dBF
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January 9, 2015

Karen Ruggels
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Re: College Avenue Apartments
Noise Assessment

Ms. Ruggels:

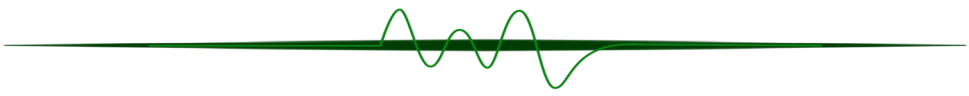
At your request, dBF Associates, Inc. (dBFA) has performed an assessment of potential noise from future occupants of the proposed College Avenue Apartments project located at 5030 College Avenue in San Diego, California.

The proposed project would consist of two four-story buildings with two levels of underground parking. A total of 95 residential apartments would be provided as one-, two-, three-, and four-bedroom suites for student housing. The project would provide one one-bedroom suite with one bed, five two-bedroom suites (two beds per suite), 39 three-bedroom suites (four beds per suite), and 50 four-bedroom suites (four beds per suite) for a total capacity of 367 beds. On-site amenities, totaling 8,300 square feet, would include a fitness center, a game room lounge, a community kitchen, study rooms, and a business center, as well as an interior pool and pool deck. A total of 236 parking spaces would be provided. Construction of the project would require approximately 14 months. Construction would take place as a single phase and is estimated to begin in May 2015.

Environmental Noise Background

Noise is generally defined as loud, unpleasant, unexpected, or undesired sound, typically associated with human activity and that interferes with or disrupts normal activities. The human environment is characterized by a certain consistent noise level, which varies with each area. This is called ambient noise. Although exposure to high noise levels has been demonstrated to cause hearing loss, the principal human response to environmental noise is annoyance. The response of individuals to similar noise events is diverse and influenced by the type of noise, perceived importance of the noise and its appropriateness in the setting, time of day and type of activity during which the noise occurs, and sensitivity of the individual.

Sound is a physical phenomenon consisting of minute vibrations that travel through a medium, such as air, and are sensed by the human ear. Sound is generally characterized by several variables, including frequency and intensity. Frequency describes the sound's pitch and is measured in cycles per second, or hertz (Hz), whereas intensity describes the sound's loudness



and is measured in decibels (dB). Decibels are measured using a logarithmic scale. A sound level of 0 dB is approximately the threshold of human hearing and is barely audible under extremely quiet listening conditions. Normal speech has a sound level of approximately 60 dB. Sound levels above about 120 dB begin to be felt inside the human ear as discomfort and eventually as pain at still higher levels. The minimum change in the sound level of individual events that an average human ear can detect is about 3 dB. The average person perceives a change in sound level of about 10 dB as a doubling (or halving) of the sound's loudness; this relation holds true for sounds of any loudness. Sound levels of typical noise sources and environments are provided in Table 1.

Because of the logarithmic nature of the decibel unit, sound levels cannot be added or subtracted directly and are somewhat cumbersome to handle mathematically. A simple rule is useful, however, in dealing with sound levels. If a sound's intensity is doubled, the sound level increases by 3 dB, regardless of the initial sound level. Thus, for example, 60 dB + 60 dB = 63 dB, and 80 dB + 80 dB = 83 dB.

The normal human ear can detect sounds that range in frequency from about 20 Hz to 20,000 Hz. However, all sounds in this wide range of frequencies are not heard equally well by the human ear, which is most sensitive to frequencies in the range of 1,000 Hz to 4,000 Hz. This frequency dependence can be taken into account by applying a correction to each frequency range to approximate the human ear's sensitivity within each range. This is called A-weighting and is commonly used in measurements of community environmental noise. The A-weighted sound pressure level (abbreviated as dBA) is the sound level with the "A-weighting" frequency correction. In practice, the level of a noise source is conveniently measured using a sound level meter that includes a filter corresponding to the dBA curve.

Because community noise fluctuates over time, a single measure called the Equivalent Sound Level (Leq) is often used to describe the time-varying character of community noise. The Leq is the energy-averaged A-weighted sound level during a measured time interval, and is equal to the level of a continuous steady sound containing the same total acoustical energy over the averaging time period as the actual time-varying sound.

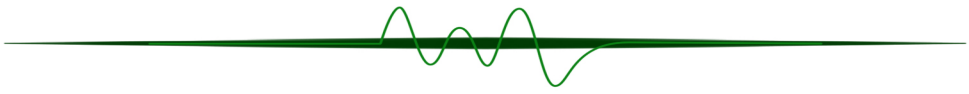


Table 1. Sound Levels of Typical Noise Sources and Noise Environments

Noise Source (at Given Distance)	Noise Environment	A-Weighted Sound Level	Human Judgment of Noise Loudness (Relative to Reference Loudness of 70 Decibels*)
Military Jet Takeoff with Afterburner (50 ft)	Aircraft Carrier Flight Deck	140 Decibels	128 times as loud
Civil Defense Siren (100 ft)		130	64 times as loud
Commercial Jet Take-off (200 ft)		120	32 times as loud **Threshold of Pain**
Pile Driver (50 ft)	Rock Music Concert Inside Subway Station (New York)	110	16 times as loud
Ambulance Siren (100 ft) Newspaper Press (5 ft) Gas Lawn Mower (3 ft)		100	8 times as loud **Very Loud**
Food Blender (3 ft) Propeller Plane Flyover (1,000 ft) Diesel Truck (150 ft)	Boiler Room Printing Press Plant	90	4 times as loud
Garbage Disposal (3 ft)	Noisy Urban Daytime	80	2 times as loud
Passenger Car, 65 mph (25 ft) Living Room Stereo (15 ft) Vacuum Cleaner (10 ft)	Commercial Areas	70	Reference Loudness **Moderately Loud**
Normal Speech (5 ft) Air Conditioning Unit (100 ft)	Data Processing Center Department Store	60	1/2 as loud
Light Traffic (100 ft)	Large Business Office Quiet Urban Daytime	50	1/4 as loud
Bird Calls (distant)	Quiet Urban Nighttime	40	1/8 as loud **Quiet**
Soft Whisper (5 ft)	Library and Bedroom at Night Quiet Rural Nighttime	30	1/16 as loud
	Broadcast and Recording Studio	20	1/32 as loud **Just Audible**
		0	1/64 as loud **Threshold of Hearing**

Source: Compiled by dBF Associates, Inc.

Sound Level Limits

City of San Diego Municipal Code Chapter 5, Article 9.5: Noise Abatement and Control (the Noise Ordinance) provides noise limits. Section 59.5.0401 specifies property line sound level limits. It is unlawful for any person to cause noise by any means to the extent that the one-hour average sound level exceeds the applicable limit given in Table 2, at any location on or beyond the boundaries of the property on which the noise is produced. The noise subject to these limits is that part of the total noise at the specified location that is due solely to the action of said person. The sound level limit at a location on a boundary between two zoning districts is the arithmetic mean of the respective limits for the two districts.

Table 2. City of San Diego Sound Level Limits

Land Use Zone	Time of Day	1 Hour Average Sound Level (decibels)
Single Family Residential	7 a.m. to 7 p.m. 7 p.m. to 10 p.m. 10 p.m. to 7 a.m.	50 45 40
Multi-Family Residential (Up to a maximum density of 1/2000)	7 a.m. to 7 p.m. 7 p.m. to 10 p.m. 10 p.m. to 7 a.m.	55 50 45
All other Residential	7 a.m. to 7 p.m. 7 p.m. to 10 p.m. 10 p.m. to 7 a.m.	60 55 50
Commercial	7 a.m. to 7 p.m. 7 p.m. to 10 p.m. 10 p.m. to 7 a.m.	65 60 60
Industrial or Agricultural	Anytime	75

Source: City of San Diego Municipal Code Section 59.5.0401.

The noise level limits at the west property line are:

- 55 dBA Leq between 7:00 a.m. and 7:00 p.m.,
- 50 dBA Leq between 7:00 p.m. and 10:00 p.m., and
- 45 dBA Leq between 10:00 p.m. and 7:00 a.m.

Assessment

The project site is currently a cleared lot. Single-family residences are located in the canyon, below the project, to the west. Anticipated noise sources associated with the project are music, swimming pool usage, parking structure traffic, and mechanical ventilation.

A review of the project plans show that effective measures to minimize noise from the project have been incorporated into the project design. These measures include the following:

- No balconies would be on the west side, restricting areas where people could gather and listen to music.
- Outdoor use areas would be limited to the interior courtyard.
- The west side of the parking structure would have solid walls (with the exception of ventilation shafts), thereby minimizing noise from wheel squeal and car alarms.
- Noise from parking structure ventilation shafts and other heating / ventilation / air-conditioning (HVAC) equipment would be designed and operated in accordance with the City Noise Ordinance.
- Noise from the swimming pool would be minimized by placing controls on the swimming pool hours of operation. Use of the swimming pool will be limited to between 10:00 a.m. and 11:00 p.m. on weekdays, and between 10:00 a.m. and 12:00 a.m. (midnight) on weekends. Amplified music will not be permitted after 10:00 p.m. on any day.

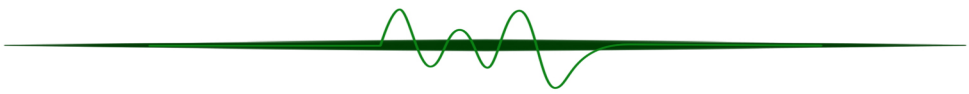
Noise from the parking structure and mechanical equipment will be designed and operated in accordance with the City Noise Ordinance and will not be discussed further in this report.

Swimming Pool and Music

The swimming pool area located in the interior courtyard is expected to be the primary source of noise. Typically, the greatest noise level associated with a swimming pool is from children playing or adults yelling. In addition, the pool area is a likely location for amplified music.

Acoustical calculations were performed to assess noise from the swimming pool area. The locations and elevations of the pool area, project buildings, and nearby residential properties were obtained from the project plans (November 19, 2014).

For the purpose of the assessment, it was assumed that up to 20 people could use the pool area at any given time. The sound power level of one user is estimated to be approximately 87 dBA [Probst 1994]. Calculations were performed to estimate a sound power source level for 20 users ($LW = 87 + 10*\log(N)$ dBA, where N = number of users). The sound pressure level of amplified music was estimated to be 85 dBA at 3 feet from the source.



Noise from pool users and amplified music were treated as point sources at the approximate center of the pool area. Strictly speaking, sound attenuates from a point source at a rate of 6 dBA per doubling of distance from the source. This is a logarithmic relationship describing the spreading of a pure undisturbed spherical wave in air. This rule applies to the propagation of sound waves with no ground interaction or the interaction with a hard (hence the term) surface such as a pool deck or hard-packed graded lots.

Because the pool and pool area will be on the interior of the project and surrounded by residential structures, the project buildings will act as a noise barrier and will therefore attenuate noise between the swimming pool area and the existing single-family residences located to the west of the project site. The Fresnel diffraction method was used to estimate the noise reduction achieved by the buildings (insertion loss $IL_{barrier}$). The calculations are based on the formulas

$$N = (2/\lambda)\left[d_1 + d_2 - d\right]$$

and

$$IL_{barrier} = 10\log\left[3 + 10NK\right]$$

where

N	=	Fresnel number,
λ	=	wavelength,
d_1	=	distance from source to top of barrier,
d_2	=	distance from receiver to top of barrier,
d	=	distance from source to barrier, and
K	=	correction factor for atmospheric effects; K=1 for distances less than 100 meters.

The noise level from pool users at the project property line and at the closest residences was calculated to be approximately 36 dBA and 31 dBA, respectively. This estimate is assumed to be a worst-case scenario, since it is considered unlikely that 20 users would constantly generate this level of noise for a one-hour period.

The noise level from amplified music at the pool at the project property line and at the closest residences was calculated to be approximately 46 dBA and 40 dBA, respectively.

The composite noise level from pool users and amplified music at the project property line and at the closest residences was calculated to be approximately 46 dBA and 40 dBA, respectively.

As previously stated, the City Noise Ordinance sound level limits at the west property line are 55 dBA between 7:00 a.m. and 7:00 p.m., 50 dBA between 7:00 p.m. and 10:00 p.m., and 45 dBA between 10:00 p.m. and 7:00 a.m. Noise from swimming pool usage would be below these limits and would be expected to comply with the City Noise Ordinance sound level limits at any time of day, provided that amplified music is prohibited after 10:00 p.m.

This concludes the assessment. Please contact me at 619-609-0712 ×101 if you have any questions.

Sincerely,

dBF ASSOCIATES, INC.

Jeffrey D. Fuller, INCE, REHS
Principal