RUGBY FOOTBALL UNION

Planning Noise Report

Twickenham Stadium – East Stand Extension

June 2016

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EXECUTIVE SUMMARY

Vanguardia have carried out a noise impact assessment for the development of the Twickenham East Stand.

Due to the stadium capacity remaining unchanged and the beneficial acoustic measures that are being introduced (such as a sealed façade and relocation of off-site hospitality), it is anticipated that the development will have a negligible acoustic impact.

Noise limits have been provided for all items of plant to achieve the agreed plant noise emission limits at the nearest noise sensitive receptors. It is anticipated that the noise limits can be achieved with modest noise control measures.

1. INTRODUCTION

1.1. It is proposed to extend the East Stand at Twickenham Stadium to provide additional internal space for hospitality purposes.

1.2. In order to supplement the planning application, a noise survey has been undertaken to determine the current noise environment around the Stadium and to provide benchmark criteria for the development.

1.3. A combination of attended and long-term unattended measurements have been made on match and non-match days. An assessment of the noise impact has been undertaken.

1.4. This report provides a noise assessment of Stadium related noise emissions suitable for planning.

2. SITE DESCRIPTION

SITE LOCATION

2.1. Twickenham Stadium is located in the London Borough of Richmond upon Thames.

2.2. The stadium is bordered by Whitton Road to the south and Rugby Road to the east. The A316 is located approximately 150m to the south of the stadium.

2.3. The area is a mixture of residential and commercial properties. There are residential dwellings located in close proximity (<60m) to the south, south-east and north-east of the stadium. There are more distant dwellings located approximately 150m to the north of the stadium on the roads off Whitton Dene. There are also properties approximately 200m to the west of the stadium on Duke of Cambridge Close. Chase Bridge Primary School is located approximately 120m to the west of the stadium. There are some commercial units located to the east of the stadium. There is a major sewage works approximately 300m to the north of the stadium.

Figure 1 Birds-eye view of the stadium and its surroundings

NOISE ENVIRONMENT (NON-MATCH DAYS)

2.4. The general noise environment in the area around the stadium on non-match days is affected by traffic on local roads as well as plant and operational activities from the Stadium and nearby commercial units. For the properties facing Rugby Road and Whitton Road, road traffic is the dominant noise source.

2.5. The area is also significantly affected by aircraft movements from Heathrow Airport. Noise contours produced for Heathrow Airport indicate that the stadium is just outside of the 57dBA $L_{eq,16h}$ contour.

NOISE ENVIRONMENT (MATCH DAYS)

2.6. In addition to the above, the general noise environment in the area around the stadium on match days is affected by the following activities related to match-day operations:

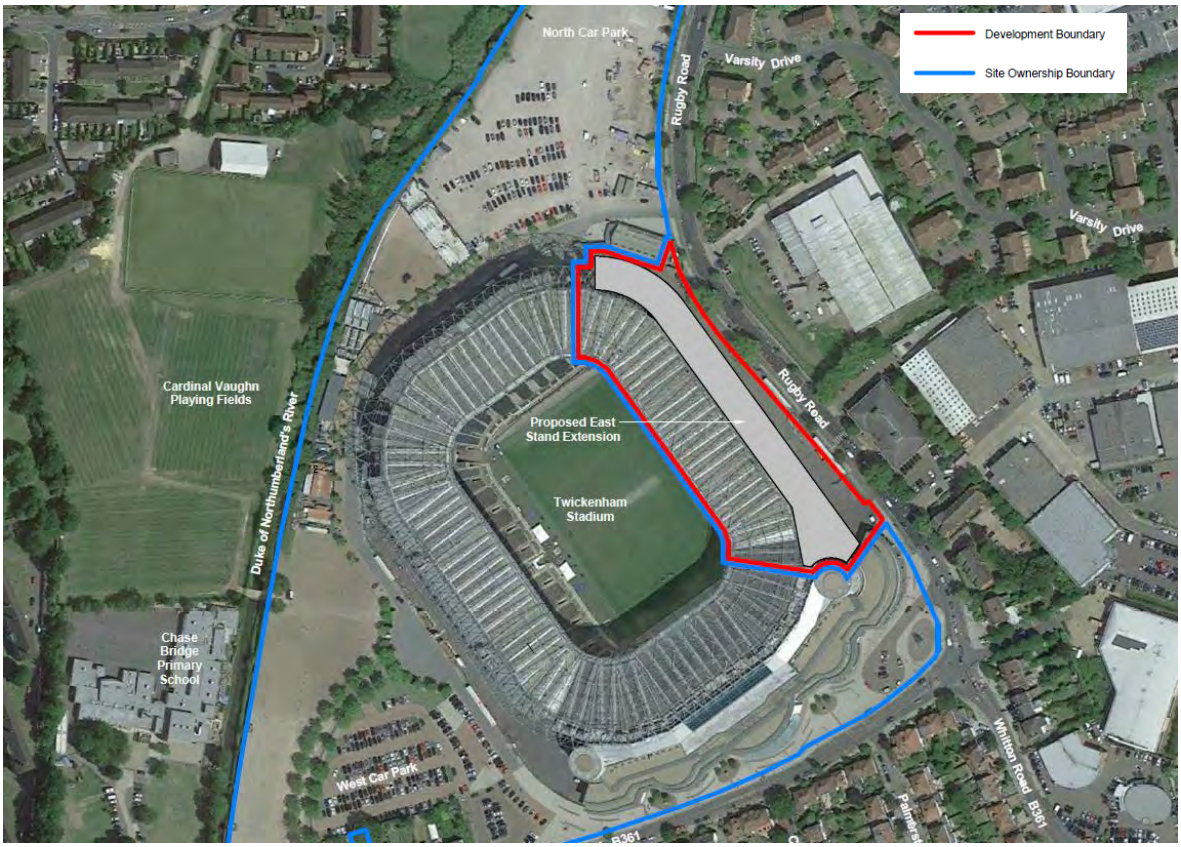
- People accessing and leaving the stadium by foot.
- People accessing and leaving the stadium by car.
- Noise breakout from activities within the stadium, including crowd noise, announcements and amplified music.
- On-site and off-site hospitality in the form of marquees, which provide pre-match and post-match catering services.
- Mobilisation of on-site and off-site temporary hospitality facilities in run up to and following matches (up to one week either side of match).

PROPOSALS

2.7. It is proposed to extend the East Stand of Twickenham Stadium to allow for additional internal space for hospitality. There are no proposals to increase the capacity of the stadium. One of the main aspirations of the development is to relocate some of the offsite temporary hospitality areas to locations within the stadium to improve the match day experience as well as protect the amenity of the local residents in the areas currently affected by off-site hospitality.

2.8. The outline of the East Stand development is shown in the following figure.

Figure 2 Indication of the extent of East Stand development.



2.9. The development will provide six levels of accommodation along the east boundary of the stadium. There will also be works carried out to some of the existing internal areas, such as the St George's Suite. The museum is to be relocated to another area of the stadium. The ground floor promenade along the eastern side of the stadium will be covered beneath the new accommodation.

2.10. The planned east stand will include a mix of the following types of accommodation:

- Internal GA, Hospitality, Restaurant, Concourse
- External Concourse
- Bars, Kitchens, WCs
- Two existing lift cores operating to all levels. One additional lift core operating from Level 01 to Level 03, 04, 04a. Two existing escalators operating from Level 02 to Level 04.
- The majority of existing plant will be retained where possible. There will be two new external plant zones at Level 05. AHU plant will also be ducted to the façade.

2.11. The following figures show the general arrangement of the development in elevation and a cross-section of the new proposals.

Figure 3 General arrangement of proposed development, Level 03 to Level 05a

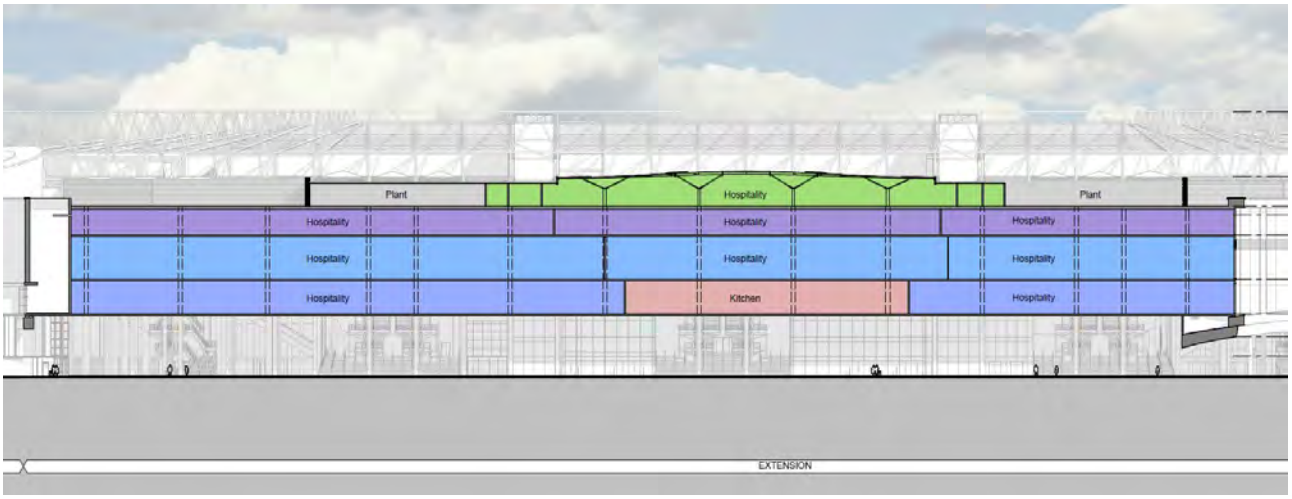


Figure 4 Cross-section through East Stand (Existing)

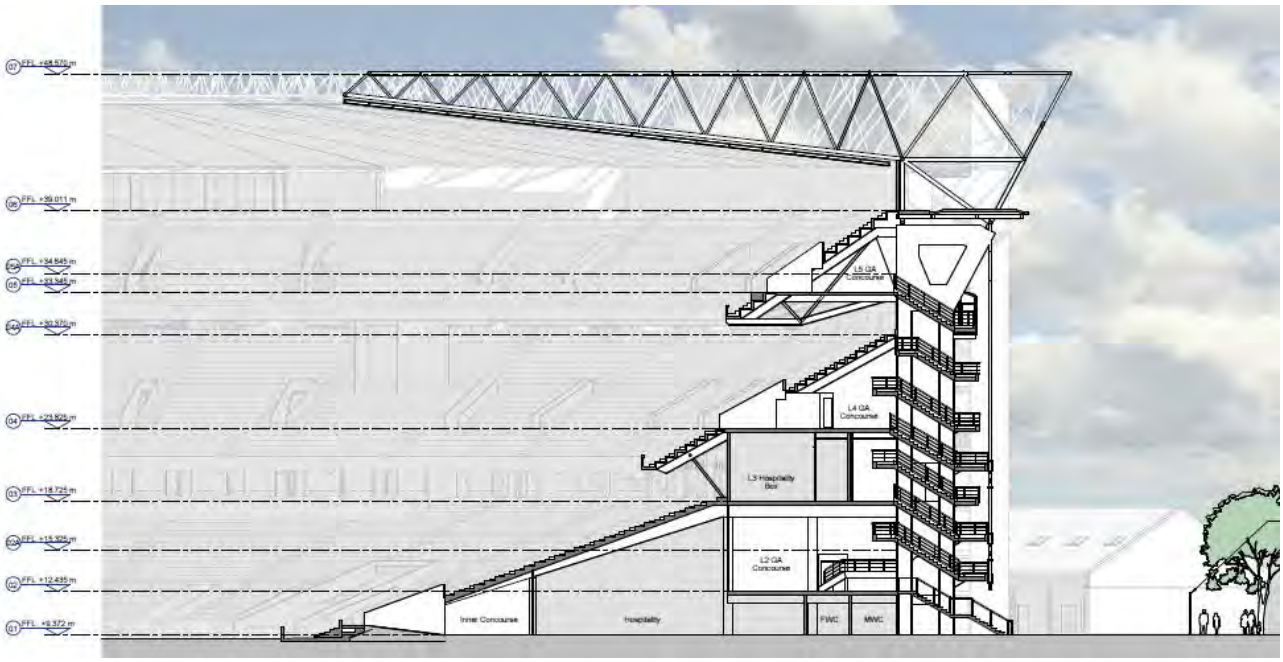
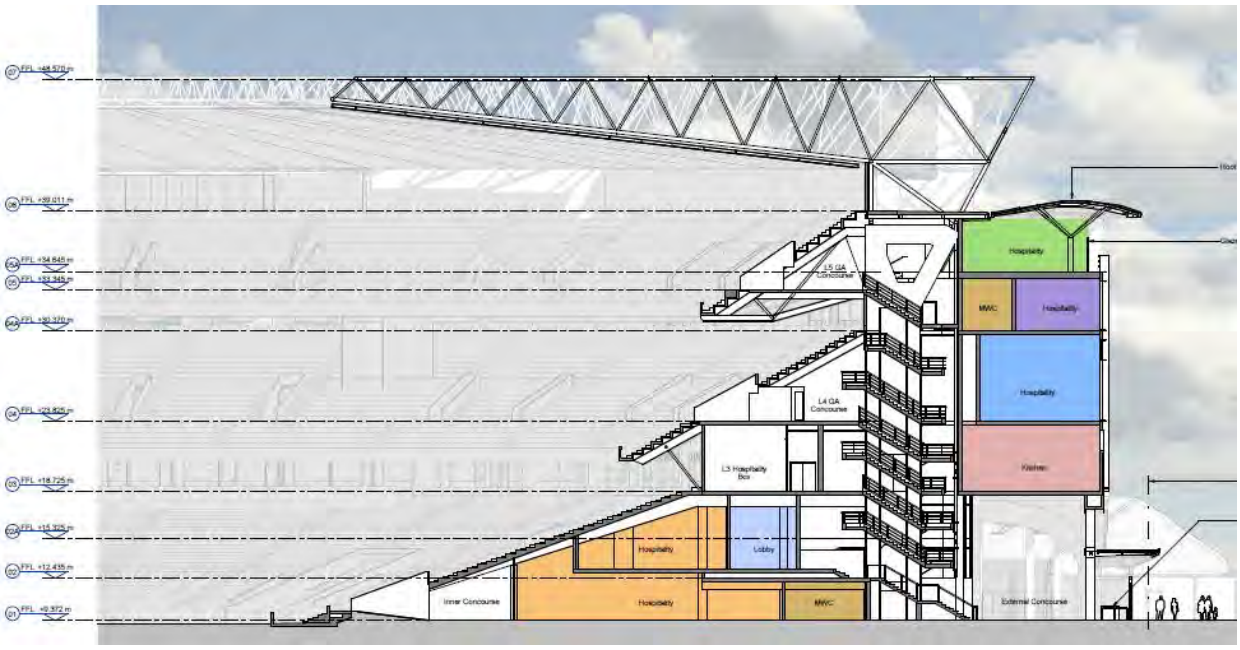


Figure 5 Cross-section through East Stand (Proposed)



3. PLANNING GUIDANCE

LOCAL PLANNING POLICY

3.1. The stadium falls within the London Borough of Richmond upon Thames (LBRuT). It is therefore assumed that the planning policies of London Borough of Richmond upon Thames are valid for all aspects of the planning assessment.

3.2. Some of the nearby properties fall within the London Borough of Hounslow. It is the responsibility of London Borough of Richmond upon Thames to make suitable agreements with neighbouring boroughs if necessary.

3.3. The London Borough of Richmond Core Strategy (adopted April 2009) sets out the strategic policies of the local plan. The Local Development Framework Development Management Plan (adopted November 2011) provides policies of a more detailed level.

NATIONAL PLANNING POLICY

3.4. In addition to the local planning policies, it is also necessary to include reference the current national planning policy. The following documents have therefore been considered:

- National Planning Policy Framework (NPPF) 2012
- Noise Policy Statement for England (NPSE) 2010
- National Planning Practice Guidance (NPPG) 2014
- London Plan 2016

3.5. Please refer to Appendix A for more information on National Planning Policy.

BRITISH STANDARDS AND GUIDANCE DOCUMENTS

3.6. In order to carry out the noise assessment, reference has been made to the following British Standards and guidance documents:

- BS 4142:2014 Method for rating and assessing industrial and commercial sound
- BS 8233:2014 Guidance on sound insulation and noise reduction for buildings
- World Health Organisation (WHO) Guidelines for Community Noise
- ISO 9613 Acoustics: Attenuation of Sound During Propagation Outdoors.
    - Part 1 (1993): Calculation of the absorption of sound by the atmosphere

- Part 2 (1996): General Method of Calculation

- BS EN 12354 – Building Acoustics: Estimation of acoustic performance of buildings from the performance of elements.
  - Part 4 (2000): Transmission of indoor sound to the outside
- BS 7445: Description and measurement of environmental noise
  - Part 1 (2003): Guide to quantities and procedures
- Design Manual for Roads and Bridges (DMRB)
- Defra – NN14-05: Evidence and Usage of LOAEL, SOAEL etc.

4. NOISE ASSESSMENT CRITERIA

4.1. Discussions have been undertaken with Christopher Hurst of LBRuT Environmental Health to agree suitable noise assessment criteria, given the context. It was agreed that the following assessment criteria be applied.

NOISE IMPACT ASSESSMENT

4.2. The noise impact of the development is based on the change in noise level when compared to the prevailing ambient noise level. The following table presents the proposed impact criteria, based on the guidance listed in Chapter 3.

4.3. The short term impact classification considers the impact when the facility has just opened (first year of operation). The long-term impact classification is based on the impact in the future.

Table 1 Noise Impact Assessment Criteria

Sound Level Change (dB)	Short Term Impact Classification	Long Term Impact Classification
0.0-0.9	Negligible	Negligible
1.0-2.9	Minor	Negligible
3.0-4.9	Moderate	Minor
5.0-9.9	Major	Moderate
≥10	Major	Major

4.4. It should be noted that future match days should be compared with current match days. Future non-match days should be compared with current non-match days.

4.5. For locations affected by off-site hospitality, a subjective assessment is undertaken.

PLANT NOISE ASSESSMENT

4.6. For new mechanical services equipment associated with the development, it will be necessary to control noise emissions to protect the amenity of nearby noise sensitive properties. Guidance is sought from BS 4142:2014, which is the most relevant and up to date British Standard for assessing industrial noise sources, as well as local planning policy.

4.7. The following plant noise criteria have been agreed with LBRuT for new plant items. These noise limits also take account of BREEAM requirements under the credit Pol 05.

Table 2 Plant noise criteria (for new plant items)

Period	Assessment duration	Match-day only plant	Regularly operating plant
Day	1h	Rating level of 5dB above background	Rating level of 5dB below background
Night	15min	Rating level of 3dB above background	Rating level of 5dB below background

4.8. The cumulative noise level of all new items of mechanical plant is assessed at the nearest noise sensitive receptors during a specific period. A penalty for impulsive or tonal characteristics can be added to give the rating level in line with BS 4142:2014. The rating level is then compared against the typical background noise level for the period to assess the impact using the criteria in Table 2 .

4.9. For existing mechanical service plant that is to be retained, there are no planning noise requirements to satisfy as part of this proposal.

5. BASELINE NOISE SURVEY

SURVEY METHODOLOGY AND INSTRUMENTATION

5.1. To quantify the existing noise environment in the area around the East Stand, a long term noise survey was carried out at the stadium between Thursday 17th and Monday 21st March 2016. This period did not include a match day and was intended to capture the baseline conditions.

5.2. In addition, some attended noise measurements were also made at a number of locations representative of the nearest residential dwellings on Monday 21st March.

5.3. The measurements were made at the following locations as agreed with LBRuT. These are described in the following table.

Figure 6 Baseline noise survey locations

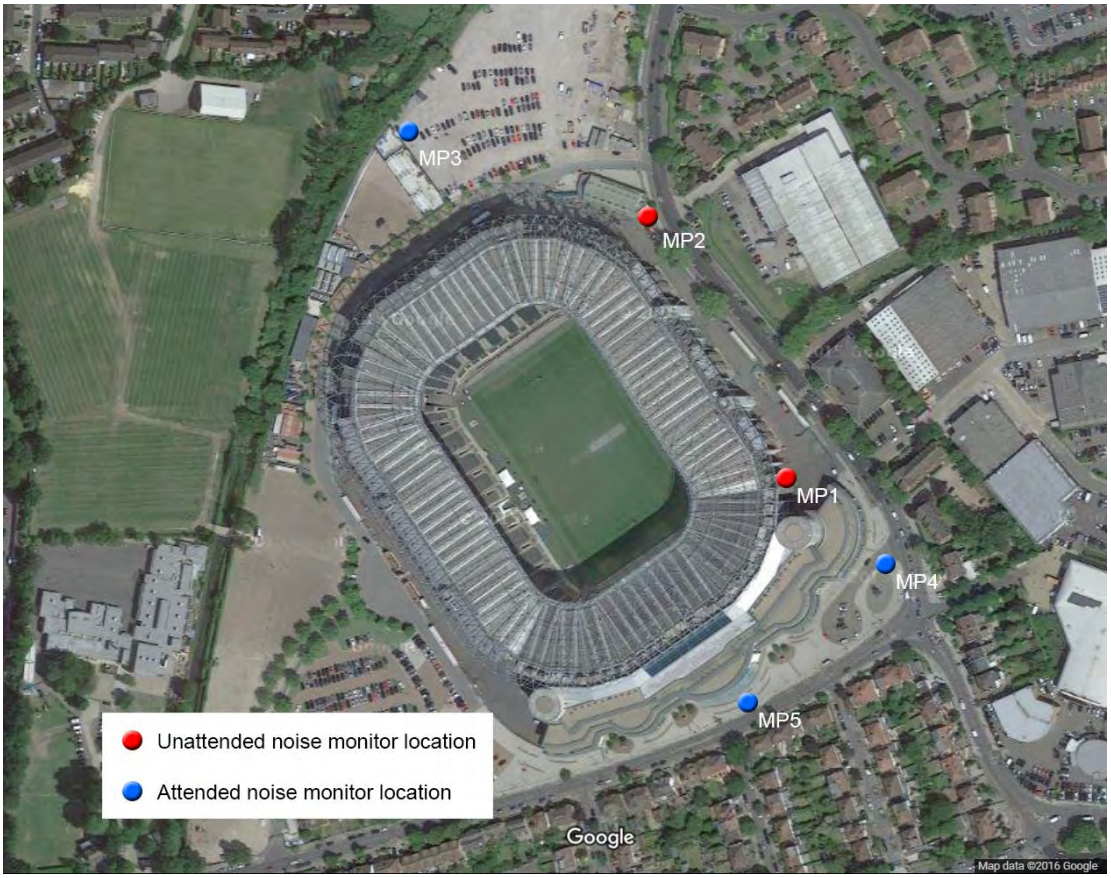


Table 3 Measurement locations for baseline noise survey

Location	Description
MP1	Fixed location at the south end of the East Stand, approximately 15m above ground overlooking Rugby Road. 40m from edge of Rugby Road.
MP2	Fixed location within a small service yard, approximately 4m above ground overlooking Rugby Road. 7m from edge of Rugby Road. No plant operating within service yard.
MP3	Attended location in west corner of car park to the north of the stadium. Approximately 130m from Rugby Road and 75m from stadium. Representative of well-screened gardens.
MP4	Attended location opposite houses on Rugby Road to south-east of stadium, 8m from road edge.
MP5	Attended location opposite houses on Whitton Road to south of stadium, 5m from road edge.

5.4. Noise measurements were made with the following equipment.

Table 4 Measurement equipment used for the survey

Item	Manufacturer/Model	Serial Number
Sound Level Meter	Larson Davis 831	4096
Sound Level Meter	Larson Davis 831	4097
Sound Level Meter	Brüel & Kjær 2250	2611539
Weatherproof windshield	Larson Davis 426A12 (x2)	-

5.5. The microphones for the unattended sound level meters were fitted with weatherproof windshields. Measurements were made of the A-weighted and octave band L_{eq}, L_{max} and L_{90} at consecutive 15 minute periods for the duration of the survey.

5.6. All equipment used for the survey was within calibration and was calibrated on site before and after the survey with no notable drift observed.

5.7. The weather for the duration of the survey was generally cloudy, dry and mild. Publicly available weather data indicates that there was minimal rain for the duration of the survey. Publicly available weather data also indicates that wind speeds were predominantly below 5m/s for the duration of the survey. It is not considered that the weather has had an adverse impact on the survey measurements.

5.8. Wind directions dictate the direction of flight operations at Heathrow Airport. For 17th, 18th, 19th and 20th March 2016, Heathrow was on easterly operations (aircraft departing towards the east, approaching from the west). For 21st March 2016, Heathrow was on westerly operations (aircraft departing towards the west, approaching from the east).

SURVEY RESULTS

5.9. The results of the two long term noise monitors are summarised in the following table. Time histories are also presented in the following figures. The noise monitor at location MP1 did not operate for the full duration of the survey, however sufficient data was gathered, including a full day and night period.

Table 5 Summary of unattended noise measurements at locations MP1 and MP2

Location	Date	Time	Period[1]	Ambient $L_{Aeq,T}$[3]	Ambient $L_{Aeq,15min}$[4]	Maxima L_{AFmax}[5]	Background L_{AF90}[6]
MP1	Thu 17/03/2016	1445-2300	Day[2]	62	57-67	67-91	52-59 (58)
	Thu 17/03/2016	2300-0700	Night	57	51-63	64-81	50-56 (50)
	Fri 18/03/2016	0700-2300	Day	63	58-67	68-90	52-60 (59)
MP2	Thu 17/03/2016	1600-2300	Day[2]	67	62-72	75-97	51-61 (60)
	Thu 17/03/2016	2300-0700	Night	60	52-67	65-85	50-55 (50)
	Fri 18/03/2016	0700-2300	Day	68	62-70	74-96	52-62 (60)
	Fri 18/03/2016	2300-0700	Night	59	54-62	71-81	50-52 (51)
	Sat 19/03/2016	0700-2300	Day	67	62-72	74-95	52-62 (59)
	Sat 19/03/2016	2300-0700	Night	59	53-65	69-91	50-52 (51)
	Sun 20/03/2016	0700-2300	Day	66	60-70	72-96	50-62 (52)
	Sun 20/03/2016	2300-0700	Night	60	51-67	67-83	49-56 (50)
	Mon 21/03/2016	0700-1500	Day[2]	67	64-69	76-92	57-62 (59)

(1) Period represent 16-hour day running from 2300-0700 and 8-hour night running from 2300-0700.
(2) Incomplete day. Please refer to time range.
(3) Ambient noise level over whole 16-hour day or 8-hour night period.
(4) Range represents highest and lowest recorded $L_{Aeq,15min}$ in the period.
(5) Range represents the highest and lowest recorded L_{AFmax} (15min) in the period.
(6) Range represents the highest and lowest recorded $L_{A90,15min}$ in the period. Number in brackets represents the most commonly occurring $L_{A90,15min}$ in the period.

Figure 7 Graphical time-history of results at MP1

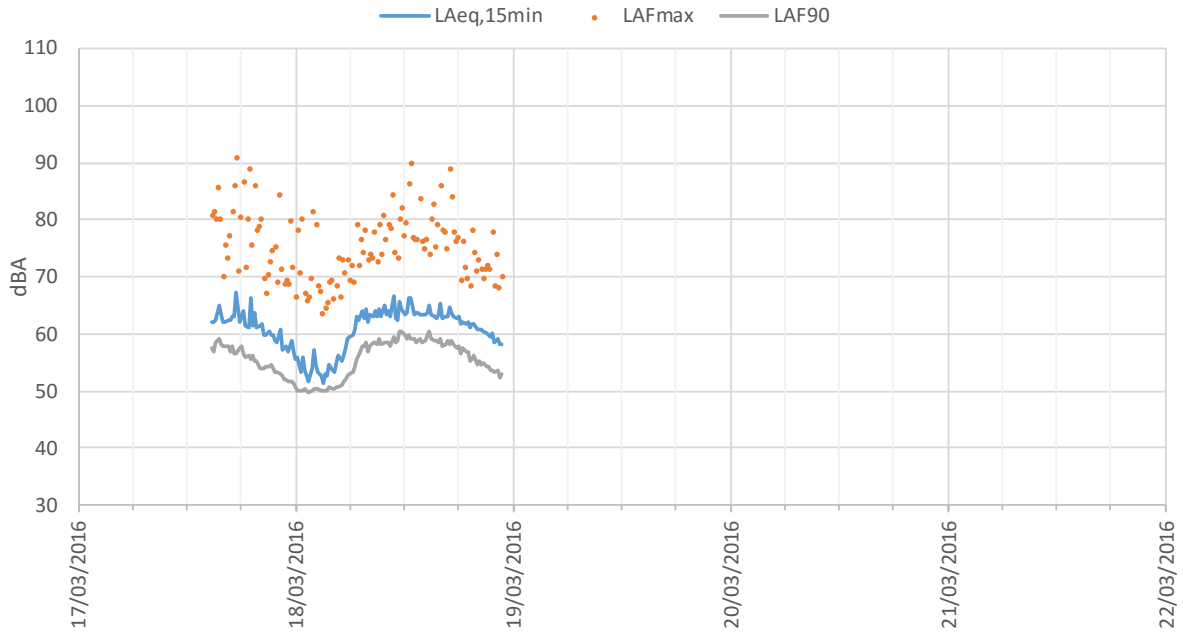
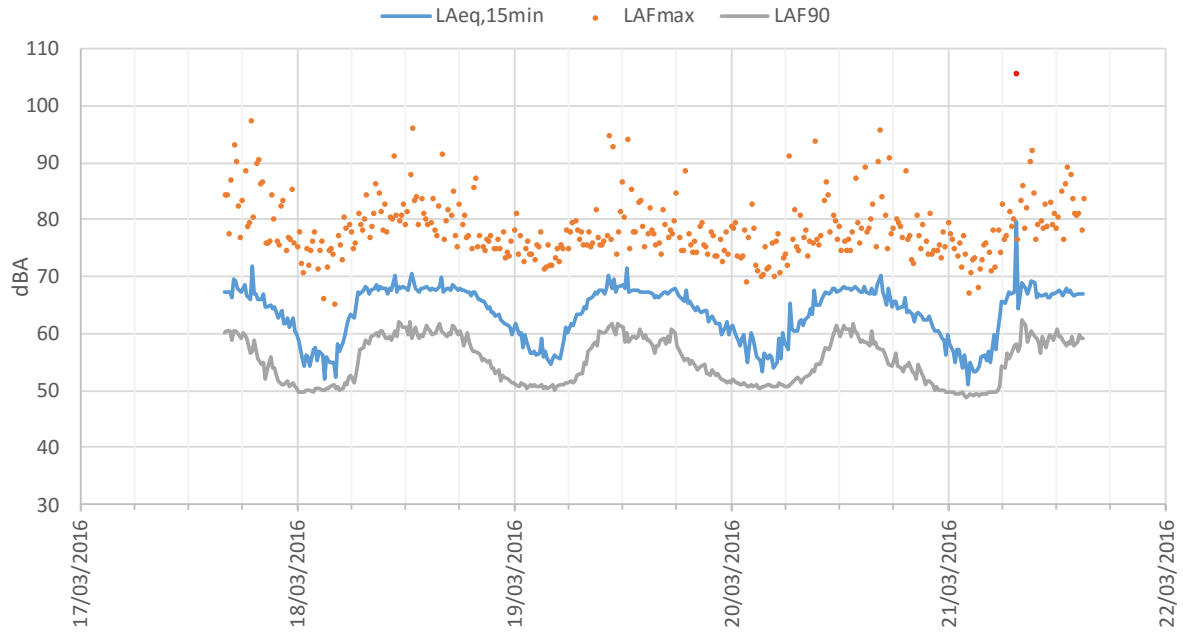


Figure 8 Graphical time-history of results at MP2



5.10. In summary the noise environment profile at the two locations is comparable, with noise levels generally slightly higher at MP2, due to the closer proximity to Rugby Road.

5.11. At MP1, measured ambient noise levels were 63 dB LAeq,16h during the day and 57 dB LAeq,8h at night. At MP2, measured ambient noise levels were 66-68 dB LAeq,16h during the day and 59-60 dB LAeq,8h at night.

5.12. Background noise levels at both locations were comparable. Typical background noise levels measured during the day were 58-60 dB $L_{A90,15min}$ from Monday to Saturday and 52 dB $L_{A90,15min}$ on Sunday. Typical background noise levels measured at night were 50-51dB $L_{A90,15min}$. The lowest background noise level recorded was 49 dB $L_{A90,15min}$ on Sunday night at 02:15 at MP2.

5.13. The attended noise results are summarised in the following table.

Table 6 Summary of attended noise measurements at locations MP3, MP4, MP5

Location	Date	Time	Duration	$L_{Aeq,15min}$	L_{AFmax}	$L_{AF90,15min}$	Notes
MP3	Mon 21/03/2016	13:38	15min	52	63	48	Location in corner of carpark approximately 130m from Rugby Road and 75m from stadium. No activity within carpark. Planes to the north approaching Heathrow (55-61). Traffic from Rugby Road audible but not dominant.
MP4	Mon 21/03/2016	14:00	15min	65	79	58	Location opposite houses on Rugby Road to south-east of stadium, approximately 8m from road edge. Regular traffic on Rugby Road with buses and lorries. Traffic dominant.
MP5	Mon 21/03/2016	14:17	15min	67	75	56	Location opposite houses on Whitton Road to south of stadium, approximately 5m from road edge. Regular traffic on Whitton Road with buses. Traffic dominant.

6. MATCH-DAY SURVEY

SURVEY METHODOLOGY

6.1. To quantify the impact of some of the current off-site hospitality in the areas around the stadium, subjective observations and measurements were made around the stadium at a number of temporary marquees used for pre-match hospitality. The dates of the measurements coincided with two RBS 6-Nations matches as follows:

- Saturday 27th February 2016: England v Ireland (K.O. 1650)
- Saturday 12th March 2016: England v Wales (K.O. 1600)

6.2. The locations of the off-site hospitality (A-E) are displayed on the figure below.

Figure 9 Locations of the off-site hospitality

SUBJECTIVE OBSERVATIONS

- The marquee facilities were generally of fabric construction, with glazed frontages. The general construction does not provide a significant level of sound insulation from internal activities.
- Activities within the marquees are generally people conversing while eating lunch. Occasional speeches are made at certain times during the build up to the match. No music of notable level is played within the marquees. Screens may play some rugby highlights; however, the sound is generally not at a high level.
- HVAC plant operates continuously outside the marquees. Several items of plant were measured to be 75 dBA at 5m. It is understood that this plant generally operates on the whole day and night before matches, as well as on the day of the match itself.
- It is understood that the set-up and dismantling of the marquees can take a number of days. There will be impulsive noise associated with the construction and dismantling of the metal frame, as well as noise from any temporary plant or tools.
- At location A, the nearest houses are predominantly affected by noise from road traffic and passers-by. The impact from noise from the marquee is considered to be negligible.
- At location B, which is within the front grounds of Chase Bridge Primary School, the marquees are in close proximity to the boundary of the properties on Duke of Cambridge Close. HVAC plant associated with marquees operates in close proximity to boundary.
- At location C are the Orchard Suite and Triple Crown Suite. These are located in close proximity (around 15m) from the houses on Varsity Drive. Activity within the marquees is clearly audible at the nearest residences. Noise level of 67 dBA were measured at the nearest residential property, however this will include other activities around the ground not associated with the marquees.
- The marquee at Location D is located on the grounds of Harlequin RFC, which is in close proximity to the A316 (around 15m), which carries high volumes of road traffic. Noise levels of 72 dBA were measured at a location representative of the nearest houses in the absence of noise from the marquee.
- At location E, the marquee is located behind All Hallows Church, adjacent to a nursery school. On match days, noise emissions from the hospitality facility included noise from HVAC plant, which was located within 7m of the nearest houses, as well as voices from inside the marquee. Measurements made of the HVAC plant were 65 dBA at the nearest residents, compared to a level of 57 dBA

at a location not affected by the plant. This plant also operates at night the evening before the match. It is considered that this would have an adverse impact on the nearest residences. Noise associated with the setting up and dismantling of the marquee during weekdays may also an adverse impact on the operation of the nursery school.

7. NOISE IMPACT ASSESSMENT

OVERVIEW

7.1. In order to assess the impact of noise from the new East Stand development, guidance has been sought from the documents listed in Chapter 3 as well as discussions with LBRuT environmental health. The noise impact criteria are provided in Chapter 4.

7.2. The following noise sensitive receptors (NSRs) will be most affected by the East Stand development.

Figure 10 Assessment positions

7.3. A description of the assessment positions is provided in the following table.

Table 7 Noise Impact Assessment Positions

Location	Description	Noise Impact Source
AP1	Properties on Varsity Drive. Approximately 60m from current East Stand.	East Stand. Off-site hospitality at location C
AP2	Properties on Butterfield Close. Approximately 65m from current East Stand.	East Stand
AP3	Properties on Corner of Warren Road and Kneller Road.	Off-site hospitality at location A
AP4	Properties on Duke of Cambridge Close	Off-site hospitality at location B
AP5	Properties on Chertsey Road	Off-site hospitality at location D
AP6	Properties on Fulwood Gardens	Off-site hospitality at location E

7.4. The main noise sources that may potentially change with the extension of the East Stand on a match day are listed as follows:

- Traffic noise
- Patron noise (from external/public areas)
- Breakout noise (from stadium bowl)
- Breakout noise (from internal areas)
- Off-site hospitality
- Mechanical services noise (see following chapter)

7.5. For each of these noise sources, a match-day and a non-match day scenario need to be considered. The key features of these scenarios are:

- Match-day operations assume 100% occupancy on a typical match-day (e.g. a six nations match)
- Non-match day operations assume no match at the stadium, with a hospitality event of 300 delegates taking place in the East Stand. This is the maximum expected attendance for a non-match hospitality event. In general, events are likely to be much smaller. The South Stand currently accommodates non-match day hospitality events of up to 900 delegates.

TRAFFIC NOISE ASSESSMENT

7.6. The stadium capacity will not increase as part of the development. On match-days, it is expected that there will be no notable increase in road traffic due to patrons attending the stadium. There are no proposals to introduce additional parking spaces. It is therefore considered that the change in road traffic noise will be **negligible** when compared to current match-day conditions.

7.7. On non-match days the current stadium is used for hospitality events of up to 900 delegates. As a worst case, the East Stand may provide an additional 300 delegates capacity, giving an overall capacity of up to 1200 delegates for the venue, although it is unlikely that over 900 delegates will be accommodated regularly. For over 90% of event days, the number of delegates will be under 300 over the both stands, which is comparable to current conditions. Typically, there will not be any increase in the number of attendees or vehicle movements at hospitality events. A **negligible** acoustic impact is expected.

7.8. There is expected to be a slight increase in traffic from servicing vehicles serving the new hospitality areas on match-days and non-match days, however it is expected that many deliveries will be shared with other stands, resulting in only a small number of additional movements during daytime hours. This is expected to have a negligible acoustic impact.

PATRON NOISE (FROM EXTERNAL/PUBLIC AREAS)

7.9. The stadium capacity will not increase as part of the development. On match-days, it is expected that there will be a comparable number of people attending the stadium compared to current match days. It is therefore expected that the noise level from people travelling to the stadium by foot will be commensurate with a current match day. A **negligible** impact is predicted when compared to the current match day conditions.

BREAKOUT (FROM STADIUM BOWL)

7.10. The stadium capacity will not increase as part of the development and the roof profile will not change. As the stadium is extending only on the non-pitch side of the stand and will be fully enclosed, noise breakout from the bowl through the current vomitories will be better contained resulting in a beneficial improvement in sound containment within the stadium bowl. A **negligible** impact is predicted when compared to current match day conditions.

BREAKOUT FROM INTERNAL AREAS

7.11. The current concourse levels and stairwells on all levels of the East Stand are currently open in design, with little in the way of screening. The proposals are for levels L03, L03a and L04 to be within a sealed glazed façade. In addition, the external Level L05 will benefit from screening. Level L01 and L02 will be contained within a covered concourse area.

7.12. It is assumed that the internal hospitality zones operate at the following internal noise levels, with no significant amplified music. These noise levels are considered high for the intended use and so include an element of headroom.

- 85 dBA within internal hospitality zones on L01, L02, L03, L04 and L04a.
- 75 dBA with the L05 Club Hospitality partially covered terrace.

7.13. The following section shows the sound insulation measures incorporated into the new scheme.

Figure 11 Proposed façade of East Stand

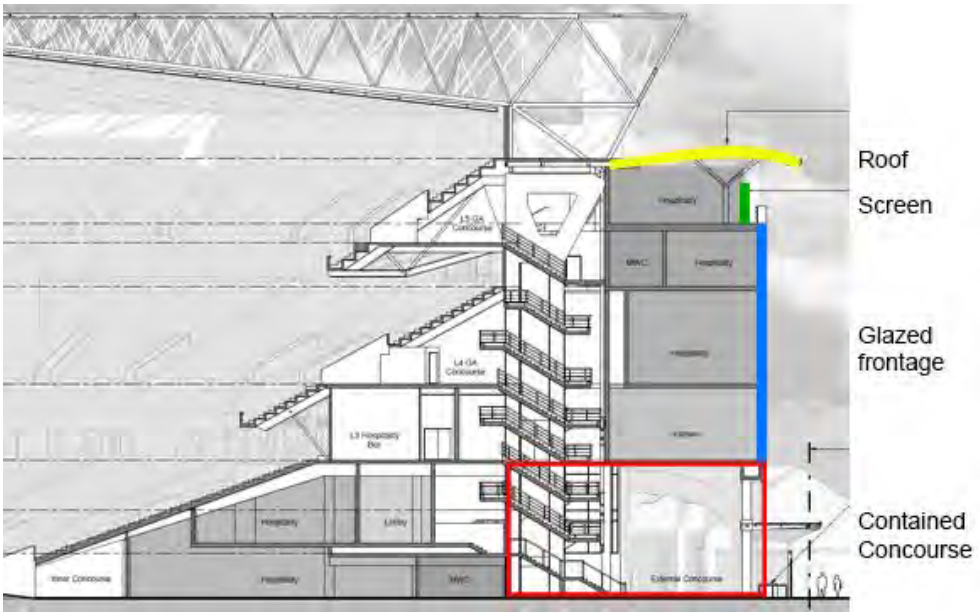
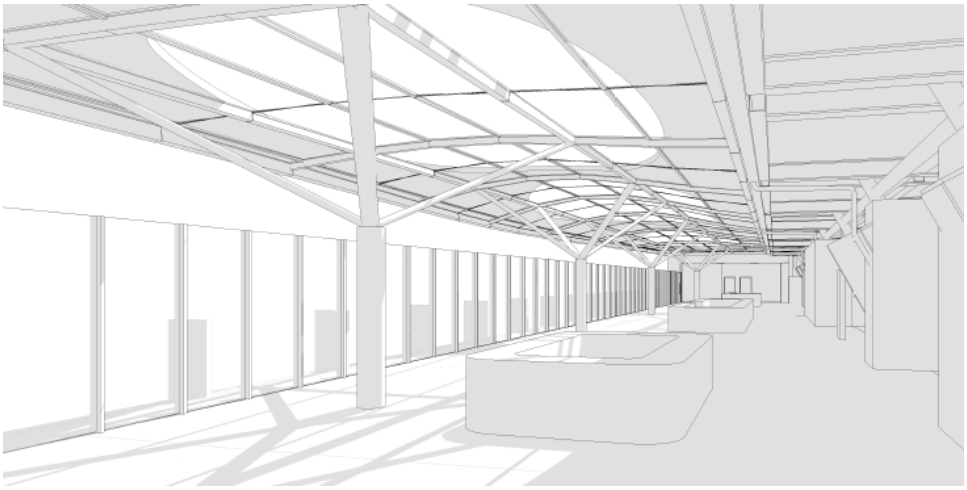


Figure 12 L05 club hospitality zone



7.14. For the purpose of assessment, it is assumed that the external glazing has a minimum acoustic performance of R_w 30dB. This is achievable by a modest glazing specification such as 6mm glass or standard double glazing. On the L05 Club Hospitality concourse, the open area facing Rugby Road is approximately 72m wide and 1m high.

7.15. On match days with all internal hospitality areas operating, noise levels at the nearest noise sensitive receptors at AP1 and AP2 will not change as a direct contribution of breakout from hospitality zones. A **negligible** impact is therefore predicted.

7.16. On non-match days, noise levels at the nearest noise sensitive receptors at AP1 and AP2 will not change as a direct contribution of breakout from hospitality zones. A **negligible** impact is therefore predicted.

7.17. The maintenance shed to the north-east of the East Stand will be dismantled as part of future works following the completion of the East Stand development. This will have a negligible impact on noise breakout from the stadium.

OFFSITE HOSPITALITY

7.18. As part of the development, the offsite hospitality indicated in Figure 9 are likely to be discontinued and relocated to internal areas within the East Stand. The impact on residents located in the vicinity of these areas will therefore reduce as a direct consequence of the East Stand Development. A **negligible** impact is therefore predicted.

ASSESSMENT SUMMARY

Table 8 Noise Impact Assessment Summary

Location	Description	Noise Impact (match-day)	Noise Impact (non-match day)
AP1	Properties on Varsity Drive.	Negligible	Negligible
AP2	Properties on Butterfield Close.	Negligible	Negligible
AP3	Properties on Corner of Warren Road and Kneller Road.	Negligible	Negligible
AP4	Properties on Duke of Cambridge Close	Negligible	Negligible
AP5	Properties on Chertsey Road	Negligible	Negligible
AP6	Properties on Fulwood Gardens	Negligible	Negligible

8. PLANT NOISE ASSESSMENT

OVERVIEW

8.1. In order to achieve the planning and BREEAM requirements, it will be necessary for new plant to achieve the following noise criteria at the nearest noise sensitive receptors (NSRs).

Table 9 Plant noise criteria at nearest NSRs (for new plant items)

Period	Match-day only plant	Regularly operating plant
Day	$L_{Ar,1h}$ 57 dBA	$L_{Ar,1h}$ 47 dBA
Night	$L_{Ar,15min}$ 52 dBA	$L_{Ar,15min}$ 44 dBA

8.2. The nearest noise sensitive receptors are identified as assessment positions AP1 and AP2 as described below.

Table 10 Assessment positions

Location	Description
AP1	Properties on Varsity Drive. Approximately 60m from current East Stand
AP2	Properties on Butterfield Close. Approximately 65m from current East Stand

8.3. In additions to the planning requirements, it will also be necessary for plant to achieve NR55 in any publically accessed external areas within the stadium grounds.

PROPOSED PLANT

8.4. There will be new plant installed as part of the East Stand development. The various plant zones are indicated in the following table.

Table 11 Plant Areas

Reference	Location	Description
A	L05 Roof Plant Zone A (north)	External plant area containing 2 no. air cooled chillers (Aermec NS4202XE – L_{wA} 88dB), 2 no. kitchen extract fans, 2 no. AHUs.
B	L05 Roof Plant Zone B (south)	Enclosed plant room containing boiler, CHW pump sets, LTWH pump sets, HWS cylinders, Cold Water Booster Set, CHP and HWS Expansions cylinders, with louvred doors located on the bowl side of the enclosure. Externally is located 1 AHU, 5 kitchen extracts and 2 kitchen supply fans.
C	L04 ventilation louvres	17 AHUs (supply and exhaust) and 9 kitchen supply terminations located at regular intervals behind a louvre strip at level L04.
D	L02 ventilation louvres	7 AHUs and 3 kitchen supply and extract fans terminating at Level 02 within the enclosed concourse.

Figure 13 Plant Zones

NOISE LIMITS FOR PLANT

8.5. It is necessary for all of the new plant collectively to achieve the plant noise requirements in Table 9 at the nearest noise sensitive receivers.

8.6. Calculations have been undertaken for each of the plant zones in order to extrapolate a practical noise limit for each zone. Where these limits are expected to be exceeded, it will be necessary to introduce mitigation measures so that these limits are achieved.

8.7. The noise emissions for each plant zone are limited as follows.

Table 12 Match day plant requirements to meet planning requirements

Items	Unit	Plant noise limit
AHU supply or extract terminations	Sound pressure level at 1m	65 dBA @ 1m
Kitchen supply or extract terminations	Sound pressure level at 1m	65 dBA @ 1m
Air cooled chiller (based on 2 units)	Sound power level	L_{wA} 88dB
Boiler enclosure walls	Sound pressure level at 1m	55 dBA @ 1m
Boiler enclosure louvre	Sound pressure level at 1m	75 dBA @ 1m

Table 13 Non-match day plant requirements to meet planning requirements

Items	Unit	Plant noise limit
AHU supply or extract terminations	Sound pressure level at 1m	60 dBA @ 1m
Kitchen supply or extract terminations	Sound pressure level at 1m	60 dBA @ 1m
Air cooled chiller (based on 2 units)	Sound power level	CHILLERS OFF
Boiler enclosure walls	Sound pressure level at 1m	50 dBA @ 1m
Boiler enclosure louvre	Sound pressure level at 1m	70 dBA @ 1m

9. APPENDIX A

NATIONAL PLANNING POLICY

9.1. The National Planning Policy Framework (NPPF) 2012 addresses noise as a planning issue primarily through a statement of four principles in paragraph 123:

> *"Planning policies and decisions should aim to:*
>
> *avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;*
>
> *mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;*
>
> *recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established, and*
>
> *identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason."*

9.2. The NPPF refers to the Noise Policy Statement for England 2010 for advice on the achievement of these aims, and particularly for explanations of "adverse impacts".

9.3. The Noise Policy Statement for England (NPSE) seeks to clarify the underlying principles and aims in past and existing policy documents, legislation and guidance in relation to all types of noise including environmental noise, neighbour noise and neighbourhood noise (but not noise in the workplace).

9.4. It introduces the concepts of the No Observed Effect Level (NOEL) and Lowest Observed Adverse Effect Level (LOAEL). Extending these concepts leads to a Significant Observed Adverse Effect Level (SOAEL). This is the level above which significant adverse effects on health and quality of life occur.

9.5. The NPSE states that it is not possible to identify a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations – the SOAEL is likely to be different for different noise sources, for different receptors and at different times.

9.6. Its vision is to 'Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development'.

This long term vision is supported by the following aims with respect to the noise types mentioned above:

> *avoid significant adverse impacts on health and quality of life;*
>
> *mitigate and minimise adverse impacts on health and quality of life; and*
>
> *where possible, contribute to the improvement of health and quality of life.*

9.7. The second aim of NPSE, to mitigate and minimise adverse impacts on health and the quality of life from noise within the context of Government policy on sustainable development, refers to noise impacts somewhere between LOAEL and SOAEL. The NPSE asserts that while this means that all reasonable steps should be taken to mitigate and minimise adverse effects, this does not mean that such adverse effects cannot occur.

9.8. National Planning Practice Guidance (NPPG) 2014 expands on the NPPF and NPSE and sets out additional guidance on noise assessment. The guidance includes a section on noise that states:

> *"Local planning authorities' plan-making and decision taking should take account of the acoustic environment and in doing so consider:*
>
> *whether or not a significant adverse effect is occurring or likely to occur;*
>
> *whether or not an adverse effect is occurring or likely to occur; and*
>
> *whether or not a good standard of amenity can be achieved."*

9.9. It then refers to the NPSE and states that the aim is to identify where the overall effect of the noise exposure falls in relation to SOAEL, LOAEL and NOEL. The guidance presents a table giving typical responses to perceptible levels of noise in terms of being noticeable/disruptive, along with corresponding effect levels and suggested actions.

9.10. Noise perceived as below the LOAEL does not require specific measures; noise perceived between the LOAEL and SOAEL should be mitigated and reduced to a minimum, and noise perceived above the SOAEL should be avoided or prevented.

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