

DEFRA
NOISE MONITORING AT POP CONCERTS
ENVIRONMENTAL MONITORING
NANR 297

NOISE MONITORING RESULTS
October 2010

DEFRA

Noise Monitoring at Pop Concerts – NANR 297

Monitoring Results

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1. INTRODUCTION

- 1.1 Vanguardia and RPS have been appointed by DEFRA (Dept. of Environment and Rural Affairs) to collate historic data collected at concerts in recent years together with a noise survey at a selected number of events during 2010. To complement this it is also proposed that a social survey of attitudes to concerts be carried out by Ipsos Mori. This will also be funded by DEFRA.
- 1.2 The purpose of the noise monitoring study is to provide the off-site noise level data to support the social survey by providing the noise context to better understand the attitudes to environmental noise from music events'
- 1.3 A method statement has been prepared and agreed with the client and all other interested parties. This statement provides an indication of the methods employed and is replicated in the Methodology section of this report.
- 1.4 The purpose of this report is to outline the methodology and present the results to clients and interested parties.

2. METHODOLOGY

Instrumentation

- 2.1 All instrumentation used for off-site measurement meet Class 1 of BS EN 61672-1:2003 (sound level meters) or Type 1 BS EN 60804:2001.
- 2.2 All on-site instrumentation meet at least Class 2 of BS EN 61672-1:2003 (sound level meters) or at least Type 2 BS EN 60804:2001.
- 2.3 All equipment was calibrated before and after taking measurements. Any drift in calibration levels was noted.
- 2.4 All instruments have been calibrated by the manufacturer or their agents within two years of the surveys.

Measurements

- 2.5 Measurements were made at specified positions. These positions were chosen to be representative of the area or a group of sensitive locations around the event and the locations were linked to the external survey completed by Ipsos Mori. Where appropriate, advice on suitable monitoring locations were sought from the Local Authority.
- 2.6 Pre-event liaison with Ipsos Mori determined where the locations are and ensures that the measurements were taken to coincide as far as is possible with the resident surveys being carried out.
- 2.7 A series of three 5 minute measurements was taken at each position with the meter set to record the following parameters: L_{Aeq} , (broadband and 1/3 octave band data), L_{Amax} , L_{A90} and L_{Ceq} . A suitable wind shield was fitted for all measurements.
- 2.8 Simultaneous uncompressed audio recordings have also been made during the most of the measurement periods.
- 2.9 At the time the measurements were taken, the consultant recorded a subjective impression of the noise climate at the monitoring point, and noted what can be heard from the site itself.

- 2.10** Any significant extraneous noise occurring during the measurements was paused out or back erased to prevent undue measurement result interferences.
- 2.11** A pro-forma detailing all information to be collected was provided to all consultants to ensure consistency of information.
- 2.12 Monitoring point(s):** Normally locations were chosen to assess noise-sensitive premises and the best position for the monitoring point(s) was often outside the sensitive premises. However, this does not mean that the monitoring point was always close to the premises. Maximum noise levels in licence conditions generally refer only to noise from the source under consideration, for example Music Noise Levels (MNLs) and not to the total measured value at a given location, which may include, for example, traffic noise. In situations where extraneous noise makes monitoring difficult it was more representative of the MNLs in the area to monitor at a point where there are less additional noise sources (e.g. at the boundary of the site instead of outside the premises to be protected.) This approach requires that the noise level at the boundary monitoring point is a reliable indicator of the level at the building. The measured level would then be adjusted¹ to correspond to levels received outside the noise sensitive location. However, this was not required during the surveys.
- 2.13** The locations of the monitoring points were recorded on a 1:50,000 Ordnance Survey map and hand drawn sketch was supplied where more detail was required. In the final reporting, these location maps are not reproduced to scale.
- 2.14** All measurements were made out of doors, away from any reflecting facades. The microphone was between 1.2m and 1.5m above ground level. To minimise the influence of reflections the microphone position were at least 3.5m from any reflecting surface other than the ground. In the event of measurements having to be made within 3.5m of reflecting facades, this was noted and a correction of -3 dB has been made to these results to convert them to free-field levels.
- 2.15 Meteorological conditions:** The noise level measured at a monitoring point is affected by wind speed and direction, and temperature gradients, particularly when the monitoring point is remote from the source. The size of these effects is hard to predict, and so measurements have been made under reasonably stable conditions if possible. A suitable condition is a light wind with a vector component up to 2 m/s from source to receiver; this will increase the noise level by about 2 dB(A) compared with the no wind case.
- 2.16** Weather conditions including wind speed and direction were recorded and measurements taken where possible so that the weather did not cause spurious

¹ Using distance attenuation correction $SPL = L1 - 20\text{Log}(r2/r1)$

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measurements, e.g. the wind speed at the microphone can sometimes cause a "fluting" effect across the microphone grid; given that the sound level meter cannot differentiate between noises, it will measure the fluting effect. Windshields were used to reduce this effect, but depending on the loudness of the "real" noise, fluting can be important when the wind speed at the microphone is as low as 5 m/s.

- 2.17** All measurements were set to synchronise with sound level meters set up on-site at the front of house(s) positions. These meters measured similar parameters for direct comparison purposes.

3. RESULTS

3.1 The results have been collected at the following events and tabulated based on information collected both on and off site.

Table 1 – Event Information

| Ref | Date | Event | Category |
|-----|----------------|---|-------------------|
| 1 | 12 May 2010 | Kiss Wembley Arena | Indoor Event |
| 2 | 30-31 May 2010 | Evolution | City Centre Event |
| 3 | 16 June 2010 | Green Day Concert – Lancashire Cricket Ground | Cricket Ground |
| 4 | 19 June 2010 | Green Day Concert, Wembley Stadium | Stadium |
| 5 | 24 June 2010 | Pink Ricoh Coventry | Stadium |
| 6 | 26 June 2010 | Pink Hampden Park | Stadium |
| 7 | 31 July 2010 | Kenwood (Motown's Greatest Hits) | Park |
| 8 | 7 August 2010 | Pride Brighton | Outdoor Festival |
| 9 | 11 Sept 2010 | BBC Proms in the Park, Swansea | Park |
| 10 | 12 Sept 2010 | Heroes Concert 2010 | Stadium |

3.2 Table A1 of Appendix A shows a summary table of the concert noise measurement data. This table shows the results for the three consecutive 5 minute measurements taken at each position and the subjective assessment.

3.3 The complete set of measurement sheets are shown in Annex A. Sketch plans of the measurement locations also accompany these sheets in Annex A.

3.4 The stage orientation and distance from mixer to stage was recorded and shown in table 2 below.

Table 2 – Stage orientation and mixer details

| Ref | Date | Event | Stage Orientation | Mixer to Stage |
|-----|------|-------|-------------------|----------------|
|-----|------|-------|-------------------|----------------|

| | | | | Distance |
|----|----------------|---|---|--|
| 1 | 12 May 2010 | Kiss Wembley Arena | Indoor venue, stage faces east. | Internal levels measured at the control room. |
| 2 | 30-31 May 2010 | Evolution | Multi Stage, Baltic Stage, open air, facing north-east. Not principal stage is at Spillers Wharf but Ipsos Mori surveys centred on Baltic Stage | 35-40 m |
| 3 | 16 June 2010 | Green Day Concert – Lancashire Cricket Ground | North | 40m |
| 4 | 19 June 2010 | Green Day Concert, Wembley Stadium | West stand facing east | 40m |
| 5 | 24 June 2010 | Pink Ricoh Coventry | South stand facing northeast | 50m |
| 6 | 26 June 2010 | Pink Hampden Park | East stand facing west | 65m |
| 7 | 31 July 2010 | Kenwood (Motown's Greatest Hits) | Facing north | 40m |
| 8 | 7 August 2010 | Pride Brighton | Multi Stage, principal stage Dance Stage, tented, facing south-east | No FOH, measurements taken parallel with stage |
| 9 | 11 Sept 2010 | BBC Proms in the Park, Swansea | Single stage, open air, facing north-west | 40m |
| 10 | 12 Sept 2010 | Heroes Concert 2010 | South stand facing north west | 40m |

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- 3.5** Onsite measurements were obtained at the mixer location during the concert. These datasets are contained in Appendix B. Onsite data for Pink at Hampden Park and Proms in the Park, Swansea has not been included as these could not be obtained from third parties.
- 3.6** The historical data collation has been presented in Appendix C.

Appendix A - Measurement Data Summary Table

Table A1 - Summary of off site noise measurements during concerts

| Meas Ref | Location | Start Time | Mixer dB L _{Aeq} 15min | L _{Aeq} 5min | L _{A90} 5min | L _{Amax} 5min | L _{ceq} 5min | L _{Aeq} 5min | L _{A90} 5min | L _{Amax} 5min | L _{ceq} 5min | L _{Aeq} 5min | L _{A90} 5min | L _{Amax} 5min | L _{ceq} 5min | Subjective Assessment |
|--|-------------------------------------|------------|---------------------------------|-----------------------|-----------------------|------------------------|-----------------------|-----------------------|-----------------------|------------------------|-----------------------|-----------------------|-----------------------|------------------------|-----------------------|--|
| Kiss Wembley Arena, May 12th 2010 | | | | | | | | | | | | | | | | |
| Ref 1-1 | Forum House, Engineers way | 21:00 | 104.3 | 52.4 | 42.2 | 61.1 | 64.4 | 52.1 | 43.9 | 64.1 | 65.6 | 57.8 | 43.5 | 72.0 | 68.1 | Music not audible |
| Ref 1-2 | Empire Court, North End Road | 19:54 | - | 51.3 | 43.3 | 60.3 | 62.0 | 50.7 | 43.6 | 62.8 | 61.5 | 53.3 | 44.1 | 65.3 | 62.7 | Music not audible |
| Ref 1-3 | 71 Dagmar Road | 19:45 | - | 45.2 | 43.2 | 58.7 | 60.1 | 46.3 | 43.2 | 56.3 | 59.8 | 46.5 | 43.4 | 50.6 | - | Music not audible |
| Ref 1-4 | R/O Raglan Court | 20:46 | 104.6 | 44.9 | 43.1 | 50.6 | 59.8 | 50.6 | 43.1 | 53.2 | 59.7 | 46.1 | 43.0 | 59.0 | 59.3 | Music difficult to identify, not dominant |
| Ref 1-5 | R/O Alexandra Court | 21:30 | 103.8 | 48.3 | 45.1 | 61.7 | 61.7 | 47.7 | 43.0 | 57.3 | 60.6 | 49.0 | 42.0 | 69.3 | 60.7 | Music not audible |
| Evolution, June 30th/31st 2010 | | | | | | | | | | | | | | | | |
| Ref 2-1 | 8 Mulgrave Terrace | 13:29 | 87.5 | 52.1 | 48.2 | 67.7 | 65.4 | 52.7 | 48.6 | 68.4 | 65.7 | 51.3 | 47.6 | 62.8 | 64.7 | Music not audible |
| Ref 2-2 | 9 Chaucer Lane | 12:45 | 94.7 | | | | | | | | | 46.5 | 42.6 | 62.3 | 60.5 | Faint music, not distinguishable as being from the venue |
| Ref 2-3 | 10 Brinkburn Street | 21:45 | 91.6 | 53.7 | 47.9 | 66.2 | 65.4 | 53.4 | 46.8 | 71.0 | 64.0 | 52.8 | 46.2 | 67.3 | 65.0 | Faint music in quiet periods |
| Ref 2-4 | 1 Dean Street | 15:46 | 88.3 | 60.8 | 57.4 | 79.1 | 72.8 | 58.8 | 56.8 | 67.3 | 70.0 | | | | | Event not audible |
| Ref 2-5 | 2 Quayside | 15:18 | 86.1 | 62.6 | 60.1 | 80.2 | 78.9 | 62.4 | 60.3 | 70.4 | 79.0 | 63.5 | 60.0 | 76.0 | 78.1 | Music audible but not discernable |
| Ref 2-6 | 3 St Anne's Street | 16:29 | 88.0 | 55.1 | 52.5 | 70.4 | 66.5 | 55.9 | 53.1 | 66.8 | 66.0 | 53.3 | 50.9 | 61.5 | 64.5 | Event is audible and main source of noise |
| Ref 2-7 | 4 Howards St | 16:58 | 88.0 | 62.8 | 60.0 | 73.4 | 71.5 | 63.4 | 59.9 | 76.5 | 71.2 | 65.2 | 60.1 | 81.9 | 70.7 | Music audible |
| Ref 2-8 | Barker Street | 16:50 | 89.6 | 57.6 | | 67.6 | 64.8 | 56.6 | | 65.0 | 67.6 | 66.8 | | 66.2 | 65.1 | Music not audible |
| Ref 2-9 | 6 Brock St | 16:02 | 83.7 | 53.6 | 50.0 | 67.3 | 64.7 | 55.4 | 50.4 | 66.8 | 65.0 | 54.6 | 50.4 | 66.3 | 67.2 | Music audible, not intrusive |
| Ref 2-10 | 7 Baltic Quays | 13:30 | 84.1 | | | | | 59.0 | 54.5 | 68.1 | 75.6 | 59.4 | 55.3 | 76.2 | 77.0 | Music clear, low level |
| Green Day, LCCC, June 16th 2010 | | | | | | | | | | | | | | | | |
| Ref 3-1 | 22 Railway Road | 17:50 | 88.4 | 59.3 | 48.1 | 84.4 | 67.7 | 54.9 | 49.7 | 71.1 | 69.4 | 54.5 | 50.2 | 67.0 | 68.7 | Music from venue audible |
| Ref 3-2 | 8-10 Barlow Road | 18:23 | 95.0 | 59.7 | 54.0 | 74.1 | 71.3 | 56.5 | 52.2 | 66.4 | 70.1 | 57.9 | 50.7 | 69.5 | 73.2 | Music clearly audible |
| Ref 3-3 | 15 Gorse Avenue | 18:53 | 99.3 | 61.1 | 50.5 | 69.5 | 75.5 | 62.1 | 57.3 | 72.5 | 75.2 | 60.8 | 54.9 | 70.1 | 75.2 | Venue clearly audible |
| Ref 3-4 | 44 Great Stone Road | 19:47 | 82.7 | 73.5 | 63.0 | 99.0 | 81.6 | 73.6 | 68.1 | 98.7 | 83.4 | 71.5 | 67.4 | 79.3 | 82.2 | Music clearly audible, included fireworks |
| Ref 3-5 | 24 Trent Bridge Walk | 20:11 | 100.5 | 71.2 | 61.5 | 96.1 | 84.5 | 70.9 | 63.6 | 96.5 | 83.5 | 66.6 | 60.4 | 75.4 | 80.1 | Music loud, included fireworks |
| Ref 3-6 | 250 Kings Road | 20:34 | 100.8 | 60.2 | 51.7 | 75.7 | 72.3 | 59.5 | 53.3 | 69.7 | 71.8 | 51.8 | 51.0 | 53.1 | 69.0 | Music clearly audible |
| Ref 3-7 | Ayres Road (mid) | 20:59 | 100.4 | 63.9 | 56.9 | 77.5 | 77.0 | 60.8 | 51.1 | 73.1 | 76.1 | 62.2 | 58.2 | 73.8 | 76.5 | Music clearly audible |
| Ref 3-8 | Addison Cres junc with Ruthen Ln | 21:21 | 100.2 | 51.5 | 44.0 | 67.1 | 65.7 | 51.9 | 44.4 | 74.7 | 64.8 | 51.9 | 44.0 | 64.6 | 64.0 | Music clearly audible |
| Ref 3-9 | 51 Sutherland Road | 21:52 | 100.0 | 48.0 | 44.5 | 60.4 | 63.7 | 49.1 | 43.9 | 73.2 | 61.9 | 47.4 | 39.2 | 73.2 | 61.0 | Music clearly audible, included fireworks |
| Green Day, Wembley Stadium, June 19th 2010 | | | | | | | | | | | | | | | | |
| Ref 4-1 | Tokyngton Community Centre | 20:00 | 82.9 | 59.7 | 54.5 | 72.4 | 72.9 | 61.4 | 56.2 | 75.7 | 77.1 | 65.6 | 60.2 | 75.7 | 80.2 | Music clearly audible |
| Ref 4-2 | Windsor Crescent (opp no. 40) | 18:00 | 79.1 | 60.1 | 48.3 | 70.1 | 69.5 | 59.0 | 46.1 | 72.1 | 68.7 | 60.8 | 47.7 | 72.2 | 69.8 | Music not audible |
| Ref 4-3 | Empire Court/North End Road | 18:50 | 91.2 | 59.4 | 50.3 | 68.9 | 67.5 | 57.2 | 48.4 | 69.8 | 65.2 | 58.7 | 50.3 | 74.2 | 67.0 | Music audible (low level) |
| Ref 4-4 | Manor Drive Junc with Hillcroft Cr | 20:00 | 82.9 | 51.8 | 43.9 | 68.9 | 60.1 | 50.9 | 44.5 | 69.2 | 61.0 | 63.4 | 47.0 | 79.8 | 73.1 | Music clearly audible |
| Ref 4-5 | Linden Ave Junc with Linden Lawn | 20:30 | 102.8 | 50.3 | 45.3 | 66.4 | 65.6 | 48.4 | 43.6 | 60.3 | 64.1 | 50.1 | 43.5 | 67.6 | 64.5 | |
| Ref 4-6 | Jesmond Avenue | 21:03 | 102.4 | 52.1 | 45.1 | 70.5 | 64.2 | 50.6 | 44.0 | 68.8 | 62.3 | 53.5 | 46.6 | 75.4 | 65.2 | Music audible |
| Ref 4-7 | Vivian Vace Junc with St Michaels | 21:27 | 101.1 | 59.1 | 54.9 | 66.8 | 71.5 | 58.8 | 53.0 | 71.0 | 71.1 | 58.3 | 52.2 | 66.8 | 69.5 | Music clearly audible |
| Ref 4-8 | Park View (opp 98) | 21:53 | 100.5 | 54.2 | 45.4 | 74.8 | 66.1 | 58.9 | 44.9 | 75.5 | 71.5 | 51.4 | 47.1 | 64.6 | 67.0 | Music clearly audible |
| Pink, Ricoh Coventry, June 24th 2010 | | | | | | | | | | | | | | | | |
| Ref 5-1 | John Sheldon Drive (opp 33) | 19:46 | 97.4 | 55.3 | 45.0 | 78.7 | 62.4 | 49.1 | 42.2 | 68.8 | 63.0 | 46.7 | 40.9 | 66.2 | 61.1 | Music not audible |
| Ref 5-2 | 44 Whitmore Park Rd | 20:12 | 98.1 | 54.4 | 40.6 | 71.6 | 64.6 | 54.0 | 40.6 | 74.1 | 63.6 | 56.3 | 40.2 | 79.4 | 65.8 | Music not audible |
| Ref 5-3 | Beacon Rd junc with St Lukes Rd | 21:00 | 97.5 | 54.7 | 54.1 | 71.0 | 64.0 | 56.7 | 49.1 | 76.9 | 66.7 | 57.2 | 48.2 | 74.0 | 66.4 | Music audible (low) |
| Ref 5-4 | 2 Allied Close | 21:27 | 99.8 | 54.9 | 49.4 | 64.0 | 65.0 | 54.7 | 48.3 | 73.2 | 65.0 | 55.2 | 49.9 | 66.7 | 66.6 | Music clearly audible |
| Ref 5-5 | Arbury Ave Junc with Evelyn Ave | 21:52 | 95.2 | 54.9 | 48.1 | 72.6 | 67.7 | 58.6 | 52.2 | 68.5 | 69.7 | 60.2 | 55.1 | 72.9 | 72.8 | Music clearly audible |
| Ref 5-6 | 16 Congleton Close | 22:15 | 98.7 | 52.9 | 49.0 | 62.0 | 62.8 | 56.4 | 50.5 | 67.3 | 70.3 | 52.1 | 48.2 | 69.3 | 64.6 | Music clearly audible |
| Ref 5-7 | Grindle Rd (opp Apt 119-123) | 17:37 | 82.4 | 49.9 | 46.1 | 49.9 | 65.8 | 55.1 | 47.0 | 63.1 | 75.2 | 56.6 | 51.7 | 69.9 | 76.4 | Music clearly audible |
| Ref 5-8 | Farndale Ave Junc with Landale Ave | 18:50 | 94.8 | 55.9 | 47.5 | 73.0 | 66.2 | 53.6 | 44.8 | 68.6 | 67.4 | 53.4 | 45.4 | 70.5 | 66.9 | Music audible (low) |
| Pink, Hampden Park, June 26th 2010 | | | | | | | | | | | | | | | | |
| Ref 6-1 | 10 Broadwood Drive | 18:05 | - | 49.0 | 41.3 | 67.3 | 60.5 | 50.1 | 39.5 | 70.6 | 60.7 | 52.6 | 41.7 | 69.5 | 65.4 | Music not audible |
| Ref 6-2 | Green Holme Street (opp 23) | 18:50 | - | 48.4 | 40.7 | 65.5 | 63.7 | 49.5 | 40.3 | 62.7 | 62.2 | 56.1 | 39.8 | 72.6 | 63.8 | Music not audible |
| Ref 6-3 | Battlefield Avenue (opp side of 20) | 19:45 | - | 54.4 | 41.6 | 66.5 | 67.8 | 5.3 | 41.3 | 67.6 | 68.2 | 54.7 | 42.9 | 71.4 | 69.3 | Music not audible |
| Ref 6-4 | Comming Dr Junc with Brownlie S | 20:15 | - | 65.7 | 62.3 | 70.3 | 84.6 | 67.2 | 65.1 | 79.8 | 85.4 | 64.7 | 57.1 | 74.9 | 82.4 | Music clearly audible |
| Ref 6-5 | Myrtle View Rd C/o 14 Myrtle Hill | 21:00 | - | 49.3 | 47.0 | 61.7 | 66.6 | 52.8 | 47.4 | 63.7 | 66.2 | 58.6 | 52.6 | 71.3 | 71.9 | Music clearly audible |
| Ref 6-6 | Ardmory Ave (opp 16) | 21:30 | - | 52.0 | 47.1 | 66.0 | 65.1 | 52.6 | 45.2 | 67.8 | 62.3 | 56.1 | 44.1 | 73.8 | 66.2 | Music clearly audible |
| Ref 6-7 | 79 Kingswood Drive | 21:55 | - | 50.0 | 44.7 | 60.9 | 65.7 | 53.3 | 41.4 | 68.3 | 66.7 | 53.0 | 46.6 | 68.6 | 68.0 | Music clearly audible |
| Ref 6-8 | 40 Kingshurst Ave | 22:30 | - | 48.9 | 39.7 | 63.5 | 62.1 | 48.2 | 39.1 | 62.3 | 60.7 | 49.8 | 39.6 | 66.4 | 62.2 | Low level sound from venue |

| Mowtowns Greatest Hits, Kenwood, July 31st 2010 | | | | | | | | | | | | | | | | |
|---|-----------------------------|-------|------|------|------|------|------|------|------|------|------|------|------|------|------|--|
| Ref 7-1 | 1 Bunkers Hill | 19:36 | 89.2 | 45.2 | 39.9 | 56.4 | 55.0 | 45.4 | 40.8 | 57.1 | 54.2 | 44.8 | 41.0 | 57.8 | 54.5 | Music not audible |
| Ref 7-2 | Spaniards Close | 20:50 | 85.8 | 46.7 | 36.5 | 67.5 | 61.4 | 37.7 | 35.3 | 48.5 | 53.1 | 45.0 | 36.2 | 64.1 | 58.6 | Distant sound from venue, very low level |
| Ref 7-3 | 8A Fitzroy Park | 21:20 | 88.6 | 52.1 | 39.9 | 67.1 | 66.4 | 51.9 | 41.7 | 67.2 | 60.8 | 51.1 | 41.6 | 73.9 | 61.7 | Music audible |
| Pride, Brighton, August 7th 2010 | | | | | | | | | | | | | | | | |
| Ref 8-1 | Rookery Close | 19:00 | 96.1 | 68.2 | 65.6 | 76.3 | 89.9 | 68.4 | 66.7 | 76.7 | 89.9 | 68.6 | 66.3 | 75.1 | 89.4 | Loud 'bassy' music from Dance tent audible |
| Ref 8-2 | Port Hall Rd | 16:25 | 97.6 | 58.2 | 47.1 | 77.1 | 71.7 | 57.6 | 47.1 | 73.9 | 71.2 | 57.7 | 47.5 | 85.0 | 69.6 | Event audible |
| Ref 8-3 | Reigate Rd | 16:55 | 97.1 | 57.8 | 44.0 | 78.2 | 64.8 | 59.1 | 44.9 | 79.8 | 66.7 | 51.3 | 44.5 | 72.1 | 65.2 | Some audible music from event but v. Faint |
| Ref 8-4 | Bevant Rd | 17:55 | 95.8 | 61.2 | 49.7 | 82.2 | 73.6 | 57.4 | 48.1 | 71.2 | 73.8 | 59.0 | 48.3 | 76.8 | 71.8 | Music from event audible |
| Ref 8-5 | Herbert Rd | 15:10 | 96.4 | 56.6 | 51.1 | 74.3 | 67.8 | 59.0 | 49.6 | 75.0 | 70.5 | 60.3 | 50.4 | 78.7 | 71.0 | Event audible |
| Ref 8-6 | Waldegrave Rd | 14:05 | 96.5 | 62.1 | 57.5 | 75.3 | 73.9 | 62.4 | 57.1 | 77.3 | 73.2 | 61.9 | 57.1 | 74.0 | 72.9 | Music audible, fluctuating due to wind |
| Ref 8-7 | Rugby Road | 19:40 | 96.6 | 59.3 | 50.4 | 81.6 | 70.5 | 56.2 | 48.9 | 68.9 | 73.9 | 61.5 | 42.3 | 81.7 | 69.8 | Event audible, mainly low freq |
| Ref 8-8 | Ditchling Rise | 13:35 | 94.5 | 59.4 | 54.9 | 77.1 | 70.8 | 60.9 | 55.4 | 77.7 | 71.2 | 59.8 | 55.2 | 75.0 | 68.2 | Event audible, inc crowd |
| Ref 8-9 | Arguyle Rd | 13:10 | 92.6 | 69.8 | 57.2 | 78.4 | 76.0 | 62.8 | 56.1 | 82.3 | 69.3 | 62.8 | 56.3 | 82.3 | 69.3 | Event and crowd audible |
| Ref 8-10 | Preston Drive | 18:15 | 96.2 | 67.0 | 57.8 | 78.0 | 80.6 | 67.6 | 56.9 | 84.6 | 81.3 | 69.2 | 59.1 | 88.3 | 80.8 | Music audible, Bassy noise |
| Ref 8-11 | Preston Park Ave | 14:40 | 95.5 | 70.6 | 67.9 | 80.1 | 55.4 | 72.2 | 68.8 | 81.2 | 83.6 | 72.7 | 67.8 | 89.3 | 87.0 | Noise from event audible |
| Ref 8-12 | North Rd | 17:30 | 97.3 | 50.8 | 44.0 | 73.6 | 66.7 | 55.0 | 44.7 | 69.7 | 70.4 | 53.7 | 44.1 | 73.2 | 66.9 | Music audible |
| BBC Proms in the Park, Swansea, September 11th 2010 | | | | | | | | | | | | | | | | |
| Ref 9-1 | Park View Terrace | 19:51 | - | 46.8 | 40.1 | 68.8 | 62.5 | 46.7 | 41.1 | 60.4 | 61.7 | 47.2 | 41.2 | 59.1 | 63.2 | Site clearly audible |
| Ref 9-2 | Eversley Road | 20:18 | - | 45.5 | 42.7 | 60.9 | 58.6 | 45.9 | 42.8 | 63.3 | 61.6 | 46.2 | 43.0 | 60.1 | 58.8 | Site audible especially singing |
| Ref 9-3 | Roper Beck Way | 20:51 | - | 49.6 | 39.3 | 76.7 | 58.1 | 45.6 | 40.3 | 68.0 | 57.5 | 45.5 | 41.0 | 69.6 | 55.8 | Music audible, mainly singing |
| Ref 9-4 | Admirals Walk | 21:15 | - | 47.2 | 38.5 | 67.3 | 57.6 | 44.1 | 37.8 | 71.5 | 63.3 | 42.1 | 38.2 | 64.2 | 56.2 | Music audible between traffic |
| Ref 9-5 | Kimberly Road | 21:44 | - | 53.1 | 35.9 | 76.7 | 61.1 | 49.3 | 36.6 | 69.6 | 60.2 | 43.2 | 33.9 | 68.2 | 53.1 | Clearly audible |
| Ref 9-6 | Sketty Avenue | 22:13 | - | 43.7 | 39.3 | 68.3 | 63.8 | 43.3 | 37.2 | 63.5 | 55.0 | 60.6 | 38.4 | 85.4 | 69.7 | Music and vocals audible |
| Heroes Concert, Twickenham, September 12th 2010 | | | | | | | | | | | | | | | | |
| Ref 10-1 | 1 Beaumont Place | 17:35 | - | 54.6 | 46.6 | 78.6 | 69.6 | 52.2 | 45.1 | 73.3 | 68.9 | 54.5 | 48.3 | 75.1 | 71.8 | Music audible |
| Ref 10-2 | Cole Park Gardens | 18:02 | - | 48.9 | 46.2 | 57.6 | 64.7 | 48.4 | 44.8 | 58.0 | 64.2 | 52.6 | 45.4 | 71.8 | 67.3 | Music audible |
| Ref 10-3 | Marlow Crescent (opp 61-67) | 18:25 | - | 54.3 | 48.1 | 69.9 | 69.4 | 54.1 | 49.3 | 66.9 | 67.9 | 50.4 | 46.2 | 65.8 | 62.1 | Music clearly audible |
| Ref 10-4 | 5 Lime Grove | 18:48 | 67.3 | 50.0 | 45.2 | 63.5 | 60.2 | 51.5 | 47.5 | 61.7 | 62.1 | 49.5 | 45.3 | 56.6 | 61.0 | Music audible, very clear |
| Ref 10-5 | 5 Stanhope Terrace | 19:15 | 68.2 | 49.9 | 43.4 | 61.1 | 63.5 | 52.5 | 42.5 | 70.6 | 62.7 | 48.6 | 43.1 | 59.8 | 63.5 | Music clearly audible |
| Ref 10-6 | 7 Godfrey Ave | 19:50 | 89.0 | 44.5 | 39.9 | 60.6 | 58.4 | 46.2 | 39.9 | 66.8 | 61.6 | 46.5 | 41.4 | 59.9 | 59.1 | Music audible in last 5mins |
| Ref 10-7 | 1-6 Duke of Cambridge Cl | 20:15 | 87.9 | 50.9 | 46.2 | 63.7 | 65.6 | 52.9 | 47.7 | 63.4 | 64.0 | 51.2 | 47.5 | 57.8 | 66.0 | Audible, very faint |
| Ref 10-8 | 1 Gainsborough Gardens | 20:46 | 85.8 | 46.4 | 42.4 | 56.2 | 64.5 | 46.2 | 41.0 | 57.6 | 65.4 | 48.2 | 40.1 | 69.9 | 66.8 | Audible very low level |
| Ref 10-9 | 61A Arnold Crescent | 21:15 | 88.6 | 46.9 | 41.9 | 62.8 | 65.1 | 46.9 | 41.9 | 58.2 | 62.7 | 49.0 | 41.1 | 70.0 | 61.8 | Audible not loud but clear |

Appendix B – Onsite Measurements

Kiss, Wembley Arena
12th May 2010

| Start Time | LAeq 15min (Mixer) |
|-------------------|---------------------------|
| 19:00:00 | - |
| 19:15:00 | - |
| 19:30:00 | - |
| 19:45:00 | - |
| 20:00:00 | - |
| 20:15:00 | - |
| 20:30:00 | - |
| 20:45:00 | 104.6 |
| 21:00:00 | 104.3 |
| 21:15:00 | 104.9 |
| 21:30:00 | 103.8 |
| 21:45:00 | 103.1 |
| 22:00:00 | 103.6 |
| 22:15:00 | 103.4 |
| 22:30:00 | 103.4 |
| 22:45:00 | 101.9 |

Evolution

| Time | Sunday 30th May | | | Monday 31st May | | |
|-------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| | LAeq 15min (Mixer) | LAeq 15min (Mixer) | LAeq 15min (Mixer) | LAeq 15min (Mixer) | LAeq 15min (Mixer) | LAeq 15min (Mixer) |
| | Spillers Wharf | Baltic Stage | Ballast Hills | Spillers Wharf | Baltic Stage | Ballast Hills |
| 21:00 | 85.4 | 92.2 | 87.2 | 86.4 | 89.5 | 89.9 |
| 21:15 | 85.0 | 91.4 | 86.4 | 84.1 | 91.3 | 89.9 |
| 21:30 | 94.7 | 90.6 | 85.7 | 91.1 | 90.7 | 88.8 |
| 21:45 | 93.8 | 91.6 | 87.5 | 94.4 | 93.1 | 89.8 |
| 22:00 | 94.2 | 91.6 | 83.5 | 93.9 | 95.7 | 93.9 |
| 22:15 | 96.1 | 90.9 | 64.6 | 93.7 | 94.3 | 68.0 |
| 22:30 | 94.3 | 92.0 | 60.0 | 94.4 | 94.5 | |
| 22:45 | 80.7 | 82.5 | 52.1 | 90.6 | | |
| 23:00 | 66.8 | 68.0 | 51.9 | | | |
| 23:15 | 62.2 | 69.5 | 51.7 | | | |
| 23:30 | 66.7 | 65.0 | 52.1 | | | |
| 23:45 | 66.3 | 62.3 | 51.3 | | | |
| 00:00 | 76.3 | 62.6 | 51.5 | | | |
| 00:15 | 67.7 | 68.7 | 62.2 | | | |
| 00:30 | 66.5 | 66.4 | 51.7 | | | |
| 00:45 | 56.0 | 65.4 | 50.5 | | | |
| 01:00 | 74.6 | 56.9 | 50.5 | | | |
| 01:15 | 73.0 | 64.8 | 50.6 | | | |
| 01:30 | 70.9 | 66.7 | 50.3 | | | |
| 01:45 | 65.4 | 59.1 | 50.6 | | | |
| 02:00 | 65.9 | 59.3 | 50.6 | | | |

NB Survey and measurements were concentrated around the Baltic Stage the other stages have been included for completeness.

Green Day, Lancashire County Cricket Club
16th June 2010

| Start Time | LAeq 15min (Mixer) |
|-------------------|---------------------------|
| 17:00:00 | 74.1 |
| 17:15:00 | 74.8 |
| 17:30:00 | 74.6 |
| 17:45:00 | 86.8 |
| 18:00:00 | 88.4 |
| 18:15:00 | 88.1 |
| 18:30:00 | 87.4 |
| 18:45:00 | 95.7 |
| 19:00:00 | 95.8 |
| 19:15:00 | 95.0 |
| 19:30:00 | 79.9 |
| 19:45:00 | 82.7 |
| 20:00:00 | 99.3 |
| 20:15:00 | 100.5 |
| 20:30:00 | 100.8 |
| 20:45:00 | 101.2 |
| 21:00:00 | 100.4 |
| 21:15:00 | 100.2 |
| 21:30:00 | 100.0 |
| 21:45:00 | 98.1 |
| 22:00:00 | 100.0 |
| 22:15:00 | 100.8 |
| 22:30:00 | 98.6 |

Green Day, Wembley Stadium
19th June 2010

| Start Time | LAeq 15min (Mixer) |
|-------------------|---------------------------|
| 14:15:01 | 91.0 |
| 14:30:01 | 65.4 |
| 14:45:01 | 82.0 |
| 15:00:01 | 72.1 |
| 15:15:01 | 88.4 |
| 15:30:01 | 86.6 |
| 15:45:01 | 63.0 |
| 16:00:01 | 62.7 |
| 16:15:01 | 63.3 |
| 16:30:01 | 65.3 |
| 16:45:01 | 82.5 |
| 17:00:01 | 78.8 |
| 17:15:01 | 77.3 |
| 17:30:01 | 76.9 |
| 17:45:01 | 79.1 |
| 18:00:01 | 79.1 |
| 18:15:01 | 91.1 |
| 18:30:01 | 93.8 |
| 18:45:01 | 91.2 |
| 19:00:01 | 91.4 |
| 19:15:01 | 98.1 |
| 19:30:01 | 98.0 |
| 19:45:01 | 97.2 |
| 20:00:01 | 82.9 |
| 20:15:01 | 86.4 |
| 20:30:01 | 102.8 |
| 20:45:01 | 102.1 |
| 21:00:01 | 102.4 |
| 21:15:01 | 101.4 |
| 21:30:01 | 101.1 |
| 21:45:01 | 100.7 |
| 22:00:01 | 100.1 |
| 22:15:01 | 99.5 |
| 22:30:01 | 100.1 |
| 22:45:01 | 100.2 |
| 23:00:01 | 100.5 |

Pink, Ricoh Coventry
24th June 2010

| Start Time | LAeq 15min (Mixer) |
|-------------------|---------------------------|
| 17:00:00 | 79.4 |
| 17:15:00 | 80.5 |
| 17:30:00 | 82.4 |
| 17:45:00 | 96.3 |
| 18:00:00 | 96.7 |
| 18:15:00 | 87.7 |
| 18:30:00 | 88.8 |
| 18:45:00 | 94.8 |
| 19:00:00 | 96 |
| 19:15:00 | 92.8 |
| 19:30:00 | 85.5 |
| 19:45:00 | 97.4 |
| 20:00:00 | 98.4 |
| 20:15:00 | 98.1 |
| 20:30:00 | 81.8 |
| 20:45:00 | 85.4 |
| 21:00:00 | 97.5 |
| 21:15:00 | 99.8 |
| 21:30:00 | 99.8 |
| 21:45:00 | 95.2 |
| 22:00:00 | 101.1 |
| 22:15:00 | 98.7 |
| 22:30:00 | 100 |

Pink, Hampden Park

26th June 2010

| Start Time | LAeq 15min (Mixer) |
|------------|--------------------|
|------------|--------------------|

No Data Available

Dancing in the Streets, Kenwood House
Saturday 31st July 2010

| Start Time | LAeq 15min (Mixer) |
|-------------------|---------------------------|
| 18:45 | 67.3 |
| 19:00 | 69 |
| 19:15 | 68.2 |
| 19:30 | 89.2 |
| 19:45 | 89 |
| 20:00 | 87.8 |
| 20:15 | 87.9 |
| 20:30 | 79.8 |
| 20:45 | 85.8 |
| 21:00 | 88.3 |
| 21:15 | 88.6 |
| 21:30 | 90 |

Brighton Pride
 Saturday 7th August

| | LAeq 15min (Mixer) | LAeq 15min (Mixer) |
|-------------|---------------------------|---------------------------|
| Time | Calabash | Dance Tent |
| 12:00 | 74.4 | 69.6 |
| 12:15 | 96.2 | 91.4 |
| 12:30 | 96.5 | 92.9 |
| 12:45 | | 91.3 |
| 13:00 | | 91.5 |
| 13:15 | | 92.6 |
| 13:30 | | 94.5 |
| 13:45 | | 95.4 |
| 14:00 | | 96.5 |
| 14:15 | | 97.3 |
| 14:30 | | 96.0 |
| 14:45 | | 95.5 |
| 15:00 | | 95.7 |
| 15:15 | 98.7 | 96.4 |
| 15:30 | 100.7 | 96.7 |
| 15:45 | 99.2 | 96.4 |
| 16:00 | 100.7 | 96.8 |
| 16:15 | 100.7 | 97.6 |
| 16:30 | 97.5 | 97.6 |
| 16:45 | 98.8 | 97.1 |
| 17:00 | 97.2 | 97.3 |
| 17:15 | 97.3 | 96.2 |
| 17:30 | 99.2 | 97.3 |
| 17:45 | 99.6 | 97.0 |
| 18:00 | 103.0 | 95.8 |
| 18:15 | 105.1 | 96.2 |
| 18:30 | 100.2 | 97.6 |
| 18:45 | 89.5 | 96.8 |
| 19:00 | 98.9 | 96.1 |
| 19:15 | 98.2 | 96.1 |
| 19:30 | 99.6 | 96.0 |
| 19:45 | 104.3 | 96.6 |
| 20:00 | 98.8 | 97.1 |

Proms in the Park, Swansea

11th September 2010

| Start Time | LAeq 15min (Mixer) |
|------------|--------------------|
|------------|--------------------|

No Data Available

Heroes Concert, Twickenham Stadium
12th September 2010

| Start Time | LAeq 15min (Mixer) |
|-------------------|---------------------------|
| 17:00:00 | 93.4 |
| 17:15:00 | 92.9 |
| 17:30:00 | 93.8 |
| 17:45:00 | 94.0 |
| 18:00:00 | 95.4 |
| 18:15:00 | 92.0 |
| 18:30:00 | 88.9 |
| 18:45:00 | 92.3 |
| 19:00:00 | 92.0 |
| 19:15:00 | 93.2 |
| 19:30:00 | 93.8 |
| 19:45:00 | 84.5 |
| 20:00:00 | 92.6 |
| 20:15:00 | 92.3 |
| 20:30:00 | 93.5 |
| 20:45:00 | 94.6 |
| 21:00:00 | 85.1 |
| 21:15:00 | 92.9 |
| 21:30:00 | 98.9 |
| 21:45:00 | 98.2 |
| 22:00:00 | 99.5 |

Appendix C – Historical Concert Noise Data