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## An Innovative Use of Hay Bales to Provide Ventilation Fan Noise Control

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This article discusses an unusual method that was successfully used to provide a low cost effective means to reduce noise. The source of noise was emitted from ventilation fans during the construction of the sewerage tunnel through the Blue Mountains west of Sydney. The article is presented to demonstrate the use of an unusual solution which solves a short term environmental problem at significant cost savings to the community.

### BACKGROUND

During the early 1990's a sewerage tunnel was constructed from Warrimoo through to Katoomba. The tunnel enabled sewerage from townships scattered through the upper Blue Mountains to be treated in a modern sewerage treatment plant with significant environmental advantages. The City of the Blue Mountains is unusual in that it is a city within a National Park.

The construction of the tunnel required the short term use of sites within close proximity to residences (30 - 150m). Ambient noise levels at night in the Blue Mountains are free of the traffic disturbances experienced in most urban areas and typically have background noise levels,  $L_{A90}$  of 30-35 dB(A).

The tunnel construction required centrifugal type ventilation fans to operate continuously. No excessive noise was being generated at the construction site near Faulconbridge and project engineers for the construction authority requested urgent technical assistance. An immediate solution was needed.

### ACOUSTIC INVESTIGATION

Statistical noise level analysis was undertaken during the early hours of the morning to establish the background noise level in a similar residential area located away from the construction site. An  $L_{A90}$  of 35.5 dB(A) was measured. The fan outlet noise level at 7 metres was measured at 92 dB(A) with predominant octave band noise levels at 500 Hz. A combination of distance and directivity losses reduced the fan noise level at the worst affected residence to 44 dB(A). The fan noise was clearly audible and sufficiently tonal to cause extreme annoyance.

A solution was required before the following night otherwise construction would be forced to cease.

### THE SOLUTION

It was clear that an attenuator was needed, but where do you obtain one on such short notice, deliver it to a site 80 kms from Sydney and have it installed before night fall?

An absorptive silencer would provide sufficient sound insertion loss. This triggered the idea of using hay bales. By early afternoon, a 5m long absorptive silencer was constructed using the bales as blocks to form a tunnel. The solution could be extended if further noise reduction was needed.

The solution worked adequately achieving a 10 - 12 dB(A) noise reduction and satisfying the residents concerns.

The next construction site was located at Woodford with the ventilation fan located within 30 metres of a residence. A shipping container was used to house the fan and a labyrinth was constructed, again from hay bales placed within the container so that discharge air passed through a series of bends. The outlet of the container was pointed away from the residence to gain noise reduction through directivity effects. Significant cost savings were achieved.