4.6 NOISE

This chapter assesses the effects of the Southeast Campus Integrated Projects (Integrated Projects) on the noise environment on and around the Integrated Projects area. The section addresses the potential increases in noise levels that would result from the implementation of the Integrated Projects and the potential for the Integrated Projects to expose people to substantial noise levels or cause substantial ground-borne vibration effects.

As explained in Chapter 3, the discussion and analyses in this section rely on the framework set up in the UC Berkeley 2020 Long Range Development Plan (2020 LRDP) EIR. The 2020 LRDP EIR described, in general, what potential environmental effects may be expected from projects planned within the 15-year period covered by the 2020 LRDP EIR, and how these impacts are to be addressed and/or mitigated. The 2020 LRDP EIR identified significant and unavoidable noise impacts resulting from demolition and construction activities necessary for implementation of the 2020 LRDP. This section expands on the noise impacts discussion of the 2020 LRDP EIR as it relates specifically to the Integrated Projects, and provides mitigation measures and performance standards specifically for this project area, while drawing from the mitigations outlined in the 2020 LRDP EIR.

Substantial permanent increases in ambient noise levels from mechanical equipment and building design, and increased vehicular traffic in the project vicinity, were identified in the Initial Study for the Integrated Projects as being adequately reviewed and addressed within the 2020 LRDP EIR and for this reason are not included in the analysis in this chapter. As explained in the Initial Study, the focus of the noise analysis in this EIR is on potential noise effects of expanded public-interest event use of the California Memorial Stadium (CMS).

During the scoping period for this EIR, comments were received regarding consistency with the City of Berkeley Noise Ordinance, noise from nighttime football games, Maxwell Family Field activities, noise resulting from additional events at CMS and nighttime construction. These issues are addressed in this chapter.

4.6.1 EXISTING SETTING

ANALYTICAL METHODS

Noise is defined as unwanted sound. Airborne sound is a rapid fluctuation of air pressure above and below atmospheric pressure. Sound levels are usually measured and expressed in decibels (dB) with 0 dB corresponding roughly to the threshold of hearing. Decibels and other technical terms are defined in Table 4.6-1.

Most of the sounds which we hear in the environment do not consist of a single frequency, but rather a broad band of frequencies, with each frequency differing in sound level. The intensities of each frequency add together to generate a sound. The method commonly used to quantify environmental sounds consists of evaluating all of the frequencies of a sound in accordance with a filter that reflects the fact that human hearing is less sensitive at low frequencies and extreme high frequencies than in the frequency mid-range.

TABLE 4.6-1
DEFINITIONS OF ACOUSTICAL TERMS

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.
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 p.m. to 10:00 p.m. and after addition of 10 decibels to sound levels in the night between 10:00 p.m. and 7:00 a.m.
Day/Night Noise Level, DNL, 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 p.m. and 7:00 a.m.
Lmax, Lmin	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.

TABLE 4.6-2
TYPICAL SOUND LEVELS MEASURED IN THE ENVIRONMENT AND INDUSTRY

Noise Generators (at a Given Distance from Source)	A-Weighted Sound Level in Decibel	Indoor Noise Environments	Subjective Impression
	140		
Civil defense siren (100 feet)	130		
Jet take-off (200 feet)	120		Pain threshold
	110	Rock music concert	
Pile driver (100 feet)	100		Very loud
Ambulance siren (100 feet)			
	90	Boiler room	
Freight cars (50 feet)		Printing press plant	
Pneumatic drill (50 feet)	80	In kitchen with garbage disposal running	
Freeway (100 feet)			
Vacuum cleaner (10 feet)	70		Moderately loud
	60	Data processing center	
		Department store	
Light traffic (100 feet)	50	Private business office	
Large transformer (200 feet)			
	40		Quiet
Soft whisper (5 feet)	30	Quiet bedroom	
	20	Recording studio	
	10		
	0		Threshold of hearing

Source: Illingworth & Rodkin, Inc., *Handbook of Acoustical Measurements and Noise Control,* 1998.

This is called "A" weighting, and the decibel level measured is called the A-weighted sound level (dBA). The level of a sound source can be measured using a sound level meter that includes an electrical filter corresponding to the A-weighting curve. Typical A-weighted levels measured in the environment and industry are shown in Table 4.6-2.

Although the A-weighted noise level may adequately indicate the level of environmental noise at any instant in time, community noise levels vary continuously. Most environmental noise includes a conglomeration of noise from distant sources that create a relatively steady background noise in which no particular source is identifiable. To describe the time-varying character of environmental noise, the statistical noise descriptors, L_{01}, L_{10}, L_{50}, and L_{90}, are commonly used. They are the A-weighted noise levels equaled or exceeded during one percent, 10 percent, 50 percent, and 90 percent of a stated time period. A single number descriptor called the L_{eq} is also widely used. The L_{eq} is the average A-weighted noise level during a stated period of time that generates equivalent acoustical energy to the time varying ambient levels.

In determining the daily level of environmental noise, it is important to account for the difference in response of people to daytime and nighttime noises. During the nighttime, exterior background noises are generally lower than the daytime levels. However, most household noise also decreases at night and exterior noise becomes very noticeable. Further, most people sleep at night and are very sensitive to noise intrusion. To account for human sensitivity to nighttime noise levels, a descriptor, L_{dn} or DNL (day/night average sound level), was developed. The L_{dn} divides the 24-hour day into the daytime of 7:00 a.m. to 10:00 p.m. and the nighttime of 10:00 p.m. to 7:00 a.m. The nighttime noise level is weighted 10 dB higher than the daytime noise level.

Noise levels from a source diminish as distance to the receptor increases. Other factors such as reflecting surfaces or shielding from barriers also help intensify or reduce noise levels at any given location. A commonly used rule of thumb for traffic noise is that for every doubling of distance from the road, the noise level is reduced by 3 to 4.5 dBA, and for a single source of noise, such as a piece of stationary equipment, the noise is reduced by 6 dBA, for each doubling of distance away from the source. Noise levels may also be reduced by intervening structures; generally, a single row of buildings between the receptor and the noise source reduces the noise level by about 5 dBA.

Community reaction to an increase in noise levels varies, depending upon the magnitude of the change. In general, a difference of 3 dBA is considered a minimally perceptible change, while a 5 dBA difference is the typical threshold that would cause a change in community reaction. An increase of 10 dBA would be perceived by people as a doubling of loudness. A doubling of traffic flow on any given roadway would cause a noise increase of approximately 3 dBA. Similarly, twice the amount of railroad activity would be required to increase the rail contribution to community noise level by 3 dBA.

For typical residential construction (i.e., light frame construction with ordinary sash windows), the amount of exterior to interior noise reduction is at least 20 dBA with exterior doors and windows closed. With windows partially open for ventilation, the typical amount of exterior to interior noise reduction that can be expected is approximately 15 dBA. Buildings constructed of stucco or masonry with dual-glazed windows and solid core exterior doors can be expected to achieve an exterior to interior noise reduction of approximately 25-30 dBA.

Noise impacts resulting from development and operation of the Integrated Projects were assessed using several methods. First, baseline noise levels were quantified using noise measurements conducted in Fall 2005 and Winter 2006. Data gathered during daytime and nighttime football games were used to assess effects from an increased number of special events at CMS. Increases in traffic noise levels in the area were calculated based on traffic data generated for the 2020 LRDP EIR. Noise and vibration impacts resulting from construction activities were assessed based on the construction noise and vibration levels, limits proposed in the Berkeley Noise ordinance, continuing best practices and measures to mitigate noise, and other thresholds to protect against vibration effects discussed in the 2020 LRDP EIR.

EXISTING NOISE ENVIRONMENT

The Integrated Projects area is located in the southeastern portion of the UC Berkeley campus. The project area is divided into two different areas, the Integrated Projects West and Integrated Projects East. Much of the discussion within this chapter is framed in terms of these two project areas. See Chapter 3 for a complete description of project location, maps and boundaries of each area, and a detailed description of the proposed projects.

The noise environment on the UC Berkeley campus and the surrounding city environs results primarily from vehicular traffic on the street network. Intermittent noise resulting from jet aircraft overflights contributes to the noise environment to a lesser extent. In the Campus Park, sounds generated by people including conversations, musical instruments, and personal transportation devices such as skateboards and bicycles, are heard where people congregate and circulate. Away from these areas, the natural sounds of water moving in the streams, wind in the trees, birds, and Sather Tower (The Campanile) chimes are heard.

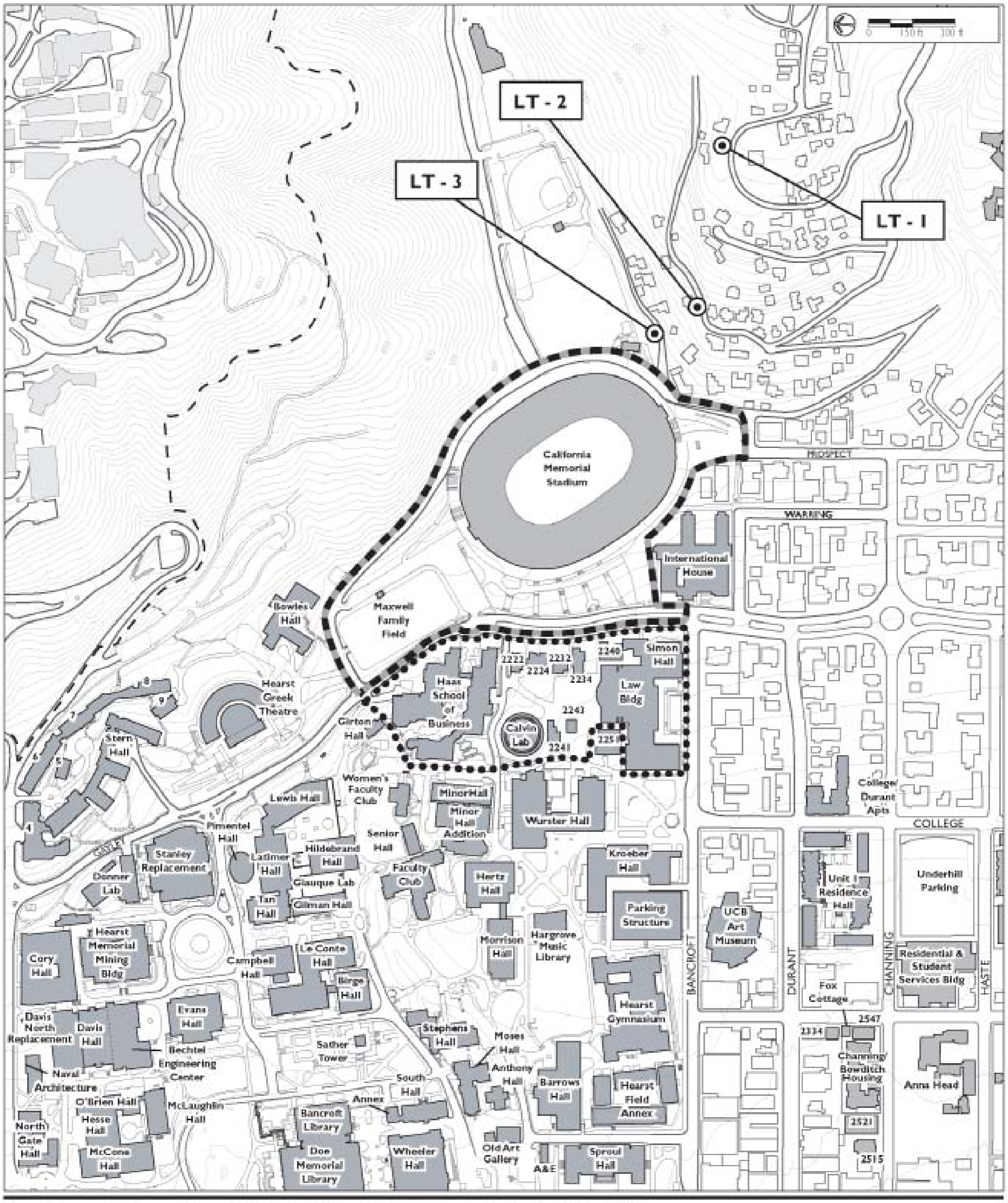
The Panoramic Hill residential neighborhood is located southeast of the Integrated Projects area. The hillside slopes upward away from the southern end of CMS. The noise environment in the Panoramic Hill neighborhood on a regular daily basis results from local traffic, distant traffic, the sound of high altitude jet aircraft overflights, sounds from the campus and city below, and local neighborhood noises, including yard maintenance, recreation, etc. Due to the proximity of the neighborhood to CMS and the steep hillside setting, the residents of this area are exposed to noise from daily activities and particularly football games in the fall. Consequently, these residents are considered the primary sensitive receptors of noise and potentially affected by the construction and operation of the Integrated Projects.

A noise survey was conducted during two weekends in fall 2005 to quantify noise levels in the Panoramic Hill neighborhood during football games at CMS.[1] Noise levels were measured using Larson Davis Laboratories Models 820 and 812 integrating precision sound level meters. The meters were fitted with high sensitivity microphones equipped with windscreens. The systems were calibrated before and after the surveys using a Larson Davis Laboratories acoustical calibrator. Pre- and post-calibration levels were within 0.2 dB so no calibration adjustments to the data were required. The meters were programmed to report data in 10-minute intervals. During each interval, the meters calculated the equivalent sound level (Leq), the maximum and minimum sound levels, and the sound levels exceeded 1, 10, 50, and 90 percent of the interval period (the L_{01}, L_{10}, L_{50}, and L_{90}). In addition, the meters were programmed to record a time history of the entire measurement period in concurrent one-minute periods. For each one-minute period, the meters recorded the Leq and the maximum sound level. These data provide a comprehensive description of the noise environment during the measurement periods.

The meters were located at three sites on Panoramic Hill shown on Figure 4.6-1. Long-term, unattended meters were located at 10 feet above the ground on the north side of Panoramic Way, Mosswood Road and Canyon Road. The three selected positions generally transect the hillside and bound the views of the homes between the meters, thus providing a good representation of the hillside's noise exposure. In addition, during the first half of the football game on Saturday, October 22, 2005, attended noise measurements were made at each location. A second sound level meter was positioned about 5 feet above the ground directly below the unattended long-term monitoring sites. Sound levels were measured and the sources and levels were annotated, thereby providing a record of the noise levels associated with the various sources from the football field as well as other ambient noise sources in the area. During the measurement surveys, the skies were clear, winds were minimal, and temperatures were moderate during the daytime and cool during the evening. The breezes that occurred were generally from the direction of the northwest, providing an optimum condition for sound propagation towards the sound level meters, yielding a worst case or maximum expected noise exposure.

NOISE SURVEY RESULTS FOR SATURDAY, OCTOBER 22, 2005-MONDAY, OCTOBER 24, 2005

Figures 1-9 in Appendix E show the noise level data measured at each of the three monitoring locations beginning between 4:00 p.m. and 5:00 p.m. on Saturday, October 22, and ending during the afternoon of Monday, October 24, 2005. Activity around the CMS began picking up around 5:00 p.m. on Saturday. The kick-off for the football game occurred shortly after 7:00 p.m. and the game ended on the evening of Saturday, October 22, 2005. Each figure shows the statistical distribution of A-weighted noise levels represented by the Lmax, L10, L50, and L90 which were measured in each 10-minute interval and the hourly equivalent noise level (Leq). Highest noise levels were measured at Location LT-2. This was the middle location on the hill on Mosswood Road and appeared to have the combination of sight line and distance that translated to the highest noise levels. Location LT-1, on Panoramic Way, was higher on the hill but further from the CMS, and Location LT-3, on Canyon Road, was at an elevation just above the stadium



Source: University, California at Berkeley; USGS Oakland West and Oakland East Quadrangles, 1993, Scale 1:24,000

Measurement Distances and Elevations		
Noise Measurement	Elevation Above Mean Sea Level (ft)	Distance Center of Stadium (ft)
LT-1	710	1,170
LT-2	550	660
LT-3	500*	520

* *Same Elevation as Stadium Rim*

FIGURE 4.6-1
LONG TERM (LT) NOISE MEASUREMENT LOCATIONS

rim but closer to the CMS. At Location LT-3, there was acoustical shielding from the top edge of the CMS and the surrounding ground. The highest maximum noise levels shown at each of the three sites during the football game were caused by a canon that was fired at the opening kickoff and after each touchdown scored by the University of California.

Ambient noise levels are shown for Sunday, October 23, 2005. A comparison between the hours during the Saturday evening game and the Sunday evening ambient condition provides an indication of the intrusiveness of noise from the football game in the Panoramic Hill neighborhood. For example, at site LT-2, it can be seen that average noise levels increased by about 25 dBA Leq during the first three hours of the game and by about 35 dBA Leq above comparable time periods on Sunday at the end of the game. Based on observations and measurements of numerous sporting events, one of the key factors in determining the noise level generated by the crowd is the level of excitement in the crowd. This was a very exciting football game from the standpoint of University of California fans because of a comeback that occurred at the end of the game.

Data collected in concurrent one-minute intervals provided a record of the noise levels from individual events that were annotated during the game. The firing of the canon showed a range in noise levels of about 5 dBA across the hillside with the maximum noise level reaching about 90 to 91 dBA at site LT-2, 88 dBA at site LT-3 on Canyon Road just above the stadium rim, and 85 dBA at site LT-1 near the top of the hill. The maximum sounds from typical crowd noise in each 10-minute interval typically ranged from about 75 to 82 dBA at site LT-2, 68 to 75 dBA at site LT-3, and 60 to 65 dBA at site LT-1. During exciting moments in the game, crowd noise was elevated about 5 to 10 dBA above typical levels. The public address system announcements were normally 70 to 75 dBA and clearly audible in the residential neighborhood on Panoramic Hill. The Cal Band also was clearly audible on the hillside.

NOISE SURVEY RESULTS FOR FRIDAY, NOVEMBER 11, 2005 – SATURDAY, NOVEMBER 12, 2005

Noise levels were monitored during a second weekend when a home football game was played at the CMS. During the second survey, noise levels were measured beginning on the Friday evening prior to a Saturday mid-day game and concluded at the end of the game on Saturday afternoon. The noise survey results are shown in Figures 10-14 in Appendix E. The football game began at about noon on Saturday and concluded at about 4:00 p.m. One apparent difference between the two football games is the sound level data during the second half of this game as compared to the sound levels during the second half of the October 22 game. Average sound levels were about 10 dBA higher on October 22 between 10:00 p.m. and 11:00 p.m. as compared to November 12 between 3:00 p.m. and 4:00 p.m. The noise levels during the first half of the November 12 game were comparable to the loudest period at the end of the October 22 game, in spite of the difference in attendance figures for both games (53,000 fans at the October 22 game and 73,000 fans at the November 12 game.) Overall, noise levels generated during each event, as represented by the 4-hour average Leq during the football game, are shown in Table 4.6-3. The consistency of these data, considering the differences in time of

TABLE 4.6-3
OVERALL NOISE LEVELS GENERATED AT FOOTBALL GAMES

Date	Opponent	Attendance	Duration of Game	Measurement Location	Leq Noise Level (dBA)
10/22/2005	Washington State	52,569	4 hrs (7pm-11pm)	LT-1	60.1
				LT-2	74.7
				LT-3	68.4
11/12/2005	USC	72,981	4 hrs (noon-4pm)	LT-1	60.9
				LT-2	74.3
				LT-3	68.8

day, level of excitement, and number of spectators, confirm that the data set represents the noise exposure levels on Panoramic Hill during a football game at the CMS, for both a game played during the daytime and a game played at night.

NOISE SURVEY RESULTS FOR THURSDAY, FEBRUARY 16, 2006-WEDNESDAY, FEBRUARY 22, 2006

Noise monitoring was repeated in the Panoramic Hill neighborhood during February 2006. The purpose for this additional ambient noise survey was to quantify ambient noise levels on weekdays and a weekend when there were no special events occurring at CMS. The data also provided ambient noise data during another time of the year to provide a baseline against which project impacts may be compared. The noise survey results are shown in Figures 15-35 in Appendix E, and are presented in the same format as the data collected during the fall monitoring. Weather conditions during the February monitoring period were variable with periods of clear skies, clouds, and some light rain showers, typical of a winter weather pattern. The intermittent maximum noise levels represented on each figure result primarily from local traffic on the streets. Average noise levels and background levels result from distant traffic and sounds from the University and the city below. A comparison of measured noise levels show that ambient noise levels in the fall and in the winter are comparable. A direct comparison can be made between the Sunday measurements from October 23, 2005 and February 19, 2006. Day/night average noise levels were 54 dBA Ldn at the three measurement locations in October and 55 dBA Ldn or 54 dBA Ldn at the three measurement locations in February. These measured noise levels are considered the same within the accuracy range in which ambient noise levels can be monitored. Fall and winter hourly noise levels obviously varied somewhat but are considered to be consistent.

NOISE ENVIRONMENT IN INTEGRATED PROJECTS WEST

Noise exposure on the Berkeley campus was described in the 2020 LRDP.[2] Noise levels on the Campus Park are highest at the campus edges, where it adjoins Hearst Avenue, Oxford Street, Bancroft Way and Gayley Road. Measurements indicate average noise levels of 64 to 71 dBA Leq along these heavily traveled streets. The noise level along Bancroft Way was calculated to be 65 dBA Ldn. Traffic noise levels diminish rapidly as one moves away from the perimeter and into the Campus Park. Only the sounds of particularly loud vehicles, such as those generated by heavy trucks and buses, intrude into the interior of the Campus Park. In the quieter interior areas, there is a distant low hum of traffic; construction activity is often heard, and distant aircraft contribute to the noise environment. The circulation of pedestrians cause a steady murmur of voices and footsteps which typically range from 61 to 63 dBA; a person on a skateboard may generate a noise level of 65 dB and a bicyclist passing by may generate a noise level of 57 dBA. Distant sounds of the Campanile Chimes are heard as well.

4.6.2 REGULATORY, PLAN, AND POLICY SETTING

FEDERAL AND/OR STATE REGULATIONS

The Noise Control Act of 1972 directed the U.S. Environmental Protection Agency (EPA) to develop noise level guidelines that would protect the population from the adverse effects of environmental noise. The EPA published guidelines (EPA Levels Document, 1974) containing recommendations of 55 dBA Ldn outdoors and 45 dBA Ldn indoors as a goal for residential land uses. The EPA is careful to stress that the recommendations contain a factor of safety and do not consider technical or economic feasibility issues and, therefore, should not be construed as standards or regulations. The Department of Housing and Urban Development (HUD) standards define Ldn levels below 65 dBA outdoors as acceptable for residential use. Outdoor levels up to 75 dBA Ldn may be made acceptable through the use of insulation in buildings. The goal of the HUD standards is to achieve a maximum interior level of 45 dBA Ldn.

The State of California has developed noise and land use compatibility guidelines. The guidelines are based on exterior noise exposure in terms of the Ldn or CNEL. Residential multi-family land uses are normally acceptable where the Ldn is up to 65 dBA and conditionally acceptable where the Ldn is 60 dBA to 70 dBA. The overlap reflects the reality that projects within this category have differing sensitivities to noise. Other land uses such as schools, libraries and office buildings are considered normally acceptable where the Ldn is up to 70 dBA and conditionally acceptable where the Ldn is 60 to 70 dBA. Conditionally acceptable noise environments may require additional noise attenuation to achieve acceptable exterior or interior noise environments. Where land uses are exposed to noise levels above those considered normally acceptable, additional mitigations are normally needed to abate noise.

The State of California additionally regulates the noise emission levels of licensed motor vehicles traveling on public thoroughfares, sets noise emission limits for certain off-road vehicles and watercraft, and sets required sound levels for light-rail transit vehicle warning signals. The extensive State regulations pertaining to worker noise exposure are for the most part applicable only to the construction phase of any project (for example California Occupational Safety and Health Administration Occupational Noise Exposure Regulations [8CCR, General Industrial Safety Orders, Article 105, Control of Noise Exposure section 5095, et. seq.]) or for workers in a “central plant’ and/or a maintenance facility, or involved in the use of landscape maintenance equipment or heavy machinery.

CITY OF BERKELEY

Although the University is constitutionally exempt from local regulations when using University property in furtherance of the University's educational purposes, it is University policy to evaluate proposed projects for consistency with local plans and policies. Therefore, this section outlines the plans and policy goals of the City of Berkeley related to noise.

BERKELEY GENERAL PLAN

The City of Berkeley General Plan does not contain a Noise Element, but instead incorporates noise policies and actions into the Environmental Management Element. Policy EM-47 seeks to eliminate existing noise problems and prevent significant future degradation of the acoustic environment. Policy EM-48 seeks to reduce local and regional traffic, "which is the single largest source of unacceptable noise in the City."[3] Policy EM-49 states that the City will "require operational limitations and all feasible noise buffering for new commercial, industrial, institutional or recreational uses that generates significant noise impacts near residential uses."

The General Plan EIR utilized a noise exposure map to illustrate the noise levels along each roadway taking into account shielding from buildings; General Plan policies, including Land Use Compatibility Standards, are intended to ensure that new development under the General Plan will be compatible with the existing and future noise environment.

The EIR found that implementation of the General Plan would increase traffic noise levels along some roadway segments, potentially exposing residences to excessive noise levels. Traffic noise modeling found a potential 3 dBA increase, an effect found not to be significant. Cumulative noise effects were found to be less than significant with the adoption of land use compatibility guidelines, and other noise effects were considered localized in nature, so that no significant cumulative noise effects would occur with implementation of the General Plan.

CITY OF BERKELEY NOISE ORDINANCE

The City of Berkeley Municipal Code, Chapter 13.40, Community Noise, establishes land use to land use noise level limits for developed lands within the City of Berkeley subject to its jurisdiction. Residential exterior noise limits are established in terms of the median hourly (L_{50}) sound level. The limits are adjusted upward in 5 dB increments for sounds of shorter duration. In residential areas, the L_{50} limits range from 55 dBA to 60 dBA during the daytime (7:00 a.m. to 10:00 p.m.) and 45 dBA to 55 dBA during the nighttime (10:00 p.m. to 7:00 a.m.). The commercial daytime limit is 65 dBA and the commercial nighttime limit is 60 dBA.

The noise ordinance also regulates construction and demolition noise. Section 13.40.070, Prohibited Acts, states: "The following acts and the causing or permitting thereof are declared to be in violation of this chapter.

7. Construction/Demolition:
   a. Operating or causing the operation of any tools or equipment used in construction, drilling, repair, alteration, or demolition work between

weekday hours of 7 p.m. and 7 a.m., or 8 p.m. and 9 a.m. on weekends or holidays such that the sound there from creates a noise disturbance across a residential or commercial real property line, except for emergency work of public service utilities or by variance issued by the NCO. (This section shall not apply to the use of domestic power tools as specified in Section 13.40.070(B)(11).)

b. Noise Restrictions at Affected Properties: Where technically and economically feasible, construction activities shall be conducted in such a manner that the maximum sound levels at affected properties will not exceed those listed in the following schedule:

Mobile Equipment
Maximum sound levels for nonscheduled, intermittent, short-term operation (less than 10 days) of mobile equipment:

	R-1, R-2 Residential (dBA)	R-3 and Above Multi-Family Residential (dBA)	Commercial/ Industrial (dBA)
Daily, 7 a.m. to 7 p.m.	75	80	85
Weekends, 9 a.m. to 8 p.m. and legal holidays	60	65	70

Stationary Equipment
Maximum sound levels for repetitively scheduled and relatively long-term operation (periods of 10 days or more) of stationary equipment:

	R-1, R-2 Residential (dBA)	R-3 and Above Multi-Family Residential (dBA)	Commercial/ Industrial (dBA)
Daily, 7 a.m. to 7 p.m.	60	65	70
Weekends, 9 a.m. to 8 p.m. and legal holidays	50	55	60

UNIVERSITY OF CALIFORNIA

This section describes existing policies and procedures that would help to minimize noise impacts of projects implementing the 2020 LRDP. It discusses both the policies in the 2020 LRDP itself and other University policies and programs affecting noise.

2020 LRDP

While the 2020 LRDP does not contain any policies that specifically address noise, several Objectives bear directly or indirectly on the noise environment, most importantly:

- **Maintain and enhance the image and experience of the campus, and preserve our historic legacy of landscape and architecture.**
- **Plan every new project to respect and enhance the character, livability, and cultural vitality of our City Environs.**

Specific policies relevant to reducing noise impacts on and around the campus include: locating all new university housing within a mile or 20 minutes of campus by transit; reducing demand for parking through incentives for alternate travel modes; collaborating with cities and transit providers to improve service to campus; and minimizing private vehicle traffic in the Campus Park. Other measures to reduce construction noise were set forth in the 2020 LRDP EIR, and appear under section 4.6.4, below.

CAMPUS POLICIES AND PROCEDURES

OFFICE OF ENVIRONMENT HEALTH AND SAFETY PROGRAMS

The campus office of EH&S works with construction project teams to implement noise reduction measures and performs noise monitoring at any specific site, upon the request of the campus community.

FACILITIES SERVICES COMMUNICATION AND RESPONSE PROGRAMS

UC Berkeley has a construction project communication program, through which the University communicates with the public and campus community neighbors about forthcoming or ongoing construction projects. Under the program, Facilities Services (FS) engages in a range of steps to ensure responsive communications.

FS reviews site utilization and staging plans early on to reduce the impacts of construction equipment and circulation on neighbors. FS then coordinates project goals, scope, and timeline for effective communications, followed by the distribution of flyers and emails to communicate construction project specifics, e.g. hours of work, dates of construction, expected impacts, and contact information. During demolition, site preparation and construction, FS sends out construction communications on a regular basis, sends special notices in advance when unusual episodes of noise are expected, provides project information for inclusion in campus publications, and responds to, and maintains records of, all complaints.

FS coordinates with City staff to communicate and lessen impacts, coordinates complaint responses with the campus EH&S, and participates in campus-wide efforts to reduce instances of construction impacts on the campus community and neighbors.[4]

HEALTH AND CONSTRUCTION WORKING GROUP

The Health and Construction Workgroup was formed in 2000, as a multi-departmental response team to advocate for the health of the campus community during on-campus construction. The major objectives of the Workgroup are to 1) identify health-related concerns that arise during the planning, design, and construction of campus facilities, 2) develop guidelines and recommendations for the campus administration that will prevent and/or minimize the negative health impacts of construction, and 3) provide input into the planning phases of capital projects so that managers and program committees address individual and community health issues in building and program plans.

4.6.3 STANDARDS OF SIGNIFICANCE

The significance of the potential impacts of the Integrated Projects on noise was determined based on the following standards:

Standard: ***Expose people to or generate noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies, without mitigation?***

Standard: ***Result in a substantial permanent increase in ambient noise levels in the project vicinity, without appropriate mitigation?***

Standard: ***Result in a substantial temporary or periodic increase in ambient noise levels in the project vicinity, without appropriate mitigation?***

Standard: ***Expose people to or generate excessive ground-borne vibration or ground-borne noise levels, without mitigation?***

4.6.4 IMPACTS AND MITIGATION MEASURES

This section describes the potential noise impacts of the Integrated Projects. The scope of this assessment is informed by a public scoping process conducted in the fall of 2005. In this section impacts are categorized according to their severity as significant, less than significant, or not significant; where possible, mitigation measures are proposed to reduce the severity of significant impacts.

2020 LRDP EIR MITIGATION MEASURES AND CONTINUING BEST PRACTICES

Design and construction of the Integrated Projects would be performed in conformance with the 2020 LRDP. The 2020 LRDP EIR concluded that noise resulting from demolition and construction activities necessary for implementation of the 2020 LRDP would, in some instances and at affected residential or commercial property lines, cause a substantial temporary or periodic increase in noise levels in excess of local standards prescribed by the City of Berkeley. This impact was determined to be significant and unavoidable. The 2020 LRDP EIR includes mitigation measures and continuing best practices developed to reduce the effects of implementation of the 2020 LRDP upon noise and vibration. Where applicable, the Integrated Projects would incorporate the following 2020 LRDP EIR mitigation measures and continuing best practices:

Continuing Best Practice NOI-2: Mechanical equipment selection and building design shielding would be used, as appropriate, so that noise levels from future building operations would not exceed the City of Berkeley Noise Ordinance limits for commercial areas or residential zones as measured on any commercial or any residential property in the area surrounding the project proposed to implement the 2020 LRDP. Controls that would typically be incorporated to attain this outcome includes selection of quiet equipment, sound attenuators or fans, sound attenuator packages for cooling towers or emergency generators, acoustical screen walls, and equipment enclosures.[5]

LRDP Mitigation Measure NOI-3: The University would comply with building standards that reduce noise impacts to residents of University housing to the full feasible extent; additionally, any housing built in areas where noise exposure levels exceed 60 Ldn would incorporate design features to minimize noise exposures to occupants.[4]

Continuing Best Practice NOI-4-a: The following measures would be included in all construction projects:

- Construction activities will be limited to a schedule that minimizes disruption to uses surrounding the project site as much as possible. Construction outside the Campus Park area will be scheduled within the allowable construction hours designated in the noise ordinance of the local jurisdiction to the full feasible extent, and exceptions will be avoided except where necessary.
- As feasible, construction equipment will be required to be muffled or controlled.
- The intensity of potential noise sources will be reduced where feasible by selection of quieter equipment (e.g., gas or electric equipment instead of diesel powered, low noise air compressors).
- Functions such as concrete mixing and equipment repair will be performed off-site whenever possible.

For projects requiring pile driving:

- With approval of the project structural engineer, pile holes will be pre-drilled to minimize the number of impacts necessary to seat the pile.
- Pile driving will be scheduled to have the least impact on nearby sensitive receptors.
- Pile drivers with the best available noise control technology will be used. For example, pile driving noise control may be achieved by shrouding the pile hammer point of impact, by placing resilient padding directly on top of the pile cap, and/or by reducing exhaust noise with a sound-absorbing muffler.
- Alternatives to impact hammers, such as oscillating or rotating pile installation systems, will be used where possible.[6]

Continuing Best Practice NOI-4-b: UC Berkeley will continue to precede all new construction projects with community outreach and notification, with the purpose of ensuring that the mutual needs of the particular construction project and of those impacted by construction noise are met, to the extent feasible.[5]

LRDP Mitigation Measure NOI-4: UC Berkeley will develop a comprehensive construction noise control specification to implement additional noise controls, such as noise attenuation barriers, siting of construction laydown and vehicle staging areas, and the measures outlined in Continuing Best Practice NOI-4-a as appropriate to specific projects. The specification will include such information as general provisions, definitions, submittal requirements, construction limitations, requirements for noise and vibration monitoring and control plans, noise control materials and methods. This document will be modified as appropriate for a particular construction project and included within the construction specification.[5]

LRDP Mitigation Measure NOI-5: The following measures will be implemented to mitigate construction vibration:[7]

- UC Berkeley will conduct a pre-construction survey prior to the start of pile driving. The survey will address susceptibility ratings of structures, proximity of sensitive receivers and equipment/operations, and surrounding soil conditions. This survey will document existing conditions as a baseline for determining changes subsequent to pile driving.
- UC Berkeley will establish a vibration checklist for determining whether or not vibration is an issue for a particular project.
- Prior to conducting vibration-causing construction, UC Berkeley will evaluate whether alternative methods are available, such as:
    - Using an alternative to impact pile driving such as vibratory pile drivers or oscillating or rotating pile installation methods.
    - Jetting or partial jetting of piles into place using a water injection at the tip of the pile.
- If vibration monitoring is deemed necessary, the number, type, and location of vibration sensors would be determined by UC Berkeley.

EFFECTS FOUND NOT TO BE SIGNIFICANT

There were no thresholds for which the Initial Study found no significant impact.

LESS THAN SIGNIFICANT IMPACTS

Impact NOI-IP-1: Implementation of the Integrated Projects could increase vehicular traffic in the area, but would not result in a substantial permanent increase in ambient levels due to increased vehicular traffic on local roadways.

The significance of noise impacts resulting from increased vehicular traffic was analyzed in the 2020 LRDP EIR.[8] A substantial permanent increase in noise would occur if traffic noise levels are projected to increase by greater than 3 dBA Ldn along roadway segments with adjoining noise sensitive land uses. The increase in vehicular traffic noise was calculated by comparing traffic resulting from the implementation of the 2020 LRDP to existing traffic volumes along the roadway segments at the 74 intersections analyzed in the 2020 LRDP EIR. The predicted increase in vehicular traffic noise is 0 to 1 dB Ldn throughout the street network. Such an increase is imperceptible and would result in a *less than significant* impact.

Impact NOI-IP-2: Heating, ventilating, and air conditioning equipment associated with the Integrated Projects would not result in operational noise levels in excess of local standards because of mitigation measures incorporated into the project.

Heating, ventilating, and air conditioning equipment associated with new buildings developed under the Integrated Projects may generate noise heard near the buildings. The noise could affect sensitive areas on the Campus Park, or other University properties, or on adjacent non-university properties. Pursuant to the 2020 LRDP EIR, Continuing Best Practice NOI-2 would mitigate this to a *less than significant* impact.

Impact NOI-IP-3: Construction of the Integrated Projects facilities could expose nearby receptors to excessive ground-borne vibration but the mitigation measures described below would ensure this impact is less than significant.

Construction activities can cause vibration that varies in intensity, depending on several factors. Of all construction activities, use of pile driving and vibratory compaction equipment typically generate high ground-borne vibration level.[9] The current plan for reconstruction of the CMS does not envision the use of pile drivers. Pile driving or ground compaction activities are also not currently proposed for construction of the Maxwell Family Field parking structure. However, as design progresses, if pile driving should be required, implementation of LRDP Mitigation Measure NOI-5 discussed above would reduce this impact to a *less than significant* level.

Impact NOI-IPE-4: Operation of a new parking structure at Maxell Family Field and relocation of the field from ground level to the roof of the new parking structure would not cause a substantial increase in permanent, periodic or intermittent noise levels at sensitive residential receivers in the area.

The Maxwell Family Field is an athletic field with a synthetic turf surface located between Gayley Road and Stadium Rim Way. The Integrated Projects propose to construct a parking structure at the current location of the field and locate a new recreational field on top of the parking structure. Current plans for the parking structure show four levels below grade and 1.5 levels above grade.[10]

The sounds emanating from the parking structure would be lower in amplitude than sounds generated by vehicular traffic circulating on the streets surrounding the parking structure. Noise from the vehicles in the parking structure would therefore not cause a substantial permanent, periodic or intermittent increase in ambient noise levels in the area. Mechanical equipment associated with the building may include ventilation exhaust fans. Noise from heating, ventilating and air conditioning equipment was addressed in Impact NOI-IP-2. The raising of the field from an at-grade position to the roof about 10 to 15 feet above grade would cause no increase in noise levels at any areas in the immediate vicinity of the field or on residences on Panoramic Hill. Because the receptors on Panoramic Hill are, for the most part, located at elevations substantially above Maxwell Family Field, the elevation of the field would cause no change in noise exposure levels radiated from the field. There are no plans to change the program for use at Maxwell Family Field that would cause a substantial change in noise generation. The proposed improvements under the Integrated Projects would, therefore, not result in a measurable or noticeable change in noise levels in the community.

SIGNIFICANT IMPACTS AND MITIGATION MEASURES

Impact NOI-IPE-5: The projected increase of up to seven nighttime and/or daytime capacity events at CMS would cause a substantial periodic increase in ambient noise levels in the project vicinity.

The CMS is in daily use from 6:00 a.m. to 10:00 p.m. seven days a week for instruction and practice, scheduled athletic programs, scheduled intra-mural athletic and recreational events, official University ceremonial occasions, education, and culturally-related activities that are administered by units of the University, and other public service events that further the purpose of the University. Use for popular entertainment, such as concerts, has not occurred at the CMS in recent years. Concerts do occur at the nearby Greek Theater; however, the University does not allow scheduling of concerts at the Greek Theater on home football game days.[11] Capacity uses of the CMS typically occur only at home football games, which occur up to eight times a year during the football season.

For purposes of analysis in this EIR, it is assumed that the updated and retrofitted CMS may be an attractive facility for University, public, or community-serving events that further the purpose of the University. Conservatively, then, in addition to capacity use of the CMS for football games, this EIR assumes a maximum of seven nighttime and/or daytime events annually which could fill the CMS to capacity, and entail operation of lights and use of the sound system during evening or weekend periods.

Use of amplified sound at the CMS after 8:00 a.m. and until 10:00 p.m. on a regular daily basis is considered part of the existing condition of the use of the CMS, and this condition would continue into the future. Because the project proposes to improve the sound systems, reducing unintended spillage of sound to areas outside the CMS, no additional analysis of use of the CMS during these time periods for normal daily uses that further the purpose of the University, and use amplified sound at practice levels as noted above, is required.

Permanent lighting of the CMS would allow football games to be played after dark. The permanent lighting would not result in an increase in the number of football games but rather the possibility that some or all of the games could shift from afternoon to evening. Data presented in Table 4.6-3 in the Existing Setting section shows that noise levels generated by a daytime football game and noise levels generated by a nighttime football game were essentially the same on Panoramic Hill. After improvements to the CMS proposed under the Integrated Projects, the capacity attendance would be approximately 60,675, which is within the range of the attendance at the two monitored games. Measured noise levels during the two football games in fall 2005 are therefore representative of what could be expected at capacity in the new CMS. If ambient noise levels during the evening were substantially lower than ambient noise levels during the daytime, then the shifting of the football games from the daytime to the evening, may cause a substantial periodic increase in noise levels. Ambient data were analyzed during the daytime and the evening on Saturday and Sunday (to expand the database for weekend days) because they are both considered representative for the purpose of establishing this differential. A review of these data demonstrates typical median (L_{50} and background L_{90}) sound levels during the daytime period of about 45 to 50 dBA. Levels may be temporarily elevated when increased traffic or neighborhood activities occur. During the evening, median and background levels are more consistent but are typically in the same range at about 43 to 48 dBA. This is true at each of the representative locations across Panoramic Hill. So whether a football game is played during the daytime or in the evening, the intrusiveness of the sound above existing ambient levels would be about the same in the Panoramic Hill neighborhood.

Another question is the relative sensitivity of people to noise from a football game during the daytime or the evening. It is assumed that on a weekend day or weekend evening, there is the same likelihood that people would be at home (as opposed to a typical workday.) Furthermore, it is more likely that people would be outdoors on their property on a fall day than at night, and therefore exposed to higher absolute levels of noise. However, people may find the intrusiveness more significant when they are inside, even if the absolute levels of the sound from the game are lower. There is, however, no firm basis for making a finding that the noise would be more intrusive and cause a greater impact during the evening, when most people are inside, as opposed to during the daytime when people may be either inside or outside of their houses. The installation of permanent lighting of the field under the Integrated Projects, which would possibly facilitate a shift in the time from daytime to evening, would therefore not cause a substantial increase in noise, even though it could be perceived as such by some sensitive receptors because of the nighttime hours.

The addition of a maximum of seven nighttime and/or daytime events scheduled for evening or weekends has the potential to cause a significant noise impact on the Panoramic Hill neighborhood. For the purposes of the noise analysis, it is assumed that noise from the additional new events would be equivalent to noise generated during the football games monitored in fall 2005. When evaluating the significance of an increase in the number of events, one must consider to what extent each event causes intrusive noise. If it is determined that an event would cause noise levels that substantially exceed existing ambient noise levels, the next question is whether the proposed number of these periodic events would lead to a finding that there would be a substantial increase in the noise environment. One measure of the intrusiveness of the sound from an event is to compare the average noise level (Leq) of the noise generated by the event with the background noise level that occurs in the absence of the event.

Table 4.6-4 presents the average noise levels from the football games measured in the fall of 2005 and compares them to the ambient noise levels measured in February 2006.

TABLE 4.6-4

COMPARISON OF AVERAGE NOISE (LEQ) DURING EVENT TO BACKGROUND NOISE (L90)

Measurement Location	Event Leq (dBA)	Background L90 (dBA)	Increase (dBA)
LT-1 Panoramic Way	61	43	18
LT-2 Mosswood Road	75	43	32
LT-3 Canyon Road	69	42	27

The differences between event and background noise levels vary from 18 to 32 dBA depending on the monitor location. A range of 5 dBA is normally considered less than significant; however, since the differential in levels far exceed 5 dBA, the event noise results in a *significant* impact on the Panoramic Hill neighborhood. Also, when comparing the noise of an event to the background noise, one must consider the character of the noise. In this case, the noise includes speech, music, and special effects, such as the firing of a cannon. While it is not known definitely, it is likely that the sound of crowds and amplified speech or music would be a realistic expectation for any special event that would fill the CMS to capacity. The combination of the character of the noise, the amplitude of the noise, and the differential with the background noise all lead to a finding that capacity events at the CMS cause a substantial periodic increase in noise levels in the Panoramic Hill neighborhood.

Given the intrusiveness of the noise described above, and the proposed increase in the number of events (approximately a doubling in the number of events annually increasing the number of events to an average of more than one per month), this increase is a *significant* noise impact.

The existing sound system projects sound in a ring from within the stadium seating bowl up and out to the last row of seats, and consequently towards surrounding areas. The proposed new system would direct sound down and towards the field. Given equal sound levels in the spectator seating area, the proposed sound system would generate lower sound levels outside the CMS than does the existing system. As the new system would have improved sound quality, particularly for bass notes, the perception of the two systems would be different. It is anticipated that the “thump” of bass-heavy music, if played through the speakers, would be more audible in the community than with the current system (as it produces little or no energy at these frequencies), even though the measured overall (dBA) sound levels would be lower than with the existing system. This is due to a difference in the character of the sound produced, not due to differences in level.

The project proposes to design and install a sound system that would reduce the sound of the PA system in the community. The Integrated Projects would reduce the capacity of the CMS, but not significantly below the crowds present during the noise surveys. There is no reasonable or feasible way to reduce the sound of the capacity crowds, the dominant noise source in the community on Panoramic Hill. There are, therefore, no additional mitigation measures which can be implemented to mitigate this impact to a less than significant level. This impact is, therefore, *significant and unavoidable*.

Impact NOI-IP-6: Noise resulting from demolition and construction activities in the Integrated Projects West and Integrated Projects East areas would, in some instances, cause a substantial temporary or periodic increase in noise levels, in excess of local standards prescribed in Section 13.40.070 of the City of Berkeley Noise Ordinance at affected residential or commercial property lines.

The 2020 LRDP Draft EIR recognized that construction and demolition activities would occur within the 2020 LRDP in proximity to residential and commercial land uses. Construction planned at CMS in the Integrated Projects East area and the various additions and modifications to buildings planned in the Integrated Projects West area, because of their location at the edge of the campus area, would intermittently result in noise levels exceeding limits set forth in the Berkeley Noise Ordinance. Noise levels would intermittently and periodically substantially exceed existing ambient noise levels at the receiving properties. Implementation of Continuing Best Practices NOI-4-a, NOI-4-b, and LRDP Mitigation Measure NOI-4 would control construction-related noise to the extent that is reasonable and feasible. The schedule for construction and demolition activities generating noise in the community would, to the extent possible, reflect the Berkeley Noise Ordinance provisions. Truck traffic is assumed to use major roadways. The siting of staging and laydown areas would consider minimizing noise as stipulated in Continuing Best Practice NOI-4-b. Even after implementation of these continuing best practices and mitigation measures, the noise impact from construction would be *significant and unavoidable*.

4.6.5 CUMULATIVE IMPACTS

Two significant project impacts were identified: the noise from an increase in capacity events at CMS facilitated by the Integrated Projects, and demolition and construction activities associated with the Integrated Projects development. Concerts do occur at the nearby Greek Theater, and the University does not allow scheduling of concerts at the Greek Theater on home football game days.[12] If events at the Greek Theater were to increase in number or sound level, a cumulative impact could occur. With up to seven additional capacity events at the CMS added to the existing up to eight football games, and if entertainment at the Greek Theater were to increase in sound or number of events, the cumulative noise impact would be significant and unavoidable and the contribution of the proposed project to a substantial periodic noise increase would be cumulatively considerable.

Construction activities are ongoing at UC Berkeley and Lawrence Berkeley National Laboratory (LBNL). The Bevatron and Building 51 Demolition Project at LBNL may coincide with construction activities of the Integrated Projects.[13] Noise from these projects may intermittently combine to cause a cumulative impact upon sensitive receivers on campus (Bowles Hall) and residents of Panoramic Hill. Implementation of Continuing Best Practices NOI-4-a, NOI-4-b, and LRDP Mitigation Measures NOI-4 would control construction-related noise to the extent that is reasonable and feasible. Even after implementation of the continuing best practices and mitigation measures, the cumulative noise impact from demolition and construction activities would be significant and unavoidable.

4.6.6 REFERENCES

[1] Illingworth & Rodkin, Inc., *Report of Noise Monitoring Survey Results During Football Games at California Memorial Stadium*, prepared for the University of California Environmental Planning Capital Projects, December 13, 2005.

[2] UC Berkeley, *2020 LRDP EIR,* Vol. 1, April 15, 2004, page 4.9-8.

[3] *Guidelines for the Preparation and Content of the Noise Element of the General Plan,* prepared by California Department of Health Services, 1988.

[4] Shaff, Christine, Communications Manager, UCB Facilities Services. Personal communication with Janet Brewster, Analyst, UCB Facilities Services, October 24, 2003.

[5] UC Berkeley, *2020 LRDP EIR,* Vol. 1, April 15, 2004, page 4.9-17.

[6] UC Berkeley, *2020 LRDP EIR*, Vol. 1, April 15, 2004, page 4.9-20.

[7] UC Berkeley, *2020 LRDP EIR,* Vol. 1, April 15, 2004, page 4.9-16.

[8] UC Berkeley, *2020 LRDP EIR,* Vol. 1, April 15, 2004, page 4.9-16.

[9] UC Berkeley, *2020 LRDP EIR,* Vol. 1, April 15, 2004, page 4.9-21.

[10] Maxwell Family Field Parking Structure plans and elevations provided by Integrated Projects Design Team to DC&E on March 16, 2006.

[11] Personal email communication from Tom Hansen, Cal Performances, to Jennifer Lawrence McDougall, Capital Projects, March 7, 2006.

[12] Personal email communication from Tom Hansen, Cal Performances, to Jennifer Lawrence McDougall, Capital Projects, March 7, 2006.

[13] LBNL, *Demolition of Building 51 and the Bevatron Draft EIR*, October 21, 2005, pages II-1 to II-2.