Technical Report Documentation Page

1. REPORT No.

VII-LA-2-LA Ventura Freeway

2. GOVERNMENT ACCESSION No.

3. RECIPIENT'S CATALOG No.

4. TITLE AND SUBTITLE

Traffic Noise Study at Three Residential Locations Near Ventura Freeway

5. REPORT DATE

November 1960

6. PERFORMING ORGANIZATION

7. AUTHOR(S)

Louis Bourget

8. PERFORMING ORGANIZATION REPORT No.

VII-LA-2-LA Ventura Freeway 100-R-6228

9. PERFORMING ORGANIZATION NAME AND ADDRESS

State of California
Department of Public Works
Division of Highways
Materials and Research Department

10. WORK UNIT No.

11. CONTRACT OR GRANT No.

12. SPONSORING AGENCY NAME AND ADDRESS

13. TYPE OF REPORT & PERIOD COVERED

14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES

16. ABSTRACT

Introduction

The purpose of this noise study is to develop graphical measurements of sound pressure levels that now exist in certain residential areas along Ventura Freeway and to determine their significance.

In some instances many of the peak noise intensities are a combination of direct noise from the freeway plus a mixture from traffic on frontage roads. Most of these frontage roads do, however, serve as approaches and exits for the freeway and therefore most of the traffic on them is intimately related to freeway traffic. Therefore no distinction will be made.

The locations chosen for the study have been sources of numerous complaints from adjacent home owners.

Most of the complaints have emphasized that the greatest disturbance is caused by heavy trucks which produce peak noise intensities far above the average noise background arising from passenger cars. However, the noise from passenger cars alone is not regarded as an insignificant item.

Another point, made in the complaints, is that the heavy truck traffic persists throughout the entire night and seriously interferes with sleep. All other points raised concerning the objectionable effects on the property owners seem to derive from the above facts.

17. KEYWORDS

VII-LA-2-LA Ventura Freeway 100-R-6228

18. No. OF PAGES:

17

19. DRI WEBSITE LINK

http://www.dot.ca.gov/hq/research/researchreports/1959-1960/60-34.pdf

20. FILE NAME

60-34.pdf

3747

3747

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

TRAFFIC NOISE STUDY
AT THREE RESIDENTIAL LOCATIONS
NEAR VENTURA FREEWAY

60-34

November 1960

MATERIALS & RESEARCH DEPARTMENT

State of California
Department of Public Works
Division of Highways
Materials and Research Department

November 1960

VII-LA-2-LA
Ventura Freeway
100-R-6228

Mr. A. L. Himelhoch
District Engineer, Operations
District VII
Division of Highways
Los Angeles, California

Dear Sir:

Submitted in accordance with your request of August 25, 1960, is a report of:

TRAFFIC NOISE STUDY

AT THREE RESIDENTIAL LOCATIONS

NEAR VENTURA FREEWAY

Study made by . . . . Structural Materials Section
Under general direction of . . . . J. L. Beaton
Work directed by . . . . Louis Bourget
Measurements by . . . . Robert L. Donner and Members of District VII Traffic Dept.
Report by . . . . Louis Bourget

Very truly yours,

F. N. Hveem
Materials and Research Engineer

LB:mw
cc: LRGillis
JALegarra
GMWebb
WLWarren
Dist. VII (50)

INTRODUCTION

The purpose of this noise study is to develop graphical measurements of sound pressure levels that now exist in certain residential areas along Ventura Freeway and to determine their significance.

In some instances many of the peak noise intensities are a combination of direct noise from the freeway plus a mixture from traffic on frontage roads. Most of these frontage roads do, however, serve as approaches and exits for the freeway and therefore most of the traffic on them is intimately related to freeway traffic. Therefore no distinction will be made.

The locations chosen for the study have been sources of numerous complaints from adjacent home owners.

Most of the complaints have emphasized that the greatest disturbance is caused by heavy trucks which produce peak noise intensities far above the average noise background arising from passenger cars. However, the noise from passenger cars alone is not regarded as an insignificant item.

Another point, made in the complaints, is that the heavy truck traffic persists throughout the entire night and seriously interferes with sleep. All other points raised concerning the objectional effects on the property owners seem to derive from the above facts.

FINDINGS

Sound measurements were made at three locations adjacent to the Ventura Freeway, one adjacent to the Santa Ana Freeway, and two along the San Bernardino Freeway. The Ventura Freeway locations were selected because of complaints about noise; the other three locations were selected as being similar in physical environment to the first three. Site plans of each location are included in the Appendix.

Measurements show that the noise level is about the same at all six locations. The readings are shown on the graphs in the Appendix.

It was evident that the high noise peaks are caused by trucks.

TEST LOCATIONS

VENTURA FREEWAY

The sites selected for noise level measurements along the Ventura Freeway will now be identified by number, description of the location, and by scale drawings in the Appendix.

Location 1: In the immediate vicinity of homes nearest to the freeway at the south end of St. Clair Drive. Distance to edge of nearest lane, approximately 105 feet.

Location 2: In the vicinity of homes nearest to the freeway at the junction of Valley Heart Drive and Hazeltine Avenue. Distance to nearest edge of freeway approximately 158 feet. Distance to Hazeltine Avenue approximately 72 feet.

Location 3: In the vicinity of homes on the south side of the junction of Zelzah Avenue and the South Frontage Road. Distance to nearest edge of freeway approximately 174 feet. Distance to closer lying South Frontage Road approximately 89 feet. Distance to Zelzah Avenue approximately 30 feet.

OTHER SITES

For reference value only, another series of tests were recorded at typical freeway sites not along Ventura Freeway:

Location 4: In the vicinity of homes near Santa Ana Freeway and Ditman Avenue junction. Distance to nearest edge of freeway approximately 120 feet. Distance to Ditman Avenue curb approximately 165 feet.

Location 5: In the vicinity of homes near San Bernardino Freeway and Rio Hondo Avenue. Distance to nearest edge of freeway approximately 56 feet. Distance to Rio Hondo Avenue curb approximately 7 feet.

Location 6: In the vicinity of homes, one house away from San Bernardino Freeway along Jackson Avenue. Distance to nearest edge of freeway approximately 170 feet.

EQUIPMENT AND TEST METHOD

The following equipment was employed during all tests:

1. General Radio Sound Level Meter, type 1551-A.
2. General Radio Graphic Level Recorder, type 1521-AM.
3. A low noise level vibrator type DC to AC power supply to operate the Recorder. This unit derived power from the automobile battery.

During all tests the Sound Level Meter was operated on the "C" scale which responds to all audio frequencies in a fairly uniform manner. The output is referred to as decibels C scale; abbreviated dbc. This output was coupled to the Graphic Level Recorder which produces a chart recording of the sound levels.

All equipment was checked for calibration accuracy at the Los Angeles office of the General Radio Corporation before tests were started. Additional periodic tests of the electronic equipment calibration (other than the microphone) are capable of being performed in the field. These tests were made at the beginning, in the middle, and at the end of every strip chart recording.

The chart recordings were made every hour on the hour for 15 minutes duration, beginning at 1500 (3 P.M.) and continuing throughout the night until 0900 (9 A.M.) the following morning. This method of presentation keeps the chart length within reason and enables a clear picture of sound level contours without loss of peak noise information.

A, B, AND C SCALES

Sound level meters which meet A.S.A. specifications are equipped with three different scales. These are known as A, B, and C scales, each having a different spectral response as shown on Exhibit 1.

In the case of traffic noise, our experience indicates that the same noise will read about 20 db lower on the A scale (dba) as compared to the C scale (dbc). For example, a traffic noise level (or peak) of 80 dbc is usually equal to a 60 dba reading.

When measurements are made out of doors in areas of high noise intensity, it is conventional to use the C scale for technical reasons.

When measurements are made indoors, it is conventional to use the A scale because human hearing corresponds more closely to the A scale curvature under the usual indoor conditions.

THE SIGNIFICANCE OF THE TESTS

In order to understand the significance of the noise recordings presented in the Appendix, some preliminary comment may be helpful.

Dr. Vern O. Knudsen[1] suggests an acceptable average noise level inside a residence around 35 to 45 dba, and in the case of a bedroom around 35 dba "with no peak levels substantially higher".

If we wish to interpret outdoor dbc noise levels in terms of indoor dba noise levels, a rough approximation may be useful even if it is an over simplification.

Say we have an outdoor level of	80 dbc
Subtract 20 for outdoor dba equivalent	-20
	60 dba
Subtract 15 for sound reduction due to walls plus absorption of interior furnishings	-15
Indoor approx.	45 dba

(Outdoor dbc minus 35 yields approximate indoor dba level)

This means that an outdoor noise level from 70 to 80 dbc will usually produce indoor levels around 35 to 45 dba. This is an acceptable daytime level[1] and many city dwellers have become accustomed to even higher noise levels, especially during the summer.

Applying the same rule indicates that nighttime outdoor noise levels of no more than 70 dbc are desirable. Again many residential areas enjoy much lower levels while some city dwellers have become accustomed to somewhat higher levels. In any case, human tolerance for noise peaks which exceed the average background by more than 10 db is quite poor.

In fact, the higher the noise peak rises above the average noise, the greater the annoyance value. We usually find it easier to ignore a fairly constant internal noise of 45 dba, such as from air-conditioners or forced air heaters, than a lower average of 35 dba which is frequently punctured by higher peak noises from outside sources.

Now please refer to the Appendix for the noise recordings at Locations 1, 2, and 3. The noise level at the center of each chart is 80 dbc and the maximum range is from 60 to 100 dbc. Each recording begins at 1500 (3 P.M.) and represents a 15 minute sample every hour as already explained. The recording at Location 1 discloses some very important information if we examine it carefully.

Note that the recording from 1500 to 1515 has more high peaks above 85 dbc than the next three at 1600, 1700, and 1800 (4, 5, and 6 P.M.). This is explained by the knowledge that heavy commuter traffic from 4 P.M. to nearly 7 P.M. tends to slow down the average speed of all vehicles -- a sort of clogging process which is familiar to all commuters. The average noise level is between 70 and 80 dbc but the peak noises are definitely suppressed during the time between 1600 through 1815. After 1900 (7 P.M.) the peak noises become very prominent even though the traffic noise average continues to drop, reaching the lowest levels between 2400 (midnight) and 0500 (5 A.M.). This is easily discerned if you look at the recording from one end.

The greatest disturbance is due to the fact that the peak noises project most objectionably above the average noise level during the usual sleeping hours. After we reach 0600 (6 A.M.) the commuter traffic once again serves to bring up the average noise level and yet reduce the noise peaks until 0900 (9 A.M.). After 0900 the average noise level will remain high and the peaks will again rise as the traffic moves more freely. This pattern persists fairly well throughout the day. Note the strong resemblance between the last recording at 0900 and the first recording at 1500.

The recordings made at Locations 2 and 3 exhibit somewhat different average and peak levels, but the general trend is entirely consistent with the description just given for Location 1.

Additional recordings made for reference purposes at Locations 4, 5, and 6 again show somewhat different average and peak levels but an over-all trend of similarity. Locations 4 and 5 have higher noise level averages than any others in the entire series, and the peak noise is well sustained at all hours for Locations 4, 5, and 6. This is no attempt to qualify Locations 1, 2, and 3 as quiet. They are not. Some other places are merely known to be noisier. As we have already seen, the highest ratios of peak noise, to average level, occur from 0100 to 0500 although the situation may be described as "not conducive to relaxation or sleep" during any period shown on the recordings.

The causes of these noise peaks can be identified. Trucks equipped with inadequate mufflers are responsible for most of the high noise peaks. Since new trucks are now equipped with adequate mufflers, it must be assumed that the mufflers on the "noisy" trucks are either burned out or have been deliberately altered. The noise allowed by such mufflers is further aggravated when freeway traffic conditions permit higher speeds as we have seen in the discussion of the noise recordings.

A noted organization specializing in acoustic studies has determined that the noise generated by one truck with a defective muffler can equal that from 90 to 100 passenger cars passing simultaneously[2]. However, such noises are entirely unnecessary and can be markedly reduced. Authorities[3,4,5] in the trucking industry agree that it is not only desirable but economical to properly muffle a truck. Such authorities also agree that the noise from a muffler is measurable. For instance, Mr. Lewis Kibbee, Automotive Trucking Engineer for the American Trucking Associations[2], states, "Replacement mufflers meeting or bettering the A.M.A. standard are available today for almost every truck on the road." And also, before the Society of Automotive Engineers, Mr. Kibbee stated[5], "Firstly let's remember that all of us are trying to arrive at the same goal, and that is quiet trucks. In this respect it will make little difference if the truck makes 120 or 130 sones (editorial note: a sone is directly related to a decibel) in loudness tests, the point is that it is so much better than 300 sones that other trucks are making, that it can be considered quiet. In the Armour Research studies, it was shown that almost any listener with average hearing can come pretty close to judging what loudness a truck has, just by ear, without the aid of any instrumentation. I wonder if the police officer needs any instrument at all. He can tell the difference between the 300 sone truck with a gutted can or no muffler at all, and a 125 sone job, without ever having to get out of his car, just the way he can spot a car doing sixty in a thirty-mile speed zone. Perhaps there would have to be a set of instrumentation in the station house to measure the sone level of a truck whose owner wanted to carry the case to court to make a test case. However, if the enforcement got off to a start by giving tickets to trucks that made over 200 sones as judged by the officer's ear, and didn't worry too much about the 130 sone mufflers, I think we would be a long way down the road toward doing what the public demands and what the administrators are trying to carry out. Such a program will meet with acceptance in many areas and this is the type of practical approach that many operators feel is needed rather than asking them to set up complicated instrumentation to check each vehicle."

REFERENCES

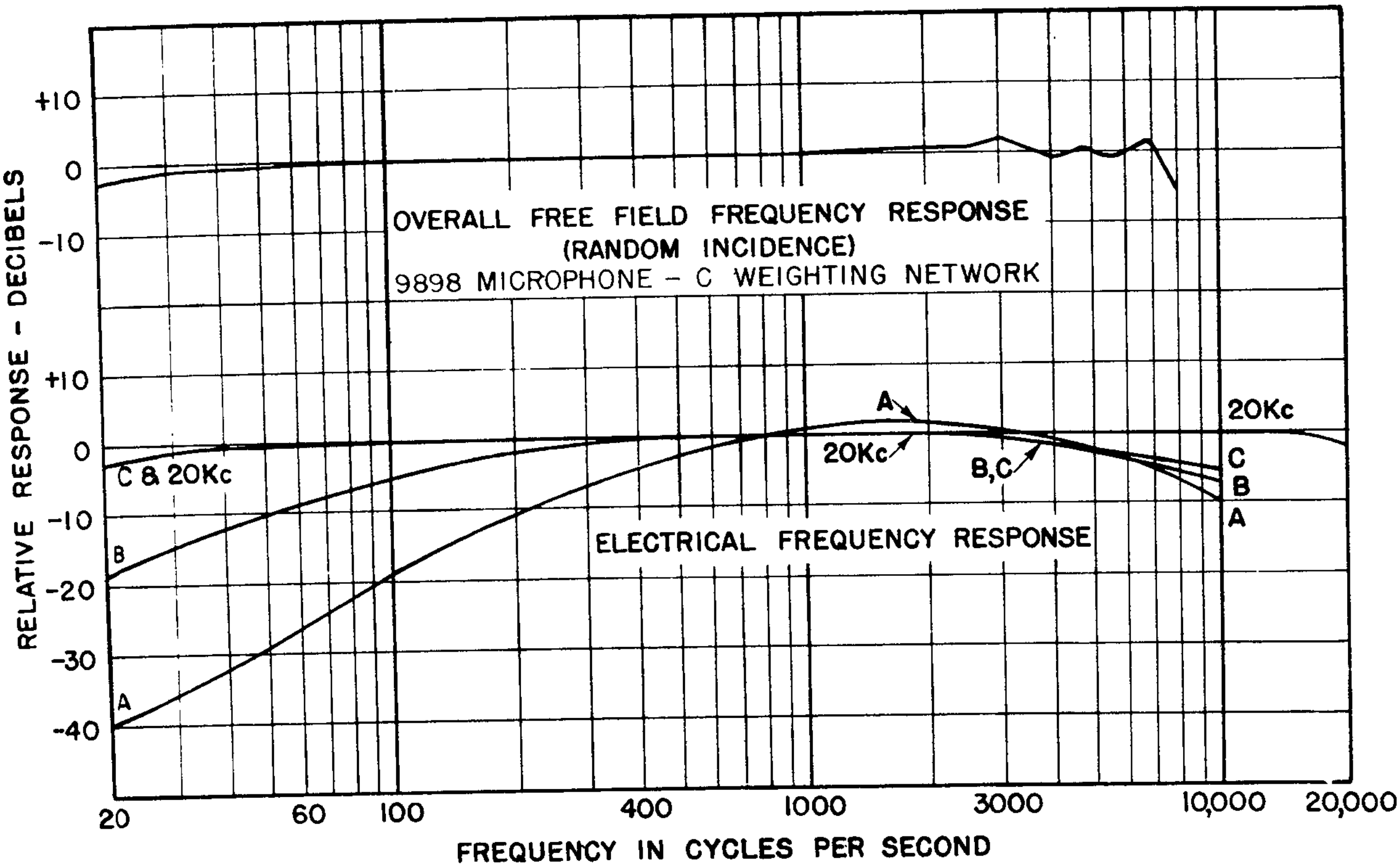
1. V. O. Knudsen and C. M. Harris, Acoustical Designing in Architecture, P 220-221, 1950, John Wiley & Sons.

2. R. and E. Brecher, article "Is The Noise Getting You Down?" Saturday Evening Post, p 33, February 6, 1960.

3. D. B. Callaway, Measurement and Evaluation of Exhaust Noise of Over-The-Road Trucks, S.A.E. Transactions, p 151-162, Vol. 62, 1954.

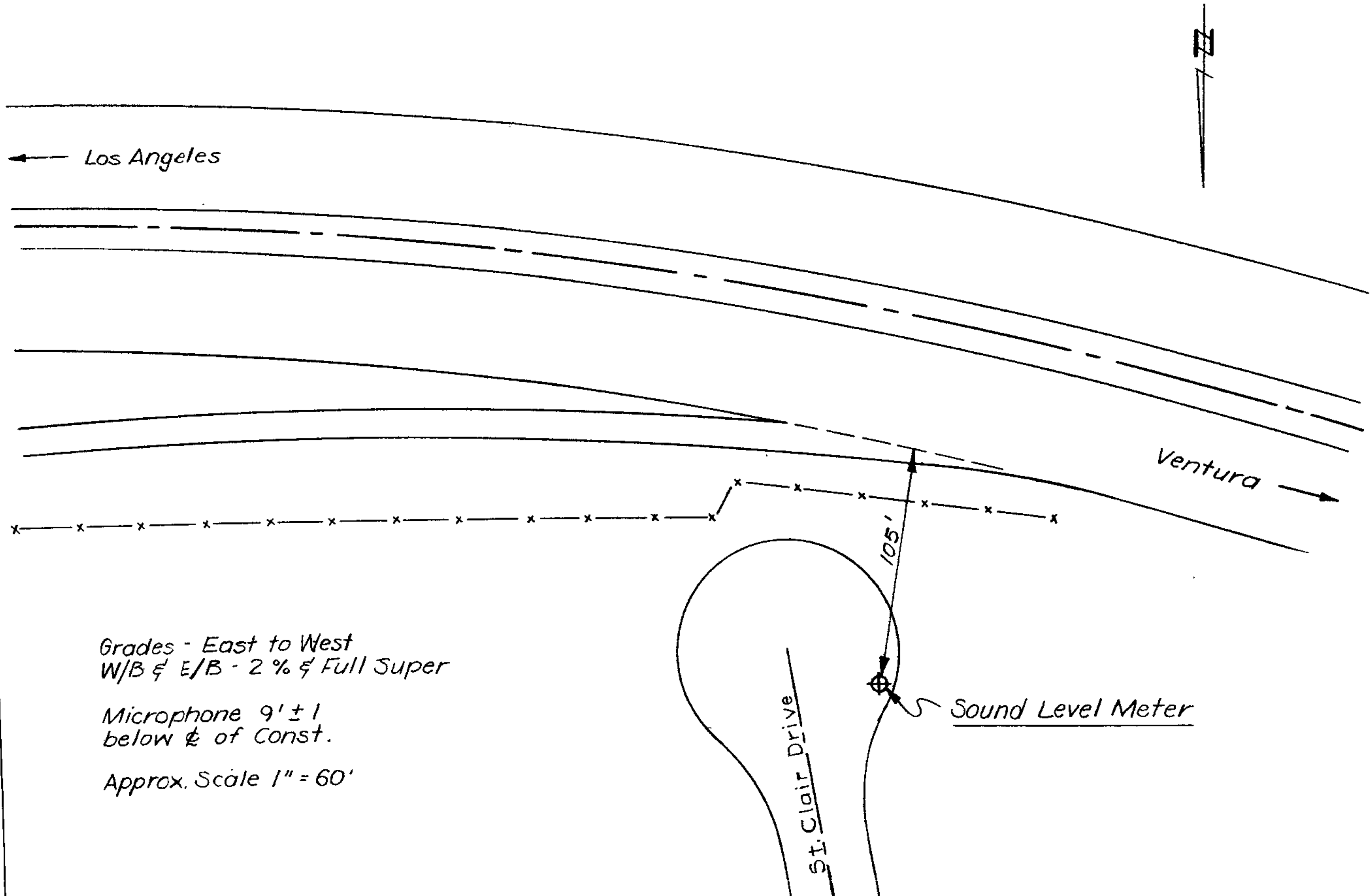
4. Ernest J. Abbott, Why Not Quiet Those Trucks? S.A.E. Preprint #520, Society of Automotive Engineers, N. Y., 1953.

5. Lewis C. Kibbee, A Practical Approach to the Truck Noise Problem, S.A.E. Preprint #569, Society of Automotive Engineers, N. Y. 1955.

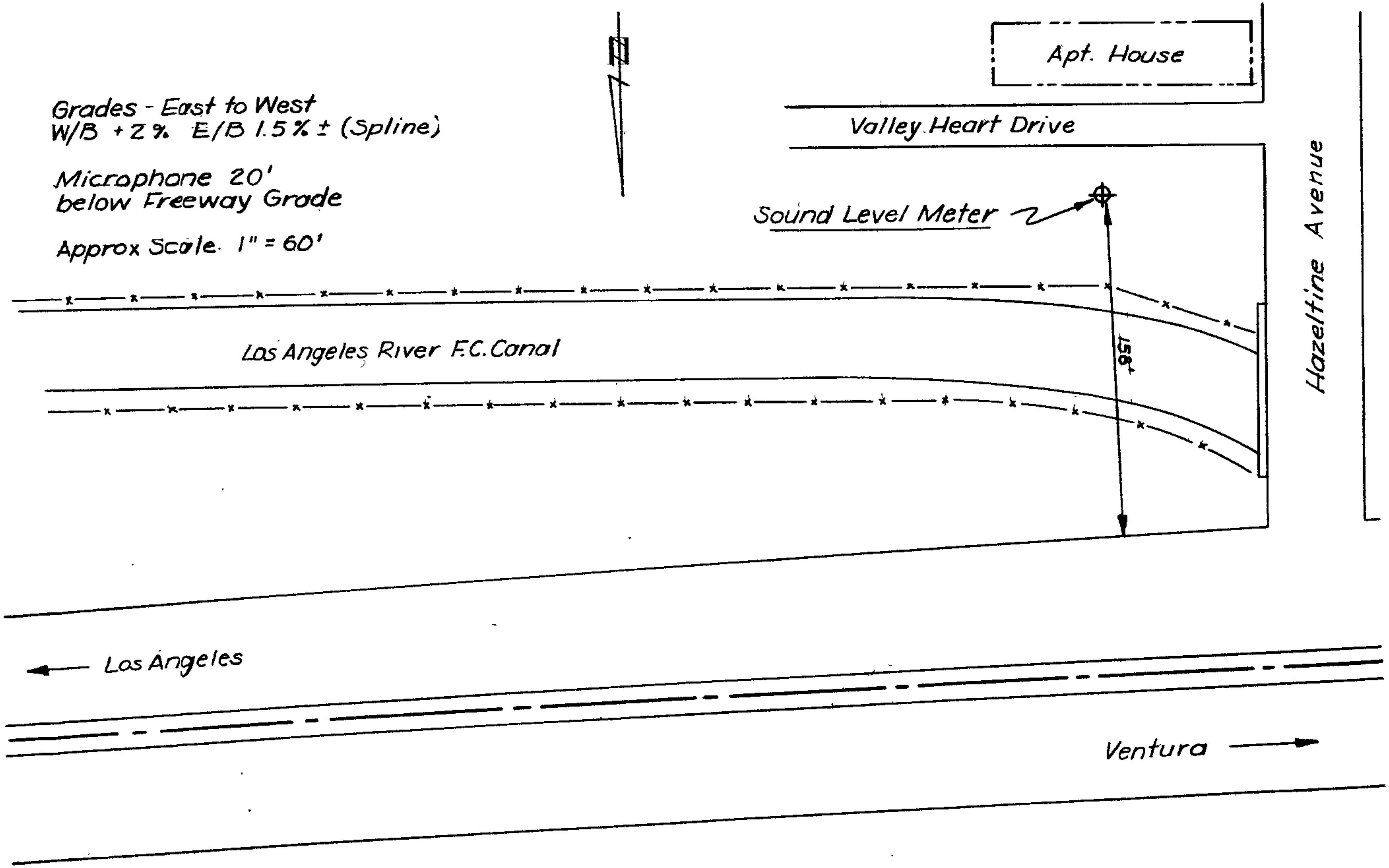


Typical average acoustical and electrical calibration curves
for the Type 1551-A Sound-Level Meter.

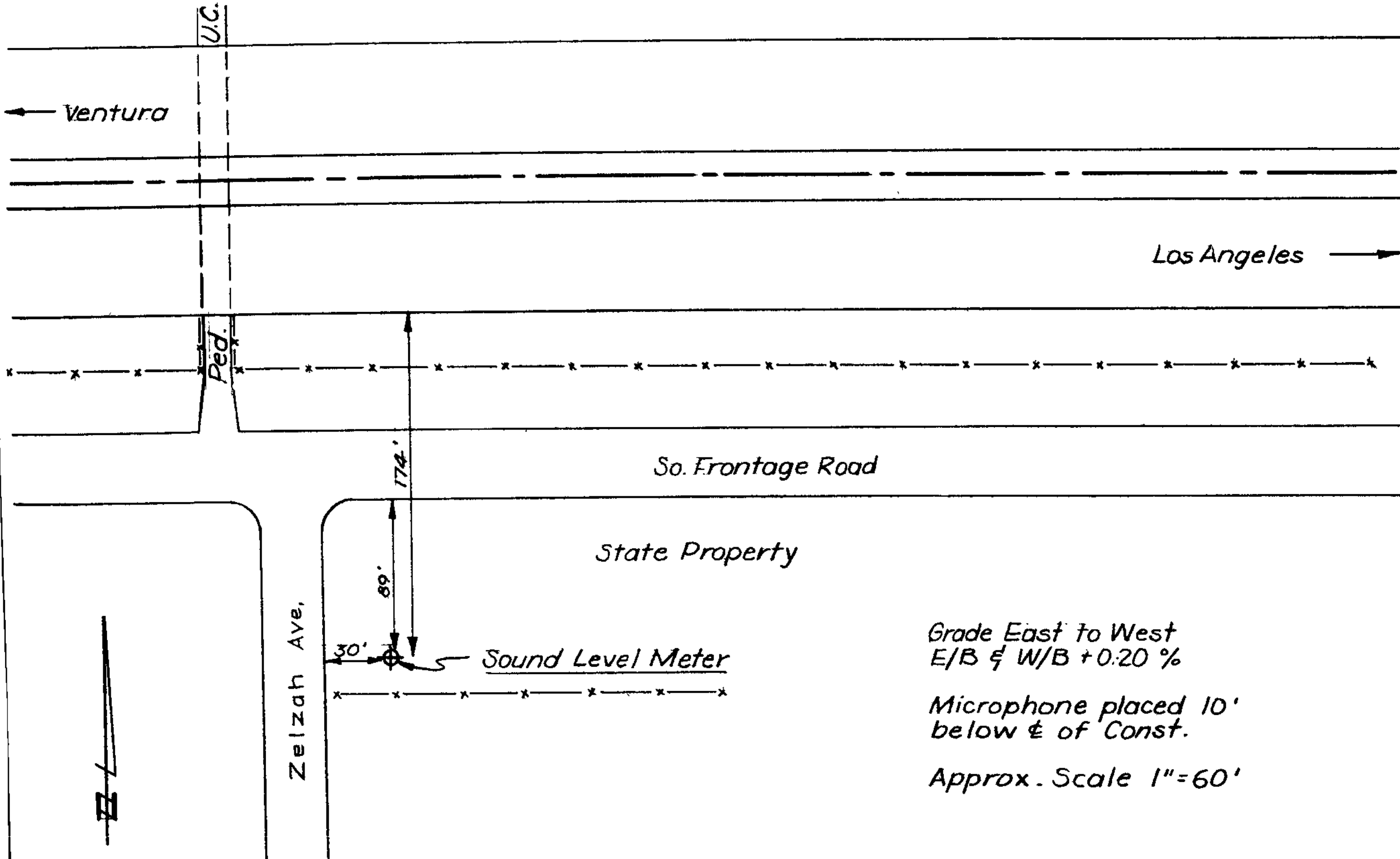
Exhibit 1



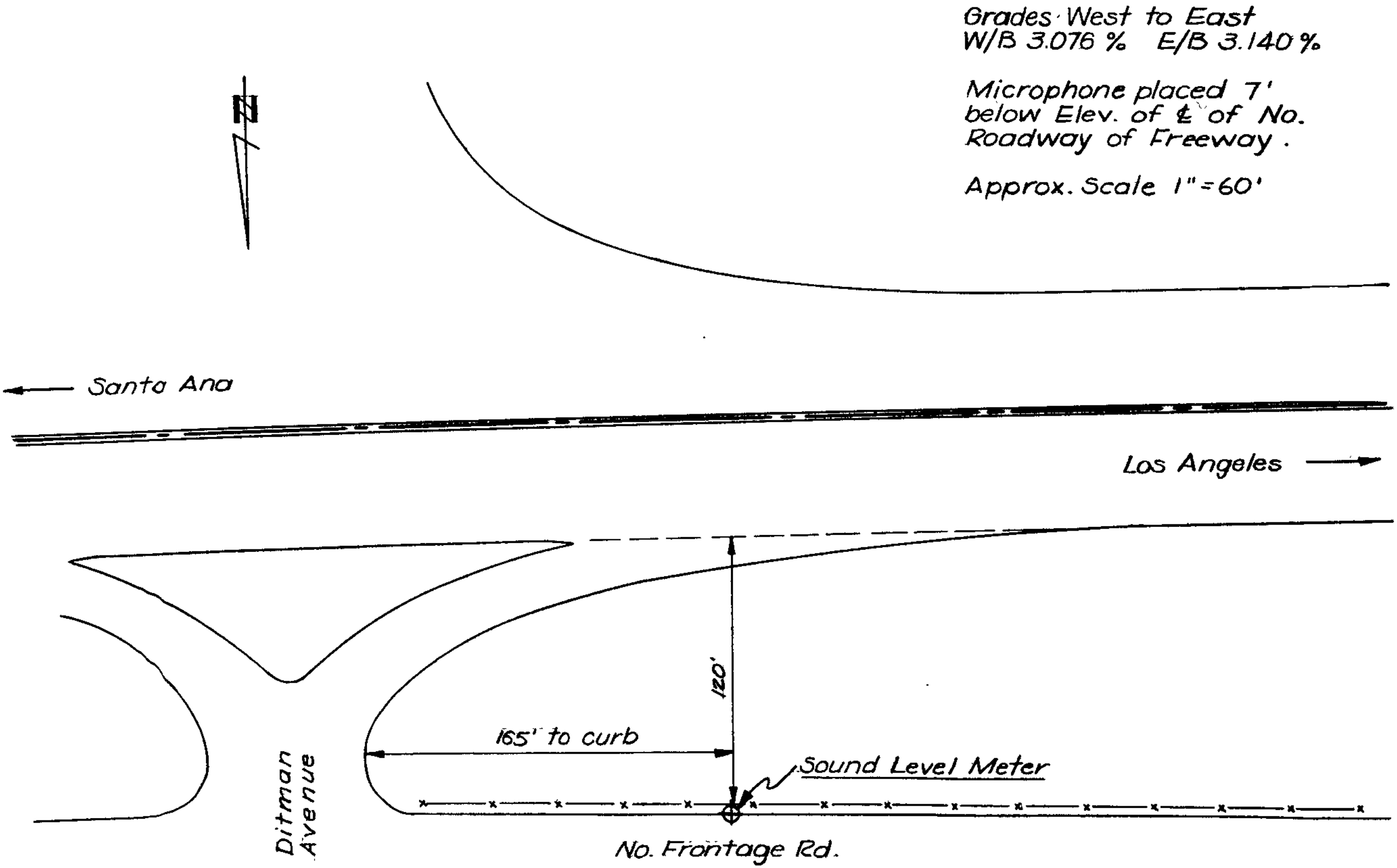
LOCATION #1 VENTURA FREEWAY AT ST. CLAIR DRIVE



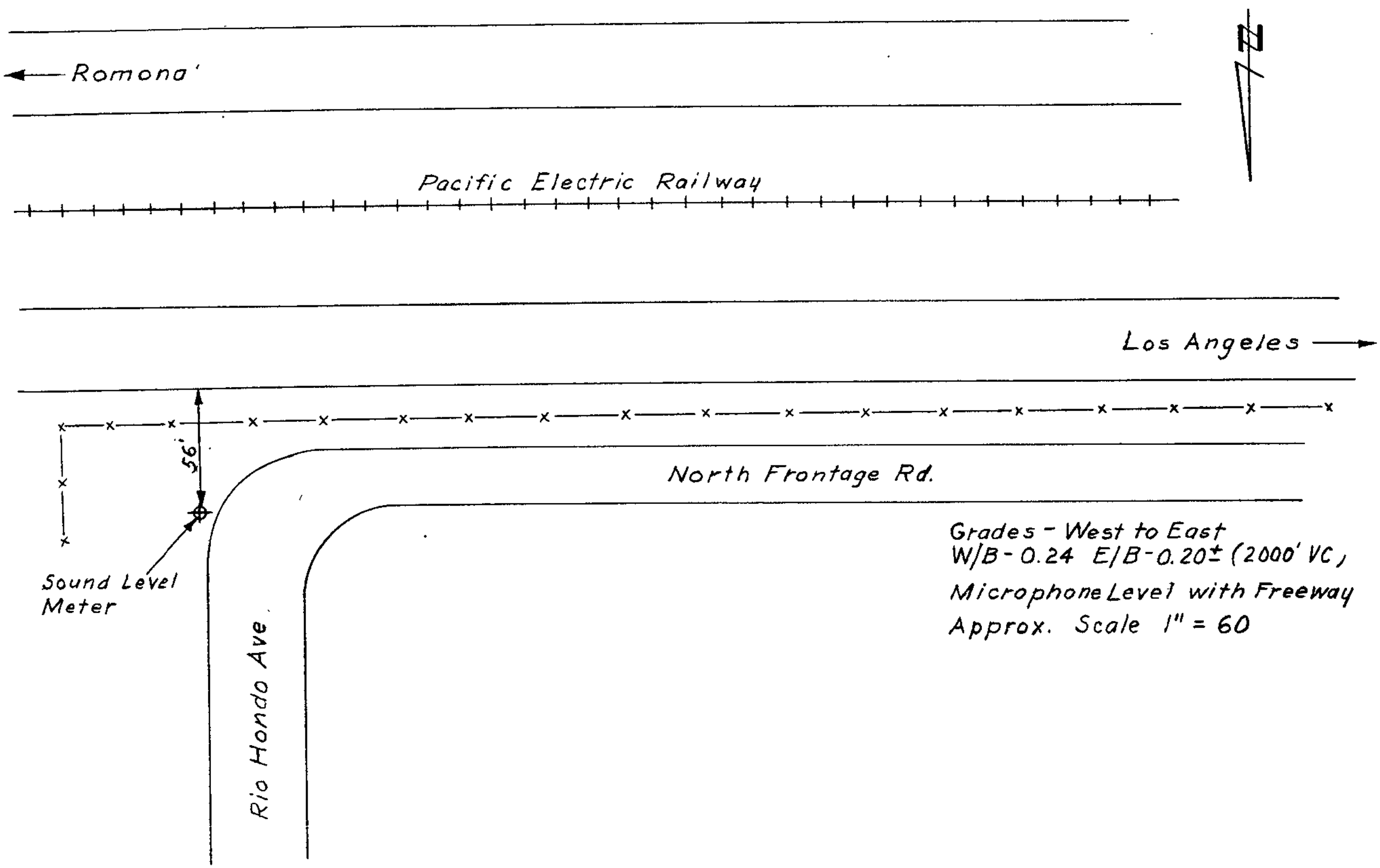
LOCATION # 2 VENTURA FREEWAY NEAR HAZELTINE AVE.



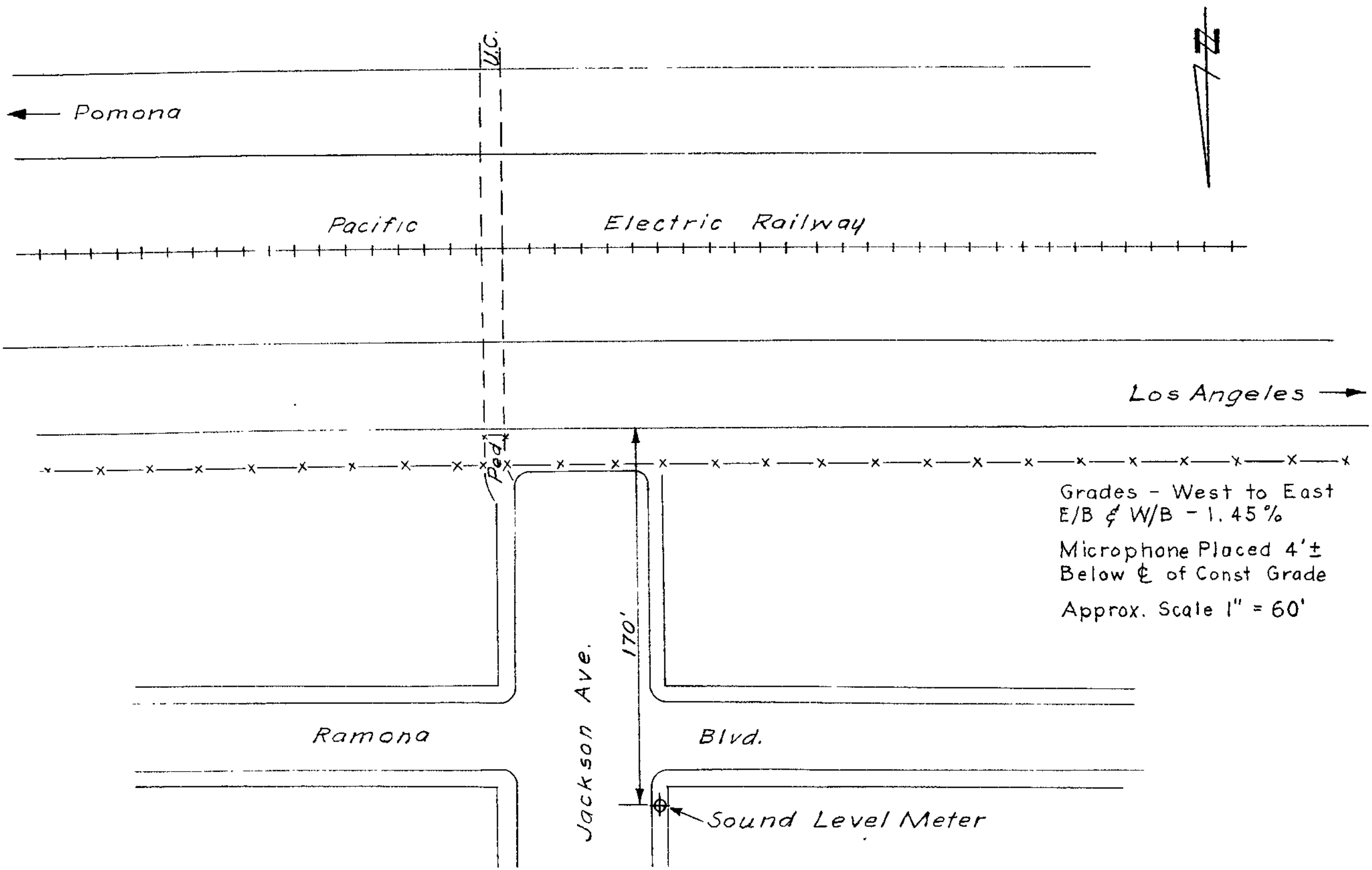
LOCATION #3 VENTURA FREEWAY AT ZELZAH AVE



LOCATION #4 SANTA ANA FREEWAY NEAR DITMAN AVE.



LOCATION # 5 SAN BERNARDINO FREEWAY AT RIO HONDO AVE



LOCATION #6 SAN BERNARDINO FREEWAY AT JACKSON AVE