Applicant: **Headingley North-South Stand Ltd**

Premises: **South Stand, Emerald Headingley Stadium, St Michael's Lane, Headingley, Leeds, LS6 3 BR**

APPLICATION FOR GRANT OF A PREMISES LICENCE

STATEMENT OF FURTHER EVIDENCE AS TO HOW THE APPLICANT WILL PROMOTE THE LICENSING OBJECTIVE IN RESPECT OF PUBLIC NUISANCE

1. The Applicant is fully aware in considering the promotion of this licensing objective, of the need to focus on the effect of licensable activities on persons living and working in the area around the premises in particular the levels of noise emanating from the premises.

2. The Applicant is in regular consultation with the Environmental Health Service to obtain advice and measures as to how it can meet the objectives set out in the licensing policy and incorporate the same into their operating schedule. These include measures to combat noise nuisance, light pollution, noxious smells and litter. For example,

   - Bottle bins not to be emptied after 23:00
   - Floodlights to be switched off at 23:00
   - Litter picking to be undertaken during and post fixture to avoid unnecessary littering outside the stadium
   - No alcohol drinks or drink holders to be taken outside of the stadium

3. 24/7 telephone contact with Emerald Headingley Stadium can be made on 0113 203 3224 should issues arise.

4. Mobile telephone numbers and e-mail addresses for the Head of Customer Service and the Head of Operations are held by the Environmental Health Service should any emergency situations arise.

5. There is a Duty Manager on site at all events. The Designated Premises Supervisor and/or his Deputy is on site at all events and fixtures. Sue Ward, Head of Operations and Sian Jones, Head of Customer Experience are on site at all fixtures.

6. In conjunction with Leeds City Council, "next fixture" match day permanent signage has been deployed on St Michael's Lane for both major cricket and rugby matches. This signage notifies residents and motorist of the next fixture and is updated after each major event by Traffic Management Services Ltd (TMS Ltd).

7. The Applicant is in regular communication with Headingley Ward Council and Residents. For example the Applicant lists below details of communications with residents since the 9th October 2018:-

    - 23rd October – Notice delivered to all those on the database re: forthcoming fixtures.

    - 30th October – Letter drops delivered to those affected by the road closure on the 4th November offering secure on-site parking (those living on St Michael's Lane), including businesses and residents.

    - 30th October – E-mail communication regarding the road closure forwarded to all registered on the Applicant's database.

8. The Applicant is also in regular contact with Kirkstall Ward Councillors.

9. On the 30th October the Applicant made telephone contact with certain local residents requesting access to the 15 The Turnways and 7 Broomfield Terrace. In addition the Applicant delivered letters re: forthcoming noise assessment and measurement survey to addresses on the Turnways, Greyshiels Avenue, Greyshiels Close and Laurel Bank Court. E-mails were also sent to those registered on the database (149 contacts including group e-mail addresses). Details were also forwarded to Jamie Friel at the Environmental Health Service so he could forward to any specific complainants he had on their database.

10. On the 15th November 2018 a Stadium Liaison Group Meeting was scheduled with the residents and the Headingley and Kirkstall Ward Councillors. However, this has been rescheduled to January at the Councillors request. A meeting between the Stadium Management and Headingley Councillors will take place on the 15th.

11. In accordance with the recommendation of the Licensing Sub-Committee the Applicant has provided an independent report in respect of the noise levels and perceptible vibrations outside the stadium in the adjacent street/properties. The report has been undertaken in consultation with local residents.

12. The report concludes that based on the measurements of noise emission from the PA system both with the New South Stand and at nearby dwellings, and the defined mitigation measures, it is determined that suitable music noise levels can be achieved within the South Stand whilst meeting the proposed noise level limits at the nearby residences.

13. The mitigation measures are set out within the report and the Applicant will ensure that the noise levels do not exceed the proposed noise level limits in the adjacent streets and properties.

14. The report also concludes that based on the vibration measurements undertaken, where music is played through the PA at the proposed noise level limits, there will be no adverse or perceptible vibration within dwellings.

15. The Applicant has submitted a copy of the report to the Environmental Health Service. The Applicant would refer to the attached e-mail from Jamie Friel at Environmental Health Services to Richard Hinton at APEX Acoustics (the author of the Applicant's Noise Impact Assessment Report) dated the 30th October 2018. The e-mail refers to Environmental Health Service receiving complaints during the testing and commissioning of the PA system and also of the subsequent event that was undertaken during the Varsity Event. The e-mail goes on to say "*There have been no complaints received by my service on other matches or events that have taken place on either side of the aforementioned*".

16. The Applicant submits that it has taken significant further steps to promote the Licensing Objective in respect of public nuisance and the Applicant will continue to work with local residents as the re-development of the ground continues.

Details of Consultations/Communications with Local Residents in the last 18 months

The Licensing Committee recommended the Applicant should consult fully with the local residents prior to the next hearing.

We currently hold 149 direct email contacts on our database. The database grows every time we issue an update and has been in operation for over 3 years. The database includes group email addresses for the following;

- Burley Top Community Association
- The Turnways
- Cardigan Triangle
- Headingley.org
- Kirkstall Neighbourhood Forum
- Ash Road
- Friends of Beckett Park
- Queenswood Tenants and Residents Association

All updates include the following statement to try and obtain further direct mail contacts

'Welcome to those of you who have joined the resident's email contact list that has been building for the last few years to ensure we are updating our neighbours surrounding Emerald Headingley Stadium of activity relating to Rugby fixtures and Events that are taking place at the Stadium.

If you have any neighbours / friends in the surrounding area to the stadium who wish to be part of the resident's email distribution list, please ask them to email their name and email address to sian.jones@leedsrugby.com. Please note, residents must volunteer their email addresses to be a part of the list and the list is only used to provide Rugby fixture and Stadium event updates – there will be a separate email relating to Yorkshire County Cricket matches and events.'

In February 2018 we carried out a letter drop of the newsletter to 6000 houses which were situated within a 1/3 of a mile of the stadium which although was to notify about a public consultation did include the above information to try and encourage residents to volunteer their email address.

The monthly updates structure currently includes the following information;

- Leeds Rhinos fixture dates
- Yorkshire Carnegie fixture dates
- Additional matches/events
- Construction activity during that month
- Any relevant information that we feel may affect the residents whether low level affecting a few people or a major event that may affect the whole community

All updates are titled ***'IMPORTANT NOTICES FROM EMERALD HEADINGLEY STADIUM'*** and are emailed directly from sian.jones@leedsrugby.com as opposed to a direct email programme which can in some cases automatically be diverted to junk/SPAM files on inboxes.

See below notices issued via the database and as letter drops to local businesses during the last 18 months;

1st June 2017 – Leeds Rhinos Fixtures

27th June 2017 – Leeds Rhinos Fixtures, Yorkshire Carnegie Fixtures and Children's Day

26th July 217 - Leeds Rhinos and Yorkshire Carnegie Fixtures

22nd August 2017 - Leeds Rhinos and Yorkshire Carnegie Fixtures

19th Sept 2017 – Varsity Game, Leeds Rhinos & Yorkshire Carnegie Fixtures

1st November 2017 – General stadium redevelopment and construction update, Yorkshire Carnegie Fixtures and Leeds Rhinos 2018 fixture list

8th December 2017 – General stadium redevelopment and construction update, Yorkshire Carnegie Fixtures and Leeds Rhinos 2018 fixture list

1st February 2018 – General stadium redevelopment and construction update, Yorkshire Carnegie Fixtures, Leeds Rhinos 2018 fixture list and Elida Gibbs public consultation

14th February 2018 – General stadium redevelopment and construction update including concrete pouring sessions

19th March 2018 – General stadium redevelopment and construction update including concrete pouring sessions

4th April 2018 – General stadium redevelopment and construction update, Yorkshire Carnegie Fixtures and Leeds Rhinos 2018 fixture list

18th April – General stadium redevelopment and construction update including concrete pouring sessions

16th May 2018 – General stadium redevelopment and construction update including concrete pouring sessions

24th May 2018 - GDPR (General Data Protection Regulation) update and Leeds Rhinos Fixtures

6th June 2018 – Public Address system test, Floodlight test, construction update including concrete pouring sessions, special ticket offers for residents

29th June 2018 - GDPR (General Data Protection Regulation) reminder, construction update including concrete pouring sessions and Leeds Rhinos Fixtures

1st August 2018 – Leeds Rhinos Fixtures, Yorkshire Carnegie Fixtures, Additional fixture, Varsity game, stadium development and construction update.

4th September 2018 - Leeds Rhinos Fixtures, Yorkshire Carnegie Fixtures, Additional fixture, Varsity game, stadium development and construction update.

14th September 2018 - Public Address system test and Varsity game road closure details

25th September 2018 – Black Building Testing notice.

27th September 2018 – Black Building Testing notice – revised date.

2nd October 2018 - Public Address system test, Floodlight test, construction update including concrete pouring sessions, special ticket offers for residents

5th October 2018 - Leeds Rhinos Fixtures, Yorkshire Carnegie Fixtures, South Stand Open Day and stadium development and construction update.

23rd October notice delivered to all those on the database re forthcoming fixtures/events;

- Leeds Beckett University fixture
- South Stand Open Day

30th October letter drops delivered to businesses and residents affected by the road closure on the 4th November offering secure onsite parking (those living on St Michael's Lane).

30th October email communication to all registered on our data base re:

- Noise & Vibration Survey date/time
- Road Closure due to crane access date/time

30th October - Telephone contact requesting property access to 15, The Turnways and 7, Broomfield Crescent. Door to door delivery of letter re noise assessment and measurement approach delivered to The Turnways, Greyshiels Avenue, Greyshiels Close and Laurel Bank Court. Email communication to those registered on our data base (149 contacts including group emails addresses). Also forwarded to Jamie Friel, EHS so he can forward to the complainants on the LCC database.

15th November - Stadium Liaison Group meeting scheduled with the Headingley Ward Councillors; Cllr Garthwaite, Walshaw, Pryor and residents.

South Stand, Emerald Headingley Stadium

Licensing noise impact assessment

5360.8

12th November 2018

Revision A

apexacoustics

South Stand, Emerald Headingley Stadium

Licensing noise impact assessment

5360.8

Revision	Description	Issued by	Date
A	First issue	RH	12th Nov 18

Prepared for

Leeds Rugby

Emerald Headingley Stadium, St Michael's Lane, Leeds, LS6 3BR

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CHAS Accredited Contractor

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2 Summary

2.1 This report has been prepared at the request of the Applicant (Headingley North-South Stand Ltd) in conjunction with its application for a Premises Licence application for the new South Stand at the Emerald Headingley Stadium, St Michael's Lane, Leeds.

2.2 Objections have been submitted to the Licensing Sub Committee by local residents with regards to concerns over noise and vibration impact from the PA system associated with the South Stand, and potential noise from the Bar / Concourse.

2.3 The submitted objections and the Licensing Sub Committee Notice of Decision dated 12th October 2018 have been reviewed.

2.4 Current guidance and standards have been reviewed, and a set of noise impact and vibration limits proposed, in absence of any specific guidance which is representative of the past and current operations at the Stadium.

2.5 With the new PA in operation, noise level measurements have been made in the new South Stand and at various locations around the Stadium which are considered representative of residential dwellings.

2.6 In most locations, the proposed vibration and noise limits are met where music is played through the PA (0 dB gain setting as advised by TG Baker) to give music noise levels of 90 – 93 dB $L_{Aeq,15mins}$ in the South Stand.

2.7 Where the proposed noise limits are exceeded at dwellings due to music noise from the PA, the following mitigation measures are proposed:

- Reduce the output of the loudspeaker at the eastern end of the South Stand (affecting St Michael's Lane) hung from the roof by 4 dB for music
- Reduce the output of the loudspeaker at the western end of the South Stand (affecting The Turnways) hung from the roof by 5 dB for music

2.8 Music noise break-out from the Bar / Concourse area has been calculated based on the construction and high music noise levels internally; the results indicate that the impact is below the proposed music noise limits for a matchday.

2.9 Where music is proposed to be played in the Bar / Concourse on non-matchdays a set of internal music noise level limits are given which are calculated to achieve the proposed limits.

3 Introduction

3.1 The Applicant (Headingley North-South Stand Ltd) has applied for the Grant of Premises Licence for the South Stand, Emerald Headingley Stadium, St Michaels Lane, Leeds.

3.2 The new South Stand directly replaces a pre-existing stand at the Stadium. The pre-existing South Stand had an inferior PA system, some elements of which are understood to have been over 20 years old.

3.3 The PA system was used for:

- communication with spectators including safety messages
- pre and post match music

3.4 The new South Stand incorporates a state-of-the-art PA system to provide more consistent coverage throughout the stand with an improved audio quality.

3.5 The PA in the new South Stand is to be used for the same purposes as with the pre-existing South Stand PA.

3.6 The Premises Licence application was brought to the Licensing Sub Committee hearing on the 9th October 2018.

3.7 Further to objections and concerns raised by local residents and their representatives, the Licensing Sub Committee adjourned the hearing and requested that an independent assessment of noise impact associated with the Licenced activities and proposed operations be submitted to the Committee.

3.8 A review of some of the written objections received by the Committee reveals local resident's concerns which include:

- the potential impact from live/recorded music over the full period of the proposed licence terms (13:00 hours – 23:00 hours)
- the potential impact from sales of alcohol in the concourse / bar area over the full period of the proposed licence terms (12:00 hours – 23:00 hours Monday to Saturday, 12:00 hours to 22:30 hours Sunday)

3.9 A review of the Licencing Sub Committee Notice of Decision, dated 12th October 2018, reported resident's objections and states that residents experience of noise associated with the new PA system has been "unbearable, with some residents reporting to not being able to hold conversations and sense vibrations in their homes".

3.10 Apex Acoustics has been commissioned to:

- carry out noise level measurements at residential locations with the new PA system in operation.
- carry out vibration measurements at residential locations with the new PA system in operation.
- carry out background noise level measurements at positions representative of nearby residential properties.
- propose noise and vibration criteria deemed to be acceptable at the nearby residential properties based on the Stadium proposed operations
- assess the impact of noise emitted from the new PA system
- assess the impact of vibration associated with the new PA system
- assess the impact of entertainment noise within the concourse / bar area

3.11 The PA noise level measurement locations are defined in Table 1 below.

No.	Location	Meas'nt	Comments
1	No. 15 The Turnways	Noise – external Vibration – internal	Resident has allowed access to measure vibration internally
2	The Turnways	Noise – external	Noise level measurements made on the road at positions indicated on Figure 1.
3	St Michaels Lane	Noise – external	As per 2016 survey location
4	St Michaels Lane / Newport View	Noise – external	Noise level measurements made on the road at positions indicated on Figure 1.
5	Greyshiels Ave	Noise – external	
6	No. 7 Broomfield Crescent	Noise – external Vibration – external	Resident has allowed access to measure noise and vibration externally on the property

Table 1: Proposed measurements

3.12 The site location and PA noise level measurement positions are shown in Figure 1.

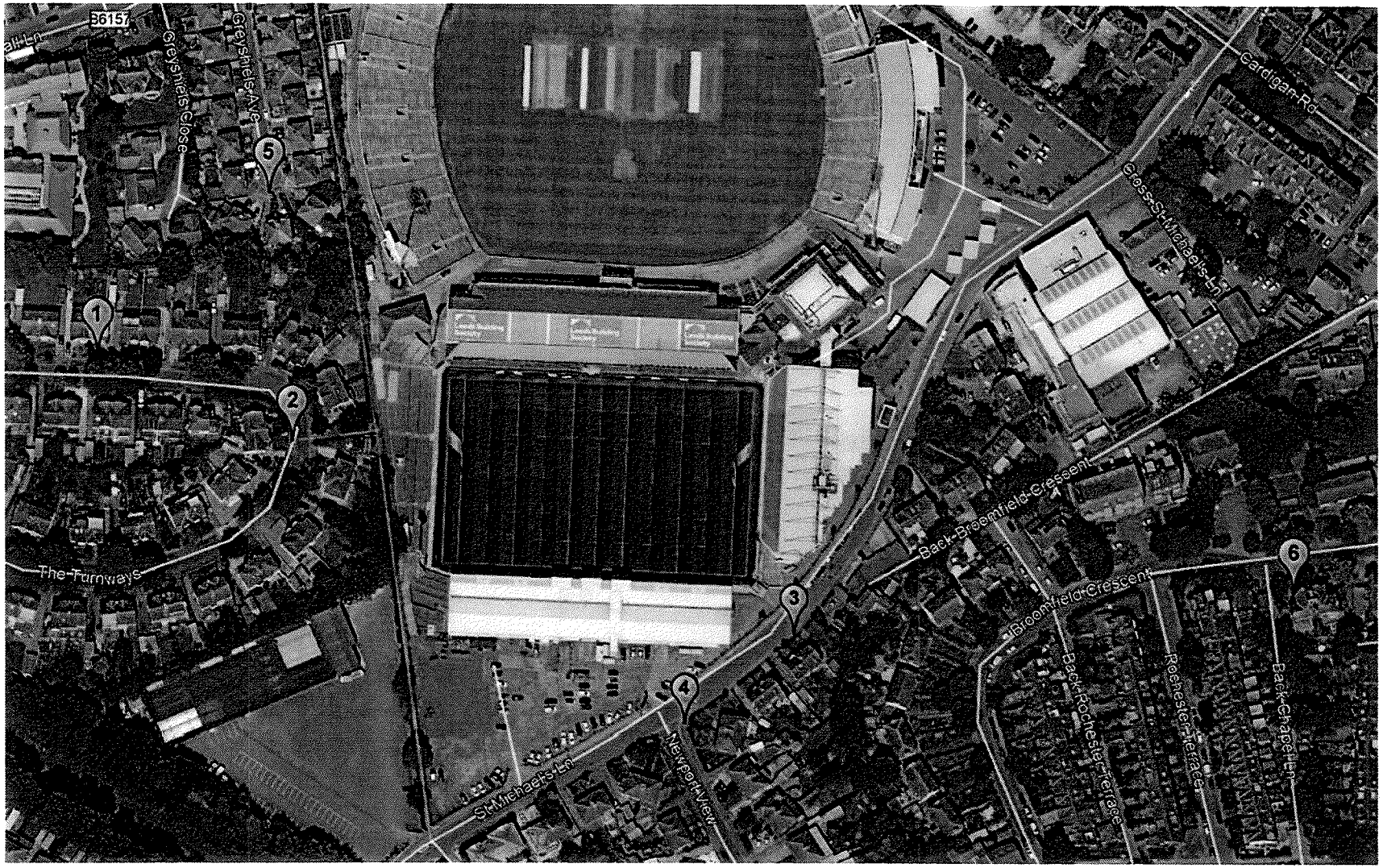

Figure 1: Site location, PA measurement positions indicated by numbered markers

4 Professional qualifications and competence

4.1 The author of this report holds a Bachelor of Science degree (1st Class with honours) in Acoustics, awarded by the University of Salford in 2008, and is a Corporate Member of the Institute of Acoustics, which can be verified by searching the Institute of Acoustics list of Members, available at: www.ioa.org.uk/membership-check.

4.2 The author's professional experience includes:

- Acoustic Consultant at WYG, Leeds, from July 2008 to June 2009, undertaking noise assessments to support planning applications and internal acoustic design for health and educational buildings.
- Acoustic Consultant at Miller Goodall Environmental Services, Bolton from June 2009 to June 2010. As well as continuing the types of projects undertaken at WYG, I provided advice to Salford Council Planning on noise issues related to Planning Applications.
- Acoustic Consultant at Apex Acoustics since June 2010. Acoustic Consultancy services for the full range of projects Apex provide including assessment of noise impact from new road schemes, internal acoustic design for residential / health / educational / commercial developments, and noise impact assessments for residential / commercial / industrial developments.
- Presented with the Association of Noise Consultants award for Good Acoustic Design for a circa £45m development in Swanley, Kent, where a residential scheme immediately adjacent to an industrial paper mill was granted planning permission with agreement from the Local Authority Environmental Health Officers, the paper mill, and their acoustic consultant.

5 2016 noise level measurements

5.1 Prior to any of the demolition and construction works for the new stands, measurement of the existing noise levels affecting the nearest residences to the Stadium were undertaken in 2016.

5.2 Match day noise levels were measured at the nearest sound sensitive location to the Stadium, considered to be the residential properties on St Michaels Lane; the measurement positions are indicated in Figure 1 by marker 3.

5.3 Measurements were made during the Super League Rugby match between Leeds Rhinos and Widnes Vikings on Sunday 3rd July 2016.

5.4 This match was chosen as it was understood to be likely to have a higher than typical attendance.

5.5 At the time of the measurements the wind speed was around 1 m/s, no precipitation occurred and the temperature was around 14 °C.

5.6 The microphone was located approximately 4 m above ground level and away from other reflecting surfaces, such that the measurements are considered free-field.

5.7 Data was recorded in octave bands at 1 second intervals throughout the measurement period.

5.8 The measurement period included most of the match; from 15:20 hours until after the match had finished and all spectators had left.

5.9 The most significant sound sources were the spectators and PA associated with the Rugby match.

5.10 The equipment used is listed in Table 4.

Equipment	Model	Serial no.
Sound Level Meter	NTi XL2	A2A-05832-E0
Calibrator	Larson Davis CAL 200	9462

Table 4: Equipment used

5.11 Both meter and calibrator have calibration certificates traceable to national standards.

5.12 A summary of the measured noise level is shown in Table 5; detailed noise data is shown in Appendix 1.

Position	Start time (hh:mm)	Period (T) / hh:mm	$L_{Aeq,T}$ (dB)
3	15:18	01:35	74

Table 5: Measured noise level

6 Review of guidance

6.1 There are no specific guidance documents or standards which refer directly to the type of operations which occur at the Stadium i.e. short-term playing of amplified music pre-and post match.

6.2 Guidance and standards which in part may be considered appropriate also rarely take into account the context and history of operations which are considered significant for this site.

6.3 **Noise**

6.4 **BS 4142:2014, Reference 1.**

6.5 BS 4142 defines a method of assessing the impact of noise from an industrial or commercial source based on comparing the specific noise level against the background noise level when the specific noise is not in operation at the identified noise sensitive receptor (typically a dwelling).

6.6 However, in para. 1.3 of the scope, it is stated that "The standard is not intended to be applied to the rating and assessment of sound from:

a) recreational activities, including all forms of motorsport;

b) music and other entertainment;

g) public address systems for speech;"

6.7 It is understood that BS 4142 is used to assess noise impact from activities and operations outside its defined scope where there is a lack of other relevant assessment guidance.

6.8 In this instance, where the activity resulting in the noise impact has been in existence for a significant amount of time, and where the activity occurs for relatively short periods of time each week, it is considered that BS 4142 is an inappropriate assessment method.

6.9 **Noise Council Code of Practice on Environmental Nosie Control at Concerts, Reference 2.**

6.10 The Code of Practice on Environmental Noise Control at Concerts (Code of Practice) is provides guidance on minimising disturbance from large amplified music events.

6.11 Table 1 of the Code of Practice is shown in Figure 2 and proposes absolute A-weighted noise level limits for music noise from concerts which depend on the number of days per year, and type of venue.

The Music Noise Levels (MNL) when assessed at the prediction stage or measured during sound checks or concerts should not exceed the guidelines shown in Table 1 at 1 metre from the façade of any noise sensitive premises for events held between the hours of 09.00 and 23.00.

TABLE 1

Concert days per calendar year, per venue	Venue Category	Guideline
1 to 3	Urban Stadia or Arenas	The MNL should not exceed 75 dB(A) over a 15 minute period
1 to 3	Other Urban and Rural Venues	The MNL should not exceed 65 dB(A) over a 15 minute period
4 to 12	All Venues	The MNL should not exceed the background noise level by more than 15 dB(A) over a 15 minute period

Figure 2: Table 1 of the Code of Practice

6.12 Note no. 2 to Table 1 of the Code of Practice is shown in Figure 3 below and notes that the spectral content of music noise can affect the perceived disturbance.

Although no precise guidance is available the following may be found helpful (Ref.8): A level up to 70 dB in either of the 63 Hz or 125 Hz octave frequency band is satisfactory; a level of 80 dB or more in either of those octave frequency bands causes significant disturbance.

Figure 3: Note 2 to Table 1

6.13 **IEMA Guidelines for Environmental Noise Impact Assessment (IEMA), Reference 3.**

6.14 The Guidelines for Environmental Noise Impact Assessment produced by the Institute of Environmental Management and Assessment is a broad document advising on general good practice when conducting a noise assessment and offers specific guidance on assessment of noise for Environmental Impact Assessments.

6.15 Unlike other assessment methods (i.e. BS 4142), the guidance and assessment methodologies given in IEMA reference, and take account of the requirements of current national planning policies.

6.16 Guidance is provided on assessing the significance of the effect of a change in noise levels between the cases before and after development. It is recommended that consideration should be given to:

- Whether the noise change is small enough such that it is likely to be unnoticeable or barely noticeable; or
- Whether it is large enough to be noticed and hence cause a noise impact but not so large as to cause that impact to be significant; or
- Whether it is so large that the noise impact causes a significant noise effect.

6.17 The IEMA guidance states that an assessment which relies solely on change in the absolute noise level is not appropriate as it can give rise to "noise creep" and that it "risks ignoring the context of the noise change".

6.18 In this instance the types of the noise sources from the pre-existing and new stands are considered to be equivalent, and a change in operation (e.g. number of Rugby matches or use of the stadium for other purposes) is not proposed, hence the nature of the change is likely to be in terms of magnitude only.

6.19 Table 7-14 of IEMA, as shown in Table 2 below, is given to indicate how impact due to a change in sound level could be assessed.

Long-term Impact Classification	Short-term Impact Classification	Sound level change
Negligible	Negligible	≥ 0 dB and < 1 dB
	Minor	≥ 1 dB and < 3 dB
Minor	Moderate	≥ 3 dB and < 5 dB
Moderate	Major	≥ 5 dB and < 10 dB
Major		≥ 10dB

Table 2: Assessment criteria from Table 7-14 of IEMA

6.20 The Short-term and Long-term classifications shown in Table 2 are understood to refer to an overall reference period. For example, DMRB, Reference 4, defines

Short-term as within the first year of completion of a development, and Long-term is defined as 15 years from the completion of a development.

6.21 The assessment criteria shown in Table 2 are based on daytime $L_{Aeq,16\ hr}$ or night-time $L_{Aeq,8\ hr}$ levels. The time periods are defined as:

- daytime - between 07:00 hours and 23:00 hours
- night-time - between 23:00 hours and 07:00 hours

6.22 It is noted that the sound impact from Rugby matches occurs during the daytime only, and is short-term in nature - typically less than 3 hours in total in any single day.

6.23 Therefore, given the context of the potential noise impact from the proposed development outlined above, it is proposed to assess the magnitude of noise impact resulting from the proposed development of the Rugby stands using the long-term impact classification criteria from Table 7-14 of IEMA, as shown in Table 2.

6.24 **Vibration**

6.25 **BS 6472-1:2008, Reference 5.**

6.26 BS 6472-1 defines a method of measuring and assessing the potential impact of groundborne vibration by occupants of a dwelling.

6.27 The standard uses Vibration Dose Value (VDV) as the assessed parameter, which is a function of acceleration.

6.28 Whilst there are no absolute levels of vibration defined as acceptable, BS 6472-1 defines levels at which various potential for adverse comment may be anticipated.

6.29 These levels are shown in Table 3.

Residential Buildings	Low probability of adverse comment	Adverse comment possible	Adverse comment probable
16 hr day	0.2 - 0.4	0.4 - 0.8	0.8 - 1.6
8 hr night	0.1 - 0.2	0.2 - 0.4	0.4 - 0.8

Table 3: Guidance of BS 6472 on Vibration Dose Values ($m/s^{1.75}$) above which various degrees of adverse comment may be expected in residential buildings

6.30 **BS 7358-1:1990, Reference 6.**

6.31 BS 7385-1 gives guidance on measurement of airborne and groundborne sources of vibration within a building and references the Peak Particle Velocity (PPV) parameter.

6.32 However, the document does not state any specific limits for vibration from any type of source.

6.33 **Lichfield District Council Guidance, Reference 7.**

6.34 The technical guidance document intended for use by Lichfield District Council Environmental Health Officers offers some guidance on assessment of vibration from commercial sources affecting proposed residential development.

6.35 Para 8.4 states:

"In circumstances where vibration is a potential source of disturbance it is expected that an appropriate vibration survey or prediction be carried out. Initially, to avoid complex investigations being carried out unnecessarily a screening survey should be carried out. If monitored vibration levels do not exceed 0.14 mm/s peak particle velocity in any axis then no further survey is necessary. If this level is exceeded then it is expected that an assessment would be carried out with reference to BS 6472."

7 Proposed criteria

7.1 **Noise - PA**

7.2 **St Michael's Lane – position 3**

7.3 The closest dwellings to the new South Stand are those on St Michael's Lane directly to the south-east of the new South Stand.

7.4 It is expected that PA music noise levels of greatest magnitude will be experienced at these dwellings.

7.5 As measurements of the pre-existing South Stand were made on a matchday prior to the works, given the context of the potential noise impact from the new South Stand, it is proposed to assess the resulting magnitude of noise impact using the long-term impact classification criteria from Table 7-14 of IEMA, as shown in Table 4 below.

Proposed Impact Classification	Sound level change dB $L_{Aeq,T}$
Negligible	≥ 0 dB and < 3 dB
Minor	≥ 3 dB and < 5 dB
Moderate	≥ 5 dB and < 10 dB
Major	≥ 10dB

Table 4: Proposed assessment criteria for PA noise impact on dwellings on St Michael's Lane

7.6 **All other dwellings**

7.7 It is noted that residents have stated that noise from the new PA system has resulted in some instances of being unable to hold a conversation indoors.

7.8 The noise level in a room as a result of an external source is a function of window area, room dimensions, room finishes and glazing type.

7.9 As these will vary between dwellings, and the guidance reviewed above all base their assessment on external noise levels, it is proposed that all noise level limit criteria associated with the new PA are based on external noise.

7.10 Based on the guidance given in the Noise Council Code of Practice and our understanding of the site context, the music noise levels shown in Table 5 are proposed for all other dwellings.

Overall level	A-weighted octave band levels	
	63 Hz	125 Hz
70 dB(A)	50	60

Table 5: Proposed music noise level limits

7.11 **Noise - Bar / concourse**

7.12 Although the new South Stand operators have stated that the intention is for the bar / concourse to be operational only on matchdays, in response to the concerns raised by the local residents, and assessment of entertainment noise breakout is proposed.

7.13 Music / entertainment noise limits are proposed based on the guidance of the Noise Council Code of Practice and with reference to the principles of BS 4142 and are shown in Table 6.

Event	Proposed limit
Matchday	70 dB $L_{Aeq,\ 15mins}$
Other	No greater than the measured background noise level in any octave band

Table 6: Proposed assessment criteria for Bar / Concourse entertainment noise impact

7.14 **Vibration**

7.15 It is proposed to use the VDV limits for degrees of adverse comment as defined in BS 6472-1 to assess the vibration associated with the new PA.

7.16 Measurement of PPV will also be undertaken and compared with any noise events associated with the PA.

8 PA noise and vibration measurements

8.1 **General**

8.2 Noise level and vibration measurements were undertaken on the 1st November 2018.

8.3 The measurement positions are shown in Figure 1.

8.4 The microphones were located 1.5 metres above ground level and where possible away from other reflecting surfaces such that the measurements are considered to be free-field.

8.5 Where measurements are considered to have been affected by reflections from a building façade, this is noted in the results below.

8.6 The equipment used is shown in Table 7; both meters and calibrators have current calibration certificates traceable to national standards; calibration certificates are available on request.

Equipment	Model	Serial no.
Sound Level Meter	NTi XL2	A2A-12479-E0
Calibrator	Larson Davis CAL 200	13405
Sound Level Meter	NTi XL2	A2A-14176-E0
Calibrator	Larson Davis CAL 200	15307
Sound Level Meter	NTi XL2	A2A-14205-E0
Calibrator	Larson Davis CAL 200	15308
Vibration meter	Vibrock V901	1315

Table 7: Equipment used

8.7 During the measurements of sound from the PA, the PA was operated by members of the TG Baker team.

8.8 Measurements were made with the PA running the following noise sources:

- Pink noise (steady state broadband controlled noise source which can be used to define the difference in noise levels between the South Stand and any measurement position for any frequency)
- Music programme material
- Voice alarm

8.9 The operational settings are noted in the measurement results. Where measurements of the voice alarm have been made, it is understood that the levels are set to achieve Health and Safety requirements.

8.10 A sound level meter was placed in the centre of the new South Stand, and noise levels and audio recordings made concurrently with the measurements at the locations around the Stadium.

8.11 Position 1 – 15 The Turnways

8.12 Noise level measurements were made with the sound level meter located in the front garden of the property approximately 1 m from the façade. Therefore the measured levels are considered to be affected by reflections from the building and the free-field levels are likely to be between 1 dB – 2.5 dB lower.

8.13 A picture of the sound level meter with the measurements in progress is shown in Figure 4.

Figure 4: Measurements in progress at position 1

8.14 Further to discussion with the resident of the dwelling, vibration measurements were made with the PPV and VDV sensors located on a table within a room between the kitchen and the hallway, on the eastern façade of the building.

8.15 The measured noise levels are shown in Table 8, the greatest measured music noise levels (Bruno Mars) at position 1 do not exceed the proposed noise limits.

Noise source	Gain setting	Limiter setting	A-weighted noise levels / dB(A)					
			Position 1			South Stand		
			$L_{Aeq,T}$	63 Hz	125 Hz	$L_{Aeq,T}$	63 Hz	125 Hz
Pink noise	0	On	59	23	47	96	95	49
Pink noise	0	Off	60	33	49	96	61	80
Pink noise	+ 7	Off	65	31	54	101	57	86
Elvis	0	On	60	25	47	96	49	79
INXS	0	On	55	31	49	90	59	77
Bruno Mars	+ 7	Off	64	38	56	99	60	87
Voice	-	-	59	22	42	94	43	71
Aircraft	-	-	72	-	-	-	-	-

Table 8: Measured noise levels at position 1

8.16 The results of the PPV vibration measurements are shown in Figure 5, the measured VDV is shown in Table 9Figure 5.

8.17 The measured PPV is at its greatest at the beginning of the measurement when there is no sound emitted from the PA. It is considered that this is due to the washing machine within the dwelling being operational at this time, and due to movement of people within the room.

8.18 The PPV values have been coloured where there was sound from the PA.

8.19 Typically, where there is noise from the PA, there is little variation in measured PPV.

8.20 Where there are variations, e.g. during Elvis, INXS and Bruno Mars, this is considered to be due to the author of this report entering the house and checking the equipment and readings.

8.21 During the Bruno Mars period, the PPV values are seen to be very low during some of the measurement period, however the music noise level did not vary concurrently.

8.22 Slightly higher PPV values are also seen at the end of the measurement period when no sound was played through the PA. Again, this is considered to be due to movement of people in the dwelling.

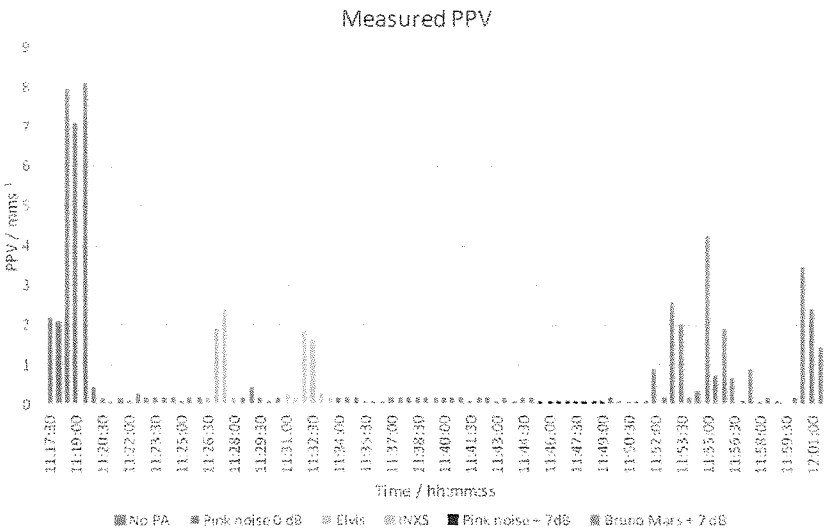

Figure 5: Measured PPV

Period	VDV / m/s$^{1.75}$ per axis		
	X	Y	Z
1 hour (measured)	0.052	0.088	0.138
16 hour (derived)	0.104	0.176	0.276

Table 9: Measured VDV and derived 16 hour VDV

8.23 The 16 hour VDV has been derived from the measured 1 hour VDV following the methodology given in BS 6742-1.

8.24 The greatest VDV_{16hour} falls within the 'low probability of adverse comment' according to BS 6472-1. This assessment is based on the assumption that the occurrences during the measurement period occur repeatedly for the full 16 hour daytime period.

8.25 It is noted that the author's subjective assessment is that no vibration was perceptible within the dwelling during the playing of sound through the PA system.

8.26 **Position 2 – The Turnways**

8.27 Noise levels were made on the west side of the road opposite the footpath which connects to the pathway which runs directly behind the Stadium West Stand.

8.28 A picture of the sound level meter with the measurements in progress is shown in Figure 6.

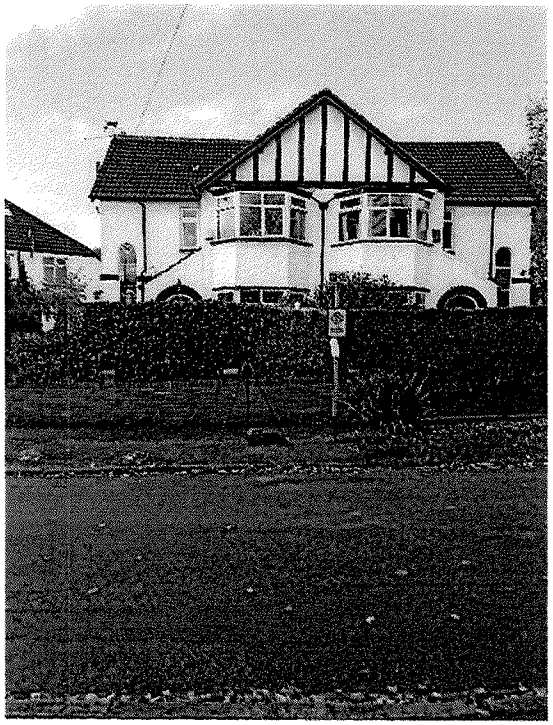

Figure 6: Measurements in progress at position 2

8.29 The measured noise levels are shown in Table 10, the greatest measured music noise levels (Bruno Mars) at position 2 exceed the proposed noise limits in both the overall noise level, and in the 125 Hz octave band.

Noise source	Gain setting	Limiter setting	A-weighted noise levels / dB(A)					
			Position 2			South Stand		
			$L_{Aeq,T}$	63 Hz	125 Hz	$L_{Aeq,T}$	63 Hz	125 Hz
Pink noise	0	On	68	34	55	96	95	49
Pink noise	0	Off	69	46	56	96	61	80
Pink noise	+ 7	Off	75	42	62	101	57	86
Elvis	0	On	70	35	56	96	49	79
INXS	0	On	64	44	54	90	59	77
Bruno Mars	+ 7	Off	73	49	63	99	60	87
Voice	-	-	68	30	49	94	43	71

Table 10: Measured noise levels at position 2

8.30 **Position 3 – St Michael's Lane**

8.31 A picture of the sound level meter with the measurements in progress is shown in Figure 7.

Figure 7: Measurements in progress at position 3

8.32 The measured noise levels are shown in Table 11, the greatest measured music noise levels (Bruno Mars) at position 3 exceed the proposed noise limits in both the overall noise level, and in the 125 Hz octave band for the proposed 'other dwellings' assessment criteria.

8.33 However, the greatest measured music noise levels fall within the 'negligible' and 'minor' impact when compared with the noise levels measured in 2016 and assessed following the IEMA guidance.

Noise source	Gain setting	Limiter setting	A-weighted noise levels / dB(A)					
			Position 3			South Stand		
			$L_{Aeq,T}$	63 Hz	125 Hz	$L_{Aeq,T}$	63 Hz	125 Hz
Pink noise	0	Off	80	40	64	96	49	80
Pink noise	+ 7	Off	86	47	70	101	55	86
Bruno Mars	0	Off	76	41	63	91	51	79
Voice	-	-	76	34	55	95	42	71

Table 11: Measured noise levels at position 3

8.34 **Position 4 – St Michael's Lane / Newport View**

8.35 The measured noise levels are shown in Table 12, the greatest measured music noise levels (Bruno Mars) at position 4 do not exceed the proposed noise limits.

8.36 It is noted that measurements made at position 4 were affected by noise from other sources such as local road traffic, hence the reported noise levels are not representative of the noise attributable to the PA only.

Noise source	Gain setting	Limiter setting	A-weighted noise levels / dB(A)					
			Position 4			South Stand		
			$L_{Aeq,T}$	63 Hz	125 Hz	$L_{Aeq,T}$	63 Hz	125 Hz
Pink noise	0	Off	64	50	53	96	49	80
Pink noise	+ 7	Off	69	50	60	101	55	86
Bruno Mars	0	Off	61	49	53	91	51	79
Voice	-	-	62	49	47	95	42	71

Table 12: Measured noise levels at position 4

8.37 **Position 5 - Greyshiels Avenue**

8.38 A picture of the sound level meter with the measurements in progress is shown in Figure 8.

Figure 8: Measurements in progress at position 5

8.39 The measured noise levels are shown in Table 13, the greatest measured music noise levels (Bruno Mars) at position 5 do not exceed the proposed noise limits.

8.40 It is noted that the measured noise levels at position 5 were significantly affected by noise from nearby construction activites, hence the reported noise levels are not representative of the noise attributable to the PA only.

Noise source	Gain setting	Limiter setting	A-weighted noise levels / dB(A)					
			Position 5			South Stand		
			$L_{Aeq,T}$	63 Hz	125 Hz	$L_{Aeq,T}$	63 Hz	125 Hz
Pink noise	0	Off	62	41	49	96	50	80
Pink noise	+ 7	Off	67	33	54	101	55	86
Bruno Mars	0	Off	60	33	48	91	54	79
Voice	-	-	61	37	41	93	50	72

Table 13: Measured noise levels at position 5

8.41 **Position 6 – 7 Broomfield Crescent**

8.42 Noise level measurements were made with the sound level meter located in the front garden of the property approximately 2 m from the façade. Therefore the measured levels are considered to be affected by reflections from the building and the free-field levels are likely to be between 1 dB – 2.5 dB lower.

8.43 A picture of the vibration meter with the measurements in progress is shown in Figure 9.

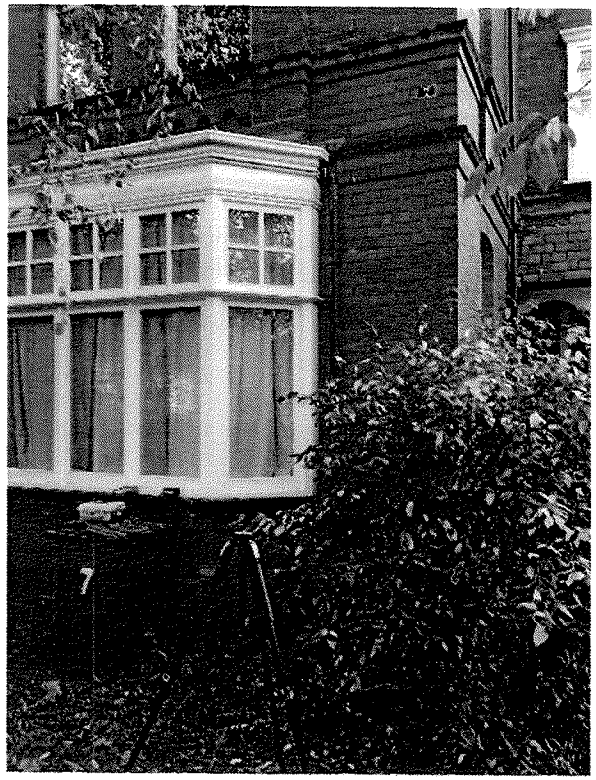

Figure 9: Vibration measurements in progress at position 6

8.44 As we did not have access to the inside of the property vibration measurements were made with the PPV and VDV sensors located on the external window ledge, on the northern façade of the building.

8.45 The measured noise levels are shown in Table 14, and the greatest measured music noise levels (Bruno Mars) at position 6 do not exceed the proposed noise limits.

Noise source	Gain setting	Limiter setting	A-weighted noise levels / dB(A)					
			Position 1			South Stand		
			$L_{Aeq,T}$	63 Hz	125 Hz	$L_{Aeq,T}$	63 Hz	125 Hz
Pink noise	0	Off	63	28	39	96	50	80
Pink noise	+ 7	Off	66	33	44	101	55	86
Bruno Mars	0	Off	61	33	43	91	54	79
Voice	-	-	62	27	34	93	50	72
Aircraft	-	-	70	-	-	-	-	-

Table 14: Measured noise levels at position 6

8.46 The results of the PPV vibration measurements are shown in Figure 10, the measured VDV is shown in Table 15.

8.47 The measured PPV is very low at all times and have been highlighted where there was sound from the PA.

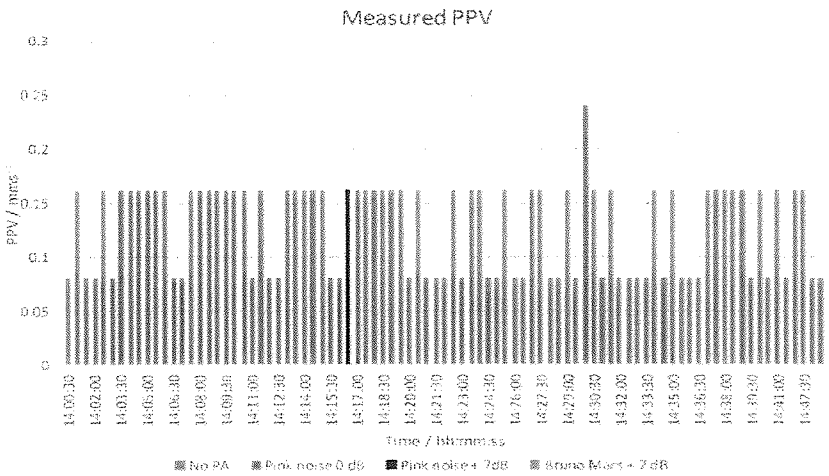

Figure 10: Measured PPV

Period	VDV / $m/s^{1.75}$ per axis		
	X	Y	Z
1 hour (measured)	0.014	0.016	0.015
16 hour (derived)	0.028	0.032	0.030

Table 15: Measured VDV and derived 16 hour VDV

8.48 The 16 hour VDV has been derived from the measured 1 hour VDV following the methodology given in BS 6742-1.

8.49 The greatest VDV_{16hour} falls within below the 'low probability of adverse comment' range according to BS 6472-1. This assessment is based on the assumption that the occurrences during the measurement period occur repeatedly for the full 16 hour daytime period.

9 Noise breakout from the Bar / Concourse

9.1 Background noise level measurements

9.2 The evening background noise levels were measured between 18:00 hours and 23:00 hours on Thursday 1st November 2018 at the positions indicated in Figure 11.

9.3 These positions were selected as being representative of the dwellings on St Michael's Lane and The Turnways.

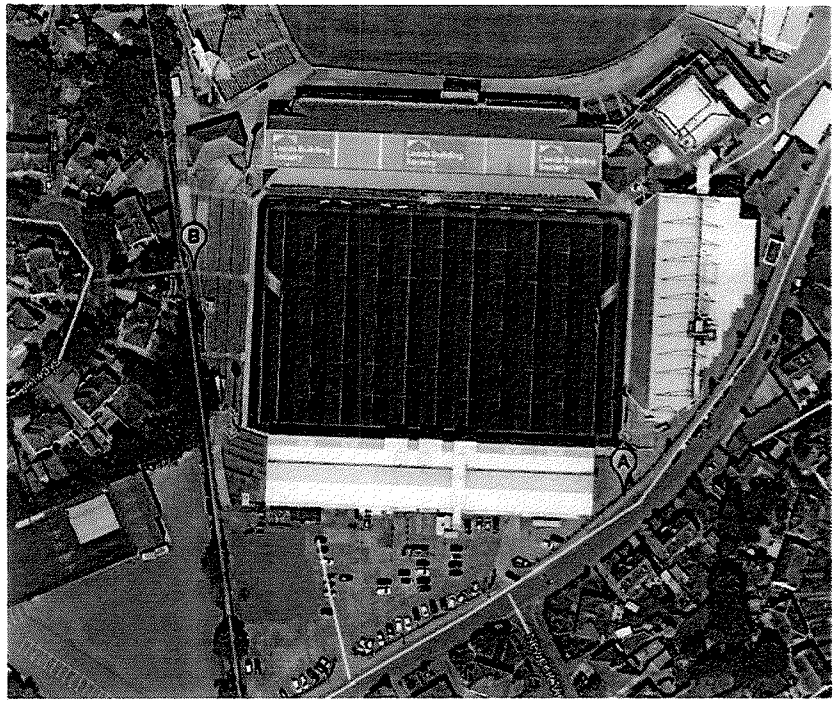

Figure 11: Evening background noise level measurement positions

9.4 The average of the measured 15 minute background sound levels are shown in Table 16.

Position	dB $L_{A90,T}$	Single-octave band centre frequency (Hz) A-weighted background noise levels dB $L_{A90,T}$						
		63	125	250	500	1k	2k	4k
A	42	24	33	34	34	37	30	22
B	42	19	27	32	35	38	31	22

Table 16: Average of evening measured background noise levels

9.5 Modelling

9.6 Based on observations made on site and architect's drawings of the new South Stand, it is considered that the significant noise break-out transmission paths are via the ventilation louvres and glazing to the southern façade, and via the entrances to the stand on the northern aspect.

9.7 An environmental noise model of the stands and surrounding area was made which includes area noise sources representative of these building elements.

9.8 A 3D view of the noise model is shown in Figure 12.

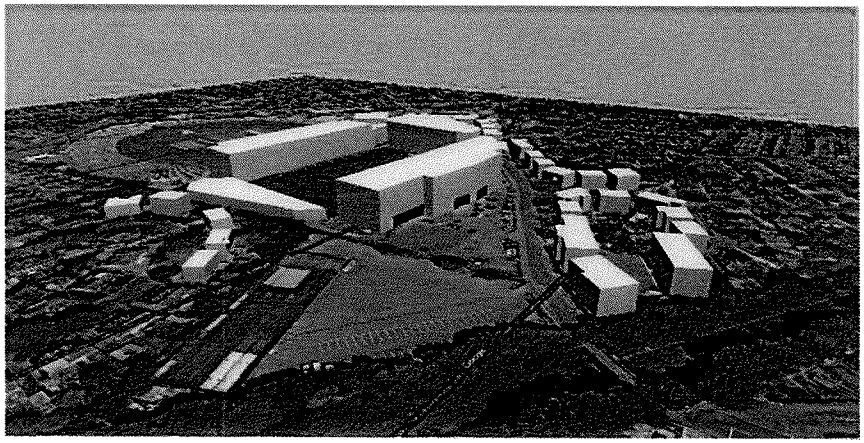

Figure 12: 3D view of noise model looking down St Michael's Lane from the west

9.9 Matchday impact

9.10 The noise level spectra measured in the South Stand from Bruno Mars music through the PA, with an overall level of 98 dB(A), is attributed to the internal Bar / Concourse space.

9.11 The level of 98 dB(A) is taken from one of the music noise level measurements made in the South Stand during the testing described in this report. It is considered unlikely this is the greatest music noise level that will be played in the Bar / Concourse area without complaints from both customers and staff.

9.12 Noise transmission and propagation is modelled to the nearby dwellings based on the noise source data detailed, using proprietary software CadnaA, Reference 8.

9.13 This models noise propagation outdoors according to ISO 9613, Reference 9.

9.14 The colour contours of music noise break-out from the Bar / Concourse are shown in Figure 13.

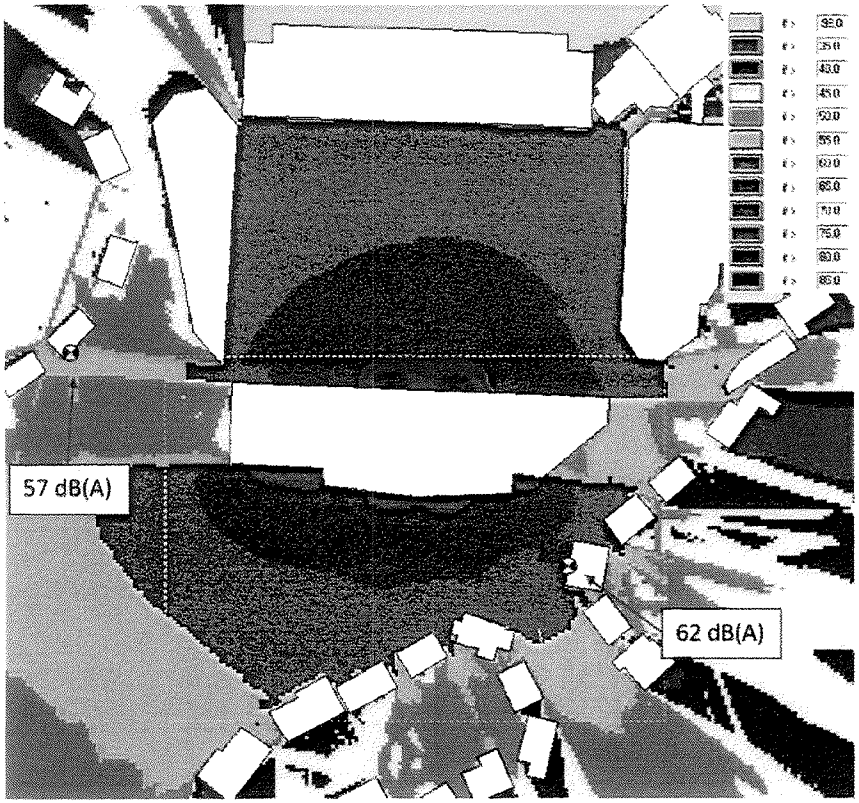

Figure 13: Calculated noise levels

9.15 The calculated music noise breakout meets the proposed matchday music noise and is typically less than that measured from the external PA system.

9.16 **Proposed evening limits**

9.17 Should the Bar / Concourse be used beyond matchdays, the internal noise level limits shown in Table 17 are calculated to meet the criteria proposed in para.s 7.11 - 7.13.

9.18 These noise levels are suitable for providing background music.

dB $L_{Aeq,15mins}$	Single-octave band centre frequency (Hz) A-weighted noise levels dB $L_{Aeq,15mins}$						
	63	125	250	500	1k	2k	4k
77	55	69	69	70	74	67	61

Table 17: Proposed Bar / Concourse music noise limits for non-match days

10 Discussion and potential mitigation measures

10.1 **PA noise levels**

10.2 It is understood that the output of each speaker array on the South Stand can be altered individually.

10.3 Where the Bruno Mars music was played with the gain set to 0 dB, it is possible to achieve a relatively high music noise level (e.g. ≈ 90 – 93 dB $L_{Aeq,15mins}$) in the South Stand with acceptable levels at most of the surrounding dwellings.

10.4 The proposed music noise level criteria was exceeded at Position2 – The Turnways.

10.5 This was where the PA gain was set to + 7dB for the Bruno Mars music used. When the gain is set to 0 dB it is expected that the levels at this location would not be exceeded.

10.6 It is noted that the music noise levels to the rear of the dwellings at the eastern end of The Turnways may be greater than those measured at Position2.

10.7 Hence, the loudspeaker array at the western end of the South Stand which is directed at the West Stand should be reduced in output by 5 dB to mitigate the impact on the closest dwellings.

10.8 The greatest music noise levels were measured at Position 3 – St Michael's Lane.

10.9 Although these levels meet the proposed criteria based on the IEMA guidance, the proposed noise level limit criteria for all other dwellings were exceeded.

10.10 At Position 3 – St Michael's Lane, there is direct line of site to the loudspeaker array at the eastern end of the stand.

10.11 The output of this array should be reduced by 4 dB in comparison with the rest of the system, it is expected that the music levels at this position will meet the criteria proposed for all dwellings.

10.12 **PA vibration**

10.13 It is considered that based on the music played through the PA with a gain setting of 0 dB, achieving levels of ≈ 90 dB(A) in the stand, that there is no adverse vibration effect at nearby residences. Hence, no further mitigation is suggested.

11 Conclusion

11.1 Based on the measurements of noise emission from the PA system both with the new South Stand and at nearby dwellings, and the defined mitigation measures, it is determined that suitable music noise levels can be achieved within the South Stand whilst meeting the proposed noise level limits at the nearby residences.

11.2 The mitigation requires:

- music is played through the PA at a 0 dB gain setting, to achieve a level of 90 – 93 dB $L_{Aeq,15mins}$ in the South Stand
- the output of the loudspeaker at the eastern end of the South Stand (affecting St Michael's Lane) hung from the roof is reduced by 4 dB for music
- the output of the loudspeaker at the western end of the South Stand (affecting The Turnways) hung from the roof is reduced by 5 dB for music

11.3 Music noise break-out from the Bar / Concourse is calculated to be below the proposed matchday noise limits with a high music noise level within this space.

11.4 Internal music noise levels are derived which are calculated to meet the proposed limits at other times, and are capable of providing background music noise levels within the Bar / Concourse space.

11.5 Based on the vibration measurements undertaken, where music is played through the PA at the levels stipulated above, there will be no adverse or perceptible vibration within dwellings.

12 References

1 BS 4142: 2014, Method for rating and assessing industrial and commercial sound.

2 The Noise Council, Code of Practice on Environmental Noise Control at Concerts, 1995

3 Guidelines for Environmental noise impact assessment, Institute of Environmental Management & Assessment, V 1.2, November 2014.

4 Design Manual for Roads and Bridges, Volume 11, Section 3 Noise and Vibration, The Highways Agency, 2011

5 BS 6472-1:2008 Guide to evaluation of human exposure to vibration in buildings Part 1: Vibration sources other than blasting.

6 BS 7385-1:1993, Evaluation and measurement in buildings – Part 1: Guide for measurement of vibrations and evaluation of their effects on buildings.

7 Lichfield District Council Environmental Health technical Planning Policy: Noise & Vibration, v2, November 2013.

8 CadnaA environmental noise modelling software, version 2018, Datakustik GmbH.

9 ISO 9613: Acoustics - Attenuation of sound during propagation outdoors.

13 Appendix 1: 2016 noise level measurements

Position	Note	dB(A)	Single-octave band centre frequency (Hz) A-weighted noise levels (dB)						
			63	125	250	500	1k	2k	4k
3 – St Michael's Lane	Crowd noise – during match	73	38	51	56	66	71	67	58
	PA – during match	75	47	58	68	71	69	65	59
	PA – post-match music	71	49	58	61	65	66	64	57