ACOUSTIC ANALYSIS

OF ORIGINAL SYSTEM

As stated earlier, Howard Hughes Medical Institute has adopted the National Institute of Health's design guidelines for buildings. NIH has developed recommended NC levels based on years of experience for spaces common in hospitals and medical research facilities. NC levels are based on rooms not being occupied and with all use equipment turned off. Values can be found in Table 13 below. The separation of mechanical equipment the in rear of the building helps to reduce sound transmission into occupied spaces.

Table 13

Recommended NC Levels	
Area	**NC Level**
Auditoriums	20-25
Audiology Suites, Audio/Speech, Pathology, Phonology/Caridac	25
Chapel, Capel Mediations	25
Private Residences	25-30
Conference Rooms	25-30
Hospital Rooms	25-35
Patient Rooms	35
Executive Offices	30-35
Open-Plan Offices	35-35
Dinning Rooms, Offices, Lobbies	40
Central Sterile, Food Service/Serving	45
Operating Rooms	40-45
Research Laboratories	40-45
Corridors	45
Kitchen, Lockers, Warehouse, Shops	50
Research Animal Housing Areas	--

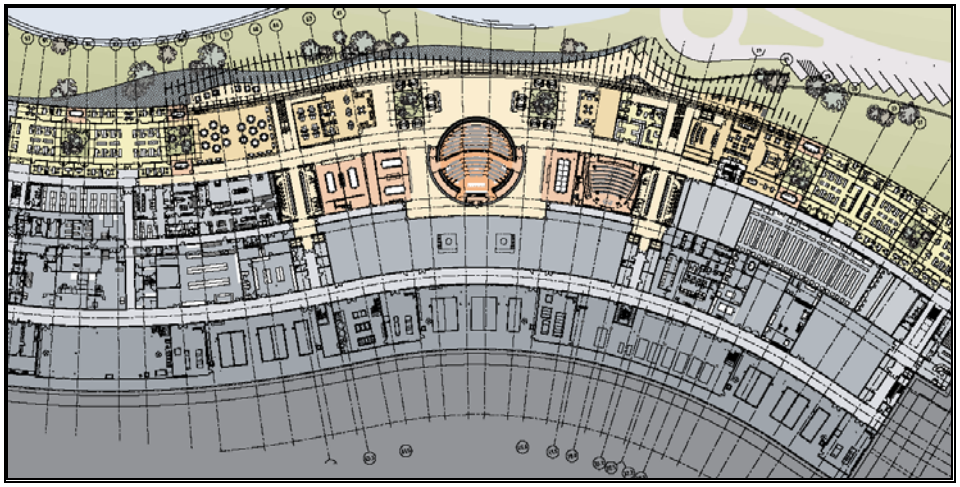

Figure 3 : First Floor Plan

Figure 14 is a rendering of the first floor plan. The area that is at the bottom of the building in gray is all mechanical space. The mechanical room in Zone F, Level One currently houses the five existing chillers, two future ones, 3 pumps and one future pump as well. This room has concrete slab floors and 8" cmu's for all interior walls. The south wall is an exterior wall that, at floor level, is approximately 60 feet below grade. The east and west walls divide the mechanical room from other mechanical rooms. On the other side of the north wall is a 15 foot wide service corridor that runs the length of the building. Directly across the hall from this mechanical room is the sterilizing room for mechanical equipment and tools. While staff does work in this room during operational hours, sound levels are not a critical issue as the room has a great deal of equipment noise itself.

The following calculation in Table 14 determines the necessary partition between the mechanical room and the corridor in order to achieve the required transmission loss. The calculation is done for both the actual equipment and for the new design with additional pumps. A major assumption that was made was that the likely noise in the corridor was comparable to that of a lobby or reception area. The table with likely noise values by space types in *Architectural Acoustics* by M. David Egan did not provide data for hallways and corridors. It would be expected that the noise in the corridor is considerably less than that of a lobby and therefore would not mask the sound from the mechanical room as well as the calculation suggests.

Table 14 : Transmission Loss Calculation

		Sound Absorption Coefficients					
Surface	**Area [SF]**	**125 Hz**	**250 Hz**	**500 Hz**	**1000 Hz**	**2000 Hz**	**4000 Hz**
Concrete Block, painted	4600	0.1	0.05	0.06	0.07	0.09	0.08
Concrete Floor	3450	0.01	0.01	0.02	0.02	0.02	0.02
Concrete Ceiling	3450	0.01	0.01	0.02	0.02	0.02	0.02
Sides Without Walls	600	1	1	1	1	1	1
		Sound Absorption [sabins]					
Surface	**Area [SF]**	**125 Hz**	**250 Hz**	**500 Hz**	**1000 Hz**	**2000 Hz**	**4000 Hz**
Concrete Block, painted	4600	460	230	276	322	414	368
Concrete Floor	3450	34.5	34.5	69	69	69	69
Concrete Ceiling	3450	34.5	34.5	69	69	69	69
Sides Without Walls	600	600	600	600	600	600	600
a2 [sabins]		**1129**	**899**	**1014**	**1060**	**1152**	**1106**
		Mechanical Room Noise Calculation: Actual Design					
		125 Hz	**250 Hz**	**500 Hz**	**1000 Hz**	**2000 Hz**	**4000 Hz**
Chiller Noise (One Unit)		85	87	87	90	98	91
Chiller Noise (Five Units)		92	94	94	97	105	98
Pump Noise (One Unit)		80	82	87	86	80	77
Pump Noise (Three Units)		85	87	92	91	85	82
Total Noise in Mech Room		**93**	**95**	**96**	**98**	**105**	**98**
		Mechanical Room Noise Calculation: New Design					
		125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz
Chiller Noise (One Unit)		85	87	87	90	98	91
Chiller Noise (Five Units)		92	94	94	97	105	98
Pump Noise (One Unit)		80	82	87	86	80	77
Pump Noise (Six Units)		88	90	95	94	88	85
Total Noise in Mech Room		**93**	**95**	**97**	**99**	**105**	**98**
		Noise Reduction & Transmission Loss : Actual Design [dB]					
		125 Hz	**250 Hz**	**500 Hz**	**1000 Hz**	**2000 Hz**	**4000 Hz**
Likely Noise in the Mech Room		93	95	96	98	105	98
Likely Noise in the Corridor		66	72	77	74	68	60
Required NR		27	23	19	24	37	38
Minus 10 log a2/S		-6	-7	-7	-6	-6	-6
Required TL		**33**	**30**	**26**	**30**	**43**	**44**
Actual Wall Assembly TL, 8" Concrete, painted		**34**	**40**	**44**	**49**	**59**	**64**
		Noise Reduction & Transmission Loss : Actual Design [dB]					
		125 Hz	**250 Hz**	**500 Hz**	**1000 Hz**	**2000 Hz**	**4000 Hz**
Likely Noise in the Mech Room		93	95	97	99	105	98
Likely Noise in the Corridor		66	72	77	74	68	60
Required NR		27	23	20	25	37	38
Minus 10 log a2/S		-6	-7	-7	-6	-6	-6
Required TL		**33**	**30**	**27**	**31**	**43**	**44**
Actual Wall Assembly TL, 8" Concrete, painted		**34**	**40**	**44**	**49**	**59**	**64**

CONCLUSION

As it can be seen for both cases, the actual wall assembly is adequate, if not over designed for the amount of noise in the mechanical room. It can be estimated that with a lower sound level in the corridor than represented above, the partition assembly would still be adequate. Also, if the 8" cmu wall does not quite prevent the necessary amount of sound from coming in to the hall, it is not critical as there aren't spaces in the close vicinity that require carefully controlled sound levels. Therefore, it can be concluded that the addition of three more pumps to the mechanical system does not require acoustical treatment for the mechanical room.

Note: All data in Figure Table 14 were taken from data in *Architectural Acoustics* by M. David Egan.