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February 4, 2021
Project No. 53-002

Mr. Jessie Bristow
Barry Swenson Builder
740 Front Street
Suite 315
Santa Cruz, CA 95060

Subject: Noise Assessment Study for the Planned Mixed-Use Development, 130 Center Street, Santa Cruz

Dear Mr. Bristow:

This report presents the results of a noise assessment study for the planned mixed-use development at 130 Center Street in Santa Cruz, as shown on the Site Plan, Ref. (a). The noise exposures presented herein were evaluated against the standards of the City of Santa Cruz Noise Element, Ref. (b), the State of California Code of Regulations, Title 24, Ref. (c) and the CalGreen Non-Residential Mandatory Measures of Title 24, Ref. (d).

The analysis of the on-site sound level measurements indicates that the existing noise environment is due primarily to vehicular traffic sources on Center Street with a minor influence from soccer playing activity at the Scott Kennedy Soccer Fields. The results of the study indicate that the exterior noise exposures in the common exterior areas will be within the limits of the standards. The interior noise exposures in project living spaces will exceed the limits of the standards. Noise mitigation measures will be required for the noise impacted interior areas. The interior noise levels in the retail units will be within the limits of the CalGreen standards. Noise mitigation measures for the retail spaces will not be required.

Sections I and II of this report contains a summary of our findings and recommendations, respectively. Subsequent sections contain the site, noise source and project descriptions, analyses and evaluations. Attached hereto are Appendices A, B and C, which include the list of references, descriptions of the applicable standards, definitions of the terminology, descriptions of the acoustical instrumentation used for the field survey, ventilation requirements, general building shell controls and the on-site noise measurement data and calculation tables.

I. Summary of Findings

A. Noise Standards

City of Santa Cruz Noise Element

The noise assessment results presented in the findings were evaluated against the standards of the City of Santa Cruz Noise Element, which utilize the Day-Night Level (DNL) descriptor. The Noise Element standards specify an exterior limit of 65 decibels (dB) DNL for multi-family exterior spaces. The noise standards are typically not applied to small, limited use areas such as balconies. The exterior noise standard will be applied to the Roof Deck area of this project. The interior noise exposures are limited to 45 dB DNL or lower.

State of California Title 24

The Title 24 standards also use the DNL descriptor and are applicable to all new multi-family developments. Title 24 specifies an interior noise exposure limit of 45 dB DNL from exterior noise sources.

The Title 24 standards also specify minimum noise insulation ratings for common partitions separating different dwelling units and dwelling units from interior common spaces. The standards specify that common walls and floor/ceiling assemblies must have a design Sound Transmission Class (STC) rating of 50 or higher. In addition, common floor/ceiling assemblies must have a design Impact Insulation Class (IIC) rating of 50 or higher. As design details for the interior partitions of the project were not available at the time of this study, an evaluation of the interior partitions has not been made.

CalGreen Non-Residential Mandatory Measures

The CalGreen Non-Residential Mandatory Measures, which are part of Title 24, are applied to the retail units of the project. Section 5.507 “Environmental Comfort” contains two methods for determining the interior noise levels. These methods impose different interior noise level requirements. When on-site noise level data are available, the “Performance Method” is used. The standards are outlined below.

5.507.4 Acoustical control. Employ building assemblies and components with Sound Transmission Class (STC) values determined in accordance with ASTM E90 and ASTM E413 or Outdoor-Indoor Sound Transmission Class (OITC) determined in accordance with ASTM E1332, using either the prescriptive or performance method in Section 5.507.4.1 or 5.507.4.2.

5.507.4 Exterior noise transmission. Wall and roof-ceiling assemblies exposed to the noise source making up the building or addition envelope or altered envelope shall meet a composite STC rating of at least 50 or a composite OITC rating of no less than 40, with exterior windows of a minimum STC of 40 or OITC of 30 in the following locations:

Within the 65 CNEL noise contour of an airport

Exceptions:

1. L_{dn} or CNEL for military airports shall be determined by the facility Air Installation Compatible Land Use Zone (AICUZ) plan.

2. L_{dn} or CNEL for other airports and heliports for which a land use plan that has not been developed shall be determined by the local general plan noise element.

3. Within the 65 CNEL or Ldn noise contour of a freeway or expressway, railroad, industrial source or fixed-guideway notice source as determined by the Noise Element of the General Plan.

5.507.4.1.1 Noise exposure where noise contours are not readily available. Buildings exposed to a noise level of 65 dB L_{eq}-1-hr during any hour of operation shall have building, addition or alteration exterior wall and roof-ceiling assemblies exposed to the noise source meeting a composite STC rating of at least 45 (or OITC 35), with exterior windows of a minimum STC of 40 (or OITC 30).

5.507.4.2 Performance method. For buildings located as defined in Section 5.507.4.1 or 5.507.4.1.1, wall and roof-ceiling assemblies exposed to the noise source making

up the building or addition envelope or altered envelope shall be constructed to provide an interior noise environment attributable to exterior sources that does not exceed an hourly equivalent noise level (Leq-1Hr) of 50 dBA in occupied areas during any hours of operations

5.507.4.2.1 Site features. Exterior features such as sound walls or earth berms may be utilized as appropriate to the building, addition or alteration project to mitigate sound migration to the interior.

5.507.4.2.2 Documentation of compliance. An acoustical analysis documenting complying interior sound levels shall be prepared by personnel approved by the architect or engineer of record.

5.507.4.3 Interior sound transmission. Wall and floor-ceiling assemblies separating tenant spaces and tenant spaces and public places shall have an STC of at least 40.

As noise level data for the site are available, the Performance Method of the CalGreen standards is used in this study. The interior noise level limit for non-residential spaces is an hourly average noise level ($L_{eq(h)}$) of 50 dBA.

The noise exposures shown below include the effects of solid railings at the Outdoor Lounge and solid railings/parapet at the Roof Garden/Deck areas and represent the noise environment for existing and project site conditions.

A. Exterior Noise Exposures

The COVID-19 pandemic has affected traffic volumes by varying degrees. Some streets have had very little affect, such as a 2-5% reduction in traffic volume, which yields a negligible difference in the overall noise exposures, to a 30-50% reduction in traffic volume, which yields a 1 to 2 decibel decrease in the overall noise exposures. Without precise traffic counts made just prior to the pandemic and during the pandemic, exact differences in the noise environment cannot be calculated. However, manual traffic counts made during the current COVID-19 environment and compared to the pre-COVID-19 (existing) traffic volumes in the Santa Cruz and similar areas (not along freeways) show that the pre-COVID or existing noise environment was 1 decibel higher than the current COVID-19 environment.

Throughout this report, the term "current" describes the noise environment today under COVID-19 conditions. The term "existing" describes the noise environment today but without the effects of the COVID-19 pandemic. The term "future" describes the worst-case buildout condition based on extrapolations from the existing noise environment.

Table I, below, provides the noise exposures from both soccer playing and traffic at the most impacted planned building setbacks and at the exterior living areas (Roof Deck) of the project.

As shown in the Table, the noise exposures at the first floor Private Open Space and at the Roof Deck will be within the 65 dB DNL limit of the City of Santa Cruz Noise Element standards. The 65 dB DNL future noise contour is within the Center Street right-of-way. Noise mitigation measures for the project exterior areas will not be required.

TABLE I				
Exterior Noise Exposures, dB DNL				
Setback/1st. Floor Private Open Space	Dist., ft.	Current	Existing	Future
Traffic	50	59	60	61
Soccer	120	55	55	55
Combined		**60**	**61**	**62**
Roof Deck				
Traffic	79	53	54	55
Soccer	134	54	54	54
Combined		**57**	**57**	**58**

The Ocean Pacific Lodge hotel adjacent to the south has swimming pool equipment in a yard immediately next to the project building. Although there is a masonry wall along the property line, there will be a view from upper floor dwelling units down into the equipment yard as the yard has no solid roof. The swimming pool equipment was not in operation at the time of this study. Therefore, when weather or other conditions permit, a review of noise emission from the swimming pool equipment should be performed to ensure noise annoyance does not occur.

For informational purposes, the instantaneous sound levels from soccer player shouts and ball kicks ranged from 47 to 60 dBA at the planned minimum building setback. These sound levels, although audible, would not be considered high for a building exterior.

B. Exterior Noise Levels (CalGreen)

- The current hourly average exterior noise levels at the most impacted commercial unit setback from Center Street (50 ft. from the centerline) range from 45 to 62 dBA $L_{eq(h)}$. Under existing (non-COVID-19) traffic conditions, the noise levels are 46 to 63 dBA $L_{eq(h)}$. Under future traffic conditions, the noise levels are expected to increase to 47 to 64 dBA $L_{eq(h)}$.

C. Interior Noise Exposures

Table II, below, provides the interior noise exposures in the most impacted living spaces closest to Center Street and the Scott Kennedy soccer fields under current, existing and future traffic conditions.

TABLE II

Interior Noise Exposures, dB DNL

	Current	Existing	Future
Traffic	44	45	46
Soccer	40	40	40
Combined	**45**	**46**	**47**

The interior noise exposures in the most noise impacted living spaces will be up to 2 dB in excess of the City of Santa Cruz Noise Element and Title 24 standards. Noise mitigation measures will be required. The recommended measures are provided in Section II of this report.

D. Interior Noise Levels (CalGreen)

- The interior noise levels in the most impacted commercial spaces closest to Center Street will range from 20 to 37 dBA $L_{eq(h)}$ under current (COVID-19) traffic conditions. Under existing (non-COVID-19) traffic conditions, the noise levels are expected to be 21 to 38 dBA $L_{eq(h)}$. Under future traffic conditions, the noise levels are expected to increase to 22 to 39 dBA $L_{eq(h)}$. Thus, the noise levels will be within the 50 dBA $L_{eq(h)}$ limit of the CalGreen Non-Residential Mandatory Measures.

The interior noise levels in the retail (non-residential) spaces will be within the limits of the CalGreen Non-Residential Mandatory Measures. Noise mitigation measures will not be required for the retail spaces.

II. Recommendations

A. Interior Noise Controls

To achieve compliance with the 45 dB DNL limits of the City of Santa Cruz Noise Element and Title 24 standards, the following window controls will be required.

- Maintain closed at all times all windows and glass doors of living spaces of the project within 80 ft. of the centerline of Center Street and with a direct or side view of the road. These windows may have any type of glass, i.e., there is no minimum Sound Transmission Class rating requirement.

- Provide some type of mechanical ventilation for all living spaces with a closed window or glass door condition.

- Please see Figure 1 for the locations of the noise impacted facades.

All other windows and glass doors of the project and all bathroom windows may have any type of glazing and may be kept opened as desired unless the bathroom is an integral part of a living space without a closeable door such as in a master bedroom suite.

When windows and glass doors are maintained closed for noise control, some type of mechanical ventilation to assure a habitable environment must be provided. The windows specified to be maintained closed are to be operable, as the requirement does not imply a “fixed” condition.


FIGURE 1
Noise impacted facade requiring closed windows and glass doors at the living spaces. Provide some type of mechanical ventilation. There is no STC rating requirement for these windows and doors.
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1 FLOOR PLAN - 2ND FLOOR
1/16" = 1'-0"

The windows and doors shall be installed in an acoustically-effective manner. To achieve an acoustically-effective construction, the operable panels must form an air-tight seal when in the closed position and the window and door frames must be caulked to the wall opening around their entire perimeter with a non-hardening caulking compound to prevent sound infiltration. Exterior doors must seal air-tight around the full perimeter when in the closed position. Spray-in or expandable foams are not acceptable acoustical sealants.

Please be aware that many dual-pane window and glass door assemblies have inherent noise reduction problems in the traffic noise frequency spectrum due to resonance that occurs within the air space between the window lites, and the noise reduction capabilities vary from manufacturer to manufacturer. Therefore, the acoustical test report of all sound rated windows and doors should be reviewed be a qualified acoustician to ensure that the chosen windows and doors will adequately reduce traffic noise to acceptable levels.

The implementation of the above recommended measures will reduce excess noise exposures to achieve compliance with the interior standards of the City of Santa Cruz Noise Element and Title 24.

III. Site, Noise Source and Project Descriptions

The planned development site is located at 130 Center Street between Pacific Avenue and Laurel Street in Santa Cruz and currently contains a Hertz car rental and the Chris Bordner Auto Body facility. The site is relatively flat and at-grade with the surrounding land uses and roadways. Surrounding land uses include the Ocean Pacific Lodge adjacent to the south, multi-family residential adjacent to the east, Scott's Auto Body adjacent to the north, and commercial uses and the Scott Kennedy soccer fields across Center Street to the west.

The on-site noise environment is controlled primarily by vehicle traffic sources on Center Street. Current (COVID-19) and existing (pre-COVID-19) traffic volume data were not available. From the traffic noise data and field observations, we estimate that the current traffic volume is approximately 4,500 vehicles Average Daily Traffic (ADT). We are also estimating that the existing (pre-COVID-19) traffic volume is approximately 30% higher, or 5,850 vehicles ADT.

The Scott Kennedy soccer fields are public fields used by quasi-organized (adult and youth) soccer teams. The teams observed playing did not have uniforms, but they used different colored jerseys. There were no official referees and no whistles were used. The fields were in use during the week (after work hours) and all day on the weekends. The small field along Center Street at Washington Street generated the highest noise levels due to its closer proximity to the project site. The highest noise levels were created by player shouts and ball kicks.

The planned project includes the construction of 232 single-room apartments in 6 levels of residential living. Parking will be in a basement, with 8 residential units, two retail units, parking and bike storage on the first floor. The upper floors will be residential. A Private Open Space area will be on the south side of the building at the first floor. A Roof Deck will be on the sixth floor facing west. The Site Plan is shown on Figure 2, below.

FIGURE 2 – Site Plan

IV. Analysis of the Noise Levels

A. Existing Noise Levels

To determine the existing noise environment at the site, continuous recordings of the sound levels were made on two separate occasions. The first measurement period was from Saturday morning to Sunday morning, January 23-24 2021 to capture full day soccer playing. The second period was from Monday morning to Tuesday morning January 25-26, 2021. The measurement period could not continue through Sunday to Monday due to inclement weather. The measurement location was 38 ft. from the centerline of Center Street and 120 ft. from the center of the small soccer field (noisier due to closer proximity). The meter was attached to the Chris Bordner Auto Body parking lot light standard at an elevation of 13 ft. above the ground. This location was chosen for security of the sound measuring instrument. The noise measurement location is shown on Figure 3, below.

FIGURE 3 – Noise Measurement Location

The sound levels were recorded and processed using a Larson-Davis Model 812 Precision Integrating Sound Level Meter. The meter yields, by direct readout, a series of descriptors of the sound levels versus time, as described in Appendix B. The measured descriptors include the L_1, L_{10}, L_{50}, and L_{90}, i.e., those levels exceeded for 1%, 10%, 50%, and 90% of the time. Also measured were the maximum and minimum levels and the continuous equivalent-energy levels (L_{eq}), which are used to calculate the DNL. The measurements were made for two continuous periods of 24 hours each and included representative hours of the daytime and nighttime periods of the DNL index. The results of the measurements are shown in the data tables in Appendix C.

As shown in the data tables, the L_{eq}'s on Saturday to Sunday (weekend), ranged from 55.5 to 62.8 dBA during the daytime and from 46.1 to 56.6 dBA at night. On Monday to Tuesday (weekday), the L_{eq}'s ranged from 52.6 to 64.3 dBA during the daytime and from 46.6 to 57.2 dBA at night.

Vehicular traffic noise and soccer game noise dissipate at the rate of 3 to 6 dB for each doubling of distance from the source and contains a wide spectrum of frequency components (from 100 to 10,000 Hz), which are associated with engine, tire, drive-train, exhaust, player shouts, ball kicks and other sources. These frequency components are centered primarily in the 250, 500 and 1,000 Hz octave bands. Additional acoustical shielding will be provided by interposed portions of the building.

B. Future Noise Levels

Future traffic volume projections for Center Street were not available at the time of this study. For the 555 Pacific Avenue project and the 401 Pacific SRO project, the City of Santa Cruz recommended the use of a 1% per year traffic volume growth rate, Ref. (e).. A 12% per year growth rate is equivalent to a 22% increase in the traffic volume over the course of 20 years. Thus, the Center Street traffic volume is estimated to increase from the existing 5,580 vehicles ADT to 7,137 vehicles ADT. This increase in traffic volume yields a 1 dB increase in the traffic noise levels between the future condition and the existing condition. This is also a 2 dB increase over the measured current COVID-19 condition.

V. Evaluations of the Noise Exposures

A. Exterior Noise Exposures

To evaluate the on-site noise exposures against the City of Santa Cruz standards, the DNL for the survey location was calculated by decibel averaging of the L_{eq}'s as they apply to the daily time periods of the DNL index. The DNL is a 24-hour noise descriptor that uses the measured L_{eq} values to calculate a 24-hour time-weighted average noise exposure. Adjustments were made to the measured noise levels to account for variations in setback distances from the measurement locations using methods established by the Highway Research Board, Ref. (f). The formula used to calculate the DNL is described in Appendix B. The on-site noise measurement data and calculation tables are provided in Appendix C.

The results of the calculations indicate that the current exterior noise exposures at the measurement location, 31 ft. from the centerline of Center Street and 115 ft. from the center of the small soccer field, were 62 dB DNL on Saturday-Sunday (weekend) and 61 dB DNL on Monday-Tuesday (weekday). Of the 62 dB DNL on the weekend, 55 dB DNL was due to soccer playing with 61 dB due to Center Street traffic.

During pre-COVID-19 conditions, the noise exposure is expected to have been 1 decibel higher than current conditions due to the estimated 30% increase in traffic volume. Thus, the existing traffic noise exposure is estimated to be 62 dB DNL with 55 dB DNL due to soccer playing. The combined noise exposure is 63 dB DNL. Under future conditions, the traffic noise exposure is estimated to increase to 63 dB DNL and the soccer playing noise exposure is estimated to remain at 55 dB DNL. The combined future noise exposure was calculated to be 64 dB DNL.

At the planned minimum setback and Private Open Space at the first floor, 50 ft. from the centerline of the road and 120 ft. from the center of the small soccer field, the current noise exposures reduce to 59 dB due to traffic and 55 dB due to soccer playing. The combined existing noise exposure is 60 dB DNL. Under existing traffic conditions, the noise exposures are expected to increase to 60 dB due to Center Street traffic and 55 dB due to soccer playing. The existing combined exterior noise exposure is 61 dB DNL. Under future traffic conditions, the noise exposures are expected to increase to 61 dB due to Center Street traffic and 55 dB due to soccer playing. The future combined exterior noise exposure is 62 dB DNL.

The exterior noise exposures at common Roof Deck on the sixth floor of the building with a receiver height (person standing) of 60 ft. above grade, the noise exposures under current conditions will be 53 dB DNL due to traffic and 54 dB DNL due to soccer playing. The combined noise exposure will be 57 dB DNL Under existing conditions, the noise exposures were calculated to be 54 dB DNL due to traffic and 54 dB DNL due to soccer playing. The combined existing noise exposure was calculated to be 578 dB DNL. Under future conditions, the noise exposures are estimated to be 55 dB DNL due to traffic and 54 dB DNL due to soccer playing. The combined noise exposure was calculated to be 58 dB DNL.

The exterior noise exposure in the Private Open Space and at the common Roof Deck area will be within the 65 dB DNL limit of the City of Santa Cruz Noise Element standards. Noise mitigation measures for the exterior areas will not be required.

B. Interior Noise Exposures

To evaluate the interior noise exposures in project living spaces against the standards of the City of Santa Cruz Noise Element and Title 24, a 15 dB reduction was applied to the exterior noise exposures at the building setbacks to represent the attenuation provided by the building shell under an *annual-average* condition. The annual-average condition assumes that windows have standard dual-pane thermal insulating glass and are kept open up to 50% of the time for natural ventilation.

The interior noise exposures under current conditions in the most impacted living spaces closest to Center Street and the Scott Kennedy soccer fields will be up to 44 dB DNL due to traffic and 40 dB DNL due to soccer playing, with a combined noise exposure or 45 dB DNL.

Under existing conditions, the interior noise exposures will be up to 45 dB DNL due to traffic and 40 dB DNL due to soccer playing. The combined noise exposure was calculated to be 46 dB DNL.

Under future conditions, the interior noise exposures will be up to 46 dB DNL due to traffic and 40 dB DNL due to soccer playing. The combined noise exposure was calculated to be 47 dB DNL.

The noise exposures will be up to 2 dB in excess of the City of Santa Cruz Noise Element and Title 24 standards.

The interior noise exposures will exceed the limits of the standards. Thus, noise mitigation measures will be required. The recommended measures are described in Section II of this report.

C. Exterior and Interior Noise Levels

To evaluate the interior noise exposures in project living spaces against the CalGreen Non-Residential Mandatory Measures, a 25 dB reduction was applied to the exterior hourly average noise levels at the commercial unit setbacks to represent the attenuation provided by a standard commercial building shell.

Table III, below, provides the current (measured) exterior hourly average noise levels at the measurement location 31 ft. from the centerline of Center Street. Also shown are the exterior and interior noise levels at the planned minimum setback of 50 ft. from the centerline of Center Street for existing and future conditions. As shown, the interior hourly average noise levels shown in the last column will be within the 50 dBA $L_{eq(h)}$ limit of the CalGreen Non-Residential Mandatory Measures. Noise mitigation measures for the commercial units will not be required.

TABLE II

CalGreen Noise Levels, dBA Leq(h)

Dist. To Source	31 ft.	50 ft.	50 ft.	50 ft.	50 ft.
	Exterior @ Meas. Loc.	Existing Noise Levels @ Setback		Future Noise Levels @ Setback	
TIME	Current	Exterior	Interior	Exterior	Interior
7:00 AM	55.5	53.4	28.4	54.4	29.4
8:00 AM	61.6	59.5	34.5	60.5	35.5
9:00 AM	59.9	57.8	32.8	58.8	33.8
10:00 AM	59.9	57.8	32.8	58.8	33.8
11:00 AM	62.0	59.9	34.9	60.9	35.9
12:00 PM	61.6	59.5	34.5	60.5	35.5
1:00 PM	61.7	59.6	34.6	60.6	35.6
2:00 PM	61.5	59.4	34.4	60.4	35.4
3:00 PM	61.9	59.8	34.8	60.8	35.8
4:00 PM	62.8	60.7	35.7	61.7	36.7
5:00 PM	62.0	59.9	34.9	60.9	35.9
6:00 PM	60.4	58.3	33.3	59.3	34.3
7:00 PM	58.8	56.7	31.7	57.7	32.7
8:00 PM	57.1	55.0	30.0	56.0	31.0
9:00 PM	55.6	53.5	28.5	54.5	29.5
10:00 PM	55.1	53.0	28.0	54.0	29.0
11:00 PM	51.5	49.4	24.4	50.4	25.4
12:00 AM	53.3	51.2	26.2	52.2	27.2
1:00 AM	49.0	46.9	21.9	47.9	22.9
2:00 AM	48.3	46.2	21.2	47.2	22.2
3:00 AM	46.1	44.0	19.0	45.0	20.0
4:00 AM	51.8	49.7	24.7	50.7	25.7
5:00 AM	53.1	51.0	26.0	52.0	27.0
6:00 AM	56.6	54.5	29.5	55.5	30.5

This report presents the results of a noise assessment study for the planned mixed-use development at 130 Center Street in Santa Cruz. The study findings for current and existing conditions are based on field measurements and other data and are correct to the best of our knowledge. Future noise level predictions and the recommendations were based on information provided by the City of Santa Cruz. However, significant changes in the future traffic volumes, speed limits, motor vehicle technology, noise regulations, or other future changes beyond our control may produce long range noise results different from our estimates. If you have any questions or would like an elaboration on this report, please call me.

Sincerely,

EDWARD L. PACK ASSOC., INC.

Jeffrey K. Pack
President

Attachment: Appendices A, B and C

APPENDIX A

References

(a) Floor Plan – 1st Floor, 130 Center Street, by Barry Swenson Builder, December 15, 2020

(b) City of Santa General Plan 2030, Chapter 8, "Hazards, Safety and Noise", Adopted, June 26, 2012

(c) California Code of Regulations, Title 24, Part 2, Volume 1, Section 1207 "Sound Transmission", Subsection 1207.4 (Allowable Interior Noise Levels), Revised 2016

(d) California Code of Regulations, Title 24, Chapter 5, Section 5.507 "Environmental Comfort", Subsection 5.507.4.2 (Exterior Noise Transmission, Performance Method), Revised 2013

(e) Information on Future Traffic Volumes Provided by Mr. Chris Schneiter, City of Santa Cruz Public Works Department, by Transmittal to Edward L. Pack Associates, Inc., May 12, 2005

(f) Highway Research Board, "Highway Noise – A Design Guide for Highway Engineers", Report 117, 1971

APPENDIX B

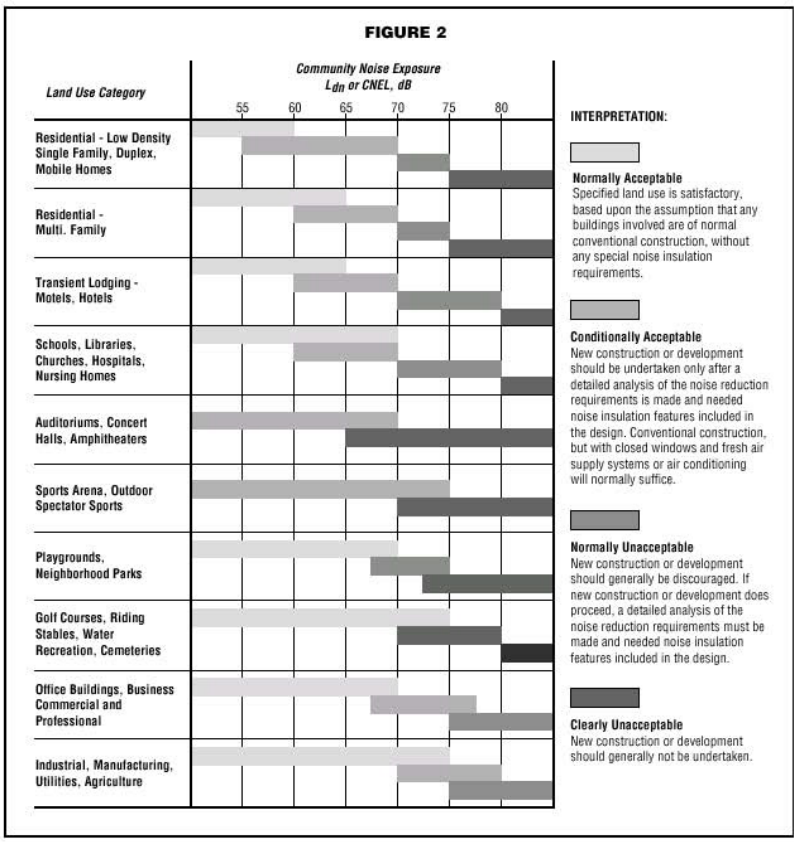
Noise Standards, Terminology, Instrumentation, Ventilation Requirements and Building Shell Controls

1. Noise Standards

A. City of Santa Cruz Noise Element Standards

The City of Santa Cruz General Plan 2030, adopted June 26, 2012, references the Land Use Compatibility chart of the State of California General Plan Guidelines. The Noise Element provides a series of noise goals for various occupancies and uses. The noise exposures are in terms of dB Day-Night Level (DNL or L_{dn}).

FIGURE 2



Goal HZ3 Noise levels compatible with occupancy and use

HZ3.1 Maintain or reduce existing noise levels and control excessive noise.

HZ3.1.1 Require land uses to operate at noise levels that do not significantly increase surrounding ambient noise.

HZ3.1.2 Use site planning and design approaches to minimize noise impacts from new development on surrounding land uses.

HZ3.1.3 Ensure that construction activities are managed to minimize overall noise impacts on surrounding land uses.

HZ3.1.4 Minimize the impacts of intermittent urban noise on residents.

HZ3.1.5 Develop a system to monitor construction noise impacts on surrounding land uses.

HZ3.1.6 Require evaluation of noise mitigation measures for projects that would substantially increase noise.

HZ3.1.7 Protect residential areas from excessive noise from traffic and from road projects.

HZ3.1.8 Require environmental review and mitigation of roadway projects that may significantly increase the average day/night noise levels.

HZ3.1.9 Limit truck traffic in residential and commercial areas to designated truck routes.

HZ3.1.10 Where noise reduction would be beneficial, consider installing quiet pavement surfaces as part of repaving projects.

HZ3.1.11 Require soundwalls, earth berms, setbacks, and other noise reduction techniques for new development when appropriate and necessary as conditions of approval.

HZ3.2 Ensure that noise standards are met in the siting of noise-sensitive uses.

HZ3.2.1 Apply noise and land use compatibility table and standards to all new residential, commercial, and mixed-use proposals, including condominium conversions, in accordance with standards set forth in the Land Use-Noise Compatibility Standards Figure 2.

HZ3.2.2 Establish DNL noise level targets of 65 dB for outdoor activity areas in new multifamily residential developments.

HZ3.2.3 Require that interior noise in all new multifamily housing not exceed a DNL of 45 dB with the windows and doors closed (State of California Noise Insulation Standards) and extend the requirement to single-family homes.

B. Title 24 Noise Standards

2019 California Building Code, Volume 1, Part 2
SECTION 1206 – SOUND TRANSMISSION

1206.1 Scope. This section shall apply to common interior walls, partitions and floor/ceiling assemblies between adjacent dwelling units and sleeping units or between dwelling units and sleeping units and adjacent public areas such as halls, corridors, stairways or service areas.

1206.2 Air-borne sound. Walls, partitions and floor/ceiling assemblies separating dwelling units and sleeping units from each other or from public or service areas shall have a sound transmission class of not less than 50, or not less than 45 if field tested, for air-borne noise when tested in accordance to ASTM E-90. Alternatively, the sound transmission class of walls, partitions and floor-ceiling assemblies shall be established by engineering analysis based on a comparison of walls, partitions and floor-ceiling assemblies having sound transmission class ratings as determined by the test procedures in ASTM E90. Penetrations or openings in construction assemblies for piping; electrical devices; recessed cabinets; bathtubs; soffits; or heating, ventilating or exhaust ducts shall be sealed lined, insulated or otherwise treated to maintain the required ratings. The requirement shall not apply to entrance doors; however, such doors shall be tight fitting to the frame and sill.

1206.3 Structure-borne sound. Floor/ceiling assemblies between dwelling units and sleeping units or between a dwelling unit or sleeping unit and a public or service area with the structure shall have an impact insulation class rating of not less than 50, or not less than 45 if field tested, when tested in accordance with ASTM E-492. Alternatively, the impact insulation class of floor-ceiling assemblies shall be established by engineering analysis based on a comparison of floor-ceiling assemblies having impact insulation class ratings as determined by the test procedures in ASTM E492.

Exception: *Impact sound insulation is not required for floor/ceiling assemblies over non-habitable rooms or spaces not designed to be occupied, such as garages, mechanical rooms or storage areas.*

1206.4 Allowable interior noise levels. *Interior noise levels attributable to exterior sources shall not exceed 45 dB in any habitable room. The noise metric shall be either the day-night average sound level (Ldn) or the community noise equivalent level (CNEL), consistent with the noise element of the local general plan.*

1206.5 Acoustical control. [BSC-CG] *See California Green Building Standards code, Chapter 5, Division 5.5 for additional sound transmission requirements.*

2. Terminology

A. Statistical Noise Levels

Due to the fluctuating character of urban traffic noise, statistical procedures are needed to provide an adequate description of the environment. A series of statistical descriptors have been developed which represent the noise levels exceeded a given percentage of the time. These descriptors are obtained by direct readout of the sound measuring instruments. Some of the statistical levels used to describe community noise are defined as follows:

L_1 - A noise level exceeded for 1% of the time.

L_{10} - A noise level exceeded for 10% of the time, considered to be an "intrusive" level.

L_{50} - The noise level exceeded 50% of the time representing an "average" sound level.

L_{90} - The noise level exceeded 90 % of the time, designated as a "background" noise level.

L_{eq} - The continuous equivalent-energy level is that level of a steady noise having the same sound energy as a given time-varying noise. The L_{eq} represents the decibel level of the time-averaged value of sound energy or sound pressure squared and is the descriptor used to calculate the DNL and CNEL.

B. Day-Night Level (DNL)

Noise levels utilized in the standards are described in terms of the Day-Night Level (DNL). The DNL rating is determined by the cumulative noise exposures occurring over a 24-hour day in terms of A-Weighted sound energy. The 24-hour day is divided into two subperiods for the DNL index, i.e., the daytime period from 7:00 a.m. to 10:00 p.m. and the nighttime period from 10:00 p.m. to 7:00 a.m. A weighting factor of 10 dBA is applied (added) to the noise levels occurring during the nighttime period to account for the greater sensitivity of people to noise during these hours. The DNL is calculated from the measured L_{eq} in accordance with the following mathematical formula:

$$DNL = \left[[(10\log_{10}(10^{\Sigma Leq(7\text{-}10)})) \times 15] + [((10\log_{10}(10^{\Sigma Leq(10\text{-}7))})+10) \times 9]\right]/24$$

C. A-Weighted Sound Level

The decibel measure of the sound level utilizing the "A" weighted network of a sound level meter is referred to as "dBA". The "A" weighting is the accepted standard weighting system used when noise is measured and recorded for the purpose of determining total noise levels and conducting statistical analyses of the environment so that the output correlates well with the response of the human ear.

3. Instrumentation

The on-site field measurement data were acquired by the use of one of the instruments specified below, which provides a direct readout of the L exceedance statistical levels including the equivalent-energy level (L_{eq}). Input to the instrument was provided by a microphone extended to a height of 5 ft. above the ground on using a tripod or mast. The "A" weighting network and the "Fast" response setting of the instruments were used in conformance with the applicable standards. The instruments conform to American National Standards Institute (ANSI) standard S1.4 for Type I instruments, and all instrumentation was acoustically calibrated before and after field tests to assure accuracy.

Instruments used for field surveys:
Larson-Davis Model 812 Integrating Sound Level Meter
Larson-Davis 2900 Real Time Analyzer
Bruel & Kjaer Model 2231 Precision Sound Level Meter
Larson-Davis Model 831 Integrating Sound Level Meter

4. Mechanical Ventilation Requirements

California Mechanical Code Chapter 4- Ventilation Air

402.3 Mechanical Ventilation

Where natural ventilation is not permitted by this section or the building code, mechanical ventilation systems shall be designed, constructed, and installed to provide a method of supply air and exhaust air. Mechanical ventilation systems shall include controls, manual or automatic, that enable the fan system to operate wherever the spaces served are occupied. The system shall be designed to maintain minimum outdoor airflow as required by Section 403.0 under any load conditions.

5. Building Shell Controls

The following additional precautionary measures are required to assure the greatest potential for exterior-to-interior noise attenuation by the recommended mitigation measures. These measures apply at those units where closed windows are required:

- Unshielded entry doors having a direct or side orientation toward the primary noise source must be 1-5/8" or 1-3/4" thick, insulated metal or solid-core wood construction with effective weather seals around the full perimeter. Mail slots should not be used in these doors or in the wall of a living space, as a significant noise leakage can occur through them.

- If any penetrations in the building shell are required for vents, piping, conduit, etc., sound leakage around these penetrations can be controlled by sealing all cracks and clearance spaces with a non-hardening caulking compound.

- Ventilation openings shall not compromise the acoustical integrity of the building shell.

- Spray-in or expandable foams are not acceptable as acoustical sealant or as sound absorptive material in walls and ceilings.

APPENDIX C

On-Site Noise Measurement Data and Calculation Tables

DNL CALCULATIONS

CLIENT: BARRY SWENSON BUILDER
FILE: 53-002
PROJECT: 130 CENTER ST.
DATE: 1/23-26/2021
SOURCE: SOCCER FIELDS, CENTER ST.

LOCATION 1	Small Soccer Field			
Dist. To Source	120 ft.			
	Saturday-Sunday			
TIME	Leq	10^Leq/10		
7:00 AM	55.5	354813.4		
8:00 AM	61.6	1445439.8		
9:00 AM	59.9	977237.2		
10:00 AM	59.9	977237.2		
11:00 AM	62.0	1584893.2		
12:00 PM	61.6	1445439.8		
1:00 PM	61.7	1479108.4		
2:00 PM	61.5	1412537.5		
3:00 PM	61.9	1548816.6		
4:00 PM	62.8	1905460.7		
5:00 PM	62.0	1584893.2		
6:00 PM	60.4	1099005.8		
7:00 PM	58.8	758577.6		
8:00 PM	57.1	512861.4		
9:00 PM	55.6	363078.1	SUM=	17449399.9
10:00 PM	55.1	323593.7	Ld=	72.4
11:00 PM	51.5	141253.8		
12:00 AM	53.3	213796.2		
1:00 AM	49.0	79432.8		
2:00 AM	48.3	67608.3		
3:00 AM	46.1	40738.0		
4:00 AM	51.8	151356.1		
5:00 AM	53.1	204173.8		
6:00 AM	56.6	457088.2	SUM=	1679040.9
			Ln=	62.3
	Daytime Level=	72.4		
	Nighttime Level=	72.3		
	DNL=	**62**		
	24-Hour Leq=	59.0		

LOCATION 1	Center St.			
Dist. To Source	38 ft.			
	Monday-Tuesday			
TIME	Leq	10^Leq/10		
7:00 AM	57.3	537031.8		
8:00 AM	59.9	977237.2		
9:00 AM	60.7	1174897.6		
10:00 AM	59.3	851138.0		
11:00 AM	60.9	1230268.8		
12:00 PM	62.5	1778279.4		
1:00 PM	64.3	2691534.8		
2:00 PM	61.3	1348962.9		
3:00 PM	60.1	1032761.4		
4:00 PM	61.1	1288249.6		
5:00 PM	60.3	1071519.3		
6:00 PM	58.4	691831.0		
7:00 PM	56.3	426579.5		
8:00 PM	54.0	251188.6		
9:00 PM	52.6	181970.1	SUM=	15533450.0
10:00 PM	53.8	239883.3	Ld=	71.9
11:00 PM	50.9	123026.9		
12:00 AM	49.0	79432.8		
1:00 AM	46.6	45708.8		
2:00 AM	47.8	60256.0		
3:00 AM	50.0	100000.0		
4:00 AM	49.9	97723.7		
5:00 AM	51.0	125892.5		
6:00 AM	57.2	524807.5	SUM=	1396731.5
			Ln=	61.5
	Daytime Level=	71.9		
	Nighttime Level=	71.5		
	DNL=	**61**		
	24-Hour Leq=	58.5		