Sound Advice

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HUD and FHA Loan Noise Requirements

by Noral D. Stewart

The Federal Housing Administration (FHA) and the US Department of Housing and Urban Development (HUD) have noise requirements that must be met before they will approve funding for housing projects. The requirements are based on the day-night average sound level. This is a long-term average sound level in which 10 dB is added to all sound after 10:00 pm and before 7:00 am. This is equivalent to counting any noisy event during this night period as equal to 10 similar events in the daytime. If there is reason to believe the day-night average sound level is above 65 dB, HUD and FHA will require a noise assessment. This assessment involves calculations according to procedures developed or approved by HUD when the noise is due to transportation systems. HUD and FHA require these methods to measurements, and the calculations are much less expensive than measurements. HUD rarely accepts actual measurements. If the calculations show the noise is below 65 dB, there should be no further questions.

In the event the noise calculations indicate levels above 75 dB, HUD and FHA will probably not approve the application even with noise control steps. If levels are between 65 and 75, the site is considered "normally unacceptable" and noise control steps are necessary for approval. If the noise reaching the site is between 65 and 70 dB, the applicant must usually satisfy <u>one</u> of the following requirements.

1. Show that the building construction is adequate to reduce the interior noise to 45 dB. This may not be difficult and the planned construction may be adequate if the noise is not much above 65 dB.
2. Provide a barrier or berm to reduce the outside noise reaching the site to 65 dB.
3. Provide a combination of barrier or berm and construction to reduce the level reaching the inside to 45 dB.

If there is a dedicated outdoor recreational area such as a pool, a berm or barrier may be required to bring the level there below 65 dB.

If the level is between 70 and 75 dB, a combination of a berm or barrier to reduce outside levels below 70 dB (below 65 dB at specified recreation areas) and improvement in the building construction is usually necessary. The outdoor noise reduction may be waived in cases where no outdoor facilities are provided, especially high-rise buildings.

For aircraft noise, noise information will usually be available from the airport showing the expected day-night average sound level. Calculations for aircraft noise can be difficult and expensive if the airport has not done them.

For road and rail noise, calculations must be done following the HUD procedure. Unfortunately, this procedure will predict significantly higher than actual sound levels in cases where there is a few hundred feet of soft ground between the road and location of concern. The methodology was developed before the full effect of soft ground was understood. The railroad methodology was also developed without a budget to do a careful study and may have flaws. These errors in the methodology may make the difference between whether a site qualifies or not, or what noise control is required. However, HUD firmly requires that these methods be used.

Certain information concerning railroad and highway noise sources is needed for the initial calculations as listed below. If some of this information is not available, the procedure requires certain assumptions be made.

For railroad noise, the following information is needed for the initial calculations.

1. The distance from the proposed building to the centerline of the railroad track. If there are multiple buildings or tracks, a plan must be provided.
2. Details of any topography or structure that blocks the line-of-sight between the proposed building and the railroad.
3. The location of whistleposts if the proposed site is between whistleposts where horns would be sounded (otherwise assumed to ¼ mile each side of crossing).
4. For the period 7:00 am to 10:00 pm, the average number of freight trains per day.
5. For the period 7:00 am to 10:00 pm, the average number of passenger trains per day.
6. For the period 10:00 pm to 7:00 am, the average number of freight trains per day.
7. For the period 10:00 pm to 7:00 am, the average number of passenger trains per day.
8. For the freight trains, the average speed, typical number of locomotives, and typical number of cars.
9. For the passenger trains, the average speed, typical number of locomotives, and typical number of cars.
10. Are the rails welded or bolted together?

This information can be obtained from the railroad, but it can be difficult to find the right person and there can be long delays in getting the information.

For highway noise, the following information is needed for the initial calculations.

1. The distance from the proposed building to the nearest edge of nearest lane and farthest edge of farthest lane of road.
2. Details of any topography or structure that blocks the line-of-sight between the proposed building and the road.
3. The distance to any stop signs on the road of concern.
4. The road gradient if 2% or more.
5. The average speed of vehicles on the road or speed limit if not known.
6. For the period 7:00 am to 10:00 pm, the average number of vehicles per day broken into three categories: (1) motorcycles, automobiles and light trucks, medium trucks (10000 to 26000 pounds, typically two-axle six-tire trucks), and (3) heavy trucks including all buses.
7. For the period 10:00 pm to 7:00 am, the average number of vehicles per day broken into three categories: (1) motorcycles, automobiles and light trucks, medium trucks (10000 to 26000 pounds, typically two-axle six-tire trucks), and (3) heavy trucks including all buses.

If no breakdown is available between day and night traffic, the procedure assumes 15% of traffic is at night. HUD also specifies some assumptions for percentages of vehicle type if that data is not available. In some cases the DOT will have “classification” survey data done typically for 48 hours counting vehicles by type and by the hour. If this is not available, it can be worthwhile to pay a traffic engineering firm to do such a count with automated equipment.

Sometimes the firm hired to do these calculations will do them for only the point of the development that is closest to the road or railroad or the loudest location. However, the sound could be varying significantly over a site. Portions of the site may be in the “acceptable” range and not require any analysis of the construction or noise control. The required noise control could vary over other parts of the site.

If calculations show a portion of the site with buildings is within the "normally unacceptable" range, then the construction of the buildings must be analyzed for their ability to reduce interior sound levels. This analysis must consider the ability of the walls and roof to block the sound of the particular source, and the size of those walls and roof relative to the size of the room. Structures block high-frequency noise better than low-frequency noise. They will block the high-frequency tire noise of a freeway better than they will block the low-frequency noise of aircraft, locomotives, or low-speed roads. A room that is exposed on two sides and a roof will be louder than one exposed on only one side unless the blockage ability of the structure is better. Unfortunately, HUD has often accepted a simplified analysis that can be very misleading. This is based on the composite STC (sound transmission class) of the walls and roof minus a safety factor of 3 dB. There are three major flaws in this. The STC can be very misleading of the ability of the structure to block the sound, especially for aircraft, locomotives, and low-speed roads, and especially if the structure is a cavity construction such as stud walls or windows with cavities. The STC rating of such structures can be improved by improving their ability to block higher frequency sounds without improving their ability to block low-frequency sound. Further, this does not account for reduced performance when the area of the wall or wall and roof combination is greater than the floor area of the room. Finally, contrasted to the situation between two rooms, a factor of 6 dB must be introduced when going from outdoor sound levels to the level in a room. The 3 dB safety factor does not even account for this 6 dB much less overstatement of sound blockage by the STC and the reduced performance when the room is on a top floor with roof exposure or has wall exposure greater than the floor area. The best analysis would be based on an actual measured spectrum of the source sound and the transmission loss of the structure at specific frequencies. However, a very good approximation for aircraft, locomotives, and low-speed roads is to use the OITC (outdoor-indoor transmission class) rating of the walls and roof. This rating is based on a spectrum very representative of aircraft, locomotives, and low-speed roads. The factor of 6 dB must then be subtracted and the result adjusted for the ratio of the exposed surface area to the room floor area. The calculated outdoor to indoor noise reduction will usually be more than 3 dB less than the composite STC of the walls and roof.

To do the analysis of the structure, the following information is required.

1. Site plan
2. Floor plans of all residential units
3. Building exterior elevations showing windows and doors.
4. Building sections showing ceiling heights
5. Details of wall and roof construction.
6. ASTM E90 sound transmission test reports for windows and preferably doors also.
7. If test reports are not available for doors, details of door construction.

Experience indicates modern construction methods and material will often result in outdoor-indoor noise reductions between 20 and 25 dB but rarely reaching 25 dB. This is better than the 20 dB common and presumed at the time the HUD regulations were adopted. Thus, for cases where the calculated sound level is just a little above DNL 65, extra steps are often not required. As levels approach DNL 70, it is likely that windows will need to be improved. Above DNL 70, other changes are likely to be required.