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Hand-arm vibration of horticultural machinery

Part 1

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Hand-arm vibration of horticultural machinery

Part 1

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In recent years there have been many cases of HAVS being reported for people who work in agriculture, horticulture and landscape gardening. HSE/HSL does not currently hold much information on vibration exposures in these areas of work.

The work described in this report assesses the standard test defined in BS EN 836:1997 (incorporating amendments Nos. 1 to 3) for repeatability and ease of use and where possible for reproducibility (by comparing machine manufacturers' declared vibration against HSL measurements to the same standardised procedures). It also assesses the validity of the measurement techniques adopted in the vibration emission test, investigates some of the factors which are likely to influence the results of the test and compares the vibration emission values with vibration magnitudes measured under real operating conditions.

The report concludes that the standard is not capable of producing vibration emission values which represent the upper quartile of in-use vibration magnitudes. The vibration risk associated with the use of the mowers tends to be underestimated. The main source of vibration appears to be governed by the motion of the lawnmower as it interacts with the surface over which it passes. The emission test is a static test and so none of these effects resulting from machine motion can be seen.

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KEY MESSAGES

The standard test as defined in BS EN 836:1997 for powered lawnmowers must be used with caution.

The standard test as defined in BS EN 836:1997 for powered lawnmowers does not show the benefit of vibration reducing devices.

The standard test as defined in BS EN 836:1997 for powered lawnmowers tends to underestimate the vibration risk associated with their use.

EXECUTIVE SUMMARY

In recent years there have been many cases of HAVS (Hand Arm Vibration Syndrome) being reported for people who work in agriculture, horticulture and landscape gardening. HSE/HSL does not currently hold much information on vibration exposures in these areas of work. Data from the HSL HAVS referrals database show that of the 329 people who have been referred for clinical assessment, approximately 10% of them list lawnmowers as one type of equipment that they had been using on a regular basis.

The objectives of the work were to provide HSE with information regarding:

1. the likely usefulness of a lawnmower's declared vibration emission value according to BS EN 836:1997 (incorporating amendments Nos. 1 to 3), for comparison of the vibration of lawnmowers, to assist avoiding purchase of high vibration machines.

2. the likely usefulness of a lawnmower's declared vibration emission value according to BS EN 836:1997 (incorporating amendments Nos. 1 to 3), for assessing and managing likely vibration risk in the workplace.

3. limitations of the test code and proposals for improvement that can be fed back into the responsible standardisation group.

Main Findings

Objective 1

In both cases, where the manufacturers' have declared to BS EN 836:1997 (incorporating amendments Nos. 1 to 3) HSL has verified their declarations according to the criteria in BS EN 12096:1997. This implies a good degree of reproducibility. The other two manufacturers declared on the basis of field measurements. HSL has not been able to verify these field measurement declarations, using either laboratory or field measurements. The reason for non-verification is likely to be that the surfaces used at HSL to replicate the declarations are more uneven and rougher than the surfaces used by the manufacturers.

Objective 2

When comparing manufacturers' declared emissions with HSL's upper quartile field magnitude at the BS EN 836:1997 measurement locations, only one of the four lawnmowers came close to the upper quartile. The other three declarations will underestimate the risk associated with the use of the lawnmowers.

When comparing HSL measured emission values with HSL's upper quartile field magnitude at the BS EN 836:1997 measurement locations, only one of the four lawnmowers achieved the upper quartile. Two emission values will underestimate the risk associated with the use of the lawnmowers and one overestimates the risk.

Objective 3

Key problems with BS EN 836:1997 (incorporating amendments Nos. 1 to 3) were:

1. It is a static test that excludes the major component of the vibration at the handles when in real use, which appears to be vibration generated by the motion of the mower over the surface being mown.

2. The test will not provide an indication of the benefits of vibration reducing devices that might successfully reduce the vibration generated by the movement of the mower.

3. The engine speed requirement is unrealistic. If an operator were to use it at the specified speed in the field and engage the forward drive the lawnmower would not be controllable. Lawnmowers are typically operated at around half maximum speed.

Recommendations

BS EN 836:1997 (incorporating amendments Nos. 1 to 3) should be revised so that it produces vibration emission test values which reflect the upper quartile of vibration magnitudes resulting from intended use of the lawnmowers. Realistic engine speeds and a non-static test could be a useful starting point for increasing the vibration magnitude. Further work would be necessary to verify this.

CONTENTS PAGE

1 INTRODUCTION

1.1 BACKGROUND

Hand-arm vibration emission test code standards support the legal requirement of the Machinery Directive (Supply of Machinery (Safety) Regulations) to report vibration emission. For vibration these standards have a central role in the legal framework for inspection of suppliers of work equipment.

Work led by HSE/HSL to evaluate vibration emission standards for hand-held power tools and machines has shown that many test codes provide vibration values that substantially under-represent vibration risk. Employers estimating the vibration exposure of their employees using the information provided by the manufacturer were unwittingly putting their employees at high risk of developing hand-arm vibration syndrome (HAVS).

The work reported here was carried out under a project that encompasses machines which are powered by internal combustion engines. There are a number of internal combustion type tools which are known to represent a risk to health, for example lawnmowers and hedge trimmers, for which HSL has not yet carried out an assessment of the emission standard. There is a lack of HSE knowledge in this area which needs to be addressed, particularly in view of the fact that prevalence of HAVS is widespread among those who work in grounds maintenance and similar occupations using these machines.

The vibration emission test code to be evaluated in this report is BS EN 836:1997 *Garden equipment – Powered lawnmowers – Safety*, which has three amendments up to 2004. The noise and vibration requirements were introduced in amendment A2 in 2001. This test code references BS EN 1033:1995, the predecessor to BS EN ISO 20643:2008 *Mechanical vibration – Hand-held and hand-guided machinery – Principles for evaluation of vibration emission*, within the references. BS EN ISO 20643:2008 provides the basis for drafting vibration test codes and introduces the concept of the 75^{th} percentile as the target emission value to be achieved by the conditions defined for the standard test. BS EN 12096:1997 *Mechanical vibration – Declaration and verification of vibration emission values*, is used in this report for the verification of manufacturers' declared emission values.

1.2 OUTLINE OF WORK

In recent years there have been many cases of HAVS being reported for people who work in agriculture, horticulture and landscape gardening. HSE/HSL does not currently hold much information on vibration exposures in these areas of work.

The machines most commonly used are pedestrian controlled lawnmowers, brush and grass cutters, chainsaws and hedge trimmers. Previous research has been carried out for the Forestry Commission looking at chain saws and brush cutters, however pedestrian controlled mowers and hedge trimmers have not been investigated. Data from the HSL HAVS referrals database show that of the 329 people who have been referred for clinical assessment, approximately 10% of them list lawnmowers as one type of equipment that they had been using on a regular basis.

The work for pedestrian controlled lawnmowers had three aims:

1. To assess the standard test defined in BS EN 836:1997 (incorporating amendments Nos. 1 to 3) for repeatability and ease of use and where possible for reproducibility (by

comparing machine manufacturers' declared vibration against HSL measurements to the same standardised procedures).

2. To assess the validity of the measurement techniques adopted in the vibration emission test and investigate some of the factors which are likely to influence the results of the test.

3. To compare the vibration emission values with vibration magnitudes measured under real operating conditions.

The objectives of the work were to provide HSE with information regarding:

1. the likely usefulness of a lawnmower's declared vibration emission value according to BS EN 836:1997 (incorporating amendments Nos. 1 to 3), for comparison of the vibration of lawnmowers, to assist avoiding purchase of high vibration machines.

2. the likely usefulness of a lawnmower's declared vibration emission value according to BS EN 836:1997 (incorporating amendments Nos. 1 to 3), for assessing and managing likely vibration risk in the workplace.

3. limitations of the test code and proposals for improvement that can be fed back into the responsible standardisation group.

2 MACHINES TESTED

Four pedestrian controlled powered lawnmowers were acquired for testing as shown in Figures 1a-d of which two are rotary lawnmowers and two are cylinder lawnmowers. The definitions of powered, rotary and cylinder as per BS EN 836:1997 are given below:

Powered lawnmower – *a grass cutting machine or a machine with grass-cutting attachment(s) where the cutting means operates in a plane approximately parallel to the ground and which uses the ground to determine the height of the cut by means of wheels, air cushion or skids, etc., and which utilises an engine or an electric motor for a power source.*

Rotary lawnmower – *a powered lawnmower in which one or more cutting means, cutting by impact, rotate about an axis normal to the cutting plane.*

Cylinder lawnmower – *a powered lawnmower with one or more cutting means rotating about a horizontal axis to provide a shearing action with a fixed cutter bar or blade.*

Figure 1a Machine A – Rotary lawnmower

Figure 1b Machine B – Rotary lawnmower

Figure 1c Machine C – Cylinder lawnmower

Figure 1d Machine D – Cylinder lawnmower

Table 1 describes the basic characteristics of the four powered lawnmowers.

Table 1 Machines used in the study

Machine	HSL Sample No.	Cutting width (mm)	Cutting heights (mm)	Weight (kg)	Rear Roller?	Declared vibration emission (m/s^2)	
						a	***K***
A	NV/10/01	530	21-76	60.2	No	4.5	2.2
B	NV/10/02	560	13-60	45.5	Yes	3	1.5
C	NV/10/03	510	2-25	110	Yes	2.5*	
D	NV/10/09	510	10-40	111	Yes	3.6*	

*Based on field measurements rather than standard emission test.

The manufacturers' of Machines A and B have declared their vibration emissions according to BS EN 836:1997.

The manufacturers' of Machines C and D have declarations based on field measurements.

3 LABORATORY TESTING OF VIBRATION EMISSION

3.1 EMISSION TEST PROCEDURE FOR POWERED LAWNMOWERS

The vibration emission test for a powered lawnmower is carried out with the machine stationary and at maximum operating engine speed. The maximum operating engine speed is the highest speed obtainable when adjusted in accordance with the manufacturer's specifications with the cutting means engaged. The lawnmowers are placed on a test floor (shown in Figures 1a-d), which consists of 19 mm plywood covered with 500 mm squares of coconut matting nailed to the plywood with precisely spaced nails. The minimum length of sides of the test floor is at least 1.5 m more than the cutting width of the lawnmower. The coconut matting has approximately 20 mm high fibres embedded in a PVC base weighing approximately 7000 g/m^2.

Measurements are carried out with the cutting height set to 30 mm or the next higher cutting position when set on a hard level surface. For lawnmowers with a maximum cutting height setting of 30 mm or less, testing is carried out at their maximum height setting. The lawnmowers are tested in the same configuration as they would be used in the field i.e. with grass catcher attached and fuel tank full. Five tests are carried out using one operator only, as required by BS EN 836:1997.

3.2 TRANSDUCER MOUNTING LOCATIONS

The transducer locations specified by BS EN 836:1997 are shown in Figure 2a for separate handles and 2b for a continuous handle. The dimension **a** in Figures 2a and 2b is 100 mm.

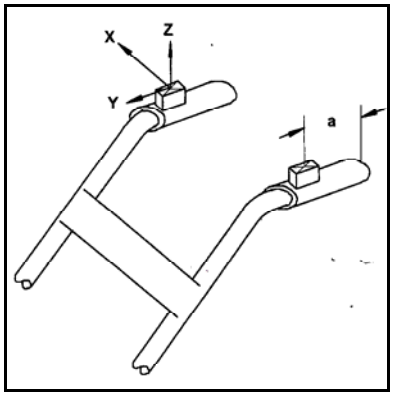

Figure 2a Position of transducers for separate handles (taken from BS EN 836:1997)

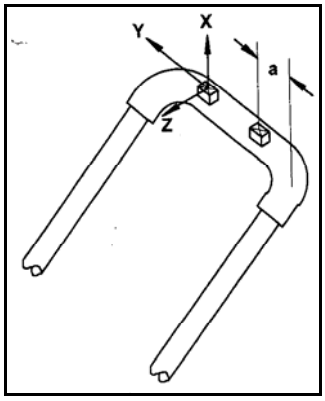

Figure 2b Position of transducers for a continuous handle (taken from BS EN 836:1997)

3.3 DATA ACQUISITION AND ANALYSIS

Details of instrumentation used for acquisition and analysis of vibration emission data is given in Appendix A.

The transducers used for all of the measurements were PCB Type 356A02 ICP triaxial accelerometers. The accelerometers were bolted to a custom-made aluminium mounting block and fixed in place using a plastic cable tie and tensioning gun. The cable tie system (shown in Figure 3) produces a reliable, repeatable fix that has been tested at HSL, and has been shown to

be rigid within and well beyond the frequency range of interest for hand-arm vibration measurements.

Figure 3 Aluminium block positioned using the cable tie system

Each of the five separate measurements for one operator was a sixteen second linear analysis, made using a Brüel & Kjær (B&K) Pulse multi-channel real time frequency analyser. One-third octave band analyses of the data were carried out. The data were also frequency weighted in accordance with BS EN ISO 8041:2005 and then stored on the PC. The overall frequency weighted vibration magnitude at each measurement position was recorded after each test.

After five measurements, the coefficient of variation C_v, was calculated. The C_v is equal to the standard deviation divided by the mean of the five measurements. BS EN 836:1997 does not give any information on the validity of the measurements, however BS EN 1033:1995, which is given in the references, states that the C_v for five consecutive measurements should be less than 0.15, for the data to be valid. BS EN 1033:1995 is no longer current and has been superseded by BS EN ISO 20643:2008, however the figure of less than 0.15 has not changed.

For each lawnmower, the vibration emission figure ***a***, is the mean value of the five measurements for one operator only.

An explanation for the use of one operator is given in BS EN ISO 20643:2008 which states that…

…if it can be shown that the vibration is not affected by operator characteristics, it is acceptable to perform measurements with one operator only.

The individual deviation ***K***, is calculated according to the provisions of BS EN 12096:1997 Annex B.2, where a single machine is used to declare the vibration emission with the standard deviation due to the different operators equal to zero.

3.4 EMISSION TEST RESULTS

The full results of the emission tests including frequency spectra are given in Appendix B.

Table 2 contains the results of the HSL emission tests at the BS EN 836:1997 mounting locations. The figures in **bold** indicate the highest vibration emissions across both mounting locations.

Table 2 Vibration emission total values measured at HSL

Machine	Frequency weighted vibration magnitude (m/s^2)			
	Left hand		Right hand	
	a	***K***	***a***	***K***
A	4.0	0.3	**4.0**	**0.3**
B	3.8	0.3	**4.0**	**0.2**
C	**6.7**	**0.7**	6.1	0.7
D	3.6	0.2	**3.6**	**0.2**

A C_v of < 0.15 was achieved easily indicating that for lawnmowers the emission test is repeatable.

4 ADDITIONAL LABORATORY MEASUREMENTS

4.1 ADDITIONAL OPERATORS

BS EN 836:1997 only specifies a single operator. To test the assumption that only one operator is necessary, the emission test was repeated with a second operator for three of the four lawnmowers. This will verify whether or not the operator does have an effect on the vibration emission. The results are shown in Table 3.

Table 3 Vibration emission total values for two operators

	Operator	Frequency weighted vibration magnitude (m/s^2)	
		Left hand	Right hand
		a	***a***
Machine A	1	4.0	4.0
	2	3.7	3.6
Machine C	1	6.7	6.1
	2	6.4	5.9
Machine D	1	3.6	3.6
	2	3.3	3.4

Table 3 shows that the second operator is slightly lower in all three cases.

4.2 CUTTING HEIGHT

The influence of the cutting height on the measured vibration magnitude was investigated using Machine A, a rotary lawnmower, and Machine D, a cylinder lawnmower. The vibration emissions were determined for cutting heights of 30 mm and 76 mm on Machine A and 30 mm and 40 mm on Machine D. The cutting heights of 76 mm and 40 mm are the maximum cutting heights for their respective machines. The results of the investigation are shown in Table 4.

Table 4 Vibration emission total values from different cutting heights

	Cutting height (mm)	Frequency weighted vibration magnitude (m/s^2)	
		Left hand	Right hand
		a	***a***
Machine A	30	4.0	4.0
	76	4.0	4.1
Machine D	30	3.6	3.6
	40	3.3	3.3

Machine A shows no difference for the left hand location and a difference of 0.1 m/s^2 for the right hand location and Machine D shows a difference of 0.3 m/s^2 for both measurement locations.

4.3 ISOLATED HANDLES

The handles on Machine C are isolated from the main body as shown in Figure 4. During the emission test the lawnmower is stationary and the handle is resting on the rubber cone stops. When the lawnmower is moving in a real situation, with the operator guiding the mower, the handles are naturally lifted up off the rubber cone stops and so isolation is likely to occur.

Figure 4 Isolated handle system

An emission test was carried out with the handles lifted up off the rubber cone stops to investigate the influence of the isolation system and the results are shown in Table 5. It should be noted that there were large variations between the five measurements and satisfactory repeatability required for validation could not be achieved, despite repeated attempts to achieve the target C_v of < 0.15. The actual C_v was almost double the required figure.

Table 5 Effect of isolated handles on measured vibration emission

	Frequency weighted vibration magnitude (m/s^2)	
	Left hand	Right hand
	a	***a***
Handles on stops	6.7	6.1
Handles off stops	3.9*	1.9*

* Validation could not be achieved. Results have been reported for information only

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5 FIELD MEASUREMENTS

5.1 MEASUREMENT PROTOCOL

Following the laboratory emission test stage, the lawnmowers were taken out on the HSL site, where they were used under three sets of conditions as shown in Figures 5a-c. The conditions in Figure 5a involved mowing on a flat, even surface with a tight turn at each end for at least one minute. The conditions in Figure 5b involved mowing on an incline on a much more uneven surface for at least one minute and required more control from the operator in guiding the mower. The conditions in Figure 5c involved mowing on an uneven surface for at least one minute in a figure of eight pattern and enabled the cutting height on Machine C to be taken down below 10mm, a height unachievable with any other mower.

Figure 5a Cutting up and down on a flat even surface

Figure 5b Cutting on an incline

Figure 5c Cutting in figure of eight pattern on an uneven surface

Triaxial vibration measurements were made at the same mounting locations as in the emission tests (Figures 2a and 2b). Three operators carried out each of the three mowing tasks for each machine. On one occasion, one of the operators was not available. On some occasions, repeat tests were made for one or more operators because the cutting height was adjusted. All the test data was used in the analysis.

5.2 DATA ACQUISITION AND ANALYSIS

Details of instrumentation used for acquisition and analysis of field measurement data is given in Appendix A.

Due to the highly mobile nature of the machines it was not possible to use the normal mains powered real time frequency analysis unit on site. The signals from the accelerometers were therefore recorded on a battery powered data recorder, then analysed using a B&K Pulse multi-channel frequency analyser when back at the laboratory at HSL. One-third octave band analyses of the data were carried out. The data were also frequency weighted in accordance with BS EN ISO 8041:2005 and then stored on the PC. The overall frequency weighted vibration magnitude at each measurement position was recorded after each test. The data acquisition instrumentation is shown in Figure 6.

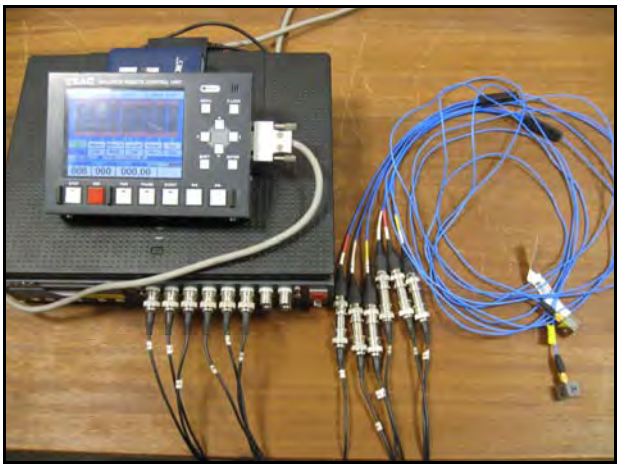


Figure 6 Data acquisition instrumentation

All of the measurements obtained for each of the mowers were then used to derive a mean frequency weighted vibration magnitude and standard deviation.

5.3 RESULTS OF FIELD MEASUREMENTS

The full results from the field measurements, including frequency spectra, are given in Appendix B. A summary of the overall results for each lawnmower is given in Table 6.

Table 6 Summary of field measurements on the lawnmowers

Machine	Conditions	Frequency weighted vibration magnitudes (m/s^2)				Number of measurements
		Left hand		Right hand		
		mean	**stdev**	**mean**	**stdev**	
A	Up and down	3.5	0.2	3.7	0.2	4
	Incline	4.0	0.3	3.9	0.3	3
	Figure of 8	4.7	1.2	4.5	1.0	2
	Average	**4.0**	**0.7**	3.9	0.5	9
B	Up and down	3.7	0.3	3.7	0.2	6
	Incline	4.7	0.9	4.7	0.7	3
	Figure of 8	5.9	0.3	6.0	0.3	3
	Average	**4.5**	**1.1**	4.5	1.0	12
C	Up and down	4.1	0.3	3.4	0.4	3
	Incline	5.1	0.9	4.6	1.0	3
	Figure of 8	5.1	0.7	4.6	0.7	6
	Average	**4.8**	**0.8**	4.3	0.9	12
D	Up and down	3.9	0.6	3.9	0.7	3
	Incline	5.8	0.7	5.8	0.9	3
	Figure of 8	5.0	0.6	5.0	0.7	3
	Average	4.9	1.0	**4.9**	**1.1**	9

The '**Average**' conditions are the mean and standard deviation across all field measurements for that lawnmower. The **bold** values indicate the highest hand position.

Table 6 shows that the vibration magnitudes are lower for the 'up and down' conditions on the flat even surface.

6 DISCUSSION

6.1 COMPARISON OF DECLARED AND MEASURED EMISSION

Verification of declared vibration emission values is established by means of vibration measurements made according to the same vibration test code or basic measurement method, and under the same operating mode as that one to which the declared vibration emission values refer. For comparison of measured and declared emission values BS EN 12096:1997 states that if one machine is evaluated, the declared vibration emission is verified if the measured vibration emission, ***a***, is less than, or equal to the value of ***a + K*** as declared by the manufacturer.

Table 7 shows a comparison of the measured and declared vibration emissions for Machines A and B, where the manufacturers' have declared their emissions to BS EN 836:1997.

Table 7 Comparison of declared emissions under BS EN 12096:1997

Machine	Declared emission (m/s^2)			Measured emission (m/s^2)			HSL verifies
	a	***K***	***a + K***	***a***	***K***	***a + K***	
A	4.5	2.2	**6.7**	**4.0**	0.3	4.3	Y
B	3.0	1.5	**4.5**	**4.0**	0.2	4.2	Y

The results in Table 7 show that HSL has verified the manufacturers' declared vibration emissions in both cases.

Table 8 shows a comparison of field measurements for Machines C and D, where the manufacturers' have given field measurements as their declarations. This is not an identical comparison, as we do not know the exact operating conditions that the manufacturers' have used.

Table 8 Comparison of field measurements under BS EN 12096:1997

Machine	Declared emission (m/s^2)			Upper quartile field (m/s^2)	HSL verifies
	a	***K***	***a + K***		
C	2.5	1.3*	**3.8**	**5.4**	N
D	3.6	1.8*	**5.4**	**5.9**	N

* Estimated according to the provisions of BS EN 12096

Table 8 shows that HSL has not verified the manufacturers' field measurements in either case.

6.2 ANALYSIS OF VARIANCE

It is important for the purposes of direct comparison between machines and tests to determine whether the measured data for the different machines are significantly different. Analysis of variance (ANOVA) was carried out on appropriate HSL measured data, to see which data could be considered as different and which could not. The statistical analysis was carried out using the vibration magnitudes at the same locations for each machine. The null hypothesis was that the two sets of 5 values obtained from the laboratory test (1 operator, 5 repeats) were not statistically separable at the 5% level, i.e. they had the same mean value.

6.2.1 Operator variations

ANOVA carried out on the data in Section 4.1 to investigate the effect of the operator, concludes that the variations between the two operators are not significantly different and so verifies the choice of using only one operator. The emission test is a static test and the operator

has to only lightly place their hands on the handles of the mowers. They may also have to operate a control, however no effort is required in doing so. These actions lead to small variations between operators.

6.2.2 HSL measured emission

The HSL measured emission data are represented graphically in Figure 7 where the standard deviation is plotted against the mean measured emission, ***a***. The mean is represented by a black diamond and the error bars indicate the standard deviation. Those machines that are not significantly different from one-another are circled.

From the ANOVA analysis and Figure 7, it is possible to get an indication of the order of magnitude or the percentage difference that might represent a significant difference between two machines. This then enables informed judgements to be made as to whether the vibration magnitudes from two different machines can be considered as different and helps to identify any machines which stand out from the rest of the machines in the category as being particularly high or low vibration machines. Machines with low vibration emission may be representative of the state-of-the-art in terms of vibration control.

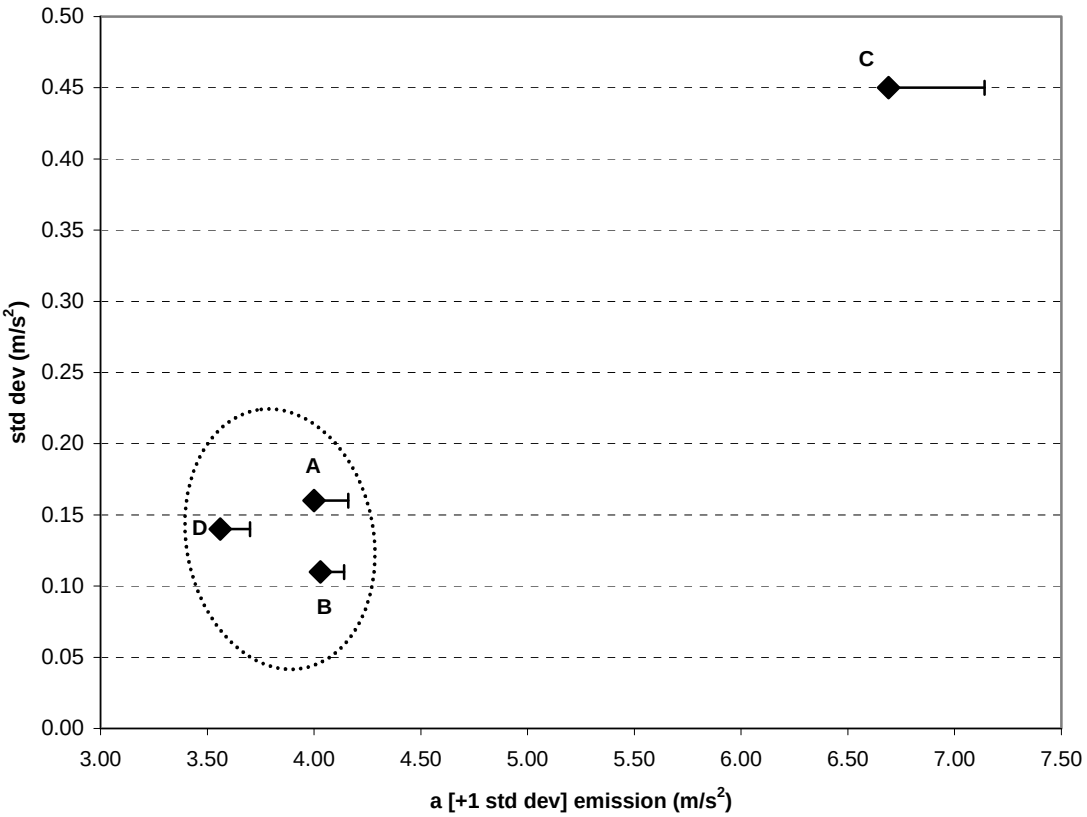


Figure 7 ***a*** [+1 std dev] emission vs standard deviation for HSL measured vibration magnitudes. The oval indicates those machines which are not significantly different

The mean emission values for Machines A, B, and D range from 3.6 to 4.0 m/s^2. Figure 7 suggests that the true means of A, B, and D could be the same. However, if the mean emission values are given in terms of time to the Exposure Action Value (EAV) under the Control of Vibration at Work Regulations as shown in Table 9, the 0.4 m/s^2 equates to approximately 40 minutes difference in the exposure time.

Table 9 Equivalent times to EAV

Machine	Mean emission value (m/s^2)	Time to EAV (hh:mm)
A	4.0	03:08
B	4.0	03:08
C	6.7	01:21
D	3.6	03:51

When the handles of Machine C are lifted off the stops as in Section 4.3 then the mean emission value falls to 3.9 m/s^2, which is within the range of emission values for the other three mowers and therefore not significantly different.

6.2.3 Cutting height variations

ANOVA carried out on the data in Section 4.2 to investigate the cutting height, concludes that 0.1 m/s^2 is not a significant difference but 0.3 m/s^2 is significantly different. The results of this additional investigation are inconclusive. The 0.3 m/s^2 can not be compared with the 0.4 m/s^2 given previously, as the data sets are completely different. The cutting height ANOVA is comparing within mowers whereas the emission value ANOVA is comparing across mowers.

6.3 COMPARISON OF DECLARED AND MEASURED EMISSION AND FIELD MEASUREMENTS

Figure 8 shows the manufacturer's declared emission, the HSL measured emission and the field measurement results for each lawnmower and measurement location. The error bars represent the ***K*** values. The measurement locations and techniques for the manufacturers' declarations are not known, however there is no difference between the HSL measured emissions for Machines A, B and D at the two measurement locations.

Figure 8 shows that of the lawnmowers tested, the HSL emission test values for Machines A and C are the only values where $\boldsymbol{a + K}$ are greater than the upper quartile values.

For Machines C and D where the manufacturers' have given declarations based on field measurements rather than the standard emission test, the HSL field measurements should be directly comparable with them. For Machine C the manufacturer's figure is below the bottom of the range of HSL field measurements and for Machine D the figure is towards the bottom of the range of HSL field measurements. The range of HSL field measurements accounts for variability from three operators each working under three different operating conditions making the differences between the HSL and manufacturers' data surprisingly large. Possible explanations of these relatively large magnitude differences may be due to the chosen operating conditions. For example, the manufacturer's conditions for Machine D are mowing on the outfield of a hockey and cricket club, which is likely to be very flat. The HSL field measurements for the 'up and down' conditions are most comparable to these outfield conditions and the vibration magnitudes measured are very similar. It is likely that the surfaces used at HSL are more uneven and rougher than most manufacturers' would use.

The upper quartiles of Machines B, C and D are all within the range 5.4 to 5.9 m/s^2 whereas for Machine A the upper quartile is much lower (4.2 m/s^2). Machine A is the only lawnmower without a rear roller i.e it has four wheels, one at each corner, and so has a smaller surface area in contact with the surface it is moving over. Consequently, the mower passes over the top of many undulations that a roller across the full width of the back of the mower would not be able to avoid. This in turn would result in lower vibration magnitudes and consequently a lower upper quartile value.

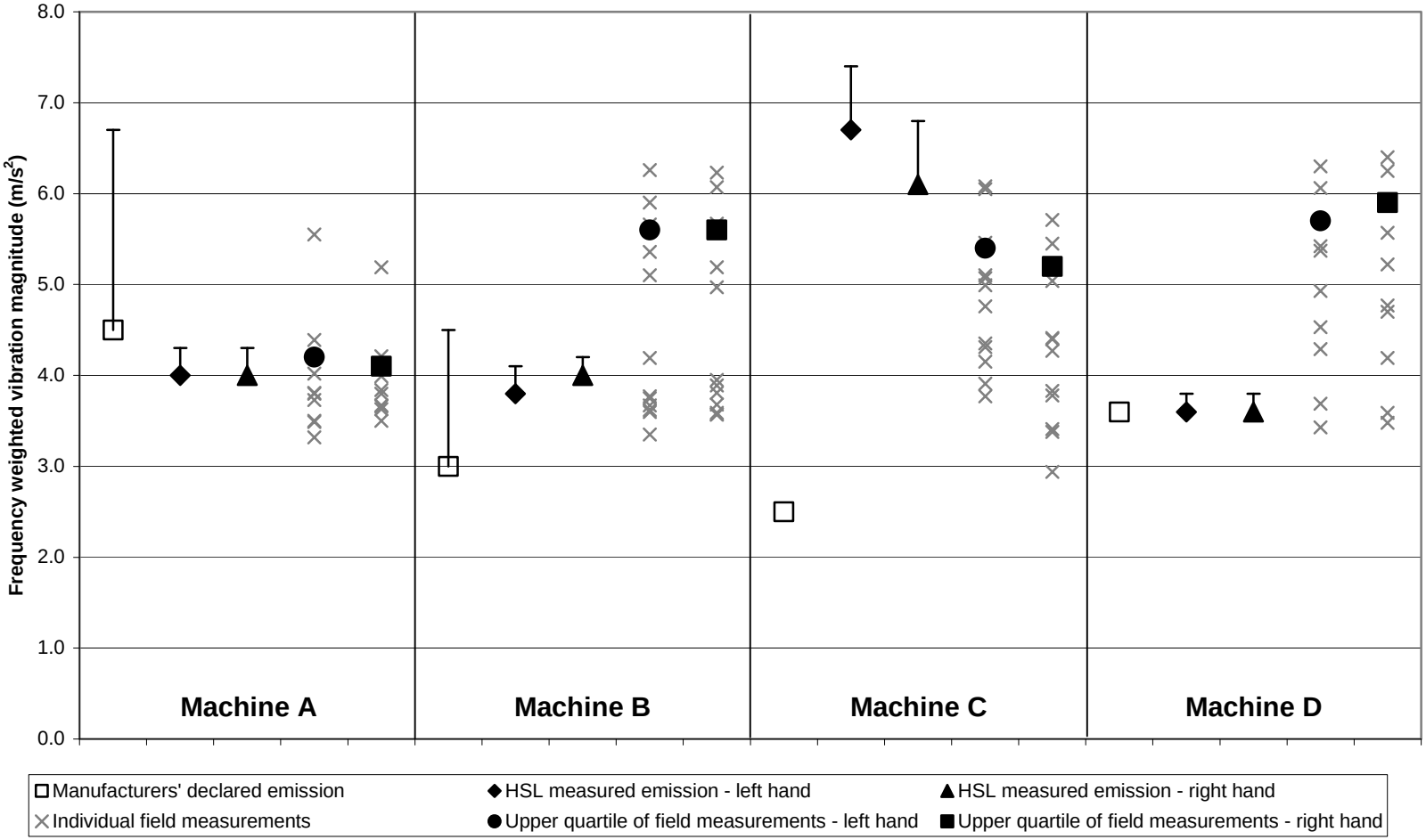


Figure 8 Comparison of manufacturers' declared and HSL measured emissions and field measurements

The frequency content of the emission test and the field measurement data were compared to see whether the differences in the frequency weighted magnitudes could be explained. Examples of the spectra for the z-axes' are shown in Figure 9 along with the W_h frequency weighting. The main differences between emission and field spectra can be seen at frequencies below the dominant frequency of the engine, typically at around 10 Hz, where the contribution to the overall frequency-weighted magnitude is much greater for the field measurements. These low frequencies may occur due to the rotational motion that is created due to the roller/wheels of the lawnmower moving across the undulations of the surface. The emission test is a static test and so none of these effects resulting from machine motion can be seen.

Realistic engine speeds during the emission test rather than full speed would go part of the way to increasing the emission value. Figure 9 shows that decreasing the engine speed for the field measurements shifts the dominant engine peak towards a higher frequency weighting, resulting in an increased vibration magnitude.

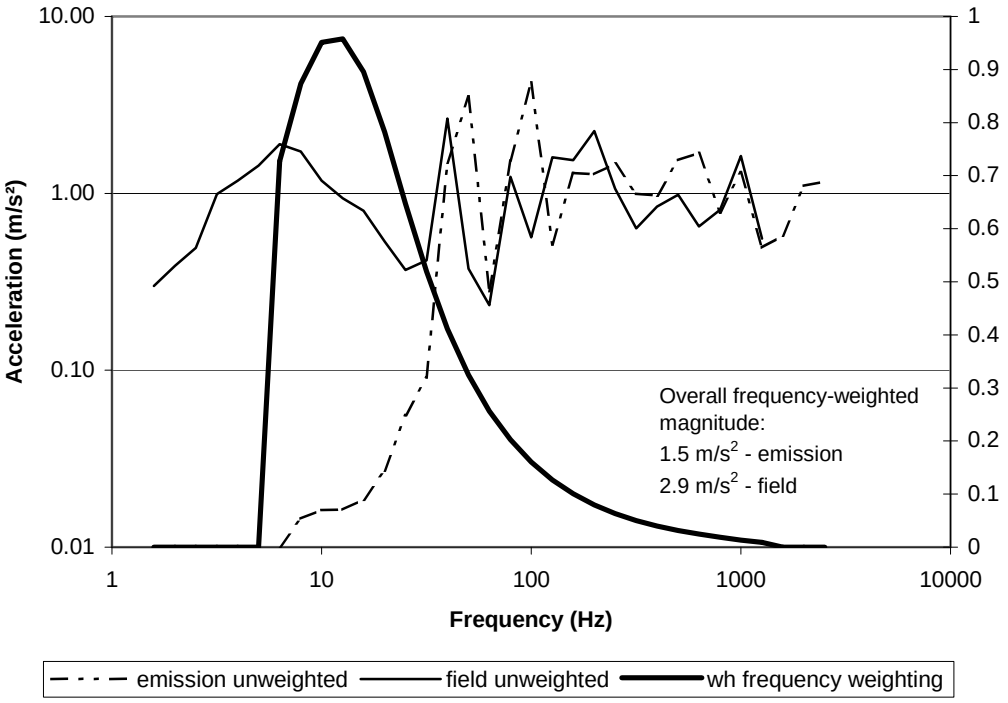


Figure 9 Differences between spectra of emission and field measurements

6.4 EMISSION VALUES AS AN INDICATOR OF RISK

One of the requirements of BS EN ISO 20643:2008 is that emission test codes should be designed to produce values which reflect the upper quartile of the in-use magnitudes. The data measured at HSL according to BS EN 836:1997 have been compared with the upper quartile of the HSL measured in-use vibration data. To do this, the ratio of the HSL measured ***a*** emission to the upper quartile of in-use values measured at the BS EN 836:1997 locations has been calculated and shown in Figure 10. Figure 11 shows the ratio of the manufacturers' ***a*** emission to the upper quartile value at the highest BS EN 836:1997 location.

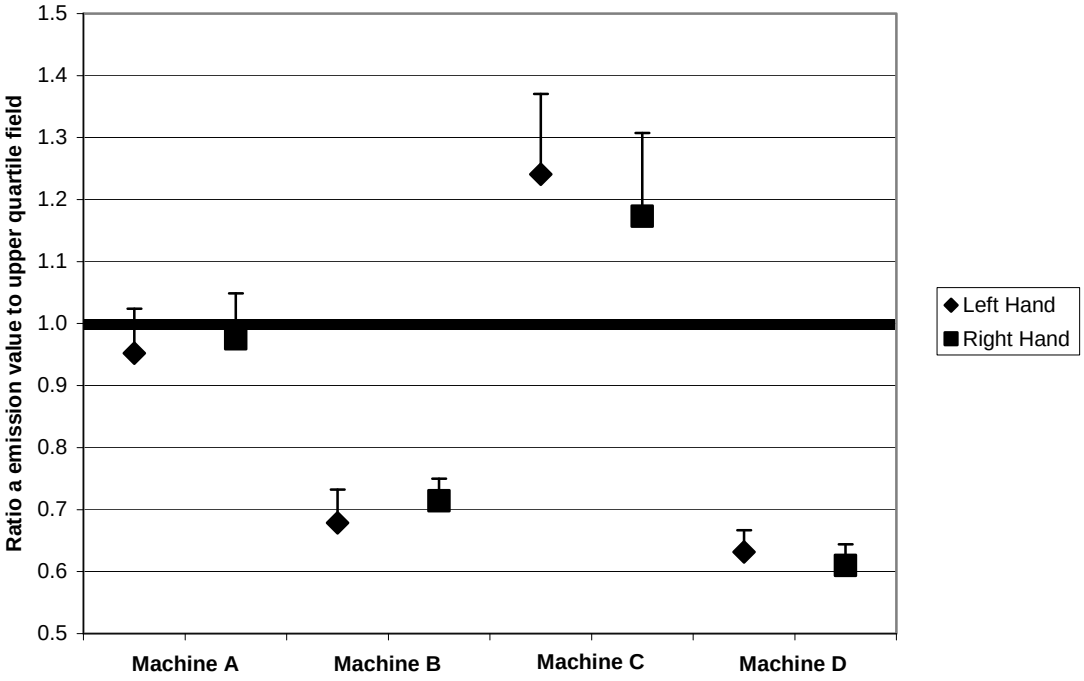


Figure 10 Ratio of HSL measured emission to the upper quartile field at the BS EN 836:1997 measurement locations

In Figures 10 and 11, a ratio of 1 indicates that the ***a*** emission and upper quartile field magnitudes are the same and therefore the value of 1 on the y-axis can be seen as the target value. A value greater than 1 indicates that the emission value overestimates the upper quartile of field measurements. A value less than 1 indicates an underestimate. The error bars on each data point indicate the difference that adding the ***K*** value makes to the ratio.

Figure 10 shows that HSL's results for Machine A represent the upper quartile. Machine C has exceeded the upper quartile but this is due to test poorly representing normal use of isolated handles. The other two emission values underestimate the risk associated with use of the lawnmowers. The reason for Machine C exceeding the upper quartile has been attributed to the isolated handles resting on the end stops during the static test. The mower needs to be in motion for the isolation to occur. Machines B and D underestimate the vibration risk because the vibration emission values during the static test are low. The static test does not give rise to the low frequencies induced by motion of the roller over the grass which dominate the frequency spectra as shown in Figure 9.

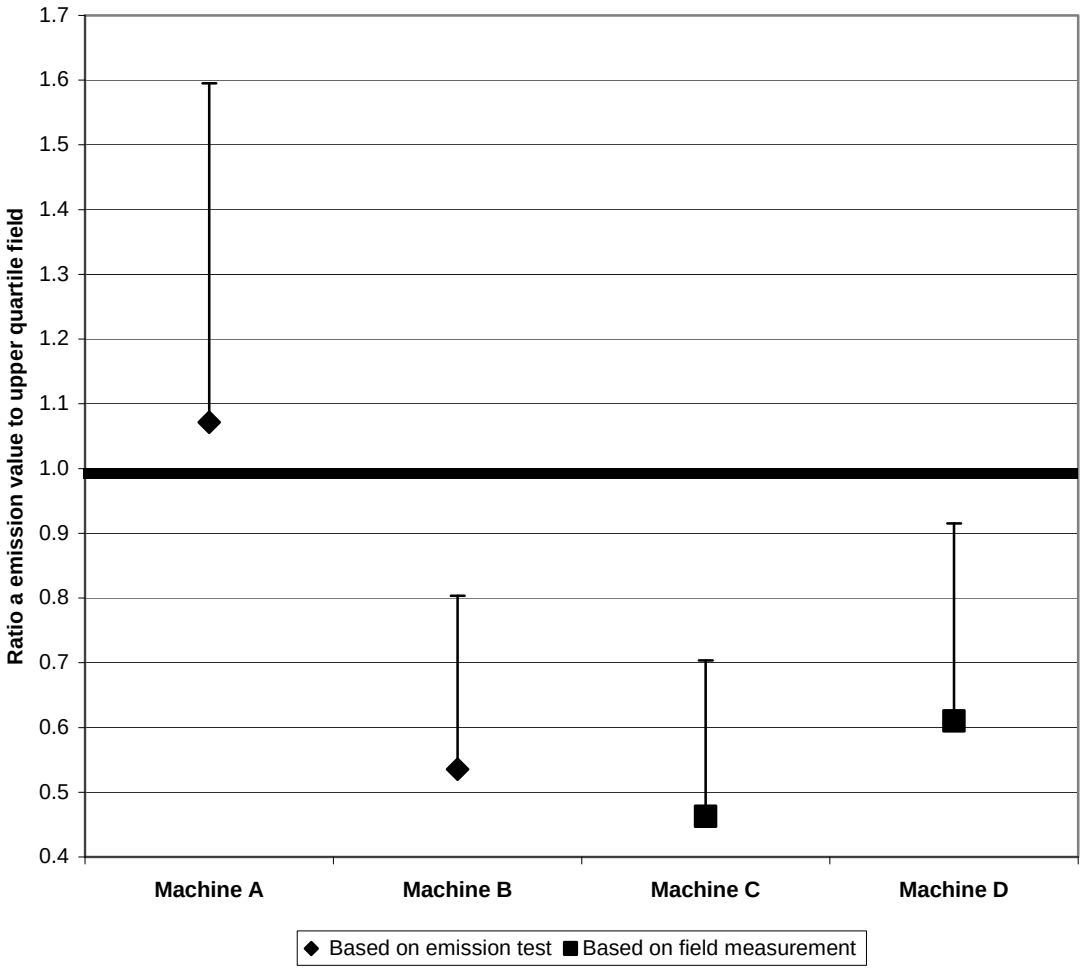


Figure 11 Ratio of the manufacturers' ***a*** emission to the highest upper quartile value at the BS EN 836:1997 locations

Figure 11 shows that if the manufacturers' data are compared to the upper quartile field magnitudes for the highest hand at the BS EN 836:1997 locations, only Machine A reflects the upper quartile, even after taking the ***K*** values into consideration. The declared values for Machines B, C and D underestimate the upper quartile field magnitude and therefore the risk associated with use of the lawnmower. This highlights the fact that the use of existing manufacturers' data for the purposes of risk assessment may result in a 40 to 50% underestimation of the vibration associated with the use of these lawnmowers.

Differences for Machines C and D can not be attributed to the effect of the static emission test, since the manufacturers have tested their lawnmowers under conditions of real use. The reasons for the differences between the HSL field data and the manufacturers' data for these lawnmowers is likely that the surfaces used at HSL are more uneven and rougher than the surfaces used by the manufacturers'. HSL has comparable results for the flat even conditions.

6.5 COMMENTS ON THE STANDARD TEST

During the test the lawnmowers are run at maximum speed with the cutting means engaged. If an operator was to use it at this speed in the field and engage the forward drive the lawnmower would not be controllable. Lawnmowers are typically operated at around half maximum speed.

The coconut matting covered plywood base is very large and cumbersome for testing lawnmowers of this cutting width. It is not possible to obtain one single, flat piece of plywood and so is constructed from joining two pieces together, making it very weak. As it is not completely flat it needs supporting on resilient material. HSL used carpet tiles for this purpose.

The standard test is a static test, which may not adequately assess the vibration of lawnmowers with isolated handles, which require the mower to be in motion for the isolation to operate effectively.

The test may underestimate the vibration at the handles during normal use because a major component of vibration for a lawnmower often appears to be generated by the motion of the mower over the surface being mown.

7 CONCLUSIONS

In both cases, where the manufacturers' have declared to BS EN 836:1997 (incorporating amendments Nos. 1 to 3) HSL has verified their declarations according to the criteria in BS EN 12096:1997. This implies a good degree of reproducibility. The other two manufacturers declared on the basis of field measurements. HSL has not been able to verify these field measurement declarations, using either laboratory or field measurements. The reason for non-verification is likely to be that the surfaces used at HSL to replicate the declarations are more uneven and rougher than the surfaces used by the manufacturers.

When comparing manufacturers' declared emissions with HSL's upper quartile field magnitude at the BS EN 836:1997 measurement locations, only one of the four lawnmowers came close to the upper quartile of the HSL in-use measurements. The other three declarations under-represented the risk associated with the use of the lawnmowers.

When comparing HSL measured emission values with HSL's upper quartile field magnitude at the BS EN 836:1997 measurement locations, only one of the four lawnmowers achieved the upper quartile. Two emission values underestimate the risk associated with the use of the lawnmowers and one overestimates the risk.

The manufacturers' of Machines C and D have given declarations based on field measurements rather than the standard emission test. These should be comparable with the HSL field measurements. For Machine C the figure is below the bottom of the range of HSL measurements and for Machine D the figure is towards the bottom of the range of HSL measurements. The range of HSL field measurements accounts for variability from three operators each working under three different operating conditions making the differences between the HSL and manufacturers' data surprisingly large. Possible explanations of these relatively large magnitude differences may be due to the chosen operating conditions with the flatness of the surface being a big factor.

Analysis of emission and field measurement frequency spectra identified that differences in frequency weighted vibration magnitude may be due to the low frequency content of the measurement. The low frequencies, below the dominant frequency of the engine, appears to be governed by the motion of the lawnmower as it interacts with the surface over which it passes for the HSL tests, but it is conceivable that other surfaces may induce less low frequency vibration.

One of the lawnmowers has isolated handles, which only give protection when the mower is in motion. As the emission test is static, it does not adequately assess the vibration of lawnmowers with this type of handle.

ANOVA carried out on the differences in emission values between operators, indicates that they are not significantly different and so verifies the decision to use only one operator in the standard test.

ANOVA carried out on the HSL measured emission values indicates that two lawnmowers would need to have a difference of more than 0.4 m/s^2 for their vibration to be considered as different.

8 RECOMMENDATIONS

BS EN 836:1997 (incorporating amendments Nos. 1 to 3) should be revised so that it produces vibration emission test values which reflect the upper quartile of vibration magnitudes and so represents the vibration risk resulting from intended use of the lawnmowers. Realistic engine speeds and a non-static test could be a useful starting point for increasing the vibration magnitude. Further work would be necessary to verify this.

The possibility of vibration at the handles being dominated by vibration induced by motion over imperfectly flat surfaces should be investigated.

A test should be devised that accurately represents the benefit of vibration reducing devices.

9 REFERENCES

BS EN 836:1997 (incorporating amendments Nos. 1 to 3). Garden equipment – Powered lawnmowers – Safety.

BS EN 12096:1997. Mechanical vibration – Declaration and verification of vibration emission values.

BS EN 1033:1995. Hand-arm vibration – Laboratory measurement of vibration at the grip surface of hand-guided machinery – General.

BS EN ISO 20643:2008. Mechanical vibration – Hand-held and hand-guided machinery – Principles for evaluation of vibration emission.

BS EN ISO 5349-1:2001. Mechanical vibration – Measurement and evaluation of human exposure to hand-transmitted vibration. Part 1: General requirements.

BS EN ISO 5349-2:2001. Mechanical vibration – Measurement and evaluation of human exposure to hand-transmitted vibration. Part 2: Practical guidance for measurement at the workplace.

BS EN ISO 8041:2005. Human response to vibration – Measuring instrumentation.

Council Directive 2006/42/EC of the European Parliament and of the Council of 7th May on machinery, and amending Directive 95/16/EC (recast).

APPENDICES

APPENDIX A – DATA AQUISTION AND ANALYSIS EQUIPMENT

Vibration emission data

	Transducers ICP Type	Serial #	Sensitivity (mV/ms^{-2})	Date of last calibration
Ch1	356A02	15793	1.060	August 2010
Ch2			1.047	
Ch3			1.056	
Ch4	356A02	97450	1.036	August 2010
Ch5			1.033	
Ch6			1.030	
B&K Pulse 3560C (Serial # 2423351) B&K Pulse LabShop software v12.1.0				Janurary 2010
Calibrator B&K 4294 (Serial # 1121535)				November 2010

Field measurement data

Data recording equipment

	Transducers ICP Type	Serial #	Sensitivity (mV/ms^{-2})	Date of last calibration
Ch1	356A02	15793	1.060	August 2010
Ch2			1.047	
Ch3			1.056	
Ch4	356A02	97450	1.036	August 2010
Ch5			1.033	
Ch6			1.030	
TEAC LX10 data recorder (Serial # 107562)				September 2010
Calibrator B&K 4294 (Serial # 1121535)				November 2010

Data analysis equipment

B&K Pulse 3560C (Serial # 2423351) B&K Pulse LabShop software v12.1.0	January 2010

APPENDIX B – DETAILED MEASUREMENT RESULTS

Vibration Emission Test report

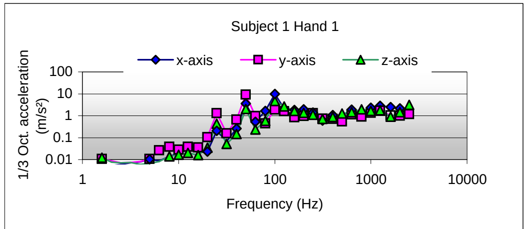
Pulse file version: HAV Emission V2.1.2 2008-07-25.pls
Sprreadsheet: Version 2.0 22/8/2008

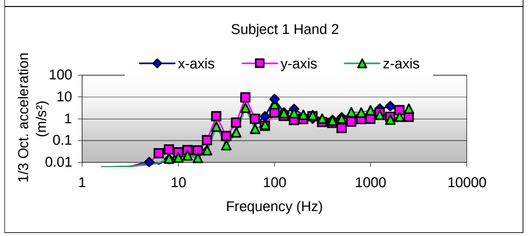
Standard: BS EN 836:1997
N&V reference ID: NV/10/09
Measurement file name: Machine A

					Hand Position 1 - Left hand							Hand position 2 - Right hand						
									Operator Statistics							Operator Statistics		
TestNo.	Operator	Meas. Name	Meas. Date	Meas Time	a_{whx}	a_{why}	a_{whz}	a_{hv}	Mean a_{hv}	S_{n-1}	C_v	a_{whx}	a_{why}	a_{whz}	a_{hv}	Mean a_{hv}	S_{n-1}	C_v
1	1	SH01	19/07/2010	16:21:18:499	2.09	3.33	1.19	4.10	3.96	0.175	0.044	2.03	3.31	1.48	4.15	4.00	0.163	0.041
2	1	SH02	19/07/2010	16:22:16:373	1.83	3.02	1.02	3.68				1.79	3.01	1.34	3.75			
3	1	SH03	19/07/2010	16:23:20:498	1.92	3.27	1.06	3.94				1.91	3.25	1.34	4.00			
4	1	SH04	19/07/2010	16:24:17:998	2.19	3.26	1.22	4.11				2.14	3.25	1.41	4.14			
5	1	SH05	19/07/2010	16:25:29:874	2.18	3.10	1.17	3.96				2.08	3.09	1.36	3.96			

	Hand Position 1 - Left hand			Hand position 2 - Right hand		
a_h (overall mean a_{hv})	3.96	m/s²		4.00	m/s²	
$\sigma_{R(single\ m/c.)}$	0.17	m/s²		0.16	m/s²	
$K_{(single\ m/c.)}$ value	0.29	m/s²		0.27	m/s²	

Single machine emission a_{hd} (= greatest a_h value)**:** **4.00** **m/s²** **$K_{(single\ m/c.)}$ value: 0.27 m/s²**





LocationName:

Occupation: Grounds maintenance
Process: Grass Cutting
RecordDate: September 30, 2010

TapeNumber: N/A
Operator#: OP#1
Up and down with tight turn at far end
VideoNumber: N/A

Notes: 41mm cut

DC-shift threshold: 10 mm

MachineManufacturer:
MachineModel:

HSLAnonymisedToolLetter: Machine A

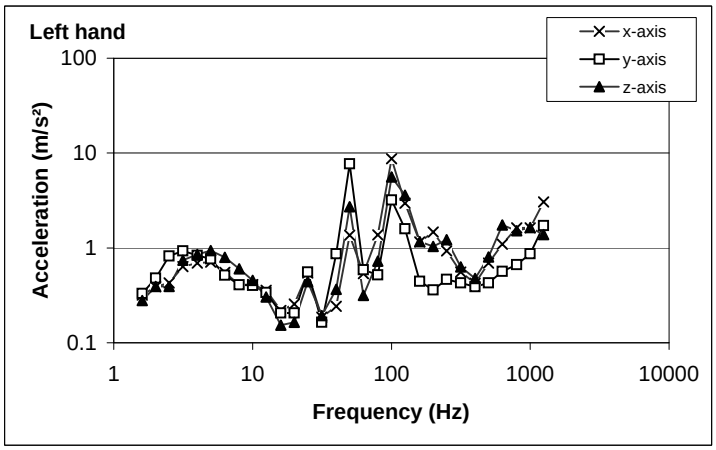
MachineModifications:
MachineSize: 530mm cutting width
MachineWeight(kg):
MachineOperating pressure:
MachineSpeed(impacts/min):
MachineSpeed(revs/min):
MachinePower:
MachinePower source: Unleaded petrol

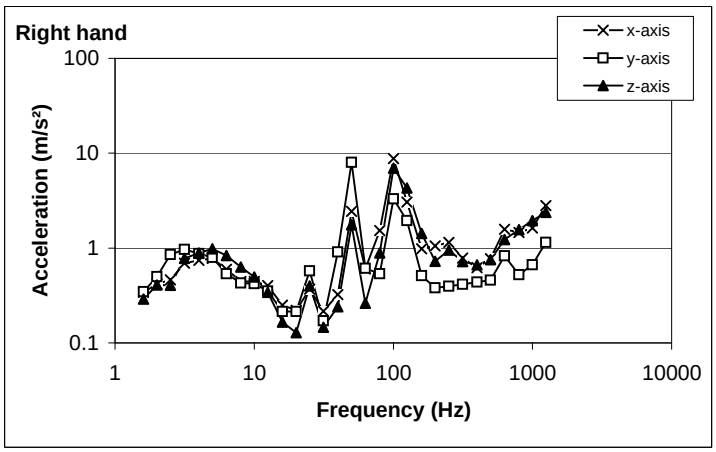
MainID: 1362
ResultsID: 9920

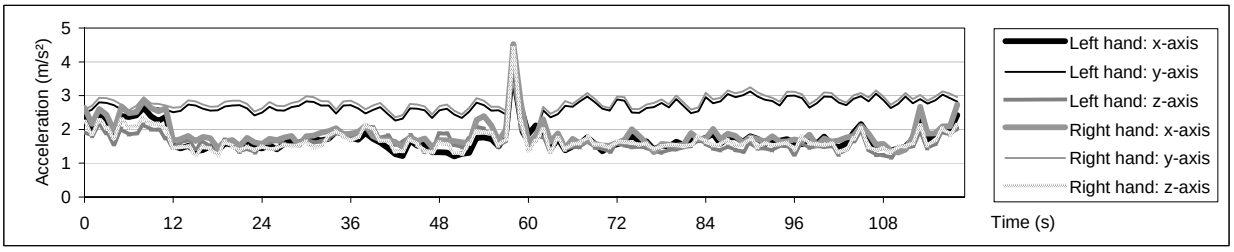
MeasurementTime: 119.75 Seconds
NumShotsInMeas:
DailyExposureTime:

InsertedTool:
InsertedToolType:
A(8) Left hand m/s²
InsertedToolManufacturer:

	Left hand			Right hand		
Frequency	x-axis	y-axis	z-axis	x-axis	y-axis	z-axis
1.6	0.319	0.332	0.28	0.341	0.348	0.291
2	0.39	0.481	0.394	0.419	0.501	0.41
2.5	0.429	0.819	0.392	0.461	0.853	0.406
3.15	0.637	0.928	0.744	0.691	0.967	0.78
4	0.69	0.834	0.851	0.744	0.871	0.886
5	0.71	0.764	0.94	0.778	0.797	0.985
6.3	0.551	0.514	0.797	0.597	0.537	0.832
8	0.408	0.409	0.603	0.444	0.427	0.632
10	0.412	0.401	0.454	0.446	0.42	0.497
12.5	0.357	0.337	0.304	0.403	0.352	0.34
16	0.219	0.206	0.153	0.25	0.214	0.165
20	0.256	0.206	0.164	0.221	0.214	0.129
25	0.544	0.557	0.442	0.369	0.575	0.397
31.5	0.186	0.164	0.193	0.216	0.171	0.146
40	0.242	0.868	0.365	0.323	0.905	0.24
50	1.358	7.693	2.716	2.433	8.016	1.763
63	0.537	0.588	0.315	0.6	0.613	0.261
80	1.37	0.521	0.723	1.527	0.537	0.886
100	8.746	3.204	5.6	8.763	3.291	6.947
125	2.955	1.588	3.594	3.05	1.945	4.314
160	1.154	0.445	1.166	0.981	0.509	1.424
200	1.473	0.36	1.041	1.056	0.381	0.724
250	0.927	0.466	1.221	1.15	0.396	0.95
315	0.558	0.427	0.628	0.785	0.416	0.718
400	0.424	0.388	0.477	0.622	0.439	0.666
500	0.691	0.427	0.803	0.769	0.458	0.753
630	1.099	0.566	1.74	1.577	0.831	1.232
800	1.628	0.666	1.521	1.46	0.525	1.568
1000	1.63	0.869	1.638	1.626	0.667	1.941
1250	3.051	1.724	1.382	2.801	1.147	2.389
ahw	**1.859**	**2.785**	**1.813**	**2.0**	**2.9**	**1.9**
av		**3.8**			**4.0**	







MainID: 1362, ResultsID: 9920

LocationName:

Occupation: Grounds maintenance
Process: Grass Cutting
RecordDate: September 30, 2010

TapeNumber: N/A
Operator#: OP#1
Up and down with tight turn at far end
VideoNumber: N/A

Notes: 30mm cut

DC-shift threshold: 10 mm

MachineManufacturer:
MachineModel:

HSLAnonymisedToolLetter: Machine A

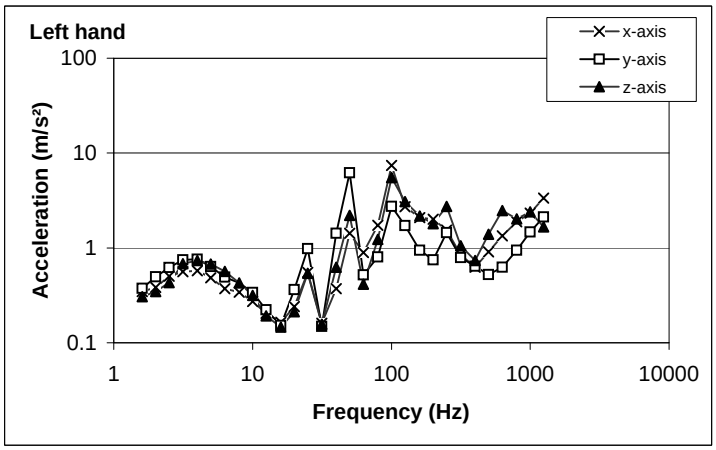
MachineModifications:
MachineSize: 530mm cutting width
MachineWeight(kg):
MachineOperating pressure:
MachineSpeed(impacts/min):
MachineSpeed(revs/min):
MachinePower:
MachinePower source: Unleaded petrol

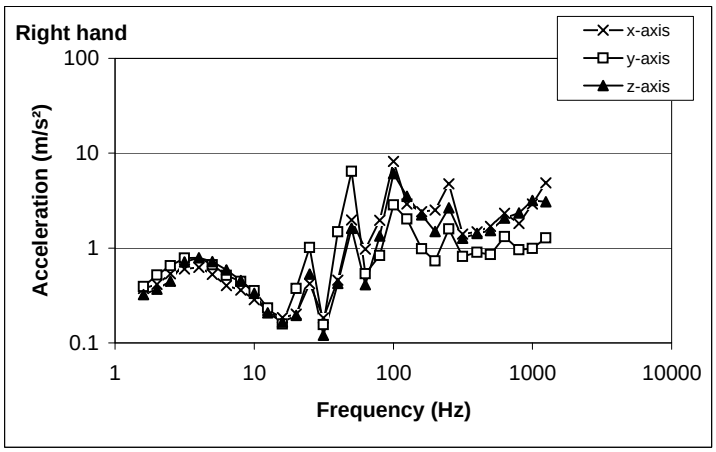
MainID: 1362
ResultsID: 9921

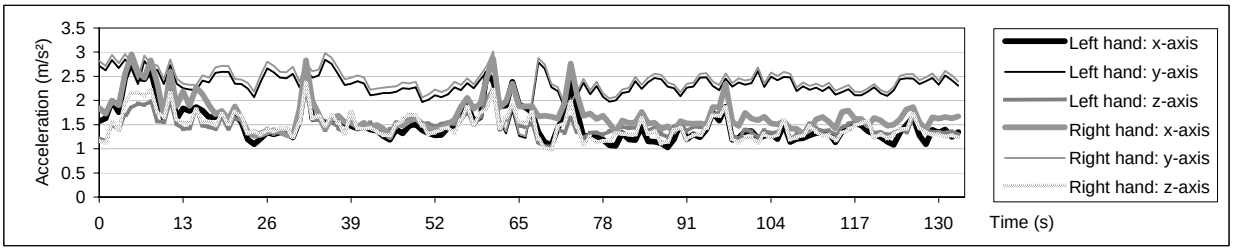
MeasurementTime: 134.25 Seconds
NumShotsInMeas:
DailyExposureTime:

InsertedTool:
InsertedToolType:
A(8) Left hand m/s²
InsertedToolManufacturer:

	Left hand			Right hand		
Frequency	x-axis	y-axis	z-axis	x-axis	y-axis	z-axis
1.6	0.347	0.376	0.306	0.374	0.394	0.323
2	0.385	0.496	0.347	0.415	0.519	0.37
2.5	0.505	0.623	0.43	0.537	0.652	0.448
3.15	0.56	0.751	0.679	0.602	0.784	0.716
4	0.575	0.762	0.735	0.626	0.793	0.788
5	0.484	0.637	0.677	0.528	0.664	0.718
6.3	0.372	0.492	0.565	0.402	0.515	0.59
8	0.342	0.426	0.428	0.362	0.446	0.456
10	0.272	0.339	0.316	0.285	0.355	0.333
12.5	0.204	0.223	0.192	0.221	0.233	0.208
16	0.165	0.152	0.147	0.185	0.159	0.166
20	0.24	0.362	0.213	0.202	0.375	0.196
25	0.552	0.982	0.539	0.421	1.015	0.53
31.5	0.161	0.149	0.157	0.184	0.156	0.12
40	0.371	1.422	0.626	0.46	1.478	0.424
50	1.427	6.171	2.203	1.971	6.414	1.614
63	0.895	0.52	0.414	0.971	0.537	0.412
80	1.735	0.8	1.227	1.96	0.832	1.336
100	7.411	2.74	5.492	8.182	2.85	6.113
125	2.718	1.713	3.088	2.905	2.027	3.504
160	2.09	0.948	2.172	2.411	0.982	2.243
200	2	0.746	1.805	2.516	0.734	1.494
250	1.538	1.453	2.74	4.764	1.59	2.66
315	0.847	0.792	1.05	1.406	0.813	1.269
400	0.625	0.641	0.734	1.485	0.902	1.421
500	0.912	0.524	1.396	1.687	0.853	1.525
630	1.338	0.625	2.476	2.317	1.315	2.069
800	1.879	0.944	2.021	1.818	0.959	2.343
1000	2.33	1.471	2.404	2.914	0.992	3.175
1250	3.341	2.123	1.66	4.866	1.279	3.086
ahw	**1.622**	**2.415**	**1.594**	**1.8**	**2.5**	**1.6**
av		**3.3**			**3.5**	



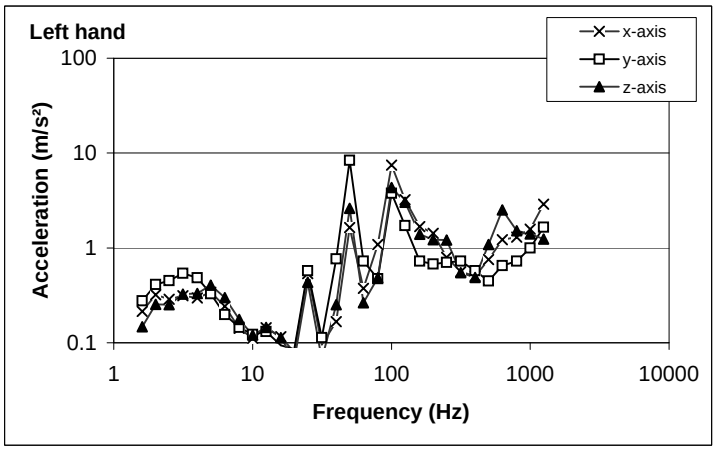


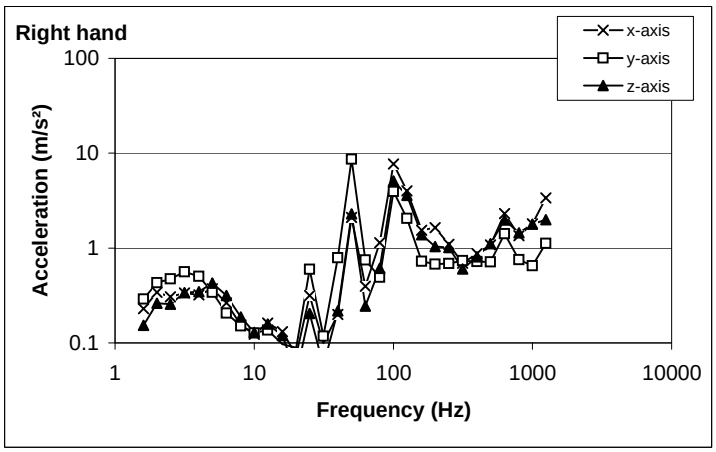


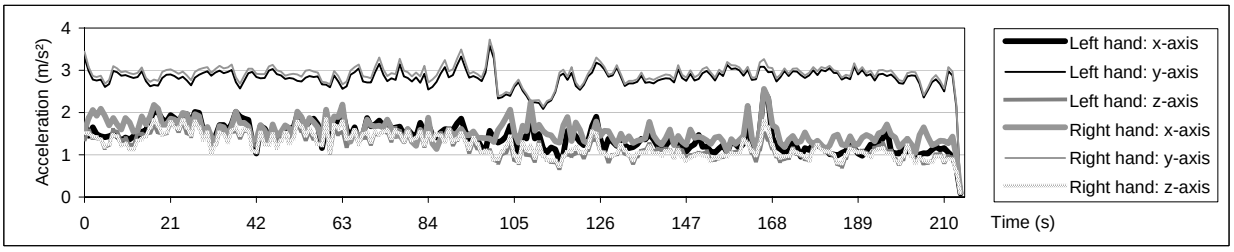
MainID: 1362, ResultsID: 9921

LocationName:		MachineManufacturer:	
		MachineModel:	
Occupation:	Grounds maintenance		HSLAnonymisedToolLetter: Machine A
Process:	Grass Cutting	MachineModifications:	
RecordDate:	September 30, 2010	MachineSize: 530mm cutting width	MainID: 1362
		MachineWeight(kg):	ResultsID: 9922
TapeNumber:	N/A	MachineOperating pressure:	
Operator#:	OP#2	MachineSpeed(impacts/min):	
	Up and down with tight turn at far end	MachineSpeed(revs/min):	
VideoNumber:	N/A	MachinePower:	
		MachinePower source: Unleaded petrol	MeasurementTime: 200 Seconds
Notes:	41mm cut		NumShotsInMeas:
		InsertedTool:	DailyExposureTime:
DC-shift threshold:	*10 mm*	InsertedToolType:	A(8) Left hand m/s²
		InsertedToolManufacturer:	

	Left hand			Right hand		
Frequency	x-axis	y-axis	z-axis	x-axis	y-axis	z-axis
1.6	0.215	0.278	0.147	0.229	0.29	0.153
2	0.321	0.413	0.254	0.342	0.431	0.263
2.5	0.287	0.453	0.252	0.306	0.475	0.257
3.15	0.313	0.538	0.325	0.337	0.561	0.34
4	0.298	0.484	0.331	0.321	0.504	0.346
5	0.342	0.328	0.405	0.371	0.34	0.427
6.3	0.243	0.198	0.299	0.265	0.206	0.316
8	0.141	0.145	0.177	0.155	0.151	0.188
10	0.112	0.122	0.121	0.124	0.127	0.129
12.5	0.144	0.131	0.145	0.162	0.136	0.158
16	0.116	0.094	0.113	0.131	0.097	0.12
20	0.079	0.086	0.065	0.074	0.089	0.047
25	0.535	0.575	0.433	0.316	0.597	0.205
31.5	0.096	0.114	0.067	0.1	0.118	0.058
40	0.167	0.764	0.252	0.199	0.788	0.217
50	1.645	8.379	2.61	2.104	8.639	2.291
63	0.374	0.724	0.263	0.397	0.745	0.245
80	1.084	0.472	0.484	1.14	0.491	0.612
100	7.476	3.778	4.34	7.705	3.957	5.114
125	3.22	1.72	3.023	4.002	2.059	3.6
160	1.68	0.727	1.393	1.539	0.726	1.383
200	1.427	0.676	1.217	1.635	0.677	1.04
250	0.797	0.701	1.212	1.097	0.686	1.012
315	0.561	0.723	0.548	0.692	0.737	0.602
400	0.504	0.574	0.488	0.873	0.717	0.808
500	0.754	0.449	1.083	1.082	0.714	1.114
630	1.219	0.651	2.519	2.3	1.415	1.974
800	1.296	0.725	1.512	1.35	0.753	1.452
1000	1.58	0.998	1.4	1.794	0.648	1.782
1250	2.882	1.651	1.235	3.387	1.125	1.996
ahw	**1.506**	**2.875**	**1.298**	**1.6**	**3.0**	**1.3**
av		**3.5**			**3.6**	







MainID: 1362, ResultsID: 9922

LocationName:

Occupation: Grounds maintenance
Process: Grass Cutting
RecordDate: September 30, 2010

TapeNumber: N/A
Operator#: OP#3
Up and down with tight turn at far end
VideoNumber: N/A

Notes: 41mm cut

DC-shift threshold: 10 mm

MachineManufacturer:
MachineModel:

HSLAnonymisedToolLetter: Machine A

MachineModifications:
MachineSize: 530mm cutting width
MachineWeight(kg):
MachineOperating pressure:
MachineSpeed(impacts/min):
MachineSpeed(revs/min):
MachinePower:
MachinePower source: Unleaded petrol

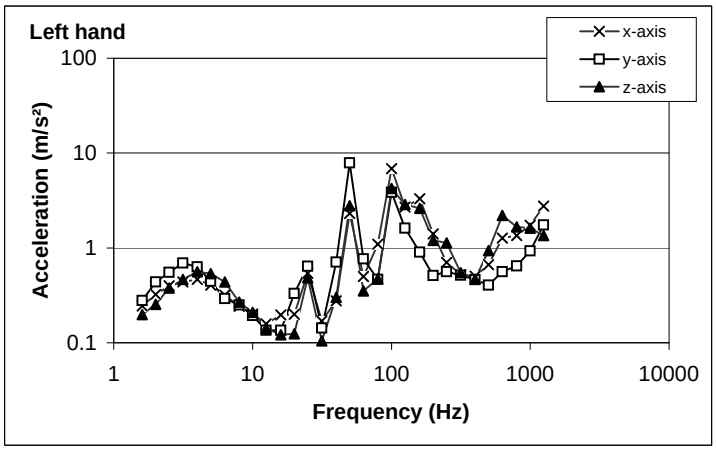
MainID: 1362
ResultsID: 9923

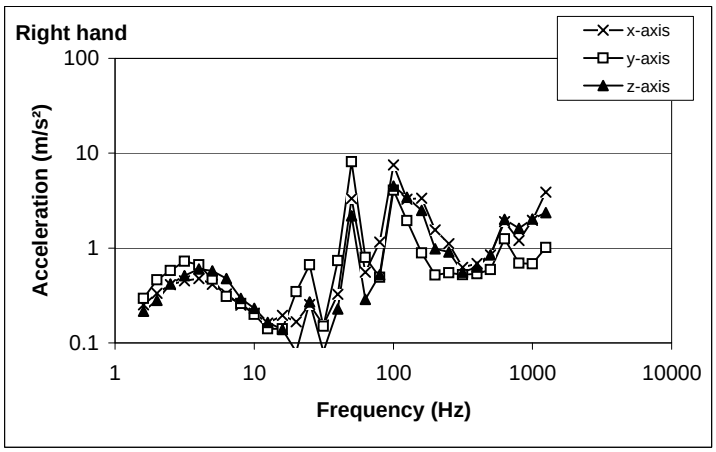
MeasurementTime: 187.5 Seconds
NumShotsInMeas:
DailyExposureTime:

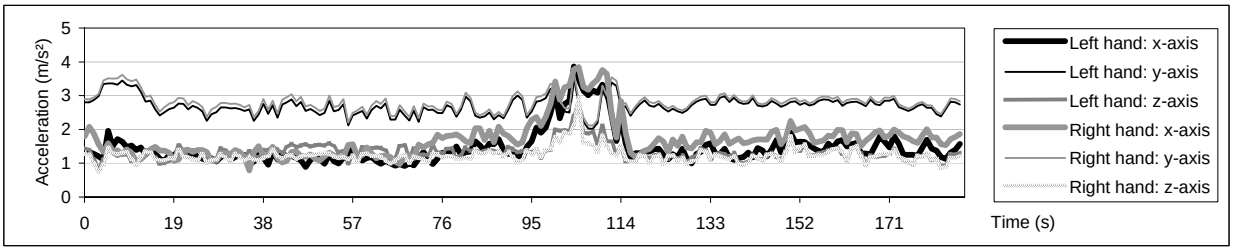
InsertedTool:
InsertedToolType:
InsertedToolManufacturer:

A(8) Left hand m/s²

	Left hand			Right hand		
Frequency	x-axis	y-axis	z-axis	x-axis	y-axis	z-axis
1.6	0.245	0.279	0.198	0.253	0.295	0.216
2	0.323	0.439	0.255	0.334	0.461	0.282
2.5	0.398	0.555	0.378	0.413	0.581	0.418
3.15	0.438	0.69	0.467	0.451	0.724	0.511
4	0.467	0.631	0.561	0.475	0.664	0.604
5	0.406	0.445	0.535	0.413	0.468	0.575
6.3	0.318	0.292	0.438	0.329	0.308	0.477
8	0.242	0.25	0.269	0.25	0.261	0.294
10	0.202	0.193	0.209	0.206	0.2	0.232
12.5	0.158	0.136	0.142	0.161	0.141	0.164
16	0.197	0.136	0.121	0.196	0.141	0.139
20	0.199	0.332	0.124	0.166	0.346	0.08
25	0.538	0.642	0.486	0.254	0.668	0.271
31.5	0.169	0.143	0.105	0.155	0.15	0.081
40	0.278	0.71	0.301	0.327	0.738	0.228
50	2.302	7.862	2.792	3.33	8.156	2.187
63	0.5	0.764	0.353	0.557	0.794	0.288
80	1.095	0.467	0.472	1.159	0.49	0.522
100	6.831	3.87	4.245	7.52	4.067	4.511
125	2.7	1.612	2.874	3.272	1.949	3.432
160	3.307	0.902	2.609	3.344	0.887	2.494
200	1.399	0.511	1.201	1.556	0.52	0.982
250	0.705	0.562	1.131	1.11	0.546	0.908
315	0.524	0.515	0.548	0.626	0.522	0.556
400	0.504	0.463	0.471	0.689	0.536	0.632
500	0.668	0.406	0.937	0.846	0.592	0.849
630	1.271	0.562	2.21	1.895	1.249	2.002
800	1.35	0.647	1.665	1.204	0.69	1.621
1000	1.735	0.928	1.609	1.958	0.682	2.025
1250	2.768	1.742	1.348	3.884	1.011	2.369
ahw	**1.587**	**2.763**	**1.422**	**1.8**	**2.9**	**1.3**
av		**3.5**			**3.7**	







MainID: 1362, ResultsID: 9923

LocationName:

Occupation: Grounds maintenance
Process: Grass Cutting
RecordDate: September 30, 2010

TapeNumber: N/A
Operator#: OP#1
Cutting in circle on incline
VideoNumber: N/A

Notes: 30mm cut

DC-shift threshold: 10 mm

MachineManufacturer:
MachineModel:

HSLAnonymisedToolLetter: Machine A

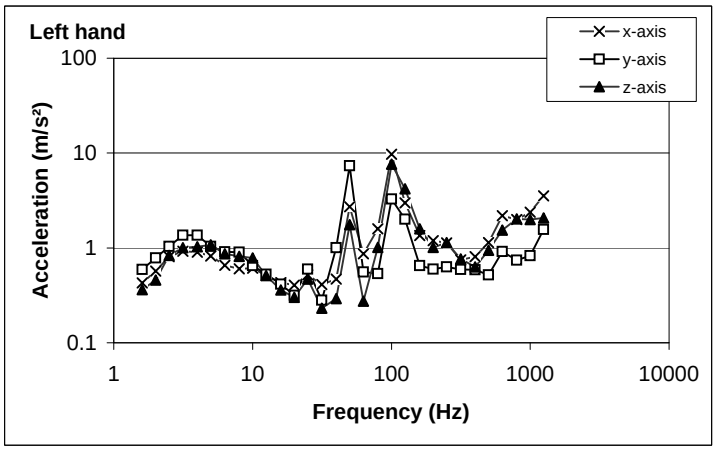
MachineModifications:
MachineSize: 530mm cutting width
MachineWeight(kg):
MachineOperating pressure:
MachineSpeed(impacts/min):
MachineSpeed(revs/min):
MachinePower:
MachinePower source: Unleaded petrol

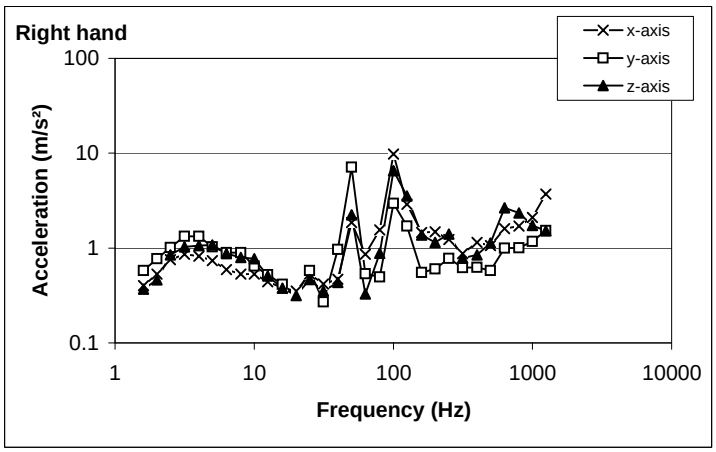
MainID: 1363
ResultsID: 9924

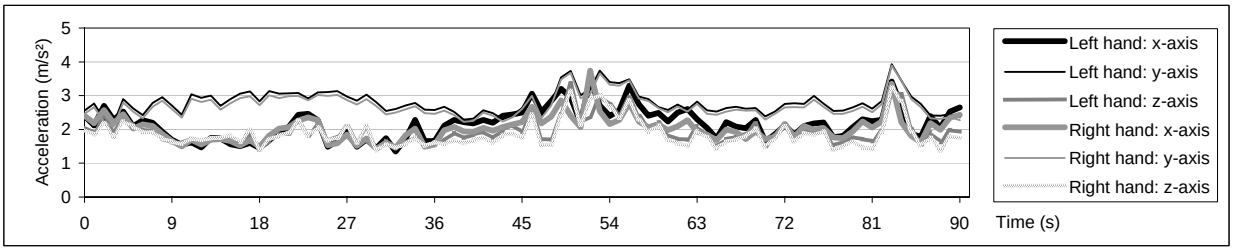
MeasurementTime: 91.75 Seconds
NumShotsInMeas:
DailyExposureTime:
A(8) Left hand m/s²

InsertedTool:
InsertedToolType:
InsertedToolManufacturer:

	Left hand			Right hand		
Frequency	x-axis	y-axis	z-axis	x-axis	y-axis	z-axis
1.6	0.428	0.591	0.363	0.402	0.581	0.37
2	0.572	0.785	0.46	0.531	0.772	0.463
2.5	0.811	1.034	0.832	0.754	1.013	0.848
3.15	0.921	1.362	1.002	0.86	1.326	1.03
4	0.903	1.364	1.033	0.824	1.334	1.063
5	0.823	1.04	1.08	0.735	1.027	1.08
6.3	0.654	0.91	0.865	0.592	0.895	0.873
8	0.603	0.905	0.816	0.533	0.892	0.798
10	0.612	0.651	0.783	0.532	0.648	0.773
12.5	0.51	0.526	0.509	0.44	0.524	0.506
16	0.429	0.414	0.361	0.38	0.414	0.378
20	0.404	0.315	0.301	0.352	0.316	0.315
25	0.521	0.599	0.47	0.533	0.578	0.464
31.5	0.412	0.282	0.232	0.419	0.271	0.351
40	0.47	1.004	0.291	0.469	0.967	0.435
50	2.727	7.337	1.762	1.861	7.099	2.233
63	0.864	0.557	0.274	0.858	0.535	0.329
80	1.595	0.537	1.015	1.559	0.495	0.88
100	9.721	3.266	7.641	9.8	2.971	6.531
125	2.995	2.014	4.184	2.884	1.701	3.539
160	1.348	0.65	1.59	1.462	0.552	1.371
200	1.19	0.596	1.017	1.487	0.601	1.147
250	1.13	0.629	1.134	1.228	0.777	1.405
315	0.748	0.59	0.763	0.877	0.623	0.786
400	0.811	0.589	0.631	1.149	0.627	0.844
500	1.135	0.518	0.942	1.063	0.578	1.131
630	2.181	0.913	1.541	1.597	0.994	2.662
800	1.992	0.74	2.02	1.709	1.003	2.34
1000	2.381	0.829	1.997	2.107	1.177	1.73
1250	3.534	1.565	2.074	3.713	1.526	1.521
ahw	**2.337**	**3.003**	**2.18**	**2.2**	**2.9**	**2.1**
av		**4.4**			**4.2**	







MainID: 1363, ResultsID: 9924

LocationName:

Occupation: Grounds maintenance
Process: Grass Cutting
RecordDate: September 30, 2010

TapeNumber: N/A
Operator#: OP#2
Cutting in circle on incline
VideoNumber: N/A

Notes: 30mm cut

DC-shift threshold: 10 mm

MachineManufacturer:
MachineModel:

HSLAnonymisedToolLetter: Machine A

MachineModifications:
MachineSize: 530mm cutting width
MachineWeight(kg):
MachineOperating pressure:
MachineSpeed(impacts/min):
MachineSpeed(revs/min):
MachinePower:
MachinePower source: Unleaded petrol

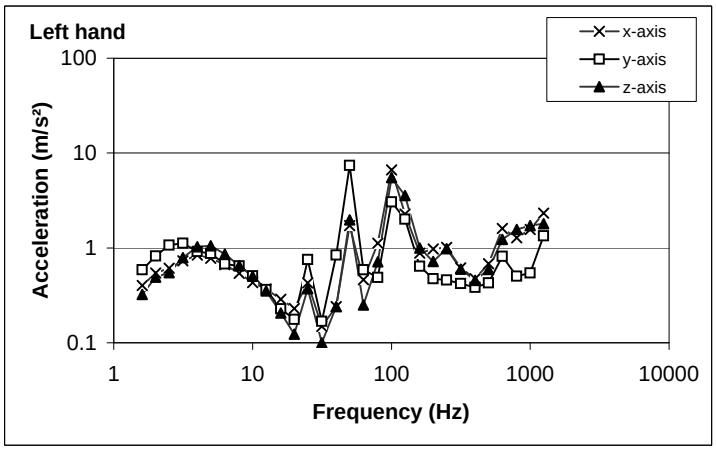
MainID: 1363
ResultsID: 9925

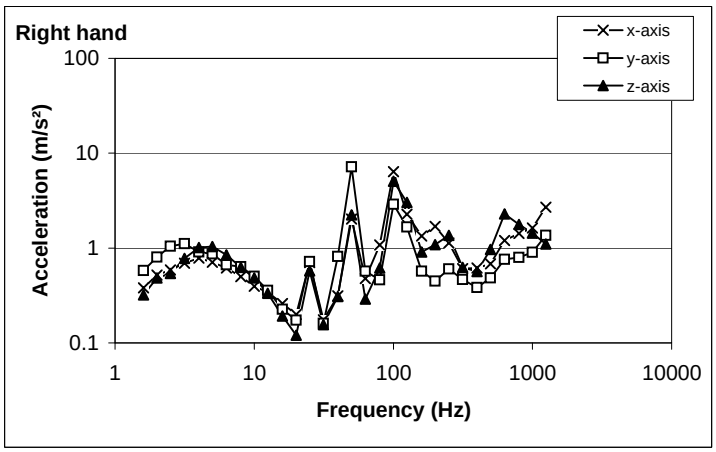
MeasurementTime: 96.25 Seconds
NumShotsInMeas:
DailyExposureTime:

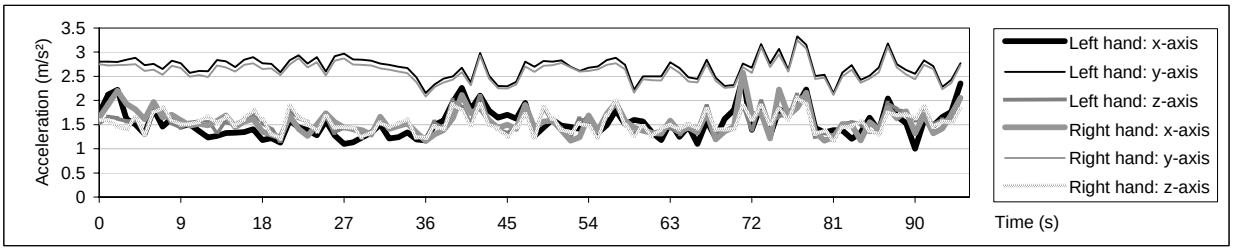
InsertedTool:
InsertedToolType:
InsertedToolManufacturer:

A(8) Left hand m/s²

	Left hand			Right hand		
Frequency	x-axis	y-axis	z-axis	x-axis	y-axis	z-axis
1.6	0.402	0.59	0.324	0.379	0.58	0.321
2	0.544	0.818	0.492	0.519	0.804	0.486
2.5	0.611	1.067	0.546	0.586	1.043	0.542
3.15	0.729	1.125	0.788	0.691	1.108	0.776
4	0.839	0.916	1.027	0.785	0.909	1.01
5	0.777	0.875	1.054	0.709	0.869	1.033
6.3	0.664	0.676	0.857	0.618	0.665	0.846
8	0.541	0.644	0.652	0.498	0.638	0.625
10	0.432	0.507	0.505	0.395	0.502	0.483
12.5	0.37	0.362	0.352	0.342	0.359	0.334
16	0.289	0.228	0.205	0.26	0.226	0.192
20	0.23	0.177	0.123	0.2	0.174	0.12
25	0.427	0.755	0.372	0.701	0.721	0.573
31.5	0.148	0.169	0.1	0.175	0.161	0.156
40	0.241	0.84	0.241	0.314	0.812	0.31
50	1.716	7.414	1.969	2.019	7.192	2.236
63	0.462	0.586	0.251	0.476	0.568	0.29
80	1.119	0.489	0.713	1.076	0.461	0.615
100	6.629	3.061	5.515	6.404	2.9	5.079
125	2.275	2.013	3.56	2.269	1.663	3.041
160	0.883	0.642	1.001	1.344	0.571	0.91
200	0.978	0.474	0.72	1.689	0.449	1.09
250	1.012	0.459	0.978	1.127	0.603	1.361
315	0.615	0.423	0.599	0.605	0.464	0.626
400	0.471	0.384	0.456	0.617	0.383	0.568
500	0.68	0.429	0.591	0.684	0.484	0.964
630	1.608	0.814	1.23	1.203	0.762	2.289
800	1.282	0.502	1.563	1.426	0.798	1.768
1000	1.563	0.543	1.718	1.632	0.899	1.436
1250	2.329	1.339	1.801	2.696	1.362	1.107
ahw	**1.696**	**2.816**	**1.771**	**1.7**	**2.7**	**1.8**
av		**3.7**			**3.7**	



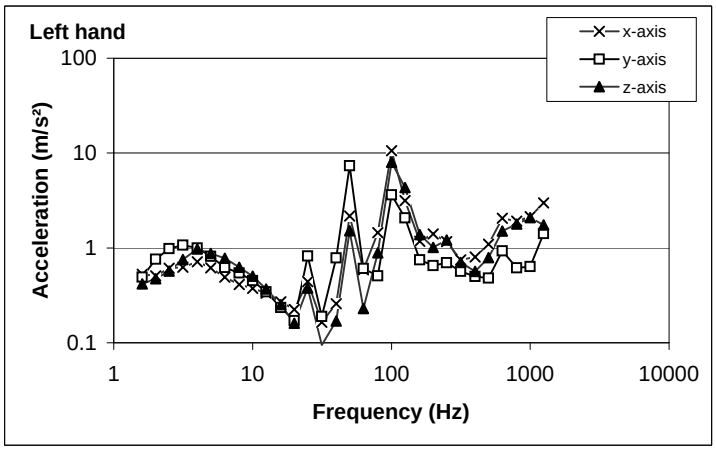


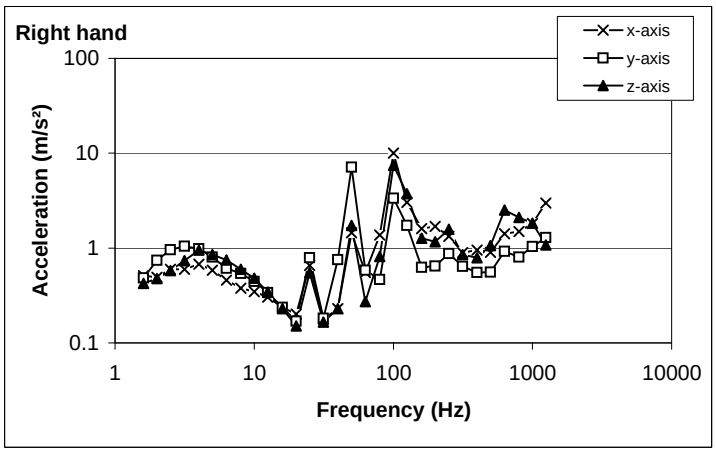


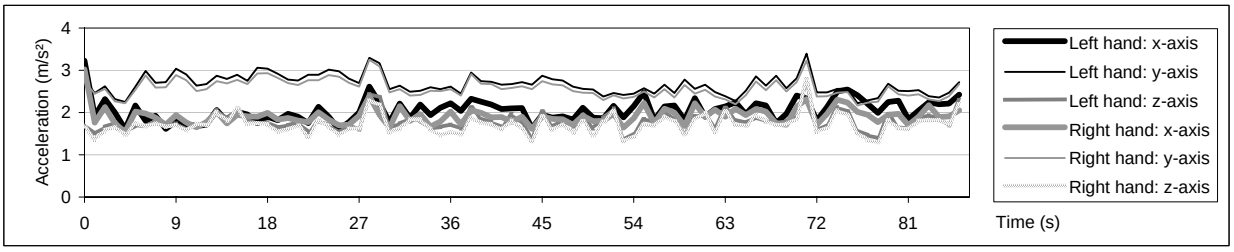
MainID: 1363, ResultsID: 9925

LocationName:		MachineManufacturer:	
		MachineModel:	
Occupation:	Grounds maintenance		HSLAnonymisedToolLetter: Machine A
Process:	Grass Cutting	MachineModifications:	
RecordDate:	September 30, 2010	MachineSize: 530mm cutting width	MainID: 1363
		MachineWeight(kg):	ResultsID: 9926
TapeNumber:	N/A	MachineOperating pressure:	
Operator#:	OP#3	MachineSpeed(impacts/min):	
	Cutting in circle on incline	MachineSpeed(revs/min):	
VideoNumber:	N/A	MachinePower:	
		MachinePower source: Unleaded petrol	MeasurementTime: 87.75 Seconds
Notes:	30mm cut		NumShotsInMeas:
		InsertedTool:	DailyExposureTime:
DC-shift threshold:	*10 mm*	InsertedToolType:	A(8) Left hand m/s²
		InsertedToolManufacturer:	

	Left hand			Right hand		
Frequency	x-axis	y-axis	z-axis	x-axis	y-axis	z-axis
1.6	0.526	0.493	0.419	0.509	0.483	0.424
2	0.507	0.761	0.473	0.492	0.744	0.478
2.5	0.611	0.983	0.571	0.598	0.957	0.578
3.15	0.628	1.066	0.752	0.596	1.049	0.737
4	0.714	0.995	0.977	0.677	0.982	0.952
5	0.615	0.816	0.873	0.581	0.802	0.855
6.3	0.493	0.62	0.776	0.46	0.612	0.747
8	0.411	0.545	0.626	0.378	0.539	0.599
10	0.374	0.453	0.502	0.347	0.446	0.479
12.5	0.332	0.343	0.37	0.303	0.34	0.344
16	0.27	0.236	0.252	0.237	0.236	0.23
20	0.224	0.171	0.16	0.201	0.17	0.151
25	0.442	0.821	0.378	0.657	0.79	0.547
31.5	0.165	0.189	0.094	0.178	0.182	0.165
40	0.257	0.781	0.17	0.229	0.753	0.23
50	2.178	7.359	1.521	1.445	7.114	1.738
63	0.586	0.605	0.229	0.554	0.584	0.273
80	1.445	0.507	0.887	1.372	0.465	0.813
100	10.6	3.629	8.023	10.04	3.348	7.444
125	3.155	2.068	4.322	3.024	1.738	3.751
160	1.179	0.745	1.387	1.597	0.627	1.266
200	1.409	0.652	1.01	1.691	0.648	1.166
250	1.169	0.697	1.214	1.33	0.872	1.582
315	0.748	0.567	0.706	0.896	0.638	0.852
400	0.804	0.499	0.567	0.954	0.554	0.788
500	1.095	0.48	0.788	0.903	0.558	1.065
630	2.062	0.93	1.505	1.417	0.924	2.52
800	1.911	0.616	1.781	1.493	0.801	2.107
1000	2.138	0.636	2.09	1.81	1.04	1.822
1250	2.985	1.417	1.742	2.995	1.284	1.076
ahw	**2.142**	**2.788**	**1.944**	**2.0**	**2.7**	**1.9**
av		**4.0**			**3.8**	



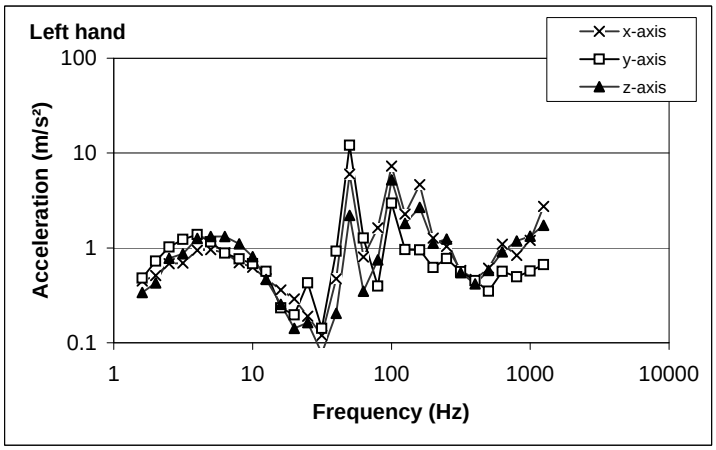


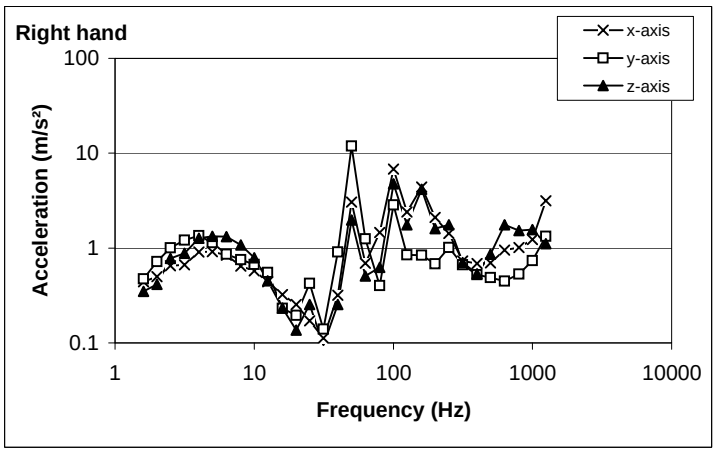


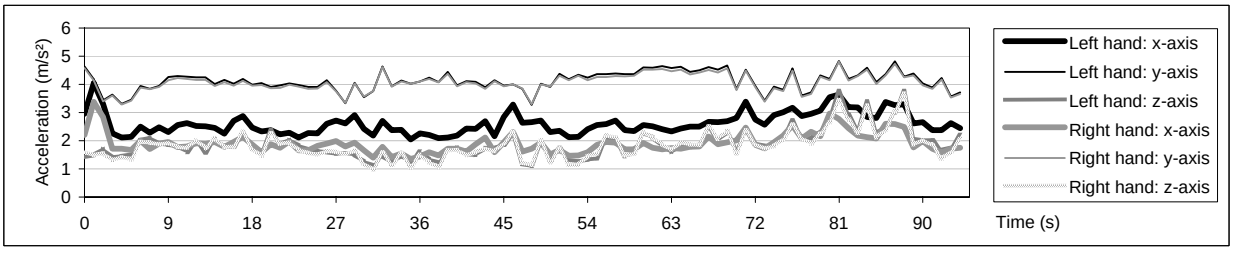
MainID: 1363, ResultsID: 9926

LocationName:		MachineManufacturer:	
		MachineModel:	
Occupation:	Grounds maintenance		HSLAnonymisedToolLetter: Machine A
Process:	Grass Cutting	MachineModifications:	
RecordDate:	September 30, 2010	MachineSize: 530mm cutting width	MainID: 1364
		MachineWeight(kg):	ResultsID: 9927
TapeNumber:	N/A	MachineOperating pressure:	
Operator#:	OP#2	MachineSpeed(impacts/min):	
	Cutting in figure of 8 on mock putting green prepa	MachineSpeed(revs/min):	
VideoNumber:	N/A	MachinePower:	
		MachinePower source: Unleaded petrol	MeasurementTime: 95.25 Seconds
Notes:	30mm cut		NumShotsInMeas:
		InsertedTool:	DailyExposureTime:
DC-shift threshold:	*10 mm*	InsertedToolType:	A(8) Left hand m/s²
		InsertedToolManufacturer:	

	Left hand			Right hand		
Frequency	x-axis	y-axis	z-axis	x-axis	y-axis	z-axis
1.6	0.449	0.482	0.338	0.441	0.473	0.348
2	0.511	0.728	0.426	0.501	0.717	0.414
2.5	0.683	1.023	0.775	0.653	1.006	0.779
3.15	0.692	1.229	0.869	0.668	1.209	0.883
4	0.944	1.379	1.259	0.909	1.354	1.269
5	0.962	1.153	1.321	0.913	1.135	1.325
6.3	0.889	0.878	1.318	0.839	0.863	1.316
8	0.7	0.766	1.103	0.646	0.757	1.081
10	0.624	0.682	0.811	0.575	0.672	0.791
12.5	0.475	0.564	0.465	0.44	0.554	0.453
16	0.362	0.233	0.254	0.323	0.232	0.233
20	0.29	0.197	0.142	0.254	0.195	0.137
25	0.19	0.429	0.163	0.171	0.423	0.253
31.5	0.12	0.142	0.077	0.112	0.14	0.095
40	0.473	0.921	0.204	0.319	0.908	0.253
50	6.007	12.05	2.197	3.053	11.91	1.981
63	0.805	1.272	0.348	0.691	1.254	0.509
80	1.622	0.397	0.747	1.454	0.4	0.626
100	7.288	2.954	5.24	6.785	2.846	4.761
125	2.266	0.958	1.813	2.394	0.844	1.765
160	4.643	0.953	2.686	4.394	0.843	4.163
200	1.271	0.619	1.12	2.097	0.683	1.6
250	1.034	0.772	1.239	1.431	1.017	1.762
315	0.577	0.56	0.548	0.73	0.668	0.702
400	0.466	0.451	0.418	0.685	0.522	0.537
500	0.609	0.351	0.581	0.698	0.486	0.861
630	1.093	0.566	0.907	0.952	0.449	1.761
800	0.832	0.495	1.184	1.014	0.532	1.531
1000	1.199	0.572	1.335	1.229	0.735	1.56
1250	2.744	0.666	1.726	3.141	1.33	1.115
ahw	**2.764**	**4.277**	**2.217**	**2.1**	**4.2**	**2.2**
av		**5.6**			**5.2**	



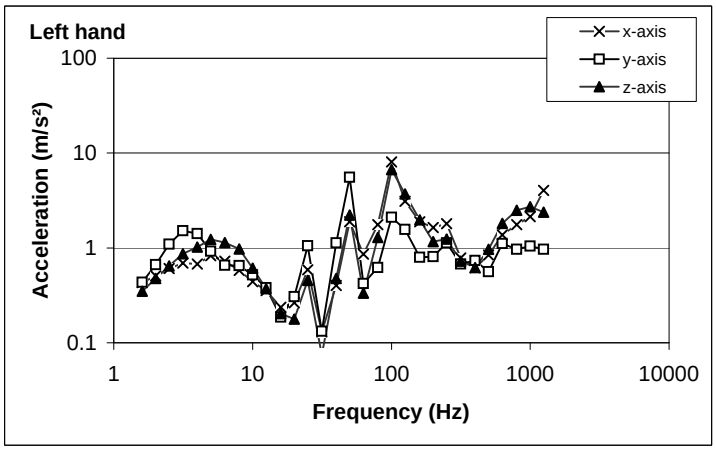


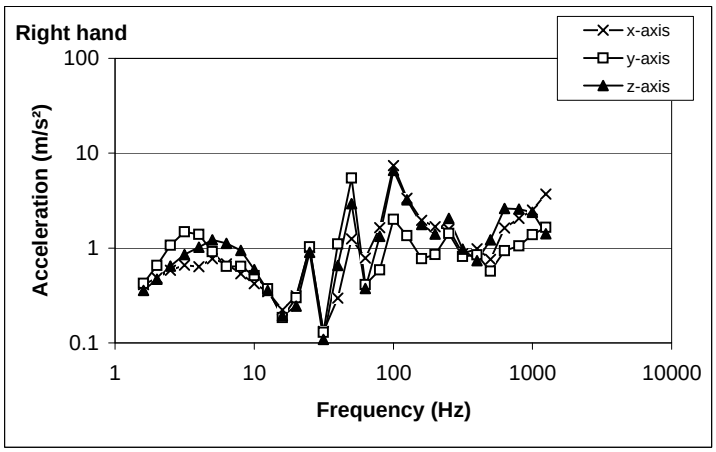


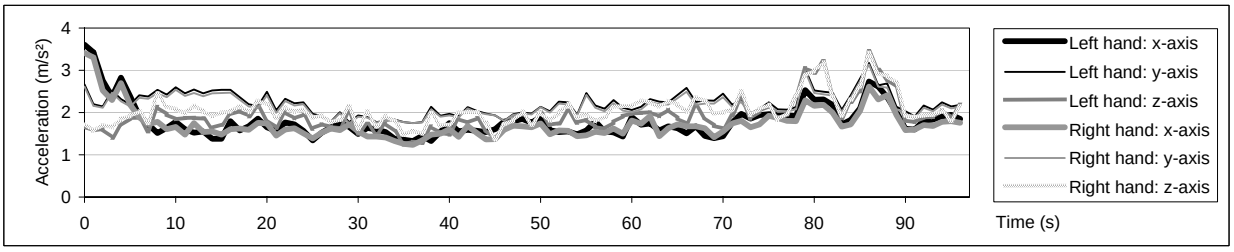
MainID: 1364, ResultsID: 9927

LocationName:		MachineManufacturer:			
		MachineModel:			
Occupation:	Grounds maintenance			HSLAnonymisedToolLetter:	Machine A
Process:	Grass Cutting	MachineModifications:			
RecordDate:	September 30, 2010	MachineSize:	530mm cutting width	MainID:	1364
		MachineWeight(kg):		ResultsID:	9928
TapeNumber:	N/A	MachineOperating pressure:			
Operator#:	OP#3	MachineSpeed(impacts/min):			
	Cutting in figure of 8 on mock putting green prepa	MachineSpeed(revs/min):			
VideoNumber:	N/A	MachinePower:			
		MachinePower source:	Unleaded petrol	MeasurementTime:	97.5 Seconds
Notes:	30mm cut			NumShotsInMeas:	
		InsertedTool:		DailyExposureTime:	
DC-shift threshold:	*10 mm*	InsertedToolType:		A(8) Left hand	m/s²
		InsertedToolManufacturer:			

	Left hand			Right hand		
Frequency	x-axis	y-axis	z-axis	x-axis	y-axis	z-axis
1.6	0.43	0.434	0.35	0.411	0.424	0.356
2	0.506	0.668	0.475	0.483	0.656	0.471
2.5	0.607	1.094	0.643	0.582	1.072	0.646
3.15	0.693	1.513	0.866	0.66	1.484	0.855
4	0.676	1.42	1.021	0.638	1.393	1.018
5	0.828	0.925	1.228	0.772	0.913	1.218
6.3	0.723	0.658	1.138	0.683	0.642	1.124
8	0.58	0.649	0.976	0.537	0.638	0.948
10	0.44	0.52	0.609	0.421	0.51	0.591
12.5	0.356	0.38	0.373	0.347	0.373	0.359
16	0.236	0.186	0.203	0.223	0.185	0.193
20	0.264	0.305	0.178	0.313	0.3	0.244
25	0.586	1.05	0.455	1.013	1.027	0.902
31.5	0.13	0.132	0.075	0.132	0.129	0.109
40	0.401	1.132	0.478	0.297	1.105	0.654
50	1.886	5.569	2.215	1.248	5.45	2.94
63	0.858	0.421	0.333	0.787	0.411	0.375
80	1.755	0.622	1.293	1.639	0.586	1.325
100	8.064	2.1	6.676	7.411	2.013	6.572
125	3.097	1.565	3.694	3.348	1.348	3.229
160	1.879	0.795	1.976	1.968	0.77	1.768
200	1.641	0.808	1.162	1.68	0.851	1.399
250	1.798	1.129	1.239	1.574	1.423	2.057
315	0.785	0.677	0.728	0.876	0.813	0.976
400	0.615	0.734	0.621	0.981	0.849	0.737
500	0.841	0.559	0.967	0.761	0.568	1.222
630	1.377	1.11	1.817	1.621	0.94	2.604
800	1.761	0.963	2.495	2.051	1.057	2.577
1000	2.13	1.045	2.726	2.512	1.383	2.376
1250	4.048	0.969	2.386	3.706	1.65	1.418
ahw	**1.96**	**2.423**	**2.174**	**1.9**	**2.4**	**2.3**
av		**3.8**			**3.8**	







MainID: 1364, ResultsID: 9928

Vibration Emission Test report

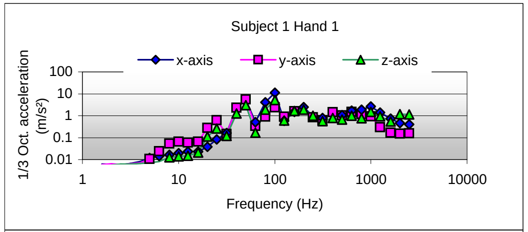
Pulse file version: HAV Emission V2.1.2 2008-07-25.pls
Sprreadsheet: Version 2.0 22/8/2008

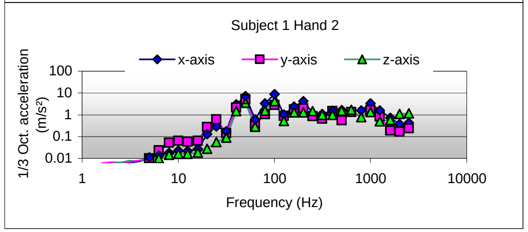
Standard: BS EN 836:1997
N&V reference ID: NV/10/09
Measurement file name: Machine B

					Hand Position 1 - Left hand							Hand position 2 - Right hand						
									Operator Statistics							Operator Statistics		
TestNo.	Operator	Meas. Name	Meas. Date	Meas Time	a_{whx}	a_{why}	a_{whz}	a_{hv}	Mean a_{hv}	S_{n-1}	C_v	a_{whx}	a_{why}	a_{whz}	a_{hv}	Mean a_{hv}	S_{n-1}	C_v
1	1	SH01	30/07/2010	13:21:39:249	2.75	2.20	1.48	3.82	3.82	0.169	0.044	3.22	2.08	1.65	4.17	4.03	0.114	0.028
2	1	SH02	30/07/2010	13:22:30:499	2.58	1.93	1.43	3.53				3.01	1.81	1.60	3.86			
3	1	SH03	30/07/2010	13:23:17:624	2.82	2.14	1.52	3.86				3.15	2.04	1.60	4.08			
4	1	SH04	30/07/2010	13:24:31:623	2.93	2.18	1.52	3.95				3.15	2.12	1.40	4.05			
5	1	SH05	30/07/2010	13:25:22:374	2.90	2.20	1.49	3.93				3.09	2.15	1.39	4.01			

	Hand Position 1 - Left hand			Hand position 2 - Right hand		
	a_h (overall mean a_{hv}) :	3.82	m/s²	a_h (overall mean a_{hv}):	4.03	m/s²
	$\sigma_{R(single\ m/c.)}$:	0.17	m/s²	$\sigma_{R(single\ m/c.)}$:	0.11	m/s²
	$K_{(single\ m/c.)}$ value:	0.28	m/s²	$K_{(single\ m/c.)}$ value:	0.19	m/s²

Single machine emission a_{hd} (= greatest a_h value)**:** **4.03 m/s²** **$K_{(single\ m/c.)}$ value: 0.19 m/s²**





LocationName:

Occupation: Grounds maintenance
Process: Grass Cutting
RecordDate: September 30, 2010

TapeNumber: N/A
Operator#: OP#1
Up and down with tight turn at far end
VideoNumber: N/A

Notes: 38mm cut

DC-shift threshold: 10 mm

MachineManufacturer:
MachineModel:

HSLAnonymisedToolLetter: Machine B

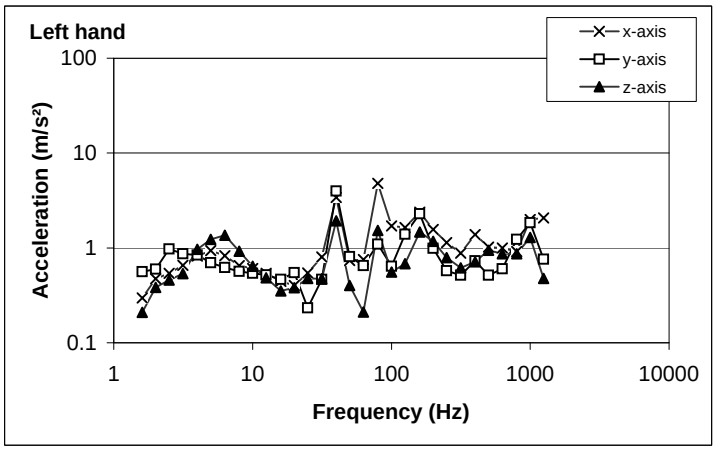
MachineModifications:
MachineSize: 560mm cutting width
MachineWeight(kg): 53
MachineOperating pressure:
MachineSpeed(impacts/min):
MachineSpeed(revs/min):
MachinePower:
MachinePower source: Unleaded petrol

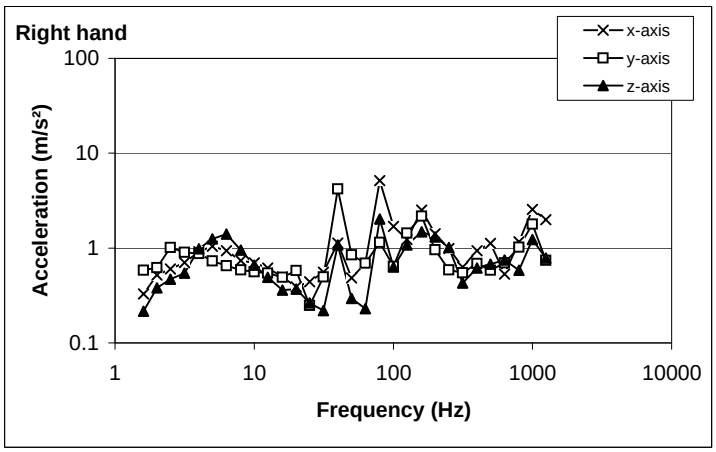
MainID: 1365
ResultsID: 9929

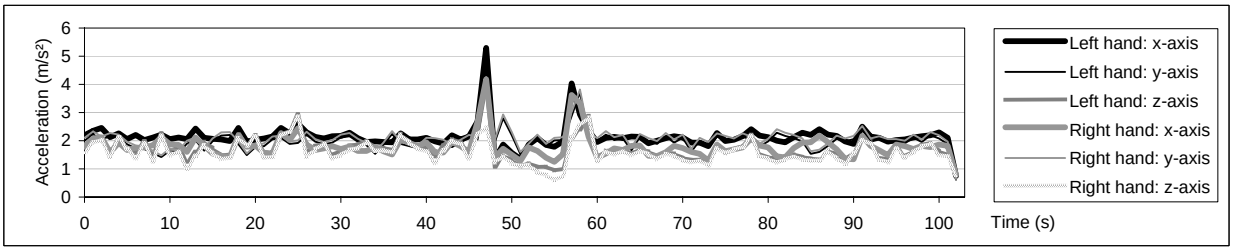
MeasurementTime: 102.75 Seconds
NumShotsInMeas:
DailyExposureTime:
A(8) Left hand m/s²

InsertedTool:
InsertedToolType:
InsertedToolManufacturer:

	Left hand			Right hand		
Frequency	x-axis	y-axis	z-axis	x-axis	y-axis	z-axis
1.6	0.297	0.56	0.209	0.329	0.583	0.215
2	0.475	0.598	0.385	0.521	0.622	0.38
2.5	0.538	0.978	0.46	0.601	1.015	0.47
3.15	0.655	0.867	0.537	0.705	0.904	0.543
4	0.819	0.841	0.968	0.914	0.877	0.98
5	0.936	0.696	1.231	1.042	0.729	1.252
6.3	0.831	0.623	1.366	0.937	0.652	1.399
8	0.648	0.565	0.926	0.737	0.586	0.954
10	0.606	0.538	0.642	0.699	0.562	0.658
12.5	0.54	0.521	0.484	0.617	0.546	0.493
16	0.444	0.465	0.352	0.496	0.491	0.36
20	0.403	0.55	0.38	0.388	0.581	0.37
25	0.546	0.234	0.475	0.442	0.249	0.264
31.5	0.802	0.466	0.473	0.558	0.497	0.219
40	3.413	3.971	1.93	1.134	4.183	1.075
50	0.737	0.81	0.401	0.485	0.85	0.295
63	0.754	0.652	0.21	0.69	0.691	0.23
80	4.81	1.099	1.525	5.124	1.144	2.023
100	1.708	0.643	0.556	1.691	0.638	0.63
125	1.638	1.392	0.683	1.235	1.441	1.076
160	2.39	2.29	1.473	2.511	2.171	1.488
200	1.57	0.991	1.178	1.411	0.958	1.304
250	1.141	0.576	0.792	0.992	0.589	1.012
315	0.883	0.514	0.614	0.628	0.549	0.429
400	1.378	0.731	0.716	0.939	0.684	0.615
500	1.02	0.516	0.944	1.118	0.585	0.678
630	0.998	0.601	0.87	0.531	0.696	0.75
800	0.919	1.227	0.868	1.166	1.021	0.581
1000	1.998	1.84	1.293	2.548	1.791	1.228
1250	2.075	0.762	0.477	1.999	0.742	0.785
ahw	**2.334**	**2.153**	**1.994**	**2.0**	**2.3**	**1.9**
av		**3.7**			**3.6**	



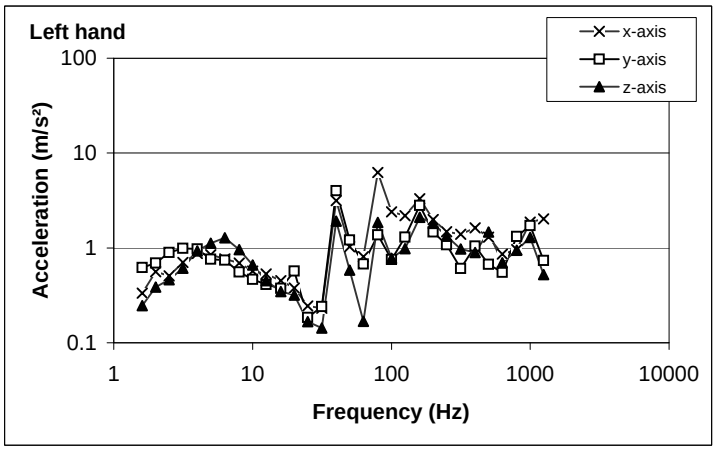


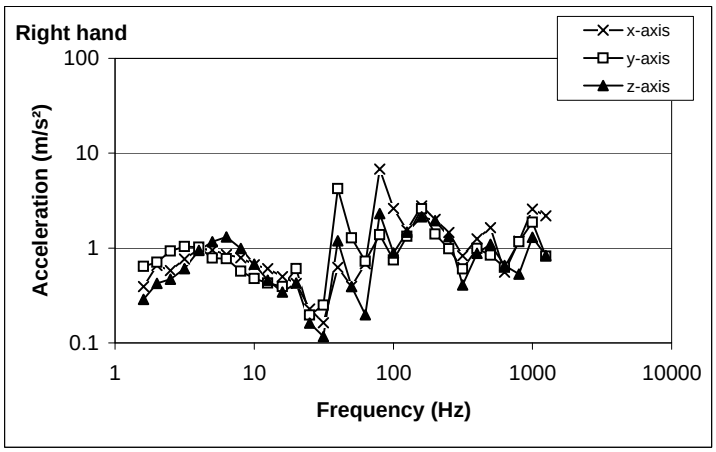


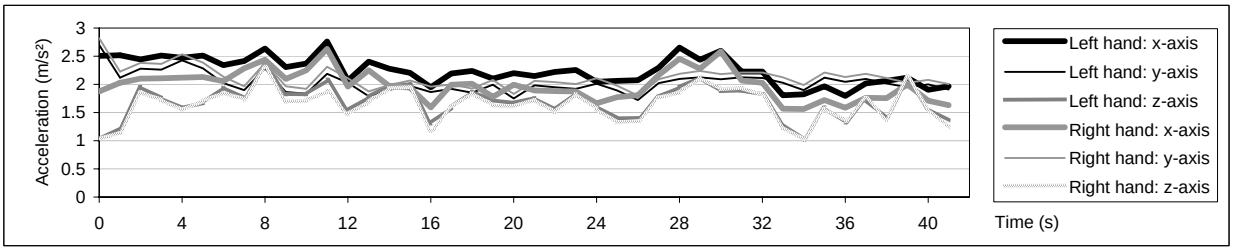
MainID: 1365, ResultsID: 9929

LocationName:		MachineManufacturer:	
		MachineModel:	
Occupation:	Grounds maintenance		HSLAnonymisedToolLetter: Machine B
Process:	Grass Cutting	MachineModifications:	
RecordDate:	September 30, 2010	MachineSize: 560mm cutting width	MainID: 1365
		MachineWeight(kg): 53	ResultsID: 9930
TapeNumber:	N/A	MachineOperating pressure:	
Operator#:	OP#1	MachineSpeed(impacts/min):	
	Up and down with tight turn at far end	MachineSpeed(revs/min):	
VideoNumber:	N/A	MachinePower:	
		MachinePower source: Unleaded petrol	MeasurementTime: 42.5 Seconds
Notes:	25mm cut		NumShotsInMeas:
		InsertedTool:	DailyExposureTime:
DC-shift threshold:	*10 mm*	InsertedToolType:	A(8) Left hand m/s²
		InsertedToolManufacturer:	

	Left hand			Right hand		
Frequency	x-axis	y-axis	z-axis	x-axis	y-axis	z-axis
1.6	0.335	0.622	0.246	0.392	0.641	0.287
2	0.562	0.691	0.387	0.657	0.707	0.423
2.5	0.509	0.894	0.462	0.578	0.927	0.471
3.15	0.705	0.989	0.613	0.765	1.034	0.607
4	0.874	0.975	0.934	0.972	1.019	0.942
5	0.844	0.762	1.119	0.952	0.783	1.162
6.3	0.767	0.742	1.275	0.852	0.771	1.305
8	0.693	0.558	0.959	0.787	0.571	0.99
10	0.571	0.464	0.659	0.664	0.476	0.679
12.5	0.53	0.411	0.451	0.605	0.427	0.459
16	0.453	0.375	0.347	0.5	0.393	0.345
20	0.377	0.572	0.319	0.423	0.608	0.429
25	0.245	0.184	0.167	0.227	0.196	0.162
31.5	0.232	0.24	0.143	0.163	0.251	0.117
40	3.142	4.018	1.917	0.627	4.229	1.19
50	1.033	1.213	0.586	0.396	1.277	0.394
63	0.809	0.678	0.169	0.682	0.726	0.199
80	6.227	1.374	1.861	6.773	1.386	2.311
100	2.393	0.755	0.778	2.609	0.749	0.889
125	2.186	1.294	0.982	1.542	1.328	1.471
160	3.305	2.793	2.109	2.785	2.597	2.133
200	1.992	1.467	1.819	2.004	1.399	1.939
250	1.484	1.075	1.327	1.462	0.982	1.316
315	1.388	0.606	0.976	0.828	0.6	0.408
400	1.625	1.045	0.896	1.25	0.992	0.88
500	1.303	0.671	1.468	1.644	0.839	1.092
630	0.862	0.552	0.697	0.555	0.626	0.655
800	0.959	1.315	0.948	1.18	1.168	0.531
1000	1.869	1.723	1.29	2.575	1.869	1.296
1250	2.025	0.738	0.524	2.189	0.821	0.832
ahw	**2.382**	**2.179**	**1.937**	**2.2**	**2.3**	**1.9**
av		**3.8**			**3.7**	



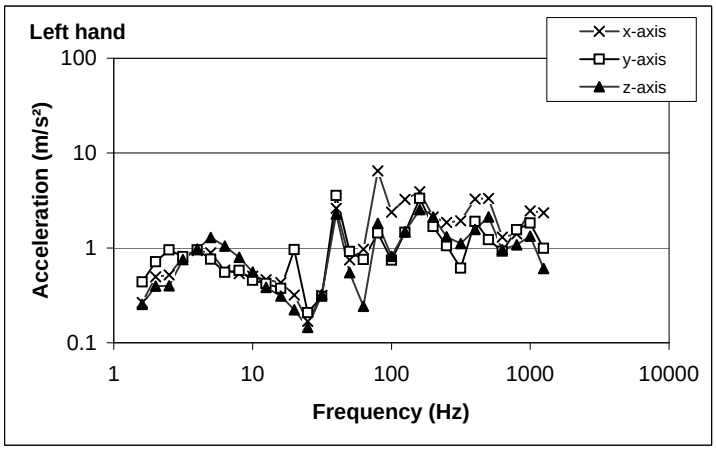


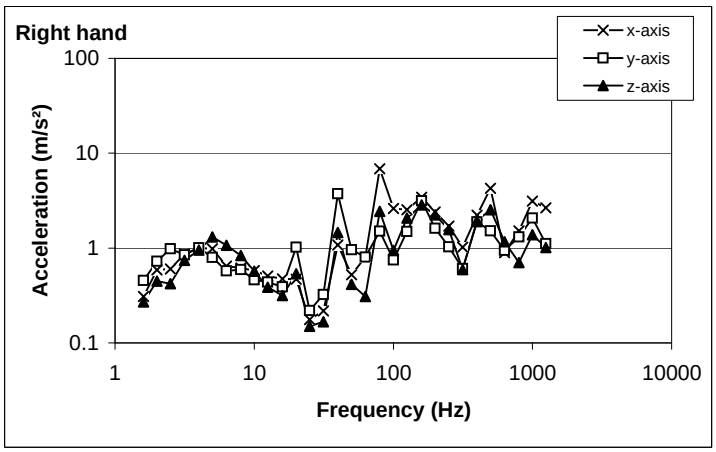


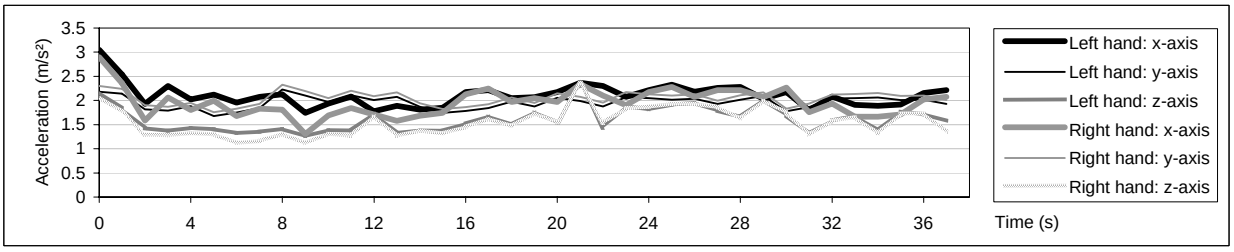
MainID: 1365, ResultsID: 9930

LocationName:		MachineManufacturer:	
		MachineModel:	
Occupation:	Grounds maintenance		HSLAnonymisedToolLetter: Machine B
Process:	Grass Cutting	MachineModifications:	
RecordDate:	September 30, 2010	MachineSize: 560mm cutting width	MainID: 1365
		MachineWeight(kg): 53	ResultsID: 9931
TapeNumber:	N/A	MachineOperating pressure:	
Operator#:	OP#1	MachineSpeed(impacts/min):	
	Up and down with tight turn at far end	MachineSpeed(revs/min):	
VideoNumber:	N/A	MachinePower:	
		MachinePower source: Unleaded petrol	MeasurementTime: 38.25 Seconds
Notes:	25mm cut		NumShotsInMeas:
		InsertedTool:	DailyExposureTime:
DC-shift threshold:	*10 mm*	InsertedToolType:	A(8) Left hand m/s²
		InsertedToolManufacturer:	

	Left hand			Right hand		
Frequency	x-axis	y-axis	z-axis	x-axis	y-axis	z-axis
1.6	0.266	0.439	0.254	0.307	0.456	0.271
2	0.497	0.713	0.397	0.59	0.728	0.446
2.5	0.518	0.952	0.4	0.604	0.985	0.422
3.15	0.794	0.809	0.756	0.866	0.849	0.744
4	0.937	0.95	0.973	1.003	1.004	0.95
5	0.886	0.76	1.293	0.981	0.795	1.308
6.3	0.584	0.551	1.045	0.646	0.573	1.068
8	0.536	0.581	0.796	0.617	0.593	0.834
10	0.504	0.454	0.557	0.58	0.464	0.569
12.5	0.463	0.422	0.385	0.508	0.438	0.387
16	0.432	0.374	0.312	0.473	0.388	0.316
20	0.317	0.961	0.223	0.471	1.018	0.534
25	0.168	0.208	0.145	0.176	0.22	0.15
31.5	0.315	0.308	0.323	0.218	0.323	0.167
40	2.611	3.571	2.273	1.08	3.747	1.456
50	0.746	0.915	0.548	0.524	0.957	0.415
63	0.966	0.755	0.242	0.803	0.803	0.31
80	6.497	1.438	1.807	6.845	1.505	2.442
100	2.39	0.745	0.816	2.606	0.749	0.943
125	3.241	1.457	1.478	2.526	1.491	2.066
160	3.931	3.335	2.533	3.424	3.14	2.841
200	2.124	1.682	2.118	2.409	1.617	2.241
250	1.856	1.055	1.312	1.702	1.032	1.561
315	1.936	0.61	1.108	1.02	0.607	0.592
400	3.274	1.903	1.57	2.226	1.886	1.945
500	3.325	1.221	2.115	4.267	1.519	2.542
630	1.295	0.922	0.958	0.896	0.947	1.169
800	1.401	1.555	1.076	1.514	1.314	0.705
1000	2.464	1.827	1.328	3.114	2.072	1.384
1250	2.342	0.988	0.606	2.655	1.111	1.015
ahw	**2.244**	**2.101**	**1.871**	**2.1**	**2.2**	**1.8**
av		**3.6**			**3.6**	







MainID: 1365, ResultsID: 9931

LocationName:

Occupation: Grounds maintenance
Process: Grass Cutting
RecordDate: September 30, 2010

TapeNumber: N/A
Operator#: OP#1
Up and down with tight turn at far end
VideoNumber: N/A

Notes: 25mm cut

DC-shift threshold: 10 mm

MachineManufacturer:
MachineModel:

HSLAnonymisedToolLetter: Machine B

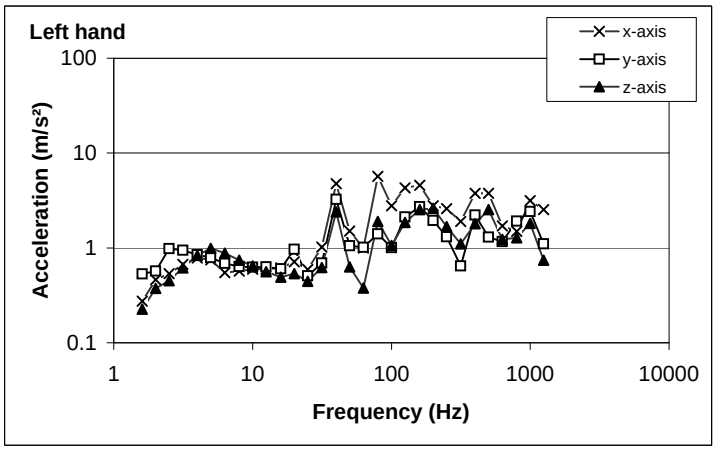
MachineModifications:
MachineSize: 560mm cutting width
MachineWeight(kg): 53
MachineOperating pressure:
MachineSpeed(impacts/min):
MachineSpeed(revs/min):
MachinePower:
MachinePower source: Unleaded petrol

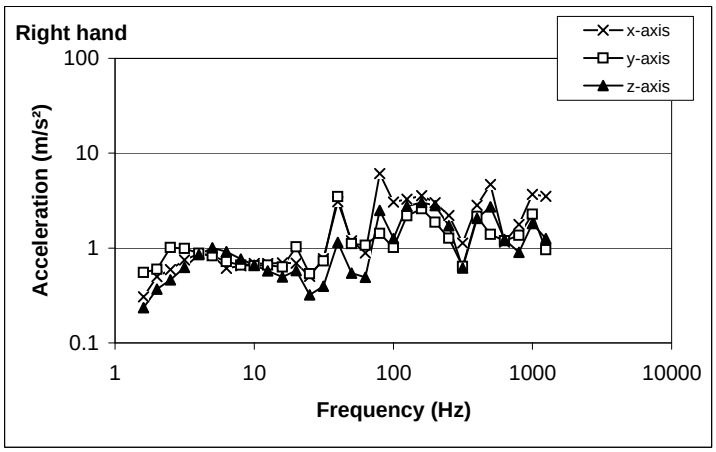
MainID: 1365
ResultsID: 9932

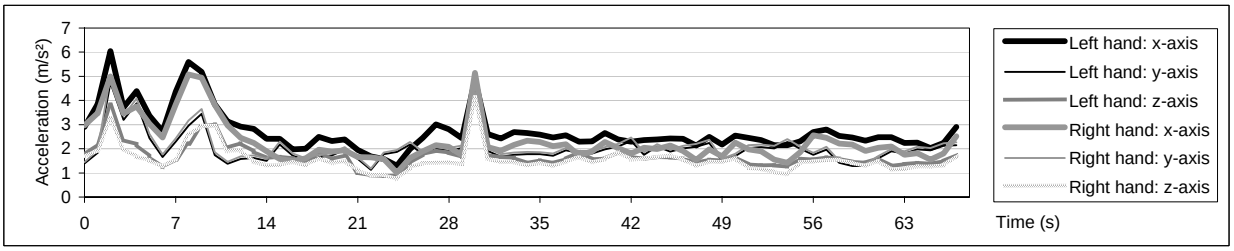
MeasurementTime: 68.5 Seconds
NumShotsInMeas:
DailyExposureTime:
A(8) Left hand m/s²

InsertedTool:
InsertedToolType:
InsertedToolManufacturer:

	Left hand			Right hand		
Frequency	x-axis	y-axis	z-axis	x-axis	y-axis	z-axis
1.6	0.275	0.532	0.227	0.307	0.554	0.235
2	0.462	0.571	0.375	0.498	0.598	0.368
2.5	0.534	0.98	0.45	0.593	1.016	0.461
3.15	0.673	0.947	0.617	0.747	0.986	0.626
4	0.784	0.849	0.832	0.873	0.883	0.851
5	0.747	0.791	0.989	0.831	0.829	1.008
6.3	0.548	0.689	0.884	0.613	0.718	0.919
8	0.571	0.633	0.742	0.649	0.662	0.765
10	0.595	0.625	0.646	0.684	0.653	0.662
12.5	0.596	0.629	0.56	0.689	0.66	0.574
16	0.617	0.6	0.491	0.698	0.63	0.497
20	0.714	0.97	0.534	0.693	1.026	0.577
25	0.591	0.508	0.445	0.503	0.534	0.32
31.5	1.021	0.692	0.622	0.772	0.732	0.397
40	4.762	3.26	2.403	3.074	3.48	1.145
50	1.505	1.057	0.631	1.194	1.115	0.545
63	0.995	1.017	0.376	0.885	1.067	0.491
80	5.695	1.404	1.904	6.084	1.427	2.493
100	2.772	1.008	1.065	3.05	1.011	1.263
125	4.315	2.121	1.859	3.272	2.178	2.76
160	4.57	2.728	2.543	3.58	2.593	3.035
200	2.779	1.947	2.613	3.015	1.877	2.811
250	2.596	1.313	1.674	2.205	1.269	1.72
315	1.903	0.646	1.1	1.131	0.642	0.616
400	3.767	2.219	1.794	2.818	2.146	2.059
500	3.775	1.3	2.544	4.69	1.394	2.719
630	1.701	1.165	1.226	1.159	1.193	1.233
800	1.495	1.909	1.278	1.775	1.362	0.903
1000	3.138	2.414	1.809	3.67	2.264	1.814
1250	2.539	1.105	0.745	3.513	0.963	1.263
ahw	**2.947**	**2.242**	**1.967**	**2.6**	**2.4**	**1.8**
av		**4.2**			**4.0**	







MainID: 1365, ResultsID: 9932

LocationName:

Occupation: Grounds maintenance
Process: Grass Cutting
RecordDate: September 30, 2010

TapeNumber: N/A
Operator#: OP#2
Up and down with tight turn at far end
VideoNumber: N/A

Notes: 25mm cut

DC-shift threshold: 10 mm

MachineManufacturer:
MachineModel:

HSLAnonymisedToolLetter: Machine B

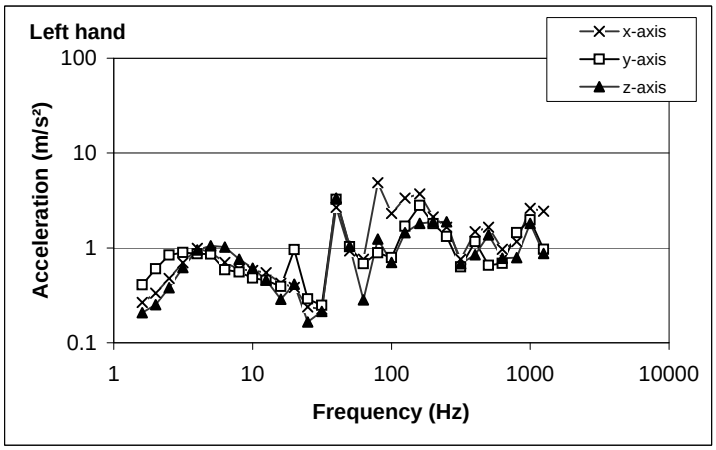
MachineModifications:
MachineSize: 560mm cutting width
MachineWeight(kg): 53
MachineOperating pressure:
MachineSpeed(impacts/min):
MachineSpeed(revs/min):
MachinePower:
MachinePower source: Unleaded petrol

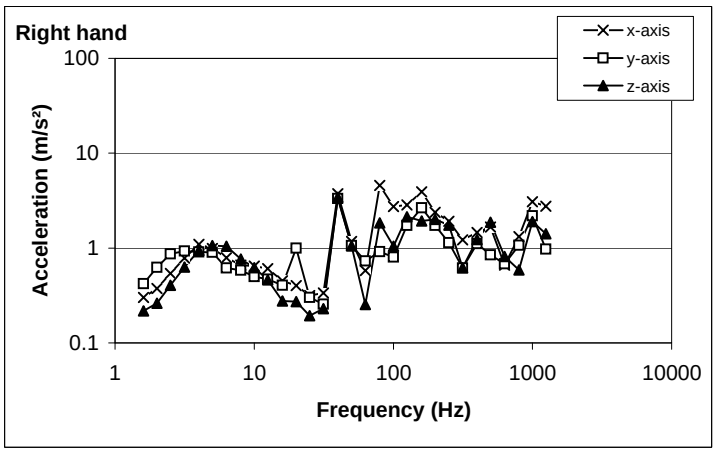
MainID: 1365
ResultsID: 9933

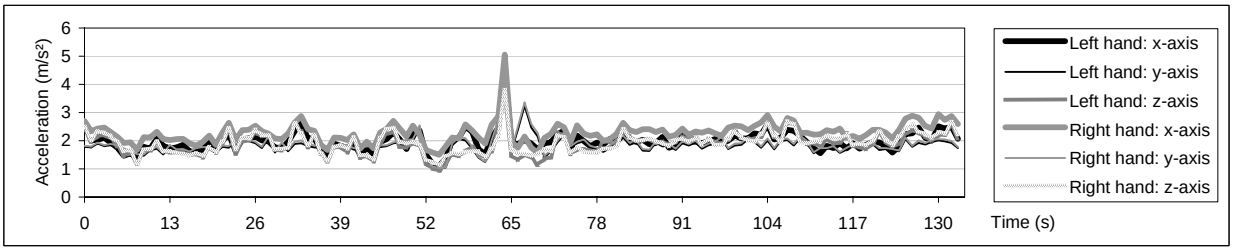
MeasurementTime: 134.25 Seconds
NumShotsInMeas:
DailyExposureTime:
A(8) Left hand m/s²

InsertedTool:
InsertedToolType:
InsertedToolManufacturer:

	Left hand			Right hand		
Frequency	x-axis	y-axis	z-axis	x-axis	y-axis	z-axis
1.6	0.266	0.407	0.208	0.301	0.422	0.218
2	0.334	0.603	0.252	0.375	0.626	0.262
2.5	0.476	0.839	0.381	0.541	0.867	0.406
3.15	0.698	0.897	0.619	0.783	0.931	0.629
4	0.992	0.867	0.95	1.092	0.912	0.946
5	0.894	0.862	1.054	0.992	0.902	1.065
6.3	0.702	0.59	1.024	0.788	0.616	1.047
8	0.592	0.557	0.758	0.658	0.585	0.766
10	0.581	0.48	0.612	0.647	0.501	0.62
12.5	0.55	0.454	0.459	0.605	0.47	0.462
16	0.425	0.391	0.288	0.453	0.406	0.277
20	0.384	0.957	0.416	0.403	0.995	0.273
25	0.239	0.29	0.166	0.317	0.302	0.193
31.5	0.226	0.249	0.215	0.335	0.256	0.23
40	2.682	3.239	3.361	3.74	3.332	3.426
50	0.928	1.03	1.042	1.173	1.063	1.054
63	0.758	0.683	0.284	0.579	0.731	0.254
80	4.849	0.885	1.235	4.575	0.915	1.848
100	2.315	0.787	0.705	2.739	0.801	1.049
125	3.365	1.693	1.447	2.848	1.732	2.144
160	3.708	2.799	1.81	3.919	2.663	1.93
200	2.117	1.805	1.878	2.378	1.728	2.009
250	1.655	1.319	1.883	1.923	1.139	1.749
315	0.76	0.631	0.682	1.222	0.617	0.622
400	1.486	1.163	0.848	1.459	1.116	1.231
500	1.647	0.655	1.369	1.671	0.849	1.865
630	0.965	0.689	0.775	0.663	0.68	0.818
800	1.164	1.451	0.793	1.317	1.073	0.589
1000	2.613	1.982	1.813	3.073	2.18	1.896
1250	2.439	0.969	0.876	2.755	0.973	1.418
ahw	**2.147**	**2.018**	**2.102**	**2.5**	**2.1**	**2.2**
av		**3.6**			**3.9**	



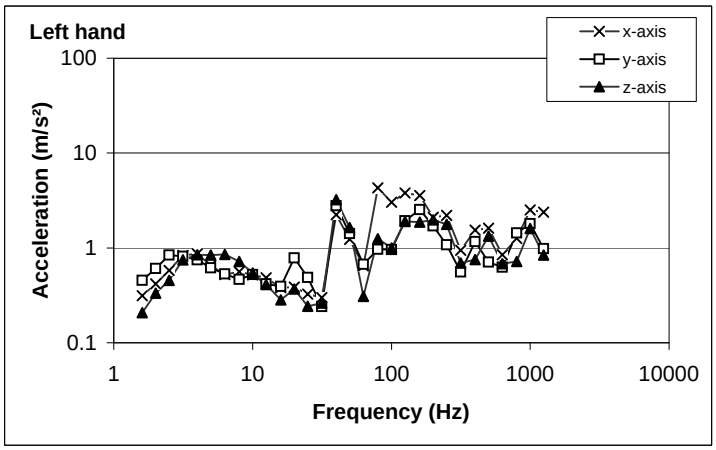


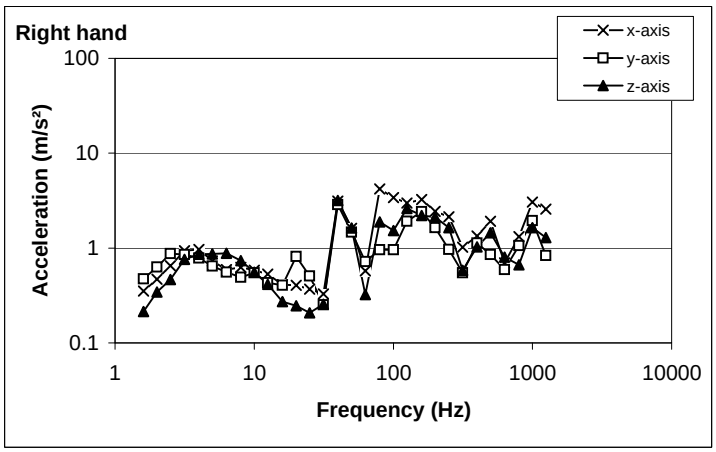


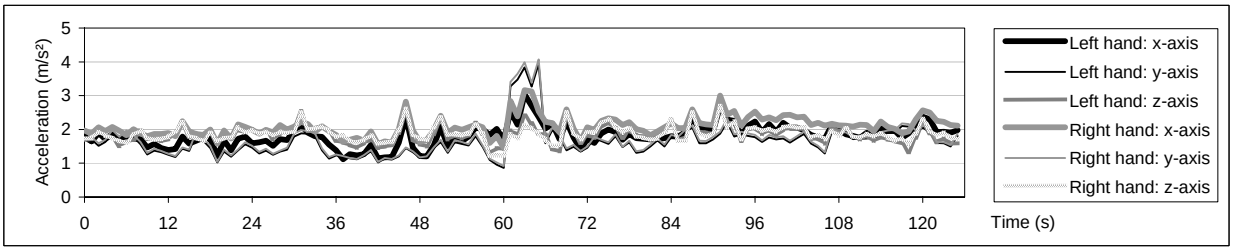
MainID: 1365, ResultsID: 9933

LocationName:		MachineManufacturer:	
		MachineModel:	
Occupation:	Grounds maintenance		HSLAnonymisedToolLetter: Machine B
Process:	Grass Cutting	MachineModifications:	
RecordDate:	September 30, 2010	MachineSize: 560mm cutting width	MainID: 1365
		MachineWeight(kg): 53	ResultsID: 9934
TapeNumber:	N/A	MachineOperating pressure:	
Operator#:	OP#3	MachineSpeed(impacts/min):	
	Up and down with tight turn at far end	MachineSpeed(revs/min):	
VideoNumber:	N/A	MachinePower:	
		MachinePower source: Unleaded petrol	MeasurementTime: 126.25 Seconds
Notes:	25mm cut		NumShotsInMeas:
		InsertedTool:	DailyExposureTime:
DC-shift threshold:	*10 mm*	InsertedToolType:	A(8) Left hand m/s²
		InsertedToolManufacturer:	

	Left hand			Right hand		
Frequency	x-axis	y-axis	z-axis	x-axis	y-axis	z-axis
1.6	0.313	0.453	0.208	0.352	0.473	0.215
2	0.419	0.608	0.334	0.47	0.632	0.344
2.5	0.578	0.841	0.453	0.65	0.875	0.464
3.15	0.834	0.816	0.746	0.935	0.851	0.758
4	0.867	0.751	0.848	0.966	0.784	0.861
5	0.652	0.617	0.843	0.732	0.644	0.867
6.3	0.522	0.533	0.853	0.591	0.556	0.882
8	0.559	0.467	0.718	0.624	0.49	0.735
10	0.521	0.525	0.543	0.583	0.547	0.556
12.5	0.483	0.419	0.411	0.531	0.432	0.414
16	0.38	0.391	0.284	0.41	0.405	0.273
20	0.387	0.784	0.368	0.406	0.818	0.246
25	0.325	0.488	0.243	0.369	0.509	0.207
31.5	0.299	0.241	0.262	0.329	0.251	0.256
40	2.241	2.775	3.213	3.133	2.877	3.173
50	1.231	1.42	1.646	1.614	1.476	1.631
63	0.647	0.67	0.308	0.574	0.72	0.324
80	4.293	0.967	1.251	4.184	0.958	1.885
100	3.033	0.959	1	3.403	0.959	1.526
125	3.806	1.924	1.897	2.972	1.918	2.608
160	3.571	2.537	1.867	3.259	2.421	2.208
200	2.095	1.701	1.972	2.429	1.643	2.122
250	2.212	1.082	1.771	2.141	0.968	1.636
315	0.947	0.559	0.695	1.023	0.549	0.581
400	1.536	1.166	0.756	1.341	1.127	1.031
500	1.61	0.709	1.328	1.913	0.854	1.445
630	0.844	0.624	0.68	0.696	0.591	0.805
800	1.26	1.442	0.718	1.323	1.058	0.666
1000	2.512	1.802	1.607	3.054	1.949	1.637
1250	2.379	0.981	0.838	2.576	0.833	1.292
ahw	**1.962**	**1.831**	**2.001**	**2.2**	**1.9**	**2.0**
av		**3.3**			**3.6**	







MainID: 1365, ResultsID: 9934

LocationName:

Occupation: Grounds maintenance
Process: Grass Cutting
RecordDate: September 30, 2010

TapeNumber: N/A
Operator#: OP#1
Cutting in circle on incline
VideoNumber: N/A

Notes: 25mm cut

DC-shift threshold: 10 mm

MachineManufacturer:
MachineModel:

HSLAnonymisedToolLetter: Machine B

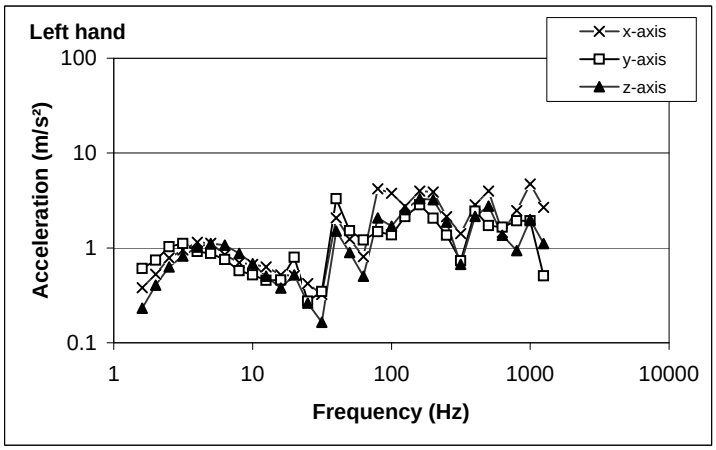
MachineModifications:
MachineSize: 560mm cutting width
MachineWeight(kg): 53
MachineOperating pressure:
MachineSpeed(impacts/min):
MachineSpeed(revs/min):
MachinePower:
MachinePower source: Unleaded petrol

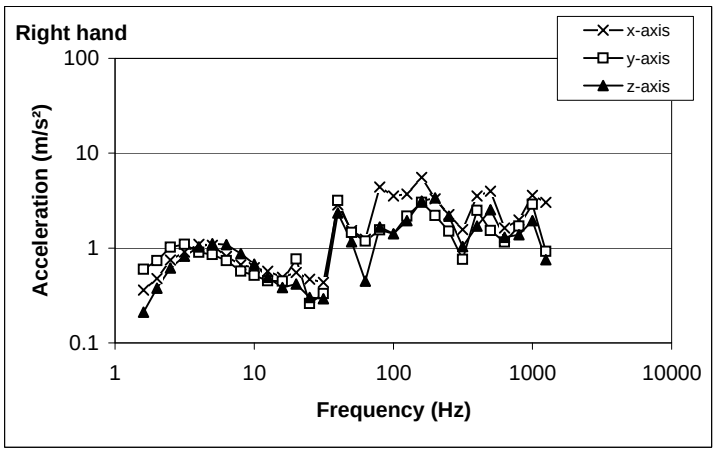
MainID: 1366
ResultsID: 9935

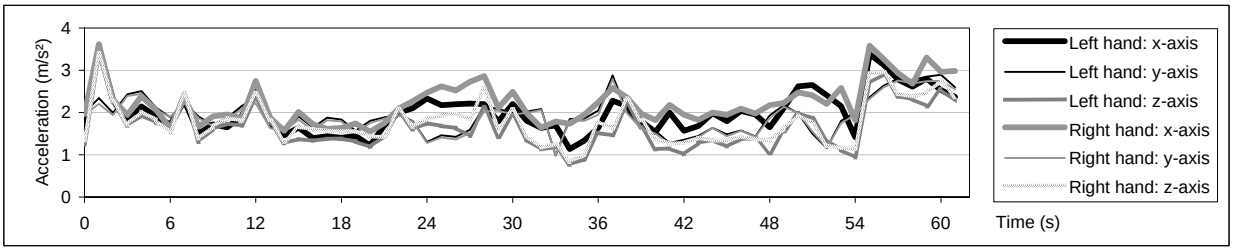
MeasurementTime: 62.25 Seconds
NumShotsInMeas:
DailyExposureTime:
A(8) Left hand m/s²

InsertedTool:
InsertedToolType:
InsertedToolManufacturer:

	Left hand			Right hand		
Frequency	x-axis	y-axis	z-axis	x-axis	y-axis	z-axis
1.6	0.381	0.607	0.231	0.361	0.598	0.211
2	0.526	0.743	0.405	0.476	0.738	0.378
2.5	0.781	1.03	0.63	0.746	1.018	0.618
3.15	0.951	1.113	0.823	0.906	1.098	0.819
4	1.148	0.917	1.021	1.093	0.902	1.027
5	1.121	0.876	1.111	1.071	0.857	1.112
6.3	0.846	0.756	1.072	0.817	0.736	1.085
8	0.7	0.573	0.877	0.668	0.569	0.873
10	0.672	0.52	0.683	0.621	0.515	0.679
12.5	0.629	0.456	0.502	0.572	0.452	0.493
16	0.518	0.459	0.377	0.494	0.446	0.385
20	0.512	0.793	0.52	0.553	0.765	0.418
25	0.419	0.275	0.262	0.469	0.26	0.301
31.5	0.324	0.346	0.165	0.435	0.33	0.291
40	2.064	3.296	1.507	2.852	3.168	2.336
50	1.242	1.516	0.894	1.533	1.464	1.167
63	0.811	1.207	0.504	1.239	1.187	0.447
80	4.215	1.484	2.067	4.404	1.552	1.67
100	3.753	1.372	1.686	3.544	1.414	1.413
125	2.73	2.134	2.541	3.701	2.163	1.945
160	3.965	2.85	3.309	5.554	3.03	3.126
200	3.871	2.052	3.22	3.293	2.202	3.371
250	2.132	1.356	1.869	2.255	1.506	2.168
315	1.42	0.733	0.671	1.568	0.757	1.04
400	2.844	2.44	2.147	3.535	2.501	1.701
500	3.977	1.72	2.769	3.982	1.529	2.529
630	1.463	1.654	1.359	1.625	1.16	1.299
800	2.468	1.926	0.94	1.98	1.709	1.386
1000	4.732	1.927	1.994	3.608	2.884	1.947
1250	2.678	0.509	1.112	3.025	0.923	0.757
ahw	**2.255**	**2.14**	**1.943**	**2.4**	**2.1**	**2.1**
av		**3.7**			**3.8**	







MainID: 1366, ResultsID: 9935

LocationName:

Occupation: Grounds maintenance
Process: Grass Cutting
RecordDate: September 30, 2010

TapeNumber: N/A
Operator#: OP#2
Cutting in circle on incline
VideoNumber: N/A

Notes: 30mm cut

DC-shift threshold: 10 mm

MachineManufacturer:
MachineModel:

HSLAnonymisedToolLetter: Machine B

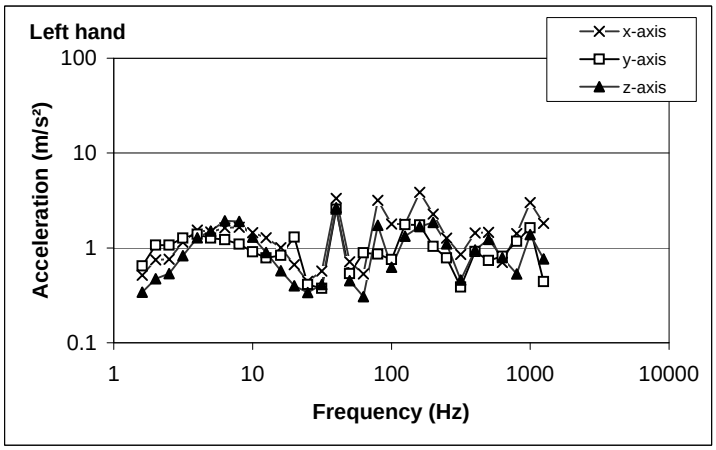
MachineModifications:
MachineSize: 560mm cutting width
MachineWeight(kg): 53
MachineOperating pressure:
MachineSpeed(impacts/min):
MachineSpeed(revs/min):
MachinePower:
MachinePower source: Unleaded petrol

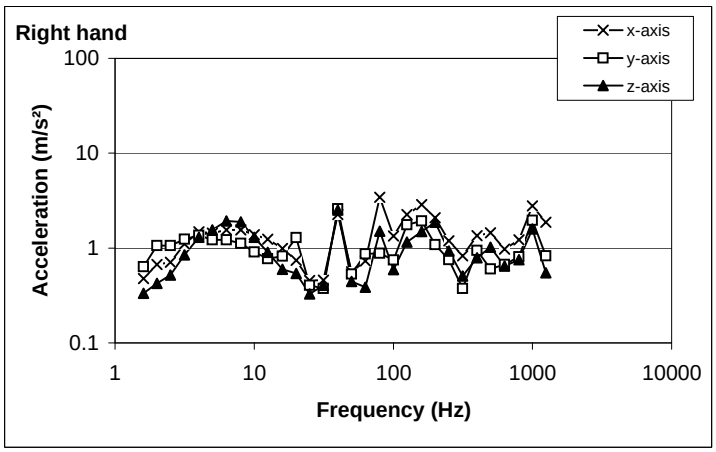
InsertedTool:
InsertedToolType:
InsertedToolManufacturer:

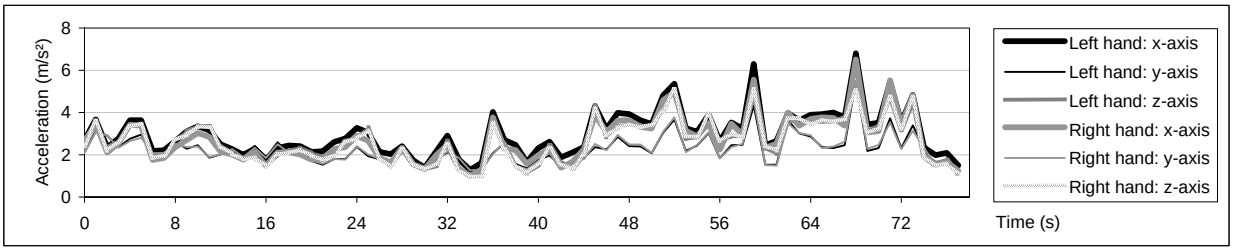
MainID: 1366
ResultsID: 9936

MeasurementTime: 78.5 Seconds
NumShotsInMeas:
DailyExposureTime:
A(8) Left hand m/s²

	Left hand			Right hand		
Frequency	x-axis	y-axis	z-axis	x-axis	y-axis	z-axis
1.6	0.513	0.644	0.341	0.477	0.635	0.334
2	0.746	1.069	0.474	0.67	1.063	0.424
2.5	0.762	1.069	0.536	0.709	1.058	0.519
3.15	1.15	1.268	0.829	1.103	1.238	0.849
4	1.546	1.395	1.276	1.484	1.366	1.298
5	1.47	1.265	1.504	1.432	1.225	1.548
6.3	1.631	1.219	1.933	1.557	1.218	1.933
8	1.653	1.095	1.903	1.556	1.122	1.887
10	1.452	0.911	1.301	1.378	0.911	1.299
12.5	1.28	0.783	0.898	1.237	0.77	0.903
16	1.009	0.834	0.575	0.992	0.819	0.596
20	0.664	1.297	0.4	0.741	1.286	0.54
25	0.444	0.41	0.338	0.456	0.404	0.328
31.5	0.569	0.374	0.411	0.457	0.373	0.406
40	3.337	2.56	2.658	2.256	2.584	2.517
50	0.713	0.536	0.452	0.562	0.53	0.445
63	0.533	0.89	0.305	0.733	0.864	0.388
80	3.166	0.858	1.734	3.442	0.882	1.511
100	1.784	0.754	0.627	1.34	0.75	0.594
125	1.791	1.76	1.333	2.261	1.752	1.153
160	3.841	1.74	1.674	2.878	1.935	1.489
200	2.267	1.033	1.854	2.09	1.088	1.878
250	1.27	0.785	1.105	1.189	0.752	0.929
315	0.853	0.387	0.458	0.83	0.374	0.505
400	1.442	0.919	0.953	1.354	0.942	0.787
500	1.46	0.736	1.232	1.445	0.603	1.023
630	0.705	0.817	0.792	0.972	0.669	0.644
800	1.412	1.177	0.532	1.218	0.81	0.754
1000	3.018	1.622	1.381	2.79	1.962	1.594
1250	1.811	0.44	0.767	1.875	0.829	0.549
ahw	**3.455**	**2.632**	**3.14**	**3.2**	**2.6**	**3.1**
av		**5.4**			**5.2**	



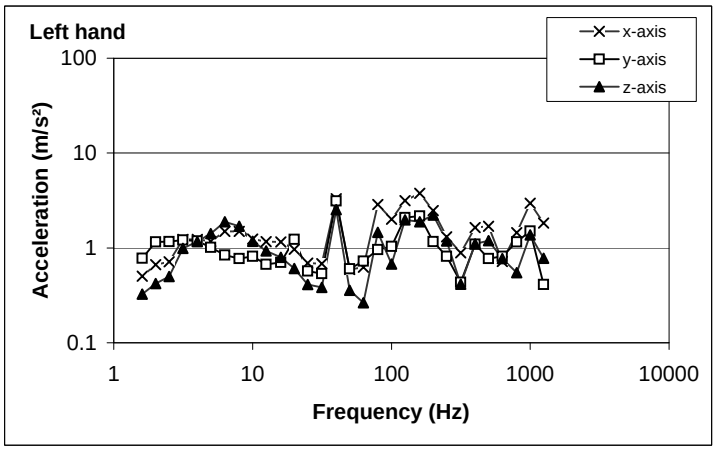


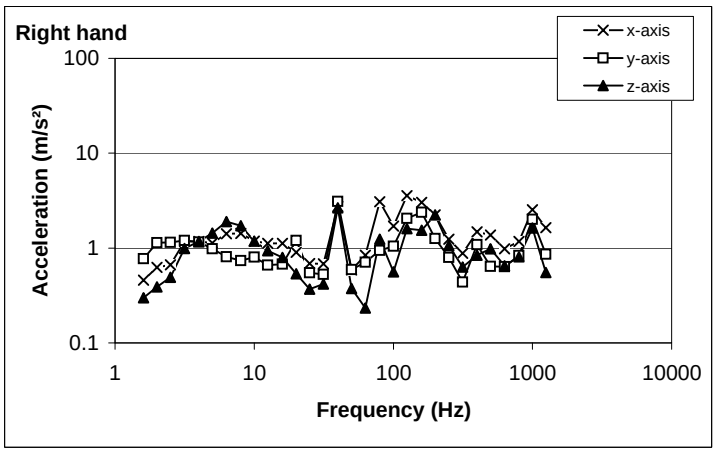


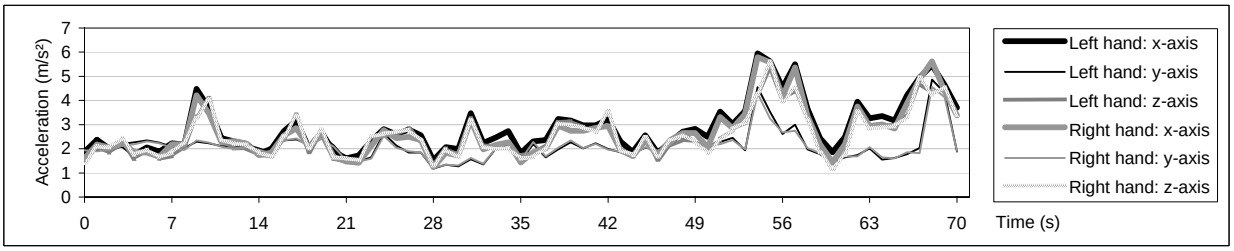
MainID: 1366, ResultsID: 9936

LocationName:		MachineManufacturer:	
		MachineModel:	
Occupation:	Grounds maintenance		HSLAnonymisedToolLetter: Machine B
Process:	Grass Cutting	MachineModifications:	
RecordDate:	September 30, 2010	MachineSize: 560mm cutting width	MainID: 1366
		MachineWeight(kg): 53	ResultsID: 9937
TapeNumber:	N/A	MachineOperating pressure:	
Operator#:	OP#3	MachineSpeed(impacts/min):	
	Cutting in circle on incline	MachineSpeed(revs/min):	
VideoNumber:	N/A	MachinePower:	
		MachinePower source: Unleaded petrol	MeasurementTime: 71.25 Seconds
Notes:	30mm cut		NumShotsInMeas:
		InsertedTool:	DailyExposureTime:
DC-shift threshold:	*10 mm*	InsertedToolType:	A(8) Left hand m/s²
		InsertedToolManufacturer:	

	Left hand			Right hand		
Frequency	x-axis	y-axis	z-axis	x-axis	y-axis	z-axis
1.6	0.503	0.779	0.325	0.459	0.772	0.3
2	0.667	1.155	0.421	0.626	1.141	0.389
2.5	0.713	1.162	0.5	0.668	1.15	0.492
3.15	1.235	1.213	0.992	1.174	1.197	0.989
4	1.228	1.182	1.166	1.173	1.156	1.178
5	1.173	1.011	1.417	1.129	0.984	1.432
6.3	1.491	0.84	1.883	1.413	0.81	1.897
8	1.495	0.771	1.691	1.429	0.737	1.723
10	1.236	0.813	1.171	1.182	0.802	1.181
12.5	1.161	0.673	0.932	1.119	0.66	0.936
16	1.156	0.702	0.798	1.118	0.675	0.797
20	0.969	1.234	0.608	0.902	1.201	0.535
25	0.694	0.571	0.412	0.687	0.549	0.369
31.5	0.681	0.537	0.384	0.683	0.525	0.418
40	3.299	3.134	2.54	2.735	3.108	2.65
50	0.592	0.601	0.358	0.588	0.59	0.375
63	0.628	0.728	0.264	0.842	0.711	0.234
80	2.864	0.961	1.457	3.086	0.942	1.239
100	2.008	1.038	0.676	1.71	1.047	0.563
125	3.147	2.08	1.977	3.569	2.052	1.602
160	3.761	2.171	1.886	3.04	2.384	1.539
200	2.469	1.166	2.217	2.232	1.256	2.246
250	1.309	0.816	1.186	1.24	0.794	1.063
315	0.889	0.436	0.414	0.878	0.438	0.633
400	1.641	1.097	1.105	1.481	1.088	0.841
500	1.693	0.772	1.191	1.375	0.643	0.981
630	0.719	0.817	0.774	0.984	0.637	0.651
800	1.451	1.152	0.549	1.176	0.837	0.807
1000	2.97	1.509	1.374	2.532	2.014	1.624
1250	1.831	0.411	0.78	1.637	0.858	0.554
ahw	**3.303**	**2.439**	**3.024**	**3.1**	**2.4**	**3.0**
av		**5.1**			**5.0**	



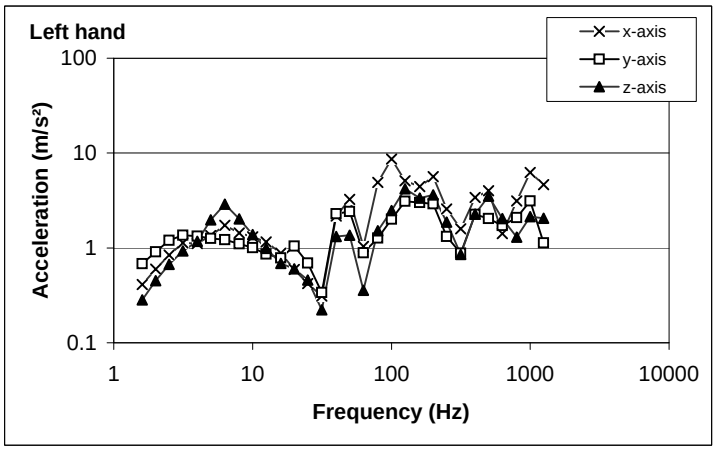


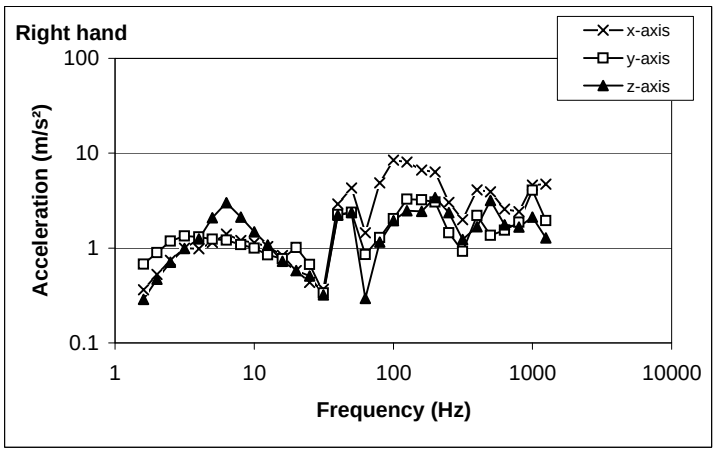


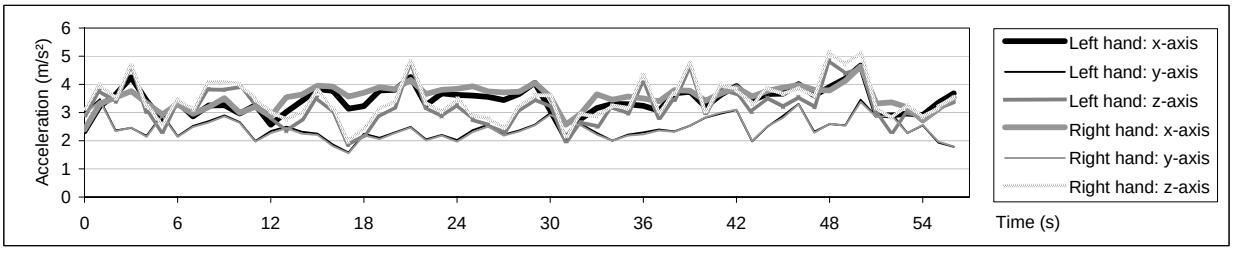
MainID: 1366, ResultsID: 9937

LocationName:		MachineManufacturer:	
		MachineModel:	
Occupation:	Grounds maintenance		HSLAnonymisedToolLetter: Machine B
Process:	Grass Cutting	MachineModifications:	
RecordDate:	September 30, 2010	MachineSize: 560mm cutting width	MainID: 1367
		MachineWeight(kg): 53	ResultsID: 9938
TapeNumber:	N/A	MachineOperating pressure:	
Operator#:	OP#1	MachineSpeed(impacts/min):	
	Cutting in figure of 8 on mock putting green prepa	MachineSpeed(revs/min):	
VideoNumber:	N/A	MachinePower:	
		MachinePower source: Unleaded petrol	MeasurementTime: 57.25 Seconds
Notes:	25mm cut		NumShotsInMeas:
		InsertedTool:	DailyExposureTime:
DC-shift threshold:	*10 mm*	InsertedToolType:	A(8) Left hand m/s²
		InsertedToolManufacturer:	

	Left hand			Right hand		
Frequency	x-axis	y-axis	z-axis	x-axis	y-axis	z-axis
1.6	0.413	0.684	0.283	0.363	0.677	0.289
2	0.596	0.912	0.45	0.527	0.898	0.471
2.5	0.839	1.2	0.671	0.744	1.187	0.708
3.15	1.129	1.358	0.927	0.997	1.341	0.987
4	1.114	1.328	1.171	0.98	1.306	1.248
5	1.35	1.26	1.983	1.145	1.242	2.084
6.3	1.726	1.225	2.896	1.409	1.207	3.006
8	1.434	1.102	2.03	1.202	1.09	2.115
10	1.313	1.008	1.386	1.139	0.996	1.477
12.5	1.154	0.86	0.993	1.039	0.849	1.077
16	0.881	0.784	0.686	0.836	0.769	0.725
20	0.594	1.044	0.601	0.577	1.015	0.578
25	0.421	0.692	0.458	0.434	0.673	0.507
31.5	0.312	0.339	0.223	0.37	0.336	0.32
40	2.167	2.298	1.321	2.92	2.262	2.229
50	3.257	2.426	1.358	4.295	2.378	2.368
63	1.038	0.888	0.356	1.452	0.855	0.295
80	4.916	1.268	1.512	4.868	1.29	1.156
100	8.671	2.014	2.471	8.467	2.039	1.948
125	5.114	3.099	4.214	8.085	3.28	2.469
160	4.446	3	3.354	6.667	3.236	2.432
200	5.645	2.904	3.631	6.348	3.053	3.401
250	2.565	1.318	1.874	3.021	1.45	2.367
315	1.591	0.878	0.855	1.992	0.921	1.234
400	3.416	2.258	2.271	4.087	2.198	1.676
500	4.022	2.031	3.522	3.928	1.357	3.169
630	1.418	1.714	2.042	2.568	1.545	1.755
800	3.119	2.093	1.302	2.415	1.871	1.667
1000	6.243	3.121	2.137	4.624	4.081	2.111
1250	4.641	1.129	2.062	4.717	1.946	1.282
ahw	**3.672**	**2.765**	**3.691**	**3.7**	**2.7**	**3.9**
av		**5.9**			**6.1**	



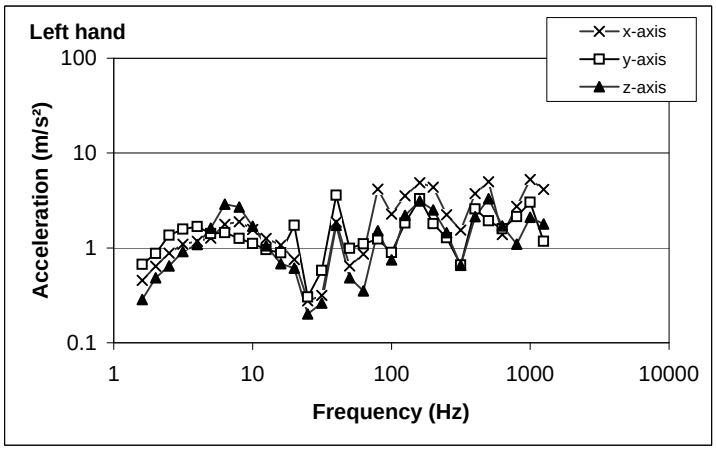


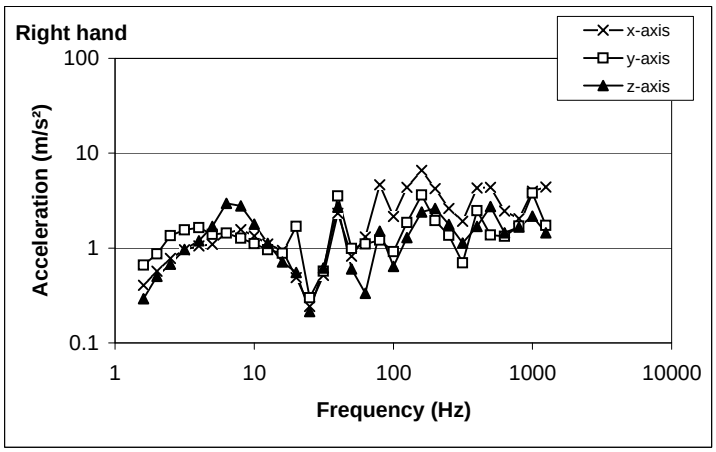


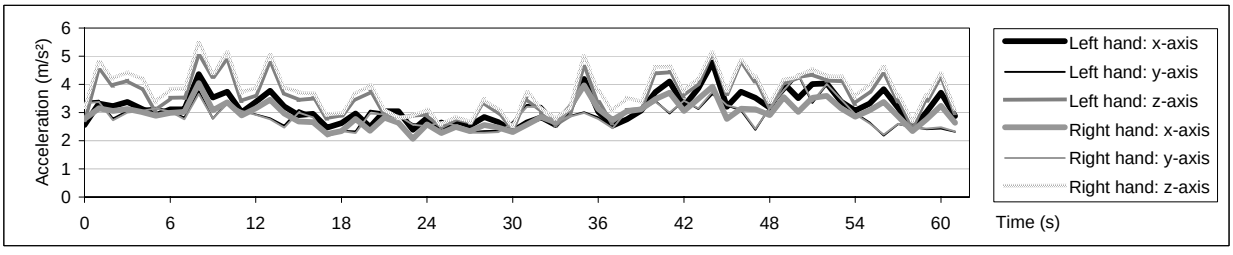
MainID: 1367, ResultsID: 9938

LocationName:		MachineManufacturer:			
		MachineModel:			
Occupation:	Grounds maintenance			HSLAnonymisedToolLetter:	Machine B
Process:	Grass Cutting	MachineModifications:			
RecordDate:	September 30, 2010	MachineSize:	560mm cutting width	MainID:	1367
		MachineWeight(kg):	53	ResultsID:	9939
TapeNumber:	N/A	MachineOperating pressure:			
Operator#:	OP#2	MachineSpeed(impacts/min):			
	Cutting in figure of 8 on mock putting green prepa	MachineSpeed(revs/min):			
VideoNumber:	N/A	MachinePower:			
		MachinePower source:	Unleaded petrol	MeasurementTime:	62.25 Seconds
Notes:	25mm cut			NumShotsInMeas:	
		InsertedTool:		DailyExposureTime:	
DC-shift threshold:	*10 mm*	InsertedToolType:		A(8) Left hand	m/s²
		InsertedToolManufacturer:			

	Left hand			Right hand		
Frequency	x-axis	y-axis	z-axis	x-axis	y-axis	z-axis
1.6	0.455	0.672	0.285	0.405	0.658	0.291
2	0.638	0.877	0.483	0.572	0.867	0.502
2.5	0.879	1.366	0.648	0.779	1.349	0.678
3.15	1.091	1.575	0.918	0.958	1.554	0.97
4	1.17	1.679	1.083	1.056	1.645	1.191
5	1.272	1.41	1.616	1.092	1.392	1.686
6.3	1.766	1.451	2.891	1.434	1.441	2.967
8	1.893	1.261	2.694	1.561	1.265	2.785
10	1.567	1.11	1.695	1.345	1.109	1.785
12.5	1.254	0.961	1.056	1.106	0.957	1.121
16	1.067	0.89	0.681	0.943	0.88	0.716
20	0.756	1.735	0.61	0.488	1.694	0.555
25	0.276	0.305	0.201	0.242	0.299	0.214
31.5	0.315	0.58	0.262	0.517	0.571	0.617
40	1.87	3.587	1.731	2.333	3.553	2.693
50	0.647	0.991	0.485	0.821	0.987	0.604
63	0.86	1.105	0.352	1.311	1.1	0.335
80	4.152	1.239	1.523	4.66	1.216	1.507
100	2.274	0.892	0.75	2.149	0.918	0.639
125	3.539	1.832	2.205	4.365	1.86	1.287
160	4.866	3.298	3.122	6.589	3.619	2.404
200	4.381	1.803	2.505	4.233	1.946	2.612
250	2.232	1.28	1.446	2.621	1.362	1.766
315	1.536	0.663	0.657	1.909	0.696	1.126
400	3.74	2.581	2.139	4.303	2.475	1.69
500	4.985	1.929	3.307	4.36	1.369	2.733
630	1.384	1.59	1.705	2.454	1.332	1.453
800	2.729	2.141	1.096	2.033	1.7	1.661
1000	5.249	3.029	2.103	3.977	3.805	2.166
1250	4.12	1.175	1.781	4.4	1.738	1.453
ahw	**3.508**	**3.277**	**4.014**	**3.2**	**3.3**	**4.2**
av		**6.3**			**6.2**	



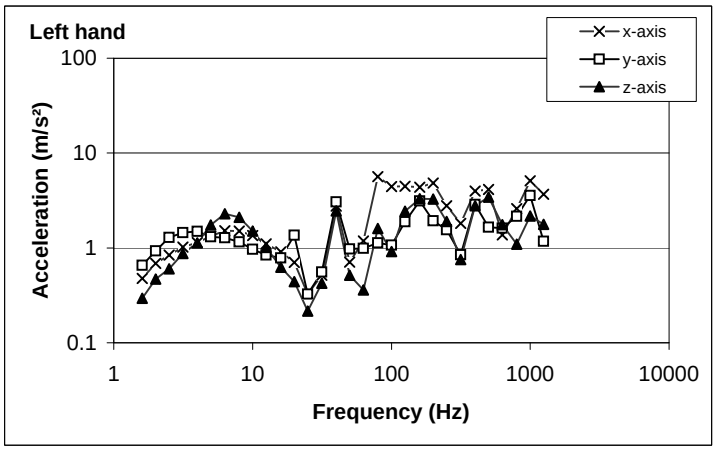


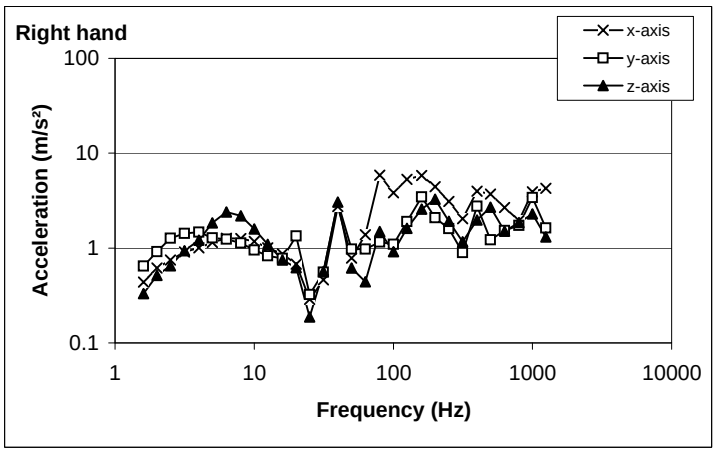


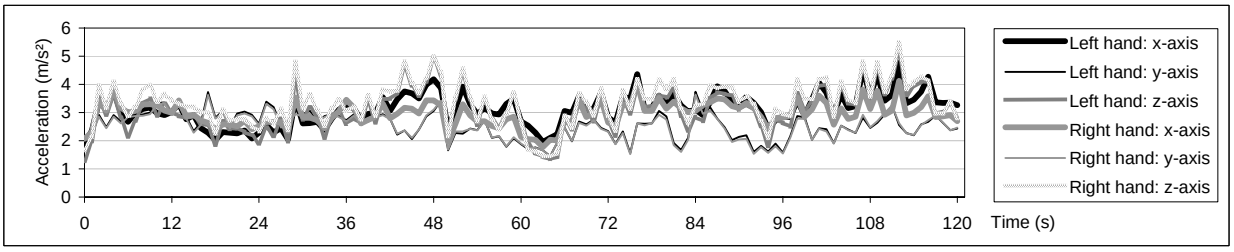
MainID: 1367, ResultsID: 9939

LocationName:		MachineManufacturer:				
		MachineModel:				
Occupation:	Grounds maintenance			HSLAnonymisedToolLetter:	Machine B	
Process:	Grass Cutting	MachineModifications:				
RecordDate:	September 30, 2010	MachineSize:	560mm cutting width	MainID:	1367	
		MachineWeight(kg):	53	ResultsID:	9940	
TapeNumber:	N/A	MachineOperating pressure:				
Operator#:	OP#3	MachineSpeed(impacts/min):				
	Cutting in figure of 8 on mock putting green prepa	MachineSpeed(revs/min):				
VideoNumber:	N/A	MachinePower:				
		MachinePower source:	Unleaded petrol	MeasurementTime:	121.5 Seconds	
Notes:	25mm cut			NumShotsInMeas:		
		InsertedTool:		DailyExposureTime:		
DC-shift threshold:	*10 mm*	InsertedToolType:		A(8) Left hand	m/s²	
		InsertedToolManufacturer:				

	Left hand			Right hand		
Frequency	x-axis	y-axis	z-axis	x-axis	y-axis	z-axis
1.6	0.478	0.654	0.294	0.438	0.643	0.331
2	0.685	0.929	0.47	0.615	0.913	0.516
2.5	0.839	1.286	0.602	0.751	1.268	0.651
3.15	1.022	1.449	0.874	0.909	1.428	0.936
4	1.134	1.493	1.132	1.005	1.469	1.208
5	1.333	1.307	1.744	1.149	1.278	1.839
6.3	1.518	1.275	2.297	1.264	1.241	2.401
8	1.502	1.159	2.096	1.255	1.133	2.191
10	1.349	0.969	1.506	1.171	0.953	1.591
12.5	1.106	0.841	1.01	1.005	0.83	1.096
16	0.908	0.787	0.627	0.868	0.777	0.747
20	0.704	1.364	0.441	0.678	1.336	0.623
25	0.327	0.326	0.215	0.289	0.324	0.188
31.5	0.516	0.555	0.425	0.463	0.557	0.565
40	2.77	3.064	2.458	2.743	3.059	3.056
50	0.706	0.974	0.516	0.783	0.972	0.618
63	1.184	0.989	0.359	1.382	0.977	0.44
80	5.662	1.128	1.606	5.883	1.161	1.489
100	4.426	1.072	0.917	3.826	1.093	0.912
125	4.459	1.882	2.429	5.302	1.905	1.612
160	4.372	3.136	3.294	5.8	3.461	2.566
200	4.841	1.931	3.267	4.434	2.092	3.264
250	2.774	1.551	1.899	3.1	1.6	1.917
315	1.809	0.849	0.757	2.035	0.894	1.166
400	3.985	2.876	2.784	3.985	2.758	1.979
500	4.119	1.648	3.432	3.72	1.225	2.697
630	1.374	1.609	1.753	2.685	1.527	1.5
800	2.593	2.16	1.094	1.941	1.738	1.86
1000	5.104	3.559	2.172	3.92	3.414	2.29
1250	3.677	1.177	1.769	4.262	1.622	1.312
ahw	**3.405**	**2.862**	**3.503**	**3.2**	**2.8**	**3.8**
av		**5.7**			**5.7**	







MainID: 1367, ResultsID: 9940

Vibration Emission Test report

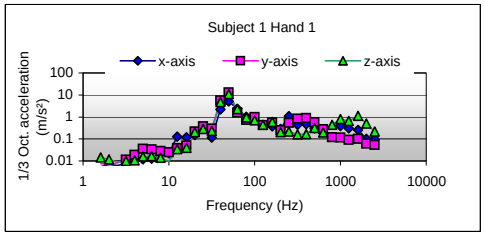
Pulse file version: HAV Emission V2.1.2 2008-07-25.pls
Sprreadsheet: Version 2.0 22/8/2008

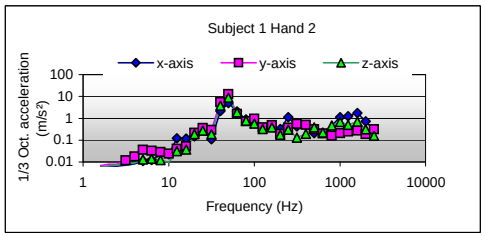
Standard: BS EN 836:1997
N&V reference ID: NV/10/09
Measurement file name: Machine C

					Hand Position 1 - Left hand							Hand position 2 - Right hand						
									Operator Statistics							Operator Statistics		
TestNo.	Operator	Meas. Name	Meas. Date	Meas Time	a_{whx}	a_{why}	a_{whz}	a_{hv}	Mean a_{hv}	S_{n-1}	C_v	a_{whx}	a_{why}	a_{whz}	a_{hv}	Mean a_{hv}	S_{n-1}	C_v
1	1	1 MIDD	27/04/2010	15:45:05:749	1.08	5.80	3.90	7.07				1.10	5.68	2.91	6.48			
2	1	2 MIDD	27/04/2010	15:45:49:874	2.45	3.67	3.97	5.94				2.36	3.65	3.33	5.48			
3	1	3 MIDD	27/04/2010	15:46:38:998	2.75	4.73	4.17	6.88	6.69	0.447	0.067	2.59	4.65	3.41	6.32	6.14	0.396	0.064
4	1	4 MIDD	27/04/2010	15:47:29:748	2.39	4.73	4.43	6.91				2.28	4.68	3.61	6.33			
5	1	5 MIDD	27/04/2010	15:48:19:874	1.50	5.08	4.06	6.67				1.44	5.01	3.15	6.09			

	Hand Position 1 - Left hand		Hand position 2 - Right hand	
a_h (overall mean a_{hv}) :	6.69	m/s²	6.14	m/s²
$\sigma_{R(single\ m/c.)}$:	0.45	m/s²	0.40	m/s²
$K_{(single\ m/c.)}$ value:	0.74	m/s²	0.65	m/s²

Single machine emission a_{hd} (= greatest a_h value): 6.69 m/s² **$K_{(single\ m/c.)}$ value: 0.74 m/s²**





LocationName:

Occupation: Grounds maintenance
Process: Grass Cutting
RecordDate: September 30, 2010

TapeNumber: N/A
Operator#: OP#1
Up and down with tight turn at far end
VideoNumber: N/A

Notes: 20mm cut

DC-shift threshold: 10 mm

MachineManufacturer:
MachineModel:

HSLAnonymisedToolLetter: Machine C

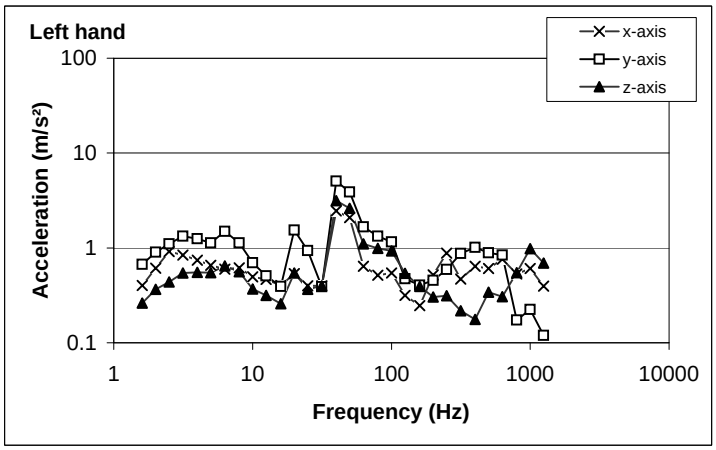
MachineModifications:
MachineSize: 510mm cutting width
MachineWeight(kg): 110
MachineOperating pressure:
MachineSpeed(impacts/min):
MachineSpeed(revs/min):
MachinePower:
MachinePower source: Unleaded petrol

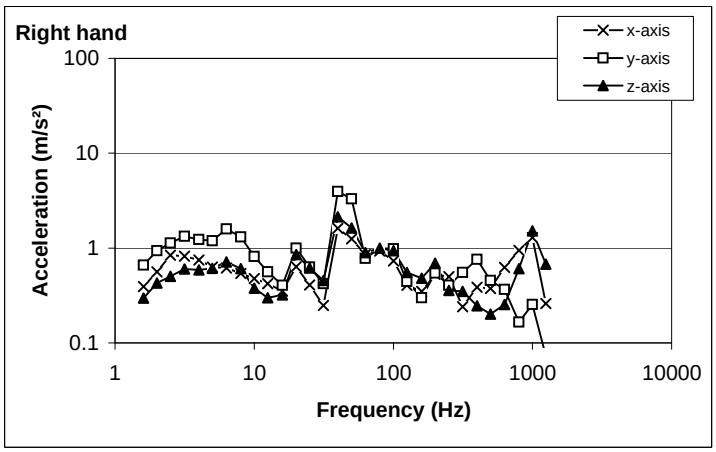
InsertedTool:
InsertedToolType:
InsertedToolManufacturer:

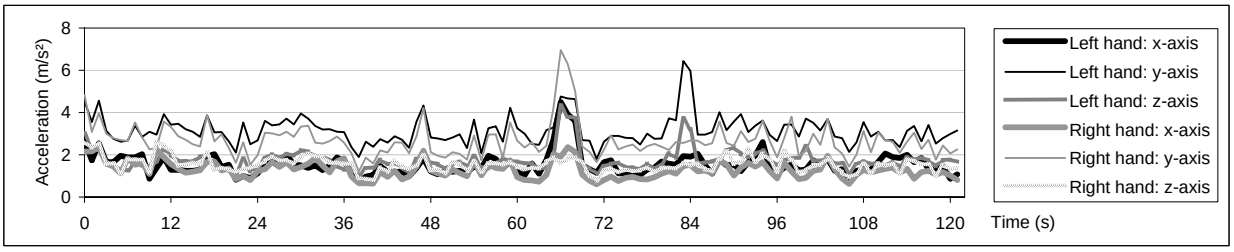
MainID: 1368
ResultsID: 9941

MeasurementTime: 122 Seconds
NumShotsInMeas:
DailyExposureTime:
A(8) Left hand m/s²

	Left hand			Right hand		
Frequency	x-axis	y-axis	z-axis	x-axis	y-axis	z-axis
1.6	0.403	0.67	0.263	0.392	0.662	0.296
2	0.611	0.905	0.366	0.559	0.94	0.427
2.5	0.914	1.1	0.436	0.843	1.126	0.503
3.15	0.843	1.331	0.545	0.818	1.334	0.604
4	0.742	1.249	0.552	0.745	1.234	0.587
5	0.657	1.126	0.548	0.633	1.197	0.61
6.3	0.597	1.497	0.646	0.615	1.596	0.717
8	0.616	1.13	0.562	0.539	1.31	0.605
10	0.497	0.699	0.369	0.478	0.814	0.378
12.5	0.465	0.506	0.315	0.421	0.563	0.3
16	0.403	0.392	0.257	0.352	0.406	0.32
20	0.535	1.542	0.546	0.637	0.998	0.855
25	0.4	0.934	0.365	0.407	0.632	0.618
31.5	0.398	0.39	0.399	0.249	0.421	0.455
40	2.453	5.057	3.152	1.612	3.958	2.131
50	2.086	3.893	2.608	1.253	3.288	1.63
63	0.64	1.662	1.1	0.852	0.778	0.894
80	0.516	1.328	0.99	0.928	0.994	1.001
100	0.545	1.157	0.928	0.73	0.985	0.935
125	0.316	0.472	0.54	0.404	0.445	0.553
160	0.247	0.405	0.393	0.35	0.3	0.48
200	0.518	0.457	0.304	0.528	0.543	0.693
250	0.884	0.593	0.314	0.499	0.404	0.357
315	0.47	0.875	0.217	0.24	0.551	0.349
400	0.638	1.015	0.176	0.386	0.76	0.247
500	0.605	0.89	0.341	0.375	0.455	0.202
630	0.763	0.841	0.306	0.628	0.367	0.254
800	0.53	0.174	0.549	0.941	0.166	0.609
1000	0.608	0.225	0.983	1.293	0.254	1.522
1250	0.396	0.119	0.694	0.26	0.073	0.678
ahw	**1.766**	**3.432**	**1.926**	**1.5**	**3.0**	**1.7**
av		**4.3**			**3.8**	







MainID: 1368, ResultsID: 9941

LocationName:

Occupation: Grounds maintenance
Process: Grass Cutting
RecordDate: September 30, 2010

TapeNumber: N/A
Operator#: OP#2
Up and down with tight turn at far end
VideoNumber: N/A

Notes: 20mm cut

DC-shift threshold: 10 mm

MachineManufacturer:
MachineModel:

HSLAnonymisedToolLetter: Machine C

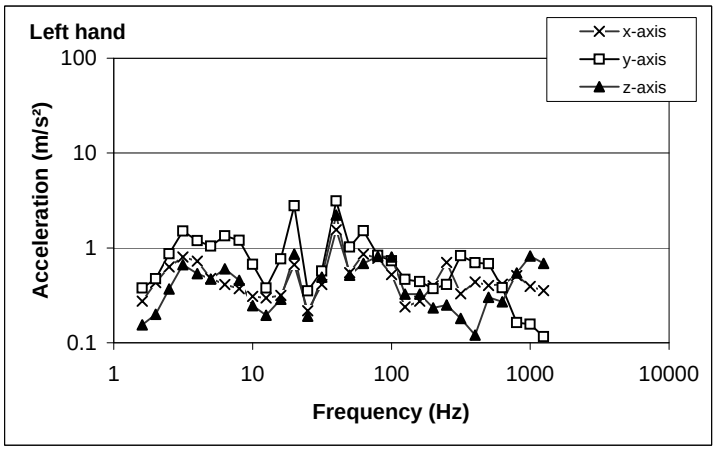
MachineModifications:
MachineSize: 510mm cutting width
MachineWeight(kg): 110
MachineOperating pressure:
MachineSpeed(impacts/min):
MachineSpeed(revs/min):
MachinePower:
MachinePower source: Unleaded petrol

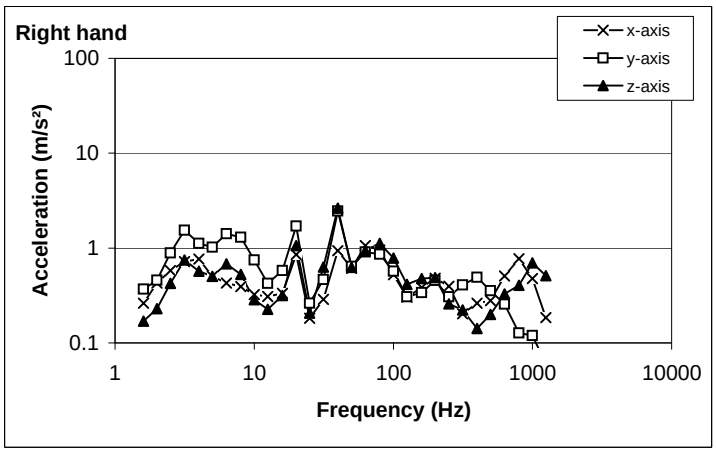
InsertedTool:
InsertedToolType:
InsertedToolManufacturer:

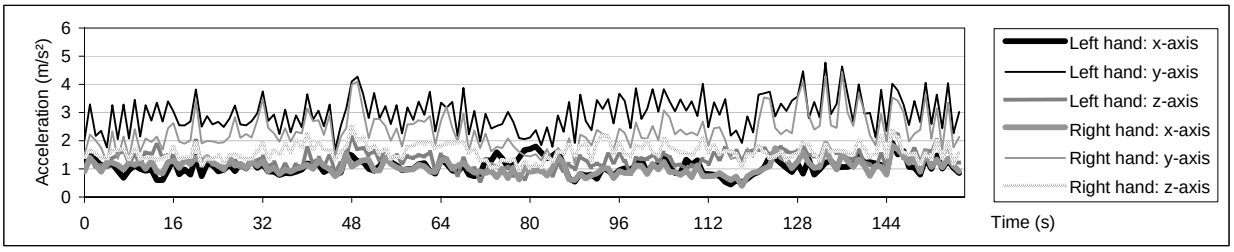
MainID: 1368
ResultsID: 9942

MeasurementTime: 158.25 Seconds
NumShotsInMeas:
DailyExposureTime:
A(8) Left hand m/s²

	Left hand			Right hand		
Frequency	x-axis	y-axis	z-axis	x-axis	y-axis	z-axis
1.6	0.274	0.379	0.155	0.262	0.37	0.17
2	0.432	0.472	0.2	0.429	0.458	0.23
2.5	0.632	0.868	0.368	0.581	0.887	0.423
3.15	0.804	1.507	0.666	0.719	1.544	0.75
4	0.725	1.196	0.536	0.769	1.125	0.571
5	0.476	1.045	0.469	0.504	1.023	0.504
6.3	0.411	1.344	0.601	0.429	1.414	0.679
8	0.372	1.205	0.454	0.394	1.302	0.529
10	0.309	0.671	0.247	0.324	0.75	0.286
12.5	0.298	0.379	0.196	0.308	0.424	0.225
16	0.317	0.768	0.287	0.333	0.58	0.317
20	0.667	2.775	0.863	0.855	1.7	1.064
25	0.218	0.351	0.191	0.182	0.262	0.207
31.5	0.411	0.57	0.493	0.288	0.464	0.632
40	1.547	3.133	2.228	0.94	2.457	2.636
50	0.549	1.021	0.517	0.611	0.638	0.627
63	0.863	1.523	0.686	1.062	0.912	0.94
80	0.777	0.834	0.814	0.952	0.861	1.12
100	0.523	0.729	0.802	0.523	0.569	0.787
125	0.239	0.467	0.327	0.304	0.305	0.413
160	0.275	0.441	0.325	0.383	0.34	0.477
200	0.398	0.37	0.232	0.481	0.454	0.49
250	0.702	0.411	0.25	0.395	0.307	0.258
315	0.329	0.825	0.18	0.203	0.408	0.222
400	0.437	0.7	0.12	0.262	0.491	0.142
500	0.403	0.682	0.301	0.279	0.356	0.199
630	0.414	0.38	0.27	0.506	0.256	0.327
800	0.51	0.164	0.544	0.773	0.127	0.404
1000	0.394	0.157	0.82	0.477	0.119	0.698
1250	0.354	0.116	0.688	0.185	0.06	0.512
ahw	**1.223**	**3.253**	**1.457**	**1.2**	**2.6**	**1.7**
av		**3.8**			**3.4**	







MainID: 1368, ResultsID: 9942

LocationName:

Occupation: Grounds maintenance
Process: Grass Cutting
RecordDate: September 30, 2010

TapeNumber: N/A
Operator#: OP#3
Up and down with tight turn at far end
VideoNumber: N/A

Notes: 20mm cut

DC-shift threshold: *10* *mm*

MachineManufacturer:
MachineModel:

HSLAnonymisedToolLetter: Machine C

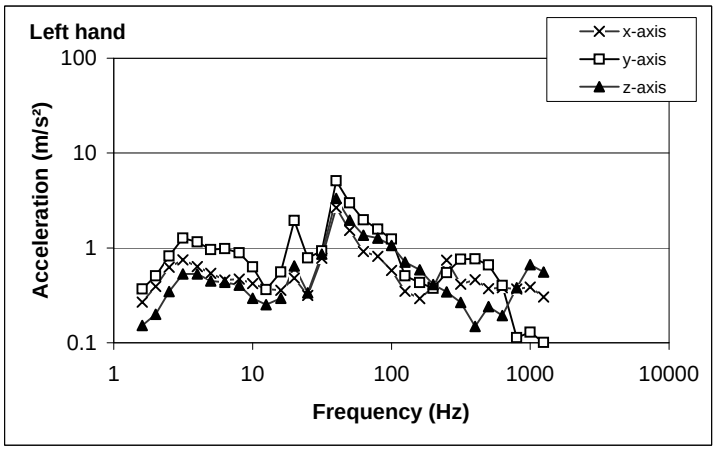
MachineModifications:
MachineSize: 510mm cutting width
MachineWeight(kg): 110
MachineOperating pressure:
MachineSpeed(impacts/min):
MachineSpeed(revs/min):
MachinePower:
MachinePower source: Unleaded petrol

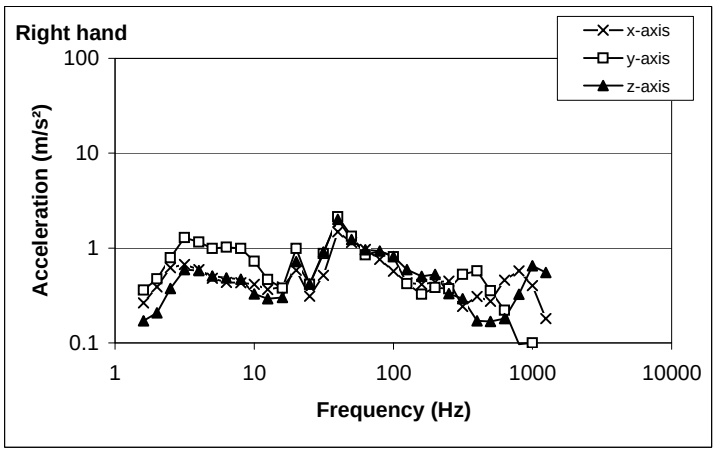
MainID: 1368
ResultsID: 9943

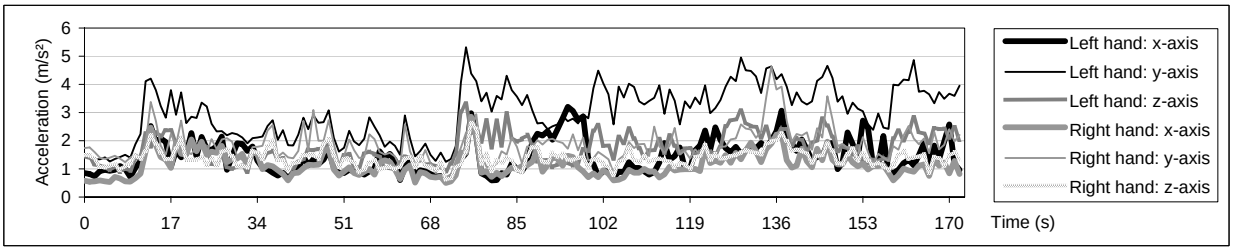
MeasurementTime: 172.75 Seconds
NumShotsInMeas:
DailyExposureTime:
A(8) Left hand m/s²

InsertedTool:
InsertedToolType:
InsertedToolManufacturer:

	Left hand			Right hand		
Frequency	x-axis	y-axis	z-axis	x-axis	y-axis	z-axis
1.6	0.268	0.37	0.152	0.264	0.36	0.17
2	0.393	0.507	0.2	0.389	0.475	0.207
2.5	0.626	0.82	0.347	0.62	0.792	0.375
3.15	0.745	1.273	0.53	0.674	1.285	0.593
4	0.634	1.158	0.53	0.593	1.154	0.578
5	0.542	0.956	0.448	0.481	0.987	0.506
6.3	0.46	0.981	0.436	0.435	1.025	0.485
8	0.469	0.885	0.406	0.43	0.99	0.471
10	0.421	0.629	0.295	0.414	0.724	0.327
12.5	0.37	0.364	0.252	0.366	0.465	0.291
16	0.359	0.557	0.293	0.388	0.378	0.302
20	0.482	1.94	0.647	0.585	0.988	0.721
25	0.315	0.781	0.337	0.311	0.416	0.417
31.5	0.777	0.93	0.863	0.514	0.875	0.907
40	2.654	5.094	3.32	1.486	2.141	2.005
50	1.529	2.995	1.968	1.147	1.332	1.229
63	0.917	1.981	1.365	0.966	0.849	0.959
80	0.813	1.576	1.265	0.762	0.93	0.932
100	0.58	1.239	1.06	0.568	0.811	0.812
125	0.35	0.506	0.707	0.433	0.421	0.591
160	0.292	0.43	0.589	0.416	0.327	0.505
200	0.387	0.375	0.411	0.438	0.385	0.526
250	0.742	0.547	0.343	0.45	0.37	0.33
315	0.416	0.763	0.267	0.243	0.529	0.293
400	0.461	0.765	0.149	0.309	0.576	0.171
500	0.372	0.661	0.241	0.276	0.355	0.169
630	0.381	0.403	0.193	0.46	0.221	0.181
800	0.368	0.114	0.38	0.572	0.097	0.327
1000	0.386	0.129	0.665	0.403	0.1	0.65
1250	0.304	0.101	0.556	0.181	0.057	0.553
ahw	**1.655**	**3.308**	**1.886**	**1.3**	**2.2**	**1.5**
av		**4.2**			**2.9**	



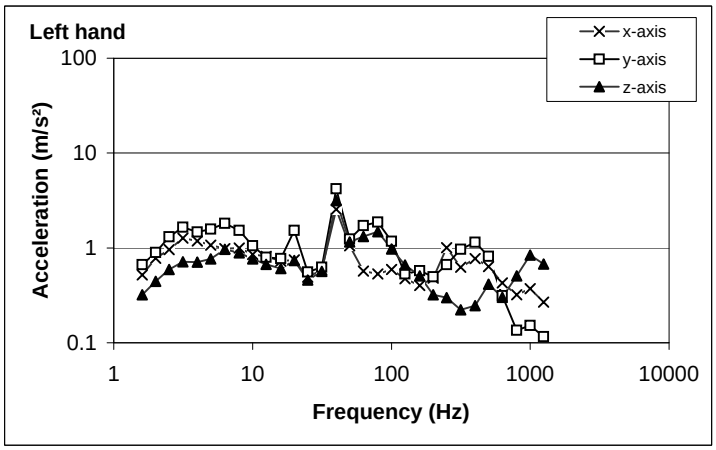


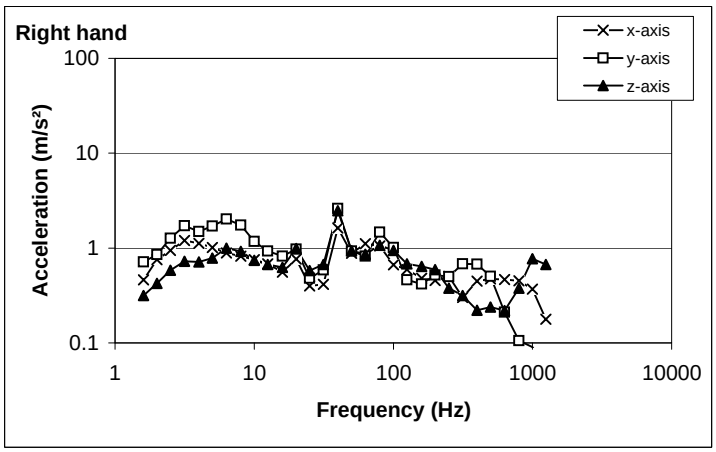


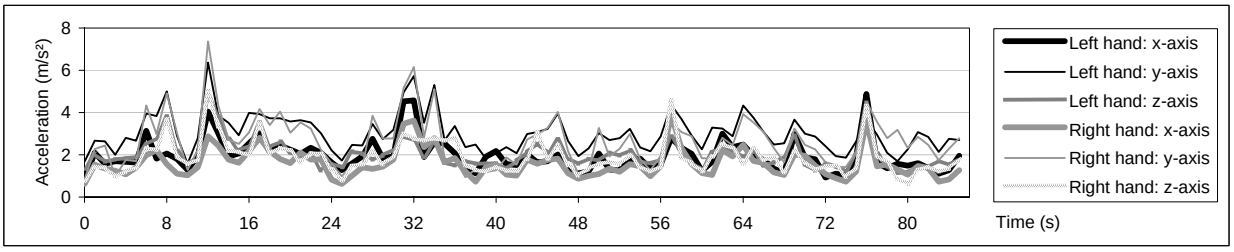
MainID: 1368, ResultsID: 9943

LocationName:		MachineManufacturer:	
		MachineModel:	
Occupation:	Grounds maintenance		HSLAnonymisedToolLetter: Machine C
Process:	Grass Cutting	MachineModifications:	
RecordDate:	September 30, 2010	MachineSize: 510mm cutting width	MainID: 1369
		MachineWeight(kg): 110	ResultsID: 9944
TapeNumber:	N/A	MachineOperating pressure:	
Operator#:	OP#1	MachineSpeed(impacts/min):	
	Cutting in circle on incline	MachineSpeed(revs/min):	
VideoNumber:	N/A	MachinePower:	
		MachinePower source: Unleaded petrol	MeasurementTime: 86.25 Seconds
Notes:	20mm cut		NumShotsInMeas:
		InsertedTool:	DailyExposureTime:
DC-shift threshold:	*10 mm*	InsertedToolType:	A(8) Left hand m/s²
		InsertedToolManufacturer:	

	Left hand			Right hand		
Frequency	x-axis	y-axis	z-axis	x-axis	y-axis	z-axis
1.6	0.519	0.667	0.32	0.462	0.712	0.317
2	0.775	0.895	0.445	0.756	0.851	0.424
2.5	0.962	1.305	0.594	0.943	1.272	0.582
3.15	1.271	1.653	0.713	1.202	1.721	0.726
4	1.179	1.466	0.71	1.124	1.494	0.716
5	1.069	1.576	0.768	1.016	1.71	0.786
6.3	0.982	1.807	0.966	0.886	2.018	0.998
8	0.994	1.527	0.891	0.824	1.751	0.926
10	0.857	1.057	0.766	0.751	1.177	0.74
12.5	0.813	0.798	0.669	0.682	0.932	0.672
16	0.723	0.774	0.608	0.556	0.824	0.624
20	0.75	1.524	0.738	0.767	0.975	0.99
25	0.494	0.555	0.457	0.398	0.481	0.58
31.5	0.586	0.625	0.565	0.416	0.586	0.67
40	2.544	4.204	3.153	1.632	2.622	2.468
50	1.051	1.241	1.159	0.884	0.932	0.941
63	0.57	1.724	1.317	1.11	0.824	0.863
80	0.531	1.878	1.477	1.05	1.468	1.072
100	0.592	1.174	0.974	0.667	1.014	0.947
125	0.472	0.533	0.661	0.595	0.462	0.683
160	0.401	0.577	0.509	0.48	0.418	0.642
200	0.48	0.496	0.321	0.455	0.521	0.592
250	1.003	0.665	0.299	0.504	0.501	0.377
315	0.624	0.964	0.223	0.302	0.683	0.316
400	0.775	1.148	0.246	0.447	0.674	0.221
500	0.635	0.817	0.416	0.472	0.504	0.239
630	0.427	0.313	0.301	0.468	0.211	0.219
800	0.321	0.136	0.507	0.452	0.106	0.378
1000	0.372	0.152	0.84	0.37	0.09	0.77
1250	0.269	0.116	0.674	0.177	0.056	0.671
ahw	**2.328**	**3.469**	**2.279**	**2.0**	**3.3**	**2.2**
av		**4.8**			**4.4**	







MainID: 1369, ResultsID: 9944

LocationName:

Occupation: Grounds maintenance
Process: Grass Cutting
RecordDate: September 30, 2010

TapeNumber: N/A
Operator#: OP#2
Cutting in circle on incline
VideoNumber: N/A

Notes: 20mm cut

DC-shift threshold: 10 mm

MachineManufacturer:
MachineModel:

HSLAnonymisedToolLetter: Machine C

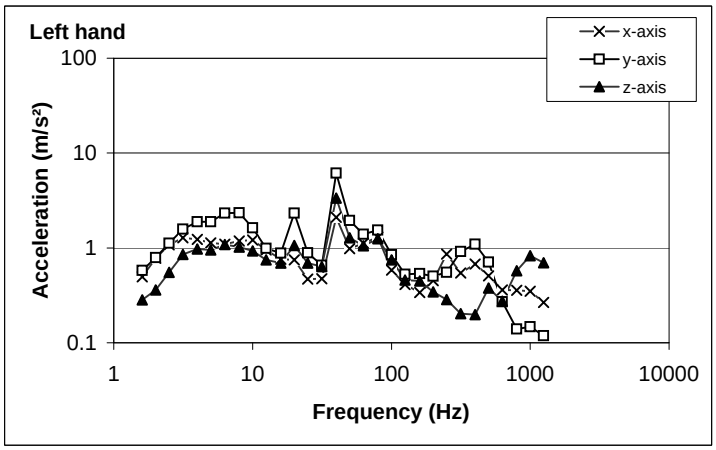
MachineModifications:
MachineSize: 510mm cutting width
MachineWeight(kg): 110
MachineOperating pressure:
MachineSpeed(impacts/min):
MachineSpeed(revs/min):
MachinePower:
MachinePower source: Unleaded petrol

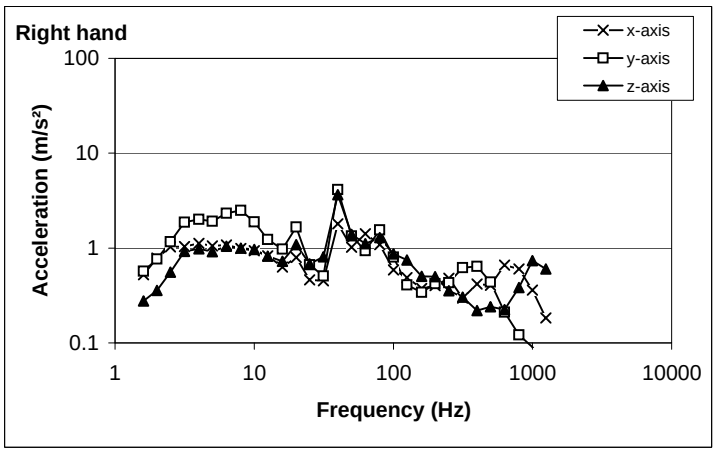
MainID: 1369
ResultsID: 9945

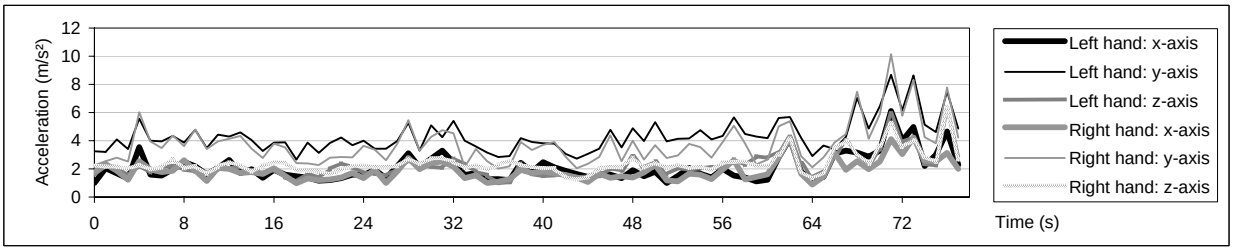
MeasurementTime: 78.5 Seconds
NumShotsInMeas:
DailyExposureTime:
A(8) Left hand m/s²

InsertedTool:
InsertedToolType:
InsertedToolManufacturer:

	Left hand			Right hand		
Frequency	x-axis	y-axis	z-axis	x-axis	y-axis	z-axis
1.6	0.496	0.58	0.283	0.524	0.57	0.277
2	0.778	0.791	0.36	0.783	0.767	0.356
2.5	1.079	1.119	0.554	1.032	1.168	0.555
3.15	1.279	1.582	0.856	1.038	1.871	0.922
4	1.226	1.889	0.973	1.117	2.003	0.983
5	1.126	1.888	0.953	1.055	1.911	0.913
6.3	1.096	2.328	1.089	1.077	2.318	1.047
8	1.183	2.353	1.023	0.986	2.491	0.997
10	1.208	1.628	0.928	0.935	1.887	0.964
12.5	0.95	0.992	0.75	0.825	1.234	0.822
16	0.758	0.881	0.692	0.63	0.977	0.728
20	0.748	2.332	1.063	0.795	1.671	1.086
25	0.471	0.89	0.695	0.461	0.666	0.68
31.5	0.472	0.656	0.634	0.453	0.506	0.807
40	2.11	6.147	3.362	1.801	4.123	3.657
50	0.984	1.947	1.282	1.02	1.344	1.398
63	1.12	1.395	1.056	1.42	0.94	1.112
80	1.303	1.543	1.254	1.084	1.548	1.286
100	0.584	0.844	0.748	0.587	0.804	0.868
125	0.413	0.526	0.46	0.486	0.409	0.749
160	0.34	0.534	0.45	0.375	0.342	0.502
200	0.45	0.505	0.345	0.401	0.421	0.499
250	0.862	0.552	0.286	0.479	0.431	0.354
315	0.544	0.915	0.203	0.297	0.623	0.304
400	0.674	1.098	0.198	0.417	0.641	0.22
500	0.509	0.711	0.377	0.406	0.439	0.241
630	0.362	0.271	0.274	0.659	0.21	0.224
800	0.359	0.14	0.573	0.602	0.121	0.385
1000	0.349	0.148	0.828	0.361	0.09	0.736
1250	0.266	0.119	0.698	0.183	0.056	0.601
ahw	**2.56**	**4.856**	**2.609**	**2.3**	**4.5**	**2.7**
av		**6.1**			**5.7**	







MainID: 1369, ResultsID: 9945

LocationName:

Occupation: Grounds maintenance
Process: Grass Cutting
RecordDate: September 30, 2010

TapeNumber: N/A
Operator#: OP#3
Cutting in circle on incline
VideoNumber: N/A

Notes: 20mm cut

DC-shift threshold: 10 mm

MachineManufacturer:
MachineModel:

HSLAnonymisedToolLetter: Machine C

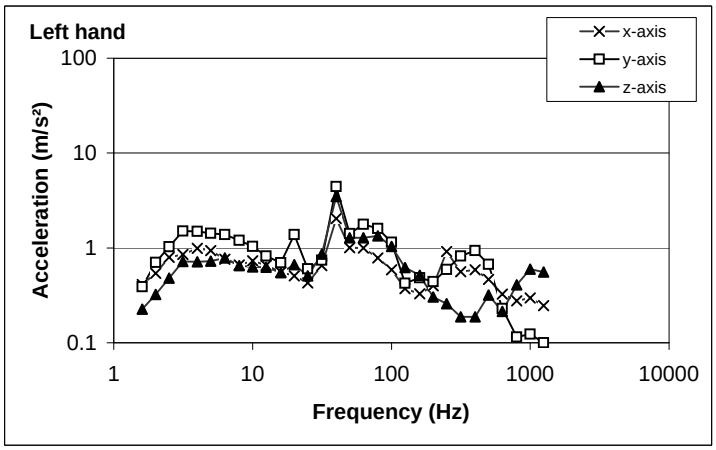
MachineModifications:
MachineSize: 510mm cutting width
MachineWeight(kg): 110
MachineOperating pressure:
MachineSpeed(impacts/min):
MachineSpeed(revs/min):
MachinePower:
MachinePower source: Unleaded petrol

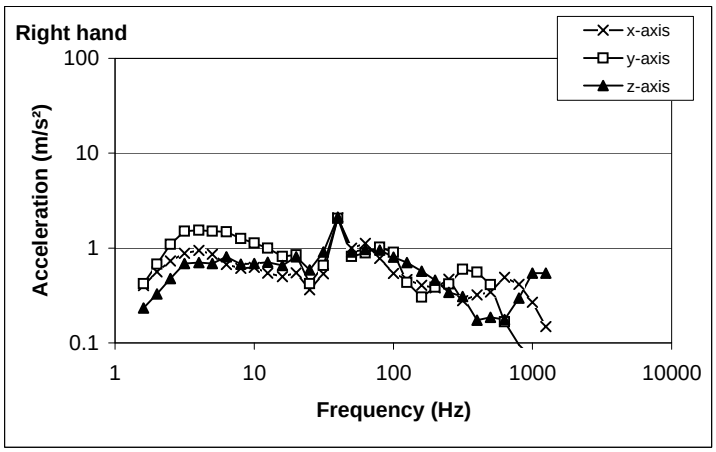
InsertedTool:
InsertedToolType:
InsertedToolManufacturer:

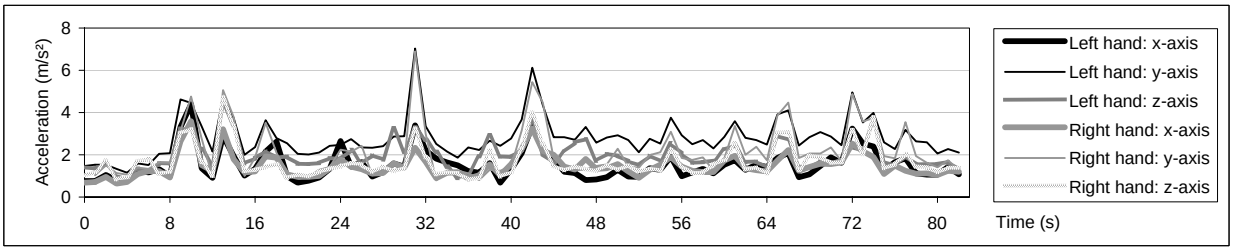
MainID: 1369
ResultsID: 9946

MeasurementTime: 83.75 Seconds
NumShotsInMeas:
DailyExposureTime:
A(8) Left hand m/s²

	Left hand			Right hand		
Frequency	x-axis	y-axis	z-axis	x-axis	y-axis	z-axis
1.6	0.411	0.388	0.226	0.402	0.421	0.233
2	0.539	0.705	0.324	0.562	0.677	0.328
2.5	0.795	1.031	0.482	0.732	1.092	0.476
3.15	0.852	1.51	0.722	0.879	1.508	0.685
4	0.993	1.491	0.713	0.943	1.542	0.705
5	0.94	1.426	0.724	0.861	1.511	0.689
6.3	0.759	1.381	0.785	0.67	1.484	0.806
8	0.66	1.201	0.649	0.612	1.264	0.676
10	0.73	1.033	0.628	0.624	1.133	0.685
12.5	0.654	0.822	0.624	0.546	1	0.707
16	0.556	0.696	0.547	0.5	0.815	0.654
20	0.507	1.387	0.667	0.549	0.847	0.809
25	0.429	0.603	0.508	0.363	0.422	0.588
31.5	0.65	0.745	0.859	0.538	0.657	0.907
40	2.044	4.436	3.481	2.085	2.048	2.114
50	1.008	1.419	1.276	0.997	0.818	0.908
63	0.998	1.777	1.275	1.119	0.886	0.968
80	0.787	1.605	1.341	0.779	1.019	0.95
100	0.586	1.146	1.038	0.542	0.904	0.805
125	0.373	0.423	0.621	0.466	0.434	0.703
160	0.329	0.483	0.516	0.406	0.303	0.571
200	0.399	0.44	0.304	0.38	0.388	0.458
250	0.916	0.592	0.258	0.468	0.418	0.342
315	0.561	0.824	0.187	0.279	0.598	0.309
400	0.586	0.941	0.188	0.32	0.558	0.173
500	0.466	0.67	0.317	0.344	0.412	0.187
630	0.325	0.23	0.214	0.492	0.168	0.176
800	0.278	0.115	0.408	0.413	0.095	0.298
1000	0.296	0.123	0.598	0.269	0.069	0.545
1250	0.246	0.1	0.558	0.149	0.052	0.543
ahw	**1.869**	**3.247**	**2.21**	**1.7**	**2.8**	**2.0**
av		**4.3**			**3.8**	



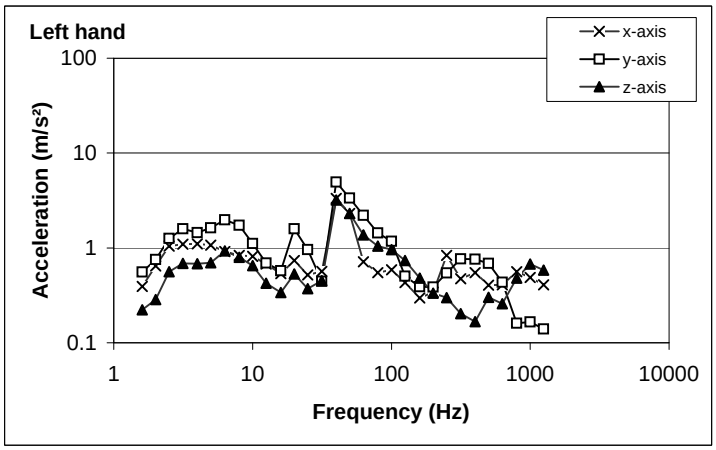


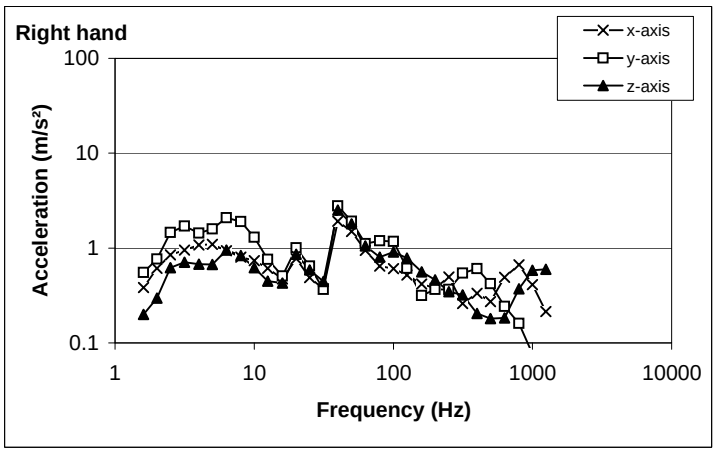


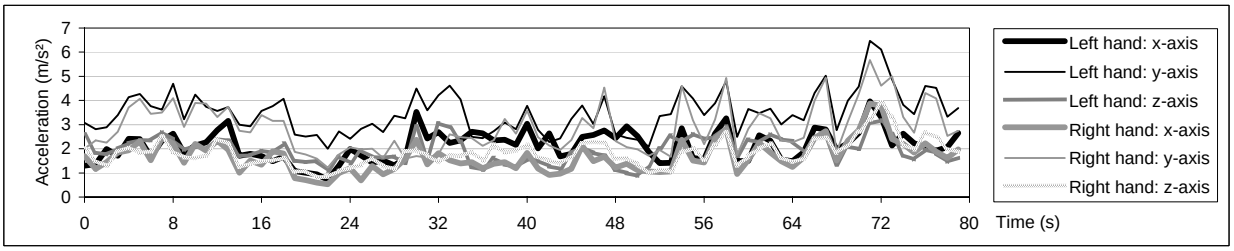
MainID: 1369, ResultsID: 9946

LocationName:		MachineManufacturer:			
		MachineModel:			
Occupation:	Grounds maintenance			HSLAnonymisedToolLetter:	Machine C
Process:	Grass Cutting	MachineModifications:			
RecordDate:	September 30, 2010	MachineSize:	510mm cutting width	MainID:	1370
		MachineWeight(kg):	110	ResultsID:	9947
TapeNumber:	N/A	MachineOperating pressure:			
Operator#:	OP#1	MachineSpeed(impacts/min):			
	Cutting in figure of 8 on mock putting green prepa	MachineSpeed(revs/min):			
VideoNumber:	N/A	MachinePower:			
		MachinePower source:	Unleaded petrol	MeasurementTime:	80 Seconds
Notes:	20mm cut			NumShotsInMeas:	
		InsertedTool:		DailyExposureTime:	
DC-shift threshold:	*10 mm*	InsertedToolType:		A(8) Left hand	m/s²
		InsertedToolManufacturer:			

	Left hand			Right hand		
Frequency	x-axis	y-axis	z-axis	x-axis	y-axis	z-axis
1.6	0.393	0.558	0.223	0.384	0.551	0.2
2	0.645	0.754	0.286	0.613	0.766	0.296
2.5	1.047	1.263	0.561	0.847	1.459	0.622
3.15	1.095	1.585	0.689	0.95	1.701	0.707
4	1.107	1.445	0.68	1.078	1.432	0.678
5	1.066	1.626	0.698	1.097	1.589	0.672
6.3	0.915	1.975	0.932	0.941	2.082	0.951
8	0.835	1.729	0.798	0.799	1.904	0.832
10	0.812	1.113	0.651	0.735	1.303	0.62
12.5	0.677	0.695	0.425	0.61	0.761	0.449
16	0.537	0.576	0.34	0.471	0.506	0.426
20	0.734	1.592	0.532	0.772	1.005	0.859
25	0.521	0.959	0.371	0.488	0.645	0.59
31.5	0.566	0.446	0.451	0.371	0.367	0.444
40	3.33	4.933	3.189	1.914	2.788	2.518
50	2.309	3.364	2.313	1.491	1.922	1.8
63	0.713	2.207	1.37	0.946	1.114	1.049
80	0.55	1.434	1.046	0.645	1.195	0.8
100	0.587	1.173	0.957	0.608	1.172	0.906
125	0.43	0.504	0.736	0.518	0.61	0.787
160	0.297	0.389	0.482	0.418	0.316	0.561
200	0.343	0.387	0.334	0.377	0.365	0.462
250	0.835	0.543	0.299	0.495	0.366	0.346
315	0.473	0.768	0.203	0.26	0.543	0.321
400	0.55	0.76	0.167	0.333	0.605	0.205
500	0.406	0.686	0.302	0.271	0.422	0.18
630	0.407	0.434	0.258	0.492	0.242	0.183
800	0.56	0.161	0.48	0.667	0.161	0.371
1000	0.487	0.166	0.675	0.41	0.077	0.585
1250	0.409	0.14	0.582	0.214	0.065	0.597
ahw	**2.422**	**3.897**	**2.146**	**2.0**	**3.4**	**2.0**
av		**5.1**			**4.4**	



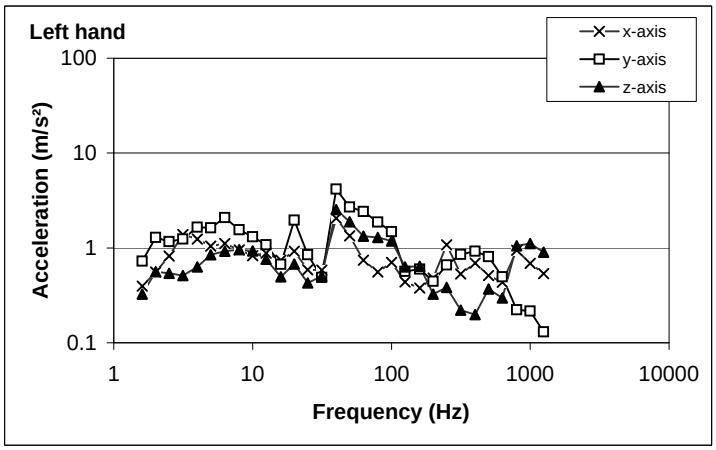


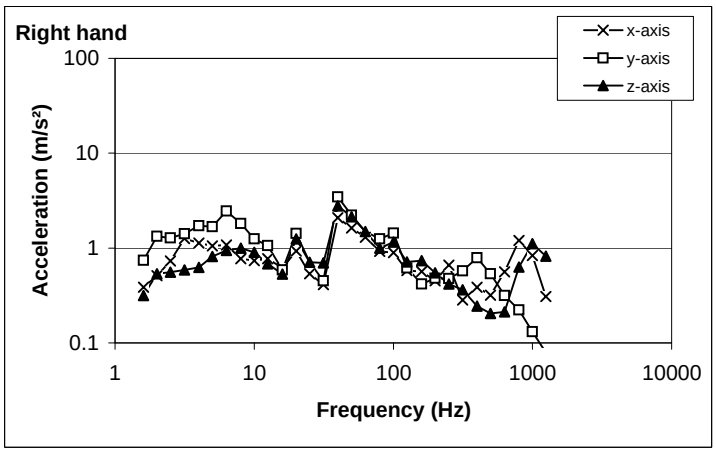


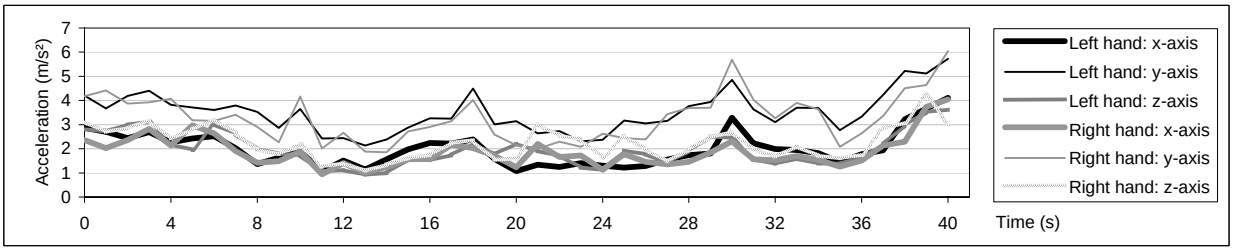
MainID: 1370, ResultsID: 9947

LocationName:		MachineManufacturer:				
		MachineModel:				
Occupation:	Grounds maintenance			HSLAnonymisedToolLetter:	Machine C	
Process:	Grass Cutting	MachineModifications:				
RecordDate:	September 30, 2010	MachineSize:	510mm cutting width	MainID:	1370	
		MachineWeight(kg):	110	ResultsID:	9950	
TapeNumber:	N/A	MachineOperating pressure:				
Operator#:	OP#1	MachineSpeed(impacts/min):				
	Cutting in figure of 8 on mock putting green prepa	MachineSpeed(revs/min):				
VideoNumber:	N/A	MachinePower:				
		MachinePower source:	Unleaded petrol	MeasurementTime:	41.75 Seconds	
Notes:	10mm cut			NumShotsInMeas:		
		InsertedTool:		DailyExposureTime:		
DC-shift threshold:	*10 mm*	InsertedToolType:		A(8) Left hand	m/s²	
		InsertedToolManufacturer:				

	Left hand			Right hand		
Frequency	x-axis	y-axis	z-axis	x-axis	y-axis	z-axis
1.6	0.396	0.725	0.326	0.386	0.741	0.316
2	0.557	1.289	0.562	0.513	1.332	0.537
2.5	0.824	1.164	0.54	0.734	1.275	0.556
3.15	1.378	1.243	0.512	1.256	1.42	0.59
4	1.242	1.647	0.631	1.127	1.717	0.625
5	1.042	1.624	0.846	1.053	1.676	0.817
6.3	1.109	2.079	0.923	1.081	2.458	0.945
8	0.948	1.557	0.963	0.771	1.82	0.995
10	0.831	1.307	0.93	0.736	1.249	0.902
12.5	0.878	1.077	0.759	0.774	1.063	0.683
16	0.742	0.67	0.495	0.616	0.587	0.531
20	0.921	1.968	0.679	0.927	1.427	1.25
25	0.59	0.846	0.429	0.535	0.711	0.71
31.5	0.582	0.489	0.505	0.411	0.451	0.699
40	2.06	4.151	2.537	2.092	3.468	2.772
50	1.337	2.706	1.882	1.63	2.221	2.142
63	0.744	2.427	1.327	1.302	1.49	1.489
80	0.558	1.877	1.288	0.926	1.254	0.995
100	0.703	1.481	1.18	0.896	1.44	1.159
125	0.438	0.564	0.63	0.577	0.616	0.711
160	0.379	0.596	0.638	0.565	0.419	0.735
200	0.481	0.446	0.325	0.45	0.479	0.549
250	1.076	0.661	0.383	0.663	0.477	0.418
315	0.533	0.855	0.221	0.282	0.576	0.364
400	0.69	0.919	0.198	0.386	0.791	0.245
500	0.511	0.808	0.37	0.317	0.534	0.204
630	0.433	0.495	0.298	0.562	0.317	0.212
800	0.942	0.223	1.049	1.205	0.223	0.631
1000	0.687	0.216	1.111	0.834	0.131	1.116
1250	0.534	0.13	0.899	0.309	0.079	0.819
ahw	**2.349**	**3.928**	**2.254**	**2.2**	**3.8**	**2.5**
av		**5.1**			**5.0**	



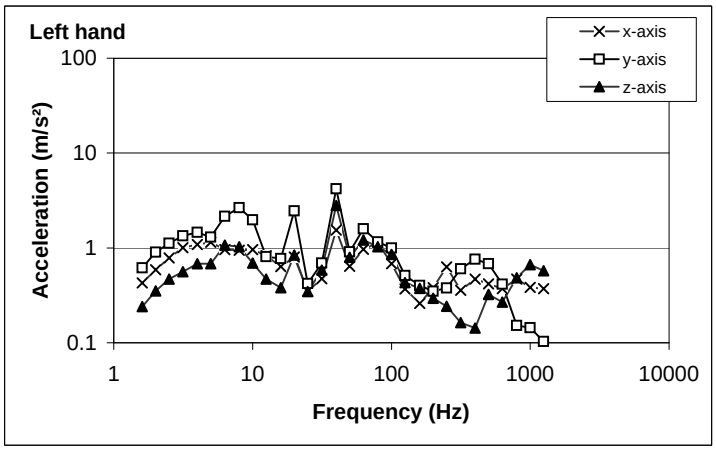


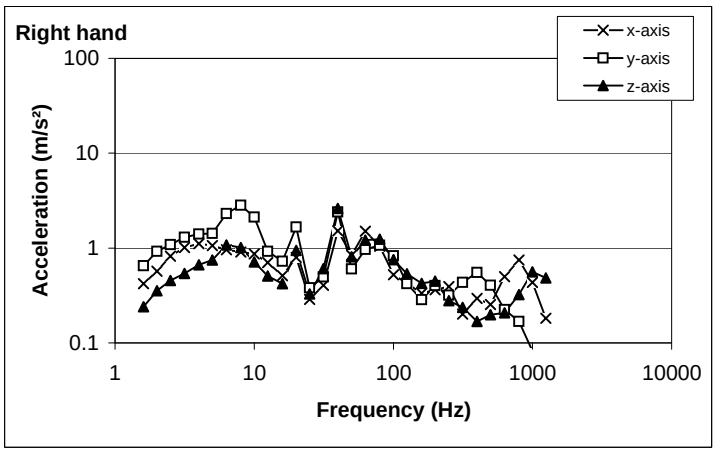


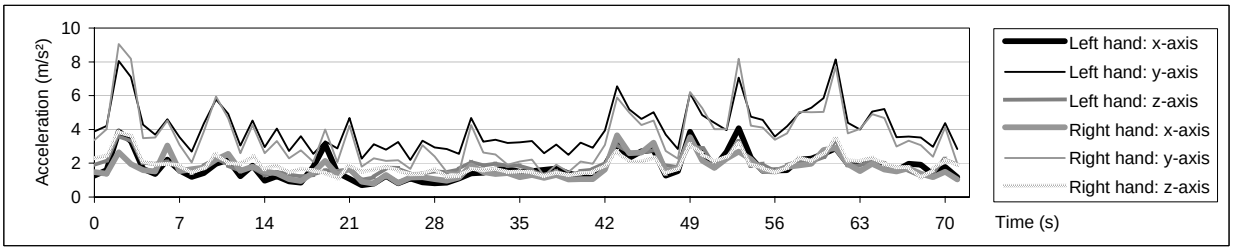
MainID: 1370, ResultsID: 9950

LocationName:		MachineManufacturer:			
		MachineModel:			
Occupation:	Grounds maintenance			HSLAnonymisedToolLetter:	Machine C
Process:	Grass Cutting	MachineModifications:			
RecordDate:	September 30, 2010	MachineSize:	510mm cutting width	MainID:	1370
		MachineWeight(kg):	110	ResultsID:	9948
TapeNumber:	N/A	MachineOperating pressure:			
Operator#:	OP#2	MachineSpeed(impacts/min):			
	Cutting in figure of 8 on mock putting green prepa	MachineSpeed(revs/min):			
VideoNumber:	N/A	MachinePower:			
		MachinePower source:	Unleaded petrol	MeasurementTime:	72.25 Seconds
Notes:	20mm cut			NumShotsInMeas:	
		InsertedTool:		DailyExposureTime:	
DC-shift threshold:	*10 mm*	InsertedToolType:		A(8) Left hand	m/s²
		InsertedToolManufacturer:			

	Left hand			Right hand		
Frequency	x-axis	y-axis	z-axis	x-axis	y-axis	z-axis
1.6	0.427	0.614	0.24	0.42	0.649	0.241
2	0.589	0.902	0.351	0.57	0.922	0.354
2.5	0.787	1.122	0.471	0.821	1.084	0.455
3.15	1.001	1.338	0.561	1.012	1.302	0.541
4	1.084	1.463	0.68	1.115	1.402	0.667
5	1.146	1.297	0.682	1.065	1.428	0.747
6.3	0.957	2.146	1.073	0.959	2.301	1.076
8	0.948	2.663	1.027	0.909	2.835	1.01
10	0.963	1.972	0.691	0.869	2.113	0.715
12.5	0.828	0.811	0.47	0.703	0.925	0.508
16	0.637	0.77	0.382	0.513	0.728	0.42
20	0.8	2.465	0.842	0.794	1.669	0.942
25	0.349	0.422	0.347	0.287	0.381	0.328
31.5	0.474	0.693	0.585	0.404	0.495	0.609
40	1.544	4.185	2.798	1.522	2.403	2.605
50	0.642	0.907	0.799	0.84	0.601	0.81
63	0.968	1.594	1.213	1.504	0.968	1.211
80	1.126	1.156	1.027	1.044	1.072	1.243
100	0.68	0.996	0.854	0.525	0.829	0.752
125	0.37	0.51	0.432	0.423	0.423	0.536
160	0.259	0.403	0.375	0.334	0.285	0.425
200	0.38	0.348	0.294	0.363	0.401	0.448
250	0.63	0.377	0.243	0.392	0.319	0.279
315	0.358	0.601	0.163	0.202	0.435	0.237
400	0.47	0.759	0.143	0.295	0.553	0.168
500	0.418	0.68	0.324	0.254	0.406	0.198
630	0.372	0.416	0.268	0.501	0.224	0.208
800	0.469	0.152	0.485	0.746	0.168	0.323
1000	0.382	0.144	0.667	0.434	0.082	0.563
1250	0.372	0.103	0.574	0.182	0.069	0.484
ahw	**2.163**	**4.54**	**2.127**	**2.0**	**4.3**	**2.1**
av		**5.5**			**5.2**	



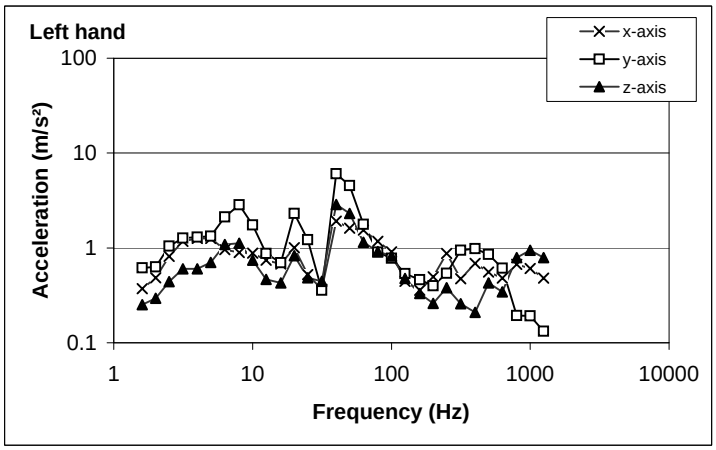


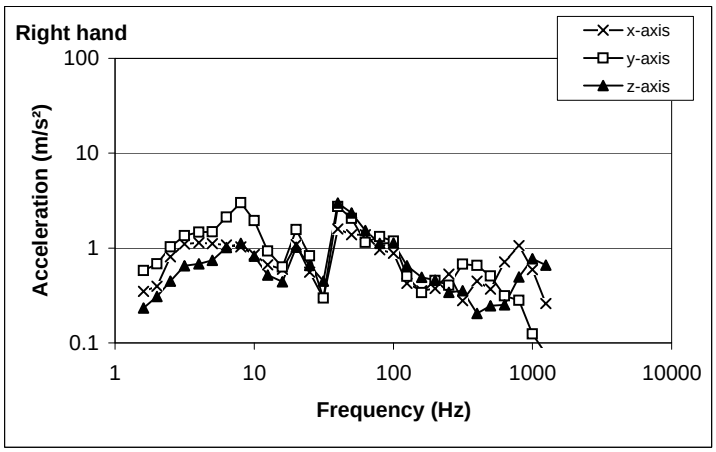


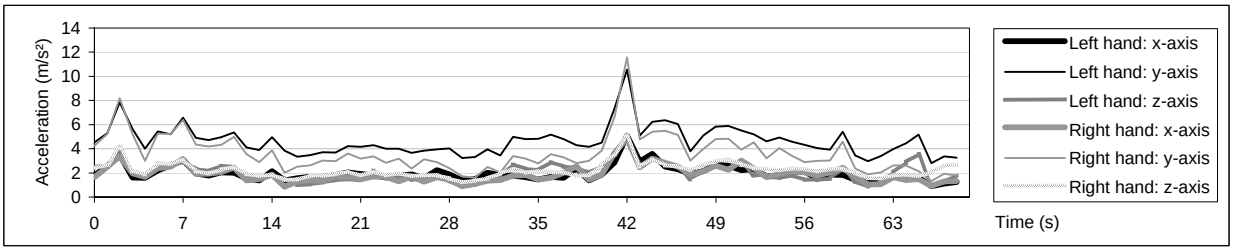
MainID: 1370, ResultsID: 9948

LocationName:		MachineManufacturer:			
		MachineModel:			
Occupation:	Grounds maintenance			HSLAnonymisedToolLetter:	Machine C
Process:	Grass Cutting	MachineModifications:			
RecordDate:	September 30, 2010	MachineSize:	510mm cutting width	MainID:	1370
		MachineWeight(kg):	110	ResultsID:	9951
TapeNumber:	N/A	MachineOperating pressure:			
Operator#:	OP#2	MachineSpeed(impacts/min):			
	Cutting in figure of 8 on mock putting green prepa	MachineSpeed(revs/min):			
VideoNumber:	N/A	MachinePower:			
		MachinePower source:	Unleaded petrol	MeasurementTime:	69.75 Seconds
Notes:	10mm cut			NumShotsInMeas:	
		InsertedTool:		DailyExposureTime:	
DC-shift threshold:	*10 mm*	InsertedToolType:		A(8) Left hand	m/s²
		InsertedToolManufacturer:			

	Left hand			Right hand		
Frequency	x-axis	y-axis	z-axis	x-axis	y-axis	z-axis
1.6	0.371	0.614	0.251	0.349	0.581	0.233
2	0.486	0.631	0.294	0.395	0.682	0.307
2.5	0.815	1.047	0.44	0.808	1.026	0.449
3.15	1.177	1.267	0.602	1.107	1.356	0.65
4	1.255	1.304	0.601	1.14	1.472	0.681
5	1.264	1.333	0.705	1.113	1.484	0.741
6.3	0.961	2.117	1.084	1.08	2.114	1.013
8	0.895	2.851	1.118	1.025	3.013	1.118
10	0.882	1.751	0.744	0.851	1.945	0.821
12.5	0.742	0.876	0.466	0.666	0.934	0.518
16	0.676	0.698	0.429	0.599	0.629	0.44
20	1.009	2.304	0.829	1.083	1.562	1.023
25	0.524	1.22	0.486	0.557	0.825	0.657
31.5	0.366	0.358	0.445	0.297	0.297	0.447
40	1.922	6.045	2.873	1.588	2.736	2.982
50	1.61	4.549	2.303	1.379	2.061	2.338
63	1.538	1.766	1.146	1.386	1.151	1.534
80	1.174	0.903	0.918	0.956	1.318	1.12
100	0.91	0.776	0.819	0.88	1.182	1.125
125	0.444	0.537	0.477	0.424	0.502	0.653
160	0.358	0.464	0.332	0.356	0.34	0.49
200	0.494	0.399	0.259	0.374	0.454	0.457
250	0.872	0.54	0.38	0.532	0.405	0.341
315	0.474	0.943	0.258	0.279	0.679	0.355
400	0.685	0.984	0.208	0.449	0.656	0.205
500	0.557	0.855	0.429	0.37	0.507	0.247
630	0.48	0.611	0.345	0.716	0.314	0.253
800	0.669	0.194	0.788	1.065	0.281	0.497
1000	0.608	0.192	0.946	0.592	0.125	0.772
1250	0.48	0.132	0.79	0.259	0.077	0.659
ahw	**2.321**	**5.085**	**2.306**	**2.3**	**4.3**	**2.4**
av		**6.0**			**5.5**	



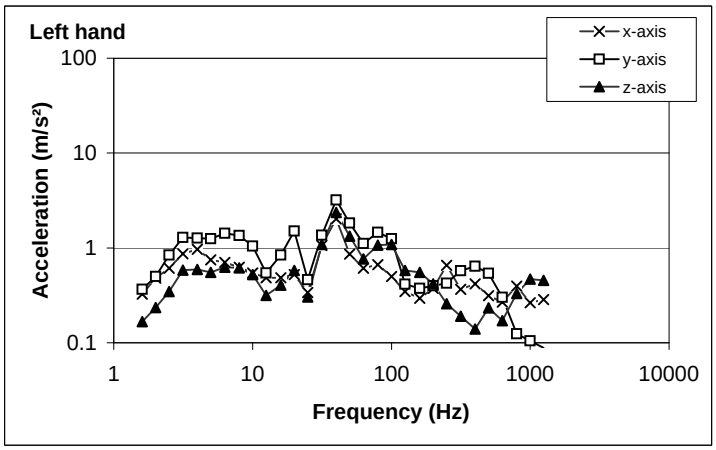


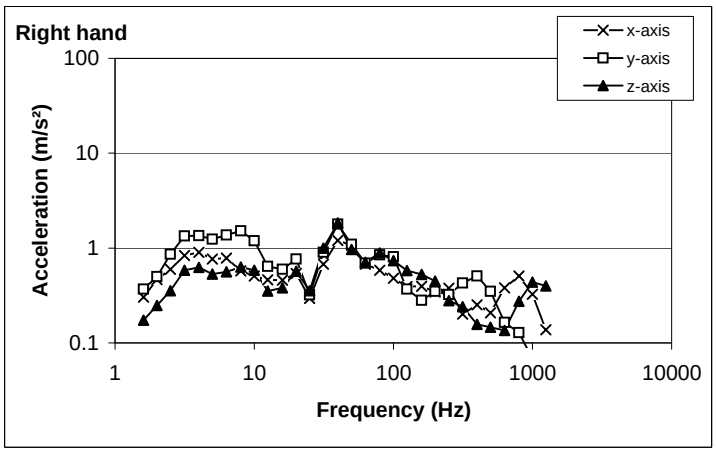


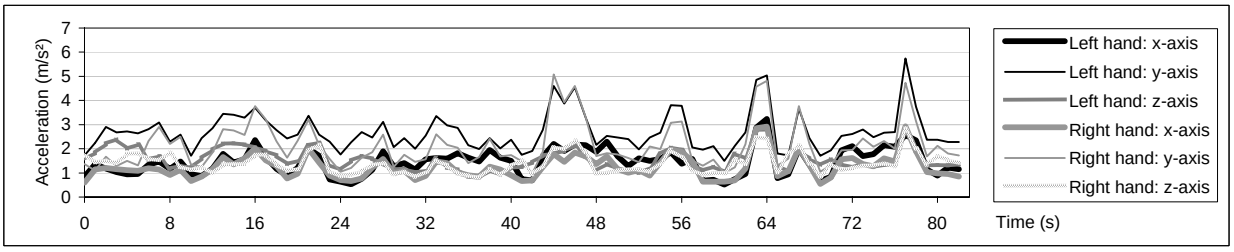
MainID: 1370, ResultsID: 9951

LocationName:		MachineManufacturer:	
		MachineModel:	
Occupation:	Grounds maintenance		HSLAnonymisedToolLetter: Machine C
Process:	Grass Cutting	MachineModifications:	
RecordDate:	September 30, 2010	MachineSize: 510mm cutting width	MainID: 1370
		MachineWeight(kg): 110	ResultsID: 9949
TapeNumber:	N/A	MachineOperating pressure:	
Operator#:	OP#3	MachineSpeed(impacts/min):	
	Cutting in figure of 8 on mock putting green prepa	MachineSpeed(revs/min):	
VideoNumber:	N/A	MachinePower:	
		MachinePower source: Unleaded petrol	MeasurementTime: 83.75 Seconds
Notes:	20mm cut		NumShotsInMeas:
		InsertedTool:	DailyExposureTime:
DC-shift threshold:	*10 mm*	InsertedToolType:	A(8) Left hand m/s²
		InsertedToolManufacturer:	

	Left hand			Right hand		
Frequency	x-axis	y-axis	z-axis	x-axis	y-axis	z-axis
1.6	0.325	0.366	0.167	0.304	0.368	0.174
2	0.48	0.5	0.235	0.466	0.499	0.249
2.5	0.61	0.843	0.347	0.598	0.858	0.355
3.15	0.87	1.289	0.582	0.837	1.34	0.584
4	0.97	1.265	0.595	0.905	1.352	0.625
5	0.746	1.247	0.551	0.765	1.243	0.53
6.3	0.705	1.425	0.627	0.784	1.374	0.56
8	0.625	1.353	0.618	0.572	1.523	0.631
10	0.544	1.047	0.525	0.509	1.196	0.584
12.5	0.483	0.544	0.315	0.461	0.641	0.352
16	0.485	0.844	0.404	0.458	0.598	0.38
20	0.524	1.51	0.577	0.54	0.765	0.568
25	0.338	0.461	0.304	0.294	0.321	0.354
31.5	1.058	1.364	1.086	0.675	0.901	0.998
40	2.023	3.206	2.363	1.204	1.78	1.84
50	0.861	1.828	1.327	1.068	1.093	0.969
63	0.613	1.114	0.769	0.677	0.691	0.709
80	0.667	1.462	1.067	0.581	0.848	0.886
100	0.5	1.249	1.085	0.482	0.809	0.739
125	0.346	0.415	0.579	0.393	0.369	0.578
160	0.295	0.376	0.551	0.395	0.281	0.525
200	0.376	0.399	0.417	0.343	0.35	0.447
250	0.655	0.425	0.258	0.379	0.323	0.278
315	0.367	0.573	0.19	0.201	0.428	0.24
400	0.417	0.642	0.139	0.253	0.508	0.157
500	0.314	0.54	0.234	0.208	0.349	0.146
630	0.267	0.302	0.171	0.382	0.165	0.135
800	0.396	0.124	0.331	0.508	0.129	0.275
1000	0.264	0.105	0.469	0.325	0.068	0.439
1250	0.286	0.088	0.456	0.137	0.058	0.397
ahw	**1.711**	**3.066**	**1.717**	**1.5**	**2.6**	**1.6**
av		**3.9**			**3.4**	



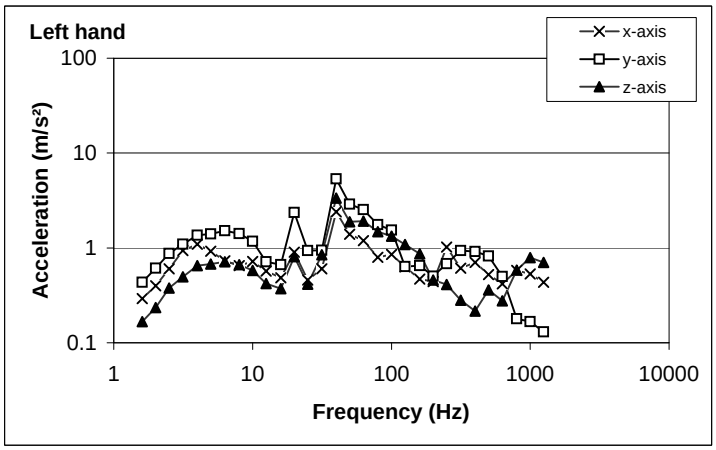


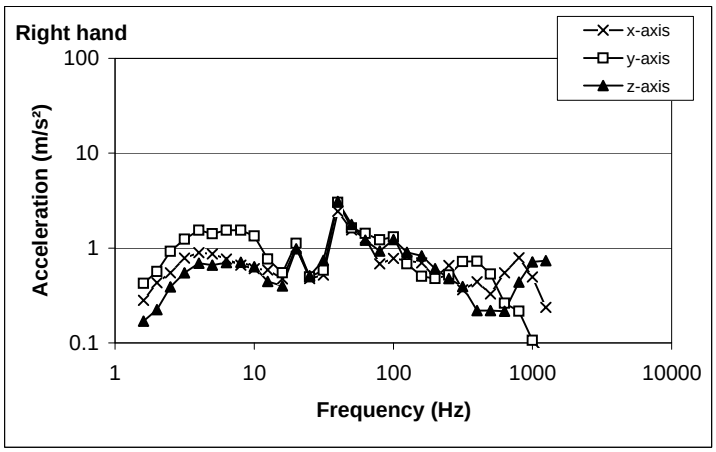


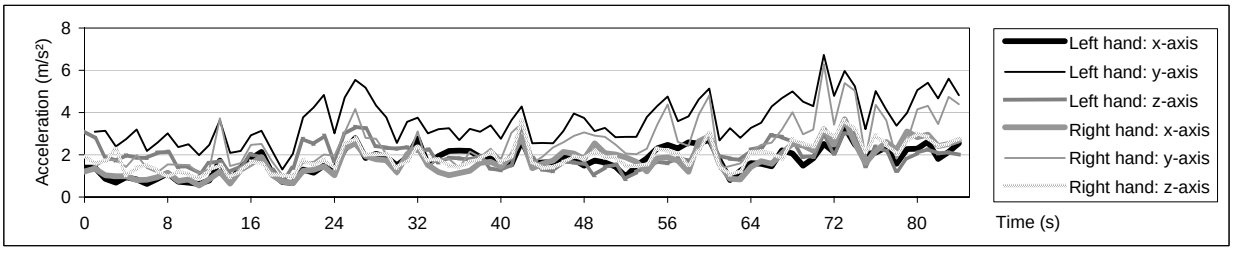
MainID: 1370, ResultsID: 9949

LocationName:		MachineManufacturer:	
		MachineModel:	
Occupation:	Grounds maintenance		HSLAnonymisedToolLetter: Machine C
Process:	Grass Cutting	MachineModifications:	
RecordDate:	September 30, 2010	MachineSize: 510mm cutting width	MainID: 1370
		MachineWeight(kg): 110	ResultsID: 9952
TapeNumber:	N/A	MachineOperating pressure:	
Operator#:	OP#3	MachineSpeed(impacts/min):	
	Cutting in figure of 8 on mock putting green prepa	MachineSpeed(revs/min):	
VideoNumber:	N/A	MachinePower:	
		MachinePower source: Unleaded petrol	MeasurementTime: 85.5 Seconds
Notes:	10mm cut		NumShotsInMeas:
		InsertedTool:	DailyExposureTime:
DC-shift threshold:	*10 mm*	InsertedToolType:	A(8) Left hand m/s²
		InsertedToolManufacturer:	

	Left hand			Right hand		
Frequency	x-axis	y-axis	z-axis	x-axis	y-axis	z-axis
1.6	0.292	0.433	0.167	0.281	0.425	0.17
2	0.398	0.609	0.235	0.43	0.565	0.225
2.5	0.601	0.874	0.379	0.548	0.925	0.39
3.15	0.94	1.095	0.495	0.786	1.241	0.549
4	1.094	1.361	0.648	0.897	1.545	0.692
5	0.924	1.403	0.674	0.868	1.417	0.661
6.3	0.729	1.522	0.712	0.768	1.543	0.704
8	0.651	1.412	0.668	0.659	1.544	0.709
10	0.722	1.17	0.578	0.606	1.34	0.636
12.5	0.57	0.715	0.422	0.588	0.767	0.445
16	0.485	0.668	0.372	0.475	0.547	0.398
20	0.902	2.357	0.81	1.02	1.124	0.978
25	0.459	0.938	0.413	0.478	0.494	0.51
31.5	0.601	0.944	0.849	0.519	0.585	0.741
40	2.398	5.339	3.351	2.438	3.033	3.112
50	1.395	2.888	1.882	1.556	1.624	1.776
63	1.192	2.539	1.923	1.269	1.43	1.208
80	0.793	1.761	1.479	0.684	1.22	0.932
100	0.856	1.541	1.333	0.778	1.31	1.23
125	0.633	0.634	1.09	0.737	0.683	0.898
160	0.471	0.649	0.868	0.699	0.505	0.827
200	0.443	0.504	0.46	0.487	0.477	0.606
250	1.02	0.682	0.41	0.654	0.52	0.477
315	0.613	0.936	0.28	0.362	0.72	0.393
400	0.704	0.916	0.215	0.439	0.725	0.219
500	0.525	0.819	0.361	0.328	0.533	0.219
630	0.419	0.499	0.276	0.548	0.262	0.215
800	0.579	0.179	0.582	0.788	0.215	0.437
1000	0.531	0.167	0.789	0.496	0.106	0.712
1250	0.435	0.13	0.705	0.238	0.072	0.734
ahw	**2.016**	**4.01**	**2.178**	**2.0**	**3.1**	**2.1**
av		**5.0**			**4.3**	







MainID: 1370, ResultsID: 9952

Vibration Emission Test report

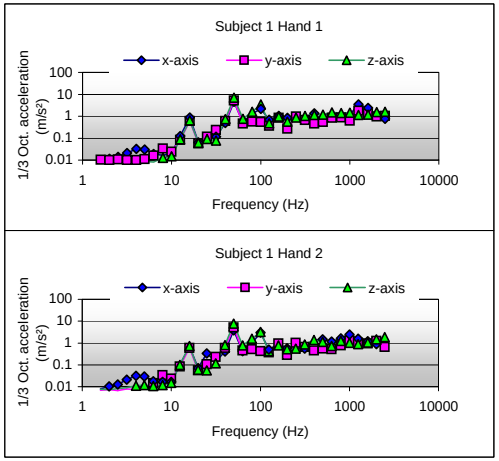
Pulse file version: HAV Emission V2.1.2 2008-07-25.pls
Spreadsheet: Version 2.0 22/8/2008

Standard: BS EN 836:1997
N&V reference ID: NV/10/09
Measurement file name: Machine D

					Hand Position 1 - Left hand							Hand position 2 - Right hand						
									Operator Statistics							Operator Statistics		
TestNo.	Operator	Meas. Name	Meas. Date	Meas Time	a_{whx}	a_{why}	a_{whz}	a_{hv}	Mean a_{hv}	S_{n-1}	C_v	a_{whx}	a_{why}	a_{whz}	a_{hv}	Mean a_{hv}	S_{n-1}	C_v
1	1	SH01	9/07/201	11:50:29:374	1.67	1.74	2.32	3.35				1.40	1.71	2.56	3.39			
2	1	SH02	9/07/201	11:52:23:874	1.74	1.83	2.41	3.49				1.51	1.81	2.63	3.53			
3	1	SH03	9/07/201	11:53:14:248	1.83	1.95	2.42	3.61	3.56	0.141	0.040	1.51	1.93	2.63	3.59	3.56	0.120	0.034
4	1	SH04	9/07/201	11:54:19:123	1.84	1.87	2.64	3.72				1.60	1.86	2.79	3.72			
5	1	SH05	9/07/201	11:55:18:248	1.78	1.75	2.61	3.61				1.59	1.74	2.71	3.59			

	Hand Position 1 - Left hand		Hand position 2 - Right hand	
a_h (overall mean a_{hv}) :	3.56	m/s²	3.56	m/s²
$\sigma_{R(\text{single m/c.})}$:	0.14	m/s²	0.12	m/s²
$K_{(\text{single m/c.})}$ value:	0.23	m/s²	0.20	m/s²

Single machine emission a_{hd} (= greatest a_h value): 3.56 m/s² **$K_{(\text{single m/c.})}$ value: 0.20 m/s²**



LocationName:

Occupation: Grounds maintenance
Process: Grass Cutting
RecordDate: September 30, 2010

TapeNumber: N/A
Operator#: OP#1
Up and down with tight turn at far end
VideoNumber: N/A

Notes: 22mm cut

DC-shift threshold: 10 mm

MachineManufacturer:
MachineModel:

HSLAnonymisedToolLetter: Machine D

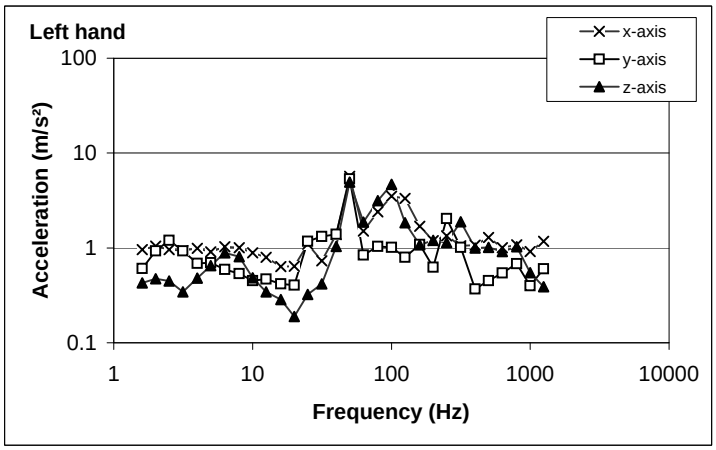
MachineModifications:
MachineSize: 510mm cutting width
MachineWeight(kg): 111
MachineOperating pressure:
MachineSpeed(impacts/min):
MachineSpeed(revs/min):
MachinePower:
MachinePower source: Unleaded petrol

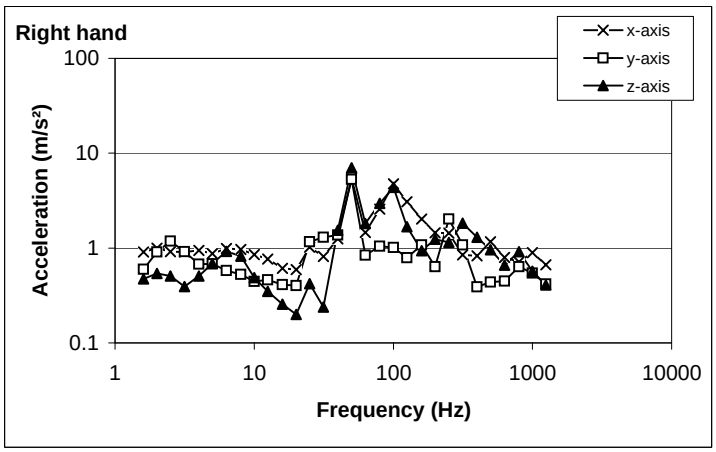
MainID: 1371
ResultsID: 9953

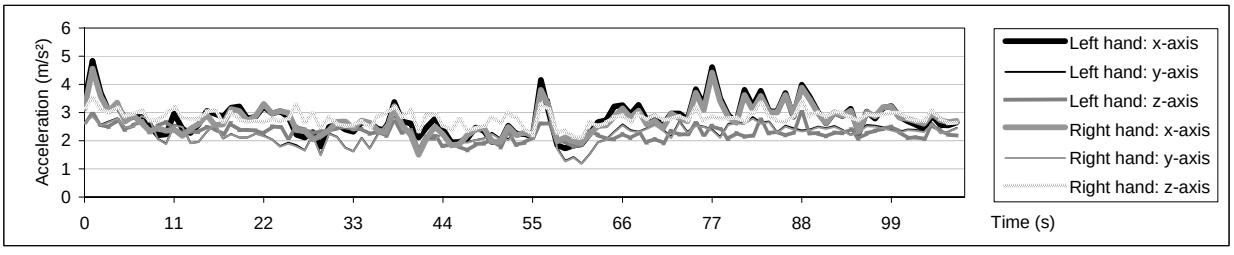
MeasurementTime: 108 Seconds
NumShotsInMeas:
DailyExposureTime:
A(8) Left hand m/s²

InsertedTool:
InsertedToolType:
InsertedToolManufacturer:

	Left hand			Right hand		
Frequency	x-axis	y-axis	z-axis	x-axis	y-axis	z-axis
1.6	0.963	0.609	0.427	0.91	0.599	0.473
2	1.046	0.927	0.473	0.997	0.906	0.54
2.5	0.958	1.205	0.45	0.919	1.18	0.507
3.15	0.94	0.933	0.344	0.91	0.914	0.392
4	0.987	0.686	0.479	0.944	0.674	0.508
5	0.908	0.696	0.65	0.872	0.682	0.686
6.3	1.031	0.595	0.888	0.991	0.58	0.923
8	1.002	0.536	0.812	0.967	0.526	0.824
10	0.887	0.452	0.486	0.853	0.445	0.487
12.5	0.797	0.47	0.345	0.768	0.461	0.349
16	0.638	0.416	0.286	0.613	0.411	0.256
20	0.639	0.405	0.189	0.593	0.403	0.199
25	1.097	1.172	0.324	1.021	1.167	0.421
31.5	0.73	1.323	0.416	0.816	1.296	0.238
40	1.384	1.388	1.034	1.25	1.368	1.546
50	5.706	5.333	4.95	5.453	5.288	7.039
63	1.511	0.843	1.87	1.461	0.842	1.82
80	2.397	1.037	3.15	2.566	1.042	2.957
100	3.52	1.017	4.679	4.754	1.013	4.371
125	3.327	0.796	1.836	3.085	0.79	1.684
160	1.686	1.085	1.08	2.022	1.076	0.935
200	1.188	0.628	1.203	1.45	0.633	1.236
250	1.34	2.035	1.136	1.44	2.02	1.151
315	1.052	1.012	1.882	0.85	1.077	1.829
400	1.073	0.368	0.997	0.827	0.389	1.295
500	1.293	0.451	1.01	1.166	0.439	0.958
630	1.008	0.545	0.919	0.798	0.448	0.661
800	1.079	0.682	1.031	0.713	0.634	0.917
1000	0.917	0.4	0.547	0.891	0.542	0.569
1250	1.17	0.603	0.389	0.666	0.417	0.408
ahw	**3**	**2.422**	**2.375**	**2.9**	**2.4**	**2.9**
av		**4.5**			**4.8**	



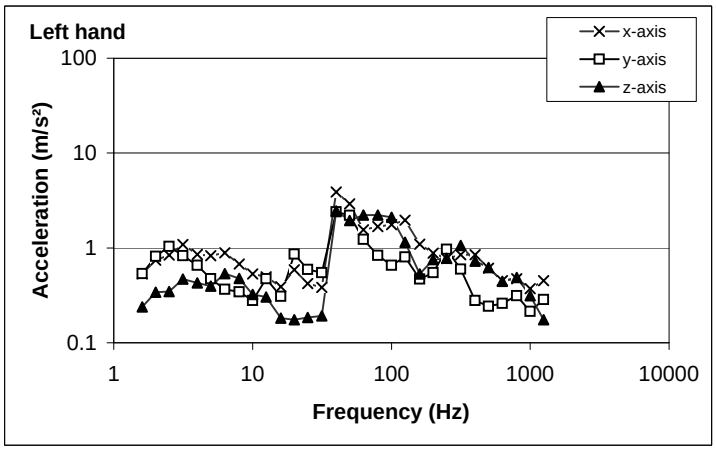


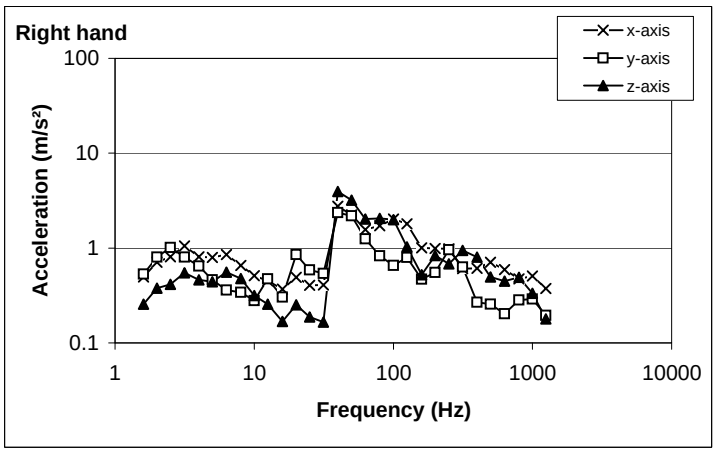


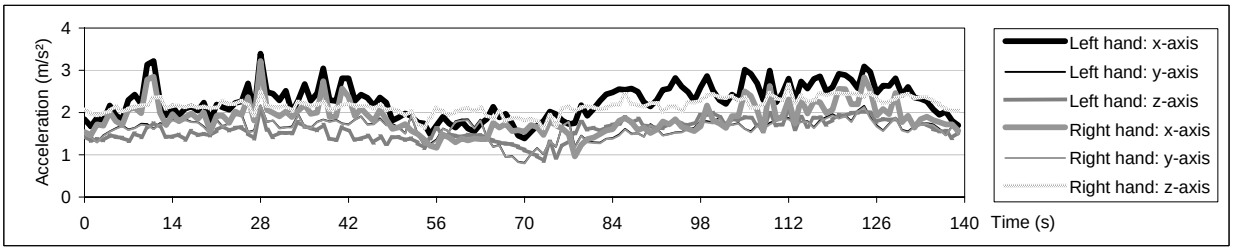
MainID: 1371, ResultsID: 9953

LocationName:		MachineManufacturer:	
		MachineModel:	
Occupation:	Grounds maintenance		HSLAnonymisedToolLetter: Machine D
Process:	Grass Cutting	MachineModifications:	
RecordDate:	September 30, 2010	MachineSize: 510mm cutting width	MainID: 1371
		MachineWeight(kg): 111	ResultsID: 9954
TapeNumber:	N/A	MachineOperating pressure:	
Operator#:	OP#2	MachineSpeed(impacts/min):	
	Up and down with tight turn at far end	MachineSpeed(revs/min):	
VideoNumber:	N/A	MachinePower:	
		MachinePower source: Unleaded petrol	MeasurementTime: 140.25 Seconds
Notes:	22mm cut		NumShotsInMeas:
		InsertedTool:	DailyExposureTime:
DC-shift threshold:	*10 mm*	InsertedToolType:	A(8) Left hand m/s²
		InsertedToolManufacturer:	

	Left hand			Right hand		
Frequency	x-axis	y-axis	z-axis	x-axis	y-axis	z-axis
1.6	0.53	0.534	0.239	0.495	0.53	0.256
2	0.744	0.814	0.341	0.707	0.802	0.378
2.5	0.84	1.034	0.346	0.806	1.015	0.415
3.15	1.086	0.827	0.469	1.051	0.802	0.548
4	0.851	0.655	0.428	0.808	0.646	0.462
5	0.825	0.474	0.397	0.796	0.463	0.44
6.3	0.885	0.367	0.534	0.856	0.36	0.557
8	0.677	0.344	0.475	0.658	0.34	0.477
10	0.531	0.28	0.324	0.512	0.278	0.315
12.5	0.496	0.473	0.304	0.453	0.472	0.257
16	0.388	0.309	0.181	0.369	0.305	0.168
20	0.587	0.858	0.175	0.492	0.857	0.252
25	0.421	0.592	0.184	0.406	0.586	0.188
31.5	0.383	0.549	0.192	0.41	0.538	0.166
40	3.881	2.401	2.458	2.759	2.367	3.949
50	2.914	2.208	1.95	2.245	2.182	3.207
63	1.552	1.235	2.213	1.56	1.248	2.03
80	1.68	0.833	2.216	1.714	0.829	2.058
100	1.753	0.656	2.11	2.023	0.655	1.99
125	1.958	0.8	1.148	1.804	0.799	1.032
160	1.098	0.468	0.532	1.006	0.471	0.522
200	0.878	0.547	0.756	0.993	0.554	0.834
250	0.769	0.969	0.778	0.984	0.959	0.681
315	0.844	0.596	1.06	0.607	0.629	0.945
400	0.848	0.278	0.728	0.612	0.269	0.802
500	0.609	0.242	0.621	0.708	0.256	0.497
630	0.451	0.26	0.444	0.595	0.203	0.448
800	0.472	0.314	0.49	0.475	0.284	0.49
1000	0.372	0.215	0.314	0.507	0.291	0.333
1250	0.452	0.286	0.175	0.376	0.195	0.18
ahw	**2.443**	**1.744**	**1.659**	**2.0**	**1.7**	**2.2**
av		**3.4**			**3.5**	







MainID: 1371, ResultsID: 9954

LocationName:

Occupation: Grounds maintenance
Process: Grass Cutting
RecordDate: September 30, 2010

TapeNumber: N/A
Operator#: OP#3
Up and down with tight turn at far end
VideoNumber: N/A

Notes: 22mm cut

DC-shift threshold: 10 mm

MachineManufacturer:
MachineModel:

HSLAnonymisedToolLetter: Machine D

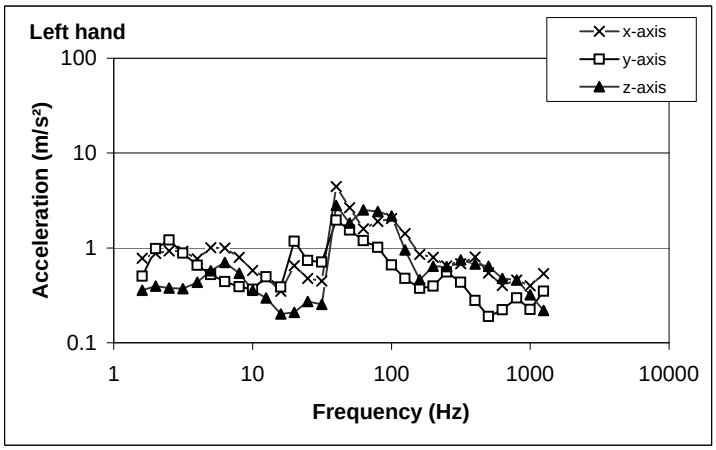
MachineModifications:
MachineSize: 510mm cutting width
MachineWeight(kg): 111
MachineOperating pressure:
MachineSpeed(impacts/min):
MachineSpeed(revs/min):
MachinePower:
MachinePower source: Unleaded petrol

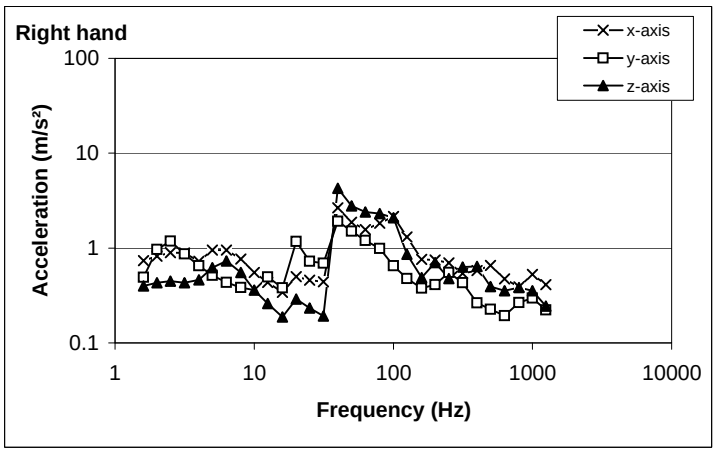
MainID: 1371
ResultsID: 9955

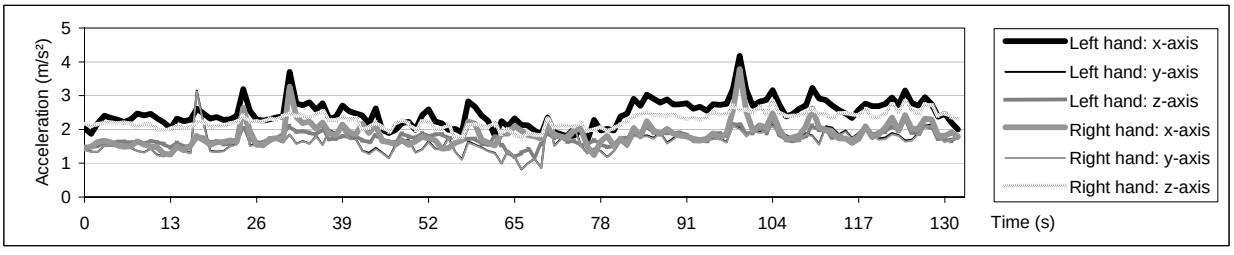
MeasurementTime: 133.75 Seconds
NumShotsInMeas:
DailyExposureTime:
A(8) Left hand m/s²

InsertedTool:
InsertedToolType:
InsertedToolManufacturer:

	Left hand			Right hand		
Frequency	x-axis	y-axis	z-axis	x-axis	y-axis	z-axis
1.6	0.777	0.505	0.359	0.734	0.493	0.398
2	0.877	0.98	0.396	0.823	0.966	0.43
2.5	0.93	1.209	0.377	0.893	1.184	0.447
3.15	0.923	0.884	0.372	0.89	0.866	0.43
4	0.766	0.658	0.435	0.727	0.649	0.463
5	1.002	0.525	0.576	0.955	0.516	0.62
6.3	1	0.441	0.701	0.951	0.434	0.729
8	0.799	0.39	0.539	0.766	0.384	0.551
10	0.58	0.367	0.358	0.552	0.361	0.361
12.5	0.488	0.497	0.298	0.433	0.497	0.261
16	0.349	0.386	0.201	0.341	0.379	0.187
20	0.65	1.178	0.21	0.5	1.17	0.29
25	0.477	0.737	0.272	0.46	0.726	0.233
31.5	0.449	0.708	0.253	0.439	0.692	0.191
40	4.42	1.958	2.806	2.663	1.914	4.259
50	2.661	1.536	1.83	1.875	1.511	2.771
63	1.587	1.191	2.507	1.568	1.2	2.397
80	1.9	1.009	2.417	1.825	0.993	2.302
100	2.036	0.659	2.174	2.147	0.653	2.09
125	1.411	0.478	0.949	1.31	0.478	0.863
160	0.853	0.373	0.462	0.759	0.377	0.486
200	0.798	0.394	0.639	0.75	0.412	0.701
250	0.644	0.557	0.633	0.696	0.553	0.478
315	0.681	0.433	0.745	0.538	0.432	0.633
400	0.8	0.28	0.675	0.577	0.263	0.639
500	0.544	0.189	0.643	0.654	0.227	0.393
630	0.401	0.223	0.478	0.474	0.193	0.355
800	0.459	0.296	0.458	0.391	0.267	0.385
1000	0.399	0.224	0.32	0.527	0.296	0.356
1250	0.535	0.35	0.218	0.41	0.222	0.244
ahw	**2.65**	**1.785**	**1.845**	**2.1**	**1.8**	**2.4**
av		**3.7**			**3.6**	







MainID: 1371, ResultsID: 9955

LocationName:

Occupation: Grounds maintenance
Process: Grass Cutting
RecordDate: September 30, 2010

TapeNumber: N/A
Operator#: OP#1
Cutting in circle on incline
VideoNumber: N/A

Notes: 22mm cut

DC-shift threshold: 10 mm

MachineManufacturer:
MachineModel:

HSLAnonymisedToolLetter: Machine D

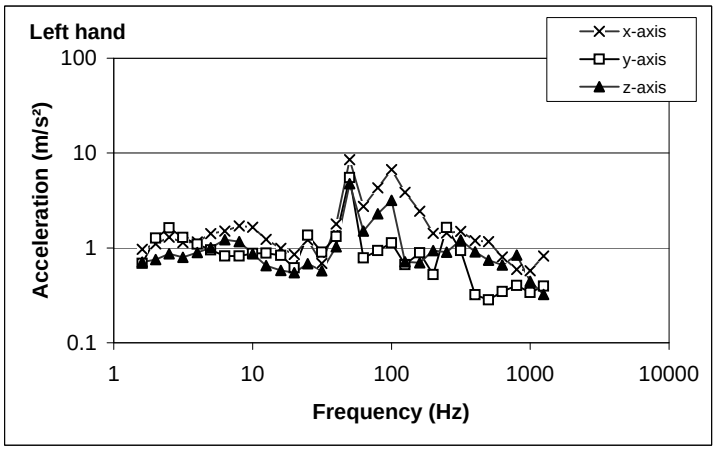
MachineModifications:
MachineSize: 510mm cutting width
MachineWeight(kg): 111
MachineOperating pressure:
MachineSpeed(impacts/min):
MachineSpeed(revs/min):
MachinePower:
MachinePower source: Unleaded petrol

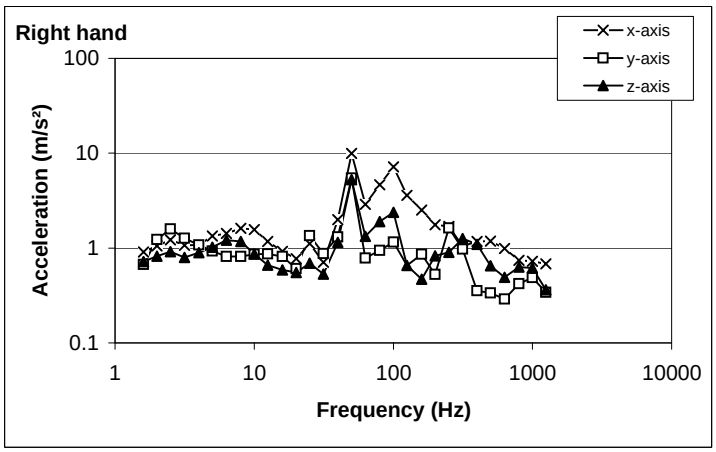
MainID: 1372
ResultsID: 9956

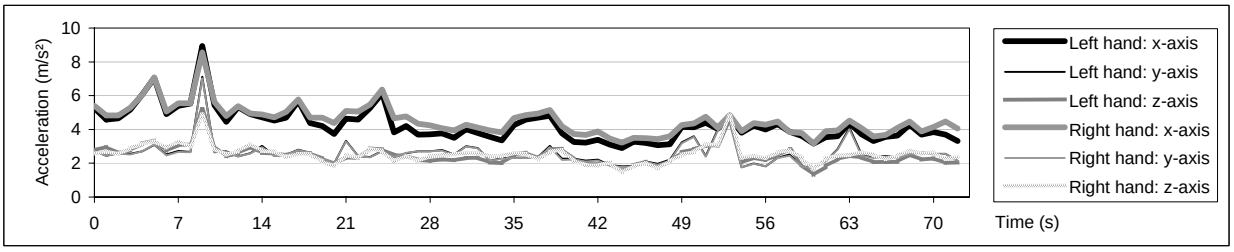
MeasurementTime: 73.5 Seconds
NumShotsInMeas:
DailyExposureTime:
A(8) Left hand m/s²

InsertedTool:
InsertedToolType:
InsertedToolManufacturer:

	Left hand			Right hand		
Frequency	x-axis	y-axis	z-axis	x-axis	y-axis	z-axis
1.6	0.965	0.685	0.711	0.908	0.67	0.722
2	1.101	1.273	0.753	1.054	1.232	0.823
2.5	1.298	1.621	0.869	1.224	1.584	0.918
3.15	1.135	1.291	0.794	1.074	1.266	0.795
4	1.159	1.097	0.897	1.082	1.079	0.895
5	1.415	0.952	1.004	1.34	0.932	1.025
6.3	1.507	0.822	1.216	1.421	0.812	1.212
8	1.711	0.824	1.167	1.62	0.813	1.174
10	1.65	0.875	0.866	1.568	0.858	0.865
12.5	1.227	0.88	0.65	1.175	0.864	0.661
16	0.987	0.832	0.581	0.919	0.812	0.586
20	0.856	0.616	0.547	0.772	0.606	0.551
25	1.215	1.366	0.68	1.11	1.351	0.69
31.5	0.689	0.9	0.575	0.71	0.876	0.532
40	1.792	1.323	1.029	1.995	1.308	1.145
50	8.52	5.514	4.765	9.964	5.481	5.25
63	2.745	0.785	1.502	2.885	0.784	1.334
80	4.302	0.936	2.295	4.651	0.944	1.898
100	6.697	1.126	3.167	7.194	1.158	2.38
125	3.862	0.666	0.716	3.6	0.658	0.655
160	2.445	0.889	0.7	2.516	0.861	0.468
200	1.428	0.525	0.935	1.765	0.527	0.826
250	1.432	1.641	0.903	1.695	1.631	0.904
315	1.494	0.939	1.211	1.047	0.976	1.263
400	1.191	0.321	0.912	1.179	0.354	1.092
500	1.161	0.283	0.742	1.183	0.336	0.649
630	0.799	0.347	0.659	0.989	0.29	0.492
800	0.591	0.402	0.84	0.742	0.42	0.63
1000	0.573	0.34	0.445	0.726	0.488	0.617
1250	0.819	0.396	0.324	0.682	0.342	0.364
ahw	**4.592**	**2.885**	**2.705**	**4.8**	**2.8**	**2.8**
av		**6.1**			**6.3**	



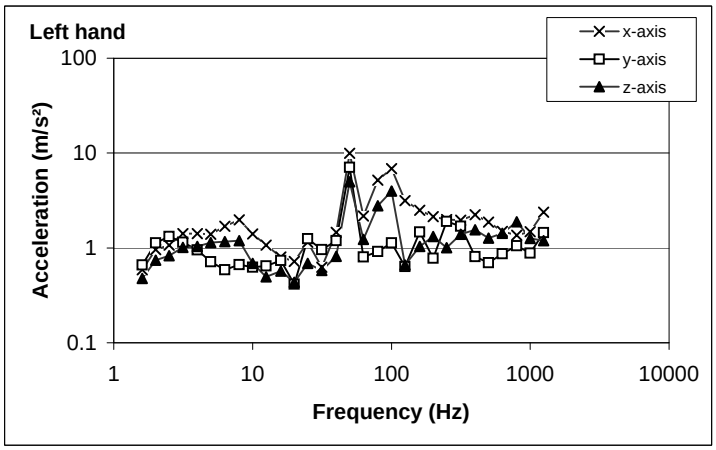


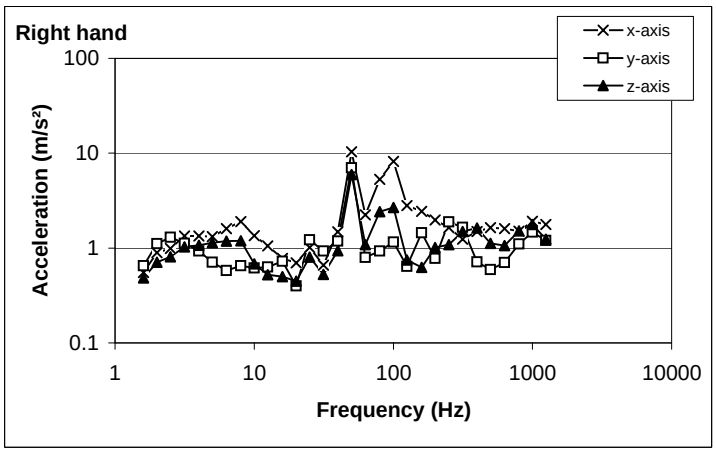


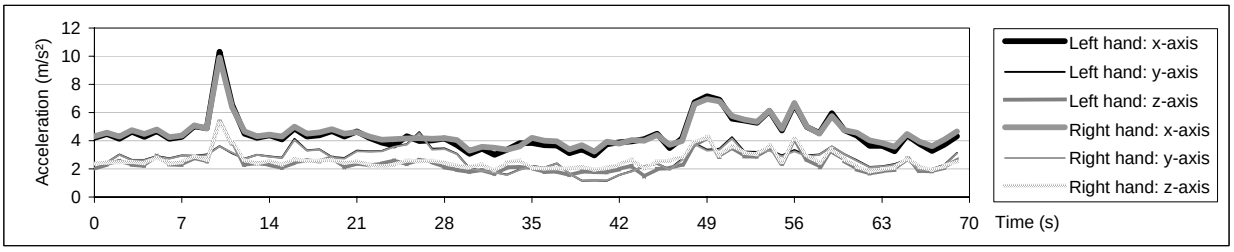
MainID: 1372, ResultsID: 9956

LocationName:		MachineManufacturer:	
		MachineModel:	
Occupation:	Grounds maintenance		HSLAnonymisedToolLetter: Machine D
Process:	Grass Cutting	MachineModifications:	
RecordDate:	September 30, 2010	MachineSize: 510mm cutting width	MainID: 1372
		MachineWeight(kg): 111	ResultsID: 9957
TapeNumber:	N/A	MachineOperating pressure:	
Operator#:	OP#2	MachineSpeed(impacts/min):	
	Cutting in circle on incline	MachineSpeed(revs/min):	
VideoNumber:	N/A	MachinePower:	
		MachinePower source: Unleaded petrol	MeasurementTime: 70 Seconds
Notes:	22mm cut		NumShotsInMeas:
		InsertedTool:	DailyExposureTime:
DC-shift threshold:	*10 mm*	InsertedToolType:	A(8) Left hand m/s²
		InsertedToolManufacturer:	

	Left hand			Right hand		
Frequency	x-axis	y-axis	z-axis	x-axis	y-axis	z-axis
1.6	0.589	0.662	0.478	0.551	0.649	0.483
2	0.956	1.129	0.743	0.893	1.115	0.71
2.5	1.066	1.315	0.83	0.991	1.294	0.806
3.15	1.417	1.144	1.01	1.338	1.123	1.027
4	1.413	0.95	1.035	1.339	0.928	1.068
5	1.393	0.714	1.135	1.314	0.708	1.138
6.3	1.692	0.589	1.17	1.606	0.58	1.185
8	1.981	0.664	1.192	1.897	0.652	1.195
10	1.402	0.625	0.685	1.354	0.615	0.684
12.5	1.071	0.645	0.495	1.051	0.63	0.524
16	0.805	0.737	0.569	0.777	0.727	0.499
20	0.718	0.413	0.435	0.698	0.4	0.449
25	1.143	1.251	0.689	1.011	1.225	0.801
31.5	0.625	0.958	0.581	0.66	0.928	0.525
40	1.458	1.194	0.813	1.484	1.181	0.938
50	9.939	7.078	5	10.37	7.033	5.939
63	2.171	0.799	1.227	2.234	0.794	1.086
80	5.172	0.912	2.783	5.281	0.927	2.427
100	6.877	1.129	3.979	8.169	1.154	2.676
125	3.144	0.634	0.66	2.802	0.641	0.747
160	2.502	1.474	1.034	2.442	1.447	0.626
200	2.136	0.775	1.323	1.969	0.778	1.013
250	1.991	1.906	1.007	1.635	1.88	1.083
315	1.966	1.69	1.392	1.237	1.653	1.493
400	2.231	0.807	1.551	1.489	0.716	1.631
500	1.874	0.698	1.265	1.642	0.591	1.117
630	1.49	0.866	1.428	1.597	0.701	1.06
800	1.362	1.05	1.887	1.502	1.106	1.517
1000	1.485	0.882	1.258	1.918	1.474	1.768
1250	2.388	1.451	1.192	1.776	1.205	1.238
ahw	**4.849**	**2.965**	**2.711**	**4.9**	**2.9**	**2.9**
av		**6.3**			**6.4**	



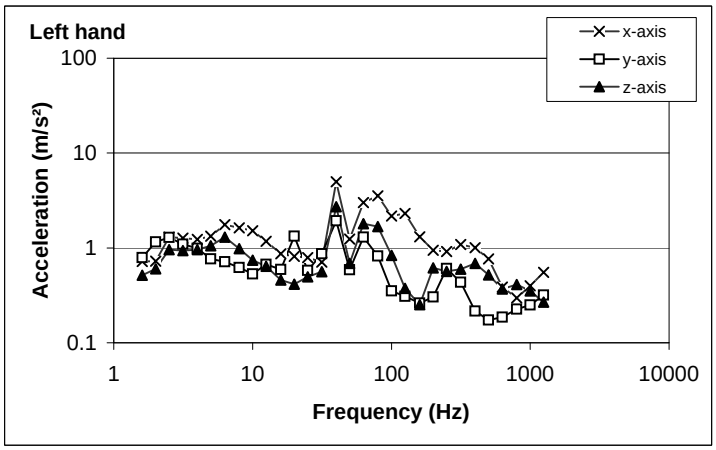


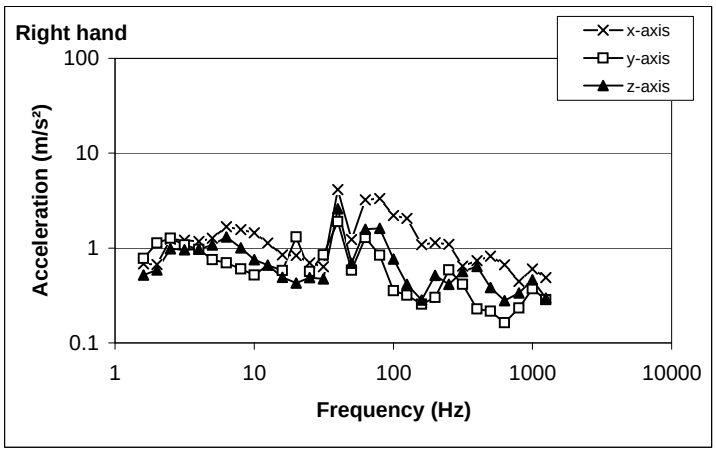


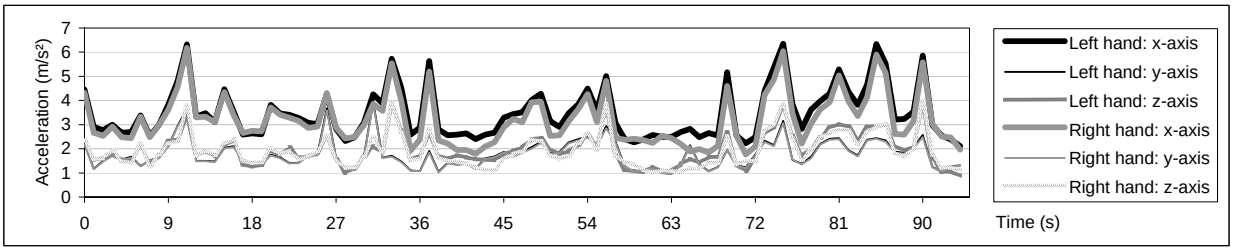
MainID: 1372, ResultsID: 9957

LocationName:		MachineManufacturer:	
		MachineModel:	
Occupation:	Grounds maintenance		HSLAnonymisedToolLetter: Machine D
Process:	Grass Cutting	MachineModifications:	
RecordDate:	September 30, 2010	MachineSize: 510mm cutting width	MainID: 1372
		MachineWeight(kg): 111	ResultsID: 9958
TapeNumber:	N/A	MachineOperating pressure:	
Operator#:	OP#3	MachineSpeed(impacts/min):	
	Cutting in circle on incline	MachineSpeed(revs/min):	
VideoNumber:	N/A	MachinePower:	
		MachinePower source: Unleaded petrol	MeasurementTime: 95.25 Seconds
Notes:	22mm cut		NumShotsInMeas:
		InsertedTool:	DailyExposureTime:
DC-shift threshold:	*10 mm*	InsertedToolType:	A(8) Left hand m/s²
		InsertedToolManufacturer:	

	Left hand			Right hand		
Frequency	x-axis	y-axis	z-axis	x-axis	y-axis	z-axis
1.6	0.72	0.793	0.514	0.681	0.777	0.519
2	0.726	1.153	0.602	0.67	1.134	0.588
2.5	1.296	1.294	0.958	1.236	1.27	0.979
3.15	1.271	1.096	0.94	1.211	1.075	0.963
4	1.233	0.988	0.958	1.173	0.969	0.976
5	1.325	0.767	1.053	1.268	0.755	1.076
6.3	1.76	0.711	1.295	1.685	0.696	1.311
8	1.631	0.62	0.986	1.562	0.603	1.006
10	1.513	0.532	0.744	1.445	0.521	0.755
12.5	1.176	0.673	0.639	1.133	0.661	0.659
16	0.865	0.591	0.458	0.85	0.578	0.493
20	0.815	1.328	0.413	0.832	1.309	0.426
25	0.787	0.58	0.497	0.696	0.565	0.486
31.5	0.709	0.869	0.561	0.634	0.848	0.472
40	4.973	1.931	2.723	4.139	1.894	2.589
50	1.236	0.588	0.685	1.231	0.583	0.694
63	3.004	1.296	1.805	3.235	1.292	1.577
80	3.546	0.819	1.685	3.321	0.844	1.614
100	2.175	0.353	0.832	2.204	0.356	0.767
125	2.302	0.31	0.375	2.054	0.319	0.415
160	1.305	0.262	0.253	1.09	0.256	0.283
200	0.941	0.304	0.616	1.14	0.302	0.513
250	0.915	0.607	0.568	1.095	0.59	0.414
315	1.086	0.435	0.598	0.647	0.413	0.563
400	1.005	0.216	0.684	0.736	0.228	0.641
500	0.764	0.174	0.517	0.82	0.216	0.384
630	0.386	0.187	0.369	0.668	0.163	0.279
800	0.297	0.225	0.411	0.444	0.233	0.336
1000	0.398	0.25	0.352	0.601	0.372	0.461
1250	0.551	0.318	0.268	0.488	0.285	0.296
ahw	**3.87**	**2.047**	**2.272**	**3.6**	**2.0**	**2.3**
av		**4.9**			**4.7**	



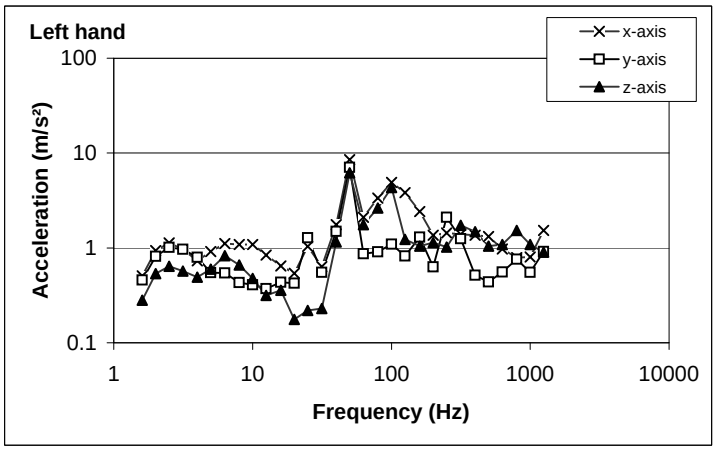


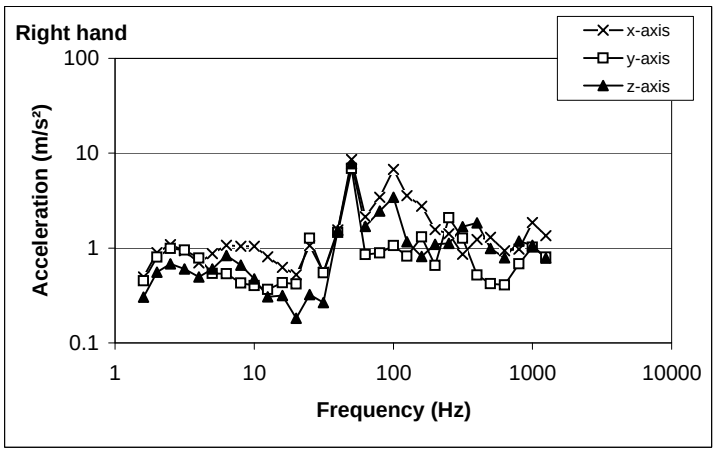


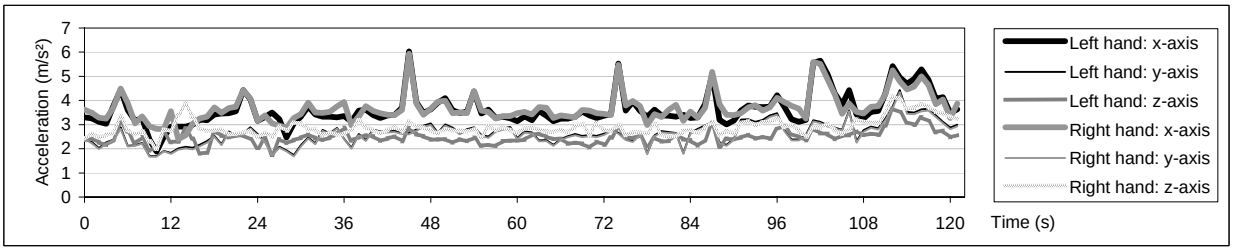
MainID: 1372, ResultsID: 9958

LocationName:		MachineManufacturer:	
		MachineModel:	
Occupation:	Grounds maintenance		HSLAnonymisedToolLetter: Machine D
Process:	Grass Cutting	MachineModifications:	
RecordDate:	September 30, 2010	MachineSize: 510mm cutting width	MainID: 1373
		MachineWeight(kg): 111	ResultsID: 9959
TapeNumber:	N/A	MachineOperating pressure:	
Operator#:	OP#1	MachineSpeed(impacts/min):	
	Cutting in figure of 8 on mock putting green prepa	MachineSpeed(revs/min):	
VideoNumber:	N/A	MachinePower:	
		MachinePower source: Unleaded petrol	MeasurementTime: 121.75 Seconds
Notes:	22mm cut		NumShotsInMeas:
		InsertedTool:	DailyExposureTime:
DC-shift threshold:	*10 mm*	InsertedToolType:	A(8) Left hand m/s²
		InsertedToolManufacturer:	

	Left hand			Right hand		
Frequency	x-axis	y-axis	z-axis	x-axis	y-axis	z-axis
1.6	0.508	0.46	0.281	0.496	0.452	0.303
2	0.939	0.818	0.537	0.896	0.803	0.555
2.5	1.131	1.011	0.641	1.089	0.993	0.679
3.15	0.969	0.969	0.568	0.936	0.951	0.603
4	0.729	0.797	0.491	0.696	0.785	0.496
5	0.913	0.549	0.595	0.875	0.541	0.604
6.3	1.116	0.542	0.828	1.07	0.537	0.832
8	1.084	0.432	0.663	1.049	0.426	0.663
10	1.083	0.409	0.478	1.045	0.403	0.473
12.5	0.842	0.372	0.316	0.811	0.367	0.305
16	0.644	0.436	0.359	0.624	0.43	0.315
20	0.541	0.424	0.177	0.523	0.419	0.181
25	1.04	1.283	0.219	1.064	1.267	0.323
31.5	0.635	0.555	0.23	0.558	0.547	0.266
40	1.76	1.496	1.157	1.558	1.465	1.541
50	8.489	7.041	6.189	8.571	6.899	7.752
63	2.108	0.868	1.763	2.13	0.855	1.685
80	3.344	0.91	2.638	3.428	0.888	2.458
100	4.899	1.095	4.34	6.72	1.062	3.427
125	3.812	0.822	1.23	3.564	0.82	1.164
160	2.427	1.298	1.042	2.751	1.31	0.817
200	1.365	0.633	1.134	1.57	0.654	1.091
250	1.44	2.099	1.021	1.413	2.094	1.125
315	1.395	1.252	1.73	0.859	1.27	1.676
400	1.363	0.513	1.482	1.227	0.52	1.839
500	1.315	0.438	1.045	1.298	0.421	0.987
630	0.973	0.557	1.084	0.935	0.408	0.789
800	0.791	0.757	1.534	0.976	0.682	1.185
1000	0.804	0.553	1.088	1.854	1.02	1.069
1250	1.525	0.918	0.9	1.35	0.801	0.781
ahw	**3.815**	**2.764**	**2.572**	**3.9**	**2.7**	**3.0**
av		**5.4**			**5.6**	



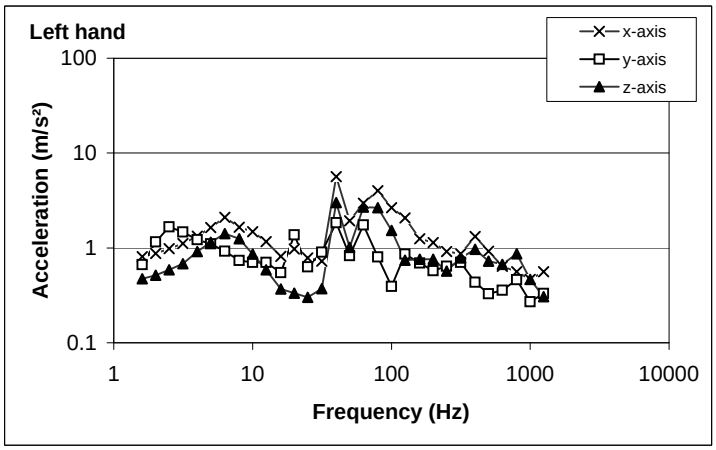


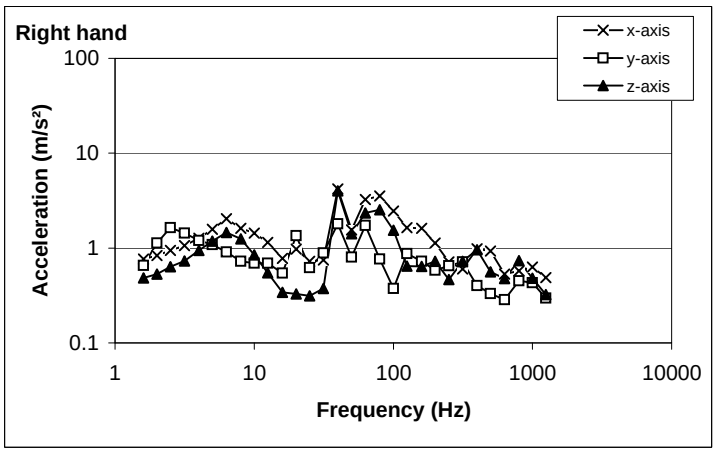


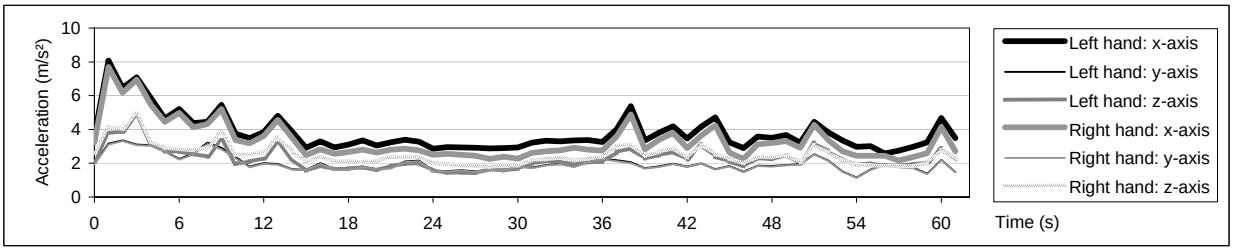
MainID: 1373, ResultsID: 9959

LocationName:		MachineManufacturer:	
		MachineModel:	
Occupation:	Grounds maintenance		HSLAnonymisedToolLetter: Machine D
Process:	Grass Cutting	MachineModifications:	
RecordDate:	September 30, 2010	MachineSize: 510mm cutting width	MainID: 1373
		MachineWeight(kg): 111	ResultsID: 9960
TapeNumber:	N/A	MachineOperating pressure:	
Operator#:	OP#2	MachineSpeed(impacts/min):	
	Cutting in figure of 8 on mock putting green prepa	MachineSpeed(revs/min):	
VideoNumber:	N/A	MachinePower:	
		MachinePower source: Unleaded petrol	MeasurementTime: 62 Seconds
Notes:	22mm cut		NumShotsInMeas:
		InsertedTool:	DailyExposureTime:
DC-shift threshold:	*10 mm*	InsertedToolType:	A(8) Left hand m/s²
		InsertedToolManufacturer:	

	Left hand			Right hand		
Frequency	x-axis	y-axis	z-axis	x-axis	y-axis	z-axis
1.6	0.808	0.666	0.475	0.765	0.656	0.483
2	0.877	1.152	0.517	0.836	1.131	0.533
2.5	0.98	1.666	0.588	0.944	1.634	0.636
3.15	1.116	1.468	0.683	1.064	1.441	0.732
4	1.328	1.221	0.918	1.274	1.201	0.944
5	1.638	1.106	1.145	1.575	1.085	1.186
6.3	2.107	0.925	1.418	2.04	0.905	1.463
8	1.657	0.737	1.246	1.618	0.725	1.247
10	1.483	0.702	0.859	1.441	0.693	0.846
12.5	1.168	0.703	0.587	1.151	0.693	0.547
16	0.817	0.547	0.369	0.775	0.542	0.341
20	0.978	1.372	0.332	0.972	1.354	0.328
25	0.781	0.633	0.302	0.723	0.622	0.314
31.5	0.728	0.905	0.37	0.748	0.89	0.375
40	5.644	1.848	3.006	4.2	1.8	3.999
50	1.926	0.827	1.01	1.553	0.805	1.41
63	2.952	1.751	2.698	3.26	1.728	2.351
80	4.003	0.805	2.66	3.537	0.764	2.536
100	2.665	0.393	1.534	2.449	0.375	1.545
125	2.065	0.859	0.743	1.634	0.873	0.647
160	1.252	0.693	0.757	1.615	0.724	0.643
200	1.134	0.576	0.761	1.127	0.582	0.727
250	0.917	0.639	0.571	0.717	0.649	0.464
315	0.868	0.705	0.787	0.603	0.713	0.724
400	1.314	0.433	0.968	0.979	0.401	0.96
500	0.924	0.329	0.728	0.93	0.331	0.56
630	0.642	0.358	0.67	0.532	0.285	0.477
800	0.56	0.461	0.869	0.574	0.452	0.739
1000	0.467	0.27	0.465	0.629	0.431	0.482
1250	0.56	0.331	0.307	0.489	0.296	0.323
ahw	**4.201**	**2.288**	**2.553**	**3.8**	**2.2**	**2.8**
av		**5.4**			**5.2**	



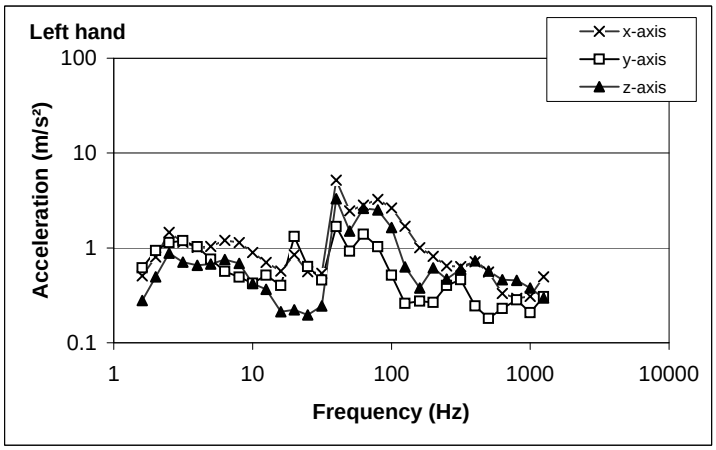


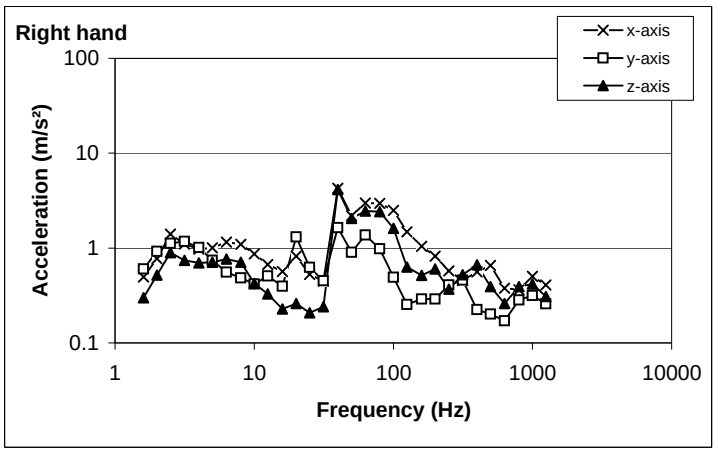


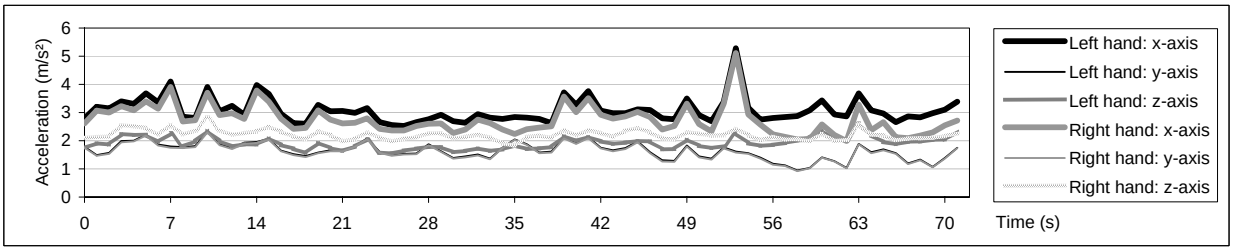
MainID: 1373, ResultsID: 9960

LocationName:		MachineManufacturer:			
		MachineModel:			
Occupation:	Grounds maintenance			HSLAnonymisedToolLetter:	Machine D
Process:	Grass Cutting	MachineModifications:			
RecordDate:	September 30, 2010	MachineSize:	510mm cutting width	MainID:	1373
		MachineWeight(kg):	111	ResultsID:	9961
TapeNumber:	N/A	MachineOperating pressure:			
Operator#:	OP#3	MachineSpeed(impacts/min):			
	Cutting in figure of 8 on mock putting green prepa	MachineSpeed(revs/min):			
VideoNumber:	N/A	MachinePower:			
		MachinePower source:	Unleaded petrol	MeasurementTime:	72.25 Seconds
Notes:	22mm cut			NumShotsInMeas:	
		InsertedTool:		DailyExposureTime:	
DC-shift threshold:	*10 mm*	InsertedToolType:		A(8) Left hand	m/s²
		InsertedToolManufacturer:			

	Left hand			Right hand		
Frequency	x-axis	y-axis	z-axis	x-axis	y-axis	z-axis
1.6	0.509	0.615	0.279	0.495	0.603	0.299
2	0.804	0.94	0.494	0.771	0.922	0.519
2.5	1.465	1.134	0.878	1.403	1.116	0.897
3.15	1.147	1.196	0.708	1.103	1.176	0.741
4	1.012	1.03	0.656	0.977	1.01	0.7
5	1.038	0.757	0.676	1.002	0.744	0.707
6.3	1.198	0.565	0.752	1.158	0.557	0.769
8	1.136	0.494	0.686	1.095	0.484	0.706
10	0.896	0.425	0.42	0.87	0.418	0.423
12.5	0.705	0.513	0.366	0.673	0.508	0.33
16	0.571	0.403	0.212	0.567	0.397	0.228
20	0.846	1.323	0.222	0.822	1.304	0.259
25	0.56	0.635	0.196	0.528	0.625	0.208
31.5	0.541	0.459	0.245	0.449	0.452	0.241
40	5.193	1.68	3.309	4.27	1.64	4.15
50	2.452	0.926	1.509	2.189	0.9	2.052
63	2.83	1.389	2.619	2.972	1.369	2.457
80	3.245	1.027	2.508	2.965	0.983	2.422
100	2.643	0.515	1.637	2.488	0.49	1.619
125	1.691	0.259	0.631	1.488	0.254	0.629
160	1.005	0.274	0.378	1.048	0.291	0.514
200	0.816	0.265	0.618	0.823	0.29	0.601
250	0.643	0.4	0.471	0.575	0.407	0.369
315	0.637	0.46	0.599	0.453	0.459	0.523
400	0.716	0.244	0.732	0.56	0.225	0.664
500	0.555	0.18	0.571	0.658	0.201	0.393
630	0.331	0.23	0.463	0.379	0.171	0.261
800	0.295	0.283	0.456	0.364	0.283	0.393
1000	0.309	0.208	0.377	0.504	0.315	0.417
1250	0.496	0.306	0.297	0.409	0.258	0.308
ahw	**3.291**	**1.839**	**2.041**	**3.0**	**1.8**	**2.3**
av		**4.3**			**4.2**	







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Hand-arm vibration of horticultural machinery

Part 1

In recent years there have been many cases of HAVS being reported for people who work in agriculture, horticulture and landscape gardening. HSE/HSL does not currently hold much information on vibration exposures in these areas of work.

The work described in this report assesses the standard test defined in BS EN 836:1997 (incorporating amendments Nos. 1 to 3) for repeatability and ease of use and where possible for reproducibility (by comparing machine manufacturers' declared vibration against HSL measurements to the same standardised procedures). It also assesses the validity of the measurement techniques adopted in the vibration emission test, investigates some of the factors which are likely to influence the results of the test and compares the vibration emission values with vibration magnitudes measured under real operating conditions.

The report concludes that the standard is not capable of producing vibration emission values which represent the upper quartile of in-use vibration magnitudes. The vibration risk associated with the use of the mowers tends to be underestimated. The main source of vibration appears to be governed by the motion of the lawnmower as it interacts with the surface over which it passes. The emission test is a static test and so none of these effects resulting from machine motion can be seen.

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