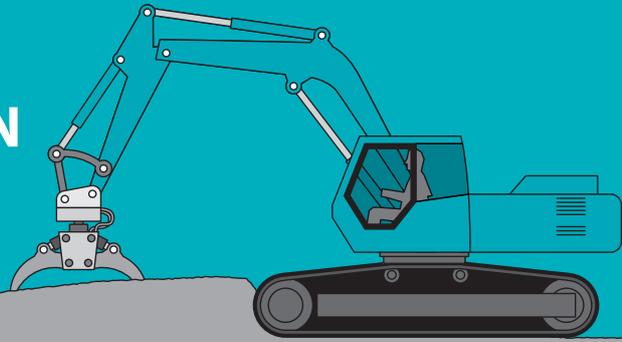




WHOLE-BODY VIBRATION



Overview

Operators, drivers and passengers of machines and vehicles in workplaces can be exposed to harmful levels of whole body vibration. Reducing exposure reduces the risk of musculoskeletal disorders.

What is whole-body vibration?

Whole-body vibration (WBV) is vibration transmitted to the whole body by the surface supporting it (i.e. via a seat or floor). It is commonly experienced by drivers, operators and passengers in vehicles and machines when travelling over uneven surfaces.

The transmission of vibration to the body is dependent on body posture. The effects of vibration are complex. Exposure to WBV causes motions and forces within the human body that may:

- cause discomfort
- adversely affect performance
- cause health effect or aggravate pre-existing conditions
- present a health and safety risk.



Health effects

The longer a worker is exposed to WBV, the greater the risk of health effects and musculoskeletal disorders. The most commonly reported disorder from exposure to WBV is low-back pain.

Epidemiological studies of long-term exposure to WBV have shown evidence for risk to the lumbar spine and the neck and shoulder. Results of epidemiological studies also show a higher prevalence rate of low-back pain, herniated disc and early degeneration of the spine in excessive WBV- exposed workers.

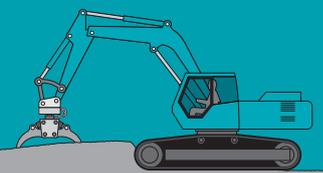
Exposure to WBV may also cause or exacerbate other health or safety effects such as:

- cardiovascular, respiratory, endocrine and metabolic changes
- digestive problems
- reproductive organ damage
- impairment of vision, balance or both
- interference with activities and discomfort that could lead to accidents.

Sources

The main sources of harmful WBV in vehicles and machines are:

- rough road and surface conditions and resistance forces, e.g. mobile plant with scraper blades
- vehicle activity
- engine vibration.



Factors that can increase or decrease WBV exposure include:

- road construction/ maintenance
- vehicle type/design
- age/condition of vehicle
- maintenance of vehicle suspension systems
- seat design, suspension and maintenance
- cab layout, design and orientation
- task design and work organisation
- vehicle speed, driver skills and awareness
- lighting and visibility

Factors that can increase health effects

Working posture, anthropometric characteristics, muscle tone, physical workload, and individual susceptibility (age, pre-existing disorders and muscle force) can also increase health effects of WBV.

Driving mobile plant/machinery also put strains on the back, shoulder or neck. Key factors include:

- prolonged sitting in constrained or poor postures
- frequent twisting of the spine
- adopting twisted head postures
- frequent lifting and material handling (e.g. delivery drivers)
- traumatic injuries
- unexpected movements
- unfavourable climatic conditions
- stress.

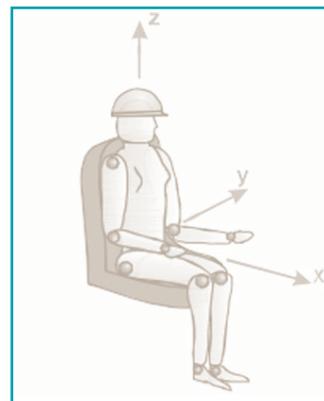
Do you need to measure vibration?

Not always. Measurement is difficult and expensive. When workers perceive that roughness of the ride reaching levels they consider unpleasant, it is likely that their exposure to whole body vibration is reaching levels that could pose a risk to health. This may be used as an indicator that there is a problem and hazard controls may be put in place.

Expert measurement and assessment of WBV exposures may be used to help identify:

- workers exposed to potentially damaging vibration levels
- vehicles or machines that produce excessive vibration
- whether controls have been effective.

WBV measurements should be collected and analysed by a competent person such as an appropriately trained occupational health and safety professional, occupational hygienist, maintenance technician or engineer, or human vibration specialist.



WBV is measured by placing a vibration sensor on the seat of a vehicle. The sensor detects vibration in three axes: x (forward to back movement), y (side to side) and z (up and down).

An attached vibration meter or data logger records the vibration signal.

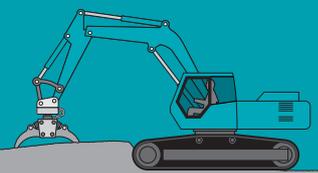
After analysis, the vibration exposure can be assessed against health, fatigue or comfort risk criteria in standards for WBV.

Reducing harmful exposure

Measures to eliminate or minimise exposure to WBV consist of minimising:

- vibration at the source
- the paths of the vibration
- vibration at the position of the worker.

The control measures introduced to reduce harmful WBV exposure should follow the hierarchy of control. Elimination, redesign and engineering controls should be implemented before administrative controls.



Workers should be consulted and involved in setting priorities and identifying solutions. Successful WBV exposure reduction usually requires a combination of control measures. Such measures, listed in order of priority, include:

- modifying the process to eliminate the task or the risk
- redesigning the task or the equipment to reduce vibration exposure
- buying machines or vehicles that are designed to reduce the vibration transmitted to the operator
- improving and maintaining road surfaces
- Implementing a seat maintenance program to ensure vibration dampened seats are maintained in good condition
- implementing speed limits
- implementing regular work breaks, posture changes or job rotation to reduce exposure time,
- providing training, information and supervision on adjusting and operating equipment, including seats to reduce exposure.
- implementing safe work procedures and standard operating procedure

Further information

McPHEE, B., FOSTER, G., and LONG, A., 2009 *Bad Vibrations: a Handbook on WBV Exposure in Mining (second edition)*- produced by Coal Services Health and Safety Trust.

The handbook can be downloaded at <http://mines.industry.qld.gov.au/assets/hiac/badvibrations2april09final.pdf>

SAFE WORK AUSTRALIA, 2011, Code of Practice for *Hazardous Manual Tasks*.

The Code provides guidance on controls to eliminate or minimise the risks from exposure to vibration during manual tasks. The code can be downloaded at www.safeworkaustralia.gov.au

The UK-based Health and Safety Executive's publications *Control Back-Pain Risks from WBV – Advice for Employers and Drive Away Bad Backs – Advice for Mobile Machine Operators and Drivers* provide guidance on managing risks from WBV for employers and employees. They can be downloaded at www.hse.gov.uk/vibration/wbv/publications.htm

Web-based tools

Web-based calculators are available that simplify the process of doing daily vibration exposure calculations, e.g.: <http://www.hse.gov.uk/vibration/wbv/calculator.htm>

Acknowledgments

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Pictures are reproduced from the *Non binding guide to good practice for implementing Directive 2002/44/EC*.