Ergonomic Considerations in Construction Projects

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INTRODUCTION

Ergonomics is about engineering the work processes and work environment to best suit the worker and to lessen fatigue and avoid injury. It is about ensuring the work to be executed by the worker becoming easier so that the worker can actually work smarter and not harder to achieve higher productivity. It is about asking the experienced workers to give ideas as how to improve the working conditions and the work processes. Ultimately, the objective is to avoid injury to the workers because this can be very costly both to the worker and to the employer as well as to the country as a whole from attendant result of medical bills, working while hurt and absence from work [1]. It is about making workers less tired because when a worker is tired the tendency for him to get into an accident and get injured is much higher. The end result of all these will be an increase in overall productivity. The construction industry is one of the important industries in a developing country like Malaysia, and it is also one with a rather poor record in terms of health and safety of its workers. Ergonomics in construction projects looks at the impact of various activities related to the work like bending and twisting, awkward postures and cramped positions due to space limitations [2,3], use of body exertion and exposure to whole body vibration [4-12], climbing and descending and exposure to unhealthy conditions. The hands and feet and the lower back are the most often used regions of the body and the lower back is recorded as the most prone to injury [13]. Despite the efforts by all parties concerned, the incidents of diseases, accidents, injuries and fatalities related to the work place are still alarmingly high. The Malaysian Factories and Machinery Act 1967 and the Occupational Safety and Health Act 1974 require that all cases of occupational injuries and diseases to be reported to the Department of Occupational Safety and Health. In Malaysia, the statistics on work related injuries and diseases do not seem to be improving very much and the accuracy of the reporting of these incidents is also questionable. This article gives a short overview of the ergonomic situation in the construction sector and attempts to suggest ways of improving some of the ergonomic factors found in construction projects.

MUSCULOSKELETAL INJURIES

Musculoskeletal ergonomics is about the safety and comfort of muscles, bones and joints while doing work. It is concerned, for example, with the effect of various work postures like stooping and bending, the effect of work movements, the effect of physical loads and other work conditions on the joints and muscles of the worker. A lot of workers find that their daily work is ergonomically strenuous and they feel so exhausted at the end of a working day. In the construction industry where the workers are predominantly male, the commonest individual cause of reported work-related disorders and reported work injuries are in fact related to musculoskeletal matters. Although in recent years it has been noticed that stress and other mental strains at work are becoming more and more prevalent, the commonest cause of work-related disorders has still consistently been the physical sprain and strain of the organs of locomotion like the hands and the legs due to heavy manhandling of loads, long strenuous work postures and short repetitive operations and locomotive movements. The majority of cases were due to prolonged strain on the body which can be classified as musculoskeletal illnesses. A large number is due to abnormal physical exertion and this can be classified as musculoskeletal accidents. Almost forty percent of all reported work-related illnesses and work accidents in the construction industry are due to musculoskeletal injuries.

The shoulder, for instance, is one of the commonest body parts which is highly prone to injury. It constitutes a complex system where most muscles are activated simultaneously to some extent during movements of the arm and the shoulder. General knowledge and understanding regarding the mechanical muscle function at the individual muscle level is well established. The relationships between force and velocity, for example, and between stress and strain are well understood [14-16]. On the other hand, the control mechanisms underlying the recruitment and gradation of muscle activity in complex multiple muscle systems during various voluntary exertions is still not fully understood. From a physiological point of view, load-sharing principles may be influenced by several factors like work demand, tiredness or fatigue, metabolic and similar factors. The control and function of multiple muscle systems like the shoulder muscle region, when performing sub maximal contractions need to be studied further [17]. Significant factors for the coordination of the activity in healthy non-fatigued muscles as well as in tired and injured muscles need further examination.

Increased cognitive demands together with the demand for concurrent physical exertion occur many times throughout the day in the construction work place. These phenomena represent a significant problem in the construction work place. Several methods have been utilised to study the effect of the application of different mental loads on the muscle activation. Widely variable results have been produced and available data seem to suggest that mental loading when combined with physical tasks may alter muscle activation. The duration of a

task, the repetitiveness of the task and the many different postures assumed by the worker are also very often overlooked as being a potential problem to doing a task. Further studies to analyse and examine the combined effects of mental loading and hand activity on the shoulder muscles in different postures and for different duration need to be carried out.

OCCUPATIONAL ACCIDENTS

Statistics and Trends

Based on SOCSO statistics, the number of industrial accidents in Malaysia has increased from about 51,340 in 1980 to about 95,000 in the year 2000. The number of industrial fatalities has also increased from 143 in 1980 to 1004 in the year 2000. There is an increase in absolute numbers of these incidents; but this can partly be attributed to the increased number of workers who are covered by the SOSCO scheme. It would be more meaningful if the figures are converted in terms of per 1000 workers. The figures would seem to have declined somewhat, and are seen to have roughly reached a plateau of about fifteen per 1000 workers in 2000. However, this figure is still considered high in comparison with similar figures in countries like Japan, Europe and USA which have an average of about 5 reported accidents per 1000 workers; and Korea has 9 reported accidents per 1000 workers in the year 2000 [18]. The small and medium sized enterprises have poor OSH resources and tend to have a higher accident rate. In absolute numbers, construction comes after manufacturing as the sector with most fatalities; but because of the different total numbers of workers engaged in each sector a better picture is given by the case fatality rates. The largest case fatality rates for the year 2000 came from construction with 3.26% followed by transportation with 2.05% and mining and quarrying with 1.75%. The higher fatality rates among construction workers have been generally attributed to the fact that construction work involves so many different activities with different associated hazards and all kinds of weather conditions encountered during the various phases of the project [19].

The priorities given to the ergonomic factors in Malaysia are different from those given in Western countries. The emphasis in Malaysia is on poisoning and work-place accidents [20]. Another characteristic feature about the situation in Malaysia is that the statistics on occupational diseases and accidents is under reported. This could be the result of an inability to diagnose occupational diseases or differentiating between occupational and non-occupational diseases; and it could also be the result of trying to safeguard the contractual agreement that the company might have which could be compromised by reporting these diseases and accidents to DOSH. It could also be the result of a desire to look good on paper in terms of figures for number of man-hours without loss-time. Under reporting is more prevalent in the small and medium sized enterprises where the workplace is more hazardous and awareness on OSH matters is low [21].

ERGONOMIC CHANGES

The common work hazards found during construction are movements of vehicles like trucks, tractors, cars, fork-lifts and back hoes; lifting equipment like cranes; working on scaffolds and ladders; using power tools and hand tools; getting shocks and burns from electrical equipment; and falls from high places like roofs and other structures. The main objective of an ergonomic change is to make a job more productive through ensuring that the worker is less fatigued and there is less possibility of injury. Generally, an ergonomic change is simple and need not be expensive. Some of these are described below:

Planning

In construction, the work can be classified into several different categories which include the handling of numerous heavy materials and the operation of heavy equipment and machinery [22-25]. Planning the job would mean to bring the number of manual handling to a minimum. If the use of a crane is required then make sure that crane time is available at the required time. Make sure that the fork lift is used to the maximum possible; and that materials are delivered and stored as close as possible to the location where they will be eventually used. Double-handling should be avoided as far as possible.

Alternative Materials

The designer can also play an important part in ensuring that the materials used are more friendlier. Rough materials surface texture can easily bruise the skin and this could be improved by making it smoother; or lighter materials such as lighter weight blocks could be used instead of heavy ones. Components could also be pre-fabricated and pre-assembled to reduce the number of moving tasks [13].

Assistance and Cooperation

A worker can get the assistance and cooperation of another when he is required to handle heavy loads. Companies could make this into a common practice by setting maximum weight limits to be handled by a single worker above which a helper is needed. Companies could also organise and practise stretching exercises before work begins each day. A short OSH awareness talk could also accompany this programme.

Tools and Equipment

All kinds of materials both light and heavy need to be moved from place to place. Materials need to be loaded and unloaded and positioned at different heights. Instead of using brute strength as much as possible carts, dollies and hoists should be used to move and position these materials. Ergonomically tools could also be better designed. They could weigh lighter, require much less brute force to operate, or they could be more comfortable to handle and fit the hand much better. The common personal protective equipment like safety helmets, safety goggles, ear muffs or ear plugs, protective overcoats, gloves, harnesses, and safety boots are mandatory in the relevant situations. Special protective equipment like knee pads and shoulder pads are recommended in order to reduce the contact stresses of kneeling work or carrying materials. Handles should also be used when carrying loads.

Training and Awareness

One of the most important factors in the management of safety and health is the general attitude of the workers and supervisors towards their own well-being. The right attitude can only result from continuous awareness training. Workers as well as supervisors need to be able to see and identify and also respond positively to any ergonomic risk factors and grasp the opportunity to solve the problems and make the work place better all the time. The continuous improvement culture needs to be built and developed into a common practice. At regular times short talks on ergonomic issues could be organised. Ideas could be invited from members on suggestions to improve the work conditions and processes; the ideas could then be actually tested for effectiveness. A review may follow and based on the review findings a decision could be made as to whether to implement the idea or to give it a miss.

CONCLUSION

Accident indicators show that there is still room for improvement in order to reach the normal standard in developed countries. Number of inspection visits could be increased especially to the small and medium scale enterprises, and workers awareness could be enhanced through active participation in OSH related activities and competitions. ■

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