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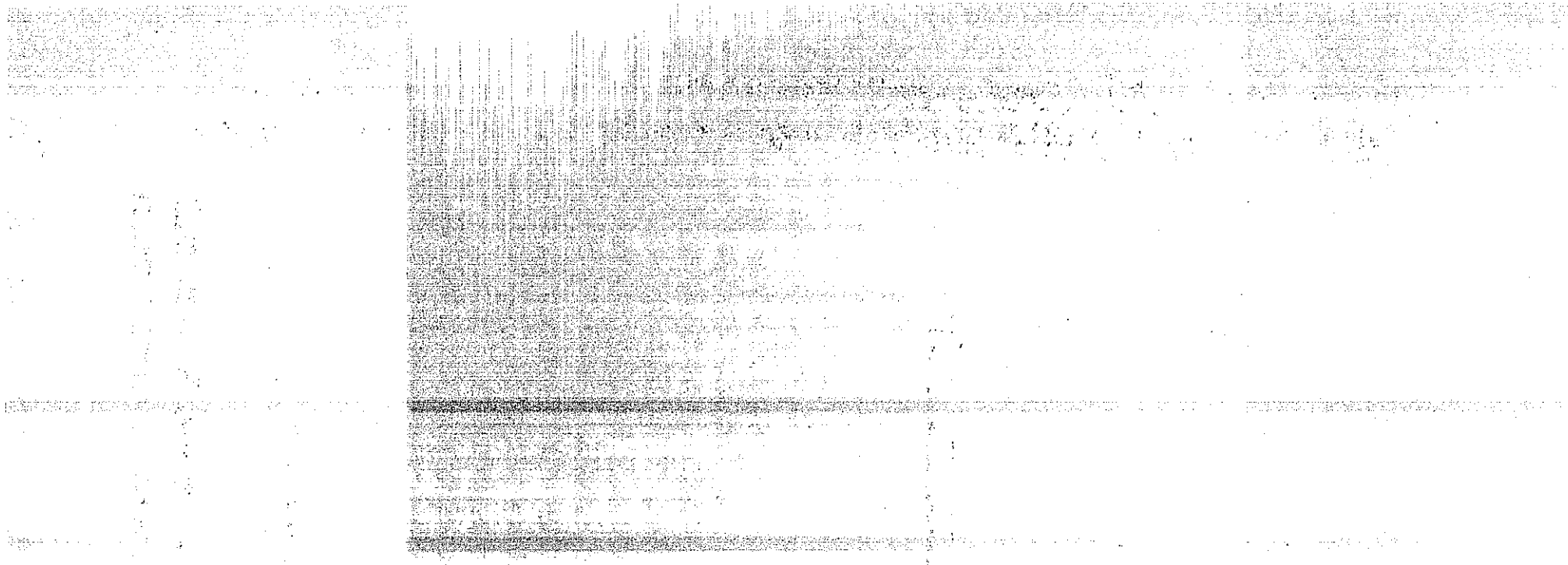
TRANSPORTATION LABORATORY

USED TIRE MATERIAL AS AN ALTERNATE PERMEABLE AGGREGATE

Caltrans



STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING SERVICES
OFFICE OF TRANSPORTATION LABORATORY

USED TIRE MATERIAL AS AN ALTERNATE PERMEABLE AGGREGATE

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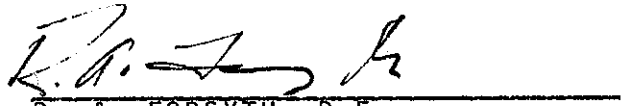

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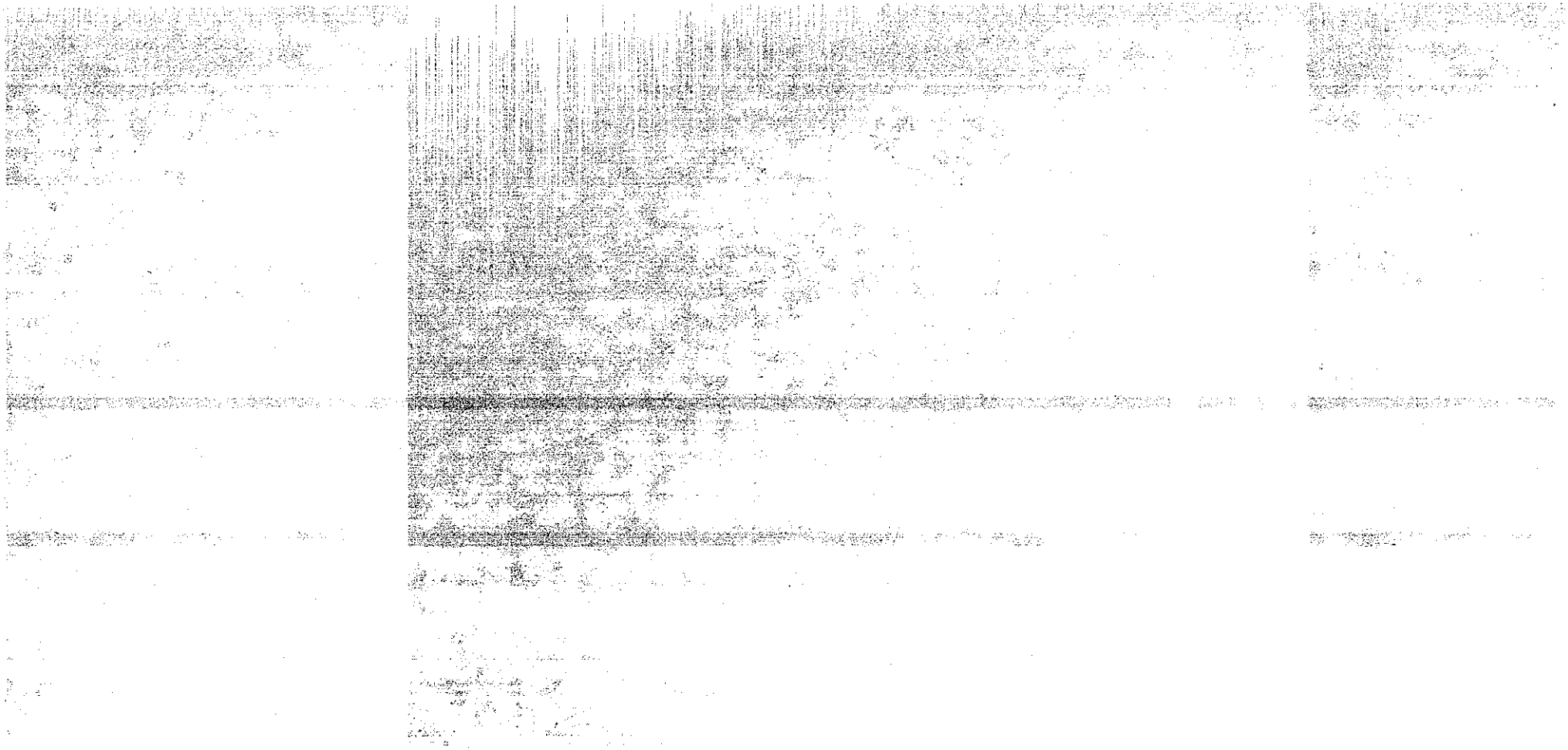

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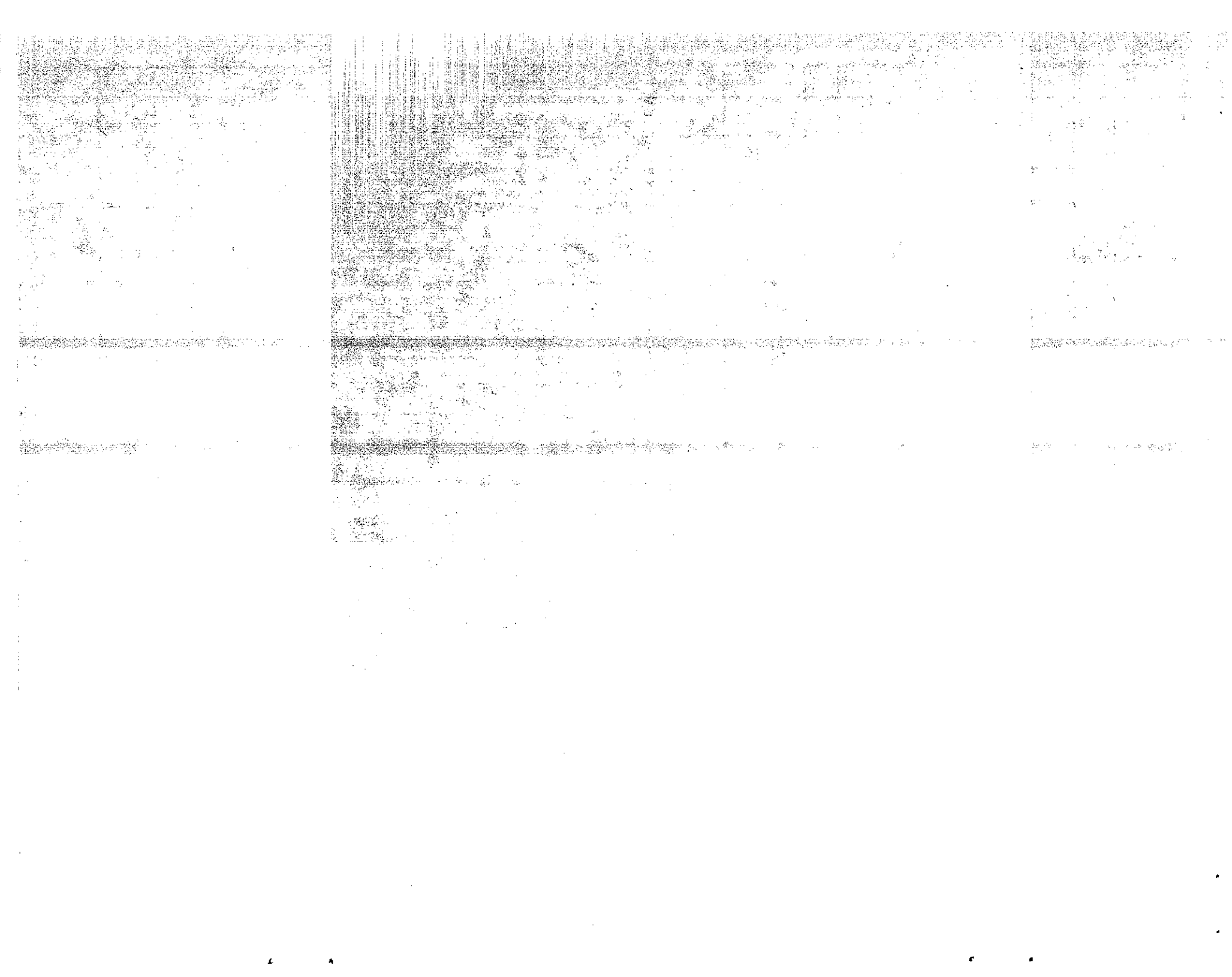

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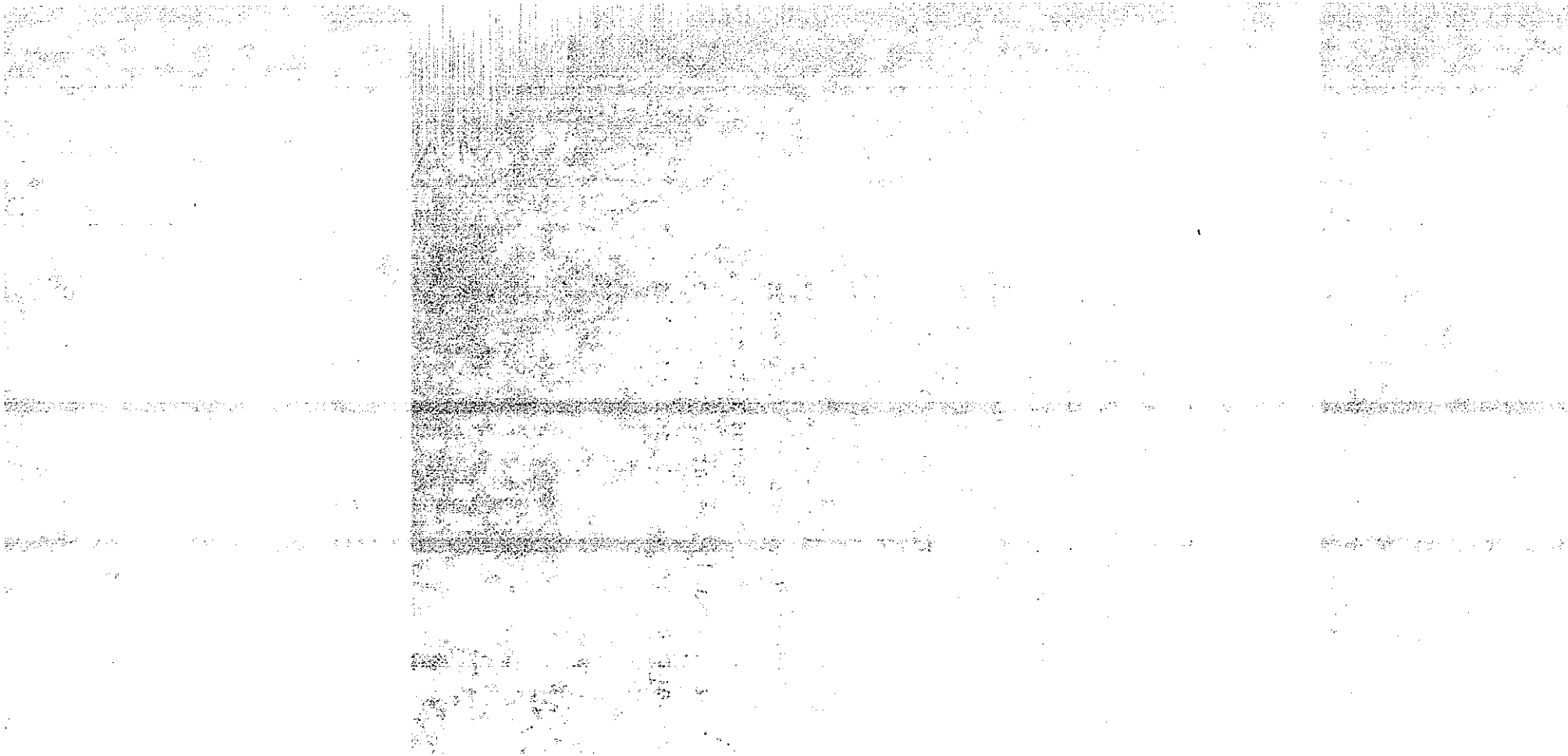
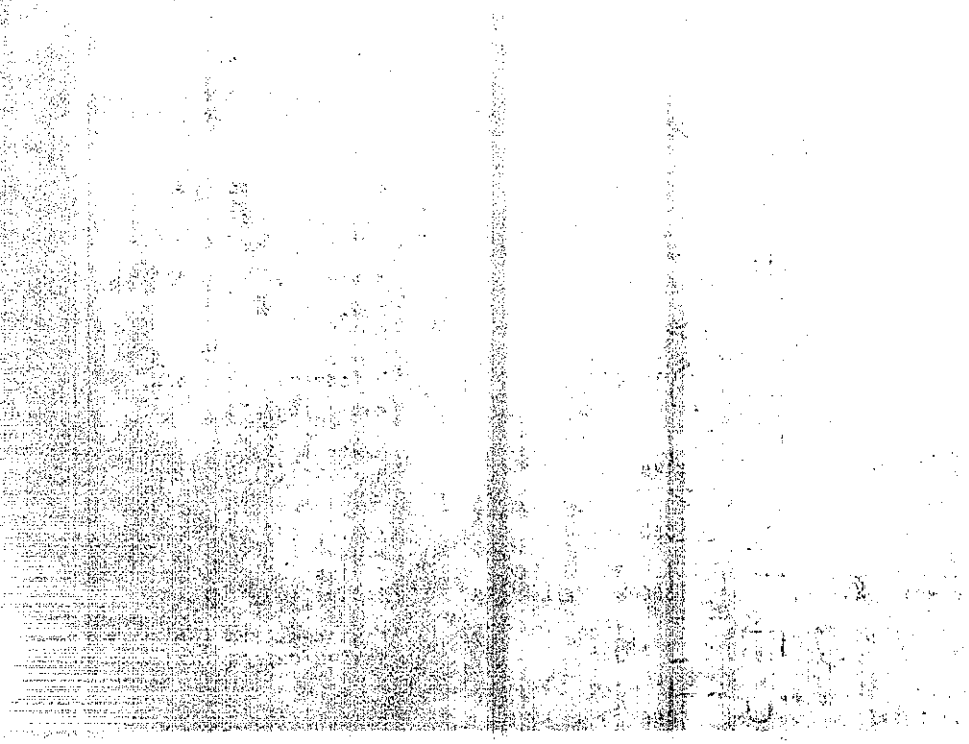


CONVERSION FACTORS

English to Metric System (SI) of Measurement

Quantity	English unit	Multiply by	To get metric equivalent
Length	inches (in)or(")	25.40 .02540	millimetres (mmm) metres (m)
	feet (ft)or(')	.3048	metres (m)
	miles (mi)	1.609	kilometres (km)
Area	square inches (in^2)	6.432×10^{-4}	square metres (m^2)
	square feet (ft^2)	.09290	square metres (m^2)
	acres	.4047	hectares (ha)
Volume	gallons (gal)	3.785	litres (l)
	cubic feet (ft^3)	.02832	cubic metres (m^3)
	cubic yards (yd^3)	.7646	cubic metres (m^3)
Volume/Time (Flow)	cubic feet per second (ft^3/s)	28.317	litres per second (l/s)
	gallons per minute (gal/min)	.06309	litres per second (l/s)
Mass	pounds (lb)	.4536	kilograms (kg)
Velocity	miles per hour (mph)	.4470	metres per second (m/s)
	feet per second (fps)	.3048	metres per second (m/s)
Acceleration	feet per second squared (ft/s^2)	.3048	metres per second squared (m/s^2)
	acceleration due to force of gravity (G)	9.807	metres per second squared (m/s^2)
Weight Density	pounds per cubic (lb/ft^3)	16.02	kilograms per cubic metre (kg/m^3)
Force	pounds (lbs)	4.448	newtons (N)
	kips (1000 lbs)	4448	newtons (N)
Thermal Energy	British thermal unit (BTU)	1055	joules (J)
Mechanical Energy	foot-pounds (ft-lb)	1.356	joules (J)
	foot-kips (ft-k)	1356	joules (J)
Bending Moment or Torque	inch-pounds (ft-lbs)	.1130	newton-metres (Nm)
	foot-pounds (ft-lbs)	1.356	newton-metres (Nm)
Pressure	pounds per square inch (psi)	6895	pascals (Pa)
	pounds per square foot (psf)	47.88	pascals (Pa)
Stress Intensity	kips per square inch square root inch (ksi $\sqrt{in}$)	1.0988	mega pascals $\sqrt{metre}$ (MPa $\sqrt{m}$)
	pounds per square inch square root inch (psi $\sqrt{in}$)	1.0988	kilo pascals $\sqrt{metre}$ (KPa $\sqrt{m}$)
Plane Angle	degrees (°)	0.0175	radians (rad)
Temperature	degrees fahrenheit (F)	$\frac{tF - 32}{1.8} = tC$	degrees celsius (°C)



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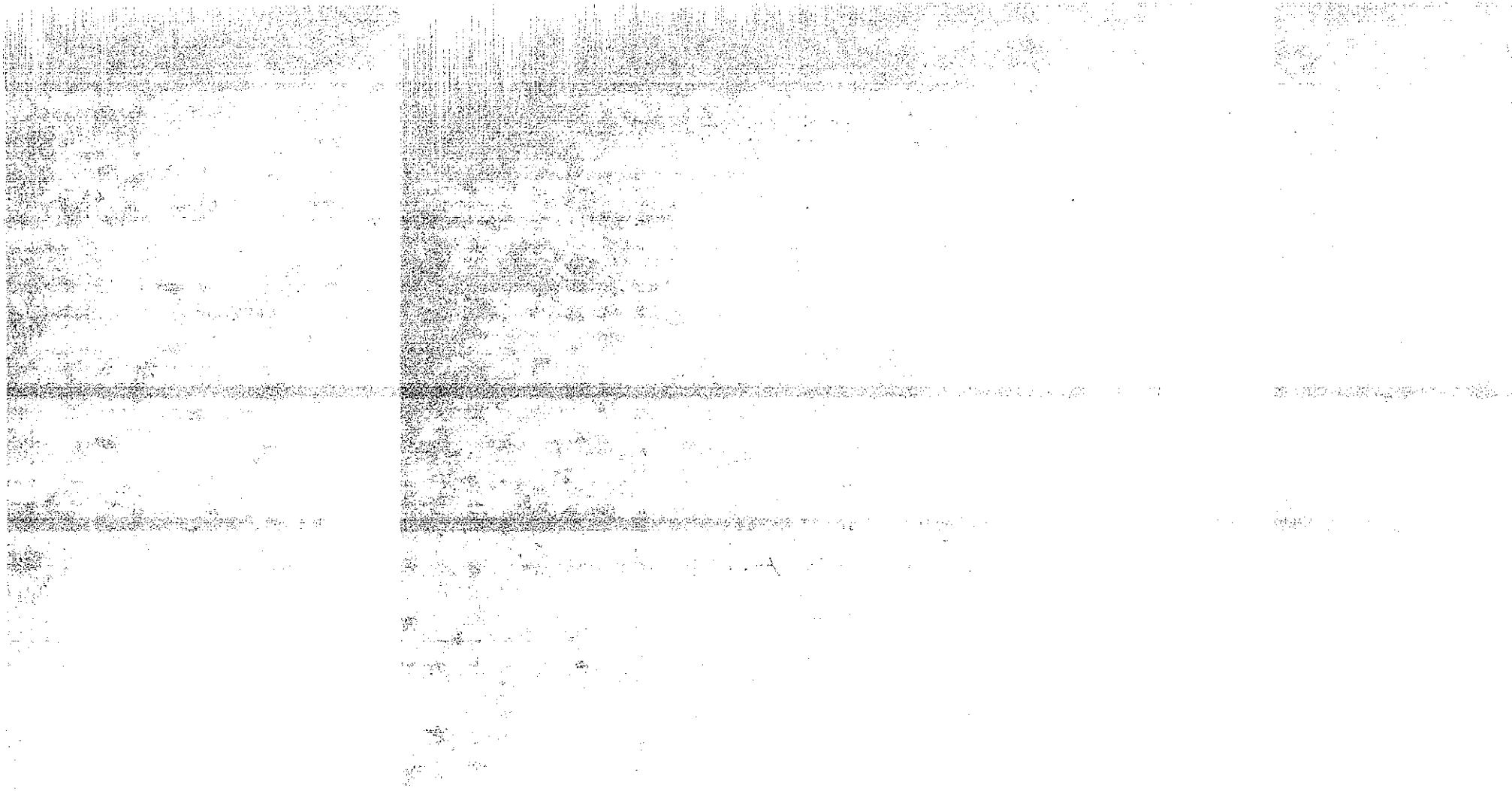


INTRODUCTION

Over the past twenty years there has been a growing concern regarding the volume of waste products requiring disposal and the depletion of natural resources. Out of this concern have arisen some creative attempts to ease both problems, sometimes with a single solution. In several instances, the California Department of Transportation has participated in different aspects of both the problem identification process and the examination of possible solutions. This report is the culmination of one such project.

In 1973, the California Assembly directed the Department of Public Works* to "study the problem of, and possible solutions to, disposing of used tires, giving consideration to the possibilities of recycling such tires..." (House Resolution No. 37 is included as Appendix A). The Department of Tranportation responded in 1975 with a comprehensive report on "The Problems and Possible Solutions to Disposing of or Recycling Used Tires"(1). That report identified some major problems: disposal of used tires in dumps or land fills, abandonment of used tires, and the downward trend in the percentage of recycled rubber used in new rubber products. Among the possible solutions that the report discussed was the use of rubber tires and rubber reclaimed from tires in roadway construction projects. Caltrans has been investigating the use of reclaimed rubber in asphalt-rubber mixtures for roadway construction(2,3)

*Department of Public Works officially became Department of Transportation on July 1, 1973.

and rehabilitation, the inclusion of chopped rubber tire particles in stabilzation of slopes(4), the use of split tires in tire sidewall reinforced earth embankment(5,6), and tire anchored timber (TAT) walls which developed from the earth reinforcement concept(7). Three TAT walls have been constructed by Caltrans. The success of these projects has prompted another state agency to use the concept.

During this same time Caltrans and other public agencies involved in highway construction were experiencing two costly and difficult problems. First, the energy crisis of the mid-70's was driving roadway construction costs up. Secondly, the coastal areas of the state were experiencing a shortage of quality aggregate for use in roadway construction. The latter problem had two facets, the shortage of quality aggregate was creating a high local market price and the cost of hauling aggregate from areas of greater availability was sky-rocketing due to inflated fuel prices. Out of these concerns, rising costs and dwindling aggregate sources in coastal areas, and the prior commitment to investigate uses for recycled tires, grew the proposal to investigate the use of chopped tires as a substitute permeable material.

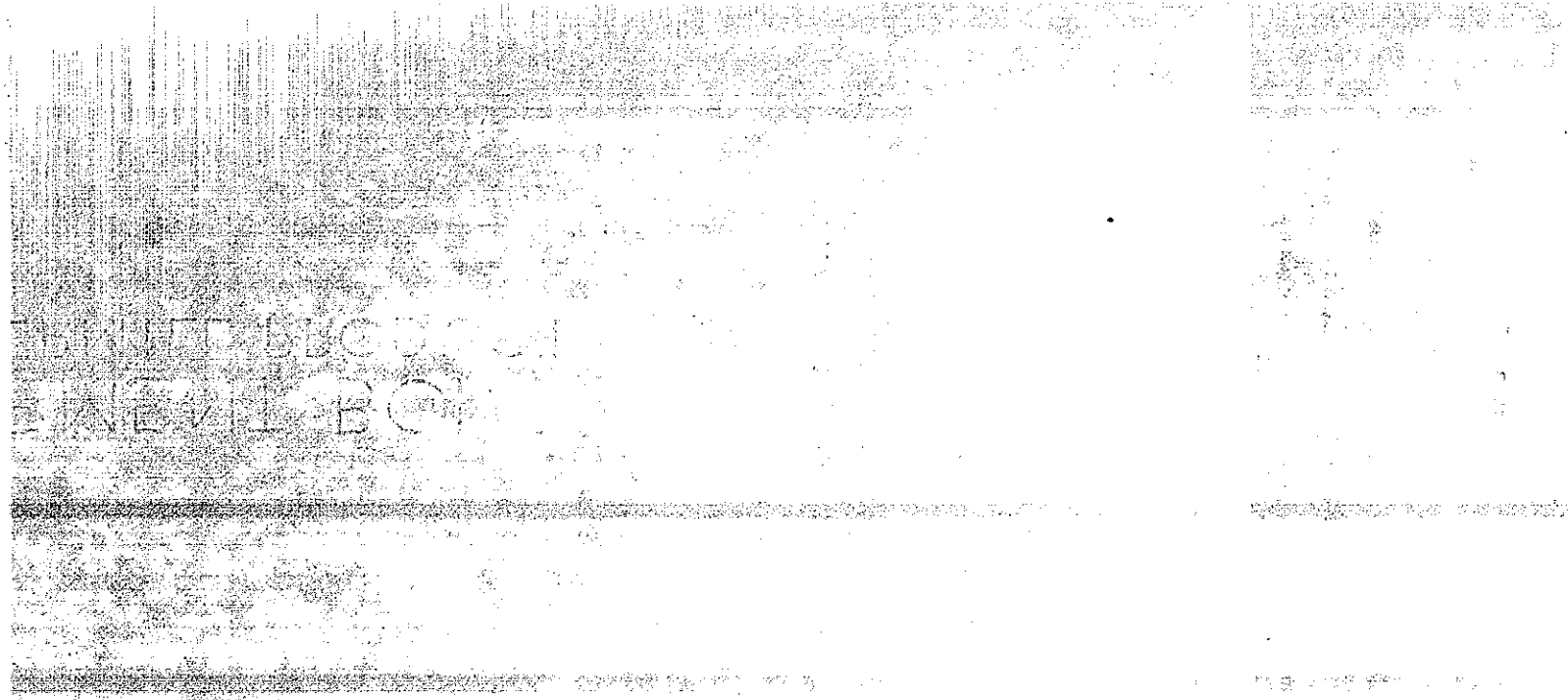
In 1981, it was estimated that between 100,000 and 200,000 cubic yards of permeable material was being used in roadway construction each year. As much as 22% of this permeable material was being used in subdrainage systems which did not require the high structural strength associated with mineral aggregates. In this application, permeable material systems only require high permeability and good filtering capabilities. The use of filter fabric

surrounding subdrainage systems effectively eliminates the need for the filtering capability in the permeable material. Therefore, the use of chopped tires as a subdrainage material could decrease the demand for mineral aggregate and would provide a means of disposal for used tires, if the tire material is sufficiently permeable.

The primary objectives of this project were to:

1. Investigate the availability of used tire material in forms which could be used as permeable material.

2. Evaluate the selected material(s) for permeability, as well as suitability for use in various subdrainage systems.



CONCLUSIONS

Used tires that are coarsely shredded or chopped can be used as an alternative permeable material. Two-inch shredded or chopped tire material has permeability values comparable to the permeability values of 1 1/2" x 3/4" Class 3 coarse aggregate. Subdrainage material must also be durable and remain relatively free of fines over an extended period of time. The relatively inert nature of the elastomer in used tires precludes disintegration and, therefore, will guarantee the integrity of the permeable material throughout the design life. Wrapping drainage material in filter fabric provides the required filtering.

Even though the shredded and chopped tire material deforms under loading and rebounds when the load is removed, that does not eliminate the use of tire material as permeable material. There are applications where the permeable material is not required to bear heavy transient loads (i.e., behind structures outside the travelled way and in deep cut-off trenches where the transient loads are distributed over large areas). Shredded or chopped tires could also be used in stabilization trenches although densification of the tire material may change the permeability. But the permeability requirements for this application are much lower than those available with the tire material as determined by this testing program.

The issue of availability of used tire by-products as an alternative for permeable material is complex. At present, the technology is available to produce shredded tire material which could be used as permeable material.

However, the trend in the used tire recycling industry appears to be toward marketing of used tires (in shredded form) as fuel and development of the technology to produce granulated by-products that are more profitable and have a wider range of uses. At this time, the commitment of the industry to shredded tire fuel has limited the availability of the product for other uses. Projections by industry sources indicate that this commitment is temporary and within 3 to 5 years the bulk of used tires being discarded will be processed for use in granular applications. It would require a major commitment on the part of Caltrans and/or other public agencies to use large quantities of shredded tires to change the present trend.

Even if the product were made available, it is questionable whether it would be economically competitive with aggregate as permeable material. At present, it costs an average of $30 per ton (or $17 per cubic yard) to produce shredded tires. Additional transportation costs, as much as 25¢ per ton-mile (or 15¢ per cubic yard-mile), plus labor and equipment costs must be considered. By comparison, aggregate costs range from $15 to $33 per cubic yard in-place. Therefore, used tire by-products may be eliminated from competition except in areas where aggregate is extremely expensive.

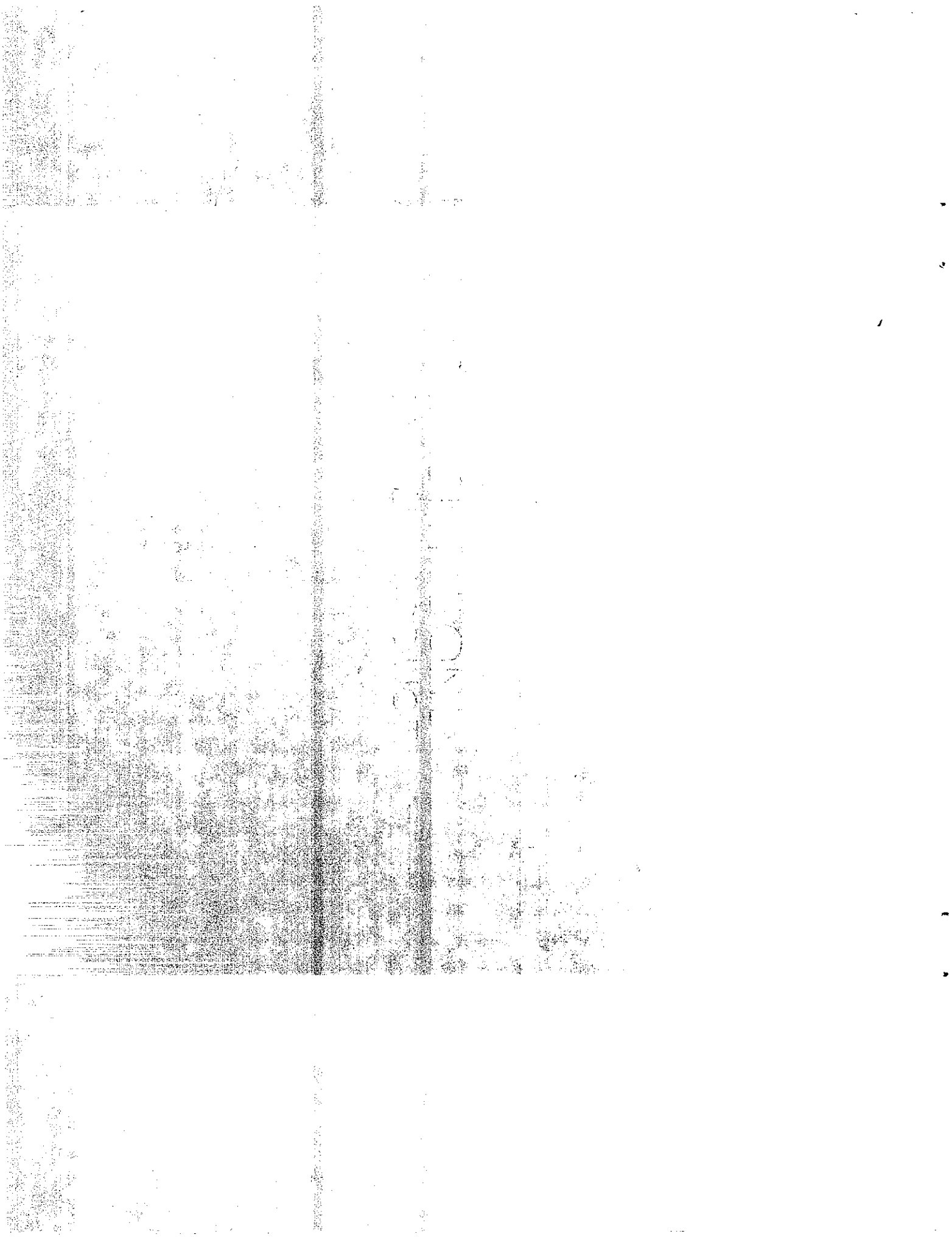
RECOMMENDATIONS

1. Due to the present trends in the availability of used tires, it appears that their use as substitute permeable material is not feasible.

2. In the event that the trend in availability and cost of used tire by-products should change, their use as permeable material should be considered. However, more work should be done to determine the relationship between permeability values and load applications.

IMPLEMENTATION

The conclusions of this study suggest that no implementation of this research is feasible in the foreseeable future.



MATERIALS AND TESTING

Materials

In 1982 an investigation was conducted to determine the availability of used tire material for use as an alternate permeable material. Several processes are used to produce granular tire by-products - used tires are frozen in liquid gases and shattered, used tires are ground, and used tires are buffed in preparation for retreading and the buffings can be reclaimed. The granular material can be screened to various sizes, and can even be processed to dust-like particles. Each of these products was considered, but eliminated from evaluation because the fine-grained nature of the product was thought to present insurmountable construction problems, and availability was limited. Also, the complexity of the processes involved in producing granular tire by-products makes the cost extremely high and, thus, uneconomic. This investigation, therefore, turned to less complex and less costly processes - shredding and chopping.

Extensive telephone inquiries produced only one source on the West Coast that could provide shredded and/or chopped tires for use in a testing program. In November 1982, Caltrans received 2 tons of chopped tires from Waste By-Products of Portland, Oregon. One ton of the material, "tire derived fuel," (Figure 1a) was primarily greater than 2 inches, fairly regular in size and shape, and graded as shown in Figure 1b. The other ton, "truck tire chips with wires," (Figure 2a) contained smaller pieces, appeared to be shredded, contained some fines, and was graded as shown in Figure 2b. In this report, these samples are referred to as "2-inch square" and "2-inch shredded", respectively.

For comparison purposes, a quantity of Class 3 coarse aggregate was obtained from a local source (Figure 3a). The grading of the aggregate (Figure 3b) was specified for the percent passing the 3/4-inch sieve size. The aggregate used was much more open-graded than Class 1 permeable material as required by Standard Specification 68-1.025, and graded similarly to the 2-inch shredded material (Figure 4). Comparison with curves for typical gradations and permeabilities of open-graded bases and filter materials (Figure 5) suggested that the control aggregate would produce a permeability rate between 36,000 and 120,000 ft/day, which is in the upper range of permeability rates normally used for subsurface drainage.

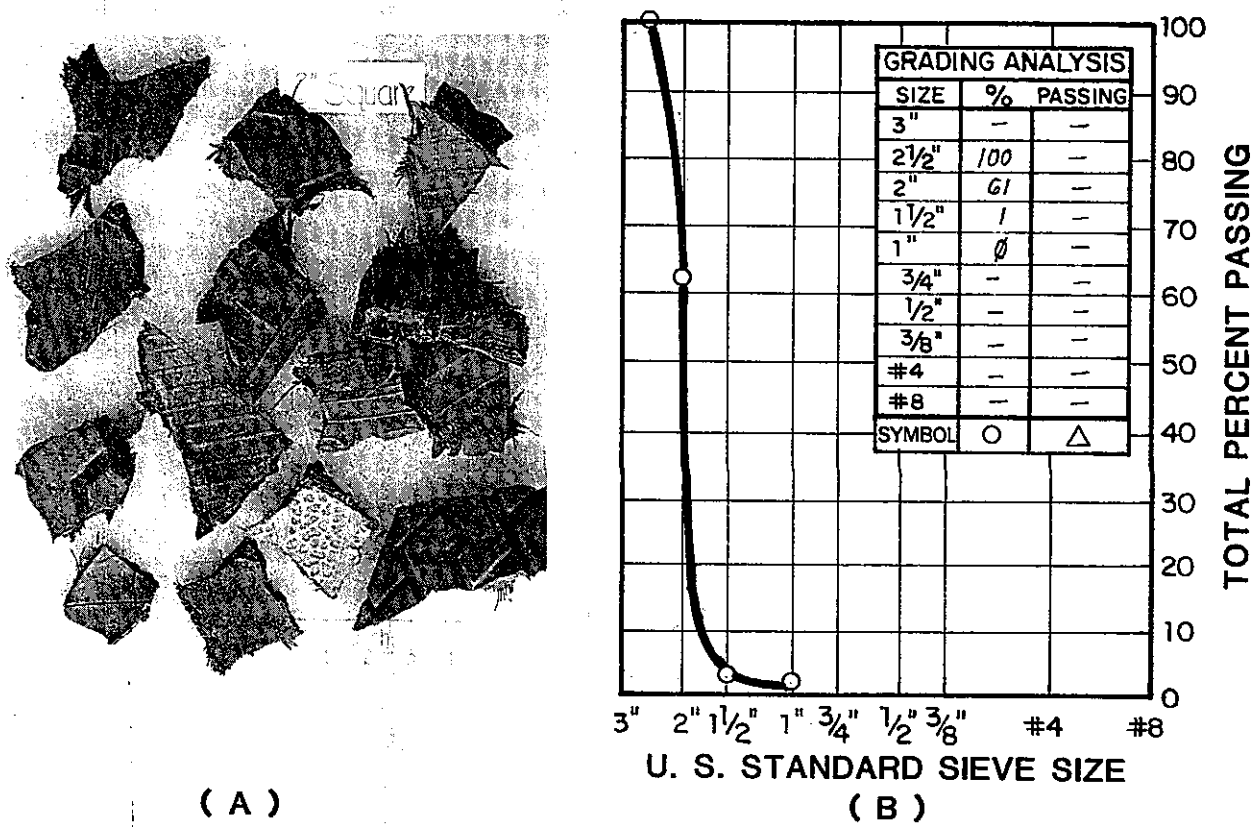
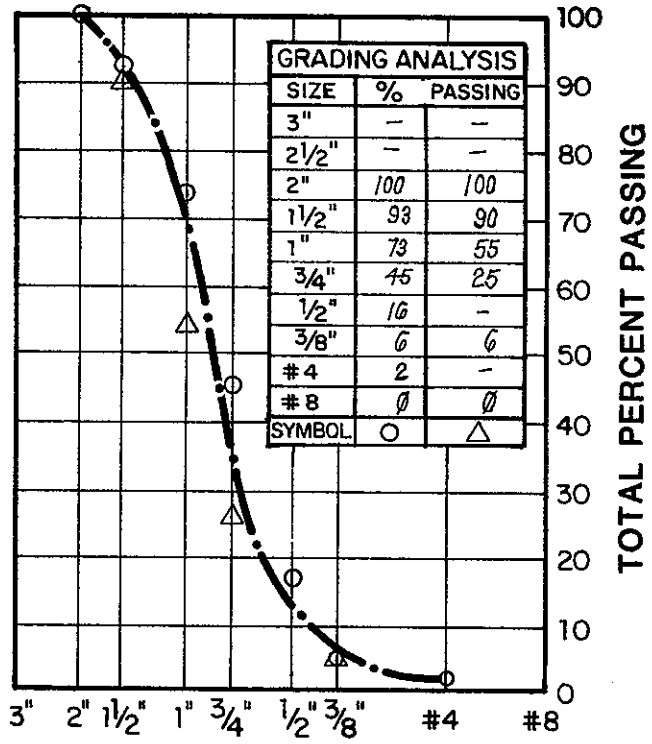


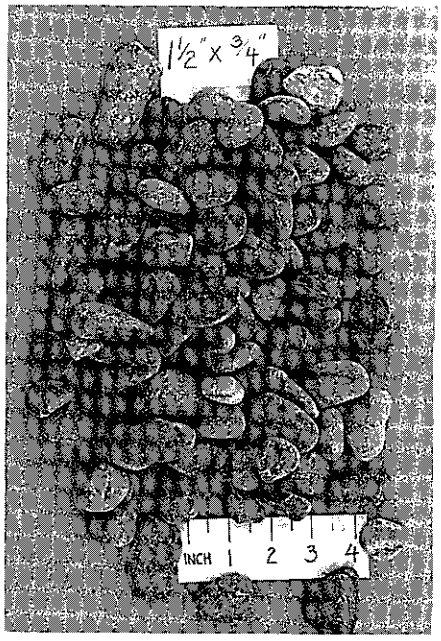
Figure 1. 2-INCH SQUARE CHOPPED RUBBER TIRES.

(A)

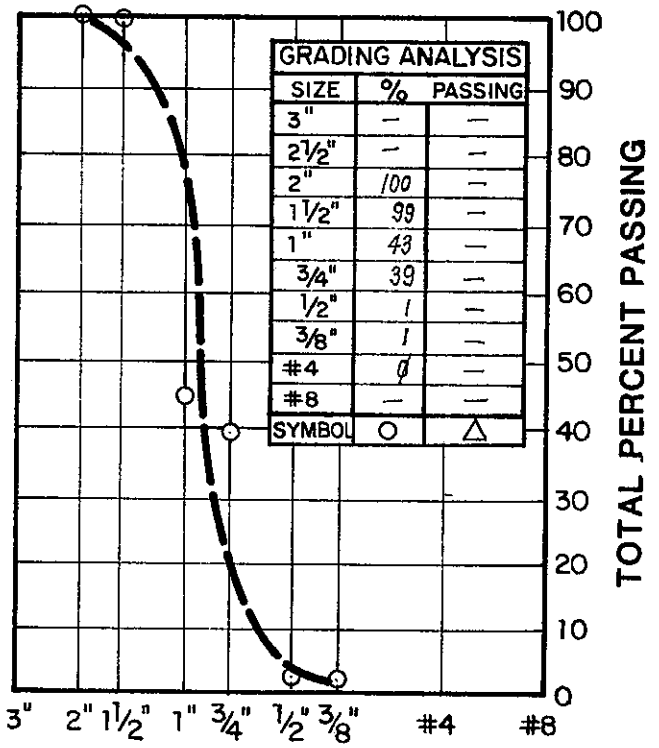


(B)

Figure 2. 2-INCH SHREDDED RUBBER TIRES.



(A)



(B)

Figure 3. CLASS 3 COARSE AGGREGATE.

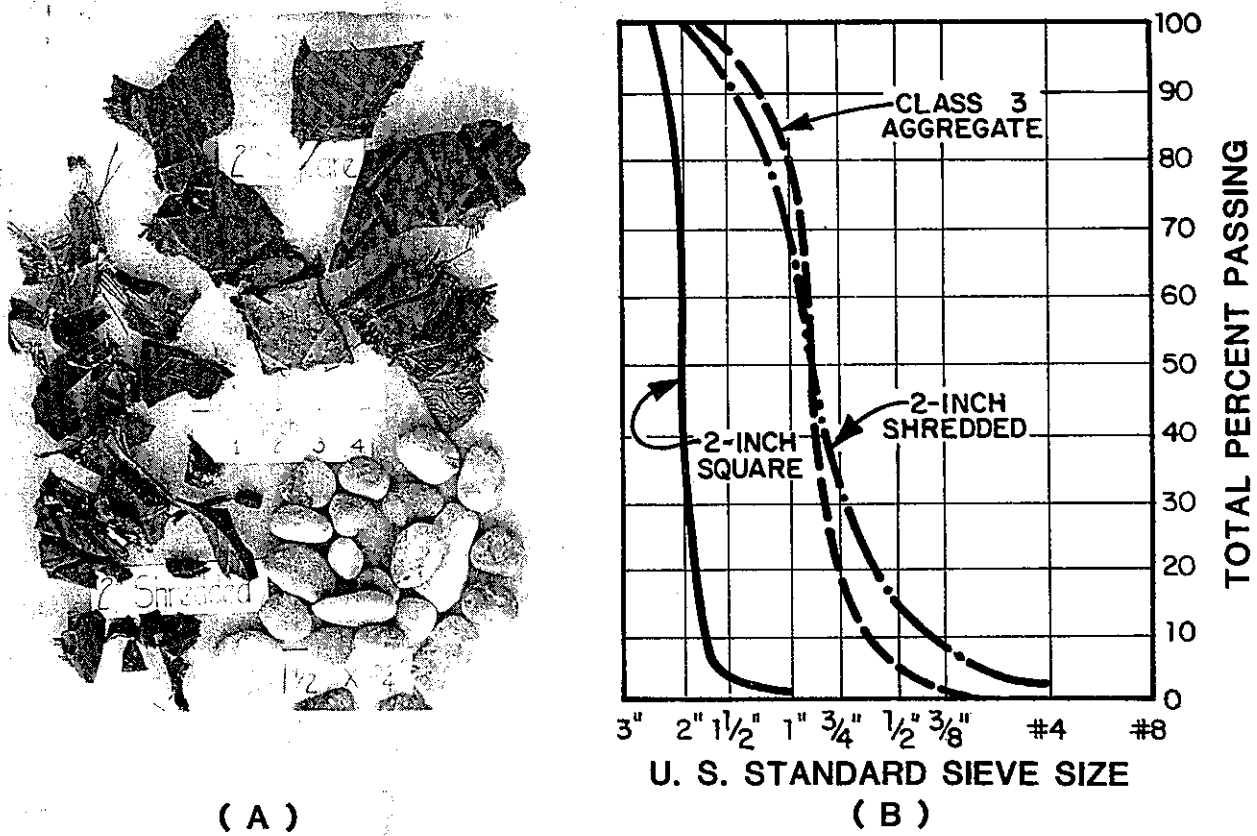


Figure 4. COMPARISON OF MATERIALS TESTED.

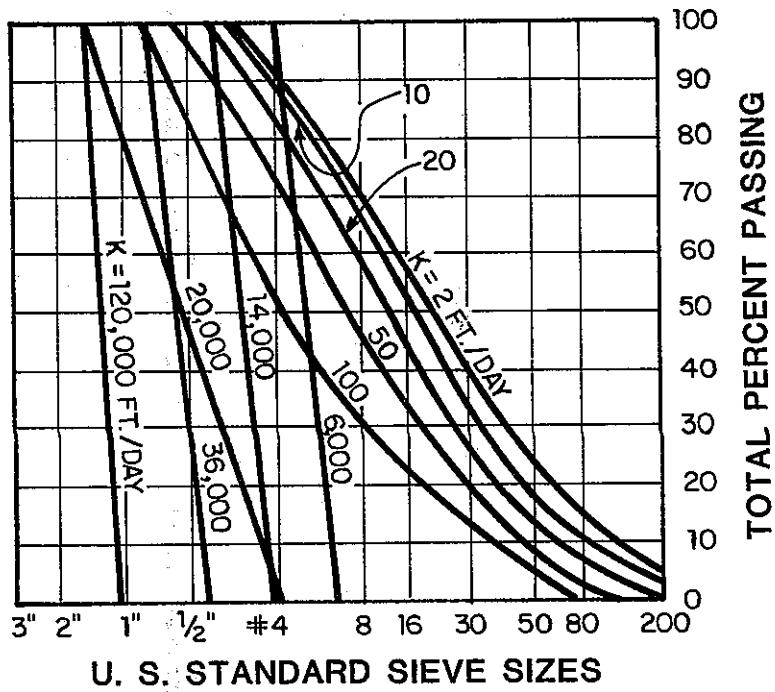
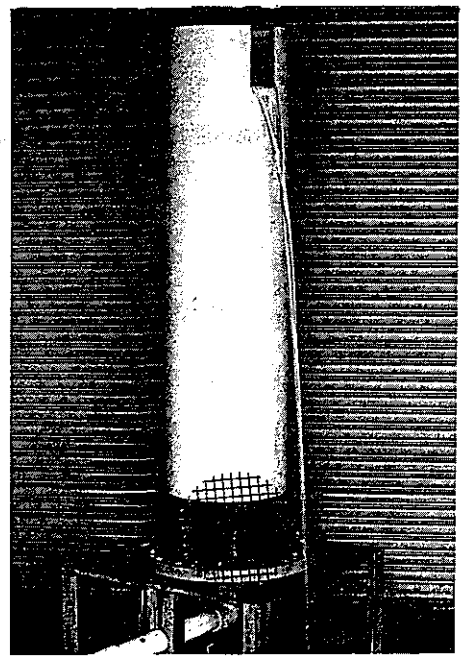


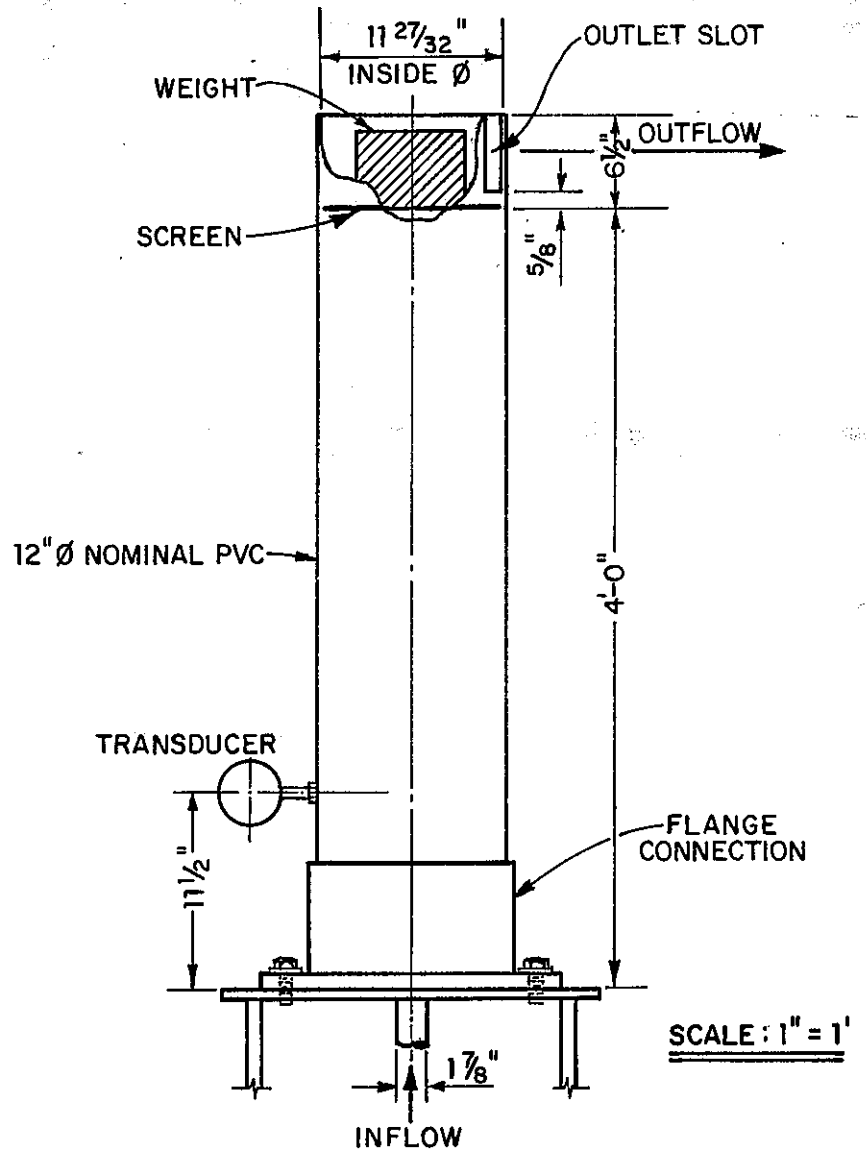
Figure 5. TYPICAL GRADATIONS AND PERMEABILITIES OF OPEN GRADED BASES AND FILTER MATERIALS.

[AFTER CEDERGREN, ARMAN, O'BRIEN 1973. (8)]

Test Equipment

To evaluate the permeability of the three materials (2-inch square chopped tires, 2-inch shredded tires, and Class 3 coarse aggregate), a constant head permeameter was constructed (as shown in Figure 6). Water is introduced into the permeameter from the bottom through a 1 7/8-inch diameter orifice. A transducer is inserted through the wall 11 1/2 inches above the base to measure chamber pressure. Four feet above the base, an overflow slot allows water to exit, thus creating a phreatic surface. A screen plus a 0.2 psi surcharge is placed over the sample to prevent particle floating. Flow is measured by catching the overflow from the slot.





(A) (B)

Figure 6. PERMEAMETER

Test Procedures

Chopped tire material was tested "as received" to be representative of the material that was readily available. No gradation requirements were specified. Permeability tests were run on both compacted and loosely placed samples of the tire material. The compacted samples were placed in the permeameter in 8 lifts of relatively equal size with each lift compacted by 25 blows of a 10-pound hammer. The uncompacted material was loosely shoveled into the permeameter. Permeability tests of the aggregate were run on uncompacted material. The aggregate was poured into the permeameter in an attempt to duplicate field placement conditions. All material was weighed at the time of placement to facilitate calculation of unit weights and relative density.

Permeability tests were conducted for 24 hours to determine if there was any significant effect from air bubbles. At intervals throughout, flow rates and chamber pressure readings were recorded. Three sets of data were taken at each interval (Figure 7). The inflow valve setting remained unchanged for the duration of the test.

Samples of both tire materials were tested for maximum density. The vertical deformation of each material was recorded for three (3) conditions - 1) A loosely placed 9-inch high column of material was subjected to a 2 psi surcharge; 2) the surcharged column of material was vibrated for 8 minutes; and (3) after vibrating the 2 psi surcharge was removed.

PERMEABILITY TEST

SAMPLE: 2-inch Shredded
TEST #: Compacted #1

TOTAL WT. OF SAMPLE: 118.0 lb
UNIT WT. OF SAMPLE: 38.56 pcf

HEAD @ TOP OF SAMPLE: 3.04 ft.
LENGTH OF SAMPLE: 4.00 ft.

CROSS SECTIONAL AREA .756 ft^2
VOLUME: 3.06 ft^3

INTERVAL	TIME	WT. OF WATER (lb)	VOLUME OF WATER (cu ft)	FLOW TIME (sec)	FLOW RATE (cfs)	CHAMBER PRESSURE (psi)	CHAMBER PRESSURE (ft)	H (ft)	HYDRAULIC GRADIENT, i	PERM. k (ft/sec)	x10⁻⁴ ft/day AVE K
1	0001	36.3	.582	6.3	.092	1.8	4.15	1.11	0.37	0.329	3.09
	0002	33.9	.543	5.9	.092	1.7	3.92	0.88	0.29	0.414	
	0003	35.9	.575	6.2	.093	1.8	4.15	1.11	0.37	0.331	
2	0118	33.4	.535	5.6	.096	2.1	4.85	1.81	0.59	0.210	1.79
	0119	34.0	.545	5.8	.094	2.1	4.85	1.81	0.59	0.207	
	0120	34.6	.554	6.0	.092	2.1	4.85	1.81	0.59	0.203	
3	0330	34.3	.550	5.7	.096	2.3	5.31	2.27	0.75	0.170	1.45
	0331	36.3	.582	6.2	.094	2.3	5.31	2.27	0.75	0.164	
	0332	35.6	.571	5.9	.097	2.3	5.31	2.27	0.75	0.169	
4	0858	33.5	.537	5.9	.091	2.2	5.08	2.04	0.67	0.178	1.53
	0901	35.5	.569	6.2	.092	2.2	5.08	2.04	0.67	0.179	
	0903	34.5	.553	6.2	.089	2.2	5.08	2.04	0.67	0.174	
5											
6											
7											

FIGURE 7. SAMPLE RECORD FORM

DISCUSSION OF PERFORMANCE OF MATERIALS

Permeability values determined for the 2-inch shredded tire material, 2-inch square tire material, and Class 3 coarse aggregate are within the same order of magnitude, 10^4 ft/day (with only 3 exceptions in 42 tests). The 2-inch shredded tire material produced essentially the same results as the 2-inch square tire material. All values are in the upper range of permeability values required for subdrainage material. A summary of the permeability values for the three materials tested is presented in Table 1.

In addition to permeability, the density, specific gravity and percent absorption were determined for both used tire materials. As expected, the 2-inch shredded tire material had the lowest minimum density, but a higher maximum density. In contrast, the 2-inch square tire material had the higher specific gravity. Triaxial compression tests of 6-inch diameter samples of each material produced similar values of cohesion and angle of internal friction. A summary of the physical properties is presented in Table 2.

The deformation measurements recorded during maximum/ minimum density testing confirmed the assumption that the used tire materials tested are capable of extreme deformation when subjected to static loading - 25% change in height for 2-inch shredded material and 12% for 2-inch square. When vibrated for 8 minutes the materials underwent further deformation - 3% for 2-inch shredded and 2% for 2-inch

square. Thus, the height change totaled 28% for 2-inch shredded material and 13% for 2-inch square. The rebound capabilities of both materials was determined by measuring the change in height after the static load was removed. The rebound was 12% for the 2-inch shredded material and 8% for the 2-inch square.

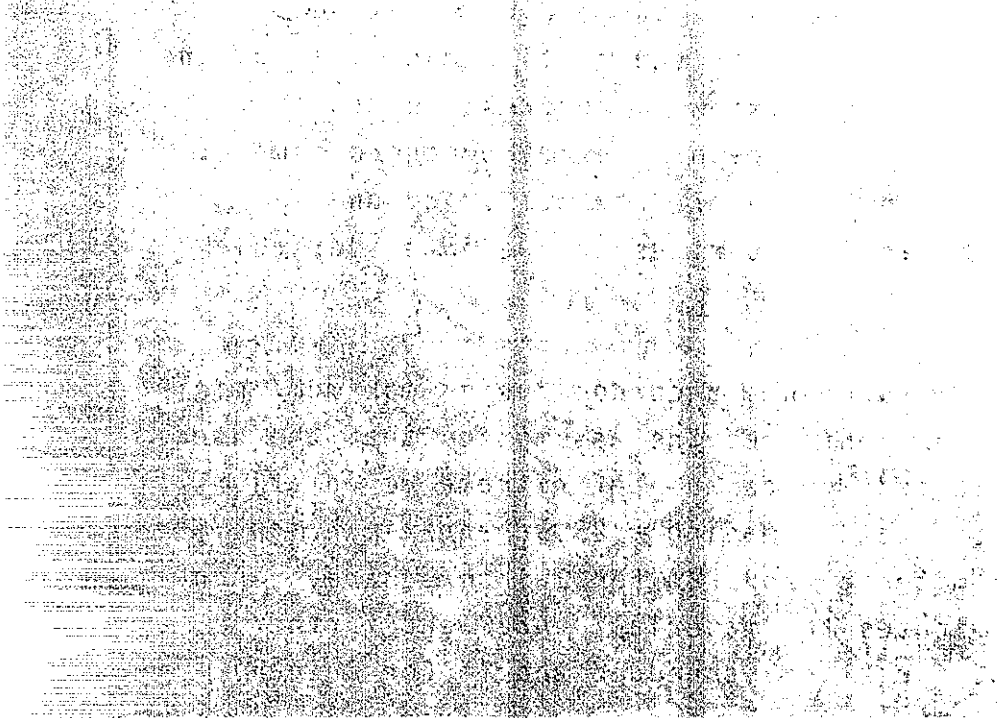
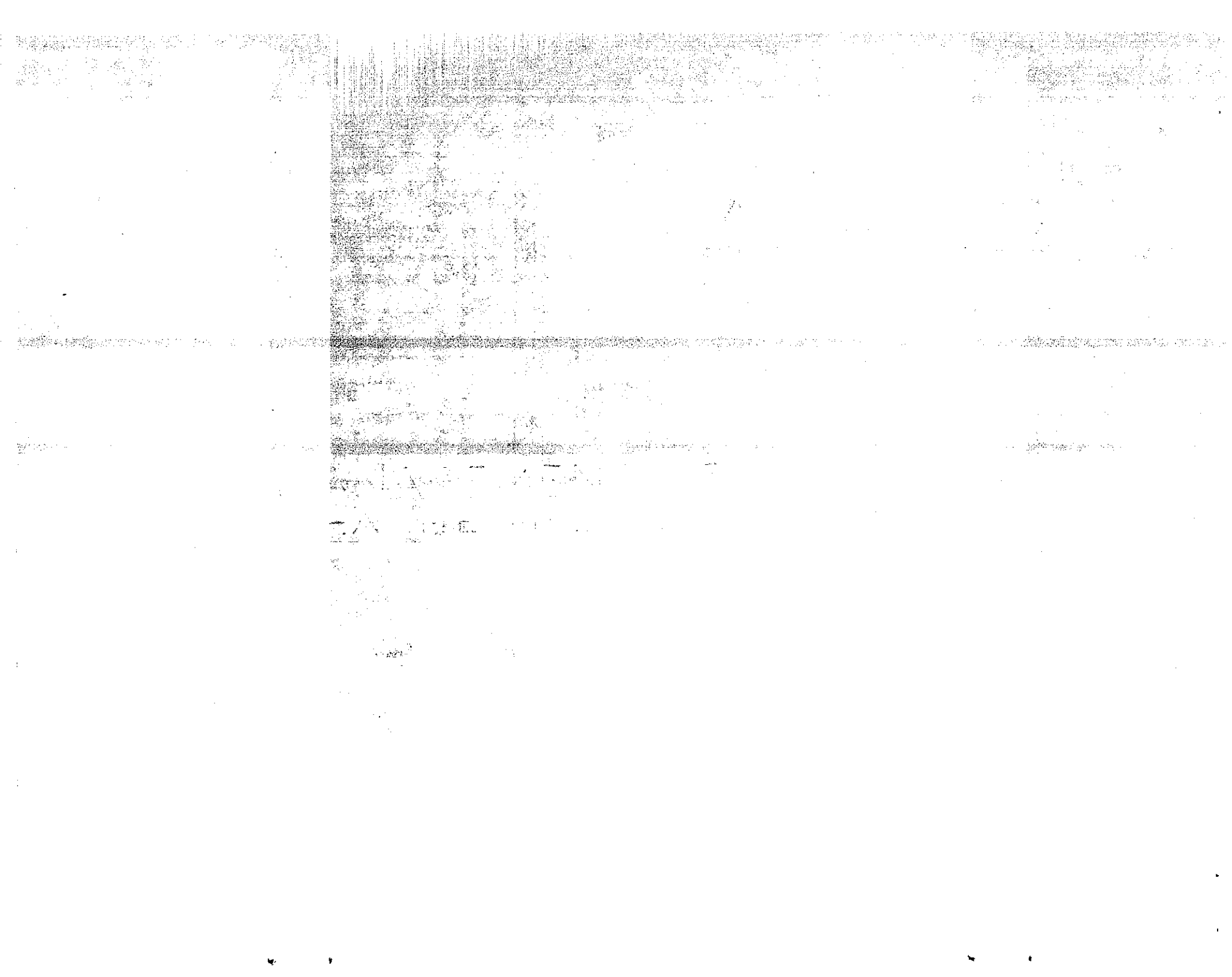


Table 1: Summary of Permeability Test Results

Sample Description	Test #	Flow Rate (cu ft/sec)	Unit Weight (lb/cu ft)	Range of Permeabilities ($x10^4$ ft/day)
2" Shredded, Compacted	1	.089-.097	38.56	1.45 to 3.09
	2	.083-.089	38.04	0.82 to 2.63
	3	.085-.089	37.19	1.15 to 1.45
2" Shredded, Loose	1	-	-	-
	2	.081-.084	29.31	2.14 to 6.66
	3	.087-.095	29.22	1.49 to 3.61
2" Square, Compacted	1	.082-.096	37.29	1.08 to 1.16
	2	.094-.099	38.43	1.81 to 5.03
	3	.034-.101	38.40	2.95 to 6.23
2" Square, Loose	1	.091-.102	28.89	1.87 to 3.62
	2	.089-.095	29.80	1.38 to 16.8
	3	.088-.093	29.38	3.48 to 4.75
Class 3 Aggregate	1	.089-.093	107.52	1.50 to 3.00
	2	.087-.098	104.74	1.57 to 3.11
	3	.085-.092	105.33	2.78 to 16.0

Table 2: Summary of Test Results

Property	Used Tire Material	
	2" Square	2" Shredded
Density (pcf)		
Maximum	31.4	35.3
Minimum	27.3	25.6
Specific Gravity		
Bulk (oven-dry)	1.15	1.06
Bulk (saturated surface dry)	1.18	1.16
Apparent	1.19	1.18
Absorption (%)	2.8	9.5
Cohesion (psf)	540	660
Angle of Internal Friction (°)	21	14



AVAILABILITY AND COST OF MATERIALS

Availability

Inquiries, during April and May, 1984, have provided more recent information regarding the status and future expectations of the tire recycling industry. Most of the recycling activity is taking place in the central valley and northern regions of the state. There are only a limited number of firms marketing used tire by-products. Three firms in Northern California and one in Oregon produce used tire material similar to the "2-inch shredded". The more regular sized "2-inch square" material is no longer available due to the high cost of processing. Granular material is produced in some locations and retread buffings are available, but both are more expensive than the shredded tire material.

Recently, a large market for shredded tire fuel has developed and seems to be expanding. Representatives of the industry point to the success of two tire shredding firms in securing long-term contracts which commit almost total production to fuel as an indication of future trends. Indications are that used tires for uses other than fuel are limited and in three to five years the demand for used tires in other recycling efforts may even surpass their use as fuel.

Cost of Materials

The cost of reducing tires to a form usable as permeable material is very high. The estimated cost of producing 2-inch shredded material is between $25 and $35 per ton

($14 to $19 per cubic yard). It was suggested that a larger-sized grading of 4 inches could be available at the lower end of the range for cost of production (approximately $25 per ton). The combination of high processing costs and the growing fuel market makes it unlikely that prices will drop.

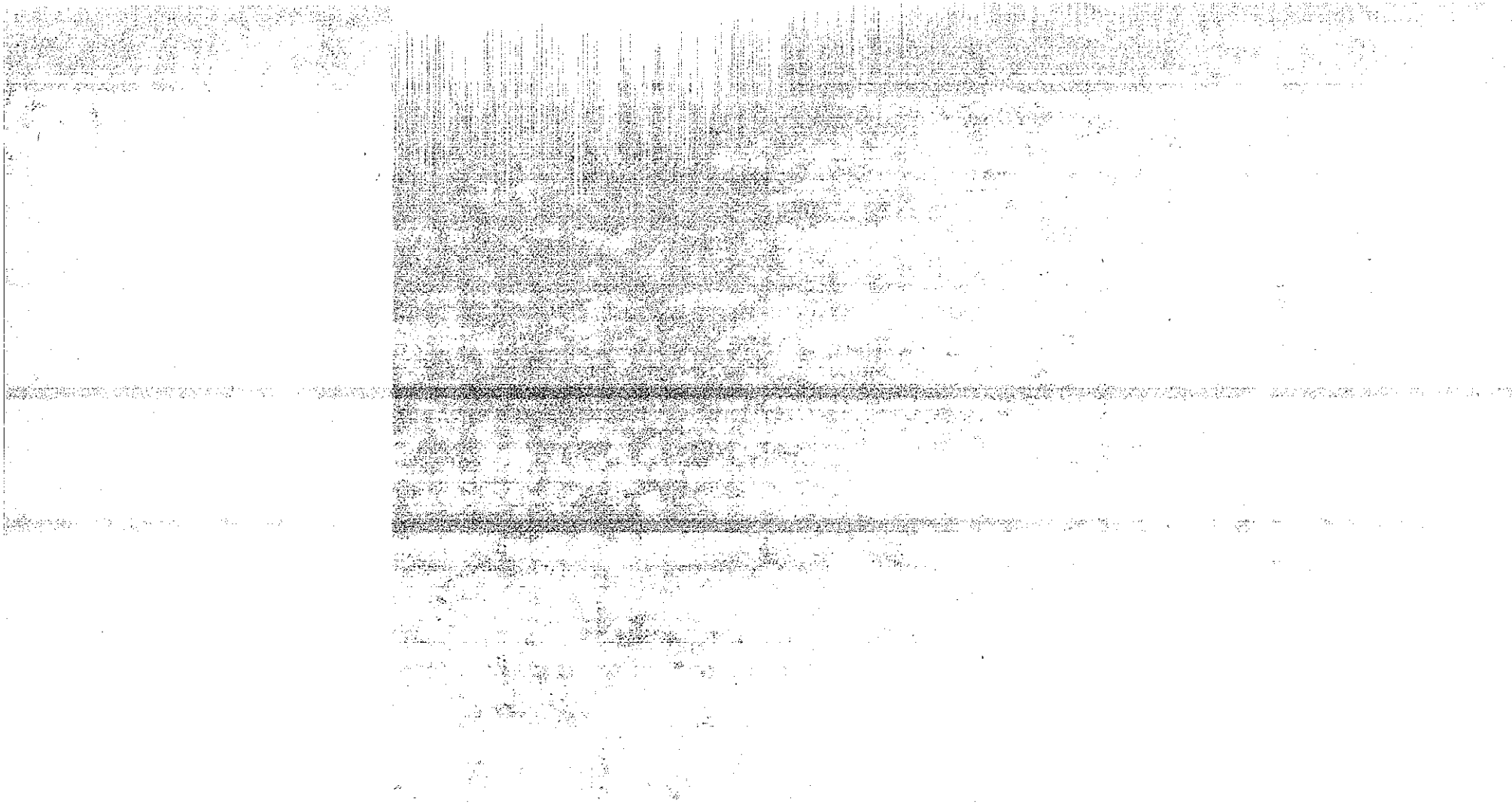
A major concern when assessing the economic viability of used tire material as permeable material is the availability of tires plus transportation costs. A 1981 investigation(9) conducted for the EPA reports truck transportation costs for shipment of tires in the following ranges:

	Distance (miles)	Cost (cents/ton-mile)
Whole Tires	<100	40
	>100	13
Shredded	<100	25
	>100	10

Availability of discarded tires near a job site and the commitment to use a large volume (approximately 1500 tons or 3700 cubic yards) could serve as an incentive to attract a producer to establish a portable plant on the job site. However, even in this instance production cost would be comparable to the cost at an established plant.

Based on production cost estimates and future trends, it appears that the cost of used tire materials for permeable material could range from $14 to $22 per cubic yard plus transportation and installation. Contract cost data for the year 1983 shows permeable material costs ranging from $15 to $33 per cubic yard in-place.

An evaluation of the feasibility of used tire by-products as a alternate for permeable material must consider: the availability of used tires, the cost of converting used tires to a usable form, transportation and construction costs, and future trends in the used tire recycling market. At this time, the prospects for future resource availability appear to be limited. The production of used tire by-products seems to be committed to fuel sources and even greater development in more complex areas. This trend points not only to limited availability for use as permeable material, but to a rise in cost of the material available.



REFERENCES

1. Cedergren, H. R., Arman, J. A., O'Brien, K. H., February 1973, Development of Guidelines for the Design of Subsurface Drainage Systems for Highway Pavement Structural Sections, FHWA-RD-73-14, Federal Highway Administration.

2. Hannon, J. B. and Forsyth, R. A., August 1973, Fill Stabilization Using Non-Biodegradable Waste Products - Phase I, California Transportation Laboratory.

3. The Problems & Possible Solutions of Disposing of or Recycling Used Tires, A report in response to House Resolution No. 37 in the 1973 Session of the California Legislature, California Department of Transportation, January 1975.

4. Scrimsher, T., May 1966 to December 1983. Performance Reviews and Project Notes of Rubberized Asphalt. California Department of Transportation.

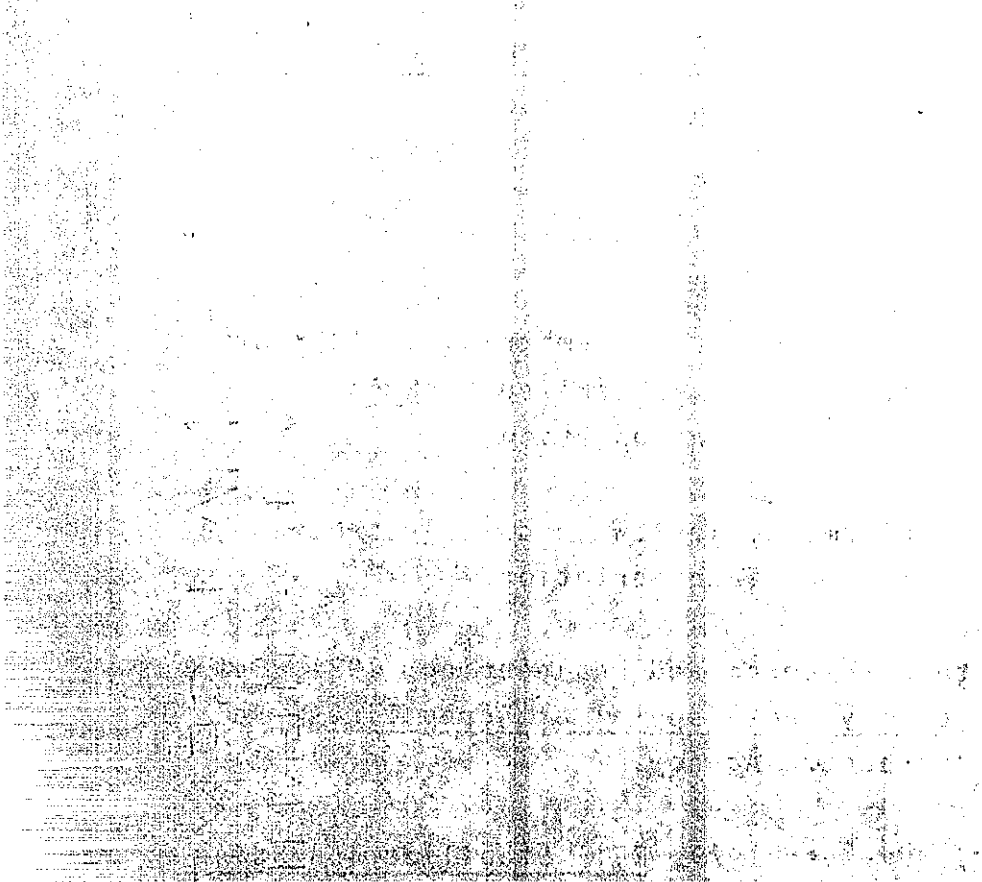
5. TAT Walls, Performance Reviews and Project Notes, California Department of Transportation.

6. Urban Systems Research and Engineering, 1981, Options for Resource Recovery and Disposal of Scrap Tires. Vol. 1, Environmental Protection Agency.

7. Yee, W. S., November 1979, Fill Stabilization Using Non-Biodegradable Waste P:roducts - Phase II, California Transportation Laboratory, Report No. FHWA/CATL-79/22.

8. Yee, W. S., May 1980, Demonstration Project No. 37 - Discarded Tires in Highway Construction, Santa Cruz, California, Demonstration Projects Program Technology Transfer, FHWA-DP-37-11.

9. Zube, E., April 1951, Experimental Field Use of Powdered Rubber in Bituminous Plant-Mix Surfacing, Division of Highways, Materials and Research Department, California.



HOUSE RESOLUTION NO. 37

Relative to tires

WHEREAS, Abandoned tires constitute a health hazard, often serve as a breeding place of mosquitoes, and constitute a fire hazard as well as an eyesore; and

WHEREAS, The disposal of abandoned tires is becoming increasingly more expensive; now, therefore, be it

Resolved by the Assembly of the State of California, That the Department of Public Works* is hereby requested to study the problems of, and possible solutions to, dispossing of used tires, giving consideration to the possibilities of recycling such tires; and be it further

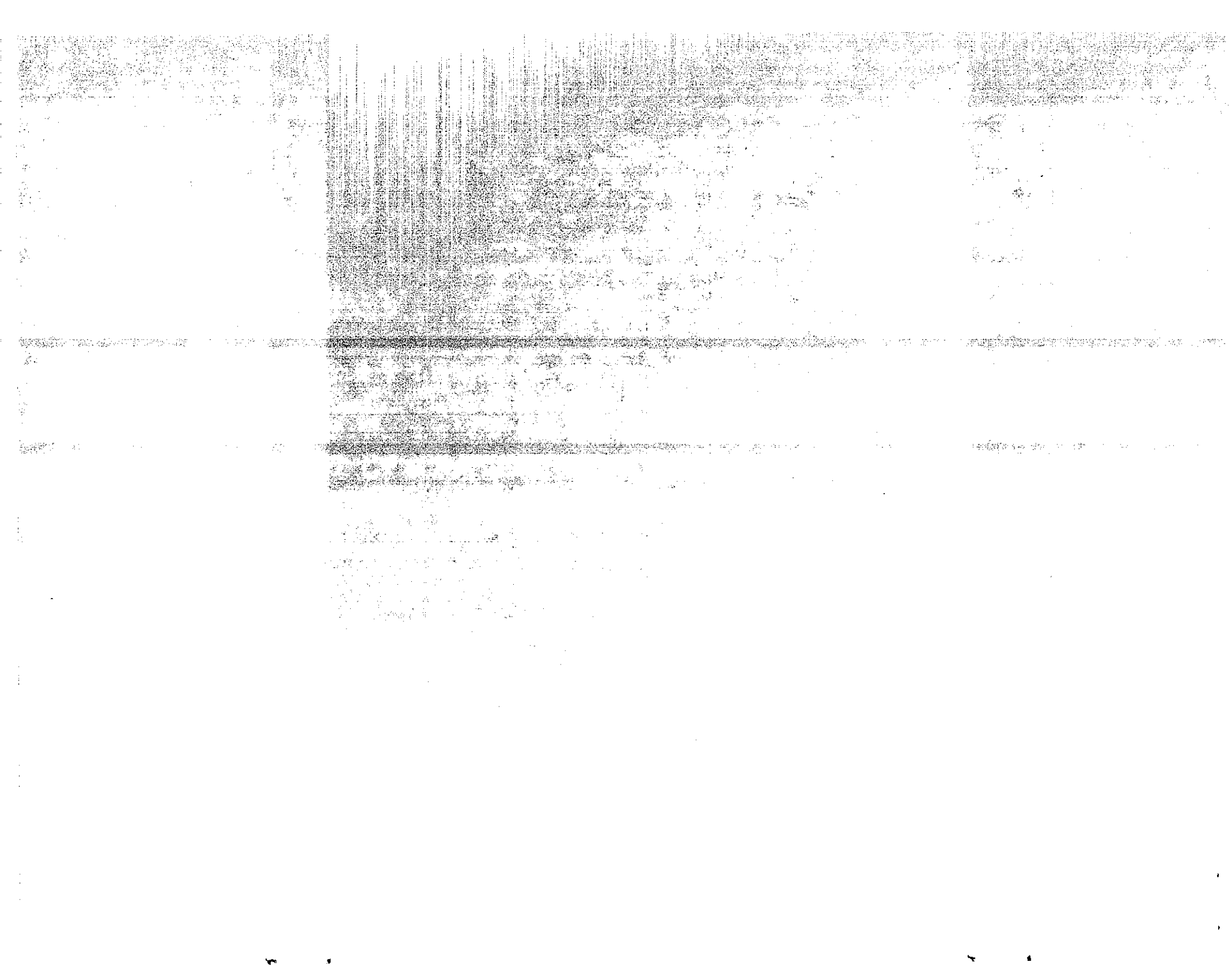
Resolved, That the Department of Public Works* submit the conclusions of its study to the Assembly by January 6, 1975; and be it further

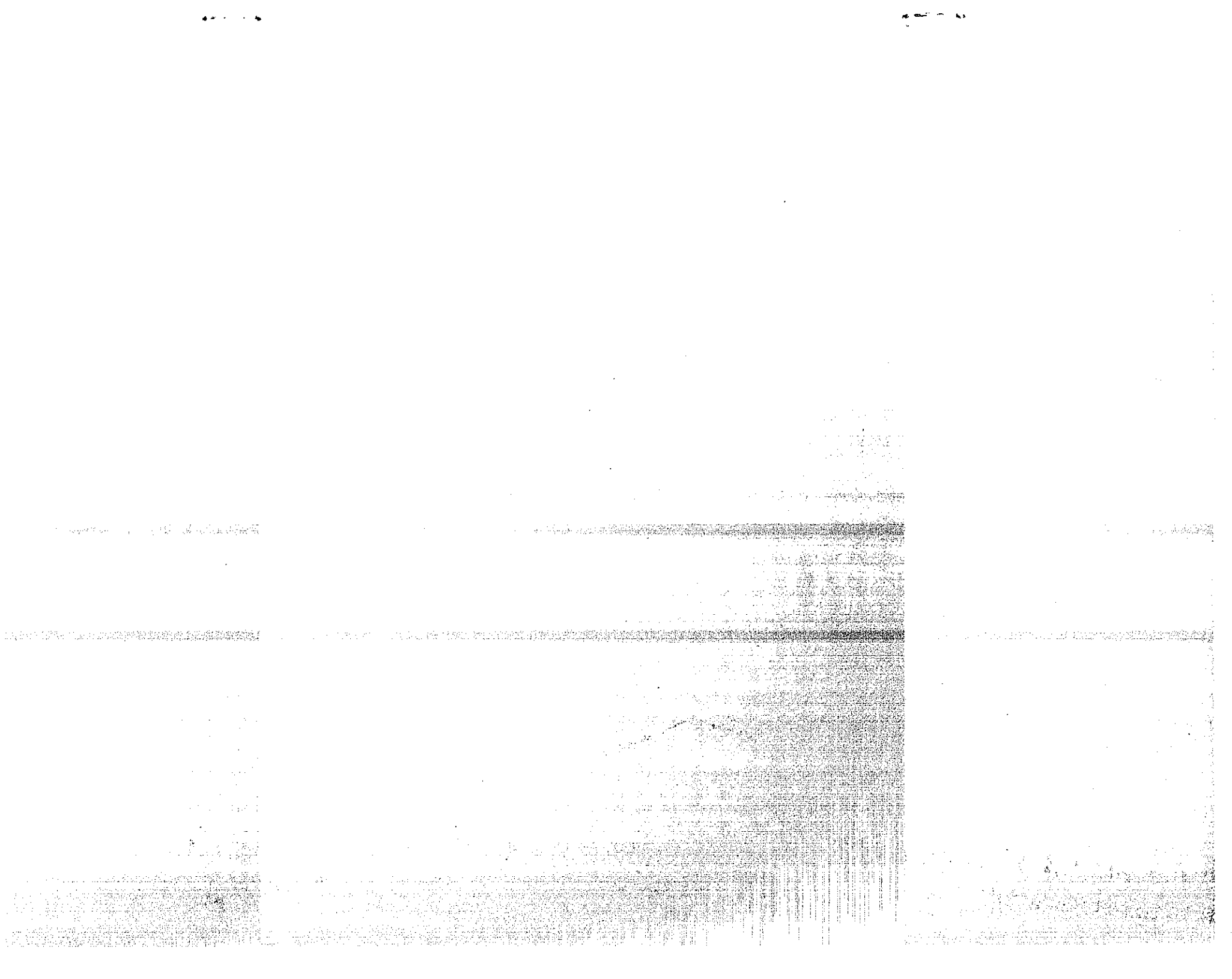
Resolved, That the Chief Clerk of the Assembly transmit a copy of this resolution to the Department of Public Works*.

Resolution read, and referred by the Speaker Pro Tempore to the Committee on Rules.

*Department of Public Works officially became Department of Transportation on July 1, 1973.

APPENDIX A





STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION
DIVISION OF FACILITIES CONSTRUCTION
OFFICE OF TRANSPORTATION LABORATORY

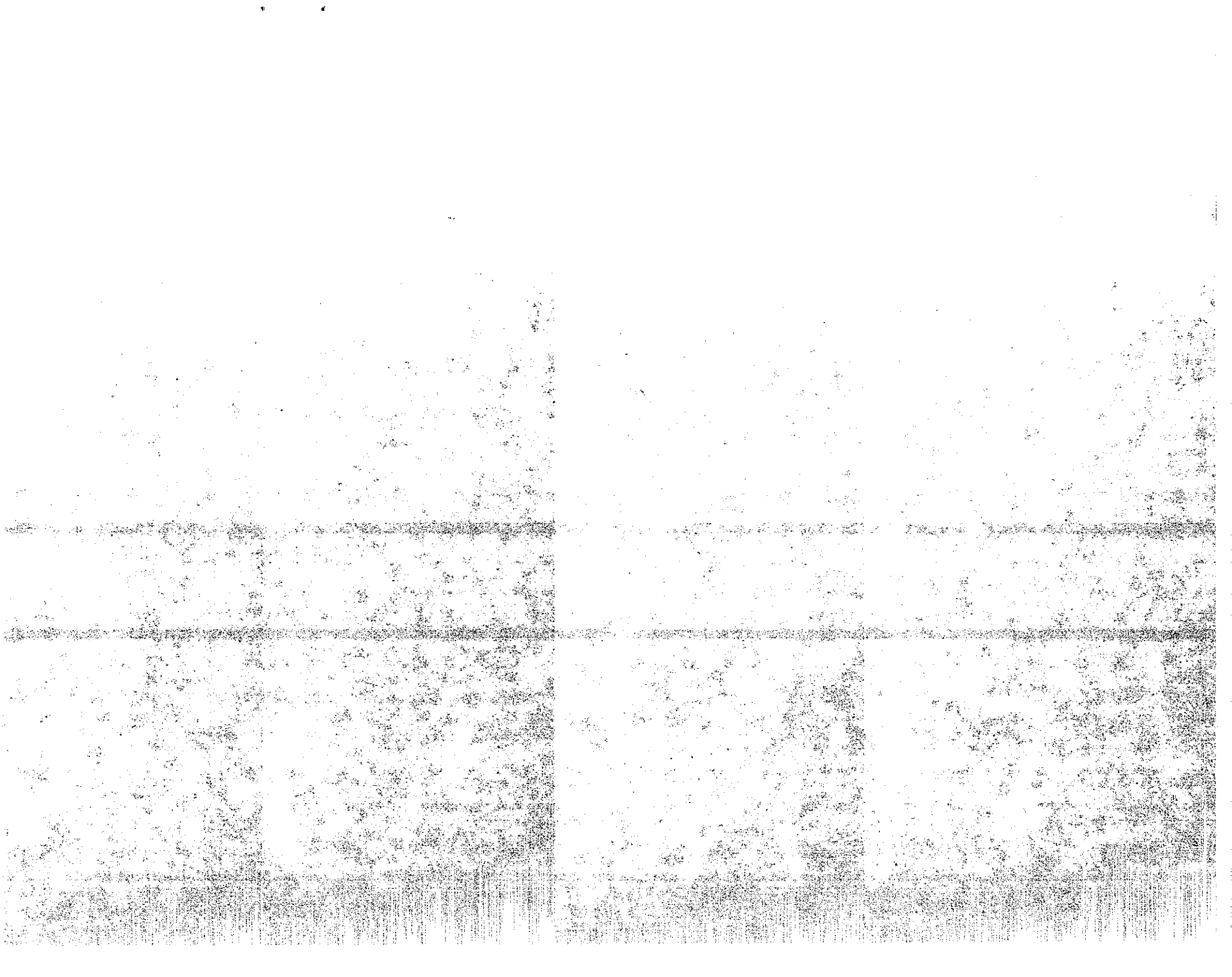
NOISE INSULATION OF RESIDENCES NEAR FREEWAYS

Principal Investigator ..... Mas Hatano, P.E.

Co-Investigator ..... Rudolf W. Hendriks

Report Prepared by ..... Mas Hatano, P.E.
Rudolf W. Hendriks

RAYMOND A. FORSYTH, P.E.
Chief, Office of Transportation Laboratory



TECHNICAL REPORT STANDARD TITLE PAGE

1. REPORT NO.	2. GOVERNMENT ACCESSION NO.	3. RECIPIENT'S CATALOG NO.
FHWA/CA/TL-85/13		

4. TITLE AND SUBTITLE	5. REPORT DATE
NOISE INSULATION OF RESIDENCES NEAR FREEWAYS	August 1985
	6. PERFORMING ORGANIZATION CODE

7. AUTHOR(S)	8. PERFORMING ORGANIZATION REPORT NO.
Mas Hatano and Rudolf W. Hendriks	54328-604168

9. PERFORMING ORGANIZATION NAME AND ADDRESS	10. WORK UNIT NO
Office of Transportation Laboratory California Department of Transportation Sacramento, California 95819	11. CONTRACT OR GRANT NO. E78TL08
	13. TYPE OF REPORT & PERIOD COVERED
12. SPONSORING AGENCY NAME AND ADDRESS California Department of Transportation Sacramento, California 95807	Final
	14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES

This study was performed in cooperation with the U.S. Department of Transportation, Federal Highway Administration, under the research project entitled: "Insulation of Buildings to Attenuate Noise (Experimental Construction)."

16. ABSTRACT

As part of a national effort to gain information on the feasibility and effectiveness of noise insulation of private homes near freeways, four residences were insulated against freeway noise on an experimental basis. This report discusses the legal ramifications, the design, specifications, and the administration of contract for trial installations. It also includes an evaluation of before and after noise measurements and homeowner reactions. The cost effectiveness of using insulation as a noise mitigation strategy is compared with that of noise barriers. It is concluded that insulation can be a viable alternative if: (1) it is done on a small scale (isolated homes) and there is no concern for mitigating noise levels outside the residence, or (2) barriers are neither feasible due to topography, nor desirable because of interference with scenic views or general aesthetics.

17. KEY WORDS	18. DISTRIBUTION STATEMENT
Noise insulation, traffic noise mitigation, highway traffic noise.	No restrictions. This document is available to the public through the National Technical Information Service, Service, Springfield, VA 22161.

19. SECURITY CLASSIF. (OF THIS REPORT)	20. SECURITY CLASSIF. (OF THIS PAGE)	21. NO. OF PAGES	22. PRICE
Unclassified	Unclassified		

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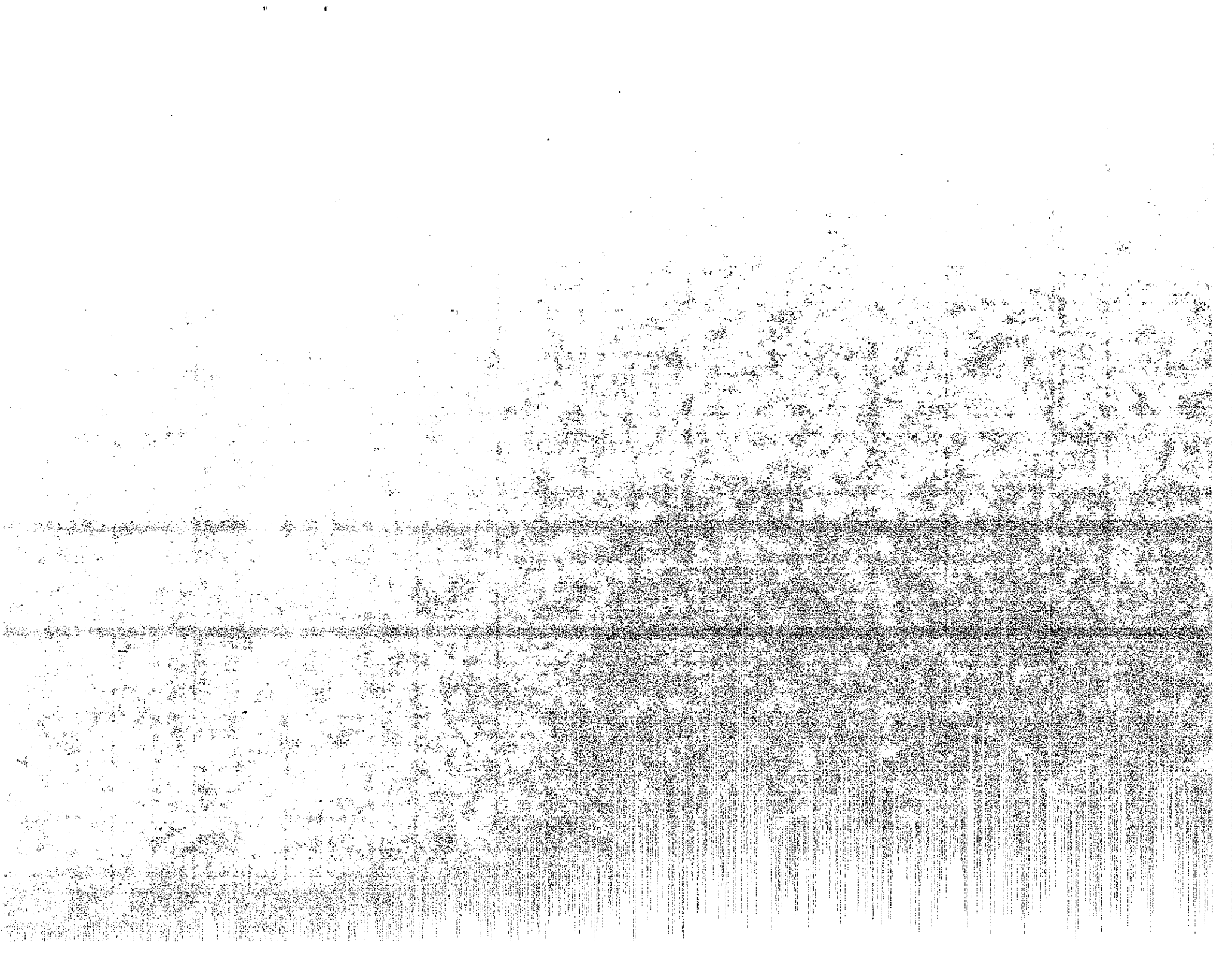
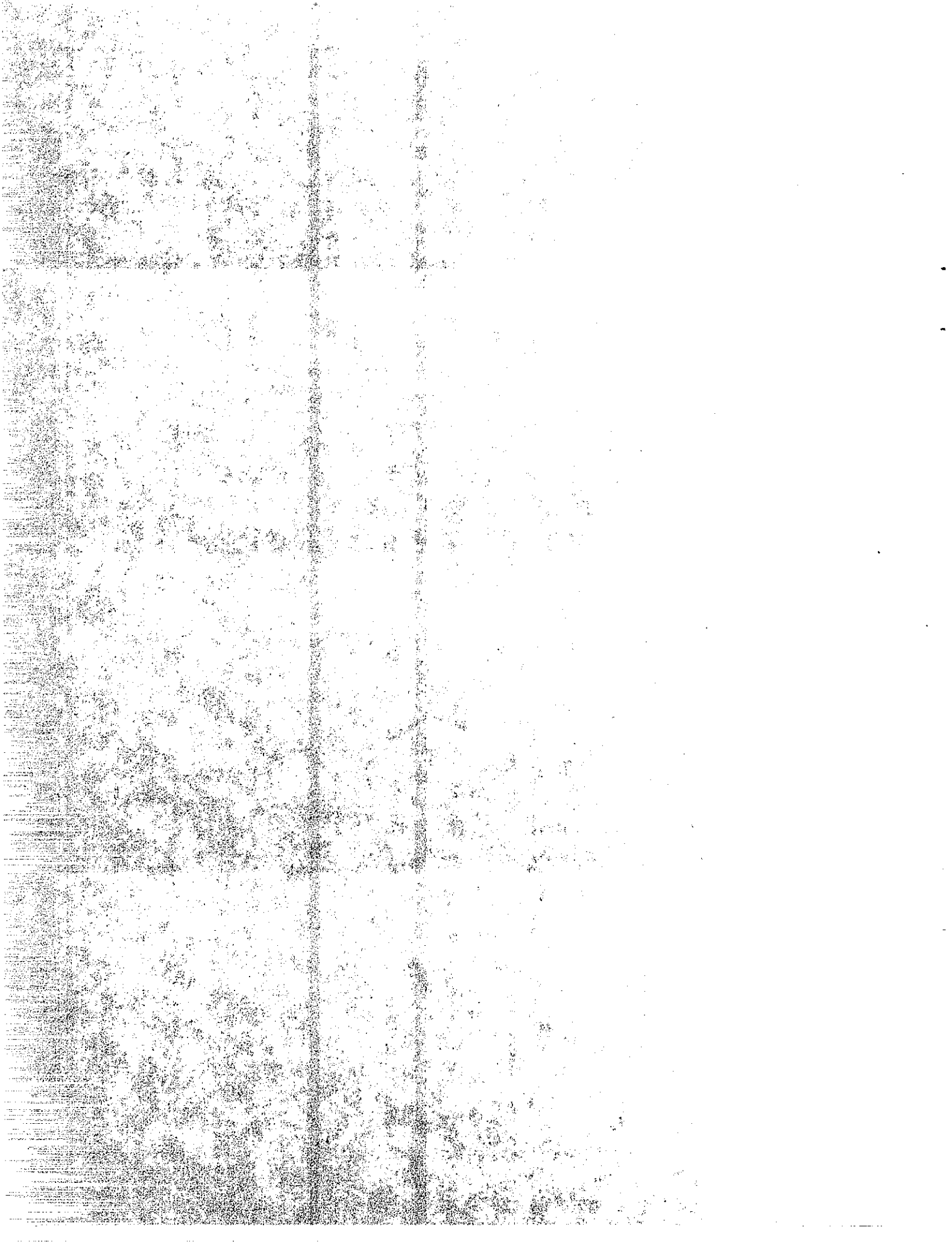


NOTICE

The contents of this report reflect the views of the Office of Transportation Laboratory which is responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the State of California or the Federal Highway Administration. This report does not constitute a standard, specification, or regulation.

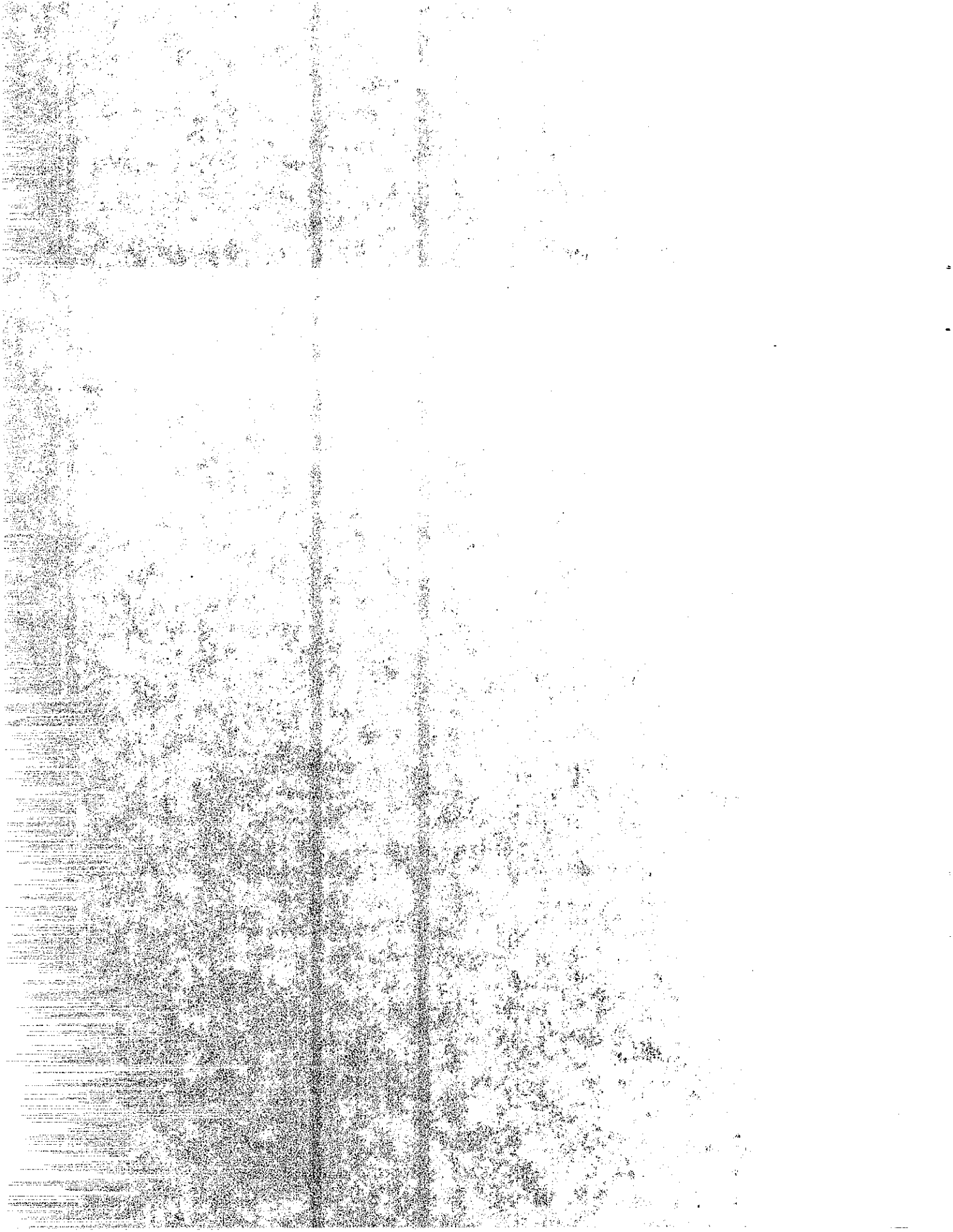
Neither the State of California nor the United States Government endorse products or manufacturers. Trade or manufacturers' names appear herein only because they are considered essential to the object of this document.



CONVERSION FACTORS

English to Metric System (SI) of Measurement

Quality	English unit	Multiply by	To get metric equivalent
Length	inches (in)or(")	25.40 .02540	millimetres (mm) metres (m)
	feet (ft)or(')	.3048	metres (m)
	miles (mi)	1.609	kilometres (km)
Area	square inches (in^2) square feet (ft^2) acres	6.432×10^{-4} .09290 .4047	square metres (m^2) square metres (m^2) hectares (ha)
Volume	gallons (gal) cubic feet (ft^3) cubic years (yd^3)	3.785 .02832 .7646	litre (l) cubic metres (m^3) cubic metres (m^3)
Volume/Time (Flow)	cubic feet per second (ft^3/s)	28.317	litres per second 1/s)
	gallons per minute (gal/min)	.06309	litres per second (1/s)
Mass	pounds (lb)	.4536	kilograms (kg)
Velocity	miles per hour (mph) feet per second (fps)	.4470 .3048	metres per second (m/s) metres per second (m/s)
Acceleration	feet per secopd squared (ft/s^2)	.3048	metres per second squared (m/s^2)
	acceleration due to force of gravity (G) (ft/s^2)	9.807	metres per second squared (m/s^2)
Density	(lb/ft^3)	16.02	kilograms per cubic metre (kg/m^3)
Force	pounds (lbs) (1000 lbs) kips	4.448 4448	newtons (N) newtons (N)
Thermal Energy	British termal unit (BTU)	1055	joules (J)
Mechanical Energy	foot-pounds (ft-lb) foot-kips (ft-k)	1.356 1356	joules (J) joules (J)
Bending Moment or Torque	inch-pounds (in-lbs) foot-pounds (ft-lbs)	.1130 1.356	newton-metres (Nm) newton-metres (Nm)
Pressure	pounds per square inch (psi) pounds per square foot (psf)	6895 47.88	pascals (Pa) pascals (Pa)
Stress Intensity	kips per square inch square root inch ($ksi\sqrt{in}$)	1.0988	mega pascals$\sqrt{metre}$ ($MPa\sqrt{m}$)
	pounds per square inch square root inch ($psi\sqrt{in}$)	1.0988	kilo pascals$\sqrt{metre}$ ($KPa\sqrt{m}$)
Plane Angle	degrees (°)	0.0175	radians (rad)
Temperature	degrees fahrenheit (F)	$\frac{+F - 32}{1.8} = +C$	degrees celsius (°C)



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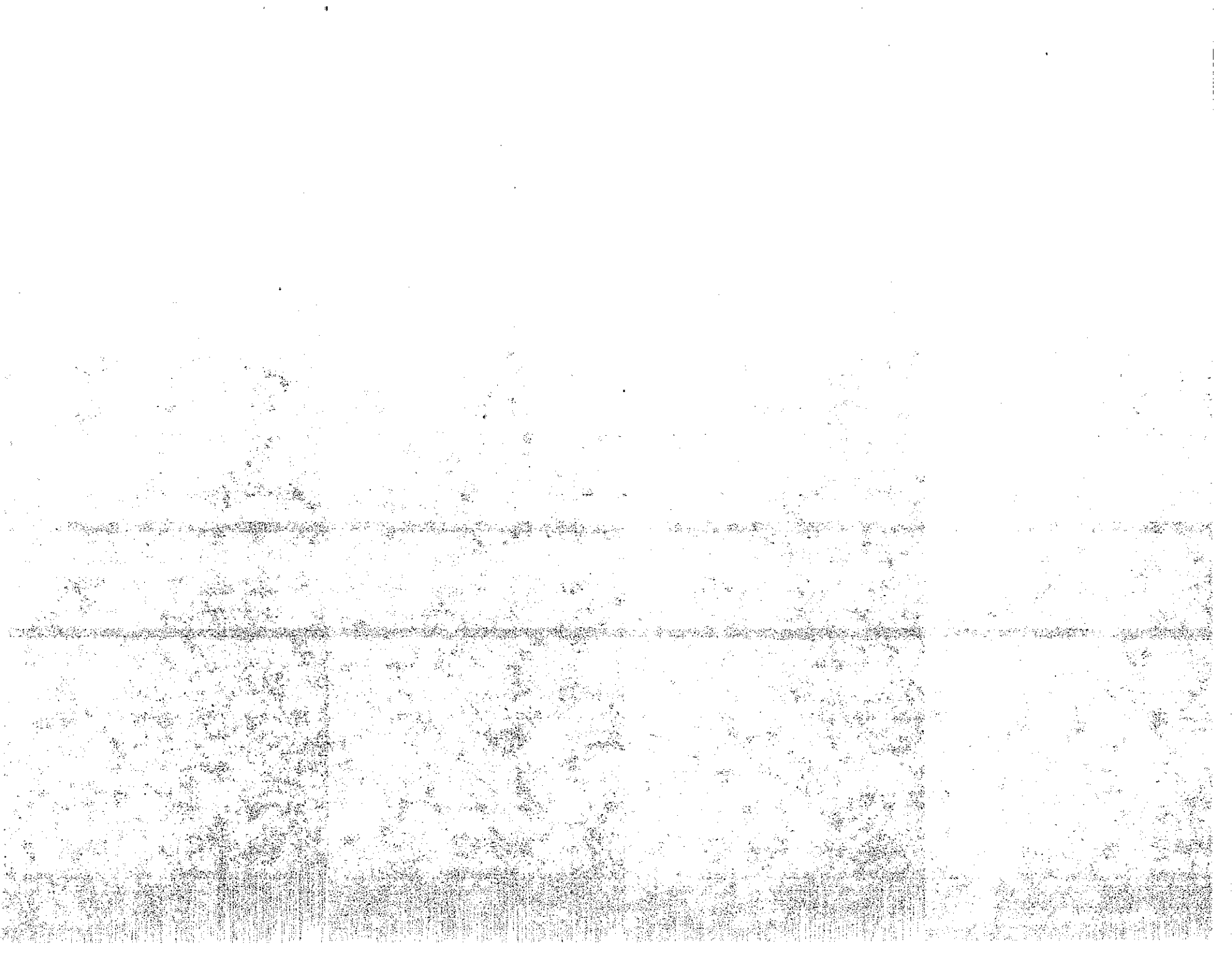
° Robert Cramer, Dick Wood, Cel Alfafaro, Victor Saschin, John Quincy, Steward Stahl, and Roland Lew, for their assistance in the field work.

° Eddie Chow, Ryu Inoue and Jim Denson for providing liaison between TransLab, Districts, homeowners, consultants and contractors. They also provided necessary project information.



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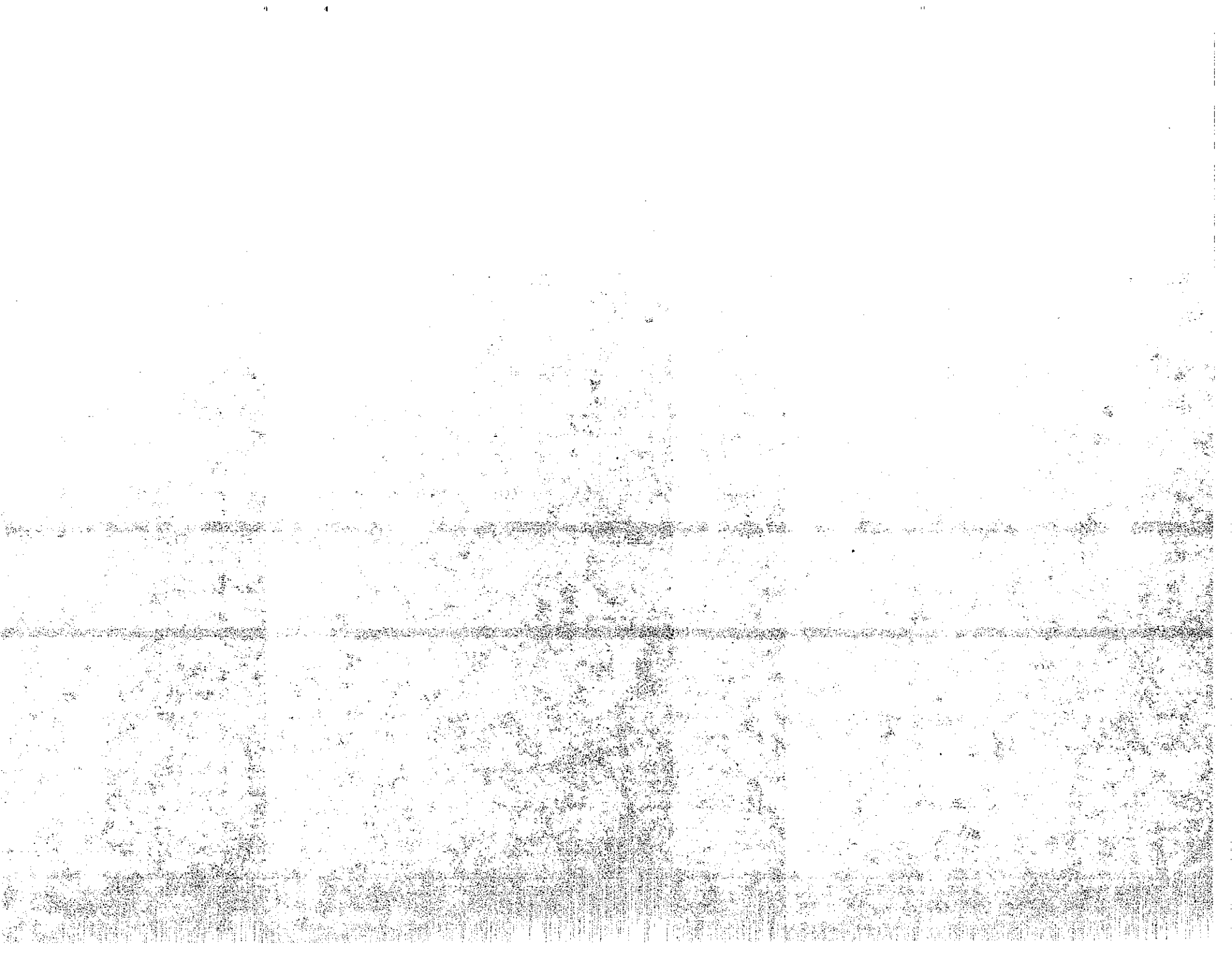

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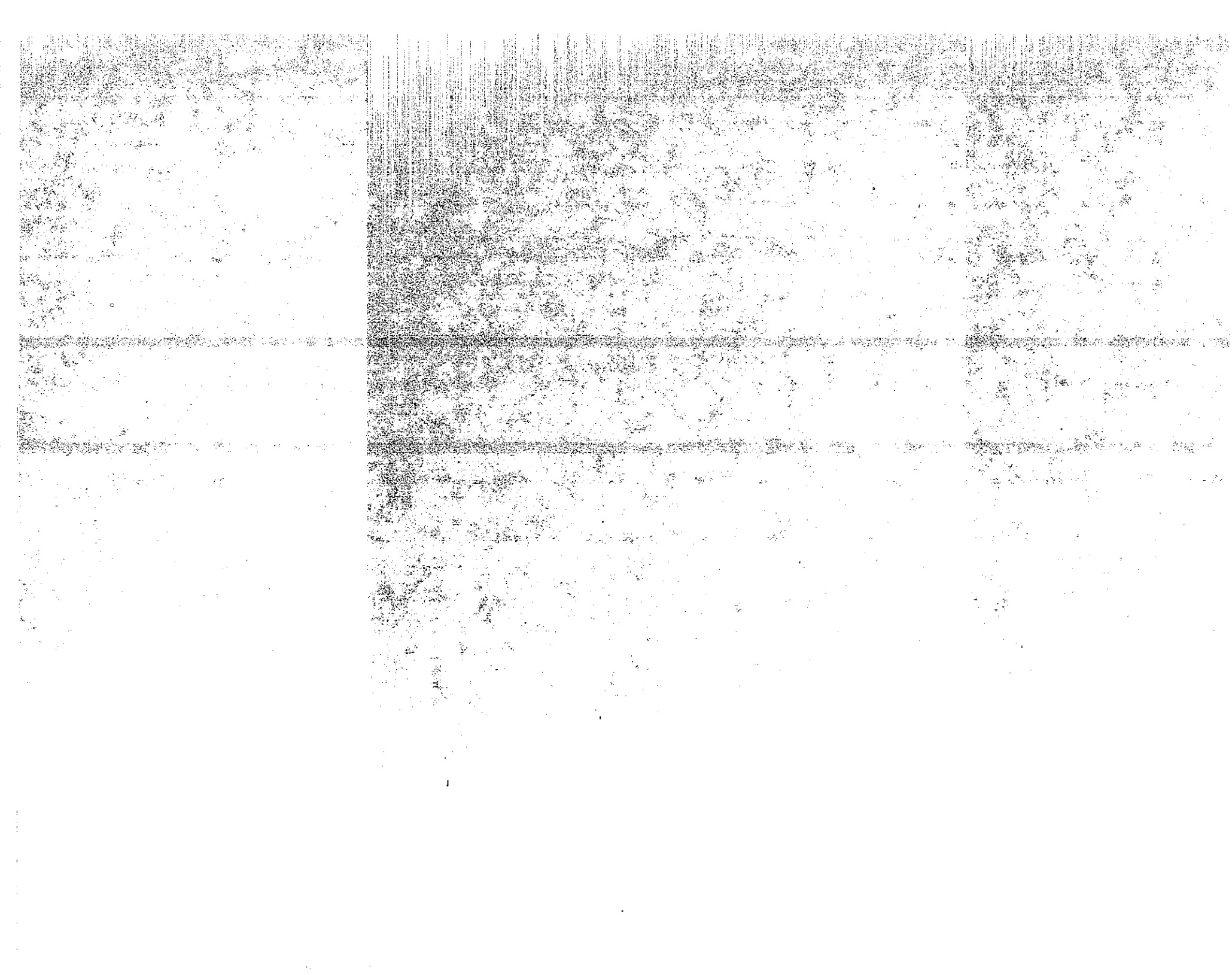

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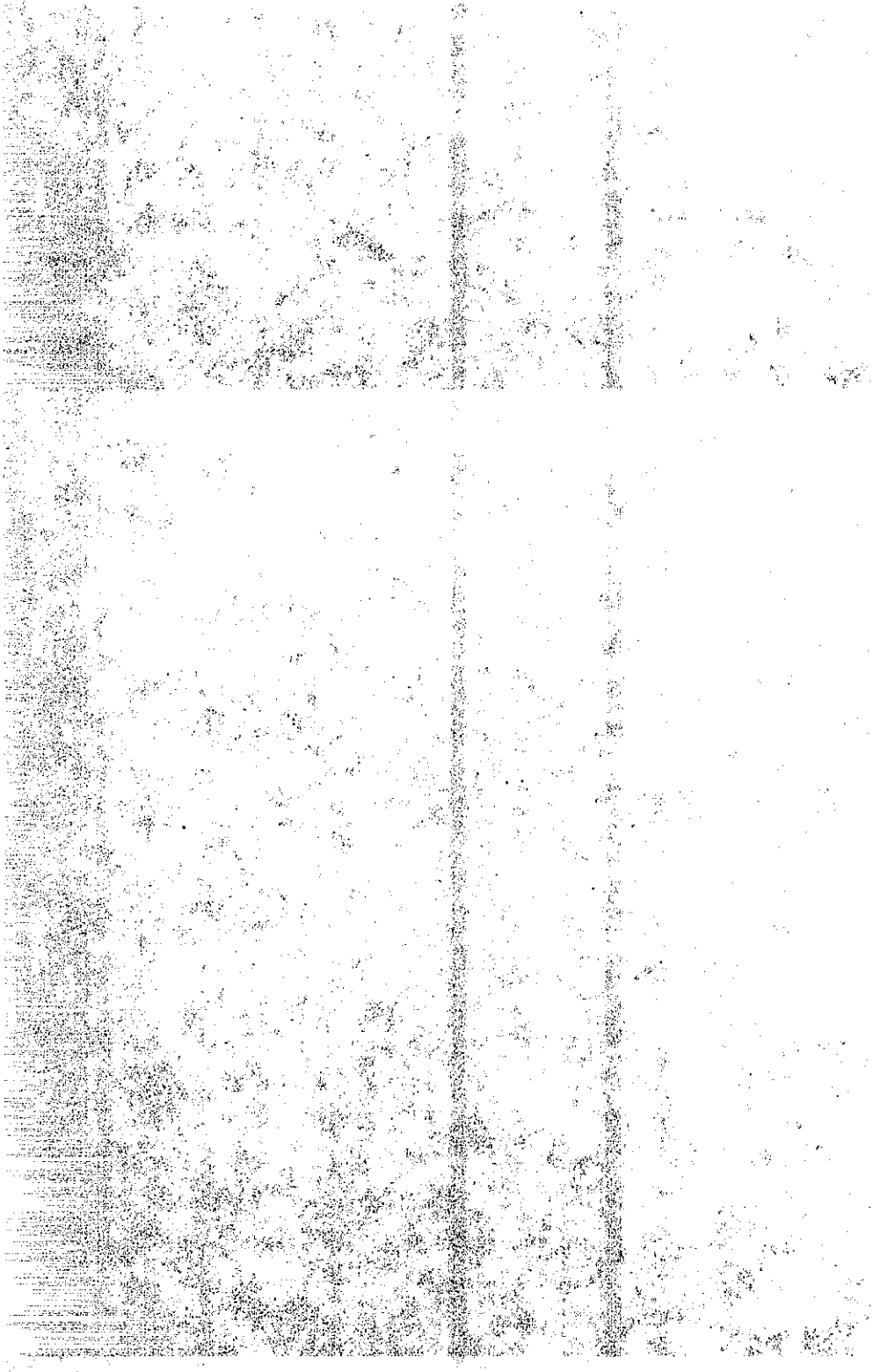

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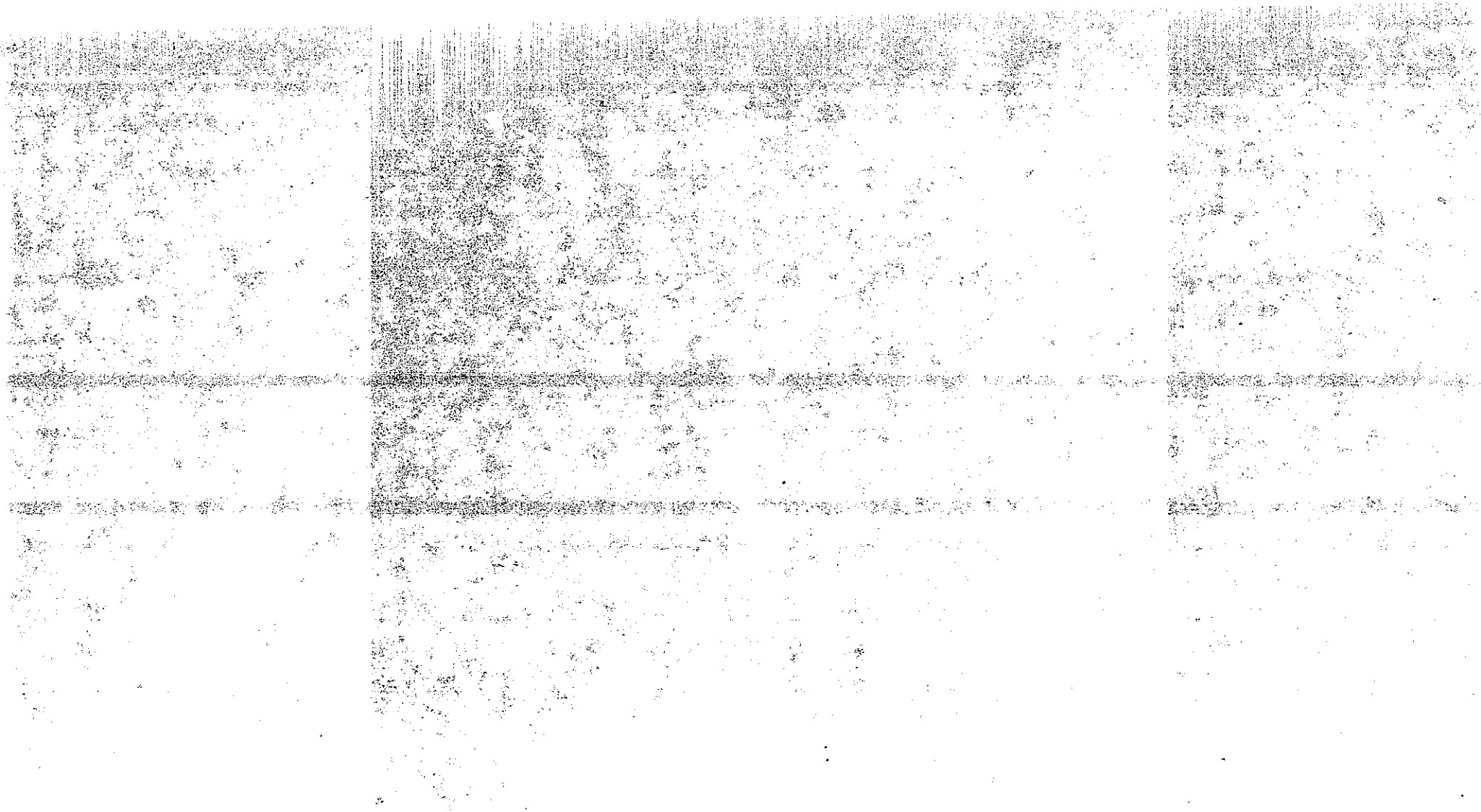


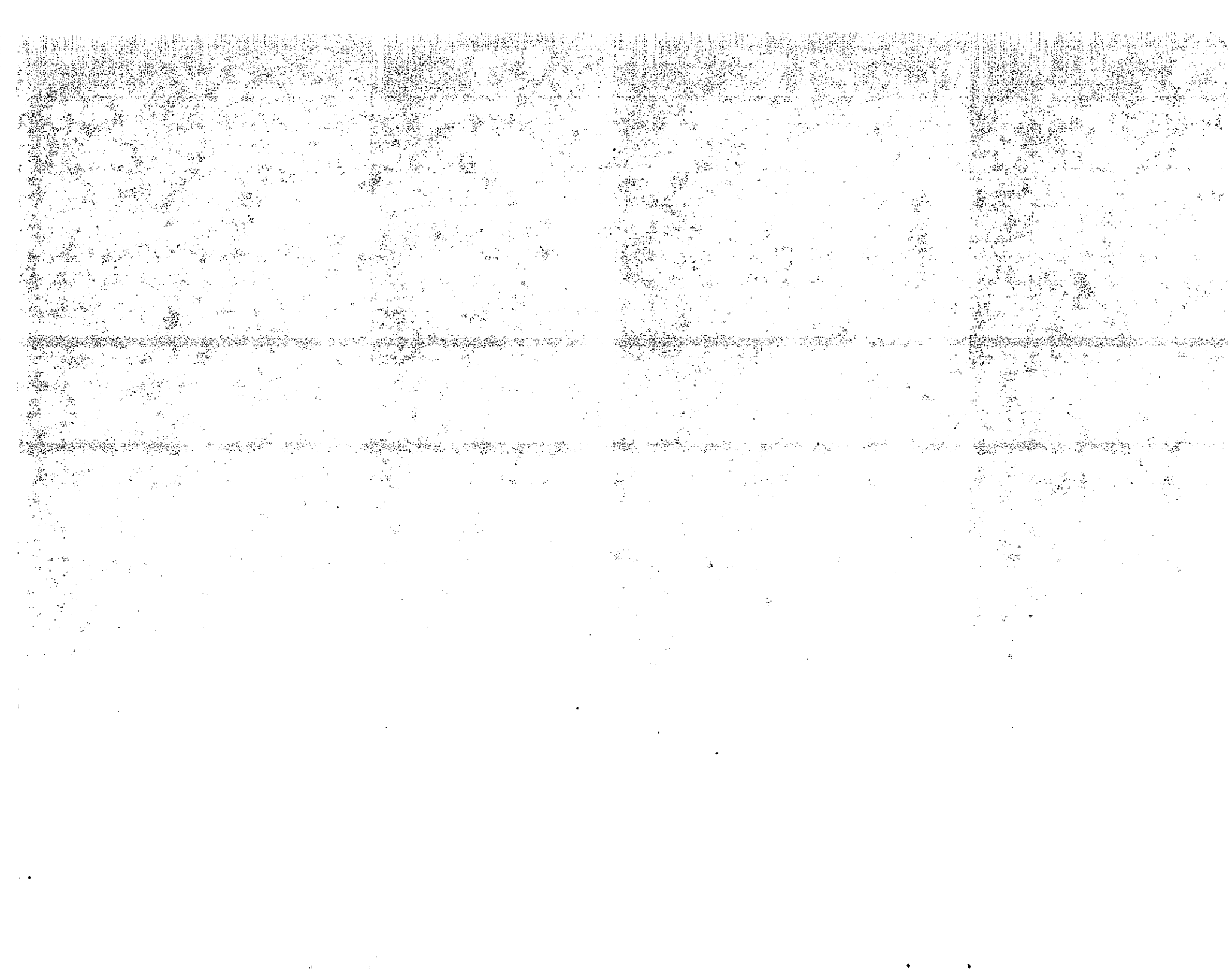
I. INTRODUCTION

Mitigation of highway traffic noise by means such as construction of barriers, changes in highway geometrics and purchase of additional right-of-way are very expensive measures and not feasible in many cases. Private residences along the right-of-way are often spaced far apart or are in situations that make it difficult to mitigate traffic noise in a cost-effective manner.

This report covers an experimental project to insulate private residences rather than construct noise barriers. In January, 1977, The Federal Highway Administration (FHWA) issued Notice 5080.62, "National Experimental and Evaluation Program (NEEP) Project No. 21 - Noise Insulation for Private Dwellings" (Appendix A).

The FHWA requested the states to consider participation in Notice 5080.62 to gather information on the feasibility of noise insulation of private residences. After much discussion and a favorable legal opinion (Appendix B), the California Department of Transportion (Caltrans) agreed to participate.

This report covers the preliminary steps necessary to comply with Notice 5080.62, and the subsequent construction to noise insulate four residences. It also describes the evaluation of the noise mitigation measures and the reaction of the homeowners.



II. BACKGROUND

The Transportation Laboratory (TransLab) was to evaluate the feasibility and effectiveness of noise insulating privately owned residences. Initially, 7 of the 11 districts in Caltrans expressed an interest in this study. This was narrowed down to District 4 (San Francisco area) and District 7 (Los Angeles area) after some effort was made to find suitable residences.

Each District (4 and 7) was responsible for locating a qualified residence, designing the project, preparing bids and administering the contract. TransLab assisted in the process, measured noise before and after construction, conducted homeowner interviews and prepared this report.

In general, the NEEP guidelines stated that information was to be gathered on things such as:

1. Legal ramifications for all parties involved.

2. Development of design and specifications.

3. Administration of the contract.

4. Reporting the results.

Each of these is addressed in detail in this report.

Design of the insulation measures was done by the Caltrans Office of Structures personnel for District 4 and by a consultant for District 7. This included acoustical (window design) and mechanical (ventilation system design) engineering. Job specifications were prepared in the same manner as for other Caltrans construction contracts.

Administration of the Contract

Plans and specifications (Appendix E) were then prepared for advertising and awarded to a local building contractor based on low bid. The contractor was responsible for obtaining permits, materials and performing the work. Inspection and acceptance of the work was all performed by the District engineering staff.

Reporting of Results

Results are fully reported and include such items as noise measurement and analysis, homeowner interviews, cost, and overall feasibility.

III. DISCUSSION

Legal

Caltrans attorneys indicated that it was permissible to insulate private residences that were outside the right-of-way for this experimental project (Appendix B). Other authority would probably be needed if this were to be carried out as a Caltrans program.

Contact with the City of San Francisco indicated there would be no additional property taxes levied as a result of the proposed improvement (Appendix C).

Responsibility for the improvements would be assumed by Caltrans for one year. The homeowner would take over after one year. This was covered in the Homeowners Agreement (Appendix D).

Design and Specifications

The first step was to find potential candidate homes for the field evaluation. Comprehensive noise measurements were then made to provide guidelines for determining whether residences qualified from a noise standpoint. This information later provided the designers with goals for noise reductions for those residences selected.

District 4 Project - There were three residences that participated. These homes were initially part of a group of homes for which a noise barrier was being considered. However, all the other homeowners opted to keep their view and not have noise barriers. This left the three homes closest to the freeway without any noise mitigation.

The major modifications were using thicker glass or double pane windows and providing for a ventilation system. Air conditioners were not warranted because of the mild climate in San Francisco.

District 7 Project - A number of candidate residences were considered but rejected because, in most cases, the noise levels were not high enough. For these situations, adequate mitigation could be achieved by merely keeping all windows closed and installing a ventilation system. This did not appear to meet the intent of the NEEP.

The home selected was a farmhouse close to a freeway. It was an older home that required extensive work to seal all cracks, and install new windows and doors. In addition to this work, a central air conditioning and heating system was installed. This also required upgrading electrical service and wiring.

IV. CONCLUSIONS

Noise Attenuations

Noise attenuations achieved by insulating homes against freeway noise ranged from 1 to 8.5 dBA in freeway-facing rooms. The average noise attenuation for the four residences studied was 4.5 dBA. The average was computed from the mean attenuations of each of the four residences. These ranged from 3 to 6 dBA. The individual means were in turn calculated by averaging measured room attenuations.

Costs

The average construction cost of insulating each residence was $11,950. The costs ranged from $6,240 to $19,000 per residence.

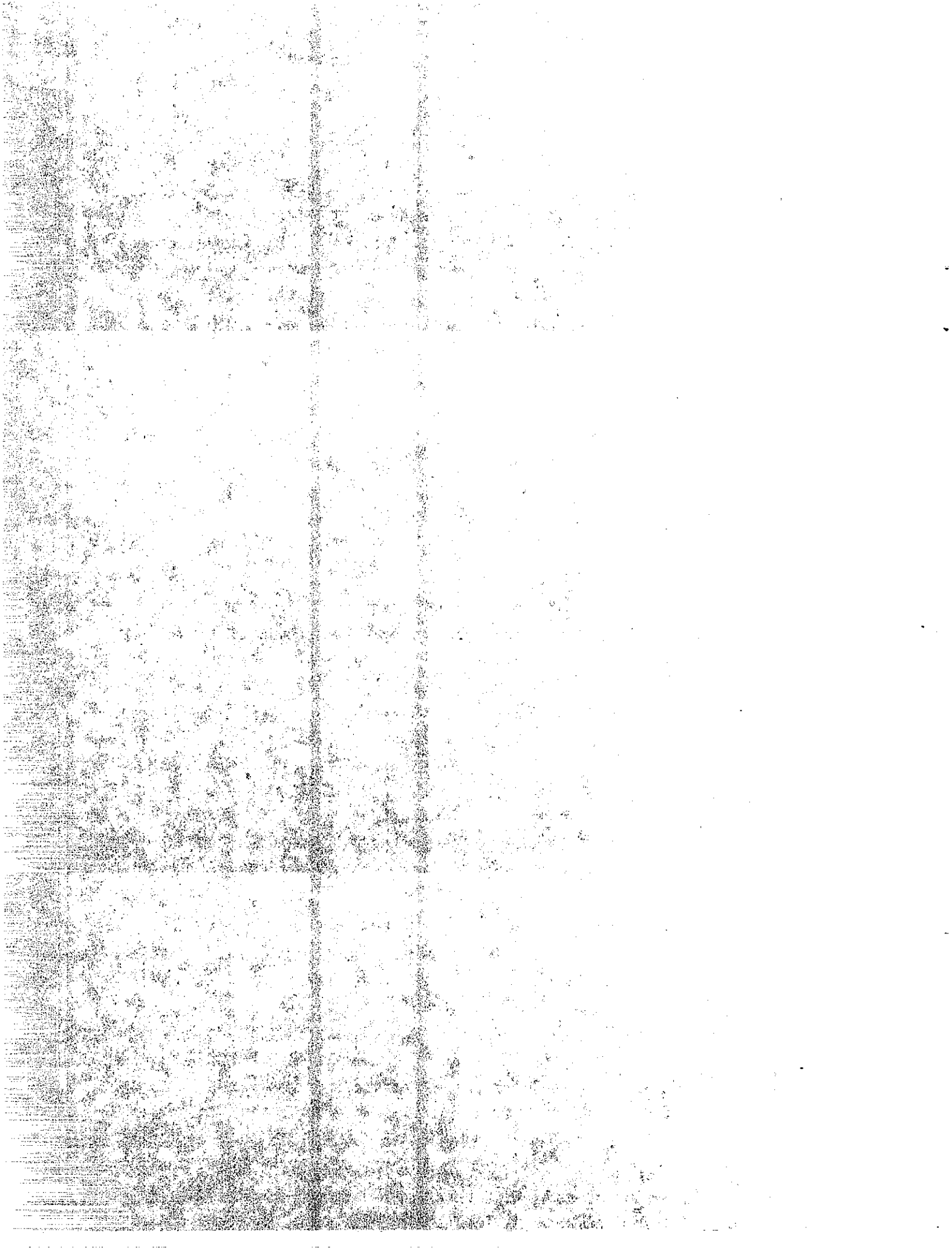
Cost-Effectiveness

Cost-effectiveness expressed in construction cost per dBA reduction per residence averaged $2,880 (1981) and ranged from $1,040 to $4,160. This compares reasonably well with the average cost-effectiveness of $2,600/dBA (1981) per residence for California masonry barriers, 6 to 10 feet high and 300 feet long, providing 5 to 7 dBA attenuation for two residences. Insulation generally becomes more cost-effective than a barrier when only one house needs to be protected. It becomes less cost-effective than a barrier when more than two residences need to be protected.

Feasibility

This study has shown that insulating private homes can be a viable highway noise mitigation measure if:

- it is done on a small scale (isolated homes), and,
- there is no concern for mitigating noise levels outside the residence. or,
- barriers are neither feasible, cost-effective, nor desirable.



V. RECOMMENDATIONS

Insulating private residences from highway noise should be considered when:

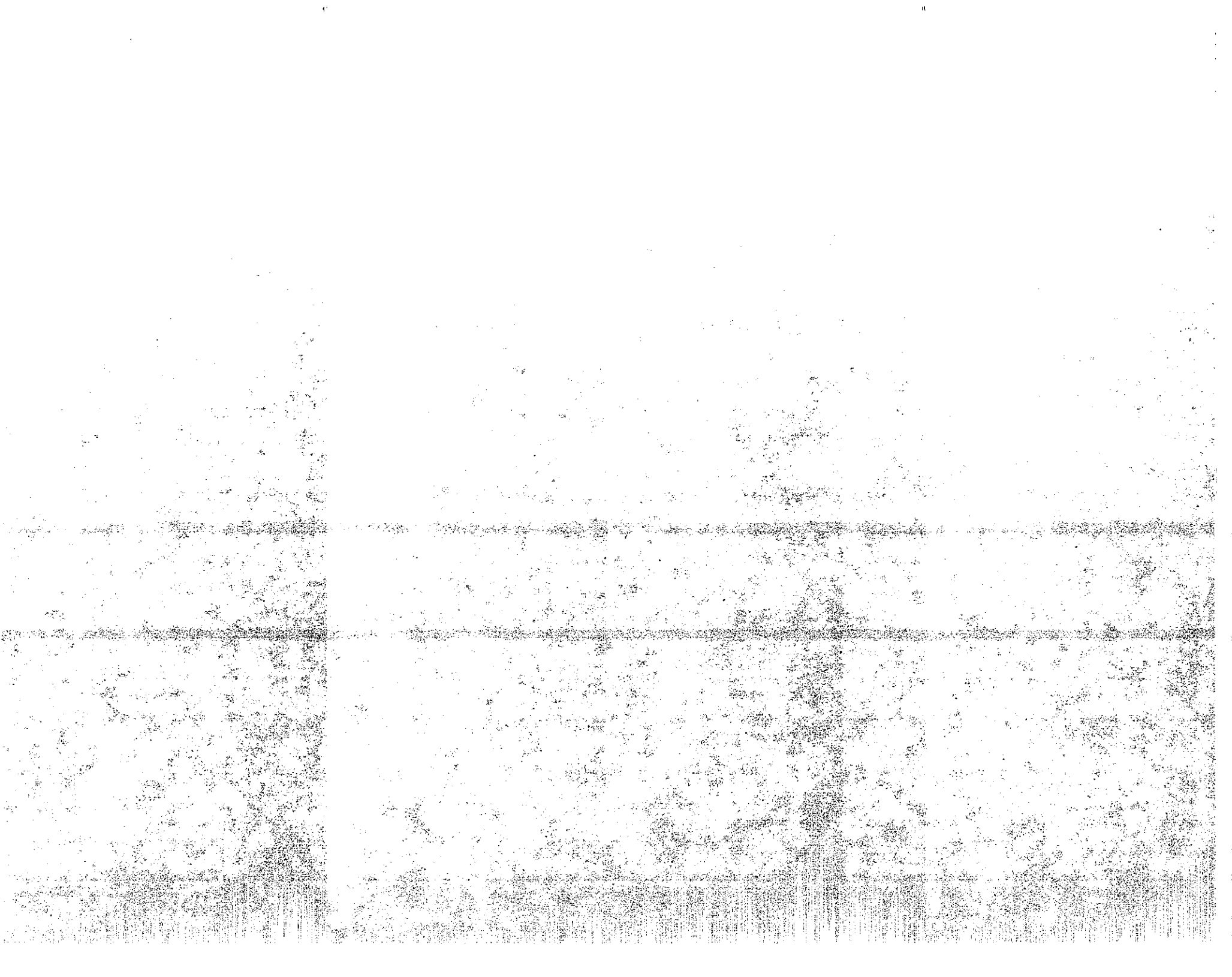
- Noise barriers are not feasible or effective. Typical situations include multi-story residences, and adverse topography.

- Noise barriers are not cost-effective. This is usually the case when mitigating isolated homes from noise.

- Noise barriers are undesirable, such as when they block scenic views, or do not "fit in" with the aesthetics of a locale.

For reasons of cost-effectiveness, noise insulation should be done on a small scale. It may be particularly effective to mix insulation with conventional barrier designs when local anomalies in terrain prevent effective mitigation by barrier alone.

However, since this study dealt with noise insulation of private residences outside the highway right-of-way, it appears that a legislative act or policy is needed if such a program is undertaken.

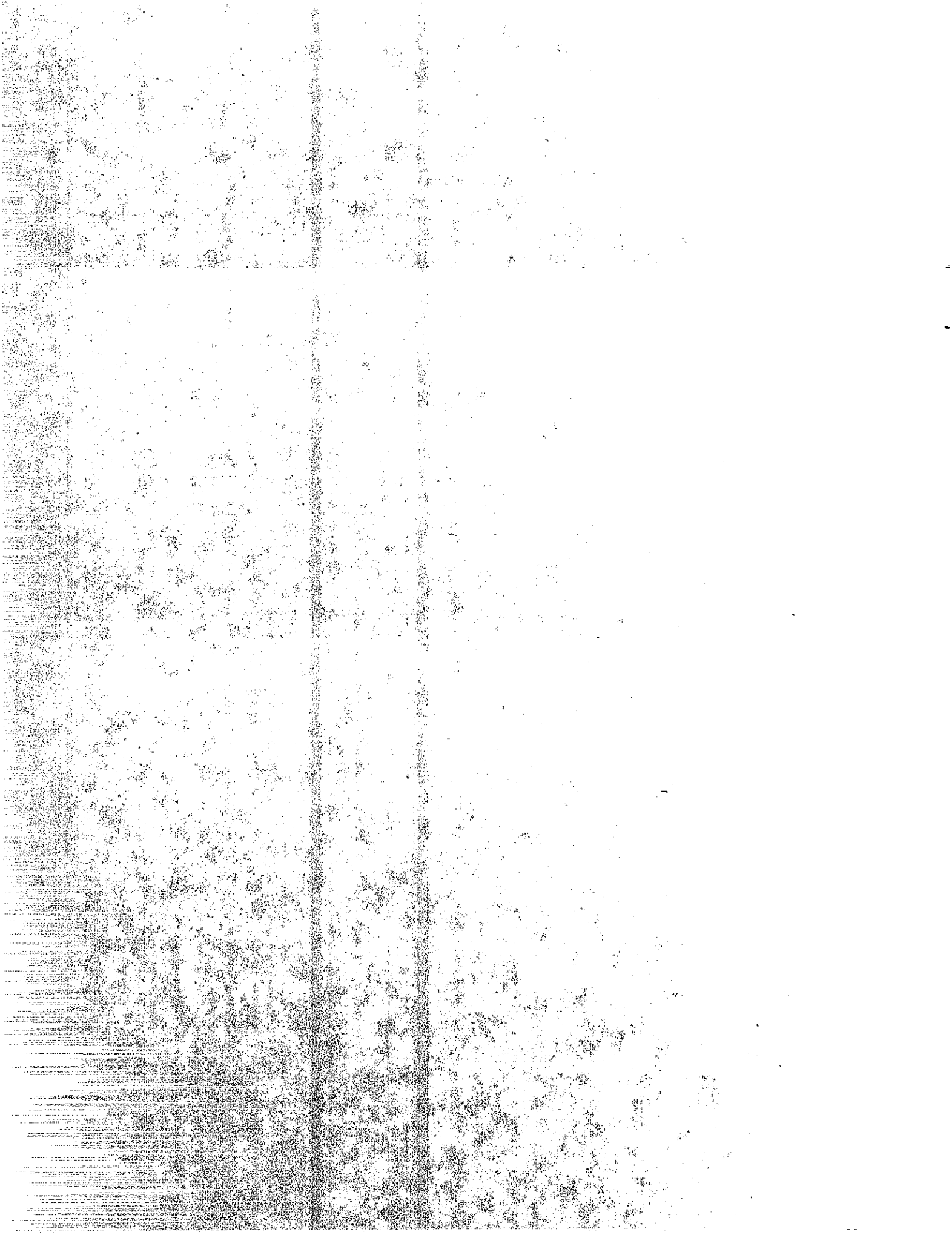


VI. BENEFITS

Information gathered in this study indicates that, in some cases, noise insulation is a feasible alternative to noise barriers and other cost-intensive noise mitigation measures such as realignment or cut-section design.

Insulation is an attractive alternative for mitigating noise impacts on isolated homes. It is estimated (using typical California construction costs) that noise mitigation of a single home through insulation can realize savings of up to $18,000 over construction of an equivalent noise barrier (based on noise reduction of 5 dBA). Caltrans has a minimum noise barrier design requirement of breaking the line of sight between an 11.5 foot high truck stack and a 5 foot receiver. Even without this requirement, a savings of $6,000 may be realized by insulating one home rather than providing protection with a noise barrier.

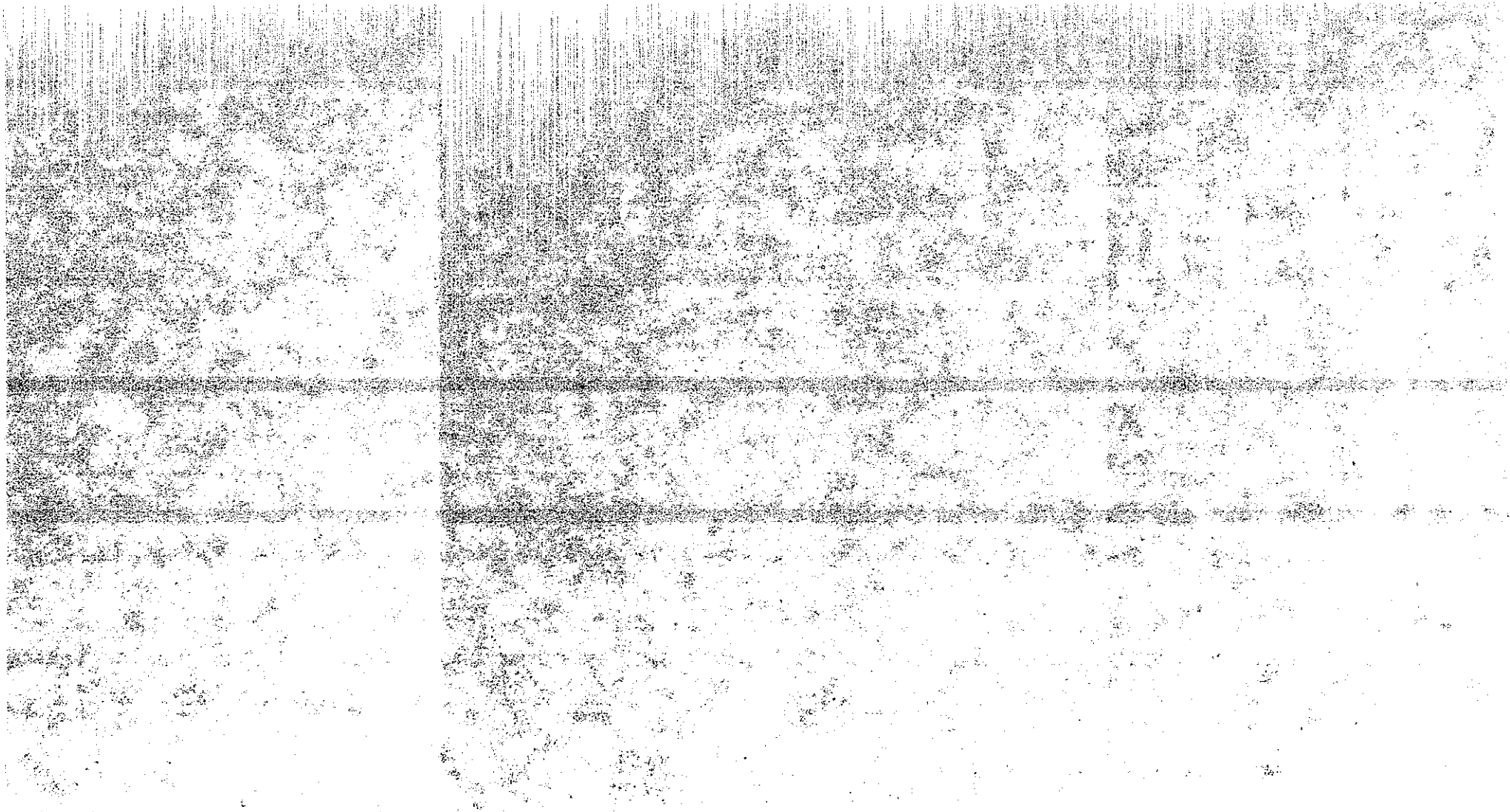
Other benefits and limitations of insulation are discussed in greater detail in the final chapter in this report.



VII. IMPLEMENTATION

This research report will be distributed statewide to Caltrans Districts and nationwide to FHWA and State Highway Agencies.

Caltrans should consider issuing a Policy and Procedure memorandum governing use of insulation based on criteria developed in this report.



VIII. PROJECT DESCRIPTION

This report covers the evaluation of two noise insulation projects, one in District 4 (San Francisco) and one in District 7 (vicinity of Los Angeles).

In general, both insulation projects included modifications of, or additions to windows, doors, walls and ventilation systems. Because of variations in layout, window area and other pertinent conditions, no meaningful evaluation could be made of the effectiveness of one treatment over another.

Construction details are described in the Notice To Bidders and Special Provisions (District 4), Project Reports (District 4 and 7) and Proposal and Contract (District 7). These are shown in Appendix E.

IX. GENERAL APPROACH

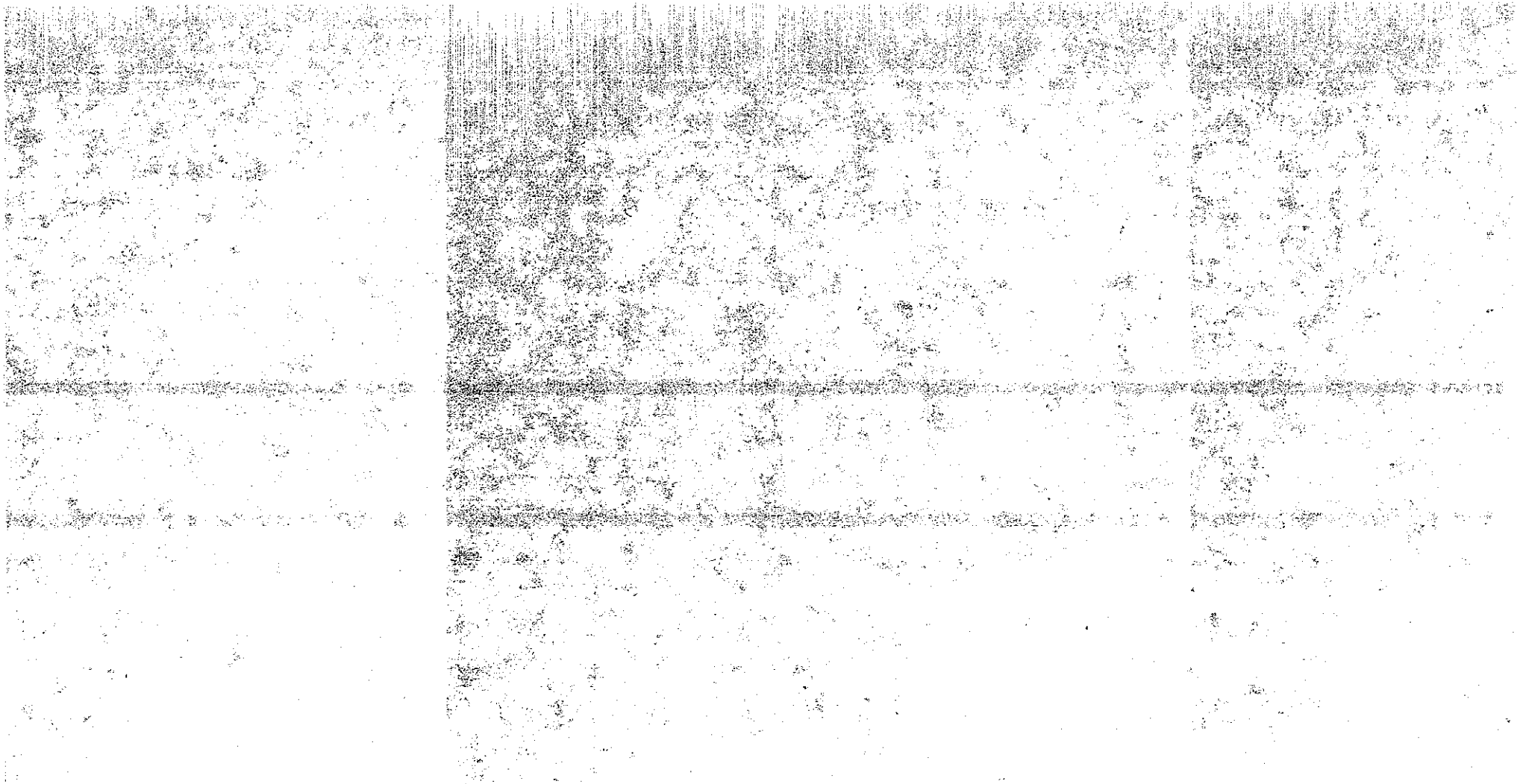
The effectiveness of the noise insulation of the residences was evaluated by objective "before-and-after" noise measurements and by subjective homeowner perceptions of noise level reductions.

Noise measurements were made inside and outside the residences, simultaneously, at the same locations and heights before and after insulation. The outside measurement served as a "control" to normalize before and after measurements for changes in traffic variables (volume, speed and vehicle type distribution). The differences between before and after outside-to-inside noise attenuations were attributed to the insulation added to the homes.

The measurements in District 7 also included a frequency analysis performed on ten prominent noise peaks obtained from simultaneous inside and outside tape recordings of the freeway noise.

In both Districts, the dominant noise source proved to be the freeway at each site. This was demonstrated by comparing measured outside noise levels to levels predicted by a traffic noise model (1). Local noise sources, such as street traffic and noisy neighbors, did not present contamination problems. The site in District 7 was in a rural area. The sites in District 4 were located in an urban neighborhood with very little local traffic or other-than-freeway activity. Inside noise measurements were carefully monitored to exclude contaminations from appliances, telephones, clocks, residents themselves and other potential sources not related to the freeway noise.

Homeowners were informally interviewed before and after insulation for their reactions to the project and perception of noise reduction. Questionnaires furnished by the Federal Highway Administration were used to record the data during personal interviews. No statistical correlation was attempted between objective measurements and subjective perceptions of noise reductions because of the small sample size (number of residents). Instead, a synopsis of the views expressed during the interviews and in the questionnaires is included in this report.



X. EVALUATION OF DISTRICT 4 PROJECT

Sites

Pre-insulation noise measurements were made inside and outside four connected two and three story residences at 575, 579, 585 and 599 San Bruno Avenue in San Francisco. Figures 1, 2, and 3 show the site layouts, cross sections and thirteen microphone (mic.) locations. The freeway (Route 101) is in a depressed section, averaging about 15 feet deep in front of the selected residences.

After the pre-insulation measurements, the owner of house No. 599 San Bruno Avenue decided to withdraw from the project. Consequently, the post-insulation measurements did not include locations No. 6 and 7. For convenience in correlating before-and-after measurements, mic. Nos. 8 through 13 were not renumbered after the elimination of Nos. 6 and 7. A list of instruments used is shown in Appendix F.

Noise Measurements

On October 15, 1980, before insulation, simultaneous noise measurements were made at the thirteen mic. locations. Three 20 minute Leq measurements (runs) were performed under several conditions. The Leq descriptor conforms to noise analyses requirements set forth by FHPM 7-7-3(2). It is the equivalent steady-state noise level which, in a stated period of time (in this case 20 minutes), contains the same acoustic energy as the time varying level during the same period. During run 1, windows and drapes were closed. Run 2 was measured with windows closed, drapes open. The windows and drapes were left open during run 3.

On February 3, 1984, after insulation, measurements were made in two setups (setups A and B). Conditions and duration of runs 1, 2 and 3, however, were the same as for the corresponding runs before insulation. Except for the elimination of mic. Nos. 6 and 7, all microphones occupied the same location as during the measurements before insulation.

MICROPHONE HEIGHTS			
MIC	HEIGHT	MIC	HEIGHT
1	15'	8	3.5'
2	15'	9	3.5'
3	15'	10	4.0'
4	15'	11	5.0'
5	17'	12	4.5'
6	3.5'	13	4.5'
7	3.5'		

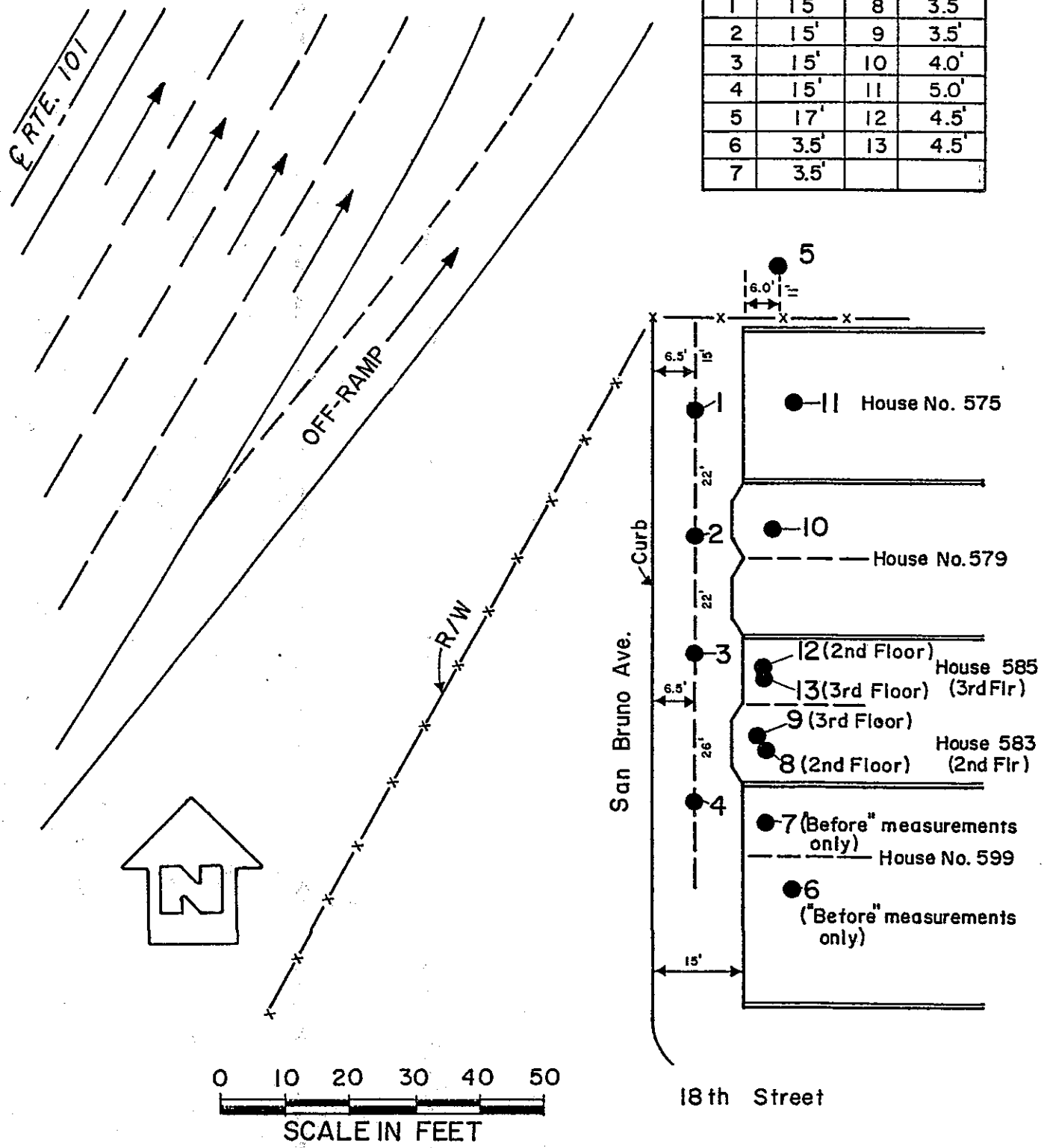


Figure 1 District 4 Sites-Layout

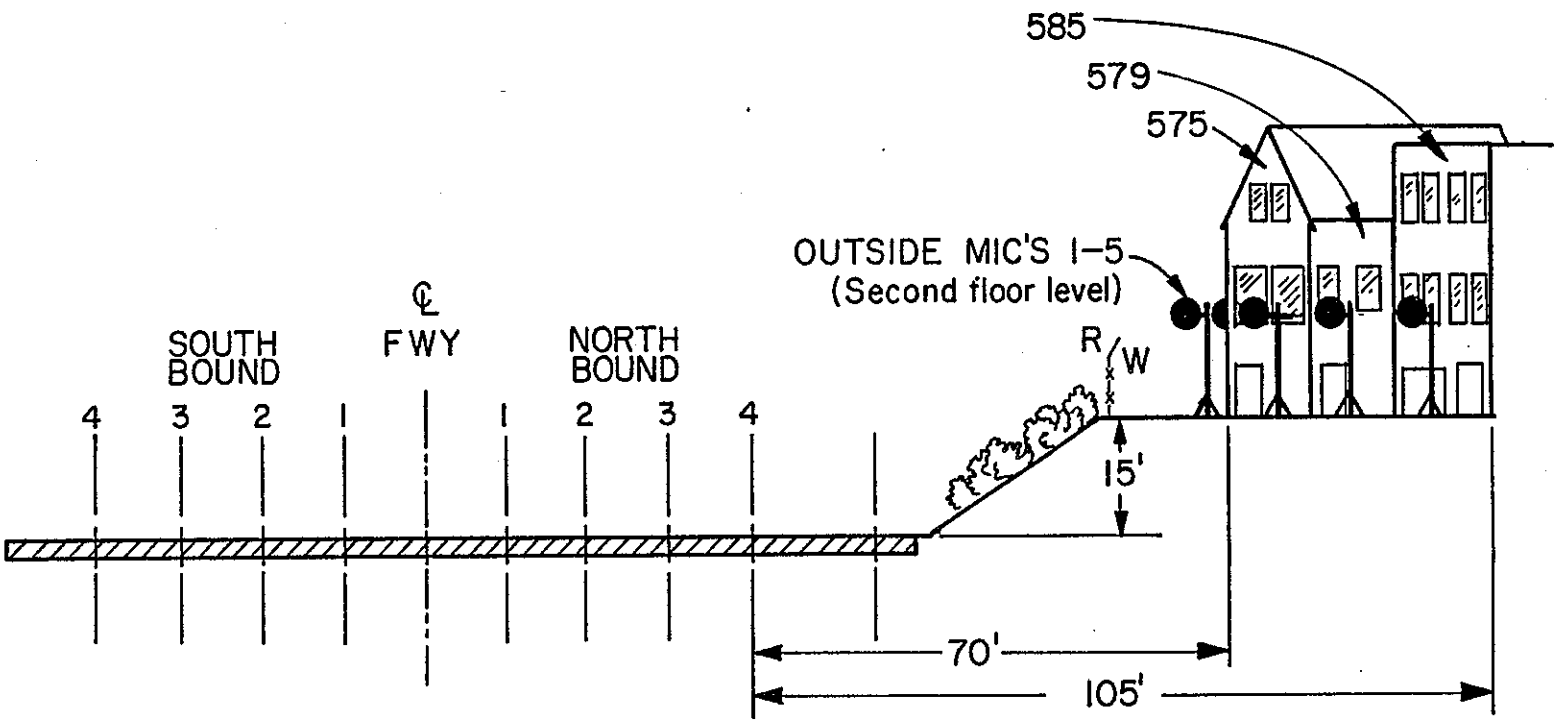


Figure 2 District 4 Sites-Cross Section

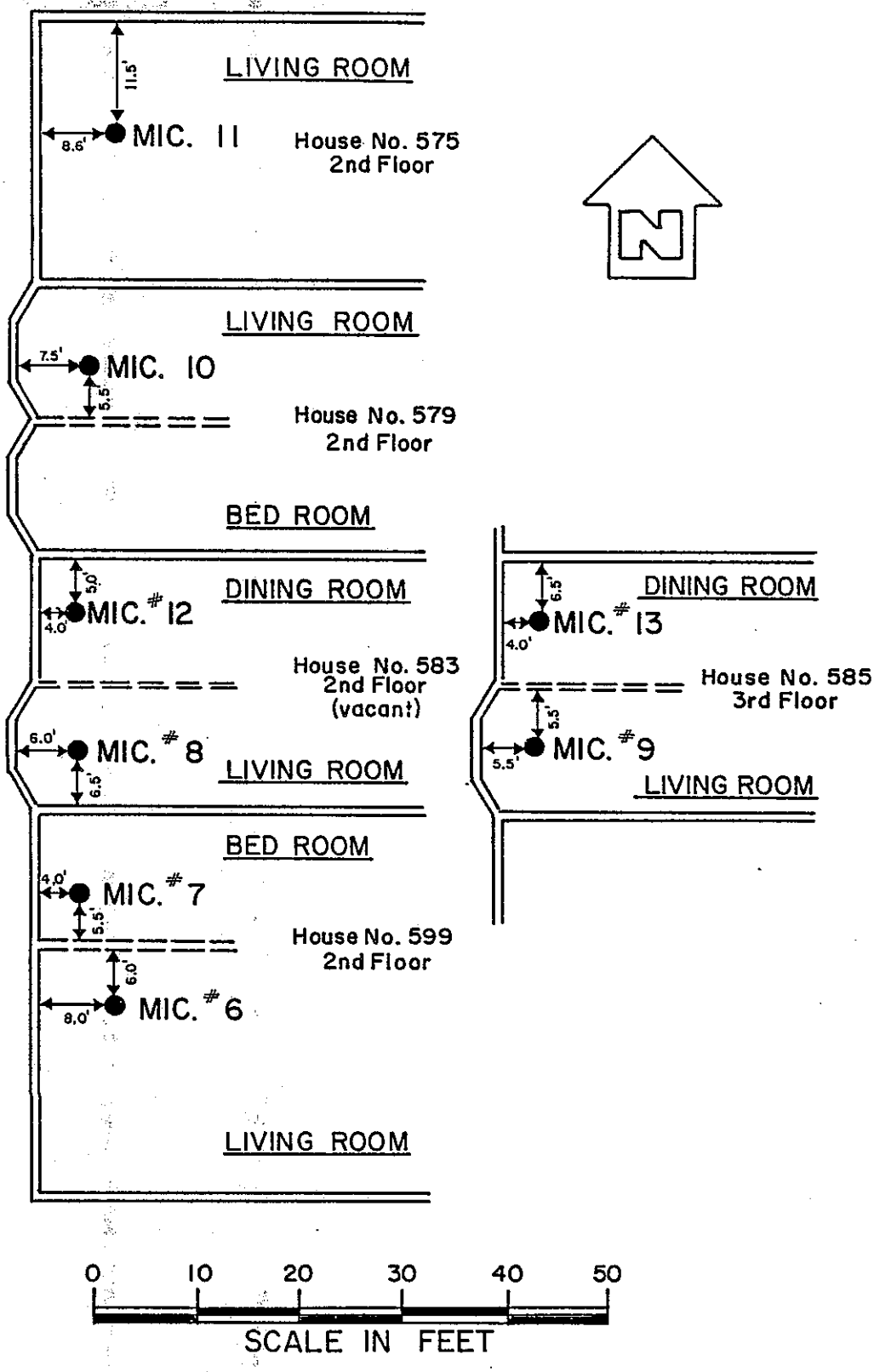


Figure 3 District 4 Sites-Inside Microphone Locations

Table 1 shows the measurement results

Freeway Traffic Volumes

Because of an observed lack of other noise sources in the site's vicinity, freeway traffic was considered the dominant noise source. This was later confirmed by comparing predicted with measured outside noise levels.

Lane-by-lane traffic counts were made simultaneously during the noise measurements (Table 2). These were expanded to hourly volumes averaged over runs 1, 2, and 3, before and after insulation (Table 3). The traffic counts were categorized by vehicle groups defined in FHWA-RD-77-108(1). Average speeds were obtained by radar.

Analyses and Results

The objective analysis of the effectiveness of the insulation procedures was based on a comparison of the before and after differences between outside and inside noise levels. These differences depend on (1) building attenuation (with and without insulation), (2) distances and topography between noise sources and receivers, and (3) location and nature of the noise sources. In order to measure the first variable, the other two variables must remain reasonably constant over the study period. Item No. 2 remained constant throughout the study, and therefore did not need further consideration. The stability of the location and nature of noise sources, however, needed to be confirmed.

Noise levels measured at outside mic. locations No. 1, 2, and 3 were compared with predictions using FHWA-RD-77-108(1) methodology with California Vehicle Noise (Calveno) Emission Levels(3). These comparisons were made for average before-and-after insulation traffic conditions. For convenience, noise and traffic measurements were averaged over runs 1, 2 and 3. The following tabulation summarizes the comparisons between measured and predicted.

Table 1

SUMMARY OF 20 MINUTE NOISE MEASUREMENTS
BEFORE AND AFTER INSULATION
DISTRICT 4 SITES

Mic. No.	BEFORE, Leq dBA			AFTER, Leq dBA					
				Setup A			Setup B		
	Run 1 Windows, Drapes, Closed	Run 2 Windows Closed, Drapes Open	Run 3 Windows, Drapes, Open	Run 1 Same as "Before"	Run 2	Run 3	Run 1 Same as "Before"	Run 2	Run 3
1	79.6	79.6	79.7	80.8	80.9	80.6	-	-	-
2	78.4	78.6	78.5	79.7	79.8	79.8	-	-	-
3	76.2	76.3	76.3	-	-	-	77.3	77.2	77.4
4	73.3	73.8	74.0	-	-	-	75.6	75.7	76.1
5	79.2	79.0	79.2	80.8	80.7	80.6	-	-	-
6	48.4	48.5	67.4	-	-	-	-	-	-
7	47.6	50.2	68.5	-	-	-	-	-	-
8	50.5	52.0	67.0	-	-	-	50.1	49.6	67.0
9	51.5	52.3	67.8	-	-	-	50.5	49.9	66.7
10	53.1	54.2	67.7	48.3	49.2	68.6	-	-	-
11	52.6	51.1	59.7*	49.0	49.3	68.0*	-	-	-
12	52.7	52.9	69.9	-	-	-	50.7	50.8	70.5
13	51.8	52.7	71.4	-	-	-	51.8	52.0	71.2

*The "after" condition included more open windows than the "before" condition.

Table 2

SUMMARY OF TRAFFIC COUNTS
(Performed Simultaneously With Noise Measurements)
District 4 - San Francisco Sites

				Avg. Speed	Southbound Lanes				Northbound Lanes				
					4	3	2	1	1	2	3	4	Ramp
BEFORE		Run 2	Autos	52 mph	366	499	529	510	486	633	525	213	98
		10:57-	Med.Tr.	" "	24	29	16	7	7	24	19	11	14
		11:17	Hvy.Tr.	" "	25	24	20	2	0	19	34	7	3
		Run 2	A	" "	403	524	570	548	435	562	493	202	99
		12:00-	MT	" "	19	18	15	7	12	26	18	6	5
		12:20	HT	" "	17	22	18	2	0	13	18	15	4
		Run 3	A	" "	360	484	507	466	489	544	514	209	73
		12:40-	MT	" "	22	20	14	10	5	30	25	17	1
		13:00	HT	" "	18	16	18	2	0	13	19	11	2
AFTER	SET UP	Run 1	Autos	55 mph	421	497	548	569	662	750	607	291	134
		9:43-	Med.Tr.	55 "	23	22	21	1	5	29	33	12	7
		10.03	Hvy.Tr.	50 "	14	22	18	1	1	17	23	9	3
		Run 2	A	55 "	413	467	509	525	553	679	557	296	141
		10:10-	MT	55 "	19	15	18	7	3	13	18	12	6
		10:30	HT	50 "	16	31	23	0	3	20	24	8	5
	A	Run 3	A	55 "	445	496	501	539	643	754	570	301	131
		10:37-	MT	55 "	18	28	14	6	8	21	19	12	7
		10:57	HT	50 "	11	16	21	1	1	19	27	4	2
	SET UP	Run 1	A	55 "	439	522	548	634	585	697	567	271	137
		12:30-	MT	55 "	14	14	14	8	2	19	14	8	3
		12:50	HT	50 "	7	10	15	0	0	18	17	11	1
		Run 2	A	55 "	428	480	607	634	648	712	585	296	141
		13:07-	MT	55 "	18	16	18	3	5	19	13	12	2
		13:27	HT	50 "	10	13	18	3	0	15	17	7	1
	B	Run 3	A	55 "	450	524	592	596	596	756	590	286	128
		13:29-	MT	55 "	10	12	10	8	6	12	10	10	2
		13:49	HT	50 "	8	12	24	2	2	10	22	8	2

Table 3

AVERAGE HOURLY TRAFFIC VOLUMES
District 4 - San Francisco Site

BEFORE INSULATION

		Average Speeds	Southbound Lanes 4	3	2	1	Northbound Lanes 1	2	3	4	Ramp
	Autos	52 mph	1129	1507	1606	1524	1410	1739	1532	624	270
	Med. Trks	52 mph	65	67	45	24	24	80	62	34	20
	Hvy. Trks	52 mph	60	62	56	6	0	75	71	33	9

AFTER INSULATION

		Average Speeds	Southbound Lanes 4	3	2	1	Northbound Lanes 1	2	3	4	Ramp
Setup A	Autos	55 mph	1279	1460	1558	1633	1858	2183	1734	888	406
	Med. Trks	55 mph	60	65	53	14	16	63	70	36	20
	Hvy. Trks	50 mph	41	69	62	2	5	49	74	21	10
Setup B	Autos	55 mph	1317	1526	1747	1864	1829	2165	1742	853	406
	Med. Trks	55 mph	42	42	42	19	13	50	37	30	7
	Hvy. Trks	50 mph	25	35	57	5	2	43	56	26	4

San Francisco Sites

Mic. No.	Before, Leq dBA		After, Leq dBA	
	Measured	Predicted	Measured	Predicted
1	80	78	81	78
2	78.5	77	80	77
3	76	76	77	76
4	74	74	75	74
5	79	78	81	78

The tendency for measurements to be 0 to 3 dBA higher than the predictions was probably caused in part by reflections off the buildings (reflections were not included in the predictions). The outside microphones were generally about 9 feet from the residences. These reflections did not introduce another variable in the insulation attenuation calculations, because they were present during both the before-and-after insulation measurements.

Considering the complexity of the site, the predicted values are in close agreement with measured values (i.e., the measured noise levels can be explained by the freeway traffic).

The noise attenuations due to insulation were calculated from measured noise levels using the following method:

$$\overline{\Delta L}_i = \frac{1}{nk} \sum_{o=1}^{n} \sum_{r=1}^{k} \left(\delta L'_{or} - \delta L_{or} \right) \qquad \text{[Eq.1]}$$

where: $\overline{\Delta L}_i$ = the average attenuation due to insulation at inside mic. location i.

$\delta L'_{or}$ = the difference in measured or noise levels (Leq, dBA) between outside mic. location o and inside mic. location i, during run r, after insulation.

δL_{or} = same as above during pre-insulation measurements.

n = number of outside mic.'s

k = number of runs (measurements).

The above method focuses on differences between outside and inside mic.'s rather than actual noise levels. This has the same effect as normalizing before-and-after insulation measurements. Each inside noise level was paired with simultaneously measured outside noise levels at 2 or 3 locations (n=2 or 3) to generate the outside/inside differences for each run.

Two runs each (k=2) were made with windows closed during the before-and-after insulation noise measurements. For obvious reasons the third run with windows open - for obvious reasons was not included in the insulation attenuation calculations. Tables 4 and 5 summarized these calculations for runs 1 and 2. Table 6 shows the average insulation attenuation at each inside microphone location, the 95% confidence limits, standard deviations and the number of attenuations averaged (N=nk).

Cost-Effectiveness

Some time ago Caltrans derived two cost-effectiveness criteria for its Community Noise Abatement Program (mitigation of noise along existing freeways)(Appendix G). These criteria are factors to be considered in determining eligibility of noise abatement projects for programming or inclusion in a priority list.

The cost-effectiveness criteria are:

1. Maximum of $2,500 per dBA noise reduction for each residence.

2. Maximum of $25,000 per residence.

These costs are based on 1981 costs and are adjusted according to a "Sound Wall Cost Construction Index" prepared by Caltrans' Office of Structures Design.

Table 4

DECREASE IN NOISE LEVELS DUE TO INSULATION
(District 4 Sites)

RUN NO. 1

BEFORE					AFTER					DECREASE
OUTSIDE		INSIDE		DIFF.	OUTSIDE		INSIDE		DIFF.	Diff. After Minus
Mic.No.	Leq,dBA	Mic.No.	Leq,dBA	Leq,dBA	Mic.No.	Leq,dBA	Mic.No.	Leq,dBA	Leq,dBA	Diff. Before
1	79.6	10	53.1	26.5	1	80.8	10	48.3	32.5	6.0
2	78.4	10	53.1	25.3	2	79.7	10	48.3	31.4	6.1
5	79.2	10	53.1	26.1	5	80.8	10	48.3	32.5	6.4
1	79.6	11	52.6	27.0	1	80.8	11	49.0	31.8	4.8
2	78.4	11	52.6	25.8	2	79.7	11	49.0	30.7	4.9
5	79.2	11	52.6	26.6	5	80.8	11	49.0	31.8	5.2
3	76.2	8	50.5	25.7	3	77.3	8	50.1	27.2	1.5
4	73.3	8	50.5	22.8	4	75.6	8	50.1	25.5	2.7
3	76.2	9	51.5	24.7	3	77.3	9	50.5	26.8	2.1
4	73.3	9	51.5	21.8	4	75.6	9	50.5	25.1	3.3
3	76.2	12	52.7	23.5	3	77.3	12	50.7	26.6	3.1
4	73.3	12	52.7	20.6	4	75.6	12	50.7	24.9	4.3
3	76.2	13	51.8	24.4	3	77.3	13	51.8	25.5	1.1
4	73.3	13	51.8	21.5	4	75.6	13	51.8	23.8	2.3

Table 5

DECREASE IN NOISE LEVELS DUE TO INSULATION
(District 4 Sites)

RUN NO. 2

BEFORE					AFTER					DECREASE
OUTSIDE		INSIDE		DIFF.	OUTSIDE		INSIDE		DIFF.	Diff. After Minus
Mic.No.	Leq,dBA	Mic.No.	Leq,dBA	Leq,dBA	Mic.No.	Leq,dBA	Mic.No.	Leq,dBA	Leq,dBA	Diff. Before
1	79.6	10	54.2	25.4	1	80.9	10	49.2	31.7	6.3
2	78.4	10	54.2	24.4	2	79.8	10	49.2	30.6	6.2
5	79.0	10	54.2	24.8	5	80.7	10	49.2	31.5	6.7
1	79.6	11	51.1	28.5	1	80.9	11	49.3	31.6	3.1
2	78.6	11	51.1	27.5	2	79.8	11	49.3	30.5	3.0
5	79.0	11	51.1	27.9	5	80.7	11	49.3	31.4	3.5
3	76.2	8	52.0	24.3	3	77.2	8	49.6	27.6	3.3
4	73.8	8	52.0	21.8	4	75.7	8	49.6	26.1	4.3
3	76.3	9	52.3	24.0	3	77.2	9	49.9	27.3	3.3
4	73.8	9	52.3	21.5	4	75.7	9	49.9	25.8	4.3
3	76.3	12	52.9	23.4	3	77.2	12	50.8	26.4	3.0
4	73.8	12	52.9	20.9	4	75.7	12	50.8	24.9	4.0
3	76.3	13	52.7	23.6	3	77.2	13	52.0	25.2	1.6
4	73.8	13	52.7	21.1	4	75.7	13	52.0	23.7	2.6

Table 6

AVERAGE DECREASE IN NOISE LEVELS
DUE TO INSULATION
(DISTRICT 4 SITES)

House No.	Mic. No.	Average Decrease Leq, dBA	95% Confidence Interval	Standard Deviation	N (nk)
575	11	4.1	3.3 - 4.9	1.0	6
579	10	6.3	6.1 - 6.5	0.2	6
585/587	8	3.0	1.6 - 4.4	1.2	4
	9	3.3	2.1 - 4.4	0.9	4
	12	3.6	2.9 - 4.3	0.6	4
	13	1.9	1.1 - 2.7	0.7	4

The following summarizes the 1981 cost of insulating each of the three residences in District 4, the average noise reduction achieved and a comparison of cost-effectiveness with the Caltrans criteria.

Cost-Effectiveness of Insulation - District 4

House No.	Cost	Average Noise Reduction	Cost/dBA	Criterion Cost/dBA
575	$10,080	4 dBA	$2,520/dBA	$2,500/dBA
579	$ 6,240	6 dBA	$1,040/dBA	$2,500/dBA
585/587	$12,480	3 dBA	$4,160/dBA	$2,500/dBA

According to the above criteria insulating house No. 585/587 was not cost-effective. Insulating house No. 575 was only marginally cost-effective.

Homeowners' Perception

Homeowners were generally satisfied with the modifications of their homes. The degree of satisfaction primarily followed the degree of achieved noise attenuation.

In one instance, quality of workmanship was critized, but only to the extent that it degraded noise attenuation properties. A cross-check with measured attenuations revealed that a minimal 2 dBA attenuation was measured at the location (mic. #13), due to a poorly constructed sliding window.

XI. EVALUATION OF DISTRICT 7 PROJECT

Sites

Originally six potential residences were identified in District 7: two in Hollywood, three in San Clemente and one in Camarillo. Pre-insulation noise measurements were performed on October 27-29, 1981 at the six sites. After reviewing the measured data, only the Camarillo site at 505 North Wood Road, was deemed suitable for the project. Inside noise levels in the five rejected sites were too low. For this reason, only data from the Camarillo site is included in this report. Figures 4 and 5 show a layout and cross section of the site in relation to the freeway (route 101). Microphone locations are shown in Figure 6.

Noise Measurements

The site was instrumented with five microphones: two outside (mic.'s 1 and 2) and three inside (mic.'s 3, 4 and 5).

Mic.'s 1 and 2 were two feet from each other, 17 feet from the residence, 5 feet above inside floor level, and 8 feet above the ground. Mic. 1 was used to make a linear tape recording via a B&K type 2218 sound level meter and a Nagra tape recorder for subsequent frequency analysis. Mic. 2 measured A-weighted noise levels via a B&K type 2218 sound level meter. A similar arrangement was used inside at mic.'s 3 (linear) and 4 (A-weighted). Mic. 5 measured A-weighted only. A full list of instrumentation is included in Appendix F.

Pre-insulation noise measurements were performed on October 28, 1981. Post-insulation measurements were taken on December 12, 1984. Table 7 shows the results of the measurements in terms of 15 minute Leq's. The pre-insulation measurements included two runs: windows open and windows closed. The two post-insulation runs were performed with windows closed only: the first run without running the newly installed heat pump (air conditioner/heater), the

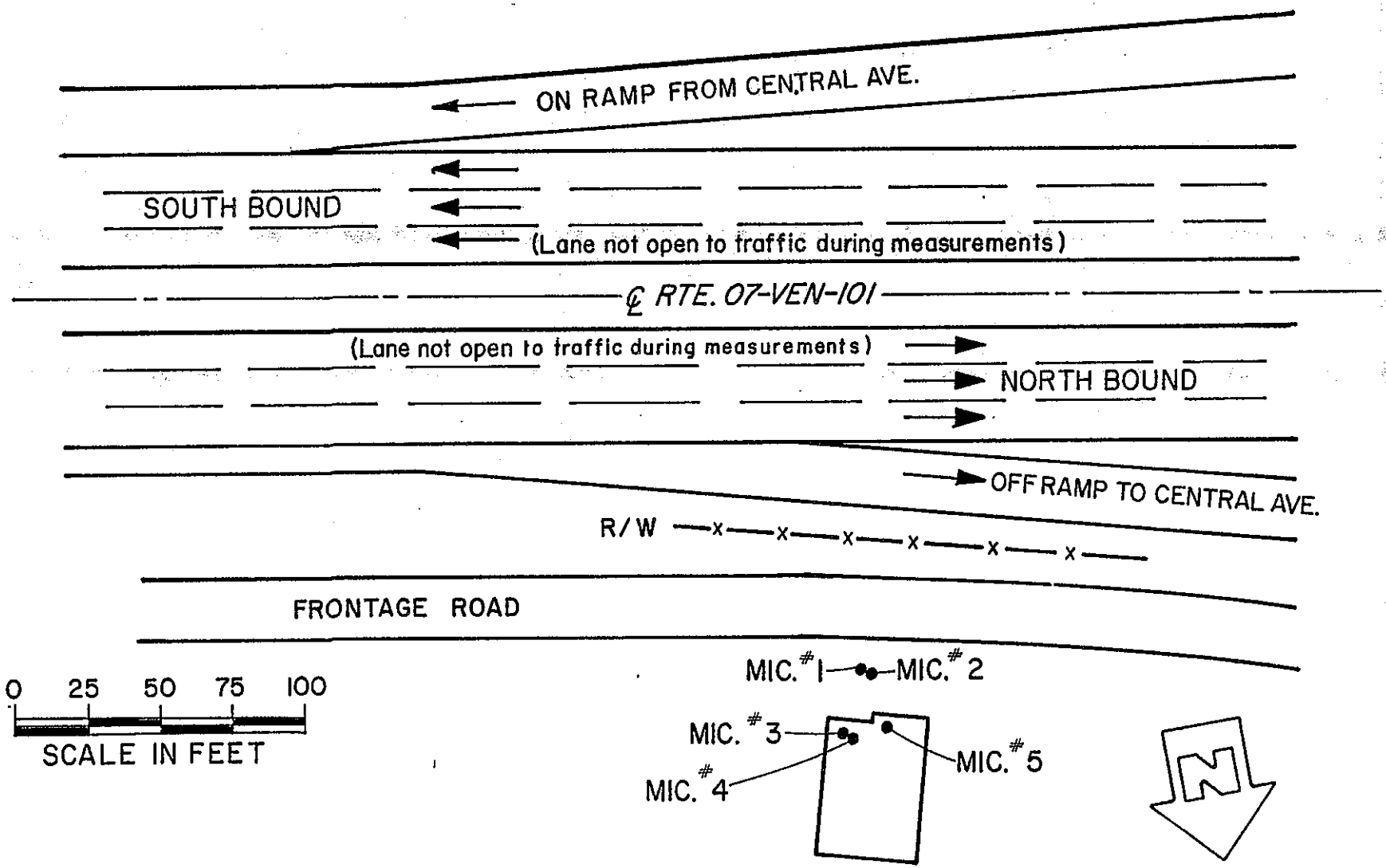


Figure 4 District 7 Site-Layout

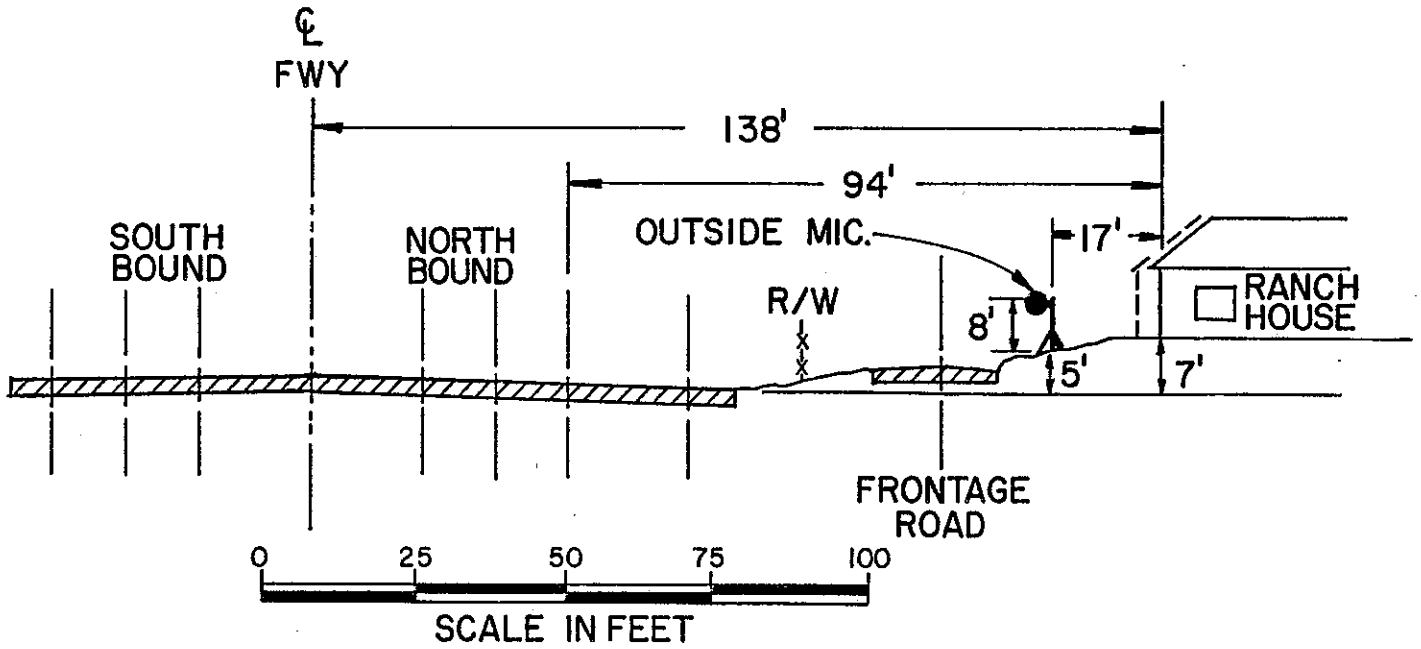


Figure 5 District 7 Site-Cross Section

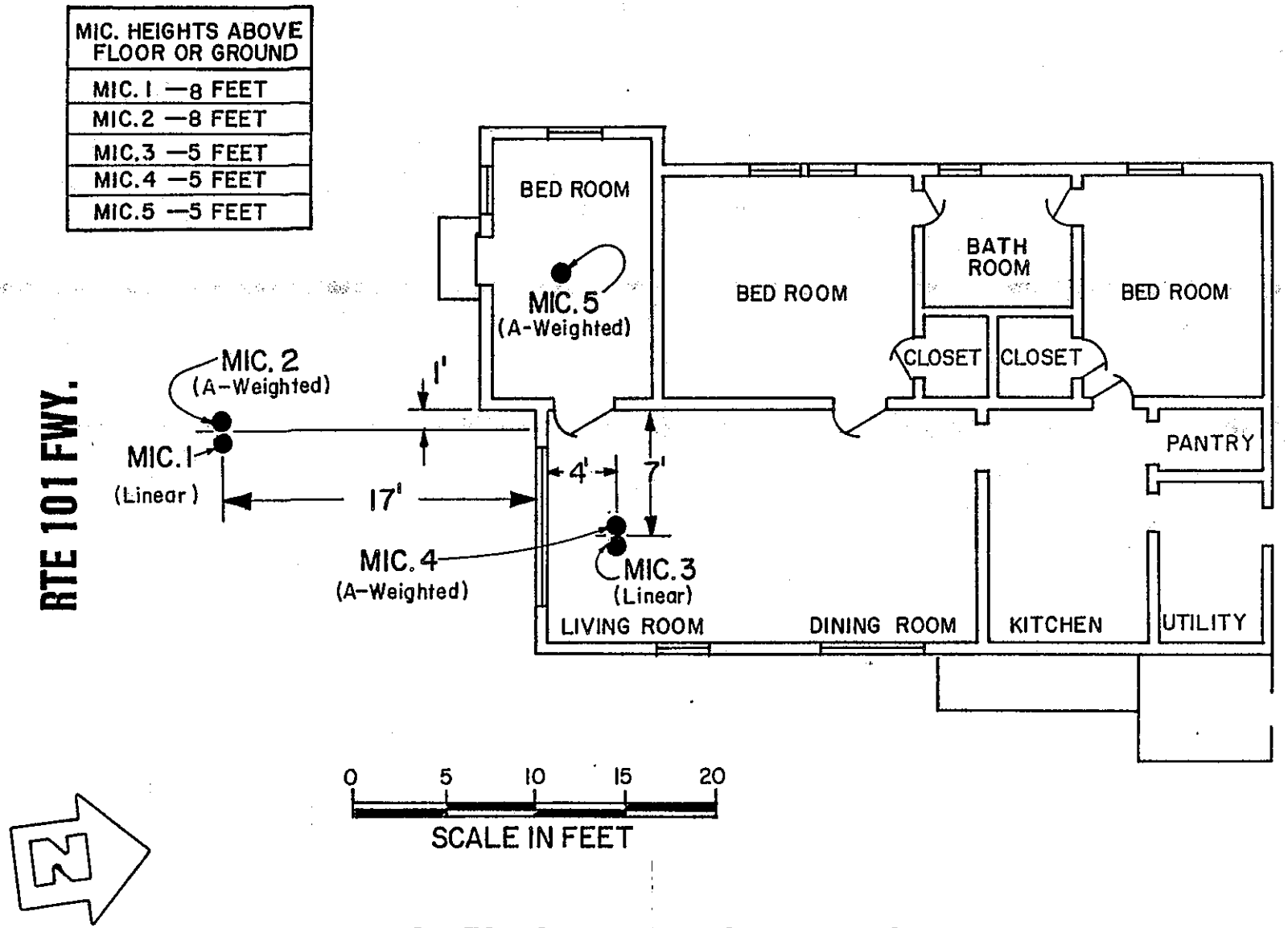


Figure 6 District 7-Microphone Locations

Table 7

SUMMARY OF 15 MINUTE NOISE MEASUREMENTS
BEFORE AND AFTER INSULATION
DISTRICT 7 SITE

Mic. No.	BEFORE, Leq		AFTER, Leq	
	Run A Windows Closed	Run C Windows Open	Run A Windows Closed W/o AC/HTR	Run B Windows Closed With AC/HTR
1	82.9 dBL*	81.5 dBL*	81.7 dBL*	83.1 dBL*
2	74.4 dBA	73.8 dBA	75.8 dBA	76.3 dBA
3	70.2 dBL*	71.8 dBL*	67.6 dBL*	68.3 dBL*
4	52.3 dBA	57.4 dBA	45.2 dBA	46.4 dBA
5	50.2 dBA	60.1 dBA	49.0 dBA	49.7 dBA

* dBL = dB Linear

second run with the heat pump on. For convenience, the runs were labeled A, B and C. Except for installing insulation, runs A before-and-after were made under the same conditions inside the residence. After normalizing for differences in traffic by using the concurrent outside measurements, these runs were compared to determine the attenuation provided by the insulation.

Freeway Traffic Volumes

Directional traffic was counted during each noise measurement run. As was the case with the District 4 San Francisco sites, freeway traffic was the dominant noise source. The 15 minute traffic counts were expanded to hourly volumes, averaged over runs A and C, before, and runs A and B after insulation. Table 8 shows the actual counts. Table 9 shows the volumes expanded to one hour. Traffic was grouped in vehicle categories defined in FHWA-RD-77-108(1). Average speeds were obtained by radar gun.

The traffic was used with the FHWA Highway Traffic Noise Prediction Model(1) for comparison with measured outside noise levels, to confirm that the measured noise levels were generated by the freeway.

Analyses and Results

Except for the addition of a frequency analysis, the analysis methods used in District 4 were applied to District 7 data.

A-weighted noise levels measured at mic. 2 were compared with predictions using FHWA-RD-77-108(1) methodology with Calveno emission levels. The following table summarizes the before-and-after comparisons of measured and predicted at mic. 2:

District 7 Site

Mic. No.	Before, Leq dBA		After, Leq dBA	
	Measured	Predicted	Measured	Predicted
2	74	74	76	75

Table 8

SUMMARY OF TRAFFIC COUNTS
(Performed Simultaneously With Noise Measurements)

DISTRICT 7 SITE

Run and Time Periods	Vehicle Type	Average Speed	S/B Lanes	N/B Lanes	Average Speed	S/B Lanes	N/B Lanes
Run A 10:20-10:35 (Before) 10:10-10:25 (After)	Autos Med.Trks Hvy.Trks	55 mph 55 mph 55 mph	365 28 30	418 18 23	55 mph 55 mph 55 mph	431 20 29	498 17 35
Run B 10:40-10:55	Autos Med.Trks Hwy.Trks	- - -	- - -	- - -	55 mph 55 mph 55 mph	462 11 29	476 24 27
Run C 10:45-11:00	Autos Med.Trks Hwy.Trks	55 mph 55 mph 55 mph	375 19 12	390 25 18	- - -	- - -	- - -

Table 9

AVERAGE HOURLY TRAFFIC VOLUMES
DISTRICT 7 - SITE

BEFORE INSULATION

	Average Speeds	S/B Lanes	N/B Lanes
Autos	55 mph	1480	1616
Med.Trks	55 mph	94	86
Hvy.Trks	55 mph	84	82

AFTER INSULATION

	Average Speeds	S/B Lanes	N/B Lanes
Autos	55 mph	1786	1948
Med.Trks	55 mph	62	82
Hvy.Trks	55 mph	116	124

The predicted values showed close agreement with the measured values. It is reasonable to infer that the measured noise levels both before and after insulation originated on the freeway.

Table 10 summarizes the calculated attenuations attributable to the insulation treatment. The comparison of run A, before-and-after, is most indicative of the attentuation provided by the insulation. A comparison of run B-after, with run A-before shows the slight degradation (insignificant) due to running the heat pump. The data suggest that noise levels from the heat pump at both inside mic. locations were approximately 38 dBA. For practical purposes, however, the degradation of insulation attenuations due to operation of the heat pump may be considered negligible.

With respect to the distinct attenuation differences shown between the two A-weighted mic. locations (mic.'s 4 and 5), the following explanation needs to be provided.

At the time of pre-insulation noise measurements, the windows near mic.'s 3 and 4 (living room) were in poor condition. One window was cracked and all windows generally provided many paths for noise to leak through. Because of the poor pre-insulation condition near mic.'s 3 and 4, the insulation treatment offered a greater-than-typical amount of attenuation. At the mic. 5 location (bedroom) the pre-insulation conditions were slightly better (from a noise leakage standpoint). The insulation treatment near mic. 5 included replacing windows and a nearby door. The post-insulation solid core door, however, did not seal off the noise properly, degrading the expected attenuation. The net result of these before-and-after conditions was the large difference in attenuations measured at mic. 4 and mic. 5. The lesser difference for mic. 3 can be understood by examining the frequency spectra. Figures 7 through 9 show simultaneous inside/outside 1/3 octave linear frequency spectra and mic.'s 1 and 3, for three conditions: (1) before insulation - windows closed (run A), (2) after insulation - windows closed, heat pump off, and (3) after insulation - windows closed, heat pump on.

Table 10

DECREASES IN NOISE LEVELS DUE TO INSULATION
DISTRICT 7 SITE

	Before					After					Decrease (Diff.Aft.) Minus Diff.Bef.)
	Outside		Inside		Diff.	Outside		Inside		Diff.	
	Mic. No.	Leq	Mic. No.	Leq		Mic. No.	Leq	Mic. No.	Leq		
Run A	1	82.0 dBL*	3	70.2 dBL*	11.8	1	82.7 dBL*	3	67.6 dBL*	15.1	3.3 dBL*
	2	74.4 dBA	4	52.3 dBA	22.1	2	75.8 dBA	4	45.2 dBA	30.6	8.5 dBA
	2	74.4 dBA	5	50.2 dBA	24.2	2	75.8 dBA	5	49.0 dBA	26.8	2.6 dBA
Run B						1	83.1 dBL*	3	63.3 dBL*	14.8	3.0 dBL*
						2	76.3 dBA	4	46.4 dBA	29.9	7.8 dBA
						2	76.3 dBA	5	49.7 dBA	26.6	2.4 dBA

* dBL = dB Linear

NOTE: Normalized differences in attenuations due to insulation, with and without Air Conditioner/Heater suggest that the AC/Htr contributions to Mic. 4 (after insulation) was approximately 38 dBA.

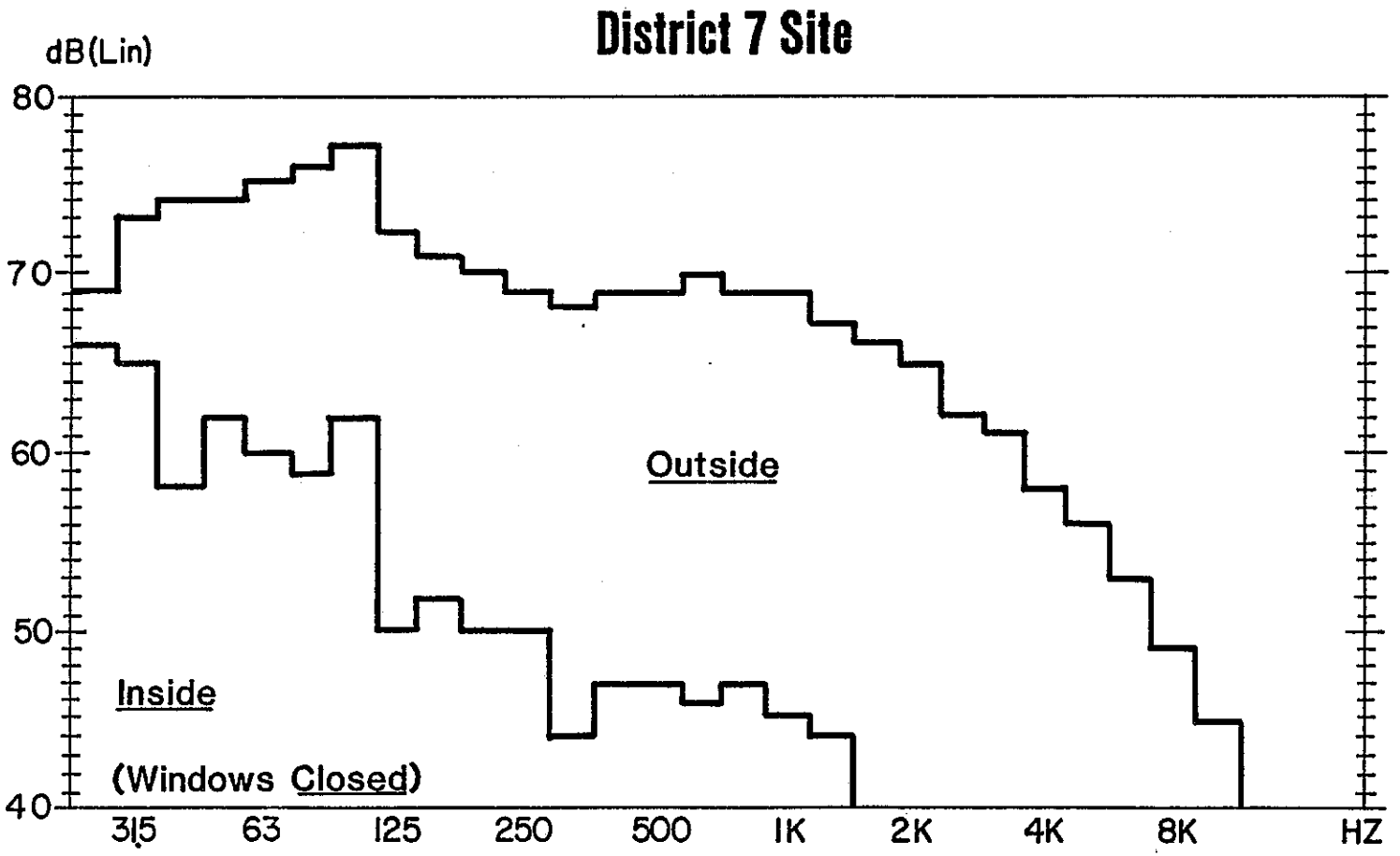


Figure 7 Before Insulation Simultaneous Inside/Outside 1/3 Octave Frequency Spectra (Averages of 10 Noise Peaks)

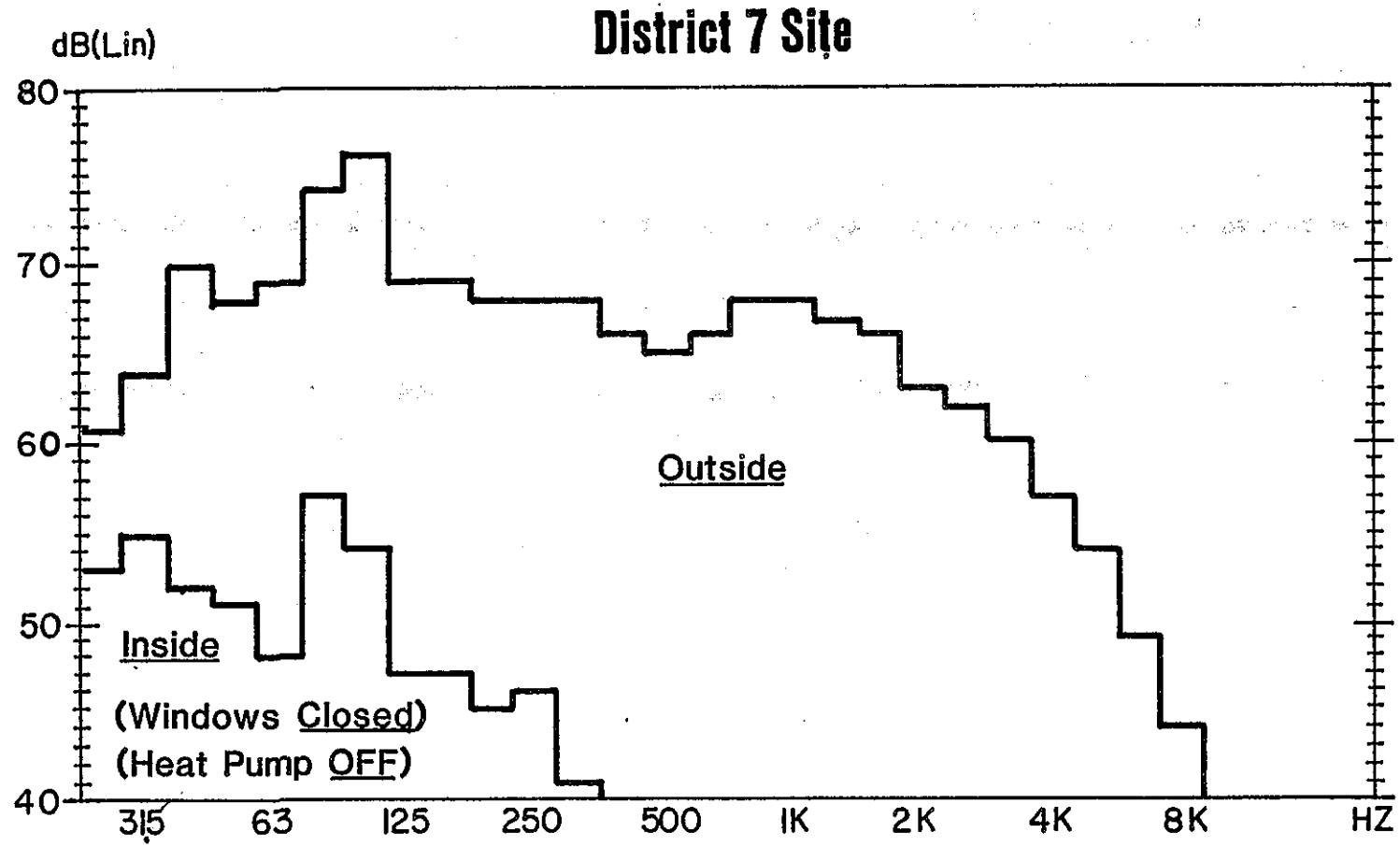


Figure 8 After Insulation Simultaneous Inside/Outside 1/3 Octave Frequency Spectra (Averages of 10 Noise Peaks)

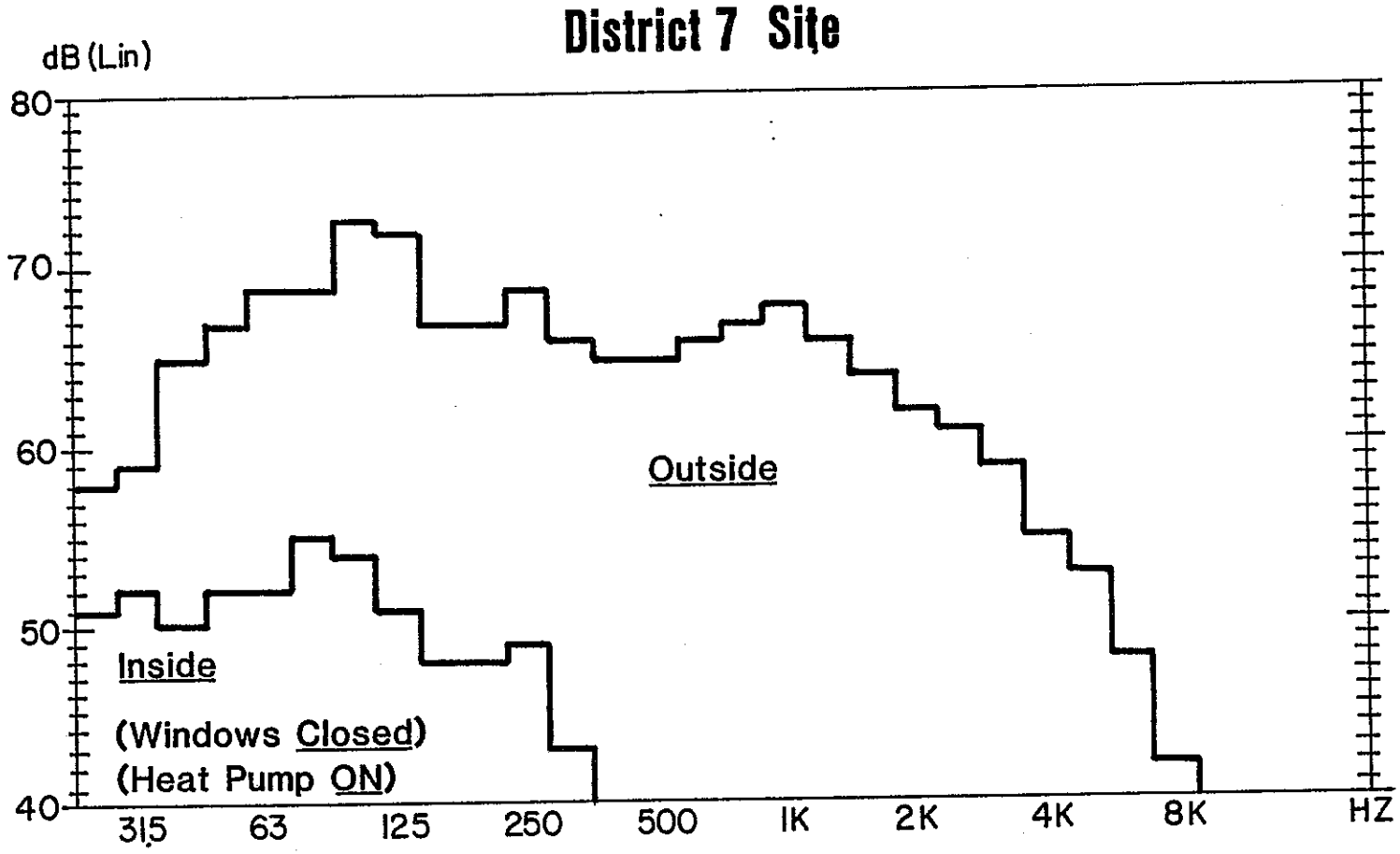


Figure 9 After Insulation Simultaneous Inside/Outside 1/3 Octave Frequency Spectra (Averages of 10 Noise Peaks)

These spectra were obtained by averaging simulataneous inside/outside frequency spectra of ten freeway noise peaks selected from the tape recordings of each measurement run.

The insulation attenuations for each 1/3 octave band were calculated from the spectra for two conditions: (1) windows closed, heat pump off and (2) windows closed heat pump on. The attenuations, shown on Figures 10 and 11, were calucated in the same manner as the total A-weighted attenuations in noise levels. For each 1/3 octave band the differences of sound pressure levels between outside and inside, before insulation, were subtracted from those after insulation. This may be mathematically expressed as:

$$\Delta L_{if} = \delta L'_{of} - \delta L_{of} \qquad \text{[Eq. 2]}$$

where: ΔL_{if} = the attenuation due to insulation at the inside mic. location (mic. #3) in the 1/3 octave band, f

$\delta L'_{of}$ = the difference in measured sound pressure levels (dB Linear) between outside mic. location 0 (mic. #1) and inside mic. location i (mic. #3) in the 1/3 octave band, f, after insulation.

δL_{of} = same as above during pre-insulation measurements.

On closer examination [Eq. 2] is a modification and simplication of [Eq. 1] discussed in the District 4 chapter of this report.

The frequency analyses indicate that most attenuations occurred in the higher frequencies, as was expected. Traffic noise, however, is composed of frequencies that are more predominant below 1 KHz than above 1 KHz, as supported by the measured outside and inside spectra. For these reasons, the mic. 3 location experienced only a 3.3 dB attenuation calculated from measurements on a linear scale (Table 10).

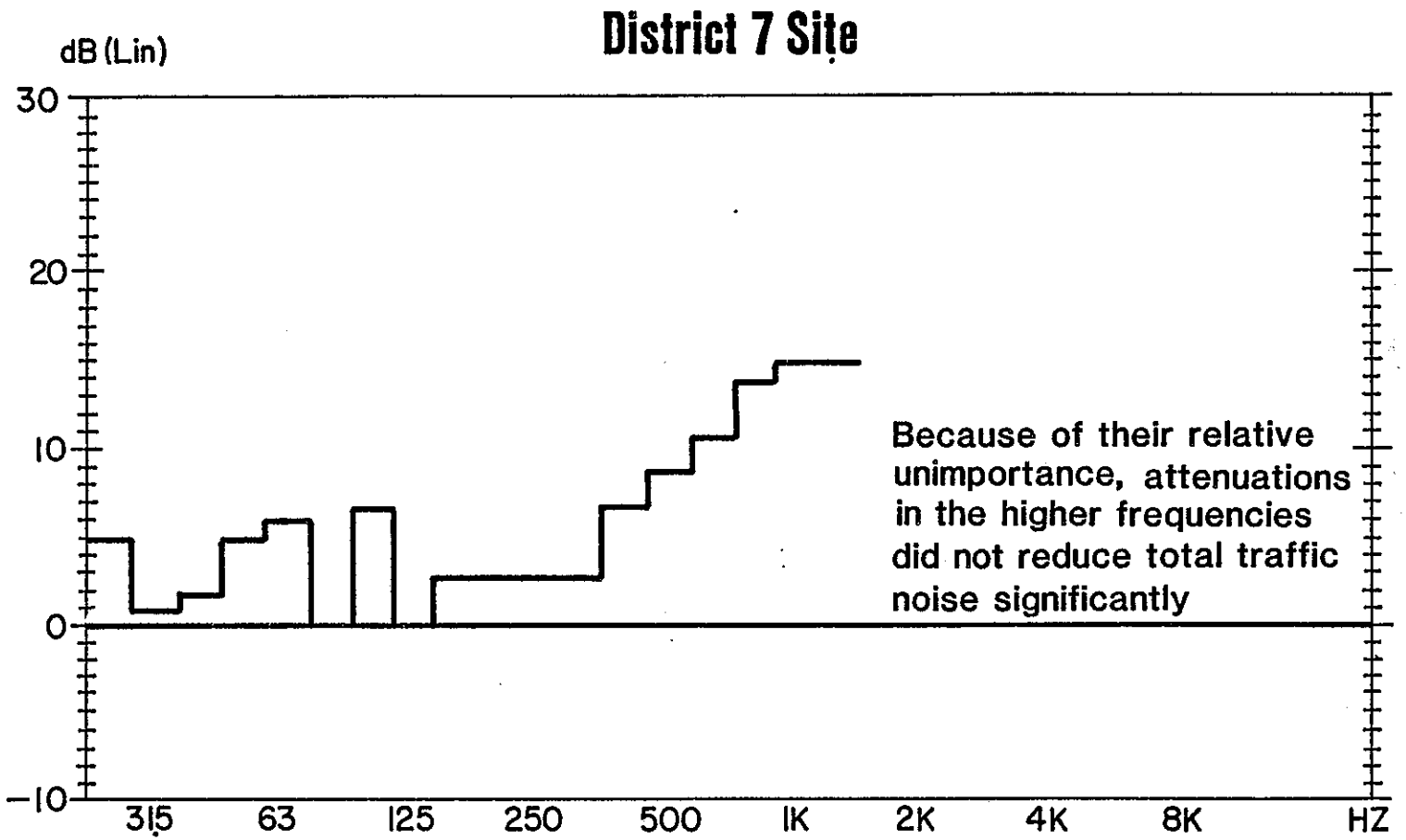


Figure 10 Insulation Attenuations by Frequency

(Heat Pump Off)

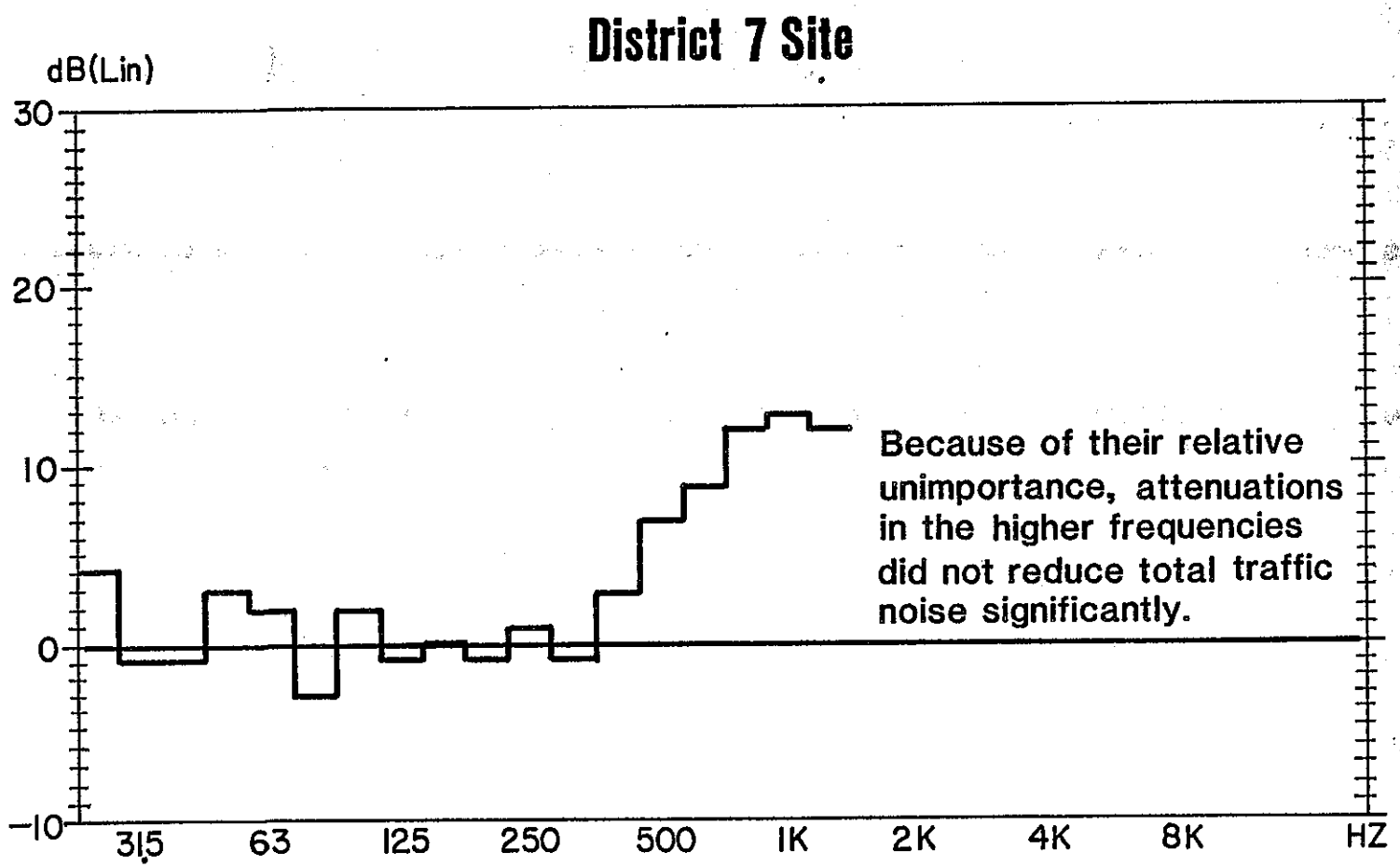


Figure 11 Insulation Attenuations by Frequency (Heat Pump On)

On the A-weighted scale, however, attenuations in the middle frequencies (centering at 1 KHz) become more important resulting in an A-weighted attenuation of 8.5 dBA for mic. 4 (Table 10).

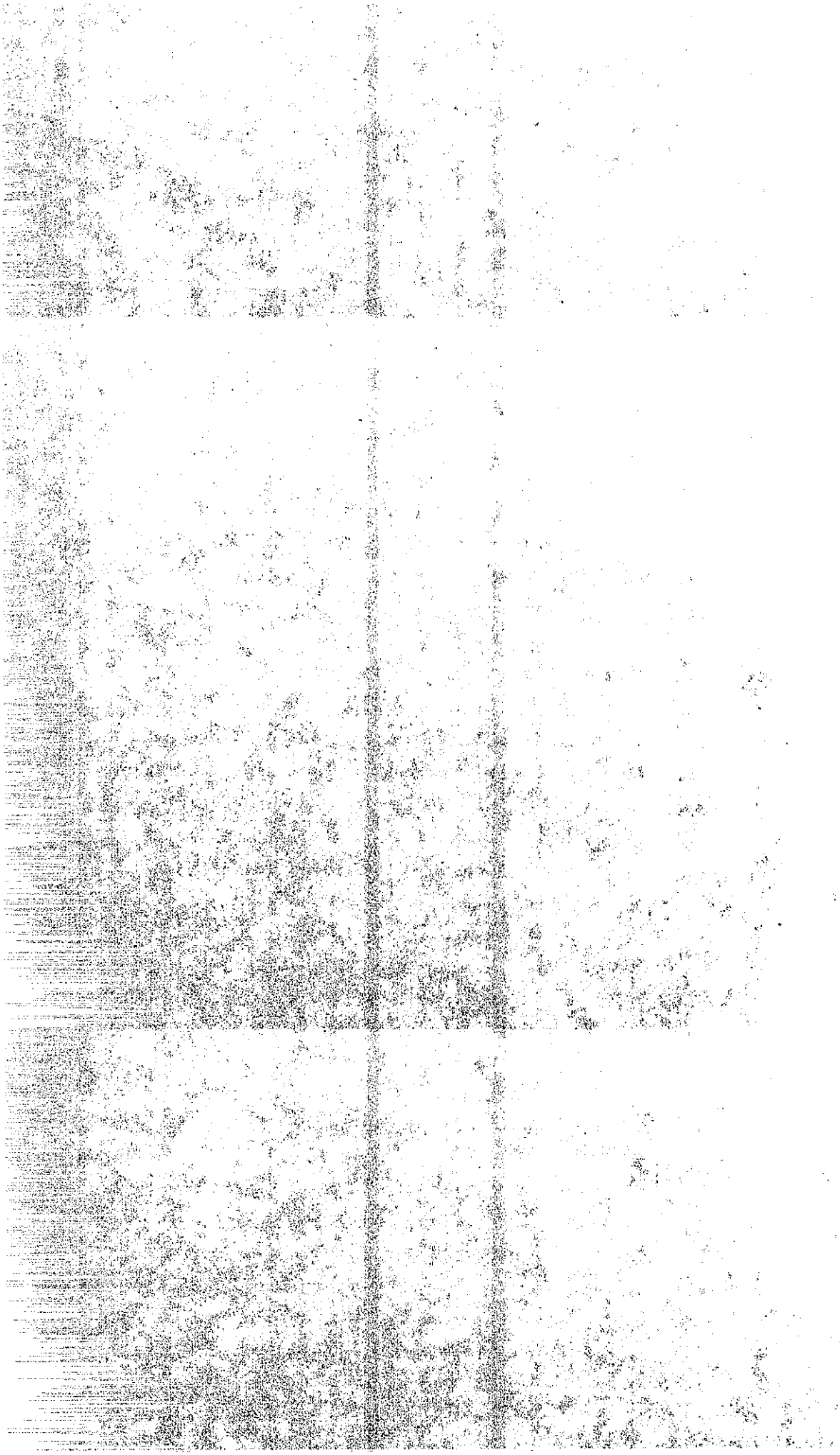
Cost-Effectiveness

The total cost of the District 7, Camarillo insulation project was $18,150 - (contractor's bid) plus the $850 which the homeowner agreed to pay for upgrading the electrical wiring and service panel.

The average noise reduction (bedroom and living room) was 5 dBA. The cost per dBA reduction was therefore $3,800/dBA. According to the previously mentioned Caltrans cost effectiveness criterion of $2,500/dBA for the Community Noise Abatement program, the Camarillo project was not cost-effective.

Home Owner's Perception

The homeowner was generally satisfied with the noise reduction provided by the insulation treatment, the quality of materials and workmanship.



XII. INSULATION AS A NOISE MITIGATION MEASURE

Limited Feasibility

Evaluation of the procedures and results covered in the previous chapters suggest that insulating homes from highway noise is a viable mitigation measure. There are several limitations, however, to this noise reduction strategy.

Data in this report suggest that noise attenuations of 3 to 6 dBA are typical and may be achieved at an average cost of $2,880 (1981 base year) per dBA per house. Compared to the Caltrans 1981 base year cost-effectiveness criterion for the Community Noise Abatement program ($2,500/dBA per residence with a maximum of $25,000 per residence), insulation is not cost-effective, especially on a large scale. It further seems reasonable to assume that the cost per dBA increases for higher attenuations, reducing the cost-effectiveness even more when higher attenuations are required.

Feasibility of insulation as a noise abatement measure is also obviously limited to the inside of the home, and should therefore be considered mainly in areas without outside activities.

Other disadvantages of insulation include a possible increase in energy use in certain climates, and lack of natural ventilation. Cost-effectiveness may also be negatively influenced by maintenance and replacement costs of air conditioners and an insulation design process that is more labor intensive than the barrier design process. These were not included in the cost-effectiveness comparisons.

The above limitations point to noise barriers as a more desirable and cost-effective mitigation measure than insulation options. However, in spite of the drawbacks associated with insulation, there are several instances when it may be preferred over noise barriers or other mitigation measures such as roadway design features.

Advantages of Insulation

Insulation may provide noise mitigation when barriers or favorable roadway design features are not feasible, cost-effective or desirable.

When adverse topography or multi-story residences render noise barriers or other alternatives ineffective for noise abatement, noise insulation can still provide an adequate reduction of inside noise levels.

Insulation may also be more cost-effective than noise barriers or other migitation alternatives when isolated homes need to be protected. Table 11 shows a comparison of cost per dBA per residence for a 6-ft and 10-ft masonry barrier protecting 1, 2, and 3 homes versus the cost per dBA per residence of insulation. Average at-grade sites are assumed.

A Caltrans noise barrier design bulletin (Appendix H) dictates a minimum barrier height of 6 feet and minimum noise reduction of 5 dBA. The bulletin also directs that the line-of-sight between an 11.5-ft truck stack and a 5-ft receiver must be intercepted by the top of the barrier. For average, at-grade site geometries, this is achieved with a 10-ft barrier. Under the same conditions a 10-ft barrier affords a 7 dBA noise reduction (insertion loss). The 6-ft, 5 dBA and 10-ft, 7 dBA barriers have therefore been chosen for the cost effectiveness comparisons in Table 11. Cost figures for these heights were derived from explicit 1981 base year masonry wall construction costs multiplied by a factor to include items such as landscaping and other associated costs. Barrier and landscape maintenance costs are not included, however, and these may very well put insulation in a more favorable light.

The table suggests that the "break-even" costs between masonry barrier and insulation choices are achieved when protecting approximately 2 homes. Given the stated assumptions, insulating one house would cost less than providing barrier protection; for more than two houses a masonry wall would be more cost-effective.

Table 11

COMPARISON OF COST-EFFECTIVENESS
MASONRY WALL VS. INSULATION

No. of Houses	MASONRY WALL, CALTRANS Minimum Length	Average Height	1981 Cost per Lin. Ft.	1981 Total Cost	Noise Reduction	1981 Cost/dBA Per House	INSULATION (This Study) Noise Reduction	1981 Cost/dBA Per House
1	250'	6'	$ 80	$20,000	5 dBA	$4,000	4.5 dBA	$2,880
2	300'	6'	$ 80	$24,000	5 dBA	$2,400	4.5 dBA	$2,880
3	350'	6'	$ 80	$28,000	5 dBA	$1,900	4.5 dBA	$2,880
1	250'	10'	$130	$32,500	7 dBA	$4,600	4.5 dBA	$2,880
2	300'	10'	$130	$39,000	7 dBA	$2,800	4.5 dBA	$2,880
3	350'	10'	$130	$45,500	7 dBA	$2,200	4.5 dBA	$2,880

In some cases noise barriers are undesirable because they block a scenic view or clash with the aesthetics of a locale. In such cases, insulation may be a preferred alternative. Since these decisions depend on value judgments, homeowner involvement and public hearings should be vital parts of the mitigation design process.

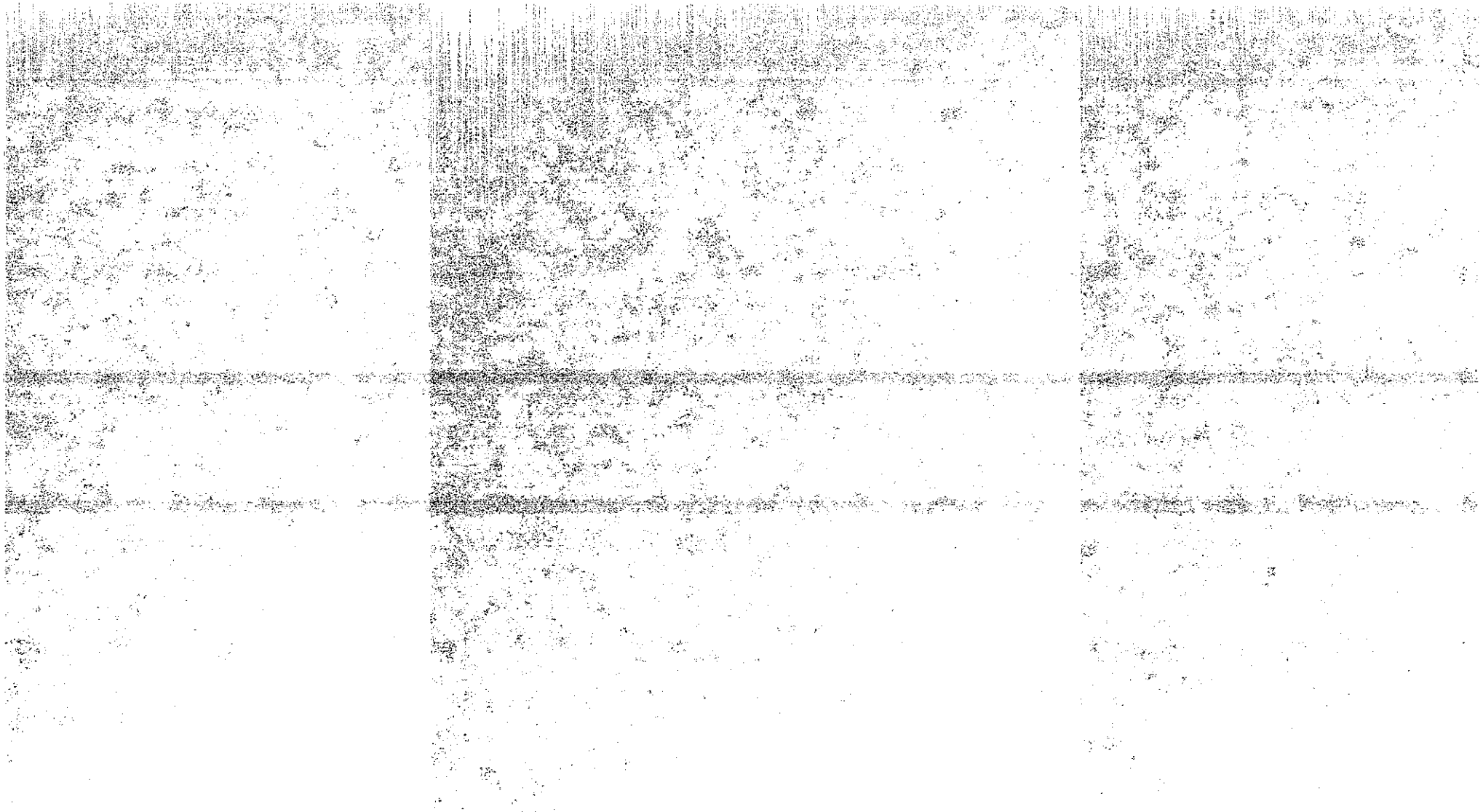
In summary, insulating homes from highway noise provides another mitigation option that is feasible and sometimes preferable when done on a limited scale. Insulation may also be incorporated effectively in conventional barrier designs by providing protection in isolated locations difficult to mitigate by barrier.

REFERENCES

1. B and Reagan, J. A., FHWA Highway Traffic Noise Prediction Modelghway Administration, FHWA-RD-77-108, December 1978.

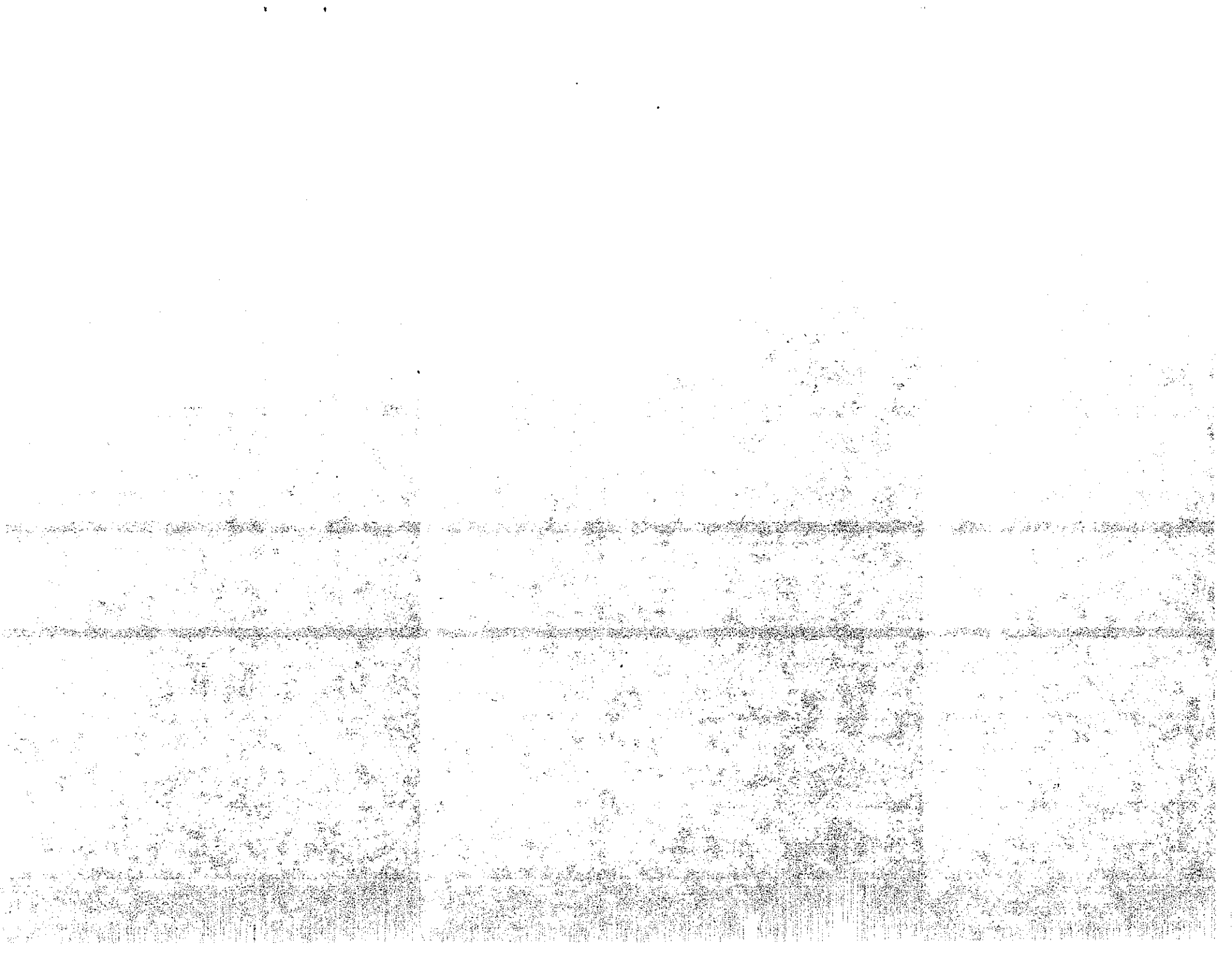
2. Fighway Program Manual, Vol. 7, Ch. 7, Sec. 3, Federal Highwation, August 9, 1982.

3. Hw., California Vehicle Noise Emission Levels, California Deparnsportation, Office of Transportation Laboratory, Interim Report4.



APPENDIX A

FHWA Notice 5080.62



U. S. DEPARTMENT OF TRANSPORTATION

FEDERAL HIGHWAY ADMINISTRATION

SUBJECT	FHWA NOTICE
National Experimental and Evaluation Program (NEEP) Project No. 21 - Noise Insulation for Private Dwellings	N 5080.62 January 17, 1977

1. PURPOSE. To provide guidance and encourage experimental projects, utilizing highway funds, designed to determine the feasibility of providing traffic noise insulation features in residences.

2. BACKGROUND

   a. Prior to FHPM 7-7-3, Procedures for Abatement of Highway Traffic and Construction Noise, May 14, 1976, noise insulation of privately owned residences was not considered eligible for federal funding under Title 23. Federal funds may be approved for these experimental projects based on the criteria established in FHPM 7-7-3, paragraph 12a. The requirements of 12e need not be met, i.e., noise insulation may be implemented even if noise impact is not especially severe and other abatement measures are feasible.

   b. A December 19, 1975, memorandum on the subject: Briefing on Highway Traffic Noise Abatement Measures, from the Associate Administrators for Right-of-Way and Environment and Engineering and Traffic Operations to the Regional Federal Highway Administrators and Division Administrators, solicited the interest of States in exploring the possibility of noise insulation projects involving privately owned noise sensitive dwellings. State responses indicated sufficient interest to justify the development of this National Experimental and Evaluation Program Project.

   c. This NEEP has been established to obtain information in the following areas:

(1) What are the legal rights, obligations, liabilities and responsibilities of each party, i.e., homeowner, (resident); State; Federal government; contractor; city; county; etc.?

(2) What specifications are required for the work?

(3) How detailed should the preliminary engineering study be to assess specific building insulation needs?

(4) To what extent should noise insulation features be made available to other homeowners in the noise sensitive area, i.e., how far do we need to go with noise insulation of homes?

(5) When noise insulation is incorporated in a home, a ventilation system may also have to be furnished. What kinds and types of equipment should funding be limited to, if any?

(6) How much of the structure needs to be insulated against noise?

(7) What are the impacts on legal obligations agreements, etc., when maintenance of equipment such as ventilating systems, air conditioners, etc., is required?

(8) What are the costs for noise insulation treatments?

3. ACTION

a. Encourage States to develop experimental projects to determine the feasibility of noise insulation of privately owned residences. Projects may be programmed as Type IA, IB, or II as defined in FHPM 7-7-3.

b. The number of projects in any one State should be limited to five.

c. Preliminary sound level measurements, analysis, etc., may be programmed for preliminary engineering funds. Sound level measurements and analysis necessary to determine the effectiveness of the special treatments, costs, etc., to answer those questions cited under paragraph 2 above and others as deemed necessary, may be programmed

for construction engineering funds. This would include the preparation of project construction and post-construction reports.

d. All project proposals should be submitted to the Division Office preferably by August 1, 1977. Because of the specialized nature of these projects, they should be forwarded to the Office of Highway Operations, HHO-31, for review and comment prior to approval by the Division Administrator. Four copies of each proposal are requested. Washington Headquarters will make every effort to provide a response to each proposal in no more than 20 work days following receipt of each proposal.

e. Attached are guidelines for preparation of work plans for use by the States in setting up and evaluating projects under this NEEP project.

f. To assist the States in determining the necessary noise insulation requirements, a recently completed report titled, "Insulation of Buildings Against Highway Noise" has been prepared. A distribution of the report will be made to all FHWA field offices and State highway agencies in early 1977.

g. To further assist the States in planning for projects under this program, a course of 2-day duration is being developed for presentation by the authors of the report cited under 3f above in March 1977. An indication of the number and identities of State and FHWA representatives interested in attending such a course is requested by February 28. This information should be sent to Mr. John Schultz, HDV-21, 202-426-9205 Implementation Division, Office of Development.

H. A. Lindberg
Associate Administrator for
Engineering and Traffic Operations

Attachment

Experimental Noise Insulation
Work Plan Guidelines

Scope: The purpose of this National Experimental and Evaluation Program (NEEP) is to determine and document the feasibility and effectiveness of noise insulation of privately owned dwellings. The evaluation of the projects will be based on personal interviews, noise measurements, and other analytical data taken before, during, and after construction.

Responsibility: The NEEP projects will be performed in accordance with FHPM 6-4-2, Construction Projects Incorporating Experimental Features.

Work Plan: A work plan will be prepared and submitted along with the project proposal. This work plan will be in sufficient detail to outline the methods and procedures that will be followed in implementing these experimental projects. The following items will be included in the work plan.

1. The legal ramifications that are involved in establishing and carrying out the projects--this will include the responsibilities, liabilities, and rights as they apply to the State, the homeowner, and the contractor.

2. The design steps that will be necessary in determining the needed modifications. (Note: These projects will be designed and implemented in accordance with a manual entitled "Insulation of Buildings Against Highway Noise" that will be distributed by FHWA.)

3. The proposed administration of the contract. This discussion will include the following:

    a. Identification of the contracting authority and the basis for this determination.

    b. How will the contract be managed?

    c. Identification of the process of selecting contractors.

    d. Identification of the work acceptance criteria.

4. The procedures to be followed for data collection and reporting.

Project Requirements and Procedures: The following tests, operations, and observations will be necessary in conducting the experimental projects.

Pre-Construction

1. Homeowner and resident interviews will be conducted prior to initiation of the projects. The purpose of the interview will be to ascertain the views and opinions of those persons directly affected by the noise impacts. Because of the need for unbiased responses, care should be taken in conducting the interviews. The interview questionnaire and instruction for its use will be supplied by FHWA.

2. Existing conditions for each structure involved in the project will be established. This will include the following data:

   a. Exterior and interior noise levels.

   b. Dwelling structural characteristics including present insulation, wall-and-roof characteristics and window-and-door construction.

   c. Current fuel heating and electricity costs.

   d. Climatic conditions (heating and cooling degree days corresponding with c. above) as defined by the National Weather Service.

3. Estimates of future conditions, based on increased traffic, should be established if applicable. The data necessary will include:

   a. Exterior and interior noise predictions.

   b. Use of an external noise source as detailed in the insulation manual supplied by FHWA if warranted for actual noise measurements.

4. The design process used in determining the necessary modifications will need to be well documented. This documentation will also include a discussion of how specifications and project related documents are prepared.

5. The administration of the contract will need to be addressed.

Construction - A methodology will be established by the State for determining the following information:

1. The availability of special acoustical and ventilation materials.

2. The incremental costs of materials and labor on a per unit and on an overall basis.

3. Quality control including the following:

   a. The method by which material and installation control will be assured.

   b. How specifications for materials will be satisfied.

   c. Inspection requirements.

Post-Construction - A methodology will be established by the State to obtain the following information:

1. Final noise level measurements, both exterior and interior. These measurements are necessary for each structure measured initially for comparative purposes.

2. Final cost data both per unit and overall.

3. Post-construction interviews. (Questionnaires will be provided by FHWA.)

4. The effectiveness of insulation and ventilation.

5. Post-construction heating and electricity costs analysis considering climatic conditions. (Heating fuel and electricity costs due to noise insulation measures will be established using methodology provided by FHWA.)

6. A comparison between the proposed and completed work.

Reporting: An initial and a 2-year report will be submitted by the State.

Initial Report - The initial report should be prepared upon completion of each project. This report should document the operations, findings, and data collected. The initial report should provide the detailed information necessary for evaluation of the experimental noise insulation projects. The following information should be included in the initial report.

1. Any legal ramifications that resulted from prosecuting the work.

2. The results of the pre-construction and post-construction homeowner and resident interviews.

3. The existing noise levels, exterior and interior, and dwelling structural conditions.

4. The future conditions that were predicted or established using an artificial source.

5. The design steps that were taken to determine the necessary modifications. This discussion should include the usability of the "manual" and any additional information that was required in the design process beyond the scope of the insulation manual.

6. A discussion on the availability of noise insulation materials.

7. Cost figures on materials and labor on a per unit and overall basis.

8. Final contract time period to complete construction including extensions.

9. The effectiveness of the quality control of material and construction.

10. Post-construction noise level measurements and locations, both exterior and interior, for the affected dwellings.

11. Final costs for the completed project.

12. Post-construction heating and electricity costs. A cost comparison will be made between pre-construction and post-construction.

13. The comparison between the designed and completed-work in terms of noise reduction and heating and ventilation requirements.

14. An analysis comparing sound insulation to other feasible abatement strategies at the experimental site such as noise barriers.

Final Report - (2-year) The final report should be prepared 2 years after completion of the construction of each experimental project. The report is necessary to determine the effectiveness and acceptability of noise insulation of private dwellings. The report should include the following information:

1. The results of follow-up interviews conducted with participating homeowners and residents.

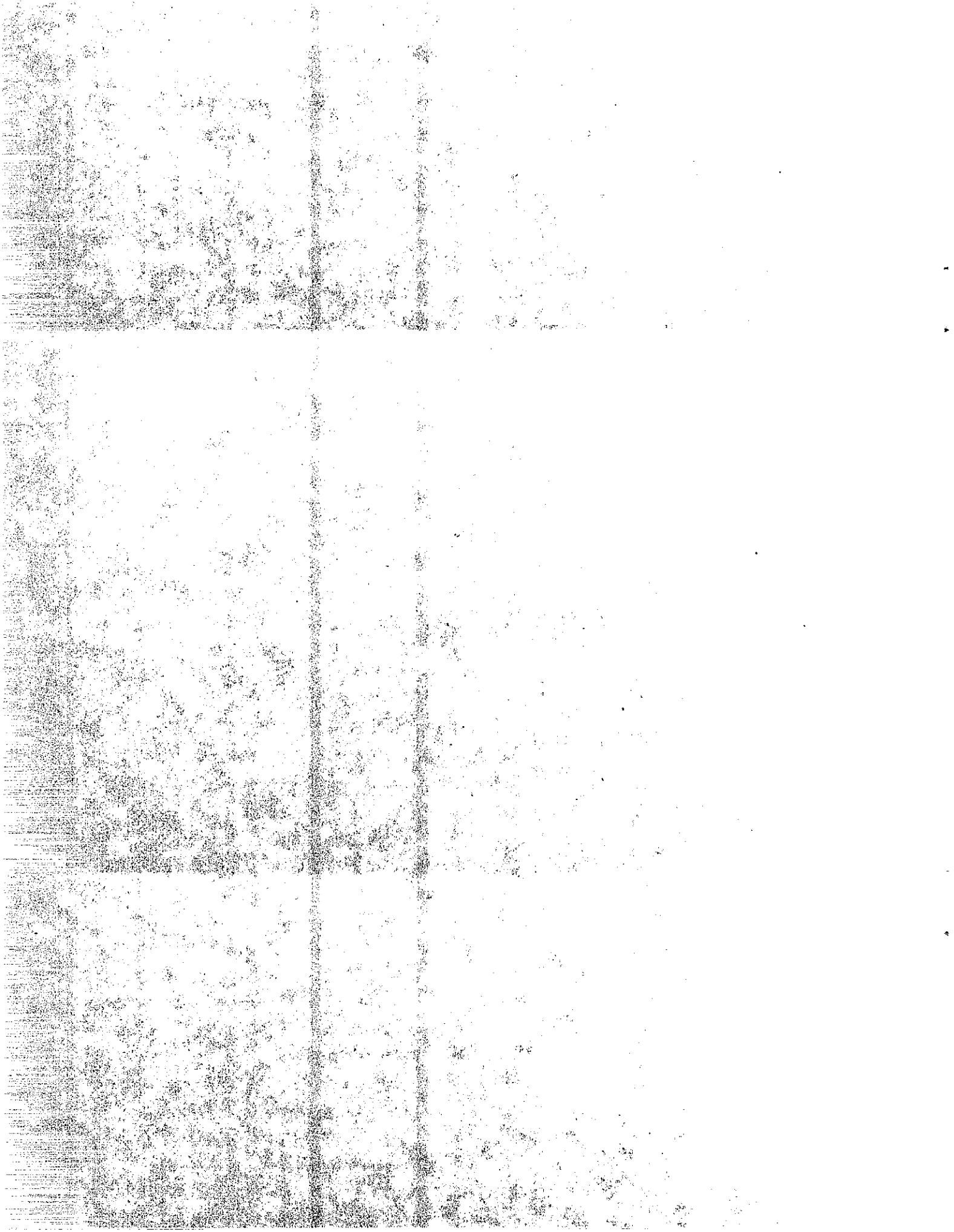
2. Exterior and interior noise level measurements taken to verify the validity of the prediction methods and to determine the condition of the noise insulation measures taken.

3. Updated cost data and the continued availability of materials for insulation and ventilation.

4. Costs associated with heating, ventilation and/or cooling.

APPENDIX B

Legal Opinions



State of California — Business and Transportation Agency

Memorandum

To : HARRY L. KAGAN, Chief R/W Agent
Division of Right of Way

Date: May 25, 1979

File :

Attn: Otto Kihm

From : A. M. LYNCH
DEPARTMENT OF TRANSPORTATION

REC'D ENV. PLAN. JUN 21 1979

Subject:

Pursuant to our recent discussion concerning the "NEEP" (National Experimental and Evaluation Program) project, the following issues appear to be critical and worthy of review.

1. The legal foundation (as set forth in memorandum dated August 8, 1977 from Bruce A. Behrens, attorney) upon which the program is based is, according to Mr. Behrens, admittedly somewhat weak.

2. The purpose of this experimental project is to sound-insulate private dwellings as a method of mitigating freeway noise along existing freeways. Mr. Behren's memorandum indicates that "CEQA does not raise any retroactive duty to mitigate the environmental effects of an already constructed facility. Instead it is keyed to mitigate the effects of future projects. Thus, while CEQA could be used for mitigation of future noise impacts, a program to mitigate existing environmental noise effects from existing facilities would require new statutory authority independent of CEQA or an amendment to CEQA itself". Therefore, it would seem to follow that a demonstration research project would not be appropriate on a completed project because new statutory authority would be required to determine noise effects on existing facilities. Mr. Behren's also indicates that the ultimate purpose served under the NEEP program is a substantial public purpose. I do not see how a substantial public purpose is served by arbitrarily insulating selected dwellings unless the study results in the proof of noise damages to similar properties, which would result in payment of damages, either voluntary or through inverse condemnation, to innumerable properties.

3. The Streets and Highways Code does require a program of noise abatement for schools located adjacent to existing freeways, and specifically sets forth the noise decibel limitations. To my knowledge there are no statutes specifically establishing noise levels pertaining to dwellings adjacent to freeways. The District is being asked to be guided by criteria for noise levels arbitrarily established by FHWA design standards set forth in FHWA Notice N5080.62, January 17, 1977.

4. New income tax laws allow deductions for the addition of insulation and other energy saving devices. Is the State, in effect, giving tax benefits to individuals at the expense of all other taxpayers?

Generally the accepted appraisal approach to damage determination is either the "before and after" or the "cost-to-cure", whichever is less.

The environmental approach, as it pertains to the NEEP program, does not consider the "before and after" approach in determining damages in its procedures, but rather is limited only to the cost of curative work. This could lead to excessive and unjustifiable spending of tax monies and does not provide for offsetting special benefits.

To my knowledge there is no State law requiring us to forsake proven appraisal practices and adopt an environmental approach to mitigate damages. In fact, the Streets and Highways Code specifically defines damages and they are presently determined by approved appraisal procedures.

No provision is made in current instructions in the NEEP program for noise attenuation except for dwellings immediately adjacent to freeways. It would appear we could be establishing a basis for damage claims for noise in residences several blocks from the freeway if the State implements instructions included in FHWA Notice N5080.62, January 17, 1977, Experimental Noise Insulation Work Plan Guidelines, and the General Criteria for Selecting Projects issued December, 1977 by the Transportation Laboratory.

Also, the method of data collection relies on being able to maintain records supplied by the property owner, but fails to take into consideration some very probable real life situations which may drastically affect the data received. These would include, but not be limited to, vacations, sale or foreclosure of the property, burning wood or other combustibles in the fireplace, or change in occupancy from owner to tenant.

In summary, it appears to me that the District is being asked to approach a noise problem affecting dwellings on an environmental basis rather than the normal approach used for the appraisal of damages.

If damages of the type referred to in FHWA Notice N5080.62, January 17, 1977, in fact, are legally compensable, it is my suggestion that the Right of Way Division of FHWA concur in this experimental project before the District takes any further action. As further support of this noise insulation experimental project, I am attaching memorandum dated May 29, 1979 from Ellen D. Tiger, attorney, Legal Division, District 07.

Original signed by A. M. Lynch

A. M. LYNCH, Chief
R/W Acquisition Branch

AML:sh
Attachs.

cc: WJKenney
Larry Loudon, Env. Planning

Business and Transportation Agency

memorandum

To : Harry L. Kagan, Chief R/W Agent
Division of Right of Way

Date: May 29, 1979

File :
ATTORNEY-CLIENT CORRESPONDENCE
FOR USE OF DEPARTMENT ONLY

From : Department of Transportation—Legal Division
Los Angeles

Subject: "NEEP"
(Paul Bohem, et al. v. State, et al.
Los Angeles County SCC No. C 237140)

I have been asked to comment on Al Lynch's memorandum regarding the federal experimental program to insulate homes adjacent to freeways, known as NEEP (National Experimental and Evaluation Program). I agree with the contents of his memorandum, and I would also like to add the following comments.

An important issue is whether this experimental project will be detrimental to the Deparment's legal position in Bohem v. State, Los Angeles Superior Court Case C 237140 filed on April 14, 1978.

In Bohem the plaintiffs are alleging a taking and damaging of their property (three separate residences) due to traffic noise from the adjacent freeway, Route 2, in the Eagle Rock area of Los Angeles County. There was no physical taking of plaintiffs' property before the freeway was completed in the mid 1970's.

Plaintiffs are attempting to set a precedent by extending the recent airport noise cases (e.g., Aaron v. City of Los Angeles (1974) 40 CA3d 471) to the operation of freeways.

If we proceed with the NEEP project, it may be used as an admission in the Bohem case. Plaintiffs could claim that the NEEP project is proof we have a duty to mitigate freeway traffic noise that adversely affects adjacent homes.

If we lose the Bohem case, it would set a precedent, and force the State to pay for noise pollution to residences adjacent to the State's freeways, even though there has been no physical taking.

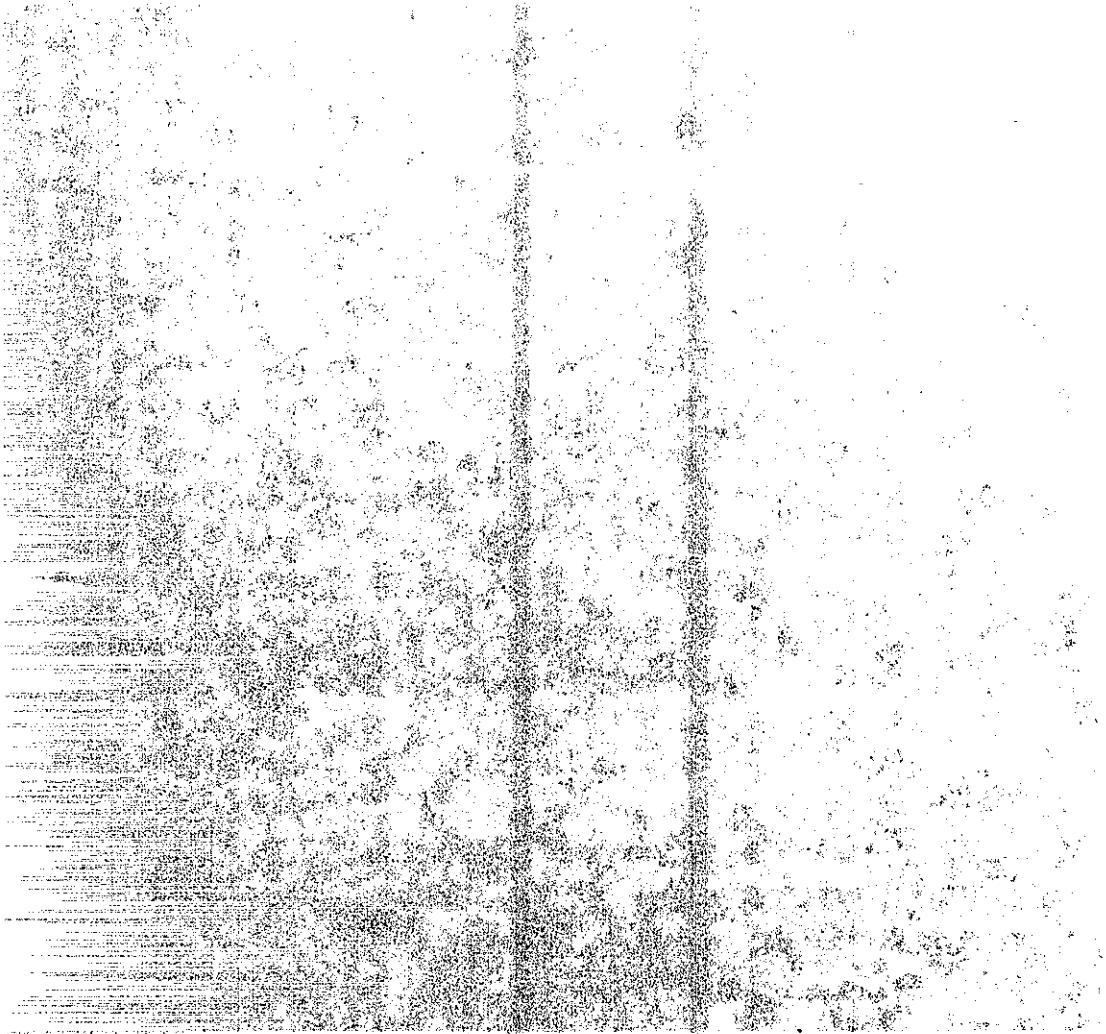
Ellen D. Tiger
Attorney

EDT:nm

B-4

APPENDIX C

Tax Assessment



March 18, 1980

04-SF-101 4.0
04226 - 100071

Mr. Robert Kennedy
Chief Appraiser
City and County of
San Francisco
400 Van Ness Avenue
San Francisco, CA 94102

Dear Mr. Kennedy:

Caltrans is participating in a Federal Highway Administration (FHWA) sponsored experimental project on noise insulation for private residences. The purpose of the project is to research the effectiveness of different noise insulation techniques relative to cost, interior noise reduction and energy conservation.

Four houses on San Bruno Avenue along the Route 101 freeway in San Francisco have been selected for this experimental project. (Please refer to the attached location maps.) We have contacted the four property owners and all have expressed a willingness to participate in the program.

Various types and combinations of insulation methods will be considered to reduce the interior noise to acceptable levels. These could include wall insulation, ceiling and floor insulation, caulking and window sealing and replacing existing windows with single or double glazed windows. In addition, a ventilation system may be required in the cases where the windows will be permanently sealed. It is estimated the insulation work will cost between $5,000 to $10,000 per house.

We would appreciate being informed if the insulation work proposed in this experimental project could result in a reassessment of the four properties involved, which may subsequently result in higher property taxes to the homeowners. This is a major concern of the homeowners and may influence their future participation in this program.

Should you require additional information or have any questions, please call Mr. L. V. Blackburn, Program Coordinator, at (415) 557-2685.

Sincerely yours,

T. R. LAMMERS
District Director

By ORIGINAL SIGNED BY
R. D. SAYRE
R. D. SAYRE, Chief
Project Development
C Branch

Attachment

EAS:dfc

cc: VJR,EAH,LVB-EAS,WWhitnack(HQ),MHatano(HQ-Trans Lab)

City and County of San Francisco

Assessor's Office

SAMUEL DUCA, M.A.I.
ASSESSOR

March 18, 1980

R. D. Sayre, Chief Project Development
Department of Transportation
P.O. Box 3366 Rincon Annex
San Francisco, California 94119

Dear Mr. Sayre:

The project as you outlined in your letter of March 18, 1980 would not seem to require a reappraisal by the Assessor's office.

Basically, Assembly Bill 1488 indicates, any substantial addition to land or improvements, or any physical alteration of any improvement which converts the improvement or any portion thereof to the substantial equivalent of a new structure shall be reappraised to market value. From this it appears the properties you refer to would be excluded from reappraisal.

If this is a state wide project I suggest you check with the State Board of Equalization for their opinion.

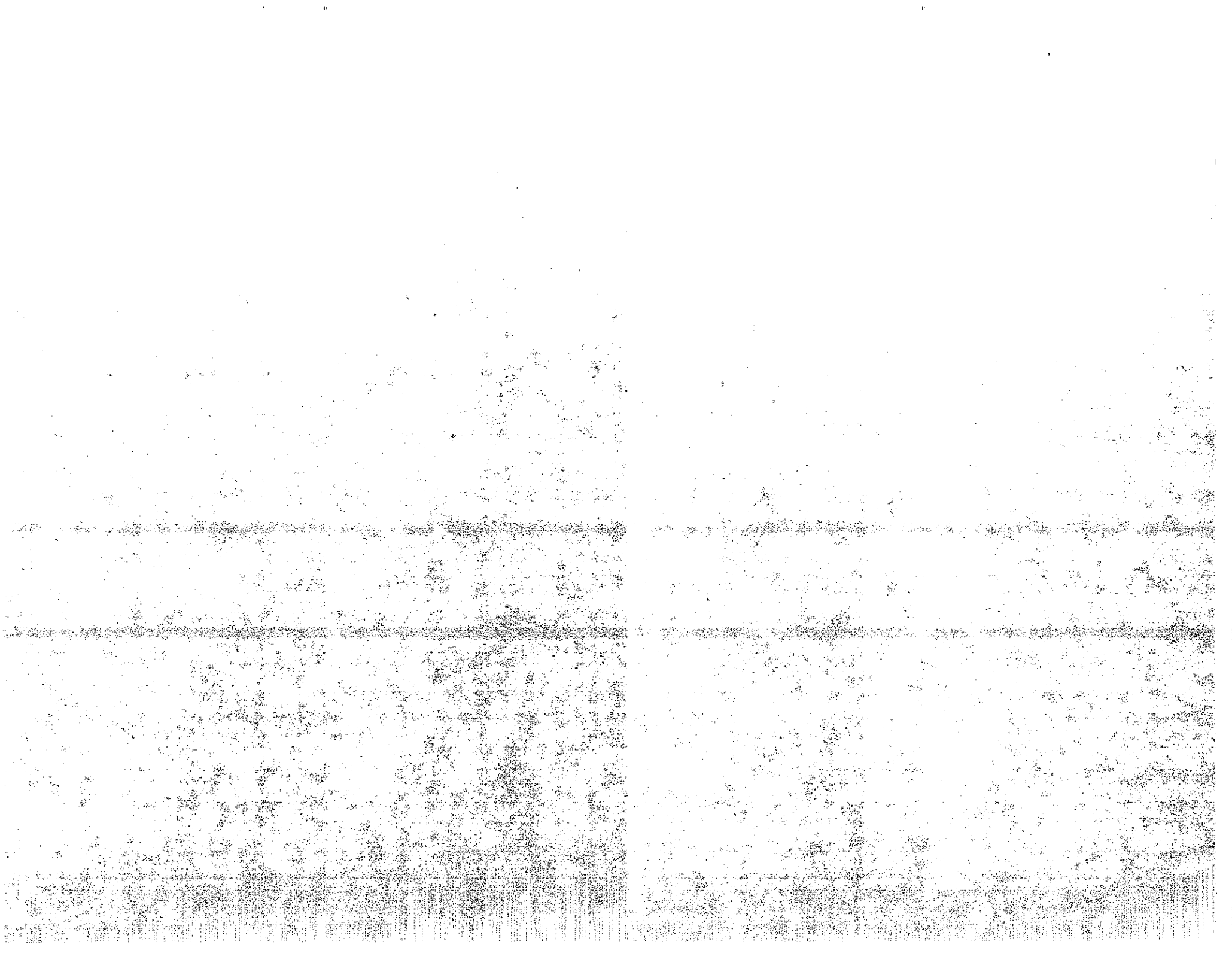
Very truly yours,

ROBERT E. KENNEDY
CHIEF APPRAISER

REK/rg

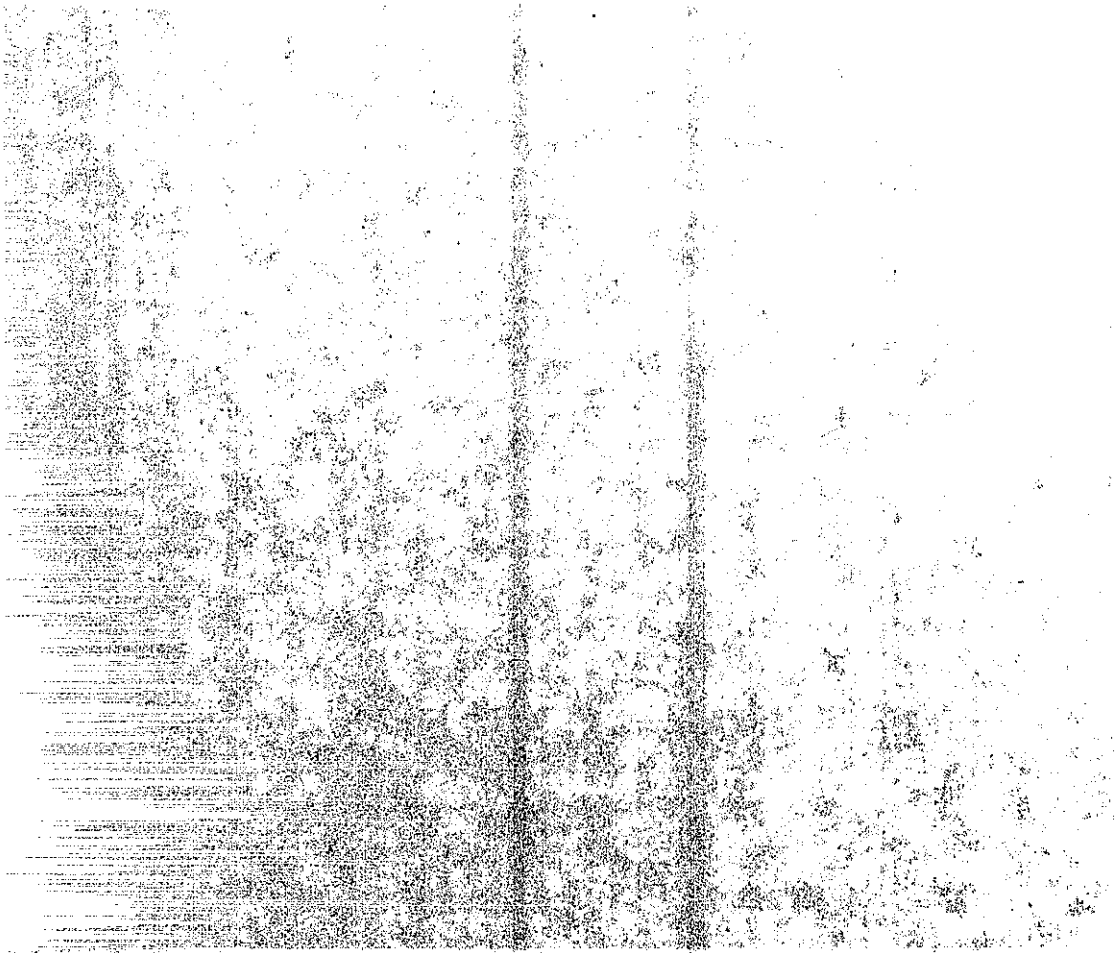
C-3

(415) 558-4011 - 558-4351 Room 101, City Hall San Francisco, CA 94102



APPENDIX D

Homeowner Agreements



DISTRICT 4

AGREEMENT

District Agreement No. 1

This Agreement, made and entered into on the 1st day of July, 1980, by and between

Austin and Teresa Morris

Legal owner(s) of the property known as 579 San Bruno Avenue, SF County in the State of California, hereinafter referred to as "HOMEOWNER".

And

STATE OF CALIFORNIA,
acting by and through the Business and Transportation Agency,
Department of Transportation,
hereinafter referred to as "STATE".

D-1

AGREEMENT

District Agreement No. 2

This Agreement, made and entered into on the 1st day of July, 1980, by and between

John De Nadai

Legal owner(s) of the property known as 575 San Bruno Avenue, SF County in the State of California, hereinafter referred to as "HOMEOWNER".

And

STATE OF CALIFORNIA,
acting by and through the Business and Transportation Agency,
Department of Transportation,
hereinafter referred to as "STATE".

D-2

-2

AGREEMENT

District Agreement No. 3

This Agreement, made and entered into on the 7th day of July, 1980, by and between

Donald Carnegie, Mabel Ehman and Emil Ehman

Legal owner(s) of the property known as 599 San Bruno Avenue, San Francisco, SF County in the State of California, hereinafter referred to as "HOMEOWNER".

And

STATE OF CALIFORNIA,
acting by and through the Business and Transportation Agency,
Department of Transportation,
hereinafter referred to as "STATE".

AGREEMENT

District Agreement No. 4

This Agreement, made and entered into on the 25 day of August, 1980, by and between

Eva Prudden
Alexis B O'Brien

Legal owner(s) of the property known as 587 & 585 San Bruno Avenue San Francisco, California County in the State of California, hereinafter referred to as "HOMEOWNER".

And

STATE OF CALIFORNIA,
acting by and through the Business and Transportation Agency,
Department of Transportation,
hereinafter referred to as "STATE".

D-4

Whereas, the U.S. Department of Transportation acting through its Federal Highway Administration, hereinafter referred to as "FHWA", on January 17, 1977, issued FHWA Notice N 5080.62 encouraging states to develop experimental projects to determine the feasibility of noise insulation of privately-owned residences; and

Whereas, STATE desires to conduct an experimental noise insulation project in the residence located on HOMEOWNER's property, hereinafter called RESIDENCE; and

Whereas, STATE desires and is willing to pay the cost of making modifications, alterations and reconstruction to RESIDENCE, hereinafter called ALTERATIONS and described herein and detailed on the plans and in the specifications to be prepared by STATE; and

Whereas, STATE desires to determine what changes in sound levels and energy use can be expected in RESIDENCE in which ALTERATIONS are made; and

Whereas, HOMEOWNER is willing and desirous to permit STATE to make ALTERATIONS to RESIDENCE with no design or construction costs accruing to HOMEOWNER; and

Whereas, HOMEOWNER, after approving ALTERATIONS as described hereinafter, is agreeable and willing to execute a "Memorandum of and Short Form of Agreement" (copy attached as Exhibit A and made a part of this agreement) and permit same to be duly recorded and become a covenant running with the land and condition on the title of HOMEOWNER's property; and

Whereas, HOMEOWNER and STATE do mutually desire to cooperate and desire to specify herein the terms and conditions under which ALTERATIONS shall be made;

NOW, THEREFORE, in consideration of the covenants and conditions herein contained, the parties hereto agree as follows:

Article I

STATE AGREES:

STATE, its contractor(s) or assignees shall do all of the following items of work in accordance with all applicable Federal, State, and local statutes, codes, ordinances, and regulations at STATE's expense without any monetary or material costs accruing to HOMEOWNER.

1. Make noise level recordings both inside and outside of RESIDENCE before and after construction determined by STATE to be necessary for the purpose of doing engineering and design work to prepare the plans and specifications for ALTERATIONS and to determine the effectiveness of ALTERATIONS in reducing noise levels. The times of the recordings shall be mutually agreed upon by both STATE and HOMEOWNER.

   HOMEOWNER further agrees to notify STATE during the testing period of any and all changes to the home which the HOMEOWNER may undertake which would alter the test data.

2. Design ALTERATIONS deemed necessary by STATE to reduce interior noise levels from exterior sources.

3. Permit HOMEOWNER to review and approve proposed plans and specifications for ALTERATIONS. STATE shall discuss any objections HOMEOWNER may have to STATE's plans and specifications and make those changes thereto mutually agreed upon by STATE and HOMEOWNER. In the event STATE and HOMEOWNER do not mutually agree upon ALTERATIONS, this agreement shall be terminated by written notice and neither STATE or HOMEOWNER shall have any further obligation to the other. Said written notice shall be mailed to HOMEOWNER by STATE or to STATE by HOMEOWNER at the address specified in Article III-10.

4. All work done under this agreement shall conform to all applicable building, fire and sanitary statutes, codes, ordinances, and regulations relating to such work, and shall be done in a good and workmanlike manner. RESIDENCE shall be left in as good a condition as found.

5. Monitor energy usage for RESIDENCE covering the time period from two (2) years immediately preceding the construction of ALTERATIONS to two (2) years following the acceptance of ALTERATIONS by STATE. Energy usage shall include but not necessarily be limited to electricity and natural gas.

6. STATE shall compensate HOMEOWNER at the prevailing rate for the quantities of electricity and natural gas used during the construction period which are in excess of the quanti-

ties of these items used during the corresponding billing periods one year earlier. The construction period shall be the period from the date the construction contract is awarded to the date the work is accepted by STATE.

7. STATE, its contractor(s) or assignees shall provide all normal servicing, repair and maintenance, including filters, of any mechanical unit such as a ventilation system that is installed pursuant to this agreement during the period STATE monitors energy usage. At the close of said energy monitoring period the unit shall be serviced and inspected to be sure it is in a state of good repair at the time HOMEOWNER assumes servicing and maintenance responsibilities.

8. If, because of the construction activities by STATE, HOMEOWNER and his/her household or any member thereof are required to vacate RESIDENCE, STATE shall reimburse HOMEOWNER for actual expenses for lodging and meals incurred. The cost to STATE for this purpose shall not exceed 46.00 dollars per day per person. HOMEOWNER shall submit receipts for lodging and meals for reimbursement. STATE shall not be responsible for any items covered by HOMEOWNER's insurance.

9. STATE shall pay all engineering, design, materials, labor, equipment, permit and other costs and fees accrued under the

terms of this agreement. STATE shall make no payment to HOMEOWNER for rent, utility bills, inconvenience, use of subject property, or any other item except as specifically noted in Articles I-6, I-7 and I-8.

Article II

HOMEOWNER AGREES:

HOMEOWNER, his assignees or successors in interest shall:

1. Notify his assignees or successors in interest, and/or tenant occupant(s) of the terms of this agreement by written notice.
2. Notify STATE by written notice of any proposed changes in ownership or occupancy subsequent to executing this agreement and during the construction and monitoring period specified in Section I-5. Said written notice shall be mailed to STATE at the address specified in Article III-10.
3. Provide STATE and its contractor(s) access to various areas inside and outside of RESIDENCE as determined by STATE for the purpose of making noise recordings, design, and the construction and maintenance work described herein and detailed on the plans and in the specifications. Access will be required before, after and during construction.
4. On demand of STATE, make or cause to be made available for

review by STATE all bills and records for RESIDENCE showing quantities of energy used during the period from two (2) years immediately preceding the construction of ALTERATIONS to two (2) years following the acceptance of ALTERATIONS by STATE. Energy usage shall include but not necessarily be limited to electricity and natural gas.

5. Upon acceptance of ALTERATIONS by STATE, assume all responsibility for the operation and maintenance of ALTERATIONS except the maintenance responsibilities STATE has specifically obligated to itself as described in Article I-7. At the termination of energy-usage monitoring by STATE, the time period being described in Article I-5, HOMEOWNER understands and agrees that the servicing, repair and maintenance responsibilities STATE has specifically obligated to itself as described in Article I-7 shall pass to HOMEOWNER and STATE shall have no further obligation therefore.

6. HOMEOWNER understands and agrees that any damage to ALTERATIONS being maintained by STATE caused by HOMEOWNER, whether willfully or accidentally shall be repaired by HOMEOWNER at no expense to STATE as expeditiously as possible.

7. In consideration of ALTERATIONS to be performed in accordance with this agreement, execute a "Memorandum of and Short Form of Agreement", attached as Exhibit A, upon approving and signing the plans and specifications for the work proposed by STATE.

8. Participate in an interview by STATE within twelve (12) months of acceptance of ALTERATIONS by STATE.

Article III

IT IS MUTUALLY UNDERSTOOD AND AGREED:

1. HOMEOWNER is not responsible for any damage or liablity occurring by reason of anything done or omitted to be done by STATE under or in connection with any work, authority or jurisdiction not delegated to HOMEOWNER under this agreement.
2. That neither STATE nor any officer or employee thereof shall be responsible for any damage or liability occurring by reason of anything done or omitted to be done by HOMEOWNER in connection with any work, authority or jurisdiction not delegated to STATE under this agreement.
3. That obligations of STATE to make ALTERATIONS approved by HOMEOWNER under the terms of this agreement are contingent upon the allocation of funds by the California Transportation Commission.
4. That construction of ALTERATIONS referred to herein may require alterations, deviations, additons to or omissions from STATE's plans and specifications, including increase or decrease of quantities in items of work. Any such changes as referred to herein will be accomplished in compliance with all local codes, laws, ordinances and regulations and

in accordance with STATE's Standard Specifications and Special Provisions in STATE's construction contract.

5. That upon the date of completion of all work under this agreement and acceptance of ALTERATIONS by STATE, ownership and title to all materials, equipment and appurtenances installed will automatically be vested in HOMEOWNER and no further action will be necessary to transfer ownership to HOMEOWNER. All materials, equipment and appurtenances installed are further to be classified as realty, and shall remain with the dwelling in the event of sale or foreclosure during the test period.

6. That all data, reports, recommendations, plan estimates, specifications, and documentation prepared or obtained pursuant to the terms of this agreement shall be the property of STATE. STATE shall furnish to HOMEOWNER at no cost to HOMEOWNER one copy of all final plans and specifications and as-built plans concerning RESIDENCE. STATE shall have unrestricted use of all data obtained pursuant to this agreement.

7. That this agreement shall terminate two (2) years following the acceptance by STATE of ALTERATIONS performed under the terms of this agreement except this agreement may be terminated by written notice by either HOMEOWNER or STATE at any time prior to start of construction of ALTERATIONS and neither will have any further obligation to the other or as

provided in Article I-3. Said written notice shall be mailed to HOMEOWNER by STATE or to STATE by HOMEOWNER at the address specified in Article III-10.

8. That construction of ALTERATIONS shall be considered to have started when STATE awards the contract to make such ALTERATIONS.

9. That this agreement may be amended in writing upon the mutual agreement of all parties, hereto.

10. That STATE's mailing address shall be:

Mr. Leland V. Blackburn
California Department of Transportation
Project Development C Branch
P. O. Box 3366, Rincon Annex
San Francisco, CA 94119

and that HOMEOWNER's address shall be:

Mr. & Mrs. Austin Morris

579 San Bruno Avenue

San Francisco, CA 94107

STATE and HOMEOWNER may change their respective mailing address by written notice mailed to the other.

11. It is estimated that the total cost to the STATE of payments to HOMEOWNER pursuant to Article I-6 and I-8 shall not exceed $3,500.00.

Terry Heath
CONSTRUCTION CO.

GENERAL CONTRACTOR
SPECIALIZING IN INSURANCE REPAIRS
RESTORATIONS . REMODELS . FOUNDATIONS
LIC. NO. 405400 Expired 5-31-83 B

7/9/84 Renewed
5-31-85 Expired

708 LEMON GROVE AVE., VENTURA, CA. 93003 (805) 644-7014

Mr. W. McGrath
c/o State of California

RE: 505 N. Wood Rd.
Camarillo, CA

PROPOSED WORK TO BE ACCOMPLISHED	QUANTITY	UNIT PRICE	AMOUNT
5/9/84 Remove and replace on East, South and West sides of home with Anderson double-glazed vertical sliders. Replace front fixed window with ¼" plate glass. Replace 9 lite patio door and mount threshold, weather strip and locks. All windows will be fitted with a compressing type gasket to insure an air-tight seal. Windows, doors and trim inside and out will be primed and painted to match existing colors. I will supply plans, permits and all materials to complete the work. Work will begin at the time the permit is attained. Also enclosed is heat pump specifications. We propose to install a 2½ ton Heil package heat pump in the residence at the above address. This equipment would deliver 1,050 cubic feet of air per minute to the conditioned area, which would allow approximately one cubic foot of air for each square foot of living area. The duct work and registers for this system would be sized so as to insure good air diffusion and circulation throughout the entire house. The outlet velocity at the face of supply air registers would be kept at 600 feet per minute so as to eliminate the "rushing" noise caused by poorly designed systems. Fresh air would be intoduced by a 6" x 6" screened air intake situated outside the house on the return air plenum. Outside air would be set at 158 CFM by means of a manual control damper. A barometric relief would also be installed in the return air so as to eliminate a positive pressure build-up. Total - E-95			$ 18,150.00

provided in Article I-3. Said written notice shall be mailed to HOMEOWNER by STATE or to STATE by HOMEOWNER at the address specified in Article III-10.

8. That construction of ALTERATIONS shall be considered to have started when STATE awards the contract to make such ALTERATIONS.

9. That this agreement may be amended in writing upon the mutual agreement of all parties, hereto.

10. That STATE's mailing address shall be:

Mr. Leland V. Blackburn
California Department of Transportation
Project Development C Branch
P. O. Box 3366, Rincon Annex
San Francisco, CA 94119

and that HOMEOWNER's address shall be:

Mr. John De Nadai

575 San Bruno Avenue

San Francisco, CA 94107

STATE and HOMEOWNER may change their respective mailing address by written notice mailed to the other.

11. It is estimated that the total cost to the STATE of payments to HOMEOWNER pursuant to Article I-6 and I-8 shall not exceed $3,500.00.

IN WITNESS WHEREOF, the parties hereto have caused this Agreement to be executed by their respective officers, duly authorized, the provisions of which Agreement are effective as of the day, month and year first hereinabove written.

HOMEOWNER John DeNadai

RECOMMENDED FOR APPROVAL:

BY Barbara M. Sunday
Right of Way Agent

BY Russell Sayre
Chief, Pro. Dev. C Branch
RUSSELL SAYRE

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

BY Richard J. Murphy
RICHARD J. MURPHY, Chief
Acquisition and Appraisal
Branch

provided in Article I-3. Said written notice shall be mailed to HOMEOWNER by STATE or to STATE by HOMEOWNER at the address specified in Article III-10.

8. That construction of ALTERATIONS shall be considered to have started when STATE awards the contract to make such ALTERATIONS.

9. That this agreement may be amended in writing upon the mutual agreement of all parties, hereto.

10. That STATE's mailing address shall be:

Mr. Leland V. Blackburn
California Department of Transportation
Project Development C Branch
P. O. Box 3366, Rincon Annex
San Francisco, CA 94119

and that HOMEOWNER's address shall be:

Gina Baracchi
Alexander B. Buen
587 San Bruno Avenue
San Francisco, Ca 94107

STATE and HOMEOWNER may change their respective mailing address by written notice mailed to the other.

11. It is estimated that the total cost to the STATE of payments to HOMEOWNER pursuant to Article I-6 and I-8 shall not exceed $3,500.00.

IN WITNESS WHEREOF, the parties hereto have caused this Agreement to be executed by their respective officers, duly authorized, the provisions of which Agreement are effective as of the day, month and year first hereinabove written.

HOMEOWNER

RECOMMENDED FOR APPROVAL:

BY
Right of Way Agent

BY
Chief, Pro. Dev. C Branch

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

BY
RICHARD J. MURPHY, Chief
R/W Appraisals-Acquisition Branch

provided in Article I-3. Said written notice shall be mailed to HOMEOWNER by STATE or to STATE by HOMEOWNER at the address specified in Article III-10.

8. That construction of ALTERATIONS shall be considered to have started when STATE awards the contract to make such ALTERATIONS.

9. That this agreement may be amended in writing upon the mutual agreement of all parties, hereto.

10. That STATE's mailing address shall be:

Mr. Leland V. Blackburn
California Department of Transportation
Project Development C Branch
P. O. Box 3366, Rincon Annex
San Francisco, CA 94119

and that HOMEOWNER's address shall be:

Mr. Donald Carnegie
513 Rhode Island Street
San Francisco, CA 94107

STATE and HOMEOWNER may change their respective mailing address by written notice mailed to the other.

11. It is estimated that the total cost to the STATE of payments to HOMEOWNER pursuant to Article I-6 and I-8 shall not exceed $3,500.00.

IN WITNESS WHEREOF, the parties hereto have caused this Agreement to be executed by their respective officers, duly authorized, the provisions of which Agreement are effective as of the day, month and year first hereinabove written.

HOMEOWNER

RECOMMENDED FOR APPROVAL:

BY
Right of Way Agent

BY
Chief, Pro. Dev. C Branch

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

BY
RICHARD J. MURPHY, Chief
Acquisition and Appraisal
Branch

EXHIBIT A

MEMORANDUM OF AND SHORT FORM OF AGREEMENT

This Memorandum of and Short Form of Agreement is made by and between the State of California, acting by and through the Business and Transportation Agency, Department of Transportation, hereinafter referred to as the "State" and _____ _____ hereinafter referred to as the "Homeowners".

State's Agreement with Homeowners, concerns the real property located at _____ and legally described as:

Lot _____ of Tract No. _____, in the City of _____ County of _____, State of California, as per map recorded in Book _____ Pages _____ of Maps, in the Office of the County Recorder of the County of _____.

The term of this Agreement shall be for a period not to exceed 4 years following the execution of this "Memorandum of an Short Form of Agreement".

This Agreement is subject to the terms and conditions of that certain unrecorded agreement between the parties entitled

"Agreement Between the State of California and _____ _____ covering a single family residence and dated, for reference purposes only, _____ and, identified as Agreement No. _____ in the official files of the Department of Transportation.

It is understood that the only purpose of this instrument is to give notice of the existence of the Agreement as described above. All rights and obligations of Homeowner and the State hereunder are governed by the terms, covenants, conditions, limitations and restrictions contained in said agreement entitled "Agreement Between the State of California and _____ _____.

Executed at _____ California on _____ 1980.

HOMEOWNERS

BY _____

BY _____

STATE

BY _____

ACKNOWNLEDGEMENT

STATE OF CALIFORNIA)ss.
County of San Francisco)

On _____, before the undersigned, a Notary Public for the State of California, personally appeared _____ _____, known to me to be the person(s) whose names(s) is/are subscribed to the within instrument, and acknowledged that he executed same.

July 27, 1981

04-SF-101 4.0
04226 - 100071

Mr. Donald Carnegie
513 Rhode Island Street
San Francisco, CA 94107

Dear Mr. Carnegie:

This letter will confirm the desire of you and your partners, Emil and Mabel Ehmen, not to proceed with the noise insulation work as proposed in our June 30, 1981 letter.

We are therefore terminating the agreement in accordance with Article III-7 of said document. Thank you for your past cooperation and we regret your decision not to continue with the project.

Sincerely yours,

JOHN WEST
District Director

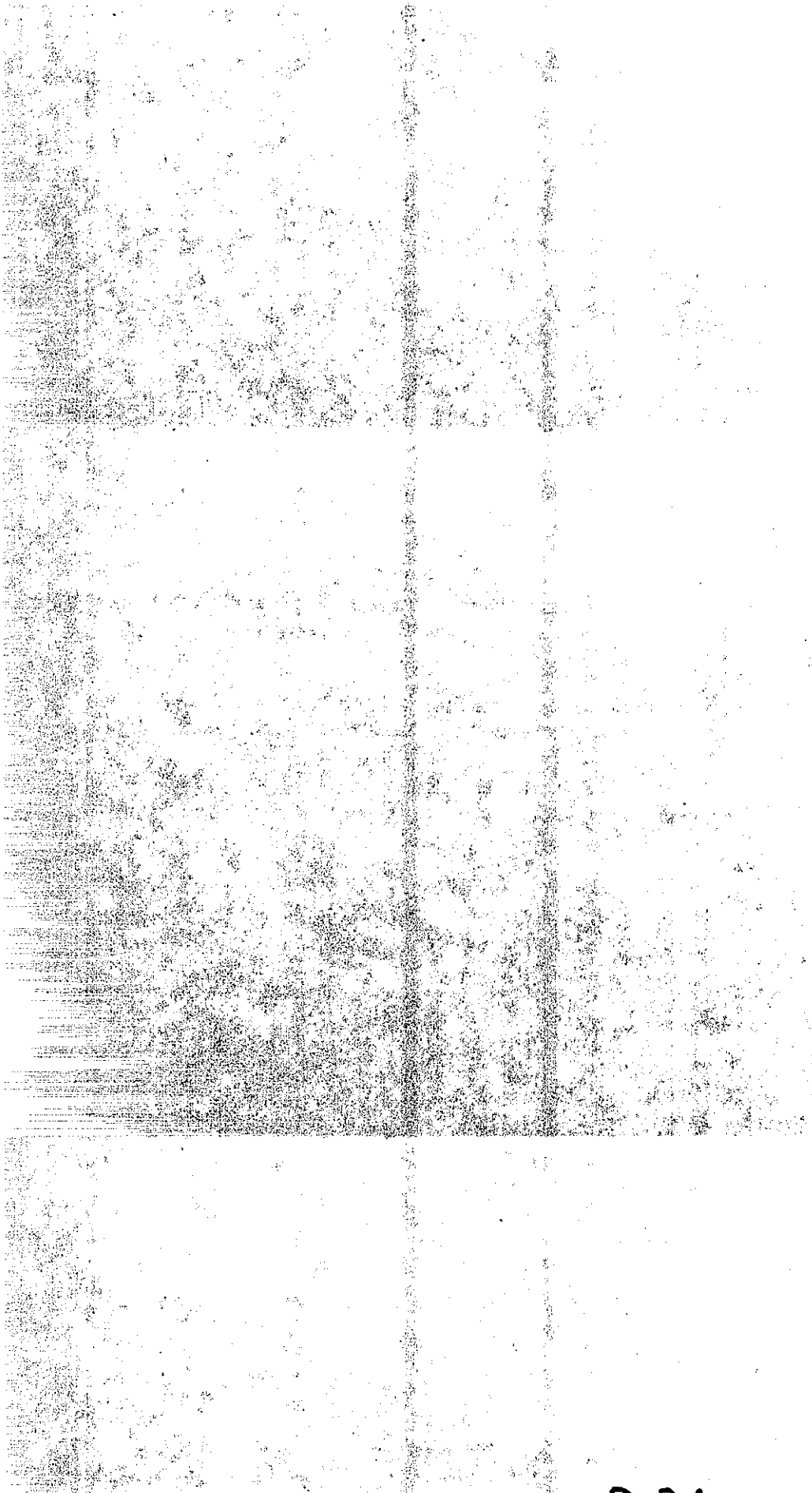
By ORIGINAL SIGNED BY

MILTON LOUIE, Chief
Project Development
C Branch

RI:dfc

cc: RJM,ML-RI,MHatano(Trans Lab),DThompson(HQ)

D-23



Recording Requested by
DEPARTMENT OF TRANSPORTATION
When Recorded Mail to
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION
Box 2304 Terminal Annex
Los Angeles, California 90051

70819

VERIFIED-5

DISTRICT 7

RECORDED IN OFFICIAL RECORDS OF VENTURA COUNTY, CALIFORNIA
JUL 10 1984 AT 8:30 AM
RICHARD D. DEAN, COUNTY RECORDER

COMP

FREE - 3

MEMORANDUM OF AND SHORT FORM OF AGREEMENT

This Memorandum of and Short Form of Agreement is made by and between the State of California, acting by and through the Business and Transportation Agency, Department of Transportation, hereinafter referred to as the "STATE" and WILLIAM McGRATH hereinafter referred to as the "Homeowners".

State's Agreement with Homeowners, concerns the real property located at 505 North Wood Road, Camarillo, California, and legally described as:

> Lot 1, Section 29, T 2 N, R 21 W, SBB&M in Camarillo, County of Ventura, State of California, as per map recorded in Book 4193 Page 303 of Maps in the Office of the County Recorder of said County.

The term of this Agreement shall be for a period not to exceed 4 years following the execution of this "Memorandum of and Short Form of Agreement".

This Agreement is subject to the terms and conditions of that certain unrecorded agreement between the parties entitled "Agreement Between the State of California and WILLIAM McGRATH covering a single family residence and dated, for reference purposes only, May 9, 1984 and, identified as Agreement No. 168-A in the official files of the Department of Transportation.

Free Recording Requested
Essential to Acquisition by
Department of Transportation
(See 6103 Gov. Code)

Ronald A. Costello
Sr. R/W Agent

D-25

It is understood that the only purpose of this instrument is to give notice of the existence of the Agreement as described above. All rights and obligations of Homeowner and the State hereunder are governed by the terms, covenants, conditions, limitations and restrictions contained in said agreement entitled "Agreement Between the State of California and WILLIAM McGRATH.

Executed at Oxnard California on June 20 1984.

HOMEOWNERS

By: William McGrath

WILLIAM MC GRATH

By: _____

STATE OF CALIFORNIA
Department of Transportation

By: _____

Acting ROY K. SASAKI
CHIEF, RIGHT OF WAY ACQUISITION BRANCH

ACKNOWLEDGEMENT

STATE OF CALIFORNIA)
) ss.
County of VENTURA)

On JUNE 20, 1984, before the undersigned a Notary Public for the State of California, personally appeared _____ WILLIAM MC GRATH, known to me to be the person(s) whose name(s) is/are subscribed to the within instrument, and acknowledged that he executed same.

OFFICIAL SEAL
JUDY THIELE
NOTARY PUBLIC - CALIFORNIA
VENTURA COUNTY
My comm. expires FEB 26, 1988

Judy Thiele

D-26

State of California — Business and Transportation Agency

Memorandum

To : MR. C. G. BORK
Construction Branch

Date: June 25, 1984

File : 7-Ven-101 17.7
Noise attenuation for
Private Dwelling at
505 North Wood Road
Camarillo
07203 - 001171 - 5952101(

MR. R. V. WALLIN
Project Development Branch C

From : DEPARTMENT OF TRANSPORTATION

Category: 452

Subject:

Attached, for your information, is a fully executed agreement covering noise attenuation in a private residence located at 505 North Wood Road, Camarillo.

The proposed work, which includes air conditioning and mechanical work, and replacing doors and windows, is discussed in the State's acoustical consultant report which is attached to the agreement as EXHIBIT B.

The homeowner, Mr. William McGrath, invited and opened bid proposals on May 30, 1984. The District will approve the homeowner to award the contract to the low bidder in 7 to 10 days and the preconstruction conference follows. Your Resident Engineer will monitor this project about the same way as they do in the School Noise Abatement projects.

As indicated in the agreement, the homeowner will administer the contract. There is no PS&E prepared for this project. The successful low bidder will prepare plans according to the State's consultant report and apply for a building permit from the city before construction starts. The homeowner will receive the payment for construction of all the work upon completion of the contract.

We will let you know of the date and place of the preconstruction conference as soon as it is arranged. You could call Eddy Chow at 3481 if you have any questions about this project.

R. V. WALLIN
Senior Transportation Engineer
Project Development Branch C

cc: WA Whitnack, HQ OPPD

EC:gm

7-VEN-101 17.7
07203-001171-595210104

District Agreement No. 168-A
Contract No. 07A894

THIS AGREEMENT, ENTERED INTO ON May 9, 1984, is between the STATE OF CALIFORNIA, acting by and through its Department of Transportation, referred to herein as STATE, and

WILLIAM McGRATH
Legal owner(s) of the property known as 505 North Wood Road Camarillo, Ventura County in the State of California, hereinafter referred to as "HOMEOWNER"

This Agreement supersedes the STATE-HOMEOWNER District Agreement No. 166-A dated November 29, 1982 entirely.

The U.S. Department of Transportation acting through its Federal Highway Administration, hereinafter referred to as "FHWA", on January 17, 1977 issued FHWA Notice N 5080.62 encouraging states to develop experimental projects to determine the feasibility of noise insulation of privately-owned residences; and

STATE desires to conduct an experimental noise insulation project in the residence located on HOMEOWNER's property, hereinafter called RESIDENCE; and

STATE desires and is willing to pay the cost of making modifications, alterations and reconstruction to RESIDENCE, hereinafter called ALTERATIONS and described herein; and

STATE desires to determine what changes in sound levels and energy use can be expected in RESIDENCE in which ALTERATIONS are made; and

HOMEOWNER is willing and desirous to permit STATE to make ALTERATIONS to RESIDENCE with no design or construction costs accruing to HOMEOWNER; and

HOMEOWNER, after approving ALTERATIONS as described hereinafter, is agreeable and willing to execute a "Memorandum of and Short Form of Agreement" (copy attached as Exhibit A and made a part of this agreement) and permit same to be duly recorded and become a covenant running with the land and a condition on the title of HOMEOWNER's property; and

HOMEOWNER and STATE do mutually desire to cooperate and desire to specify herein the terms and conditions under which ALTERATIONS shall be made;

NOW, THEREFORE, in consideration of the covenants and conditions herein contained, the parties hereto agree as follows:

ARTICLE I

STATE AGREES:

STATE, contractor(s) or assignees shall do all of the following items of work in accordance with all applicable Federal, State, and local statutes, codes, ordinances, and regulations at STATE's expense without any monetary or material costs accruing to HOMEOWNER.

1. Make noise level recordings both inside and outside of RESIDENCE before and after construction determined by STATE to be necessary for the purpose of determining the effectiveness of

ALTERATIONS in reducing noise levels. The times of the recordings shall be mutually agreed upon by both STATE and HOMEOWNER.

HOMEOWNER further agrees to notify STATE during the testing period of any and all changes to the home which the HOMEOWNER may undertake which would alter the test data.

2. To bear the costs of ALTERATIONS plan check fee and building permit as approved by STATE.

3. To make payment to HOMEOWNER after contract completion as approved by HOMEOWNER and STATE, and upon receipt of billing therefor. The total contribution to be borne by the STATE will not exceed $25,000.00 unless provided for in a supplement to this agreement. Such supplement will be executed and approved prior to the obligation of the additional funds.

4. All work done under this agreement shall conform to all applicable building, fire and sanitary statutes, codes, ordinances, and regulations relating to such work, and shall be done in a good and workmanlike manner. RESIDENCE shall be left in as good a condition as found.

5. Monitor energy usage for RESIDENCE covering the time period from two (2) years immediately preceding the construction of ALTERATIONS to two (2) years following the acceptance of ALTERATIONS by STATE. Energy usage shall include but not necessarily be limited to electricity and natural gas.

6. STATE shall compensate HOMEOWNER at the prevailing rate for the quantities of electricity and natural gas used during the construction period which are in excess of the quantities of these items used during the corresponding billing periods one year earlier. The construction period shall be the period from the date the construction contract is awarded to the date the work is accepted by HOMEOWNER.

7. STATE, contractor(s) or assignees shall provide all normal servicing, repair and maintenance, including filters, of any mechanical unit such as an air conditioning or ventilation system that is installed pursuant to this agreement during the period STATE monitors energy usage. At the close of said energy monitoring period the unit shall be serviced and inspected to be sure it is in a state of good repair at the time HOMEOWNER assumes servicing and maintenance responsibilities.

8. If, because of the construction activities by STATE, HOMEOWNER and his/her household or any member thereof are required to vacate RESIDENCE, STATE shall reimburse HOMEOWNER for actual expenses for lodging and meals incurred. The cost to STATE for this purpose shall not exceed 62.00 dollars per day per person. HOMEOWNER shall submit receipts for lodging and meals for reimbursement. STATE shall not be responsible for any items covered by HOMEOWNER's insurance.

9. STATE shall pay all materials, labor, equipment, permit and other costs and fees accured under the terms of this agreement.

STATE shall make no payment to HOMEOWNER for rent, utility bills, inconvenience, use of subject property, or any other item except as specifically noted in Articles I-6, I-7, and I-8.

ARTICLE II

HOMEOWNER AGREES:

HOMEOWNER, his assignees or successors in interest shall:

1. Construct ALTERATIONS by contracts with licensed construction contractors; such contracts to be completed in conformity with the report prepared by Purcell & Noppe & Associates, Inc., a STATE acoustical consultant, and dated November 9, 1982, attached hereto as Exhibit "B".

2. HOMEOWNER shall obtain sealed bids indicating the contract amount for each item of work required for ALTERATIONS from at least 3 licensed construction contractors, and submit for STATE's review, a summary of proposals submitted bythe respective bidders. The STATE shall approve the award of the contrat to the lowest responsible bidder for the constructin of ALTERATIONS.

3. HOMEOWNER shall submit the contract proposed between HOMEOWNER and the contractor for STATE's review prior to award authorization being issued.

4. HOMEOWNER shall execute and administer the contract, and provide supervision and inspection of the contractor's operations.

5. STATE shall monitor and exercise general supervision over ALTERATIONS and may assume full or direct control over the project whenever STATE, at its sole discretion, determines that its responsibility so requires. In that event, STATE will act in the capacity of the designated agent of HOMEOWNER.

6. Upon completion of the ALTERATIONS, HOMEOWNER shall accept full responsibility for the proposed work and make no claim against STATE for further noise abatement measures.

7. Within 60 days after completion of ALTERATIONS, HOMEOWNER shall furnish STATE with a detailed statement of construction cost and related costs required to complete ALTERATIONS and refund to STATE any remaining amount of STATE's payment.

8. HOMEOWNER shall retain all records and accounts relating to construction of ALTERATIONS for audit for STATE and other government auditors for a period of three (3) years from date of completion of ALTERATIONS.

9. Notify his assignees or successors in interest, and/or tenant occupant(s) of the terms of this agreement by written notice.

10. Notify STATE by written notice of any proposed changes in ownership or occupancy subsequent to executing this agreement and during the construction and monitoring period specified in Article I-5. Said written notice shall be mailed to STATE at the address specified in Article III-9.

11. Provide STATE and its contractor(s) access to various areas inside and outside of RESIDENCE as determined by STATE for the purpose of making noise recordings, the construction and maintenance work described herein. Access will be required before, after and during construction.

12. On demand of STATE, make or cause to be made available for review by STATE all bills and records for RESIDENCE showing quantities of energy used during the period from two (2) years immediately preceding the constructin of ALTERATIONS to two (2) years following the acceptance of ALTERATIONS by HOMEOWNER. Energy usage shall include but not necessarily be limited to electricity and natural gas.

13. Upon acceptance of ALTERATIONS, assume all responsibility for the operation and maintenance of ALTERATIONS except the maintenance responsibilities STATE has specifically obligated to itself as described in Article I-7. At the termination of energy-usage monitoring by STATE, the time period being described in Article I-5, HOMEOWNER understands and agrees that the servicing, repair and maintenance responsibilities STATE has specifically obligated to

itself as described in Article I-7 shall pass to HOMEOWNER and STATE shall have no further obligation therefore.

14. HOMEOWNER understands and agrees that any damage to ALTERATIONS being maintained by STATE caused by HOMEOWNER, whether willfully or accidentally shall be repaired by HOMEOWNER at no expense to STATE as expeditiously as possible.

15. In consideration of ALTERATIONS to be performed in accordance with this agreement, execute a "Memorandum of and Short Form of Agreement", attached as Exhibit A, prior to the award of the contract for the construction of ALTERATIONS.

16. Participate in an interview by STATE within twelve (12) months of acceptance of ALTERATIONS.

ARTICLE III

IT IS MUTUALLY UNDERSTOOD AND AGREED:

1. HOMEOWNER is not responsible for any damage or liability occurring by reason of anything done or omitted to be done by STATE under or in connection with any work, authority or jurisdiction not delegated to HOMEOWNER under this agreement.

2. That neither STATE nor any officer or employee thereof shall be responsible for any damage or liability occurring by reason of anything done or omitted to be done by HOMEOWNER in connection

with any work, authority or jurisdiction not delegated to STATE under this agreement.

3. That obligations of STATE to make ALTERATIONS approved by HOMEOWNER under the terms of this agreement are contingent upon the allocation of funds by the California Transportation Commission.

4. That upon the date of completion of all work under this agreement and acceptance of ALTERATIONS by HOMEOWNER, ownership and title to all materials, equipment and appurtenances installed will automatically be vested in HOMEOWNER and no further action will be necessary to transfer ownership to HOMEOWNER.

All materials, equipment and appurtenances installed are further to be classified as realty, and shall remain with the dwelling in the event of sale or foreclosure during the test period.

5. That all data, reports, recommendations, and documentation prepared or obtained pursuant to the terms of this agreement shall be the property of STATE. STATE shall have unrestricted use of all data obtained pursuant to this agreement.

6. That this agreement shall terminate two (2) years following the acceptance of ALTERATIONS performed under the terms of this agreement, but no later than December 31, 1986, except this agreement may be terminated by written notice by either HOMEOWNER or STATE at any time prior to start of construction of ALTERATIONS and

obligation to the other. Said written notice shall be mailed to HOMEOWNER by STATE or to STATE by HOMEOWNER at the address specified in Article III-9.

7. That construction of ALTERATIONS shall be considered to have started when HOMEOWNER awards the contract to make such ALTERATIONS.

8. That this agreement may be amended in writing upon the mutual agreement of all parties, hereto.

9. The STATE's mailing address shall be:

Mr. Satish Chander
California Department of Transportation
Environmental Planning Branch
P. O. Box 2304, Terminal Annex
Los Angeles, CA 90051

and that HOMEOWNER's address shall be:

Mr. William McGrath
505 North Wood Road
Camarillo, CA 93010

STATE and HOMEOWNER may change their respective mailing address by written notice mailed to the other.

10. It is estimated that the total cost to STATE of payments to HOMEOWNER pursuant to Articles I-6 and I-8 shall not exceed $4,000.00.

IN WITNESS WHEREOF, the parties hereto have caused this Agreement to be executed by their respective officers, duly authorized, the provisions of which Agreement are effective as of the day, month and year first hereinabove written.

STATE OF CALIFORNIA
Department of Transportation

By _____
District Director

HOMEOWNER

William H McGrath Ranch
by: William H. McGrath
Partner

RECOMMENDED FOR APPROVAL

By _____
Right of Way Agent

STATE OF CALIFORNIA)
) SS
COUNTY OF Ventura)

On April 13th 1984, 1987 before me Richard V Laubacher a Notary Public in and for said County and State, personally appeared William H. McGrath, known to me to be the person whose name is subscribed to the within instrument, and acknowledged to me that they executed the same.

WITNESS my hand and official seal.

OFFICIAL SEAL
RICHARD V. LAUBACHER
NOTARY PUBLIC - CALIFORNIA
PRINCIPAL OFFICE IN
VENTURA COUNTY
My Commission Exp. June 20, 1986

Richard V Laubacher

D-39

EXHIBIT A
MEMORANDUM OF AND SHORT FORM OF AGREEMENT

This Memorandum of and Short Form of Agreement is made by and between the State of California, acting by and through the Business and Transportation Agency, Department of Transportation, hereinafter referred to as the "STATE" and _____ hereinafter referred to as the "Homeowners".

State's Agreement with Homeowners, concerns the real property located at _____ and legally described as:

Lot _____ of Tract No. _____ in the City of _____ County of _____, State of California, as per map recorded in Book _____ Pages _____ of Maps in the Office of the County Recorder of the County of _____.

The term of this Agreement shall be for a period not to exceed 4 years following the execution of this "Memorandum of and Short Form of Agreement".

This Agreement is subject to the terms and conditions of that certain unrecorded agreement between the parties entitled "Agreement Between the State of California and _____ covering a single family residence and dated, for reference purposes only, _____ and, identified as Agreement No. _____ in the official files of the Department of Transportation.

It is understood that the only purpose of this instrument is to give notice of the existence of the Agreement as described above. All rights and obligations of Homeowner and the State hereunder are governed by the terms, covenants, conditions, limitations and restrictions contained in said agreement entitled "Agreement Between the State of California and _____

_____.

Executed at _____ California on _____ 1984.

HOMEOWNERS

By: _____

By: _____

STATE

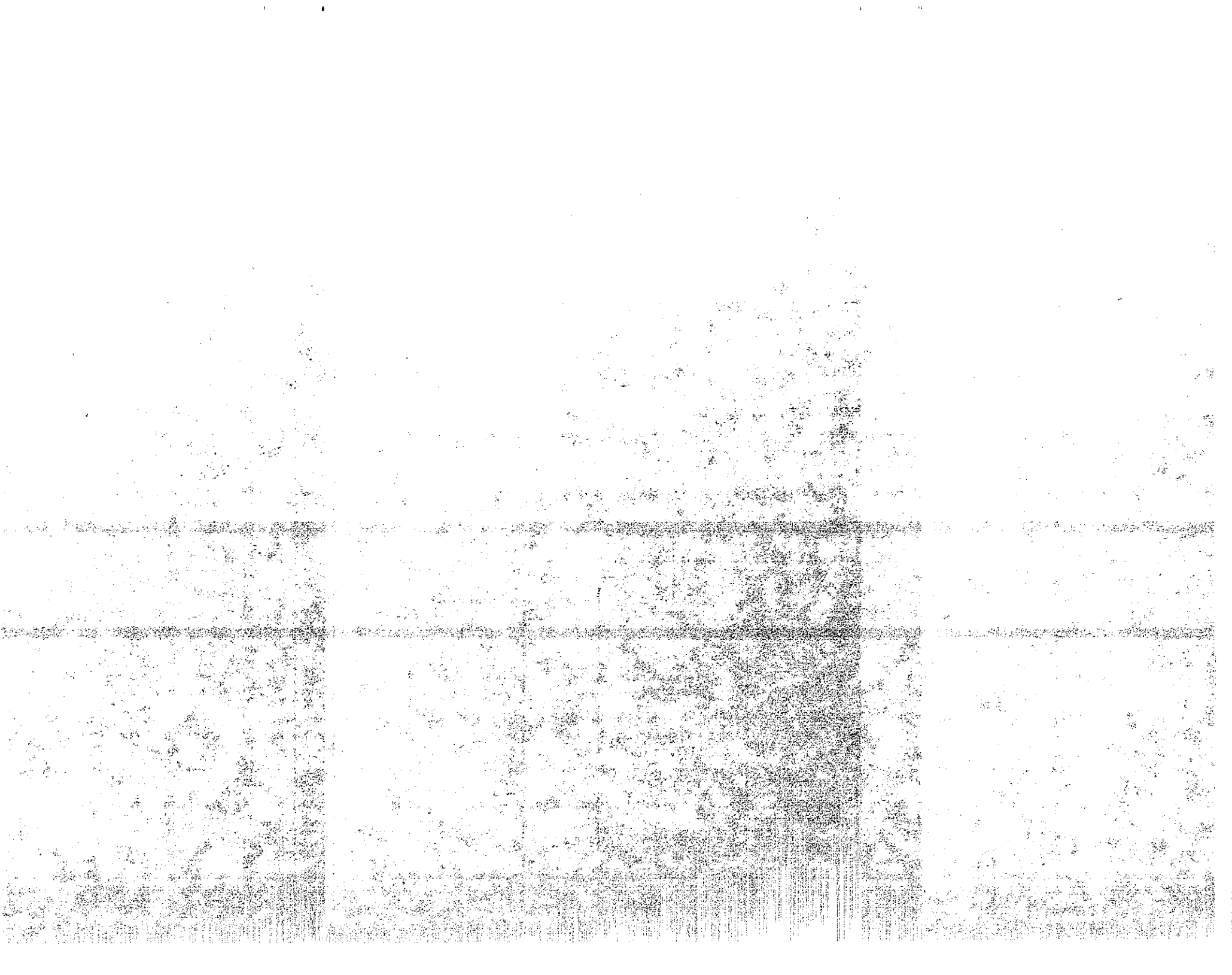
By: _____

ACKNOWLEDGEMENT

STATE OF CALIFORNIA)
) ss.
County of Los Angeles)

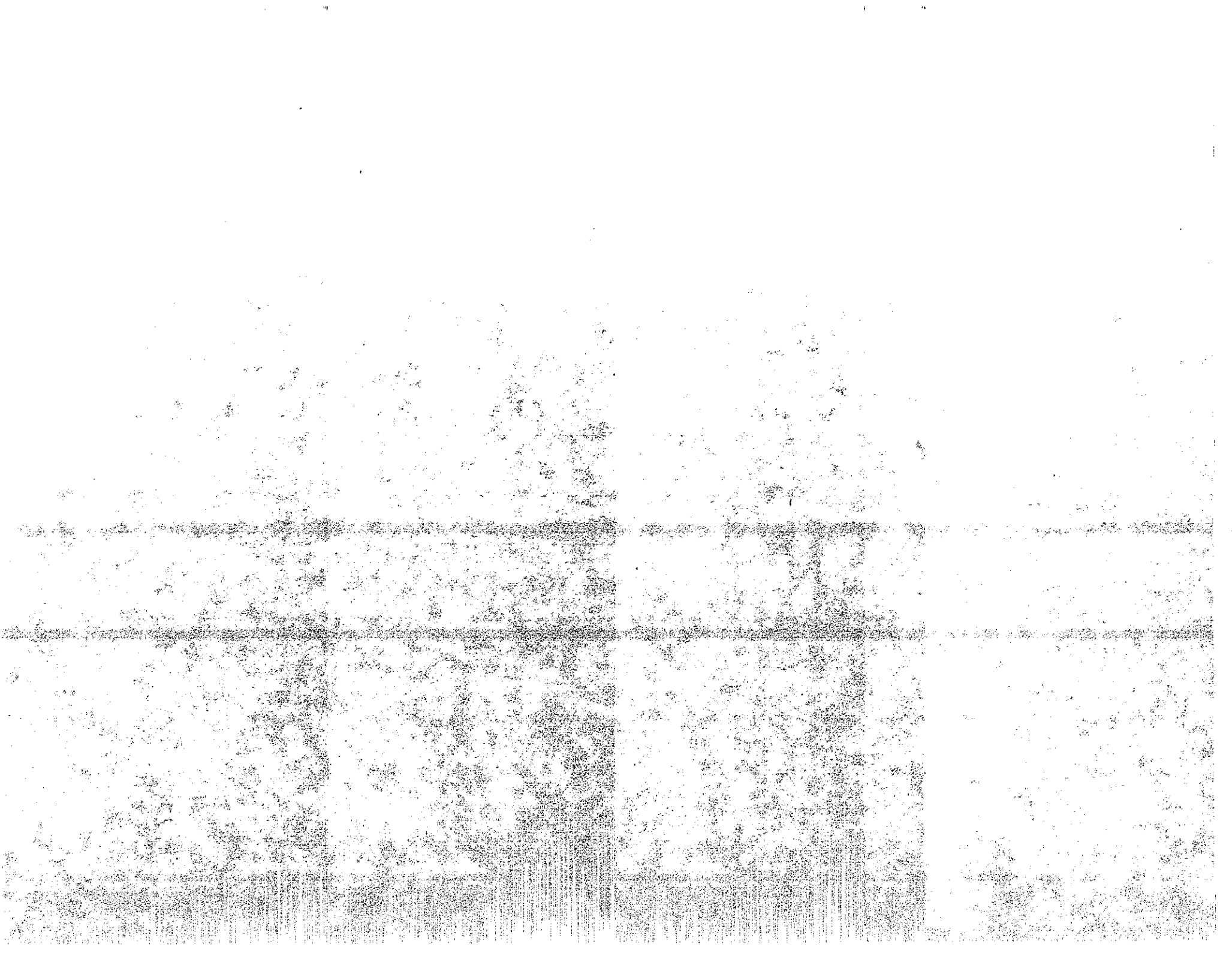
On _____, before the undersigned a Notary Public for the State of California, personally appeared _____

_____, known to me to be the person(s) whose name(s) is/are subscribed to the within instrument, and acknowledged that he executed same.



APPENDIX E

Plans, Specifications, Bids and Contracts



STATE OF CALIFORNIA—BUSINESS AND TRANSPORTATION AGENCY

EDMUND G. BROWN JR., Governor

DEPARTMENT OF TRANSPORTATION
P.O. BOX 3366, RINCON ANNEX
SAN FRANCISCO 94119
(415) 557-1840

DISTRICT 4

June 14, 1982

04-SF-101 4.0
04226 - 100071

Mr. John DeNadai
575 San Bruno Avenue
San Francisco, CA 94107

Dear Mr. DeNadai:

Final plans are enclosed for your review and approval. Changes from the preliminary plans include:

1. The new wall (existing garage door) has been stiffened with an extra 3/8" plywood sheathing. The new windows will consist of a single pane, 5/16" laminated glass without muntins.

2. The northerly windows in your dining room will be a single pane, 5/16" laminated glass without muntins.

3. All of the windows in your living room will be double pane with the outer glass being tinted.

4. The operable windows (E, F and G) will all have double panes with new frames similar to the existing.

5. The existing raised platform adjacent to the garage door will be removed.

6. Exterior painting will be restricted to the new wall and trim at the front of your house.

7. The location for the switch to the fan motor has been moved to the interior of the living room closet.

Please let us know at your earliest convenience if the proposed alterations are satisfactory by calling Mr. Ryu Inoue at 557-2561 between the hours of 7:30 a.m. and 4:00 p.m. If they are satisfactory, he will make arrangements with you to sign the original tracing of the Title Sheet of the plans and the exhibit that was attached to the Homeowners Agreement.

The next step involves finalizing the construction contract and advertizing for bids. We anticipate that the contract will be advertized in late July or early August. Work at your home should begin around early October and be completed by early November.

Thanks again for your continuing cooperation and do not hesitate to call if you have any questions.

Sincerely yours,

J. C. BRADFIELD
Senior Engineer
Project Development
C Branch

Attachment

RI:dfc

cc: MEH,JCB-RI,MHatano(HO),DThomson(HO)

STATE OF CALIFORNIA—BUSINESS AND TRANSPORTATION AGENCY — EDMUND G. BROWN JR., Governor

DEPARTMENT OF TRANSPORTATION
P.O. BOX 3366, RINCON ANNEX
SAN FRANCISCO 94119
(415) 557-1840

June 14, 1982

04-SF-101 4.0
04226 - 100071

Mr. & Mrs. Austin Morris
579 San Bruno Avenue
San Francisco, CA 94107

Dear Mr. & Mrs. Morris:

Final plans are enclosed for your review and approval. Changes from the preliminary plans include:

1. The window framing has been simplified to match your existing frames.

2. Exterior painting has been reduced due to the elimination of trim work at each window.

3. The position of the new in-line cabinet fan shown on Sheet ME-1 has been revised to reflect its proper relation to the furnace.

Please let us know at your earliest convenience if the proposed alterations are satisfactory by calling Mr. Ryu Inoue at 557-2561 between the hours of 7:30 a.m. and 4:00 p.m. If they are satisfactory, he will make arrangements with you to sign the original tracing of the Title Sheet of the plans and the exhibit that was attached to the Homeowners Agreement.

The next step involves finalizing the construction contract and advertizing for bids. We anticipate that the contract will be advertized in late July or early August. Work at your home should begin around early October and be completed by early November.

Thanks again for your continuing cooperation and do not hesitate to call if you have any questions.

Sincerely yours,

ORIGINAL SIGNED BY

J. C. BRADFIELD
Senior Engineer
Project Development
C Branch

Attachment

E-3

RI:dfc

cc: MEH,JCB-RI,MHatano(HO),DThomson(HO)

STATE OF CALIFORNIA—BUSINESS AND TRANSPORTATION AGENCY

EDMUND G. BROWN JR., Governor

DEPARTMENT OF TRANSPORTATION
P.O. BOX 3366, RINCON ANNEX
SAN FRANCISCO 94119
(415) 557-1840

June 14, 1982

04-SF-101 4.0
04226 - 100071

Mr. Gino Biradelli
Ms. Alexis O'Brien
587 San Bruno Avenue
San Francisco, CA 94107

Dear Ms. O'Brien and Mr. Biradelli:

Final plans are enclosed for your review and approval. The only change from the previous preliminary plans is the clarification of work involving the ventilation system.

Please let us know at your earliest convenience if the proposed alterations are satisfactory by calling Mr. Ryu Inoue at 557-2561 between the hours of 7:30 a.m. and 4:00 p.m. If they are satisfactory, he will make arrangements with you to sign the original tracing of the Title Sheet of the plans and the exhibit that was attached to the Homeowners Agreement.

The next step involves finalizing the construction contract and advertizing for bids. We anticipate that the contract will be advertized in late July or early August. Work at your home should begin around early October and be completed by early November.

Thanks again for your continuing cooperation and do not hesitate to call if you have any questions.

Sincerely yours,

J. C. BRADFIELD
Senior Engineer
Project Development
C Branch

Attachment

E-4

RI:dfc

cc: MEH,JCB-RI,MHatano(HO),DThomson(HO)

State of California

Business, Transportation and Housing Agency

Memorandum

To : R. H. Jahrling, Chief
Project Development A Branch

Attention R. M. Schroll

Date: July 8, 1982

File : 04-SF-101 4.0
04226 - 100071

From : DEPARTMENT OF TRANSPORTATION
Project Development C Branch

Subject:

As discussed, enclosed is the original PS&E for the Noise Insulation of Private Dwellings project adjacent to SF-101 near the 18th Street Pedestrian Overcrossing. Please process and advertise as a Minor B, State-only funds, contract.

This is a FHWA Experimental Project administered through our Transportation Laboratory. FHWA approved the Project Report on January 6; 1982 and right of way was certified on January 5, 1982. Agreements with the homeowners have been executed for doing all of the necessary work.

We have contacted the Construction Branch and they indicate that they will be administering the contract. We will prepare and transmit a Resident Engineer's file to the Construction Branch prior to advertisement.

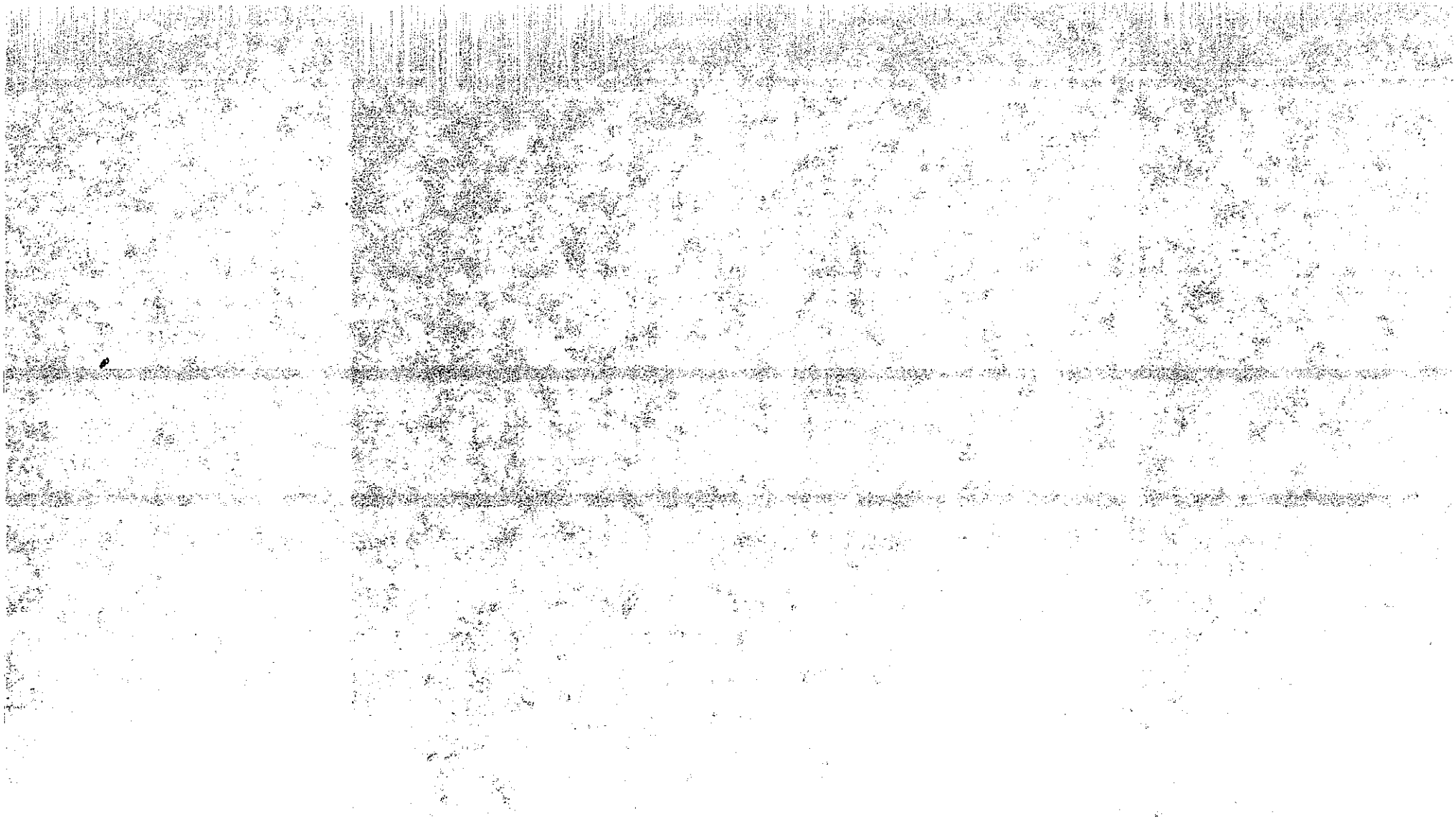
Please expedite in order to advertise the contract in August and to complete the work before the holiday and rainy season. Keep us informed in order that we may continue to coordinate the on-going studies with Transportation Lab. Contact Duane Thomson, the Project Architect, at 8-454-1975 if you have specific questions on the plans and specifications.

J. C. BRADFIELD
Senior Engineer
Project Development C Branch

Attachment

RI:dfc

cc: MEH,RAS-RJM,RWS,LC,EBD,JCM,JCB-RI,WWhitnack(HQ),MHatano(Trans Lab), DThomson(HQ-Struct. Arch.)



STATE OF CALIFORNIA
BUSINESS AND TRANSPORTATION AGENCY
DEPARTMENT OF TRANSPORTATION
DISTRICT 4

September 1981
04-SF-101 PM 4.0
04226 - 100071

TO: J. T. KASSEL
Chief, Office of Planning and Design

PROJECT REPORT

FOR THE PROPOSED

INSULATION OF PRIVATE DWELLINGS

ON

ROUTE 101

IN

SAN FRANCISCO COUNTY

NEAR THE

18TH STREET PEDESTRIAN OVERCROSSING

APPROVAL RECOMMENDED:

VERNON J. RICHEY
Deputy District Director

I. PROJECT DEVELOPMENT CATEGORY

This is a Category 5 project because of its minimal social, economic, and environmental significance.

II. PROJECT LIMITS AND DESCRIPTION

The proposed project is located in the Potrero Hill District of San Francisco, adjacent to Route 101 near the 18th Street Pedestrian Overcrossing. (See Exhibits A and B.)

This is an experimental project for noise insulation of three private dwellings located adjacent to the freeway. The purpose of the project is to test the effectiveness of various noise insulation techniques relative to cost, interior noise reduction and energy conservation. The project will be designed and administered in accordance with the National Experimental and Evaluation Program (NEEP) Project No. 21 - Noise Insulation for Private Dwellings.

III. BACKGROUND INFORMATION

The project was initiated in January 1978 in response to a request from the Department's Transportation Laboratory for a list of potential sites that could be used in the Program. Three sites (in Oakland, San Jose and San Francisco) were submitted with the San Francisco site having the top priority based on its location, structure and site characteristics, noise level, and other criteria used in the selection process. A sound wall had been proposed along SF-101, between 17th and 19th Streets, but was rejected by a majority of the residents at the September 1977 public meeting. Preliminary interior readings taken at one of the residences indicated a noise level of 61 dBA (L10), which is a 6 dBA over the Federal Standard.

IV. EXISTING FACILITIES

The site consists of four residences, closely spaced along the easterly side of San Bruno Avenue. (See Exhibit C.) The project originally included all four residences. It was reduced to the three residences closest to the freeway when a mutual agreement could not be reached on the proposed work with the owners of the fourth residence.

The remaining three residences are 2 and 3 story structures. The house closest to the freeway (#575) is a 3-story structure with living quarters on all 3 floors. The second house from the freeway (#579) is 2 stories with living quarters on the second floor. The first level consists of a garage and a

small room used as a work area by the owner. The third house (#585/587) is a 3-story structure with living quarters (separate apartments) on the second and third floors. The ground level is used as a garage and storage area.

The homes are typical of this area in that the sides of each house touch the adjoining houses, thereby creating a continuous structure (See Exhibit C). They were constructed between 1910 and 1941.

The Route 101 freeway is a major north-south freeway. It links the metropolitan area of San Jose to the south, downtown San Francisco, the Golden Gate Bridge and Marin County to the north and Interstate 80 and the San Francisco-Oakland Bay Bridge to the east. Route adoption was in April 1948.

V. TRAFFIC DATA

The freeway in the project area is an 8-lane facility that carried an annual ADT of 216,000 vehicles in 1979. The freeway is depressed approximately 15 feet in front of the houses. However, from the second and third levels of the houses, there is an uninterrupted line of sight to both the northbound and southbound freeway lanes.

Vehicle classification counts were taken during the measurement of baseline noise levels on October 15, 1980. See Exhibit D.

VI. ULTIMATE DEVELOPMENT

No new freeway construction is scheduled in this area in the six-year program. A 12-foot high sound wall was recently constructed on the opposite (westerly) side of the freeway under Contract No. 04-102064. A proposed wall on the easterly side between 17th and 19th Street was rejected by the residents in September 1977.

VII. PROJECT JUSTIFICATION

This is a FHWA Experimental Project covered by FHWA Notice N5080.62, dated January 17, 1977. It indicates that noise insulation for private residences may be implemented even if noise impact is not especially severe and other abatement measures are feasible. These projects are encouraged by FHWA and will qualify for Federal funds.

VIII. PHASING-SECTION 188.8 STUDY

Minor A projects are not currently listed in the State Highway Inventory.

IX. DESCRIPTION OF PROPOSAL

BUILDING	PROPOSED WORK		COST	
#585/587	See Exh. F	Architectural	$3,400	
		Mech./Elec.	7,000	$10,400
#579	See Exh. G	Architectural	2,200	
		Mech./Elec.	3,000	5,200
#575	See Exh. H	Architectural	6,900	
		Mech./Elec.	1,500	8,400
		Sub Total		$24,000
		20% Contingency		4,800
		Total		$28,800

The proposed work at each resident was approved by the property owners in July 1981.

X. ENGINEERING AND RIGHT-OF-WAY DATA

Project is to be financed from the HB-311, Minor Category A Program in the 1981-82 fiscal year. Project is eligible for Federal participation.

The estimated construction cost is $28,800 including 20% contingencies. No right-of-way is required.

Certification

I have reviewed the right of way data contained in this Project Report and find it to be complete, current and accurate.

for R. A. SPECK
Deputy District Director
Right of Way

9-18-81
Date

XI. COOPERATIVE FEATURES

A State/Homeowners Agreement specifying the duties, responsibilities, and obligations of both parties has been executed with the owners of the three residences.

The Agreement generally includes the following provisions:

State Agrees:

- To conduct before and after noise studies.
- To design and construct alterations to the buildings.
- To monitor energy use for two years preceding and following construction. *This was eliminated on k*
- To provide normal maintenance of any mechanical unit installed as part of the alteration during the monitoring period of energy use.
- To pay all engineering, construction, permit and other costs accrued under the terms of the agreement including any excess utility costs during construction and per diem allowances for temporary relocations.

Homeowners Agrees:

- To notify his assignees of the terms of the agreement.
- To give State written notice of change in property ownership.
- To provide access to residence.
- To provide energy use records during monitoring period.
- To assume all responsibility for operation and maintenance of alterations upon termination of the monitoring period.
- To participate in an "after" study interview.

XII. ENVIRONMENTAL ASPECTS

This action is a Categorical Exemption under Article 10 of the Caltrans regulations for the implementation of the California Environmental Quality Act (CEQA).

It has been further determined by FHWA that this action is a Categorical Exclusion under 7-7-2 of the Federal-aid Highway Program Manual.

The Categorical Exemption/Categorical Exclusion Determination is attached. (See Exhibit E.)

ETHLYN ANN HANSEN, Chief
Environmental Planning Branch

XIII. COMMUNITY INTERACTION AND CONTACTS

The following meetings and contacts have been made with the property owners:

1. July 20, 1979. Letters to property owners inviting them to participate in the Experimental Project.

2. August 8, 1979. First meeting with property owners to explain program scope and to obtain initial input.

3. March 25, 1980. Second meeting with property owners to provide update of project and for completing a pre-project questionnaire provided by FHWA.

XIV. PROJECT REVIEWS

This draft Project Report was reviewed by the Headquarters Coordinator on August 25, 1981. A copy of the draft Project Report was also sent to FHWA for their review. Approval is pending. A-95 review is not required for Category 5 projects.

A Work Plan was approved by FHWA on December 20, 1979.

XV. RECOMMENDATION

It is recommended that this Project Report be approved and authorization given to prepare PS&E.

XVI. ATTACHMENTS

1. Exhibit A - Location Map

2. Exhibit B - Aerial Plan View

3. Exhibit C - Photographs

4. Exhibit D - Baseline Noise Level Measurements

5. Exhibit E - Environmental Evaluation Document

6. Exhibit F - Proposed Work at #585/587

7. Exhibit G - Proposed Work at #579

8. Exhibit H - Proposed Work at #575

PREPARED BY:

Milton Louie, Chief, P/D-C Branch	7-3274
J. C. Bradfield, Sr. Trans. Engr.	7-2685
R. Inoue, Project Engr.	7-2561

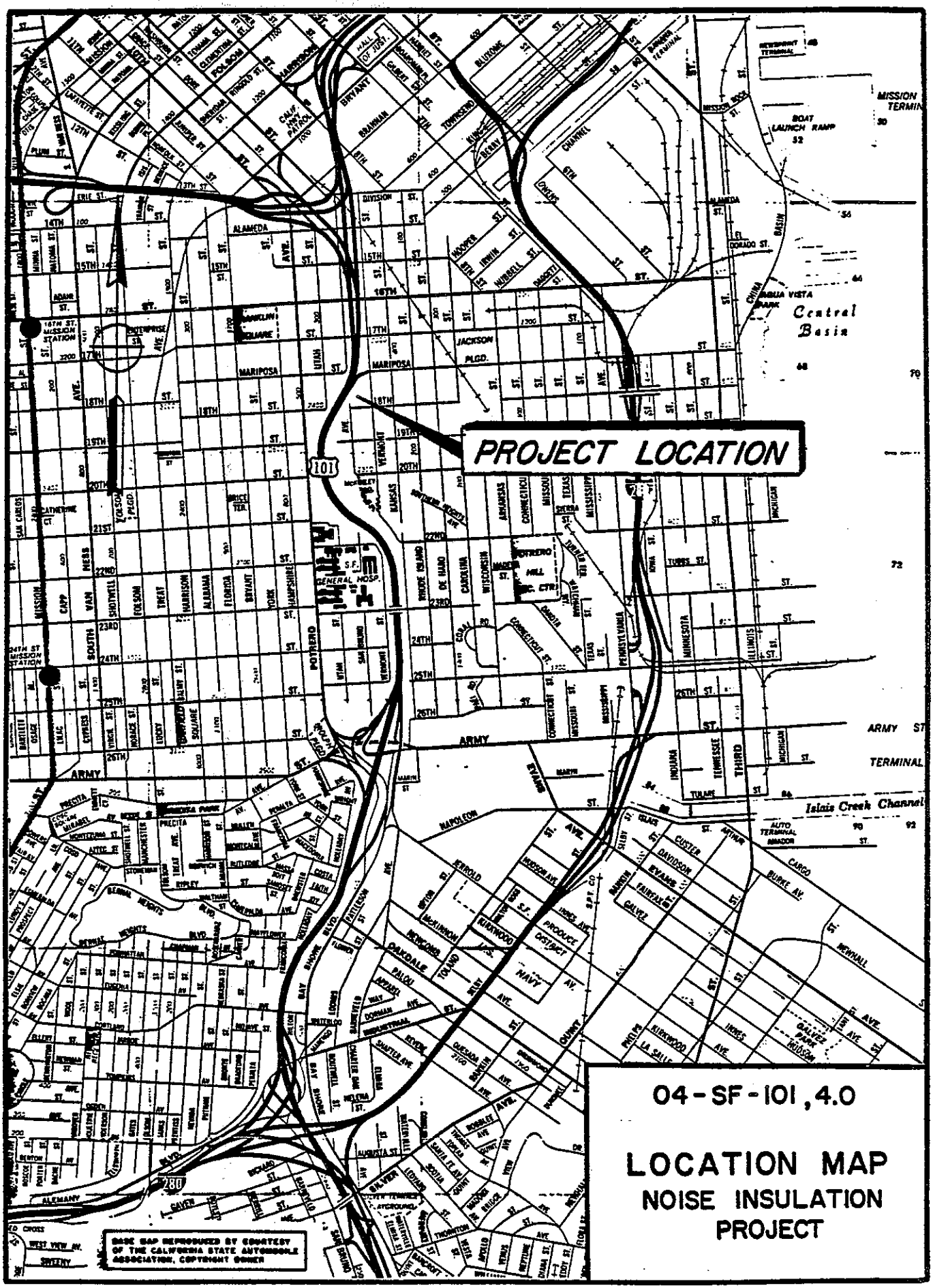
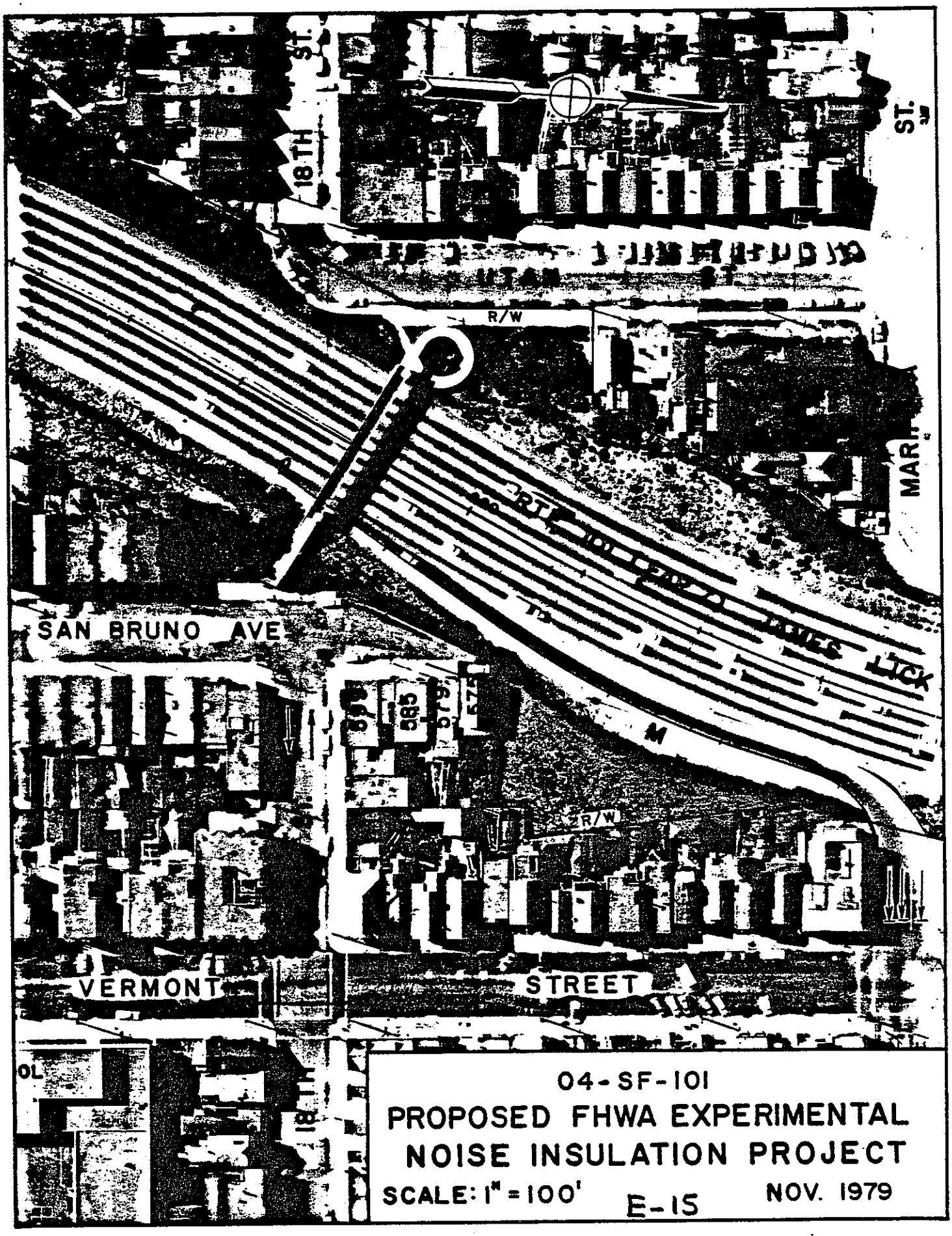

PROJECT LOCATION
Central Basin
Islais Creek Channel
ARMY ST TERMINAL
04-SF-101, 4.0
LOCATION MAP
NOISE INSULATION PROJECT
BASE MAP REPRODUCED BY COURTESY OF THE CALIFORNIA STATE AUTOMOBILE ASSOCIATION, COPYRIGHT OWNER

EXHIBIT A



04-SF-101

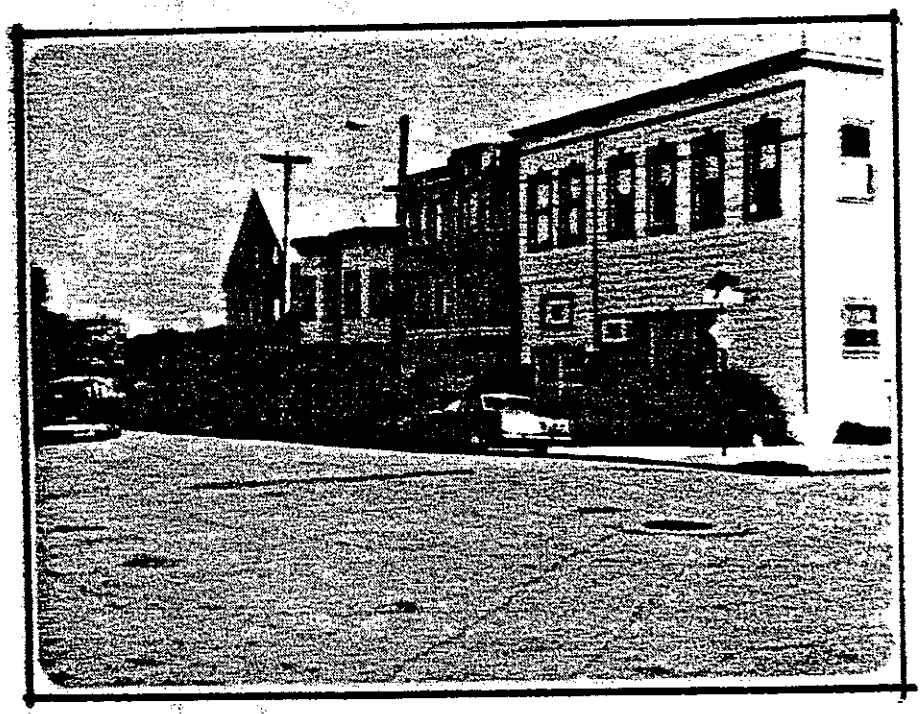
PROPOSED FHWA EXPERIMENTAL NOISE INSULATION PROJECT

SCALE: 1" = 100'

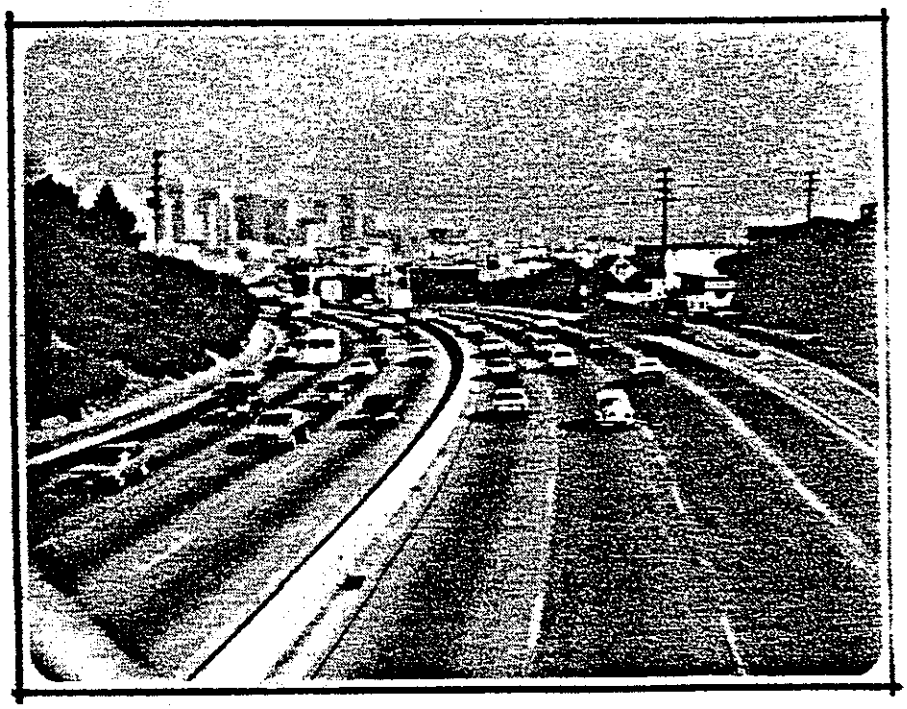
E-15

NOV. 1979

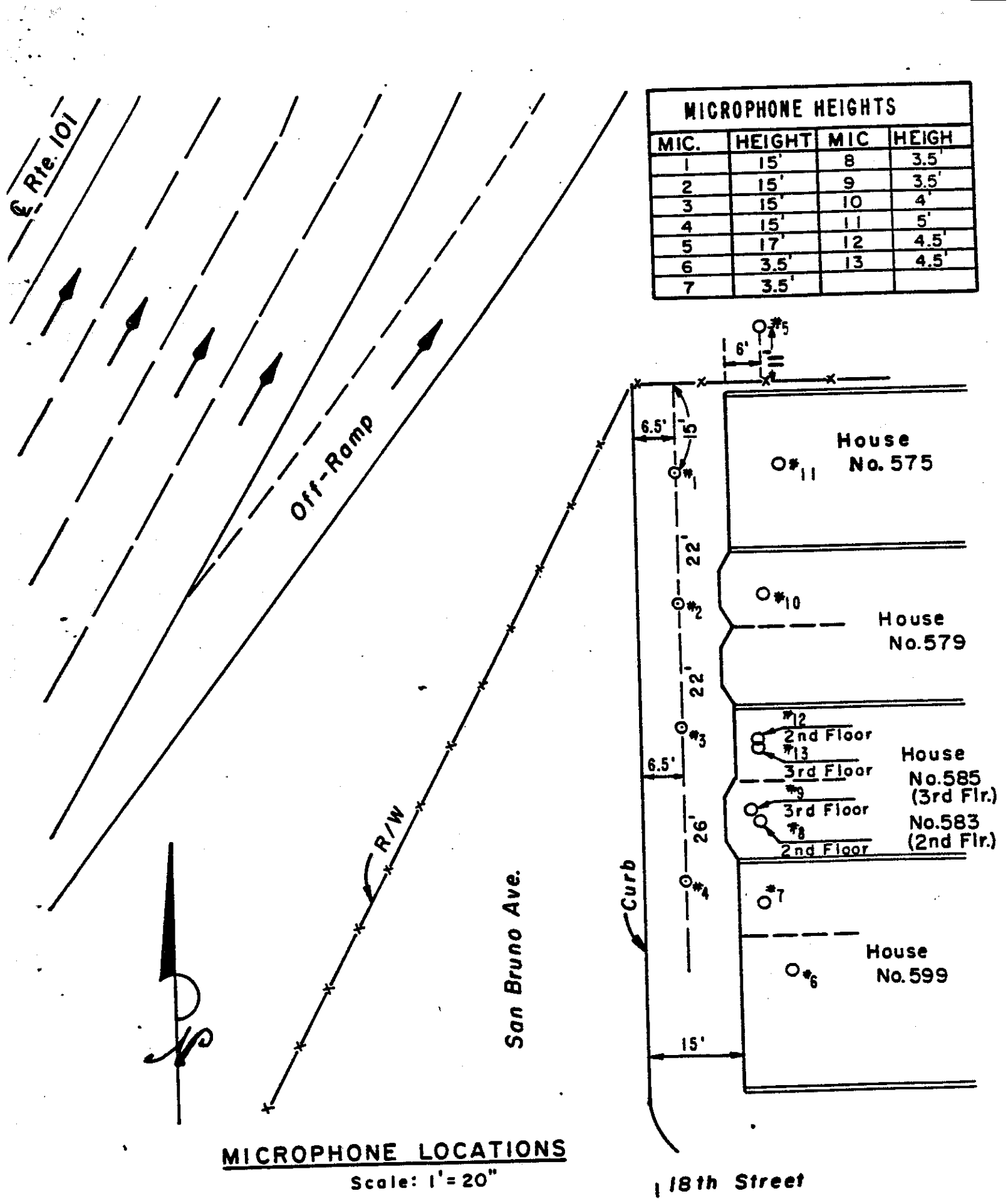
EXHIBIT B



Close-up view of four houses. Route 101 freeway is on the left, behind landscaping.



View of freeway, looking north, adjacent to the four houses. Houses are located on the right side, outside the photograph. Downtown San Francisco is in the background.

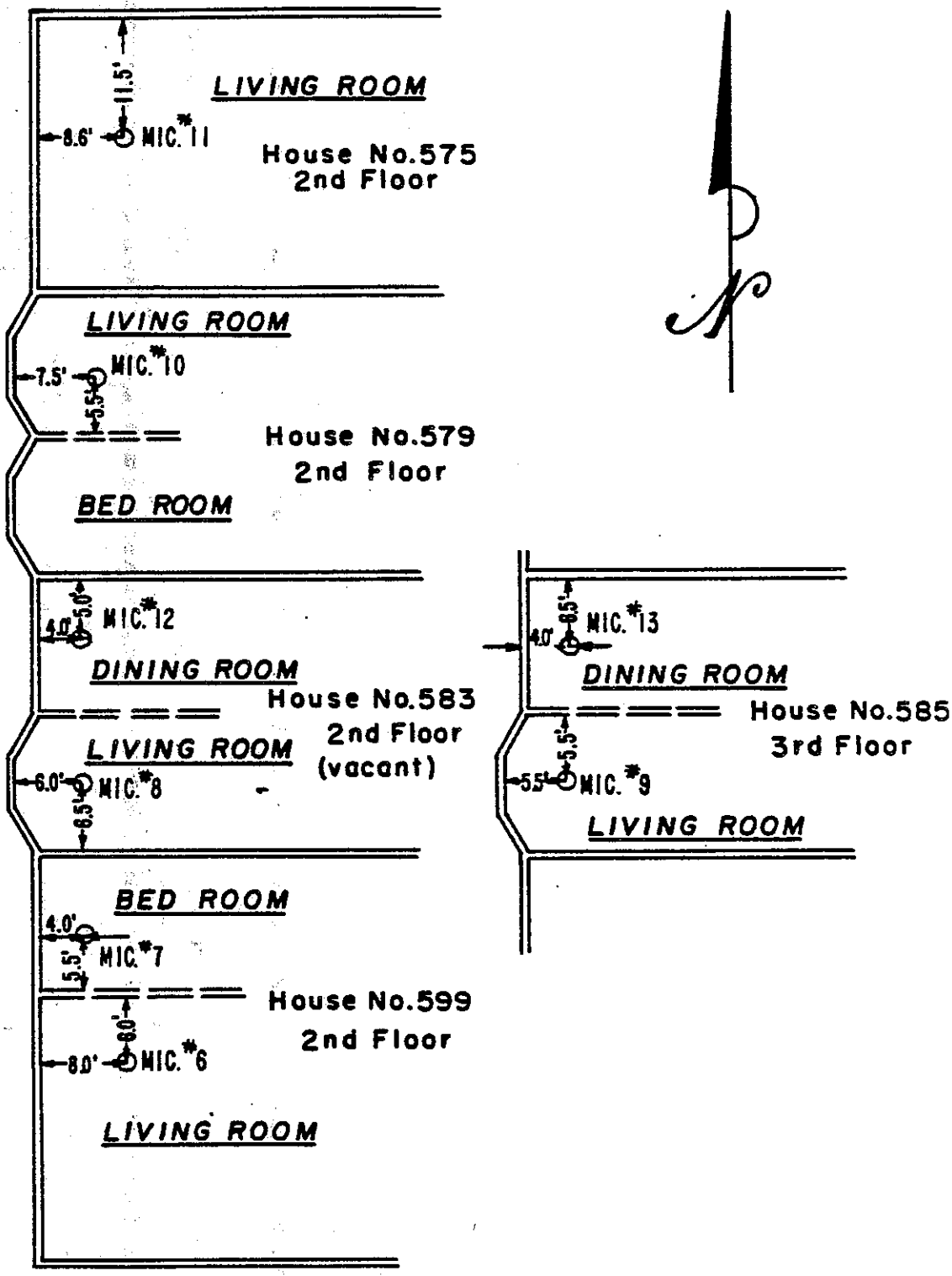


MICROPHONE HEIGHTS			
MIC.	HEIGHT	MIC	HEIGH
1	15'	8	3.5'
2	15'	9	3.5'
3	15'	10	4'
4	15'	11	5'
5	17'	12	4.5'
6	3.5'	13	4.5'
7	3.5'		

MICROPHONE LOCATIONS

Scale: 1' = 20"

E-17 Attachment 1 EXHIBIT D-1



INSIDE MICROPHONE LOCATIONS

Scale: 1" = 15'

E-18 Attachment 2

EXH. D-2

NOISE MEASUREMENTS, 20-MINUTE $L(_{eq})$dBA

TAKEN ON 10/15/80, ALONG SAN BRUNO AVE., AT RTE 101

Microphone Location Number	House Number	Inside or Outside	Floor	Room	Run #1 Windows, Drapes, Shutters* Closed	Run #2 Windows Closed, Drapes, Shutters** Open	Run #3 Windows, Drapes, Shutters Open	Remarks
1	575	out	2nd	Living	80	80	80	
2	579	out	2nd	Living	78	79	79	
3	583& 585	out	2nd	Dining	76	76	76	
4	599	out	2nd	Bed	73	74	74	
5	575	out	2nd	Living	79	79	79	
6	599	in	2nd	Living	48	49	68	
7	599	in	2nd	Bed	48*	50**	69	Shutter on inside
8	583	in	2nd	Living (vacant)	51	52	67	Rug on floor - no furniture
9	585	in	3rd	Living	52	52	68	
10	579	in	2nd	Living	53	54	68	
11	575	in	2nd	Living	53	52	60	Run 3, only 2 end windows open Could not open other windows
12	583	in	2nd	Dining (vacant)	53	53	70	Rug on floor - no furniture
13	585	in	3rd	Dining	52	53	71	

Attachment 3

Exh. D-3

TRAFFIC COUNTS

Date: 10/15/80

RUN	TIMES START/END	VEHICLE TYPE*	LANES** S. BOUND 4	3	2	1	N. BOUND 1	2	3	4	RAMP
1	10:57/11:17	Autos	366	499	529	510	486	633	525	213	98
		Med.Tr.	24	29	16	7	7	24	19	11	14
		H.Trucks	25	24	20	2	0	19	34	7	3
2	12:00/12:20	Autos	403	524	570	548	435	562	493	202	99
		Med.Tr.	19	18	15	7	12	26	18	6	5
		H.Trucks	17	22	18	2	0	13	18	15	4
3	12:35/12:55	Autos	360	484	507	466	489	544	514	209	73
		Med.Tr.	22	20	14	10	5	30	25	17	1
		H.Trucks	18	16	18	2	0	13	19	11	2

* Vehicle types per FHWA RD-77-108

** Lane 1 is inside, or fast lane, lane 4 is slow lane

Average speed of the vehicles in the S. Bound and N. Bound lanes was 52 mph during runs 1, 2, and 3.

Attachment 4

EXH. D-4

04-SF-101 4.0
Co-Rte-PM

04226 - 100071
CC-EA

Date Requested May 21, 1981

CATEGORICAL EXEMPTION/CATEGORICAL EXCLUSION
DETERMINATION

PROJECT DESCRIPTION

Experimental project for noise insulation of private dwellings involving sealing windows, installing single or double-glazed windows and providing ventilation systems for air circulation.

DETERMINATION

Based on an examination of the proposal, it is

1. concluded that this project is a categorically exempt action under CALTRANS' Environmental Regulations for the implementation of CEQA.

   (a) Class 1, Section 1510.1, or

   (b) General rule exemption applies N/A

2. recommended that this project be determined to be a Categorical Exclusion in accordance with Volume 7, Chapter 7, Section 2 (7-7-2) of the Federal-Aid Highway Program Manual.

Evelyn Ann Johnson 5/29/81
Chief, Environmental Planning Branch — Date

Milton Lewis 6/2/81
Chief, Originating Branch — Date

Reviewed by and approve Categorical Exclusion recommendation.

J. A. Lamb 8-13-81
FHWA Representative — Date

EXHIBIT E-1

ENVIRONMENTAL SETTING

Urban setting; work to be performed within private dwellings.

STATE (CEQA)

Categorical Exemption:

1. Will there be a significant cumulative impact by this project and successive projects of the same type in the same place? No
2. Does this project fall within exempt Class 1, 3, 4, 5, 6, or 11, and might it impact on an environmental resource or hazard designated in the Environmental Goals and Policy Report issued by the Governor, or an environmental resource of hazardous or critical concern where designated, precisely mapped, and officially adopted pursuant to law? No
3. If a Class 1 (c) project, will it result in significant damage to or removal of a scenic resource? No
4. If for a conveyance of Excess Land, does the conveyance comply with the provisions of Section 1510.9 of the Caltrans Guidelines for the Implementation of CEQA? N/A

General Rule Exemption (if applicable):

This project does not fall within an exempt class but it can be seen with certainty that there is no possibility that the activity may have a significant effect on the environment. N/A

FEDERAL (NEPA)

Categorical Exclusion (if applicable):

1. Is this project likely to precipitate significant foreseeable alterations in land use, planned growth, development patterns, traffic volumes, traffic patterns, transportation service, or resources? No
2. Will the project affect property protected by Section 4(f) of the Department of Transportation Act? No
3. Will the project affect property protected by Section 106 of the National Historic Preservation Act? No
4. Will the project affect wetlands as defined in Executive Order 11990? No
5. Will the project affect habitats under the Endangered Species Act? No
6. Will the project affect lands subject to the Coastal Zone Management Act? No

Are other Federal agencies involved? No

If yes, specify _____

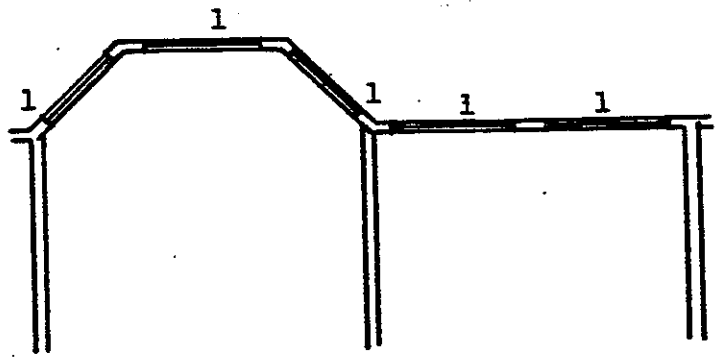
INTERDISCIPLINARY REVIEW

Air by	Russ Weeks	Date: 5-28-81
Noise by	Russ Weeks	Date: 5-28-81
Energy by	Russ Weeks	Date: 5-28-81
Water by	James W. Ross	Date: 5-28-81
Natural Environment by	Fred M. Shadle	Date: 5/29/81
Heritage Resources by	Jeffery C. Bingham	Date: 5/28/81
Socio-Economic by	Lillie M. Blackwell	Date: 5/28/81
R/W	Yes ____ No X	

Comments

EXH. E-2

SAN BRUNO AVENUE



Second Floor 2M
Third Floor 3M

585/587

*1. Replace existing single pane glass lites with new laminated glass in existing metal frames. Repair and/or replace weatherstripping and caulk as necessary for maximum air tightness.

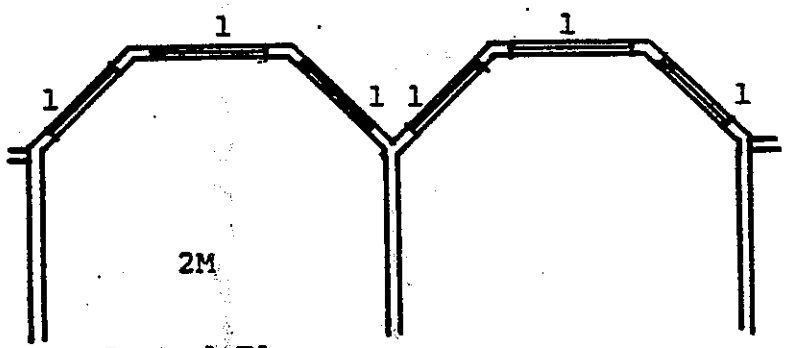
2M. Existing extended dual baseboard register for living and dining areas offer sufficient airway section to accommodate a booster fan for forced air circulation from existing return air duct. A branch circuit will be provided from the existing panel with a remote on-off switch in the living area.

3M. Existing air duct risers in stud wall spaces provide for only limited air flow. Accordingly a floor-standing or ceiling fan may be considered for air movements.

*Operable Windows.

EXHIBIT F

SAN BRUNO AVENUE



Second Floor

579

*1. Replace existing vertical hung wood window with new double glazed wood framed window to match existing appearance. Outer lite to be float glass and inner lite to be laminated glass. Caulk for continuous seal before installing window.

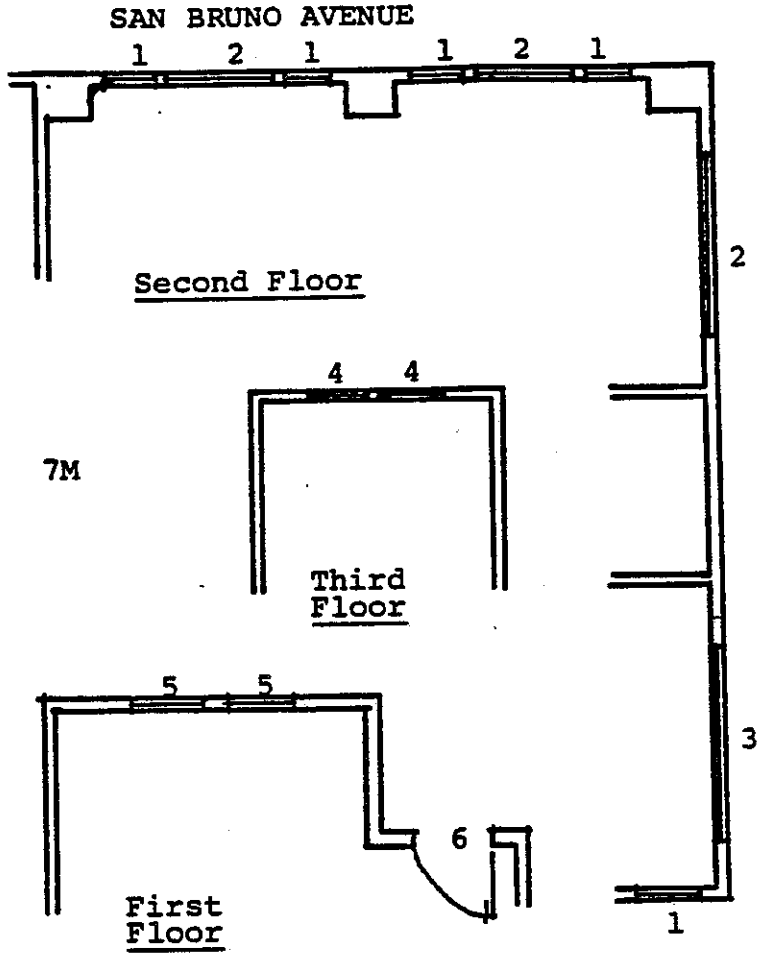
2M. Existing extended baseboard register for front bedroom offers sufficient airway section to accommodate a booster fan for forced air circulation from existing return air duct.

An alternate selection would be replacing existing ceiling light fixture with a combination paddle fan with light.

A branch circuit will be provided as necessary with an on/off switch in the bedroom.

*Operable Windows.

EXHIBIT G



575

*1. Replace existing vertical hung wood window with new double glazed wood framed window to match existing appearance (mullions, etc.). Outer lite to be float glass and inner lite to be laminated glass. Caulk for continuous seal before installing window.

2. Add inner lite of laminated glass to inside of existing fixed glass wood framed window. Separate glass lites by approximately 1" and seal for air tightness.

3. Replace existing metal framed window with single glazed fixed laminated glass window. Match the appearance of the large living room window with no operable vents. Caulk before installation for continuous seal.

*4. Replace existing vertical hung wood windows as described in Note No. 1. Add interior roll down insulated fabric shutters with continuous edge guides to window opening.

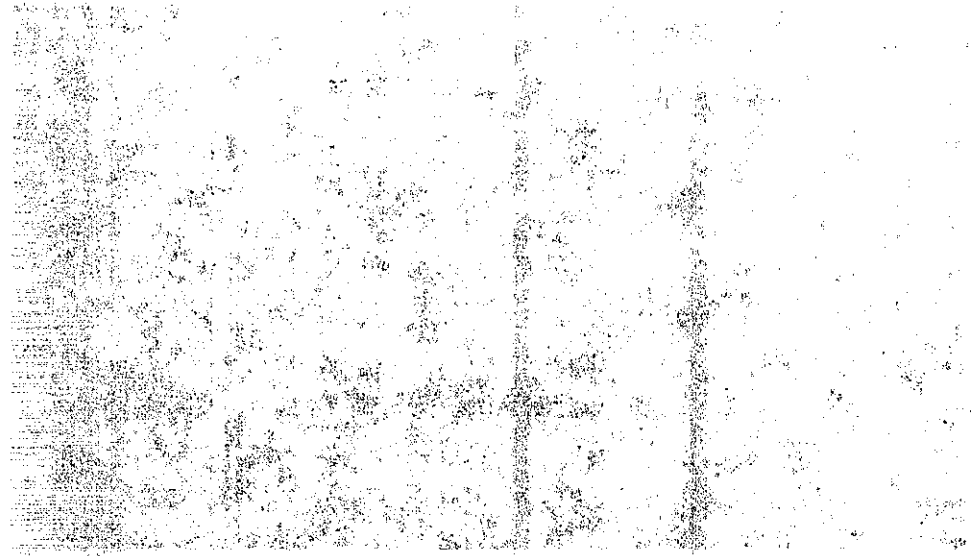
5. Add fixed laminated glass to inside of existing wood framed windows with 1" air space. Seal for air tight fitting.

6. Add new weatherstripping to existing wood door at head, jambs and sill.

7M. Existing forced air furnace provides ducted air distribution throughout this residence. Provide an on/off switch at the second floor for independent fan operation during the warmer months.

*Operable Windows.

EXHIBIT H



SF	101	4.0
Co.	Route	P.M.

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DISTRICT 04

No. 46559-MN
(04-100075)

NOTICE TO BIDDERS AND SPECIAL PROVISIONS

Sealed proposals will be received by the Department of Transportation, at the office of the District Director, 150 Oak Street, San Francisco, California, in the Sealed Bid Box, First Floor Lobby, until 10:00 A.M., November 29, 1982 at which time they will be publicly opened and read, in Room 266, for the performance of work as follows:

IN THE CITY AND COUNTY OF SAN FRANCISCO ON SAN BRUNO AVENUE ADJACENT TO ROUTE 101 NEAR THE 18TH STREET PEDESTRIAN OVERCROSSING; BUILDING MODIFICATIONS TO PROVIDE THREE EXISTING PRIVATE RESIDENCES WITH NOISE INSULATION.

IT IS ESTIMATED THAT THE WORK WILL INCLUDE:

1 - LUMP SUM BUILDING WORK

BIDS ARE TO BE SUBMITTED IN A LUMP SUM AMOUNT.

The foregoing is a general description of the work to be performed and the Department of Transportation does not expressly or by implication agree that the actual items or amount of work will correspond therewith.

Further inquiries concerning the proposed work may be directed to the Department of Transportation. Resident Engineer E. Coble, 100 Rickard Street, San Francisco, Telephone (415) 557-2303.

The Department of Transportation reserves the right to reject any or all bids. E-27 Phone No.
E-27 BID INFORMATION WILL BE AVAILABLE AFTER 1:00 P.M. (557-2101)

The work embraced herein constitutes a "Minor Contract". It shall be done in accordance with the General Specifications for Service Contracts of the Department of Transportation, dated 1981,* hereinafter referred to as General Specifications, and in accordance with the following special provisions and proposal, the proposed "Form of Contract" (Form OE-1284PW (Rev. 5/80)), the attached project plans and applicable "Standard Plan" sheets.

*and "Instructions to Bidders and General Conditions for Building Construction dated March 1980".

Project Plans consist of:

General Plan	Sheet A-1
Building No. 575	Sheet A-2, A-3, A-4
Building No. 579	Sheet A-5
Building Nos. 585/587	Sheet A-6
Mechanical, Electrical Details	Sheet ME-1, ME-2

AWARD OF CONTRACT
PROPOSAL REQUIREMENTS AND CONDITIONS

A proposal guaranty is not required.

If the bidder is awarded the contract and refuses to execute the prescribed forms presented to him for signature within the time and manner required of him, he will be liable to the Department of Transportation for damages resulting to the Department therefrom, but said damages will be limited to either the actual damages or 10% of the amount bid, whichever is less.

The bid of any contractor who is currently in default with Caltrans on a contract already awarded may be regarded as nonresponsive and may be rejected. Default is defined as being within a period of liquidated damages on uncompleted work or under notice to begin or complete a contract where work has not commenced or was suspended without cause.

TIME OF COMPLETION AND LIQUIDATED DAMAGES

The Contractor shall begin work by the date specified in the Engineer's letter informing him that the contract has been approved and shall diligently prosecute the work so that all work shall be completed before the expiration of 65 consecutive working days including the specified starting date.

The Contractor shall notify Resident Engineer, E. Coble
(name and position)

100 Rickard Street, San Francisco
(address and telephone number)

(415) 557-2303

at least 24 hours in advance of starting work.

The Contractor shall pay the State of California the sum of $100.00 per day for each and every calendar day's delay in finishing the work in excess of the number of working days prescribed above.

In addition to any penalties prescribed herein, should the Contractor fail to commence work within five (5) working days after notification of the starting date, or suspend work for a period of five (5) continuous working days after work has begun, the State may provide three (3) days written notice, posted at the job site or mailed to the Contractor, to timely prosecute and complete the work or the contract may be terminated and penalties of $900.00 assessed for administrative costs for rebidding the work.

In addition, the Contractor shall be liable to the State for the difference between the Contractor's bid price and the actual cost of performing the work by the second low bidder or by another contractor.

DEPARTMENT OF TRANSPORTATION

GENERAL PREVAILING WAGE RATES

DAS-OBM-1203 (1/82)

Contract No.	Sheet
46559-MN	4 of 32

Pursuant to Section 1771 of the Labor Code, if this contract is for more than $1,000, not less than the general prevailing rate of wages for work of a similar character in the county in which the work is to be performed shall be paid to all workers employed on this contract.

Pursuant to Section 1773 of the Labor Code, the general prevailing rate of wages in the county in which the work is to be done has been determined and the Department has listed these wage rates in the Department of Transportation publication entitled General Prevailing Wage Rates, dated September , 1982 . **Future effective wage rates which have been predetermined and are on file with the Department of Industrial Relations are referenced but not printed in said publication. The wage rates determined by the Director of Industrial Relations and published in the Department of Transportation publication entitled General Prevailing Wage Rates refer to expiration dates. If the published wage rate does not refer to a predetermined wage rate to be paid after the expiration date, said published rate of wage shall be in effect for the life of this contract. If the published wage rate refers to a predetermined wage rate to become effective upon expiration of the published wage rate and the predetermined wage rate is on file with the Department of Industrial Relations, such predetermined wage rate shall become effective on the date following the expiration date and shall apply to this contract in the same manner as if it had been published in said publication. If the predetermined wage rate refers to one or more additional expiration dates with additional predetermined wage rates, which expiration dates occur during the life of this contract, each successive predetermined wage rate shall apply to this contract on the date following the expiration date of the previous wage rate. If the last of such predetermined wage rates expires during the life of this contract, such wage rate shall apply to the balance of the contract.**

If this contract is more than $1,000, the general prevailing wage rates set forth in the Department of Transportation publication entitled "General Prevailing Wage Rates", which establish minimum wages for this contract shall be posted by the Contractor in a prominent place at the site of the work.

All copies of prevailing wage rates to be posted at the job site will be furnished by the Department.

If this contract is for more than $1,000, and involves the employment of people, the contractor and each subcontractor shall comply with the following provisions. The contractor shall be responsible for compliance with these provisions by his subcontractors.

"(a)" Each contractor and subcontractor shall keep an accurate payroll record, showing the name, address, social security number, work classification, straight time and overtime hours worked each day and week, and the actual per diem wages paid to each journeyman, apprentice, worker, or other employee employed by him or her in connection with the public work.

"(b)" The payroll records enumerated under subdivision (a) shall be certified and shall be available for inspection at all reasonable hours at the principal office of the contractor on the following basis:

(1) A certified copy of an employee's payroll record shall be made available for inspection or furnished to such employee or his or her authorized representative on request.

(2) A certified copy of all payroll records enumerated in subdivision (a) shall be made available for inspection or furnished upon request to a representative of the body awarding the contract, the Division of Labor Standards Enforcement and the Division of Apprenticeship Standards of the Department of Industrial Relations

(3) A certified copy of all payroll records enumerated in subdivision (a) shall be made available upon request to the public for inspection or copies thereof made; provided, however, that a request by the public shall be made through either the body awarding the contract, the Division of Apprenticeship Standards, or the Division of Labor Standards Enforcement. The public shall not be given access to such records at the principal office of the contractor

"(c)" Each contractor shall file a certified copy of the records enumerated in subdivision (a) with the entity that requested such records within 10 days after receipt of a written request.

"(d)" Any copy of records made available for inspection as copies and furnished upon request to the public or any public agency by the awarding body, the Division of Apprenticeship Standards or the Division of Labor Standards Enforcement shall be marked or obliterated in such a manner as to prevent disclosure of an individual's name, address and social security number. The name and address of the contractor awarded the contract or performing the contract shall not be marked or obliterated.

"(e)" The contractor shall inform the body awarding the contract of the location of the records enumerated under subdivision (a), including the street address, city and county, and shall, within five working days, provide a change of location and address.

"(f)" In the event of noncompliance with the requirements of this section, the contractor shall have 10 days in which to comply subsequent to receipt of written notice specifying in what respects such contractor must comply with this section. Should noncompliance still be evident after such 10-day period, the contractor shall, as a penalty to the state or political subdivision on whose behalf the contract is made or awarded, forfeit twenty-five dollars ($25) for each calendar day, or portion thereof, for each worker, until strict compliance is effectuated. Upon the request of the Division of Apprenticeship Standards or the Division of Labor Standards Enforcement, such penalties shall be withheld from progress payments then due."

The penalties specified in subdivision (f) of Labor Code Section 1776 for noncompliance with the provisions of said Section 1776 may be deducted from any moneys due or which may become due to the Contractor.

A copy of all payrolls shall be submitted to the Engineer within 10 days, not including Saturdays, Sundays or legal holidays, following completion of the work.

Payrolls shall contain the full name, address and social security number of each employee, his correct classification, rate of pay, daily and weekly number of hours worked, itemized deductions made and actual wages paid. They shall also indicate apprentices and ratio of apprentices to journeymen. The employee's address and social security number need only appear on the first payroll on which his name appears. The payroll shall be accompanied by a "Statement of Compliance" signed by the employer or his agent indicating that the payrolls are correct and complete and that the wage rates contained therein are not less than those required by the contract. The "Statement of Compliance" shall be on forms furnished by the department or on any form with identical wording. The Contractor shall be responsible for the submission of copies of payrolls of all subcontractors.

The Contractor and each subcontractor shall preserve their payroll records for a period of 3 years from the date of completion of the contract.

The Contractor by signing this contract, swears under penalty of perjury that no more than one final unappealable finding of contempt of court by a Federal Court has been issued against him within the preceding two-year period because of his failure to comply with an order of a Federal Court which orders the contractor to comply with an order of the National Labor Relations Board.

In connection with the performance of work under this contract, the Contractor agrees as follows:

(1) The Contractor will not willfully discriminate against any employee or applicant for employment because of race, religious creed, color, national origin, ancestry, physical handicap, medical condition, marital status, sex or age. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, religious creed, color, national origin, ancestry, physical handicap, medical condition, marital status, sex or age. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship.

(2) The Contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice advising the said labor union or workers' representative of the Contractor's commitments under this section.

(3) The Contractor will permit access to his records of employment, employment advertisements, application forms, and other pertinent data and records by the Fair Employment and Housing Commission, the awarding authority or any other appropriate agency of the State of California designated by the awarding authority, for the purposes of investigation to ascertain compliance with the Fair Employment Practices section of this contract.

(4) A finding of willful violation of the Fair Employment Practices section of this contract or of the California Fair Employment and Housing Act shall be regarded by the awarding authority as a basis for determining the Contractor to be not a "responsible bidder" as to future contracts for which such Contractor may submit bids.

The awarding authority shall deem a finding of willful violation of the California Fair Employment and Housing Act to have occurred upon receipt of written notice from the Fair Employment and Housing Commission that it has investigated and determined that the Contractor has violated the California Fair Employment and Housing Act and has issued an order under Government Code Section 12970 or obtained an injunction under Government Code Section 12973.

(5) The Contractor agrees, that should the awarding authority determine that the Contractor has not complied with the Fair Employment Practices section of this contract, then pursuant to Labor Code Sections 1735 and 1775, the Contractor shall, as a penalty to the awarding authority, forfeit, for each calendar day, or portion thereof, for each person who was denied employment as a result of such non-compliance, the penalties provided in the Labor Code for violation of prevailing wage rates. Such monies may be recovered from the Contractor. The awarding authority may deduct any such damages from any monies due the Contractor from the State of California.

(6) (a) Nothing contained in this Fair Employment Practices section shall be construed in any manner or fashion so as to prevent the awarding authority of the State of California from pursuing any other remedies that may be available at law.

(b) Nothing contained in this Fair Employment Practices section shall be construed in any manner or fashion so as to require or permit the hiring of an employee not permitted by the National Labor Relations Act.

(7) Prior to award of the contract, the Contractor shall certify to the awarding authority that he has or will meet the following standards for affirmative compliance, which shall be evaluated in each case by the awarding authority:

(a) The Contractor shall provide evidence, as required by the awarding authority, that he has notified all supervisors, foremen and other personnel officers in writing of the content of the anti-discrimination clause and their responsibilities under it.

(b) The Contractor shall provide evidence, as required by the awarding authority, that he has notified all sources of employee referrals (including unions, employment agencies, advertisements, Department of Employment) of the content of the anti-discrimination clause.

SPECIAL PROVISIONS

DESCRIPTION OF WORK

The building work to be done consists, in general, of modifying three existing residences by installing new double glazed windows, installing laminated glass in existing windows, framing and sheathing a wall at one residence, mechanical and electrical modifications, and such other items or details, not mentioned above, that are required by the plans, General Conditions, or these special provisions shall be performed, placed, constructed or installed.

AREAS FOR CONTRACTOR'S USE

No area is available within the contract limits for the exclusive use of the Contractor. The Contractor shall arrange with the Engineer for areas to store equipment and materials within the work area.

COOPERATION

Attention is directed to Sections 5-1.06, "Responsibility for Utilities," and 5-1.12, "Cooperation," of the General Conditions and these special provisions.

Residences will be occupied during the working period for this contract.

The Contractor shall provide security closures for the residences and furnishings at the end of each day until all openings are closed securely.

The Contractor shall plan his work to minimize interference with the residents. Interruptions to any services for the purpose of making or breaking a connection shall be made only after consultation with and for such time periods as directed by the Engineer.

MATERIALS

Shop drawings, material lists, descriptive data, samples and other submittals specified in these special provisions shall be submitted for approval in accordance with the provisions in Section 2-1.04, "Shop Drawings, Descriptive Data, Samples, and Alternatives," of the General Conditions.

Attention is directed to the provisions in Section 2-1.01, "Authority of Engineer," of the General Conditions. The Engineer may request submittals for materials or products where submittals have not been specified in these special provisions, or may request that additional information be included in specified submittals, as necessary to determine the quality or acceptability of such materials or products.

Submittals shall be delivered to the locations indicated in these special provisions. If a specific location is not indicated, the submittal shall be delivered to the Office of Structures Design, Documents Unit, Third Floor, 1201 I Street, Sacramento, or the submittals shall be mailed to the Office of Structures Design, Documents Unit, P.O. Box 1499, Sacramento, California 95807.

Each submission of drawings, material lists and descriptive data shall consist of at least 5 copies. Two copies will be returned to the Contractor either approved for use or returned for correction and resubmittal.

The Contractor shall furnish all materials required to complete the work.

TEMPORARY UTILITIES

The Contractor, at his own expense, shall obtain any electrical power and water or other utilities required for his operations and shall make and maintain the necessary service connections.

The Contractor shall provide and pay for telephone service he may require.

SANITARY FACILITIES

Sanitary facilities will not be available for use by the Contractor's employees.

EXAMINATION OF PLANS, SPECIAL PROVISIONS, AND SITE OF THE WORK

Attention is directed to Section 1-1.03, "Examination of Plans, Special Provisions and Site of the Work," of the Instructions to Bidders and these special provisions.

Memorandums of Agreement have been signed by the Homeowners providing access to areas inside and outside the residences for investigation and construction work and are available for inspection at the Office of Structures Design, Specifications Section, 3rd floor, 1201 I Street, Sacramento, California.

CONSTRUCTION TIME RESTRICTION

Once construction, demolition or modifications are begun in a residence, all work in that residence shall be completed within 5 working days. Work shall not begin until all materials are on hand to complete the work.

REMOVING PORTIONS OF EXISTING FACILITIES

Portions of the existing facilities which interfere with the building work shall be removed to the limits shown on the plans to provide for alterations. Removal shall be done carefully to minimize damage to the portions to remain. Remaining portions that are damaged by the Contractor's operation shall be restored to original condition at the Contractor's expense.

Surfaces that are exposed to view at the limits of removal work shall be patched, bumps shall be removed and depressions filled, and the surface shall be finished to match the existing surrounding surfaces. Depressions in concrete less than one inch deep shall be deepened to one inch minimum depth before filling with cement mortar.

Surplus removed materials shall be disposed of away from the premises. Such disposal shall conform to the laws, rules, and regulations of all agencies having jurisdiction at the disposal site.

CARPENTRY

Carpentry shall conform to the requirements in these special provisions.

Softwood lumber shall be quality grade stamped or shall be accompanied by a certificate of inspection. Inspection certificates or grade stamps shall indicate compliance with the grading requirements of WWPA, WCLIB (grade stamped WCLB), RIS, or other approved lumber inspection agencies.

Framing lumber	Solid stock lumber Douglas fir No. 2 or the grades and species indicated.
Sheathing	APA grade stamped plywood with exterior glue and conforming to the requirements in Voluntary Product Standard PS 1. Group 1 or 2, Grade CD except as otherwise indicated.
Felt (building paper)	Asphalt saturated organic felt, No. 15, UL Specification: 55A.
Siding	Match existing species and shapes
Sheet steel (flashing)	ASTM Designation: A 366 or A 569, zinc coated, not less than 0.028-inch 24 gage nominal thickness. Surfaces to be painted shall not have factory coatings on galvanizing that cannot be removed by paint thinner.

Trim :

Exterior	Clear, all heart redwood, shape as noted or to match existing.
Interior	Hardwood, species to match existing.

Rough Carpentry Hardware

Screws, Bolts nuts, washers	Commercial quality. Fasteners for galvanized hardware shall be galvanized.
Powder driven fasteners	Commercial quality, washered drive pin type.
Joist hangers, clips and other standard framing hardware	Commercial quality, ICBO approved, rated by the manufacturer for safe working load capacity shown. Sheet steel items shall be galvanized.

Fasteners in contact with redwood shal be aluminum, galvanized steel, or stainless steel.

Stored lumber shall be neatly stacked off the ground and shall be protected from the weather.

Wood framing shall be accurately cut and assembled to provide closely fitted members. Framing shall be erected true to the lines and grades shown and shall be rigidly secured in place. Bracing shall be placed wherever necessary to support all loads on the structure during erection.

Wall coverings exposed to the weather shall have a backing of waterproof building paper or asphalt saturated rag felt applied weather-board fashion to the framing or sheathing. Backing shall be lapped 2 inches at horizontal joints and 6 inches at vertical joints.

Carpentry for millwork and finish woodwork shall conform to the standards established for custom grade work in the latest edition of "Manual of Millwork" published by the Woodwork Institute of California.

Nails shall be countersunk and the holes filled, moulds shall be neatly mitered and all joints shall be tight and true.

Sheet metal shall be formed to the sizes, shapes and dimensions shown on the plans or specified with angles and lines straight, sharp and in true alignment. The number of joints shall be kept to a minimum.

Sheet metal that is marred or incorrectly bent will be considered damaged and shall be replaced with undamaged units.

INSULATION

Insulation shall conform to the requirements in these special provisions.

A list of materials shall be submitted for approval. The list shall include the trade name, manufacturer's name, resistance rating and thickness for the insulation materials and a schedule showing where each material is to be installed.

Wall insulation	Fiberglass batts with asphalted paper vapor barrier having vapor transmission rating of one perm. R-11 resistance rating.

Insulation material that has been wet or is wet will be considered damaged. The completed work shall not have damaged insulation material.

Insulation stockpiles shall be protected from weather damage and from migration of moisture from the ground.

Insulation batts shall be installed to completely fill the space between framing members. Installation shall conform to the manufacturer's recommendations and these requirements.

The vapor retarder shall be toward the interior and shall be fastened to provide a sealed barrier. Any punctures and holes in the barrier shall be repaired.

WINDOWS

Windows shall be furnished and installed with all necessary hardware, anchors and miscellaneous equipment in accordance with the following requirements.

Glazing for windows shall conform to the requirements under "Glazing" in these special provisions.

MATERIALS

Schedules shall be submitted for approval. Schedules shall include description of location, size and type for each window.

Windows shall be wood frame windows except as otherwise indicated.

The window shall meet the requirements of ANSI Standard A 200.1.

Double Hung Windows (custom fabricated)	Wood sashes, custom fabricated, from clear redwood to match shape, size, and details of existing sashes, glazed from inside, one single light of clear glass with second light of tinted laminated glass at living room of Building No. 575, two clear lights at all other double hung windows.

	Glass panes shall be bonded together with an aluminum spacer with dessicant. Existing balances shall have additional weights and new cords or cables installed to match weight of new sashes.
Weatherstripping (replacement for existing sliding windows)	Continuous, replaceable type, wool pile mounted in metal or double runs of ultra-violet resistant neoprene or vinyl.
Sealant	Self-leveling, nonsag, single component, solvent type acrylic, Federal Specification TT-S-230.
Tape	Compatible with sealant, Pecora "B-44 Extra-Seal," Pittsburg Plate Glass "Duribbon," Protective Treatment "PTU 606," Tremco "440 Tape," or equal.

Frame and sash shall be accurately machined and fitted to hairline joinery that develops the members. Joints shall be factory sealed weathertight.

Sash shall not be removable. Sash of custom fabricated double hung windows shall have concealed condensation weeps to the outside.

Window units shall be set straight, level, plumb and in true alignment in prepared openings in accordance with the installation instructions. Windows shall be centered in openings. Clearance between the window unit and the building framing shall be from 3/16 inch to 1/4 inch at the sides and 1/2 inch at the top. Ventilators shall be adjusted after glazing for easy, smooth and proper operation.

The installation shall be flashed and sealed weathertight.

Isolation coatings shall be provided to separate adjoining incompatible materials.

Existing weather stripping in horizontal sliding windows at building No. 587 shall be replaced with new original type or material specified in "Products" of this section.

The first floor entry door to Building No. 575 shall have a soft plastic or vinyl, bulb type weatherstripping installed at jambs and head.

GLAZING

Glazing, consisting of furnishing and installing glass for windows, and other glazed openings, shall conform to the requirements in these special provisions.

Safety glass shall be furnished and installed at all locations designated in Consumer Product Safety Commission's Safety Standard For Architectural Glazing Materials 16 CFR 1201.

A detailed list of glazing materials including glass, sheet, sealants, tapes, setting blocks, shims, compression seals, and glazing channels shall be submitted for approval. The list shall include a schedule of the materials to be used at each location.

Each individual pane of glass shall bear the identification label as specified in the applicable Federal Specification.

All panes shall be clear laminated glass except as otherwise shown. At double glazed windows, at living room of Building No. 575, one pane shall be tinted, laminated and one pane shall be clear glass.

Sheet glass, float glass, or plate glass	Federal Specifications: DD-G-451, q5 quality or better, double strength for panes to 10 square feet, 3/16 inch thick for panes between 10 and 28 square feet, and 1/4 inch thick for panes over 28 square feet, except as otherwise shown.
Safety glass	Consumer Product Safety Commission Safety Standard For Architectural Glazing Materials: 16 CFR 1201, and ANSI Standard Z97.1.

Safety glass, 1/4 inch minimum thickness laminated glass fused to plastic interlayers, except thickness for replacement lights at building No. 587 shall match existing as close as possible.

Grey; all the same tint, highest light transmittance available.

.es, .ms, seals glazing — Top grade, commercial quality, as recommended by the glass or sheet manufacturer and conforming to the requirements in the publications of the Flat Glass Marketing Association.

. conform to the general conditions and applicable detitions of the Flat Glass Marketing Association.

›e bedded fully and evenly, set straight and square wit a manner that the pane is entirely free of any conjes and surfaces.

; on the exterior of the building, the glazing on botbanes shall provide a watertight seal and watershec extend more than 1/16 inch beyond the holding mem

›uble glazed installations shall have desiccant plaminum spacers set in sealantin grooves at bottom of ı the plans.

ɛmblies using extruded gasket glazing shall be set in ɛ assembly manufacture's instructions using gaskets and said manufacturer.

ıss shall be set on setting blocks.

r cracked glass and glass with scratches that redhall be replaced before completion of the project.

be kept clean of cement and plaster products, cletapes and all other foreign material that may cause

discoloration, etching, staining, or surface blemishes to the materials.

Excess sealant left on the surface of the glass or surrounding materials shall be removed during the work life of the sealant.

Solvents and cleaning compounds shall be chemically compatible with materials, coatings and glazing compounds to remain. Cleaners shall not have abrasives that scratch or mar the surfaces.

All panes shall be cleaned just before the final inspection. All stains and defects shall be removed. Paint, dirt, stains, labels (except etched labels), and surplus glazing compound shall be removed without scratching or marring the surface of the panes or metal work.

GYPSUM WALLBOARD

Gypsum wallboard shall conform to the requirements in these special provisions.

Where assembly fire ratings are indicated on the plans, construction shall provide the fire resistance in accordance with the applicable standards in the Fire Resistance Design Manual published by the Gypsum Association.

Wallboard	ASTM Designation: C 36 for wallboard
Joint tape and joint compound	ASTM Designation: C 475
Corner beads, metal trim and control joints	Galvanized steel of standard manufacture
Fasteners	Gypsum wallboard nails or screws, except screws are required at metal framing.

Materials shall delivered in original packages, containers or bundles bearing brand name, applicable standard of manufacture, and name of manufacturer or supplier.

Materials shall be kept dry and fully protected from weather and direct sunlight exposure. Gypsum wallboard shall be stacked flat with adequate support to prevent sagging or damage to edges, ends and surfaces.

Edges of wallboard panels shall be butted loosely together. All cut edges and ends shall be smoothed as needed for neat fitting joints.

All edges and ends of gypsum wallboard panels shall coincide with the framing members, except those edges and ends which are perpendicular to the framing members. End joints on opposite sides of a partition assembly shall be staggered.

Gypsum wallboard panels for walls indicated as fire resistive or shear walls shall be fastened to all framing members. Gypsum wallboard panels on other types of walls shall be fastened to all framing members except panels shall not be fastened to top plates unless otherwise permitted by the Engineer.

Ceiling panels shall not be fastened within 7 inches of ceiling corners.

Adhesives shall not be used for securing panels for framing members. Fasteners shall be spaced at least 3/8 inch from panel edges and ends. The maximum spacing of nails shall be 7 inches and the maximum spacing of screws shall be 12 inches.

Nails shall penetrate into wood framing at least 1 1/8 inches. Screws shall penetrate into wood framing at least 5/8 inch.

All metal fasteners shall be driven slightly below surface level without breaking the paper or fracturing the core.

All nail and screw heads, dents, dimples and other voids or surface irregularities shall be patched with the same joint compound as used for the taped joints. Each patch shall consist of at least 3 coats and each coat shall be applied in a different direction. Each coat shall be dry before applying the next coat.

Metal trim shall be installed at all free edges and external corners and at locations shown on the plans. Metal trim shall be placed where gypsum wallboard abuts dissimilar materials.

Joints and corners shall be taped and filled to provide a true surface.

Filled areas shall be finished by sanding lightly.

Good lighting of the work area is required during the final application of joint compound.

A commercial texture finish product shall be used to apply a finish textured surface to match pattern and texture of adjacent walls.

PAINTING

This work shall consist of field painting all exposed surfaces indicated or noted on the plans except those surfaces excluded in these special provisions or on the plans. The term "coating," as used herein, includes enamels, paints, pretreatment primers, stains, sealers, fillers, emulsions, and other coatings whether used as first, intermediate, or finish coats.

The coatings specified in this section are in addition to any factory finishes, shop priming, or surface treatment specified under other sections.

A list of materials, schedule of coatings, and color cards for finish coatings the Contrator proposes to use shall be submitted for approval.

The list shall include the manufacturer's name, trade name and current descriptive data for each coating.

The schedule shall list the coatings, number of coats, and finish color for each surface to be coated.

Five sample color cards, approximately 8" x 8" in size, for each separate finish color shall be submitted for approval. Samples for stains or clear finish shall be made of the same wood species closely matching the grain, color and character of the wood to receive the stain. Coatings shall closely match the approved samples. Work that is not in compliance with these requirements shall be removed, refinished or recoated.

Brass surfaces, nameplates, push buttons, operating handles, locks, plastic parts, cover plates on wall mounted outlets and switches,

and any other item which would be impaired in legibility, life expectancy or function shall not be coated. Said items in place prior to coating shall be removed or loosened as required for coating operations and replaced upon completion of the work.

Stainless steel or anodized aluminum surfaces shall not be coated. Nonferrous piping, equipment or duct work shall not be coated. Pipe to be insulated and pipe and duct supports in walls, shafts, closets or furred ceilings shall not be coated.

Surfaces of concrete, plaster or masonry shall not be coated.

Finish coats specified in these special provisions to be factory applied need not be recoated in the field unless damaged.

All coatings shall be the best quality grade of specified types as regularly manufactured by a recognized coating manufacturer. Materials shall be delivered to the project site in original unopened containers with labels intact.

Thinners and coloring tints shall conform to the coating manufacturer's recommendations.

Coatings shall conform to the rules for control of volatile organic compound emissions adopted by the air pollution control district in the air basin in which such coatings are applied.

Coats for each coating system shall be compatible with one another and made by the same manufacturer.

Colors shall match existing as determined by the Engineer.

Coatings shall be applied only when surfaces are dry and properly prepared, and surrounding conditions are satisfactory for coating. Nailholes, cracks, open joints, dents, scars and other surface irregularities shall be patched, puttied, filled and repaired to provide smooth surfaces for the application of coatings.

Hardware, fixtures, cover plates and similar attachments to surfaces to be coated shall be removed during coating.

Surfaces shall be prepared in accordance with the coating manufaturer's printed instructions.

Metal shall have rust, loose mill scale, grease, dirt, wax, oil, preservative coatings and any other deleterious matter removed. Galvanized surfaces shall be cleaned and then etched or roughened before coating. Etching shall be done by treating with a zinc-acid phosphate solution or an acid-bound resinous film in accordance with the treatment manufacturer's recommendations. Roughening shall be by abrasive blasting with No. 30 or finer abrasive. Roughening shall not remove the galvanizing. All bare and clean metal surfaces shall be treated with pretreatment primer before applying coatings.

Aluminum surfaces without factory applied finish coatings shall be cleaned with mineral spirit solvent and coated with pretreatment, vinyl wash primer. Lubricants and temporary oxidation retarders used by the manufacturer of aluminum products shall be readily removable using mineral spirits solvents.

Wood surfaces shall be dusted and cleaned, as required, before the application of stains or primers. Smooth surfaced wood shall have surfaces sanded. Sealer shall be applied to seal knots, sap, pitch, tar, creosote and other bleeding substances likely to affect the appearance of finished work. Imperfections on wood surfaces to receive stain shall be filled after the first coat of stain has been applied. The filler color shall match the stain color.

Existing gloss enameled surfaces to be recoated shall be cleaned with trisodium phosphate solution after removing all peeled, loose or cracked paint. Edges of partially removed coatings shall be sanded smooth.

Existing coated surfaces shall be coated with one application of undercoat paint prior to applying acrylic latex coatings. Undercoat shall be exterior type for surfaces exposed to weather and interior type for interior surfaces.

Exposed surfaces of patches in walls or ceilings shall be coated as required for new work. Where such patches are made, the entire surface to corners on every side of the patch shall be coated with one application of finish coat.

The number of coats specified for surfaces listed below is a minimum. Additional coats shall be applied if necessary to obtain a uniform color, texture and appearance.

Surface	Finish	Specifications
Gypsum board	paint	1 application pigmented sealer 2 applications acrylic paint
Galvanized metal	paint	2 applications acrylic paint
Aluminum	paint	1 application zinc chromate primer 2 applications acrylic paint (1)
Bare ferrous metals	paint	2 applications red iron oxide primer 2 applications acrylic paint (1)
Shop primed metals	paint	1 application pretreatment vinyl wash primer 2 applications acrylic paint (1)
Wood	paint	1 application exterior oil base wood primer at exterior surfaces and 1 application interior oil base wood primer on interior surfaces. 2 applications acrylic paint (1)
	stain	2 applications Olympic semi-transparent wood stain followed by 2 applications of compatible waterproofing; or 2 applications Cuprinol wood stain and water-proofing; or 2 applications Chemstop Waterproofing wood stain; or equal. Factory application may be counted as the first application of stain.
	clear	3 applications water clear satin urethane varnish over water clear stain to match existing.

Note 1: For exterior surfaces use weather resistant, semi-gloss, house and trim type, acrylic paint. For interior surfaces use washable, interior, semi-gloss acrylic paint. Finish paint for electrical and mechanical equipment shall be manufacturer's recommended industrial grade machinery finish coating.

Precautions in the handling and application of coatings shall be in accordance with the General Industry Safety Orders of the Division of Industrial Safety.

Coatings shall be applied in accordance with the printed instructions and at the rates recommended by the manufacturer.

Thinning and tinting shall conform to the manufacturer's printed instructions. Thinning will be allowed only when required.

The air temperature shall be at least 50 F and relative himidity not more than 75 percent when applying water based coating.

Application rollers shall be of a type which do not leave a stippled texture in the paint film. If spray methods are used, runs, sags, thin areas in the coating film, or skips and holidays shall be considered as evidence that the work is unsatisfactory and the Contractor may be required to apply the remainder of the coating by brush. A water trap acceptable to the Engineer shall be furnished and installed on all equipment used in air atomized spray coating.

Each coating shall be evenly spread and cured in a uniform film. Each application of material shall be thorougly cured and any skips, holidays, thin areas or other deficiencies corrected before the succeeding application.

Drying time between applications of water based coatings shall be at least 12 hours.

Enamels and clear finishes shall be lightly sanded, dusted and wiped clean between applications.

Each application of finish paint shall closely resemble the final color coat, except each application shall provide enough contrast in shade to distinguish the separate applications. Finished surfaces shall be free of cloudiness, spotting, holidays, laps, brush marks, runs, sags, curtains, ropiness, improper cutting in, overspray or other surface deviations or imperfections.

Alurfaces without factory applied finish coatings shall be coated wi chromate primer not more than 4 hours after applying preteatment ash primer. After zinc chromate primer has thoroughly cured, a sedication of pretreatment vinyl wash primer shall be applied foll hin 4 hours by the first application of vinyl acrylic fini

Onation of undercoat shall be applied the same day that cleaning of al is performed. A second application shall be applied as dying time of the first permits. The first application of the speciting system shall be applied to all wood surfaces (face, back, ends) of siding, facia, exterior trim, room doors, and cabinet hat are not factory coated, immediately upon delivery to the proje Surfaces of interior finish woodwork that adjoin concrete or shall be coated with one appllication of oil base wood primer installation.

Whe or stain type coatings are required on millwork, trim, or panhe required finish coatings or spar varnish shall be used for the back faces.

Dis ons caused by the Contractor's operation which result in anly appearance on surfaces not designated to be coated shal ved by the Contractor at his expense. Coated surfaces mad amaged as a result of the Contractor's operations shall be rep t his expense, with materials and to a condition equal to tha coating specified. Upon completion of all operations, ed surfaces shall be thoroughly clean of dust, dirt, greas r unsightly materials.

INSULATED WIDES

Insindow shades with an advertised R-5 rating shall be furnished, with all hardware, and installed at the locations noted on the

PRODUCTS

Shade	Multi-layered aluminized mylar sheet assembly with permanently shaped spacers to hold layers apart, approximately 2 1/2 inch total thickness, when rolled down and which allow shade to compress and be rolled up on an ordinary wood shade roller.

Jambs	Extruded plastic frames with flexible-plastic seals built into the head and side jambs.

Assembly shall be installed as recommended by the manufacturer. Unit shall provide a positive, air tight seal at top and sides.

MECHANICAL

This work consists of installing in-line fans, new ducting, motorized dampers, and necessary alterations to existing work.

In line cabinet fans shall be Penn, Loren-Cook, Briedert, or equal, with metal housing, automatic relief damper and UL label. Fans shall be installed in new ducting between existing supply air and return air ducts as noted on the plans. Fans shall be Air Moving and Conditioning Association (AMCA) certified for air flow and sound rating. Fans shall have built-in thermal overload protection. Fan motor shall be grounded and mounted on neoprene or rubber in shear mountings.

All ductwork shall be galvanized steel sheet metal conforming to the sheet metal and Air Conditioning Contractors National Association (SMACNA) "Low Velocity Duct Construction Standards".

Dampers shall be Omnizone Type OMR, Duro Dyne-Duro Zone Damper, or equal. The unit shall consist of spiral duct with elliptical or round damper. The unit shall be operated by a remote on-off swith and have built in microswitch or auxiliary switch for cabinet fan control.

Equipment included in this work shall be installed complete and in proper operational condition. Incidental material not mentioned in these special provisions or shown on the plans, which may be necessary, shall be furnished and installed as though shown or provided for.

All work shall conform to the manufacturer's recommendations and instructions.

Ducting and equipment shall be installed as acceptable to the Engineer.

ELECTRICAL

Work covered by this section shall include furnishing all labor, materials, and equipment required to construct and install the complete electrical system shown on the plans and specified in this section and the work of installing and wiring motors, and controls as specified under Section 12-15, "Mechanical," of these special provisions.

All work performed and materials installed shall conform to the National Electrical Code; the California Administrative Codes, Title 24, Part 3, "Basic Electrical Regulations," and Title 8, Chapter 4, "Electrical Safety Orders;" and all local ordinances.

The Contractor shall submit for approval a complete list of equipment which he proposes to install and such other data as may be required by the Engineer.

Ater the wiring is complete, the installation shall be tested in the presence of an Engineer to demonstrate that the equipment functions properly. The Contractor shall make necessary repairs, replacements and retests at his expense.

Unless otherwise shown on the plans, the following mounting height above finished floor shall apply:

Fan switches	4' 2"

Equipment shall be identified with nameplates fastened with self-tapping, cadmium-plated screws or nickel-plated bolts.

Nameplates shall be made from laminated phenolic plastic with white core and black front and back. Letters shall be 1/4"-inch high.

Fan switch	Fan switch Fan - Off - Heat

Conduit shall be electrical metallic tubing. Electrical metallic tubing shall be cold-rolled steel with zinc coating outside and enamel or lacquer coating inside. Fittings shall be compression ring or gripping ring type.

Flexible conduit shall be used to connect motors and other equipment subject to vibration.

Exposed conduits and surface metal raceways shall be run parallel to or at right angles to building lines.

Conductors shall be copper.

Building wire conductors shall be solid.

Unless otherwise shown or specified, conductor types shall be Type THHN.

Conductor connectors and lugs shall be pressure or compression type except that connectors for No. 10 AWG and smaller conductors in dry locations may be preinsulated spring-pressure type. All pressure type connectors and lugs shall be retightened after the initial set.

Splices and joints shall be insulated with insulation equivalent to that of the conductors.

Unless otherwise shown or specified, all boxes shall be sheet steel boxes galvanized after fabrication with standard galvanized covers.

Fan switch shall be heavy duty, double-pole, double-throw, 20-ampere, 120/277-volt, AC, three-position switch with center off. Switch shall be surface-mounted in NEMA-1 enclosure.

Hangers, brackets, conduit straps, supports, and electrical equipment shall be secured to surfaces by means of toggle bolts on hollow masonry; expansion shields and machine screws or standard preset inserts on concrete or solid masonry; machine screws or bolts on metal surfaces; and wood screws on wood construction.

Supporting devices shall be corrosion resistant.

The operation of damper motor, in-line cabinet fan, and furnace heating cycle shall be controlled as follows:

When the fan switch is in the fan position, thermostat shall be disconnected and damper motor shall close the damper in supply air duct and activate the micro-switch. The micro-switch then activates the in-line cabinet fan. When the switch is in the off position, the damper shall open and both in-line cabinet fan and thermostat shall be disconnected. When switch is in heat position, thermostat shall control the furnace heating cycle while the damper stays open and the in-line cabinet fan stays off.

FINAL CLEANING UP

The Contractor's attention is directed to Section 2-1.05 of the General conditions.

PAYMENT

In lieu of any other provisions for payment, the lump sum amount to be paid for the building modifications to provide three existing private residences with noise insulation shall be considered to include full compensation for furnishing all labor, tools, materials and equipment necessary to complete the work described herein, and no additional compensation will be allowed therefor.

A bill in triplicate shall be submitted upon completion of the work.

DEPARTMENT OF TRANSPORTATION
DISTRICT 4

R.J. AIELLO
DEPUTY DISTRICT DIRECTOR

BY Rhoda D Brown
RHODA D. BROWN
DISTRICT CONTRACT OFFICER

Dated: August 31 | 82

DEPARTMENT OF TRANSPORTATION
BID PROPOSAL FOR
LUMP SUM BID (STATE FUNDS)

CONTRACT NO.	SHEET
46559-MN	31 OF 32

PROPOSAL TO THE STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

SUBMITTED IN RESPONSE TO NOTICE TO BIDDERS NO.:

APPROXIMATE MAGNITUDE OF WORK

For: IN THE CITY AND COUNTY OF SAN FRANCISCO ON SAN BRUNO AVENUE ADJACENT TO ROUTE 101 NEAR THE 18TH STREET PEDESTRIAN OVERCROSSING; BUILDING MODIFICATIONS TO PROVIDE THREE EXISTING PRIVATE RESIDENCES WITH NOISE INSULATION.

The undersigned, as bidder, declares that the only persons or parties interested in this proposal as principals are those named herein; that this proposal is made without collusion with any other person, firm or corporation; that he has carefully examined the proposed form of contract and the plans therein referred to, and he proposes and agrees if this proposal is accepted, that he will contract with the State of California to provide all necessary materials, and equipment and to do all the work specified in the contract, in the time and manner therein prescribed, and take in full payment therefor the following:

LUMP SUM $ _____
(In figures)

If the bidder is awarded the contract and refuses to execute the prescribed forms presented to him for signature within the time and manner required of him, he will be liable to the Department of Transportation for all damages resulting to the Department therefrom or 10% of the amount bid, whichever is less.

The bid of any contractor who is currently in default with Caltrans on a contract already awarded may be regarded as nonresponsive and may be rejected. Default is defined as being within a period of liquidated damages on uncompleted work or under notice to begin or complete a contract where work has not commenced or was suspended without cause.

The Department of Transportation hereby notifies all bidders that it will affirmatively insure that in any contract entered into pursuant to this advertisement, minority business enterprises will be afforded full opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of race, color, or national origin in consideration for an award.

By execution of this proposal, the bidder certifies that he has or will meet the standards of affirmative compliance with the Fair Employment Practices requirements of the special provisions.
IMPORTANT NOTICE: If bidder or other interested person is a corporation, state legal name of corporation, also names of the president, secretary, treasurer and manager thereof; if a copartnership, state true name of firm, also names of all copartners composing the firm; if an individual, state first and last names in full.

BIDDER (NAME MUST BE THE SAME AS ON LICENSE)		DATE
BY (MUST BE SIGNED)	TITLE	PHONE
BUSINESS ADDRESS		
LICENSE NO.	LICENSE CLASSIFICATION	

SUBCONTRACTING LIST

Subcontractor(s)* who will perform work or render service to prime Contractors.		Description of portion of work which will be done by each subcontractor.
Name	**Place of Business**	

*If none, bidder to write "NONE" in this space.....

INDEX OF SHEETS

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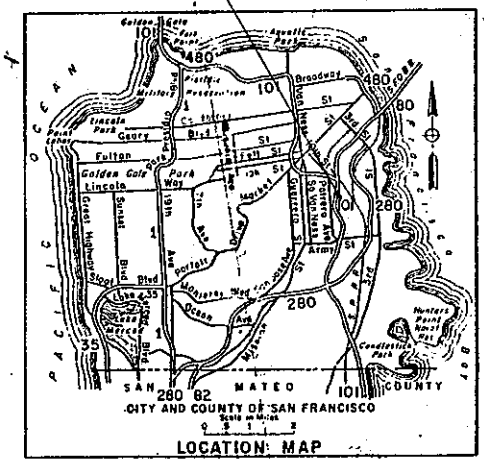
LOCATION OF RESIDENCES

PROJECT SITE



LOCATION MAP

VICINITY MAP

Jim Sullivan
HOMEOWNER AT 575 SAN BRUNO

HOMEOWNER AT 579 SAN BRUNO

HOMEOWNER AT 585/587 SAN BRUNO

PROJECT PLANS FOR CONSTRUCTION ON SAN BRUNO AVENUE IN THE CITY AND COUNTY OF SAN FRANCISCO ADJACENT TO ROUTE 101 NEAR THE 18 TH. STREET PEDESTRIAN OVERCROSSING.

Contract No. 04-100074

CU 04226
WO 100071

04	SF	101	

ABBREVIATIONS

⌀	DIAMETER		
&	AND	GA.	GAGE
@	AT	GALV.	GALVANIZED
℄	PLATE	GYP.	GYPSUM
		INT.	INTERIOR
BD.	BOARD		
BLK.	BLOCK	NO.	NUMBER
C	CONDUIT	R.A.	RETURN AIR
CONT.	CONTINUOUS	RM.	ROOM
		RWD.	REDWOOD
DIM.	DIMENSION	S.A.	SUPPLY AIR
DN.	DOWN	SHT.	SHEET
DWG.	DRAWING	S.F.	SAN FRANCISCO
EXT.	EXTERIOR	TYP.	TYPICAL
		WIN.	WINDOW

SYMBOLS & LEGEND

- WOOD, CONT.
- WOOD, BLK.
- WOOD, FINISH
- BATT INSULATION
- DETAIL NO. / DRAWING NO.
- WINDOW IDENTIFICATION
- REMOVE EXISTING

GENERAL NOTES

1. CONTRACTOR TO VERIFY ALL DIMENSIONS AND SIZES SHOWN ON PLAN AT PROJECT SITE BEFORE COMMENCING ANY WORK.
2. CONTRACTOR TO TAKE EXTREME CARE TO LIMIT SCOPE OF WORK TO THAT INDICATED ON THESE PLANS AND PROTECT ADJACENT SURFACES, TRIM AND MOULDINGS FROM DAMAGE.
3. ALL EXISTING WALLS, CEILINGS AND FLOORS, WHERE DAMAGED BY WORK, SHALL BE PATCHED OR REPLACED TO MATCH EXISTING ADJACENT FINISH.
4. PAINT EXTERIOR OF BUILDINGS MATCHING EXISTING COLOR ON BUILDING FACES WHERE WORK OCCURS:
   #575 - REAR WALL & TRIM @ WEST ELEVATION.

   WHERE DAMAGE OR REPLACEMENT OCCURS NECESSITATING PAINTING TOUCH-UP, THEN THE NEW PAINTING WILL EXTEND TO THE NEAREST VERTICAL OR HORIZONTAL SURFACE BREAK.
5. STAIN AND/OR PAINT NEW INTERIOR TRIM TO MATCH EXISTING.

E-59

BUILDING NO. 575 | BUILDING NO. 579 | BUILDING NOS. 585/587

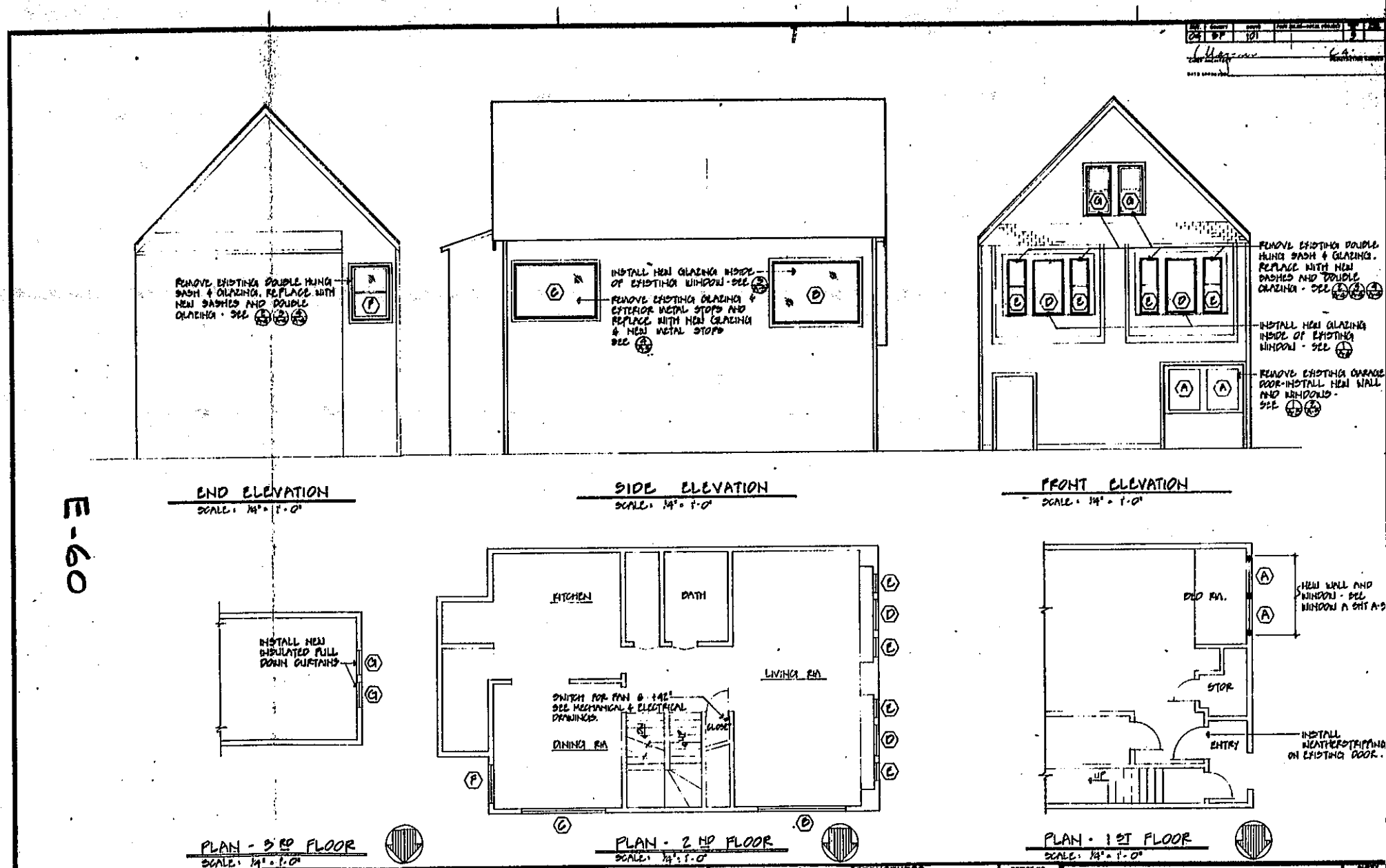
ELEVATIONS

DESIGNED BY: L.	CHECKED BY:	SHEET LEGEND: A-1 ARCHITECTURAL, M-1 MECHANICAL, S-1 STRUCTURAL, E-1 ELECTRICAL, C-1 CIVIL, L-1 LANDSCAPE	State of CALIFORNIA DEPARTMENT OF TRANSPORTATION	STRUCTURES TRANSPORTATION ARCHITECTURE	BRIDGE NO.	S.F. DWELLING - NOISE ATTENUATION	A-1
DRAWN BY: L. LUCHO	STRUCTURAL REVIEW				POST MILE	GENERAL PLAN	
	SPECIFICATIONS						

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS: 0 1 2 3

CU 04225
WO 109071

Disregard prints bearing earlier revision dates

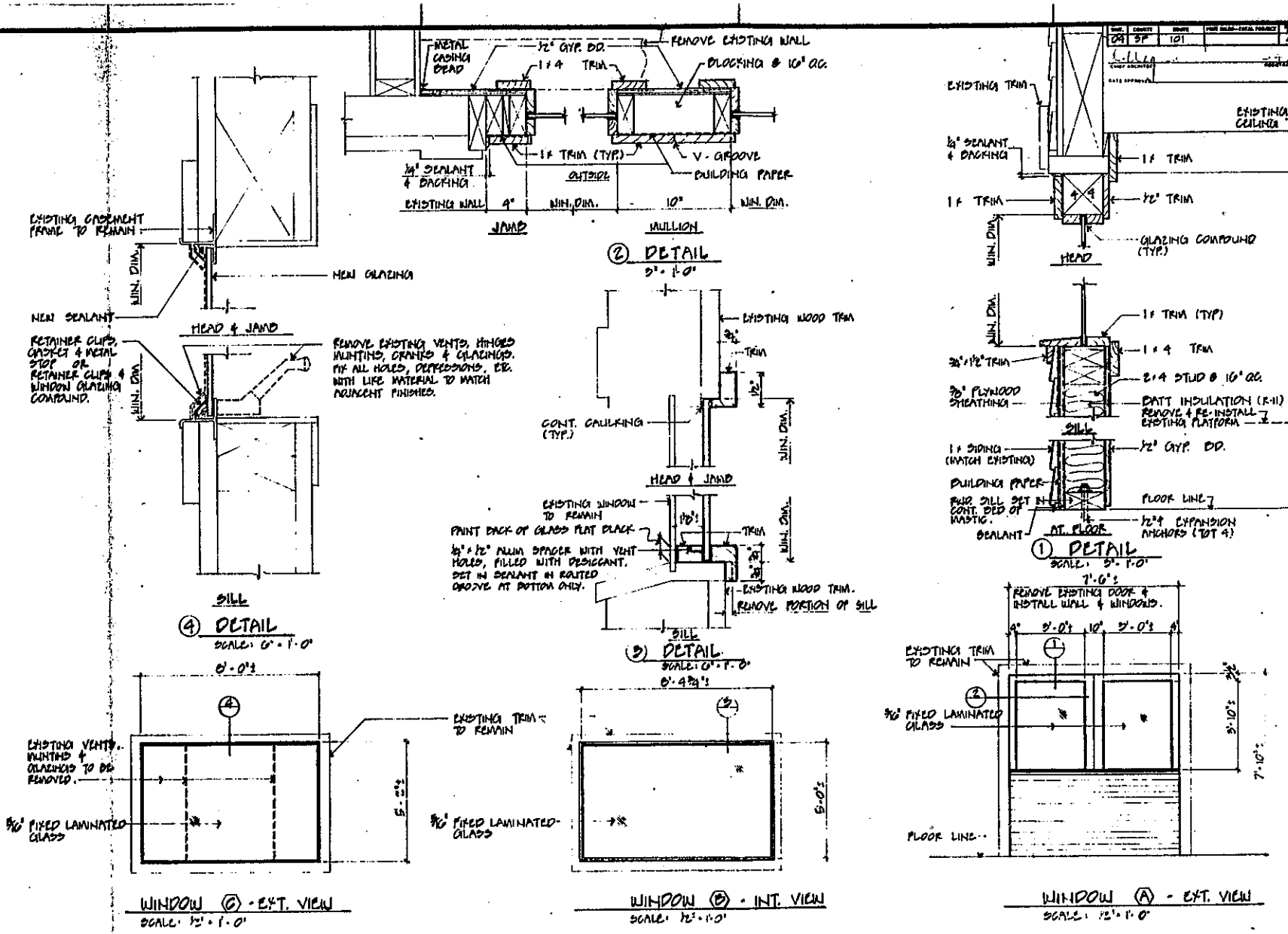


E-60

DESIGNED BY	CHECKED BY	State of CALIFORNIA DEPARTMENT OF TRANSPORTATION	STRUCTURES TRANSPORTATION ARCHITECTURE	BRIDGE NO.	S.F. DWELLING - NOISE ATTENUATION
DRAWN BY F. UYENO	STRUCTURAL ASTMO SPECIFICATIONS			POST MILE	BUILDING NO. 575
			CU 04226 WO 100071		A-2

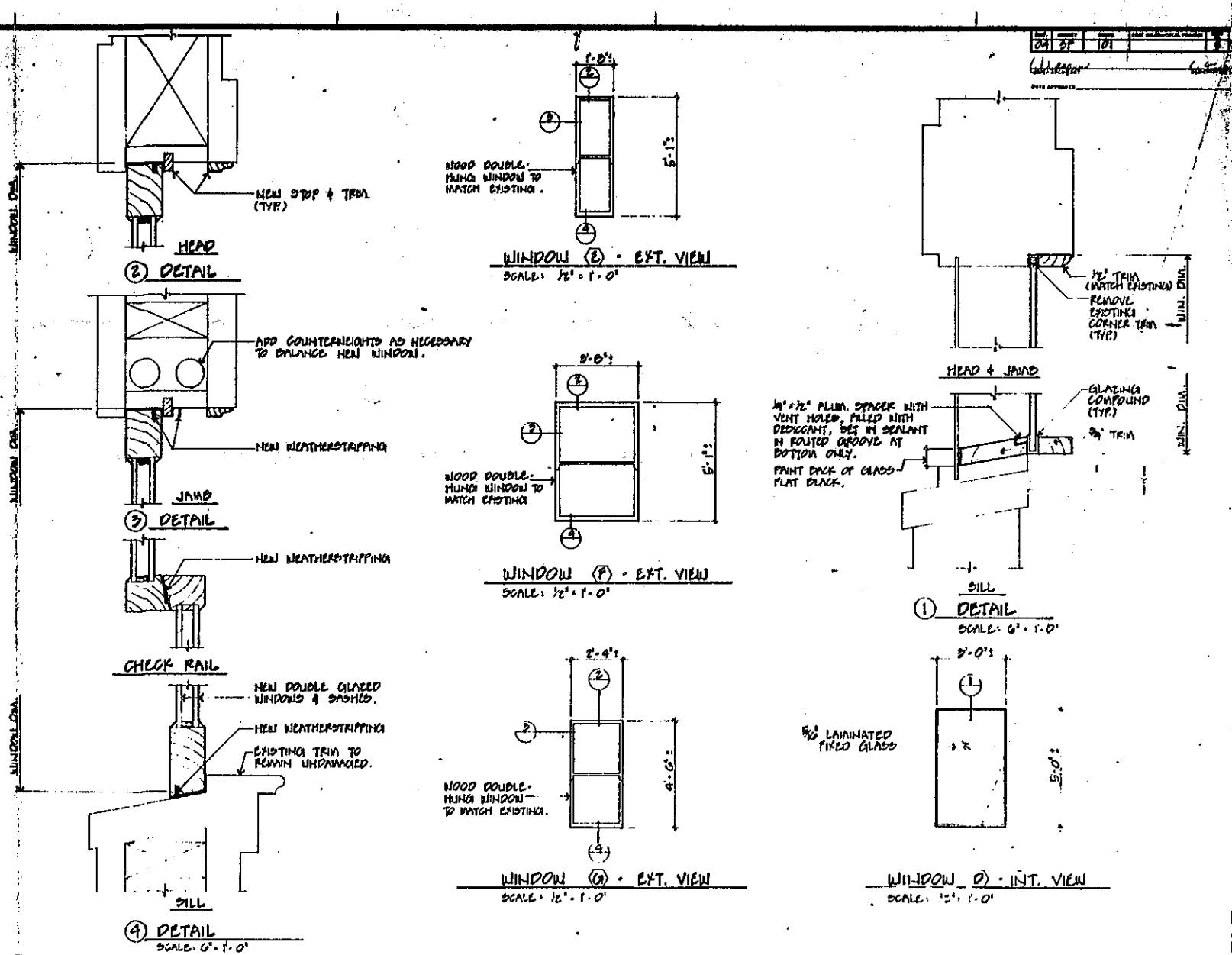
ORIGINAL SCALE IN INCHES FOR REDUCED PLANS

Disregard prints bearing earlier revision dates



E-61

DRAWN BY: F. LYENO	CHECKED BY: STRUCTURAL REVIEW: SPECIFICATIONS:	State of CALIFORNIA DEPARTMENT OF TRANSPORTATION	STRUCTURES TRANSPORTATION ARCHITECTURE	BRIDGE NO. POST MILE	S.F. DWELLING - NOISE ATTENUATION BUILDING NO. 575 DETAIL NO. 1
ORIGINAL SCALE IN INCHES FOR REDUCED PLANS				CU WO	Disregard prints bearing earlier revision dates



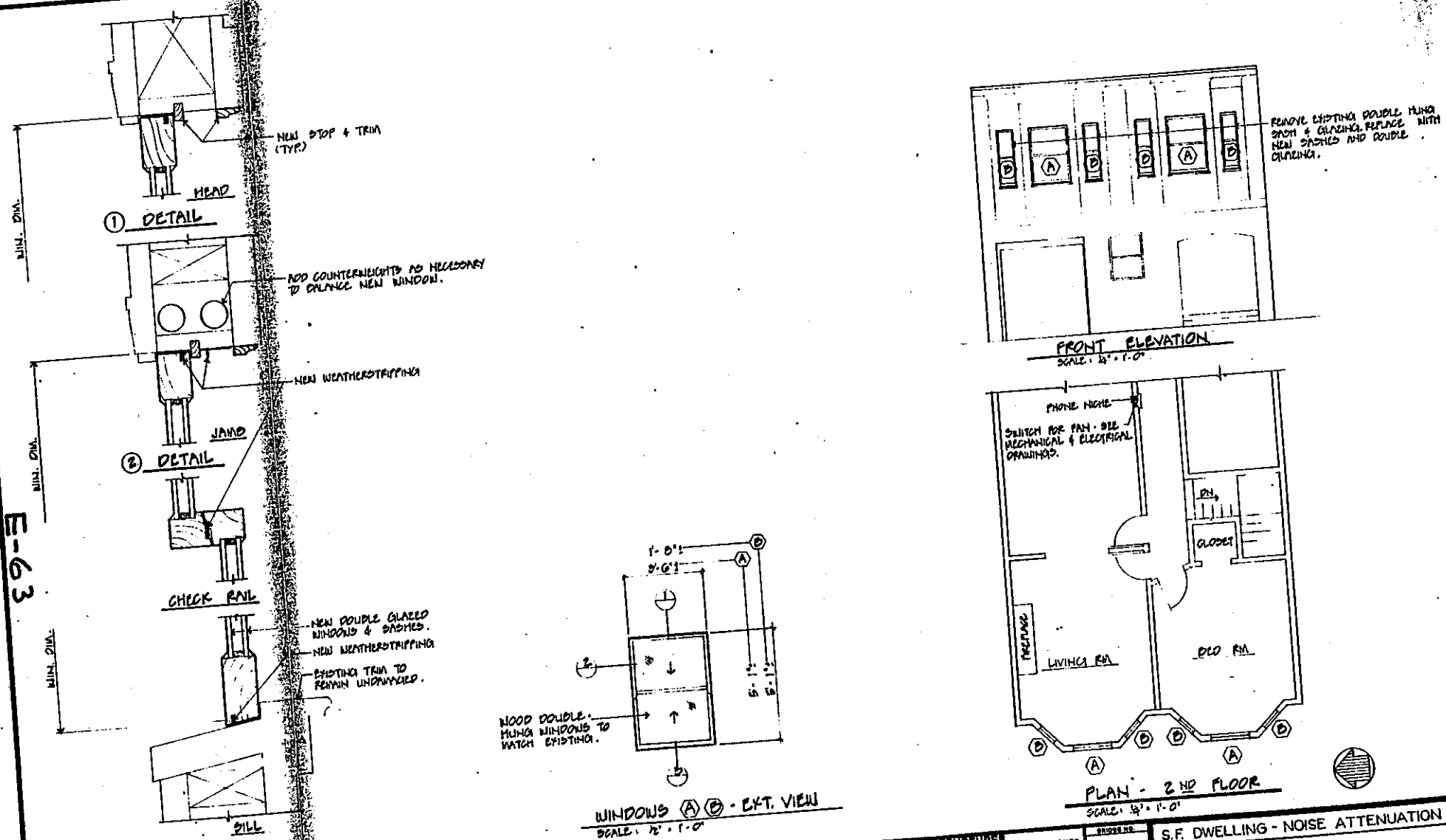
E-62

DESIGNED BY	CHECKED BY	State of CALIFORNIA DEPARTMENT OF TRANSPORTATION	STRUCTURES TRANSPORTATION ARCHITECTURE	S.F. DWELLING - NOISE ATTENUATION
DRAWN BY F. [illegible]	STRUCTURAL REVIEW			BUILDING NO. 575 DETAIL NO. 2
	SPECIFICATIONS			A-[illegible]

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS

CU [illegible]
WO [illegible]

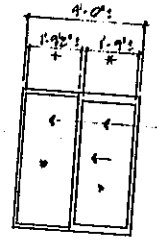
Disregard prints bearing earlier revision dates



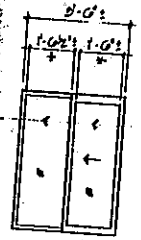
E-63

DESIGNED BY	CHECKED BY	State of CALIFORNIA DEPARTMENT OF TRANSPORTATION	STRUCTURES TRANSPORTATION ARCHITECTURE	BRIDGE NO.	S.F. DWELLING - NOISE ATTENUATION
DRAWN BY F. UYENO	STRUCTURAL REVIEW			POST MILE	BUILDING NO. 579
	SPECIFICATION		CU 04226 WO 100071		A-5

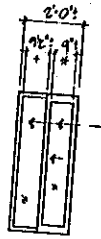
ORIGINAL SCALE IN INCHES FOR REDUCED PLANS



(A)



(B)



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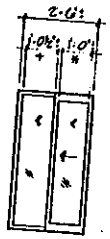
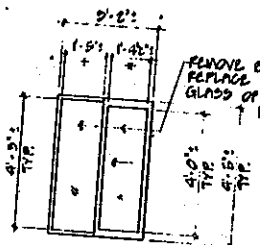


(D)



(E)

REMOVE EXISTING GLASS AND REPLACE WITH NEW LAMINATED GLASS OF EQUAL THICKNESS IN EXISTING FRAMES.

WINDOW SCHEDULE

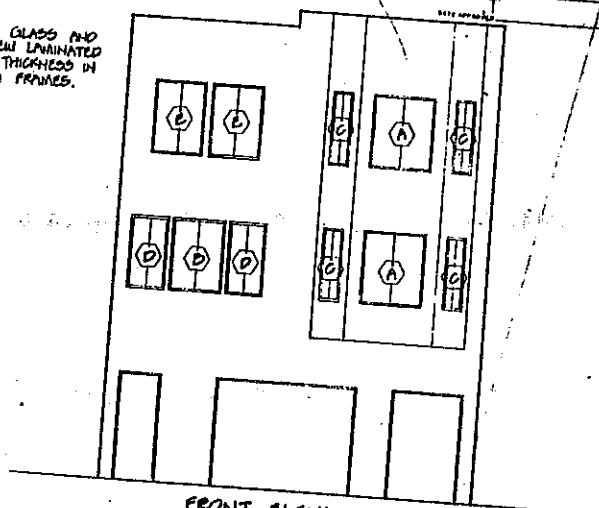
SCALE: ½" = 1'-0"

NOTE:

* SLIDING REMOVABLE WINDOW.
+ FIXED GLASS

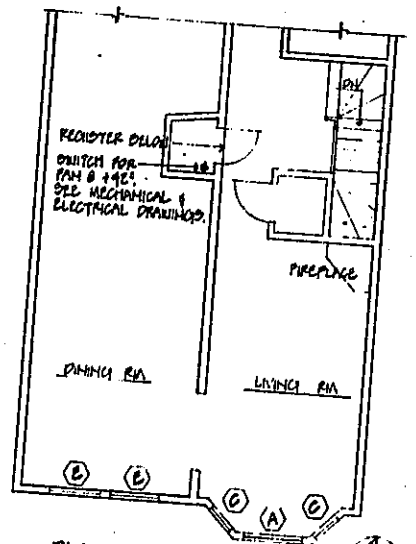
ALL DIMENSIONS SHOWN ARE APPROXIMATE AND TO BE VERIFIED BY THE CONTRACTOR.

REPLACE EXISTING WEATHERSTRIPPING ON WINDOW FRAME WITH NEW MATERIAL.



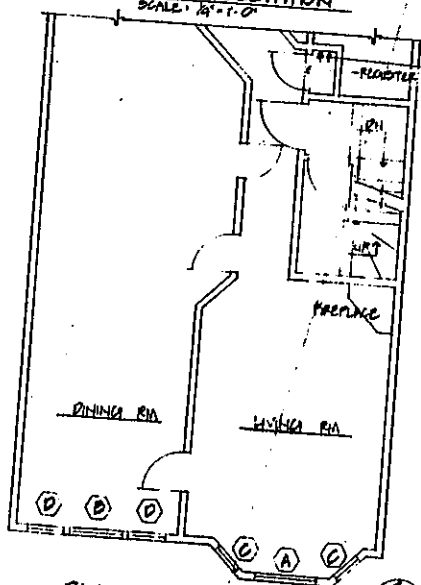
FRONT ELEVATION

SCALE: ½" = 1'-0"



PLAN - 3RD FLOOR

SCALE: ½" = 1'-0"



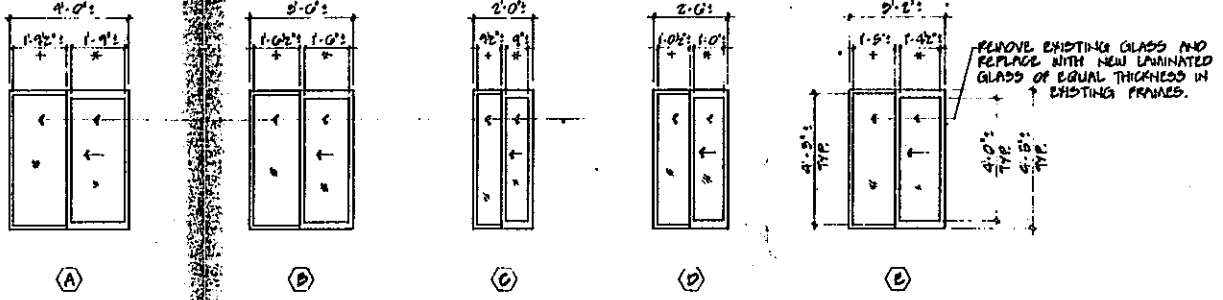
PLAN - 2ND FLOOR

SCALE: ½" = 1'-0"

E-64

DESIGNED BY	CHECKED BY	State of CALIFORNIA DEPARTMENT OF TRANSPORTATION	STRUCTURES TRANSPORTATION ARCHITECTURE	BRIDGE NO.		S.F. DWELLING - NOISE ATTENUATION	A-6
DRAWN BY F. UYENO	STRUCTURAL REVIEW			DISTRICT		BUILDING NOS. 585/ 587	
	SPECIFICATIONS			CU 04220 WD. 100071			

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS



WINDOW SCHEDULE

SCALE: ½" = 1'-0"

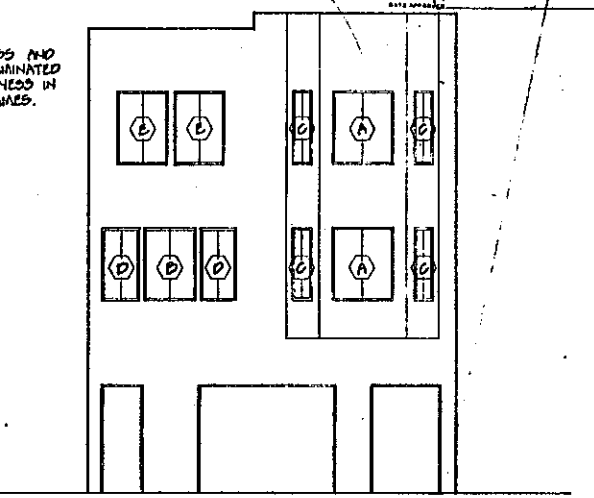
NOTE:

* SLIDING REMOVABLE WINDOW.

\+ FIXED GLASS

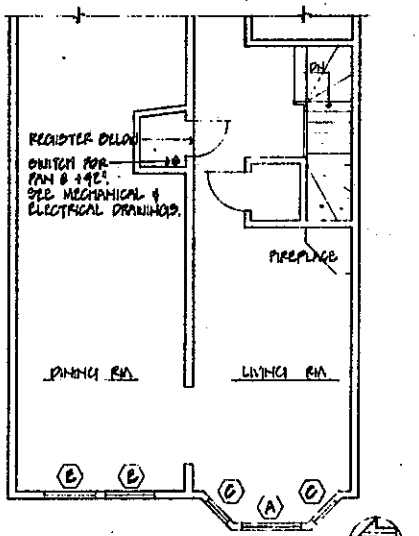
ALL DIMENSIONS SHOWN ARE APPROXIMATE AND TO BE VERIFIED BY THE CONTRACTOR.

REPLACE EXISTING WEATHERSTRIPPING ON WINDOW FRAME WITH NEW MATERIAL.



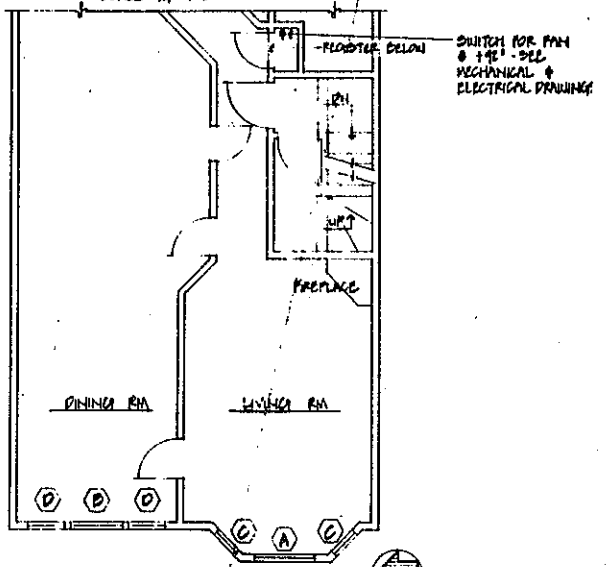
FRONT ELEVATION

SCALE: ½" = 1'-0"



PLAN - 3RD FLOOR

SCALE: ½" = 1'-0"



PLAN - 2ND FLOOR

SCALE: ½" = 1'-0"

E-64

DESIGNED BY

DRAWN BY F. LIYENO

CHECKED BY

STRUCTURAL REVIEW

SPECIFICATIONS

State of CALIFORNIA DEPARTMENT OF TRANSPORTATION

STRUCTURES TRANSPORTATION ARCHITECTURE

BRIDGE NO.

POST MILE

S.F. DWELLING - NOISE ATTENUATION

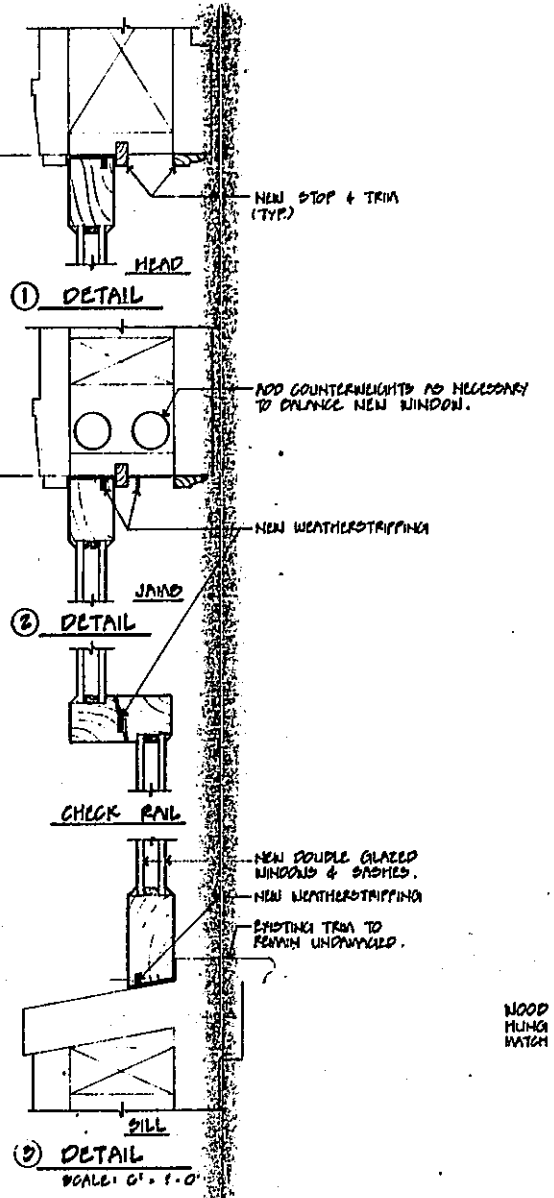
BUILDING NOS. 585/587

SHEET A-6

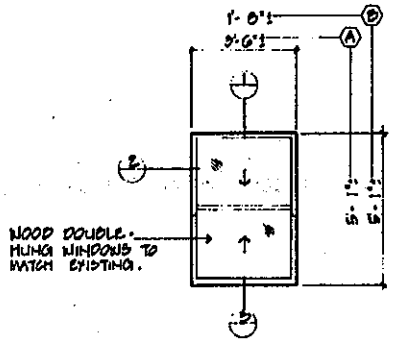
ORIGINAL SCALE IN INCHES FOR REDUCED PLANS

CU 04220

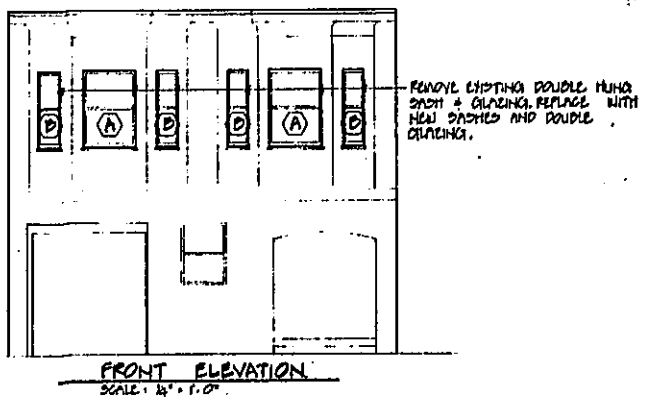
WO 160071



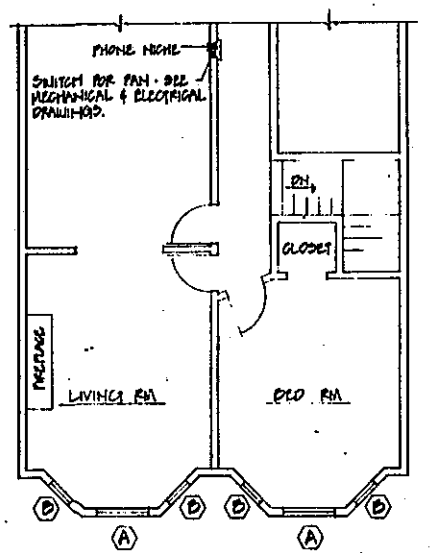
E-63



WINDOWS Ⓐ Ⓑ - EXT. VIEW
SCALE: ½" = 1'-0"

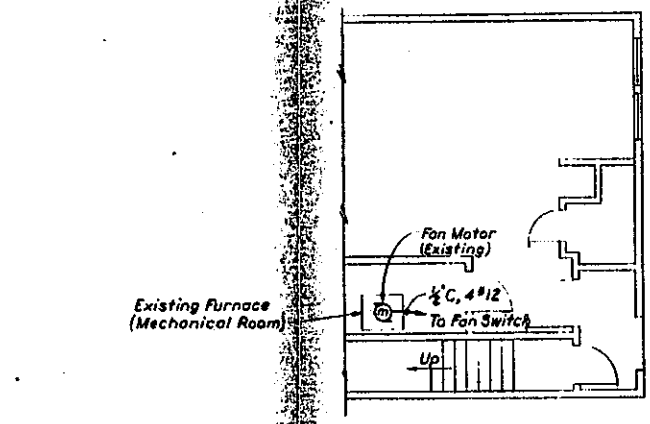


FRONT ELEVATION
SCALE: ½" = 1'-0"

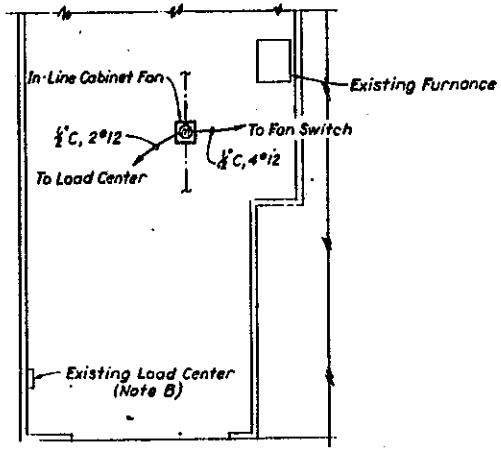


PLAN - 2ND FLOOR
SCALE: ½" = 1'-0"

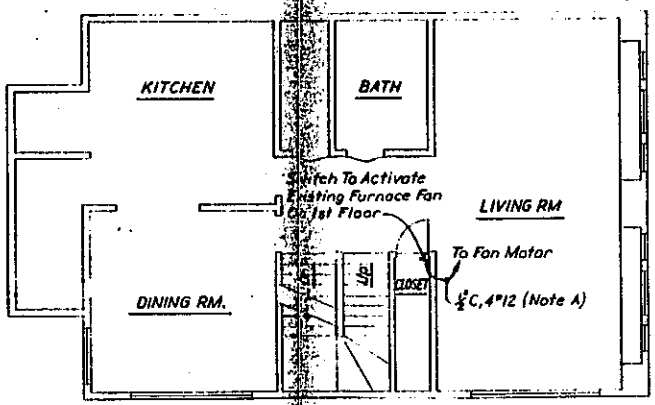
DESIGNED BY	CHECKED BY	State of CALIFORNIA DEPARTMENT OF TRANSPORTATION	STRUCTURES TRANSPORTATION ARCHITECTURE	BRIDGE NO.	S.F. DWELLING - NOISE ATTENUATION BUILDING NO. 579
DRAWN BY F. LYCHO	STRUCTURAL REVIEW SPECIFICATIONS			POST MILE	A-5
ORIGINAL SCALE IN INCHES FOR REDUCED PLANS			CU 04 2330 WD 1200324	Disregard prints bearing earlier revision dates	



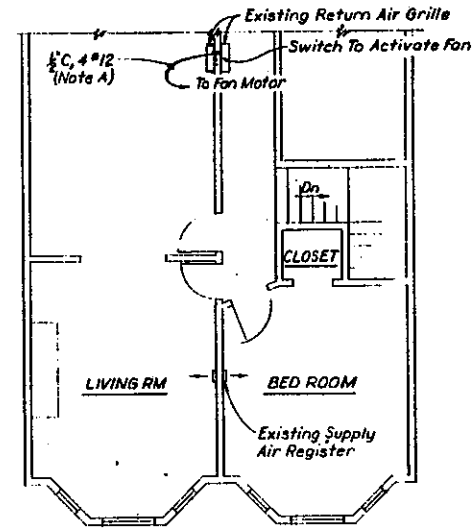
PARTIAL PLAN-1ST FLOOR
BUILDING NO. 575



PARTIAL PLAN-1ST FLOOR
BUILDING NO. 579



PLAN-2ND FLOOR
BUILDING NO. 575



PARTIAL PLAN - 2ND FLOOR
BUILDING NO. 579

NOTES:

A. INSTALL CONDUIT OR CABLE IN THE RETURN AIR PLENUM EXPOSED RACEWAY IN THE LIVING QUARTER SHALL BE A 2-PIECE, LAY-IN TYPE SURFACE METAL RACEWAY.

B. EXISTING LOAD CENTER IS CUTLER HAMMER, 100-AMPERE, 120/240-VOLT, AC, 1-PHASE, AND 3-WIRE. INSTALL ONE 15-AMPERE, 1-POLE MOLDED CASE CIRCUIT BREAKER TO SUPPLY THE IN-LINE FAN.

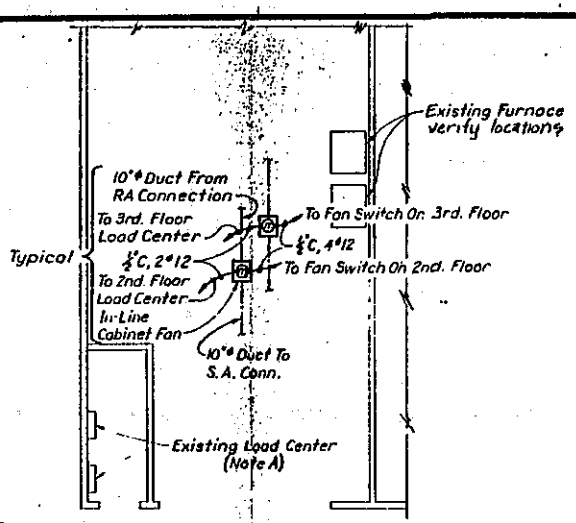
E-65

DESIGN			State of CALIFORNIA DEPARTMENT OF TRANSPORTATION	STRUCTURES MECHANICAL-ELECTRICAL	S.F. DWELLING - NOISE ATTENUATION BUILDINGS NOS. 575 AND 579
DETAILS	Frank Segura 2/11/82				
QUANTITIES					

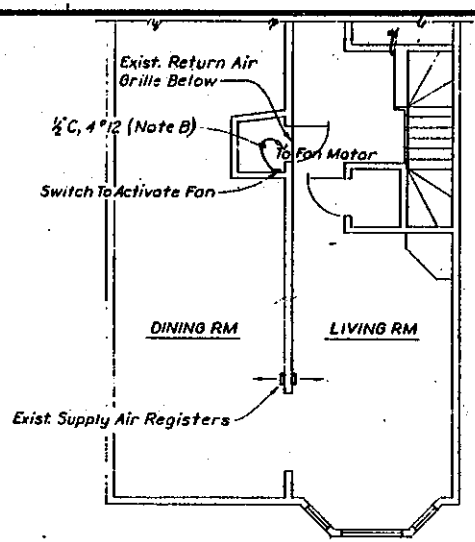
ORIGINAL SCALE IN INCHES FOR REDUCED PLANS

CU 04226
WO 100071

SHEET ME-



PARTIAL PLAN-1ST FLOOR-BUILDING NOS.585/587

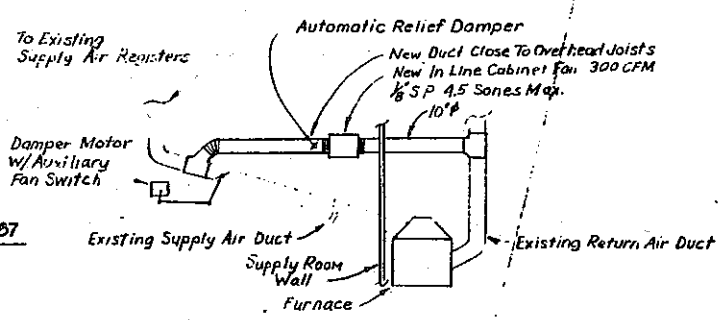


PARTIAL PLAN-3RD FLOOR-BUILDING NO 585/587

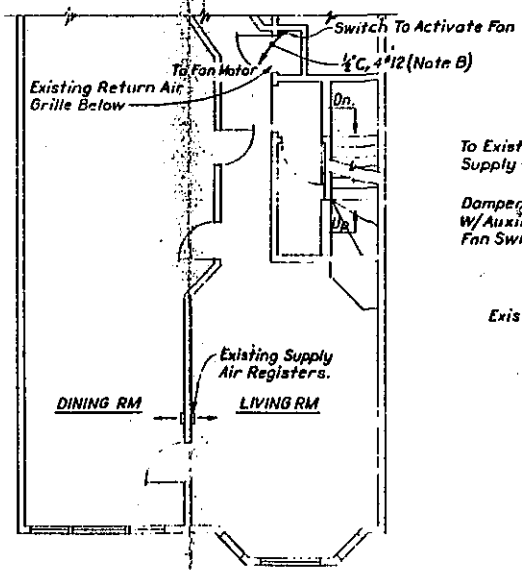
NOTES:

A. EXISTING LOAD CENTER IS 100-AMPERE, 120/240-VOLT, AC, 1Ø, 3-WIRE, STABLOCK CATALOG NO. 108-16H1 LOAD CENTER. INSTALL 15-AMPERE, 1-POLE MOLDED CASE CIRCUIT BREAKER IN EACH LOAD CENTER TO SUPPLY NEW IN-LINE FANS.

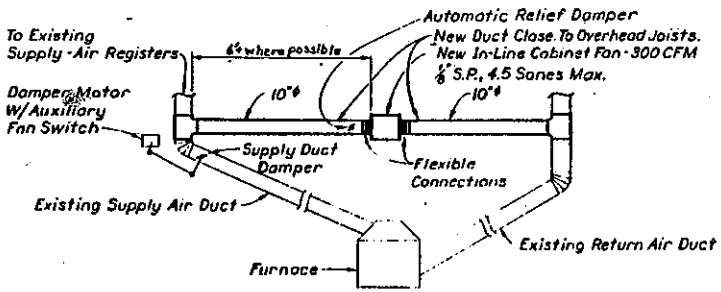
B. INSTALL CONDUIT OR CABLE IN THE RETURN AIR PLENUM. EXPOSED RACEWAY IN THE LIVING QUARTER SHALL BE 2-PIECE, LAY-IN TYPE SURFACE METAL RACEWAY.



IN LINE VENTILATION FAN INSTALLATION
BLDG 585/587

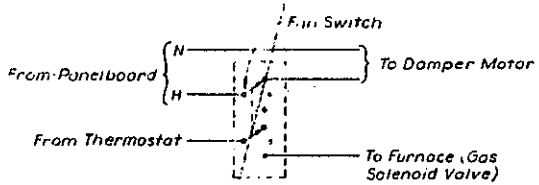


PARTIAL PLAN-2ND FLOOR-BUILDING NOS.585/587



IN-LINE VENTILATION FAN INSTALLATION

NOTES:
1. INSTALL CONDUIT AND WIRES BETWEEN INLINE CABINET FAN, DAMPER MOTOR, AND FURNANCE AS REQUIRED FOR PROPER OPERATION.
2. DAMPER MOTOR SHALL CLOSE SUPPLY DUCT DAMPER PRIOR TO STARTING IN-LINE CABINET FAN.
3. DRAWING TYPICAL FOR BLDG. 570.
4. INSTALL IN-LINE CABINET FANS WHERE DESIGNATED BY THE ENGINEER. PROVIDE DUCT MODIFICATIONS AS NECESSARY.
5. BLDG. 585/587: MODIFY NEW DUCT TO MEET STRUCTURAL RESTRICTIONS.



FAN SWITCH SCHEMATIC

E-66

Scale: None	DESIGN: N. Oafuro	State of CALIFORNIA DEPARTMENT OF TRANSPORTATION	STRUCTURES MECHANICAL-ELECTRICAL	BRIDGE NO.	S.F. DWELLING - NOISE ATTENUATION	SHEET ME-
	DETAILS: Frank Segura 2/9/82			POST MILE	BLDG.NOS.585/587 & TYP. FAN INSTALLATION	
	QUANTITIES: D. Oafuro		CU 04226 WO 100071			

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS

A. --The Contractor shall keep himself fully informed of all existing and future State and Federal laws and county and municipal ordinances and regulations which in any manner affect those engaged or employed in the work, or the materials used in the work, or which in any way affect the conduct of the work, and of all such orders and decrees of bodies or tribunals having any jurisdiction or authority over the same. He shall at all times observe and comply with, and shall cause all his agents and employees to observe and comply with all such existing and future laws, ordinances, regulations, orders, and decrees of bodies or tribunals having any jurisdiction or authority over the work; and shall protect and indemnify the State of California, and all officers and employees thereof connected with the work, including but not limited to the Director of Transportation and staff, against any claim or liability arising from or based on the violation of any such law, ordinance, regulation, order, or decree, whether by himself or his employees. If any discrepancy or inconsistency is discovered in this contract in relation to any such law, ordinance, regulation, order or decree the Contractor shall forthwith report the same to the State in writing.

B. --The attention of the Contractor is directed to, and he agrees to comply with, all of the applicable provisions of the Labor Code including those provisions requiring the payment of not less than the general prevailing rate of wages; and he further agrees to the forfeitures provided for in said Code in the event a violation of any of the provisions occurs in the execution of this contract.

C. The mentioning of certain statutes in this contract shall not relieve the Contractor from the responsibility of complying with any other statutes applicable to the service or rental to be furnished hereunder.

D. The Contractor shall indemnify the State against all loss and damage to the Contractor's property or equipment during its use under this contract and he shall at his own expense maintain such fire, theft, liability or other insurance as he deems necessary for his protection. The Contractor assumes all responsibility which may be imposed by law for property damage or personal injuries caused by defective equipment furnished under this contract or by operations of the Contractor or his employees under this contract.

E. The cost of employer payments to or on behalf of employees, subsistence, travel, compensation insurance premiums, unemployment contributions, social security taxes, contract bond premiums, and any other taxes or assessments INCLUDING SALES TAXES required by law or otherwise shall be included in the price bid and no additional allowance will be made therefor, unless *separate payment provision should specifically be provided for.*

F.—It is expressly agreed that all persons engaged on this work are employees of the Contractor and that none are employees of the Department of Transportation of the State of California.

G.—If contract bonds are required, alterations, extensions of time, extra and additional work, and other authorized contract changes may be made without securing consent of the sureties on said bonds.

H.—Pursuant to the authority contained in Section 591 of the Vehicle Code, the Department has determined that within such areas as are within the limits of the project and are open to public traffic, the Contractor shall comply with all of the requirements set forth in Divisions 11, 12, 13, 14 and 15 of the Vehicle Code. The Contractor shall take all necessary precautions for safe operation of his equipment and the protection of the traveling public from injury and damage from such equipment.

I.—ASSIGNMENT OF ANTITRUST ACTIONS.—The Contractor's attention is directed to the following provisions of Government Code Sections 4551 and 4552 (Stats. 1978, Ch. 414) which shall be applicable to the Contractor and his subcontractors on public works contracts or to the bidder on contracts for the purchase of goods, materials or services:

> "In entering into a public works contract or a subcontract to supply goods, services, or materials pursuant to a public works contract, the Contractor or subcontractor offers and agrees to assign to the awarding body all rights, title, and interest in and to all causes of action it may have under Section 4 of the Clayton Act (15 U.S.C. Sec. 15) or under the Cartwright Act [Chapter 2 (commencing with Section 16700) of Part 2 of Division 7 of the Business and Professions Code], arising from purchases of goods, services, or materials pursuant to the public works contract or the subcontract. This assignment shall be made and become effective at the time the awarding body tenders final payment to the Contractor, without further acknowledgement by the parties."
>
> "In submitting a bid to a public purchasing body, the bidder offers and agrees that if the bid is accepted, it will assign to the purchasing body all rights, title, and interest in and to all causes of action it may have under Section 4 of the Clayton Act (15 U.S.C. Sec. 15) or under the Cartwright Act [Chapter 2 (commencing with Section 16700) of Part 2 of Division 7 of the Business and Professions Code], arising from purchases of goods, materials, or services by the bidder for sale to the purchasing body pursuant to the bid. Such assignment shall be made and become effective at the time the purchasing body tenders final payment to the bidder."

WHITE-HEADQUARTERS
YELLOW-CONTRACTOR
GREEN-CONTROLLER
PINK-DISTRICT OFFICE
GOLDENROD-FIELDMAN
BLUE-CONTRACTOR'S FILE

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

Sheet ..... of .....

Co. Route P.M.

SOURCE		CHARGE		EXP. AUTH.		SPECIAL DESIGNATION		OBJECT	AMOUNT DEBIT OR CREDIT	FISCAL YEAR	ENC. CODE	ENCUMBRANCE DOCUMENT NUMBER
DIST.	UNIT	DIST.	UNIT	GEN. LED.	SUB-ACCT	PRE-FIX	SUB-JOB NO -R/W PARCEL NO					
				WORK ORDER NO.			LOCATION BRIDGE NO. ETC.					

ITEM	CHAPTER	STATUTES	FISCAL YEAR

I hereby certify upon my own personal knowledge that budgeted funds are available for the period and purpose of the expenditure stated above.

SIGNATURE OF ACCOUNTING OFFICER	DATE

CONTRACT NO. _____
This number to be placed on all bills

....., CALIFORNIA,

....., 19 .....

Contractor's Name ..... Phone .....
(Please bill as above)

Address .....
License No. and Class

The Contractor hereby agrees to furnish the service or rental as hereinafter set forth to the Department of Transportation in accordance with the provisions on BOTH SIDES of this form and on the attached sheets, if any, and he agrees to receive and accept as full compensation therefor the prices named herein:

All labor, materials, tools and equipment necessary to

SAMPLE CONTRACT

The work is to be done in accordance with Notice to Bidders, and Special Provisions No. and General Specifications therein referred to and with the Proposal attached hereto and made a part hereof.

By my signature hereunder, as Contractor, I certify that I am aware of the provisions of Section 3700 of the Labor Code which require every employer to be insured against liability for worker's compensation or to undertake self-insurance in accordance with the provisions of that code, and I will comply with such provisions before commencing the performance of the work of this contract.

The said Department of Transportation hereby agrees to the terms as above set forth, and hereby agrees to pay the same, provided, that by mutual consent this agreement may be modified and that the State reserves the right to terminate this agreement upon written notice to the Contractor.

IN WITNESS WHEREOF, the parties to these presents have hereunto set their hand the year and date first above written.

DEPARTMENT OF TRANSPORTATION

By .....

Approved by .....

CONTRACTOR

Firm Name .....

By .....

Title or Position .....

→ MAIL BILLS IN TRIPLICATE TO:

DAS-OBM-1284PW (Rev. 5/80)

E-68

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION
PAYROLL
Form HC-347 (REV. 6-75) (WH-347)

(For Contractor's Optional Use; See Instruction. FORM HC-347 (Instructions)

NAME OF CONTRACTOR OR SUBCONTRACTOR (1) | ADDRESS

PAYROLL NO. | FOR WEEK ENDING | PROJECT AND LOCATION | PROJECT OR CONTRACT NO.

(1) NAME, ADDRESS AND SOCIAL SECURITY NUMBER OF EMPLOYEE	(2) NO. OF WITH-HOLDING EXEMPTIONS	(3) WORK CLASSIFICATION	OT OR ST.	(4) DAY AND DATE / HOURS WORKED EACH DAY	(5) TOTAL HOURS	(6) RATE OF PAY	(7) GROSS AMOUNT EARNED: THIS PROJECT	(7) GROSS AMOUNT EARNED: ALL PROJECTS	(8) DEDUCTIONS (BASED ON GROSS AMOUNT EARNED - ALL PROJECTS): FED. TAX.	FICA (SOC. SEC	STATE TAX	SDI	VAC	OTHER	TOTAL DEDUCTIONS	(8) NET WAGES PAID FOR WEEK	CHE NO
(2)		(3)	O / S	(4)		(5)										(6)	(7)
			O / S														
			O / S														
			O / S														
			O / S														
			O / S														
			O / S														
(8) OWNER - OPERATOR			O / S														
			O / S														

SAMPLE

E-69

INSTRUCTIONS TO COMPLETE FORM SHOWN BY CORRESPONDING NUMBERS.

1. Reporting Contractor's Name, Address, Payroll No., Project Location and Contract No.
2. Employee(s) full name, address and social security number. (Address and social security number need only be shown on the first payroll on which employee appears.)
3. Employee(s) classification according to work acutally performed. Not necessarily union classification. (Might be Painter one day and Laborer next day.)
4. Employee(s) daily and weekly hours worked in each class cation including actual overtime hours worked on this contract only.
5. Employee(s) basic hourly wage rate and overtime hourly wage rate.
6. Net wages paid.
7. Check Number. (Payrolls not acceptable without check n
8. Owner-operator and/or partnership companies must also f out 1,2,3,4,5,6 listed above. Certification as owner/ operator and/or partnership may be made on face of the

9. Statement of Compliance must accompany each payroll and be filled out in its entirety.

a. Fringe benefit payments will be indicated by checking appropriate box on statement.
b. Statement must be signed by an authorized officer or employee of the contractor or subcontractor.

STATEMENT OF COMPLIANCE (9)

Date _____

I _____ _____ _____ do hereby state:
(Name of signatory party) (Title)

(1) That I pay or supervise the payment of the persons employed by _____ on
(Contractor or subcontractor)
the _____ that during the payroll period commencing on the _____ day of _____,
(Building or work)
19____ and ending the _____ day of _____, 19 _____, all persons employed on said project have been paid the full weekly wages earned, that no rebates have been or will be made either directly or indirectly to or on behalf of said
_____ from the full weekly wages earned by any person and that no deductions have
(Contractor or subcontractor)
been made either directly or indirectly from the full wages earned by any person, other than permissible deductions, as described below:

_____

_____

_____

(2) That any payrolls otherwise under this contract required to be submitted for the above period are correct and complete; that the wage rates for laborers or mechanics contained therein are not less than the applicable wage rates contained in any wage determination incorporated into the contract; that the classifications set forth therein for each laborer or mechanic conform with the work he performed.

(3) That any apprentices employed in the above period are duly registered in a bona fide apprenticeship program registered with a State apprenticeship agency.

(4) That:

(a) WHERE FRINGE BENEFITS ARE PAID TO APPROVED PLANS, FUNDS, OR PROGRAMS

☐ In addition to the basic hourly wage rates paid to each laborer or mechanic listed in the above referenced payroll, payments of fringe benefits as listed in the contract have been or will be made to appropriate programs for the benefit of such employees, except as noted in Section 4(c) below.

(b) WHERE FRINGE BENEFITS ARE PAID IN CASH

☐ Each laborer or mechanic listed in the above referenced payroll has been paid, as indicated on the payroll, an amount not less than the sum of the applicable basic hourly wage rate plus the amount of the required fringe benefits as listed in the contract, except as noted in Section 4(c) below.

(c) EXCEPTIONS

EXCEPTION (CRAFT)	EXPLANATION

Remarks:

NAME AND TITLE	SIGNATURE

On federally-funded projects, permissible deductions are defined in Regulations, Part 3 (29 CFR Subtitle A), issued by the Secretary of Labor under the Copeland Act, as amended (48 Stat. 948, 63 Stat. 108, 72 Stat. 967; 76 Stat. 357; 40 U.S.C. 276c).

Also, the willful falsification of any of the above statements may subject the contractor or subcontractor to civil or criminal prosecution (see Section 1001 of Title 18 and Section 231 of Title 31 of the United States Code).

HC-347 (REV. 6 73)
FWH-347

DISTRICT 7

PROJECT REPORT

Approved by: Approval date: 3/8/83

R H Ramey
R. H. RAMEY
Deputy District Director

To: MR. R. H. RAMEY
Deputy District Director

From: MR. C. E. SHEARER, Chief
Project Development Branch C

07-VEN-101 17.7
At Central Avenue
Private Residence at
505 N. Wood Road
Camarillo
07203-001171-595210104
HB311

PR 07-2675

I. INTRODUCTION

It is proposed to noise insulate a privately owned dwelling on Route 101 (Ventura Freeway) at Central Avenue. This is an experimental project. The purpose of the project is to determine the feasibility of providing noise insulation features in residences and to research the effectiveness of different noise attenuation techniques relative to cost, interior noise reduction and energy conservation.

Cost is estimated at $25,000 to be funded from the HB311 Program in the 1983/84 Fiscal Year.

II. PROJECT CATEGORY

This is a Category 5 project on the basis of the definitions under Category 5 (2-5.2(5) of the PDPM) and the finding by the Environmental Planning Branch that this project is categorically exempt under Class 1(c)(21), Section 1510.1, of the Department Environmental Regulations.

III. BACKGROUND

On January 17, 1977, the Federal Highway Administration issued notice N5080.62 regarding the National Experimental and Evaluation Program (NEEP) Project No. 21 - Noise Insulation for Private Dwellings. District 07 is one of the two districts to participate in the program. Six residences located in the

cities of Camarillo, Hollywood and San Clemente were selected for noise attenuation based on their location site characteristics, cost effectiveness, and noise levels. The interior noise readings of five selected houses were too low for research study. Only one house located adjacent to the Ventura Freeway in Camarillo qualifies for the noise insulation program. The interior noise levels with windows closed and open were from L_{eq} 50 dBA to 52 dBA and from L_{eq} 57 dBA to 60 dBA respectively.

More lanes are being added to the portion of the freeway adjacent to this residence, and there will be a slight increase in noise levels. Because there is only one home isolated in this area, the District made a commitment to the property owner to air condition his residence rather than constructing a soundwall.

IV. EXISTING FACILITY

The project site is located at 505 North Wood Road, Camarillo. The structure is a one-story farmhouse surrounded by agricultural areas. The house consists of three bedrooms and one living room. It is about 75' from the Central Avenue off-ramp of the northbound freeway. (See Exhibit A and B)

The Route 101 Freeway is a major north-south freeway joining Santa Barbara County in the north and Los Angeles County in the south. The existing freeway in the project area is a 4-lane freeway, and is now being increased to 3 lanes in each direction. It was constructed in 1954 as a Federal-Aid project.

V. TRAFFIC DATA

Not applicable.

VI. DEFICIENCIES AND JUSTIFICATION

The results of noise measurements indicate that the interior noise levels in rooms with windows and doors open vary from L_{eq} 57 dBA to 60 dBA, which is 5 to 8 dBA over the Federal standard. (See Exhibit C)

A lane in each direction is being added to the Ventura Freeway in the City of Camarillo. The noise level at the residence would be expected to increase by 3 dBA after construction is completed.

Construction of noise barrier for this isolated residence is not feasible for economical and archeological reasons. A practical method is to provide acoustical insulation in lieu of soundwall to reduce freeway traffic noise in the house.

VII. PROPOSAL DESCRIPTION

A. Detailed Description of Work to be Performed

It is proposed to provide acoustical insulation. Acoustical insulation treatment of the private home will include the following:

1. Remove all window assemblies and replace with aluminum and/or wood sash with 1/4" thick plate glass.

2. Modify existing doors with installation of weather strips and gaskets.

3. Fully seal all windows and doors to make essentially airtight.

4. Install an air conditioning system.

B. Alternatives

The only alternative to this project is soundwall construction. This alternative is rejected because it costs considerably more than acoustical insulation alternative. Also, because of an archeological resource, construction of a soundwall has been ruled out.

C. Cooperation

The District and the homeowner will enter into an agreement to perform noise insulation work at the residence. This agreement will include the following provisions:

State Agrees:

To conduct noise measurement inside and outside the residence before and after construction.

To design and construct alterations to the building and to permit homeowner to review and approve plans and specifications for the alterations.

To monitor energy usage for residence for two years preceding and following construction of alterations.

To provide normal maintenance of mechanical unit installed as part of the alterations during the monitoring period of energy usage.

To pay all engineering, construction and other costs accrued under the terms of the agreement including any excess utility cost and per diem allowances for temporary relocation during construction.

Homeowner Agrees:

To notify his assignees of the terms of the agreement by written notice.

To notify State by written notice of any proposed changes in property ownership.

To provide access to residence before, during and after construction.

To provide energy use records during monitoring period.

To assume all responsibility for the operation and maintenance of alterations upon termination of the monitoring period.

To participate in an interview by State after alterations.

D. Cost Estimates

The estimated cost for the acoustical treatment of this house will be approximately $25,000 including air conditioning.

E. Right-of-Way

Right-of-Way would not be required.

VIII. PROPOSAL FUNDING

A. Programming

This project will be part of the Community Noise Attenuation Program Minor A Category (coded HB311) in the 1983/84 Fiscal Year.

B. Recommended Project Budgetary Description

The project should be described as:

07-VEN-101	17.7	In Camarillo at Central Avenue; install acoustical insulation of private dwelling (experimental project); estimated construction cost $25,000.

IX. OTHER CONSIDERATIONS

Not applicable.

X. PROJECT REVIEWS

A. FHWA

We discussed this project with Jim Lee, FHWA Reviewer, on October 15, 1982. He indicated that since there was only one residential home to be noise attenuated by air conditioning and we followed the procedure of the work plan prepared by District 04 and approved by the FHWA earlier, a work plan for this project was not required. He also stated that this project would qualify for Federal participation.

B. Community Involvement - Homeowner

This is a research project involved with only one property owner who has been contacted personally and interviewed. He accepted the acoustical insulation treatment in his house.

XI. PUBLIC HEARING PROCESS

Not applicable.

XII. FREEWAY AGREEMENTS

Not applicable.

XIII. ENVIRONMENTAL CERTIFICATION

The appropriate environmental documentation has been prepared in accordance with Department Environmental Regulations for the proposed work as described in this report. The work described herein is categorically exempt in accordance with Class 1(c) of the Department Environmental Regulations and is a categorical exclusion under Federal Highway Guidelines.

K. D. STEELE, Chief
Environmental Planning Branch

Date: 3-1-83

XIV. RIGHT OF WAY CERTIFICATION

I have reviewed the right-of-way data contained in this Project Report and find it to be complete, current and accurate.

Kay M. Campbell
K. M. CAMPBELL, Chief
R/W Planning & Management Branch

Date: 7-8-83

XV. PROJECT PERSONNEL

E. Chow Project Engineer, Project Development Branch C	ATSS 640-3481
R. V. Wallin Senior Engineer, Project Development Branch C	ATSS 640-3170
C. E. Shearer Chief, Project Development Branch C	ATSS 640-3170
W. B. Ballantine Senior Planner, Environmental Planning Branch	ATSS 640-4978
G. R. Morton Reviewer, Office of Right of Way	ATSS 640-3121
S. Brown Transportation Planning Branch Representative	ATSS 640-4428
R. Kermode Program Advisor	ATSS 640-5166
H. T. Yamaguchi Chief, Program Management Branch	ATSS 640-3340
D. W. Cross Chief, Project Management Branch	ATSS 640-3738

XVI. RECOMMENDATION

It is recommended that this Project Report be approved as proposed in Section VII and authorization be given to prepare PS&E.

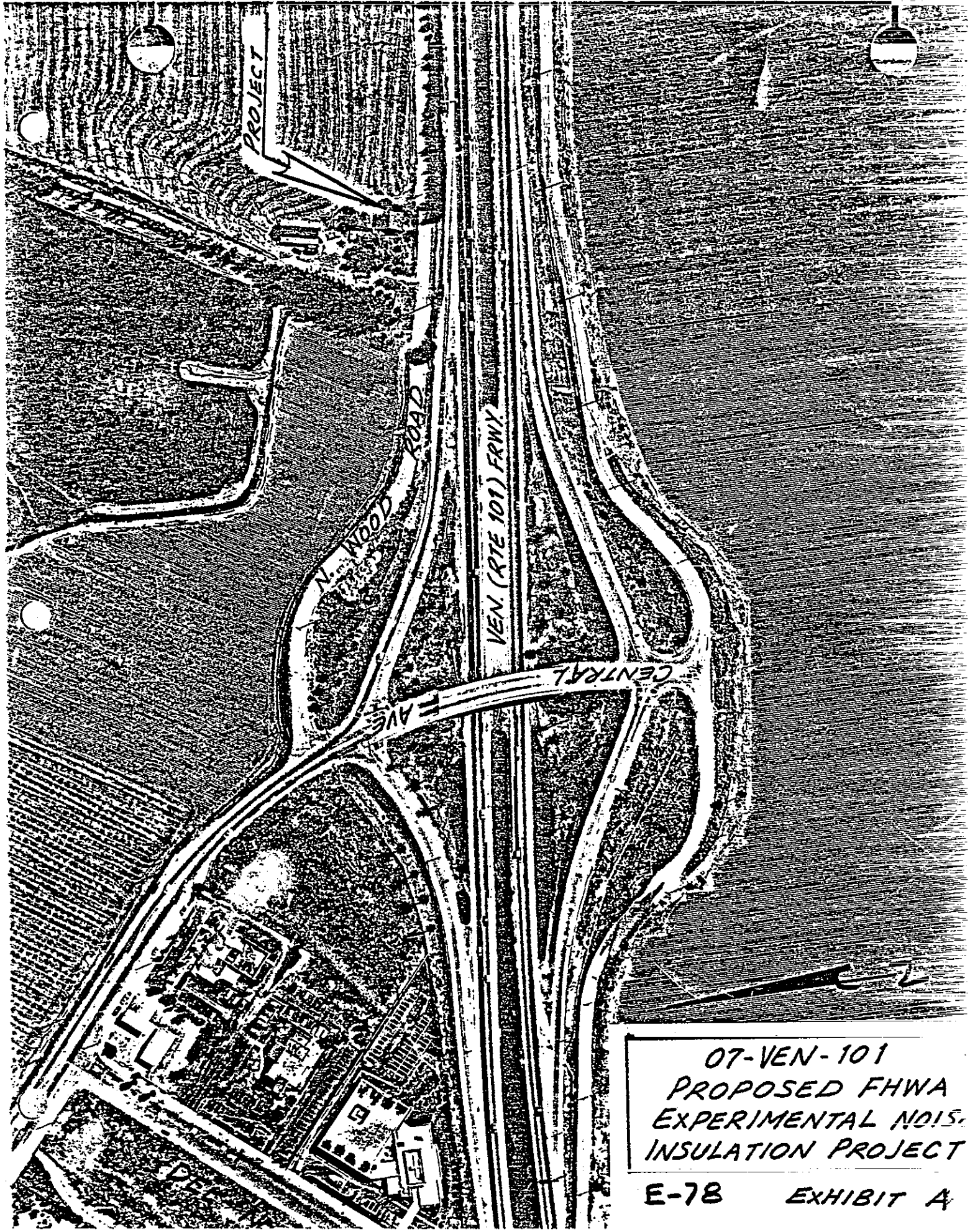
XVII. ATTACHMENTS

1. Exhibit A - Project Location Map
2. Exhibit B - Photographs
3. Exhibit C - Pre-insulation Noise Measurements and Traffic Data
4. Exhibit D - Floor Plan
5. Exhibit E - Environmental Evaluation Document

RECOMMENDED BY:

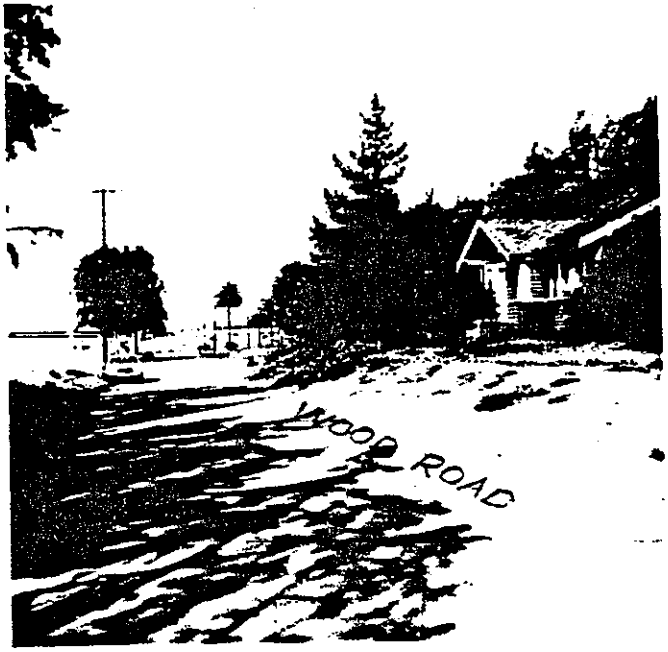
C. E. SHEARER, Chief
Project Development Branch C

Date: 2-18-83



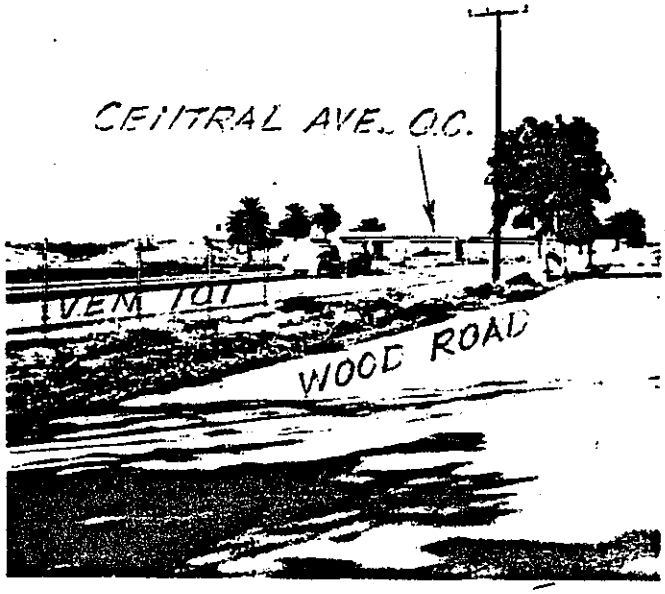
07-VEN-101
PROPOSED FHWA
EXPERIMENTAL NOISE
INSULATION PROJECT

E-78 EXHIBIT A



VIEW OF FREEWAY, WOOD RD., AND HOUSE.

SOUTH END VIEW OF HOUSE,
505 N. WOOD ROAD
CAMARILLO, CA



VIEW OF FREEWAY WITH
CENTRAL AVE. O.C.
LOOKING NORTH

EXHIBIT B

TRANSLAB NOISE SECTION

DISTRICT 7 NOISE INSULATION MEASUREMENTS
BEFORE INSULATION
SUMMARY OF 15 MINUTE L_{eq}'s.
L_{eq}, dBA

Site & Run	Date	Time	Mic.No.	Outside	Inside Closed	Inside Open	Inside AdBA	Location & Comments (Refer to Fig. 1-6)
3	10-28-81	10:20-10:35	2	74				Outside-Front
			4		52		22	Living Room
Run 2			5		50		24	Front Bedroom
3	10-28-81	10:45-11:00	2	74				Outside Front
			4			57	17	Living Room
Run 3			5			60	14	Front Bedroom

DISTRICT 7 NOISE INSULATION MEASUREMENTS

SUMMARY OF TRAFFIC VOLUMES

(Hourly Volumes Extrapolated From Fifteen Minute Counts.)

SITE & DATE	RUN	*VEH. TYPE	VEHICLES PER HOUR SOUTH BOUND LANES 4	3	2	1(Fast)	NORTH BOUND LANES 1(Fast)	2	3	4
3 10-28-81	1	A		84	536	600	988	540	136	
		MT		4	44	8	20	48	20	
		HT		16	36	12	24	108	0	
	2	A		128	568	764	980	588	104	
		MT		12	84	16	16	40	16	
		HT		28	64	28	12	68	12	
	3	A		84	616	800	912	568	80	
		MT		12	60	4	28	56	16	
		HT		0	36	12	20	48	4	

*VEHICLE TYPES Per FHWA RD 77-108:
A = Autos
MT = Medium Trucks
HT = Heavy Trucks

EXHIBIT C-1

TRANSLAB NOISE SECTION

DISTRICT 7 NOISE INSULATION MEASUREMENTS
SUMMARY OF BEFORE INSULATION,
OUTSIDE & INSIDE FREQUENCY SPECTRA, CAMARILLO SITE
(Each run averaged from 10 simultaneous outside/inside peaks)
dB, Linear

Site: 3

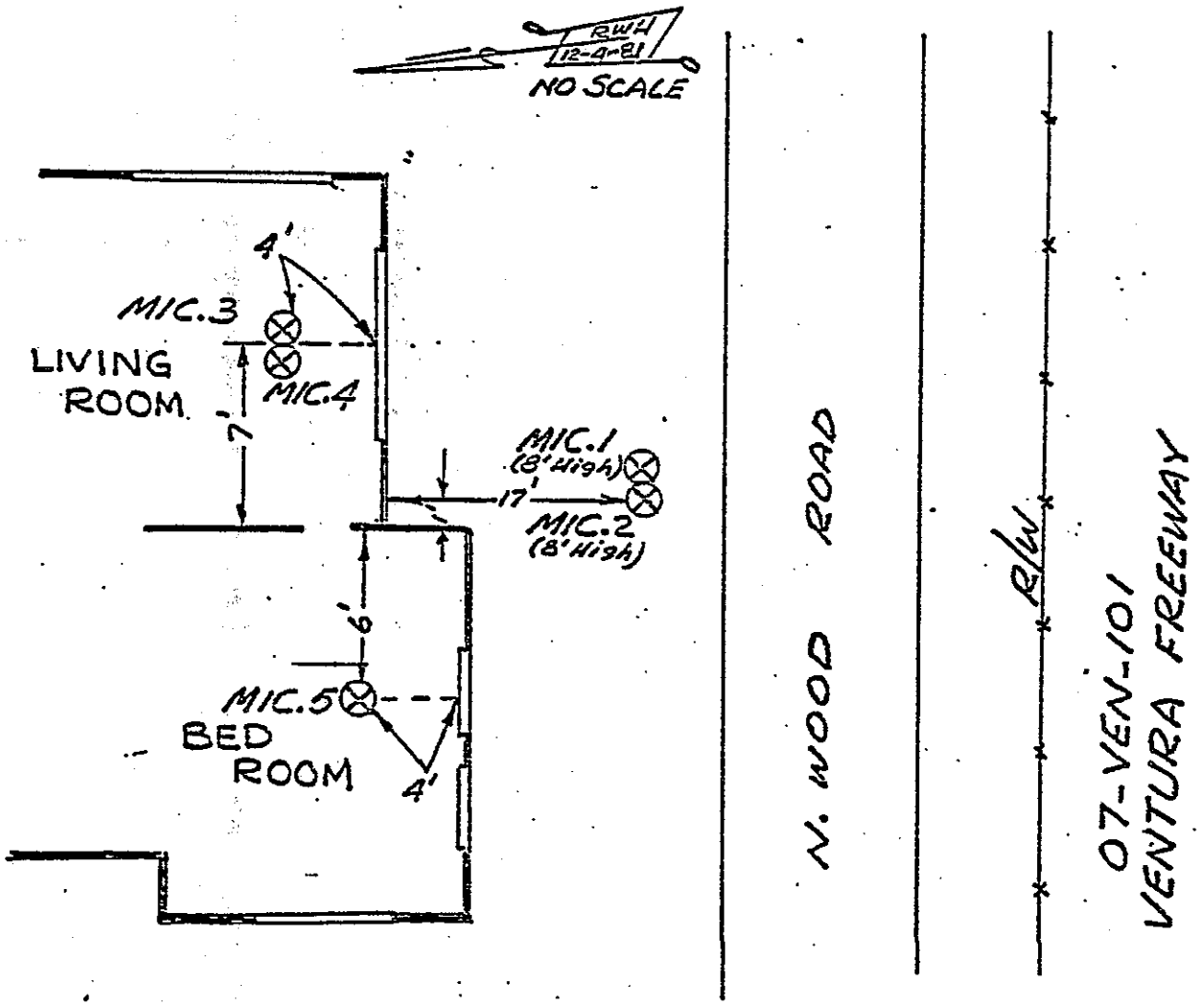
1/3 Octave Center Frequency	Run: 2 Closed Mic.1 Out	Mic.3 In	Δdb	Run: 3 Open Mic.1 Out	Mic.3 In	Δdb
25 Hz	69	66	3	66	64	2
31.5	73	65	8	69	65	4
40	74	58	16	73	60	13
50	74	62	12	73	64	9
63	75	60	15	78	68	10
80	76	59	17	73	61	12
100	77	62	15	73	58	15
125	72	50	22	73	53	20
160	71	52	19	70	55	15
200	70	50	20	70	53	17
250	69	50	19	69	54	15
315	68	44	24	66	51	15
400	69	47	22	69	53	16
500	69	47	22	68	53	15
630	70	46	24	68	53	15
800 Hz	69	47	22	68	54	14
1 KHz	69	45	24	68	53	15
1.25	67	44	23	67	51	16
1.6	66	<40		65	47	18
2	65	<40		64	48	16
2.5	62	<40		61	45	16
3.15	61	<40		60	42	18
4	58	<40		57	<40	
5	56	<40		55	<40	
6.3	53	<40		51	<40	
8	49	<40		47	<40	
10 KHz	45	<40		44	<40	

Notes: Closed and open refer to inside doors and/or windows.
Out and in refer to outside and inside; ΔdB refers to outside minus inside.

TRANSLAB NOISE SECTION
DISTRICT 7 NOISE INSULATION MEASUREMENTS

MICROPHONE LOCATIONS

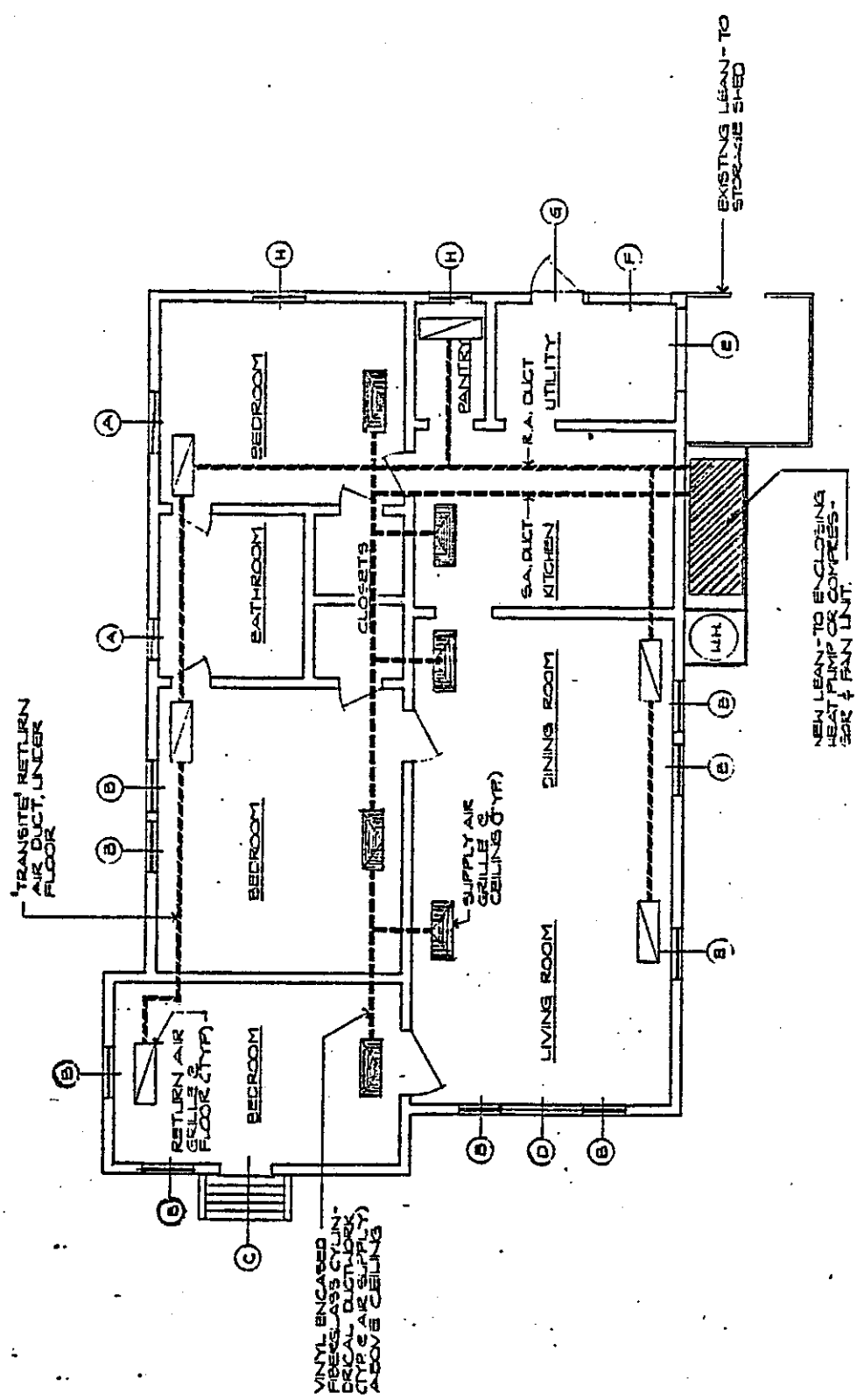
SITE NO: 3 DATE MEASURED: 10-28-'81
ADDRESS: 505 N. WOOD ROAD
CAMARILLO, CA.



⊗ = MIC. LOCATION & NUMBER (UNLESS OTHERWISE NOTED, ALL MICROPHONES WERE 5' ABOVE THE GROUND OR FLOOR)

E-82

EXHIBIT C-2



FLOOR PLAN

SCALE: 1/4" = 1'-0"

LABEL	EXISTING
A	HORIZONTAL ALUMINUM SLIDING WINDOW
B	DOUBLE HUNG WOOD
C	GLASS PANEL DOOR
D	FIXED GLASS PANEL
E	SCREENED OPENING NO GLAZING
F	SCREENED OPENING NO GLAZING
G	DOOR W/ DOUBLE HUNG WINDOW
H	DOUBLE HUNG WOOD

E-83

EXHIBIT D

Sheet No. 1

Job 108106.3

Drn SCHMIDT

Date 11-9-82

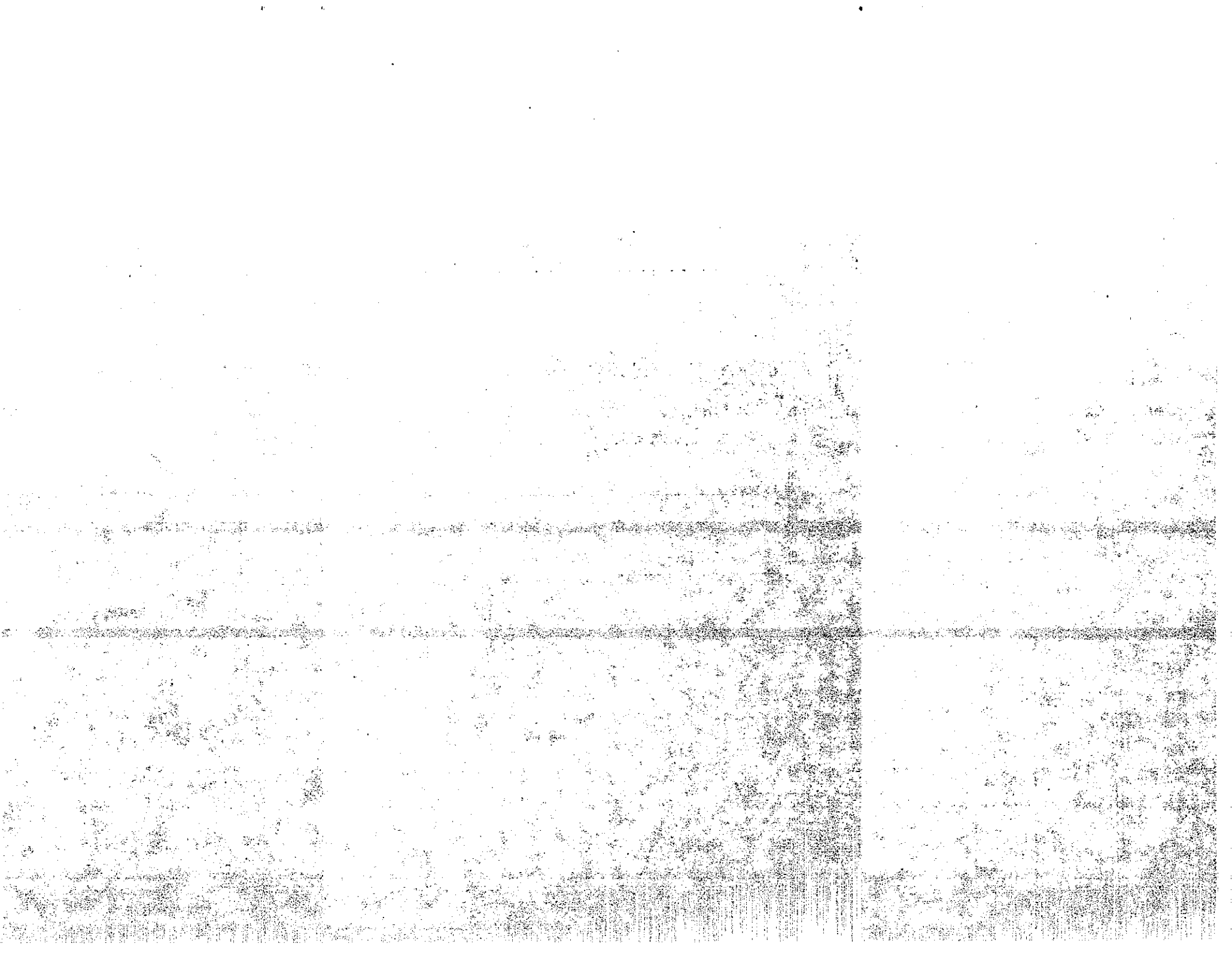
NOISE CONTROL RECOMMENDATIONS

DEPARTMENT OF TRANSPORTATION

McGRAFF RESIDENCE

Purcell + Noppe + Assoc., Inc.

Consultants on Acoustics



Consultants in Acoustics

Purcell + Noppe + Assoc., Inc. 21408 Devonshire Street, Chatsworth, California 91311 Phone (213) 882-1[illegible]

9 November 1982

Mr. Eddy Chow
Department of Transportation
Project Development, Branch D
120 South Spring Street
Los Angeles, California 90012

Subject: Remedial Noise Control Measures
District 7 Residential Noise Insulation Program
Site No. 3
P+N+A Project No. 1081065

Dear Mr. Chow:

In accordance with your authorization, we have conducted a follow-up study on the noise control requirements for the residence located at 505 North Wood Road, Camarillo, California (Site No. 3), located adjacent to the 07-LA-101 Ventura Freeway. The information transmitted by Mr. Shirley in his memorandum dated 11 December 1981 and received in this office on 20 October 1982, together with follow-up site visits by our staff are used as the reference source for determining the remedial noise control measures as set forth herein.

The attached Sheet No. 1 (Page E-83) presents a floor plan of the existing residence based on dimensional measurements obtained at the site. The plan of the residence presents keyed symbols illustrating existing

EXHIBIT B

conditions on the east, south, and west elevations which will require modifications to the existing construction as indicated below. It was observed that the exterior noise levels measured at the rear (north side) of the residence are sufficiently down in level (due to acoustic shielding), so that noise control measures on the north exposure of the residence will not be required.

Our calculations indicate that the existing frame structure and roof construction are adequate for the control of noise intrusion into the residence. It was clearly observed that the principal path of sound transmission occurs through the perimeter openings consisting of both fixed and operable glazing and an entry door which is no longer in active use. Upon close inspection of the typical openings, it was observed that the wood framing and trim has deteriorated to the point where modifications to the existing windows would not be practical from an acoustics standpoint. Accordingly, it is recommended that all window assemblies be removed and replaced with aluminum and/or wood sash and trim as apporpriate to secure a weather-tight seal. Descriptive information on the corrective measures is presented below.

It was observed that the existing glazing consists of a single strength glass and that the weather stripping is either non-existant or seriously deteriorated.

As previously stated, it will be necessary to replace the existing windows as follows:

Remove the A designated sliding windows and replace with aluminum sash which contains 1/4" thick plate glass. A suitable window for this installation is the Glide Window Series 360R as manufactured by the Unitspan Architectural Systems Incorporated, Chatsworth, California (contact Mr. Al Grossman at (213) 654-5801). We are advised by the Manufacturer's Representative that vinyl barriers can be incorporated within the window extrusion, so as to provide excellent weather stripping in addition to the typical felt weather stripping. It is also recommended that a compression gasket be supplied against the closing jamb to ensure a tight seal when the window is closed.

The openings labled "B" are double hung wood windows which should preferably be replaced with a casement type window (with 1/4" plate glass) of wood or aluminum construction. The casement configuration

would provide for an excellent seal on its entire perimeter through a compression type gasket. Suitable windows for this installation as described above are manufactured by Alcoa Building Products Model Series 500.

In the event that the Resident or Property Owner prefers a double hung unit in lieu of the casement type, a suitable product for this installation would be the De-Vac unit Model No. 450 or Clearview Model 80.

In all cases described above, the glazing would be 1/4" thickness. Also , the frame assemblies shall meet or exceed the Aluminum Manufacturers Association Specification No. DH-A2-HP.

The lower glazed panel of opening "D" should be replaced with a fixed sheet of 1/4" glass. The upper pane of decorative glass should be retained without change.

Openings designated E, F, G, and H may be retained in their present condition. Alternatively, they may be replaced at the Owner's expense with window units similar to those installed on the other elevations.

Door opening "C" is essentially a non-used door. It is recommended that the door stop be removed and a new stop be installed with weather-tight gaskets at head and jambs. Suitable gaskets would be a hollow vinyl tubing of approximately 3/8" diameter, which in the closed door configuration would be compressed to approximately 3/16". An interlocking weatherstripping at the threshold should be incorporated. Care should be taken to ensure that an air-tight seal occurs on the entire door perimeter after installation of the weather stripping and gasketing.

The glazing of the existing door is acoustically inadequate. In order to increase the overall transmission loss of the door construction, it is recommended that a sheet of 1/4" Lexan be secured to the inside of the door. The Lexan would be a single sheet which would span the entire glazed area. The Lexan would, of course, be framed with a wood trim to enhance the appearance. An alternative to the Lexan would be the installation of a full-sized mirror properly secured to the inside frame of the door.

In order that the noise levels within the residence comply with the regulations, it is essential, of course, that all windows and doors be fully sealed, essentially air-tight. Under these conditions, provisions must be incorporated to distribute air, either re-circulated

and/or fresh air within the residence. On the enclosed plan, we have shown a schematic configuration of a heat pump unit that could be conveniently located on a concrete pad within an enclosure on the east elevation of the residence. This unit would provide for the circulation of air, the heating and cooling as appropriate, and the make-up of fresh air as required. The air would be supplied to the residence by means of a vinyl encased fiberglass cylindrical duct which would enter the side of the residence on the east side above the level of the ceiling joists. The supply air routing would be ducted in the ceiling void as shown schematically in the plan. Each of the five major rooms would be furnished with a ceiling mounted supply air diffuser (two in the Living Room) which would be positioned flush in the plane of the ceiling. The diffusers would be of the 3-way throw type, which would ensure good air distribution within the separate rooms. The return air ductwork would be located beneath the floor of the residence within the existing crawl space. The return air registers would be metal grilles located flush in the floor, as appropriate. The under-floor ductwork would be of the transite type and would return directly into the lean-to beneath the heat pump. It is recommended that the services of a professional Mechanical Engineer be engaged to select the primary air source equipment and to size the

ducting and diffusers and return air grilles as appropriate to ensure a proper air change consistent with the State Health Standards.

We are of the opinion that the above recommended changes can be implemented by a General Contractor and a Mechanical Systems Contractor licensed to perform such services. It is recommended that prior to the installation of the recommended units, all details of installation be submitted to this office for review. This completes our report.

Should you have any questions re the above, please contact our office.

Sincerely yours,

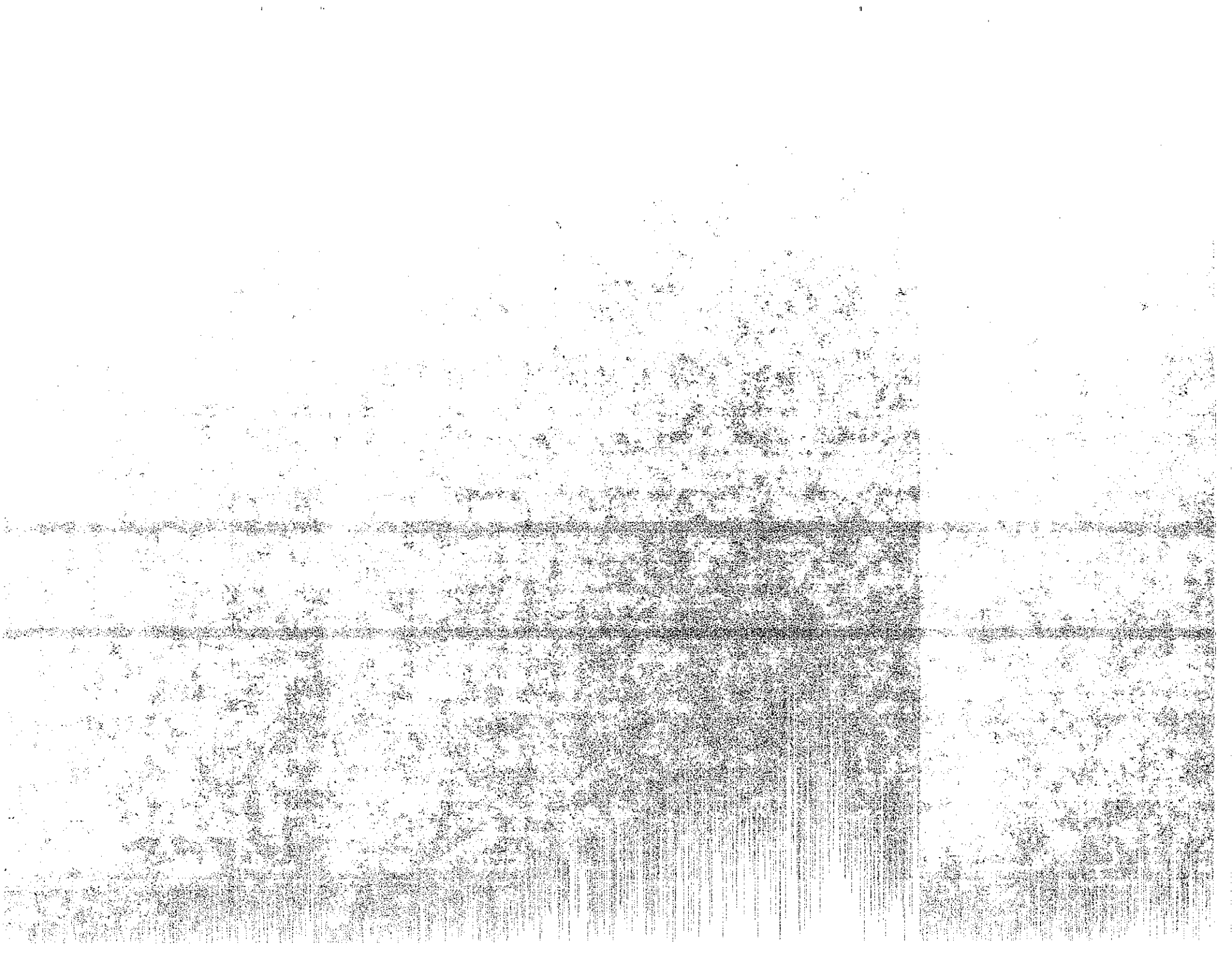
PURCELL + NOPPE + ASSOCIATES. INC.

Jack B. C. Purcell

JBCP:jpl

cc: Addressee (3)

Enclosure



Categorical Exclusion

LA CATEGORICAL EXEMPTION/~~NORMAJOR ACTION~~-DETERMINATION

Ora Ven	Various	Various	07836 292 2990 001171 595 3066 595 5669	11-23-79
County	Route	Post Miles	R.U. - E.A.	Date

Location Limits In District 07 - near state highways.

Proposal Description and Purpose (NEEP) Project No. 21) to demonstrate applicability of building insulation of private dwellings to reduce noise from transportation sources.

Categorical Exemption:

1. Will there be a significant cumulative impact by this project and successive projects of the same type in the same place? No
2. Does this project fall within exempt class 1, 3, 4, 5, 6, or 11, and might it impact on an environmental resource or hazard designated in the Environmental Goals and Policy Report issued by the Governor, or an environmental resource of hazardous or critical concern where designated, precisely mapped, and officially adopted pursuant to law? No
3. If Class 1 (c) project, will it result in significant damage to or removal of a scenic resource? No

General Rule Exemption (if applicable):

This project does not fall within an exempt class but ~~it~~ can be seen with certainty that there is no possibility that the activity may have a significant effect on the environment. N/A

Normajor Action (if applicable):

1. Is this project likely to precipitate significant foreseeable alterations in land use, planned growth, development patterns, traffic volumes, traffic patterns, transportation service, or resources? No
2. Will the project affect property protected by Section 4(f) of the DOT Act? No
3. Will the project affect property protected by Section 106 of the Historic Preservation Act? No
4. Will the project affect wetlands as defined in Executive Order 11990? No

Determination:

Based on an examination of the proposal and the response to each of the above questions:

1. It is concluded that this project properly falls within the class indicated below which is one of the classes that the Secretary for Resources has found to be and has declared categorically exempt.

   Categorically Exempt. Class 1(c) (21) Section 1510. 1 of the Environmental Regulations.

OR,

2. It is concluded the General Rule Exemption applies. N/A

GJB

C B Ballantine	12-10-79	K H Zermoglen	12/10/79
Signature-Environmental Section Senior	Date	Signature-Originating Branch Chief	Date

Are other Federal agencies involved? No

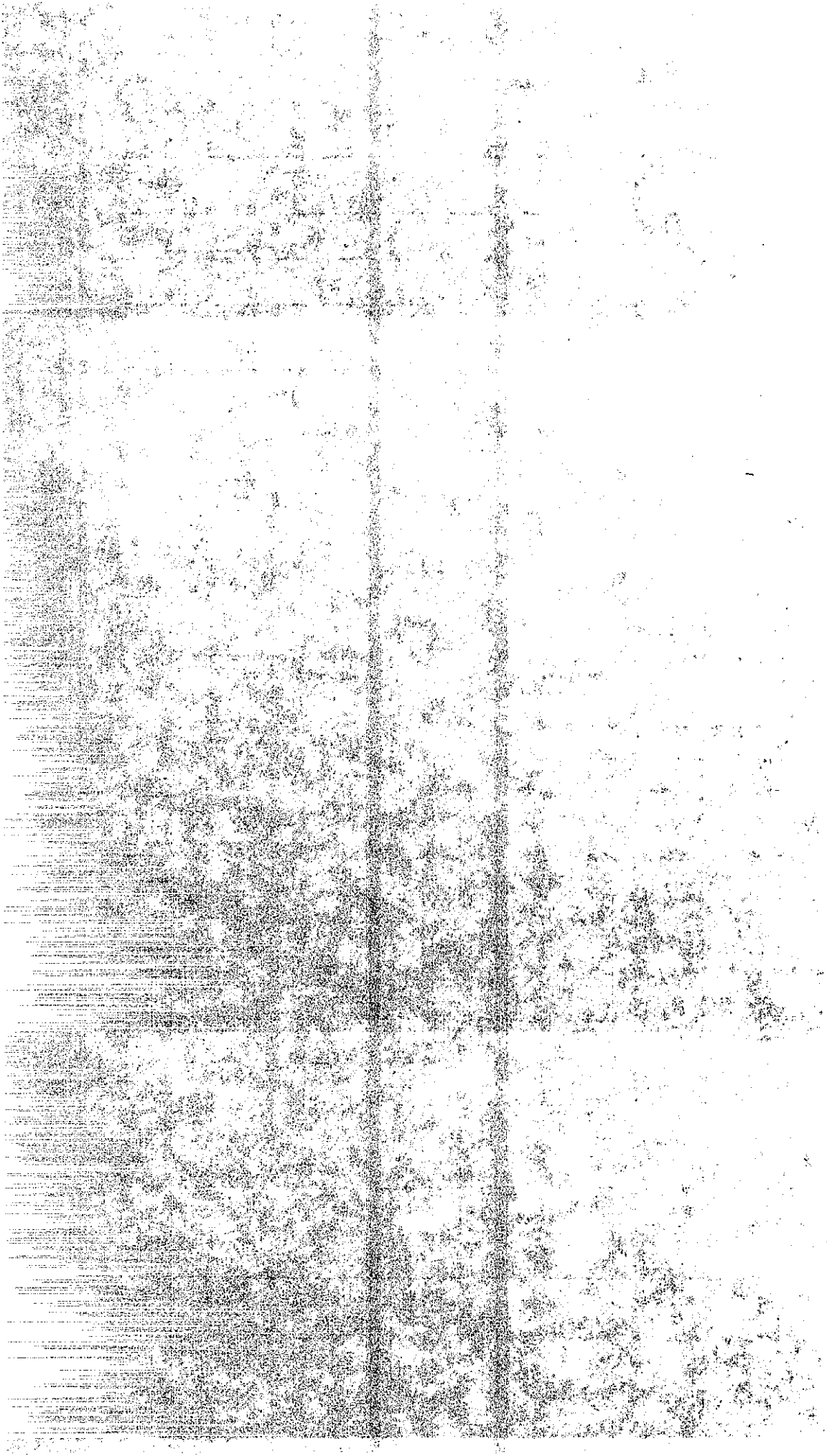
If yes, specify

Based on the evaluation of this project, it is determined that the project is a normajor action in accordance with FHPM 7-7-2, Paragraph 10.e (5).

Categorical Exclusion proposal conforming to Section 15004 of the CEQ regulations.

E-93

EXHIBIT F



Terry Heath
CONSTRUCTION CO.

GENERAL CONTRACTOR
SPECIALIZING IN INSURANCE REPAIRS
RESTORATIONS . REMODELS . FOUNDATIONS
LIC. NO. 405400 Expired 5-31-83 B

7/9/84 Renewed
5-31-85 Expired

708 LEMON GROVE AVE., VENTURA, CA. 93003 (805) 644-7014

Mr. W. McGrath
c/o State of California

RE: 505 N. Wood Rd.
Camarillo, CA

PROPOSED WORK TO BE ACCOMPLISHED	QUANTITY	UNIT PRICE	AMOUNT
5/9/84 Remove and replace on East, South and West sides of home with Anderson double-glazed vertical sliders. Replace front fixed window with ¼" plate glass. Replace 9 lite patio door and mount threshold, weather strip and locks. All windows will be fitted with a compressing type gasket to insure an air-tight seal. Windows, doors and trim inside and out will be primed and painted to match existing colors. I will supply plans, permits and all materials to complete the work. Work will begin at the time the permit is attained. Also enclosed is heat pump specifications. We propose to install a 2½ ton Heil package heat pump in the residence at the above address. This equipment would deliver 1,050 cubic feet of air per minute to the conditioned area, which would allow approximately one cubic foot of air for each square foot of living area. The duct work and registers for this system would be sized so as to insure good air diffusion and circulation throughout the entire house. The outlet velocity at the face of supply air registers would be kept at 600 feet per minute so as to eliminate the "rushing" noise caused by poorly designed systems. Fresh air would be intoduced by a 6" x 6" screened air intake situated outside the house on the return air plenum. Outside air would be set at 158 CFM by means of a manual control damper. A barometric relief would also be installed in the return air so as to eliminate a positive pressure build-up. Total - E-95			$ 18,150.00

PROPOSAL and CONTRACT

Date August 3, 19 84

TO W. McGrath, 588 Wood Road, Camarillo, California

Telephone 805/485-4210

Dear Sir:

I propose to furnish all materials and perform all labor necessary to complete the following:

as per specifications supplied by the Department of Transportation of the State of California. All work will be completed per codes, zoning and permit requirements.

All of the above work to be completed in a substantial and workmanlike manner according to standard practices of the industry for the sum of Eighteen thousand one hundred fifty Dollars ($ 18,150.00)

Payments to be made 10% of contract price when the job begins and the remainder ($16,335.00) to be paid within 30 days of completion of job.

as the work progresses to the value of _____ per cent (_____%) of all work completed. The entire amount of contract to be paid within 30 days after completion.

Any alteration or deviation from the above specifications involving extra cost of material or labor will only be executed upon written orders for same, and will become an extra charge over the sum mentioned in this contract. All agreements must be made in writing. This proposal is valid for 60 days only. Void if not accepted within the specified time.

"NOTICE TO OWNER"
(Section 7019—Contractors License Law)

Under the Mechanics' Lien Law, any contractor, subcontractor, laborer, materialman or other person who helps to improve your property and is not paid for his labor, services or material, has a right to enforce his claim against your property.

Under the law, you may protect yourself against such claims by filing, before commencing such work of improvement, an original contract for the work of improvement of a modification thereof, in the office of the county recorder of the county where the property is situated and requiring that a contractor's payment bond be recorded in such office. Said bond shall be in an amount not less than fifty percent (50%) of the contract price and shall, in addition to any conditions for the performance of the contract, be conditioned for the payment in full of the claims of all persons furnishing labor, services, equipment or materials for the work described in said contract.

Respectfully submitted,

By Larry Heath Construction Co.

685 County Square Drive, #40, Ventura
Address

805/644-7014
Telephone

State License No. 405400

Contractors are required by law to be licensed and regulated by the Contractors' State License Board. Any question concerning a contractor may be referred to the registrar of the board whose address is:

Contractors' State License Board
1020 N Street
Sacramento, California 95814

ACCEPTANCE

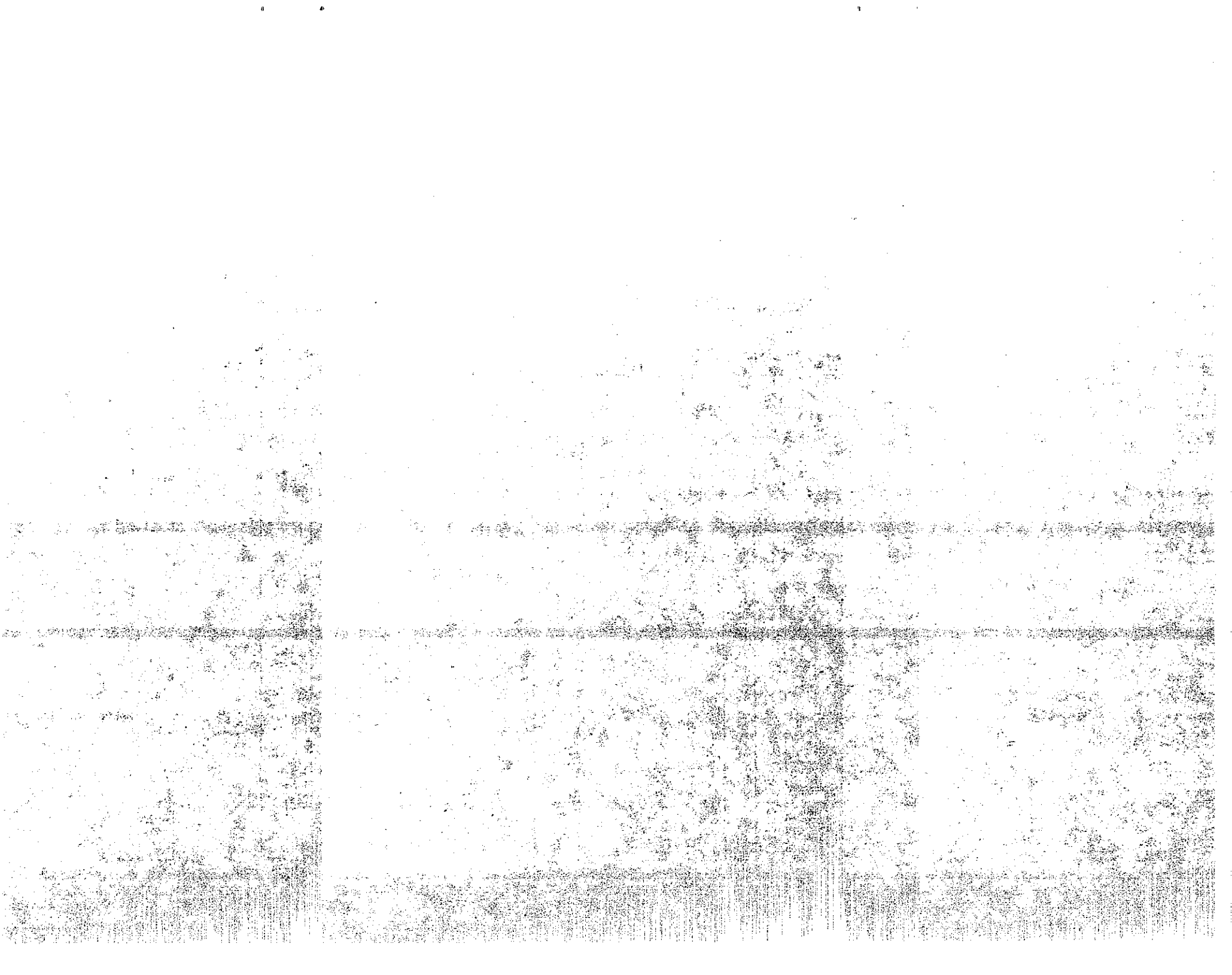
You are hereby authorized to furnish all materials and labor required to complete the work mentioned in the above proposal, for which _____ agree to pay the amount mentioned in said proposal, and according to the terms thereof.

ACCEPTED William H. McGrath Ranch

William H. McGrath

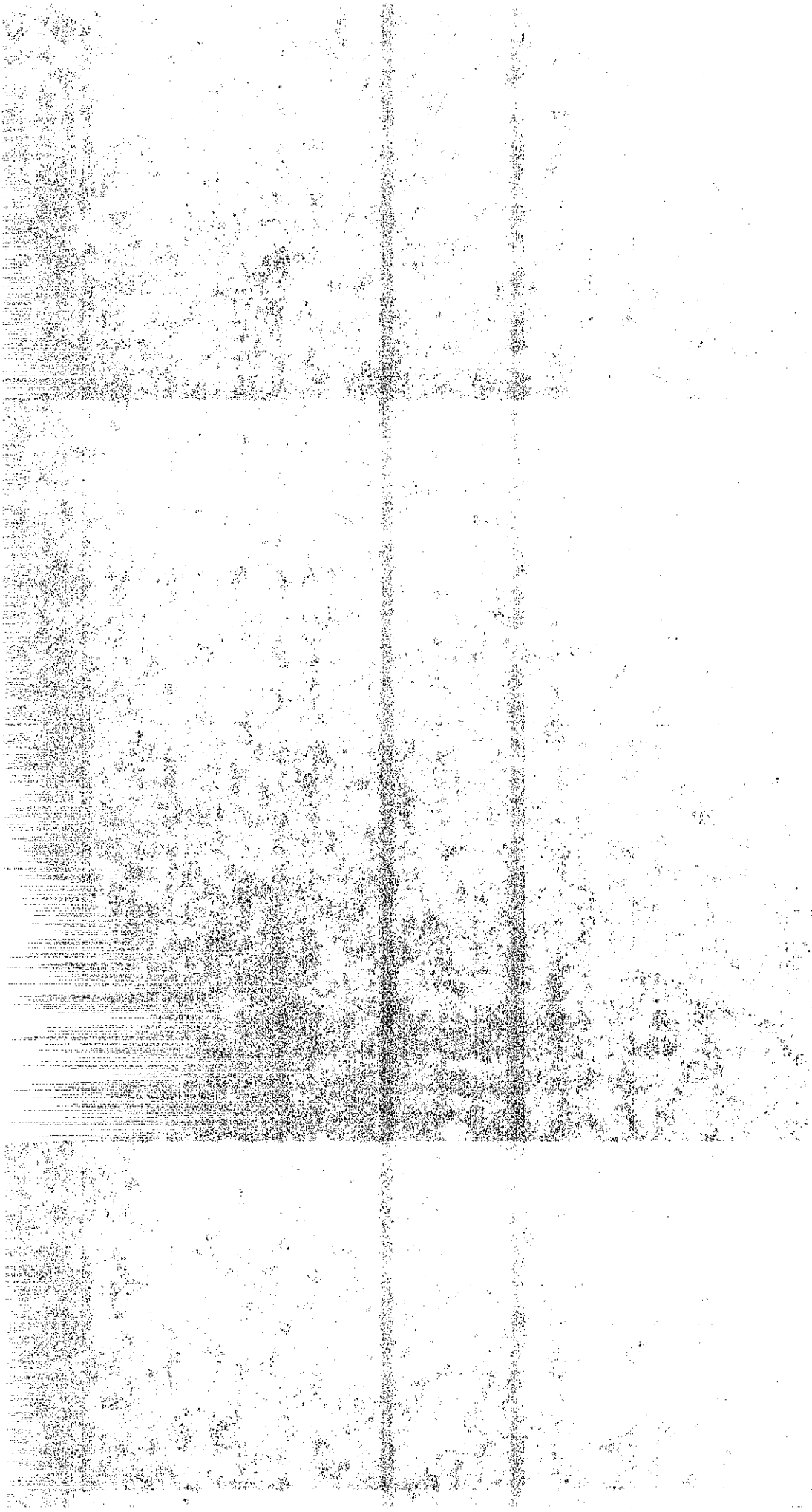
Date Aug 3, 19 84

E-97



APPENDIX F

Instrumentation



INSTRUMENTATION

All instruments were calibrated by Transportation Laboratory under the Quality Assurance Program. TransLab has the facilities and instruments for performing calibrations traceable to the National Bureau of Standards in Washington, D.C. via two B&K 4160 one inch laboratory standard microphones. These microphones are sent alternately to NBS every six months to insure the availability of a recently calibrated standard microphone at TransLab.

The following instruments were used during measurements at locations shown:

District 4 Sites

"Before" Measurements (10/15/80)

Mic. No.	Sound Level Meter	Serial No.
1	B&K 4426 #1	722789
2	B&K 4426 #2	722728
3	B&K 4426 #3	762227
4	B&K 4607 #3	359870
5	B&K 4426 (Dist. 4)	669213
6	B&K 2218 #6	742381
7	B&K 2218 #5	742328
8	B&K 2218 #4	742329
9	B&K 2218 #3	742330
10	B&K 2218 #1	742378
11	B&K 2218 #2	742327
12	Metrosonics dB-306(Dist. 4)	1653
13	Metrosonics dB-306(Dist. 4)	1654

With the exception of Mic.'s No. 12 and 13 all in instruments were connected to a custom built Noise Data Acquisition System (Data Logger) which allowed simultaneous measurements at all locations.

INSTRUMENTATION
(continued)

"After" Measurements (2/3/84)

Setup	Mic. No.	Sound Level Meter	Serial No.
A	1	B&K 2218 #2	742327
A	2	B&K 2218 #3	742330
A	5	B&K 2218 #1	742378
A	10	B&K 2218 #5	742328
A	11	B&K 2218 #6	742381
B	3	B&K 2218 #2	742327
B	4	B&K 2218 #3	742330
B	8	B&K 2218 #1	742378
B	9	B&K 2218 #4	742329
B	12	B&K 2218 #6	742381
B	13	B&K 2218 #5	742328

At each setup all instruments measured simultaneously. No data logger was used.

District 7 Site

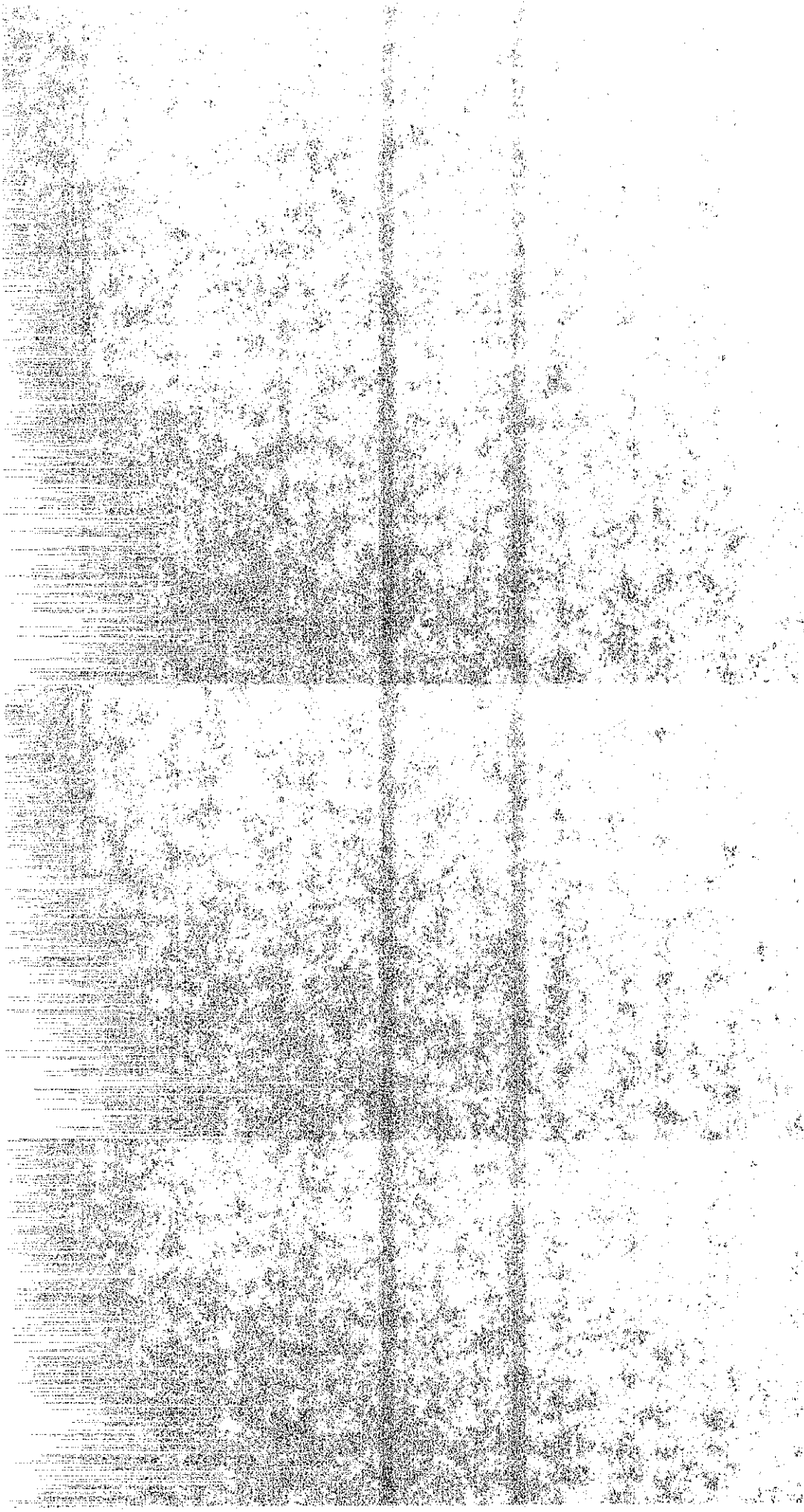
"Before" (10/28/81) and "After" (12/12/84) Measurements

Mic. No.	Sound Level Meter	Serial No.
1	B&K 2218 #1	742378
2	B&K 2218 #2	742327
3	B&K 2218 #3	742330
4	B&K 2218 #4	742329
5	B&K 2218 #5	742328

Sound level meters at Mic.'s 1 and 3 were connected to a two channel Nagra IV-SJ tape recorder for frequency analyses.

APPENDIX G

Caltrans Policy and Procedure
No. P82-2
Community Noise Abatement Program



CALIFORNIA
DEPARTMENT OF TRANSPORTATION
DAS—MA—4

policy & procedure

TITLE Traffic Noise Reduction on Existing Freeways - Community Noise Abatement Program (HB 311)	NO. P82-2
APPROVED BY R. E. WATKINS	DATE ISSUED 4-26-82
	PAGE 1 OF 3
SUBJECT AREA Motor Vehicle Noise	ISSUING UNIT Division of Transportation Facilities Design
SUPERSEDES Portions of P74-47 dated July 24, 1974	DISTRIBUTION Divisions and Districts through Section Chiefs

I. PURPOSE

This directive outlines the basic policy and responsibilities of the Department in dealing with noise generated by motor vehicles on existing State freeways.

II. POLICY

It is the objective of the Department of Transportation to reduce highway traffic noise to achievable levels within practical and financial limits on existing freeways. Policies in support of this Departmental objective are described below in terms of residential areas qualifying for noise attenuation, establishing noise abatement project priorities, and determining practical project cost effectiveness.

A. Residential Areas Qualifying for Noise Attenuation

Reduction of traffic noise along existing freeways will primarily be limited to residential areas which were developed prior to November 1, 1974 and prior to construction of the adjacent freeway and when the existing exterior hourly Leq A-weighted sound level exceeds 67 decibels. In addition, residential areas which were developed after construction of the freeway also qualify if the existing noise level exceeds 67 dBA, Leq, and there has been a *"noticeable increase" in noise levels by reason of the widening.

B. Establishing Project Priority

All qualifying areas described in Section IIA will be segregated into logical construction units and assigned a statewide priority based on the Priority Index (cost effectiveness) formula outlined in Attachment.

*Defined in Attachment

C. Cost Effectiveness

An additional "cost effectiveness" factor will be considered in determining eligibility of projects for programming or inclusion in the Priority List, as discussed in Attachment of this P&P.

III. PROCEDURE

Pursuant to Section 215.5 of the Streets and Highways Code, the Department shall develop and implement a system of priorities for ranking the need for installation of noise attenuation barriers along freeways in the California Freeway and Expressway System.

When all eligible residential areas have been ranked in priority order the Department shall, in accordance with the Priority Index formula outlined in Attachment and consistent with available funding, recommend in the State Transportation Improvement Program (STIP), a program of construction of noise barriers beginning with the highest priority. The program of construction included in the approved STIP will be considered a commitment except in cases where the noise level criteria is not met or where the cost exceeds the cost-effectiveness criteria in Section II-C above, or funds are lacking.

IV. ACTION REQUIRED

A. Division of Highways

1. Approve criteria for setting the priorities of community noise abatement projects.

2. Approve statewide priority list for community noise projects.

3. Include noise abatement projects to abate noise from existing freeways in residential areas in the State Transportation Improvement Program, giving proper consideration to the priority listings developed by the Department, previous commitments, and funding and geographic constraints.

B. Division of Transportation Facilities Design

1. Develop criteria for designating priorities of community noise abatement projects.

2. Determine the statewide priorities of District candidate projects and recommend, to the Division of Highways, a statewide priority list for community noise abatement projects.

3. Develop and issue design criteria for construction of noise barriers along existing freeways.

4. Provide noise control consulting service and workshop training to Districts for Project Development.

C. Division of Construction (TRANSLAB)

1. Develop and maintain manual of technical procedures for measuring, predicting, and mitigating traffic noise.

2. Provide review, training, and consulting service to Districts for measuring, predicting, and mitigating traffic noise.

3. Conduct an active program of research on noise problems including, but not limited to, noise reducing devices and noise limits for motor vehicles, noise reduction barriers, and the impact of highway traffic noise on people.

D. The Transportation District

1. Develop and determine Priority Index for all eligible candidate community noise abatement projects within the District, which will in turn be assigned a state-wide priority index by Headquarters Office of Planning and Design.

2. Implement the Community Noise Abatement Program in accordance with the scheduling and funding provided in the California Transportation Commission (CTC) approved Statewide Transportation Improvement Program.

PROCEDURES FOR MITIGATING NOISE

ALONG EXISTING FREEWAYS

The State Highway Improvement Program (STIP) provides funds for mitigating noise along existing freeways under the HB 311 (Community Noise Abatement) Program. The basis for this program is an inventory of the following locations where noise-sensitive development along existing freeways is exposed to noise levels in excess of the design standards set forth in Federal Highway Administration Program Manual, Volume 7, Chapter 7, Section 3, (FHPM 7-7-3) entitled "Procedures for Abatement of Highway Traffic Noise and Construction Noise".

- Residential areas which were developed prior to November 1, 1974 and prior to construction of the freeway, and
- Residential areas which were developed after freeway construction, but prior to widening of the freeway which caused at least a 3 dBA increase in noise levels.

This inventory of residential areas will be broken down into logical project limits. Individual projects will then be prioritized in accordance with the following formula:

P.I. (Priority Index) =

$$\frac{\text{Achievable Reduction (dB)} \times (\text{Noise Level} - 67)^2 \times \text{Number of Living Units}}{\text{Cost (\$1,000)}}$$

In the above formula, the achievable reduction shall be the average reduction in noise levels that the proposed noise barrier project will achieve. The Federal Highway Administration noise level standards (or lower) are a goal for achievement, but are not mandatory. However, any noise barrier considered under this program should provide a minimum of 5 dBA reduction.

The noise level should be the average of the actual field measured design hour levels for the project in Leq and should be adjusted as follows to account for future increases in noise levels, unless unique conditions dictate otherwise:

Present design hour level of service*	Adjustment
A	+ 2 dBA
B	+ 1 dBA
C, D, E, & F	0

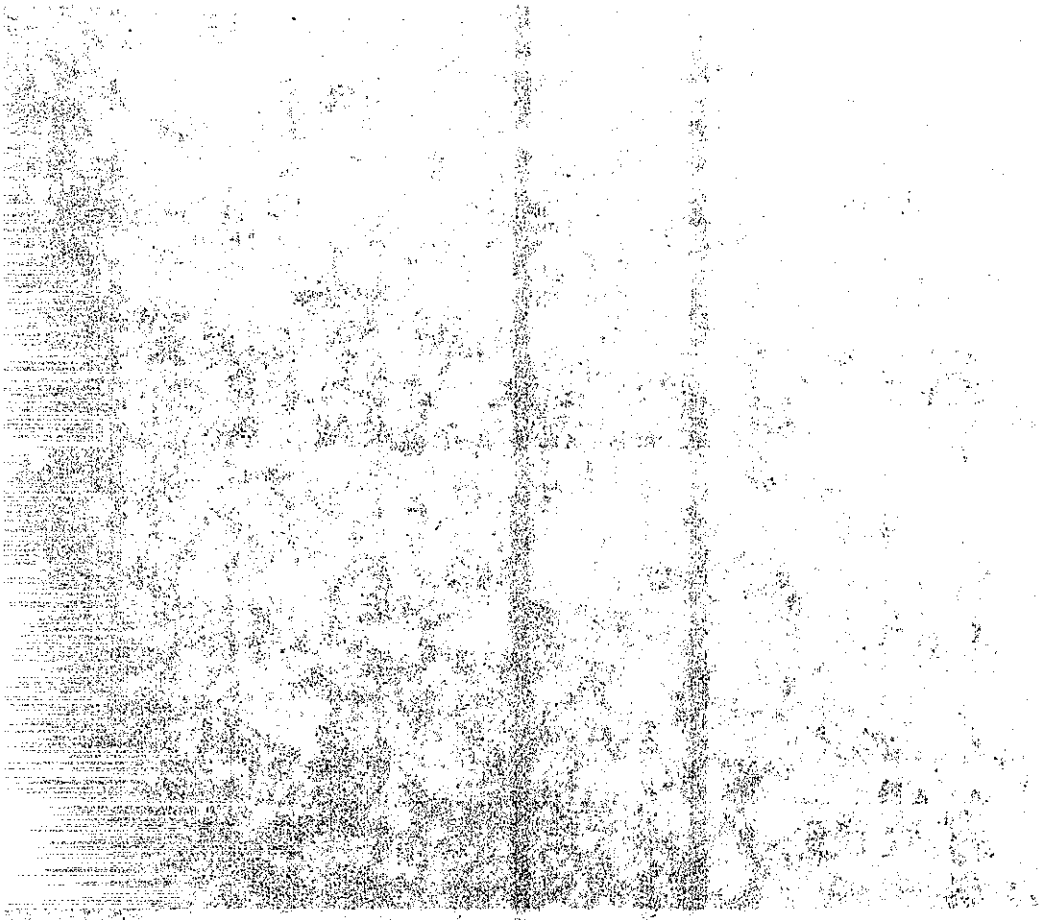
*As defined in Highway Capacity Manual - 1965

The number of living units shall be limited to the residences immediately adjacent to the freeway. Residences located above the first floor in multistory units should be included in the residential count if the proposed noise barrier will provide at least a 5dBA reduction for these units.

In determining the time relationship between residential development and freeway construction, the date of residential development means the date of the issuance of a building permit and the date of freeway construction means the date of the opening of the adjacent freeway segment.

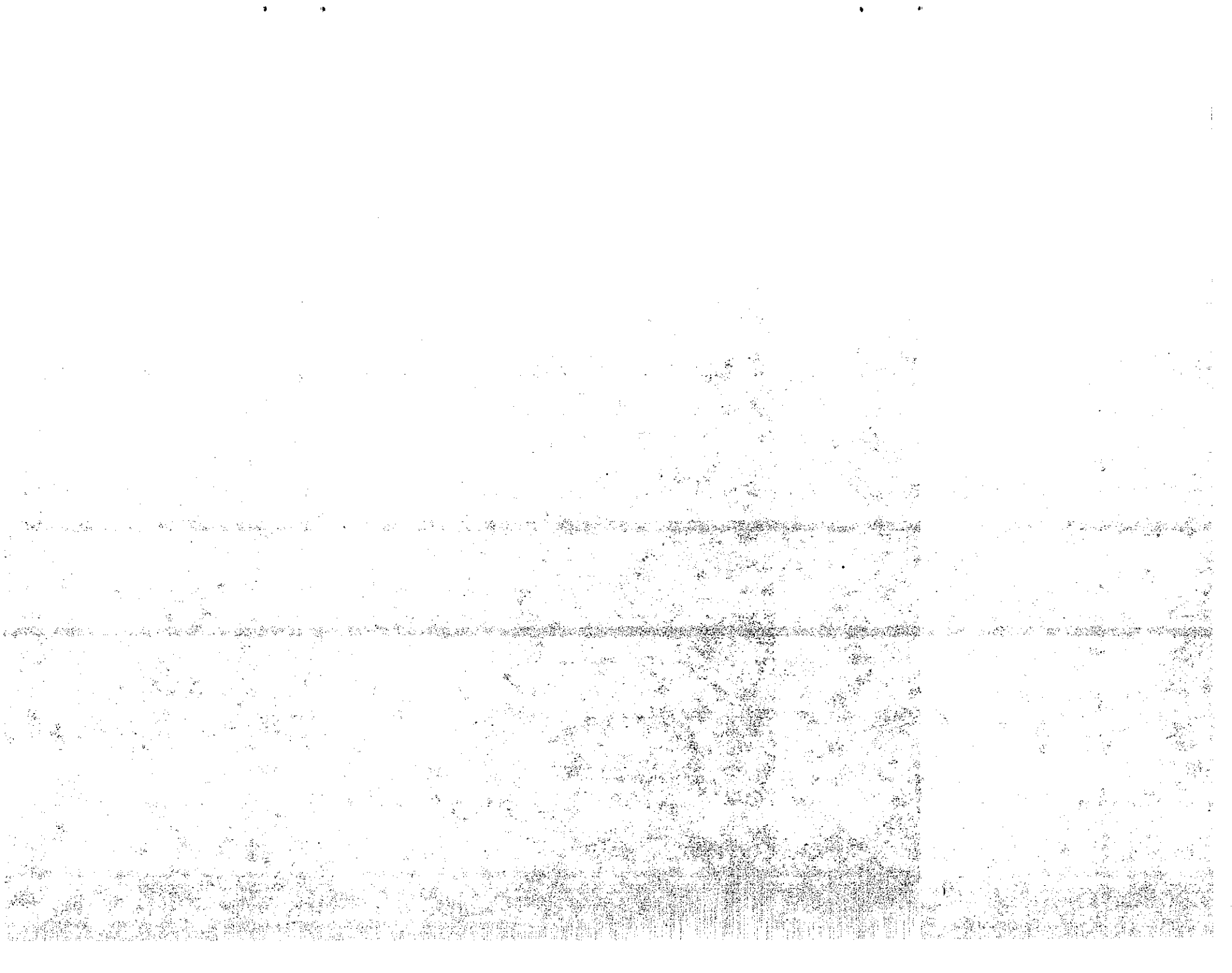
A "noticeable increase" in noise levels, as referred to in II.A. of this P&P, is assumed to be 3 dBA, or more.

A "cost-effective" project, as referred to in II.C. of this P&P is assumed to be limited to no more than $2,500/dBA noise reduction/residential unit and $25,000 total per residential unit. These values will be adjusted in accordance with the "Sound Wall Cost Construction Index" prepared by the Office of Structures Design using 1981 as a base year. If projects are included in the District Priority List, which exceed either or both of these factors (for the noise barrier and directly related costs only), the District shall submit special justification.



APPENDIX H

Caltrans Design Informaiton Bulletin No. 58
Noise Barrier



Memorandum

To : All District Directors

Date: December 8, 1980

Fred Jackson, Chief
Sacramento Project Design Branch

File :

From : **DEPARTMENT OF TRANSPORTATION**
Division of Transportation Facilities Design - Office of Planning and Design

Subject: Design Information Bulletin No. 58
Noise Barrier

The purpose of this Design Bulletin is to establish guidelines for noise barriers constructed as a part of freeway construction or reconstruction, and the Community Noise Abatement Program (HB311) for existing freeways.

This supersedes the February 21, 1980, Design Bulletin No. 56, Aesthetics and Highways Safety Committee Bulletin dated April 15, 1974, and Section III C. 3. and 4. of the appendix to Policy and Procedure No. P77-40. Policy and Procedure No. P74-47 dated July 24, 1974, and the appended September 12, 1974, policy memo are in the process of revision but, in general, the provisions therein still apply as they relate to the Department's position in dealing with freeway traffic generated noise. It is further intended that all of the basic Caltrans' policy and design guidelines be in agreement with Federal policy and guidelines, as stated in FHPM 7-7-3.

I. NOISE REDUCTION

The design noise levels in Figure 3-1 of FHPM 7-7-3 represent a balancing of what may be desirable and that which is achievable. For new construction, reconstruction, and Community Noise Abatement Projects, every effort should be made to achieve the maximum reduction of noise levels within reason. The design levels of FHPM 7-7-3 should not automatically be considered the lower limit of attenuation. On the other hand, achievement of these levels may have adverse social, economic, and environmental effects; and under these circumstances partial noise abatement measures should be considered. Whenever a noise barrier is proposed, it should achieve a minimum attenuation of 5 dBA, except under certain conditions such as where a gap in a barrier is closed to provide continuity to avoid lateral end "cutoff" walls.

Any major reconstruction where the resulting noise level will exceed the design levels prescribed in FHPM 7-7-3 (even though lower than the preconstruction level) should include consideration

of noise mitigation. This would be limited to areas where the adjacent development occurred prior to November 1, 1974. Exceptions to providing noise mitigation would be allowed for valid reasons. Noise mitigation is usually not required for low-cost traffic capacity improvement projects such as restriping for use as an auxiliary lane, as the additional cost of mitigation can make the project not viable. In most cases, the noise increase for this type of project should be discussed with the FHWA Area Engineer early in the project development stage to determine if an exception request is necessary. Many of these low-cost projects are considered temporary; and noise mitigation, if required, should be included with ultimate construction. If the low-cost project is permanent, the noise mitigation may be included in the Community Noise Abatement Program with programming in accordance with the established priority system.

The Federal Highway Administration Program Manual, Volume 7, Chapter 7, Section 3 (FHPM 7-7-3) specifies a design Leq level of 67 dBA (70 dBA L_{10}) for exterior noise levels in residential areas (activity Category B). However, FHPM 7-7-3 implies that noise mitigation should be included in new construction or reconstruction when the predicted traffic noise levels substantially exceed the existing traffic noise levels even though the predicted levels are below the design levels. FHPM 7-7-3 doesn't define the term "substantial" and in order to provide a uniform approach, the Districts should propose noise mitigation on all construction and reconstruction projects when the predicted design year traffic noise level will increase by 12 dBA over the ambient level and the design year traffic noise level equals or exceeds an Leq level of 65 dBA (68 dBA L_{10}).

II. BARRIER LOCATION

The most desirable location for a noise barrier is just inside the right of way or at least 30 feet or more from the edge of pavement. However, it is recognized that this is frequently impractical, especially when noise barriers are added within an existing freeway right of way. When this clearance is not obtainable, the minimum clearance is 10 feet to the face of a safety shape barrier. When an existing freeway has a 10-foot shoulder and a 13-foot hinge point, the minimum clearance is 11 feet 6 inches to the face of a safety shape barrier. When the clearance is 15 feet or less, the noise barrier should generally be placed on top of a Type 27 concrete safety barrier.

A safe stopping sight distance is an important fundamental consideration particularly for noise barriers located along the inside of a curve. Horizontal clearances which reduce the standard stopping sight distance should be avoided.

Care must be exercised when locating noise barriers near gore areas. In general, the barrier should begin or terminate, as the case may be, at least 200 feet from the theoretical curb nose location.

The minimum lateral clearances of 10 feet and 11 feet 6 inches should not be construed as rigid standards. Research by others, as well as pure logic, indicates that the frequency of run-off-the-road vehicle collisions with fixed objects varies inversely (on a somewhat logarithmic scale) with the lateral distance from the edge of the traveled way (EP). Therefore, accident costs would tend to reduce the first-cost economic benefits of placing barriers closer to the EP. Other factors such as ADT, accident history, average traffic speed, safety of maintenance and emergency stops, and the potential for future widening should be considered in deciding on the wall location.

Current traffic safety standards require that guardrailing be used in front of barriers located between 15 and 29 feet from the EP. Each project should be reviewed on its own merits, considering all factors, before a decision is made.

III. BARRIER HEIGHT

The height of noise barriers is a significant environmental impact factor that must be considered in the development of projects. The psychological impact, the restriction of air passage, the cutoff of sunlight, and the obstruction of view as well as the noise reduction potential, costs, and aesthetics are all factors that must be considered at the planning and design stages and should be brought to the attention of potentially effected property owners at that time. High walls adjacent to the freeway shoulder can have an unpleasant claustrophobic effect to the motorist, and similarly to the dwelling occupants with high walls at the R/W line. Landscaped earth berms or combination walls and berms tend to minimize apparent barrier height and are probably the most acceptable, to all concerned, but unfortunately are not suitable for many sites due to limited space.

Noise barrier walls shall have a minimum height of 6 feet, shall not exceed 14 feet above pavement when placed on the shoulder, and shall not exceed 16 feet above the ground line when placed between the shoulder and the right of way line, unless there is special justification and approval is given by the HQ Office of Planning and Design coordinator. Earth berms or berm and wall combinations should be considered when feasible.

Current design procedures result in noise barrier heights which often do not intercept noise emitted from the exhaust from trucks. This can create a problem in that the wall blocks out lower level noise and may result in a more intrusive change in noise level as the trucks pass by. In order to avoid this situation, barrier heights should be designed to intercept the majority of exhaust stacks of trucks. For design purposes, a 11.5-foot stack height shall be used.

For uniformity in the design of barrier heights, the receptor shall be considered to be 5 feet above ground located 5 feet from the structure nearest the roadway. If this location is clearly not representative of potential outdoor activities, then another more appropriate location may be considered. If another location is used, it should be clearly justified in the project report.

In general, the noise barrier height should not be designed to shield the second story of two-story residences as there usually isn't any outdoor living activity at that level. Attenuation of the second story may be considered if it can be done at very little additional cost and there is a relatively large percentage of two-story homes involved. In some cases, design of the noise barrier to shield the first floor from truck exhaust stacks will also provide some attenuation for the second floor. Each location should be examined on its own merits.

IV. BARRIER LENGTHS

Careful attention should be given to the barrier length to assure that it provides adequate attenuation for the end dwelling of a project. Where there is no residential area beyond the end dwelling consideration should be given to including a noise barrier terminal section perpendicular to the freeway which could reduce the overall barrier length. This would require an easement from the property owner to permit construction of the barrier off the State right of way.

At the present time, only areas developed prior to route adaption (Category C-1) are being protected by noise barriers under the Community Noise Abatement Program (HB311). This can result in a project which has residential areas of a lower priority category intermingled with residential areas of a higher category. In these cases, consideration should be given to protect the lower category areas in order to prevent short gaps in the noise barriers. The closure of gaps should be evaluated on a project by project-basis, considering such factors as the noise level the lower category area is receiving, funds available, and the disruption that would occur if the barrier is constructed at a later date. Any significant protection of lower category areas within a project should be cleared with the Headquarters' Planning and Design Coordinator.

On ramp connections to local streets, the question arises as to where the responsibility of noise mitigation ends for the State and begins for the local agencies. Because of the many possible variables, the determination of this responsibility will have to be done on an individual basis. As a general rule, the State's responsibility for noise mitigation should be limited to areas where the influence of the traffic noise level from the freeway or freeway ramps is the predominant noise source which causes the total noise level to exceed the design standards.

V. ALTERNATE DESIGNS

The Districts should include two or more alternative noise barrier designs (configuration and/or materials) in the project plans when more than one is aesthetically acceptable both to the community and Caltrans. Alternates selected should not result in an aesthetic "hodge-podge" along a route. Alternative designs should, of course, consider the effective complimentary use of landscaping where appropriate.

To date, masonry block has been used more extensively than other building materials for the construciton of Caltrans' noise barriers because it is competitive in cost, popular with adjacent property owners, and the availability of standard plans minimizes the engineering effort required to produce PS&E. There are other materials which can be used to produce attractive barriers that cost about the same amount as masonry block. The competitive position of these alternative materials, several of which are being incorporated into new standard plans, should improve if they are used frequently enough to encourage development of efficient mass production techniques.

VI. MAINTENANCE CONSIDERATIONS

Any noise barrier placed within the area between the shoulder and the right-of-way line complicates the ongoing maintenance and landscaping operations with subsequent increased costs, especially if landscaping is provided and it is on both sides of the barrier. The area behind noise barriers not located at the right-of-way line warrants special consideration. If the adjoining land is occupied with streets, roads, parks, or other large parcels, an effort should be made during the right-of-way negotiations to get the abutting property owners to maintain the area. In this case, chain link fence at the right-of-way line would not be required. Maintenance by others may not be practical if a number of small individual properties abut the barrier.

Access to the back side of noise barrier must be provided if the area is to be maintained by the State. In subdivided areas, access can be via local streets, when available. If local streets do not exist, access gates or openings are essential at intervals along the noise barrier. Offset barriers concealing the access opening should be overlapped sufficiently to maintain the integrity of the sound attenuation of the main barrier. The District designers should discuss this subject with maintenance personnel.

At locations where an access control fence would normally be constructed, use of the noise barrier as the access control fence (whether on the right-of-way line or within the right of way)

should be seriously considered. When noise barriers are constructed by developers immediately adjacent to an existing access control fence, consideration should be given to removing the access control fence in order to properly maintain the narrow strip between the fence and noise barrier.

VII. AESTHETICS

The appearance of noise barriers is an important factor worthy of special consideration. Some moderate additional cost to enhance the noise barriers' aesthetic quality is usually warranted. Elaborate individualized designs which add greatly to the cost should be avoided. The use of various textures, colors, and simple patterns can often be utilized to enhance compatibility with the environment at a minimum cost. Relatively simple designs can often be made aesthetically pleasing at a moderate cost when combined with carefully designed planting. It is desirable for landscaping to be started prior to or in conjunction with noise barrier construction. Noise barriers should not be designed with abrupt beginnings and ends. Generally, these should be tapered or stepped if the height of the barrier exceeds 6 feet.

Standard aesthetic treatments for sound walls are being developed along with more alternative wall design standards by the Office of Structures Design. These should provide some aesthetically-pleasing, cost-saving alternatives that will minimize the need for costly "customized" aesthetic treatments. In any case, close cooperation between the project engineer, landscape and structures architects, the citizens' aesthetics advisor, and other multi-discipline team members throughout the project development process should enhance the aesthetic quality of the barrier and hopefully do so at a reasonable cost.

O. T. KASSEL
Chief, Office of Planning and Design

WHA:dah
cc:
OLHomme - FHWA
GWishman - FHWA
RGAdams
ROWatkins
WRGreen
WAWhitnack
WHAmes
Planning and Design File