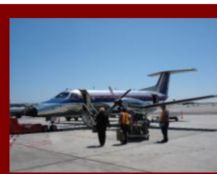
  

11 – Noise

11.1 Introduction

This chapter presents background information on noise issues and noise-related constraints as they currently (2011) exist in Merced County. In technical terms, sound is mechanical energy transmitted by pressure waves in a compressible medium such as air. Simply, sound is what we hear. As sounds reach undesirable or unacceptable levels, this is referred to as noise. To develop goals and policies related to noise abatement in the updated General Plan, it is important to understand how sound, and noise, are measured and compared, and to understand what sound levels occur in the County today.

This chapter is divided into the following sections:

- Introduction (Section 11.1)
- Existing Noise Environment (Section 11.2)
- Noise Mitigation Options (Section 11.3)
- Major Findings (Section 11.4)

11.2 Existing Noise Environment

Introduction

The ambient noise environment in Merced County is defined primarily by traffic on Interstate 5; State Routes 33, 59, 99, 140, and 152; local roads; intermittent Union Pacific Railroad (UPRR) and Burlington Northern Railroad (BNRR) operations; and aircraft operations associated with five public airports. The noise environment in Merced County is also locally influenced by commercial uses, active recreation areas, and outdoor play areas of schools. There are no significant industrial noise sources identified within Merced County. Subjectively, the ambient noise environment in Merced County is considered to be fairly quiet at locations removed from the Interstate 5, major State Routes, and railroad tracks.

Key Terms

Acoustics. The science of sound.

Ambient Noise. The distinctive acoustical characteristics of a given space consisting of all noise sources audible at that location. In many cases, the term ambient is used to describe an existing or pre-project condition such as the setting in an environmental noise study.

Attenuation. The reduction of an acoustic signal.

A-Weighting. A frequency-response adjustment of a sound level meter that conditions the output signal to approximate human response.

Decibel or dB. Fundamental unit of sound, A Bell is defined as the logarithm of the ratio of the sound pressure squared over the reference pressure squared. A Decibel is one-tenth of a Bell.

CNEL Community Noise Equivalent Level. Defined as the 24-hour average noise level with noise occurring during evening hours (7 - 10 p.m.) weighted by a factor of three and nighttime hours weighted by a factor of 10 prior to averaging.

Frequency. The measure of the rapidity of alterations of a periodic signal, expressed in cycles per second or hertz.

Ldn Day/Night Average Sound Level. Similar to CNEL but with no evening weighting.

Leq. Equivalent or energy-averaged sound level.

Lmax. The highest root-mean-square (RMS) sound level measured over a given period of time.

Loudness. A subjective term for the sensation of the magnitude of sound.

Masking. The amount (or the process) by which the threshold of audibility is for one sound is raised by the presence of another (masking) sound.

Noise. Unwanted sound.

Peak Noise. The level corresponding to the highest (not RMS) sound pressure measured over a given period of time. This term is often confused with the "Maximum" level, which is the highest RMS level.

RT6600. The time it takes reverberant sound to decay by 60 dB once the source has been removed.

Sabin. The unit of sound absorption. One square foot of material absorbing 100 percent of incident sound has an absorption of 1 sabin.

SEL. A rating, in decibels, of a discrete event, such as an aircraft flyover or train passby, that compresses the total sound energy of the event into a 1-s time period.

Threshold of Hearing. The lowest sound that can be perceived by the human auditory system, generally considered to be 0 dB for persons with perfect hearing.

Threshold of Pain. Approximately 120 dB above the threshold of hearing.

Regulatory Setting

Environmental Protection Agency. The Environmental Protection Agency (EPA) recommended in 1974 that Day/Night Noise Level (Ldn) should be kept below 55 A-Weighted Sound Level (dBA) in residential areas "to protect public health and welfare with an adequate margin of safety" (EPA 1974). This level relates to the level normally present in a typical suburban community of about 770 people per square kilometer. This goal did not account for economic or technological feasibility and was not designed as a regulation. The study recognized that many people lived in both quieter and noisier areas. The EPA guideline has methodologies for evaluating other size communities, as well as "correction" factors used to adjust for seasonal operations, the existence of pure tones and impulse sounds.

Federal Highway Administration. The Federal Highway Administration uses a one-hour equivalent (time-average) sound level criteria of 67 dBA to determine when to consider noise barriers for new highway projects. Before actually building barriers, the Federal Highway Administration requires that the project further qualify based on the cost and benefit of the barrier per protected home.

California Environmental Quality Act. The state legislature adopted the California Environmental Quality Act (CEQA) as a result of a public mandate for thorough environmental analysis of projects that might affect the environment. CEQA considers excessive noise to be an environmental impact. Implementation of CEQA ensures that during the decision making stage of development, City officials and the general public assess the noise impacts associated with public and private development projects.

Merced County Noise Ordinance. Chapter 10.60 of the County Code contains the Noise Ordinance. Table 1 of that Chapter contains noise level standards for residential and non-residential land uses. Specifically, the County Code sets 65 dB Ldn and 75 dB Lmax standards for residential property, with standards applicable to nonresidential properties 5 dB higher.

Existing Conditions

The present Noise Element of 1990 Merced County General Plan provides a basis for comprehensive local policies to control and abate environmental noise and to protect the citizens of Merced County from excessive noise exposure. The fundamental goals of the 1990 Noise Element are as follows:

- To provide sufficient information concerning the community noise environment so that noise may be effectively considered in the land use planning process;
- To develop strategies for abating excessive noise exposure through cost-effective mitigation measures in combination with appropriate zoning to avoid incompatible land uses;
- To protect those existing regions of the planning area whose noise environments are deemed acceptable and also those locations throughout the community deemed "noise sensitive"; and
- To protect existing noise-producing commercial and industrial uses in Merced County from encroachment by noise-sensitive land uses.

Fundamentals of Noise

Noise is often described as unwanted sound. Sound is defined as any pressure variation in air that a person's ear can detect. If the pressure variations occur 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, called Hertz (Hz).

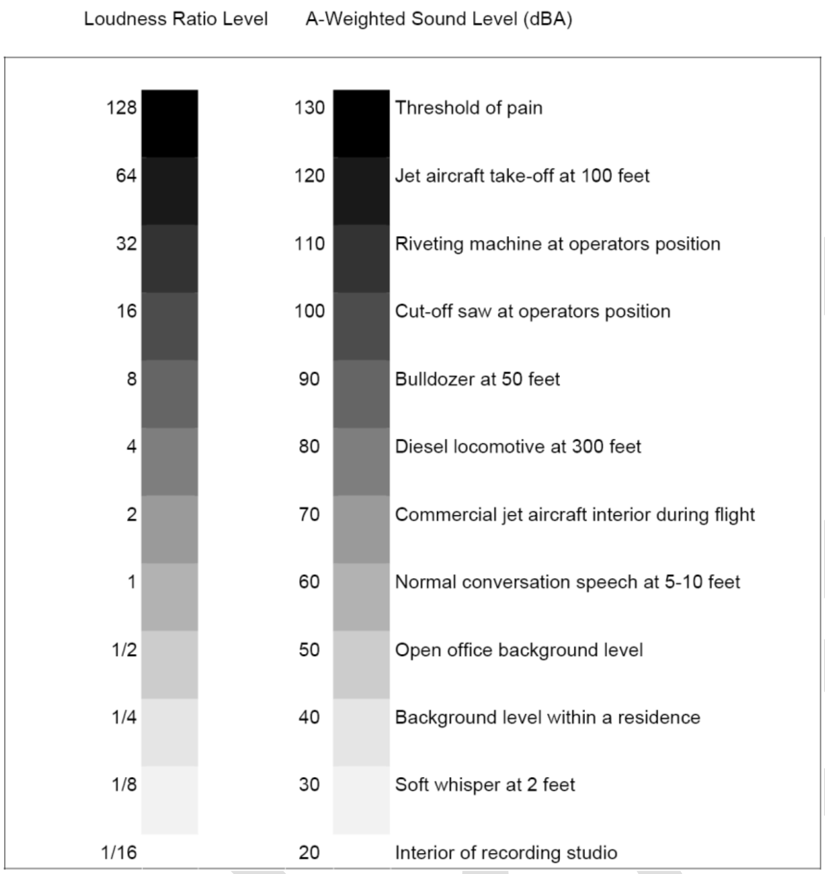
Measuring sound directly in terms of pressure would require a very large and awkward range of numbers. To avoid this, the decibel scale was devised. The decibel scale uses the hearing threshold (20 micropascals) as a point of reference, defined as 0 dB. Other sound pressures are then compared to the 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. Figure 1 shows examples of noise levels for several common noise sources and environments.

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 weighing the frequency response of a sound level meter by means of the standardized A-weighing network. There is a strong correlation between A-weighted sound levels (expressed as dBA) and community response to noise. For this reason, the A-weighted sound level has become the standard tool of environmental noise assessment. All noise levels in this chapter are in terms of A-weighted 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 (Leq), which corresponds to a steady-state A-weighted sound level containing the same total energy as a time-varying signal over a given time period (usually one hour). The Leq is the foundation of the composite noise descriptor, Ldn, and shows very good correlation with community response to noise.

The Day-Night Average Level (Ldn) is based upon the average noise level over a 24-hour day, with a +10 decibel weighing applied to noise occurring during nighttime (10:00 p.m. to 7:00 a.m.) hours. 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. Because Ldn represents a 24-hour average, it tends to disguise short-term variations in the noise environment.

Figure 11-1
Typical A-Weighted Sound Levels of Common Noise Sources



Source: Bollard Acoustical Consulting, 2011.

Noise in the community has often been cited as being a health problem, not in terms of actual physiological damages 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 and/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 exposures to excessive community noise levels.

Many jurisdictions have adopted community noise control ordinances as a means to control noise from fixed sources other than through zoning or land use planning,. 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 A weighted noise 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 dBA 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.

Existing Transportation Noise Environment

Transportation noise generation of the various representative noise sources identified within Merced County is described in this section. The major noise sources in Merced County consist of traffic on Interstate 5; State Routes 33, 59, 99, 140, 152, and 165; local traffic on city streets; agricultural activities; commercial uses; airport operations; active recreation areas of parks; outdoor play areas of schools; and railroad operations on the Union Pacific Railroad and Burlington Northern Railroad.

Roadways

The Federal Highway Administration Highway Traffic Noise Prediction Model (FHWA-RD-77-108) with the Calveno vehicle noise emission curves was used to predict traffic noise levels within the Merced County General Plan Study Area. The FHWA Model is the traffic noise prediction model currently preferred by the Federal Highway Administration, the State of California Department of Transportation (Caltrans), and most city and county governments for use in traffic noise assessment. Although the FHWA Model is in the process of being updated by a more sophisticated traffic noise prediction model, the use of RD-77-108 is considered acceptable for the development of General Plan traffic noise predictions.

State Route 99 is the most heavily traveled roadway in Merced County. The FHWA Model was used with traffic data obtained from published Caltrans traffic counts and Bollard Acoustical Consultants field surveys to develop Ldn contours for State Route 65 within Merced County, as well as local roadways. The FHWA Model input data for those roadways is provided in Table 11-1. The distances from the centerline of the major roadways to the 60 and 65 dB Ldn contours are also summarized in Table 11-1. Many roadways are not contained in Table 11-1; however, these roadways are not major traffic arterials within Merced County.

It is recognized that the speeds shown in Table 11-1 do not necessarily correspond to posted limits within the County. However, the speeds shown are intended to provide reasonably conservative estimates of traffic noise exposure along the roadways in order to trigger a more detailed project-site specific acoustical review for projects which fall within the critical noise contours.

Railroads

The railroad tracks in Merced County are operated by the Union Pacific Railroad and Burlington Northern Railroad. Freight service provides industrial, manufacturing, and agricultural companies within Merced County use of the rail by means of flat beds, fuel tankers, refrigerated produce, regular stock box, and piggy back cars. While both of these rails provide freight service, the BNRR also provides Amtrak passenger service with 12 trips per day.

A spur line of the UPRR operates on the western tracks of the county through the cities of Volta and Gustine. Daily operations are few, up to two per day according to the office staff at the Volta Elementary School. Train stops at the Ingomar Packing Company and the Liberty Packing Company for delivers and pick-up. Trains speeds range of 25-35 mph.

According to noise level measurements and field observations conducted by Bollard Acoustical Consultants, the UPRR line was observed to support approximately 23 train operations and BNSF approximately 32 train operations in a 24-hour period. Given this level of railroad activity, a measured average railroad Sound Exposure Level (SEL) of 101 dB at the measurement distance of 100 feet, and a random distribution of railroad activity throughout the day and nighttime periods, the Ldn computed for the UPRR railroad tracks in Merced County was 71dB and for the BNSF 73 dB at a distance of 100 feet from the tracks. Table 11-2 shows the distances from the railroad tracks to the 60 and 65 dB Ldn railroad noise contours based on 30 operations per day, and likely variations from that observed number of daily operations.

TABLE 11-1
FHWA-RD-77-108 Highway Traffic Noise Prediction Model Data Inputs and Distances to 60 and 65 dB Ldn Contours, Merced County General Plan Update & EIR - Existing (2010) Conditions

	Roadway Name	Segment Description	ADT	Day %	Night %	Truck Usage		Speed	Distance to Ldn Contours, feet	
						Med.	Hwy.		60 dB Ldn	65 dB Ldn
1	Interstate 5	Fresno County Line to SR 165	35,000	83	17	6	23	65	1325	627
2		SR 165 to SR 152	31,000	83	17	6	23	65	1222	627
3		SR 152 to SR 33	31,000	83	17	6	23	65	1222	561
4		SR 33 to SR 140	33,000	83	17	4	21	65	1211	612
5		SR 140 to Stanislaus County Line	35,000	83	17	4	21	65	1259	623
6	State Route 99	Madera County Line to Childs Ave.	41,000	83	17	4	23	65	1452	630
7		Childs Ave. to SR 140	42,000	83	17	4	23	65	1476	696
8		SR 140 to SR 59 (N)	52,000	83	17	4	16	65	1478	677
9		SR 59 (N) to Buhach Rd.	56,000	83	17	4	16	65	1553	730
10		Buhach Rd. to Atwater (East Atwater)	50,000	83	17	4	16	65	1440	677
11		Atwater (East Atwater) to Atwater (West Atwater)	37,000	83	17	4	16	65	1178	576
12		Atwater (West Atwater) to Collier Rd.	46,000	83	17	4	16	65	1362	642
13		Collier Rd. to Golden State Blvd.	65,000	83	17	4	16	65	1716	876
14		Golden State Blvd. to Stanislaus County Line	57,000	83	17	5	20	65	1722	855
15	State Route 33	Fresno County Line to Dos Palos (Blossom Street)	2,550	83	17	4	10	65	170	92
16		Dos Palos (Blossom Street) to State Route 152	4,700	83	17	4	10	65	256	137
17		State Route 152 to Henry Miller Avenue	7,900	83	17	4	25	65	502	250
18		Henry Miller Avenue to Interstate 5	9,300	83	17	4	25	65	560	267
19		Interstate 5 to Gustine (State Route 140 South)	4,300	83	17	4	16	65	281	134
20	State Route 33	Gustine (SR 140 North) to Stanislaus County Line	5,800	83	17	3	12	65	308	167
21	State Route 59	Madera County Line (SR 152) to Mission Ave.	7,600	83	17	5	7	65	327	154
22		Mission Ave. to Childs Ave.	11,400	83	17	5	7	65	428	198

TABLE 11-1
FHWA-RD-77-108 Highway Traffic Noise Prediction Model Data Inputs and Distances to 60 and 65 dB Ldn Contours, Merced County General Plan Update & EIR - Existing (2010) Conditions

	Roadway Name	Segment Description	ADT	Day %	Night %	Truck Usage		Speed	Distance to Ldn Contours, feet	
						Med.	Hwy.		60 dB Ldn	65 dB Ldn
23		Childs Ave. to SR 99	14,000	83	17	5	7	65	491	234
24		16th St. to Sante Fe Dr.	17,200	83	17	1	6	65	517	232
25		Santa Fe Dr. to Oakdale Rd.	2,050	83	17	1	6	65	125	58
26		Oakdale Rd. to Snelling	1,400	83	17	1	12	65	117	54
27	State Route 140	Interstate 5 to SR 33 (West Gustine)	1,600	83	17	3	10	65	124	57
28		SR 33 (West Gustine) to SR 33 (East Gustine)	7,000	83	17	3	12	65	349	162
29		SR 33 (East Gustine) to SR 165	3,250	83	17	3	9	65	193	89
30		SR 165 to X St.	7,400	83	17	3	8	65	323	150
31		SR 99 to Motel Dr.	14,700	83	17	1	5	65	449	208
32		Motel Dr. to Sante Fe Dr.	10,400	83	17	1	5	65	357	166
33		Sante Fe Dr. to Planada – Plainsburg Rd.	7,200	83	17	1	3	65	258	120
34		Planada to Mariposa County Line	4,200	83	17	1	10	65	230	107
35	State Route 152	Santa Clara County Line to SR 33	23,800	83	17	4	13	65	818	380
36		SR 33 to Interstate 5	23,000	83	17	4	13	65	800	371
37		Interstate 5 to Ortigalita Rd. (West Los Banos)	21,600	83	17	3	7	65	640	297
38		Ortigalita Rd. to SR 165	26,500	83	17	3	7	65	733	340
39	State Route 152	SR 165 to Ward Rd. (East Los Banos)	32,000	83	17	3	7	65	831	386
40		Ward Rd. to SR 33 (Dos Palos)	17,500	83	17	4	12	65	650	302
41		SR 33 to SR 59	15,300	83	17	4	12	65	594	276
42		SR 59 to Madera County Line	15,400	83	17	1	12	65	579	269
43	State Route 165	Interstate 5 to Pioneer Rd. (Los Banos)	2,400	83	17	1	9	65	154	71
44		Pioneer Rd. to SR 152	12,000	83	17	1	7	65	421	196
45		SR 152 to Overland Ave.	15,500	83	17	1	8	65	517	240
46		Overland Ave. to Henry Miller Ave.	6,600	83	17	1	8	65	292	136

TABLE 11-1
FHWA-RD-77-108 Highway Traffic Noise Prediction Model Data Inputs and Distances to 60 and 65 dB Ldn Contours, Merced County General Plan Update & EIR - Existing (2010) Conditions

	Roadway Name	Segment Description	ADT	Day %	Night %	Truck Usage		Speed	Distance to Ldn Contours, feet	
						Med.	Hwy.		60 dB Ldn	65 dB Ldn
47		Henry Miller Ave. to SR 140	5,300	83	17	1	7	65	244	113
48		SR 140 (Stevinson) to Westside Blvd.	6,300	83	17	1	9	65	293	136
49		Westside Blvd. to Williams Ave.	8,500	83	17	1	9	65	357	166
50		Williams Ave. to Bloss Ave. (Hilmar)	10,500	83	17	1	9	65	411	191
51		Bloss Ave. (Hilmar) to American Ave.	11,800	83	17	1	9	65	445	206
52	Arboleda Dr	SR 99 to Yosemite Ave	1,600	83	17	2	2	45	51	24
53	August Ave	Stanislaus Co. to SR 165	1,500	83	17	2	2	45	49	23
54		SR 165 to Merced Ave	1,600	83	17	2	2	45	51	24
55	Ballico Ave	Bradbury Rd to Santa Fe Dr	1,100	83	17	2	2	45	40	19
56	Bloss Ave	Hilmar SUDP (E) to Hilmar Bypass	2,800	83	17	2	2	45	74	35
57		Hilmar Bypass to Collier Rd	2,700	83	17	2	2	45	73	34
58	Bradbury Rd	Stanislaus Co to SR 165	3,000	83	17	2	2	45	78	36
59		SR 165 to Hilmar Bypass	2,000	83	17	2	2	45	59	28
60		Hilmar Bypass to Delhi SUDP (W)	2,000	83	17	2	2	45	59	28
61		Delhi SUDP (E) to Ballico Ave	1,100	83	17	2	2	45	40	19
62	Central Ave	Liberty to Walnut Ave	650	83	17	2	2	45	28	13
63	Childs Ave	Tower Rd to Planada SUDP (W)	2,900	83	17	2	2	45	76	35
64	Collier Rd	Bloss Ave to SR 99	2,700	83	17	2	2	45	73	34
65	El Captain Way	Palm Ave to Golden State Blvd	2,650	83	17	2	2	45	72	33
66	G St	Merced P/A (N) to Snelling Rd	1,500	83	17	2	2	45	49	23
67	Golden State Blvd	SR 99 to Stanislaus Co.	10,800	83	17	2	2	45	183	85
68	Griffith Ave	Bloss Ave to Golden State Blvd	1,350	83	17	2	2	45	46	21

TABLE 11-1
FHWA-RD-77-108 Highway Traffic Noise Prediction Model Data Inputs and Distances to 60 and 65 dB Ldn Contours, Merced County General Plan Update & EIR - Existing (2010) Conditions

	Roadway Name	Segment Description	ADT	Day %	Night %	Truck Usage		Speed	Distance to Ldn Contours, feet	
						Med.	Hwy.		60 dB Ldn	65 dB Ldn
69	Gurr Rd	Sandy Mush Rd to SR 140	1,300	83	17	2	2	45	45	21
70	Henry Miller Ave	Santa Nella SUDP to Ingmar Grade Road	2,250	83	17	2	2	45	64	30
71		Ingomar Grade Road to SR 165	2,550	83	17	2	2	45	70	32
72	Ingomar Grade Rd	Los Banos P/A (N) to Los Banos Bypass	3,000	83	17	2	2	45	78	36
73		Los Banos Bypass to Henry Miller Ave	3,000	83	17	2	2	45	78	36
74	La Grange Rd	SR 59 to Stanislaus Co.	1,800	83	17	2	2	45	55	26
75	Le Grand Rd	SR 99 to Le Grand SUDP (W)	2,450	83	17	2	2	45	68	32
76	Liberty Ave	Campbell Ave to Central Ave	700	83	17	2	2	45	30	14
77	Lincoln Blvd	SR 140 to Livingston C/L	2,650	83	17	2	2	45	72	33
78	Livingston Cressey Way	Olive Ave to Cressey Way	1,250	83	17	2	2	45	43	20
79	Merced Ave	Bloss Ave to Delhi SUDP (S)	500	83	17	2	2	45	24	11
80	Mintum Rd	Madera Co. to Le Grand Rd	2,450	83	17	2	2	45	68	32
81	Olive Ave	Campus Pkwy to Arboleda Dr	1,850	83	17	2	2	45	56	26
82	Peach Ave	Dwight Way to Sultana Dr	250	83	17	2	2	45	15	7
83	Pioneer Rd	Volta Rd to Los Banos P/S (W)	900	83	17	2	2	45	35	16
84	Plainsburg Rd	SR 99 to Gerard Ave	1,200	83	17	2	2	45	42	20
85	Sandy Mush Rd	Nickel Rd to SR 99	400	83	17	2	2	45	20	9
86	Santa Fe Ave	Madera Co. to Fresno Rd	1,150	83	17	2	2	45	41	19
87		Fresno Rd to Miles Creek	1,300	83	17	2	2	45	45	21
88	Santa Fe Dr	Beachwood Dr to Franklin Rd	21,650	83	17	2	2	45	191	135
89		Shaffer Rd to Chestnut Ln	10,100	83	17	2	2	45	175	81

TABLE 11-1 FHWA-RD-77-108 Highway Traffic Noise Prediction Model Data Inputs and Distances to 60 and 65 dB Ldn Contours, Merced County General Plan Update & EIR - Existing (2010) Conditions										
	Roadway Name	**Segment Description**	**ADT**	**Day %**	**Night %**	**Truck Usage**		**Speed**	**Distance to Ldn Contours, feet**	
						Med.	**Hwy.**		**60 dB Ldn**	**65 dB Ldn**
90		Olive Ave to Bradbury Rd	4,800	83	17	2	2	45	107	49
91		Bradbury Rd to Stanislaus Co.	4,450	83	17	2	2	45	101	47
92	Shaffer Rd	Olive Ave to Oakdale Rd	3,500	83	17	2	2	45	86	40
93	Snelling Rd	G St to SR 59	1,900	83	17	2	2	45	57	27
94	So. Bear Creek Dr	Merced P/A (E) to Arboleda Dr	1,050	83	17	2	2	45	39	18
95	Sultana Dr	SR 140 to Westside Blvd	200	83	17	2	2	45	13	6
96	Turner Island Rd	SR 152 to Sand Slough Rd	1,300	83	17	2	2	45	45	21
97	Vincent Rd	Bradbury Rd to Stanislaus Co.	3,050	83	17	2	2	45	79	37
98	Volta Rd	Pioneer Rd to SR 152	800	83	17	2	2	45	32	15
99		SR 152 to Ingomar Gd	1,200	83	17	2	2	45	42	20
100	Walnut Ave	Livingston C/L (E) to Sultan Dr	4,400	83	17	2	2	45	101	47
101		Sultana Dr to Vine Ave	4,400	83	17	2	2	45	101	47
102		Gertrude Lateral to Shaffer Rd	400	83	17	2	2	45	20	9
103	Westside Blvd	SR 165 to SR 99	2,000	83	17	2	2	45	59	28
104	Yosemite Ave	UC Community SUDP to Arboleda Dr	1,950	83	17	2	2	45	58	27

Source: Annual Average Daily Traffic on the California State Highway System, Caltrans, 2010; Annual Average Daily Truck Traffic on the California State Highway System, Caltrans, 2009; kdAnderson and Associates, 2011; FHWA-RD-77-108; and Bollard Acoustical Consultants, 2011.

TABLE 11-2 Roadway Noise Exposure as a Function of the Number of Daily Trains in Merced County			
Number of Daily Trains	**Ldn at 100 Feet, dB[1]**	**60 dB**	**65 dB**
20	71	567	263
25	72	671	311
30	73	819	347
35	74	263	380
40	75	347	417

[1]The predicted distances to the Ldn contours assume a mean railroad sound exposure level of 101 dB (with horn usage) at a reference distance of 100 feet from the tracks and that train operations are uniformly distributed across day and nighttime hours.

Source: California Department of Finance 1990-2005

Aircraft Noise

Merced Municipal Airport. Located in the southwest portion of the city of Merced, the airport has 77 aircraft operations per day with 53 percent of the traffic being local general aviation on average. The airport houses 90 single engine and 9 multi-engine airplanes.

Castle Airport. Located just north of the city of Atwater (formally Castle Air Force Base), In 1996 the Castle Joint Powers Authority (JPA) adopted a Reuse Plan which includes commercial, maintenance, air cargo, training, general aviation, and transit operations reuses for the aviation facilities of the former base. The airport has 3,854 aircraft operations per week, 80 percent due to pilot training. Castle Airport is home to 76 single engine, 12 multi-engine, and 6 jet airplanes.

Los Banos Municipal Airport. Located on the western portion of the city of Los Banos, the airport has local general aviation, which accounts for 60 percent of the 44 aircraft operations per day. Based at the airport are 26 single engines planes, 2 multi-engines planes, and 6 helicopters.

Gustine Airport. Located approximately 1.5 miles east of the city of Gustine, the airport has 22 aircraft operations per day on average, 75 percent of which are local general aviation. Based at the airport are 19 single engine, 1 multi-engine, and 2 ultra-light planes.

Turlock Municipal Airport. Located approximately six miles east of the city of Turlock and five miles northeast of the city of Delhi, the airport operates 28 aircrafts a day on average, 79 percent of which is local general aviation. Turlock Municipal is home to 62 single engine and 2 multi-engine planes. Although Turlock Municipal Airport is within the Merced County, it is owned and operated by the city of Turlock (Stanislaus County).

Existing Non-Transportation Noise Sources

The production of noise is a result of many processes and activities, 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 those noise performance standards.

Descriptions of existing fixed noise sources in Merced County are provided in this section. These uses are intended to be representative of the relative noise generation of such uses, and are intended to identify specific noise sources which should be considered in the review of development proposals. Site specific noise analyses should be performed where noise sensitive land uses are proposed in proximity to these (or similar) noise sources, or where similar sources are proposed to be located near noise-sensitive land uses.

Agricultural Noise

There are active agricultural uses both within and adjacent to the plan area, and agricultural operations will continue to occur on adjacent properties into the foreseeable future. As a result, agricultural-related equipment and processes contribute to the existing ambient noise environment in the Plan Area. Due to the wide array of equipment types and conditions under which that equipment is used in the agriculture industry, noise generated by agricultural processes varies substantially.

Maximum noise levels generated by farm-related tractors typically range from 77 to 85 dB at a distance of 50 feet from the tractor, depending on the horsepower of the tractor and the operating conditions.

Due to the seasonal nature of the agricultural industry, there are often extended periods of time when no noise is generated on properties which are actively being farmed, followed by short-term periods of intensive mechanical equipment usage and corresponding noise generation. Due to this high degree of variability of agricultural activities, it is not feasible to reliably quantify the noise generation of agricultural uses in terms of noise standards commonly utilized to assess impacts of other noise sources. However, these uses generate short-term periods of elevated noise during all hours of the day and night and possess the potential to generate adverse public reaction during intensive farm-related activities.

Industrial Fixed Sources

Valley Towing and Auto Wrecking. Valley Auto Wrecking is located on 1330 North Lander Avenue in the city of Stevinson. Primary daily operations consist of dismantles and repairs of automobiles according to manger Bill Hipolite. The only noise generated other than by normal automotive repair equipment is a forklift. The facility does not generate truck trips or train operations. There are no current plans for expansion and the facility has never received a complaint regarding noise generated from their business.

Farm Management. Farm Management is located on 11016 N. Ballicao Avenue with in the city of Ballicao. Their hours of operations are from 7 am - 4:30 pm, and they farm peaches, almonds, and walnuts. Noise producing equipment: almond shelling plant, tractors, and trucks. The facility produces eight truck trips per day from September to October. The facility does not use railroad for deliveries. There are no current plans for expansion and the facility has never received a complaint regarding noise generated from their business.

Foster Farms. Foster Farms is located on 1000 Davis Street in Livingston. Foster Farms produces raw chicken, cooked chicken, deli meats, and fertilizer. Their hours of operation are seven days a week, 24-hours a day. Noise producing equipment at the facility includes truck traffic, forklifts, industrial plant noise, and railroad traffic. Foster Farms generates approximately 1,100 truck trips pre day, and has no current plans for expansion.

Morning Star Packing Company & Liberty Packing Company. The Morning Star Packing & Liberty Packing Company are located on 13448 Volta Road and 12045 South Ingomar Grade, respectfully. Both plants produce tomato and peach products, and are owned by Chris J. Rufer. According to Mr. Rufer, typical peak season operations is 24 hours a day, seven days a week through the months of July to October and 16 hours a day, five days a week off peak months. Noise producing equipment at the facilities includes turbines, boiler fans, motors, steam values, and pumps. The facilities generate 1,000-1,300 truck trips on a typical day. Railroad is used for delivers six days a week for approximately two hours each day. The Morning Star Packing Plant has had minor complaints about their facility noise levels, but levels are in compliance with County standards. Currently there are plans to expand the facilities which could cause noise levels to increase in the community.

Triangle Rock Products. Triangle Rock Products is located at 22101 Sunset Avenue in the city of Los Banos. The plant produces aggregate and concrete between the hours of 6 a.m. – 5 p.m., Monday through Friday, and 6 a.m. – 12 p.m. on Saturday. Noise producing equipment includes rock crushers, screens, conveyors, and loading equipment. The plant generates approximately 100 truck trips per day. Triangle Rock Products plans to expand their operations which should not increase community noise levels, however, this assumes that sensitive land uses do not encroach upon their operation. Triangle Rock Products has never received noise complaints.

Ingomar Packing Company. The Ingomar Packing Company is a large facility located at 9950 South Ingomar Grade in the community of Ingomar. According to the Director of Operations, Tim Durham, the plant produces tomato paste and diced tomatoes year round. During seasonal operations the plant is open 24-hours a day from July 1 through November 1, and off-season plant hours are 6 a.m. – 6 p.m. Noise producing equipment that is used include boilers, yard tractors, forklifts, evaporators, and processing equipment. The facility generates 500 seasonal and 15 off-season truck trips per day. Railroads are used once a day for pick-up and delivery. Expansion of the plant could double according to the original plant design which would raise the seasonal daily truck trips to 800.

JR Simplot. JR Simplot Company has a receiving facility located at 10985 Ballico Avenue in Ballico. The typical hours of operation are from 7 a.m. – 7 p.m. Monday through Friday during the summer months and 7 a.m. -12 p.m. during the winter months. Noise producing equipment on site includes forklifts and truck traffic. This facility generates 25-50 truck trips on a typical day. The facility does not use the railroad for deliveries, and there are currently no plans for expansion. There have been no noise complaints.

Blue Diamond. The Blue Diamond Growers Company has a receiving station located at 11710 N. Santa Fe Drive in the community of Ballico. The station serves only as a transfer facility according to Assistant Manager Robert Ketcher. The typical hours of operation are from 7 a.m. – 11 p.m., seven days a week. The plant is seasonal and operates approximately from August 15 until November 22. Noise producing equipment on site includes elevators, conveyors, and a bag house. Seasonal truck trips range from 20-25 per day. The facility does not use the railroad for deliveries, and there are currently no plans for expansion. There have been no noise complaints according to Mr. Ketcher.

Dole Packing Foods. Dole Packing Foods is located 7916 West Bellevue Road near Atwater. The plant produces frozen fruit, and operates five-seven days per week depending on fruit demand during the peak season from June – October. The plant runs three shifts, two for production and one for cleaning the production line. No noise generating equipment was disclosed in the survey except for truck traffic, which the plant generates approximately 30 truck trips per day. There are no plans for expansion and they have not received any noise complaints.

Calaveras Materials. Calaveras Materials is located at 12523 North Highway 59 in a rural area approximately 8 miles north of the city of Merced. The company produces crushed sand and gravel, and hot asphalt. The site is depressed from the roadway. Typical operating hours are 6 a.m. – 4 p.m., according to area manger Terry Howard. Noise producing equipment used includes earth moving equipment, crushers, dumping of aggregates into truck beds, and exhaust fan on asphalt plant. The facility generates up to 400 truck trips demanding on demand. There have been no noise related complaints and there are no plans for expansion at this time.

General Service Commercial & Light Industrial Uses

Noise sources associated with service commercial uses such as automotive repair facilities, car washes, loading docks, retail stores, are found at various locations within Merced County. The noise emissions of these types of uses are dependant on many factors, and are therefore, difficult to quantify precisely. Nonetheless, noise generated by the these uses contributes to the ambient noise environment in the immediate vicinity of these uses, and should be considered where either new noise-sensitive uses are proposed nearby or where similar uses are proposed in existing residential areas.

Parks and School Playing Fields

There are several park and school uses within the General Plan Study Area, spread throughout the county. Noise generated by these uses depends on the age and number of people utilizing the respective facility at a given time, and the types of activities they are engaged in. School playing field activities tend to generate more noise than those of neighborhood parks, as the intensity of school playground usage tends to be much higher. At a distance of 100 feet from an elementary school playground being used by 100 students, average and maximum noise levels of 60 and 75 dB, respectively, can be expected. At organized events such as high-school football games with large crowds and public address systems, the noise generation is often significantly higher. As with service commercial uses, the noise generation of parks and school playing fields is variable.

Community Noise Survey

A community noise survey was performed at 18 locations within Merced County which are removed from major noise sources. This survey was conducted in order to quantify existing noise levels in the quieter parts of the county. Two of the 18 locations were monitored over a continuous 24-hour period, while the other 16 locations were each monitored for two short-term periods during daytime hours and one during nighttime hours. The community noise survey noise measurement locations are shown on Figure 11-2. The results of the community noise survey are provided in Table 11-3.

Please See Next Page

Merced County General Plan

Legend

L : Continuous Hourly Measurement Site

: Short-Term Noise Measurement Site

0 1 2 3 4 6 8 10
SCALE IN MILES

N

Mintier & Associates

BOLLARD Acoustical Consultants

Figure 11-2
Measurement Locations
Merced County, California

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TABLE 11-3
Community Noise Measurement Survey results
Merced County General Plan Update & EIR - July 19-21, August 2-4, and September 13-15, 2006

Site	Location	Dates	Time Period	Leq	Lmax	Estimated Ldn	Sources
1	Le Grand High School, Le Grand	07/19/06	Morning	52.7	63.8	52	Traffic, Natural sounds
		07/21/06	Afternoon	47.7	57.1		
		08/03/06	Nighttime	44.3	54.7		
2	Gage St. & Stanford St., Planada	07/19/06	Morning	47.5	57.4	50	Traffic, Natural sounds
		07/21/06	Afternoon	47.7	61.1		
		08/03/06	Nighttime	41.7	50.5		
3	Cunningham Rd. & Childs Rd., Planada	07/19/06	Morning	39.2	59.1	47	Traffic
		07/21/06	Afternoon	37.6	53.3		
		08/03/06	Nighttime	41.0	43.9		
4	4th St. & Emma St., Snelling	07/21/06	Morning	43.9	56.3	52	Traffic, Natural sounds
		07/19/06	Afternoon	48.8	67.0		
		08/04/06	Nighttime	44.5	46.7		
5	East Ave. & Looney Rd., Snelling	07/21/06	Morning	44.4	58.7	44	Traffic, Aircraft flyovers
		07/19/06	Afternoon	40.6	50.8		
		08/03/06	Nighttime	36.5	42.1		
6	9955 6th St., Delhi	07/21/06	Morning	46.1	61.0	57	Traffic, Natural sounds, Aircraft flyovers
		07/19/06	Afternoon	48.9	61.2		
		08/03/06	Nighttime	51.3	53.7		
7	American Ave. & Cypress St., Hilmar	07/21/06	Morning	47.1	62.1	59	Traffic, Natural sounds, Industrial noise
		07/19/06	Afternoon	48.7	58.6		
		08/03/06	Nighttime	52.6	59.1		
8	End of 1st, Hilmar	07/21/06	Morning	45.1	52.7	53	Traffic, Natural sounds, Aircraft flyovers
		07/19/06	Afternoon	42.0	54.6		
		08/03/06	Nighttime	46.8	52.4		
9	9921 Crocker Ave.,	07/19/06	Morning	46.4	54.8	48	Traffic, Natural sounds

TABLE 11-3 Community Noise Measurement Survey results Merced County General Plan Update & EIR - July 19-21, August 2-4, and September 13-15, 2006							
Site	**Location**	**Dates**	**Time Period**	**Leq**	**Lmax**	**Estimated Ldn**	**Sources**
	Cressey	07/21/06	Afternoon	46.5	56.5		
		08/03/06	Nighttime	40.5	50.0		
10	Crawford St. & Meadowlark Ave., Winton	07/19/06	Morning	45.9	56.7		
		07/21/06	Afternoon	45.1	55.4		
		08/04/06	Nighttime	38.0	46.4	47	Traffic, Natural sounds
11	Station Ave. & Mulberry Ave., Atwater	07/19/06	Morning	51.3	64.9		
		07/21/06	Afternoon	50.8	62.0		
		08/04/06	Nighttime	45.6	49.7	53	SR- 99 Traffic, Natural sounds
12	Fir Ave & Maple Ave., Merced	07/19/06	Morning	50.9	64.3		
		07/21/06	Afternoon	53.5	64.2		
		08/03/06	Nighttime	41.6	46.1	52	Traffic, Natural sounds, Aircraft flyovers
13	E. Roosevelt Rd. & S. Bliss Rd., El Nido	07/19/06	Morning	50.8	65.8		
		07/21/06	Afternoon	47.6	64.2		
		08/02/06	Nighttime	43.8	45.4	51	Traffic, Natural sounds
14	Lexington Ave. & K St., Dos Palos	07/21/06	Morning	48.8	61.3		
		07/21/06	Afternoon	46.8	61.3		
		08/02/06	Nighttime	42.0	51.0	50	Traffic, Natural sounds
15	Volta Rd. & Ramos Rd., Los Banos	07/21/06	Morning	49.4	59.0		
		07/19/06	Afternoon	48.7	56.8		
		08/02/06	Nighttime	55.2	63.3	61	Traffic, Natural sounds
16	Mercury Cr. & W. Comet St., Santa Nella	07/21/06	Morning	45.9	52.6		
		07/19/06	Afternoon	51.9	61.8		
		08/02/06	Nighttime	49.6	57.2	56	Natural sounds, I-5 Traffic
A	2640 Gurr Road	9/13/06	Day	67.4	91.6		
		9/13/06	Night	65.6	81.1	72	I-5 Traffic, Train

TABLE 11-3 Community Noise Measurement Survey results Merced County General Plan Update & EIR - July 19-21, August 2-4, and September 13-15, 2006							
Site	**Location**	**Dates**	**Time Period**	**Leq**	**Lmax**	**Estimated Ldn**	**Sources**
B	8688 Santa Fe Drive	9/15/06	Day	67.5	96.7	76	Traffic on Santa Fe Drive, Train
		9/15/06	Night	69.8	94.3		

Source: Bollard Acoustical Consultants, Inc., 2006

11.3 Noise Mitigation Options

Introduction

Noise mitigation, also know as noise attenuation, is used to reduce noise levels by using a substance, material, or surface. This section describes noise mitigation options that can be used in the county, including setbacks, barriers, site design, building design, and use of vegetation.

Key Terms

See Key Terms under Section 11.2.

Regulatory Setting

California Environmental Quality Act. The state legislature adopted the California Environmental Quality Act (CEQA) as a result of a public mandate for thorough environmental analysis of projects that might affect the environment. CEQA considers excessive noise to be an environmental impact. Implementation of CEQA ensures that during the decision making stage of development, City officials and the general public assess the noise impacts associated with public and private development projects.

California Noise Insulation Standards (Title 24). The California Commission of Housing and Community Development officially adopted noise standards in 1974. In 1988, the Building Standards Commission approved revisions to the standards (Title 24, Part 2, California Code of Regulations). As revised, Title 24 establishes an interior noise standard of 45 dBA for residential space (Community Noise Equivalent Level [CNEL] or Ldn). Acoustical studies must be prepared for residential structures that are to be located within noise contours of 60 dBA or greater from freeways, major streets, thoroughfares, rail lines, rapid transit lines or industrial noise sources. The studies must demonstrate that the building is designed to reduce interior noise to 45 dBA or lower.

California General Plan Guidelines. The California Governor's Office of Planning and Research published the current General Plan Guidelines in 2003. These advisory guidelines serve as valuable reference for cities and counties in the preparation of local general plans. The Office of Planning and Research aims to realize the sustainable developmental goals of protecting the environment, maintaining a healthy economy, and ensuring equitable treatment of all people.

Existing Conditions

Any noise problem can be composed of three basic elements: noise source, transmission path, and receiver. 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 (Ldn, Leq, or Lmax), the location of the sensitive receiver (inside or outside), and when the problem occurs (daytime or nighttime). Noise control techniques are selected to provide an acceptable noise environment for the receiving property while remaining consistent with local aesthetic standards and practical structural and economic limits. This section summarizes the fundamental noise control techniques.

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, and storage yards. The available noise attenuation from this technique is limited by the characteristics of the noise source, but is generally about 4 to 6 dB per doubling of distance from the source.

Use of Barriers

Shielding by barriers can be obtained by placing walls, berms, buildings, or other structures between the noise source and the receiver. The effectiveness of a barrier depends upon the ability to block the line-of-sight between the source and receiver. This technique increases the distance 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 path-length-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 four lbs. per square foot. A lesser mass may be acceptable if the barrier material provides sufficient transmission loss. 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.

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 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 combinations of the two. The use of an earth berm in lieu of a solid wall may 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.

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. Carports or garages can be used, for example, 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.

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.

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.

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.

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 façades 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 façades and attention to the orientation of the building can reduce this effect.

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 façades. Standard residential construction practices provide 10 15 dB noise reduction for building façades with open windows, and approximately 25 dB noise reduction when windows are closed. Thus a 25 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 façade to remain closed under any weather condition.

Where greater noise reduction is required, acoustical treatment of the building façade 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.

Which ever noise control techniques are employed, it is essential that attention be given to installation of weather-stripping and caulking of joints. Openings for attic or sub-floor 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 façades 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 façade 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 façade.

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.

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.

11.4 Major Findings

Existing Noise Environment

- There are no significant industrial noise sources identified within Merced County.

- The ambient noise environment in Merced County is considered to be fairly quiet at locations removed from the Interstate 5, major State Routes, and railroad tracks.

Noise Mitigation Options

- Any noise problem can be composed of three basic elements: noise source, transmission path, and receiver. The appropriate acoustical treatment for a given project should consider the nature of the noise source and the sensitivity of the receiver.

- Adverse noise can be mitigated and reduced through the careful use of setbacks, barriers, site design, building design, and vegetation