iAcoustics
Integrated Acoustic Solutions

Unit A16
Kingswood Business Park
Baldonnell, Dublin 22 Ireland

00353 1 452 1133
info@iacoustics.net
www.iacoustics.net

Noise Impact Assessment

Proposed Skatepark at Ballywaltrim, Co Wicklow

Report Prepared by: Glen Plunkett, Acoustic Consultant, MIOA, MSc Acoustics

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Glossary of Terms

A-weighting	A frequency-dependent correction that is applied to a measured or calculated sound of moderate intensity to mimic the varying sensitivity of the ear to sound for different frequencies.
Ambient Sound	The all-encompassing sound at a given location, comprised of many sound sources near and far.
Ambient sound level, $L_{Aeq,T}$	Defined in BS 4142:2014 as the equivalent continuous A-weighted sound pressure level of the totally encompassing sound in a given situation at a given time at the assessment location over a given time interval, T
Background sound level, L_{A90}	Defined in BS 4142:2014 as the 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
Break-in/out	Noise transmission into a building from outside, or noise transmission from a building to outside.
$L_{A10,T}$	The A-weighted sound pressure level exceeded for 10% of the measurement time. Used to assess traffic noise.
$L_{A90,T}$	The A-weighted sound pressure level exceeded for 90% of the measurement time. Used as an indicator for the relative 'quietness' of a given location.
$L_{Aeq,T}$	Defined in ISO 1996-1:2016 as A-weighted, equivalent continuous sound pressure level during a stated time interval, expressed in decibels (dB), at a given point in space.
$L_{AF,max}$	Maximum time-weighted and A-weighted sound pressure level with a FAST time constant (125ms) within a stated time interval t.
Measurement time interval	The total time over which measurements are taken
Rating Level, L_{Ar}	Defined in BS 4142 as the specific sound level plus any adjustment for the characteristic features of the sound
Reference time interval	The specified interval over which the specific sound level is determined. This is typically 1 h during the day (0700-2300) and a shorter period of 15 min at night (2300-0700)
Residual sound	Defined in BS 4142:2014 as the 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	Defined in BS 4142:2014 as the equivalent continuous A-weighted sound pressure level of the residual sound at the assessment location over a given time interval, T
Specific sound level, $L_{Aeq,Tr}$	Defined in BS 4142:2014 as the equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, Tr.
Specific sound source	The sound source being assessed
SPL	Sound pressure level

1 Introduction

At the request of Wicklow County Council, This noise impact assessment has been prepared to assess the potential impact of noise arising from a proposed skatepark at Ballywaltrim, Bray, Co Wicklow.

The assessment sets out the following objectives:

- Describe relevant assessment standards and guidelines on skatepark noise.
- Conduct a baseline noise survey at the Nearest Noise-Sensitive Location (NNSL).
- Determine representative background sound levels during daytime using L_{A90}.
- Compare the estimated noise levels with the background sound level and assess the need for noise mitigation measures, if necessary.
- Evaluate the skatepark development's size, context, and design and offer a conclusive remark on its potential noise impact on the surrounding receptors.

It is beyond the scope of this report to assess:

- Potential amplified music.
- Noise arising from other pre-existing nearby amenities (i.e. playground, sports court).

There are currently no plans to provide lighting for the skate park, meaning the use of the skatepark will be constrained to daylight hours.

2 Assessment Criteria, Relevant Standards & Guidance

2.1 Noise Assessment Guidelines for Skateparks

Currently, there are no Irish/UK standards or guidance dealing with noise arising from skateparks or similar activities. British Standard 4142:2014 *'Methods for rating and assessing industrial and commercial sound'* is commonly used in Ireland to assess the risk of adverse impact from noise on local residents. However, the Standard is intended for assessing industrial and/or commercial sounds and explicitly states its scope does not extend to recreational activities, such as a skatepark. Some aspects of BS 4142 might be relevant to this assessment, such as establishing a background sound level, impulsive penalties and contextual appraisals; however, a direct application of the Standard is not appropriate. In the absence of authoritative skatepark noise guidance, there is little option but to base our assessment methodology against the guide values set out in the following guidance/standards:

- The World Health Organisation's *Guidelines for Community Noise* (1999) and *Environmental Noise Guidelines for the European Region* (2018) provide guidance levels for steady-state noise inside and outside a dwelling.
- BS 8233:2014 *'Guidance on sound insulation and noise reduction for buildings'*, which provides similar guidance based on the aforementioned WHO documents.
- The 'Guidelines for Environmental Noise Impact Assessment' (2014) document produced by the Institute of Environment Management & Assessment (IEMA), which considers the impact of an increase/change in average ambient sound levels from the existing baseline.
- The Chartered Institute of Environmental Health (CIEH) guidance document '*Clay Target Shooting: Guidance on the Control of Noise'* (2003) contains a method for assessing short, high-level impulsive sounds associated with clay target shooting – a sound source with similar impulsive characteristics to skateboarding impacts.

A noise impact assessment methodology that incorporates a mixture of the aforementioned guidelines seems to align with the approach followed by other noise impact assessment reports for skateparks in Ireland and the UK.

Appropriate assessment criteria for a new skatepark should be based on controlling both the peak level (L_{Amax}) *and* the time-averaged level ($L_{Aeq,T}$). The L_{Amax} corresponds to the highest noise level produced during a single impulse, such as a skateboarder's landing. $L_{Aeq,T}$ is the average sound level over a given period, typically measured over several minutes; $L_{Aeq,T}$ would capture the range of noise levels associated with a skatepark, including the rolling noise of skateboards/BMX's and chatter as well as impulsive events.

The *Public Skatepark Development Guide* is commonly referenced by designers of new skateparks. Regarding community noise impacts, the guide states that skatepark noise *"consistently falls well below ordinary recreational standards and is completely appropriate for residential areas."*, although it does not provide guide values. https://publicskateparkguide.org/maintenance-and-operations/noise/

2.2 WHO Guidelines

In 2018, the WHO published *Environmental Noise Guidelines for the European Region,* which provides guidance to policymakers on noise levels above which it considers adverse effects on health and sleep occur.

It covers exposure to environmental noise from various sources: transportation (road, railway and aircraft), wind turbine, and leisure noise. The 2018 guidelines follow the WHO's Guidelines for Community Noise (1999) and Night Noise Guidelines for Europe (2009); the latter is irrelevant to this report as the skatepark is not expected to be used at night.

The WHO recommends that any values not covered by the current 2018 guidelines should remain valid. *Guidelines for Community Noise* (1999) sets out environment-specific noise exposure levels in residential properties from all sources, both indoors and outdoors, as follows:

- To protect the majority of people from *serious* annoyance during the daytime, the sound pressure level on balconies, terraces and outdoor living areas should not exceed 55 dB L_{Aeq} for a steady, continuous noise. To protect the majority of people *moderate* annoyance during the daytime, the outdoor sound pressure level should not exceed 50 dB L_{Aeq}.
- To enable casual conversation indoors during the daytime, the sound level of interfering noise should not exceed 35dB L_{Aeq}.

In the absence of any specific skatepark noise guidance, we will adopt WHO guide values as assessment criteria.

2.3 BS 8233:2014' Guidance on sound insulation and noise reduction for buildings'

This British Standard provides guidance for the control of noise in buildings and is widely used in Ireland. The Standard defines upper limits for internal ambient noise levels in habitable areas of a home as an average over a 16-hour day (0700 – 2300) from all sources. The BS 8233 values reflect those suggested by the WHO (1999 guidance), as Table 2-1 outlines.

Activity	Location	07:00 – 23:00	23:00 – 07:00
Resting	Living Room	$L_{Aeq,16hr}$ 35dB	-
Dining	Dining Room	$L_{Aeq,16hr}$ 40dB	-
Sleeping	Bedroom	$L_{Aeq,16hr}$ 35dB	$L_{Aeq,8hr}$ 30dB

Table 2-1 BS 8233:2014 Guidance on internal ambient noise levels in dwellings

2.4 CIEH Impulsive Noise Guidance

The Chartered Institute of Environmental Health (CIEH) guidance document '*Clay Target Shooting: Guidance on the Control of Noise'* (2003) contains a method for assessing short, high-level impulsive sounds associated with clay target shooting. In the absence of guidance on skatepark noise, some aspects of the CIEH guide are considered relevant since target shooting shares similarities with the impulsive nature of skateboarding impacts. We have observed the CIEH guidance being referenced in other noise consultants' reports for proposed skateparks.

The guidance states that *"there is no fixed shooting noise level at which annoyance starts to occur. Annoyance is less likely to occur at a mean shooting noise level below 55 dB(A), and highly likely to occur at a mean shooting noise level above 65dB(A)."* Each shot level is measured as the maximum A-weighted sound pressure level caused by the shot using time weighting 'F', L_{AFmax}. We have also applied L_{AFMax} for measuring and assessing skateboarding impacts (see section 4) and in modelling (see section 5.3).

Considering the above, we have adopted a target skateboarding impact noise criteria of ≤ L_{AFmax} 55dB (free-field) at the nearest noise-sensitive properties.

3 Baseline Noise Environment

3.1 Methodology

A baseline noise survey of the receiving environment was carried out on the 12th of May 2023.

- ISO 1996-1:2016 Acoustics — Description, measurement, and assessment of environmental noise — Part 1: Basic quantities and assessment procedures.
- ISO 1996-2:2017 Acoustics — Description, measurement, and assessment of environmental noise — Part 2: Determination of sound pressure levels.

Figure 3-1 Ariel view showing the location of baseline noise monitoring marked with a red dot. The two nearest noise-sensitive locations are identified as NSL 1 & 2.

The complete sound measuring systems deployed conform to BS EN 61672-1, Class 1. Sound calibrators conform to BS EN 60942, Class 1. The microphone was placed on a tripod at a height of 1.5m from the ground and was fitted with an all-weather protection kit (*NTI Audio WP30*) to minimise interference. Field calibration was carried out at the beginning and end of the measurement. No calibration drift occurred. The equipment description is as follows:

Type	Make & Model	Serial No.	Calibrated on	Next Calibration
Sound Level Meter	*NTI XL2-TA*	*a2a-06306-EO*	*18/05/2021*	*18/05/2023*
Microphone	*NTI MA220*	*8285*	*18/05/2021*	*18/05/2023*
Calibrator	*CAL01, 01dB*	*11756*	*18/05/2022*	*18/05/2024*

Temperature, wind speed and direction readings were obtained at the beginning and end of the survey using a *Holdpeak HP-866B* Anemometer.

	Beginning of survey	End of survey

Temperature:	12°C	12°C
Wind speed & direction:	4 m/s NW	3 m/s NW
Precipitation	None	

3.2 Results

Date [dd-mm-yyyy]	Start [hh:mm:ss]	Stop [hh:mm:ss]	L_{Aeq} [dB]	L_{A10} [dB]	L_{A90} [dB]	L_{AFmax} [dB]
12/05/2023	10:47:06	11:02:06	55	57	53	75

Table 3-1 Baseline noise survey results

3.3 TII/EPA Noise Maps

The Transport Infrastructure Ireland (TII) noise maps for roads include data for the receiving environment. Values of L_{den} 55 – 64dB are indicated for the nearest dwellings, which correlates with our site survey.

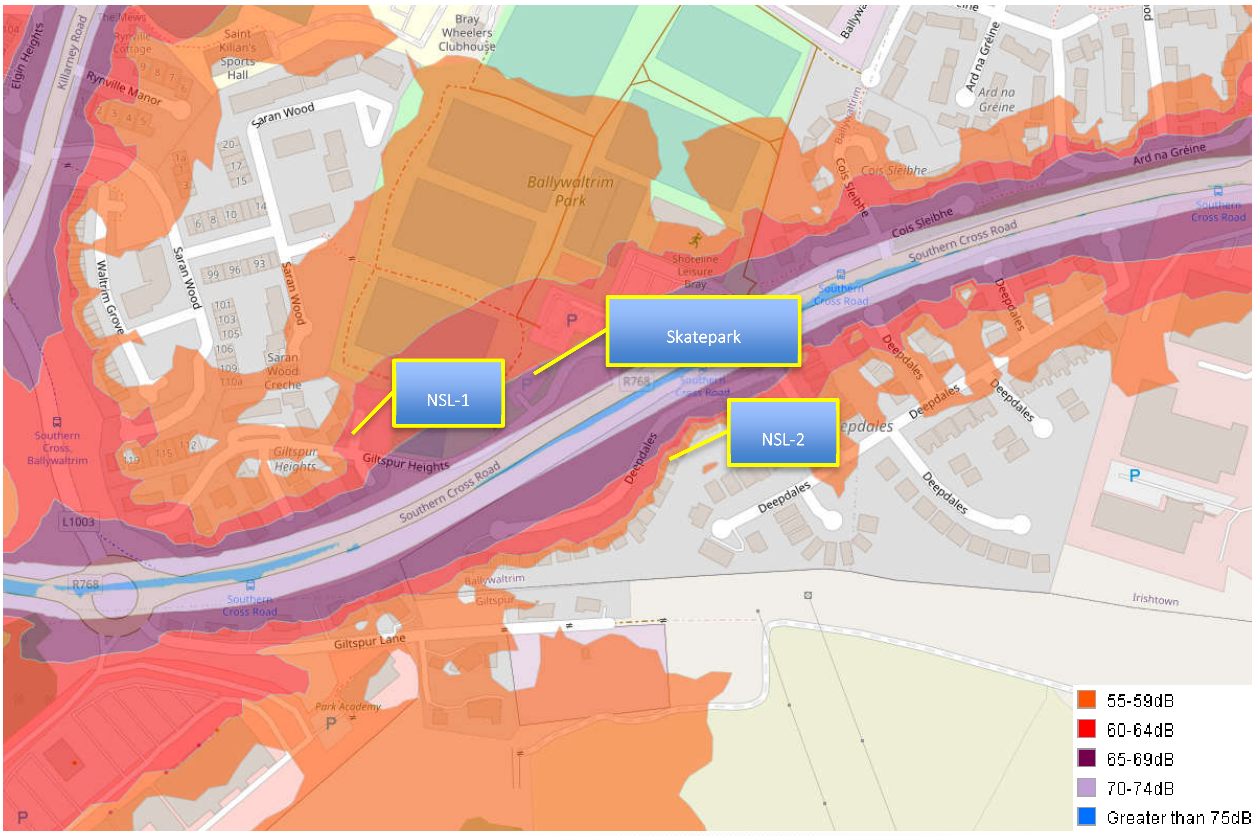


Figure 3-2 This is a polygon dataset of the strategic noise mapping of roads. The dB value represents the average decibel value during the L_{den} time.

4 Skatepark Noise Sources and Levels

4.1 Overview of Skatepark Noise Sources

Typical noise sources include:

a) Skateboard impacts; short impulsive noise from the impact of the skateboard against the concrete. This is typically the loudest source of peak noise from a skatepark.
b) Grinding on metal rails. Noise generated from metal-to-metal contact.
c) Rolling noise; noise generated from the interaction of the wheels/tyres along the surface. Rolling noise is most significant for skateboards but not particularly loud.
d) BMX bikes. Usually, the quietest activity as the rolling noise is minimal due to tyres being made from rubber and the air absorbing impact when landing.
e) Voices; chatting in small groups most of the time, occasionally raising voice or cheering.

4.2 Field Measurement of Similar Skateparks

To determine the noise impact of the proposed Ballywaltrim skatepark, iAcoustics have undertaken noise measurements at similar, existing skateparks in Clondalkin, Dublin 22 and Bushy Park, Dublin 6. Skateparks are typically busiest at weekends. Hence, measurements were taken both at low occupancy (weekday) and high occupancy (weekend).

<u>Reference Measurement A:</u>

Location:	Clondalkin Skatepark, Dublin 22
Measurement Location:	Edge of the skatepark
Time & Duration:	Tuesday the 16th of May, 14:02 to 14:17 (15mins)
Occupancy:	2no. skateboarders, 3no. BMX, 1no. skating. 8no. people present
$L_{Aeq,15min}$ result:	55 dB(A)

<u>Reference Measurement B:</u>

Location:	Bushy Park, Dublin 6
Measurement Location:	Edge of skatepark
Time & Duration:	Saturday the 20th of May 2023, 12:50 to 13:20 (30mins)
Occupancy:	5no. skateboarders, 6no. BMX, no skating. 15no. people present
$L_{Aeq,15min}$ result:	63 dB(A)

4.3 Field Measurement of Simulated Activities

iAcoustics conducted sound measurements of simulated activities to assess the potential noise impact on nearby noise-sensitive locations. A skateboard was dropped onto the existing hard surface to generate a short impulsive sound event to mimic that which might be experienced when the skateboarder lands or fails to land a trick.

The measurements were taken on Friday 12th of May, 2023 between 10:30 am – 10:40 am.

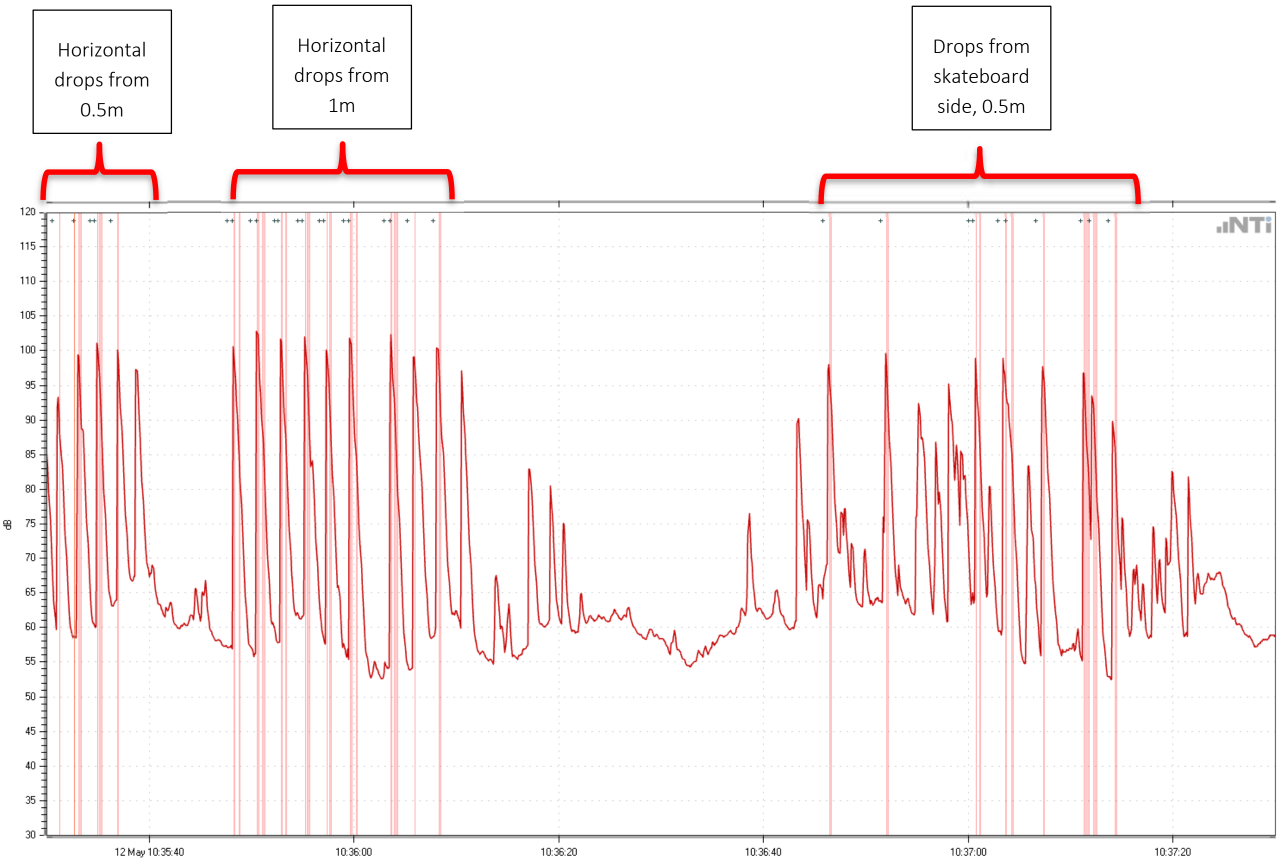
Simultaneous measurements were taken 1m from the sound source and also at the nearest residential property on Deepdales (NSL-2). We measured the A-weighted peak sound pressure level L_{AFMax} which was logged every 100 milliseconds. Markers were generated at each drop and then overlayed onto the receiver measurement file, allowing us to determine if any correlation was found. The criteria for marker generation was $L_{AFmax\_dt} \geq L_{Aeq\_dt}$ by 20dB or more. The following simulations were performed;

a) Horizontal skateboard drops from 0.5m.
b) Horizontal skateboard drops from 1m.
c) Skateboard drop onto side from 0.5m.

	Activity:		
	Horizontal skateboard drops from 0.5m	Horizontal skateboard drops from 1m	Skateboard on side, dropped from 1m
No. of drops	5	10	8
Arithmetic average of L_{AFmax} levels	98 dB(A)	101 dB(A)	96 dB(A)

Table 4-1 Summary of simulated skateboard drops, indicating the number of drops which occurred and the mean value of the L_{AFMax} measured 1m from the impact.

The graphs below demonstrate that the peak sound level of simulated skateboard drops was not distinguishable above the existing ambient sound level. There is no evidence of skateboard impact noise on the graph corresponding to measurements taken at the Nearest Noise-Sensitive Location (NNSL). Our findings indicate that the peak sound level generated by local road traffic movements was greater than that of simulated skateboard drops. Subjectively, skateboard drops were just detectable above the ambient sound to the iAcoustics practitioner standing at Deepdales; however, the noise was not above and beyond the general ambient sound and would likely go unnoticed by most people.



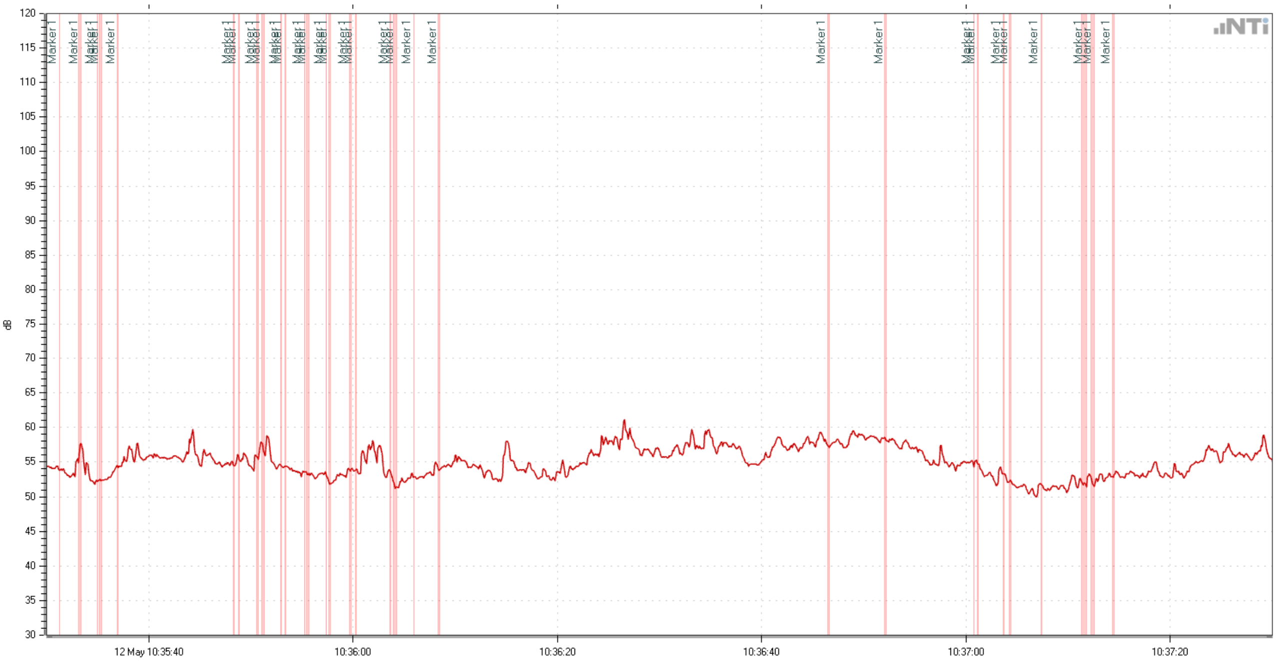


Figure 4-1 (top) Time-level log of the A-Weighted sound pressure level measured 1m from skateboard drops.

Figure 4-2 (bottom) Time-level log of the A-Weighted sound pressure level measured close to the nearest noise-sensitive location.

5 Assessment

5.1 Separation Distance

Table 5-1 lists similar-sized skateparks in the Wicklow, South Dublin and Dun Laoghaire-Rathdown districts and the minimum separation distance to the nearest residential property. In most cases, the distance between the skateparks and nearby residential properties is shorter than the proposed separation distance for the Ballywaltrim skatepark of 101m. The implication is that other skateparks of a similar scale can coexist successfully with nearby residential properties, suggesting that skateparks close to residential areas have not posed significant noise issues that would warrant larger separation distances.

Skatepark, Location	Approximate distance to nearest residential property*
Murrough, Wicklow Town, Co Wicklow	258m
Greystones, Kockroe, Co Wicklow	222m
Manho Hui, Arklow, Co Wicklow	117m
Proposed Ballywaltrim Skatepark	*101m*
Bushy Park, Terenure, Dublin 6	92m
Ballyogan, Ballyogan Ct, Dublin 18	84m
Clondalkin, Dublin 22	80m
Monkstown, Co Dublin	72m
Blessington, Co Wicklow	69m
Le Fanu, Kylemore Road, Dublin 10	59m
Lucan, Glebe, Co Dublin	55m
Tinahely, Churchland, Co Wicklow	49m

**Calculated on Google Earth as the minimum distance from the edge of the skatepark to the nearest residential dwelling*

Table 5-1 List of skateparks in South Dublin, Dun Laoghaire-Rathdown and Wicklow with minimum distances to the nearest dwelling.

5.2 Noise Modelling

The Standard ISO 9613-2[1] describes a method for calculating the attenuation of sound during propagation outdoors in order to predict the levels of environmental noise at a distance from a noise source. Noise modelling was carried out in the modelling software CadnaA® which integrates the ISO 9613 calculation method. The noise propagation model provides a single-scenario output representative of only the specified configuration of the model and for the specified source levels. Appendix B reports the model's general configuration, settings and applied calculation methods.

As discussed in Section 2 of this report, noise criteria have been proposed based on control over *both* the maximum peak sound level L_{AFmax} and the average sound level $L_{Aeq,T}$. Therefore, the following two models were developed:

Model A: Prediction of L_{AFmax} peak sound levels for skateboarding activities.

Model B: Prediction of average sound levels $L_{Aeq,T}$

5.2.1 Model A Output (Prediction of Peak Sound Levels, L_{Amax})

We modelled 2no. point sources with a reference SPL of 98 dB(A) @1m to mimic the peak sound level of skateboarding impacts on a hard surface. One point source was situated at the closest point to NSL 1, and the other at the closest point to NSL 2. It is assumed for modelling purposes that skateboard impacts occur at both points at the exact same time. The following spectral input data was specified in the CadnaA model:

Frequency:	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
Linear L_w spectra for skateboard impact	80	86	104	110	107	104	98	95

Table 5-2 Description of the spectral input data used for modelling skateboarding impacts

[1] *ISO 9613-2:1996 Acoustics — Attenuation of sound during propagation outdoors — Part 2: General method of calculation*

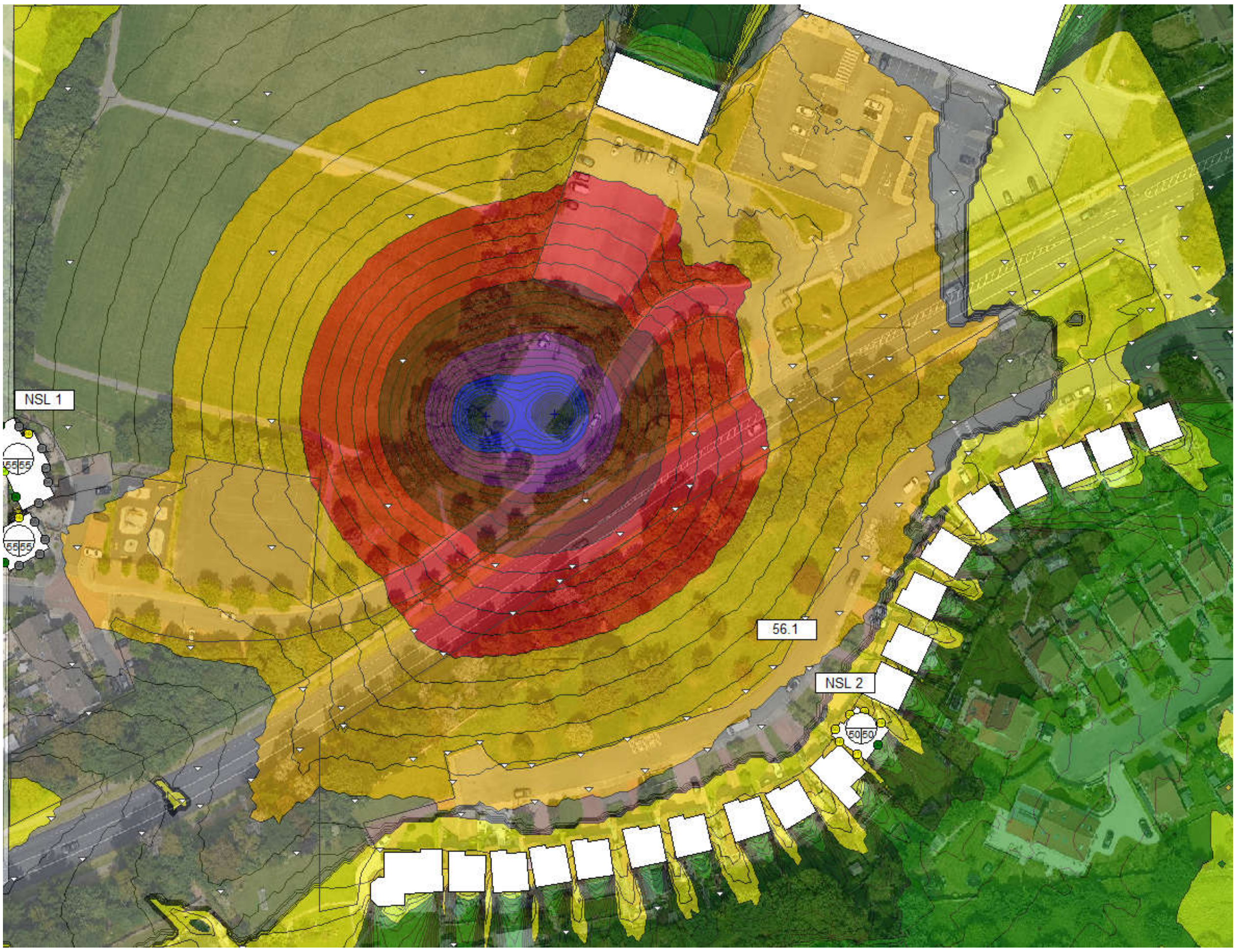


Figure 5-1 Noise map showing the predicted A-Weighted peak sound levels L_{Amax} from skateboard impacts. The noise map assumes 2no. point sources co-occurring.

The predicted L_{Amax} peak sound levels are L_{Amax} 55 dB at NSL 1, and L_{Amax} 50 dB at NSL 2.

5.2.2 Model B Output (Prediction of Average Sound Levels, $L_{Aeq,T}$)

The average sound pressure levels from the skate park were modelled as an area source (30m x 16m). The input data is based on **Reference Measurement B** from section 4.2, representing typical skatepark SPL's.

Frequency:	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
Linear L_W average skate park levels	75	68	71	70	72	63	58	54

Table 5-3 Description of the spectral input data used for modelling the average noise levels from a skatepark sample measurement

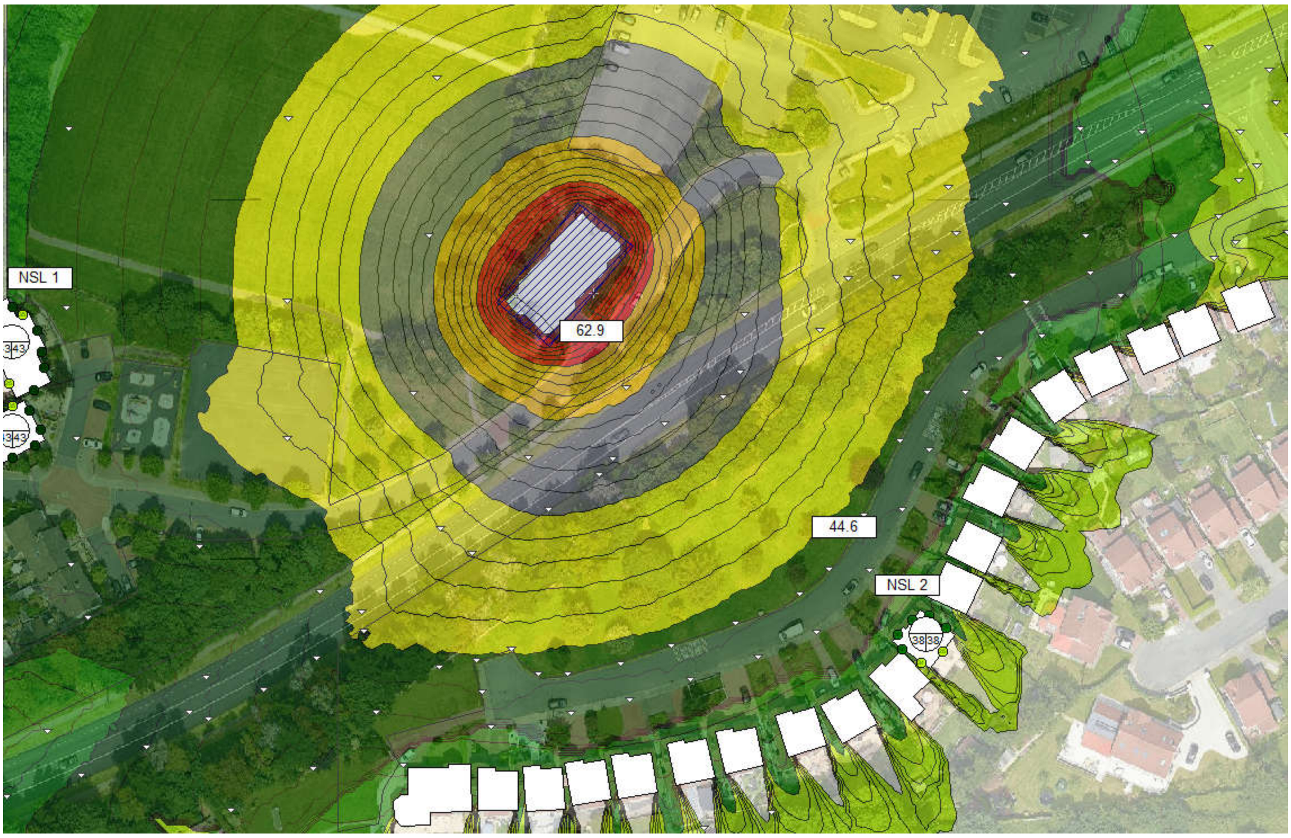


Figure 5-2 Noise map showing the predicted A-Weighted Average sound levels L_{Amax} from skate park. The input data is based on sample measurements taken at a similar skatepark.

The predicted average sound pressure level at NSL 1 and NSL 2 is $L_{Aeq,T}$ 43dB and $L_{Aeq,T}$ 38dB respectively.

5.3 Findings

In relation to peak sound levels, it is anticipated that the *peak sound level*, denoted as L_{AFMax}, resulting from skateboard impacts, will comply with the proposed criteria of $L_{AFMax} \leq$ 55dB at nearby Noise-Sensitive Locations (NSL's).

Regarding average sound levels, the sound emissions from the skatepark are anticipated to remain below the World Health Organization's (WHO) criterion of ≤ LAeq,16hr 50dB for outdoor areas adjacent to residential properties, encompassing both front and rear gardens. Additionally, these projected levels will not hinder nearby dwellings from meeting the indoor noise criteria outlined by the WHO and BS 8233:2014, which recommend sound levels below 35 dB(A) during the day and below 30 dB(A) in bedrooms at night. It is worth noting that the average sound levels from the skatepark are also expected to be lower than the existing daytime background sound level.

5.4 Local Context

While BS 4142:2014 cannot be directly applied to rating and assessing recreational noise, such as that from a skatepark, certain aspects of the Standard are pertinent to this evaluation, especially regarding contextual assessments. BS 4142:2014 highlights that *"the significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the* ***context in which the sound occurs****."*

It should be noted that other recreational facilities within the broader complex would produce similar noise levels. Therefore, the addition of a skatepark would not be incongruous with the existing noise environment.

For NSL 1 in particular, these dwellings are in close proximity to community amenities (playground, courts) from which there would be regular noise impacts from children playing, raised voices and sporting activities; the addition of skatepark noise would not be out of context for this environment. Furthermore, the proposed skatepark is further removed from NSL 1 than these other amenities.

6 Conclusion

Overall, based on the assessment of both peak and average sound levels associated with skateboarding activities and considering the local context, it can be concluded that the proposed skatepark is unlikely to have a significant adverse noise impact on nearby dwellings.

The peak sound levels associated with skateboarding tricks (ollies, kickflips etc.) will be the dominant peak sound source. iAcoustics conducted a simulation by dropping skateboards onto the existing hard surface at the skatepark's proposed location; measurements were taken 1m from the impacts and also at the residential properties along Deepdales. There did not appear to be any correlation of impacts when measured at the Deepdales (NSL 2); the peak levels from passing cars were found to occur at a higher level than the peak levels of skateboard impacts.

There is an appreciable separation distance of circa. 101m from the proposed skatepark to the nearest residential property, which is generally a greater distance than most other skate parks in the Wicklow and South Dublin regions. The implication is that other skateparks of a similar scale can coexist successfully with nearby residential properties, suggesting that skateparks do not pose significant noise issues that would warrant larger separation distances.

There are currently no plans to provide lighting for the skate park, meaning the use of the skatepark will be constrained to daylight hours.

The average sound levels were measured in two similar skateparks. When these reference levels were placed in our acoustic model, the expected noise impact at the nearest properties was found to be low; the predicted levels were significantly lower than the guide values set out by the WHO and in BS 8233:2014.

As stated in the introduction, it is beyond the scope of this report to consider amplified music or potential anti-social noise arising outside the intended use of a skatepark.

Appendix A– Noise Modelling Configuration

Sound propagation predictions are carried out to ISO 9613-2. The A-weighted sound pressure level at a receiver point L_{AT} (equivalent continuous sound pressure level) according to ISO 9613-2 is calculated by:

$$L_{AT} = L_w + DI + D\Omega - A_{div} - A_{atm} - A_{gr} - A_{bar} - A_{misc}$$

where:

PWL	sound power level in dB, relative to the reference sound power of 1 pW
D_I	Directivity index: deviation of the continuous sound pressure level for the directionally radiating source in a specified direction from the level of an omnidirectional point source with the sound power level PWL.
$D_{\Omega(K0)}$	Correction for solid angle: Term that accounts for sound propagation into angles of less than 4π steradians.
A_{div}	attenuation due to geometrical divergence: The geometrical divergence calculates from the distance d between source and receiver: Adiv = [20 lg (d/d_0) + 11] dB with d distance source-receiver, d_0 = 1m
A_{atm}	atmospheric absorption: $A_{atm} = \alpha L * d / 1000$ where αL atmospheric attenuation coefficient per kilometre, d distance source-receiver.
A_{gr}	Attenuation due to ground effect
A_{bar}	Attenuation due to screening (due to berms, barriers, buildings, topography, cylinders, etc.)
A_{misc}	attenuation due to miscellaneous effects: - foliage A_{fol} - industrial sites A_{site} - housing A_{house}

CadnaA® model configuration:

- A default ground absorption coefficient of *G* = 0 (reflective) was assumed for hard surfaces such as roads and paving; *G* = 1 (porous soil) was assumed for grass/green areas.
- To account for the screening effect of buildings and other objects, lateral diffraction is traced in a convex path around the objects.
- Yearly average temperature / relative humidity values were set to 10°C / 70%.
- Foliage and barriers were excluded from the modelling.
- For grid calculations, receivers were spaced at 2m vertically and horizontally, and the grid height was 1.5m.
- Building Heights: 5.8m.
- All buildings are fully reflective *G* = 0.