Noise barriers — Sounds or silence?

What factors influence how sound travels outdoors? How can planners reduce the noise level in our communities? Two specialists in the physics of sound are looking for answers.

Years ago, our environment was a much quieter one. But multiplying snowmobiles, motorbikes and other motor transport have changed all that. Today, urban noise problems, particularly near airports and major traffic arteries, pose a challenge to scientists and engineers seeking counter measures.

One practical remedy may be improved sound insulation in buildings. Another, sound barriers erected between residential communities and the noise source. Sections of Toronto's Don Valley Parkway and Ottawa's Highway 17 have recently been equipped to test this scheme. Yet at a more fundamental level, scientists realize that there is still much to learn about sound and the way it travels outdoors.

For some years now, two NRC physicists, Dr. Tony Embleton and Dr. Joe Piercy, have been studying noise propagation phenomena hoping both to add to the store of basic acoustical knowledge and to provide understanding for others faced with treating real-life sound problems.

"Some sound reduction schemes work well, but others don't," says Embleton. "We'd like to be able to assess what's going on more precisely, so that those concerned can spend the money where problems are most severe or affect most people."

Of particular interest to the researchers was the mode of sound propagation over different kinds of surfaces. Asphalt or concrete, they found, reflect virtually all incident sound at any angle. Grass-covered surfaces, on the other hand, interact with sound quite differently. Although still reflecting it, they also change the sound's phase. As a result, sound travelling directly from a source to a listener is partly cancelled by this out-of-phase reflection, leaving the listener in a type of sound shadow. The net effect is a reduction in sound levels near the ground. The physicists discovered that this ability to change phase could be explained, quite literally, at a grass roots level. It appears that roots keep the soil surface open and porous, effectively making the ground a sound absorbing material.

Another result to come out of their work has been a series of accurate measurements on the impedance value of grass surfaces as related to the sound frequency and angle of incidence. "These numbers," explains Piercy, "are vital to any consideration

MODES OF SOUND REDUCTION

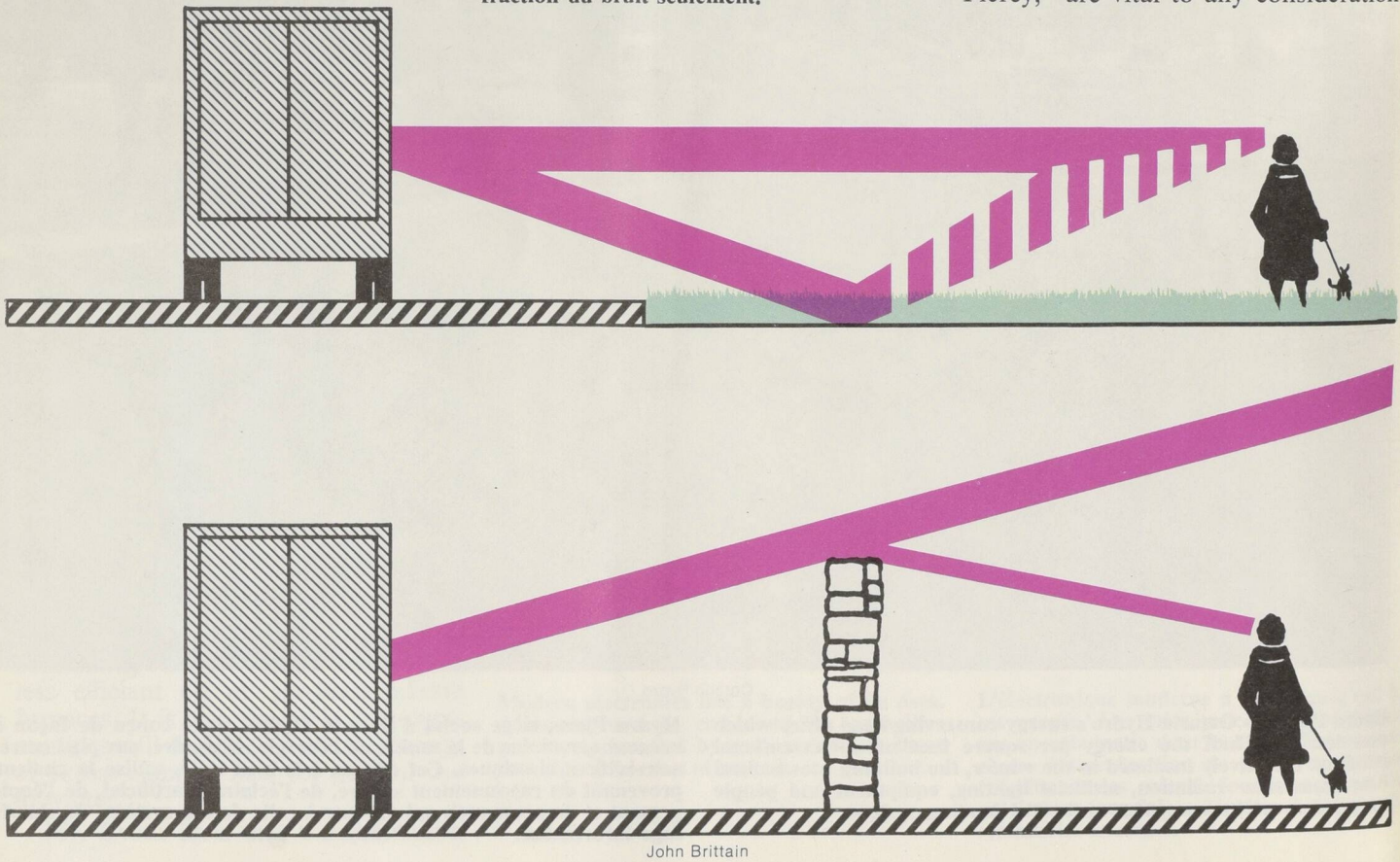
Above
Over a grass-covered surface, one component of vehicle noise reaches the listener in a direct fashion. Another, changing phase on reflection, partly cancels the first by interference. Lower sound intensity results. A barrier erected here would mainly block the reflected sound (the cancelling component) leaving greater sound intensity.

Below
Only a fraction of vehicle noise creeps over a sound barrier placed over concrete.

MÉTHODES D'INSONORISATION

Ci-dessus
Sur une surface recouverte de gazon, une composante des ondes acoustiques produites par un véhicule atteint directement le passant. L'autre composante, réfléchie et déphasée, annule partiellement la première. Le résultat est un bruit plus faible. Un mur antibruit placé à cet endroit arrêterait la composante réfléchie et neutralisante mais n'atténuerait en aucune façon l'onde horizontale.

Ci-dessous
Les écrans acoustiques construits sur une surface en ciment ne laissent passer qu'une fraction du bruit seulement.



John Brittain