CONSTRUCTION: GOOD PRACTICE FOR CONTROL OF TODAY'S NOISE AND HAND-ARM VIBRATION EXPOSURES

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1 INTRODUCTION

Noise and hand-arm vibration (HAV) exposures represent a significant health risk to workers for many activities in the construction industry. The Health and Safety Executive (HSE) identified a need to update HSE information and practical knowledge on the construction industry activities that cause the highest health risks from noise and HAV and the current good practice for control of those risks. In partnership with the Hire Association Europe, the Construction Plant Association, HSE's Construction Industry Advisory Committee and Build UK, HSE identified six high-risk noise and HAV activities within the construction industry in Great Britain (GB). The six activities are:

- Ceiling fixing/drylining
- Concrete working/formwork joinery/carpentry
- Demolition
- First fix joinery/carpentry
- Scaffolding
- Second fix joinery/carpentry

For each activity HSE produced a brief guidance document for the industry (in press at the time of writing). The guidance documents contain details about likely noise levels and HAV magnitudes from the different tasks and tools used for each activity. They also contain guidance on the types of noise and HAV controls that HSE inspectors expect to see. This paper details the scientific work carried out to inform the development of the guidance documents together with a summary of the controls that are considered good practice and the headline noise and HAV exposures with reference to the action and limit values in both the Control of Noise at Work Regulations 2005 (CNWR 2005) [1] and the Control of Vibration at Work Regulations 2005 (CVWR 2005) [2].

2 LITERATURE REVIEW

2.1 Literature sources

Five literature sources were considered:

- British Standard BS 5228-1:2009+A1:2014 "Code of practice for noise and vibration control on construction and open sites – Part 1: Noise" [3]
- British Standard BS 5228-2:2009+A1:2014 "Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration" [4]
- HSE Topic Inspection Pack for noise (2008) [5]
- HSE Topic Inspection Pack for hand-arm vibration (2010) [6]
- Paper and journal search carried out by HSE Information Services

BS 5228-1:2009+A1:2014 (noise) contains a vast amount of noise level data (Annexes C and D) and information for the control of noise from construction sites. Whilst the descriptions of basic noise controls serve as a good starting point, the noise level data is of little use in determining worker noise exposures as all quoted A-weighted sound pressure levels for listed tools, plant and processes are given for a distance of 10 m from the source, which is not necessarily representative of the level experienced by the exposed worker.

BS 5228-1:2009+A1:2014 (vibration) is largely concerned with vibration as an environmental nuisance and damage to property, either existing or under construction. It contains data for likely vibration levels from construction activities as experienced in a residential dwelling. Clause 5 addresses personal vibration exposure, citing the CVWR 2005, but provides no additional information.

The Topic Inspection Packs (TIPs) were published in 2008 for noise and 2010 for HAV. The noise and vibration values contained in the TIPs precede these publication dates, and some predate the introduction of both the CNWR 2005 and the CVWR 2005. The basic control information in the TIPs remains current and appropriate. However, knowledge of what other high-risk activities are now prevalent in the construction industry is lacking, along with an understanding of current practices in construction trades and the current industry approach to control of exposure, in particular with respect to noise.

2.2 Literature review summary

The literature review yielded no information on current control practice and very little on actual exposures to noise and hand-arm vibration in the GB construction industry. There is plentiful data on machine vibration emissions from standard tests and how these data compare to vibration emissions from machines during actual use. However, the link between the vibration data and worker exposure is missing in the published information.

The paper and journal search focused on realistic, in-use tool or task related emission data for noise and HAV in the construction industry. Abstracts were sourced through Web of Science/Proquest/Science Direct/Ergonomic Abstracts, and the most relevant papers identified and obtained. In addition, a web-based search, specifically of journals, peer reviewed papers, white papers, trade journals and conference proceedings, was also carried out. The search identified 88 references related to noise and 86 references to HAV, which were reduced to two papers of relevance to the current project, one for noise and one for HAV. None of the data from the two papers relates to construction activity in GB.

A study by Fernández *et al* [7] reports construction workplace noise exposures for Spanish workers. Spain is subject to the same European Union Directive [8] as GB. The data reported by Fernández *et al* are comparable to that collected by HSE.

A study carried out by Coggins *et al* [9] contains actual-use vibration data for 20 different machine types. Three of the machines (demolition hammer, jigsaw and rotary hammer) can be compared to the data for tools observed in use during HSE site visits. However, comparison with HSE data is difficult because there is not enough information in the Coggins *et al* study regarding work activities.

3 WORKPLACE DATA COLLECTION

3.1 Site visit details

Early industry engagement allowed for four site visits to observe and evaluate the noise and HAV risks, and controls, from the short-list of six high-risk tasks and processes. General site details including tasks and activities are given in Table 1.

Noise measurements were taken at all sites for all activities of interest. Noise measurements were made using a sound level meter (SLM) and dosimeters. The dosimeters were positioned on tool/machine operators according to HSE guidance [10]. The dosimeters logged the A-weighted equivalent continuous sound pressure level, L_{Aeq}, and the C-weighted peak sound pressure level, L_{Cpk}, values every minute. The SLM was used to carry out “follow me” measurements for the purposes of data signal recording the activity and sanity checking the dosimeter readings. Although

L_{Cpk} data were collected using the dosimeters they were often affected by the physical nature of the activities, for example, safety harnesses and other items impacting the dosimeter. For this reason, the dosimeter L_{Cpk} data are not reported.

HSE already has suitable HAV data for all the tools used at each site. It was therefore unnecessary to make HAV measurements.

Table 1. General details of the four sites visited

Site location	Site description	Site activities
West Midlands	Large city-centre retail building undergoing renovation.	• Scaffold erection
Scotland	Groundworks for new construction.	• Concrete working • Formwork joinery/carpentry
Worcestershire	Care home facility undergoing full refurbishment, with demolition and new build structures.	• Ceiling fixing • Drylining • First fix joinery/carpentry • Second fix joinery/carpentry • Demolition
Nottinghamshire	City-centre carpark demolition.	• Demolition

3.2 West Midlands

Three operators repositioned handrails and completed a stay tower erection on a large scaffold installation. The operations all involved tightening and untightening scaffolding bolts in two different types of scaffold clamp, forged steel and pressed steel. Two of the three operators used battery powered impact wrenches. Impact wrenches were only used on the forged steel clamp. The pressed steel clamp could only be tightened with a manual wrench.

A total of five SLM measurements and three dosimeter measurements were made. The SLM outputs are given in Table 2. The dosimeter outputs for 09:00 am to 11:00 am are given in Table 3. Using the data signal recording from the SLM it was possible to extract individual impact wrench noise events for each operator. The duration of impact wrench noise events was variable, between 0.5 and 2.5 seconds. For this reason, L_{Aeq} values are not directly comparable. The results have therefore been converted to the event sound exposure levels (SEL), given in Table 4. The SELs may be directly compared.

Table 2. SLM results for scaffold erection (West Midlands)

Meas no.	Measurement description	Meas. location	Operator location	Meas. duration (hh:mm:ss)	L_{Aeq} (dB)	L_{Cpk} (dB)
001	Repositioning of handrail (approx. 8 m from activity)	Gantry	Level 1	00:00:31	77	107
002	Background noise: central Birmingham traffic noise only	Gantry	n/a	00:00:31	63	92
003	Following Operator #1 repositioning handrail	Level 1	Level 1	00:01:24	91	122
004	Following Operator #3 repositioning handrail	Level 1	Level 1	00:01:48	84	117
005	Following Operator #2 repositioning handrail	Level 1	Level 1	00:01:31	90	120

Table 3. Dosimeter results for scaffold erection including a 25-minute break from 10:35 to 11:00 am (West Midlands))

Activity description	Operator	Meas. duration (hh:mm)	L_{Aeq} (dB)
The three operators worked as a team to: a. Reposition handrails b. Complete a stay tower erection (kick boards and ties)	1	02:00	87
	2	02:00	88
	3	02:00	86

Table 4. Impact wrench noise event SELs and event L_{Cpk} (West Midlands)

Meas. location	Operator location	Impact wrench noise event description	Average event SEL (dB)	L_{Cpk} (dB)
Gantry	Level 1	Noise from all impact wrench operations	80	98
Level 1	Level 1	Operator 1; noise from own impact wrench	103	122
Level 1	Level 1	Operator 1; noise from Op2 impact wrench	101[a]	117
Level 1	Level 1	Operator 2; noise from own impact wrench	102	120
Level 1	Level 1	Operator 2; noise from Op1 impact wrench	92	107
Level 1	Level 1	Operator 3; noise from Op1 and Op2 impact wrenches	91[b]	112

[a] Op1 and Op2 working close to each another
[b] Op3 occasionally working close to Op1 and Op2

3.3 Scotland

3.3.1 Formwork joiners

The formwork joiners' tasks consisted of erecting the formwork and observing the pouring of concrete to ensure that any bowing of formwork panels is controlled. Larger formwork items were lowered into place using mobile plant. Smaller elements were positioned by hand. Formwork was spaced and clamped into place using a combination of scaffold poles and clamps as well as timber spacers. Hammering and tightening of clamps involved use of hammers. During the concrete pour it was not uncommon for the formwork joiners to assist in the trowelling of the concrete surface.

Three formwork joiners worked as a team to complete the formwork tasks. Two were fitted with dosimeters. The results from the dosimeters are shown in Table 5.

Table 5. Dosimeter results for formwork joiners including a 15-minute break at 10:00 to 10:15 am and a 30-minute break at 12:00 to 12:30 pm (Scotland)

Activity description	Operator number	Meas. duration (hh:mm)	L_{Aeq} (dB)
The three operators worked as a team to: a. Fixing and locating formwork panels b. Setting steel and timber spaces and knocking into place c. Observing concrete pour to check for bowing d. Assisting with trowelling	1	08:00	88
	2	08:00	86

3.3.2 Concrete workers

The concrete workers directed the pouring of concrete into formwork from the digger bucket, occasionally hand shovelling concrete from the bucket into the formwork. A vibrating poker was used to compact concrete. Hand trowels were used to level the concrete as pouring continued further along the formwork.

The three concrete workers worked as a team to complete the concreting tasks. All three were fitted with dosimeters. The results from the dosimeters are shown in Table 6.

Table 6. Dosimeter results for concrete workers including a 15-minute break at 10:00 to 10:15 am and a 30-minute break at 12:00 to 12:30 pm (Scotland)

Activity description	**Operator number**	**Meas. duration (hh:mm)**	**L_{Aeq} (dB)**
The three operators worked as a team to: a. Direct pour of concrete from digger bucket b. Use spades to hand-ball concrete into smaller gaps and initially even out spread of material c. Use vibrator poker to compact concrete d. Trowel concrete surface to acceptable finish	1	08:00	88
	2	08:00	81
	3	06:27[#]	85

[#] Operator left site early for personal appointment.

Noise from concrete compaction was the significant noise source on site. It affected both concrete workers and formwork joiners. Formwork joiners were also affected by hammering noise.

Three concrete pours were observed over the course of the 8-hour shift, each lasting for approximately one hour and occurring at approx. 10:15 am, 12:45 pm and 14:55 pm.

3.4 Worcestershire

Noise measurements for 18 separate activities and associated power tools were carried out at the Worcestershire site. Measurements were made using a combination of dosimetry and one-off spot measurements with a SLM. For each activity the L_{Aeq} and L_{Cpk} were recorded. Table 7 summarises the L_{Aeq} and L_{Cpk} values from the SLM spot measurements and the dosimetry.

3.5 Nottinghamshire

Noise measurements were made with a SLM for drilling operations that were being carried out in preparation for the lifting of concrete sections during demolition of a car park. Two operators drilled holes into a chest-high concrete barrier wall on the open-air top deck of the car park. The first operator dry-drilled 20 mm diameter bolt holes for mounting a drill rig. The second operator followed with the rig-mounted drill with water suppression and drilled holes of 78 mm diameter, 340 mm deep (this included a 90 mm cavity in the concrete section). Table 8 gives the L_{Aeq} and L_{Cpk} values from the SLM measurements.

3.6 Observed controls for high-risk noise and HAV activities during site visits

There was little evidence of notable control measures, for either noise or HAV, being applied at any of the four site visits.

The control of noise was reliant on the use of hearing protection. In many instances the use of hearing protection was not consistent between contractors and in some cases was inconsistent within individual sites.

The only apparent HAV control was logging of tool usage times by workers. However, the methods used were inconsistent and it is not clear how the usage times were being used to control HAV exposures. HSE guidance advises that routine monitoring of HAV exposure is not required by the regulations.

Table 7. Summary of SLM spot measurements and dosimeter outputs (Worcestershire)

Activity no.	Activity description	SLM L_{Aeq} (dB)	SLM L_{Cpk} (dB)	Dosimeter L_{Aeq} (dB)
1	Electrician cutting five holes for ceiling lighting into plaster board	86	107	81
2	Trimming around interior plaster board walls	92	112	88
3	Cutting skirting board	91	113	91
4	Cutting composite board with cement coating	104	121	
5	Preparation of temporary tarmac paths	89	113	89#
6	Installing roof timbers	95	137	84
7	Carpenter installing roof timbers	91	108	
8	Concrete removal inside a building	94	111	89#
9	Chasing block walls in area with unglazed windows and part tiled roof	104	121	92
10	Fixing metal strips to brickwork ready for plaster boarding	96	132	82
11	Drilling into underside of concrete floor slab	94	112	
12	Drilling into block wall	93	109	
13	Cutting galvanised steel studs for standing board	98	118	
14	Cutting galvanised steel studs for board wall	102	122	
		105	123	
15	Brick column removal inside building	96	116	No DM+
16	Diamond drill cutting into interior wall	98	114	95
17	Scaffolder fitting right angle scaffold fittings in lift shaft	93	122	87
		92	125	
18	Scaffolder fitting right angle fittings on outdoor scaffolding	94	122	No DM+

Activities contained within same dosimeter time history.
+ No dosimeter available for data collection.

Table 8. Summary of SLM spot measurements (Nottinghamshire)

Activity description	Operator	Ear	Meas. duration (sec)	L_{Aeq} (dB)	L_{Cpk} (dB)
Hammer drilling pilot hole into solid concrete wall	1	Left	9	100	119
	2	Left	6	103	120
		Right	9	99	119
		Left	6	101	120
		Right	10	100	119
Cutting concrete wall with diamond tipped core-cutter	1	Left	26	95	119
		Right	14	92	112
		Left	17	89	105
		Right	17	92	111
		Left	12	90	105
	2	Right	12	88	104
		Left	20	92	112
		Right	14	91	108
		Left	13	90	107

4 ESTIMATING NOISE AND HAV EXPOSURES FOR HIGH-RISK CONSTRUCTION ACTIVITIES

4.1 General

The data from the sites, together with existing data from HSE, were used to estimate times to the action values for both noise and HAV for inclusion in the brief industry guidance documents. The action value identifiers are:

- CNWR, Lower Exposure Action Value (LEAV)
- CNWR, Upper Exposure Action Value (UEAV)
- CVWR, Exposure Action Value (EAV)

4.2 Ceiling fixing and drylining

For the construction of metal studwork or metal lining systems for walls and ceilings the primary sources of noise are cutting of the metal track or channel and fixing floor/ceiling track and brackets to masonry or concrete substructures. These activities use tools such as chop saws, hammer drills and nail guns. Noise levels from fixing insulation, boards, taping, filling and skimming are negligible.

Workers involved in the construction of metal studwork or metal lining systems for more than 5 hours per day or firing over 220 nails are likely to exceed the LEAV. The UEAV may be exceeded, depending on the combination of tasks undertaken. Peak noise levels are unlikely to exceed the peak LEAV.

Use of chop/cold cut/mitre saws or hammer drills for more than 25 minutes per day is likely to result in the HAV EAV being exceeded. For nail guns, firing around 740 nails is likely to exceed the EAV.

4.3 Concrete working and formwork joinery/carpentry

The primary sources of noise and HAV for concrete and formwork joiners are likely to be petrol driven motors and vibrating pokers. This exposure occurs when the workers stand by the formwork during a pour in case there is a problem, such as controlling any bowing of the formwork. When the poker and motor are not in use, the remaining noise risk is from the use of power tools, such as power saws to cut timber. Formwork joiners are also likely to be exposed to manual hammering noise.

Workers involved in formwork joinery for between 1 and 2 hours per day are likely to exceed the LEAV; more than 4 hours per day and they are likely to exceed the UEAV.

Workers involved in concrete working activities for more than 1 hour per day are likely to exceed the LEAV; more than 4 hours per day and they are likely to exceed the UEAV.

Use of a vibrating poker, holding the poker hose, for more than 40 minutes per day is likely to result in the HAV EAV being exceeded.

4.4 Small to medium demolition work

The primary sources of noise and HAV for small to medium scale demolition are drilling, breaking-out and removal of cast in-situ or precast concrete. This includes the use of breakers, demolition hammers (rotary drills) and core cutting tools. Breakers and core cutting tools can be mounted on rigs or mini-excavators reducing hand-arm vibration exposure, but noise exposure will persist.

Workers involved in small to medium scale demolition for more than 15 minutes per day are likely to exceed the LEAV; exposures of more than 45 minutes per day are likely to exceed the UEAV. Peak noise levels are unlikely to exceed the peak UEAV.

Any combination of use of demolition hammers (rotary drills) and breakers for more than 10 minutes per day is likely to result in the HAV EAV being exceeded. For core drill use, more than 45 minutes per day is likely to result in the HAV EAV being exceeded.

4.5 First fix joinery/carpentry

The primary sources of noise and HAV for first fix joiners are from the use of hand-held circular saws and nail guns in timber preparation and installation. The use of a framing hammer may contribute to the noise risk depending on its frequency of use. The use of battery powered screwdrivers is unlikely to be a significant risk.

Workers involved in first fix joinery for more than 3 hours per day or firing over 230 nails are likely to exceed the LEAV. Peak levels may reach or exceed the UEAV.

The use of circular saws for more than 35 minutes per day is likely to result in the HAV EAV being exceeded. For nail guns, firing around 740 nails is likely to exceed the EAV.

4.6 Scaffolders

The primary sources of noise and HAV for scaffolders are from the use of impact wrenches and metal to metal contact between the scaffolding components. The use of battery powered impact wrenches is likely to contribute greatly to a worker's noise exposure.

In general, workers involved in scaffold erection for more than 1¼ hours per day are likely to exceed the LEAV. More specifically, if using a battery powered impact wrench, the LEAV is likely to be exceeded if fitting and/or removing more than 180 bolts per day; the UEAV is likely to be exceeded if fitting and/or removing more than 450 bolts per day. Peak noise levels are unlikely to exceed the peak LEAV.

Use of battery powered impact wrenches for about 25 minutes, or fitting and/or removing 990 bolts, is likely to result in the HAV EAV being exceeded, based on one bolt every 1.5 seconds.

4.7 Second fix joinery/carpentry

The primary sources of noise and HAV for second fix joiners are from the use of bench mounted cutting saws for timber preparation. Some noise contributions come from hand nailing and use of a multi-tool for plunge cutting. The use of powered hand tools such as battery powered screwdrivers is not significant.

Workers involved in second fix joinery for more than 1 hour per day are likely to exceed the LEAV; and for more than 2 hours per day are likely to exceed the UEAV. Peak noise levels are unlikely to exceed the UEAV.

Use of a multi-tool for more than 35 minutes per day is likely to result in the HAV EAV being exceeded.

5 PRACTICAL RISK CONTROLS

5.1 The hierarchy of control

The principles of noise and HAV control follow the general principles in the hierarchy of control (Figure 1) adopted across a wide range of occupational health and safety topics.

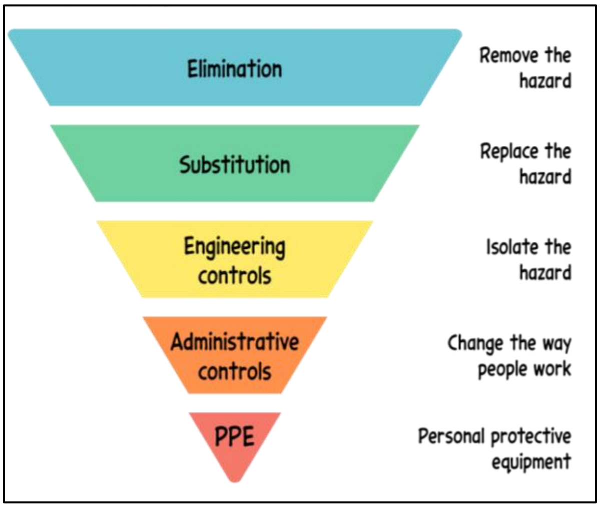

Figure 1. The hierarchy of control

Employers must assess the risks to workers from hazards and put into place controls to mitigate those risks. Employers are encouraged to use the controls at the top of the hierarchy, though often take what is perceived as the ‘easy route’ and start at the bottom.

5.2 Construction specific control examples

5.2.1 General

Figure 1 illustrates the basic principles behind each type of control (e.g. elimination means remove the hazard). For each of the six high-risk activities or processes in the construction industry, a specific guidance document was written with examples of what are currently considered reasonably practicable controls across the hierarchy of control. The six guidance documents are not reproduced as part of this paper. However, some specific examples are selected to illustrate control options for different elements of the hierarchy of control.

5.2.2 Elimination: remove the hazard

Noise and vibration hazards can be eliminated before they occur, at the design stage of construction. Architects and designers can plan and design using standardized dimensions of building elements, thereby reducing the need for on-site modifications. Materials suppliers are well placed to advise on the most suitable and efficient building elements/systems.

Cast in-situ concrete can sometimes be substituted by pre-cast concrete. The option to use pre-cast concrete is dictated by cost, site conditions and lead times. Being able to select this option often goes back to the length of time allowed for site selection, site surveys and design programming. Pre-cast units can reduce exposure to noise from concrete working, but it can introduce other hazards, such as lifting.

Similarly, the use of off-site construction and modern methods of construction (MMC), can also help reduce the amount of on-site tool use. Prefabricated panels, floor cassettes and roof dormers are credible construction options, which remove tool usage from site. They are also likely to speed up construction and improve productivity.

Concrete scabbling is a high-vibration, high-noise task that should be avoided. The need for scabbling can be eliminated or significantly reduced by:
- Leaving mating surface rough when trowelling
- Applying a scabbling mesh prior to the concrete curing
- Applying a concrete retardant to the mating surface prior to curing

5.2.3 Substitution: replace the hazard

When replacing tools and equipment use the principles of Buy Quiet [11] and buying low-vibration alternatives. Selected tools and equipment must be fit for purpose before applying the Buy Quiet and low-vibration principles.

The National Access and Scaffolding Confederation's 2015 statement [12] on impact wrenches looks for tools which can deliver a torque of 50 Nm in order to tighten a fitting. Angled impact wrenches that can achieve this force may be a suitable alternative to pistol style wrenches. The shape of the angled tool allows its body to be held against the scaffolding to act as a reaction surface. The use of reaction bars or bracing of power tools can reduce overall vibration levels as some vibration from the tool can be restrained and transmitted into the scaffolding rather than into the hand.

In second fix joinery/carpentry screwing flooring into position is quieter than using a hammer, reduces future movement of the floor and timber-to-timber squeak. Gluing is also a low-noise option that can be used for fixing timber and may be preferred where nailing could compromise subfloor components (e.g. underfloor heating or acoustic battens).

5.2.4 Engineering: isolate the hazard

Noise exposure from concrete being poured, either by boom pipe or by bucket, is relatively low for the concrete worker. However, at the pump the noise level may be higher, and this will affect the individual tasked with operating the vehicle mounted pump. Options to control the noise include:

- Use of remote control pads, allowing the operator to stand further away from the noise of the pump.
- Where stationary or trailer mounted concrete pumping systems are used, these are available with acoustic enclosures.

For first or second fix joinery/carpentry, locating the bench or table-mounted saw in a room where it can be isolated or screened from the rest of the work force will reduce exposure to others working on site.

5.2.5 Administrative: change the way people work

Administrative controls do not directly address the hazard. However, they can be useful additions to a programme of control.

Training operators how to use their tools is important to ensure optimum performance from the tools. For example, using the correct torque setting, keeping spare batteries charged, letting the tool do the work without forcing or pushing, knowing when to replace cutting disks and selecting the correct fixings can all impact on noise and HAV exposures.

During concrete compaction the poker vibrator is usually left running throughout the compaction process. Ideally, the poker should be switched off when not in use; this may be impractical for petrol driven pokers, however, pneumatically and electrically driven pokers should be operated in this way.

Tool maintenance, repair and replacement should be part of any noise and vibration control regime. Allowing tools to fall into a poor state of repair is likely to increase the overall level of noise and vibration as well as increase the time taken to complete a task.

Understanding and managing tool usage times is an important part of noise and vibration risk management. In demolition, tendering surveys that are used to determine the volume of materials to be removed can also inform employers of the likely levels of noise and vibration. For example, if it is known how many minutes it takes to remove 1 m^2 of concrete then it is possible to estimate how long it would take to remove a concrete floor based on its dimensions. This time estimate can be used to estimate daily exposure.

5.2.6 PPE

PPE is often referred to as the first line of defence and the last resort. Whilst there is recognized PPE for noise (hearing protection), there is none for HAV.[1] Hearing protection can be a useful interim measure for noise hazards whilst measures further up the hierarchy of control are researched and implemented. The selected hearing protection must be appropriate to the noise hazard and not simply the hearing protector with the greatest attenuation.

6 SUMMARY

The aim of this project was to identify high-risk noise and HAV activities in the construction sector, establishing realistic noise and HAV exposure estimates from the identified high-risk activities. This was with a view to determining current good practice control methods for those high-risk activities, and to disseminate the information gathered to the construction industry.

Together with industry stakeholders, HSE identified six high-risk tasks or processes. Each related to either a phase of work (e.g. preconstruction site preparation, fit out, etc.), type of construction activity (e.g. civils work, housebuilding, refurbishment etc.) or specialist activity. The six high-risk tasks or processes were:

- Ceiling fixing and drylining
- Concrete working and formwork joinery/carpentry
- Small to medium demolition work
- First fix joinery/carpentry
- Scaffolding
- Second fix joinery/carpentry

Realistic noise and HAV exposure estimates were made from a combination of the data gathered from the four HSE site visits and data already available to HSE.

There was little evidence of good control practices being applied for either noise or HAV at any of the four sites visited. The anecdotal view from the sites, and duty holder feedback given to HSE noise and vibration specialist inspectors, was that noise and HAV are difficult to evaluate and difficult to control. The control of noise was reliant on the use of hearing protection. In many instances the use of hearing protection was not consistent between contractors and in some cases was inconsistent within individual sites. The only apparent HAV control was logging of tool usage times by workers. However, the methods used were inconsistent and it is not clear how the usage times were being used to control HAV exposures. HSE guidance advises that routine monitoring of HAV exposure is not required by the regulations.

Practical and achievable noise and HAV controls are available to the construction sector, though not in wide use. The controls are not necessarily ground-breaking or novel. However, they are reasonably practicable controls that will eliminate or reduce individuals' exposure to noise and HAV, thereby reducing their risk of coming to harm.

[1] Anti-vibration gloves are available. However, they attenuate at frequencies greater than the operating frequency of most hand-held power tools, and therefore the frequencies that can cause harm. Gloves do keep operators' hands warm and dry, but they should not be relied on as a control for HAV exposure.

7 REFERENCES

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