



# Noise Element

## Introduction

The purpose of the Noise Element is to identify potential current and future noise sources and provide goals, policies, and implementation actions to ensure that noise levels are not excessive and don't negatively impact the residents of the City of San Diego. The Noise Element will ensure that development is directed through planned land uses and/or constructed with noise abatement to avoid an excessive noise environment. This purpose becomes more relevant as the city continues to grow with infill and mixed use development along transit corridors pursuant to the Strategic Framework Element.

Noise can be generally defined as perceived, unwanted sound. Noise in excessive levels can affect our living environment and our quality of life. Because its effect is based on perception and is therefore subjective, noise is dependent on the listener's reaction, the time of day, distance between source and receptor, and its tonal characteristics. For instance, while most receivers would be awakened by a loud, backup signal of a delivery truck or a car alarm in the middle of the night, the annoyance of invasive noise while watching television, playing, or studying varies depending on the listener's sensitivity.

Studies have shown that excessive noise can have adverse physiological and psychological effects. Extreme levels can cause pain and hearing loss. Continuous exposure to low level noise can have such insidious, long term effects as raising blood pressure, lessening the quality of sleep, or inhibiting children's ability to learn.

Noise is generated by several different sources including civilian, commercial, and military aircraft operations; automobile, truck, bus, and rail traffic; industrial and commercial activity; sporting events, and periodic nuisances such as construction, motorized recreational watercraft, loud parties, leaf blowers, and special events. The most prevalent noise sources in San Diego are vehicular traffic on interstate freeways, state highways, and local major roads and air traffic (airplanes and helicopters). Local streets are not considered a major source of noise since traffic volume and speed are generally much lower than for freeways and major roadways. In addition, rail, industrial, and commercial sources contribute to the noise environment.

The City of San Diego is primarily a developed, urbanized area, and an elevated ambient noise level is a normal part of the urban environment. However, controlling noise to acceptable levels can make a substantial improvement in the quality of life for city residents.



The information in the Noise Element serves as the basis for guidelines describing compatible land uses and the standards for using noise attenuation devices or measures to reduce the noise to acceptable noise standard levels citywide. The major issues pertaining to noise sources are identified and related goals and policies are established. The policies listed in this Element serve as guides for addressing noise issues and implementation measures for minimizing the effects of existing and foreseeable noise issues. It also contains noise attenuation methods for minimizing noise from noise sources as well as minimizing noise affecting sensitive land uses.

## **Definitions**

**Decibel (dB)** - A unit describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure.

**A-Weighted Sound Level (dBA)** - Sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network, which de-emphasizes very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise. All sound levels referenced in the Noise Element are A-weighted, unless reported otherwise.

**Community Noise Equivalent Level (CNEL)** - A noise measurement scale (average A-weighted noise level) applied over a 24-hour period to all noise events received at the measurement point. It is weighted more heavily for evening and night periods in order to account for the lower tolerance of individuals to noise during those periods.



**Table NE-1**

**RELATED PLANS, PROGRAMS, AND REGULATIONS USED TO  
IMPLEMENT THE NOISE ELEMENT**

Many plans, programs, and regulations adopted by state or the city directly relate to the Noise Element and assist in its implementation as listed in the table below.

<p>California Environmental Quality Act (CEQA)</p>	<p>Exposure to excessive noise is considered an environmental impact under CEQA. Implementation of CEQA ensures that during the decision making stage of development, city officials and the public will be informed of any potentially excessive noise levels and available mitigation measures to reduce them to acceptable levels.</p>
<p>California Noise Insulation Standards (California Code of Regulations, Title 24)</p>	<p>Establishes an interior noise standard of 45 dBA for multiple unit and hotel/motel structures. Acoustical studies must be prepared for multiple unit residential and hotel/motel structures that are proposed to be located within the Community Noise Equivalent Level (CNEL) noise contours of 60 dBA or greater. In addition, the city requires single unit residential structures located within the CNEL noise contours of 60 or greater to prepare an acoustical study. The studies must demonstrate that the building is designed to reduce interior noise to 45 dBA or lower (CNEL).</p>
<p>Airport Comprehensive Land Use Plans (CLUP)</p>	<p>Address aviation operations for each of the airports within the City of San Diego. These adopted plans are updated or amended periodically by the San Diego County Regional Airport Authority and policies within the General Plan are revised to be consistent with any changes to the CLUPs as required by California Government Code Section 65302.3. The city uses the airport noise contours within each CLUP to review the noise compatibility of all proposed development.</p>
<p>The City of San Diego Noise Abatement and Control Ordinance (Municipal Code Section 59.5.0101 et seq.)</p>	<p>Provides controls for excessive and annoying noise from sources such as refuse vehicles, parking lot sweepers, watercraft, animals, leaf blowers, alarms, loud music, and construction activities.</p>



## A. Noise and Land Use Compatibility

### Goal

- Consider potential excessive noise levels when making land use planning decisions to minimize the exposure to city residents

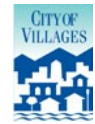
### Discussion

The Noise Element is related to the Land Use Element because excessive noise affects residential land uses, specifically, the quality of life of city residents. Noise producing and noise sensitive land uses should be planned, sufficiently separated, and/or made to be compatible. In addition to residential uses, other noise sensitive land uses include, but are not limited to: schools, libraries, parks, places of worship, hospitals, and care facilities. Permanent noise generating activities in proximity to these uses must ensure that they do not expose sensitive uses to unacceptable noise levels.





If the proposed use is not compatible with the noise levels from existing or expected excessive noise levels, noise attenuation devices and/or measures should be incorporated in the development design to reduce the noise to an acceptable interior level of 45dBA or lower (CNEL) as required by state regulations (CCR Title 24).

### Policies

- NE-A.1. Separate excessive noise generating uses and residential and other noise sensitive land uses with sufficient spatial buffer of less sensitive uses.
- NE-A.2. Assure the appropriateness of proposed developments relative to existing and forecasted noise levels by consulting the guidelines for noise compatible land use (shown on Figure NE-1) to minimize the effects on noise sensitive land uses.
- NE-A.3. Require an acoustical study showing the ability to meet noise standards for proposed developments in areas where the noise level exceeds or would exceed the “normally acceptable level” (shown on Figure 1).
- NE-A.4. Require noise attenuation devices or measures to reduce the noise to an acceptable noise level for proposed developments to ensure an acceptable interior noise level, as appropriate, in accordance with California’s noise insulation standards (CCR Title 24).
- NE-A.5. Support state regulation streamlining to allow standardized building material and/or construction material noise attenuation as an option to current requirements for acoustical evaluation.



**Figure NE-2**  
**Guidelines for Noise Compatible Land Use**

Land Use Category	Community Noise Exposure Ldn or CNEL, dBA						
	55	60	65	70	75	80	85
Residential – Single Units, Mobilehomes							
Residential – Multiple Units, Group Living, Mixed Commercial/Residential Use							
Transient Lodging - Motels, Hotels, Transient Housing							
Institutional, Schools, Libraries, Churches, Hospitals, Nursing Facilities							
Auditoriums, Concert Halls, Amphitheatres							
Sports Arena, Outdoor Spectator Sports							
Open Space, Playgrounds, Parks, Natural Resources Preservations							
Golf Courses, Riding Stables, Water Recreation, Cemeteries							
Commercial Services, Office, Research and Development, Retail Sales, Vehicle Sales							
Industrial, Manufacturing, Wholesale, Storage, Utilities, Extractive, Agriculture							
 <b>Normally Acceptable</b> Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.							
 <b>Conditionally Acceptable</b> New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and necessary noise insulation features included in the design. Conventional construction, with closed windows and fresh air supply systems or air conditioning will normally suffice.							
 <b>Normally Unacceptable</b> New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and necessary noise insulation features included in the design.							
 <b>Clearly Unacceptable</b> New construction or development should generally not be undertaken.							

Source: California General Plan Guidelines, Appendix C Noise Element Guidelines, 2003. Office of Planning and Research



## **B. Motor Vehicle Traffic Noise**

### **Goal**

- Minimal excessive motor vehicle traffic noise on residential and other noise sensitive land uses

### **Discussion**

Motor vehicle traffic noise is ubiquitous within the City of San Diego. Excessive noise levels along major roads, interstate freeways, and state highways affect much of the urban environment. Traffic noise level is dependent upon volume, speed, flow, and vehicle mix as well as distance to the receptor.

The city has no control over the noise generated by vehicular traffic on freeways and highways. For these and more aptly for city-controlled major roads, the city can, however, influence daily traffic volumes and reduce peak hour traffic by promoting alternative transportation modes and integration of mixed-use infill development. In addition, local roadway design features and traffic management techniques can minimize noise from traffic speed, frequent vehicle acceleration and deceleration, and innovative roadway paving material can further reduce traffic noise. Increasing use of hybrid transit buses can reduce noise along mixed-use transit corridors. For noise sensitive land uses adjacent to freeways and highways, these uses should be buffered or shielded from excessive noise levels by intervening, less sensitive, industrial-commercial uses. (Refer to Figure fold-out map)

### **Policies**

- NE-B.1. Encourage noise compatible land uses adjoining existing and future highways and freeways.
- NE-B.2. Require traffic calming design and traffic control measures that minimize motor vehicle traffic noise in noise sensitive land use areas.
- NE-B.3. Require noise reducing, site design and/or traffic control measures for new development in areas of high noise to ensure that the mitigated levels meet acceptable decibel limits.
- NE-B.4. Require new development to provide facilities which support the use of alternative transportation modes such as walking, bicycling, carpooling and, where applicable, transit to reduce peak hour traffic.
- NE-B.5. Continue to designate local truck routes to reduce truck traffic in noise sensitive land uses areas.



NE-B.6. Continue to work with Caltrans to landscape freeway-highway, rights-of-way buffers and install noise barriers.

## C. Trolley and Train Noise

### Goal

- Minimal excessive fixed rail related noise on residential and other noise sensitive land uses

### Discussion

Daily train traffic produces noise that may disrupt activities in proximity to rail-road tracks. Trains can generate high yet relatively brief, intermittent noise events. Rail noise primarily depends upon the speed of the train with horns and diesel engine noise from freight and passenger trains also contributing. When operating in residential areas, trains are required to travel at a reduced speed to minimize noise. Factors that influence the overall rail noise level on adjacent uses include the train speed, distance of the uses from the tracks, the intermittent nature of train events, time of day, and the lack of sound walls or other barriers between the tracks and adjacent uses.

Typically, trains are required by state and federal regulations to sound their horns at all at-grade crossings and the warning sound of train horns is a common sound experienced by communities near the rail corridor. In an effort to minimize excess train horn noise, the federal government now allows local jurisdictions to establish train horn “quiet zones.” The recently enacted federal Train Horn Rule requires jurisdictions to implement supplementary and alternative safety measures to compensate for loss of the train horn used at crossings within the quiet zone.

The commuter, intra-city rail, and freight trains operate on the coastal rail corridor, which traverses south/north direction adjacent to Interstate 5 through the city. Passenger rail service operates from the northern areas of the Southern California and San Diego region to the Santa Fe Depot in Centre City. Freight service operates from the Marine Terminal to Mexico and to northern areas of Southern California. Generally, the rail corridor is bounded by industrial, commercial, and other non-residential areas, except in Centre City and the communities in the southern area of the city, which includes residential uses adjacent to the corridor. Freight rail service between the Marine Terminal and Mexico operates at late night and early morning hours, which can affect adjacent residential uses. Rail traffic is expected to increase with additional commuter, inter-city, and freight train service, which is likely to result in an increase in rail noise.



The California High Speed Rail Authority is studying the feasibility of high-speed rail service connecting the San Diego region to other regions in the state. Future high-speed train traffic will generate noise that may affect noise-sensitive uses along the potential rail corridors. For high-speed rail vehicles, air turbulence can be a significant source of noise.

The San Diego Trolley light rail transit (LRT) system consists of two operating lines, a third line currently nearing completion, and a planned mid-coast extension. The Orange Line operates between Centre City and the City of Santee via Southeastern San Diego within the city; and the Blue Line operates between San Ysidro and Mission Valley. The Blue Line operates between San Ysidro and Old Town, serving downtown and the communities of Barrio Logan and Nestor, within the freight rail corridor. The Green Line, which was recently constructed, operates between Old Town and the City of Santee via a tunnel under San Diego State University. This line connects with the Orange Line in the City of La Mesa. There are segments of the trolley tracks which are adjacent to residential and other sensitive land uses, and the trolley generates noise from the movement of its wheels over the tracks. The highest noise levels of intermittent but excessive noise levels are generated by warning horns and rail guard signals at at-grade crossings. The trolley's electric motor, welded tracks, and concrete cross ties on newer segments all contribute in reducing excessive noise.

A future San Diego Trolley extension is being planned to connect North University City and the University of California San Diego with Old Town. Part of the extension will operate in the existing rail corridor that is adjacent to Interstate 5. The level of the trolley generated noise will be determined during the planning processes and environmental review for the trolley extension.

## **Policies**

- NE-C.1. Encourage noise-compatible land uses near the rail corridors and trolley lines.
- NE-C.2. Work with the SANDAG, Caltrans, Metropolitan Transit System (MTS), and passenger and freight rail operators to install noise attenuation features if freight or passenger rail or trolley operations adversely affect existing adjacent residential or other noise-sensitive uses.
- NE-C.3. Establish train horn "quiet zones" consistent with the federal Train Horn Rule.
- NE-C.4. Work with the MTS to minimize excessive noise from the future trolley extensions affecting residential and other noise sensitive land uses.





- NE-C.5. Work with the California High Speed Rail Authority to minimize excessive noise from the future high-speed rail service affecting residential and other noise sensitive land uses.

## D. Aircraft Noise

### Goal

- Minimal excessive aircraft related noise on residential and other noise sensitive land uses

### Discussion

Aircraft noise affects communities that are adjacent to an airport during takeoffs, approaches and landings. Aircraft noise varies in how it affects land uses depending upon the type and size of the aircraft and the height of the aircraft along the flight path. Another variable affecting the overall impact of noise is a perceived sensibility to aircraft noise at night.

Airport facilities within the City of San Diego include military aircraft at Marine Corp Air Station (MCAS) Miramar, general aviation operations at Brown Field and Montgomery Field Municipal Airports, and commercial operations at San Diego International Airport (SDIA) at Lindbergh Field. Aircraft noise sources from airport facilities outside of the city include military aircraft operations at Naval Air Station (NAS) North Island and helicopters at Naval Outlying Field (NOF) – Ream Field Imperial Beach and commercial aircraft operations at the Tijuana International Airport in Mexico.

The city has adopted the Airport Environs Overlay Zone to provide supplemental regulations for property surrounding the facilities within the city, which include Brown Field, Montgomery Field, Lindbergh Field, and Marine Corps Air Station Miramar. The intent of these regulations is to ensure that land uses are compatible with the operation of airports by implementing the Comprehensive Land Use Plans (CLUP) prepared by the San Diego County Regional Airport Authority and to ensure that the California Code of Regulations (CCR) Title 21 for incompatible land uses are satisfied.

The California Airport Noise Standards (CCR Title 21), under the authority of the California Department of Transportation (Caltrans), establishes the 65 Community Noise Equivalent Level (CNEL) contour as the boundary for the acceptable level of aircraft noise for persons living near an airport. As such, the 65 CNEL noise contour serves as the boundary for determining land use compatibility. Within the 65 CNEL boundaries, the noise environment is generally not compatible for residential land uses; non-residential uses generally are compatible with a higher level



of noise. Incompatible uses can be made compatible if appropriate noise insulation, which can provide an interior CNEL of 45 dB or less, is installed and/or avagation easements (also know as noise easements) across all or a portion of the proposed development site are recorded.

Noise from commercial aircraft primarily affects communities that are adjacent to Lindbergh Field during takeoffs, approaches and landings. Commercial jet aircraft takeoffs tend to produce intense noise, but also landings can be noisy especially when reverse thrust is applied. Generally, larger and heavier aircraft produce more noise than lighter ones. Noise generated by commercial jet engines has been declining because of advances in engine technology and fleet turnover.

Lindbergh Field is unique in that it is situated adjacent to downtown. The communities adjacent to Lindbergh Field have included residential land uses since the late 1800s. Although the ongoing introduction of quieter planes into commercial service and the curfew on night operations have helped reduce noise at Lindbergh Field, the airport still requires a variance from the California Airport Noise Standards. The state requires that airport operators receive a variance to the California Airport Noise Standards in order to operate an airport with noise impacts within the 65 CNEL. The San Diego County Regional Airport Authority, as Lindbergh Field's operator, has implemented monitoring and mitigation measures to minimize airplane noise levels and their effects on Lindbergh Field's adjacent communities.

Noise from military air bases may present particular noise issues compared to civilian and commercial airports. For example, the military conducts landing and takeoff training exercises, which require planes to increase thrust to takeoff as soon as they land. MCAS Miramar, operating large numbers of helicopters, can create a noise problem for sensitive land uses within the flight path used by the helicopters.

Noise from military aircraft (airplanes and helicopters) based at MCAS Miramar affects adjacent communities. The areas adjacent to the airport are occupied primarily by industrial and commercial land uses, which are reasonably compatible with Miramar's noise levels. However, residential areas that are more distant are affected by aircraft noise. The Marine Corps has implemented monitoring and mitigation measures to minimize their aircraft noise effects on Miramar's adjacent communities.

Noise levels from other airports within the city are not as extensive as the noise levels from Lindbergh Field and MCAS Miramar. Only smaller civilian aircraft operate from both Brown and Montgomery Fields. Both these municipal general aviation airports have noise monitoring programs to continuously assess aircraft noise effects. In addition, the areas adjacent to both airports are occupied primarily by industrial and commercial land uses. A potential higher percentage of corporate jet use at these airports may affect future noise levels. The city implements adopted land use policies to ensure compatible development within the surrounding areas.



The city has also adopted a noise limit for Montgomery Field and adjacent residential areas that limits aircraft noise for day and nighttime hours (Municipal Code section 68.0158).

Aircraft noise levels from airport facilities outside of the city are also less extensive. Military aircraft operations (jets and helicopters) at NAS North Island and NOF Imperial Beach primarily use the airspace over the San Diego Bay. Occasionally, there are single event noises that can affect adjacent sensitive land uses. Aircraft noise from commercial jet aircraft operations at the Tijuana International Airport only affect open space and industrial land uses on Otay Mesa within the city.

In addition to military helicopters, helicopter activity from private, police/emergency, medical and news/traffic monitoring helicopters contribute to the general noise environment in the city. In particular, low-flying helicopters are a source of noise complaints in the city, especially at night. Helicopter noise is associated with the sound generated by rotor blades slapping against wind currents, not by aircraft engines. Improvements in rotor systems are the primary means of reducing noise generated by helicopters.

The noise levels associated with operations at a heliport depend upon the flight path, the helicopter types used, the number of operations, and the time of day. Each of these aspects of heliport operation must be defined to assess the potential noise impacts upon noise sensitive land uses. The city regulates the siting of non-military helipads/helistops in the city through the Conditional Use Permit (CUP) process. The city requires an analysis to identify potential noise levels and may regulate the hours of operation and arrival/departure routes, and type of helicopters, which may use the helipads/helistops in order to minimize excessive noise affecting noise sensitive land uses.



## **Policies**

- NE-D.1. Encourage noise-compatible land uses within the 65 CNEL airport noise contour area in accordance with California Code of Regulations Title 21.
- NE-D.2. Continue to update, implement, and enforce city regulations intended to minimize airport noise.
- NE-D.3. Continue to work with regional, state, and federal agencies, including the San Diego County Regional Airport Authority and the Marine Corps to implement noise-reducing measures in communities with existing noise sensitive land uses that are affected by airport noise and to monitor and reduce excessive noise associated with commercial and military aircraft.
- NE-D.4. Continue to regulate the siting and operation of heliport/helistops through the Conditional Use Permit process in order to minimize excessive noise.

## **E. Commercial and Mixed-Use Activity Noise**

### **Goal**

- Minimal excessive commercial-related noise on residential and other sensitive land uses and within mixed-use structures where residential units are either located above ground floor commercial uses or in an adjacent building within the same development

### **Discussion**

Noise generated by ground floor commercial operations, maintenance, truck deliveries, and vehicular and pedestrian traffic can affect adjacent and above ground floor residential areas. Day and night commercial/entertainment activities and special events in the Centre City and other mixed residential/commercial use areas located citywide are expected to generate urban noise throughout the year. The city requires bars and nightclubs over five thousand square feet to minimize excessive noise to surrounding uses by limiting their hours of operation. The city's noise ordinance also limits noise levels to 65 dBA during the day and 60 dBA during the night generated on-site by commercial uses to minimize the effect of noise on adjacent sensitive land uses.



## Policies

- NE-E.1. Encourage the design and construction of commercial and mixed-use structures to minimize excessive noise to the residential land use and other noise sensitive land uses.
- NE-E.2. Encourage new mixed-use developments to site loading areas, parking lots, driveways, trash enclosures, mechanical equipment, and other noisier components away from the residential component of the development.
- NE-E.3. Limit the hours of truck deliveries to commercial uses abutting residential uses and other noise sensitive land uses to minimize excessive noise unless there is no feasible alternative or there are overriding transportation benefits by scheduling deliveries at other hours.
- NE-E.4. Limit hours of commercial/entertainment operations to minimize excessive noise to residential and other noise sensitive land uses.
- NE-E.5. Limit on-site noise levels generated by commercial uses.
- NE-E.6. Encourage mixed-use developments and residential developments adjacent to commercial/entertainment uses to notify potential residents that they may be affected by noise from commercial/entertainment related activities, such as music, delivery vehicles, pedestrian and vehicular traffic, and other urban noise.

## F. Industrial Activity Noise

### Goal

- Minimal excessive industrial related noise on residential and other noise sensitive land uses

### Discussion

Industrial land uses have the potential to be a noise source. The degree of noise generated by industrial uses are dependent upon various factors, including type of industrial activity, hours of operation, and the location relative to other land uses. Industrial noise sources are located throughout the city. Outdoor truck activity, air compressors, and generators, are potential noise sources associated with industrial use that can interfere with activities conducted on noise-sensitive land uses, which include residential uses. The city's noise ordinance limits noise levels to 75 dBA generated on-site by industrial uses to minimize the effect of noise on adjacent land uses.



## **Policies**

- NE-F.1. Encourage the design and construction of industrial uses to minimize excessive off-site noise impacts.
- NE-F.2. Limit outdoor industrial activities or operations to minimize excessive noise.
- NE-F.3. Limit the hours of operation of high-noise generating industrial equipment.
- NE-F.4. Limit the hours of truck deliveries to industrial uses abutting residential uses and other noise sensitive land uses to minimize excessive noise unless there is no feasible alternative or there are overriding transportation benefits by scheduling deliveries at other hours.
- NE-F.5. Continue to enforce limits to on-site noise levels generated by industrial uses.

## **G. Construction/Refuse Vehicles and Parking Lot Sweepers Noise**

### **Goal**

- Minimal excessive construction/refuse vehicles and parking lot sweeper related noise on residential and other noise sensitive land uses.

### **Discussion**

Construction, refuse vehicle, and parking lot sweeper activity in all land use areas will temporarily elevate noise levels. The city recognizes that construction, refuse vehicle, and parking lot sweeper activities are necessary and noise control of these activities is limited. In order to control excessive noise from these activities, the city's Noise Abatement and Control Ordinance limits the hours of operation.

### **Policies**

- NE-G.1. Continue to enforce the City of San Diego Municipal Code restricting the hours of operation for construction activity.
- NE-G.2. Continue to enforce the City of San Diego Municipal Code restricting the hours of operation for refuse vehicle and parking lot sweepers activity in residential areas.



- NE-G.3. Limit the hours of operation for refuse vehicles and parking lot sweepers on commercial uses if their activity results in an excessive noise level that adversely affects adjacent residential uses.

## H. Typical Noise Attenuation Methods

### Discussion

Noise impacts can typically be abated in four basic methods: by reducing the sound level of the noise generator, by interrupting the noise path between the source and receiver, by increasing the distance between the source and receiver, and by insulating the receiver (building material and construction methods).

Quieting certain noise sources may often be successfully achieved through design or the use of mufflers. Although the city has little direct control over noise produced by motor vehicle because state and federal noise regulations pre-empt local regulations, the most efficient and effective means of abating noise from transportation systems is to reduce the noise at the source. Noise generated by aircraft, motor vehicles, and trains, for example, may be abated through improved engine design. Noise generated by land uses, such as industrial uses, may be abated through site design, structure design and construction, and the limiting of noise producing operations. This method most directly assigns the responsibility to the generator of the noise.

Noise may also be minimized by strategically placing walls, landscaped berms, or a combination of the two, between the noise source and the receptor. Generally, effective noise shielding requires a continuous, solid barrier with a mass which is large enough to block the line of sight between source and receiver. Variations may be appropriate in individual cases based on distance, nature, and orientation of buildings behind the barrier, and a number of other factors. Garages or other structures may be used to shield dwelling units and outdoor living areas from non-aircraft noise.

The effects of noise may also be minimized by separating or isolating the noise source from the potential receiver. Wide buffers along freeways, for example, may reduce the noise level affecting adjacent noise sensitive land uses. These buffer areas may be developed with less sensitive but non-impactive commercial/industrial structures. Sufficient isolation of airport noise is impractical in existing urban areas.

The noise problem may be abated by protecting the receiver with acoustical structures, enclosures, or construction techniques. In addition to site design techniques, noise insulation can be accomplished through proper design of buildings. Nearby noise sources should be recognized in determining the location of doors, windows, and vent openings. Sound-rated windows (extra thick or multi-paned) and wall insulation are also effective as specified in CCR Title 24. Care should be taken in actual construction: doors and windows fitted properly; openings sealed; joints caulked



and plumbing constructed to ensure adequate insulation from structural members. Sound-rated doors and windows will have little effect if left open. This may require installation of air conditioning for adequate ventilation. The acceptable maximum level for interior noise level is 45 dBA; the following table depicts typical noise mitigation measures to attain this acceptable level.

**Table NE-3 Noise Attenuating Construction Material/Methods for the Interior of Residential Structures - Typical Mitigation Measures to Attain 45 dBA Interior Noise Level**

Exterior Noise Level	Typical Mitigation
60 to 65 dBA	<ol style="list-style-type: none"><li>1. Air conditioning or mechanical ventilation</li><li>2. Double-paned glass</li><li>3. Solid core doors with weather stripping and seals</li></ol>
65 to 70 dBA	<p>Mitigation 1, 2, and 3 plus</p> <ol style="list-style-type: none"><li>4. Stucco or brick veneer exterior walls or wood siding w/one-half inch thick fiberboard underlayer</li><li>5. Glass portions of windows/doors not exceed 20%</li><li>6. Exterior vents facing noise source shall be baffled</li></ol>
70 to 75 dBA	<p>Mitigation 1 through 6 plus</p> <ol style="list-style-type: none"><li>7. Interior sheetrock of exterior wall attached to studs by resilient channels or double walls</li><li>8. Window assemblies shall have a lab-tested STC rating of 30 or greater.</li></ol>