Effect of Hydraulic Hammers Vibrations on Healthy of Users

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ABSTRACT

Vibrations coming to the body are divided into two groups whole body vibrations and hand-arm vibrations. Whole body vibrations are transferred to whole body that are usually done through leaning points such as feet back ad bottom. For example a driver is exposed to vibrations that are transferred through the seat and if the seat has backing vibration is transferred through it to his (her) body too [1, 2, 3]. Generally in this research vibrations of a hydraulic hammer and vibrations coming to the left hand and arm were measured in three directions horizontal vertical and axial while cutting the road. Level of vibrations of hydraulic hammer were studied and so the effect of different factors on level of vibrations were studied. Results of this research show that the rate of vibration speed in vertical direction on the hammer while cutting asphalt is more than the other cases. In other words, wherever the road is softer vibration speed is slower. Rate of vibration speed while transferring from handle of hammer to the wrist is lowered by fingers wrist and palm and this is done while transferring vibration from wrist to arm. Rate of vibration speed for side direction on hydraulic hammer increases while cutting concrete. Users of hydraulic hammer should be aware of dangers of working with it and they should be encouraged to use anti vibration things such as special gloves.

KEYWORD

Hydraulic Hammers - Vibrations - Healthy - Users

INTRODUCTION

Vibrations coming to the body are divided into two groups whole body vibrations and hand-arm vibrations. Whole body vibrations are transferred to whole body that are usually done through leaning points such as feet back ad bottom. For example a driver is exposed to vibrations that are transferred through the seat and if the seat has backing vibration is transferred through it to his (her) body too [1, 2, 3]. Hand-arm vibrations are transferred to hand and arm. These kinds of vibrations are experienced by those who work by their hands and arms. Complete and slight vibration can affect health and cause problem such as backache and spinal column damage. Exposing to vibration can damage nervous central system and so can affect systems. Low frequency vibration can cause moving problems that are accompanied with signs such as paling perspiring vomiting and so on [4, 5, 6, 7]. So little move of the head (more than 1 millimeter) can affect retina and can damage the persons sight [8, 9, 10, 11]. The main aim of this research is getting tiredness threshold in different positions of the driver who works with a machine that cuts earth and finding the relation between vibration produced by the machine while cutting the road and level of vibration that comes to the operator.

MATERIALS AND METHODS

Generally in this research vibrations of a hydraulic hammer and vibrations coming to the left hand and arm were measured in three directions horizontal vertical and axial while cutting the road. Level of vibrations of hydraulic hammer were studied and so the effect of different factors on level of vibrations were studied. Paying attention to this case that this kind of hammer mostly is used for cutting asphalt and breaking cement inside the city so in this research three choices were selected asphalt hard concrete and normal wall made with brick [12, 13, 14, 15, 16].

For doing the research HH23 hydraulic hammer Hycan model was used shown in figure 1. The hammer was tested completely before doing the experiment. All of its parts were safe. You can see its specifications in table 1. Figure 2 shows measuring machine for recording vibrations with piezoelectric...
sensor and special cables for connecting it to the computer.

Table 1 Technical specifications of hydraulic hammer the machine used in this research has special software by the software and then they are saved for later use.

<table>
<thead>
<tr>
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<th>Kg</th>
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<tbody>
<tr>
<td>Weight</td>
<td>23.4-23.5</td>
<td></td>
</tr>
<tr>
<td>Flow of oil</td>
<td>20-30</td>
<td>l.p.m</td>
</tr>
<tr>
<td>Working pressure</td>
<td>120</td>
<td>bar</td>
</tr>
<tr>
<td>Maximum of pressure</td>
<td>160</td>
<td>bar</td>
</tr>
<tr>
<td>Frequency</td>
<td>2380</td>
<td>l/min</td>
</tr>
<tr>
<td>Dimension of blade</td>
<td>25*108</td>
<td>mm</td>
</tr>
</tbody>
</table>

A VMI-192 piezoelectric speedometer was used as sensor of vibrations. You can see this speedometer fig 2. For installing the sensor on the machine a special leg was made. You can see it in fig 3. Leg of the sensor was installed on the hammer and vibrations were measured. Also vibrations coming to the left hand of the user from hydraulic hammer were studied. The position of installing speedometer for connecting the sensor to the arm and wrist has been shown in figure 4, also the position of installing the sensor on the whist in three directions has been shown in figure 5. Figure 6 shows the position of installing the sensor on the arm in three directions.
RESULTS

Signals of vibration speed in the area of hydraulic hammer time were measured and saved in different positions and cases. You can see some samples of measuring data about vibration speed during 2 seconds in fig 7.

Fig 7 a sample of vibration speed signal measured in time area

As it is seen in the picture these data can be used to get factors such as RMS and …., but these signals are formed from Aewx, that A is and W is frequency. Each of these harmonic functions show vibration of special part of hydraulic hammer that is vibrating with special frequency because hydraulic hammer has different moveable parts that are vibrating simultaneously with different ex

Tents and frequencies. Speed signal of measured vibration in frequency area has been shown in fig 8. As it is seen in the diagram there is a top at 40 hertz Frequency that shown vibration of hammer shocks. When we know which point of the hammer has the most frequency we can use it for designing better handle for the hammer. The handle should be designed in such a way that can remove vibration.

Fig 8 a sample of speed signal measured in frequency area

This signal can be used for getting octave 1.3 band. This amount can be used for measuring the effect of factors such as level and vibrations. Fig 9 shows octave 13 band of speed signal. By multi plying the coefficients of the band we can calculate new speed amounts of octave 1.3 band. You can see a sample of it in fig 10.

Fig 9 a sample of speed amount in octave 1.3 band

Fig 10 a sample of weighted speed amounts of octave 1.3 band

CONCLUSION

You can see the results of vibration analyses of hydraulic hammer in the following

The rate of vibration speed in vertical direction on the hammer while cutting asphalt is more than the other cases.

In other words, wherever the road is softer vibration speed is slower.

Rate of vibration speed while transferring from handle of hammer to the wrist is lowered by fingers wrist and palm and this is done while transferring vibration from wrist to arm.

Rate of vibration speed for side direction on hydraulic hammer increases while catting concrete.

Users of hydraulic hammer should be aware of dangers of working with it and they should be encouraged to use anti vibration things such as special gloves.

REFERENCES


