphs (a) or (b) above, other effective measures, including the use of personal protective equipment and protective clothing.
- 3. Where workers are required to enter any area in which a toxic or harmful substance may be present, or in which there may be an oxygen deficiency, or a flammable atmosphere, adequate measures shall be taken to guard against danger."



(Photo: Fiona Murie, BWI)

The photo above shows a respirator. For more information on protection from health hazards, see the Theme Summary 9: "Personal protective clothing and equipment".

"4. Waste shall not be destroyed or otherwise disposed of on a construction site in a manner which is liable to be injurious to health."

Asbestos

Asbestos was extensively used in buildings in the past, as insulation and fire-proofing. It is still being used in some countries.

Exposure to asbestos is a highly dangerous material to human health. Asbestosis and lung cancer are dose-related diseases, meaning the more asbestos one breathes, the more likely the person is to get sick. Mesothelioma is different; it can be obtained from very small amounts of asbestos. Asbestos workers' families may get mesothelioma from the dust the workers bring home on their clothes or from exposure to houses and materials with asbestos.



(Photo: BWI)

Exposure to asbestos-bearing materials is now a particular risk in demolition.

Workers may be more at risk from the presence of asbestos than almost any other category of worker.

Exposure to asbestos that was commonly used in sprayed insulation on columns and on the underside of ceilings and roofs for fire protection or for thermal insulation is common and very dangerous.

Stringent precautions need to be taken to avoid contaminating the general atmosphere and to prevent breathing in of the dust.

Material containing asbestos must be removed in isolation from other work, and workers must wear positive pressure breathing apparatus and protective clothing, and be trained in their use and the techniques of asbestos removal. Where possible, wet methods of asbestos removal should be adopted rather than dry methods.

Special arrangements need to be made by management for the safe disposal of asbestos-contaminated debris. The best way to deal with asbestos is to employ a specialist company.

BWI offer good guidance on their Internet site: See http://www.bwint.org/default.asp?Issue=asbestos&Language=EN, and a comprehensive PowerPoint presentation is included in the 'Theme PPPs' as Theme PPP 3a - BWI - Asbestos'.

HIV/AIDS

This is one of the most serious and complex health issues in the construction industry in countries where HIV/AIDS is a common or even epidemic illness. The ILO has a Code of Practice (http://www.ilo.org/public/english/protection/trav/aids/publ/bcctoolkit.htm) and a training manual that all those involved with managing or coping with this illness will find useful. The Code of Practice is based on the following 'Key Principles':

A workplace issue. HIV/AIDS is a workplace issue because it affects the workforce, and because the workplace can play a vital role in limiting the spread and effects of the epidemic.

Non-discrimination. There should be no discrimination or stigma against workers on the basis of real or perceived HIV status - casual contact at the workplace carries no risk of infection.

Gender equality. More equal gender relations and the empowerment of women are vital to preventing the spread of HIV infection and helping people manage its impact.

Healthy work environment. The workplace should minimize occupational risk, and be adapted to the health and capabilities of workers.

Social dialogue. A successful HIV/AIDS policy and programme needs cooperation and trust between employers, workers, and governments.

No screening for purposes of employment. Testing for HIV at the workplace should be carried out as specified in the Code and should be voluntary and confidential, and never used to screen job applicants or employees.

Confidentiality. Access to personal data, including a worker's HIV status, should be bound by the rules of confidentiality set out in existing ILO instruments.

Continuing the employment relationship. Workers with HIV-related illnesses should be able to work for as long as medically fit in appropriate conditions.

Prevention. The social partners are in a unique position to promote prevention efforts through information, education and support for behaviour change.

Care and support. Workers are entitled to affordable health services and to benefits from statutory and occupational schemes.

6 INSPECTION AND MAINTENANCE

Regular OS&H inspections are required to ensure that the requirements of safe workplaces are maintained. These inspections will be part of the **Construction OS&H** "Active OS&H management" system, as described in Theme Summary 7: "Processes and systems" and should follow the simple principles given below.

All workplaces must be inspected, and the results recorded by a 'competent person':

- Before being taken into use
- At periodic intervals thereafter as prescribed in the agreed OS&H plan
- After any alteration, interruption in use, exposure to weather or any other occurrence likely to have affected their suitability for use by employees as a workplace

Inspection by the 'competent person' should more particularly ascertain that:

- The workplace is suitable and adequate for the proposed work and agreed method statement
- Materials, components and equipment to be used are sound and do not present a hazard to the employees
- The working platform is of sound construction and stable
- All the required safeguards are in position and their use is understood by the employees

Non-compliance must be reported to the line-manager immediately, and where non-compliance represents an immediate danger the 'competent person' should have the power to order work to cease and the employees to be evacuated urgently.



'Competent person' on a project in Dar es Salaam. Note the lightweight, ventilated safety waistcoat (Photo: Richard Neale.)

Note also from C167:

Article 34

Reporting of accidents and diseases

National laws or regulations shall provide for the reporting to the competent authority within a prescribed time of occupational accidents and diseases.

7 APPENDIX

Extract from:

BWI Construction Hazards Fact Sheet

Source: BWI web site http://www.bwint.org/default.asp?index=323&Language=EN&Print=1

Preventing injuries and ill health in construction. You might think that the active, outdoor life in the construction sector would keep you fit and healthy. Quite the reverse is true and the construction industry has a deservedly notorious reputation as being dirty, difficult and dangerous.

More than 100, 000 people suffer fatal injuries on building sites every year. That means that one person is killed in a site accident every five minutes. Many hundreds of thousands more people suffer serious injuries and ill health because of bad, and often illegal, working conditions.

The fragmentation of the industry and the widespread use of flexible employment practices seriously undermine Trade Union capacity to organise in the sector. Downsizing, outsourcing, the use of labour-only sub contracting and the so-called self-employed has a negative impact on the management of health and safety. Responsibilities for planning and coordination of health and safety are often unclear, and compliance with health and safety law is generally poor.

Informal contractual conditions in the sector make it difficult for workers to exercise their rights, and to push for more progressive and effective prevention initiatives based on workers participation, collective bargaining and training on skills and health and safety. The consequence of poor management standards in the sector is the deterioration of working and living conditions and an alarmingly high incidence of injuries.

To make matters worse, many governments do not have a coherent legislative and policy framework for prevention. Self-regulation in construction is increasingly widespread, and the relevant administrations frequently have a permissive, passive attitude towards employers who ignore health and safety laws, even when this leads to the death of a worker.

Deaths on Site - Predictable but not Prevented

The real tragedy behind the statistics is that deaths are preventable. Most people are killed whilst carrying out perfectly routine work, where the hazards are well known. Some of the principal causes of fatal injuries in construction are described below. Although this is not an exhaustive list, these are all priority hazards for prevention. Deaths from these causes can and should be avoided by the use of collective prevention measures.

Any of the circumstances described below can be a recipe for disaster. However, the lack of collective prevention measures is particularly dangerous when combined with work organisation factors. That is the management failures which characterise the industry:

spectacularly poor housekeeping; chaotic working conditions; lack of planning and coordination; lack of training and supervision, and the intense productivity and time pressure.

Falls:

The number one construction killer in any country is falling from heights, and this is principally due to the lack of proper edge protection in a variety of construction tasks:

Scaffolding falls

Inadequate, improvised scaffolding with no proper access or no guard rails to prevent falls. Often scaffolding is erected by unqualified operatives, and thereafter the lives of everyone who works from the scaffold are endangered. Scaffolding is often improvised using inappropriate materials. Common, fundamental scaffolding problems are:

- the base is not stable
- materials used to construct the scaffold are defective or unsuitable
- it has no guard rails or has guarding that creates a false sense of security
- it has no proper access, so workers are obliged to perform acrobatics
- it has only single, or insufficient, boards and is full of traps, resulting in more balancing acts for the workers
- it is not properly tied in to the building

The overloading of scaffolding for storage of materials is often the straw that breaks the camel's back and leads to the collapse of the scaffold.

All of these factors can and do kill. It seems almost ridiculous to mention the absence of toe boards, netting, fall arrest systems and other more sophisticated equipment.

Other causes of falls

- Unprotected openings, stairwells and shafts inside buildings, (for lifts, heating, air conditioning, ventilation)
- No edge protection in roof work to prevent falls, or falling through fragile roofs (particularly asbestos cement roofs) due to lack of crawling boards.
- Demolition work.
- Inappropriate use of ladders.
- Inappropriate use of hoists.
- Fatal Crush injuries and being struck by falling objects.
- Excavations which are not shored up (or at least sloped) may be unstable and collapse, particularly after rainfall, crushing, burying and asphyxiating the workers trapped below the heavy soil.
- Vehicles operating too close to the edge, where there are no stop blocks, may also cause a cave in.
- Walls collapse when excavations undermine them.
- Buildings collapse when supporting structures are injudiciously altered.

- Falling objects, materials or tools can strike and kill workers. Hard hats can save lives or reduce injuries in many circumstances. The causes are lack of toe boards on scaffolding, lack of tool belts for workers, bad storage and stacking, and poor housekeeping.
- Improper use of hoists and cranes.
- Being struck or crushed by vehicles, due to poor organisation and signalling.
- Overturned dumper trucks, due to overloading, or where gradients are too steep, or approaching too close to excavations.
- Machinery crushing or trapping workers, resulting in fatal injuries.
- Electrocutions.
- Cable strikes.
- Contact with or arcing from overhead cables.

Workers in the building trades are exposed to a wide range of hazardous substances and physical hazards. In many countries, the resulting health problems are not recognised as being work related, and are not reported, recorded or compensated. This social invisibility, this censorship of the true damage to workers health, means that there is no national policy to prevent occupational ill health in the sector. It is a vicious circle. Yet, as with accidents, the causes of ill health are well know and can be prevented or controlled. Improvements can be made by substitution of hazardous materials for safer ones; by the introduction of safe working methods; by the use of good PPE; through information, training and workers participation.

Access to Occupational Health Services and health surveillance is extremely scarce in developing countries. In the informal economy, building workers are excluded from social security and health schemes. Trade Unions are working to promote recognition and compensation of occupational ill health. Below, some of the most common health hazards are discussed.

Deafness. Exposure to hazardous noise levels is so widespread as to be routine, and occupational deafness is very common among building workers. Noise reduction methods can be used, for example on compressors, but Personal Protective Equipment and training are essential to prevent hearing loss.

Vibration syndromes. Hand arm vibration can cause damage to blood vessels and nerves that leads to lack of sensitivity in the fingers called Raynaud's Syndrome. This condition is particularly due to the use of pneumatic tools. Whole body vibration caused by operating heavy machinery and vehicles can cause damage to the spine.

Back injuries. Caused by manual handling of heavy loads, sometimes over long distances. For example bricks, cement blocks and cement bags weighing 50 kilos. Confined spaces, awkward postures, heavy task and productivity demands, and long hours lead to lower back injuries, sciatica, hernias and slipped discs which can put people out of the labour market for good. Other musculo-skeletal disorders, injuries to muscles, nerves, tendons and joints

caused by physically demanding work. Risk factors include: uncomfortable postures, forceful and repetitive movements, awkward tools and sustained effort.

In many developing countries work is really labour intensive, there is little mechanisation and tools are rudimentary, recycled and improvised. Typical injuries include: Bursitis, from kneeling, for example floor laying. Tenosinovitis is the inflammation of the tendon sheaths due to overuse and repetitive and forceful movements. (eg plasterers, painters, carpenters) Tendonitis, inflammation of the tendons, especially in the shoulder, is common. Working with the arms reaching above shoulder level is a typical cause of this problem. (eg plasterers, carpenters, painters). Neck problems are also widespread in these occupations. Epicondilitis, more commonly known as tennis elbow, caused by the impact absorbed when making repeated blows. Arguably, carpenters elbow, or stonemasons elbow might be a more appropriate name for this condition.

Hazardous substances also have a serious impact on building workers health. These may come in the form of liquids, gases, vapours, fumes or dusts. They are contained in a variety of commonly used products and materials in construction. The main exposure route is through inhaling them, but substances such as solvents can also be absorbed through the skin. There may even be some additional exposure from ingestion due to poor hygiene and welfare facilities on site. Very often, workers are not aware of what chemicals are contained in the products they use, and are not told about the health hazards and how to avoid them. Renal, hepatic, cardio-vascular problems and central nervous system disorders can result from exposure to hazardous chemicals, such as pesticides and solvents. Respiratory illness, bronchitis, asthma, fibrosis and cancer may also be caused by exposure to certain materials on site.

Commonly used hazardous substances are: Vapours and fumes Solvents of many different kinds are used in paints, varnishes, lacquers or adhesives, sometimes several are used in a single product. They can cause central nervous system damage and can harm the skin, liver, kidneys and cardio vascular system and some increase the likelihood of cancer. Painters, for example, have a higher risk of lung cancer. In recent years in the Scandinavian countries 'painters syndrome' has been recognised as an occupational disease. This refers to brain damage caused by solvents affecting the central nervous system. Solvents can also cause reproductive problems. They can reduce fertility, they can cause congenital birth defects, and they can readily cross the placenta and affect the health of the foetus causing malformations or miscarriage. Isocyanates such as TDI and MDI. Used in two pack polyurethane paints and varnishes, bonding agents and resins, paints. These can cause athsma, dermatitis and, in the long term, are associated with cancer and reproductive hazards. Pesticides, such as insecticides or fungicides. Pesticides are poisons. They are used in timber treatments to protect them from insect infestation or from the elements. Commonly used and dangerous ones are: Lindane, TBTO (tri- butyl tin oxide), PCP (penta-chloro phenol), or CCA compounds (copper, chrome, arsenic). Chemical treatments for damp courses and fire retardants can also be hazardous. Pesticides can also present serious reproductive hazards. Welding fumes, welding can generate a cocktail of metal fumes of all kinds, depending on

what is being welded - painted metals, brass, copper, steel, coated rods, alloys, and so on. Fumes (such as chromium oxide, zinc oxide, or lead to give a few examples) can cause serious health problems in the long term. The respiratory system is affected and, as chemicals are absorbed, they can slowly affect the brain and internal organs.

All dust is bad for your health. There are higher death rates from respiratory disease, lung and stomach cancers in dusty trades. Dust affects all sites and all trades, but is especially problematic in plastering, demolition, excavations, tunnelling and in certain tasks, such as cutting concrete blocks. Low cost solutions are to get materials pre-cut off site where exhaust ventilation can be used, and to dampen work and isolate dusty work. Good hygiene facilities for washing and changing and proper protective clothing are needed for hazardous jobs, and this is seldom the case in developing countries. Ideally, exhaust ventilated tools, and tools fitted with a water supply for dust suppression should be used. Respiratory Protective Equipment needs to be selected carefully as different types give widely varying standards of protection. Unfortunately, what is normally given out as PPE is a "dust mask" made of paper or cloth, rather than filtering respirator masks. Cement dust can cause serious respiratory problems over time, such as pneumoconiosis (lung scarring). Cutting concrete blocks can generate huge clouds of silica -containing dust. Plasterers have a high rate of lung cancers because of the dust they inhale. Cement contains lots of chemicals, some of which cause skin problems: lime (calcium oxide), which can cause burns from wet concrete and mortars. These burns can be severe enough to need skin grafts. Chromates, which cause dermatitis from contact with cement in both wet and dry states. This is a very widespread problem. Irritant, or contact, dermatitis is direct damage caused by contact with the skin. Allergic dermatitis is caused by sensitivity to the chromate impurities in cement and can be severe. Once a person is sensitised it is almost impossible to get rid of the allergic reaction. Silica Breathing in silica can cause silicosis. This means irreversible scarring of the lungs, causing shortness of breath and premature death. Jobs such as stone masonry; sand blasting for cleaning and façade renovation; concrete cutting or drilling; tunnelling and many demolition jobs. Using power tools to cut stone will lead to high exposures. Wood dust causes respiratory system problems, irritation and allergies, asthma, rhinitis. Some types of wood dust and oils can cause nasal cancer, particularly certain hard woods. Sawdust needs to be controlled. Medium Density Fibre boards, chip board and plywood, contain glues and urea

formaldehyde, and dust from working these materials can cause irritation.

Asbestos should be banned. Safe substitutes exist for all its applications and there is no justification whatsoever for its continued use. Asbestos causes fatal diseases - asbestosis, mesothelioma and cancer of the lung and digestive system. The use of asbestos in building and insulation materials has been widespread for many years. Millions of buildings all over the world contain asbestos, and workers carrying out maintenance, repairs, renovation or demolition work are often exposed without even being aware of it.

Manufactured Mineral Fibres. Certain types of MMFs which are used as substitutes for asbestos mimic its properties so closely that they can also cause fibrosis and lung cancer.

Welfare and biological hazards. Living and working conditions of building workers are poor in developing countries. Many workers live in slums and barely make enough money to feed themselves and their families, so nutrition is poor. Often there is no access to clean drinking water. On many sites, the accommodation offered in the bunk houses is dirty, overcrowded and infested with rats. Tuberculosis, cholera and parasistic diseases from contaminated water can occur. Dengue and malaria, caused by mosquito bites can also be a health hazard. Where pools of water are allowed to accumulate, they make perfect breeding grounds for mosquitoes. Communities around construction sites may also be affected.

HIV AIDS. Migration, including rural -urban migration, to seek work in large construction projects means being away from home and family for long periods. This places construction workers at risk.

Work organisation and Stress. Caused by the hazardous and constantly changing working environment. Noise, dirt, dust, chemicals, work at heights, confined spaces, heavy work, and lack of information and training all contribute. Particularly acute is the fear of accidents, most notably fear of falling. Bullying and pressure is commonplace, and generally the worker, particularly labourers, will have little or no control over how the work is to be done.

8 RELEVANT ELEMENTS OF THE KNOWLEDGE BASE

Title	C167 Safety and Health in Construction Convention, 1988	
Author(s)	The General Conference of the International Labour Organisation	
Type of source	ILO Convention concerning Safety and Health in Construction	
Publication or other	Convention: C167	
source details	Place: Geneva	
	Session of the Conference: 75	
Date & ISBN/ISSN	Date of adoption: 20:06:1988	
	Date of coming into force: 11:01:1991	
Summary of	I. Scope and definitions	
contents	II. General provisions	
	III. Preventive and protective measures	
	IV. Implementation	
	V. Final provisions	
	There are also some useful cross-references at the end.	
Comments on	The core document for Construction OS&H, containing fundamental general	
relevance	provisions and much detailed guidance.	
Other information	This Convention has very similar detailed content to the ILO's Code of Practice,	
	1992, which is also summarised in this Knowledge Base.	

Title	BWI web site
Type of source	Web site
Publication or other source details	http://www.bwint.org and refer to the 'Building and Construction' button on the left
Date & ISBN/ISSN	Accessed December 2008
Summary of contents	The first page in the Building and Construction section has a very good summary of the characteristics and employment issues of these industries, and sets out BWI's views:
	"For the BWI, the most effective way to ensure that worker's interests are
	protected in the work place is through legislation and regulation. In this
	connection, we work with the International Labour Organization (ILO) to lobby
	for the implementation of ILO standards and their respect in World Bank
	agreements.
	We promote the social dimension of sustainable development in economic
	growth, environmental conservation and society since it will not make
	construction more expensive. For example, a good working environment reduces
	the risks of heavy physically demanding work, leads to fewer accidents at work,
	fewer sick days and thus shorter times and lower costs for the total
	construction."
	There are many interesting and relevant articles, especially concerned with women workers with some excellent photos of women at work.
Comments on relevance	There is much in this site of general relevance, and the photos can be downloaded and used in training materials.
Other information	See other BWI source summaries

Title	ILO Code of Practice: Safety & health in construction
Type of source	Code of practice, 174 pages
Publication or other	ILO Publications
source details	http://www.ilo.org/global/Publications
Date & ISBN/ISSN	1992. 92-2-107104-9
Summary of	"It goes a long way in mapping out the agenda for health and safety
contents	professionals in this most dangerous and populous industry."
	Content:
	1. General provisions
	2. General duties
	3. Safety of workplaces
	4. Scaffolds and ladders
	5. Lifting appliances and gear
	6. Transport, earth-moving and materials-handling equipment
	7. Plant, machinery, equipment and hand tools
	8. Work at heights including roof work
	9. Excavations, shafts, earthworks, underground works and tunnels 10. Cofferdams and caissons and work in compressed air
	11. Structural frames, formwork and concrete work
	12. Pile-driving
	13. Work over water
	14. Demolition
	15. Electricity
	16. Explosives
	17. Health hazards, first aid and occupational health services
	18. Personal protective equipment and protective clothing
	19. Welfare
Comments on	This Code of Practice is fundamental to this training package. It has influenced
relevance	the structure and informed the content.
Other information	Downloaded as "ILO Code of Practice"

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Title	Hong Kong – bastion of bamboo scaffolding
Type of source	Journal article
Publication or other	Journal name: Civil Engineering
source details	Author(s): Ramanathan
	DOI: 10.1680/cien.2008.161.4.177
	Volume: 161 Issue 4
	Pages: 177 - 183
Date & ISBN/ISSN	01/11/2008. 0965-089X
Summary of	Hong Kong's skyline is dominated by some of the world's tallest buildings.
contents	Nevertheless, the city still uses bamboo scaffolding for much of its construction
	work – a traditional skill passed down over 5000 years. Bamboo is sustainable,
	lightweight and cheap and, as long as it remains fairly dry, a good construction
	material with significant mechanical properties. Researchers, engineers,
	environmentalists and bureaucrats have taken an increasing interest in the craft,
	such that regulations and practice continue to be improved and refined.
	However, to alleviate remaining design and safety concerns a structural design
	code is needed.
Comments on	Generally relevant to the Themes 'General plant and equipment' and 'Working
relevance	at height'.

Title	ILO Safety, health and welfare on construction sites
	A training manual
Author(s)	ILO
Type of source	Training manual, 134 pages
Publication or other	ILO Geneva, International Labour Office
source details	Can be downloaded from:
	http://www.ilo.org/public/english/protection/safework/training/english/download
	/architecture.pdf
Date & ISBN/ISSN	1995. ISBN 92-2-109182-1
Summary of	Preface
contents	1. Introduction
	2. Safety organization and management
	3. Site planning and layout
	4. Excavations
	5. Scaffolding
	6. Ladders
	7. Hazardous processes
	8. Vehicles
	9. Movement of materials
	10. Working positions, tools and equipment
	11. The working environment
	12. Personal protective equipment (PPE)
	13. Welfare facilities
	Annexes
	1. Safety, health and welfare on construction sites: Check-list
	2. The Safety and Health in Construction Convention, 1988 (No. 167), and
Comments	Recommendation, 1988 (No175)
Comments on relevance	This is a comprehensive manual, which follows the contents of ILO C167 very
reievance	closely. Extracts have been used in Construct OS&H, especially in the technical sections.
Other information	22222
Other information	It has been Downloaded as ILO Safety, health and welfare on construction sites:
	A training manual

T:41 -	Managina international content of the second
Title	Managing international construction projects: an overview
Author(s)	R Neale (Ed)
Type of source	Book, 239 pages
Publication or other	International Labour Office, Geneva.
source details	International construction management series No 7
Date & ISBN/ISSN	1995. 92-2-108751-4 & 4020-0142
Summary of	An edited book with contributions from Richard Neale, Williams Sher, Alistair
contents	Gibb and Simon Barber
	Chapters 1: Construction project management 2: Project management organisation 3: System support for projects 4: Control of quality and quality assurance 5: Site layout and facilities 6: Key considerations for site layout and facility planning 7: Construction site safety 8: Planning case studies 9: Cost analysis case study
Comments on relevance	A useful but very general book, apart from the case studies which are quite detailed. This is the last book (No7) in the series so some detailed case studies were seen to be useful. The planning case study has been adapted to provide an integrative project on OS&H for Construction OS&H
Other information	See Tutor's Guide for more on the content of this book.