Proceedings of The Institute of Acoustics

A REVIEW OF NOISE POLLUTION AND CONTROL AT KNEBWORTH PARK POP CONCERTS

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INTRODUCTION

The two hundred and fifty acres of Knebworth Park deep in the heart of the Hertfordshire countryside provides in its thirty acre natural bowl, a venue for probably the biggest pop concerts that have been held in this Country. This Stately Home has felt the music from a succession of popular bands over the years including the Rolling Stones in 1976 with an estimated audience of over 100,000 and Queen this year with an actual 120,000 audience.

North Hertfordshire District Council (N.H.D.C.) has been responsible for licensing these events, since its creation at Local Government Re-organisation in 1974. Until 1983 this was under the Home Counties (Music and Dancing) Licensing Act 1926 and since that date the Local Government (Miscellaneous Provisions) Act 1982. The control of noise as unreasonable disturbance and in respect of damage to hearing being thereby controlled.

THE PERIOD 1974 TO 1985

This brief review of the main concerts or festivals that have been held shows the problems that have arisen from noise and the Local Authority's involvement.

The first concert, held within months of the Council's creation in 1974, was The Allman Brothers, playing to an estimated 60,000 audience - some 25,000 more than the licence number. A 25,000 watt sound system was apparently used and arena sound pressure levels were low. The 17 noise complaints recorded were probably due to the concert over-running the licensed 11.00 p.m. finish and eventually ending after midnight.

In 1975 Pink Floyd played to an audience many times greater than the licensed 40,000. A condition was imposed that noise must be kept to the reasonable requirements of the Environmental Health Officer and no nuisance was caused.

Some of the highest noise levels recorded occurred at the 1976 Rolling Stones concert which, it would seem was in the true '60s' undisciplined style. The audience was greater than the licence number, the concert over-ran the 11.00 p.m. finish until 2.00 a.m. and the noise in the villages outside the Park caused a severe nuisance in the latter part of the concert. Maximum sound pressure levels in the arena were in excess of 100 dB(A) with 83 dB(A) maximum recorded in the villages. Strangely only 9 complaints were recorded.

In 1978 the Council imposed a 10.30 p.m. finish time and modified the noise condition. The sound engineers were required to consult with the Environmental Health Officer to ensure that excessive noise did not affect

the noise sensitive areas in the vicinity of the festival location. It also required that no person should be exposed to a sound pressure level in excess of 94 dB(A) for any length of time anywhere in the arena and that the sound engineers must fulfil any request of the Health Officer to reduce the sound. Two concerts that year caused no noise problems but were on a reduced scale, with Frank Zappa playing to 30,000 people and Genesis to less than 50,000. The sound system was estimated at 55,000 watts.

Two concerts in 1979 by Led Zepplin on successive weekends, over-ran and severe but short-term nuisance was caused in the villages, with levels as high as 78 and 82 dB(A) recorded in these areas from a sound system estimated at 100,000 watts. As a result of this the Licensee, the Honourable David Lytton Cobbold, was successfully prosecuted for the late finish. Local reaction against concerts on successive weekends was noted. Strong public objection was raised to the Licence application the following year although it was granted.

In 1980 the Beach Boys concert did not cause a nuisance although arena levels exceeded 100 dB(A).

A 4 day Christian Festival by Greenbelt in 1983 (Cliff Richard) did not create excessive noise, but 4 days of festival including a Bank Holiday was unpopular with the residents and was made worse by over-running of the finish times.

In 1985 in addition to stipulating the finish time and the maximum noise level in the arena, a maximum sound pressure level outside the Park was specified - this was 40 dB(A). The music was 'heavy metal' and the bands included Deep Purple and Meatloaf. Despite extensive pre-concert consultation on noise, both the arena and boundary levels were exceeded - in one village a short term Leq of 70 dB(A) was recorded during the evening. For the majority of this performance Deep Purple exceeded the level set for outside of the Park. The Promoters control office failed to ensure that the sound was reduced after being informed on a number of occasions that the Licence Condition was being exceeded. Further disturbance was created by an exceptionally loud firework display as a finale.

As a result of this N.H.D.C. prosecuted the Licensee. He pleaded guilty and was fined £500.00. He was also fined £500.00 for another breach of the Licence Condition, and so has a total of three convictions for breaches of Licence Conditions.

NOISE MONITORING AND CONTROL FOR THE 1986 'QUEEN' CONCERT

Following the successful prosecution taken by the Council, the future of Knebworth for staging other larger scale concerts was in the balance. Positive action was therefore taken, and noise consultants from Associated Environmental Sciences Limited (A.E.S.L.) were retained by the promoter to operate a noise control programme (1) which had been successfully used at other environmentally sensitive venues.

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This section of the paper summarises the additional noise control steps and changes which were instrumental to enable this years Queen concert to be held successfully at Knebworth.

NOISE CONDITIONS

The promoter and N.H.D.C. entered into discussions regarding the noise conditions to be imposed. The previous 40 dB(A) limit at the boundary represents a minimal increase on the background noise level at the quietest hamlets, and the promoter felt this to be unduly stringent. The Environmental Health Department had been considering adopting the G.L.C. Code of Practice for Pop Concerts (2), but had reservations about the 10 dB(A) increase over the background noise level. However, it was finally adopted at a special meeting of the Council's Environmental Health and Control Committee which granted the Licence and which heard a technical case presented by A.E.S.L. This included a reference to other concerts where the 10 dB(A) increase over the background noise level has shown to limit the number of complaints (3).

The noise condition relating to inside the arena was set to an Leq noise level of 93 dB(A) for the duration of the concert (8 hours) 50 metres from the speakers, again in line with the Code of Practice.

The relatively early finish time of 10.30 p.m. was agreed as an important means of reducing potential annoyance and after 10.30 p.m. until the licensed finish time of 11.00 p.m. a 6 dB(A) increase over background was made a condition.

ROLES AND PROTOCOL

Once the changes to the Licence had been adopted, the Environmental Health Officers and A.E.S.L. agreed to a joint exercise with an aim to monitor and control the noise from the concert to the satisfaction of all parties. This worked well with the Officers having the detailed knowledge of the area and past problems and A.E.S.L. having experience with their noise control programme at a number of previous pop concerts. It was however, made clear by the E.H.O.s that they were Enforcing Officers and any breach in the Licence regarding noise would lead to likely prosecution.

BACKGROUND NOISE MONITORING

An extensive background noise survey was undertaken jointly by A.E.S.L. and the Environmental Health Department prior to the concert in order that the noise criterion set in the Licence could be accurately assessed. Measurements were made in various areas surrounding the park. In particular, noise levels were recorded in areas where high noise levels or complaints had arisen from previous concerts e.g. Old Knebworth and Drivers End (figure 1). Monitoring continued to the planned finish time of the concert in order to record the rapid fall in the ambient level which is often a feature of the noise climate in rural areas. In this case the fifteen minute Leq noise level reduced by an average 6 to 7 dB(A).

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PUBLIC AWARENESS

Providing information to residents regarding a forthcoming event of this nature, plays an important part in helping to reduce annoyance. At Knebworth, letters were sent by the promoter to all the local residents giving such information as the concert date, the start and finish times of the concert and sound check. The noise control procedure was also highlighted and a complaints telephone number was published for people to complain if they felt unduly disturbed by the level of noise.

PREDICTION OF OUTSIDE NOISE LEVELS

Predicting accurately the likely receiver noise levels from large open air sound systems is affected by many external factors. However, source level, distance and directivity data can give a useful guide to the likely distribution of sound. Data from other concerts were used to calculate the 60 dB(A) and 50 dB(A) Leq contours and predict the Leq noise levels at various community sites. Some of the predicted results in table 1 show that most of the villages would receive noise levels below the licence conditions except at Drivers End, a hamlet of six houses. Previous results showed the noise level to be high in this area and also at a closer and larger village (Old Knebworth).

It was necessary to choose a site which could be used as a control monitoring position during the concert. Old Knebworth was chosen due to its close proximity to the venue, the prevailing wind direction, the predicted concert noise level and the larger number of people affected compared with the smaller village, Drivers End.

In order to take into account all the variables, a propagation test was carried out on the night before the concert. Simultaneous measurements were made at the mixer position and at the control site of a steady shaped spectrum (typical of that of 'rock' music) played through the sound system. The initial results showed increases over the background in excess of 10 dB(A). Reductions were initially made from the main sound system where the Leq was set to 101 dB(A) at the mixer. Finally the sound level output from the stage left delay tower facing Old Knebworth was reduced, and this enabled the receiver noise level to comfortably meet the Licence condition.

ACTIVE NOISE CONTROL DURING THE CONCERT

The 1986 Queen concert was one of the largest concerts to be held at Knebworth. It was Licensed for 120,000 spectators and the main sound system was 245,000 watts (4) with additional amplification required for the delay tower speakers. Active noise control on the concert day was essential in order to achieve the noise limits. The control procedure used by A.E.S.L. has been described elsewhere (1) and its application at Knebworth is summarised below.

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The standard practice of monitoring at the mixer, in the audience and at various community sites was adopted. A communications link was established between the joint monitoring teams outside and inside the venue, the promoters production office and a control room where complaints of noise were recorded. The 60s Leq parameter was monitored and displayed at the mixer position with the maximum control noise level set to 101 dB(A). For the majority of the time this was adhered to. Isolated breaches did occur, but once reported to the sound engineer, the level was quickly reduced.

The noise exposure was measured at 50 metres from the speakers. The current Leq noise exposure and predicted total noise exposure was calculated after each band to assess compliance with the inside licence condition. The final Leq noise exposure was 93 dB(A) which just complied with the Licence condition.

The fifteen minute Leq noise levels were monitored continuously at the control site, in Old Knebworth. As can be seen from table 1, the results were well below the noise limits and significantly below the levels measured during the sound propagation test carried out the previous evening. Sound absorption due to the huge crowd, especially absorption of sound from the delay tower speakers together with favourable weather conditions, are likely to account for the better than expected performance.

Short term measurements carried out at various sites showed much the same results with little increase in the background noise level, except at Drivers End where the environmental noise limit was just met. The only complaint of the day regarding noise was recorded from this area.

CONCLUSIONS

The local residents living by Knebworth Park have clearly suffered excessive levels of noise from many of the concerts held since 1974. Other factors such as the number of days the concerts last, the late finishing times and the loud finale fireworks have caused further disturbance. In many cases therefore, the noise and disturbance has amounted to a nuisance and in some instances legal proceedings have followed.

The results from this years concert are clearly a great improvement on previous years (table 2). Receiver noise levels were greatly reduced and only one complaint of noise was reported from an area where the environmental noise limit was just being met. Complying with the revised criterion of allowing the Leq noise level of the concert to increase the background Leq noise level by 10 dB(A), minimised the number of complaints and the noise control operation enabled the Licence conditions to be met. The environmental impact was further reduced by the lower than expected noise levels compared with the previous evenings test. This better than expected performance was likely to have been due to the sound absorption of the crowd and the favourable weather conditions.

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This event has shown that minimal noise disturbance can be achieved from one-off large scale pop concerts providing adequate planning and control steps are taken. At this years Knebworth Concert, the combination of the noise control programme, the early finish time, and the public awareness of the event helped to achieve the aims of all parties concerned - to stage a successful concert entertaining 120,000 patrons without causing undue disturbance to the local community.

REFERENCES

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3. Noise Control Techniques and Guidelines for Open Air Pop Concerts (J.E.T. Griffiths, Proc. 10A Vol. 7 Part 3, 1985).

4. Private Communication - Clair Brothers (Suppliers of the main sound equipment).

ACKNOWLEDGEMENTS

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2. The views exposed are those of the authors and not necessarily those of the Officers or Members of the North Hertfordshire District Council.

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TABLE 1 PREDICTED AND MEASURED NOISE LEVELS FOR THE 'QUEEN' CONCERT HELD IN AUGUST 1986.

Site	Number of Properties	Distance & angle to speaker (0o in front of speaker)	Predicted Leq noise level due to concert / dB(A)	Measured noise level from the sound prop. test / dB(A)	Average 15 min. Leq noise level during concert / dB(A)	Number of Complaints
Old Knebworth	40	1000m, 45o	57 (7)	63 - 58* (13 - 8)	51 (1)	0
Drivers End	6	1500m, 30o	54 (12)	-	49 (7)	1
Langley	35	1500m, 135o	43 (0)	-	45 (2)	0
Nup End	15	1300m, 15o	60 (10)	-	-	0
Stevenage (S.W. area)	5,000	2100m, 135o	40	-	BL (0)	0

( ) Increase above the average background noise level.
* Receiver noise level after the reduction from the main sound system and delay towers.
BL Background noise level, music barely audible.

TABLE 2 A COMPARISON OF SOUND PRESSURE LEVELS RECORDED AT THE FOUR LARGEST CONCERTS.

Date	Main Band	Measured Noise Levels [dB(A)]				Complaints
		South West			South East	
		Min.*	Max.*	Leq 15 min.	Leq 15 min.	
1976	Rolling Stones	54	83	-		9
1979	Led Zepplin	-	76-82	-		substantial nos.
1985	Deep Purple	-	-	60	70	substantial nos.
1986	Queen	-	-	49	51	1

* Slow response.

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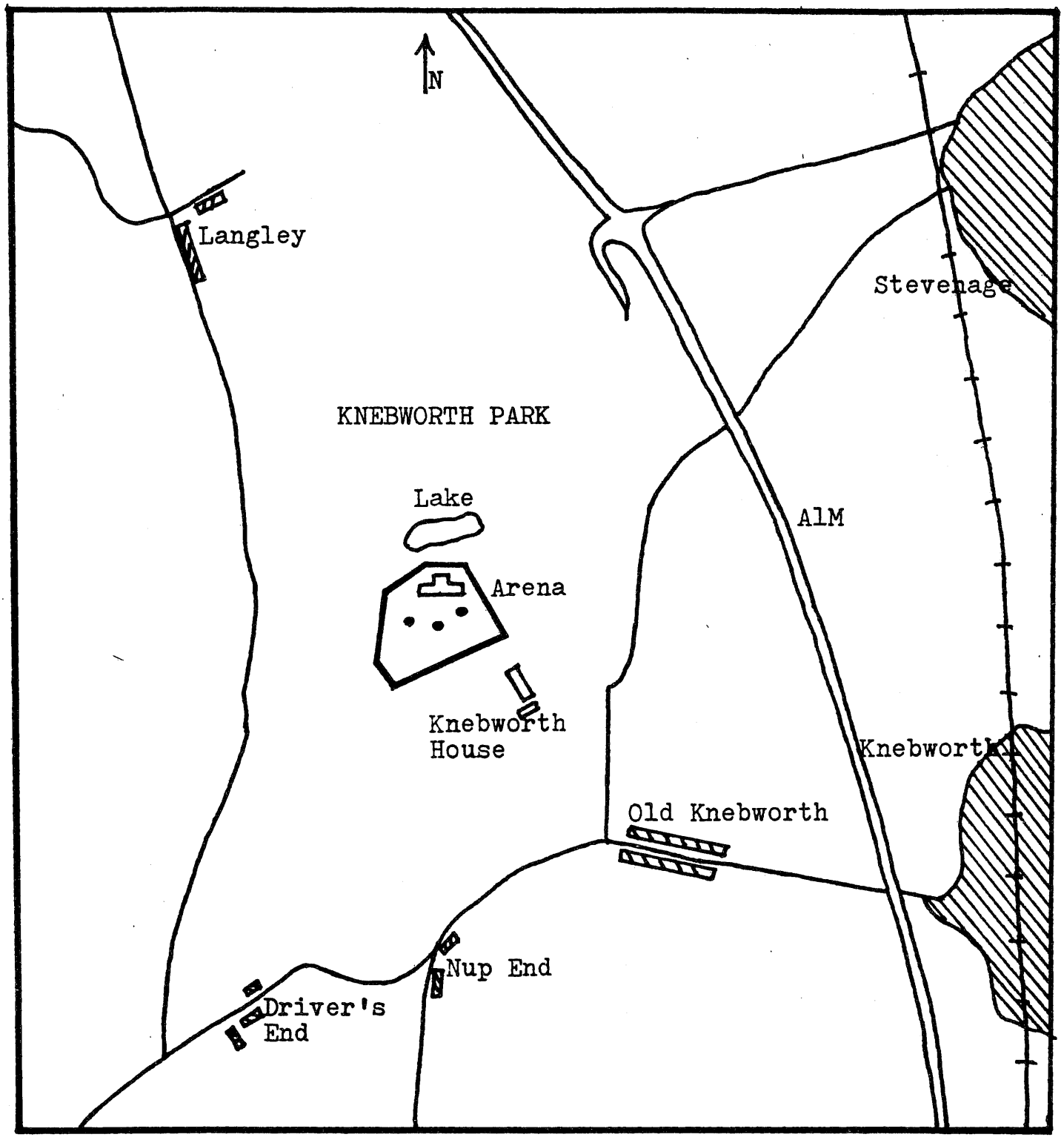

Villages-res. property
Towns
Minor Roads
Stage and speakers
Delay speaker towers
Railway

Approx. scale 1 : 20,000

FIGURE 1 KNEBWORTH PARK AND THE SURROUNDING AREA