

APPENDIX 18.1

BASIC ACOUSTIC TERMINOLOGY

Sound is produced by mechanical vibration of a surface, which sets up rapid pressure fluctuations in the surrounding air.

Between the quietest audible sound and the loudest tolerable sound there is a million to one ratio in sound pressure level. It is because of this wide range that a noise level scale based on logarithms is used in noise measurement. This is the decibel or dB scale.

Audibility of sound covers a range of about 0 to 140 decibels (dB) corresponding to the intensity of the sound pressure level. The ability to recognise a particular sound is dependent on the pitch or frequencies present in the source. Sound pressure measurements taken with a microphone cannot differentiate in the same way as the ear, consequently a correction is applied by the noise measuring instrument in order to correspond more closely to the frequency response of the ear which responds to sounds from 20 Hz to 20000 Hz. This is known as 'A weighting' and written as dB(A).

The use of this unit is internationally accepted and correlates well with subjective annoyance to noise.

The logarithmic basis of noise measurements means that when considering more than one noise source their addition must be undertaken in terms of logarithmic arithmetic. Thus, two noise sources each of 40 dB(A) acting together would not give rise to $40 + 40 = 80$ dB(A) but rather $40 + 40 = 43$ dB(A). This 3 dB(A) increase represents a doubling in sound energy but would be only just perceptible to a human ear.

The attached chart gives typical noise levels in terms of dB(A) for common situations.

Noise levels can vary with time according to source activity and indices have been developed in order to be able to assign a value to represent a period of noise level variations and to correspond with subjective response.

The definition in layman's terms is given below for terminology used in the measurement and results obtained during the survey work.

A-weighting: Normal hearing covers the frequency (pitch) range from about 20Hz to 20,000 Hz but sensitivity of the ear is greatest between about 500Hz and 5000Hz. The "A-weighting" is an electrical circuit built into noise meters to mimic this characteristic of the human ear.

Ambient noise: The totally encompassing sound in a given situation at a given time usually composed of sound from many sources near and far.

Attenuation: Noise reduction

Background noise: The general quiet periods of ambient noise when the noise source under investigation is not there.

Decibel (dB): The unit of measurement for sound based on a logarithmic scale. 0dB is the threshold of normal hearing; 140dB is the threshold of pain. A change of 1dB is only detectable under controlled laboratory conditions.

dB(A) [decibel A weighted]: Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) serves to distinguish sounds of different frequency (or pitch) in a similar way to how the human ear responds. Measurements in dB(A) broadly agrees with an individual's assessment of loudness. A change of 3dB(A) is the minimum perceptible under normal everyday conditions, and a change of 10dB(A) corresponds roughly to doubling or halving the loudness of sound.

dB(C): [decibel C weighted]: Frequency weighting which does not alter low frequency octave band levels by very much compared to 'A' weighting. Similar to linear reading (i.e. linear does not alter frequency spectra at all)

Frequency (Hz): The number of sound waves to pass a point in one second.

L_{Aeq}: This is a noise index used to describe the "average" level of a noise that varies with time (T). It allows for the different sensitivities of the human ear to different frequencies (pitch), and averages fluctuating noise levels in a manner, which correlates well with human perceptions of loudness.

L_{A10,T}: This noise index gives an indication of the upper limit or peak levels of the fluctuating noise. It is the "A weighted" noise level exceeded for 10 per cent of the specified measurement period (T). e.g. If the measurement period was over 10 hours and the L_{A10} reading was say 60dB, then this means that for 1 hour out of 10 the level went above 60dB.

L_{A90,T}: This noise index gives an indication of the lower limit or levels of the fluctuating noise. It is the "A weighted" noise level exceeded for 90 per cent of the specified measurement period (T). e.g. If the measurement period was over 10 hours and the L_{A90} reading was say 50dB, then this means that for 9 hours out of 10 the level went above 50dB.

L_{Amax}: This is the highest A weighted noise level recorded during a noise measurement period.

Residual noise: The ambient noise remaining at a given position in a given situation when the noise source under investigation is not there.

Specific noise: The noise source under investigation for assessing the likelihood of complaints

Examples of typical noise levels

Source/Activity	Indicative noise level [dB(A)]
Threshold of hearing	0
Rural night-time background	20-40
Quiet bedroom	35
Wind farm at 350m	35-45
Busy road at 5km	35-45
Car at 65km/h at 100m	55
Busy general office	60
Conversation	60
Truck at 50km/h at 100m	65
City Traffic at 5m	75-85
Pneumatic drill at 7m	95
Jet aircraft at 250m	105
Threshold of pain	140

VIBRATION TERMINOLOGY

Ground Borne Vibrations

For any source of vibration on or near the surface of the ground, energy propagates away from the source via:

- a) elastic body (or compression) waves – which radiate energy into the ground in all directions
- b) surface (or shear) waves – which carry energy along the ground surface, caused when body waves are reflected back into the ground at the ground-surface interface

Thus, at any point away from that source, the ground motion is the sum of all the wave motions at that point. When wave motion has been generated, the waves will be attenuated as they travel away from the source. The two main mechanisms for attenuation are:

- a) enlargement of the wave front as the distance from the source increases, and
- b) internal damping of the transmitting medium (the ground)

Ground borne vibration is therefore made up of a combination of different waves, traveling in different directions, at different speeds and at different frequencies. The frequency component of the vibration will affect the rate at which attenuation occurs since the internal damping of the ground is frequency dependent.

Since vibration enters buildings through the foundations, the hard structure of the building is normally affected to a greater degree than by air borne vibration. Often ground borne vibrations are more noticeable when standing or sitting near the middle of suspended wooden floors.

Ground Borne Vibration Measurement Units

Ground borne vibration is caused when the individual particles making up the strata are caused to oscillate by the passage of a pressure wave. The resulting vibration can be summarized in terms of 4 main parameters:

- a) **Velocity** – how fast the particles move when they are oscillating. Since the velocity of these particles continually change as the pressure wave passes the most useful value that is often reported is the maximum or peak particle velocity (PPV). PPVs are usually expressed in terms of ms^{-1} or mms^{-1} .
- b) **Acceleration** – is the rate at which the particle velocity changes during oscillation. It is usually measured in ms^{-2} mms^{-2} or “g’s”. 1g is that acceleration imparted to an object by the earth’s gravitational pull and is approximately 9.81 ms^{-2} .
- c) **Displacement** – is the distance moved by oscillating particles. This is usually very small and measured in mm or even μm .
- d) **Frequency** – is the number of oscillations per second which a particle undergoes due to the passage of a vibration wave. It is measured in cycles per second or Hertz (Hz).

The movement of particles induced to oscillate by vibration waves are usually measured in three mutually perpendicular directions to fully describe the vibration intensity, as particles will be oscillating in three dimensions. These are:

- a) **Longitudinal** – back and forth particle movement in the same direction that the vibration wave is traveling.
- b) **Vertical** – up and down movement perpendicular to the direction the vibration wave is traveling.
- c) **Transverse** – left and right particle movement perpendicular to the direction the vibration wave is traveling.

Air Transmitted Vibration

The maximum excess pressure above the ambient is known as the peak (air) overpressure.

Air overpressure waves can generally be likened to ordinary sound waves and are propagated in exactly the same manner. Thus meteorological conditions, e.g. wind speed, wind direction, temperature, cloud cover and humidity can all affect the

intensity of an air overpressure wave measured at a distance from the passage of a vehicle.

The main effect of air overpressure is to rattle loose windows and doors. Occasionally air overpressure effects are perceived indoors with the rattling of crockery or swaying of light fittings or even sometimes as perceptible floor vibrations. Actual structural damage is very rare. It appears to more commonly act to enhance a persons perceptibility to vibration.

Air Overpressure Measurement Units

The air overpressure is normally measured in units of pressure, pascals (Pa) or more usually in decibels (dB).

APPENDIX 18.2

NOISE SURVEY DETAILS

Instrumentation

The following instrumentation was used for all noise measurements:

For noise measurements at the site boundary positions and roaming noise measurements undertaken in 2006 at Port Solent Marina:

<i>Manufacturer</i>	<i>Description</i>	<i>Type</i>	<i>Calibration due date</i>
Cirrus	Integrating Sound Level Meter	CR: 831	August 2007
Cirrus	Data Logging Sound Level Meter	CR: 704B	August 2007
Pulsar	Real-time Analyser	Model 30	January 2007
Cirrus	Electronic Calibrator	CR: 513A	August 2007

For baseline noise measurements at residential locations undertaken at Holyhead in March 2019:

<i>Manufacturer</i>	<i>Description</i>	<i>Type</i>	<i>Calibration Due date</i>	<i>Serial No.</i>
Norsonic	Real Time Analyser	116	July 2020	27342
Cirrus	Real Time Analyser	171A	February 2020	G061253
Cirrus	Electronic Calibrator	CR: 513A	August 2020	031523

The following set-up parameters were used on the sound level meters during noise measurement:

Static Noise Monitoring:

Time Weighting: Fast
Frequency Weighting: 'A'
Measurement Period: 5-15 minutes (Port Solent) & 15-60 minutes (Holyhead)

Spot Roaming Noise Monitoring:

Time Weighting: Fast
Frequency Weighting: 'A' (linear for frequency analysis)
Measurement Period: 5-15 minutes

Calibration

Calibration setting: 94dB

The noise meters were calibrated with the electronic calibrator prior to commencement and on completion of the noise surveys. No significant drift in calibration was observed.

Survey Dates and Personnel

Port Solent Marina Site Survey:

Two static noise monitoring measurements positions were chosen at the rear garden and first floor level of a residential property facing the marina lock to establish typical ambient noise data of a large UK marina site (see Appendix 13C for detailed information). Additional noise monitoring on a spot roaming monitoring basis was also undertaken to determine broadband and frequency spectra close to specific noise sources within the marina complex. Mr. D.R. Kettlewell of Noise & Vibration Consultants Limited undertook these measurements on the 19th to 20th August 2006.

Baseline Noise Survey:

Static noise measurements positions (shown on figure 18.1) were chosen at the nearest residential areas to the site to establish typical ambient noise data (see Appendix 18.3 for detailed information). Mr. D.R. Kettlewell of Noise & Vibration Consultants Limited undertook these measurements on the Friday 22nd to 25th March 2019.

Monitoring Period and Test Details

Measurements were recorded over a period of at least 24 hours. Data logging of L_{Aeq} , L_{A10} , L_{A90} and L_{Amax} were recorded at Port Solent over 5 or 15-minute intervals for information on the variation of typical noise levels.

Measurements recorded of baseline sound levels at Holyhead were recorded over approximately 72 hours during a Friday morning through to a Monday morning. Data logging of L_{Aeq} , L_{A10} , L_{A90} and L_{Amax} were recorded over 15-minutes or 1-hour monitoring periods to establish representative background sound levels.

The noise meters were mounted on a tripod at a height of between 1.2 to 1.5 metres above ground level and fitted with a wind and rain shield.

Meteorological Conditions

Weather details were recorded by the NVC engineer during the period of the surveys, and appear below:

Friday 22nd March 2019

Daytime: Mostly dry, occasional light drizzle, variable wind (3-4m/s). Temperature 7-10degC.

Overnight: Dry, mostly clear, west-north-west wind (2-3m/s). Temperature 4-7degC.

Saturday 23rd March 2019

Daytime: Dry, mostly clear, variable wind (1-3m/s). Temperature 5-9degC

Overnight: Dry, clear skies, westerly wind (2-3m/s). Temperature 4-5degC

Sunday 24th March 2019

Daytime: Dry, variable cloud, west to west-north-west wind (3-4m/s). Temperature 7-10degC.

Overnight: Dry, variable cloud, north-west to north-north-west wind (3-4m/s). Temperature 7-8degC

Monday 25th March 2019

Daytime: Dry, partly cloudy, north-north-west wind (2-3m/s). Temperature 8-10degC

The above climatic conditions were suitable for monitoring environmental noise levels in accordance with advice given in BS 7445:2003 'Description and measurement of environmental noise'.

APPENDIX 18.3

NOISE SURVEY RESULTS

Noise Survey Results

Date: Friday 22nd March 2019

Location: Holyhead Marina

TABLE 1

Client: AXIS

Project: Holyhead Waterfront Regeneration Scheme

Data: **Baseline Sound Survey: Position 1 - 15 Maes Y Mor**

Instrumentation: Cirrus 171A Real Time Analyser (G066350)

Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmx (dB)	Observations
11:15	15:00	56.5	60.6	48.7	75.5	
11:30	15:00	56.8	60.3	48.1	70.0	
11:45	15:00	56.6	60.3	47.7	71.7	
12:00	15:00	57.8	61.0	47.5	76.7	
12:15	15:00	55.9	58.9	46.3	81.0	
12:30	15:00	55.1	58.8	47.0	70.1	
12:45	15:00	55.5	59.4	47.5	69.8	
13:00	15:00	56.7	60.6	47.7	74.1	
13:15	15:00	56.9	60.2	46.8	76.3	
13:30	15:00	57.3	60.5	48.3	74.3	
13:45	15:00	55.6	59.6	46.7	66.8	
14:00	15:00	56.0	59.9	45.2	70.5	
14:15	15:00	57.7	60.7	45.9	73.5	
14:30	15:00	55.8	59.7	47.0	69.8	
14:45	15:00	58.0	61.7	47.8	74.8	
Log Average 1115-1500		56.6	60.2	47.3	67-81	
Average 1115-1500		56.5	60.1	47.2	67-81	

Noise Survey Results

Date: Friday 22nd March 2019 TABLE 2
 Location: Holyhead Marina
 Client: AXIS
 Project: Holyhead Watefront Regeneration Scheme
 Data: **Baseline Sound Survey: Position 1 - 15 Maes Y Mor**
 Instrumentation: Cirrus 171A Real Time Analyser (G066350)
 Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmx (dB)	Observations
15:00	15:00	58.2	62.2	48.0	72.5	
15:15	15:00	59.1	63.2	47.7	71.9	
15:30	15:00	60.2	62.4	47.8	88.9	
15:45	15:00	53.4	56.3	46.7	69.9	
16:00	15:00	51.6	55.3	44.7	64.3	
16:15	15:00	51.8	54.8	44.9	66.0	
16:30	15:00	51.0	55.1	40.2	63.4	
16:45	15:00	50.0	53.4	39.7	63.3	
17:00	15:00	49.9	53.7	39.6	66.5	
17:15	15:00	48.2	52.6	39.5	59.1	
17:30	15:00	49.2	53.3	39.6	64.7	
17:45	15:00	48.4	52.8	38.6	60.0	
18:00	15:00	48.7	52.9	38.7	65.4	
18:15	15:00	48.7	53.1	37.5	65.8	
18:30	15:00	48.4	52.9	37.9	60.6	
18:45	15:00	47.4	52.0	36.9	59.7	
19:00	15:00	48.0	52.5	37.5	64.3	
19:15	15:00	46.8	51.3	37.0	61.3	
19:30	15:00	47.8	52.2	37.2	60.6	
19:45	15:00	46.3	51.0	36.8	65.9	
20:00	15:00	47.1	51.6	37.5	60.9	
20:15	15:00	46.4	51.3	37.1	59.3	
20:30	15:00	45.9	49.8	36.7	66.6	
20:45	15:00	44.8	49.2	35.5	58.3	
21:00	15:00	45.2	49.8	34.7	59.2	
21:15	15:00	44.3	48.5	31.9	58.1	
21:30	15:00	50.6	47.2	32.8	86.4	
21:45	15:00	44.8	49.5	32.2	61.7	
22:00	15:00	44.9	49.2	34.7	64.9	
22:15	15:00	42.8	44.4	37.2	60.3	
22:30	15:00	43.1	45.2	34.9	60.2	
22:45	15:00	44.5	47.3	34.8	64.6	
Log Average 1500-2300		51.5	55.0	41.2	58-89	
Average 1500-2300		48.7	52.4	38.6	58-89	

Noise Survey Results

Date: Friday 22nd - Saturday 23rd March 2019

Location: Holyhead Marina

TABLE 3

Client: AXIS

Project: Holyhead Waterfront Regeneration Scheme

Data: **Baseline Sound Survey: Position 1 - 15 Maes Y Mor**

Instrumentation: Cirrus 171A Real Time Analyser (G066350)

Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmx (dB)	Observations
23:00	15:00	41.7	44.5	33.2	60.6	
23:15	15:00	42.6	46.2	33.4	57.9	
23:30	15:00	41.3	43.4	34.7	56.1	
23:45	15:00	42.7	44.5	35.4	62.2	
00:00	15:00	42.2	43.3	36.7	57.5	
00:15	15:00	43.7	46.1	39.1	53.6	
00:30	15:00	40.2	41.3	37.2	54.7	
00:45	15:00	39.4	39.9	36.3	55.7	
01:00	15:00	38.7	40.2	36.5	49.8	
01:15	15:00	40.8	42.4	37.5	52.4	
01:30	15:00	41.3	41.8	36.6	56.8	
01:45	15:00	40.1	42.1	36.4	53.5	
02:00	15:00	39.0	39.9	36.4	52.5	
02:15	15:00	40.4	40.7	36.3	54.4	
02:30	15:00	43.3	45.8	38.6	57.7	
02:45	15:00	39.1	39.8	32.8	60.0	
03:00	15:00	37.4	34.2	30.7	56.2	
03:15	15:00	34.4	34.9	30.3	52.8	
03:30	15:00	31.9	33.7	30.0	46.6	
03:45	15:00	41.8	35.6	32.3	62.6	
04:00	15:00	34.7	34.7	32.3	50.1	
04:15	15:00	34.3	34.4	32.2	48.7	
04:30	15:00	34.4	35.8	32.7	52.0	
04:45	15:00	34.4	35.4	33.2	41.9	
05:00	15:00	41.5	40.6	35.0	61.8	
05:15	15:00	42.3	42.5	36.8	60.6	
05:30	15:00	45.8	48.1	39.4	67.1	
05:45	15:00	55.2	53.9	40.7	79.2	
06:00	15:00	52.2	52.4	41.1	75.7	
06:15	15:00	52.5	52.2	41.9	77.1	
06:30	15:00	56.6	51.7	40.8	77.8	
06:45	15:00	52.4	50.0	42.2	86.8	
Log Average 2300-0700		47.0	46.0	37.1	41-87	
Average 2300-0700		41.8	42.3	35.9	41-87	
Average 1115-2300		53.8	57.4	44.1	58-89	

Noise Survey Results

Date: Saturday 23rd March 2019

Location: Holyhead Marina

TABLE 4

Client: AXIS

Project: Holyhead Waterfront Regeneration Scheme

Data: **Baseline Sound Survey: Position 1 - 15 Maes Y Mor**

Instrumentation: Cirrus 171A Real Time Analyser (G066350)

Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmx (dB)	Observations
07:00	15:00	47.5	49.5	42.7	69.6	
07:15	15:00	47.2	48.1	41.3	69.5	
07:30	15:00	49.8	51.3	40.5	75.4	
07:45	15:00	47.3	51.1	39.5	67.0	
08:00	15:00	45.7	49.5	38.4	67.6	
08:15	15:00	49.9	51.0	37.7	81.2	
08:30	15:00	60.8	52.7	39.6	92.0	
08:45	15:00	48.3	52.7	35.7	67.6	
09:00	15:00	56.2	53.9	39.8	79.6	
09:15	15:00	57.5	53.1	39.7	81.8	
09:30	15:00	53.5	54.5	38.3	74.9	
09:45	15:00	60.2	54.2	39.5	92.1	
10:00	15:00	50.9	53.8	37.5	73.3	
10:15	15:00	49.6	52.7	35.7	74.2	
10:30	15:00	49.0	52.7	40.5	62.6	
10:45	15:00	49.9	53.0	41.9	69.0	
11:00	15:00	50.1	53.6	43.4	62.0	
11:15	15:00	57.1	55.9	44.9	90.1	
11:30	15:00	50.6	52.6	43.8	69.7	
11:45	15:00	50.5	53.6	45.0	63.2	
12:00	15:00	52.4	53.7	44.8	73.4	
12:15	15:00	52.8	55.0	44.4	75.9	
12:30	15:00	50.0	52.8	43.9	69.1	
12:45	15:00	58.7	52.4	44.8	91.3	
13:00	15:00	60.5	52.7	44.6	89.7	
13:15	15:00	59.6	53.3	45.0	89.5	
13:30	15:00	72.2	55.2	45.1	97.9	
13:45	15:00	52.6	53.1	44.1	75.9	
14:00	15:00	52.3	53.2	40.7	75.9	
14:15	15:00	50.3	52.7	40.2	70.1	
14:30	15:00	59.0	56.1	39.8	90.2	
14:45	15:00	53.6	53.0	40.0	75.3	
Log Average 0700-11500		59.1	52.9	42.1	62-98	
Average 0700-11500		53.3	52.9	41.3	62-98	

Noise Survey Results

Date: Saturday 23rd March 2019

TABLE 5

Location: Holyhead Marina

Client: AXIS

Project: Holyhead Waterfront Regeneration Scheme

Data: **Baseline Sound Survey: Position 1 - 15 Maes Y Mor**

Instrumentation: Cirrus 171A Real Time Analyser (G066350)

Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmx (dB)	Observations
15:00	15:00	58.2	59.8	42.9	81.0	
15:15	15:00	53.0	56.3	41.7	72.9	
15:30	15:00	54.2	53.2	41.8	77.8	
15:45	15:00	48.2	51.9	37.1	65.0	
16:00	15:00	50.3	53.1	39.5	70.8	
16:15	15:00	53.6	53.4	39.0	77.3	
16:30	15:00	49.9	53.2	39.8	66.0	
16:45	15:00	53.4	52.7	39.5	74.9	
17:00	15:00	48.6	52.2	36.4	74.1	
17:15	15:00	50.1	53.0	36.8	76.3	
17:30	15:00	47.8	51.8	36.0	68.3	
17:45	15:00	48.5	52.7	37.8	60.3	
18:00	15:00	50.0	52.8	42.4	69.2	
18:15	15:00	61.9	53.2	46.3	96.6	
18:30	15:00	50.2	52.7	45.1	73.2	
18:45	15:00	49.7	53.4	44.1	64.8	
19:00	15:00	49.4	52.4	44.9	63.4	
19:15	15:00	48.8	52.3	44.3	59.7	
19:30	15:00	49.3	52.4	45.3	59.8	
19:45	15:00	47.0	49.2	43.3	56.2	
20:00	15:00	49.8	51.6	45.1	72.2	
20:15	15:00	47.8	50.2	38.4	61.5	
20:30	15:00	43.5	47.4	35.2	58.4	
20:45	15:00	45.6	49.8	34.2	60.8	
21:00	15:00	45.3	49.7	35.7	61.9	
21:15	15:00	44.8	49.9	34.0	62.8	
21:30	15:00	41.2	42.3	33.6	60.2	
21:45	15:00	42.6	45.8	33.4	61.3	
22:00	15:00	42.6	44.9	32.9	59.8	
22:15	15:00	42.3	45.4	32.3	58.8	
22:30	15:00	42.3	46.7	32.7	56.4	
22:45	15:00	42.4	46.0	34.6	56.0	
Log Average 1500-2300		51.6	52.3	41.0	56-97	
Average 1500-2300		48.5	51.0	38.9	56-97	

Noise Survey Results

Date: Saturday 23rd - Sunday 24th March 2019

Location: Holyhead Marina

Client: AXIS

Project: Holyhead Waterfront Regeneration Scheme

Data: **Baseline Sound Survey: Position 1 - 15 Maes Y Mor**

Instrumentation: Cirrus 171A Real Time Analyser (G066350)

Calibration: 94dB

TABLE 6

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmx (dB)	Observations
23:00	15:00	38.5	40.4	34.1	56.5	
23:15	15:00	39.4	40.1	33.4	56.8	
23:30	15:00	39.2	41.4	32.6	57.6	
23:45	15:00	40.8	42.0	33.0	59.1	
00:00	15:00	44.7	46.8	37.2	57.2	
00:15	15:00	48.9	48.4	42.0	79.4	
00:30	15:00	42.6	43.5	39.7	54.8	
00:45	15:00	53.8	45.8	40.7	78.2	
01:00	15:00	44.7	46.1	41.4	56.0	
01:15	15:00	43.1	44.1	40.8	54.7	
01:30	15:00	41.4	42.8	36.9	56.2	
01:45	15:00	41.5	41.1	37.1	57.6	
02:00	15:00	41.0	41.7	38.5	54.8	
02:15	15:00	42.8	45.5	39.1	54.1	
02:30	15:00	40.0	43.5	32.1	57.1	
02:45	15:00	37.6	38.2	35.2	49.8	
03:00	15:00	39.0	39.2	35.0	55.5	
03:15	15:00	39.7	39.8	34.6	58.3	
03:30	15:00	39.1	39.1	34.4	59.8	
03:45	15:00	40.2	39.9	35.4	53.3	
04:00	15:00	40.4	40.3	35.7	52.8	
04:15	15:00	40.8	40.9	35.8	61.1	
04:30	15:00	41.2	39.6	33.2	52.8	
04:45	15:00	37.6	38.8	33.4	52.4	
05:00	15:00	40.7	40.4	33.2	57.2	
05:15	15:00	39.9	39.8	32.2	52.6	
05:30	15:00	45.2	48.0	35.5	59.8	
05:45	15:00	47.5	49.6	36.2	74.8	
06:00	15:00	54.3	52.1	36.9	77.2	
06:15	15:00	44.0	47.4	37.3	64.4	
06:30	15:00	42.9	46.7	37.7	58.9	
06:45	15:00	52.1	49.6	37.8	80.5	
Log Average 2300-0700		45.7	44.9	37.1	50-81	
Average 2300-0700		42.6	43.2	36.2	50-81	
Average 0700-2300		56.8	52.7	41.6	56-98	

Noise Survey Results

Date: Sunday 24th March 2019

Location: Holyhead Marina

Client: AXIS

Project: Holyhead Waterfront Regeneration Scheme

Data: **Baseline Sound Survey: Position 1 - 15 Maes Y Mor**

Instrumentation: Cirrus 171A Real Time Analyser (G066350)

Calibration: 94dB

TABLE 7

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmx (dB)	Observations
07:00	15:00	50.0	52.9	35.3	72.3	
07:15	15:00	48.7	50.8	36.0	73.9	
07:30	15:00	47.7	49.2	35.4	67.1	
07:45	15:00	46.6	50.6	36.7	68.7	
08:00	15:00	48.2	51.5	35.9	67.8	
08:15	15:00	49.0	51.7	36.5	70.4	
08:30	15:00	63.5	48.4	36.5	90.6	
08:45	15:00	47.9	51.9	35.7	66.6	
09:00	15:00	46.6	50.9	36.2	61.9	
09:15	15:00	49.1	52.3	38.1	72.9	
09:30	15:00	48.0	51.6	37.5	68.9	
09:45	15:00	51.0	54.6	40.7	69.8	
10:00	15:00	49.6	53.6	39.7	63.1	
10:15	15:00	51.3	54.5	39.6	69.7	
10:30	15:00	50.5	53.8	42.3	69.2	
10:45	15:00	55.4	54.4	41.0	87.0	
11:00	15:00	50.2	53.8	41.6	63.4	
11:15	15:00	53.4	55.4	41.1	71.8	
11:30	15:00	56.9	54.0	41.9	80.3	
11:45	15:00	50.3	53.2	41.7	69.9	
12:00	15:00	53.1	54.3	45.0	70.9	
12:15	15:00	56.1	54.6	44.9	85.4	
12:30	15:00	51.8	54.7	46.3	67.9	
12:45	15:00	52.7	55.6	44.7	67.5	
13:00	15:00	51.9	54.6	43.0	67.7	
13:15	15:00	55.1	57.5	45.4	75.0	
13:30	15:00	57.4	57.8	46.1	80.1	
13:45	15:00	56.5	59.4	45.8	70.8	
14:00	15:00	55.6	59.0	42.8	75.7	
14:15	15:00	50.5	54.0	41.2	64.8	
14:30	15:00	51.3	53.8	40.9	71.6	
14:45	15:00	51.5	54.9	41.2	68.2	
Log Average 0700-1500		53.8	54.4	41.8	62-91	
Average 0700-1500		51.8	53.7	40.5	62-91	

Noise Survey Results

Date: Sunday 24th March 2019

TABLE 8

Location: Holyhead Marina

Client: AXIS

Project: Holyhead Waterfront Regeneration Scheme

Data: **Baseline Sound Survey: Position 1 - 15 Maes Y Mor**

Instrumentation: Cirrus 171A Real Time Analyser (G066350)

Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmx (dB)	Observations
15:00	15:00	51.6	53.8	41.7	73.3	
15:15	15:00	53.5	55.1	42.0	75.2	
15:30	15:00	49.9	53.3	40.2	74.4	
15:45	15:00	51.2	53.6	41.5	75.2	
16:00	15:00	52.4	52.8	39.5	82.7	
16:15	15:00	54.9	52.3	38.7	85.8	
16:30	15:00	60.5	52.6	39.6	93.9	
16:45	15:00	50.8	51.9	39.5	75.9	
17:00	15:00	48.8	52.2	39.7	67.6	
17:15	15:00	47.1	51.3	37.5	64.4	
17:30	15:00	50.4	53.1	40.1	67.9	
17:45	15:00	48.7	52.3	39.7	74.5	
18:00	15:00	46.3	50.1	39.1	66.6	
18:15	15:00	47.1	51.7	38.8	64.3	
18:30	15:00	57.9	52.1	39.9	89.9	
18:45	15:00	47.4	51.5	40.0	59.5	
19:00	15:00	46.8	50.2	38.9	68.4	
19:15	15:00	45.5	49.7	38.3	60.5	
19:30	15:00	44.0	48.5	37.1	57.2	
19:45	15:00	45.4	49.7	37.1	58.3	
20:00	15:00	44.1	46.9	38.1	59.0	
20:15	15:00	44.7	47.6	39.0	58.5	
20:30	15:00	45.2	48.9	39.0	58.8	
20:45	15:00	44.9	48.3	39.3	58.4	
21:00	15:00	42.8	44.8	37.7	56.0	
21:15	15:00	42.6	45.7	33.7	56.1	
21:30	15:00	42.2	42.6	34.9	58.3	
21:45	15:00	43.7	45.9	35.7	61.5	
22:00	15:00	42.5	44.7	36.9	57.5	
22:15	15:00	43.0	44.1	38.3	57.6	
22:30	15:00	42.9	43.3	37.8	62.0	
22:45	15:00	43.4	44.9	38.5	61.1	
Log Average 1500-2300		50.7	50.7	39.0	56-94	
Average 1500-2300		47.6	49.5	38.7	56-94	

Noise Survey Results

Date: Sunday 24th - Monday 25th March 2019

Location: Holyhead Marina

TABLE 9

Client: AXIS

Project: Holyhead Waterfront Regeneration Scheme

Data: **Baseline Sound Survey: Position 1 - 15 Maes Y Mor**

Instrumentation: Cirrus 171A Real Time Analyser (G066350)

Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmx (dB)	Observations
23:00	15:00	40.3	39.8	35.4	57.0	
23:15	15:00	39.9	38.9	34.3	60.6	
23:30	15:00	38.2	38.6	34.5	51.6	
23:45	15:00	41.5	43.9	37.5	52.3	
00:00	15:00	42.8	44.4	38.3	52.8	
00:15	15:00	42.5	43.6	38.4	56.7	
00:30	15:00	44.9	46.2	38.2	58.8	
00:45	15:00	43.2	44.2	38.3	56.7	
01:00	15:00	41.7	43.0	38.0	54.0	
01:15	15:00	40.3	41.2	37.8	50.4	
01:30	15:00	41.0	42.3	37.6	46.3	
01:45	15:00	42.2	43.2	37.8	54.7	
02:00	15:00	43.2	44.1	38.2	55.3	
02:15	15:00	45.5	48.3	38.4	53.6	
02:30	15:00	44.0	46.8	39.3	58.5	
02:45	15:00	40.9	42.0	39.5	52.7	
03:00	15:00	43.0	44.4	40.1	56.7	
03:15	15:00	43.5	45.2	40.3	56.9	
03:30	15:00	44.2	45.7	41.6	58.4	
03:45	15:00	42.7	43.7	39.2	56.2	
04:00	15:00	40.2	41.2	37.7	52.6	
04:15	15:00	42.7	43.7	40.0	58.2	
04:30	15:00	41.4	43.1	38.0	53.6	
04:45	15:00	39.7	41.2	36.9	52.1	
05:00	15:00	42.9	44.4	38.4	56.0	
05:15	15:00	44.7	46.3	41.3	56.2	
05:30	15:00	55.8	52.6	43.7	82.3	
05:45	15:00	57.9	54.9	45.0	82.2	
06:00	15:00	51.4	53.2	45.5	70.3	
06:15	15:00	49.0	51.4	45.7	62.4	
06:30	15:00	51.2	52.0	45.2	79.5	
06:45	15:00	53.2	54.5	44.3	78.9	
Log Average 2300-0700		48.0	47.8	40.6	46-82	
Average 2300-0700		44.2	45.3	39.5	46-82	
Average 0700-2300		56.8	52.7	41.6	56-94	

Noise Survey Results

Date: Monday 25th March 2019

Location: Holyhead Marina

TABLE 10

Client: AXIS

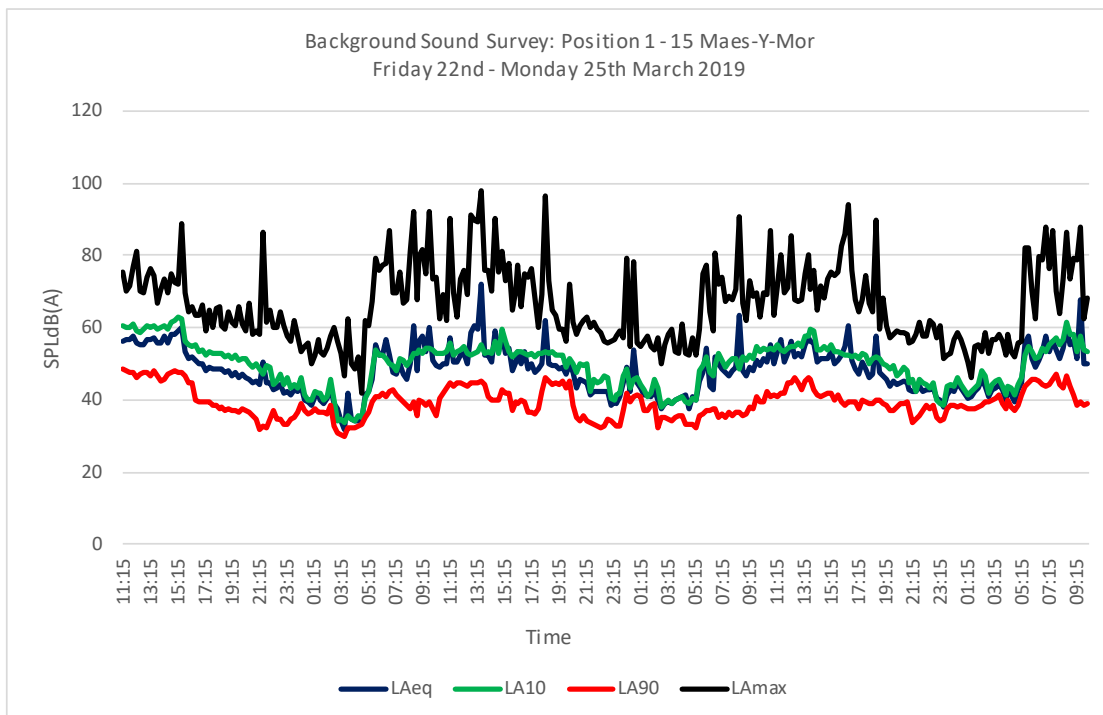
Project: Holyhead Waterfront Regeneration Scheme

Data: **Baseline Sound Survey: Position 1 - 15 Maes Y Mor**

Instrumentation: Cirrus 171A Real Time Analyser (G066350)

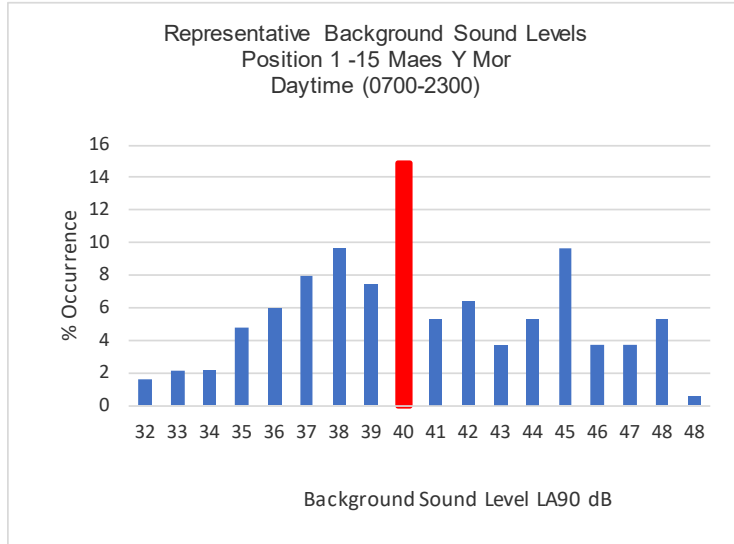
Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmix (dB)	Observations
07:00	15:00	57.8	53.3	44.0	87.8	
07:15	15:00	53.2	55.1	44.4	76.4	
07:30	15:00	56.4	56.5	45.7	86.9	
07:45	15:00	54.1	57.1	47.2	70.1	
08:00	15:00	51.3	55.1	44.1	63.7	
08:15	15:00	54.5	56.6	43.4	73.4	
08:30	15:00	59.8	61.6	46.8	86.3	
08:45	15:00	55.1	58.1	43.6	73.6	
09:00	15:00	56.2	58.3	41.6	79.2	
09:15	15:00	51.3	53.2	38.7	78.6	
09:30	15:00	67.8	57.8	39.7	87.8	
09:45	15:00	49.8	54.0	38.6	62.6	
10:00	15:00	50.0	53.6	39.1	68.4	
Log Average 0700-1015		58.8	56.8	43.7	63-88	
Average 0700-1015		55.2	56.2	42.8	63-88	
Overall Log Average		45.4	45	37.6	41-87	
Overall Log Average		55.2	54.6	42.3	56-98	



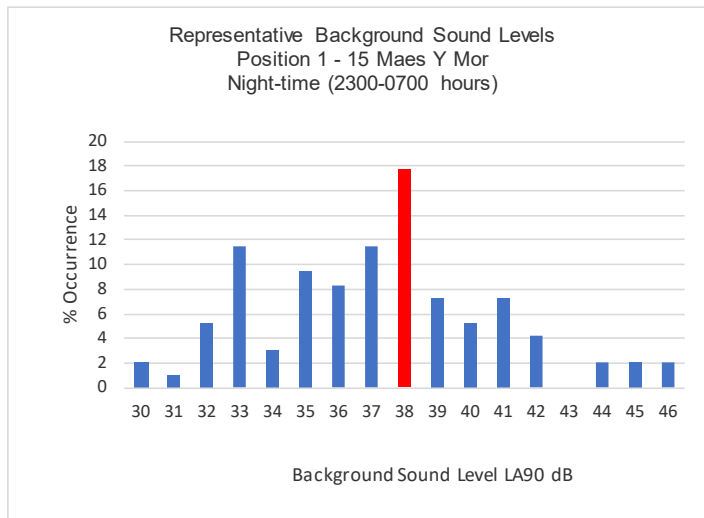
LA90 % Occurrence

32	1.6
33	2.1
34	2.1
35	4.8
36	5.9
37	8
38	9.6
39	7.4
40	14.9
41	5.3
42	6.4
43	3.7
44	5.3
45	9.6
46	3.7
47	3.7
48	5.3
48	0.5



LA90 % Occurrence

30	2.1
31	1.0
32	5.2
33	11.5
34	3.1
35	9.4
36	8.3
37	11.5
38	17.7
39	7.3
40	5.2
41	7.3
42	4.2
43	0
44	2.1
45	2.1
46	2.1



Noise Survey Results

Date: Friday 22nd March 2019
 Location: Holyhead Marina
 Client: AXIS
 Project: Holyhead Waterfront Regeneration Scheme
 Data: **Baseline Sound Survey: Position 2 - Boathouse Hotel**
 Instrumentation: Norsonic 116 Real Time Analyser (27342)
 Calibration: 94dB

TABLE 11

Start Time	Run Time (hrs.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmx (dB)	Observations
12:00	01:00	54.7	56.8	43.0	82.1	
13:00	01:00	55.2	55.6	44.2	73.3	
14:00	01:00	55.3	55.9	44.1	72.2	
15:00	01:00	55.2	56.1	42.7	69.9	
16:00	01:00	55.4	56.6	40.2	70.3	
17:00	01:00	54.9	53.9	40.3	76.3	
18:00	01:00	51.0	49.7	39.8	67.9	
19:00	01:00	51.4	50.4	39.5	67.3	
20:00	01:00	50.1	49.2	36.0	67.6	
21:00	01:00	50.5	49.3	38.3	66.5	
22:00	01:00	52.0	49.4	39.0	78.9	
Average 1200-2300		53.7	54.0	41.3	67-82	
Average 1200-1900		54.7	55.4	42.3	68-82	

Noise Survey Results

Date: Friday 22nd - Saturday 23rd March 2019
 Location: Holyhead Marina
 Client: AXIS
 Project: Holyhead Waterfront Regeneration Scheme
 Data: **Baseline Sound Survey: Position 2 - Boathouse Hotel**
 Instrumentation: Norsonic 116 Real Time Analyser (27342)
 Calibration: 94dB

TABLE 12

Start Time	Run Time (hrs.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmx (dB)	Observations
23:00	01:00	46.8	45.8	38.3	72.7	
00:00	01:00	43.5	45.0	38.6	65.6	
01:00	01:00	43.6	45.7	39.4	60.8	
02:00	01:00	40.2	40.4	36.2	72.1	
03:00	01:00	37.7	39.3	34.8	58.0	
04:00	01:00	37.7	39.2	35.2	52.2	
05:00	01:00	45.5	46.5	35.0	73.3	
06:00	01:00	44.6	42.6	38.3	71.5	
Log Average 2300-0700		43.5	43.9	37.3	52-73	
Average 2300-0700		42.5	43.1	37.0	52-73	
Average 1200-2300		51.1	53.8	40.4	67-82	

Noise Survey Results

Date: Saturday 23rd March 2019
 Location: Holyhead Marina
 Client: AXIS
 Project: Holyhead Watefront Regeneration Scheme
 Data: **Baseline Sound Survey: Position 2 - Boathouse Hotel**
 Instrumentation: Norsonic 116 Real Time Analyser (27342)
 Calibration: 94dB

TABLE 13

Start Time	Run Time (hrs.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmx (dB)	Observations
07:00	01:00	44.9	42.8	37.1	70.0	
08:00	01:00	49.7	52.9	37.6	68.8	
09:00	01:00	49.6	53.7	37.9	67.9	
10:00	01:00	50.6	54.8	39.2	71.5	
11:00	01:00	51.1	55.3	38.8	70.5	
12:00	01:00	51.6	54.6	39.3	75.3	
13:00	01:00	53.8	55.2	40.3	78.3	
14:00	01:00	53.1	56.3	40.2	76.4	
15:00	01:00	52.9	56.2	39.5	81.5	
16:00	01:00	50.7	55.2	39.1	70.3	
17:00	01:00	51.8	55.3	39.7	78.9	
18:00	01:00	49.0	51.9	36.2	75.7	
19:00	01:00	48.2	49.5	35.4	76.2	
20:00	01:00	48.1	47.2	32.2	67.8	
21:00	01:00	42.4	38.8	32.6	64.2	
22:00	01:00	43.4	38.1	32.1	67.4	
Average 0700-2300		50.4	53.4	38.0	64-82	
Average 0700-1300		50.0	53.6	38.3	68-75	

Noise Survey Results

Date: Saturday 23rd - Sunday 24th March 2019
 Location: Holyhead Marina
 Client: AXIS
 Project: Holyhead Watefront Regeneration Scheme
 Data: **Baseline Sound Survey: Position 2 - Boathouse Hotel**
 Instrumentation: Norsonic 116 Real Time Analyser (27342)
 Calibration: 94dB

TABLE 14

Start Time	Run Time (hrs.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmx (dB)	Observations
23:00	01:00	41.9	34.5	27.3	63.5	
00:00	01:00	40.2	33.0	29.4	64.0	
01:00	01:00	35.6	32.8	28.7	61.2	
02:00	01:00	32.9	34.0	29.8	53.7	
03:00	01:00	39.1	35.2	30.4	65.5	
04:00	01:00	38.0	39.9	31.9	59.8	
05:00	01:00	48.2	48.9	35.7	75.5	
06:00	01:00	52.2	49.5	35.3	79.1	
Log Average 2300-0700		45.4	43.7	32.0	54-79	
Average 2300-0700		41.0	38.5	31.1	54-79	
Average 0700-2300		50.4	53.4	33.1	64-82	

Noise Survey Results

Date: Sunday 24th March 2019
 Location: Holyhead Marina
 Client: AXIS
 Project: Holyhead Waterfront Regeneration Scheme
 Data: **Baseline Sound Survey: Position 2 - Boathouse Hotel**
 Instrumentation: Norsonic 116 Real Time Analyser (27342)
 Calibration: 94dB

TABLE 15

Start Time	Run Time (hrs.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmx (dB)	Observations
07:00	01:00	51.8	51.0	36.7	78.6	
08:00	01:00	49.1	52.4	39.6	76.6	
09:00	01:00	51.7	55.5	40.4	70.4	
10:00	01:00	53.4	56.7	42.4	75.3	
11:00	01:00	52.9	56.5	41.9	73.6	
12:00	01:00	54.8	58.2	42.2	76.0	
13:00	01:00	53.9	56.8	42.0	77.8	
14:00	01:00	53.0	56.8	41.9	75.6	
15:00	01:00	52.6	56.1	41.5	78.4	
16:00	01:00	52.6	55.7	41.1	75.0	
17:00	01:00	52.5	55.3	42.8	74.4	
18:00	01:00	49.6	52.3	42.1	67.4	
19:00	01:00	47.9	49.8	40.5	67.4	
20:00	01:00	51.2	53.4	40.7	74.5	
21:00	01:00	49.5	52.2	42.5	67.8	
22:00	01:00	48.0	51.1	40.2	65.8	
Log Average 0700-2300		51.9	55.0	41.3	66-79	
Average 0700-2300		51.5	54.4	41.2	66-79	

Noise Survey Results

Date: Sunday 24th - Monday 25th March 2019
 Location: Holyhead Marina
 Client: AXIS
 Project: Holyhead Waterfront Regeneration Scheme
 Data: **Baseline Sound Survey: Position 2 - Boathouse Hotel**
 Instrumentation: Norsonic 116 Real Time Analyser (27342)
 Calibration: 94dB

TABLE 16

Start Time	Run Time (hrs.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmx (dB)	Observations
23:00	01:00	41.8	44.3	35.1	60.8	
00:00	01:00	42.7	45.3	36.4	65.5	
01:00	01:00	41.7	44.3	36.6	64.7	
02:00	01:00	46.1	48.9	35.4	67.6	
03:00	01:00	46.4	47.3	35.6	66.2	
04:00	01:00	43.2	46.4	37.3	68.5	
05:00	01:00	47.3	48.0	38.6	70.3	
06:00	01:00	48.9	49.4	38.3	78.7	
Log Average 2300-0700		45.5	47.1	36.8	61-79	
Average 2300-0700		44.8	46.7	36.7	61-79	
Average 0700-2300		51.9	55	41.5	66-79	

Noise Survey Results

Date: Monday 25th March 2019

Location: Holyhead Marina

TABLE 17

Client: AXIS

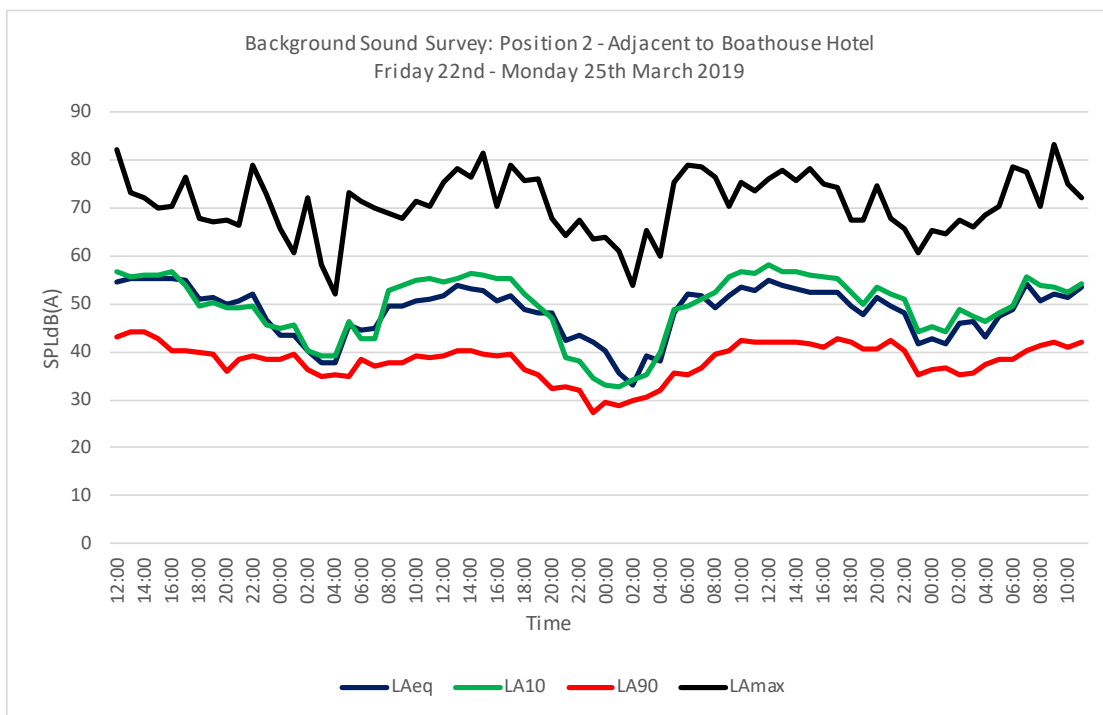
Project: Holyhead Waterfront Regeneration Scheme

Data: **Baseline Sound Survey: Position 2 - Boathouse Hotel**

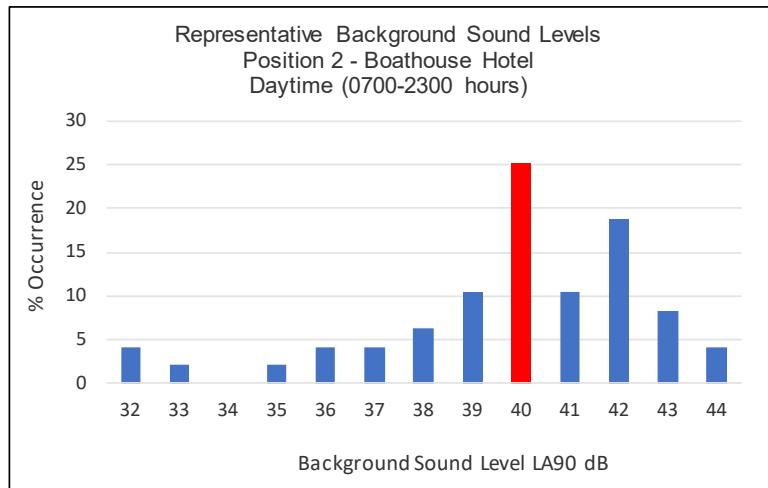
Instrumentation: Norsonic 116 Real Time Analyser (27342)

Calibration: 94dB

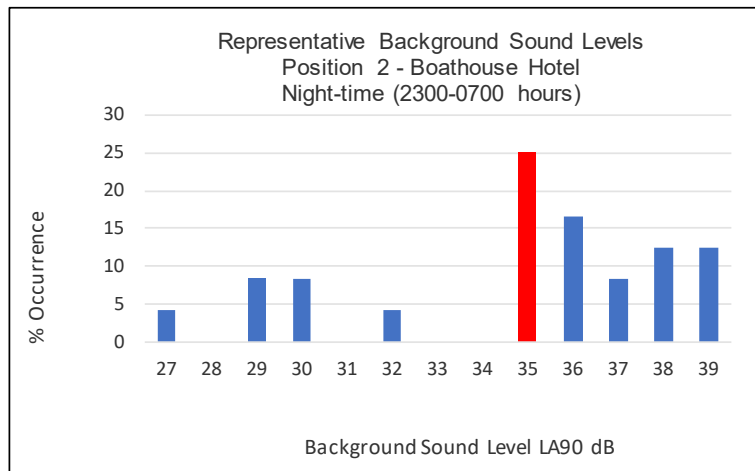
Start Time	Run Time (hrs.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmix (dB)	Observations
07:00	01:00	54.1	55.8	40.3	77.4	
08:00	01:00	54.7	56.3	41.3	70.3	
09:00	01:00	55.0	55.3	42.2	83.4	
10:00	01:00	54.6	55.0	41.0	75.1	
11:00	01:00	55.1	56.2	42.2	72.3	
Average 0700-1100		54.6	55.5	41.4	66-84	
Overall Log Average		44.9	45.2	35.9	52-79	
Overall Log Average		52.4	54.4	40.5	64-84	



LA90	% Occurrence
32	4.2
33	2.1
34	0
35	2.1
36	4.2
37	4.2
38	6.3
39	10.4
40	25
41	10.4
42	18.8
43	8.3
44	4.2



LA90	% Occurrence
27	4.2
28	0
29	8.3
30	8.3
31	0.0
32	4.2
33	0.0
34	0
35	25
36	16.7
37	8.3
38	12.5
39	12.5



Noise Survey Results at Port Solent Marina

Noise Survey Results

Date: 19th-20th August 2006

Location: Port Solent

Client: Axis

Project: Martello Quay Development

Data: **Port Solent Noise Monitoring at Marina - Rear Garden Facing Lock**

Instrumentation: Cirrus 704B Integrating Data Logging Precision SLM

Weather Conditions: Dry, sunny periods, temp. 15-20deg C, westerly light winds (1-2m/s)

Calibration: 94dB

TABLE 1

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmx (dB)	Observations
12:00	15:00	49.1	51.9	42.6	61.6	
12:15	15:00	49.6	51.3	45.4	62.9	
12:30	15:00	62.6	66.9	43.5	69.1	Engine start at adjacent pontoon
12:45	15:00	46.8	48.1	43.6	58.9	
13:00	15:00	55.9	58.5	45.2	68.3	
13:15	15:00	46.4	47.9	43.6	57.1	
13:30	15:00	50.9	53.7	45.1	65.1	
13:45	15:00	51.3	53.1	44.4	63.7	General boating activities at lock
14:00	15:00	55.2	55.6	46.5	72.3	
14:15	15:00	53.3	55.7	48.4	62.7	
14:30	15:00	50.9	53.5	45.5	60.4	
14:45	15:00	51.1	54.1	44.5	62.6	
15:00	15:00	52.8	54.3	46	65.7	
15:15	15:00	53.4	53.7	45.6	68.6	
15:30	15:00	51.1	51	44.3	75.4	
15:45	15:00	49.3	50.1	44	71.8	
16:00	15:00	52.5	55.1	45.7	66.1	
16:15	15:00	48.6	50.6	43	62.1	
16:30	15:00	48	49.7	44	63.1	
16:45	15:00	51.6	54.3	45.9	61.9	
17:00	15:00	49.7	50.4	45.6	69.9	
17:15	15:00	56.4	53.5	45.2	75.7	
17:30	15:00	47.6	49.1	43.8	59.2	
17:45	15:00	47.4	49.2	44.3	55.4	
Average		51.31	52.97	44.82	64.98	

Noise Survey Results

Date: 19th-20th August 2006

Site: Port Solent

Client: Axis

Project: Martello Quay Development

Data: **Port Solent Noise Monitoring at Marina -Rear Garden Facing Lock**

Instrumentation: Cirrus 704B Integrating Data Logging Precision SLM

Weather Conditions: Dry, sunny periods, temp. 15-20deg C, westerly light winds (1-2m/s)

Calibration: 94dB

TABLE 2

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmix (dB)	Observations
18:00	15:00	47.2	48.3	44.1	60.1	General noise from boardwalk
18:15	15:00	47	48.7	43.8	55.5	
18:30	15:00	48.9	50.6	44.9	59.6	
18:45	15:00	47.9	50.7	42.5	60	
19:00	15:00	48.3	50.8	43.4	60.2	
19:15	15:00	47.8	49.9	43.5	59.1	
19:30	15:00	45.1	46.5	42.4	53.1	
19:45	15:00	45.1	47.3	40.9	54.5	
20:00	15:00	49.4	51.2	41.5	64.4	
20:15	15:00	45.4	47.3	40.8	57.2	
20:30	15:00	44.7	47	40.6	55.9	
20:45	15:00	44.7	45.8	40.4	58.9	
21:00	15:00	45	45.9	40.3	61.7	
21:15	15:00	43.6	45.3	39.9	58.6	
21:30	15:00	41.8	42.9	39.7	49.6	
21:45	15:00	43.5	45	40.6	52.2	
22:00	15:00	44.4	45.1	40.6	59.1	
22:15	15:00	43.1	44.4	39.9	55.2	
22:30	15:00	42.2	43.4	39.9	49.1	
22:45	15:00	52.3	45.8	39.9	76.4	
		45.87	47.09	41.48	58.02	

Noise Survey Results

Date: 19th-20th August 2006

Site: Port Solent

TABLE 3

Client: Axis

Project: Martello Quay Development

Data: **Port Solent Noise Monitoring at Marina -Rear Garden Facing Lock**

Instrumentation: Cirrus 704B Integrating Data Logging Precision SLM

Weather Conditions: Dry, skies clear, light south westerly winds (0-1m/s), temp.10-13deg C

Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmx (dB)	Observations
23:00	15:00	43.1	44.1	41.1	51.4	No significant noise
23:15	15:00	45	46.5	41.8	56.5	
23:30	15:00	42.2	43.2	40.4	46.9	
23:45	15:00	42.6	43.8	40.5	52	
00:00	15:00	42	43	39	54.6	
00:15	15:00	43.9	45	40.5	58.8	
00:30	15:00	41.6	42.8	39	54.7	
00:45	15:00	41.7	43.3	38.8	49.4	
01:00	15:00	41.2	42.9	38.6	50.9	
01:15	15:00	41	42.3	38.5	51.3	
01:30	14:59	39.5	40.4	37.7	45	
01:45	14:59	40	41	37.8	49.9	
02:00	15:00	38.9	39.8	36.9	48.4	
02:15	14:59	39.8	42.4	36.5	52.5	
02:30	15:00	39.2	40.2	37	48.9	
02:45	15:00	38.3	39.2	36.3	45.1	
03:00	15:00	39.3	40.6	36.8	48.7	
03:15	14:59	39.7	41.9	36	54.4	
03:30	15:00	37.8	39.1	35	47.8	
03:45	15:00	38	39.2	35.6	47.4	
04:00	15:00	38	39.1	35.7	46.5	
04:15	15:00	38	39.5	35.5	45.9	
04:30	15:00	37.4	38.3	35.4	45.3	
04:45	15:00	37.7	38.9	35.5	45.7	
05:00	15:00	37.6	39	35.2	44.5	
05:15	15:00	38	39.1	35.6	47.5	
05:30	14:59	41.3	43.7	36.2	58.6	
05:45	14:59	40.9	42.7	37.7	53.9	
06:00	14:59	41.3	43.1	37.8	52.1	
06:15	15:00	40.7	41.9	38.5	49.3	
06:30	14:59	42.3	43.2	38.7	56.3	
06:45	15:00	44.2	44.2	40.5	60	
Average		40.4	41.7	37.7	50.6	

Noise Survey Results

Date: 19th-20th August 2006

Site: Port Solent

TABLE 4

Client: Axis

Project: Martello Quay Development

Data: **Port Solent Noise Monitoring at Marina -Rear Garden Facing Lock**

Instrumentation: Cirrus 704B Integrating Data Logging Precision SLM

Dry, variable cloud cover, light to moderate southwesterly winds (2-4m/s),

Weather Conditions: temp. 12-17deg C

Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmix (dB)	Observations
07:00	15:00	43.5	45.2	41	54.2	General boating activities
07:15	15:00	44.2	45.4	41.8	53.4	
07:30	15:00	44.3	45.1	41.1	63.4	
07:45	15:00	43.7	45	41.1	51.8	
08:00	15:00	44.3	45.3	41.4	56.8	
08:15	15:00	44.1	45.4	41.7	51.5	
08:30	15:00	42.9	43.8	41	50.5	
08:45	15:00	45.4	46.6	42.9	54	
09:00	15:00	45.8	47.6	42.8	56.4	
09:15	15:00	47.5	48.5	44.8	56.5	
09:30	15:00	48.1	49.3	45.6	59.4	
09:45	15:00	49.7	50.8	46.1	63.5	
10:00	15:00	51.4	53.1	47.7	62.5	
10:15	15:00	50.2	51.2	45.7	66.6	
10:30	15:00	48.5	49.4	46.3	61.4	
10:45	15:00	49.8	51.6	46.9	57.4	
11:00	15:00	50	51.2	47.6	58.1	
11:15	15:00	51.1	52.1	49.3	56.2	
11:30	15:00	50.2	51.2	46.7	60.2	
11:45	15:00	48.1	49.1	46	55.1	
12:00	15:00	48.5	49.2	45.4	62.7	
12:15	15:00	48	49.2	45.4	59.4	
12:45	01:17	52.9	56.9	47.9	60.5	
Average		47.5	48.8	44.6	57.9	
Average 0700-2300		48.3	49.7	43.7	60.4	A
Average 2300-0700		40.4	41.7	37.7	50.6	A

Average 1700-1800 46.15

Noise Survey Results

Date: 19th-20th August 2006

Location: Port Solent

Client: Axis

Project: Martello Quay Development

Data: **First floor rear façade facing lock**

Instrumentation: Cirrus 831A Integrating Data Logging Precision SLM

Weather Conditions: Sat: Dry, sunny periods, temp. 15-20deg C, westerly light winds (1-2m/s)

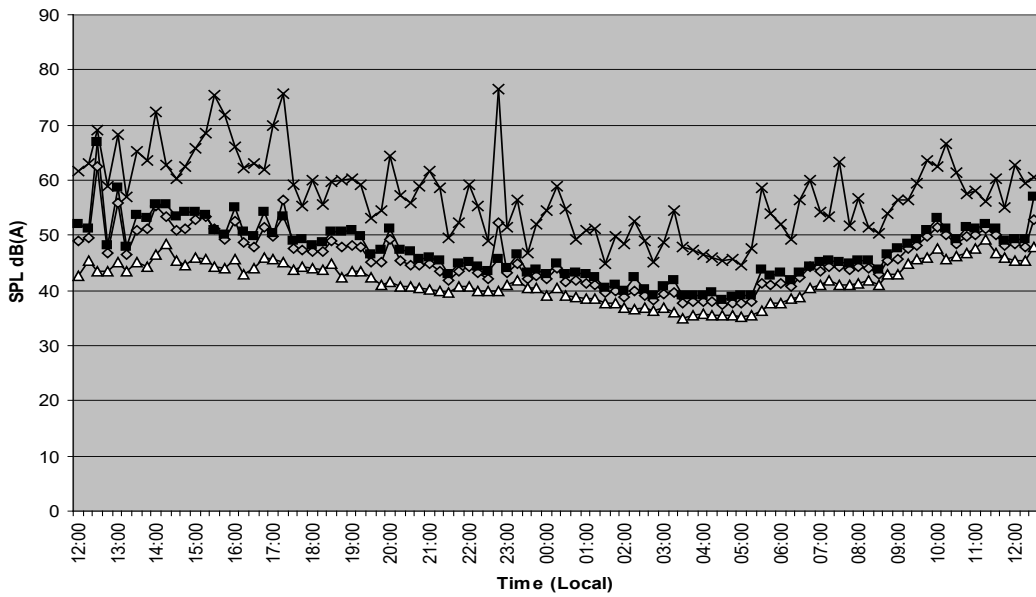
Sun: Dry, variable cloud cover, light to moderate southwesterly winds (2-4m/s), temp. 12-17deg C

TABLE 5

Calibration: 94dB

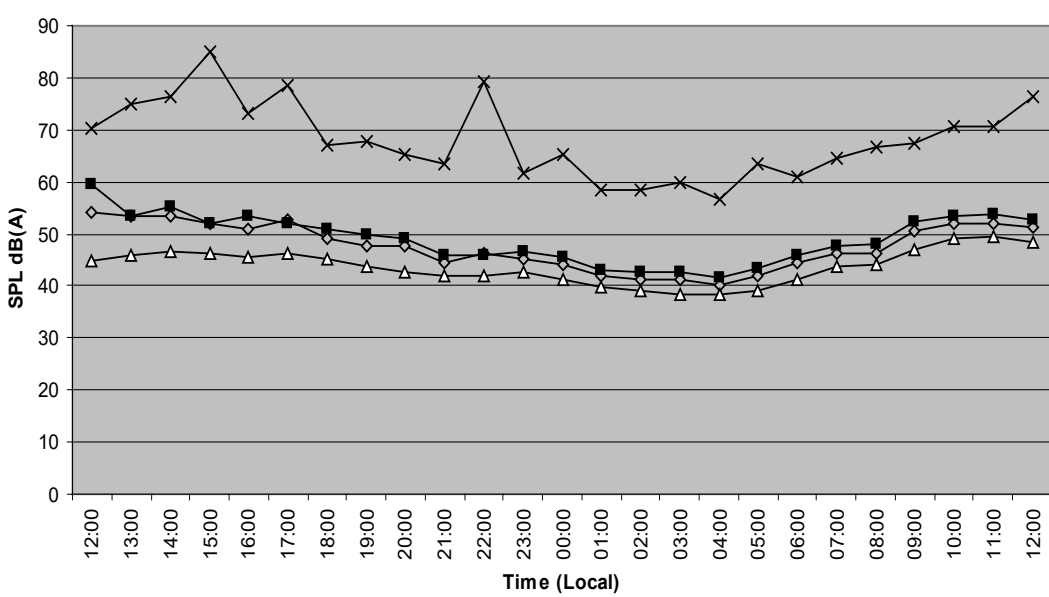
Start Time	Run Time (hours:mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmix (dB)	Observations
12:00	01:00	54.1	59.6	45.0	70.3	Engine start at pontoon General boat movement activity
13:00	01:00	53.5	53.4	45.8	74.8	
14:00	01:00	53.3	55.1	46.6	76.2	
15:00	01:00	51.9	52.0	46.1	84.9	
16:00	01:00	50.9	53.4	45.6	73.1	
17:00	01:00	52.7	52.0	46.4	78.5	
18:00	01:00	49.1	51.0	45.2	67.0	
19:00	01:00	47.8	49.8	43.7	67.7	
20:00	01:00	47.6	49.3	42.7	65.4	
21:00	01:00	44.6	45.9	42.1	63.4	
22:00	01:00	46.3	46.0	41.9	79.4	
23:00	01:00	45.1	46.6	42.7	61.5	Boating activities
00:00	01:00	44.0	45.4	41.4	65.4	
01:00	01:00	41.9	43.2	39.9	58.5	
02:00	01:00	41.4	42.7	39.1	58.5	
03:00	01:00	41.1	42.6	38.3	60.0	
04:00	01:00	40.2	41.5	38.2	56.5	
05:00	01:00	42.0	43.5	39.0	63.3	
06:00	01:00	44.3	45.9	41.3	60.9	
07:00	01:00	46.1	47.6	43.9	64.7	
08:00	01:00	46.4	47.9	44.1	66.7	
09:00	01:00	50.4	52.2	46.9	67.3	
10:00	01:00	51.9	53.6	49.1	70.6	
11:00	01:00	52.1	53.7	49.5	70.5	
12:00	01:00	51.3	52.7	48.4	76.2	
Average		47.6	49.06	43.71	68.05	
Average 0700-2300		50.0	51.5	45.5	71.6	A
Average 2300-0700		42.5	43.9	40.0	60.6	A

**Port Solent Noise Monitoring Residential Location
Saturday-Sunday at Rear Garden Position**



◇ LAeq
 ■ LA10
 △ LA90
 × LAmax

**Port Solent Noise Monitoring - Marina Residential Location: Saturday -Sunday
at First Floor Balcony Position**



◇ LAeq
 ■ LA10
 △ LA90
 × LAmax

APPENDIX 18.4

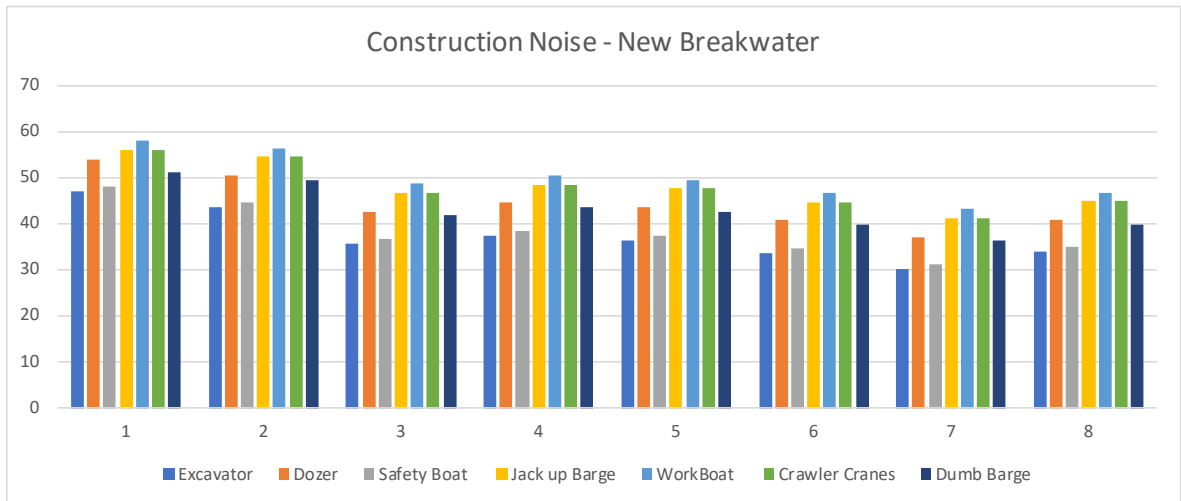
Construction Plant Inventory & Prediction Calculations

Plant Type	Sound Power Level	% Operating Time
Lorry	105	100
JCB	108	50
Dumper	95-110	50-100
Lorry	96-110	10-50
Compressor	98-109	100
Excavator	110	50
Asphalt Melter	103	80
Asphalt Spreader	110	80
Truck Mixer	100	20
Concrete Pump	107	75-100
Generator	95	100
Compressor	105	100
Poker Vibrator	102	100
Welding Set	98	100
Rock Drill	128	100
Crawler Cranes	110	50-100
Safety Boat	100	100
Jack up Barge	110	100
Workboat	112	100
Tipper Lorries	113	50
Dumb Barge	105	100
Cyclone	116	100

Construction Plant Prediction Calculations:

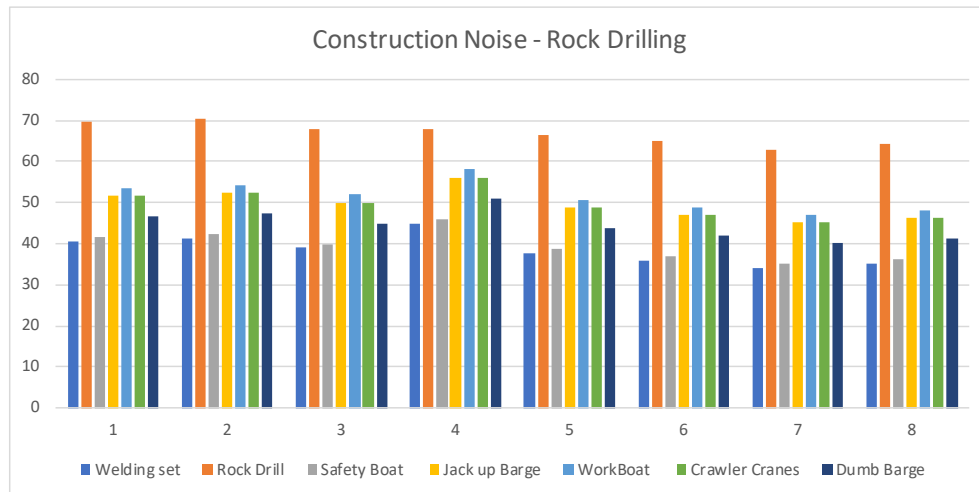
New Breakwater Construction

Noise Source	Beach Road East	Beach Road West	Soldiers Point	Trinity Court	Beach Road East	Beach Road West	Soldiers Point	Trinity Court
	Noise Level dB(A)							
	120	180	440	300	400	550	830	460
Excavator	46.9	43.4	35.6	37.5	36.5	33.7	30.1	33.7
Dozer	54.0	50.4	42.7	44.5	43.5	40.7	37.2	40.8
Safety Boat	48.0	44.4	36.7	38.5	37.5	34.7	31.2	34.8
Jack up Barge	56.0	54.4	46.7	48.5	47.5	44.7	41.2	44.8
WorkBoat	58.0	56.4	48.7	50.5	49.5	46.7	43.2	46.8
Crawler Cranes	56.0	54.4	46.7	48.5	47.5	44.7	41.2	44.8
Dumb Barge	51.0	49.4	41.7	43.5	42.5	39.7	36.2	39.8
	62.8	60.9	53.2	55.0	54.0	51.2	47.7	51.3



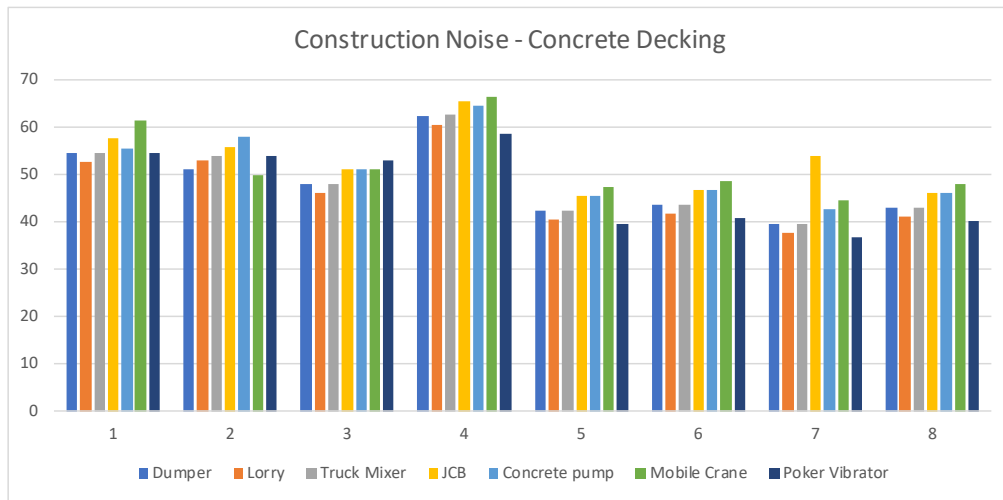
Rock Drilling – Pontoon Construction

	Beach Road East	Beach Road West	Soldiers Point	Trinity Court	Beach Road East	Beach Road West	Soldiers Point	Trinity Court
	Noise Level dB(A)							
Noise Source	250	230	300	150	350	430	530	390
Welding set	40.5	41.3	39.0	45.0	37.6	35.8	34.0	35.2
Rock Drill	69.6	70.3	68.0	68.0	66.7	64.9	63.1	64.2
Safety Boat	41.6	42.3	40.0	46.0	38.7	36.9	35.1	36.2
Jack up Barge	51.6	52.3	50.0	56.0	48.7	46.9	45.1	46.2
WorkBoat	53.6	54.3	52.0	58.0	50.7	48.9	47.1	48.2
Crawler Cranes	51.6	52.3	50.0	56.0	48.7	46.9	45.1	46.2
Dumb Barge	46.6	47.3	45.0	51.0	43.7	41.9	40.1	41.2
	69.8	70.6	68.3	69.0	66.9	65.1	63.3	64.5



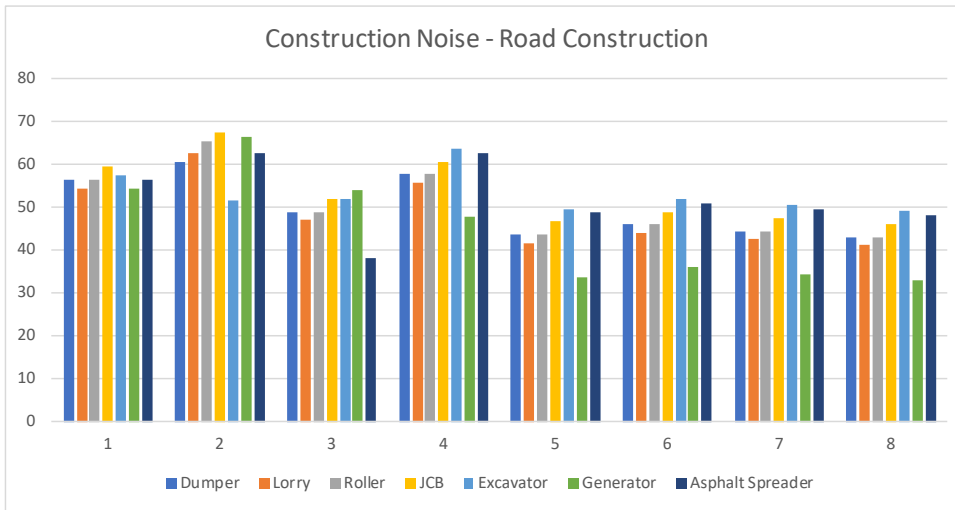
Concrete Decking Construction

	Beach Road East	Beach Road West	Soldiers Point	Trinity Court	Beach Road East	Beach Road West	Soldiers Point	Trinity Court
	Noise Level dB(A)							
Noise Source	100	120	210	40	400	350	560	375
Dumper	54.5	51.0	48.1	62.5	42.5	43.6	39.5	43.0
Lorry	52.5	53.0	46.1	60.5	40.5	41.7	37.6	41.1
Truck Mixer	54.5	54.0	48.1	62.5	42.5	43.7	39.6	43.1
JCB	57.5	55.9	51.1	65.5	45.5	46.7	54.0	46.1
Concrete pump	55.5	58.0	51.1	64.4	45.5	46.6	42.5	46.0
Mobile Crane	61.5	50.0	51.1	66.5	47.5	48.7	44.6	48.1
Poker Vibrator	54.5	54.0	53.1	58.5	39.5	40.7	36.6	40.1
	67.0	65.2	60.5	74.2	54.9	56.1	55.9	55.5



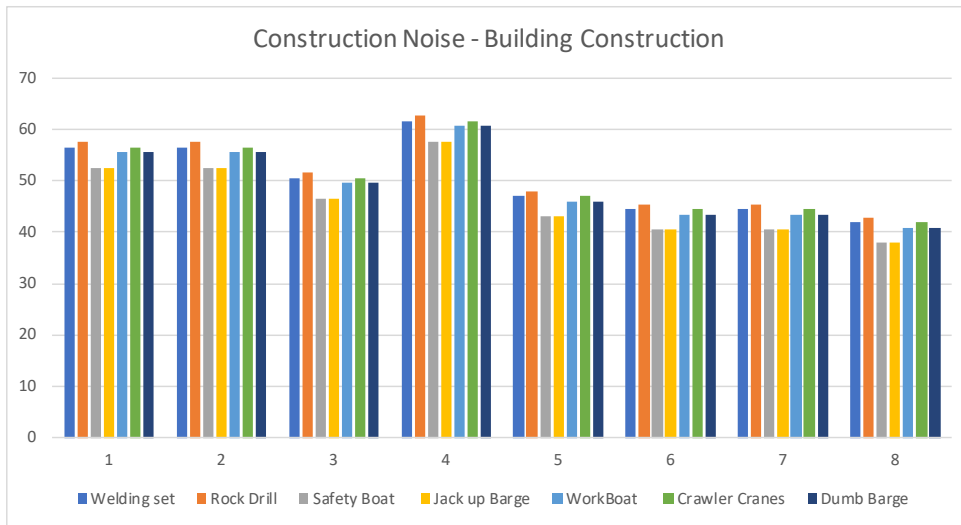
Road Construction

	Beach Road East	Beach Road West	Soldiers Point	Trinity Court	Beach Road East	Beach Road West	Soldiers Point	Trinity Court
	Noise Level dB(A)							
Noise Source	80	40	190	70	350	270	320	375
Dumper	56.4	60.5	48.9	57.6	43.6	45.9	44.4	43.0
Lorry	54.5	62.5	47.0	55.6	41.7	43.9	42.4	41.1
Roller	56.5	65.5	49.0	57.6	43.7	45.9	44.4	43.1
JCB	59.5	67.4	52.0	60.6	46.7	48.9	47.4	46.1
Excavator	57.5	51.5	52.0	63.6	49.6	51.9	50.4	49.0
Generator	54.5	66.5	54.1	47.6	33.7	35.9	34.4	33.1
Asphalt Spreader	56.5	62.5	38.1	62.6	48.7	50.9	49.4	48.1
	68.2	73.5	60.2	69.3	55.3	57.6	56.1	54.7



Building Construction

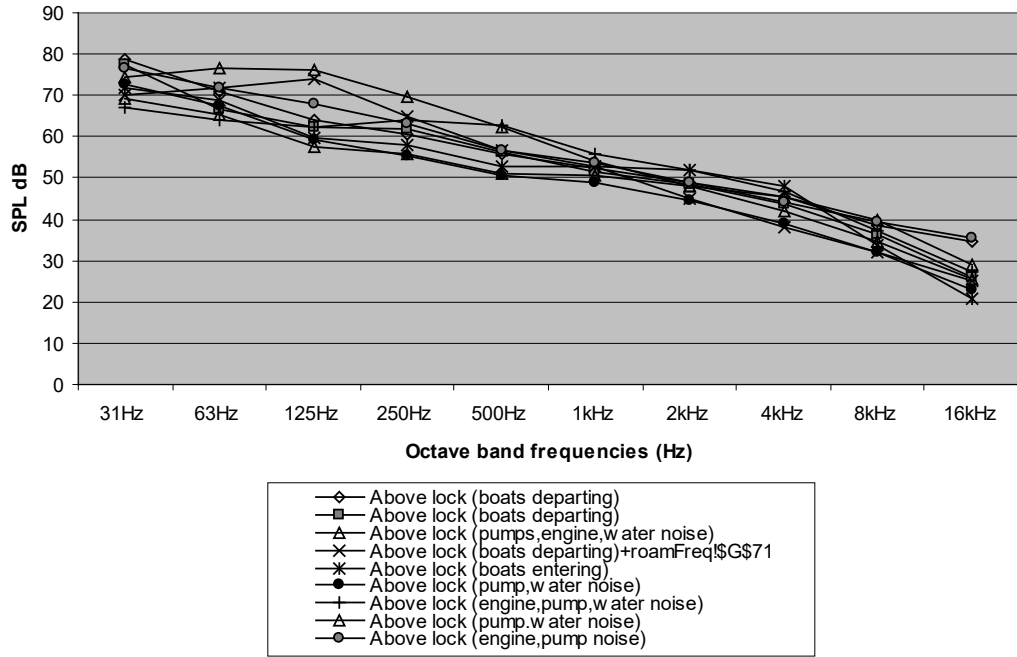
	Beach Road East	Beach Road West	Soldiers Point	Trinity Court	Beach Road East	Beach Road West	Soldiers Point	Trinity Court
Noise Source	Noise Level dB(A)							
	100	100	200	55	300	400	400	450
Welding set	56.5	56.5	50.5	61.7	47.0	44.5	44.5	41.9
Rock Drill	57.5	57.5	51.5	62.7	48.0	45.5	45.5	43.0
Safety Boat	52.5	52.5	46.5	57.7	43.0	40.5	40.5	38.0
Jack up Barge	52.5	52.5	46.5	57.7	43.0	40.5	40.5	38.0
WorkBoat	55.5	55.5	49.5	60.7	46.0	43.5	43.5	41.0
Crawler Cranes	56.5	56.5	50.5	61.7	47.0	44.5	44.5	42.0
Dumb Barge	55.5	55.5	49.5	60.7	46.0	43.5	43.5	41.0
	64.0	64.0	58.0	69.2	54.5	52.0	52.0	49.5



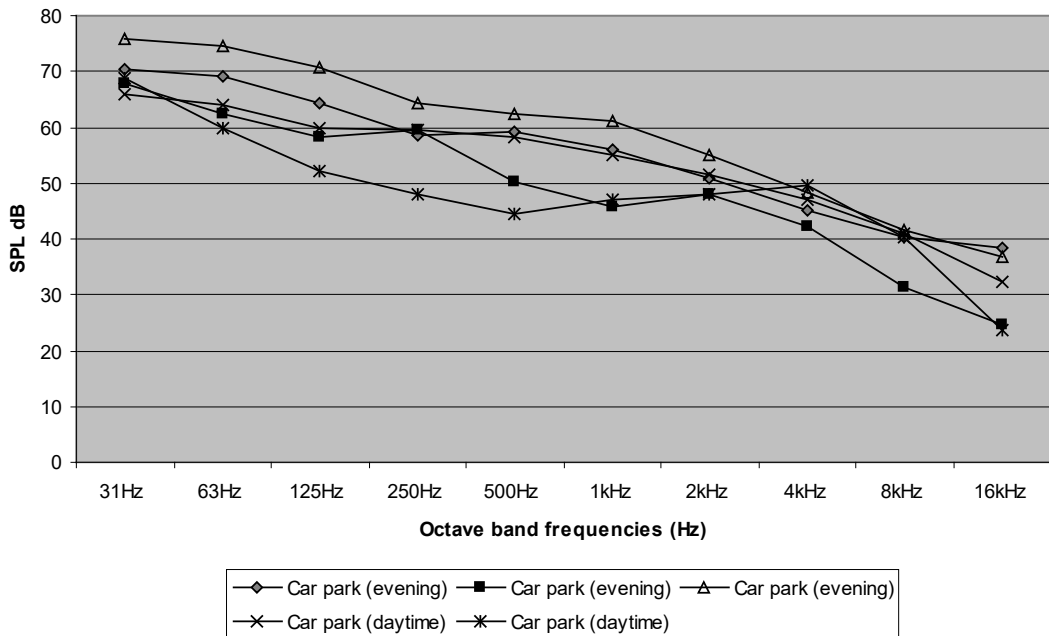
APPENDIX 18.5

FREQUENCY ANALYSIS

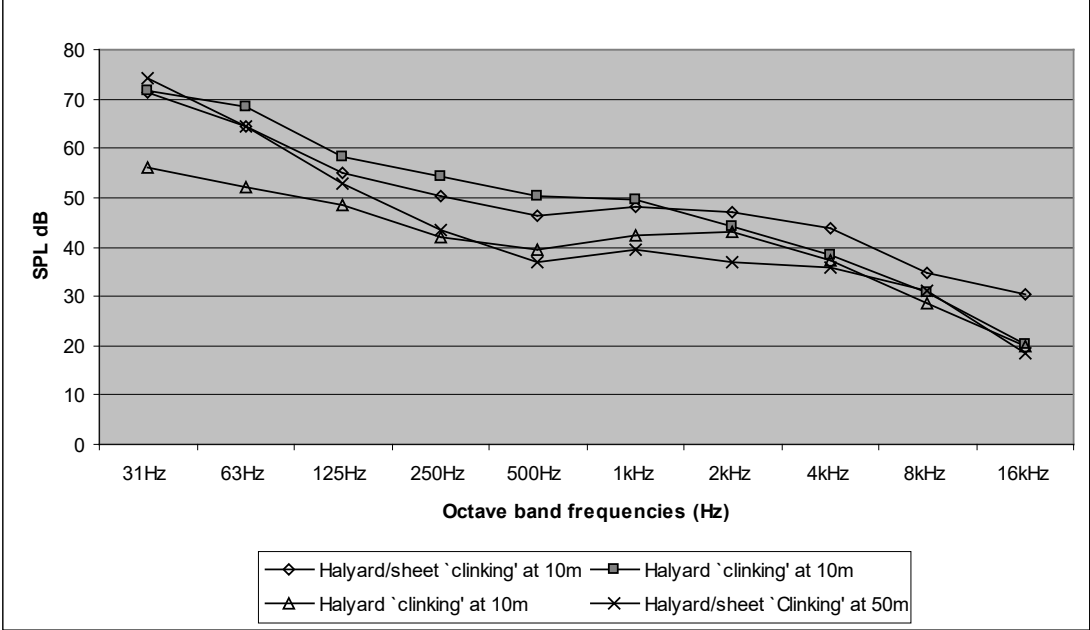
Port Solent Marina - Noise at Marina Lock - Noise from boat engines, water pumps and water noise



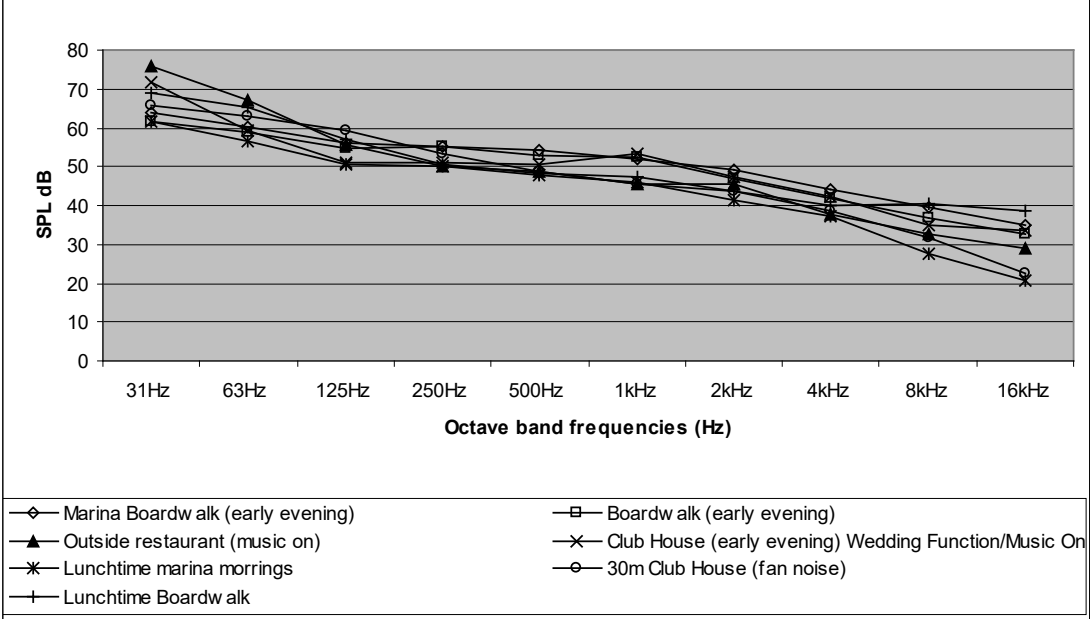
Port Solent Marina - Noise at Car Park Areas (Saturday/Sunday)



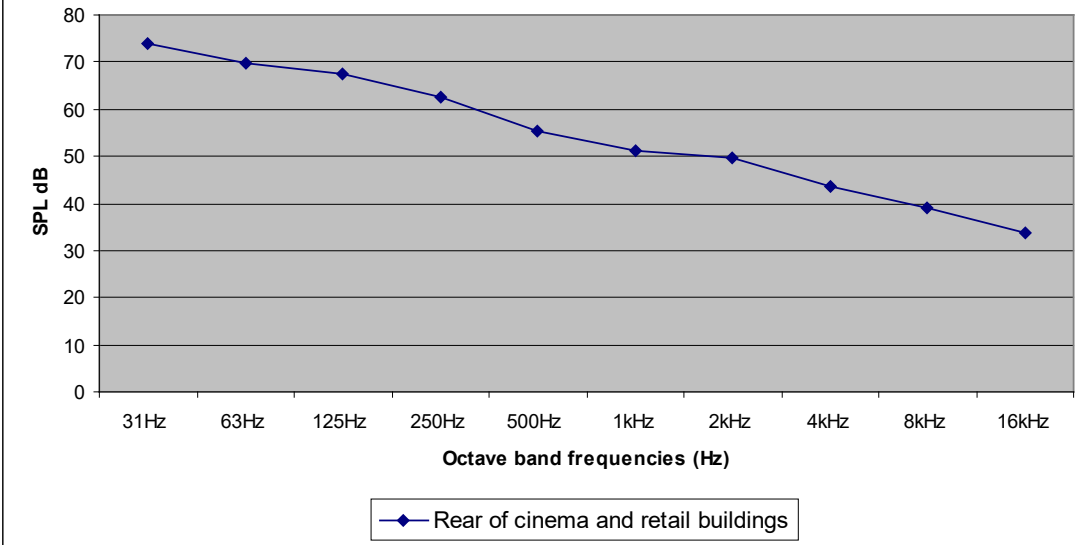
Port Solent Marina - Halyard/Sheet 'Clinking' Noise



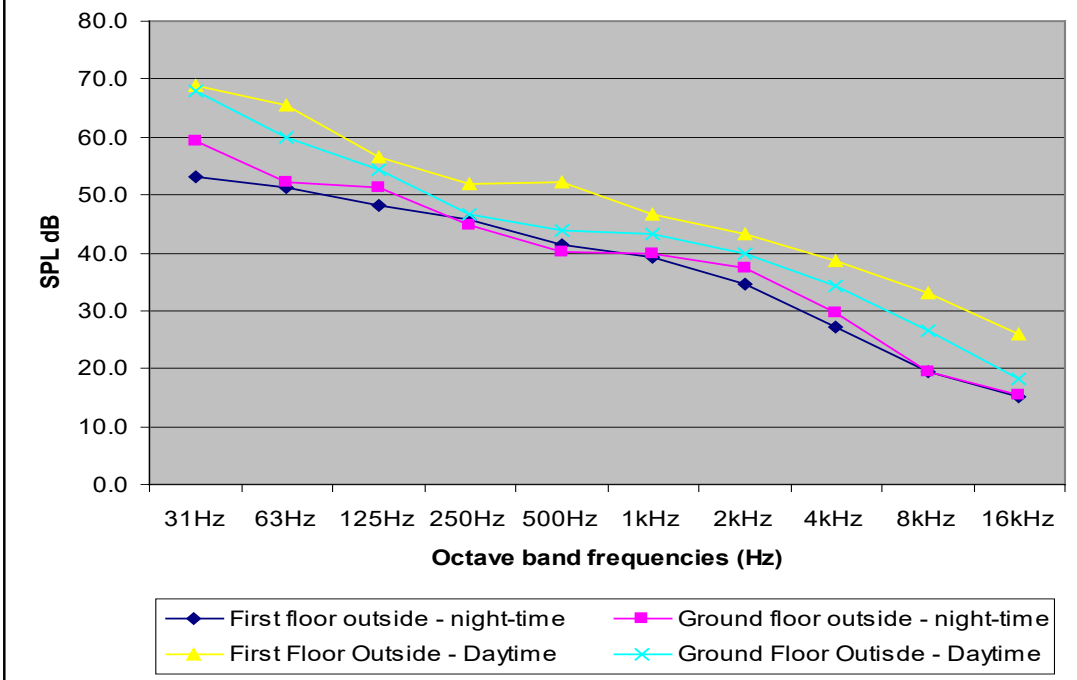
Port Solent Marina - Saturday/Sunday General Retail/Commercial Noise



Port Solent Marina: Rear of cinema and retail buildings - building service noise



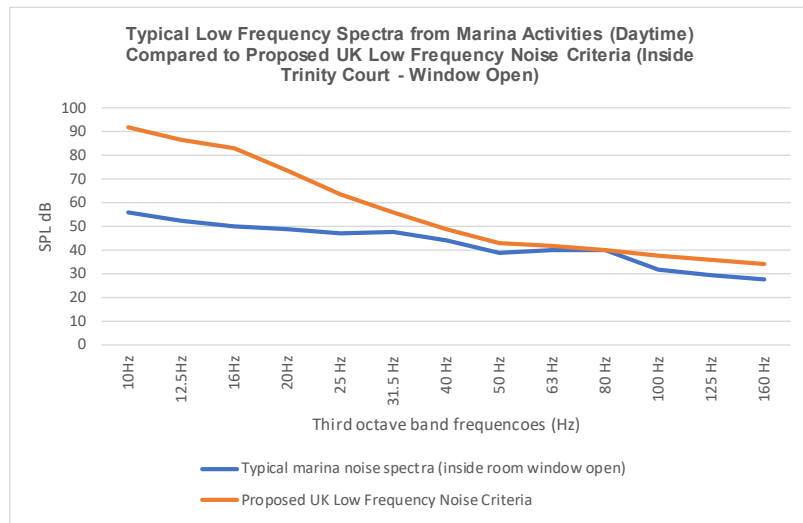
Port Solent Marina - Residential Property Garden/Balcony



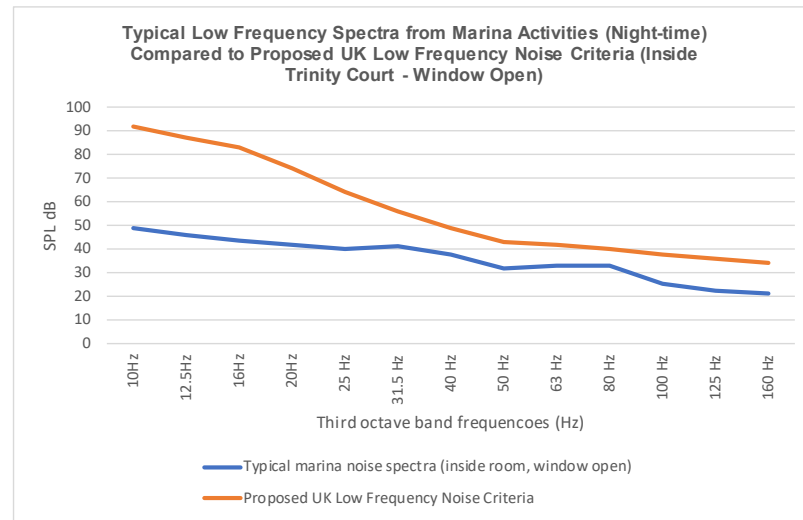
Low Frequency Noise Analysis

Trinity Court

Frequency (Hz)	Typical Marina Noise (dB)	Proposed UK Criteria (dB)
10Hz	56.1	92
12.5Hz	52.8	87
16Hz	50.4	83
20Hz	49.1	74
25 Hz	47.2	64
31.5 Hz	48.1	56
40 Hz	44.6	49
50 Hz	39	43
63 Hz	40	42
80 Hz	40.1	40
100 Hz	32.1	38
125 Hz	29.3	36
160 Hz	28.1	34

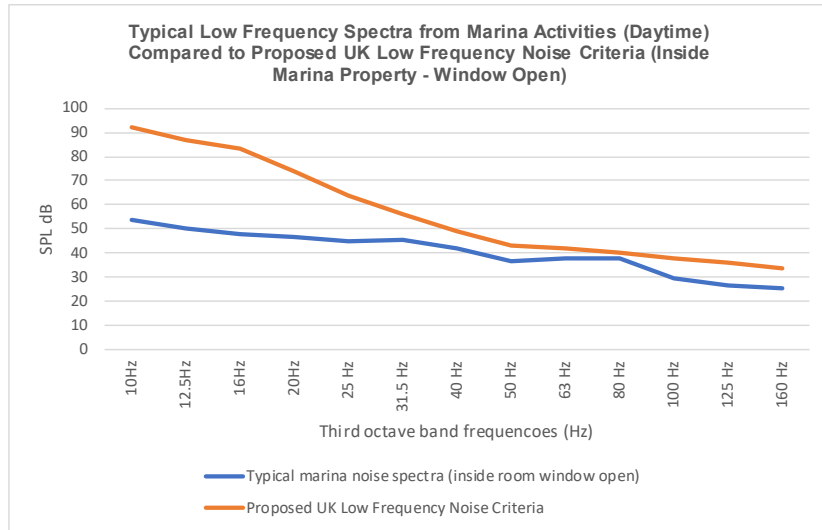


Frequency (Hz)	Typical Marina Noise (dB)	Proposed UK Criteria (dB)
10Hz	49.1	92
12.5Hz	45.8	87
16Hz	43.4	83
20Hz	42.1	74
25 Hz	40.2	64
31.5 Hz	41.1	56
40 Hz	37.6	49
50 Hz	32	43
63 Hz	33	42
80 Hz	33.1	40
100 Hz	25.1	38
125 Hz	22.3	36
160 Hz	21.1	34

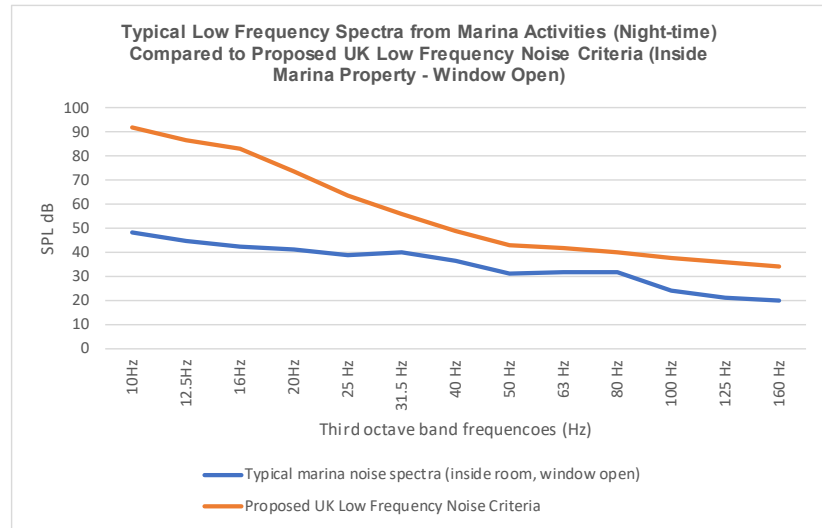


Marina Properties

		Low Freq Criteria
10Hz	53.7	92
12.5Hz	50.4	87
16Hz	48	83
20Hz	46.7	74
25 Hz	44.8	64
31.5 Hz	45.7	56
40 Hz	42.2	49
50 Hz	36.6	43
63 Hz	37.6	42
80 Hz	37.7	40
100 Hz	29.7	38
125 Hz	26.9	36
160 Hz	25.7	34



		Low Freq Criteria
10Hz	48.2	92
12.5Hz	44.9	87
16Hz	42.5	83
20Hz	41.2	74
25 Hz	39.3	64
31.5 Hz	40.2	56
40 Hz	36.7	49
50 Hz	31.1	43
63 Hz	32.1	42
80 Hz	32.2	40
100 Hz	24.2	38
125 Hz	21.4	36
160 Hz	20.2	34



APPENDIX 18.6

ASSUMED SITE OPERATIONAL NOISE LEVELS

Noise Source	Sound Pressure Level LAeq dB	Distance (m)	Operating Time %
General noise from peak operations (daytime)	48-50	50	100
General noise from peak operations (night-time)	40-42	50	100
Boat Arrival/Departure (daytime)	55-60	5	50
Boat Arrival/Departure (night-time)	55-60	5	10
Building Service plant	60	10	100
Clinking of halyards, sheets and shrouds	48-53	10	100
Engine Testing	55-65	10	25
Boat Maintenance/Launching	75-80	1	25
General bar, café & restaurant levels at boardwalk	52-57	5	100

APPENDIX 18.7

TYPICAL CONSTRUCTION PLANT VIBRATION LEVELS

