A c o u s t i c a l A n a l y s i s

Introduction

Acoustical requirements should always be considered at the earliest stages of design. The performance of an acoustical system for any type of construction is extremely important for buildings with multiple residents. Sounds traveling through the walls, floors, and openings can seriously reduce the resident's level of comfort. Since the Academic Villages are college dormitories, acoustics is a major concern in these buildings due to student's general loud behavior. In the process of designing a new floor system, the metal decking from the existing composite deck is no longer present. The 4 ½" slab from the existing system is relatively the same as the proposed 5" slab post-tensioned system. The main objective of this analysis is to verify that the proposed post-tensioned system works sufficiently with the existing walls to keep the sound transmission to a minimum.

Goals:

The following two goals will be evaluated:

1. The existing system was designed using the BOCA 99 code with STC and IIC rating limits of 45 dB. However, the IBC 2000 requires STC and ICC ratings of 50 dB. The *proposed* system will be evaluated along with the existing walls to make sure it meets IBC 2000 requirements.

2. There are two rooms that share a common wall with the mechanical room. The air handling unit in the mechanical room is rated for 975 cfm.

Analysis I – IBC 2000 Requirements

According to the IBC 2000, the required STC and IIC sound transmission requirements can be no less than 50 dB. The Sound Transmission Class (STC) is the single number rating of the air-borne sound transmission loss TL performance measured at various frequencies. The STC rating was developed to correlate noise level with interference of speech activities. The IIC is the single number rating given to impact sounds. The higher the STC and IIC values are for a particular structure, the more efficient that structure will be in resisting sound transmissions. For this project, the following surfaces were analyzed:

Surface	Materials	STC	ICC
Walls	8" cmu blocks	58	N/A
Floor/Ceiling	5" concrete slab	48	25
Interior wall	2x4 steel studs 16" o.c. w/ 5/8" gypsum board both sides	52	N/A

Table 13: STC/IIC Ratings

(See full table in Appendix 4) The interior stud walls and exterior bearing/shear walls satisfied IBC 2000 requirements. The proposed post-tensioned slab however did not. Consequently, a new acoustic floor system will be integrated with the post-tensioned slab in order to meet IBC requirements.

Solution

A solution for this issue was found at the Acoustic Product Division (AMI). The use of ACOUSTIK acoustic subflooring between the concrete slab and carpet in each apartment unit will increase the STC rating to 65 dB and the IIC rating to 55 dB, easily satisfying IBC 2000 requirements. The ACOUSTIK comes in 2' x 2' tiles and is only 5/16" thick. It can be applied with DURO ACOUSTICAL ADHESIVE to further increase the IIC rating but that is not required in this case.

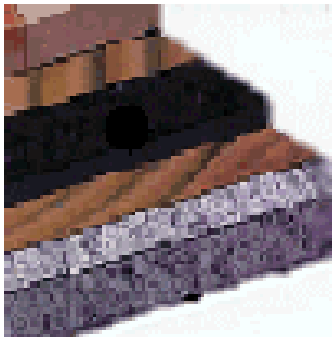

Figure 15: ACOUSTIK acoustic subflooring

Analysis II – Mechanical Room

In order to calculate the required transmission loss for the common wall next to the mechanical room, the source power level, L_{source}, of the air handling unit needed to be calculated in decibels. This was done using an acoustics program called TAP. The results are listed in the table below. The following equations were used to find the actual transmission loss through the common wall:

$$SA \times \bullet = a$$

$$NR = L_1 - L_2$$

$$TL_{actual} = NR - 10(\log(a/S))$$

where:

SA = total surface area of the apartment (ft^2)
• = absorption coefficient
a = absorption (sabins)

NR = Noise Criteria
S = surface area of common wall (ft^2)

The RC level for apartments is between 25-35. For the apartment, I chose an RC value of 30. Please see Appendix 4 for the complete RC table. All calculations for the

Frequency (Hz)	L_{source} (dB)	RC-value	$TL_{required}$
125	86	45	41
250	85	30	55
500	84	35	49
1000	83	30	53
2000	82	25	57
4000	80	20	60

Table 14: $TL_{required}$

Frequency (Hz)	• (sabins)	S (ft^2)	TL_{actual}
125	106.25	216	44
250	70.08	216	60
500	85.44	216	53
1000	94.08	216	57
2000	111.36	216	60
4000	96	216	64

Table 15: TL_{actual}

Conclusion

Since the actual transmission loss is greater than the required loss for all frequency levels between 125 and 4000 Hz, the current system is adequate for resisting sound from the adjacent mechanical room.