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1990 April 19
File: 59-045-10-10 C

City of Regina
P.O. Box 1790
Regina, Saskatchewan
S4P 3C8

Attention: **Mr. A.N. Duff**
Manager Traffic Engineering

Dear Sir:

Reference: **Roadway Noise Attenuation Policy**

Please find enclosed our Roadway Noise Attenuation Policy report for the implementation of a traffic noise standard along major roadways in the City.

The report contains procedures and standards to implement a traffic noise level policy of 65 dBA Ldn.. Procedures to identify and prioritize candidate sites in developed areas for barriers as well as policy guidelines for new development are also presented herein.

The assistance provided by City personnel in the preparation and review of this report was most appreciated.

Should you have any questions or comments, please feel free to contact the undersigned. We are prepared to assist with program implementation at your direction.

Yours truly,

STANLEY ASSOCIATES ENGINEERING LTD.

D. L. Halliday

David L. Halliday, P.Eng.
Manager, Engineering Services

DLH/bv

Attachment

CITY OF REGINA
ROADWAY NOISE ATTENUATION POLICY

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CITY OF REGINA

ROADWAY NOISE ATTENUATION POLICY

1.0 INTRODUCTION

1.1 PURPOSE

The purpose of the Roadway Traffic Noise Attenuation Policy is:

To define acceptable standards for community noise levels originating from roadway traffic sources,

To define implementation strategies for roadway noise attenuation that are technically, administratively and economically feasible to implement, and

To provide standards, guidelines and procedures to effectively deal with roadway traffic noise in the land use, land development and transportation planning process.

1.2 BACKGROUND

Transportation noise represents a major component of the total community noise found in many residential areas in the City of Regina. Although train and airport noise is evident in several areas of the City, vehicular traffic, and in particular heavy truck traffic, provide a major continuous noise source which impacts upon many City residents. These impacts range from general annoyance, speech interference, interference with radio or TV, through to sleep interference and reduced property values.

In recognition of the above and in response to several noise related complaints in specific problem areas, the City of Regina initiated a Noise Attenuation Policy Study to develop an acceptable design noise level and to identify noise barrier requirements adjacent to major roadways. As follow up to that study, this document has been prepared to identify mechanisms and procedures whereby a noise level standard of 65 dBA Ldn could be implemented to attenuate traffic noise along major roadways.

1.3 GLOSSARY OF TERMS

The following definitions are provided as an aid in understanding acoustical terminology to those persons reading this policy document and to those involved in noise and land use planning and decision making including planners, elected officials, private developers and the general public.

A-Weighted Sound Level

The sound level as measured on a sound level meter, using a setting that emphasizes the middle frequency components similar to response of the human ear. The A-weighted sound level is found to correlate well with subjective assessments of the annoying or disturbing effects of sounds.

Absorption

Absorption is a property of materials that reduces the amount of sound energy reflected. Thus, the introduction of an "absorbent" into the surfaces of a room will reduce the sound pressure level in that room by virtue of the fact that sound energy striking the room surfaces will not be totally reflected. It should be mentioned that this is an entirely different process from that of transmission loss through a material, which determines how much sound gets into the room via the walls, ceiling and floor. The effect of absorption merely reduces the resultant sound level in the room produced by energy which has already entered the room.

Ambient Noise Level

The sound level of background noise characteristic of an environment. Practically speaking, the level of a specific sound must be above the ambient noise level in order to be perceived.

Annoyance	General term encompassing adverse citizen opinion of a roadway that generally correlates with noise level increases caused by peak hour traffic or trucks. Annoyance is generally predicted by the amount the vehicular noise exceeds existing neighborhood noise.
Attenuation	A reduction in sound level in travelling from a source to a receiving point.
Barrier	A solid physical obstruction between the roadway and the observer, which interrupts the line of sight between them.
Barrier Attenuation	The reduction in level of sound travelling over hard ground resulting from a barrier between source and receiving point.
Berm	A mound of earth that interrupts the line of sight between a source and receiving point, thus acting as a barrier.
Day-Night Average Sound Level (Ldn)	Day-night sound level in dBA is derived by averaging time varying sound energy over the daytime (daytime Leq) with the varying sound energy over the nighttime (nighttime Leq) to which an additional ten decibel weighting is applied to the nighttime hours between 2200 and 0700.
Decibel (dB)	One tenth of a bel. Sound is measured in decibels. The zero on the decibel scale is based on the lowest sound level that the healthy, unimpaired human ear can detect. Decibels are not linear units, but representative points on a

sharply rising (exponential) curve. Thus, 100 decibels represents 10 billion times as much acoustic energy as one decibel.

Equivalent Level (Leq)

An hourly unit of noise. The Leq condenses an hour's worth of noise fluctuations into a single number, with units of dBA. The Leq is also called the "energy-equivalent level". Leq (24) is the average noise level over a 24 hour period.

Line Source of Noise

A source of noise spread out into a line, such as the combined traffic on a roadway or railway.

Loudness

A psychological quantity that corresponds to noise intensity where a ten-fold increase in noise energy results in a two-fold increase in loudness. Similarly, a ten-fold decrease in noise energy is heard as a halving of the loudness.

Noise Sensitive Land Uses

Noise sensitive land uses include: residential, schools, libraries, churches, hospitals, auditoriums and outdoor recreation areas. These typify land uses whose suitability is restricted by intrusive noise, hence are termed "noise sensitive". Noise sensitivity factors include: interference with speech communication, subjective judgements of noise acceptability and relative noisiness, need for freedom from noise intrusion, and sleep interference criteria.

Point Source of Noise:

A source of noise essentially concentrated at a single source, such as noise from a single vehicle.

Propagation

The passage of sound energy from noise source to observer.

Road Classifications

Freeway

Divided roadway or street with fully controlled access with traffic to be free flowing and all intersections grade separated.

Expressway

Divided roadway or street with fully controlled access. Intersections are controlled by traffic signals.

Major Arterial I

Divided roadway with or without emergency lanes. No frontage allowed. Sidewalks optional.

Sound Insulation

The use of structures and materials designed to reduce the transmission of sound from one room or area to another or from the exterior to the interior of a building.

2.0 NOISE LEVEL MEASUREMENT PROCEDURE

1. For actual noise measurements, noise monitoring receptors shall be located in the ground level outdoor living space area, 1.5 m above typical ground elevation and approximately 3.0 m away from the dwelling wall, unless otherwise approved by the City of Regina Municipal Engineering Department.

2. For the purposes of calculating or measuring the interior noise level, the noise monitoring receptors shall be located approximately 3.0 m from the wall of the dwelling. This noise level may be used as a representative indicator of the interior noise level by subtracting from this noise level the generally accepted standard noise level reduction of 15 dBA (or greater depending on the use of acoustical building materials), that may be attributed to standard building face construction.

3. Noise levels shall be measured using the A-weighted 24 hour day-night sound level Ldn (24) expressed in decibels (dBA) and be based on the higher of the Average Annual Daily Traffic Volume or Summer Average Daily Traffic Volume for existing residential areas.

4. Ambient noise measurements to determine noise levels contributed by sources other than the roadway traffic noise in question shall be measured in the outdoor living space area 1.5 m above typical ground elevation and approximately 3.0 m away from the dwelling wall of the third row of dwellings away from the subject roadway.

3.0 NOISE LEVEL PROJECTION PROCEDURE

1. In the case of new residential development or in the evaluation of barriers, the twenty year projection of future traffic volumes will be used in noise studies.

2. Traffic volume projections will be provided by the Municipal Engineering Department.

3. Vehicle speed shall be the proposed or posted speed.

4. Truck volumes shall comprise 6% of the total projected traffic flow, unless known, by actual traffic count or by trip generation rates and land use.

5. Noise levels shall be calculated using traffic noise prediction methods approved by the City of Regina Municipal Engineering Department Traffic Division. These methods include: The Alberta Surface Transportation Noise Attenuation Study Manual for the Prediction of Surface Transportation Noise, the Canada Mortgage and Housing Corporation method, the Federal Highway Administration method Stamina 2.0/Optima. Other technically accurate methods of noise prediction shall be subject to Municipal Engineering Department approval. When appropriate, actual measurements with noise monitoring equipment shall be employed.

6. Noise levels shall be calculated as the A-weighted 24-hour day-night sound level Ldn (24) expressed in decibels (dBA).

4.0 NOISE LEVEL STANDARDS

1. The noise level standards of this policy shall apply to all existing or proposed transportation corridors with roadway classification "freeway", "expressway", or "Arterial I".

2. For existing or proposed transportation corridors abutting residential land, a noise level standard of 65 dBA Ldn shall apply subject to a maximum barrier height of 5.0 m, a minimum barrier height of 2.0 m, and a reduction of 5 dBA Ldn by the installation of a noise barrier.

3. For future or existing transportation corridors where abutting lands are to be zoned industrial or commercial, with good expectation that commercial buildings will occupy these lands and with enforcement of such zoning: no noise barrier standard shall apply.

4. The requirement for barriers for other land uses or zoning classifications shall be at the discretion of the City of Regina Municipal Engineering Department.

5. Where residential developments are being planned adjacent to existing or proposed transportation corridors, the developer shall be responsible for ensuring that noise levels in the ground level outdoor living space area do not exceed 65 dBA Ldn.

6. For residential development where the incident sound level at the facade of any dwelling unit is project to exceed 55 dBA Leq (24), the City shall require as a condition of approval that the building construction standard shall be in accordance with Canada Mortgage and Housing Corporation recommendations for "adequate sound insulation".

5.0 ACOUSTICAL BARRIER DESIGN STANDARDS

The following design requirements are not to be considered as all inclusive but specify minimum basic requirements for the design and construction of such facilities.

General

1. The noise barrier must be acoustically designed so as to reduce noise levels to the objective noise level of 65 dBA Ldn or less.

2. Design of any noise attenuation facility must be to the satisfaction of the City of Regina Municipal Engineering Department.

3. Where required by the City, all property required for noise attenuation facilities shall be in addition to road right-of-way requirements.

4. Design heights of noise attenuation facilities are 2.0 m, 2.5 m, 3.0 m, 4.0 m, 4.5 m and 5.0 m above top of footing and/or above general site grade unless otherwise approved by the City of Regina Municipal Engineering Department.

5. Changes in wall profile elevation greater than 2% shall be achieved by stepping successive sections.

6. Visual and physical relief at uniform intervals is required on both sides of the barrier by the use of posts or other approved means.

7. Changes in horizontal alignment shall occur at the posts by suitable means to avoid noise leaks at corners.

8. If a berm of a height of 2.0 m or more is used, a 3.0 m berm top is required. Noise attenuation walls or screen fences should be centered on the berm. The 1.5 m on the public side of the fence or wall should include 0.65 m rounding from the slope to the top. Where applicable, access and maintenance agreements shall be negotiated with abutting landowners.

9. The maximum slope on the public side of berms shall be 1 vertical to 4 horizontal.

10. Berm material shall be compacted to a minimum of 95% Standard Proctor Density.

11. Noise walls which are to be in whole or in part publicly maintained must be constructed of steel sheeting or concrete compound. Minimum density required is 9.76 kg/m^2 (2 lbs/ft^2). The design life of the wall shall be a minimum of fifty (50) years with a minimum maintenance-free life of twenty (20) years.

Materials

1. General - Any material used in the construction of noise barriers must meet the specified requirements for sound transmission loss and structural design.

   All exposed steel components shall be hot dip galvanized after fabrication in accordance with the requirements of CSA Standard G164.

   All reinforcing steel must be epoxy coated. The concrete cover shall be a minimum of 35 mm.

2. Steel Panels - Any profile which is vertically mounted is acceptable. Panels must be constructed of minimum 0.91 mm (nominal) galvanized steel (20 gauge) and coated with a "Barrier Series" vinyl coating system or approved equal, 0.2 mm thickness on the traffic side of the wall and a 0.1 mm thickness on the reverse side.

   Pop-rivets shall be either aluminum with an aluminum mandrel or aluminum with a stainless steel mandrel.

6.0 PRIORITIZATION OF CANDIDATE SITES - EXISTING DEVELOPMENT

1. Candidate sites for noise attenuation shall be those with noise sensitive land use where noise level exposure in the ground level outdoor living space area nearest the roadway noise source is greater than 65 dBA Ldn.

2. Areas where barrier installations would not be technically or economically feasible will not be candidate sites. Such sites will include, but will not necessarily be limited to those sites where barrier heights required to meet the noise level standard would exceed 5 m or where property access requirements would prevent construction of an effective barrier.

3. Where noise level reduction due to a barrier is expected to be less than 5 decibels, a barrier is not considered to be cost effective. Such sites will not be candidate sites.

4. Where roadways are scheduled to be upgraded within the next 5 years; noise attenuation will be addressed at the time of roadway reconstruction.

5. Feasibility of barrier placement will respect future twenty year road right-of-way requirements.

6. Candidate sites will be prioritized using the Barrier Priority Index which is a relative measure of the noise attenuation cost benefit ratio for each site. The Barrier Priority Index is defined as:

$$BPI = \frac{(ENL - DNL)N}{C} \quad \text{where}$$

BPI = Barrier Priority Index
ENL = Estimated Noise Level in dBA Ldn based on current or projected traffic counts or actual noise measurement
DNL = Design Noise Level in dBA Ldn or the minimum noise level for consideration in prioritization (65 dBA Ldn)
N = Number of first row ground level dwelling units which would be protected by barrier attenuation
C = Barrier construction cost in thousands of dollars (including all associated costs such as utility modifications)

The value of the index increases with the traffic noise level and number of residences protected, and decreases with the cost. The larger the value of the index the higher the relative priority of the site.

7. Implementation of attenuation of candidate sites will be dependent upon budget allocations, priority ranking and cost/benefit analysis.

7.0 IMPLEMENTATION - NEW DEVELOPMENT

1. For proposed development adjacent to roadways where projected traffic noise levels exceed these standards, the Developer shall be responsible for provision of noise attenuation measures to meet the City of Regina Noise Level Standards.

2. Upon request from the Developer, the City of Regina Municipal Engineering Department will provide traffic volume projections for use in predicting noise levels.

3. The noise barrier shall be designed and accredited by a Professional Engineer. Six (6) copies shall be submitted to the City of Regina Municipal Engineering Department and shall include the following:

   - All design calculations
   - Detailed design drawings
   - Specifications regarding installation requirements, i.e. sequence of construction
   - Specifications for all materials
   - If requested by the City of Regina Municipal Engineering Department six (6) copies of the following shall also be submitted:
     - Effective sound transmission loss report
     - Noise reduction coefficient report.

4. Restrictive access and use agreements between the Developer and the City of Regina shall be entered into and registered against the lots abutting roadways where noise attenuation is to be provided.

   Terms of the agreement are to be negotiated with the City of Regina Municipal Engineering Department and, in general, address the following:

- Location of barrier with respect to property line.
- For berms, top width, rounding, backslopes and, where applicable, positioning of barriers within a berm section.
- Drainage.
- Access restriction from roadway to abutting lots.
- Removal of and modifications or attachments to the barrier.
- Maintenance.
- Access by City of Regina.