

IMPACT SONORE DE LA CIRCULATION

SUR L'AUTOROUTE 51 PRES DE RICHMOND

DANS LE COMTE DE MELBOURNE, QUEBEC

CANQ  
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231

MINISTÈRE DES TRANSPORTS  
Centre de documentation  
35, rue de Port-Royal Est  
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Montréal (Québec)  
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CENTRE DE DOCUMENTATION  
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Etude effectuée par monsieur  
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## I.0 INTRODUCTION

Une étude d'impact sonore idéale serait celle qui permettrait d'évaluer le changement du climat sonore existant en un lieu.

Celà suppose deux choses:

- a- Que l'on connaisse déjà le climat sonore existant en ces lieux.
- b- Que l'on dispose de modèles de simulation permettant d'évaluer le niveau de bruit qui résultera d'une action escomptée sur le milieu.

Cette étude d'impact sonore produit par la circulation sur l'autoroute 51, près de Richmond dans le comté de Melbourne, est donc partielle puisque nous n'y connaissons pas complètement le climat sonore.

Nous savons par contre que les terrains adjacents à l'autoroute 51 à cet endroit doivent jouir d'un climat sonore particulièrement clément, puisqu'aucune source importante de bruit (industries, routes importantes, etc.) ne semble perturber le fond sonore.

On peut estimer que le bruit de fond à cet endroit doit se situer entre 35 et 45 d B(A). Cette dernière affirmation reste à confirmer et j'espère pouvoir le faire dans les plus brefs délais.

## 2.0 METHODE EMPLOYEE

- 2.1 Nous nous servirons pour cette étude des normes fédérales américaines reliant le niveau sonore  $L_{10}$  à l'utilisation des terrains. Voir annexe
- 2.2 Pour l'évaluation de ce niveau  $L_{10}$ , nous prendrons la méthode décrite dans "Ontario Highway Noise Prediction Method", Ministry of Transportation and Communication: jan. 1975.
- 2.3 Nous pourrions ainsi déterminer la distance minimale devant exister entre l'autoroute 51 et les terrains adjacents, compte tenu de l'usage que l'on veut en faire. (Zonage)
- 2.4 Cette méthode nous permettra de localiser les lieux où l'utilisation actuelle des terrains ne sera plus compatible dans le futur, compte tenu du climat sonore qui y existera après la construction de l'autoroute 51.
- 2.5 Pour cette étude, nous négligerons l'influence de la topographie sur la propagation du bruit en provenance de l'autoroute 51.

Cette approximation est valable pour les terrains entre la rivière St-François et l'autoroute 51 près de Richmond, puisqu'il n'existe aucune barrière acoustique due à la topographie.

- 2.6 Nous négligerons la correction à apporter au modèle pour le gradient, car ce dernier est presque nul pour la section qui nous intéresse.
- 2.7 Nous évaluerons la distance minimale à laquelle devraient être situées les constructions de type résidentiel pour que les pointes sonores produites par ces derniers n'excèdent pas 70 d B(A).

Pour cette évaluation nous nous servirons de la méthode décrite dans "Guide on Evaluation and Attenuation of Traffic Noise" American Association of State Highway and Transportation Officials, 1974.

### 3.0 PROJECTIONS DU MINISTÈRE DES TRANSPORTS

Le Ministère des Transports estime que le débit des véhicules sur la future autoroute 51 sera:

environ 6,000 véhicules/jour en 1980

et 10,000 véhicules/jour en 1990, si l'on suppose une augmentation annuelle de 5% pour le volume journalier.

## 4.0 VALEURS DES DIFFERENTS PARAMETRES

- 4.1 Nous fixerons à 7 ou 15% le pourcentage de camions constituant la circulation sur l'autoroute 51.
- 4.2 La vitesse des véhicules sera fixée à 55 milles/heure.
- 4.3 Pour l'évaluation du débit horaire maximum, nous nous servirons du "Highway Capacity Manual" du Highway Research Board, special report art. 87, 1965.

Note: Nous prenons le débit horaire maximum pour évaluer le niveau sonore  $L_{10}$ , tel que stipulé dans l'annexe (1).

Selon le "Highway Capacity Manuel" le débit horaire maximum serait égal à 8% du débit journalier.

On obtient donc pour l'année 1980:

$$6,000 \frac{\text{véhicules}}{\text{jour}} \times 8\% = 480 \text{ véhicules/heure}$$

et pour l'année 1990:

$$10,000 \frac{\text{véhicules}}{\text{jour}} \times 8\% = 800 \frac{\text{véhicules}}{\text{heure}}$$

### 5.0 COMPOSITION DU DEBIT HORAIRE

Cas I

soit 7% le pourcentage de camions constituant la circulation, on obtient alors pour 1980:

$$480 \frac{\text{véhicules}}{\text{heure}} \times \frac{7}{100} \frac{\text{camions}}{\text{véhicules}} = 34 \frac{\text{camions}}{\text{heure}}$$

$$\text{nombre d'"autos"}/\text{heure} = 480 \frac{\text{véhicules}}{\text{heure}} - 34 \frac{\text{camions}}{\text{heure}} = 446 \frac{\text{"autos"}}{\text{heure}}$$

Cas II

soit 15% le pourcentage de camions constituant la circulation, on obtient alors pour 1980:

$$480 \frac{\text{véhicules}}{\text{heure}} \times \frac{15}{100} \frac{\text{camions}}{\text{véhicules}} = 72 \frac{\text{camions}}{\text{heure}}$$

$$\text{nombre d'"autos"}/\text{heure} = 480 \frac{\text{véhicules}}{\text{heure}} - 72 \frac{\text{camions}}{\text{heure}} = 408 \frac{\text{"autos"}}{\text{heure}}$$

Cas III

soit 7% le pourcentage de camions constituant la circulation, on obtient alors pour 1990:

$$800 \frac{\text{véhicules}}{\text{heure}} \times \frac{7}{100} \frac{\text{camions}}{\text{véhicules}} = 56 \frac{\text{camions}}{\text{heure}}$$

$$\text{nombre d'"autos"}/\text{heure} = 800 \frac{\text{véhicules}}{\text{heure}} - 56 \frac{\text{camions}}{\text{heure}} = 744 \frac{\text{"autos"}}{\text{heure}}$$

Cas IV

soit 15% le pourcentage de camions constituant la circulation, on obtient alors pour 1990:



$$800 \frac{\text{véhicules}}{\text{heure}} \times \frac{15}{100} \frac{\text{camions}}{\text{véhicules}} = 120 \text{ camions/heure}$$

$$\text{Nombre d'"autos"} \frac{\text{}}{\text{heure}} = 800 \frac{\text{véhicules}}{\text{heure}} - 120 \frac{\text{camions}}{\text{heure}} = 680 \frac{\text{"autos"}}{\text{heure}}$$

## 6.0 MODELE DE SIMULATION

Le modèle de simulation utilisé pour cette étude est essentiellement résumé par l'équation suivante:

$$L_{10} = 52.7 + 11.2 \log (V_e + 3V_T) - 14.8 \log D + .21S$$

où  $V_e$   $\equiv$  débit horaire des automobiles

$V_T$   $\equiv$  débit horaire des camions

$D$   $\equiv$  distance entre le bord de la chaussée et l'observateur en pi

$S$   $\equiv$  vitesse moyenne des véhicules en milles/heure

## 7.0 CAS NO (I)

Trouvons  $D$  (distance entre le bord de la chaussée de l'autoroute 51 et l'observateur) pour laquelle le niveau  $L_{10} \leq 60$  d B(A) dans le cas no (I)

Note:  $L_{10} \leq 60$  d B(A)  $\Rightarrow$  compatibilité avec les usages des terrains décrit dans les catégories A, B et C. (Voir annexe).

Le cas no I est celui de 1980 pour lequel nous avons fixé à 7% le pourcentage de camions constituant la circulation.

Pour ce cas on a:  $V_e = 446$  "autos"/heure

$V_T = 34$  camions/heure

$S = 55$  milles /heure

en substituant ces valeurs dans le modèle de simulation on obtient:

$$60 \text{ d B(A)} \leq 52.7 + 11.2 \log (446 + 3 \times 34) - 14.8 \log D + .21 \times 55$$

ce qui implique  $D \geq 230'$

Trouvons  $D$  pour laquelle le niveau  $L_{10} \leq 70$  d B(A) dans le cas no (I).

On obtient alors:

$$70 \text{ d B(A)} \leq 52.7 + 11.2 \log (446 + 3 \times 34) - 14.8 \log D + .21 \times 55$$

ce qui implique que  $D \geq 50'$

Note:  $L_{10} \leq 70$  d B(A)  $\Rightarrow$  compatibilité avec les usages des terrains décrits dans les catégories B et C. (Voir annexe).

Trouvons  $D$  pour laquelle le niveau  $L_{10} \leq 75$  d B(A) dans le no (I)  $\Rightarrow$  compatibilité avec les usages décrits dans la catégorie C.

On obtient alors:

$$75 \text{ d B(A)} \leq 52.7 + 11.2 \log (446 + 3 \times 34) - 14.8 \log D + .21 \times 55$$

Ce qui implique que  $D \geq 22'$

## 8.0 CAS NO (II)

Trouvons  $D$  pour laquelle le niveau  $L_{10} \leq 60$  d B(A) dans le cas no II.

Le cas no II est celui de 1980 pour lequel nous avons fixé à 15% le pourcentage de camions constituant la circulation.

$$\text{Pour ce cas on a: } V_e = 408$$

$$V_T = 72$$

$$S = 55 \text{ milles/heure}$$

En substituant ces valeurs dans le modèle de simulation on obtient:

$$60 \text{ d B(A)} \leq 52.7 + 11.2 \log (408 + 3 \times 72) - 14.8 \log D + .21 \times 55$$

ce qui implique que  $D \geq 250'$

Trouvons  $D$  pour laquelle le niveau  $L_{10} \leq 70$  d B(A) dans le cas no II.

On obtient alors:

$$70 \text{ d B(A)} \leq 52.7 + 11.2 \log (408 + 3 \times 72) - 14.8 \log D + .21 \times 55$$

ce qui implique que  $D \geq 53'$

Trouvons  $D$  pour laquelle le niveau  $L_{10} \leq 75$  d B(A) dans le cas no II.

On obtient alors:

$$75 \text{ d B(A)} \leq 52.7 + 11.2 \log (408 + 3 \times 72) - 14.8 \log D + .21 \times 55$$

ce qui implique que  $D \geq 25'$

## 9.0 CAS NO III

Trouvons  $D$  pour laquelle le niveau  $L_{10} \leq 60$  d B(A) dans le cas no III.

Le cas no III est celui de 1990 et pour lequel nous avons fixé à 7% le pourcentage de camions constituant la circulation.

$$\text{Pour ce cas on a: } V_e = 744$$

$$V_T = 56$$

$$S = 55 \text{ milles/heure}$$

En substituant ces valeurs dans le modèle de simulation on obtient:

$$60 \text{ d B(A)} \leq 52.7 + 11.2 \log (774 + 3 \times 56) - 14.8 \log D + .21 \times 55$$

ce qui implique que  $D \geq 334'$

Trouvons  $D$  pour laquelle le niveau  $L_{10} \leq 70$  d B(A) dans le cas no III

On obtient alors:

$$70 \text{ d B(A)} \leq 52.7 + 11.2 \log (744 + 3 \times 56) - 14.8 \log D + .21 \times 55$$

ce qui implique que  $D \geq 70'$

Trouvons  $D$  pour laquelle le niveau  $L_{10} \leq 75$  d B(A) dans le cas no III.

On obtient alors

$$75 \text{ d B(A)} \leq 52.7 + 11.2 \log (744 + 3 \times 56) - 14.8 \log D + 21 \times 55$$

ce qui implique que  $D \geq 32'$

## 10.0 CAS NO IV

Trouvons  $D$  pour laquelle le niveau  $L_{10} \leq 60$  d B(A) dans le cas no IV.

Pour ce cas on a:  $V_e = 680$

$V_T = 120$

$S = 55$  milles/heure

Le cas no IV est celui de 1990 et pour lequel nous avons fixé à 15% le pourcentage de camions constituant la circulation.

En substituant ces valeurs dans le modèle de simulation on obtient:

$$60 \text{ d B(A)} \leq 52.7 + 11.2 \log (680 + 3 \times 120) - 14.8 \log D + .21 \times 55$$

ce qui implique que  $D \geq 370'$

Trouvons  $D$  pour laquelle le niveau  $L_{10} \leq 70$  d B(A) dans le cas no IV.

On obtient alors:

$$70 \text{ d B(A)} \leq 52.7 + 11.2 \log (680 + 3 \times 120) - 14.8 \log D + .21 \times 55$$

ce qui implique que  $D \geq 78'$

Trouvons  $D$  pour laquelle le niveau  $L_{10} \leq 75$  d B(A) dans le cas no IV.

On obtient alors:

$$75 \text{ d B(A)} \leq 52.7 + 11.2 \log (680 + 3 \times 120) - 14.8 \log D + .21 \times 55$$

ce qui implique que  $D \geq 34'$

## II.0 TABLEAU DES RESULTATS

Cas	Catégories d'utilisation des terrains	Distance minimale du bord de la chaussée en pi.
I	A	230
	B	50
	C	22
II	A	250
	B	53
	C	24
III	A	334
	B	70
	C	32
IV	A	370
	B	78
	C	34

Voir: A- L'annexe pour une description des catégories d'utilisation des terrains.

B- Les pages antérieures pour une description des quatre cas ci-haut mentionnés.

## 12.0 POINTES SONORES PRODUITES PAR LES CAMIONS (POINTES NOCTURNES)

Pour de telles études d'impact sonore, les Américains fixent à 90 d B(A) le niveau de pointe produit par les camions diésels à une distance de 50'. Voir réf. "Establishment of Standards for Highway Noise Levels" vol. 3 Prepared for Transportation Research Board National Cooperative Highway Research Program National Academy of Sciences, nov. 1974.

Un camion peut être considéré comme une source sonore ponctuelle. Voilà pourquoi le niveau sonore à une distance  $X'$  de ce dernier est donné par l'équation suivante:

$$L(X') = 90 \text{ d B(A)} + 20 \log 50'/X'$$

Idéalement le niveau de pointe nocturne ne devrait pas excéder 60 d B(A) en façade d'une résidence. L'équation ci-dessus nous permet de trouver la distance  $X'$  minimale pour laquelle les pointes sonores produites par les camions n'excéderaient pas ce niveau idéal de 60 d B(A).

$$60 \text{ d B(A)} \leq 90 \text{ d B(A)} + 20 \log 50'/X'$$

on obtient donc  $X' \geq 1,600'$

Note: Ce maximum de 60 d B(A) est une limite idéale. Cependant, le niveau de pointe ne devrait jamais excéder 70 d B(A). Ceci implique que:

$$70 \text{ d B(A)} \leq 90 + 20 \log 50'/X'$$

soit  $X' \geq 500'$

Ces derniers résultats nous permettent de diviser les terrains adjacents à l'autoroute en 3 zones distinctes, soit:

$$\begin{array}{ccc} 500' & \left| \begin{array}{c} \geq \\ X' \\ \geq \end{array} \right. & 1,600' \\ \text{Zone 1} & \left| \begin{array}{c} \text{Zone 2} \\ \text{Zone 3} \end{array} \right. & \end{array}$$



L'impact sonore produit par le passage des camions est:

- a) sévère dans la zone 1 (zone en rouge sur la carte à cet effet)
- b) modéré dans la zone 2 (zone en jaune sur la carte à cet effet)
- c) faible dans la zone 3

## 13.0 CONCLUSIONS

- 13.1 Selon le modèle de simulation utilisé et les normes américaines décrites dans l'annexe, il serait souhaitable qu'aucune construction de type résidentiel ne soit construite à moins de 53' du bord de la chaussée de l'autoroute 51 en 1980.
- 13.2 Si l'on suppose une augmentation annuelle de 5% pour le trafic journalier, il serait souhaitable qu'aucune construction de type résidentiel ne soit située à moins de 78' du bord de la chaussée de l'autoroute 51 en 1990.
- 13.3 Si l'on utilise 90 d B(A) comme le niveau de pointe produite par un camion diésel à 50' comme le font certaines études américaines, il serait idéal qu'aucune résidence ne soit située à moins de 1,600' du bord de la chaussée de l'autoroute 51.
- 13.4 En se servant de ce même niveau de pointe, il serait intolérable qu'une résidence soit construite à moins de 500' du bord de la chaussée de l'autoroute 51.

*Yves Ste-Marie*  
Yves Ste-Marie, physicien

I4.0 ANNEXE

POLICY AND PROCEDURE MEMORANDUM

NOISE STANDARDS AND PROCEDURES

- Par. 1. Purpose  
2. Authority  
3. Noise Standards  
4. Applicability  
5. Procedures

Appendix A - Definitions  
Appendix B - Noise Standards

1. PURPOSE

To provide noise standards and procedures for use by State highway agencies and the Federal Highway Administration (FHWA) in the planning and design of highways approved pursuant to Title 23, United States Code, and to assure that measures are taken in the overall public interest to achieve highway noise levels that are compatible with different land uses, with due consideration also given to other social, economic and environmental effects.

2. AUTHORITY

Sections 109(h) and (i), Title 23, United States Code, state that guidelines shall be promulgated "to assure that possible adverse economic, social, and environmental effects relating to any proposed project on any Federal-aid system have been fully considered in developing such project, and that the final decisions on the project are made in the best overall public interest, taking into consideration the need for fast, safe and efficient transportation, public services, and the costs of eliminating or minimizing such adverse effects and the following: (1) air, noise, and water pollution; . . ." and that "The Secretary, after consultation with appropriate Federal, State, and local officials, shall develop and promulgate standards for highway noise levels compatible with different land uses and after July 1, 1972, shall not approve plans and specifications for any proposed project on any Federal-aid system for which location approval has not yet been secured unless he determines that such plans and specifications include adequate measures to implement the appropriate noise level standards."

3. NOISE STANDARDS

a. Noise standards are appended as Appendix B. Federal Highway Administration encourages application of the noise standards at the earliest appropriate stage in the project development process.

b. There may be sections of highways where it would be impossible or impracticable to apply noise abatement measures. This could occur where abatement measures would not be feasible or effective due to physical conditions, where the costs of abatement measures are high in relation to the benefits achieved, or where the measures required to abate the noise condition conflict with other important values, such as desirable esthetic quality, important ecological conditions, highway safety, or air quality. In these situations, highway agencies should weigh the anticipated noise impacts together with other effects against the need for and the scope of the project in accordance with other FHWA directives (PPM's 20-8, 90-1, and 90-4).

4. APPLICABILITY

In order to be eligible for Federal-aid participation, all projects to which the noise standards apply shall include noise abatement measures to obtain the design noise levels in these standards unless exceptions have been approved as provided herein.

a. Projects to which noise standards apply. The noise standards apply to all highway projects planned or constructed pursuant to Title 23, United States Code, except projects unrelated to increased traffic noise levels, such as lighting, signing, landscaping, safety and bridge replacement. Pavement overlays or pavement reconstruction can be considered as falling within this category unless the new pavement is of a type which produces more noise than the type replaced.

b. Approvals to Which Compliance with Noise Standards Is Prerequisite

(1) Projects for which location was approved prior to July 1, 1972: Compliance

with noise standards shall not be a prerequisite to any subsequent approval provided design approval is secured prior to July 1, 1974. If design approval is not secured for such a project prior to July 1, 1974, compliance with the noise standards shall be a prerequisite to securing both design approval and approval of plans and specifications. However, such compliance shall not be a basis for requiring reconsideration of the highway location or any other approval action which has previously been taken for such projects.

(2) Projects for which location is approved on or after July 1, 1972:

(a) If location approval was requested on or before December 31, 1972, compliance with the noise standards shall be a prerequisite to obtaining design approval and approval of plans and specifications. Compliance with the noise standards shall not be a prerequisite to obtaining location approval, nor shall such compliance be a basis for requiring reconsideration of the highway location or any other approval action which has previously been taken for such projects. Combined location and design approval shall be handled in the same manner as separate design approval.

(b) If location approval is requested after December 31, 1972, compliance with the noise standards shall be a prerequisite to obtaining location and design approvals as well as approval of plans and specifications.

## 5. PROCEDURES

The noise standards should be implemented at the earliest appropriate stage in the project development process. These procedures have been developed accordingly:

a. Project Development. A report on traffic noise will be required during the location planning stage and the project design stage. The reports may be sections in the location and design study reports, or they may be separate. The procedures for noise analysis, identification of solutions, coordination with local officials, and incorporation of noise abatement measures are as follows:

(1) Nonapplicable Projects. If a State highway department determines (in accordance with paragraph 4a that noise standards do not apply to a particular project, the requests for location approval and design approval shall contain statements to that effect, including the basis on which the State made its determination.

(2) Noise Analysis. For applicable projects, analyses of noise and evaluation of effects are to be made during project development studies using the following general steps:

(a) Predict the highway-generated noise level as described in the standards for each alternative under detailed study.

(b) Identify existing land uses or activities which may be affected by noise from the highway section.

(c) By measurement, determine the existing noise levels for developed land uses or activities.

(d) Compare the predicted noise levels with the design level values listed in the standards. Also compare the predicted noise levels with existing noise levels determined in paragraph 5a(2)(c). These comparisons will be the basis for determining the anticipated impact upon land uses and activities.

(e) Based upon the noise impacts determined in paragraph 5a(2)(d), evaluate alternative noise abatement measures for reducing or eliminating the noise impact for developed lands.

(f) Identify those situations where it appears that an exception to the design noise levels will be needed. Prepare recommendations to be included in the traffic noise report. (This report may be a portion of the location and design study reports or it may be a separate report.)

(3) Location Phase and Environmental Impact Statement Requirements. To the extent this PPM is applicable to the location phase of projects under paragraph 4, the noise report shall describe the noise problems which may be created and the plans for dealing with such problems for each alternative under detailed study. The level of detail of the noise analysis in the location phase should be consistent with the level of detail in which the location study itself is made. This information including a preliminary discussion of exceptions anticipated, shall be set forth in the location study report and summarized in the environmental impact statement (if one is prepared) and, as appropriate, at the location hearing (for location hearings after December 31, 1972). Studies and reports for highway locations approved before December 31, 1972, need not include an analysis and report on noise. In such instances, the noise analysis and report will be required only for the design approval.

(4) Design Phase Requirements. The noise analysis prepared for the location phase is to be updated and expanded using the refined alignment and design information developed during the design studies. The report on traffic noise will include a detailed analysis of the anticipated noise impact, alternative or proposed abatement measures, discussion of coordination with local officials, and recommended exceptions.

(5) Coordination with Local Officials on Undeveloped Lands. Highway agencies have the responsibility for taking measures that are prudent and feasible to assure that the location and design of highways are compatible with existing land use. Local governments, on the other hand, have responsibility for land development control and zoning. Highway agencies can be of considerable assistance to local officials in these efforts with a view toward promoting compatibility between land development and highways. Therefore, for undeveloped lands (or properties) highway agencies shall cooperate with local officials by furnishing approximate generalized future noise levels for various distances from the highway improvement, and shall make available information that may be useful to local communities to protect future land development from becoming incompatible with anticipated highway noise levels.

(6) Noise Abatement Measures for Lands Which are Undeveloped at Time of Location Approval

(a) Noise abatement measures are not required for lands which are undeveloped at the time of location approval; however, the highway agency may incorporate noise abatement measures for such undeveloped lands in the project design (if approved by FHWA) when a case can be made for doing so based on consideration of anticipated future land use, future need, expected long term benefits, and the difficulty and increased cost of later incorporating abatement measures.

(b) For land uses or activities which develop after location approval, noise abatement measures should be considered for incorporation in the project in the following situations:

1 It can be demonstrated that all practicable and prudent planning and design were exercised by the local government and the developer of the property to make the activity compatible with the predicted noise levels which were furnished to the local government and especially that a considerable amount of time has elapsed between location approval and highway construction

thus limiting local government's ability to maintain control over adjoining land uses.

2 The benefits to be derived from the use of highway funds to provide noise abatement measures is determined to outweigh the overall costs.

3 The noise abatement measures can be provided within the highway's proposed right-of-way or wider rights-of-way or easements acquired for that purpose.

(c) There are some situations where the design noise levels should be applied to lands which are undeveloped at the time of location approval. Some of these instances occur where the development of new land uses or activities is planned at the same time as the highway location studies. Other instances occur where planning for the new development has preceded the highway location studies but the development has been delayed. These types of situations should be treated as though the land use or activity were in existence at the time of location approval provided:

1 The State highway agency is apprised of such prior planning.

2 The construction of the new land use or activity is started prior to highway construction or there is good reason to believe that it will start before highway construction.

(7) Incorporation of Noise Abatement Measures in Plans and Specifications. For those projects to which the standards apply, the plans and specifications for the highway section shall incorporate noise abatement measures to attain the design noise levels in the standards, except where an exception has been granted.

(8) Requests for Exceptions. Requirements and supporting materials for requests for exceptions to the design noise levels are described in paragraph 2 of Appendix B to this PPM. To the extent possible, consistent with the level of detail of the location study, identifiable exceptions should be reported in the location study report. The request for location approval shall contain or be accompanied by a request for approval of exceptions that have been identified in the location stage. Supporting material may be contained in the location study report. Subsequent requests for review and approval of additional exceptions, if any, will be similarly processed in conjunction with design approval.

b. Federal Participation

(1) Shifts in alignment and grade are design measures which can be used to reduce noise impacts. The following noise abatement measures may also be incorporated in a project to reduce highway-generated noise impacts. The costs of such measures may be included in project costs.

(a) The acquisition of property rights (either in fee or a lesser interest) for providing buffer zones or for installation or construction of noise abatement barriers or devices.

(b) The installation or construction of noise barriers or devices, whether within the highway right-of-way or on an easement obtained for that purpose.

(2) In some specific cases there may be compelling reasons to consider measures to "sound-proof" structures. Situations of this kind may be considered on a case by case basis when they involve such public or non-profit institutional structures as schools, churches, libraries, hospitals, and auditoriums. Proposals of this type, together with the State's recommendation for approval, shall be submitted to FHWA for consideration.

c. Approval Authority

(1) Exceptions to the Design Noise Levels. The FHWA Division Engineer is authorized to approve exceptions to the design noise levels and alternate traffic characteristics for noise prediction as provided in paragraph 3b, Appendix B.

(2) Noise Prediction Method. Noise levels to be used in applying the noise standards shall be obtained from a prediction method approved by FHWA. The noise prediction method contained in National Cooperative Highway Research Program Report 117 and the method contained in Department of Transportation, Transportation Systems Center Report DOT-TSC-FHWA-72-1 are approved as of the date of this issue for use in applying the noise standards. Other noise prediction methods or variations of the above should be furnished to the FHWA Office of Environmental Policy together with supporting and validation information for approval.



R. R. Bartelsmeyer  
Acting Federal Highway Administrator

DEFINITIONS (As used in this PPM)

Design Approval - the approval (described in PPM 20-8) given by the Federal Highway Administration (FHWA) (at the request of a State highway department) based upon a design study report and a design public hearing or opportunity therefor. This action establishes FHWA acceptance of a particular design and is prerequisite to authorization of right-of-way acquisition and construction.

Design Noise Level - the noise levels established by the noise standards set forth herein for various land uses or activities to be used for determining traffic noise impacts and the assessment of the need for and type of noise abatement treatment for a particular highway section.

Design Year - the future year used to estimate the probable traffic volume to be used as one of the primary bases for the roadway design. A time 20 years from construction is common for multilane and other major projects. Periods of 5 or 10 years are not uncommon for low volume roads.

Developed Land Uses or Activities - those tracts of land or portions thereof which contain improvements or activities devoted to frequent human use or habitation. The date of issue of a building permit (for improvements under construction or subsequently added) establishes the date of existence. Park lands in categories A and B of Table 1, Appendix B, include all such lands (public and private) which are actually used as parks on the date the highway location is approved and those public lands formally set aside or designated for such use by a governmental agency. Activities such as farming, mining, and logging are not considered developed activities. However, the associated residences could be considered as a developed portion of the tract.

Highway Section - a substantial length of highway between logical termini (major cross-roads, population centers, major traffic generators, or similar major highway control elements) as normally included in a single location study.

L<sub>10</sub> - the sound level that is exceeded 10 percent of the time (the 10th percentile) for the period under consideration. This value is an indicator of both the magnitude and frequency of occurrence of the loudest noise events.

Level of Service C - traffic conditions (used and described in the Highway Capacity Manual - Highway Research Board, Special Report 87) where speed and maneuverability are closely controlled by high volumes, and where vehicles are restricted in freedom to select speed, change lanes, or pass.

Location Approval - the approval (described in PPM 20-8) given by the FHWA (at the request of a State Highway Department) based upon a location study report and a corridor public hearing or opportunity therefor. This action establishes a particular location for a highway section and is prerequisite to authorization to proceed with the design. (Concurrent location and design approval is sometimes given for projects involving upgrading existing roads. In these instances, location approval is not a prerequisite to authorization of design.)

Noise Level - the weighted sound pressure level obtained by the use of a metering characteristic and weighting A as specified in American National Standard Specification S1.4-1971. The abbreviation herein used is dBA.

Operating Speed - the highest overall speed at which a driver can travel on a given highway under favorable weather conditions and under prevailing traffic conditions without at any time exceeding the safe speed as determined by the design speed on a section-by-section basis.

Project Development - studies, surveys, coordination, reviews, approvals, and other activities normally conducted during the location and design of a highway project.

Truck - a motor vehicle having a gross vehicle weight greater than 10,000 pounds and buses having a capacity exceeding 15 passengers.



NOISE STANDARDS

1. Design Noise Level/Land Use Relationship

a. The design noise levels in Table 1 (page B-4) are to be used during project development of a highway section to determine highway traffic noise impacts associated with different land uses or activities in existence at the time of location approval. In addition, the table is to be used to determine the need for abatement measures for traffic generated noise for developed land uses and activities in existence at the time of location approval. Exceptions to the design noise levels may be granted on certain types of highway improvements or portions thereof when the conditions outlined in paragraph 2 are met.

b. The exterior noise levels apply to outdoor areas which have regular human use and in which a lowered noise level would be of benefit. These design noise level values are to be applied at those points within the sphere of human activity (at approximate ear level height) where outdoor activities actually occur. The values do not apply to an entire tract upon which the activity is based, but only to that portion in which the activity occurs. The noise level values need not be applied to areas having limited human use or where lowered noise levels would produce little benefit. Such areas would include but not be limited to junkyards, industrial areas, railroad yards, parking lots, and storage yards.

c. The interior design noise level in Category E applies to indoor activities for those situations where no exterior noise sensitive land use or activity is identified. The interior design noise level in Category E may also be considered as a basis for noise abatement measures in special situations when, in the judgment of FHWA, such consideration is in the best public interest. In the absence of noise insulating values for specific structures, interior noise level predictions may be estimated from the predicted outdoor noise level by using the following noise reduction factors:

<u>Building Type</u>	<u>Window Condition</u>	<u>Noise Reduction Due to Exterior of the Structure</u>	<u>Corresponding Highest Exterior Noise Level Which Would Achieve an Interior Design Noise Level of 55 dBA</u>
All	Open	10 dB	65 dBA
Light Frame	Ordinary Sash		
	Closed	20	75
	With Storm Windows	25	80
Masonry	Single Glazed	25	80
Masonry	Double Glazed	35	90

Noise reduction factors higher than those shown above may be used when field measurements of the structure in question indicate that a higher value is justified. In determining whether to use open or closed windows, the choice should be governed by the normal condition of the windows. That is, any building having year round air treatment should be treated as the closed window case. Buildings not having air conditioning in warm and hot climates and which have open windows a substantial amount of time should be treated as the open window case.

2. Exceptions

a. The design noise levels set out in these standards represent the highest desirable noise level conditions. State highway departments shall endeavor to meet the design noise levels in planning, locating, and designing highway improvements. However, there may be sections of highways where it would be impracticable to apply noise abatement measures. This could occur where abatement measures would not be feasible or effective due to physical conditions, where the costs of abatement measures are high in relation to the benefits achieved or where the measures required to abate the noise condition conflict with other important values, such as desirable esthetic quality, important ecological conditions, highway safety, or air quality.

b. A request for an exception to the design noise levels can be approved by the FHWA provided the highway agency has supported its request by a written summary report demonstrating that the following steps have been taken and outlining the results.

(1) Identified noise sensitive land uses along the section of highway in question which are expected to experience future highway traffic noise levels in excess of the design levels.

(2) Thoroughly considered all feasible measures that might be taken to correct or improve the noise condition.

(3) Weighed the costs or effects of the noise abatement measures considered against the benefits which can be achieved as well as against other conflicting values such as economic reasonableness, esthetic impact, air quality, highway safety, or other similar values, and thereby established that reduction of noise levels to desirable design levels is not in the best overall public interest for that particular highway section.

These decisions must ultimately be based upon case-by-case judgment. However, every effort should be made to obtain detailed information on the costs, benefits and effects involved to assure that final decisions are based on a systematic, consistent and rigorous assessment of the overall public interest.

(4) Considered lesser measures that could result in a significant reduction of noise levels though not to the design levels, and included such partial measures in the plans and specifications to the extent that they meet the test of economic reasonableness, practicability, and impact on other values, in the same manner as outlined in paragraph 2b(3).

c. In reviewing request for exception, the FHWA will give consideration to the type of highway and the width of the right-of-way. New freeway projects and most projects for the major reconstruction or upgrading of freeways allow for the use of noise control measures. Noise control measures are progressively more difficult to apply on other highways, particularly on local roads and streets because of numerous points of access, at-grade intersections, limited ability to acquire additional right-of-way as buffer zones, and the impossibility of altering roadway grades, constructing noise barriers and taking advantage of the terrain and other natural features.

d. Except in the most unusual situations, exceptions will be approved when the predicted traffic noise level from the highway improvement does not exceed the existing ambient noise level (originating from other sources) for the activity or land use in question.

### 3. Noise Level Predictions

a. Noise levels to be used in applying these standards shall be obtained from a predictive method approved by the FHWA. The predictive method and the noise level predictions should account for variations in traffic characteristics (volume, speed, and truck traffic), topography (vegetation, barriers, height, and distance), and roadway characteristics (configuration, pavement type, and grades). In predicting the noise levels, the following traffic characteristics shall be used:

(1) Automotive volume - the future volume (adjusted for truck traffic) obtained from the lesser of the design hourly volume or the maximum volume which can be handled under traffic level of service C conditions. For automobiles, level of service C is considered to be the combination of speed and volume which creates the worst noise conditions. For those highway sections where the design hourly volume or the level of service C condition is not anticipated to occur on a regular basis during the design year, the average hourly volume for the highest 3 hours on an average day for the design year may be used.

(2) Speed - the operating speed (as defined in the Highway Capacity Manual) which corresponds with the design year traffic volume selected in paragraph 3a(1) and the truck traffic predicted from paragraph 3a(3). The operating speed must be consistent with the volume used.

(3) Truck volume - the design hourly truck volume shall be used for those cases where either the design hourly volume or level of service C was used for the automobile volume.

Where the average hourly volume for the highest 3 hours on an average day was used for automobile traffic, comparable truck volumes should be used.

b. There are instances where activities associated with a particular land use (such as churches, schools, and resort hotels or residences) do not coincide with design hourly volumes. This may be particularly true when the design hourly volumes are seasonally oriented or where the activity associated with the land use is somewhat infrequent. There are other instances where changes in land use can be reasonably expected to occur before design year volumes are realized. In such instances, State highway agencies may request approval to compute noise predictions using traffic characteristics different from those specified in paragraph 3a. Such requests should be made on a project-by-project basis and should be accompanied by a justification.

TABLE 1  
DESIGN NOISE LEVEL/LAND USE RELATIONSHIPS

<u>Land Use Category</u>	<u>Design Noise Level - L<sub>10</sub></u>	<u>Description of Land Use Category</u>
A	60dBA (Exterior)	Tracts of lands in which serenity and quiet are of extraordinary significance and serve an important public need, and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose. Such areas could include amphitheaters, particular parks or portions of parks, or open spaces which are dedicated or recognized by appropriate local officials for activities requiring special qualities of serenity and quiet.
B	70 dBA (Exterior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, picnic areas, recreation areas, playgrounds, active sports areas, and parks.
C	75 dBA (Exterior)	Developed lands, properties or activities not included in categories A and B above.
D	--	For requirements on undeveloped lands see paragraphs 5a(5) and (6), this PPM.
E*	55 dBA (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals and auditoriums.

\* See paragraph 1c of this Appendix for method of application.

ACTIVITY CATEGORY	DESIGN NOISE LEVELS NOISE DESCRIPTOR		DESCRIPTION OF ACTIVITY CATEGORY
	L <sub>eq</sub>	L <sub>10</sub>	
A	57 (Exterior)	60 (Exterior)	Tracts of land in which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose. Such areas could include amphitheaters, particular parks or portions of parks, or stages, or open spaces, or historical districts which are dedicated or recognized by appropriate local officials for activities requiring special qualities of serenity and quiet.
B	67 (Exterior)	70 (Exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, and parks which are not included in category A and residences, motels, hotels, public meeting rooms, schools, churches, libraries and hospitals.
C	72 (Exterior)	75 (Exterior)	Developed lands, properties or activities not included in categories A or B above
D	-----	-----	For requirements on undeveloped lands see Section 772.19 (a) and (c)
E	52 (Interior)	55 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums

1 plan en pochette

MINISTÈRE DES TRANSPORTS



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