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REPORT ON

VIBRATION OF PILING RIGS MODELS CM-50 AND CM-70

Work carried out for: Soilmec Ltd.
New Lodge, Polebrook,
Peterborough PE8 5LL

Work carried out at: Berkeley First Site, Winstanley Road,
Clapham, London SW11 **(CM-50)**
And
Willmott Dixon Site G532, Akerman Road,
Lambeth, London SW9 **(CM-70)**

Machines operated by: Rock Alluvium

Measurements made on: 12th January 2011

Summary:

Vibration was measured on a CM-50 Piling Rig in typical working conditions. Magnitudes were 0.3m/s^2 for hand vibration, 0.2m/s^2 for whole-body vibration.

These magnitudes were considerably lower than criteria in the Machinery Directive (2006/42/EC), and confirm that these machines do not present a significant vibration hazard to the operator.

From observation, similar vibration values apply to the model CM-70 Piling Rig.

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REPORT ON VIBRATION OF PILING RIGS MODELS CM-50 AND CM-70

1. Introduction and Objectives

Historically, Soilmec Piling Rigs such as models CM-50 and CM-70 have been supplied without any information about vibration to which the operator may be exposed. The reason for this has been that these machines do not present a significant vibration hazard to the operator. A customer has questioned this. The observations and measurements reported here were therefore made to confirm that vibration is indeed not a hazard for the operator.

Because vibration has not been considered a hazard on Piling Rigs, no standard vibration test code has been developed. Vibrations were therefore to be measured during representative normal work, following the principles set out in BS EN 1032:2003. Subjective observations would determine whether both hand-transmitted and whole-body vibration should be measured, and for which parts of the operational cycle.

2. Machine description and identification

Each of the Piling Rigs (photographs 1, 2 below) comprises a long vertical auger that is driven into the ground by hydraulic motor, and that is hollow to allow concrete to be pumped into the ground as the auger is removed. Power is provided by a diesel engine mounted on the main chassis. The unit is mounted on tracks that are driven and steered to move between pile positions. The operator is seated in a cab with a clear view of the entry of the auger into the ground. The operating cycle is as follows:

1. Tracking to position the auger over the desired position.
2. Adjustment of the auger to the vertical.
3. Boring to create the space to cast the concrete pile.
4. Pumping the concrete.

Photograph 1: Piling Rig CM-50

Photograph 2: Piling Rig CM-70

The rigs observed were identified by serial number as follows:

Model CM-50, Serial Number 2182
Model CM-70, Serial Number 2139

3. Test Method and Equipment

From observation, hand-transmitted vibration was noticeable only during the boring phase of the operating cycle, and whole-body vibration only when tracking. Also, the sources of excitation and the mechanisms of transmission do not differ between the two models of Piling Rig. The vibrations on one machine would be similar to those measured on the other. For operational reasons, measurements were made on the model CR-50.

Hand-transmitted vibration was measured on the joystick control nearest to the cab doorway (Photograph 3 below). A PCB model 356A24 triaxial accelerometer, serial number 31199, sensitivity 10mV/g, was fixed to the joystick by means of tensioned cable tie, and connected to a a Larson Davis Human Vibration meter (model HVM100, s/n 386). This was set to store the root-sum-of-squares of the three measurement axes (vector sum), frequency weighted for hand-arm vibration according to ISO 8041.

Photograph 3: Joystick controls

Whole-body vibration was measured on the seat cushion, using a standard seat pad fitted with a PCB model 356B40 triaxial accelerometer, serial number 18201, sensitivity 100mV/g. The pad was located on the cushion by means of "gaffa" tape. The accelerometer was connected to the same Human Vibration Meter, but set to store all three component channels, with frequency weightings:

weightings:	X-axis (fore-and-aft)	w_d
	Y-axis (transverse)	w_d
	Z-axis (vertical)	w_k (according to ISO 8041).

For hand-transmitted vibration, 3 measurements were stored through a single boring phase.

For whole-body (seat) vibration, 1 measurement only was possible during the time of a single tracking phase.

Ground conditions on both sites were sandy gravel over London clay.

4. Results

Hand-transmitted vibration:

Time, Sec	Acceleration m/s^2 RSS
20	0.33
15	0.26
30	0.33

Whole-body vibration:

Time, sec	Acceleration m/s^2		
	X (fore-and-aft)	Y (transverse)	Z- (vertical)
25	0.19	0.17	0.21

5. Comments

The phases of the operational cycle during which vibration was present were clearly very short

The magnitudes of vibration even during those phases, were very small.

The machinery directive (2006/42/EC) requires that magnitudes be published when

1. Hand-transmitted vibration exceeds 2.5 m/s^2 (RSS), or
2. Whole-body vibration exceeds 0.5 m/s^2 on the largest single axis.

Neither of these criteria is exceeded. It is possible that different ground conditions would lead to higher magnitudes, but most unlikely of sufficient magnitude to approach the criteria.

6. Conclusions

The results confirm that the Piling Rigs do not expose their operators to significant vibration hazard. This can be published wherever lists of hazards associated with the machines are published.

Alternatively, it can be published that, in typical working conditions, hand-transmitted vibration is less than 2.5 m/s^2 (RSS) and whole-body vibration is less than 0.5 m/s^2.