MMC Responses to City's Helipad Questions
02/22/2018

QUESTION: The original study conducted by consultants for MMC in 2004(by Resource Systems Engineering) noted that the location of the helipad on the top of the employee garage was beneficial regarding noise as this location would "...enable the existing and proposed buildings to block sound propagation to noise sensitive areas to the west and south." Could you ask your consultants to advise as to whether relocation of the helipad (albeit higher) out from "behind" those buildings will increase sound levels in different community locations than were studied in 2004. *(FROM EMAIL DATED 2/16/2018)*

ANSWER: Refer to MMC submission to the City on 1/31/2018 titled WS – S – 6A Heliport Memo

The attached memo dated February 2, 2018 from Russell Acoustics seeks to recreate two tables from the 2004 noise study that summarizes the sound study by comparing average ambient noise with average flight test noise – tables 2 and 3. It is impossible to recreate the 2004 study because the environment has changed significantly. In addition to the developments that have occurred since 2004, the City has seen an increase in population which results in more traffic and more ambient noise.

1. Construction of Crescent Heights apartment building;
2. Construction of the East Tower; and,
3. Construction of the Visitor Garage.

Therefore, rather than comparing the 2017 study to the 2004 study, the attached memo from Russell Acoustics compares average ambient to average flight test.

As stated in the memo, the proposed change has a varying affect to the 9 monitoring positions.

In order to simplify the City's review, MMC has directly compared the 2004 study with the 2017 study.

	Ambient Average		Flight Test Average		Change in Sound Level (2003 to 2017)	
	2003	2017	2003	2017	Ambient	Flight Test
CP1	79	84	82	77	5	-5
CP2	79	93	88	88	14	0
CP3	71	92	80	96	21	16
CP4	69	89	79	89	20	10
CP5	83	88	66	66	5	0
CP6	75	79	71	72	4	1
CP7	68	81	71	86	13	15
CP8	78	89	63	63	11	0
CP9	74	92	65	70	18	5

QUESTION: The City's sound consultant at that time (2004) noted that the direction the helicopter was facing when on the pad could make a significant difference in the sound levels nearby. Could you please confirm that the orientation of the helicopter on the relocated pad will be the same as for the current pad. *(FROM EMAIL DATED 2/16/2018)*

ANSWER: The direction of the helicopter will be the same.

RUSSELL ACOUSTICS, LLC
Consulting Engineers in Sound and Vibration

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973.464.9724 (CELL)

2 February 2018

Mr. Dennis Morelli, AIA
Manager of Facilities Development
Maine Medical Center
22 Bramhall Street
Portland, ME 04102

Re: Heliport Relocation Project
Sound Exposure Comparison

Dear Mr. Morelli:

Regarding the various sound tests of ambient and helicopter flights we did last year, you asked that we put the results in a format like that used in the previous report, specifically Tables 2 and 3 of the 30 October 2003 report you provided us. This report describes the process we followed to do this and the results.

The sound measurements we conducted were made over three calendar days at nine test locations (CP1 to CP9); from 12:00 to 12:00 (noon to noon) on 1 to 2 May 2017, and 14:00 to 15:00 on 2 and 3 May. The locations were chosen to reproduce the locations used in the 2003 report. The first set of measurements included ambient sounds only; there were no helicopter operations of any type. Test flights were flown on the afternoon of 2 May, between 17:00 and 18:00, but the rest of the time there were no helicopter flights of any type. The flight tests were done within the one hour (i.e., not split across the on-the-hour times) to make working with the data easier. By removing all the sounds during the hour of flight testing we were more easily able to analyze the other 48 hours of ambient measurements. All of our measurements are A-weighted decibels, or "dBA."

Recall that in the 30 October 2003 sound study report by Resource Systems Engineering (RSE) comparisons were made between the ambient community sound levels and the levels during the flight tests. Page 6 of the report stated:

> *Summary tables of results were prepared based on review of sound level readings from the Figure Sets. There are many comparisons that could be made to quantify the differences between ambient (non-helicopter) sound levels and sound levels measured during the flight testing. Considering that each of the four flight tests was a distinct and relatively short-term event, we chose to compare the four flight test events with the four loudest non-helicopter community events based on a 5-second basis first and then one a one-minute basis.*

The report then presented two tables (Tables 2 and 3) for the loudest 5-second and 1-minute Leq sound measurements for the ambient sounds and the helicopter tests. We are doing the same for the 1-3 May 2017 measurements to enable a direct comparison.

The following process was used:

- From the original instrument data files from our measurements, spreadsheets with 5-second and 1-minute duration Leqs were generated for the two different sets of measurements. (Recall Leqs of these durations were used in the first sound study; we wanted to compare "apples to apples".)
- For the second set of spreadsheets the data for the flight test time from 17:00 to 18:00 were moved to another location so the ambient-only measurements were together.
- The time history of the 5-second and 1-minute Leqs in the 18 different files (nine locations for two days) were individually sorted by their Leq values, highest to lowest.
- Where the instrument indicated an "overload" condition or at the beginning of some of the measurements made on the first day when we were setting up a few of the instruments and interfered with the measurements, we excluded the unnaturally high ambient levels.
- For each of the nine locations we took the four highest of the 5-second and 1-minute ambient Leqs (ignoring any of the discarded high levels). When levels in the highest four were close together in time (implying they were part of the same sound event) we skipped the lesser levels in the set and continued down the list to include other events in the top four. (This has the more conservative effect of lowering the bottom range of the ambient sounds.)
- For the flight tests we took the four highest maximum levels for the different passes. While some of the events were clearly defined when one looks at a graph of sound level over time for the test hour, others were difficult to pick out because the other sounds in the area during this time were significant. We made our best estimate of the different events and used timing information to try to identify the helicopter events from other fluctuating sounds.
- Both the "Ambient Range" and "Flight Test Range" values show the lowest to highest levels from the four highest levels for the data. The "Average" values are the arithmetic average of the two numbers for the corresponding "Range" values. (The RSE report used arithmetic average.)

Table 2 Replicate

Position	Ambient Range	Ambient Average	5-Second Leq Flight Test Range	Flight Test Average	Sound Level Change of Averages
CP1	83-84.1	83.5	76.1-77.3	76.7	-6.8
CP2	92-94.1	93	85.8-89.2	87.5	-5.5
CP3	84.1-99	91.5	95.1-97.2	96.2	4.7
CP4	78.1-81.5	79.8	88.3-89.6	89	9.2
CP5	84.6-92	88.3	65.8-66.8	66.2	-22.1
CP6	76.3-82.3	79.3	71.1-73	72.4	-6.9
CP7	77.8-83.4	80.6	84.7-87.7	86.2	5.6
CP8	85.2-91.9	88.5	58.7-68.1	63.4	-25.1
CP9	89.9-94.8	92.4	68.8-71.1	70	-22.4

Table 3 Replicate

Position	Ambient Range	Ambient Average	1-Minute Leq Flight Test Range	Flight Test Average	Sound Level Change of Averages
CP1	75.3-76.1	75.7	69.4-71.2	70.3	-5.4
CP2	82.2-84.4	83.3	82.8-86.4	84.6	1.3
CP3	73.7-78.3	76	88-90.1	89	13
CP4	71-74.1	72.6	79.5-82.7	81.1	8.5
CP5	75.6-83.3	79.4	56.8-58.8	57.8	-21.6
CP6	70.4-75.2	72.8	64.5-67.3	65.9	-6.9
CP7	70.5-75.6	73	79.8-82.7	81.2	8.2
CP8	78-83.3	80.6	55.4-62	58.7	-21.9
CP9	81.5-88	84.8	62.6-64.6	63.6	-21.2

An obvious question is "How do these changes compare to the changes in sound levels in the 2003 study?" The tables below compares the changes:

5-Second Sound Level Comparisons

Position	Sound Level Change of Averages	Sound Level Change of Averages (2003)
CP1	-6.8	3
CP2	-5.5	8
CP3	4.7	9
CP4	9.2	10
CP5	-22.1	-17
CP6	-6.9	-4
CP7	5.6	3
CP8	-25.1	-15
CP9	-22.4	-11

1-Minute Sound Level Comparisons

Position	Sound Level Change of Averages	Sound Level Change of Averages (2003)
CP1	-5.4	5
CP2	1.3	12
CP3	13	11
CP4	8.5	10
CP5	-21.6	-14
CP6	-6.9	-2
CP7	8.2	6
CP8	-21.9	-13
CP9	-21.2	-6

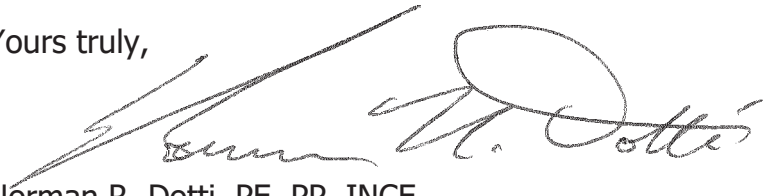
The green highlights show where the change in sound level vs. ambient was less of an increase or more of a decrease compared to the 2003 study. This was the case for 15 of the 18 comparisons. The red highlight shows where the changes were less favorable than in 2003. There were three of the 18 comparisons where this was the case, with the maximum difference being 2.6 dBA.

We realize there are differences in structures around the hospital than might affect past and present sound level comparisons. All we can do is look at the past and present sounds and present them, as we have done above.

From our several decades of experience with aircraft sounds in general and helicopters in particular, we would not expect substantial changes in sound levels due to moving the pad from one rooftop to that of another nearby building, and I believe the two comparison tables above show this to be the case. In a built-up area in and around an urban area it is not at all unusual to find ambient sound levels for the many other sounds sources in the area to be comparable to or even higher than the sound from the helicopter, and, as the measurements show, that is the case here.

When assessing community sounds the U.S. Department of Housing and Urban Development (HUD) in fact uses the annual average day-night sound level, abbreviated Ldn or DNL. With an average of about one flight in and out of the hospital per day, with the "duration" of the approach or departure event lasting about 30 seconds (there are 86,400 seconds in one day), the effect on the annual DNL is insignificant.

Yours truly,



Norman R. Dotti, PE, PP, INCE
Principal

NRD/me

SOUTH REDDING 6-LANE PROJECT

LOUDNESS COMPARISON CHART (dBA)

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
Jet Fly-over at 1000 ft	110	Rock Band
	100	
Gas Lawn Mower at 3 ft	90	Food Blender at 3 ft
		Garbage Disposal at 3 ft
Diesel Truck at 50 ft at 50 mph	80	
Noisy Urban Area, Daytime		Vacuum Cleaner at 10 ft
Gas Lawn Mower at 100 ft	70	
Commercial Area		Normal Speech at 3 ft
Heavy Traffic at 300 ft	60	
		Large Business Office
Quiet Urban, Daytime	50	Dishwasher Next Room
Quiet Urban, Nighttime		
Quiet Suburban, Nighttime	40	Theater, Large Conference Room (Background)
	30	Library
Quiet Rural, Nighttime		Bedroom at Night, Concert Hall (Background)
	20	Broadcast/Recording Studio
	10	
Lowest Threshold of Human Hearing	0	Lowest Threshold of Human Hearing

An increase of 3 dBA is barely perceptible to the human ear.

City of Redding, California · Shasta County Regional Transportation Planning Agency · Caltrans