

CHRISTOPHER JEAN & ASSOCIATES, INC.
ACOUSTICAL CONSULTING SERVICES

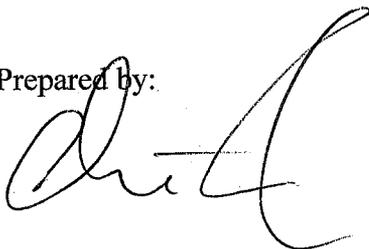
September 18, 2019

ACOUSTICAL ANALYSIS

FAIRFIELD INN & SUITES

CITY OF GREENFIELD, CA

Prepared by:



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Prepared for:

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CHRISTOPHER JEAN & ASSOCIATES, INC.

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SUMMARY

This analysis has been completed to determine the exterior and interior noise exposure and the necessary mitigation measures for the proposed Fairfield Inn & Suites project located in the City of Greenfield, California. A list of requirements and recommendations is given in the following summary. Details are discussed in the body of the report.

A. EXTERIOR NOISE CONTROL

Sound walls at least ten feet (10') high must be constructed around the perimeter of the pool area if the City wants this area to comply with its 65 dBA CNEL exterior noise limit. However, the City's General Plan allows the City to exempt pool areas of hotels that would be difficult to mitigate.

B. NOISE CONTROL BARRIER CONSTRUCTION MATERIALS

The required noise control barriers may be constructed using any of the following materials:

- (1) Masonry block
- (2) Stucco on wood frame
- (3) 3/4" plywood
- (4) 1/4" tempered glass or 1/2" Lexan
- (5) Earthen berm
- (6) Any combination of the above materials or any material with a surface weight of at least 3.5 pounds per square foot.

Each completed noise control barrier must present a solid face from top-to-bottom and end-to-end. Cutouts are not permitted except for drain holes.

C. INTERIOR NOISE CONTROL

The buildings shall be constructed, as a minimum, in accordance with the outline of Table 5 found in the body of the report. This will be adequate for all units with the following exceptions:

- (1) Add STC 26 glazing to all rooms on the front of the building
- (3) Add STC 34 glazing to all rooms on the left or right sides of the building
- (4) Add STC 38 glazing to all rooms on the rear of the building
- (5) Install two layers of interior drywall on all exterior walls and all third floor ceilings of rooms on the rear of the building

D. VENTILATION

This analysis assumed that all windows and doors are kept closed. If the allowable interior noise levels are met by requiring that windows and doors be kept closed, then the design of the structure must also specify a ventilation or air conditioning system to provide a habitable interior environment. The ventilation system must not compromise the dwelling or guest room noise reduction.

E. UNIT-TO-UNIT NOISE CONTROL

Common floor/ceiling assemblies between units are subject to Title 24 Sound Transmission Class (STC) and Impact Insulation Class (IIC) requirements. The plan set provided for this analysis proposes the following common floor/ceiling assembly:

- (1) Finish flooring, 1" Gyp-Crete, Acousti-Mat II (in hard flooring areas), plywood sub-floor, TJI joists, 3 1/2" thick fiberglass insulation, resilient channels, 5/8" drywall ceiling (STC 58 per acoustical test number NGC 5012050, FIIC 52 with ceramic tile per acoustical test number 1801 99 1736.4, FIIC 53 with vinyl per acoustical test number 1801 99 1736.3, and 70 IIC with carpet and pad per acoustical test number IN 86-6)

Note that all hard flooring areas must employ the Acousti-Mat II underlayment to achieve the required minimum rating of IIC 50.

Common wall assemblies between units are subject to Title 24 Sound Transmission Class (STC) requirements. The plan set provided for this analysis proposes the following common wall assembly:

- (1) One layer of 5/8" direct nailed drywall, 2" by 4" plate, 2" by 4" studs, 3 1/2" thick fiberglass insulation, resilient channels, one layer 5/8" drywall screwed to channels (this detail cites the Gypsum Association file WP 3242 and claims a sound rating of STC 50 to 54)

While it may be true that a laboratory built wall of this type can indeed achieve a rating of STC 50+, years of field testing has shown that few field built walls of this type can achieve a rating of FSTC 45. Normal conversation, television and radio sounds will be clearly audible through such walls and hotel guests may complain about noise. Thus, it is highly recommended that this wall be used only as a corridor wall and that it be upgraded by adding a second layer of drywall on one side.

It is highly recommended that one of the widely used common wall assemblies, all of which rate at least STC 50, be incorporated into the building plans:

- (1) Two layers 1/2" direct nailed drywall, 2" by 6" plate, 2" by 4" staggered studs, fiberglass insulation, two layers 1/2" direct nailed drywall (Owens/Corning Fiberglas, OCF W-55-69, 1969, 16f, Owens/Corning Fiberglas, STC 54)
- (2) Two layers of 5/8" direct nailed drywall, 2" by 6" plate, 2" by 4" staggered studs, 3 1/2" thick fiberglass insulation, two layers 5/8" direct nailed drywall (National Gypsum Company NGC 2376, 1970, 16f, STC 53)
- (3) 5/8" direct nailed drywall, 2" by 4" plate with 2" by 4" studs, 3 1/2" thick fiberglass insulation, 1" clear air space at plate, 2" by 4" plate with 2" by 4" studs, 5/8" direct nailed drywall (Owens/Corning Fiberglas OCF 448, 1967, 16f, STC 56)
- (4) Same as #3 but with two layers of 3 1/2" thick fiberglass insulation (Riverbank Acoustical Labs TL 75-83, 1975, 16f, for U. S. Department of Agriculture, STC 57)
- (5) Two layers 5/8" direct nailed drywall, 2" by 4" plate with 2" by 4" studs, 3 1/2" thick fiberglass insulation, 1" clear air space at plate, 2" by 4" plate with 2" by 4" studs, two layers 5/8" direct nailed drywall (National Gypsum Company, NGC 3056, 1970, 16f, for Gypsum Association, STC 58)
- (6) Same as #5 but with two layers of 3 1/2" thick fiberglass insulation (Riverbank Acoustical Labs TL 75-82, 1975, 16f, for U. S. Department of Agriculture, STC 63)

All wall assemblies between any common space and a living unit must be an STC 50 minimum rated assembly. All plumbing, mechanical and electrical installations shall be installed per the instructions and details contained in Appendix 6. Add all appropriate details to the project plans.

F. PROJECT DISCLOSURE

The acoustical code requirements represent minimal acceptable standards. Compliance with the Building Department acoustical criteria does not require, guarantee or even imply that local sound sources will be mitigated to inaudibility. Compliance with an exterior noise limit of 65 dBA CNEL means that exterior noise will remain clearly audible within the mitigated exterior space. Compliance with an interior noise limit of 45 dBA CNEL means that exterior noise sources will remain audible on the interior of a building.

Due to quality control and other field related problems, the code minimum laboratory ratings of STC/IIC 50 for common assemblies does not guarantee that all common assemblies will pass a field test. In fact, there is a 50 percent chance that half of all common assemblies rated at the STC/IIC minimum could fail field tests. An STC 50 rated assembly will produce around 45 dBA of voice reduction in the field. This means that normal conversation in adjoining units will be audible a certain percentage of the time.

Do not misrepresent the degree of exterior to interior or unit-to-unit acoustical isolation as anything more than meeting code during any phase of this project. Never, ever, use any form of the term "Soundproof" to describe any portion of this project.

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1.0 INTRODUCTION

This report presents the results of a noise impact and design study of the proposed Fairfield Inn & Suites project located in the City of Greenfield, California. This report includes a discussion of the expected exterior community noise environment and the recommendations for control of noise in the exterior and interior living spaces.

A vicinity map showing the general location of the project site is presented in Exhibit 1 – Site Location Map. An aerial photograph of the existing project site and its surroundings is shown on Exhibit 2. The project site plan is shown on Exhibit 3. The project consists of a hotel building.

2.0 APPLICABLE NOISE CRITERIA

The City of Greenfield requires all residential projects to conform to the requirements of Table 1.

TABLE 1

APPLICABLE NOISE CRITERIA (1)

Exterior	65 dBA CNEL*
Interior	45 dBA CNEL
Unit-to-Unit	STC 50/IIC 50

- (1) Please see Noise Rating Methods (Appendix 1) for an explanation of the commonly applicable acoustical terminology. The asterisk denotes the City's option to waive the 65 dBA CNEL exterior noise limit for hotel pool areas that could prove difficult to mitigate per a General Plan exemption.

3.0 DESIGN NOISE LEVELS

3.1 ROADWAYS

The expected future roadway noise impact was projected using the Federal Highway Administration's Highway Noise Prediction Model (FHWA RD-77-108) together with several roadway and site parameters that determine the projected impact of vehicular traffic noise. These include the roadway cross-section (e.g. number of lanes), the roadway active width, the average daily traffic (ADT), the vehicle travel speed, the percentage of auto and truck traffic, the roadway grade, the angle of view, the site conditions ("hard" or "soft" site), and the percentage of average daily traffic that flows each hour throughout a 24 hour period.

The arterial forecast traffic volume was obtained by applying a twenty-year traffic projection, at a growth rate of two percent per year, to the existing traffic volume quoted in the General Plan of the City of Greenfield. The percentage of truck traffic was taken from a standard arterial mix. The same source was used to project the distribution by time of day. The input data is listed in Table 2.

TABLE 2

TRAFFIC INPUT DATA

	<u>% DAY</u>	<u>% EVENING</u>	<u>% NIGHT</u>	<u>% VOLUME</u>
Autos	75.51	12.57	9.34	100.0
Medium Trucks	1.56	0.09	0.19	100.0
Heavy Trucks	0.64	0.02	0.08	100.0
Volume =	5,600 ADT on Walnut Avenue			
Speed =	35 MPH (posted)			

The U.S. 101 Freeway forecast traffic volume was obtained from CALTRANS data. CALTRANS data was also used for the percentage of truck traffic and to project the distribution by time of day. The input data is listed in Table 3 on the following page.

TABLE 3TRAFFIC INPUT DATA – 101 FREEWAY

	<u>% DAY</u>	<u>% EVENING</u>	<u>% NIGHT</u>	<u>% VOLUME</u>
Autos	73.00	8.60	18.40	88.4
Medium Trucks	73.00	8.60	18.40	4.2
Heavy Trucks	69.10	6.70	24.20	7.5
Volume =	48,200 ADT			
Speed =	65 MPH (posted)			

The calculations are contained in Appendix 2. The calculations yield design noise levels of 60 dBA CNEL at 100 feet from the centerline of Walnut Avenue and 81 dBA CNEL at 100 feet from the centerline of the 101 Freeway.

3.2 RAILROAD

There are no railroad operations in the vicinity of the project site. Railroad noise will not impact the site.

3.3 AIRCRAFT

There are no concentrated aircraft operations in the vicinity of the project site. Aircraft noise does not impact the site.

4.0 MITIGATION MEASURES

4.1 EXTERIOR

The mitigation of exterior noise would require a sound barrier around the proposed pool area. For purposes of analysis, the barrier height calculations assume that the barrier is located at the perimeter of the pool area, and is only intended to reduce exterior noise to 65 dBA CNEL at the first floor level. The assumptions for the barrier height calculations are listed in Table 4 on the following page.

TABLE 4

BARRIER ANALYSIS GENERAL ASSUMPTIONS
FOR RECEIVER AND SOURCE GEOMETRY

<u>RECEIVER ASSUMPTIONS</u>	
<u>HORIZONTAL GEOMETRY</u>	<u>VERTICAL GEOMETRY</u>
Distance behind top-of-roadways barrier: 5' to 10'	Height above pad for ground level receivers: 5'
Distance behind individual patio and balcony barriers: 1' to 3'	Height above pad for second level receivers: 14'
<u>SOURCE ASSUMPTIONS</u>	
<u>HORIZONTAL GEOMETRY *</u>	<u>VERTICAL GEOMETRY</u>
For roadways with grades no greater than 2%, all vehicles were located at the single lane equivalent acoustic center of the full roadway. For roadways with over 2% grade, vehicle count was divided in half and located at the single lane equivalent acoustic center for each side of the roadway.	Automobiles: 0' above center of road grade
	Medium Trucks: 2.3' above center of road grade
	Heavy Trucks: 8' above center of road grade

* = Single Lane Equivalent (SLE) location.

The barrier calculations are contained in Appendix 3. These calculations show that sound barriers at least ten feet (10') high must be erected around the perimeter of the pool area to meet the City's 65 dBA CNEL exterior noise limit. However, the City's General Plan allows for the pool area of a hotel to be exempt from compliance should such compliance be deemed impractical for a specific location.

The required noise control barriers may be constructed using any of the following materials:

- (1) Masonry block
- (2) Stucco on wood frame
- (3) 3/4" plywood
- (4) 1/4" tempered glass or 1/2" Lexan
- (5) Earthen berm

- (6) Any combination of the above materials or any material with a surface weight of at least 3.5 pounds per square foot.

Each completed noise control barrier must present a solid face from top-to-bottom. Cutouts and/or openings are not permitted except for drain holes.

4.2 INTERIOR

The City's exposure criteria for new hotel construction require that the interior noise environment, attributable to outside noise sources, be limited to 45 dBA CNEL. Analysis and recommendations for control of outdoor-to-indoor noise intrusion are presented in this section.

The exterior-to-interior noise reduction expected for the planned construction was based on a detailed analysis of sample rooms and units planned for the development. Calculations of the expected typical noise reduction performance were performed for sample rooms. The analysis was based on the typical spectra expected for the primary sources of community noise impact, the typical octave-band transmission loss for each element in the planned building shell, the relative square footage of each element of the planned building shell, the expected typical interior surface treatment, and the acoustical absorption coefficient for each interior surface treatment. Corrections for the "A" Weighted room absorption factors are also included.

Each component of the building shell (e.g. exterior wall, windows, doors, etc.) provides a different amount of transmission loss for each "A" Weighted octave-band of community noise. With the knowledge of the building shell components and their individual octave band transmission loss values for the noise sources, calculations of the composite building shell transmission loss can be made for each room.

The characteristics of the basic building shell are listed in Table 5 on the following page.

TABLE 5BASIC BUILDING SHELL CHARACTERISTICS

<u>PANEL</u>	<u>CONSTRUCTION</u>
Exterior Wall	Siding or stucco, 2" X 4" studs, R-13 fiberglass insulation, 1/2" drywall
Windows	Double pane
Roof	Built-up over 1/2" plywood, fiberglass insulation, 5/8" drywall, vented
Floor	Carpeted
HVAC	PTAC unit sound rated at least STC 29

Table 5 construction minimums will provide around 20 dBA of interior noise reduction.

For convenience of assessment, the specific noise levels at the building faces are given in Table 6.

TABLE 6NOISE LEVELS AT THE BUILDING FACES

<u>F A C E</u>			
<u>NORTH</u>	<u>EAST</u>	<u>SOUTH</u>	<u>WEST</u>
73	67	73	76

The results of Table 6 show that interior noise reduction levels as high as 31 dBA will be required for units facing the 101 Freeway. Since Table 5 construction will yield only around 20 dBA, specific room calculations were carried out to determine whether additional mitigation is needed.

The calculations are contained in Appendix 4, and the results are given in Table 7 on the following page.

TABLE 7ROOM NOISE REDUCTION VALUES

<u>ROOM</u>	<u>NOISE REDUCTION VS. GLAZING STC</u>									
	<u>24</u>	<u>26</u>	<u>28</u>	<u>30</u>	<u>32</u>	<u>34</u>	<u>36</u>	<u>38</u>	<u>40</u>	
King/King Suite	21	23	24	26	27	28	28	29	29	

The results of Table 7 show that glazing upgrades alone cannot achieve the required 31 dBA of interior noise reduction. Thus, additional calculations were performed assuming that exterior walls and top floor ceilings receive two layers of drywall. These calculations are contained in Appendix 5 and the results are listed in Table 8.

TABLE 8ROOM NOISE REDUCTION VALUES
WITH WALL AND CEILING UPGRADES

<u>ROOM</u>	<u>NOISE REDUCTION VS. GLAZING STC</u>									
	<u>24</u>	<u>26</u>	<u>28</u>	<u>30</u>	<u>32</u>	<u>34</u>	<u>36</u>	<u>38</u>	<u>40</u>	
King/King Suite	21	23	25	27	28	29	30	31	31	

The results of Table 8 show that Table 5 construction should be adequate for all units with the following exceptions:

- (1) Add STC 26 glazing to all rooms on the front of the building
- (3) Add STC 34 glazing to all rooms on the left or right sides of the building
- (4) Add STC 38 glazing to all rooms on the rear of the building
- (5) Install two layers of interior drywall on all exterior walls and all third floor ceilings of rooms on the rear of the building

4.3 VENTILATION

If interior allowable noise levels are met by requiring that windows be unopenable or remain closed, then the design of the structure must also specify a ventilation or air conditioning system to provide a habitable interior environment. The ventilation system must not compromise the dwelling unit or guest room noise reduction.

4.4 UNIT-TO-UNIT NOISE CONTROL

Common floor/ceiling assemblies between units are subject to Title 24 Sound Transmission Class (STC) and Impact Insulation Class (IIC) requirements. The plan set provided for this analysis proposes the following common floor/ceiling assembly:

- (1) Finish flooring, 1" Gyp-Crete, Acousti-Mat II (in hard flooring areas), plywood sub-floor, TJI joists, 3 1/2" thick fiberglass insulation, resilient channels, 5/8" drywall ceiling (STC 58 per acoustical test number NGC 5012050, FIIC 52 with ceramic tile per acoustical test number 1801 99 1736.4, FIIC 53 with vinyl per acoustical test number 1801 99 1736.3, and 70 IIC with carpet and pad per acoustical test number IN 86-6)

Note that all hard flooring areas must employ the Acousti-Mat II underlayment to achieve the required minimum rating of IIC 50.

Common wall assemblies between units are subject to Title 24 Sound Transmission Class (STC) requirements. The plan set provided for this analysis proposes the following common wall assembly:

- (1) One layer of 5/8" direct nailed drywall, 2" by 4" plate, 2" by 4" studs, 3 1/2" thick fiberglass insulation, resilient channels, one layer 5/8" drywall screwed to channels (this detail cites the Gypsum Association file WP 3242 and claims a sound rating of STC 50 to 54)

While it may be true that a laboratory built wall of this type can indeed achieve a rating of STC 50+, years of field testing has shown that few field built walls of this type can achieve a rating of FSTC 45. Normal conversation, television and radio sounds will be clearly audible through such walls and hotel guests may complain about noise. Thus, it is highly recommended that this wall be used only as a corridor wall and that it be upgraded by adding a second layer of drywall on one side.

It is highly recommended that one of the widely used common wall assemblies, all of which rate at least STC 50, be incorporated into the building plans:

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- (2) Two layers 5/8" direct nailed drywall, 2" by 6" plate, 2" by 4" staggered studs, R-11 insulation, two layers 5/8" direct nailed drywall (National Gypsum Co. NGC 2376, 1970, 16f, STC 53)

- (3) 5/8" direct nailed drywall, 2" by 4" plate with 2" by 4" studs, R-11 insulation, 1" airspace at plate, 2" by 4" plate with 2" by 4" studs, 5/8" direct nailed drywall (Owens/Corning Fiberglas OCF 448, 1967, 16f, STC 56)
- (4) Same as #3 with two layers of R-11 insulation (Riverbank Acoustical Labs TL75-83, 1975, 16f, U.S. Department of Agriculture, STC 57)
- (5) Two layers 5/8" drywall direct nailed, 2" by 4" plate with 2" x 4" studs, 1" air space, 2" by 4" plate with 2" by 4" studs, R-11 insulation, two layers 5/8" drywall (National Gypsum Co. NGC 3056, 1970, 16f, Gypsum Association, STC 58)
- (6) Same as #5 with two layers of R-11 insulation (Riverbank Acoustical Labs TL 75-82, 1975, 16f, U.S. Department of Agriculture, STC 63)

All wall assemblies between any common space and a living unit must be an STC 50 minimum rated assembly. All Plumbing and electrical installations shall be installed per the instructions contained in Appendix 6. Put all details onto Plans.

4.5 PROJECT DISCLOSURE

The acoustical code requirements are minimal acceptable standards. Compliance with Building Department acoustical criteria does not require, guarantee or even imply that local sound sources will be mitigated to inaudibility. Compliance with an exterior noise limit of 65 dBA CNEL means that exterior noise will remain clearly audible within the mitigated exterior space. Compliance with an interior noise limit of 45 dBA CNEL means that exterior noise sources will remain audible on the interior of a structure.

Due to quality control and other field related problems, the code minimum laboratory rating of STC/IIC 50 for common assemblies does not guarantee that all common assemblies will pass a field test. In fact, there is a 50% chance that half of all laboratory rated STC/IIC 50 common assemblies could fail field tests. An STC 50 rated assembly will produce around 45 dBA of voice reduction in the field. This means that normal conversation in adjoining units will be audible a certain percentage of the time.

Do not misrepresent the degree of exterior to interior or unit to unit acoustical isolation as anything more than meeting code during any phase of this project. Never, ever, use any form of the term "Soundproof" to describe any portion of this project.

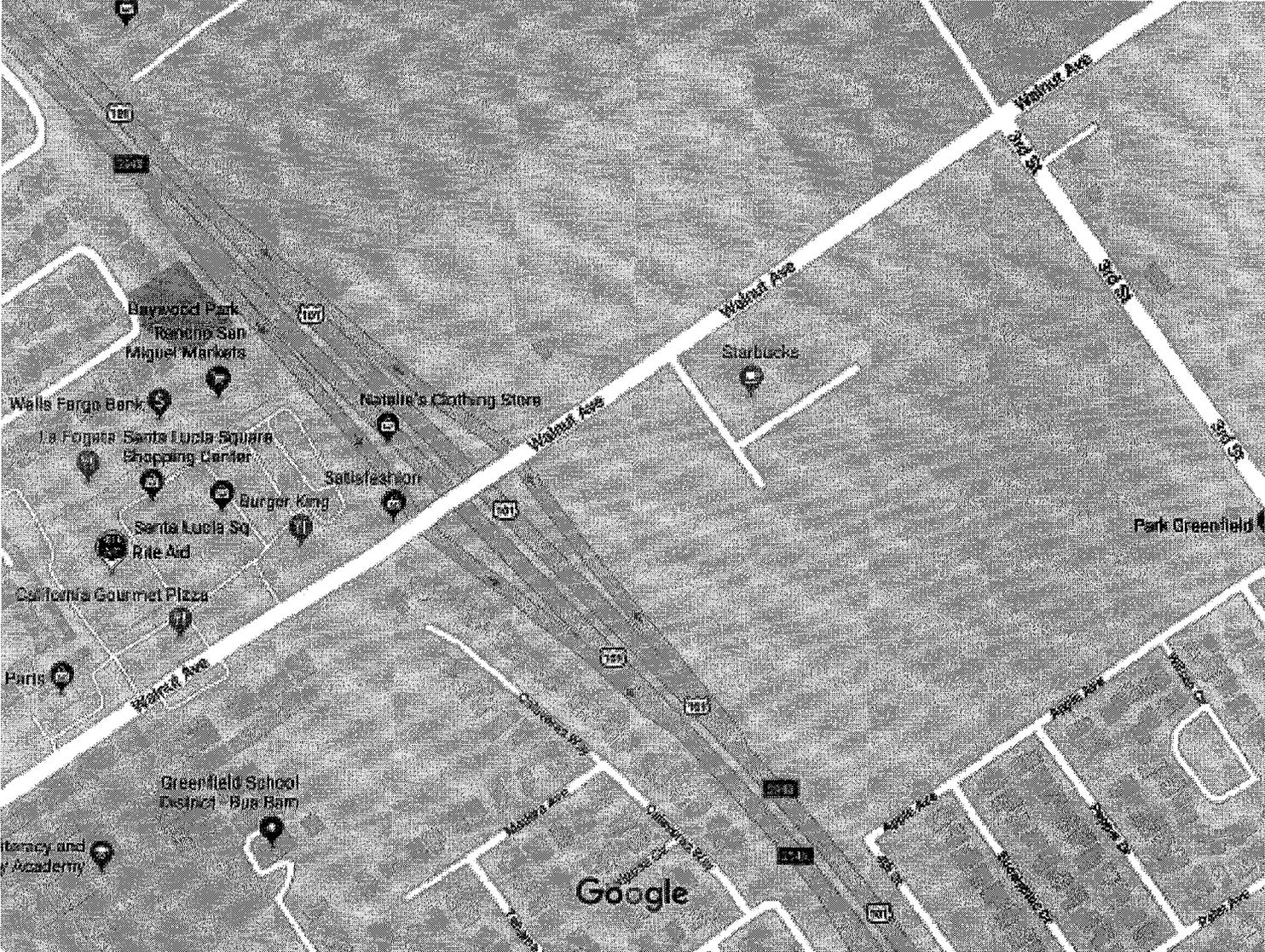
EXHIBIT 2 AERIAL PHOTO

Google Maps Fairfield Inn & Suites



EXHIBIT 1 SITE LOCATION

Google Maps Fairfield Inn & Suites



Map data ©2019 200 ft

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APPENDIX 1

NOISE RATING METHODOLOGY

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NOISE RATING METHODOLOGY

The A-weighted decibel (dBA) or "A" scale on a sound level meter is typically used for environmental noise measurements because the weighting characteristics of the "A" scale approximate the subjective response of the human ear to a broad frequency band noise source by discriminating against the very low and very high frequencies of the audible sound spectrum.

Since community noise is seldom constant, varying from moment to moment and throughout the day, the "A" weighted noise level needs to be further described to provide meaningful data. The Environmental Protection Agency, the Federal Department of Transportation, several foreign countries and many private consultants are now using three time-exceeded percentile figures to describe noise, which are:

- (1) L_{90} is the noise level that is exceeded 90 percent of any sample measurement period (such as 24 hours) and is often used to describe the background or ambient noise level.
- (2) L_{50} is the noise level that is exceeded 50 percent of any sample measurement period. It is generally considered to represent the median noise level.
- (3) L_{10} is the noise level that is exceeded 10 percent of any sample measurement period. It is a good descriptor of fluctuating noise sources such as vehicular traffic. It indicates the near-maximum noise levels that occur for groups of single noise events. Being related to the subjective annoyance to community noise, the L_{10} is a good design tool in the planning of acoustical barriers.

More recent noise assessment methods are based on the equivalent energy concept where $Leq(x)$ represents the average energy content of a fluctuating noise source over a sample measurement period. The subscript (x) represents the period over which the energy is computed and/or measured. Current practice references the time quantity to either one (1) hour, eight (8) hours, or twenty-four (24) hours. When referenced to one (1) hour, Leq is also called the HNL (Hourly Noise Level).

Since Leq is the summation of the functional products of noise level and duration, many different combinations of noise levels, duration times and time histories can produce similar Leq values. Thus a value of $Leq(24)$ equals 50 means only that the average noise level is 50 dB. During that 24-hour period, there can be times when the noise level is higher than 50 dB and times when it is lower than 50 dB.

If the period of the measurement is only a single event, the energy content is not averaged. The energy expression for a single event is simply the sum of the functional product of the noise level and duration time of the event. This term is called the Le or SENEL (Single Event Noise Exposure Level). The summation of Le values averaged over one hour is $Leq(1)$, over eight hours is $Leq(8)$, over 24 hours is $Leq(24)$, etc.

Leq is further refined into Ldn (Level Day-Night) and $CNEL$ (Community Noise Equivalent Level), where noise that occurs during certain hours of the day are weighted (or penalized) in an attempt to compensate for the general perception that such noise is more annoying during these time periods (typically evening and nighttime hours).

- (1) Ldn is the sound level in dBA that corresponds to the average energy content of the noise being measured over a 24-hour period but includes a ten (10) dBA weighting penalty for noise that occurs during the nighttime hours between 10:00 PM and 7:00 AM. The Ldn is a noise rating method recommended by the Environmental Protection Agency because it takes into account those subjectively more annoying noise events that occur during normal sleeping hours.
- (2) $CNEL$ is the sound level in dBA that corresponds to the average energy content of the noise being measured over a 24-hour period but includes a five (5) dBA penalty for noise that occurs during the evening hours between 7:00 PM and 10:00 PM, and a ten (10) dBA penalty for noise that occurs during the nighttime hours between 10:00 PM and 7:00 AM. For typical highway vehicular traffic situations, computer analysis has shown that the Ldn and $CNEL$ values correlate within 0.5 dBA.

The percentile figures L_{10} , L_{50} and L_{90} can be directly scaled from a graphical recording of the measured noise sample over a particular time period. These figures can also be measured directly using modern automatic noise measuring equipment. Measurement of the parameters Le , Leq , Ldn and $CNEL$ requires even more sophisticated and correspondingly expensive noise measuring equipment. As a result, engineers have devised ways of estimating Leq (and hence, Ldn) using standard instrumentation and methods.

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APPENDIX 2

FUTURE TRAFFIC NOISE CALCULATIONS

FHWA RD-77-108 HIGHWAY NOISE PREDICTION MODEL

PROJECT NAME :FIARFIELD INN
 SITE LOCATION :GREENFIELD
 DESCRIPTION :WALNUT AVENUE
 SITE TYPE :HARD

INPUT DATA AUTO MEDIUM TRUCK HEAVY TRUCK
 SPEED 35 35 35
 % DAY 75.51 1.56 .64
 % EVENING 12.57 0.09 0.02
 % NIGHT 9.34 .19 .08
 % VOLUME 100 100 100
 VOLUME 5600

-----AVERAGE HOURLY NOISE LEVELS AT 50 FEET-----

	DAY	EVENING	NIGHT	24 HOUR	CNEL
AUTO	60.09	58.33	52.27	58.19	61.45
MEDIUM TRK.	53.93	47.56	46.03	51.63	54.70
HEAVY TRK.	55.73	46.70	47.95	53.35	56.42
TOTAL	62.16	58.94	54.33	60.09	63.29

NOISE LEVEL AT SPECIFIED DISTANCES

DISTANCE	CNEL
50	63.29
75	61.53
100	60.28
125	59.31
150	58.52
175	57.85
200	57.27
225	56.76
250	56.30
275	55.88
300	55.51
325	55.16
350	54.84
375	54.54
400	54.26
450	53.74
500	53.29
550	52.87
600	52.50
650	52.15
700	51.83

FHWA RD-77-108 HIGHWAY NOISE PREDICTION MODEL

PROJECT NAME : FAIRFIELD INN
 SITE LOCATION : GREENFIELD
 DESCRIPTION : ROUTE 101
 SITE TYPE : HARD

INPUT DATA AUTO MEDIUM TRUCK HEAVY TRUCK
 SPEED 65 65 65
 % DAY 73 73 69.1
 % EVENING 8.60 8.60 6.70
 % NIGHT 18.4 18.4 24.2
 % VOLUME 88.4 4.2 7.5
 VOLUME 48200

----AVERAGE HOURLY NOISE LEVELS AT 50 FEET----

	DAY	EVENING	NIGHT	24 HOUR	CNEL
AUTO	76.31	73.05	71.58	74.67	79.18
MEDIUM TRK.	72.64	69.37	67.90	70.99	75.51
HEAVY TRK.	78.09	73.98	74.78	76.69	81.89
TOTAL	80.99	77.31	77.04	79.47	84.36

NOISE LEVEL AT SPECIFIED DISTANCES

DISTANCE	CNEL
50	84.36
75	82.60
100	81.35
125	80.38
150	79.59
175	78.92
200	78.34
225	77.83
250	77.37
275	76.96
300	76.58
325	76.23
350	75.91
375	75.61
400	75.33
450	74.82
500	74.36
550	73.95
600	73.57
650	73.22
700	72.90

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APPENDIX 3

SOUND WALL HEIGHT CALCULATIONS

BARRIER NOISE REDUCTION ANALYSIS, WALL HEIGHT VARIABLE

REFERENCE VEHICLE LEVELS AT 50 FEET

AUTO.....= 79.18
M.TRUCK.....= 75.51
H.TRUCK.....= 81.89

PROJECT.....FAIRFIELD INN
DESCRIPTION..POOL AREA SOUND WALL
SOURCE ELEVATION..... 10
RECEIVER ELEVATION..... 0
BARRIER ELEVATION..... 0
RECEIVER HEIGHT..... 5
DISTANCE TO SOURCE..... 385
DISTANCE TO RECEIVER... 10
AUTO NOISE LEVEL..... 70.20373
M.TRK NOISE LEVEL..... 66.53373
H.TRK NOISE LEVEL..... 72.91373
SOURCE NOISE LEVEL..... 75.38

ANGULAR CORRECTION(DB) - 0

WALL HEIGHT	ANL	MTNL	HTNL	TNL	TIL
5.00	70.20	66.53	72.91	75.38	0.00
FN	0.0000	0.0000	0.0000		
6.00	64.76	61.14	67.65	70.05	5.33
FN	0.0386	0.0344	0.0228		
7.00	63.77	60.15	66.66	69.06	6.32
FN	0.1772	0.1681	0.1409		
8.00	62.56	58.96	65.55	67.91	7.47
FN	0.4125	0.3984	0.3557		
9.00	61.17	57.57	64.18	66.53	8.85
FN	0.7381	0.7191	0.6608		
10.00	59.86	56.25	62.85	65.21	10.18
FN	1.1464	1.1225	1.0486		
11.00	58.69	55.08	61.66	64.02	11.36
FN	1.6288	1.5999	1.5105		
12.00	57.67	54.06	60.62	62.99	12.39
FN	2.1769	2.1431	2.0380		

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APPENDIX 4

INTERIOR NOISE REDUCTION CALCULATIONS

WORK SHEET FOR CALCULATING ROOM NOISE REDUCTION VALUE

ROOM NAME KING/KING SUITE + STC = 24

FLOOR AREA 167

SURFACES	TL	a	AREA	T*S
EXT. WALL 1	40		58	0.00580
EXT. WALL 2	43		0	0.00000
EXT. WALL 3	50		0	0.00000
INT. WALL			313	
WINDOW 1	22	.05	33	0.20822
WINDOW 2	25	.05	0	0.00000
WINDOW 3	32	.05	0	0.00000
SGD	22	.05	0	0.00000
DOORS	29	.04	9	0.01133
ROOF	40	.04	167	0.01670
FLOOR		.6	167	

ET*S 0.24205
 -10LOG(ET*S) 6.2
 10LOGA 21.0
 NOISE REDUCTION 21.1

WORK SHEET FOR CALCULATING ROOM NOISE REDUCTION VALUE

ROOM NAME KING/KING SUITE + STC = 26

FLOOR AREA 167

SURFACES	TL	a	AREA	T*S
EXT. WALL 1	40		58	0.00580
EXT. WALL 2	43		0	0.00000
EXT. WALL 3	50		0	0.00000
INT. WALL			313	
WINDOW 1	24	.05	33	0.13138
WINDOW 2	27	.05	0	0.00000
WINDOW 3	34	.05	0	0.00000
SGD	24	.05	0	0.00000
DOORS	29	.04	9	0.01133
ROOF	40	.04	167	0.01670
FLOOR		.6	167	

ET*S	0.16521
-10LOG(ET*S)	7.8
10LOGA	21.0
NOISE REDUCTION	22.8

WORK SHEET FOR CALCULATING ROOM NOISE REDUCTION VALUE

ROOM NAME KING/KING SUITE + STC = 28

FLOOR AREA 167

SURFACES	TL	a	AREA	T*S
EXT.WALL 1	40		58	0.00580
EXT.WALL 2	43		0	0.00000
EXT.WALL 3	50		0	0.00000
INT.WALL			313	
WINDOW 1	26	.05	33	0.08289
WINDOW 2	29	.05	0	0.00000
WINDOW 3	36	.05	0	0.00000
SGD	26	.05	0	0.00000
DOORS	29	.04	9	0.01133
ROOF	40	.04	167	0.01670
FLOOR		.6	167	

ET*S 0.11672
 -10LOG(ET*S) 9.3
 10LOGA 21.0
 NOISE REDUCTION 24.3

WORK SHEET FOR CALCULATING ROOM NOISE REDUCTION VALUE

ROOM NAME KING/KING SUITE + STC = 30

FLOOR AREA 167

SURFACES	TL	a	AREA	T*S
EXT.WALL 1	40		58	0.00580
EXT.WALL 2	43		0	0.00000
EXT.WALL 3	50		0	0.00000
INT.WALL			313	
WINDOW 1	28	.05	33	0.05230
WINDOW 2	31	.05	0	0.00000
WINDOW 3	38	.05	0	0.00000
SGD	28	.05	0	0.00000
DOORS	29	.04	9	0.01133
ROOF	40	.04	167	0.01670
FLOOR		.6	167	

ET*S	0.08613
-10LOG(ET*S)	10.6
10LOGA	21.0
NOISE REDUCTION	25.6

WORK SHEET FOR CALCULATING ROOM NOISE REDUCTION VALUE

ROOM NAME KING/KING SUITE + STC = 32

FLOOR AREA 167

SURFACES	TL	a	AREA	T*S
EXT. WALL 1	40		58	0.00580
EXT. WALL 2	43		0	0.00000
EXT. WALL 3	50		0	0.00000
INT. WALL			313	
WINDOW 1	30	.05	33	0.03300
WINDOW 2	33	.05	0	0.00000
WINDOW 3	40	.05	0	0.00000
SGD	30	.05	0	0.00000
DOORS	29	.04	9	0.01133
ROOF	40	.04	167	0.01670
FLOOR		.6	167	

ET*S 0.06683
 -10LOG(ET*S) 11.8
 10LOGA 21.0
 NOISE REDUCTION 26.7

WORK SHEET FOR CALCULATING ROOM NOISE REDUCTION VALUE

ROOM NAME KING/KING SUITE + STC = 34

FLOOR AREA 167

SURFACES	TL	a	AREA	T*S
EXT. WALL 1	40		58	0.00580
EXT. WALL 2	43		0	0.00000
EXT. WALL 3	50		0	0.00000
INT. WALL			313	
WINDOW 1	32	.05	33	0.02082
WINDOW 2	35	.05	0	0.00000
WINDOW 3	42	.05	0	0.00000
SGD	32	.05	0	0.00000
DOORS	29	.04	9	0.01133
ROOF	40	.04	167	0.01670
FLOOR		.6	167	

ET*S	0.05465
-10LOG(ET*S)	12.6
10LOGA	21.0
NOISE REDUCTION	27.6

WORK SHEET FOR CALCULATING ROOM NOISE REDUCTION VALUE

ROOM NAME KING/KING SUITE + STC = 36

FLOOR AREA 167

SURFACES	TL	a	AREA	T*S
EXT. WALL 1	40		58	0.00580
EXT. WALL 2	43		0	0.00000
EXT. WALL 3	50		0	0.00000
INT. WALL			313	
WINDOW 1	34	.05	33	0.01314
WINDOW 2	37	.05	0	0.00000
WINDOW 3	44	.05	0	0.00000
SGD	34	.05	0	0.00000
DOORS	29	.04	9	0.01133
ROOF	40	.04	167	0.01670
FLOOR		.6	167	

ET*S 0.04697
 -10LOG(ET*S) 13.3
 10LOGA 21.0
 NOISE REDUCTION 28.2

WORK SHEET FOR CALCULATING ROOM NOISE REDUCTION VALUE

ROOM NAME KING/KING SUITE + STC = 38

FLOOR AREA 167

SURFACES	TL	a	AREA	T*S
EXT. WALL 1	40		58	0.00580
EXT. WALL 2	43		0	0.00000
EXT. WALL 3	50		0	0.00000
INT. WALL			313	
WINDOW 1	36	.05	33	0.00829
WINDOW 2	39	.05	0	0.00000
WINDOW 3	46	.05	0	0.00000
SGD	36	.05	0	0.00000
DOORS	29	.04	9	0.01133
ROOF	40	.04	167	0.01670
FLOOR		.6	167	

ET*S	0.04212
-10LOG(ET*S)	13.8
10LOGA	21.0
NOISE REDUCTION	28.7

WORK SHEET FOR CALCULATING ROOM NOISE REDUCTION VALUE

ROOM NAME KING/KING SUITE + STC = 40

FLOOR AREA 167

SURFACES	TL	a	AREA	T*S
EXT. WALL 1	40		58	0.00580
EXT. WALL 2	43		0	0.00000
EXT. WALL 3	50		0	0.00000
INT. WALL			313	
WINDOW 1	38	.05	33	0.00523
WINDOW 2	41	.05	0	0.00000
WINDOW 3	48	.05	0	0.00000
SGD	38	.05	0	0.00000
DOORS	29	.04	9	0.01133
ROOF	40	.04	167	0.01670
FLOOR		.6	167	

ET*S 0.03906
 -10LOG(ET*S) 14.1
 10LOGA 21.0
 NOISE REDUCTION 29.0

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APPENDIX 5

INTERIOR NOISE REDUCTION CALCULATIONS
WITH WALL AND CEILING UPGRADES

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WORK SHEET FOR CALCULATING ROOM NOISE REDUCTION VALUE

ROOM NAME KING/KING SUITE + STC = 24

FLOOR AREA 167

SURFACES	TL	a	AREA	T*S
EXT. WALL 1	45		58	0.00183
EXT. WALL 2	48		0	0.00000
EXT. WALL 3	55		0	0.00000
INT. WALL			313	
WINDOW 1	22	.05	33	0.20822
WINDOW 2	25	.05	0	0.00000
WINDOW 3	32	.05	0	0.00000
SGD	22	.05	0	0.00000
DOORS	29	.04	9	0.01133
ROOF	45	.04	167	0.00528
FLOOR		.6	167	

ET*S 0.22666
 -10LOG(ET*S) 6.4
 10LOGA 21.0
 NOISE REDUCTION 21.4

WORK SHEET FOR CALCULATING ROOM NOISE REDUCTION VALUE

ROOM NAME KING/KING SUITE + STC = 26

FLOOR AREA 167

SURFACES	TL	a	AREA	T*S
EXT. WALL 1	45		58	0.00183
EXT. WALL 2	48		0	0.00000
EXT. WALL 3	55		0	0.00000
INT. WALL			313	
WINDOW 1	24	.05	33	0.15138
WINDOW 2	27	.05	0	0.00000
WINDOW 3	34	.05	0	0.00000
SGD	24	.05	0	0.00000
DOORS	29	.04	9	0.01133
ROOF	45	.04	167	0.00528
FLOOR		.6	167	

ET*S	0.14982
-10LOG(ET*S)	8.2
10LOGA	21.0
NOISE REDUCTION	23.2

WORK SHEET FOR CALCULATING ROOM NOISE REDUCTION VALUE

ROOM NAME KING/KING SUITE + STC = 28

FLOOR AREA 167

SURFACES	TL	a	AREA	T*S
EXT.WALL 1	45		58	0.00183
EXT.WALL 2	48		0	0.00000
EXT.WALL 3	55		0	0.00000
INT.WALL			313	
WINDOW 1	26	.05	33	0.08289
WINDOW 2	29	.05	0	0.00000
WINDOW 3	36	.05	0	0.00000
SGD	26	.05	0	0.00000
DOORS	29	.04	9	0.01133
ROOF	45	.04	167	0.00528
FLOOR		.6	167	

ET*S 0.10134
 -10LOG(ET*S) 9.9
 10LOGA 21.0
 NOISE REDUCTION 24.9

WORK SHEET FOR CALCULATING ROOM NOISE REDUCTION VALUE

ROOM NAME KING/KING SUITE + STC = 30

FLOOR AREA 167

SURFACES	TL	a	AREA	T*S
EXT.WALL 1	45		58	0.00183
EXT.WALL 2	48		0	0.00000
EXT.WALL 3	55		0	0.00000
INT.WALL			313	
WINDOW 1	28	.05	33	0.05230
WINDOW 2	31	.05	0	0.00000
WINDOW 3	38	.05	0	0.00000
SGD	28	.05	0	0.00000
DOORS	29	.04	9	0.01133
ROOF	45	.04	167	0.00528
FLOOR		.6	167	

ET*S	0.07075
-10LOG(ET*S)	11.5
10LOGA	21.0
NOISE REDUCTION	26.5

WORK SHEET FOR CALCULATING ROOM NOISE REDUCTION VALUE

ROOM NAME KING/KING SUITE + STC = 32

FLOOR AREA 167

SURFACES	TL	a	AREA	T*S
EXT. WALL 1	45		58	0.00183
EXT. WALL 2	48		0	0.00000
EXT. WALL 3	55		0	0.00000
INT. WALL			313	
WINDOW 1	30	.05	33	0.03300
WINDOW 2	33	.05	0	0.00000
WINDOW 3	40	.05	0	0.00000
SGD	30	.05	0	0.00000
DOORS	29	.04	9	0.01133
ROOF	45	.04	167	0.00528
FLOOR		.6	167	

ET*S 0.05145
 -10LOG(ET*S) 12.9
 10LOGA 21.0
 NOISE REDUCTION 27.8

WORK SHEET FOR CALCULATING ROOM NOISE REDUCTION VALUE

ROOM NAME KING/KING SUITE + STC = 34

FLOOR AREA 167

SURFACES	TL	a	AREA	T*S
EXT. WALL 1	45		58	0.00183
EXT. WALL 2	48		0	0.00000
EXT. WALL 3	55		0	0.00000
INT. WALL			313	
WINDOW 1	32	.05	33	0.02082
WINDOW 2	35	.05	0	0.00000
WINDOW 3	42	.05	0	0.00000
SGD	32	.05	0	0.00000
DOORS	29	.04	9	0.01133
ROOF	45	.04	167	0.00528
FLOOR		.6	167	

ET*S	0.03927
-10LOG(ET*S)	14.1
10LOGA	21.0
NOISE REDUCTION	29.0

WORK SHEET FOR CALCULATING ROOM NOISE REDUCTION VALUE

ROOM NAME KING/KING SUITE + STC = 36

FLOOR AREA 167

SURFACES	TL	a	AREA	T*S
EXT. WALL 1	45		58	0.00183
EXT. WALL 2	48		0	0.00000
EXT. WALL 3	55		0	0.00000
INT. WALL			313	
WINDOW 1	34	.05	33	0.01314
WINDOW 2	37	.05	0	0.00000
WINDOW 3	44	.05	0	0.00000
SGD	34	.05	0	0.00000
DOORS	29	.04	9	0.01133
ROOF	45	.04	167	0.00528
FLOOR		.6	167	

ET*S 0.03158
 -10LOG(ET*S) 15.0
 10LOGA 21.0
 NOISE REDUCTION 30.0

WORK SHEET FOR CALCULATING ROOM NOISE REDUCTION VALUE

ROOM NAME KING/KING SUITE + STC = 38

FLOOR AREA 167

SURFACES	TL	a	AREA	T*S
EXT. WALL 1	45		58	0.00183
EXT. WALL 2	48		0	0.00000
EXT. WALL 3	55		0	0.00000
INT. WALL			313	
WINDOW 1	36	.05	33	0.00829
WINDOW 2	39	.05	0	0.00000
WINDOW 3	46	.05	0	0.00000
SGD	36	.05	0	0.00000
DOORS	29	.04	9	0.01133
ROOF	45	.04	167	0.00528
FLOOR		.6	167	

ET*S	0.02673
-10LOG(ET*S)	15.7
10LOGA	21.0
NOISE REDUCTION	30.7

WORK SHEET FOR CALCULATING ROOM NOISE REDUCTION VALUE

ROOM NAME KING/KING SUITE + STC = 40

FLOOR AREA 167

SURFACES	TL	a	AREA	T*S
EXT. WALL 1	45		58	0.00183
EXT. WALL 2	48		0	0.00000
EXT. WALL 3	55		0	0.00000
INT. WALL			313	
WINDOW 1	38	.05	33	0.00523
WINDOW 2	41	.05	0	0.00000
WINDOW 3	48	.05	0	0.00000
SGD	38	.05	0	0.00000
DOORS	29	.04	9	0.01133
ROOF	45	.04	167	0.00528
FLOOR		.6	167	

ET*S 0.02368
 -10LOG(ET*S) 16.3
 10LOGA 21.0
 NOISE REDUCTION 31.2

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APPENDIX 6

PLUMBING AND ELECTRICAL INSTALLATIONS

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PLUMBING NOISE REDUCTION REQUIREMENTS FOR
COMPLIANCE WITH THE CALIFORNIA CODE OF REGULATIONS

TITLE 24, PART 2, APPENDIX CHAPTER 35

REQUIRED PLUMBING DESIGN FEATURE IN COMMON WALL AND FLOOR/CEILING
ASSEMBLIES

The plumbing system, by its nature, can degrade the acoustical integrity of a common wall or floor/ceiling assembly. This is primarily due to the fact that the plumbing system, a sound carrier and a sound source, is generally attached to the studs, plates, joists and drywall of a building's walls and floors. In order to alleviate the problem of plumbing system noise, one hundred percent of the plumbing system must be isolated from the building structure (not just at the common assemblies). Special installation requirements are necessary in order to:

- (1) reduce the level of noise from the plumbing system, and
- (2) isolate the total plumbing system from the building structure.

These special isolation procedures may be accomplished by using an approved commercial isolation system. Hard plastic "isolators" are **NOT** acceptable. Examples of approved commercial isolation systems in order of preference are:

- (1) "Acousto-Plumb"™ system by Specialty Products, Inc. (www.ispproducts.com),
- (2) Holdrite Silencer System by Holdrite, Inc. (www.holdrite.com), and
- (3) the felt lined series of isolators, clamps and hangers from Tolco, Inc.

Only when appropriate commercial isolation products are not available for unusual applications or extra large pipe sizes, will it be acceptable to use high density, 1/4" thick, 2" wide, adhesive backed felt wrap and/or 1/2" thick pre-formed, self-adhesive foam rubber pipe insulation such as Armaflex or Rubatex. If the felt wrap or pre-formed pipe insulation is used,

great care must be taken not to compress the insulation material when strapping or anchoring the attachment points. Use of expanding foam products as plumbing isolation is **strictly prohibited**.

SUPPLY LINES

- All hot and cold water pipes, fittings and valves shall NEVER come in direct contact with either the building structure framing or drywall. Supply lines are to be isolated using Acousto-Plumb, Holdrite Silencer System, Tolco I.S.P. felt lined isolator products, 1/4" high density felt wrap or 1/2" pre-formed pipe insulation. Acousto-Plumb products and installation details can be found at www.lspproducts.com. Holdrite Silencer System products and installation details can be found at www.holdrite.com. Tolco I.S.P. products can be found at www.cooperindustries.com. Installation details for use of felt wrap or pre-formed pipe insulation are available upon request and approval. If felt wrap or pre-formed pipe insulation are used (and only with prior written approval by the acoustical consultant when appropriate commercial isolation products cannot be located), these installation details must be followed to the letter. No deviations from these details will be allowed.
- All sink and shower faucets, spouts and risers shall be isolated with resilient gaskets that are positioned between the faucet, spout or riser and its mounting surface.
- Water supply stub-outs shall be temporarily isolated from the drywall using the Acousto-Sleeve™ during drywall installation, and then permanently isolated using the Acousto-Scutcheon™ or resilient caulking and a standard plumbing escutcheon.
- Water pressure shall not exceed 65 psi.
- Shower head flow restrictors shall be used to limit water flow to less than three (3) gallons per minute.
- The pipe stubs commonly installed to combat water hammer are not effective. A commercially produced water hammer device consisting of a bellows, similar to that made by Plumbing Products, Inc., is recommended.
- Sections of the plumbing supply system employing PEX (cross linked polyethylene tubing) do not require acoustical isolation except where it transitions to or from conventional copper lines.

WASTE LINES

- The cavity under plastic or fiberglass tubs and showers shall be packed with fiberglass or spray-on insulation materials and/or lightweight concrete pours. The bottoms of such tubs shall be blocked or supported by lightweight concrete to reduce drumming.
- All waste lines above the slab and at the penetrations of any floor/ceiling assemblies and any walls (including non-common walls) shall be cast iron. The use of ABS waste lines is not recommended. If ABS is used, the entire framing cavity surrounding the ABS pipe shall be completely packed with fiberglass, mineral wool or spray-on adhesive cellulose insulation materials. All elbows below toilet and tub waste outlets shall be isolated from all positioning blocks using carpet padding or high-density 1/4" felt material. The entire framing cavity surrounding these elbows shall be completely packed with fiberglass, mineral wool or spray-on adhesive cellulose insulation materials.
- Waste lines of a diameter greater than two and a half inches (2.5") shall never be installed in a wall framed with less than 2" by 6" studs. Walls framed with 2" by 4" studs simply don't allow sufficient clearance to properly insulate and isolate waste lines and/or avoid pipe contact with the drywall.

Failure to COMPLETELY isolate the plumbing system from the building structure will result in a significant transfer of plumbing noise into the building. Therefore, it is important that all of the above measures and techniques are employed. Collectively, these measures and techniques act as parts of a complete system, each designed to perform a particular function of the total effort. Any circumvention of the function of any one component, whether intentional or not, will ultimately lessen the effectiveness of the entire system. **QUALITY CONTROL IS CRITICAL TO PROPER PLUMBING SYSTEM ISOLATION.**

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ELECTRICAL SYSTEM INSTALLATION NOTES

The following items shall be incorporated into the building plans:

COMMON WALLS

- Electrical outlets, switches, phone jacks, television antennae boxes and computer outlet boxes installed in opposite sides of a common wall shall be offset a minimum of 24" to comply with the fire code. This offset is not needed for acoustical reasons if insulation is used in the framing cavities and Lowry's #10 putty pads or 3M fire pads are applied around the backs and sides of all outlets, switches, phone jacks, etc.
- All electrical outlets, switches, phone jacks, television antennae boxes and computer outlet boxes installed in common walls shall be backed by and Lowry's #10 putty pads, 3M fire pads or equivalent. Pads shall be stapled to the studs to insure that they remain in place indefinitely (the adhesive backing of the pads deteriorates over time).
- Wiring shall avoid crossing over the air gap of common walls. Where unavoidable, wiring crossovers between common wall studs shall include a loop where the depth is equal to its width.
- Electrical panel boxes, fixture boxes or outlet boxes greater than 25 square inches shall be set in raised boxes that do not touch the opposite side of the common wall.

COMMON FLOOR/CEILINGS

- Recessed lighting shall be set in recessed and airtight boxes made of plywood or drywall.
- All other precautions applicable to common wall installations shall also apply to common floor/ceiling installations.

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