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HARRIS MILLER MILLER & HANSON INC.

NOISE ANALYSIS OF SELECTED RAIL CORRIDORS FOR THE PROPOSED ~~ATST/STP~~ ATSF/SPT OPERATIONS MERGER

June 1986

PREPARED FOR:
Interstate Commerce Commission
Office of Transportation Analysis
Section of Energy and Environment
Washington, D.C. 20423

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1. EXECUTIVE SUMMARY

The proposed merger of the Atchison, Topeka and Santa Fe (ATSF) and Southern Pacific Transportation Company (SPT) rail operations will result in rail traffic increases in some corridors. The Environmental Assessment prepared by the Interstate Commerce Commission on November 11, 1986 evaluated the corridors where the rail traffic or tonnage will increase significantly and identified a number of corridors in which there could be significant noise impact. On further examination, it was found that four of the corridors warranted more detailed study because of the potential noise impact from the increase in rail traffic.

The four corridors evaluated were Richmond - Lathrop, California; Warm Springs - San Jose, California; Mobest - Phoenix, Arizona; and Dallas - Wylie, Texas. Site investigations were made of the four corridors. Considering the number of noise sensitive land uses within the noise impact corridor and the projected increase in the volume of train traffic, merger-related noise impact is expected to be minimal for three of the corridors. As a result, detailed noise measurements and projections were not performed for the Warm Springs - San Jose, Mobest - Phoenix, or Dallas - Wylie corridors. In contrast, there are a large number of residences that are affected by railroad noise in the Richmond - Lathrop corridor and the number could change dramatically with the proposed merger of operations. The existing and future noise impacts in this corridor were studied in detail.

The analysis focused on determining the number of residential units (single family houses, town houses, apartments, etc.) and schools at which the Community Noise Equivalent Level (CNEL)* would exceed 65 dBA and the change in the number of sensitive receptors within the 65 dBA contour due to the proposed rail traffic changes. Because the proposed change will move ATSF trains to the SPT tracks, there will be a significant increase in the number of trains on the SPT tracks and an increase in the noise levels along the SPT tracks. A positive effect will be the reduction in the noise levels along the ATSF tracks. We also analyzed the potential impact of ground-borne vibration from train operations on the historic district of Tracy. The conclusion of the analysis was that there is very little probability that ground-borne vibration will damage any buildings in the historic district.

Four different train traffic scenarios were evaluated for the Richmond - Lathrop corridor:

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*CNEL is used in California for evaluating community noise. It includes a 5 dBA penalty for noises during the evening hours of 7 p.m. to 10 p.m. and a 10 dBA penalty for noises during the nighttime hours of 10 p.m. to 7 a.m. The Day-Night Equivalent Level (L_{dn}) was used for the Environmental Assessment. CNEL is rarely more than 0.5 dBA higher than L_{dn}.

Case 1. Existing Condition: Existing rail traffic based on the 1985 average traffic levels.

Case 2. 1986 Operations Plan: Future rail traffic based on 110% of the updated operations plan. This is the most likely scenario based on the existing traffic conditions.

Case 3. 1984 SPT-ATSF Merged Operations Plan: Traffic projections based on the 1984 block plan from the original merger application.

Case 4: Worst Case: Assumes most likely scenario (Case 2) plus granting of the proposed trackage rights of the Denver & Rio Grand Western and Union Pacific.

The 1984 merger plan, which was included in the applicant's 1984 block plan, was the basis of the Environmental Assessment. The 1986 plan revises the traffic projections downward to reflect present operations. The Amtrak trains using the ATSF and SPT tracks were included in all of the analyses, although, there are very few locations where the existence of the Amtrak trains has a measurable effect on the distance to the CNEL 65 dBA contour.

The noise projections were based on standard models of train noise calibrated using measurements of train noise in the Richmond - Lathrop corridor. The projections included the effect of number of trains, train speed, train length, number of locomotives, excess ground attenuation, atmospheric absorption, and shielding. A typical source of shielding is a row of houses between the railroad tracks and the observer. The model was found to give reasonable agreement with the community noise survey results. The noise survey consisted of continuous monitoring over a 24-hour period at 21 locations within the corridor.

The final results of our analysis show the following number of residential units within the CNEL 65 dBA contour for the various scenarios:

TOTAL NUMBER OF RESIDENCES

	SPT	ATSF	TOTAL
Case 1: Existing	286	493	779
Case 2: 1986 Plan	756	12	768
Case 3: 1984 Plan	887	12	899
Case 4: Worst Case	892	12	904

PERCENT CHANGE IN NUMBER OF RESIDENCES
FROM EXISTING CONDITIONS (CASE 1)

	SPT	ATSF	TOTAL
Case 2: 1986 Plan	164%	-98%	-1%
Case 3: 1984 Plan	210%	-98%	15%
Case 4: Worst Case	212%	-98%	16%

With the proposed changes in distribution of rail traffic, there would be very few trains using the existing ATSF lines in the Richmond - Lathrop corridor for Cases 2, 3 and 4. The analysis shows that for these cases, the number of residences within the CNEL 65 dBA contour will drop from 493 to 12, a 98% reduction. One option that has not been specifically addressed is leaving all of the ATSF trains on the existing ATSF line. With the projected growth in traffic, the number of residences along the ATSF line within the 65 dBA CNEL contour would increase from 493 to 502, an insignificant 2% increase.

The proposed operations plan would dramatically increase the number of residences along the SPT tracks that are within the CNEL 65 dBA contour. The increase is projected to range from 164% to 212% depending on the scenario. This represents an increase of 470 to 606 residences that will be within the CNEL 65 dBA contour.

The projections show relatively small changes in the total number of residences within the CNEL 65 dBA contour for all three of the cases analyzed. Case 2, the most likely scenario, shows a 1% decrease. Cases 3 and 4 show a 15% and 16% increase, respectively. As would be expected, the merged operations plan would act to transfer the adverse noise impact from the ATSF line to the SPT line leaving the total impact for the corridor approximately constant.

A final part of our analysis was to analyze mitigation measures that can be used to minimize the noise impact. The SPT track sections analyzed include Pinole Point to Hercules, Pittsburg, Antioch, and Tracy. The noise mitigation options we have evaluated are sound barriers, and operational and schedule changes. CNEL, the descriptor used to evaluate the noise impact, includes a 5 dB penalty for noises during the evening hours and 10 dB penalty for noises during the nighttime hours. Reducing the number of nighttime trains will significantly reduce the levels of CNEL. This is not expected to be a practical option for the railroads. Operational changes such as reducing speeds will provide very little benefit and are not recommended.

The most practical method of controlling the noise impact from trains is the construction of noise barriers along the railroad right-of-way. Barriers are widely used in California to protect new residential developments from highway noise and, to a lesser degree, from railroad noise. To be effective at reducing the locomotive exhaust and fan noise, a sound barrier must be at least 12 ft above the top-of-rail elevation. Depending on the specific topography, this usually means that the barrier must be 13 to 15 ft high in order to provide significant noise reduction (5-10 dBA).

The areas where barriers will provide substantial benefit are shown in Section 6. With 25,500 ft of barrier placed as shown in Section 6, the noise impact along the four track segments evaluated would be less than the present level of impact. With barriers, the total number of residences inside the CNEL 65 dBA contour are projected to be:

TOTAL NUMBER OF RESIDENCES
(sound barriers for Cases 2, 3 & 4)

	SPT	ATSF	TOTAL
Case 1: Existing	286	493	779
Case 2: 1986 Plan	398	12	410
Case 3: 1984 Plan	503	12	515
Case 4: Worst Case	540	12	552

PERCENT CHANGE IN NUMBER OF RESIDENCES
(future with sound barriers compared to existing without sound barriers)

	SPT	ATSF	TOTAL
Case 2: 1986 Plan	39%	-98%	-47%
Case 3: 1984 Plan	76%	-98%	-34%
Case 4: Worst Case	89%	-98%	-29%

The conclusion from these results is that sound barriers can effectively reduce the noise impact from the increased train traffic along the SPT tracks. The numbers for the ATSF tracks have not changed from the previous table. Some observations about the level of noise impact assuming the implementation of the barriers are:

- o The corridor wide impact will be reduced below the present level.
- o There will be some shifting of impact from the ATSF tracks to the SPT tracks. Even with the barriers, the number of residents along the SPT tracks that are within the 65 dBA contour will increase significantly.
- o Our summary numbers on the benefit of noise barriers only include the residences within the 65 dBA contour which generally means the first row of houses. There also will be significant benefit for some residences beyond the first rows of houses.

2. INTRODUCTION

2.1 Project Scope

This report summarizes the detailed analysis of noise impact that will result from the proposed merger of the Atchison, Topeka and Santa Fe Railway Company (ATSF) and the Southern Pacific Transportation Company (SPT). Four of the corridors identified in the November 11, 1985 environmental assessment prepared by the U.S. Interstate Commerce Commission (ICC) have been evaluated. The selected segments are:

1. Richmond-Lathrop, CA: In this corridor the SPT and ATSF tracks are roughly parallel. The proposed plan is to shift the ATSF trains to the SPT line. The SPT line would be upgraded with new track, ties, sidings, and signals. On much of the SPT line the traffic would be dramatically increased. A counter balancing effect is removing the traffic from the ATSF lines. Applicants have proposed to abandon a portion of the line between Richmond and Martinez (through Franklin Canyon) and discontinue service on portions of the ATSF Delta Line between Antioch and Stockton. Figure 1 is a regional map of this corridor.

2. Warm Springs-San Jose, CA: This corridor is projected to have more trains because of an increase in shipments to and from the General Motors-Toyota plant in Warm Springs.

3. Mobest-Phoenix, AZ: This three mile rail segment in downtown Phoenix is currently used by local trains interchanging cars between the SPT and ATSF yards. As a result of the merger, this corridor is projected to experience a net increase of six trains per day.

4. Dallas-Wylie, TX: The ATSF route between Dallas and Wylie is projected to carry four new trains each day. This line presently handles one ATSF train and four trackage-rights trains daily.

These four corridors were selected for more detailed study because preliminary examination indicated that noise levels along these corridors had the potential to increase by 5 dBA or more as a result of the merger. Threshold criteria indicated that either the increase in trains or the expected increase in tonnage moved over the line had the potential to increase noise levels significantly.

The purpose of the present study is to look at all four of the rail corridors and determine the magnitude of the noise impact. For the Warm Springs - San Jose, Mobest - Phoenix, and Dallas - Wylie corridors, the site investigation and the increases in rail traffic and total tonnage indicate that there will not be a significant increase in the noise impact. In contrast, the evaluation of the Richmond - Lathrop corridor indicated the potential for significant impact on several hundred residences. As a result, this study focuses on providing a detailed evaluation of the noise impact in the Richmond - Lathrop corridor. The evaluation of the Richmond-Lathrop corridor has included detailed measurements of the existing noise environment and projections of the noise environment following the proposed merger. The three remaining corridors were visited and inspected. The evaluation of these sites has not included measurements or detailed projections.

Our study of the Richmond-Lathrop corridor has included extensive measurements of the existing ambient noise, measurements of the train noise, detailed projections of the noise along the SPT and ATSF tracks, inventorying of the noise sensitive land uses that will be impacted, and analysis of noise mitigation measures to reduce the impact. Because of special concern about some historical buildings in Tracy, we also have evaluated the potential for ground-borne vibration from the train operations in Tracy causing damage to the historical buildings.

2.2 Noise Parameters

The concept of noise impact is based on the relationships between people's reactions to noise and appropriate physical measures of noise. The acceptability of a project in terms of noise is related to the magnitude of the noise as well as the number of people disturbed by the noise. A number of different parameters have been used to describe community noise. One of the problems has been to find a descriptor that will accurately indicate the community disturbance created by different types of noise sources.

Social surveys [2.1] have indicated a good correlation between the percentage of people highly annoyed by noise from various sources and the magnitude of the noise outside their residences in terms of the day-night average sound level (L_{dn}). Because of its high correlation with annoyance, the L_{dn} is an appropriate measure for assessing community noise. The Community Noise Equivalent Level (CNEL) is often used in California for noise assessment instead of L_{dn}. Both L_{dn} and CNEL include a 10 dB penalty for noise during the nighttime hours of 10 p.m. to 7 a.m. In addition, CNEL includes a 5 dB penalty for noise during the evening hours of 7 p.m. to 10 p.m. The Environmental Assessment was based on projections of L_{dn}; for the assessment of the Richmond - Lathrop corridor all the projections are in terms of CNEL. Experience with the two metrics has shown that there is rarely more than 0.5 dB difference between the two.

Several noise concepts are incorporated in the formulation of L_{dn} and CNEL:

- o They are expressed in decibels (dB), which is a measure of sound pressure amplitude; noise levels of 0 dB correspond roughly to the threshold of hearing.

- o They are always A-weighted, which is the name of a frequency weighting scale that de-emphasizes the high and low frequencies of sounds to correspond to the response of the human ear. When A-weighting is used, the unit is dBA instead of dB. Because L_{dn} and CNEL are always in terms of dBA, it is common practice to simply use dB.

- They are both based on energy average sound levels, sometimes called the equivalent sound level (Leq), which is numerically equal to the value of a steady sound level that would carry the same sound energy as does the actual time-varying sound in the same time period.

- They are 24-hour average sound levels in which, as discussed above, nighttime noise levels are penalized by an increase of 10 dB before calculation of the 24-hour average. CNEL includes a 5 dB penalty for noise in the evening hours.

Another acoustic parameter that is used extensively in this study is the Single Event Noise Exposure Level (SENEL). SENEL a measure of the acoustic energy of an event over the time period that the event noise exceeds the background noise level. The energy is normalized (compressed) to a one second "dose" for ease in calculating other measures of noise exposure. The SENEL of a train pass-by is the sound level that would be required for a one second event to have the same total acoustic energy as the train pass-by. The SENEL of an event is almost always significantly greater than the maximum sound level. For example, a sound level of 80 dBA that lasts for 10 seconds would have a SENEL of 90 dBA. If the same 80 dBA sound lasted 100 seconds, the SENEL would be 100 dBA.

2.3 Noise Criteria

Nationwide surveys sponsored by the U.S. Environmental Protection Agency [2.2] and the U.S. Department of Housing and Urban Development [2.1] have identified specific L_{dn} values with public health and welfare effects:

- L_{dn} = 55 dBA: satisfactory residential environment; 4 percent of people highly annoyed.

- L_{dn} = 65 dBA: threshold for normally unacceptable housing environment; 15 percent of people highly annoyed.

- L_{dn} = 75 dBA: unacceptable permanent residential environment; 37 percent of people highly annoyed.

These conclusions are equally applicable to CNEL levels of 55, 65 and 75 dBA. A commonly selected criterion for noise impact is an L_{dn} threshold of 65 dBA. This level is consistent with the noise policy of Federal agencies such as current Federal Aviation Administration regulations [2.3] as well as the EPA National Strategy for reducing noise through rigorous planning action [2.4]. This is also consistent with California Title 25 which requires acoustical studies for any multi-family development in areas where the CNEL exceeds 60 dBA. In practice, the Title 25 requirements usually results in noise control in the form of either sound barrier walls or extra sound insulation for the exterior walls when the CNEL exceeds 65 dBA. Locations at which a project results in additional people being exposed to L_{dn} greater than 75 dB (an unacceptable residential environment) are generally considered to be severely impacted and high-priority candidates for noise mitigation.

In addition to absolute criteria, relative criteria are also appropriate for the purpose of noise assessment. Although a definite relationship has not yet been established between noise increase and annoyance, it is generally accepted that an increase greater than 5 dB is noticeable and an increase greater than 10 dB (corresponding to a subjective doubling of loudness for steady-state noise) is undesirable.

For the original environmental assessment [2.5], the ICC required that an acoustical analysis be carried out for all proposed actions where the rail traffic would increase by either 8 trains per day and/or by 100% as measured by tonnage and/or trains. The analysis determined whether the action would result in increasing the railroad noise levels, expressed in terms of L_{dn}, by 3 dBA or would result in an L_{dn} in excess of 65 dBA. In all areas where these impact criteria were met, an estimate of the increase in the total number of residences that would fall within the 65 dBA was provided.

The evaluation of noise impact in this study has concentrated on estimating the number of dwelling units (houses and apartments) and other noise sensitive land uses (primarily schools) where the CNEL exceeds, or will exceed 65 dBA. In areas where the proposed action will result in a significant increase in both the noise level and the number of sensitive receptors within the CNEL 65 dBA contour, we have evaluated noise mitigation measures that can be applied to minimize the noise exposure.

2.4 Report Organization

The remainder of this report presents the results of our study. Section 3 summarizes the field survey measurements carried out along the Richmond-Lathrop, CA rail corridor for the purpose of documenting existing noise levels from trains and other noise sources. The detailed results of the noise survey are contained in Appendix A. Section 4 describes the noise prediction model that we used and the calibration of the model using the measurement data. Section 5 provides details of the noise assessment methodology and results. The noise contours that were developed for the entire Richmond - Lathrop corridor are presented in Appendix B (bound separately). The mitigation of the noise impact in the Richmond - Lathrop corridor is discussed in Section 6. In Section 7 we present a brief evaluation of the potential for the vibration from the rail traffic damaging buildings in the Tracy Historic Area.

References

2.1 Schultz, T.J., "Synthesis of Social Surveys on Noise Annoyance," J. Acoust. Soc. Am., Vol. 64, No. 2, pp. 377-405 (August 1978).

2.2 U.S. Environmental Protection Agency, "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety," Report No. EPA-550/9-74-004 (March 1974).

2.3 Federal Aviation Regulations, Part 150, "Airport Noise Compatibility Planning" (CFR 14, Subchapter 1, Airports").

2.4 U.S. Environmental Protection Agency, "National Strategy for Noise Control" (1977).

2.5 Environmental Assessment, "Merger: The Atchison, Topeka and Santa Fe Railway Company and Southern Pacific Transportation Company," Finance Docket No. 30400, Interstate Commerce Commission (November 1, 1985).

3. FIELD SURVEY MEASUREMENTS

Noise measurements were carried out in the Richmond-Lathrop, CA rail corridor between 31 March and 10 April 1986. The purpose of these measurements was to document existing noise levels from trains and other sources at representative noise-sensitive receptors (e.g. residences, schools, churches, etc.) that may be affected by changes in rail traffic following the proposed merger. In addition to overall noise monitoring, measurements of noise from individual train passages were obtained in order to help calibrate the noise prediction model, as discussed in Section 4.

3.1 Measurement Locations

Ambient noise measurements were carried out at 21 locations. Figure 1 is a regional map of the corridor study area indicating the noise measurement locations. Specific details about the measurement locations are summarized in Table 1. Table 1 includes specific addresses and distances from the rail lines for each site. The measurement locations also are shown on the noise contour drawings in Appendix B (bound separately). As indicated, measurements were made at locations near both the ATSF and the SPT railroad lines that run parallel to each other through the study area. Measurement sites were selected to be representative of noise-sensitive land use that would most likely be affected by merger related changes in rail traffic. These changes may result in either increases or decreases in train noise, depending on location.

3.2 Measurement Methodology

Digital Acoustics Model 607 portable noise monitors were used to continuously sample the overall, A-weighted sound level during one 24-hour period at each measurement location. The A-weighted sound level, expressed as dBA, is a single-number measure of sound intensity with weighted frequency characteristics that correspond to human subjective response to noise. All noise levels given in this report are in terms of dBA. The monitors were set to print out hourly data including the equivalent (energy-average) sound level (L_{eq}), the maximum sound level (L_{max}) and the statistical percentile sound levels (L_x) which refer to the sound levels exceeded x-percent of the time. For example, the level exceeded 1-percent of the time (L_1) is often taken to approximate the "maximum" community noise level and would generally be influenced by train noise. On the other hand, the level exceeded 90-percent of the time (L_{90}), which is often considered to represent the background noise in a community, would not be expected to be influenced by train noise. For the purposes of noise assessment, however, the L_{eq} and related descriptors (L_{dn} and CNEL) are most useful because they apply to all types of noise sources and can be correlated with the effects of noise on people.

The hourly L_{eq} data collected at each site were used to compute the 24-hour, A-weighted, equivalent (energy-average) sound level, $L_{eq}(24)$, as well as the day-night equivalent sound level, L_{dn}, and the Community Noise Equivalent Level, CNEL. As discussed in Section 2.2, the CNEL descriptor has been adopted by the State of California, and will be used for the purpose of noise assessment in this study. It is very rare for CNEL to be more than 0.5 dB higher than L_{dn}.

In addition to obtaining overall community noise levels, the noise monitors were set to collect data on single events, notably train passages. For this purpose, noise level thresholds and event durations were prescribed such that the monitors would compute the Single Event Noise Exposure Level (SENEL) for higher level, longer duration noise events (e.g. trains) while excluding lower level and/or shorter duration events (e.g. motor vehicles). The SENEL is a time integrated, A-weighted sound level for a single event that is equivalent in magnitude to a reference signal with a duration of one second. SENEL provides a measure that accounts for both the magnitude and duration of a single noise event and that can be used to calculate the contribution of such events to the overall noise environment. For practical purposes, a threshold level that is 10 dB below the maximum event level is sufficient for determining the sampling interval for measurement of SENEL since lower sound levels do not contribute significantly to the total sound energy. Train log data obtained from ATSF and SPT dispatcher offices were subsequently used to correlate SENEL printouts from the noise monitors with specific train passages so that the contribution of train noise to the total noise environment could be determined for each measurement site. This was done by recalculating the noise levels at each site after taking out the SENEL attributable to known train passages.

Additional train noise data were collected at the monitoring sites and at other locations using Bruel & Kjaer (B&K) Model 2230 integrating sound level meters directly or in combination with a Marantz Model 430 cassette tape recorder. These data were used to help calibrate the noise prediction model as described in Section 4.

All sound measurement equipment used for the survey conforms to ANSI Standard S1.4.1971 for Type 1 sound level meters. Calibration of the instruments in the field was carried out before and after each set of measurements using an acoustic calibrator (General Radio Model 1567 or B&K Type 4230). These calibrations are traceable to the U.S. National Bureau of Standards.

3.3 Measurement Results

The results of the ambient noise measurement survey are summarized in Table 1. In addition to 24-hour noise data, this table lists the address, measurement starting date, and the distance from the railroad tracks, as well as the number of trains monitored and average train SENEL for each measurement location. The 24-hour noise data include $L_{eq}(24)$, L_{dn} and CNEL for each location, for the following cases:

1. total noise (i.e. including trains),

2. noise from non-railroad sources (i.e. excluding trains), and

3. noise from trains only.

Detailed information, including hourly noise data as well as train noise, consist and operational data for each monitoring site, is included in Appendix A of this report.

The results in Table 1 indicate that in terms of CNEL, the total noise measured at the 21 sites in the study area ranged from a low of 58 dBA to a high of 83 dBA. Without trains, the CNEL is estimated to range between 55 and 72 dBA. The results also suggest that train noise currently dominates the noise environment at about one-third of the measurement sites and that non-railroad sources are dominant at about one-third of the sites. At the remaining one-third of the sites, the contribution of train noise and noise from other sources appears to be about equal. It is also of interest that, in nearly all cases, the L_{dn} and CNEL values are within 1 dB of each other. The $L_{eq}(24)$ values are observed to average about 5 dB less than the L_{dn} and CNEL values. The field survey measurement results presented herein are used to aid in the assessment of noise impact as described in the succeeding sections of this report.

There are a number of significant noise sources in the rail corridor in addition to the trains that contributed to the measured levels of CNEL and L_{dn}. The noise sources include street traffic, aircraft flyovers, local community activities, and off-road vehicles. The street traffic was particulary important in the areas such as Brentwood, Byron and Oakley where the railroad tracks are often located near heavily traveled roads. Even though these are relatively rural areas, the noise level from the road traffic often exceeded that from the railroad tracks, even at the houses abutting the railroad right-of-way.

It is somewhat unusual for off-road vehicles to be a significant community noise source. We observed that in some areas of Pinole and Rodeo it is relatively common for dirt bikes and small off-road vehicles to use the railroad right-of-way, particularly in the afternoon and on weekends. Since many of these vehicles are poorly muffled, the acoustic energy from the dirt bikes sometimes exceeded that of the railroad trains.

Table 1. Summary of Noise Measurements

Loc.	Address	Starting Date	L_{eq} (Including Trains)	L_{dn}	CNEL	L_{eq} (Excluding Trains)	L_{dn}	CNEL	L_{eq} (Trains Only)	L_{dn}	CNEL	Dist to Track (Ft)	# Trains	Avg. SENEL
1.	545 Brackman Lane Martinez	3/31/86	61	67	67	60	64	64	56	64	64	100 (ATSF)	20	95
2.	1251 Escobar St. Martinez	3/31/86	65	69	69	64	66	66	59	66	66	120 (SPT)	32	97
3.	64 Woodview Rd. Pittsburg	3/31/86	60	65	65	60	63	63	52	62	62	150 (SPT)	3	98
4.	186 MacMurty Dr. Martinez	4/2/86	58	63	64	50	55	55	57	63	63	140 (ATSF)	12	95
5.	68 Russell Dr. Antioch	4/2/86	56	58	58	52	56	56	54	54	54	75 (SPT)	1	104
6.	301 W. 13th St. Pittsburg	4/2/86	64	70	70	60	67	67	62	67	67	75 (ATSF)	12	101
7.	125 W. 6th St. Tracy	4/3/86	57	60	60	57	60	60	--	--	--	600-1100 (SPT)	--	--
8.	620 Gary Ave. Antioch	4/3/86	60	62	62	56	59	60	58	58	58	75 (SPT)	2	104
9.	1150 Hazel St. Pinole	4/3/86	65	73	73	55	64	64	64	72	72	30/275 (ATSF/SPT)	30	99
10.	1262 Sequoia Blvd Tracy	4/4/86	59	61	62	59	61	62	39	39	39	130 (SPT)	1	88
11.	901 Carpino Ave. Pittsburg	4/4/86	59	62	62	56	60	61	57	57	57	75 (SPT)	1	106
12.	2047 Cypress Ave. Pinole	4/4/86	74	83	83	64	68	68	74	83	83	30 (SPT)	20	110
13.	4413 Jenkins Way Richmond	4/7/86	64	70	70	53	58	59	63	69	69	75 (SPT)	21	99
14.	4 Prospect Ave. Port Costa	4/7/86	61	67	67	52	54	58	60	67	67	250 (SPT)	20	97
15.	16061 Seventh St. Lathrop	4/7/86	61	66	67	61	66	67	44	54	54	200 (SPT)	1	92
16.	904 Stanton St. San Pablo	4/8/86	63	69	69	61	64	65	58	66	67	150 (ATSF)	12	97
17.	800 Windward Dr. Rodeo	4/8/86	58	67	67	55	62	62	56	65	65	130 (ATSF)	13	94
18.	4147 Byron Hwy. Byron	4/8/86	69	72	72	68	72	72	61	61	61	100 (SPT)	3	105
19.	103 Bay Ave. Hercules	4/9/86	58	65	65	58	65	65	--	--	--	350 (SPT)	--	--
20.	155 Eden Plains Rd. Knightsen	4/9/86	61	67	68	50	56	57	60	67	67	110 (ATSF)	17	97
21.	865 Walnut Blvd. Brentwood	4/9/86	58	64	64	52	57	57	57	63	63	225 (SPT)	3	102

4. NOISE PREDICTION METHODOLOGY

A total of 26,000 miles of track were evaluated in the original Environmental Assessment. Through that assessment, four track segments were identified for more detailed evaluations. The original assessment was based on relatively general assumptions regarding the noise levels produced by railroad trains. For this assessment, a more detailed noise model is required. Our approach has been to apply documented prediction procedures that have been modified to reflect the noise measurement data collected in the Richmond-Lathrop corridor. Basically, we used the measurement data to calibrate the prediction procedures.

4.1 Characteristics of Train Noise

The noise from railroad trains is the combination of a number of independent noise sources. As a train approaches, the first sounds heard are often the warning horn and bells at crossing gates. As the locomotives approach, the low-frequency noise of the diesel engine exhaust, the engine cooling fans, and other locomotive noises are heard. The maximum noise level usually occurs as the locomotives pass. Under heavy loads the exhaust noise will increase making the low-frequency characteristic of the noise more noticeable. Once the locomotives have passed, the noise level drops and the noise from the steel wheels of the freight cars rolling on the steel rails is heard. This noise is referred to as wheel/rail noise. If the track is jointed, the characteristic "clickity-clack" noise associated with trains will be heard. Many rail systems are now installing continuously welded rail which removes the impact noise at the rail joints.

Some of the characteristics of train noise are:

- The locomotive noise is not strongly dependent on speed. Most of the locomotive noise comes from the exhaust and the cooling fans, both of which create noise that is dependent on the engine operating condition rather than train speed.

- Stationary tests of locomotives indicate that the noise level changes approximately 3 dBA with each change in throttle setting. For example, going from throttle setting 4 to the maximum setting of 8 will increase the noise level by about 12 dBA. We did not observe this noise level dependence on throttle setting in our field measurements of train noise in the Richmond - Lathrop corridor. This is consistent with the observations of other studies of railroad noise [4.1].

- The level of locomotive noise seems to be better correlated to the grade rather than to the throttle setting. A recommended adjustment is -3 to -4 dBA for a 2% downgrade and a +1 to +2 dBA for 2% upgrade [4.1]. For upgrades the low-frequency part of the spectrum is more prominent.

- Freight car noise is strongly dependent on the speed of the cars. A typical assumption is that the level is proportional to 20 log(speed). This means that the freight car noise level will increase 6 dBA for every doubling of train speed.

- The noise from the freight cars will be lower if the track is welded instead of jointed. Freight cars on poor condition jointed track will produce noise levels that are up to 10 dBA higher than if the same cars are on welded track. For good condition jointed track, the difference will be 1 to 3 dBA. Poor condition wheels on the rail cars will negate the benefit of welded track. With poor condition wheels, the levels will be approximately the same irrespective of the track condition.

- The relative levels of the noise created by the locomotives and the freight cars is dependent on the speed. Considering just the maximum noise level, as speed decreases the locomotive noise tends to stay constant while the freight car noise drops proportionally to 20 log speed. As a result, the locomotive noise tends to be dominant at lower speeds and the freight car noise dominant at higher speeds.

The noise from the warning horns and crossing gates also can make an important contribution to the total acoustic energy. These noises are very site specific and depend on the manner in which the horn is blown by the train engineer. We observed that in areas such as Pinole, Antioch and Pittsburg where the tracks go through residential areas, it is not unusual for people to be on or near the tracks when trains pass-by. Hence, it is common for the horns to be sounded in these areas even when the train is not near a crossing. Another factor that affects the occurrence of warning horn noise is maintenance of the track. During track maintenance when there may be workers on or near the tracks, the train engineers will usually sound the horn in a more vigorous manner than normal as a safety measure.

Figure 2 illustrates the time history of the A-weighted noise level during three train pass-bys recorded in the Richmond - Lathrop corridor. The first example was recorded at Location 4 on MacMurty Drive in Martinez. The noise level rises from the background level to a maximum of approximately 82 dBA as the locomotives pass by. The noise from the locomotives is dominant for about 10 seconds. The noise from the freight cars fluctuates between 74 dBA and 80 dBA. The average freight car noise level is about 77 dBA. The SENEL's for this pass-by are 91 dBA for the locomotives and 95 dBA for the cars. Although the locomotive noise is 5 dBA higher, the acoustic energy of the locomotive noise is 4 dBA <u>less</u> than the energy of the freight car noise.

The second example in Figure 2 is a train passing the crossing at Parr and Giant Roads in San Pablo. The measurement location was just over 100 ft from the track on Parr Road. The bells on the crossing gate create a noise level fluctuating around 65 to 70 dBA. The horns sounded as the locomotives approach the crossing reached a maximum of just over 100 dBA. The noise from the locomotives peaked at about 93 dBA and the freight car noise ranged from 75 to 84 dBA. The train seemed to be accelerating as it passed, which would explain the gradual increase in the noise level as the freight cars pass by.

The SENEL values for example 2 of Figure 2 are:

Horns:	106 dBA
Locomotives:	102 dBA
Cars:	101 dBA

The acoustic energy from the horns, even though they were blown for only a few seconds, exceeded that of the rest of the train. This is a typical train pass-by in that the locomotive acoustic energy is approximately equal to that of the freight cars.

The third example in Figure 2 is an Amtrak train recorded at Location 13 on Jenkins Way in Richmond. The noise level rises from a background level of about 55 dBA to about 88 dBA. The total event lasts about 10 seconds. Even though the Amtrak trains are powered by diesel locomotives that are similar to those used for the freight trains, the locomotive and passenger vehicle noise can not be separated.

4.2 Prediction Model

The noise level projections of the Environmental Assessment used the prediction methods summarized by Swing and Pies [4.1]. The model separates the locomotives and freight cars assuming that the locomotives act as individual point sources and the freight cars act as a finite length line source. The method calculates the SENEL at the observer location for each freight train. The SENEL's for the trains during the three periods of the day (day, evening, night) are then weighted appropriately and combined to give either L_{dn} or CNEL. In order to perform the initial screening of the affected corridors, relatively general assumptions were made about the train length, distribution through the day, and speed. In addition, it was assumed that there were no natural or man-made barriers that attenuate the noise as it propagates from the railroad tracks.

A more detailed assessment of the noise from the trains is required for the environmental impact evaluation of this analysis. Our projections have been based on the following assumptions:

1. The noise from the freight cars and the locomotives can be represented as two finite length dipole line sources. Peters [4.2] showed that railroad train noise is well represented as a finite length dipole line source.

2. The relationship between the maximum level (L_{MAX}) and the SENEL for a length of rail cars can be approximated as:

$$SENEL = L_{MAX} + 10 \log[(1.5*D+L)/V] -1.6$$

where D is the distance (in ft) to the observer, L is the length (in ft) of the train, and V is the train speed in miles/hour. This relationship, which was take from Saurenman, et al [4.3], is based on the dipole line source model.

3. The freight car L_{MAX} is proportional to 20 log(speed) and the locomotive L_{MAX} does not vary with speed.

4. The attenuation of L_{MAX} with distance from the track is determined by the dipole line source model with adjustments to approximately account for atmospheric absorption and excess ground attenuation. The adjustments for atmospheric absorption and ground attenuation were based on the results presented by Kurzweil [4.4].

5. Shielding by one row of houses provides 5 dB of attenuation. This is based on standard assumptions used for predicting highway noise [4.5] and two measurements during our survey of the noise in front of and behind a row of houses during train pass-bys. The measurements confirm that the assumption of 5 dB attenuation is reasonable (see Section 4.5).

Using the assumptions listed above, we used a calculation algorithm for railroad noise which is implemented on an in-house computer system. The inputs to the computer model are:

- the SENEL's or L_{MAX}'s for a reference train at a reference distance and speed,
- the length of the reference train,
- the number of locomotives in the reference train,
- the average train length, train speed, and number of locomotives for the train traffic,
- the average number of trains during the day, evening and nighttime periods, and
- the distances from the track for the noise level projections.

For each distance, the model calculates L_{MAX}, SENEL and CNEL.

4.3 Calibration of Model

In the original Environmental Assessment it was necessary to make some general assumptions about the noise levels generated by the trains. Because this study focuses on a single rail corridor, we were able to use train noise measurements in the corridor to tailor the noise predictions to the specific rail traffic and operating conditions in the corridor. Table 2 summarizes the train noise measurement data that was used. The basic approach was to normalize all the measurement data to a set of reference conditions, then calculate the energy average SENEL's for the locomotives and cars. Unusually high or low values were discarded from the average. The average values were than used as the reference train for the predictions. Following is a summary of the analysis.

APPROACH FOR AMTRAK TRAIN NOISE PREDICTIONS

1. The Amtrak train SENEL values were all normalized to 100 ft from the track, 40 mph, 500 ft train, two locomotives.

2. Two possible assumptions were examined, first that the SENEL is dominated by the locomotives and second that the passenger cars dominate the SENEL. As can be seen in Figure 2, there is no clear distinction between the noise levels of the locomotives and the passenger cars. In the first pass, the passenger vehicle noise was assumed to be proportional to 20 log (speed) and the locomotive noise was assumed to be independent of speed.

3. Based on inspection of the data, it appeared that assuming that the locomotives were the dominant source of noise made the normalized data more consistent. As a compromise, we used the locomotive assumption with the L_{MAX} level assumed to vary as 20 log[speed].

4. The normalized SENEL's were energy averaged giving 95.7 dBA at 100 ft (2 locomotive train at 40 mph). The SENEL's from locations shielded from the track were not included in the energy average. This SENEL gives the following reference values for the Amtrak trains:

Max Level:	86.6 dBA
Speed dependence:	20 log[speed]
Speed:	40 mph
Reference distance:	100 ft

APPROACH FOR FREIGHT TRAIN NOISE PREDICTIONS

1. The tabulated SENEL's were normalized to 100 ft from the track and a reference train 5000 ft long with 3 locomotives at 30 mph. For some train passbys, we obtained separate SENEL's for the locomotives and the cars. When the SENEL's could not be separated, if the train was shorter than 1500 ft, the SENEL was assumed to be for locomotives only. For longer trains the SENEL was assumed to be for the freight cars only.

2. The normalized SENEL data were tabulated and any "abnormal" points eliminated. High levels were usually eliminated because of horns corrupting the data, low points were usually due to partial shielding.

3. The normalized locomotive and vehicle SENEL's were energy averaged. The average SENEL's for the reference train were 99.0 dBA for the

freight cars and 97.0 dBA for the locomotives. These levels used to develop the following reference values for the projections:

	LOCOMOTIVES	FREIGHT CARS
Max Level:	84.8 dBA	78.2 dBA
Length:	One locomotive	5000 ft
Speed dependence:	none	20 log[speed]
Speed:	30 mph	30 mph
Reference distance:	100 ft	100 ft

4.4 Verification of Prediction Methodology

To develop the projections of train noise, the first step is to estimate the SENEL for a typical train by adjusting the reference train SENEL to the actual train parameters and observer distance. Figure 3 illustrates the variation of SENEL with observer distance for the reference freight and passenger trains. To check the projection methodology, we used the derived freight and passenger train values to project the CNEL's at each measurement position. The observed train traffic was used as the input to the model. We used either train speeds that we derived from on-site observations (e.g. timing the trains) or speeds derived from event durations in the noise monitor SENEL summary. The results of this exercise are shown in Table 3. Eliminating the locations where there was only one train pass-by during the measurement period, the projections are generally in good agreement with the measurements. The projected levels are higher than the measurements at several locations because of partial shielding. At other locations the projected level is significantly lower than the measured level. These are primarily in areas where the warning horns are sounded.

Figure 3 illustrates the projected SENEL levels for typical freight and Amtrak trains in the Richmond - Lathrop corridor. The values used for the projected SENEL levels are:

	FREIGHT TRAINS	AMTRAK TRAINS
LENGTH	3600 ft	640 ft
SPEED	40 mph	40 mph
NUMBER OF LOCOMOTIVES	3	1.5

These parameters are typical of those used in the projections discussed in Section 5. The 1.5 locomotives used in the Amtrak projections represents half the trains with one locomotive and half with two locomotives. The projected level of freight train SENEL is between 1 and 2 dBA higher with the existing track than in the future after the track is upgraded. The upgrading is to include replacing the jointed track with continuously welded track. To account for this, we have assumed that the noise from the freight cars will be 3 dBA lower in the future and the locomotive noise levels will not change.

The curves in Figure 3 show that the typical Amtrak train creates 5-6 dB less acoustic energy than a typical freight train. This means that one freight train is acoustically equivalent to approximately four Amtrak trains. Since there are more freight trains than Amtrak trains on most of the lines in the Richmond - Lathrop corridor, it is clear that the noise from the freight trains dominates the L_{dn} levels.

Another significant factor that can be gleaned from Figure 3 is the rate of sound attenuation with increasing distance from the track. Going from 20 to 30 ft from the track is projected to reduce the SENEL approximately 2 dBA. However, at a distance of 200 ft from the track, it is necessary to increase the distance to nearly 300 ft before realizing a 2 dBA reduction. This illustrates that it is difficult to use buffer zones to mitigate noise problems except in areas close to the noise source.

4.5 Estimates of Shielding by a Row of Houses

The noise measurements included measurements at two locations of the shielding provided by a row of houses. The first measurement was at Jenkins Way (Location 13). The results showed a 5.3 dBA reduction for an Amtrak train on the far track and an 11.5 dBA reduction for an Amtrak train on the near track. The houses along Jenkins Way are tightly spaced 20 to 30 ft apart with 6 ft fences bridging the gap between the houses.

We were able to perform only one measurement of the shielding of freight train noise by a row of houses. Two portable sound level meters were used, one positioned in front of the houses 100 ft from the tracks, the second was positioned 200 ft from the tracks behind the first row of houses. The SENEL's of the locomotives and the freight cars were measured at both locations. After normalizing the measurements to the 100 ft position, we found a reduction of 4.6 dBA for the locomotive noise and 4.7 dBA for the freight car noise.

Although these measurements are very limited, they are consistent with the common assumption of 5 dBA attenuation for the first row of houses and 1.5 dBA for each successive row [4.5].

References

4.1 Swing, J.W. and Pies, D.B., "Assessment of Noise Environments Around Railroad Operations," prepared by Wyle Laboratories for SPT Company, Union Pacific Railroad, ATSF Railway Company, and The Association of American Railroads (July 1973).

4.2 Peters, S., "Prediction of Railway Noise Contours," Journal of Sound and Vibration, 32(1), pp 87-99 (1974).

4.3 Saurenman, H.J., Nelson, J.T. and Wilson, G.P., "Handbook of Urban Rail Noise and Vibration Control," prepared under contract to U.S. Department of Transportation, Urban Mass Transportation Administration, Report # UMTA-MA-06-0099-82-1 (October 1982).

4.4 Kurzweil, L.G., "Prediction of Community Noise from Rail Systems," Community Noise, ASTM SPT 692, R.J. Peppin and C.W. Rodman, Eds., American Society for Testing and Materials, pp 197-216 (1979).

4.5 Barry, T.M. and Regan, J.A., "FHWA Highway Traffic Noise Prediction Model," Federal Highway Administration Report No. FHWA-RD-77-108 (December 1978).

Table 2. Train Noise Measurement Data

TRAIN	MEAS. LOC.	DATE	TIME	DIST (FT)	SPEED (MPH)	# LOCO	# CAR	LENG. (FT)	SENEL LOCOS	SENEL CARS	SENEL TOTAL	COMMENT
1. IB-F (SPT)	2	4/1/86	10:43:46	120	27			4000	93.3	93.3	95.9	
2. IB-A (SPT)	2	4/1/86	11:32:22	120	32	1		425			99.4	w/horn
3. OB-A (SPT)	2	4/1/86	12:25:11	120	20	2	9	765			91.8	
	2A(Park)				40						96.0	
4. IB-F (ATSF)	1	4/1/86	15:03:12	100	28	3	15	1170			90.4	
	1A(Brackman La.)				200				83.6	85.9	87.9	
5. OB-F (ATSF)	4	4/2/86	12:31:34	140	22	2	78	5310	87.4	95.0	96.1	
6. IB-F (ATSF)	4	4/2/86	15:35:20	140	20	2	26	1160	93.7	91.0	95.8	
7A. OB-F (ATSF)	4	4/2/86	16:20:23	140	20	2	80	3330	91.2	95.2	96.8	tape rec.
7B. IB-F (ATSF)	4	4/2/86	18:16:06	140	20	4	27	1520	90.9	92.7	94.8	tape rec.
9. OB-F (SPT)	Banta	4/4/86	18:45:00	85	20	3		3240	100.0	94.0		w/horn
10. IB-F (ATSF)	20	4/9/86	17:08:13	110	53	2	46	3480	96.8	98.7	101.1	
11. IB-F (SPT)	9	4/3/86	14:32:34	275	38	4	100	6442			92.3	
12. OB-F (ATSF)	9	4/3/86	14:37:32	30	27	3	75	4760			101.8	
13. OB-F (ATSF)	9	4/3/86	15:49:07	30	20	2	0	0			85.2	
14. IB-F (ATSF)	9	4/3/86	16:15:32	30	27	2	8	480			96.6	
15. OB-F (SPT)	9	4/3/86	16:30:46	275	44	3	38	3451			89.2	
16. OB-A (SPT)	9	4/3/86	17:39:44	275	27	1	5	425			82.1	
17. IB-F (ATSF)	9	4/3/86	17:49:49	30	37	3	28				102.2	
18. IB-F (SPT)	11	4/5/86	13:15:00	75	20	2	8	750			98.7	
19. OB-F (ATSF)	Pinole (Montara Rec.Ctr.)	4/5/86	15:13:00	150	40	3	75	6150			103.8	
20. OB-F (ATSF)	Pittsb'g 12th St.&York	4/10/86	14:25:00	100	20	3	30	2345	85.0	87.9	89.7	
				200					77.0	79.1	81.2	shielded
21. IB-F (SPT)	Tracy (curve)	4/3/86	12:45:00	550	20	4	100	6442	79.8	87.3	88.0	tape rec. (squeal)
22. IB-A (SPT)	Pinole (Seaview School)	4/4/86	12:18:00	480	40	1	5	425			73.5	tape rec.

F = freight
A = Amtrak
IB = In-bound (West bound)
OB = Out-bound (East bound)
SPT = train on Southern Pacific tracks
ATSF = train on Atchison, Topeka & Santa Fe tracks

Table 2. Train Noise Measurement Data (continued)

TRAIN	MEAS. LOC.	DATE	TIME	DIST (FT)	SPEED (MPH)	# LOCO	# CAR	LENG. (FT)	SENEL LOCOS	SENEL CARS	SENEL TOTAL	COMMENT
23. IB-F (ATSF)	Pinole (Seaview School)	4/4/86	13:00:00	350	30	2	15		90.5	90.4	94.2	tape rec.
24. IB-F (ATSF)	Pinole (Montara Rec.Ctr.)	4/4/86	14:45:00	270		2	4				84.3	tape rec.
25. OB-F (ATSF)	Pinole (Montara Rec.Ctr.)	4/4/86	15:48:00	270	37	2	28	1840	93.9	93.6	96.3	tape rec.
26. IB-A (SPT)	Pinole (Montara Rec.Ctr.)	4/5/86	12:05:00	570		1	5	425			77.6	tape rec.
27. IB-F (SPT)	Pinole (Montara Rec.Ctr.)	4/5/86	14:02:00	570	40	2	12	500			84.0	tape rec.
28. IB-F (ATSF)	Pinole (Montara Rec.Ctr.)	4/5/86	14:10:00	150	44	2	3				89.1	tape rec.
29. OB-A (SPT)	13	4/7/86	11:58:00	75	40	2	8	680			97.1	tape rec.
30. IB-A (SPT)	Richmond (Morton Ave.)	4/7/86	15:26:00	105	40	2	8	680			97.6	tape rec.
31. IB-F (SPT)	Richmond (Morton Ave.)	4/7/86	15:52:00	105	32		37	3132	99.1	99.7	102.4	tape rec.

F = freight
A = Amtrak
IB = In-bound (West bound)
OB = Out-bound (East bound)
SPT = train on Southern Pacific tracks
ATSF = train on Atchison, Topeka & Santa Fe tracks

Table 3. Projected and Observed Noise Levels

LOC.	MEAS. CNEL	PROJECTED TRAIN CNEL'S		NUMBER OF TRAINS		NOTES
		Freight	Amtrak	Freight	Amtrak	
1	63.7	66.7		10		Trestle, some shielding
2	66.3	68.2	58.6	10	7	Some shielding
3	61.5	58.4		1		One train
4	63.0	63.4		11		
5	54.4	53.2		1		One train
6	67.4	67.1	56.9	8	3	SF 45 mph, Amtrak 60 mph
7	--	--				No trains
8	57.8	56.9		2		
9	72.3	71.4		9		ATSF trains only
10	38.5	45.2		1		One train
11	57.0	52.8		1		One train
12	82.8	76.4	65.9	12	8	Very high SEL's at night
13	69.1	69.4	58.9	11	9	
14	66.9	63.9	52.3	11	8	No ground effect
15	53.5	56.5		1		One train
16	66.5	65.9		9		
17	64.7	63.8		6		EB trains only
18	61.2	56.6		3		Horns? Other noises?
19	--	--				Freight cars shielded mic.
20	67.1	65.7	62.0	11	4	
21	63.2	58.1		3		Horns?

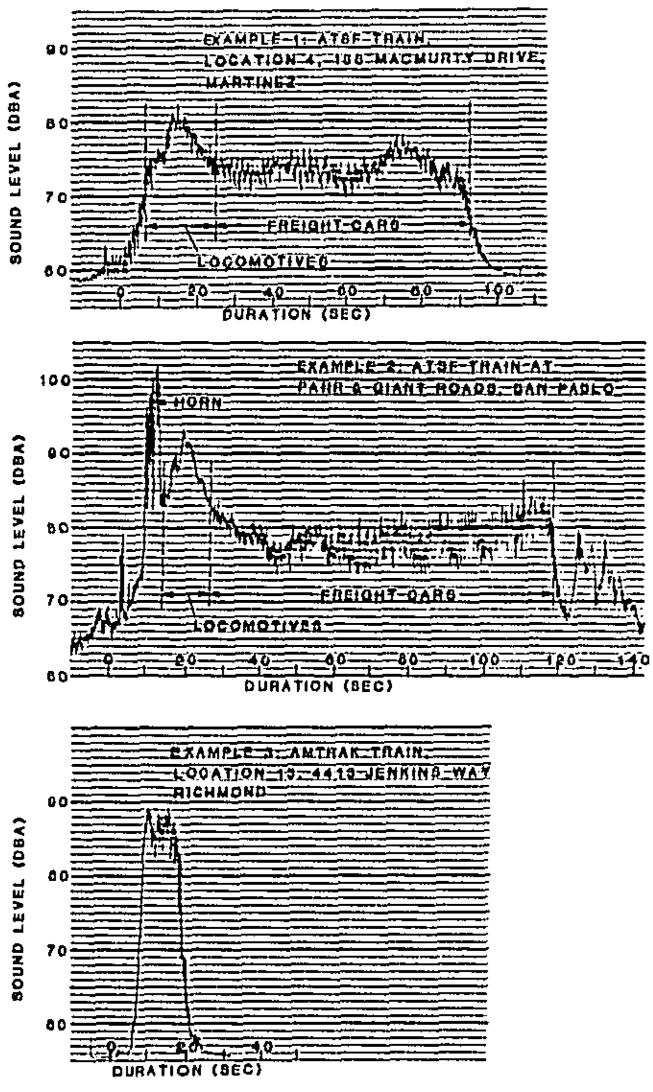


Figure 2. Example Time History of Train Pass-bys

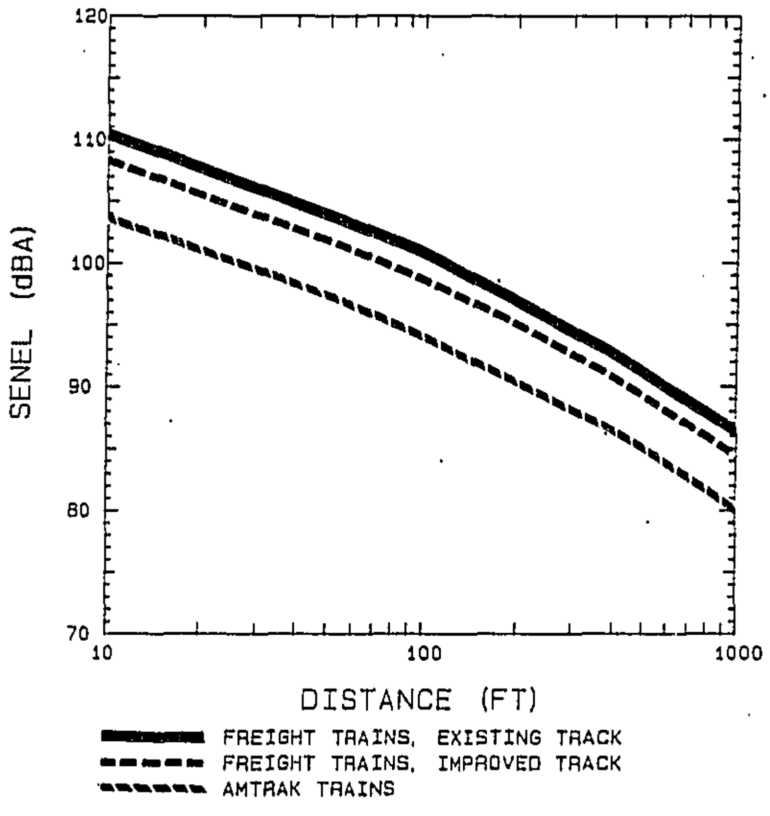


Figure 3. SENEL as a Function of Distance for Freight and Passenger Trains

5. NOISE ASSESSMENT

5.1 Dallas to Wylie

This rail line extends from downtown Dallas northeast approximately 23 miles to Wylie, Texas. The line starts in an industrial section of Dallas moving to mixed residential and agricultural land uses outside of the Dallas area. There are a large number of residential units close enough to the rail line to be affected by train noise.

The line presently carries one Santa Fe train daily and is projected to carry five Santa Fe/Southern Pacific trains following the merger. In addition it presently carries four trackage rights trains per day. The trackage rights trains will not be affected by the merger. With the merger plan the total number of trains on this line is projected to be 9 trains per day compared to the present 5 trains per day. Assuming that the future train consists will similar to existing train consists, this increase in traffic is expected to increase the L_{dn} by 2 to 3 dBA on property abutting the right-of-way.

The conclusion is that the increase in the train traffic will result in a minimal increase in the noise impact to the communities along this line.

5.2 Mobest to Phoenix

The Mobest to Phoenix section of concern is a three mile segment presently used by local trains interchanging cars between the SPT and ATSF yards. In the future it is projected that this corridor will carry six more trains per day. Most of the land near the railroad right-of-way in this area is used for industrial or light commercial activities. The principal noise sensitive land use consists of approximately 10 single family houses that are about 200 ft from the track. The railroad track separates the houses from a heavily-traveled, divided road.

The trains using this track segment operate at low speeds and power settings. As such, the noise from the trains is unlikely to exceed an L_{dn} of 65 dBA at any of the residential units. The noise from traffic on the surface streets will probably exceed that of the trains. The conclusion of our site investigation is that the noise impact in this area due to the increased rail traffic will be minimal.

5.3 Warm Springs to San Jose

The Warm Springs to San Jose track segment is expected to experience an increase in rail traffic because of shipments to and from the General Motors-Toyota plant at Warm Springs. Considering the number of residential units that will be affected, only 11 were found to be within 200 ft of the track in the Environmental Assessment, and with the low train speeds and power settings, the increase in the noise impact is judged to be minimal.

5.4 Richmond to Lathrop

The Richmond to Lathrop corridor was identified in the environmental assessment as one of the major areas of noise impact following the proposed merger of SPT and ATSF operations. Figure 1 is a regional map of the corridor. As can be seen on this figure, the SPT and ATSF lines are roughly parallel in this corridor. The study area begins in Richmond. The lines are close together through Richmond, Pinole and Rodeo. In Hercules, the lines diverge with the ATSF tracks taking a route through the hills to Franklin Canyon in Southern Martinez and the SPT line continuing to follow the waterfront. The lines again join near Port Chicago and are roughly parallel through Pittsburg and Antioch. In Oakley, the lines diverge with the ATSF tracks heading due east towards Stockton and the SPT line going southeast to Tracy and Lathrop.

5.4.1 Existing and Future Levels of Rail Traffic

With the proposed operations plan, most of the traffic will be on the existing SPT lines. The ATSF lines would be used only for local traffic and, in some areas, Amtrak trains. To evaluate the noise impact of the operations merger, we have developed noise assessments for four different operations scenarios:

Case 1. Existing Condition: Noise levels based on the 1985 average train traffic. Since the train traffic during our measurements did not correspond to the yearly average, the measurements were used to calibrate the prediction procedure. The noise levels with the existing average levels of rail traffic are based on projections.

Case 2. 1986 Operations Plan: Noise level projections are based on 110% of the updated operations plan. For this scenario the analysis included the Amtrak trains on both the SPT Mococo line and the ATSF Delta line.

Case 3. 1984 SPT-ATSF Merged Operations Plan: This scenario uses the traffic from the applicant's 1984 block plan. As for Case 2, the noise analysis considered the Amtrak trains on both the SPT Mococo line and the ATSF Delta line. This case was analyzed because it is the traffic level used for the Environmental Assessment of November 1985.

Case 4. Worst Case: This case bases the noise levels on the 1986 operations plan at 110%, and the proposed trackage rights of the Union Pacific and the Denver & Rio Grand Western. This is basically a worst case since it includes both a growth in traffic and trackage rights. The trackage rights primarily affect the SPT track segments between Richmond and the cut-off to Roseville east of Martinez. If only one trackage rights request is approved, the level of traffic would be approximately equal to that assumed for Case 3, the 1984 merger plan.

For the analysis we divided the SPT line into 10 segments and the ATSF line into 5 segments. The average traffic and train speed for each case outlined above was determined for both freight and passenger traffic. Tables 4 through 7 tabulate the assumptions used for the train traffic. The basic assumptions are:

Train Length: The lengths of the trains for Case 1, Existing Traffic, were based on observations during the two week field survey. The average train lengths used in the Case 1 projections were 3600 ft for the SPT trains and 2000 ft for the ATSF trains. The projections for the future noise levels used 3600 ft length trains, which is significantly shorter than the 5000 ft train length used for the analysis of the Environmental Assessment. The 3600 ft long train is more representative of the length of trains in the Richmond - Lathrop corridor.

Number of Locomotives: The number of locomotives pulling a train can have a strong effect on the overall noise level. For Cases 1 and 3, we assumed an average of 3 locomotives for each train. This is consistent with the number of locomotives observed during the field survey and the 1984 block plan. For the most likely case, Case 2, and the worst case, Case 4, we used an average of 3.5 locomotives.

Welded Track: Most of the existing SPT and ATSF track in the Richmond - Lathrop corridor is jointed. For the future projections of Cases 2, 3 and 4, we have assumed that the jointed track will be replaced with welded track on the SPT line and that the freight car noise levels will be 3 dBA lower than presently exists.

In all cases we combined the freight train and Amtrak trains in the projections of CNEL. There were very few locations where the Amtrak trains add significantly to the CNEL. Typically, the Amtrak trains increase the CNEL by less than 0.5 dB.

5.4.2 Noise Projections

The levels of train traffic outlined in Tables 4 through 7 were used to develop projections of CNEL for the entire Richmond - Lathrop corridor. The following projections were generated:

1. The CNEL at 100 ft distance from the track assuming no

shielding. The results of this analysis are summarized in Table 8.

2. The distance from the track to the CNEL 65 and 75 dBA contours. The CNEL 55 dBA contour was not included in the calculation since the field survey showed that the ambient noise level exclusive of the trains exceeds 55 dBA in most of the corridor. It also was assumed that non-railroad noise adds at least 1 dBA to the 65 dBA CNEL contour at all locations, and therefore, the train noise contribution is actually 64 dBA at the 65 dBA contour distance. The distances to the contours are summarized in Table 9.

3. The distance to the CNEL 65 and 75 dBA contours with 5 dBA of attenuation due to shielding, the amount of shielding that has been assumed for a single row of houses between the track and the receiver. These distances also are summarized in Table 9.

The general noise impact of the three different rail traffic scenarios can be understood from the results in Table 9. A common rule of thumb is that an increase in the ambient noise level that is less than 3 dBA is unlikely to be noticed, an increase of 5 dBA or more will be noticed and is likely to be annoying to some residents, and an increase of 10 dBA or more is likely to be annoying to many residents.

For this general analysis, the corridor can be divided into five segments: (1) SPT line from Richmond to Martinez, (2) SPT line from Martinez to Tracy, (3) SPT line from Tracy to Lathrop, (4) ATSF line from Richmond to Pittsburg, and (5) ATSF line from Pittsburg to Knightsen. The train noise level increase in each segment is discussed below:

SPT-Richmond to Martinez: For Cases 2 and 3 the noise level increase in this area will be marginal at 2 to 4 dBA. With the worst case trackage rights of Case 4, the projected noise level increase of 5 to 6 dBA would be sufficient to expect some noise-related complaints. If only one of the trackage rights requests are granted, the noise level increase will be approximately 3 dBA.

SPT-Martinez to Tracy: For all three of the future cases the noise level increase along this segment will be significant, ranging from +5 to +8 dBA.

SPT-Tracy to Lathrop: For the most likely train traffic levels of Cases 2 and 4, the noise level increase is projected to be a marginal +2 dBA. A greater increase (+4 dBA) has been projected for Case 3, primarily due to a larger number of evening and nighttime trains.

ATSF-Richmond to Pittsburg: For Cases 2, 3 and 4, the train traffic will be removed from this segment eliminating the trains as an adverse noise impact.

ATSF-Pittsburg to Knightsen: This segment is projected to carry only Amtrak trains. As a result, future noise levels will decrease 5 to 11 dBA.

5.4.3 Noise Sensitive Land Uses Affected by Train Noise

The distances to the contours in Table 9 were used to draw noise contours on aerial photographs of the Richmond - Lathrop corridor at a scale of 400 ft/in. for the purpose of counting the number of noise sensitive receptors affected. The contours have been transferred from the 400 ft/in. scale aerial photographs to 600 ft/in. scale base maps that were obtained from Contra Costa and San Joaquin Counties. These drawings are reproduced in Appendix B, which is bound separately. The contours shown in Appendix B reflect continuation of rail traffic on the ATSF line as a "worst case" condition. Because this would not coincide with the projected increase in rail traffic on the SPT line for Case 4, the buildings located along the ASTF line outside of the Case 2 contours were not included in the Case 4 inventory.

The contours include the effect of shielding by buildings and terrain and the noise from major roads (based on our measurements). In most cases, the shielding by the first row of houses prevents the contour from reaching the second row of houses. Road noise was found to be particularly significant in the Brentwood to Tracy area where the SPT tracks parallel State Routes 4 and J4. Referring to Map 38 in Appendix B for example, because of the noise from State Route 4 the contours on the west side of the tracks are closer in than the contours on the east side.

The count of residences within the CNEL 65 dBA contour for each case is summarized in Table 10. Each of the areas where there is a significant change in the number of residences affected is discussed below:

Point Pinole to Hercules: There are a number of single family houses that are adjacent to the SPT tracks in this area. With the increase in rail traffic, the number of houses within the 65 dBA contour is projected to increase from 27 to 49 for Case 2 and 69 for Case 4. This area also includes the Seaview School which is located between the SPT and ATSF tracks. For all of the cases, the school is projected to stay within the 65 dBA contour. On the positive side, elimination of traffic on the ATSF line will reduce the number of residences exposed to CNEL above 65 dBA by 178 along this line.

Crockett/Port Costa: A number of residences in Crockett and Port Costa are close enough to the tracks to be affected by the railroad noise. The number within the 65 dBA contour is projected to stay the same except for the Worst Case, Case 4. The level of train traffic in Case 4 is sufficient to just encompass a new set of houses within the 65 dBA contour.

Pittsburg: In Pittsburg, the traffic along the SPT tracks is projected to increase from an average of 2 to an average of over 15 trains per day. The are a number of residential properties that abut the SPT tracks that will be affected by the increase in noise level. The total number within the 65 dBA contour is projected to increase from 37 to 152. The noise level increase will also put part of the grounds of Pittsburg's Central Junior High School within the 65 dBA contour. None of the school buildings are within the projected contour. For the future cases, removing the train traffic from the ATSF tracks will reduce the noise levels at a number of houses in Pittsburg. The total number near the ATSF tracks within the 65 dBA contour is projected to decrease from 109 to 12. As a result, the total number of homes in Pittsburg within the 65 dBA contour is expected to increase from 146 to 164.

Antioch: The situation along the SPT line in Antioch is very similar to that in Pittsburg. The train traffic on the SPT line is projected to increase from an existing level of 2 trains to a future level of 15 trains per day. This is projected to put 164 residences that abut the right-of-way within the 65 dBA contour. Because there are relatively few residences in Antioch that are affected by the noise from the existing ATSF trains, there will not be a significant noise benefit due to the removal of traffic from the ATSF tracks.

Brentwood: Brentwood is projected to experience a 7 to 8 dBA increase in CNEL with the future train traffic. For Cases 2 and 4 this noise level increase is projected to increase the number of residences within the 65 dBA contour from 20 to 30, a relatively moderate increase. For Case 3, changes in the day/evening/night distribution move the projected CNEL 65 dBA contour out just far enough to include a large group of houses. Hence, even though the difference in noise level between Cases 2 and 3 is only 1 dBA, the number of houses within the 65 dBA contour is 30 for Case 2 and 80 for Case 3.

Byron to Tracy: In the relatively rural area from Byron to the outskirts of Tracy, the number of residences within the 65 dBA contour is projected to increase from an existing number of 17 to over 50 in the future. Most of these are on the outskirts of Tracy and are also affected by highway noise.

Tracy: The number of trains that go through Tracy is projected to increase from an existing number of 2 per day to a future level of just over 15 per day. In addition, the large curve in Tracy will be rebuilt reducing the radius but moving the tracks closer to some residences. Reducing the curve radius will reduce the incidence of wheel squeal as trains enter and leave Tracy. The total number of residences within the 65 dBA contour is projected to go from zero now to over 80 with the new levels of train traffic.

Referring to the subtotal and total lines of Table 10, the effect of the changes in operations is a significant increase in the noise impact along the SPT lines and a virtual elimination of the train related noise impact along the ATSF lines. The total number of houses within the CNEL 65 dBA contour decreases slightly for the traffic levels of Case 2 and increases slightly for the traffic projections of Case 3 and 4.

Residential dwellings represent the major noise sensitive land use that is affected by the trains in the Richmond - Lathrop corridor. We also have identified seven schools, which are impacted by the train noise. The schools, and the impact for each case analyzed are summarized in Table 11. Most of the school buildings are far enough from the tracks to be outside the 65 dBA CNEL contour for all four cases. The primary exception is the Sea View Elementary School which is located between the ATSF and SPT tracks in Pinole. This school building is within the 65 dBA contour for all four cases. The only other exception is the Bay Vista Elementary School in Rodeo. At this location, the school building is within the 65 dBA contour for the worst case scenario only (Case 4).

5.4.4 Impact of Warning Horns and Crossing Gate Bells

The noise from warning horn and crossing gate bells can be a major source of community noise near rail lines. To illustrate the effect that these noises have on the CNEL in a residential area near a crossing, we have analyzed one crossing gate area in detail. The crossing selected is Railroad Avenue at the SPT tracks in Pittsburg. We developed estimates of the CNEL at the crossing with and without the noise from the warning horns using the levels of train traffic from Case 2, the most likely future case.

To estimate the noise levels due to the horns, we modeled the train horns as moving point sources. Based on our field observations, we assumed that the horn blowing starts at 750 ft from the crossing and continues in an intermittent manner until the crossing is reached. (There are signals for the engineers to start blowing the horn when they are 1/4 mile from the crossing; our observation was that the horn was not usually sounded until 1/8 mile before the crossing.) The horns have a maximum level of 105 dBA at a distance of 100 ft; however, we observed that they are not usually blown at full power. To account for the less than full power horn blasts, we assumed a maximum level of 100 dBA at a distance of 100 ft. These procedures give a reasonable estimate of the SENEL for a typical horn blast; however, there is a wide variation in the manner in which the horns are blown.

Figure 4 illustrates the CNEL 65 dBA contours with and without the horn noise. The horn noise causes a significant bulging in the contours at Railroad Avenue. The bulge is non-symmetrical because of the shielding provided by the buildings to the northwest and southeast of the crossing. The effect of the horn noise is localized to about 1000 ft on either side of the crossing. This crossing was selected for analysi since there are single family houses that are affected by the horn noise. The analysis shows an increase of 7 houses within the 65 dBA CNEL contour when the horn noise is included.

We also looked at the effect of the warning bells on the overall noise exposure. The warning bells create noise levels between 70 and 75 dBA at 100 ft from the crossing. This is sufficient to signal that a train is coming; however, the noise does not add measurably to the noise exposure levels. The acoustic energy from the bell noise is at least 10 dBA less than that from a typical freight train or the warning horn.

Table 4. Train Assumptions, Case 1, Existing Traffic
(F = Freight train, A = Amtrak train)

TRACK SEGMENT	NUMBER OF TRAINS Day	Eve.	Night	LENGTH (ft)	NUMBER OF LOCOS.	SPEED (mph)	
SPT TRACKS							
1. S. RICHMOND-	4.4	1.0	4.4	3600	3	60	F
RICHMOND	6.0	2.0	0.0	640	1.5	60	A
2. RICHMOND-	3.6	0.8	3.6	3600	3	60	F
W. PINOLE	6.0	2.0	0.0	640	1.5	60	A
3. W. PINOLE-	3.6	0.8	3.6	3600	3	40	F
W. MARTINEZ	6.0	2.0	0.0	640	1.5	40	A
4. W. MARTINEZ-	5.8	1.9	5.2	3600	3	30	F
E. MARTINEZ	6.0	2.0	0.0	640	1.5	30	A
5. E. MARTINEZ-	2.0	0.4	1.3	3600	3	40	F
PORT CHICAGO	3.0	1.0	0.0	425	1	40	A
6. PORT CHICAGO- W. PITTSBURG	1.0	0.2	0.7	3600	3	40	F
7. W. PITTSBURG- E. PITTSBURG	1.0	0.2	0.7	3600	3	40	F
8. E. PITTSBURG- W. TRACY	1.0	0.2	0.7	3600	3	40	F
9. W. TRACY- E. TRACY	1.0	0.2	0.7	3600	3	20	F
10. E TRACY- LATHROP	3.4	0.6	2.2	3600	3	40	F
ATSF TRACKS							
11. RICHMOND- W. PINOLE	5.3	1.3	6.7	2000	3	55	F
12. W. PINOLE- E. MARTINEZ	5.3	1.3	6.7	2000	3	35	F
13. E. MARTINEZ- PORT CHICAGO	5.3	1.3	6.7	2000	3	45	F
14. PORT CHICAGO-	11.3	1.9	5.6	2000	3	45	F
E. ANTIOCH	3.0	1.0	0.0	425	1	45	A
15. E. ANTIOCH-	5.3	1.3	6.7	2000	3	55	F
STOCKTON	3.0	1.0	0.0	435	1	79	A

Table 5. Train Assumptions, Case 2, 1986 Operating Plan
(F = Freight train, A = Amtrak train)

TRACK SEGMENT	NUMBER OF TRAINS Day	Eve.	Night	LENGTH (ft)	NUMBER OF LOCOS.	SPEED (mph)	
SPT TRACKS							
1. S. RICHMOND-	6.4	0.8	8.8	3600	3.5	60	F
RICHMOND	6.0	2.0	0.0	640	1.5	60	A
2. RICHMOND-	7.3	0.9	10.0	3600	3.5	60	F
W. PINOLE	6.0	2.0	0.0	640	1.5	60	A
3. W. PINOLE-	7.3	0.9	10.0	3600	3.5	40	F
W. MARTINEZ	6.0	2.0	0.0	640	1.5	40	A
4. W. MARTINEZ-	10.7	1.2	11.9	3600	3.5	30	F
E. MARTINEZ	6.0	2.0	0.0	640	1.5	30	A
5. E. MARTINEZ-	10.7	0.0	4.6	3600	3.5	60	F
PORT CHICAGO	3.0	1.0	0.0	425	1	60	A
6. PORT CHICAGO-	10.7	0.0	4.6	3600	3.5	60	F
W. PITTSBURG	3.0	1.0	0.0	425	1	60	A
7. W. PITTSBURG-	10.7	0.0	4.6	3600	3.5	45	F
E. PITTSBURG	3.0	1.0	0.0	425	1	45	A
8. E. PITTSBURG-	10.7	0.0	4.6	3600	3.5	70	F
W. TRACY	3.0	1.0	0.0	425	1	79	A
9. W. TRACY-	10.7	0.0	4.6	3600	3.5	35	F
E. TRACY	2.0	2.0	0.0	425	1	35	A
10. E TRACY-	10.7	0.0	4.6	3600	3.5	70	F
LATHROP	2.0	2.0	0.0	425	1	79	A
ATSF TRACKS							
11. RICHMOND- W. PINOLE	--	--	--	--	--	--	
12. W. PINOLE- E. MARTINEZ	--	--	--	--	--	--	
13. E. MARTINEZ- PORT CHICAGO	--	--	--	--	--	--	
14. PORT CHICAGO-	3.2	0.5	1.6	3600	3.5	45	F
E. ANTIOCH	3.0	1.0	0.0	425	1	45	A
15. E. ANTIOCH-	0.6	0.1	0.3	3600	3.5	55	F
STOCKTON	3.0	1.0	0.0	425	1	79	A

Table 6. Train Assumptions, Case 3, 1984 Merger Plan
(F = Freight train, A = Amtrak train)

TRACK SEGMENT	NUMBER OF TRAINS Day	Eve.	Night	LENGTH (ft)	NUMBER OF LOCOS.	SPEED (mph)	
SPT TRACKS							
1. S. RICHMOND-	8.3	2.0	12.0	3600	3	60	F
RICHMOND	6.0	2.0	0	640	1.5	60	A
2. RICHMOND-	8.3	2.0	12.1	3600	3	60	F
W. PINOLE	6.0	2.0	0.0	640	1.5	60	A
3. W. PINOLE-	8.3	2.0	12.1	3600	3	40	F
W. MARTINEZ	6.0	2.0	0.0	640	1.5	40	A
4. W. MARTINEZ-	10.5	1.2	11.7	3600	3	30	F
E. MARTINEZ	6.0	2.0	0.0	640	1.5	30	A
5. E. MARTINEZ-	6.6	1.6	6.7	3600	3	60	F
PORT CHICAGO	3.0	1.0	0.0	425	1	60	A
6. PORT CHICAGO-	6.6	1.6	6.7	3600	3	60	F
W. PITTSBURG	3.0	1.0	0.0	425	1	60	A
7. W. PITTSBURG-	6.6	1.6	6.7	3600	3	45	F
E. PITTSBURG	3.0	1.0	0.0	425	1	45	A
8. E. PITTSBURG-	6.6	1.6	6.7	3600	3	70	F
W. TRACY	3.0	1.0	0.0	425	1	79	A
9. W. TRACY-	6.6	1.6	6.7	3600	3	35	F
E. TRACY	2.0	2.0	0.0	425	1	35	A
10. E TRACY-	7.4	1.9	7.6	3600	3	70	F
LATHROP	2.0	2.0	0.0	425	1	79	A
ATSF TRACKS							
11. RICHMOND- W. PINOLE	--	--	--	--	--	--	
12. W. PINOLE- E. MARTINEZ	--	--	--	--	--	--	
13. E. MARTINEZ- PORT CHICAGO	--	--	--	--	--	--	
14. PORT CHICAGO-	3.2	0.5	1.6	3600	3	45	F
E. ANTIOCH	3.0	1.0	0.0	425	1	45	A
15. E. ANTIOCH-	0.6	0.1	0.3	3600	3	55	F
STOCKTON	3.0	1.0	0.0	425	1	79	A

Table 7. Train Assumptions, Case 4, Worst Case With Trackage Rights
(F - Freight train, A - Amtrak train)

TRACK SEGMENT	NUMBER OF TRAINS Day	Eve.	Night	LENGTH (ft)	NUMBER OF LOCOS.	SPEED (mph)	
SPT TRACKS							
1. S. RICHMOND-	9.1	1.3	15.6	3600	3.5	60	F
RICHMOND	6.0	2.0	0.0	640	1.5	60	A
2. RICHMOND-	9.9	1.4	16.9	3600	3.5	60	F
W. PINOLE	6.0	2.0	0.0	640	1.5	60	A
3. W. PINOLE-	9.9	1.4	16.9	3600	3.5	40	F
W. MARTINEZ	6.0	2.0	0.0	640	1.5	40	A
4. W. MARTINEZ-	15.1	1.9	20.8	3600	3.5	30	F
E. MARTINEZ	6.0	2.0	0.0	640	1.5	30	A
5. E. MARTINEZ-	6.9	0.9	9.5	3600	3.5	60	F
PORT CHICAGO	3.0	1.0	0.0	425	1	60	A
6. PORT CHICAGO-	10.7	0.0	4.6	3600	3.5	60	F
W. PITTSBURG	3.0	1.0	0.0	425	1	60	A
7. W. PITTSBURG-	10.7	0.0	4.6	3600	3.5	45	F
E. PITTSBURG	3.0	1.0	0.0	425	1	45	A
8. E. PITTSBURG-	10.7	0.0	4.6	3600	3.5	70	F
W. TRACY	3.0	1.0	0.0	425	1	79	A
9. W. TRACY-	10.7	0.0	4.6	3600	3.5	35	F
E. TRACY	2.0	2.0	0.0	425	1	35	A
10. E TRACY-	10.7	0.0	4.6	3600	3.5	70	F
LATHROP	2.0	2.0	0.0	425	1	79	A
ATSF TRACKS							
11. RICHMOND- W. PINOLE	--	--	--	--	--	--	
12. W. PINOLE- E. MARTINEZ	--	--	--	--	--	--	
13. E. MARTINEZ- PORT CHICAGO	--	--	--	--	--	--	
14. PORT CHICAGO-	3.2	0.5	1.6	3600	3.5	45	F
E. ANTIOCH	3.0	1.0	0.0	425	1	45	A
15. E. ANTIOCH-	0.6	0.1	0.3	3600	3.5	55	F
STOCKTON	3.0	1.0	0.0	425	1	79	A

Table 8. Projected CNEL 100 ft From Track

TRACK SEGMENT	CNEL AT 100 FT* (dBA) CASE 1	CASE 2	CASE 3	CASE 4
SPT TRACKS				
RICHMOND - PT. PINOLE	68	70 (+2)	71 (+3)	73 (+5)
PT. PINOLE - HERCULES	68	70 (+2)	71 (+3)	73 (+5)
HERCULES - RODEO	67	70 (+3)	71 (+4)	72 (+5)
RODEO - C.S. BRIDGE	67	70 (+3)	71 (+4)	73 (+6)
CROCKETT/PORT COSTA	67	70 (+3)	71 (+4)	72 (+5)
MARTINEZ	69	71 (+2)	71 (+2)	74 (+5)
SHORE ACRES	63	68 (+5)	69 (+6)	70 (+7)
W. PITTSBURG	61	68 (+7)	69 (+8)	68 (+7)
PITTSBURG	61	67 (+6)	68 (+7)	67 (+6)
ANTIOCH	61	68 (+7)	69 (+8)	68 (+7)
NEW LOVE-BRENTWOOD	61	68 (+7)	69 (+8)	68 (+7)
BRENTWOOD	61	68 (+7)	69 (+8)	68 (+7)
BRENTWOOD - BYRON	61	68 (+7)	69 (+8)	68 (+7)
BYRON	61	68 (+7)	69 (+8)	68 (+7)
BYRON - TRACY	61	68 (+7)	69 (+8)	68 (+7)
TRACY	60	67 (+7)	68 (+8)	67 (+7)
TRACY - BANTA	66	68 (+2)	70 (+4)	68 (+2)
BANTA	66	68 (+2)	70 (+4)	68 (+2)
BANTA - LATHROP	66	68 (+2)	70 (+4)	68 (+2)
LATHROP	66	68 (+2)	70 (+4)	68 (+2)
ATSF TRACKS				
RICHMOND - PT. PINOLE	69	-- (**)	-- (**)	-- (**)
PT. PINOLE - HERCULES	69	-- (**)	-- (**)	-- (**)
HERCULES - ATSF TUNNEL	69	-- (**)	-- (**)	-- (**)
MARTINEZ	69	-- (**)	-- (**)	-- (**)
PITTSBURG	68	63 (-5)	63 (-5)	63 (-5)
ANTIOCH	68	63 (-5)	63 (-5)	63 (-5)
OAKLEY	68	57 (-11)	57 (-11)	57 (-11)
OAKLEY - KNIGHTSEN	68	57 (-11)	57 (-11)	57 (-11)
KNIGHTSEN	68	57 (-11)	57 (-11)	57 (-11)
KNIGHTSEN - CO. LINE	68	57 (-11)	57 (-11)	57 (-11)

*The number in parentheses represent the change in train noise relative to the existing condition (Case 1).

**Elimination of train traffic is expected to result in a 5-15 dBA reduction in overall noise level.

Table 9. Distances to the CNEL 65 dBA and 75 dBA Contours
(Numbers in parentheses include 5 db of shielding)

	DISTANCES FROM RAIL LINE IN FT							
	EXISTING		1986 PLAN		1984 PLAN		WORST CASE	
TRACK SEGMENT	65	75	65	75	65	75	65	75
SPT TRACKS								
1. S. RICHMOND- RICHMOND	255 (110)	30	280 (125)	30	350 (150)	40	430 (185)	55
2. S. RICHMOND- W. PINOLE	220 (95)	25	310 (135)	35	350 (150)	40	450 (195)	60
3. W. PINOLE- W. MARTINEZ	195 (75)	20	310 (130)	35	340 (140)	40	450 (190)	55
4. W. MARTINEZ- E. MARTINEZ	255 (105)	25	320 (160)	40	350 (140)	35	550 (240)	75
5. E. MARTINEZ- PORT CHICAGO	95 (30)	10	200 (75)	20	235 (100)	25	300 (125)	35
6. PORT CHICAGO- W. PITTSBURG	45 (15)	5	200 (75)	20	235 (100)	25	200 (75)	20
7. W. PITTSBURG- E. PITTSBURG	45 (15)	5	190 (70)	20	225 (90)	25	190 (70)	20
8. E. PITTSBURG- W. TRACY	45 (15)	5	200 (80)	20	250 (110)	25	200 (80)	20
9. W. TRACY- E. TRACY	40 (10)	5	200 (70)	15	230 (90)	20	190 (70)	15
10. E TRACY- LATHROP	130 (45)	10	210 (80)	20	270 (115)	30	200 (80)	20
ATSF TRACKS								
11. RICHMOND- W. PINOLE	240 (95)	25	--	--	--	--	--	--
12. W. PINOLE- E. MARTINEZ	230 (90)	20	--	--	--	--	--	--
13. E. MARTINEZ- PORT CHICAGO	230 (90)	20	--	--	--	--	--	--
14. PORT CHICAGO- E. ANTIOCH	230 (90)	25	80 (25)	5	75 (25)	5	245 (100)	25
15. E. ANTIOCH- STOCKTON	200 (75)	20	20 (5)	--	20 (5)	--	200 (75)	20

Table 10. Noise Impact Inventory of Dwelling Units

	NUMBER OF DWELLING UNITS WITHIN CNEL 65 dBA			
TRACK SEGMENT	CASE 1	CASE 2	CASE 3	CASE 4
SPT TRACKS				
RICHMOND - PT. PINOLE	43	47	56	60
PT. PINOLE - HERCULES	27	49	62	69
HERCULES - RODEO	0	0	0	5
RODEO - C.S. BRIDGE	10	14	14	32
CROCKETT/PORT COSTA	21	21	21	60
MARTINEZ	18	18	18	32
SHORE ACRES (SPT & ATSF)	24	13	21	24
W. PITTSBURG (SPT & ATSF)	13	4	8	20
PITTSBURG	37	152	152	152
ANTIOCH	0	164	164	164
NEW LOVE-BRENTWOOD	3	17	20*	17
BRENTWOOD	20	30	80*	30
BRENTWOOD - BYRON	0	6	6	6
BYRON	17	33	40*	33
BYRON - TRACY	17	52	60*	52
TRACY	0	81	98*	81
TRACY - BANTA	0	1	1	1
BANTA	7	15	26	15
BANTA - LATHROP	2	8	9	8
LATHROP	27	31	31	31
TOTAL, SPT TRACKS	286	756	887	892
ATSF TRACKS				
RICHMOND - PT. PINOLE	74	0	0	0
PT. PINOLE - HERCULES	178	0	0	0
HERCULES - ATSF TUNNEL	13	0	0	0
MARTINEZ	81	0	0	0
PITTSBURG	109	12	12	12
ANTIOCH	5	0	0	0
OAKLEY	15	0	0	0
OAKLEY - KNIGHTSEN	4	0	0	0
KNIGHTSEN	6	0	0	0
KNIGHTSEN - CO. LINE	8	0	0	0
TOTAL, ATSF TRACKS	493	12	12	12
COMBINED TOTAL	779	768	899	904

*Additional dwelling units affected due to difference in day/evening/night distribution compared with Cases 2 and 4.

Table 11. Summary of Noise Impact on Schools in the Richmond - Lathrop Corridor

TRACK SEGMENT	SCHOOL	DEGREE OF IMPACT*, CASE 1	2	3	4
SPT TRACKS					
PT. PINOLE - HERCULES	Seaview School	2	2	2	2
RODEO - C.S. BRIDGE	Bay Vista Elem. School	0	1	1	2
PITTSBURG	Central Jr High	0	1	1	1
ANTIOCH	Bidwell School	0	1	1	1
ATSF TRACKS					
SAN PABLO	Lake School	1	0	0	0
PITTSBURG	Marina School	1	0	0	0
KNIGHTSEN	Knightsen School	1	0	0	0

*Impact Ratings:

0 = CNEL 65 dBA contour does not include any of the school grounds or buildings

1 = CNEL 65 dBA contour includes at least part of the school grounds

2 = CNEL 65 dBA contour includes at least some of the school buildings

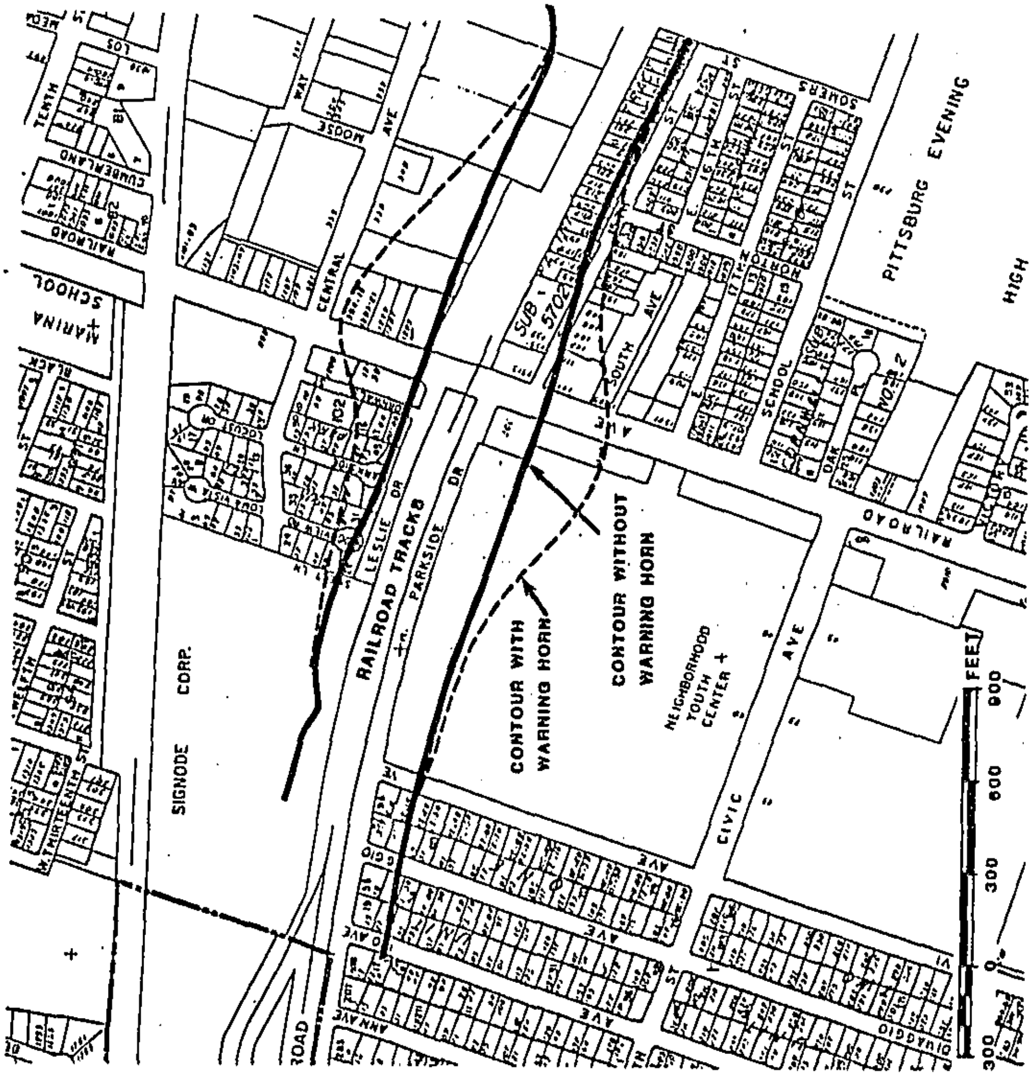


Figure 4. CNEL 65 dBA Contours with and without Including the Noise of the Warning Horn

6. NOISE MITIGATION

It is clear from the noise assessment in Section 5 that the proposed merger of SPT and ATSF operations in the Richmond-Lathrop corridor will increase the ambient noise level and the number of residences within the CNEL 65 dBA contour along some segments of the route. There is some balancing of this increase by the reduction in the number of residences along the ATSF tracks that will be impacted by train noise.

We have evaluated noise mitigation measures for all track segments where the CNEL for the worst-case scenario (Case 4) will increase by 5 dBA or more with respect to existing conditions (Case 1), and the number of residences inside the CNEL 65 dBA contour will increase by more than 25 units. We have thereby identified four SPT track segments where noise mitigation will result in the greatest benefit. The segments are Point Pinole to Hercules, and the track sections through Pittsburg, Antioch and Tracy.

6.1 Noise Mitigation Options

As for any noise problem, potential noise control options include (1) reduction of the noise at the source, (2) control of the noise propagation path and (3) control of noise at the receiver (i.e. sensitive receptor). In general, noise control at the source is the most desirable approach, followed by path control. Noise control at the receiver is least desirable, and is often not a feasible approach. In the case of the proposed merger, there are relatively few practical options available for controlling noise from freight and passenger trains. Some of the general means are discussed below.

1. Noise control at the source. Noise control at the source can be achieved by both physical and operational modifications. The former method requires modifying either the locomotives and cars to create less noise or modifying the rail and track bed to reduce noise. The proposed operations merger includes upgrading the SPT track to continuously welded rail. This will reduce the noise of the freight cars by a noticeable amount. The reduction has been included in the projections. Modifying the locomotives and freight cars to reduce noise is an impractical approach since the entire fleet would need to be refurbished to reduce the noise.

   Operational modifications for noise control include reducing the number of evening and nighttime operations, and operating at reduced speeds. The first of these is not expected to be a practical option for the railroads while the second will provide very little benefit and is therefore not recommended.

2. Path noise control. The most practical way of controlling the noise impact is by installing wayside noise barriers along the railroad right-of-way. Barriers are widely used in California to protect new

residential developments from highway noise and, to a lesser degree, from railroad noise. An example is the barrier along the northeast corner of the residential development next to the ATSF tracks in Oakley at Teakwood Drive.

In order to be effective at reducing the locomotive exhaust and fan noise, a sound barrier must be at least 12 ft above top-of-rail height. Depending on the specific topography, this usually means that the barrier must be 13 to 15 feet high in order to provide a 5-10 dBA noise reduction. Furthermore, if parallel barriers are required to protect residences on both sides of the rail line, noise reflection between the barriers can seriously degrade their acoustical performance. Noise reflection between a single barrier and the sides of passing rail cars can similarly degrade the barrier acoustical performance. In order to avoid this problem, such barriers may need to be treated on their inner surfaces with sound-absorptive material, or be angled back (away from the tracks) at least 5 degrees from the vertical. Another limitation of wayside barriers is that they cannot extend over grade crossings or turnouts.

3. Noise control at the receiver. Noise control at the receiver could include treatments such as residential window improvements, construction of noise barriers around residences and the purchase of noise-impacted property. None of these are expected to be feasible options for the railroads.

6.2 Recommended Mitigation Measures

The residential areas along the four track segments have been evaluated to determine practical noise control measures. In all cases, reducing the number of trains in the nighttime hours will reduce the CNEL. A 6 to 7 dBA reduction will be achieved if there are no nighttime operations. Cutting the nighttime operations by a factor of 2 will reduce the CNEL by 2 dBA. The conclusion is that mitigating the noise impact by reducing the number of nighttime operations will require virtual elimination of nighttime operations. It is unlikely that this is a viable option for the railroad.

The most practical noise control option is expected to be the installation of sound barriers along the railroad right-of-way. As discussed in Section 6.1, to effectively control the locomotive noise requires that the barriers extend at least 12 ft above the top-of-rail. We have developed preliminary noise control recommendations for each of the four track segments identified as candidates for noise control. These segments are limited to locations at which the construction of noise barriers is feasible, and where such barriers can provide significant benefit. The following paragraphs discuss noise control for each track segment:

1. Pt. Pinole-Hercules. The greatest noise impact along this segment, in terms of both severity and number of people affected, is expected to

occur in the vicinity of Cypress Avenue near the Sea View School. The 3200 ft-long noise barrier indicated in Figure 4 is intended to minimize noise impact at residences along this street as well as at the school itself. The best location to end the barrier on the eastern end depends on the local topography. Cypress Avenue goes up a slight incline east of the Sea View School and the SPT tracks stay level. At some point, the terrain starts to shield the houses from the railroad tracks. There is no need to continue the barrier beyond this point.

The increase in the CNEL along this corridor is projected to be 2 to 5 dBA, depending on the trackage rights that are granted. Without the trackage rights, the noise level will increase less than 3 dBA, an amount that is not generally considered a significant increase in the noise impact. This is an area where it will be particularly important to work with the community if the noise barrier option is selected. It is likely that many residents on Cypress Avenue will oppose a barrier since the barrier would block their view of the Bay.

2. Pittsburg. Figure 5 indicates noise barrier segments 2200, 1000 and 3400 ft long, located to minimize noise impact on the south side of the SPT line through Pittsburg. Barriers on the north side of the rail line are not recommended due to their limited benefit. For example, the overall noise reduction for the residences along Fourteenth St. would be limited by the noise from traffic on Fourteenth Street and in the area west of Railroad Avenue, only three residences are impacted. Therefore, noise barriers at these two locations would not provide significant benefit.

3. Antioch. Figures 6 and 7 indicate locations for noise barrier segments, 1400, 2200, 4200 and 2400 ft long, that will minimize noise impact on both sides of the SPT line in Antioch. Barriers are not recommended between A Street and L Street where the rail line is in cut. This depressed configuration already provides shielding to the residences in this area. In addition, construction of such a barrier would be likely to require the acquisition of additional right-of-way.

4. Tracy. Figure 8 indicates locations for barriers to control the increase in noise levels at nearby residences in Tracy. The three noise barrier segments are 2200, 900 and 2400 ft long.

In addition to residential areas, we have also investigated noise mitigation for schools. As discussed above, the approximately 3200 ft-long noise barrier shown in Figure 4 would serve to mitigate noise impact at the Sea View School. The only other school building that might be exposed to a CNEL above 65 dBA is the Bay Vista Elementary School in Rodeo; noise impact at this building is anticipated for the worst case scenario only (Case 4). However, a noise barrier along the rail line in this area would not be expected to provide significant reduction in overall noise at the school due to traffic noise from San Pablo Avenue which runs between the rail line and the school.

6.3 Comparison of Noise Impact With and Without Noise Mitigation

The benefits anticipated from the noise mitigation discussed above are summarized in Tables 12 and 13 in terms of the number of residences within the 65 dBA CNEL contour. Table 12 provides results for the segments where barriers have been suggested, and Table 13 indicates the results on a corridor-wide basis.

The conclusion from these results is that sound barriers can effectively control the impact from the increased train traffic along the SPT tracks. The number of residences exposed to a CNEL above 65 dBA would be reduced by 358, 384 and 352 for Cases 2, 3 and 4, respectively, by incorporation of the recommended barriers.

Compared with existing conditions, the total number of residences within the CNEL 65 dBA contour will decrease by 393 and 288 (49 and 36 percent) for the 1986 and 1984 operating plans (Cases 2 and 3), respectively, with inclusion of the recommended barriers. For the worst case with trackage rights (Case 4), the total number of impacted residences will increase by 263 (33 percent). A very rough rule-of-thumb for the cost of sound barriers is $15/sq. ft. For a 12 ft barrier, this translates to $180 per linear foot of barrier. Using this estimate of the cost, the costs and benefits for the barriers for the four sections are as follows:

LOCATION	LENGTH (ft)	COST	NUMBER OF HOUSES			COST PER RESIDENCE		
			Case 2	Case 3	Case 4	Case 2	Case 3	Case 4
Pinole	3,200	$ 580,000	41	42	35	$14,000	$14,000	$16,000
Pittsburg	6,600	1,200,000	112	112	112	11,000	11,000	11,000
Antioch	10,200	1,850,000	132	132	132	14,000	14,000	14,000
Tracy	5,500	1,000,000	73	88	73	14,000	11,000	14,000
	======	==========						
TOTAL	25,500	$4,630,000						

The cost per house protected is somewhat high, typically in the range of $14,000 per residence. That is the cost per residence removed from the 65 dBA CNEL contour by the noise control measures. The noise control also will benefit many other residences that are not projected to be within the 65 dBA contour.

Table 12. Change in Number of Residences Within CNEL 65 dBA Contour with Noise Control

	NUMBER OF DWELLING UNITS WITHIN CNEL 65 dBA			
LOCATION	CASE 1	CASE 2	CASE 3	CASE 4
WITHOUT NOISE CONTROL				
PT. PINOLE - HERCULES	27	49	62	69
PITTSBURG	37	152	152	152
ANTIOCH	0	164	164	164
TRACY	0	81	98	81
TOTAL, WITHOUT BARRIERS	64	446	476	466
WITH NOISE CONTROL				
PT. PINOLE - HERCULES	--	8	10	34
PITTSBURG	--	40	40	40
ANTIOCH	--	32	32	32
TRACY	--	8	10	8
TOTAL, WITH BARRIERS	--	88	92	114

Table 13. Summary of Number of Residences Within CNEL 65 dBA Contour With and Without Sound Barriers

	TOTAL NUMBER OF RESIDENCES		
	SPT	ATSF	TOTAL
Case 1: Existing	286	493	779
WITHOUT SOUND BARRIERS			
Case 2: 1986 Plan	756	12	768
Case 3: 1984 Plan	887	12	899
Case 4: Worst Case	892	12	904
WITH SOUND BARRIERS			
Case 2: 1986 Plan	398	12	410
Case 3: 1984 Plan	503	12	515
Case 4: Worst Case	540	12	552

	PERCENT CHANGE IN NUMBER OF RESIDENCES		
	SPT	ATSF	TOTAL
WITHOUT SOUND BARRIERS			
Case 2: 1986 Plan	164%	-98%	-1%
Case 3: 1984 Plan	210%	-98%	15%
Case 4: Worst Case	212%	-98%	16%
WITH SOUND BARRIERS			
Case 2: 1986 Plan	39%	-98%	-47%
Case 3: 1984 Plan	76%	-98%	-34%
Case 4: Worst Case	89%	-98%	-29%

7. VIBRATION ASSESSMENT

The 1 November 1985 environmental assessment for the proposed merger indicated that there is some concern with regard to the effects of vibration from increased train traffic on a number of officially designated historic structures in the City of Tracy, CA. These structures are located in the local historic district, just north of the proposed new rail connection. Construction of the new connection will result in train operations as close as 200 feet from the nearest National Register building (the West Side Bank building, located on W. 6th Street).

7.1 Vibration Damage Criteria

Under some circumstances, buildings can be damaged by severe or prolonged ground vibration caused by earthquakes, dynamite blasting and the like. If exposed to extremely high levels of ground vibration from such sources, a building may suffer "major damage," such as serious structural damage, glass breakage, and serious plaster cracking. For lower levels of vibration, naturally-occurring stress concentrations may be triggered to failure causing minor damage. This is typically characterized by fine plaster cracking and reopening of old cracks and is generally referred to as "architectural damage."

The U.S. Bureau of Mines has identified ground vibration levels that may produce damage in residential structures, and recommends a safe limit of 2.0 in./sec peak particle velocity [7.1]. A reassessment of the Bureau of Mines vibration data by Jackson [7.2] has determined that the threshold of architectural damage to buildings occurs at a peak particle velocity of 0.2 in./sec. In the case of historic buildings, the latter threshold is probably adequate as a simple level, but it may not account for long-term fatigue damage that could occur after many years of exposure to vibration. In view of this uncertainty, a peak ground vibration velocity of 0.08 in./sec is often applied as a conservative architectural damage criterion for historic structures, based on German Standard DIN 4150 [7.3]. This level is low enough that it is extremely unlikely that building damage of any sort will occur, particularly in areas where buildings are exposed to earthquake vibrations without sustaining significant damage.

7.2 Ground-borne Vibration From Trains

Vibration from railroad operations is generated by train-track interaction and is transmitted directly from the track to the underlying soil. The vibration propagates through the soil to adjacent buildings, resulting in vibration of the floors and walls. Parameters which affect building vibration from trains include train speed and weight, type of suspension system, wheel and rail conditions, soil and foundation characteristics and the building-to-track distance.

Recent measurements of ground vibration from SPT freight train operations in Los Angeles, CA [7.4] can be used to estimate the levels of train-induced ground vibration at the Tracy historic district. These data suggest a maximum root-mean-square (rms) ground vibration velocity of 0.003 in./sec at 200 feet from continuous welded rail track during a freight train pass-by at 20 mph. The levels of ground-borne vibration are expected to be higher at speeds above 20 mph. Using a conservative estimate that ground vibration level varies approximately in proportion to 20 log train speed [7.5], this corresponds to 0.005 in./sec (rms) at the proposed 35 mph train speed in Tracy. Assuming a peak-to-rms factor of three, the peak ground vibration velocity is estimated to be less than 0.015 in./sec at the nearest historic structure in Tracy. Even though this is a conservative estimate of the vibration level, it is well below the conservative threshold of architectural damage. The conclusion is that vibration induced damage is very unlikely from train operations near the Tracy historic district.

References

7.1 Nicholls, H.R., Johnson, C.F, and Duvall, W.I., "Blasting Vibrations and Their Effects on Structures," U.S. Bureau of Mines, Bulletin 656 (1971).

7.2 Jackson, M.W., "Threshold of Damage Due to Ground Motion," International Symposium on Wave Propagation and Dynamic Properties of Earth Materials, University of New Mexico, p. 961 (1967).

7.3 German Standards Institute, "Vibrations in Building Construction," Draft Revision of DIN 4150 (1971).

7.4 Saurenman, H.J., "Preliminary Analysis, Freight Train Vibration Measurements in the Mid-Corridor Section, Long Beach-Los Angeles Rail Transit Project," Harris Miller Miller & Hanson Inc. Technical Memorandum prepared for the Los Angeles County Transportation Commission (18 August 1985).

7.5 Kurzweil, L.G. and Lotz, R., "Prediction and Control of Noise and Vibration in Rail Transit Systems," U.S. Department of Transportation Urban Mass Transportation Administration, Report No. UMTA-MA-06-0025-78-8 (September 1978).

APPENDIX A: NOISE MEASUREMENT DATA

This appendix contains summaries of the measurement data obtained at the 21 measurement locations. Included for each site is the following information:

1. An hourly summary of the L_{eq}, L_1, L_{10}, L_{50}, and L_{90} through the 24 hour measurement period,

2. The hourly data graphed over the 24 hour period, and

3. A summary of the train SENEL's and the train parameters associated with each SENEL.

The continuous noise monitors were unattended for most of the measurements. Hence, it is not possible to positively associate each train with a specific SENEL. Other noises such as traffic, airplanes, construction noise, and home use of power tools can create SENEL's that are indistinguishable from trains. Identifying the trains was a particular problem at Location 9 in Pinole. Many people seem to use the railroad right-of-ways in this area for riding dirt bikes and other small off-road vehicles, most of which are poorly muffled. When we were at these sites we observed that the off-road vehicles created noise levels comparable to the railroad trains.

The train SENEL data were used to approximate the contribution of the train noise to the CNEL, L_{dn}, and $L_{eq}(24)$. All of the information used to estimate the "train only" noise levels and the noise level descriptors without the train noise is shown with the SENEL data.

Location 1, 545 Brackman Lane, Martinez

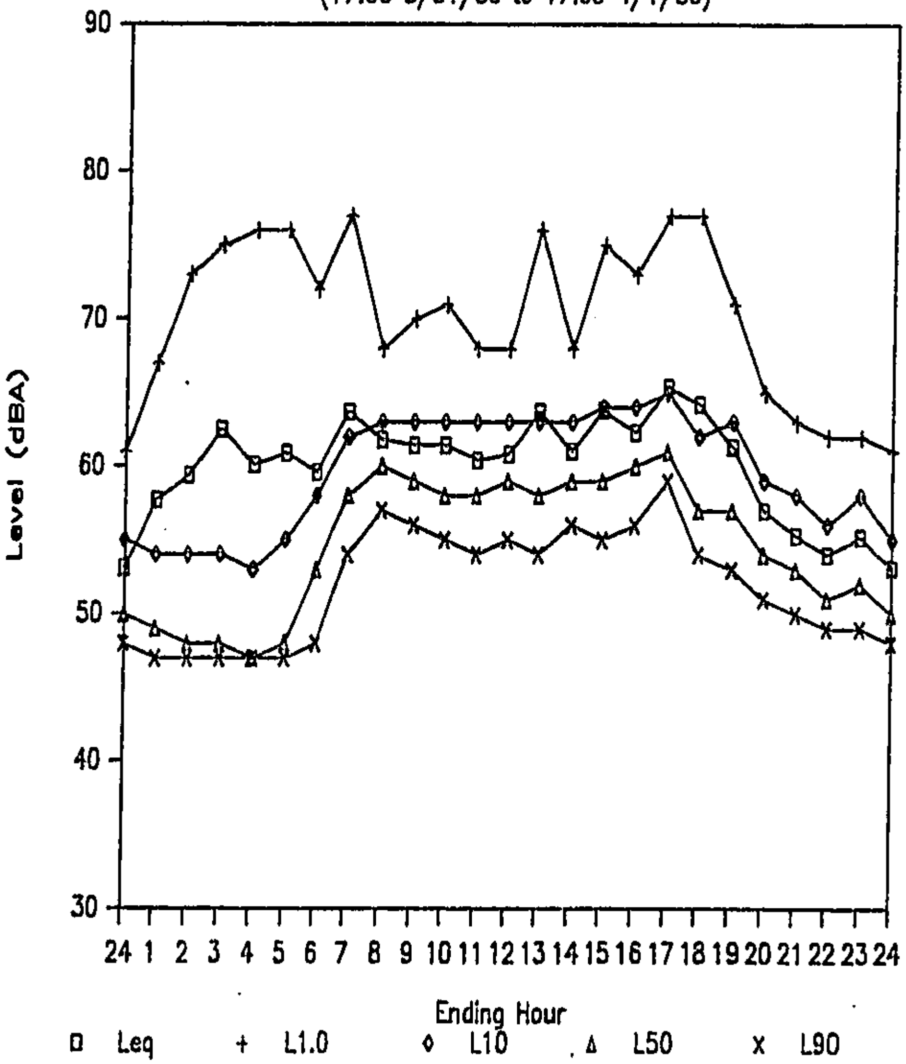
(Start 17:00, 3/31/86)

L_{dn}=66.8, CNEL=66.9
Leq(24)=61.3

Ending Hour	L_{eq}	L_1	L_{10}	L_{50}	L_{90}	Date
1	57.7	67	54	49	47	4/1/86
2	59.4	73	54	48	47	4/1/86
3	62.5	75	54	48	47	4/1/86
4	60.1	76	53	47	47	4/1/86
5	60.9	76	55	48	47	4/1/86
6	59.6	72	58	53	48	4/1/86
7	63.7	77	62	58	54	4/1/86
8	61.8	68	63	60	57	4/1/86
9	61.4	70	63	59	56	4/1/86
10	61.4	71	63	58	55	4/1/86
11	60.4	68	63	58	54	4/1/86
12	60.8	68	63	59	55	4/1/86
13	63.7	76	63	58	54	4/1/86
14	61.0	68	63	59	56	4/1/86
15	63.8	75	64	59	55	4/1/86
16	62.3	73	64	60	56	4/1/86
17	65.4	77	65	61	59	4/1/86
18	64.2	77	62	57	54	3/31/86
19	61.3	71	63	57	53	3/31/86
20	57.0	65	59	54	51	3/31/86
21	55.3	63	58	53	50	3/31/86
22	54.0	62	56	51	49	3/31/86
23	55.2	62	58	52	49	3/31/86
24	53.1	61	55	50	48	3/31/86

Location 1, 545 Brackman Ln, Martinez

(17:00 3/31/86 to 17:00 4/1/86)



Location 1, 545 Brackman Lane, Martinez
Start 17:00 3/31/86

SENEL	Lmax	Duration (sec)	Max at	TRAIN	NO. OF LOCOS.	NO. OF CARS	HP
98.1	85.2	116.0	17:19:20	WB-FREIGHT	4	59	12000
91.6	83.5	34.4	00:10:07	EB-FREIGHT	2	15	6000
94.0	82.3	65.1	01:05:26	WB-FREIGHT	2	25	6000
97.6	87.4	98.1	02:54:19	WB-FREIGHT	2	42	6000
94.8	82.7	45.4	03:24:30	EB-FREIGHT	2	23	6000
95.7	81.5	80.0	04:48:35	EB-FREIGHT	5	44	15000
93.9	82.9	90.5	05:58:57	EB-FREIGHT	2	27	6000
95.6	85.2	57.5	14:45:57	WB-FREIGHT	2	28	6000
90.4	78.7	34.4	15:03:12	WB-FREIGHT	3	15	9000
97.5	85.5	85.9	16:28:12	EB-FREIGHT	2	60	6000
85.3	80.0	7.9	16:42:50	WB-FREIGHT	2	1	4000

Leq,Ldn,CNEL= 61.3 66.8 66.9 (with trains)
Leq,Ldn,CNEL= 59.7 63.8 64.0 (without trains)

TRAINS ONLY
Leq(24)= 56.2
Ldn= 63.7
CNEL= 63.7

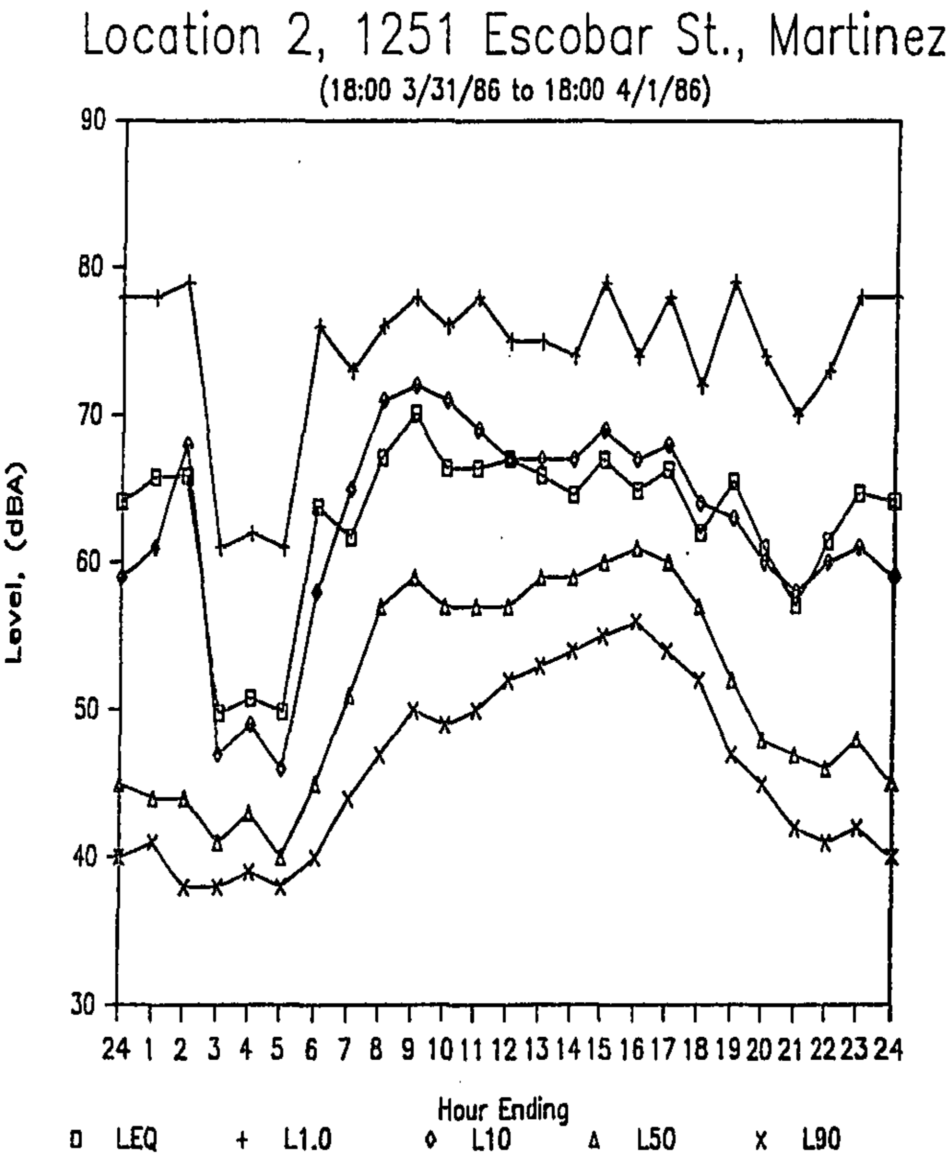
84.9	80.0	13.3	18:17:37	WB-FREIGHT	2	35	6000
85.0	80.0	7.0	22:25:37	EB-FREIGHT	2	1	6000
93.3	82.3	51.4	23:58:44	EB-FREIGHT	2	26	6000
97.8	87.6	90.5	00:58:33	WB-FREIGHT	2.	39	6000
94.3	82.7	46.3	02:46:16	EB-FREIGHT	2	23	6000
95.4	80.8	77.6	04:40:22	EB-FREIGHT	4	49	12000
94.9	84.7	31.4	05:24:16	EB-FREIGHT	2	15	6000
88.3	80.8	14.6	06:32:32	WB-FREIGHT	2	20	6000
92.5	85.8	52.3	06:49:03	EB-FREIGHT	2	8	6000

Location 2, 1251 Escobar St, Martinez

(Start 18:00, 3/31/86)

L_{dn}=69.0, CNEL=69.1
Leq(24)=64.9

Ending Hour	L_{eq}	L_1	L_{10}	L_{50}	L_{90}	Date
1	65.8	78	61	44	41	4/1/86
2	65.9	79	68	44	38	4/1/86
3	49.8	61	47	41	38	4/1/86
4	50.8	62	49	43	39	4/1/86
5	49.9	61	46	40	38	4/1/86
6	63.8	76	58	45	40	4/1/86
7	61.7	73	65	51	44	4/1/86
8	67.1	76	71	57	47	4/1/86
9	70.1	78	72	59	50	4/1/86
10	66.4	76	71	57	49	4/1/86
11	66.4	78	69	57	50	4/1/86
12	67.0	75	67	57	52	4/1/86
13	65.9	75	67	59	53	4/1/86
14	64.6	74	67	59	54	4/1/86
15	67.0	79	69	60	55	4/1/86
16	64.9	74	67	61	56	4/1/86
17	66.3	78	68	60	54	4/1/86
18	62.0	72	64	57	52	4/1/86
19	65.5	79	63	52	47	3/31/86
20	61.0	74	60	48	45	3/31/86
21	57.1	70	58	47	42	3/31/86
22	61.4	73	60	46	41	3/31/86
23	64.7	78	61	48	42	3/31/86
24	64.1	78	59	45	40	3/31/86


Location 2, 1251 Escobar St., Martinez
(18:00 3/31/86 to 18:00 4/1/86)
Level, (dBA)
90
80
70
60
50
40
30
24 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Hour Ending
□ LEQ
+ L1.0
◊ L10
Δ L50
x L90

Location 2, 1251 Escobar St, Martinez
Start 18:00 3/31/86

SENEL	Lmax	Duration (sec)	Max at	TRAIN	NO. OF LOCOS.	NO. OF CARS	LENGTH (FT)
96.0	82.6	60.1	18:49:33	IB-FREIGHT	3	38	2267
93.0	86.1	15.8	21:55:14	OB-AMTRAK	2	13	
96.1	86.7	20.4	22:16:07	IB-AMTRAK	1	5	
91.9	80.7	29.1	22:33:09	OB-FREIGHT	3	17	1547
96.9	82.8	107.4	23:33:58	IB-FREIGHT	4	59	3476
93.4	84.1	20.1	23:49:39	OB-FREIGHT	4	49	3833
98.9	88.1	38.9	00:57:49	OB-FREIGHT	3	67	4048
99.6	84.9	92.4	01:51:42	IB-FREIGHT	3	43	5003
96.1	85.7	32.4	05:53:55	OB-FREIGHT	3	33	2970
97.0	88.9	27.9	07:25:00	IB-FREIGHT	4	77	5092
92.4	83.2	19.1	08:20:06	OB-AMTRAK	1	5	
89.7	80.1	21.6	08:57:52	IB-AMTRAK	1	5	
95.9	84.3	55.5	10:43:46	IB-FREIGHT	3	23	2081
99.4	99.0	13.0	11:32:22	IB-AMTRAK	1	5	
91.8	84.0	15.5	12:25:11	OB-AMTRAK	2	9	
90.5	84.6	9.3	14:51:47	IB-AMTRAK	2	9	
98.1	81.5	110.4	16:50:47	IB-FREIGHT	4	73	4283

Leq,Ldn,CNEL= 64.9 69.0 69.1 (with trains)
Leq,Ldn,CNEL= 63.6 65.6 65.9 (without trains)

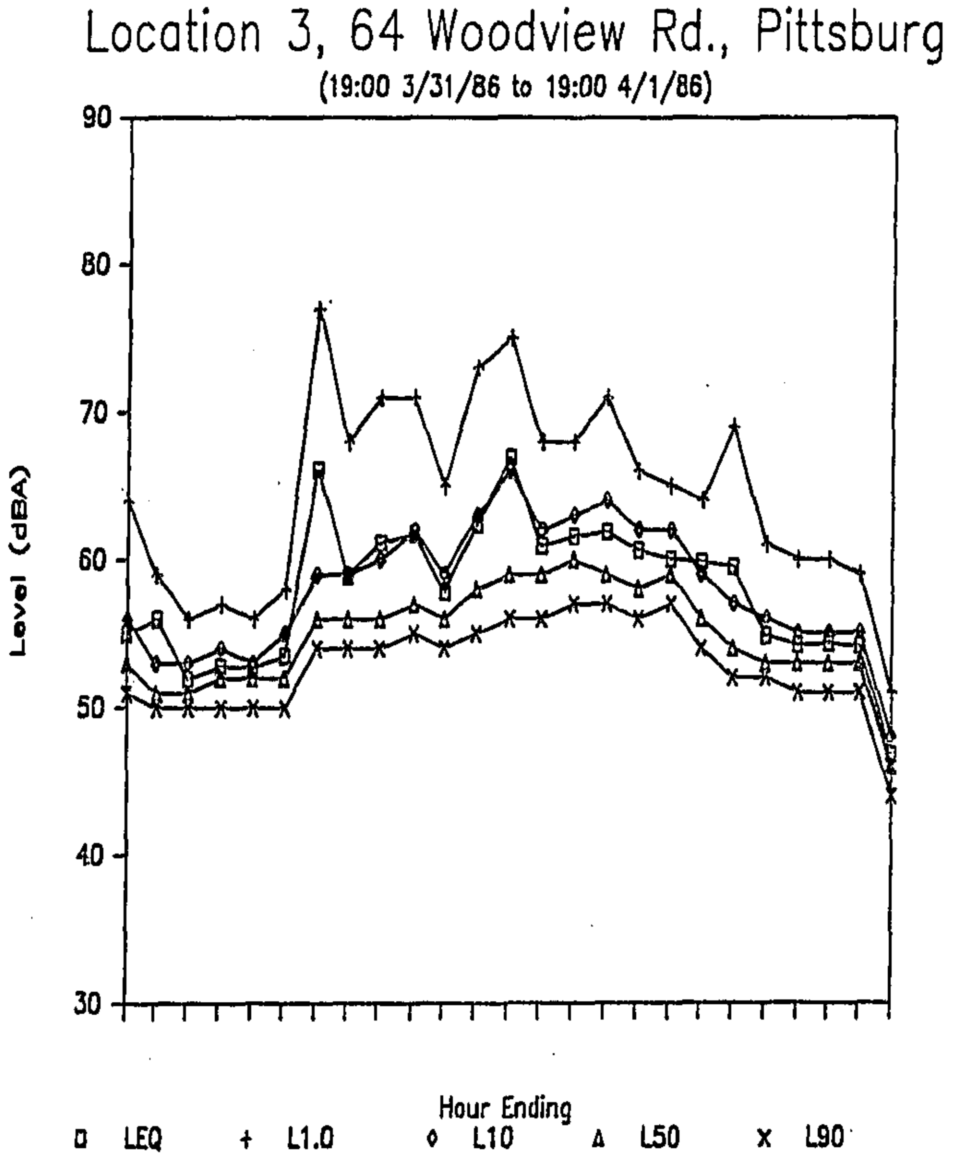
TRAINS ONLY
Leq(24)= 59.0
Ldn= 66.3
CNEL= 66.3

88.0	79.6	10.9	18:01:37	OB-AMTRAK	1	5	
97.0	82.8	79.4	19:25:07	OB-FREIGHT	5	59	3135
103.3	91.5	71.6	19:51:59	IB-FREIGHT	4	55	2132
88.7	80.7	13.8	21:17:15	IB-AMTRAK	1	5	
101.1	83.9	130.3	21:35:45	IB-FREIGHT	3	39	2276
94.4	85.4	20.6	22:00:01	OB-AMTRAK	2	11	
95.3	85.3	52.8	23:17:16	OB-FREIGHT	2	33	2984
91.1	81.5	18.0	23:50:47	IB-FREIGHT	3	38	2306
98.2	86.9	80.9	23:59:59	OB-FREIGHT	2	62	4913
				IB-FREIGHT	3	115	6783
99.9	89.5	56.3	01:40:36	OB-FREIGHT	3	49	2390
				IB-FREIGHT	3	33	2383
101.6	89.5	117.8	05:29:13	OB-FREIGHT	3	128	7250
96.0	90.6	29.6	07:49:57	OB-FREIGHT	3	42	3853
92.4	84.2	15.9	08:19:29	OB-AMTRAK	1	5	

Location 3, 64 Woodview Rd., Pittsburg

(Start 19:00 3/31/86) L_{dn}=65.3, CNEL=65.4
Leq(24)=60.3

Ending Hour	L_{eq}	L_1	L_{10}	L_{50}	L_{90}	Date
1	55.0	64	56	53	51	4/1/86
2	56.0	59	53	51	50	4/1/86
3	51.9	56	53	51	50	4/1/86
4	52.8	57	54	52	50	4/1/86
5	52.7	56	53	52	50	4/1/86
6	53.5	58	55	52	50	4/1/86
7	66.1	77	59	56	54	4/1/86
8	58.9	68	59	56	54	4/1/86
9	61.1	71	60	56	54	4/1/86
10	61.8	71	62	57	55	4/1/86
11	57.8	65	59	56	54	4/1/86
12	62.4	73	63	58	55	4/1/86
13	66.9	75	66	59	56	4/1/86
14	60.9	68	62	59	56	4/1/86
15	61.6	68	63	60	57	4/1/86
16	61.9	71	64	59	57	4/1/86
17	60.6	66	62	58	56	4/1/86
18	60.0	65	62	59	57	4/1/86
19	59.8	64	59	56	54	4/1/86
20	59.5	69	57	54	52	3/31/86
21	54.8	61	56	53	52	3/31/86
22	54.2	60	55	53	51	3/31/86
23	54.3	60	55	53	51	3/31/86
24	54.1	59	55	53	51	3/31/86


Location 3, 64 Woodview Rd., Pittsburg
(19:00 3/31/86 to 19:00 4/1/86)
90
80
70
60
50
40
30
Level (dBA)
Hour Ending
□ LEQ
+ L1.0
◊ L10
Δ L50
x L90

Location 3, 64 Woodview Rd., Pittsburg
Start 19:00 3/31/86

SENEL	Lmax	Duration (sec)	Max at	TRAIN	NO. OF LOCOS.	NO. OF CARS	LENGTH (FT)
100.9	94.3	74.8	06:19:44	OB-FREIGHT	3	33	2970

Leq,Ldn,CNEL= 60.3 65.3 65.4 (with trains)
Leq,Ldn,CNEL= 59.7 63.0 63.1 (without trains)

TRAINS ONLY
Leq(24)= 51.5
Ldn= 61.5
CNEL= 61.5

90.2	87.4	11.3	19:05:41	IB-FREIGHT	4.0	55	2132
98.3	84.9	53.0	19:06:30	IB-FREIGHT	4.0	55	2132

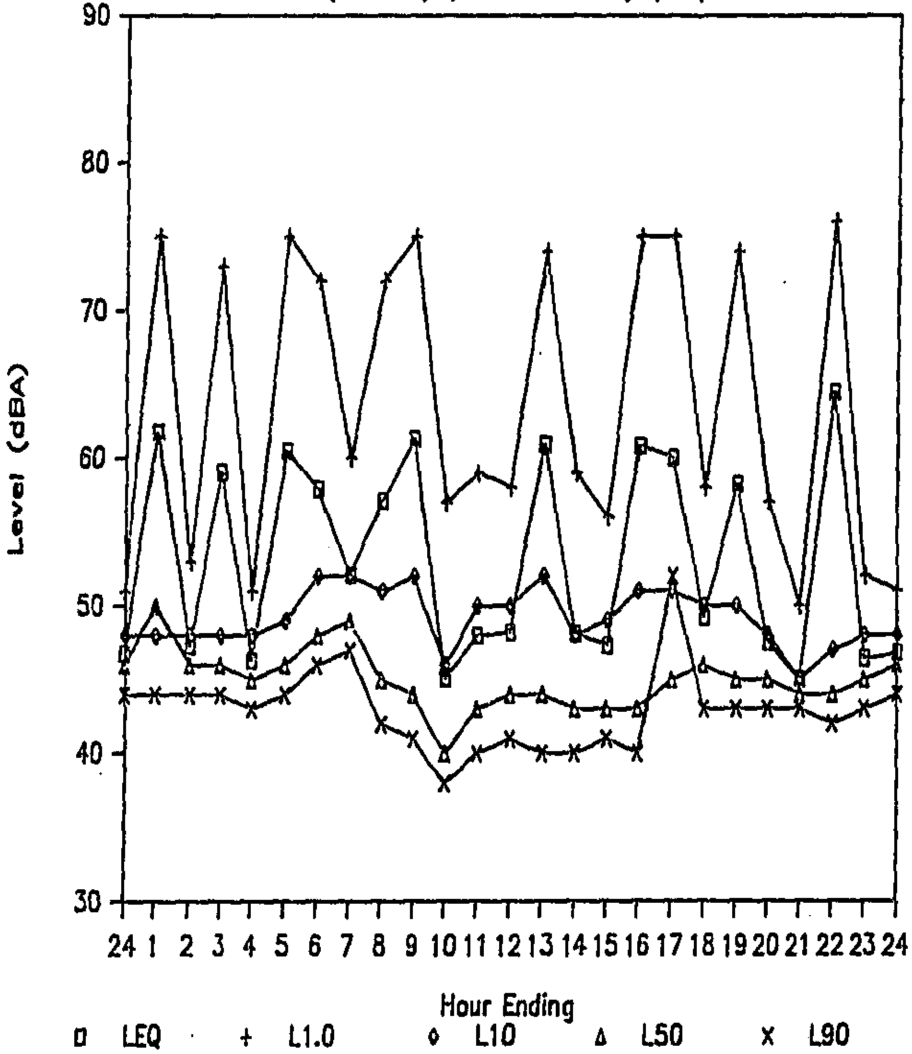
Location 4, 186 MacMurty Dr., Martinez

(Start 11:00 4/2/86) L_{dn} = 63.2, CNEL = 63.7
Leq(24)=57.5

Ending Hour	L_{eq}	L_1	L_{10}	L_{50}	L_{90}	Date
1	61.8	75	48	50	44	4/3/86
2	47.3	53	48	46	44	4/3/86
3	59.1	73	48	46	44	4/3/86
4	46.3	51	48	45	43	4/3/86
5	60.5	75	49	46	44	4/3/86
6	57.9	72	52	48	46	4/3/86
7	52.1	60	52	49	47	4/3/86
8	57.1	72	51	45	42	4/3/86
9	61.3	75	52	44	41	4/3/86
10	45.1	57	46	40	38	4/3/86
11	48.0	59	50	43	40	4/3/86
12	48.2	58	50	44	41	4/2/86
13	60.9	74	52	44	40	4/2/86
14	48.1	59	48	43	40	4/2/86
15	47.3	56	49	43	41	4/2/86
16	60.8	75	51	43	40	4/2/86
17	60.0	75	51	45	52	4/2/86
18	49.2	58	50	46	43	4/2/86
19	58.2	74	50	45	43	4/2/86
20	47.5	57	48	45	43	4/2/86
21	45.0	50	45	44	43	4/2/86
22	64.4	76	47	44	42	4/2/86
23	46.4	52	48	45	43	4/2/86
24	46.8	51	48	46	44	4/2/86

Location 4, 186 MacMurty Dr., Martinez

(11:00 4/2/86 to 11:00 4/3/86)



Location 4, 186 MacMurty Dr., Martinez
Start 11:00 4/2/86

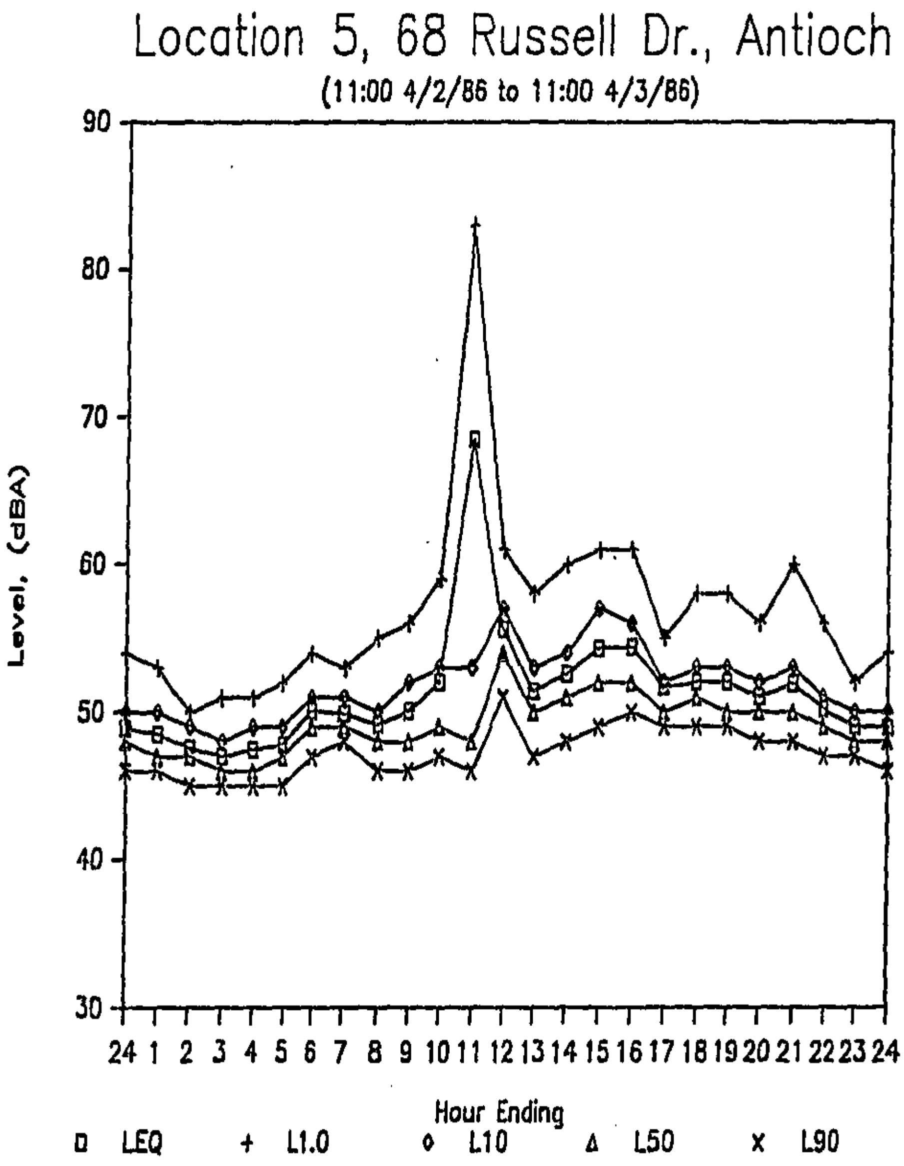
SENEL	Lmax	Duration (sec)	Max at	TRAIN	NO. OF LOCOS.	NO. OF CARS	HP
96.1	81.0	180.5	12:31:34	EB-FREIGHT	2	78	6000
95.8	84.3	59.3	15:35:20	WB-FREIGHT	2	26	6000
94.7	79.9	89.3	16:20:23	EB-FREIGHT	2	80	----
93.2	80.2	69.6	18:16:06	WB-FREIGHT	4	27	12000
99.8	88.8	110.8	21:22:32	WB-FREIGHT	2	41	6000
96.4	85.1	79.5	00:00:28	EB-FREIGHT	3	33	8000
94.3	84.2	61.1	02:47:04	EB-FREIGHT	2	21	6000
95.7	81.5	95.8	04:51:35	EB-FREIGHT	5	39	15000
92.6	82.7	41.9	05:14:34	EB-FREIGHT	5	14	15000
82.7	77.8	11.6	07:17:00	EB-FREIGHT	2	1	4000
91.4	80.4	36.1	07:36:53	EB-FREIGHT	2	13	6000
96.5	91.1	80.5	08:15:53	WB-FREIGHT	2	27	6000
Leq,Ldn,CNEL=			57.5	63.2	63.7 (with		
Leq,Ldn,CNEL=			49.6	55.0	55.2 (without trains)		

TRAINS ONLY
Leq(24)= 56.7
Ldn= 62.5
CNEL= 63.0

Location 5, 68 Russell Dr., Antioch

(Start 11:00 4/2/86) L_{dn}=58.2, CNEL=58.4
Leq(24)=56.3

Ending Hour	L_{eq}	L_1	L_{10}	L_{50}	L_{90}	Date
1	48.5	53	50	47	46	4/3/86
2	47.6	50	49	47	45	4/3/86
3	47.0	51	48	46	45	4/3/86
4	47.5	51	49	46	45	4/3/86
5	47.8	52	49	47	45	4/3/86
6	50.1	54	51	49	47	4/3/86
7	49.9	53	51	49	48	4/3/86
8	49.1	55	50	48	46	4/3/86
9	50.1	56	52	48	46	4/3/86
10	52.0	59	53	49	47	4/3/86
11	68.5	83	53	48	46	4/3/86
12	55.6	61	57	54	51	4/2/86
13	51.4	58	53	50	47	4/2/86
14	52.6	60	54	51	48	4/2/86
15	54.3	61	57	52	49	4/2/86
16	54.4	61	56	52	50	4/2/86
17	51.7	55	52	50	49	4/2/86
18	52.0	58	53	51	49	4/2/86
19	52.0	58	53	50	49	4/2/86
20	51.0	56	52	50	48	4/2/86
21	51.9	60	53	50	48	4/2/86
22	50.2	56	51	49	47	4/2/86
23	49.0	52	50	48	47	4/2/86
24	48.9	54	50	48	46	4/2/86


Location 5, 68 Russell Dr., Antioch
(11:00 4/2/86 to 11:00 4/3/86)
Level, (dBA)
90
80
70
60
50
40
30
24 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Hour Ending
LEQ
L1.0
L10
L50
L90

Location 5, 68 Russell Dr., Antioch
Start 11:00 4/2/86

SENEL	Lmax	Duration (sec)	Max at	TRAIN	NO. OF LOCOS.	NO. OF CARS	LENGTH (FT)
103.8	93.6	108.9	10:45:37	OB-FREIGHT	2	84	5298

Leq, Ldn, CNEL=	56.3	58.2	58.4	(with trains)
Leq, Ldn, CNEL=	51.8	55.9	56.2	(without trains)

TRAINS ONLY

Leq(24)=	54.4
Ldn=	54.4
CNEL=	54.4

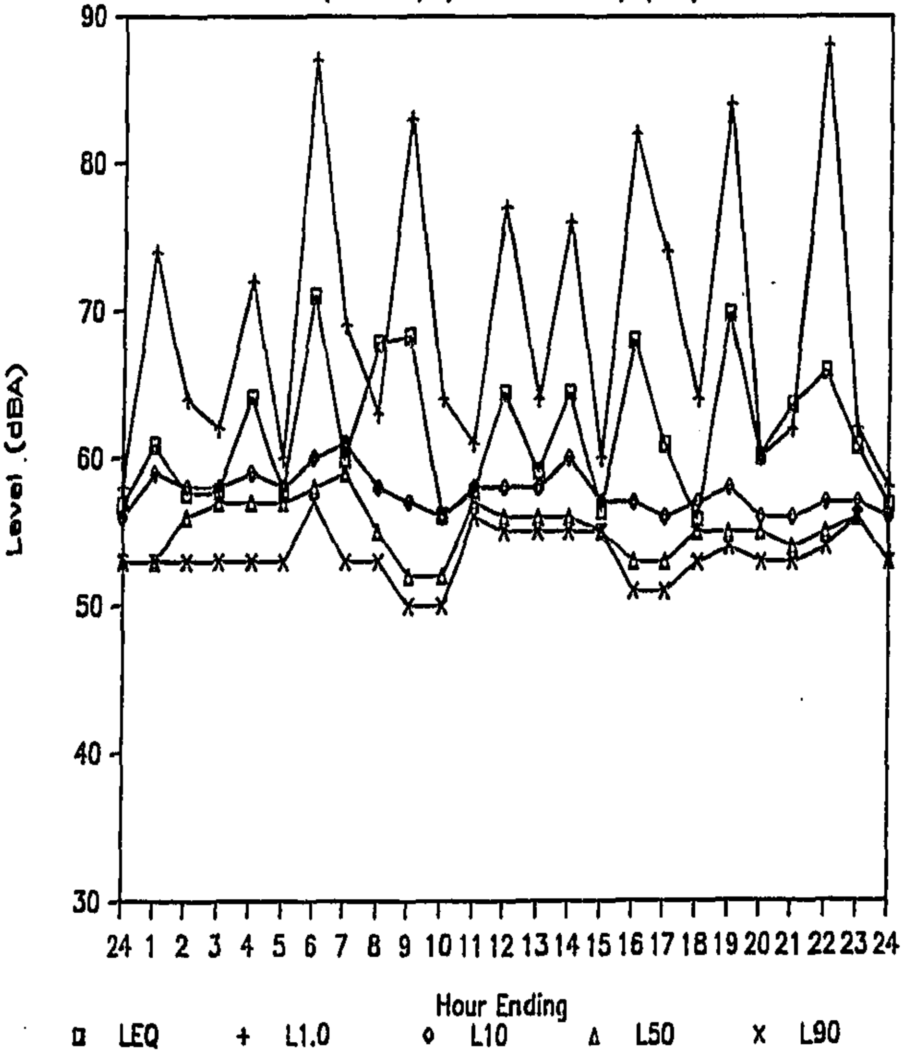
Location 6, 301 W. 13th St., Pittsburg

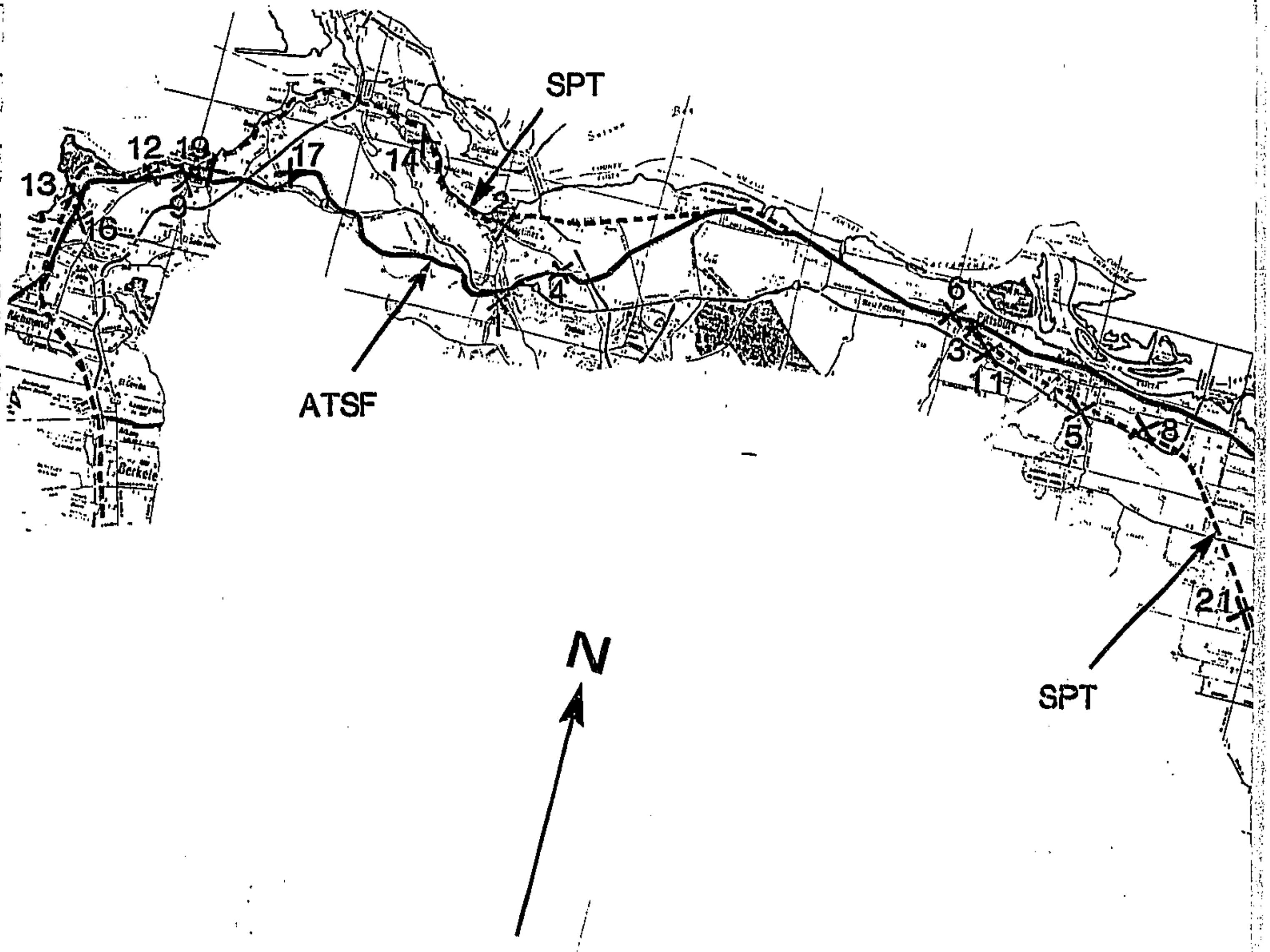
L_{dn}=70.2, CNEL=70.4
(Start 10:00 4/2/86) Leq(24)=64.4

Ending Hour	L_{eq}	L_1	L_{10}	L_{50}	L_{90}	Date
1	60.9	74	59	53	53	4/3/86
2	57.6	64	58	56	53	4/3/86
3	57.7	62	58	57	53	4/3/86
4	64.1	72	59	57	53	4/3/86
5	57.7	60	58	57	53	4/3/86
6	71.0	87	60	58	57	4/3/86
7	59.9	69	61	59	53	4/3/86
8	67.8	63	58	55	53	4/3/86
9	68.3	83	57	52	50	4/3/86
10	56.1	64	56	52	50	4/3/86
11	57.7	61	58	57	56	4/2/86
12	64.4	77	58	56	55	4/2/86
13	59.1	64	58	56	55	4/2/86
14	64.4	76	60	56	55	4/2/86
15	56.4	60	57	55	55	4/2/86
16	68.0	82	57	53	51	4/2/86
17	60.9	74	56	53	51	4/2/86
18	55.8	64	57	55	53	4/2/86
19	69.8	84	58	55	54	4/2/86
20	60.1	60	56	55	53	4/2/86
21	63.6	62	56	54	53	4/2/86
22	65.9	88	57	55	54	4/2/86
23	60.8	62	57	56	56	4/2/86
24	56.8	58	56	53	53	4/2/86

Location 6, 301 W. 13th St., Pittsburg

(10:00 4/2/86 to 10:00 4/3/86)





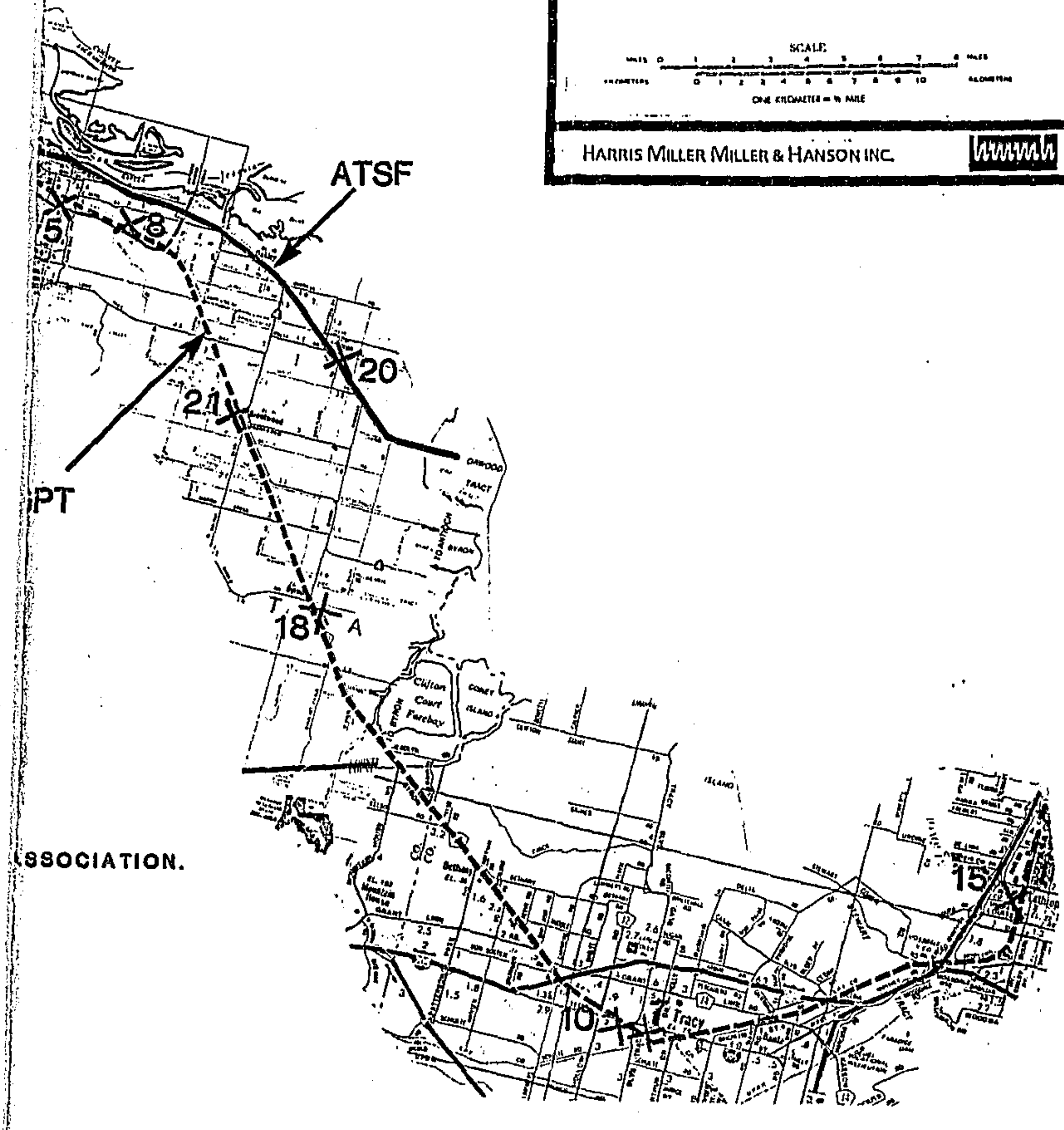
SECTIONED DOCUMENT

FIGURE 1

STUDY AREA MAP INDICATING RAILROAD LINES AND NOISE MONITORING LOCATIONS

SCALE

HARRIS MILLER MILLER & HANSON INC.



SECTIONED DOCUMENT

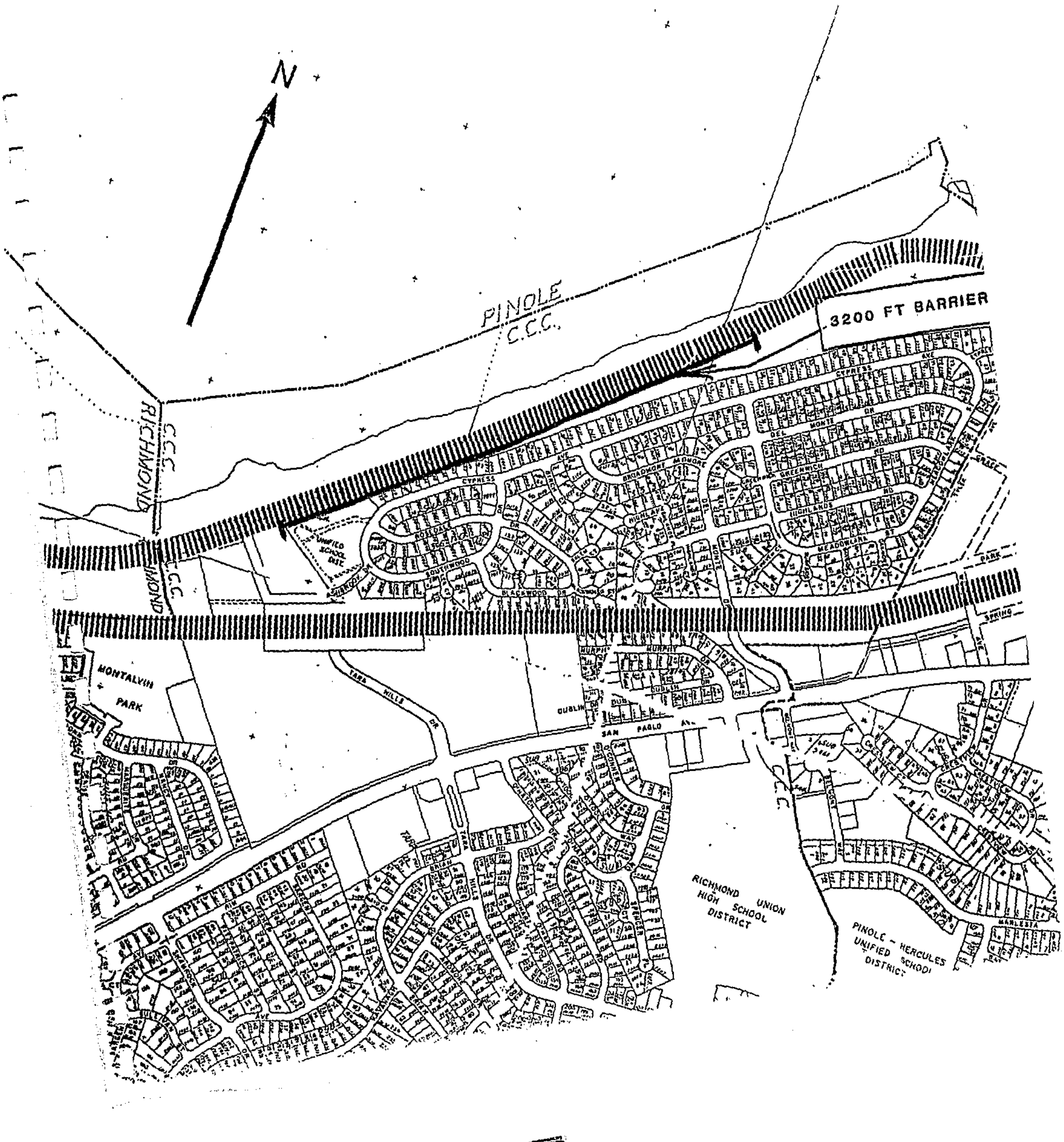
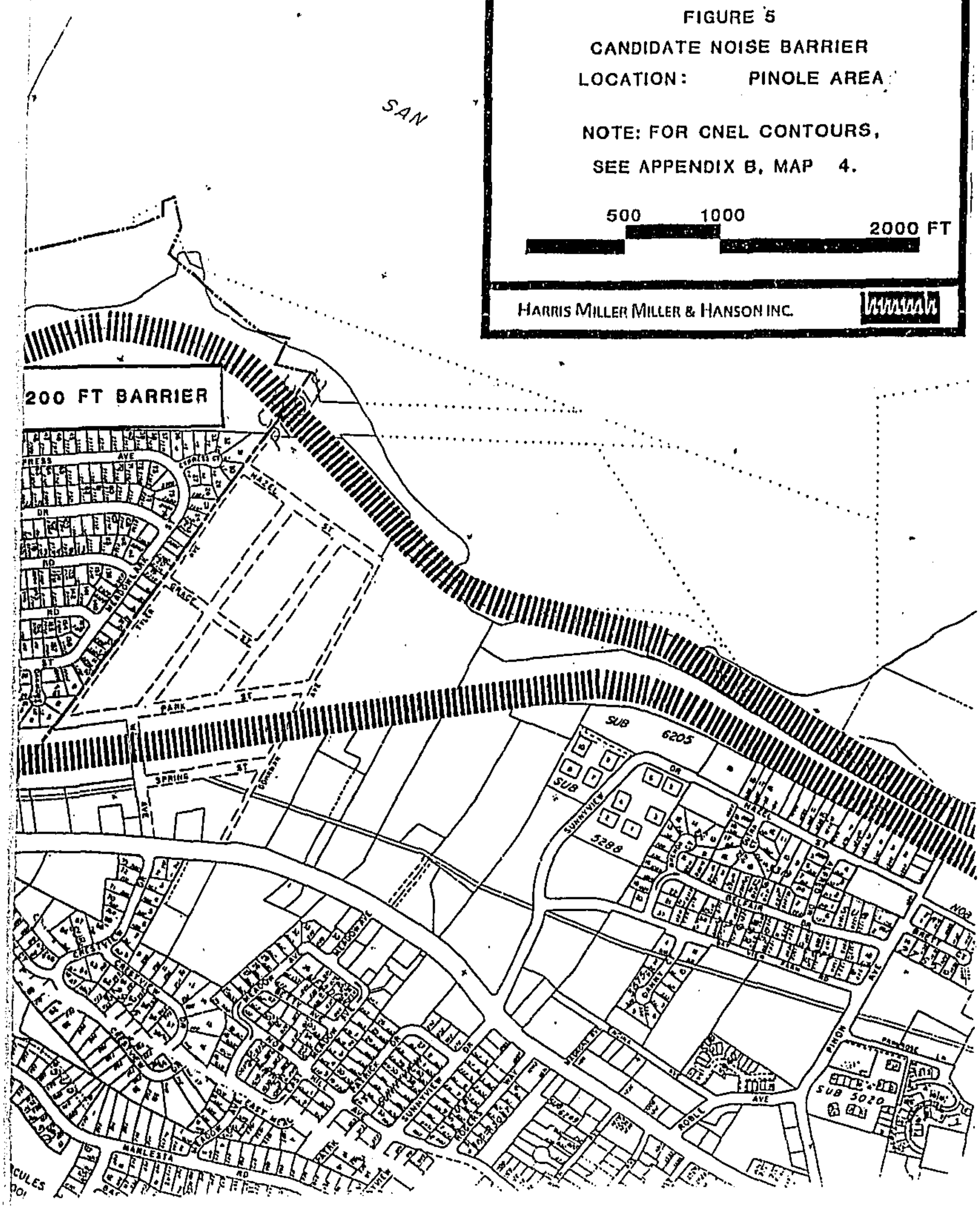

N
PINOLE
C.C.C.
RICHMOND
C.C.C.
3200 FT BARRIER
CYPRESS
DEL MONTE DR
GREENWICH
HIGHLANDS
MEADOWLARK
ROSEDALE
SOUTHWOOD
BLACKWOOD DR
MURPHY
DUBLIN
SAN PABLO AVE
TARA HILLS DR
MONTALVIN PARK
RICHMOND UNION HIGH SCHOOL DISTRICT
PINOLE - HERCULES UNIFIED SCHOOL DISTRICT

FIGURE 5

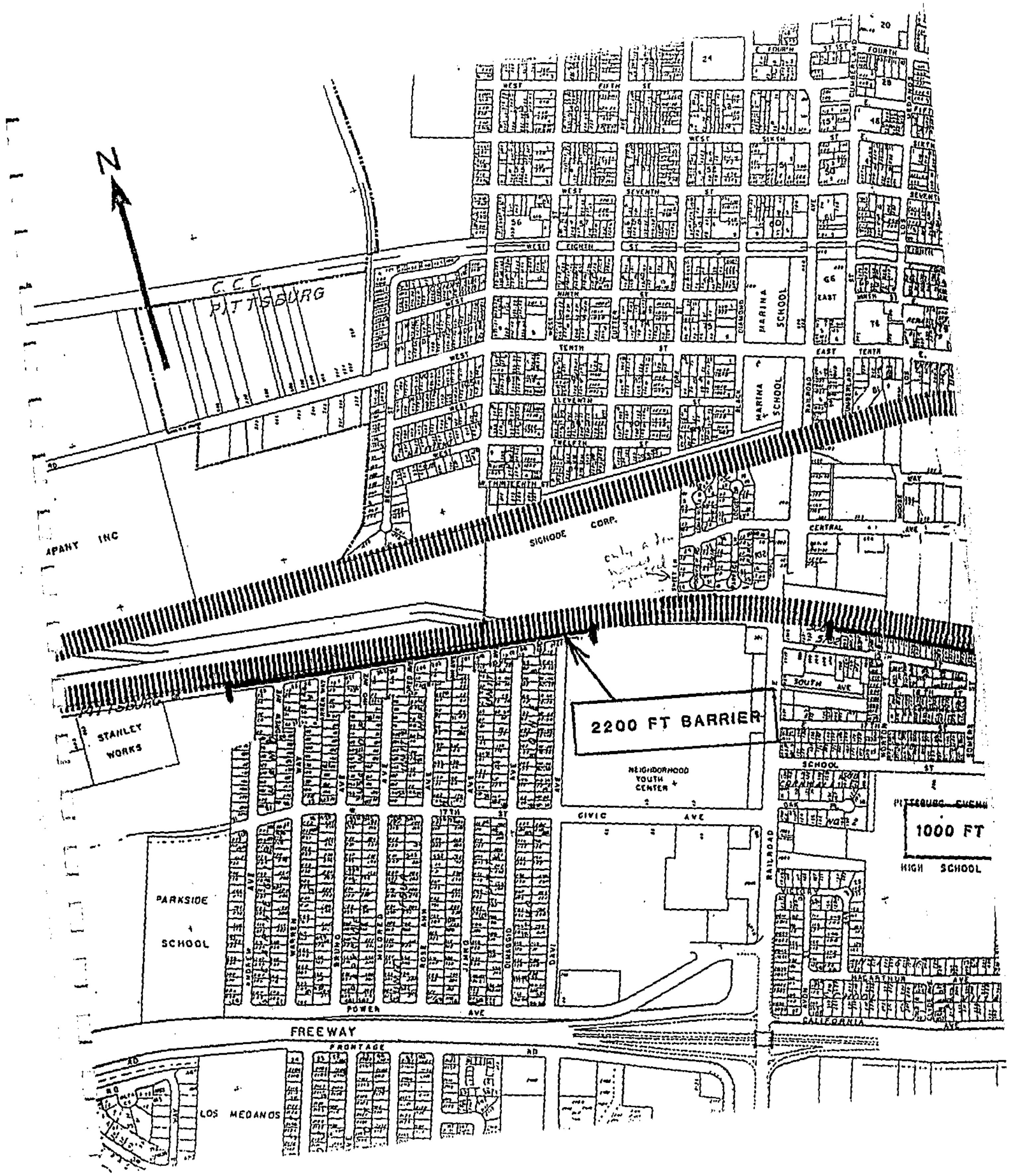
CANDIDATE NOISE BARRIER

LOCATION: PINOLE AREA

NOTE: FOR CNEL CONTOURS, SEE APPENDIX B, MAP 4.



HARRIS MILLER MILLER & HANSON INC.


N
C.C.C.
PITTSBURG
WEST FIFTH ST
WEST SIXTH ST
WEST SEVENTH ST
WEST EIGHTH ST
NINTH
TENTH ST
ELEVENTH ST
TWELFTH ST
THIRTEENTH ST
EAST TENTH
MARINA SCHOOL
SIGNODE CORP.
CENTRAL AVE
SOUTH AVE
2200 FT BARRIER
STANLEY WORKS
NEIGHBORHOOD YOUTH CENTER
SCHOOL ST
CIVIC AVE
RAILROAD
1000 FT
HIGH SCHOOL
PARKSIDE SCHOOL
POWER AVE
FREEWAY
CALIFORNIA AVE
FRONTAGE RD
LOS MEDANOS

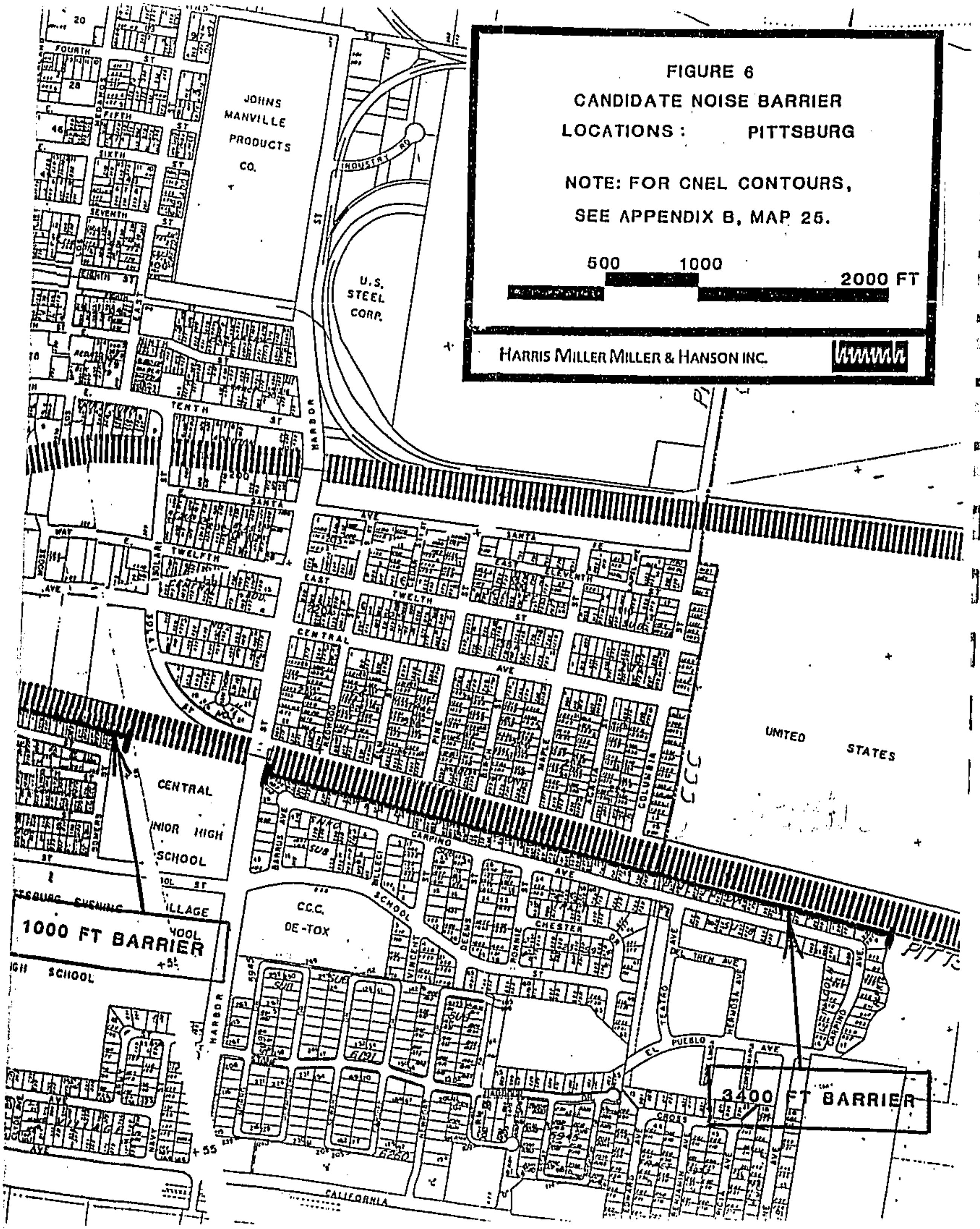
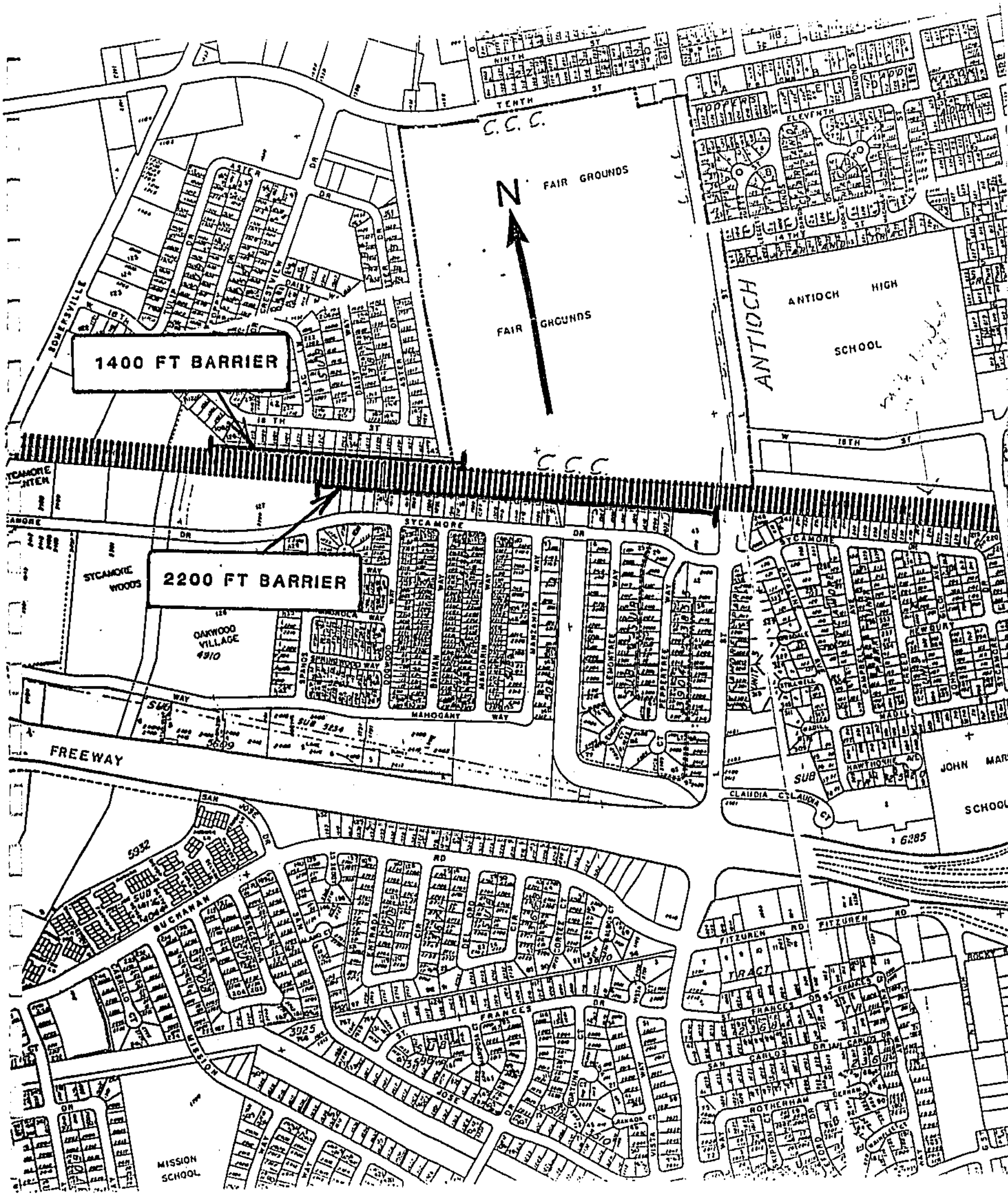


FIGURE 6
CANDIDATE NOISE BARRIER
LOCATIONS : PITTSBURG
NOTE: FOR CNEL CONTOURS,
SEE APPENDIX B, MAP 25.
500
1000
2000 FT
HARRIS MILLER MILLER & HANSON INC.
JOHNS MANVILLE PRODUCTS CO.
U.S. STEEL CORP.
UNITED STATES
CENTRAL
HIGH
SCHOOL
C.C.C.
DE-TOX
1000 FT BARRIER
3400 FT BARRIER
FOURTH
FIFTH
SIXTH
SEVENTH
EIGHTH
TENTH
TWELFTH
CENTRAL
HARBOR
CARPINO
CHESTER
EL PUEBLO
CALIFORNIA
COLUMBIA
INDUSTRY RD



SECTIONED DOCUMENT

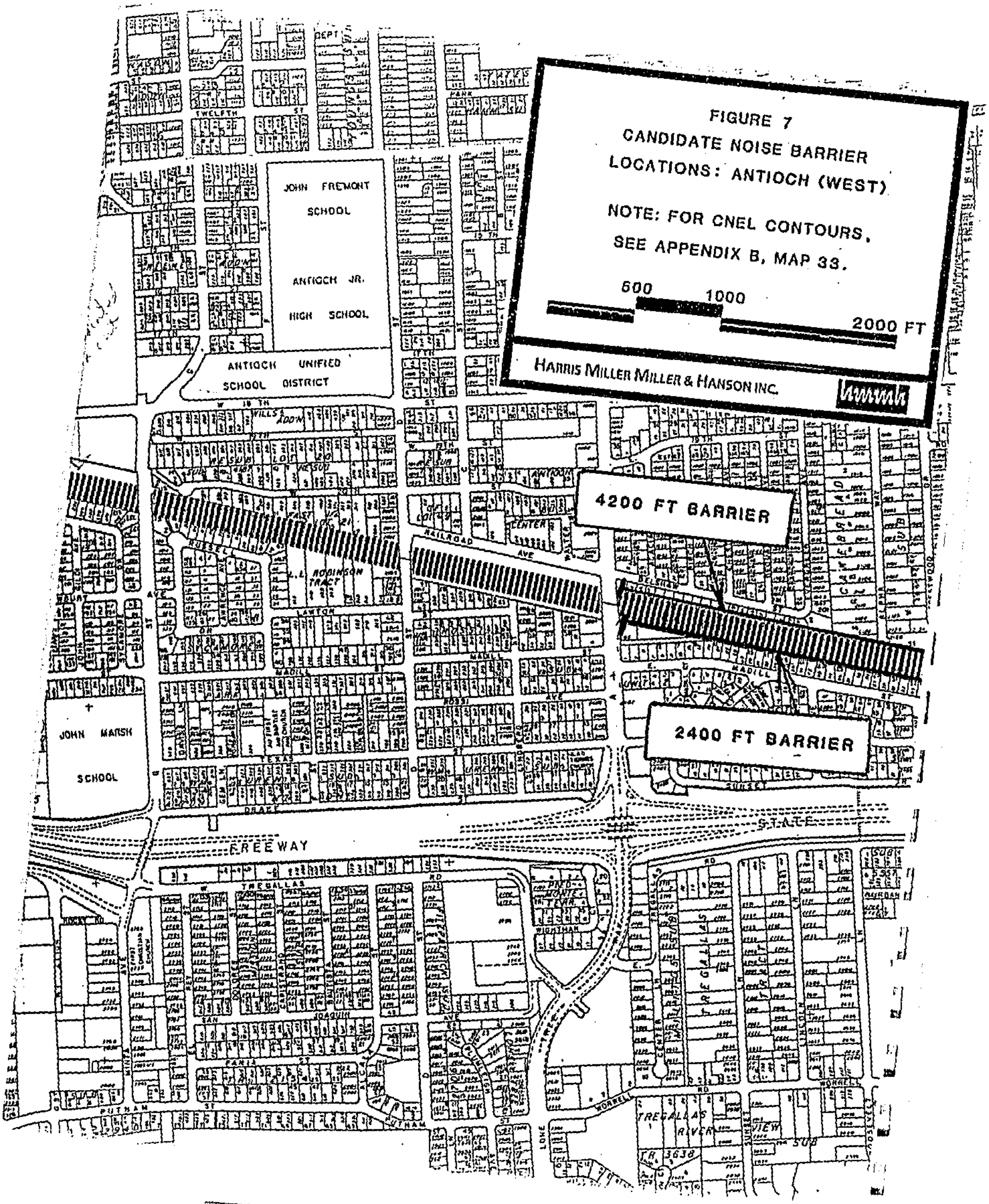
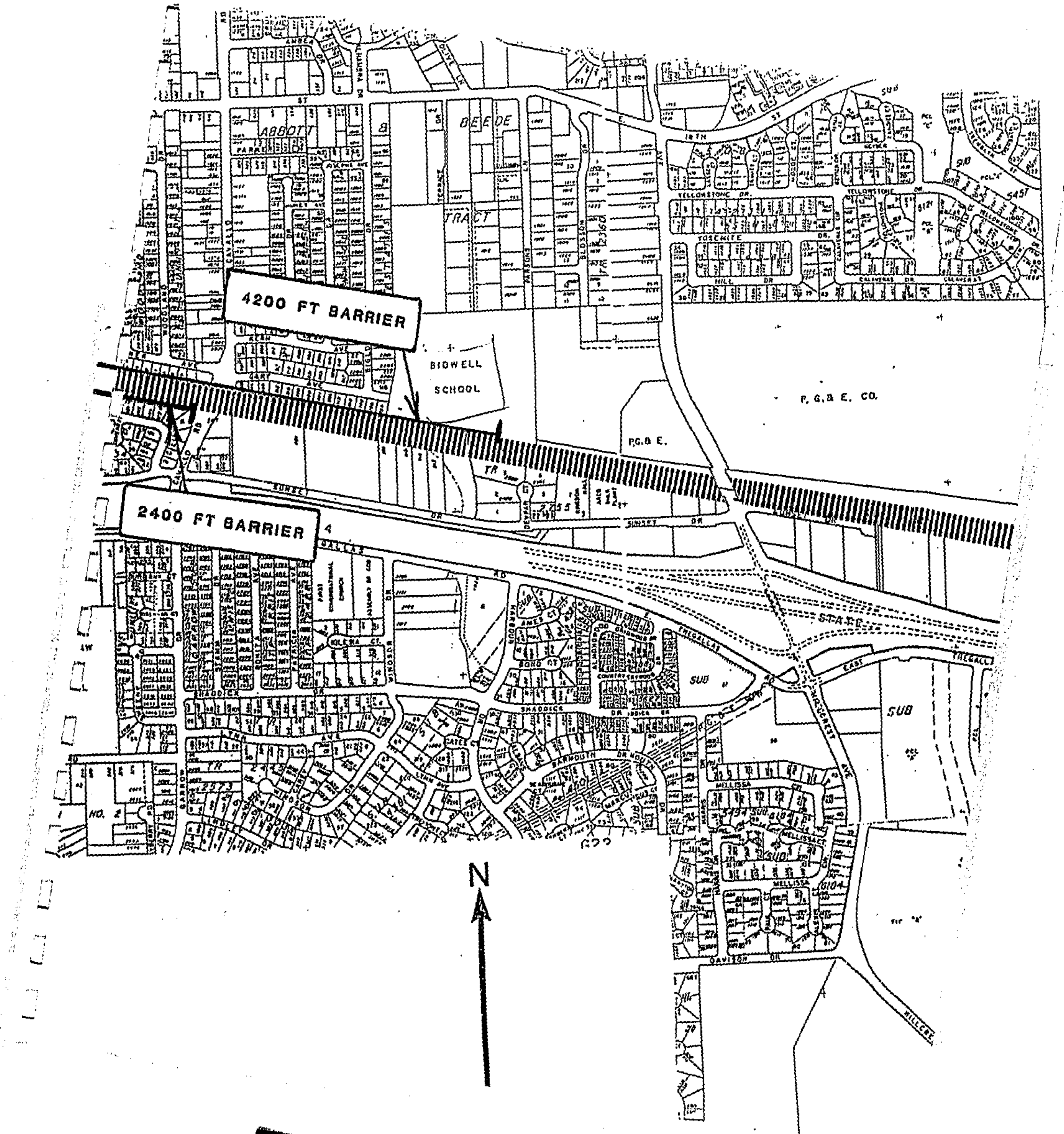


FIGURE 7
CANDIDATE NOISE BARRIER LOCATIONS: ANTIOCH (WEST)

NOTE: FOR CNEL CONTOURS, SEE APPENDIX B, MAP 33.

HARRIS MILLER MILLER & HANSON INC.


4200 FT BARRIER
2400 FT BARRIER
BIDWELL SCHOOL
P.G.& E. CO.
P.G.& E.
ABBOTT
TRACT
SUNSET DR
DALLAS RD
SHADDICK DR
YELLOWSTONE DR.
MELLISSA
SUB
N

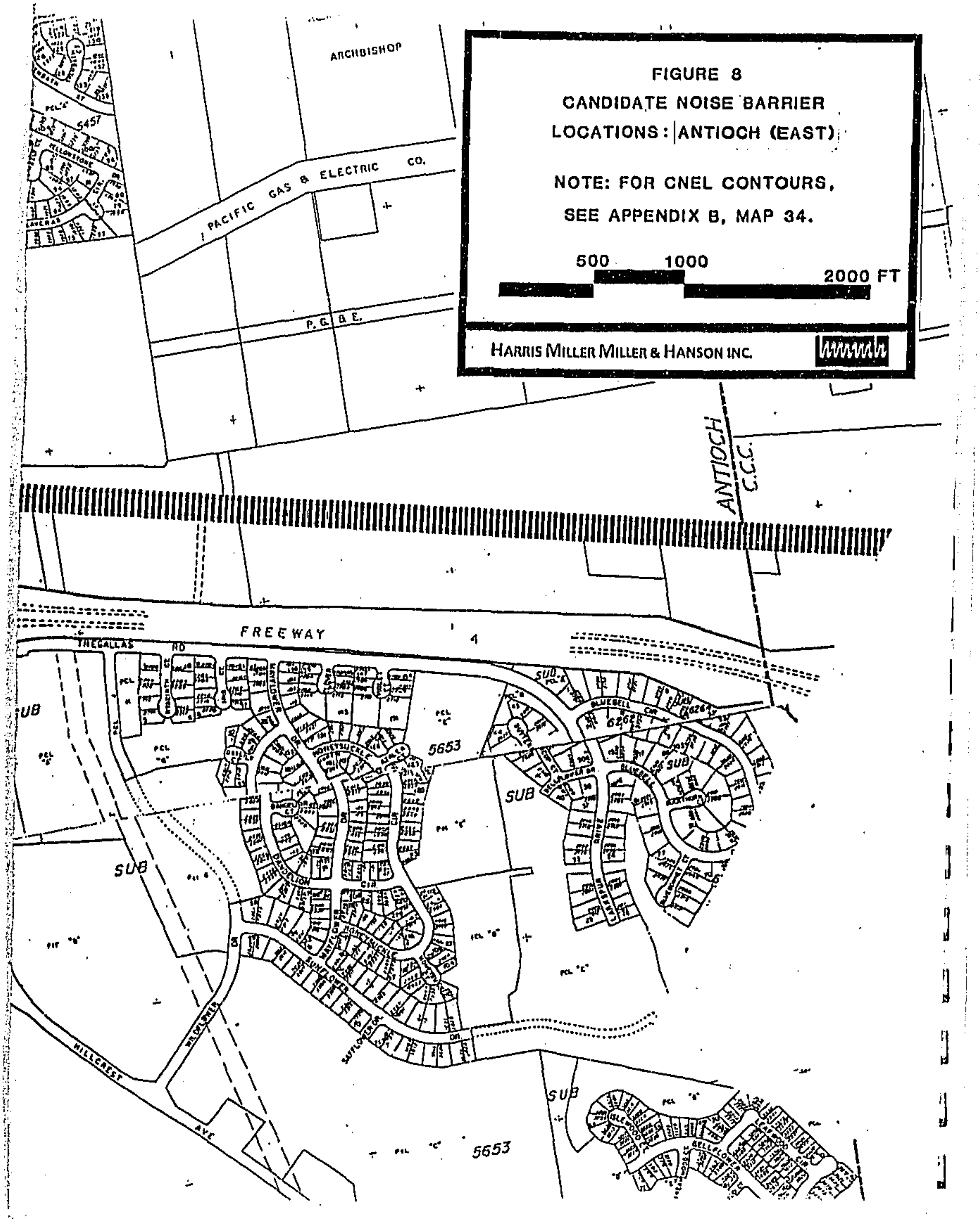
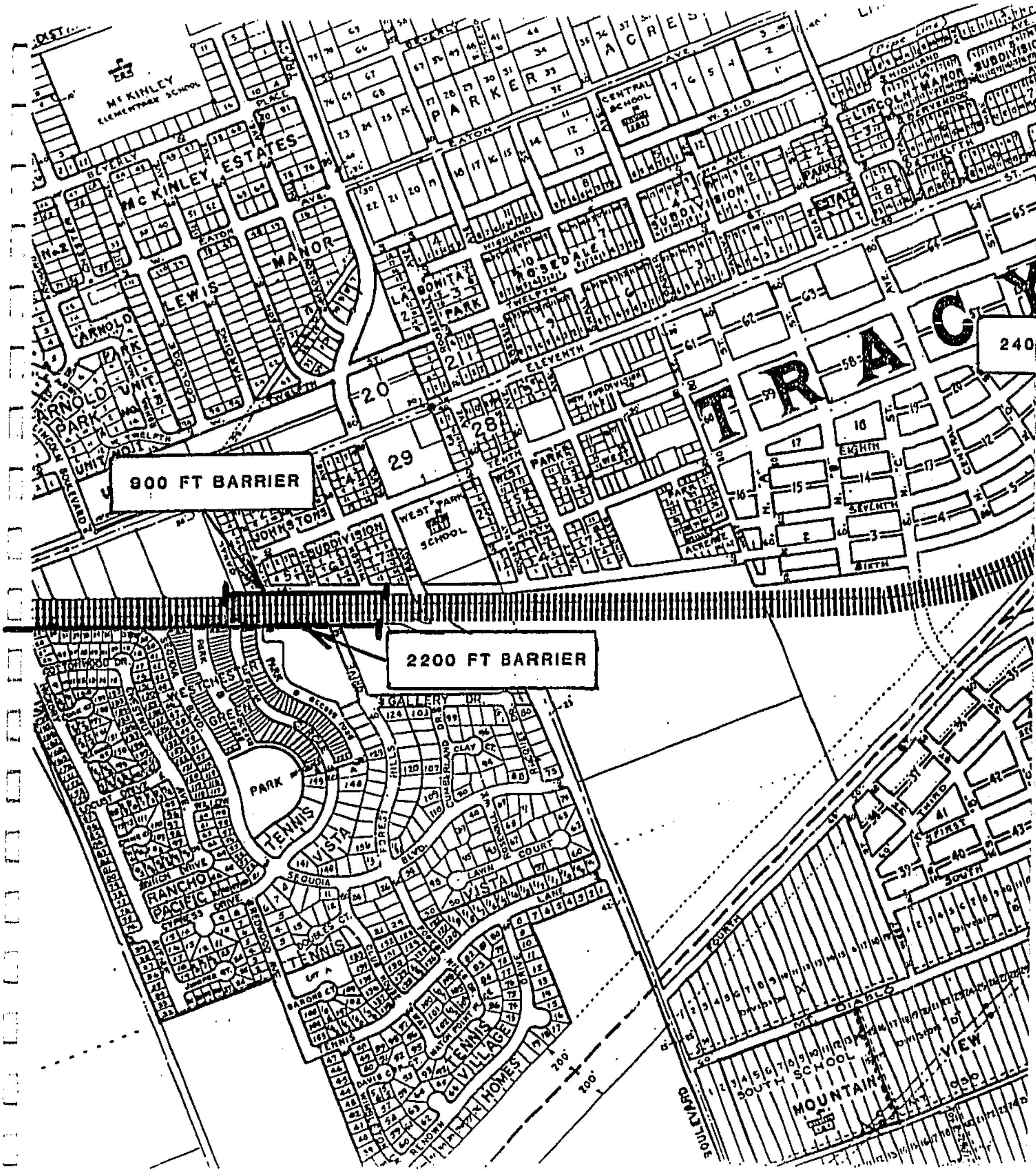


FIGURE 8
CANDIDATE NOISE BARRIER
LOCATIONS: ANTIOCH (EAST)

NOTE: FOR CNEL CONTOURS, SEE APPENDIX B, MAP 34.

SECTIONED DOCUMENT



SECTIONED DOCUMENT

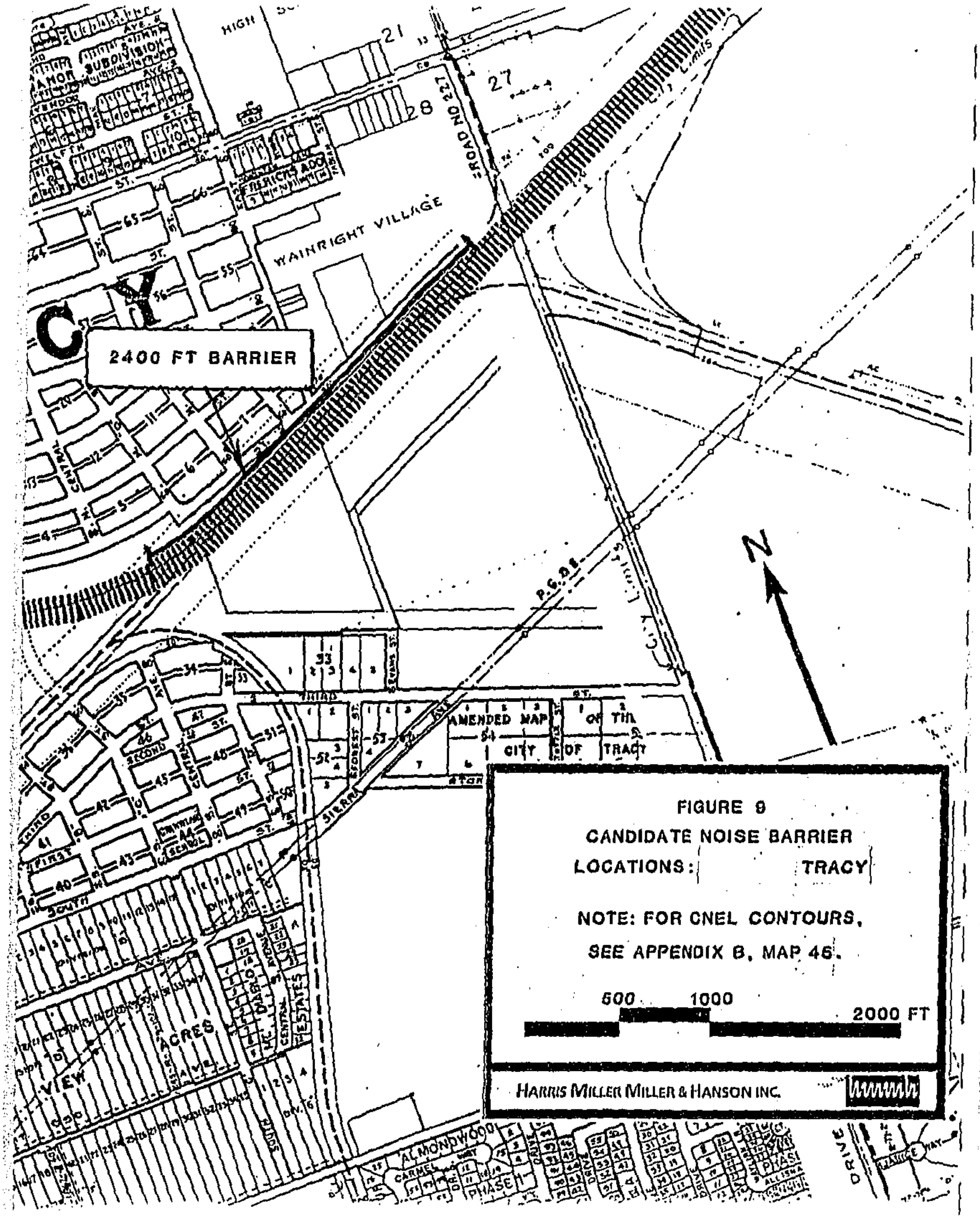


FIGURE 9
CANDIDATE NOISE BARRIER LOCATIONS: TRACY

Location 6, 301 W. 13th St., Pittsburg
Start 10:00 4/2/86

SENEL	Lmax	Duration (sec)	Max at	TRAIN	NO. OF LOCOS.	NO. OF CARS	HP
95.5	89.4	10.1	11:10:04	WB-AMTRAK	1	5	----
95.4	81.4	75.5	11:40:32	EB-FREIGHT	2	78	6000
103.2	93.6	61.8	15:07:09	WB-FREIGHT	2	26	6000
102.6	90.2	39.8	18:10:28	WB-FREIGHT	4	27	12000
101.4	97.7	23.9	18:30:32	EB-AMTRAK	1	5	----
98.4	92.7	12.9	20:44:00	WB-AMTRAK	1	5	----
100.8	88.7	39.3	21:06:34	WB-FREIGHT	2	41	6000
89.6	79.6	23.9	00:23:54	EB-FREIGHT	3	33	8000
98.4	86.1	37.9	03:05:48	EB-FREIGHT	2	21	6000
104.0	91.7	37.9	05:08:14	EB-FREIGHT	5	39	15000
104.4	95.8	65.5	07:59:55	WB-FREIGHT	2	27	6000
96.6	90.7	12.4	08:45:31	EB-AMTRAK	1	6	----

Leq,Ldn,CNEL=	64.4	70.2	70.4 (with trains)
Leq,Ldn,CNEL=	60.4	67.3	67.4 (without trains)

TRAINS ONLY

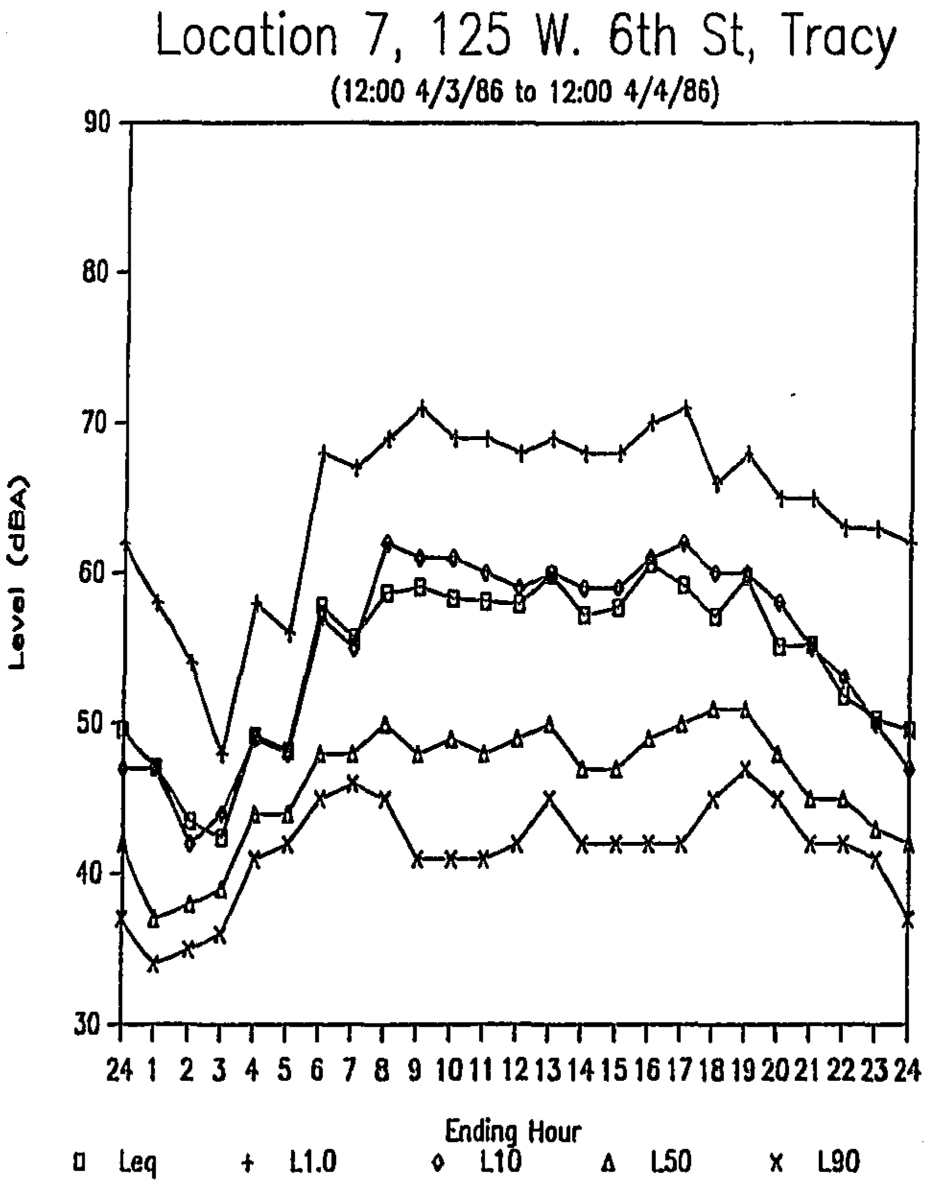
Leq(24)=	62.2
Ldn=	67.0
CNEL=	67.4

Location 7, 125 W. 6th St., Tracy

(Start 12:00, 4/3/86)

L_{dn}=60.0, CNEL=60.3
Leq(24)=56.7

Ending Hour	L_{eq}	L_1	L_{10}	L_{50}	L_{90}	DATE
1	47.1	58	47	37	34	4/4/86
2	43.5	54	42	38	35	4/4/86
3	42.4	48	44	39	36	4/4/86
4	49.2	58	49	44	41	4/4/86
5	48.2	56	48	44	42	4/4/86
6	57.8	68	57	48	45	4/4/86
7	55.7	67	55	48	46	4/4/86
8	58.7	69	62	50	45	4/4/86
9	59.1	71	61	48	41	4/4/86
10	58.3	69	61	49	41	4/4/86
11	58.1	69	60	48	41	4/4/86
12	57.9	68	59	49	42	4/4/86
13	59.9	69	60	50	45	4/3/86
14	57.2	68	59	47	42	4/3/86
15	57.7	68	59	47	42	4/3/86
16	60.6	70	61	49	42	4/3/86
17	59.2	71	62	50	42	4/3/86
18	57.1	66	60	51	45	4/3/86
19	59.8	68	60	51	47	4/3/86
20	55.1	65	58	48	45	4/3/86
21	55.2	65	55	45	42	4/3/86
22	51.8	63	53	45	42	4/3/86
23	50.3	63	50	43	41	4/3/86
24	49.6	62	47	42	37	4/3/86


Location 7, 125 W. 6th St, Tracy
(12:00 4/3/86 to 12:00 4/4/86)
Level (dBA)
90
80
70
60
50
40
30
24 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Ending Hour
□ Leq
+ L1.0
◊ L10
Δ L50
x L90

Location 7, 125 W. 6th St., Tracy
Start 12:00 4/3/86

SENEL	Lmax	Duration (sec)	Max at

[NO TRAIN DATA DURING 24 HOUR MEASUREMENT PERIOD]

Leq,Ldn,CNEL-	56.7	60.0	60.3	(with trains)
Leq,Ldn,CNEL-	56.7	60.0	60.3	(without trains)

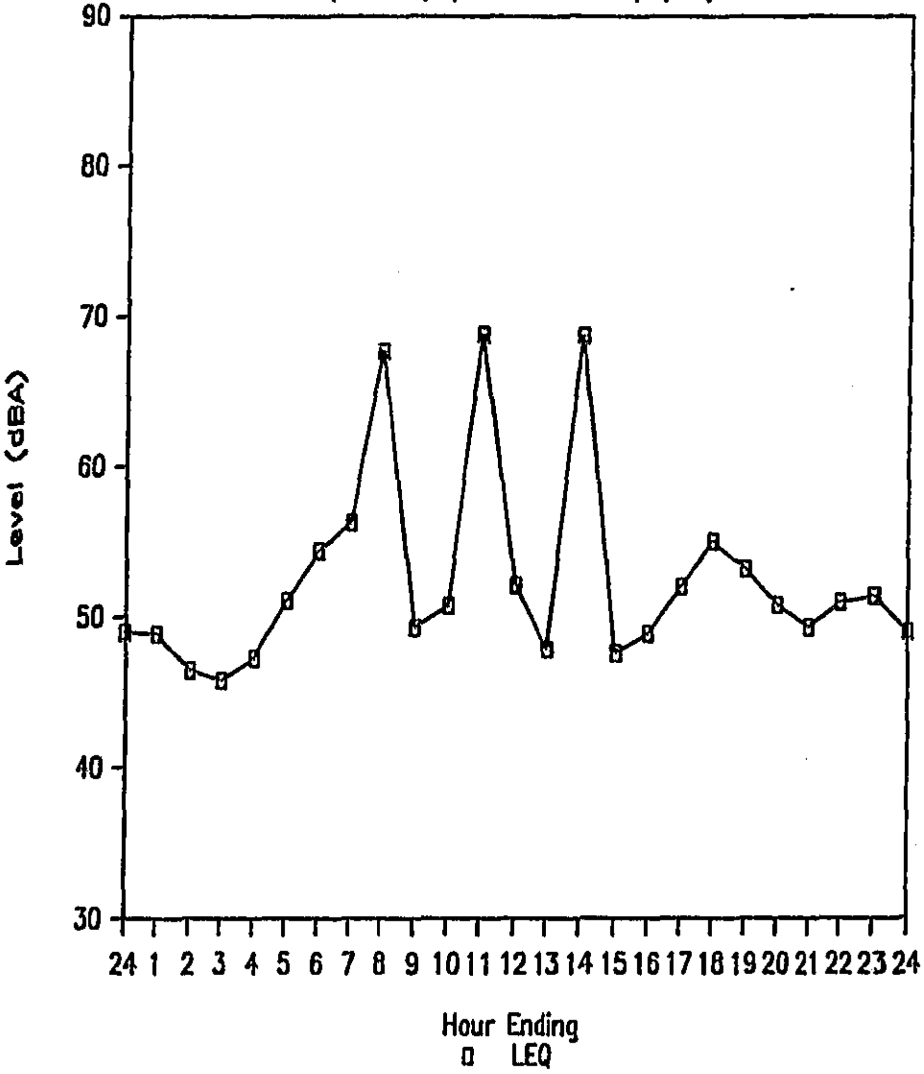
Location 8, 620 Gary Ave., Antioch

(Start 12:00 4/3/86)

L_{dn}=61.6, CNEL=61.7
Leq(24)=60.0

Ending Hour	L_{eq}	L_1	L_{10}	L_{50}	L_{90}	Date
1	48.9					4/4/86
2	46.5					4/4/86
3	45.8					4/4/86
4	47.3					4/4/86
5	51.1					4/4/86
6	54.4					4/4/86
7	56.3					4/4/86
8	67.7					4/4/86
9	49.3					4/4/86
10	50.8					4/4/86
11	68.8					4/4/86
12	52.1					4/4/86
13	47.9					4/3/86
14	68.7					4/3/86
15	47.6					4/3/86
16	48.9					4/3/86
17	52.0					4/3/86
18	55.0					4/3/86
19	53.2					4/3/86
20	50.8					4/3/86
21	49.3					4/3/86
22	51.0					4/3/86
23	51.4					4/3/86
24	49.0					4/3/86

Location 8, 620 Gary Ave., Antioch
(12:00 4/3/86 to 12:00 4/4/86)



Location 8, 620 Gary Ave., Antioch
Start 12:00 4/3/86

SENEL	Lmax	Duration (sec)	Max at	TRAIN	NO. OF LOCOS.	NO. OF CARS	LENGTH (FT)
104.1	87.7	125.0	13:26:10	IB-FREIGHT	4	100	6442
104.2	87.0	111.6	10:10:09	IB-FREIGHT	2	96	5569

Leq,Ldn,CNEL=	60.0	61.6	61.7	(with trains)
Leq,Ldn,CNEL=	56.1	59.3	59.5	(without trains)

TRAINS ONLY

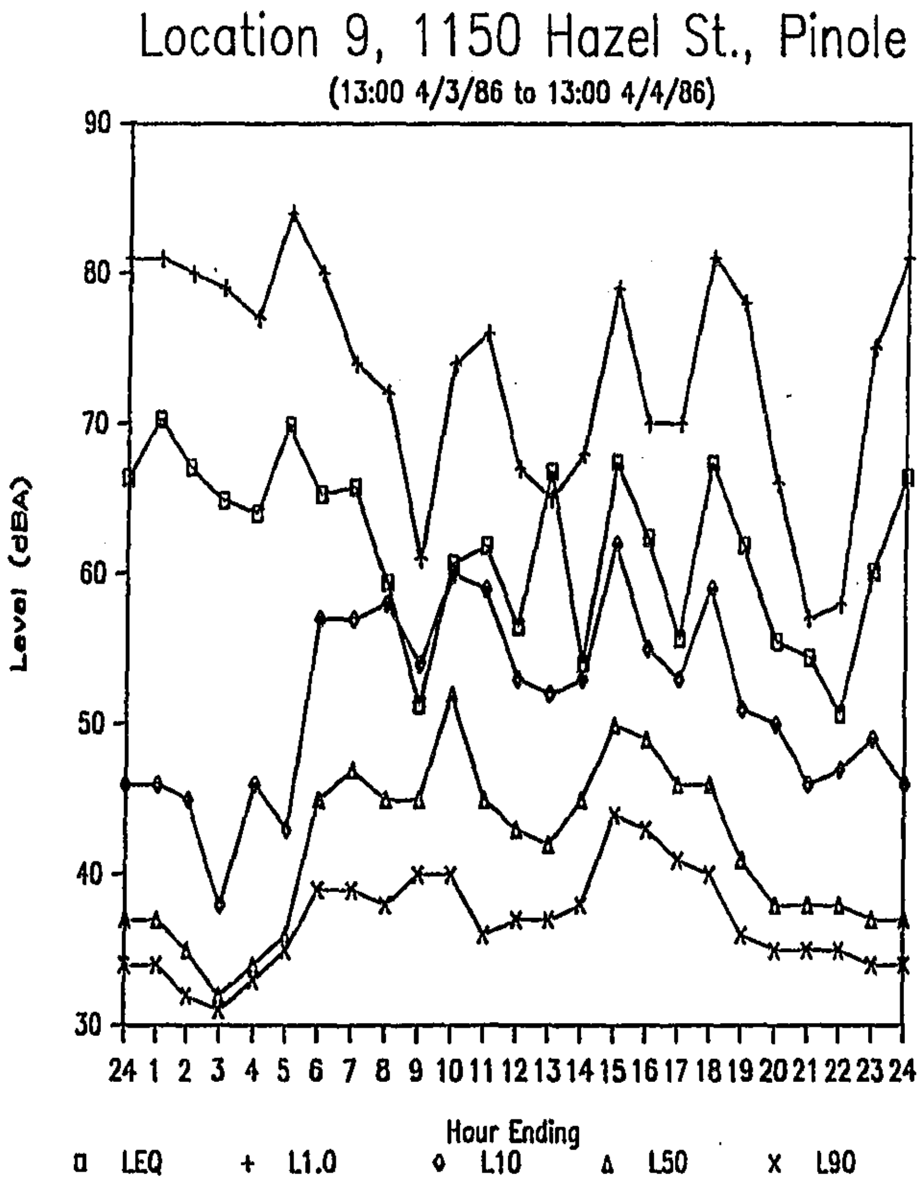
Leq(24)=	57.8
Ldn=	57.8
CNEL=	57.8

Location 9, 1150 Hazel St., Pinole

(Start 13:00 4/3/86)

L_{dn}=72.8, CNEL=72.8
Leq(24)=64.5

Ending Hour	L_{eq}	L_1	L_{10}	L_{50}	L_{90}	Date
1	70.3	81	46	37	34	4/4/86
2	67.1	80	45	35	32	4/4/86
3	64.9	79	38	32	31	4/4/86
4	64.0	77	46	34	33	4/4/86
5	69.9	84	43	36	35	4/4/86
6	65.3	80	57	45	39	4/4/86
7	65.8	74	57	47	39	4/4/86
8	59.4	72	58	45	38	4/4/86
9	51.3	61	54	45	40	4/4/86
10	60.7	74	60	52	40	4/4/86
11	61.9	76	59	45	36	4/4/86
12	56.5	67	53	43	37	4/4/86
13	66.8	65	52	42	37	4/4/86
14	54.0	68	53	45	38	4/3/86
15	67.4	79	62	50	44	4/3/86
16	62.4	70	55	49	43	4/3/86
17	55.7	70	53	46	41	4/3/86
18	67.3	81	59	46	40	4/3/86
19	61.9	78	51	41	36	4/3/86
20	55.5	66	50	38	35	4/3/86
21	54.4	57	46	38	35	4/3/86
22	50.7	58	47	38	35	4/3/86
23	60.1	75	49	37	34	4/3/86
24	66.4	81	46	37	34	4/3/86


Location 9, 1150 Hazel St., Pinole
(13:00 4/3/86 to 13:00 4/4/86)
Level (dBA)
90
80
70
60
50
40
30
24 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Hour Ending
□ LEQ
+ L1.0
◊ L10
Δ L50
x L90

Location 9, 1150 Hazel St., Pinole
Start 13:00 4/3/86

SENEL	Lmax	Duration (sec)	Max at	TRAIN	# LOCO	# CARS	LENGTH (FT)	HP
92.3	76.4	125.0	14:32:34	IB-SPT	4	100	6442	
101.8	91.6	159.6	14:37:32	EB-SF	3	75		9000
82.4	73.3	18.3	14:57:35	IB-AMTK	2	8	680	
92.3	84.5	24.8	15:13:17	Maint.(SF)	-	--		
85.2	82.0	6.0	15:49:07	EB-Loco.(SF)	1	0	0	
96.6	92.0	15.1	16:15:32	WB-ATSF	2	28		6000
89.2	78.0	67.5	16:30:46	OB-SPT	3	38	3451	
82.1	73.9	13.0	17:39:44	OB-AMTK	1	5	425	
102.2	96.6	43.6	17:49:49	WB-ATSF	3	28		6000
97.0	82.9	66.1	18:45:04	OB-SPT	4	73	4020	
90.2	77.4	35.0	19:25:38	IB-SPT	3	20	1202	
89.5	80.0	21.0	21:15:36	OB-AMTK	2	9	765	
84.6	74.9	18.9	21:36:43	IB-AMTK	1	5	425	
95.4	79.8	106.8	23:14:42	OB-SPT	4	59	5366	
100.1	88.8	49.4	23:44:21	EB-SF	2	24		4000
96.9	84.3	92.1	00:07:02	OB-SPT	4	62	4753	
98.3	81.9	139.3	00:49:04	OB-SPT	3	127	7340	
104.9	97.0	67.1	00:53:37	WB-SF	2	42		6000
102.5	95.0	106.5	01:34:03	WB-SF	2	58		6000
100.3	89.9	42.5	02:32:01	EB-SF	2	25		6000
96.7	81.3	101.0	03:59:53	IB-SPT	3	83	4976	
95.9	79.8	79.9	04:16:49	IB-SPT	4	62	3683	
104.7	95.2	71.4	04:41:07	EB-SF	5	43		15000
96.0	82.4	79.9	05:11:50	OB-SPT	3	41	3662	
100.5	88.5	43.5	05:26:16	EB-SF	2	24		6000
100.7	93.8	35.1	07:01:12	EB-SF	2	20		6000
80.7	78.7	5.1	07:26:17	IB-AMTK	2	10	850	
85.2	77.8	14.0	07:54:15	OB-AMTK	1	8	680	
93.6	79.7	75.2	10:12:51	IB-SPT	3	67	3568	
84.1	74.3	19.6	12:02:02	OB-AMTK	2	10	850	
102.0	96.5	29.4	12:57:48	WB-SF	2	1		6000

Leq,Ldn,CNEL-	64.5	72.8	72.8	(with trains)
Leq,Ldn,CNEL-	55.1	63.6	63.5	(without trains)

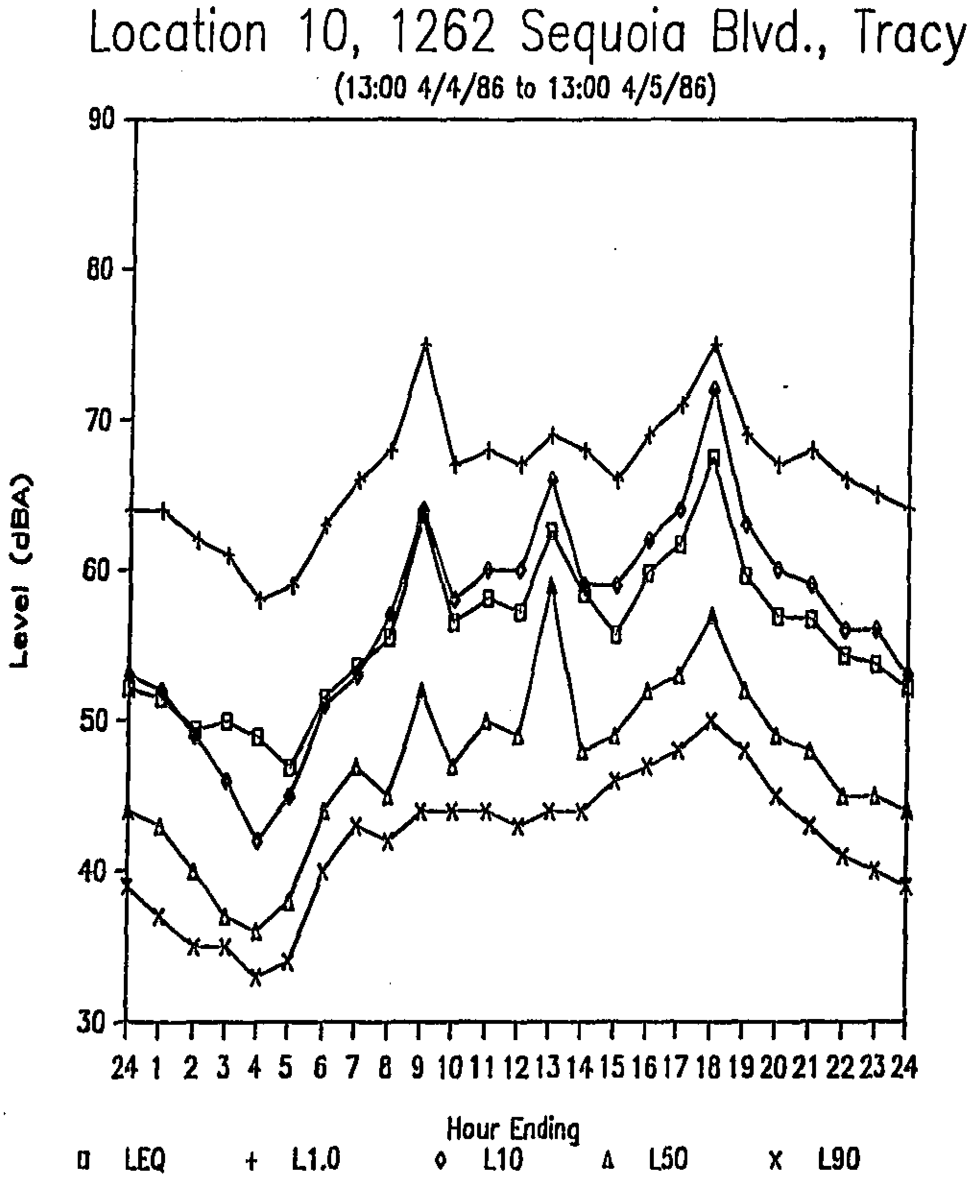
TRAINS ONLY

Leq(24)-	64.0
Ldn-	72.2
CNEL-	72.3

Location 10, 1262 Sequoia Blvd., Tracy

(Start 13:00 4/4/86) L_{dn}=61.3, CNEL=61.6
Leq(24)=58.9

Ending Hour	L_{eq}	L_1	L_{10}	L_{50}	L_{90}	Date
1	51.5	64	52	43	37	4/5/86
2	49.4	62	49	40	35	4/5/86
3	50.0	61	46	37	35	4/5/86
4	48.9	58	42	36	33	4/5/86
5	46.9	59	45	38	34	4/5/86
6	51.5	63	51	44	40	4/5/86
7	53.6	66	53	47	43	4/5/86
8	55.5	68	57	45	42	4/5/86
9	63.6	75	64	52	44	4/5/86
10	56.5	67	58	47	44	4/5/86
11	58.1	68	60	50	44	4/5/86
12	57.2	67	60	49	43	4/5/86
13	62.6	69	66	59	44	4/5/86
14	58.4	68	59	48	44	4/4/86
15	55.7	66	59	49	46	4/4/86
16	59.8	69	62	52	47	4/4/86
17	61.7	71	64	53	48	4/4/86
18	67.5	75	72	57	50	4/4/86
19	59.6	69	63	52	48	4/4/86
20	56.9	67	60	49	45	4/4/86
21	56.7	68	59	48	43	4/4/86
22	54.3	66	56	45	41	4/4/86
23	53.7	65	56	45	40	4/4/86
24	52.1	64	53	44	39	4/4/86


Location 10, 1262 Sequoia Blvd., Tracy
(13:00 4/4/86 to 13:00 4/5/86)
Level (dBA)
90
80
70
60
50
40
30
24 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Hour Ending
□ LEQ + L1.0 ◊ L10 Δ L50 x L90

Location 10, 1262 Sequoia Blvd., Tracy
Start 13:00 4/4/86

SENEL	Lmax	Duration (sec)	Max At	TRAIN	NO. OF LOCOS.	NO. OF CARS	LENGTH (FT)
87.9	82.0	240.9	08:02:37	OB-FREIGHT	3	57	4156

	Leq	Ldn	CNEL	
Leq,Ldn,CNEL=	58.9	61.3	61.6	(with trains)
Leq,Ldn,CNEL=	58.9	61.3	61.6	(without trains)

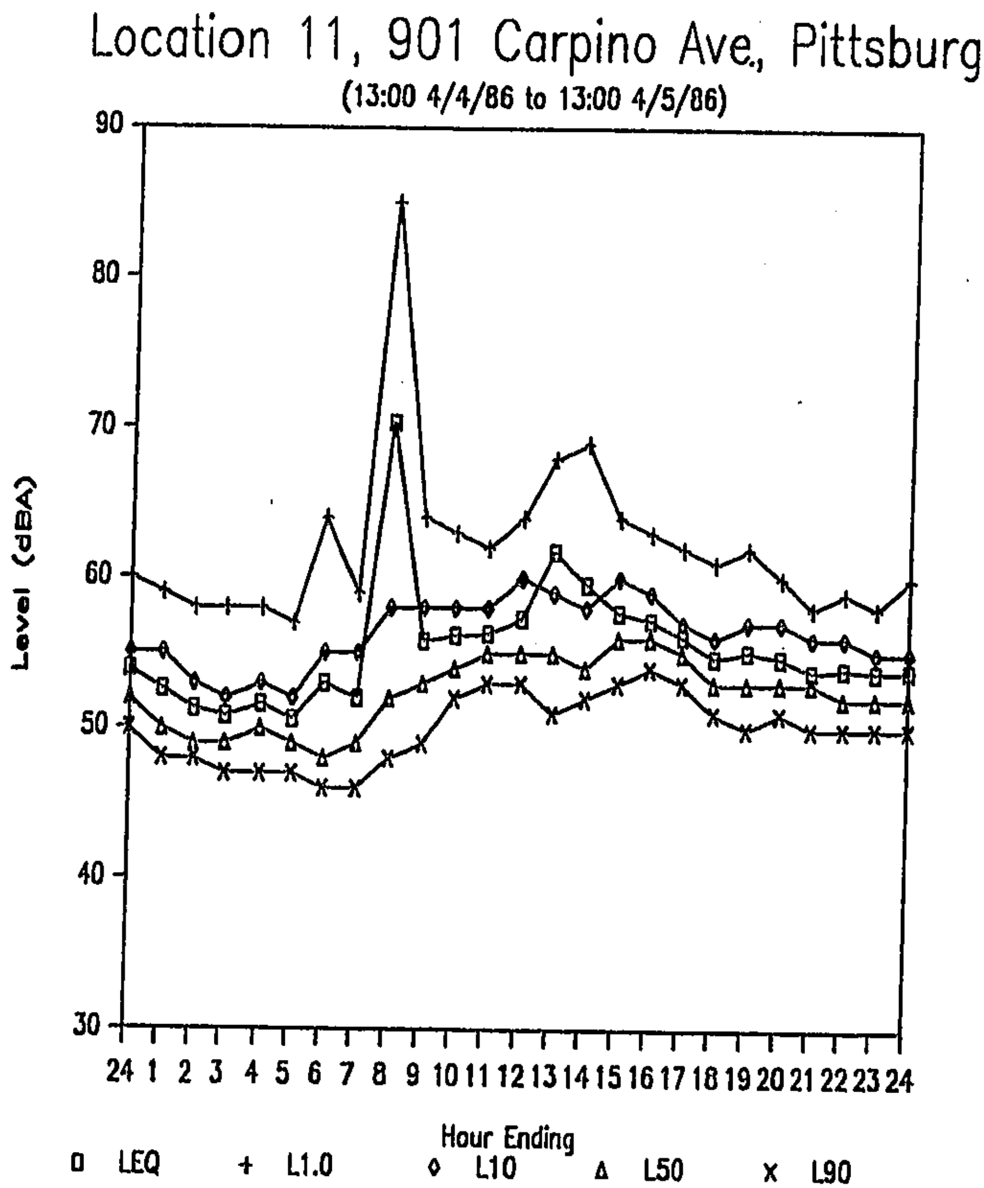
TRAINS ONLY

Leq(24)=	38.5
Ldn=	38.5
CNEL=	38.5

Location 11, 901 Carpino Ave., Pittsburg

(Start 13:00 4/4/86) L_{dn}=61.7, CNEL=61.9
Leq(24)=59.1

Ending Hour	L_{eq}	L_1	L_{10}	L_{50}	L_{90}	Date
1	52.6	59	55	50	48	4/5/86
2	51.3	58	53	49	48	4/5/86
3	50.8	58	52	49	47	4/5/86
4	51.6	58	53	50	47	4/5/86
5	50.6	57	52	49	47	4/5/86
6	53.0	64	55	48	46	4/5/86
7	52.0	59	55	49	46	4/5/86
8	70.3	85	58	52	48	4/5/86
9	55.8	64	58	53	49	4/5/86
10	56.2	63	58	54	52	4/5/86
11	56.3	62	58	55	53	4/5/86
12	57.3	64	60	55	53	4/5/86
13	61.8	68	59	55	51	4/5/86
14	59.6	69	58	54	52	4/4/86
15	57.7	64	60	56	53	4/4/86
16	57.2	63	59	56	54	4/4/86
17	56.1	62	57	55	53	4/4/86
18	54.7	61	56	53	51	4/4/86
19	55.1	62	57	53	50	4/4/86
20	54.7	60	57	53	51	4/4/86
21	53.8	58	56	53	50	4/4/86
22	54.0	59	56	52	50	4/4/86
23	53.8	58	55	52	50	4/4/86
24	53.9	60	55	52	50	4/4/86


Location 11, 901 Carpino Ave., Pittsburg
(13:00 4/4/86 to 13:00 4/5/86)
Level (dBA)
90
80
70
60
50
40
30
24 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Hour Ending
□ LEQ + L1.0 ◊ L10 Δ L50 x L90

Location 11, 901 Carpino Ave., Pittsburg
Start 13:00 4/4/86

SENEL	Lmax	Duration (sec)	Max at	TRAIN	NO. OF LOCOS.	NO. OF CARS	LENGTH (FT)
105.7	91.6	103.9	07:13:10	OB-FREIGHT	3	57	4156

Leq,Ldn,CNEL= 59.1 61.7 61.9 (with trains)
Leq,Ldn,CNEL= 55.9 60.2 60.5 (without trains)

TRAINS ONLY
Leq(24)= 57.0
Ldn= 57.0
CNEL= 57,0

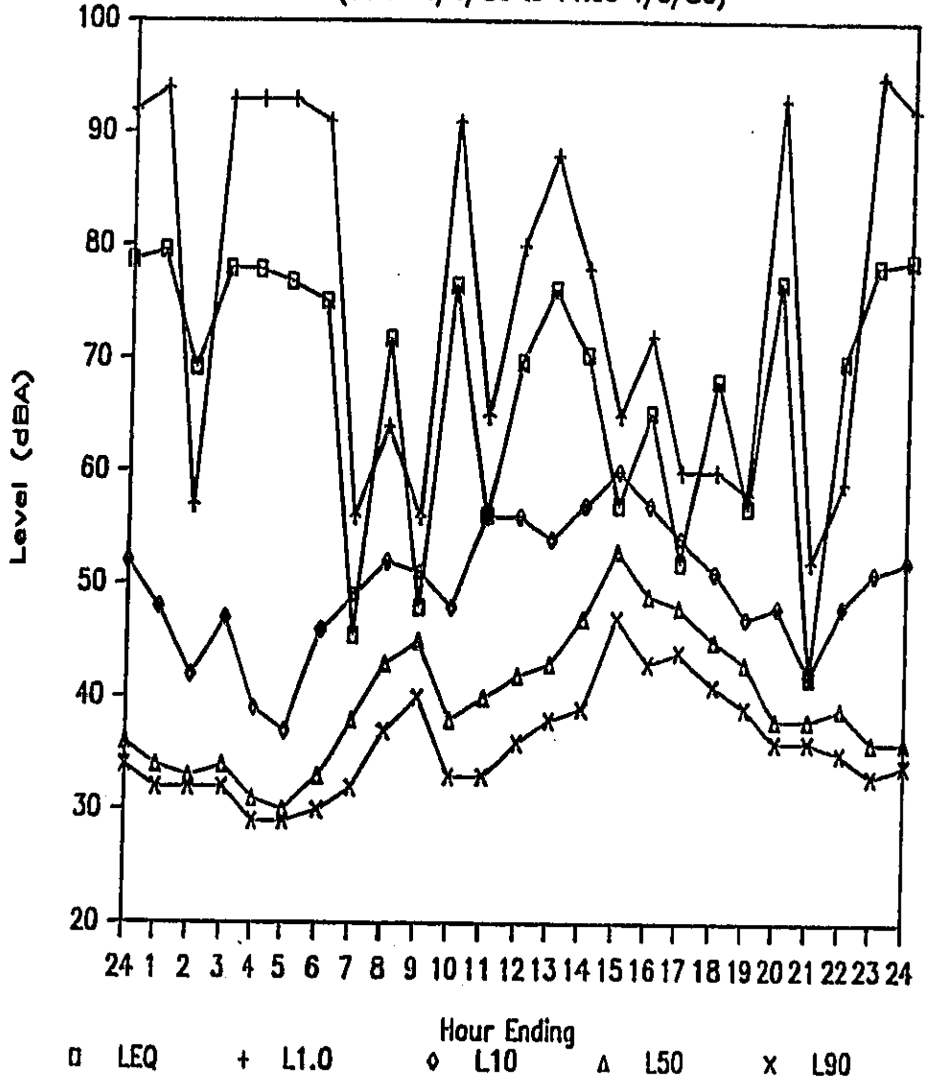
Location 12, 2047 Cypress Ave., Pinole

(Start 14:00 4/4/86) L_{dn}=82.8, CNEL=82.9
Leq=74.2

Ending Hour	L_{eq}	L_1	L_{10}	L_{50}	L_{90}	Date
1	79.6	94	48	34	32	4/5/86
2	69.2	57	42	33	32	4/5/86
3	78.0	93	47	34	32	4/5/86
4	77.9	93	39	31	29	4/5/86
5	76.8	93	37	30	29	4/5/86
6	75.1	91	46	33	30	4/5/86
7	45.5	56	49	38	32	4/5/86
8	71.8	64	52	43	37	4/5/86
9	48.0	56	51	45	40	4/5/86
10	76.5	91	48	38	33	4/5/86
11	56.2	65	56	40	33	4/5/86
12	69.7	80	56	42	36	4/5/86
13	76.2	88	54	43	38	4/5/86
14	70.4	78	57	47	39	4/5/86
15	57.0	65	60	53	47	4/4/86
16	65.2	72	57	49	43	4/4/86
17	51.9	60	54	48	44	4/4/86
18	68.1	60	51	45	41	4/4/86
19	56.8	58	47	43	39	4/4/86
20	76.7	93	48	38	36	4/4/86
21	41.8	52	42	38	36	4/4/86
22	69.7	59	48	39	35	4/4/86
23	78.2	95	51	36	33	4/4/86
24	78.7	92	52	36	34	4/4/86

Location 12, 2047 Cypress Ave., Pinole

(14:00 4/4/86 to 14:00 4/5/86)



Location 12, 2047 Cypress Ave., Pinole
Start 14:00 4/4/86

SENEL	Lmax	Duration (sec)	Max at	TRAIN	NO. OF LOCOS.	NO. OF CARS	LENGTH (FT)
102.4	95.5	12.3	17:35:31	OB-AMTRAK	1	6	
109.2	97.4	50.0	19:05:23	OB-FREIGHT	2	12	
106.6	98.9	18.6	19:23:19	IB-FREIGHT	2	27	2388
105.3	97.7	19.3	19:41:14	OB-FREIGHT	2	14	671
105.1	97.4	19.0	21:16:46	OB-AMTRAK	2	11	
103.0	96.2	18.8	22:01:24	IB-AMTRAK	1	5	
113.2	99.1	75.5	22:39:09	OB-FREIGHT	2	49	4504
111.1	99.0	81.4	23:04:10	IB-FREIGHT	3	69	3654
111.1	99.9	89.3	23:54:47	OB-FREIGHT	2	43	4522
115.0	101.2	146.3	00:49:43	OB-FREIGHT	3	140	8066
104.6	96.0	22.6	01:53:22	IB-AMTRAK	2	9	
113.4	98.9	104.4	02:52:38	OB-FREIGHT	2		5162
113.3	99.3	95.1	03:04:33	IB-FREIGHT	3	84	5121
112.3	96.8	90.3	04:43:50	IB-FREIGHT	5	61	4400
110.5	95.3	99.5	05:46:46	OB-FREIGHT	3	57	4156
105.7	98.1	20.1	07:35:11	IB-AMTRAK	2	9	
101.7	96.2	12.3	07:52:44	OB-AMTRAK	1	5	
111.9	99.7	119.1	09:22:10	OB-FREIGHT	3		6490
110.3	107.2	33.9	12:02:18	OB-AMTRAK	2	11	
102.1	95.6	15.3	12:08:51	IB-AMTRAK	1	5	

Leq,Ldn,CNEL=	74.2	82.8	82.9	(with trains)
Leq,Ldn,CNEL=	63.7	68.3	68.0	(without trains)

TRAINS ONLY
Leq(24)= 74.0
Ldn= 82.7
CNEL= 82.8

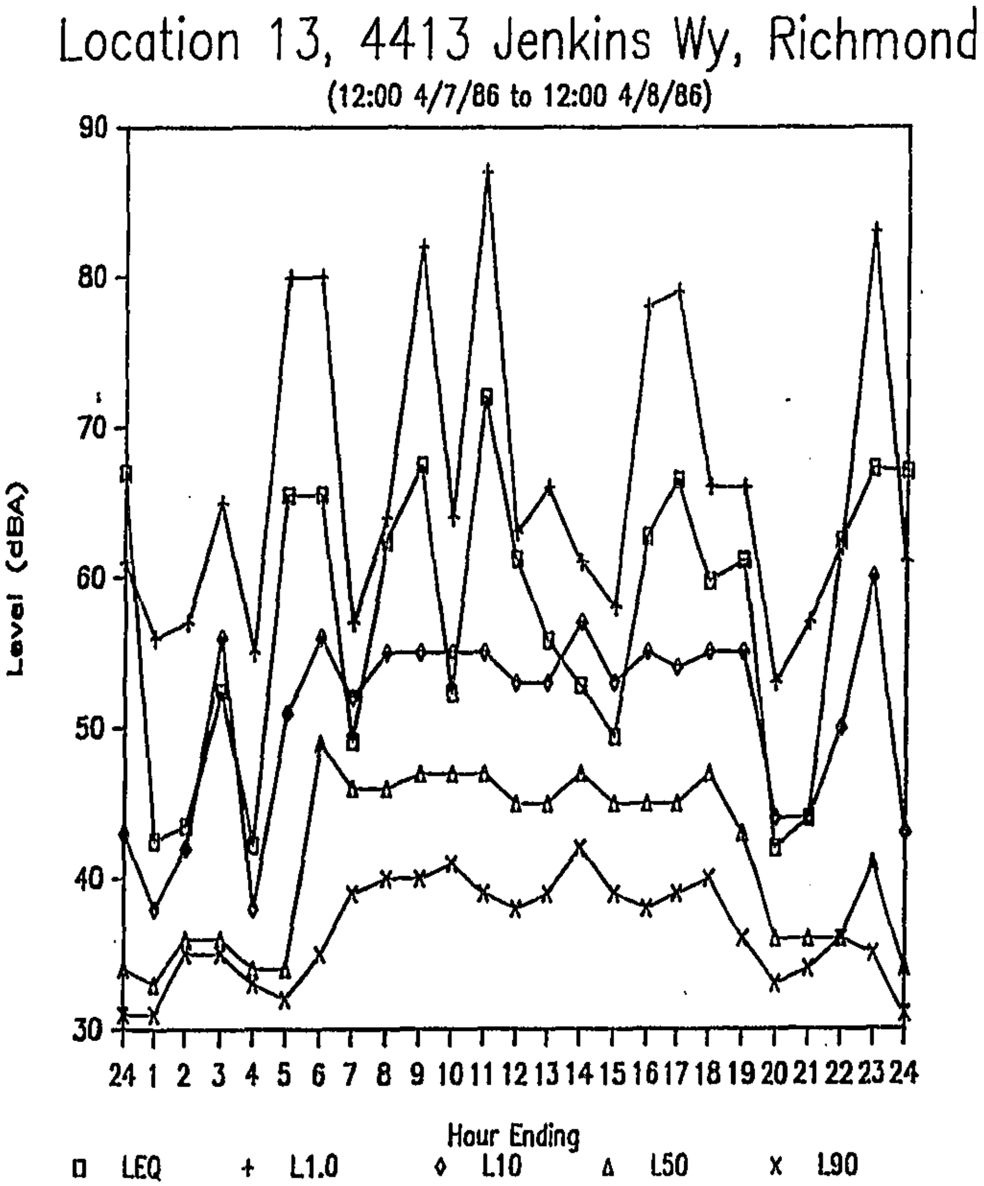
106.3	100.3	23.0	14:00:55	IB-FREIGHT	1	5	428

Location 13, 4413 Jenkins Way, Richmond

(Start 12:00 4/7/86)

L_{dn}=69.5, CNEL=69.5
Leq(24)=63.5

Ending Hour	L_{eq}	L_1	L_{10}	L_{50}	L_{90}	Date
1	42.5	56	38	33	31	4/8/86
2	43.5	57	42	36	35	4/8/86
3	52.4	65	56	36	35	4/8/86
4	42.2	55	38	34	33	4/8/86
5	65.5	80	51	34	32	4/8/86
6	65.5	80	56	49	35	4/8/86
7	49.1	57	52	46	39	4/8/86
8	62.4	64	55	46	40	4/8/86
9	67.5	82	55	47	40	4/8/86
10	52.3	64	55	47	41	4/8/86
11	72.0	87	55	47	39	4/8/86
12	61.2	63	53	45	38	4/8/86
13	55.8	66	53	45	39	4/7/86
14	52.8	61	57	47	42	4/7/86
15	49.4	58	53	45	39	4/7/86
16	62.7	78	55	45	38	4/7/86
17	66.5	79	54	45	39	4/7/86
18	59.7	66	55	47	40	4/7/86
19	61.1	66	55	43	36	4/7/86
20	42.0	53	44	36	33	4/7/86
21	44.0	57	44	36	34	4/7/86
22	62.4	62	50	36	36	4/7/86
23	67.2	83	60	41	35	4/7/86
24	67.0	61	43	34	31	4/7/86


Location 13, 4413 Jenkins Wy, Richmond
(12:00 4/7/86 to 12:00 4/8/86)
Level (dBA)
90
80
70
60
50
40
30
24 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Hour Ending
LEQ
L1.0
L10
L50
L90

Location 13, 4413 Jenkins Way, Richmond
Start 12:00 4/7/86

SENEL	Lmax	Duration (sec)	Max at	TRAIN	NO. OF LOCOS.	NO. OF CARS	LENGTH (FT)
88.8	82.3	11.1	12:05:33	IB-AMTRAK	1	5	
92.1	85.7	15.3	15:25:19	IB-AMTRAK	2	11	
96.6	85.5	52.1	15:50:22	IB-FREIGHT	3	47	3358
98.4	90.1	53.5	16:10:29	IB-FREIGHT	3	64	3265
99.3	90.0	73.1	16:48:34	IB-FREIGHT	?	37	3132
94.0	88.7	12.6	17:35:34	OB-AMTRAK	1	5	
95.8	89.5	16.9	18:44:59	OB-FREIGHT	4	3	170
97.2	89.3	19.4	21:40:41	OB-AMTRAK	2	11	
88.7	82.8	11.1	21:44:19	IB-AMTRAK	1	5	
102.4	91.6	53.6	22:45:58	OB-FREIGHT	7	31	2826
102.4	92.8	31.9	23:16:55	OB-FREIGHT	6	17	1203
98.2	82.8	106.6	04:15:59	IB-FREIGHT	4	74	4428
97.7	85.3	54.3	04:49:16	IB-FREIGHT	3	44	2513
100.7	91.1	61.9	05:12:12	IB-FREIGHT	4	56	3386
93.3	88.0	17.8	07:38:70	IB-AMTRAK	2	11	
95.4	89.8	13.5	07:50:42	OB-AMTRAK	1	5	
101.3	91.3	54.8	08:00:57	OB-FREIGHT	4	41	2371
97.6	81.6	89.9	08:10:26	IB-FREIGHT	3	94	2174
107.5	95.3	90.3	10:03:06	OB-FREIGHT	3	90	5630
87.4	81.5	9.8	11:56:31	OB-AMTRAK	2	8	
95.7	88.7	14.0	11:58:40	IB-AMTRAK	1	5	

Leq,Ldn,CNEL-	63.5	69.5	69.5	(with trains)
Leq,Ldn,CNEL-	52.6	57.9	58.8	(without trains)

TRAINS ONLY

Leq(24)-	63.2
Ldn-	69.1
CNEL-	69.1

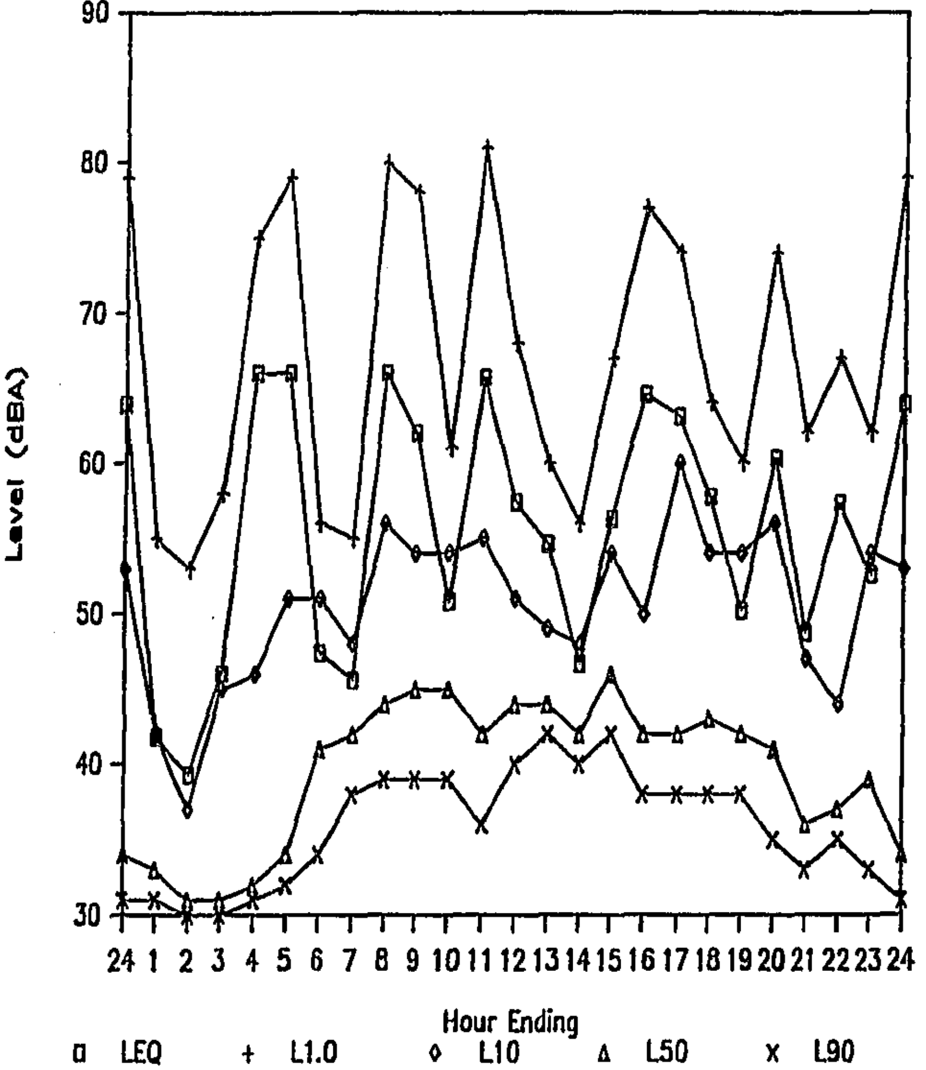
Location 14, 4 Prospect Ave, Port Costa

(Start 11:00 4/7/86) L_{dn}=67.1, CNEL=67.3
Leq(24)=60.8

Ending Hour	L_{eq}	L_1	L_{10}	L_{50}	L_{90}	Date
1	41.8	55	42	33	31	4/8/76
2	39.3	53	37	31	30	4/8/76
3	46.0	58	45	31	30	4/8/76
4	66.0	75	46	32	31	4/8/76
5	66.0	79	51	34	32	4/8/76
6	47.4	56	51	41	34	4/8/76
7	45.6	55	48	42	38	4/8/76
8	66.0	80	56	44	39	4/8/76
9	62.0	78	54	45	39	4/8/76
10	50.8	61	54	45	39	4/8/76
11	65.7	81	55	42	36	4/8/76
12	57.4	68	51	44	40	4/7/86
13	54.6	60	49	44	42	4/7/86
14	46.7	56	48	42	40	4/7/86
15	56.3	67	54	46	42	4/7/86
16	64.6	77	50	42	38	4/7/86
17	63.1	74	60	42	38	4/7/86
18	57.7	64	54	43	38	4/7/86
19	50.2	60	54	42	38	4/7/86
20	60.3	74	56	41	35	4/7/86
21	48.7	62	47	36	33	4/7/86
22	57.3	67	44	37	35	4/7/86
23	52.6	62	54	39	33	4/7/86
24	63.9	79	53	34	31	4/7/86

Location 14,4 Prospect Ave., Port Costa

(11:00 4/7/86 to 11:00 4/8/86)



Location 14, 4 Prospect Ave., Port Costa
Start 11:00 4/7/86

SENEL	Lmax	Duration (sec)	Max at	TRAIN	NO. OF LOCOS.	NO. OF CARS	LENGTH (FT)
86.4	79.4	13.5	11:44:39	IB-AMTRAK	1	5	
89.3	80.2	20.0	12:15:37	OB-AMTRAK	2	8	
90.1	81.9	20.5	15:08:54	IB-AMTRAK	2	8	
96.5	87.3	62.3	15:32:47	IB-FREIGHT	3	47	3358
96.5	87.0	69.5	15:52:36	IB-FREIGHT	3	64	3265
98.2	88.3	112.6	16:30:53	IB-FREIGHT	?	37	3132
88.3	80.1	17.4	17:54:06	OB-AMTRAK	1	5	
95.2	80.7	18.4	19:06:31	OB-FREIGHT	4	3	170
88.0	80.4	11.6	21:27:28	IB-AMTRAK	1	5	
90.7	81.6	22.3	21:58:26	OB-AMTRAK	2	11	
96.4	82.0	6.6	23:05:17	OB-FREIGHT	7	31	2826
95.8	85.3	40.0	23:34:46	OB-FREIGHT	6	17	1203
101.4	90.5	100.6	03:56:46	IB-FREIGHT	3	44	2513
96.4	82.4	52.8	04:30:48	IB-FREIGHT	4	74	4428
99.7	89.5	82.9	04:54:48	IB-FREIGHT	4	56	3386
90.4	81.7	22.1	07:21:03	IB-AMTRAK	2	11	
100.9	89.9	92.5	07:51:34	OB-FREIGHT	4	41	2371
89.0	80.3	18.8	08:08:33	OB-AMTRAK	1	5	
96.4	84.0	53.9	08:20:56	IB-FREIGHT	3	94	2174
101.0	87.4	113.9	10:22:44	OB-FREIGHT	3	90	5630

Leq,Ldn,CNEL- 60.8 67.1 67.3 (with trains)
Leq,Ldn,CNEL- 52.1 54.4 58.1 (without trains)

TRAINS ONLY
Leq(24)- 60.3
Ldn- 66.8
CNEL- 66.9

Location 15, 16061 Seventh St., Lathrop

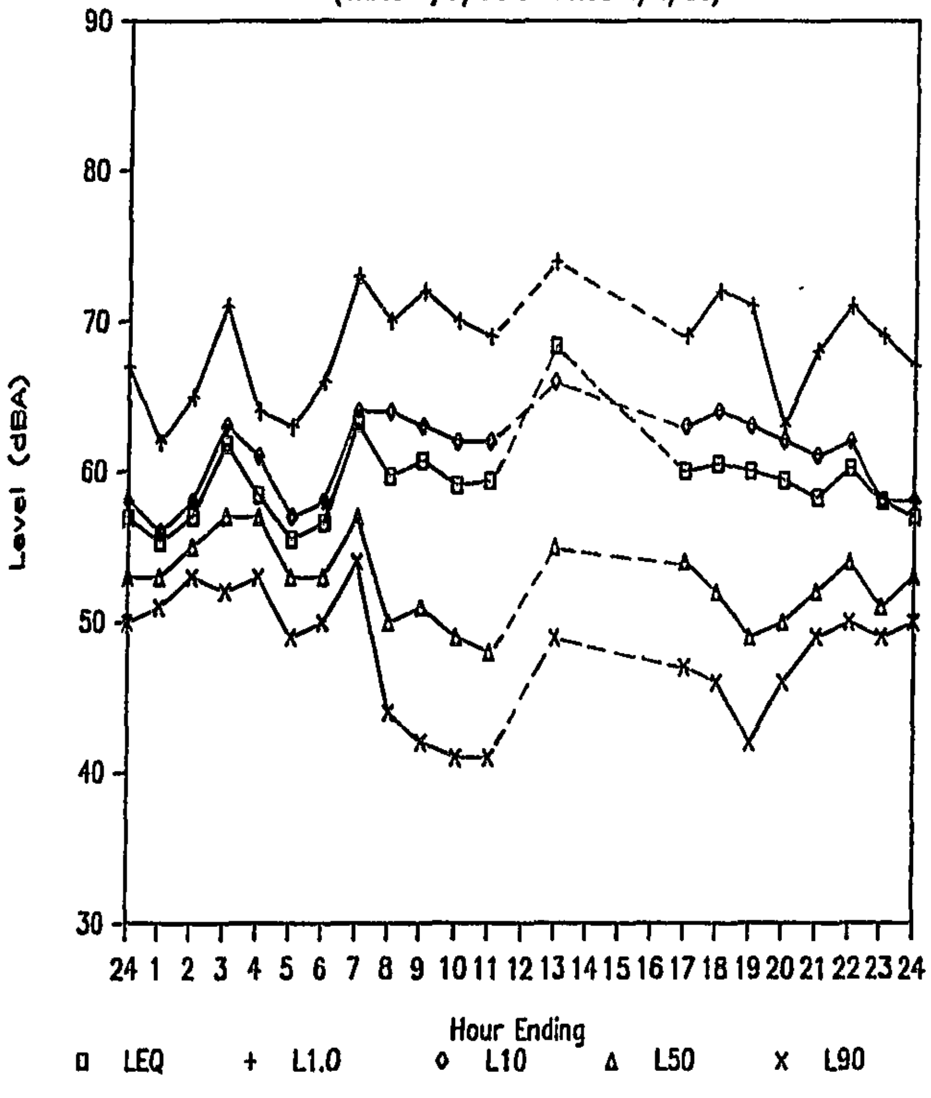
(Start 12:00 4/7/86)

L_{dn}=66.4, CNEL=66.7
Leq(20)=60.7

Ending Hour	L_{eq}	L_1	L_{10}	L_{50}	L_{90}	Date
1	55.3	62	56	53	51	4/8/86
2	57.0	65	58	55	53	4/8/86
3	61.8	71	63	57	52	4/8/86
4	58.4	64	61	57	53	4/8/86
5	55.5	63	57	53	49	4/8/86
6	56.6	66	58	53	50	4/8/86
7	63.2	73	64	57	54	4/8/86
8	59.7	70	64	50	44	4/8/86
9	60.7	72	63	51	42	4/8/86
10	59.1	70	62	49	41	4/8/86
11	59.4	69	62	48	41	4/8/86
12	--	--	--	--	--	--
13	68.4	74	66	55	49	4/7/86
14	--	--	--	--	--	--
15	--	--	--	--	--	--
16	--	--	--	--	--	--
17	60.0	69	63	54	47	4/7/86
18	60.5	72	64	52	46	4/7/86
19	60.0	71	63	49	42	4/7/86
20	59.4	63	62	50	46	4/7/86
21	58.2	68	61	52	49	4/7/86
22	60.2	71	62	54	50	4/7/86
23	58.0	69	58	51	49	4/7/86
24	56.9	67	58	53	50	4/7/86

Location 15, 16061 Seventh St., Lathrop

(12:00 4/7/86 to 11:00 4/8/86)



Location 15, 16061 Seventh St., Lathrop
Start 12:00 4/7/86

SENEL	Lmax	Duration (sec)	Max at	TRAIN	NO. OF LOCOS.	NO. OF CARS	LENGTH (FT)
92.1	76.3	103.0	02:14:06	WB-FREIGHT	?	50	?

Leq,Ldn,CNEL	60.7	66.4	66.7 (with trains)
Leq,Ldn,CNEL	60.6	66.2	66.5 (without trains)

TRAINS ONLY

Leq(20)=	43.5
Ldn=	53.5
CNEL=	53.5

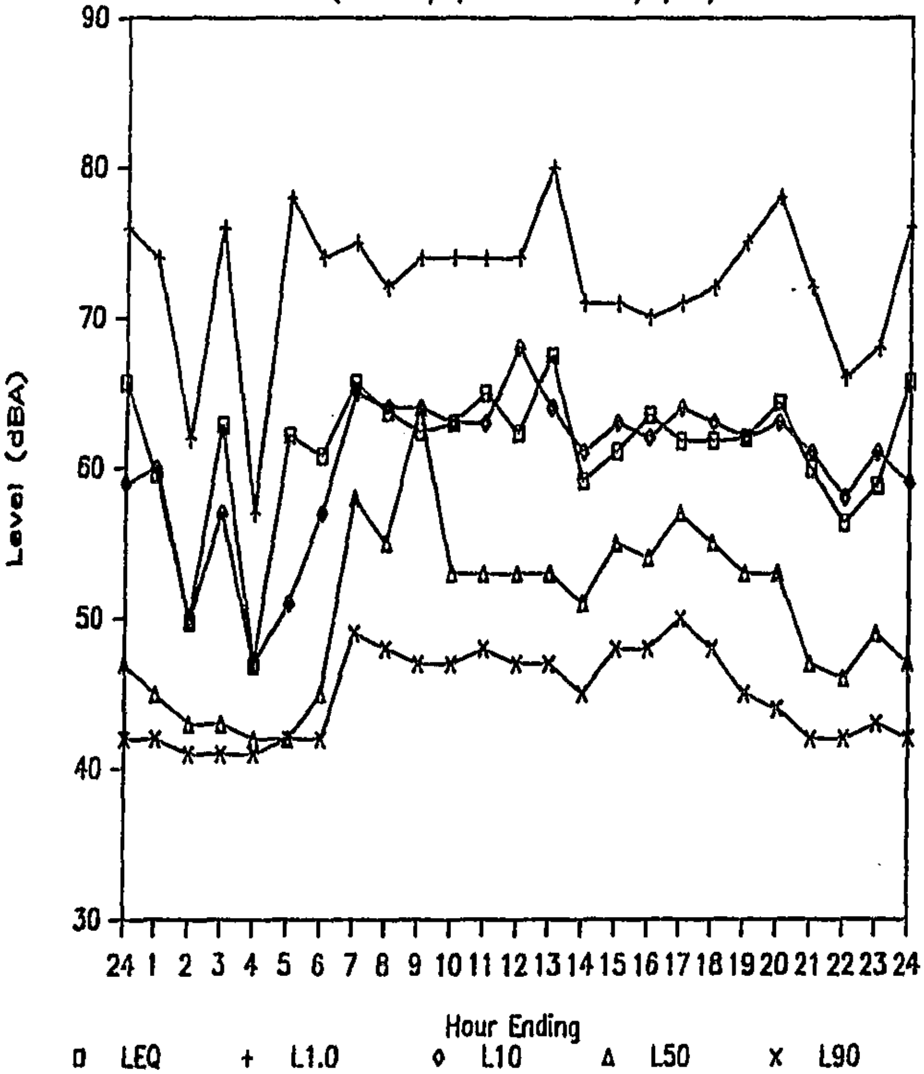
Location 16, 904 Stanton St., San Pablo

(Start 13:00 4/8/86) L_{dn}=68.5, CNEL=68.7
Leq(24)=62.6

Ending Hour	L_{eq}	L_1	L_{10}	L_{50}	L_{90}	Date
1	59.6	74	60	45	42	4/9/86
2	49.8	62	50	43	41	4/9/86
3	62.9	76	57	43	41	4/9/86
4	46.9	57	47	42	41	4/9/86
5	62.2	78	51	42	42	4/9/86
6	60.8	74	57	45	42	4/9/86
7	65.7	75	65	58	49	4/9/86
8	63.7	72	64	55	48	4/9/86
9	62.4	74	64	64	47	4/9/86
10	63.0	74	63	53	47	4/9/86
11	65.0	74	63	53	48	4/9/86
12	62.3	74	68	53	47	4/9/86
13	67.5	80	64	53	47	4/9/86
14	59.1	71	61	51	45	4/8/86
15	61.1	71	63	55	48	4/8/86
16	63.5	70	62	54	48	4/8/86
17	61.8	71	64	57	50	4/8/86
18	61.8	72	63	55	48	4/8/86
19	62.0	75	62	53	45	4/8/86
20	64.3	78	63	53	44	4/8/86
21	59.9	72	61	47	42	4/8/86
22	56.3	66	58	46	42	4/8/86
23	58.8	68	61	49	43	4/8/86
24	65.7	76	59	47	42	4/8/86

Location 16, 904 Stanton St., San Pablo

(13:00 4/8/86 to 13:00 4/9/86)



Location 16, 904 Stanton St., San Pablo
Start 13:00 4/8/86

SENEL	Lmax	Duration (sec)	Max at	TRAIN	NO. OF LOCOS.	NO. OF CARS	HP
93.5	83.8	33.6	18:07:41	WB-FREIGHT	3	16	9000
96.5	87.3	53.6	19:42:08	WB-FREIGHT	2	35	6000
100.8	95.5	77.6	23:29:28	EB-FREIGHT	2	43	6000
93.1	83.0	38.0	00:38:23	WB-FREIGHT	2	43	6000
97.4	89.1	52.4	02:15:48	EB-FREIGHT	2	32	6000
83.2	78.8	5.1	02:50:25	WB-FREIGHT	2	1	6000
97.4	85.6	68.9	04:17:15	EB-FREIGHT	5	56	15000
95.1	90.3	38.8	05:04:31	EB-FREIGHT	3	23	9000
97.3	96.5	19.0	06:48:22	EB-FREIGHT	3	10	8000
91.8	94.2	5.9	06:56:34	EB-FREIGHT	2	1	4000
89.9	89.3	5.6	09:08:39	WB-FREIGHT	2	1	4000
101.7	93.2	73.6	12:55:11	EB-FREIGHT	2	54	6000

Leq,Ldn,CNEL	62.6	68.5	68.7 (with trains)
Leq,Ldn,CNEL	60.6	64.4	64.7 (without trains)

TRAINS ONLY

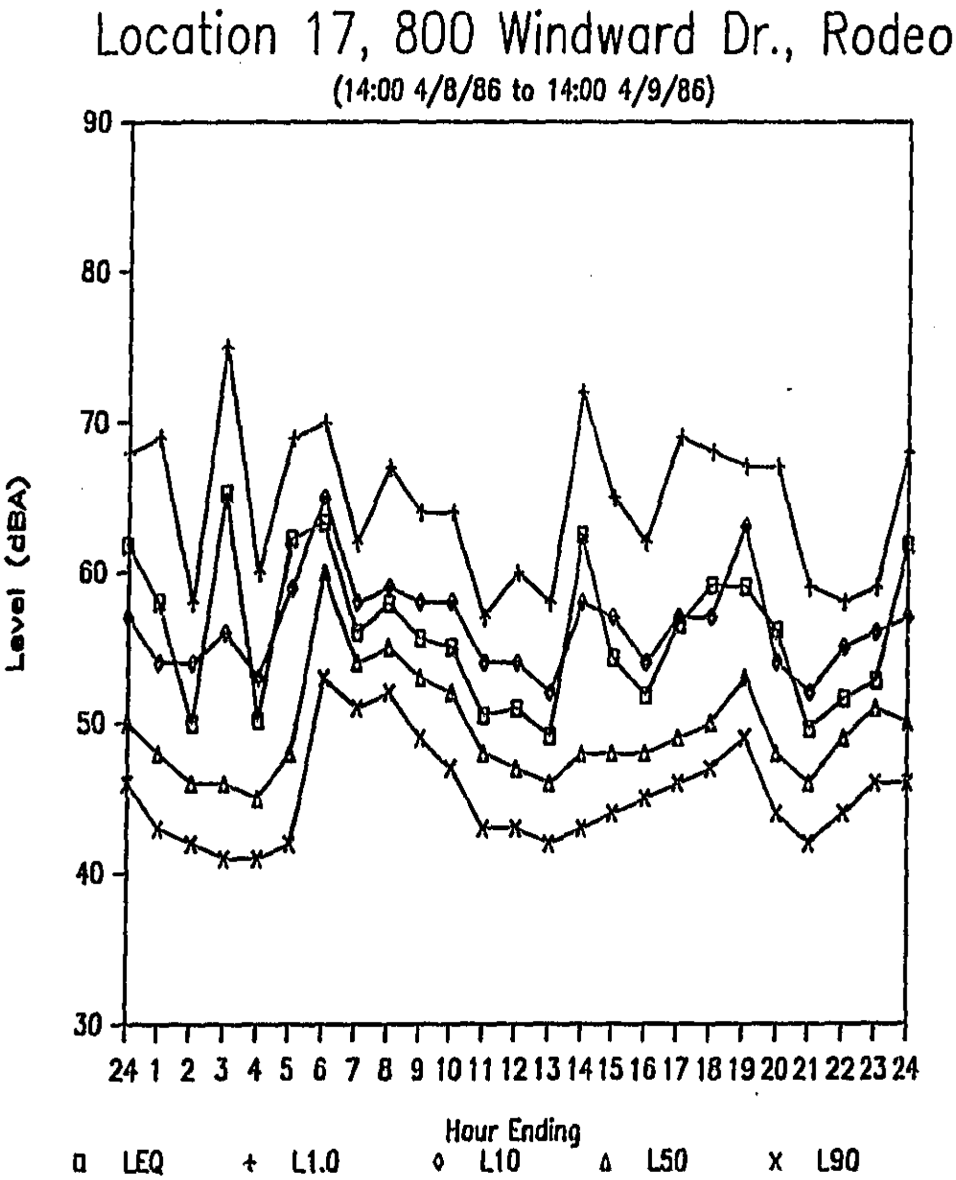
Leq(24)-	58.2
Ldn-	66.4
CNEL-	66.5

Location 17, 800 Windward Dr., Rodeo

(Start 14:00 4/8/86)

L_{dn}=66.5, CNEL=66.6
Leq(24)=58.4

Ending Hour	L_{eq}	L_1	L_{10}	L_{50}	L_{90}	Date
1	58.0	69	54	48	43	4/9/86
2	50.0	58	54	46	42	4/9/86
3	65.3	75	56	46	41	4/9/86
4	50.2	60	53	45	41	4/9/86
5	62.3	69	59	48	42	4/9/86
6	63.3	70	65	60	53	4/9/86
7	56.0	62	58	54	51	4/9/86
8	57.9	67	59	55	52	4/9/86
9	55.6	64	58	53	49	4/9/86
10	55.0	64	58	52	47	4/9/86
11	50.5	57	54	48	43	4/9/86
12	51.0	60	54	47	43	4/9/86
13	49.1	58	52	46	42	4/9/86
14	62.5	72	58	48	43	4/9/86
15	54.3	65	57	48	44	4/8/86
16	51.8	62	54	48	45	4/8/86
17	56.5	69	57	49	46	4/8/86
18	59.1	68	57	50	47	4/8/86
19	59.0	67	63	53	49	4/8/86
20	56.1	67	54	48	44	4/8/86
21	49.6	59	52	46	42	4/8/86
22	51.6	58	55	49	44	4/8/86
23	52.8	59	56	51	46	4/8/86
24	61.8	68	57	50	46	4/8/86


Location 17, 800 Windward Dr., Rodeo
(14:00 4/8/86 to 14:00 4/9/86)
Level (dBA)
90
80
70
60
50
40
30
24 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Hour Ending
□ LEQ + L1.0 ◇ L10 △ L50 X L90

Location 17, 800 Windward Dr., Rodeo
Start 14:00 4/8/86

SENEL	Lmax	Duration (sec)	Max at	TRAIN	NO. OF LOCOS.	NO. OF CARS	HP
93.1	85.0	80.3	17:55:36	WB-FREIGHT	3	16	9000
82.2	79.4	68.8	19:29:09	WB-FREIGHT	2	35	6000
96.4	88.1	87.9	23:42:43	EB-FREIGHT	2	43	6000
92.5	82.9	68.1	00:25:24	WB-FREIGHT	2	43	6000
100.1	91.5	102.3	02:26:47	EB-FREIGHT	2	32	6000
90.1	83.0	15.9	02:39:06	WB-FREIGHT	2	1	6000
97.0	88.4	149.3	04:28:07	EB-FREIGHT	5	56	15000
94.1	83.5	121.8	05:16:40	EB-FREIGHT	3	23	9000
86.5	76.0	42.1	07:00:08	EB-FREIGHT	3	10	8000
81.6	72.5	16.0	07:08:46	EB-FREIGHT	2	1	4000
76.6	69.4	10.0	08:41:41	WB-FREIGHT	2	1	4000
96.7	87.2	60.9	13:10:27	EB-FREIGHT	2	54	6000
88.5	79.1	57.6	13:36:42	WB-FREIGHT	2	25	6000

Leq,Ldn,CNEL	58.4	66.5	66.6 (with trains)
Leq,Ldn,CNEL	54.9	61.8	62.1 (without trains)

TRAINS ONLY

Leq(24)	55.8
Ldn	64.7
CNEL	64.7

Location 18, 4147 Byron Highway, Byron

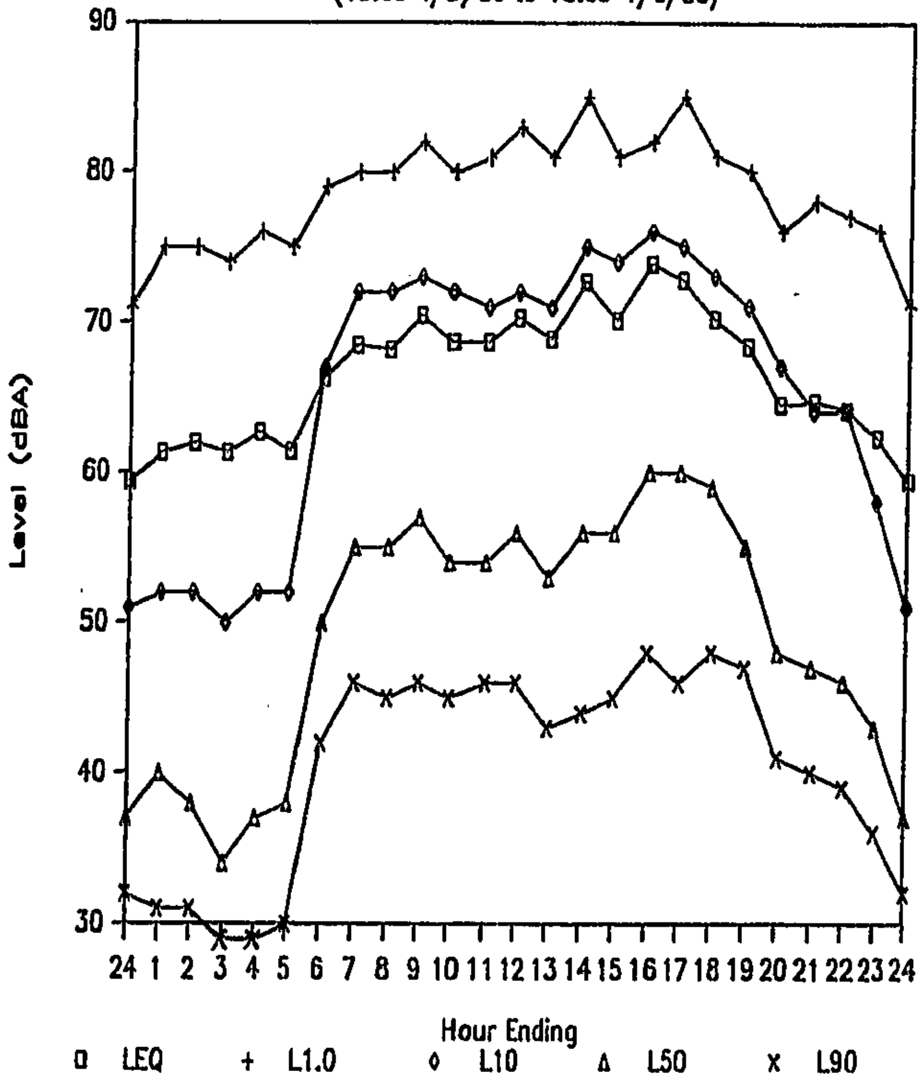
(Start 13:00 4/8/86)

L_{dn}=71.8, CNEL=72.0
Leq(24)=68.5

Ending Hour	L_{eq}	L_1	L_{10}	L_{50}	L_{90}	Date
1	61.3	75	52	40	31	4/9/86
2	62.0	75	52	38	31	4/9/86
3	61.3	74	50	34	29	4/9/86
4	62.7	76	52	37	29	4/9/86
5	61.4	75	52	38	30	4/9/86
6	66.3	79	67	50	42	4/9/86
7	68.5	80	72	55	46	4/9/86
8	68.2	80	72	55	45	4/9/86
9	70.5	82	73	57	46	4/9/86
10	68.7	80	72	54	45	4/9/86
11	68.7	81	71	54	46	4/9/86
12	70.3	83	72	56	46	4/9/86
13	68.9	81	71	53	43	4/9/86
14	72.7	85	75	56	44	4/8/86
15	70.1	81	74	56	45	4/8/86
16	73.9	82	76	60	48	4/8/86
17	72.8	85	75	60	46	4/8/86
18	70.2	81	73	59	48	4/8/86
19	68.4	80	71	55	47	4/8/86
20	64.5	76	67	48	41	4/8/86
21	64.7	78	64	47	40	4/8/86
22	64.1	77	64	46	39	4/8/86
23	62.3	76	58	43	36	4/8/86
24	59.4	71	51	37	32	4/8/86

Location 18, 4147 Byron Hwy., Byron

(13:00 4/8/86 to 13:00 4/9/86)



Location 18, 4147 Byron Highway, Byron
Start 13:00 4/8/86

SENEL	Lmax	Duration (sec)	Max at	TRAIN	NO. OF LOCOS.	NO. OF CAR	LENGTH (FT)
104.4	90.4	120.8	13:25:12	OB-FREIGHT	3	90	.5630
106.3	102.8	82.4	15:28:47	IB-FREIGHT	4	49	3141
102.4	86.2	84.1	11:41:20	OB-FREIGHT	3	51	4581

Leq,Ldn,CNEL	68.5	71.8	72.0 (with trains)
Leq,Ldn,CNEL	67.8	71.5	71.7 (without trains)

TRAINS ONLY

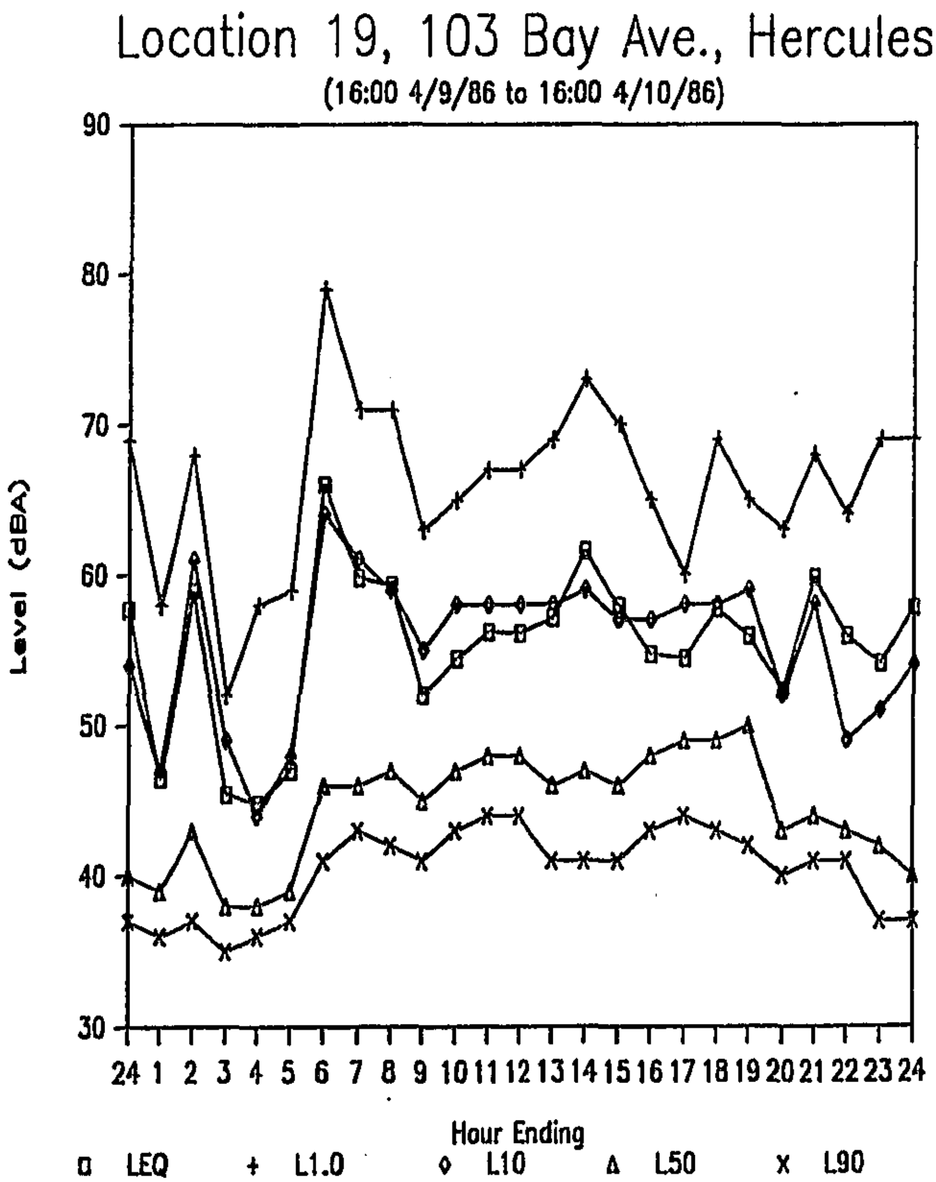
Leq(24)	61.2
Ldn	61.2
CNEL	61.2

Location 19, 103 Bay Ave., Hercules

(Start 16:00 4/9/86)

L_{dn}=64.9, CNEL=65.1
Leq(24)=57.8

Ending Hour	L_{eq}	L_1	L_{10}	L_{50}	L_{90}	Date
1	46.5	58	47	39	36	4/10/86
2	58.9	68	61	43	37	4/10/86
3	45.4	52	49	38	35	4/10/86
4	44.8	58	44	38	36	4/10/86
5	47.0	59	48	39	37	4/10/86
6	66.0	79	64	46	41	4/10/86
7	59.8	71	61	46	43	4/10/86
8	59.3	71	59	47	42	4/10/86
9	52.0	63	55	45	41	4/10/86
10	54.4	65	58	47	43	4/10/86
11	56.2	67	58	48	44	4/10/86
12	56.1	67	58	48	44	4/10/86
13	57.1	69	58	46	41	4/10/86
14	61.6	73	59	47	41	4/10/86
15	57.9	70	57	46	41	4/10/86
16	54.7	65	57	48	43	4/10/86
17	54.4	60	58	49	44	4/09/86
18	57.7	69	58	49	43	4/09/86
19	55.9	65	59	50	42	4/09/86
20	52.3	63	52	43	40	4/09/86
21	59.8	68	58	44	41	4/09/86
22	55.9	64	49	43	41	4/09/86
23	54.1	69	51	42	37	4/09/86
24	57.7	69	54	40	37	4/09/86


Location 19, 103 Bay Ave., Hercules
(16:00 4/9/86 to 16:00 4/10/86)
Level (dBA)
90
80
70
60
50
40
30
24 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Hour Ending
□ LEQ
+ L1.0
◊ L10
Δ L50
X L90

Location 19, 103 Bay Ave., Hercules
Start 16:00 4/9/86

SENEL	Lmax	Duration (sec)	Max at

[NO SENEL'S MEASURED; THE TRACKS WERE BLOCKED BY A ROW OF FREIGHT CARS]

Ldn, CNEL	57.8	64.9	65.1 (with trains)
Ldn, CNEL	57.8	64.9	65.1 (without trains)

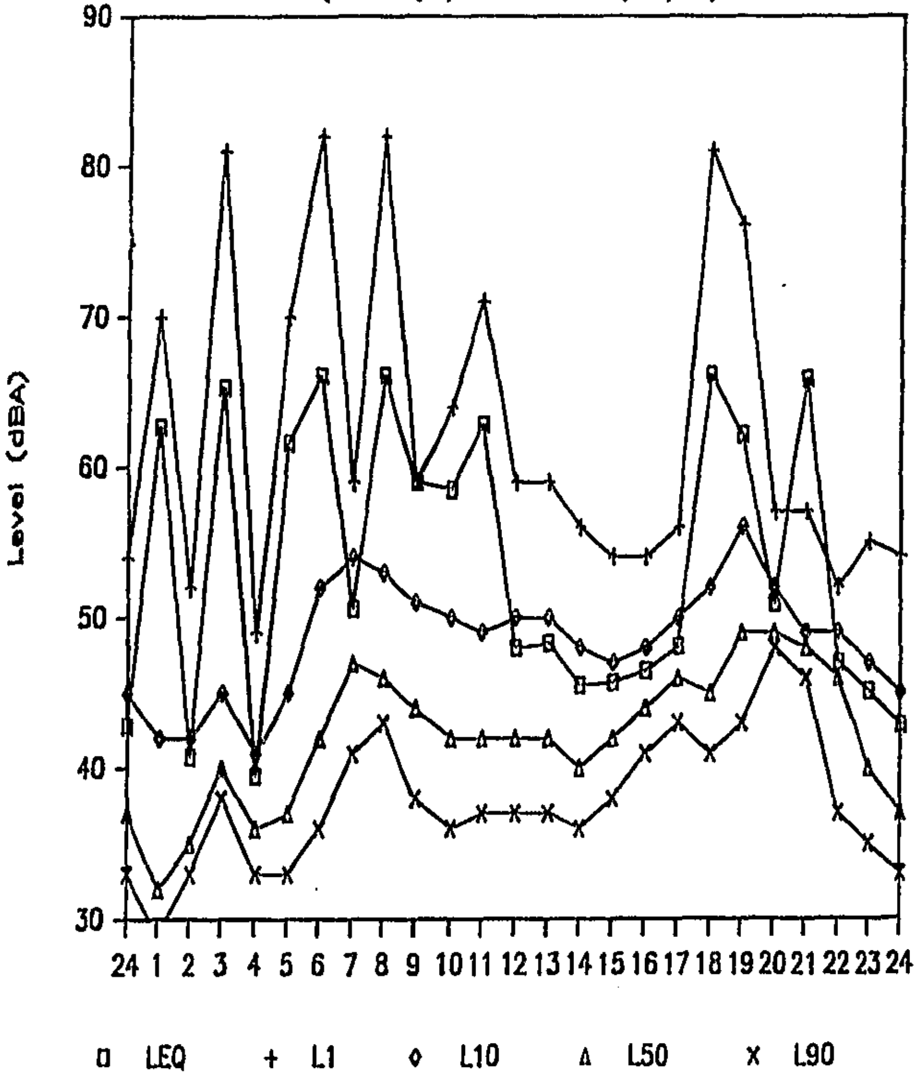
Location 20, 155 Eden Plains Rd., Knightsen

(Start 15:00 4/9/86) L_{dn}=67.2, CNEL=67.5
Leq(24)=60.7

Ending Hour	L_{eq}	L_1	L_{10}	L_{50}	L_{90}	Date
1	62.7	70	42	32	29	4/10/86
2	40.8	52	42	35	33	4/10/86
3	65.3	81	45	40	38	4/10/86
4	39.5	49	41	36	33	4/10/86
5	61.6	70	45	37	33	4/10/86
6	66.1	82	52	42	36	4/10/86
7	50.6	59	54	47	41	4/10/86
8	66.1	82	53	46	43	4/10/86
9	59.0	59	51	44	38	4/10/86
10	58.5	64	50	42	36	4/10/86
11	62.8	71	49	42	37	4/10/86
12	48.0	59	50	42	37	4/10/86
13	48.3	59	50	42	37	4/10/86
14	45.5	56	48	40	36	4/10/86
15	45.7	54	47	42	38	4/10/86
16	46.5	54	48	44	41	4/09/86
17	48.1	56	50	46	43	4/09/86
18	66.1	81	52	45	41	4/09/86
19	62.1	76	56	49	43	4/09/86
20	50.9	57	52	49	48	4/09/86
21	65.8	57	49	48	46	4/09/86
22	47.0	52	49	46	37	4/09/86
23	45.1	55	47	40	35	4/09/86
24	42.8	54	45	37	33	4/09/86

Location 20, 155 E.P. Rd. Knightsen

(15:00 4/9/86 to 15:00 4/10/86)



Location 20, 155 Eden Plains Rd., Knightsen
Start 15:00 4/9/86

SENEL	Lmax	Duration (sec)	Max at	TRAIN	NO. OF LOCOS.	NO. OF CARS	HP
101.1	90.1	57.0	17:08:13	WB-FREIGHT	2	46	6000
90.6	83.4	17.5	17:35:19	WB-FREIGHT	2	5	4000
90.0	79.5	39.9	18:55:43	WB-FREIGHT	2	54	6000
88.8	84.5	10.9	18:56:53	EB-AMTRAK	1	5	
95.2	83.6	85.8	18:58:07	WB-FREIGHT	2	54	6000
101.2	98.1	17.1	20:28:17	WB-AMTRAK	2	10	
97.6	87.6	39.0	00:42:24	EB-FREIGHT	2	23	6000
100.7	90.0	58.1	02:25:27	WB-FREIGHT	2	40	6000
96.9	85.4	40.9	04:13:07	EB-FREIGHT	2	26	6000
100.1	87.3	67.5	05:27:07	EB-FREIGHT	3	50	9000
95.5	85.5	32.4	05:50:44	EB-FREIGHT	2	14	6000
101.5	89.9	79.6	07:25:20	WB-FREIGHT	2	12	6000
93.6	87.4	16.3	08:08:26	EB-FREIGHT	2	7	6000
84.2	79.7	7.8	08:43:32	EB-FREIGHT	2	1	4000
92.5	86.8	10.5	09:06:20	EB-AMTRAK	1	5	
93.4	89.7	10.0	10:48:51	WB-AMTRAK	1	5	
95.9	85.4	31.8	11:00:58	WB-FREIGHT	6	17	14000

Leq,Ldn,CNEL	60.7	67.2	67.5 (with trains)
Leq,Ldn,CNEL	50.3	56.4	56.9 (without trains)

TRAINS ONLY

Leq(24)=	60.3
Ldn=	66.8
CNEL=	67.1

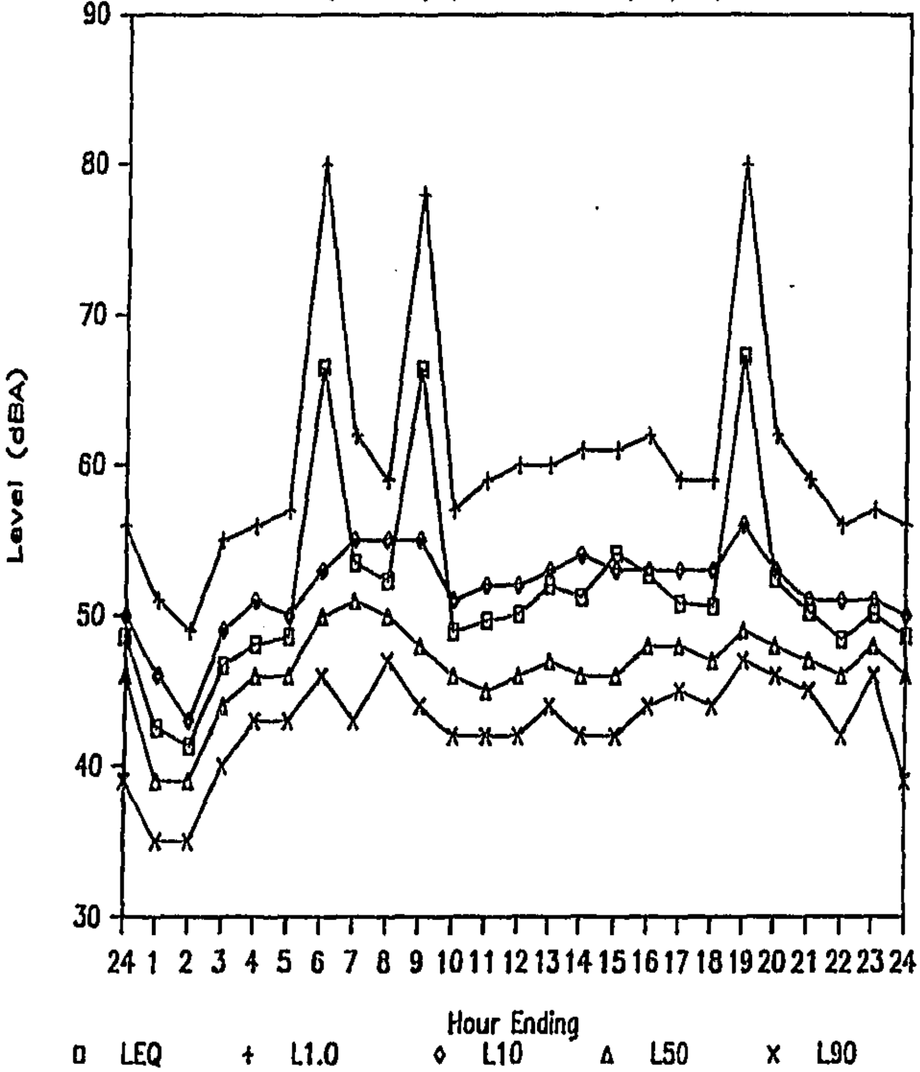
Location 21, 865 Walnut Blvd., Brentwood

(Start 14:00 4/9/86) L_{dn}=64.1, CNEL=64.2
Leq(24)=58.4

Ending Hour	L_{eq}	L_1	L_{10}	L_{50}	L_{90}	Date
1	42.5	51	46	39	35	4/10/86
2	41.3	49	43	39	35	4/10/86
3	46.7	55	49	44	40	4/10/86
4	48.1	56	51	46	43	4/10/86
5	48.6	57	50	46	43	4/10/86
6	66.5	80	53	50	46	4/10/86
7	53.5	62	55	51	43	4/10/86
8	52.3	59	55	50	47	4/10/86
9	66.4	78	55	48	44	4/10/86
10	48.9	57	51	46	42	4/10/86
11	49.7	59	52	45	42	4/10/86
12	50.1	60	52	46	42	4/10/86
13	52.0	60	53	47	44	4/10/86
14	51.2	61	54	46	42	4/10/86
15	54.1	61	53	46	42	4/09/86
16	52.7	62	53	48	44	4/09/86
17	50.8	59	53	48	45	4/09/86
18	50.6	59	53	47	44	4/09/86
19	67.2	80	56	49	47	4/09/86
20	52.4	62	53	48	46	4/09/86
21	50.2	59	51	47	45	4/09/86
22	48.4	56	51	46	42	4/09/86
23	50.1	57	51	48	46	4/09/86
24	48.6	56	50	46	39	4/09/86

Location 21, 865 Walnut Blvd, Brentwood

(14:00 4/9/86 to 14:00 4/10/86)



Location 21, 865 Walnut Boulevard, Brentwood
Start 14:00 4/9/86

SENEL	Lmax	Duration (sec)	Max at	TRAIN	NO. OF LOCOS.	NO. OF CARS	LENGTH (FT)
102.5	87.5	197.3	18:48:03	IB-FREIGHT	3	99	8932
101.8	91.7	112.1	05:41:15	IB-FREIGHT	4	82	4947
101.7	96.5	86.3	08:19:56	OB-FREIGHT	3	43	3860

Leq,Ldn,CNEL	58.4	64.1	64.2 (with trains)
Leq,Ldn,CNEL	51.6	56.6	57.1 (without trains)

TRAINS ONLY

Leq(24)	57.4
Ldn	63.2
CNEL	63.2

APPENDIX B: PROJECTED CNEL 65 dBA CONTOURS

Appendix B (bound separately) presents the projected noise contours for three of the train traffic scenarios that have been evaluated (Cases 1, 2 and 4). The techniques used to develop the contours are discussed in Section 4. The contours were originally drawn on 400 ft/in. scale aerial photographs, and subsequently transferred to 600 ft/in. base maps that were obtained from Contra Costa and San Joaquin Counties. The aerial photographs were used for the purpose of counting houses within the 65 dBA contour.

It should be noted that the contours for Case 4 reflect a continuation of rail traffic on the ATSF line as a "worst case" condition. Because this would not coincide with the projected increase in traffic on the SPT line, buildings located along the ATSF line outside of the Case 2 contours were not included in the Case 4 inventory.

A total of 52 figures are included which cover most populated areas along the corridor. A key map precedes the contour maps.