Chapter 10 -- Noise

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10.1 INTRODUCTION

The main purpose of the Noise Element is to identify noisy areas and to provide measures for protecting residents from the harmful effects of excessive noise. The Noise Element is based on an analysis of current and projected noise levels for streets and highways, railroads, and airports. Existing noise-sensitive land uses such as hospitals, rest homes, schools, and long-term medical care facilities are identified and a set of City policies are established to deal with excessive noise.

10.1.1 Scope of the Noise Element

The Noise Element, one of the seven State-required elements of the General Plan, provides a systematic approach to: (1) the measurement and modeling of noise; (2) the establishment of noise standards; (3) the control of major noise sources; (4) community planning for the regulation of noise; and, (5) the achievement of land use compatibility through the adoption of specific policies with respect to noise.

Existing noise contours for all major sources of noise in the City of Merced have been identified and are presented in the Noise Element. These noise contours are used as a guide for establishing land use patterns in the Land Use Element that minimize the exposure of community residents to excessive noise. The Noise Element also includes policies and implementation measures that address existing and any foreseeable noise problems.

10.1.2 Existing Noise Environment

Noise is often defined as unwanted sound, and its perception can be characterized as a subjective reaction to a physical phenomenon. Researchers have grappled for many years with the problem of translating objective measurements of sound into directly correlated 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. ***Table 10.1*** provides examples of maximum or continuous noise levels associated with common noise sources.

A common statistical tool to measure the ambient noise level is the average sound level (Leq), which is the sound level corresponding to a steady-state A-weighted sound level in decibels (dB) containing the same total energy as a time-varying signal over a given time period (usually one hour). The Leq, or average sound level, is the foundation for determining composite noise descriptors such as Ldn and CNEL (see below), and shows very good correlation with community response to noise.

Two composite noise descriptors commonly used are: Ldn and CNEL. The Ldn (Day-Night Average Level) is based upon the average hourly Leq over a 24-hour day, with a +10 decibel weighting applied to nighttime (10:00 p.m. to 7:00 a.m.) Leq values. The nighttime penalty is based upon the assumption that people react to nighttime noise exposures as though they were subjectively twice as loud as daytime exposures. The CNEL (Community Noise Equivalent Level), like Ldn, is based upon the weighted average hourly Leq 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 Leq values.

The CNEL was developed for the California Airport Noise Regulations, and is normally applied to airport/aircraft noise assessment. The Ldn descriptor is a simplification of the CNEL concept, but the two will usually agree, for a given situation, within 1 dB. Like the Leq, these descriptors are also averages and tend to disguise short-term variations in the noise environment. Because they presume increased evening or nighttime sensitivity, these descriptors 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.

The State Office of Planning and Research Noise Element Guidelines require that major noise sources be identified and quantified by preparing generalized noise contours for current and projected conditions. Noise measurements and modeling are used to develop these contours. Significant noise sources include traffic on major roadways and highways, railroad operations, airports, representative industrial activities and fixed noise sources.

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 such as roadways, railroad line operations and industrial plants. Such methods produce reliable results so 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 levels 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 also conducted in 2007 to describe existing noise levels in noise-sensitive areas within the General Plan study area so that noise level performance standards may be developed to maintain an acceptable noise environment.

Table 10.1
Typical A-Weighted Maximum Sound Levels of Common Noise Sources

Decibels	*Description*
130	Threshold of pain
120	Jet aircraft take-off at 100 feet
110	Riveting machine at operators position
100	Shot-gun at 200 feet
90	Bulldozer at 50 feet
80	Diesel locomotive at 300 feet
70	Commercial jet aircraft interior during flight
60	Normal conversation speech at 5-10 feet
50	Open office background level
40	Background level within a residence
30	soft whisper at 2 feet
20	Interior of recording studio

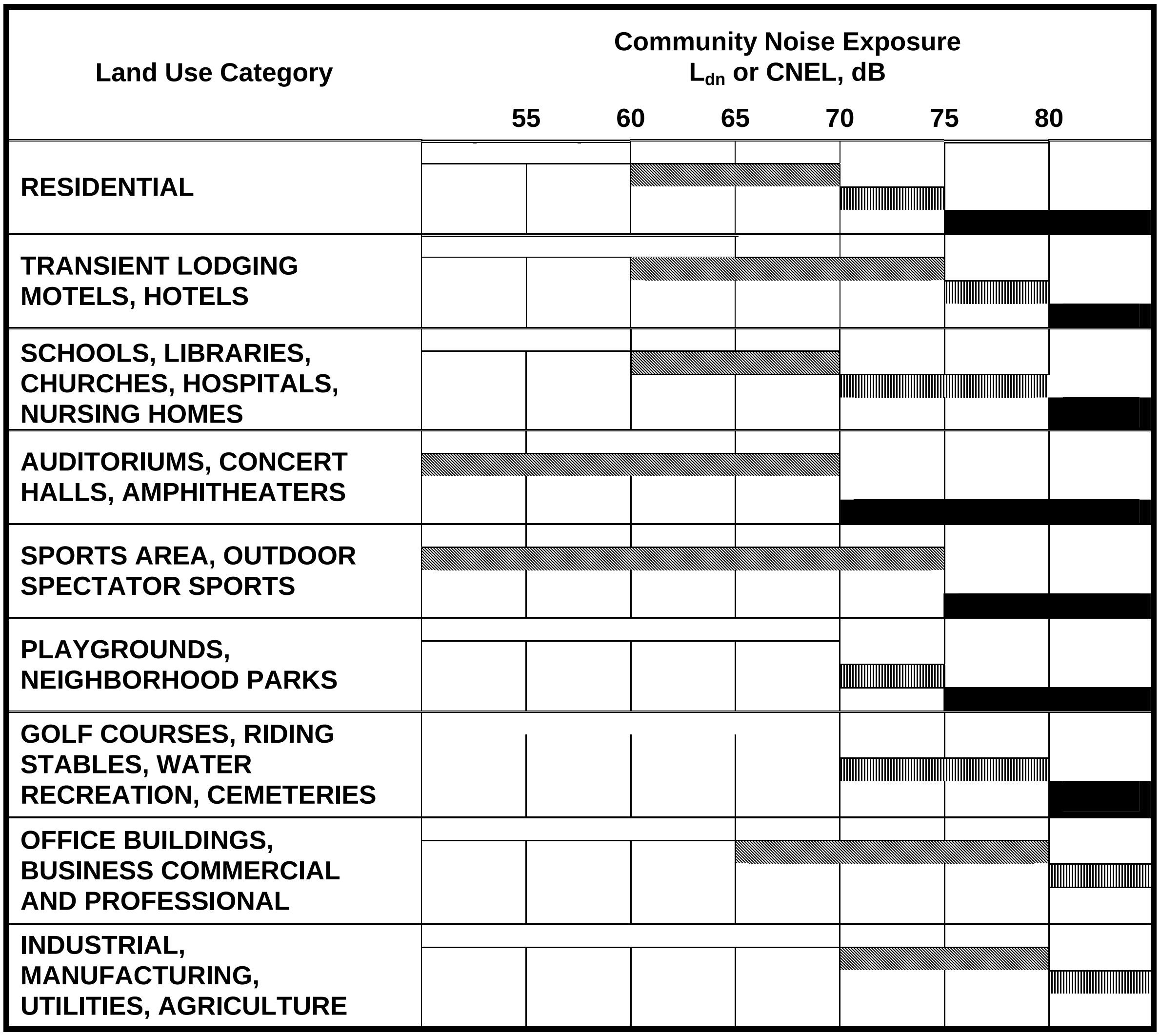
Existing Regulatory Framework

The City of Merced General Plan Noise Element is based upon recommendations by the California State Office of Noise Control as contained in the *Guidelines for the Preparation and Content of Noise Elements of the General Plan.*

The criteria in the Noise Element are established for determining potential noise conflicts between various land uses, and noise sources. The standards for all noise sources are based upon the CNEL/Ldn descriptor. ***Figure 10.1*** shows the land use compatibility chart.

As described earlier, the CNEL and Ldn are 24-hour average noise level descriptors, which assume that individuals are more sensitive to noise occurring during the evening and nighttime hours. The CNEL and Ldn descriptors have been found to provide good correlation to the potential for annoyance from transportation-related noise sources (ie: roadways, airports and, to a lesser extent, railroad operations). However, these descriptions do not provide a good correlation to the potential for annoyance from non-transportation or stationary noise sources, such as industrial and commercial operations, because many times stationary noise sources operate sporadically or for short durations. Examples of these types of noise sources include loading docks, special event concerts, pressure relief valves or alarms, which tend to be short duration noise events. When applying an Ldn or CNEL descriptors, the noise levels associated with these types of short term operations will be averaged over a 24-hour period, underscoring the potential for annoyance.

Figure 10.1
Land Use Compatibility



NORMALLY ACCEPTABLE

Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise requirements

NORMALLY UNACCEPTABLE

New construction or development should be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirement must be made and needed noise insulation features included in the design.

CONDITIONALLY ACCEPTABLE

New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design.

CLEARLY UNACCEPTABLE

New construction or development clearly should not be undertaken.

Source: Adapted from the State of California General Plan Guidelines, 1990. Office of Planning and Reasearch. Suggested CNEL/Ldn metrics for evaluating land use noise compatibility.

The State of California "Model Community Noise Control Ordinance" suggests that an exterior hourly L50/Leq noise level of 55 dBA should be used for evaluating stationary noise source impacts during the daytime period (7 am-10 pm) and 45 dBA during the nighttime period (10 pm - 7 am), within "suburban" areas. The hourly Leq, or hourly average noise level, has been found to provide good correlation to noise sources which operate for a short duration.

Since the Leq is calculated on a logarithmic scale, loud noise levels of short duration are emphasized. For example, a maximum noise level of 70 dBA can only be generated for 2 minutes without exceeding an hourly average (Leq) noise level of 55 dBA. If an on-site noise source generated a noise level of 73 dBA for 1 minute, the hourly average (Leq) noise level would be approximately 55 dBA.

Research indicates that interior noise levels suitable for sleeping areas is within the range of 38 dBA to 48 dBA. The State of California "Model Community Noise Control Ordinance" suggests that an interior maximum noise level (Lmax) of 45 dBA should be used for residential uses between the hours of 10 pm and 7 am.

10.1.3 Noise Sources & Noise Abatement Techniques

Cars and trucks, aircraft, and trains are the most pervasive outdoor residential noise sources. Several approaches can be taken to lower the impact of noise from all the previously-mentioned sources. Barriers can be used to provide some attenuation. The amount of noise reduction depends upon the material and design of the barrier. Solid structures provide the most attenuation; vegetation will only abate noise a little, but psychologically can provide a more relaxed environment. An intervening row of buildings will decrease the amount of noise reaching more distant property.

<u>Reducing Vehicular Noise</u>

At the source, vehicular noise can be lowered through enforcement of noise level regulations and, if federal or state legislation provide the proper incentives, quieter vehicles can be produced. Reducing traffic speed can also reduce noise output.

Measures that eliminate stop-and-go traffic help to reduce noise levels. To a certain extent, grade separations will do this, although increased acceleration of trucks will minimize the benefits. Wider rights-of-way and increased setbacks can reduce the possible impact on adjacent land uses. Recessing or elevating a roadway also reduces noise levels on adjacent property.

<u>*Reducing Train Noise*</u>

Like vehicular traffic, trains produce a linear noise pattern. Noise attenuation measures used to abate noise along highways also can be used along railways. Other noise-reduction methods include reducing the speed of the train, improving rail connections, and limiting night-time traffic.

<u>*Reducing Aircraft Noise*</u>

Noise from aircraft radiates in all directions so building noise barriers is not effective. It is possible to insulate buildings to achieve an acceptable interior noise level, and changes are being made to reduce aircraft noise at the source. In many cases, it is possible to modify flight patterns, take-off and landing techniques, or flight schedules.

The most effective means for reducing the impact of aircraft noise is to prohibit noise-sensitive uses in high noise areas through land use planning and zoning. Effective land use controls should be initiated early to minimize the level of development in areas impacted by aircraft noise.

Military aircraft are noisier than civilian airplanes. The closure of nearby Castle Air Force Base in 1995 and its conversion to civilian use means much lower noise levels for the City.

10.2 MAJOR SOURCES OF NOISE IN THE CITY OF MERCED

Major sources of noise in the City of Merced are cars and trucks, trains, and aircraft. Other sources of noise are home appliances, tools, and construction equipment.

10.2.1 Vehicular Noise

<u>*State Highway Noise Contours*</u>

There are three State highways within the Merced area (Routes 99, 140, and 59). The highest vehicular noise levels are associated with Highway 99. Current noise levels are approximately 78 LdN at 100 feet from the center of the highway, and future levels are projected to increase approximately 3 dB(A) LdN at the same distance.

The Federal Highway Administration's (FHWA) Highway Traffic Noise Prediction Model (FHWA-RD 77-108) was used to develop Ldn (24-hour average) noise contours for all highways and major roadways in the proposed SUDP/SOI. The model is based upon the CALVENO noise emission factors 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 Leq values for free-flowing traffic conditions, and is generally considered to be accurate within 1.5 dB. To predict Ldn values, it is necessary to determine the hourly distribution of traffic for a typical 24-hour period.

Traffic data representing annual average traffic volumes for existing conditions were obtained from Caltrans and the General Plan traffic consultant. Day/night traffic distribution for Highway 99, State Route 59, and State Route 140 were based upon continuous hourly noise measurement data collected for those roadways. Truck mix data were also based upon Caltrans and j.c. brennan & associates, Inc. file data. Using these data sources and the FHWA traffic noise prediction methodology, traffic noise levels were calculated for existing traffic volumes in terms of the Ldn metric. Distances from the centerlines of selected highways to the 60, 65 and 70 dB Ldn contours are summarized in ***Table 10.2***.

In many cases, the actual distances to noise level contours may vary from the distances predicted by the FHWA model. Factors such as roadway curvature, roadway grade, shielding from local topography or structures, elevated roadways, or elevated receivers may affect actual sound propagation. The distances reported in ***Table 10.2*** are generally considered to be conservative estimates of noise exposure along highways in the City of Merced.

The effects of factors such as roadway curvature, and grade, can be determined from site-specific traffic noise measurements. The noise measurement results can be compared to the FHWA model results by entering the observed traffic volumes, speed and distance as inputs to the FHWA model. The differences between the measured and predicted noise levels can be used to adjust the FHWA model and more precisely determine the locations of the traffic noise contours. ***Table 10.2*** shows the Existing and Projected General Plan Buildout Traffic Noise Levels.

Noise Contours and Methods of Measurement for Major Local Streets

LdN noise contours have been computed for Olive, Yosemite, Childs, Gerard and Mission Avenues, “G”, “M” and “R” Streets, 13^{th} 14^{th} and 16^{th} Streets and Bellevue, Cardella, Dickenson Ferry, North Bear Creek and Parsons/Gardner Roads which are considered major local streets that carry relatively heavy traffic. (Truck routes are designated in Section 10.40 of the Merced Municipal Code.) In 2007, j.c. brennan & associates, noise consultants, performed traffic noise exposure calculations for the above-mentioned streets for the City of Merced. ***Table 10.2*** shows the Existing and Projected General Plan Buildout Traffic Noise Levels for these major local streets.

Table 10.2
Existing and Projected General Plan Build Out Traffic Noise Levels

Roadway	***Segment***	***Distance[1]***	***Traffic Noise Levels (dBA, Ldn)***			***Distance[1] to Ldn Contours Existing***			***Distance[1] to Ldn Contours General Plan Build Out***		
			Existing	***General Plan Build Out***	***Change***	***70 dB***	***65 dB***	***60 dB***	***70 dB***	***65 dB***	***60 dB***
SR 59	16th to Olive	100’	67.3	70.4	3.1	66	142	306	106	227	490
SR 59	Olive to Yosemite	100’	69.3	73.2	**4.0**	89	192	415	164	353	761
SR 59	Yosemite to Cardella	100’	66.9	72.6	**5.7**	62	133	287	148	320	688
SR 59	Cardella to Bellevue	100’	65.6	73.1	**7.5**	51	109	235	160	345	743
SR 59	Bellevue to Old Lake	100’	64.9	73.9	**9.0**	45	98	211	182	392	844
SR 59	Old Lake to Castle Farms	100’	64.9	71.9	**7.1**	45	98	211	134	289	623
SR 59	Roduner to Mission	100’	63.4	68.7	**5.3**	36	78	169	82	177	381
SR 59	Mission to Gerard	100’	63.8	68.5	**4.7**	39	83	180	80	172	370
SR 59	Gerard to Childs	100’	65.8	69.7	3.9	52	113	243	96	206	445
SR 59	Childs to SR 99	100’	64.0	66.5	2.5	40	86	185	59	127	273
SR 59	SR 99 to 16th Street	100’	65.4	67.0	1.6	49	106	229	63	136	292
SR 59	North of Castle Farms Rd	100’	61.0	69.8	**8.8**	25	54	116	97	208	448
SR 99	Franklin to Thornton	100’	79.3	81.0	1.7	416	897	1933	542	1167	2515
SR 99	Thornton to V Street	100’	78.5	80.4	1.9	369	795	1712	492	1059	2282
SR 99	V Street to R Street	100’	78.5	80.3	1.8	369	795	1712	485	1046	2253
SR 99	R Street to MLK JR	100’	78.3	80.5	2.2	360	775	1670	504	1085	2338
SR 99	MLK JR to G Street	100’	78.6	80.5	2.0	373	804	1732	505	1088	2343
SR 99	G Street to SR 140	100’	79.4	81.5	2.1	425	915	1970	585	1261	2717
SR 99	SR 140 to Childs	100’	79.3	81.7	2.5	414	892	1922	607	1307	2815
SR 99	Childs to Gerard	100’	79.0	81.3	2.3	396	853	1837	563	1213	2613
SR 99	Gerard to Mission	100’	78.3	80.9	2.6	357	770	1659	531	1144	2465
SR 99	South of Mission to Mariposa	100’	78.3	80.3	2.0	357	770	1659	483	1041	2243
SR 99	Atwater-Merced Expressway (AME) to Franklin	100’	79.4	81.0	1.6	422	910	1960	543	1169	2519
SR 140	Tina to Thornton	100’	71.8	73.8	2.0	132	285	614	179	385	829
SR 140	Thornton to “V” St.	100’	63.6	64.5	0.9	37	80	173	43	92	199

Roadway	***Segment***	***Distance[1]***	***Traffic Noise Levels (dBA, Ldn)***			***Distance[1] to Ldn Contours Existing***			***Distance[1] to Ldn Contours General Plan Build Out***		
			Existing	***General Plan Build Out***	***Change***	***70 dB***	***65 dB***	***60 dB***	***70 dB***	***65 dB***	***60 dB***
SR 140	G Street to Parsons/ Gardner	100’	67.1	72.3	5.2	64	138	296	143	307	662
SR 140	Parsons/Gardner to Campus Parkway	100’	67.1	69.6	2.5	64	138	298	94	202	435
13th Street	V Street to R Street	100’	58.0	60.5	2.5	16	34	74	23	50	109
13th Street	R Street to M Street	100’	55.9	59.5	3.6	11	25	53	20	43	92
13th Street	M Street to MLK JR	100’	58.2	61.7	3.5	16	35	75	28	60	129
13th Street	MLK JR to G Street	100’	58.5	59.4	0.9	17	37	79	20	42	91
13th Street	G Street to B Street	100’	56.8	61.0	**4.2**	13	28	61	25	54	116
14th Street	V Street to R Street	100’	57.9	60.0	2.1	16	34	73	22	47	100
14th Street	R Street to M Street	100’	56.7	61.4	**4.7**	13	28	60	27	57	124
14th Street	M Street to MLK JR	100’	48.2	61.6	**13.4**	4	8	16	28	59	128
16th Street	SR 99 to V Street	100’	62.8	64.3	1.5	33	72	155	42	90	195
16th Street	V Street to R Street	100’	63.4	64.4	0.9	36	79	169	42	91	196
16th Street	R Street to M Street	100’	62.6	63.6	1.0	32	69	149	38	81	175
16th Street	M Street to G Street	100’	60.6	64.0	3.4	23	51	109	40	85	184
16th Street	G Street to SR 99	100’	59.1	63.4	**4.2**	19	41	88	36	78	168
Bellevue Road	SR 59 to R Street	100’	62.1	72.2	**10.2**	30	64	137	141	303	654
Bellevue Road	R Street to M Street	100’	61.9	72.0	**10.1**	29	63	135	136	293	630
Bellevue Road	M Street to G Street	100’	61.9	72.2	**10.2**	29	63	135	139	300	647
Bellevue Road	G Street to Parsons/ Gardner	100’	62.8	71.8	**9.0**	33	71	153	132	284	612
Bellevue Road	Parsons/Gardner to Campus Parkway	100’	60.2	71.6	**11.3**	22	48	104	127	274	590
Bellevue Road	SR 59 to Thornton	100’	60.4	72.0	**11.6**	23	49	106	136	293	631
Bellevue Road	Thornton to AME	100’	60.4	73.3	**12.9**	23	49	106	165	356	768
Campus Parkway	SR 99/Mission to Childs	100’	--	67.8	--	--	--	--	71	153	330
Campus Parkway	Childs to SR 140	100’	--	65.2	--	--	--	--	48	104	223
Campus Parkway	SR 140 to Olive	100’	--	64.8	--	--	--	--	45	98	210
Campus Parkway	Olive to Yosemite	100’	--	65.1	--	--	--	--	47	101	218
Campus Parkway	Yosemite to Cardella	100’	--	65.3	--	--	--	--	49	105	226
Campus Parkway	Cardella to Bellevue	100’	--	65.1	--	--	--	--	47	102	220
Cardella Road	SR 59 to R Street	100’		64.8	--	--	--	--	45	97	209

Roadway	***Segment***	***Distance[1]***	***Traffic Noise Levels (dBA, Ldn)***			***Distance[1] to Ldn Contours Existing***			***Distance[1] to Ldn Contours General Plan Build Out***		
			Existing	***General Plan Build Out***	***Change***	***70 dB***	***65 dB***	***60 dB***	***70 dB***	***65 dB***	***60 dB***
Cardella Road	R Street to M Street	100'	56.8	65.3	**8.5**	13	28	61	48	104	224
Cardella Road	M Street to G Street	100'	58.1	65.0	**6.9**	16	35	75	47	100	217
Cardella Road	G Street to Parsons/ Gardner	100'	--	65.0	--	--	--	--	47	100	216
Cardella Road	Parsons/Gardner to Campus Parkway	100'	--	64.9	--	--	--	--	46	99	212
Childs Avenue	West Ave to SR 59	100'	57.7	59.8	2.1	15	33	71	21	45	97
Childs Avenue	SR 59 to Tyler	100'	56.5	64.2	**7.7**	13	27	58	41	88	190
Childs Avenue	Tyler to SR 99	100'	58.0	66.5	**8.5**	16	34	73	58	125	270
Childs Avenue	SR 99 to Coffee	100'	60.9	66.1	**5.2**	25	53	114	55	119	255
Childs Avenue	Coffee to Campus Parkway	100'	58.0	64.8	**6.9**	16	34	73	45	98	210
Childs Avenue	Campus Parkway to Tower	100'	55.0	62.7	**7.7**	10	21	46	32	70	150
Dickenson Ferry	Thornton to West Ave.	100'	52.6	64.5	**12.0**	7	15	32	43	93	201
Dickenson Ferry	West Ave to SR 59	100'	52.6	65.3	**12.8**	7	15	32	49	105	227
Dickenson Ferry	SR 59 to Tyler	100'	52.6	61.0	**8.4**	7	15	32	25	54	116
G Street	Mission to Childs	100'	57.9	60.6	2.7	16	34	73	24	51	110
G Street	Childs to SR 99	100'	63.1	65.1	2.0	34	74	160	47	101	218
G Street	SR 99 to Bear Creek	100'	63.2	64.9	1.7	35	76	164	46	98	212
G Street	Bear Creek to Olive	100'	65.3	66.5	1.2	48	104	225	58	125	269
G Street	Olive to Yosemite	100'	65.8	67.5	1.6	53	114	245	68	146	315
G Street	Yosemite to Cardella	100'	62.8	68.8	**6.0**	33	71	154	84	180	388
G Street	Cardella to Bellevue	100'	62.6	69.4	**6.8**	32	69	149	91	196	423
G Street	Bellevue to Old Lake	100'	59.4	70.2	**10.9**	20	42	91	103	223	480
G Street	Old Lake to Snelling	100'	59.4	68.7	**9.4**	20	42	91	82	177	381
Gerard Avenue	M to SR 59	100'	53.0	61.0	**8.0**	7	16	34	25	54	117
Gerard Avenue	SR 59 to Tyler	100'	53.0	59.6	**6.6**	7	16	34	20	44	94
Gerard Avenue	Tyler to Henry	100'	--	56.4	--	--	--	--	12	27	58
Gerard Avenue	Parsons/Gardner to Coffee	100'	59.8	65.1	**5.4**	21	45	97	47	102	220
Gerard Avenue	Coffee to Campus Parkway	100'	45.8	65.0	**19.2**	2	5	11	46	100	215
Gerard Avenue	Campus Parkway to Tower	100'	45.8	58.3	**12.5**	2	5	11	16	36	76
M Street	Mission to Childs	100'	56.3	60.9	**4.6**	12	26	57	25	53	114
M Street	Childs to SR 99	100'	59.1	61.6	2.5	19	41	87	28	59	128
M Street	SR 99 to Bear Creek	100'	62.9	63.9	1.0	34	72	156	39	84	181

Roadway	***Segment***	***Distance[1]***	***Traffic Noise Levels (dBA, Ldn)***			***Distance[1] to Ldn Contours Existing***			***Distance[1] to Ldn Contours General Plan Build Out***		
			Existing	***General Plan Build Out***	***Change***	***70 dB***	***65 dB***	***60 dB***	***70 dB***	***65 dB***	***60 dB***
M Street	Bear Creek to Olive	100'	63.0	64.6	1.6	34	74	159	44	94	202
M Street	Olive to Yosemite	100'	64.3	67.3	3.0	42	90	194	66	142	307
M Street	Yosemite to Cardella	100'	61.0	66.7	**5.7**	25	54	116	60	129	278
M Street	Cardella to Bellevue	100'	--	62.3	--	--	--	--	30	66	141
M Street	Bellevue to Old Lake	100'	--	61.9	--	--	--	--	29	62	134
M Street	East of Old Lake	100'	--		--	--	--	--	--	--	--
Mission Avenue	SR 59 to Tyler	100'	52.3	65.2	**12.9**	7	14	31	48	103	222
Mission Avenue	Tyler to Henry	100'	50.7	65.1	**14.3**	5	11	24	47	101	218
Mission Avenue	Henry to SR99	100'	52.8	67.8	**15.0**	7	15	33	71	154	331
Mission Avenue	East of Coffee	100'	47.6	52.5	**5.0**	3	7	15	7	15	32
North Bear Creek	SR 99 to Campus Parkway	100'	56.3	61.4	**5.1**	12	26	57	27	58	125
North Bear Creek	R Street to M Street	100'	57.9	61.4	3.5	16	34	72	27	58	124
North Bear Creek	M Street to G Street	100'	59.0	61.5	2.5	18	40	86	27	58	126
North Bear Creek	G Street to Parsons/ Gardner	100'	59.2	61.7	2.5	19	41	89	28	60	130
North Bear Creek	Parsons/Gardner to McKee	100'	53.6	57.8	**4.3**	8	17	37	15	33	72
Old Lake Road	SR 59 to R Street	100'	--	63.0	--	--	--	--	34	73	158
Old Lake Road	R Street to M Street	100'	--	62.3	--	--	--	--	31	66	142
Old Lake Road	M Street to G Street	100'	--	62.1	--	--	--	--	30	64	138
Old Lake Road	G Street to Parsons/Gardner	100'	--	59.1	--	--	--	--	19	41	88
Old Lake Road	Parsons/Gardner to Lake	100'	45.1	55.6	**10.5**	2	5	10	11	24	51
Olive Avenue	SR 99 to Campus Parkway	100'	66.2	67.8	1.5	56	121	260	71	153	329
Olive Avenue	R Street to M Street	100'	66.0	67.3	1.3	54	116	251	66	142	305
Olive Avenue	M Street to G Street	100'	65.6	67.7	2.0	51	110	238	70	151	325
Olive Avenue	G Street to Parsons/ Gardner	100'	63.8	66.6	2.8	39	83	179	59	127	274
Olive Avenue	Parsons/Gardner to Campus Parkway	100'	59.9	63.4	3.5	21	45	98	36	78	168
Parsons	Coffee to Gerard	100'	50.7	62.8	**12.1**	5	11	24	33	71	154
Parsons	Gerard to Childs	100'	--	64.1	--	--	--		40	87	187
Parsons/Gardner	Childs to SR 140	100'	59.6	64.9	**5.3**	20	44	94	46	98	212
Parsons/Gardner	SR 140 to Bear Creek	100'	60.3	65.3	**4.9**	23	49	105	48	104	224

Roadway	***Segment***	***Distance[1]***	***Traffic Noise Levels (dBA, Ldn)***			***Distance[1] to Ldn Contours Existing***			***Distance[1] to Ldn Contours General Plan Build Out***		
			Existing	***General Plan Build Out***	***Change***	***70 dB***	***65 dB***	***60 dB***	***70 dB***	***65 dB***	***60 dB***
Parsons/Gardner	Bear Creek to Olive	100’	56.1	64.5	**8.3**	12	26	55	43	92	198
Parsons/Gardner	Olive to Yosemite	100’	57.3	65.2	**7.9**	14	30	66	48	103	221
Parsons/Gardner	Yosemite to Cardella	100’	51.8	65.0	**13.3**	6	13	28	47	100	216
Parsons/Gardner	Cardella to Bellevue	100’	--	64.6	--	--	--	--	44	95	204
Parsons/Gardner	Bellevue to Old Lake	100’	--	62.2	--	--	--	--	30	65	140
Parsons/Gardner	Old Lake to Golf Club	100’	--	59.6	--	--	--	--	20	44	95
R Street	Gerard to Childs	100’	46.8	60.1	**13.4**	3	6	13	22	47	102
R Street	Childs to SR 99	100’	60.1	62.1	2.1	22	47	101	30	65	139
R Street	SR 99 to Bear Creek	100’	61.5	62.8	1.3	27	59	126	33	72	154
R Street	Bear Creek to Olive	100’	62.4	64.1	1.7	31	67	145	40	87	187
R Street	Olive to Yosemite	100’	63.8	67.5	**3.7**	39	83	179	68	147	317
R Street	Yosemite to Cardella	100’	--	66.6	--	--	--	--	59	127	274
R Street	Cardella to Bellevue	100’	--	66.6	--	--	--	--	59	128	276
R Street	Bellevue to Old Lake	100’	--	66.5	--	--	--	--	59	127	273
R Street	Old Lake to New Road	100’	--	61.1	--	--	--	--	26	55	119
Santa Fe Ave	SR 59 to Franklin	100’	66.0	67.7	1.7	54	116	250	70	151	325
Thornton Avenue	Mission to SR140	100’	55.6	65.0	**9.4**	11	24	51	46	100	215
Tyler Road	Childs to Mission	100’	--	59.7	--	--	--	--	21	44	96
West Road	Hwy 140 to V Street	100’	--	57.3	--	--	--	--	14	31	67
West Road	V Street to Childs	100’	--	60.5	--	--	--	--	23	50	108
West Road	Childs to Gerard	100’	--	59.0	--	--	--	--	19	40	86
West Road	Gerard to Mission	100’	--	58.8	--	--	--	--	18	39	84
West Road	South of Mission	100’	--	60.1	--	--	--	--	22	47	102
Yosemite Ave	SR 59 to Campus Parkway	100’	62.0	65.3	3.3	29	63	136	49	105	226
Yosemite Ave	R Street to M Street	100’	63.2	67.0	3.8	35	75	163	63	136	292
Yosemite Ave	M Street to G Street	100’	65.3	68.3	2.9	49	105	227	77	165	356
Yosemite Ave	G Street to Parsons/ Gardner	100’	64.2	68.3	**4.1**	41	88	190	77	166	357
Yosemite Ave	Parsons/Gardner to Campus Parkway	100’	61.2	67.1	**5.9**	26	55	119	64	138	297

[1]Distances are measured in feet from the centerline of the roadway.
Bold indicates a relative change of approximately 4 dB or higher.

10.2.2 Rail Traffic Noise

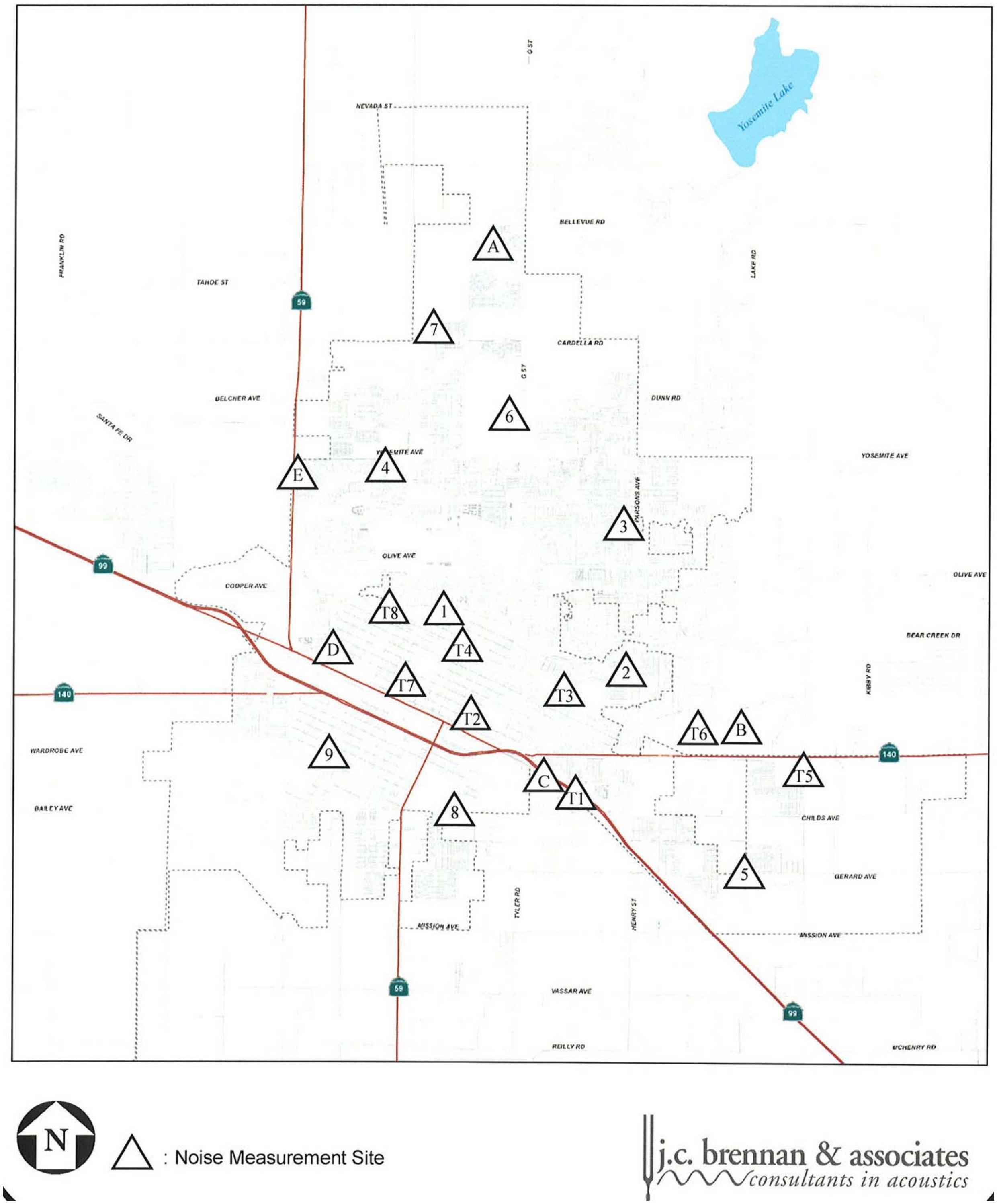
Railroad activity in the City of Merced SUDP/SOI occurs along the Union Pacific Railroad (UPRR) and Burlington Northern/Santa Fe (BNSF) railroad tracks. The UPRR mainline track generally runs parallel to the State Route 99 outside of the Downtown area. Within the Downtown area of Merced, the Union Pacific Railroad (UPRR) runs parallel and directly between 16th Street and 15th Street. The Burlington Northern Santa Fe Railroad generally runs parallel to Santa Fe Avenue until reaching the intersection of Highway CA-140. At which point the tracks redirect easterly and follow Highway 140/ Yosemite Park Way towards Planada.

In order to quantify existing train usage, j.c. brennan & associates, Inc., conducted continuous noise level monitoring at three locations within the General Plan area. The purpose of the noise level measurements was to determine typical sound exposure levels (SEL) for railroad line operations in the area, accounting for the effects of travel speed, warning horns and other factors which may affect noise generation. In addition, the noise measurement equipment was programmed to identify individual train events, so that the typical number of train operations could be determined. Locations of continuous noise monitoring sites are shown on ***Figure 10.2 (sites B, C and D)***. ***Table 10.3*** shows a summary of the continuous noise measurement results for the UPRR and BNSF railroad lines. ***Figures 10.3 through 10.5*** show the results of the continuous railroad noise measurements.

Table 10.3
Railroad Noise Measurement Results

Measurement Location	*Railroad Track*	*Grade Crossing /Warning Horn*	*Trains Events Per Day*	*Distance to CL*	*Average SEL*
Site B	BNSF	No	26	110’	100 dB
Site C	UPRR	No	16	114’	103 dB
Site D	UPRR	Yes	16	46’	108 dB

Source: j.c. brennan & associates, Inc - 2007



BASE MAP AND NOISE MEASUREMENT SITE LOCATIONS

Figure 10.2

Noise measurement equipment consisted of Larson Davis Laboratories (LDL) Model 820 and Model 824 precision integrating sound level meter equipped with a LDL ½" microphone. The measurement systems were calibrated using a LDL Model CAL200 acoustical calibrator before testing. The measurement equipment meets all of the pertinent requirements of the American National Standards Institute (ANSI) for Type 1 (precision) sound level meters.

Based upon the noise level measurements shown in ***Table 10.3***, the average SEL for train operations along the UPRR line is 103 dB at 114 feet, with approximately 16 train events occurring per day. The average SEL for train operations along the BNSF railroad line is 100 dB at 110 feet, with approximately 26 train events occurring per day. Train operations for each railroad line are assumed to be equally and randomly distributed throughout the daytime and nighttime hours.

To determine the distances to the Ldn railroad contours, it is necessary to calculate the Ldn for typical train operations. This was done using the SEL values and above-described number and distribution of daily freight train operations for each railroad line.

The Ldn may be calculated as follows:

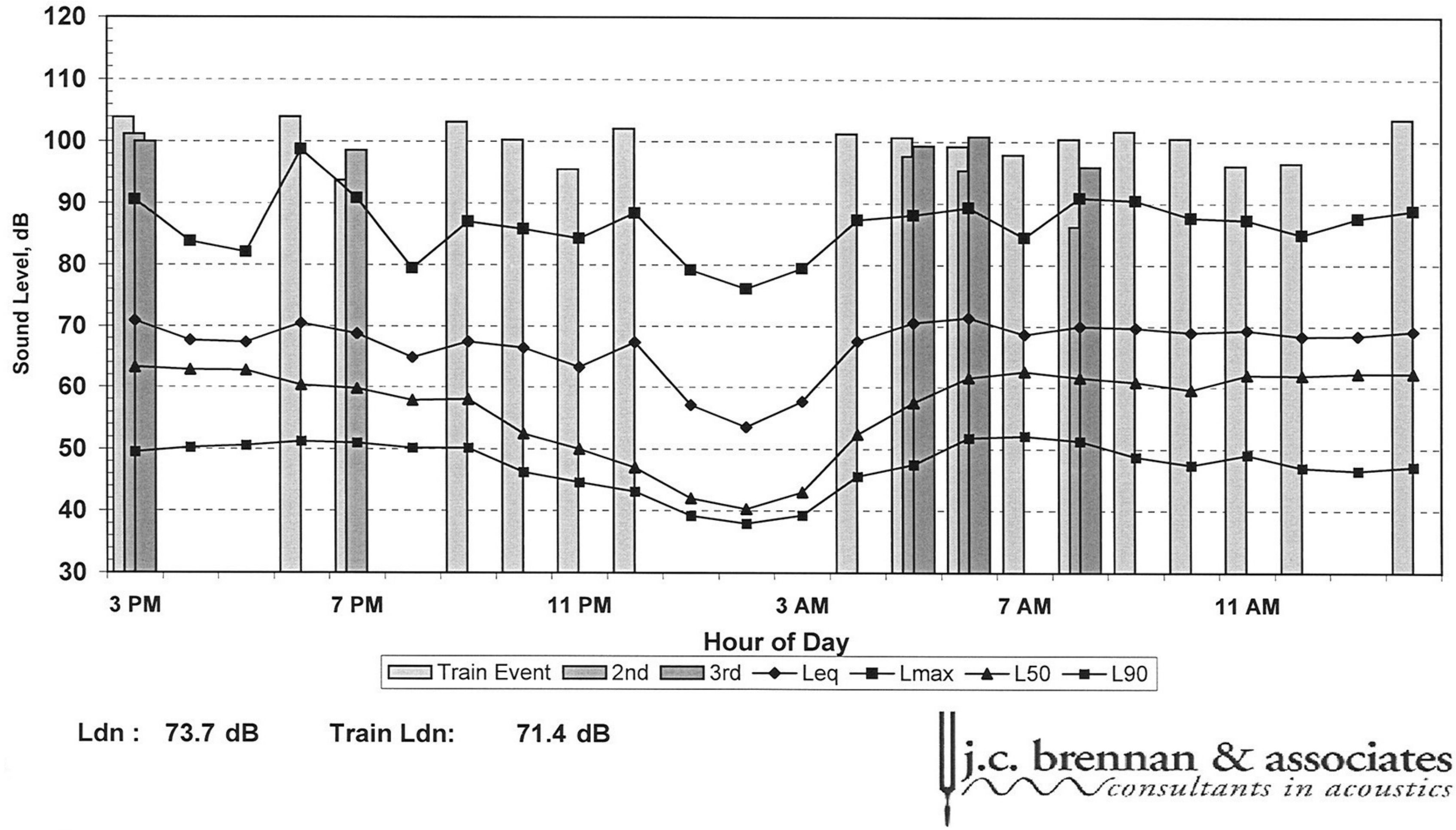
Ldn = SEL + 10 log N_{eq} - 49.4 dB, where:

SEL is the mean Sound Exposure Level 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. Based upon the above-described noise level data, number of operations and methods of calculation, the Ldn value for railroad line operations have been calculated, and the distances to the Ldn noise level contours are shown in ***Table 10.4***.

Table 10.4
Approximate Distances to the Railroad Noise Contours
Without Horn Use

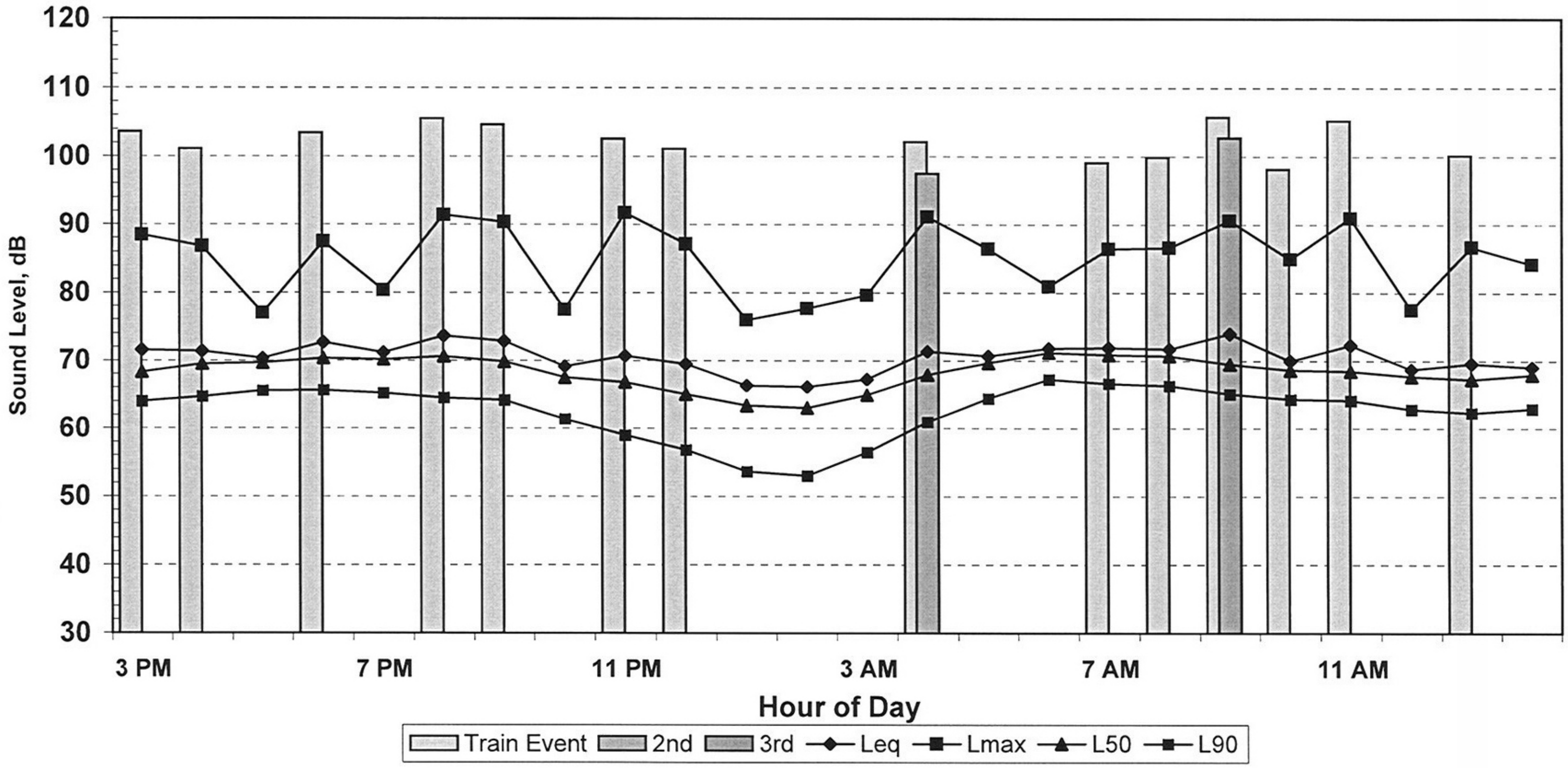
Ldn at 100 feet	*Distance to Ldn Contour*		
	60 dB	*65 dB*	*70 dB*
UPPR line			
72.6 dB	700 feet	325 feet	151 feet
BNSF line			
72.0 dB	635 feet	295 feet	137 feet

Source: j.c. brennan & associates, Inc.



CONTINUOUS MEASURED RAILROAD AND HOURLY NOISE LEVELS – SITE B (JUNE 11-12, 2007)

Figure 10.3



Ldn : 76.4 dB **Train Ldn: 71.8 dB**

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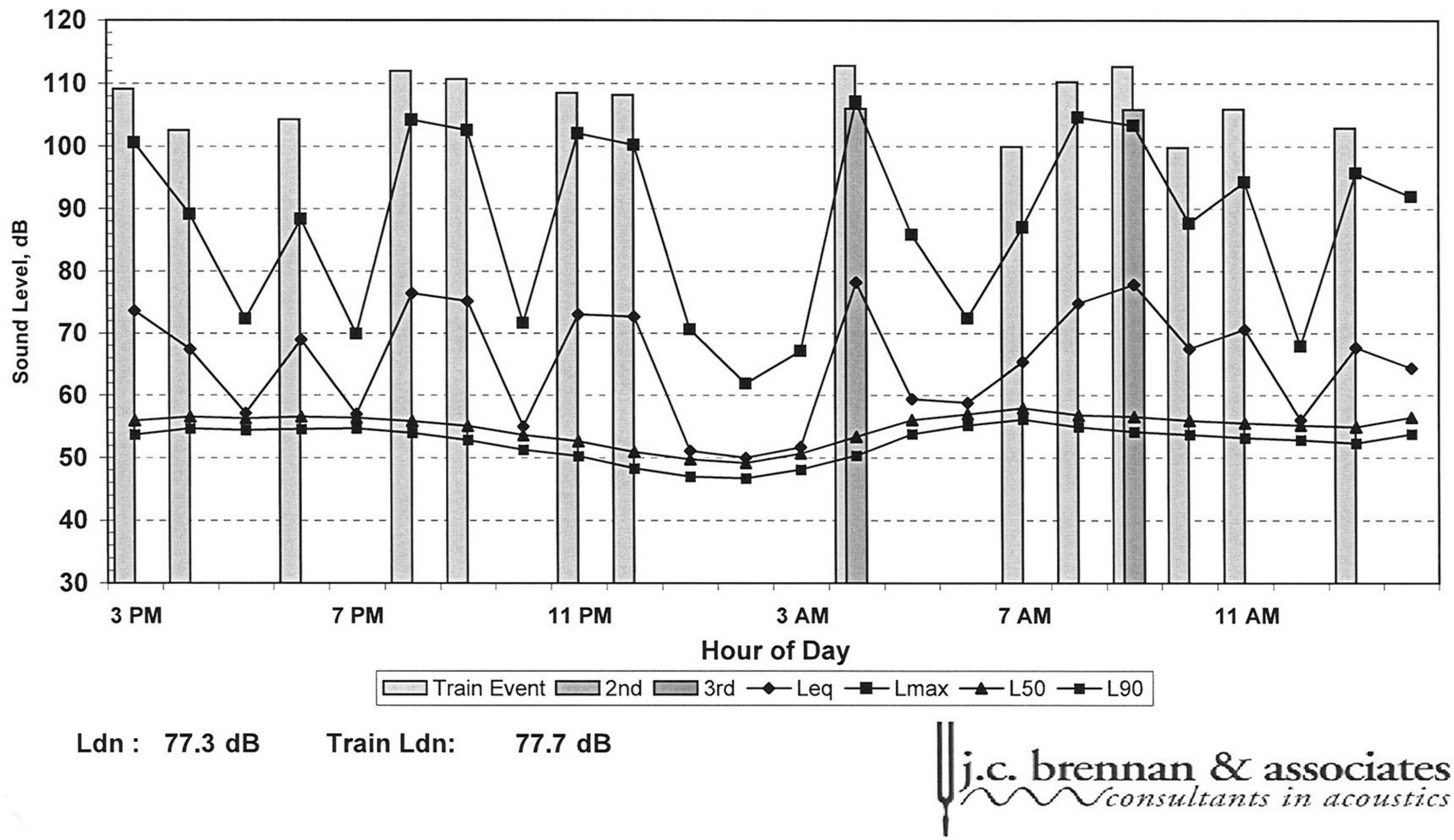
CONTINUOUS MEASURED RAILROAD AND HOURLY NOISE LEVELS – SITE C (JUNE 11-12, 2007)

Figure 10.4



CONTINUOUS MEASURED RAILROAD AND HOURLY NOISE LEVELS – SITE D (JUNE 11-12, 2007)

Figure 10.5

In addition, j.c. brennan & associates, Inc. conducted short-term noise measurements of train operations at eight locations throughout the City. The intent of the short-term noise monitoring was to determine the effects of railroad grade-crossings and the use of warning horns on environments in the vicinity of railroad tracks.

Short-term noise monitoring was conducted for the UPRR line at: the End of Brantley St, 16th and "G" St., and 16th and "M" Street. Noise measurements of the BNSF railroad line were conducted at: Santa Fe and Glenn Ave, The Amtrak Station, end of Baker Dr., off SR 140 near Santa Fe, and "R" Street.

Union Pacific Railroad sound exposure levels (SEL) within the City ranged from 101 dB to 103 dB, with maximum noise levels ranging from 92 dB to 96 dB Lmax at a distance of 100 feet. Burlington Northern Santa Fe Railroad sound exposure levels (SEL) within the City ranged from 100 dB to 108 dB, with maximum noise levels ranging from 89 dB to 103 dB Lmax at a distance of 100 feet. Grade crossings and the use of warning horns was found to raise noise levels associated with train operations 5 dB to 10 dB.

10.2.3 Aircraft Noise

In the vicinity of the City of Merced there are currently two public airports in operation: Castle Airport, and Merced Regional Airport. The Merced Regional Airport is owned and operated by the City of Merced. Ownership of Castle Airport was turned over from the US Military to the Castle Joint Powers Authority (CJPA) and finally to Merced County. Additionally, there are a number of privately owned and operated airfields in the area surrounding the City of Merced.

Noise impacts and contours associated with Castle Airport and Merced Regional Airport are addressed in the *Merced County Airport Land Use Compatibility Plan,* adopted by the Airport Land Use Commission on April 15, 1999. This document is due to be updated.

<u>*Measuring Aircraft Noise*</u>

The noise standards established in the California Administrative Code, Title 21, Subchapter 6, designate Community Noise Equivalency Level (CNEL) as the noise rating method to be used at California airports. The noise descriptor used by the Air Force to measure existing and projected noise levels when Castle was an active military facility was the LdN method.

LdN is similar to the CNEL method; the two descriptors are generally within one dB of one another, and both can be used for noise contours for local compliance with the State Noise Installation Standards. These standards require specified levels of outdoor to indoor noise reduction for new multi-family residential construction in areas where outdoor noise exposure exceeds CNEL (or LdN) 60 dB.

Merced Regional Airport

The Merced Regional Airport/Macready Field is located 2 miles southwest of the center of the City of Merced. This airport has a single runway with a heading of 12/30, at an elevation of 157 feet above sea level. The airport is open 24 hours per day, and has a lighted runway for night operations.

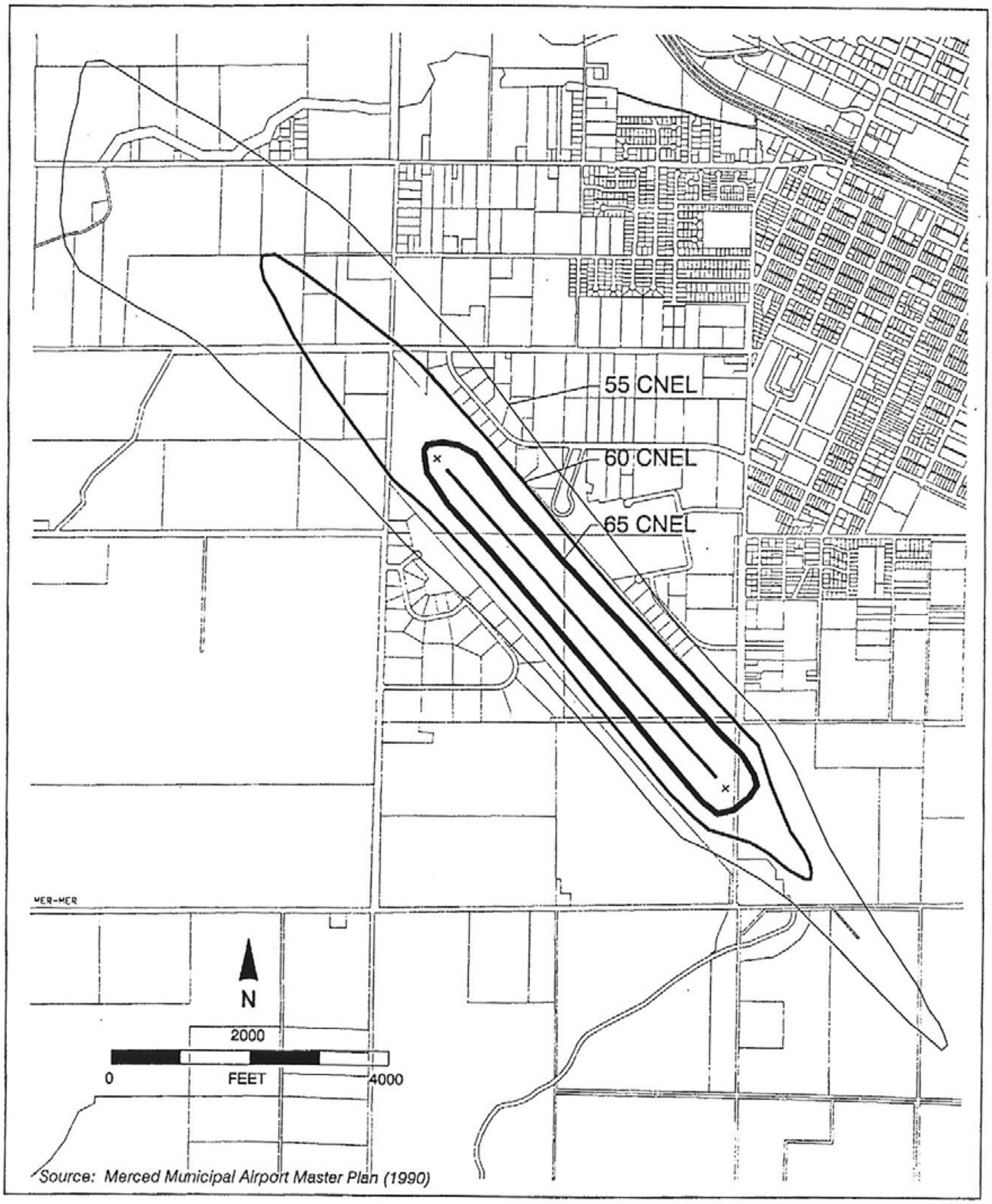
Primary use of the airport is single-engine fixed wing aircraft used for general aviation purposes. Twin engine, business jet, and turbo prop aircraft also frequent the airport. Commercial passenger flights to Las Vegas occur at the airport on a daily basis. On an annual average basis, there are approximately 229 operations per day, with the majority of aircraft using the southeast approach (Runway 30). Further information and analysis for this airport can be found in the above referenced ALUCP. ***Figure 10.6*** shows the Merced Regional Airport noise impact area.

Castle Airport

Castle Airport is located approximately 6 miles northwest of the City of Merced. Prior to October 1995, Castle Airport was operated for more than fifty years by the military and is now operated by Merced County. The Airport consists of a single runway with a heading of 13/31. The airport is open 24 hours per day, and has a lighted runway for night operations. Aircraft that primarily use the airport are single-engine fixed-wing general aviation aircraft. Twin-engine aircraft, business jets, and commercial jet airplanes also utilize the airport. On an annual average basis, there are approximately 579 operations per day, with the majority of aircraft using the southeast approach (Runway 31). Further information and analysis for this airport can be found in the above referenced ALUCP. ***Figure 10.7*** shows the Castle Airport noise impact area.

Other Aviation Activity

Other general aviation activities can be expected to occur in the vicinity of the City of Merced. The Mercy Medical Center Merced owns and operates a Bell 407 helicopter for emergency airlift services, which is operated as needed 24 hours a day. Other general aviation activity may be associated with agricultural, forestry, recreational or other private operations.



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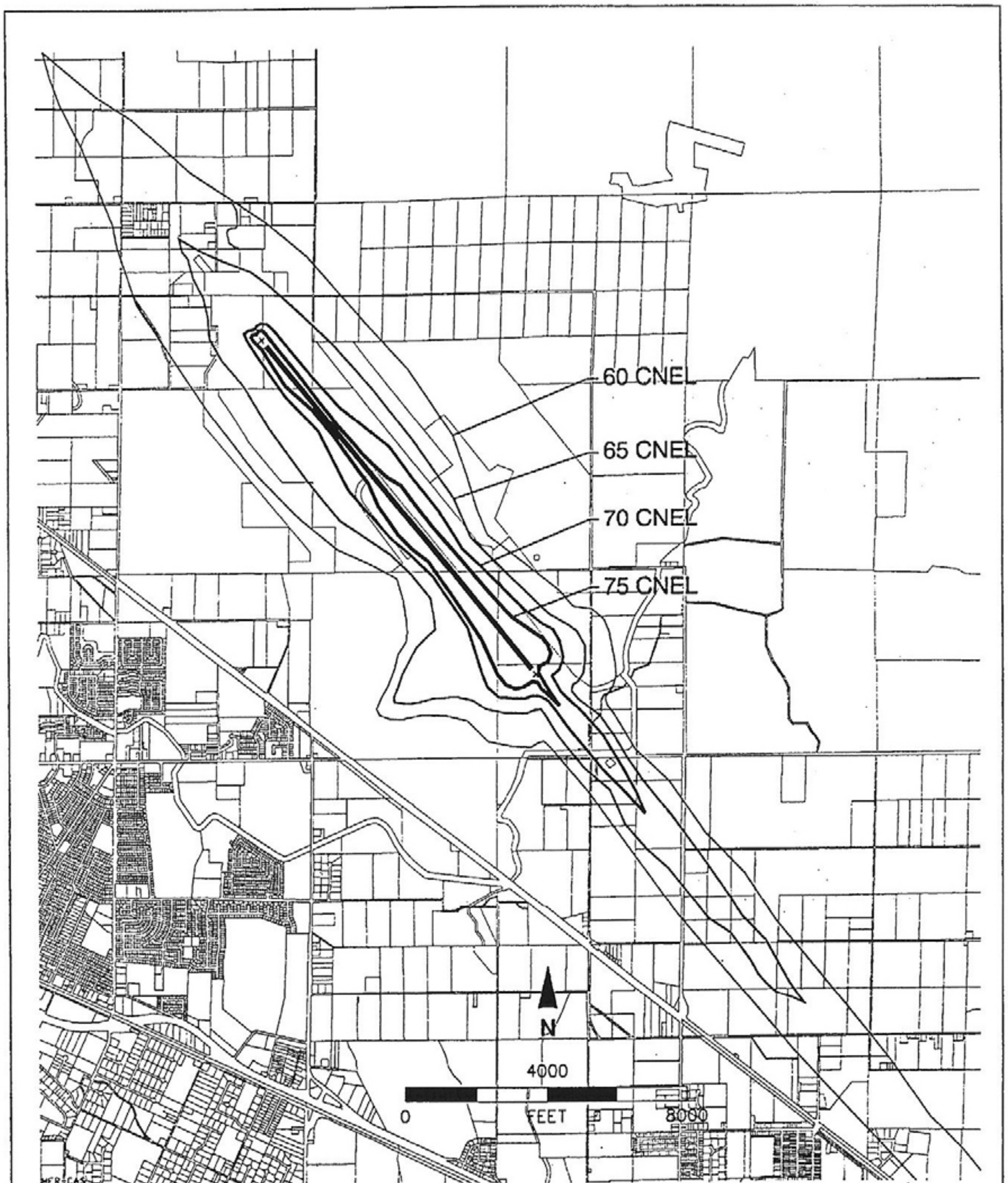
	MERCED REGIONAL AIRPORT NOISE CONTOURS	Figure 10.6



Source: Castle AFB Disposal and Reuse FEIS (1996)

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CASTLE AIRPORT NOISE CONTOURS

Figure 10.7

10.2.4 Other Sources of Noise

<u>*Fixed Noise Sources*</u>

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 and Cal-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. These noise sources can be continuous and may contain tonal components which have a potential to annoy individuals who live nearby. In addition, noise generation from fixed noise sources may vary based upon climatic conditions, time of day and existing ambient noise levels.

From a land use planning perspective, fixed-source noise control issues focus upon two goals:

1) To prevent the introduction of new noise-producing uses in noise-sensitive areas, and,
2) To prevent encroachment of noise sensitive uses upon existing noise-producing facilities.

The first goal can be achieved by applying noise level performance standards to proposed new noise-producing uses. The second goal can be met by requiring that new noise-sensitive uses in near proximity to noise-producing facilities include mitigation measures that would ensure compliance with noise performance standards.

Fixed noise sources which are typically of concern include but are not limited to the following:

- HVAC Systems
- Pump Stations
- Steam Valves
- Generators
- Conveyor Systems
- Transformers
- Pile Drivers
- Grinders
- Drill Rigs
- Gas or Diesel Motors
- Welders
- Cutting Equipment
- Outdoor Speakers
- Blowers
- Chippers
- Cutting Equipment
- Loading Docks
- Amplified music and voice
- Cooling Towers/Evaporative Condensers
- Lift Stations
- Steam Turbines
- Fans
- Air Compressors
- Heavy Equipment

The types of uses which may typically produce the noise sources described above, include, but are not limited to: wood processing facilities, pump stations, industrial facilities, trucking operations, tire shops, auto maintenance shops, metal fabricating shops, shopping centers, drive-up windows, car washes, loading docks, public works projects, batch plants, bottling and canning plants, recycling centers, electric generating stations, race tracks, landfills, sand and gravel operations, special events such as concerts, and athletic fields.

According to the Community Noise Survey conducted by j.c. brennan in 2007, the City of Merced has three primary areas where industrial noise sources exist. The primary industrial noise generating areas are located along the western, southwestern and southeastern City boundaries. The following descriptions are intended to be representative of the relative noise impacts of such uses and to identify individual noise sources needing consideration during the environmental review process of developments in their vicinity. Pepsi-Cola Metropolitan Bottling and Distribution facility, Werner Corporation, McLane Pacific Grocery Distribution, and Quebecor World have been identified as primary industrial noise generators located within the City of Merced.

Pepsi-Cola Bottling Facility

Pepsi-Cola operates a bottling, production, and distribution facility at the corner of West Avenue and Eagle Street. Noise sources associated with the facility include air compressors, cooling towers and evaporator equipment located at the north side of the facility, and on-site truck circulation along the southern and western property boundaries. Liquid carbon dioxide is delivered generally once per week, causing 15-20 minutes of elevated noise levels along the eastern portion of the facility. The facility is operated continuously year-round, 24 hours a day. Noise measurements were conducted outside the northern property line, adjacent to the facilities cooling towers.. The cooling towers generated an average noise level of 69.8 dB Leq and a maximum noise level of 70.8 dB Lmax, at a distance of 50 feet.

Werner Corporation

The Werner Corporation is located west of the Grogan Avenue and West avenue intersection. The facility manufactures, assembles, and distributes fiberglass, wood, and metal climbing equipment such as ladders and scaffolding. Hours of operation are 6:00 a.m. to 11:15 p.m. seven days a week. Noise sources include manufacturing equipment located inside the building, audible through bay doors at the northwestern façade, and on-site truck operations. Werner Co. receives and dispatches approximately ten semi tractor-trailers per day. j.c. brennan & associates file data indicates that slowly moving trucks may produce maximum noise levels of 71-74 dB at 100 feet, and idling trucks generate approximately 62-63 dB at 100 feet. Noise measurements of manufacturing operations ranged from 71 dB to 75 dB Lmax 110 feet north of the facility.

McLane Pacific

McLane Pacific operates a 250,000 square foot food service/grocery processing and distribution facility located at the northwest corner of Childs Ave and Kibby Rd. Hours of operation are 24 hours a day, Sunday through Saturday. Primary noise sources associated with the facility include rooftop cooling towers, refrigeration equipment, loading dock activities, and on-site truck circulation. Due to the nature of the product, the majority of trailers are outfitted with diesel powered refrigeration units and may remain idling at the facility for extended periods of time. McLane Pacific dispatches between 30 and 35 trucks per day and receives 45 to 60 trucks per day. Noise measurements conducted east of the McLane Pacific facility ranged from 56 dB to 63 dB Leq, and 72 dB to 77 dB Lmax approximately 450 feet from the primary noise sources.

Quebecor World (now known as Quad/Graphics)

Quebecor World Incorporated (now known as Quad/Graphics) operates a 500,000 square foot digital media production, printing, and distribution facility located northwest of Cooper Avenue and Highway 59 in Merced, California. A representative for the facility was not available for comment during the survey, and therefore operational statistics are unknown. Daytime noise levels associated with the facility were at or below the ambient noise environment in the vicinity, which was primarily comprised of transportation noise on Highway 59 and Santa Fe Boulevard. Nighttime noise measurements of the Quebecor World facility resulted in noise levels of 64 dB Leq, and 68 dB Lmax at a distance of 650 feet.

Aggregate Batch Plants

There are three aggregate/rock processing facilities in the vicinity of Merced: Builders Concrete, Boulders Unlimited, and Central Valley Concrete/Trucking. Central Valley Concrete processes batches of concrete and supplies sand and gravel throughout Merced and many neighboring counties. The main plant is located at the Highway 59 and Buena Vista Ave intersection, with a secondary plant located in southern Merced on Brantley Street. Operations at the facility are dependent on type of material, demand from contractors, and number of internal CVC jobs in operation. Typical hours of operation are 6:00 a.m. to 4:00 p.m., four to five days per week. Approximately 30-40 trucks of concrete are produced per day; however, when demand peaks production can accommodate 120 trucks per day.

Builders Concrete located northwest of the City limits operates in a similar manner to Central Valley Concrete. Hours of operation are typically 5:00 a.m. to 3:00 p.m. but may vary considerable to meet demand. Builders Concrete operates locally in the Merced area with a fleet of 10-22 trucks making multiple trips when required. At a distance of 280 feet from the center of the batch plant the average noise level was 59 dB Leq, with a maximum noise level of 63 dB Lmax.

Boulders Unlimited, located at the Highway 59 and Yosemite Avenue intersection, batches concrete and supplies sand, gravel, boulders, and landscaping materials. Hours of operation are 7:30 am to 5:30 pm, five days per week. Boulders Unlimited also provides crane, and general trucking services which are dispatched from the facility.

Merced County Fairgrounds

The Merced County Fairgrounds are located on Martin Luther King Junior Way, between East 11th Street and Childs Avenue, in the City of Merced. There are a variety of potential noise sources associated with fairground operations including parking lot noise, amplified speech/music, amusement/ carnival rides, livestock, concerts, and the Merced Speedway. The majority of these activities are limited to one week of operation during the Merced County Fair. Off-season use of the fairgrounds is generally associated with the Merced Flea Market, held weekly year-round, private facilities rentals, and the Merced Speedway.

Merced Speedway

Merced Speedway is a 3/8th of a mile dirt oval located on the northwestern portion of the Merced County Fairgrounds. The speedway can accommodate 3,250 guests in grandstand seating and an additional 1,750 in bleacher seating. Racing series' range from super modified, high output classes to small sport compacts. The Merced Speedway track schedule shows the pit areas opening at 4 pm, racing beginning at 7 pm, and awards/standings closing between 9:30 pm and 10:00 pm. Racing events occur Saturdays and some Sundays from March through October.

In order to evaluate noise levels associated with the Merced Speedway, j.c. brennan & associates, Inc. conducted short-term noise level measurements at the fairgrounds. Short-term measurements were conducted at three locations at the speedway. Continuous noise level measurements were conducted at a nearby residential receiver, located adjacent speedway along East 11th street. ***Table 10.5*** summarizes the results of the noise monitoring. Noise measurement locations are shown on ***Figure 10.8***.

Nightly Concert Series

The Merced County Fair hosts a nightly concert series during the County Fair. Nightly concerts are held at a temporary outdoor theater located in the western portion of the fairgrounds. The outdoor theater is arranged with a main seating area for 2,000 attendees surrounded by bleacher seating for an additional 3,000 guests. Performances at the outdoor theater ranged from contemporary/pop styles to country, and alternative rock music. The performance stage was approximately 72 feet by 40 feet, and was outfitted with four JBL Vertec line array speaker cabinets and four sub woofers per side. Noise levels associated with concerts and musical events such as these can vary considerably depending on several factors: crowd size, type of music, operational levels of the sound system, and the duration of the event.

During the July 17, 2007 visit to the Merced County Fair, j.c. brennan & associates, Inc. performed short-term noise measurements at five locations at the outdoor theater. ***Table 10.5*** shows the results of noise monitoring for the concert series.

Table 10.5
Existing Merced County Fair Noise Measurement Results
July 17, 2007

Site	*Location*	*Time*	*Measured Noise Level, dBA*		
			Leq	*L50*	*Lmax*
1	145 West 11th Street, 800' from Speedway Center	Continuous Monitoring – 6:00 pm to 10:00 pm	61.2	57.9	85.7
			63.0	60.7	75.4
			66.4	61.6	91.1
			64.0	60.5	88.7
			65.3	61.8	82.6
Speedway – Short Term					
2	105' South of Track Center Line, 350' to Center of Oval	7:11 pm	90.0	82.0	99.6
2	105' South of Track Center Line, 350' to Center of Oval	7:22 pm	90.4	86.3	98.8
3	Center of Speedway Oval	7:29 pm	88.9	81.7	99.3
4	300' North of Speedway Center, Crowd Cheering & Announcer over PA	7:48 pm	69.1	69.1	71.2
4	300' Northeast of Speedway Center,	7:53 pm	86.5	80.6	96.3
Concert Series – Short Term					
5	Center of Main Seating Area, 100' South of Center Stage	9:08 pm	86.8	86.0	97.6
6	200' South of Center Stage	9:27 pm	85.3	84.8	88.9
7	100' West of Center Stage	9:35 pm	93.0	80.8	92.7
8	100' North of Center Stage	9:39 pm	75.2	74.2	80.0
9	100' West of Center Stage	9:42 pm	86.0	85.5	90.7

Source: j.c. brennan & associates, Inc. - 2007

Community Noise Survey

A community noise survey was conducted to document noise exposure in the City containing noise sensitive land uses and for major roadways. Noise monitoring sites were selected to be representative of typical residential, commercial or recreational areas within the City.

Three sets of short-term noise measurements were conducted at nine locations on July 11, 2007 through July 13, 2007. In addition, five continuous 24-hour noise monitoring sites were also established throughout the City of Merced to record day-night statistical noise level trends. The data collected included the hourly average (Leq), and the maximum level (Lmax) during the measurement period. Noise monitoring sites and the measured noise levels at each site are summarized in ***Table 10.6*** and ***Table 10.7***.

Community noise monitoring equipment included Larson Davis Laboratories (LDL) Model 820 precision integrating sound level meters equipped with a LDL ½" microphone. The measurement systems were calibrated using a LDL Model CAL200 acoustical calibrator before testing. The measurement equipment meets all of the pertinent requirements of the American National Standards Institute (ANSI) for Type 1 (precision) sound level meters.

The results of the community noise survey shown in ***Tables 10.4*** and ***10.5*** are indicative of the major noise sources, such as SR 99, Highway 59, Highway 140, Union Pacific Railroad, Burlington Northern Santa Fe Railroad, and some industrial uses which are located in close proximity to noise-sensitive receivers such as residential uses. Measured noise levels within most areas of Merced are consistent with typical urban and suburban communities. Recently developed residential areas within the City of Merced are generally located away from major noise sources, or have included noise mitigation in the project designs, so as to reduce overall noise levels at the developments.

Table 10.6
Existing Continuous 24-Hour Ambient Noise Monitoring Results
July 11-12, 2007

Site	***Location***	***Average Measured Hourly Noise Levels, dBA***								
		Ldn (dBA)	***Daytime (7:00 am - 10:00 pm)***				***Nighttime (10:00 pm – 7:00 am)***			
			Leq	***Lmax***	***L50***	***L90***	***Leq***	***Lmax***	***L50***	***L90***
A	West of the Gilmore Ct. and Beckman Way intersection.	54.0	47.5	67.8	42.4	38.7	47.7	62.1	43.5	38.6
B	State Route 140 near Santa Fe Avenue.	73.7	68.9	87.6	61.2	49.5	66.9	84.2	49.6	43.9
C	South of State Route 99 near the Childs Avenue over-crossing.	76.4	71.7	86.0	69.3	64.5	69.7	83.1	66.6	59.2
D	West of the 16th Street, V Street intersection.	77.3	71.9	90.7	56.1	54.0	70.7	82.1	52.6	50.1
E	Southwest of the State Route 59, Yosemite Avenue Intersection.	70.4	67.0	81.5	62.4	50.6	63.2	79.5	52.3	43.6

Source – j.c. brennan & associates, Inc. - 2007

Table 10.7
Existing Short-Term Community Noise Monitoring Results

Site	*Location*	*Date*	*Time¹*	*Measured Sound Level, dB*			
				Leq	*Lmax*	*L50*	*L90*
1	Applegate Community Park – Near Entrance	July 11, 2007	7:37 pm	59.0	74.1	55.1	52.8
		July 12,2007	1:48 am	45.2	51.1	44.6	43.3
		July 12, 2007	1:31 pm	54.7	68.2	51.7	48.5
2	Entrance to Ada Givens Park	July 11, 2007	8:45 pm	54.4	64.3	52.6	48.8
		July 12,2007	12:12 am	44.6	51.8	44.5	43.5
		July 12, 2007	10:36 am	51.9	68.6	45.1	43.1
3	Nottingham @ Rahilly Park	July 11, 2007	9:24 pm	46.3	56.7	45.0	43.5
		July 12,2007	12:31 am	40.1	51.6	39.8	38.2
		July 12, 2007	11:00 am	44.8	58.8	42.5	40.0
4	Donna and Tres Logos (Open Space Area)	July 11, 2007	8:07 pm	49.3	61.6	48.6	46.3
		July 12,2007	1:28 am	40.3	48.0	39.9	39.1
		July 12, 2007	3:02 pm	44.6	54.2	44.1	42.5
5	60' NW of Coffee and Gerard	July 11, 2007	7:36 pm	51.2	69.5	46.3	43.3
		July 11,2007	11:32 pm	48.2	55.4	48.6	45.8
		July 12, 2007	9:51 am	54.8	74.1	48.8	45.7
6	Merced Community College	July 11, 2007	8:43 pm	55.4	65.9	52.4	44.7
		July 12,2007	12:52 am	39.2	46.4	38.8	38.1
		July 12, 2007	11:26 am	59.1	71.5	55.7	48.8
7	Cardella Road and Freemark Avenue	July 11, 2007	9:02 pm	42.8	61.8	42.0	39.9
		July 12,2007	1:08 am	40.3	48.0	39.9	39.1
		July 12, 2007	3:24 pm	41.5	62.7	38.5	36.5
8	"G" Street and Childs Avenue	July 11, 2007	7:56 pm	60.1	70.3	56.3	51.6
		July 12,2007	2:08 am	59.3	77.1	50.2	47.2
		July 12, 2007	2:07 pm	58.7	71.1	62.2	55.5
9	"S" Street and 6th Street	July 11, 2007	8:19 pm	53.5	63.3	51.8	49.6
		July 12,2007	2:26 am	48.5	53.3	48.1	46.0
		July 12, 2007	2:28 pm	58.7	65.9	58.1	55.3
10	Kibby and E. Childs Avenue	July 11, 2007	7:20 pm	62.1	74.4	57.9	55.0
		July 11,2007	11: 49 pm	56.3	72.2	50.7	48.8
		July 12, 2007	10:13 am	63.0	77.1	52.4	49.1

1 - All Community Noise Measurement Sites have a test duration of 10:00 minutes.
Source - j.c. brennan & associates, Inc.

FAIR CONFIGURATION/MEASUREMENT SITE LOCATIONS

Figure 10.8

10.3 NOISE GOALS, POLICIES AND ACTIONS

Goal Area N-1: Noise

GOALS

- **Protection of City residents from the Harmful and Annoying Effects of Exposure to Excessive Noise.**
- **Protection of the Economic Base of the City by Preventing Incompatible Land Uses from Encroaching upon Existing or Planned Noise-Producing Uses.**
- **The Application of State of the Art Land Use Planning Methodologies in Areas of Potential Noise Conflicts.**

POLICIES

N-1.1 Minimize the impacts of aircraft noise.

N-1.2 Reduce surface vehicle noise.

N-1.3 Reduce equipment noise levels.

N-1.4 Reduce noise levels at the receiver where noise reduction at the source is not possible.

N-1.5 Coordinate planning efforts so that noise-sensitive land uses are not located near major noise sources.

N-1.6 Mitigate all significant noise impacts as a condition of project approval for sensitive land uses.

Policy N-1.1
Minimize the Impacts of Aircraft Noise

Implementing Actions:

1.1.a **Continue to follow the established noise abatement procedures for the Merced Regional Airport**

1.1.b **Encourage the use of noise-reducing flight procedures for large aircraft using Merced Regional Airport, such as maintaining minimum flight altitudes.**

1.1.c **Follow the recommendations stated in the Merced Regional Airport Master Plan and the Merced County Airport Land Use Compatibility Plan, such as limitations on occupancy and density levels, and restrictions on certain land uses near airports.**

1.1.d **Work with Merced County to minimize future noise impacts from Castle Airport.**

1.1.e **Update projected airport noise contours as information becomes available.**

The above implementing actions will address noise impacts associated with the Merced Regional Airport/Macready Field. The Airport is surrounded by industrial zoning (the Merced Airport Industrial Park) for the most part, but some residential/commercial land is located on the outer limits of some of the Merced County Airport Land Use Compatibility Zones (the Plan adopted in 1995 but due for an update). The City has always strived to avoid residential land use designations adjacent to the Merced Regional Airport in order to protect its long-term future. When residential development is allowed to locate adjacent to airports, many times airport operations suffer due to noise, safety, and other complaints. The City is committed to minimizing as much as feasible the noise impacts of the Airport per the Implementing Actions above.

Policy N-1.2
Reduce Surface Vehicle Noise

Implementing Actions:

1.2.a Continue to discourage truck traffic and through traffic in residential areas in Merced.

1.2.b Evaluate the need to prepare and adopt a Noise Ordinance for the City of Merced.

1.2.c New development of noise-sensitive land uses may not be permitted in areas exposed to existing or projected levels of noise from transportation noise sources which exceed the levels specified in Table N-3, unless the project design includes effective mitigation measures to reduce exterior noise and noise levels in interior spaces to the levels specified in Table N-3.

1.2.d Noise created by new transportation noise sources shall be mitigated to the extent feasible so as not to exceed the levels specified in Table N-3 at outdoor activity areas or interior spaces of existing noise-sensitive land uses.

1.2.e It is anticipated that roadway improvement projects will be needed to accommodate build-out of the General Plan. Therefore, existing noise-sensitive uses may be exposed to increased noise levels due to roadway improvement projects as a result of increased roadway capacity, increases in travel speeds, etc. It may not be practical to reduce increased traffic noise levels consistent with those contained Table N-3. Therefore, as an alternative, the following criteria may be used for roadway improvement projects:

- **Where existing traffic noise levels are less than 60 dB L_{dn} at the outdoor activity areas of noise-sensitive uses, a +5 dB L_{dn} increase in noise levels due to roadway improvement projects should be mitigated to the extent feasible; and,**
- **Where existing traffic noise levels range between 60 and 65 dB L_{dn} at the outdoor activity areas of noise-sensitive uses, a +3 dB L_{dn} increase in noise levels due to roadway improvement projects should be mitigated to the extent feasible; and,**
- **Where existing traffic noise levels are greater than 65 dB L_{dn} at the outdoor activity areas of noise-sensitive uses, a + 1.5 dB L_{dn} increase in noise levels due to roadway improvement projects should be mitigated to the extent feasible.**

In order to minimize noise impacts associated with vehicular traffic, the City will use the above implementing actions to address new development proposals. The City designates truck routes (in Merced Municipal Code Section 10.40) that minimize truck traffic through residential areas. The City does not currently have a noise ordinance—noise complaints are currently addressed through nuisance regulations, but adoption of a noise ordinance should be considered in order to provide better guidance on acceptable community noise levels for residents in relation to loud music, construction hours, etc.

Policy N-1.3
Reduce Equipment Noise Levels

Implementing Actions:

1.3.a Limit operating hours for noisy construction equipment used in the City of Merced.

1.3.b Review City functions (e.g. construction, refuse collection, street sweeping, tree trimming) to insure that noise generated by equipment has been reduced to the lowest practicable level.

1.3.c Include maximum noise level permitted for City equipment purchases and construction contracts.

The Inspection Services Division currently addresses noise levels for construction equipment on a case-by-case basis, but adoption of a City Noise Ordinance could provide additional guidance (if one is adopted). The City will continue to review and monitor noise generated by City functions and seek to reduce noise levels to the practical extent feasible.

Policy N-1.4
Reduce Noise Levels at the Receiver where Noise Reduction at the Source is Not Possible

Implementing Actions:

1.4.a Require new residential projects to meet acceptable noise level standards as follows:

- **A maximum of 45 dB Ldn/CNEL for interior noise level for residential projects.**
- **A maximum of 65 dB Ldn/CNEL for exterior noise level for residential projects proximate to major road way and railroad corridors. For other arterial, collector and local streets a maximum of 60 dB Ldn/CNEL exterior noise with a maximum of 65 dB Ldn/CNEL when all the best available noise-reduction techniques have been exhausted without achieving 60 dB, and the strict application of such a maximum becomes a hindrance to development needed or typical for an area.**
- **For Railroad operations the standard shall be 65 dB L_{dn}/CNEL or less for exterior noise level using a practical application of the best-available noise reduction measures. An exterior noise level of up to 70 dB L_{dn}/CNEL may be allowed provided that available exterior noise level reduction measures have been implemented and interior noise levels are in compliance with Table N-3.**

1.4.b Encourage Merced County Airport Land Use Commission to update the Airport Land Use Compatibility Plan, especially for Castle Airport, and to require stringent noise reduction standards as applied at other airports in the County.

1.4.c Use the "normally acceptable" noise levels as established in the "Noise and Land Use Compatibility Guidelines" for the review of non-residential land uses.

Where it is not possible to reduce noise levels at the source, the City will seek to minimize noise levels at the receiver through the above Implementing Actions. Noise abatement techniques are varied, but include sound walls or barriers, landscaping, additional building insulation for noise, strategic placement of windows and bedrooms away from noise sources, site and building designs to shield outdoor spaces from excessive noise, etc. The Merced County Airport Land Use Compatibility Plan needs to be updated for all Merced County Airports, but especially for Castle Airport to reflect the absence of military aircraft after the closing of Castle Air Force Base. The County should require stringent noise reduction standards for Castle Airport equivalent or greater to those standards applied at other airports in the County.

Policy N-1.5
Coordinate Planning Efforts so that Noise-Sensitive Land Uses are not Located Near Major Noise Sources

Implementing Actions:

1.5.a New development of noise-sensitive uses should not be allowed where the noise level due to noise sources will exceed the exterior noise level standards of Table N-1 as measured immediately within the property line or within a designated outdoor activity area (at the discretion of the Director of Development Services) of the new development, unless effective noise mitigation measures have been incorporated into the development design to achieve the standards specified in Table N-1.

1.5.b Noise created by new proposed non-transportation noise sources should be mitigated to the extent feasible so as not to exceed the exterior noise level standards of Table N-1 as measured immediately within the property line of lands designated for noise-sensitive uses.

1.5.c The City of Merced shall also apply an interior maximum nighttime noise level criterion (Lmax) of 50 dB in bedrooms for new residential uses affected by a non-transportation noise source.

1.5.d Where proposed non-residential land uses are likely to produce noise levels exceeding the performance standards of Table N-1, or the maximum interior noise level criterion, at existing or planned noise-sensitive uses, an acoustical analysis, at the discretion of the Director of Development Services, may be required as part of the environmental review process so that noise mitigation may be included in the project design. The general requirements for the content of an acoustical analysis are given by Table N-2.

1.5.e Create a master noise contours map to be used in the review and approval process for development proposals

1.5.f As feasible, require noise barriers and/or increased setbacks between heavy circulation corridors and noise-sensitive land uses.

Table N-1
Exterior Noise Level Performance Standards for New Projects
Affected by or Including Non-Transportation Noise Sources

Noise Level Descriptor	Daytime (7 a.m. to 10 p.m.)	Nighttime (10 p.m. to 7 a.m.)
Hourly L_{eq}, dB	55	45

Each of the noise levels specified above shall be lowered by five dB for simple tone noises, noises consisting primarily of speech or music, or for recurring impulsive noises (e.g., humming sounds, outdoor speaker systems). These noise level standards do not apply to residential units established in conjunction with industrial or commercial uses (e.g., caretaker dwellings).

The City can impose noise level standards that are more restrictive than those specified above based upon determination of existing low ambient noise levels.

Fixed noise sources which are typically of concern include, but are not limited to the following:

The types of uses which may typically produce the noise sources described above include but are not limited to: industrial facilities including pump stations, trucking operations, tire shops, auto maintenance shops, metal fabricating shops, shopping centers, drive-up windows, car washes, loading docks, public works projects, batch plants, bottling and canning plants, recycling centers, electric generating stations, race tracks, landfills, sand and gravel operations, and athletic fields.

HVAC Systems	Cooling Towers/Evaporative Condensers	Pump Stations
Lift Stations	Emergency Generators	Boilers
Steam Valves	Steam Turbines	Generators
Fans	Air Compressors	Heavy Equipment
Conveyor Systems	Transformers	Pile Drivers
Grinders	Drill Rigs	Gas or Diesel Motors
Welders	Cutting Equipment	Outdoor Speakers
Blowers		

Table N-2
General Requirements for an Acoustical Analysis
(Modifications may be approved at the discretion of the Director of Development Services)

An acoustical analysis prepared pursuant to the Noise Element should:

A. Be the financial responsibility of the applicant.

B. Be prepared by a qualified person experienced in the fields of environmental noise assessment and architectural acoustics.

C. Include representative noise level measurements with sufficient sampling periods and locations to adequately describe local conditions and the predominant noise sources.

D. Estimate existing and projected cumulative (20 years) noise levels in terms of L_{dn} or CNEL and/or the standards of Table N-1, and compare those levels to the adopted policies of the Noise Element.

E. Recommend appropriate mitigation to achieve compliance with the adopted policies and standards of the Noise Element, giving preference to proper site planning and design over mitigation measures which require the construction of noise barriers or structural modifications to buildings which contain noise-sensitive land uses.

F. Estimate noise exposure after the prescribed mitigation measures have been implemented.

G. Describe a post-project assessment program that could be used to evaluate the effectiveness of the proposed mitigation measures.

The above Implementing Actions will be used in City Planning efforts in order to ensure that noise sensitive land uses are not located adjacent to major noise sources or if they are, that the noise impacts are minimized as much as possible, using the standards described above.

Policy N-1.6
Mitigate All Significant Noise Impacts as a Condition of Project Approval for Sensitive Land Uses

Implementing Actions:

1.6.a Where noise mitigation measures are required to achieve the standards of Tables N-1 and N-3, the emphasis of such measures should be placed upon site planning and project design. The use of noise barriers should be considered a means of achieving the noise standards only after all other practical design-related noise mitigation measures have been integrated into the project.

1.6.b Where noise-sensitive land uses are proposed in areas exposed to existing or projected exterior noise levels exceeding the levels specified in Table N-3 or the performance standards of Table N-1, an acoustical analysis may be required as part of the environmental review process so that noise mitigation may be included in the project design.

Table N-3
Maximum Allowable Noise Exposure
Transportation Noise Sources

Land Use	**Outdoor Activity Areas[1] L_{dn}/CNEL, dB**			**Interior Spaces**	
	Roadways	**Railroads**	**Aircraft**	**L_{dn}/CNEL, dB**	**L_{dn}dB[2]**
Residential	60/65[3]	65[5]	60[3]	45	--
Transient Lodging	65[4,5]	65[4,5]	65[4,5]	45	--
Hospitals, Nursing Homes	60[3]	65[5]	60[3]	45	--
Theaters, Auditoriums, Music Halls	--			--	35
Churches, Meeting Halls	60[3]	65[5]	60[3]	--	40
Office Buildings	--			--	45
Schools, Libraries, Museums	--			--	45
Playgrounds, Neighborhood Parks	70		75	--	--

1 Where the location of outdoor activity areas is unknown, the exterior noise level standard shall be applied to the property line of the receiving land use.

Where it is not practical to mitigate exterior noise levels at patio or balconies of apartment complexes, a common area such as a pool or recreation area may be designated as the outdoor activity area.

2 As determined for a typical worst-case hour during periods of use.

3 Where it is not possible to reduce noise in outdoor activity areas to 60 dB Ldn/CNEL or less using a practical application of the best-available noise reduction measures, an exterior noise level of up to 65 dB Ldn/CNEL may be allowed provided that available exterior noise level reduction measures have been implemented and interior noise levels are in compliance with this table. For residential uses located adjacent to major roadways such as S.R. 99, S.R. 59, and S.R. 140, the normally acceptable exterior noise level is 65 dB Ldn/CNEL.

4 In the case of hotel/motel facilities or other transient lodging, outdoor activity areas such as pool areas may not be included in the project design. In these cases, only the interior noise level criterion will apply.

5 Where it is not possible to reduce noise in outdoor activity areas to 65 dB Ldn/CNEL or less using a practical application of the best-available noise reduction measures, an exterior noise level of up to 70 dB Ldn/CNEL may be allowed provided that available exterior noise level reduction measures have been implemented and interior noise levels are in compliance with this table.

The above Implementing Actions will be used in the City development process in order to ensure that noise impacts are mitigated to the greatest extent feasible by incorporating noise abatement into project conditions and mitigation measures.

10.4 TECHNICAL DATA

10.4.1 Basic Characteristics of Noise

Noise is sound that the individual considers unwanted, uncomfortable, or aesthetically displeasing. Because noise is a subjective determination, it is possible for one person to consider a sound to be noise and another person to consider the same sound pleasing.

The degree of disturbance from noise depends upon three factors: (1) the amount (amplitude) and nature (frequency) of the intruding noise; (2) the amount of background noise present before the intruding noise; and (3) the nature of the working or living activity of the people occupying the area where the noise is heard. A smooth, continuous flow of noise is more comfortable or acceptable than impulsive or intermittent noise, even though all of these noises might be judged as unwanted. Noises that are more identifiable tend to be more annoying. Other terms defined below are additional characteristics of sound that help determine whether the sound will be considered pleasing or displeasing.

Sound

Sound is a mechanical form of radiant energy which is transmitted in waves through the air (or other medium) and received as vibrations on the ear drum. Sound waves are measured in terms of frequency or number of cycles per second, and in terms of amplitude or decibels.

Frequency (Cycles per Second)

Frequency or pitch is influential in determining the pleasantness of a sound. The human ear can perceive frequencies as low as 15 cycles per second (or Hertz, abbreviated Hz) which would be a very low rumble, and as high as 20,000 cycles per second, a very high screech. The piano ranges from a low of 28 Hz to a high of 4,186 Hz. High frequencies are more irritating to the human ear and can make a low volume noise seem noisier.

Amplitude

Decibels, the unit of measurement for amplitude, make up a logarithmic scale. Instead of increasing arithmetically, as in cycles per second, decibels increase exponentially as is characteristic with the Richter Scale used in measuring the force of an earthquake. There are several adaptations of the decibel unit of measurement that take into account the way humans react to sound. These adaptations are listed below.

Decibel (A Scale)-dB(a)

The decibel is the unit used for describing the amplitude of sound. The decibel scale is relative to the human ear, with 0 decibels being the threshold of hearing. Because the human ear's perception of sound varies with the frequency, a modified decibel scale (A Scale) has been developed which incorporates the human's greater sensitivity to high frequency sound and lower sensitivity to low frequency sound.

Leq

In measuring a sound that is recurring but not maintaining a constant level, it is necessary to get a sound reading that takes into account the inconsistency of sound. L50 measurements indicate a sound level that is being exceeded 50 percent of the time.

Day-Night Average Sound Levels (LdN)

This method of measuring sound levels incorporates the noise from the individual events and weights them according to time of day of the event. The 24-hour day is divided into two time periods: (1) Day, 7:00 a.m. to 10:00 p.m.; and, (2) Night, 10:00 p.m. to 7:00 a.m. In order to more accurately reflect the annoyance level of day and night-time events, they are weighted by a multiplier of one (1) for day and ten (10) for night. LdN does not measure the actual noise of, for example, passing trains, but rather the average noise over a period of 24 hours. LdN or CNEL are the two descriptors to be used in Noise Elements for local compliance with the State Noise Insulation Standards.

CNEL

Community Noise Equivalent Level (CNEL) is similar to LdN, but with an additional adjustment for the evening hours to account for conversation, relaxation, TV viewing, etc. Along with the 10 dBA penalty for the 10:00 p.m. to 7:00 a.m. hours, 5 dBA is added to the 6:00 p.m. to 10:00 p.m. hours.

Decibel Addition

Decibels progress at a logarithmic rate. As a result, when two sounds of 90 dB(A) are produced together, the combined dB(A) reading will be 93 dB(A) and not 180 dB(A). The following chart can be used to determine the sound level of the combined sounds:

When two decibel values differ by:	***Add the following amount to the higher Figure:***
0 - 1 dB	3 dB
2 - 3 dB	2 dB
4 - 9 dB	1 dB
10 or more dB	0 dB

The human ear, however, perceives a doubling (or halving) of loudness for every change of 10 dB(A).

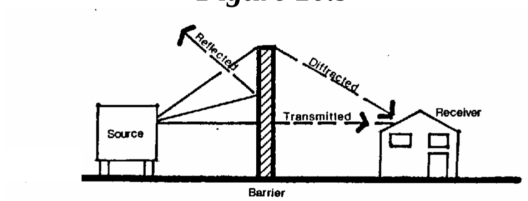
Attenuation

Sound from a localized source spreads out uniformly and the rate of attenuation (sound reduction) is about 6 dB for every doubling of distance, varying somewhat according to humidity, temperature, and other climatic conditions. Therefore, if a sound is 60 dB at 50 feet, it will read 54 dB at 100 feet. At very long distances (greater than a few hundred feet), and especially in a hot, dry climate, the air absorbs a certain amount of high frequency energy and the sound level drops off at a slightly higher rate. For a line source like nonstop automobile traffic, the rate of sound attenuation is 3 dB for each doubling of distance. Because traffic is seldom sufficiently constant to use the line source rate of attenuation, the National Cooperative Highway Research Program has adopted a 4.5 drop-off rate for highway traffic.

Barrier/Noise Reduction Concepts for Noise Attenuation

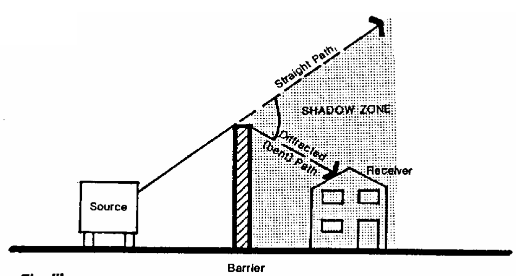
In general, three basic techniques provide noise attenuation: (1) the use of barriers or berms; (2) site design; and, (3) acoustical construction. Acoustical construction is recommended when barriers or site design cannot provide all the attenuation necessary. Basically, acoustical construction reduces the interior noise level of a building, but would not reduce exterior noise levels. In some cases, a quiet exterior environment is as important as the interior environment; therefore, special attention should be given to the type of project that is being reviewed to determine the type(s) of attenuation needed.

Figure 10.9



Several barrier noise reduction concepts shown graphically in ***Figures 10.9*** and ***10.10)*** and are explained as follows: *Diffracted path, transmitted path,* and *reflected path* are the redistribution of the sound energy when a barrier is introduced between the source of the noise and the receiver. If no barrier exists between the noise source and adjoining areas, the sound will travel in a direct path from the source, diminishing only with distance. But, if a barrier is introduced, some attenuation is possible at shorter distances.

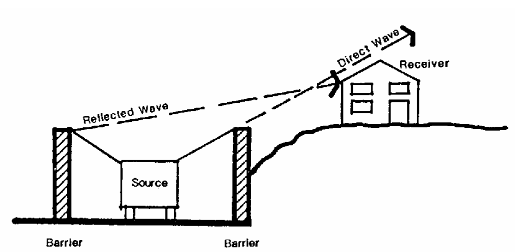
Figure 10.10



The amount of sound that "passes through" a barrier (barrier transmission) depends upon the barrier material weight and stiffness, and the holes or openings in the barrier. In the case of the latter, any openings or holes may seriously degrade the noise reduction since the sound pressure increases upon striking the barrier wall, and results in an amplification of the transmitted sound. Materials that provide a good sound absorption are concrete, masonry, brick, and granite, among others.

As shown in ***Figure 10.9***, sound energy is also reflected by a barrier wall. When there is only one wall used as a sound barrier for a specific receiver, the reflected energy would not affect the receiver and the purpose of attenuating noise is accomplished, even though some noise will be diffracted or transmitted and might reach the receiver. But, when a double noise barrier is involved, additional sound energy can reach the receiver by a reflection from the opposite wall as illustrated in ***Figure 10.11***. If the walls are made of materials which have a good sound absorption rate, the contribution of each reflection will be decreased by the amount that depends upon the absorptive characteristics of the barrier. So, this in turn will usually recover all of the lost noise reduction.

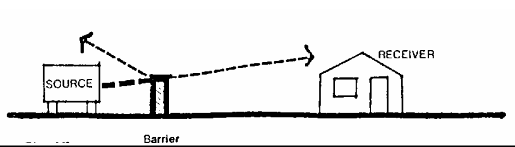
Figure 10.11



Barrier defraction (and attenuation) is the amount of sound waves that can reach a receiver by bending over the top of the barrier. Once the sound is diffracted behind a barrier, it creates a "shadow zone" (***Figure 10.10***). Any receiver located in this area or zone will experience some sound attenuation; the amount of attenuation will depend on the magnitude of the diffraction angle. As the angle increases, the barrier attenuation also increases (see ***Figures 10.11 and 10.12***). The diffraction angle will increase if the barrier height increases, or if the source or the receiver is placed closer to the barrier**.** ***Figure 10.13*** illustrates the effect of moving the barrier closer to the source of noise.

Figure 10.12

Figure 10.13



<u>*Noise Levels Combination*</u>

With a typical sound barrier, the noise levels are reduced by the sound waves being diffracted over the barrier and by the sound waves passing through the barrier. The noise level at the receiver will be the combination of the attenuated levels resulting from each attenuation step. For example, if the starting noise level is 70 dB and the noise level is reduced 10 dB when the sound passes through the wall, then the attenuated level reaching the receiver is 60 dB. On the other hand, if the attenuation provided by the sound waves being diffracted over the barrier is also 10 dB, the attenuated noise reaching the receiver will be 60 dB as well. However, as explained previously, when the two attenuated levels are combined, the final level becomes 63 dB and not 60 dB. Thus, even though the attenuation value of each step was 10 dB, the combined reduction is only 7 dB. Noise levels combine in such a way that only when the difference between levels is less than 10 dB does it affect the combined noise level.

Site planning can also be used as a tool for noise reduction. Many site planning techniques can be employed to protect sensitive uses from excessive noise. These are among others: (1) increasing the distance between the noise source and the receiver; (2) placing noise compatible land uses (parking, utility rooms, maintenance buildings, etc.) between the source and the receiver; (3) locating the barrier-type facility or building parallel to the noise source; and, (4) orienting the noise-sensitive use away from the source of noise. All these techniques can be used to attenuate the actual noise reaching a noise-sensitive land use, without adding an excessive burden or cost to a specific proposal.

10.4.2 Psychological and Physiological Effects of Noise

The psychological and physiological effects of noise have been studied, but not to such an extent that conclusions can be drawn with any degree of finality. Further research may determine that existing noise levels are, and have been, having a severe impact on health, or it may find that human beings can tolerate much higher everyday noise levels without ill effects. The following discussion describes three areas where concern has encouraged research. While the results of this research are not conclusive, the potential damage should be sufficient to warrant concern. According to the U.S. Environmental Protection Agency (EPA), “There is no definitive evidence that noise can induce either neurotic or psychotic illness. There is evidence that the rate of admissions to mental hospitals is higher from areas experiencing high levels of noise from aircraft operations than in similar areas with lower levels of noise.”

<u>*Hearing Ability*</u>

Clear evidence is available that noise with A-weighted sound levels above 80 decibels can contribute to inner ear damage and eventual hearing handicap if such noises are frequently and regularly encountered. A slight hearing loss at an early age may be considered insignificant. However, when combined with the natural decrease in hearing ability due to old age, the total hearing loss may become significant. The exposure to a combination of noise sources may be damaging even though exposure to the same sources individually is not. For this reason, any significant noise sources should be included in the study of the overall community noise exposure level.

Sleep

Men and women vary in sensitivity to noise during sleep. Research points out that sleep disturbance from subsonic-aircraft noise or sonic booms is greater for middle-aged women than for middle-aged men. Thus, it appears that women's sleep is more easily disturbed by noise than is men's, even when other variables such as motivation and stage of sleep are equated. In other research, it was found that people over 60 years of age are more sensitive to noise while sleeping and, if awakened, find it more difficult to fall back to sleep compared to people in other age groups.

The highest degree of adaptation to noise will probably be apparent in not awakening or awakening for shorter periods. It will be less likely that the individual will adapt to an extent that upwards shifts from deep to light sleep are experienced, and it is improbable that there will be complete adaptation as shown in responses to the electroence-phalogram (EKG-method of measuring heart rhythms) and in changes in heart rate and blood flow. In other words, while the individual may think he is completely adapting to the high noise level, he is probably only adapting partially; instead of awakening, he is moving into a lighter stage of sleep, or instead of moving into a lighter stage of sleep, he is registering changes in blood flow and heart rate and rhythm.

10.4.3 Social and Economic Effects of Noise

Social Effects

High noise levels can disrupt normal communications and cause people to change their behavior so that the noise is lessened or avoided. To some people, these changes merely indicate an adaptation to the stimulus and are unlikely to do any great harm; others find the disruption and adaptation behavior to be equally damaging in that they both discourage spontaneity. The following comments review the types of effects noise can have on communication and behavior patterns of people.

Communication

Distances between people while talking varies with the situation. In one-to-one personal conversations, the distance is usually around five feet with noise level as high as 66 dB(A). In group situations, the distance maintained is somewhere between five and twelve feet with background noise levels of no more than 50 to 60 dB(A). For outdoor gatherings where distances range from 12 to 30 feet, any noise level higher than 45 to 55 dB(A) will hinder communications.

Behavior Patterns

Not being able to communicate spontaneously or without difficulty will affect the behavior patterns of people. In one area that was subjected to high noise levels from aircraft, the impact on the community was evident in the schools. The NEF 30 or greater noise level meant that the teaching was interrupted for a total of an hour each day and a "jet pause" teaching style had to be adopted to accommodate the noise. According to the Jamaica Bay Environmental Study Group, the noise interference goes beyond the periods of enforced non-communication, for it destroys the spontaneity of the educational process and subjects it to the rhythm of the aeronautical control system.

Even when people claim they are "used to" the high noise levels, there is evidence that they have changed their behavior to suit the interference; that is, they adopt a "non-communicating lifestyle" using less verbal communication and more non-verbal techniques: gestures, posture, and facial expressions. Among adults, free and easy speech communication is probably essential for full development of social relations and self.

Economic Effects

The economic effects of noise range from the involuntary costs associated with lowered property values and decreased worker output, to the voluntary costs of mitigating the noise problem. In many cases, the economic benefits of a project are used as the sole determinants and little attention is given to the effects on the individual's psychological, physiological, social, and economic well-being.

Property Values

Property values can be negatively affected by noise. In San Francisco, it was found that the noise variable was a statistically significant determinant of property values in a majority of cases cited. In other studies, the relationship between noise and property values was confused by the rapid turnover (and, therefore, more frequent tax assessments) of housing in high noise areas. The property values in high noise areas appeared not to have been affected by the noise since the higher number of reassessments had brought the value of the house up at a more rapid rate.

Job Production

High noise levels may affect worker output and worker safety. According to the EPE, a tired and nervous person is obviously not as attentive or able to concentrate on the tasks that he is performing as a rested and relaxed person; i.e., noise can contribute to making a person more prone to accidents in both the home and the work environment.

Mitigation Costs

Mitigating measures can be implemented at the noise source or at the point of reception. The amount of exposure to noise is most efficiently regulated at the same source since the individual is free to participate in activities at innumerable locations that can expose him to high noise levels. However, costs of insulating houses, constructing barriers, and obtaining easements should also be considered as long as the City does not have jurisdiction over most of the sources of noise. Examples on noise abatement techniques are included in Section 10.4 of this Noise Element.

Products have been developed that reduce the noise generated by such things as garbage trucks, waste disposal units, truck exhaust, and garbage cans. The adoption of these products will probably take legislation since invariably the newer, more silent product is also more costly to produce. According to the EPA, with the rapid growth in noise sources within the home...and with the growth in noise-density, due to increased population concentration, these annoyance effects and the associated economic costs are likely to increase dramatically in the near future.

10.4.4 Noise Pollution Standards

As noise levels have risen, Federal, State, and local governments have become more concerned and more willing to consider methods for reducing exposure to noise. These methods include setting limits on the noise levels that can be produced by a piece of equipment and limiting the noise that can be experienced by a particular land use.

Related Federal Standards

The U. S. Department of Housing and Urban Development sets criteria and standards for noise acceptability for its Housing programs.

Related State Regulations

California Administrative Code, Title 21, Subchapter 6, establishes noise criteria for civilian airports in California, whereas the 65 dB(A) CNEL contour is established as the boundary for requiring residential development to provide adequate mitigation. Measures for mitigation are specified to attain land use compatibility with respect to aircraft/ airport noise.

Title 24 of the California Administrative Code regulates interior noise levels within multiple-occupied dwellings affected by noise from traffic, aircraft operations, railroads, and industrial facilities. The California Vehicle Code sets noise emission standards for new vehicles, including autos, trucks, motorcycles, and off-road vehicles. Section 216 of the Streets and Highways Code regulates traffic noise as received at schools near freeways. The California Environmental Quality Act (CEQA) includes noise as one of the factors in determining environmental impacts.

Local Standards

The City of Merced Municipal Code (MMC) section which pertains to noise is 8.08.090 (11), "Conditions Declared Nuisance." The reference to noise problems is within the category of "any other condition or use of property" which is a public nuisance under law. Title 17 of the MMC also deals with noise as a result of the adoption of the Building Code. Indirectly, noise levels are being regulated by land use planning, as in the establishment of truck routes, which are designated in Section 10.40 of the MMC. When enforced, the regulations and standards contribute to a quieter environment. Section 10.3, "Noise Goals, Policies, and Actions," of this Noise Element is intended to guide continued and expanding efforts to reduce noise and noise impacts in Merced.