

Acoustic Impact Assessment

Prepared for Storrington Tennis Club
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Prepared by

Martin Higgins AMIOA

Director
MW Acoustic Consultants



01432 683164



martin@maywalters.co.uk

May Walters Acoustic Consultants specialise in delivering noise impact assessments and research for padel and sporting facilities.



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1 EXECUTIVE SUMMARY

Storrington Tennis Club have planning permission for construction of 2 x open air padel courts at their site and wanted a noise impact assessment to help inform a number of options of court layouts in order to decide on the most noise effective design. Attended on site measurements were made on site at Storrington Tennis Club to understand the ambient noise levels. Predictions of padel noise were then calculated at the nearby residences by drawing on extensive measurements of established fully utilised padel courts in an alternative location. The calculations and results are detailed in the report and mitigative solutions were incorporated to ensure that each design was compliant with guidance to ensure the noise created would be in keeping with the context of the existing soundscape.

The development is noted to be in line with accepted regards noise criteria.

2 INTRODUCTION

2.1 May Walters Acoustic Consultants Statement of Experience

May Walters Acoustic Consultants (MWA) specialise in delivering noise assessments for padel and sporting venues, the Director and Principal Consultant Martin Higgins is a qualified acoustic consultant and an Associate member of the IOA (Institute of Acoustics).

In 2024 we published one of the most detailed research papers into the noise created by outdoor padel courts, which was conducted independently and under the technical supervision of the IOA. This research has subsequently been presented to the members of the Chartered Institute of Environmental Health (CIEH) at conference, formed content into their training resource and presented at the National IOA Conference for peer review.

The research comprised just under 50 hours of on-site assessment and can quantify the not only the composition of the noise, but the frequency of the different types of impact noise created, the variability of this noise over playing time and even indicates how the noise created by padel is linked to player skill levels. Similar studies were also performed on tennis for comparison and a more accurate and relatable benchmark when entering into discussions of the applicability of a proposed site.

A noise model has been created from this research to accurately describe noise and predict it's propagation from the courts to any local residences so that the impact of construction of padel facilities can be fully understood.

2.2 Project Circumstances

MWA were instructed by Storrington Lawn Tennis Club, 'the Client' to prepare a Noise Impact Assessment to provide guidance on a planning application for a development of a 2 padel courts to be constructed on the site of their club at Greyfriars Lane, Storrington, RH20 4HE, which will be referred to as 'the Site'.

The Client is in possession of planning permission for 2 courts, but the purpose of the assessment is to investigate the design for which permission was granted and in addition to investigate alternative designs

which may be more effective from a noise perspective. The report aims to profile and quantify the sensitivity of any properties adjacent to the site which may be affected by noise from the proposed development, understand the impact of the noise produced by the proposed padel court development on these and other local residences in line with current UK guidance and provide advice on mitigative measures should they be required.

Designs for the proposed development are detailed in 2.3 together with the alternatives considered.

The layout of the Site is shown in fig 2.1 below

All acronyms used within this report are defined in the Glossary presented in the Glossary of Terms at the end of this document.



Fig2.1 shows the outline of the proposed development at the site. Site boundaries are outlined in red, the area proposed for padel construction is shown in blue.

2.3 Proposed Development

The Site is currently an active tennis club with 9 courts located on the south side of Storrington village. The site is enclosed by private housing to the north and east, the south and west of the site leads directly onto the South Downs where there are no residential properties. The building situated to the northeast of the clubhouse was formerly a squash club but has been highlighted for development into further residential properties. Although Storrington is a relatively well developed and busy village, the location of the Site is situated some distance from the main traffic routes, therefore is relatively well insulated from traffic noise, accepting activity in the club carpark. The main noise sources at the site during peak times tend to be activity on the court, carpark and wind, due to the exposed location of the Site connected to the South Downs and large number of trees at the site.

The area of proposed development is located at the end of the tennis courts located at the south side of the club. It is noted that the south side of the area marked for development is adjacent to a small landbank which will need to be excavated prior to construction. This will form an earth embankment of approximately 2m in height on the south side of the padel courts.

The area of risk associated with this location are the properties located adjacent to the Site. The two properties that have been identified as greatest risk are Ivy Cottage and April Cottage/Ashton House (and Ashton House which will be assessed as one location as they are adjacent to each other) due to their proximity and the position relative to the courts.

Ivy Cottage is noted to be just over 40m from the nearest corner of the proposed development to the rear building façade. It appears that the area of the rear garden near to the façade of Ivy Cottage is well manicured and therefore may be used occasionally for rest and relaxation purposes. There is a thin wooden fence and a tree line which forms the boundary between the garden to the tennis club. The garden area of the property does stretch up to an area adjacent to the area where the padel courts are proposed, however this area of garden is not well manicured and contains a derelict building which shows no signs of recent attention or development and there is a thin line of shrubbery forming the boundary at this point.

April Cottage/Ashton House is noted to be approximately 37m from the nearest corner of the proposed development to the front façade of the building. The front façade forms part of the main access to the property via a road and driveway and does have a limited garden area, which is unlikely to be used for rest and relaxation. It is noted that the building is a 2 storey residence, with double-glazed windows. The area in between the proposed development and façade is separated by some tree line and foliage, but no major structures that would reflect sound.

Planning permission has been gained for a set of 2 padel courts constructed in the design detailed in *fig 2.3a* named 'Option A'.

After reviewing a number of options, an alternative was selected for a comparison which is shown in *fig2.3b* named 'Option F'

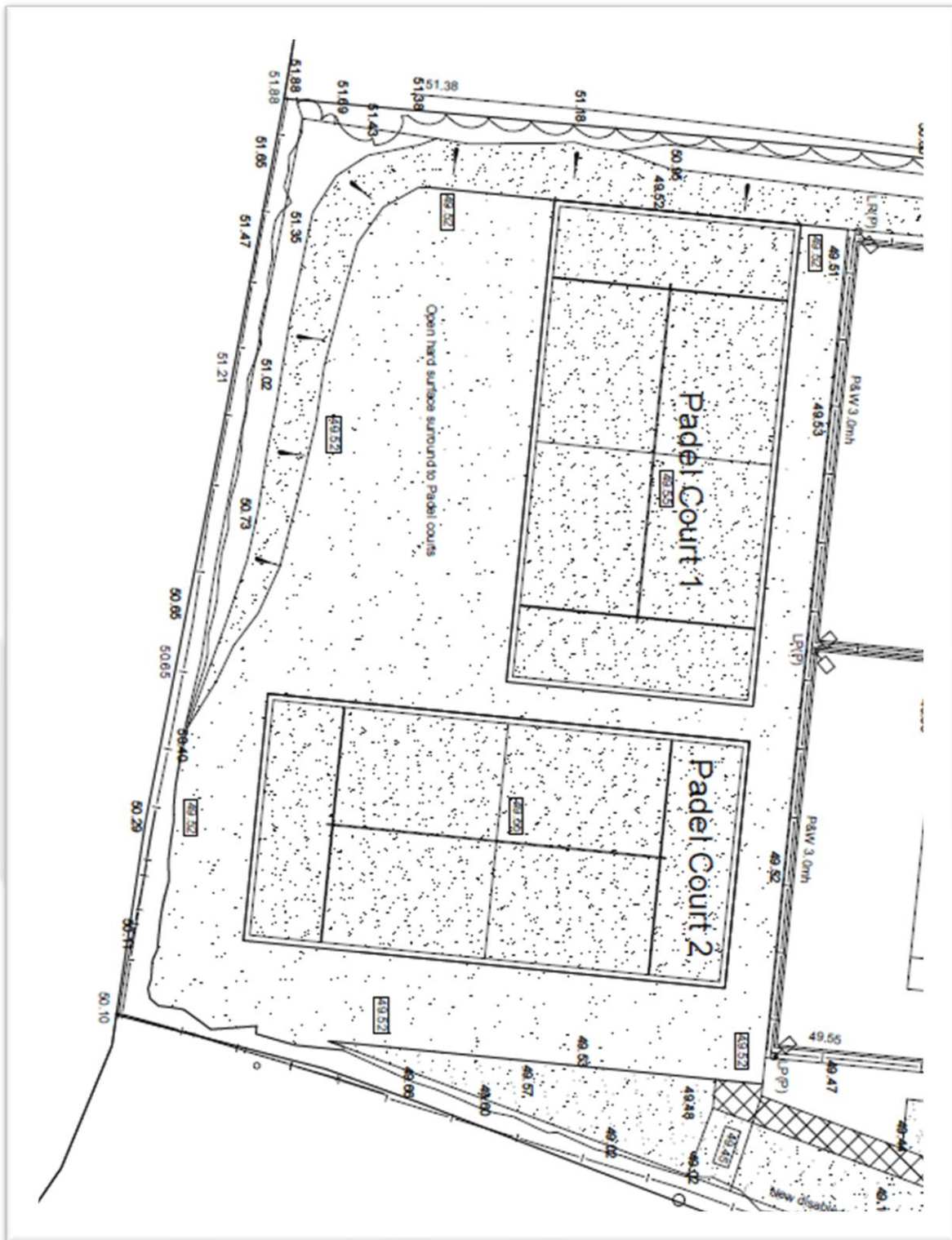
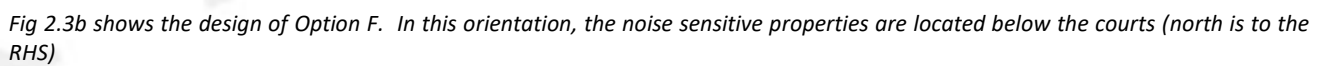


Fig 2.3a shows the design of Option A. In this orientation, the noise sensitive properties are located below the courts (north is to the RHS)



2.4 Limitations

The limitations of this report are presented in Appendix 1.

2.5 Confidentiality

This document has been prepared for sole use of our client identified on the title page of this report (the “Client”) in accordance with generally accepted consultancy principles, the budget for fees and the terms of reference agreed by MWA and the Client.

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3 PADEL NOISE RESEARCH

3.1 Research Introduction

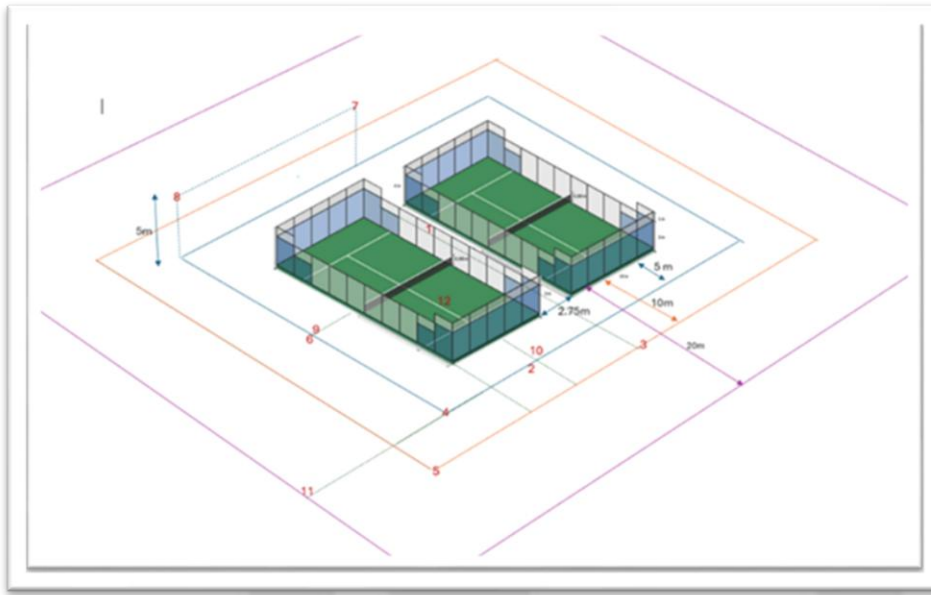
A detailed noise assessment for padel was researched in 2024 and published in 2025. This research was independently funded and performed within the academic framework of one of the qualifications delivered by the Institute of Acoustics (IOA), who had technical oversight of the project.

3.2 Project Scope & Objectives

Nearly 50 hours of continuous measurements were taken via 3 Class 1 Sound Level Meters, on external, uncovered padel and equivalent tennis courts. A schematic for the courts and measurement positions is detailed below in *fig 3.2*. The project was designed to achieve the following;

- Describe the noise created by a padel court and benchmark it to tennis for comparison
- Quantify and qualify the major noise sources produced by padel
- Investigate way noise propagates from a padel court
- Build a noise model to predict padel noise propagation

Fig 3.2 shows a schematic of the padel courts research area, detailing measurement points in relation to the court.



3.3 Results Overview

Noise generated by both padel and tennis courts can be divided into vocal and also impulse (created by impacts) noise. In the case of tennis, the majority of intrusive impulse noise is generated by ball striking the racquet (the strings of which have a dampening effect). In padel, impact noise of ball on; bat, glass boundary and metal grille tend to be the most intrusive impulse noises. All of these impacts have different frequency of occurrence and create a different sound.

The metal grille on the side is typically acoustically transparent, unless it is struck by a ball. The glass boundaries on the padel court act as reflecting barriers, inhibiting the noise propagation from the ends of the court, but also reflecting noise back into the court, creating a reverberant environment and increasing the noise levels inside the court by approximately 10 dB, which would be perceived by most people as doubling in loudness.

3.4 Overall Noise levels (L_{Aeq})

Like most sports, the noise emitted from continuous play on both padel and tennis courts was found to be intermittent in nature. The overall noise levels measured in L_{Aeq} (continuous average sound energy levels over a period) were measured at various points around the court, as detailed in *fig 3.2*. These measurements were taken over 5-minute intervals during continuous play on the courts containing mixed club level players.

It was found that measurements taken at 5m from the baseline with each sport, the average L_{Aeq} levels were both around 70 dB. Readings were taken at 5m from the net line for each sport, it was found that padel was on average 6 dB more than tennis (approximately 50% louder).

In padel, the average noise levels taken from 5m behind the baseline and 5m from the net line (both external from the court). It was found that the point at the net line was 12 dB L_{Aeq} greater than the base, which would

be perceived by most as just over twice as loud). This is due to the barrier effect of the boundary, and it confirms the theory that noise egress from the side of the courts is greater than from the end.

3.5 Impulse / impact noise (L_{MAX})

Each of the major impact noises were studied, which included the ball striking the tennis racquet / padel bat. In padel the additional impact noises of ball striking glass boundary and metal grille were also analysed. Similar ball speeds were used in order to gain comparison results and readings were taken to determine 'average' and 'worst case scenario' impact noise levels and the noise propagation of these sounds from the court were studied. A spectral analysis of each impact noise is shown in Fig 3.5 and an example of the impact noise propagation from a metal grille strike is detailed in fig 3.5a

Fig 3.5 shows a spectral analysis of the major impact noises emanating from a padel court

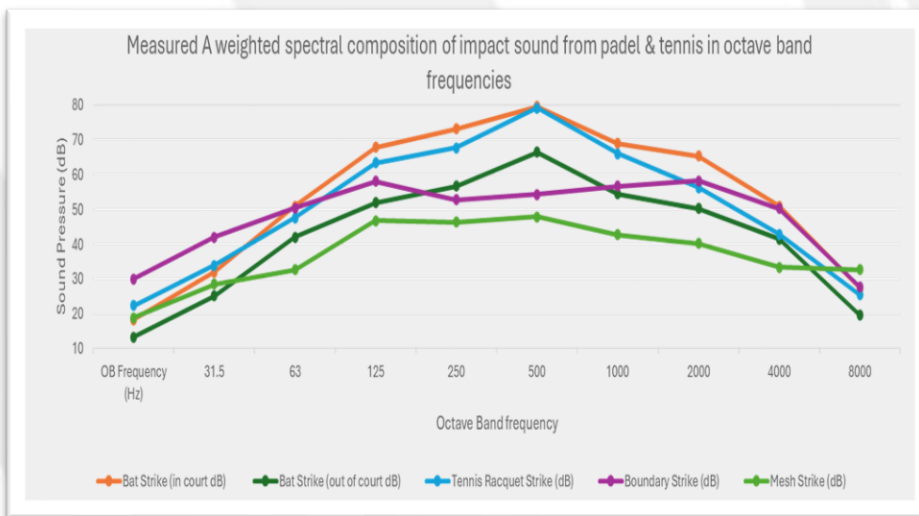
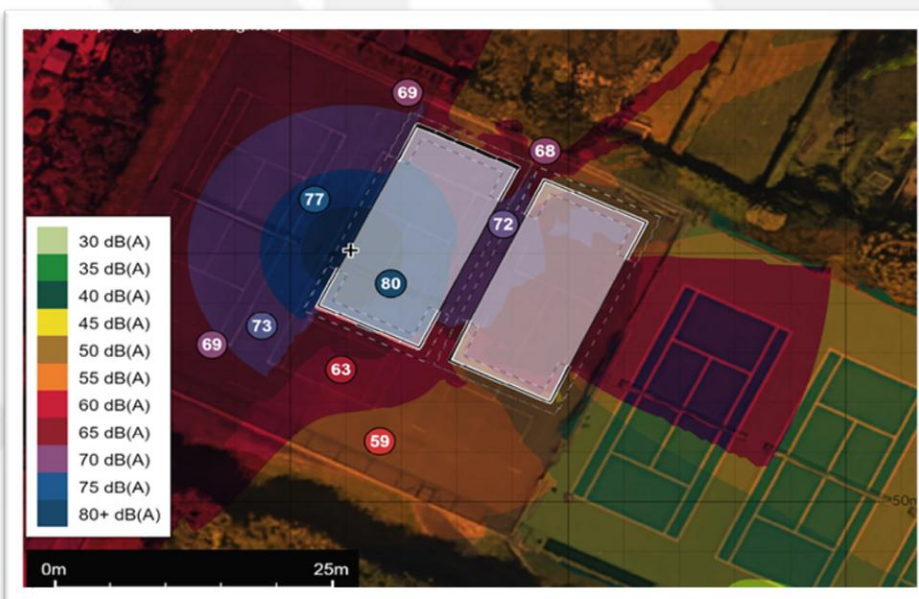


Fig 3.5a shows an impact measurement from a ball strike on the metal grille (side of the court) and shows the propagation of the subsequent sound



3.6 Impulse Noise Frequency

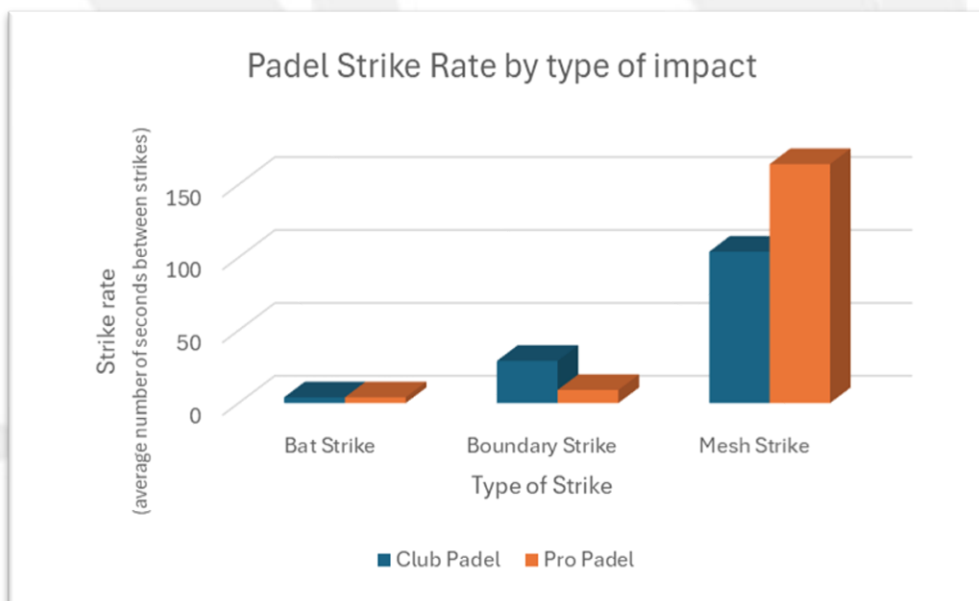
As the noise from padel and tennis is dominated by impulse noise created by ball impacts, a number of assessments were performed to quantify these individual sounds. Impact noises were counted during 5 minutes of continuous play for club level and elite players.

Key observations include;

Bat/ball strike was by far the most frequent in both sports, occurring once every 4.5 seconds in padel and once every 6 seconds in tennis. This type of impact was the major contributor to the overall L_{AEQ} , and when completing an on-time calculation, the other impacts contributed negligibly to the overall result. In practice, noise generated by padel would include, on average, boundary impacts (occurring every 30 seconds at club level) and grille strike impacts (occurring every 100 seconds at club level), this is summarized in *fig 3.6*. This difference in sound created for each strike and the intermittency would create a subjective impact to the local area, which is not fully described by the L_{AEQ} .

When the frequency of impact noise from elite players were compared, in padel the bat frequency of mesh grille strikes decreased and the frequency of boundary strikes increased substantially. Further the speed of the impacts appeared to decrease, which would make the L_{AMAX} (measure of total sound energy) levels of each boundary impact decrease. This is consistent with the players controlling and positioning the ball at the corners of the boundary to reduce bounce back, a similar tactic which is seen in squash. This supports the theory that as a padel court becomes established and the skill level of players using it increases over time, the noise profile of the court will change to provide a greater number of impulse noises, but with lower L_{AMAX} values with boundary and grille impact sounds.

Fig 3.6 summarises the frequency of ball impact strikes on the padel court of different surfaces. The results are presented in the form of number of seconds between strikes and it also indicates the difference in skill level with strike frequency



4 RELATED POLICY & GUIDANCE

4.1 National Planning Policy Framework & National Planning Practice Guidance

The Government updated the National Planning Policy Framework (NPPF) on 7th February 2025 and its associated National Planning Practice Guidance (NPPG) on 14th February 2024. Together, the NPPF and NPPG set out what the Government expects of local authorities. The overall aim is to ensure the planning system allows land to be used for new homes and jobs, while protecting valuable natural and historic environments.

Noise needs to be considered when development may create additional noise or would be sensitive to the prevailing acoustic environment. When preparing plans or taking decisions about new developments, there may also be opportunities to make improvements to the acoustic environment. Good acoustic design needs to be considered early in the planning process to ensure that the most appropriate and cost-effective solutions are identified from the outset.

Decision making needs to 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.

In line with the Explanatory note of the noise policy statement for England, this would include identifying whether the overall effect of the noise exposure (including the impact during the construction phase wherever applicable) is, or would be, above or below the significant observed adverse effect level and the lowest observed adverse effect level for the given situation. As noise is a complex technical issue, it may be appropriate to seek experienced specialist assistance when applying this policy.

The Observed Effect Levels are detailed in Table 4.1 below and the likely averaged responses;

The subjective nature of noise means that there is not a simple relationship between noise levels and the impact on those affected. This will depend on how various factors combine in any particular situation.

These factors include:

- the source and absolute level of the noise together with the time of day it occurs. Some types and levels of noise will cause a greater adverse effect at night than if they occur during the day
- the character of the introduced noise and how it relates to the existing sound environment – greater similarities there between the source and ambient noise tends towards less intrusion
- the qualities of non-continuous sources of noise, e.g. frequency of noise, pattern of intermittency etc. Introduction of non-continuous or intermittent noise can increase intrusion.
- the local arrangement of the environment, i.e. buildings, surfaces and green infrastructure, which may reflect or absorb sound and therefore will change the propagation path of the noise.

And consideration should also be given to;

- the cumulative impacts of the introduction of the source as it acts with other existing sources of noise.
- the effect of noise on wildlife. Noise can adversely affect wildlife and ecosystems.

Table 4.1 Noise Exposure Hierarchy

Perception	Examples of Outcomes	Increasing Effect Level	Action
No Observed Effect Level			
Not present	No Effect	No Observed Effect	No specific measures required
No Observed Adverse Effect Level			
Present & not intrusive	Noise can be heard but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level			
Present & Intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level			
Present & disruptive	The noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Effect	Avoid
Present & very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent

4.2 BS8233:2014 'Guidance on sound insulation and noise reduction for buildings'

Provides guidance and noise criteria for the control of noise in and around buildings. It suggests appropriate criteria and limits for different situations, which are primarily intended to guide the design of new buildings or refurbished buildings undergoing a change of use, rather than to assess the effect of changes in the external noise climate.

The standard suggests suitable internal noise levels within different types of buildings, including dwellings, as shown in Table 4.2.

Table 4.2 BS8233:2014 Internal Target Noise Levels

Criterion	Typical Situation	Design $L_{Aeq,T}$ (dB)
Suitable resting / sleeping conditions	Living Room	35
	Bedroom*	30
*For a Reasonable standard in bedrooms at night, individual noise events (measured with fast time weighting) should not exceed 45dB L_{max}		

BS8233 goes on to recommend noise levels for gardens as follows:

“It is desirable that the external noise level does not exceed 50dB $L_{Aeq,T}$, with an upper guideline value of 55dB $L_{Aeq,T}$ which would be acceptable in noisier environments. However, it is also recognised that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors might be warranted”.

“In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces but should not be prohibited”.

With regards to external noise within balcony areas, BS8233: 2014 provides the following advice:

“Other locations, such as balconies, roof gardens and terraces, are also important in residential buildings where normal external amenity space might be limited or not available, i.e. in flats, apartment blocks, etc. In these locations, specification of noise limits is not necessarily appropriate. Small balconies may be included for uses such as drying washing or growing pot plants, and noise limits should not be necessary for these uses. However, the general guidance on noise in amenity space is still appropriate for larger balconies, roof gardens and terraces, which might be intended to be used for relaxation. In high-noise areas, consideration should be given to protecting these areas by screening or building design to achieve the lowest practicable levels”

4.3 Lawn Tennis Association – Planning Guidance

Regarding noise, the LTA guidance states;

“Installation of Padel Tennis courts. If applying for planning permission for a Padel court and there is a neighbouring property within 30m of the court, then sound attenuation could be required.”

4.4 Sports England Artificial Grass Pitch (AGP) Noise Guidance 2015

The guidance produced by Sports England provides guidance for sports facilities in the form of AGP or multi-use games area (MUGA) and has relevance to padel courts. It recognizes the benefits of recreational and sports facilities to the community and encourages a positive approach to the planning process for these and encouragement to consider the context of the site for its appropriateness. Noise criteria are provided as a single figure L_{Aeq} 1 hour of 58 dB, taken at 10m from the centre line of the pitch to use as a benchmark for propagation to the façade of the nearest noise sensitive receptor and suggests the following criteria;

'The determining noise criteria for APGPs proximity to residential properties to avoid moderate annoyance in daytime and evenings, as set by The World Health Organisation's 'Guidelines for community Noise': = 50 dB $L_{Aeq(1hour)}$ upper noise limit external to residential properties and within external living areas"

Where the site has an existing level ambient level which exceeds this, "A 'slight' impact is considered for an increase less than 3 decibels" on sites where a new noise source is introduced.

It also recognizes the issue of impact noise from hockey in particular and provides details of mitigative process for this.

4.5 Institute of Environmental Management & Assessment 'Guideline for Environmental Noise Impact Assessment', October 2014

The guidelines address the key principles of noise impact assessment and are applicable to all development proposals where noise effects are likely to occur. The guidelines provide specific support on how noise impact assessment fits within the Environmental Impact Assessment (EIA) process. They cover:

- How to scope a Noise Assessment;
- Issues to be considered when defining the baseline noise environment;
- Prediction of changes in noise levels as a result of implementing development proposals; and
- Definition and evaluation of the significance of the effect of changes in noise levels (for use only where the assessment is undertaken within an EIA).
- Although the guidance states that it is only applicable for use in an Environmental Impact Assessment (EIA), in the absence of any other specific guidance for assessing changes in ambient noise levels, it provides a useful benchmark for establishing the significance of the effect of introduced noise levels.

Table 4.5 categorises the change in noise level for a noise sensitive receptor such as a residential dwelling.

Table 4.5 Effect Descriptors for Residential Dwellings

Effect	Change in Ambient Noise Level (dB)
Very substantial	≥10.0
Substantial	5.0 – 9.9
Moderate	3.0 – 4.9
None / not significant	≤2.9

4.6 Local Authority Guidance and Criteria

Research was conducted into finding any local guidance published by the local authority. There is no policy or procedure found which specifically addresses padel developments.

5 NOISE IMPACT ASSESSMENT

5.1 Methodology

Although UK planning guidance encourages a positive stance on proposed sporting facilities, due to their positive effect on health & wellbeing in the community, it is essential to ensure that this is not at the expense of excessive noise for those living in immediate area. As all sites will maintain their own unique identity due to existing noise sources from various types of infrastructure but also spatial and cultural differences, we are encouraged to look at the context of both site and proposal so that an appropriate decision can be made.

For the introduction of any new noise source into an area of this nature, the amount of sound energy and also the character of the noise would be key in influencing the scale of impact. For example, as the difference between the ambient and proposed noise levels increases, and the difference in character of the new noise and the existing soundscape increases, the potential impact would increased.

Padel produces intermittent noise which is dominated by verbal, but also impulsive sounds created by the ball striking bats and other surfaces. When considering the impact of the new noise source, it would be beneficial therefore to consider both the overall sound levels (L_{Aeq}) and also the level on impulse/impact noise (L_{Amax}) and this project has considered both elements within the scope of the report. Therefore, it will compare the overall impact by comparison of existing (ambient) and predicted levels of overall noise and impulse noise at the site.

To understand what may constitute an acceptable difference in levels we must initially look towards guidance, however there are currently no specific UK noise criteria for padel courts. However, inference can be taken from guidance addressing other related areas which may be used to help steer decision on what would be reasonable levels, so it links in with the larger planning strategy.

Noise Impact Assessment Guidance from IEMA (2014) suggest a scale of overall noise levels and the associated significance of intrusive effect. An increase up to 2.9 dB would have an impact which is 'not significant' rising to a 'moderate' impact up to 4.9 dB (as summarised in Table 4.5), although it should be stressed that this project does not form part of an impact assessment under this guidance.

Sports England AGP Noise Guidance (2015) suggests that any development would be acceptable if it produces an overall noise of less than 50 dB L_{Aeq} at the façade of the nearest noise sensitive receptor, or if the existing noise levels currently exceed that, an increase of 3 dB L_{Aeq} would be considered a 'slight impact'.

All of the guidance noted above uses overall noise levels (L_{Aeq}) for criteria, but for impact noise there is no specific noise criteria for padel as to what would be an acceptable impact noise level. Again, inference can be drawn from related guidance to provide a benchmark.

The World Health Organisation (WHO) 'Guidelines for Community Noise' published in 1999 does not provide noise criteria during the day for impact noise, however, does set a nighttime only threshold of 60 dB. This criterion was brought in to protect health & wellbeing and to help prevent disturbed sleep. The nighttime ambient noise levels in most areas are significantly lower than during other times of the day, therefore these impact criteria could be justified as a lower end benchmark for daytime criteria.

Chartered Institute of Environmental Health (CIEH) Shooting Guidance published in 2003 refers to the sport of clay pigeon shooting which produces impulsive noise. The guidance suggests that as the level of L_{Amax} for impulse noise reaches 65 dB, it starts to encourage annoyance in the community. It is noted however, that this is subjective measure which would be influenced by a number of factors, including the local environment and the listeners perception of the source, both of which would be different in sites containing padel courts.

5.1.1 Measurement Points and Results

The purpose of the on-site measurements is to study the ambient noise levels, particularly at the façade of the nearest houses so that an impact can be calculated. In order to gain accurate measurements, attended noise measurements were taken during the course of the day so that noise levels could be assessed around the site, including;

Measurement Point 1 (MP1) Side of courts, adjacent to the car park

Measurement Point 2 (MP2) Side of the elevated courts near to tennis hut

These locations are depicted below in fig 5.1 which shows an aerial view of the site and MP locations.



Fig 5.1 shows the location of measuring points at the Site

Measurement Position (MP) 1:

This measurement point was located on the side of the courts, adjacent to the carpark. These measurements were taken as representative of the noise levels on the court, the car park and capture the noise created by any foot traffic going to and from the higher level courts.

Attended ambient sound measurements were taken in free-field conditions on 25/02/26 from 2130 hours to 26/02/26 at 1730 hours.

Measurement Position (MP) 2:

This measurement was located at the corner of the court of the higher elevated courts on the Site, approximately 5m from a tennis hut (used for storage) and an area with benching for viewing matches. This was used to estimate the noise levels coming from the higher level courts when in operation. The adjacent courts were in operation from around 1700 hours onwards, prior to this due to the quiet nature of the site it is fair to assume that the readings would be representative of the ambient levels at the facades of the local buildings.

The meter was located approximately 0.5m from fencing boundary of the properties at the entrance to the carpark. It was set away from reflective surfaces. Readings were from 25/02/26 at 2130 hours to 26/02/26 at 1730 hours.

5.2 Subjective Assessment & Environmental Conditions

Environmental conditions during the monitoring are summarised;

Temperature during daytime was 11°C, slightly gusty wind during early part of the day tending towards a consistent southern gusty wind as the day progressed. There was 100% cloud coverage, major ambient noise sources at the site included wind/tree noise as the main contributor, some road traffic noise from the village in quieter periods. Some activity at the tennis club started at 0900 hours and finished by 2200 hours.

5.3 Results**5.3.1 Method of Calculation of Predicted L_{Aeq} & L_{Amax}**

The research conducted into padel have benchmarked the average L_{Aeq} levels from a padel court. These are summarised in Table 4.3a. This data may be used to calculate the attenuation of the sound over distance so that the levels of noise from padel can be predicted at the façade of the nearby properties, taking into account any obstructions such as fences or walls, or the 2m high earth bund that will be created which may act as barriers or reflectors.

The results in Table 5.3a represent noise levels generated during doubles play on a fully 100% utilised court and includes noise generated by congregating players. The results are therefore considered to be a worst-case scenario in assessing padel play. Measurements have been calculated at a point of 1.5m in height, which is consistent with the average height of noise generation on the court and the average noise receiver height. The ground conditions between the proposed court and facades are noted to be soft, consistent with earth and grassed areas and the mid-range frequency of 500Hz has been selected as a benchmark for the calculation.

Table 5.3a shows the average sound levels emanating from a padel court, measured during doubles play, during 100% utilisation of the court

Position	Average Overall Sound Level $L_{AEQ,1 \text{ Hour}}$ (dB)	Average Impact Maximum Sound Level L_{AMAX} (dB)
10m from boundary wall corner (position 5 in research)	51	71
10m from boundary wall end, 20m from side of court (position 11 in research)	51	73

5.3.2 Calculation of Predicted levels

We will be predicting the levels at two locations;

Ivy Cottage - The rear façade of this building being 40m from the nearest corner of the development area and it is noted that the garden area may be used for rest and relaxation.

April Cottage/Ashton House – The front façade of the building being 37m from the nearest corner of the development area.

As the Site is located in a relatively quiet area, removed from major busy roads, the main noise source at the site was wind on foliage which was consistent throughout the area surrounding the site up to and including the nearby residences. Noise levels at the façade of each property have been taken from readings taken at the site when there was no activity on court and whilst there was reduced wind, readings were averaged from between 0400-0700 hours to provide a benchmark of L_{AEQ} . Given the remote location of the Site, this value would be representative of the façade noise levels when there is no wind or tennis activity, the value obtained was 43 dB.

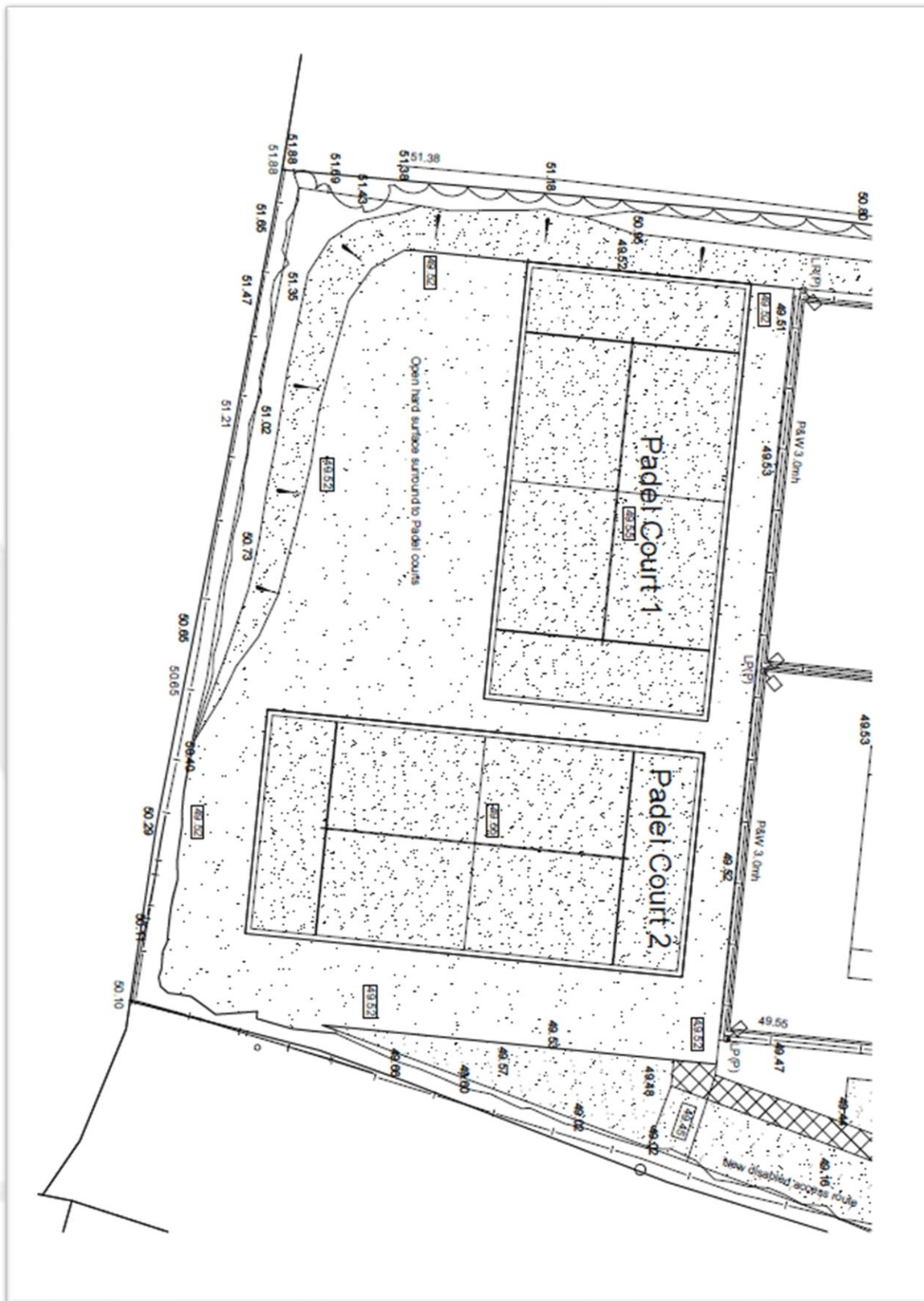
When conducting the calculations for the insertion loss of the barrier, it is assumed that the barrier runs the full length of the padel court and is separated from the court by a distance of 1m. The sound source of the padel court is assumed to be a point in the middle of the court for the purposes of the calculation and based on the single frequency of 500Hz. The calculation does not account for environmental factors, obstructions or reflective surfaces in the propagation path, topology gradients, quality of the barrier and it assumes soft ground in the area. Therefore, the calculation should be taken as an approximation. Fig 5.3a below shows the position of the barrier relative to the courts in Option A and Fig 5.3b shows an example calculation of the barrier effect.

5.3.3 Option A Research

The predicted noise attenuation from each court over the distance to each residence was calculated and the results are summarised in Table 5.3b

Option A Results	Ivy Cottage (no mitigation) dB	April Cottage/Ashton House (no mitigation) dB	Ivy Cottage (3m barrier) dB	April Cottage/Ashton House (3m barrier) dB	Ivy Cottage (4m barrier) dB	April Cottage/Ashton House (4m barrier) dB
Estimated Ambient façade LAEQ (without wind & tennis activity)	43	43	43	43	43	43
Ambient facade readings LAEQ (including tennis activity)	51	51	51	51	51	51
Court 1 contribution (LAeq)	36	36	36	36	36	36
Court 2 contribution (LAeq)	46	46.5	36	36	32	32
Combined padel contribution (LAeq)	46.5	46.5	39	39	37.5	37.5
Court 1 average contribution (LAMAX)	56	58	56	58	26	58
Court 2 average contribution (LAMAX)	68	68.5	58	58	54	54
Site Measured average impact noise (including tennis activity)	61	61	61	61	61	61

Table 5.3b shows the results of the calculations for the padel contribution to the nearest properties to the Site and includes the insertion loss created by installing barriers at different heights adjacent to the courts as detailed in Fig 5.3a & 5.3b



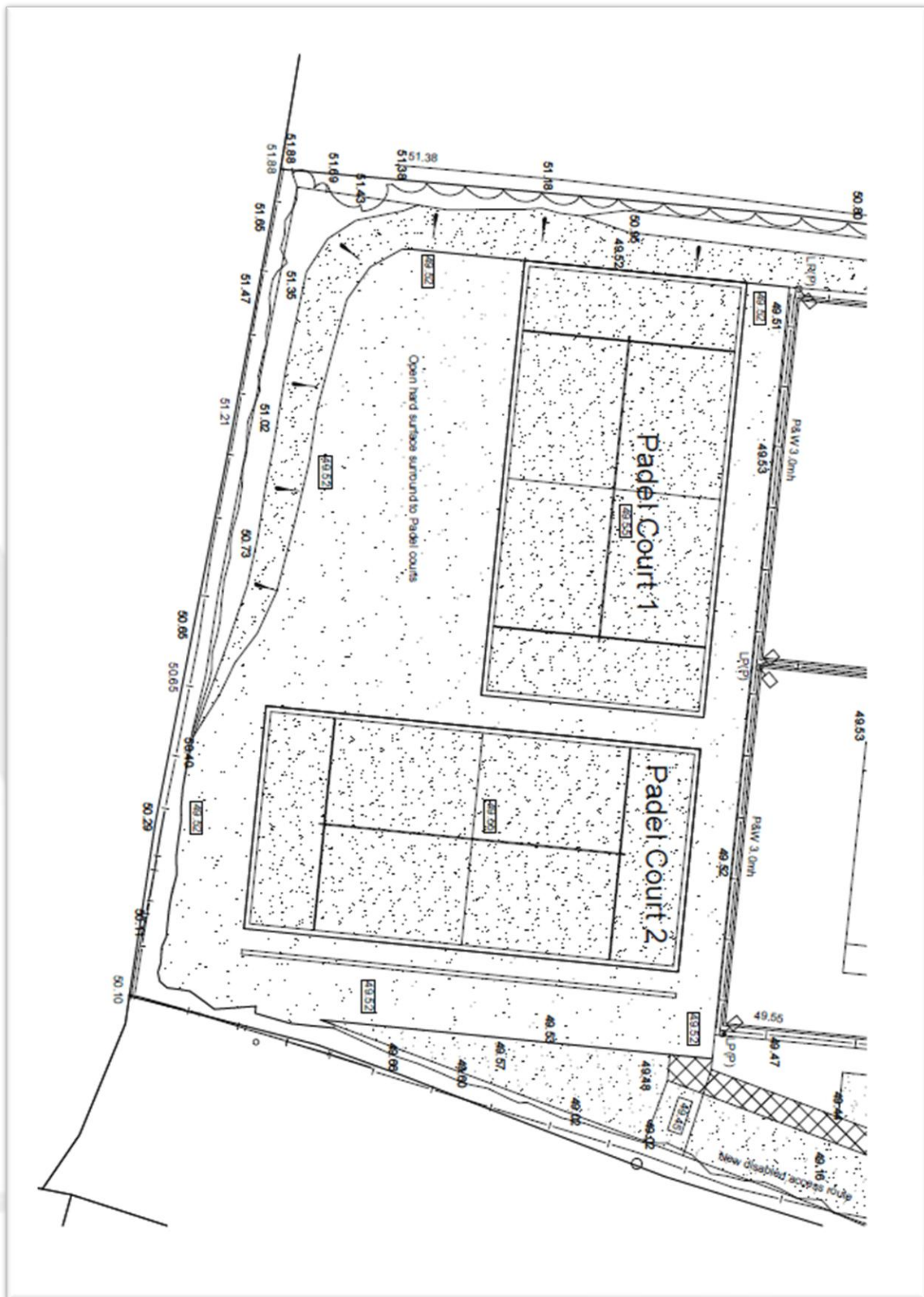


Fig 5.3b shows the position of the barrier relative to the courts in Option A upon which the calculations were performed, the distance from the barrier to the side of the court was measured as 1m.

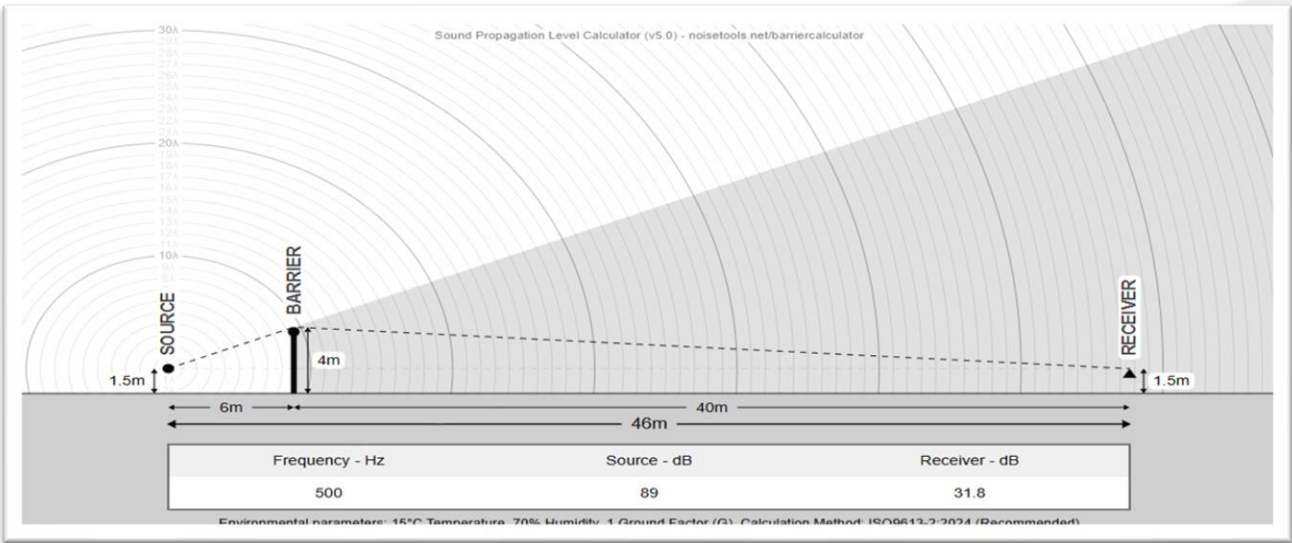


Fig 5.3c shows an example calculation of the barrier calculation and how it effects the noise propagation via 'line of site'. Both source and receiver measurements are taken at a standard height of 1.5m

5.3.4 Option F Research

The predicted noise attenuation from each court to each residence was calculated and the results are summarised in Table 5.3c

Option F Results	Ivy Cottage (no mitigation) dB	April Cottage/Ashton House (no mitigation) dB	Ivy Cottage (3m barrier) dB	April Cottage/Ashton House (2m barrier) dB	Ivy Cottage (4m barrier) dB	April Cottage/Ashton House (2.5m barrier) dB
Estimated Ambient façade LAEQ (without wind & tennis activity)	43	43	43	43	43	43
Ambient facade readings LAEQ (including tennis activity)	51	51	51	51	51	51
Court 1 contribution (LAEQ)	46	31.5	32.5	32.5	29	32.5
Court 2 contribution (LAEQ)	31	33.5	34	27	30	24
Combined padel contribution (LAEQ)	46	35.5	36.5	33.5	32.5	33
Court 1 average contribution (LAMAX)	66	51.5	55	55	51.5	55
Court 2 average contribution (LAMAX)	51	53.5	40	49	37	46
Site Measured average impact noise (including tennis activity)	61	61	61	61	61	61

Table 5.3c shows the results of the calculations for the padel contribution to the nearest properties to the Site and includes the insertion loss created by installing barriers at different heights. The blue barrier detailed in 5.3c represents a constructed acoustic barrier, the purple barrier represents the earth embankment which will be created after construction and calculated at different heights.

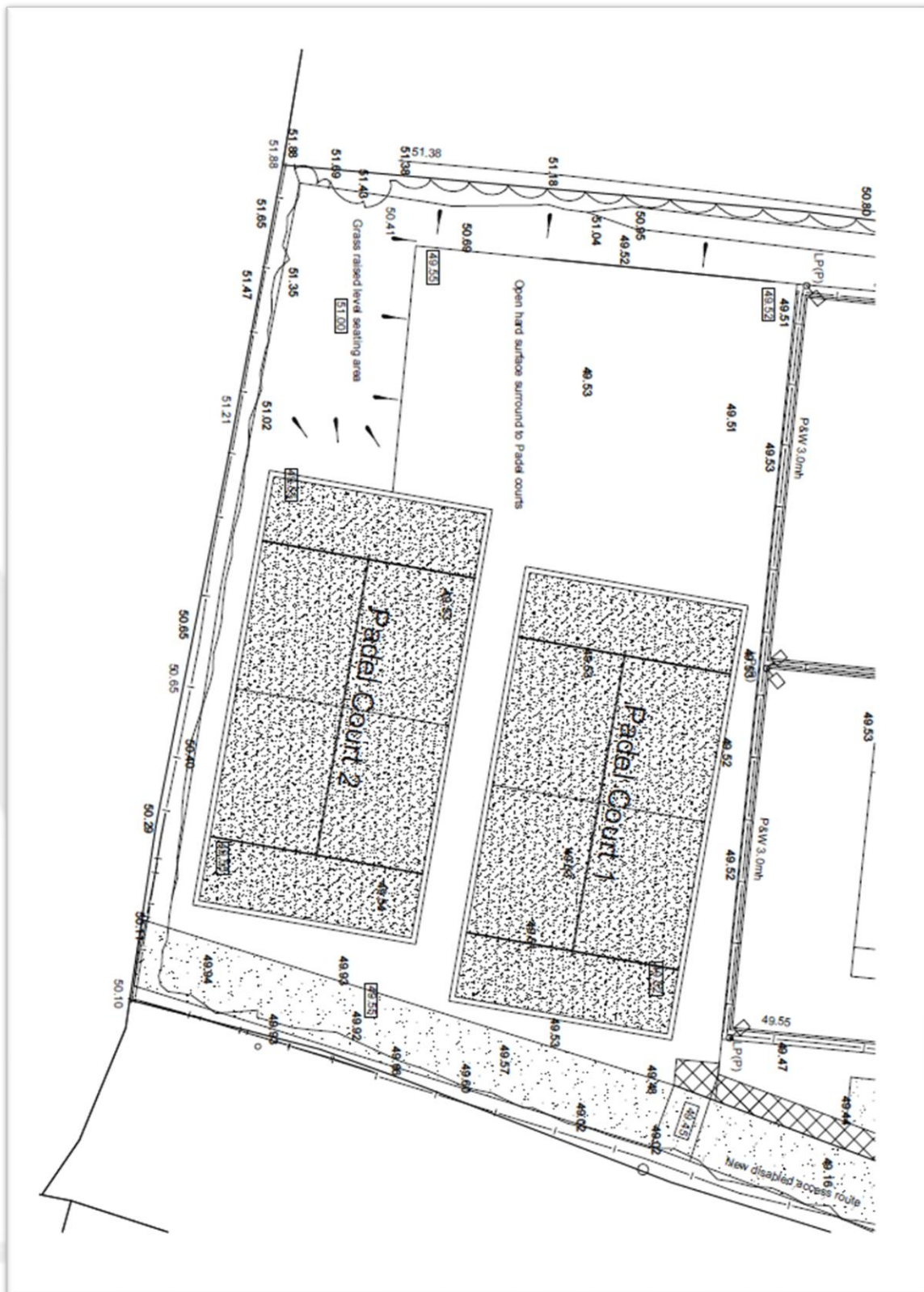


Fig 5.3d shows the layout of the courts in Option F upon which the calculations were performed.

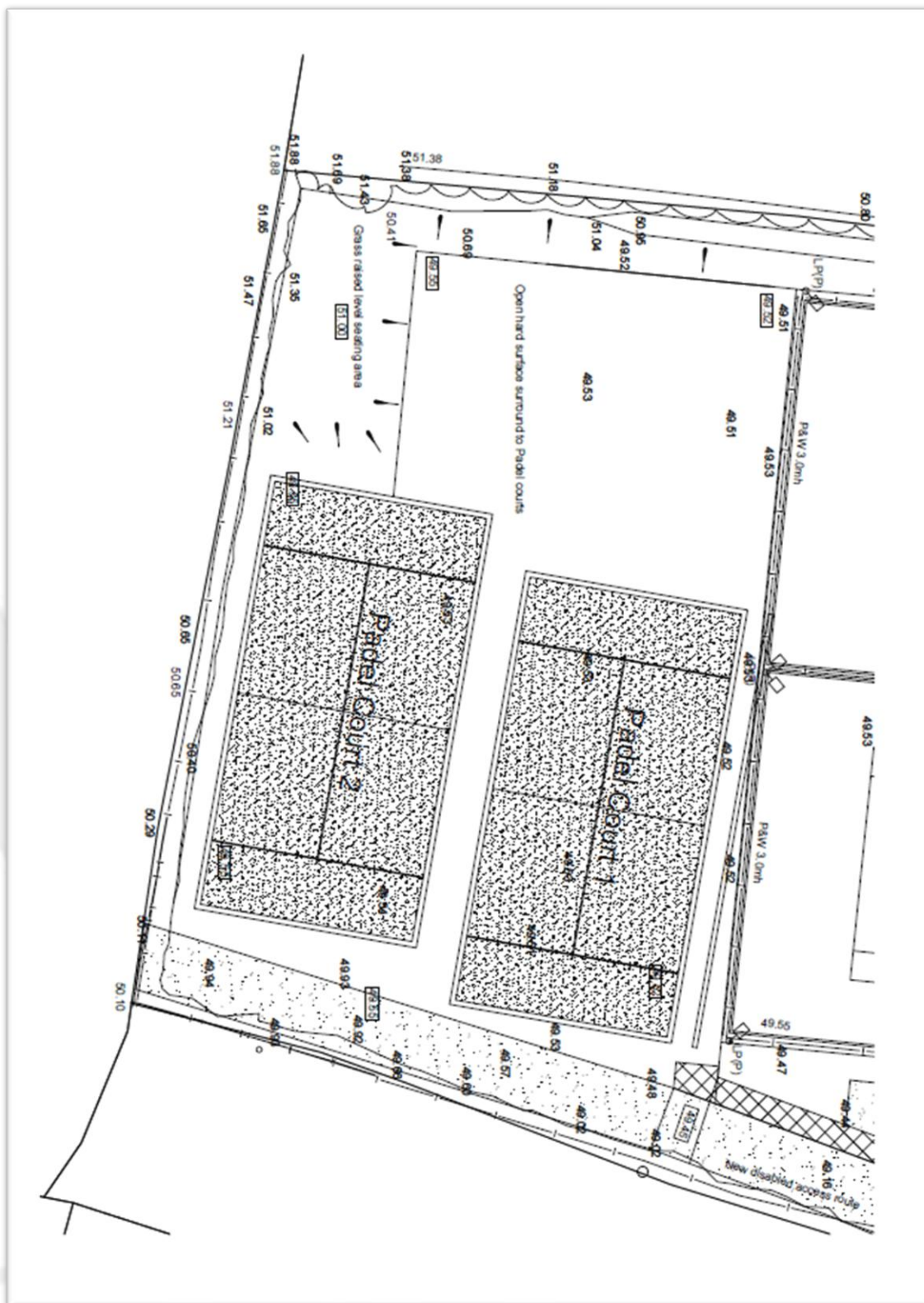


Fig 5.3e shows the position of the barrier relative to the courts in Option F upon which the calculations were performed, the distance to from the barrier to the side of the court was measured as 1m.

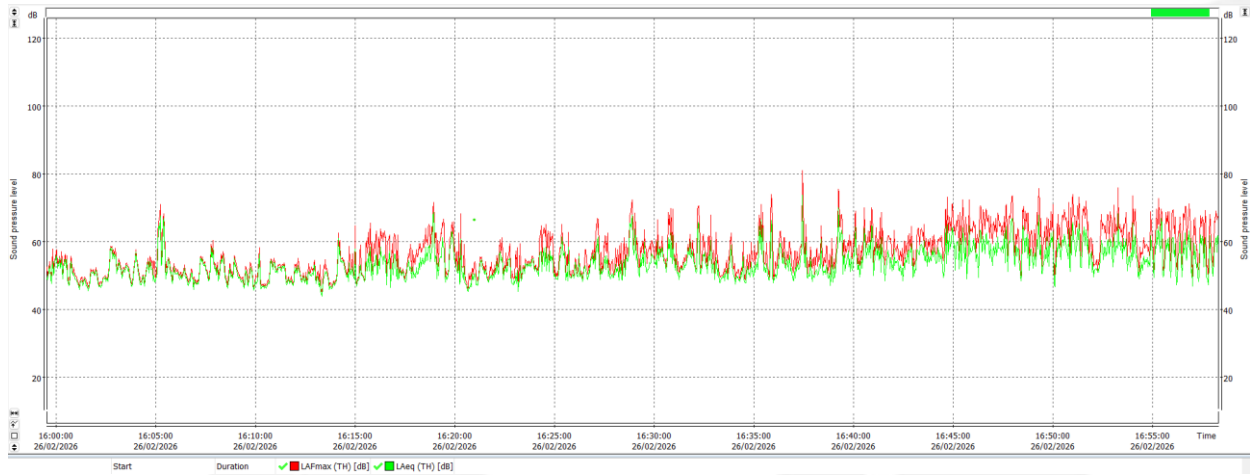


Fig 5.3f shows a time trace of the sound generated at MP2 when tennis play was occurring on the adjacent court. The green line represents the LAeq (continuous average noise), whereas the red line shows LAMAX (impact noise) cause by tennis.

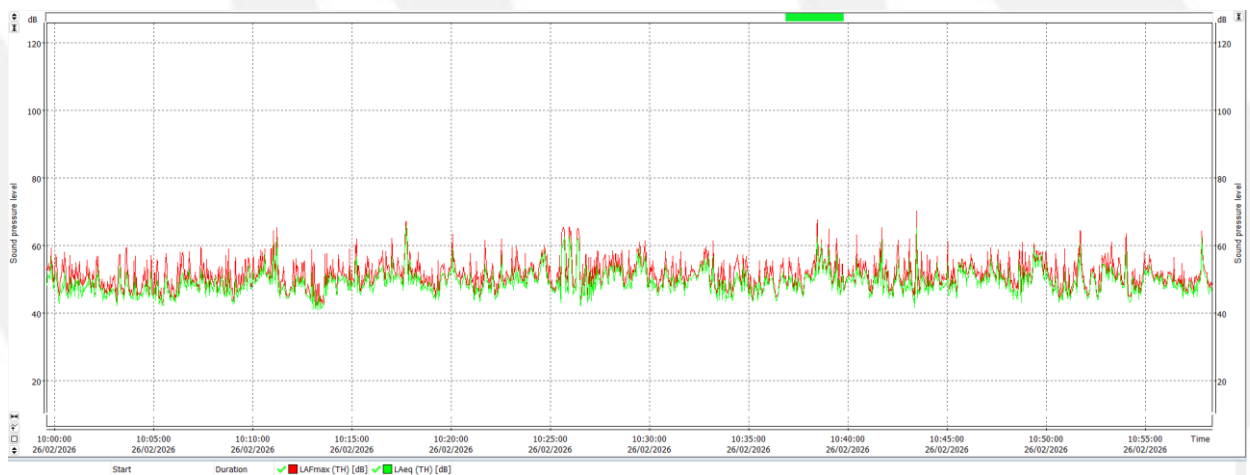


Fig 5.3g shows a time trace of the sound generated at MP2 with no tennis play. The green line represents the LAeq (continuous average noise), whereas the red line shows LAMAX (impact noise).

6 INTERPRETATION

The residences in of April Cottage/Ashton House and Ivy Cottage had been identified as being the most sensitive to the new padel noise source, due to their proximity and direct line of sight to the to the courts.

Attended measurements were taken over the 20 hours of continuous measurements on the site in order to estimate the ambient noise levels at all of the nearest buildings to establish the impact of new courts.

Predicted noise levels from the proposed padel courts were established from extensive measurement of existing padel courts in a club environment, where the courts were 100% utilised with doubles play and these levels included noise generated by congregating players. The prediction has been demonstrated to be a worst-case scenario in this regard.

The range of ambient overall (L_{Aeq}) noise levels were measured and estimated for the houses facades. Measurements taken for overall L_{Aeq} levels were higher than expected during times when tennis was not being played due to high wind during the day and its effect on numerous trees around the site. The exposed nature of the courts adjacent to the South Downs makes the site susceptible to this level of noise frequently, however for the purposes of best practice and anticipate a worst case scenario when this noise is not present average readings were taken from earlier in the day when there was no tennis play and less wind to estimate the façade levels.

Predicted noise levels were calculated and summarised in Table 6.1 below. In performing calculations, L_{Aeq} values (average continuous noise) were added logarithmically and a difference of more than 10 dB between values mean there would be no additional increase in levels. It was assumed during calculation of barrier effects that the noise source emanated from the middle of the court and the barriers were 100% effective.

The average ambient impulse noise values at the façade of the all the residences were measured and summarised also. The frequency (propensity) of impulse noises at the site is demonstrated in Fig 5.3f & 5.3g which shows an increase in the number of impact noises during tennis play and their L_{Amax} values (this will be within the same order of magnitude as will be produced by padel courts).

Comparative Results	Ivy Cottage (no mitigation) dB	April Cottage/Ashton House (no mitigation) dB	Ivy Cottage (3m barrier) dB	April Cottage/Ashton House (3m barrier) dB	Ivy Cottage (4m barrier) dB	April Cottage/Ashton House (4m barrier) dB
Estimated Ambient façade LAEQ (without wind / tennis)	43	43	43	43	43	43
Option A Combined padel & ambient facade level (LAEQ)	48	48	44.5	44.5	44	44
Predicted difference in facade levels with padel (LAEQ)	5	5	1.5	1.5	1	1
Option F Combined padel & ambient facade level (LAEQ)	48	44	44	43.5	43	43
Predicted difference in facade levels with padel (LAEQ)	5	1	1	0.5	0	0
Site measured average impact noise (with tennis)	61	61	61	61	61	61
Site Measured average impact noise (with tennis)	56	56	56	56	56	56
Option A Highest padel court contribution (LAMAX)	68	68.5	58	58	54	54
Option A Average padel contribution (LAMAX)	62	63	57	57	40	56
Option F Highest padel contribution (LAMAX)	66	51.5	55	55	51.5	55

Table 6.1 summarises the calculations of predicted noise levels from the proposed padel courts and compares them to existing levels for Option A and F. Values highlighted in red represent values which would exceed guidance (from estimated façade levels with no wind, when tennis was not in play)

7 CONCLUSIONS

There is currently no guidance for padel or tennis planning applications for the UK, therefore we must infer standards from associated guidance.

Sports England AGP guidance recommends that LAEQ noise levels should ideally be kept below 50 dB at the façade of the neighbouring properties, or where that is not possible, an increase of up to 3 dB would be acceptable (which would equate to a just audible increase for most people). BS8223 also recommends that these areas should be kept below 50 dB if possible, (the predicted values in the garden area of Ivy Cottage would be approximately the same as the façade values).

Table 6.1 shows that both options listed would require mitigation to fall within guidance.

Padel, like tennis is dominated by impulse noise so it is necessary to assess the impact of this also, however there is currently no UK guidance for impulse noise during daytime hours (2200-0700 hours).

CIEH (Chartered Institute of Environmental Health) published research for Clay Pigeon Shooting which recommended that impulse noise over 65 dB would have a greater chance of causing annoyance, however it should be noted that annoyance is a subjective measurement and will be influenced by a number of factors including the environment and an individual's attitude towards the source. WHO (World Health Organisation) recommends that 60 dB should be maximum criteria for impulse noise during the hours of nighttime (2200-0700) to avoid interference with sleep. This criterion is likely to be weighted lower to compensate for lower ambient noise levels during this period.

Average impulse levels were measured in the ambient environment whilst tennis was being played and not played, the readings were 61 & 56 dB respectively. In the absence of guidance, it is good practice to keep the average noise levels as close to those in the existing environment as possible. Both Options without mitigation have impulse levels exceeding 60 dB, but these would be reduced considerably in line with ambient levels with the addition of a 3m barrier. The frequency (propensity) of impact noise generated by padel is within the same order of that generated by tennis, therefore, when compared to the existing environment the impact of adding a further impulsive source is also reduced.

From the configurations investigated with mitigation, Option F does appear to be the most efficient in terms of noise reduction, however, the difference is marginal and certainly within the parameters of error of these calculations. Both options allow for congregation of players to occur at the far side of the courts, further away from residences which would reduce vocal noise. It is therefore recommended from a noise perspective, that both options are relevant and would conform to guidance.

In practice, as noise from padel courts comprise a series of intermittent vocal and impact noises, this would likely be heard on occasion in the garden area of Ivy Cottage in the same way that tennis would be. It is highly unlikely to be heard within the house, even with open windows. When there is wind present at the site as there was during the attended measurements, the ambient noise would mask most of the padel noise, but it may be heard intermittently. In both cases from experience and also from comparison to the benchmarks used in guidance, I would consider the impact of the padel courts to be non-intrusive at this site when mitigation is adopted. Performance specifications for mitigative wall construction are detailed in the Appendix.

It is noted that despite obtaining planning permission for this development, the Client has opted to consider a number of designs with the aim of reducing noise levels on the site for the local residents and has incorporated recommendations into the design.

8 APPENDIX

8.1 Measurement Limitations & Uncertainty

Measurements have been taken in accordance with guidelines which minimises, where possible any uncertainty in results, however, it would be impossible to eliminate uncertainty and therefore good practice to quantify where possible.

Limitations exist with the measurement equipment;

The devices used for measurement were Cirrus class 1 sound level meters. These are calibrated to an uncertainty level of +/- 0.7 dB @1KHz and are recalibrated every 2 years under laboratory conditions.

Prior to and post measurement, calibration of the sound level meter is performed by a field calibrator, which in turn is calibrated under laboratory conditions every 12 months. The pre and post project calibration variance in this instance was 0.3 dB and 0.4 dB respectively.

Uncertainty in environment;

Although assessments were made with regards to the environment, it cannot be guaranteed that the conditions were during the assessment remained, as variation of these assessments would lead to uncertainty, including;

Meteorological fluctuations, wind, temperature, humidity, rain

External polluting noise; in this instance road traffic and urban noise from the surrounding area being the major contributors

Subjective factors, assessment of the source being subject to varying opinion

8.2 Noise Survey Equipment

The following equipment was used for the noise survey.; Serial Number

8.3 Table 7.1 Noise Measurement Equipment

Measurement Position	Equipment Description	Manufacturer & Type No	Serial No.	Calibration Due Date
MP1	Sound Level Meter	Svantek SV971A	159458	11/12/27
	Calibrator	Svantek	48872	01/05/26
MP2	Sound Level Meter	Svantek SV971A	159480	11/12/27
	Calibrator	Svantek	48872	01/05/26

8.4 Mitigative Wall / Barrier performance Specifications

Designing an effective external acoustic wall to limit noise from a padel court requires consideration of wall orientation, material selection, and construction methodology. The primary objective is to prevent airborne sound which comprises typically ball impact noise, player vocalisations and equipment resonance from propagating toward nearby houses. Good performance within the barrier is a factor of both high surface mass and minimal sound leakage via good construction practice.

A well-designed acoustic barrier should provide a minimum surface density of 20–25 kg/m², as mass is the dominant factor in reducing airborne sound transmission. Common materials meeting this threshold such as concrete or brick are often selected for superior low-frequency attenuation due to their high mass (concrete block is denser than brick, if hollowed concrete blocks are selected, they can be filled with sand).

Internally, a multi-layer configuration can enhance absorption and reduces reverberant sound build-up. A typical construction might include:

- Single or double skin layer of block / brick
- An internal gap of typically 50–100 mm acoustic mineral wool absorber between structural layers
- An external render on which can increase sound reduction by up to 3dB

The internal gap reduces sound transmission through the wall by reduction of flanking noise (vibration). This gap offers a greater mitigative effect where there are reduced structural connections between both walls to prevent vibration transfer. This is more effective in preventing vibration caused by physical impacts.

Typical noise reduction values for common materials are listed below

Material	Typical noise reduction (dB)
Single skin brick	40
Double skin brick	42.5
Single skin concrete block wall (100mm)	45
Single skin concrete block wall (140mm)	50
Render	3

In practice, the efficiency of any barrier would be reduced by sound passing around and over the structure and therefore investment to higher levels than those detailed above would provide diminishing returns. As mentioned above, double leaf construction with an internal gap is most effective in reducing flanking noise caused by physical impacts, but this configuration would offer substantially less value for a barrier constructed at Storrington, which needs to reduce airborne noise. For efficient reduction of airborne noise, construction of the barrier with a dense material will be efficient in reflecting noise including low frequencies.

For the options noted above, the most effective construction would be for a single skin concrete block wall (140mm) which would effectively reduce sound passing through the barrier by 50 dB.

8.5 Images of the padel site



Fig 8.4a shows border of the garden area of Ivy Cottage adjacent to the proposed padel development



Fig 8.4b shows the image of the clubhouse and car park, with the border of Ivy Cottage



Fig 8.4c shows an image of the area earmarked for development of the padel courts

9 GLOSSARY OF TERMS

Sound – an acoustic effect perceived by an individual. Sound is perceived differently by individuals and is highly subjective. Acoustically for sound to be perceived it has to be above the threshold of hearing (typically taken to be 0dB) but this threshold varies between individuals.

Noise – noise is defined as unwanted sound. The level at which noise is present will indicate the potential impact. In order for a sound to become noise, it has to be perceivable by the individual. Technically noise can be described in terms of its acoustic profile, typically though noise at or below the ambient levels is rarely loud enough to be considered significant.

Acoustic environment sound from all sound sources as modified by the environment [BS ISO 12913-1:2013]

'A' Weighting – This function modifies the linear frequency response of the meter sound profile to attempts to simulate the characteristics of human hearing. Hence a dB(A) reading is a subjective evaluation of what we actually hear whereas dB(LIN) (now written dBZ), is an objective reading of what is actually present. A weightings are normally used in environmental and occupational measurements

Ambient – This is the general level of sound in an area. It is usually composed of sound from many sources near and far, that together make the 'average' noise for an area. Ambient noise is normally described using a long term average sound level (typically L_{Aeq}).

Ambient sound – totally encompassing sound in a given situation at a given time, usually composed of sound from many sources near and far. *NOTE The ambient sound comprises the residual sound and the specific sound when present.*

Ambient Sound Level, $L_{Aeq,T}$ – equivalent continuous A-weighted sound pressure level of the totally encompassing sound in a given situation at a given time, usually from many sources near and far, at the assessment location over a given time interval, T . *NOTE The ambient sound level is a measure of the residual sound and the specific sound when present.*

Attenuation – The loss in energy level of the sound usually used in relation to the loss due to sound passing through a structure or enclosure.

Background Noise Level – The underlying level of sound in the absence of the source is normally measured as an LA90, the level which is exceeded by 90% of sound present. This measurement effectively screens out transient noises. Occasionally LA99 is used which is the level which is exceeded by 99% of the sound present.

Background sound level, $L_{A90,T}$ – A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T , measured using time weighting F and quoted to the nearest whole number of decibels

Decibel (dB) – a unit or level, derived from the logarithm of the ratio between the sound pressure measured and a reference value. For sound pressure level the reference quantity is 20μPa, the threshold of normal hearing is in the region of 0 dB and 140 dB is the threshold of pain. A change of 1 dB is only barely perceptible whilst a change of 10dB is considered significant. Sound pressure levels are noted as SPL, sound power can also be measured as a ratio of energy values, and is normally noted as SWL.

dB(A) (See A weighting above) – decibels measured on a sound level meter weighted by a scale which is designed to reflect the perception by the human ear. A noise meter incorporates a frequency weighting device to create this differentiation. Measurements in dB(A) broadly agree with people's assessment of loudness for broadband noise. A change of 3 dB(A) is the minimum perceptible under normal conditions, and a change of 10 dB(A) corresponds roughly to halving or doubling the loudness of a sound. The

background noise level in a living room may be about 30 dB(A); normal conversation about 60 dB(A) at 1 metre; a busy factory may have a level around 85dB(A); the level near a pneumatic drill about 100 dB(A).

Equivalent continuous A-weighted sound pressure level, $L_{Aeq,T}$ – value of the A-weighted sound pressure level in decibels of continuous steady sound that, within a specified time interval, $T = t_2 - t_1$, has the same mean-squared sound pressure as a sound that varies with time. *NOTE The equivalent continuous A-weighted sound pressure level is normally quoted to the nearest whole number of decibels.*

Frequency – This is the number wavelengths passing a given point per second. The unit is the hertz (Hz). Frequency is the normal variation in pitch that most sounds have over time. Sound is normally made up of many different frequencies, and they behave differently within the environment. For example, moderate and high frequencies are damped out easily by barriers, screens or enclosures while low frequencies are more difficult to attenuate, which explains why loud music from a neighbour perceived through a wall often only sounds like a dull base thumping noise.

Impulse Noise – Single or repeated sound of short duration such as a bang or crash.

L_{A90} – The A weighted noise level exceeded for 90% of the specified measurement period. It is a statistical measurement. Used in BS 4142:2014 as the baseline for impact assessment and more generally it is used to define background noise level. Example, if a sound measurement carried out each second over 100 seconds the L_{A90} result would be the level representing the quietest 10% of the readings i.e. 10seconds.

L_{Aeq} – The equivalent continuous sound level - the sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period. L_{Aeq} is used to describe many types of noise and can be measured directly with an integrating sound level meter. It is obtained by continuously integrating ('adding up the energy of') a fluctuating sound signal and dividing by the elapsed time, to give the true mathematical average of any time varying signal. An L_{eq} reading must always be related to a time period, it should not be read as an instantaneous value of sound pressure.

L_{Amax} – The highest A weighted noise level recorded during a noise event. The time weighting used (F or S) should be stated. Almost all environmental measurements are 'Fast' weighted.

Logarithmic – A scale where the exponent indicating the power to which a fixed number, the base, must be raised to produce a given number. The base used in acoustics is 10. Thus, the logarithm of 10 = 1, the logarithm of 100 = 2 and the logarithm of 1000 = 3. Logarithms are used to convert very spans of pressure or energy measurements into usable scales.

Loudness – An observer's auditory impression of the strength of a sound. It is a subjective effect which is a function of the way we hear, and psychoacoustic response as well as the amplitude and frequency of the sound.

Masking – The process by which the threshold of hearing of one sound is reduced due to the presence of another which 'masks' the first.

Measurement Periods (T) – is the period over which the measurement is taken, normally varies between 5mins to an hour. More commonly 'real time' analysis and new data storage capabilities has allowed measurement times to be reduced to 1 second

Measurement time interval, T_m – total time over which measurements are taken. *NOTE This may consist of the sum of a number of non-contiguous, short-term measurement time intervals.*

Meter response and time weightings – Sound Level Meters are provided with a sampling reference time weightings dependent on the sounds to be assessed. The variable time response control with settings are:- 'S' Slow; 'F' Fast; 'I' Impulse; 'P' Peak.

'S' Slow – meter response is over damped with a time constant of approximately 1000ms. The setting tends to average out variations in sound levels in the readings.

'F' Fast – meter responses sample over a response of 125ms. i.e. the measurement for variable sound will respond each 1/8th of a second showing a value.

'I' Impulse – uses a special electrical circuit with a time constant of about 35ms (of the same order as the response time of the human ear) to permit a very rapid response for investigating very sudden, short duration - impulsive - sounds. This setting incorporates a detector which in effect stores the signal for sufficient time to allow it to be displayed. Also a slow decay rate is incorporated with time response of approx. 1500ms to allow more easy reading of the maximum value as the indicator moves back relatively slowly.

Peak – Sound Level Meters often incorporate this setting which enables the **absolute peak** (as opposed to the rms) value of an impulsive waveform to be measured. A time constant of the order of 20 - 50 micro seconds is now involved to permit the following of very sharp impulsive events. Evidently electrical signal storage is also required to permit the meter to register the peak of such very fast events.

Rating Level – The specific noise level of a source when measured at receiver location (usually averaged over a time interval) plus any adjustment (penalty or weighting) for the characteristic features of the noise. It is used in BS4142 to rate the likelihood of complaints.

Reference time interval, T_r – specified interval over which the specific sound level is determined. *NOTE This is 1 h during the day from 07:00 h to 23:00 h and a shorter period of 15 min at night from 23:00 h to 07:00 h.*

Residual sound – ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound

Residual sound level, $L_r = L_{Aeq,T}$ – equivalent continuous A-weighted sound pressure level of the residual sound at the assessment location over a given time interval, T

Specific sound level, $L_s = L_{Aeq,T_r}$ – equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T_r

Specific sound source – sound source being assessed

WHO – World Health Organisation