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Noise Control In Low-Income Housing

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This thesis, directed and approved by the candidate's committee, has been accepted by the Graduate Committee of The University of New Mexico in partial fulfillment of the requirements for the degree of

Master of Architecture

Noise Control In Low-Income Housing
Title

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NOISE CONTROL IN LOW-INCOME HOUSING

BY
JOSE RAFAEL CARBALLEIRA
B.A. University of New Mexico, 1970

THESIS

Submitted in Partial Fulfillment of the
Requirements for the Degree of
Master in Architecture
in the Graduate School of
The University of New Mexico
Albuquerque, New Mexico

August, 1972

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Jose R. Carballeira

July, 1972

NOISE CONTROL IN LOW-INCOME HOUSING

BY
JOSE RAFAEL CARBALLEIRA

ABSTRACT OF THESIS

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This study is directed toward the problem of noise pollution. Noise pollution, being a recent type of pollution, has not received the amount of attention given to the other types of ecological pollution.

Thus far, very little consideration has been given to noise. Architects have shown some interest in hushing our environment and owners of low income housing have shown even less consideration of the matter. Although the situation of silencing our environment looks grim, since the writer embarked on this study, there has come into being the first and only public listing of an acoustical consultant in Albuquerque.

Information, although scarce, was gathered. Studies were made on problem sites and conclusions were derived that will help an architect choose his criteria when designing low-income housing. In this type of housing, money is a major factor, while noise is given little consideration. Noise could be eliminated through the utilization of acoustical materials and expensive construction. Low-income housing is limited in this respect and in another way - the design structure itself through

the sociological backgrounds of the residents with consideration to the location and budget used.

The design structure is mostly derived from the studies on the technical data of acoustics. The sociological background was limited to pertinent effects of environment on an individual throughout his life.

Modification of existing structures would have astronomical figures. Therefore, for obvious reasons, this study will be applied to those buildings in the design stage.

Every interested architect will be given a program listing the alternative solutions as to the actual acoustical and financial needs.

This report represents extensive research and analysis on the problem of noise pollution. It expresses several authority's opinions along with pertinent facts. It also contains some of my own studies and analysis on the subject matter.

Several newspapers and book reports have been compiled and summarized in an attempt to better understand acoustical types of offending noises and their effects on people. This information assembled by bits and pieces will prove to be valuable to this little known, neglected and most offensive type of pollution: Noise.

In the following pages there will be an attempt to solve noise pollution in an architectural manner; i.e., through investigation, analysis, simplification of acoustics, awareness of people to noise dangers, and actual design will be the result of all research, analysis and studies.

As a student in Architecture as well as a resident of Albuquerque, how can I help improve the control over

noise pollution? Where is noise the most offensive? How can it be prevented? What is the basis on which the present system acts to terminate noise in the world, as related to Albuquerque? How can we make people aware that noise is an evergrowing pollution problem in Albuquerque? What can we do to help those who cannot afford the price of acoustics, to have a quieter, more peaceful life in their homes?

We are talking about a kind of pollution which does not have an immediate reaction on the human body. It does not clog your lungs, nor water your eyes or nose, nor leave a bad taste in your mouth. Noise reacts on the ears at a slower but irrevocable pace. Therefore, a hearing impediment is not detected until it is too late. Its effects range from hearing loss to mental disorders. Many people are aware of the noisy environment although they simply do not think that it will make them gradually grow deaf.

If you are hearing more now, and enjoying it less, face the facts: It is getting noiser. During the past 25 years, the average increase in urban noise levels has

been one decibel a year....and you do not have to know what a decibel is to hear the message.

Noise is a well established part of our society; we know it is, but the design profession has turned their eyes away in complete disregard of the problem, keeping our ears exposed. In the U. S., the average city will take at least 10 years before our ears notice any decrease in noise after corrective measures have been initiated.

People are demanding more peace and quiet. Scientists are discovering new facts every day on the damaging effects of noise - from contracting blood vessels to the increase of colesterol in the bloodstream - from heart attacks to bizarre emotional or mental behavior. Several organizations have been formed for the purpose of suppressing noise and their memberships include hundreds of people.

Every noise-producing apparatus is being suppressed for the sake of our ears - from motor vehicles to aircraft - from lawn mowers to church chimes.

Successful silencing of our streets will most readily follow individual interest. Individual interest aroused through the funding of organizations is the most important and probably the only course of action remaining as noise will continue to become a nuisance and health hazard in our industrial society of today.

Controlling the noise pollution, like other environmental problems, is multiple-sided, and costly. In construction, architects, engineers, and contractors, it must be learned, to assimilate changes brought on by environmental restrictions, and manufacturers must produce equipment to meet environmental requirements. In return for this, the public must then be willing to pay more for capital improvements and wait prolonged periods of time for them to be finished.

The United States is by far the noisiest of all the countries and by far the one nation that lags the most in noise control. Our picture seems very grim, and it is. Again,we were inadequate in our endeavors and yet we will not rectify our negligence until compelled to do so. Laws have been lacking sufficient comprehensiveness to control noise. Individuals, each being concerned with

his financial improvement, tends to overlook his health.

INTRODUCTION

Acoustical materials are kept to a minimum, thus emphasizing the criteria for the design of the units themselves. The individual design of the rooms comes almost directly from the formulas used to describe the properties and effects of acoustics.

Ideally, the environment will be kept quiet by properly positioning the walls, roofs and floors, thus keeping acoustical materials to a minimum.

What types of noise pollution as directed to low-income family housing, are covered in this study?

The major types of pollution include:

1. Aircraft: Becoming more and more common in this new era, aircraft constitutes the most intense community noise problem.
2. Motor vehicles: This is an air as well as a noise pollutant that is becomming a major concern in our populace today. Here, careless driving (accident-collision noise) and the freeway roar is a contributor of primary importance.
3. Industrial: The victims of this type of noise pollution are the workers themselves. When exposed for several hours to loud noises a hearing impediment is noticed.
4. Construction: Here, not only the machinists themselves are injured, but the passersby and neighbors adjacent to the job site.
5. Household: This kind is the least noticed, but it is the one we live with day in and day out. Noise abatement should begin at home. Children playing in neighborhood, electric appliances, lawn mowers.

The extent to which the psycho-sociological backgrounds of the residents of low-income housing have upon the design was limited only to that pertinent to past experiences in former houses lived in, as opposed to present experiences in the houses currently inhabited by said resident.

Limiting factors or categories included in this study (which will determine the design of a low-income family housing) are the following:

I. Resident:

A. Psychology:

Limited only to the obvious reasons involved e.g. not wanting to live with noise in a house nor desiring to become deaf.

These reasons might vary according to past experiences.

B. Sociological backgrounds

The upbringing of the resident during his childhood may decide how loud a sound has to be before becoming noise. What is noise to one resident, might be music to another.

II. Owner: *(here we assume owner is in favor of the laws of noise abatement and is concerned with the health of the residents).*

A. Limited by the budget for construction.

III. Ambiance--A definite factor for our design rests upon the nature of noise and intensity

of it. To be solved by:

A. Design:

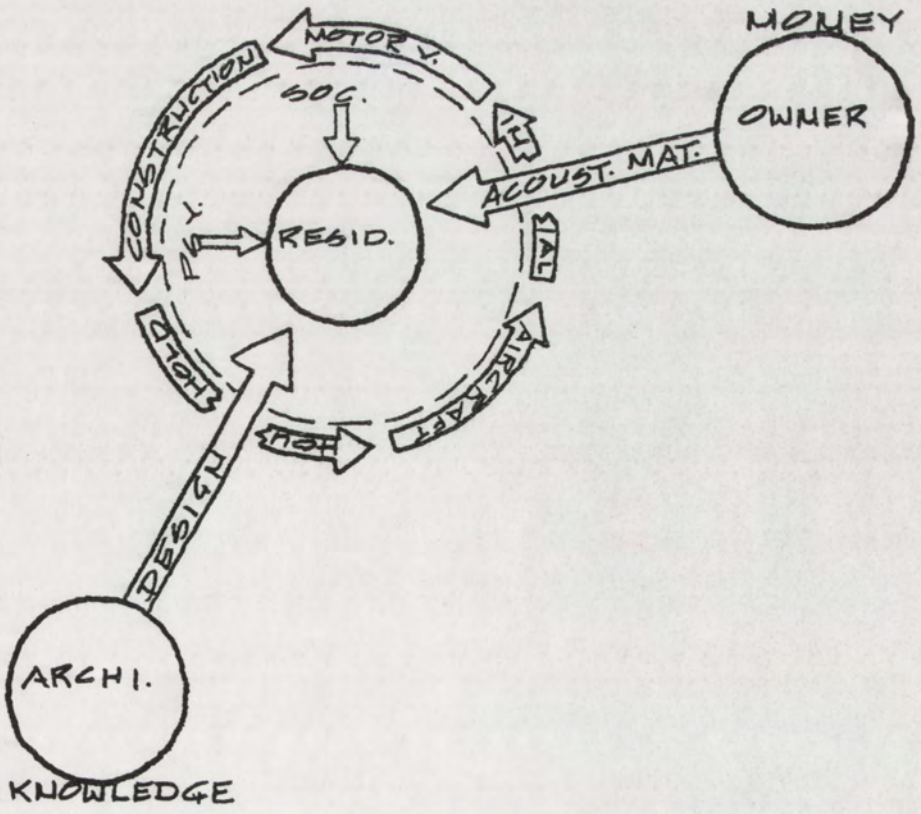
1. Floor, roofs and walls of unit
2. Site plan
3. Proper zoning

B. Acoustical materials

To help clarify the criteria stated above, a diagram was developed:

DIAGRAM 1.

ENVIRONMENTAL SOLUTION



PART I

To determine what has been done about noise pollution; the offensive factors and their effects on people.

PART II

To determine what effect impact noise and its annoyance have on residents and the surroundings of studied areas.

PART III

To establish what is necessary for the practicing architect to alleviate the problem of noise pollution in low-income family housing, namely - future constructions.

PART I.

The science of modern acoustics dates from the work of Galileo (1565-1642) the founder of modern physics. He was the first to recognize that the subjective notion of pitch was connected with the frequency of vibration of the object originating sound. Galileo also experimented with the vibration of pendulums and with strings. Although Galileo's work was done earlier, Marin Mersenne (1588-1648) gave the first published account of the vibration of strings. He was the first also to measure the frequency of a musical tone.

Robert Hoole (1635-1703) produced sound of a known frequency by having a rotating cogged wheel vibrate a piece of cardboard. Felix Sauveur much later (1830) used a similar technique for determining the frequency of a sound, giving rise to the name "Sauveur Wheel" for such a device. Joseph Sauveur (1653-1716) and John Wallis (1616-1703) experimented with strings and organ pipes. Sauveur first suggested the name "acoustics" (from the Greek *"Akoustos"* meaning "audible").

During the eighteenth century, the formal mathematical description of vibrating objects and the propagation of sound were worked out by the mathematicians: Daniel Bernovlli (1700-1782); Jean d'Alembert (1717-1783); Leonhard

T. Euler (1707-1783) and Joseph Louis Lagrange (1736 - 1813). The differential equation we now call a "wave equation", which is the basic description of all wave propogation was first derived by d'Alembert for the motions of a string.

There has been fairly general agreement that sound is carried by the air itself, a view emphasized by the Greek Philosopher - Aristotle (384-322 B.C.). Occasionally, the belief has been expressed that sound is due to the emission of small invisible particles.

The value of the speed of sound has been the subject of disagreement in the past. Early measurements of the speed of propagation in air were made by Gassendi, who measured 1,570 feet per second and by Mersenne, who measured 1,470 feet per second. Later it was shown that the actual value depends greatly upon the temperature. The value accepted today for the speed of sound in air at a temperature of 70 degrees is 1,130 feet per second.[1]

The nineteenth century showed great progress in the science of acoustics, the greatest contribution of Lord Rayleigh (1842-1919), was his "theory of sound", the first volume of which appeared in 1977 . This work still used by

theoretical investigators, organized and extended the formal descriptions of acoustics as a science.

Hermann Von Helmholtz (1821-1844) was one of the greatest physicists of the nineteenth century. His most significant contribution in acoustics dealt with the mechanism of hearing and the physical and physiological losses of musical acoustics. He developed the theory of summation and different tones, and the general scientific theory of music. His book, *"Sensations of Tone"* (1862), is one of the great scientific "classics".

Rudolphe Koenig (1832-1901) developed many of the experimental devices which were used in the nineteenth century, manometric flames for analyzing wave forms, acoustic sirens, a universal "tonometer" which could produce sound of any known frequency between 32 and 180,000 cycles per second. He is the most famous for his precise tuning forks, which became the generally accepted standards for pitch. Koenig also experimented with the physics of hearing and music, his disputes with von Helmholtz on the physical explanation of tone quality (timbre) still echo today.

Acoustical technology had its birth in the nineteenth century with the invention of the telephone -- Alexander

Bell in 1876 and its subsequent developments - the phonograph by Thomas A. Edison in 1877 and the invention of motion pictures in 1891 were the beginning stages of fields which stimulated the growth of acoustical technology in the twentieth century.

Two entirely new branches of acoustics have attained importance in the twentieth century. One is the general understanding of sound control in architectural design. The real beginning of architectural acoustics, as we know it, is that it was made by Wallace C. Sabine of Harvard University about 1900. He established excessive reverberation as the principal cause of bad hearing conditions in tones, and proved that it could be reduced to a satisfactory level by the use of sound absorbing material. When his students began tacking hair felt on the walls and ceilings, they started the acoustical materials industry. Today, the sales of acoustical materials amounts to more than $20,000,000 annually. The installed footage amounting to approximately 150,000,000 square feet annually.

The growth of acoustics as a technical science in the U.S. was signaled by the formation of the Acoustical Society of America in 1929. The contents of the journal of this society are indicative of the wide variety of modern

scientific and technical concerns with acoustics. In the "Journal of the Acoustical Society" one finds interest in architectural acoustics and noise control; in biological, psychological, and physiological question of the effects of sounds in speech analysis; in the acoustics of music; and the propagation of sound in the ocean and atmosphere.

This variety of categories reflects the host of ways in which sound had become important in modern life.

Acoustics is of primary importance in the general field of noise pollution. This section deals with such a field and the pioneers that made the major contributions in the discovery and application of acoustics.

To further contribute to the information required on how important acoustics had become, a questionaire was developed, on February 21, 1972. This questionaire was mailed to 52 architects in the city of Albuquerque.

STATISTICS ON QUESTIONAIRE:

As of March 10, 1972, 33 questionaires (60.5%) were returned in the self-addressed,stamped envelopes.

On March 11, 1972, the results were tabulated and an analysis was drawn as follows:

1. Percentage of work that has been related to low-income family housing:

PERCENTAGE		ANSWERED
0-25% =	26	(78.78%)
25-50% =	2	(6.06%)
50-75% =	2	(6.06%)
Over 75% =	3	(9.06%)
TOTAL	33	100% Answered

2. Importance of acoustics as expressed by architect or firm:

INTEREST	ANSWERED	
None	4	(13.33%)
Somewhat	10	(33.33%)
Mostly	4	(13.33%)
Always	12	(40.00%)
TOTAL	30	90.90% Answered

3. Interest shown by owner of low-income family housing:

INTEREST	ANSWERED	
None	13	(46.42%)
Little	12	(42.50%)
Much	3	(11.08%)
TOTAL	28	84.84% Answered

4. Studies made by architect or firm in regards to noise in given site.

STUDIES	ANSWERED	
Yes	15	(45.16%)
No	16	(54.84%)
TOTAL	31	93.93% Answered

5. If a general interest has been shown in favor of combating noise, state if an acoustical engineer was needed or if problem was hoped to be solved once the partitions were put in place and filled with insulation.

ANSWER	ANSWERED
Acoustical Eng. used in low-income housing	2 (6.06%)
Acoustical Eng. used in other jobs	2 (6.06%)
Staff used, no acoustical Eng.	15 (44.35%)
No answer (questions 2-4 were mostly negative)	13 (41.39%)
Questions not clear	1 (3.03%)
TOTAL	30 100% Answered

6. Offices currently involved in low-income housing and how far advanced.

STUDIES	ANSWERED
No	18 (60.00%)
Yes	11 (36.66%)
Cannot release information	1 (3.33%)
TOTAL	30 90.90% Answered

7. Would a program guide encourage provisions for the abatement of noise?

ANSWERS	# OF ANSWERS
Mostly Yes	18 (64.28%)
Mostly No	8 (28.57%)
Not Clear	2 (7.14%)
TOTAL	28 84.84% Answered

(For a sample questionaire SEE APPENDIX C.)

Some personal comments found in questionaires expressed the feeling that the best way to attenuate sound was to buffer the noise source itself. Other feelings expressed pity of the low-income housing for nobody ever wanted to expand the budget to provide for the noise control in the area.

SUMMATION: Although only a few interviewed showed any major concern with the abatement of noise, the majority of the architects who returned the questionaire felt that the use of a program guide would be helpful when designing for low budget housing. These feelings only reaffirm the feasibility of this study.

Those architects having over 75% of their work load related to low-income housing expressed the strongest concern, not necessarily imitated by the owners,in favor of acoustics.

Most architects showing the least concern for acoustics and/or a program guide missed the questions the most or did not understand them.

CONCLUSIONS: The following conclusions express only the personal view points of the writer as he sees the results of the questionaire.

1. The answers were taken as valid and truthful.
2. Albuquerque's architectural manpower lags behind in the production of noise-controlled environments.
3. Most architectural firms are actively in favor of the abatement of noise, but need a guiding source.
4. More architects in the city of Albuquerque should have more concern for the architectural students of the city.
5. As seen by the writer, most architects in the city of Albuquerque play a very small role in solving the different problems brought about by the sociological and psychological characteristics of the different cultures in the state of New Mexico.
6. Like most people, practicing architects should be made more aware of the dangers caused by uncontrolled noise.

The findings and recommendations of *"The Noise Around U.S."* by the U.S. Department of Commerce, September 1970, states that "the past few years have seen the dawning of an awareness of noises as a significant factor in the degradation of the quality of man's life. However, public awareness of the noise pollution problem has not yet reached a level that will precipitate the actions necessary to bring this problem under control."

"It is the considered opinion of the Panel [Panel on Noise Abatement, Jack E. Goldman, Chairman] that action should be taken at an early date in order to reverse the present trend toward an increasingly noisy environment, and to avert what could later become a noise pollution crisis."

In addition, it was stated that, "the Panel's feeling is that there is not sufficient public awareness of the nature of the magnitude of the noise problem."

This section is dedicated to the different offending factors causing noise pollution.

Herein, these types of major noise sources are taken in the broad scope per se, not necessarily as applied only to low-income housing. The general approach employed was solely for the purpose of identifying the most common contributors to noise in our society.

NOTE: For correlation of the decibel levels mentioned in this section, see Table III.

Because of the nature of the section that is to follow it will be necessary to exhibit Tables I, II, III and IV *(see the following pages)* to make clear the definition of decibels.

TABLE I

PERMISSIBLE NOISE EXPOSURE:
WALSH-HEALY FEDERAL CONTRACT ACT, 1969

DURATION per day HOURS	SOUND LEVEL dBA SOUND RESPONSE
8	90
6	92
4	95
3	97
2	100
1 1/2	102
1	105
1/2	110
1/4	115

19
14
36

TABLE II.

(dB) TYPICAL SOUND PRESSURE LEVEL

SOURCE	HZ 125	HZ 250	HZ 500	HZ 1000	HZ 2000	HZ 4000	HZ 8000
Rock Band	--	--	100	101	104	98	--
Birds	--	--	--	--	50	52	54
Trucks at 20' away	86	81	77	73	70	67	64
Cars at 20' away	77	73	69	65	62	56	50
Jets 2-3 miles; take off	95	100	98	95	88	86	75
Motorcycles at 20'	96	93	89	79	73	70	63
Train Pulling Hard - 100'	102	94	90	86	87	83	79
Car Horn at 15'	--	--	92	95	90	80	60
Audio-Visual Rooms	89	92	90	89	87	85	80
Classrooms	66	72	70	74	68	60	50
Computer Rooms	75	73	78	80	78	74	70
Gymnasiums	78	84	89	86	80	74	64
Kitchens	85	79	78	77	72	65	57
Lab Work Spaces	70	73	75	72	69	65	61
Libraries	63	66	67	64	58	50	40
Mech. Equip. Room	86	85	84	83	82	81	80
Musical Practice Room	94	96	96	96	91	91	90
Reception and Hobbies	66	72	77	74	68	60	50
Electric Shaver 1 1/2 ft.	58	49	62	60	64	60	59
Vacuum Cleaner 3 ft.	66	69	73	79	73	73	72
Garbage Disposal 2 ft.	83	69	56	55	50	50	49
Washing Machine	68	59	62	59	60	62	69
Window Air Conditioner Unit	64	65	56	56	48	44	37
Radio (ave. listening) 10 feet.	55	71	74	74	70	64	--
T.V. (ave. Listening) 10 ft.	62	64	67	70	68	63	39

TABLE II. (CONTINUED)

(DB) TYPICAL SOUND PRESSURE LEVEL

SOURCE	125 HZ	250 HZ	500 HZ	1000 HZ	2000 HZ	4000 HZ	8000 HZ
Stereo by Teenage	72	83	82	82	80	75	60
Stereo by Adult	65	75	72	70	66	64	48
Ringing Phone 4 - 13 ft.	41	44	56	68	73	69	83
Flushing Toilet	55	53	54	57	56	57	52
Violin at 5 ft.	--	91	91	87	83	79	66
Normal Conversation	60	75	78	75	65	55	38
Barking Dogs	--	90	104	106	101	89	79

TABLE III.

STANDARD SOUND RATINGS OF TYPICAL URBAN ENVIRONMENTAL ACTIVITIES IN

	(DB)	
DEAFENING	175	Experimental animals have died
	150	Jet plane at take off
		Near jet engine
	140	Threshold of pain
		Pneumatic hammer on I beam
	130	Pneumatic riveter
		30-30 cal. gun at 5 ft.
UNCOMFORTABLY LOUD	120	Threshold of feeling
		Accelerating high power motorcycle
	110	Rock and roll band
		Jet flyover at 1,000 feet
	100	Farm Tractor
		Power mower
VERY LOUD	90	Motorcycle at 25 ft.
		Food blender
	80	Heavy street traffic at 10 feet
		Car, 65 mph. at 25 ft.
MODERATELY LOUD	70	Stenographic room
		Shouting Conversation
	60	Normal Conversation
		Background music
	50	Light traffic at 100 ft.
		Idling V-8 Engine of '68 car at 5 ft.
QUIET	40	Very quiet radio at home
		Library
	30	Average walking on carpeted floor
		Average noise in quiet residence
VERY QUIET	20	Broadcasting studio
		Average whisper
	10	Leaves rustling at 20 ft.
		Breathing at 15 ft.
	0	Threshold of audibility

TABLE IV

INTENSITY LEVEL	DECIBELS
100,000,000,000,000	140
10,000,000,000,000	130
1,000,000,000,000	120
100,000,000,000	110
10,000,000,000	100
1,000,000,000	90
100,000,000	80
10,000,000	70
1,000,000	60
100,000	50
10,000	40
1,000	30
100	20
10	10
1	0

The table above shows that the range of sounds that must be tolerated by the ear is enormous, extending from a threshold of 1 arbitrary unit for a faint sound that can barely be detected to 100,000,000,000,000 units for a very loud sound.

Smaller numbers to express the vast range have been developed by using the decibel unit; the number of decibels between two intensity levels being obtained by taking 10 times the logarythm of the rates of intensity. Although the tolerable range is very great, the absolute energy of sound is very small; an average voice having only about

one-millionth of the energy needed to operate an ordinary electric lamp.

Decibels could be defined as follows: In acoustics, to relate the intensity of sound to an intensity level corresponding to the human hearing experience the "Bel" unit (after Alexander Bell) was introduced so that:

$IL = \log I/Io$ (in Bels)

$IL = 10 \log I/Io$ (in decibels or dB)

("deci" indicates that the logarithm is multiplied by 10)

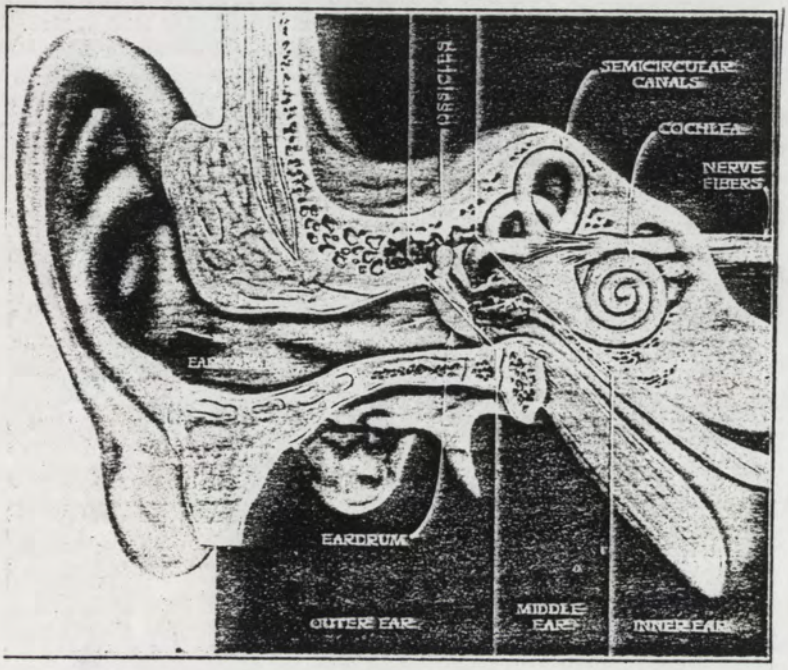
SOUND CONTROL:

When we apply the science of acoustics to architecture, we find that we have two tasks in mind: we must propogate an audible signal so some sort - usually either speech or music - from one part of a room to another part - from the speaker to the listener - from the musician to the audience. This is called Sound Control. There has to be provided an acoustical environment that is acceptable for the use to which the space is put.

Any audible signal is sound. The source of a sound is some system of vibration. A sound source causes stress changes in the surrounding medium, air. However, sound may be transmitted in water, gases other than air, and in solids. Without a transmitting medium, sound cannot exist. A sound

source can cause compressive stress changes in gases and liquids, and compressive shear and bending stresses in solids. The vibrations established in the medium travel with a finite velocity characteristic of the medium. In air, the vibrations travel about 1,100 ft/sec., in water about 5,000 ft/sec., in steel about 15,000 ft/sec. The end of the sound-propagation chain is the ear. The vibrations of the sound source set the air in motion, which in turn, transmits its small changes in pressure to the eardrum membrane. The vibrations on the eardrum are multiplied by means of small bones arranged as levers in the middle ear. These vibrations are then transmitted through a fluid to the nerve endings and then to the brain which translates these impulses as a message.[2]

FIGURE 1.



Most of the sounds that we hear are quite complex in quality. While our ear does not respond to pressure changes that occur at a rate of less than 20 times per second and more than approximately 20,000 times per second. This range permits a practically unlimited number of combinations of sound.

The concept of the quantity of sound is merely the average deviation in atmospheric pressure above or below the static atmospheric pressure. The deviation in pressure is very small. For example, a very loud noise produces a change in pressure of only .001% of the atmospheric pressure. Since this is an alternating pressure change, it may be defined as a root mean square (rms) quantity.[3] This rms pressure change is known as the sound-pressure level and is measured by microphones and sound level meters.

Today in everyone of the 50 states there is some form of anti-noise ordinance in the statute books. Only California and Connecticut have made some serious efforts to enforce their laws. Even in these two states, their laws are exclusively on transportation noise.

A. AUTOMOBILES

FIGURE 2.

For cars, exhaust noise is primarily a problem and heads this list because the vehicle is capable of being operated so that the exhaust noise is dominant; and when a vehicle is capable of being operated in a way which is more extreme than is normally needed or used, some people can be expected to operate them that way.

For a car, normal operating conditions is considered too uncommon. Normal operating conditions is considered to

consist of moderate acceleration, e.g. away from a city stop light and gradual braking and cornering slow enough so that tires do not squeal. But most cars can make nearly as much noise as large trucks. Next in importance, cooling fans are listed third, since the fan has been found to be almost as important as exhaust during maximum noise tests on some cars; and, as exhaust noise is reduced, cooling fans will become even more important.

At this time, noise radiated from the engine, itself and aerodynamic noise due to the car pushing through the air are not apparently significant problems in relationship to the others.

B. TRUCKS:

FIGURE 3.

For trucks, there is no question that exhaust is by far the predominant problem for the number of trucks on our highways today. (Trucks and motorcycles - up to 35 mph-88db, mor than 35 mph-90 db, passerger cars up to 35 mph-88 db, over 35 mph-90 db.) The cooling fan is at least as important as the exhaust noise. But for various reasons, probably half of the large trucks on the highway in the U.S. today have either inadequate exhaust muffling or no mufflers at all. Tires also can be the predominant noise producer on muffled trucks. Certain kinds of tires, in particular, are bad offenders from a noise standpoint. The engine itself is also a significant source of noise for large diesel trucks. It has also become apparent that other sources of noise from large truck-transmission gear noise, accessory noises, hydraulic pump system noise, and so forth, will soon become problems as the currently major sources of noise are reduced in importance. Finally, noises due to rattles and loose loads as trucks impact road bumps, are significant and cannot be ignored.

C. BUSSES:

Bus noise of major significance today is due to transit coaches being operated in the city areas. Their operation is typically wide-open throttle as they accelerate away from

bus stops. This results in making as much noise as busses can while they are very close to people and other vehicles. Exhaust comes next in importance even though it is not a major problem with coaches because space is available and has been used to provide very large mufflers. Rather, cooling fans and engine noises are the predominant causes of objectionable noises.

D. MOTORCYCLES:

Motorcycle noise though minimal, is one of the most disturbing ones. It usually comes in loud bursts and in sporadic fashion. Like automobile exhaust noise, much motorcycle noise comes from side streets and from short distances. The few motorcycles that are standing still are especially noisy.

Motorcycle riders are considered more responsible for noise than other drivers. Some even take the added time and trouble necessary to make their motorcycles noisier by removing mufflers.

E. AIRCRAFT:

In the U.S. alone there are more than 120 million transportation noise sources ranging from outboard motors to jumbo jets. Of this 120 million vehicles, the 3,000

FIGURE 4.

commercial jet transport aircrafts constitute the most intense community noise problem. While airport-aircraft noise is a severe problem for those exposed to the ever-increasing number of aircraft operations, the vast majority of U.S. residents find themselves in a residential acoustic environment which is controlled by surface traffic noise.

Aircraft creates several forms of noise pollution. Take-off and landing procedures as well as sonic boom. Sonic booms are only considered important when it occurs on earth. Once on the ocean, sonic booms are inaudible 100 feet deep in the ocean. Some kinds of vibrations are created which cause windows to break and ears to shatter. On the ocean the fish living above this 100 foot buffer of water will be endangered and most likely exterminated.

Aircraft noise is an area that is now receiving a great deal of attention by the news media. A major investigation, the Congressional hearings relative to the SST, dealt with the effect of the aircraft on the environment, sonic booms and high levels of noise at take-off and landing.[4] Besides many other reasons for abandoning the SST program, the exageration of noise over heavily populated areas was of primary importance. An additional problem is the noise of conventional aircraft now in use. Aircraft take off noise has been measured at 105 dB *(See Table III)* at distances of 1,000 feet from the engine.

There are several regulations as to where and when airplanes may fly over populated areas. Zoning off residential areas has been but the first step in controlling jet engine noises. Several programs have been adopted by several airports to make sure the pilots do not deviate from their marked plan, thus aggrevating the residents near by.

Noises in the vicinity of the houses contribute a great part of the nuisance type of noises. These are the noises not associated with industrial production but simply produced by day-to-day living and social activities.

Here are included the racket from such things as home appliances; the noisy dishwasher, the disposal unit, washing machines, etc. (See Table I for decibel readings on some of these household appliances.)

From the time the alarm bell sounds in the morning, the modern housewife has to go through an enormous amount of noise without being completely aware of it. The majority of these noises do not last for more than 5 to 10 minutes, etc. Some of them might last all day long like an air conditioner unit or the radio and/or stereo being played by her children. These noises make her feel tensed and up-tight. It raises the blood pressure and the colesterol in her blood. If something is not done about noise, many scientists believe that by the year 1980, in the average U.S. city we will have to shout to hear ourselves in the streets.

Outside the house, probably the most serious offender is the power lawn mower, whether it be an electric mower with its high speed whine or the internal combustion engine. Both of these appliances cannot only be very disturbing to the neighborhood but they can also be very dangerous to the

operator. The levels of mower noise are well in excess of what is allowed in an industrial plant under the new Walsh-Healy Act. *(See Table II)*.

FIGURE 5.

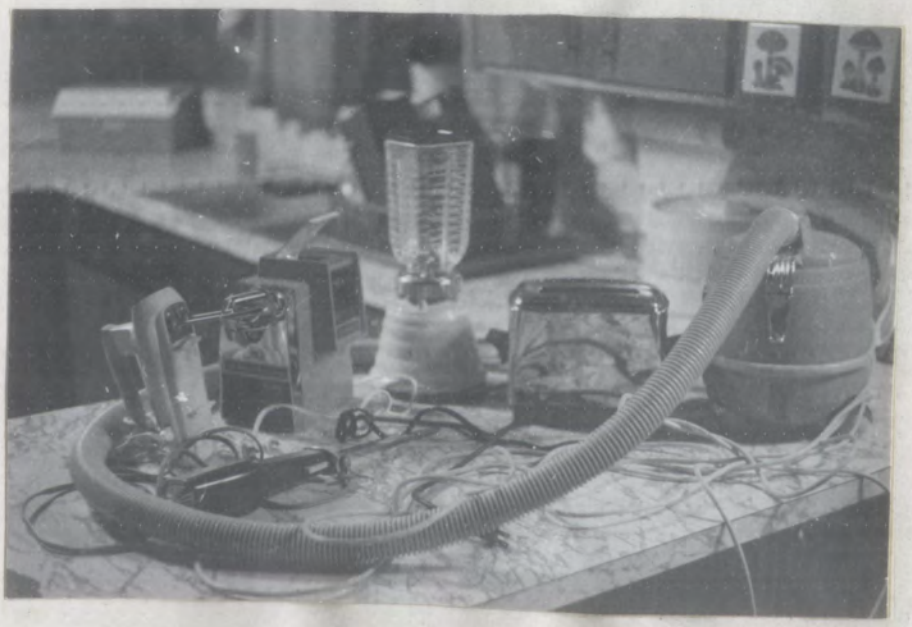


FIGURE 6.

FIGURE 7.

Industrial and construction noises have received attention mostly in the form of citizen complaints. More investigation and study should be devoted to this area of noise pollution. This heavy equipment noise is not only annoying to the neighborhood area, but of maximum danger to the worker exposed 8 hours a day. Constant exposure, as well as loud impact noise could cause damaging effects to the eardrum if protection is not used.

In 1969 the U.S. Department of Labor through the Walsh-Healy Public Contract Act, adopted standards for occupational noise exposure. These rules and regulations apply to any manufacturer who sells goods (or services) to the Federal Government having a value in excess of certain nominal amounts. *(For permissible noise exposures see Table II)*

In addition to this table, exposure to impulsive noise

such as gunfire or impact noise from machinery, etc. should not exceed 140 dB A peak sound pressure level.

The sound pressure level limitations above are in terms of dB A which refers to the A-scale reading on a sound level meter. A-scale is used to simulate normal human hearing characteristics. For construction and industrial machinery manufactured after January 1, 1972, the limit will be 94 dB. After January 1, 1975, 86 dB. After January 1, 1980, 80 dB. This includes tractors, dozers, drills, loaders, power shovels, cranes, derricks, motor graders, paving machines, off-highway trucks, trenchers, compactors, scrapers, pavement breakers, compressors and pneumatic powered equipment excluding piledrivers.

Construction operations are prohibited in Chicago between 9:30 p.m. and 8:00 a.m. within 600 feet of a hospital or residential building, except for public improvements and work of public service utilities. The ordinance holds manufacturers and operators responsible for compliance and prescribes fines of $15 to $500, and up to 6 months in jail for violations.

This section devotes itself to the efforts caused by noise on people. Herein an attempt will be made to clarify these different effects, ways to alleviate them and what has been done to correct them.

I. NOISE EFFECTS:

"Hush-up" has been the sound shouted by scientists around the world. Too much noise is apparently taking a heavy toll of human health and is really a pollution as dangerous as smog or dirty water, they declared.[5] The health costs may well include heart attacks, high blood pressure, damage to unborn babies, disorders of nerves and glands, irritability, tensions, not to mention hearing losses.

Loss of hearing is becoming more and more apparent in our noisy society of today. Persons working in noisy environments are the first ones to loose their hearing. The rest of us who live in average size cities will follow. Finally those who live in small towns.

The Army has also taken its toll on hearing loss. The Army issues earplugs to all recruits, but their wearing is not actively enforced. In addition, the plugs are not individually fitted by trained technicians or doctors. Many of the troops complain that the earplugs hurt them, especially when worn within sound range of firing cannons. Many

soldiers substitute cigarette filters for the earplugs but they offer scant protection.

Thus far, 1,761 veterans of the war in Vietnam are receiving $81,450. per month for damage done to their hearing while in the service. It would have been far more sensible for our Army, richest in the world, to have equipped each of these men with a pair of $6.00 earmuffs.[6]

"The Noise Around US" by the U.S. Department of Commerce, September, 1970 has this to say:

> "Noise is a widespread pollutant which can have many adverse effects on man. Prolonged exposure to high-level noise causes irreversible hearing damage. There is a growing body of evidence that noise also may have other physiological and psychological effects on the human organism. Even low levels of noise impair and satisfactory interrelationships between man and his environment - for example speech communication is rendered difficult, sounds of warning are not heard, and the normal pattern of rest and sleep may be interrupted even by low level noise."

II. NOISE CONTROL:

Many cities have been taking big steps in controlling noise pollution. Chicago, for example, has a new noise ordinance affecting vehicles, construction equipment and various power tools. It became effective July 1, 1971. Based on readings taken 50 feet from the vehicles, cars, motorcycles and other motor vehicles manufactured after January 1, 1980 will be limited to 75 dB.

NOTE: It might be interesting to note that amplified Rock and Roll music at 120 dB would exceed the shortest permissible noise exposure given in Table II. Sound level meters are usually equipped with weighing networks that tend to represent the frequency characteristics of the average human ear for various sound levels. The average rock music band today, with all of the electronic amplification available to them, find that to be "one of the most popular bands in town," they must play their music just slightly below the level of the threshold of pain.

It has been clearly demonstrated that noise produces vasoconstriction of the extremities and that the degree of constriction is proportional to the number of decibels by which the level exceeds 70. *(See Table III)*

NOTE: Gerd Jansen has been conducting laboratory experimentation of the interference of sleep at the French Bioclimatic Research Center in Strasbourg.

Relative human response to noise would therefore be measured in terms of such changes in blood flow, blood pressure or heart rate.

Studies performed at the French Bioclimatic Research Center in Strasbourg concluded that:

> "...using recorded aircraft and road noises indicate that sleep disturbance is dependent on the following factors: the level of the noise, the difference between the peak and average levels, the number of repetitions and the rapidity of the variations in the level."

However, they also admit that there is a problem of

habituation - their laboratory subjects showed loss effects on successive evenings. They ran one series of tests using simulated aircraft flyers of 79 to 90 dB A, peak levels. If one can extrapolate from two points, then a flyover reaching only 70 dB A would produce no disturbance of sleep. They recorded indicators of depth of sleep only during the last four hours (although the noises were presented all night) and found that the last two hours of sleep (from 5 to 7 a.m.) were actually deeper in the noise conditions than on control noise-free nights.[7]

During the eighty-second meeting of the Acoustical Society of America in Denver, October 19-22, 1971, the writer attended another lab-simulation experiment which was described as follows:

"A laboratory simulation of sonic boom and its effect on sleep and human performance was conducted at the North Carolina State University. There were 6 males ranging in age 24-40. The subjects were put in a simulated motel room for 10 days. An 80 dB A *(See Table III)* aircraft noise was sounded 8 times per night every other night for a total of 6 hours of continuous data. The subjects were not told which night the boom would be. Every morning they were given a memory and performance test. On the morning following the

disturbance, the score was considerably lower than on the other nights although it kept leveling off as the subject became accustomed to the noise. Their sleep went from deep to light. 7 seconds of disturbance lasted 5 minutes of sleep interruption."

By the foregoing data one could reach the conclusion that the definition of sound is any sensation to the ear recognized by the brain. Noise is any unwanted sound.

Confusion sometimes results in the use of the word noise as a meaning for unwanted sound because there are two general classes of "unwantedness." The first category is that in which the sound signifies or carries information about the source of the sound that the listener has learned to associate with some unpleasantness not due to the sound per se, but due to some meaning the source has for the listener. The sound of the fingernail on the blackboard suggests perhaps, an unpleasant feeling in tissues under the fingernail. The sound of an airplane suggests some fear of the plane falling on their home. A baby's cry causes anguish in a mother. The squeak of a floorboard is frightening--indicating the presence of a prowler, etc. In these cases it is not the sound itself that is "unwanted" (although for other reasons it may also be unwanted) but the information it conveys to the listener is unwanted. This information is

strongly influenced by the past experiences of each individual and, in the writer's opinion, its effects are not the sort of thing that can or need be quantitatively related to the physical characteristics of the sounds.

Psychological judgement tests of perceived noisiness have demonstrated that people will rather consistently judge among themselves the "unwantedness," "unacceptableness," "objectionableness," or "noisiness" of sounds that vary in spectral and temporal nature provided that the sounds do not differ significantly in their meaning and are equally expected. The subjects in these tests are asked to consider the terms in question marks as being synonymous when making their judgements. It is to be emphasized again that the effects of a sound due to its meaning (such as fear, pleasure, etc.) and unexpectedness (because of unfamiliarity) with a sound as a natural and expected part of ones environment) are for the most part, specifically excluded from or kept constant for the attribute here designated as perceived noisiness.[8]

Many psychological-sociological factors must be understood and manipulated in the development of standards for environmental noise control, but these factors must always probably somehow be reconciled with the general attribute of

sound called perceived noisiness. For example, Borsky and Caterloff have found that propaganda stressing the importance of military aviation to the country and the plans of the government to control and lessen the noise from military aircraft, reduced the willingness to complain about the aviation noise; the reduction was equivalent to the effect that would have been obtained by lowering the noise levels by 6 dB or so.

This section is intended to simplify the meaning of acoustics. Although the utilization of acoustical material will be limited because of their expense and esthetical redundancy, they will definitely have to be mentioned and analysed for, so far, the "easiest" and "simplest" way to attenuate noise is by "padding" around the listener, not by controlling the noise source itself.

A. ROOM ACOUSTICS:

The reflection of sound signals from large planes or convex surfaces, enhances the quality and signal strength of both speech and music. The paths of the reflected sound may be predicted by the law of sound propagation, "the angle of incidence equals the angle of reflection."

The first reflection is especially important. Reflected sound that arrives at the ear within an interval of 50 milliseconds after the direct sound, tends to reinforce the sound of individual speech syllables. All later arriving reflected sounds have a blurring and interfering effect which reduces speech intelligibility. It is considered good practice to arrange the room surfaces so that as much reflected sound as possible arrives at each seat by a path not more than 50 feet longer than the direct sound path. Fifty feet corresponds to approximately 50 milliseconds at the speed of sound.[9]

NOTE: This section deals primarily with the basics of architectural acoustics and acoustical materials. For more definitions of the different characteristics of acoustics, refer to Appendix A.

B. ACOUSTICAL MATERIALS: *(See Appendix B for sound coefficient)*

1) Sound absorption coefficient of acoustical material:

The sound absorption coefficient of the surface of a material depends on its physical constants, such as flow resistivity, porosity, and thickness; on its surface treatment; on the method of mounting; on the frequency of the sounds; and of the angle of incidence of the sound wave. It has become a universal practice to rate the efficiency of an acoustical material in terms of its "sound absorption coefficient," which is defined as the fraction of incident sound energy absorbed by the surface of the material. The vibrating air molecules inside the material, however, encounter friction at the surfaces of the individual fibers which is not present in the free air outside the material. This friction converts some of the vibratory sound energy of the air molecules to random heat energy and results in progressive damping of the sound wave as it travels through the material. Generally the material is backed by a rigid reflecting surface and is thin

enough that the wave travels through the face, meantime having lost a considerable portion of its original magnitude.[10]

2) Acoustical material may be fire hazardous.

Acoustical materials are generally used as interior finish for wall and ceilings and in some complicated way, it contributes to spread the flame and adds fuel to the fire. Certain classifications such as "incombustible," "fire-retardant," "slow burning, etc., have taken on definite meanings based on old test methods and code requirements, and yet the limits set on these classifications are purely arbitrary and there is little to prove that they have any relationship to life hazard or property damage.

The last technical bulletin published by the Acoustical Manufacturer's Association lists 79 different acoustical materials of all degrees of combustibility. Federal Specification SSA-118 on acoustical materials contains a conveniently small scale method of measuring "combustibility" of "flame resistance" or whatever else you want to call it. It can be assured that the acoustical materials industry, with the diversity of products represented, has no axes to grind. The industry is

convinced that it has certain benefits to offer mankind and has promoted these with evangelical zeal.

3) Maintenance.

Maintenance of acoustical materials installations has become a problem of considerable economic importance. Improper methods of application often lead to later maintenance difficulties. Certain types of material are more amenable to redecoration than others. Proper maintenance of acoustical materials is a problem of considerable magnitude and one which is of great economic importance. Since the initial outlay for an acoustical material installation often amounts to a large capital investment, loss of the ability of the material to absorb sound as a result of excessive deterioration of the surface or of faulty redecoration procedures, cause excessive depreciation of the initial investment.

Preserving the acoustical life of an acoustical material is a procedure which may be characterized by the following steps: 1) selecting the proper materials for the particular job involved, 2) supervising the installation of the material (this mainly refers to acoustical plasters), 3) minimizing staining and soiling of material in such a way as not to impair its acoustical effectiveness.

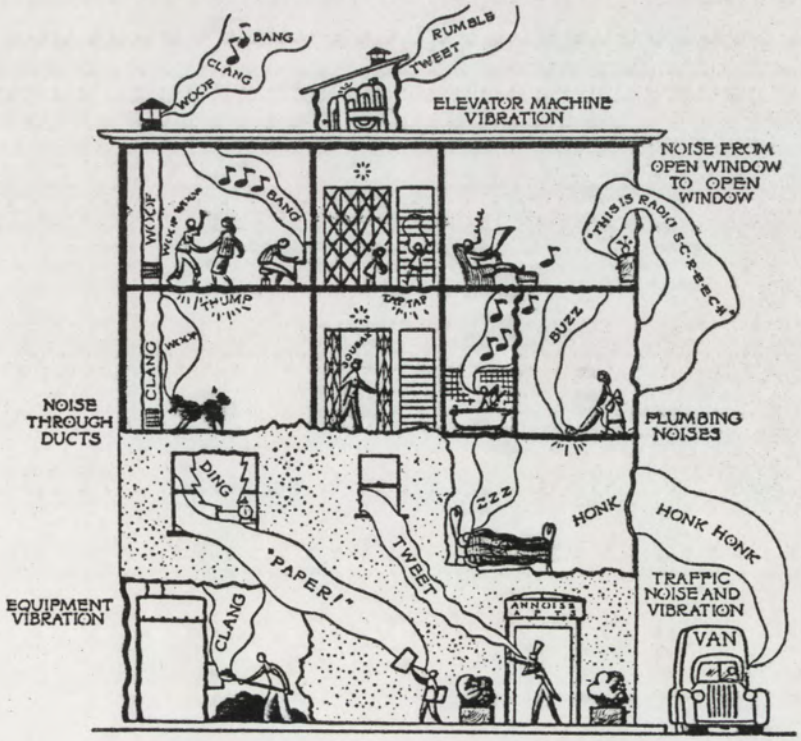
C. SOUND ISOLATION:

As important as acoustical materials, sound isolation by design is a very important factor when total sound control is desired.

In multi-family dwellings, the sound-transmission loss of partitions, floors, and even doors become extremely important because of the effect of noise on sleep, rest and health. The noise generated by neighbors talking, radios, and t.v. is transmitted through air before reaching the separating partition or floor. It is therefore designated as airborne sound transmission.

FIGURE 8.

AIRBORNE SOUND TRANSMISSION



The Federal Housing Administration minimum property standards for multifamily housing (FHA No. 26000) contains airborne-transportation-loss standards to provide a high degree of acoustics separation and privacy between living units and similar spaces.

As far as ordinances, laws and restrictions against noise pollution are concerned, Albuquerque falls behind as do the majority of other cities.

The writer in an effort to further investigate what Albuquerque has done to fight the problem of noise pollution has consulted several authorities which were capacitated to "do something" about the problem.

The organizations contacted were:

1) Building and Inspection Department stated that "Nothing has been done in the building code to attenuate noise."

2) City Zoning Department stated that "No special zoning ordinances restrict housing being close to noise sources."

3) Traffic Engineering Department stated that "Vehicular activities on the street as far as noise is concerned has no limit as to how loud a vehicle might be."

4) City Planning Commission stated that "Nobody has done anything about noise in the city."

Part One has identified noise, clarified its major sources and effects on people, the accomplishments carried out so far and the basic definitions of architectural acoustics and acoustical materials.

Noise, being a new kind of pollution, has been widely neglected and misunderstood. The designing for the control of noise has been taken very casually and passively.

The architect, being influenced by clients, contractors, building codes and most of all, financial conditions, tend to loose control of some of the basic design criteria. Within the past 5 years more legislation has been passed in the United States and the rest of the world than in all of the precedent history.

Obviously the world is getting nosier. The people are apparently getting used to it but different sicknesses are being linked to it.

To alleviate this condition, architects should become aware of the new phase the world is seeking. Seeded with this idea in mind, it will flourish and vast amounts of conceptual images will flow. Noise, being one of the problems the world is now facing, will undoubtedly be included as part of an array of problem solving ideas which will encounter a final masterpiece solution.

[1]Vern O. Knudsen, Ph.D. and Cyril M. Harris, Ph. D., Accoustical Design in Architecture, 1950, John Wiley and Sons, Inc., New York, p. 5.

[2]Rettinger, Accoustics-Room Design and Noise Control, 1960, Prentice-Hall, Inc., pp. 200-202.

[3]Ibid., p. 204.

[4]Robert Lindsey, Albuquerque Tribune, July 22, 1971, p. C-6.

[5]Editor, Albuquerque Journal, "Cost of Human Health Cited," Dec. 29, 1969.

[6]Parade, Albuquerque Journal, "G.I. Deafness," 1971.

[7]James D. Chalupnik, Transportation Noises: A Symposium On Acceptability Criteria, 1969, University of Washington Press, Seattle and London, p. 70.

[8]Ibid., pp. 70-71.

[9]Vern O. Knudsen, Ph.D. and Cyril M. Harris, Ph.D., Accoustical Design in Architecture, 1950, John Wiley & Sons, Inc. New York, pp. 50-51.

PART II.

Part two is primarily concerned with actual on-the-site studies to determine the noise factor versus the psychological and sociological background of the residents of the studied areas. Herein will be determined the problems or problem areas of the residents of the low income housing neighborhoods.

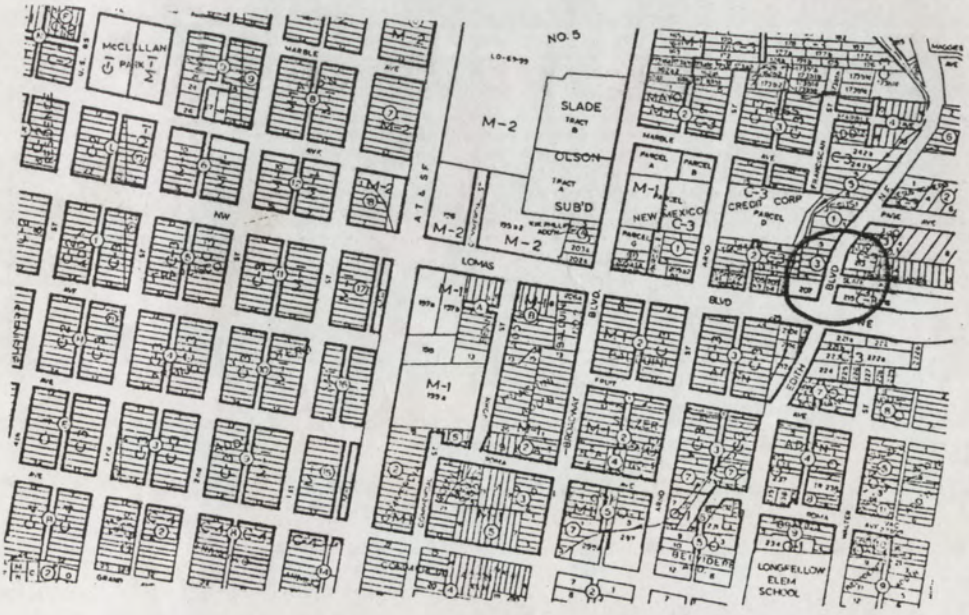
Note: The writer now takes this opportunity to make clear that, due to the time limit imposed, this study will be concerned only with the control of noise surrounding the listener's ambiance, and not in any way with the redesigning of the noise source itself.

The following study was conducted in four different low-income family housing units in the metropolitan area of Albuquerque, New Mexico. These four areas were:

1. Martinez Town at the corner of Edith Blvd. and Lomas Blvd.

FIGURE 9.

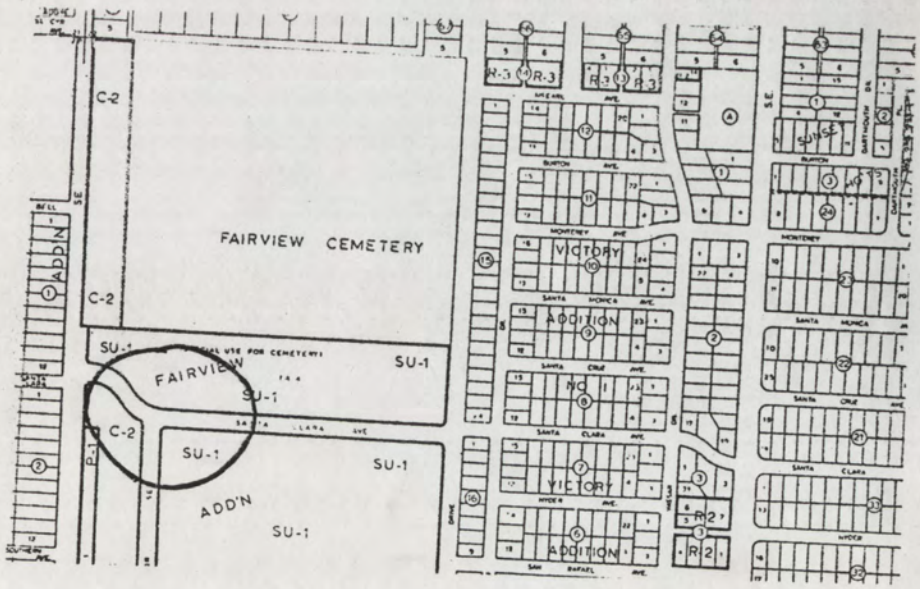
FIGURE 10.



2. Mountain View Apartments at the corner of Stadium Blvd. and Yale Blvd.

FIGURE 11.

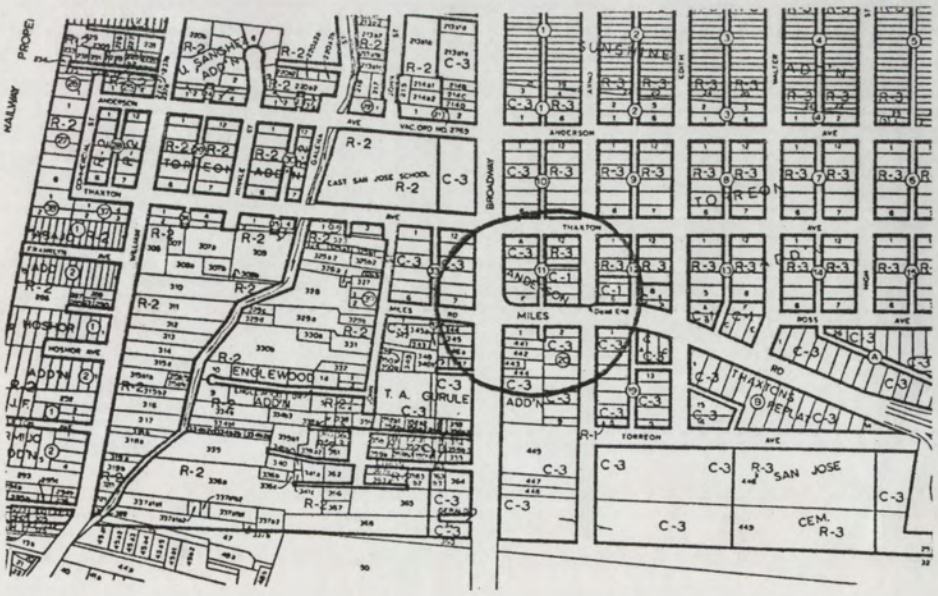
FIGURE 12.



3. South Broadway at the corner of Broadway and Miles Road.

FIGURE 13.

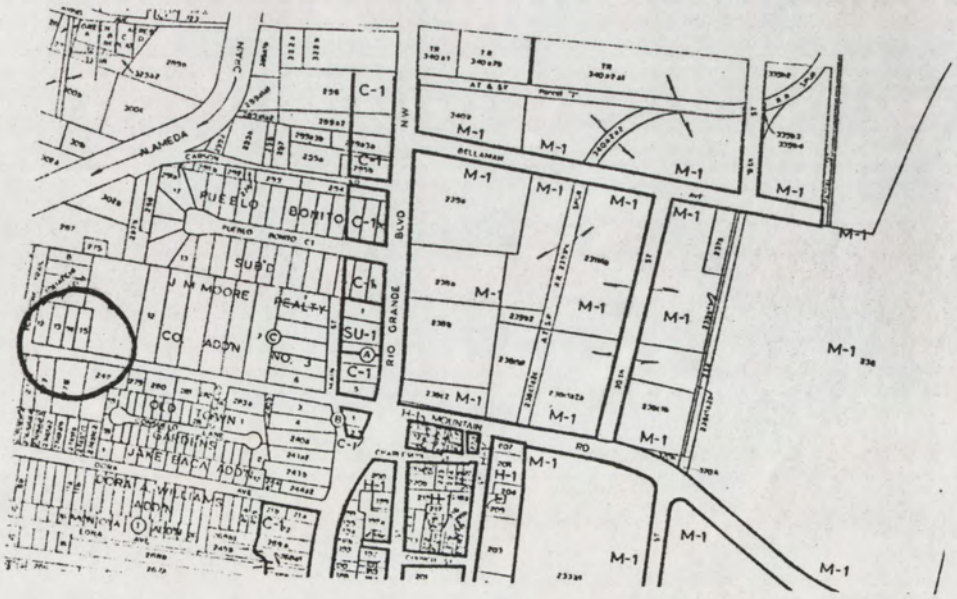
FIGURE 14.



4. Lulac Apartments at the corner of Mountain Road and Lulac Street.

FIGURE 15.

FIGURE 16.



Martinez Town and South Broadway. These areas were chosen as the typical old poverty areas. These two neighborhoods have been in existance for a long time. The people living in these two areas have lived there for the greater part of their lives. Noise was not relevant at the time the houses were erected. Getting used to the noise accounts for a great part of the different opinions of the residents living in fairly newer neighborhoods. This will be discussed more in depth in the section that is to follow.

The other two low-income neighborhoods are more modern and newer in design. These are Mountainview Apartments and Lulac Project. Both of these, for many residents, represent moving into a little more luxury, making the residents a little more sophisticated and more sensitive to some finer qualities, e.g., noise perception and identification.

These four areas represent a cross section of the low income housing in Albuquerque. The decision of choosing these areas rests on the experience and knowledge the writer has had in living close to or personally knowing people that have lived in said areas. In addition, the writer believes, through more than 10 years experience, that these areas (due to their location) exhibit a full range of noise levels:

airport traffic, vehicular activities,children playing to the low noise level of a faulty ballast on a lamp post at night.

THE SOUND LEVEL METER

Because of the nature of the study which involves a sound level meter, we will pass on the explanation and quick review of the meter used. This device consists of a microphone and appropriate electrical equipment for converting sound that is incident on the microphone into a meter reading that indicated the sound pressure level in decibels. (The explanation of decibels will follow the discussion of the sound level meter.)

The sound level meter is a physical instrument which, although lacking certain characteristics of the ear, is nevertheless extremely useful for measuring the levels of sounds including those of interest in architectural acoustics.

The ear is not equally sensitive at all frequencies, hence, even though two noises produce exactly the same sound level, one may be judged to be louder than the other. This happens if more of its energy is concentrated in a frequency region where the ear is most sensitive. Sound-pressure level, a physical quantity, is not a direct measure of the loudness of a sound. The

sensivity of the ear is not uniform with the respect to frequency. This is illustrated by the curves which represent contours of equal loudness for pure tones.

In order to obtain meter readings which have a closer relationship to what the ear hears than to sound-pressure levels, the frequency response of sound-level meters is modified by the introduction of so-called "40 and 70 dB frequency-weighting networks," these networks alter the sensitivity of the sound-level meter with respect to frequency, so that its sensitity as a function of frequency approximates that of the ear indicated by the 40 and 70 marks. The readings of the sound level meter with either of these networds in use are indicated in terms of decibels and are called "weighted sound-levels". In reporting such reading, the weighing network used should be specified. When the third or "flat" network is used, the meter reads sound-pressure level.

The "A-scale" weighting network was the one used by the writer for the study. A-scale decibels (dBA) are used to rate human reaction to traffic noise.

Shown below is the A-scale discrimination against sound of different frequencies.[13]

TABLE V

RELATIVE RESPONSE (dB)

A-SCALE WEIGHTING NETWORK

63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	8000Hz
-26	-16	-8	-3	0	+1	+1	-1

HOW THE STUDY WAS EXECUTED:

The purpose of this study was to measure the decibels when noise was at its loudest, or when the noise in the areas became a nuisance. Therefore, the decibels readings were made during the weekday. A day was dedicated to each area in which noise was measured at 8:00 a.m., 7:00 p.m., 5:00 p.m. and 12:00 p.m. 8: am and 5: pm were chosen for the heavy traffic pattern due to rushing back and forth from work. 2: pm and 12: pm were the extremes in which silence prevailed the most - as the study shows.

The noise was measured in eleven minute sequences at a time. For example: if measuring at 8:00 a.m., the reading was made from 7:55 a.m. through 8:05 a.m. for a total of 11 minutes at a "fast response" of the meter. For every minute measured, an average reading was arrived at by simple observation, then recorded. Another average was calculated for the entire eleven minutes and recorded as the noise

level for that given time of day. Also, a minimum and maximum noise level was recorded together with the average background noise, i.e. traffic from streets of more than one block away, street cleaner, people walking, birds, etc.

(For the full report on how the reading was conducted, refer to Appendix D.)

1. MARTINEZ TOWN:

In this area, vehicular activity proved to be the overpowering factor that contributed the most to the problem of noise. Lomas Blvd. provided virtually all of the traffic noise, especially at the take-off from the light which went up to 80 dB A. Smaller sports cars, motorcycles and "hot rodders" were the major offenders. At 12:00 p.m. when traffic was negligible, the average background noise (52 dB A) was composed of the freeway (at 5 blocks) and a faulty ballast from a light post up above.

Construction machinery, industrial and aircraft noise were nil. The neighborhood noises such as children playing, dogs barking and people walking were kept to an average of 55 dB A. The lowest decibel reading was at night while the loudest was at 2:00 p.m. when school lets out.

READINGS

Background (dB A)	Time	Hourly Average (dB A)	Min. (dB A)	Max. (dB A)
65	8: a.m.	68.6	62	82
58	2: p.m.	64.1	58	76
64	5: p.m.	66.7	56	80
52	12: p.m.	56.1	46	90
59.7			55.5	82
Average for the day		63.8		

Incidents of causes by percentages:

Cars	60%	Airplanes	0%
Motorcycles	10%	Const. Ind.	0%
Trucks	20%	Neighborhoods	10%

2. MOUNTAINVIEW APARTMENTS:

Here again, traffic noise was the major offender, followed closely by aircraft noise (72). In the morning hours, traffic became sporadic; constant in the early afternoon. At the times when both traffic and aircraft noises were neglibible, birds could be heard from the trees nearby at 51 dB A. Motorcycles were a nuisance. Construction equipment was at a constant of 66 dB A. Trucks were up to 80 dB A one block away from meter. A street cleaner was heard at 86 dB A while 5 feet from the meter.

This particular area showed the most variety of noise sources making it the third noisiest area studied. Noises came in very sporadic manners. This was the only area

exhibiting a very unstable noise quality, with the minimum noise level recorded at 40 dB (the lowest of all areas) and the maximum at 90 dB A (the highest of all areas.)

READINGS

Background (dB A)	Time	Hourly Average (dB A)	Min. (dB A)	Max. (dB A)
52	8: a.m.	62.1	48	80
50	2: p.m.	58.0	48	90
54	5: p.m.	60.9	47	74
42	12: p.m.	49.0	40	70
49.0			45.7	78.5

Average for the day 58.0

Incidents of causes by percentages:

Cars	40%	Airplanes	15%
Trucks	10%	Const. Ind.	5%
Motorcycles	15%	Neighborhoods	15%

3. SOUTH BROADWAY:

This area was very similar to the Mountainview Apartment area because of the airport, making it the second noisiest area studied. The aircraft noise recorded from the Army planes was somewhat louder than from the commercial airlines. Traffic was rather constant in the emission of noise.

The nature of sounds make them noise. According to the writer's observations, the noise level and its nature here were very similar to the noise recorded in Martinez Town. Here is where the psychological factor takes effect.

Late at night the traffic became very casual, causing the reading of decibels to drop to a minimum of 43 dB A. Generally speaking the average noise recorded was above average - the sporadic sonic booms and "hot rodders" contributed immensly.

READINGS

Background (dB A)	Time	Hourly Average (dB A)	Min. (dB A)	Max. (dB A)
57	8: a.m.	62.2	56	84
52	1: p.m.	61.1	53	86
55	5: p.m.	65.6	56	81
49	12: p.m.	53.0	43	79
55.7	Ave. for day	60.4	52.0	82.5

Incidents of causes by percentages:

Cars	60%	Airplanes	10%
Motorcycles	5%	Const. Ind.	0%
Trucks	20%	Neighborhoods	5%

4. LULAC APARTMENTS:

This area proved to be the quietest one that was studied. It was 10 decibels lower than the highest area recorded.

The main source of noise was produced by the nearby Elementary School. When the children were in class, the main source of noise became the freeway.

The noise level was so low at times that birds, people talking a block away, and children laughing inside the

classrooms became commonplace.

Thus, Lulac Project illustrates the importance of placing a low income residential area in a district where noise is not of major importance.

In this area, traffic still remained the worst offender, followed closely by children playing. At night traffic became negligible; only noise from the freeway was heard.

READINGS

Background (dB A)	Time	Hourly Average (dB A)	Min. (dB A)	Max. (dB A)
50	8: a.m.	59.7	48	79
43	2: p.m.	47.5	38	88
44	5: p.m.	57.2	40	79
46	12: p.m.	48.6	42	76
45.7			42.0	80.5

Average for the day 53.2

Incidents of causes by percentages:

Cars	40%	Airplanes	0%
Motorcycles	5%	Const. Ind.	0%
Trucks	5%	Neighborhoods	50%

CONCLUSION:

Of the areas investigated, the varieties of sound remained constant: vehicular traffic, aircraft noises, construction machinery, children playing, animals and people.

In the overall aspect, Martinez Town proved to be the noisiest of all the areas studied. Traffic was the major

contributor.

The Lulac Apartment area proved to be the quietest one studied. It was 10 decibels lower than the highest recorded.

The two older districts, South Broadway and Martinez Town proved to have the highest level of noise. This may be justified by the fact that several years ago when the areas were being built, they were accomodated close to the main arteries of the city for easier access. These main arteries became boulevards and freeways and the surrounding houses remained. Only those who could afford to move went to quieter places while those remaining got accustomed to the noise. (This will be discussed in greater detail in the study that is to follow).

The two newer areas were built with the plan for the given neighborhoods already laid out. The main streets had already been designated and zoned properly, therefore the choosing of a quieter site was more available. Only the evergrowing air traffic and population have infringed on the right for a quieter life in these areas. Since the expense of acoustics cannot be afforded in low income housing, primary importance should be given to the choosing of a quiet site.

The averaged hourly noise level at the end of the day ranged from 53.2 dB A to 63.8 dB A. According to Table III, 53.2 dB A will be equal to the intensity of sound produced by background music. 63.8 will be equal to a shouting conversation.

NOTE: Loudness should not be confused with sound intensity. The loudness of a sound is related to the annoyance it conveys. Example: The sound intensity for a boiler room is 110 dB A; everybody considers this as noise. The sound intensity for a rock and roll band is also 110 dB A; many consider this relaxation.

To the maker of the foregoing study, all four areas carried relatively the same quality of sound: from traffic noise to children playing in the streets. The recorded reading from the sound-level meter showed a difference of only 10 dB A from the quietest to the loudest area. 10 dB A is the difference between "zero listening" to "leaves rustling" in a breeze 20 feet away. The areas studied are considered to be noisy.

The above paragraph was repeated in order to keep the point in mind as the reader engages in reviewing the study which follows.

A. PURPOSE:

This study represents the personal feelings involved because of the noise actually surrounding the resident. By questioning the resident, the sociological and psychological characteristics are brought about. These will be of definite falue to the end result. Also, by analyzing the resident, or the person inside the "house" (the word "house" here means the place protecting the resident from the outside noise), there could be an estimation of the acoustical properties of the "house."

The actual measurement of noise from within the house was considered but due to reasons beyond the writer's control, it was promptly abandoned.

The necessity of completing the study by the foregoing suggestion was considered to be of great importance. Therefore the writer decided to study himself and his environment. This study of the writer as "I" will be reviewed in detail as follows:

B. HOW THE STUDY WAS EXECUTED:

There were 10 interviews conducted in each of the four neighborhoods. The subjects were selected through telephone numbers from the City Directory on the basis of an address identified in the site evaluation. Although an even balance

was desired, 70% of the respondents were women and 30% were men. There were no pre-teenagers interviewed.

The following are the questions asked:

1) How many people live in your household at the present time?

2) How long have you (the respondent) lived in the area?

3) Do you notice any noise in the surroundings?

4) From what source do you get most of the noise?

5) In your own words, how would you rate the noise?

(For a full list of addresses responding see Appendix E)

The homes interviewed were selected on the basis of the proximity to the actual decibel reading location. Although the percentage of telephone subscriptions in the area was relatively low, a high percentage of those reached (95%) completed the interview. The privilege of speaking both native languages fluently (English and Spanish) was considered an extreme advantage to the writer and accounts for the high percentage of interviews completed.

The interviews were conducted both day and night in order to have a broader selection of residents during the noisiest and quietest hours of the day. In addition, the interviews were conducted the same day that the decibel readings were taken for the different areas. This secured the possibility of interviewing those respondents who were

home during the decibel readings.

C. ANALYSIS OF QUESTIONS:

The questions were kept short and conscise in order to achieve a more uniform type of answer and a higher percentage of respondents living close to the actual readings.

Questions one (How many people live in your household at the present time?) and two (How long have you lived in this area?) were designed to establish the background of the respondents. This background is a determining factor in the type of response when compared to the actual readings.

The size of the family determines a noise level already existing in the home. This accounts for the outside noise perceived by the respondent. Here by common opinion, the more people living at home, the better the chance of more noise inside -- thus influencing the opinion about the noise outside. The influence of such opinion, either for or against the outside noise, will superficially (and that is all that is needed) determine certain psychological aspects considered valuable to the end result of this paper.

The length of time that the respondent has lived in any given area will undoubtedly determine certain socio-

logical aspects also considered of primary importance.

When question number two (How long have you lived in the area?) is evaluated in relation to question number five (In your own words, how would you rate the noise?) it brings in certain sociological as well as psychological aspects such as:

1. Financial: Resident has lived "too long" or has just moved into the noisy environment and has thought about leaving the area but can't.
2. Cultural: People living with many children in the house are more concerned about not having a son run over by a truck than they are concerned with the "noise" of the truck itself.
3. Psycho-physiological: A person living with a noise for a long period of time has usually adjusted to it. They simply got "used to it."

If the respondent perceives a certain noise degree in the area and is an old resident, his answer to question four (From what source do you get most of the noise?) will be evaluated according to the number of years lived in the area. If the respondent has lived too many years in the area he either got used to the noise or has a more accurate explanation of the "seasonability" of the noises than has the "new" resident.

Although the trend of the noise level keeps moving in an upward direction, there exists the fact that construction equipment is used seasonally. Therefore the answer to question number four (From what source do you get most of the noise?) by a fairly new resident (one to six months) will be given less value than the answer of a resident that has lived a longer period of time in the given area.

D. SUMMARY OF QUESTIONS:

1-MARTINEZ TOWN:

a) People living in house 2.7 average

b) Length of time in area 24.0 Years

c) Noticeable noise in area

Yes 60% No 40%

d) Worst kinds of noises heard

Cars	30%	Airplanes	0%
Motorcycles	0%	Trucks	20%
Neighborhoods	50%	Construct.	0%

23

e) Degree of Noise

Very bad	50%	Not too bad	10%
Bad	20%	Okay	20%

2-MOUNTAINVIEW APARTMENTS:

a) People living in house 2.9 average

b) Length of time in area 2.6 Years

c) Noticeable noise in area

Yes 70% No 30%

d) Worst kinds of noises heard

Cars	10% 12	Airplanes	30% 31
Motorcycles	10.9 0% 0	Trucks	0%
Neighborhood	50% 50	Construct.	0%

e) Degree of noise

Very bad	10%	Not too bad	10%
Bad	20%	Okay	30%

3-SOUTH BROADWAY:

a) People living in house 3.5 Average

b) Length of time in area 40.0 Years

c) Noticeable noise in area

Yes 90% No 10%

d) Worst kinds of noises heard

Cars	30% 7	Airplanes	20% 30
Motorcycles	10% 5	Trucks	40% 50
Neighborhoods	0% 11.00	Const/Ind.	0%

d) Degree of noise

Very bad	50%	Not too bad	10%
Bad	30%	Okay	10%

4-LULAC APARTMENTS:

a) People living in home 3.8 Average

b) Years lived in area 7.1 Years

c) Noticeable noise in area

Yes 50% No 50%

d) Worst kind of noise

Cars	20%	Airplanes	10%
Motorcycles	10%	Trucks	20%
Neighborhoods	40%	Const/Ind	0%

e) Degree of noise

Very Bad	40%	Not too bad	20%
Bad	30%	Okay	10%

NOTE: The telephone numbers for the Lulac Apartments were unavailable because of the short time these apartments have been operating. Therefore the telephone numbers selected were chosen from the houses closest to the Lulac Apartments in which the noise level reading was conducted.

E. CONCLUSION:

By general classification the following percentage contributions were stated for various noise sources:

NOISE SOURCE:

Neighborhoods (People walking, animals, etc.)	37.5%	(5)
Cars	22.5%	(4)
Trucks	20.0%	(3)
Airplanes	15.0%	(2)
Motorcycles	5.0%	(1)
Construction/Industrial	0.0%	

The number beside the given % shows the order of annoyance with Number 1 being the most annoying. The figures given above merely express the noise noticed, not necessarily the annoyance of the noise.

Although the neighborhood noises head the list, it was the least annoying.

Airplane and motorcycle noises were the least noticed and yet they were described as "irritable," thus accounting for the highest level of annoyance.

Noise coming from cars and trucks were the easiest to "get used to" and live with. No construction or industrial noises were recorded since there was not a factory or a building under construction close to the studied areas.

The "getting used" to the noise accounts directly to the frequency of such a noise as produced.

The average number of people living at home was 3.22. The average number of years lived in the same home was 18.42. The percentage of people that noticed noise was 67.5. The degree of the noise rated as "very bad" was 37.5%; "bad" was 25.0%;"not too bad" was 20.0%; "OK" was 17.5%.

The more people living at home, the less sounds from the outside were noticed. The more years lived at home, the less the noise bothered the resident, and the more variety of sounds perceived. Those who did not notice noise had a more accurate description of the noise source; the time it was most annoying and what should be done about it. Yet, these people did not notice noise. Rather than notice the noise, they had become used to the noise. Noise actually was noticed but it did not bother them.

Men and women exhibit about the same degree of annoyance to vehicle noise. Men's description of some of

the vehicle annoyance were as follows: 'long haired dudes know better", "hotrodders down the main drag", "noise from bikes is out of sight". Women expressed their interest rather on the danger coming from the proximity of the traffic to their homes.

PART TWO - ACTUAL DECIBEL READING -vs- RESIDENTS INTERVIEW

We will now evaluate individually the different major types of noise sources as compared to the answers given through the interviews. There will also be an analysis of the observation by the writer in conjunction with the actual noise readings as compared to the resident's feelings being influenced by their social and psychological characteristics demonstrated by the answers of the interviews.

A. MOTOR VEHICLE TRAFFIC:

1. Cars

The word "cars" was used interchangeably to mean traffic. Therefore, there might be a tendency to misuse "cars" which may account for the highest rate of incidents in the motor vehicles section according to the interviews. According to the readings made, the writer found that cars alone contributed only to 22.5% of all noise involved; it includes the factors of annoyance. Cars proved to be the type of non-human noise that could be most readily accepted. The ratio of cars per family in the United States is one of the highest in the world; everybody "needs" one, it is a part of our lives and it is taken for granted.

2. Trucks

Here all kinds of trucks were considered, from the pick-up truck to the diesel types.

In the newer areas, trucks were considered overly noisy when compared with the actual readings. Trucks, in addition, are the most dangerous of all motor vehicles.

Incidents of truck noises were higher in the older areas as both studies shown. Here again, the factor of the number of people living at home took effect on how they rated the truck noise. The more people living at home, the more chance of these people having children, therefore the more trucks noticed and labeled as dangerous. This was quite the opposite demonstrated with cars.

3. Motorcycles

Measurable incidents of motorcycles were very unstable. Both actual readings and interviews show an inconsistancy of the noise noticed from motorcycles. Motorcycles are few on the road and are hardly responsible in the over all average for the noise produced in the city. Although motorcycle noise is very sporadic, it is by far the most noticed

and accused of being the loudest. In the decibel readings, noise from motorcycles was on the average of 10 decibels higher than the average car noise, and was up to 40% in the annoyance factor. Comments from respondents of interviews claim that the driver of the motorcycles is much more responsible for the noise than the noise produced by the motorcycle.

4. Aircraft

Aircraft was only pertinent to the areas close to the airport-South Broadway and Mountainview Apartments. Both readings and interviews were constant in their findings except for Lulac Apartments. When in the area, the writer found no existance of air traffic yet one respondent made clear the point of air traffic above the area of the Lulac Apartments. The respondent had lived in the area for 3 years with a family of four and it was, by the way, the most cooperative one; thus indicating his concern with the problems attacking his community. Although noise from aircraft was not mentioned by any other resident of the area, aircraft noise was considered to be an offender of the community.

5. Neighborhood Noises

Neighborhood noise was referred to in the actual readings as "background noise." On-the-street readings account for a large amount of noises not coming from humans or animals. Background noises average only 3.5 decibels higher than the minimum recorded in the areas. According to the interviews, neighborhood noises, i.e. people walking, children playing and animals accounted for the highest number of incidents; yet they were the lowest in annoyance. Those homes which had the most people had a higher degree of incidents of this type of noise. 25% of such homes complained about their own household having a higher degree of annoyance than the people in the street. There were no complaints whatsoever about the electric appliances in homes or the lawn mower of the neighbor. (For a decibel account of the typical sounds heard in the average day see Table I.)

The writer decided to conduct another study based on both studies previously made, the actual readings and the residents interviewed. The purpose of this was to get a clearer picture of the influence noise has on a human life, i.e. personal characteristic changes, creation of new habits and comprehension of the adverse effects caused by noise. The writer, who in this section will be referred to as "I" had lived in reasonably quieter Albuquerque areas prior to moving into another neighborhood.

"As a matter of fact, what motivated me to write my thesis about noise pollution was the fact that the area to which "I" had just moved was considerably noiser than all of the other areas put together.

"Based on the experiences acquired while researching noise and on the different studies conducted while working on my thesis, "I" consider this last study (based on 24-hours a day for the last 18 months) to be of the greatest value.

"I" conducted a one-week decibel reading study based on a six-times-per-day measurement, in the front yard of my home. These hours were: 8:00 a.m., 10:00 a.m., 12:00 a.m., 2:00 p.m., 5:00 p.m. and 12:00 p.m. Here again the intensity of noise subject to the different hours of the day was constant with the results from previous studies.
The house I lived in is 30 years old and enters the cate-

gory of low-income family housing. The rent was $60.00 a month including utilities and "I" lived alone.

FIGURE 17.

Another test on noise was conducted for one week using the same hours given above. This time the readings were measured from inside the house. The house is constructed of adobe, one of the finest materials for the attenuation of noise.

NOTE: For a full report of study see Appendix C.

ACTUAL READINGS FROM OUTSIDE OF HOUSE

TIME	AVE. dB A	MIN.	MAX.
8:00 a.m.	70.1	65	89
10:00 a.m.	60.5	56	82
12:00 a.m.	65.0	57	88
2:00 p.m.	60.0	52	80
5:00 p.m.	69.0	65	88
12:00 p.m.	58.0	54	80
Average for week	63.9	58.1	84.5

All of the figures given above exceed those from all of the other four areas studied.

OCCURENCE BY PERCENTAGE

		AVERAGE
Cars	40%	82
Trucks	25%	90
Motorcycles	5%	92
Construction/Industrial	25%	88
Neighborhood	5%	75
Aircraft	0%	none

ACTUAL READING FROM INDOORS

TIME	AVE. dB A	MIN.	MAX.
8:00 a.m.	60.1	55	79
10:00 p.m.	50.5	55	72
12:00 p.m.	55.0	47	78
2:00 p.m.	50.0	42	70
5:00 p.m.	59.0	55	78
12:00 p.m.	48.9	44	70
Average for week	53.9	48.1	74.5

"The annoyance factor aforementioned was evaluated from the indoors readings which I had experienced."

"It was not necessarily the loudness of the noise but rather the message conveyed through trucks which scored the highest on both counts. The noise coming from trucks is a low pitch, grinding sound. Although the noise from a motorcycle, in intensity, was 2 dB A louder than the trucks, the thought of the big machine accelerating was far more annoying than the small engine of a motorcycle accelerating.

"Neighborhood sounds were negligible on all counts. Animal sounds, especially birds, were even welcomed as a contrast to the traffic noise.

"I" considered the "hotrodder" noise as irritable. This is true not because of the loudness of the machine, but because of the irresponsibility and carelessness of the driver.

"Construction equipment, although new in the area, held the second worst rating in annoyance. For the endurance of one month, construction equipment was very constant on the noise level (88 dB A) and although most of it has been literally diminished, it still lingers in memory as being as noisy as the diesel trucks.

"Learning to live in a noisy home had many adverse affects on my way of life. I found myself becoming more irritable and many times lacked the energy to do things

which I would normally have considered easy and enjoyable. Although I lived by myself and one's self-made noise is not very aggrevating, the noise from outside caused severe headaches and edginess.

"Having to keep the windows shut because of noise became a major issue in the summer time. The lack of natural light from keeping the curtains drawn gave me a feeling of loneliness and depression. The music I played had to be louder than the noise from the diesel trucks, making "listening" very unpleasant and simply added more to the already existing noise.

"Night time provided peace and silence until the sudden screeching of a "hot rodder's" tires, created from the intensity of its loudness, a high degree of annoyance. Many times I had been suddenly and completely awakened by the acceleration of the high powered diesel engines.

"Unconsciously I started to find more and more excuses to stay away from home. I left my house at 8:00 a.m. and did not return until 8:00 p.m.

"Instead of becoming accustomed to the noise, I became more sensitive to it. I began to speak lower, looking for quieter places. I noticed certain nervousness and the constant noise which surrounded me began to reflect on my hearing. Although it is a known fact that as we

grow older we begin to loose our hearing, I felt that for me this problem was very much premature.

"The facts stated earlier in this paper about the damaging effects of noise began to appear factual as my personality changes demonstrate in this section.

"I found that camping out and outdoor sports provided me with a peace of mind and tranquility of nerves. Escaping to the wilderness became a dream which I lived over and over again.

"When confronted with the decision of choosing a topic for my master's thesis, my very first idea became my only topic. I thought of "Noise Pollution." Perhaps by making other people aware of noise I would be able to share in solving a small portion of the problems and desperations caused by noise. This in fact, became the main purpose for my thesis.

Disinterest for other people's quieter life, money-hungry developers and auto and machinery makers all contribute to the ever-growing noise pollution of our world today.

In every design encountered by an architect, little importance is given to the acoustical properties of the building. If special attention has to be given to a building, i.e. large lecture rooms, auditoriums, play theaters, etc. an acoustican is hired from outside the state of New Mexico. There are no acoustical engineers in New Mexico as of October, 1971.

Many times the acoustical problems are expected to be solved by themselves once the partitions are in place. Insulation against weather is put into the partition hoping it will also keep the noise out, or in.

For the majority of constructions, especially in low-income family housing apartment units, it may work If it does it is merely because the renter is already accustomed to living in a disturbing environment, with kids playing and dogs barking at all hours. Moving into a new home means a touch of luxury they have probably never had so noise can be over-looked. In some of the poverty areas, people have more important things in their

lives to worry about than just noise. Also, with "progress" stretching into these isolated areas of the city, the noise moves in gradually so that it is less noticeable. One gets used to living with noise. One doesn't begin to think about the damaging effects it has on ears or the risk to health.

Poverty areas, in particular, exhibit a relatively high degree of noise. This noise might better be classified as nuisance noise which causes emotional stress. (For measurements of several everyday noises, see Table I).

Obviously much of the responsibility for quieter low income housing depends upon the integrity of whoever is building such a complex. In many cases these projects are government sponsored. The architect should also have some consideration for acoustical properties of these houses so that all, rich or poor, may enjoy a more peaceful and quieter life.

One of the most important facits of this paper is to create awareness, especially among the poor, of the damaging effects of noise. Day in and day out the worry of where each meal is coming from or how to pay the next years taxes is sometimes too much to bear. As a personal experience of the writer, poor people consider noise as something acceptable. Only a few complain about it.

Noise, for all they are concerned, is listed as one of the last items, other than the proximity of traffic to their homes, that may endanger their lives.

[13] Tulane University School of Architecture, Concepts in Architectural Acoustics, 1971, New Orleans, La., p. 30.

PART III.

The primary concern of Part III will be to consider what changes in the designability of the architectural profession should be made to accomodate the form - determining factor of noise.

Rather than arriving at one single solution in which one single house will be solved, the approach herein will be to develop a "system approach" applicable to any structure -- thus becoming more versatile and broader in range at the different design stages of a given building project.

There are two variable factors and one constant factor arrived at by the studies reviewed in Part II. The two variables are: Acoustical needs of the area and the budget allowed for construction. The constant found was the psycho-sociological factor. All areas investigated kept the same level, or degree and therefore a generalization may be utilized.

This part also includes recommendations as to how to arrive at the acoustical needs, or demands, required by the site.

The field of noise pollution is fairly new. The cost of acoustical materials has only been established in the acoustical field as a cost-per-item criteria. In other words, the only well established fact was the cost per unit

of installed acoustic tile and the rolls of insulation padding or fiberglass blanket. (For the different prices on acoustical materials see Appendix F). Millions of dollars have been literally wasted because of the improper use of these same materials. Bad connections on windows, doors, even ducts have been greatly responsible for the noise produced inside the home. Very little information has been gathered pertaining to the extra cost of labor and materials needed to insure the proper handling of acoustics.

There is a shortage of personnel trained in acoustical engineering and noise control and there is a large body of scientific knowledge which has not been applied effectively to the control of noise. In some cases the corresponding technology has not been fully developed -- largely because of economic and social constraints. This temporary hindrance, however, should not present a serious impediment to effective control. Although additional technological research and development is needed to enable more effective and less expensive noise control, it is evident that existing technological knowledge could be applied with great success in controlling many present-day noise problems.[14]

Instead of determining the budget allowed for noise control in dollars and cents on a given construction pro-

ject, the budget expense should be made according to the annual income of the residents.

It is very unrealistic to think that there is an "average" type of housing and that all criteria on which the control of noise is based should be acquired through this "average" house. Nevertheless, designs have been achieved through such a criteria which leave the majority of housing greatly lacking in noise control. If properly accomodated at all stages of the design of a construction, a new design machinery must be added to the already existing one.

To implement such a machinery, the acoustical needs, or noise involved in any given site will be categorized as: a) noisy; b) medium; c) quiet. The psycho-sociological factor was established as a constant, therefore it will be accounted for by the number of people living in a single unit. This is a determining factor in the control of noise within the home. The budget allowed for the inclusion of noise control will be as explained earlier -- according to the annual income of the residents.

NOTE: The figures are merely average representations and will not in any way be established as boundary lines between the different budget allowances.

This is accounted for because of the different variables in existence which are beyond the reach of this

writer. These variables are determined according to the feasibility, integrity, honesty and experience surrounding both the professional and the labor forces acting upon a given structure. For example, the budget allowed on two different occasions may be similar in monies appropriated, yet the effectiveness with which they are carried out to control noise might be quite different.

Low income housing is primarily sponsored by government agencies. Such projects include mass production of single family units, duplexes or triplexes grouped together, as well as the construction of apartment buildings. This type of construction criteria, accounting for most if not all of the low income housing, is the one on which this study is primarily based in order to incorporate the new design machinery explained earlier in this section.

All those earning less than $6,000 a year or $500 a month were considered as the low income families to which this study is directed. No special criteria was used. It only serves as a point of reference upon which to base the budget allowance. Three types of budgets were used: low - under $2,000/year; medium - $2,000-$4,000/year; and, high-$4,000-$6,000/year. It may be noted that some of these classifications might represent a larger number of residences than do the others.

The reason for this loose arrangement lies in the

dynamism the construction industry is based on. The ever-increasing prices on both material and labor, and as explained later in this part, because this study is to be used as a guideline which could be easily adopted to future requirements when necessary.

The following table VI is presented to demonstrate the budget allowed and the acoustical needs having the psycho-sociological factors needed only for this study, as a common denominator.

TABLE VI.

A/B RATIO

ACOUSTICAL NEEDS	BUDGET ALLOWED: LOW	MEDIUM	HIGH
NOISY	L N	M N	H N
MEDIUM	L M	M M	H M
QUIET	L Q	M Q	H Q

The new design machinery would accomodate all three types of budgets as well as all three acoustical requirements. More specifically, low budget noise environment, low budget medium environment, etc. Although in some cases it would be necessary to provide for a variety of these variables, e.g. all low budget stages including the "noisy," "medium," "quieter" environments) it would be ideal to specifically determine the acoustical needs through different studies of the surrounding noise before the preliminary drawings were finished. This will avoid the unnecessary expenses of the acoustical and noise control used for certain structures.

The following Table VII represents a summary of those building components or problem areas which should be considered when being designed.

DEFINITIONS:

Description: The problem area in need of attention.

DS: The Design Stage of the building in study which is explained after "definition."

DE/AM: If the problem area could be solved by attenuating the noise through Design Elements (location of walls, plat plan, landscaping, proximity to street, etc) or by Acoustical Materials.

NOTE: The extra labor cost is already estimated in the budget allowed.

The design stages will be abbreviated as follows:

P.S.: The Preliminary Study of the site before construc-

tion. This will include actual decibel readings with a reliable sound level meter. The type of test recommended will be similar in design to those conducted in this study.

P.D.: Preliminary Drawings will include conceptual interpretation of the spatial requirements as subordinated by the design of elements needed in the control of noise.

W.D.: Working Drawings immediately following the preliminary drawings will be the first attempt to permanently establish the type of construction needed. Because at this stage construction will begin, special attention should be given to the quality of labor needed to make an effective noise control.

TABLE VII.

PROBLEM AREAS INVESTIGATED.

DS	NO.	DESCRIPTION	SOLUTION DE	AM
P.S.	1	Landscaping	X	
	2	Barriers (from traffic noise)	X	
	3	Elec. Appliances (used by resident)	X	X
P.D.	1	Floors	X	X
	2	Walls	X	X
	3	Ceilings	X	X
	4	Partitions	X	X
	5	Corridors	X	
	6	Circulation (resident)	X	
	7	Doors (location)	X	
	8	Windows (location)	X	
W.D.	1	Doors (connect to walls)	X	
	2	Windows (connect to walls)	X	
	3	Ducts (cooling & heating)	X	

TABLE VII (CONTINUED)

DS	NO.	DESCRIPTION	SOLUTION DE	AM
W.D.	4	Pipes (plumbing)	X	
	5	Outlets (electrical)	X	
	6	Switches (electrical)	X	
	7	Mechanical Equip. (isolation)	X	
	8	Grills	X	
	9	Workmanship	X	

As of this writing, noise control has been accomodated primarily within those structures requiring special attention, i.e. auditorium, coliseums and the like. As concluded in the architects questionaires, acoustical engineers have never been hired for the low income housing projects. A question that came into being was the one of cost. It is true that acoustical treatment adds to the cost of the unit but this seems a very minimal amount to pay when considering all the ill effects it brings to the residents. In addition, this study, as stated earlier, aims toward the change in the design of the elements rather than to the materials used to muffle out noise. This will in no way restrict the design solutions created by the architect -- no more than the building codes would.

Laws or codes which will compel the architect to be aware of the noise surrounding a home have not yet been forseen. Nevertheless, it is the purpose of this study to appeal to the architect's conscious mind to enhance their design by making it a complete one. A quiet one.

Except for the acoustical materials, which in this study are almost entirely negligible, the rest of the noise controlling devices used would be limited to "added care" if and when incorporated in the preliminary stages of the building. If the problem were dealt with at the

beginning stages of a building project, the "added care" would not appear as an "added bother" but would become as necessary and common as a door or window.

In conclusion, we must support legislation in the making of laws and codes to attenuate noise. That these be extended to all types of environments whether public, private, low income or luxury structures. That provisions for the control of noise be a part of the appropriated funding and part of the line of design. The architects must, by visualization in the conceptual or preliminary design stages, make noise control as intimate to the end result as plumbing fixtures and electrical outlets.

In retrospect, the architect must first become aware of the physical, psychological and sociological characteristics of the group of individuals he is designing for, thereby helping him to develop the design machinery appropriate.

It is now necessary to make the reader aware that the three budget allowances considered (low, medium, high) are merely representation of "how much" acoustical materials to allow for. The real meaning of noise control lies not in the materials used, but in the proper use of the design elements. (For the categorization of the acoustical materials in the three budget allowances see Appendix F).

Also, in no way does this paper attempt to be an end result in itself, but only to be used as a guide on directing creative designability and the correct use of the elements involved to produce a living space.

It now becomes necessary to establish what is required by the designer to incorporate noise control into his already existing design machinery. As stated earlier, because of the tremendous extra cost involved, the buildings that are in existance shall be left as they are for this study which is aimed at low cost housing would then be self-defeating if an attempt to recondition already existing buildings should be made. In addition, if existing buildings should be reconditioned, a phony and extremely "plastic" feeling would be added instead. The purpose of the original design would be endangered and the indigenous modifications would become displeasing and distasteful to both resident and designer.

CONCLUSION:

In order for the architect to incorporate noise control into his design he must bear in mind the following:

1. The psycho-sociological characteristics of the residents.
2. Awareness of the noise level surrounding the site.

3. According to the budget, what acoustical materials to use in what quantities.
4. At what design stage (preliminary study, preliminary drawings, working drawings) should he interpolate the new design machinery suggested in this study.

NOTE: For on-the-job recommendations or implementations of the new design machinery see "Exhibits." Herein details of construction of the problem areas as seen in Table VII.

A. TO THE ARCHITECT-ENGINEER:

1. It must be understood that all structures exhibit a need for the control of noise. The degree of need may be arrived at through the suggestions previously explained.
2. Noise control should be considered at the very early stages of design, thus becoming part of the "routine." This should be done within the detail level.
3. Special consideration should be given to low income housing. Their financial situation deters the usage of acoustical materials and extra expensive devices such as double glass windows and heavy massive walls.

B. TO LEGISLATION:

1. The establishment of an office for the abatement of noise within the city government.
2. The creation of an agency for developing standards allowance in the exposure of all workers to industrial noise.
3. The government should expand its research on noise to encompass:
   a) Physiological and psychological effects of noise on human health and welfare.

b) Community response to noise exposure.

c) Economic costs and benefits of noise and noise control standards.

d) The application of noise control technology to vehicles and transportation systems, machinery, appliances and buildings.[15]

4. The zoning of noise

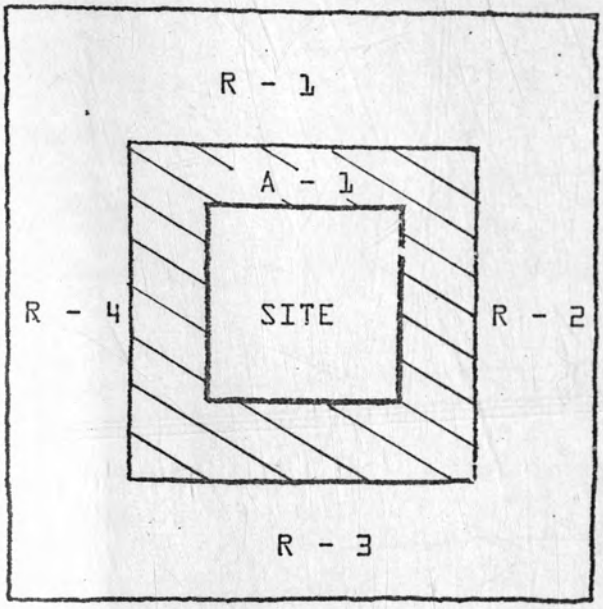
5. The making of laws to enforce quieter products

6. The government should make public all of the scientific data which could be used to control the major noise sources.

[14]United States Department of Commerce, The Noise Around US: Findings and Recommendations, U.S. Dept. of Commerce Publications, p. 19.

[15]Ibid., p. 22.

EXHIBITS



A-1 RURAL

R-1 ONE FAMILY DWELLING

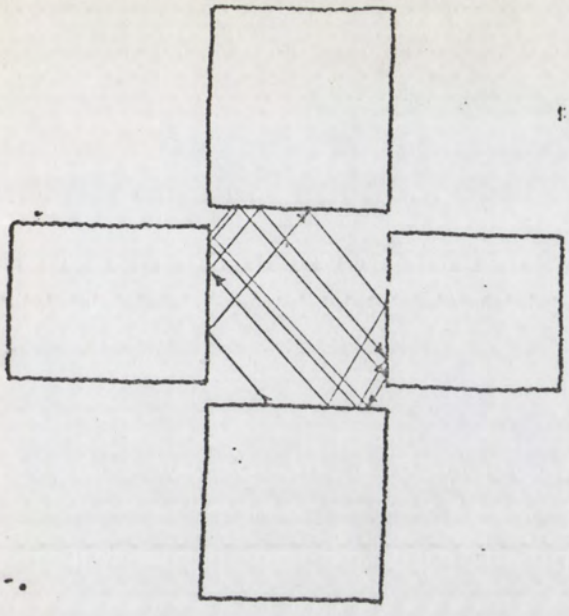
R-2 MULTI-FAMILY DWELLING

R-3 APARTMENT

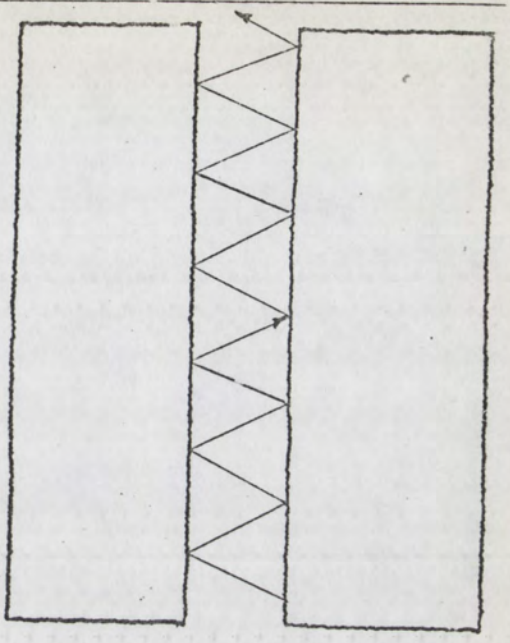
R-4 APARTMENT

Detail No. 1 Ideal Zoning For Site Location
No Scale

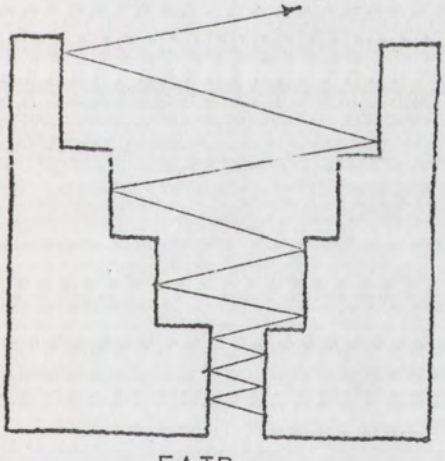
Indicates buffer zone - non living space



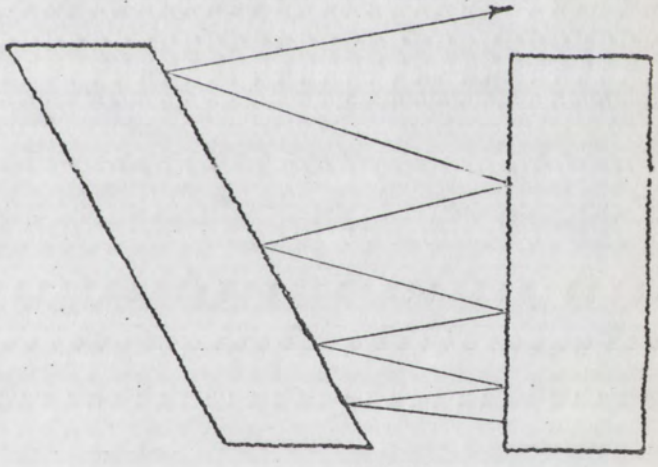
WORST



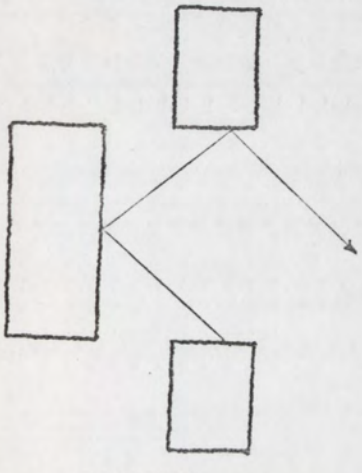
POOR



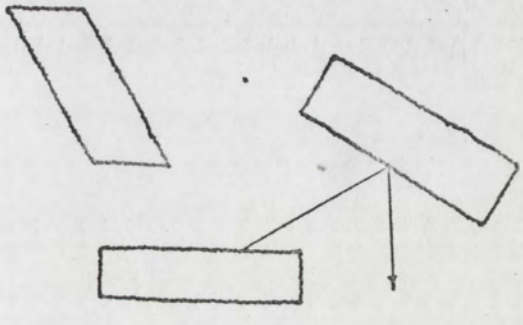
FAIR



GOOD

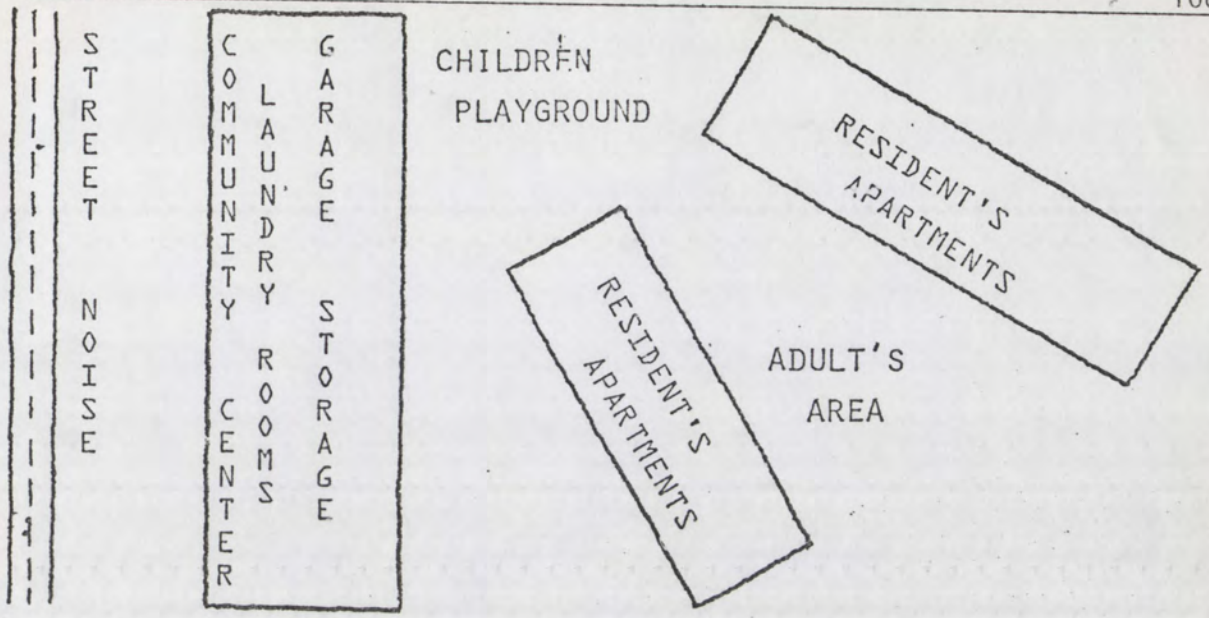


BETTER

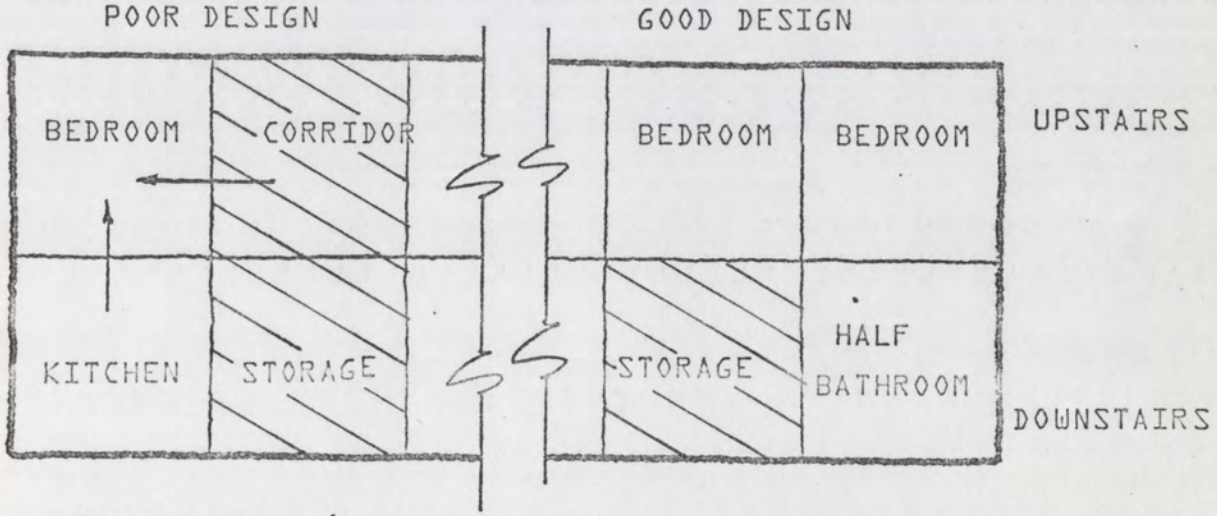


BEST

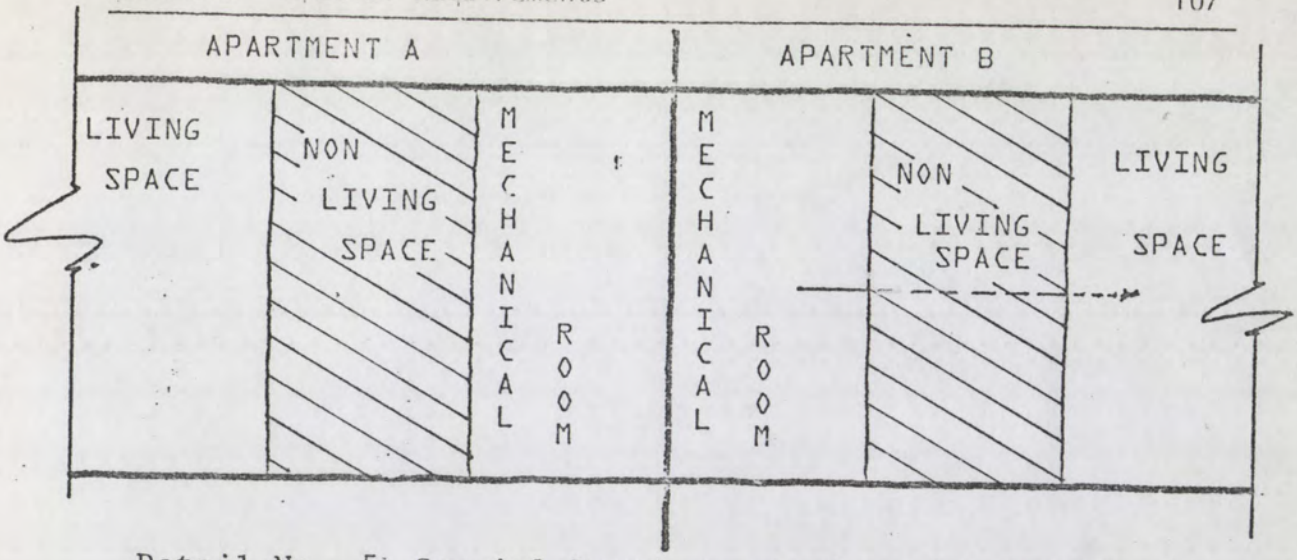
Detail No. 2 Location Of Buildings
On Site
No Scale



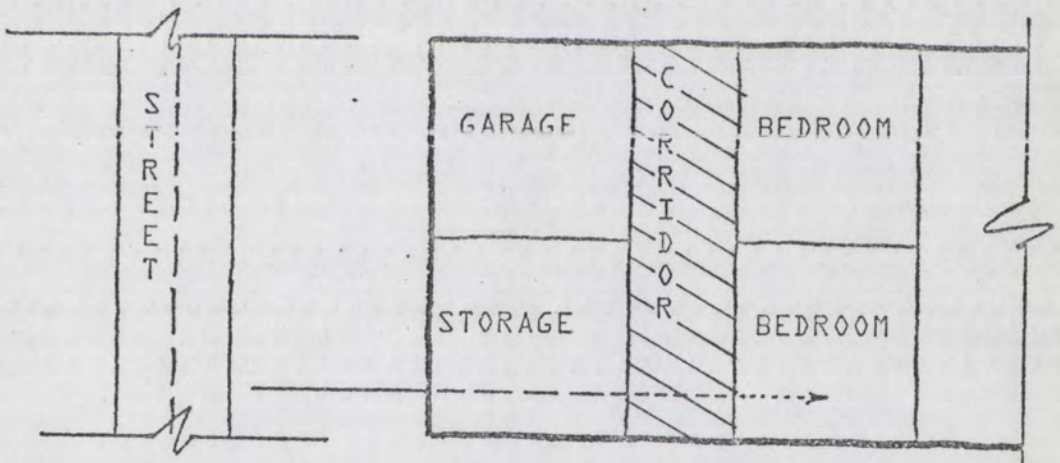
Detail no. 3 Apartment Complex Distribution - Buffer Zone Between Noise Source And Living Areas
No Scale



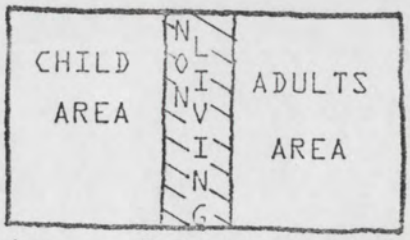
Detail No. 4 - Spacial Requirements - Grouping Of Quiet Separated From Noisy Areas Through Floor Plan Design
(Sound Transmission: Horizontal And Vertical - Internal)
No Scale



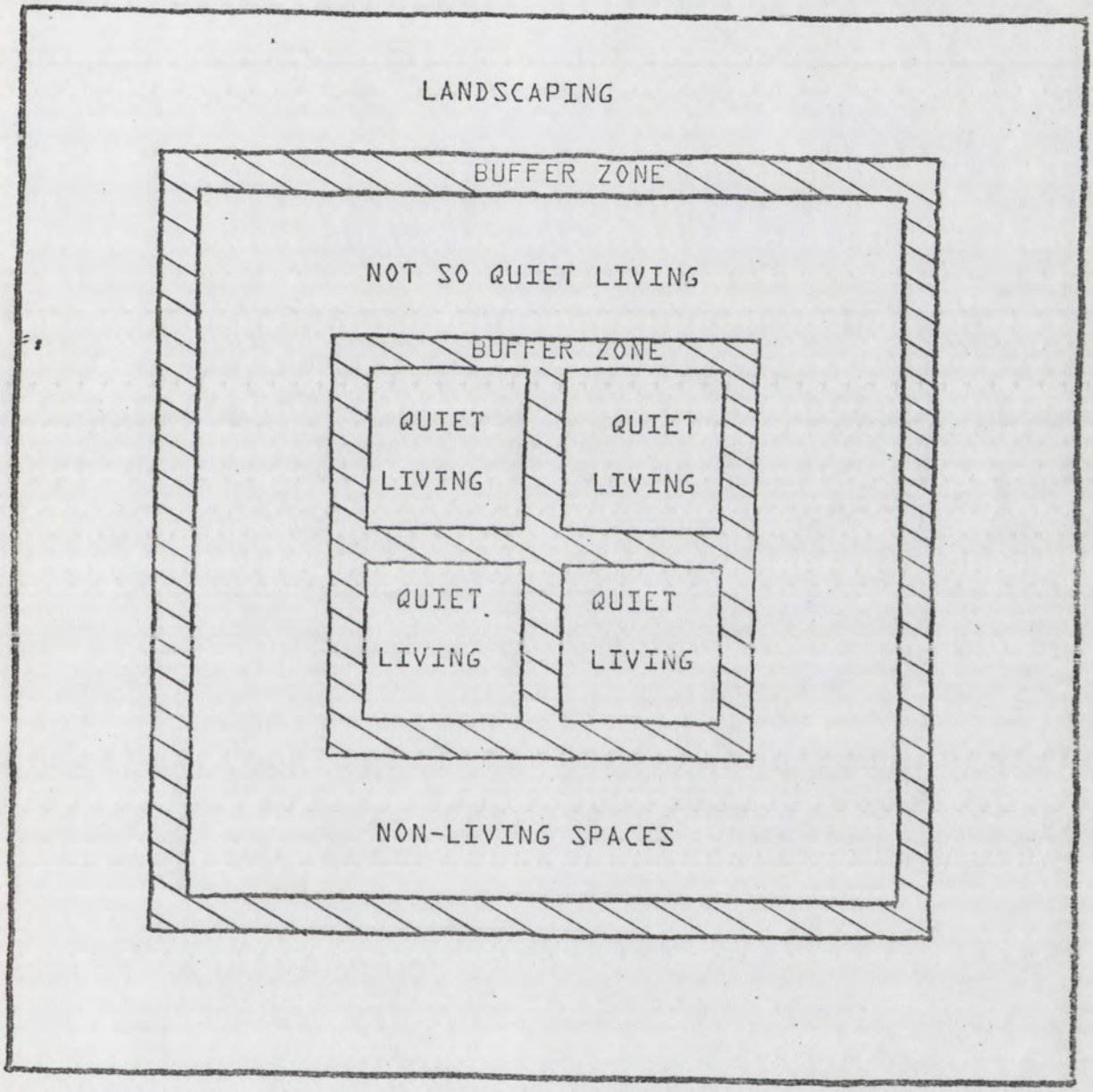
Detail No. 5 Spacial Requirements Opposite Hand Design, Buffer Area Between Noise Source And Living Space (Sound Transmission: Horizontal - From Apt To Apt.)
No Scale



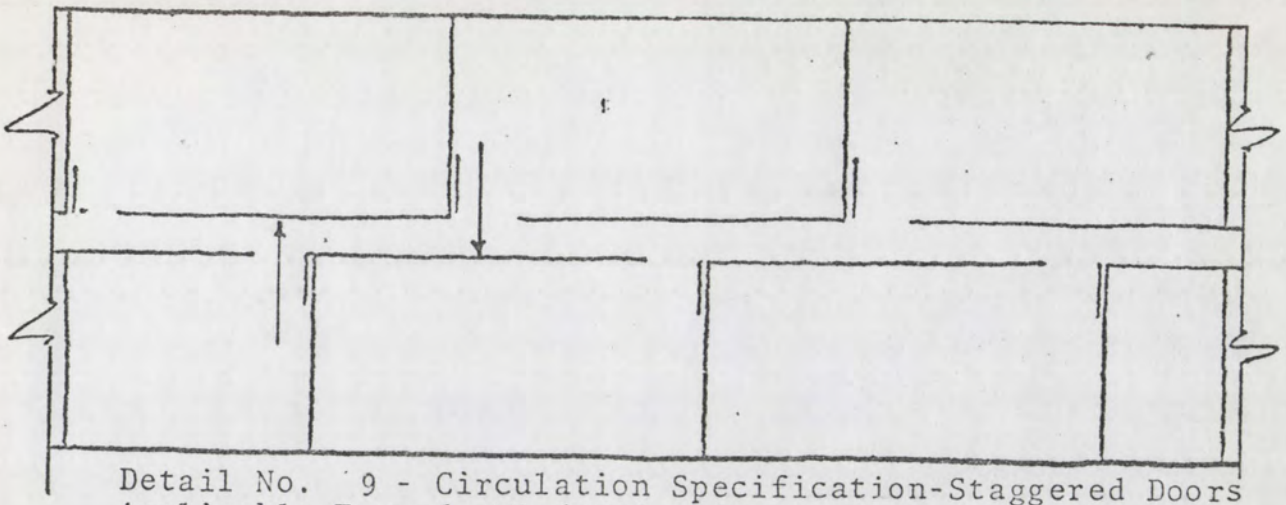
Detail No. 6 Spacial Requirements-Living Space Isolation From Noise Source (Sound Transmission: Horizontal Motor Vehicle To Exterior Of House Through The Interior To Living Spaces)
No Scale



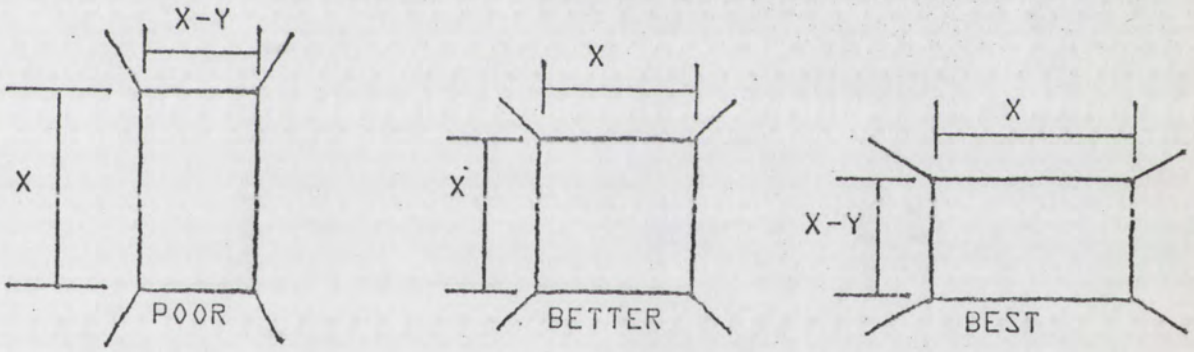
Detail No. 7 Spacial Requirements - Inter- familiar Separation (Sound Transmission: Horizontal - Internal)
No Scale



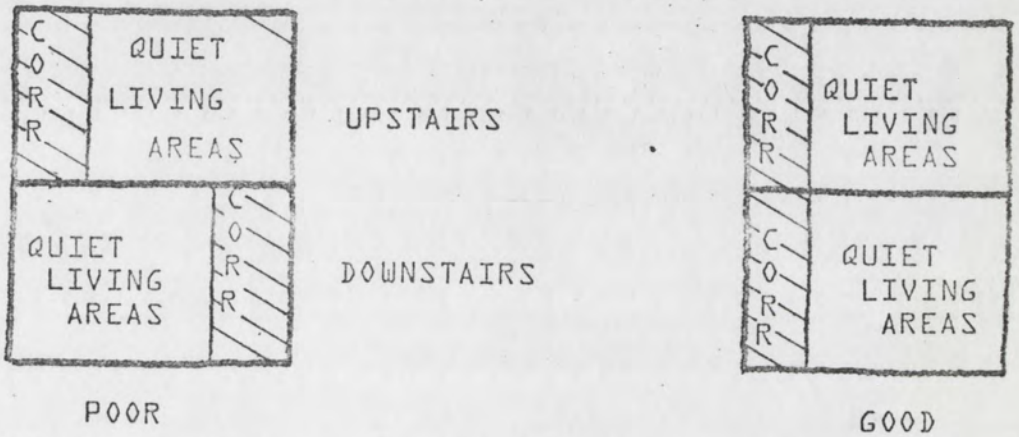
Detail No. 8 Space Requirements Summarized Solved For Noise Control To Be Incorporated With Other Design Criterias (Sound Transmission: Horizontal - Internal - External)
No Scale



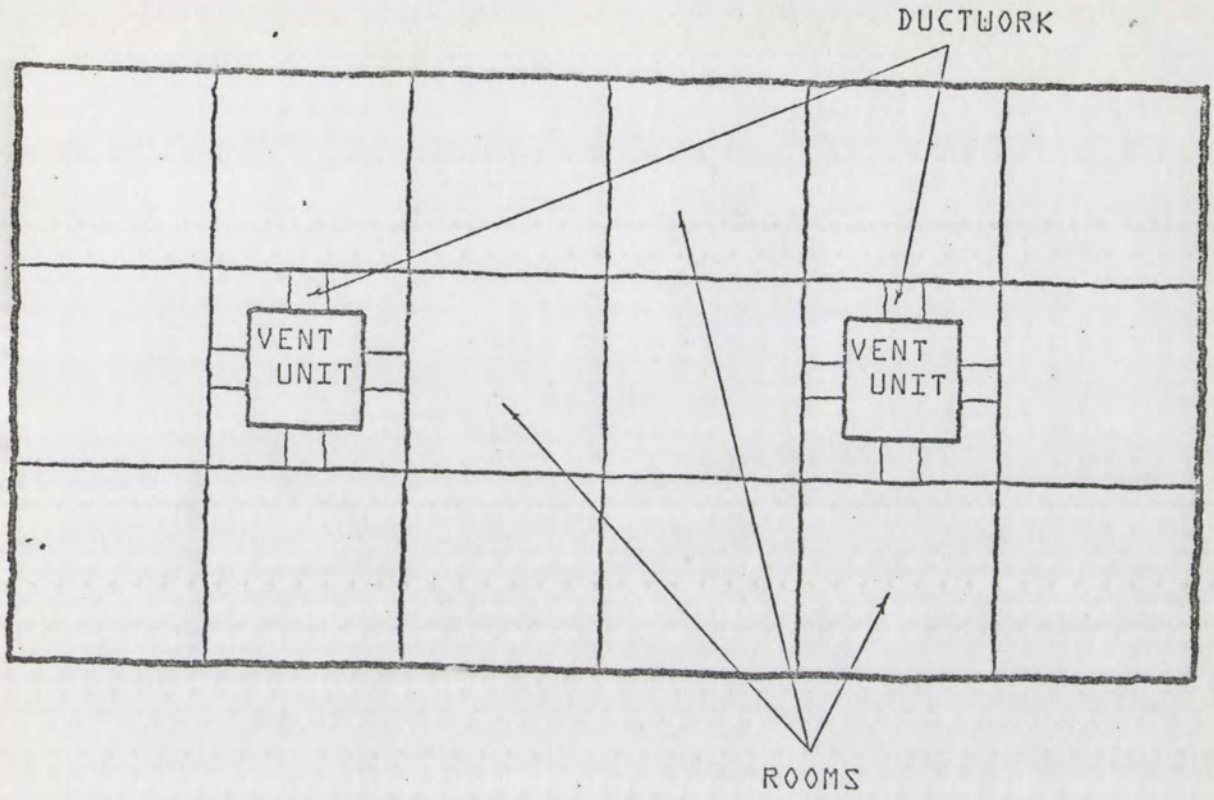
Detail No. 9 - Circulation Specification-Staggered Doors Applicable Towards Window Treatment (Sound Transmission: Horizontal - Internal)
No Scale



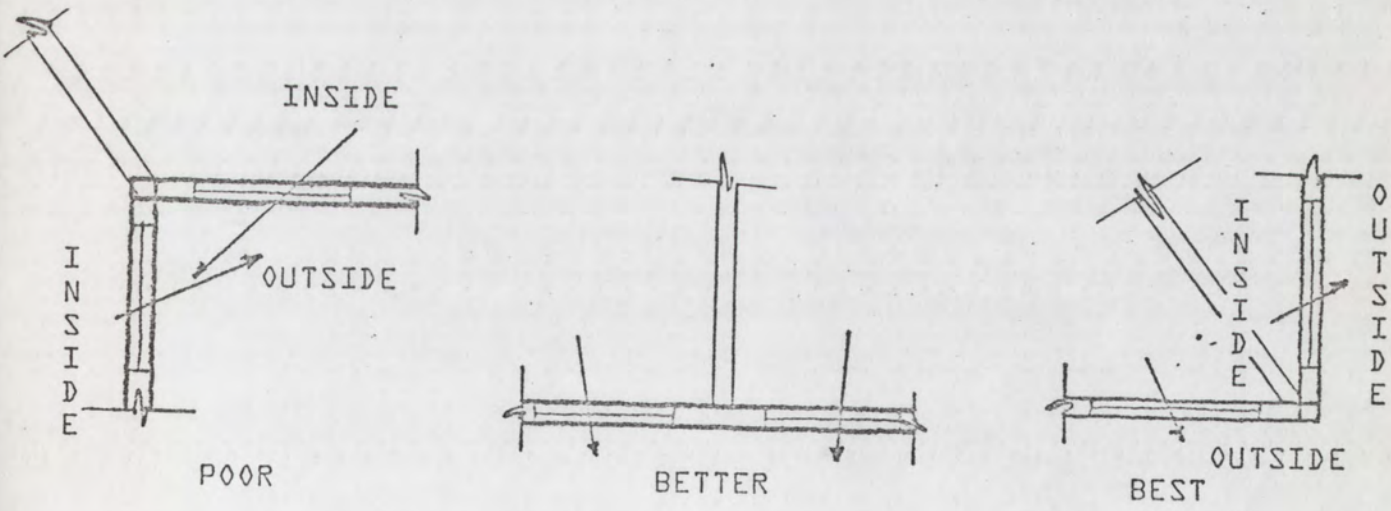
Detail No. 10 - Circulation Specification - Width Of Corridors Recommened To Be greater Than Height (Sound Transmission: Internal - Horizontal or Vertical According To Above Design)
No Scale



Detail No. 11 - Circulation Specifications - Circulation Should Be Grouped Vertically (Sound Transmission: Vertical - Interior)
No Scale

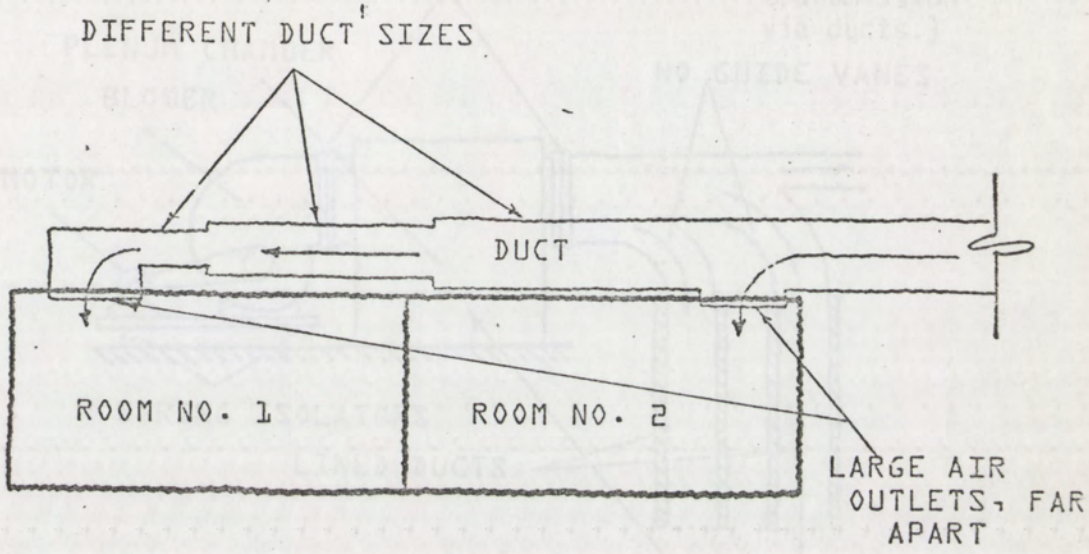


Detail No. 12 Centralized Separate Units
(Sound Transmission: Horizontal & Vertical - Internal)
No Scale

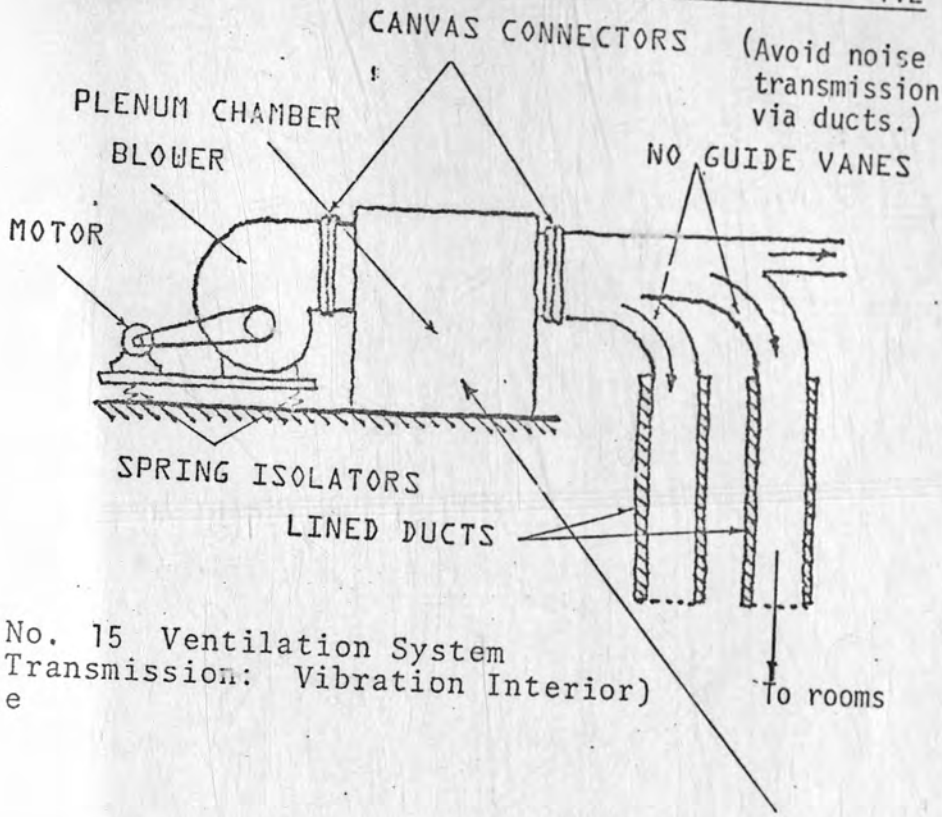


Detail No. 13 Window Treatment Interior Noises To Be Carried Outside, Applicable To Doors.
(Sound Transmission: Horizontal & Vertical - Interior To Outside)
No Scale

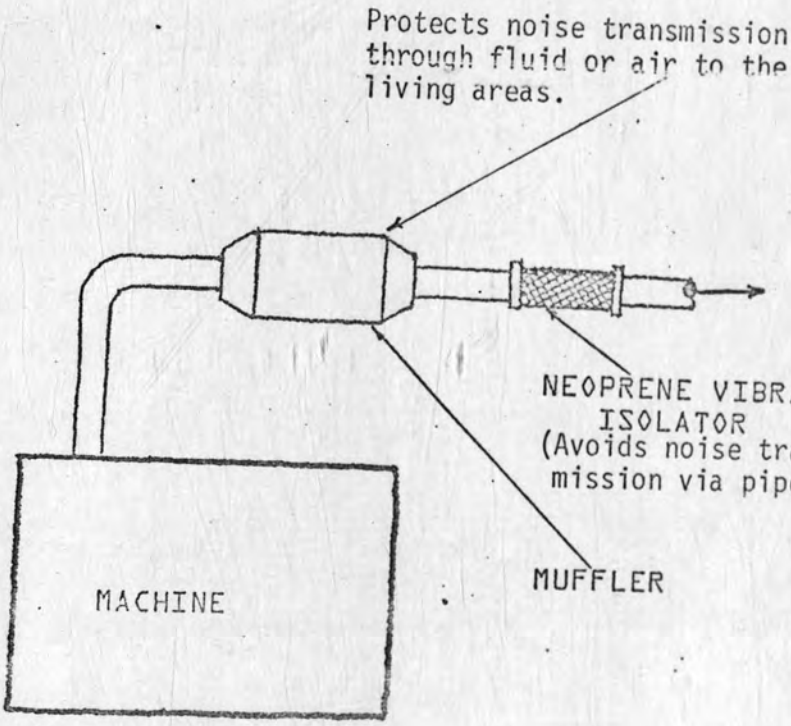
Note: Opening Windows And Doors Should Be Specified As Air Tight In Closed Position. Glass Panel Window Must Be Caulked And Sealed.



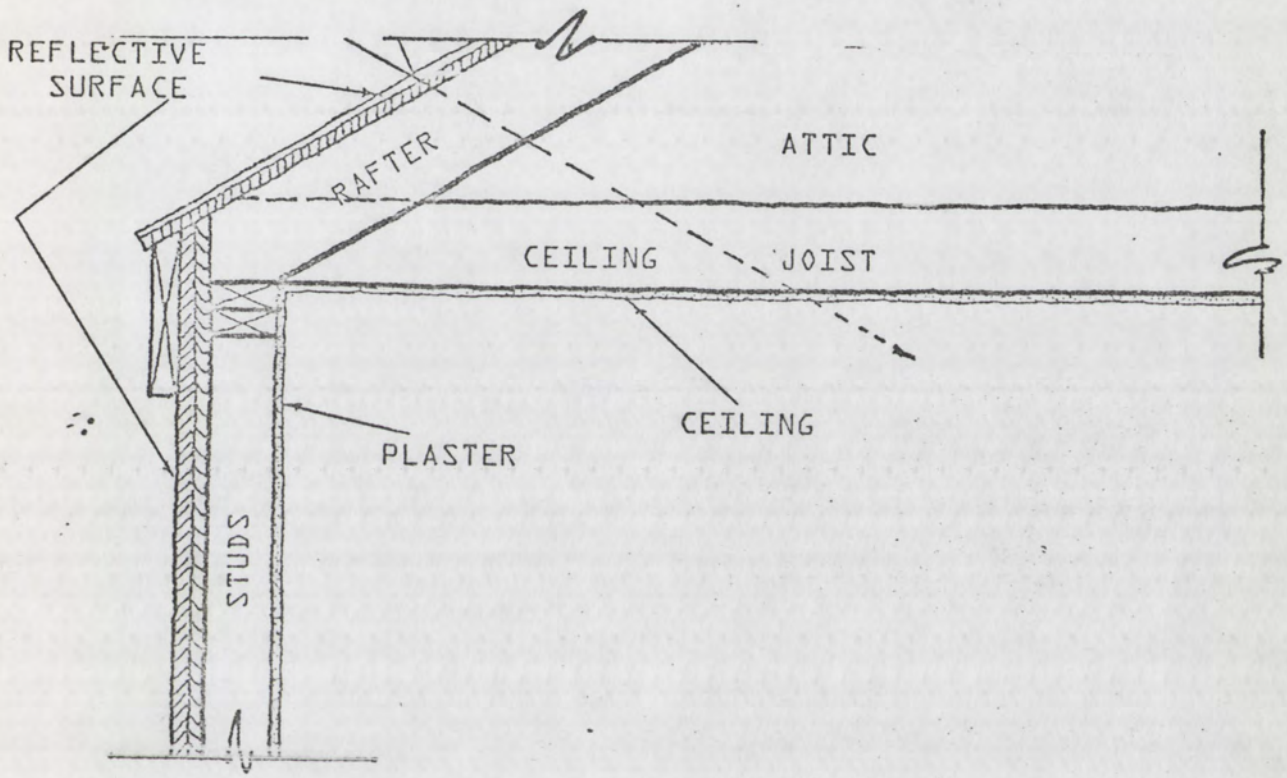
Detail No. 14 - Ductwork
(Sound Transmission: Room To Room, Ventilating Unit To Rooms - Internal)
No Scale



Detail No. 15 Ventilation System
(Sound Transmission: Vibration Interior)
No Scale

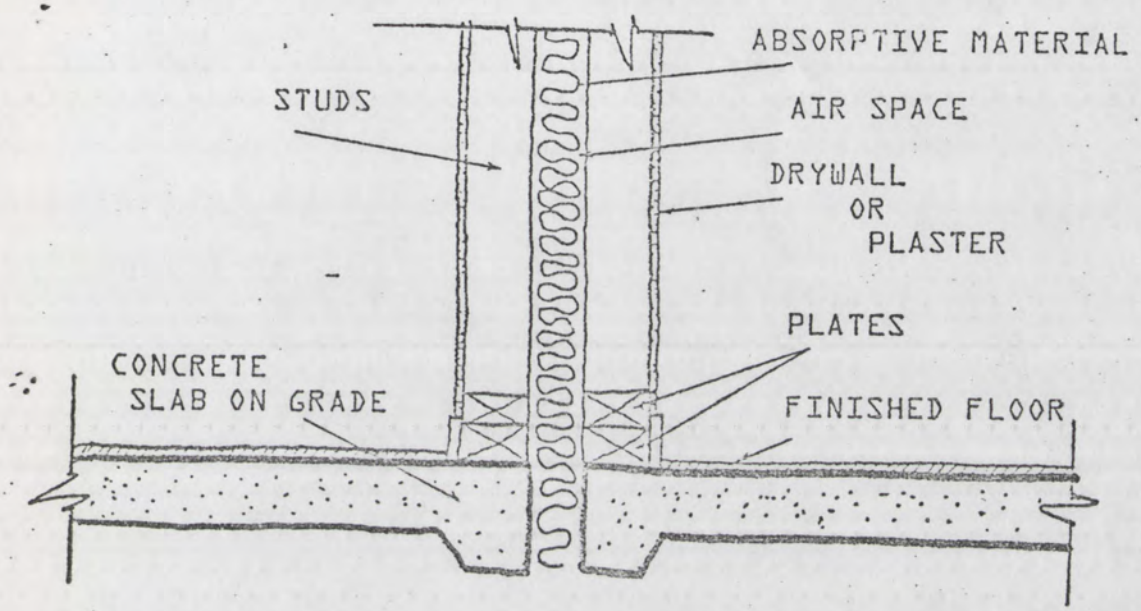


Detail No 16 Plumbing System
(Sound Transmission: Through Pipes)
No Scale

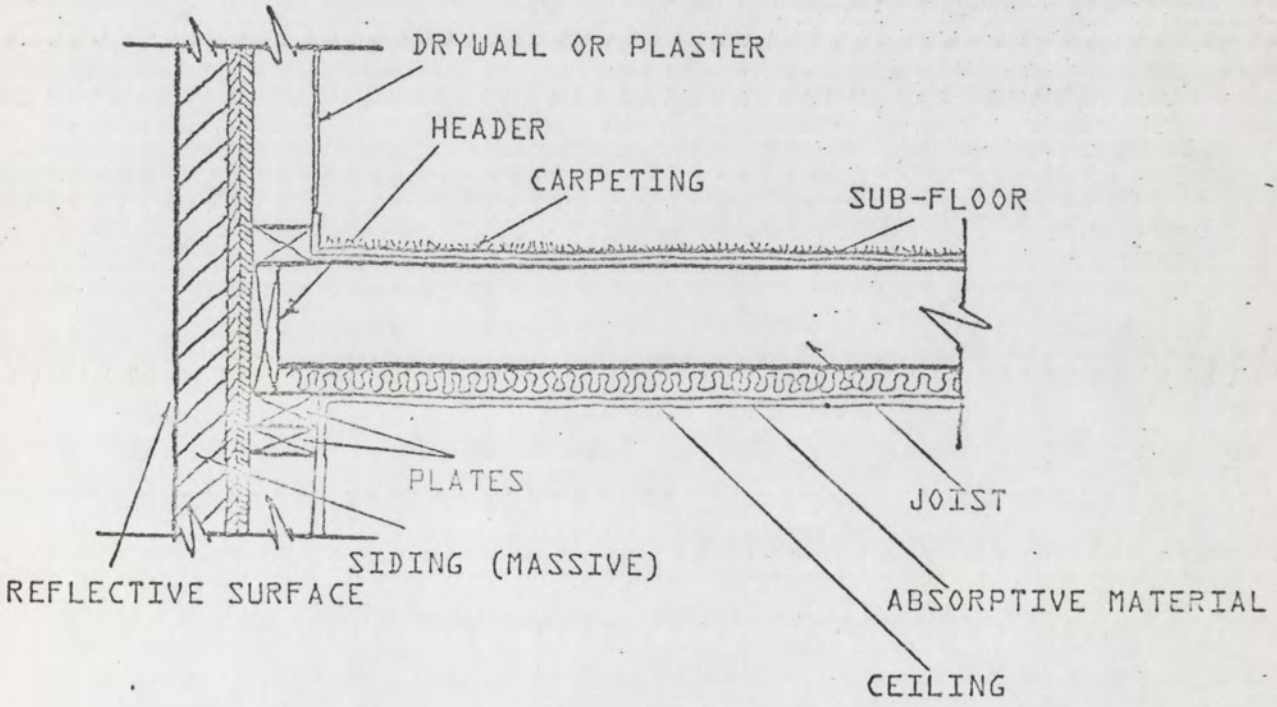


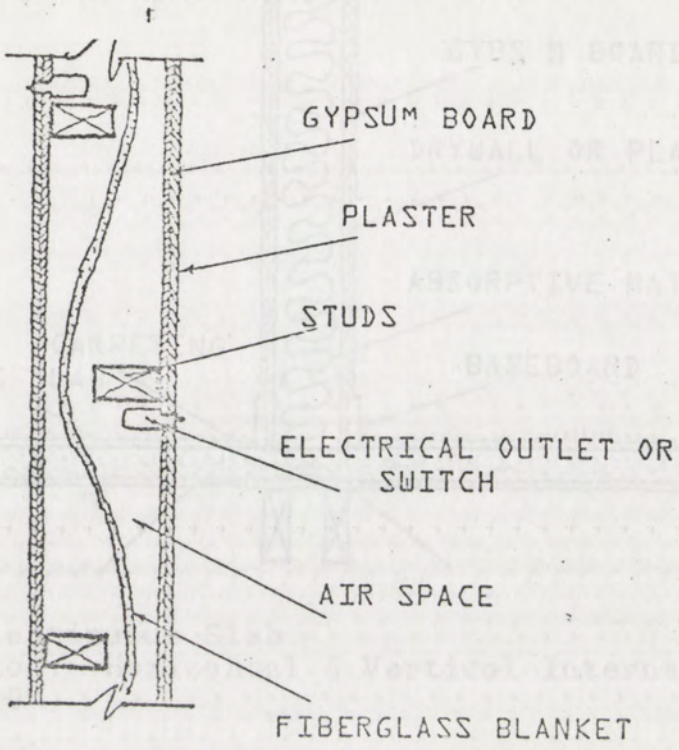
Detail No. 17 - Added Space Treatment - Attic: Extra Space Between Living Space And Outdoors (Sound Transmission: Aircraft To Attic To Interior Of House)
Scale: 1" - 1' 0"

Detail No. 18. Discontinuous Slab-Double Wall
(Sound Transmission: Horizontal-Internal)
Scale: 1"!= 1' 0"

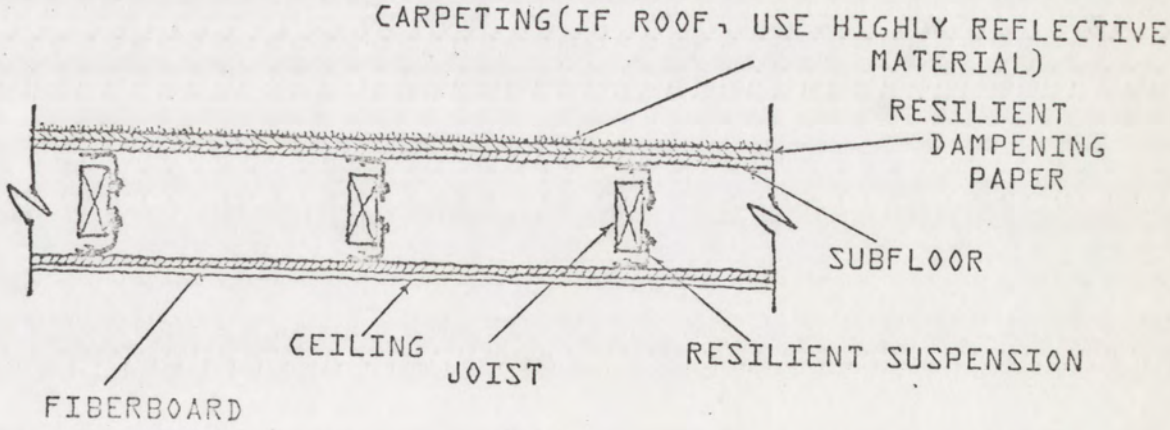


Detail No. 19. Discontinuous Studs
(Sound Transmission: Vertical-Internal)
Scale: 1" = 1'0"



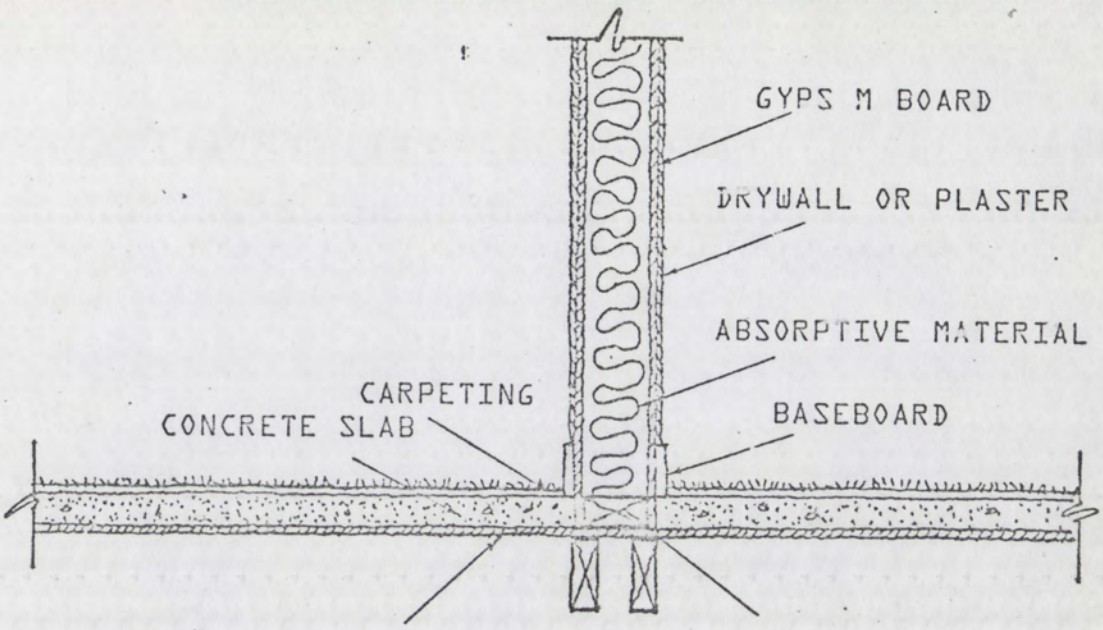


Detail No. 20 Staggered Studs - Alternate Electrical Elements
(Sound Transmission: Horizontal - Internal)
Scale: 1" - 1' 0"

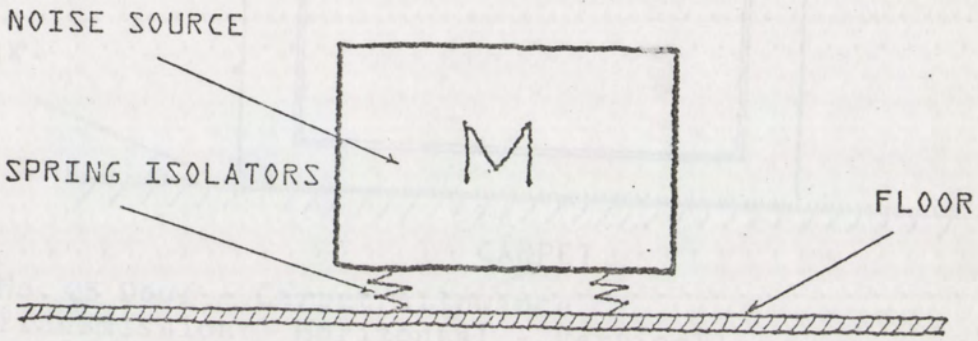


Detail No. 21 Resilient Suspension - Damping Boards
(Sound Transmission: Vertical - Internal)
Scale: 1" - 1' 0"

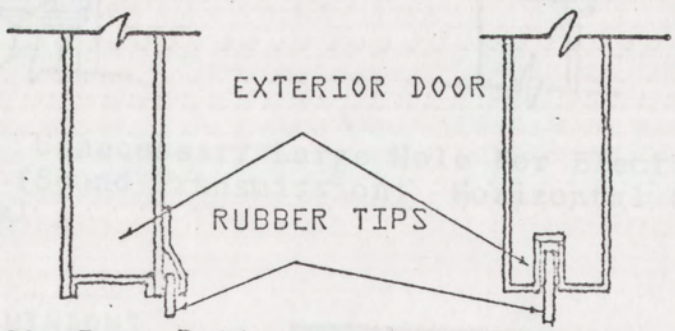
Note: Resilient suspension under floor to be used as an experimental basis.



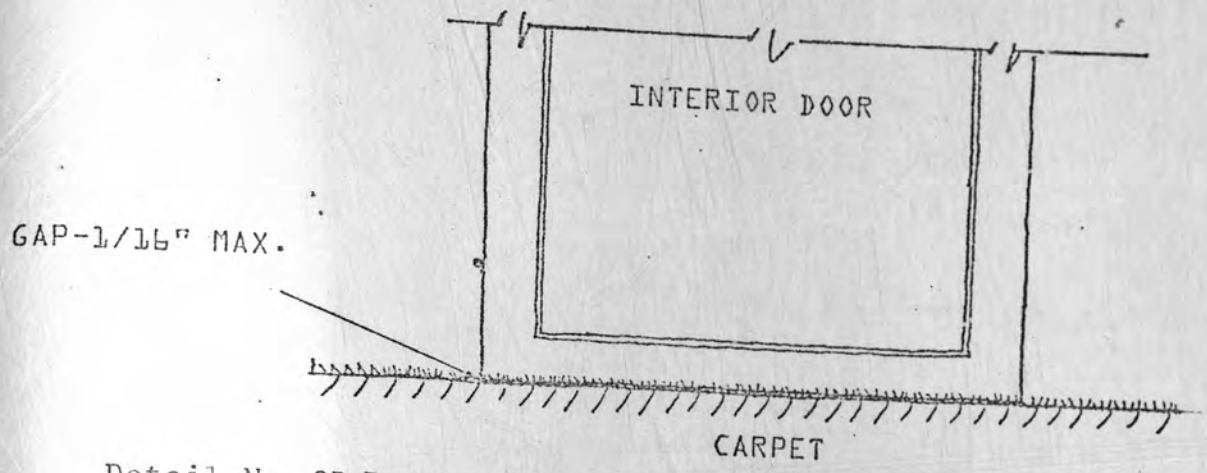
Detail No. 22 Discontinuous Slab
(Sound Transmission: Horizontal & Vertical Internal)
Scale: 1" = 1' - 0"



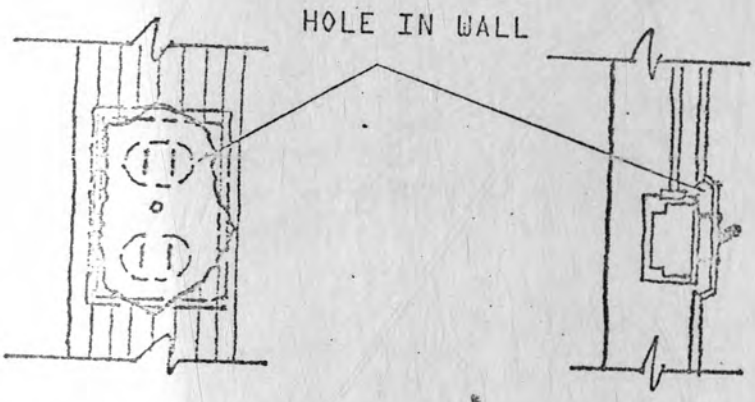
Detail No. 23 - Spring Mounted Machinery
(Vibration Type Noise)
No Scale



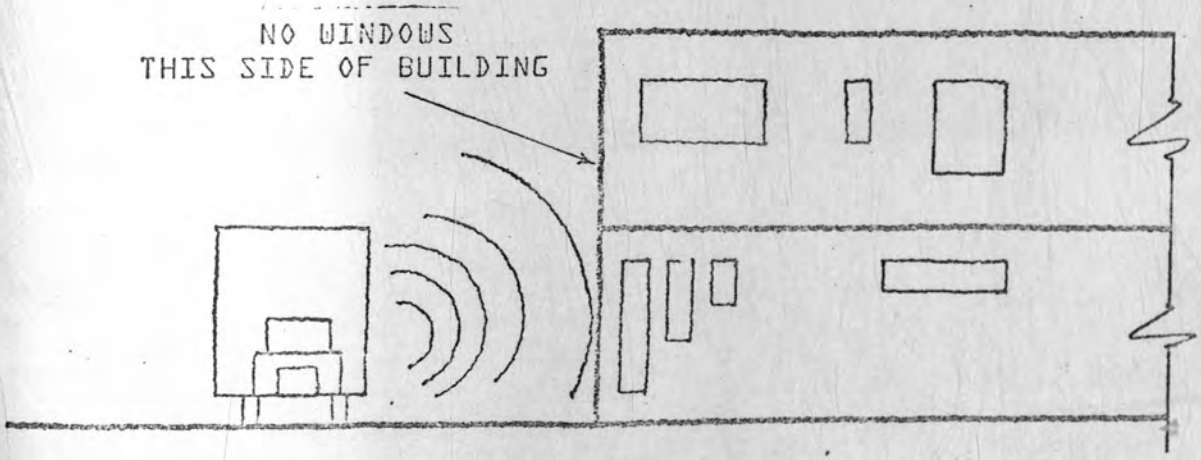
Detail No. 24 Door Bottoms
(Sound Transmission - Horizontal - External)
No Scale



Detail No. 25 Door - Carpet Allowance
(Sound Transmission: Horizontal - Vertical)
No Scale

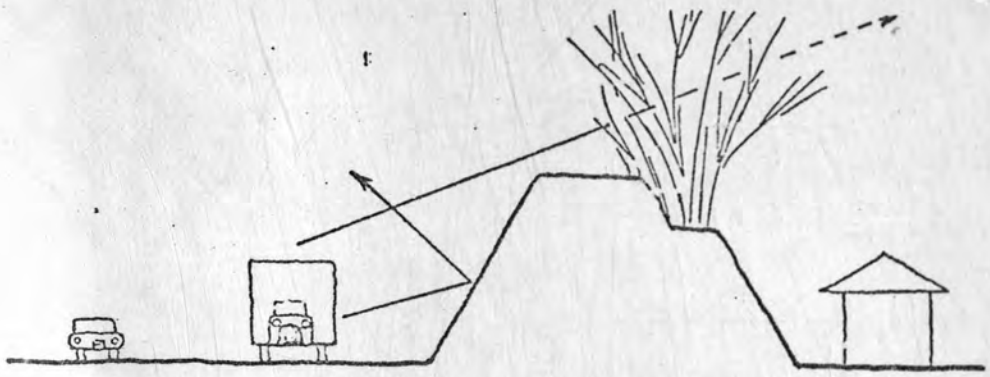


Detail No. 26 Unnecessary Large Hole For Electrical Elements (Sound Transmission: Horizontal & Vertical - Internal)
No Scale



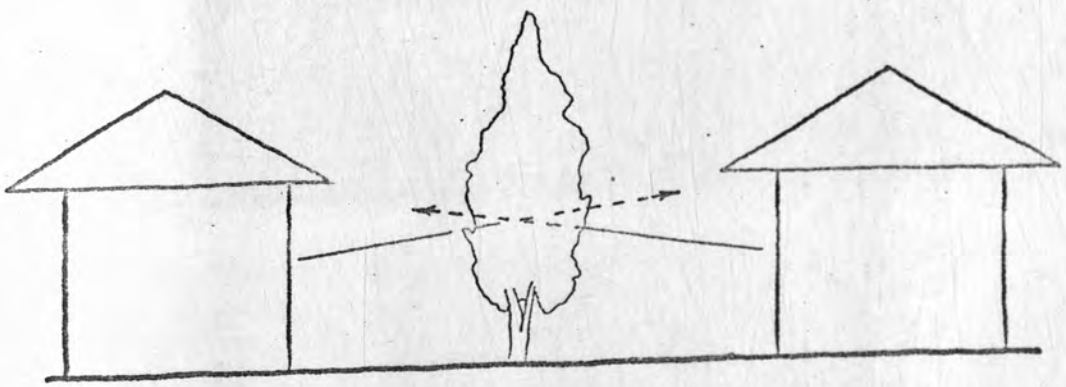
Detail No. 27 Window Treatment Solid Wall Facing Noise Source (Sound Transmission: Exterior to Interior)

No Scale

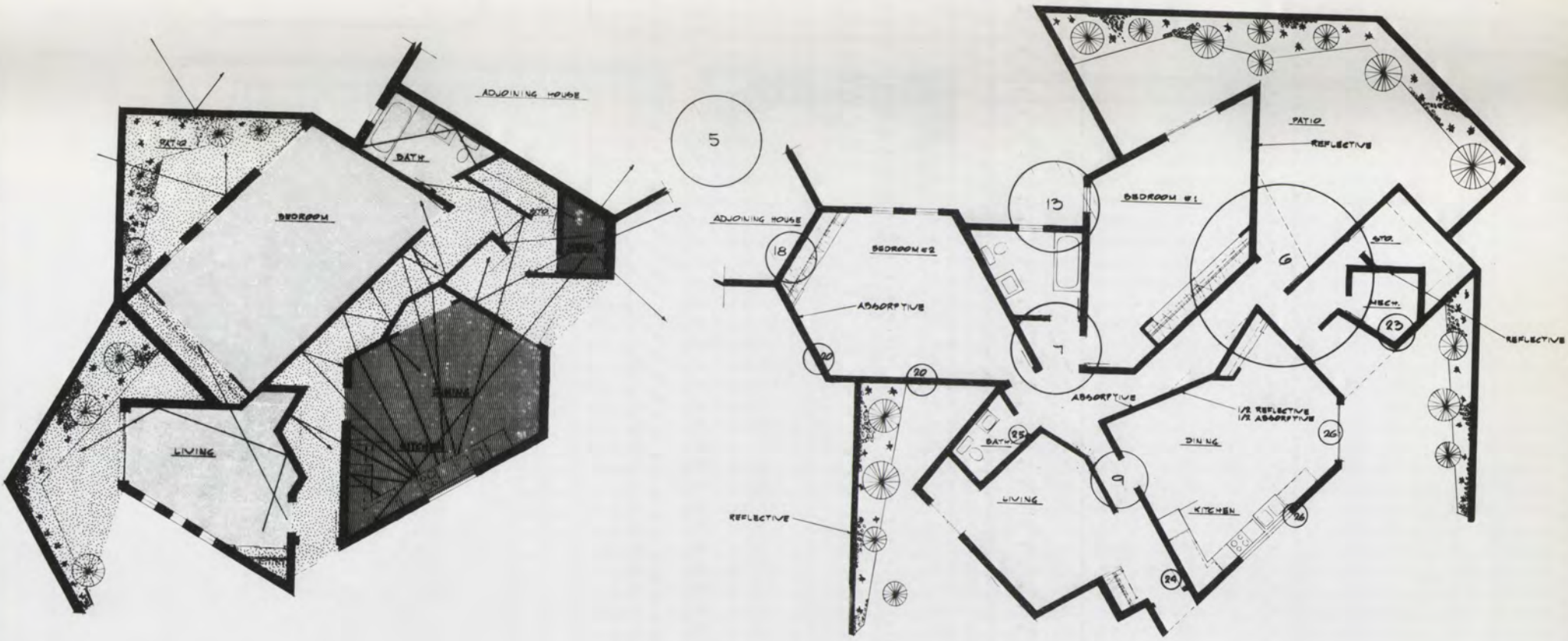


Detail No. 28 - Landscaping - Elevated Topography With Vegetation No Barriers Across Street (Sound Transmission: Motor Vehicles, Pedestrians To Exterior Of House)
No Scale

Detail No. 29 - Landscaping - Irregular Topography With Tall And Dense Vegetation Preferably On Both Sides Of Street (Sound Transmission : Motor Vehicles, Aircraft To Exterior Of House)
No Scale



Detail No. 30 - Landscaping - Tree Rows Replacing Masonry Fence (Sound Transmission: House To House)
No Scale

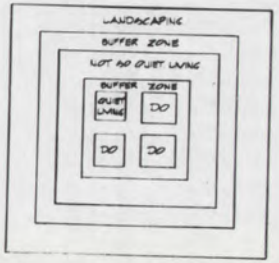


1 BEDROOM UNIT (TYPICAL)

SCALE: 1/8"=1'-0"

LEGEND

- QUIET LIVING
- NOT SO QUIET LIVING
- BUFFER ZONE
- NOISY AREA



DETAIL #8 - IDEAL SPACE REQUIREMENTS

2 BEDROOM UNIT (TYPICAL)

SCALE: 1/8"=1'-0"

DETAIL DESCRIPTION.

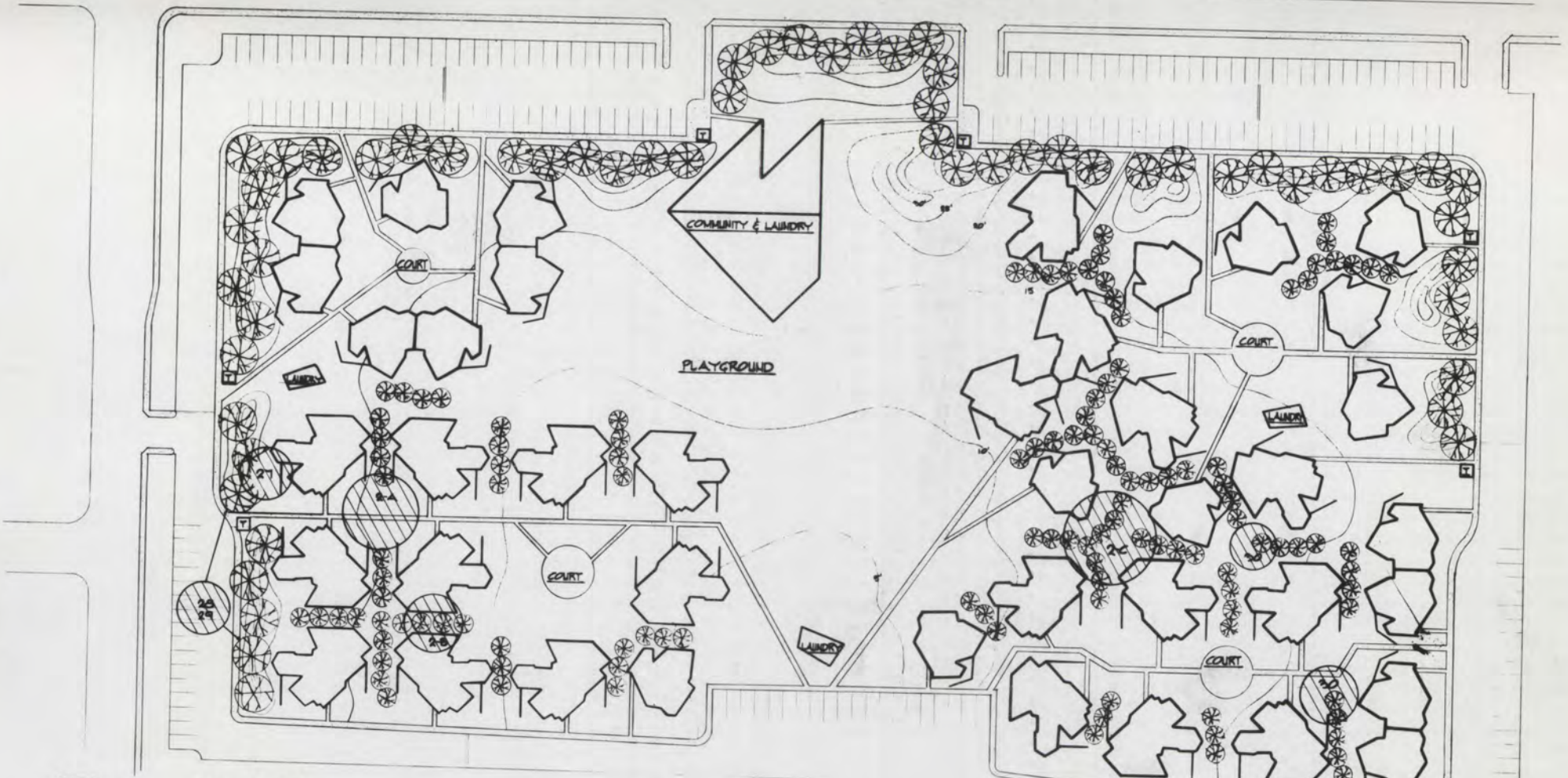
5 OPPOSITE HAND DUPLEX.
6 BUFFER ZONE BETWEEN NOISE AND QUIET AREA.
7 ADULT'S AREA ISOLATED FROM CHILDREN'S.
9 STAGGERED DOOR DESIGN.
13 EXAMPLE OF WHAT TO AVOID. SEE PAGE 110.
18 POSSIBILITY OF DOUBLE WALL.
20 STAGGERED STUDS, ALTERNATE ELECTRICAL ELEMENTS.
23 SPRING MOUNTED MACHINERY.
24 RUBBER TIPPED DOOR BOTTOMS.
25 DOOR CARPET ALLOWANCE.
26 UNNECESSARY LARGE HOLES.

NOTES:

Reflective surface to be used when the least amount of sound is to go through wall. Absorptive surface to be used when most of the sound is not to be reflected, thus some of the sound may be transmitted through the wall into the next room.

Highly reflective surface to be used in all outside walls. Quiet living areas: inside walls, absorptive; outside walls, reflective. Not-so-quiet living areas: inside walls, 1/2 reflective, 1/2 absorptive; outside walls, absorptive. Buffer zone depends on the rooms adjoining. Noisy non-living areas: inside wall, reflective; outside wall, absorptive.

For the sound absorption coefficient for common building materials, see Appendix 'B'



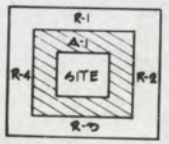
ONE BEDROOM UNIT

TWO BEDROOM UNIT

SITE PLAN

SCALE: 1"=50'-0"

ONE BEDROOM UNIT		20
TWO BEDROOM UNIT		21
TOTAL APARTMENT UNITS		41
COMMUNITY BLDG. & LAUNDRY		
LAUNDRY BLDGS.		3
OFF-STREET PARKING		180
TRASH AREAS		6



DETAIL #1 IDEAL ZONING FOR SITE

DETAIL#	DESCRIPTION
2	LOCATION OF BLDGS. A-WORST, B-POOR, C-BEST.
27	SOLID WALL FACING NOISE, NO WINDOWS.
28,29	VEGETATION BARRIER AS BUFFER ZONE
30	TREE ROWS REPLACING MASONRY FENCE.

SITE PLAN CHARACTERISTICS

Low density apartment design. Courts provide a meeting place for the four subdivisions which at the same time can all meet either at the community bldg. or at the playground. The sides of the site facing the streets are provided with high topography and dense vegetation. Walking is encouraged by minimization of vehicular activity. Parking lots and roads are furnished with 'bumps' to cut down on the noise coming from fast moving vehicles.

EXHIBIT

SUMMARY OF DETAILS

DETAIL NO.	ESTIMATED ADDED COST	A/B RATIO (TABLE 7)	DESIGN PROFESSION	RECOMMENDED FOR NO. OF PEOPLE	EXPLANATIONS & INSTRUCTIONS
1 Zoning	Depending on land	All	Arch.	1 or more	Acoustical needs will be low thus making substantial savings in the overall structure.
2 Bldg. Location	No added cost.	All	Arch.	1 or more	Poor design in this area would increase the noise ratio.
3 Bldgs. Distrib.	No added cost.	N,L/L,M.H.	Arch.	1 or more per unit	Careful distribution of activities surrounding completely is very important in making the site effective.
4, 5, 6, 7, 8, 9, 11, Space & Circulation Requirements	No added cost	All	Arch.	2 or more	May affect floor plan design.  = Buffer Zone. Buffer zones used to separate Living from noisy areas.
10 Corridor Width	Added cost	L/L,M,H	Struct. Arch.	2 or more	Very limiting to floor plan design.
12 Separate Units	Saves on duct work, adds in machinery. Undeterminable	M,L/M,H	Mech.	2 or more per unit	To be used in apartment complex. Small ventilating units if each apartment has one. Larger and more expensive units if used for more than one apartment.
13 Window Treatment	No added cost.	All	Arch.	1 or more	Helps in carrying sound waves away from building, slightly limiting to architectural design.

SUMMARY OF DETAILS
(CONTINUED)

DETAIL NO.	ESTIMATED ADDED COST	A/B RATIO (TABLE 7)	DESIGN PROFESSION	RECOMMENDED FOR NO. OF PEOPLE	EXPLANATIONS & INSTRUCTIONS
14 Ductwork	Varies according to manufacturer. Added cost not detrimental.	L/M,H	Mech.	2 or more	To lower cost, any change could be made retaining an air outlet of at least a room's length. Different duct sizes changes sound waves. Air outlets should be kept far apart to avoid sound transmission room to room.
15, 16 Vent. System	Affordable only in large apartment complex.	M,L/H	Mech.	1 or more per unit.	Choose reliable manufacturer. Worth the added cost in large constructions. Plenum chamber and muffler should be kept large enough in smaller construction to avoid the knocking sound of the fluid or air being pumped. The canvas connector and neoprene isolator must be included to avoid conduction of noise through pipes or ducts. Round corners should be used in order to avoid the use of guide vanes which create noise. This might be a form determining factor. All motors should be spring mounted and isolated. Ducts should be lined.
17 Attic Addition	Add 30-40% for materials and labor per linear foot of pitched roof.	L/M,H	Struct. Arch.	1 or more	Reflective surface must be used on roof. Insulation may be on top of ceiling joist if attic is not used. Attic space used as buffer area.
18 Discont. slab Double Wall	Add 30-40% per linear foot of extra wall.	L/H	Struct.	3 or more	To be affordable to low or medium budgets. Convert to single wall retaining split slab.

SUMMARY OF DETAILS
(CONTINUED)

DETAIL NO.	ESTIMATED ADDED COST	A/B RATIO (TABLE 7)	DESIGN PROFESSION	RECOMMENDED FOR NO. OF PEOPLE	EXPLANATIONS & INSTRUCTIONS
19 Discont. Studs	Add 5% of extra labor at current salary.	M,L/M.H.	Struct.	3 or more	Carpeting recommended for tapping noises. Retain discontinuous studs.
20 Staggered Studs	Varies according to contractor	L/L,M,H	Struct.	2 or more	Fiberglass blanket may be removed for lower budgets and for one or two residents retain alternate electrical elements - no added cost.
21 Resilient Suspen-sion	Added cost for resilient sus-pension and labor 5% or more added.	M,L/H	Struct	4 or more	To lower cost, install resilient suspension to one surface only. Retain resilient damping paper.
22 Discont. slab	No added cost	M,L/L,M,H	Struct.	2 or more	To lower more the cost, remove absorptive material.
23 Spring Mounted Machines	No added cost. specify reliable brand name offering machinery with spring isolators	All	Arch.	1 or more	Locate machinery away from rigid construction as much as possible.
24 Door Bottoms	Negligible	M,L/L,M,H	Arch.	1 or more	Necessary only if specially noisy neighborhoods.
25 Door - Rug Allowance	No added cost if carpet was originally specified.	All	Arch.	2 or more	Bottom of door must always touch carpet. Shag rug preferred.

SUMMARY OF DETAILS
(CONTINUED)

DETAIL NO.	ESTIMATED ADDED COST	A/B RATIO (TABLE 7)	DESIGN PROFESSION	RECOMMENDED FOR NO. OF PEOPLE	EXPLANATIONS & INSTRUCTIONS
26 Unnecessary Large Holes	No added cost	All	Elect.	2 or more	Extra supervision of electrical contractor is required.
27 No Window Wall	Saves on window cost.	L/L,M,H	Arch.	1 or more	Slightly limiting to arch. design.
28, 29, 30 Landscaping	Variable. Depending on kinds and sizes of trees.	Q,M,L/M,H	Arch.	1 or more	Burns must be kept high with deep vegetation to achieve noticeable decibel loss.

APPENDICES

APPENDIX A - DEFINITIONS

The following list of definitions represent a cross-section of the terms used most frequently in this text.

FREQUENCY: The number of complete to-and-fro vibrations that the source, and the particles in the medium makes in 1 second in Hz.

PROPAGATION OF SOUND: Sound has its origin in vibrating bodies. As it moves in an outward direction it pushes a "layer of air" along with it. This layer of air is compressed, and its density and temperature are correspondingly increased.

SPEED OF SOUND: 1130 feet per second in air at room temperature. The results are echoes and reverberation. Speed in water: 5,000'/sec. In hard wood along fibers: 13,000'/sec. Against grain: 4,000'/sec. Stone: 12,000'/sec.

REVERBERATION: The persistence of sound in an enclosure as a result of these repeated reflections.

ECHOES: Sound that reaches a listener in a room by a path involving reflection from its boundaries always travels a greater distance than does the sound that comes by the direct path.

SOUND INTENSITY: In a specified direction at a point in a sound field is defined as the rate of flow of sound energy through a unit area at that point, the unit area being perpendicular to the specified direction $I = p2/10^7 pc\ W/cm^2$.

DIRECTIONALITY OF SOUND SOURCES: 1) when the wavelength of the emitted sound is very large in relation to the dimensions of the source, energy is radiated uniformly in all directions; 2) On the other hand, when the wavelength is small in relation to the dimensions of the source, most of the radiated sound is confined to a relatively narrow beam; the higher the frequency, the sharper the beam.

MASKING: The shift in threshold of audibility and the shift in decibels defines the amount of masking. Low pitched sound can make hi-pitched ones, more than the reverse.

LOUDNESS CALCULATION: 1) determine the masking spectrum from the sound-pressure spectrum; 2) plot the masking M on the special loudness Computing Chart; 3) determine area under this curve.

SPEECH POWER: 15,000,000 lectures = 1 hp. Ave. speech power had in general much lower value than peak power. Men ave. = 34 microwatts; women ave. = 18 microwatts.

REFLECTION: Law of, the angle of reflection for this ray equals the angle of incidence and the reflected ray lies in the plan of incidence. Concave surfaces concentrate sound. Convex one spreads.

DIFFRACTION: The change in the direction of propagation of sound waves due to their passage around an obstacle. Properties of, 1) when an obstacle is large in relation to the wavelength of the incident sound, a sharp shadow similar to a light shadow is cast. 2) When an obstacle is small in comparison to the wave length of the incident wave, the sound is scattered in all direction. 3) When the size of the obstacle is comparable to the wave length, the sound is scattered in a complex but regular pattern, which depends on such factors as the shape, size and absorptive properties of the obstacle and the wavelength of the sound and its direction of propagation with respect to the obstacle.

ACOUSTICAL MAT: Types of, 1) Pre-fab units ex. acoustical tile. Mech. perforated units backed with absorbent material, wall, boards,tile boards, and absorbent sheets. 2) Acoustical plaster and sprayed on mat. ex. plastic and porous mat. applied with a trowel; and fibrous mat. w/binder agents, sprayed on; 3) acoustical blankets ex. of wood, glass fibers, kapok batts, and hair felt.

DIFFUSION: Promotes a uniform distribution of sound, it insures a relatively smooth growth and decay of sound and it improves the "liveness" of the room. The greater the ratio the more "live" the room. The greater the acoustical absorption the more dead the room.

SOUND-ENERGY DENSITY: $E = P2/qc2$ ergs/cm3
$= I/c$
P = sound pressure (dynes/cm2)
c = velocity of sound (cm/sec)
I = sound intensity (ergs/sec/cm2)
q = density of air (g/cm3)

ACOUSTIC IMPEDANCE: The complex quotient of the alternating pressure applied to the system by the resulting volume current.

INSULATION: The separation or attenuation of air borne sound between 2 points in space.

ISOLATION: The same as above but for solid-borne sound, i.e. mech. vibration in solids.

NOISE OR SOUND REDUCTION: The amount by which the average sound-pressure level, L_1(dB) in a sound source enclosure or locale exceeds the same level L_2 averaged throughout the sound-receiving enclosure or locale, it being assumed that some sort of barrier or wall separates the 2 spaces of measurement $NR = L_1 - L_2$

SOUND TRANSMISSION COEFFICIENT OR ACOUSTIC TRANSMITTING: of a partition is the fraction of incident sound energy transmitted through it and unless otherwise specified assumes random sound incidence on the source side of the divider. Its symbol is t.

TRANSMISSION LOSS: of a partition, symbol is TL, is -10 log t, and is expressed in dB.

$NR = TL - 10 \log S/A$ = :s= size of partition
A= Total absorption

SOUND TRANS. CLASS: (STC) originated by the American Soc. for Testing Materials not the intension of overcoming certain inadequacies that develop in the insulating quality of a material by means of the averages in transmission losses at certain test frequencies coincided w/"dips" or "peaks" in the transmission loss characteristic.

INTENSITY: The dimensions of a stimulus, or the strength of magnitude of the stimulating agent, and all of us employ the adjective "intense" to imply high degree, as in "intense heat," etc. To the Acoustician, however, it means the average rate at which sound energy is transmitted through a unit area perpendicular to the specified direction at the point considered.

LOUDNESS LEVEL: In phons, that median sound pressure level in decibels of a free progressive wave of 1,000Hz presented to qualified listeners facing the source judged by the listeners in a number of trials to be equally loud. Obtained only aurally, not by meters.

SOUND LEVEL METER: A sound level meter consists of a microphone which transforms the sound pressure variation in air into a corresponding electrical signal. This signal is then amplified internally and measured by appropriate electrical weighting networks with the results in decibels (dB) displayed on an indicating meter. The weighting networks tend to represent the frequency characteristics of the human ear by dicriminating electronically in a pattern similar to the equal loudness curves.

OCTAVE: The interval between any two tones whose frequency ratio is 2:1.

TONE: A sound giving a definite sensation of pitch, loudness and timbre and therefore, lying between 15 and 15,000 cps.

	SOUND ABSORPTION COEFFICIENT					
	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz
WALLS						
Sound Reflecting:						
1) Brick, unglazed	0.03	0.03	0.03	0.04	0.05	0.07
2) Brick, unglazed & painted	0.01	0.01	0.02	0.02	0.02	0.03
3) Concrete block, painted	0.10	0.05	0.06	0.07	0.09	0.08
4) Cork on brick or concrete	0.02	0.03	0.03	0.03	0.03	0.02
5) Glass, heavy plate	0.18	0.06	0.04	0.03	0.02	0.02
6) Glass, typ. window	0.35	0.25	0.18	0.12	0.07	0.04
7) Gypsum board, 1/2" paneling	0.29	0.10	0.05	0.04	0.07	0.09
8) Marble or glazed tile	0.01	0.01	0.01	0.01	0.02	0.02
9) Metal venetian blinds	0.06	0.05	0.07	0.15	0.13	0.17
10) Plaster, gypsum or lime, on brick	0.01	0.02	0.02	0.03	0.04	0.05
11) Plaster, gypsum or lime, on concrete block	0.12	0.09	0.07	0.05	0.05	0.04
12) Plaster, gypsum or lime, on lath	0.14	0.10	0.06	0.05	0.04	0.03
13) Plywood, 3/8" paneling	0.28	0.22	0.17	0.09	0.10	0.11
14) Wood, 1/4" paneling, with air-space behind	0.42	0.21	0.10	0.08	0.06	0.06
Sound Absorbing:						
15) Concrete block, coarse	0.36	0.44	0.31	0.29	0.39	0.25
16) Cork, 1" with airspace behind	0.14	0.25	0.40	0.25	0.34	0.21
17) Lightweight drapery, 10 oz./sq. yd., flat on wall (Note: sound reflecting at most freqs.)	0.03	0.04	0.11	0.17	0.24	0.35
18) Mediumweight drapery, 14 oz./ sq. yd., draped on half area	0.07	0.31	0.49	0.75	0.70	0.60
19) Heavyweight drapery, 18 oz./sq. yd., draped on half area	0.14	0.35	0.55	0.72	0.70	0.65
20) Fiberglas fabric curtain, 8 1/2 oz. sq. yd., draped on half area	0.09	0.32	0.68	0.83	0.39	0.76
21) Shredded wood fiberboard 2" thick on concrete (mounting #4)	0.32	0.37	0.77	0.99	0.79	0.88
22) Thick porous sound absorbing mat'l. with open facing	0.60	0.75	0.82	0.80	0.60	0.38

MATERIAL	SOUND ABSORPTION COEFFICIENT					
	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz
WALLS (Continued)						
23) Carpet, heavy, on 5/8" perf. mineral fiberboard with air-space behind	0.37	0.41	0.63	0.85	0.96	0.92
24) Wood, 1/2" paneling, perf. 3/16" dia. holes, 11% open area, with 2 1/2" glass fiber in airspace behind	0.40	0.90	0.80	0.50	0.40	0.30
FLOORS						
Sound Reflecting:						
25) Concrete or terrazo	0.01	0.01	0.02	0.02	0.02	0.02
26) Cork, rubber, linoleum or asphalt tile on concrete	0.02	0.03	0.03	0.03	0.03	0.02
27) Marble or glazed tile	(same as material no. 8)					
28) Wood	0.15	0.11	0.10	0.07	0.06	0.07
29) Wood parquet on concrete	0.04	0.04	0.07	0.06	0.06	0.07
Sound Absorbing:						
30) Carpet, heavy, on concrete	0.02	0.06	0.14	0.37	0.06	0.65
31) Carpet, heavy, on foam rubber	0.08	0.24	0.57	0.69	0.71	0.73
32) Carpet, heavy, with impermeable latex backing on foam rubber	0.08	0.27	0.39	0.34	0.48	0.63
33) Indoor-outdoor carpet	0.01	0.05	0.10	0.20	0.45	0.65
CEILINGS						
Sound Reflecting:						
34) Concrete	0.01	0.01	0.02	0.02	0.02	0.02
35) Gypsum board, 1/2" thick	0.29	0.10	0.05	0.04	0.07	0.09
36) Plaster, gypsum or lime, on lath	(same as material no. 12)					
37) Plywood, 3/8" thick	0.28	0.22	0.17	0.09	0.10	0.11
Sound Absorbing:						
38) Suspended acoustical tile, 3/4" thick (mounting #7)	0.76	0.93	0.83	0.99	0.99	0.94

MATERIAL	SOUND ABSORPTION COEFFICIENT					
	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz
CEILINGS (Continued)						
39) Shredded wood fiberboard, 2" thick on lay-in grid (mounting #7)	0.59	0.51	0.53	0.73	0.88	0.74
40) Thin Porous sound absorbing material, 2" thick, (mounting #1)	0.10	0.60	0.80	0.82	0.78	0.60
41) Thick porous sound absorbing material, 2" thick (mounting #1)	0.38	0.60	0.78	0.80	0.78	0.70
42) Sprayed cellulose fibers, 1" thick on concrete (mounting #4)	0.80	0.29	0.75	0.98	0.93	0.76

APPENDIX C - ARCHITECT'S QUESTIONAIRE

DATE: February 21, 1972

SUBMITTED BY: Jose R. Carballeira
2421 Second Street N.W.
Albuquerque, New Mexico

SUBJECT: I am a student of architecture at the University of New Mexico currently writing the last steps to conclude all my information regarding my Master's Thesis: Noise Pollution as applied to low income family housing. I will very much appreciate your spending five minutes of your time to fill in the following questionaire and return it in the self addressed, stamped envelope.

Thank you.

1. What percentage of your work load has been related to low-income family housing? (Circle one)

   0-25% 25-50% 50-75% Over 75%

2. Has acoustics ever played an important role in your office when designing for family housing units? (Circle One):

   None Somewhat Mostly Always

3. What degree of interest has the owner of a low-income family housing project ever shown for the acoustical properties of the house in relation to the surroundings of the site. (Circle One):

   None Little Much

4. Has there ever been any kind of studies made by your office in regards to any noisy environment within any given site? (Circle One):

   Yes No

5. If any of the three questions above have been mostly affirmative, please state whether an acoustical engineer had been hired or if your office concluded that the problem will be solved after the partitions were put in place and then filled with insulation.

6. Is your office currently involved in a low-income family housing project? If yes, please state how far advanced.

7. Will the availability of a program which will include the acoustical properties needs of the different surroundings and sociological back - as related to the kind of project involved and the budget allowed will encourage you and/or your firm in providing for the control of noise in Albuquerque? Feel free to state your personal comments.

The following list represents those firms to whom the questionaire was mailed.

Because the questionaires were returned anonymously in order to achieve a greater percentage of return, there are no notations as to which architects were willing to assist in this project.

1. REMBERT C. ALLEY, JR.
   Winrock Village
2. CRAIG G. ANDREWS
   8200 1/2 Menaul N.E.
3. WILLIAM BARBER & ASSOC.
   2610 Monroe N.E.
4. HLDRETH H. BARKER
   2841 San Mateo N.E.
5. JOE BOEHING
   2005 Carlisle N.E.
6. JOSEPH BURWINKLE & ASSOC.
   3209 Silver S.E.
7. ROBERT C. CAMPBELL
   3500 Indian School NE
8. DALE L. CRAWFORD
   3223 Silver S.E.
9. DYER-McCLERNON
   6320-D Linn N.E.
10. GORDON FERGUSON
    115 Amherst S.E.
11. JACK FICKET
    2609 Quincy N.E.
12. CHANNELL GRAHAM
    316 Val Verde S.E.
13. LOUIS G. HESSELDEN
    213 4th S.W.

14. LAWRENCE A. GARCIA & ASSOC.
1705 Carlisle Blvd. N.E.

15. DON GARLAND
7800 Phoenix N.E.

16. MAX FLATOW
First National Bank Bldg.

17. PATRICK G. GATES
8322 Zuni Rd. S.E.

18. JOHN J. GINNER
4320 2nd St. N.W.

19. ANDREW S. BOL
2841 San Mateo N.E.

20. BURK & BURK
512 Yale Blvd. S.E.

21. JAMES VAUGHN COTTRELL
4125 Carlisle Blvd. N.E.

22. ARTHUR W. DECKER
2609 Quincy N.E.

23. WILLIAM W. ELLISON & ASSOC.
1617 University N.E.

24. MANUEL A. FERNANDEZ
4008 Pitt N.E.

25. WILLIAM HELFRICH
1028 San Mateo S.E.

26. JESS HOLMES
5905 Marble N.E.

27. HARVEY HOSHOUR
201 Coal S.W.

28. DONALD A. KRUEGER
408 Arbor Place N.E.

29. JOSEPH D. LONG JR.
511 San Mateo N.E.

30. LOREN MASTIN
302 8th N.W.

31. EARL L. MAYNE
630-D Linn Ave. N.E.

32. WILLIAM McCONNELL.
120 Madeira Dr. N.E.

33. ALFRED R. MILLINGTON & ASSOC.
211 Sierra Dr. N.E.

34. DONALD A. MITCHELL
2018 Coal Pl. S.E.

35. AUGUST A. NEUNER
120 Vassar Dr. S.E.

36. PACHECO & GRAHAM
316 Val Verde Dr. S.E.

37. ROBERT PONTO
1030 San Pedro Dr. N.E.

38. ANTOINE PREDOCK
300 12th N.W.

39. JOHN REED
5905 Marble N.E.

40. VITRY deREIDENBAUGH & CONRAD
414 Silver S.W.

41. DON P. SCHLEGEL
1620 Central S.E.

42. BILL J. SHELTON
335 Jefferson S.E.

43. JERRY TORR
2622 San Mateo N.E.

44. ROBERT TORRES
208 Central S.W.

45. WYBE J. vanDer MEER
5017 Sunningdale N.E.

46. JOHN PETER VARSA
903 Rio Grande N.W.

47. ROBERT C. WALTERS
1620 Central S.E.

48. GEORGE S. WRIGHT
2018 Coal Pl. S.E.

49. GEORGE WYNN
6303 Indian School Rd. N.E.

QUESTIONS USED IN THE INTERVIEW:

1. How many people are presently living in household?

2. How long have you (the respondent) lived in area?

3. Do you notice the noise in the area?

4. What kinds of noises are the worst?

5. How bad would you say the noise is?

LIST OF ADDRESSES:

Following is the list of those residents who were reached and successfully interviewed. The list was acquired through the City Directory.

MARTINEZ TOWN:

EDITH BLVD. N.E.	617
	601
	509
	703

	Study conducted at Lomas & Edith

	808
	809
	814
	822
	902
	904

MOUNTAINVIEW

All interviews were conducted at the Apartment Complex located at:

2323 Kathryn Avenue S.E.

Study was taken at the corner of Yale and Santa Clara S.E.

SOUTH BROADWAY

SOUTH BROADWAY:

1828
1831
1832
1910
1914
1919
2301
2305
2321

Study conducted at corner of South Broadway & Miles Road

2703

LULAC

MOUNTAIN ROAD:

2225
2304
2307
2323
2416
2502
2602
2617

LULAC:

Study conducted at corner of Lulac & Mountain Rd.

2701
2733

MARTINEZ TOWN:

CORNER OF EDITH BLVD. AND LOMAS BLVD.

TIME	MEAN	
A.M.		
7:55	64	Minimum (dB A) - 62
7:56	70	
7:57	72	Maximum (dB A) - 82
7:58	76	
7:59	74	
8:00	68	Average for hr. - 68.6
8:01	66	
8:02	66	
8:03	68	
8:04	67	Background
8:05	64	(dB A) - 58
P.M.		
1:55	68	Minimum (dB A) - 58
1:56	68	
1:57	64	Maximum (dB A) - 76
1:58	62	
1:59	62	
2:00	60	Average for hr. - 64.1
2:01	60	
2:02	62	
2:03	64	
2:04	68	Background
2:05	68	(dB A) - 58

MARTINEZ TOWN (CONTINUED)

CORNER OF EDITH BLVD. AND LOMAS BLVD.

TIME	MEAN	
P.M.		
4:55	66	Minimum (db A) - 56
4:56	67	
4:57	68	Maximum (db A) - 80
4:58	68	
4:59	67	
5:00	70	Average for hr.- 66.7
5:01	62	
5:02	68	
5:03	66	
5:04	66	Background
5:05	66	(db A) - 63

TIME	MEAN	
P.M.		
11:55	56	Minimum (db A) - 46
11:56	56	
11:57	58	Maximum (db A) - 90
11:58	60	
11:59	58	
12:00	56	
12:01	54	
12:02	58	
12:03	52	
12:04	54	Background
12:05	56	(db A) - 52

MOUNTAIN VIEW APARTMENTS

STADIUM AND YALE

TIME	MEAN	
A.M.		
7:55	64	Minimum (db A) - 48
7:56	66	
7:57	62	Maximum (db A) - 80
7:58	62	
7:59	62	
8:00	69	Average for hr. - 62.1
8:01	62	
8:02	60	
8:03	58	
8:04	60	Background
8:05	61	(db A) - 52
P.M.		
1:55	62	Minimum (db A) - 48
1:56	61	
1:57	60	Maximum (db A) - 90
1:58	59	
1:59	56	
2:00	54	Average for hr. - 58.0
2:01	52	
2:02	66	
2:03	56	
2:04	57	Background
2:05	56	(db A) - 58

MOUNTAIN VIEW APARTMENTS (CONTINUED)

STADIUM AND YALE

TIME	MEAN	
P.M.		
4:55	58	Minimum (db A) - 47
4:56	60	
4:57	64	Maximum (db A) - 74
4:58	64	
4:59	68	
5:00	60	Average for hr. - 60.9
5:01	58	
5:02	60	
5:03	61	
5:04	59	
5:05	58	

P.M.		
11:55	48	Minimum (db A) - 40
11:56	49	
11:57	43	
11:58	46	
11:59	48	
12:00	54	Average for hr. - 49.0
12:01	56	
12:02	48	
12:03	50	
12:04	48	Background (db A) - 42
12:05	50	

SOUTH BROADWAY:

BROADWAY & MILES ROAD

TIME	MEAN	
A.M.		
7:55	60	Minimum (db A) - 56
7:56	67	
7:57	64	Maximum (db A) - 84
7:58	63	
7:59	62	
8:00	64	Average for hr. - 62.2
8:01	61	
8:02	61	
8:03	60	
8:04	60	Background
8:05	63	(db A) 57
P.M.		
1:55	63	Minimum (db A) - 53
1:56	70	
1:57	58	Maximum (db A) - 86
1:58	60	
1:59	60	
2:00	61	Average for hr. - 61.1
2:01	60	
2:02	60	
2:03	60	
2:04	60	Background
2:05	61	(db A) 52

SOUTH BROADWAY (CONTINUED)

BROADWAY & MILES ROAD

P.M.

TIME	MEAN	
4:55	65	Minimum (db A) - 56
4:56	66	
4:57	64	Maximum (db A) - 81
4:58	70	
4:59	60	
5:00	66	Average for hr. - 65.6
5:01	66	
5:02	66	
5:03	65	
5:04	66	Background
5:05	68	(db A) - 55

P.M.

11:55	54	Minimum (db A) - 43
11:56	56	
11:57	58	Maximum (db A) - 79
11:58	54	
11:59	54	
12:00	56	Average for hr. - 53.0
12:01	46	
12:02	54	
12:03	55	
12:04	47	Background
12:05	51	(db A) - 79

LULAC APARTMENTS

MOUNTAIN VIEW & LULAC STREET

TIME	MEAN		
A.M.			
7:55	64	Minimum (db A) -	48
7:56	62		
7:57	63	Maximum (db A) -	79
7:58	64		
7:59	53		
8:00	55	Average for hr. -	59.7
8:01	66		
8:02	55		
8:03	60		
8:04	57	Background	
8:05	58	(db A) -	50
P.M.			
1:55	44	Minimum (db A) -	38
1:56	42		
1:57	46	Maximum (db A) -	88
1:58	50		
1:59	51		
2:00	50	Average for hr. -	47.5
2:01	52		
2:02	62		
2:03	50		
2:04	47	Background	
2:05	49	(db A) -	43

LULAC APARTMENTS (CONTINUED)

MOUNTAIN VIEW & LULAC STREET

P.M.

TIME	MEAN	
4:55	52	Minimum (db A) - 40
4:56	53	
4:57	62	Maximum (db A) - 79
4:58	58	
4:59	63	
5:00	64	Average for hr. - 57.2
5:01	64	
5:02	60	
5:03	58	
5:04	53	Background
5:05	43	(db A) - 44

P.M.

11:55	44	Minimum (db A) - 42
11:56	50	
11:57	48	Maximum (db A) - 76
11:58	47	
11:59	49	
12:00	50	Average for hr. - 48.6
12:01	51	
12:02	49	
12:03	50	
12:04	49	Background
12:05	48	(db A) - 46

*As per acoustical contractors.

CLASS A TILE. . . . . 15¢ each

CLASS A TILE. . . . . 19 1/2¢ each

This Appendix represents the correspondence that was carried out with different authorities on "Noise Control."

Some investigation for information was done through telephone contact to the different acoustical consultants in San Francisco, Los Angeles, Denver and Chicago.

October 10, 1971

Bolt Beranek and Newman Inc.
1740 Ogden Avenue
Downers Grove, Illinois

Dear Sirs:

I am a student at the University of New Mexico. I am currently involved in the writing of my thesis: Noise Pollution.
I would very much appreciate your sending me of additional information in regards to my thesis. I also understand that your office has recently finished a study on traffic noise for the Automobil Manufactures Association Inc. Such a report would also be of great help in gathering information required to further accomplished different studies necessary for the completion of my thesis.
Thank you very much for your time and cooperation.
Sincerely yours,

Jose R. Carballeira

Jose R. Carballeira
2421 Second St. NW
Albuquerque, New Mexico
87107

1740 Ogden Avenue
Downers Grove, Illinois 60515
Telephone (312) 969-6150

Bolt Beranek and Newman Inc. 15 October 1971

Mr. Jose Carballeria
2421 Second Street
Albuquerque, New Mexico 87107

Dear Jose:

Listed below are a number of publications in which traffic noise and noise control techniques are discussed:

General Reference:

Noise and Vibration Control, edited by Leo L. Beranek, McGraw-Hill Book Company, 1971.

Urban Noise:

Chicago Urban Noise Study, Volumes 1,2,3, 1970. Copies available from: Department of Environmental Control, The City of Chicago, 320 North Clark Street, Chicago, Illinois 60610. (The reference lists are extensive).

London Noise Survey, Building Research Station, Ministry of Public Building and Works, 1968. Available from: Her Majesty's Stationery Office, 49 High Holborn, London WC1.

Highway Noise: A Design Guide for Highway Engineers, NCHRP 117. Available from: National Cooperative Highway Research Program, Highway Research Board, National Academy of Sciences, 2101 Constitution Avenue, Washington D.C. 20418. $4.60.

You should also check recent issues of the technical acoustics journals - "Applied Acoustics", "The Journal of Sound and Vibration Control", "The Journal of the Acoustical Society of America". As I mentioned on the phone, traffic noise has received much attention in the last few years; the "public" information is generally first published in these journals.

Best of luck. Please do not hesitate to call again if you have any questions.

Very Truly Yours,

BOLT BERANEK AND NEWMAN INC.

Tedd Boys

TB/kb

LIST OF FILMS ON NOISE AND HEARING

list was compiled by the Technical Committee on Noise with the assis-
e of the Environmental Protection Agency. Additional entries or
ections are welcome, and should be addressed to G. C. Maling, Jr.,
Acoustics Laboratory, P.O. Box 390, Bldg. 704, Poughkeepsie, NY 12602.

An approved Technique for Pure
Tone, Air Conduction Audiometry
14 min.
$220 Purchase; $25 Rental
Price Filmakers
3491 Cahuenga Blvd. West
Hollywood, CA 90028
(213) 851-3777

Cacophony
26 min. Color
$250 Purchase
United Productions of America
145 E. 49 Street
New York, NY 10017
(212) 758-8400
(not finished)

Death be Not Loud
28 min. Color
McGraw-Hill Book Co.
Box 404
Hightstown, NJ 08520

"Degrees of Hearing Impairment"
Audio Demonstration Tape
Magnetic Tape 7 1/2 min., 7 1/2 ips
$20 Purchase
Price Filmakers
3491 Cahuenga Blvd. West
Hollywood, CA 90028
(213) 851-3777

Ear Protection in Noise
12 min.
$120 Purchase; $25 Rental
Price Filmakers
3491 Cahuenga Blvd. West
Hollywood, CA 90028
(213) 851-3777

6. Hear - It Takes Two (Parts I & II)
20 1/2 min.
$350 Purchase; $35 Rental
Price Filmakers
3491 Cahuenga Blvd. West
Hollywood, CA 90028
(213) 851-3777

7. Hearing: The Forgotten Sense
17 1/2 min.
$225 Purchase; $25 Rental
Price Filmakers
3491 Cahuenga Blvd. West
Hollywood, CA 90028
(213) 851-3777

8. Meet Mr. Noise
Air Force Training Film TF 1-8193
26 min. Color
USAF Central Audio Visual Library
AF Audio Visual Center
Norton Air Force Base, CA 92409

9. Noise and Health
#1073 Film Library
California St. Library
Librarian Courts Bldg.
9th and Capitol
Sacramento, CA 95809
(916) 445-4248

10. Noise, the New Pollutant
28 min.
NET Film Library
Att: Dr. James Cole
Audio Visual Department
University of Indiana
Bloomington, IN 47401

Not Cleared for Hearing
14 1/2 min.
$225 Purchase; $25 Rental
Price Filmakers
3491 Cahuenga Blvd.
Hollywood, CA 90028
(213) 851-3777

Pandora's Box
#M1640-X
National Medical Audio-Visual Center
Station K
Atlanta, Georgia 30324
(404) 526-3551

Protect Your Hearing
Color
$10 Rental
Bray Studios
630 9th Ave.
New York, NY 10036
(212) 245-4582

Sound Off
10 min. Color 1969
$120 Purchase; $10 Rental
Pyramid Film Producers
Box 1048
Santa Monica, CA 90046

15. The Noise Boom
26 min. Color 1969
$330 Purchase; $15 Rental
NBC Educational Enterprises
30 Rockefeller Plaza
New York, NY 10020
(212) C17-8300, x-2977

16. To Conserve and Protect
#3866
14 1/2 min. Color 1969
Free Loan
Modern Talking Picture Service
2000 L Street, N.W.
Washington, D.C. 20036
(202) 659-9234

17. Noise--Polluting the Environment
#3045 Color
$8 Rental
Encyclopedia Britannica
Educational Corporation
1822 Pickwick Avenue
Glenview, IL 60025
(312) 729-6710

November 1971

October 25, 1971

California St. Library
Sacramento California

Dear Sirs:

I am a graduate student at the University of New Mexico, currently working on my thesis entitled "Noise Pollution". I recently attended an Acoustical Association of America convention in which I was given your name and address to order the film entitled "Noise and Health" free of charge. Being a student this fitted me perfectly.
I would very much appreciate your sending me this film.
Appreciating your cooperation.

Jose R. Carballeira

Jose R. Carballeira
2421 Second St. N.W.
Albuquerque, New Mexico 87107

The California State LIBRARY

CARMA R. LEIGH, STATE LIBRARIAN
PHYLLIS I. DALTON, ASSISTANT LIBRARIAN

LIBRARY-COURTS BUILDING
P O BOX 2037
SACRAMENTO, CALIFORNIA 95809

Thank you for your letter requesting a film from the California State Library. We are going to refer you to your local library for assistance. We serve all residents of the state by means of our interlibrary loan service which is provided through the local libraries throughout the state rather than directly to individuals.

Please ask your local library to make the request for you; we will then send the film to your library where you can pick it up.

Sincerely yours,

Mrs. K. H. Murdock

✓

Title requested in _____, not in _____State Library collection.

M-184

INDIANA UNIVERSITY
Audio-Visual Center
BLOOMINGTON, INDIANA 47401

TEL. NO. 812—337-

October 29, 1971

Mr. Jose R. Carballeira
2421 Second Street, N.W.
Albuquerque
New Mexico 87107

Dear Mr. Carballeira;

This is in response to your request for information about "free" films available from the Audio-Visual Center of Indiana University. The Center does not distribute films on a "free" basis but we do have a large film rental library and our rental rates are minimal. If you are interested in renting films, please let us know your areas of interest and we will be glad to send you appropriate descriptive film listings and/or catalogs.

Thank you for your interest.

Sincerely yours,

Patricia C. Wetmore ck

(Mrs.) Patricia C. Wetmore
Customer Service
Audio-Visual Center

PCW/lsm

FILM RELEASE FACT SHEET

The following information is for immediate release and may be reproduced in any form without further authorization. For additional information contact:

Barry Rummel
Telephone: 812/337-8087

FROM: Indiana University
Audio-Visual Center
Bloomington, Indiana 47401

August 14, 1967

Title: NOISE: THE NEW POLLUTANT
16mm/30 min./b&w/order # FS-1196/sale $125/rental $6.75

Producer: National Educational Television with a grant from the Acoustical Materials Association

Available: Immediately for purchase (including free previewing), rental, rental leading to ownership, and for CCTV use upon licensing.

Dr. Vern O. Knudsen, acoustical physicist at UCLA, demonstrates that sound is caused by a difference in air pressure and explains with animated drawings how this differential in pressure is able to induce the sensation of hearing. The main portion of the film reports on several research projects into the harmful physiological and psychological effects of excessive noise on human beings.

Subject: *Public health; Sound*

Level: *Secondary, College, Adult*

INDIANA UNIVERSITY
Audio-Visual Center
BLOOMINGTON, INDIANA 47401

TEL. NO. 812—337- 8087

RENTAL INFORMATION

RENTAL RATES: Films from Indiana University Film Library are available for one to five days of use at the listed rantal rate. Films will be scheduled for three days' use unless a longer period is requested. It is possible to rent for more than five days at the rate of .6 times the listed rate for each additional calendar week.

SCHEDULING: Films are booked in the order in which requests are received. Even though a number of duplicate prints makes it possible for the Center to book a large number of requests for the first choice of dates, it is advisable to provide alternate use dates. All orders should normally reach the Center at least four weeks before the requested date of use.

CONFIRMATION OF ORDERS: Confirmations are generally sent within seven to twelve days after the receipt of your order. If you do not receive a confirmation within a reasonable length of time, please call this to our attention indicating the film title requested and the use dates.

EXTENSION OF BOOKINGS: Films should be returned after the final showing on the last scheduled day of use. If it should be found necessary to hold materials beyond dates requested, permission should be obtained from the Center.

USE RESTRICTIONS: Films rented from Indiana University are not to be used for television purposes unless the renter obtains written permission from the copyright owners. National Educational Television and Indiana University film productions may be licensed for use on closed-circuit, fixed service or dial access television systems. Information about this electronic license is available upon request from the Center. Renters agree not to use the materials where an admission charge is made.

Rental orders should be sent to the Audio-Visual Center, Attention: Mrs. Elizabeth McPheron (812) 337-8087.

ACOUSTI-CELOTEX® PRODUCTS

BULLETIN

The Celotex Corporation • Acoustical Department • Tampa, Florida

December 5, 1969

TAMPA STAFF PERSONNEL

TO ALL DISTRIBUTOR SALES PERSONNEL,
HOME AND BRANCH OFFICES:

Recently several new people have been added to our staff and there has been re-alignment of some duties. Following is a list of the Tampa Acoustical Department personnel and their general responsibilities:

R. P. (Dick) Adams	Sales Manager - 872-3482
J. D. (Dan) Wilkin	Merchandise Manager - 872-3133 All phases of department activities.
M. C. (Mike) Garland	Technical Supervisor - 872-3135 Product and technical data on all products, ventilating and UL time rated materials; special products.
K. W. (Karl) Holm	Manager, Lighting Division - 872-3137 All phases of Lighting Division.
J. A. (Jerry) Smith	Technical Assistant - 872-3138 Complaints; special size products; ventilating and UL time rated materials.
W. J. (Warren) Wheeler	Technical Assistant - 872-3139 Complaints; ventilating materials; general product information.
Mrs. Helen Gonzalez	Office Manager - 872-3132 Administrative matters and Secretary to Mr. Burgen
Mrs. Lori Harris	Secretary to Mr. Wilkin - 872-3134
Mrs. Nancy Godwin	Secretary to Messrs. Adams, Smith and Wheeler 872-3482
Mrs. Ann Hockman	Secretary to Messrs. Garland and Holm 872-3136

Sales promotion and all advertising matters should be referred to Mr. K. C. (Ken) Lindley of the Advertising Department, 872-3557.

Your business is greatly appreciated and we will continue to strive to give you the best service and assistance possible to help you sell more Celotex products.

F. S. Burgen

October 6, 1971

Mr. Mike Garland
The Celotex Corp.
1500 N. Dale Mabry
Tampa, Florida

Dear Sir:

My name is Jose R. Carballeira and I live at: 2421 Second St. NW, Albuquerque, New Mexico, 87107. My reason for my calling on you is that at this time I am working for my thesis at the University of New Mexico. The general topic of my thesis is Noise Pollution. I am also very much concerned about acoustics. Celotex deals greatly with this kind of problem, therefore making it beneficial to me to get some information from you.
The kind of information I would need would be some literature pertaining to the different qualities and specifications of your acoustical systems, prices NRC, sound attenuation factors and ceiling STC's.
Also I would be very much interested if you have made any studies concerning sound control in the interior for the outside noise of cars, airplanes, etc. Actually any literature that you might find pertaining to noise control will be very much appreciated.

Thank you very for your time.

José R. Carballeira

6 January 1972

Attached is a copy of the paper you requested.
Thank you for your interest.

Sincerely,

Dwight E. Bishop

Bolt Beranek and Newman Inc.
21120 Vanowen Street
Canoga Park, California 91303

Bibliography

1. "A Study of the Magnitude of Transportation Noise Generation and Potential Abatement," Vol. II, "Measurement Criterion," November 1970.

2. "A Study of the Magnitude of Transportation Noise Generation and Potential Abatement," Vol. IV, "Motor Vehicle/Highway System Noise," November 1970.

3. "Transportation Noise Pollution: Control and Abatement," NASA Langley Research Center and Old Dominion University, Summer 1970, NASA Contract NGT 47-003-028.

4. "Highway Noise Measurement, Simulation, and Mixed Reactions," National Cooperative Highway Research Program Report No. 78, 1969.

5. "Highway Noise - A Design Guide for Highway Engineers," National Cooperative Highway Research Program Report No. 117, 1971.

6. "A Review of Road Traffic Noise. The Working Group on Research Into Road Traffic Noise," Road Research Laboratory, Crowthorne, England, 1970, PB 195 892.

7. "Evaluating the Noises of Transportation," Proceedings of a Symposium on Acceptability Criteria for Transportation Noise, Held at The University of Washington, Seattle, Washington, March 26-28, 1969, Report No. OST-ONA-70-2 dated April 1970.

8. Society of Automotive Engineers Technical Report J366 Recommended Practice Exterior Sound Level for Heavy Trucks and Busses (Available from SAE, Two Pennsylvania Plaza, New York, New York 10001).

References 1, 2, 6, and 7 are available at $3.00 per copy from:

National Technical Information Service
Operations Division
Springfield, Virginia 22151

Reference 3 is available by writing to:

Old Dominion University
Norfork, Virginia 23508
Attention: Dr. Gaglie, Assistant Dean of Engineering

References 4 and 5 available from:

National Cooperative Highway Research Program
National Academy of Sciences
Highway Research Board
2101 Constitution Avenue
Washington, D. C. 20418

This Appendix contains press releases regarding "noise."

I would like to thank Mr. "Bud" Boehning, for providing me with most of the articles herein shown.

LOBO March 1, 1972

House OK's Noise Pollution Act

Provides for $25,000 Fine

WASHINGTON (UPI) — Told that the nation's cities have become "Accoustical slums," the House voted Tuesday to authorize government noise standards for new products ranging from motorcycles to rock music amplifiers.

The 356 to 32 roll call vote sent the bill to the Senate after sponsors said standards set by the Environmental Protection Agency (ERA) under the measure would make America a significantly quieter place in which to work and live.

Rep. Paul G. Rogers (D-Fla.) warned that unless the bill was enacted "we may expect by the year 2000 that three quarters of this nation will have significant hearing imparities."

At least 44 million persons live near highways or airports, Rogers said, and "noise from transportation has created acoustical slums in almost every major city in our nation."

Noise Standards

Under the bill, EPA would establish noise emission standards for new products identified as major noise sources in four categories: construction and transportation equipment including recreational vehicles, motors or engines, and electronic and electric equipment.

"Does the bill cover rock music and all that jazz? asked a skeptical Rep. H.R. Gross (R-Iowa), who also wanted to know if the $25,000 fine stipulated in the bill could be levied on the operator of a loud motorcycle.

Rogers, a chief sponsor of the bill which also has administration backing, said the fines would be directed at manufacturers whose products do not meet EPA standards.

He noted tests showed 40 per cent of the University of Tennessee freshman class suffered from hearing imparity and Rogers said a contributing factor was believed to be loud music.

"I think they will take a look at these amplifiers so that when you go into a place you are going to be assured of not being deaf when you go out," said Rogers.

Aircraft Noise

In addition to requiring EPA to publish standards within 18 months of passage, the bill would direct the administrator of the Federal Avaiation Administration to prescribe standards and regulations to lessen aircraft noise.

The EPA would be authorized to request the FAA to review standards which do not adequately protect the public. The Nixon Administration had proposed giving EPA veto power over FAA noise standards and regulations.

The House rejected an amendment backed by members representing residents who live near busy commercial airports that would have given EPA authority over the FAA in setting noise standards.

Other amendments also rejected would have set up a commission to study possible curfews for after midnight operation of airports and banned flights at supersonic speed by civilian aircraft.

The bill, which authorizes $26 million over three years for the noise abatement program, also provides:

—Citizen suits may be brought against violators of noise control requirements or the EPA or FAA for failure to carry out provisions of the bill.

—Authority for EPA to issue regulations requiring labeling of products which emit noise that can adversely affect the public health or welfare or which are sold on the basis of their effectiveness in noise reduction.

—That it is the policy of the United States to promote an environment for all Americans "free from noise that jeopardizes their health or welfare."

—EPA will identify products that are major noise sources and provide information on techniques to control noise within 18 months of passage. The EPA will also coordinate all federal programs on noise research and control.

THE TYRANNY OF NOISE. By Robert Alex Baron. St. Martin's Press. $7.50.

THE FIGHT FOR QUIET. By Theodore Berland. Prentice Hall. $8.95.

IN OUR TECHNICAL SOCIETY everyone is the victim of noise. Only recently has noise been recognized as a type of pollution which can with patience, be fought. "The Tyranny of Noise" by Robert Alex Baron and "The Fight for Quiet" by Theodore Berland, explain what noise is and what can be done to stop it.

Baron began his fight against noise in 1963 after a team of street construction workers moved into his block in New York City armed with 80-pound pneumatic paving-breakers, cranes and high-impact rock drills. He spent three years trying to get relief from city, county, state and national agencies, to no avail. After all else had failed, he formed Citizens for a Quieter City to educate the public about noise and attempt to control it even in Manhattan.

In "The Tyranny of Noise," blame is placed on corporations and public officials whose greed and the public-be-damned attitude have brought acoustic anarchy to our modern world.

"One does not get used to noise. Somewhere in the human body sound is being absorbed — at an unknown price," he explains.

Baron proposes that only legislation or governmental regulations will force compliance to protect and promote environmental quality.

"THE FIGHT FOR QUIET" while a more technical book than "Tyranny," reaches many of the same conclusions. Berland documents that noise at a high level over a long period of time may be harmful to human beings. Energy doesn't disappear, Berland adds, and noise as energy is absorbed one way or the other. At exactly what price to human beings, science has yet to discover.

Both authors agree that the fight for noise abatement is an uphill one. But it has its delicious moments.

At a recent Department of Transportation symposium on evaluating criteria for transportation noise a spokesman for the auto industry gave the impression it was busy tackling the problem of effective noise standards.

Baron said, "The auto industry once told the City of New York it was setting up a committee to abate auto horn noise. That was in 1930. It is now 1969. Has the committee been formed and has it submitted its report?"

You know the stunned answer.

"The Tyranny of Noise" and "The Fight for Quiet" should be read not only by people who can remember a quieter world but by those who must face the uncertain future.

—LARRY CANTWELL

Aids Irritating Noise

1-3-70 GALLUP-INDEP.

MELBOURNE (AP) — When someone snores, someone else suffers.

Thirty-six-year-old Melbourne engineer Ronald Carr is only too well aware of this. His wife, Jill, 36, and a busy mother of three, is his victim.

But Ron Carr might have the answer. He has developed a machine to deal with the problem by making even more noise.

Carr doesn't claim his anti-snoring machine solves the problem. But it helps the victim.

Carr is an expert in noise research and control. His "noise box" evolves from a new technique in noise control called "sound conditioning." The idea is that irritating noises can be made more acceptable by introducing a soft background noise.

"The background noise is very faint and the person can still hear the original no clearly; but it becomes mu more bearable," says Carr.

"It is similar to the situati when you walk into a dark roo and someone shines a torch your eyes. But if the lights a switched on, the torch does affect the eyes anywhere near as much."

Carr says his wife could sleep because of his snoring, t til she was given the noise bo

Says Mrs. Carr: "It does stop him snoring. Let's get th straight from the start. But does allow you to put up with He'll continue to snore wheth he's on his side or his back. sleep in a double bed, but amount of rib-digging will st him snoring."

The noise box developed wh an architectural firm want something to counteract t noise of a lot of people in one office area.

The Carr firm devised t machine which emits sou ranging from rushing air to w ter falling on a metal roof. It effectively masks the noises.

"At the moment," says Car "it costs about $112, but we ho to bring the price down to abo $33.60 before we try to mark the box through a manufactu ing firm."

TRIBUNE 8-11-71

New Health Dept. chief plans reorganization

The new director of the city's Environmental Health Department said he plans to reorganize the department.

Pat Kneafsey said this reorganization will give the department "a much broader direction than just physical health."

Succeeds Bickel

Mr. Kneafsey will assume his duties as director Sept. 7. He succeeds Victor Bickel who stepped down from the post last week.

Kneafsey said he and City Manager Richard Wilson are in agreement as to what is needed in "the way of direction, healthwise, for the future.

"Environmental health is not just a health problem in its common term," he said.

Include Problems

"And with that idea understood we will reorganize and plan for Albuquerque's future and its problems, to encompass all health and environmental problems," he added.

Kneafsey will receive a starting salary of $17,000 a year. He is currently environmental manager for Region 1 of the State Environmental Improvement Agency.

He formerly was with the city health department from 1958 to 1969. He held various positions, including acting director.

TRIBUNE 7-27-71

Raises voice

EDITOR, THE TRIBUNE:

How long will this city permit the intolerably deafening racket of motor bikes, scooters and the like?

Why should people be shocked out of a sound sleep because some irresponsible bumpkin delights in racing his motor?

One of these little monsters drowns out the sound of a dozen cars.

Scientists have convincingly proved the devastating effect of these unnecessary explosions on hearing and nerves.

I say stop it — immediately!

CECIL CORNER
2704 Alvarado NE

ary 8, 1969

4-25-69

uture Craft

lane Noise Curb roposed by FAA

NGTON (UPI) — The viation Administration roposed a set of tough ndards designed to he "escalation of noise" around the irports.

w rules were aimed y at the new jetliners nned, including the o jets that will carry 400 passengers.

DING TO the FAA, ed standards would ise level of all new n "amount substan- y" that of the noisiest e jetliner now in or example, the new er Boeing 747 Jumbo ot be as noisy as the used Boeing 707

rm to the new rules, an for the FAA said would have to make of both the new l y-designed "quiet nd noise supression

esman said it was ogically feasible to antinoise in- n all types of older it he said the FAA idying the possibility d some "relevancy" liners.

said it also is con- orcing the rules for irliners, helicopters akeoff and landing

FAA's rule-making procedure, the deadline for filing comments on the standards is March 12. When the comments are received, the FAA will hold a public hearing, and then issue a final decision on the noise control proposal.

The FAA noted that its proposal is not designed as substitute for noise abatement regulations now in use at airports. Nor is it designed to upset the present division of responsibility for noise control now shared by the federal local and state authorities, a spokesman said.

ALBUQUERQUE JOU... The Albuquerque Tribune

Young

WASHINGTON (a -- The Young Americans for Freedom, concerned the presumed majority's silence is moving public opinion toward a defeatist attitude, is starting to grow its opposition to antiwar radicals.

The conservative YAF acknowledges it started too late to provide an effective direct confrontation with this week's planned demonstrations against the Vietnam war.

"If we attempt to stage a competing nationwide demonstration at this late date we may show up badly and the public would get the wrong impression," Randal C. Teague, YAF executive director, said in a recent interview.

BUT IT IS gearing up a campaign on behalf of what President Nixon described in his Nov. 3 speech on Vietnam as "the great silent majority." Activities started after the Oct. 15 Moratorium Day activities against the war.

"We were flooded with mail saying, 'We don't agree with this. Do something," Teague said.

Teague and his director of regional and state activities, lawyer Ron Dear, are urging each YAF chapter on 513 campuses to be active during the mass antiwar demonstrations in

N. MEXICAN 8-22-71

'Be Patient,' Is Plea on Aircraft Noise

Aviation Director Clyde Sharrer today appealed for public patience during a forthcoming shutdown of the Sunport's east-west runway.

The runway will be closed for repairs beginning May 19 for about 90 working days, Mr. Sharrer said.

Mr. Sharrer said that everything possible would be done to minimize the noise problems over the Heights when the north-south runway is used instead of the east-west runway.

Resurface

The project is necessary to resurface the runway and to strengthen it in anticipation of handling "superjets."

"Unfortunately, runways wear out, just as streets do," Sharrer said. "And this one has not been worked on for many years.

"Normally, we do not permit takeoff to the north by planes larger than a DC-3, and this policy will be maintained insofar as it is possible," Sharrer said.

Weather Problems

He said, however, that there will be times when weather conditions will make it imperative for larger planes to takeoff toward the north.

"When this is necessary, we apologize in advance to anyone who is inconvenienced," Sharrer said.

Some easing of the traffic problem will be provided by using an east-west taxiway which runs parallel to the east-west runway. Planes weighing less than 12,500 pounds can use this taxiway as a runway, Sharrer said.

Guard Returning

Sharrer said the runway shutdown originally had been scheduled to start May 15.

"But then we found out that the fine fellows of our Air National Guard are coming back on May 18 so we postponed the job," Sharrer said. "We certainly don't want to inconvenience those men after all they have been through."

MR. CITIZEN

. . . His views on issues of the day

Complains about noisy trucks

Editor:

The residents of Santa Fe join you in commending the police for cracking down on loud motor bikes. This is a step in the right direction and is long past due. But a more important and serious problem is being overlooked. I refer to the many large trucks (some larger than boxcars) that are permitted to pass through Santa Fe each hour of the night and day. Each one of these trucks are 10 times louder than the loudest motor bike and 100 times more deadly.

Each one belches far more air pollution than the limits set by the federal, state and city environmental control boards. There must be some way to route these trucks around the city; if not one should be made.

Residents of Santa Fe have been concerned with this problem for some time and the patience is wearing thin. If the state and city administrations, with all the facts of this issue in their possession, do not act to resolve this problem the people will. A citizens' committee already formed, is prepared to file a class action case, representing all the residents, asking the court for an injunction, with an order restraining state and city authorities from permitting these trucks from coming through the city at all. A federal court will be automatically bound to find for the people and grant this injunction and restraining order.

--Roger White

Santa Fe

XICAN 5-21-71

...age by sonic booms

...storic sites told

...ON (AP) — Sonic ...U.S. Air Force jets ...g some of Ameri... natural treasures, ...the National Park ...

...zog, in testimony ...e Appropriations ... said prehistoric ...en smashed and cliff faces disintegrated by the force. And, he added, even booms which cause no appreciable damage violate the peace and solitude people go to parks to find.

The park director said he hasn't been able to identify the planes, since they fly so fast and high, but said he believes they come from bases in California.

Six P.M.

The R-RUM-BL-ing sound of traffic
sings to the people.
Sings the song of coming-going.
Horns humming!
Sirens yelling!
Buses tooting!
The snarling sound of the motorcycle—
singing himself out.
The whine of the scooter, not singing as loud.
The wheels riding under the car
All of a sudden—STOP!
And the scared tires sing a screeching song.

—Phyllis Garcia, 6th, Eubank

A.P.S. JOURNAL 1-71

...Campaign' against noise

TRIBUNE 6-29-70

Every now and then ...mebody gets off a gripe ...out noise.

Every now and then a ...ientist or comparable person ...lls us noise is physically ...rmful to people.

Occasionally the government ...reatens to do something ...out noise.

But we still have noise. If ...ything, more of it than ever. ...e promised "campaign" ...ainst noise hasn't toned ...wn a single decibel.

* * *

Experts at the National ...reau of Standards, which ...idies such things, predict ...at in another 10 years the din ...ll be twice as loud.

...t has been demonstrated ...at excessive noise leads to ...afness, causes ulcers, raises ...od pressure, leads ...metimes to heart attacks ...d even can affect unborn ...bies.

...But hardly anyone needs ...tistics or scientific evidence ...understand the high degree ... personal irritability which ...n be caused by an idiot lay... on his auto horn in the ...ddle of the night, or an oaf ...alking the streets with a ...nsistor turned on full volume, or a rumbling truck which shivers the timbers, or a motorcyclist who figures the more noise his cycle makes the more power he's got.

Not much is being done about this, either. The government has a study under way; report due some time next year.

* * *

There is a lot of prattle about the constitutional right to privacy, about electronic eavesdroppers, and about government questionnaires which get too personal.

But no evidence of official concern about the most obnoxious of all invasions of privacy—noise.

There is a good deal of alarm about the "unrest" in the country, but it just could be that one of the causes is the infernal racket going on about us all the time—in cities, at least.

How about a national "Shut Up" campaign?

SOUND BARRIER TO EDUCATION

Last week Airport Junior High School in Los Angeles, Calif., closed for good. The school, erected in 1955 to serve 1600 students, is now, 15 years later, unusable.

PARADE 2-8-70

The reason? Noise.

The constant roar of jets taking off and landing at nearby Los Angeles International Airport had made teaching and learning physically impossible. In 1968, Westchester Elementary School closed for the same reason.

Three months ago the Los Angeles City Unified School District filed a suit for approximately $96 million against the International Airport. Jet noise, the suit claimed, had seriously interfered with the education of 46,000 youngsters in 31 Los Angeles schools.

This brought the total damages claimed against the airport by various interests in the area to $2.3 billion.

Los Angeles is not the only city in the nation wracked by jet noise. As airports grow in size to handle the jumbo jets, as prop-driven aircraft become fewer and fewer, jet noise becomes a greater problem.

No one suggests the abandonment of jet transportation. After all, 22 million people use Los Angeles International Airport each year, making it the nation's second busiest. It handles 975 million pounds of freight each year, provides jobs for 34,000 people.

Given jets and jetports as accepted ingredients of American life, the two apparent solutions to the noise problem are relocation of airports and redesigning of jet engines.

Unfortunately, the engines on the new 747 jumbo jets are noisier than their predecessors. Unfortunately, too, airports are not being constructed 40 or 50 miles away from schools.

The racket is sinful

TRIBUNE
6-5-71

Noise is injurious to health Enough of it can cause deafness. Sonic booms can harm unborn babies.

Scientists say these things.

But noise is more. It is shattering to the nerves. It can induce headaches. It riles the disposition. It interferes with television, phone calls, conversation, reading and sleeping.

The economic losses from disrupted work must be staggering. And it is an inhumane invasion of privacy, which everybody these days keeps saying is so precious.

* * *

Moreover, most of it is unnecessary, much of it deliberate.

Now and then some public officials talk of doing something about all this.

President Nixon has sent to Congress legislation to give the Environmental Protection Agency (EPA) power to coordinate research programs, set minimum noise standards, require manufacturers to come up with quieter apparatus.

The National Industrial Pollution Control Council (whew!) has filed a report deploring noise from motorcycles (top culprits) and such other gadgets as snowmobiles, chain saws, boats, power mowers.

* * *

But what about buses, trucks, autos without mufflers, ambulances, fire apparatus, sirens of all descriptions?

A police car in a hurry could be excused, but does it need three types of sirens?

Ambulances, it has been proved, don't need to speed in nine of 10 cases, and could do

Fire trucks need to speed, but they don't need fog horns to blast the skin off every citizen for a mile around.

* * *

The government's office of noise abatement and control (a branch of EPA) is making studies.

Okay, but if the noise isn't diminished pretty soon, the people in this country will be setting up a din everybody can hear—a din of protest!

September 23, 1971 NEWS Page 2

Cutting Noise Pollution

WASHINGTON (NANA)

Motorcycles race along city streets late at night, roaring their engines and shattering our sleep.

Monster machines rip at asphalt, pound structural steel, grind rubbish. Brakes squeal, horns blow, sirens wail.

Beneath us in the subways inadequately maintained vehicles offer a discomforting blend of sounds. Airplanes climb and descend over our cities. Gasoline powered rotors slice the grass. Transistor radios seem everywhere at high decibel level.

America, especially its cities, is becoming much too noisy.

What were once the pleasant sounds of a city growing and working, alive and joyful, have become discordant and destructive.

The Nixon Administration and Congress are talking about doing something about what they generally agree is an alarming national problem – noise pollution.

The President has asked that the Environmental Protection Agency (EPA) be authorized to set federal standards for transportation vehicles, machinery, appliances, and other manufactured products sold across state lines.

The problem with this proposal is that it will take years before any effective results are heard. Meanwhile the harm would go on.

As Rep. William P. Ryan, D-N.Y., told the House this week: "Scientific research has clearly shown that prolonged exposure to noise levels of 85 decibels or more will result in permanent hearing impairment for the average individual."

Yet the federal standard for noise set recently by the labor department was fixed at a higher decibel level.

Ryan has proposed that manufacturers be required to affix to their machinery a label showing the operational noise level. Then the consumer would know what he was getting and would be able to pick the quieter device.

Ryan would also make federal fund available to encourage local communities t designate noise polluters and do somethin about them.

More than 30 members of Congress hav already signed on as co-sponsors of Ryan's bill

Ryan and the Nixon Administratio disagree over whether standards on nois should be made retroactive to cover existin machinery. Ryan, claiming that the problem i so great that it must be dealt wit immediately, wants existing machines force into modifications to comply with the new law

The Administration would apply the standards only to machines manufactured after the standards are set.

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DOUGLAS BRYANT
...tension Service
...er Associated Press

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TRIBUNE 9-6-69

Restrictions Are Near on Plane Noise

By ROBERT LINDSEY
(C) 1969 New York Times News Service

NEW YORK —The Federal Aviation Administration is set to issue the nation's first restrictions on the noise from commercial airliners.

"We hope to have the rule out sometime in September," said Isaac Hoover, an FAA noise-abatement specialist.

Hoover said the restrictions would follow "fairly closely" a series of proposed noise limits outlined in January by the agency.

May Not Please Anybody

If so, the rule may not please anybody. Airlines and plane manufacturers contend that the January proposals are too strict, while airport officials around the nation have assailed them as being much too lenient.

Under the regulation, all new airplanes would have to meet certain measurable limits on noise during take-off, landing, and when they are on the ground, to receive FAA certification for commercial service.

Study Current Models

Although this rule would apply to new planes only, Hoover said that FAA-sponsored research was under way to determine the effectiveness and costs of partially muffling the roar and whine of current jet models.

The regulation is a product of protests over the noise of jet planes in commu... airports.

All of the prop... would require future planes to be substantially more quiet than those now in service.

Proposed Roles

Following are the proposed restrictions:

—While approaching an airport airplanes weighing up to 75,000 pounds could generate no more than 102 effective perceived decibels within one nautical mile of the runway threshold. The limits would increase for larger planes, so an airliner weighinb 600,000 pounds could generate 108 decibels during its approach.

For comparison, a large jet today, such as the Boeing 707, which weighs up to about 335,000 pounds, can generate a noise level of about 120 decibels under certain conditions.

'Sideline' Sounds

Noise pollution studied on Hill

By LIN MEADE

LOS ALAMOS—Almost 600 residents of Los Alamos believe there is noise pollution in the county.

A statement by Al Lieber, roganizer of an anti-noise pollution petition, says in part, "The problem of noise pollution in the county has become so severe that it has begun to eclipse the advantages of the life style of Los Alamos."

The petition, presented to the County Council October 4, states that trail bikes and motorcycles are presently being operated in and near populated areas without "regard to the safety and peace of mind of county residents."

Also, the petition said, present county laws are unenfordeable and police are not equipped to make quantitative on-site measurements of noise nuisances which will secure convictions.

The petitioners requested that the county council adopt a plan of action and appoint a commission to obtain quantitative data on sources of noise pollution.

"The commission should," the petition stated, "draw upon the volunteered expertise of members within the health physics group of the Los Alamos Scientific Laboratory in making the study and setting absolute limits on noise tolerance."

The petition urged that the commission include representatives of motorcycle organizations as well as property owners.

The petitioners felt that the first order of business for the proposed commission should be the problem of noise from two wheel vehicles. They also stressed that police should be equipped with inspection equipment and enforceable laws.

The Los Alamos County Council, meeting in a special work session Tuesday night, assured the petitioners that an ad hoc committee would be formed to study the petition and the possibility of a County Ordinance. The council also indicated that members of motorcycle organizations and property owners would be represented on the committee.

While the petition stressed noise from vehicles and other machines such as power lawn mowers and chain saws, it did not ignore other noise sources. However it did not mention them specifically.

Another report on noise was issued by the police department covering the period of September 1 through 14. The report listed 19 noise complaints during that two week period.

Cancer cure, end of pollution seen within thirty years

TRIB. 6-24-70

NEW YORK (AP) — A cure for cancer and drugs to prevent it. Clean air and clean water. Noise-free trains and planes. A cashless and checkless society.

All of this could be a reality before the end of the century, according to a McGraw-Hill Publications Co. survey.

From Data

The survey, compiled from data on all phases of modern life from more than 150 industrial firms and research agencies, shows scientific researchers are confident modern technology can make inroads into most of today's complex problems in 15 years and solve them in our lifetime.

Among the other good news researchers foresee in the future are effective methods of solid waste disposal, chemical control of the aging process, biochemical methods for growing new limbs and organs, undersea farming and mining, and a compact total energy plant for the home.

The Weather

But one of the few areas in which researchers lack confidence in technology is weather; we'll still be talking about the weather and won't be able to do anything about it.

ALBUQ. NEWS 7-29-71

rnal Noise

lians are at last taking action against onwide din of radios and TVs turned up volume, the clatter from millions of ikes, souped-up cars, juke boxes, sirens axons — a noise that is driving nds of tourists from sun-drenched

ttalions of officers from the Italian n and Interior Ministries are deployed r cities with anti-noise police swooping nders, who can be fined up to $200 on t, or face trial and a possible three in jail for making too much clamour.

decibel terms, modest traffic registers, ara Falls 90. Rome traffic now scores hin a year, it could be the same as

cking the new moves, the Rome daily Il comments; "We don't want to admit vulsions and cacophony are born of our , exhibitionism, lack of education and y."

JOURNAL 6-6-71

People, Not Cycles Make Noise

MR. WOLLMAN is not alone in his recent criticism of noisy motorcycles. The latest issue of the leading motorcycle magazine contains editorial comment on this same subject and exhorts all concerned to take corrective steps.

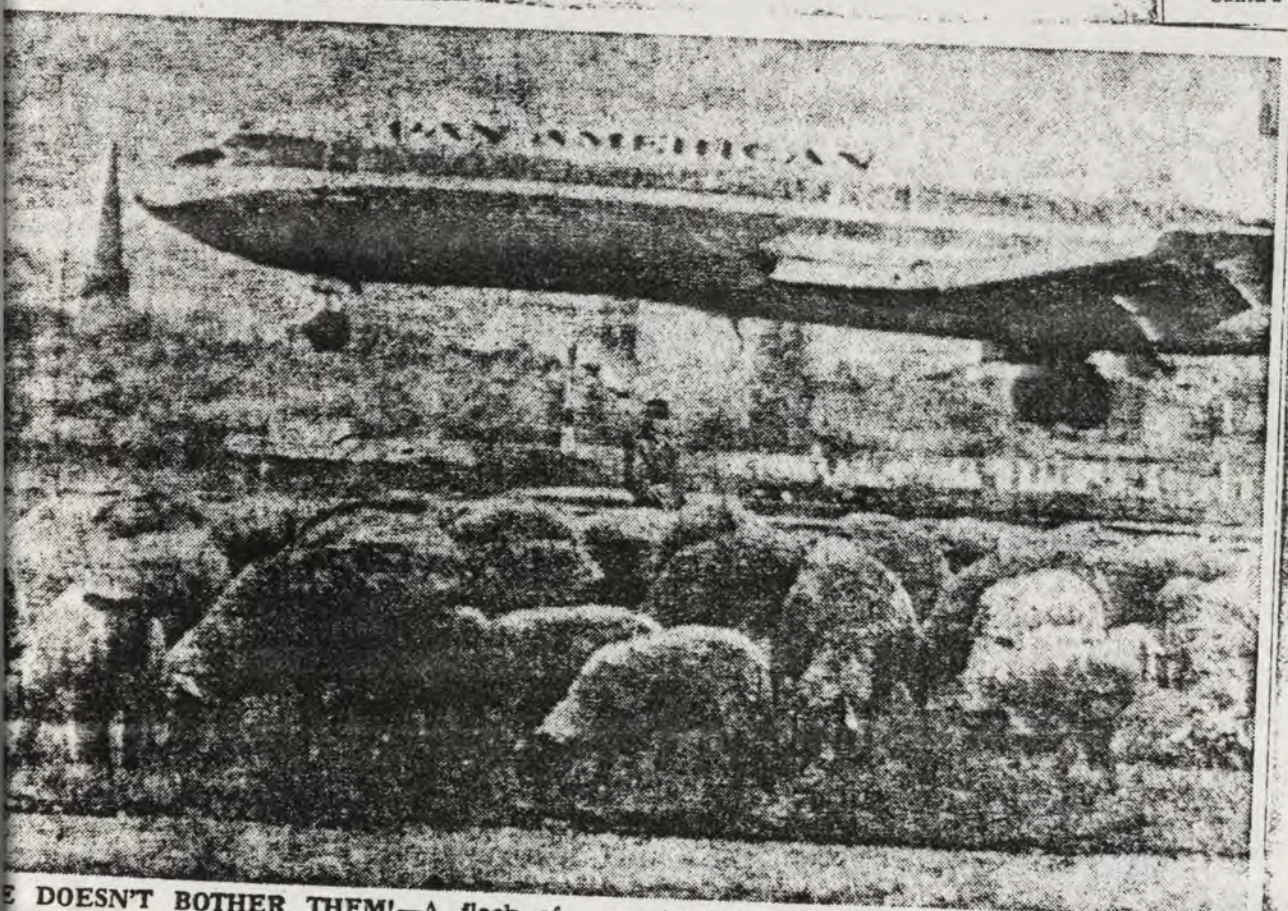
But before commenting further may I offer my qualifications for such comments? I am 67-years-old, have ridden motorcycles with great pleasure and some consideration for others for more than eight years, have enough hearing loss to necessitate wearing a hearing aid for the last 15 years, and have presented papers on the injurious effect of high decibel level noise encounterd in industry.

May I suggest that motorcycles don't make noise —rather, people create noise through the medium of motorcycles, trucks, excessively loud music, or certain industrial processes. The answer lies not in legislating motorcycles out of existence, banning all trucks, eliminating all rock-and-roll music and shutting down all industry, but rather in regulating the manner in which people conduct themselves in these situations. My bike has a Forest Service approved spark arrestor to guard against fire in brush and timber areas, also a very effective standard muffler which I have not tampered with; I dislike noise as much as Mr. Wollman does.

Motorcycles have no minds of their own and hence cannot possibly be responsible for the obscene collection of beer and soft drink cans, plastic, old car bodies, garage and other trash which desecrates Rio Frijoles and other once-beautiful streams. I have personally ridden (on my motorcycle, if you will) through the campground in Holy Ghost Canyon and collected in just a few minutes some 74 drink cans left by others, to be deposited in designated trash receptacles. What a pity that the anti-litter laws cited by Mr. Wollman haven't been adequate to control this type of slobbishness.

If we're going to get all bent out of shape about some (not all) motorcycles, let's be honest enough to recognize that our basic problem is not the machine or process, per se, but that of ignorant, sloppy, inconsiderate people behaving in an offensive fashion. Keep the riders in line and you won't have any more problem of noisy motorcycles.

RUSSELL STEWART
Box 4942
Santa Fe



E DOESN'T BOTHER THEM!—A flock of placidly munch grass as a modern jetliner at West Berlin's Tempelhof Airport. The Ger- tradition of keeping sheep on airfields has survived the age of jumbo jetliners. It used to be German law that every air field have sheep grazing. The pilots liked the close, even cut the sheep gave the grass fields. N. MEXICAN 5-26-71 (AP)

N. MEXICAN 10-13-71

'hurch chimes silenced n noise pollution charge

:CAGO (AP) — The Rev. en Mueller reluctantly lenced the chimes of his h and the Chicago Noise ion Board which made lo it may find it has d a Pandora's box.

22 years the carillon at ter's United Church of was sounded at rhour intervals from 8 9 p.m. and was heard a oneblock residential n Chicago's Northwest

lought everybody loved d the Rev. Mr. Mueller. the noise pollution ame up on a complaint ie residents. The next knew, I was ticketed veeks ago."

Rev. Mr. Mueller said y time the chimes have d since then was for a l reading by the ny that installed them

"

ympathy in court [illegible] e appeared to answer nplainants and he car- th him a petition signed)0 residents who said anted the electrically ed carillon turned back

than 200 persons gath- hear the proceedings uit Court.

e Vincent W. Tondryk ne look at the noisy and requested a al hearing in his ers. He advised Lillian and Virginia Anderson ıdraw their complaint. lid.

dryk said their aint would not stand up t on a nuisance charge ınd would have to come the city's noise nent ordinance which into effect July 1. He ited that city inspectors decibel readings next to determine if the s are above the noise

epresentative of the facturer of the chimes that when he took a decibel reading the volume was no louder than at other churches.

The judge said if the sound was found to be in violation of the noise abatement ordinance, the city could file a new complaint against the church.

But, the judge added, if the matter is brought to court again it could become a precedent "if other complaints ever were filed against the loudness of church bells."

"I won't turn the carillon on again until the city inspectors determine the noise level," said the Rev. Mr. Mueller. "I won't defy a court order. I'll try to work something out if my church is in violation.

"But I have a lot going for me. How long have church bells been ringing in the world?"

GALLUP INDEP. 6-10-71

Traffic to Triple

Aviation in America

By HOWARD BENEDICT
AP Aerospace Writer

KEY BISCAYNE, Fla. (AP) — America's aviation industry faces a decade of growth, with passenger traffic expected to triple by 1981. To meet the challenge it must solve many problems, from noise and pollution to safety and air congestion.

For three days, many of the nation's leading aviation experts have been discussing the future of U.S. air transportation at a meeting here sponsored by the Federal Aviation Administration and the American Institute of Aeronautics and Astronautics.

Most forecast that air traffic, slowed by an economic recession, will begin to pick up late this year and that the annual growth rate of domestic air transportation should return in a year or two to a normal 11-13 per cent. This is based on an anticipated upturn in the economy.

The aviation officials predict that more than 450 million passengers will be carried by U.S. domestic and U.S. international carriers in 1981, compared with 160 million in 1970. The number of commercial jets flown by U.S. airlines is expected to increase in that period from 1,900 to 3,200.

About 10 per cent of the 1981 fleet will consist of new-type planes—supersonic transports and short take off and landing STOL jets. Unless the United States revives the recently killed SST program, the supersonic craft will be Russian TU144s or British-French Concordes.

Here are some other major conclusions of the conference:

—A large increase in aircraft will require intense research into improved safety, including airborne collision avoidance systems which should be placed on all aircraft, large or small. Increased all-weather capability will be required to maintain rigid schedules.

—An effective national air traffic control system, perhaps using satellites, must be developed capable of handling aircraft speeds from low subsonic to supersonic.

Traffic capacity could be greatly increased with automated systems such as a microwave landing guidance which would permit curved approach paths instead of the straight-in approach required today.

—Airport land is scarce and administrators might have to increase airport capacity within current boundaries. It may be necessary to restrict major airports to runways, ramps and taxiways, with all other functions such as maintenance, ticketing, parking, cargo and baggage handling moved elsewhere.

TRIBUNE 9-3-71

L.A. fights jets' noise

LOS ANGELES (UPI) — The city of Los Angeles is spending almost $300 million to "eradicate" 1,994 private homes around the ocean coast airport, the nation's second busiest, to deal with the protest over the noise of jetliners.

The city is buying the homes, some with fine sea views and swimming pools, at prices ranging from $28,000 to $115,000 and either demolishing them or reselling them for movement elsewhere.

400 Acres

The homes are spread over 400 acres on the outskirts of Los Angeles International Airport which is exceeded only by Chicago's O'Hare Field in volume of traffic.

In the most extreme method ever devised to deal with airport noise, the city, for example, bought one house for $97,000 and paid a wrecking company $360 to destroy it.

Take Two Years

The project will take about two years. When it is finished, only bare land will remain where until recently more than 8,000 people lived. The purchases are being financed by 30-year revenue bonds.

Not only homes but other buildings are being destroyed. One school covering a 10-acre square of ground was demolished.

LOS LUNAS-VALENCIA NEWS 4-30-70

Noise Pollution

"Threaten Community Life"

By PHILIP H. LOVE

(NANA)– Air pollution and water pollution are grave problems, to be sure, but something also needs to be done about sound pollution.

In New York City, according to a 17-member task force on noise control appointed by Mayor John V. Lindsay, sound pollution has reached a level "intense, continuous and persistent enough to threaten community life."

New York's noises, the task force found, regularly go above the 75-decibel level, which is generally recognized as the "injury threshold." Compressors used in construction commonly reach 110 decibels and subway noises go to 100.

In Washington, we have no subway as yet—and at the rate we're going, we may never have—but there are enough other noises to keep our nerves on edge. And the same must be true of every city, town, village and hamlet in the United States.

Come to think of it, this may be the cause of many of our other problems. It could be that criminals, dope addicts, alcoholics, rioters and demonstrators of various stripes have been jarred off their rockers, so to speak, by noises beyond the "injury threshold."

Who can say how many sit-ins, for example, are prompted by unconscious desires to get away from the unbearable sounds of our modern environment? The fact that the efforts to escape only add to the din is beside the point.

I thought I'd found a refuge from sound pollution when my friend, Capt. Homer Windsor, took me on a walking tour of Tylerton, a Smith Island village 10 miles out in the Chesapeake Bay from the mainland town of Crisfield, Md.

"The reason we have to walk," Homer explained, "is that automobiles aren't allowed in Tylerton."

As he spoke, a pretty teen-aged girl strolled toward us with a transistor radio tuned to a rock-'n'-roll station somewhere on the mainland. Loud as it was, its yeh-yeh-yehs were suddenly reduced to a whisper by the roar of a motor.

"Power mower," Homer shouted. "There's just no getting away from the blasted things—except maybe in the Mojave Desert!"

I don't know about the Mojave, but in Tylerton there's apparently no getting away from television either. Every house we passed had an antenna.

Two other friends of mine, Paul and Ruth Hallett, returned from a long automobile trip bemoaning the dearth of highway restaurants without jukeboxes.

"The worst of it is," Paul said, "that they're always going full blast. You get the impression that the customers are afraid of quiet."

"Only once," Ruth recalled, "did we go into a restaurant in which a jukebox wasn't blaring. It was such a refreshing change—so relaxing—that we congratulated each other. Our pleasure was short-lived, however. We'd no sooner given our order than the noise started. The only reason we didn't cancel the order and walk out was that we knew from experience that the next place would have a jukebox just as loud—maybe even louder."

The trouble is, I surmise, that a whole generation of Americans has grown up without ever knowing silence. These people have been subjected to noise of one kind or another all their lives; they're conditioned to it. Some of them can't even go to sleep without it. And in those rare waking moments when there isn't any, they make some—with radio, TV, record player, sometimes all three.

JOURNAL 5-16-71

te War on Noises Urged in California

MENTO, Calif. (AP) — A committee of the a Dept. of Public riday urged a state war aimed at making free-irports, industry and ieter.

mmittee's 39-page the legislature — to be a by the Assembly tation Committee May /s noises from motor 'constitute the greatest noise offensive to the umber of people."

COMMITTEE of 20 and public officials ption of legislation to gal noise limits on all o 70 decibels by 1983; e noise screening of and to set up a state system for muffler mprove anti-noise law nt.

nmittee also proposed ise standards for city n other vehicles be-heir closer proximity umbers of people and on of anti-noise stan-tires, which they call predominant vehicle ce at 60 miles an hour

OMMITTEE saw no to airport noise prob- urged new zoning ut "more compatible und airports and to oise shields around existing airports.

THE COMMITTEE proposed setting noise standards for new products as a first step to make homes and businesses quieter. It suggested development of criteria to pick which existing equipment needs to be modified to reduce noise would be a second stedp.

It also urged adding antinoise standards to building codes to reduce interoffice and interapartment transmission of noise.

Present legal noise limits on California highways are 88 decibels for trucks, buses and motorcycles measured from 50 feet away and 86 decibels for automobiles.

JOURNAL 10-3-69

Noise Annoying

CHICANOS and Gringos in New Mexico have had a lot to say in recent weeks about pollution of our air and water with smoke, odor, and waste, while noisy trucks and still louder motorbikes merrily continue to raise our blood pressure, cause hypertension, ulcers, bronchial asthma, coronary thrombosis, colitis, and other known and unknown diseases of civilization.

Some medical authorities will no doubt disagree with the above diagnosis and observation, but there can be no disagreement with the fact that noise at high levels and for long durations causes deafness, irritability, is distracting, interferes with communications, is mentally exhausting, startling and annoying.

Noise really pollutes our air and environment, and deserves as much research and control to reduce it as whatever may come out of some industrial smokestack or waste pipe.

There is not one of these noise-makers running up and down our streets and highways today that a muffler won't fit. We already have laws covering noise. They aren't being enforced.

C. W. WEBB
Tularosa

The Albuquerque Tribune 7-22-71

$200 million project to buy 1,944 homes in 75 square blocks

L.A. tries to still roar of protest over roar of jets

By ROBERT LINDSEY
(C) 1971 New York Times News Service

LOS ANGELES — The two-story, tile-roof house at 8814 Vista Del Mar here seems to have everything — four bedrooms, three baths, a huge swimming pool, and a spectacular view of the Pacific Ocean.

The City of Los Angeles recently bought the house for $97,000.

Soon it will pay a wrecking company $300 to destroy it.

Most Expensive Remedy

The house is one of 1,944 homes that Los Angeles is buying in the most extreme — and most expensive — remedy ever applied by an airport to deal with community protests over the roar of jet airliners overhead.

In a project that, with interest, will cost more than $200 million, the city is eradicating three residential neighborhoods that cover more than 400 acres on the borders of Los Angeles International Airport.

Los Angeles airport commissioners agreed to buy about one-third of the homes last summer after shouting, angry crowds of protesters jammed their meetings.

Opened New Runway

The outbursts were precipitated by the opening of a new runway within 500 to 600 feet of their homes in the Westchester section.

The other homes are under or near the approach and take-off paths of jetliners, in neighborhoods where residents have complained of steadily worsening jet noise for years.

When the project is finished in about two years, only bare land will remain on the sites where, until recently, more than 8,000 persons lived.

Growing Complaints

Some airport managers in other cities believe that what is happening here could be a portent of similar massive acquisitions of airport-community homes elsewhere because of the growing public complaints over jet noise.

Heavy jet traffic at the Los Angeles airport — the nation's second-busiest, after Chicago's O'Hare — and its proximity to residential communities have created a lengthy and bitter conflict over noise with residents of the adjacent towns.

But the conflict is equally severe at some other airports, including Kennedy International in New York and O'Hare.

75 Square Blocks

Here in Los Angeles, all the homes, a school and several commercial buildings in an area of about 75 square blocks will disappear.

The city is buying the houses through condemnation proceedings and direct negotiation with the owners, at prices ranging from about $28,000 to $115,000.

In all, the city will pay the property owners more than $80 million.

The purchases will be financed by 30-year revenue bonds. Whose interest payments will bring the total cost to more than $200 million.

"Such a Waste"

As he stood in the backyard of one of the doomed houses in the Playa del Rey section — a deserted, $77,000 hillside home with an empty swimming pool and a panoramic view of the Pacific surf below — Jack E. Long, an airport official who helps supervise the property acquisition program, said:

"Sometimes I go home sick. It's such a waste. If this were my sole job at the airport, I couldn't stomach it.

"The only way I've been able to psych myself into accepting it is the idea that maybe some people will benefit from the houses."

About 30 per cent of the homes are being sold, at prices ranging from $300 to about $3,000, to individuals and commercial developers who move them to other sites.

Between 1965 and 1968, the airport bought 379 homes near the airport to clear a runway approach path. Some were sold and moved to adjacent neighborhoods that are now being leveled in the current project.

As a result the city has bought some houses twice. For example, the city purchased one attractive two-story home on Trask Avenue in 1967 for 160,000 and sold it to a developer for $3,000. Recently it bought the house again — for $73,500.

Airport officials expect more than half of the homes in the present project to be demolished because of lack of interested buyers or for other reasons.

The city gave 34 of the houses to the Los Angeles Community redevelopment Agency.

Airport officials say they do not foresee a significant drop in complaints about noise as a result of their expensive land acquisition.

"The noise is just as bad in Inglewood and El Segundo (two neighboring towns) and we're not doing anything there," said Donald A. Miller, assistant manager of airport property.

It's getting noisier. I said, IT'S GETTING NOISIER!

Construction equipment is a prime target of new noise control laws

If you're hearing more now and enjoying it less, face the facts: it's getting noisier.

During the past 25 years the average increase in urban noise levels has been one decibel a year. You don't have to know what a decibel is to get the message.

Congress is well aware of the problem and may act on federal noise control legislation this year. When it does, transport and construction equipment—the kind that public works men use—will receive a lot of attention.

It already has received some. The House Subcommittee on Public Health and Welfare has agreed on a bill similar to a Nixon Administration proposal. It empowers the head of the Environmental Protection Agency to set maximum noise decibel levels for construction and transportation equipment and all internal combustion engines, including those on recreational vehicles. The Senate Commerce Committee is expected to take similar action.

In July Dr. Alvin F. Meyers, Jr., head of the government's noise abatement program, was in Chicago for 2 days of fact-finding public hearings on noise pollution. The picture he and his 5-member committee got was not a very bright one.

Noise was called "the ultimate insult" by Dr. Alfred Etter of Morton Arboretum, Lisle, Ill. "It belittles us. It gives us nothing at which to strike back," he told the committee. "When animals are made to listen to noise, they grow sullen, unresponsive, erratic and violent. Is it any wonder we have silent, despondent, indifferent people?"

The committee learned that industrial noises in most cases range from 90 to 120 decibels (dB). Dr. Edward Herrmann, professor of environmental health at Northwestern University, said that "85 is quite noisy and at 95 dB you would have to shout from a foot away to be heard. At 120 dB a person is uncomfortable."

As a point of reference: normal conversation heard from 3 ft. is rated 60 dB; a kitchen blender may produce 90 dB; a 10-hp outboard motor at 50 ft. is close to 90 dB; construction noise from compressors and hammers 10 ft. away rates 100 dB; a rock and roll band may generate noise up to 120 dB; a four-engine jet airliner beginning to take off 100 ft. away is 140 dB. Research has shown that sound at 160 dB can kill small animals.

In May 1969 the U. S. Labor Department set 90 dB—the noise output of a motorcycle—as the loudest continuous noise a workman can take in an 8-hr. day; the higher the decibels, the less the exposure time.

One encouraging development the committee heard about is Chicago's new noise ordinance affecting vehicles, construction equipment, and various powered tools. The ordinance became effective July 1.

Based on readings taken 50 ft. from the vehicle, cars, motorcycles, and other motor vehicles manufactured after Jan. 1, 1980, will be limited to 75 dB. For construction and industrial machinery manufactured after Jan. 1, 1972, the limit will be 94 dB; after Jan. 1, 1975, 86 dB; after Jan. 1, 1980, 80 dB. This classification includes tractors, dozers, drills, loaders, power shovels, cranes, derricks, motor graders, paving machines, off-highway trucks, trenchers, compactors, scrapers, pavement breakers, compressors, and pneumatic powered equipment, excluding pile drivers.

Construction operations are prohibited in Chicago between 9:30 p.m. and 8 a.m. within 600 ft. of a hospital or residential building, except for public improvements and work of public service utilities. The ordinance holds manufacturers and operators responsible for compliance and prescribes fines of $15 to $500 and up to 6 months in jail for violations.

When the Chicago ordinance became law in July, Theodore Berland, president of Citizens Against Noise (CAN) and author of "The Fight for Quiet," termed it "a strong beginning, but only that. It may take 10 years before our ears will be able to detect any drop in noise pollution."

Cities are slowly beginning to crack down on noise violations, perhaps following the example of Memphis, Tenn., which has won "the quietest city in the U. S." award many consecutive years because of strong enforcement of its noise ordinance.

In 1968, New York City passed a building code requiring acoustical insulation and noise controls in multi-family dwellings. Now it is considering a code calling for quieter construction equipment and reduced hours of construction.

Milton Musicus, municipal service administrator of the City of New York, says plans are being made for the certification and inspection of such equipment as air compressors, air hammers, and pavement breakers.

Several years ago Bethlehem Steel Corporation developed a sound-deadened garbage can that "thuds" instead of "clangs." General Motors designed a garbage truck that was said to be 60% quieter than existing models. Today equipment manufacturers are developing quieter machinery and some companies conscientiously provide quiet work surroundings for their employees. Although silencing packages are available for rear dump trucks, loaders, engine-powered air compressors, and power-operated chain saws, manufacturers report they are seldom installed until a local noise regulation is passed.

Controlling the noise pollution, like other environmental problems, is many-sided, complex, and costly. In construction, for example, Mr. Musicus pointed out that architects, engineers, and contractors must learn to accommodate changes brought on by environmental restrictions, and manufacturers must produce equipment to meet environmental requirements. The public must be willing to pay more for capital improvements and wait longer for them to be finished. ■

EMBLEM of the Department of Environmental Control, Chicago, reflects its concern with the total environment—including noise.

ENQUIRER 9-9-71

Acoustical Expert Says:

By 1985 We Will Have to Shout to Be Heard in Street

If something isn't done, people more than 3 feet apart will have to shout to be heard on the streets of the average city by 1985, an acoustical scientist says.

And the background of noise from automotive and aircraft traffic will increase so much by the year 2000 that people on an average street corner will be unable to communicate normally even at 3 feet, Dr. Franklin Hart added.

"They'll have to scream at each other," said Dr. Hart, director of the North Carolina State University Center for Acoustical Studies.

"I predict that noise levels in the average city will be so high by 1985 that two friends meeting on a street corner will have to shout their greetings if they want to be understood," Dr. Hart told The ENQUIRER in his sound-research laboratories at Raleigh, N.C.

He explained that his research, which began in 1967, is being sponsored by the National Aeronautics and Space Administration.

Most of it is geared to learn about noise pollution caused by aircraft in flight.

"Noise is just as undesirable as any other kind of pollutant. It pollutes the atmosphere and is a health hazard.

"Medical research shows that loud sounds can cause blood vessels to constrict, muscles to tense and adrenalin to be suddenly injected into the bloodstream. Excessive noise makes normal people nervous and nervous people neurotic," Dr. Hart said.

He pointed out that only recently has noise been recognized as a pollutant. The federal government did not establish regulations to restrict noise levels until 1969, he said.

"But the government could not enforce the regulations even if it wanted the job," he explained. "Yet this is the answer — enforcement of the law."

He added that noise pollution around the world will continue to rise unless something is done to stop it.

Dr. Hart currently is engaged in research on the noise created by truck tires. "At speeds above 60 miles per hour, the tires of an average truck make more noise than its engine exhaust.

"And recent studies show that by 1985 there will be 58 percent more trucks and buses on the road, not to mention an increase in other noise polluters — 60 percent more cars, 324 percent more motorcycles and an estimated jump in aircraft traffic of 438 percent.

TESTING NOISE: Dr. Hart measures noise made by truck tire at 60 mph in his Raleigh, N.C., laboratory.

"Noise-control devices must be designed and built at the same rate as noise-making machinery," concluded Dr. Hart.

— LLOYD MALLAN

Laws Proposed to Cut Down Noise

GALLUP-INDEPENDENT 11-18-69

Jet Noise is Quieter than Rock'n'Roll

WASHINGTON (AP) — The nation's first limits on jet airplane noise go into effect Dec. 1, but it probably will be many months before the public notices any less whine in the sky.

Initially the limits are aimed first of the jumbo jets, a 360-passenger flying hotel lobby scheduled to enter airline service late in February.

The Federal Aviation Administration said the noise rules will FAA Nov. 12, will apply to the three engine Lockheed L1011 and Douglas DC10 air-bus giants, scheduled for delivery to the airlines late in 1971 or 1972.

Sometime after next June 30, however, the FAA will come up with noise restriction proposals for jets now in operation, such as the Douglas DC8 and the Boeing 707. With a six-month allowance for the filing of comments, the amended rules could hardly

the 707 about $1.2 million each.

Bakke said these planes have a noise output on takeoff and landing of 110 to 120 EPNDB—effective perceived noise decibels. Depending on size and type of plane, 93 and 108 EPNDB will be the maximum permitted for new planes such as 747s and DC10s.

The FAA noted that the 102-to-108 EPNDB range is equivalent to "noise experienced by the

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