INVESTIGATION ON WHOLE BODY VIBRATION AND HAND ARM VIBRATION EXPOSURE LEVELS OF WORKERS IN CONSTRUCTION INDUSTRY


ABSTRACT

It is necessary to understand the level of Whole-Body-Vibration (WBV) and Hand-Arm-Vibration (HAV) exposure since it affects comfort and health performance of humans in construction sector. Objective of this study is to investigate the WBV and HAV exposure levels of workers in construction industry. Twenty operators were selected where the vehicles were chosen so that those are vastly used in the construction sector. In this study, three construction vehicle types and three construction tools were selected. A questionnaire survey was carried out with each operator regarding their profession, age, working experiences, health and exposure duration. The vibration exposure levels induced on operators’ bodies and hand were measured using a tri axial vibration meter (SV 106) attached to a seat pad accelerometer and hand vibration sensor, respectively. The sensors were placed accordingly and measurements were taken during the usual operation. Measured vibration exposure levels were assessed based on recommendations. It was found that 90% and 80% HAV and WBV operators, respectively, were in danger.

1. INTRODUCTION

Employees involve with the vibration related work regularly during the construction. It may cause negative health effects and reduce working performance. However operators employed in civil engineering construction industry are not aware about the health effects associated with long term exposure to whole body vibration and hand arm vibration. Vibration related injuries are often neglected in developing countries like Sri Lanka.

Whole-Body vibration (WBV) and Hand Arm Vibration are associated with workers discomfort, health and interfere with activities. WBV occurs due to transmitted vibration by machines or vehicles through the operator’s feet, buttocks and back into his body. HAV is transmitted through the handles or surface of the work piece, via palms, and the fingers in to the hands and arms while workers engage with the on hand held or manually guided machines (Garcia, et al., 2014).

Objective of the present study is to investigate whole body vibration exposure levels and hand arm vibration exposure levels of operators in construction sector.

2. METHODOLOGY

Two study groups were selected to measure WBV exposure levels and HAV exposure levels. For the WBV, four vibrating roller operators, three excavator operators, and three backhoe operators were selected. For the HAV, four drilling machine operators, four plate compactor operators and two jack hammer operators were selected. A questionnaire survey was carried out with each operator regarding their profession, age, working experiences, health and exposure duration. While placing sensor to obtain the vibration, defined axis systems (Mansfiled, 2005) were followed (Figure 1). Then the vibration levels were measured during the usual operation.

![Figure 1: Placing the sensors.](image)

(a) For hand are vibration
(b) For whole body vibration

Obtained exposure levels were assessed based on the standards (i.e. ISO 2136-1 and ISO 5349-2).

3. RESULTS AND DISCUSSION

It seems that age and past experience are the most critical factors that could be affected on the operators’ health relative to the others. Among vibrating roller operators, one who has one year experience and age is 23 years does not feel any health issues in his career as an operator. All three backhoe operates were affected by the vibration perhaps, attributed by long term WBV exposures (i.e., experience of those operators relatively greater)

Operators, who have been exposed to WBV in several years with fairly older age have been suffered with health issues: 50% operators have back pain and 30% of operators have Normal daily tiredness.

When consider about the Jack hammer operators, one who have 10 years of experience as well as the jack hammer 13 who has a 15 years of work experience affected from the pain and weakness in hands. Among the
drilling machine operators, one has some considerable work experience of 20 years, felt pain and weakness in hands. In addition, two plate compacter operators felt any uncomfortable while working.

Figures 2 and 3 illustrate operators vibration exposure levels in A (8) (i.e. daily exposure 8hr values with respect to the root mean square value) for WBV and HAV, respectively.

Exposure limit values (ELV) and exposure action values (EAV) that were used for assessments of WBV and HAV are indicated in Figures 2 and 3, respectively. It can be seen that sixty percent of the operators who are exposed to the WBV in the study group is in danger. Ninety percent of the HAV operators are also in the health risk.

4. CONCLUSIONS

It seems that age and past experience (number of years exposing to vibration) are the most critical factors that could be affected on the operators’ health in addition to the daily vibration exposure, which could be determined from vibration measurements. Majority (60% of WBV operator group) of operators in the study groups are in “in the caution zone”. Vibrating roller operators have higher potential of facing health effect than other two category discussed in this study.

More than 90% of hand arm vibration related equipment generate higher vibration exposure levels which exceeded the limiting values recommended in ISO 5349:2001

For WBV, when compare the vibration exposure levels of three axis (i.e. fore and aft, lateral and vertical), it was identified that highest average value always taken by the vertical axis than other two directions. Therefore, to minimize the health risk on the operators, it is desired to damp the vibration that comes in the direction of vertical axis.

REFERENCES
