1013

AN INVENTORY OF TRAFFIC NOISE LEVELS ALONG LIMITED ACCESS FREEWAYS IN MICHIGAN

MICHIGAN
RESEARCH LABORATORY SECTION

LAST COPY
DO NOT REMOVE FROM LIBRARY

MICHIGAN DEPARTMENT OF
STATE HIGHWAYS AND TRANSPORTATION

AN INVENTORY OF TRAFFIC NOISE LEVELS ALONG LIMITED ACCESS FREEWAYS IN MICHIGAN

G. H. Grove
M. E. Scarlata

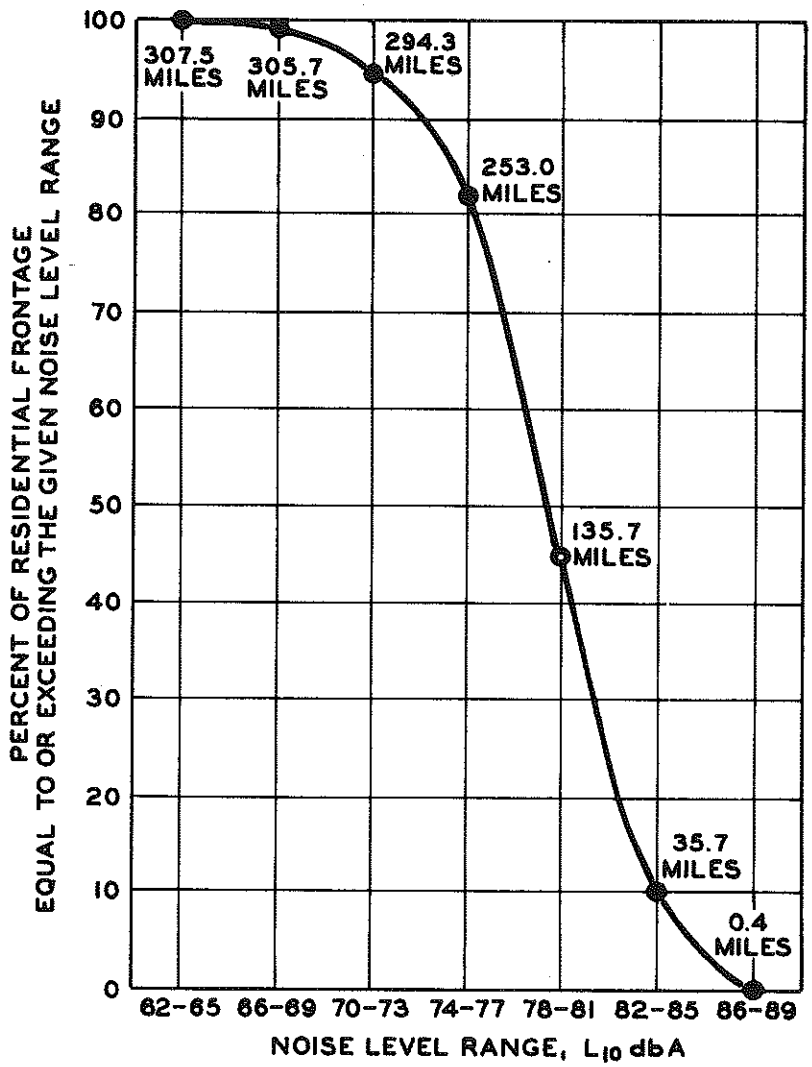
Research Laboratory Section
Testing and Research Division
Research Project 75 G-211
Research Report No. R-1013

Michigan State Highway Commission
Peter B. Fletcher, Chairman; Carl V. Pellonpaa,
Vice-Chairman, Hannes Meyers, Jr., Weston E. Vivian
Lansing, September 1976

The information contained in this report was compiled exclusively for the use of the Michigan Department of State Highways and Transportation. Recommendations contained herein are based upon the research data obtained and the expertise of the researchers, and are not necessarily to be construed as Department policy. No material contained herein is to be reproduced—wholly or in part—without the expressed permission of the Engineer of Testing and Research.

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 3,083.2 roadway frontage miles (each mile of freeway has two miles of roadway frontage) were physically inventoried; the resulting 307.5 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 150 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)

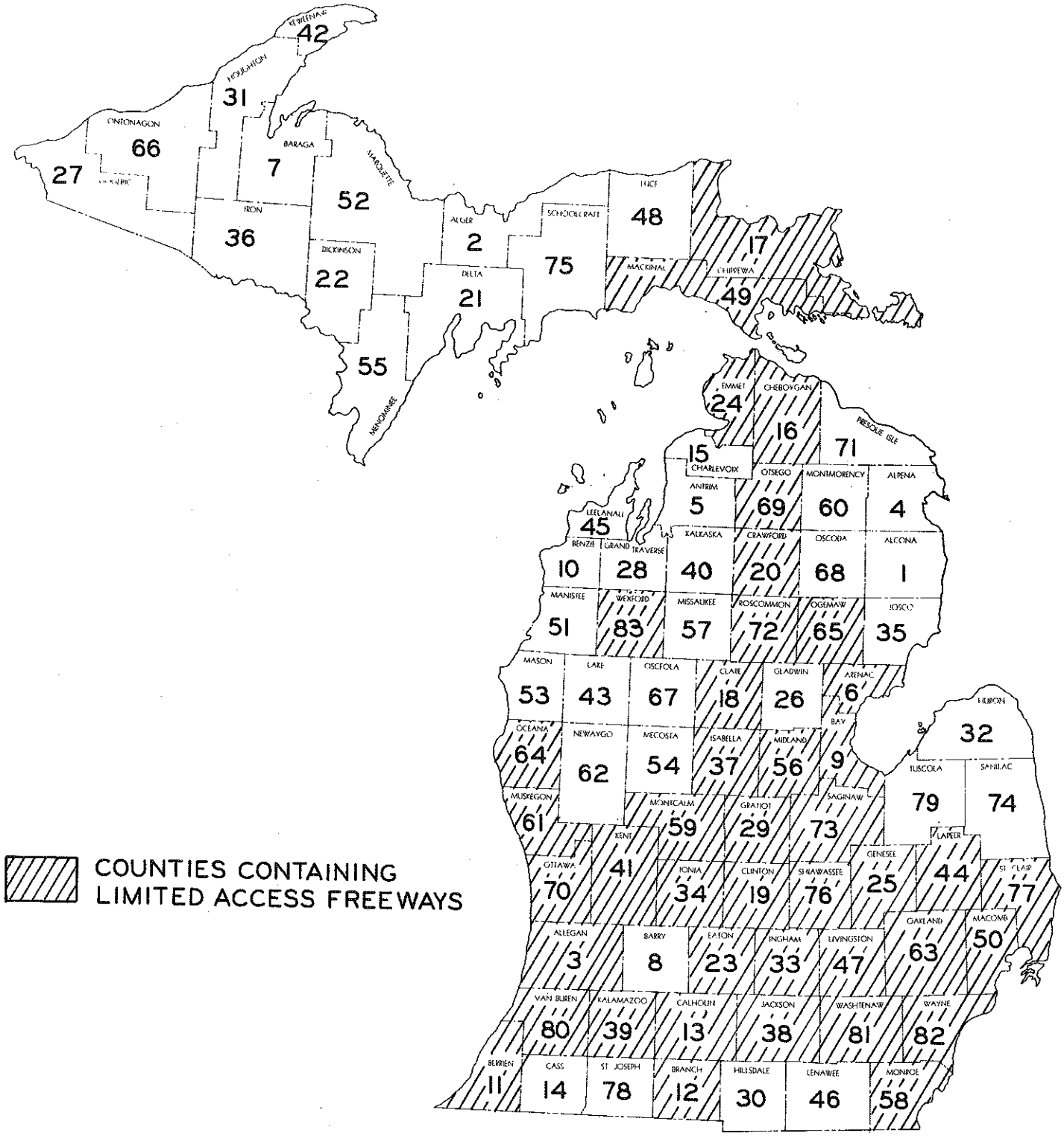


Figure 1. Noise level inventory survey area.

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 42 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 3,083.2 roadway frontage miles (each mile of freeway has two miles of roadway frontage) were physically inventoried during the winter months of 1975-76. 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 2,600 miles of frontage on undeveloped lands (Category D) and the 137 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. 153 (3). 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 both the magnitude and frequency

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.

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 (294.3 miles) of the total Category B area (307.5 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 100 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 $148 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	70.3	25.4	421.1
I 96	326.7	24.5	12.6	289.6
I 194	6.8	1.3	0.3	5.2
I 196	147.6	11.1	3.6	132.9
I 275	8.0	3.6	0.9	3.5
I 296	7.0	1.3	1.9	3.8
I 375	2.2	0.0	2.2	0.0
I 475	19.0	6.9	0.5	11.6
I 496	23.6	5.6	4.3	13.7
I 675	15.6	5.7	0.9	9.0
I 696	13.4	4.2	0.3	8.9
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	71.4	7.0	1.9	62.5
US 127	77.4	10.3	4.1	63.0
US 131	194.2	7.3	10.8	176.1
Conn. 4	2.6	0.3	0.4	1.9
Conn. 14	4.8	0.4	0.0	4.4
M 14	16.8	1.6	0.4	14.8
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	3,083.2	307.5	137.4	2,638.3
Percent	100.0	9.97	4.46	85.57

Summary and Conclusions

The completed inventory has located hundreds of residential areas totaling nearly 300 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 $150 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.

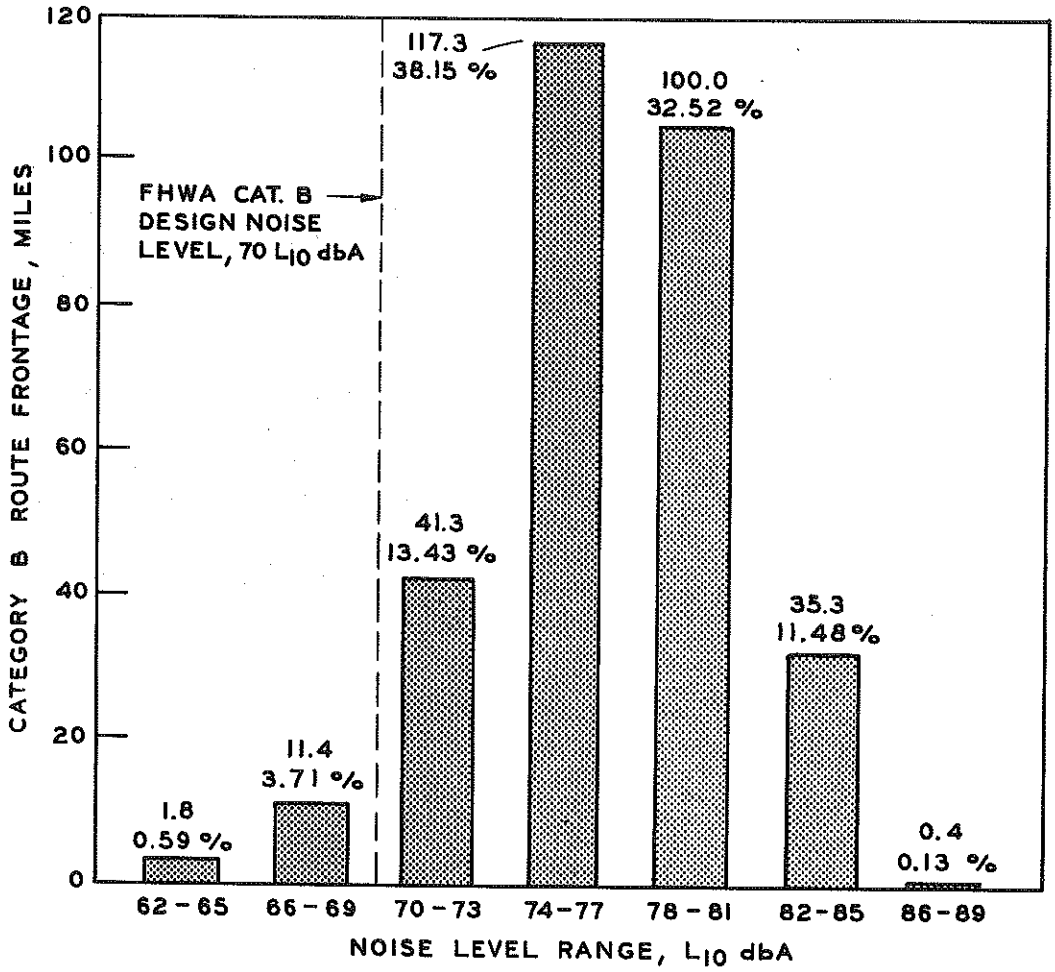


Figure 2. Michigan limited access freeway traffic noise inventory Category B distribution (307.5 miles total).

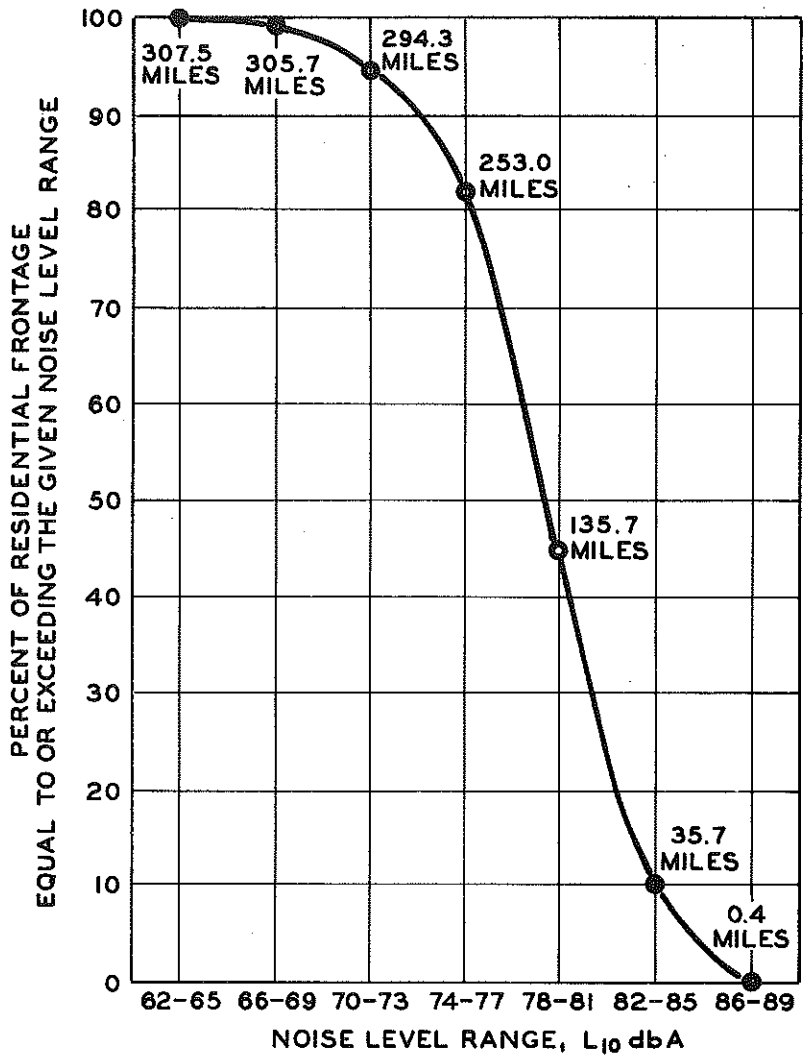


Figure 3. Category B (residential) cumulative distribution (307.5 miles total).

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	29.4	15.1	0.1
I 96	0.0	0.5	1.0	15.4	7.3	0.3	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	0.0	0.6	3.0	0.0	0.0	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	0.0	0.7	4.6	1.6	0.0	0.0	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	0.0	0.5	3.7	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	0.0	0.3	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	1.8	11.4	41.3	117.3	100.0	35.3	0.4
Percent	0.59	3.71	13.43	38.15	32.52	11.48	0.13
Cumulative Total	307.5	305.7	294.3	253.0	135.7	35.7	0.4
Cumulative Percent	100.00	99.42	95.71	82.28	44.13	11.61	0.13

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

Type of Route	Residential Frontage With $L_{10} \geq 70$ dbA, miles		Total Cost, millions	Federal/State Cost Sharing Ratio	State's Cost, millions
	Total	Without Service Drive (approx.)			
Interstate	193.5	120	88.7	90/10	8.87
US and M	100.8	80	59.1	70/30	17.73
Totals	294.3	200	147.8		26.60

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.

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.

APPENDIX A

BUREAU OF HIGHWAYS
GUIDELINES FOR HIGHWAY NOISE BARRIERS

MICHIGAN DEPARTMENT OF STATE HIGHWAYS
AND TRANSPORTATION

BUREAU OF HIGHWAYS
GUIDELINES FOR HIGHWAY NOISE BARRIERS

I PURPOSE:

To establish guidelines for use by the Bureau of Highways in the planning, design and construction of earth mound or wall type barriers to abate noise radiating from Michigan highways. Also, for guiding the procedures for review and issuance of construction permits for barriers within the highway right of way, to be financed and built by private interests; further to provide guidance with respect to the matter of barrier funding — public, private or shared.

The guidelines have been established to insure 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, they provide the decision maker with answers as to whether a noise barrier should be built, or permitted; if it is to be built by the Bureau 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 urban, suburban and rural FAI, FAP and FAS Michigan State trunkline projects covered by Federal Highway Administration Draft FHPM 7-7-3 (update of FHWA PPM 90-2 to include the congressional directive, with respect to noise, contained in the Federal-Aid Highway Act of 1973).

III EXCEPTIONS:

The conditions set forth here in answering the above questions will be complied with by Bureau personnel unless an exception has been authorized, in writing, by the Deputy Director, Bureau of Highways.

4-23-74
12-4-74
12-19-74
2-4-75
4-10-75
9-11-75

IV CRITERIA FOR DECISION AS TO WHETHER OR NOT A PROPOSED BARRIER SHOULD BE BUILT, OR A PERMIT ISSUED:

A. DEVELOPED LANDS:

The first decision with respect to any noise problem at a developed site will be whether or not construction of a noise barrier in the highway right of way is justified. An affirmative decision requires that all of the following conditions be met.

1. For a residential area the noise problem must be brought to the Bureau's attention by the citizens affected or by an agency or organization representing their interests.

2. The request for noise abatement must be supported by a formal, local government resolution.

3. The local government must furnish the Department with documentation of its existing future land use controls, or which demonstrates or supports that government's intention to control future land development within its boundaries, so as to reasonably preclude the necessity for noise barriers in highway rights of way adjacent to such future developments.

4. 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.

5. In any FHPM 7-7-3 Category B area the 70 dbA L_{10} limit must be exceeded during that area's sound sensitive hours (usually 9:00 p.m. to 12:00 midnight).

4-23-74
12-4-74
12-19-74
2-4-75
4-10-75
9-11-75

6. Highway traffic noise must be the principal constituent of the area noise.

7. The relationship between barrier cost and estimated value of area to be protected, must be in accordance with Figure 1 to qualify for affirmative consideration of a noise barrier. (In general a barrier which costs more than 50 percent of the value of the area being protected, shall be deemed unjustified.)

8. In general, noise abatement projects will be programmed in accordance with the priorities of Figure 1.

9. The noise abatement benefits must be judged by the Bureau to outweigh the overall social, economic and environmental costs of the project.

10. There must be no foreseeable, future public need for the highway right of way on which the noise barrier is to be erected.

11. It must be reasonably proven that the subject noise barrier should be built on highway right of way rather than on adjacent non-highway property.

12. The standards and specifications of Section VI of this Guideline must be fully complied with.

13. The plans must be reviewed and approved by the Bureau.

4-23-74
12-4-74
12-19-74
2-4-75
4-10-75
9-11-75

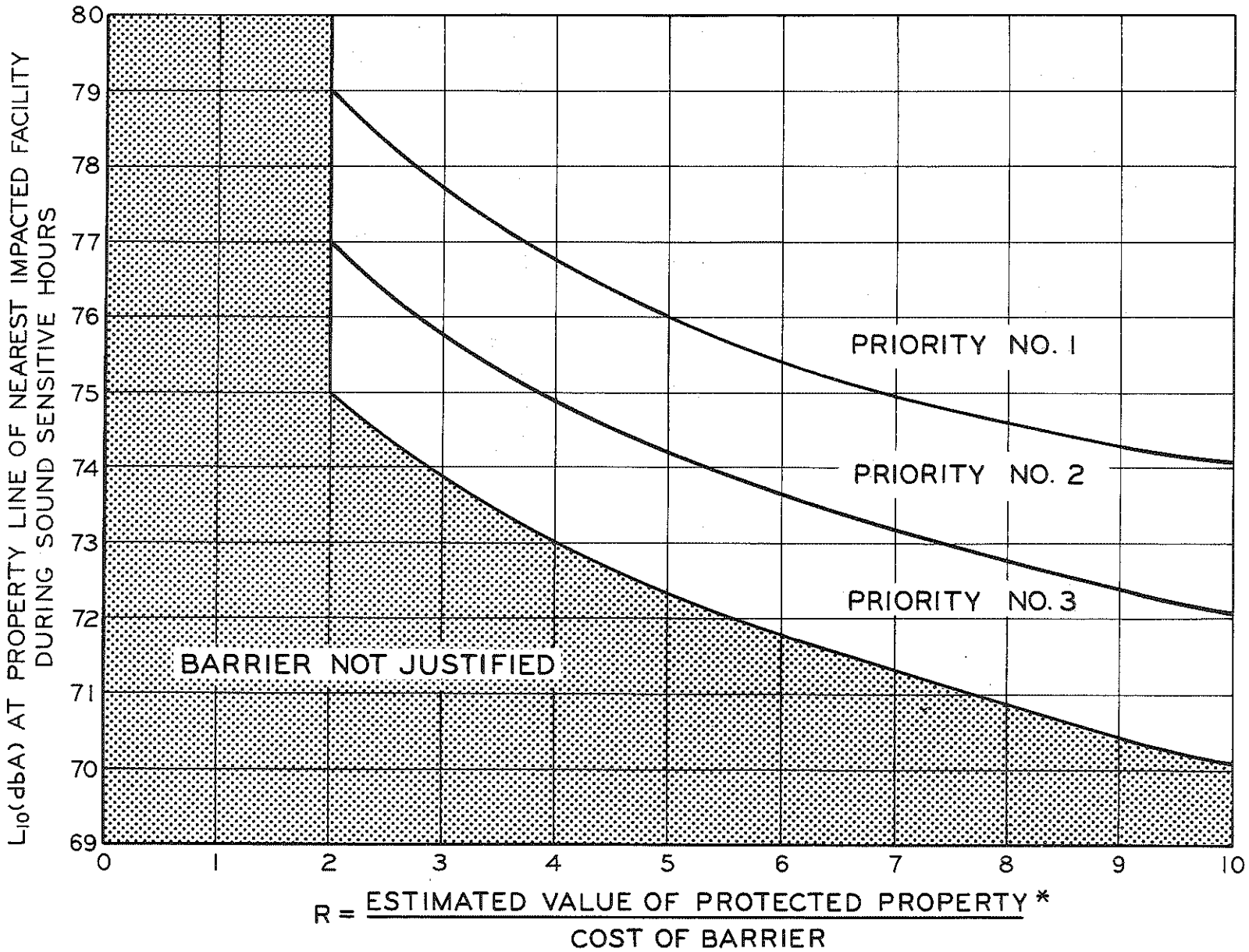


Figure 1

*Property enclosed by contour of appropriate FHPM 7-7-3 Design Noise Level.

4-23-74
12-4-74
12-19-74
2-4-75
4-10-75
9-11-75

B. UNDEVELOPED LANDS:

To justify, approve or permit erection of a noise barrier in the highway right of way adjacent to undeveloped lands shall require that the following conditions be met.

1. No prudent or feasible alternatives to such erection exist.

2. The local government unit must approve placement of the barrier in the highway right of way.

3. The barrier will be non-Departmentally funded.

4. Items 3, 4, 5, 6, 7, 9, 10, 12, and 13 of Section IV also apply.

5. The barrier must be maintenance free (vegetation covered earth mound would qualify), and wall-types will not be permitted.

4-23-74
12-4-74
12-19-74
2-4-75
4-10-75
9-11-75

V FUNDING NOISE BARRIERS

Funding for noise barriers will be arranged by the Department, or will be the responsibility of the affected property owners. When arranged by the Department it will include: (1) city participation as indicated by resolution and as required by state statute, (2) Federal Highway Administration participation as applicable and (3) Department participation as applicable. The source of funds will be determined as follows:

A. The Department will arrange barrier fundings when the potentially impacted facility (usually a residence or group of residences) was in existence on the date of construction contract award. "In existence" for a potentially impacted facility will be defined as beginning on the date of building permit issuance.

B. If the facility proposed for noise barrier protection was developed after the roadway, but it can be demonstrated that highway noise has increased by 10 dbA, or more, since the facility's construction then the Department will arrange funding. (This assumes that at the time of impacted facility construction the subject highway was completely open and had been open sufficiently long for traffic to stabilize.)

C. If neither A nor B above apply, funding will be a responsibility of the property owners.

4-23-74
12-4-74
12-19-74
2-4-75
4-10-75
9-11-75

VI BARRIER CONSTRUCTION AND PERFORMANCE SPECIFICATIONS.

For purposes of safety, economy, esthetics and effective noise abatement any noise barrier constructed by the Bureau or permitted by the Department to be constructed by others, within the right-of-way or on excess property, 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, may be no closer than 30 ft from the edge of pavement. Also, the toe of any earth mound may not be closer than 30 ft from the edge of pavement.

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 establishment shall be in accordance with the Standard Specifications and current special provisions.

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 side of the excess property line, whichever is closest to the roadway. (There could be cases where adjacent excess property, by itself, is sufficient to accomodate the earth fill.)

G. Construction of any earth mound within the right-of-way must be completed within six (6) months after start of construction.

H. 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.

I. 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.

J. Where existing utilities must be adjusted or relocated due to noise barrier construction the work shall be coordinated with the affected utilities.

4-23-74 2-4-75
12-4-74 4-10-75
12-19-74 9-11-75

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 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
ALLEGAN (#3)														
US 131	48.6	0.8		47.8				0.1	0.7					
I 196	50.8	0.2	0.1	50.5					0.2					
Totals	99.4	1.0	0.1	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					1.0					
M 47	4.2		0.3	3.9										
US 10	23.2	1.3		21.9					0.8	0.5				
I 75	56.6	1.5		55.1				0.1	0.4	1.0				
Conn. 14	4.8	0.4		4.4					0.4					
Totals	91.6	4.2	0.3	87.1				0.1	2.6	1.5				
BERRIEN (#11)														
I 94	85.4	3.9	0.4	81.1					0.7	3.2				
I 196	15.8	1.1		14.7					1.1					
Totals	101.2	5.0	0.4	95.8					1.8	3.2				
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	0.0	49.8					0.4					
I 94	63.0	3.0	0.3	59.7						0.8	2.2			
I 194	6.8	1.3	0.3	5.2				1.3						
Totals	120.0	4.7	0.6	114.7				1.3	0.4	0.8	2.2			

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
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	19.0	6.9	0.5	11.6			0.7	4.6	1.6					
Totals	151.4	24.6	8.0	118.8			1.1	9.4	6.3	3.8	4.0			
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					
I 496	16.8	4.8	3.9	8.1			1.9	1.3	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	1.9				
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			
LAPEER (#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				
Totals	44.4	19.7	3.8	20.9			0.1	1.5	11.3	6.8				
MIDLAND (#56)														
US 10	52.4	6.0	1.1	45.3				1.0	5.0					
M 20	4.8	0.8	1.8	2.2		0.3	0.5							
Totals	57.2	6.8	2.9	47.5		0.3	0.5	1.0	5.0					

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
MONROE (#58)														
US 23	51.0	1.0	1.8	48.2						1.0				
I 75	53.8	1.6		52.2						1.6				
Totals	104.8	2.6	1.8	100.4						2.6				
MONTCALM (#59)														
US 131	18.8			18.8										
Totals	18.8			18.8										
MUSKEGON (#61)														
US 31	51.0	6.5	1.3	43.2			0.6	1.4	3.0	1.5				
I 96	11.0	0.6		10.4				0.2	0.4					
Totals	62.0	7.1	1.3	53.6			0.6	1.6	3.4	1.5				
OAKLAND (#63)														
M 39	2.4	1.6		0.8					1.6					
M 59	20.6	4.1	0.4	16.1			0.2	2.9	1.0					
US 10	9.8	1.5	6.6	1.7				1.0		0.5				
I 75	85.2	19.0	6.9	59.3				0.6	6.2	12.2				
I 96	12.4	6.1	3.6	2.7				0.5	0.9	4.7				
I 696	13.4	4.2	0.3	8.9					0.5	3.7				
BI 75	2.4	0.9		1.5		0.3	0.6							
Totals	146.2	37.4	17.8	91.0		0.3	0.8	5.0	10.2	21.1				
OCEANA (#64)														
US 31	14.4			14.4										
Totals	14.4			14.4										
OGEMAW (#65)														
I 75	30.6			30.6										
Totals	30.6			30.6										

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
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					
I 96	39.0	2.5	0.6	35.9				0.3	1.7	0.5				
I 196	30.0	0.2		29.8					0.2					
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	4.2				
SHIAWASSEE (#76)														
I 69	33.0	0.6		32.4					0.6					
Totals	33.0	0.6		32.4					0.6					
ST. CLAIR (#77)														
M 21	12.6	0.9		11.7		0.4	0.5							
I 94	50.2	2.4	0.4	47.4			0.4	1.1	0.9					
Totals	62.8	3.3	0.4	59.1		0.4	0.9	1.1	0.9					
VAN BUREN (#80)														
I 94	48.2	1.3		46.9					1.1	0.2				
I 196	27.2	1.6		25.6					0.8	0.8				
Totals	75.4	2.9		72.5					1.9	1.0				

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
WASHTENAW (#81)														
M 14	16.8	1.6	0.4	14.8				0.3	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	139.0	11.9	3.5	123.6				0.3	1.6	3.6	6.4			
WAYNE (#82)														
M 39	23.2	16.6	2.5	4.1					4.1	8.4	4.1			
US 10	22.8	11.6	11.2						9.9	1.7				
I 75	60.6	23.7	20.1	16.8				1.1	9.7	8.7	3.9	0.3		
I 94	72.2	31.6	17.0	23.6					12.3	14.9	4.4			
I 96	9.3	6.3	3.0						6.3					
I 275	8.0	3.6	0.9	3.5				0.6	3.0					
I 375	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				2.0	45.3	33.7	12.4	0.3		
WEXFORD (#83)														
US 131	7.0			7.0										
Totals	7.0			7.0										
Grand Total	3,083.2	307.5	137.4	2,638.3		1.8	11.4	41.3	117.3	100.0	35.3	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.