RFU

Twickenham Stadium

Monster Jam

Noise Assessment and Noise Management Scheme

Working Document

VC-101923-SCS-DB

Rev 02

June 2015

Vanguardia consulting

CONTENTS

Page

1. INTRODUCTION 3

2. ACOUSTIC MODEL 5

3. NOISE CRITERIA AND CONDITIONS 7

4. SUMMARY OF SOUND CONTROL SCHEME 8

APPENDIX A – GLOSSARY OF TERMS 9

APPENDIX B – PROVISIONAL SITE PLAN SHOWING LOCATIONS OF EXTERNAL ACTIVITIES. 10

Vanguardia Consulting Document Control			
Document Title:	Monster Jam – Working Document	Revision:	02
Project Number:	101923	Date:	June 2015
Document Reference:	VC-101923-Noise Assessment and Noise Management Scheme-DB	Author:	Deni Butterfield
Status:	Working document	Checked:	OC
Issued To:	RFU	Passed:	DB
Issue Notes:			

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1. INTRODUCTION

1.1 Vanguardia Consulting has been appointed by the RFU to prepare a noise assessment and noise management scheme to support an application for planning permission for a Monster Jam event to be held in Twickenham Stadium.

1.2 It is understood that although Monster Jam is classed as a sport, under the General Development Planning Order motor racing is a separate class/category and thus a separate planning permission is required.

1.3 Monster Jam is a live motorsport event tour and television show operated by Feld Entertainment. The series is sanctioned under the umbrella of the United States Hot Rod Association (USHRA) and takes place primarily in the United States but is now spreading throughout Europe. Although individual event formats can vary, the main attraction is always the racing and freestyle competitions by monster trucks. It is a family event.

1.4 Monster Jam Shows - monster trucks face off in two different forms of competition – Racing and Freestyle. In the smaller shows they have a wheelie competition and/or a donut contest or sometimes both. The wheelie contest consists of hitting a ramp to get airborne whilst remaining perpendicular to the ground, whilst the donut contest requires the driver to prove as many spins as possible to secure points.

1.5 Side-by-side racing is traditional heads up tournament racing, where the first truck to cross the finish line moves onto the next round until it is eliminated or wins the racing trophy by winning the Championship race.

1.6 The freestyle competition allows drivers 90 seconds plus a 30 second bonus period on an open floor to show off their driving skills as they perform stunts and tricks with their trucks. The winner is then determined by a judging panel.

1.7 Whilst the proposed Twickenham Monster Jam event is not yet finalised, a typical programme schedule would likely be as outlined below:

Wednesday Morning: Begin general move in (unload trucks from containers, hang banners within the stadium, begin working on safety holds (seat holds), start forming bone yard, pit areas, general prep work, etc.

Thursday: Continue general move in from Wednesday and progress dirt installation (geotextile or plastic barrier layer goes down, plywood goes down, dirt goes down).

Friday: Shaping/forming the dirt to create the actual track. Limited rehearsals may then take place potentially with quad bikes (four wheelers), FMX motorcycle and limited individual Monster Trucks. Any rehearsals will not be a dress rehearsal of the entire show but individual quad/four wheeler, motorcycle and /or Monster Truck work on the track to test the circuit etc.

Saturday Morning: Finishing up track details (crush car placements, painting the track, etc. and potentially some rehearsals (same as above) in the morning.

Saturday Afternoon/Evening: The Static Showcase will happen early afternoon followed by a break of up to 2hrs and then the show will take place in the late afternoon. The Static Showcase is where fans can interact with drivers, get their pictures taken with the trucks and drivers, get autographs, etc. The trucks absolutely do not start their engines during this period. It is a static event. There are also sponsor areas/activations, merchandise booths, etc. There may be a small PA.

1.8 The stadium show starts at about 3pm and runs between 2 – 2 ½ hours with intermission included. The first half of the show comprises elimination style racing between the Monster

Trucks. There will likely be Quad racing (four wheeler racing) mixed into the first half as well. The intermission period could have freestyle motocross or some other element included. The second half of the show is a freestyle competition (where the trucks are doing tricks, jumps, donuts, crushing cars, etc.). There is a live announcer that will be speaking throughout the show. There is also pre-recorded music that is played during down periods (between races and/or when the trucks are not on the floor performing) but this is not loud. The event is scheduled to finish before 7pm. A typical event will run as follows:

- ATV's/Quads: It is probable that ATVs/Quads (4 wheelers) will run during the first half of the show. There would be a maximum of 20 and they would run a maximum of 3 races (2 heats and a main). Each heat would be 4 total laps and less than 5 minutes
- Monster Trucks: Twickenham will likely be a 12 truck show
- The show opens with intros. This would comprise of all 12 trucks coming out and doing a parade lap around the track
- The first half of the show will likely be comprised of ATV/Quad racing (detailed above) and Monster Truck bracket racing. Bracket racing is elimination style racing where pairs of trucks race with the winner advancing and the loser being eliminated. This is repeated until one truck wins the final pairing. So there are only two trucks racing at any one given time
- Monster Trucks: It is conceivable that 4 trucks could be moving at the same time (after one pair finishes racing/moving back into their parking position and two new trucks are leaving their parking position to move to the start line for the next race
- Depending on final track design each pair of trucks will race for roughly 15 – 18 seconds at a time So take a 12 truck show as an example (6 trucks in each bracket):
    - 12 trucks (6 pairs) race for 15-18 seconds and the 6 winners moving on
    - 6 winning trucks (3 pairs) race for 15-18 seconds and the winners move on
    - 3 winning trucks plus the fastest truck eliminated in the last round (2 pairs - 4 total trucks) race for 15 – 18 seconds and the winners move on
    - 2 winning trucks race for 15-18 seconds and the winner is crowned champion

There is some down time in between each race and there are variables involved (such as a truck coming to the start line late, a truck stalling, etc.)

Saturday Night: Dirt removal will begin immediately after the performance ends Saturday evening subject to commercial vehicle restrictions.

Sunday Around Noon: Handover complete.

1.9 The purpose of this document is to provide information relating to the likely sound levels at noise sensitive premises during the event and to explain what noise management measures will be put in place to minimise the likely impact in line with any Planning Conditions imposed.

1.10 The most recent version of our acoustic model is presented in Section 2 of this document, suggested noise limits are proposed in Section 3 together with the practical measures that will be adopted to ensure compliance with the Planning Conditions.

1.11 A provisional site plan showing intended locations for activities external to the Stadium and the proposed route for importing/exporting the track topsoil is shown in Appendix B.

1.12 This is a working document and as such will be amended / updated as information becomes available.

2. ACOUSTIC MODEL

2.1 An acoustic model using IMMI software has been prepared for the venue. In order to produce the model, source noise measurements were taken at an event from a Monster Truck (Grave Digger) which is reported to be one of the louder vehicles. The measurements were taken when the vehicle was idling and revving but stationary.

2.2 There are also Quad bikes, ATV and motocross vehicles taking part in the show. This element of the show is significantly quieter than the Monster Jam trucks.

2.3 The source measurements taken of the truck (normalised to 1m) were as follows:

1/1 LZeq	63.0	125	250	500	1000	2000	4000
dB	122	130	121	119	117	116	114

Table 1 – source data obtained during static measurements

2.4 These measurements were verified using additional measurements taken in the stands during an event. The event measurements indicated that the source may be slightly higher than those recorded during the static measurements. This is probably due to the fact that the engines work harder during a race than during static revving. The measurements used also include the initial vehicle parade which is the only time during an event when more than 4 trucks are on the track at the same time. For this reason these higher measurements were input into the model to ensure that a 'worst case' was modelled. The measurements input into the model are shown below in Table 2 (normalised to 1m).

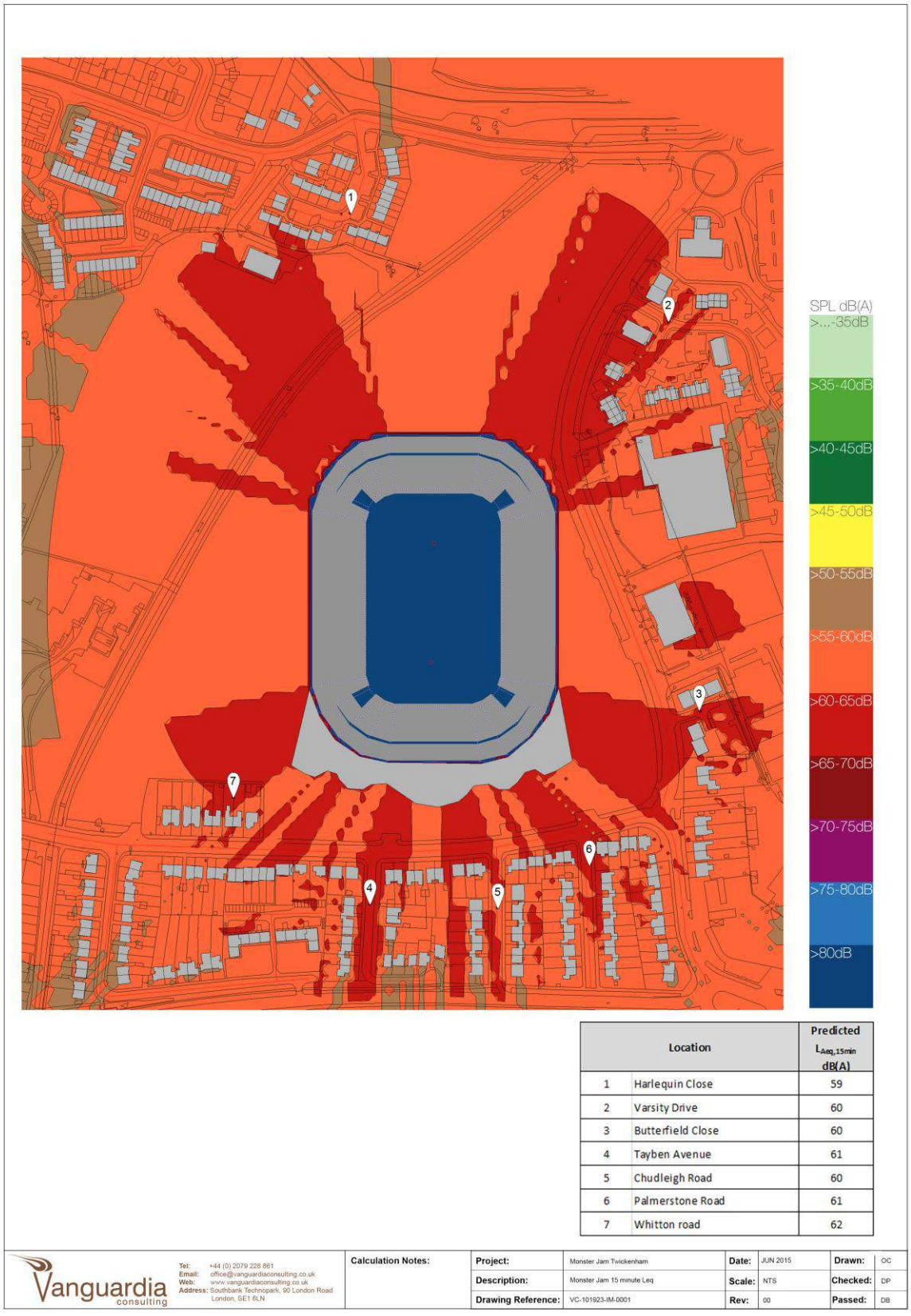
1/1 LZeq	63.0	125	250	500	1000	2000	4000
dB	135	133	128	130	130	127	124

Table 2 – source data used in IMMI model

2.5 The contour plot reproduced below in Figure 1 shows the predicted output using the higher 'event' source measurements and includes some PA (incidental music and some commentary) during a 15 minute period. This level would represent a period when all of the competing cars are on the track doing their initial parade and a few following 2 vehicle races. The plot indicates the predicted off-site level at specified off site noise monitoring locations. The results are also shown in Table 3:

	Location	Predicted $L_{Aeq,15min}$ dB(A)
1	Harlequin Close	59
2	Varsity Drive	60
3	Butterfield Close	60
4	Tayben Avenue	61
5	Chudleigh Road	60
6	Palmerstone Road	61
7	Whitton road	62

Table 3 – table of results of IMMI model showing predicted levels at agreed noise sensitive locations.



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Calculation Notes:

Project:	Monster Jam Twickenham	Date:	JUN 2015	Drawn:	OC
Description:	Monster Jam 15 minute Leq	Scale:	NTS	Checked:	DP
Drawing Reference:	VC-101923-IM-0001	Rev:	00	Passed:	DB

Figure 1 – IMMI contour plot showing noise breakout from Stadium during a Monster Jam event

3. NOISE CRITERIA AND CONDITIONS

3.1 Twickenham Stadium already has a number of noise conditions which relate to Concert Events. As previously described there is a requirement by the planning authority (LBRuT) that the RFU apply for a separate planning permission for this sporting event and it is suggested that due to the nature of the event, the noise conditions applied to the music noise levels generated at the Concerts are not appropriate for the Monster Jam event.

3.2 It would nevertheless be reasonable to apply the 'other' noise conditions to the Monster Jam event where appropriate, namely:

Days: Monster Jam Events should only be held on a Saturday, Sunday or Bank Holiday

Commercial Vehicles: No heavy commercial vehicles should enter or leave the site between the hours of 2100hrs and 0700hrs. Regarding the delivery of the topsoil needed to build the track it is suggested that deliveries of topsoil are received during the permitted hours and the soil is stockpiled during the day. Any landscaping activity required in the Stadium bowl outside of the permitted hours should be not audible beyond the site boundary.

Amplified Sounds: There may be a requirement for some amplified sounds to be provided during the Static Showcase which is external to the Stadium. This would only be a very small PA used for commentary or background music. This should be compliant with the final agreed offsite limits for the main Event. The Static Showcase only lasts for an hour or two.

Rehearsals: These would only take place the day before and on the day of the Event. The hours should be restricted to between 1030hrs and 1900hrs.

Offsite Noise Limits: There is no national noise guideline that deals specifically with this type of event. It can be seen from the noise contour plot that using a 'worst case' scenario the offsite levels are generally predicted to be less than 62dB(A) Leq, 15minutes during the event within the Stadium. Although the 15minute period is tailored specifically to deal with music events it does still seem appropriate to set the limit in 15minute intervals due to the dynamic nature of the levels generated when the vehicles are on and off the track. It is also reasonable to use the LAeq metric as a method of assessing the noise from vehicles as this is a good indicator of community response.

3.3 Although the noise from the vehicles on the track is predicted to be less than 62dB(A) Leq, 15mins during the event, there needs to be an allowance made for Monster Jam truck movements external to the Stadium Bowl. The trucks will need to start up to move from the storage area to the Static Showcase area and then after the Static Showcase they will need to drive into the Stadium Bowl and vice versa. It is recommended therefore that an offsite limit of not more than 70dB(A) is applied to these events not to be exceeded at the agreed noise monitoring locations. This would accommodate any 'unknowns'. It is also important to note that there is no facility to 'turn it down' as there would be for a music event. The noise levels generated by the trucks are fixed and without some leeway built into the offsite noise limit there is a risk that the offsite noise criterion could be breached with no way of reducing the levels on the day of the event. The RFU do not want to breach any noise conditions applied by the planning permission.

3.4 It is also understood by the RFU and the event organisers that the limit set in any planning permission would not be treated as a target and generally it is predicted for the majority of the event that the received levels would be lower than the suggested criterion.

4. SUMMARY OF SOUND CONTROL SCHEME

4.1 Due to the nature of the noise sources this event does not lend itself to the normal method of noise management throughout the event.

4.2 It is suggested that the appointed acoustic consultant attends the event on the day and manages the noise generated external to the Stadium before the event to ensure compliance with the noise condition.

4.3 Measurements will also be taken during the event itself and reported to LBRuT demonstrating compliance with the offsite noise limits.

4.4 A pre-event meeting should be held with LBRuT and the event organisers to discuss all issues with respect to noise management. Details of the programme of the event, rehearsals and testing should be agreed and included in this document when available.

4.5 Pre-event publicity will be essential for this event and advance information should be circulated to local residents in the normal way.

4.6 It is understood that the normal PA system in the Stadium will be used for this event.

4.7 All instrumentation used for off-site and on site measurement will meet a minimum of Class 2 of BS EN 61672-1:2003 (sound level meters) or Type 2 BS EN 60804:2001 and will be calibrated on a routine basis according to the manufacturer's instructions.

External Sound Monitoring

4.8 Noise measurements outside of the site will be taken at locations agreed with the Council's Environmental Health Officers. In addition noise measurements will be taken in response to any complaints that may be received. Where appropriate, action necessary to ensure the noise limit is not exceeded will be relayed to the onsite consultant and immediate instructions will be issued to resolve any potential problems. It is however not practicable to manage the noise generated by the vehicles during the race.

Telephone Complaints Line

4.9 There is a resident's line operated by the RFU at Twickenham Stadium and any complaints received will be passed to the appointed acoustic consultant. The area of the complaint will then be visited with LA officers if required. The noise levels will be assessed and again if action is necessary this will be transmitted by radio through to onsite staff.

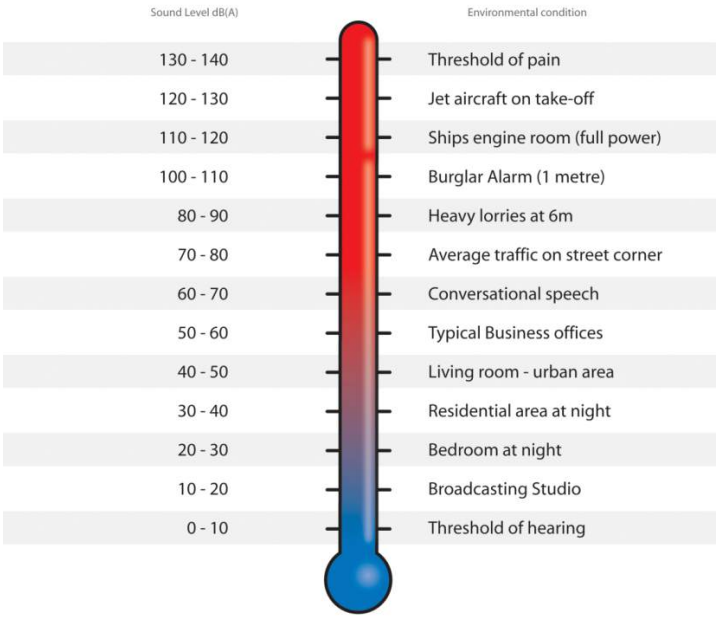
APPENDIX A – GLOSSARY OF TERMS

A.1 Noise is defined as unwanted sound. The range of audible sound is from 0dB to 140dB, which is taken to be the threshold of pain. The sound pressure detected by the human ear covers an extremely wide range. The decibel (dB) is used to condense this range into a manageable scale by taking the logarithm of the ratio of the sound pressure and a reference sound pressure.

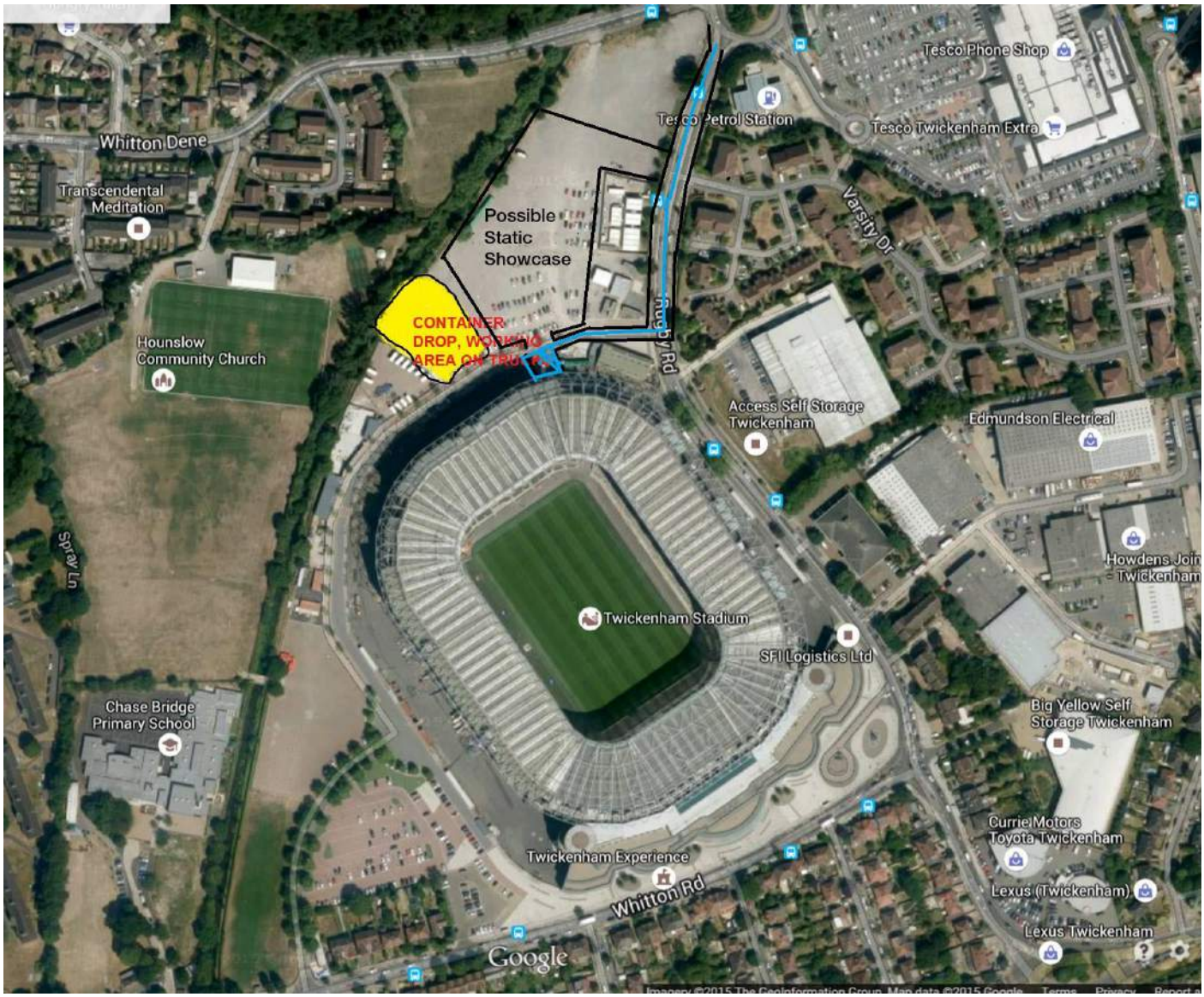
A.2 The frequency response of the ear is usually taken to be about 18Hz (number of oscillations per second) to 18,000Hz. The ear does not respond equally to different frequencies at the same level. It is more sensitive in the mid-frequency range than at the lower and higher frequencies, and because of this, the low and high frequency component of a sound are reduced in importance by applying a weighting (filtering) circuit to the noise measuring instrument. The weighting which is most used and which correlates best with the subjective response to noise is the dB(A) weighting. This is an internationally accepted standard for noise measurements.

A.3 The ear can just distinguish a difference in loudness between two noise sources when there is a 3dB(A) difference between them. Also when two sound sources of the same noise level are combined the resultant level is 3dB(A) higher than the single source. When two sounds differ by 10dB(A) one is said to be twice as loud as the other.

A.4 The subjective response to a noise is dependent not only upon the sound pressure level and its frequency, but also its intermittency. Various indices have been developed to try and correlate annoyances with the noise level and its fluctuations. The parameter used for this measure is Equivalent Continuous Sound Pressure Level (L_{Aeq}). The A-weighted sound pressure level of a steady sound that has, over a given period, the same energy as the fluctuating sound under investigation. It is in effect the energy average level over the specified measurement period (T) and is the most widely used indicator for environmental noise. A few examples of noise of various levels are given right:



APPENDIX B – PROVISIONAL SITE PLAN SHOWING LOCATIONS OF EXTERNAL ACTIVITIES.



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