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LeBreton Flats Development Evaluation 3

Traffic Noise Barrier Walls

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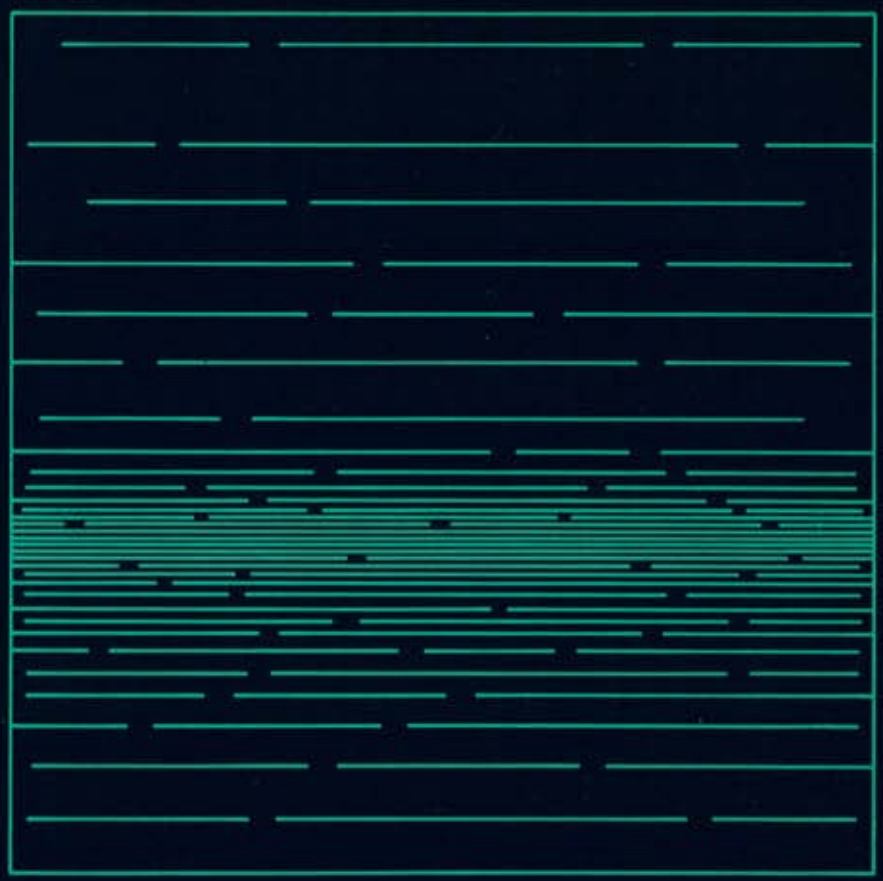

Canada

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Aussi disponible en français

Canada Mortgage and Housing Corporation
Société canadienne d'hypothèques et de logement

Honourable Paul Cosgrove
Minister

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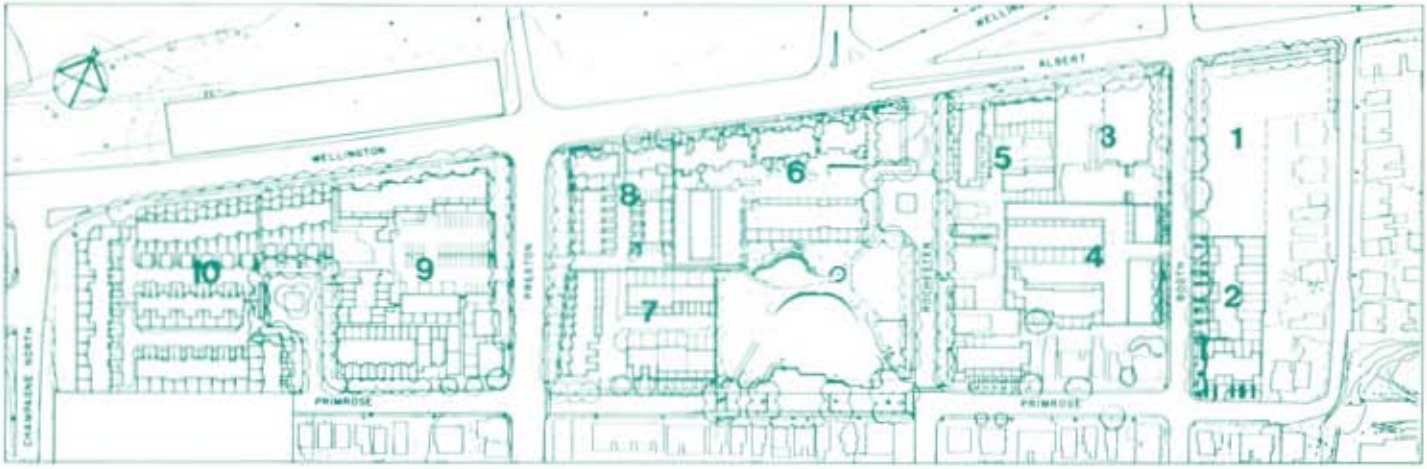
Preface

The LeBreton Flats residential community is located in downtown Ottawa, within view of the Ottawa River, just 1 km west of Parliament Hill. Phase I, consisting of 425 housing units, has been developed by Canada Mortgage and Housing Corporation as an exemplary inner city community. This development adjoins an existing residential neighbourhood on the south and borders a major traffic artery on the north. Within its ten development subdivisions new approaches to construction, to energy conservation and to environmental constraints have been tried. The results are now under evaluation.

This pamphlet is the third in a series describing the experiments undertaken at LeBreton Flats in sound attenuation, energy conservation, snow control, storm-water management and recreation facility design.

Each pamphlet identifies a specific problem or need encountered in the LeBreton Flats development and describes its experimental solution in terms of concept, design and performance. Suggestions for improving the experimental design and adapting it to other sites and circumstances are included.



LeBreton Flats, Ottawa

Map showing the ten housing projects which make up phase I of the development.

The noise environment

LeBreton Flats, phase I's northern border is Wellington Street, a four-lane collector road to downtown Ottawa, which carries heavy bus and commuter traffic at peak hours. Unit entrances, ground-floor living areas and second-storey bedrooms face the roadway from a distance of only three to seven metres; the recreation area for one apartment block is also adjacent to this thoroughfare. The noise level increases at traffic lights opposite the development where vehicles slow down, stop and accelerate. Another major traffic route (Preston Street) runs at right angles to some of the residences, creating a noisy intersection where it meets Wellington Street.

This diverse residential development of townhouses, stacked housing units and two five-storey apartment blocks was built close to the roadway in order to make maximum use of expensive urban land. Noise attenuation principles were applied to the LeBreton site plan and project planners have also used several different types of sound barriers to lessen traffic noise.

Sound barriers

Window sound barrier boxes were installed at second-storey windows of selected townhouses (see LeBreton Flats Development Evaluation 1).

Three different types of sound barrier walls were built to reduce traffic noise at ground-floor level. This pamphlet describes the construction of these walls and evaluates their performance.

Principles of design

As a rule of thumb, traffic noise is reduced by any barrier that interrupts the line of sight between the noise source and the receiving point, in this case the ground floor of the townhouses. The barrier can be a road embankment or cutting, earth berm, building or wall. A sound barrier wall should have an impervious, dense surface, weigh at least 10 kg/m^2 and have as few openings, holes or cracks as possible (preferably covering less than 0.5 per cent of the total surface).

The CMHC publication *Road and Rail Noise: Effects on Housing* (NHA 5156) provides details and examples of how to calculate barrier height and length for desired levels of noise attenuation. The height and length of a barrier wall and its position relative to the noise source and the listener are factors critical to its noise-reducing capacity.

The geometry of a barrier wall is illustrated in Figure 1 which shows a vertical section along the line from point O (the noise source) to point R (the receiving point). The distance s is the equivalent height of the noise source above the road surface.

For a barrier of infinite length, the sound attenuation depends on the difference between the straight line (distance c) from the source to the receiver and the distance (a + b) over the top of the barrier. This is called the "path length difference".

For most purposes, if these dimensions are known, the degree of attenuation possible can be obtained from tables presented in *Road and Rail Noise: Effects on Housing*, (Tables 3.6 and 3.7).

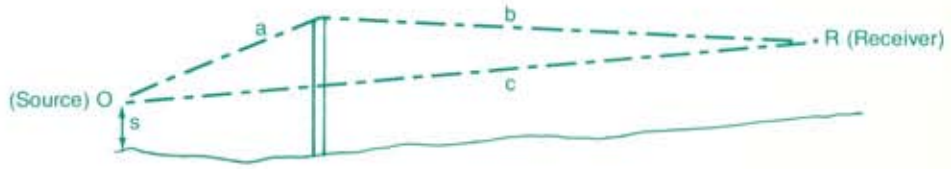


Figure I.

Basic barrier model (vertical section) which interrupts line of sight

The use of sound barriers at LeBreton Flats

Noise attenuation principles were applied to the LeBreton site plan. The housing blocks were located so that the buildings themselves act as a noise barrier to create a quiet environment for the private amenity spaces behind the building. The noise barriers planned to shield the ground-floor living areas of the units were to serve multiple functions. In addition to diminishing traffic noise, the walls were designed as an integral part of the project's overall design so that the entrances to the housing units would be private and secure. The walls would screen traffic, but also complement the façades of the buildings and give the interior walkways and the recreation area an atmosphere of pleasant seclusion rather than a feeling of confinement.

The three types of barrier walls designed at LeBreton vary in construction material, surface texture, cap design and deflectors.

The traffic noise barrier wall was also designed to protect the entrances to the units.

The standard brick wall used for sound attenuation at LeBreton.

The brick wall with precast cap built along Wellington Street.

The sound attenuation performance of each wall built at LeBreton was measured by the National Research Council. The following table shows the barrier height, relevant space relationships, construction details and evaluation results.

The traffic noise barrier wall of brick is topped with a louvered deflector which also reduces snow drifting behind the wall.

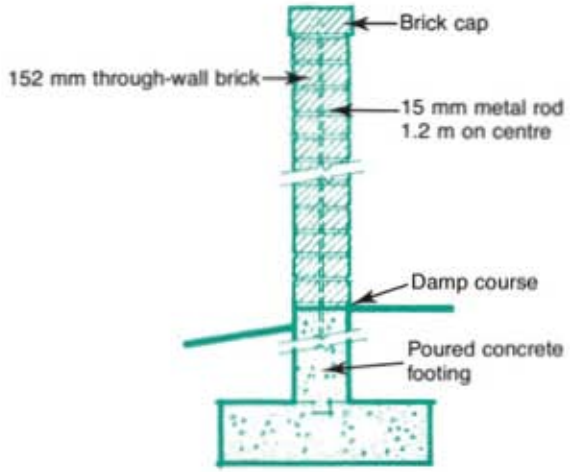
Construction of the Sound Barrier Walls

Walls

a) Standard brick wall

Section

Materials

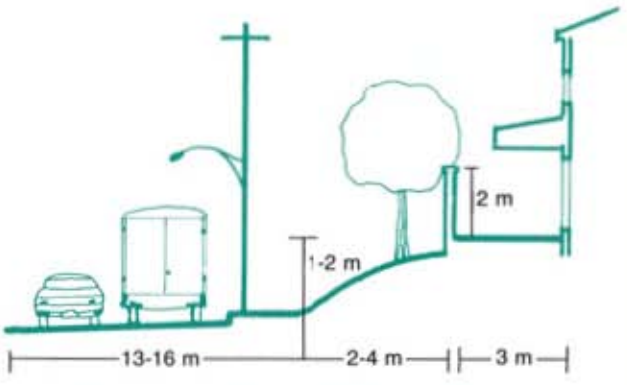


Construction

Built of 152 mm wide through-wall brick reinforced with 15 mm metal rods at 1.2 m vertical centres set on a poured concrete foundation wall and footing below frost line. The wall is capped with a brick course laid on edge.

1981 cost*

$2975.00
$1140.00 per unit



Sound attenuation at first-floor window as measured by the National Research Council of Canada

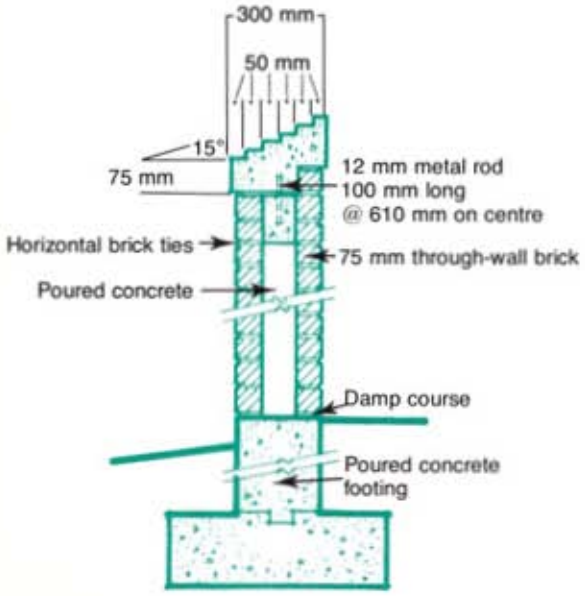
6 dBA

Comment

Average cost, reasonably effective.

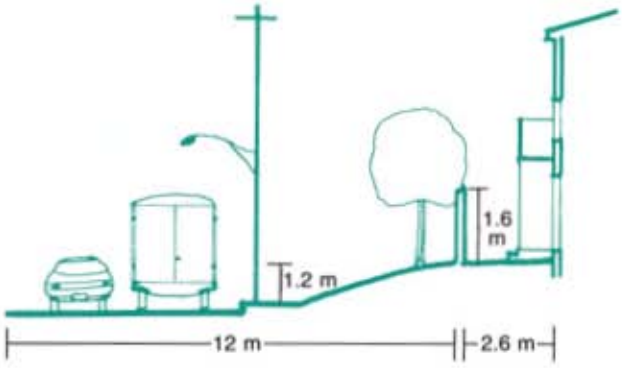
*Cost calculated for wall section 10 m (32.5 ft.) long 2 m (6.5 ft.) high, thickness varies.

b) Brick-faced wall with precast cap



Constructed of two 75 mm wide brick walls, spaced 100 mm apart set on a poured concrete foundation wall and footing below the frost line. The space between the two top courses of brick is filled with concrete, to secure the precast concrete cap by a 12 mm metal rod 100 mm long set 610 mm on centre. The precast cap is 300 mm wide and angled on the street side at 15° in 50 mm steps.

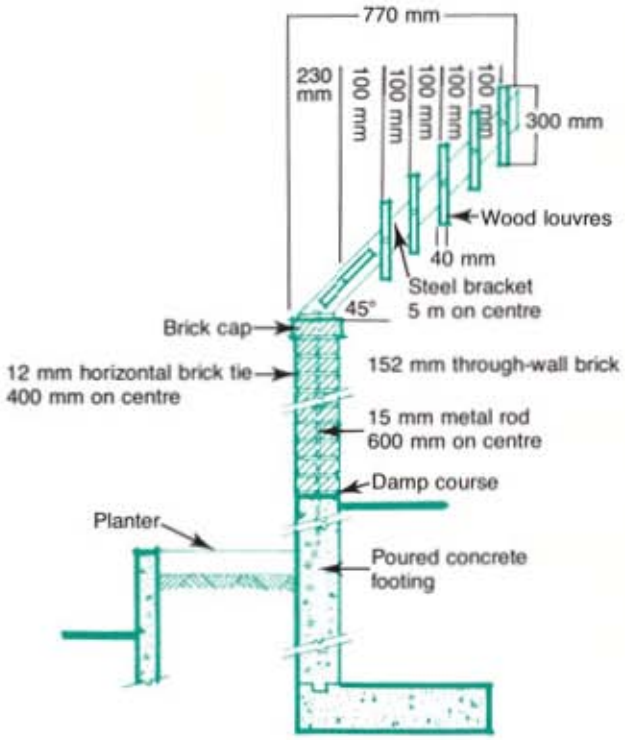
$4015.00
$1606.00 per unit



6 dBA

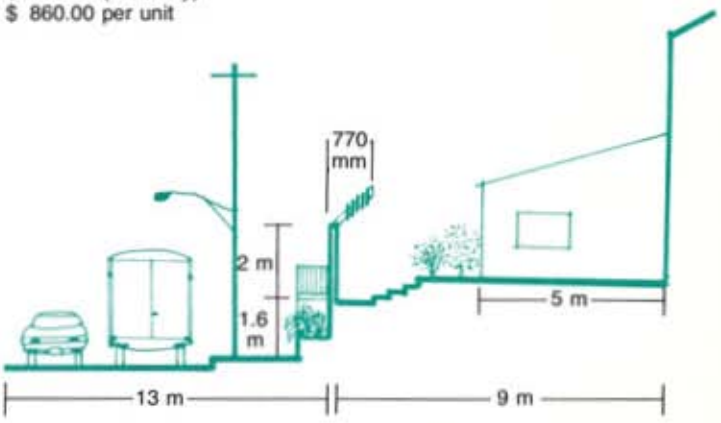
Expensive, easy construction.

c) Brick wall with louvered deflector



Built of 152 mm wide through-wall brick reinforced with 15 mm metal rods on 600 mm centres, set on a poured concrete foundation wall and footing below frost line. Precast concrete planters, formed of 610 × 1220 mm interlocking pivotal sections are tied to the base of the wall on the street side. A steel frame 0.75 mm high, inclined at 45°, with six adjustable wood louvres, is fixed to the top of the brick wall to deflect wind and snow.

$3250.00 (wall & louvres)
$1300.00 per unit
$2150.00 (wall only)
$ 860.00 per unit



7 dBA

Expensive, louvres provide some additional noise attenuation as well as serving as a snow deflector to prevent drifting behind the wall.

Evaluating wall performance

The 24-hour average noise level along Wellington Street is 68 dBA. CMHC recommends maximum acceptable noise levels at specific locations in residential housing — in living rooms, for example, the recommendation is 40 dBA and in outdoor recreation areas, 55 dBA.

The barrier walls reduce noise levels by 6 to 8 dBA at first-floor windows and in the walkway between the housing and the walls. This noise reduction makes useable an otherwise extremely noisy outdoor area. The sound attenuation provided by wall (a) was tested both with and without the sloped concrete cap. There was no measurable difference.

All barrier attenuations were consistent with values predicted in the CMHC publication *Road and Rail Noise: Effects on Housing* (NHA 5156).

Because the barrier walls were components in an integrated design, they blend well with the façades of the housing units and with each other. The walls were sufficiently high to give a 10 per cent reduction in traffic noise and also fulfil their other intended functions of providing protection, visual screening, privacy and a wind and snow break without dominating the design. The paths and spaces behind the wall and the entrances to the dwellings were landscaped to create a pleasant secluded atmosphere.

The traffic barrier walls can be designed to blend with the façades without dominating the design.

The walkway behind the wall is landscaped to provide a pleasant secluded space for residents' use.

Alternative applications

Where conditions are suitable, a berm with a low wood fence along the top is an alternative type of sound attenuation barrier, and creates a softer landscaped effect. Its performance will depend on its height, and its position relative to the traffic noise and the housing unit.

For further reading:

Road and Rail Noise: Effects on Housing, NHA 5156, Ottawa: Canada Mortgage and Housing Corporation, Revised edition, 1981.

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