Noise and acoustics in Hospitals.

Hospitals are not the first things that spring to mind when considering problems with noise and acoustics. Those of us who have been in-patients in the past may have had a poor nights sleep due to what seems like constant activity on the wards or the adjacent corridors, but few would be aware of the noise problems typically affecting hospitals.
The most common are:-
· Speech privacy
· Mechanical services noise within the hospital e.g. lifts, generators, etc.
· Environmental noise (i.e. complaints from nearby residents) from areas such as laundries, boiler houses, incinerators, etc.

Speech Privacy

Speech privacy is, in fact a quantifiable feature of a room or area. It is based upon the level of speech versus the level of background noise. The higher the level of background noise compared with the level of speech, the greater will be the masking of the speech and hence the privacy. A simple example would be to compare having a conversation in a noisy pub where speech from the adjacent table would be unintelligible, if not completely inaudible, with a conversation in a doctors waiting room where even whispered conversation can be clearly heard all round.

In hospitals, a quiet waiting room is not really a problem, as conversation is unlikely to have a specific privacy requirement. It is important, however, if the adjacent consulting room is not adequately insulated to a degree which recognises the quiet background conditions of the adjacent waiting room, or other consulting rooms. Often the designers will be charged with ensuring low levels of background noise without adequate consideration of consequent speech privacy problems.

As an alternative approach to improved sound insulation of such areas requiring speech privacy, we can consider ensuring an adequate level of background noise. It is, of course, odd that an acoustic consultant should be advocating higher noise levels but, where it is done carefully, it can be a highly effective technique. Some open-plan offices, for instance, actually go as far as generating noise over a sound system which is not really noticeable but makes speech from an adjacent desk an unintelligible murmur.

Mechanical Services

Internal noise, other than that generated by the general hustle and bustle of hospital life is often dominated by mechanical services noise, especially in modern, light-weight buildings

where noise and vibration can be transmitted over quite large distances.

A fascinating project with in which PDA was involved recently was associated with a brand new hospital with severe lift noise problems in virtually all bedrooms and some operating theatres. Noise levels when the lift operated were as high as 62 dB(A) in parts, at least 25 dB(A) above what one would expect as an upper limit. This was made worse by the fact that the noise was intermittent (as and when the lifts were used) and took the form of an annoying whine.

Initially is was tempting to assume that the plant room, which housed the lift power packs, was inadequately insulated against airborne noise. In fact, after a great deal of analysis, we found that two other paths were far more important and lent themselves to cheaper solutions than conventional sound insulation. In the worst-affected bedroom, the components of the overall noise of 62.0 dB(A) stacked-up as follows:-

· Airborne noise, i.e. straightforward transmission of airborne sound from the plant room to the nearest bedroom accounted for 29.5 dB(A). In its own right this would be acceptable.

· Structure borne noise in the walls. This is where the power packs body and pipe work is hard-fixed to the floor and walls and sets them vibrating. The vibration can travel over large distances and is radiated off walls as airborne sound. This accounted for 51.5 dB(A).
· Structure-borne and airborne noise in the pipe work. The pipes were rigidly connected to the power pack, were of lightweight material, and were rigidly fixed to the floors, walls, structural steel work, etc. Noise from the pipe work was also travelling large distances through a common void above the false ceiling. This accounted for 61.6 dB(A) in the worst-affected bedroom.

To break down the overall noise into these three components was an involved analytical process, but solutions were cheap and simple to implement in-house. They mainly involved vibration isolation of the power packs, design of anti-vibration supports for the pipe work, silencers and flexible connectors in the pipe work, etc.

Environmental Noise

Noise created by the hospital which can disturb neighbours can take many forms but people are often quite tolerant of general activity noise. It is the more industrial-type noise which tends to cause the problems, such as laundries, incinerators, generators, etc.

We were asked to examine a severe problem with eight laundry fan discharges, which were responsible for fan noise of 75 dB(A) in the back gardens of nearby houses. Background noise was 46 dB(A), an exceedance of some 29 dB(A). As a rule of thumb, an exceedance of 10 dB(A) would give rise to justified complaints. This severe noise problem had to be tackled without imposing pressure drops on the fans and was done using very large straight-through silencers.

An entirely different kind of problem was experienced with a noisy incinerator. We built a very full and detailed computer model of the incinerator, including all its significant noise sources. This allowed us to "install" noise control in the model and predict the performance. The most severe problem was from the main induced draught fan which was not as loud as the above laundry fans but equally disturbing to residents due to a very clear and unstable tone. The fan was supplied with an off-the-shelf silencer which was wholly inadequate and, due to the pressure drop it imposed, it was instrumental in the creation of the tones as the fans load went up and down. The solution was to fit a negligible-pressure silencer which was large enough to be effective on the tones.

The above examples offer a very brief insight into the kind of noise problems encountered in hospitals and the solutions which are often straight forward and easy to implement. The key to success is not to opt for ready-made solutions either at the new facility design stage, or in trouble-shooting an existing problem, as noise problems are always set in a context, unique to that situation.

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