

Noise pollution in South Africa

South Africa is becoming an increasingly noisy country, due to the rapid densification of urban areas. New townships, densification of suburbs, a growing demand for new housing and an ever increasing population are causing further residential growth in noisy locations, as well as construction of highways cutting through previously quiet suburbs and an increase of traffic volume on most roads.

The loudness of traffic noise is also increased by defective mufflers or other faulty equipment on vehicles, something which is not uncommon in South Africa. Yet town planning, highway planning and design, motor vehicle control and the current noise regulations are not up to the task of protecting communities from exposure to continuous highway traffic noise.

Says Adrian Jongens from Jongens Keet Associates, Cape Town based acoustical consultants: "Town planning is compromised in the sense that dwellings are closer to roads that were not meant to carry large volumes of traffic, and previously peaceful neighbourhoods are now noisier than ever before."

"In other words, noise levels have increased in terms of land area exposed, as well the levels themselves. The seriousness of the situation becomes clear when we consider that the WHO (World Health Organisation) considers traffic noise to be the greatest pollutant in the industrial world."

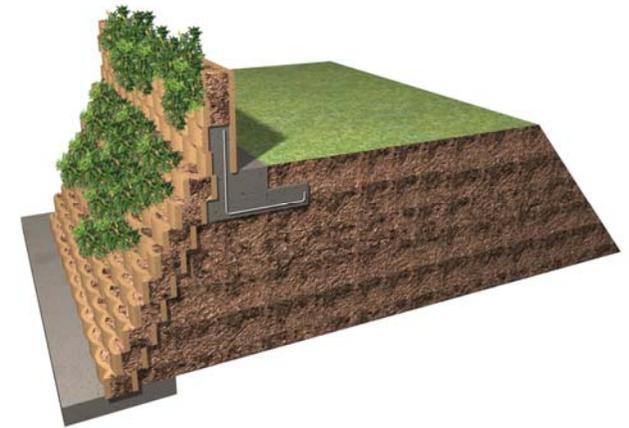
Jongens also predicts a sharp increase in the residential noise climate alongside certain roads such as Ottery Arterial, Cape Town, where the current noise levels of 61 dBA (Decibels) is

expected to increase to 72 dBA in the future, values that far exceed the daytime limit of 55 dBA (for residential dwellings - on balconies, terraces and outdoor living areas) recommended by the guidelines for community noise (1999) - noise emitted from all sources except noise at the industrial workplace - finalized by the WHO in London, March 1999.

Yet South African noise control regulation is still far below par, stating that road traffic noise directly adjacent to a road may not exceed 65 dBA, particularly next to a residential area. Considering that the WHO guidelines confirm that noise levels in outdoor living spaces ranging between 55 to 60 dBA can already create moderate to serious annoyance in a person, this is not enough to protect the public from the negative side-effect of constant exposure to traffic noise.

Noise pollution is not just a local issue, it affects the entire globe. The WHO guidelines state that in the European Union about 40% of the population is exposed to road traffic noise with an equivalent sound pressure level exceeding 55 dBA daytime; and 20% is exposed to levels exceeding 65 dBA (Lambert & Vallet 19 1994). When all transportation noise is considered, about half of all European Union citizens live in zones that do not ensure acoustical comfort to residents. At night, it is estimated that more than 30% is exposed to equivalent sound pressure levels exceeding 55 dBA, which are disturbing to sleep.

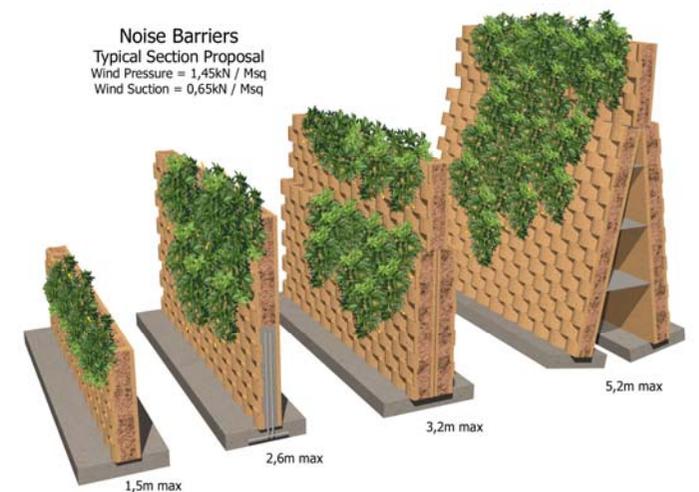
The noise pollution problem is also severe in the cities of developing countries and is caused mainly by traffic. Data collected, by the WHO researchers, alongside densely traveled roads were found to have equivalent sound pressure levels for 24 hours of 75–80 dBA. This overall growth in urban environmental noise pollution is unsustainable, because it involves not simply the direct and cumulative adverse effects on health - such as interference with communication;



Proposal for noise barrier in Sao Paulo, Brazil

Keeping the noise down – highway traffic noise barriers

Karin Johns, Freelance Journalist, investigates the effectiveness of pre-cast interlocking concrete block retaining walls in reducing highway traffic noise, as well as the urgency to reduce noise pollution - unwanted human-created sound that disrupts the environment - in South Africa.



Other design options for noise barriers using Terraforce blocks

annoyance responses; effects on sleep, the cardiovascular and psycho physiological systems; effects on performance, productivity, and social behavior; and noise-induced hearing impairment. It also adversely affects future generations by degrading residential, social and learning environments, with corresponding economical losses (Berglund 1998).

New legislation in South Africa

In South Africa, noise control is three decades old. It began with codes of practice issued by the South African Bureau of Standards to address noise pollution in various sectors of the country (e.g. see SABS 1994 1996; and the contribution of Grond in Appendix 2). In 1989, the Environment Conservation Act made provision for the Minister of Environmental Affairs and Tourism to make regulations for noise, vibration and shock (DEAT 1989). These regulations were published in 1990 and local authorities could apply to the Minister to make them applicable in their areas. Later, the act was changed to make it obligatory for all authorities to apply the regulations.

However, according to the new Constitution of South Africa of 1996, legislative responsibility for noise control rests exclusively with provincial and local authorities. The noise control regulations apply to local authorities in South Africa, giving local authorities the power to enforce the regulations, but also place an obligation on them to see that the regulations are enforced.

Today, any new development that might increase highway traffic noise for any residential area will have to consider methods of reducing noise pollution. Not only because of increasing noise from the road system and the public's demand for quieter environments, but also because of imminent draft revisions of the 1996 noise

regulations.

Says Adrian Jongens from Jongens Keet Associates, Cape Town based acoustical consultants: "The new legislation will refer to SABS (South African National Standards) guidelines, a code of practice that, based on current barrier calculations, sets the daytime limit of urban residential districts at 55 dBA and suburban residential districts (with little road traffic) at 50 dBA."

"In future, daytime limits for outdoor living spaces in South Africa will match the World Health Organisation (WHO) recommendations of a daytime limit 55 dBA (for residential dwellings - on balconies, terraces and outdoor living areas) more closely, forcing road builders and key decision makers in the industry to consider ways of keeping the noise down."

How concrete acoustic barriers work

According to British Precast, trade body for the United Kingdom precast concrete industry, one very effective way to reduce levels of noise alongside a busy section of highway is by placing a barrier - a solid obstruction - in the direct path between the source and receiver that significantly reflects (transmitting it back across the highway) the sound energy reaching the receiver. Highway noise barriers can effectively reduce noise levels by five to ten dBA, cutting the loudness of traffic noise by as much as 50 percent.

However, the pressure waves hitting the top of the barrier will be diffracted downwards and some of this sound will still be received. A small amount of the incident sound may also pass through the barrier which needs to be sufficiently dense (at least 20kg per m²) and continuous to reduce this directly transmitted sound to an insignificant level compared with the sound diffracted at the top of

the barrier. Concrete and masonry are ideal materials for this as their inherent mass will always meet this requirement.

The key acoustic considerations are the height and length of the required barrier. A noise barrier can achieve a 5 dBA noise level reduction, when it is tall enough to break the line-of-sight from the highway to the home or receiver. After it breaks the line-of-sight, it can achieve approximately 1.5 dBA of additional noise level reduction for each meter of barrier height. In addition, its length must extend far beyond the area to be protected to avoid its performance being compromised by noise diffracted around the ends of the barrier.

Barrier location is also a vital decision. Optimum performance can be achieved by maximising the difference between the direct line between the source and the receiver and the diffracted path over the top of the barrier. On level ground it is normally desirable to place barriers as close as possible to the noise source, but where roads and railways are in cuttings or an embankment, placing the barrier further away at the top of the slope is usually the best solution.

Interlocking Concrete block retaining walls

Pre-cast, interlocking concrete blocks, such as those supplied by Terraforce, a well-known local concrete block system, lend themselves ideally to the construction of highway noise barriers. Terraforce blocks, having undergone rigorous testing in Canada and the United States, comply with I.C.B.O. (International Conference of Building Officials) standards (2000), and provide inherent properties of strength, durability and versatility that allow for aesthetically pleasing and cost effective noise barrier designs. Not only are they easy to maintain and resistant to rot, vermin, vandalism and fire, but they are also plant friendly and can be filled with a planting medium to accommodate suitable plants.

An example of a Terraforce retaining wall effectively reducing noise pollution would be the Stanhope Road Barrier Project in Cape Town, undertaken in

1999. During this time, the old noise regulations had just taken effect, requiring Manong and Associates, a Cape Town based Civil, Structural and Developmental Engineering firm, to implement a noise barrier next to some high density residential units - the Doncaster Apartment building - at the same time Stanhope Road was to be upgraded and re-aligned.



The completed noise barrier, constructed using Terraforce L11 blocks, works by reflecting noise back across Stanhope Road. To minimise an increase in noise on the opposite side of the road the lower section of the retaining wall was constructed at an angle to reflect the noise upwards to pass above any possible receivers on the other side. A sub-set of this type of barrier includes a range of modifications to the top edge, such as wide flattops and multiple vertical edges to reduce the level of diffraction.

According to Adrian Jongens, who acted as acoustic consultant, the retaining wall effectively achieved its goal of reducing highway traffic noise to a level that is in compliance with the current (South African) daytime limit of 65 dBA. Says Jongens: "The 10th floor of the building experienced a 5 dBA reduction

and the 2nd floor a 12 dBA reduction of noise, which is a substantial reduction in noise levels overall. Below the 10th floor, daytime levels below 60 dBA were recorded, which is well below the local daytime limit and approaching those of world best practice."

As a result of this drop in noise levels, the normally high rotation of flats came to a standstill after people realised that with the new barrier, easy access to a main road would not mean being exposed to constant traffic noise. "Now the road has been upgraded and the barrier wall erected the body corporate has suddenly experienced a much greater demand for these units as a result. 'Live near, yet live peacefully' is the correct adage," says Jongens.



Barriers can also be formed from earth mounds or "berms" along the road, or from a combination of earth berms and walls. Earth berms have a very natural appearance and are usually attractive.

They also reduce noise by approximately 3 dB more than vertical walls of the same height. However, earth berms can require a lot of land to construct, especially if they are very tall.

Such a noise barrier recently won one of four Concrete Manufacturers Association (CMA) Premier Awards, the Cathay Pigments Trophy, as well as receiving regional and national awards in the Retaining Wall Elements category, having impressed the judges as "an innovative and ecological application which dampens the noise levels and prevents problems due to drifting sand dunes".

The barrier, designed by Planning Partners, Cape Town based landscape architects, was constructed adjacent to a new development within Century City complex that is located next to busy Ratanga Road, connecting the N1 highway with Montagu Gardens Industrial estate.

In order to protect future residents from excessive traffic noise from a planned double carriage highway and any possible negative visual impact associated with this, a 4.5 metre high and 500m long earth berm was created with the surplus site material. To reduce the footprint of this structure and to improve noise absorption capability, a steep Terraforce embankment with three terraces of varying widths was built on the road facing side. A subsoil drainage system was located behind the bottom row of the blocks and the earth backfill reinforced with polytex 115 geofabric on every third row of blocks.

Jacques Dohse from Planning Partners explained the principle behind the noise barrier: "The Terraforce retaining wall design was based on the 'out of sight out of mind' principle. The property developers were concerned with the urban scale that residents and pedestrians would experience by being confronted with a major road alongside their development. They felt that by introducing a middle level of scale, namely the highly landscaped earth berm and retaining wall, the visual impact of both road and building would be softened."

The retaining wall runs all along the full boundary length of the road and instead of a standard single slope running at a 70% incline, it consists of three 1.5m terraces that each run at their own

curvature line, breaking down the façade to accommodate plant pockets at different levels, to soften the overall appearance of the retaining wall.

Terraforce L12 blocks lend themselves perfectly to the above task, because of their unique horizontal interlock and convex and concave corners and curves of unrestricted radius allow complex designs to suit any site conditions. Jacques Dohse agrees: "The block's open bottom allows root growth which further stabilises the berm, and also allows the plants to grow to their full height. We used the rock face block in a sandstone colour, to add to the natural appearance of the wall, thus further enhancing the aesthetic aspect of the barrier. All this contributes to reducing the surface and overall scale of the wall, making it appear smaller than it really is."



The landscaping team used the terraces to good effect by creating almost instant hanging gardens with mostly water-wise indigenous planting. These hardy plants are fast growers and adapted to dry spells and high winds that can

occur in this part of South Africa. They will also be very effective in preventing wind erosion on the sloping embankments facing the buildings.

Holger Rust, Director of Terraforce, has no doubt that the future residents of this development will appreciate the abundance of flora with the fauna that will be attracted to this mini nature reserve: "Essentially two things have happened here. The resident's legal rights have been met, and a sustainable, eco-friendly environment created, one that will last for many years. Instead of an unsightly grey concrete expanse, both motorist and resident are treated to a lush, green embankment."



Future Goals

Although some effort has been made to reduce the level of noise in our communities, it is still not enough. Jonges is of the opinion that until road builders are told to build quieter roads, traffic noise level will not decrease. "Very little is being done in South Africa to check the ever increasing noise that a large number of the population is exposed to.

What we need is an increase in awareness that quiet communities are a necessary part of living."

He points out Holland as a first-rate example of a country that has achieved, through awareness and strict legislation, acceptable community noise levels. "Holland is one of the quietest places to be, even though it has the highest density of population per land area. And why? Because money was spent on creating the necessary awareness amongst the general population and key decision makers!"

He feels that the improved legislation is a first step towards reducing noise pollution, but if any real change is to happen, then the man on the street needs to start demanding protection from highway traffic noise, and to do that, they need to be educated of their legal right to an acceptable level of noise exposure and the bad effects of noise on overall health.

The WHO says that a major step forward in raising the awareness of both the public and of decision makers is the recommendation to concentrate more research and development on variables which have monetary consequences. The Guidelines state, "that research should consider not only dose-response relationships between sound levels, but also politically relevant variables, such as noise-induced social handicap; reduced productivity; decreased performance in learning; workplace and school absenteeism; increased drug use; and accidents".

For South Africa's noise levels to reduce significantly many things need happen, and some of the right steps are being taken. Yet one thing is clear: environmental noise barriers should become standard features around housing sites, being one of the more straightforward methods of cutting down noise - effectively.