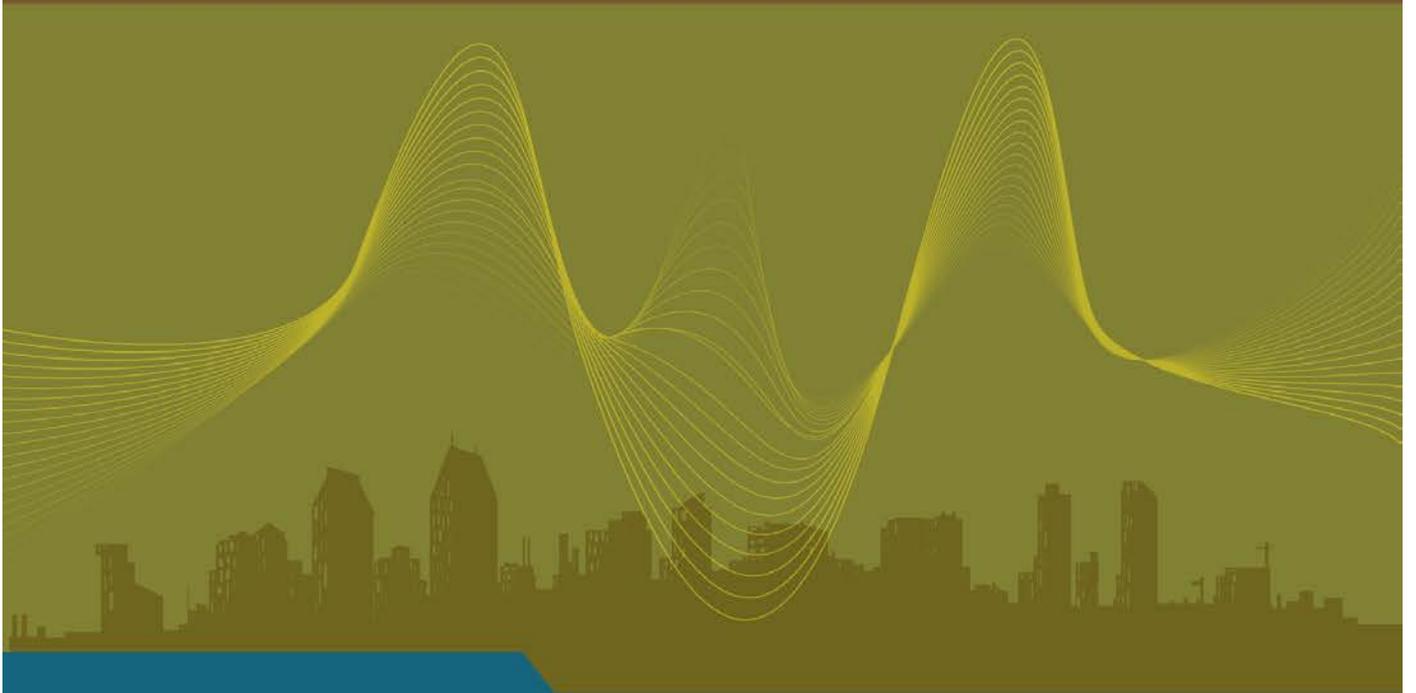


Report #2014-027
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Exterior Noise Analysis

City Commons
City of Costa Mesa, California

Prepared for:

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1.0 Definitions

- **Noise** is undesired sound.
- **Sound** is an oscillation in pressure, stress, particle displacement, particle velocity, etc., in a medium with internal forces.
- **Decibel (dB)** is a unit of level when the base of the logarithm is the tenth root of ten, and the quantities concerned are proportional to power.
- **Level** in acoustics is the logarithm of the ratio of a quantity to a reference quantity of the same kind.
- **Time-Weighted** refers to the fact that noise occurring during certain time periods is given more significance because it occurs at times when people are more sensitive to noise.
- **“A-Weighting”** is a frequency correction that correlates overall sound pressure levels with the frequency response of the human ear.
- **Leq** is the equivalent sound pressure level or “energy” average noise level during a specific time period. It can be measured for any time period, but is typically measured for fifteen minutes, 1 hour, or twenty-four hours.
- **Community Noise Equivalent Level (CNEL)** is a 24-hour, time-weighted, average noise level based on the “A-weighted” decibel. In the calculation process, noise occurring in the evening time period (7 p.m. to 10 p.m.) is penalized by adding 5 dB, while noise occurring in the nighttime period (10 p.m. to 7 a.m.) is penalized by adding 10 dB. These time periods and decibel increases were selected to reflect a person's increased sensitivity to noise during late-night and early morning hours.
- **L(N), or L%**, is a statistical method of describing noise which accounts for the variance in noise levels throughout a given measurement period. L(N), where N equals a percentage, is a way of expressing the noise level exceeded for a percentage of time in a given measurement period. For example, since 15 minutes is 25% of 60 minutes, L(25) is the noise level that is exceeded for 15 minutes of a 60 minute measurement period.

2.0 Introduction

The purpose of this report is to determine compliance of *City Commons* with the City of Costa Mesa's exterior noise standards for single family residential land use. Refer to Figure 1 for the location of the project. Refer to Figure 2 for the conceptual site plan showing home lot numbers. Refer to Figure 3 for the open space exhibit showing home lot numbers.

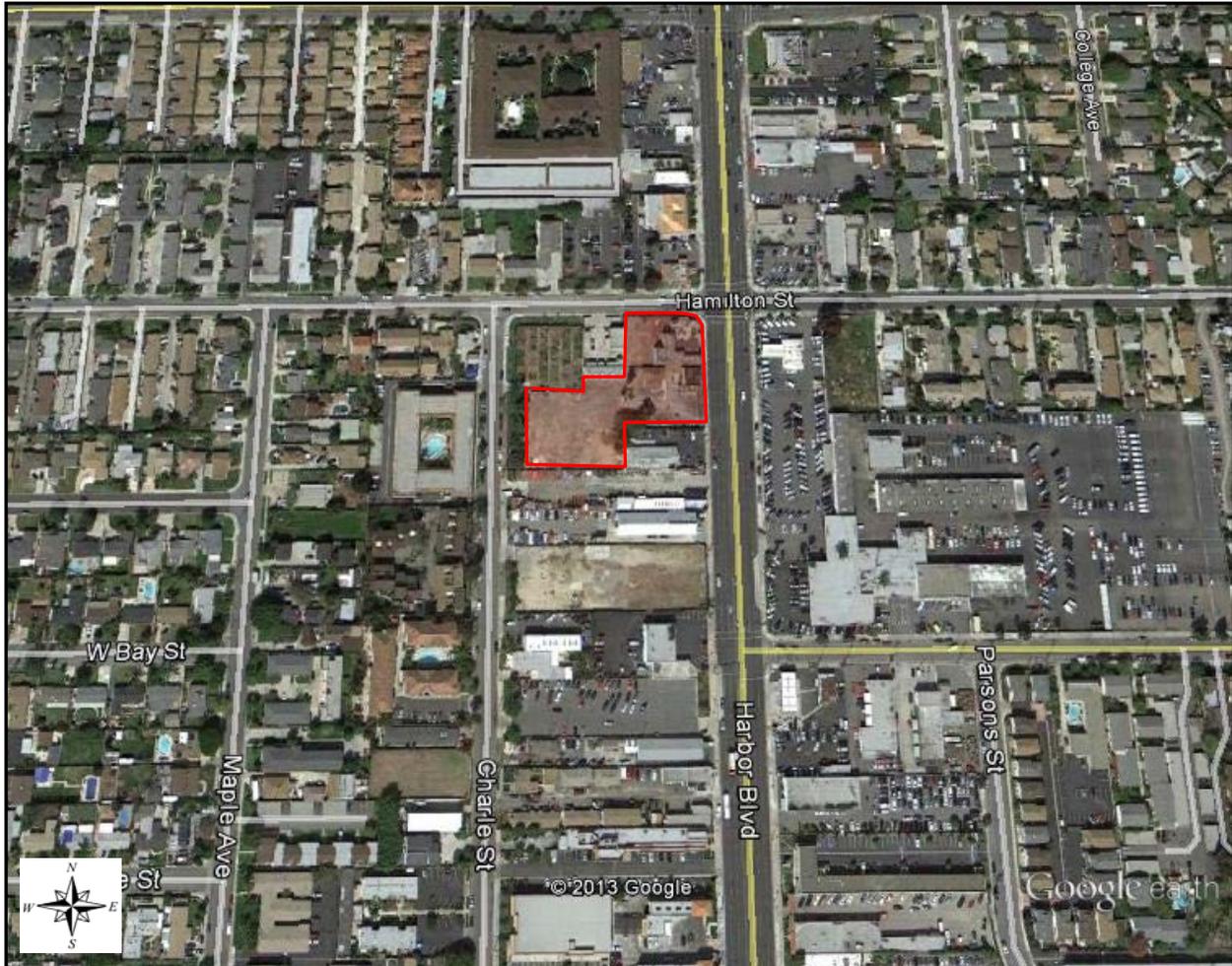


Figure 1 - Location of the Project

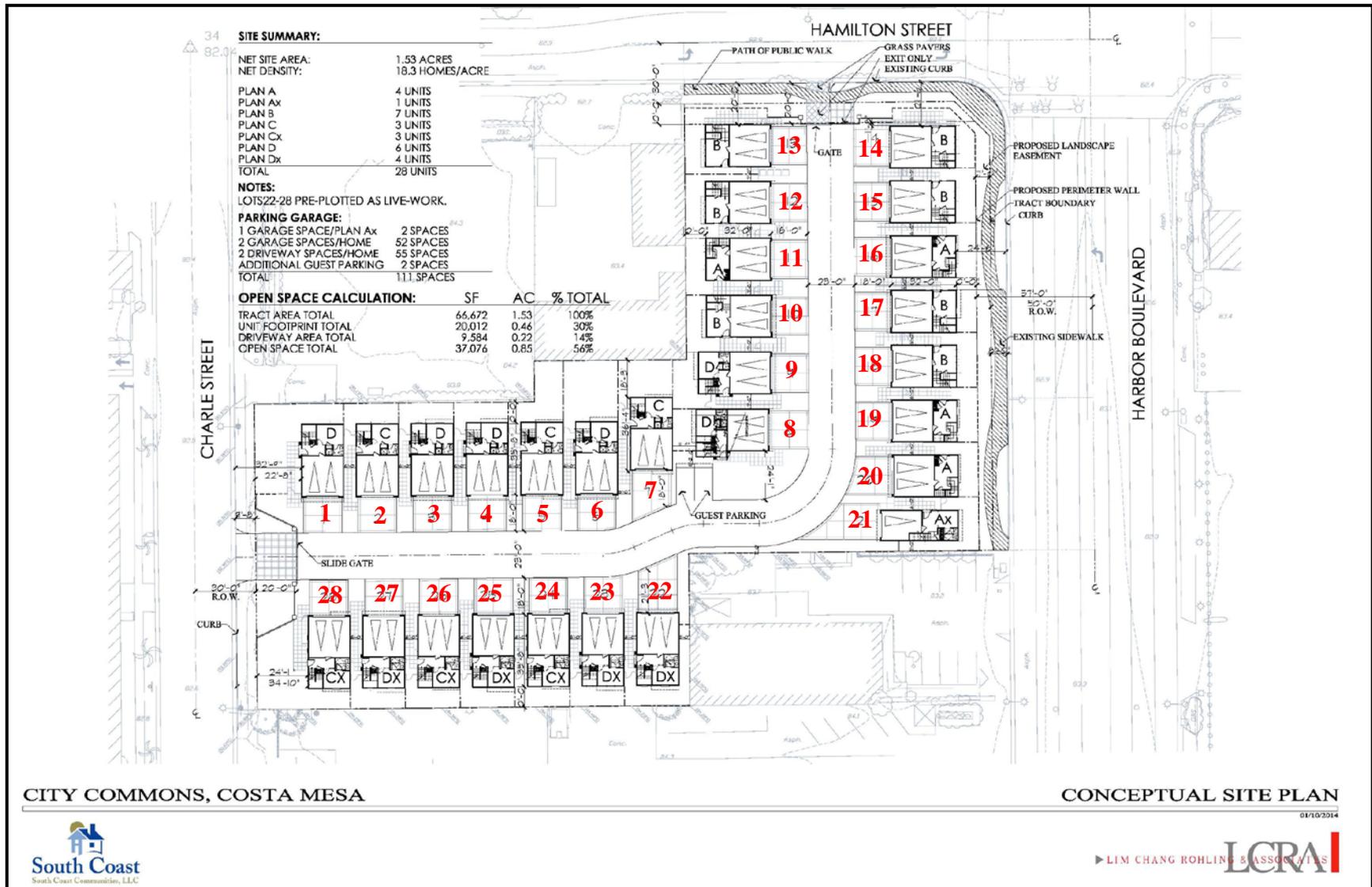


Figure 2 – Conceptual Site Plan with Home Lot Numbers

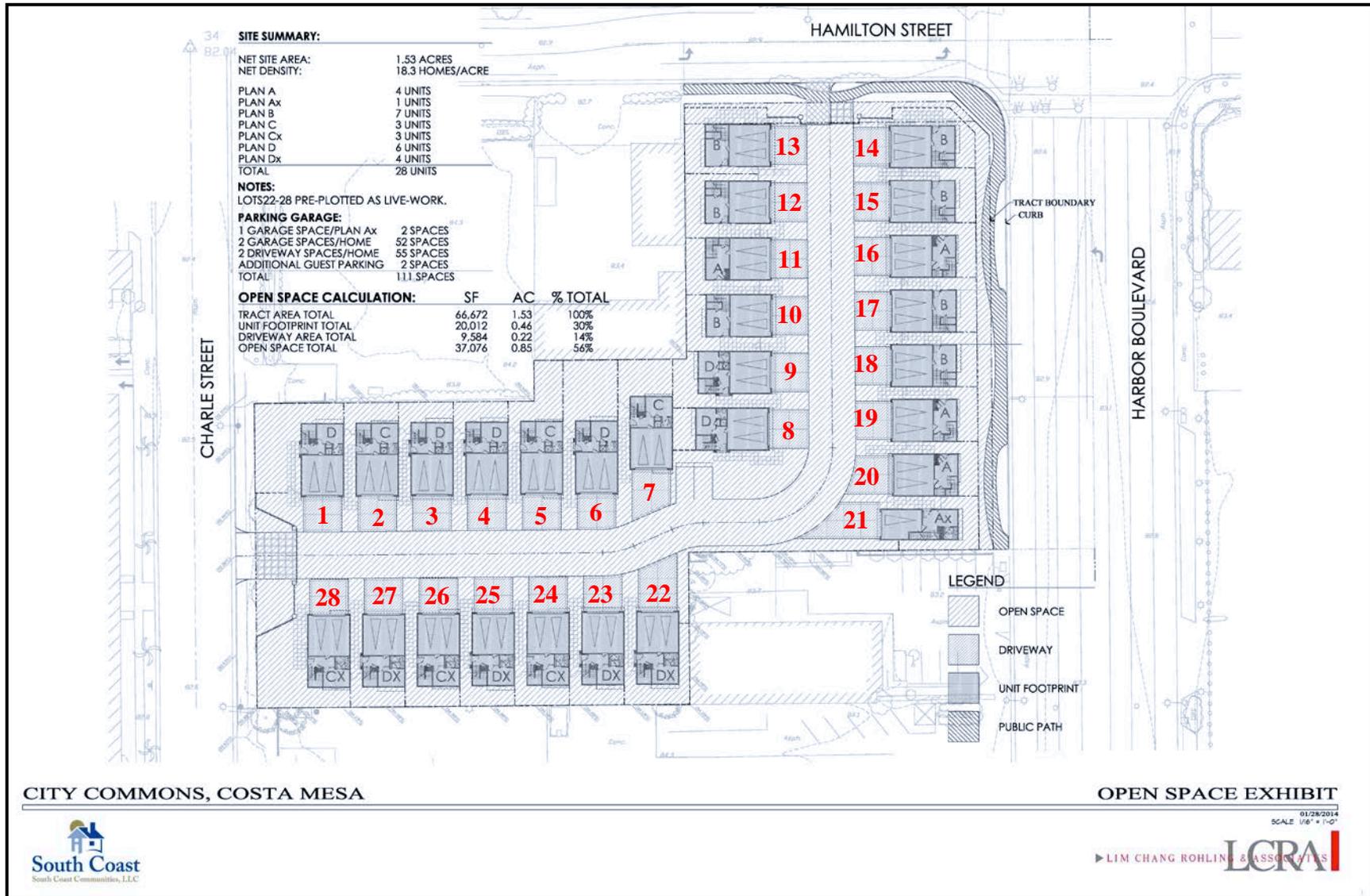


Figure 3 – Open Space Exhibit with Home Lot Numbers

3.0 Noise Exposure Standards

3.1 City of Costa Mesa, California

3.1.1 Noise Element of the General Plan (Transportation Noise Sources)

The City of Costa Mesa’s Noise Element of their General Plan (Adopted January 2002) specifies an exterior noise standard of 65 dB CNEL and an interior noise standard of 45 dB CNEL with closed windows for single family residential land use. The exterior noise standard for single residential land use is limited to private yards. The interior environment excludes bathrooms, closets and corridors.

3.1.2 Noise Ordinance of the Municipal Code (Stationary or Non Transportation Noise Sources)

The City of Costa Mesa has established exterior and interior noise standards within Title 13- Chapter XIII (Planning, Zoning and Development – Noise Control). The ordinance is designed to control unnecessary, excessive and annoying sounds generated on one piece of property from impacting an adjacent property and to protect residential areas from noise sources other than transportation sources. The residential exterior and interior noise standards are contained in Table 1 below.

Table 1 – City of Costa Mesa’s Exterior and Interior Noise Standards

Time Period	Exterior Noise Standards (dBA)					Interior Noise Standards (dBA)		
	L50	L25	L8	L2	LMax	L8	L2	LMax
Daytime (7 a.m. to 11 p.m.)	55	60	65	70	75	55	60	65
Nighttime (11 p.m. to 7 a.m.)	50	55	60	65	70	45	50	55

In the event that the alleged offensive noise consists entirely of impact noise, simple tone noise, speech, music, or any combination thereof, each of the noise levels shall be reduced by 5 dBA.

It also states corrections for time characteristics. No person shall create noise or allow the creation of noise on property owned, leased, occupied, or otherwise controlled by such person, with causes the noise level measured on any other residential property to exceed:

- 1) The exterior noise standard for a cumulative period of more than 30 minutes in any hour (L50);
- 2) The exterior noise standard plus 5 dBA for a cumulative period of more than 15 in any hour (L25);
- 3) The exterior noise standard plus 10 dBA for a cumulative period of more than 5 minutes in any hour (L8);
- 4) The exterior noise standard plus 15 dBA for a cumulative period of more than 1 minute in any hour (L2); or
- 5) The exterior noise standard plus 20 dBA for any time period (LMax).
- 6) The interior noise standard for a cumulative period of more than 5 minutes in any hour (L8);
- 7) The interior noise standard plus 5 dBA for a cumulative period of more than 1 minute in any hour (L2); or
- 8) The interior noise standard plus 10 dBA for any time period (LMax).

If the measured ambient level exceeds any of noise limit categories 1-4 and 6-7 above, the cumulative period applicable to said category shall be increased to reflect said ambient noise level. In the event measured ambient level exceeds noise limit categories 5 and 8 above, the maximum allowable noise level under said category shall be increased to reflect the maximum ambient noise level.

The noise ordinance exempts several categories of noise sources, including construction activities which take place between the hours of 7 a.m. and 7 p.m. Monday through Friday and 9 a.m. to 6 p.m. on Saturday. Construction activities are prohibited for all hours on Sundays and federal holidays.

3.2 State of California

Within the 2013 California Building Code (CBC) (California Code of Regulations, Title 24, Part 2, Volume 1, Chapter 12 – Interior Environment, Section 1207 – Sound Transmission), it is stated that residential structures located in noise critical areas shall be designed to prevent the intrusion of exterior noises beyond prescribed levels and should be consistent with the local land-use standards. Interior noise levels attributable to exterior sources shall not exceed 45 dB CNEL in any habitable room and should be consistent with the noise element of the local general plan.

Worst-case noise levels, either existing or future, shall be used as the basis for determining compliance. Future noise levels shall be predicted for a period of at least 10 years from the time of the building permit application.

Residential structures to be located where the CNEL exceeds 60 dB shall require an acoustical analysis showing that the proposed design will limit the exterior noise to the prescribed allowable interior noise level.

4.0 Noise Measurement Survey

A noise measurement survey was conducted on Monday, February 3, 2014, from the hours of 9 a.m. to 5 p.m. The goal of the noise measurement survey was to determine the existing ambient noise environment. Noise measurements recorded one second A-weighted noise values at four locations around the project's property line. Refer to Figure 4 for the noise measurement locations.

The sound level meters used to measure the noise levels were 01dB-Mettravib SOLO sound level meters. The microphones used were 01dB-Mettravib 1/2" condenser microphones. The equipment used meets the American National Standards Institute (ANSI) S1.4 specification for a Type 1 precision sound level meter. The sound level meters were calibrated before and after the test with a Brüel & Kjær Type 4231 sound level calibrator with calibration traceable to the National Institute of Standards and Technology (NIST).

Noise measurement Location 1 was selected for its close proximity to the medical office building on the southern portion of the project site adjacent to Harbor Boulevard. The sound level meter at this location was placed at a distance of 10 feet from the nearest property line. There is an existing 6-foot wood fence around the property at this location. There are currently two occupants of the medical office building: Women's Health Care Specialists and Black Robin OGNT. They both normally operate Monday-Friday from 8 a.m. to 5 p.m. and sometimes between these hours on the weekend.

Noise measurement Locations 2 and 3 were selected for their close proximity to Red-E-Rentals on the southern portion of the project site. The sound level meters at these locations were placed at a distance of 10 feet from the nearest property line. There is an existing 6-foot chain link fence around the property at these locations. Red-E-Rentals is a tool and construction equipment rental business that operates Monday-Saturday from 7 a.m. to 5:30 p.m. and Sunday from 8 a.m. to 2 p.m.

Noise measurement Location 4 was selected for its close proximity to Rudy's Garage on the north portion of the project site adjacent to Hamilton Street. The sound level meter at this location was placed at a distance of 10 feet from the nearest property line. There is an existing 6-foot chain link fence around the property at this location. Rudy's Garage is largely shielded from the project site from its own building. Rudy's Garage operates Monday-Friday from 7:30 a.m. to 5:30 p.m.



Figure 4 – Noise Measurement Locations

4.1 Noise Measurement Results

The noise measurement survey results for noise measurement Location 1 are presented in Table 2. The table lists the resulting L50, L25, L8, L2, LMax and Leq noise values in terms of dBA for each hour of the measurement. The City of Costa Mesa’s daytime exterior noise standards are listed on the bottom row of the table for comparison and values that exceed these standards are shown in red within the table. The noise at this location was dominated by traffic on Harbor Boulevard. Noise from the medical office building was not audible and therefore should have a less than significant impact to the project site.

Table 2 – Location 1 Noise Measurement Results (dBA)

Date	Start Time	End Time	L50	L25	L8	L2	LMax	Leq
2/3/2014	9:00 AM	10:00 AM	61.9	62.2	63.0	64.8	76.0	61.6
2/3/2014	10:00 AM	11:00 AM	54.4	55.3	58.1	62.5	72.0	55.8
2/3/2014	11:00 AM	12:00 AM	49.0	52.1	59.6	68.4	76.8	56.7
2/3/2014	12:00 AM	1:00 PM	49.9	52.7	59.2	75.3	82.6	62.4
2/3/2014	1:00 PM	2:00 PM	51.5	55.2	63.3	75.0	79.8	62.5
2/3/2014	2:00 PM	3:00 PM	52.1	55.5	63.5	75.0	81.3	63.3
2/3/2014	3:00 PM	4:00 PM	51.2	53.1	56.4	60.9	78.4	54.3
2/3/2014	4:00 PM	5:00 PM	51.9	53.9	57.0	62.2	75.8	54.5
Daytime Exterior Noise Standards:			55.0	60.0	65.0	70.0	75.0	-

The noise measurement survey results for noise measurement Location 2 are presented in Table 3. The table lists the resulting L50, L25, L8, L2, LMax and Leq noise values in terms of dBA for each hour of the measurement. The City of Costa Mesa’s daytime exterior noise standards are listed on the bottom row of the table for comparison and values that exceed these standards are shown in red within the table. The noise at this location was dominated by noise emanating from Red-E-Rentals. The main noise sources were from various tools, construction equipment and intercom system that operate throughout the day. Since the noise at this location was dominated by noise emanating from Red-E-Rentals and some of the noise values exceed the City of Costa Mesa’s daytime exterior noise standards, additional exterior mitigation measures will be required.

Table 3 – Location 2 Noise Measurement Results (dBA)

Date	Start Time	End Time	L50	L25	L8	L2	LMax	Leq
2/3/2014	9:00 AM	10:00 AM	57.4	60.9	63.5	66.1	71.7	59.6
2/3/2014	10:00 AM	11:00 AM	56.9	60.6	63.6	67.1	74.5	59.7
2/3/2014	11:00 AM	12:00 AM	57.0	60.5	63.0	65.7	76.3	59.3
2/3/2014	12:00 AM	1:00 PM	56.6	60.0	62.6	66.0	76.7	59.1
2/3/2014	1:00 PM	2:00 PM	57.1	60.8	63.5	67.5	76.4	63.9
2/3/2014	2:00 PM	3:00 PM	58.0	61.1	63.5	66.6	76.6	60.0
2/3/2014	3:00 PM	4:00 PM	57.2	61.2	63.7	67.8	78.3	62.9
2/3/2014	4:00 PM	5:00 PM	58.0	61.9	64.4	67.9	79.1	62.2
Daytime Exterior Noise Standards:			55.0	60.0	65.0	70.0	75.0	-

The noise measurement survey results for noise measurement Location 3 are presented in Table 4. The table lists the resulting L50, L25, L8, L2, LMax and Leq noise values in terms of dBA for each hour of the measurement. The City of Costa Mesa’s daytime exterior noise standards are listed on the bottom row of the table for comparison and values that exceed these standards are shown in red within the table. The noise at this location was dominated by noise emanating from Red-E-Rentals and since some of the noise values exceed the City of Costa Mesa’s daytime exterior noise standards, additional exterior mitigation measures will be required.

Table 4 – Location 3 Noise Measurement Results (dBA)

Date	Start Time	End Time	L50	L25	L8	L2	LMax	Leq
2/3/2014	9:00 AM	10:00 AM	52.5	53.6	56.0	59.5	64.3	53.5
2/3/2014	10:00 AM	11:00 AM	52.5	54.6	58.7	65.7	72.9	56.2
2/3/2014	11:00 AM	12:00 AM	48.4	52.9	61.5	67.7	76.7	57.3
2/3/2014	12:00 AM	1:00 PM	49.6	52.8	57.3	69.1	76.3	57.3
2/3/2014	1:00 PM	2:00 PM	51.3	54.3	59.4	69.8	74.7	58.0
2/3/2014	2:00 PM	3:00 PM	50.9	53.8	59.4	68.8	75.3	57.7
2/3/2014	3:00 PM	4:00 PM	50.3	52.2	55.2	59.9	71.5	53.0
2/3/2014	4:00 PM	5:00 PM	51.0	53.4	56.4	61.3	72.3	54.4
Daytime Exterior Noise Standards:			55.0	60.0	65.0	70.0	75.0	-

The noise measurement survey results for noise measurement Location 4 are presented in Table 5. The table lists the resulting L50, L25, L8, L2, LMax and Leq noise values in terms of dBA for each hour of the measurement. The City of Costa Mesa’s daytime exterior noise standards are listed on the bottom row of the table for comparison and values that exceed these standards are shown in red within the table. The noise at this location was dominated by traffic on Hamilton Street. Noise from Rudy’s garage was not audible and therefore should have a less than significant impact to the project site.

Table 5 – Location 4 Noise Measurement Results (dBA)

Date	Start Time	End Time	L50	L25	L8	L2	LMax	Leq
2/3/2014	9:00 AM	10:00 AM	58.5	60.2	60.0	62.4	70.6	60.3
2/3/2014	10:00 AM	11:00 AM	50.3	52.9	56.1	58.3	68.3	53.2
2/3/2014	11:00 AM	12:00 AM	48.7	50.3	57.3	65.7	72.9	54.7
2/3/2014	12:00 AM	1:00 PM	47.9	49.2	56.5	72.6	78.1	60.2
2/3/2014	1:00 PM	2:00 PM	49.4	52.9	60.4	73.2	76.5	58.5
2/3/2014	2:00 PM	3:00 PM	51.8	53.7	62.8	71.0	77.2	61.9
2/3/2014	3:00 PM	4:00 PM	49.2	50.1	53.9	57.9	74.7	50.1
2/3/2014	4:00 PM	5:00 PM	48.0	50.7	55.0	60.2	70.4	51.3
Daytime Exterior Noise Standards:			55.0	60.0	65.0	70.0	75.0	-

4.2 Required Exterior Mitigation Measures

4.2.1 Backyards of Lots 22-28

To reduce the noise emanating from Red-E-Rentals to levels that comply the City of Costa Mesa's daytime exterior noise standards at the backyards of Lots 22-28, it was calculated that a perimeter wall with a height of at least 6 feet would be required along the property line between Red-E-Rentals and the project site.

A perimeter wall with a height of 6 feet will provide approximately 5-6 dB of noise reduction, which would reduce the noise levels in Tables 3 and 4 above to within the City of Costa Mesa's daytime exterior noise standards. There are already 6-foot perimeter walls planned around the project site that will satisfy this requirement. Refer to Figure 6 for the location of the planned perimeter walls around the project site. With a perimeter wall with a height of at least 6 feet constructed along the property line between Red-E-Rentals and the project site, the noise emanating from Red-E-Rentals will comply with the City of Costa Mesa's daytime exterior noise standards at the backyards of Lots 22-28.

The perimeter walls are required to have a surface density of at least 3.5 pounds per square foot, and have no openings or gaps. They may be constructed of wood studs with stucco exterior, 3/8-inch plate glass, 5/8-inch Plexiglas, any masonry material, or a combination of these materials.

According to the commercial businesses adjacent to the project site at the time of this report, they only operate between daytime hours (7 a.m. to 11 p.m.) and not nighttime hours (11 p.m. to 7 a.m.); therefore the City of Costa Mesa's nighttime exterior noise standards are not applicable.

4.2.2 2nd Floor Balconies of Lots 22-28

Based upon the preliminary architectural plans, the 2nd floor balconies for the homes of Lots 22-28 will not have line of sight to Red-E-Rentals, but will be located in the front of each home. It was calculated that the noise levels at the 2nd floor balconies for the homes of Lots 22-28 from Red-E-Rentals will comply the City of Costa Mesa's daytime exterior noise standards. Additional exterior mitigation measures will not be required.

4.3 Interior Noise Standards

The project must comply with the City of Costa Mesa's daytime interior noise standards for Lots 22-28 adjacent to Red-E-Rentals. To comply with the daytime interior noise standards, the homes of Lots 22-28 must provide sufficient exterior to interior noise attenuation to reduce the interior noise exposure to acceptable levels.

The worst-case measured exterior noise levels within Tables 3 and 4 were 64.4 dBA L₈, 69.8 dBA L₂ and 79.1 dBA L_{Max}. The City of Costa Mesa's daytime interior noise standards are 55 dBA L₈, 60 dBA L₂ and 65 dBA L_{Max}. Therefore the rooms within the 1st-3rd floors of the homes of Lots 22-28 must provide 9.4, 9.8 and 14.1, respectively of exterior to interior noise reduction in order to meet the daytime interior noise standards. Our experience has shown that new standard construction in southern California will typically provide 25-30 dB of noise reduction.

Based upon the preliminary architectural plans, meeting the City of Costa Mesa’s daytime interior noise standards is achievable. We estimate that standard construction with double paned STC 26 windows should be sufficient to achieve the amount of noise reduction required.

An interior noise analysis will be required for the project when architectural plans become available.

5.0 Roadway Methodology

The roadway noise exposure in this report was computed using an acoustical planning and modeling program called SoundPLAN (Version 7.2). SoundPLAN was created by Braunstein & Berndt GmbH and incorporates the Federal Highway Administration (FHWA) Traffic Noise Model (TNM) (Version 2.5) noise emission and noise prediction methodology. Table 6¹ lists the arterial vehicle mix percentages for day, evening, and night time periods. The vehicles are divided into automobiles, medium trucks and heavy trucks.

Table 6 – Arterial Roadway Vehicle Mix Percentages

	Day	Evening	Night
Automobiles	75.51%	12.57%	9.34%
Medium Trucks	1.56%	0.09%	0.19%
Heavy Trucks	0.64%	0.02%	0.08%

6.0 Roadway Exterior Noise Exposure

The proposed project will be subject to noise from traffic on the three arterial roadways closest to the site: Harbor Boulevard, Hamilton Street and Charle Street.

The latest existing (2010) ADT volume for Harbor Boulevard was obtained from the Orange County Transportation Authority (OCTA) website. The future (2024) ADT volume for Harbor Boulevard was estimated using the existing (2010) ADT volume with a 1% annual growth rate.

The latest existing (2004) ADT volume for Hamilton Street was obtained from the City of Costa Mesa’s Traffic Engineering Department. The future (2024) ADT volume for Hamilton Street was estimated using the existing (2004) ADT volume with a 1% annual growth rate.

The Orange County Transportation Authority (OCTA) and City of Costa Mesa’s Traffic Engineering Department do not have an ADT volume for Charle Street because it is a small residential street with minimal traffic. Therefore, it will not modeled in this analysis.

The speed limits for Harbor Boulevard and Hamilton Street were obtained from a site visit. The existing and future traffic volumes and speed utilized in calculating the traffic noise exposure are presented in Table 7.

¹ County of Orange Environmental Management Agency, *Sound Attenuation Guidelines*, File C54-115, September 4, 1984.

Table 7 – Existing and Future Traffic Volumes and Speeds

Roadway	Type	Traffic Volumes				Speed (mph)
		Existing Year	ADT	Future Year	ADT	
Harbor Boulevard	Arterial	2010	40,000	2024	45,979	40
Hamilton Street	Arterial	2004	8,000	2024	9,762	25

The worst-case exterior noise levels at the backyards and 2nd-3rd floors of the homes were calculated and are presented in Table 8. Figure 5 shows the results as lines, or contours of equal noise exposure. The figure shows the 40-75 dB CNEL roadway noise exposure contours at ground level. The worst-case exterior noise levels within Table 8 and Figure 5 take into account the planned 6-foot perimeter walls around the project. Refer to Figure 6 for the location of the planned 6-foot perimeter walls around the project site.

The worst case exterior noise levels at the backyards were calculated to be as high as 64.6 dB CNEL along Harbor Boulevard. Since this level does not exceed the City of Costa Mesa’s exterior noise standard of 65 dB CNEL, additional exterior mitigation measures will not be required.

Table 8 – Worst-Case Exterior Noise Levels (dB CNEL)

Home Lot #	Backyard	2nd Floor	3rd Floor
1	55.6	55.7	56.1
2	55.4	55.6	56.1
3	55.0	55.2	55.8
4	54.3	54.7	55.3
5	52.3	53.6	54.6
6	50.8	52.8	54.2
7	47.9	52.1	54.1
8	50.3	53.0	55.3
9	48.1	51.0	56.0
10	57.4	58.3	59.3
11	58.8	59.7	60.3
12	60.6	61.2	61.7
13	64.6	63.9	63.9
14	63.1	70.4	70.0
15	63.7	70.7	70.3
16	63.6	71.0	70.9
17	64.0	70.8	70.3
18	63.7	70.8	70.4
19	63.7	70.8	70.4
20	63.6	70.8	70.4
21	63.5	70.6	70.1
22	56.2	57.8	60.3
23	54.5	54.3	54.6
24	52.9	53.3	53.9
25	52.2	52.7	53.2
26	50.3	52.3	52.5
27	50.6	52.1	52.1
28	50.9	52.2	52.3

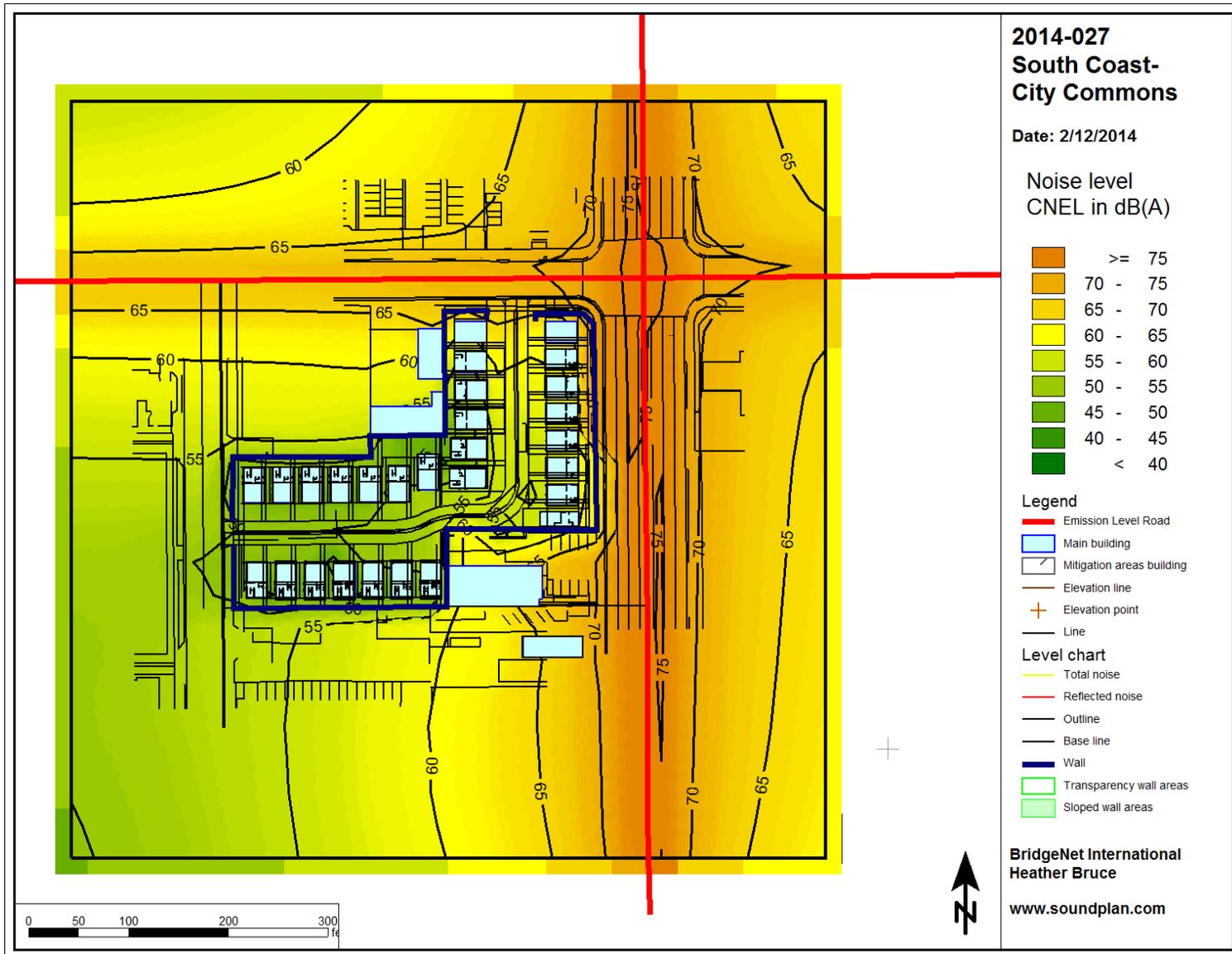


Figure 5 – Roadway Noise Exposure Contours at Ground Level (dB CNEL)

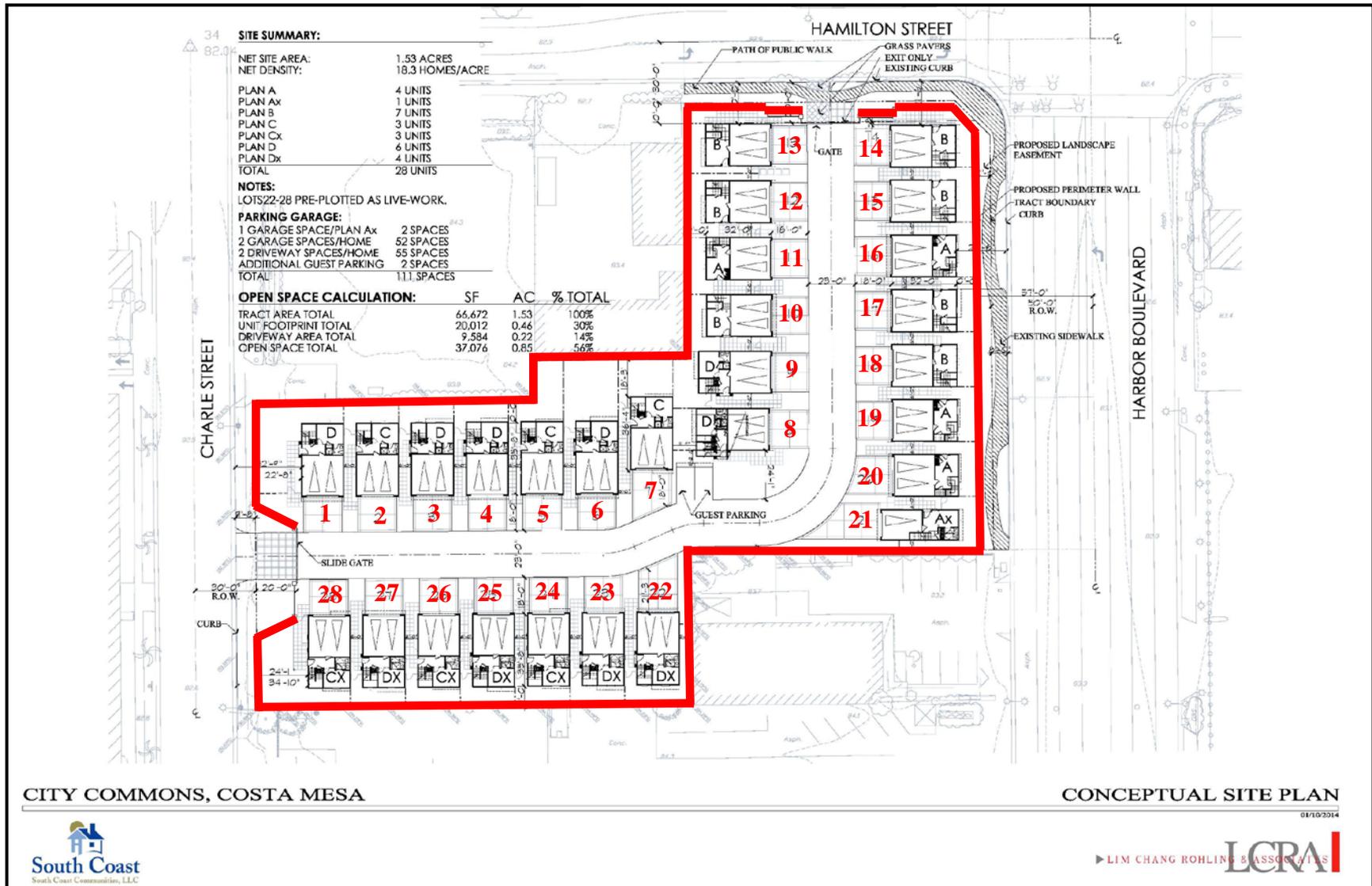


Figure 6 – Location of the Planned 6-Foot Perimeter Walls

6.0 Roadway Interior Noise Exposure

The project must comply with the City of Costa Mesa's interior noise standard of 45 dB CNEL for single family residential land use. To comply with the interior noise standard the homes must provide sufficient exterior to interior noise attenuation to reduce the interior noise exposure to acceptable levels.

The worst-case exterior noise levels at the 1st-3rd floors of the homes were calculated to be as high 64.6, 71.0 and 70.9 dB CNEL, respectively. This means the rooms within the 1st-3rd floors of the homes must provide at least 19.6, 26.0 and 25.9 dB, respectively of exterior to interior noise reduction in order to meet the interior noise standard. Our experience has shown that new standard construction in southern California will typically provide 25-30 dB of noise reduction.

Based upon the preliminary architectural plans, meeting the City of Costa Mesa's interior noise standard of 45 dB CNEL for single family residential land use is achievable. We estimate that some of the windows/doors within the rooms of the 2nd and 3rd floors of some of the homes adjacent to Harbor Boulevard may need to be upgraded from STC 26 to between STC 28-30.

An interior noise analysis will be required for the project when architectural plans become available.

7.0 References

County of Orange Environmental Management Agency, *Sound Attenuation Guidelines*, File C54-115, September 4, 1984.

Lim Chang Rohling & Associates., Civil Engineering Site Plan for *City Commons*, City of Costa Mesa, California, January 28, 2014.