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June 25, 2020

Mr. Jonathan Mallahan
CHSEW
12 E. 5th Avenue
Spokane, WA 99202
cc: Mr. John Fisher - Inland Construction

Subject: HUD Noise Analysis for the Gonzaga Family Haven Noise Study

Dear Mr. Mallahan:

At your request, the j.c. brennan & associates, Inc. has conducted a detailed noise analysis for the Gonzaga Family Haven project in Spokane, Washington. Figure 1 shows the project site plan. This analysis is used for the NEPA Environmental Assessment for HUD-Funded Proposals. Specifically, this will address the ability to comply with the required HUD exterior and interior noise level standards.

HUD Criteria

According to HUD guidelines, all of the following noise sources are to be evaluated when determining if a project site has a suitable noise environment:

- Major roadways within 1,000 feet of the project site
- Rapid transit and railway lines within 3,000 feet of the project site
- Airports within 15 miles of the project site

The U.S. Department of Housing and Urban Development (HUD) establishes an acceptable exterior noise environment of 65 dB DNL (also expressed as "Ldn" or Day/Night Level) at exterior areas of residential uses. Noise levels in the 65-75 dB DNL range are considered Normally Unacceptable. However, 65-75 dB DNL may be allowed, but require special approvals and additional sound attenuation measures. Such measures include a 5 dB improvement to the building facade noise level reduction (NLR) for exterior noise levels in the 65-70 dB range, and an improvement of 10 dB for exterior noise levels in the 70-75 dB range. The improvement is required in addition to "attenuation provided by buildings as commonly constructed in the area, and requiring open windows for ventilation." Noise levels exceeding 75 dB L_{dn}/DNL are considered unacceptable and may only be allowed under special circumstances.

In addition, HUD established an interior noise level goal of 45 dB DNL, while assuming a typical exterior to interior noise level reduction (NLR) of 20 dB.

ANALYSIS OF EXTERIOR NOISE LEVELS

Based upon review of the project location, the two primary roadways which potentially affect the project site include East North Foothills Drive and North Hamilton Street, as shown on Figure 1.

The Spokane International Airport is located 6.8 miles to the southwest of the project site, and Felts Field is located 3.0 miles to the east of the project site, as shown on Figure 2.

There are no rail lines located near the project site. Therefore, this analysis will evaluate the cumulative noise levels from the two identified roadways, and the two air fields.

Traffic Exterior Noise Levels

There are several highway traffic noise prediction models which can be used for calculating traffic noise levels at the project site. HUD has a DNL calculator which can be used. It is based upon the formulas, algorithms, and calculation procedures contained in the Federal Highway Administration (FHWA RD77-108) traffic noise prediction model. The FHWA also has a model which is referred to as the TNM. The TNM allows for the input of topography, intervening buildings, roadway grade, and existing barriers. HUD has historically accepted these traffic noise prediction models for calculating exterior noise levels.

j.c. brennan & associates, Inc. utilizes the Federal Highway Administration (FHWA RD77-108) Traffic Noise Prediction Model. Traffic volumes, day/night traffic splits, and roadway speeds are all based upon the assumptions used in the original HUD worksheet analyses which were prepared by Landau Associates for the project site.

The FHWA model was used to predict traffic noise levels at the nearest building facades and at the identified outdoor activity areas. The assisted living outdoor activity area is a courtyard which is shielded by the surrounding buildings, and the pool area associated with the Villa portion of the site is the other identified outdoor activity area.

Table 1 shows the results of the traffic noise modeling for the project site. Appendix B provides the inputs and results of the modeling.

Table 1 Predicted Roadway Traffic Noise Levels Gonzaga Family Haven			
Location	Roadway	Predicted DNL	Cumulative DNL
Building A / Plaza	North Foothills Drive North Hamilton Street	63.4 dB 67.1 dB	68.7 dB
Building B	North Foothills Drive North Hamilton Street	63.4 dB 67.1 dB	68,6 dB
Building C	North Foothills Drive North Hamilton Street	50.6 dB 52.9 dB	54.9 dB
Splash Pad / Gathering Pavilion	North Foothills Drive North Hamilton Street	47.8 dB 55.3 dB	56.0 dB
Child Play Area	North Foothills Drive North Hamilton Street	52.6 dB 55.8 dB	57.5 dB
Community Garden / Dog Park	North Foothills Drive North Hamilton Street	52.6 dB 52.1 dB	55.4 dB
Community Patio	North Foothills Drive North Hamilton Street	51.0 dB 56.0 dB	57.2 dB
Gathering Pavilion	North Foothills Drive North Hamilton Street	52.1 dB 52.8 dB	55.5 dB
Walking Trail	North Foothills Drive North Hamilton Street	50.6 dB 60.4 dB	60.8 dB
Buildings / Areas indicated in Red exceed the 65 dB DNL standard Source: j.c. brennan & associates, Inc. - 2020			

Based upon Table 1, the project complies with the normally acceptable exterior noise level standard of 65 dB DNL at Building C, and at the Splash Pad / Gathering Pavilion, Child Play Area, Community Garden / Dog Park, Community Patio, Gathering Pavilion, and Walking Trail.

The project would exceed the normally acceptable exterior noise level standard of 65 dB DNL at Building A / Plaza, and Building B.

Therefore, the project would simply need to achieve an additional 5 dB (25 dB overall) exterior to interior noise level reduction (NLR) for those areas which exceed the normally acceptable noise level standard of 65 dB DNL.

In the case of the Plaza, which is adjacent to Building A, other mitigation such as a barrier may be required. This will be discussed later in this report.

Aircraft Exterior Noise Levels

Both the Spokane International Airport, and Felts Field Airport are within 15-miles of the site. Figure 2 shows the locations of the airports in relation to the project site.

Spokane International Airport: Figure 3 shows the airport noise contours which have been developed for the Spokane International Airport, based upon Year 2030. Based upon the location of the 65 dB DNL contour, the project site is 4.8 miles northeast of the 65 dB DNL contour. Based upon the distance of the 65 dB DNL contour from the end of the runway, the predicted noise level at the project site is less than 55 dB DNL.

Felts Field: Based upon the Spokane International Airport / Felts Field website, Felts Field is a General Aviation relief airport, and is jointly owned by Spokane County and the City of Spokane. There are no airport operations noise contours which have been developed for Felts Field due to the limited number of daily aircraft operations. With approximately 166 operations per day, and the distance to the project site, it is expected that the DNL associated with Felts Field would be less than 45 dB.

Cumulative Exterior Noise Levels

The cumulative noise levels from all sources at the project site are dominated by roadway traffic, and are shown in Table 1 of this report. It is not expected that aircraft operations will increase overall exterior noise levels at the project site.

Therefore, as stated earlier in this report, the project complies with the normally acceptable exterior noise level standard of 65 dB DNL at Building C, and at the Splash Pad / Gathering Pavilion, Child Play Area, Community Garden / Dog Park, Community Patio, Gathering Pavilion, and Walking Trail.

The project would exceed the normally acceptable exterior noise level standard of 65 dB DNL at A / Plaza, and Building B.

A barrier analysis was conducted for the Plaza Area which is located adjacent to Building A.

Exterior Noise Mitigation for Plaza Area

Based upon the analysis, a barrier 6-feet in height adjacent to Foothills Drive would reduce overall traffic noise levels at the Plaza Area to 55 dB DNL. It should extend the length of the Plaza Area facing Foothills Drive. Appendix C provides the inputs and results of the barrier analysis.

ANALYSIS OF INTERIOR NOISE LEVELS

As a means of determining the ability to comply with the interior noise level standard of 45 dB DNL, and have a 25 dB exterior to interior noise level reduction, the HUD Exchange STraCAT Tool was used. A typical window in the STraCAT library was included along with a typical wood siding exterior with an interior of 5/8" gyp board. The STraCAT analysis indicates that the combined attenuation of the wall component is 36.5 dB, and the interior noise level would be 30.7 dB DNL. This assumes a worst case exterior noise level of 67.2 dB DNL.

If you have any questions, please contact me at 530-823-0960 or jbrennan@jcbrennanassoc.com.

Respectfully submitted,

j.c. brennan & associates, Inc.

Jim Brennan
President
Member: Institute of Noise Control Engineering
file: 2020-113 Gonzaga Family Haven - June 2020 - V2

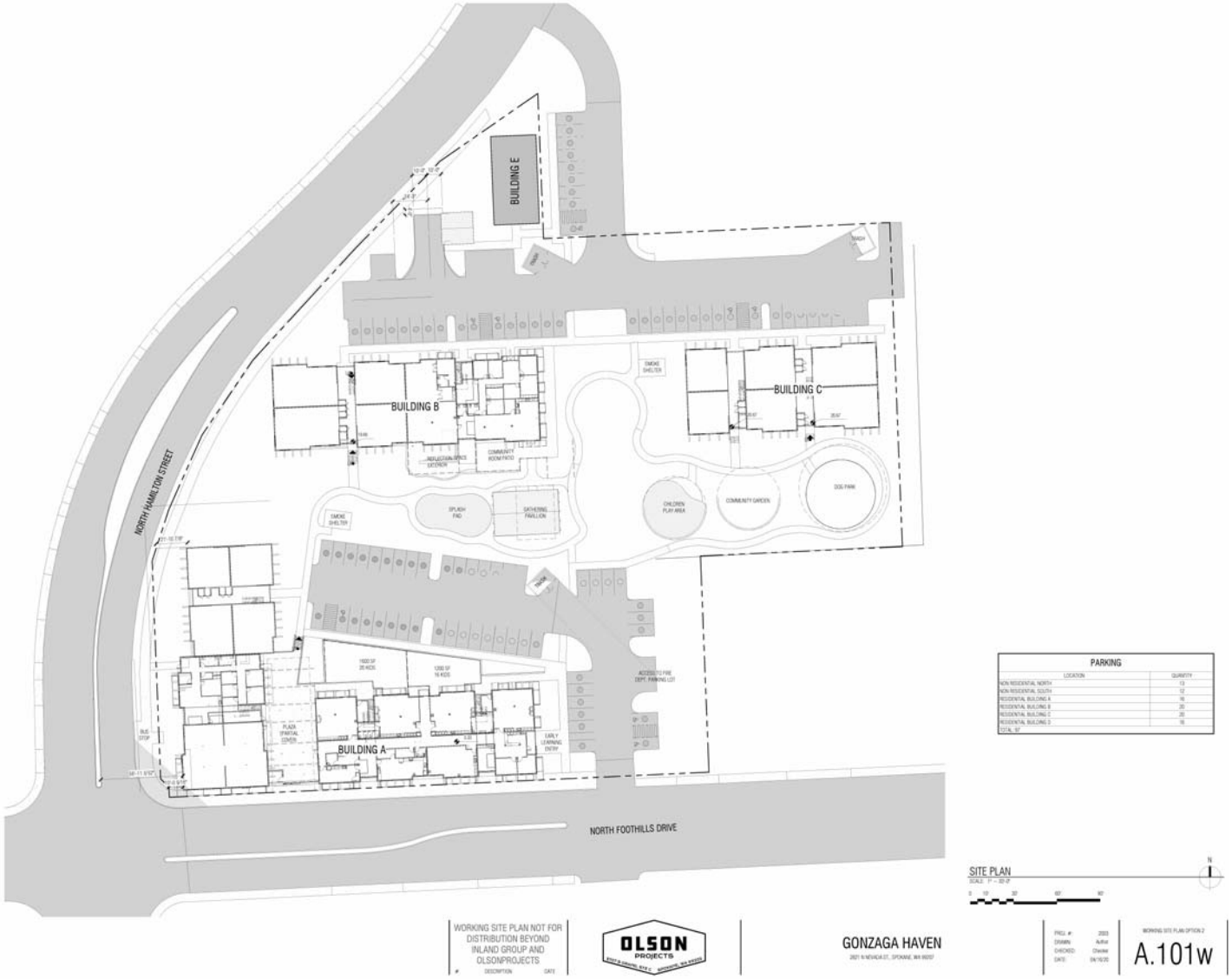

Figure 1
Gonzaga Family Haven Site Plan

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Figure 2
Project Location in Relation to Airports

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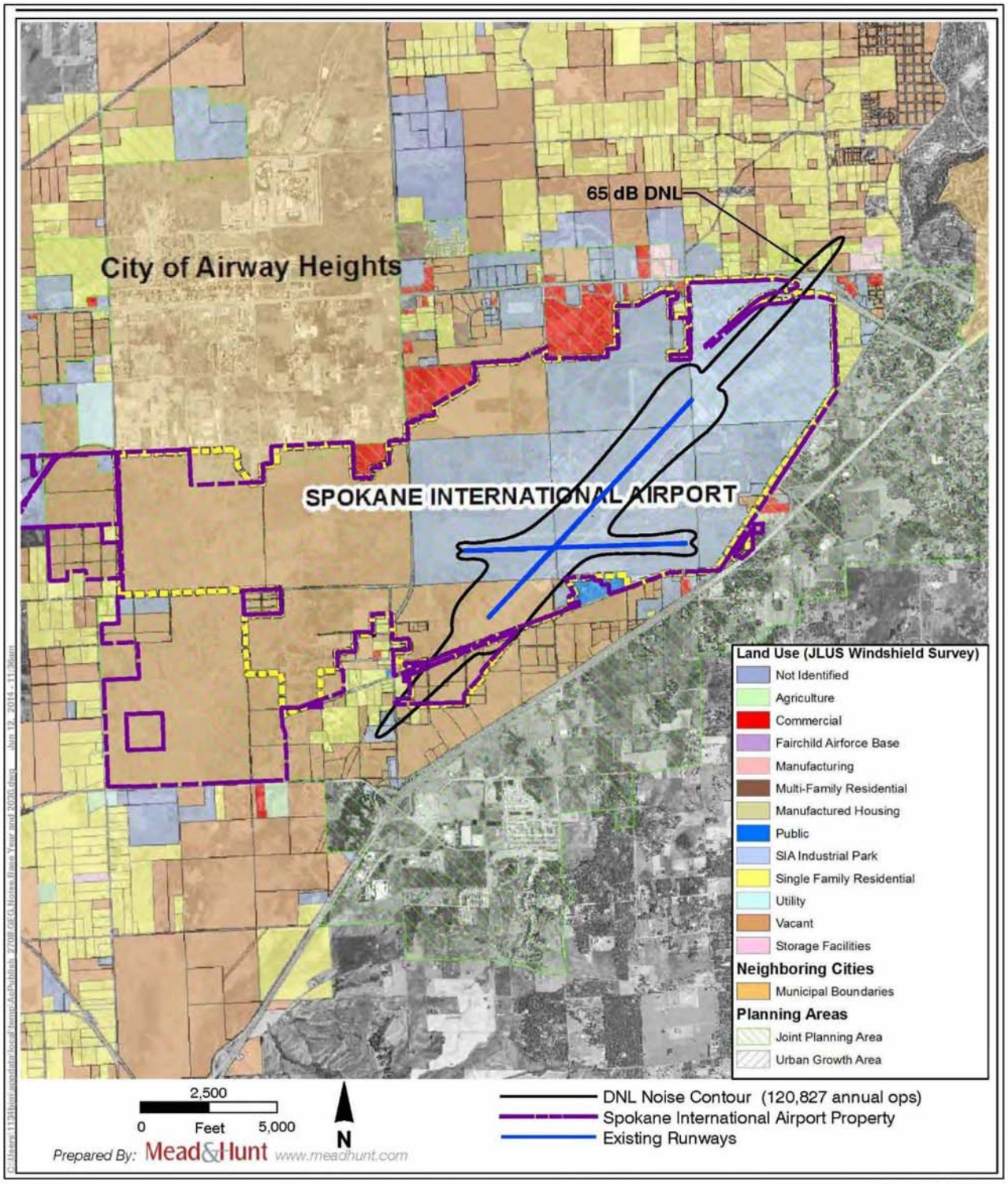

FIGURE 6-4

Future Scenario (2030) Noise Contours

Spokane International Airport

Figure 3
Spokane International Airport
Noise Contours

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Date:
6/15/2020

Appendix A
Acoustical Terminology

Acoustics	The science of sound.
Ambient Noise	The distinctive acoustical characteristics of a given space consisting of all noise sources audible at that location. In many cases, the term ambient is used to describe an existing or pre-project condition such as the setting in an environmental noise study.
Attenuation	The reduction of an acoustic signal.
A-Weighting	A frequency-response adjustment of a sound level meter that conditions the output signal to approximate human response.
Decibel or dB	Fundamental unit of sound, A Bell is defined as the logarithm of the ratio of the sound pressure squared over the reference pressure squared. A Decibel is one-tenth of a Bell.
CNEL	Community Noise Equivalent Level. Defined as the 24-hour average noise level with noise occurring during evening hours (7 - 10 p.m.) weighted by a factor of three and nighttime hours weighted by a factor of 10 prior to averaging.
Frequency	The measure of the rapidity of alterations of a periodic signal, expressed in cycles per second or hertz (Hz).
L_{dn}	Day/Night Average Sound Level. Similar to CNEL but with no evening weighting.
L_{eq}	Equivalent or energy-averaged sound level.
L_{max}	The highest root-mean-square (RMS) sound level measured over a given period of time.
$L_{(n)}$	The sound level exceeded a described percentile over a measurement period. For instance, an hourly L_{50} is the sound level exceeded 50% of the time during the one hour period.
Loudness	A subjective term for the sensation of the magnitude of sound.
Noise	Unwanted sound.
NRC	Noise Reduction Coefficient. NRC is a single-number rating of the sound-absorption of a material equal to the arithmetic mean of the sound-absorption coefficients in the 250, 500, 1000, and 2,000 Hz octave frequency bands rounded to the nearest multiple of 0.05. It is a representation of the amount of sound energy absorbed upon striking a particular surface. An NRC of 0 indicates perfect reflection; an NRC of 1 indicates perfect absorption.
Peak Noise	The level corresponding to the highest (not RMS) sound pressure measured over a given period of time. This term is often confused with the AMaximum@ level, which is the highest RMS level.
RT_{60}	The time it takes reverberant sound to decay by 60 dB once the source has been removed.
Sabin	The unit of sound absorption. One square foot of material absorbing 100% of incident sound has an absorption of 1 Sabin.
SEL	Sound Exposure Level. SEL is s rating, in decibels, of a discrete event, such as an aircraft flyover or train passby, that compresses the total sound energy into a one-second event.
STC	Sound Transmission Class. STC is an integer rating of how well a building partition attenuates airborne sound. It is widely used to rate interior partitions, ceilings/floors, doors, windows and exterior wall configurations.
Threshold of Hearing	The lowest sound that can be perceived by the human auditory system, generally considered to be 0 dB for persons with perfect hearing.
Threshold of Pain	Approximately 120 dB above the threshold of hearing.
Impulsive	Sound of short duration, usually less than one second, with an abrupt onset and rapid decay.
Simple Tone	Any sound which can be judged as audible as a single pitch or set of single pitches.

Appendix B

FHWA-RD-77-108 Highway Traffic Noise Prediction Model

Data Input Sheet

Project #: 2020-113
Description: Gonzaga Family Haven
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	ADT	Day %	Eve %	Night %	% Med. Trucks	% Hvy. Trucks	Speed	Distance	Offset (dB)
1	Foothill	Building A	12,025	86		14	2	0.08	30	45	
2	Foothill	Plaza	12,025	86		14	2	0.08	30	45	
3	Foothill	Building B	12,025	86		14	2	0.08	30	320	
4	Foothill	Building C	12,025	86		14	2	0.08	30	320	
5	Foothill	Splash Pad Gathering Pavillion	12,025	86		14	2	0.08	30	490	
6	Foothill	Child Play Area	12,025	86		14	2	0.08	30	235	
7	Foothill	Community Garden / Dog Park	12,025	86		14	2	0.08	30	235	
8	Foothill	Community Patio	12,025	86		14	2	0.08	30	300	
9	Foothill	Gathering Pavilion	12,025	86		14	2	0.08	30	255	
10	Hamilton	Building A	28,230	86		14	2	0.08	30	45	
11	Hamilton	Plaza	28,230	86		14	2	0.08	30	65	
12	Hamilton	Building B	28,230	86		14	2	0.08	30	45	
13	Hamilton	Building C	28,230	86		14	2	0.08	30	395	
14	Hamilton	Splash Pad Gathering Pavillion	28,230	86		14	2	0.08	30	275	
15	Hamilton	Child Play Area	28,230	86		14	2	0.08	30	255	
16	Hamilton	Community Garden / Dog Park	28,230	86		14	2	0.08	30	450	
17	Hamilton	Community Patio	28,230	86		14	2	0.08	30	245	
18	Hamilton	Gathering Pavilion	28,230	86		14	2	0.08	30	405	
19	Foothill	Walking Trail	12,025	86		14	2	0.08	30	320	
20	Hamilton	Walking Trail	28,230	86		14	2	0.08	30	126	
21											
22											
23											
24											
25											

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Appendix B

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Predicted Levels

Project #: 2020-113
Description: Gonzaga Family Haven
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	Autos	Medium Trucks	Heavy Trucks	Total
1	Foothill	Building A	62.3	56.0	49.1	63.4
2	Foothill	Plaza	62.3	56.0	49.1	63.4
3	Foothill	Building B	49.5	43.2	36.3	50.6
4	Foothill	Building C	49.5	43.2	36.3	50.6
5	Foothill	Splash Pad Gathering Pavillion	46.7	40.4	33.5	47.8
6	Foothill	Child Play Area	51.5	45.2	38.3	52.6
7	Foothill	Community Garden / Dog Park	51.5	45.2	38.3	52.6
8	Foothill	Community Patio	49.9	43.6	36.7	51.0
9	Foothill	Gathering Pavilion	51.0	44.7	37.8	52.1
10	Hamilton	Building A	66.0	59.7	52.8	67.1
11	Hamilton	Plaza	63.6	57.3	50.4	64.7
12	Hamilton	Building B	66.0	59.7	52.8	67.1
13	Hamilton	Building C	51.8	45.5	38.7	52.9
14	Hamilton	Splash Pad Gathering Pavillion	54.2	47.9	41.0	55.3
15	Hamilton	Child Play Area	54.7	48.4	41.5	55.8
16	Hamilton	Community Garden / Dog Park	51.0	44.7	37.8	52.1
17	Hamilton	Community Patio	54.9	48.6	41.8	56.0
18	Hamilton	Gathering Pavilion	51.7	45.4	38.5	52.8
19	Foothill	Walking Trail	49.5	43.2	36.3	50.6
20	Hamilton	Walking Trail	59.3	53.0	46.1	60.4

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Appendix B

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Noise Contour Output

Project #: 2020-113
Description: Gonzaga Family Haven
Ldn/CNEL: Ldn
Hard/Soft: Soft

			-------- Distances to Traffic Noise Contours --------				
Segment	Roadway Name	Segment Description	75	70	65	60	55
1	Foothill	Building A	8	16	35	75	162
2	Foothill	Plaza	8	16	35	75	162
3	Foothill	Building B	8	16	35	75	162
4	Foothill	Building C	8	16	35	75	162
5	Foothill	Splash Pad Gathering Pavillion	8	16	35	75	162
6	Foothill	Child Play Area	8	16	35	75	162
7	Foothill	Community Garden / Dog Park	8	16	35	75	162
8	Foothill	Community Patio	8	16	35	75	162
9	Foothill	Gathering Pavilion	8	16	35	75	162
10	Hamilton	Building A	13	29	62	133	287
11	Hamilton	Plaza	13	29	62	133	287
12	Hamilton	Building B	13	29	62	133	287
13	Hamilton	Building C	13	29	62	133	287
14	Hamilton	Splash Pad Gathering Pavillion	13	29	62	133	287
15	Hamilton	Child Play Area	13	29	62	133	287
16	Hamilton	Community Garden / Dog Park	13	29	62	133	287
17	Hamilton	Community Patio	13	29	62	133	287
18	Hamilton	Gathering Pavilion	13	29	62	133	287
19	Foothill	Walking Trail	8	16	35	75	162
20	Hamilton	Walking Trail	13	29	62	133	287

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Appendix C

FHWA Traffic Noise Prediction Model (FHWA-RD-77-108)
Noise Barrier Effectiveness Prediction Worksheet

Project Information:

Job Number: 2020-113
Description Gonzaga Family Haven
Roadway Name: Foothill
Location(s): 2

Noise Level Data:

Year: 2025
Auto L_{dn}, dB: 62
Medium Truck L_{dn}, dB: 56
Heavy Truck L_{dn}, dB: 49

Site Geometry:

Receiver Description: Building B / Plaza Area
Centerline to Barrier Distance (C_1): 25
Barrier to Receiver Distance (C_2): 20
Automobile Elevation: 0
Medium Truck Elevation: 2
Heavy Truck Elevation: 12
Pad/Ground Elevation at Receiver: 0
Receiver Elevation[1]: 5
Base of Barrier Elevation: 0
Starting Barrier Height 6

Barrier Effectiveness:

Top of Barrier Elevation (ft)	Barrier Height[2] (ft)	---------- L_{dn}, dB ---------- Autos	Medium Trucks	Heavy Trucks	Total	Barrier Breaks Line of Sight to… Autos?	Medium Trucks?	Heavy Trucks?
6	6	54	49	48	**56**	Yes	Yes	No
7	7	53	48	45	**54**	Yes	Yes	No
8	8	52	46	44	**53**	Yes	Yes	No
9	9	51	45	44	**52**	Yes	Yes	Yes
10	10	50	44	43	**51**	Yes	Yes	Yes
11	11	49	43	41	**51**	Yes	Yes	Yes
12	12	48	42	40	**50**	Yes	Yes	Yes
13	13	48	42	39	**49**	Yes	Yes	Yes
14	14	47	41	38	**48**	Yes	Yes	Yes

Notes: 1.Standard receiver elevation is five feet above grade/pad elevations at the receiver location(s)

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Sound Transmission Classification Assessment Tool (STraCAT)

Part I - Description

Project

Gonzaga Family Haven

Sponsor/Developer

CHSEW

Location

Spokane, Washington

Prepared by

j.c. brennan & Assocaites

Noise Level

67.2

Date

2020-06-16

Primary Source(s)

Roadway Traffic

Part II - Wall Components

Wall Construction Detail	Area	STC
Wood Siding 2x4 studs insulation 5/8" gypsum	200	40

Add new wall

	200 Sq. Feet	**40**

Window Construction Detail	Quantity	Sq Ft/Unit	STC
32"x24"x24" wood-framed aluminum clad double-hung window each sash has one 3/32" and one 1/8" glass panel 13/16" air space	2	**10.67**	**29**

Add new window

Door Construction Detail	Quantity	Sq Ft/Unit	STC

Add new door

Part III - Results

Wall Statistics

Stat	Value
Area:	200 ft²
Wall STC:	40

Aperture Statistics

Aperture	Count	Area	% of wall
Windows:	2	**21.34 ft²**	**10.67%**
Doors:	0	**0 ft²**	**0%**

Evaluation Criteria

Criteria	Value
Noise source sound level(dB):	**67.2**
Combined attenuation for wall component:	**36.5 dB**
Required attenuation:	**25.200000000000003**
Do Wall components meet requirements?	**Yes**

Print

Part 4 - Tips

What do you do if the preferred wall design is not sufficient to achieve the required attenuation? Another wall design with more substantial materials will work, but may not be the most cost-effective solution. Try adding some other elements for just a little more attenuation.

For example:

- Staggering the studs in a wall offers approximately 4dB of additional protection.
- Increasing the stud spacing from 16" on center to 24" can increase the STC from 2-5dB.
- Adding a 2" air space can provide 3dB more attenuation.
- Increasing a wall's air space from 3" to 6"can reduce noise levels by an additional 5dB.
- Adding a layer of ½" gypsum board on "Z" furring channels adds 2dB of attenuation.
- Using resilient channels and clips between wall panels and studs can improve the STC from 2-5dB.
- Adding a layer of ½" gypsum board on resilient channels adds 5dB of attenuation.
- Adding acoustical or isolation blankets to a wall's airspace can add 4-10dB of attenuation.
- A 1" rockwool acoustical blanket adds 3dB to the wall's STC.
- Filling the cells of lightweight concrete masonry units with expanded mineral loose-fill insulation adds 2dB to the STC.