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Transportation Noise by T. K. Willson

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The problems caused by transportation noise may be examined from two viewpoints: Firstly the implications of building in an existing noise environment caused by road, rail or air traffic and secondly planning the routes of transportation links bearing in mind the existing environment. I intend to concentrate mainly on the first aspect, but I will touch briefly on the problems raised by the second.

The previous speakers have described in some detail the various units which may be used to measure sound levels and I do not therefore intend to do other than to suggest that the statistical levels which apply to most planning exercises are the peak level, (that is to say the L_1); the L_{10} level; and the Noise Pollution Level, these being applied to different uses of buildings. Some examples of these are: peak levels for concert halls and cinemas, 10% levels for schools and Noise Pollution Level for dwellings.

The first question which has to be asked when planning a new development is whether or not the site is or will be exposed to noise. This aspect may appear to be obvious but many projects have been built with apparently little or no concern for external noise. It is worthwhile noting in passing that the absence of external noise may also be a problem, leading to loss of privacy inside a building.

It is relatively easy to check for existing noise sources, and any future developments are usually known locally, either by the Local Council or, in some cases, a local solicitor may be able to help. Having once established the existence, or future existence, of a noise source, it is then necessary to choose the criteria applicable to a particular situation - for example, schools, houses, offices and other types of building. There are many criteria available in various units, but we at Atkins have developed our own criteria for internal and external housing noise. These are tentative figures, but they do have the advantage that criteria for different types of noises may be expressed in a standard form and that an easy comparison may be made between the various units. For instance, for a general acceptable suburban level the external criterion for housing may be given in terms of 65 NPL dBA, 25% annoyance, 30 NNI or a 10% level of 62 dBA.

The planning process may, therefore, be thought of in three stages.

1. Establish whether noise sources exist or will exist in the vicinity of a development.

2. Set criteria in terms of internal or external noise level as applicable to the project.

3. Decide what steps should be taken to reduce the noise to the criteria levels.

Obviously, stage 3 requires fairly detailed knowledge of the characteristics of the noise sources - these may be obtained by either site measurements or calculations based on established data. The time at which each external noise level occurs is very important, motorway noise may be more significant during the night, depending upon traffic flow patterns.

There are many ways in which noise may be reduced - the classical order of noise reduction effort is to treat, in this order, the source, the transmission path or the receiver. Generally the receiver will be treated where buildings and transportation noise are concerned, but it is possible to reduce the transmitted levels by means of building orientation. The Heston Grange development on the M4 Motorway is an example of this type of planning, and there are no reasons why land right up to the edge of a motorway cannot be utilised in urban areas by building continuous warehouses or offices immediately adjacent to the road in order to provide effective screening for residential developments further from the road.

Having decided the orientation of the building to minimise the noise levels at the most important facades, the internal layout of the building should be examined and any obviously critical areas should be placed in such a position to enable noise reduction requirements to be minimised. The required sound insulation for the building structure may then be established. In general, for buildings of traditional construction (that is to say fairly heavy external walls and roof) the major decision is concerning the type of glazing to be used and is basically a case of deciding between three types of glazing. Openable single glazing, that is single glazing which may be opened when necessary to provide ventilation and then closed to reduce noise levels in order that telephone conversations may be carried out in comfort; sealed single glazing, and double glazing. The last two require some form of artificial ventilation and it is often the cost of the artificial ventilation which is the deciding factor in whether the Client will go ahead with providing double glazing or single glazing.

As far as motorways are concerned, some reduction in noise level at ground level, or in some cases at first floor level depending on the distance from the building to the motorway, may be outlined by the use of screens, e.g. closeboarded fences. Contrary to a widely held belief, trees, unless planted in rather thick belts, have very little effect on the propagation of noise over short distances. However, the psychological effect of trees

and landscaping may well be out of proportion to the actual reduction of noise levels achieved and some useful masking noise can be provided by the rustling of leaves in even low wind speed.

I would like to turn now to the second aspect which I have referred to, i.e. planning of transportation links having regard to the existing environment. Nowadays, it is very rare that new rail links are envisaged apart from monorail or rapid transit systems which may well need to be investigated as completely separate subjects. The location of new airports tends to be decided at Governmental level and would appear to be a mainly political decision and is in any case not the sort of problem which would occur very frequently. Motorways and ringroads are now a major problem of the 1970's, although studies have indicated that motorways can cause no more annoyance than local roads. That is, the noise caused by congestion or traffic lights in a typical High Road may be worse than noise from freely flowing traffic on a By-Pass.

Over the next few years many miles of motorway will be planned and built, and it is necessary at this stage to make planning decisions which will affect the lives of a large number of people for many years. The route of the motorway is obviously fairly critical. However, the disturbance which it causes at present must be weighed against the future development of the area through which it passes, since in many cases it will be necessary to route the motorway through areas of dense population. It will be necessary in these cases to take steps to ensure that the existing noise environment is not increased unduly. This may be achieved by careful planning of the elevation of the motorway with respect to existing ground level, e.g. sinking the motorway into even a relatively shallow cutting has an effect on noise transmitted from the motorway. In some situations, the motorway may well be in cut and cover, i.e. in a retained cutting with a roof. In marginal situations closeboarded fences along the boundary of the motorway will reduce the noise level quite sufficiently for existing housing.

As far as the subjective response of people to noise is concerned, the traffic flow, that is the number of vehicles per hour, is not critical to within a factor of 2. Once a reasonable flow rate has been reached on the motorway, either a halving or a doubling of flow rate makes very little difference to the overall response to the noise. An increase of flow from 1000 to 2000 v.p.h. makes a difference in L_{10} of about 2 dBA and a similar increase in NPL. This implies that, in order to minimise nuisance, it is preferable to provide high capacity roads carrying large amounts of traffic rather than a number of smaller roads carrying the same level of traffic.

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