SANTA CRUZ COUNTY REGIONAL TRANSPORTATION COMMISSION SANTA CRUZ BRANCH LINE FOR RECREATIONAL SERVICE PROJECT NOISE AND VIBRATION ASSESSMENT

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1.0 Introduction and Project Description

The project consists of capital improvements needed to provide for recreational rail services within Santa Cruz County between the City of Capitola (Jade Street Park) and the Aptos Seascape Area, a distance of approximately six miles. The service is proposed to operate a maximum of 120 days during peak tourist months in the spring, summer, and fall seasons, with an option of additional special service to accommodate special events. Operations would consist of hourly round trips between 11:00 AM and 8:00 PM. The operator of the service would be chosen through a future process and it is not known exactly what the rolling stock would be. Previous studies have suggested the use of a two-car, self-propelled train or diesel multiple unit DMU. This type of train was also assumed for the environmental assessment of the Santa Cruz County Major Transportation and Investment Study conducted in 1998. This assessment assumes that the same rolling stock would be used for the recreational service.

The project would include stop facilities at six locations. Track extensions are required at either termini of the service to allow trains to stand by for schedule recovery and for overnight storage off the main track. These storage tracks will also provide a location off the main track for the trains to wait while the freight train uses the track.

In addition to the proposed project this assessment also evaluates an alternative project called the Business Plan Project. The Business Plan Project would have four round trips per day within two 3-hour service windows (11:00 am to 2:00 pm and 4:00 pm to 7:00 pm) on Fridays, Saturdays, Sundays and Mondays for a total of 48 days during the season.

1.2 Background Information on Noise

Noise may be defined as unwanted sound. Noise is usually objectionable because it is disturbing or annoying. The objectionable nature of sound could be caused by its pitch or its loudness. Pitch is the height or depth of a tone or sound, depending on the relative rapidity (frequency) of the vibrations by which it is produced. Higher pitched signals sound louder to humans than sounds with a lower pitch. Loudness is intensity of sound waves combined with the reception characteristics of the ear. Intensity may be compared with the height of an ocean wave in that it is a measure of the amplitude of the sound wave.

In addition to the concepts of pitch and loudness, there are several noise measurement scales which are used to describe noise in a particular location. A decibel (dB) is a unit of measurement which indicates the relative amplitude of a sound. The zero on the decibel scale is based on the lowest sound level that the healthy, unimpaired human ear can detect. Sound levels in decibels are calculated on a logarithmic basis. An increase of 10 decibels represents a ten-fold increase in acoustic energy, while 20 decibels is 100 times more intense, 30 decibels is 1,000 times more intense, etc. There is a relationship between the subjective noisiness or loudness of a sound and its intensity. Each 10 decibel increase in sound level is perceived as approximately a doubling of loudness over a fairly wide range of intensities. Technical terms are defined in Table 1.

There are several methods of characterizing sound. The most common in California is the A-weighted sound level or dBA. This scale gives greater weight to the frequencies of sound to which the human ear is most sensitive. Representative outdoor and indoor noise levels in units

TERM	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, which is 20 micropascals (20 micronewtons per square meter).
Frequency, Hz	The number of complete pressure fluctuations per second above and below atmospheric pressure.
A-Weighted Sound Level, dBA	The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise. All sound levels in this report are A-weighted, unless reported otherwise.
L_{01}, L_{10}, L_{50}, L_{90}	The A-weighted noise levels that are exceeded 1%, 10%, 50%, and 90% of the time during the measurement period.
Equivalent Noise Level, L_{eq}	The average A-weighted noise level during the measurement period.
Community Noise Equivalent Level, CNEL	The average A-weighted noise level during a 24-hour day, obtained after addition of 5 decibels in the evening from 7:00 pm to 10:00 pm and after addition of 10 decibels to sound levels measured in the night between 10:00 pm and 7:00 am.
Day/Night Noise Level, L_{dn}	The average A-weighted noise level during a 24-hour day, obtained after addition of 10 decibels to levels measured in the night between 10:00 pm and 7:00 am.
L_{max}, L_{min}	The maximum and minimum A-weighted noise level during the measurement period.
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Intrusive	That noise which intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level.

Source: Illingworth & Rodkin, Inc

Definitions of Acoustical Terms **Table 1**

of dBA are shown in Table 2. Because sound levels can vary markedly over a short period of time, a method for describing either the average character of the sound or the statistical behavior of the variations must be utilized. Most commonly, environmental sounds are described in terms of an average level that has the same acoustical energy as the summation of all the time-varying events. This energy-equivalent sound/noise descriptor is called L_{eq}. The most common averaging period is hourly, but L_{eq} can describe any series of noise events of arbitrary duration.

The scientific instrument used to measure noise is the sound level meter. Sound level meters can accurately measure environmental noise levels to within about plus or minus 1 dBA. Various computer models are used to predict environmental noise levels from sources, such as roadways and airports. The accuracy of the predicted models depends upon the distance the receptor is from the noise source. Close to the noise source, the models are accurate to within about plus or minus 1 to 2 dBA.

Since the sensitivity to noise increases during the evening and at night -- because excessive noise interferes with the ability to sleep -- 24-hour descriptors have been developed that incorporate artificial noise penalties added to quiet-time noise events. The Community Noise Equivalent Level, CNEL, is a measure of the cumulative noise exposure in a community, with a 5 dB penalty added to evening (7:00 pm - 10:00 pm) and a 10 dB addition to nocturnal (10:00 pm - 7:00 am) noise levels. The Day/Night Average Sound Level, L_{dn}, is essentially the same as CNEL, with the exception that the evening time period is dropped and all occurrences during this three-hour period are grouped into the daytime period.

1.3 Effects of Noise

1.3.1 Hearing Loss

While physical damage to the ear from an intense noise impulse is rare, a degradation of auditory acuity can occur even within a community noise environment. Hearing loss occurs mainly due to chronic exposure to excessive noise, but may be due to a single event such as an explosion. Natural hearing loss associated with aging may also be accelerated from chronic exposure to loud noise.

The Occupational Safety and Health Administration (OSHA) has a noise exposure standard which is set at the noise threshold where hearing loss may occur from long-term exposures. The maximum allowable level is 90 dBA averaged over eight hours. If the noise is above 90 dBA, the allowable exposure time is correspondingly shorter.

1.3.2 Sleep and Speech Interference

The thresholds for speech interference indoors are about 45 dBA if the noise is steady and above 55 dBA if the noise is fluctuating. Outdoors the thresholds are about 15 dBA higher. Steady noise of sufficient intensity (above 35 dBA) and fluctuating noise levels above about 45 dBA have been shown to affect sleep. Interior residential standards for multi-family dwellings are set by the State of California at 45 dBA L_{dn}. Typically, the highest steady traffic noise level during the daytime is

At a Given Distance From Noise Source	A-Weighted Sound Level in Decibels	Noise Environments	Subjective Impression
	140		
Civil Defense Siren (100')	130		
Jet Takeoff (200')	120		Pain Threshold
	110	Rock Music Concert	
Diesel Pile Driver (100')	100		Very Loud
	90	Boiler Room	
Freight Cars (50')		Printing Press Plant	
Pneumatic Drill (50')	80		
Freeway (100')		In Kitchen With Garbage	
Vacuum Cleaner (10')	70	Disposal Running	Moderately Loud
	60	Data Processing Center	
Light Traffic (100')	50	Department Store	
Large Transformer (200')			
	40	Private Business Office	Quiet
Soft Whisper (5')	30	Quiet Bedroom	
	20	Recording Studio	
	10		Threshold of Hearing
	0		

Source: Illingworth & Rodkin, Inc

Typical Sound Levels Measured in the Environment and Industry **Table 2**

about equal to the L_{dn} and nighttime levels are 10 dBA lower. The standard is designed for sleep and speech protection and most jurisdictions apply the same criterion for all residential uses. Typical structural attenuation is 12-17 dBA with open windows. With closed windows in good condition, the noise attenuation factor is around 20 dBA for an older structure and 25 dBA for a newer dwelling. Sleep and speech interference is therefore possible when exterior noise levels are about 57-62 dBA L_{dn} with open windows and 65-70 dBA L_{dn} if the windows are closed. Levels of 55-60 dBA are common along collector streets and secondary arterials, while 65-70 dBA is a typical value for a primary/major arterial. Levels of 75-80 dBA are normal noise levels at the first row of development outside a freeway right-of-way. In order to achieve an acceptable interior noise environment, bedrooms facing secondary roadways need to be able to have their windows closed, those facing major roadways and freeways typically need special glass windows.

1.3.3 Annoyance

Attitude surveys are used for measuring the annoyance felt in a community for noises intruding into homes or affecting outdoor activity areas. In these surveys, it was determined that the causes for annoyance include interference with speech, radio and television, house vibrations, and interference with sleep and rest. The L_{dn} as a measure of noise has been found to provide a valid correlation of noise level and the percentage of people annoyed. People have been asked to judge the annoyance caused by aircraft noise and ground transportation noise. There continues to be disagreement about the relative annoyance of these different sources. When measuring the percentage of the population highly annoyed, the threshold for ground vehicle noise is about 55 dBA L_{dn}. At an L_{dn} of about 60 dBA, approximately 2 percent of the population is highly annoyed. When the L_{dn} increases to 70 dBA, the percentage of the population highly annoyed increases to about 12 percent of the population. There is, therefore, an increase of about 1 percent per dBA between an L_{dn} of 60-70 dBA. Between an L_{dn} of 70-80 dBA, each decibel increase increases by about 2 percent the percentage of the population highly annoyed. People appear to respond more adversely to aircraft noise. When the L_{dn} is 60 dBA, approximately 10 percent of the population is believed to be highly annoyed. Each decibel increase to 70 dBA adds about 2 percentage points to the number of people highly annoyed. Above 70 dBA, each decibel increase results in about a 3 percent increase in the percentage of the population highly annoyed.

1.4 General Information on Ground-borne Vibration

Vibrations generated by trains and other transportation systems can be annoying to persons living along the alignments. The vibrations could also potentially interfere with precision manufacturing processes. Both the level (or amplitude) and frequency of the vibration affect the potential impact that the vibration could cause. In this report, the vibration spectrum is presented in terms of the root mean square (RMS) velocity level in decibels re 10^{-6} in./sec. The measured vibration levels are presented in each 1/3 octave band whose center frequency ranges from 4 Hz to 100 Hz. The decibel scale, which is commonly used in noise studies, is also a convenient scale for depicting vibration levels. The velocity is used in this report because it has been found to correlate well with building motion and people's perception to vibration. Acceleration is another commonly used measure of vibration.

The amount of vibration which is imparted into the ground is a function of the speed and weight of the train, the roundness of the wheels, the type of track, and the presence of switches. The distance one is from the track is an important factor in determining anticipated vibration levels.

The rate of dissipation of vibration in the ground varies depending upon the characteristics of the ground. Typical attenuation rates measured by researchers have ranged from 3-10 dB per doubling of distance. The vibration velocity varies with the speed of the train at a rate roughly proportional to 6 dB per doubling or halving of the speed of the train.

Another important factor in assessing the potential impacts of ground vibration is how the energy is transferred from the ground into the building of concern. There is not a reliable base of data to determine how the coupling of the building to ground will affect how the vibration levels are attenuated or amplified. In this study, it is assumed that vibration levels measured on the ground adjacent to the structure of concern represent the potential exposure of people to vibration levels.

2.0 REGULATORY BACKGROUND

2.1 Federal and State Regulations

There are no applicable Federal or State regulations which set forth limits on allowable transit-generated noise and vibration levels. Guidelines for assessing the impacts of noise and vibration related to transit systems have been published by the Federal Transit Administration (FTA), formerly the Urban Mass Transit Administration.

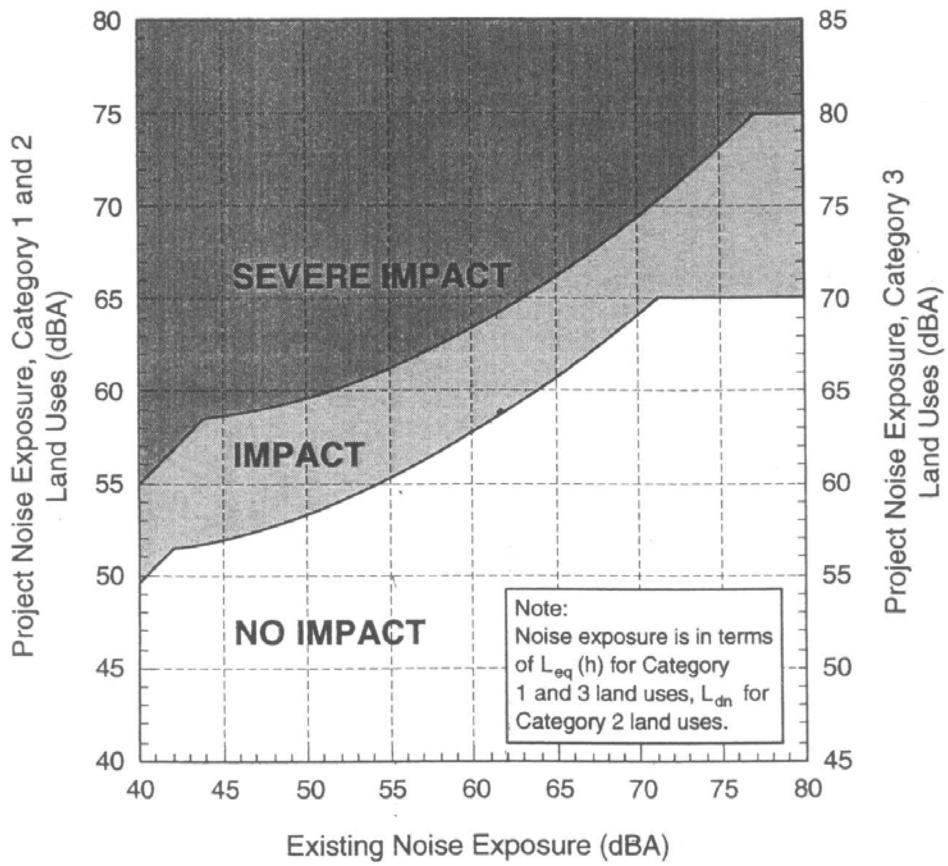
The noise impact assessment guidelines adopted by these agencies are described in the following subsections.

2.2 Noise Impact Criteria for Transit Projects

The noise impact criteria for mass transit projects involving rail or bus facilities are shown graphically in Figure 1. The criteria apply to all rail projects (e.g., rail rapid transit, light rail transit, commuter rail, and automated guideway transit) as well as fixed facilities such as storage and maintenance yards, passenger stations and terminals, parking facilities, and substations.

The noise impact criteria in Figure 1 are based on comparison of the existing outdoor noise levels and the future outdoor noise levels from the proposed project. They incorporate both absolute criteria, which consider activity interference caused by the transit project alone, and relative criteria, which consider annoyance due to the change in the noise environment caused by the transit project.

Whereas noise impact criteria that have been used for previous transit project take existing ambient noise levels into account based on generalized community categories, the criteria in this manual depend on specific estimates of existing community noise levels as a part of the determination of noise impact. These criteria were developed to apply to various transit modes, to recognize the heightened community annoyance caused by late-night or early-morning transit service, and to respond to the varying sensitivity of communities to projects under different background noise conditions. The noise criteria and descriptors depend on land use, as defined in Table 3.



Source: U.S. Dept. of Transportation, *Transit Noise and Vibration Impact Assessment*, April 1995

Noise Impact Criteria for Transit Project	Figure 1

Table 3
Land Use Categories and Metrics for Transit Noise Impact Criteria

Land Use Category	Noise Metric (dBA)	Description of Land Use Category
1	Outdoor $L_{eq}(h)^{*}$	Tracts of land where quiet is an essential element in their intended purpose. This category includes lands set aside for serenity and quiet, and such land uses as outdoor amphitheaters and concert pavilions, as well as National Historic Landmarks with significant outdoor use.
2	Outdoor L_{dn}	Residences and buildings where people normally sleep. This category includes homes, hospitals, and hotels where a nighttime sensitivity to noise is assumed to be of utmost importance.
3	Outdoor $L_{eq}(h)^{*}$	Institutional land uses with primarily daytime and evening use. this category includes schools, libraries, and churches where it is important to avoid interference with such activities as speech, meditation and concentration on reading material. Buildings with interior spaces where quiet is important, such as medical offices, conference rooms, recording studios and concert halls, fall into this category. Places for meditation or study associated with cemeteries, monuments, museums. Certain historical sites, parks and recreational facilities are also included.

* L_{eq} for the noisiest hour of transit-related activity during hours of noise sensitivity.

Source: U.S. Dept. of Transportation, Transit Noise and Vibration Impact Assessment, April 1995

The noise impact criteria are defined by two curves which allow increasing project noise levels as existing noise increases up to a point, beyond which an impact is determined based on project noise alone. Below the lower curve in Figure 1, a proposed project is considered to have no noise impact since, on the average, the introduction of the project will result in an insignificant increase in the number of people highly annoyed by the new noise. The curve defining the onset of noise impact stops increasing at 65 dBA for Categories 1 and 2 land use, a standard limit for an acceptable living environment defined by a number of Federal agencies. Project noise above the upper curve is considered to cause Severe Impact since a significant percentage of people would be highly annoyed by the new noise. This curve flattens out at 75 dBA for Categories 1 and 2 land use, a level associated with an unacceptable living environment. As indicated by the right-hand scale on Figure 1, the project noise criteria are 5 decibels higher for Category 3 land uses since these types of land use are considered to be slightly less sensitive to noise than the types of land use in Categories 1 and 2.

Between the two curves the proposed project is judged to have an impact, though not severe. The change in the cumulative noise level is noticeable to most people, but may not be sufficient to cause strong, adverse reactions from the community. In this transitional area other project-specific factors must be considered to determine the magnitude of the impact and the need for mitigation, such as the predicted level of increase over existing noise levels and the types and numbers of noise-sensitive land uses affected.

Although the curves in Figure 1 are defined in terms of the project noise exposure and the existing noise exposure, it is important to emphasize that it is the increase in the cumulative noise -- when project is added to existing -- that is the basis for the criteria.

People already exposed to high levels of noise will notice and be annoyed by only a small increase in the amount of noise in their community. In contrast, if the existing noise levels are quite low, a greater change in the community noise will be required for the equivalent level of annoyance. It should be noted that these annoyance levels are based on general community reactions to noise at varying levels which have been documented in scientific literature and do not account for specific community attitudinal factors which may exist.

As indicated above the noise impact criteria and descriptors depend on land use, designated either Category 1, Category 2 or Category 3. Category 1 includes tracts of land where quiet is an essential element in their intended purpose, such as outdoor concert pavilions or National historic Landmarks where outdoor interpretation routinely takes place. Category 2 includes residences and buildings where people sleep, while Category 3 includes institutional land uses with primarily daytime and evening use such as schools, places of worship and libraries.

The criteria do not apply to most commercial or industrial uses because, in general, the activities within these buildings are compatible with higher noise levels. They do apply to business uses which depend on quiet as an important part of operations, such as sound and motion picture recording studios.

Historically significant sites are treated as noise-sensitive depending on the land use activities. Sites of national significance with considerable outdoor use required for site interpretation would be in Category 1. Historical sites that are currently used as residences will be in Category 2. Historic buildings with indoor use of an interpretive nature involving meditation and study fall into Category 3. Theses include museums, significant birthplaces and buildings in which significant historical events occurred.

Most busy downtown areas have buildings which are historically significant because they represent a particular architectural style or are prime examples of the work of an historically significant designer. If the buildings or structures are used for commercial or industrial purposes and are located in busy commercial areas, they are not considered noise-sensitive and the noise impact criteria do not apply. Similarly, historical transportation structures, such as terminals and railroad stations, are not considered noise-sensitive land uses themselves. These buildings or structures are, of course, afforded special protection under Section 4(f) of the DOT Act and Section 106 of the National Historic Preservation Act. However, based strictly on how they are used and the settings in which they are located, these types of historical buildings are not considered noise-sensitive sites.

While parks are considered in general to be noise-sensitive sites, there are cases where actual noise-sensitivity depends on how the park is being used. Parks used for passive purposes, such as reading, meditation and conversation, would be considered more noise-sensitive than ones used for sports or other active recreational pursuits.

The basis of the development of the noise impact criteria is the relationship between the percentage of highly annoyed people and the noise levels of their residential environment. Consequently, the criteria are centered around residential land use with the use of L_{dn} as the noise descriptor, which is sensitive to noise intrusion at night. The noise criteria use L_{dn} for other land uses where nighttime sensitivity is a factor. The criteria are also to be applied to non-residential land uses that are sensitive to noise during daytime hours. Because the L_{dn} and the maximum daytime hourly L_{eq} have similar values for a typical noise environment, the daytime or early evening L_{eq} can be used for evaluating noise impact at locations where nighttime sensitivity is not a factor. For land use involving only daytime activities (e.g., churches, schools, libraries, parks) the impact is evaluated in terms of L_{eq} (h), defined as the L_{eq} for the noisiest hour of transit-related activity during which human activities occur at the noise-sensitive location.

However, due to the types of land use included in Category 3, the criteria allow the project noise for Category 3 sites to be 5 decibels greater than for Category 1 and Category 2 sites. With the exception of recreational facilities, which are clearly less sensitive to noise than Category 1 and 2 sites, Category 3 sites include primarily indoor activities and thus the criteria account for the noise reduction provided by the building structure.

Although the maximum noise level (L_{max}) is not used by the Federal Transit Administration as the basis for the noise impact criteria for transit projects, it is a useful metric for providing a fuller understanding of the noise impact from some transit operations. Specifically, rail transit characteristically produces high intermittent noise levels which may be objectionable depending on the distance from the alignment. Thus, it is recommended that L_{max} information be provided in environmental documents to supplement the noise impact assessment and to help satisfy any "full disclosure" requirements.

2.3 Vibration Impact Criteria

Because of the relatively rare occurrence of annoyance due to ground-borne vibration and noise, there has been only limited sponsored research of human response to building vibration and structure-borne noise. However, with the construction of new rail rapid transit systems in the past 20 years, considerable experience has been gained as to how communities will react to various levels of building vibration. This experience, combined with the available national and international standards, represents a good foundation for predicting annoyance from ground-borne noise and vibration in residential areas.

The criteria for environmental impact from ground-borne vibration and noise are based on the maximum levels for a single event. The criteria presented in Table 4 account for variation in project types as well as the frequency of events, which differ widely among transit projects. Most

Table 4:
Ground-Borne Vibration and Noise Impact Criteria

Land Use Category	Ground-Borne Vibration Impact Levels (VdB re 1 micro inch/sec)		Ground-Borne Noise Impact Levels (dB re 20 micro Pascals)	
	Frequent Events[1]	Infrequent Events[2]	Frequent Events[1]	Infrequent Events[2]
Category 1: Buildings where low ambient vibration is essential for interior operations.	65 VdB[3]	65 VdB[3]	-[4]	-[4]
Category 2: Residences and buildings where people normally sleep.	72 VdB	80 VdB	35 dBA	43 dBA
Category 3: Institutional land uses with primarily daytime uses	75 VdB	83 VdB	40 dBA	48 dBA

Notes:

1. "Frequent Events" is defined as more than 70 vibration events per day. Most rapid transit projects fall into this category.
2. "Infrequent Events" is defined as fewer than 70 vibration events per day. This category includes most commuter rail systems.
3. This criterion limit is based on levels that are acceptable for most moderately sensitive equipment such as optical microscopes. Vibration sensitive manufacturing or research will require detailed evaluation to define the acceptable vibration levels. Ensuring lower vibration levels in a building often requires special design of the HVAC systems and stiffened floors.
4. Vibration-sensitive equipment is not sensitive to ground-borne noise.

Source: U.S. Dept. of Transportation, Transit Noise and Vibration Impact Assessment, April 1995

experience is with the community response to ground-borne vibration from rail rapid transit systems with typical headways in the range of 3 to 10 minutes and each vibration event lasting less than 10 seconds. It is intuitive that when there will be fewer events each day, as is typical for commuter rail projects, it should take higher vibration levels to evoke the same community response. This is accounted for in the criteria by distinguishing between projects with frequent and infrequent events where Frequent Events is defined as more than 70 events per day. Most commuter rail projects will fall into the infrequent event category, although some commuter rail lines serving major cities are in the frequent event category. As shown in Table 4, the criteria for residential uses such as those lining the project corridor is 80 VdB for infrequent events such as the proposed recreational rail line.

2.4 Local Regulations

The study corridor is located within Santa Cruz County. It runs through the unincorporated areas of Rio Del Mar and Aptos, and the City of Capitola. There are policies set forth by these local jurisdictions that apply to this project. The County and the City of Capitola require that new development conform with Land Use Compatibility Guidelines (see Table 5). Noise levels at residential or other noise-sensitive uses are not considered compatible if they exceed a day/night standard of 60 dBA outside and 45 dBA indoors.

2.4.1 Santa Cruz County

The County has set policies to meet an objective of maintaining lower existing noise levels generated by the ground transportation system:

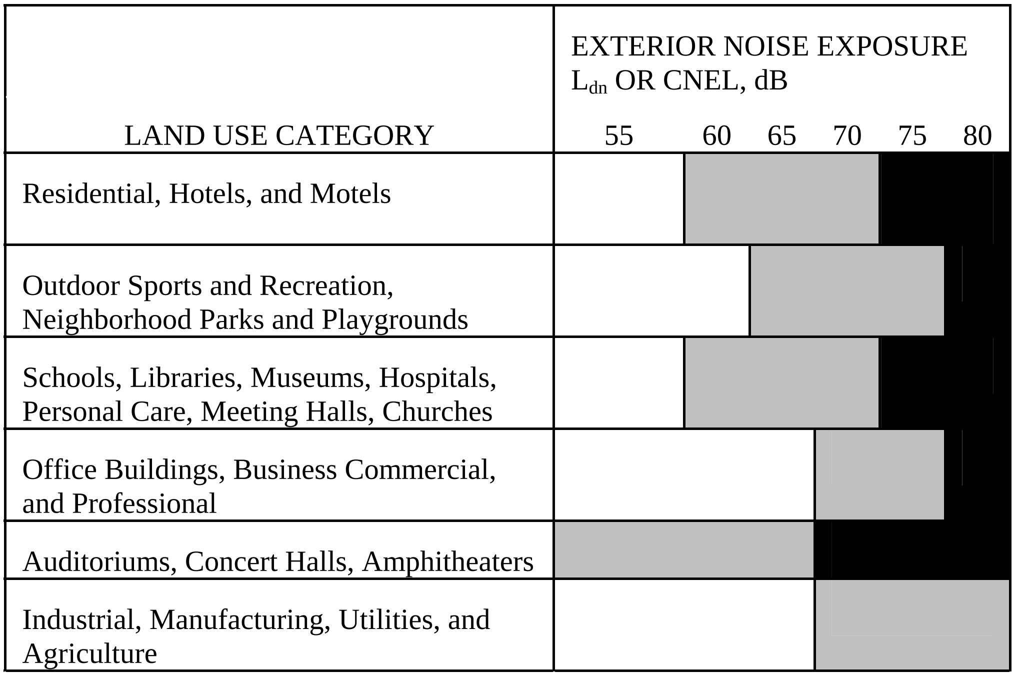
C Require environmental review of all proposed transportation projects which may increase the average day/night noise levels including any increased or new uses of the UP/SP right-of-way.

C Require the evaluation of mitigation measures for any project that would cause significant degradation of the noise environment by:

a) Causing the day/night noise level in existing residential areas to increase by 5 dBA or more and remain below 60 dBA;
b) Causing the day/night noise level in existing residential areas to increase by 3 dBA or more and, thereby, exceed 60 dBA;
c) Causing the day/night noise level in existing residential areas to increase by 3 dBA or more if the day/night noise level currently exceeds 60 dBA.

2.4.2 City of Capitola

Noise is not considered to be a major problem in the City of Capitola. However, the city has established a goal to minimize vehicular and stationary noise sources and noise emanating from temporary activities. While acknowledging that current railroad operations have a minimal impact on the noise environment, one policy for achieving the City's goal is to consider the effect of any proposed rail operations on abutting properties.



<u>NORMALLY ACCEPTABLE:</u> Specific land use is satisfactory, based upon the assumption that any buildings involved are of normal construction, without any special insulation requirements.

<u>CONDITIONALLY ACCEPTABLE:</u> Specific land use may be permitted only after detailed analysis of the noise reduction requirements and needed noise insulation features included in the design.

<u>UNACCEPTABLE:</u> New construction or development should generally not be undertaken because mitigation is usually not feasible to comply with noise element policies.

Source: Santa Cruz County General Plan

LAND USE COMPATIBILITY FOR COMMUNITY NOISE ENVIRONMENT	**TABLE 5**

3.0 EXISTING ENVIRONMENT

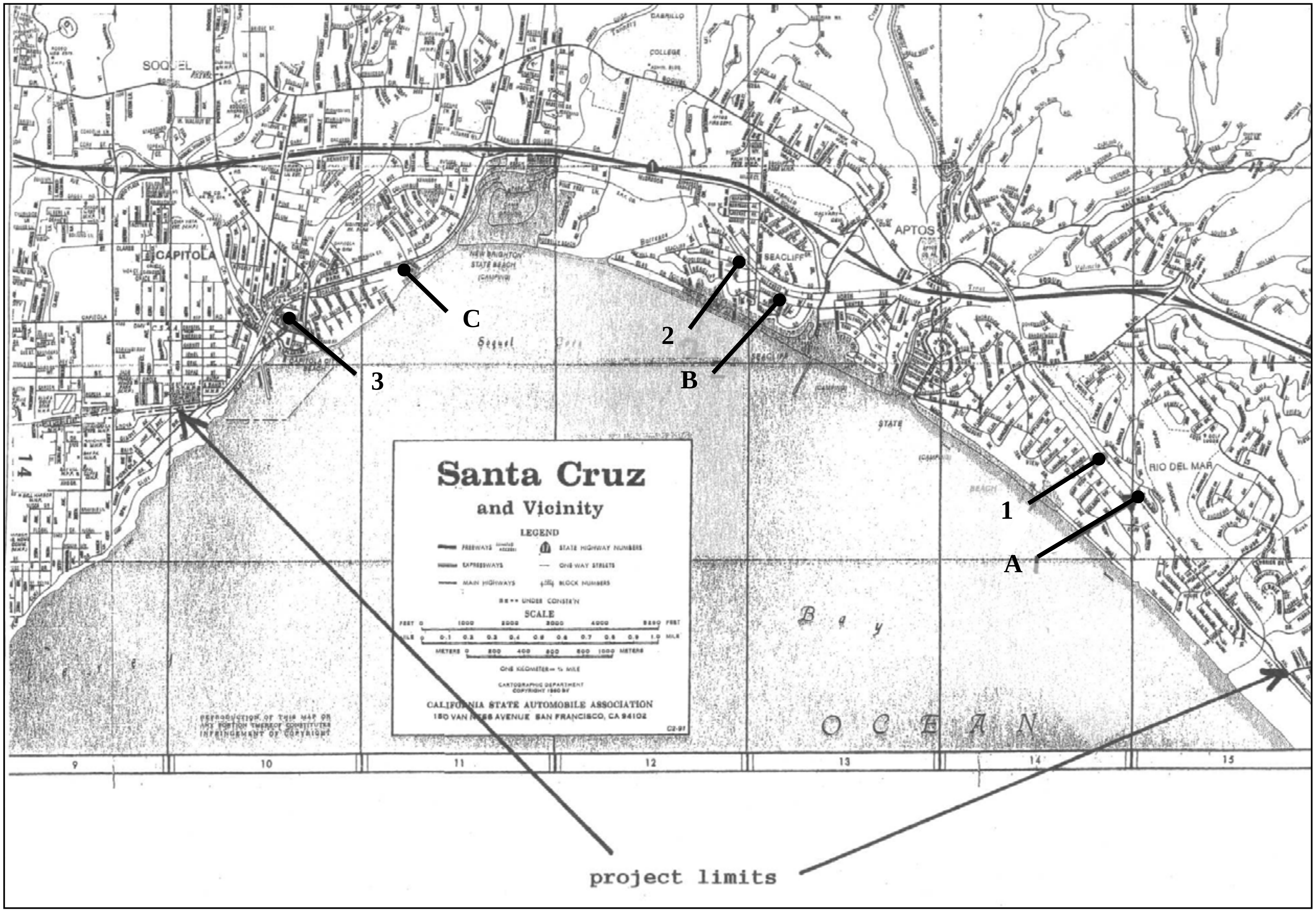
3.1 Existing Noise Environment

The project study area is shown in Figure 2. The rail line is flanked by a single- and multi-family residential development along almost its entire length. The only exceptions are the portion of the project that passes through Aptos Village where commercial uses flank the railroad and passage through New Brighton State Beach Park. There are no other noise sensitive receptors, such as schools or rest homes, located adjacent to the railroad. The residential development along the railroad right-of-way varies in distance from the tracks from about 25 feet to over 100 feet. However, through the majority of the project, residential development is located further than 35 feet from the center of the tracks.

Noise measurements were conducted in the study area as part of the environmental assessment for the Major Transportation and Investment Study[1]. These measurement locations are shown as measurement Locations 1, 2, and 3 on Figure 2. These sites were all revisited as part of the current assessment, and noise measurements were conducted on Monday, November 10, 2003.

[1] Environmental Screening Technical Report for the Watsonville Junction to Santa Cruz Corridor, Parsons Brinckerhoff Quade and Douglas, Inc., April 1, 1998.

Figure 2: Study Area and Noise Measurement Locations



The noise measurement data from the previous study and for this study is shown in Table 6. The area is generally very quiet with noise in each location dominated by traffic on the local streets, general aviation aircraft overflights, and distant traffic. Daytime noise levels are similar in all the residential areas along the right-of-way with average daytime noise levels ranging from 42 to 48 dBA. Noise levels have not changed noticeably (less than 3 dBA) since 1995. The highest noise levels at each location is generated by the existing two to three freight trains that pass by per week. The freight train was measured during the previous study at several locations along the rail line. The maximum noise level generated by the freight engines currently on the tracks range from 83 to 91 dBA at a distance of 25 feet from the track, depending upon throttle setting.

Table 6
Results of Short-Term Noise Measurements
(November 1995 - November 2003)

Site	Location	Start Time/Date	L_{eq}	L_{90}	L_{50}	L_{10}	Noise Sources
Site 1	Farmer Way near Cherry St.	2:55 PM/Nov. 28, 1995	44	40	42	44	Background sources, Capitola traffic
		12:47 PM/Nov. 10, 2003	45	42	44	46	Capitola traffic
Site 2	Rio Del Mar - Dry Creek Rd. near Sumner Ave.	5:15 PM/Nov. 28, 1995	48	42	46	50	Sumner Ave. traffic
		11:28 AM/Nov. 10, 2003	47	34	42	50	Summer Ave. traffic
Site 3	Seacliff residential area; Hillscrest Dr. near Beachgate Way	3:32 PM/Nov. 28, 1995	44	39	42	47	Background traffic.
		12:18 PM/Nov. 10, 2003	42	35	39	46	Distant traffic and general aviation aircraft.

The noise measurements conducted in 1995 and repeated in 2003 were done for short periods of time to establish the quietest background noise levels that might be anticipated during the hours of operation of the proposed rail service at various locations in the corridor. The measurements were conducted with an observer present so that the minimum background noise level in the area could be monitored and the influence of more localized activities, such as instantaneous vehicle passbys, dogs barking, yard maintenance, leaf blowers, airplane overflights, etc., would not be included. Strictly speaking, of course, these events do contribute to the background noise environment and average noise levels over an hour would be anticipated to be higher. 24-hour noise measurements were conducted at three additional locations on Monday and Tuesday, September 20 and 21, 2004. These locations were in the vicinity of the original locations but were purposely made at different locations to expand the geographic area covered. All of the locations were near the railroad tracks to represent the noise environment of typical backyards in these areas. The weather was clear with no wind. The measurements were conducted using Larson Davis Laboratories Model 700, 812 and 820 Integrating Sound Level Meters. The meters were calibrated before each use. (Instruments are also sent back to the manufacturer each year for laboratory calibration).

Location A was in Rio Del Mar, on the west side of Sumner Avenue at Doris Avenue. The noise measurement location was 39 feet from the centerline of the near lane of Sumner Avenue and 30 feet from the railroad tracks. Noise measurement Location B was in the Sea Cliff area near the intersection of Poplar Avenue and Maple Avenue, both lightly traveled residential streets. The measurement was made at a distance of 15 feet from the centerline of the near lane of Poplar Avenue and 20 feet from the railroad tracks. Noise measurement Location C was located on the west side of Park Avenue on Grove Lane in Capitola. The sound level meter was located at a distance of 90 feet from the centerline of Park Avenue and 42 feet from the railroad tracks. The measurement locations are shown on Figures 3, 4, and 5. The results of the noise measurements at each of these locations are summarized in Figures 6, 7, and 8. Each graph shows the average noise level, or Leq, for the hour and the maximum instantaneous noise level reached during the hour. A freight train passed through the corridor around 6:00 PM on Monday evening, September 20, 2004, allowing the 24-hour average noise level, or L_{dn}, to be calculated at each location with and without the train passby.

Location A

The measurements indicate the following about noise exposure in each of the three areas. Hourly noise levels in the Rio Del Mar area, as indicated by measurement Location A, ranged from a low of 51 dB between 8:00 and 9:00 PM to a high of 63 dB between 11:00 AM to noon when typical maximum noise levels routinely reached 80 to 85 dB. The Leq during the hour the train passed by between 6:00 and 7:00 PM was 64 dB. The L_{dn} was 57.5 with the train passby and 56.2 without the train passby.

Location B

Noise levels in the Sea Cliff area as indicated by the measurement at Location B ranged from 51 dB between 8:00 to 9:00 PM to 55 dB from 11:00 AM to noon. Typical maximum levels reached 75 to 80 dBA. The L_{dn} at this location was 57.7 dB without the train and 59.6 dB with the train passby.

Location C

Noise levels in the Capitola area at Location C ranged from 55 dBA at 8:00 to 9:00 PM to 68.6 dB from 11:00 AM to noon. Maximum noise levels typically ranged from 70 to 80 dBA, although the noise level reached 103 dB when the train passed and 97 dB probably from a siren on Park Avenue. The L_{dn} at this location was 62.7 dB with the train passby and 60.9 dB without the train passby.

These data show that the existing hourly average noise level during the typical operating hours of the train (11:00 AM to 8:00 PM) is above 51 dBA. When the influence of local traffic near the microphones (which would not be typical for many of the rear yards along the tracks) is factored out by analyzing the background noise levels, the hourly average noise level would be above 46 dBA even at the quietest locations in the corridor. For the purposes of this impact assessment an hourly L_{eq} of 46 dBA is assumed to represent the existing daytime background noise level. The existing 24 hour $_{Ldn}$ ranges from 56-61 dB.

Figure 6: Daily Trend in Noise Levels at Location A (See Figure 2)

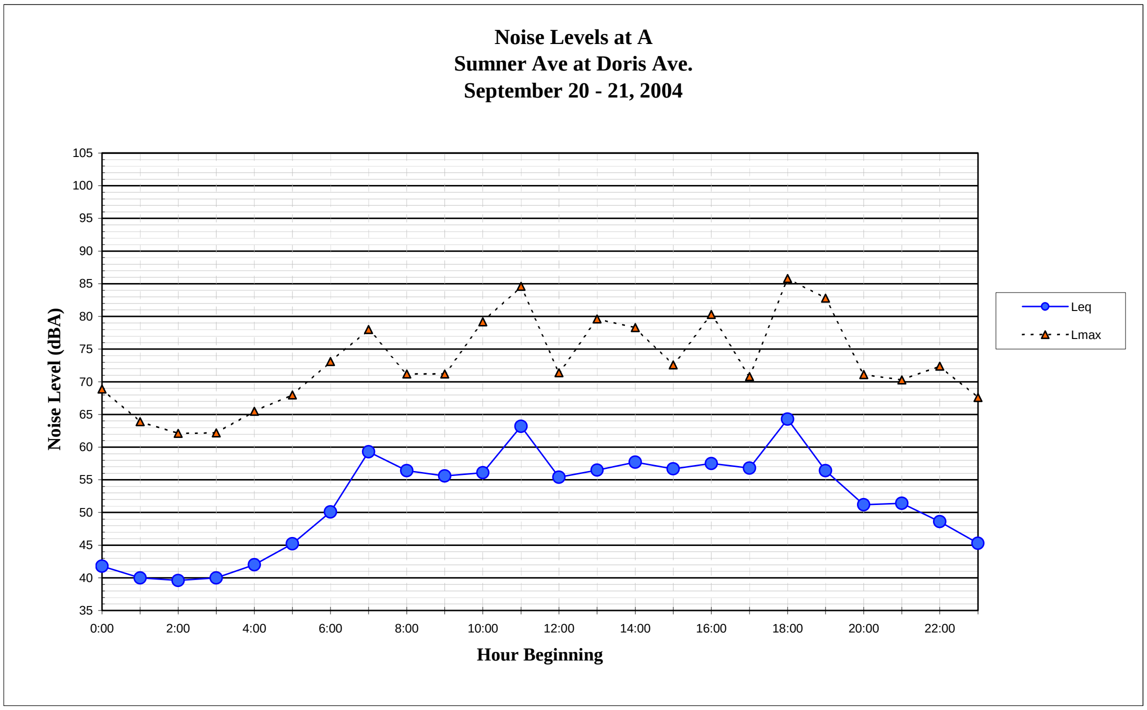


Figure 7: Daily Trend in Noise Levels at Location B (See Figure 3)

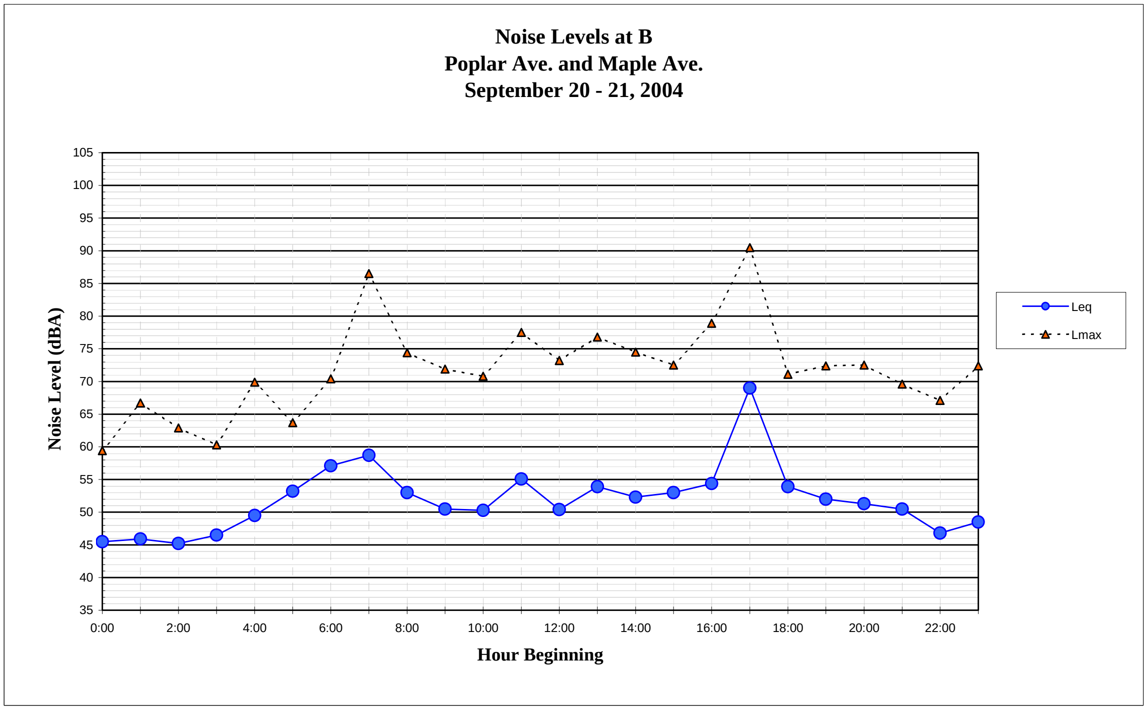
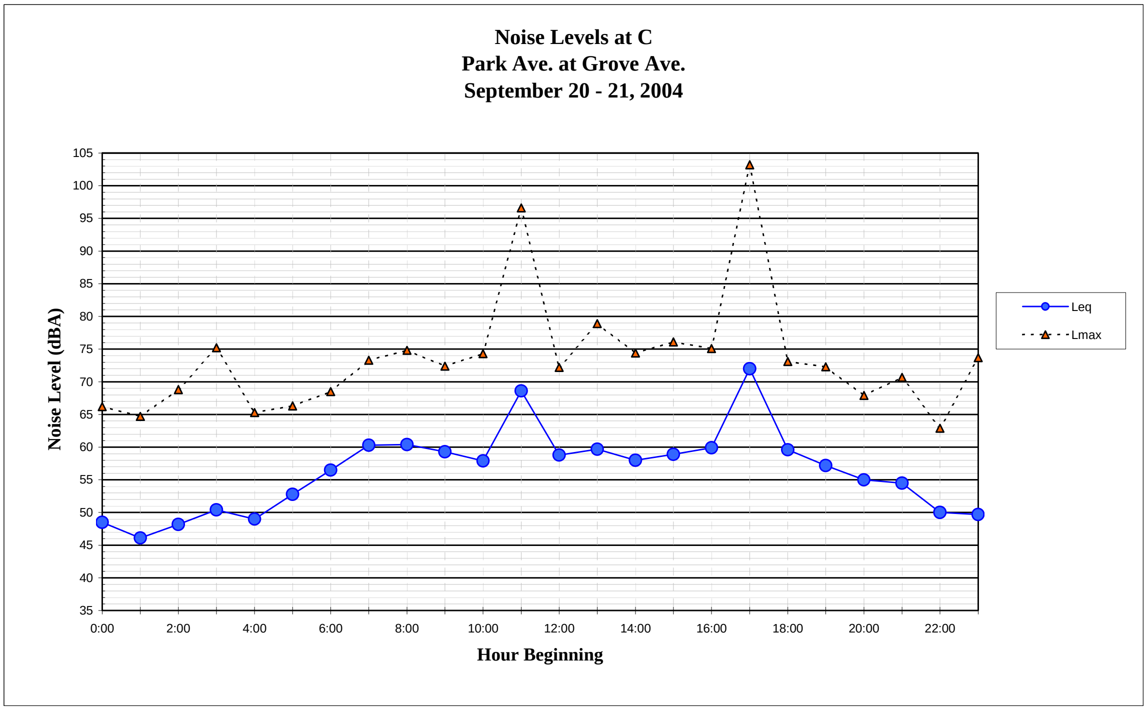


Figure 8: Daily Trend in Noise Levels at Location C (See Figure 4)



3.2 Existing Vibration Environment

Vibration measurements were made along the railroad line to establish baseline vibration levels at representative sensitive receptors. The vibration measurements were made at locations that would characterize vibrations felt in residential structures located closest to the railroad tracks.

The vertical component of ground-borne vibration was measured using a Bruel and Kjaer Type 4366 Accelerometer connected to a LarsonCDavis Laboratories Model 3100 Real Time Analyzer. The system was calibrated using a Bruel and Kjaer Type 4294 Calibration Exciter. The Real Time Analyzer provides spectra of the root-mean square vertical component of ground-borne vibration in units of micro inches per second. One-second samples were taken over a one-minute period during each train passage. The accelerometer was attached to a flat surface that was fixed to the ground (e.g., sidewalk curb).

A freight train travels the corridor approximately three times per week at speeds of 10-25 mph. Ground-borne vibration measurements were made at several distances from the tracks. The vibration levels ranged from 78-85 VdB when equalized to a distance of 25 feet from the tracks.

4.0 NOISE AND VIBRATION ASSESSMENT

4.1 Operational Noise

The project proposes to operate a two- to three-car, self-propelled diesel train. These trains are quieter than typical freight engines. The actual train that would be used for the project has not been selected by SCCRTC. The SCCRTC is considering the BUDD diesel unit or another similar diesel mechanical unit.

A BUDD train has been operated by the Oregon Department of Transportation between Portland, Oregon and Astoria, Oregon as part of their Lewis & Clark Explorer Train Program. The train was operated between May 28 and September 20, 2004, Friday, Saturday, Sunday, and Monday. Under SCCRTC direction, noise measurements were taken in Oregon on September 12 and 13, 2004 to measure the noise generated by the BUDD train. The train in question is a self-propelled rail diesel unit consisting of three cars. Noise measurements conducted at a distance of 30 feet from the unit traveling at a speed of about 15 miles per hour indicated a maximum instantaneous noise level of 81 dBA. Another measurement conducted where the train was going at approximately 35 miles per hour indicated a maximum instantaneous noise level of 82 dBA at a distance of 70 feet from the tracks. When normalized to a distance of 50 feet, these noise levels were equivalent to a maximum instantaneous noise level of 77 dBA at 15 miles per hour and 84 dBA at 35 miles per hour. The train horn was also measured at several locations. The maximum noise level was measured at 105 dBA at a distance of 30 feet from the train.

Based on the measurements, it is clear that faster speeds equal higher noise levels. The noise level increases at 20 times the logarithm to the base 10 of the ratio of the speeds. Based on the data measured for the Portland Astoria BUDD train, the noise level at 50 feet at a speed of 25 miles per hour would be about 81 dB when the train passes.

Under the proposed project train service would occur on a maximum of 120 days per year, and the trains would run between 11:00 AM and 8:00 PM on one-hour headways. This means that there would be two train passbys at a given location each hour between 11:00 AM and 8:00 PM or a total of 18 train passbys per day. The train would have a maximum speed of 25 mph.

Under the Business Plan Project there would be 2 round trips during two service windows (11:00 am to 2:00 pm and 4:00 pm to 7:00 pm) for a total of 4 round trips (8 passbys) per day. Service would be restricted to Friday through Monday during the season for a total of 48 days per year. The train would have a maximum speed of 25 mph.

The maximum passby noise level for a train passby at 25 mph, at a distance of 25 feet, is calculated to be 87 dBA. For the proposed project the hourly average noise level during hours when the train is operating would be 54 dBA. The 24-hour average noise level, or L_{dn}, on days when the train was operating would be about 50 dB at a distance of 25 feet from the tracks. During the hours of operation of the trains (11:00 am to 8:00 pm), the long-term noise measurements show that the background Leq, in the quietest residential areas along the tracks is at least 46 dBA and the Ldn is 56 dBA or more. This means that at 25 feet from the track the train activity would generate a noisiest hour L_{eq} which exceeds the background noise level by 8 dBA and which, according to the Federal Transit Administration would not be an impact. However, if the train were only 2 dBA louder (not a generally detectable difference), the impact threshold would be reached. For this reason, the impact should be considered potentially significant and Mitigation Measure C-1 is included to assure that the trains do not generate more than 83 dBA at 50 feet at 25 miles per hour so that noise levels stay below the impact threshold. The Ldn in the area due to train passbys would increase by less than 2 dBA. The L_{dn} at this distance is below the strictest noise and land use compatibility guidelines adopted by Santa Cruz County and the City of Capitola. Further, the

L_{dn} would increase by less than 5 dB and would remain below an L_{dn} of 60 dB. Noise levels generated by the project would, therefore, be consistent with the Noise Elements of both the County of Santa Cruz and the City of Capitola. Noise levels would be lower at greater distances from the railroad track.

Under the proposed Business Plan the maximum noise level and hourly noise levels during train operation would be the same as for the proposed project. The L_{dn} would, however, be only 43 dB due to the much lower level of activity.

Trains are required to sound a horn as they approach a grade crossing to warn motorists and pedestrians of their approach. Noise levels generated by train horns within a 700-foot radius of the crossing could be expected to reach over 100 dBA.

When the sounding of the train horn is added to the noise generated by the train itself, and the number of horn soundings at a given location is calculated over a 24-hour period, a 24-hour combined average sound level can be calculated. This average will vary depending on the location within the corridor, since average sound levels vary throughout the corridor from 56 dBA to 61 dBA. For the Original Project, with 9 round trips and 18 horn soundings per day at a given crossing location, the 24-hour average (L_{dn}) would range between 63 dBA and 65 dBA within 700 feet of a grade crossing. For the Business Plan Project Alternative, with 4 round trips and 8 horn soundings per day at a given crossing location, the 24-hour average (L_{dn}) would range between 60 dBA and 63 dBA within 700 feet of a grade crossing.

Crossing bells typically generate a sound level of 69 - 71 dBA at a distance of 100 feet, much less than a train whistle. The noise generated by the crossing bells alone would cause an increase in the hourly L_{eq} within 100 feet of a crossing to increase by up to 10 dBA. The L_{dn} would increase by less than 2 dBA. This is important only if whistle noise is eliminated in the corridor.

4.2 Ground Vibration

Ground vibration adjacent to the rail transportation system depends on a number of factors. The type of system (i.e., locomotive powered passenger or freight, rapid transit or light rail vehicles, or rubber tired, geological conditions, track conditions, etc.) is the most important factor. The Federal Transit Administration has developed a screening procedure for ground vibration. It is anticipated that the self-powered diesel mechanical units proposed will generate vibration levels at 25 feet of approximately 78 VdB, which is similar to a rapid transit vehicle, somewhat less than a locomotive-powered passenger or freight train (85 VdB) and more than a rubber-tired fixed-guideway vehicle (65 VdB). Restricting speeds to a maximum of 25 mph will result in low vibration levels. Assuming good suspension, true wheels and normal soil conditions, it is estimated that the ground-borne vibration levels adjacent to the rail line would be about 78 VdB at a distance of 25 feet. This is below the 80 VdB criterion for infrequent events as described previously in Section 2.3. Furthermore, the vibration generated by the recreational service is projected to be less than that currently generated by the freight train.

5.0 IMPACTS AND MITIGATION

5.1 Standards of Significance

Based on inquiries found in the sample Initial Study Checklist attached as Appendix G to the CEQA Guidelines, as well as local and federal regulations and the professional judgment of SCCRTC staff and consultants, the proposed project would have a significant impact if any of the following criteria are met:

Criterion 1: Pursuant to the Policy 6.10.2 of the General Plan of Santa Cruz County, the project resulted in any of the following conditions:

a. causing the L_{dn} in existing residential areas to increase by 5 dBA or more and remain below 60 dBA;
b. causing the L_{dn} in existing residential areas to increase by 3 dBA or more and, thereby, exceed 60 dBA; or
c. causing the L_{dn} in existing residential areas to increase by 3 dBA or more if the day/night noise level currently exceeds 60 dBA.

Criterion 2: Pursuant to criteria of the FTA, the proposed project would cause the hourly L_{eq} at a sensitive receptor to increase by 10 dBA or more.

Criterion 3: The project would expose persons to or generate excessive ground-borne vibrations (>80 VdB) or ground-borne noise levels (>43 dBA) pursuant to FTA criteria.

Criterion 4: Pursuant to the criteria of the FTA, the project would result in a substantial permanent increase of more than 10 dBA in ambient noise levels in the project vicinity above levels existing without the project.

Criterion 5: Pursuant to the criteria of the FTA, the project would result in a substantial temporary or periodic increase of more than 10 dbA in ambient noise levels in the project vicinity above levels existing without the project.

Criterion 6: The project is located within an airport land use plan or within two miles of a public airport and would expose people residing or working in the project area to excessive noise levels.

Criterion 7: The project is located within the vicinity of a private air strip and would expose people residing or working in the project area to excessive noise levels.

The following section presents the project's potential impacts relative to each of these criteria.

5.2 Less Than Significant Impacts

Criteria 1 and 4 (Local Sound Regulations):

Train Noise

Regarding the operation of the train itself, neither the Original Project nor the Business Plan Project Alternative would result in a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project. The 24-hour average sound level (L_{dn})

at any individual location studied would increase by 1 dB or less with the addition of either the Original Project or the Business Plan Project Alternative, as explained in more detail below.
The current estimate of 24-hour L_{dn} in the project corridor ranges from a low of 56 dBA at Location A to a high of 60 dBA at Location C. The projected future L_{dn} with the Original Project would range from 57 dBA at location A to 61 dBA at Location C at a distance of 25 feet from the tracks. The projected future L_{dn} with the Business Plan Project Alternative would range from 56 dBA at Location A and 61 dBA at Location C at a distance of 25 feet from the tracks.
Pursuant to the local criteria that utilize L_{dn} as the measure of significant impact, neither project would result in an increase of 5 dB or more over the existing L_{dn} at any location studied within the project corridor. The L_{dn} does not increase dramatically because it is a 24-hour average and each train passby represents a very short period of time within the 24-hour period.

Table III.C.6 Comparison of Projected Train Noise to Local Standards

Local standards (Santa Cruz County and Capitola)	Existing L_{dn} Range	Original Project Future L_{dn} Range	Business Plan Project Future L_{dn} Range	Impact
>5 dBA increase over existing L_{dn}	56-61 dBA	57-61 dBA	56-61 dBA	Less than Significant

Train Noise plus Train Horn Noise at Crossings

Trains are required to sound a horn as they approach a grade crossing to warn motorists and pedestrians of their approach. Noise levels generated by train horns within a 700-foot radius of the crossing could be expected to reach over 100 dBA.

When the sounding of the train horn is added to the noise generated by the train itself, and the number of horn soundings at a given location is calculated over a 24-hour period, a 24-hour combined average sound level can be calculated. This average will vary depending on the location within the corridor, since average sound levels vary throughout the corridor from 56 dBA in the quietest locations to 61 dBA in the loudest locations as described in Table III.C.5.
For the Original Project, with 9 round trips and 18 horn soundings per day at a given crossing location, the 24-hour average (L_{dn}) would range between 63 dBA at the quietest locations and 65 dBA at the loudest locations in the corridor.

For the Business Plan Project Alternative, with 4 round trips and 8 horn soundings per day at a given crossing location, the 24-hour average (L_{dn}) would range between 60 dBA at the quietest locations and 63 dBA at the loudest locations in the corridor.

According to the criteria established by the Santa Cruz County General Plan, the Original Project would result in a potential significant impact because at both the quietest and loudest locations studied the Original Project would result in a greater than 5 dB increase and the future noise level would be above 60 dBA.

The Business Plan Project Alternative, at the quietest location would result in a 4 dB increase and the future noise level would be 60 dBA. At the loudest locations, the increase would be only 2 dB which is not considered a potentially significant impact.

Table III.C.7 Train Noise and Train Horn Noise (all measurements are dBA)					
		Original Project		Business Plan Project Alternative	
	Existing 24-hour noise level	Future 24-hour Avg.	Significant Impact?	Future 24-hour avg.	Significant Impact?
Quietest Location	56	63	Yes	60	No
Loudest Location	61	65	Yes	63	No

Criterion 3 (Ground Borne Vibration): The proposed project would not expose the public to excessive ground-borne vibrations or noise levels.

The proposed self-propelled diesel train units would generate vibration levels of approximately 78 VdB at 25 feet, which is similar to a rapid transit vehicle[2], and is considerably less than what is currently generated by the freight trains operating along the rail line. Freight trains currently generate between 78-85 VdB with each passby. The 78 VdB generated by either the Original Project or the Business Plan Project Alternative is within the 78-85 VdB of vibration currently experienced in the corridor, and is also below the 80 VdB criterion for infrequent events as described in Table III.C.3. No mitigation would be required.

Ground-borne noise is only a problem where the railroad is underground. There would be no ground-borne noise generation due to the project.

Table III.C.8 Comparison of Project to Ground-Borne Vibration Standards			
Federal standard (FTA criteria)	**Existing VdB**	**Project VdB**	**Impact**
(>80 VdB) ground-borne vibration	78-85 VdB	78 VdB	No Impact (Project would not increase existing level of vibration)

Criteria 6 and 7 (proximity to a public or private airport): The proposed project is not located within two miles of a public airport or within the vicinity of a private airstrip and therefore would not be anticipated to create an adverse impact.

[2] Rapid transit refers to urban transportation systems which utilize either at-grade or underground rail systems, or a combination of both.

5.3 Potentially Significant Impacts

Criterion 2 (Federal Regulations):

Regarding the 1-hour average sound level, (L_{eq}), neither the Original Project nor the Business Plan Project Alternative would cause the existing L_{eq} at a residence to increase by 10 dB or more. For the measurement locations shown in Figure 3, the current hourly average noise level (L_{eq}) without the project is 46 dBA at a distance of 25 feet from the rail line, while the future projected L_{eq} when the train is operating would be 54 dBA at 25 feet, representing an 8 dBA increase. This result is the same for both the Original Project and the Business Plan Project Alternative since both projects would result in a maximum of one round trip (two passbys) in any given hour.

Although an 8 dBA increase is less than the 10 dBA increase identified by FTA as the threshold of significance, this increase is nevertheless considered potentially significant because the projected increase approaches 10 dBA and there is uncertainty about the level of noise emission of the actual train to be used by the SCCRTC.

Table III.C.8 Comparison of Project to Federal Noise Standards

Standard (FTACriteria)	Existing L_{eq}	Future L_{eq}	Impact
>10 dBA increase over existing L_{eq}	46 dBA	54 dBA	8 dBA increase - Potentially significant, since uncertainty of actual noise emission could result in >10 dBA increase during operation.

Criterion 5 (temporary or periodic increase in ambient noise): The frequency of train horn soundings at at-grade crossings and the sounding of grade crossing warning bells would increase proportionally with the increase in train trips. The frequency of this type of sound would increase during the days of operation, representing a potentially significant temporary or periodic increase in ambient sound.

Train Horns

Noise levels generated by train whistles within a 700-foot radius of the crossing could be expected to reach over 100 dBA which would generate hourly Leq noise levels of more than 10 dBA above the existing hourly average of 46 dBA. This periodic increase in whistle soundings would be considered substantial and would be considered a significant impact.

Crossing Bells

Crossing bells typically generate a sound level of 69 to 71 dBA at a distance of 100 feet, which would represent an increase of up to 10 dBA above the existing hourly average of 46 dBA. This periodic increase in warning bell soundings would not be considered a substantial increase and would not represent a potentially significant impact.

Establishment of Community Quiet Zone

In December 2003, the Department of Transportation Federal Railroad Administration (FRA) issued an Interim Final Rule (49 CFR Parts 222 and 229 Use of Locomotive Horns at Highway-Rail Grade Crossings) regarding the use of locomotive horns at highway-rail crossings. The rule provides exemptions for the creation of community quiet zones. In order to determine whether an area or community is eligible for an exemption, the SCCRTC would coordinate with the FRA to create a risk index by which a prospective Capitola to Seascape quiet zone could be rated. If an exemption is granted, supplementary safety measures may be required.

In accordance with the Federal Railroad Administration (FRA) guidance, the SCCRTC has taken the following steps towards creation of a community quiet zone:

On February 2, 2005, SCCRTC staff conducted a site visit of all proposed crossings with FRA representatives and staff from other affected local jurisdictions: Capitola, Aptos, Santa Cruz County, and California State Parks.

The SCCRTC will submit an application to the Federal Railroad Administration for the establishment of a quiet zone in the project corridor. The Final EIR will include an update on the progress towards creation of the community quiet zone.

5.3 Mitigation Measures

Mitigation Measure C-1: To ensure that noise generated by the proposed project is minimized, the specifications for new trains shall require that under cruising conditions at 25 mph, the maximum noise level during a train passby shall not exceed 83 dBA at a distance of 50 feet from the centerline of the track, which would correspond to an L_{eq} of 56 dBA or less. Implementation of this requirement would ensure that operation of the train itself will not result in an increase in sound of more than 8 dB over existing conditions. According to the FTA thresholds outlined in criterion 2, an increase of less than 10 dB is not considered significant. This mitigation measure will insure that the train finally selected will not be noisier than the Budd train and will have the noise characteristics of a self-contained diesel mechanical unit rather than a freight engine.

Mitigation Measure C-2: Pursuant to FTA regulations, the Santa Cruz County Regional Transportation Commission (SCCRTC) shall implement sound attenuation measures for homes that could experience an increase of 10 dBA in ambient noise during the proposed period of service. With the implementation of Mitigation Measure C-1, homes along the rail line would not experience a significant increase in sound level from the operation of the train itself. However, homes within 700 feet of the train horn and homes within 100 feet of the crossing gates would experience a substantial temporary or periodic increase in ambient sound.

Sound attenuation measures could include double-paned windows as well as other sound insulating techniques, such as a sound wall or home insulation appropriate for the location.

Implementation of this measure would ensure that the project would not result in a temporary or periodic increase in ambient sound of more than 10 dB over existing conditions.

The cost of implementing sound attenuation techniques for homes within 100 feet of crossing gates would not cause a substantial financial burden. There are approximately 16 residential dwellings within 100 feet of the 10 grade crossings. To replace windows facing the grade crossing could cost up to approximately $5,000 per home. However, the cost of implementing sound attenuation techniques for homes within 700 feet of the sounding of a train horn is likely to be prohibitively expensive and therefore infeasible. The establishment of a community quiet zone, discussed under Mitigation Measure 3 below, would allow the sounding of train horns to be discontinued within the project corridor except in emergency situations. The successful implementation of a community quiet zone would therefore remove the impact of train horn noise from both the Original Project and the Business Plan Project Alternative. However, if a community quiet zone cannot be established, then either project would result in a significant and unavoidable impact related to the sounding of the train horn.

Mitigation Measure C-3: The SCCRTC shall establish a community quiet zone for the proposed project corridor, if the Secretary of Transportation determines that the creation of a community quiet zone and the cessation of the use of train horns at rail crossings would not present a significant risk with respect to loss of life or serious personal injury.

This measure shall be based upon the rules outlined in the Federal Register, Department of Transportation Federal Railroad Administration Use of Locomotive Horns at Highway-Rail Grade Crossings; Interim Final Rule (December 18, 2003).

If the SCCRTC is unsuccessful in establishing the community quiet zone, both the Original Project and the Business Plan Project Alternative would result in a significant and unavoidable noise impact, due to the sounding of the train horn.