

APPLICATION FOR FEDERAL FINANCIAL
PARTICIPATION IN TRAFFIC NOISE
BARRIER CONSTRUCTION ALONG A
SELECTED SEGMENT OF I 75 IN THE
CITY OF TAYLOR IN SOUTHEASTERN MICHIGAN



MICHIGAN DEPARTMENT OF
STATE HIGHWAYS AND TRANSPORTATION

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PARTICIPATION IN TRAFFIC NOISE
BARRIER CONSTRUCTION ALONG A
SELECTED SEGMENT OF I 75 IN THE
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Application is made to the Federal Highway Administration
Under Section 114 of the Federal-Aid Highway Act of 1973,
Section 109(i), Title 23 U.S.C.
Noise Standards and Procedures for Type II Projects

Research Laboratory Section
Testing and Research Division
Research Project 73 TI-191
Research Report No. R-1017

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

PREFACE

The purpose of this document is to describe and justify a traffic noise abatement project for which Federal Financial participation is requested. Specifically, it is proposed to construct 2,000 lin ft of traffic noise barrier along the west side of I 75 approximately between Eureka Rd and the Detroit, Toledo and Ironton Railroad in the city of Taylor.

The authority for the application herein being made to the Federal Highway Administration derives from Section 114 of the Federal-Aid Highway Act of 1973, Section 109(i), Title 23 U.S.C., Noise Standards and Procedures for Type II projects.

NOISE ABATEMENT APPLICATION

Application

The Michigan Department of State Highways and Transportation is requesting Interstate Financial participation by the Federal Highway Administration in the noise abatement measures detailed here for the described segment of I 75.

Authority

The Federal Highway Noise Standards were first promulgated as Federal Highway Administration Policy and Procedure Memorandum 90-2 on January 24, 1973. On February 20, 1974, "Interim Guidelines for Noise Abatement Projects on Previously Constructed Highways," was issued. These existing issuances have been consolidated by the Federal-Aid Highway Program Manual, Volume 7, Chapter 7, Section 3 (FHPM 7-7-3), effective May 24, 1976. Under these guidelines, Regional Federal Highway Administrators or delegated Division Engineers were given authority to approve noise abatement projects for previously constructed highways on any Federal-Aid system, provided:

- 1) A noise analysis has been performed using the general guidelines outlined in FHPM 7-7-3,
- 2) A determination has been made that the noise abatement projects are clearly of high priority,
- 3) The noise abatement project will achieve a significant noise reduction,
- 4) The noise abatement benefits are judged to outweigh the overall economic and environmental cost of the project,

5) The noise abatement measures are for noise-sensitive developed activities which are in existence on May 24, 1976.

Selection of I 75 Segment

The Michigan Department of State Highways and Transportation has selected the herein described segment of I 75 to be the subject of an optional application for Federal-Aid on a traffic noise abatement project. Under the permissive authority granted by the Federal-Aid Highway Act of 1973 the Federal Highway Administration has established regulations for dealing with noise on "previously constructed" highways. These are designated as Type II projects (location approval received prior to July 1, 1972 and authorization to advertise for the major grade and drain elements granted prior to July 1, 1976) and are undertaken at the option of the State Highway agency.

The subject route segment of I 75 is located along the southern edge of the Metropolitan Detroit area. The area immediately adjacent to the freeway is occupied by a moderate density group of single-family dwellings.

The freeway is composed, generally, of two roadways of three lanes each, separated by a 46-ft median. It is a limited access facility built to Interstate standards. The selected segment studied here is primarily a suburban facility and is elevated throughout.

The decision to apply noise abatement procedures to the subject roadway segment, and as to the type or types of abatement devices to use, is based primarily on its high noise levels. It would probably fall in the 60th to 70th noise level percentile of all Michigan limited access freeway residential frontage where the FHWA L₁₀ 70 dbA standard is being exceeded. The percentile level for a distribution of freeway residential frontage which is more readily treatable (no service drives between freeway and residences) would be considerably higher.

Certain preceding decisions and other factors also form part of the basis for this application:

- 1) Noise levels along the route in future years will almost certainly be much lower than those at the time of opening. This should occur because of eventual enforced statutory limits on the noise of both new and in-service vehicles, technological improvements in the noise abatement aspects of vehicle design and manufacture, and possibly from reduced future traffic volumes and speeds resulting from energy conservation measures. However, because of the uncertainty of the timetable for these future events, and of the magnitude of the reductions that may result, the Department believes it appropriate to treat the problem as it appears to exist at the present — not at some hopefully quieter future time.

2) The applicable Federal regulations for Type II projects do not require that the Federal noise standards be met to obtain FHWA financial participation. The Department believes, however, that every effort should be made to achieve those standards. Therefore, they are designed for in this project.

3) Care must be exercised in the selection and design of any barrier walls to guard against light reflections, sight distance problems, to minimize the hazards of sharp shadows falling across the roadways, and to provide for drainage and snow removal. Because of the nature of this project, these problems are concluded to be minimal and do not require any extensive or involved remedies.

Selection of this particular segment of I 75 for noise abatement application is not meant to imply that it is the only noise problem area along I 75, or that it precludes future noise abatement application for other segments of this freeway. The segment was selected because of a serious noise problem in the adjacent residential area brought to the Department's attention by objections and protests from the area residents and requests from city and state officials and legislators.

NOISE ANALYSIS

Definitions

In order to prevent any ambiguities, several terms used in the FHPM 7-7-3 Federal Highway Noise Standards are given Michigan definitions as follows:

1) Significant Noise Reduction - An attenuation of at least 6 dbA (preferably over 10 dbA), in the L₁₀ noise level at the protected human activity facility nearest the barrier.

2) Noise Abatement Benefits - Any improvement in, or the betterment of, the environmental noise conditions associated with humans.

3) Noise Sensitive Developed Activities - Those portions of land which contain improvements or activities devoted to frequent human use or habitation. For improvements under construction or subsequently added, the date of issue of a building permit establishes the date of existence.

Analysis

Existing noise levels were measured at representative locations in the subject area during off-peak traffic flow. These L₁₀ levels ranged from 73 to 79 dbA at the freeway R-O-W.

Based upon the traffic data given in Table 1, and the appropriate plan and elevation sheets, L_{10} noise levels were predicted as outlined in FHPM 7-7-3. The resulting L_{10} levels for the existing year (1973) ranged from 76 to 80 dbA and for the future year (1990) also ranged from 76 to 80 dbA. The L_{10} dbA contours for the existing and future years were also predicted and are shown in Figure 1.

The residential communities bordering on I 75 and the plat registration or site approval dates also are identified on Figure 1. This information was obtained from the public records of the city of Taylor.

Normally, the funding for noise abatement projects on previously constructed highways, such as this portion of I 75, will be requested by the Department only for those noise-sensitive developed activity areas which existed prior to the date of construction contract award of the highway. In addition, only those noise-sensitive developed human activity areas in which a significant portion of the area has been impacted will be considered for noise abatement measures in this application.

NOISE ABATEMENT ALTERNATIVES

Having identified the existing and predicted noise levels, and thereby becoming aware of the potential problem, it is appropriate to consider the available alternates. It is the Department's opinion that in this case there are essentially only three:

Alternate A - Do Nothing

This alternate calls for no special action for noise abatement. Noise complaints would be rejected because the project predates the Federal Noise Standards.

Alternate B - Build Noise Barriers Along Both Sides of I 75

Under this alternate the Federal residential noise limit of L_{10} 70 dbA and a significant noise reduction would be achieved at all residences within noise-sensitive, developed activity areas which existed prior to the date of construction contract award of the highway.

The existing and future noise predictions were calculated for these non-sensitive areas according to FHPM 7-7-3 and are given in Table 2, and the predicted existing and future no-barrier 70 dbA noise contour is shown on Figure 1.

On the west side of I 75, the impacted residential area would receive existing L_{10} noise levels of 78 to 80 dbA and future L_{10} noise levels of 79 to 80 dbA. The noise barrier required to reduce these noise levels to 70

dbA or less would be 12 ft high and 2,000 ft long, and have an estimated cost of \$200,000. The real estate to be protected has been appraised at \$440,000. The resulting R-value of 2.2 (ratio of 440,000 to 200,000) in combination with the predicted L_{10} dbA noise levels places this project in the "Barrier Justified" area of the Department's Barrier Guidelines (Fig. 2).

That portion of the area on the east side appropriate for inclusion in a R-value determination discloses the following: a 12 ft high, 2,200 ft long barrier with an estimated cost of \$220,000 would be required to shield real estate with an appraised value of \$380,000. The resulting R-value of 1.7 falls into the "Barrier Unjustified" area of the Department's Barrier Guidelines (Fig. 2).

A condominium complex has recently been constructed along the east side of I 75 in the area between the Detroit, Toledo, and Ironton Railroad and Allen Rd. In the above R-value determination for the residential area on the east side, the value of this complex has been omitted since the condominiums were built after the freeway was completed and open to traffic. Also omitted from the calculations is any length of barrier to protect the condominiums.

Since I 75 at this location is an elevated facility, the noise barriers would have to be constructed at the edge of the shoulder, at a distance of 20 ft from the center of the near lane, and would be of the wall type design. The necessary safety considerations such as protecting guardrail where appropriate would be part of the design.

Alternate C - Build Noise Barrier on West Side Only

This alternate calls for construction of a noise barrier along the west side of I 75 only. This noise barrier would reduce the noise levels in all noise-sensitive, developed activity areas, where the noise abatement benefits are judged to outweigh the economic cost of the project, to meet the Federal Noise Standards design limit of 70 dbA for residential areas (Category B land uses). The required noise barrier would be 12 ft high, 2,000 ft long and have an estimated cost of \$200,000. The real estate to be protected has been appraised at \$440,000. The resulting R-value of 2.2 in combination with the existing noise levels of 78 to 80 dbA places this project in the "Barrier Justified" area of the Department's Barrier Guidelines (Fig. 2).

Since I 75 at this location is an elevated facility, the noise barrier would have to be constructed at the edge of the shoulder, at a distance of 20 ft from the center of the near lane, and would be of the wall type design. The necessary safety considerations such as protecting guardrail where appropriate will be part of the design.

The residential area for which the noise barrier is proposed constitutes a severe environmental noise impact as demonstrated by the existing measured and predicted L_{10} noise levels. Moreover, treatment of an area of such high noise levels must be considered a high priority project.

The proposed 2,000 ft of 12 ft high noise barrier would be located between Stations 604+00 and 624+00 of I 75. This barrier wall would be of the concrete slab-panel type as used and proven on I 35W near the University of Minnesota in Minneapolis. These units have reasonable esthetics, practically no maintenance, are relatively easy to erect (need no foundation or upright supports) and meet all physical requirements for noise barriers.

Recommended Alternate

It is the considered recommendation of the Michigan Department of State Highways and Transportation that the Federal Highway Administration approve Interstate participation for implementation of Alternate C as described above and in Figure 1.

MICHIGAN TRAFFIC NOISE ABATEMENT

To support and supplement this application a brief review of the Department's noise abatement related activities has been included below.

Noise Committee

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

Noise Barrier Guidelines

The Department's Bureau of Highways Guidelines for Noise Barriers (Appendix A) was 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, the guidelines 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 specifications.

Vehicle Noise Control Legislation

In July, 1975 Michigan House of Representatives Bill No. 5486 was introduced and referred to the House Committee on Public Safety. The bill

establishes noise emission limits for all new and existing cars, trucks and motorcycles using Michigan roadways. It was prepared by the Michigan Motor Vehicle Noise Control Committee, chaired by a member of Highways and Transportation and with representatives from State Police, Commerce, and Natural Resources plus support personnel from the Governor's Office, Attorney General and the House of Representatives. This group and their respective departments are actively supporting vehicle noise control legislation to supplement that already implemented by the Federal Government for vehicles in Interstate commerce.

Noise Level Inventory

In a further attempt to ensure equitable distribution of Michigan noise abatement funds, a statewide freeway noise level inventory has been conducted. This just completed inventory should enable the state to better determine where its limited noise abatement funds should be utilized to achieve maximum citizen benefit.

Earlier Michigan Noise Barriers

To date several experimental barriers have been constructed in the state, notably a wooden wall along I 75 in Allen Park, a steel wall along I 75 in Southgate and an earth mound along I 94 near Kalamazoo. A questionnaire has been sent out to the residents shielded by the Allen Park wooden wall resulting in over a 50 percent response to the subjective questions. These and other results are being correlated with attenuation measures in order to help the Department select the most visually acceptable and effective noise barriers.

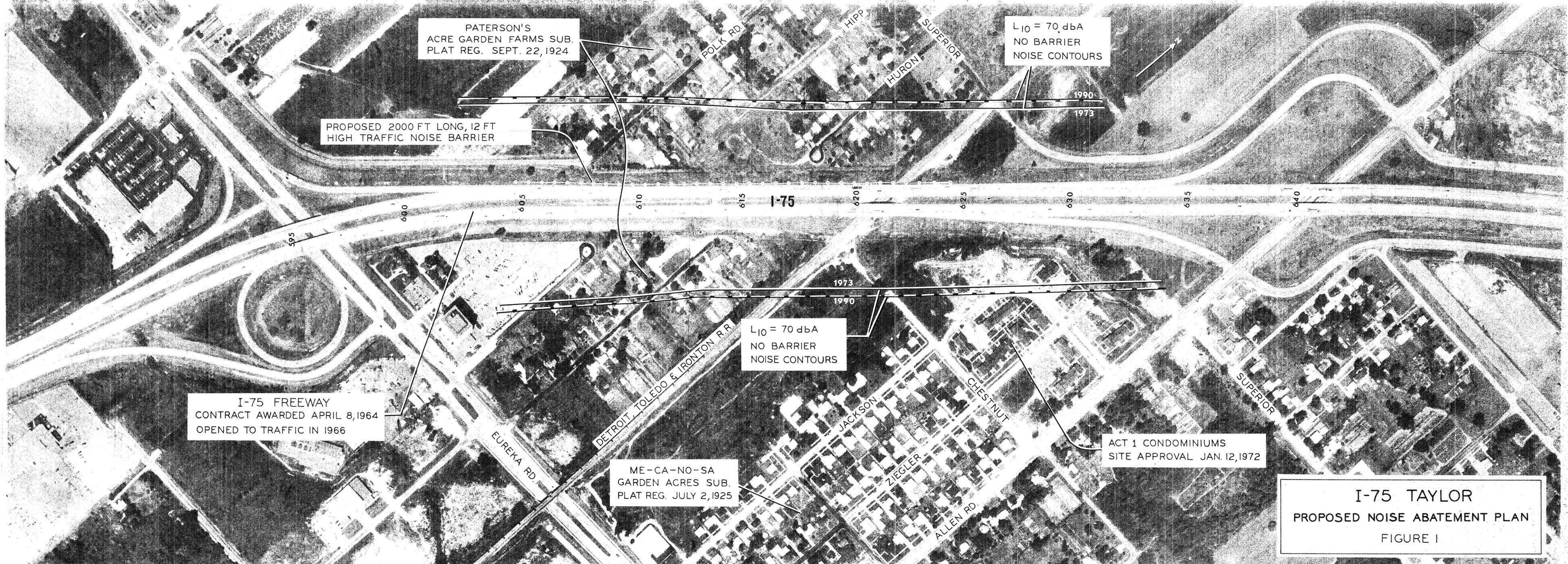
TABLE 1
 INTERSTATE HIGHWAY I 75, CITY OF TAYLOR, MICHIGAN
 TRAFFIC DATA

Item	Roadway Element									
	I 75 Allen to Eureka		I 75 at Allen Rd NB Off Ramp		I 75 at Allen Rd NB On Ramp		I 75 at Eureka Rd SB Off Ramp		I 75 at Eureka Rd SB On Ramp	
	1973	1990	1973	1990	1973	1990	1973	1990	1973	1990
Direction DHV*	3,260	3,850	230	580	350	650	720	650	100	450
DHV Percent Commercial*	10	10	5	5	5	5	5	5	5	5
DHV Auto Speed*	55	55	35	35	35	35	35	35	35	35
DHV Truck Speed*	55	55	35	35	35	35	35	35	35	35
Service C Hourly Volume	3,270	4,080	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200
Service C Auto Speed	55	55	35	35	35	35	35	35	35	35

* Traffic volumes and speeds used in FHPM 7-7-3 noise predictions.

TABLE 2
NOISE LEVEL IDENTIFICATION AND COMPARISON OF
INTERSTATE HIGHWAY I 75 IN THE CITY OF TAYLOR

Area Location	FHPM 7-7-3 Category and Design Level	Measured Ambient L10 Noise Level	Predicted L10 dbA Noise Level at R-O-W				Distance From R-O-W to L10 70 dbA Without Barrier (ft)		R-O-W to Center of Near Lane of I 75 (ft)	Elevated Roadway Height (ft)
			Without Barrier		With 12 ft Barrier		1973	1990		
			1973	1990	1973	1990				
			1973	1990	1973	1990	1973	1990		
Station 602 East - Residential	B(70)	--	78	79	67	67	260	300	100	14
Station 602 West - Undeveloped	D(--)	--	78	79	--	--	---	---	100	14
Station 608 East - Residential	B(70)	--	80	80	69	69	280	310	100	7
Station 608 West - Residential	B(70)	79	80	80	69	69	280	310	100	7
Station 615 East - Residential	B(70)	--	78	79	67	67	240	270	100	17
Station 615 West - Residential	B(70)	--	78	79	67	67	240	270	100	17
Station 619 East - Residential	B(70)	--	76	77	65	65	210	245	125	24
Station 619 West - Residential	B(70)	73	78	79	66	66	235	270	100	24
Station 622 East - Residential	B(70)	--	76	76	64	65	200	235	135	24
Station 622 West - Residential	B(70)	--	78	79	66	66	235	270	100	24
Station 630 East - Residential	B(70)	--	75	76	66	69	190	225	140	18
Station 630 West - Undeveloped	D(--)	--	78	79	--	--	---	---	100	18



PATERSON'S
ACRE GARDEN FARMS SUB.
PLAT REG. SEPT. 22, 1924

PROPOSED 2000 FT LONG, 12 FT
HIGH TRAFFIC NOISE BARRIER

$L_{10} = 70 \text{ dBA}$
NO BARRIER
NOISE CONTOURS

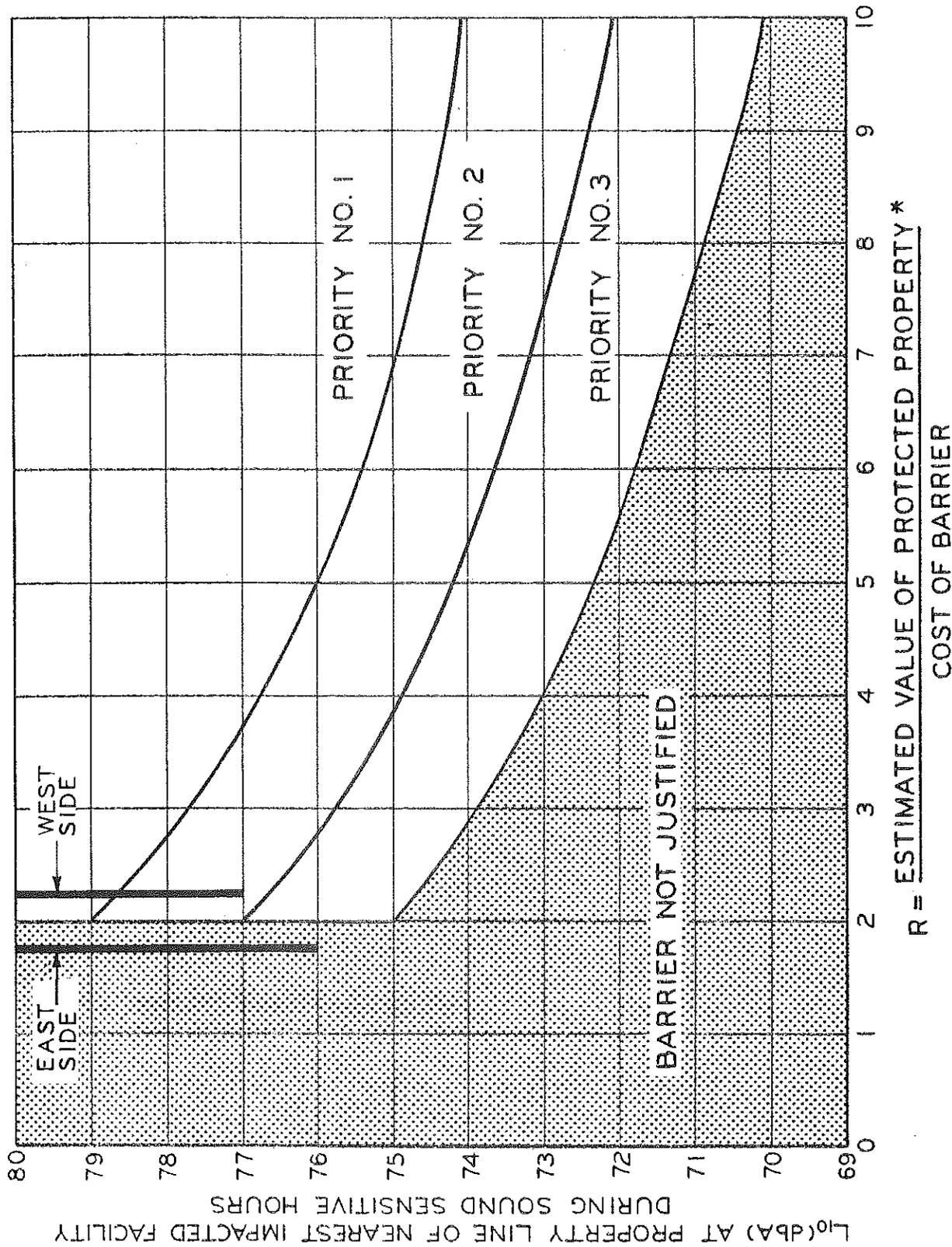
I-75 FREEWAY
CONTRACT AWARDED APRIL 8, 1964
OPENED TO TRAFFIC IN 1966

$L_{10} = 70 \text{ dBA}$
NO BARRIER
NOISE CONTOURS

ME-CA-NO-SA
GARDEN ACRES SUB.
PLAT REG. JULY 2, 1925

ACT 1 CONDOMINIUMS
SITE APPROVAL JAN. 12, 1972

I-75 TAYLOR
PROPOSED NOISE ABATEMENT PLAN
FIGURE I



$$R = \frac{\text{ESTIMATED VALUE OF PROTECTED PROPERTY}^*}{\text{COST OF BARRIER}}$$

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

Figure 2.

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

APPENDIX A
BUREAU OF HIGHWAYS GUIDELINES
FOR
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.

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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 L₁₀ limit must be exceeded during that area's sound sensitive hours (usually 9:00 p. m. to 12:00 midnight).

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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.

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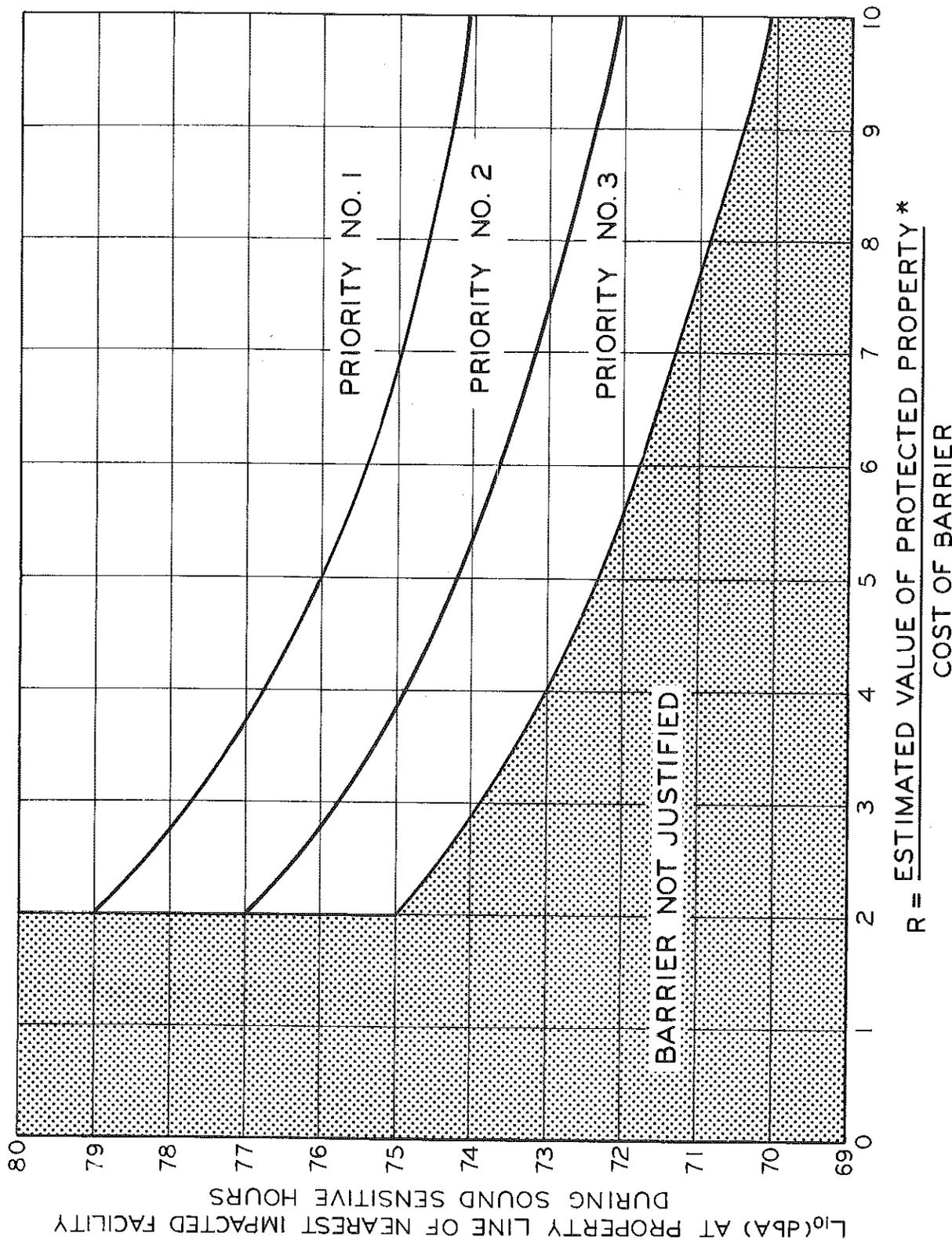
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*Property enclosed by contour of appropriate FHPM 7-7-3 Design Noise Level.

Figure 1

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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.

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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.

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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.

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