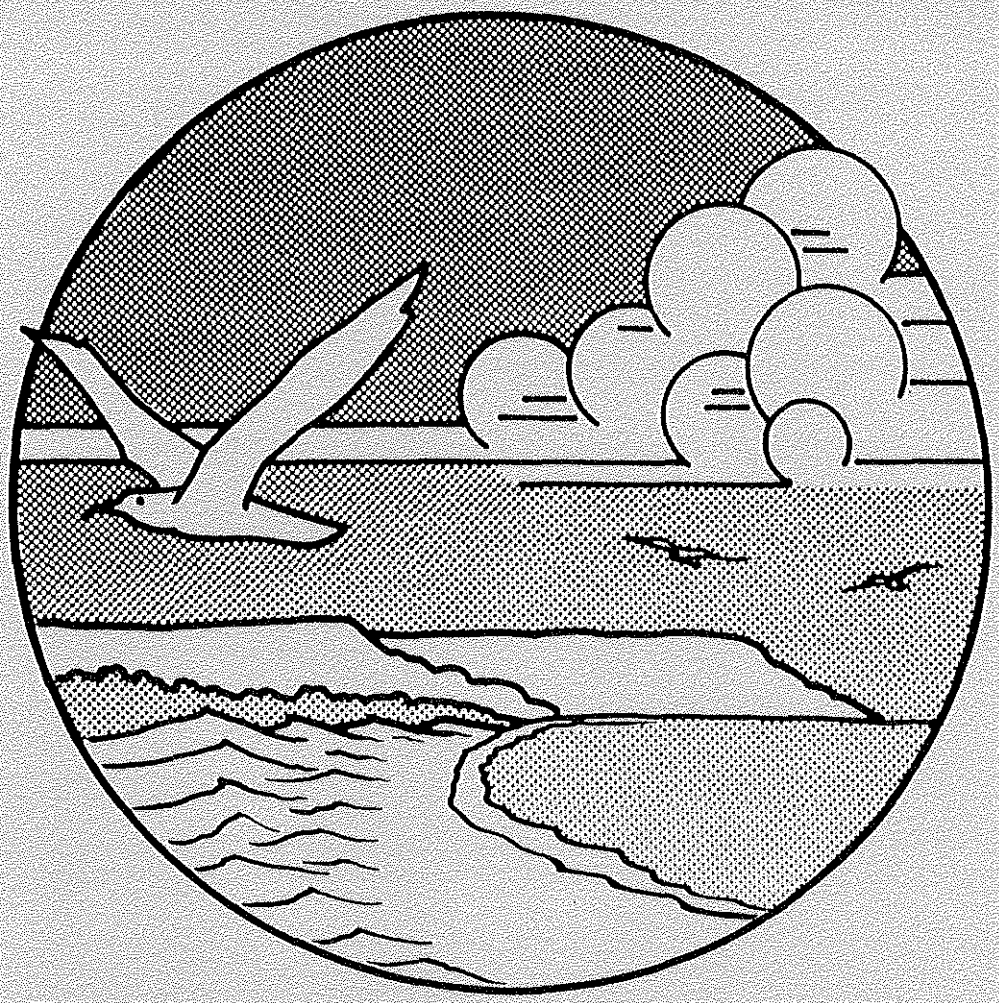
CITY OF GROVER BEACH



GENERAL PLAN
NOISE ELEMENT

CITY OF GROVER BEACH
GENERAL PLAN

NOISE ELEMENT

Volume 1 - Policy Document
Volume 2 - Technical Reference Document
Volume 3 - Acoustical Design Manual

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THE GENERAL PLAN

Grover Beach's General Plan is composed of sections called "elements". Each element focuses upon a topic as required or allowed by State law. Each element carries equal weight and must be consistent with the other elements. The following elements comprised the General Plan on March 1, 1993:

Element Title	Adoption or Last Major Revision Date
Land Use	12/7/92
Housing	11/3/86
Circulation	1/18/88
Open Space and Conservation	8/6/73
Parks and Recreation	7/15/91
Noise	1/3/77
Scenic Routes	11/2/81
Safety	1/3/77
Seismic Safety	9/2/75

The City Planning Department is currently updating the Housing and Noise elements. Some elements may be combined in the future.

CITY OF GROVER BEACH - COMMUNITY DEVELOPMENT DEPARTMENT

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CITY OF GROVER BEACH
GENERAL PLAN

NOISE ELEMENT, VOLUME 1
POLICY DOCUMENT

Adopted by City Council Resolution No. 93-23
June 21, 1993

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CHAPTER 1 INTRODUCTION

1.1 Purpose and Scope

This Noise Element of Grover Beach's General Plan consists of three documents: the Policy Document (Volume 1), a Technical Reference Document (Volume 2), and an Acoustical Design Manual (Volume 3).

The Policy Document describes the policies through which noise impacts are to be addressed in the City of Grover Beach. The Technical Reference Document identifies and discusses existing and future noise within the City. It is intended that the Technical Reference Document serve as a reference for City staff during the development review process on issues relating to the measuring and effects of noise. The Acoustical Design Manual provides guidance, including an offering of standard noise mitigation packages, on how to mitigate noise and prevent future land use conflicts as a result.

This Noise Element is designed to minimize future noise conflicts. A noise ordinance is necessary to address current noise levels. Some noise sources, such as traffic on public roadways, railroad operations and aircraft in flight, are protected by State and/or Federal regulations from municipal regulation. Any noise level standards contained within an ordinance should be consistent with the standards and policies contained within this Noise Element.

The Government Code requires this Element to include noise exposure information for the following major noise sources:

1. Highways and freeways
2. Primary arterial and major local streets
3. Aircraft and airport operations
4. Railroad operations
5. Local industrial facilities
6. Other stationary sources

These major noise sources are the creators and senders of noise.

The noise-sensitive receivers are identified in this Element as:

1. Residential development
2. Schools
3. Nursing homes and hospital-type facilities
4. Churches
5. Meeting halls, auditoriums, theaters and libraries
6. Motels, hotels and transient lodging
7. Parks and playgrounds
8. Office buildings

Naturally, noise receivers can also send noise. One of the major purposes of this Element is to prevent major noise impacts upon proposed noise-sensitive receivers by requiring the potential receiver to include noise mitigation measures during the development review process. A second major purpose of the Element is to prevent the development or creation of additional major noise senders, whenever possible.

Research and expertise for this Noise Element was provided by Brown-Buntin Associates, Inc. of Visalia, California through a contract with the County of San Luis Obispo and most, if not all, of the cities of San Luis Obispo County, including the City of Grover Beach. The draft Noise Element provided to Grover Beach contained information and references to other contracting jurisdictions which the staff of the City of Grover Beach believed to be distracting if included within this City's Noise Element. The consultant's draft documents were, therefore, modified to uniquely reflect Grover Beach's needs.

1.2 Authority and Compliance

The contents of the Noise Element and the methods used in its preparation were determined by Section 65302 (f) of the California Government Code and by the Guidelines for the Preparation and Content of Noise Elements of the General Plan adopted and published by the California Office of Noise Control (ONC) in 1976. This Noise Element complies with Government Code Section 65302 (f).

The ONC Guidelines require that major noise sources and areas containing noise-sensitive land uses be identified and quantified by preparing generalized noise exposure contours for current and projected conditions. Contours may be prepared in terms of either the Community Noise Equivalent Level (CNEL) or the Day-Night Average Level (L_{dn}), which are descriptors of total noise exposure at a given location or an annual average day. CNEL and Ldn are generally considered to be equivalent descriptors of the community noise environment within plus or minus 1.0 Db. (See Chapter 2 for definitions of terminology used in this document.)

1.3 Relationships of General Plan Elements

The Noise Element is related to the Land Use, Housing, Conservation, and Open Space Elements of the City's General Plan. Recognition of the interrelationship of noise and the other mandated elements is necessary to prepare an internally consistent general plan. A summary of some important relationships follow:

1. Land Use: The Noise Element provides noise exposure information for use in the Land Use Element. Together these two elements show acceptable land uses in relation to existing and projected noise levels.

2. Housing: Noise exposure information must be considered when planning the locations of new housing. The State Noise Insulation Standards may influence the construction and location of multi-family housing.

3. Circulation: Noise exposure information will be a decisive factor in the location and design of new circulation facilities, and in the mitigation of noise produced by existing circulation facilities. Of special concern are roads which carry a significant number of trucks and railroad operations.

4. Open Space: Noise exposure should be considered when planning for open space and recreational pursuits. Open space can also serve as a buffer between noise sources and noise-sensitive areas.

CHAPTER 2 DEFINITIONS

The following terms are used in the Noise Element Policy Document, Acoustical Design Manual, and Technical Reference Document. Unless otherwise stated, all sound levels used in this Noise Element are A-weighted decibels (dB).

A-Weighted Sound Level: The sound level obtained by using the A-weighting filter of a sound level meter, expressed in decibels (dB). A-weighting de-emphasizes the very low and very high frequencies of sound in a manner similar to the human ear. Most community noise standards use A-weighting, as it provides a high degree of correlation with human annoyance and health effects.

Community Noise Equivalent Level (CNEL): The equivalent energy (or energy average) sound level during a 24-hour day, obtained after addition of approximately five decibels to sound levels in the evening from 7:00 p.m. to 10:00 p.m. and ten decibels to sound levels in the night before 7:00 a.m. and after 10:00 p.m. The CNEL is generally computed for annual average conditions.

Day/Night Average Sound Level (L_{dn}): The equivalent energy (or energy average) sound level during a twenty-four (24) hour day, obtained after the addition of 10 dB to sound levels in the night after 10 p.m. and before 7 a.m. The Ldn is generally computed for annual average conditions.

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

Equivalent Sound Level (L_{eq}): The sound level containing the same total energy as a time varying signal over a given sample period. Thus, the L_{eq} is a single-valued level that expresses the time-averaged total energy of a fluctuating sound level. For example, if 64 dB is measured for 10 minutes, 68 dB is measured for 20 minutes and 73 dB is measured for 30 minutes, the 1-hour L_{eq} is about 71 dB. L_{eq} is typically computed over 1, 8 and 24 hour sample periods.

Impulsive Noise: Noise of short duration, usually less than one second, with an abrupt onset and rapid decay.

New Development: Projects requiring land use or buildings permits, but excluding remodelling or additions to existing structures. Includes modifications to existing stationary noise sources that increase noise levels.

Noise Exposure Contours: Lines drawn about a noise source indicating constant noise exposure levels. CNEL and Ldn contours are frequently used to describe community noise exposure.

Noise Level Reduction (NLR): The arithmetic difference between the outside and inside sound levels measured in decibels. For example, if the sound level outside a house is 70 dB and the sound level inside the house is 45 dB, the NLR is 25 dB. (70-45=25).

Noise-Sensitive Land Use: The following uses are considered sensitive to noise:

1. Residential development
2. Schools
3. Nursing homes and hospital-type facilities
4. Churches
5. Meeting halls, auditoriums, theaters, and libraries
6. Motels, hotels, and transient lodging
7. Parks and playgrounds
8. Office buildings.

Outdoor Activity Areas: Patios, decks, balconies, outdoor eating areas, swimming pool areas, yards of dwelling units and other areas that have been designated for outdoor activities and recreation.

Resilient Channel (CLIP): A metal device that allows the indirect attachment of an interior wall to a stud or a ceiling to a joist. Resilient channels reduce noise transmissions of walls and roof/ceiling assemblies.

Sound Transmission Class (STC): A single-numbered rated system used to determine the amount of noise reduction a window, door or other building component provides. The higher the STC rating the higher the NLR. Windows and doors having a minimum STC rating are sometimes required to ensure that a building facade will achieve a minimum NLR. STC ratings <u>may</u> <u>not</u> be subtracted from exterior noise exposure values to determine interior noise exposure values.

Stationary Noise Source: Any fixed or mobile source not preempted from local control by existing federal or state regulations. Examples of such sources include industrial and commercial facilities and vehicle movements on private property (e.g., parking lots, truck terminals, auto race tracks, etc.)

Transportation Noise Source: Traffic on public roadways, railroad line operations and aircraft in flight.

CHAPTER 3 EXISTING AND FUTURE NOISE ENVIRONMENT

3.1 Overview of Noise Sources

There are a number of significant noise sources within Grover Beach. These include traffic on State Highway One, Grand Avenue, and other major roadways; railroad operations; and industrial and commercial activities. The Technical Reference Document discusses noise levels produced by these sources and their effects upon people.

3.2 Methods Used to Develop Noise Exposure Information

Analytical noise modeling techniques were used in conjunction with actual field noise level measurements to develop generalized L_{dn} or CNEL contours for major noise sources within the City for existing and future conditions.

The analytical methods used in the preparation of this Element closely follows ONC recommendations. Methods include the FHWA Highway Traffic Noise Prediction Model for roadway sources, the Wyle Laboratories method for determining railroad noise exposure and the FAA Integrated Noise Model for aircraft/airport noise source assessment.

Information developed does not include all conceivable noise sources of industry, commerce and agriculture. Information gathered is a representative sampling of typical noise sources. The noise exposure information developed for this Element should only be used as an indicator of potential noise impacts when other, similar sources are concerned.

3.3 Determining Noise Exposure Information for Specific Locations

Figure 1 shows where noise exposure information for a particular location may be found. Once the noise level is determined for a particular location, it may be determined if a particular proposed use for the location is allowable or if noise mitigation measures can make the location suitable for the proposed use. Note that Table 1 should be consulted to adjust traffic noise exposure in areas with varying topography.

Figure 2 is a flow chart that illustrates the process to be followed when determining noise exposure and appropriate mitigation for specific locations.

TABLE 1
Adjustments to Traffic Noise Exposure for Topography

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

FIGURE 1
Chart for Locating Noise Exposure Information

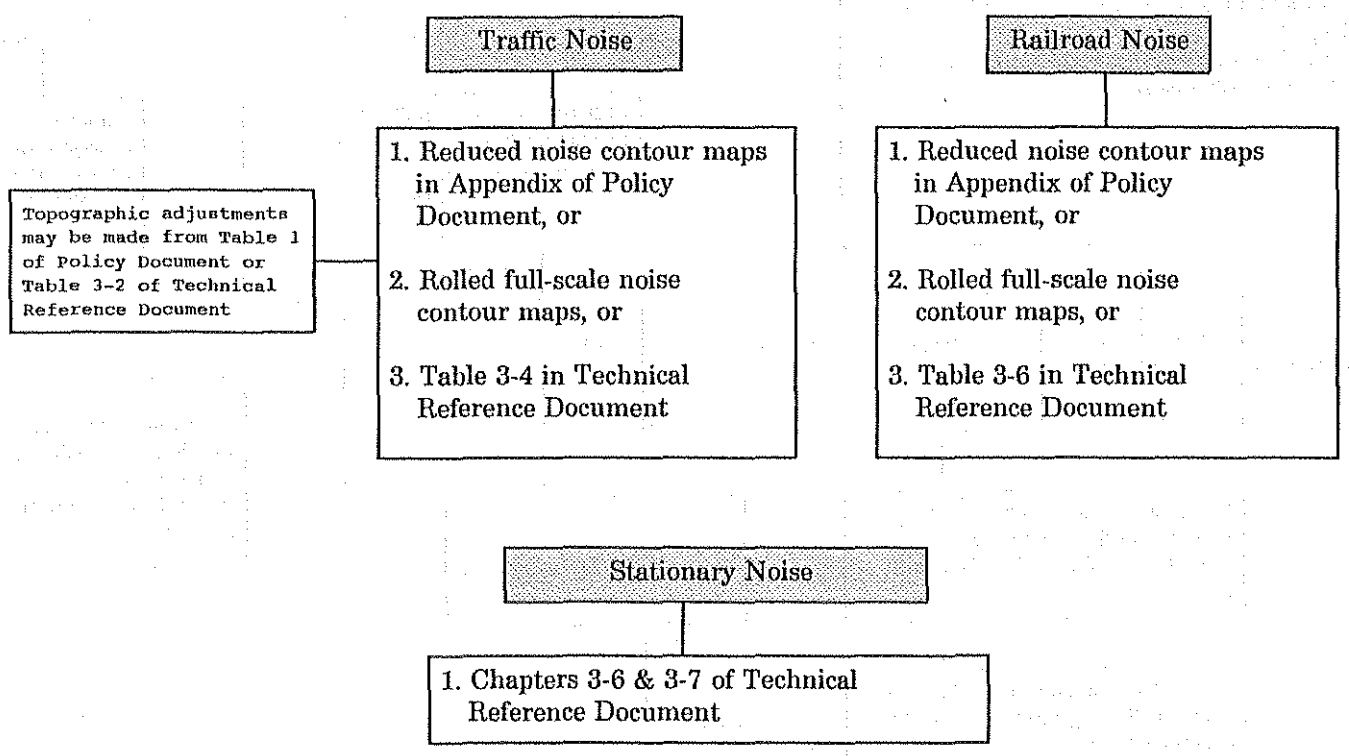
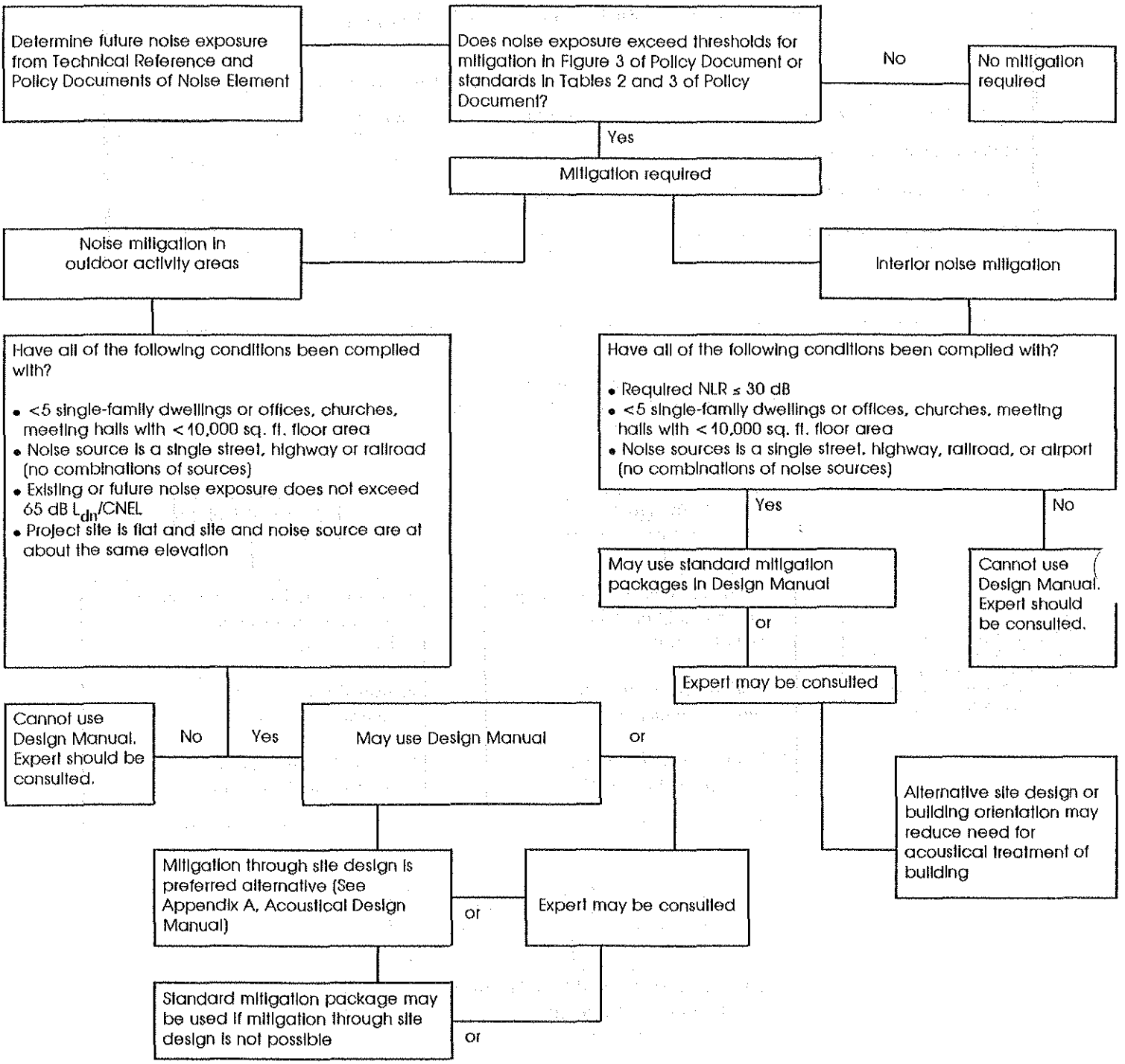


FIGURE 2
Flow Chart for Determining Noise Exposure and Mitigation for New Development



3.4 Community Noise Survey Background

A community noise survey was conducted in the city during August, 1990 to document background noise levels within noise-sensitive land use areas. The survey revealed that Grover Beach was relatively quiet. Noise level data collected during the community noise survey are summarized in Table 2 below. Maximum noise levels are generally caused by local automobile traffic or heavy trucks. Background noise levels in the absence of traffic noise were generally caused by wind, birds, the surf or insects. Noise level standards and policies contained within this Element were adopted to help preserve quiet conditions. A more detailed discussion of the community noise survey may be found in the Technical Reference Document.

TABLE 2
Summary of Community Noise Survey Data
City of Grover Beach

	Level, dB				
Location	L_D	L_N	L_{max} (source)	L_{min} (source)	**Estimated L_{dn}***
Grover Heights Park	50	42	63 (traffic)	40 (distant A/C)	49-53 db
240 No. Eighth Street**	47	39	72	26	50-54 db
Mentone Park	54	39	73 (traffic)	35 (wind)	51-55 db

L_D = Average L_{eq} of two 15-minute samples obtained between 7:00 a.m. and 10:00 p.m. except for sites where 24-hour monitoring was conducted.

L_N = L_{eq} for one 15-minute sample obtained between 10:00 p.m. and 7:00 a.m. except for sites where 24-hour monitoring was conducted.

* L_{dn} estimated from LD and LN

** L_{dn} 24-hour monitoring site

CHAPTER 4 GOALS AND POLICIES

4.1 Goals

The goals of this Noise Element and the City are listed below with policies designed to accomplish the goals.

Goal 1: Protect Grover Beach citizens and visitors from harmful and annoying effects of excessive noise exposure

Goal 2: Protect the Grover Beach's economic base by preventing incompatible land uses from encroaching upon existing or planned noise-producing uses

Goal 3: Preserve residential area tranquility by preventing noise producing uses from encroaching upon existing or planned noise sensitive uses

Goal 4: Educate citizens of the effects of excessive noise exposure and methods available for minimizing exposure

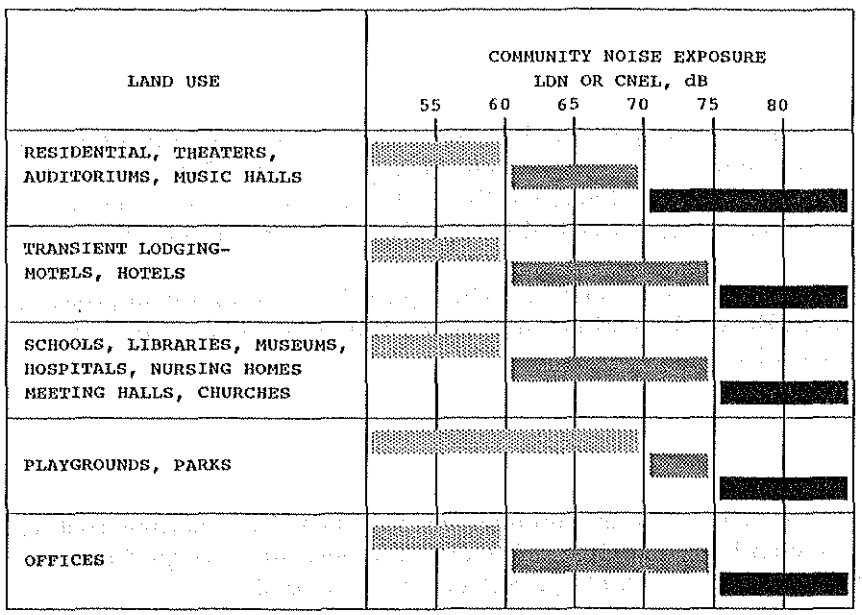
Goal 5: Emphasize the reduction of noise impacts through careful site planning and project design, giving second preference to the use of sound barriers and/or structural modifications to buildings containing noise-sensitive uses

4.2 Land Use Compatibility - Transportation

Figure 3 shows the ranges of noise exposure from transportation noise sources that are considered to be acceptable, conditionally acceptable, or unacceptable for the development of different land uses. Figure 3 is used to determine whether mitigation is needed for development of land uses near major transportation sources.

If the noise level on the development site falls within the chart's **acceptable** range, the project may be approved without mitigation measures. If the noise level on the proposed development site falls within the **conditionally acceptable** range on the chart, the project may be permitted after study and inclusion of mitigation measures in the development process. Sound levels in the **unacceptable** range on the chart normally prohibit development, however, the developer may submit mitigation measures to planning authorities for consideration.

FIGURE 3
Land Use Compatibility Guidelines for New Development Near Transportation Noise Sources*



INTERPRETATION

ACCEPTABLE
Specified land use is satisfactory. No noise mitigation measures are required.

CONDITIONALLY ACCEPTABLE

Use should be permitted only after careful study and inclusion of protective measures as needed to satisfy the policies of the Noise Element.

UNACCEPTABLE

Development is usually not feasible in accordance with the goals of the Noise Element.

* This figure indicates whether mitigation is required. See Table 2 for noise standards.

4.3 Policies

General:

Policy 4.3.1 The noise standards in this chapter represent maximum acceptable noise levels. New development should minimize noise exposure and noise generation.

Transportation Noise Sources:

Policy 4.3.2 Noise-sensitive land uses shall not be permitted in areas exposed to existing or projected future levels of noise from transportation sources which exceed 60 dB L_{dn} or CNEL (70 dB L_{dn}/CNEL for playgrounds and parks) unless the project design includes effective mitigation measures to reduce noise in outdoor activity areas and interior spaces to levels specified for the given land use in Table 2.

Policy 4.3.3 Noise created by new transportation noise sources, including roadway improvement projects, shall be mitigated so they will not exceed the levels specified in Table 2 within the outdoor activity areas and interior spaces of existing noise-sensitive land uses.

Stationary Noise Sources:

Policy 4.3.4 The development of new noise-sensitive uses is prohibited where the noise level from existing stationary noise sources exceeds the standards of Table 3. If noise mitigation measures designed into the project reduce noise levels to the standards of Table 3, the project may be permitted.

Policy 4.3.5 Modifications of existing stationary noise sources that increase noise levels on lands designated for noise-sensitive uses in excess of the standards of Table 3 are prohibited. This policy does not apply to noise levels associated with agricultural uses.

Policy 4.3.6 No new stationary noise sources shall be allowed if they increase the noise on lands designated for noise-sensitive uses to a level that exceeds the standards of Table 3. This policy does not apply to noise levels associated with agricultural uses.

Existing and Cumulative Noise Impacts:

Policy 4.3.7 The City should consider implementing or requiring noise mitigation measures where existing noise levels produce significant noise impacts within noise-sensitive land uses or where new development may result in cumulative increases of noise upon noise-sensitive land uses.

Policy 4.3.8 The City should consider requiring that new City equipment and vehicle purchases include the best-available noise reduction technology at a reasonable cost.

TABLE 2
Maximum Allowable Noise Exposure for New Development
Transportation Noise Sources

Land Use	Outdoor Activity Area[1] L_{dn}/CNEL, dB	Interior Spaces L_{dn}/CNEL, dB	L_{eq},db[2]
Residential	60[3]	45	--
Transient Lodging	60[3]	45	--
Hospitals, Nursing Homes	60[3]	45	--
Theaters, Auditoriums	--	--	35
Churches, Meeting Halls	60[3]	--	45
Office Buildings	60[3]	--	45
Schools, Libraries, Museums	--	--	45
Playgrounds, Neighborhood Parks	70	--	--

1 The exterior noise level standard shall apply to the property line of the receiving land use when the outdoor activity area is unknown.

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

3 An exterior noise level of up to 65 dB L_{dn}/CNEL may be allowed if:
- a. exterior noise level reduction measures were implemented; and
- b. the best-available exterior noise level reduction measures do not result in 60 dB, L_{dn}/CNEL; and
- c. interior noise levels comply with this table.

TABLE 3
Maximum Allowable Noise Exposure for New Development
Stationary Noise Sources[1]

	Daytime (7 a.m. to 10 p.m.)	Nighttime[2] (10 p.m. to 7 a.m.)
Hourly L_{eq}, dB	50	45
Maximum Level, dB	70	65
Maximum Level, dB-Impulsive Noise	65	60

1 As determined at the property line of the receiving use. When determining the effectiveness of noise mitigation measures, the standards may be applied on the receptor side of noise barriers or other property line noise mitigation measures. Add ten decibels to the noise level standards in this table for parks and playgrounds.

2 Applies only where the receiving land use operates or is occupied during nighttime hours.

CHAPTER 5 IMPLEMENTATION MEASURES

Implementation measures prevent new noise-related land use conflicts by requiring proposed projects to be reviewed to determine if they comply with the policies of Chapter 4. Noise exposure maps, which are a part of this Element, are used to determine if a proposed project will be exposed to excessive noise levels that require mitigation. The maps also provide guidance in the long range planning process. The noise exposure maps provide a worst-case assessment of noise exposure for the major noise sources identified in this study. In many cases, the proposed project design review process will review additional noise sources, particularly stationary noise sources, not identified in this study or on the maps.

The project review process will use the information concerning the effects of noise upon people contained in the Technical Reference Document. Also, techniques available for noise control will be reviewed during this process. The Acoustical Design Manual describes standard noise mitigation packages which may be used to reduce inside and outside noise.

Controlling noise at its source and thoughtful location and orientation of receiving uses should take priority over controlling noise during its transmission with noise barriers and acoustical treatments of buildings.

In order to implement the goals and policies of this Element, the following measures can be implemented:

Measure 5.1 The City could review new public and private development proposals to determine conformance with Noise Elements policies.

Measure 5.2 The City could require an acoustical analysis early in the design process whenever there is an indication that a proposed project will exceed the Noise Element's noise standards. Acoustical analyses shall be paid for by the developer-applicant and include mitigation measures (see Table 4 for acoustical analysis requirements). City approved mitigation measures resulting from the analysis shall be included in the project's plans prior to issuance of any building permit.

Measure 5.3 The Community Development Department could waive the requirements for an acoustical analysis if <u>all</u> of the following conditions are met:

Outdoor Activity Areas:

a. The proposed development is less than five single-family dwellings or is a office building, church or meeting hall that has a total project gross floor area of less than 10,000 square feet. No waiver is permitted for apartments, condos or similar residential developments where multiple dwelling units are contained in a single structure or mobile homes when contained in a park or setting containing more than one unit.

b. The noise source in question consists of a single transportation noise source (rail or highway/street) for which current noise exposure information is available. No waiver is permitted for a stationary noise source or when there are multiple transportation noise sources.

c. The existing or projected noise exposures at the exterior of the proposed noise-sensitive building or within the proposed outdoor activity areas of the project site do not exceed 65 dB L_{dn} (or CNEL) prior to mitigation. The existing or project noise exposure for playgrounds and parks may not exceed 75 dB L_{dn} (or CNEL) prior to mitigation.

d. The project area is flat and the noise source and receiving land use are at the same grade.

Interior Spaces:

a. Required Noise Level Reduction (NLR) is equal or less than 30 dB.

b. The development is for less than five single-family dwellings or for offices, churches, meeting halls with less than 10,000 square feet of floor area.

c. The noise source in question consists of a single transportation noise source (rail or highway/street) for which current noise exposure information is available. No waiver is permitted for a stationary noise source or when there are multiple transportation noise sources.

General:

Effective noise mitigation measures, as determined by the planning agency, is incorporated into the project design to reduce noise levels to those specified in Table 2. Mitigation measures may include use of building setbacks, orientations, noise barriers and the standard noise mitigation packages. If closed windows are required to meet interior standards, a mechanical ventilation system or air conditioning will be required by the planning authority.

Measure 5.4 Where mitigation of noise levels in accordance with the policies and standards of this Noise Element is not feasible, the City Council could reduce or waive the applicable policies and standards to the degree needed to allow reasonable use of the property, provided that noise levels are mitigated to the maximum extent feasible.

Measure 5.5 The City's Community Development Department could develop and implement procedures that ensure that noise mitigation measures required by planning authorities are implemented in the development review and building permit processes.

Measure 5.6 The Community Development Department could monitor compliance of completed project with Noise Element policies.

Measure 5.7 The Community Development Department could enforce the State Noise Insulation Standards (California Code of Regulations, Title 24) and Uniform Building Code, Chapter 35.

Measure 5.8 The City Police Department could request the California Highway Patrol and the San Luis Obispo Sheriff's Office to actively enforce the California Vehicle Code sections relating to adequate vehicle muffler and modified exhaust systems.

Measure 5.9 The City Police Department could actively enforce California Vehicle Code muffler and exhaust system regulations and City noise ordinances and regulations.

Measure 5.10 The City planning staff could review and report to the Planning Commission and City Council the need to update or amend the Noise Element in order to ensure the City is using current noise exposure information and that it is amending its specific policies to adjust to changing conditions. Such reports shall be presented every other year after the adoption of this Element and shall also advise of the need to amend or adopt City ordinances.

Measure 5.11 The Acoustical Design Manual could be made available to the public for nominal price and for the purpose of allowing citizens to incorporate noise reduction measures into private projects.

Measure 5.12 Where existing noise levels significantly impact existing noise-sensitive land uses, the City could consider one or more of the following mitigation measures:

a. Reroute traffic to low traffic volume streets or to streets that do not adjoin noise-sensitive uses

b. Reroute trucks to streets that do not adjoin noise-sensitive land uses

c. Construct noise barriers

d. Lower speed limits

e. Acoustically treat buildings

f. Finance low cost loans for noise-impacted property mitigation measures

Measure 5.13 When the result of adding proposed noise from a project to the existing noise is a cumulative effect that exceeds the standards of this Element, the City could consider one or more of the following measures:

a. Reroute traffic to low volume street or to streets not adjoining noise-sensitive land uses

b. Reroute trucks to street not adjoining noise-sensitive uses

c. Construct noise barriers

d. Lower speed limits

e. Acoustically treat buildings

f. Finance low cost loans for noise-impacted property mitigation measures

g. Impose noise mitigation impact developer fees

Measure 5.14 Alternatives to the use of existing noisy equipment by City personnel, such as leaf blowers, could be studied.

TABLE 4

REQUIREMENTS FOR AN ACOUSTICAL ANALYSIS

An acoustical analysis prepared pursuant to the Noise Element shall:

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. Where actual field measurements cannot be conducted, all sources of information used for calculation purposes shall be fully described. When the use being studied is a commercial or industrial use, all noise sources related to the operation, service and maintenance of the facility shall be considered, including but not limited to the following: parking lot and landscape maintenance, refuse collection and truck loading/unloading activities, amplified sound, and outdoor sales and activities.

D. Estimate existing and projected (20 years) noise levels in terms of the descriptors used in Tables 2 and 3, and compare those levels to the adopted policies of the Noise Element. Projected future noise levels shall take into account noise from planned streets, highways and road connections.

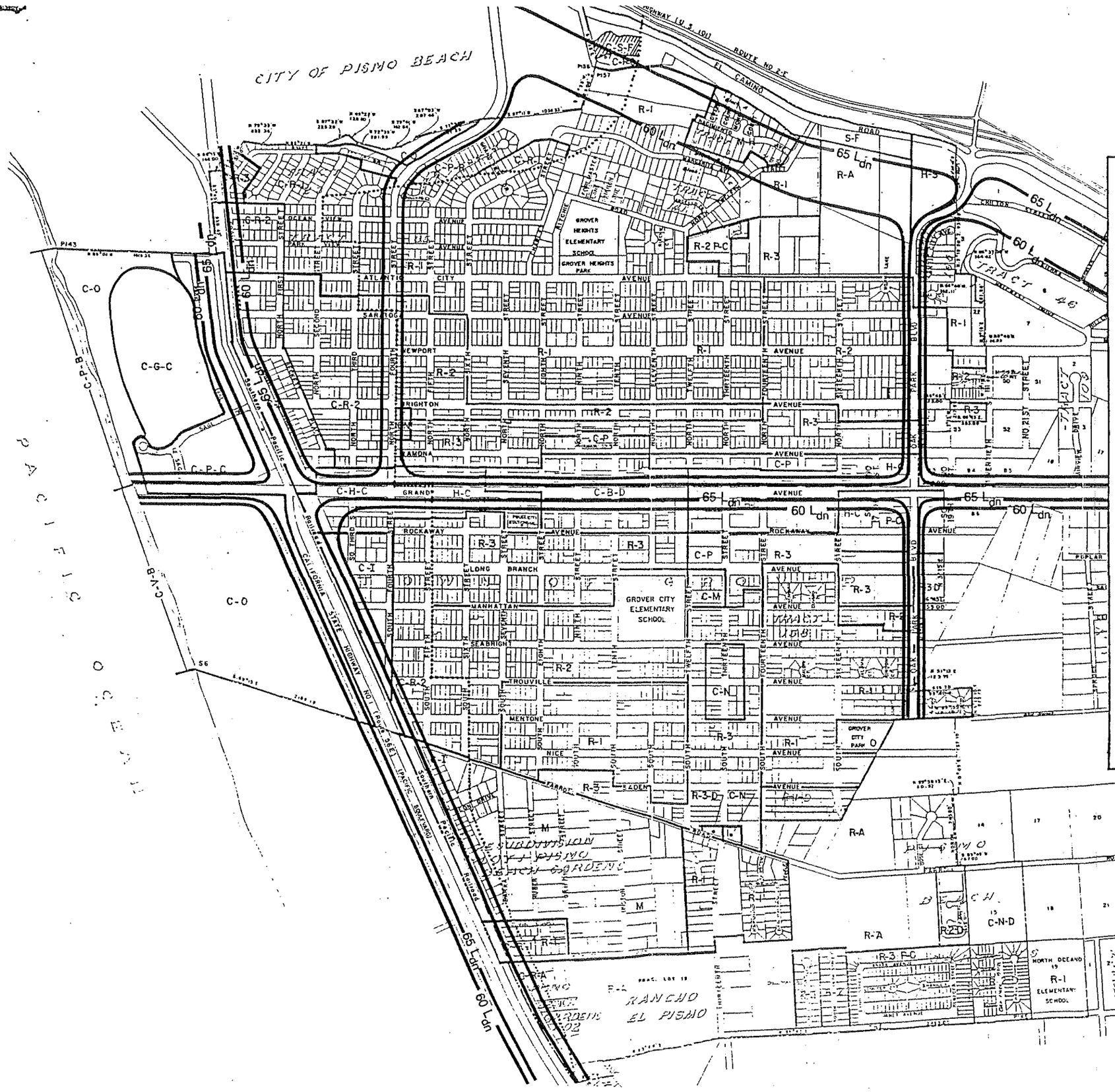
E. Recommend appropriate mitigation to meet or exceed the policies and standards of the Noise Element, giving preference to proper site planning and design over mitigation measures which require the construction of noise barriers or structural modifications to buildings which contain noise-sensitive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

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

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

APPENDIX A

NOISE CONTOUR MAP (1990)



LEGEND

SYMBOL	DISTRICT
R-A	RESIDENTIAL AGRICULTURAL
C-R-A	COASTAL RESIDENTIAL AGRICULTURAL
C-P-R	COASTAL PLANNED RESIDENTIAL
R-1	SINGLE FAMILY RESIDENTIAL
C-R-1	COASTAL SINGLE FAMILY RESIDENTIAL
R-2	DUPLEX RESIDENTIAL
C-R-2	COASTAL RESIDENTIAL
R-3	MULTIPLE RESIDENTIAL
C-R-3	COASTAL MULTIPLE RESIDENTIAL
C-P	COMMERCIAL PROFESSIONAL
C-N	NEIGHBORHOOD COMMERCIAL
C-B-D	CENTRAL BUSINESS DISTRICT
H-C	HIGHWAY COMMERCIAL
C-H-C	COASTAL HIGHWAY COMMERCIAL
C-P-C	COASTAL PLANNED COMMERCIAL
H-S	HIGHWAY SERVICE
C-M	COMMERCIAL MANUFACTURING
M	INDUSTRIAL
C-I	COASTAL INDUSTRIAL
P-C	PLANNED COMMUNITY
O	OPEN SPACE
C-O	COASTAL OPEN SPACE
P-F	PRIMARY FLOOD PLAIN
S-F	SECONDARY FLOOD PLAIN
C-S-F	COASTAL SECONDARY FLOOD PLAIN
S-C	SCENIC CORRIDOR
C-V-B	COASTAL VEHICULAR BEACH
C-P-B	COASTAL PEDESTRIAN BEACH
C-G-C	COASTAL GOLF COURSE
M-H	MOBILE HOME
------	COASTAL ZONE BOUNDARY

Existing Noise Contours

CITY OF GROVER CITY

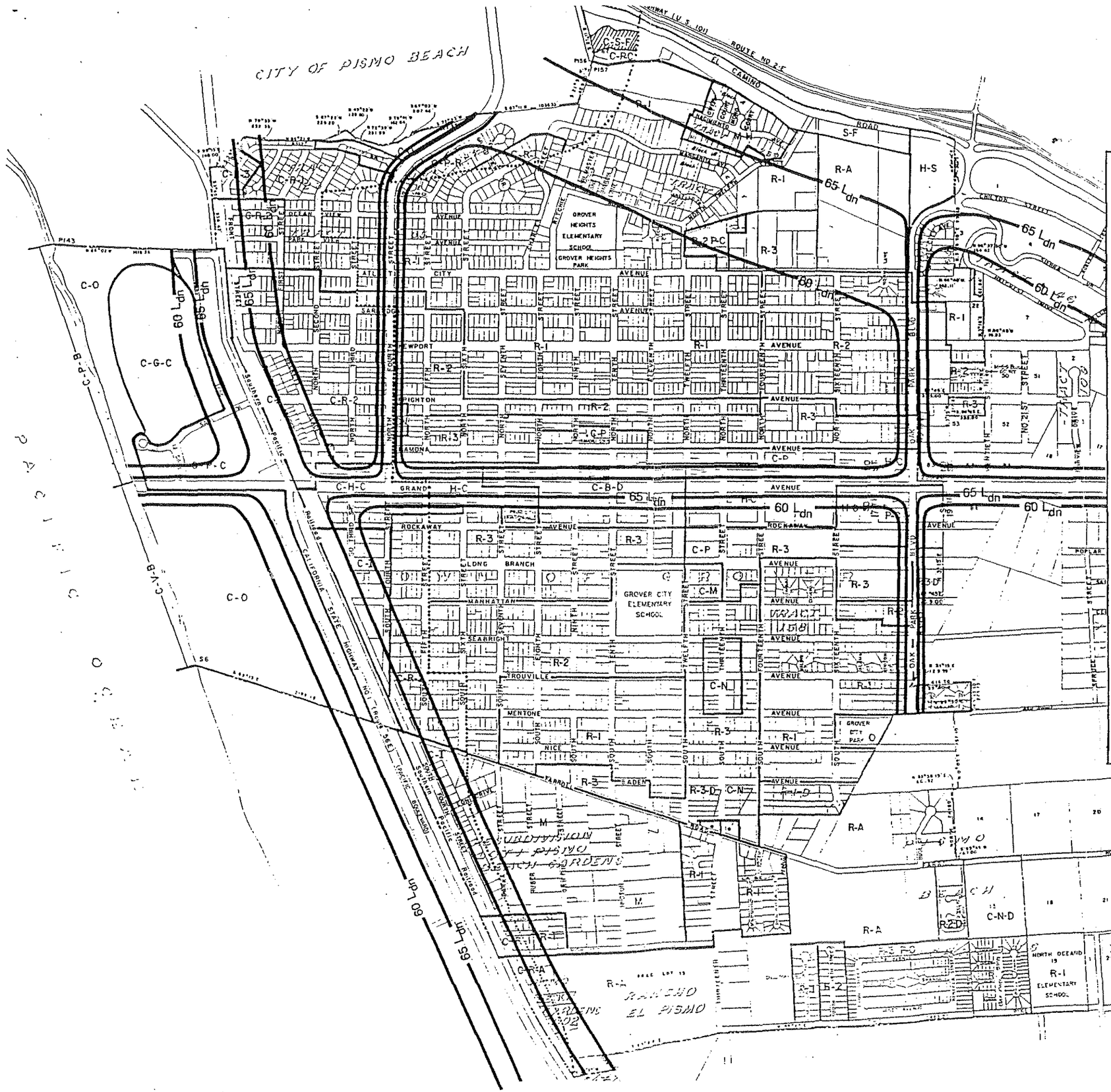
SAN LUIS OBISPO, COUNTY

CALIFORNIA

Scale: 1"=1000'

APPENDIX B

NOISE CONTOUR MAP (BUILDOUT)



LEGEND

SYMBOL	DISTRICT
R-A	RESIDENTIAL AGRICULTURAL
C-R-A	COASTAL RESIDENTIAL AGRICULTURAL
C-P-R	COASTAL PLANNED RESIDENTIAL
R-1	SINGLE FAMILY RESIDENTIAL
C-R-1	COASTAL SINGLE FAMILY RESIDENTIAL
R-2	DUPLEX RESIDENTIAL
C-R-2	COASTAL RESIDENTIAL
R-3	MULTIPLE RESIDENTIAL
C-R-3	COASTAL MULTIPLE RESIDENTIAL
C-P	COMMERCIAL PROFESSIONAL
C-N	NEIGHBORHOOD COMMERCIAL
C-B-D	CENTRAL BUSINESS DISTRICT
H-C	HIGHWAY COMMERCIAL
C-H-C	COASTAL HIGHWAY COMMERCIAL
C-P-C	COASTAL PLANNED COMMERCIAL
H-S	HIGHWAY SERVICE
C-M	COMMERCIAL MANUFACTURING
M	INDUSTRIAL
C-I	COASTAL INDUSTRIAL
P-C	PLANNED COMMUNITY
O	OPEN SPACE
C-O	COASTAL OPEN SPACE
P-F	PRIMARY FLOOD PLAIN
S-F	SECONDARY FLOOD PLAIN
C-S-F	COASTAL SECONDARY FLOOD PLAIN
S-C	SCENIC CORRIDOR
C-V-B	COASTAL VEHICULAR BEACH
C-P-B	COASTAL PEDESTRIAN BEACH
C-G-C	COASTAL GOLF COURSE
M-H	MOBILE HOME
------	COASTAL ZONE BOUNDARY

Future Noise Contours

CITY OF GROVER CITY

SAN LUIS OBISPO COUNTY

CALIFORNIA

Scale: 1"=1000'

CITY OF GROVER BEACH
GENERAL PLAN

NOISE ELEMENT, VOLUME 2
TECHNICAL REFERENCE DOCUMENT

Adopted by City Council Resolution No. 93-23
June 21, 1993

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APPENDIX A FHWA Model Traffic Noise Input Data

CHAPTER 1 INTRODUCTION

This Technical Reference Document is adopted as part of the Noise Element of the General Plan. It provides background information on the data and methods used to prepare noise exposure information for major noise sources within San Luis Obispo County and its incorporated cities in compliance with the Government Code. Information concerning the measurement and effects of noise on the community is also included in this document. The Technical Reference Document should be used as a resource when evaluating the noise-related implications of specific development proposals or long-range planning efforts.

This document was edited by Grover Beach planning staff to remove extraneous tables and figures relating to areas outside of southern San Luis Obispo County.

CHAPTER 2 NOISE AND ITS EFFECTS ON PEOPLE

2.1 Fundamentals of Noise Assessment

Noise is often defined simply as unwanted sound, and thus is a subjective reaction to characteristics of a physical phenomenon. The descriptors of community noise in current use are the results of many years of effort to translate objective measurements of sound into measures of subjective reaction to noise. Before elaborating on these descriptors, it is useful to discuss some fundamental concepts of sound.

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

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

To measure sound directly in terms of pressure would require a very large and awkward range of numbers. To avoid this, the decibel (dB) scale was devised.

The decibel scale uses the hearing threshold as a point of reference, defined as 0 dB. Other sound pressures are then compared to the reference pressure, and the logarithm is taken to keep the numbers in a practical range. Use of the decibel scale allows a million-fold increase in pressure to be expressed as 120 dB. Another useful aspect of the decibel scale is that changes in levels (dB) correspond closely to human perception of relative loudness.

The perceived loudness of sounds is dependent upon many factors, including sound pressure level and frequency content. In the range of usual environmental noise levels, perception of loudness is relatively predictable, and can be approximated by weighting the frequency response of a sound level measurement device (called a sound level meter) by means of the standardized A-weighting network. There is a strong correlation between A-weighted sound levels and community response to noise. For this reason, the A-weighted sound level has become the standard tool of environmental noise assessment. Figure 2-1 illustrates typical A-weighted sound levels due to recognizable sources.

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

Examples of Noise Levels

Level, dBA	Activity	Subjective Evaluations
140	Sonic booms	Deafening
130	Threshold of pain	
120	Threshold of discomfort	
	Amplified music	
110	Commercial jet takeoff at 200 feet	
100	Auto horn at 10 feet	Very loud
90	Noisy factory interior	
	Heavy truck at 50 feet	
80	New automobile at 50 feet	Loud
70	Stenographic room	
60	Normal conversation at 6 feet	Moderate
50	Office interior	
40	Soft radio music	Faint
30	Residence interior	
20	Whisper at 6 feet	Very faint
10	Human breathing	
0	Threshold of audibility	

BBA

Two composite noise descriptors are in common use today: L_{dn} and CNEL. The L_{dn} (day-night average level) is based upon the average hourly L_{eq} over a 24-hour day, with a +10 decibel weighting applied to nighttime (10:00 p.m. to 7:00 a.m.) L_{eq} values. The nighttime penalty is based upon the assumption that people react to nighttime noise exposures as though they were subjectively twice as loud as daytime exposures. The CNEL (Community Noise Equivalent Level), like L_{dn}, is also based upon the weighted average hourly L_{eq} over a 24-hour day, except that an additional 4.77 decibel penalty is applied to evening (7:00 p.m. to 10:00 p.m.) hourly L_{eq} values.

The CNEL was developed for the California Airport Noise Regulations, and is applied specifically to airport/aircraft noise assessment. The L_{dn} scale is a simplification of the CNEL concept, but the two will usually agree, for a given situation, within 1 dB. Like the L_{eq}, these descriptors are also averages and tend to disguise variations in the noise environment. Because L_{dn} and CNEL presume increased evening or nighttime sensitivity, they are best applied as criteria for land uses where nighttime noise exposures are critical to the acceptability of the noise environment, such as residential developments.

Noise in the community has often been cited as being a health problem, not in terms of actual physiological damage, such as hearing impairment, but in terms of inhibiting general well-being and contributing to undue stress and annoyance. The health effects of noise in the community arise from the interference with human activities such as sleep, speech, recreation, and tasks demanding concentration or coordination. When community noise interferes with human activities or contributes to stress, public annoyance with the noise source increases, and the acceptability of the environment for people decreases. This decrease in acceptability and the threat to public well-being is the basis for land use planning policies directed towards the prevention of exposure to excessive community noise levels. There are also economic effects of community noise: reduction in property values, inefficiency in the workplace and lost hours due to stress.

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

2.2 Criteria for Acceptable Noise Exposure

The Guidelines for the Preparation and Content of the Noise Element of the General Plan (Reference 1), includes recommendations for exterior and interior noise level standards to be used by local jurisdictions to identify and prevent the creation of incompatible land uses due to noise. The State Guidelines contain a land use compatibility table which describes the compatibility of different land uses with a range of environmental noise levels in terms of L_{dn} or CNEL. An exterior noise environment of 50 to 60 dB L_{dn} or CNEL is considered to be "normally acceptable" for residential uses according to those guidelines. The recommendations in the State Guidelines also note that, under certain conditions, more restrictive standards may be appropriate. As an example, the standards for quiet suburban and rural communities may be reduced by 5 to 10 dB to reflect lower existing outdoor noise levels.

The U.S. Environmental Protection Agency (EPA) also prepared guidelines for community noise exposure in the publication Information on the Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety (Reference 2). These guidelines are based upon assumptions regarding acceptable noise levels which consider occupational noise exposure as well as noise exposure in the home. The guidelines recognize an exterior noise level of 55 dB L_{dn} as a goal to protect the public from hearing loss, activity interference, sleep disturbance and annoyance. The EPA notes,

however, that this level is not a regulatory goal, but is a level defined by a negotiated scientific consensus without concern for economic and technological feasibility or the needs and desires of any particular community. The EPA and other governmental agencies have adopted suggested land use compatibility guidelines which indicate that residential noise exposures of 55 to 65 dB L_{dn} are within acceptable limits.

For control of noise nuisances, a community noise control ordinance is the most appropriate tool. The State Office of Noise Control has prepared a Model Community Noise Control Ordinance (Reference 3) which contains recommended noise standards in terms of "time-weighted" sound levels. The time-weighting concept allows discrimination of both short- and long-term noise exposures, and sets allowable levels for each. The Model recommends more stringent standards for residential land uses than for commercial and industrial, with the most stringent standards recommended for "rural suburban" situations. The primary exterior noise standard for rural residential uses is 50 dB in the daytime hours (7 a.m. to 10 p.m.), and 40 dB at night. The standard is expressed in terms of the level exceeded for 30 minutes of an hour, equivalent to the median level, or L50. This ordinance format is successfully applied in many California cities and counties.

The U.S. Environmental Protection Agency has also prepared a Model Community Noise Control Ordinance (Reference 4), using the "Equivalent A-weighted Sound Level" (L_{eq}) as the means of defining allowable noise level limits. The EPA model contains no specific recommendations for local noise level standards, but reports a range of L_{eq} values as adopted by various local jurisdictions. The mean daytime noise standard reported by the EPA is 56.75 dB (L_{eq}); the mean nighttime noise standard is 51.76 dB (L_{eq}). This ordinance format has been successfully applied by the City and County of San Diego and by many other jurisdictions looking for a simplified approach to the enforcement of a local noise control ordinance.

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

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

Table 2-1 is commonly used to show expected public reaction to changes in environmental noise levels. This table was developed on the basis of test subjects' reactions to changes in the levels of steady-state pure tones or broad-band noise, or to changes in levels of a given noise source. It is probably most applicable to noise levels in the range of 50 to 70 dB, the usual range of voice and interior noise levels. It is probably not directly applicable to public perception of identifiable intrusive noise sources in very quiet environments because of the difference in frequency content between background noise sources and intrusive sounds, as well as the fact that the absolute amount of energy required to make a given change in sound pressure level is much smaller at low noise levels than at higher levels. Table 2-1 should therefore only be applied in a general manner to show the relationship between changes in sound energy, sound pressure levels and subjective reaction.

The comparisons of subjective reaction outlined in Table 2-1 are not applicable to noise exposures which are very quiet or very loud. For example, a whisper which is increased by 10 decibels, e.g., from 20 dB to 30 dB, remains a whisper, and would still be described as quiet. In contrast, an increase in the noise level of a diesel locomotive from 90 dB to 100 dB would be a change from a loud noise to a very loud noise. Thus the subjective reaction to a 10 dB change in either case may be different, even though the change in level is the same.

TABLE 2-1
Subjective Reaction to Changes in Noise Levels of Similar Sources

Increase in Sound Pressure Level, dB	Relative Increase in Acoustical Energy	Subjective Reaction
1	1.26 times	Minimum Detectable Change (Lab)
3	2.0 times	Usually Noticeable Change
5	3.2 times	Definitely Noticeable Change
10	10.0 times	Twice as Loud as Before

Sources: Various, reported by Brown-Buntin Associates, Inc.

CHAPTER 3 EXISTING AND FUTURE NOISE ENVIRONMENT

3.1 Overview of Sources

Based on discussions with San Luis Obispo County staff, information provided by the seven (7) incorporated cities of the county and field studies conducted by BBA, it was determined that there are a number of potentially significant sources of community noise within the county and its incorporated cities. These sources include traffic on state highways, major county roadways and city streets, railroad operations, airport operations, military activities and industrial facilities. Specific noise sources selected for study are discussed in the following sections. Figure 3-1 shows the generalized locations of major noise sources selected for study, and for which generalized noise exposure contours have been prepared.

3.2 Methods and Noise Exposure Maps

Analytical noise modeling techniques in conjunction with actual sound noise level measurements were used to develop generalized noise exposure contours for major sources of noise within San Luis Obispo County and its incorporated cities for existing (1990) and future conditions.

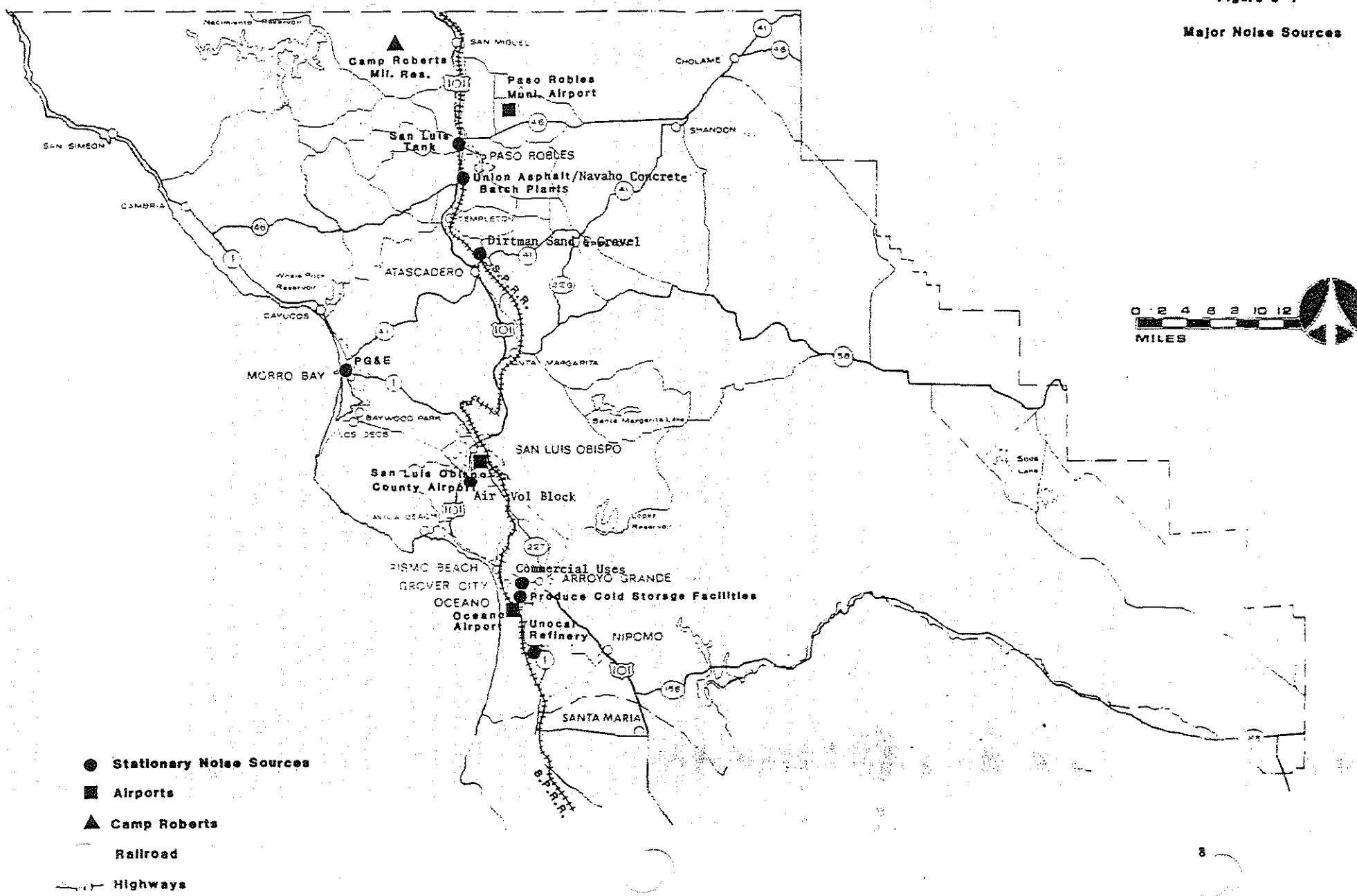
Analytical noise modeling techniques generally make use of source-specific data including average levels of activity, hours of operation, seasonal fluctuations, and average levels of noise from source operations. Analytical methods have been developed for many environmental noise sources including roadways, railroad line operations, railroad yard operations, industrial plants and aircraft/airport operations. Such methods will produce reliable results as long as data inputs and assumptions are valid for the sources being studied. The analytical methods used in this report closely follow recommendations made by the State Office of Noise Control, and were supplemented where appropriate by source-specific sound level data to account for local conditions.

Noise exposure contours for major sources of noise are contained within the Policy Documents for each jurisdiction. The maps depict noise exposure within each of the incorporated or major unincorporated communities of the county. Noise exposure in outlying areas of the county may be derived from the tables and discussions of the following text which describe the distance from the center of the source to noise exposure contours. Additionally, noise exposure maps for aircraft operations at public use airports and the major stationary sources selected for study are contained within this document.

It should be noted that the noise exposure contours shown or described in this or the Policy Document are generally based upon annual average conditions (unless otherwise noted), and are not intended to be site-specific where local topography, vegetation or intervening structures may significantly affect noise exposure at a given receiver location. The contours should be used as a screening device when determining whether a project may result in a noise-related land use conflict. Generally, a site specific study will be required to determine noise exposure in situations involving complex topography or shielding by buildings or vegetation. Where the reviewing agency wishes to estimate site-specific traffic noise exposure, adjustment factors for topography and shielding may be used as discussed in Section 3.3.1 of this document.

Figure 3-1

Major Noise Sources



3.3 State Highways and Major County and City Roadways

The Federal Highway Administration (FHWA) Highway Traffic Noise Prediction Model (Reference 5) was used to develop L_{dn} contours for major traffic noise sources within the county and cities. The FHWA Model is the analytical method presently favored for traffic noise prediction by most state and local agencies, including Caltrans. The model is based upon reference energy emission levels for automobiles, medium trucks (2 axles) and heavy trucks (3 axles or greater), with consideration given to vehicle volume, speed, roadway configuration, distance to the receiver and the acoustical characteristics of the site. As recommended by Caltrans, the Calveno noise emission curves have been used in this document to more accurately portray noise exposure along roadways in California. (The full FHWA Model is available from the Federal Highway Administration; see Reference 5).

Traffic data for existing and projected future conditions used in the calculation process were obtained from San Luis Obispo County and each of the cities of the county. For some roadways, where traffic data were unavailable, traffic counts were conducted during peak traffic periods so that estimates of daily vehicle movements could be prepared.

The FHWA Model was developed to predict hourly L_{eq} values for free-flowing traffic conditions, and is generally considered to be accurate within plus or minus 1.5 dB. To predict L_{dn} values it is necessary to determine the hourly distribution of traffic for a typical 24-hour day and to adjust the traffic volume input data to yield an equivalent hourly traffic volume. BBA experience with the use of the FHWA Model has indicated that for most situations where the roadway and receiving land use are at the same grade, the Model will generally provide a conservative (worst-case) estimate of traffic noise exposure.

3.3.1 Traffic Calibration Study

Since many areas within the study area contain complex topographical features, a traffic calibration study was conducted to determine the types of adjustments which should be applied to calculated traffic noise levels along certain roadway segments. The findings of the traffic calibration study may also be applied to other noise sources where the height and precise location of the source with respect to the location of the receiving use are known.

The calibration study consisted of conducting sound level measurements and concurrent traffic counts in areas where the following topographic relationships between the roadway and surrounding area exist. Suitable measurement locations were found along SR1 between San Luis Obispo and Morro Bay and along SR101 between Arroyo Grande and Nipomo.

- Terrain gradually rises above roadway. This is typical of many areas where a potential receptor would look down on the roadway.
- Roadway is elevated above surrounding terrain.
- Roadway is located in a cut or is below a steep embankment.

Traffic noise levels were measured in terms of the L_{eq} descriptor for 15 minute intervals while traffic counts were being conducted. Traffic counts were projected for a one-hour period and measured L_{eq} values were compared to the levels calculated by the FHWA Model using the projected hourly number of vehicles, posted speed and distance to the microphone. Calculations were based upon an acoustically "soft" site (that is, a site where absorption of sound by the ground is significant) since experience has shown that this generally provides the closest correlation with measured results. These comparisons are summarized in Table 3-1.

TABLE 3-1
Summary of Traffic Noise Calibration Studies

Distance (Roadway)*	Hourly Veh. Volumes A	MT	HT	Posted Speed	L_{eq}, dB Pred.**	Meas.	Meas. Minus Pred.
Rising Topography							
100' (SR1)	1636	16	108	55	69.1	69.5	-0.4
150' (SR101)	2656	72	96	55	67.9	64.8	+3.1
150' (SR101)	2868	68	140	55	68.6	65.5	+3.1
200' (SR1)	1636	16	108	55	64.6	63.1	+1.5
300' (SR101)	2656	72	96	55	63.3	62.8	+0.5
300' (SR101)	2868	68	140	55	64.0	63.3	+0.7
400' (SR1)	1636	16	108	55	60.1	62.3	-2.2
450' (SR101)	2656	72	96	55	60.7	60.0	+0.7
405' (SR101)	2868	68	140	55	61.4	63.5	-2.1
500' (SR1)	1636	16	108	55	58.6	62.4	-3.8
Elevated Roadway							
100' (SR1)	2096	52	20	55	68.4	60.8	+7.6
120' (SR1)	1172	32	24	55	65.2	55.9	+9.3
240' (SR1)	1172	32	24	55	60.7	57.0	+3.7
240' (SR1)	1416	12	-0-	55	60.2	56.8	+3.4
480' (SR1)	1416	12	-0-	55	55.7	54.9	+0.8
Roadway in Cut							
75' (SR1)	1592	28	4	55	68.6	64.7	+3.9
150' (SR1)	1612	44	16	55	64.7	59.1	+5.6
150' (SR101)	2656	72	96	55	67.9	63.1	+4.8
150' (SR101)	2868	68	140	55	68.6	63.4	+5.2

* Distance from the center of the roadway
** Calculated using the FHWA Model and Calveno noise emission curves for an acoustically "soft" site.

A = Automobiles
MT = Medium Trucks (2 axles)
HT = Heavy Trucks (3 or more axles)

Source: Brown-Buntin Associates, Inc.

From Table 3-1 it may be seen that the FHWA Model generally overpredicted noise exposure in all situations. This is consistent with BBA experience with the use of the model, and is probably due mostly to the fact that the model does not account for excess ground attenuation or atmospheric absorption over distance. The greatest amount of overprediction occurred in areas which were shielded from view of all or part of the roadway by either a cut, steep embankment or elevated roadway situation. In these instances, predicted noise levels were found to be approximately 4-10 dB higher than measured levels at distances of 150 feet or less from the center of the roadway. The shielding effect was found to diminish as the distance from the roadway was increased.

For topography that rises above the roadway, such as on a hillside overlooking the roadway it was found that the FHWA Model generally overpredicted noise exposure at distances of approximately 100-200 feet from the center of the roadway and somewhat underpredicted noise exposure at distances greater than 400 feet. The greatest amount of underprediction was found to occur in instances where the observer was elevated significantly above the roadway and there was a clear view of the entire roadway surface.

Table 3-2 has been prepared to serve as a guide when applying the traffic noise exposure contour information presented later in this section to areas with varying topography. It should be noted that the adjustment factors presented in Table 3-2 are intended to provide conservative (worst-case) results, and that complex situations should be evaluated by a trained professional when the potential for significant noise impact exists.

TABLE 3-2
Adjustments to Traffic Noise Levels Due to Topography

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

Noise exposure may also be reduced when the receiver is located behind a row of houses or other buildings. The amount of shielding provided depends upon whether or not the row of buildings is continuous and effectively interrupts line-of-sight between the noise source and receiver. Shielding by buildings can reduce noise exposure by up to 15 dB.

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

3.3.2 Traffic Counts

In some instances, traffic counts were not available from the cities for individual roadways which were thought to have the potential for generating significant noise levels. For these roadways, short-term traffic counts were performed during the peak hours of either 7:00 a.m. - 8:30 a.m. or 4:00 p.m. - 5:30 p.m. to provide a basis for estimating annual average daily traffic (AADT). Counts were generally conducted for a period of 15 minutes and then projected for an hour. For the purposes of this study, AADT values were then calculated based on the assumption that peak hour traffic flows represent approximately 10 percent of the AADT. A summary of the traffic counts and estimated AADTs are shown in Table 3-3.

3.3.3 Traffic Noise Exposure Calculations

Traffic data representing annual average daily traffic volumes (AADT), truck mix and the day/night distribution of traffic for existing (1990) and future conditions were obtained from Caltrans, San Luis Obispo County, and the Cities of San Luis Obispo, Pismo Beach, Paso Robles, Arroyo Grande, Grover Beach, Atascadero and Morro Bay. For the county and the Cities of Morro Bay and Paso Robles, the future situation was assumed to be the year 2010; for the Cities of San Luis Obispo, Grover Beach, Atascadero, Arroyo Grande and Pismo Beach, it was assumed to be the time at which buildout would occur under the general plan. For the state highways in the county or the cities, the future situation was assumed to be 2010, except for Highway 101 which was assumed to be 2005. Future traffic volumes for a few county and city roadway segments were estimated by BBA based upon growth rates for comparable roadways since these data were not available from the jurisdiction. Traffic data used in the traffic noise exposure modelling process are summarized in Appendix A. The odd numbered segments in Appendix A refer to existing traffic volumes and the even numbered segments refer to future traffic volumes.

Using the FHWA Model and the traffic data summarized in Appendix A, the distances from the center of the roadway to the 60, 65 and 70 dB L_{dn} contours for existing and projected future traffic conditions were calculated. Contour distances are summarized in Table 3-4. Table 3-4 is subdivided into city streets, state highways and rural county roadways. Roadway segments listed in Table 3-4 refer to the traffic data print-out summarized in Appendix A. Noise contour calculations generally were performed only for roadways which had an existing or projected future ADT of 5000 or greater, since at lower traffic volumes the 60 dB L_{dn} contour would be confined to an area closer to the roadway than normal residential setbacks. Where medium and heavy truck volumes were greater than about 5% or where speeds were greater than 50 mph, noise contours were calculated for roadways with less than 5000 AADT. The approximate locations of the 60 dB L_{dn} contours for existing and projected future conditions are shown on maps contained within the Policy Document for each major unincorporated community or incorporated city within the county.

It should be noted that since noise contour calculations did not take into consideration shielding caused by local buildings or topographical features, the distances reported in Table 3-4 and depicted in the noise exposure maps should be considered worst-case estimates of noise exposure. Noise exposure behind the first row of houses or other types of buildings may be reduced by up to 15 dB. The effects of elevated or depressed roadways or other topographic features, which are common along many roadway segments throughout the county, are described in Section 3.3.1 of this document.

Simple adjustments to traffic noise levels shown in Table 3-4 can be made using Figure 3-2 if a new or different AADT is assumed. For example, if it is known that a highway with an AADT of 10,000 produces a noise level of 60 dB L_{dn} at 200 feet, the noise level at that same distance can be calculated if the AADT increases to 20,000 (assuming no changes in other traffic conditions, such as percentage of truck traffic and speed). From Figure 3-2 it can be seen that a +100% change in traffic volume (10,000 to 20,000) increases the relative noise level by +3 dB. Therefore, the new traffic noise level is 63 dB L_{dn} (60 dB +3 dB) at 200 feet.

TABLE 3-3
Summary of Traffic Counts
Within Cities of San Luis Obispo County

City Street	Date	Time	Observed Peak Hour Volume	Estimated* ADT	Obsv. MT (%)	Obsv. HT (%)	Posted Speed (MPH)
Arroyo Grande							
West Branch Street (Camino Mercado)	8/29/90	8:12 am	308	3,080	1.3	0	30
Huasna Road (near Route 227)	8/29/90	7:20 am	532	5,320	0	0.8	35
Oak Park Boulevard (at James Way)	8/28/90	8:34 am	532	5,320	0.8	1.5	40
South Elm Street (north of Farroll Avenue)	8/29/90	8:18 am	352	3,520	0	0	30
South Halcyon Road (north of Fair Oaks)	8/29/90	7:50 am	756	7,560	2.1	0	35
North Halcyon Road (north of Grand Avenue)	8/29/90	7:30 am	572	5,720	1.4	2.1	35
James Way (at Oak Park Boulevard)	8/29/90	7:53 am	113	1,130	0.9	1.8	35
Camino Mercado (at West Branch Street)	8/29/90	8:12 am	124	1,240	0	3.2	30
The Pike (west of Elm Street)	8/29/90	8:08 am	280	2,800	5.7	2.9	35
Farroll Avenue (west of South Elm)	8/29/90	8:35 am	120	1,200	0	0	35
Rancho Parkway (at West Branch Street)	8/29/90	8:31 am	92	920	4.3	4.3	30
Grover Beach							
Grand Avenue (at 3rd Street)	8/28/90	4:24 pm	924	9,240	0.4	0.9	30
Oak Park Boulevard (at Newport Avenue)	8/28/90	5:16 pm	948	9,480	0	0.8	25
North 12th Street (at Atlantic City Avenue)	8/28/90	5:06 pm	120	1,200	0	0	30
Farroll Road (at 12th Street)	8/28/90	5:38 pm	384	3,840	0	0	30
The Pike (21st Street)	8/30/90	7:20 am	192	1,920	0	0	35
13th Street (at Grand Avenue)	8/28/90	4:45 pm	308	3,080	0	1.3	35
North 4th Street (Ramona Avenue)	8/28/90	4:07 pm	844	8,440	0.9	0.5	30
Pismo Beach							
Shell Beach Road/Price Street (Cliff Avenue)	8/28/90	7:18 am	176	1,760	2.3	2.3	35
Price Canyon Road (at Dell Court)	8/28/90	7:48 am	444	4,440	1.8	5.4	35
Mattie Road	8/29/90	8:20 am	84	840	4.8	0	35
Oak Park Boulevard (near James Way)	8/28/90	8:34 am	532	5,320	0.8	1.5	30
James Way (at 4th Street)	8/30/90	7:50 am	528	5,280	0.8	0.8	35
4th Street (near Highway 101)	8/28/90	8:11 am	808	8,080	1.5	3.0	30

* Assumes that the peak hour traffic volume is equal to 10% of the ADT
MT = Medium Trucks (2 axles)
HT = Heavy Trucks (3 or more axles)

Source: Brown-Buntin Associates, Inc.

TABLE 3-4
Noise Contour Data
Distance (Feet) from Center of Roadway
to L_{dn} contours

Segment Nos.	Description	Existing 60 dB	Existing 65 dB	Existing 70 dB	Future 60 dB	Future 65 dB	Future 70 dB
STATE HIGHWAYS							
Highway 1							
1-2	Santa Barbara County to Valley Road	95	44	21	136	63	29
3-4	Valley Road to Halcyon Road	152	71	33	223	104	48
5-6	Halcyon Road to Grand Avenue	179	83	39	257	119	55
7-8	Grand Avenue to Jct. Route 101	123	57	27	168	78	36
9-10	Jct. Route 101 to Highland Drive (Santa Rosa Street)	296	137	64	384	178	83
11-12	Highland Drive to South Morro Bay Interchange	478	222	103	644	299	139
13-14	South Morro Bay Interchange to North Morro Bay Interchange	456	212	98	614	285	132
15-16	North Morro Bay Interchange to Jct. Route 41	470	218	101	594	276	128
17-18	Jct. Route 41 to Old Creek Road Interchange	370	172	80	463	215	100
19-20	Old Creek Road Interchange to Ardath Drive	190	88	41	209	97	45
21-22	Ardath Drive to Pico Creek	171	80	37	207	96	44
23-24	Pico Creek to Hearst Castle State Park	172	80	37	197	91	42
25-26	Hearst Castle State Park to Monterey County	79	37	17	103	48	22
Route 101							
57-58	Santa Barbara County to Oak Park Road Interchange	855	397	184	1,204	559	259
59-60	Oak Park Road Interchange to South Pismo Beach Interchange	989	459	213	1,851	859	399
61-62	South Pismo Beach Interchange to Avila Road	919	426	198	1,519	705	327
63-64	Avila Road to Los Osos Valley Road Interchange	986	457	212	1,391	645	300
65-66	Los Osos Valley Road Interchange to Higuera Street	891	414	192	1,268	589	273
67-68	Higuera Street to Jct. Route 1	1,077	500	232	1,588	737	342
69-70	Jct. Route 1 to Grand Avenue	970	450	209	1,698	788	366
71-72	Grand Avenue to South Paso Robles Interchange	861	400	185	1,420	659	306
73-74	South Paso Robles Interchange to Jct. Route 46 East	674	313	145	1,156	537	249

TABLE 3-4 (Continued)

Noise Contour Data
Distance (Feet) from Center of Roadway
to L_{dn} Contours

Segment Nos.	Description	Existing 60 dB	Existing 65 dB	Existing 70 dB	Future 60 dB	Future 65 dB	Future 70 dB
COUNTY AREA ROADS							
San Luis Bay							
143-144	San Luis Bay Drive (west of Hwy 101)	114	53	25	193	90	42
145-146	Avila Road (west of San Luis Bay Street)	222	103	48	325	151	70
147-148	Corbett Canyon Road (Hwy 227 to Arroyo Grande)	92	43	20	149	69	32
149-150	Noyes Road	54	25	12	107	50	23
151-152	Lopez Drive (Arroyo Grande Fringe)	108	50	23	148	69	32
153-154	San Luis Street (Avila Beach urban area)	38	18	8	61	28	13
155-156	Pier Avenue	62	29	13	65	30	14
157-158	Halcyon Road (north of Hwy 1)	92	43	20	101	47	22
South County							
167-168	Tefft Street (west of Highway 101 - Nipomo)	114	53	25	317	147	68
169-170	Orchard Avenue (Nipomo urban area)	77	36	17	173	80	37
171-172	Pomeroy Road (south of Sandydale Road)	105	49	23	133	62	29
173-174	Thompson Avenue (Nipomo urban area)	57	27	12	128	59	28
175-176	North Frontage (Nipomo urban area)	86	40	19	114	53	24
177-178	South Frontage (Nipomo urban area)	62	29	13	99	46	21
179-180	Division Street (Nipomo urban area)	45	21	10	82	38	18

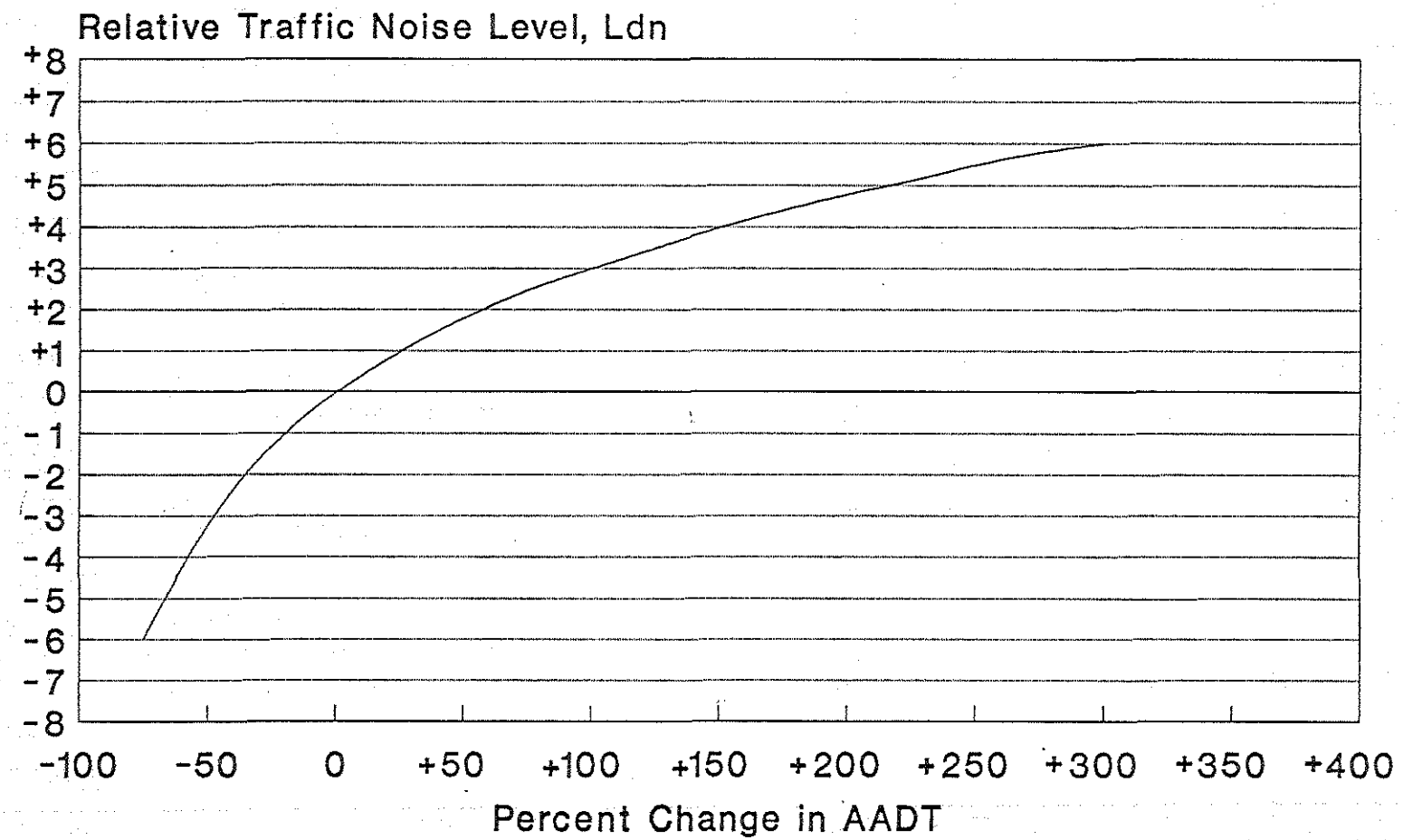
TABLE 3-4 (Continued)
Noise Contour Data
Distance (Feet) from Center of Roadway
to L_{dn} Contours

Segment Nos.	Description	Existing 60 dB	Existing 65 dB	Existing 70 dB	Future 60 dB	Future 65 dB	Future 70 dB
CITY STREETS							
Grover Beach							
277-278	North Oak Park Boulevard	100	46	21	126	58	27
279-280	North 4th Street (north City limits)	86	40	19	113	52	24
281-282	Grand Avenue	144	67	31	189	88	41
Arroyo Grande							
315-316	West Branch Street	49	23	11	62	29	13
317-318	Huasna Road	58	27	13	74	34	16
319-320	Grand Avenue	143	66	31	180	84	39
321-322	Brisco Road	91	42	20	115	53	25
323-324	South Elm Street (south of Grand Avenue)	76	35	16	97	45	21
325-326	South Halcyon Road	87	40	19	111	51	24
327-328	North Halcyon Road	68	32	15	86	40	19
329-330	Fair Oaks Avenue	76	35	16	96	45	21
331-332	El Camino Real	70	32	15	88	41	19
333-334	Valley Road	63	29	13	79	37	17
335-336	Oak Park Boulevard	144	67	31	224	104	48
Pismo Beach							
337-338	Oak Park Boulevard	144	67	31	224	104	48
339-340	4th Street	121	56	26	152	70	33
341-342	Shell Beach Road/Price Street	64	29	14	81	37	17
343-344	Mattie Road	95	44	20	126	59	27
345-346	Price Canyon Road	79	36	17	103	48	22

Source: Brown-Buntin Associates, Inc.

Figure 3-2

Percent Change In Annual Average Daily Traffic (AADT) Compared To Traffic Noise Level



Note: All other traffic conditions are unchanged

BBA

3.4 Railroad Noise

The mainline of the Southern Pacific Transportation Company Railroad (S.P.R.R.) passes through the county generally in a north-south direction. According to railroad officials there are presently two freight and two passenger train movements per day within the San Luis Obispo County area. One of the freight trains generally passes through the county at night between the hours of 10:00 p.m. and 7:00 a.m. Estimates of future railroad operations were not available from the railroad, although it is likely that the number of train movements could increase.

There are a variety of railroad operating conditions which occur in San Luis Obispo County due to the presence of grade crossings, curves, grades and congested areas within cities or unincorporated communities. For this reason, speeds and the use of the warning horn vary considerably from location to location.

In order to document railroad noise exposure within different areas of the county where residential or other noise-sensitive development has occurred, measurements of noise levels generated by individual train passbys were conducted. Measurement sites were selected to quantify the effects of grade crossings, grades and variations in speeds.

The results of railroad noise level measurements are summarized in Table 3-5. From Table 3-5 it is apparent that measured sound levels from railroad passbys as defined by the Sound Exposure Level (SEL) at approximately 100 feet from the tracks ranged from approximately 98-101 dB for freights and 93-104 dB for passenger trains. At approximately 50 feet from the tracks, SEL values were approximately 110 dB for a freight train and 87-106 dB for passenger trains. The most significant variable in measured levels was whether or not the horn was in use during the measurements.

Railroad noise exposure may be quantified in terms of L_{dn} using the following formula:

$$L_{dn} = \overline{SEL} + 10 \text{ Log } N_{eq} - 49.4$$

where,

$\overline{SEL}$ is the average SEL for a train passby,

N_{eq} is the equivalent number of passbys in a typical 24-hour period determined by adding 10 times the number of nighttime events (10:00 p.m-7:00 a.m.) to the actual number of daytime events (7:00 a.m.-10:00 p.m.), and 49.4 is a time constant equal to 10 log the number of seconds in the day.

Operational data used for the calculation of railroad noise exposure for existing conditions were obtained from the railroad. For future conditions, an estimate was developed by BBA in conjunction with county staff which includes ten freight and four passenger trains per day. Fifty (50) percent of the freight trains and one of the passenger trains would pass through the county during the nighttime hours. This should be considered a worst-case estimate of future railroad operations.

TABLE 3-5
Summary of Railroad Noise Level Measurement Data
Southern Pacific Transportation Company

Location	Date	Time	Type	Dir	Distance (Feet)	#Locos/ #Cars	Speed (mph)	Lmax	SEL (dB)	Horn
Atascadero										
Highway 41 and SPRR	8/21/90	2:18 pm	P	S	100	---	60	86.7	97.0	N
	8/21/90	2:45 pm	F	N	100	---	50	85.0	98.7	N
Santa Margarita										
West of Wilhelma Avenue Crossing	8/28/90	2:00 pm	P	S	100	3/15	35	105.0	104.2	Y
	8/28/90	4:07 pm	P	N	100	2/15	35	96.0	100.8	Y
	8/28/90	4:52 pm	F	N	100	4/65	25	90.0	98.4	Y
East of Wilhelma Avenue Crossing	8/28/90	2:00 pm	P	S	100	3/15	35	87.9	94.1	Y
	8/28/90	4:07 pm	P	N	100	2/15	40	83.1	92.7	Y
	8/28/90	4:52 pm	F	N	100	4/65	25	83.8	97.6	Y
Oceano										
Railroad Street near Highway 1	8/22/90	3:05 pm	P	S	110	2/13	---	82.0	92.5	N
	8/23/90	2:45 pm	F	N	110	---	---	88.0	98.4	N
	8/24/90	3:14 pm	P	S	110	---	---	92.0	98.0	N
South of Oceano near Callender	8/29/90	9:00 am	F	S	120	4/55	55	92.0	101.3	N
San Luis Obispo										
Near Industrial Way	8/21/90	3:04 pm	P	N	48	2/16	40	84.5	92.9	N
	8/21/90	3:30 pm	P	S	54	2/15	40	101.0	104.6	Y
Near Marsh Street	8/24/90	2:19 pm	P	S	50	---	40	78.0	87.0	N
	8/24/90	3:00 pm	P	N	50	---	40	103.0	105.5	Y
	8/24/90	3:50 pm	F	N	50	---	40	104.0	109.5	Y

Source: Brown-Buntin Associates, Inc.

Using the above-described railroad noise level and operational data, the distances from tracks to the L_{dn} 60, 65 and 70 dB contours were calculated for existing and future conditions. Calculated distances are summarized in Table 3-6. The mean SEL values at 100 feet used for the calculations for areas away from grade crossings and horn usage were 94.5 dB for passenger trains and 99.7 dB for freight trains. For areas within 1000 feet of grade crossings where horns are likely to be used, mean SEL values used for calculations were 100.4 dB for passenger trains and 101.7 dB for freight trains. As shown by the data presented in Table 3-5, noise levels from individual trains passbys can vary considerably from event to event.

TABLE 3-6
Distance (Feet) from Center of Track to
L_{dn} Contours - Southern Pacific Transportation Company
San Luis Obispo County

	Existing		Future*	
L_{dn} Contour Values	**w/o Horn**	**w/Horn**	**w/o Horn**	**w/Horn**
70 dB	25'	35'	76'	113'
65 dB	53'	76'	163'	244'
60 dB	115'	163'	352'	525'

* Based on a hypothetical operational scenario consisting of 10 freight and 4 passenger trains per day.

Source: Brown-Buntin Associates, Inc.

3.5 Airport Noise

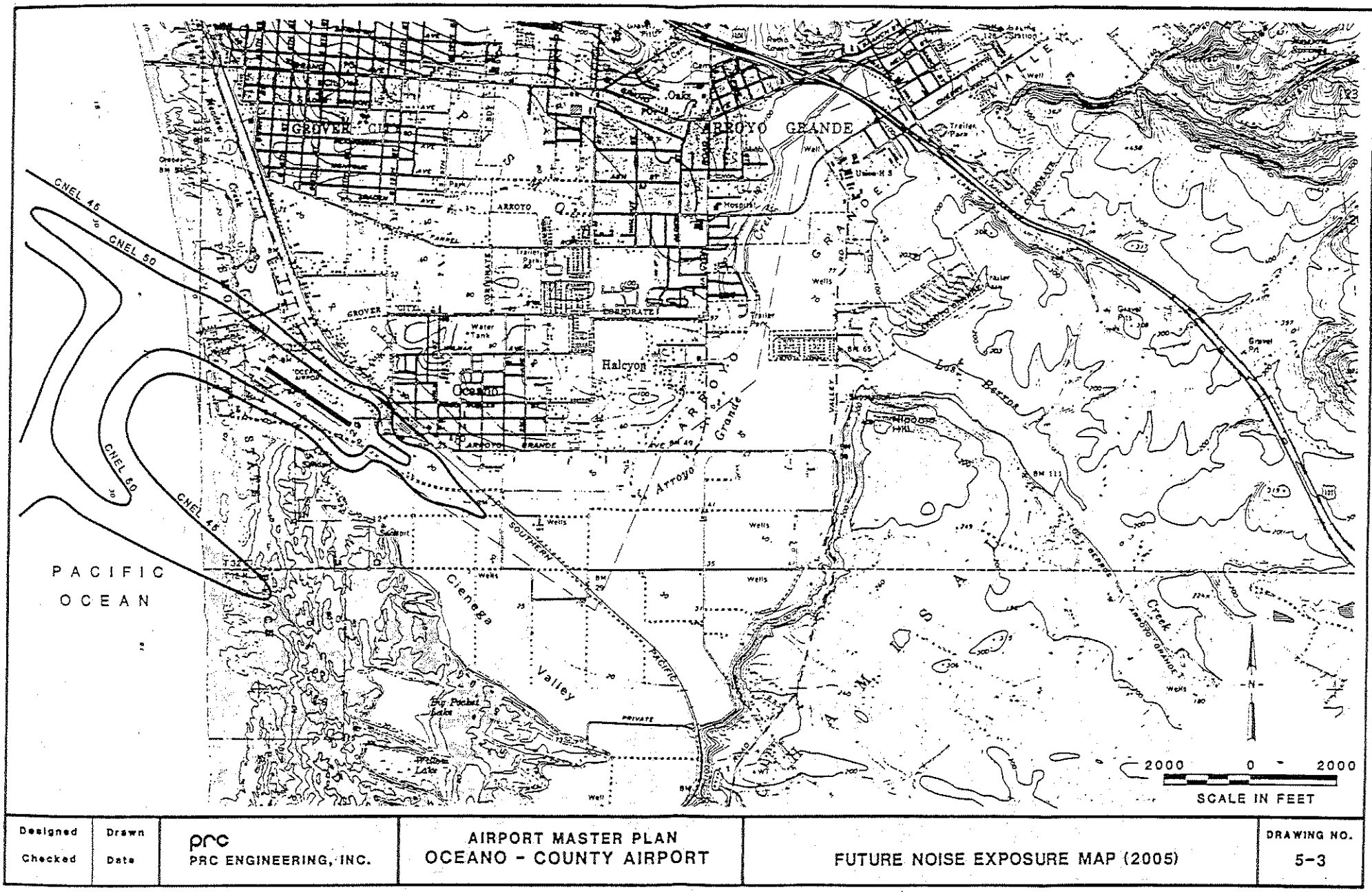
The State of California requires that aircraft noise be quantified in terms of the CNEL descriptor in California Code of Regulations (CCR) Title 21. CNEL is considered to be equivalent to the L_{dn} descriptor used for other noise sources addressed in this document within approximately ± 1 dB.

Noise exposure information for the Oceano Airport was obtained from the Airport Master Plan Update Study prepared by PRC Engineering, Inc. in 1987 (Reference 8). Version 3.8 of the INM was used in this study to prepare CNEL contour maps for the airport based upon the following assumptions concerning the total number of annual aircraft operations.

- 1985 - 4,000 (17% Multi-Engine; 83% Single Engine)
- 2005 - 13,000 (11% Multi-Engine; 89% Single Engine)

Figure 3-3 shows the projected-future (2005) CNEL contours for the airport. Shown are noise exposure values of 45 and 50 CNEL. Such values represent lower noise exposure than the land use compatibility criteria established by the State of California or the policies of this Noise Element. For this reason, they may be used to represent a worst-case picture of noise exposure in areas around the airport which are normally subject to aircraft overflights.

It should be noted that the airport noise exposure map shown in Figure 3-3 depicts noise levels of aircraft in flight. Noise levels from aircraft engine runups on the ground and other stationary noise sources at the airports were not studied during the preparation of this document. It is unknown if these sources are significant.



Designed	Drawn	PRC ENGINEERING, INC.	AIRPORT MASTER PLAN OCEANO - COUNTY AIRPORT	FUTURE NOISE EXPOSURE MAP (2005)	DRAWING NO.
Checked	Date				5-3

Figure 3-4: Oceano Airport(2005)

3.6 Major Stationary Noise Sources

The production of noise is an inherent part of many industrial, commercial and agricultural processes, even when the best available noise control technology is applied. Noise production within an industrial or commercial facility or in close proximity to many types of agricultural equipment is controlled indirectly by Federal and State employee health and safety regulations (OSHA and Cal-OSHA), but exterior noise emissions from such operations have the potential to exceed locally acceptable standards at nearby noise-sensitive land uses.

Noise control issues focus upon two objectives: to prevent the introduction of new noise-producing uses in a noise sensitive area, and to prevent encroachment of noise-sensitive land uses upon existing noise-generating facilities. The first objective can be achieved by applying performance standards to proposed new industrial or other noise generating uses. The second objective can be met by requiring that new noise-sensitive uses in proximity to existing noise sources include receiver-based mitigation measures to ensure compliance with the same performance standards.

There were no major stationary noise sources within Grover Beach that were selected as part of this study. In addition, specific noise sources related to agriculture were not studied as a part of this Noise Element, although such operations are common in the South Grover Beach Neighborhood Area and the rural areas of the county south of the City. Agricultural operations have the potential to produce significant noise impacts. The following is a list of typical operations or equipment for which noise level measurements have been obtained in Tulare County. This noise exposure information should be used as a general guide to identify potential noise conflicts.

Equipment/Operation	Noise Level, dB	Distance (Ft.)
Wind Machine (National	91-92	50
Frost 391 G.P., 391 cu. in. Ford V-8 engine)	61-71	350
Cotton Gin	74-77	120
Diesel Engine	74-85	50
Aerial Application Aircraft (Crop Dusters)		
Piper Brave (400 H.P./3-bladed prop.)	85-88	600
Grumman Ag Cat (600 H.P./2-bladed prop.)	103	100-150
Turbine Thrush (800 H.P./3-bladed prop.)	90-95	100
Cotton Pickers	58	500
Large Tractor	72-75	150
Small Tractor	69-79	50

CHAPTER 4 COMMUNITY NOISE SURVEY

As recommended by the Government Code and ONC Guidelines, a community noise survey was conducted to document noise exposure in representative areas of the county and cities containing noise-sensitive land uses. The following noise-sensitive land uses have been identified for the purpose of this survey:

1. All residential uses
2. Schools
3. Long-term care medical facilities, such as hospitals, nursing homes, etc.
4. Office buildings
5. Parks

Noise monitoring sites were selected to be representative of typical conditions where such uses are located. A total of 41 monitoring sites throughout the County were selected as shown in Figure 4-1. A combination of short-term and continuous noise monitoring was used to document existing noise levels at these locations during August, 1990.

At 33 of the community noise survey sites, noise levels were sampled for approximately 15 minutes during each of three periods of the day and night so that reliable estimates of L_{dn} could be prepared. The data collected during the short-term sampling program included the L_{eq}, maximum noise level, minimum noise level and a description of noise sources which were audible at the monitoring sites.

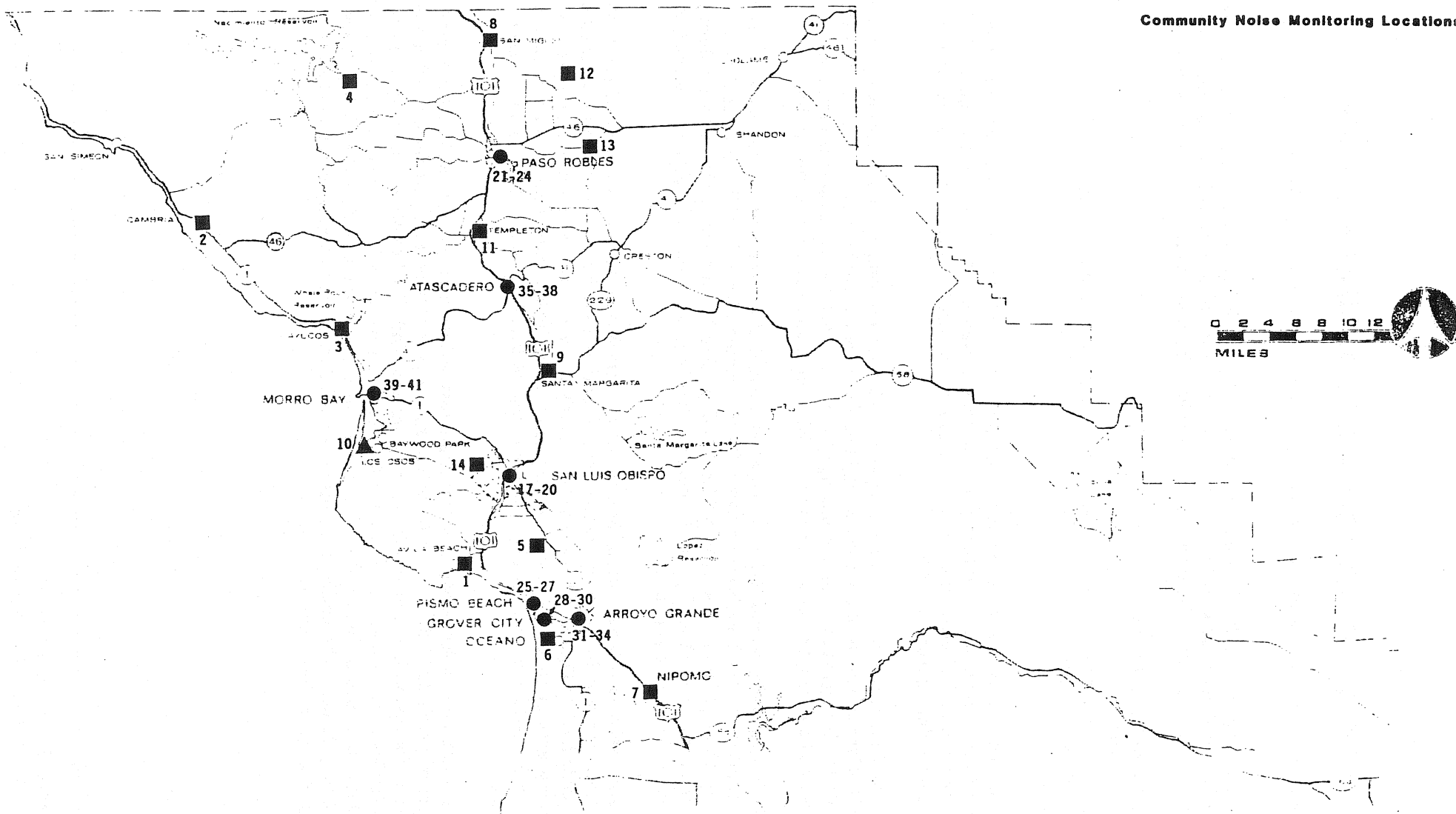
Continuous noise monitoring was conducted at eight of the community noise survey sites to document fluctuations in noise levels over a typical 24-hour period within the different types of noise environments (City, County Rural Area, County Urban/Village Area). Noise level data collected during continuous monitoring included the L_{eq}, maximum noise level and the statistical distribution of noise levels for each hour of the sample period.

Noise level data collected during the community noise survey are summarized in Table 4-1. Typical hourly fluctuations of noise levels at the sites where continuous noise monitoring was conducted are shown in graphic form in Figures 4-2 through 4-4. Hourly L_{eq} values shown in these figures are representative of energy average sound levels, and are very sensitive to single events such as vehicle or railroad passbys or aircraft overflights. L_{max} and L_{min} values represent the maximum and minimum values measured each hour.

The community noise survey results indicate that typical noise levels in noise-sensitive areas range from approximately 39-62 dB L_{dn}. As would be expected, the quietest areas are those which are removed from major transportation-related noise sources and local industrial or other stationary noise sources. Good examples of these quiet areas are the County Rural Areas defined by the El Pomar-Estella, San Luis Obispo and South County Planning Areas and some of the County Urban/Village Areas such as at Heritage Ranch. The noisier locations monitored during the survey were in areas located near Highway 101 and major local streets.

Figure 4-1

Community Noise Monitoring Locations



■ Short-Term Monitoring Sites

▲ 24-hour Monitoring Sites

Short-Term and 24-hour Monitoring Sites

Maximum noise levels observed during the survey were generally caused by local automobile traffic or heavy trucks. Other sources of maximum noise levels included occasional aircraft overflights, construction activities and nearby industrial/commercial equipment or machinery. Background noise levels in the absence of the above-described sources were generally caused by distant traffic, wind, birds, the surf or insects.

One factor that is difficult to quantify, but is often mentioned by persons who reside in rural areas, is the greater expectation for a quiet living environment by persons who have made the choice to live away from urbanized areas. This factor, coupled with the quiet existing background noise levels discussed above, greatly increases the likelihood that noise from a new noise generating land use will be perceived by residents of these areas as a significant intrusion over existing conditions.

Results of the community noise survey indicated that existing background noise levels in many areas of the county that contain noise-sensitive land uses are relatively quiet. To preserve quiet conditions, noise level standards and policies (see Policy Document) have been adopted which will prevent degradation of the existing noise environment as much as possible.

TABLE 4-1
Summary of Community Noise Survey Data

Map. Loc. #	Location	L_D	L_N	Level, dB L_{max} (Source)	Level, dB L_{min} (Source)	Estimated L_{dn}*
	COUNTY URBAN/VILLAGE AREAS					
	Avila Beach					
1	Avila Valley Drive (1/2 miles south of San Luis Bay Drive)	41	42	59 (traffic, aircraft)	32 (dist. traffic)	46-50 dB
	Cambria					
2	Sunbury Avenue and Weymouth Street	45	38	58 (birds)	36 (dist. traffic)	44-48 dB
	Cayucos					
3	Cayucos Drive and Birch Street	58	41	72 (traffic, hammering)	39 (dist. traffic)	54-58 dB
	Heritage Ranch					
4	Gateway Drive and Heritage Road	38	34	58 (traffic, blasts)	30 (crickets)	39-43 dB
	Los Ranchos/Edna					
5	6030 Kathy Court	42	34	57 (traffic)	32 (dist. pump)	41-45 dB
	Oceano					
6	Oceano School	50	31	62 (traffic)	31 (ocean)	46-50 dB
	Nipomo					
7	Nipomo Park	51	36	66 (children)	29 (dist. traffic)	48-52 dB
	San Miguel					
8	Joint Union Elementary School	57	52	70 (Hwy 101)	41 (dist. traffic)	58-62 dB
	Santa Margarita					
9	Margarita Avenue and "K" Street	45	38	63 (children)	35 (dist. traffic)	44-48 dB

TA[illegible] 4-1 (Continued)
Summary of Community Noise Survey Data

Map. Loc. #	Location	L_D	L_N	Level, dB: L_{max} (Source)	Level, dB: L_{min} (Source)	Estimated L_{dn}*
	South Bay					
10	1821 Don Avenue **	41	36	66	24	42-46 dB
	Templeton					
11	Foxtail Court	43	43	59 (wind)	36 (dist. traffic)	47-51 dB
	COUNTY RURAL AREAS					
	El Pomar-Estrella Planning Area					
12	Hog Canyon Road (halfway between Von Dollen Road & Estrella Road)	42	36	63 (traffic)	27 (wind)	42-46 dB
13	Union Road and Geneseo Road	43	39	61 (traffic)	30 (wind)	44-48 dB
	San Luis Obispo Planning Area					
14	Johe Lane (near Foothill Road)	45	41	53 (wind)	34 (dist. traffic)	46-50 dB
15	1595 Tiffany Ranch Road	45	27	61 (aircraft)	21 (crickets)	41-45 dB
	South County Planning Area					
16	Stanton and Viejo	50	30	70 (traffic)	27 (crickets)	46-50 dB
	CITIES					
	San Luis Obispo					
17	2325 Parkland Terrace **	48	38	82	27	46-50 dB
18	Brookpine Drive (south end of road)	46	33	56 (traffic)	30 (crickets)	43-47 dB
19	Conrad L. Smith School	45	40	54 (aircraft)	29 (wind)	46-50 dB
20	Bishop's Peak School	46	30	59 (wind)	26 (crickets)	43-47 dB

TABLE 4-1 (Continued)
Summary of Community Noise Survey Data

Map. Loc. #	Location	L_D	L_N	Level, dB L_{max} (Source)	Level, dB L_{min} (Source)	Estimated L_{dn}*
	Paso Robles					
21	Vine Street and 28th Street **	53	46	83	28	52-56 dB
22	Turtle Creek Park	44	35	56 (industrial)	33 (dist. traffic)	42-46 dB
23	Centennial Park	45	38	61 (traffic)	35 (dist. traffic)	44-48 dB
24	Call-Booth House (Northwest corner of Vine and 13th)	50	39	69 (traffic)	37 (dist. traffic)	48-52 dB
	Pismo Beach					
25	930 Fresno Street **	43	34	70	25	41-45 dB
26	El Viento (near Morgan Drive)	47	48	64 (traffic)	35 (traffic)	52-56 dB
27	Terrace and Shoreline	51	48	63 (traffic)	40 (wind)	53-57 dB
	Grover Beach					
28	Grover Heights Park	50	42	63 (traffic)	40 (distant A/C)	49-53 dB
29	240 No. Eighth Street **	47	39	72	26	50-54 dB
30	Mentone Park	54	39	73 (traffic)	35 (wind)	51-55 dB
	Arroyo Grande					
31	Alder Street and Ash Street	54	38	68 (traffic)	36 (Hwy 101)	51-55 dB
32	La Cresta Drive and Platino Lane	49	35	66 (traffic)	35 (crickets)	46-50 dB
33	225 Short Street **	53	37	84	26	50-54 dB
34	Via Bandolero and Via Poca	48	31	63 (traffic)	27 (crickets)	44-48 dB

TABLE 4-1 (Continued)
Summary of Community Noise Survey Data

Map. Loc. #	Location	L_D	L_N	L_{max} (Source)	L_{min} (Source)	Estimated L_{dn}*
	Atascadero					
35	4320 Estrada Avenue **	48	44	75	30	49-53 dB
36	Pinal Avenue and Sonora Avenue	44	36	55 (birds)	35 (crickets)	43-47 dB
37	9355 Mountain View Drive	43	41	52 (children)	35 (wind)	46-50 dB
38	Cascabel Road (1/2 mile north of Santa Lucia Avenue)	42	43	56 (wind)	31 (dist. traffic)	47-51 dB
	Morro Bay					
39	Tide Avenue and Nevis Street**	53	46	83	23	52-56 dB
40	Anchor Street and Morro Avenue	49	37	65 (traffic)	33 (dist. traffic)	46-50 dB
41	2060 Ironwood Avenue	55	40	82 (traffic)	36 (wind)	52-56 dB

L_D = Average Leq of two 15-minute samples obtained between 7:00 a.m. and 10:00 p.m. except for sites where 24-hour monitoring was conducted.

L_N = Leq for one 15-minute sample obtained between 10:00 p.m. and 7:00 a.m. except for sites where 24-hour monitoring was conducted.

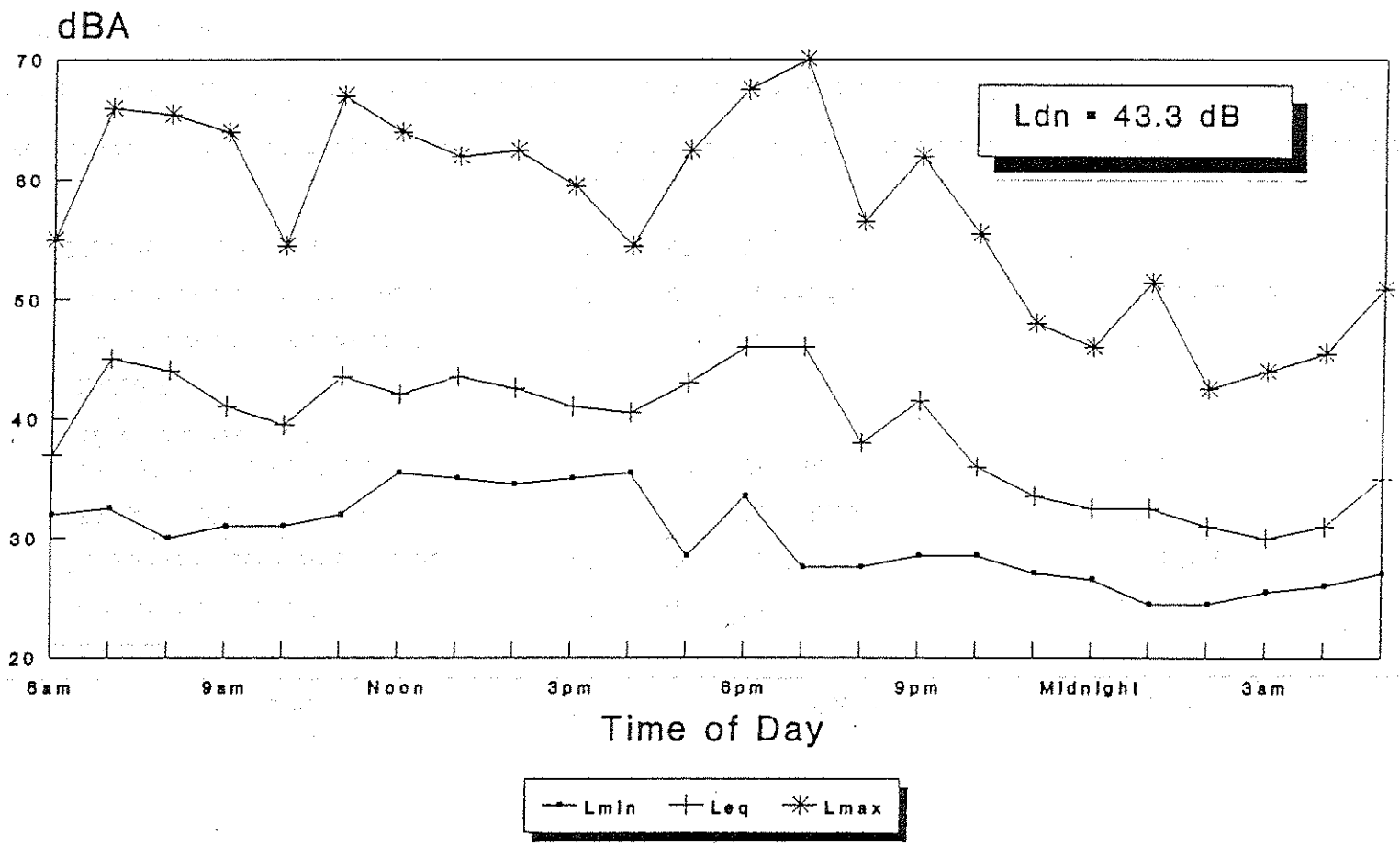
* L_{dn} estimated from L_D and L_N

** L_{dn} 24-hour monitoring site

Source: Brown-Buntin Associates, Inc.

Figure 4-2

Ambient Noise Levels
City of Pismo Beach

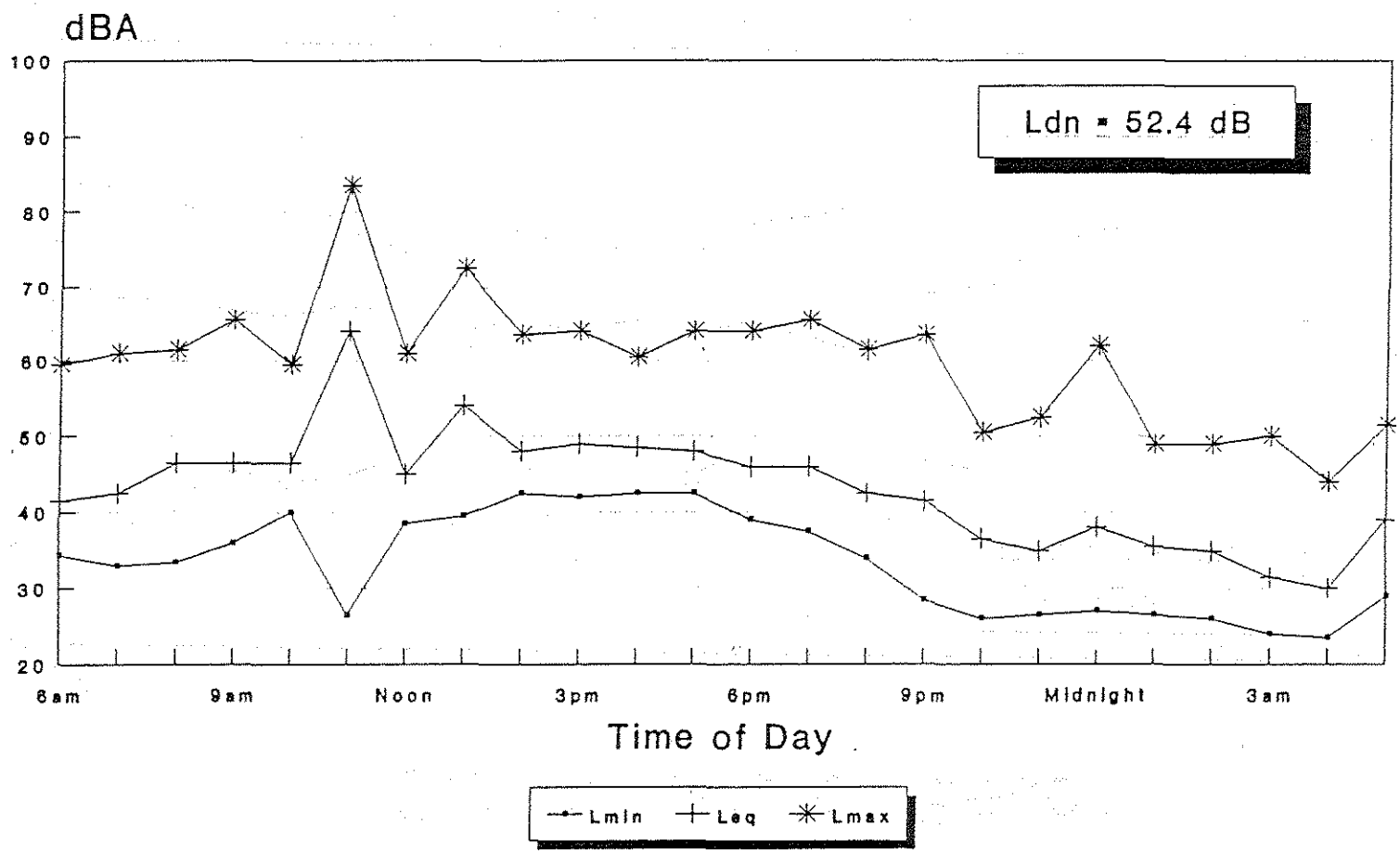


930 Fresno St. 8/20-21/90

BBA

Figure 4-3

Ambient Noise Levels
City of Arroyo Grande

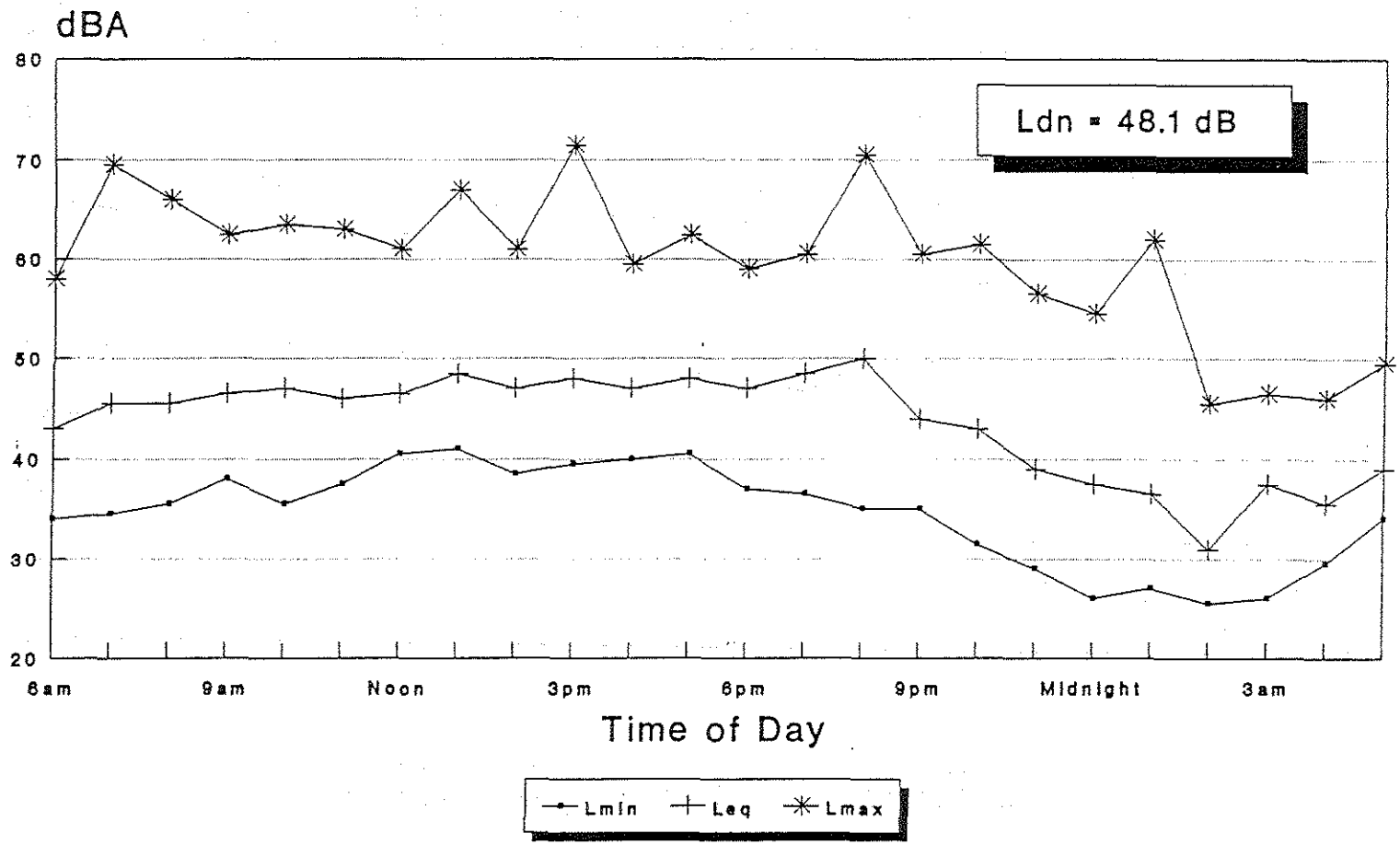


225 Short St. 8/23-24/90

BBA

Figure 4-4

Ambient Noise Levels
City of Grover Beach



240 Eight St. 8/21-22/90

BBA

CHAPTER 5 REFERENCES

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3. California Department of Health, Office of Noise Control, Model Community Noise Control Ordinance, April, 1977.

4. U.S. Environmental Protection Agency, Model Community Noise Control Ordinance,September, 1975.

5. Federal Highway Administration, FHWA Highway Traffic Noise Prediction Model, December, 1978.

6. Brown-Buntin Associates, Inc., Aircraft Noise Assessment, Chandler Ranch Specific Plan EIR, July, 1990.

7. Federal Aviation Administration, Integrated Noise Model, Version 3.9, October, 1982.

8. PRC Engineering, Inc., Future Noise Exposure Map (2005) Oceano-County Airport.

9. PRC Engineering, Inc., Airport Master Plan, Update Study, San Luis Obispo County Airport, December, 1986.

10. Brown-Buntin Associates, Inc., Airport Capacity CNEL Contour Map, San Luis Obispo County Airport, January 8, 1991.

11. Department of the Army, Environmental Noise Study No. 52-34-0493-89, Noise Contours for Camp Roberts, California, June, 1989.

APPENDIX A TRAFFIC DATA

HWA Model RD-7 : Brown-Buntin Associates, Inc.
alveno Emission Curves Run Date: 05-15-1991
roject Number: 90-001 Run Time: 15:14:13
ear: 1991
oft Site

NPUT DATA SUMMARY:

egment	ADT	Day%	Eve%	Nite%	%MT	%HT	Speed	Distance	Offset
1	3800	90.0	0.0	10.0	5.0	2.1	50.0	100.0	0.0
2	6500	90.0	0.0	10.0	5.0	2.1	50.0	100.0	0.0
3	5800	89.0	0.0	11.0	6.1	10.1	40.0	100.0	0.0
4	10300	89.0	0.0	11.0	6.1	10.1	40.0	100.0	0.0
5	7400	89.0	0.0	11.0	6.1	10.1	40.0	100.0	0.0
6	12700	89.0	0.0	11.0	6.1	10.1	40.0	100.0	0.0
7	12400	89.0	0.0	11.0	1.5	0.7	40.0	100.0	0.0
8	19700	89.0	0.0	11.0	1.5	0.7	40.0	100.0	0.0
9	30000	87.0	0.0	13.0	1.9	0.9	45.0	100.0	0.0
10	44300	87.0	0.0	13.0	1.9	0.9	45.0	100.0	0.0
11	21000	85.0	0.0	15.0	3.0	1.2	65.0	100.0	0.0
12	32800	85.0	0.0	15.0	3.0	1.2	65.0	100.0	0.0
13	17800	88.0	0.0	12.0	3.3	1.5	70.0	100.0	0.0
14	27800	88.0	0.0	12.0	3.3	1.5	70.0	100.0	0.0
15	21700	90.0	0.0	10.0	2.4	0.8	70.0	100.0	0.0
16	30900	90.0	0.0	10.0	2.4	0.8	70.0	100.0	0.0
17	15000	90.0	0.0	10.0	2.9	0.8	70.0	100.0	0.0
18	21000	90.0	0.0	10.0	2.9	0.8	70.0	100.0	0.0
19	8200	95.0	0.0	5.0	4.4	1.2	65.0	100.0	0.0
20	9500	95.0	0.0	5.0	4.4	1.2	65.0	100.0	0.0
21	6500	95.0	0.0	5.0	5.1	2.2	65.0	100.0	0.0
22	8600	95.0	0.0	5.0	5.1	2.2	65.0	100.0	0.0
23	8000	95.0	0.0	5.0	1.9	0.4	65.0	100.0	0.0
24	9800	95.0	0.0	5.0	1.9	0.4	65.0	100.0	0.0
25	2500	95.0	0.0	5.0	1.9	0.4	65.0	100.0	0.0
26	3700	95.0	0.0	5.0	1.9	0.4	65.0	100.0	0.0
27	9000	90.0	0.0	10.0	3.0	1.2	55.0	100.0	0.0
28	17400	90.0	0.0	10.0	3.0	1.2	55.0	100.0	0.0
29	6000	90.0	0.0	10.0	2.7	1.6	55.0	100.0	0.0
30	9400	90.0	0.0	10.0	2.7	1.6	55.0	100.0	0.0
31	11900	90.0	0.0	10.0	2.7	1.6	45.0	100.0	0.0
32	30500	90.0	0.0	10.0	2.7	1.6	45.0	100.0	0.0
33	25000	90.0	0.0	10.0	2.2	1.5	45.0	100.0	0.0
34	46100	90.0	0.0	10.0	2.2	1.5	45.0	100.0	0.0
35	2800	90.0	0.0	10.0	2.2	1.5	45.0	100.0	0.0
36	4800	90.0	0.0	10.0	2.2	1.5	45.0	100.0	0.0
37	1900	90.0	0.0	10.0	2.3	1.2	45.0	100.0	0.0
38	3000	90.0	0.0	10.0	2.3	1.2	45.0	100.0	0.0
39	560	90.0	0.0	10.0	10.4	3.1	45.0	100.0	0.0
40	1100	90.0	0.0	10.0	10.4	3.1	45.0	100.0	0.0
41	4300	84.0	0.0	16.0	5.6	8.7	60.0	100.0	0.0
42	7900	84.0	0.0	16.0	5.6	8.7	60.0	100.0	0.0
43	2100	94.0	0.0	6.0	2.4	1.1	65.0	100.0	0.0
44	2600	94.0	0.0	6.0	2.4	1.1	65.0	100.0	0.0
45	3900	94.0	0.0	6.0	2.8	1.2	60.0	100.0	0.0

FHWA Model RD-77-108: Brown-Buntin Associates, Inc.
Calveno Emission Curves Run Date: 05-15-1991
Project Number: 90-001 Run Time: 15:14:16
Year: 1991
Soft Site

INPUT DATA SUMMARY:

Segment	ADT	Day%	Eve%	Nite%	%MT	%HT	Speed	Distance	Offset
46	5000	94.0	0.0	6.0	2.8	1.2	60.0	100.0	0.0
47	16000	85.0	0.0	15.0	8.6	11.4	65.0	100.0	0.0
48	23400	85.0	0.0	15.0	8.6	11.4	65.0	100.0	0.0
49	10000	81.0	0.0	19.0	8.3	12.5	65.0	100.0	0.0
50	17000	81.0	0.0	19.0	8.3	12.5	65.0	100.0	0.0
51	5200	84.0	0.0	16.0	5.8	18.2	65.0	100.0	0.0
52	8840	84.0	0.0	16.0	5.8	18.2	65.0	100.0	0.0
53	5100	88.0	0.0	12.0	3.5	2.5	60.0	100.0	0.0
54	8500	88.0	0.0	12.0	3.5	2.5	60.0	100.0	0.0
55	2400	88.0	0.0	12.0	3.0	3.0	60.0	100.0	0.0
56	4000	88.0	0.0	12.0	3.0	3.0	60.0	100.0	0.0
57	40000	89.0	0.0	11.0	2.2	5.3	70.0	100.0	0.0
58	66800	89.0	0.0	11.0	2.2	5.3	70.0	100.0	0.0
59	52000	90.0	0.0	10.0	2.3	5.3	70.0	100.0	0.0
60	133200	90.0	0.0	10.0	2.3	5.3	70.0	100.0	0.0
61	45000	90.0	0.0	10.0	2.6	5.9	70.0	100.0	0.0
62	95700	90.0	0.0	10.0	2.6	5.9	70.0	100.0	0.0
63	50000	90.0	0.0	10.0	2.6	5.9	70.0	100.0	0.0
64	83800	90.0	0.0	10.0	2.6	5.9	70.0	100.0	0.0
65	43000	90.0	0.0	10.0	2.6	5.9	70.0	100.0	0.0
66	73000	90.0	0.0	10.0	2.6	5.9	70.0	100.0	0.0
67	56000	90.0	0.0	10.0	2.7	6.3	70.0	100.0	0.0
68	100200	90.0	0.0	10.0	2.7	6.3	70.0	100.0	0.0
69	44000	89.0	0.0	11.0	3.0	7.0	70.0	100.0	0.0
70	102000	89.0	0.0	11.0	3.0	7.0	70.0	100.0	0.0
71	33000	86.0	0.0	14.0	3.0	6.6	70.0	100.0	0.0
72	69900	86.0	0.0	14.0	3.0	6.6	70.0	100.0	0.0
73	24000	86.0	0.0	14.0	3.9	8.5	65.0	100.0	0.0
74	53900	86.0	0.0	14.0	3.9	8.5	65.0	100.0	0.0
75	17000	86.0	0.0	14.0	4.6	13.3	70.0	100.0	0.0
76	30200	86.0	0.0	14.0	4.6	13.3	70.0	100.0	0.0
77	15500	86.0	0.0	14.0	4.6	13.3	70.0	100.0	0.0
78	30200	86.0	0.0	14.0	4.6	13.3	70.0	100.0	0.0
79	2450	90.0	0.0	10.0	5.6	16.0	60.0	100.0	0.0
80	3400	90.0	0.0	10.0	5.6	16.0	60.0	100.0	0.0
81	3000	91.0	0.0	9.0	4.3	1.7	50.0	100.0	0.0
82	6700	91.0	0.0	9.0	4.3	1.7	50.0	100.0	0.0
83	11000	92.0	0.0	8.0	4.3	1.7	50.0	100.0	0.0
84	23900	92.0	0.0	8.0	4.3	1.7	50.0	100.0	0.0
85	21900	92.0	0.0	8.0	2.0	3.0	40.0	100.0	0.0
86	40000	92.0	0.0	8.0	2.0	3.0	40.0	100.0	0.0
87	29000	92.0	0.0	8.0	2.0	3.0	40.0	100.0	0.0
88	52000	92.0	0.0	8.0	2.0	3.0	40.0	100.0	0.0
89	10400	92.0	0.0	8.0	2.0	3.0	40.0	100.0	0.0
90	17000	92.0	0.0	8.0	2.0	3.0	40.0	100.0	0.0

FHWA Model RD-77-108: Brown-Buntin Associates, Inc.
Calveno Emission Curves Run Date: 05-15-1991
Project Number: 90-001 Run Time: 15:14:18
Year: 1991
Soft Site

INPUT DATA SUMMARY:

Segment	ADT	Day%	Eve%	Nite%	%MT	%HT	Speed	Distance	Offset
91	14300	90.0	0.0	10.0	2.0	2.4	60.0	100.0	0.0
92	29000	90.0	0.0	10.0	2.0	2.4	60.0	100.0	0.0
93	17000	90.0	0.0	10.0	2.5	2.5	50.0	100.0	0.0
94	30000	90.0	0.0	10.0	2.5	2.5	50.0	100.0	0.0
95	17000	90.0	0.0	10.0	2.5	2.5	36.0	100.0	0.0
96	30000	90.0	0.0	10.0	2.5	2.5	36.0	100.0	0.0
97	10100	90.0	0.0	10.0	1.0	1.0	40.0	100.0	0.0
98	20000	90.0	0.0	10.0	1.0	1.0	40.0	100.0	0.0
99	8500	90.0	0.0	10.0	1.0	1.0	40.0	100.0	0.0
100	11000	90.0	0.0	10.0	1.0	1.0	40.0	100.0	0.0
101	13000	90.0	0.0	10.0	2.5	2.5	52.0	100.0	0.0
102	22000	90.0	0.0	10.0	2.5	2.5	52.0	100.0	0.0
103	2800	90.0	0.0	10.0	1.0	1.0	35.0	100.0	0.0
104	7000	90.0	0.0	10.0	1.0	1.0	35.0	100.0	0.0
105	3300	90.0	0.0	10.0	1.0	1.0	41.0	100.0	0.0
106	5500	90.0	0.0	10.0	1.0	1.0	41.0	100.0	0.0
107	2900	90.0	0.0	10.0	1.0	1.0	40.0	100.0	0.0
108	6000	90.0	0.0	10.0	1.0	1.0	40.0	100.0	0.0
109	3000	90.0	0.0	10.0	1.0	1.0	40.0	100.0	0.0
110	5000	90.0	0.0	10.0	1.0	1.0	40.0	100.0	0.0
111	6100	90.0	0.0	10.0	1.0	1.0	32.0	100.0	0.0
112	10500	90.0	0.0	10.0	1.0	1.0	32.0	100.0	0.0
113	5800	90.0	0.0	10.0	1.0	1.0	35.0	100.0	0.0
114	8000	90.0	0.0	10.0	1.0	1.0	35.0	100.0	0.0
115	6300	90.0	0.0	10.0	1.0	1.0	33.0	100.0	0.0
116	10500	90.0	0.0	10.0	1.0	1.0	33.0	100.0	0.0
117	4500	90.0	0.0	10.0	1.0	1.5	39.0	100.0	0.0
118	17000	90.0	0.0	10.0	1.0	1.5	39.0	100.0	0.0
119	5500	90.0	0.0	10.0	1.0	1.0	35.0	100.0	0.0
120	12000	90.0	0.0	10.0	1.0	1.0	35.0	100.0	0.0
121	4200	90.0	0.0	10.0	1.0	1.0	31.0	100.0	0.0
122	13000	90.0	0.0	10.0	1.0	1.0	31.0	100.0	0.0
123	3600	90.0	0.0	10.0	1.0	1.0	35.0	100.0	0.0
124	7300	90.0	0.0	10.0	1.0	1.0	35.0	100.0	0.0
125	2800	90.0	0.0	10.0	1.0	1.0	40.0	100.0	0.0
126	5400	90.0	0.0	10.0	1.0	1.0	40.0	100.0	0.0
127	5237	92.0	0.0	8.0	1.0	1.0	55.0	100.0	0.0
128	5110	92.0	0.0	8.0	1.0	1.0	55.0	100.0	0.0
129	5237	92.0	0.0	8.0	1.0	1.0	55.0	100.0	0.0
130	15260	92.0	0.0	8.0	1.0	1.0	55.0	100.0	0.0
131	5190	93.0	0.0	7.0	1.0	1.0	45.0	100.0	0.0
132	6380	93.0	0.0	7.0	1.0	1.0	45.0	100.0	0.0
133	5190	93.0	0.0	7.0	1.0	1.0	45.0	100.0	0.0
134	27650	93.0	0.0	7.0	1.0	1.0	45.0	100.0	0.0
135	3800	93.0	0.0	7.0	1.0	1.0	45.0	100.0	0.0

FHWA Model RD-77-108: Brown-Buntin Associates, Inc.
Calveno Emission Curves Run Date: 05-15-1991
Project Number: 90-001 Run Time: 15:14:22
Year: 1991
Soft Site

INPUT DATA SUMMARY:

Segment	ADT	Day%	Eve%	Nite%	%MT	%HT	Speed	Distance	Offse
136	7410	93.0	0.0	7.0	1.0	1.0	45.0	100.0	0.
137	4600	92.0	0.0	8.0	2.5	2.5	45.0	100.0	0.
138	12100	92.0	0.0	8.0	2.5	2.5	45.0	100.0	0.
139	4600	92.0	0.0	8.0	2.5	2.5	45.0	100.0	0.
140	18180	92.0	0.0	8.0	2.5	2.5	45.0	100.0	0.
141	4400	90.0	0.0	10.0	5.0	5.0	45.0	100.0	0.
142	10000	90.0	0.0	10.0	5.0	5.0	45.0	100.0	0.
143	5900	88.0	0.0	12.0	1.0	1.0	50.0	100.0	0.
144	13000	88.0	0.0	12.0	1.0	1.0	50.0	100.0	0.
145	11000	86.0	0.0	14.0	3.0	3.1	50.0	100.0	0.
146	19500	86.0	0.0	14.0	3.0	3.1	50.0	100.0	0.
147	2900	90.0	0.0	10.0	1.0	1.0	60.0	100.0	0.
148	6000	90.0	0.0	10.0	1.0	1.0	60.0	100.0	0.
149	2300	90.0	0.0	10.0	1.0	1.0	48.0	100.0	0.
150	6500	90.0	0.0	10.0	1.0	1.0	48.0	100.0	0.
151	2500	90.0	0.0	10.0	8.5	10.0	50.0	100.0	0.
152	4000	90.0	0.0	10.0	8.5	10.0	50.0	100.0	0.
153	3000	90.0	0.0	10.0	1.0	1.0	35.0	100.0	0.
154	6000	90.0	0.0	10.0	1.0	1.0	35.0	100.0	0.
155	6500	90.0	0.0	10.0	1.0	1.0	34.0	100.0	0.
156	7000	90.0	0.0	10.0	1.0	1.0	34.0	100.0	0.
157	5200	90.0	0.0	10.0	1.0	1.0	48.0	100.0	0.
158	6000	90.0	0.0	10.0	1.0	1.0	48.0	100.0	0.
159	23000	92.0	0.0	8.0	0.5	0.5	60.0	100.0	0.
160	32000	92.0	0.0	8.0	0.5	0.5	60.0	100.0	0.
161	14300	90.0	0.0	10.0	2.0	2.4	60.0	100.0	0.
162	29000	90.0	0.0	10.0	2.0	2.4	60.0	100.0	0.
163	11000	92.0	0.0	8.0	5.0	6.4	45.0	100.0	0.
164	18000	92.0	0.0	8.0	5.0	6.4	45.0	100.0	0.
165	2000	90.0	0.0	10.0	2.5	2.5	45.0	100.0	0.
166	16000	90.0	0.0	10.0	2.5	2.5	45.0	100.0	0.
167	5200	90.0	0.0	10.0	2.5	2.5	50.0	100.0	0.
168	24000	90.0	0.0	10.0	2.5	2.5	50.0	100.0	0.
169	3600	90.0	0.0	10.0	1.0	1.0	50.0	100.0	0.
170	12000	90.0	0.0	10.0	1.0	1.0	50.0	100.0	0.
171	5700	90.0	0.0	10.0	1.0	1.0	50.0	100.0	0.
172	8100	90.0	0.0	10.0	1.0	1.0	50.0	100.0	0.
173	3000	90.0	0.0	10.0	1.0	1.0	45.0	100.0	0.
174	10000	90.0	0.0	10.0	1.0	1.0	45.0	100.0	0.
175	4300	90.0	0.0	10.0	2.5	2.5	45.0	100.0	0.
176	6500	90.0	0.0	10.0	2.5	2.5	45.0	100.0	0.
177	3400	90.0	0.0	10.0	1.0	1.0	45.0	100.0	0.
178	6800	90.0	0.0	10.0	1.0	1.0	45.0	100.0	0.
179	3200	90.0	0.0	10.0	1.0	1.0	38.0	100.0	0.
180	7800	90.0	0.0	10.0	1.0	1.0	38.0	100.0	0.

FHWA Model RD-77-108: Brown-Buntin Associates, Inc.
Calveno Emission Curves Run Date: 05-15-1991
Project Number: 90-001 Run Time: 15:14:24
Year: 1991
Soft Site

INPUT DATA SUMMARY:

Segment	ADT	Day%	Eve%	Nite%	%MT	%HT	Speed	Distance	Offset
181	3600	92.0	0.0	8.0	0.5	0.5	30.0	100.0	0.0
182	3600	92.0	0.0	8.0	0.5	0.5	30.0	100.0	0.0
183	10400	92.0	0.0	8.0	2.0	3.0	40.0	100.0	0.0
184	17000	92.0	0.0	8.0	2.0	3.0	40.0	100.0	0.0
185	29000	92.0	0.0	8.0	2.0	3.0	40.0	100.0	0.0
186	52000	92.0	0.0	8.0	2.0	3.0	40.0	100.0	0.0
187	21900	92.0	0.0	8.0	2.0	3.0	40.0	100.0	0.0
188	40000	92.0	0.0	8.0	2.0	3.0	40.0	100.0	0.0
189	4100	92.0	0.0	8.0	0.5	0.5	30.0	100.0	0.0
190	10000	92.0	0.0	8.0	0.5	0.5	30.0	100.0	0.0
191	16400	92.0	0.0	8.0	0.5	0.5	40.0	100.0	0.0
192	24000	92.0	0.0	8.0	0.5	0.5	40.0	100.0	0.0
193	12300	92.0	0.0	8.0	0.5	0.5	35.0	100.0	0.0
194	12000	92.0	0.0	8.0	0.5	0.5	35.0	100.0	0.0
195	2700	92.0	0.0	8.0	0.5	0.5	33.0	100.0	0.0
196	16000	92.0	0.0	8.0	0.5	0.5	33.0	100.0	0.0
197	11500	92.0	0.0	8.0	0.5	0.5	33.0	100.0	0.0
198	15000	92.0	0.0	8.0	0.5	0.5	33.0	100.0	0.0
199	2700	92.0	0.0	8.0	0.5	0.5	35.0	100.0	0.0
200	8000	92.0	0.0	8.0	0.5	0.5	35.0	100.0	0.0
201	8900	92.0	0.0	8.0	0.5	0.5	40.0	100.0	0.0
202	12000	92.0	0.0	8.0	0.5	0.5	40.0	100.0	0.0
203	11400	92.0	0.0	8.0	0.5	0.5	35.0	100.0	0.0
204	32000	92.0	0.0	8.0	0.5	0.5	35.0	100.0	0.0
205	11400	92.0	0.0	8.0	0.5	0.5	35.0	100.0	0.0
206	17000	92.0	0.0	8.0	0.5	0.5	35.0	100.0	0.0
207	12800	92.0	0.0	8.0	1.5	2.0	30.0	100.0	0.0
208	18000	92.0	0.0	8.0	1.5	2.0	30.0	100.0	0.0
209	15000	92.0	0.0	8.0	1.5	2.0	30.0	100.0	0.0
210	40000	92.0	0.0	8.0	1.5	2.0	30.0	100.0	0.0
211	15000	92.0	0.0	8.0	1.5	2.0	40.0	100.0	0.0
212	31000	92.0	0.0	8.0	1.5	2.0	40.0	100.0	0.0
213	12600	92.0	0.0	8.0	2.0	2.0	45.0	100.0	0.0
214	19000	92.0	0.0	8.0	2.0	2.0	45.0	100.0	0.0
215	18000	92.0	0.0	8.0	2.0	2.0	45.0	100.0	0.0
216	20000	92.0	0.0	8.0	2.0	2.0	45.0	100.0	0.0
217	21000	92.0	0.0	8.0	1.5	1.5	40.0	100.0	0.0
218	34000	92.0	0.0	8.0	1.5	1.5	40.0	100.0	0.0
219	4800	92.0	0.0	8.0	1.0	1.0	40.0	100.0	0.0
220	15000	92.0	0.0	8.0	1.0	1.0	40.0	100.0	0.0
221	18000	92.0	0.0	8.0	1.5	1.5	35.0	100.0	0.0
222	29000	92.0	0.0	8.0	1.5	1.5	35.0	100.0	0.0
223	23000	92.0	0.0	8.0	0.5	0.5	45.0	100.0	0.0
224	32000	92.0	0.0	8.0	0.5	0.5	45.0	100.0	0.0
225	33000	92.0	0.0	8.0	1.5	2.0	45.0	100.0	0.0

FHWA Model RD-77-108: Brown-Buntin Associates, Inc.
Calveno Emission Curves Run Date: 05-15-1991
Project Number: 90-001 Run Time: 15:15:22
Year: 1991
Soft Site

INPUT DATA SUMMARY:

Segment	ADT	Day%	Eve%	Nite%	%MT	%HT	Speed	Distance	Offset
226	51000	92.0	0.0	8.0	1.5	2.0	45.0	100.0	0.0
227	16200	92.0	0.0	8.0	1.0	1.0	30.0	100.0	0.0
228	23000	92.0	0.0	8.0	1.0	1.0	30.0	100.0	0.0
229	12900	92.0	0.0	8.0	0.5	0.5	35.0	100.0	0.0
230	20000	92.0	0.0	8.0	0.5	0.5	35.0	100.0	0.0
231	12700	92.0	0.0	8.0	1.5	1.5	30.0	100.0	0.0
232	14000	92.0	0.0	8.0	1.5	1.5	30.0	100.0	0.0
233	15100	92.0	0.0	8.0	2.0	2.0	30.0	100.0	0.0
234	23000	92.0	0.0	8.0	2.0	2.0	30.0	100.0	0.0
235	16800	89.0	0.0	11.0	1.5	0.7	35.0	100.0	0.0
236	28000	89.0	0.0	11.0	1.5	0.7	35.0	100.0	0.0
237	13500	92.0	0.0	8.0	0.5	0.5	40.0	100.0	0.0
238	27000	92.0	0.0	8.0	0.5	0.5	40.0	100.0	0.0
239	9700	92.0	0.0	8.0	0.5	0.5	35.0	100.0	0.0
240	19000	92.0	0.0	8.0	0.5	0.5	35.0	100.0	0.0
241	14000	92.0	0.0	8.0	0.5	0.5	40.0	100.0	0.0
242	23000	92.0	0.0	8.0	0.5	0.5	40.0	100.0	0.0
243	2000	90.0	0.0	10.0	2.5	2.5	45.0	100.0	0.0
244	16000	90.0	0.0	10.0	2.5	2.5	45.0	100.0	0.0
245	2900	92.0	0.0	8.0	0.5	0.5	30.0	100.0	0.0
246	5800	92.0	0.0	8.0	0.5	0.5	30.0	100.0	0.0
247	3600	92.0	0.0	8.0	0.5	0.5	30.0	100.0	0.0
248	4300	92.0	0.0	8.0	0.5	0.5	30.0	100.0	0.0
249	3000	92.0	0.0	8.0	0.5	0.5	30.0	100.0	0.0
250	4000	92.0	0.0	8.0	0.5	0.5	30.0	100.0	0.0
251	4100	92.0	0.0	8.0	0.5	0.5	35.0	100.0	0.0
252	32000	92.0	0.0	8.0	0.5	0.5	35.0	100.0	0.0
253	5900	93.0	0.0	7.0	1.0	1.0	40.0	100.0	0.0
254	17200	93.0	0.0	7.0	1.0	1.0	40.0	100.0	0.0
255	11100	93.0	0.0	7.0	2.0	2.0	35.0	100.0	0.0
256	32400	93.0	0.0	7.0	2.0	2.0	35.0	100.0	0.0
257	9200	93.0	0.0	7.0	1.0	1.0	35.0	100.0	0.0
258	26700	93.0	0.0	7.0	1.0	1.0	35.0	100.0	0.0
259	6600	93.0	0.0	7.0	1.0	1.0	35.0	100.0	0.0
260	19100	93.0	0.0	7.0	1.0	1.0	35.0	100.0	0.0
261	7900	93.0	0.0	7.0	1.0	1.0	25.0	100.0	0.0
262	22900	93.0	0.0	7.0	1.0	1.0	25.0	100.0	0.0
263	5900	93.0	0.0	7.0	1.0	1.0	25.0	100.0	0.0
264	17200	93.0	0.0	7.0	1.0	1.0	25.0	100.0	0.0
265	15100	93.0	0.0	7.0	1.0	1.0	25.0	100.0	0.0
266	43800	93.0	0.0	7.0	1.0	1.0	25.0	100.0	0.0
267	10500	93.0	0.0	7.0	1.0	1.0	25.0	100.0	0.0
268	30500	93.0	0.0	7.0	1.0	1.0	25.0	100.0	0.0
269	5200	93.0	0.0	7.0	1.0	1.0	25.0	100.0	0.0
270	15200	93.0	0.0	7.0	1.0	1.0	25.0	100.0	0.0

FHWA Model RD-77-108: Brown-Buntin Associates, Inc.
Calveno Emission Curves Run Date: 05-15-1991
Project Number: 90-001 Run Time: 15:16:27
Year: 1991
Soft Site

INPUT DATA SUMMARY:

Segment	ADT	Day%	Eve%	Nite%	%MT	%HT	Speed	Distance	Offset
271	16400	93.0	0.0	7.0	2.0	2.0	40.0	100.0	0.0
272	47700	93.0	0.0	7.0	2.0	2.0	40.0	100.0	0.0
273	6300	93.0	0.0	7.0	1.0	1.0	30.0	100.0	0.0
274	18300	93.0	0.0	7.0	1.0	1.0	30.0	100.0	0.0
275	3000	93.0	0.0	7.0	1.0	1.0	45.0	100.0	0.0
276	8800	93.0	0.0	7.0	1.0	1.0	45.0	100.0	0.0
277	12686	90.0	0.0	10.0	1.0	1.0	35.0	100.0	0.0
278	18000	90.0	0.0	10.0	1.0	1.0	35.0	100.0	0.0
279	12980	90.0	0.0	10.0	1.0	1.0	30.0	100.0	0.0
280	19500	90.0	0.0	10.0	1.0	1.0	30.0	100.0	0.0
281	28167	90.0	0.0	10.0	1.0	1.0	30.0	100.0	0.0
282	42250	90.0	0.0	10.0	1.0	1.0	30.0	100.0	0.0
283	7000	90.0	0.0	10.0	5.0	1.6	35.0	100.0	0.0
284	8200	90.0	0.0	10.0	5.0	1.6	35.0	100.0	0.0
285	3700	90.0	0.0	10.0	1.9	0.1	35.0	100.0	0.0
286	6200	90.0	0.0	10.0	1.9	0.1	35.0	100.0	0.0
287	6100	90.0	0.0	10.0	1.9	0.1	35.0	100.0	0.0
288	7100	90.0	0.0	10.0	1.9	0.1	35.0	100.0	0.0
289	17000	90.0	0.0	10.0	1.3	2.6	45.0	100.0	0.0
290	22000	90.0	0.0	10.0	1.3	2.6	45.0	100.0	0.0
291	2320	90.0	0.0	10.0	0.1	0.1	35.0	100.0	0.0
292	5000	90.0	0.0	10.0	0.1	0.1	35.0	100.0	0.0
293	6400	90.0	0.0	10.0	1.3	2.6	45.0	100.0	0.0
294	7400	90.0	0.0	10.0	1.3	2.6	45.0	100.0	0.0
295	13400	90.0	0.0	10.0	2.0	2.0	35.0	100.0	0.0
296	73700	90.0	0.0	10.0	2.0	2.0	35.0	100.0	0.0
297	9500	90.0	0.0	10.0	2.0	2.0	35.0	100.0	0.0
298	41900	90.0	0.0	10.0	2.0	2.0	35.0	100.0	0.0
299	900	90.0	0.0	10.0	1.0	1.0	45.0	100.0	0.0
300	33800	90.0	0.0	10.0	1.0	1.0	45.0	100.0	0.0
301	15700	90.0	0.0	10.0	1.0	1.0	30.0	100.0	0.0
302	26500	90.0	0.0	10.0	1.0	1.0	30.0	100.0	0.0
303	5000	90.0	0.0	10.0	2.0	2.0	45.0	100.0	0.0
304	54700	90.0	0.0	10.0	2.0	2.0	45.0	100.0	0.0
305	2000	90.0	0.0	10.0	2.0	2.0	35.0	100.0	0.0
306	11000	90.0	0.0	10.0	2.0	2.0	35.0	100.0	0.0
307	3400	90.0	0.0	10.0	2.0	2.0	35.0	100.0	0.0
308	16700	90.0	0.0	10.0	2.0	2.0	35.0	100.0	0.0
309	6800	90.0	0.0	10.0	2.0	2.0	35.0	100.0	0.0
310	16900	90.0	0.0	10.0	2.0	2.0	35.0	100.0	0.0
311	2400	90.0	0.0	10.0	1.0	1.0	35.0	100.0	0.0
312	5400	90.0	0.0	10.0	1.0	1.0	35.0	100.0	0.0
313	3400	90.0	0.0	10.0	2.0	2.0	40.0	100.0	0.0
314	6500	90.0	0.0	10.0	2.0	2.0	40.0	100.0	0.0
315	[illegible]	[illegible]	0.0	7.0	1.0	1.0	33.0	100.0	0.0

FHWA Model RD-77-108: Brown-Buntin Associates, Inc.
Calveno Emission Curves Run Date: 05-15-1991
Project Number: 90-001 Run Time: 15:17:32
Year: 1991
Soft Site

INPUT DATA SUMMARY:

Segment	ADT	Day%	Eve%	Nite%	%MT	%HT	Speed	Distance	Offset
316	8000	93.0	0.0	7.0	1.0	1.0	33.0	100.0	0.0
317	3641	90.0	0.0	10.0	1.0	1.0	42.0	100.0	0.0
318	5200	90.0	0.0	10.0	1.0	1.0	42.0	100.0	0.0
319	31971	94.0	0.0	6.0	1.0	1.0	31.0	100.0	0.0
320	45400	94.0	0.0	6.0	1.0	1.0	31.0	100.0	0.0
321	11610	90.0	0.0	10.0	1.0	1.0	34.0	100.0	0.0
322	16500	90.0	0.0	10.0	1.0	1.0	34.0	100.0	0.0
323	10899	90.0	0.0	10.0	1.0	1.0	30.0	100.0	0.0
324	15500	90.0	0.0	10.0	1.0	1.0	30.0	100.0	0.0
325	10855	90.0	0.0	10.0	1.0	1.0	34.0	100.0	0.0
326	15500	90.0	0.0	10.0	1.0	1.0	34.0	100.0	0.0
327	7833	90.0	0.0	10.0	1.0	1.0	33.0	100.0	0.0
328	11200	90.0	0.0	10.0	1.0	1.0	33.0	100.0	0.0
329	12618	95.0	0.0	5.0	1.0	1.0	32.0	100.0	0.0
330	18000	95.0	0.0	5.0	1.0	1.0	32.0	100.0	0.0
331	7747	90.0	0.0	10.0	1.0	1.0	34.0	100.0	0.0
332	11000	90.0	0.0	10.0	1.0	1.0	34.0	100.0	0.0
333	6314	90.0	0.0	10.0	1.0	1.0	35.0	100.0	0.0
334	9000	90.0	0.0	10.0	1.0	1.0	35.0	100.0	0.0
335	9300	90.0	0.0	10.0	2.5	2.5	45.0	100.0	0.0
336	18000	90.0	0.0	10.0	2.5	2.5	45.0	100.0	0.0
337	9300	90.0	0.0	10.0	2.5	2.5	45.0	100.0	0.0
338	18000	90.0	0.0	10.0	2.5	2.5	45.0	100.0	0.0
339	9250	90.0	0.0	10.0	1.0	1.0	45.0	100.0	0.0
340	12900	90.0	0.0	10.0	1.0	1.0	45.0	100.0	0.0
341	3500	90.0	0.0	10.0	1.0	1.0	45.0	100.0	0.0
342	5000	90.0	0.0	10.0	1.0	1.0	45.0	100.0	0.0
343	6380	90.0	0.0	10.0	1.0	1.0	45.0	100.0	0.0
344	9800	90.0	0.0	10.0	1.0	1.0	45.0	100.0	0.0
345	4440	90.0	0.0	10.0	1.8	5.4	35.0	100.0	0.0
346	6660	90.0	0.0	10.0	1.8	5.4	35.0	100.0	0.0

Figure 3-1

Major Noise Sources

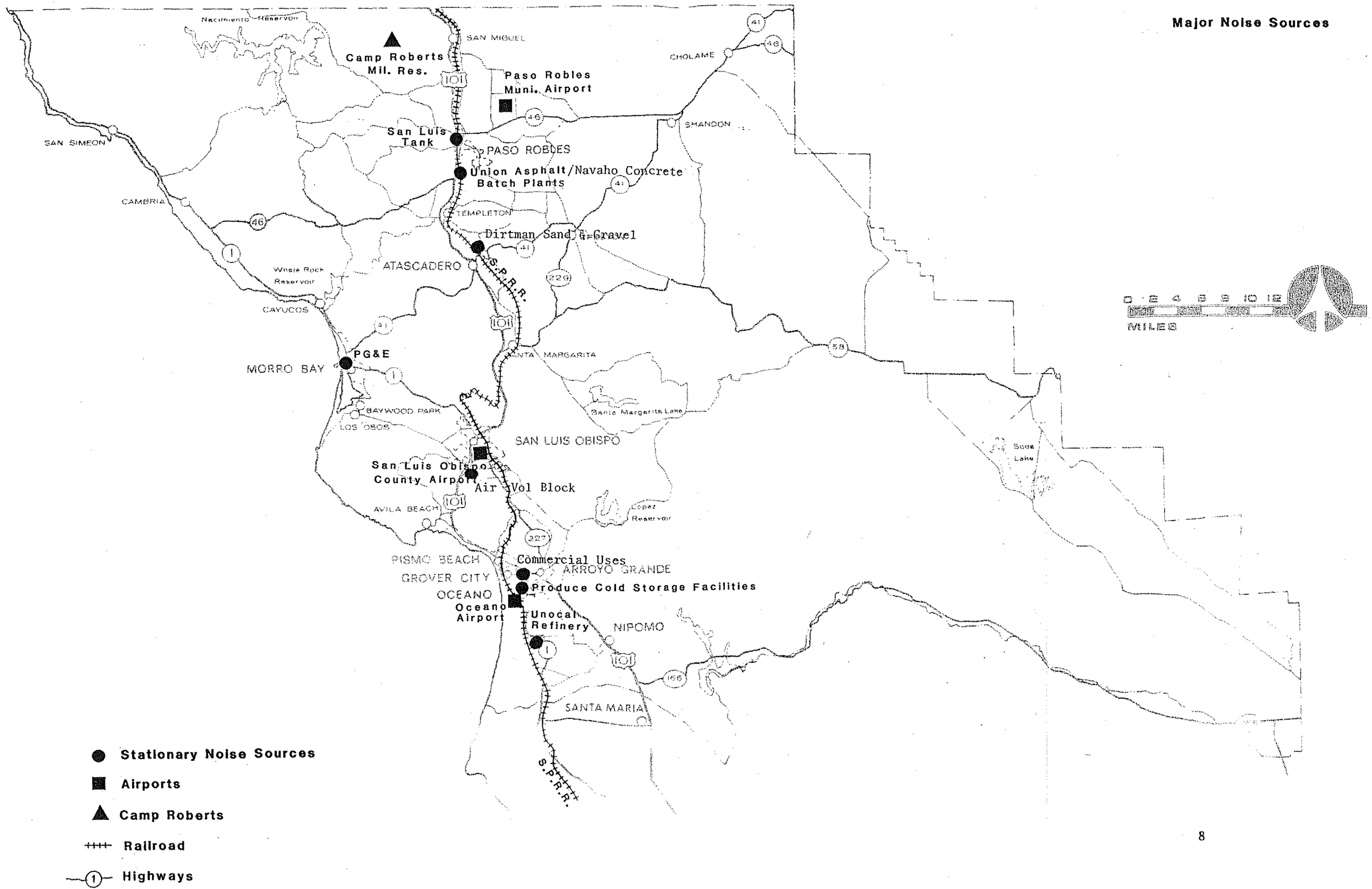
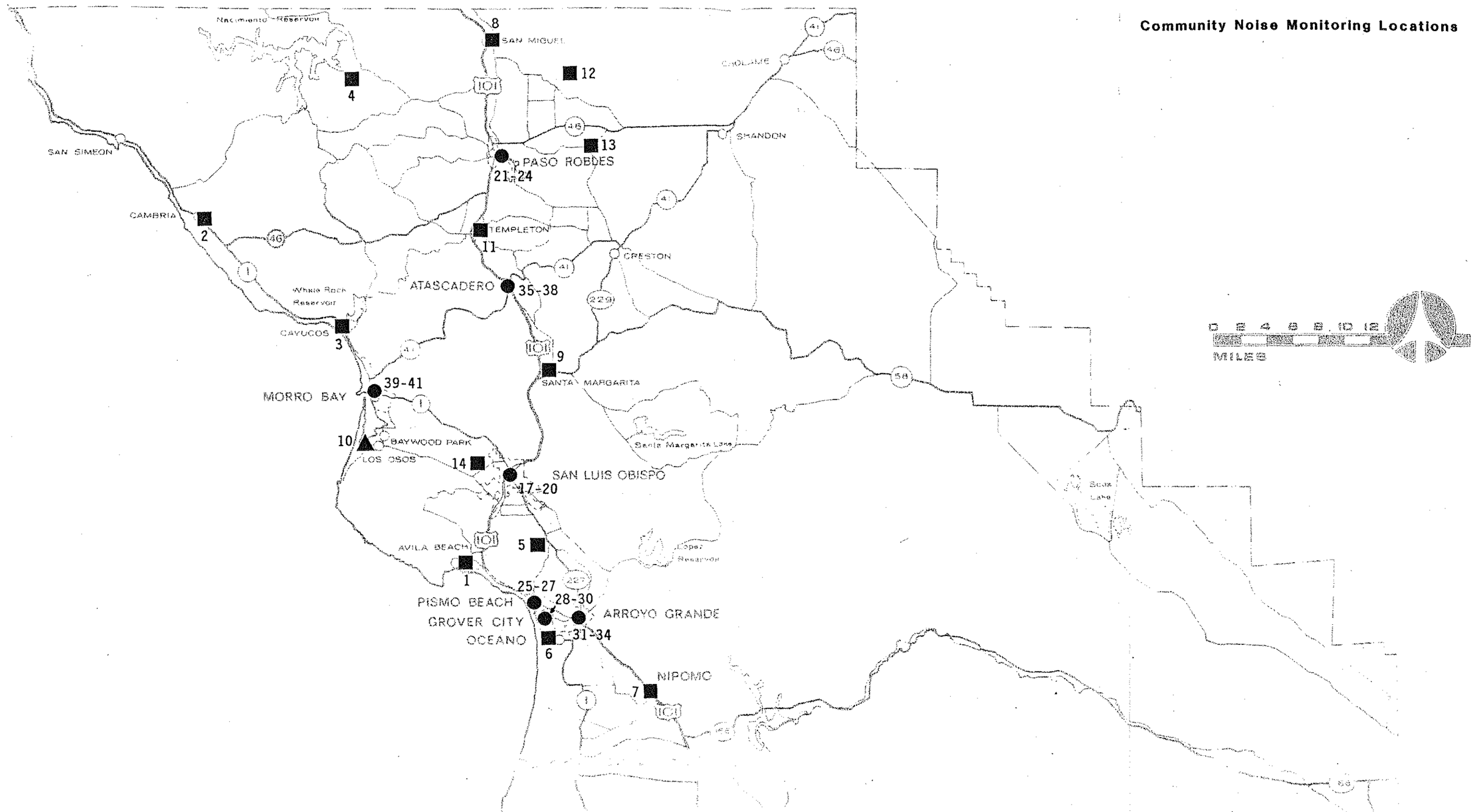


Figure 4-1

Community Noise Monitoring Locations



■ Short-Term Monitoring Sites

▲ 24-hour Monitoring Sites

● Short-Term and 24-hour Monitoring Sites

CITY OF GROVER BEACH
GENERAL PLAN

NOISE ELEMENT, VOLUME 3
ACOUSTICAL DESIGN MANUAL

Adopted by City Council Resolution No. 93-23
June 21, 1993

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CHAPTER 1 INTRODUCTION

1.1 Purpose and Limitations of This Manual

This Manual is a guide to reducing outdoor and indoor noises from rail, road and air traffic. This Manual does not address noise from stationary sources. This Manual is not intended to be used to address complex acoustical situations where the elevation of the noise sender and noise receiver differ significantly or where the noise source is shielded by buildings or topography. An acoustical expert must study these situations.

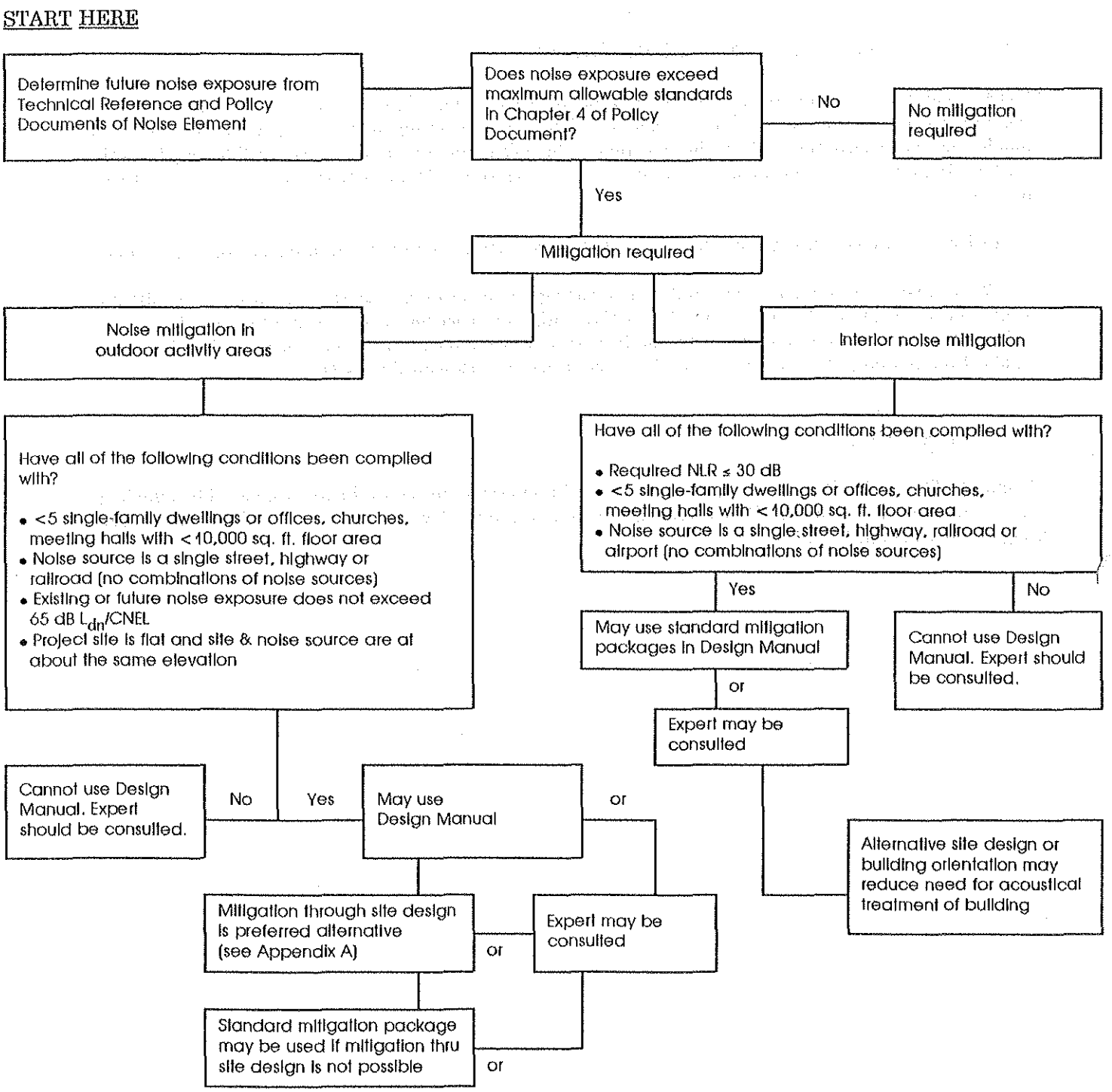
Figure 1 is a flow chart illustrating the process to follow when applying this Manual's recommendations.

This Manual contains standard noise mitigation packages which can reduce exterior noise up to 5 dB and interior noise up to 30 dB. These standard noise mitigation packages can be prescribed by the City to achieve compliance with this Element in relatively simple situations. When authorized by the City, these standard mitigation packages may be used in lieu of detailed acoustical analysis.

1.2 Terminology

Chapter 2 of the Noise Element Policy Document (Volume 1) contains definitions of acoustical terminology used throughout the Element. Unless otherwise stated, all sound levels referred to in this manual are A-weighted decibels (dB).

FIGURE 1
Design Manual Flow Chart



CHAPTER 2 DETERMINING NOISE EXPOSURE

2.1 Noise Element Documentation

The noise exposure information contained within the Policy Document and Technical Reference Document should be used to determine if a particular project site requires expert analysis or mitigation measures. Remember, stationary noise sources should be evaluated by an acoustical expert.

The flow chart in Figure 2 shows where noise exposure information for a particular project may be found. Once the noise exposure information is located, it may be used to determine if the proposed project is consistent with the policies and goals of this Noise Element.

2.2 Noise Source Characteristics

In determining the magnitude of noise impact and strategies for reducing noise impact, it is important to be aware of the characteristics of noise produced by different sources. The most important characteristics of the three transportation noise sources this manual has been designed to address are described below:

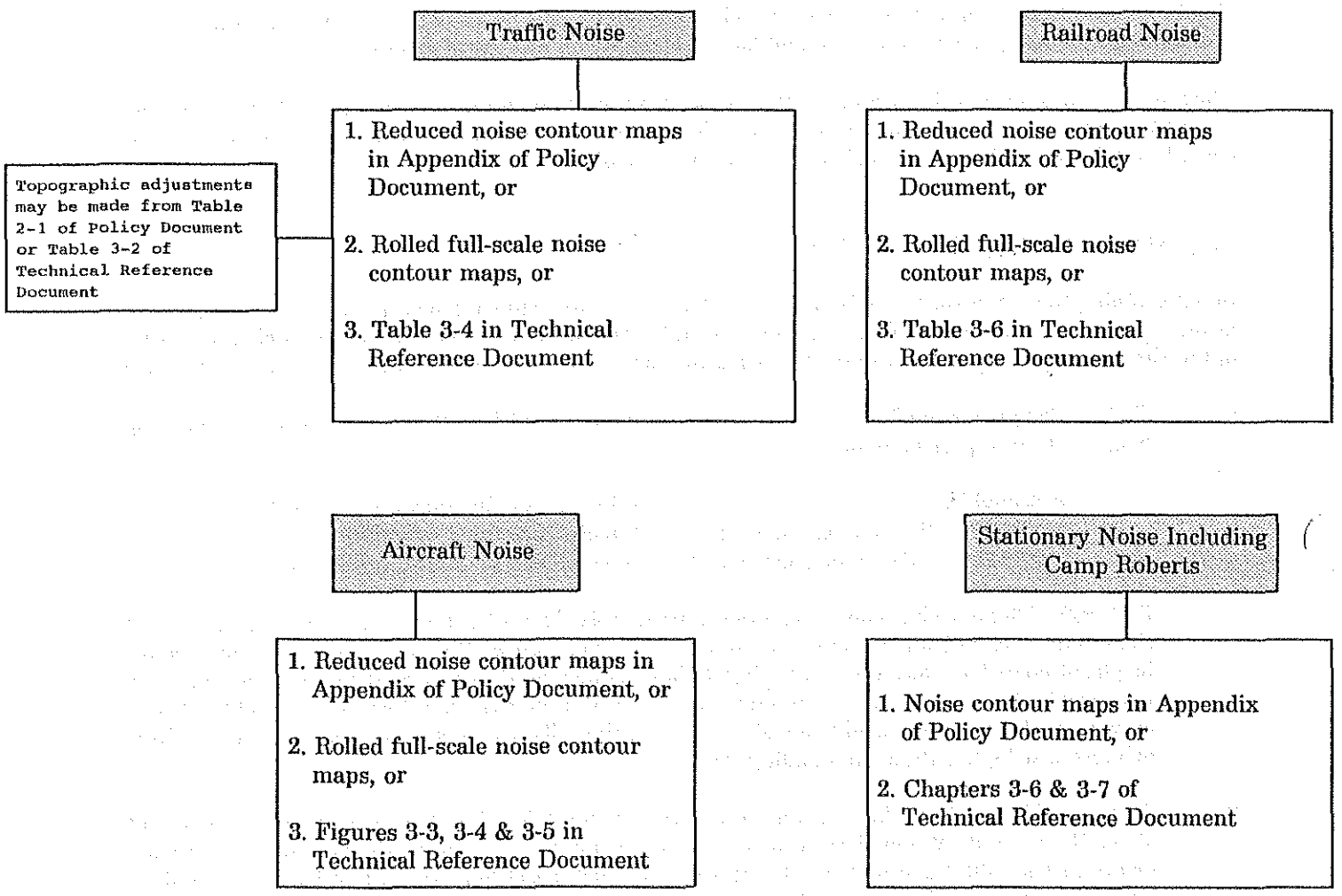
- **Traffic**: For purposes of noise assessment, traffic is divided into three categories with differing heights of noise propagation:

Automobiles:	0 feet above the crown of the road.
Medium trucks (only two axles):	2 feet above the crown of the road.
Heavy trucks (three or more axles):	8 feet above the crown of the road.

- **Railroads**: The effective source height of railroad noise is mostly determined by noise emitted by the locomotive, which is generally assumed to be 10 feet above the rails. However, the effective height of noise for a locomotive blowing its horn is increased to 15 feet above the rails since the horn is situated on top of the locomotive. In many situations the effective source height of trains is even greater than the heights noted above since the rails rest on a gravel bed that is often three or more feet higher than surrounding terrain.

- **Aircraft**: Aircraft in flight near an airport are usually a few hundred to several thousand feet above the ground. When aircraft noise exposure is an issue, generally the aircraft are overhead or are at least 30 degrees above the horizon. In such situations, the use of barriers to reduce exterior noise levels is not feasible.

FIGURE 2
Chart For Locating Noise Exposure Information



CHAPTER 3 NOISE MITIGATION

3.1 Site Design

The most effective design does not place noise-sensitive land users in excessive noise areas. Using building setbacks, natural topography, building orientation, and intervening buildings that do not contain noise-sensitive uses effectively reduces noise at a receiving location. Such measures may minimize or eliminate the need to construct noise barriers.

Appendix A to this Manual provides an overview of various techniques available to mitigate noise. This information should be used to evaluate, in a general way, the acoustical effectiveness of project site designs and proposed noise mitigation measures. There is no simple way to assure an effective plan without an acoustical analysis, therefore, an acoustical analysis is required for all proposed projects, unless the City waives this requirement.

3.2 Standard Noise Mitigation Packages

Exterior and interior noise mitigation measures will be required as part of project approval or the building permit process for all projects when noise levels exceed the standards of this Noise Element. An acoustical analysis prepared by an expert will be required to quantify noise exposures and to propose effective noise mitigation measures. The requirement for an acoustical analysis may be waived, under certain conditions, by the City. A standard noise mitigation package may then be used to comply with the Noise Element.

Standard noise mitigation packages are sets of mitigation measures which may be used to reduce interior and exterior noise by prescribed amounts. These packages may be used to reduce outside noise levels up to 5 dB and inside noise levels up to 30 dB. Reductions greater than these amounts will require the recommendations of an expert after an acoustical analysis has been completed.

3.2.1 Exterior Noise Mitigation

The City may waive the requirements for an acoustical analysis if <u>all</u> of the following conditions are met:

1. The proposed development is less than five single-family dwellings or is an office building, church or meeting hall development with a total project gross floor area of less than 10,000 square feet. No waiver is permitted for apartments, condos or similar residential developments where multiple dwelling units are contained in a single structure or mobile homes when contained in a park or setting containing more than one unit.

2. The noise consists of a single source from rail or road for which current noise exposure information is available. Complex noise sources coming from multiple sources such as rail and road or more than one road must be addressed through an acoustical analysis by an expert.

3. The existing or future noise level within outdoor activity areas or at the building facade does not exceed 65 dB L_{dn} prior to mitigation. The existing or project noise exposure for playgrounds and parks may not exceed 75 dB L_{dn} (or CNEL) prior to mitigation.

4. The topography in the project area is flat and both the noise source and proposed project are at the same grade.

An acoustical analysis by an expert is required if all of these conditions are not met.

The following exterior standard noise mitigation packages may be implemented to reduce noise levels by approximately 5 dB.

Exterior Package 1 - Traffic Noise Sources:
(Maximum 5 dB Reduction)

Construct a barrier of sufficient height to interrupt line-of-sight between the noise source and receiver. A noise source height of two feet above the roadway crown shall be used when trucks are less than 5% of the roads average daily traffic (ADT). When truck traffic is greater than 5% of the ADT, the source height shall be eight feet above crown. In both cases, a receiver height of five feet above grade of the outdoor activity location shall be used.

Exterior Package 2 - Railroad Noise Sources:
(Maximum 5 dB Reduction)

Construct a barrier of sufficient height to interrupt the line-of-sight between the noise source and receiver. A noise source fifteen feet above rails shall be assumed when the noise source is a railroad grade crossing. At other rail locations, a noise source height of ten feet above rails shall be assumed. When determining the total height of a railroad noise source, the height of the rail bed must be added to the source heights described above. Use a receiver height of five feet above grade of the outdoor activity area of concern.

Aircraft Noise: Mitigating exterior noise from aircraft overflights is not possible in most cases. No package is offered or provided.

Industrial/Commercial Noise: The unpredictability of source heights, noise spectra and noise levels associated with commerce and industry prevents the offer of a package. An acoustical analysis will be necessary.

3.2.2 Barrier Design

Use Table 1 for barrier design assistance. A scaled cross-section of the proposed barrier showing relative source, barrier, and receiver heights and distances between source, barrier, and receiver will be required. Figure 3 provides examples of noise barrier cross-sections for simple and more complex site conditions. The closer the barrier is placed to the source or to the receiver, the greater the noise reduction.

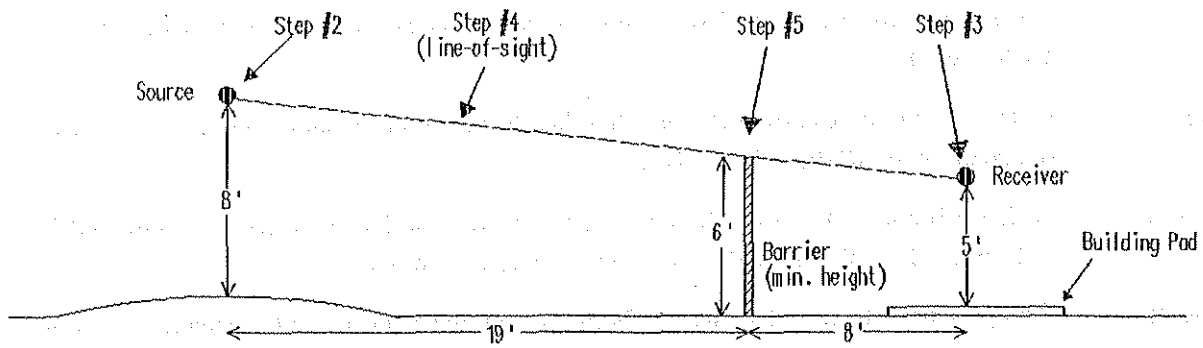
Effective barriers must consist of massive, tight-fitting materials, such as grouted concrete block or stucco wall. No openings are permitted in the wall or at the ground/wall interface. Other noise barrier materials may be acceptable if recommended by an acoustical expert. The use of wood is not recommended due to warpage, shrinkage and deterioration problems.

A line-of-sight barrier will reduce sound by about 5 dB. Reductions from 5 to 15 dB are difficult to achieve and must depend upon design by an expert. Noise reductions exceeding 15 dB from barriers are generally not feasible.

TABLE 1
Determination of Noise Barrier Effectiveness

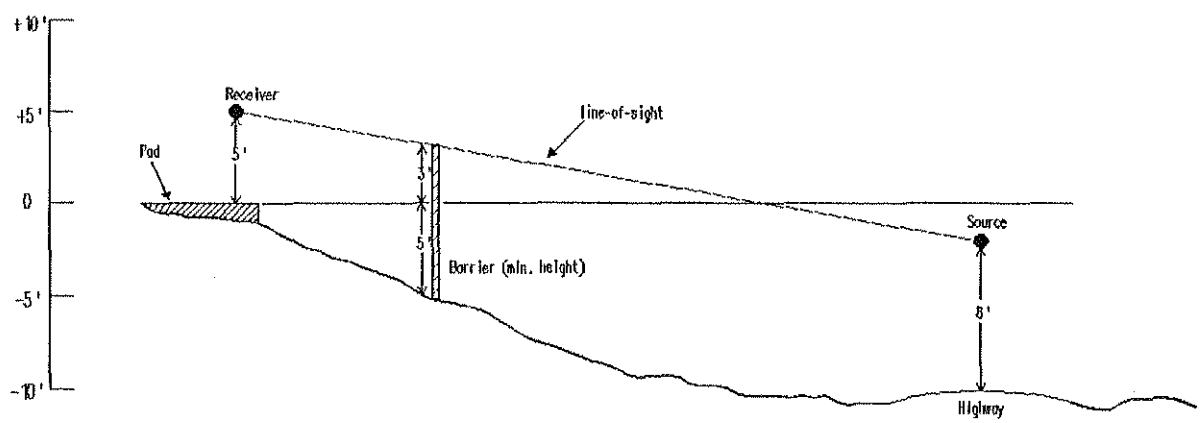
Step 1:	Select an appropriate scale on graph paper to accommodate the distance from the noise source to receiver and the heights of the noise source and receiver (e.g. 1"=20', 1"=50', etc.).
Step 2:	Mark a point representing the effective height of the noise source above the crown of the road or top of the railroad track.
Step 3:	Scale off the distance from the noise source to the receiver and mark a point that is 5 feet above the building pad or outdoor activity area of concern.
Step 4:	Using a ruler, draw a straight line between the noise source and receiver. This line represents line-of-sight between the noise source and receiver (See Figure 4-1).
Step 5:	Determine the location of the proposed noise barrier between the noise source and receiver, and draw a vertical line that extends from the ground to a height that intercepts line-of-sight. The height of this line represents the minimum height of a noise barrier necessary to reduce exterior noise by approximately 5 decibels. Higher barriers will further reduce noise levels.

FIGURE 3
Examples of Noise Barriers



Note: Truck traffic > 5% ADT

Example of Simple Barrier Situation
(may use standard noise mitigation packages)



Note: Truck traffic > 5% ADT

Example of Complex Barrier Situation
(consult an acoustical expert)

3.2.3 Interior Noise

It is not possible to measure interior noise levels in buildings not yet constructed. It is equally difficult to measure interior noise once the building is occupied due to interference caused by activities and the length of time required to obtain representative results.

Interior noise levels can be estimated if the exterior noise level is known and the outdoor to indoor NLR for the building is known. The NLR provided by a building should equal or exceed the arithmetic difference between the exterior noise level and the required interior noise level prescribed in Table 2 of the Policy Document. As an example, if the exterior noise level is 70 dB L_{dn} and the required interior noise level is 45 dB L_{dn}, the minimum building NLR must be 25 dB L_{dn}. (70 - 45 = 25)

The following interior standard noise mitigation packages can achieve NLR reductions of 15, 20, 25 and 30 dB. If more than 30 dB is required or the City questions the effectiveness of standard noise mitigation packages in a given situation, the recommendations of an acoustical expert will be required.

All of the following conditions must be met in order for the following standard noise mitigation packages to be used:

1. Required Noise Level Reduction (NLR) is equal to or less than 30 dB.

2. Less than 5 single-family dwellings or offices, churches, meeting halls with less than 10,000 sq. ft. floor area.

3. Noise source in question consists of a single transportation noise source (roadway, railway or airport) for which up-to-date noise exposure is available. An acoustical analysis will be required when the noise source is a stationary noise source or consists of multiple transportation noise sources.

For all of the following noise mitigation packages, careful workmanship, including caulking of joints and base plates and installation of weather stripping, is essential to ensure the proper performance of building assemblies. Acoustical "leaks" in walls and roof/ceilings should be avoided by properly sealing penetrations and by eliminating flanking paths.

Interior Package 1 - 15 dB NLR:

Construct to latest edition of the Uniform Building Code. A 15 dB NLR is achieved even if windows and doors are partially open for ventilation.

Interior Package 2 - 20 dB NLR:

Construct to latest edition of the Uniform Building Code and:

1. Install air conditioning or mechanical ventilation system so that doors and windows may remain closed.

2. Mount windows and doors in low air filtration rate frames (0.5 cfm or less, per ANSI specifications).

3. Install solid-core exterior doors with perimeter weatherstripping and threshold seals.

Interior Package 3 - 25 dB NLR:

Implement Interior Package 2 and:

1. Build stucco or brick veneer exterior walls. Wood siding with a one-half inch minimum thick fiberboard (soundboard) underlayer may also be used.

2. Install window and door glass in each room that does not exceed 20% of the floor area of the same room.

3. Box roof and attic fans which face the noise source. (See Appendix C for example of a suitable vent treatment.)

To reduce aircraft noise exposure, complete all the steps in Interior Package 3 outlined above and:

1. Fit fireplaces with tight-fitting dampers and glass doors.

2. Underlay roofing materials with one-half inch minimum solid sheeting.

3. Do not install sky lights in rooms which will be occupied (as opposed to storage).

Interior Package 4 - 30 dB NLR:

Complete mitigation measures in Interior Package 3 and the following measures:

1. Attach interior sheetrock of exterior wall assemblies to studs by resilient channels. Staggered studs or double walls are acceptable alternatives.

2. Install laboratory-tested window assemblies with a STC rating of 30 or more. (Windows that provide superior noise reduction capability and that are laboratory-tested are sometimes called "sound-rated" windows. In general, these widows have thicker glass and/or increased air space between panes. However, standard energy-conservation double-pane glazing with an 1/8" or 1/4" air space may be less effective in reducing noise from some noise sources than single-pane glazing.

To reduce aircraft noise exposure, complete all Interior Package 4 measures, those listed for aircraft noise under Package 3, and eliminate all fireplaces.

APPENDIX A TECHNIQUES FOR NOISE CONTROL

Any noise problem may be considered as being composed of the following three basic elements: the noise source, a transmission path and a receiver. The emphasis of noise control in land use planning is usually placed upon acoustical treatment of the transmission path and the receiving structures.

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

Use of Setbacks:

Noise exposure may be reduced by increasing the distance between the noise source and receiving use. Setback areas can take the form of open space, frontage roads, recreational areas, storage yards, and other non-noise sensitive uses. The amount of noise attenuation provided by this technique is limited by the characteristics of the site and the noise source. Each doubling of distance from the noise source will reduce noise exposure by about 4 to 6 dB.

Use of Barriers:

Shielding by barriers can be obtained by placing walls, earthen berms or other structures between the noise source and the receiver. The use of earthen berms may be acceptable but an acoustical expert should be consulted. The effectiveness of a barrier depends upon blocking line-of-sight between the source and receiver, and is improved with increases in the distance the sound must travel to pass over the barrier as compared to a straight line from source to receiver. The use of barriers to reduce noise is discussed in Chapter 3.2.1 where standard noise mitigation packages designed to reduce noise by 5 decibels are recommended for certain prescribed situations. For situations other than those described in this Design Manual, the recommendations of an acoustical expert should be obtained.

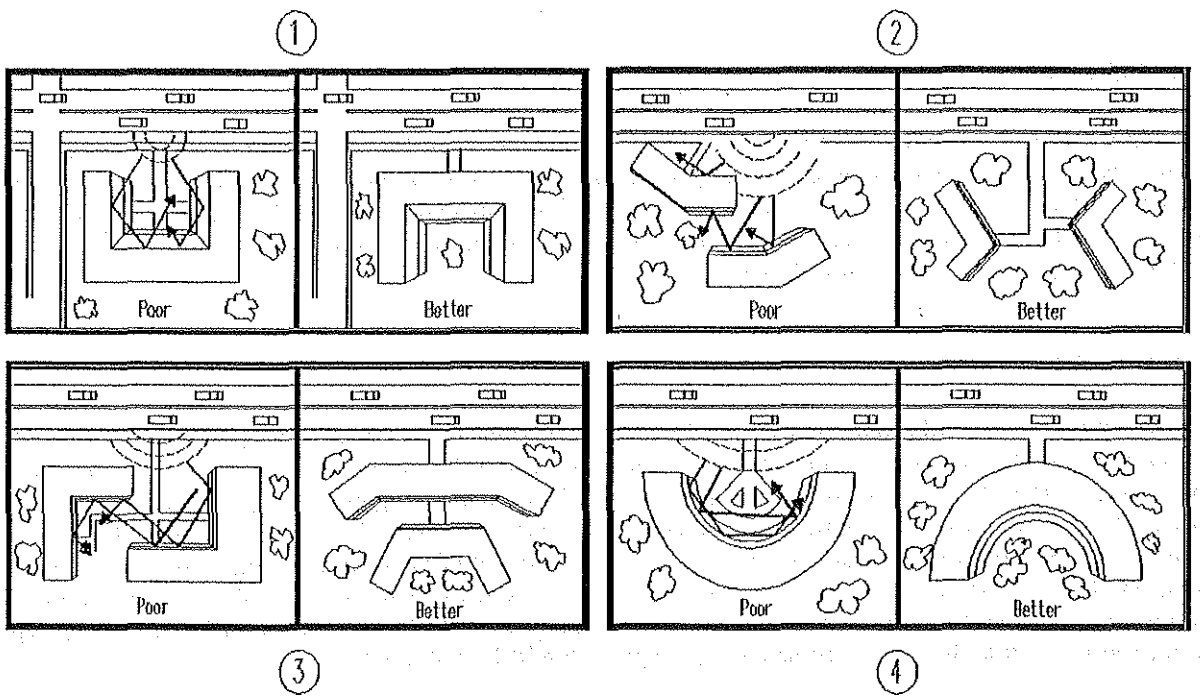
Building Location and Orientation:

Buildings containing noise-sensitive uses may be located on a site so that they are outside the area requiring noise mitigation. Buildings can be placed on a site to shield other structures or areas and to prevent an increase in noise level caused by reflections. The use of one building to shield another can significantly reduce overall project noise control costs, particularly if the shielding structure is insensitive to noise. As an example, carports or garages can be used to form or complement a barrier shielding adjacent dwellings or an outdoor activity area. Similarly, one residential unit can be placed to shield another so that noise reduction measures are needed for only the building closest to the noise source. Placement of outdoor activity areas within the shielded portion of a building complex, such as a central

courtyard, can be an effective method of providing a quiet retreat in an otherwise noisy environment. Patios or balconies should be placed on the side of a building opposite the noise source, and "wing walls" can be added to buildings or patios to help shield sensitive uses. Shielding by buildings can reduce noise impacts by up to 15 decibels. The exact amount of reduction depends on the efficiency of the design.

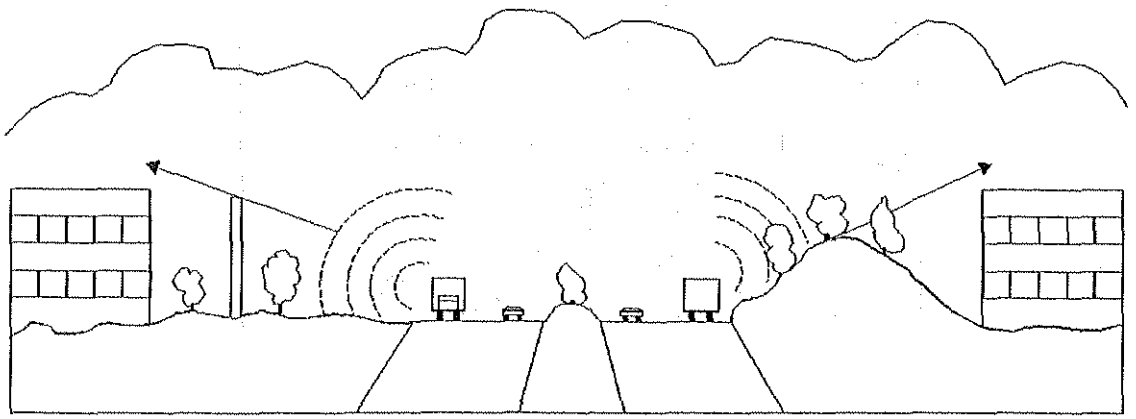
Where project design does not allow using buildings or other land uses to shield sensitive uses, noise control costs can be reduced by orienting buildings with the narrow end facing the noise source, thereby reducing total area of the building requiring acoustical treatment. Some examples of building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

FIGURE A-1



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

FIGURE A-2



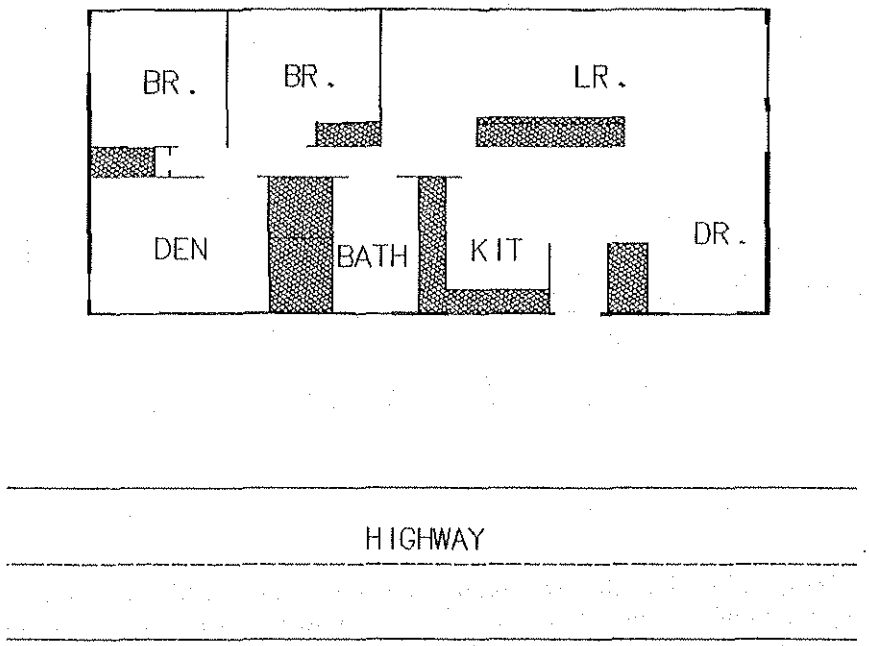
Site design should also guard against the creation of reflecting surfaces which may increase on-site noise levels. For example, two buildings placed at an angle facing a noise source may cause noise levels within that angle to increase by up to 3 dB (see example No. 3, Figure A-1). The open end of a "U"-shaped building should point away from noise sources for the same reason (see example No. 4, Figure A-1). Landscaping walls or noise barriers located within a development may inadvertently reflect noise back to a noise-sensitive area unless carefully located.

In some cases, external building facades can influence reflected noise levels affecting adjacent buildings. This is primarily a problem where high-rise buildings are proposed, and the effect is most evident in urban areas, where an "urban canyon" may be created. Bell-shaped or irregular building facades, setbacks and attention to building orientation can reduce this effect. Avoidance of these problems, as well as attaining an effective, aesthetic site design requires close coordination between local agencies, the project engineer and architect, and the acoustical consultant.

Acoustical Design of Buildings:

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

FIGURE A-3



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

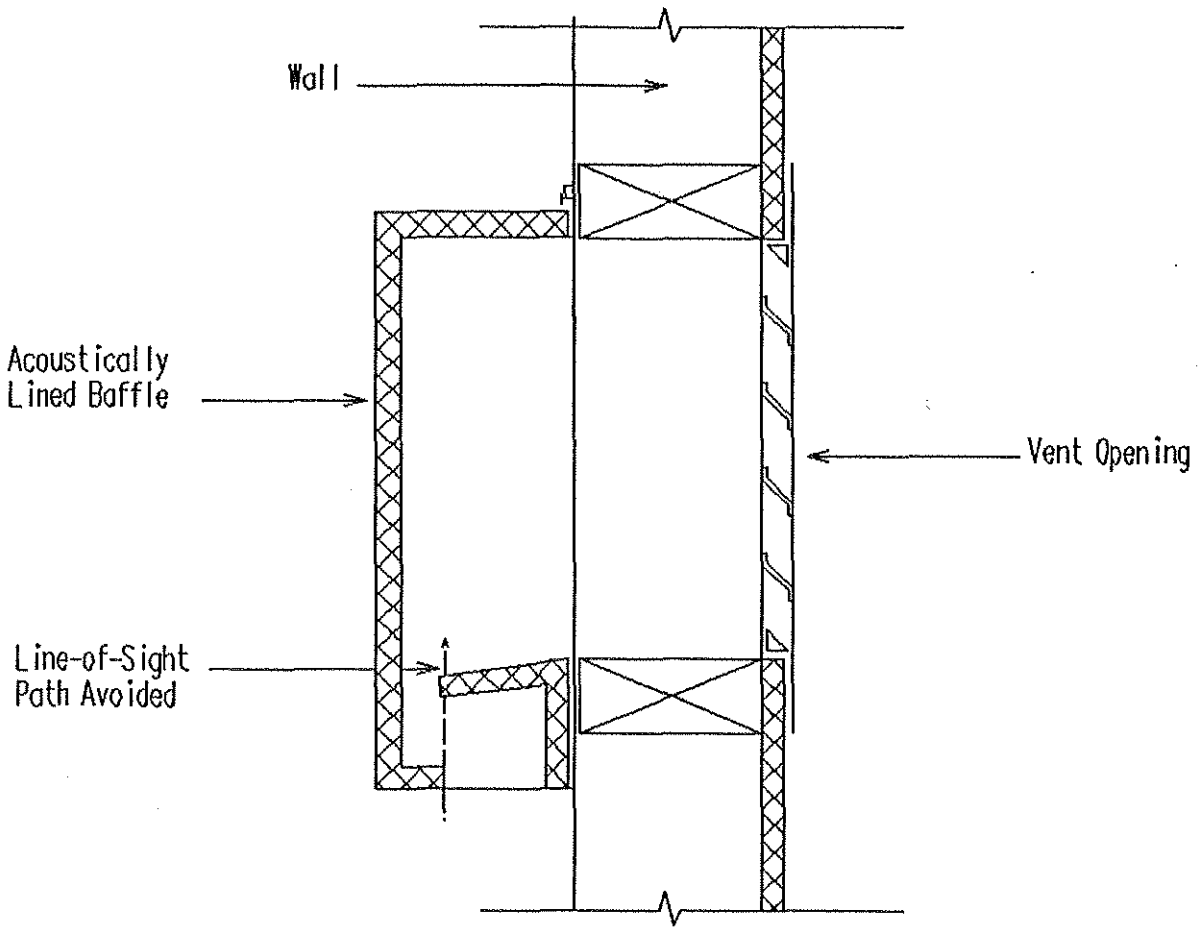
When structures containing noise-sensitive uses are to be located in a noisy environment, interior noise exposure may be reduced through the acoustical design of building facades. Standard noise mitigation packages are recommended in this Design Manual for noise level reduction (NLR) values of 15, 20, 25 and 30 decibels. If an NLR greater than 30 decibels is required or if there is a question about the effectiveness of the standard noise mitigation packages in a certain situation, the reviewing agency may require an acoustical analysis.

Use of Vegetation:

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

Vegetation can be used to acoustically "soften" intervening ground between a noise source and receiver by increasing ground absorption of sound. Vegetative barriers have been shown to reduce tire noise and other high frequency components of traffic noise. Planting of trees and shrubs is also of aesthetic and psychological value, and may reduce adverse public reaction to a noise source by removing the source from view, even though noise levels may be largely unaffected.

Sound Absorbing Materials:

Absorptive materials such as fiberglass, foam, cloth, and acoustical tiles are used to reduce reflections or reverberation in closed spaces. Their outdoor use is usually directed toward reducing reflections between parallel noise barriers or other reflective surfaces. Maintenance of absorptive materials used outdoors is difficult because such materials are easily damaged by sunlight and moisture. Their application as an outdoor noise control tool is limited to cases where the control of reflected noise is critical.

APPENDIX B EXAMPLE OF ATTIC VENT BAFFLE TREATMENT