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HELICOPTER URBAN NOISE STANDARDS

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1. INTRODUCTION

Helicopters derive their commercial and emergency use appeal from their ability to save time. Aerodynamics of lift rotor systems do not allow helicoptors to achieve the high cruise speeds of fixed wing aircraft. Time saving is obtained by the unique ability of helicopters to operate from small and virtually unprepared locations which are very close to embarkation points and final destination in other words, to operate from city centres. Herein lies the environmental conflict resulting from helicopter noise. In order to be viable as a business tool or emergency evacuation vehicle the helicopter needs to interact with the noise sensitive regions it serves much more intimately than other aircraft.

Whilst many businesses can argue very strongly for the benefits to commerce that can be achieved by time saved they are not, in general, averse to crying "NIMBY" if the operational needs of others puts the facility too close for comfort. The same can be also be said for emergency services such as accident evacuation and organ transfers, but the cry is not usually so loud!

Operating in such intimate relationship to the urban community which is the key to successful discharge of operational needs brings a number of problems which take on much more significant importance when development density does not allow an appeal to the inverse square law to reduce noise. In summary the issues fall into a number of categories:

1.1 Operational contraints. Helicopters, just like any other aircraft, can glide and land safely in the event of engine failure, even being capable of landing safely back on the take off spot. However, to achieve this end, the helicopter can only fly within closely prescribed flight profiles during the early and late stages of flight. Once a certain altitude has been achieved twin engined helicopters can safely fly away even with one engine out, but the overall effect is to constrain flight profiles in a way which prolongs and concentrates noise. If, as is often required in an urban area, the helicopter is to operate from an elevated landing site, the flight profile will include a near vertical section which, depending on the helicopter type, could take a minute or more to achieve with only about 100ft climb. The potential effect on L_{AE} is obvious.

1.2 Ground Running. Lack of manoeuvreing space can often mean that ground running required to satisfy the needs of the engines for safety purposes must take place on the restricted land site. In dense urban areas the contribution to total L_{AE} from the ground running phase can be dominant in the overall noise burden.

1.3 Routing. Whilst use can be made of corridors of open space such as rivers, the Thames is the obvious and one of the designated helicopter routes in London, it is inevitable that part of the journey will be from city centre over the urban sprawl. Regulations require that helicopters will not fly closer than 500ft from any building, but often interaction with fixed wing overflight patterns will mean that heights above 2000ft cannot be achieved. In parts of London at certain times maximum heights cannot exceed 750ft! The versatility of helicopters can, however, offer great flexibility in the use of routes thereby offering reduction in local noise done through route distribution.

1.4 Sensitivity. There is nothing like a helicopter flight over an urban area to expose the apparent inconsistences in noise indices and assessment procedures. A typical flight might begin in the vicinity of an office block where total noise exposure is important, but so is potential speech interference particularly for offices very close to the landing pad. The noise intrusion may often be no more than that of a heavy lorry and we, as noise experts must judge how many events can be reasonably tolerated. Even urban areas have open space, and the enjoyment of parks or walkways can be disturbed - is it peak noise or dose which should be the deciding factor? Schools have their own sensitivity and again, a single low flying helicopter could interrupt teaching for a very short period. The same applies to courts and theatres, both having exacting requirements expressed often in indices and units peculiar to their function. Housing is also sensitive particularly if it is expected that growth in traffic will be unconstrained and operators unconcerned. A major difficulty is in combining the inconsistent criteria of each potential receiver when assessing the impact or setting the environmental capacity of a proposed heliport.

1.5 Helicopter noise emission. ICAO and national legislation is only concerned with maximum noise at fixed locations, often bearing little or no relation to the critical parts of a flight path and certainly not attempting to anticipate the kind of special profiles that may be needed for urban operation. Certification procedures, flight profiles and limits bears little resemblance to elevated platform flight profiles or the profiles required to operate from a congested urban site. Ground noise is completely ignored in the certification process yet can play the major role in an urban heliport's total noise impact.

Despite all the potential noise intrusion helicopters are, in the general scale of aviation sources, far from the most noisy and offer great versatility in their mode of operation which can be used to reduce specific impacts and spread the load of overflight noise exposure. Acoustic treatment to buildings in the immediate vicinity of the heliport can be effective and the area likely to suffer unreasonable disturbance clearly defined and minimised. Means must be agreed to determine the general acceptability or non acceptability of a planned helicopter service. Once the overall impact can be determined, then specific measures and controls must be applied to manage the operation of the helicopters so that agreed noise exposures are met and demonstrated to be met. At an early stage, the environmental capacity[1] needs to be determined and agreements on the scope of helicopter operation secures.

2. NNI and L_{Aeq}

When discussing a suitable method of assessing exposure from helicopter noise reference must be made to the Noise and Number Index (NNI). This has been the index used for assessing aircraft noise in the UK since the 1960s and at the present time remains the official assessment method as described in Planning and Noise Circular 10/73[2]. Although a long overdue revision of Circular 10/73 is expected in the not too distant future and despite the announcement by the Department of Trade on 4 September 1990 that NNI is to be replaced by 16 hour L_{Aeq} as a measure of aircraft noise exposure, the current planning guidance is still to use NNI. This was the view of the Inspector of the recent public inquiry into the application for a Central London heliport when he said "the starting point for any assessment must, therefore, remain Circular 10/73 until this is replaced by new advice". It was further accepted at that inquiry that although Circular 10/73 states that it does not apply to helicopters evidence presented from the 1982 Helicopter Disturbance Study[3] suggests that noise caused by helicopters is similar to that caused by fixed wing aircraft at the same noise exposure. Hence it is reasonable to assume that a replacement for assessing fixed wing aircraft noise will, in the absence of any evidence to the contrary, be equally applicable to helicopters.

The Department of Trade announcement mentioned above stated the Government's intention to change the day-time index for aircraft noise from NNI to 16 hour L_{Aeq} following the Aircraft Noise Index Report[4] (ANIS) and the subsequent consultation exercise. For continuity and to assist in the interpretation of future L_{Aeq} levels, the Department of Transport have suggested that a change of five NNI can be regarded as equivalent to three dB in L_{Aeq} as indicated below although it must be acknowledged that there is no absolute correlation between the two.

L_{Aeq}	NNI
57	35
60	40
63	45
66	50
69	55
72	60

Although DORA of the CAA have reported that an 8 hour L_{Aeq} from 2300 to 0700 hours is a relevant measure of night noise, present suggestions for change only relate to day-time noise.

The guidance given in Appendix 2 of Circular 10/73 can easily be converted to a day-time L_{Aeq} using the above approximation but in some cases it would seem desirable to try to improve on merely specifying a period L_{Aeq} which could include a number of high noise level events. In situations where good communication is essential, perhaps teaching or in offices where the use of telephone communication is important, it may be necessary to add a rider based on L_{Amax} or even Speech Interference Level (SIL). Although SIL is usually used to indicate satisfactory communication distances

for background noise levels it can be used as an indicator for the degree of temporary disturbance during a transient event such as a passing helicopter. At night-time a similar rider can be added to the night L_{Aeq} period for dwellings but in this case it should be based on sleep disturbance criteria.

The difficulty is in deciding if it is reasonable to apply a rider in the form of an L_A max limit as an absolute never to be exceeded limit or whether a specified number of exceedances should be allowed for that period. This principle was suggested as long ago as 1975 when Crook and Langdon's[5] research (the effects of aircraft noise in schools around London Airport) suggested that the number of disturbances to speech communication should be limited to less than one every two hours in an attempt to prevent disruption to teaching. There is however little or no evidence available to show how many disturbances to speech communication is acceptable in say a general office environment. There is clearly a need for further research.

3. CONTROL

To be effective, helicopter noise controls must be expressed in terms which are understandable, enforceable and easily managed by the operators. Such a requirement usually results in two sets of management action. The first is designed to offer operators and those on the receiving end of noise nuisance means to establish a reasonable range of activities; in effect set the environmental capacity. The second must demonstrate on an operational basis that agreed procedures are being applied and that their effect on noise is that which was anticipated.

For commercial reasons, an operator would expect the management action to anticipate changes of helicopter type, demand patterns, destination etc. He must be in position to relate his operational demands to the environmental capacity of his facility. So far, the best means of achieving such management action is to allow operations only of designated helicopter types so that pre-agreed numbers of movements and operational details result in an acceptable overall exposure. Of course, there must be means to determine whether helicoptors new to the site and not specifically considered at the planning stage should be offered access once the facility is operational. It may also be acceptable to offset small numbers of noisy helicopters against a larger number of quiet machines or to anticipate future noise trends. Whilst it would be perfectly reasonable to noise test each machine for operation at a particular site this would be both time consuming and inordinately expensive. The versatility of the helicopter flight envelope makes repeatable noise tests difficult to manage and carry out. Noise Certification does, however call upon very clearly defined procedures which can be used to categorise helicopters and establish operational limits for a small number of groups of helicopters likely to desire access. Noise exposure forecasts can be made based upon the published certificated noise values taking into account additional factors specific to the heliport to represent local operating procedures.

Having established the broad classes of helicopters which, if operated as required within the environmental capacity of the heliport, will achieve the necessary noise exposures, real time monitoring of noise can be used to police the management procedures and

pick out rogue operators or types. The complex flight profiles required for safe operations are likely to be a cause of suspicion for the community, and the ability of helicopters to evade simple monitoring regimes a further reason for distrust of the ability of operators to keep to their agreed noise exposures. It is now fairly well established that a combination of noise monitoring and positional fixing is not a difficult technical problem. Use of "expert" monitoring systems can allow interrogation of flight transponders fitted to helicopters in order to obtain altitude and identification. With such information processed in real time, a small number of monitoring stations at critical locations relative to a heliport can be used to define go/no go "gates" in the flight profile and relate the noise generated during the flight to pre-arranged limits.

For success, noise control must be effective, simple and easily proved. By the establishment of criteria to determine helicopter types which can be operated within the established environmental capacity, observers can recognise breaches of condition directly from the operational log. Simply, is the helicopter on the approved list and does its published noise characteristics fall within those set for the heliport? In addition, noise and positional monitoring will demonstrate that the flight rules regarding track, altitude etc are being observed and that the resulting noise immission is within the predicted tolerance. Action against those disregarding the rules can be immediate, taking the form of fines or exclusion from the heliport.

4. CONCLUSION

Whilst overall criteria for noise exposure are still a matter of debate individual noise impacts on specific sensitive locations can be determined, albeit perhaps in an inconsistent way. Helicopters can operate from city centres without causing unreasonable environmental disbenefit providing proper management and control measures are put in place at the outset. Simple categorisation and record keeping is the first and strategic control measure which can be related back to overall noise exposure. Day to day noise and track keeping monitoring can prove the effectiveness of the management procedures and facilitate the integration of helicopters with other noise sensitive urban activities.

5. REFERENCES

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