

AN INVENTORY OF TRAFFIC NOISE LEVELS
ALONG LIMITED ACCESS FREEWAYS IN MICHIGAN
(Revision of Research Report R-1013)



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TESTING AND RESEARCH DIVISION
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ALONG LIMITED ACCESS FREEWAYS IN MICHIGAN
(Revision of Research Report R-1013)

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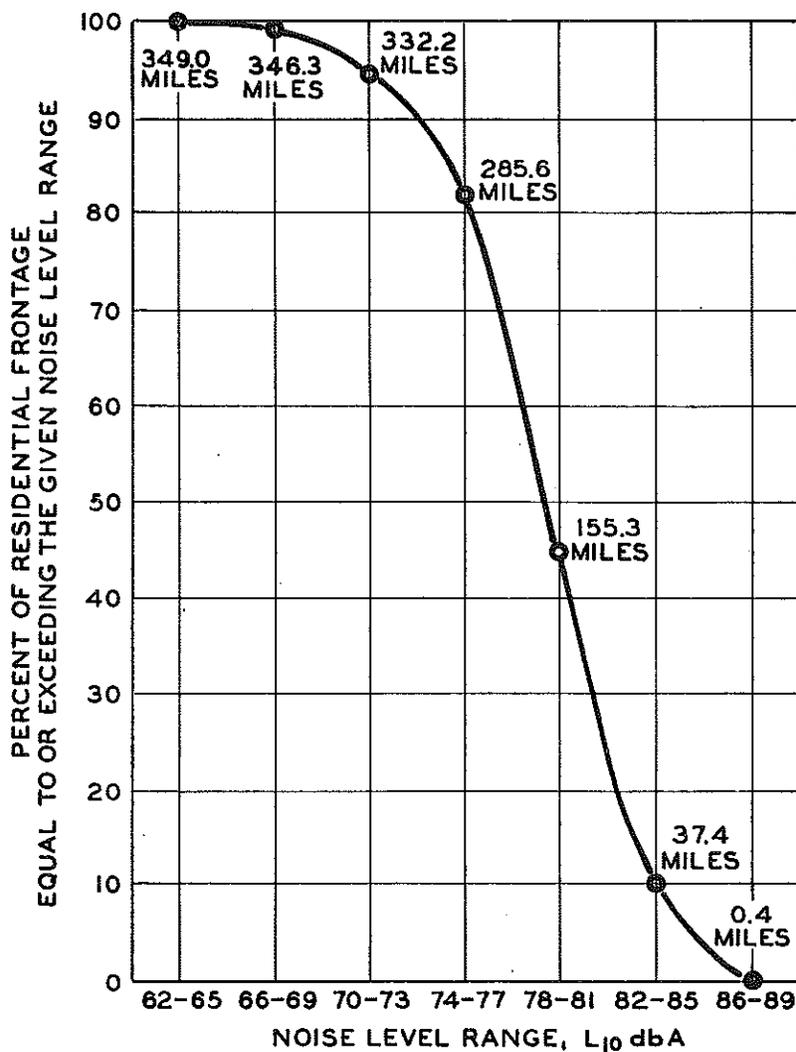
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Michigan Transportation Commission
Hannes Meyers, Jr., Chairman; Carl V. Pellonpaa,
Vice-Chairman; Weston E. Vivian, Rodger D. Young,
Lawrence C. Patrick, Jr., William C. Marshall
John P. Woodford, Director
Lansing, July 1981

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ABSTRACT

An inventory of the noise levels in the residential areas along Michigan's limited access freeways is reported. Its purpose is to provide guidance for decisions on noise abatement projects. A total of 3,326.6 roadway frontage miles (each mile of freeway has two miles of roadway frontage) were physically inventoried; the resulting 349.0 residential frontage miles are experiencing the noise levels illustrated below. The cost of applying noise abatement procedures along the areas where it is reasonable and feasible to do so is estimated at over 152 million dollars; the State's share being nearly 30 million dollars.



Background

The Federal Highway Noise Standards were first promulgated as Federal Highway Administration (FHWA) Policy and Procedure Memorandum PPM 90-2 on January 24, 1973. On February 20, 1974, "Interim Guidelines for Noise Abatement Projects on Previously Constructed Highways" (FHPM 7-7-3-1) was issued.

In response, in the spring of 1974, the Department established an ad hoc Noise Committee to formulate guidelines for the construction of noise barriers. In September 1974 this committee was redesignated as 'standing' and given the assignment of dealing with, and advising the Department upon, all noise problems.

The Department's Bureau of Highways Guidelines for Noise Barriers (Appendix A) were established by the Noise Committee to ensure that consistent, appropriate, and safe measures are taken with regard to noise barriers on existing highways; and that these measures are in the best public interest to achieve noise levels compatible with different land uses, with due consideration to social, economic, and environmental effects. Specifically, this document furnishes information to management to aid in deciding whether a noise barrier should be built; if it is to be built by the Bureau of Highways, what its priority should be; who should pay for it; and its design and construction specifications.

Finally, on May 14, 1976, the FHWA issued their "Procedures for Abatement of Highway Traffic Noise and Construction Noise," commonly referred to as FHPM 7-7-3.* Under FHPM 7-7-3, noise abatement projects on existing highways (located on a Federal-Aid system), not including construction or reconstruction of the highway section, are defined as Type II projects. These noise abatement projects are not mandatory requirements of Title 23 U.S.C., Section 109(i) and are therefore not requirements of FHPM 7-7-3. When Type II projects are proposed, at the option of the Michigan Department of State Highways and Transportation, Federal funds may be used for noise abatement measures if:

- 1) a traffic noise impact has been identified,
- 2) the noise abatement measures will reduce the noise impact, and
- 3) the overall noise abatement benefits are determined to outweigh the overall adverse social, economic, and environmental effects of the noise abatement measures.

* Ref. (1)

Need for Noise Level Inventory

In requesting Federal funding for a Type II noise abatement project, the Department must indicate the priority of the proposed project relative to other potential Type II projects in the State. Thus, in an attempt to establish these priorities and also to ensure equitable distribution of Michigan noise abatement funds, a statewide freeway noise level inventory has been conducted at the request of the Department's Deputy Director for Highways. The State, by virtue of this inventory report, will be better able to determine where its limited noise abatement funds should be utilized to achieve maximum citizen benefit.

Scope of Inventory

Only limited access routes or portions thereof were selected for this inventory, due to the inapplicability of barrier construction along unlimited access routes. Of Michigan's 83 counties, only 44 contain limited access facilities (Fig. 1). Included are Interstate roadways and certain lengths of 'US' and 'M' routes built to Interstate standards. A total of 3,326.6 roadway frontage miles (each mile of freeway has two miles of roadway frontage) were physically inventoried (3,083.2 miles were inventoried in 1976 and 243.4 miles in 1981). The 1981 inventory in this updated edition was added to the original 1976 edition. All lands adjacent to these routes were categorized according to the Activity Categories as described in the FHWA Noise Standards, FHPM 7-7-3 (Table 1).

Table 2 shows that there were no areas identified along the State's freeway system requiring extraordinary serenity and quiet (Category A). Most of the system is represented by the approximately 2,800 miles of frontage on undeveloped lands (Category D) and the 164 miles of frontage on industrial/commercial/professional/other lands (Category C).

The frontage type of significance in this inventory is that of Category B. Although that category includes many facilities and activity areas other than residential, the survey found almost all such existing frontage to consist of single or multi-family residential properties.

These residential areas are the locations where traffic noise impacts are often identified and where noise complaints usually originate, and therefore are the areas wherein existing traffic noise levels were calculated and analyzed as shown in Figures 2 and 3.

Noise levels were predicted at the right-of-way line adjacent to all Category B activity areas (primarily residential) by a FHWA approved method (2). Traffic data were taken from the 1974 Sufficiency Rating Report No. 152 for the 1976 inventory and from the 1980 Sufficiency Rating Report No. 153 for the 1981 inventory (3, 4). The predicted noise levels are in terms of $L_{10}(h)$, defined as the hourly value of the sound level that is exceeded 10 percent of the sample time. This $L_{10}(h)$ value is an indicator of

TABLE 1
DESIGN NOISE LEVEL/ACTIVITY RELATIONSHIPS

Activity Category	Design Noise Levels - dbA L ₁₀ (h)	Description of Activity Category
A	60 (Exterior)	Tracts of land 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, open spaces, or historic districts which are dedicated or recognized by appropriate local officials for activities requiring special qualities of serenity and quiet.
B	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	75 (Exterior)	Developed lands, properties or activities not included in Categories A or B above.
D	--	For requirements on undeveloped lands see paragraphs 11a and c, of Ref. (1).
E	55 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

both the magnitude and frequency of occurrence of the loudest events and is one of the descriptors specified in the Federal Noise Standards. It is determined in terms of dbA because the A-weighted decibel scale most closely approximates the scaling of sound by the human ear.

Inventory Results

The actual amount of frontage mileage in each Activity Category, per route and noise level range, is presented on a county basis in Appendix B, and on a route basis in Tables 2 and 3.

An overall traffic noise inventory Category B Activity Area Distribution (Figs. 2 and 3) indicates that nearly 96 percent (332.2 miles) of the total Category B area (349.0 miles) exceeds the $L_{10}(h) = 70$ dbA design noise level (Table 1) set forth in the Federal Noise Standards (1).

Estimated Cost to Abate Noise by Means of Barrier Walls

At the present time the most feasible method of reducing freeway traffic noise in residential areas is to insert a barrier between the freeway and the residences. The barrier may be simply a mound of earth or an elaborate wall of steel, wood, concrete, or other materials; but no matter what material is used, it is relatively expensive.

To arrive at a reasonable cost-to-abate estimate, a number of assumptions and factors are necessary:

1) A reasonable average cost per lineal foot of noise barrier including all materials, installation, and traffic control has been assumed at \$100.

2) To prevent noise from diffracting around the end of a noise barrier (end flanking) it is necessary to extend each end of the structure at least four times the normal distance between the end receiver and barrier. A sampling of existing and potential projects indicates that about 40 percent of designed barrier length is assigned to prevention of end-flanking. Therefore, when calculating barrier lengths for cost estimates, 40 percent is added to the actual residential frontages.

3) Those freeway sections that are paralleled by service drives cannot, as a rule, be effectively treated for noise by building barriers. Therefore, in the barrier cost estimate, the approximately 125 miles of such freeway-service drive length is deleted.

On the basis of these assumptions, and as detailed in Table 4, the total cost to abate noise in the readily treatable areas would be \$152 million. Of this amount the State would need to provide approximately \$27 million, assuming FHWA approval.

TABLE 2
ACTIVITY AREA CATEGORIZED ROUTE FRONTAGE
(Miles)

Route No.	Total Miles	Category B Miles	Category C Miles	Category D Miles
I 69	183.8	3.9	0.5	179.4
BI 75	2.4	0.9	0.0	1.5
I 75	771.6	62.8	33.5	675.3
I 94	516.8	70.6	25.4	420.9
I 96	355.5	39.0	25.6	290.9
I 194	6.8	1.3	0.3	5.2
I 196	147.6	11.1	3.6	132.9
I 275	72.4	8.3	3.2	60.9
I 296	7.0	1.3	1.9	3.8
I 375	2.2	0.0	2.2	0.0
I 475	32.8	14.5	4.0	14.3
I 496	23.6	5.6	4.3	13.7
I 675	15.6	5.7	0.9	9.0
I 696	35.0	17.2	7.7	10.1
US 10	130.3	20.6	18.9	90.8
US 23	186.4	15.6	5.2	165.6
US 27	207.2	5.5	0.4	201.3
US 31	116.6	7.0	1.9	107.7
US 127	77.4	10.3	4.1	63.4
US 131	239.8	7.3	10.8	221.7
Conn. 4	2.6	0.3	0.4	1.9
Conn. 14	4.8	0.4	0.0	4.4
M 14	40.8	3.0	1.0	36.8
M 20	4.8	0.8	1.8	2.2
M 21	50.0	8.0	3.1	38.9
M 25	2.8	1.0	0.0	1.8
M 39	25.6	18.2	2.5	4.9
M 47	8.6	0.0	0.3	8.3
M 53	21.0	4.3	0.0	16.7
M 55	3.4	0.0	0.0	3.4
M 59	24.6	4.5	0.7	19.4
M 60	6.8	0.0	0.0	6.8
Totals	3,326.6	349.0	164.2	2,813.4
Percent	100.0	10.49	4.94	84.57

TABLE 3
CATEGORY B ROUTE FRONTAGE
(Miles)

Route No.	Below FHWA Standard L ₁₀ dbA		Equal to or Above FHWA Standard L ₁₀ dbA				
	62 - 65	66 - 69	70 - 73	74 - 77	78 - 81	82 - 85	86 - 89
I 69	0.2	0.0	2.0	1.7	0.0	0.0	0.0
BI 75	0.3	0.6	0.0	0.0	0.0	0.0	0.0
I 75	0.1	1.8	4.5	18.4	29.8	7.9	0.3
I 94	0.0	0.5	2.6	22.6	29.7	15.1	0.1
I 96	0.0	0.5	1.0	21.6	14.7	1.2	0.0
I 194	0.0	0.0	1.3	0.0	0.0	0.0	0.0
I 196	0.5	0.3	1.3	6.3	2.7	0.0	0.0
I 275	0.0	0.9	2.4	3.5	1.1	0.4	0.0
I 296	0.0	0.0	0.0	1.0	0.3	0.0	0.0
I 375	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I 475	0.9	1.9	6.1	4.3	0.9	0.4	0.0
I 496	0.0	1.9	2.1	1.6	0.0	0.0	0.0
I 675	0.0	1.2	3.2	1.3	0.0	0.0	0.0
I 696	0.0	0.0	1.2	4.1	11.9	0.0	0.0
US 10	0.0	0.2	2.0	15.7	2.7	0.0	0.0
US 23	0.0	0.0	0.0	0.4	7.9	7.3	0.0
US 27	0.0	0.4	2.7	2.4	0.0	0.0	0.0
US 31	0.0	0.9	1.4	3.2	1.5	0.0	0.0
US 127	0.0	0.6	4.2	2.3	3.2	0.0	0.0
US 131	0.0	0.2	0.9	2.7	2.9	0.6	0.0
Conn. 4	0.0	0.0	0.3	0.0	0.0	0.0	0.0
Conn. 14	0.0	0.0	0.0	0.4	0.0	0.0	0.0
M 14	0.0	0.6	1.1	1.1	0.2	0.0	0.0
M 20	0.3	0.5	0.0	0.0	0.0	0.0	0.0
M 21	0.4	0.9	2.9	3.8	0.0	0.0	0.0
M 25	0.0	0.0	0.0	1.0	0.0	0.0	0.0
M 39	0.0	0.0	0.0	5.7	8.4	4.1	0.0
M 47	0.0	0.0	0.0	0.0	0.0	0.0	0.0
M 53	0.0	0.0	0.3	4.0	0.0	0.0	0.0
M 55	0.0	0.0	0.0	0.0	0.0	0.0	0.0
M 59	0.0	0.2	3.1	1.2	0.0	0.0	0.0
M 60	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	2.7	14.1	46.6	130.3	117.9	37.0	0.4
Percent	0.77	4.04	13.35	37.33	33.78	10.60	0.11
Cumulative Total	349.0	346.3	332.2	285.6	155.3	37.4	0.4
Cumulative Percent	100.00	99.23	95.19	81.83	44.50	10.72	0.11

TABLE 4
 COST ESTIMATE OF TRAFFIC NOISE BARRIERS ALONG TRAFFIC NOISE
 IMPACTED LIMITED ACCESS FREEWAYS

Type of Route	Residential Frontage With L10 \geq 70 dbA, miles		Total Cost, millions	Federal/State Cost Sharing Ratio	State's Cost, millions
	Total	Without Service Drive (approx.)			
Interstate	230.6	125	92.4	90/10	9.24
US and M	101.6	81	59.9	70/30	17.97
Totals	332.2	206	152.3		27.21

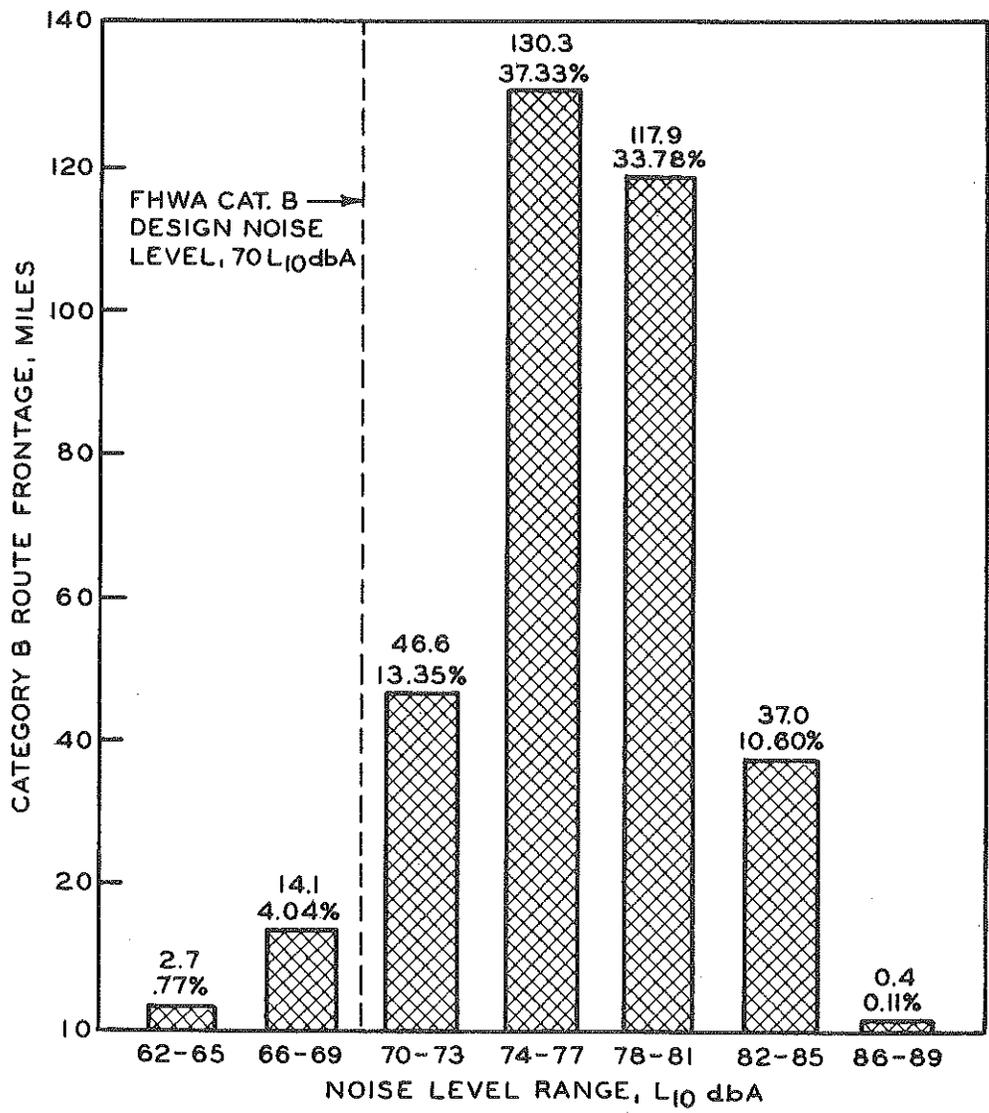


Figure 2. Michigan limited access freeway traffic noise inventory Category B distribution (349.0 miles total).

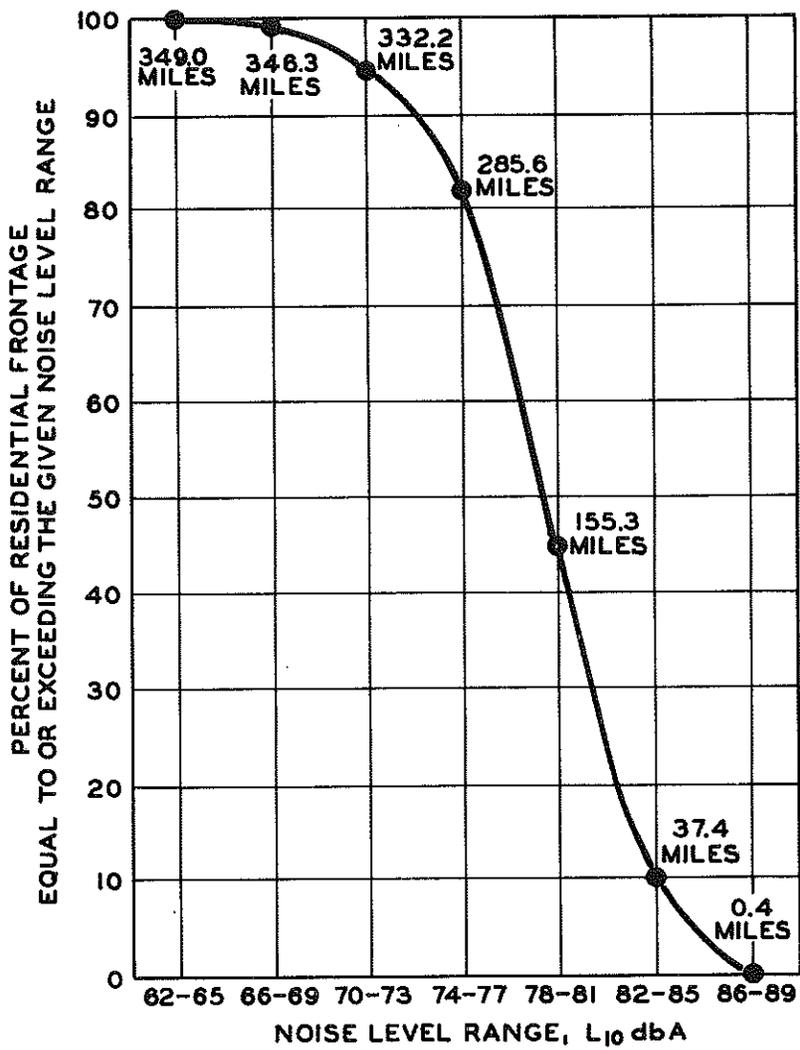


Figure 3. Category B (residential) cumulative distribution (349.0 miles total).

Summary and Conclusions

The completed inventory has located hundreds of residential areas totaling nearly 350 frontage miles, along Michigan freeways, which are being adversely impacted by freeway and service road traffic noise. Applying noise abatement procedures along all the areas where it is reasonable and feasible to do so would cost (at current prices) about \$152 million. Fortunately, the Federal Government (upon their approval) will contribute a significant portion of this cost. Even so, the State's share could be nearly \$30 million.

In considering the implications of the inventory findings, it is important to remember that only freeways were surveyed. If the inventory were to be extended to include all trunklines, especially those in urban areas, the impacted residential frontage would almost certainly exceed 1,000 miles. Further, recognizing the great complexity, difficulty, and large cost in noise-treating free access trunklines leads to a total estimated treatment cost almost certainly to exceed \$1 billion, and probably closer to \$1.5 billion.

These huge and unacceptable dollar amounts, although only coarse estimates, constitute an impressive basis for vigorously supporting Federal and State level efforts toward vehicle noise control. Such vehicle quieting is the only realistic way of reducing the noise impact along free access roadways. Moreover, once the vehicles have been quieted, they will take their quiet along wherever they go, day or night—residential areas, city streets, parks, trunklines, freeways, everywhere.

REFERENCES

1. "Procedures for Abatement of Highway Traffic Noise and Construction Noise," Federal-Aid Highway Program Manual, Vol. 7, Chapter 7, Section 3, May 1976 (revised May 1979).
2. Grove, G. H., "Traffic Noise Level Predictor Computer Program," Michigan Department of State Highways and Transportation, Research Report R-942, October 1974.
3. "Michigan Highways 1974 Sufficiency Rating by Districts," Michigan Department of State Highways and Transportation, Bureau of Transportation Planning, Report No. 153.
4. "Michigan Highways 1980 Sufficiency Rating by Districts," Michigan Department of Transportation, Bureau of Transportation Planning, Report No. 153.

APPENDIX A
GUIDELINES FOR HIGHWAY NOISE BARRIERS
FOR TYPE II PROJECTS

MICHIGAN DEPARTMENT OF TRANSPORTATION

GUIDELINES FOR HIGHWAY NOISE BARRIERS FOR TYPE II PROJECTS

I PURPOSE:

To establish guidelines for use in the planning, design and construction of earth mound or wall type barriers to abate noise radiating from Michigan highways into developed areas. They are to insure that consistent, appropriate and safe measures are taken with regard to noise barriers on existing highways not presently being considered for reconstruction, and that these measures are in the best public interest to achieve noise levels compatible with different land uses, with due consideration to social, economic, and environmental effects. Specifically, they provide the decision maker with guidance as to whether any given noise barrier should be built; if it is to be built what its priority should be; who should pay for it; and its design and construction details.

II APPLICABILITY:

These guidelines may be applied, as appropriate, to those Type II urban, suburban, and rural FAI, FAP, and FAS Michigan State trunkline projects covered by Federal Highway Administration FHPM 7-7-3.

A Type II project is a proposed Federal or Federal-Aid Highway project for noise abatement on an existing highway (located on a Federal-Aid System) which does not include construction or reconstruction of a highway section (or portion thereof).

III EXCEPTIONS:

The conditions set forth in these guidelines will be complied with by Department personnel unless an exception is authorized, in writing, by the Deputy Director, Bureau of Highways and approved by the FHWA.

IV CRITERIA FOR ACTION AND PRIORITY:

Construction of a Type II project noise barrier in the highway right-of-way adjacent to a developed site requires the following:

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- A. Proposed noise barrier projects must be supported by a formal, local government resolution.

- B. The local government must also furnish the Department with documentation of its land use controls. These controls must be such as to reasonably preclude the necessity for publicly funded noise barriers in highway rights-of-way adjacent to such future developments. They should include, but are not limited to:
 - 1. Transportation noise as a component of the community's general development plan.
 - 2. Regulation of subdivision development providing for proper site design and building location where noise sensitive uses are to locate close to freeways.
 - 3. Zoning regulations which separate noise sensitive land uses from proximity to freeways and locate land uses compatible with traffic noise adjacent to freeways.
 - 4. Construction regulations insuring that all future buildings located close to freeways will be soundproofed against exterior noise.

- C. A noise analysis performed in accordance with the general guidelines outlined in FHPM 7-7-3 must confirm that the noise level for the appropriate land use category is being exceeded.
 - 1. The day-night use of residential property, in the absence of evidence to the contrary, will be assumed typical. That is, it will consist of a daytime activity period beginning between 5:00 and 7:00 a. m. and ending between 9:00 and 12:00 p. m.; and a sleep period beginning between 9:00 and 12:00 p. m. and ending between 5:00 and 7:00 a. m.
 - 2. In residential areas the Design Noise Level of FHPM 7-7-3 must be exceeded during the period 9:00 p. m. to 6:00 a. m.
 - 3. In reducing the noise impact (level) in a residential area the barrier design must, to the extent technically and economically feasible, insure that there is no increase in the variability factor (L_{10} minus L_{90}).

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D. The assignment of priorities to noise barrier projects will be as follows:

Priority 1: Development that existed or was under development before the date that the Department officially notified the public of the adoption of the route location of the highway project. (FHPM 7-7-3 - Date of Public Knowledge of a Proposed Highway Project.)

Priority 2: Development started after route adoption but before the date of construction contract award.

Priority 3: Development started after date of construction contract award.

Within each of the above priorities, highest consideration will be given to development experiencing the highest noise levels. To differentiate between those areas of similar noise level, that is, to further prioritize the above, the following will be used:

$$\text{Priority Factor} = \frac{\text{Achievable Reduction} \times \text{Number of Living Units Protected}}{\text{Adjusted Barrier Cost}}$$

where:

"Achievable Reduction" is the difference between the predicted average existing noise level and the predicted average noise level after barrier construction. Its determination will be based on achieving a noise level of $L_{10}(h)$ 70 dbA or $L_{eq}(h)$ 67 dbA at the development nearest the roadway.

"Number of Living Units Protected" is the total number of living units whose external traffic noise level will be reduced to or below $L_{10}(h)$ 70 dbA or $L_{eq}(h)$ 67 dbA by the barrier.

"Adjusted Barrier Cost" - On FAI projects the Adjusted Barrier Cost will equal the total cost of installation minus those portions paid by the Federal Government, Local Government, and others.

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On FAP and FAS projects the Adjusted Barrier Cost will equal the total cost of installation minus those portions paid by the Local Government, and others. (Financial participation by Local Government, citizen groups, homeowner associations, and others are to be encouraged, where appropriate, as a means to reduce the denominator in the Priority Formula above and thereby achieve a higher priority.)

- E. Where structures post-dating route adoption are intermixed with those pre-dating route adoption, as a general rule, no distinction will be made. All will be considered as warranting protection. Judgment, however, will be required in deciding whether or not to treat high ratio mixes of post-date to pre-date structures and the extent of barrier to install, if any.
- F. The noise abatement benefits must be judged to outweigh the overall social, economic, and environmental effects of the project.
- G. There must be no foreseeable, future public need for the highway right-of-way on which the noise barrier is to be erected.

V NOISE BARRIER CONSTRUCTION AND PERFORMANCE SPECIFICATIONS:

For purposes of safety, economy, esthetics and effective noise abatement any noise barrier constructed by the Department will meet the following requirements:

- A. A minimum decrease in the L_{10} noise level of 6 dbA must be achieved at the protected human activity facility nearest the barrier.
- B. An earth mound, if constructed, shall blend with existing slopes and shall provide for continued proper drainage. A sound barrier wall, whether constructed on top of an earth mound, or in lieu of an earth mound, or the toe of any earth mound having slopes steeper than 1:4, should not be closer than 30 ft from the edge of pavement. At locations where a barrier wall is to be placed on a fill section or in a narrow right-of-way a lesser distance may be permitted.

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- C. The front slope of an earth mound having its toe 50 ft or less from the edge of pavement, may be no steeper than 1 on 3. This slope may be increased to 1 on 2 if the beginning of the mound is 50 ft or more from the edge of pavement. The back slope of the mound may be 1 on 2 or any slope that will stand if it is outside the right-of-way.
- D. Slopes steeper than 1 on 2 must be sodded.
- E. Erosion control and turf establishments on all slopes shall be in accordance with the Standard Specifications and current Department practices.
- F. If the right-of-way fence must be removed and replaced, it shall be replaced in a condition equal to the existing fence; and shall be installed at the right-of-way line. If excess property owned by the Department is involved, the fence shall be installed at either the foot of the slope on the property owner side or, at the far end of the excess property line, whichever is closest to the roadway. (There could be cases where adjacent excess property, by itself, is sufficient to accommodate the earth fill.)
- G. Construction of any barrier shall not obstruct existing drainage, unless alternate drainage is provided. Adequate precaution shall be taken to prevent sediment from entering adjacent watercourses. Sediment must be removed from the road ditch at the conclusion of construction of the barrier.
- H. Any slopes damaged during the course of barrier construction shall be smoothed and restored and the entire highway facility shall be restored to pre-barrier construction condition.
- I. Where existing utilities must be adjusted or relocated due to noise barrier construction the work shall be coordinated with the affected utilities.

VI FUNDING NOISE BARRIER PROJECTS:

Funding for noise barriers will be arranged by the Department as follows:

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- A. Federal Highway Administration participation as applicable: FHPM 7-7-3, 12.c.(1).

"The Federal share for noise abatement measures on Type II projects shall be the same as that for the Federal-aid system on which the project is located. For Type II projects on the Interstate system (including completed sections), the Federal share shall be from Federal-aid Interstate Funds."

- B. Local government participation as indicated by resolution and as required by state law.
- C. Department participation as applicable.

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APPENDIX B

**ADJACENT LAND USE (ACTIVITY AREA) AND
NOISE LEVEL MILEAGE BY COUNTIES**

INVENTORY OF MICHIGAN FREEWAY TRAFFIC NOISE LEVEL MILEAGE BY COUNTIES

County and Freeway Route	Length Within County, miles	Land Use Categories Fronting on Freeway, ¹ miles..														
		Category B, ² (70 dbA)		Category C, (75 dbA) Developed Lands Not Included in Category B		Category D, (--) Undeveloped Lands		Category B route frontage (both sides of freeway) in miles falling within the noise level range from below 62 to above 93 L ₁₀ dbA as measured at the property line nearest the freeway.								
								below 62	62 - 65	66 - 69	70 - 73	74 - 77	78 - 81	82 - 85	86 - 89	90 - 92
ALLEGAN (#8)																
US 131	48.6	0.8	47.8	0.1	0.7											
I 196	50.8	0.2	50.5	0.1	0.2											
Totals	99.4	1.0	98.3	0.1	0.9											
ARENAC (#6)																
US 23	5.0		5.0													
I 75	39.0		39.0													
Totals	44.0		44.0													
BAY (#9)																
M 25	2.8	1.0	1.8	0.3	1.0											
M 47	4.2		3.9													
US 10	23.2	1.3	21.9	0.8	0.5											
I 75	56.6	1.5	55.1	0.1	1.0											
Conn. 14	4.8	0.4	4.4													
Totals	91.6	4.2	87.1	0.3	1.5											
BERRIEN (#11)																
I 94	85.4	3.9	81.1	0.4	0.7											
I 196	15.8	1.1	14.7		1.1											
US 31	6.8		6.8													
Totals	108.0	5.0	102.6	0.4	1.8											
BRANCH (#12)																
I 69	44.2	0.5	43.7		0.5											
Totals	44.2	0.5	43.7		0.5											
CALHOUN (#13)																
I 69	50.2	0.4	49.8	0.0	0.4											
I 94	63.0	3.0	59.7	0.3	0.8											
I 194	6.8	1.3	5.2	0.3	1.3											
Totals	120.0	4.7	114.7	0.6	2.2											

¹ No Category A land use mileage was observed.

² Residences, motels, hotels, public meeting rooms, schools, churches, hospitals, picnic areas, recreation areas, playgrounds, active sports areas and parks.

**INVENTORY OF MICHIGAN FREEWAY
TRAFFIC NOISE LEVEL MILEAGE BY COUNTIES (Cont.)**

County and Freeway Route	Length Within County, miles	Land Use Categories Fronting on Freeway, ¹ miles				Category B route frontage (both sides of freeway) in miles falling within the noise level range from below 62 to above 93 L ₁₀ dbA as measured at the property line nearest the freeway.								
		Category B, ² (70 dbA)	Category C, (75 dbA) Developed Lands Not Included in Category B	Category D, (--) Undeveloped Lands	below 62	62 - 65	66 - 69	70 - 73	74 - 77	78 - 81	82 - 85	86 - 89	90 - 92	over 93
CHEBOYGAN (#16)														
I 75	85.4	0.5		84.9			0.5							
Totals	85.4	0.5		84.9			0.5							
CHIPPEWA (#17)														
I 75	53.6		0.7	52.9										
Totals	53.6		0.7	52.9										
CLARE (#18)														
US 10	9.5			9.5										
US 27	50.2	1.1		49.1		0.2		0.9						
Totals	59.7	1.1		58.6		0.2		0.9						
CLINTON (#19)														
US 127	8.2	0.2		8.0			0.2							
I 96	20.4			20.4										
Totals	28.6	0.2		28.4			0.2							
CRAWFORD (#20)														
I 75	51.2	1.2	1.1	48.9		0.1		1.1						
US 27	12.6			12.6										
Totals	63.8	1.2	1.1	61.5		0.1		1.1						
EATON (#23)														
I 69	28.2	0.4	0.1	27.7		0.2		0.2						
I 496	6.8	0.8	0.4	5.6				0.8						
I 96	19.4	0.7		18.7			0.3		0.4					
Totals	54.4	1.9	0.5	52.0		0.2	0.3	1.0	0.4					
EMMETT (#24)														
I 75	3.4	0.6	0.3	2.5			0.2		0.4					
Totals	3.4	0.6	0.3	2.5			0.2		0.4					

¹ No Category A land use mileage was observed.
² Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, picnic areas, recreation areas, playgrounds, active sports areas and parks.

**INVENTORY OF MICHIGAN FREEWAY
TRAFFIC NOISE LEVEL MILEAGE BY COUNTIES (Cont.)**

County and Freeway Route	Length Within County, miles	Land Use Categories Fronting on Freeway, ¹ miles										Category B route frontage (both sides of freeway) in miles falling within the noise level range from below 62 to above 93 L ₁₀ dbA as measured at the property line nearest the freeway.									
		Category B, ² (70 dbA)		Category C, (75 dbA) Developed Lands Not Included in Category B		Category D, (--) Undeveloped Lands		below 62	62 - 65	66 - 69	70 - 73	74 - 77	78 - 81	82 - 85	86 - 89	90 - 92	over 93				
GENESEE (#25)																					
M 21	23.4	7.1	3.1	13.2	0.4	2.9	3.8														
US 23	24.8	1.9	1.8	21.1			0.2				1.7										
I 69	28.2	2.0	0.4	25.8		1.8	0.2														
I 75	56.0	6.7	2.2	47.1		0.1	0.5			2.1	4.0										
I 475	32.8	14.5	4.0	14.3	0.9	1.9	4.3	0.4													
Totals	165.2	32.2	11.5	121.5	0.9	2.3	9.0	4.4													
GRATIOT (#29)																					
US 27	37.8	1.6		36.2		0.9	0.7														
Totals	37.8	1.6		36.2		0.9	0.7														
INGHAM (#33)																					
I 96	48.0	1.9	3.8	42.3		1.9	1.3	1.9													
I 496	16.8	4.8	3.9	8.1			1.6														
US 127	37.4	7.1	3.2	27.1		4.0	1.2	1.9													
Totals	102.2	13.8	10.9	77.5		1.9	5.3	4.7													
IONIA (#34)																					
I 96	51.4	1.4		50.0			1.4														
Totals	51.4	1.4		50.0			1.4														
ISABELLA (#37)																					
US 27	57.6	2.7	0.4	54.5	0.2	1.8	0.7														
US 10	12.6	0.2		12.4	0.2																
Totals	70.2	2.9	0.4	66.9	0.4	1.8	0.7														
JACKSON (#38)																					
M 60	6.8			6.8																	
US 127	31.8	3.0	0.9	27.9	0.6	1.1	1.3														
I 94	61.4	1.8	1.2	58.4		0.2	0.5	1.0	0.1												
Totals	100.0	4.8	2.1	93.1	0.6	1.3	1.8	1.0	0.1												

¹ No Category A land use mileage was observed.

² Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, picnic areas, recreation areas, playgrounds, active sports areas and parks.

**INVENTORY OF MICHIGAN FREEWAY
TRAFFIC NOISE LEVEL MILEAGE BY COUNTIES (Cont.)**

County and Freeway Route	Length Within County, miles	Land Use Categories Fronting on Freeway, ¹ miles					Category B route frontage (both sides of freeway) in miles falling within the noise level range from below 62 to above 93 L ₁₀ dbA as measured at the property line nearest the freeway.									
		Category B, ² (70 dbA)		Category C, (75 dbA) Developed Lands Not Included in Category B		Category D, (---) Undeveloped Lands	below 62	62 - 65	66 - 69	70 - 73	74 - 77	78 - 81	82 - 85	86 - 89	90 - 92	over 93
KALAMAZOO (#39)																
US 131	47.0	2.5	0.1	44.4				0.3	1.5	0.7						
I 94	50.2	4.3	0.6	45.3				0.5		1.4		2.4				
Totals	97.2	6.8	0.7	89.7				0.8	1.5	2.1		2.4				
KENT (#41)																
US 131	72.8	4.0	10.7	58.1			0.2	0.5	0.5	2.2		0.6				
I 96	60.6	3.3	1.4	55.9			0.2		2.4	0.4		0.3				
I 196	23.8	8.0	3.5	12.3		0.5	0.3	1.3	4.0	1.9						
I 296	7.0	1.3	1.9	3.8					1.0	0.3						
Totals	164.2	16.6	17.5	130.1		0.5	0.7	1.8	7.9	4.8		0.9				
LAPER (#44)																
M 21	14.0			14.0												
Totals	14.0			14.0												
LIVINGSTON (#47)																
I 96	55.2	1.7	0.2	53.3						1.7						
US 23	50.2	9.4	0.5	40.3						3.4		6.0				
Totals	105.4	11.1	0.7	93.6						5.1		6.0				
MACKINAC (#49)																
I 75	50.0	0.8	0.2	49.0				0.8								
Totals	50.0	0.8	0.2	49.0				0.8								
MACOMB (#50)																
M 53	21.0	4.3		16.7					0.3	4.0						
M 59	4.0	0.4	0.3	3.3					0.2	0.2						
I 94	19.4	15.0	3.5	0.9			0.1	1.0	7.1	6.8						
I 696	18.4	11.5	5.7	1.2				0.9	3.1	7.5						
Totals	62.8	31.2	9.5	22.1			0.1	2.4	14.4	14.3						
MECOSTA (#54)																
US 131	16.6			16.6												
Totals	16.6			16.6												

¹ No Category A land use mileage was observed.

² Residences, motels, hotels, public meeting rooms, schools, churches, hospitals, picnic areas, recreation areas, playgrounds, active sports areas and parks.

**INVENTORY OF MICHIGAN FREEWAY
TRAFFIC NOISE LEVEL MILEAGE BY COUNTIES (Cont.)**

County and Freeway Route	Length Within County, miles	Land Use Categories Fronting on Freeway, ¹ miles					Category B route frontage (both sides of freeway) in miles falling within the noise level range from below 62 to above 93 L ₁₀ dbA as measured at the property line nearest the freeway.									
		Category B, ² (70 dbA)	Category C, (75 dbA) Developed Lands Not Included in Category B	Category D, (-) Undeveloped Lands	below 62	62 - 65	66 - 69	70 - 73	74 - 77	78 - 81	82 - 85	86 - 89	90 - 92	over 93		
OGEMAW (#65)																
I 75	30.6					30.6										
Totals	30.6					30.6										
OSCEOLA (#67)																
US 131	21.8					21.8										
Totals	21.8					21.8										
OTSEGO (#69)																
I 75	51.4	2.4	0.9	48.1	1.6	0.8										
Totals	51.4	2.4	0.9	48.1	1.6	0.8										
OTTAWA (#70)																
US 31	6.0	0.5	0.6	4.9	0.3	0.2	0.2	1.7	0.5							
I 96	39.0	2.5	0.6	35.9												
I 196	30.0	0.2		29.8												
Totals	75.0	3.2	1.2	70.6	0.3	0.3	2.1	0.5								
ROSCOMMON (#72)																
M 55	3.4			3.4												
US 27	49.0	0.1		48.9			0.1									
I 75	47.6			47.6												
Totals	100.0	0.1		99.9			0.1									
SAGINAW (#73)																
M 47	4.4			4.4												
I 75	47.2	4.8	1.1	41.3			0.1	0.5	4.2							
I 675	15.6	5.7	0.9	9.0	1.2	3.2	1.3									
Totals	67.2	10.5	2.0	54.7	1.2	3.3	1.8	0.5	4.2							
SHIAWASSEE (#76)																
I 69	33.0	0.6		32.4			0.6									
Totals	33.0	0.6		32.4			0.6									

¹ No Category A land use mileage was observed.

² Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, picnic areas, recreation areas, playgrounds, active sports areas and parks.

**INVENTORY OF MICHIGAN FREEWAY
TRAFFIC NOISE LEVEL MILEAGE BY COUNTIES (Cont.)**

County and Freeway Route	Length Within County, miles	Land Use Categories Fronting on Freeway, ¹ miles										Category B route frontage (both sides of freeway) in miles falling within the noise level range from below 62 to above 93 L ₁₀ dbA as measured at the property line nearest the freeway.									
		Category B, ² (70 dbA)			Category C, (75 dbA) Developed Lands Not Included in Category B			Category D, (--) Undeveloped Lands				below 62	62 - 65	66 - 69	70 - 73	74 - 77	78 - 81	82 - 85	86 - 89	90 - 92	over 93
ST. CLAIR (#77)																					
M 21	12.6	0.9	0.4	11.7	0.4	0.5															
I 94	50.2	2.4	0.4	47.4										1.1	0.9						
Totals	62.8	3.3	0.4	59.1										1.1	0.9						
VAN BUREN (#80)																					
I 94	48.2	1.6		46.6										1.1	0.5						
I 196	27.2	1.6		25.6										0.8	0.8						
Totals	75.4	3.2		72.2										1.9	1.3						
WASHTENAW (#81)																					
M 14	27.6	1.9	0.4	25.3										1.1	0.2						
US 23	55.4	3.3	1.1	51.0										0.2	1.8						1.3
I 94	66.8	7.0	2.0	57.8										0.3	1.6						5.1
Totals	149.8	12.2	3.5	134.1										1.6	3.6						6.4
WAYNE (#82)																					
M 14	13.2	1.1	0.6	11.5										0.3	0.8						
M 39	23.2	16.6	2.5	4.1										4.1	8.4						4.1
US 10	22.8	11.6	11.2	16.8										9.9	1.7						
I 75	60.6	23.7	20.1	16.8										1.1	8.7						0.3
I 94	72.2	31.6	17.0	23.6										12.3	14.9						4.4
I 96	38.1	20.8	16.0	1.3										12.5	7.4						0.9
I 275	51.2	8.0	1.5	41.7										3.5	1.1						0.4
I 375	2.2	2.2	2.2																		
Conn. 4	2.6	0.3	0.4	1.9										0.3							
Totals	200.9	93.7	57.3	49.9										52.0	42.2						13.7
WEXFORD (#83)																					
US 131	7.0			7.0																	
Totals	7.0			7.0																	
Grand Total	3,326.6	348.7	164.2	2,813.7										2.7	14.1						46.6
																					130.3
																					37.0
																					0.4

¹ No Category A land use mileage was observed.

² Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, picnic areas, recreation areas, playgrounds, active sports areas and parks.