

Musculoskeletal disorders in construction

Construction is a high-risk sector, but it is not just a worker's safety at risk, but also his health. While there are well over a thousand workers killed each year in accidents in the construction sector, there are also many more who suffer ill health.

Musculoskeletal disorders are some of the most common forms of ill health in construction. Musculoskeletal disorders are particularly prevalent across a range of Construction industry trades with estimates suggesting that as many as 30% of the workforce may be affected. Recent research has indicated that musculoskeletal disorders are particularly prevalent in certain construction trades or occupational groups such as bricklayers, plasterers and joiners.

Introduction

What are Work-related musculoskeletal disorders?

Work-related musculoskeletal disorders (WMSDs) as defined by the International Commission on Occupational Health, are disorders and diseases of the musculoskeletal system that have a causal determinant that is work-related.

The term 'work related' has been used by the World Health Organisation to specify a multi-factorial aetiology (scientific cause of a disease), where the performance of the work, and the work environment are two significant factors from a number that may contribute to the onset of the disease. There are a wide variety of WMSDs, from back injuries caused by the manual handling of heavy loads to wrist injuries caused by repetitive work.

What is the cost of WMSDs?

The cost to the worker of WMSDs is pain, along with loss of income through being unable to work. This results in significant cost to organisations through sickness absence or ill-health retirement, and to the State, that may have to support a person unable to work.

Legal duties

All employers have legal duties to fulfil in their Member State, based upon European Directives, to prevent harm to workers. Perhaps the most important directives are:



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- 89/391/EEC - the "framework" directive - that sets out the basic requirements for workplaces.
- 90/269/EEC- the "manual handling" directive
- 92/57/EEC on the minimum health and safety requirements for temporary and mobile construction sites.

Preventing WMSDs at the pre-build phase

Architects and quantity surveyors should be made aware of the potential improvements that can be introduced if manual handling methods are reviewed during the design phases of projects. Contractors, clients, and suppliers can encourage good practice standards to be fully implemented. Employers have legal duties to protect workers from WMSDs, based on European Directives.

Where the risk of musculoskeletal disorders cannot be designed out at the pre-build phase, then employers should carry out a risk assessment to identify the hazards, assess the risks, and take action to prevent ill health or injury.

Avoidance of manual handling

The first consideration that needs to be made is can the manual handling activity be eliminated. There are many tasks in construction that can be avoided by mechanisation. Cranes, hoists, vacuum lifting devices, conveyor systems and other methods of mechanisations are always preferable to the task being carried out manually. Not only are there benefits for safety and health at work, but often productivity bonuses. Vacuum lifting devices are more efficient at carrying out slab and kerb laying than the manual task. The use of a crane on site enables it to be always available for use, such as taking delivery of materials. However, the siting of the cranes is important to enable them to carry out this task efficiently, as is the suitability of the load for lifting by crane.

Risk assessment

It is most important that a suitable and sufficient assessment of the hazards and risks in the workplace is carried out to provide the basis for the introduction of improvements. Employers are required to evaluate risks to safety and health within their workplaces and then to improve the standards of safety and health for workers and others who may be harmed. This process is called a risk assessment.

A risk assessment involves identifying the hazards present and then evaluating the extent of the risks involved. The challenge is to eliminate, or



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at least reduce, the potential for accidents, injury or ill health that arise from working activities and tasks. A good risk assessment, therefore, will form the basis for workplace changes to avoid accidents and ill health that can ruin lives, and for introducing measures that will help reduce the costs to businesses from lost output, compensation claims and higher insurance premiums.

The person carrying out the assessment should have appropriate training and experience. The complexity of the risk assessment will depend upon the size and type of site. Employers have a duty to cooperate to ensure that all workers are protected at work.

There are several models for carrying out a risk assessment. Here is one step-by-step approach.

1. Look for the hazards

Think about the work that is done and identify what may cause or increase the risk of work related musculoskeletal disorders. For example:

- The handling of heavy materials;
- Having to work on untidy, slippery, badly lit sites;
- Having to carry out a lot of work reaching above the shoulder height

Talk to the workers and their representatives. Involve them in the risk assessment process and tell them what you are doing to reduce risk.

2. Decide who may be harmed and how.

Think about everyone who may be hurt by each hazard. This means not just employees, but also contractors, self-employed persons, and members of the public. Specific attention should be paid to young workers and pregnant women. Consider how the dangers identified are going to cause harm.

3. Evaluate the risks and decide on action

Evaluate the risk for each hazard, which means calculating the likelihood that any harm occurs and how severe it will probably be. If someone could be hurt:

- Can the hazard be removed completely?
- Can the risk be controlled?
- Can protective measures be taken to protect the whole workforce?
- Is personal protective equipment needed to protect the worker from a risk that cannot be adequately controlled by collective preventive measures?



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For example:

- Can building materials be supplied in smaller bags?
- Can mechanical handling aids be used to remove or reduce the need to handle materials?
- Can the site be better maintained and kept clean and well lit to reduce the risk of minor accidents that lead to further ill health and injury?
- Is particular hand protection required in some tasks?

4. Take action

After completing the risk assessment, list the preventive measures needed in order of priority, then take action, involving the workers and their representatives in the process. Actions should be focused on preventive measures (to stop the accident or ill health occurring in the first place), but consideration should also be given to measures to minimise harm in the event of an accident, ill health, or emergency

As part of preventive actions, it is important to ensure that all workers receive appropriate information, education, and training. Provide good documentation of hazards and risks discovered, of groups harmed most often and the kind of injury, of measures to improve OSH and avoid the specific hazards and risks and their effectiveness.

When considering preventive actions, look at the:

- Workplace – Can conditions be improved to reduce the risk of injury, such as by improving the lighting, or reducing the likelihood of slip injuries during manual handling. Can traffic routes be designed so that materials can be safely transported to where they are needed to avoid the manual carrying of loads to the actual workplace?
- Work equipment – Are tools in use ergonomically designed? Can powered tools be used to reduce the force required for a task?
- Worker - the workers have to be trained to increase their awareness of ergonomic factors and to recognise and avoid unsafe working conditions. Furthermore, workers have to be convinced why it is important to pay attention to prevention and what happens if this is neglected.
- Work task - One of the most important is to reduce the physical demands of the job, which means decreasing the levels of force, repetition, awkward postures and/or vibration. This often necessitates the use of manual material handling devices.
- Work management (e.g. by better planning of the work or implementing safe systems of work) - At the organisational level, practical solutions are to develop appropriate work rest ratios to reduce the build up of fatigue, organise breaks and provide job rotation. At the corporate level, a safety culture should be promoted



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which involves a high stakeholder commitment to identify and control occupational risk factors and improve safety and surveillance measures.

5. Review the findings

Ways of working, along with equipment and chemicals change. When a significant change takes place, check to make sure that there are no new hazards that need controlling.

The causes of **all** forms of injury should be investigated. Although fatalities resulting from falls, collapsed excavations or vehicle collisions are major priorities for prevention, other types of accident are also a major cause of loss to individuals, employers and to society. These occurrences provide valuable information to help further reduce the risks to workers.

Hazards and risk factors for MSDs arising from construction

Accidents

A serious accident can cause death or permanent invalidity in construction work. In past years serious accidents have often resulted in deaths or permanent invalidity. Today, many injuries can be treated medically so that no permanent invalidity will be suffered after the return to normal health.

A less severe accident, such as a sprain or strain, can greatly increase the risk of future work related musculoskeletal disorders.

Without very intensive rehabilitation however, the injured body remains weaker than it was before the accident. Therefore, all injuries of the body make the person more liable for future MSD injuries. The best predictor of pain in the future years in the low -back, neck, shoulders, upper arm or wrist is previous pain in these body parts. Thus, prevention of accidents at the first occurrence of pain helps prevent further disorders.

Slips and trips are a major cause of injuries. Even a "near miss" situation may cause the muscles to automatically contract in order to correct the posture. Sometimes these corrective movements can be so forceful that the result is microscopic ruptures in the tissues. Slippery or unstable surfaces and walkways, stairs, and anything that hinders walking can cause loss of balance. Tidy and safe walkways and general site organisation helps to prevent slips and falls.



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There are often simple but effective measures that can be taken to reduce or eliminate slip and trip risks.

A tidy site is an indicator of a safe site, and a well managed site.

Preventive actions to consider include:

- Good housekeeping –Poor housekeeping and general untidiness are a major cause of slips and trips. Keep the working environment clean and tidy, with floors and access routes kept clear of obstacles. Remove rubbish regularly so it does not build up.
- Lighting – Ensure good lighting levels, functioning and position of lights to ensure all floor areas are evenly lit and all potential hazards, e.g. obstructions and spills can be clearly seen. Lighting levels need to allow safe passage through the premises.
- Stairways - Many accidents occur on stairways. Handrails, slip resistant covers to steps, high visibility and non-slip marking of the front edges of steps, and sufficient lighting can all help in preventing slips and trips on stairs. Other changes of level such as ramps are often difficult to see. They need to be well marked, with appropriate use of safety signs.
- Spillages - Clean up spills immediately using an appropriate cleaning method (chemical treatment may be required). Use warning signs where the floor is wet and arrange alternative routes. What caused the spill to occur -can work methods or workplace be changed to minimise spillages?
- Obstructions - Where possible, obstructions should be removed to prevent trips occurring. If it is not possible to remove an obstruction then suitable barriers and/or warning notices should be used. Trailing cables - Place equipment so cables do not cross pedestrian routes. Alternatively consider using battery powered tools to avoid cables (and reduce risk of electric shock).

Manual material handling

Handling of heavy loads manually can cause injuries if the load suddenly hits the worker or causes slipping or falling. Handling of smaller loads for a long time without rest can result in fatigue. For a tired person loads can become too heavy after hours of handling, resulting in faulty movements, and the risk of injuries and disorders will increase.

European Union Directive 90/269/EEC, transposed into law in all Member States gives the minimum health and safety requirements for the manual handling of loads. The directive requires employers to use the appropriate means to:

- Avoid the need for manual handling of loads by workers;



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- Take the appropriate organisational measures to reduce the risk if manual handling cannot be avoided;
- Ensure that workers receive adequate information on the weight of a load, the centre of gravity or the heaviest side when a package is unevenly loaded; and
- Ensure proper training and precise information on how to handle loads correctly.

The risk of back injury depends on range of factors, including: the

- Characteristics of the load;
- Working environment, and
- The demands of the activity.

Characteristics of the load

The risk of back injury increases during lifting, carrying, pushing and pulling of loads, if the load is:

- Too heavy - There is no exact weight limit that is safe. A weight of 25 to 30 kg is heavy to lift for most people, especially if the load is handled several times in an hour. Note that pushing or pulling often imposes less loading on the body than lifting or carrying.
- Too bulky - One basic rule for lifting and carrying is to keep the load as close to the middle of trunk as possible. In order to get a broad load close to the body the worker has to open the arms to reach and hold the load. The arm muscles cannot produce force with when reaching as effectively as with the arms held in close. Thus, the muscles will get tired more rapidly while handling when reaching to hold a large bulky load.
- Difficult to grasp - Loads that are difficult grasp can result in the object slipping and can cause sudden movement of the load. Gloves usually make the grasping more difficult than with bare hands. Providing the objects with handles or using aids for gripping (e.g. when carrying plate material) reduces the load on the worker.
- Unbalanced, unstable or if the contents can move - With unbalanced objects, it is difficult to hold the centre of gravity of the load close to the middle of body. This leads to uneven loading of muscles and fatigue. An unstable or moving content, like liquid, causes uneven loading of the muscles and sudden movements of the load can make the worker lose their balance and fall.
- Is located so that they can be handled only with outstretched arms, or by bending or twisting the trunk - More muscle force is needed while lifting with outstretched arms. The spine will be easily hurt if the trunk is bent or twisted while lifting.
- If it has sharp edges or the shape or the material can injure the workers, especially in the event of a collision.



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Work environment

The following characteristics of the work environment may increase a risk of back injury if:

- There is not enough room, in particular vertically, to carry out the activity;
- The floor is uneven, thus presenting tripping hazards, or is slippery in relation to the worker's footwear;
- The place of work or the working environment prevents the handling of loads at a safe height or with good posture by the worker;
- There are variations in the level of the floor or the working surface, requiring the load to be manipulated on different levels;
- The floor or foot rest is unstable; or
- The temperature, humidity or ventilation is unsuitable

Task requirements

The risk of back injury increases if:

- The activity is carried out for too long or too frequently with insufficient bodily rest or recovery period;
- There is continuous lifting, lowering or carrying for long distances;
- The rate of work is imposed by a process which cannot be altered by the worker
- The physical effort is too strenuous;
- The lifting can be carried out only by a twisting movement of the trunk;
- The activity is likely to result in a sudden movement of the load; or
- Loads are handled with the body in an unstable posture

Constrained postures

With stretched arms or bent postures, the muscles have to do extra work in order to maintain the posture. In a constrained posture the muscles can produce less force than in a more extended, comfortable one. This means that muscles will get tired faster in awkward postures, even when the work activity does not demand high muscle forces. Also, the mechanical load on the spine and joints is higher in these postures than in comfortable ones.

Kneeling and squatting results in high loads to the knees - In a kneeling posture the front part of the knee can be irritated due to contact with the hard floor, pavement, or ground. If working when kneeling cannot be avoided by technical changes, the workers should be provided with kneepads for protection.



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Working above head level

Working with the arms extended above head level is common in several tasks such as assembling electricity or ventilation channels in the ceiling, or painting the ceiling. While working with arms stretched upwards the small shoulder muscles have to do extra work in order to hold the weight of the arms. The load is extremely high if the worker also holds a tool or load in the hand far away from the shoulder. To see the work being done, the worker also has to bend the neck backwards, which stresses the neck. These situations give extra risk for shoulder and neck disorders.

Repetitive work

Repetitive tasks require the same movements to be repeated several times in a minute. Construction work includes manual tasks like:

- Hammering
- Drilling
- Driving screws
- Sawing
- Painting with brushes
- Cutting sheet metal with scissors
- Loading and unloading small pieces – like tiles or bricks – to be transported from intermediate storage locations to the final assembly site.

It is not only the repetitive movements that can cause harm but especially when required in combination with large muscle forces used for gripping. Grasping the heavy objects between the thumb and the fingers needs more force if a pinch grip is used (for thin objects) or too broad (for large objects). The risk is increased if the wrist cannot be held straight during these tasks.

Providing ergonomically designed hand tools can reduce this risk. Electric or pneumatic tools can also reduce repetitive forceful movements. These tools can, however, bring new problems, such as vibration, or more gripping force can be needed to hold the powered tool if it is too heavy or incorrectly designed.

Static work

Static muscle work means the continuous contraction of some muscles to maintain the posture or to hold the force level constant. If static contraction is held for an extended period, the circulation in the muscles will be disturbed and this can result in disorders.

With high muscle load, fatigue will force the worker to take a rest. With lower loads the level of fatigue is not so evident and the worker can spend too long a time the same posture.



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Operators in the cabins of modern machines (lorries, caterpillar trucks, etc) can easily spend too long a period in the same posture, without any clear indications of fatigue. Therefore, it is important when undertaking these tasks to stop regularly and move the body around to avoid disorders.

Local compression of tools and surfaces

All sharp edges or hard surfaces can harm the body if the contact compression lasts for too long. Using the hand as a hammer can cause local injuries on the hand. The symptoms may not appear during the task but several hours later. This bad habit can be continued without any early warnings of danger.

Cold

Construction work in winter brings additional hazards. Icy walkways are slippery. More muscle force is needed to hold tools and materials, especially if the worker has to wear gloves. In cold environments, the circulation of muscles is worse, which can lead to more rapid fatigue.

How do these hazards cause injuries to the body?

Direct impacts from heavy mechanical loads can cause ruptures of soft tissues or broken bones. Smaller loads may not appear to cause immediate injury, but if they are imposed regularly over many months or years, can cause tiring of muscles and lead to microscopic injuries in the tissues.

If sufficient time to rest is allowed, the body will grow stronger (this is the goal in training or rehabilitation). If, however, there is not enough time to recover from the tiredness, or if the loading is sustained for too long, this can result in MSDs.

Thus, there are two important risks to look out for at work:

- The magnitude of the loading: the amount of physical effort applied including the weights that are handled or the forces to be resisted; and
- Time: the duration and frequency of the physical activity leading to the tiredness and need for recovery.

The overall loading on the body can be minimised by reducing any of these factors. Even if the weights to be handled cannot be reduced, it may be possible to reduce the frequency and duration of handling, so that there will be enough time for recovery. With technical assistance, it is often possible to reduce the amount of material to be handled and to shorten the distances that loads must be moved manually using only muscle force.