ENVIRONMENTAL NOISE ANALYSIS

AUBURN/BOWMAN COMMUNITY PLAN

Auburn, California

Prepared For

Placer County
Division of Environmental Health
11454 "B" Avenue
Auburn, CA 95603

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NOISE ELEMENT

GOALS AND POLICIES

Please refer to the Auburn/Bowman Community Plan text for Noise Element goals and policies.

IMPLEMENTATION MEASURES

Please refer to the Auburn/Bowman Community Plan text for Noise Element implementation measures.

I. EXISTING AND FUTURE NOISE ENVIRONMENTS

GENERAL

The State Office of Planning and Research (OPR) Noise Element Guidelines require that major noise sources be identified and quantified by preparing generalized noise contours for current and projected conditions. Significant noise sources include traffic on major roadways and highways, railroad operations, airports and heliports, and representative industrial activities and fixed noise sources.

Noise modeling techniques, noise measurements and use of existing noise measurement data were used to develop generalized L_{dn} noise contours for the major roadways, railroads and fixed noise sources in the study area for existing conditions.

Noise modeling techniques use source-specific data including average levels of activity, hours of operation, seasonal fluctuations, and average levels of noise from source operations. Modeling methods have been developed for a number of environmental noise sources including roadways, railroad line operations, industrial plants and airports. Such methods produce reliable results as long as data inputs and assumptions are valid. The modeling methods used in this report closely follow recommendations made by the State Office of Noise Control, and were supplemented where appropriate by field-measured noise level data to account for local conditions. The noise exposure contours are based upon annual average conditions. Because local topography, vegetation or intervening structures may significantly affect noise exposure at a particular location, the noise contours should not be considered site-specific.

A community noise survey was conducted to describe existing noise levels in noise-sensitive areas within the Plan Area so that noise level performance standards could be developed to maintain an acceptable noise environment.

ROADWAYS

The Federal Highway Administration (FHWA) Highway Traffic Noise Prediction Model (FHWA-RD-77-108) was used to develop L_{dn} contours for all highways and major roadways in the Study Area. The FHWA Model is the analytical method presently favored for traffic noise prediction by most state and local agencies, including Caltrans. The current version of the model is based upon California noise emission factors (CALVENO) for automobiles, medium trucks, and heavy trucks, with consideration given to vehicle volume, speed, roadway configuration, distance to the receiver and the acoustical characteristics of the site. The FHWA Model predicts hourly L_{eq} values for free-flowing traffic conditions, and is generally considered to be accurate within 1.5 dB. To predict L_{dn} values, it is necessary to determine the hourly distribution of traffic for a typical 24-hour day and to adjust the traffic volume input data to yield an equivalent hourly traffic volume.

BBA conducted short-term (15 minute) traffic noise measurements and concurrent traffic counts adjacent to the major roadways in the Plan Area. In addition, continuous (24-hour) noise measurements were conducted by BBA adjacent to I-80 and Highway 49. BBA also made use of available traffic noise level measurement data which was collected for various recent projects in the Plan Area. The noise measurements were made to evaluate the noise exposure due to traffic on all major roadways in the Plan Area. The locations of the traffic noise measurement sites are shown on Figure I-1.

Instrumentation used for the traffic noise measurements included Bruel & Kjaer (B&K) Type 2218 and Larson Davis Laboratories (LDL) Model 700 and 800 precision integrating sound level meters which were calibrated in the field before measurements with matched acoustical calibrators to ensure measurement accuracy.

The purpose of the traffic noise level measurements was to determine the accuracy of the FHWA model in describing the existing noise environment within the Plan Area. Noise measurement results were compared to the FHWA model results by entering the observed traffic volumes, speed and distance as inputs to the FHWA model. The results of the traffic noise measurements are summarized in Table I-1.

TABLE I-1
COMPARISON OF FHWA MODEL TO MEASURED NOISE LEVELS
Auburn/Bowman Community Plan Area Roadways

Site	Roadway	Location	Dist. (Feet)	Measured L_{eq}, dB	Modeled L_{eq}, dB	Difference dB
1	Interstate 80	Indian Hill Road	150	69	70	1
2	"	High Street	300	62	64	2
3	"	Bowman Road	275	58	64	6
4	"	Mill Pond Road	200	65	67	2
5	"	Werner Road	100	72	74	2
6*	"	Old Airport	25	--	--	--
7	S.R. 49	Joeger - Dry Creek	200	57	61	4
8	"	Bell Road	75	66	68	2
9	"	Lone Star Road	700	47	54	7
10	"	Palm Avenue	75	62	69	7
11*	"	Lone Star Road	75	--	--	--
12	Auburn/Folsom Road	Rancheria Road	80	62	62	0
13	Bell Road	S.R. 49	75	64	67	3
14	Bell Road (cont)	New Airport Road	135	60	63	3
15	"	1st Street	50	63	63	0
16	"	East of New Airport	75	72	69	-3
17	Dry Creek Road	Valley Quail Road	60	57	59	2
18	Indian Hill Road	Auburn/Folsom Road	100	60	59	-1
19	Luther Road	Channel Hill Road	45	64	63	-1
20	"	Dairy Road	50	68	67	-1
21	"	East of S.R. 49	50	62	63	1

TABLE I-1
COMPARISON OF FHWA MODEL TO MEASURED NOISE LEVELS
Auburn/Bowman Community Plan Area Roadways

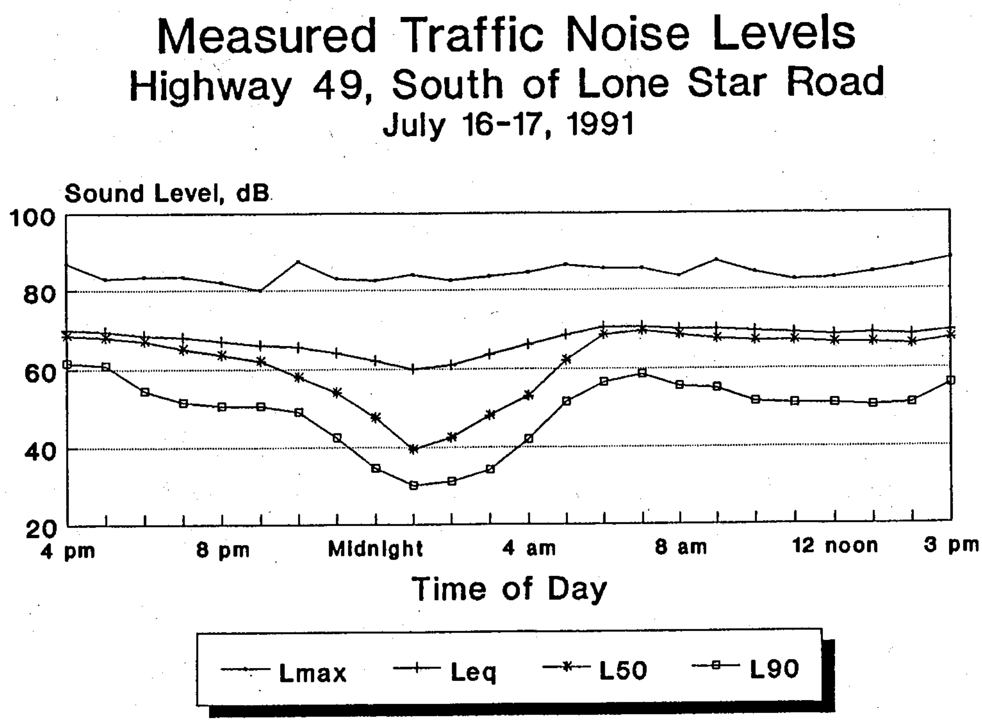
Site	Roadway	Location	Dist. (Feet)	Measured L_{eq}, dB	Modeled L_{eq}, dB	Difference dB
22	Mt. Vernon Road	Edgewood Road	60	53	55	2
23	Nevada Street	Palm Avenue	35	63	62	-1
24	Palm Avenue	Nevada Street	50	63	63	0

* - Continuous noise measurement site. See Figure I-2 for measurement data.

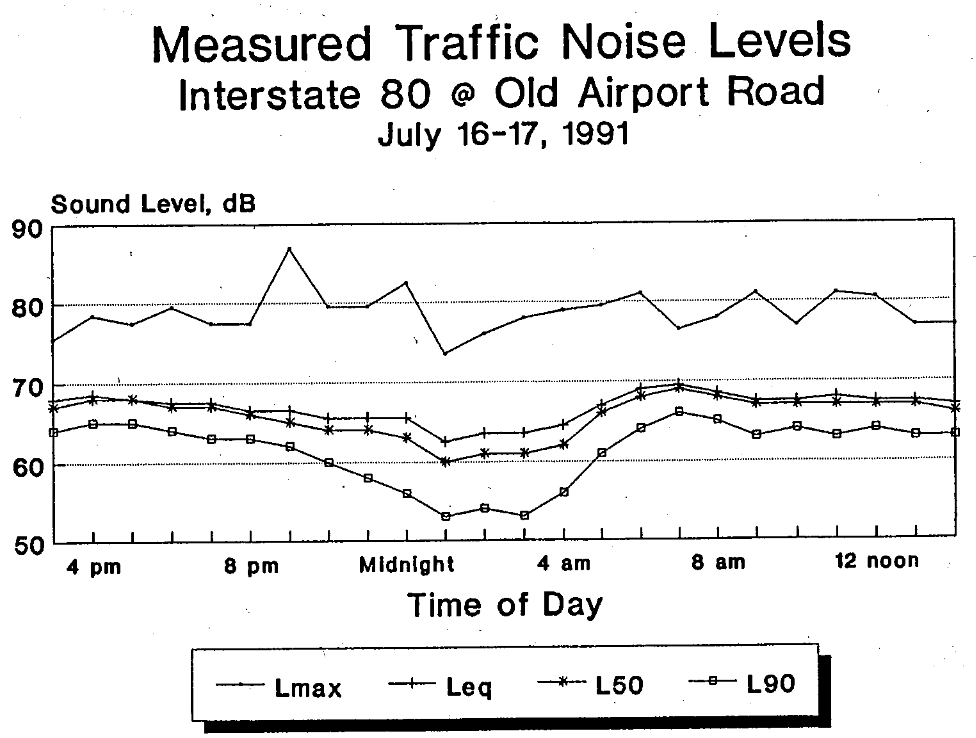
The differences between measured and predicted noise levels were primarily due to the presence or lack of shielding of traffic noise by intervening topography. Topography in the Plan Area varies considerably, sometimes alternating from flat to hilly along relatively short roadway segments. Due to the size and topographic complexity of the Plan Area, it was not possible to evaluate the effects of topography on the propagation of traffic noise for every possible topographic configuration. Where it is necessary to generally evaluate the effects of topography on the propagation of traffic noise at a location not represented by the noise measurements in Table I-1, the following information may be useful.

Table I-1 shows that the FHWA Model generally overpredicted noise exposure at all of the measurement locations within the Plan Area, with the exception of locations which were basically at grade with the roadways being measured. This is consistent with BBA experience with the model, and is probably due mostly to the fact that the predicted levels do not account for excess ground attenuation, shielding, or atmospheric absorption over distance. The greatest amount of overprediction occurred in areas which were shielded from view of all or part of the roadway by intervening topography.

FIGURE I - 2



Microphone located approx. 75 feet from roadway centerline.



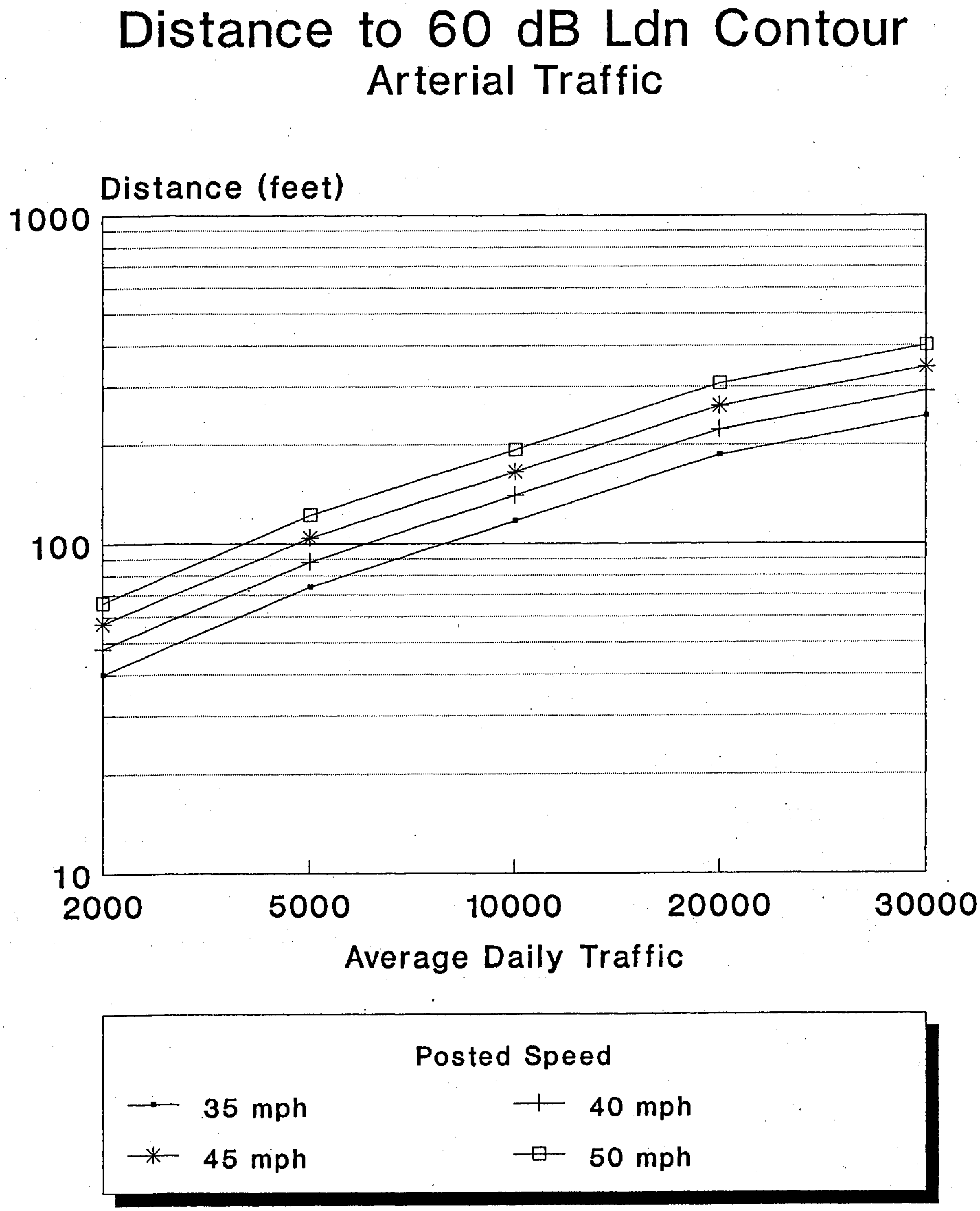
Microphone located approx. 250 feet from roadway centerline.

Traffic data representing annual average traffic volumes for existing conditions and the future Preferred Alternative scenario were obtained from Placer County Department of Public Works. These data are summarized in Appendix B. Day/night traffic distribution and truck mix were based upon Caltrans data and BBA file data. Using these data and the FHWA methodology, traffic noise levels as defined by L_{dn} were calculated for existing (1988) traffic volumes. Distances from the centerlines of selected roadways to the 60 dB L_{dn} contour are summarized in Table I-2 for existing conditions and for the three future development scenarios. The approximate 60 dB L_{dn} traffic noise contours for existing and future conditions are shown on Figures I-4 and I-5.

These calculations do not include consideration of shielding caused by local buildings or topographical features, so the distances reported in Table I-2 are worst-case estimates of noise exposure along roadways in the community.

Figure I-3, prepared using the FHWA Model, may be used to estimate the distance to the existing 60 dB L_{dn} contour for projected volumes of arterial traffic on the roadways not included in this analysis. For arterial traffic, the predicted distance to the 60 dB L_{dn} contour is determined by the Average Daily Traffic Volume (ADT) and the posted speed limit. L_{dn} contours derived from Figure 3 are only indicators of potential noise conflicts, requiring more detailed analysis to determine traffic noise levels at any given location.

FIGURE I - 3



FHWA RD-77-108

TABLE I-2
DISTANCE (FEET) FROM CENTER OF ROADWAY
TO 60 dB L_{dn} CONTOURS

Segment	Description	Distance to Contour, feet 1988*	Distance to Contour, feet Future Preferred Alternative
Interstate 80:			
1	Newcastle to S.R. 49	1532	2659
2	S.R. 49 to Eastern Plan Area Boundary	1204	2225
State Route 49:			
3	Lone Star to Dry Creek	397	756
4	Dry Creek to Bell	363	669
5	Bell to Cottage	417	627
6	Cottage to Atwood	484	662
7	Atwood to Luther	468	696
8	Luther to Palm	451	710
9	Palm to I-80	400	710
10	I-80 to Lincoln	199	404
11	Lincoln to Foresthill	118	324
Atwood Road:			
12	Bean to S.R. 49	98	94
Auburn/Folsom Road:			
13	South City Limits to Indian Hill	65	206
14	Indian Hill to Maidu	121	422
15	Maidu to Sacramento (south)	126	415
16	Sacramento (south) to Sacramento (north)	151	334
17	Sacramento (north) to Lincoln	181	376
Auburn Ravine Road:			
18	Palm to Interstate 80	83	143

TABLE I-2
DISTANCE (FEET) FROM CENTER OF ROADWAY
TO 60 dB L_{dn} CONTOURS

Segment	Description	Distance to Contour, feet	
		1988*	Future Preferred Alternative
Bell Road:			
19	Joeger to S.R. 49	141	202
20	S.R. 49 to New Airport	253	384
21	New Airport to Interstate 80	295	426
Bowman Road:			
22	Foresthill to Luther	156	157
Elm Street:			
23	S.R. 49 to Auburn Ravine	178	202
Foresthill Road:			
24	Interstate 80 to Eastern Plan Area Boundary	99	135
Fulweiler Road:			
25	Carson to S.R. 49	83	83
High Street:			
26	Elm to Lincoln	103	49
27	Lincoln to College	88	102
28	College to Auburn/Folsom	80	124
Lincoln Way:			
29	Bowman to Foresthill	192	241
30	Russell to El Dorado	136	224
31	El Dorado to High	75	262
32	High to East	91	109
33	East to Maple	113	212

TABLE I-2
DISTANCE (FEET) FROM CENTER OF ROADWAY
TO 60 dB L_{dn} CONTOURS

Segment	Description	Distance to Contour, feet	
		1988*	Future Preferred Alternative
Luther Road:			
34	S.R. 49 to Dairy	127	173
35	Dairy to Bowman	102	157
Maple Street:			
36	Lincoln to Interstate 80	95	168
Nevada Street:			
37	S.R. 49 to Mt. Vernon	70	59
38	Palm to Enterprise	90	102
39	Enterprise to Fulweiler	113	102
40	Fulweiler to Interstate 80	83	102
Quartz Drive:			
41	Galena to S.R. 49	69	78
Sacramento Street:			
42	Auburn Folsom to Auburn Folsom	67	150
Dry Creek Road:			
43	West of S.R. 49	62	94
44	East of S.R. 49	84	86
New Airport Road:			
45	North of Bell	37	69
Dairy Road:			
46	South of Luther	37	49

TABLE I-2
DISTANCE (FEET) FROM CENTER OF ROADWAY
TO 60 dB L_{dn} CONTOURS

		Distance to Contour, feet	
Segment	Description	1988*	Future Preferred Alternative
Mt. Vernon Road:			
47	West of Edgewood	28	78
48	Edgewood to Nevada	59	94
Maidu Drive:			
49	East of Auburn Folsom	59	150
Indian Hill Road:			
50	West of Auburn Folsom	85	201
* - 1988 counts are latest traffic data available.			

Table I-3 has been prepared to serve as a guide when applying the traffic noise exposure contour information presented in this section to areas with varying topography. The table is used by adding the correction factor to the noise level predicted at a given distance. It should be noted that the adjustment factors presented in Table I-3 are intended to provide conservative (worst-case) results, and that complex situations should be evaluated by an acoustical consultant where the potential for significant noise impact exists.

TABLE I-3

TRAFFIC NOISE ADJUSTMENTS FOR VARIOUS TOPOGRAPHIC CONDITIONS

	Distance from Center of Roadway (Feet)		
Topographic Situation	<200	200 - 400	>400
Hillside overlooks roadway	-0-	+1 dB	+3 dB
Roadway Elevated (>15')	-5 dB	-2 dB	-0-
Roadway in cut/below embankment	-5 dB	-5 dB	-5 dB

RAILROADS

Railroad activity in the Plan Area includes freight and passenger activity on the eastbound and westbound Southern Pacific Transportation Company (SPTCo) trackage.

SPTCo officials from the Roseville Dispatcher's Office report that approximately 12 freight and 2 Amtrak passenger train operations per day occur on SPTCo tracks in the study area. The freight trains are distributed equally on the eastbound and westbound tracks on a random basis throughout the day. Passenger train operations are scheduled to pass through the study area during daytime hours.

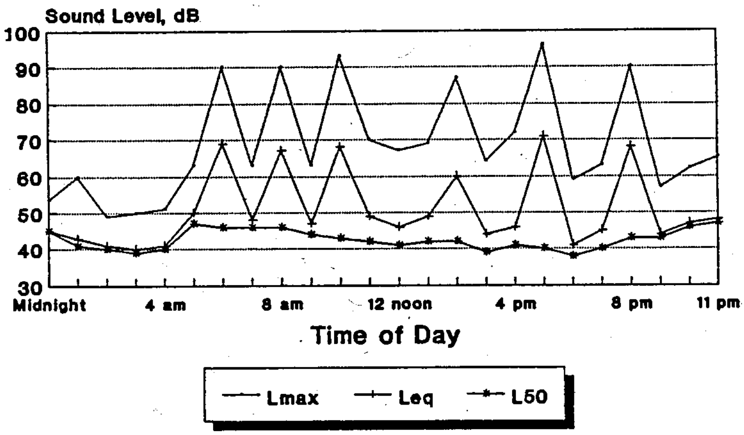
The new Capital Corridor passenger rail service, operated by Amtrak, currently runs between San Jose, Oakland and Sacramento. In the future, Capital Corridor passenger train service will likely be extended to Auburn. The number of daily Capital Corridor trains which will extend to extend to the Auburn Area is not specifically known at this time, but will likely be a function of demand. Caltrans' preferred location for a passenger rail terminal is near the intersection of Old Airport Road and Bowman Road. There is insufficient data at this time to fully analyze the potential impacts of this expanded passenger service. However, because the noise emissions of freight train operations are substantially louder than passenger train operations, 5 additional passenger operations would be required to increase existing railroad noise levels by 1 dB.

Noise measurements were conducted by BBA at various locations within the Plan Area to determine the contribution of SPTCo railroad operations to the area noise environment. The monitoring locations are shown on Figure I-6. Instrumentation consisted of B&K and LDL precision integrating sound level meters. The systems were calibrated before use with B&K and LDL acoustical calibrators.

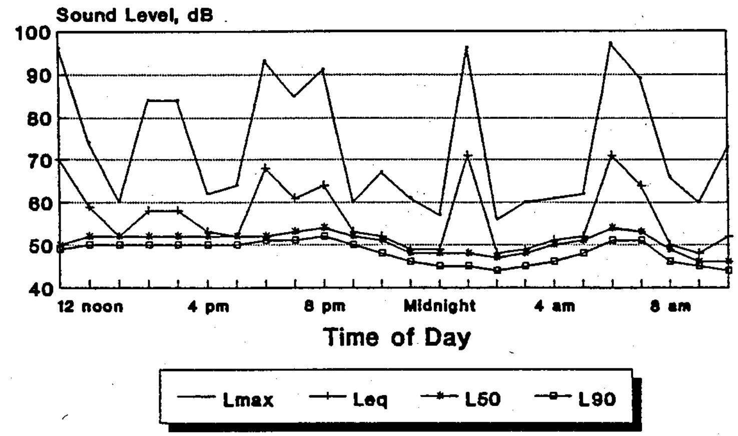
The purpose of the noise level measurements was to determine typical sound exposure levels (SEL), number of daily operations, and existing L_{dn} values for railroad line operations in the Plan Area, accounting for the effects of local topography, climate, train speed and other factors which may affect noise generation. The results of the continuous railroad noise measurements are shown on Figure I-7.

FIGURE I-7

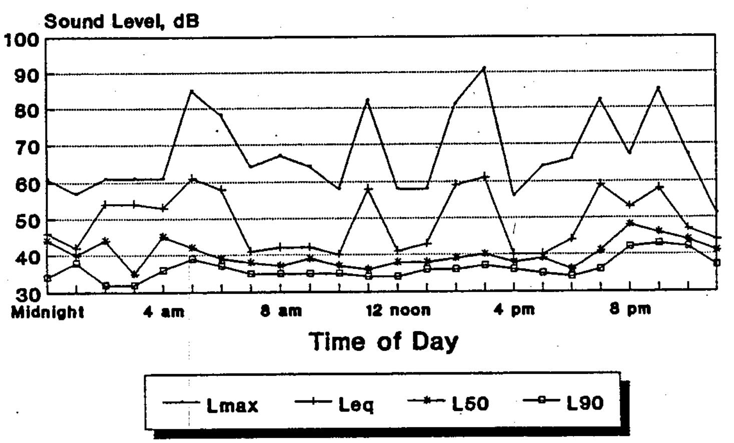
Measured Railroad/Ambient Noise Levels
Auburn/Bowman Plan Site 2 - Lilac Lane
June 16, 1991



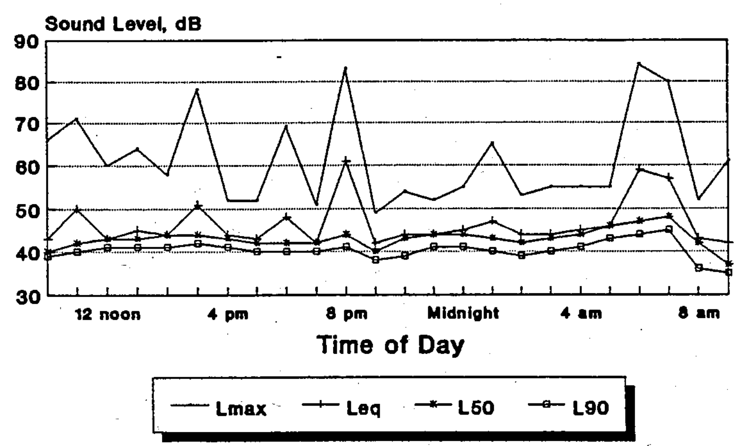
Measured Railroad/Ambient Noise Levels
Auburn/Bowman Plan Site 4 - Bell Road
August 8-9, 1991



Measured Railroad/Ambient Noise Levels
Auburn/Bowman Plan Site 5 - Virginia Ave
August 2, 1991



Measured Railroad/Ambient Noise Levels
Auburn/Bowman Plan Site 6 - Newcastle
August 8-9, 1991



To determine the distance to the 60 dB railroad L_{dn} contour, it was necessary to calculate the L_{dn} for typical freight and passenger train operations. This was done using the SEL data collected during the railroad noise measurements and the above-described number and distribution of daily freight and passenger train operations. The L_{dn} contribution may be calculated as follows:

$$L_{dn} = SEL + 10 \log N_{eq} - 49.4 \text{ dB, where:}$$

SEL is the mean SEL of the event, N_{eq} is the sum of the number of daytime events (7 a.m. to 10 p.m.) per day plus ten times the number of nighttime events (10 p.m. to 7 a.m.) per day, and 49.4 is ten times the logarithm of the number of seconds per day. The measured railroad noise levels and predicted L_{dn} values at the measurement sites are shown in Table I-4.

TABLE I-4
RAILROAD NOISE MEASUREMENT RESULTS
AUBURN/BOWMAN COMMUNITY PLAN AREA

Site	Location	Measurement Date(s)	Train Direction	Apparent Number of Daily Trains	Average Sound Exposure Level (SEL) @ 100 ft.	Measured L_{dn}, 100 feet from tracks	Computed L_{dn}, 100 feet from tracks*
1	High Street	Sept. 26-27, 1989	Eastbound	6	101 dB	66 dB	66 dB
2	Lilac Lane	June 14-17, 1990	Eastbound	7	103 dB	68 dB	68 dB
3	New Airport Rd.	July 6-7, 1989	Eastbound	7	99 dB	65 dB	64 dB
4	Headquarter House	Aug. 8-9, 1991	Both	11	102 dB	70 dB	70 dB
5	Virginia Avenue	Aug. 1-4, 1991	Westbound	6	99 dB	64 dB	64 dB
6	Dillon Circle - Newcastle	Aug. 8-9, 1991	Westbound	7	91 dB	55 dB	56 dB

* - L_{dn} computation based on typical railroad distribution of 7 trains per day in each direction, randomly distributed.

At the measurement sites, locomotive and warning horn noise were the major contributors to railroad noise levels as defined by SEL. The SEL for freight train operations varied, depending on the train speed, track grade, and the amount of shielding provided by intervening topography.

The railroad noise levels measured at site 6 were less than the levels measured at the other locations due to slow train speeds and topographic shielding. At site 2, the railroad tracks were elevated approximately 20 feet relative to the noise measurement site. The elevated tracks reduced the effects of ground absorption, and the measured noise levels were therefore higher than at the other railroad noise measurement sites.

Table I-5 may be used to estimate railroad noise levels at existing or proposed noise sensitive developments. The railroad noise contour information provided in Table I-5 is based on the railroad noise measurement results of Table I-4, and assumes that the tracks are approximately at grade with the development and that there is no shielding of railroad noise by intervening topography.

TABLE I-5
APPROXIMATE DISTANCE TO RAILROAD NOISE CONTOURS
AUBURN/BOWMAN COMMUNITY PLAN AREA

R/R Direction	L_{dn}, dB, 100 Feet From Tracks*	Distance to 60 dB L_{dn} contour (feet)	Distance to 65 dB L_{dn} contour (feet)
Eastbound	66	250	120
Westbound	64	185	85
Both	69	400	185

* - If 5 Capital Corridor trains operate on these tracks in the future, this level should be increased by 1 dB. Less than 5 additional passenger trains would not result in a increase of even 1 dB.

The noise levels provided in Table I-5 should be increased by 3 dB where warning horns are used. The railroad noise exposure will differ from these values where the tracks are significantly elevated or shielded relative to the receiver location.

FIXED NOISE SOURCES

The production of noise is a result of many industrial processes, even when the best available noise control technology is applied. Noise exposures within industrial facilities are controlled by Federal and State employee health and safety regulations (OSHA), but exterior noise levels may exceed locally acceptable standards. Commercial, recreational and public service facility activities can also produce noise which affects adjacent sensitive land uses.

From a land use planning perspective, fixed-source noise control issues focus upon two goals: to prevent the introduction of new noise-producing uses in noise-sensitive areas, and to prevent encroachment of noise sensitive uses upon existing noise-producing facilities. The first goal can be achieved by applying noise performance standards to proposed new noise-producing uses. The second goal can be met by requiring that new noise-sensitive uses in proximity to noise-producing facilities include mitigation measures to ensure compliance with noise performance standards.

The following descriptions of existing fixed noise sources in the Plan Area are intended to be representative of the relative noise impacts of such uses, and to identify specific noise sources which should be considered in the review of development proposals. These sources were identified through recommendations by City and County staff and by BBA observations.

California Department of Forestry Helipad:
Contact: Steve Taylor

The California Department of Forestry (CDF) operates a helipad near the intersection of Lincoln way and Rhodes Krueger Drive, northeast of the I-80/Bowman Road interchange. The CDF Helipad location is shown on Figure I-8. According to CDF staff, the helipad is used by the CDF, United States Drug Enforcement Agency (DEA), California Highway Patrol (CHP), UC Davis LifeFlight, Reno CareFlight and Stockton MediFlight.

The CDF operates a Bell 204B helicopter, capable of carrying 9 passengers and equipment. CDF staff reported that the CDF operates a Bell 204B helicopter (Huey) at the helipad during the Summer months when there is a fire in the immediate vicinity of the CDF station. Because the CDF refuels the helicopter near the fire operations, the helicopter is seldom operated from the helipad. The majority of the fire-related operations occur at the fire site, where it is fueled and loaded with staff and equipment. CDF staff reported that the helicopter was used once a day at the helipad during the "49'er" fire of 1988.

CDF staff further reported that helicopters using the helipad typically approach and depart perpendicular to I-80, over the canyon area east of the helipad. However, pilots may deviate from that pattern in response to safety concerns.

The California Highway Patrol (CHP) operates a Bell 206 Jet Ranger in the Auburn area, and uses the helipad infrequently when necessary to provide medical support to accident victims or other governmental agencies. The Drug Enforcement Agency (DEA) stations a Hughes 500 helicopter at the helipad during the period of September through November. The DEA helicopter is reportedly used for aerial search and observation of marijuana growing areas. DEA operations are reported to be two arrivals and departures per day during those months.

For medical emergencies in the Auburn area, UCD Lifeflight and Reno CareFlight operate Alouette helicopters, and Stockton MediFlight operates an A-Star. These organizations typically use the CDF helipad only when it is not possible to land nearer to situations requiring aerial evacuation of persons in need of immediate and/or specialized medical attention.

Noise levels generated by the regular DEA helicopter operations at the CDF helipad were calculated using noise level data reported by the FAA for the Hughes 500 helicopter, assuming 4 operations per day. An L_{dn} of 50 dB was computed at a distance of 1000 feet from the helipad directly under the flight path.

Auburn Truss & Lumber:
Contact: Wayne Larson

Auburn Truss & Lumber, located at 14002 Musso Road, manufactures trusses. Typical hours of operation are from 7 am - 3:30 pm, Monday through Friday. The facility reportedly does not operate on weekends, but may operate until 6 pm during periods of high demand. Noise producing equipment used at this facility includes forklifts, staple guns, air compressors, saws and a crane (boom truck).

Heavy truck usage at the facility consists of 4 flatbed trucks per day and 1-2 heavy lumber trucks per week. BBA noise measurements conducted at the site indicated that saws generated 77 dB at a distance of 25 feet. There are currently no plans for future expansion of the facility.

Chevreaux Concrete:
Contact: Joe Chevreaux

The Chevreaux Concrete company is located east of the intersection of Marguerite Mine Road and State Route 49. Typical hours of operation are reportedly 6 am to 6 pm with occasional operations during early morning and evening hours as demand dictates. Noise is generated at this facility by the concrete batch plant and by front loaders and cement and gravel trucks. BBA conducted noise measurements at the plant on August 19, 1991 to quantify typical plant noise levels. An average noise level of 77 dB was measured at a distance of 75 feet from the concrete batch plant during normal operations. There does not appear to be any noise sensitive land use in the immediate plant vicinity. Plant noise is attenuated to the east by steep topography.

Public Address Systems/Drive up Window Speakers:
Source: Brown-Buntin Associates, Inc.

Public address systems and drive up window speakers are used extensively in the Auburn/Bowman Community Plan Area. The most prevalent usage of these systems is at car dealerships and fast food restaurants. Studies have shown that people are more highly annoyed by amplified speech or music than by continuous noise sources of similar intensity such as highway traffic. Noise generated by these systems depends primarily on the amplifier setting, and is therefore highly variable. BBA conducted noise measurements of the public address system at Goldrush Chevrolet and of the drive-up window speaker at Burger King to quantify typical noise emissions for these types of uses. BBA measured levels of 78 dB at 12 feet from the PA speaker, and 65 dB at a distance of 5 feet from the drive-up window speaker.

Airport Industrial Area:
Source: Brown-Buntin Associates

Uses identified in this area include Century Lighting, Coherent Industries, Doug Spense Construction, Pacific Bell, Mussetter Distributing Inc., RJT Construction, Auburn Foothill Quality Door, Harris & Ruth Contractors, Nella Oil Company, the Skunk Works, advanced ceramics, and various aviation maintenance facilities. The most notable noise sources associated with these operations were operation and/or maintenance of medium and heavy commercial truck fleets. Although there does not appear to be any noise sensitive development in the immediate vicinity of the airport industrial area, the potential for noise generation in this area should not be overlooked if neighboring noise sensitive developments are considered.

Auburn Container Company:
Contact: Arthur Moorehouse

The Auburn Container company is located on the east side of State Route 49, between the Southern Pacific Railroad tracks and Luther Road. According to the plant manager, normal operating hours are from 7 am to 3:30 pm, Monday through Friday. The plant occasionally operates on Saturday from 7 am to 12 noon. Equipment used at the plant consists of resaws, cutoff saws, a ripsaw, a molder, a cleat machine, cyclones, and a chipper. The cyclones are located about 30 feet above ground level at the plant building. The chipper is located at ground level near the east property line of the plant. The chipper normally operates the entire time the plant is in operation. In addition to the aforementioned noise sources, there are 5 diesel trucks per day entering and leaving the plant.

BBA noise measurements indicate that the exterior noise level due to the plant cyclones is approximately 69 dB at a distance of 100 feet. The 50 dB L_{eq} noise contour for the plant would be located approximately 850 feet from the plant.

Community Plan Area Parks and Schools:
Source: Brown-Buntin Associates

Parks are often considered noise sensitive uses due to the passive recreation which takes place there. However, such uses may also be significant noise producers during active recreation activities such as basketball and softball games. The amount of noise generated by such uses varies with age of participants, event size and location, as well as the hour during which the activity takes place. To some degree, the noise generated by such uses can be controlled by enforcing curfews, and by locating noise generating activities away from existing or proposed noise sensitive land uses.

Schools are similar to parks in that active recreation at outdoor playing fields of the schools could result in significant noise levels. School buses also add to the facility noise levels. Future land use planning should consider the potential for noise generation at the playing fields, and noise sensitive land uses should be discouraged adjacent to those areas.

Motorcycle Races - Auburn Fairgrounds
Contact: Hank Maul

Motorcycle races at the Auburn Fairgrounds occur on Friday nights from may to september. Approximately 24-30, 4-lap sprint races take place on a typical Friday evening during the race season, and all racing is completed by 11 pm. BBA conducted noise measurements of typical motorcycle races on September 13, 1991. The measurements were conducted at three locations in the vicinity of the racing. The first location was the southeast corner of the Fairgrounds at the access road. Average and maximum noise levels of 68.5 dB and 77 dB, respectively, were measured at that location. Site 2 was located 100 feet east of site 1. Average noise levels at that location ranged from 59 dB to 65 dB, and maximum noise levels ranged from 66 to 68 dB at site 2. Site 3 was located at Pleasant Avenue, at the residence nearest the riding arena. BBA measured average noise levels of 61 to 63 dB at that location, with maximum noise levels ranging from 66 to 68 dB during the races.

Auburn Placer Disposal
Contact: Eileen Dominguez

Auburn Placer Disposal is located on Shale Ridge Road, east of S.R. 49. The facility serves as a refuse disposal transfer station and recycling center. The facility is open to the public between 8 am and 5 pm, but garbage trucks start leaving the facility at 4 am. Approximately 40 heavy truck trips are generated by the facility daily. Noise is also generated by use of the compactor and maintenance operations at the facility. BBA conducted noise measurements at the facility on September 23, 1991 to document typical operating noise levels. An average noise level of 63 dB was measured at 100 feet from the opening of the transfer building. Noise generated by heavy truck passages was not included in the measurement sample.

AIRPORT NOISE

The Auburn Municipal Airport is situated on 210 acres in the northwest section of the City 1/2 mile east of Highway 49, one mile north of Bell Road. The Airport is a Basic Utility, Stage I category facility which can handle 75% of small general aviation aircraft (12,500 pounds gross weight maximum). The existing paved runway, Runway 7-25, is 3,100 feet long and 60 feet wide.

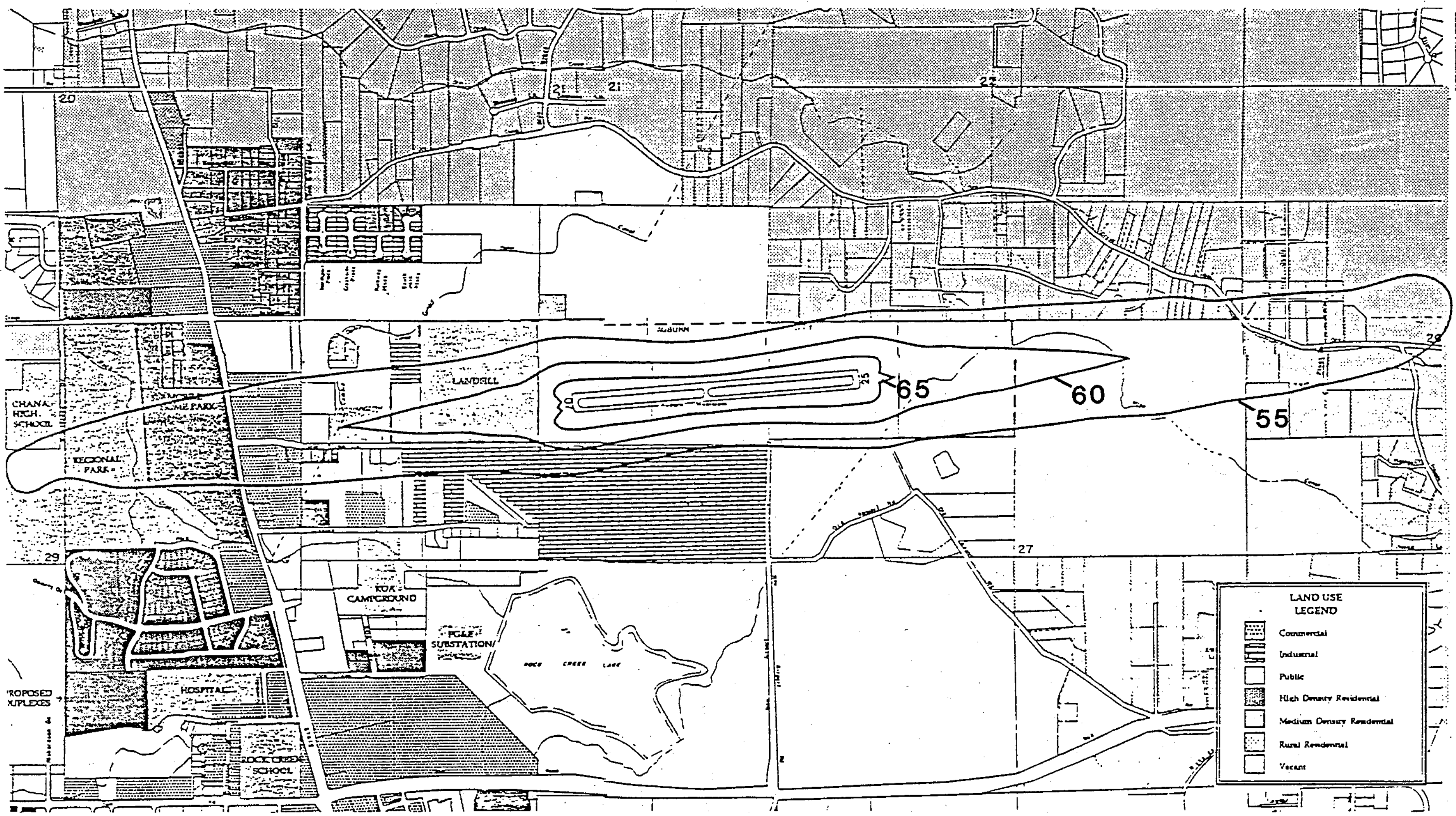
An Airport Master Plan and Environmental Impact Report are currently in progress for the Auburn Municipal Airport. The existing and worst-case future Airport noise contours which were prepared for these documents are reproduced in Figures I-9 and I-10, respectively. According to these contours the noise sensitive use most affected by airport operations is the Rock Creek Mobile Home Park, located west of Highway 49 between Bell and Dry Creek Roads. The contours indicate that the Mobile Home Park is currently exposed to aircraft noise levels between 60 and 65 dB CNEL.

BBA conducted continuous aircraft noise measurements at the Rock Creek M.H.P. from June 27-30, 1991 to gather single event noise level data and to compute the aircraft CNEL at that location. A Metrosonics dB-604 Environmental Noise Analyzer was used for the aircraft noise level measurements. The equipment was calibrated before use with a Bruel & Kjaer Type 4230 acoustical calibrator, and meets all pertinent specifications of the American National Standards Institute for Type I Sound level measurement systems.

In order for an aircraft to register as a single event, the noise level generated by the aircraft had to remain above 60 dB for a minimum of 10 seconds. These thresholds were set in order to filter out non-aircraft events such as passing cars. The results of the aircraft noise level measurements are shown in Table I-6, and are displayed graphically on Figure I-11.

FIGURE I-9

EXISTING AUBURN MUNICIPAL AIRPORT CNEL NOISE CONTOURS



BBA

FIGURE I-10

FUTURE AUBURN MUNICIPAL AIRPORT CNEL INOISE CONTOURS
(Including East and West Extensions)

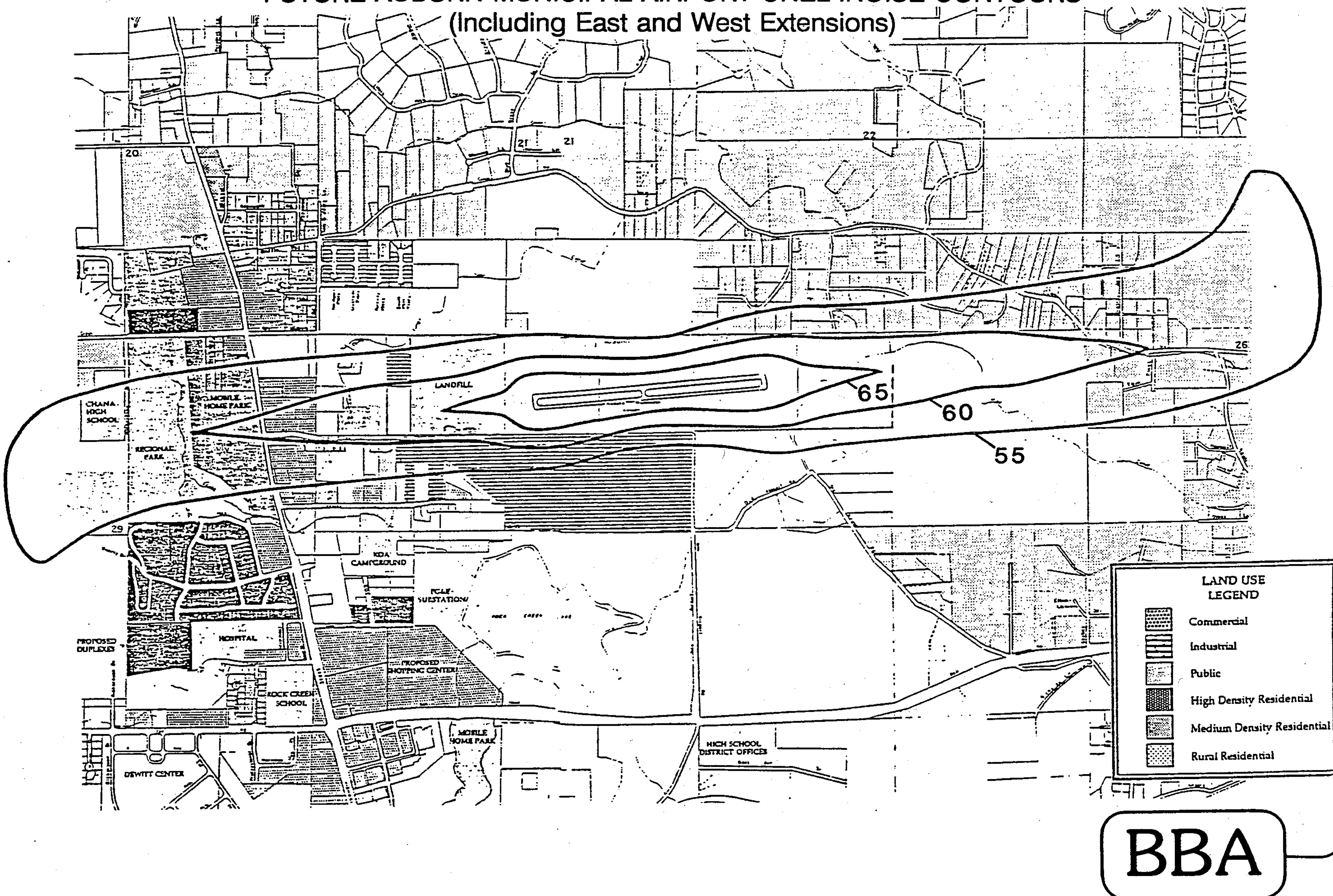


TABLE I-6
AIRCRAFT NOISE MEASUREMENT RESULTS
ROCK CREEK M.H.P - JUNE 27-30, 1991

Date	Day of Week	Apparent # of Aircraft Departures	Range of Maximum Noise Levels, dB	Mean Sound Exposure Level, dB	Aircraft CNEL, dB
June 27	Thursday	98	61-81	79	50
June 28	Friday	8	61-77	80	40
June 29	Saturday	53	64-79	81	49
June 30	Sunday	83	62-81	81	53

The Table I-6 data indicate that the apparent number of daily operations on the 27th and 30th closely approximates the number of existing daily operations reported in the Airport EIR. The decrease in number of apparent operations on the 28th and 29th was probably caused by a shift in wind direction, resulting in departures to the east. Because the Rock Creek M.H.P. is located west of the airport, the eastern departures would probably not register as single events based on the aforementioned single event thresholds.

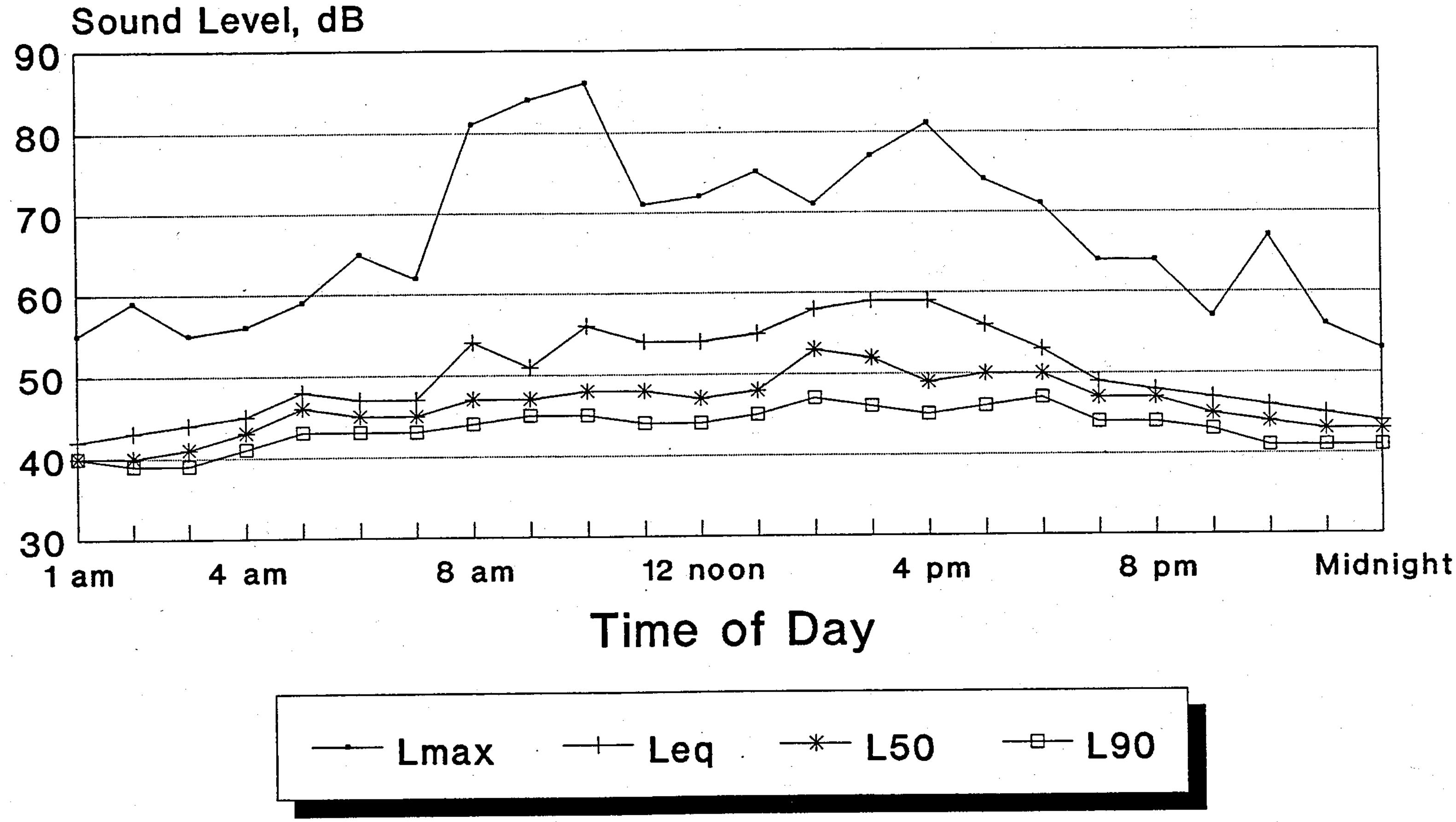
Although a considerable number of aircraft single events were logged on June 27th and 30th, the computed CNEL values for those days were 50 and 53 dB, respectively. The measured CNEL values on those days were approximately 10 lower than the values illustrated on the EIR noise contour maps.

FIGURE I-11

Measured Ambient Noise Levels

Rock Creek Mobile Home Park

June 27, 1991



COMMUNITY NOISE SURVEY

A community noise survey was conducted to document noise exposure in areas of the community containing noise sensitive land uses. For that purpose, noise sensitive land uses in the Plan Area were considered to include residential areas, parks and schools. Noise monitoring sites were selected to be representative of typical noise sensitive locations within the Plan Area.

Short-term noise monitoring was conducted on July 17-18, 1991. Each site was monitored three different times during the day and night so that estimates of L_{dn} could be prepared. Two long-term noise monitoring sites were established in the Plan Area to record day-night statistical trends. The data collected included the L_{eq} and other statistical descriptors. Noise monitoring sites, measured noise levels and estimated L_{dn} values at each site are summarized in Table I-7. Monitoring sites are shown by Figure I-12.

Community noise monitoring systems were calibrated with acoustical calibrators in the field prior to use. The systems comply with all pertinent requirements of the American National Standards Institute for Type I sound level meters.

The community noise survey results indicate that typical noise levels in noise sensitive areas of the Plan Area are in the range of 43 dB to 58 dB L_{dn}. Traffic on local roadways, railroad and aircraft operations, and neighborhood activities are the controlling factors for background noise levels in the majority of the Plan Area. Noise from industrial uses was audible during the evening and nighttime hours at residential uses adjacent to some industrial areas. In general, the areas of the Plan Area which contain noise sensitive uses are relatively quiet.

The L_{90} values shown in Table I-7 represent background noise levels, where there are typically no identifiable local noise sources. The L_{50} values represent median noise levels. The L_{eq} values in Table I-7 represent the average noise energy during the sample periods, and show the effects of brief noisy periods. The L_{eq} values were the basis of the estimated L_{dn} values. L_{max} values show the maximum noise levels observed during the samples, and are typically due to passing cars or small aircraft overflights. The results of the continuous ambient noise measurements are shown on Figure I-13.

TABLE I-7
SUMMARY OF MEASURED NOISE LEVELS AND ESTIMATED DAY-NIGHT AVERAGE LEVELS (L_{dn}) IN AREAS CONTAINING NOISE SENSITIVE LAND USES

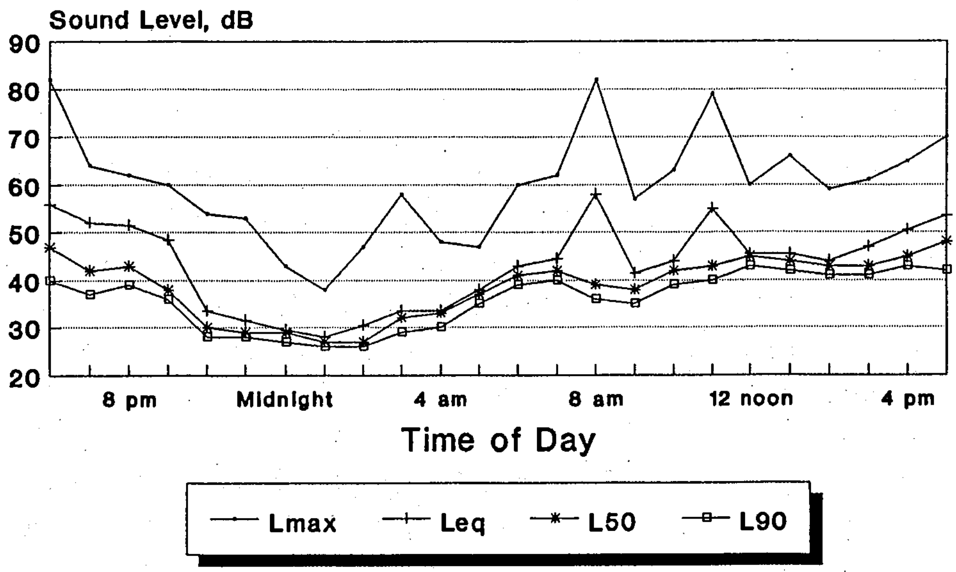
Site	Location	Date	Time	Sound Level, dB					
				L_{90}	L_{50}	L_{10}	L_{eq}	L_{max}	Est. L_{dn}
1	Shirland Road 0.3 mi. east of Auburn Folsom Road	7-17-91	9:30	36	39	41	47.8	72	47
		7-17-91	13:43	38	44	47	46.8	66	
		7-18-91	1:37	31	34	36	35.0	41	
2	Sky Ridge School	7-17-91	10:05	33	36	46	47.7	72	47
		7-17-91	14:33	41	44	48	48.8	73	
		7-18-91	1:21	33	34	36	34.5	44	
3	Beggs Field/Auburn Recreation Park	7-17-91	10:44	48	52	61	59.8	78	55
		7-17-91	15:03	40	45	50	48.8	63	
		7-18-91	1:10	33	35	38	35.5	41	
4	Paved Recreation Area near College Way and High Street	7-17-91	11:10	44	46	49	46.9	56	51
		7-17-91	15:28	48	50	54	54.9	77	
		7-18-91	00:52	33	34	35	34.0	37	
5	Gold Street	7-17-91	11:40	32	35	53	55.6	75	51
		7-17-91	15:56	33	39	42	43.9	69	
		7-18-91	1:03	34	35	38	36.5	50	
6	Ashford Park	7-17-91	12:15	45	47	51	49.9	69	58
		7-17-91	17:35	50	52	56	53.0	66	
		7-18-91	00:42	47	50	55	52.0	64	

TABLE I-7
SUMMARY OF MEASURED NOISE LEVELS AND ESTIMATED
DAY-NIGHT AVERAGE LEVELS (L_{dn}) IN AREAS
CONTAINING NOISE SENSITIVE LAND USES

Site	Location	Date	Time	Sound Level, dB					
				L_{90}	L_{50}	L_{10}	L_{eq}	L_{max}	Est. L_{dn}
7	Kemper Road between Bean and Country Villa Roads	7-17-91	9:22	39	44	55	55.0	74	52
		7-17-91	13:35	34	37	45	47.1	66	
		7-18-91	00:29	36	39	44	40.5	52	
8	Corner of Copper Penny and Rock View Court	7-17-91	10:00	33	40	50	48.2	66	50
		7-17-91	14:05	38	42	50	52.5	73	
		7-18-91	00:20	34	37	40	37.0	42	
9	Auburn District Regional Park	7-17-91	10:27	40	44	53	50.6	67	50
		7-17-91	14:30	37	41	49	49.2	68	
		7-18-91	00:13	35	38	40	38.5	51	
10	Old Airport Road near Auburn Airport	7-17-91	10:57	40	44	51	51.7	68	52
		7-17-91	15:00	42	44	51	48.8	65	
		7-17-91	23:58	40	41	43	43.5	56	
11	Squirrel Drive	7-17-91	11:27	44	48	54	51.5	66	49
		7-17-91	15:30	36	42	49	45.4	60	
		7-17-91	23:47	36	37	39	37.5	49	
12	Ray Circle	7-17-91	12:03	29	33	39	36.2	48	43
		7-17-91	16:00	32	34	44	46.2	63	
		7-17-91	23:00	28	30	32	32.1	38	
13	175 Smith Court	Continuous site - results are shown on Figure I-13							50
14	1235 Oak Ridge Way	Continuous site - results are shown on Figure I-13							47

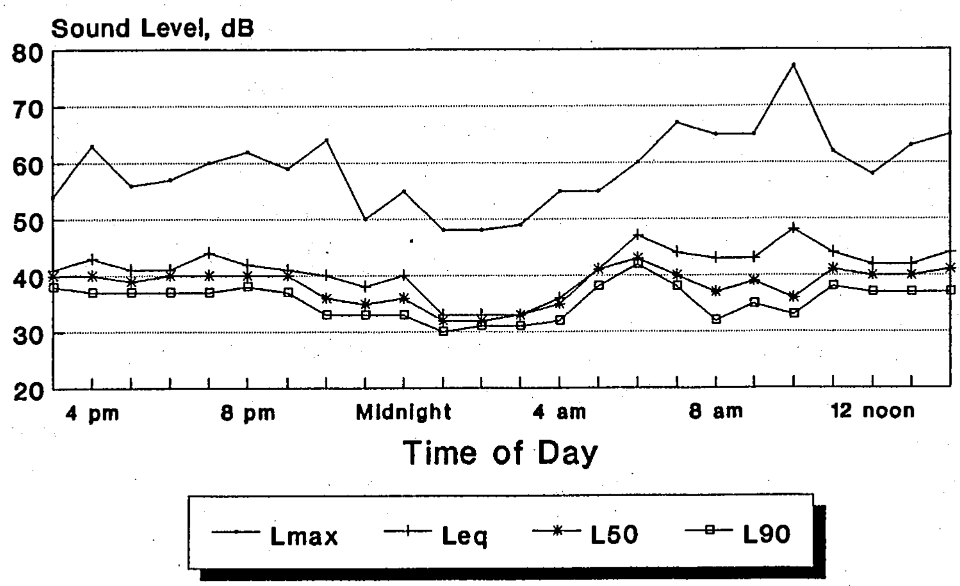
FIGURE I-13

Measured Ambient Noise Levels
Site 13: 175 Smith Court
July 17-18, 1991



Ldn=50

Measured Ambient Noise Levels
Site 14: 1235 Oak Ridge Road
July 16-17, 1991



Ldn=47

II. NOISE PREDICTION METHODOLOGY

The following noise prediction methodologies are approved for use in acoustical analyses submitted to Placer County for the Auburn/Bowman Community Plan area. Other methodologies may be used if approved by the County Planning Department after review of supporting technical justification.

Traffic Noise:

1. The Federal Highway Administration <u>Highway Traffic Noise Prediction Model</u> (FHWA RD-77-108) is the preferred traffic noise prediction methodology. The CALVENO standardized noise emission factors must be used (published in FHWA-CA-TL-84/13, "California Vehicle Noise Emission Levels"). Any form of the FHWA Model may be used, such as manual calculation and versions for programmable calculators and computers, including STAMINA.

2. Noise barrier insertion loss shall be calculated using the FHWA Model methodology. The effective center frequency of the noise sources shall be assumed to be 550 Hz. Source heights of 0, 2 and 8 feet above roadway centerline shall be assumed for autos, medium trucks and heavy trucks, respectively.

3. Noise sensitive receiver locations are assumed to be the back yards of single-family dwellings, and the patios and balconies of multi-family dwellings. The exterior receiver height shall be assumed to be 5 feet above back yard or patio elevation for ground-floor receivers, and 4 feet above balcony elevation for upper-floor receivers. The exterior ground-floor receiver shall be placed 10 feet from the building facade. The exterior upper-floor receiver shall be placed midway from the building facade to the edge of the balcony, and a correction factor of +2 dB shall be applied to account for reflections from the building facade.

4. For multi-family developments, common outdoor activity areas are also considered to be noise sensitive receiver locations. The assumed exterior receiver height is 5 feet above ground level, and the assumed receiver location is normally in the center of the recreation area.

5. Traffic noise attenuation with distance for ground level receivers should be consistent with an acoustically "soft" site, at 4.5 dB attenuation per doubling of distance. Noise attenuation for receivers and building facades at upper floors, and for receivers overlooking the roadway, should be consistent with an acoustically "hard" site, at 3 dB attenuation per doubling of distance. These assumptions may be modified on the basis of onsite noise measurements at proposed receiver locations and elevations.

6. Noise measurements for traffic noise analyses should include at least one 15-minute sample of daytime traffic noise levels (including the L_{eq} value) under free-flowing traffic conditions, with a concurrent traffic count. Nighttime traffic noise levels may be estimated from 24-hour noise measurement data or published hourly traffic distribution data. For major arterials and highways, continuous hourly noise measurements over a 24-hour period are recommended to describe the effective day/night traffic distribution and to supplement the 15-minute sample(s). Noise measurement sites should be selected to represent proposed receiver locations and representative sound propagation conditions.

8. Existing traffic volume, truck mix and day/night distribution should be obtained from the Placer County Department of Public Works or Caltrans as appropriate. Projected future traffic volume may be obtained from those agencies or the project traffic consultant. Traffic speed shall be assumed to be the posted or projected design speed, unless shown otherwise by observation or noise measurements. Typical traffic data for the Community Plan area are shown by the FHWA Model input data listed in the Noise Element handbook.

Railroad Noise:

1. The preferred method of predicting railroad noise exposure is to calculate L_{dn} values at the proposed receiver locations based upon onsite single event and cumulative noise level measurements, assuming noise attenuation of 4.5 dB per doubling of distance for all receiver elevations. Alternative methods include the "Simplified Procedure for Developing Railroad Noise Exposure Contours," prepared by Jack W. Swing of the California Office of Noise Control, and the more detailed procedures

prescribed in the Assessment of Noise Environments Around Railroad Operations, Wyle Research Report No. WCR 73-5. In the Community Plan area, variations in site topography, railroad grade and use of warning horns may require adjustments to the modeling assumptions. For this reason, onsite noise measurements and observations are preferred. The Noise Element handbook lists railroad noise measurement results in the Community Plan area.

2. Noise barrier insertion loss for railroad noise sources should be calculated using standard methods, such as those described by the FHWA Model or in Noise and Vibration Control, by Leo Beranek. Receiver locations for railroad noise exposures are the same as for traffic noise exposures. To account for differences in source heights and frequency content, it may be necessary to determine the relative contribution of different noise sources, such as wheel/rail interaction, locomotives or horns. For a generalized railroad noise source on smooth rails, the effective center frequency of the source may be assumed to be 1000 Hz with a source height of 10 feet above the rail bed. Other assumptions may be used as supported by published data or experimental results.

3. Day/night distribution of railroad freight operations may be assumed to be uniform over a 24-hour day, unless otherwise indicated by noise measurements or information from the railroad company. Passenger train operations should be distributed according to the published schedules. The numbers and distribution of freight operations may be obtained from the railroad company dispatcher. Refer to the Noise Element handbook for typical railroad operations in the Community Plan area.

4. Railroad noise measurements should include a representative number of single event noise levels from freight and passenger operations. Noise levels recorded over a 24-hour period are normally sufficient. The data collected should include the Sound Exposure Level (SEL) and maximum sound level (L_{max}) due to the passage of the train, and a notation of whether a warning horn or whistle was used. The noise levels due to bells at rail crossings should also be described.

Aircraft Noise:

1. Noise produced by aircraft operations at an airport may be described by reference to published noise exposure contours for that airport. If the project site is within the 60 dB CNEL contour of an airport, predicted single event aircraft noise levels at the project site should be described. Predicted single event noise levels may be based upon noise measurements at the project site, or by using the FAA's Integrated Noise Model (INM). Aircraft noise levels should be expressed in terms of the Community Noise Equivalent Level (CNEL) and (where applicable) typical SEL and L_{max} values.

2. Noise produced by aircraft operations at other than an established airport should be described in terms of predicted Community Noise Equivalent Level (CNEL), SEL and L_{max} values. Predicted noise levels may be based upon noise measurements at the project site or other representative locations, or may be predicted using the FAA's Integrated Noise Model (INM). Helicopter noise level predictions may also be based upon the data reported in Helicopter Noise Exposure Curves for Use in Environmental Impact Assessment, FAA-EE-82-16.

Interior Noise Levels:

1. Interior noise levels should be calculated from the predicted exterior sound level and source spectrum at the affected building facades, and the sound transmission characteristics of the building facades. The calculation should account for the types and sizes of the building elements used in the facade, the amount of exposure of each facade to the noise source, and the cumulative noise exposure from each facade. If detailed building plans are not available, generalized building descriptions may be employed, subject to review when detailed plans are provided.

2. One-third octave or 1/1 octave band analysis is preferred, describing the source frequency content and facade transmission loss characteristics from 125 Hz to 4000 Hz. Corrections should also be made for absorption of sound by the receiving room. A safety factor of 3 dB is recommended to

allow for potential degradation of acoustical performance from variables in construction and materials. Source spectra and transmission loss values should be obtained from published test results, if available.

3. If it is necessary to close windows and doors to achieve the required interior noise level standard, the analysis should indicate that adequate ventilation must be provided to meet the fresh air exchange requirements of the Uniform Building Code. Recommendations should also be made to ensure that the ventilation system does not compromise the acoustical integrity of the building facades, and that it does not create excessive interior noise levels due to its operation.

4. The report should cite the assumptions used for building elements and design features. Any building design features required to achieve the interior noise level standard should be clearly specified.

III. DESCRIPTION OF NOISE

Noise is often defined simply as unwanted sound, and thus is a subjective reaction to characteristics of a physical phenomenon. Researchers for many years have grappled with the problem of translating objective measurements of sound into directly correlatable measures of public reaction to noise. The descriptors of community noise in current use are the results of these efforts, and represent simplified, practical measurement tools to gauge community response. Before elaborating on these descriptors, it is useful to first discuss some fundamental concepts of sound.

Sound is defined as any pressure variation in air that the human ear can detect. If the pressure variations occur frequently enough (at least 20 times per second), they can be heard and hence are called sound. The number of pressure variations per second is called the frequency of sound, and is expressed as cycles per second, now called hertz (Hz) by international agreement.

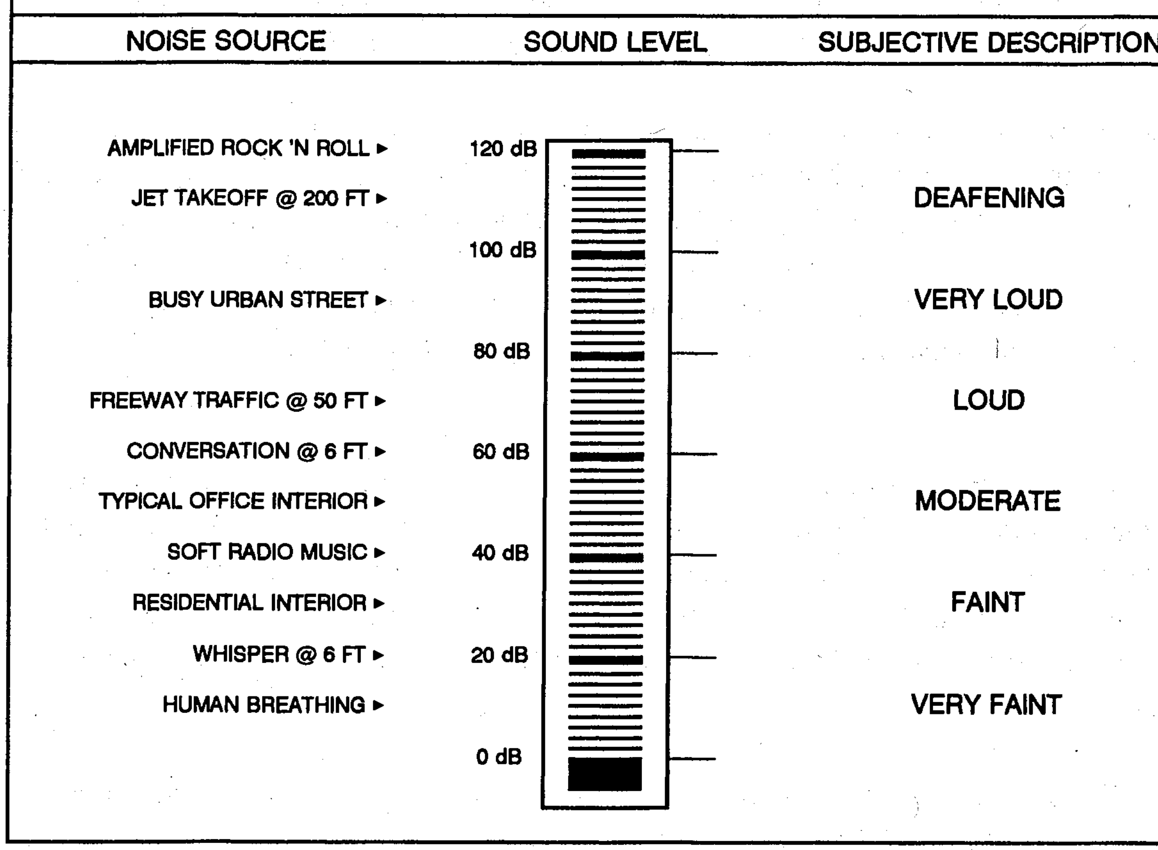
The speed of sound in air is approximately 770 miles per hour, or 1,130 feet/second. Knowing the speed and frequency of a sound, one may calculate its wavelength, the physical distance in air from one compression of the atmosphere to the next. An understanding of wavelength is useful in evaluating the effectiveness of physical noise control devices such as mufflers or barriers, which depend upon either absorbing or blocking sound waves to reduce sound levels.

Measuring sound directly in terms of pressure would require a very large and awkward range of numbers. To avoid this, the decibel scale was devised. The decibel scale uses the hearing threshold of 20 micropascals as a point of reference, defined as 0 dB. Other sound pressures are then compared to the reference pressure, and the logarithm is taken to keep the numbers in a practical range.

The decibel scale allows a million-fold increase in pressure to be expressed as 120 dB. Another useful aspect of the decibel scale is that changes in levels (dB) correspond closely to human perception of relative loudness.

The perceived loudness of sounds is dependent upon many factors, including sound pressure level and frequency content. However, within the usual range of environmental noise levels, perception of loudness is relatively predictable, and can be approximated by weighting the frequency response of a sound level measurement device (called a sound level meter) by means of the standardized A-weighting network. There is a strong correlation between A-weighted sound levels (expressed as sound levels in dB) and community response to noise. For this reason, the A-weighted sound pressure level has become the standard tool of environmental noise assessment. Figure III-1 illustrates typical sound levels and subjective reaction due to recognizable sources.

FIGURE III-1
EXAMPLES OF SOUND LEVELS



Community noise is commonly described in terms of the "ambient" noise level, which is defined as the all-encompassing noise level associated with a given noise environment. A common statistical tool to measure the ambient noise level is the average, or equivalent, sound level (L_{eq}), which corresponds to a steady-state sound level containing the same total energy as a time-varying signal over a given time period (usually one hour). The L_{eq} is the foundation of the composite noise descriptors such as L_{dn} and CNEL, and shows very good correlation with community response to noise.

Two composite noise descriptors are in common use today: L_{dn} (Day-night Average Level) and CNEL (Community Noise Equivalent Level). The L_{dn} is based upon the average hourly L_{eq} over a 24-hour day, with a +10 decibel weighting applied to nighttime (10:00 p.m. to 7:00 a.m.) L_{eq} values. The nighttime penalty is based upon the assumption that people react to nighttime noise exposures as though they were twice as loud as daytime exposures. The CNEL, like L_{dn}, is based upon the weighted average hourly L_{eq} over a 24-hour day, except that an additional +4.77 decibel penalty is applied to evening (7:00 p.m. to 10:00 p.m.) hourly L_{eq} values. The CNEL was developed for the California Airport Noise Regulations, and is applied specifically to airport/aircraft noise assessment. The L_{dn} descriptor is a simplification of the CNEL concept, but the two will usually agree, for a given situation, within 1 dB. Like the L_{eq}, L_{dn} and CNEL are averages and tend to disguise short-term variations in the noise environment. Because they presume increased evening or nighttime sensitivity, they are best applied as criteria for land uses where nighttime noise exposures are critical to the acceptability of the noise environment, such as residential developments.

Noise in the community has often been cited as being a health problem, not in terms of actual physiological damage such as hearing impairment, but in terms of inhibiting general well-being and contributing to undue stress and annoyance. The health effects of noise in the community arise from interference with human activities such as sleep, speech, recreation, and tasks demanding concentration or coordination. When community noise interferes with human activities or contributes to stress, public annoyance with the noise source increases, and the acceptability of the environment for people decreases. This decrease in acceptability and the threat to public well-being are the bases for land use planning policies preventing exposure to excessive community noise levels.

To control noise from fixed sources which have developed from processes other than zoning or land use planning, many jurisdictions have adopted community noise control ordinances. Such ordinances are intended to abate noise nuisances and to control noise from existing sources. They may also be used as performance standards to judge the creation of a potential nuisance, or potential encroachment of sensitive uses upon noise-producing facilities. Community noise control ordinances are generally designed to resolve noise problems on a short-term basis (usually by means of hourly noise level criteria), rather than on the basis of 24-hour or annual cumulative noise exposures.

In addition to the sound level, other factors should be considered in establishing criteria for noise sensitive land uses. For example, sounds with noticeable tonal content such as whistles, horns, droning or high-pitched sounds may be more annoying than the A-weighted sound level alone suggests. Many noise standards apply a penalty, or correction, of 5 dB to such sounds. The effects of unusual tonal content are generally more of a concern at nighttime, when residents may notice the sound in contrast to low levels of background noise.

Because many rural residential areas experience very low noise levels, residents may express concern about the loss of "peace and quiet" due to the introduction of a sound which was not audible previously. In very quiet environments, the introduction of virtually any change in local activities will cause an increase in noise levels. A change in noise level and the loss of "peace and quiet" is the inevitable result of land use or activity changes in such areas. Audibility of a new noise source and/or increases in noise levels within recognized acceptable limits are not usually considered to be significant noise impacts, but these concerns should be addressed and considered in the planning and environmental review processes.

IV. CRITERIA FOR ACCEPTABLE NOISE EXPOSURES

The State Office of Planning and Research (OPR) Noise Element Guidelines include recommended exterior and interior noise level standards for local jurisdictions to identify and prevent the creation of incompatible land uses due to noise. The OPR guidelines contain a land use compatibility table which describes the compatibility of different land uses with a range of environmental noise levels in terms of L_{dn} or CNEL. A noise environment of 50 to 60 dB L_{dn} or CNEL is considered to be "normally acceptable" for residential uses according to those guidelines. The OPR recommendations also note that, under certain conditions, more restrictive standards than the maximum levels cited may be appropriate. As an example, the standards for quiet suburban and rural communities may be reduced by 5 to 10 dB to reflect lower existing outdoor noise levels.

The U.S. Environmental Protection Agency (EPA) also offers guidelines for community noise exposure in the publication "Information on the Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety". These guidelines consider occupational noise exposure as well as noise exposure in the home. The "Levels Document" recognizes an exterior noise level of 55 dB L_{dn} as a goal to protect the public from hearing loss, activity interference, sleep disturbance and annoyance. The EPA notes, however, that this level is not a regulatory goal, but is a level defined by a negotiated scientific consensus without concern for economic and technological feasibility or the needs and desires of any particular community. The EPA and other Federal agencies have adopted suggested land use compatibility guidelines which indicate that residential noise exposures of 55 to 65 dB L_{dn} are acceptable.

The U.S. Environmental Protection Agency has also prepared a Model Community Noise Control Ordinance, using L_{eq} as the means of defining allowable residential noise level limits. The EPA model contains no specific recommendations for local noise level standards, but reports a range of L_{eq} values as adopted by various local jurisdictions. The mean daytime residential noise standard reported by the EPA is 56.75 dB (L_{eq}); the mean nighttime residential noise standard is 51.76 dB (L_{eq}). This ordinance format has been applied by the City and County of San Diego.

V. TECHNIQUES FOR NOISE CONTROL

Any noise problem may be considered as being composed of three basic elements: the noise source, a transmission path, and a receiver. Local control of noise sources is practical only with respect to fixed sources (e.g., industrial facilities, outdoor activities, etc.), as control of vehicular sources is generally preempted by federal or state law. Control of fixed noise sources is usually best obtained by enforcement of a local noise control ordinance. The emphasis of noise control in land use planning is therefore placed upon acoustical treatment of the transmission path and the receiving structures.

The appropriate acoustical treatment for a given project should consider the nature of the noise source and the sensitivity of the receiver. The problem should be defined in terms of appropriate criteria (L_{dn}, L_{eq}, or L_{max}), the location of the sensitive receiver (inside or outside), and when the problem occurs (daytime or nighttime). Noise control techniques should then be selected to provide an acceptable noise environment for the receiving property while remaining consistent with local aesthetic standards and practical structural and economic limits. Fundamental noise control techniques include the following:

a. Use of Setbacks

Noise exposure may be reduced by increasing the distance between the noise source and receiving use. Setback areas can take the form of open space, frontage roads, recreational areas, storage yards, etc. The available noise attenuation from this technique is limited by the characteristics of the noise source, but is generally 4 to 6 dB per doubling of distance from the source.

b. Use of Barriers

Shielding by barriers can be obtained by placing walls, berms or other structures, such as buildings, between the noise source and the receiver. The effectiveness of a barrier depends upon blocking line-of-sight between the source and receiver, and is improved with increasing the distance the sound must travel to pass over the barrier as compared to a straight line from source to receiver. The difference between the distance over a barrier and a straight line between source and receiver is called the "path length difference," and is the basis for calculating barrier noise reduction.

Barrier effectiveness depends upon the relative heights of the source, barrier and receiver. In general, barriers are most effective when placed close to either the receiver or the source. An intermediate barrier location yields a smaller pathlength difference for a given increase in barrier height than does a location closer to either source or receiver.

For maximum effectiveness, barriers must be continuous and relatively airtight along their length and height. To ensure that sound transmission through the barrier is insignificant, barrier mass should be about 4 lbs./square foot, although a lesser mass may be acceptable if the barrier material provides sufficient transmission loss in the frequency range of concern. Satisfaction of the above criteria requires substantial and well-fitted barrier materials, placed to intercept line of sight to all significant noise sources. Earth, in the form of berms or the face of a depressed area, is also an effective barrier material.

Transparent noise barriers may be employed, and have the advantage of being aesthetically pleasing in some environments. Transparent barrier materials such as laminated glass and polycarbonate provide adequate transmission loss for most highway noise control applications. Transparent barrier materials may be flammable, and may be easily abraded. Some materials may lose transparency upon extended exposure to sunlight. Maintaining aesthetic values requires that transparent barriers be washed on a regular basis. These properties of transparent barrier materials require that the feasibility of their use be considered on a case-by-case basis.

The attenuation provided by a barrier depends upon the frequency content of the source. Generally, higher frequencies are attenuated (reduced) more readily than lower frequencies. This results because a given barrier height is relatively large compared to the shorter wavelengths of high frequency sounds, while relatively small compared to the longer wavelengths of the low frequency sounds. The effective center frequency for traffic noise is usually considered to be 550 Hz. Railroad engines, cars and horns emit noise with differing frequency content, so the effectiveness of a barrier will vary for each of these sources. Frequency analyses are necessary to properly calculate barrier effectiveness for noise from sources other than highway traffic.

There are practical limits to the noise reduction provided by barriers. For highway traffic noise, a 5 to 10 dB noise reduction may often be reasonably attained. A 15 dB noise reduction is sometimes possible, but a 20 dB noise reduction is extremely difficult to achieve. Barriers usually are provided in the form of walls, berms, or berm/wall combinations. The use of an earth berm in lieu of a solid wall will provide up to 3 dB additional attenuation over that attained by a solid wall alone, due to the absorption provided by the earth. Berm/wall combinations offer slightly better acoustical performance than solid walls, and are often preferred for aesthetic reasons.

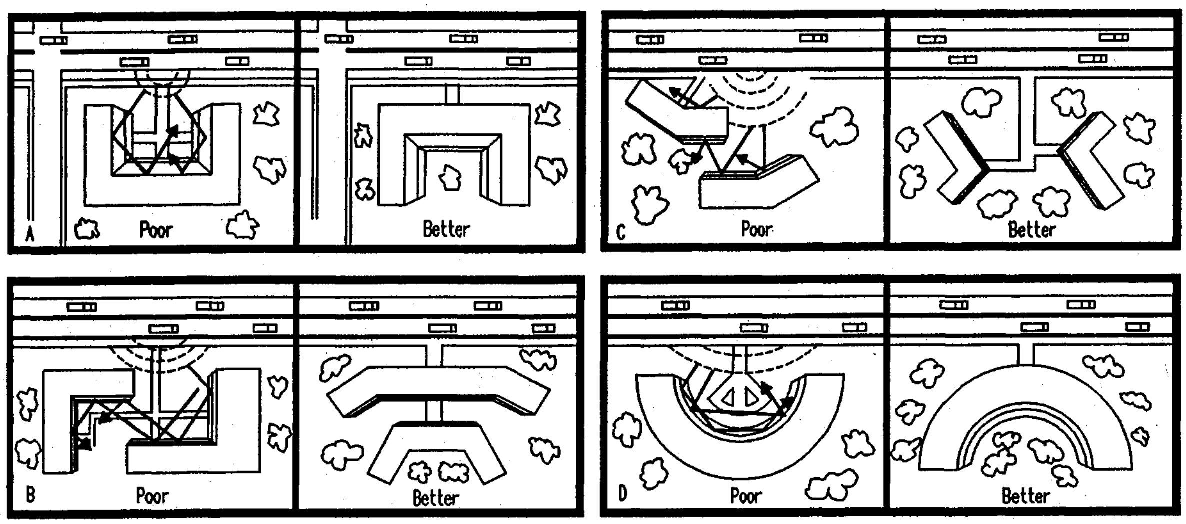
Another form of barrier is the use of a depressed noise source location, such as depressed loading areas in shopping centers or depressed roadways. The walls of the depression serve to break line-of-sight between the source and receiver, and will provide absorption if left in earth or vegetative cover.

c. Site Design

Buildings can be placed on a project site to shield other structures or areas, to remove them from noise-impacted areas, and to prevent an increase in noise level caused by reflections. The use of one building to shield another can significantly reduce overall project noise control costs, particularly if the shielding structure is insensitive to noise. As an example, carports or garages can be used to form or complement a barrier shielding adjacent dwellings or an outdoor activity area. Similarly, one residential unit can be placed to shield another so that noise reduction measures are needed for only the building closest to the noise source. Placement of outdoor activity areas within the shielded portion of a building complex, such as a central courtyard, can be an effective method of providing a quiet retreat in an otherwise noisy environment. Patios or balconies should be placed on the side of a building opposite the noise source, and "wing walls" can be added to buildings or patios to help shield sensitive uses.

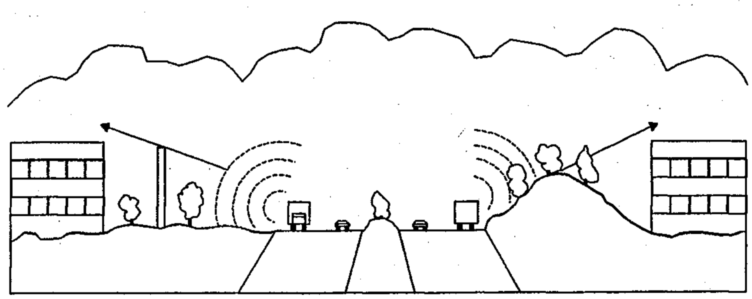
Where project design does not allow using buildings or other land uses to shield sensitive uses, noise control costs can be reduced by orienting buildings with the narrow end facing the noise source, reducing the total area of the building requiring acoustical treatment. Some examples of building orientation to reduce noise impacts are shown in Figure V-1.

FIGURE V-1



Another option in site design is the placement of relatively insensitive land uses, such as commercial or storage areas, between the noise source and a more sensitive portion of the project. Examples include development of a commercial strip along a busy arterial to block noise affecting a residential area, or providing recreational vehicle storage or travel trailer parking along the noise-impacted edge of a mobile home park. If existing topography or development adjacent to the project site provides some shielding, as in the case of an existing berm, knoll or building, sensitive structures or activity areas may be placed behind those features to reduce noise control costs, (See Figure V-2).

FIGURE V-2



Site design should also guard against the creation of reflecting surfaces which may increase onsite noise levels. For example, two buildings placed at an angle facing a noise source may cause noise levels within that angle to increase by up to 3 dB. The open end of "U"-shaped buildings should point away from noise sources for the same reason. Landscaping walls or noise barriers located within a development may inadvertently reflect noise back to a noise-sensitive area unless carefully located. Avoidance of these problems while attaining an aesthetic site design requires close coordination between local agencies, the project engineer and architect, and the noise consultant.

Another important aspect of site design is avoiding the creation of noise problems at adjacent noise-sensitive properties. For example, air conditioning units should not be placed adjacent to living areas of adjoining residences unless adequate shielding is provided. Swimming pools and outdoor activity areas such as "tot lots" should be located away from adjoining residences, or should be adequately shielded.

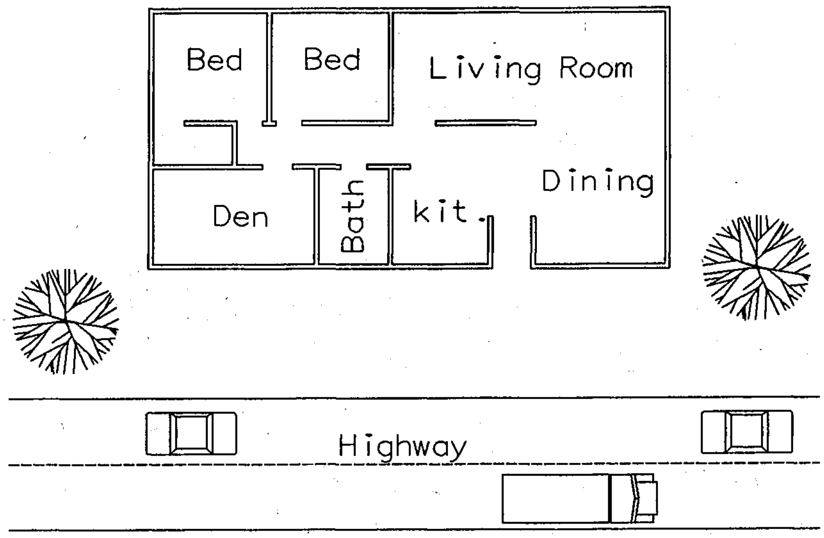
d. Building Design

When structures have been located to provide maximum noise reduction by barriers or site design, noise reduction measures may still be required to achieve an acceptable interior noise environment. The cost of such measures may be reduced by placement of interior dwelling unit features. For example, bedrooms, living rooms, family rooms and other noise-sensitive portions of a dwelling can be located on the side of the unit farthest from the noise source, as shown by Figure V-3.

Bathrooms, closets, stairwells and food preparation areas are relatively insensitive to exterior noise sources, and can be placed on the noisy side of a unit. When such techniques are employed, noise reduction requirements for the building facade can be significantly reduced, although the architect must take care to isolate the noise impacted areas by the use of partitions or doors.

In some cases, external building facades can influence reflected noise levels affecting adjacent buildings. This is primarily a problem where high-rise buildings are proposed, and the effect is most evident in urban areas, where an "urban canyon" may be created. Bell-shaped or irregular building facades and attention to the orientation of the building can reduce this effect.

FIGURE V-3



e. Noise Reduction by Building Facades

When interior noise levels are of concern in a noisy environment, noise reduction may be obtained through acoustical design of building facades. Standard residential construction practices provide 12-15 dB noise reduction for building facades with open windows, and 20-25 dB noise reduction when windows are closed. Thus a 20 dB exterior-to-interior noise reduction can be obtained by the requirement that building design include adequate ventilation systems, allowing windows on a noise-impacted facade to remain closed under any weather condition.

Where greater noise reduction is required, acoustical treatment of the building facade is necessary. Reduction of relative window area is the most effective control technique, followed by providing acoustical glazing (thicker glass or increased air space between panes) in low air infiltration rate frames, use of fixed (non-movable) acoustical glazing or the elimination of windows. Noise transmitted through walls can be reduced by increasing wall mass (using stucco or brick in lieu of wood siding), isolating wall members by the use of double- or staggered- stud walls, or mounting interior walls on resilient channels. Noise control for exterior doorways is provided by reducing door area, using solid-core doors, and by acoustically sealing door perimeters with suitable gaskets. Roof treatments may include the use of plywood sheathing under roofing materials.

Standard energy-conservation double-pane glazing with an 1/8" or 1/4" air-space is not considered acoustical glazing, as its sound transmission loss for some noise sources is actually less than that of single-pane glazing.

Whichever noise control techniques are employed, it is essential that attention be given to installation of weatherstripping and caulking of joints. Openings for attic or subfloor ventilation may also require acoustical treatment; tight-fitting fireplace dampers and glass doors may be needed in aircraft noise-impacted areas.

Design of acoustical treatment for building facades should be based upon analysis of the level and frequency content of the noise source. The transmission loss of each building component should be defined, and the composite noise reduction for the complete facade calculated, accounting for absorption in the receiving room. A one-third octave band analysis is a definitive method of calculating the A-weighted noise reduction of a facade.

A common measure of transmission loss is the Sound Transmission Class (STC). STC ratings are not directly comparable to A-weighted noise reduction, and must be corrected for the spectral content of the noise source. Requirements for transmission loss analyses are outlined by Title 24 of the California Code of Regulations.

f. Use of Vegetation

Trees and other vegetation are often thought to provide significant noise attenuation. However, approximately 100 feet of dense foliage (so that no visual path extends through the foliage) is required to achieve a 5 dB attenuation of traffic noise. Thus the use of vegetation as a noise barrier should not be considered a practical method of noise control unless large tracts of dense foliage are part of the existing landscape.

Vegetation can be used to acoustically "soften" intervening ground between a noise source and receiver, increasing ground absorption of sound and thus increasing the attenuation of sound with distance. Planting of trees and shrubs is also of aesthetic and psychological value, and may reduce adverse public reaction to a noise source by removing the source from view, even though noise levels will be largely unaffected. It should be noted, however, that trees planted on the top of a noise control berm can actually slightly degrade the acoustical performance of the barrier. This effect can occur when high frequency sounds are diffracted (bent) by foliage and directed downward over a barrier.

In summary, the effects of vegetation upon noise transmission are minor, and are primarily limited to increased absorption of high frequency sounds and to reducing adverse public reaction to the noise by providing aesthetic benefits.

g. Sound Absorbing Materials

Absorptive materials such as fiberglass, foam, cloth and acoustical tiles or panels are used to reduce reflections or reverberation in closed spaces. Their use in exterior environmental noise control may reduce reflections between parallel noise barriers or other reflective surfaces. Maintenance of absorptive materials used outdoors may be difficult, as most such materials are easily damaged by sunlight and moisture. Their application as an outdoor noise control tool is limited to special cases where the control of reflected noise is critical and where the material is sufficiently durable.

APPENDIX A
ACOUSTICAL TERMINOLOGY

AMBIENT NOISE LEVEL: The composite of noise from all sources near and far. In this context, the ambient noise level constitutes the normal or existing level of environmental noise a a given location.

CNEL: Comunity Noise Equivalent Level. The average equivalent sound level during a 24-hour day, obtained after addition of approximately five decibels to sound levels in the evening from 7:00 p.m. to 10:00 p.m. and ten decibels to sound levels in the night before 7:00 a.m. and after 10:00 p.m.

DECIBEL, dB: A unit for describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure, which is 20 micropascals (20 micronewtons per square meter).

L_{dn}: Day-Night Average Sound Level. The average equivalent sound level during a 24-hour day, obtained after addition of ten decibels to sound levels in the night after 10:00 p.m. and before 7:00 a.m.

L_{eq}: Equivalent Sound Level. The sound level containing the same total energy as a time varying signal over a given sample period. L_{eq} is typically computed over 1, 8 and 24-hour sample periods.

Note: CNEL and L_{dn} represent daily levels of noise exposure averaged on an annual basis, while L_{eq} represents the average noise exposure for a shorter time period, typically one hour.

L_{max}: The maximum sound level recorded during a noise event.

L_n: The sound level exceeded "n" percent of the time during a sample interval. L_{10} equals the level exceeded 10 percent of the time (L_{90}, L_{50}, etc.)

BBA

ACOUSTICAL TERMINOLOGY

NOISE EXPOSURE CONTOURS: Lines drawn about a noise source indicating constant levels of noise exposure. CNEL abd L_{dn} contours are frequently utilized to describe community exposure to noise.

SEL OR SENEL: Sound Exposure Level or Single Event Noise Exposure Level. The level of noise accumulated during a single noise event, such as an aircraft overflight, with reference to a duration of one second. More specifically, it is the time-intgrated A-weighted squared sound level for a stated time interval or event, based on a reference pressure of 20 micropascals and a reference duration of one second.

SOUND LEVEL: The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the response of the human ear and gives good correlation with subjective reactions to noise.

BBA

APPENDIX B-1

FHWA HIGHWAY TRAFFIC NOISE PREDICTION MODEL INPUTS

FHWA Model RD-77-108: Brown-Buntin Associates, Inc.
Calveno Emission Curves Run Date: 09-27-1991
Project Number: Auburn Bowman Community Plan Run Time: 14:49:08
Year: Existing (1988) Conditions - Based on County Counts
Soft Site

INPUT DATA SUMMARY:

Segment	ADT	Day%	Eve%	Nite%	%MT	%HT	Speed	Distance	Offset
1	56000	73.0	0.0	27.0	4.0	11.0	60.0	100.0	0.0
2	39000	73.0	0.0	27.0	4.0	11.0	60.0	100.0	0.0
3	19000	78.0	0.0	22.0	3.5	3.5	50.0	100.0	0.0
4	26000	78.0	0.0	22.0	3.5	3.5	40.0	100.0	0.0
5	32000	78.0	0.0	22.0	3.5	3.5	40.0	100.0	0.0
6	40000	78.0	0.0	22.0	3.5	3.5	40.0	100.0	0.0
7	38000	78.0	0.0	22.0	3.5	3.5	40.0	100.0	0.0
8	36000	78.0	0.0	22.0	3.5	3.5	40.0	100.0	0.0
9	30000	78.0	0.0	22.0	3.5	3.5	40.0	100.0	0.0
10	13500	78.0	0.0	22.0	3.5	3.5	35.0	100.0	0.0
11	6200	78.0	0.0	22.0	3.5	3.5	35.0	100.0	0.0
12	8500	87.0	0.0	13.0	2.0	2.0	35.0	100.0	0.0
13	4700	87.0	0.0	13.0	2.0	2.0	45.0	100.0	0.0
14	6800	87.0	0.0	13.0	2.0	2.0	45.0	100.0	0.0
15	7200	87.0	0.0	13.0	2.0	2.0	45.0	100.0	0.0
16	9400	87.0	0.0	13.0	2.0	2.0	45.0	100.0	0.0
17	16400	87.0	0.0	13.0	2.0	2.0	40.0	100.0	0.0
18	6600	87.0	0.0	13.0	2.0	2.0	35.0	100.0	0.0
19	11000	87.0	0.0	13.0	2.0	2.0	40.0	100.0	0.0
20	12800	87.0	0.0	13.0	2.0	2.0	55.0	100.0	0.0
21	16100	87.0	0.0	13.0	2.0	2.0	55.0	100.0	0.0
22	9900	87.0	0.0	13.0	2.0	2.0	45.0	100.0	0.0
23	15600	87.0	0.0	13.0	2.0	2.0	40.0	100.0	0.0
24	5000	87.0	0.0	13.0	2.0	2.0	45.0	100.0	0.0
25	5000	87.0	0.0	13.0	2.0	2.0	40.0	100.0	0.0
26	9200	87.0	0.0	13.0	2.0	2.0	35.0	100.0	0.0
27	7200	87.0	0.0	13.0	2.0	2.0	35.0	100.0	0.0
28	6200	87.0	0.0	13.0	2.0	2.0	35.0	100.0	0.0
29	13500	87.0	0.0	13.0	2.0	2.0	45.0	100.0	0.0
30	8100	87.0	0.0	13.0	2.0	2.0	45.0	100.0	0.0
31	4300	87.0	0.0	13.0	2.0	2.0	40.0	100.0	0.0
32	7600	87.0	0.0	13.0	2.0	2.0	35.0	100.0	0.0
33	10500	87.0	0.0	13.0	2.0	2.0	35.0	100.0	0.0
34	9400	87.0	0.0	13.0	2.0	2.0	40.0	100.0	0.0
35	6800	87.0	0.0	13.0	2.0	2.0	40.0	100.0	0.0
36	8100	87.0	0.0	13.0	2.0	2.0	35.0	100.0	0.0
37	5100	87.0	0.0	13.0	2.0	2.0	35.0	100.0	0.0
38	7500	87.0	0.0	13.0	2.0	2.0	35.0	100.0	0.0
39	10500	87.0	0.0	13.0	2.0	2.0	35.0	100.0	0.0
40	6600	87.0	0.0	13.0	2.0	2.0	35.0	100.0	0.0
41	5000	87.0	0.0	13.0	2.0	2.0	35.0	100.0	0.0
42	4800	87.0	0.0	13.0	2.0	2.0	35.0	100.0	0.0
43	2500	87.0	0.0	13.0	2.0	2.0	45.0	100.0	0.0
44	3900	87.0	0.0	13.0	2.0	2.0	45.0	100.0	0.0
45	2000	87.0	0.0	13.0	2.0	2.0	35.0	100.0	0.0

FHWA Model RD-77-108: Brown-Buntin Associates, Inc.
Calveno Emission Curves   Run Date: 09-27-1991
Project Number: Auburn Bowman Community Plan   Run Time: 14:49:13
Year: Existing (1988) Conditions - Based on County Counts
Soft Site

INPUT DATA SUMMARY:

Segment	ADT	Day%	Eve%	Nite%	%MT	%HT	Speed	Distance	Offset
46	2000	87.0	0.0	13.0	2.0	2.0	35.0	100.0	0.0
47	1000	87.0	0.0	13.0	2.0	2.0	40.0	100.0	0.0
48	3000	87.0	0.0	13.0	2.0	2.0	40.0	100.0	0.0
49	4000	87.0	0.0	13.0	2.0	2.0	35.0	100.0	0.0
50	4000	87.0	0.0	13.0	2.0	2.0	45.0	100.0	0.0

FHWA Model RD-77-108: Brown-Buntin Associates, Inc.
Calveno Emission Curves   Run Date: 04-13-1992
Project Number: 91-216   Run Time: 23:23:37
Year: Placer County #s - Preferred Alternative
Soft Site

INPUT DATA SUMMARY:

Segment	ADT	Day%	Eve%	Nite%	%MT	%HT	Speed	Distance	Offset
1	128000	73.0	0.0	27.0	4.0	11.0	60.0	100.0	0.0
2	98000	73.0	0.0	27.0	4.0	11.0	60.0	100.0	0.0
3	50000	78.0	0.0	22.0	3.5	3.5	50.0	100.0	0.0
4	65000	78.0	0.0	22.0	3.5	3.5	40.0	100.0	0.0
5	59000	78.0	0.0	22.0	3.5	3.5	40.0	100.0	0.0
6	64000	78.0	0.0	22.0	3.5	3.5	40.0	100.0	0.0
7	69000	78.0	0.0	22.0	3.5	3.5	40.0	100.0	0.0
8	71000	78.0	0.0	22.0	3.5	3.5	40.0	100.0	0.0
9	71000	78.0	0.0	22.0	3.5	3.5	40.0	100.0	0.0
10	39000	78.0	0.0	22.0	3.5	3.5	35.0	100.0	0.0
11	28000	78.0	0.0	22.0	3.5	3.5	35.0	100.0	0.0
12	8000	87.0	0.0	13.0	2.0	2.0	35.0	100.0	0.0
13	15000	87.0	0.0	13.0	2.0	2.0	45.0	100.0	0.0
14	44000	87.0	0.0	13.0	2.0	2.0	45.0	100.0	0.0
15	43000	87.0	0.0	13.0	2.0	2.0	45.0	100.0	0.0
16	31000	87.0	0.0	13.0	2.0	2.0	45.0	100.0	0.0
17	48000	87.0	0.0	13.0	2.0	2.0	40.0	100.0	0.0
18	15000	87.0	0.0	13.0	2.0	2.0	35.0	100.0	0.0
19	19000	87.0	0.0	13.0	2.0	2.0	40.0	100.0	0.0
20	24000	87.0	0.0	13.0	2.0	2.0	55.0	100.0	0.0
21	28000	87.0	0.0	13.0	2.0	2.0	55.0	100.0	0.0
22	10000	87.0	0.0	13.0	2.0	2.0	45.0	100.0	0.0
23	19000	87.0	0.0	13.0	2.0	2.0	40.0	100.0	0.0
24	8000	87.0	0.0	13.0	2.0	2.0	45.0	100.0	0.0
25	5000	87.0	0.0	13.0	2.0	2.0	40.0	100.0	0.0
26	3000	87.0	0.0	13.0	2.0	2.0	35.0	100.0	0.0
27	9000	87.0	0.0	13.0	2.0	2.0	35.0	100.0	0.0
28	12000	87.0	0.0	13.0	2.0	2.0	35.0	100.0	0.0
29	19000	87.0	0.0	13.0	2.0	2.0	45.0	100.0	0.0
30	17000	87.0	0.0	13.0	2.0	2.0	45.0	100.0	0.0
31	28000	87.0	0.0	13.0	2.0	2.0	40.0	100.0	0.0
32	10000	87.0	0.0	13.0	2.0	2.0	35.0	100.0	0.0
33	27000	87.0	0.0	13.0	2.0	2.0	35.0	100.0	0.0
34	15000	87.0	0.0	13.0	2.0	2.0	40.0	100.0	0.0
35	13000	87.0	0.0	13.0	2.0	2.0	40.0	100.0	0.0
36	19000	87.0	0.0	13.0	2.0	2.0	35.0	100.0	0.0
37	4000	87.0	0.0	13.0	2.0	2.0	35.0	100.0	0.0
38	9000	87.0	0.0	13.0	2.0	2.0	35.0	100.0	0.0
39	9000	87.0	0.0	13.0	2.0	2.0	35.0	100.0	0.0
40	9000	87.0	0.0	13.0	2.0	2.0	35.0	100.0	0.0
41	6000	87.0	0.0	13.0	2.0	2.0	35.0	100.0	0.0
42	16000	87.0	0.0	13.0	2.0	2.0	35.0	100.0	0.0
43	8000	87.0	0.0	13.0	2.0	2.0	35.0	100.0	0.0
44	7000	87.0	0.0	13.0	2.0	2.0	35.0	100.0	0.0
45	5000	87.0	0.0	13.0	2.0	2.0	35.0	100.0	0.0

FHWA Model RD-77-108: Brown-Buntin Associates, Inc.
Calveno Emission Curves   Run Date: 04-13-1992
Project Number: 91-216   Run Time: 23:23:40
Year: Placer County #s - Preferred Alternative
Soft Site

INPUT DATA SUMMARY:

Segment	ADT	Day%	Eve%	Nite%	%MT	%HT	Speed	Distance	Offset
46	3000	87.0	0.0	13.0	2.0	2.0	35.0	100.0	0.0
47	6000	87.0	0.0	13.0	2.0	2.0	35.0	100.0	0.0
48	8000	87.0	0.0	13.0	2.0	2.0	35.0	100.0	0.0
49	16000	87.0	0.0	13.0	2.0	2.0	35.0	100.0	0.0
50	25000	87.0	0.0	13.0	2.0	2.0	35.0	100.0	0.0

APPENDIX C
MODEL NOISE CONTROL ORDINANCE
AUBURN/BOWMAN COMMUNITY PLAN - PLACER COUNTY
10/2/91

I. Purpose:

The Board of Supervisors declares and finds that excessive noise levels are detrimental to the public health, welfare and safety and contrary to the public interest as follows:

A. By interfering with sleep, communication, relaxation and the full use of one's property;

B. By contributing to hearing impairment and a wide range of adverse physiological stress conditions; and

C. By adversely affecting the value of real property.

It is the intent of this chapter to protect persons from excessive levels of noise within or near a residence, school, church, hospital or public library.

II. Definitions:

The following words, phrases and terms as used in this chapter shall have the following meanings:

A. "Agricultural property" means land used for or devoted to the production of crops and livestock.

B. "Ambient noise level" means the composite of noise from all sources excluding the alleged offensive noise. In this context it represents the normal or existing level of environmental noise at a given location for a specified time of the day or night.

C. "Construction" means construction, erection, enlargement, alteration, conversion or movement of any building, structures or land together with any scientific surveys associated therewith.

D. "Decibel" means a unit for measuring the amplitude of a sound, equal to twenty times the logarithm to the base ten of the ratio of the pressure of the sound measured to the reference pressure, which is twenty micropascals.

E. "Emergency Work" means the use of any machinery, equipment, vehicle, manpower or other activity in a short term effort to protect, or restore safe conditions in the community, or work by private or public utilities when restoring utility service.

F. "Enforcement officer" means the Health Officer or his duly authorized deputy.

G. "Equivalent Hourly Sound Level (L_{eq})" means the constant sound level that contains the same total energy as the actual time-varying sound level over a one-hour period.

H. "Fixed noise source" means a device or machine which creates sounds while fixed or stationary, including but not limited to motor vehicles operated off public roads, and residential, agricultural, industrial and commercial machinery and equipment, pumps, fans, compressors, air conditioners and refrigeration equipment.

I. "Hospital" means any building or portion thereof used for the accommodation and medical care of the sick, injured or infirm persons and includes rest homes and nursing homes.

J. "Impulsive noise" means a noise of short duration, usually less than one second, with an abrupt onset and rapid decay.

K. "Intruding noise level" means the sound level created, caused, maintained or originating from an alleged offensive source, measured in decibels, at a specified location while the alleged offensive source is in operation.

L. "Mobile noise source" means any noise source other than a fixed noise source.

M. "Noise disturbance" means any sound which violates the quantitative standards set forth in this chapter.

N. "Residential property" means a parcel of real property which is developed and used either in whole or in part for residential purposes.

O. "School" means public or private institutions conducting regular academic instruction at preschool, kindergarten, elementary, secondary or collegiate levels.

P. "Simple tone noise" means any noise which is distinctly audible as a single pitch (frequency) or set of pitches as determined by the enforcement officer.

Q. "Sound level" means the sound pressure level in decibels as measured with a sound level meter using the A-weighting network. The unit of measurement is referred to herein as dB(A) or dBA.

R. "Sound level meter" means an instrument meeting American National Standard Institute Standard S1.4A-1985 for Type 1 or Type 2 sound level meters or an instrument and the associated recording and analyzing equipment which will provide equivalent data.

III. Noise Measurement Criteria:

Any noise measurement made pursuant to the provisions of this chapter shall be made with a sound level meter using the A-weighting network at Slow meter response, except that Fast meter response shall be used for impulsive type sounds. Calibration of the measurement equipment utilizing an acoustical calibrator shall be performed immediately prior to recording any noise data.

The exterior noise levels shall be measured within fifty feet of the affected residence, school, hospital, church or public library. Where practical, the microphone shall be positioned three to five feet above the ground and away from reflective surfaces.

The interior noise levels shall be measured within the affected dwelling unit, at any number of points at least four feet from the wall, ceiling or floor nearest the noise source, with windows in the normal seasonal configuration. The reported interior noise level shall be determined by taking the energy average of the readings taken at the various microphone locations.

IV. Exterior Noise Standards:

A. It is unlawful for any person at any location within the unincorporated area of the county to create any noise, or to allow the creation of any noise, on property owned, leased, occupied or otherwise controlled by such person which causes the exterior noise level when measured at any affected single-or multiple-family residence, school, hospital, church or public library situated in either the incorporated or unincorporated area to exceed the noise level standards as set forth in Table I.

TABLE I
Exterior Noise Level Standards

Time Period	Allowable Equivalent Hourly Sound Level (L_{eq})
7 am to 10 pm	50 dBA
10 pm to 7 am	45 dBA

B. In the event the measured ambient noise level exceeds the applicable noise level standard, the applicable standard shall be adjusted so as to equal the ambient noise level.

C. Each of the noise level standards specified above shall be reduced by five dB(A) for simple tone noises, noises consisting primarily of speech or music, or for recurring impulsive noises.

D. Where there is a conflict between noise level standards adjusted in accordance with Sections IV.B. and IV.C., the standard established by IV. B. shall prevail.

E. If the intruding noise source is continuous and cannot reasonably be discontinued or stopped for a time period whereby the ambient noise level can be measured, the noise level measured while the source is in operation shall be compared directly to the noise level standards.

F. Table II may be used to determine whether the measured equivalent sound level in a given measurement period will cause the equivalent hourly sound level to exceed the noise level standards of this ordinance. If the measured L_{eq} during a given time period exceeds the level corresponding to the noise standard in the column labeled "Equivalent Hourly L_{eq}," the noise standard shall be considered to have been exceeded.

TABLE II

Short Term Determination of Equivalent Hourly Sound Level (L_{eq})

Measurement Period (minutes)	30	15	8	4	2	1	0.5	0.25	Equivalent Hourly L_{eq}, dBA
	Measured L_{eq}, dBA								
	38	41	44	47	50	53	56	59	35
	43	46	49	52	55	58	61	64	40
	48	51	54	57	60	63	66	69	45
	53	56	59	62	65	68	71	74	50
	58	61	64	67	70	73	76	79	55
	63	66	69	72	75	78	81	84	60
	68	71	74	77	80	83	86	89	65
	73	76	79	82	85	88	91	94	70
	78	81	84	87	90	93	96	99	75

V. Interior Noise Standards:

A. It is unlawful for any person, at any location within the unincorporated area of the county, to operate or cause to be operated within a dwelling unit, any source of sound or to allow the creation of any noise which causes the noise level when measured inside a receiving dwelling unit situated in either the incorporated or unincorporated area to exceed the noise level standards as set forth in Table III.

TABLE III Interior Noise Level Standards	
Time Period	Allowable Equivalent Hourly Sound Level (L_{eq})
7 am to 10 pm	40 dBA
10 pm to 7 am	35 dBA

B. In the event the measured ambient noise level exceeds the applicable noise level standard, the applicable standard shall be adjusted so as to equal the ambient noise level.

C. Each of the noise level standards specified above shall be reduced by five dB(A) for simple tone noises, noises consisting primarily of speech or music, or for recurring impulsive noises.

D. Where there is a conflict between noise level standards adjusted in accordance with sections V.B. and V.C., the standard established by section V.B. shall prevail.

E. If the intruding noise source is continuous and cannot reasonably be discontinued or stopped for a time period whereby the ambient noise level can be measured, the noise level measured while the source is in operation shall be compared to the noise level standards.

F. Table III may be used to determine whether the measured equivalent sound level in a given measurement period will cause the equivalent hourly sound level to exceed the noise level standards of this ordinance. If the measured L_{eq} during a given time period exceeds the level corresponding to the noise standard in the column labeled "Equivalent Hourly L_{eq}," the noise standard shall be considered to have been exceeded.

VI. Noise Source Exemptions:

The following activities shall be exempt from the provisions of this chapter:

A. Activities conducted in public parks, public playgrounds and public or private school grounds, including but not limited to school athletic and school entertainment events;

B. Any mechanical device, apparatus or equipment used related to or connected with emergency activities or emergency work;

C. Noise sources associated with construction, provided such activities do not take place before seven a.m. or after seven p.m. on any day except Saturday or Sunday, or before eight a.m. or after seven p.m. on Saturday or Sunday.

D. Noise sources associated with the maintenance of residential property provided such activities take place between the hours of seven a.m. and seven p.m. on any day except Saturday or Sunday, or between the hours of eight a.m. and seven p.m. on Saturday or Sunday;

E. Noise sources associated with agricultural activities on agricultural property.

F. Noise sources associated with a lawful commercial or industrial activity caused by mechanical devices or equipment, including air conditioning or refrigeration systems, installed prior to the effective date of this chapter; this exemption shall expire on one year after the effective date of this chapter;

G. Noise sources associated with work performed by private or public utilities in the maintenance or modification of its facilities;

H. Noise sources associated with the collection of waste or garbage from property devoted to commercial or industrial uses;

I. Any activity to the extent regulation thereof has been preempted by state or federal law.

VII. Air Conditioning and Refrigeration:

Notwithstanding the provisions of Sections IV or V where the intruding noise source when measured as provided in Section III is an air conditioning or refrigeration system or associated equipment installed prior to the effective date of this chapter, the exterior equivalent hourly sound level shall not exceed fifty-five dBA, except where such equipment is exempt from the provisions of this chapter. The exterior equivalent hourly sound level shall not exceed fifty dBA for such equipment installed or in use after one year after the effective date of this chapter.

VIII. Electrical Substations:

Notwithstanding the provisions of Sections IV and V, the equivalent hourly sound level produced by sources associated with the operation of electrical substations shall not exceed fifty dBA when measured as provided in Section III.

IX. Variances:

A. The owner or operator of a noise source which the enforcement officer has determined violates any of the provisions of this chapter may file an application with the enforcement officer for variance from strict compliance with any particular provisions of this chapter where such variance will not result in a hazardous condition or a nuisance and strict compliance would be unreasonable in view of all circumstances. The owner or operator shall set forth all actions taken to comply with such provisions, and the reasons why immediate compliance cannot be achieved. A separate application shall be filed for each noise source; provided, however, that several mobile sources under common ownership or fixed sources under common ownership on a single property may be combined into one application.

B. Upon receipt of the application and within thirty days, the enforcement officer shall either (1) approve such request in whole or in part, (2) deny the request, or (3) refer the request directly to the Board of Supervisors for action thereon in accordance with the provisions of this chapter. In the event the variance is approved, reasonable conditions may be imposed which may include restrictions on noise level, noise duration and operating hours, an approved method of achieving compliance and a time schedule for its implementation.

C. Factors which the enforcement officer or the Board of Supervisors must consider shall include but not be limited to the following:

1. Uses of property within the area affected by noise;
2. Factors related to initiating and completing all remedial work;
3. Age and useful life of the existing noise source;
4. The general public interest, welfare and safety.

D. Within ten (10) days following the decision of the enforcement officer on an application for a variance, the applicant may appeal the decision to the Board of Supervisors for a hearing de novo by filing a notice of appeal with the Clerk of the Board. The Board of Supervisors shall either affirm, modify or reverse the decision of the enforcement officer. Such decisions shall be final and shall be based upon the considerations set forth in this section.

X. Violation-Enforcement:

The violation of any of the provisions of this chapter shall be an infraction punishable as provided in Section ________ of this code. The provisions of this chapter may also be enforced by an injunction issued out of the superior court upon suit of the county. Any violation of the provisions of this chapter shall be deemed to be a public nuisance.

The Health Officer shall enforce the provisions of this chapter. Right of entry for inspection shall be as provided in Section ________ of this code.