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HIGHWAY NOISE ATTENUATION

A SHARED RESPONSIBILITY

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California Division of Highways

AASHO ANNUAL MEETING
December 7, 1971
Miami Beach, Florida

Operating Subcommittee on Roadway Design

71-44

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We have all become aware in recent years of noise as a pollutant and irritant in the human environment. There have been a number of technical studies and papers produced on this subject. Since noise is a form of sound, it is a physical phenomenon which can be defined, measured, and predicted according to physical laws. The technical state of the art is relatively well advanced and is not a particular problem to highway engineers.

Medical and physiological studies have been made on the effects of noise on the human body and there is fairly well defined knowledge in this area.

Noise also has psychological ramifications which are not as well understood. I think that we have all experienced the phenomenon of suddenly becoming conscious of noise which had been occurring for some time. Also, a very moderate noise in terms of decibels can be disturbing when one is accustomed to little or no noise. It is the change that is disturbing, rather than the absolute level of noise.

Noise emanating from vehicles traveling on roads, streets, and freeways can range in its effect on the human environment from negligible to intolerable, depending on many factors. Some of the more important are:

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1) Type and mix of vehicles causing the noise.
2) Character of the surrounding land and developments.
3) Distance from roadway to receivers of the noise.
4) Configuration of the roadway.
5) Psychological factors as mentioned above.
6) Vehicle noise as compared to noise originating from other sources.

All things considered, there is general agreement that, under the right combination of circumstances, highway noise can be a problem. Who, then, is responsible for solving or minimizing this problem?

1) Since the source of the noise is the vehicles using the roads, one prime segment of responsibility should be the manufacturers of the vehicles. This responsibility has been recognized by the industry to a degree, and some voluntary research is being performed toward producing quieter vehicles, especially trucks.

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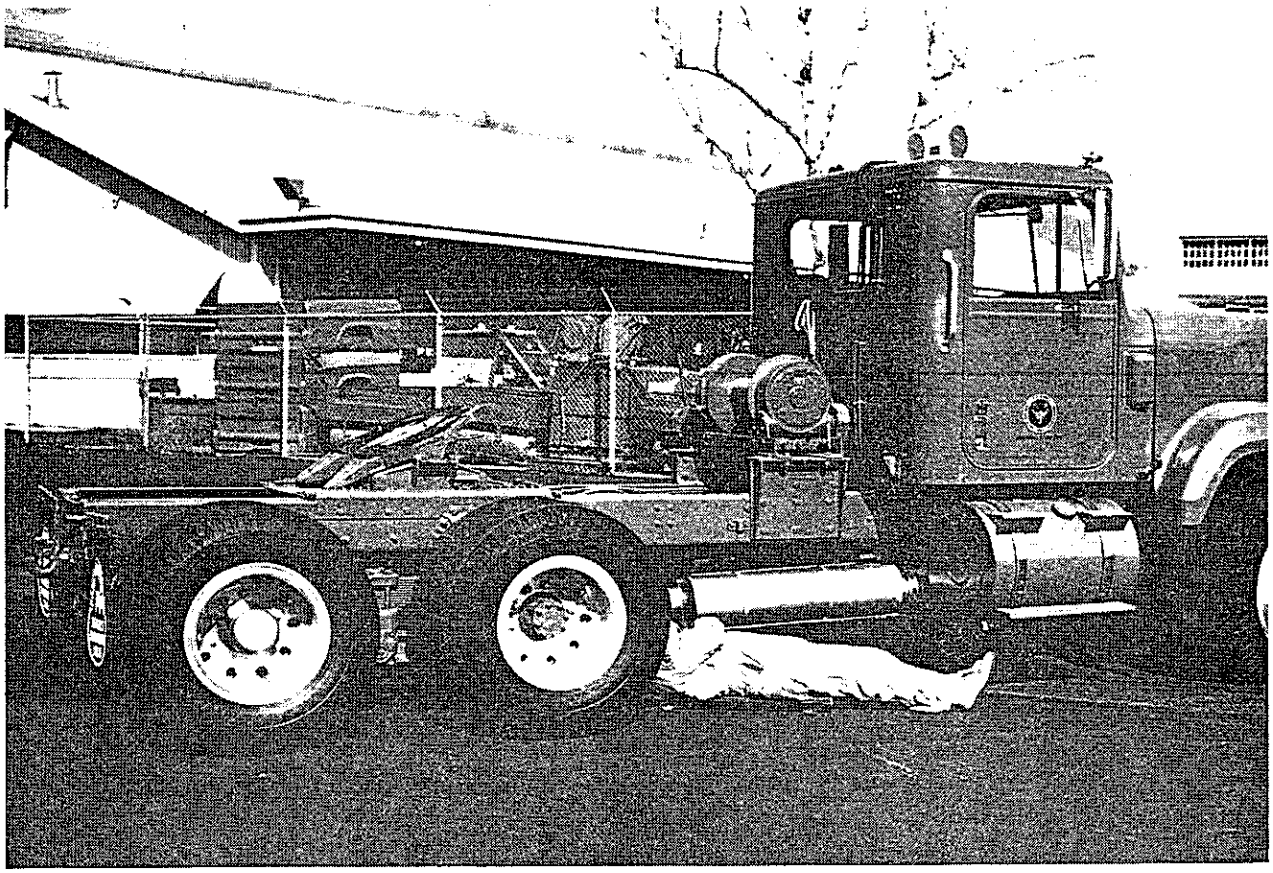

Slide No. 1

The International Harvester Company has been working with the Division of Highways to build this "quiet" truck. Our Equipment Department has recently purchased the truck, and will continue experimenting for further noise reductions. At the present time this truck will meet the California noise limit of 86dBA in 1973, actually being measured at about 83 dBA. The International Harvester Company has stated that the exhaust is no longer the dominant source of noise, and any further reductions will have to result from modifications to reduce noise from the fan, engine, drive train, and tires.

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2) National and State setting of direction and policy is vital in this effort. The Federal-aid Highway Act of 1970 requires the Secretary of Transportation to "develop and promulgate standards for highway noise levels compatible with different land uses", and a bill has been introduced in Congress which, if it passes, will empower the Environmental Protection Agency to set and enforce noise standards for motor vehicles.

Some state legislatures have also been active in setting legal limits on vehicle noise. The California Vehicle Code presently contains standards which limit vehicular noise levels when measured at a distance of 50 feet from the centerline of travel. Two sets of standards have been established, one which is applicable to new motor vehicles sold or offered for sale and one which applies to the operation of motor vehicles subject to registration. In the case of vehicles with a gross vehicle weight of 6000 pounds or more, the allowable noise level for new vehicles sold or offered for sale is 88 decibels. The present allowable operating noise level is also 88 decibels while operating at speeds of 35 mph or less. These allowable noise levels will be reduced to 86 decibels beginning in 1973.

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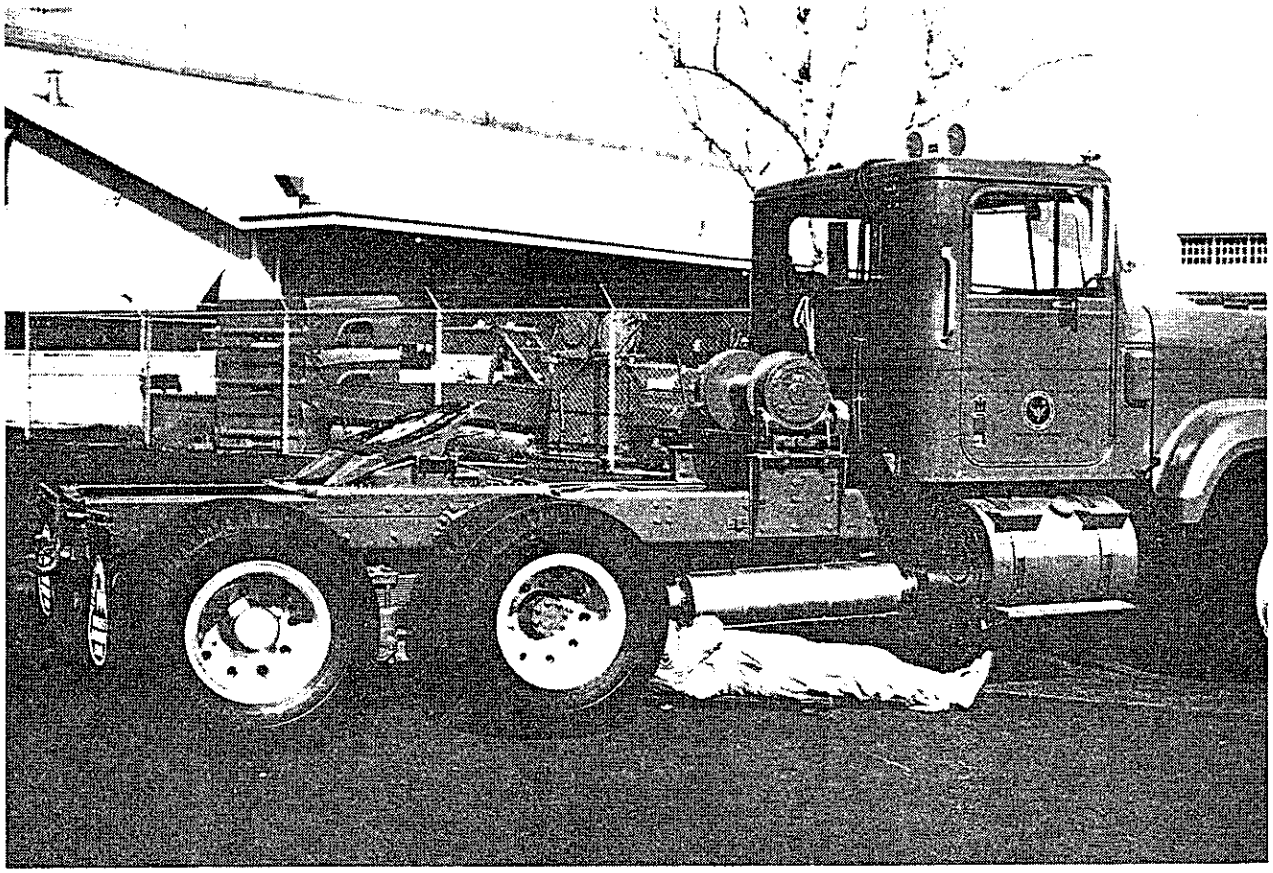

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In 1970 the California Legislature requested the State Department of Public Health to prepare a report on the subject of noise. The report subsequently submitted to the 1971 Legislature contained recommendations for legislation which, if enacted, will further reduce allowable vehicle noise levels after 1973.

PROPOSED
- NEW VEHICLE NOISE LIMITS -
FOR CALIFORNIA

Year	6000 lbs. or more GVW (Trucks and Buses)	Less than 6000 lbs. GVW (Passenger Cars, Pickups and Motor-Driven Cycles)	Motorcycles
Present	88 dBA	86 dBA	88 dBA
1973	86	84	86
1975	83	80	80
1978	80	75	75
1988	70	70	70

Slide No. 2

Again, with regard to vehicles of 6000 pounds or more, the allowable noise level for new vehicles sold or offered for sale would be 83 decibels beginning in 1973, 80 decibels beginning in 1978, and 70 decibels beginning in 1988. The allowable noise level while operating at 35 mph or less would be reduced to 83 decibels beginning in 1975. Also included in the report

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to the Legislature were recommendations to establish noise standards for motor vehicle mufflers and tires.

These statutory provisions are, of course, much more effective than relying on volunteer efforts.

3. The road building agency's responsibilities are limited but well defined within those limitations.

   a) The type of road must be considered. A conventional city street, county road, or State highway, even of the higher type such as a main arterial, is basically for the provision of land access, and there is practically very little that can be done to minimize highway noise which reaches the adjacent land (except to quiet the vehicles as mentioned).

      A freeway or expressway does not serve the same purpose and can be designed to minimize vehicle noise.

   b) When a freeway is constructed on new alignment, the freeway agency should be responsible for minimizing noise reaching development which existed prior to route adoption. Due to the long time interval which can elapse between route adoption and construction, the agency may wish to consider attenuating noise for development which occurs for some period of time after route adoption; say until the Design Hearing or possibly later. The type of development is a factor, and consideration should be given to residences, schools, etc., but usually would not be necessary for heavy industry.

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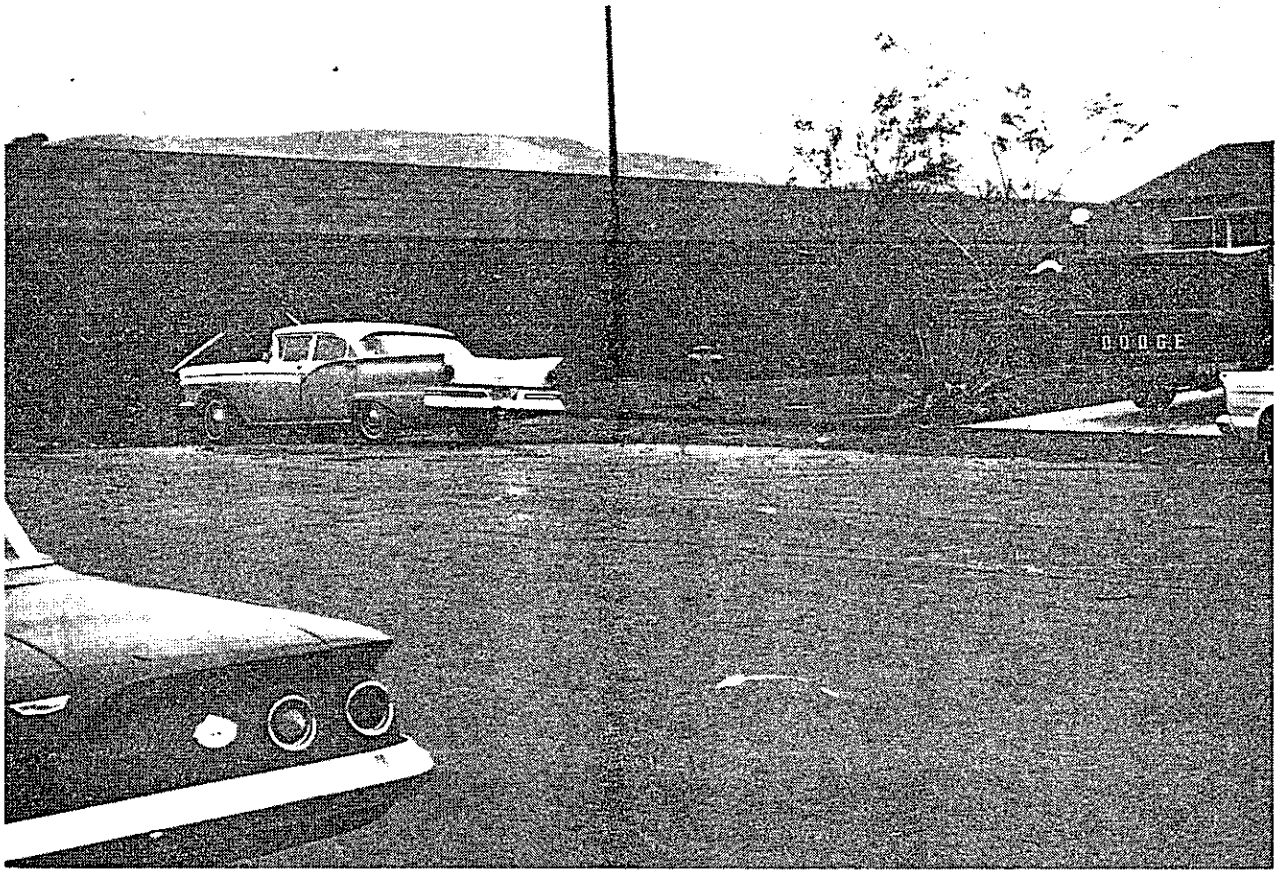

Slide 3

This is a wall which has been constructed on Interstate 680 north of San Jose. At this location the residential development existed before the route was adopted. This wall, which was designed as a retaining wall in order to support the variable height of fill, costs in the range of $50 per lineal foot. In most cases a concrete block wall 6' high can be built for $15 to $20 per lineal foot.

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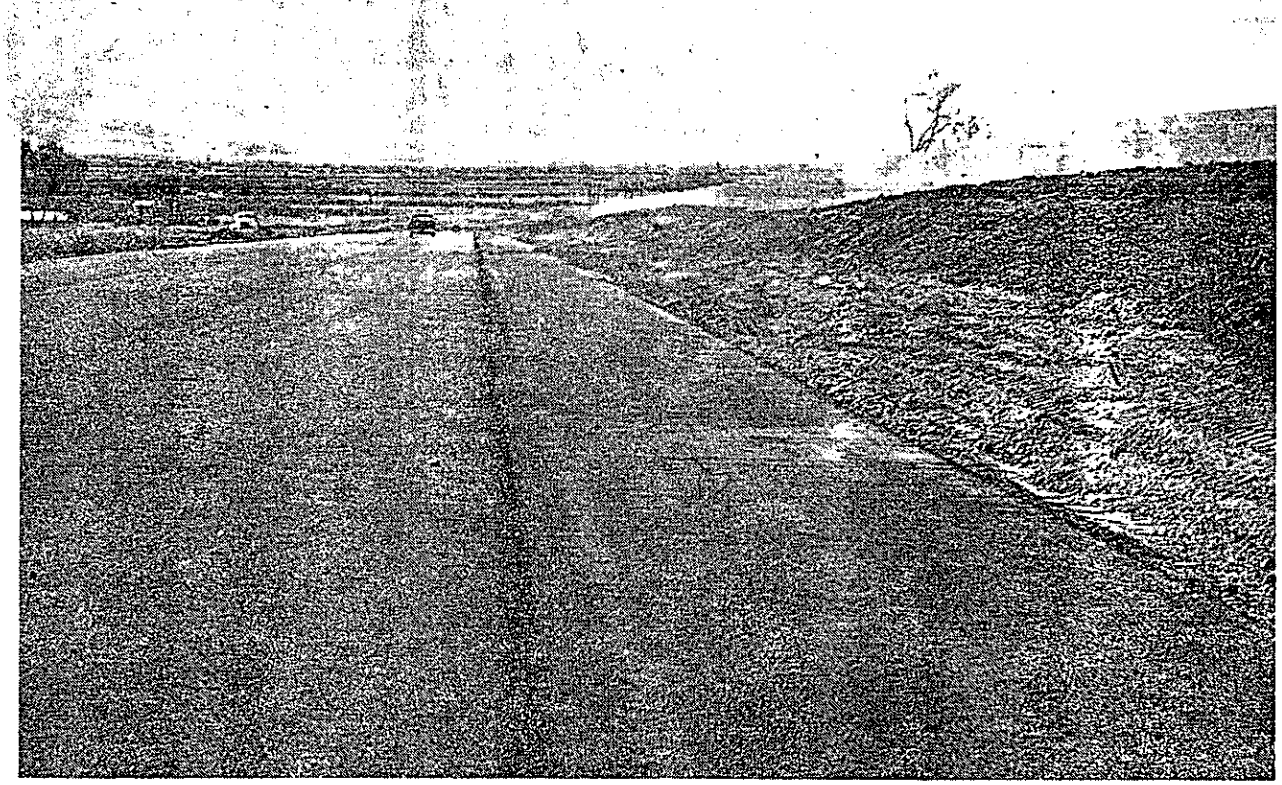

Slide No. 4

The California Division of Highways has built or approved plans for several million dollars worth of walls or earth mounds in satisfying its responsibility.

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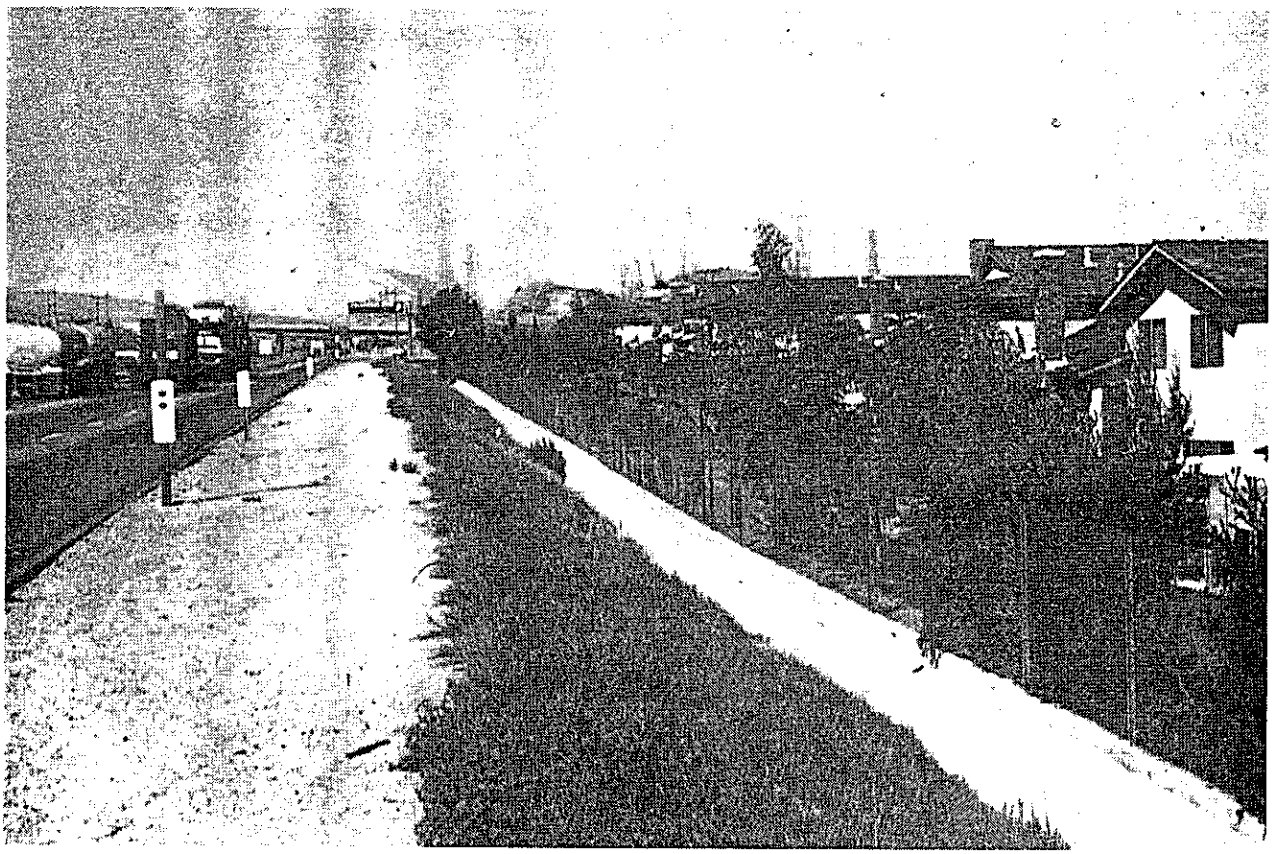
c) Existing freeways which are widened on the outside cause traffic to be moved closer to existing development and thus raise the noise level. Where the development existed prior to public knowledge of the widening plans, the road agency should assume responsibility for minimizing the increase of noise. Again, the type of adjoining development is important.



Slide No. 5

Another lane will be added on the outside of this freeway without acquiring additional right of way. Even though the

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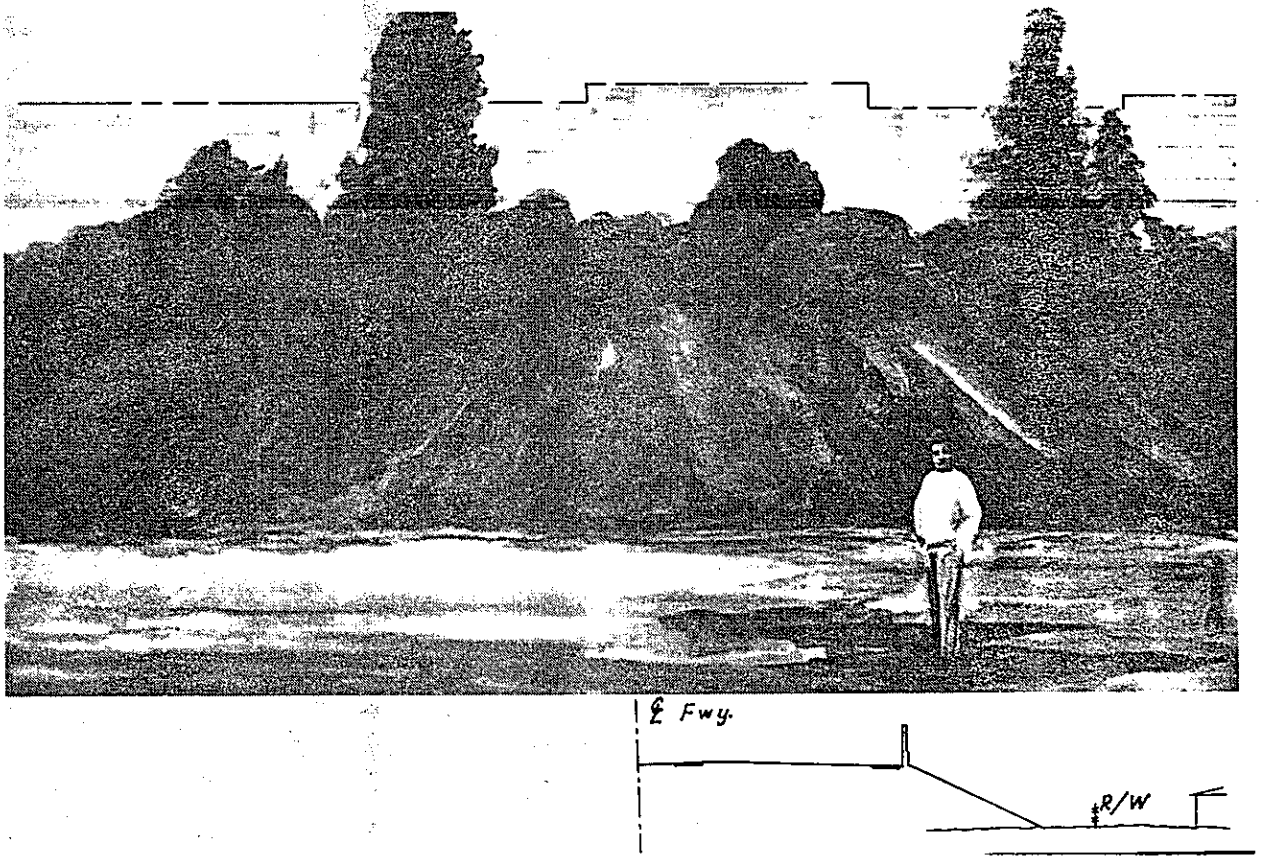
homes were built subsequent to freeway construction, we plan to construct a noise barrier because adjacent residents will detect a noticeable increase in the noise level when the trucks are moved 12 feet closer to them.



Slide No. 6

This is an artist's rendition of the noise barrier as seen from the property side that we will construct in conjunction with the widening project.

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4. Those that plan and develop land adjacent to known freeway locations (either adopted or constructed) should assume the responsibility for inclusion of noise attenuation features in the plan of development. This could include providing open space immediately adjacent to the right of way; arrangement of the buildings and rooms within buildings; construction features such as building wall design, windows or air conditioning, or even type of development.

To date, there have only been isolated voluntary efforts in this area. We have all seen new subdivisions spring up almost as soon as the freeway fence was finished, many with houses, and their bedrooms, only a few feet from the fence. There have been instances in California where two story homes have been built next to a freeway noise attenuation wall, with the second story containing the bedrooms well above the top of the wall.

In the absence of a voluntary assumption of responsibility by developers, then, it would appear necessary for local governments, or even national agencies such as the Federal Housing Administration, to fill the breach and assure that development adjacent to freeways is compatible with regard to the noise originating therefrom.

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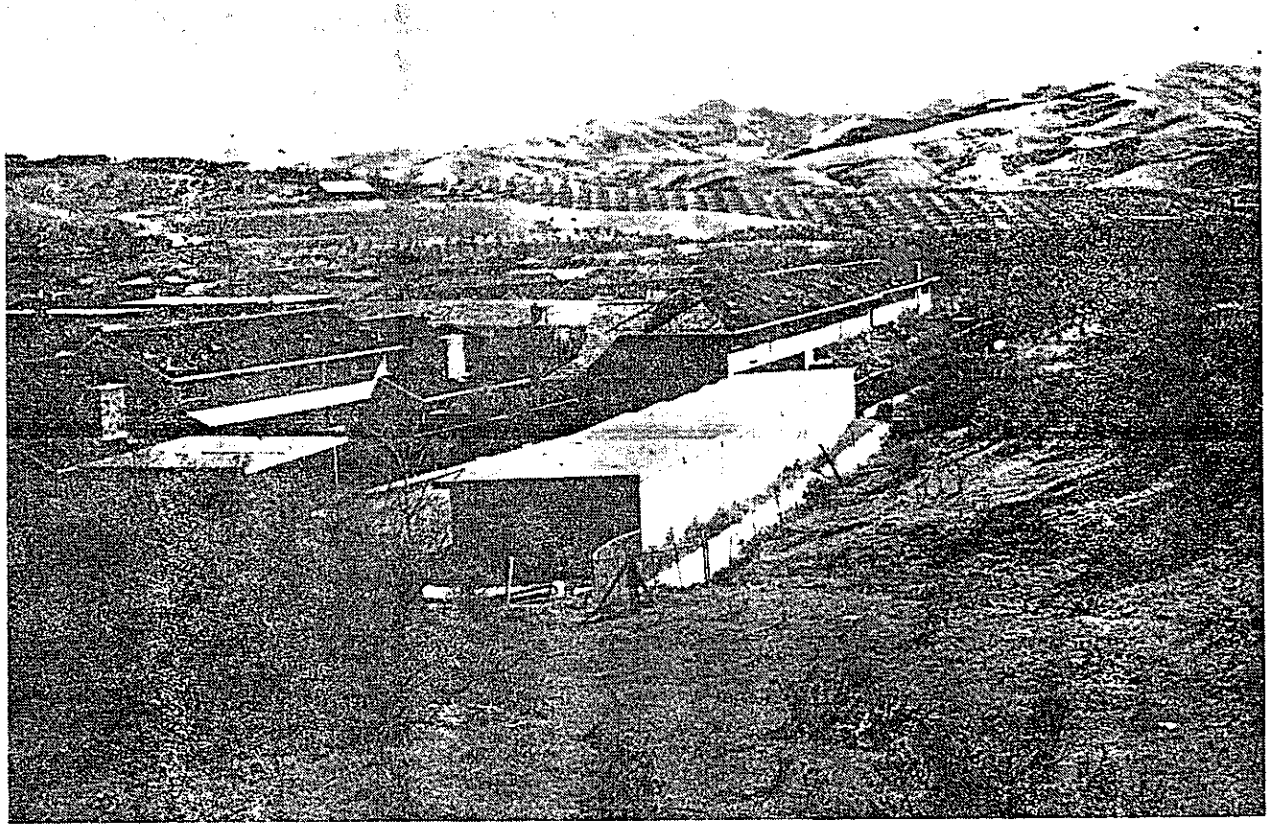

Slide No. 7

This subdivision in Moraga, east of Oakland, was constructed after adoption of a freeway route, which will pass through the open area on the right.

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Slide No. 8

This is a situation where residential development occurred around all four quadrants of an existing interchange. The responsibility for noise attenuation in this case belongs with the developer.

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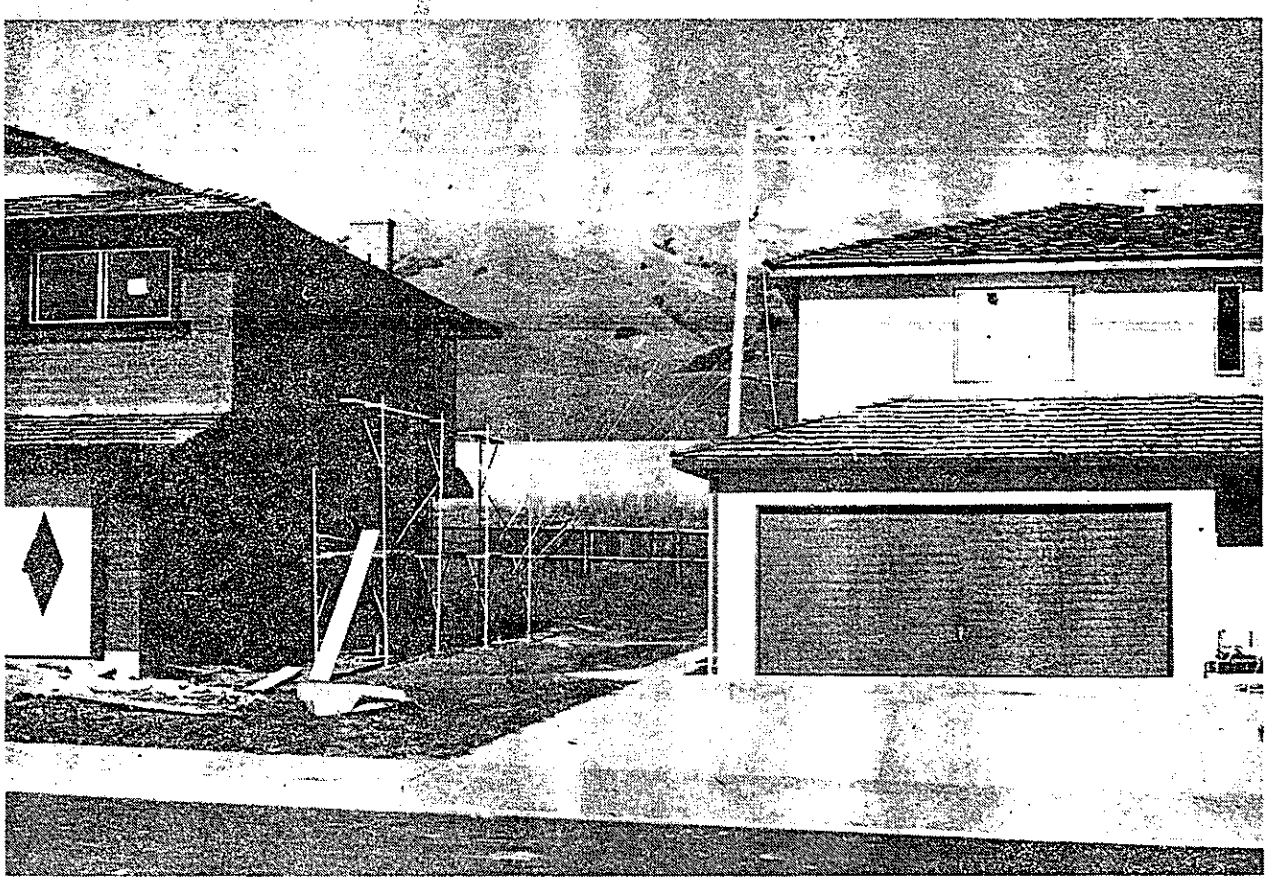

Slide No. 9

This is an excellent example of what some developers will do if local governments do not impose noise abatement controls. The noise barrier is immediately behind these 2-story homes that are under construction. Single story homes on these lots would have received about 15 dBA's of noise attenuation, but the bedrooms on the second floor of these homes will be fully exposed to freeway traffic noises.

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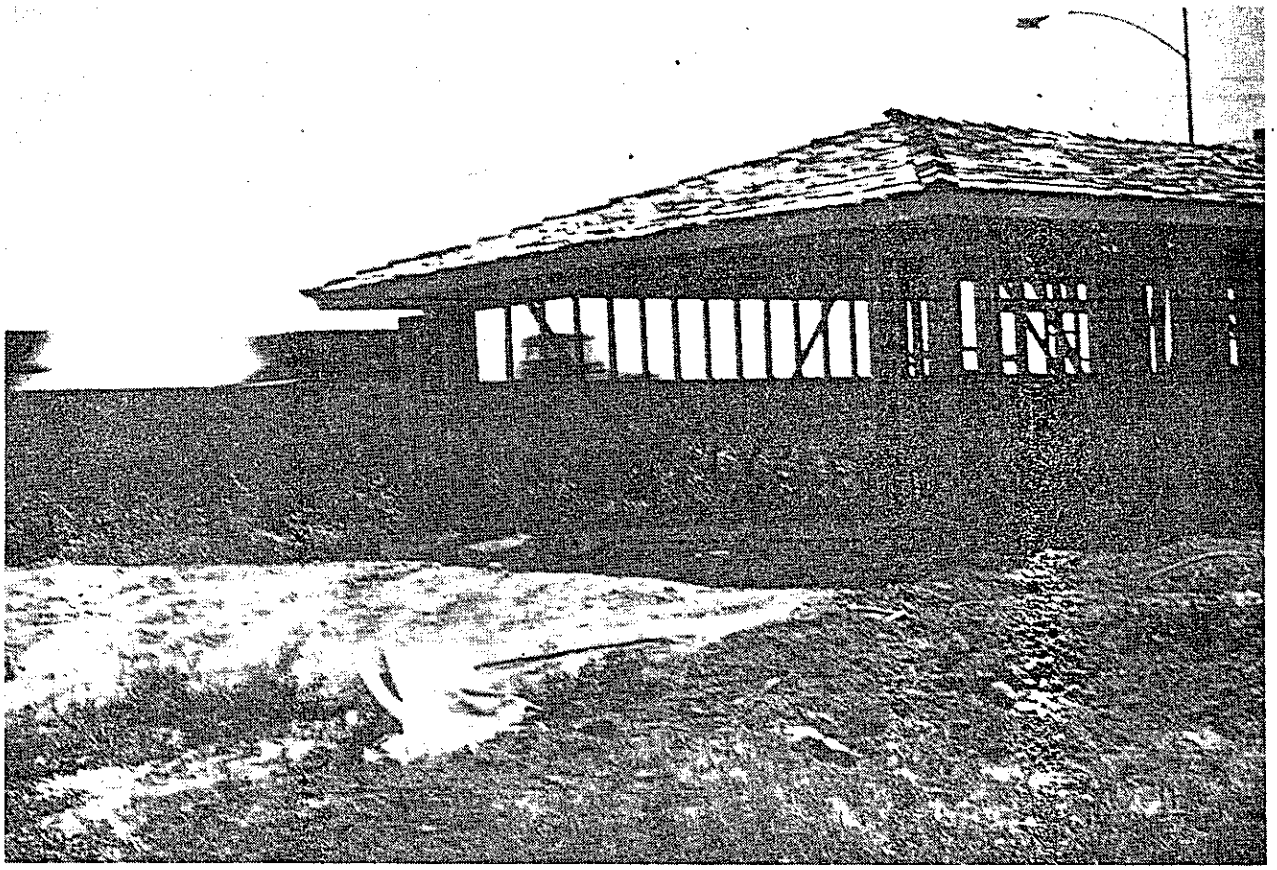

Slide No. 10

These homes are being built adjacent to the heavily traveled San Gabriel Freeway in Los Angeles. The houses are about five feet from our right-of-way line and about fifty feet from the edge of pavement. Since the freeway is slightly elevated, the 6 foot block wall will provide little protection for living and sleeping areas of these homes.

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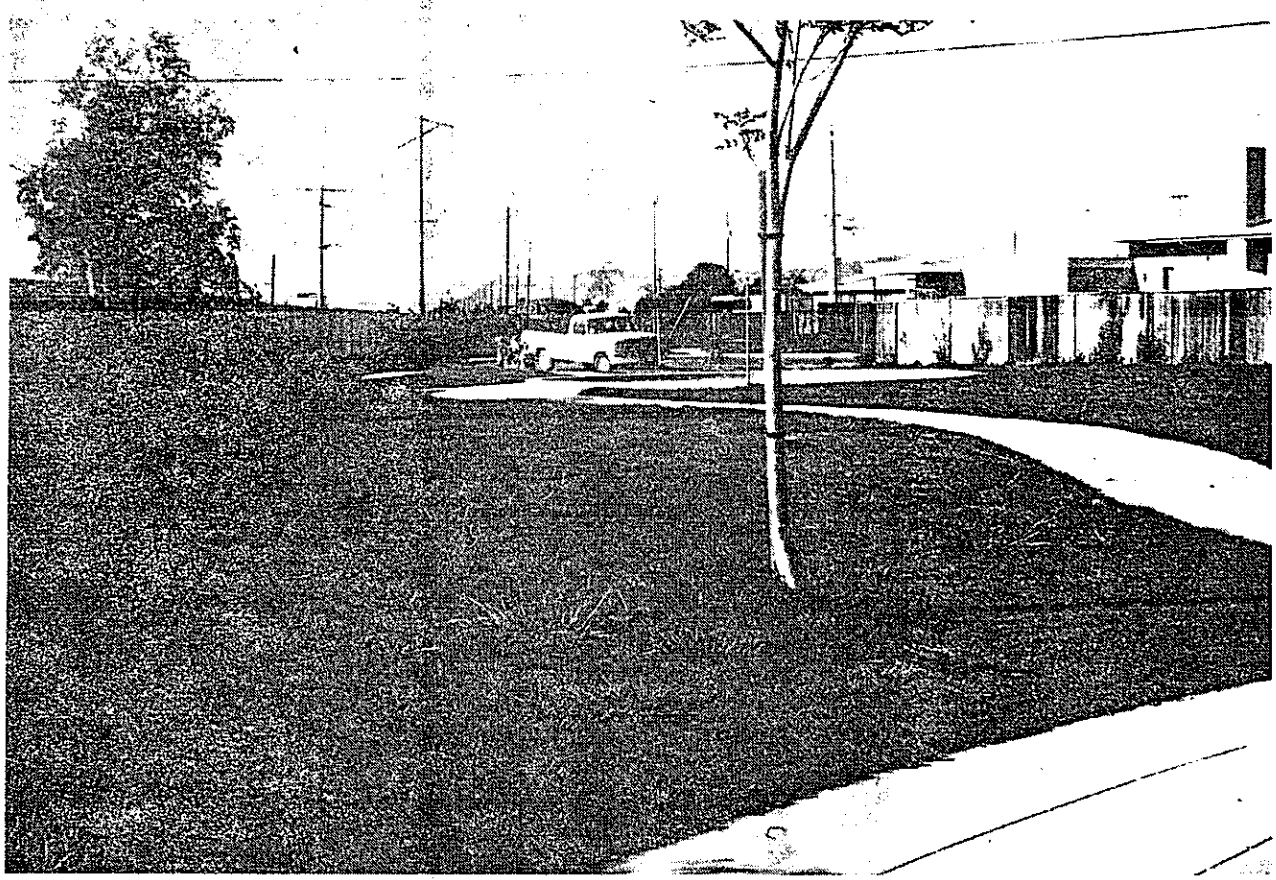

Slide No. 11

We have also noted some good examples of consideration for noise attenuation by developers. The developer of this subdivision provided a 6-foot high block wall at the right-of-way line and an additional 75 to 100 feet of distance developed as a linear park, between the wall and the homes.

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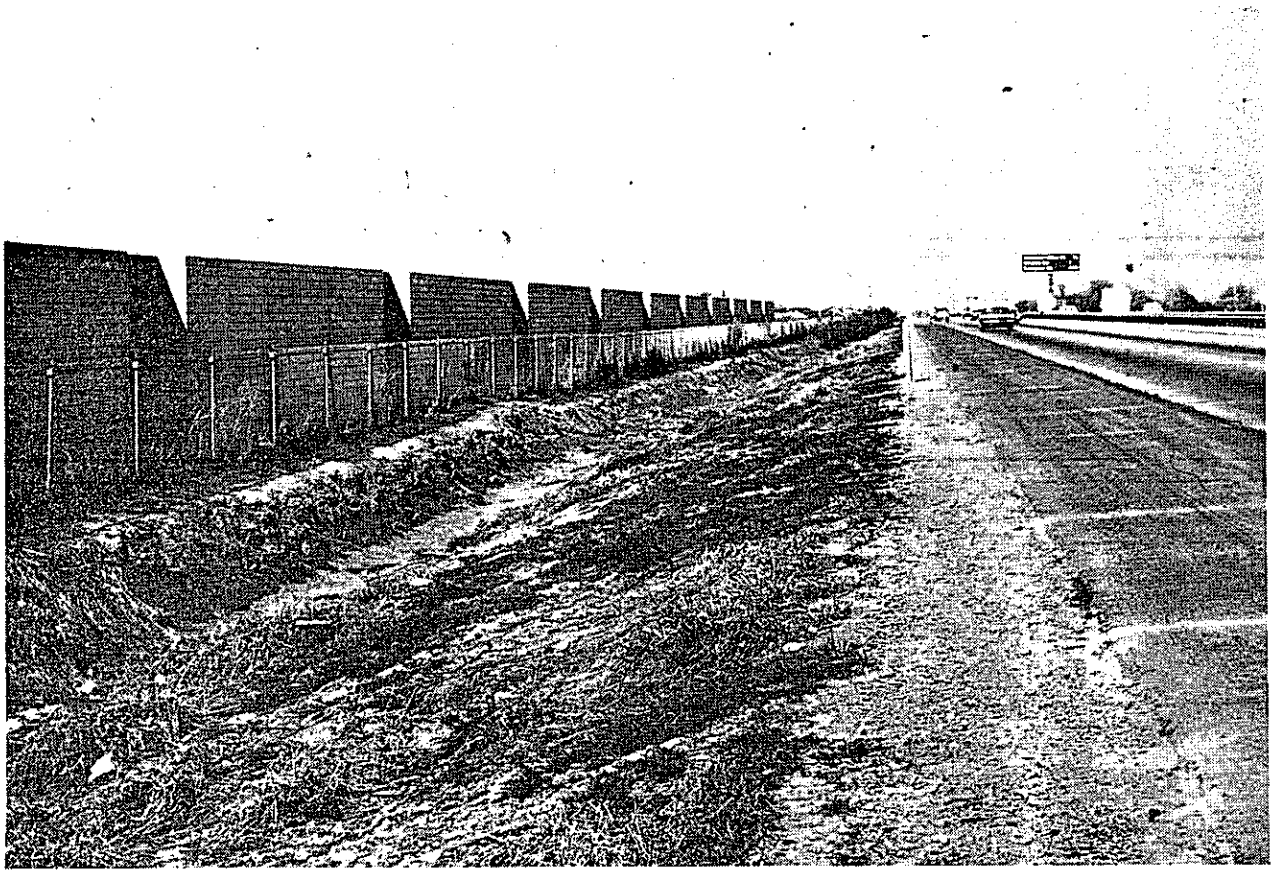

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Condominiums are being constructed behind this 10-foot high wall along Route 17 north of San Jose. At the urging of the Federal Housing Administration, the City of Fremont required the developer to include this noise barrier with his plan of development.

Our most encouraging development toward getting others to recognize the incompatibility of freeways and residences next to each other was provided recently by the City of Cerritos in Southern California. The City Council and the developer reached an agreement to provide special features for homes located next to the Artesia Freeway (Route 91). These include:

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1. Rear lot lines no closer than 30 feet to the freeway.
2. Sound attenuated rear house walls. Also a 6-foot high block wall at the freeway right-of-way line.
3. An air conditioning system which includes a filtration system to reduce the level of carbon monoxides and other gases which are emitted by motor vehicles.
4. Double-plated windows along the rear side of the home.
5. "Specimen trees" (larger than gallon size) along the rear lot line.

5. The final responsibility for consideration of noise must be borne by the individual person or company who plans to make use of property. The common situation is that of a person who wants to buy, build, or rent a home, although subdividers or those wishing to locate offices, hospitals, schools, etc., would be included.

The home buyer, or whatever his mission is, should consider many factors before making his decision. Besides factors which are advantageous to his particular situation, he should investigate those which could be a disadvantage. These might include zoning, character of the surrounding area, traffic, drainage, local master plans, and noise which might be produced from nearby planned or existing highways, airports, factories, or whatever.

The necessary information should be available to the potential home buyer and in the case of highways, should include adopted but unconstructed freeway locations. But the individual himself

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should bear the responsibility for considering all factors before making his decision.

The situation where housing development has occurred next to an adopted but unconstructed freeway is probably our largest single category of noise problems in California. When the freeway is actually constructed 5 or 10 years later, and the noise begins, the complaints aren't far behind. Our present policy has been to end our responsibility for noise attenuation at the time of route adoption, but some liberalization is presently under consideration, at least partially due to the many years that can elapse between route adoption and construction.

To summarize, under certain combinations or conditions, noise originating from vehicles on streets and highways can be irritating or worse to those within hearing range. The responsibility for minimizing this problem can be divided at least 5 ways, one of which is the road building agency. The California Division of Highways, in recognition of its share of the responsibility, has built or has approved plans for several million dollars worth of noise attenuation devices. The most practical approach, however, is to quiet the source of the noise. This includes trucks, motorcycles, and some sports cars. A combination of voluntary work by manufacturers and legal restrictions will probably be required. Quieting the source will not only be beneficial on freeways but also on conventional roads and streets where noise attenuation barriers are not practical. Increasing attention to proper land use and design and layout of buildings by developers and local governments is also necessary.

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