Siting of Synthetic Grass Pitches - Guidance on Noise and Floodlighting

Introduction

Synthetic Grass Pitches (SGPs) provide many hours of play for pitch sports, and are a valuable resource for sport and recreation. They enable pitch sports to be played outside for longer, particularly given the climatic conditions in Scotland.

Suitable provision of SGPs aligns with sportscotland's Corporate Plan 2015-2019; a key priority of which is "Everyone will have access to a network of quality places where you can get involved in sport." SGPs can also help make quality places which promote healthy lifestyles; 'placemaking' being a key Scottish Government priority for the Scottish planning system.

Planning proposals for SGPs can be controversial, with concerns expressed around issues such as noise and floodlighting. However, experience of SGPs in use suggests that they do not generally result in noise related problems except when located in very quiet areas or where offensive language is prevalent, and that modern design of floodlighting allows 'bleed' or light spillage to be well controlled.

In light of concerns expressed around planning proposals for SGPs; with these often focussed on noise and lighting; this guidance note considers both elements; it provides further information on lighting and the type and amount of noise generated by use of SGPs; it suggests methods of mitigating impacts on neighbours; and outlines a recommended planning application approach where a Noise Impact Assessment (NIA) is required, and where floodlighting is to be addressed. This is intended to assist Clubs and other groups who may be looking to develop an SGP.

The accompanying Technical Note, in Appendix 1, provides technical acoustic data and suggested approaches and methodologies for assessment and mitigation of noise impacts by acoustic consultants where NIAs are requested by the Planning Authority.

Noise from Synthetic Grass Pitches

Synthetic Grass Pitches are primarily developed for football, rugby and hockey use, for both training and match play. There are therefore a number of variables that need to be considered when carrying out NIAs, including the type of sport(s) that will use the pitch, the number of teams and participants that could be on site at any one time, and the potential changing location of the goals when used for either training or match play.

It should also be noted that Multi-Use Games Areas (MUGAs), which are used for a range of informal sports activity, may also have similar noise impact issues. The data below is also helpful when assessing the noise impact of MUGAs.

Studies (see Appendix 1) have been undertaken to assess the noise levels obtained for the range of activities (training and match play) and groups for the three principal SGP sports; taking into account player, ball impact, referee whistles and spectator noise. This data has been standardised to levels at distances of 10 metres from the main SGP pitch perimeter lines – which should be considered the source lines for the generated noise.

These standardised noise levels, which are recommended for use in assessment of SGP generated noise, are shown below:

Sport	Mean, L_{Aeq}
Football	61dB(A)
Rugby	58dB(A)
Hockey	66dB(A)

Standardised Noise levels 10m from pitch perimeter line

Design Targets

Design targets that are appropriate for typical uses of SGPs are set out in World Health Organisation (WHO) guidelines for community noise. These guidelines indicate that levels external to dwellings should be no more than:

- 50dB, $L_{Aeq,16hrs}$ close to windows to dwellings, to ensure reasonable conditions within dwellings for daytime rest and relaxation (with windows open for ventilation); and
- 55dB,$L_{Aeq,16hrs}$ for outdoor living spaces (often interpreted as referring to private 'amenity areas' in Scotland).

The level "close to windows" determines inside levels and relates therefore to criteria for internal conditions.

The external level for outdoor living spaces relates to daytime external use of amenity areas - which may be much closer to the pitch than the nearest windows of a dwelling.

Levels in excess of the WHO guideline values do not necessarily imply significant noise impact and indeed, it may be that significant impacts do not occur until much higher levels of noise exposure are reached. The impact of noise from SGPs will often depend upon the difference between the new noise and existing ambient levels.

In certain circumstances, therefore, it may be appropriate to assess noise impacts by comparison of the probable SGP generated noise level with existing ambient noise levels, taking account of both the characteristics of the noise and the context i.e. the existing noise environment. Discussions with the Local Authority Environmental Health Department will establish which criteria and assessment methodology should be used for a given site and specific development.

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Mitigating Noise Impacts

Site Layout

Application of the following design principles can be helpful in reducing noise impacts upon neighbours and should be considered at the earliest stages of possible site identification and assessments of suitability:

- Bench and main entrance areas to pitch areas should be planned to be as far as possible from neighbours which could be affected.
- Hockey pitches, which are noisier than other sports pitches (due to the use of hard backboards), should be located, whenever possible, at distances further from houses than any football / rugby pitches planned for the same site.
- The location of sports facilities in areas where ambient noise levels are high will help reduce noise impacts.
- Main and temporary goals on hockey / football pitches are principal sources of noise particularly during training and warm up sessions. Accordingly the distance to houses and the orientation of pitches should take this into account (distance attenuation and barriers).

Offensive Language

There can be concerns about the use of offensive language at sports pitches. The impact of this can be reduced by management and / or by using barriers or acoustic separation between pitches and homes. Management tools should be encouraged but it is recommended that, as a minimum, signage discouraging the use of offensive language should be erected on, or around, pitches.

Reducing, or eliminating, the impact of offensive language will depend upon background noise levels, availability of space for achieving distance attenuation and the affordability / practicality of introducing one or more noise control barriers to reduce separation distances.

This issue can be discussed with the Local Authority when determining the criteria to be applied in any required NIA. However, it should be noted that offensive language is by no means an issue at all sites and it may be appropriate simply to ensure that it is possible, at a later date, to introduce mitigation measures should the need arise.

Operational Hours of Use

The operational hours for use of SGP pitches can extend from mornings (e.g. 0900 / 1000hrs) into evenings, until 2200hrs. There can be intensive use of SGPs during late afternoons and evenings and weekends, especially for training.

sportscotland recommends that every site is considered on its own merits and does not recommend standard planning conditions regarding operating hours. We suggest that conditions restricting hours of use are used only where an NIA has demonstrated that this will have a clear need in relation to the particular site and proposal.

Fencing

Ball impacts on metal fences are significant sources of noise. This can be reduced by the use of fence mounting systems which employ resilient connections between the perimeter fencing and the supporting structural columns. Increasing the distances between the pitch fence and the perimeter of the playing areas will also reduce the impact noise levels from balls hitting perimeter fences.

Noise resilient clip retrospectively fitted to fence at Primary School pitch site. Site had been subject of noise complaints from neighbours due to ball being kicked off fence; and after clips fitted; no further complaints have been received.

Hockey Backboard Protection

Protection pads can be inserted onto hockey backboards during training to reduce noise. These pads can then be removed during match play, when the noise of the ball against the backboard is used as confirmation of penalties. Given the additional cost we do not recommend this for all sites; however this may represent appropriate mitigation if hockey training is leading to noise complaints.

Barriers

Barriers are most effective if they are located close to the noise source or close to the Noise Sensitive Receptor (i.e. homes) and work well when they provide large differences between the direct sound path (between source and NSR) and the sound path over the top of the barrier.

It's necessary to consider the noise generated at the pitch boundary furthest away from the barrier – as it may be that the barrier will not offer the same levels of reduction, at the nearest NSR, due to the effects of sight-line differences between the nearest source line and the furthest source line.

Barriers can readily reduce noise levels by between 5db and 15dB but much will depend upon the relative ground levels between pitch and NSRs and the effective height of a barrier, as shown below in Diagram 2 below. The first plan shows a straightforward situation of a barrier on horizontal terrain; whilst the latter two show the different implications when the pitch and house or other Noise Sensitive Receptor are on different levels.

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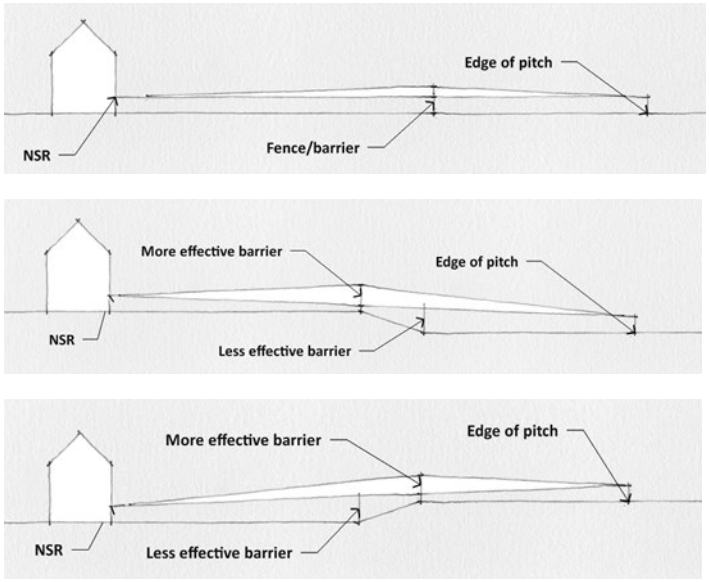


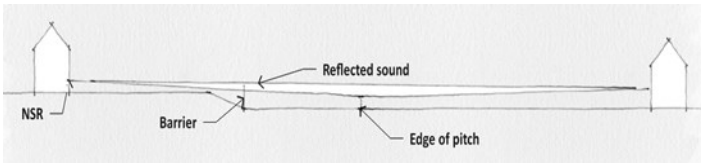
Barrier effectiveness – effects of levels and heights

Barrier Choice

To be effective; barriers have to be without gaps and cracks and weigh at least 10 to 15 kg/sq.m. Earth bunds, masonry walls and solid timber fences are often used to provide acoustic barrier effects and sometimes planted "living walls", glass or acrylic panels are used to reduce the visual impacts of barriers.

Reflections from Building Facades

Reflections from nearby building facades can increase the noise directed towards noise sensitive receptors and reduce the effects of barriers by reflecting sound over the top of proposed barriers. Siting SGPs away from building facades will help reduce this effect, or barrier heights would need to be adjusted to take account of such reflection paths, as shown below.



Impact of reflections from building facades

Expert Advice

As the assessment of barrier reductions, reflections and attenuation of sound with distance can be complex; it is recommended that an acoustic consultant is appointed to carry out the assessments and provide advice on noise mitigation.

Planning Application Approach

When a Local Authority has indicated that an NIA will be required; we recommend that you appoint an acoustic consultant before the planning application is prepared. Then in conjunction with the acoustic consultant:

- Agree Noise Impact Assessment criteria with Local Authority Environmental Health Officer (EHO)
- Agree anti-social behaviour criteria / controls
- Use recommended assessment levels in Table 1 above
- Measure Background Noise Levels for critical periods of pitch use
- Consider options for reduction of fence noise
- Take source location(s) as perimeter of pitch nearest each NSR / house
- Predict distance attenuation taking into account source data standardised at 10metres from pitch perimeter
- Assess barrier effects in relation to nearest and furthest perimeter located source positions for each pitch
- Assess impacts at nearest noise sensitive uses
- Prepare and submit NIA to accompany the planning application
- Ensure the report provides plain English summary and recommendations

Acoustic consultants are listed on the **Association of Noise Consultants** website at www.association-of-noise-consultants.co.uk or in the **Institute of Acoustics Directory of Service Providers** at www.ioa.org.uk/find-acoustics-specialist-or-supplier

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Floodlighting - Design Guidance

Full details of floodlighting systems are normally required by the planning authority – as part of the planning application or by way of planning condition(s). sportscotland recommends appointing a suitably qualified contractor and / or consultant at an early stage in the project, and submitting full details of floodlighting alongside the planning application. This can reduce delays from information requests while the planning application is being considered, it may help alleviate neighbour concerns, and can reduce the number of planning conditions associated with any grant of planning permission.

Artificial light can be deemed a statutory nuisance – where it creates an adverse impact on a person's reasonable enjoyment of their property. To minimise or avoid such impact, and to minimise light pollution; it is important to select floodlighting (including height, lighting angle and number of columns) to ensure optimum visibility but without "over" lighting. Over lighting is a waste of energy and cost so the floodlighting design should reflect the use of the pitch.

Design information is provided below to help this process.

Minimum Lux Levels (Maintained) Class	Maintained Lux	Activity
Hockey		
I	500	High-grade national club and international competition
II	350	Higher league club competition
III	350	Junior and lower league club
Football		
I	200	Competitive play
II	75	Training level
Rugby		
I	200	Competitive play
II	100	Training level

It is recommended that a flexible system is installed to allow the floodlighting system to be efficiently switched between the two lighting levels (training and competition).

It is recommended that to ensure an even lighting level is distributed across the field of play the uniformity values noted below are achieved:

- Hockey – Minimum/Average uniformity – 0.7
- Football – Minimum/Average uniformity – 0.6
- Rugby – Minimum/Average uniformity – 0.6

The closer the figure is to 1; the more uniform the lighting across the space.

Good lighting design aims to achieve four things:

- Ensuring optimum visibility for participants and spectators ;
- Creating a visually satisfying and interesting scene;
- Ensuring that the lighting system integrates well with the surrounding architecture; and
- Minimising light spillage and making good use of energy resources.

The last point (light spillage) is often a concern of neighbours and the next section considers mitigation in this respect.

Mitigating Floodlighting Impacts

Mast height

Mast height should be calculated to allow the lighting across the field of play to comply with specified uniformity requirements for the primary sport played on the area, whilst maintaining a maximum beam angle of 70 degrees. The average recommended mounting height for a pitch with a fenced width of up to 70m is between 13m and 18m.

Sections

Floodlighting systems should be installed such that they can be switched into sections when the whole pitch is not is use. An example of this is a full sized synthetic grass pitch sub-divided into smaller training areas.

Maintenance

Floodlighting systems should be well maintained to perform to the intended illuminance level. It is recommended that a maintenance package is included within the original floodlight installation and forms part of the installation guarantee. This should include the annual cleaning of lamps and replacing any lamps that fail within the first 4000 hours.

Reflection

The design should ensure that no floodlighting bulb reflecting surface should be visible within any residential premises.

Painting

Lighting poles can be painted to minimise contrast with the sky. This does not affect illuminance levels but can reduce visual impact.

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Planning Conditions

Planning permissions for SGPs often have a number of planning conditions related to floodlighting. Whilst the wording of these conditions can vary; they generally seek to control:

- Floodlighting position and direction
- Floodlight height and technical specification
- Light spill / illumination of neighbouring land / glare / upward light levels
- Hours of use / lights to be on only when in use / use of a cut-off device

Where the floodlighting has been appropriately designed, and this has been detailed within the planning application; then there may be no requirement for planning conditions dealing with the first three issues.

sportscotland does not recommend the use of conditions limiting hours of use as standard since this can unnecessarily restrict play. However, an agreement to switch floodlights on only when the SGP is in use is considered to be a reasonable approach.

3G pitch at Craigie Sports Hub, Dundee – 8 floodlighting masts allowing the pitch to be split into thirds.

Planning Application Approach

When submitting a planning application for an SGP with floodlighting; we recommend that you follow these steps:

- Consider, in consultation with a contractor and / or consultant; your floodlighting needs, addressing factors including which sports(s) are to be played, level of play and potential subdivision of pitch
- Design a floodlighting system taking all these factors into account, and ensure you have a suitable maintenance plan
- Discuss your proposals with the local authority Environmental Health Officer (EHO)
- Consider any amendments following this pre-application discussion
- Prepare a revised floodlighting plan and a non-technical summary; to include impacts on neighbours etc. (This summary can be of assistance for neighbours, planning officers and Councillors)
- Submit the plan and summary alongside the planning application

Appendix 1: Technical Note

1.0 Introduction

1.1 sportscotland commissioned CSP Acoustics LLP to carry out studies of SGP activity noise, for a range of conditions, so that the preparation of noise impact assessments in relation to new facilities or development of existing ones can be carried out with reasonable confidence that potential impacts are being effectively assessed and the layout and construction of sites informed by a range of potentially effective remedial measures.

This section is intended primarily for use by acoustic consultants and EHOs.

2.0 Impacts on Dwellings and other Noise Sensitive Receptors and Uses

2.1 Noise sensitive uses that may be affected by the activities on new or redeveloped SGP sports facilities can include existing or proposed:

- Dwellings
- Hospitals
- Schools
- Health Centres (consulting rooms)
- Hotels / Conference facilities
- Drama / Theatre spaces

The criteria for assessment of these facilities normally will be determined by the Local Authority in accordance with *PAN and TAN 1/2011: "Planning and Noise"*. For dwellings (and hotels and hospitals) the criteria will typically be based on the rest and relaxation criteria outlined by the World Health Organisation (WHO) *"Guidelines for Community Noise": Berglund*) and *BS8233: 2014 – "Guidance on sound insulation and noise reduction for buildings" w*hich identify maximum internal levels of 35dB, $L_{Aeq(16hrs)}$ to 40dB, $L_{Aeq(16hrs)}$ with windows open for ventilation. These criteria result in equivalent external levels of 50 to 55dB(A), close to the façades of the relevant buildings. For external living spaces, often interpreted as private amenity area, the WHO recommends 55dB, $L_{Aeq\ (16hrs)}$. Accordingly for Noise Impact Assessments data for period L_{Aeq} levels for the SGP based activities will need to be available.

[Only during night-time are L_{max} levels utilised in specifying sleep disturbance criteria (dwellings and hospitals). As night-time is categorised as 2300hrs to 0700hrs, the use of L_{max} criteria will not normally be applicable to the assessment of SGP pitch facilities.]

2.2 In certain circumstances (where existing Background Noise Levels are low) it may be appropriate to assess the probable impact in terms of BS4142 style assessments (c.f. TAN 1/2011, Example 2), which would enable both the characteristics of the noise and the context i.e. existing ambient noise levels and time of day, to be taken into account.

Where ambient levels are relatively high in relation to the probable impact of noise levels from sports activities then use of simple maximum exposure levels (e.g. WHO criteria for rest and relaxation) should normally be appropriate. Nonetheless, given the character of sports related noise it may be appropriate to consider use of the sports L_{eq} level (not adjusted to give a 16hr L_{eq} value) and compare with the WHO Rest and Relaxation criteria. This will provide a safety factor in assessment comparable to one of the noise character adjustments applied to rating levels under BS4142 type assessments.

3.0 Assessment Criteria - Daytime (0700 - 2300hrs)

3.1 World Health Organisation (WHO)

From research commissioned to examine community noise the WHO has recommended that criteria for daytime levels within indoor living areas should be maximum exposure levels of 35dB $L_{Aeq,16hr}$).

By assuming a reduction through a window, opened for ventilation, of 15dB the WHO concluded that external levels in relation to indoor use should not exceed 50dB(A), L_{Aeq} at 3.5metres from the facade of a dwelling. (It should be noted that these are free-field values and façade reflection effects will give levels some 2.5 to 3dB(A) higher at 1metre in front of receiving facades).

3.2 BS 8233:2014: "Guidance on sound insulation and noise reduction for buildings"

This document establishes basic criteria for dwellings as follows:

Daytime Criteria for Dwellings:

Living Rooms 35dB, $L_{Aeq,16hrs}$
Dining Rooms 40dB, $L_{Aeq,16hrs}$
Bedrooms 35dB, $L_{Aeq,16hrs}$

3.3 Levels to External Living Areas

WHO recommends 55 or 50dB $L_{Aeq,16hrs}$ for external living areas. In Scotland this is often interpreted as a criterion level for the designated private external "amenity" areas to dwellings.

3.4 PAN 1 / 2011 - Planning and Noise

In March 2011, the Scottish Government issued PAN1 / 2011 "Planning and Noise" together with an associated Technical Advice Note. This permits, inter alia, individual Local Authorities to specify criteria and methodologies for Noise Impact Assessments that each considers appropriate.

TAN1/2011 suggests, in Example 2, a method of assessment which, unlike BS4142: 2014, can be used for assessing the likelihood of complaint in relation to recreational developments. This method of assessment takes account of the nature of the noise being rated, compares the predicted impact rating level with ambient levels (measured in L_{Aeq}) and takes account of the sensitivity of a receptor, based upon comparison of rating level with background noise level - as shown below:

Table 3.5: Significance of Effects

Magnitude of Impact (After – Before) $L_{Aeq,T}$ dB	Sensitivity of Receptor based on likelihood of complaint x = (Rating ($L_{Ar,Tr}$) – Background ($L_{A90,T}$)) dB		
	Low (x < 5)	Medium (5 ≤ x < 10)	High (x ≥10)
Major (≥5)	Slight/Moderate	Moderate/Large	Large/Very Large
Moderate (3 to 4.9)	Slight	Moderate	Moderate/Large
Minor (1 to 2.9)	Neutral/Slight	Slight	Slight/Moderate
Negligible (0.1 to 0.9)	Neutral/Slight	Neutral/Slight	Slight
No change (0)	Neutral	Neutral	Neutral

Very Large: These effects represent key factors in the decision-making process. They are generally, but not exclusively associated with impacts where mitigation is not practical or would be ineffective.

Large: These effects are likely to be important considerations but where mitigation may be effectively employed such that resultant adverse effects are likely to have a Moderate or Slight significance.

Moderate: These effects, if adverse, while important, are not likely to be key decision making issues.

Slight: These effects may be raised but are unlikely to be of importance in the decision making process.

Neutral: No effect, not significant, noise need not be considered as a determining factor in the decision making process.

4.0 Noise from Training and Matches

4.1 Surveys to establish Noise levels from SGP activities and uses:

A series of surveys of whole matches, part matches, intensive training sessions, casual matches and casual training sessions were carried out over an extended period of time (more than 10 survey days) at a number of SGP facilities in the East of Scotland covering the most common SGP based sports - football, rugby and hockey. Measurements were carried out at standardised distances from the edge of the SGP pitches, on the centre-line of the length and width of the pitches and at locations remote from reflecting surfaces (other than ground plane) and when background noise levels were unlikely to influence period values of the sports activities.

4.2 Team sizes and Age Group Variables

Matches and training sessions involving different groups of participants (male, female, adults, youths and juniors) were surveyed with team sizes varying from small groups of players, to large group number of players and including one session where more than 300 juniors were involved in training sessions.

4.3 Survey Results

The resultant extensive set of measurements and scenarios was then utilised to establish typical / mean period levels and the range of sound levels (between the levels exceeded for 90% of the survey periods and the levels exceeded for 10% of the survey periods) for each aspect of use of SGPs for matches and training for each sport.

4.4 Noise Generation - Training and Matches

From the three measured sports, hockey was considered to be the noisiest sport with hockey 'warm up" the noisiest exercise activity.

Most of the higher levels of noise were due to ball impacts on the metal fence and boards located at low level to the goals and on the bottom parts of field perimeter metal fences. Coach / players shouting / encouraging other players was a predominant source of noise for all of the three measured sports.

There was no significant noise impact from the presence of small crowds during training sessions / matches. Only when large crowds (especially parents) were at a training / match sessions, did this source of noise increase significantly. This was noticeable during a survey carried out during a weekend youth football training session where more than 300 juniors were playing, with parents adjacent to the boundary of the pitch lines / fence.

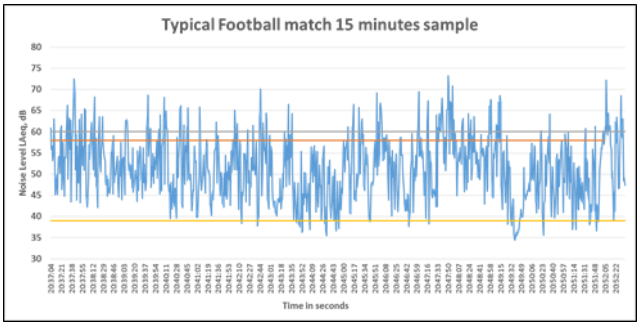
Table 1 (below) summarises the average noise levels obtained for the ranges of activities and groups for the three principal SGP sports. The data was standardised to levels at distances of 10 metres from the main SGP pitch perimeter lines.

Sport	Range $L_{A90\%}$ - $L_{A10\%}$	Range & Mean, L_{Aeq}
Football	41 - 69dB(A)	(55 - 66) **61dB(A)**
Rugby	41 - 65dB(A)	(50 - 66) **58dB(A)**
Hockey	45 - 67dB(A)	(59 - 72) **66dB(A)**

Table 1: Noise output from sports pitch activities

4.5 Variability in Levels

The variability in levels at a sample survey location (for football) is shown below in Diagram 1. This illustrates the relationship between range and mean L_{eq} level.



Variability of noise levels during football match

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4.6 Source Levels for Noise Impact Assessment

In assessing the noise impact of a pitch for any type of SGP assessments should be made using the data given in Table 2 below:

Scenario	Mean, L_{Aeq}
Rugby / Football	61dB(A)
Hockey	66dB(A)

Recommended noise levels for use in assessments of SGP generated noise

4.7 Period Values

The L_{eq} values shown in Table 2 represent the on-going use of the SGPs over the whole of the various survey periods when measuring noise output from training session(s) and matches. The range of L_{eq} values in Table 1 indicate the variability dependent upon activity, whereas the mean L_{eq} provides a period value for the varying use of the pitches for all activities relating to a specific sport.

This value is therefore the most appropriate for use in assessing the noise generated by use of a pitch for a type of sport and can be taken as a representative L_{Aeq} value for the whole of a daily period of SGP use. This period level takes account of any and all uses of a pitch over all periods of availability and can be used to compare with WHO or other criteria, without adjustment (to 16hr values). This will be the equivalent of comparing a 1hr L_{Aeq} with a 16hr L_{Aeq} criterion and provides a safety factor in assessments with some recognition of the character and nature of sport noise (see also para 3.2 above). However, for comparison purposes it would be helpful to compute the $L_{Aeq,\ 16hr}$ value to compare with WHO and other $L_{Aeq,16hr}$ criteria especially where daily periods of SGP use are relatively short.

Example: *If a pitch is available for use from 1600 to 2200hrs for Hockey then the L_{eq} for the noise output would be the Table 2, L_{Aeq} value applied to the whole 6hr period. If the same pitch were to be available for use from 0900hrs to 2200hrs the Table 2, L_{Aeq} would be applied to the 13hr period, These values would be used for assessment against the $L_{eq,16hr}$ criterion, without any adjustment to take account of the proportion of the 16hrs that the sports facility is intended to be in use. If the adjusted, period equivalent is compared with the 16hr criterion impact levels would be some 4dB (6hr use) or 1dB (13hr) less. It could be helpful in making a judgement of impact to be able to consider both values.*

4.8 Noise Source Location

Given the variability of use of the pitches (whole and sectional), the variations and predominance of noise producing edge activities, typical locations of observers/ bystanders at the edges of pitches and the use of perimeter locations for training exercises, the noise source location for pitches should be considered to be the boundary lines of the SGP pitch area nearest the relevant Noise Sensitive Receptors (NSRs) and a notional source height of 1.5m metres should be utilised. *This source location definition is critical to noise impact assessments and should be utilised as the determinant of predictions of distance attenuation effects.*

4.9 Vehicle Movement and Parking

Noise generated by car movements and parking in areas associated with the proposed SGPs may also be considered a potential noise impact issue. If this issue is considered a potential impact issue, then assessment should be carried out using standard road traffic noise survey / source data and assessment techniques.