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Successful noise management in construction



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Several West Australian companies in the construction industry have agreed to share their experiences in practical noise control management, to enable more workplaces achieve the 85 dB(A) exposure standard for occupational noise.

The following case studies provide real examples of the basic steps of a noise control management program: elimination, substitution, isolation, maintenance, engineering control at source, engineering control in transmission path, quiet work practices and administrative control.

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G-Pile system: Australasian Piling Company

The noise of pile driving operations on construction sites has long been acknowledged as a source of major risk of noise-induced hearing loss. Over recent years many attempts have been made to reduce noise from impact piling or to employ alternative piling techniques. These alternative techniques include hydraulic, vibratory and bored piling.

Recently a new, quiet technique that employs a grip jacking technique, has been introduced to Western Australia. This system is low in noise, free of vibration and other pollution, reducing hazards to employees and making it particularly suitable for use in urban, noise sensitive areas. It can install precast, steel or timber piles to unlimited depth. The method has been successfully applied in various types of soil, from soft and stiff clays, loose and dense sands, gravel to weathered rocks.

To reduce the noise levels even further the company has fitted the bottom of the machine with acoustic baffles which resulted in 1 to 6 dB(A) decrease depending on position.

The G-Pile Model XZY 600T system was assessed for noise emission at the Multiplex site at Perth City Convention Centre in January 2002. The noise measurements were carried out at one metre radius from the edge of the machine and at operators' positions. The machine was fully loaded and operational during the measurements. Additional measurements were conducted in March 2002 after installation of acoustic baffles to the bottom of the piling rig. The results are presented in the following table.

Table: G-Pile system, Convention Centre site

Measurement position	Noise levels LAeq,T dB(A)	
	Before baffles installed	After baffles Installed
Background	68	
Driving piles 1 metre radius from G-Pile edge:		
front	76	75
right side	76	71
left side	75	69
back	78	75
Driving piles Operator's position:		
Under machine/checking pile alignment	88	86
In control cabin	84	84
On machine, near gripping part	86	83

Boulderstone Clough Joint Venture

Boulderstone Clough Joint Venture was the main contractor for construction of the Graham Farmer Road Tunnel in Northbridge.

New equipment

The company's noise policy requires the use of equipment with the lowest practicable noise emission levels. This requirement applies to both purchasing and hiring policies, with the aim of achieving employee daily noise exposure levels of 85 dB(A) or below.

The policy was exercised during the purchasing of new excavators. Several machines were taken into consideration and finally one of the quieter types available was chosen. The purchased excavators were Yanmar Diesel Vio50 with noise levels at 7 m distance of 65 dB(A). When purchasing a new portable generator, the company researched what was available on the market and finally decided to buy a 5 kVA FNG Peacekeeper set with a noise level at 7 m distance of 64 dB(A).

Substitution

Boulderstone Clough Joint Venture, in the early stages of its operation, used an impact sheet pile driver with noise levels of 105 dB(A) at 5 m and 96 dB(A) at the crane operator's position. This method was soon replaced by a Franki Pile drilling rig emitting noise levels of 95 dB(A) at 5 m and 94 dB(A) at the operator's position. To further improve the operation and reduce the noise levels the company decided to use a bore piling rig, the Bauer BG22. This technique further reduced noise levels to 90 dB(A) at 5 m.

Additionally the company replaced most of their Honda 9 hp portable generators with low noise Yanmar units, reducing noise levels from 96 to 78 dB(A) at 1m distance. Also, by using middle range jackhammers instead of large jackhammers the company achieved a reduction in noise levels of about 10 dB(A).

Engineering noise control at source

Boulderstone Clough J V has an internal noise policy to keep the daily noise exposure levels to 85 dB(A) or below. To achieve this goal it was important to keep background noise levels inside the tunnel as low as possible. The background noise levels ranged from 80 dB(A) to 85 dB(A) due to the ventilation fans and the very reverberant character of the tunnel itself. To reduce these noise levels, ventilation fans were fitted with intake and exhaust silencers, ducts were lined inside with absorptive fibrous material and wrapped outside. This reduced the noise levels from around 85-88 dB(A) down to 81 dB(A) at 1 m from the fans.

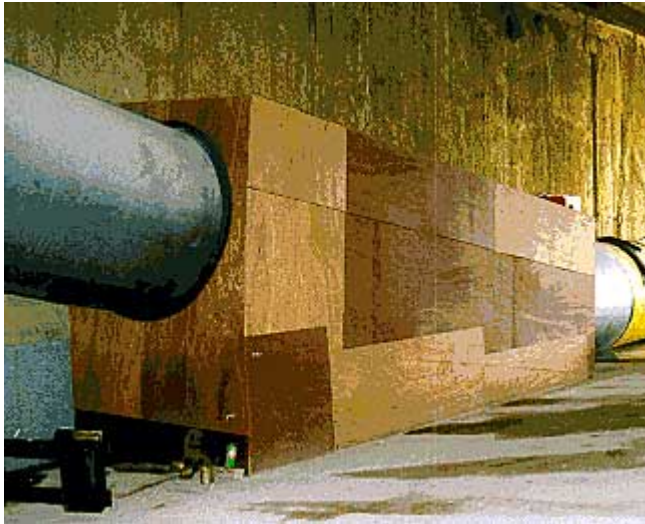


Photo 1. Ventilation fan equipped with site-made silencer encased in plywood



Photo 2. Duct wrapped in geotextile fabric to reduce radiated noise



Photo 3. Intake outlet placed outside tunnel away from workers

Consolidated Constructions Pty Ltd

Consolidated Constructions Pty Ltd is a construction company handling commercial building construction and refurbishment in both city and remote locations.

New equipment

When new generators were needed for powering site offices in remote locations, soundproofed models were investigated. The selected generator, a 20 kVA Denyo model DCA-25SP111, produced only 75 dB(A) at 1 m and 65 dB(A) at 7 m when under load. (Cost: about \$3000 more than unsilenced models.) This enabled it to be placed alongside the office units.

Engineering noise control in transmission path

A larger 90 kVA generator set was needed at a shopping centre construction site. An acoustic enclosure was built for an existing generator; enabling people to work close by without being exposed to excessive noise.



Enclosure built for existing generator

Quieter work practices and administrative controls

Refurbishment work at a major city hotel required the adoption of quiet work practices to avoid hotel guest complaints. These had the added benefit of reducing construction workers' noise exposures. The practices included the following:

- carpet grippers were glued to the floor instead of using nails;
- old carpet left in place to the last moment to reduce impact noise of tools, machines and footsteps on floor;
- skirtings were pre-cut off site, leaving only a small amount of trimming to be done on-site;
- heavy demolition work was done on Saturday mornings while only a few workers were on-site and the hotel was changing guests; and
- noisy activities were restricted to only two hours a day, the same time each day.

These practices did incur extra costs (about five per cent), but this was part of the original contract.

Macmahon Contractors

Macmahon Contractors is a large construction company involved mainly in mining and sewage operations throughout the state, with a maintenance workshop in the metropolitan area.

New equipment

The company is working towards a 'buy quiet' policy. It requires all future equipment that is bought for construction sites to have the lowest practicable noise emission levels. For example:

- all earth moving equipment is fitted with operator cabins that have noise levels of 75 dB(A) or below; and
- all future generators and compressors bought will have noise levels below 85 dB(A) at 1 m.

When purchasing new pneumatic hand tools for the workshop, Macmahon requires that they be fitted with exhaust silencers, as these reduce noise levels of an idling tool by around 10 dB(A). For example, a silenced pencil grinder emits a noise level of 85 dB(A) at 0.5 m away when idling, whereas an unsilenced version has a noise level of 95 dB(A) under the same conditions.

Elimination

Macmahon Contractors eliminated the use of hand hammers when installing or removing bearings. Before, bearings were manually knocked into position with hammers. Since the change, the bearings are either heated or cooled, which allows them to easily slip into position. A pie warmer is used for heating and liquid nitrogen for cooling the bearings. The pie warmer cost approximately \$300, much less expensive than bearing induction heaters which range from \$3000 to \$12000, depending on size.

Substitution

Macmahon Contractors use both four inch and nine inch grinders. Supervisors and employees are instructed in when each type is best used, as the four inch achieves a reduction in noise level at the operator's position of 6 dB(A), from 108 dB(A) down to 102 dB(A).



Photo 1. nine inch grinder (left) is noisier than four inch one (right)

The company decided to substitute its Makita 2414 cut-off saw with a Flexovit F16 saw, reducing noise levels from 97 dB(A), when cutting a one inch hollow tube to 92 dB(A).

Engineering noise control at source

One of the problems experienced in the maintenance workshop was noise from steam cleaners used to clean various parts. They were replaced by very quiet RoboWash machines, with noise levels at 1 m below the background noise level of 75 dB(A).

However, it is often required to fast dry some parts. For this purpose compressed air is used, again producing very high noise levels. To try to overcome this problem, the air pressure was reduced. This didn't solve the problem so air gun nozzles were fitted with specially designed cups and the work technique was changed. This reduced noise levels at the operator position by 22 dB(A) from 112 to 90 dB(A).



Photo 2. Special cup fitted over air gun nozzle.

Quieter work practices

Macmahon Contractors recognised that part of their noise problem came from the way some of the work was carried out. To overcome this, employees received extra training on noise issues and were delegated with the responsibility of addressing noise in their areas.

The first step was to set up designated noisy areas where all hammering was done.

It was also noticed that using air gun nozzles very close to holes in parts being dried, instead of blowing air from a distance, decreased noise levels significantly. Measurements proved this and the noise reduction achieved was 9 dB(A), from 99 to 90 dB(A).

On construction sites Macmahon delineates an 85 dB(A) contour around any noisy equipment and reschedules work so it is done outside this boundary. This method was first introduced when a contractor brought on site a drill rig that produced noise levels in excess of 90 dB(A). A noise assessment was carried out and Macmahon's employees were removed from the affected area. Work was rescheduled and was either done outside the 85 dB(A) boundary or after hours when the drill rig was not operating.