330 MONTAGUE EXPRESSWAY
ENVIRONMENTAL NOISE ASSESSMENT
MILPITAS, CALIFORNIA

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INTRODUCTION

This report summarizes our environmental noise assessment for a residential project between Montague Expressway and Trade Zone Boulevard in Milpitas, California. The purpose of this study is to quantify the noise environment at the site, compare it with applicable City and State standards, and propose conceptual noise mitigation measures as needed. For readers not familiar with the fundamental concepts of environmental noise, please refer to Appendix A. Following is a summary of our findings:

1. Incorporating sound-rated windows and exterior doors at selected locations will reduce interior noise levels to DNL 45 dBA or lower. Preliminary estimates suggest that sound insulation ratings up to approximately STC 37 may be needed along Montague Expressway and Trade Zone Boulevard.
2. Where windows will need to be closed to meet the indoor noise criterion, units must incorporate ventilation or air-conditioning systems to provide a habitable interior environment.
3. Solid noise barriers in the range of 6 to 8 feet tall at the yards of single-family homes along Montague Expressway will reduce future traffic noise to approximately DNL 64 to 66 dBA: the City's *conditionally acceptable* level. The proposed houses will reduce traffic noise to these levels, or lower, in the yards of other single-family homes across the site.
4. Estimated future environmental noise in the common outdoor use spaces along Montague Expressway exceed the City's *normally* and *conditionally acceptable* levels (DNL 65 and 70 dBA). Options to reduce environmental noise include incorporating solid barriers or re-locating buildings to shield the outdoor use spaces.
5. The Milpitas Municipal Code does not identify specific noise levels that are acceptable for mechanical equipment. Noise should be considered when selecting and locating air condensing units.

DESCRIPTION

The project consists of a combination of multi-family and single-family detached residences with approximately 13 townhouse-style buildings and 42 detached houses (see Figure 1, attached). Shared outdoor use space is expected to consist of landscaped areas throughout the site, individual balconies for the multi-family units, and fenced yards for the detached houses. Mechanical equipment may consist of residential air-conditioning units.

The 8-acre site is located in the northeast quadrant of the intersection of Montague Expressway and Trade Zone Boulevard. A commercial office complex, comprised of 3 buildings, currently occupies the site. Surrounding land uses include commercial office buildings and an auto-wrecking yard. The site is part of a larger area that is included in a specific plan titled the Milpitas Transit Area Specific Plan.

APPLICABLE CRITERIA

City of Milpitas General Plan

The Noise Element of the Milpitas General Plan contains land use compatibility guidelines for environmental noise in the community. Noise levels are characterized in terms of Day/Night Average Sound Levels (DNL). Table 1, below, summarizes these guidelines for single- and multi-family residential land uses.

Table 1: Summary of Table 6-1 – Land Use Compatibility for Community Noise Environments

Exterior DNL Value		Residential Compatibility Level
Single-family	Multi-family	
60 dBA or less	65 dBA or less	Normally Acceptable: Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.
55 to 70 dBA	60 to 70 dBA	Conditionally Acceptable: New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design.
70 to 75 dBA		Normally Unacceptable: New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.

- Policy 6-1-4 of the Noise Element prompts the use of mitigation measures to reduce sound levels in rear yards and common open space in single- and multi-family residences, respectively, to acceptable levels when environmental noise exceeds the *normally acceptable* levels.
- Policy 6-1-5 of the Noise Element defines DNL 45 dBA as the interior noise level goal for all residences, and requires the incorporation of mechanical ventilation where "use of windows for ventilation will result in higher than DNL 45 dBA interior noise levels". This is consistent with CBC requirements for multi-family residences.

City of Milpitas Municipal Code

Chapter 213 of the Milpitas Municipal Code prohibits the generation of disturbing noise on residentially zoned properties during nighttime hours between 10:00pm and 7:00am. Disturbing noise is defined as "…any sound or vibration caused by sound which occurs with such intensity, frequency or in such a manner as to disturb the peace and quiet of any person."

California Building Code (CBC)

The California Building Code limits indoor noise from outdoor sources to DNL 45 dBA in habitable rooms of attached housing.[1] Projects exposed to an outdoor DNL greater than 60 dBA require an acoustical analysis during the design phase showing that the proposed

[1] 2010 California Building Code, California Code of Regulations, Title 24, Part 2, Chapter 12, Section 1207: Sound Transmission.

design will limit outdoor noise to the prescribed allowable interior level. Additionally, if windows must be closed to meet the interior standard, "the design for the structure must also specify a ventilation or air-conditioning system to provide a habitable interior environment."

ENVIRONMENTAL NOISE

Existing Noise Environment

To quantify the existing noise environment, three long-term monitors continuously measured noise levels at the site between the 6th and 9th of June 2011. In addition, short-term "spot" measurements were conducted and compared with corresponding time periods of the long-term monitors to determine how noise levels vary across the site and at different elevations. Table 2 summarizes existing noise levels at the site. Figure 1, attached, shows approximate measurement locations.

Table 2: Existing Noise Environment

Site	Location	Date / Time	DNL
LT-1	Montague Expressway Monitor Approx. 85' east of Montague Expy centerline	6 to 9 June 2011	72 dBA
LT-2	Montague and Trade Zone Corner Monitor Approx. 110' southeast of Montague Expy centerline, 95' north of Trade Zone Blvd centerline		72 dBA
LT-3	Trade Zone Boulevard Monitor Approx. 65' north of Trade Zone Blvd centerline		71 dBA
ST-1	Montague Expressway Spot Measurement Approx. 95' southeast of Montague Expy centerline (1st floor / 2nd floor and above)	9:05 to 9:20 9 June 2011	67 / 70 dBA
ST-2	Central Site Spot Measurement Approx. 1st floor elevation	9:05 to 9:20 9 June 2011	54 dBA
ST-3	Trade Zone Boulevard Spot Measurement Approx. 70' north of Trade Zone Blvd centerline (1st floor / 2nd floor and above)	10:05 to 10:20 9 June 2011	65 / 70 dBA

Environmental noise at the site is dominated by vehicle traffic on local roadways. However, future residents should be made aware that they may hear intermittent noise from adjacent businesses including the auto-wrecking yard (e.g., forklifts, impact wrenches, saws, etc.).

Future Noise Environment

The Draft Environmental Impact Report (DEIR) for the Milpitas Transit Area Specific Plan (TASP), dated October 2007, indicates that AM peak-hour traffic volumes along Montague Expressway will increase by approximately 4 percent per year. Over a ten-year period, the cumulative annual increase plus the future increase due to the build-out of the TASP corresponds with an approximate 3-decibel increase in environmental noise. In the absence of future traffic data along Trade Zone Boulevard, this assessment assumes a similar increase in noise levels across the site. Estimated future noise levels are shown in

Figure 1, attached, and assume that site elevation will not change significantly in the future.[2]

ANALYSIS AND RECOMMENDATIONS

Environmental Noise

As shown in Figure 1 attached, estimated future environmental noise levels at the site range from approximately DNL 57 dBA at the interior shielded areas to DNL 75 dBA at the proposed setback of homes along Montague Expressway. Consider the following:

1. The project must incorporate sound-rated windows and doors to reduce environmental noise to DNL 45 dBA or lower indoors. To provide an estimate of the extent of mitigation that may be needed, preliminary estimates assume a 12-foot by 14-foot room with approximately one-third of one or two exterior facades consisting of windows, and exterior walls consisting of 3-coat stucco over wood sheeting.

   Based on these assumptions, preliminary estimates suggest that windows along Montague Expressway and Trade Zone Boulevard will need to be in the range of STC[3] 34 to 37 on the second and third stories, and STC 30 to 34 at first floor elevations. For the second row of houses, windows with sound insulation ratings in the range of STC 26 to 32 may be needed. Standard construction-grade dual pane windows will likely suffice in other portions of the site.[4]

2. Where windows will need to be closed to meet the interior noise criterion, the design must include "…a ventilation or air-conditioning system to provide a habitable interior environment." This should be discussed with the project mechanical engineer, and must not compromise sound insulation. This will apply to all units except the northeastern-most units without a line of sight to the adjacent roadways. Specific units should be determined once the site plan is finalized.

3. Noise levels in outdoor use spaces will vary, depending on location and orientation on site. The conceptual site plan shows individual fenced yards at single-family homes and common open spaces throughout the site. Preliminary estimates suggest the following: [5]

   a. Single-family homes – Solid noise barriers approximately 6 to 8 feet tall at the yards of single-family homes along Montague Expressway would reduce estimated traffic noise to approximately DNL 64 to 66 dBA: within the City's *conditionally acceptable* range. Details should be determined during the design phase when site and grading plans have been finalized.

   b. Multi-family homes – Estimated future traffic noise is in the City's *normally unacceptable* land use category at the common outdoor use spaces nearest to and along Montague Expressway. There may be some trade-off between the City's

[2] The elevation of the site appears to be higher than Montague Expressway and Trade Zone Boulevard.
[3] Sound Transmission Class (STC) — A single number used to compare walls, floor/ceiling assemblies, windows and doors for their sound insulating properties with respect to speech and small household appliance noise.
[4] For reference, typical dual-zone construction-grade windows and sliding glass doors have sound insulation ratings in the range of STC 26 to 28.
[5] Barrier heights are with respect to finish grade of the receiving location (residents).

aesthetic goals for the site and allowable noise levels. Options for reducing noise exposure include the following:

i. Incorporate noise barriers to shield roadway traffic. Preliminary estimates suggest that incorporating approximately 7-foot-tall noise barriers along Montague Expressway would reduce traffic noise to the City's *normally acceptable* level of DNL 65 dBA.

ii. Re-orient buildings so that common open spaces are not located along Montague Expressway. Shielding from the proposed buildings would reduce estimated traffic noise to the City's *normally* and *conditionally acceptable* ranges.

Effective barriers should be solid from bottom to top with no cracks or gaps and should have a minimum surface density of three pounds per square foot. Details should be determined during the design phase.

4. It is recommended that the owners disclose the potential for intermittent noise from adjacent businesses to future residents.

Mechanical Equipment (associated with the project)

Mechanical equipment associated with the project is expected to consist of residential air-conditioning units. While the Milpitas Municipal Code does not identify specific noise level limits, the project should consider noise levels at neighboring units when selecting and locating units.

* * *

● INDICATES APPROXIMATE NOISE MEASUREMENT LOCATION

NOTE: DRAWING PROVIDED BY OTHERS; NOT TO SCALE

330 MONTAGUE EXPRESSWAY RESIDENTIAL SITE PLAN INDICATING ESTIMATED FUTURE NOISE ENVIRONMENT

FIGURE 1

CSA PROJECT NO. 11-0229
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APPENDIX A

FUNDAMENTAL CONCEPTS OF ENVIRONMENTAL NOISE

This section provides background information to aid in understanding the technical aspects of this report.

Three dimensions of environmental noise are important in determining subjective response. These are:

a) The intensity or level of the sound;
b) The frequency spectrum of the sound; and
c) The time-varying character of the 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.

The "frequency" of a sound refers to the number of complete pressure fluctuations per second in the sound. The unit of measurement is the cycle per second (cps) or hertz (Hz). Most of the sounds which we hear in the environment do not consist of a single frequency, but of a broad band of frequencies, differing in level. The name of the frequency and level content of a sound is its sound spectrum. A sound spectrum for engineering purposes is typically described in terms of octave bands, which separate the audible frequency range (for human beings, from about 20 to 20,000 Hz) into ten segments.

Many rating methods have been devised to permit comparisons of sounds having quite different spectra. Surprisingly, the simplest method correlates with human response practically as well as the more complex methods. This method consists of evaluating all of the frequencies of a sound in accordance with a weighting that progressively de-emphasizes the importance of frequency components below 1000 Hz and above 5000 Hz. This frequency weighting reflects the fact that human hearing is less sensitive at low frequencies and at extreme high frequencies relative to the mid-range.

The weighting system described above is called "A"-weighting, and the level so measured is called the "A-weighted sound level" or "A-weighted noise level." The unit of A-weighted sound level is sometimes abbreviated "dBA." In practice, the sound level is conveniently measured using a sound level meter that includes an electrical filter corresponding to the A-weighting characteristic. All U.S. and international standard sound level meters include such a filter.

Although a single sound level value may adequately describe environmental noise at any instant in time, community noise levels vary continuously. Most environmental noise is a conglomeration of distant noise sources, which results in a relatively steady background noise having no identifiable source. These distant sources may include traffic, wind in trees, industrial activities, etc. and are relatively constant from moment to moment. As natural forces change or as human activity follows its daily cycle, the sound level may vary slowly from hour to hour. Superimposed on this slowly varying background is a succession of identifiable noisy events of brief duration. These may include nearby activities such as single vehicle passbys, aircraft flyovers, etc. which cause the environmental noise level to vary from instant to instant.

To describe the time-varying character of environmental noise, statistical noise descriptors were developed. "L_{10}" is the A-weighted sound level equaled or exceeded during 10 percent of a stated time period. The L_{10} is considered a good measure of the maximum sound levels caused by discrete noise events. "L_{50}" is the A-weighted sound level that is equaled or exceeded 50 percent of a stated time period; it represents the median sound level. The "L_{90}" is the A-weighted sound level equaled or exceeded during 90 percent of a stated time period and is used to describe the background noise.

As it is often cumbersome to quantify the noise environment with a set of statistical descriptors, a single number called the average sound level or "L_{eq}" is now widely used. The term "L_{eq}" originated from the concept of a so-called equivalent sound level which contains the same acoustical energy as a varying sound level during the same time period. In simple but accurate technical language, the L_{eq} is the average A-weighted sound level in a stated time period. The L_{eq} is particularly useful in describing the subjective change in an environment where the source of noise remains the same but there is change in the level of activity. Widening roads and/or increasing traffic are examples of this kind of situation.

In determining the daily measure of environmental noise, it is important to account for the different response of people to daytime and nighttime noise. During the nighttime, exterior background noise levels are generally lower than in the daytime; however, most household noise also decreases at night, thus exterior noise intrusions again become noticeable. Further, most people trying to sleep at night are more sensitive to noise.

To account for human sensitivity to nighttime noise levels, a special descriptor was developed. The descriptor is called the DNL (Day/Night Average Sound Level), which represents the 24-hour average sound level with a penalty for noise occurring at night.

The DNL computation divides the 24-hour day into two periods: daytime (7:00 am to 10:00 pm); and nighttime (10:00 pm to 7:00 am). The nighttime sound levels are assigned a 10 dB penalty prior to averaging with daytime hourly sound levels. For highway noise environments, the average noise level during the peak hour traffic volume is approximately equal to the DNL.

The effects of noise on people can be listed in three general categories:

a) Subjective effects of annoyance, nuisance, dissatisfaction;
b) Interference with activities such as speech, sleep, and learning; and
c) Physiological effects such as startle, hearing loss.

The sound levels associated with environmental noise usually produce effects only in the first two categories. Unfortunately, there has never been a completely predictable measure for the subjective effects of noise nor of the corresponding reactions of annoyance and dissatisfaction. This is primarily because of the wide variation in individual thresholds of annoyance and habituation to noise over time.

Thus, an important factor in assessing a person's subjective reaction is to compare the new noise environment to the existing noise environment. In general, the more a new noise exceeds the existing, the less acceptable the new noise will be judged.

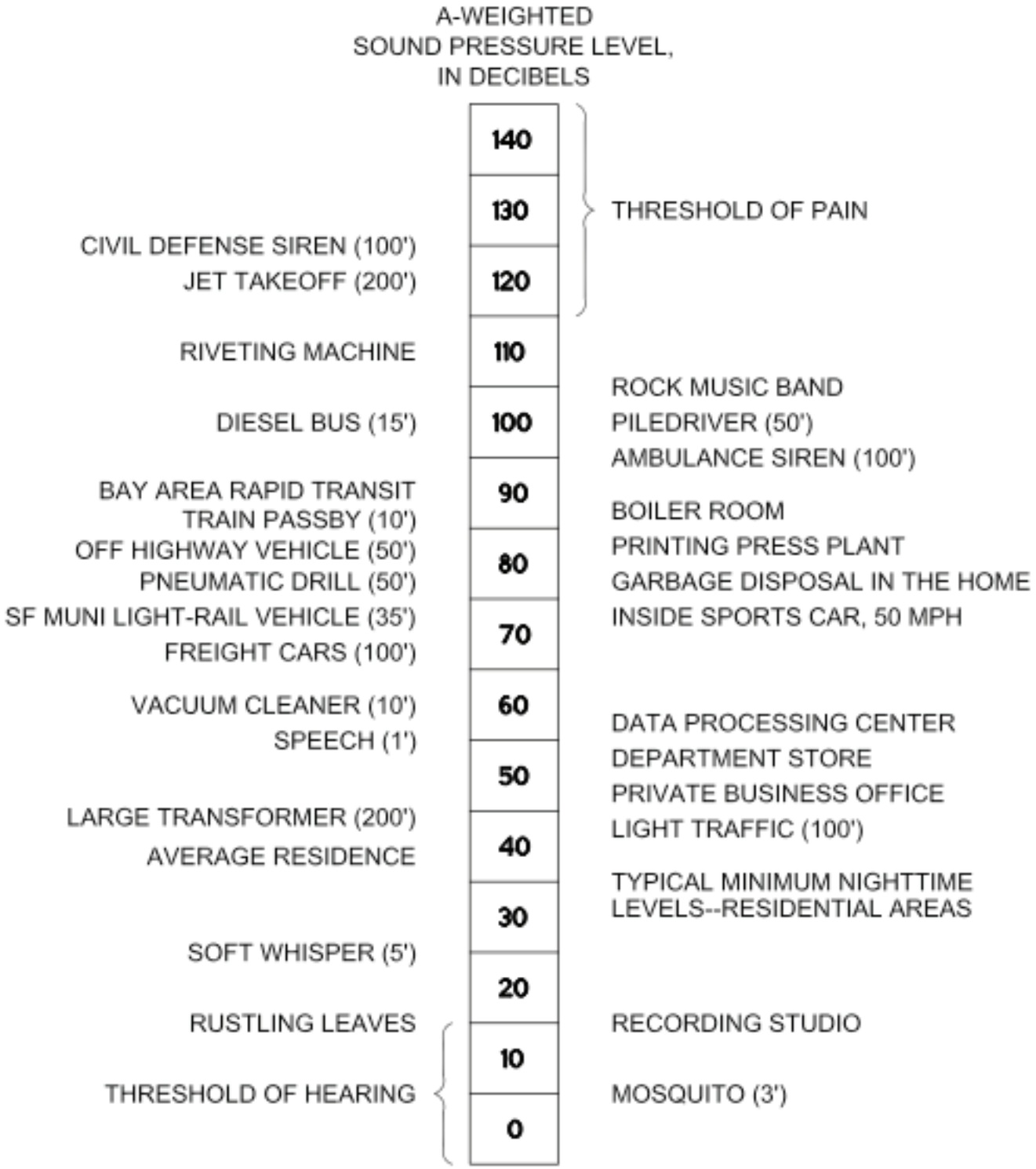
With regard to increases in noise level, knowledge of the following relationships will be helpful in understanding the quantitative sections of this report:

a) Except in carefully controlled laboratory experiments, a change of only 1 dB in sound level cannot be perceived.

b) Outside of the laboratory, a 3 dB change is considered a just-noticeable difference.

c) A change in level of at least 5 dB is required before any noticeable change in community response would be expected.

d) A 10 dB change is subjectively heard as approximately a doubling in loudness, and would almost certainly cause an adverse community response.



(100') = DISTANCE IN FEET BETWEEN SOURCE AND LISTENER

TYPICAL SOUND LEVELS MEASURED IN THE ENVIRONMENT AND INDUSTRY

FIGURE 2

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