

Environmental Noise Impact Study
for the
Chabot College Facilities Master Plan
Hayward, CA

SUBMITTED TO:

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DATE:

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SETTING

A. Fundamental Concepts of Noise

Noise can be defined as unwanted sound. It is commonly measured with an instrument called a sound level meter. The sound level meter captures the sound with a microphone and converts it into a number called a sound level. Sound levels are expressed in units of decibels.

To correlate the microphone signal to a level that corresponds to the way humans perceive noise, the A-weighting filter is used. A weighting de-emphasizes low-frequency and very high-frequency sound in a manner similar to human hearing. The use of A-weighting is required by most local General Plans as well as federal and state noise regulations (e.g. Caltrans, EPA, OSHA and HUD). The abbreviation dBA is commonly used when the A weighted sound level is reported.

Because of the time-varying nature of environmental sound, there are many descriptors that are used to quantify the sound level. Although one individual descriptor alone does not fully describe a particular noise environment, taken together, they can more accurately represent the noise environment. The maximum instantaneous noise level (L_{max}) is often used to identify the loudness of a single event such as a train passby or airplane flyover.

To express the average noise level the L_{eq} (equivalent noise level) is used. The L_{eq} can be measured over any length of time but is typically reported for periods of 15 minutes to 1 hour. The background noise level (or residual noise level) is the sound level during the quietest moments. It is usually generated by steady sources such as distant freeway traffic. It can be quantified with a descriptor called the L_{90} which is the sound level exceeded 90 percent of the time.

To quantify the noise level over a 24-hour period, the Day/Night Average Sound Level (DNL or L_{dn}) or Community Noise Equivalent Level (CNEL) is used. These descriptors are averages like the L_{eq} except they include a 10 dB penalty during nighttime hours (and a 5 dB penalty during evening hours in the CNEL) to account for peoples increased sensitivity during these hours.

In environmental noise, a change in noise level of 3 dBA is considered a just noticeable difference. A 5 dBA change is clearly noticeable, but not dramatic. A 10 dBA change is perceived as a halving or doubling in loudness.

B. Regulatory Framework

a. State of California

The Office of Planning and Research promulgates guidelines for the acceptable noise levels¹. The guidelines are divided into various land use categories. For schools, the State considers an L_{dn} of 70 dBA or less as “normally acceptable”. However, if the L_{dn} is between 60 and 70 dBA, the noise level is also considered “conditionally acceptable”. These standards are consistent with those contained in the City of Hayward General Plan. A listing of the various land use categories with an interpretation for the various community noise exposure limits (e.g. definition of “conditionally acceptable”) is found in Figure 1.

b. County of Alameda Airport Land Use Commission (ALUC)

The Alameda County Airport Land Use Policy Plan was adopted by the ALUC on July 16, 1986. The policy for airport noise is represented by Figure 1, Land Use Compatibility Standards for Community Noise Environments. These standards are the same as those contained in the Hayward General Plan. The ALUC Plan also contains noise contour maps a referral area map. Under the policy, new land uses and developments that fall within the ALUC referral area must be submitted by the City for review by ALUC staff or the full commission.

c. City of Hayward

i. Noise Element

Appendix N of the City of Hayward General Plan is entitled *Guidelines for the Review of New Development*. The guidelines identify goals and standards to protect new development from excessive noise and these standards depend on the type of land use. According to guideline C, the goal is to “protect schools, hospitals, libraries, churches, convalescent homes, and other noise sensitive uses from noise levels exceeding those allowed in residential areas.

The “acceptable” noise standards for residences are established in Figure 1 of the Noise Element entitled: Land Use Compatibility Standards for Community Noise Environments. According Figure 1, an L_{dn} of 60 dBA or less is considered normally acceptable. In addition to the standards in figure 1, Appendix N has the following requirements:

¹ General Plan Guidelines, Governor’s Office of Planning and Research, October 2003.

1. *The maximum acceptable exterior noise level in residential areas is an L_{dn} of 55 dB[A] for single family development and an L_{dn} of 60 dB[A] for multi-family development. These levels shall guide the design and location of future development, and are the goals for the reduction of noise in existing development. These goals will be applied where outdoor use is a major consideration (e.g. backyards in single-family developments, recreation areas in multi-family housing projects). The outdoor standard will normally be applied to any area considered to be "useable open space", including decks and balconies associated with apartments and condominiums.*
2. *Indoor noise level shall not exceed and L_{dn} of 45 dBA in new housing units.*
3. *If the primary noise source is aircraft or a railroad, noise levels in new residential development exposed to an exterior L_{dn} of 60 dBA or greater should be limited to a maximum instantaneous noise level in bedrooms at night of 50 dBA. Maximum instantaneous noise levels in bedrooms during the daytime and in other rooms should not exceed 55 dBA*

ii. Noise Ordinance

Chapter 4 of the City's municipal code addresses public nuisances such as noise. Section 4-1.03 includes supplementary provisions related to construction and it states that no person shall produce a construction noise level more than 6 dB above the local ambient level at any point outside the property plane before the hour of 7:00 a.m. and after the hour of 7:00 p.m. daily except on Sundays and holidays. On Sundays and holidays the restrictions apply before 10:00 a.m. and after 6:00 p.m.

Section 4-1.03 does allow an exception if the applicant can show that a diligent investigation of available noise abatement techniques indicates that immediate compliance with the requirements of the code would be impractical or unreasonable. A permit to allow the exception may be issued by the City Manager or his or her designee with appropriate conditions to minimize the public detriment caused by such exception. Any permit shall be of as short duration as possible up to one month, but renewable upon a showing of good cause and shall be conditioned by a schedule for compliance and details of methods.

Figure 1: Land Use Compatibility Standards for Community Noise Environments

**TABLE I
 LAND USE COMPATIBILITY FOR COMMUNITY NOISE ENVIRONMENTS**

LAND USE CATEGORY	COMMUNITY NOISE EXPOSURE L _{dn} OR CNEL, dB						INTERPRETATION
	55	60	65	70	75	80	
RESIDENTIAL – LOW DENSITY SINGLE FAMILY, DUPLEX, MOBILE HOMES							NORMALLY ACCEPTABLE Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.
RESIDENTIAL – MULTI. FAMILY							
TRANSIENT LODGING – MOTELS, HOTELS							CONDITIONALLY ACCEPTABLE New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning will normally suffice.
SCHOOLS, LIBRARIES, CHURCHES, HOSPITALS, NURSING HOMES							
AUDITORIUMS, CONCERT HALLS, AMPHITHEATRES							NORMALLY UNACCEPTABLE 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 needed noise insulation features included in the design.
SPORTS ARENA, OUTDOOR SPECTATOR SPORTS							
PLAYGROUNDS, NEIGHBORHOOD PARKS							CLEARLY UNACCEPTABLE New construction or development should generally not be undertaken.
GOLF COURSES, RIDING STABLES, WATER RECREATION, CEMETERIES							
OFFICE BUILDINGS, BUSINESS COMMERCIAL AND PROFESSIONAL							
INDUSTRIAL, MANUFACTURING UTILITIES, AGRICULTURE							

CONSIDERATIONS IN DETERMINATION OF NOISE-COMPATIBLE LAND USE

A. NORMALIZED NOISE EXPOSURE INFORMATION DESIRED
 Where sufficient data exists, evaluate land use suitability with respect to a "normalized" value of CNEL or L_{dn}. Normalized values are obtained by adding or subtracting the constants described in Table 1 to the measured or calculated value of CNEL or L_{dn}.

B. NOISE SOURCE CHARACTERISTICS
 The land use-noise compatibility recommendations should be viewed in relation to the specific source of the noise. For example, aircraft and railroad noise is normally made up of higher single noise events than auto traffic but occurs less frequently. Therefore, different sources yielding the same composite noise exposure do not necessarily create the same noise environment. The State Aeronautics Act uses 65 dB CNEL as the criterion which airports must eventually meet to protect existing residential communities from unacceptable exposure to aircraft noise. In order to facilitate the purposes of the Act, one of which is to encourage land uses compatible with the 65 dB CNEL criterion wherever possible, and in order to facilitate the ability of airports to comply with the Act, residential uses located in Community Noise Exposure Areas greater than 65 dB should be discouraged and considered located within normally unacceptable areas.

C. SUITABLE INTERIOR ENVIRONMENTS
 One objective of locating residential units relative to a known noise source is to maintain a suitable interior noise environment at no greater than 45 dB CNEL of L_{dn}. This requirement, coupled with the measured or calculated noise reduction performance of the type of structure under consideration, should govern the minimum acceptable distance to a noise source.

D. ACCEPTABLE OUTDOOR ENVIRONMENTS
 Another consideration, which in some communities is an overriding factor, is the desire for an acceptable outdoor noise environment. When this is the case, more restrictive standards for land use compatibility, typically below the maximum considered "normally acceptable" for that land use category, may be appropriate.

Source: California Office of Noise Control, "Guidelines for the Preparation and Content of Noise Elements of the General Plan," February 1976

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Source: Alameda County Airport Land Use Policy Plan, July 16, 1986

Table 1: Noise and Land Use Compatibility Standards

Adjustments to Ambient Noise Levels for Periodic Noise Events

Maximum Cumulative Duration of Noise Event in Any One-Hour Period	Residential Exterior Noise Level Standards dB(A)	
	Daytime (7 AM-10PM)	Nighttime (10PM-7AM)
30 Minutes+	+5	0
15 Minutes+	+10	+5
5 Minutes+	+15	+10
1 Minute+	+20	+15
0-1 Minute	+25	+20

Source: City of Hayward General Plan, Appendix N (2001)

C. Existing Noise Environment

Major noise sources that affect the project site are vehicular traffic on Hesperian Blvd. and Depot Road. Noise from aircraft using the Hayward Air Terminal and Oakland International Airport are also audible throughout the project site.

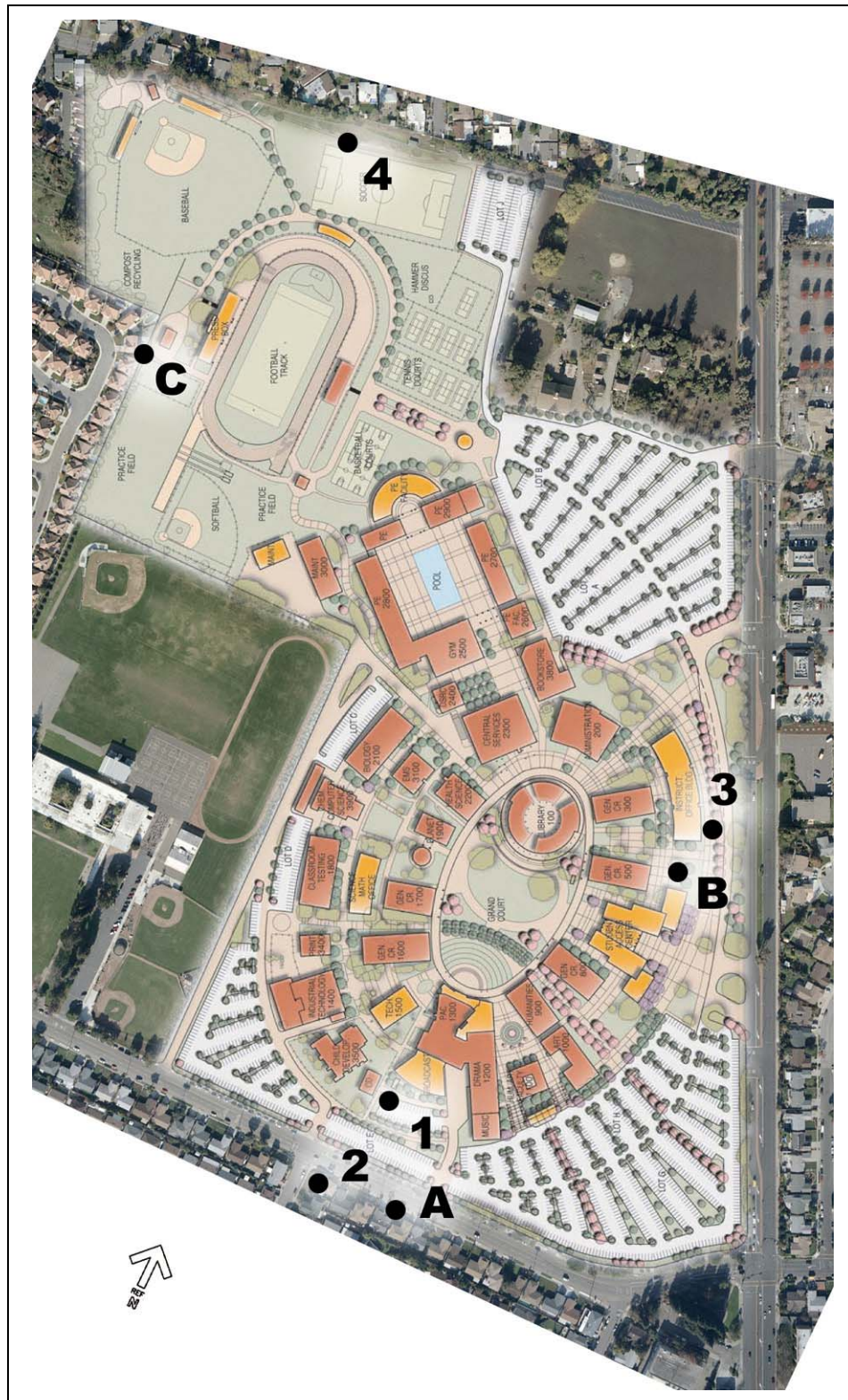
Noise measurements were made on and around the project site to quantify the existing noise environment. The measurements included three 72-hour noise measurement and four short term, 15-minute measurements. The noise measurement locations are shown in Figure 2.

The short-term measurements were made at locations that represent the noise exposure of existing residences or of new, proposed buildings. The short term measurement results were correlated with simultaneous measurements at the long-term monitoring location to determine the L_{dn} at the short-term measurement locations. Table 2 shows the results of the short term measurements. Figures 3a, 3b and 3c show the hourly plot of the measured noise levels. Note that there is a large “spike” in the hourly noise levels on 25 June 2005 around noon (Fig. 3b and 3c). This spike was caused by a loud jet airplane takeoff that generated maximum noise levels of 91 to 93 dBA.

Figure 4 shows the major flight tracks associated with the Hayward Executive Airport and Oakland International Airport. The figure shows that the northwest portion of the project site is under a departure track from the Hayward Air Terminal. In addition, the approach path for Oakland International Airport is just west of the site. According to the ALUC Policy Plan², the project site is within the ALUC referral zone.

² Alameda County Airport Land Use Policy Plan, Adopted July 16th, 1986.

Figure 2: Noise Measurement Locations

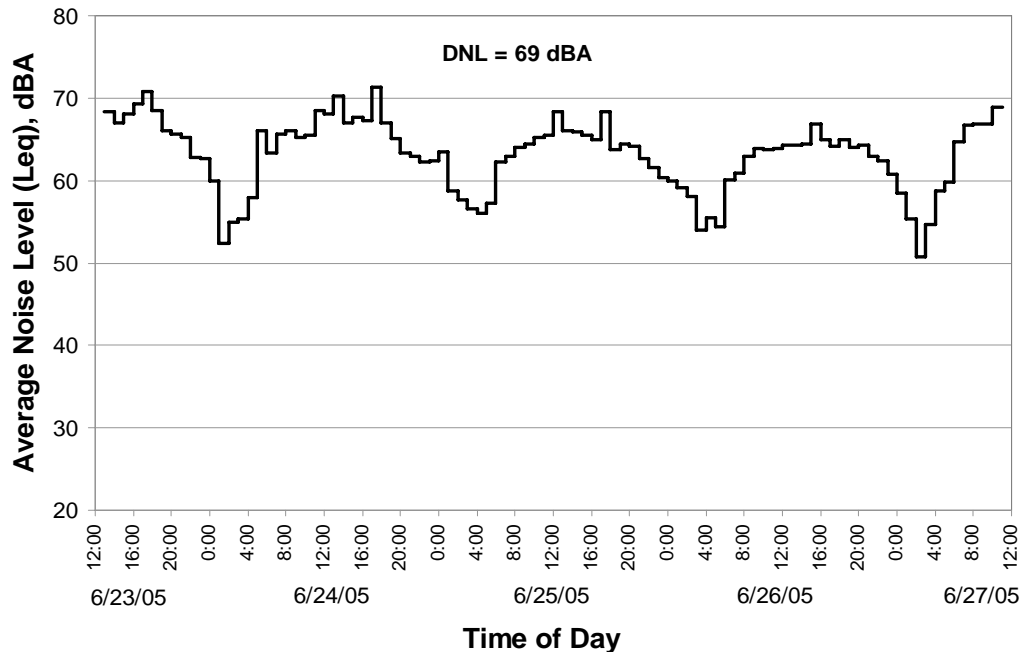


**Table 2: Short-term Noise Measurement Results
 27 June 2005**

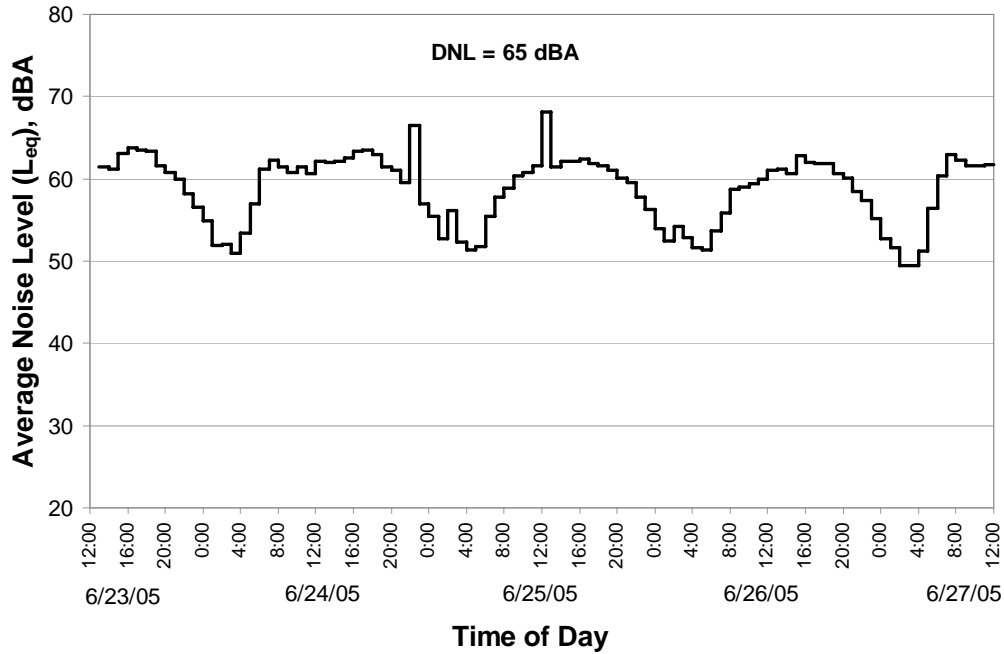
	Location	Time	L _{eq}	L ₁₀	L ₅₀	L ₉₀	DNL
1	Along Depot Road at existing campus building, 159 feet from the roadway centerline	10:30 - 10:45 A.M.	59	62	56	52	57
2	Along Depot Road at Dodge Avenue. 70 feet from the roadway centerline at setback of nearest houses	10:30 - 10:45 A.M.	67	68	61	54	65
3	Along Hesperian Blvd., 88 feet from roadway centerline	11:15 - 11:30 A.M.	64	68	62	54	57
4	Along Northern residential property line, north of soccer field	12:00 - 12:15 A.M.	59	63	51	47	62

* Estimate of L_{dn} based on comparison of Short-term measurements with results of Long-term measurements

**Figure 3a: Long-term Noise Measurement Results
 Location A – Depot Road**



**Figure 3b: Long-term Noise Measurement Results
Location B – Hesperian Boulevard**



**Figure 3c: Long-term Noise Measurement Results
Location C – Near Football Field.**

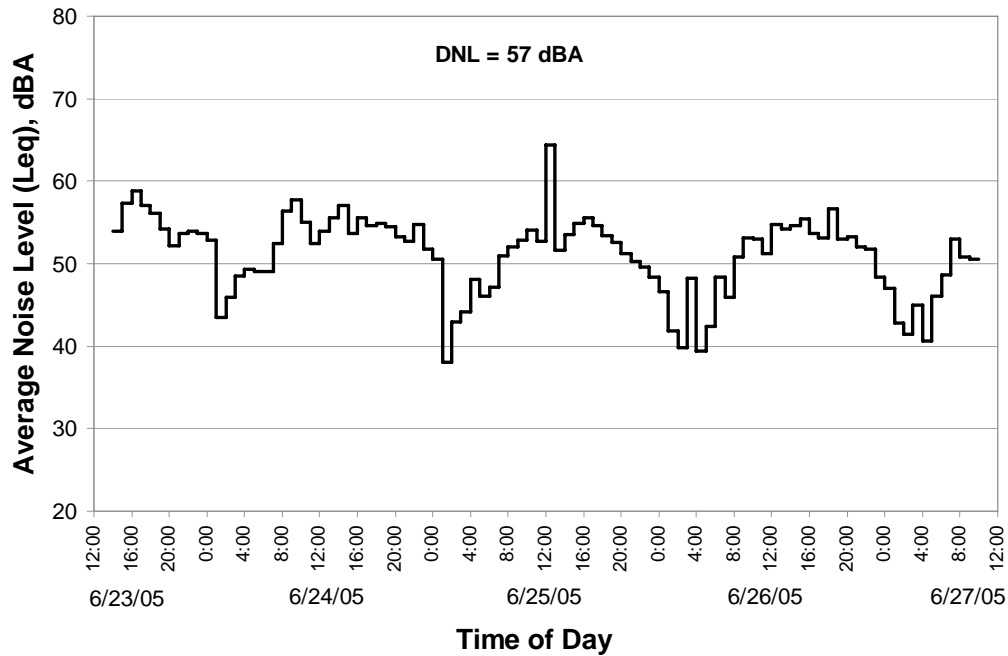
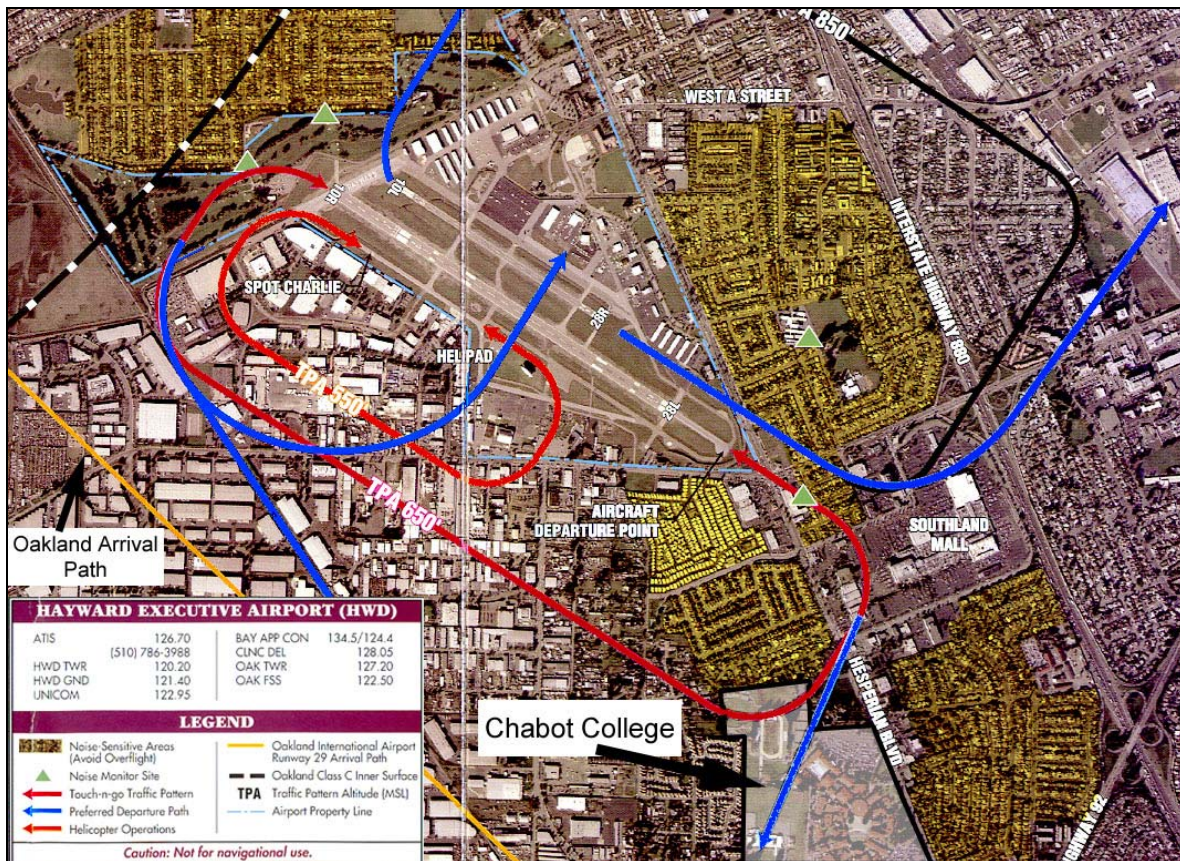


Figure 4: Flight Tracks of Nearby Airports



Impacts and Mitigation

Standards of Significance

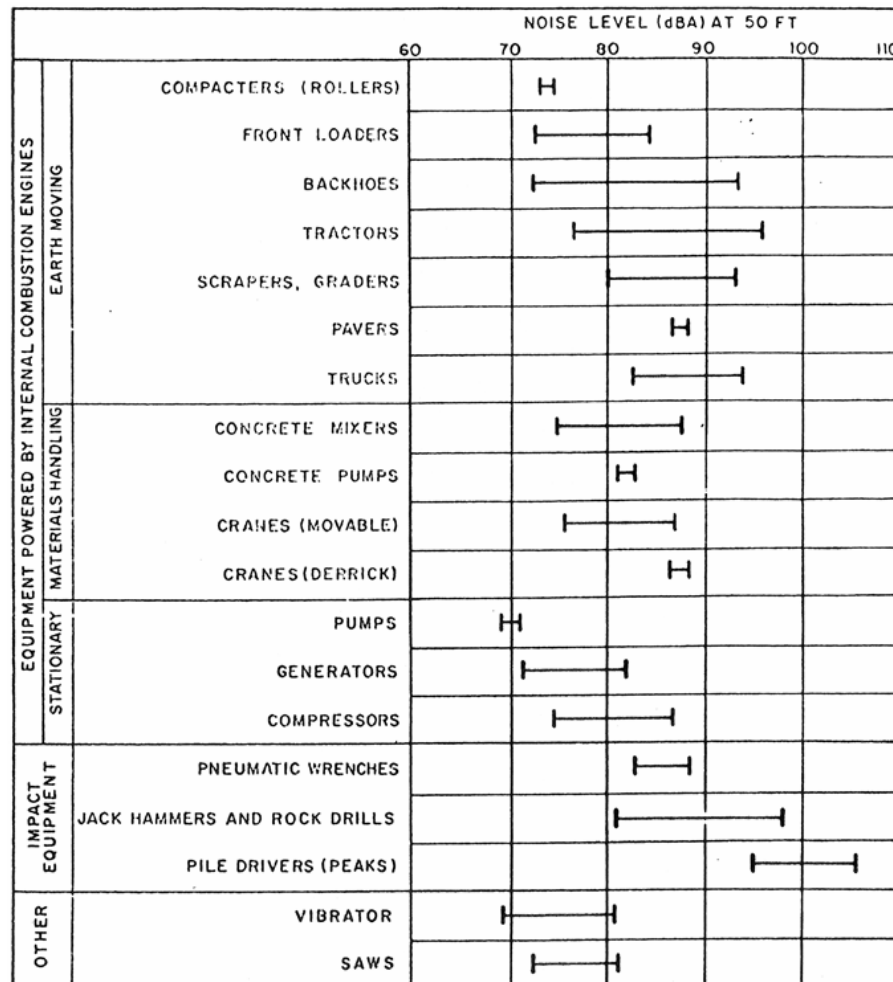
The project would result in a significant noise impact if it would:

- o Generate construction or demolition noise levels that would cause a substantial temporary increase in ambient noise levels.
- o Expose existing residences to a permanent increase in L_{dn} of more than 3 dBA due to project operations or traffic.
- o Expose project uses to noise levels greater than an L_{dn} of 60 dBA outdoors.

Impact 1: Project would cause increased noise from demolition and construction.

The noisier activities will be the demolition of existing buildings and use of heavy diesel powered machines during demolition and construction. The applicant has not provided detailed information on the equipment that will be used or its duration, however, it is assumed that there will be no pile driving and that the noisiest equipment will be concrete breaking tools (jack-hammers and hydraulic hammers) used during demolition and mobile diesel equipment (trucks and front-end loaders) during construction. Based on published noise data for construction equipment, mobile diesel equipment typically generates noise levels of about 88 dBA at a distance of 50 feet (see Figure 5). A hydraulic hammer breaking concrete generates a maximum noise level (L_{max}) of 95 dBA at a distance of 50 feet.

Figure 5: Construction Equipment Noise Levels



Source: US EPA, "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances," 1971.

Demolition and construction activities will occur in a phased manner with four distinct phases. Construction will generally consist of site grading to create building pads, foundation work and assembly of the building structure. There will also be some related activities such as trenching for utilities and delivery/removal of materials. The Master Plan³ includes a phasing plan for the project buildout. For the purposes of this report, the activities are grouped as per the sequencing diagram on page 18 of the Master Plan. This approach tends to group activities that would occur in proximity to one another. Table 3 shows the calculated noise levels from construction and demolition at the nearest on and off campus buildings. The noise levels are calculated using the standard noise level drop off at a rate of 6 dBA per doubling of distance from the source.

TABLE 3 - Construction Noise Levels at Nearest Land Uses

Construction/Demolition Activity (noise source)	Noise Receivers - Campus Buildings and Residences	Distance, feet (Demo./Construction)	Sound Level, dBA	
			Demolition	Construction
Demolish Building 400 and Construct new Instructional Office Building	Bldg 300	84/54	90	87
	Bldg 500	90	90	82
	Bldg 700	180/230	84	75
	Homes on Hesperian	300	79	72
Demolish Buildings 600, 700 and Construct new Student Access Center	Bldg 500	90	90	83
	Bldg 800	90	90	83
	Bldg 1000	250	81	74
	Homes on Hesperian	315	79	72
Construct Perimeter Road and Improve Lots	Homes on Hesperian	200	--	76
Construct new PE Building and Remove Field Building, Replace Press Boxes	Bldg 2900	680/50	72	88
	Homes east of Athletic Fields	200/750	83	64
Demolish Portable Building 3200	Bldg 2700	20	103	
	Homes on Hesperian	720	72	
Construct new Maintenance and Operations Building	Bldg 2800	250		74
	Homes east of Athletic Fields	520	--	68
Construct Broadcast Center (PAC Expansion)	Bldg 3500 and 1500	140	--	79
	Bldgs 900 and 1100	100	--	82
	Homes on Depot Road	300	--	72
Demolish Building 1500 and Construct New Technology Building	Bldgs 1400 and 1600	125	87	80
	Bldg 3500	100	89	82
	Bldg 1300	100	89	82
	Homes on Depot Road	475	75	68
Demolish Building 2000 and Construct new Science/Math Building	Bldgs 3900, 2100, 3100, 2200, 1900, 1700 and 1800	65	93	86

³ Chabot College 2005 Facilities Master Plan, tBP/Architecture, Final Draft (revised), July 1, 2005

There are no quantitative noise level limits in the City of Hayward Noise Ordinance provided that construction activities occur during daytime hours (7 a.m. to 7 p.m. Monday through Saturday and 10 a.m. to 6 p.m. Sunday and holidays). At night, the ordinance requires that construction noise be controlled so as to not exceed the ambient noise level by more than 6 dBA. Though the College is not required to comply with local noise standards, construction noise does have the potential to cause a substantial temporary increase in ambient noise levels. Therefore, construction noise is considered a potentially significant impact.

MITIGATION 1: A demolition and construction noise control plan must be prepared.

All phases of construction/demolition have the potential to significantly exceed existing ambient noise levels and interfere with normal daily activities such as conversation outdoors. In particular excessive noise may interfere with teaching inside classrooms since demolition and construction may be in close proximity to operating classes. The following measures are recommended to minimize noise levels at adjacent classrooms and residences:

- Prepare a demolition and construction noise control plan that identifies detailed, site-specific noise attenuation measures that will be used. The plans should be prepared under the supervision of a qualified acoustical consultant. The plan may include but is not limited to the following:
 - Relocate stationary equipment (if feasible) to minimize noise impacts on the community.
 - Provide portable enclosures for stationary equipment that must be located near noise sensitive areas;
 - Use self-adjusting ambient-sensitive back-up alarms, manually-adjustable alarms on low setting, use of observers, and/or schedule activities so that alarm noise is minimized
 - Install and maintain intake and exhaust mufflers on all equipment, particularly pneumatic impact tools;
 - Install acoustically attenuating shields or shrouds on noise producing equipment;
 - Line or cover hoppers, conveyor transfer points, storage bins and chutes with sound-deadening material;
 - Use temporary sound barriers, to inhibit transmission of noise to sensitive receptors where enclosures or shrouds are not effective or feasible.
- Designate an on-site construction noise complaint manager for the duration of the project.
- Post signs around the project site to inform persons of the construction hours and the name and phone number of the person or persons to notify in the event of a noise related problem.

- Notify neighbors within 300 feet of the project construction area at least 30 days in advance of any extreme noise-generating activities. The notification should include an estimate of the duration of the activity.
- A pre-construction meeting shall be held with the job inspectors and the general contractor/on-site project manager to confirm that noise mitigation practices (including construction hours, neighborhood notification, posted signs, etc.) are completed.

Impact 2: Project would increase noise in surrounding residential areas

Traffic Noise: Existing and future traffic volumes for roadways surrounding the project site were provided by the project traffic engineer⁴. In order to determine the project effect on future noise, a comparison was made between existing traffic volumes and future traffic volumes since traffic noise increases in logarithmic proportion to the number of vehicles. For example a doubling in traffic volumes would correspond to a 3 dBA increase in the existing L_{dn} .

Noise levels along Hesperian Boulevard, Deport Road and Turner Road would increase by less than 0.5 dBA due to the project. By the year 2015, cumulative growth combined with project traffic would result in future noise level increases of 1 dBA or less along the aforementioned roadways. An increase of 1 dBA or less in future traffic is considered a less than significant impact.

Operational Noise: Noise from mechanical ventilation equipment and other stationary sources has the potential to impact adjacent residences. According to the City's Noise Element, project noise must not increase existing levels by more than 3 dBA. Though the project is not required to comply with the goals of the Noise Element, the project does have the potential to increase noise levels significantly and therefore operational noise is considered a potentially significant impact.

MITIGATION 2: Acoustical studies shall be prepared to show how mechanical noise from project buildings will be controlled so as to not increase noise levels significantly at surrounding residences. The study must show how noise from mechanical equipment would be reduced so as to not increase existing noise levels by more than 3 dBA. Based on the measurements made for this report, mechanical noise should not exceed an L_{dn} of 65 dBA at homes along Depot Road and an L_{dn} of 70 dBA at homes along Hesperian Blvd. The exact noise level design goal must be refined as part of the required study.

⁴ Email from Brian Jackson, Hextrans, 20 July 2005.

Impact 3: Project uses would be exposed to conditionally acceptable noise levels according to State guidelines

Traffic noise: The proposed master plan development would locate new buildings in relative close proximity to the roadways surrounding the site. Future noise from these roadways would exceed an L_{dn} of 60 dBA at three proposed buildings: the Instructional Office Building, Student Access Center and Broadcast Building (see Table 4). Exposure of these buildings to and L_{dn} greater than 60 dBA is conditionally acceptable and this is considered a potentially significant impact.

Table 4: Future Noise Levels at Proposed Campus Buildings

Project Building	Roadway	Distance, feet	Future L_{dn} , dBA
Instructional Office Building	Hesperian Boulevard	150	64
Student Access Center	Hesperian Boulevard	180	63
Broadcast Building	Depot Road	250	60

MITIGATION 3- Acoustical studies shall be prepared for new buildings to show how future noise will be reduced to acceptable levels. The studies must identify what measures will be taken to reduce noise inside the affected buildings to acceptable levels. The exact indoor noise goal may vary depending on the type of use but an L_{dn} of 45 dBA is a reasonable upper limit. For example, the broadcast building may require a higher degree of sound insulation if there are noise sensitive uses in the building. It is likely that an L_{dn} 45 dBA goal can be met with standard construction. Rooms facing the roadways, and with exposure greater than an L_{dn} of 60 dBA, should be provided with some form of mechanical ventilation (e.g. air conditioning) so that windows can remain closed while still allowing for a habitable indoor environment.

Aircraft noise: The project site is outside the most recently published CNEL 65 dBA noise contours (year 2005 and year 2020)⁵. According to the ALUC plan, there are no contours that indicate that the site is within the CNEL 60 dBA noise contour. Therefore, the project would be compatible with aircraft noise according the ALUC land use compatibility standards and the City of Hayward General Plan.

The project is within the ALUC referral zone for both the Hayward Air Terminal and Oakland International Airport. This is in part, due to the presence of aircraft flyovers on approach to Oakland as well as an existing flight track from Hayward that is close to the site. Though aircraft overflights are audible, and potentially disruptive, aircraft noise is considered a less than significant impact.

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⁵ Jenny Donnelley, Acting Airport Operations Manager, Hayward Executive Airport.