ITEM	9
MANAGER'S REPORT NO.	67
COUNCIL MEETING	Oct. 25/76

Re: REPORT ON TRAFFIC NOISE AND HOUSING

Council was advised that a report on traffic noise and its impact on housing would be submitted for consideration in October.

A comprehensive report on the subject has now been submitted to the Municipal Manager by the Director of Planning, but the Technical Committee on Noise Control which developed our Noise Control By-law and which consists of a representative from the Environmental Health Sub-Department, Engineering Department, R.C.M.P. and B.C.I.T., would like to have an opportunity to comment on the report and review it in greater detail. The preliminary comments of the Technical Committee have brought forward some differences of opinion which should be resolved before the matter is considered by the Council. Further, the Chief Building Inspector should also be involved in the process of the detailed review.

It is for these reasons that the Municipal Manager has delayed the introduction of the report and has referred it to the Technical Committee on Noise Control for study and comment. The Committee will submit a report on its findings in four to six weeks time. Council should therefore expect to receive a full report sometime within the first half of December.

This is for the information of Council.

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PLANNING DEPARTMENT
OCTOBER 14, 1976

TO: MUNICIPAL MANAGER

FROM: DIRECTOR OF PLANNING

SUBJECT: TRAFFIC NOISE AND HOUSING

A. BACKGROUND

Council, on October 20, 1975, adopted the following resolution:

> THAT the Municipal Manager be asked to bring in a report on ways and means of regulating noise proofing by double glazing and other methods in higher density development which borders arterial traffic roads or other noise producing sources.

This report will briefly outline some aspects of responses to noise, propose a standard to be met in judging the suitability of a residential rezoning site, describe methods of meeting this standard and recommend a policy for the consideration of Council. Our report is not intended to provide an exhaustive treatment of the scientific theory, but to provide some detail and scientific background to give a basic understanding of the principles which led to the recommended policy. Our proposals are not in any way intended to duplicate or contradict the Burnaby Noise or Sound Abatement Bylaw which deals with the production of noise. Rather, the recommended policy is proposed as a guide for the site planning and design of residential developments.

In line with Council's resolution, this report deals with external noise sources. Standards for controlling noise nuisance from internal sources are set out in the National Building Code.

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B. SUMMARY

Within the context of a highly complex scientific subject which has been the subject of significant public interest in recent years, the Planning Department recommends the use of the United States Department of Housing and Urban Development (HUD) (see Section D) guideline criteria as an appropriate guide for the determination of the suitability of development sites for residential rezoning proposals with respect to indoor and outdoor noise environments. The HUD guideline criteria will be utilized by acoustical engineering consultants in evaluating the effects of external noise on a specific residential development site which is the subject of a rezoning proposal. It is acknowledged that external noise levels in urban areas due to the high population density, current technology (i.e. motor vehicles) and the necessity of providing a comprehensive road network to serve municipal needs will be higher than in, for example, less dense, more suburban or rural areas.

However, the utilization of adjustments of a building design and construction nature such as the use of double-glazing or heavier single-glazing and the orientation and size of windows with respect to noise generating sources; and to a lesser extent, of a landscaping nature such as the use of treed buffer zones, berms, fencing, and solid barriers - will assist in reducing the effect of external noise levels in physical and psychological terms within residential units and sites which are located in affected areas of the municipality. Other specific noise reduction proposals may be appropriate for individual residential developments as a result of detailed reports which will be prepared by the acoustical engineering consultant retained by the rezoning applicant.

Therefore, through the use of a wide range of building and site planning measures the effect of external noise should be able to be reduced to reasonable and acceptable levels within proposed appropriate residential units and sites.

C. RESPONSES TO NOISE

Noise, defined as unwanted or excessive sound, is generally recognized as a form of environmental pollution. The noise problem concerns people's responses to the loudness, frequency and variability of sound in relation to the general ambient level to which they have become accustomed.

The subjective responses of people to community noise are affected by factors apart from the physical nature of the sound. Each human activity such as active recreation, crowd situations, leisure pursuits, and sleep is influenced differently by noise.

Noise is generally more annoying if it is variable, rather than a background sound of a steady level and frequency. In fact, in some instances, background sounds are useful in "masking" unwanted sounds. Individual differences with respect to previous exposure to noise and attitudes to noise or the noise producing source are also significant.

A study conducted in 1961 in Central London indicated that about 10% of a typical population are so sensitive to noise that they object to almost any noise not of their own making. Another sizable proportion (about 25%) seems to be almost imperturbable (Figure 1).

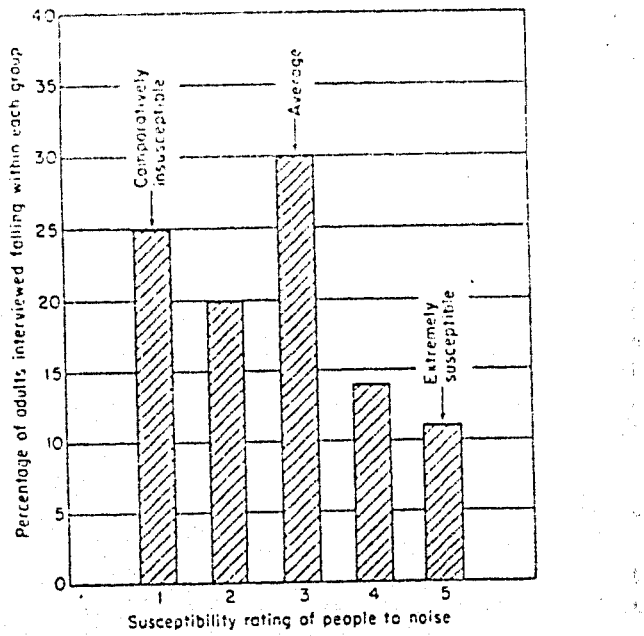


Fig. 1 This bar graph shows the percentage of 1,377 adult residents interviewed in depth in a 1961 Central London community survey for each of five categories of noise susceptibility rating. The susceptibility rating was derived from the answers to six questions on a 40-item questionnaire that evoked statements from the interviewees about their sensitivity to noise as follows: (1) Does noise ever bother, annoy, or disturb you in any way? (2) When you hear the noise most annoying to you in your home do you feel very annoyed, moderately annoyed, a little annoyed, or not at all annoyed? (3) Would you say you were more sensitive or less sensitive than other people to noise? (4) Is there too much or too little fuss made about noise nowadays? (5) How far would you agree that noise is one of the biggest nuisances of modern times? (6) Could you sum up your opinion by saying whether you find noise in general: very disturbing, disturbing, a little disturbing, or not at all disturbing?

(Source: Beranek, P. 572)

Although the general public is more aware of noise and its effects on health than in 1961, this study illustrates that people's response to noise varied and that not all people would be expected to express appreciation of the results of noise control measures, although all persons would surely benefit. Thus, any criterion for design must represent the result of a statistical evaluation of how a sample of people, involved in a particular mode of behavior, react to noise in a given situation. The "noise exposure" of a site, meaning a description of time-varying sound levels throughout a 24 hour period rather than a simple average level, must also be considered.

D. MEASUREMENT OF SOUND LEVELS AND A DESIGN CRITERION

Sound levels are measured by a sound level meter in decibels (dB) on a logarithimic scale. Readings taken in this way, however, do not necessarily correspond to the subjective loudness. It is possible to compensate electronically for the response of the ear by weighting the readings on the sound level meter to emphasize certain frequencies. There exist several possible weightings but the A-weighted decibel (dB(A)) scale is considered most suitable for the measurement of traffic noise. On this rating, an increase of 6-10 dB corresponds to approximately a doubling of loudness.

Many countries have sponsored studies to determine acceptable noise levels for dwellings. These standards may be used either as a guide to land use, or as a guide to site planning, landscaping and construction where the noise situation and land use are established.

Based on social surveys in the United States and a review of internationally conducted studies, the Department of Housing and Urban Development (HUD) in the United States has adopted "guideline criteria" for noise exposure at residential development sites (Figure 2). 128

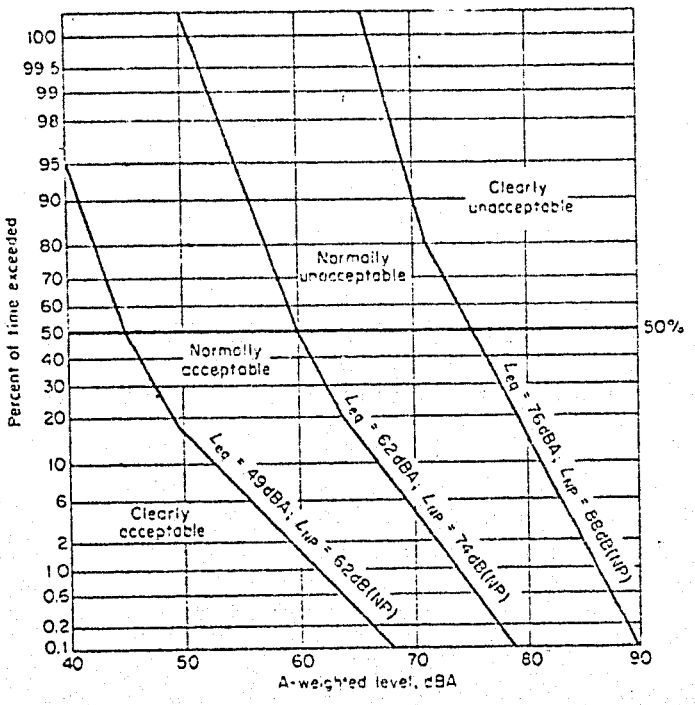


Figure 2. Criteria adopted by U.S. Department of Housing and Urban Development for non-aircraft noise measured outdoors in residential areas. L_{eq} is the mean-square A-weighted sound level. L_{NP} is the noise pollution level.

(Source: Beranek, P. 580)

These criteria are expressed graphically and, under certain conditions, they can be converted to an index -- the noise pollution level (LNP). Both the graph and the noise pollution level take into account two general observations:

(a) Annoyance is related to the intensity or perhaps even to the total energy of the noise measured throughout a period of time, such as a 24 hour day, or during sleeping or waking hours.

(b) Annoyance increases with the variability of the noise, given the same total energy of the noise for the time period.

The graph or noise pollution level is determined for a 24 hour period using outdoor readings. Following are definitions of the HUD acceptability categories.

Figure 3

HUD's Acceptability Categories for Proposed Housing Sites

Clearly Acceptable:	the noise exposure is such that both the indoor and outdoor environments are pleasant.

Normally Acceptable:	the noise exposure is great enough to be of some concern but common building constructions will make the indoor environment acceptable, even for sleeping quarters, and the outdoor environment will be reasonably pleasant for recreation and play.
Normally Unacceptable:	the noise exposure is significantly more severe so that special building constructions are necessary to ensure some tranquility indoors, and barriers should be erected between the site and prominent noise sources to make the outdoor environment acceptable.
Clearly Unacceptable:	the noise exposure at the site is so severe that the construction costs to make the indoor environment acceptable would be prohibitive and the outdoor environment would still be intolerable.

(Source: Shultz, P. 149)

It is recommended that the criteria, as outlined on Figure 2, be adopted for a trial period in evaluating a residential rezoning development site's acceptability with respect to noise exposure. That is, the indoor noise environment must be within the "Clearly Acceptable" category, while the outdoor noise environment should generally be within the "Normally Acceptable" category. It is not necessary that all outdoor areas of a residential site meet this standard, but areas requiring good speech intelligibility for safety reasons (for example, swimming pools) must. Thus, upon plotting the sound environment for a site and relating it to the HUD criteria, it would be determined what approaches in terms of construction, siting and landscaping would have to be utilized to result in appropriate indoor and outdoor noise environments. The adoption of this approach will result in a performance standard which can be met in a variety of ways by architects and their acoustical consultants.

The Chief Public Health Inspector has stated that he does not feel the HUD Criteria is stringent enough. The adoption of the HUD criteria will necessitate special building and site constructions and site planning measures to reduce the impact of noise on residents and may even rule out the development of some Community Plan sites for housing. The adoption of a more stringent criteria would quite likely rule out the development of many more proposed housing sites within the Municipality or would necessitate very unusual, and likely economically unfeasible building and site constructions on these affected potential housing sites. Therefore, we recommend the adoption of the HUD criteria for a trial period. During this period the effect in terms of building and site constructions and planning can be evaluated as individual rezoning proposals are considered. After this trial period a review of the impact of the HUD criteria in comparison with a more stringent criteria will be prepared.

The Burnaby Noise and Sound Abatement Bylaw and the adoption of the HUD Criteria will work together as continued enforcement of the Bylaw will improve general ambient noise levels, while compliance to the HUD Criteria will ensure appropriate site planning and site and building constructions.

E. METHODS OF REDUCING TRAFFIC NOISE

The most common noise source affecting housing developments within Burnaby is traffic.

Logically, traffic noise should be minimized at its source. Steps have been taken by various levels of government to do this. At the federal level, regulations related to the maximum permitted sound levels for new vehicles tested at the point of manufacture are in force. At the provincial and municipal levels, regulations and enforcement programs controlling the operation and maintenance of all vehicles tested beyond the point of manufacture are in effect. Burnaby's Noise or Sound Abatement Bylaw, adopted 21 February 1972, was praised in Urban Reader (September/October 1975) as a "progressive piece of legislation (which World Soundscape Project judged the best in Canada)..."

However, notwithstanding the legislation existing to control the emission of noise from individual vehicles, the cumulative local product of noise emissions from a large number of moving vehicles is highly significant in terms of the urban living environment. Traffic noise at a site increases with traffic volume, speed, proximity and mix (trucks/automobiles).

The reduction of speed limits on highways to 55 mph, in addition to reducing fuel consumption and motor vehicle accidents, has thus theoretically reduced noise levels along these routes.

An increase in truck traffic in the traffic stream results in an increase in perceived noise levels. This factor, among others, has determined the location of new truck routes throughout the Municipality.

The reduction of volumes of traffic, and thereby noise levels within community plan areas, has been an important goal in their planning. In general, through traffic has been eliminated; developments are accessed via local streets which are cul-de-saced. The encouragement of mixed use development (for example Rezoning Reference #63/75, a mix of residential, office and retail uses), as well as providing other benefits, potentially reduces the need to travel if people work within walking distance of their home; and within the urban context may assist in reducing noise by reducing traffic volumes. However, mixed use developments must be carefully planned with respect to noise generating sources such as delivery trucks and ventilation equipment.

In some cases, due to overall planning considerations, a relatively major traffic route passes proximate to a multiple family residential area such that the noise environment is relatively high. In these instances, methods of sound reduction other than distance from the source must be sought.

In setting up a performance standard such as the HUD criteria, the Municipality is providing a flexible framework for private developers through their architects and acoustical consultants to provide appropriate sound environments. That is, the Municipality is not dictating a specific solution, but rather is setting a standard which can be met in a variety of ways, depending upon the specifics of a particular site, severity of noise problem, and the innovation of the design engineers and architects.

The following comments are to inform Council of some approaches which may be selected in ensuring that a site and dwelling units meet the standard.

(a) Noise Screens

Noise screens are continuous solid barriers placed along the side of roads. Well designed noise screens can achieve significant reductions in noise levels experienced on adjacent properties. The screen should provide as great an angle of acoustic shadow as possible. Accordingly, it should be placed as close to the pavement edge as possible, be as high as practical and of adequate length. A screen must be very long so that it is not outflanked by noise. Unless the distance from the reception point (building facade) to the end point of the screen is at least ten times the shortest path to the screen, the noise screen will substantially lose effectiveness. Screens interrupted by driveway accesses and road intersections are therefore ineffective.

Figure 4 shows the extra attenuation of noise levels provided by long screens of 3.28 ft., 6.56 ft. and 9.84 ft. high. It is assumed that the screens are 82 ft. from the traffic noise source as would apply to the traffic lane farthest from the screen on a divided highway, e.g. Trans-Canada.

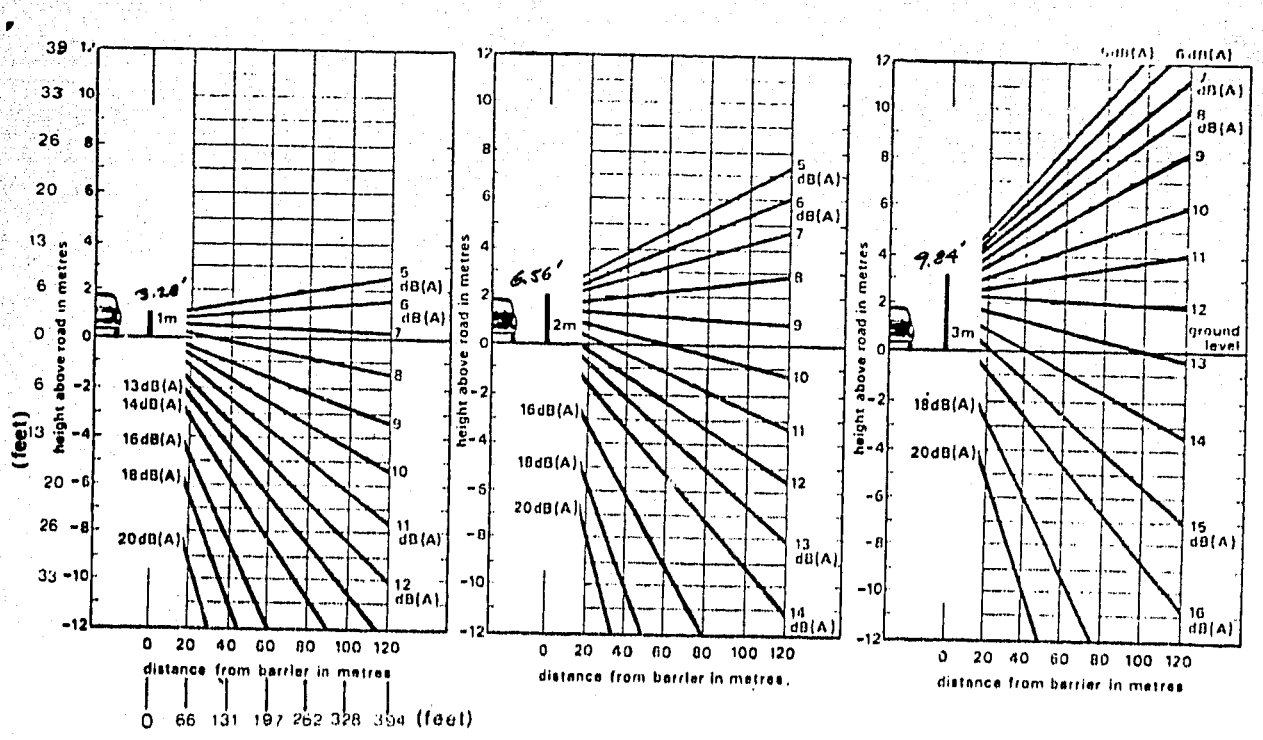


Figure 4: Reduction of L_{10} by very long screen barriers. (L_{10} = noise level exceeded for more than 10% of the time.)

(Source: British Research Station Digest, November 1971, P. 4)

The diagrams indicate that a 6.56 ft. (2M) screen "protecting" a two-storey building 295 ft. (90M) distant (assuming a flat site) would reduce sound levels by 6dB(A) or the perceived apparent loudness by approximately 50% at height of 16 ft. (5M). Higher storeys would be uneffected by the screen. While noise screens are ineffective in protecting high rise structures from noise, they appear to be of some value in protecting low rise housing forms provided the housing is at or below the road elevation and the barrier is of adequate length. Further, they are valuable in improving the outdoor acoustic environment of outdoor recreational or garden areas.

Along the Trans Canada Highway within West Vancouver, the Department of Highways has installed attractive screens, Figures 5, 6 and 7.

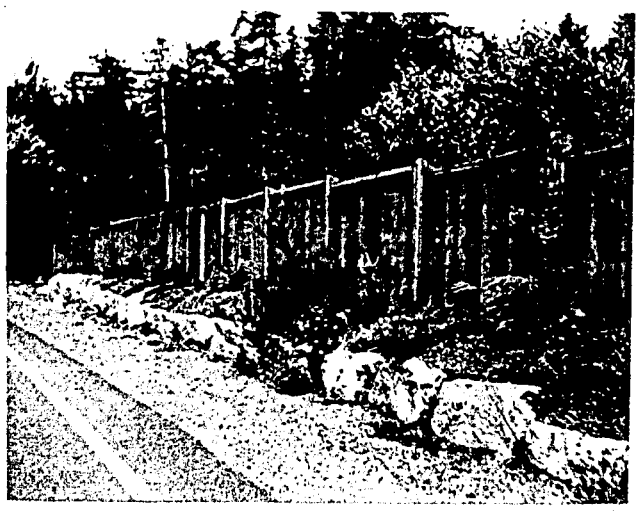


Figure 5

Figure 6

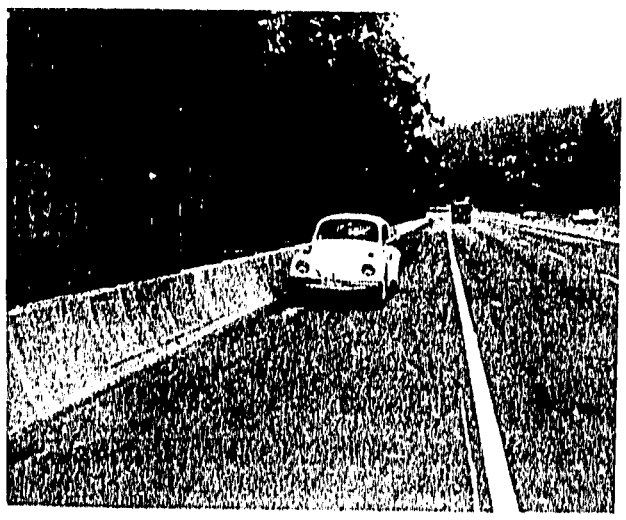


Figure 7

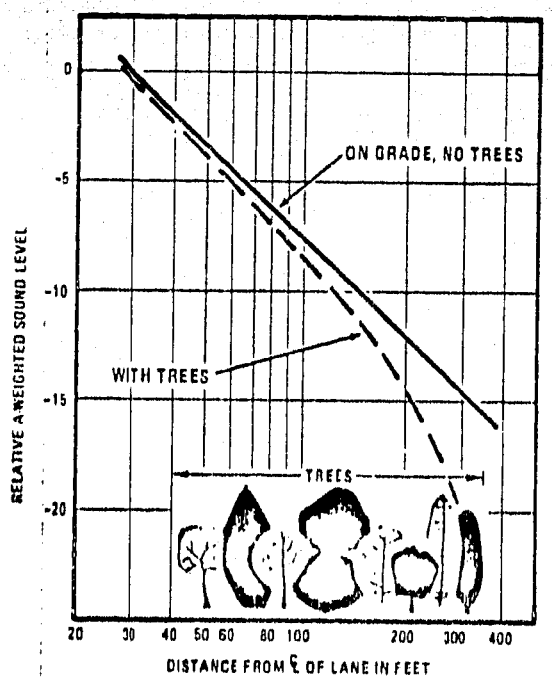
These barriers, which are located adjacent residential areas, are constructed of stained cedar boards, including, in some areas, planting and stone walls. These wood fence barriers may be less effective in reducing noise than other constructions, but they do provide an effective and pleasing visual barrier.

The Planning Department will study such installations in greater detail and approach the Department of Highways and the appropriate Municipal Departments in order to determine the advisability and feasibility of the installation of similar screens in appropriate locations within the Municipality. Such a study would consider the effectiveness of the existing screens, alternate designs and estimated effectiveness of particular installations as related to ground slope between residential development and the arterial road and interruptions of the roadway (and necessarily, screens) by driveways or road intersections. Consideration would also be given to cost of installation and effect on motorists related to view obstruction and "closed-in" feeling.

(b) Landscaped Buffers

Planting adjacent to a roadway produces little physical reduction in sound levels unless it is extremely dense and of significant depth. The sound level reduction is shown in Figure 8, when the roadside is lined with trees at a distance of 40 feet from the edge of the road to beyond 300 feet.

FIG. 8 NOISE REDUCTION WITH AND WITHOUT TREES



(Source: U.S. Department of Transportation, June 1972, P. 15)

From 200-300 feet a significant reduction in sound level is noted; however, this approach is of limited value as rights-of-way more than 400 feet wide are uncommon.

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The reduction in sound levels as a result of dense planting of depth over 200 feet is not enough to justify the large expenditures required for this purpose alone. However, it has been shown that buffering planting has reduced the incidence of complaints about noise. Since noise is defined as unwanted sound, the problem of noise is as much psychological ("unwanted") as it is physical ("sound"). Hence, it is contended that buffering planting, which to some extent visually screen the road, reduces people's awareness of the road's negative aspects. This factor lends further support to current policies requiring high landscaping quality for all new developments and tree planting along boulevards. 134

Planting berms, however, are generally more effective than flat planted areas. The ability of berms to reduce noise is related to their height and the grade relationship between the noise source, the intervening berm, and the residential units to be protected.

(c) Building Facade

The normal building wall utilizing frame construction has a sound transmission loss (sound reduction capacity) of 34 - 37 dB, while a 6" concrete wall has a sound transmission loss of 50 dB. A typical single glazed closed window has a sound transmission loss of 15 - 20 dB reducing to 10 dB when open. Therefore windows are the greatest source of sound penetration even though they may constitute only a small percentage of facade area. Efforts at sound reduction through facade treatment should therefore be concentrated on window design and installation.

The simplest way of increasing the sound insulation capacity of an element of structure is to increase its mass; in a general sense this is true for windows but, with such lightweight components, a substantial improvement can be obtained by double glazing construction, as shown in Figure 9, provided that the windows are sealed by weatherstripping and that the air space is wide enough to give the required insulation at the lower frequencies typical of traffic noise.

Fig. 9 Sound insulation of windows

Description	Sound Reduction (av 100–3150 Hz)
Any type of window when open	about 10 dB
Ordinary single openable window closed but not weather-stripped, any glass	up to 20 dB
Single fixed or openable weather-stripped window, with 6 mm glass	up to 25 dB
Fixed single window with 12 mm glass	up to 30 dB
Fixed single window with 24 mm glass	up to 35 dB
Double window, openable but weather-stripped, 150–200 mm airspace, any glass	up to 40 dB
Double window in separate frames, one frame fixed, 300–400 mm airspace, 6–10 mm glass, sound-absorbant reveals	up to 45 dB

(Source: Building Research Station Digest, April 1972, P. 4)

The optimum air space width for thermal insulation is about 20 MM (0.79 in.), but this is too small to be of any practical advantage for sound insulation. For protection against traffic noise a minimum air space width of 150 MM (5.9 in.) is recommended and preferably more - say 200-300 MM (7.9 - 11.8 in.) wherever it is economically obtainable. Unless an air space at least 100 MM (3.9 in.) wide can be provided, practical insulation against traffic noise may well be obtained more effectively by heavy single glazing.

Design charts are available to calculate the sound transmission loss of walls consisting of varying percentages of different materials, for example concrete and glass, siding - wood frame - dry wall and glass. Through the use of these charts and with a knowledge of the exterior sound environment, a suitable wall can be designed to reduce the sound to an acceptable level within the living unit. This can be accomplished by reducing the amount of glazed area or by treating the glazed areas with double glazing or heavy single glazing.

While double glazing or heavy single glazing is effective when the window is closed, they become ineffective when the window is open. Thus, there is a conflict between the ventilation function of a window and the sound reducing function. Window areas could be reduced to reduce sound penetration, but this conflicts with the lighting and viewing functions of windows. Clearly, a compromise must be sought by residents when double glazing units are installed--increased ventilation resulting in increased sound (unless an air conditioning or ventilating system is incorporated which is generally very expensive). But this fact should not rule out the use of double glazing or heavy single glazing where necessary as, in our relatively cool climate, windows can be closed much of the time.

Attached as an appendix is a report from an acoustical engineering consultant which outlines how some of the above measures and others were implemented in a project within the Municipality. It suggests some of the above noted measures in addition to others such as solid balcony railings, projecting building walls to shield balconies, absorptive treatment on the underside of balcony roofs, perimeter walls to shield private courtyards and site planning and building layout considerations to minimize noise penetration.

This report is the recommended format for acoustical reports to be prepared in compliance with the recommended policy.

F. PROPOSED POLICY GUIDELINES

In consideration of the foregoing summary of findings, the following guidelines are proposed for a one year trial period after which a review will be conducted:

1. THAT the HUD criteria be adopted as the standard for judging the acceptability with respect to noise of residential rezoning proposals for higher density development which borders arterial traffic roads or other noise producing sources. That is the indoor noise environment must be within the "Clearly Acceptable" category, while the outdoor noise environment must be within the "Normally Acceptable" category as described in Section D of this report.

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2. THAT the first report to Council on residential rezoning proposals for higher density development which borders arterial traffic roads or other noise producing sources include a discussion of the noise environment of the site. It will generally be concluded that an acoustical engineering consultant's report will be required. These reports will form a part of the suitable plan of development as a prerequisite to rezoning. The report shall include an evaluation of the site in terms of HUD criteria and describe (in a format similar to Appendix A of this report) measures to be taken to ensure that the dwellings and appropriate parts of the site meet the HUD acceptability criteria.

3. THAT current policies requiring high landscaping quality and retention of as many existing mature trees as possible in all new developments and, where practical, along boulevards be continued to reduce the psychological impact of noise, as well as to improve the visual aspect of the community.

G. RECOMMENDATION

In view of the basic question of stringency referred to on page 5 of the Report it is RECOMMENDED:

THAT the Proposed Policy Guidelines be referred to the Technical Committee on Noise Control for consideration and comment.

A. L. Parr,
DIRECTOR OF PLANNING.

CBR:KI:cm
Attach.

c.c. Chief Public Health Inspector
Municipal Engineer
Chief Building Inspector

REFERENCES

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2. Building Research Establishment Digest. Motorway Noise and Dwellings. May 1973.

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10. U.S. Department of Transportation. Transportation Noise and Its Control. June 1972.

11. Beranek, Leo L. Noise and Vibration Control. 1971.

12. Schultz, Theodore J. Noise Assessment Guidelines from a Technical Background. HUD Report #T.E./NA172.

13. Barron and Strachan, Consulting Acoustical Engineers. Research assistance and library.

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APPENDIX 'A'

Barron & Strachan

January 17th, 1975.

Project: 581 401.

Beinhaker/Irwin Associates,
Suite 340 - 1152 Mainland Street,
Vancouver, B.C.
V6B 2V1

Attention: Mr. R. Bowman

Dear Mr. Bowman:

Re: Government Street Housing Project

This letter will document the results of discussions between Beinhaker/ Irwin Associates and Barron & Strachan relating to the acoustical treatment which is either being incorporated into the project design or is currently under consideration.

Housing Design

1. The housing units will be designed such that internal noise levels will meet the recommended criterion (U.S. Department of Housing and Urban Development, HUD).

2. All critical rooms facing the highway (living and bedrooms) will be treated acoustically.

3. The types of treatment currently under consideration are:

   a) A ventilation system consisting of a small fan and lined duct in order that the windows can be kept closed.

   b) A system of double glazing which would allow air to pass into the living spaces while attenuating noise from outside.

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3284 HEATHER ST VANCOUVER, BRITISH COLUMBIA V5Z 3K5 Telephone (604) 872-2508

4. The housing is also being designed to minimize external noise levels using the following treatment:

   a) Balconies incorporating solid railings.

   b) Building walls projecting to partially shield balconies from the highway (i.e. to minimize the angle of view to the highway).

   c) Where the effect will be significant, absorptive treatment is being incorporated into the underside of balcony roofs to attenuate reflections. This treatment will have more effect on the hi-rise blocks.

5. Where courtyards are not adequately shielded by the "massing" of buildings, perimeter walls are being provided.

Housing Layout

1. Low rise housing is being located closer to the road at the west end of the site both to take advantage of the acoustical shielding provided by the highway embankment and to minimize the number of people living in closer proximity to the highway.

2. The housing is generally oriented at an angle to the road to avoid a 180 degree line of sight to the highway.

3. The "massing" of houses on the site will provide attenuation for buildings at the north end of the site where the line of sight to the highway is obscured.

4. Wherever possible and consistent with sunshine requirements, patios are being positioned to take advantage of the shielding provided by buildings.

5. The proposed hi-rise development is being located at the north end of the site to maximize the distance from the highway to the higher density areas.

Landscaping

1. The landscaping of the site is being designed to take advantage of existing vegetation on the site. Although no attenuation will result

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from trees between the housing and the highway, the psychological effects are significant.

2. The soft ground and vegetation will minimize noise levels in certain areas of the site where a "ground effect" occurs.

3. At the southeast corner of the site, where the roadway around the south side may eliminate a "ground effect", berms are being considered for incorporation into the landscaping design between the housing and the roadway.

Recreation Facilities

1. The children's recreation facilities (swimming pools, etc.), requiring good speech intelligibility for safety reasons, are being located at the north end of the site.

2. Other recreation facilities at the south end of the site will not be as critical, but any buildings will be arranged to maximize shielding from highway noise.

Highway Barriers

1. Highway barriers are currently under investigation and have been discussed with the Highways Department.

2. The Department is agreeable to extending the existing 18 inch concrete crash barriers but the acceptability of higher barriers (e.g. similar to those being installed on the Upper Levels Highway) would be dependent on the specific design as it relates to highway safety criteria.

3. Barron & Strachan are preparing a specific barrier design proposal for the consideration of the Highways Department.

Train Noise

1. A barrier in the southwest corner of the site is under consideration to attenuate train noise. Fill removed from the site would be used for a berm in this location.

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2. The closest residents to the rail tracks have been provided with a setback of approximately 200 feet from the tracks.

Internal Noise Control

1. Internal isolation between suites will be designed to exceed the requirements of the National Building Code.

2. A plumbing noise control specification will be included to ensure acceptability of the plumbing systems.

Please call me if you wish to discuss the above in greater detail.

Yours very truly,

BARRON & STRACHAN

D.W. Brown.

D. W. Brown, P. Eng.

DWB:fa