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ASSESSMENT OF COMPLAINTS FROM AMPLIFIED MUSIC AND NOISE REDUCTION TECHNIQUES

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INTRODUCTION

This paper deals with complaints from people living adjacent to premises with amplified music rather than the noise exposure of individuals inside the premises. As the level of the complainants' noise depends upon the sound level at source, some reference will also be made to the factors affecting the sound level of the music in the premises.

Attention was focussed on discotheques in the early 1970's when it was realised that the high sound levels from amplified music could lead to noise induced deafness. A great controversy raged when Leeds City Concil imposed a maximum legal limit of 96 dB L_{Aeq} in premises licensed for public entertainment. One of the last acts of the Noise Advisory Council was to prepare a Code of Practice for sound levels in discotheques(1) which was published in draft form in 1986. This recommends a maximum acceptable level of 100 dB L_{Aeq} at the nearest position to the loudspeakers. When dealing with community noise problems, it is useful to have some internal noise limit as a reference in assessing levels of external noise. The main problem is getting operators to keep to the limit. The Draft Code(1) refers to noise nuisance as follows:

"This Code does not seek to indicate measures for the reduction of community noise nuisance although the recommendations made will clearly have an effect on the problem in some cases. The operation of premises within the recommendations of this Code should not be construed as a defence under any action for noise nuisance or to supersede the requirements of any planning or licensing condition". This means that keeping the music to 100 dB L_{Aeq} inside the premises is no defence against complaints from neighbours.

Dibble(2) notes that the typical power of amplification systems has increased from 50-100 Watts in the 1960's to several thousand Watts today. Even levels of discotheque noise at 100 dB L_A can exceed 120 dB in the lower octaves and levels significantly above 100 dB L_A can occur. Peak noise levels of 120 dB L_A are not uncommon. It is common for mobile discotheques to commence operations with source levels at 80-85 dB L_A in the early evening. Then the venue gradually fills with people who are sound absorbent and the sound level increases when people are having a good time, the controls are turned up and levels of at least 95-100 dB L_A can occur. Some people who do not attend discotheques do not understand the requirement for high sound levels. The Noise Advisory Council(3) notes that "someone who enjoys listening to a large and powerful orchestra playing the 1812 Overture may well recoil in alarm at similar levels of sound in a discotheque".

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ASSESSMENT OF COMPLAINTS

When an acoustic consultant is called in to advise either the operator or the complainant, the first question is to decide whether the "complaint is justified" and this is normally taken to mean the same as a "nuisance" under Section 58 and 59 of the Control of Pollution Act 1974. People do not usually complain of any type of noise without good reason, allowing for the hypersensitive and those with a grudge against the noise producer. Even if the results of a BS4142 type of assessment do not show a problem, it is normally the safest course of action to take the complainant seriously and attempt to resolve their problem. If the noise from amplifiers is audible in someone's bedroom late at night, then it is plainly capable of disturbing them. Recent work on the assessment of entertainment noise in Edinburgh (4) has used the concept of inaudibility as a criterion for licensing entertainment premises. Proceedings under the Control of Pollution Act 1974 require proof that a nuisance exists. In my own experience, a calibrated tape recording of the music in the complainants bedroom has been sufficient to persuade a Magistrates Court. Attempts to quantify the magnitude of the problem have recently been made by Dibble (2) and Scannell (5). A simple assessment of the received noise level in dBL_A does not always illustrate the problem in terms of a significant difference between the intrusive noise and the background noise. Dibble suggests the difference between dBL_A and dBL_{LIN} as an indicator of the amount of low frequency noise present. It is usually the presence of a rhythmic low frequency thump which causes annoyance to unwilling listeners, but this is not always the case. Dibble suggests C weighted or linear measurements while Scannell would prefer a weighting which emphasised low frequencies, but would choose linear as the best available option. Scannell suggests that avoiding an increase in the linear background level, due to the entertainment noise, will avoid problems. The Edinburgh experience was that complaints were still received for music which was audible but was more than $10dBL_A$ less than the background. An assessment of the linear sound level difference would seem to be more suitable. Measurements of frequency spectra are necessary in order to formulate noise control proposals and these can be used to illustrate the problem where an excess of dBL_A levels above background cannot be measured. My own experience shows that the difference between octave band spectra for the intrusive noise and the background noise is sometimes necessary to illustrate the problem and the octave band levels allow for calculations to be made to determine the effect of noise reduction proposals. Assessments in third octave levels are useful but the lack of information on the transmission loss of building elements below 100Hz does not allow for great precision in calculations.

NOISE REDUCTION TECHNIQUES

NOISE AT SOURCE

In all noise investigations, the first consideration should be to attempt to reduce the noise at source. People who attend discotheques require high noise levels and it would be helpful if operators could be persuaded to keep to the code of practice with a maximum of $100dBL_{Aeq}$ for the audience. The recent use of noise level switching devices has become popular in premises

which hold discotheques. These devices provide visible warnings that sound levels are approaching some pre-set noise limit for the premises and switch off the mains power supply to the amplifiers when the limit is reached. They can be installed to limit noise exposure of the audience or to reduce community annoyance. The commonest system can work on a choice of weighted sound level limits which can be used to control low frequencies. However, once these devices are installed it is always possible to alter the control settings unless the controls are locked and one individual is responsible for keeping the key.

TRANSMISSION PATH

It is helpful if the premises where amplified music is produced, is not structurally connected to residential property. To have a discotheque in a continuous terrace, including residential properties, would normally require a special isolated "room within a room" construction. Careful attention is required throughout the construction works to ensure that no mechanical bridging exists between inner and outer structures. This principle has been used, apparently successfully, for a night club producing sound levels up to 110dB$_A$ which is inaudible in residential flats sharing party walls (6).

Usually, it is fortunate to find the discotheque premises in a separate building structure and the weakest links in the transmission paths to neighbours are the doors, windows and ventilation openings. Often, open windows produce the greatest annoyance to neighbours. The first approach is to close all direct openings and make sure they can remain closed. A ventilation and air conditioning system may be necessary. When the obvious deficiencies in sound insulation have been attended to, lightweight building elements, especially the roofs of small halls can be the weakest link in the sound insulation. A suspended ceiling, hung with vibration isolated hangers could be a possible solution.

In all community noise problems, the last resort is to offer the complainant acoustic secondary glazing. This is hardly ever likely to solve problems with amplified music. The increased performance of secondary glazing may not be significant at the offending low frequencies and it is common to find residents annoyed by external as well as internal levels.

The following case histories illustrate real life problems with entertainment noise and the procedure followed by the acoustic consultant to resolve the problem.

SCOTTISH HOTEL FUNCTION ROOM USED FOR MOBILE DISCOTHEQUE

Acoustic consultancy advice was required by a hotel in the suburbs of Edinburgh which had been served a noise abatement notice for "Excessive noise of amplified music and vocals". At this time, in 1984, Edinburgh City Council were requiring an internal maximum limit of both 35dB$_A$ and NR25. The first floor function room was 30m from the nearest residential property where complaints had been received. Noise levels of 98dB$_A$ were measured inside the function room from a mobile discotheque which performed there

regularly. The windows were secondary glazed with a reasonable air gap of 100mm, but both primary and secondary panes were badly fitting with significant gaps at the closing surfaces. Even when the windows were "closed", there were two "vent axia" units in the wall which allowed a direct sound transmission path to the surrounding properties. Measurements at the nearest properties when the discotheque was in operation were as follows:

Outside façade	57dBL$_{AMAX}$	(function room windows open)
	47dBL$_{AMAX}$	(function room windows closed)
Background noise	42dBL$_{A90}$	
Inside	37dBL$_{AMAX}$	(function room windows closed, complainants
faintly audible		partly open)

This shows that considerable noise was produced outside the residents properties and that the Edinburgh City Councils internal criterion was exceeded even when the function room windows were closed. The Hotel was aware of the problem and had tried to keep the windows closed during functions, but had been unable to restrain discotheque clients from opening windows when ventilation was required. The use of a sound level limiting device was suggested by the Hotel Manager, but there were obvious deficiencies in the building envelope which should be attended to first.

It was recommended that:

a) The windows should be sealed in a closed position.
b) The vent axia units should be removed and the holes bricked up.
c) An adequate ventilation and cooling system should be devised so that all windows can be kept firmly closed.

The work on the windows and vent axia holes was completed without any difficulties, but the design of the ventilation system had to take account of the potential noise problem. Discotheque noise should not be transmitted via the ducts to the surrounding residents. Ventilation system fan noise should also not affect the surrounding residents, and ventilation system fan noise in the function room was required not to exceed NC40.

With suitable positioning of attenuators these requirements were all allowed for; the work was completed and a commissioning site visit was arranged. The vent axia holes had been bricked up, but there were still gaps in the glazing system. A supply and extract ventilation system had been installed. The music was faintly audible immediately outside the function room and in the gardens of the complainants, but could not be heard inside the properties, even with the windows wide open. Attention to the windows subsequently reduced the noise transmission to the gardens. Noise levels of up to 100dBL$_A$ were being produced in the function room and the residents noise problem was resolved.

It was afterwards that it was mentioned that live groups used the function room, so that noise levels at source could be greater than 100dBL$_A$. It was also mentioned that the room is used for conferences and therefore the ventilation system noise of NC40 (which was only achieved on half speed of the fans) was higher than desirable.

were carried out to the club. Ventilation ducts and connecting doors were bricked up and windows were sealed in a closed position. A test was carried out in conjunction with the club's consultants with a sound level of $90dBL_{Aeq}$ with peaks up to $95dBL_{AMAX}$ internally. The music was inaudible on the patio outside the complainants window, with a background level of around $40dBL_{A}$. The remedial works had proved to be very effective in reducing the noise level by at least $30dBL_{A}$.

GREEK RESTAURANT IN WEST LONDON

Acoustic advice was required by the owner of a Greek restaurant who wished to convert two upper floors on top of his restaurant to be used as lodgings. Live amplified music is provided two nights per week and can last until 0200 hrs. No complaints had been received from neighbours on either side of this continuous terrace (the restaurant shared party walls with a public house and storage areas above shops).

A specification for sound insulation between the restaurant and rooms above was required in order to satisfy the local authority that no disturbance would occur. Sound levels of $80-84dBL_{AMAX}$ were recorded from the Greek band. No plate smashing occurred during the acoustic survey. Levels in the rooms above were $64dBL_{AMAX}$ on the first floor with windows open, ($58dBL_{A}$ windows closed), providing a sound transmission path from a skylight above the band. Second floor levels were up to $50dBL_{AMAX}$.

As no specific criteria had been imposed by the local authority, it was decided to recommend the most practical "in principle" ways of improving the sound insulation. A suspended ceiling in the restaurant could not be constructed as the ceiling height was too low, so a floating floor on 25mm of mineral fibre was recommended together with improvements to the sealing of the existing floor/ceiling construction and insertion of 100mm mineral fibre quilt.

The skylight above the band was to be removed and adequately sealed and the windows replaced with good fitting 6mm panes.

We await the completion of the works with interest.

ENGLISH SOCIAL CLUB IN WEST LONDON

Acoustic advice was required by a social club in West London where complaints had been received from surrounding neighbours. A noise limiting device switched off the mains supply to the amplifiers where $88dBL_{AMAX}$ was reached in the hall. At this level in the hall, $50dBL_{AMAX}$ was achieved outside the nearest complainants window above a background of $42dBL_{A90}$ with a consistent difference across the octave band frequency range 63Hz to 4kHz of 7 to 9dB. The complaints were judged to be justified and remedial action was recommended.

Although the basic structure of the hall was lightweight plasterboard with a thin concrete render, the main weaknesses in the sound transmission path were two vent axia holes and badly fitting emergency exit doors. The club had

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WELSH RUGBY CLUB WITH RESIDENT AMPLIFIED SINGERS

A noise abatement notice had been served on a Welsh Rugby Football Club which shares a party wall with residential flats. Amplified music and singing takes place in the club and complaints had been received from the neighbours. A site visit showed that the club had an electronic noise limiting device, but on inspection it was found that the monitoring microphone was coated with wax, the microphone lead had a faulty connection and the key switch allowed full power to the amplifiers. Amplified music produced sound levels of up to $85dBL_{Aeq}$ in the club and $40dBL_{Aeq}$ above a background of $33dBL_{A90}$ in the adjoining flat. The relatively low level of $85dBL_{Aeq}$ was produced during test conditions - we assumed it could be at least 10dB greater at times. As the club wanted to have functions which lasted till after midnight, it was decided that the noise should be inaudible in the adjoining flats and a design criterion of keeping the entertainment noise to 10dB below the background level was attempted. This reduction in noise level could only be achieved with an isolated structure in the club. It was decided to proceed on a step by step basis, starting with a partition covering the party wall and then proceeding to the ceiling and floor. It had been checked that the intervening party wall was performing as well as could be expected and the presence of some suspicious interconnecting chimney flues was not a weakness in the sound insulation between the club and the flats.

No works have yet commenced on site at this time. We have recommended that the electronic noise limit is used in the meantime to effectively limit the entertainment noise.

IRISH CLUB IN CENTRAL LONDON

Acoustic consultancy advice and an expert witness was required for proceedings under the Control of Pollution Act 1974, taken out by an annoyed resident in the Belgravia area of S.W. London. A site visit was made to the complainant's flat on 17th March, which is of course, St. Patrick's day. St. Patrick's day was chosen because the use of amplified music did not occur every Saturday night, and it was difficult for the complainant to plan on whether he could have a quiet evening or not. It was envisaged that amplified music would be an essential ingredient for St. Patrick's Night. The rear of the complainant's flat looked out onto a patio and the rear of the Irish Club ballroom also looked down onto the patio.

In cases of annoyance from entertainment noise, it is usual to hear the music as a muffled rhythmic beat which is disturbing late at night and prevents people getting to sleep. In this case, the music was crystal clear on the patio outside the complainants window. Levels of $70dBL_A$ from "When Irish Eyes are Smiling" meant that the patio became effectively part of the club. Levels of $50dBL_A$ were obtained in the complainants bedroom above a background of $35dBL_A$. A tape recording was made in each of the two measurement locations. An affidavit was prepared and sent to the club, but this did not prevent a court hearing under the Control of Pollution Act. After some debate between the legal parties, the tape recording was played in the open court to the magistrates. The hearing had to be adjourned because of a shortage of time and before it was reconvened, sound insulation works

already been advised by others that the lightweight structure was responsible, sound insulation tests showed that the vent axia holes and emergency exit doors were responsible for the level of noise received at the complainants window.

Blocking off the vent axia holes and allowing for ventilation on the opposite wall of the club along with an effective compressible seal for the emergency exit doors was estimated to reduce noise levels by 5dBL$_A$ which may have been enough to resolve the problem and satisfy the Local Authority. However, if the noise was still audible, the complainants would be unlikely to be satisfied, even if a significant reduction had occurred.

SUMMARY

Annoyance from amplified music is greatest during the hours of late evening when people are getting to sleep. Any audible noise at this time is capable of disturbance and should be treated seriously. The use of BS4142 and the expression of the level of intrusion in dBL$_A$ or dBL$_{LIN}$ can numerically illustrate the magnitude of the problem, but frequency analysis in at least octave bands, is usually necessary in order to specify remedial works.

The case histories illustrate that it is normally the obvious weak links in the sound transmission path which need attention. Windows and ventilation ducts are the most common causes of problems. Amplified music in the same building structure as residential properties has its own particular problems of isolation.

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