

Community noise monitoring around the Llanwern Steel Works 2020

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Summary

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Community noise measurements were carried out in residential areas along the Llanwern Works boundary between the 6th and 8th of December 2020. This work was carried out as part of the routine annual monitoring plan that provides the site with information for discussions with Natural Resources Wales.

- The daytime noise levels measured at the residual/background site at Whitewall had returned to those measured in 2018, the reason for the increased noise levels in 2019 which were thought to be associated with increased road traffic due to time of day would not appear to be the case as the 2020 measurements were carried out at a similar time.
- The night-time monitoring period however was fairly similar to that measured in 2019.
- This reduced daytime noise level was also seen at the Church of St Cadwaladr location but not at the east end of Bishton monitoring site.
- It was felt that in the daytime, that site activities would have an adverse influence on the noise environment at both sites in Bishton. It is however tempered when other transport noise (both road and rail) is taken into account and this also holds for the night-time noise levels in this area.
- Of the 5 night-time noise monitoring locations, only one, that at the rear of the Llanwern Bull public house, may exceed the interim target value for night-time noise as set out as guidance by the WHO; this however would be wholly down to road traffic, principally along the A4810 Queensway, as the site activities were not audible at this location.
- Of the site noise sources observed, those involved with transport have the most impact on the noise environment around the site. As horns and alarms are part of safety systems these are potentially very difficult to control, having been set up to prevent potential injury. In regard to coupling/decoupling noise, this as a source has been investigated previously with no suitable alternative system of control identified.

It is recommended to continue to undertake a regular assessment of the community noise levels to ensure that the present noise levels are being maintained or hopefully reduced with further attention given to the new housing development to the west of the site. An alternative background location should also be sought possibly further west along the A4810 so that more representative evaluations can be carried out for the new housing developments,

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although whether this could be done to BS4142 is debatable due to the other noise sources present in this area.

A further monitoring location within the new housing development overlooking Llanwern Village should also be considered in the future.

Community noise monitoring around the Llanwern Steel Works 2020

1. Introduction

Community noise measurements were carried out in residential areas along the Llanwern Works boundary between the 6th and 8th of December 2020. This work was carried out as part of the routine annual monitoring plan that provides the site with information for discussions with Natural Resources Wales.

The monitoring locations used in the assessment are indicated in Table 1 and Figure 1. These sites were considered to be the most sensitive receptors surrounding the site's perimeter that could potentially be affected by noise from the site.

The monitoring locations north of the works have been used for a number of years with those to the west of the works having been added more recently as the housing and light industrial units have started to develop in this area which once housed the works main office block and the 'heavy end' of the site.

The housing developments have continued since the previous report in which it was stated that "they were now developing the land behind the Llanwern Bull public house", with a new street of houses now occupied that runs west of the rear carpark of the pub and there is also the partially constructed shell of a further industrial building adjacent to the Amazon depot on the Celtic Business Park.

Table 1: Monitoring locations

No.	Location	Grid Reference	Receptor
1	Before Railway Crossing East end Bishton on road to Wilcrick	ST3951687184	Residential
2	Road to the Parish Church of St Cadwaladr	ST3871387240	Residential/Church
3	Church of St Mary, Bishton Rd	ST3708987889	Residential/Church
4	Llanwern Bull	ST3559686502	Residential
5	Entrance to Celtic Business Park	ST3682486350	Light industrial



Figure 1
Environmental noise monitoring locations for the Llanwern site

2. Assessing the Impact

The acknowledged adverse effects of exposure to high levels of environmental noise can include sleep disturbance, cardiovascular/physiological effects, mental health effects, reduction in performance levels and effects on behaviour/annoyance. Further information is provided in Appendix 1. The aforementioned health effects of noise have further been highlighted in a European Environment Agency published report¹ and while industrial noise cannot be considered a significant factor when compared to transport noise at a pan-European level, it should be considered as a factor at a local level.

2.1. British Standard Methodology

The method for assessing the noise impact of the site's processes was that specified in BS4142:2014 'Method for rating and assessing industrial and commercial sound'.

This method of assessment ideally requires a comparison to be made between periods when the works are operating (measured value) and a period when the source is not present (residual and background noise); by subtracting the residual value from the measured value the specific value (the noise produced by the works) can be estimated.

To obtain a period when the works' noise is not present would require a full works' shutdown or similar to occur. An alternative approach which can be adopted is to use a suitable comparable location. As the works operates 24 hours a day 7 days a week, the site at Whitewall previously used (Figure 2) has once more been used to represent the residual and background noise levels for the area. The Whitewall location is removed from steel works

¹ "Healthy environment, healthy lives: how the environment influences health and well-being in Europe"¹, EEA Report No. 21/2019, September 2020

sources but potentially will still be influenced by noise from the M4 motorway. For those locations to the west of the works the noise from other localised industrial operations are not replicated at Whitewall and so the works' impact on the monitoring sites by the Llanwern Bull and at the entrance to the Celtic Business Park will be over estimations, as not all conditions can be replicated.



Figure 2
Background noise monitoring location - Whitewall

Once the specific noise levels have been calculated, an acoustic feature correction is then applied to give the rating level for the source. The acoustic feature correction is a determined value added to take into account the fact that some acoustic features will have more detrimental effects on the residential population than others, i.e. sources with a strong tonal component or that are highly impulsive may have more of an effect than steady broadband sources of an equivalent noise level. The difference between the calculated rating level and the background noise level $L_{A90,T}$ (the noise at the assessment position that is exceeded for 90% of a given time interval T, when that source is not present) gives the excess of rating over background sound level, which indicates the likelihood of an adverse impact resulting from the noise.

The present version of the standard has the following sliding scale of correction features for both tonal and impulsive characteristics and these feature corrections can be additive. The method of assessment can also either be Subjective or Objective, which gives rise to the following sets of criteria:

- Tonality
 - Subjectively: add +2dB for a tone which is just perceptible at the noise receptor, +4dB where it is clearly perceptible and +6dB where it is highly perceptible.
 - Objectively: this can be further split into two methods; one based on $\frac{1}{3}$ Octave measurements where if a tone is identified then a value of +6dB is applied or where there is dispute as to whether a tone is

present a more detailed narrowband frequency analysis can be applied giving corrections from not tonal to prominently tonal and a grading of correction of 0 to +6dB.

- Impulsivity
 - Subjectively: a penalty of +3dB for impulsivity which is just perceptible at the noise receptor, +6dB where it is clearly perceptible and +9dB where it is highly perceptible.
 - Objectively: a correction of up to +9dB can be applied for sound that is highly impulsive, and is calculated taking into account both the rapidity of the change in sound level and the overall change in sound level.

The time weighting for daytime measurements is 1 hour and for night-time measurements it is set at 15 minutes.

Once the excess of the rating value over background has been calculated, the standard then defines the likelihood of an adverse impact from the noise, based on this difference.

The BS4142 calculations are presented in Appendix 2.

2.2. World Health Organisation Guidelines

Alternative guidance on the potential impact of noise on the community can be found in guidance produced by the World Health Organisations (WHO) who during 2009 published 'Night noise guidelines for Europe' an extension/update of the previous WHO work on environmental noise 'Guidelines for community noise' (1999). This report indicated that the target level to protect the public is 40 dB as an $L_{\text{night, outside}}^2$ with an interim target of 55 dB $L_{\text{night, outside}}$ in countries where this cannot be achieved. More recently the WHO regional office for Europe issued 'Environmental Noise Guidelines for the European Region' (2018) which focuses primarily on transport noise and leisure noise as this is where most data is available and most complaints over noise arise. This guidance suggests that noise levels of between 40 and 45 dB L_{night} (depending on the source) be the target which is as was recommended in the previous document.

3. Measurement

3.1. Measurement Procedure

The Llanwern Works operates 24 hours a day 7 days a week, with no general discernible shutdown period. Daytime noise measurements have been carried out over 1 hour periods with night-time noise measurements undertaken over 90 minutes with the results presented as the range of 15 minute L_{AeqS} over that period.

3.2. Measurement Equipment

The noise monitoring was undertaken using a 01 dB dB4 computer-based sound level meter system (serial number 00701245) conforming to BS EN 61672:1. The meter was calibrated

² $L_{\text{night, outside}}$ is the night-time noise indicator of the European Noise Directive (END) 2002/49/EC and is the Long term average sound level over all the night periods of a year. The night time period is the 8 hour from 23:00 to 07:00.

prior to use in accordance with STC Procedure no. ENV.ENI.308 using a Bruel and Kjaer 4231 (serial number 2619411). The unit variation from the initial calibration value during the monitoring exercise was no greater than 0.1dB.

All measurement locations were more than 3.5m from any reflecting surface (apart from the ground). The microphone was mounted on a tripod and set to measure at a height between 1.2 and 1.5 m above ground as required by the standard. In order to minimise the effect of any air movement a windshield was used on all measurements. Wind speeds were assessed during monitoring using a vane anemometer.

4. Noise Monitoring Conditions

4.1. Weather Conditions during daytime monitoring 6th December 2020

During the daytime measurements the temperature increased from 5 to 7°C with the cloud cover varying between 80 and 100%. There was no wind at ground level.

4.2. Weather Conditions night of the 6th December 2020

During the night-time period the temperature dropped from 6 to 5°C there was no measurable wind and there was 100% cloud cover throughout. There was a very light shower midway through the monitoring at the 'east end of Bishton' location but this did not affect the monitoring.

4.3. Weather Conditions during daytime monitoring 7th December 2020

During the measurements carried out on the 7th December the temperature was 6°C with 50% cloud cover and no wind.

4.4. Weather Conditions night of the 7th December 2020

During the night-time period the temperature dropped from 3 to 2°C there was no measurable wind. The cloud cover was variable starting at 100% before dropping to around 50% at the second monitoring location before increasing again to 80% at the last location; there was no suggestion of a temperature inversion having taken place.

5. Results and Discussion

5.1. Summary of Results

The results of this year's measurements are presented in Tables 2 and 3 for daytime and night-time periods respectively, with the results for the previous three years' measurements for daytime and four years for night-time presented for comparison.

The daytime measurements are presented as the average over a one-hour monitoring period, excluding the periods where the measurement was influenced by external sources such as cars passing by close to the microphone. The night-time measurements are presented, where appropriate, as the range of 15 minute L_{Aeq} measurements during the monitoring period.

Table 2

Daytime noise measurements taken within the communities that border the Llanwern Works.

No	Location	Residual/ Background		Residual/ Background		Residual/ Background		Operational measurements		
		2018		2019		2020		2018	2019	2020
		L _{Aeq} dB	L _{A90} dB	L _{Aeq} dB	L _{A90} dB	L _{Aeq} dB	L _{A90} dB	L _{Aeq} dB	L _{Aeq} dB	L _{Aeq} dB
1	East end Bishton	-	-					48 (31 mins)	. ³	46(40mins)
2	St Cadwaladr Church, Bishton Rd	-	-					49 (45 mins)	52(49 mins)	39(32mins)
3	Church of St Mary, Bishton Rd	-	-						-	41 ⁴ (37 mins)
4	Llanwern Bull	-	-						-	-
5	Entrance to Celtic Business Park	-	-						-	-
6	Whitewall	39	35	48	47	38	35		-	-

Table 3

Night-time noise measurements taken within the communities that border the Llanwern works.

No	Location	Residual/ Background		Residual/ Background		Operational measurements				
		2019		2020		2016	2017	2018	2019	2020
		L _{Aeq} dB	L _{A90} dB	L _{Aeq} dB	L _{A90} dB	L _{Aeq} (15 mins) dB	L _{Aeq} (15 mins) dB	L _{Aeq} (15 mins) dB	L _{Aeq} (15 mins) dB	L _{Aeq} dB
1	East end Bishton	-	-			44 - 45	46 - 48	40	39 - 48	35 – 37
2	St Cadwaladr Church, Bishton Rd	-	-			53 - 55	48	48 - 52	48	39 – 48
3	Church of St Mary, Bishton Rd	-	-			35 - 36	36 - 39	32 - 33	41	38
4	Llanwern Bull	-	-			40	37	35	38 - 42	43
5	Entrance to Celtic Business Park	-	-			40 - 41	37	36	49	44
6	Whitewall	38 ⁵	35	37 ⁶	33	-	-	-	-	-

5.2. Residual and Background noise measurements

The daytime and night-time noise traces taken at Whitewall during this and the previous two years monitoring are presented in Figures 3 to 5 for daytime and 6 to 8 for the night-time periods.

³ The breeze present at the monitoring location was causing the leaves of a nearby tree to rustle and mask other site noise sources. Daytime noise measurements were therefore not feasible at this location.

⁴ Construction work in the development of the new housing estate in Llanwern village was the dominant source at this location, masking all other potential sources.

⁵ Residual and Background measured over 51 minutes

⁶ Residual and Background measured over 52 minutes

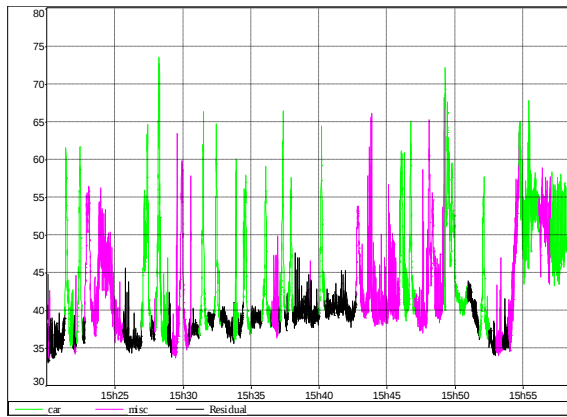


Figure 3
Daytime noise trace taken at Whitewall 6th
December 2020

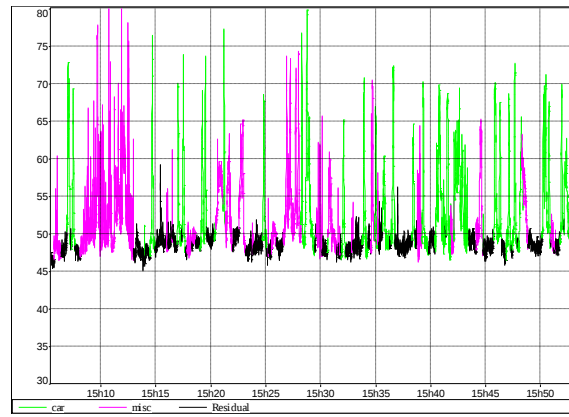


Figure 4
Daytime noise measurements at Whitewall,
November 2019

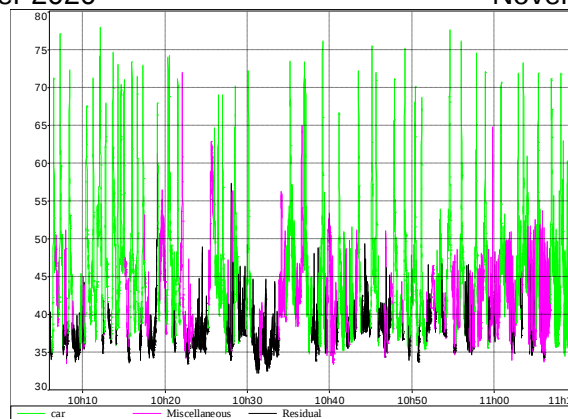


Figure 5
Daytime noise measurements at Whitewall, October 2018

The daytime noise trace in Figure 3 shows noise levels similar to those measured in 2018 (Figure 5), it was suggested in the previous report that part of the reason for the elevated level measured in 2019 may have been due to the time of day, related to increased school and motorway traffic, but as this year's measurements were taken at about the same time this would appear not to have been the case, although issues relating to Covid-19 may have some influence.

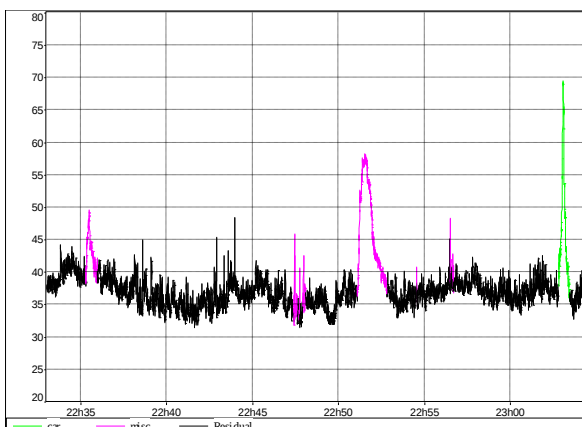


Figure 6
Sample from night-time noise measurement
Whitewall 6th Decemer 2020

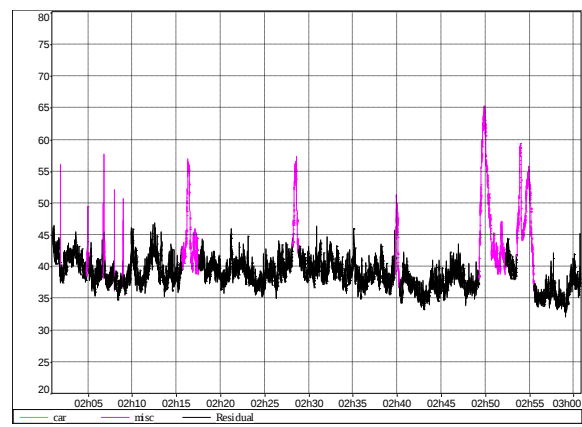


Figure 7
Night-time noise measurements at
Whitewall, November 2019

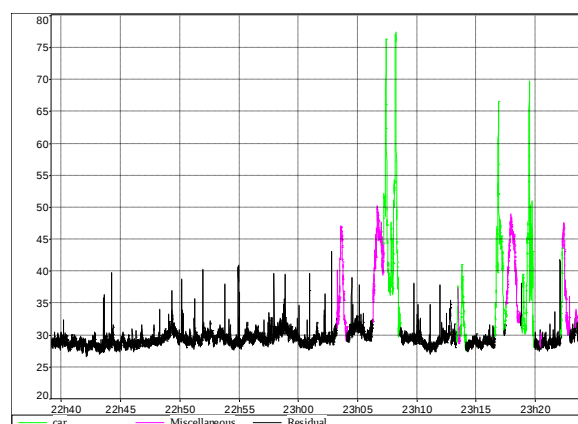


Figure 8

Night-time noise measurements at Whitewall, October 2018

In contrast the night-time noise levels measured during this monitoring event (Figure 6, 37dB $L_{Aeq}(52mins)$, 33dB $L_{A90}(52mins)$) were far closer to the noise levels measured in Whitewall in 2019 (Figure 7, 38dB $L_{Aeq}(51mins)$, 35 dB $L_{A90}(51mins)$) than those measured in 2018 (Figure 8, 29dB $L_{Aeq}(37mins)$, 28dB $L_{A90}(37mins)$); it is unclear as to why the 2018 levels are a potential outlier.

5.3. Community noise monitoring results and BS4142 Assessment

The results from the BS 4142 assessments from this and the three previous years' measurement campaigns are presented in Tables 4 and 5. The methods of calculation are shown in Appendix 2. At two of the three locations where daytime monitoring was undertaken, the noise levels in the communities were close to the levels of the Residual/background noise site and no BS4142 assessments were possible. This was also the case at four of the five night-time monitoring locations.

Table 4

Excess of rating over background values around the Llanwern site during daytime monitoring 2017 to 2020 based on BS4142:2014 methodologies.

Locations	2017		2018		2019		2020	
	BS4141:2014 Rating values based on							
	Subjective method	Objective method	Subjective method	Objective method	Subjective method	Objective method	Subjective method	Objective method
East end Bishton	+15dB	+15dB	+19dB	+22dB			+24dB	+22dB
St Cadwaladr Church, Bishton Rd	+20dB	+18dB	+20dB	+20dB	+15dB	+11dB		
Church of St Mary, Bishton Rd			-	-	-	-	-	-
Llanwern Bull			-	-	-	-	-	-
Entrance to Celtic Business Park			-	-	-	-	-	-

Table 5
Excess of rating over background values around the Llanwern site during night-time monitoring 2017 to 2020 based on BS4142:2014 methodologies.

Locations	2017		2018		2019		2020	
	BS4141:2014 Rating values based on							
	Subjective method	Objective method	Subjective method	Objective method	Subjective method	Objective method	Subjective method	Objective method
East end Bishton	+25dB	+20dB	+18dB	+21dB	+22dB	+22dB		
St Cadwaladr Church, Bishton Rd	+12dB	+12dB	+33dB	+36dB	+19dB	+19dB	+26dB	+26dB
Church of St Mary, Bishton Rd	-	-	+9dB	+8dB	+6dB	+9dB		
Llanwern Bull	-	-	+9dB	+6dB	+8dB	+10dB		
Entrance to Celtic Business Park	+2dB	+2dB	+8dB	+8dB	+26dB	+27dB		

5.4. East end Bishton

5.4.1. Daytime

The noise trace taken for the daytime measurements at the East end of Bishton are shown in Figure 9 along with the previous two monitoring events where it was possible to monitor at this location Figures 10 and 11. The measured noise level for this location during the daytime was 46dB $L_{Aeq}(40mins)$ which is comparable to the 2017 (46dB $L_{Aeq}(33mins)$) and 2018 (48dB $L_{Aeq}(31mins)$) noise levels.

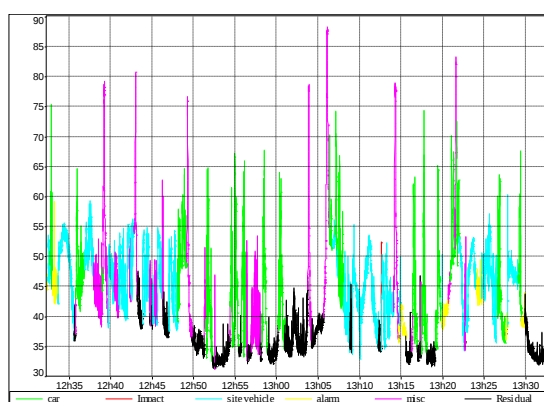


Figure 9

Daytime noise measurements taken at the East end of Bishton 6th December 2020

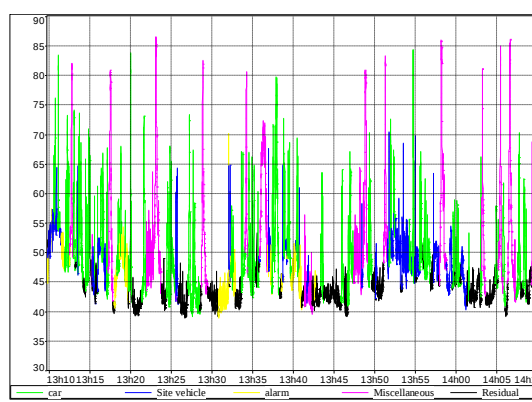


Figure 10

Operational noise levels East end of Bishton October 2018

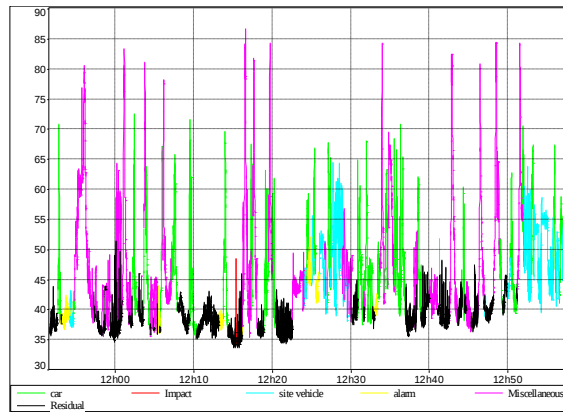


Figure 11

Operational noise levels East end of Bishton October 2017

During the monitoring a significant amount of internal rail movement was audible, which included the coupling/decoupling of rail wagons, loco movements (Figure 12) and loco horns (Figure 13).

During the locomotive activity there was a suspicion of a low frequency noise resulting from the diesel engine (Figure 14), but on further investigation this noise did not meet the criterion to be identified as a tone as set out within BS4142.

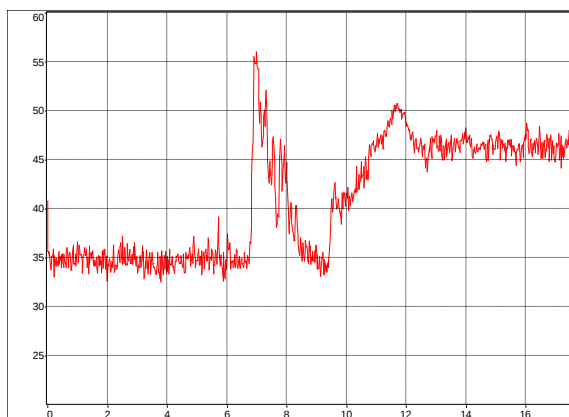


Figure 12

Coupling/Decoupling of rail wagons and loco moving off 13:12, 6th December 2020

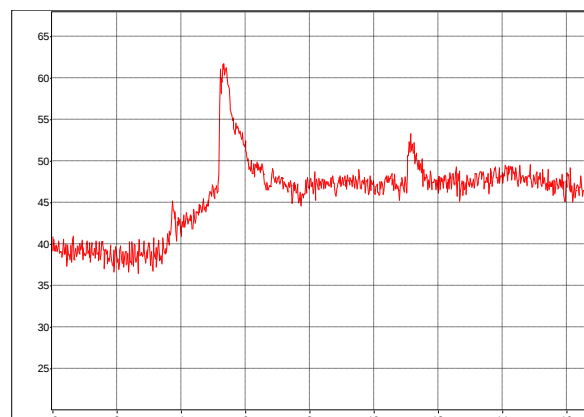


Figure 13

Locomotive horn sounding, 13:27, 6th December 2020

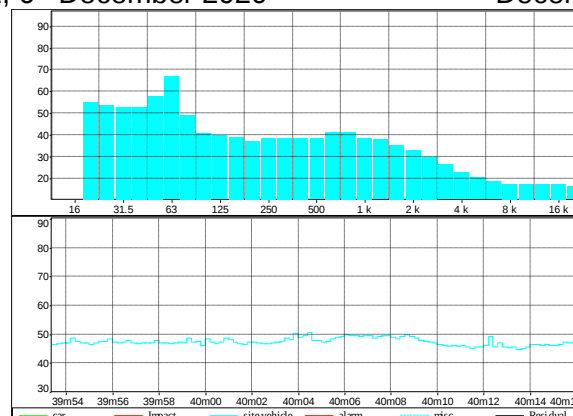


Figure 14

Potential tone produced by diesel locomotive engine

The BS4142 assessment of the noise at this location in Bishton on this occasion indicated that the site had a significant impact on the community with a rating over background using the subjective method of +24dB and +22dB using the objective method. In both instances there were acoustic corrections for intermittency of the noise +3dB and impulsivity of the noise +9dB (decoupling of wagons). Where the methods vary is in the tonal component which, when the noise is assessed using the $\frac{1}{3}$ rd Octave method suggested in BS4142, concluded that the noise at 50Hz was not distinct enough from the frequencies around it to be considered a tone and did not require a feature correction be added.

5.4.2. Night-time

While the night-time measurements taken at the location on the east end of Bishton were carried out on a Sunday evening, the site operations are 24 hours a day 7 days a week so the day of the week was not expected to be influential. It was just unfortunate that the monitoring event took place during what appears to have been a lull in activity at this end of the works. The noise trace taken during this year's monitoring and those taken between 2017 to 2019 are shown in Figures 15 to 18.

On completion of the monitoring exercise distant rail movement was heard confirming that the site was operating.

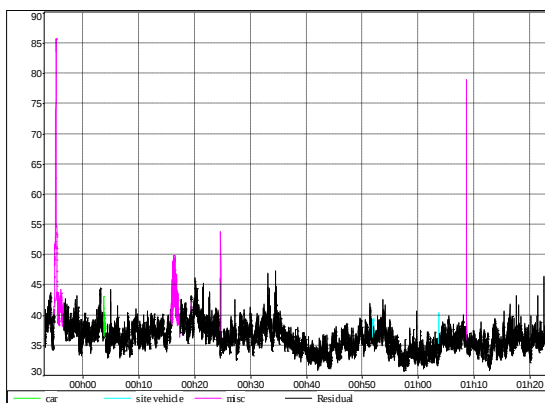


Figure 15

Night-time operational noise levels, East end of Bishton December 6th 2020

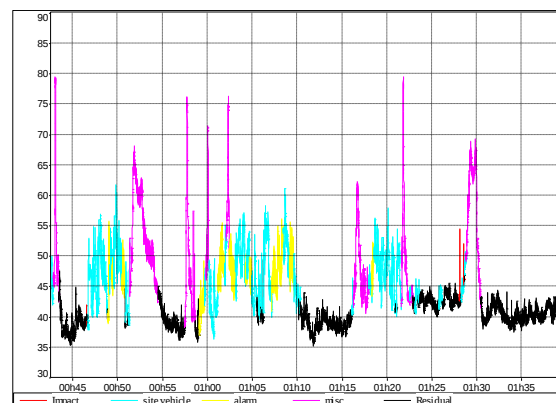


Figure 16

Night-time operational noise levels, East end of Bishton November 2019

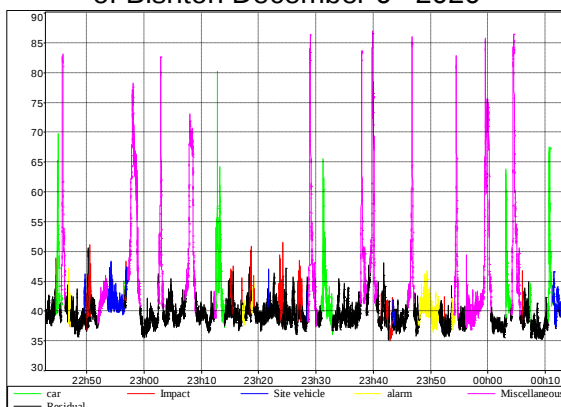


Figure 17

Operational noise levels East end of Bishton October 2018

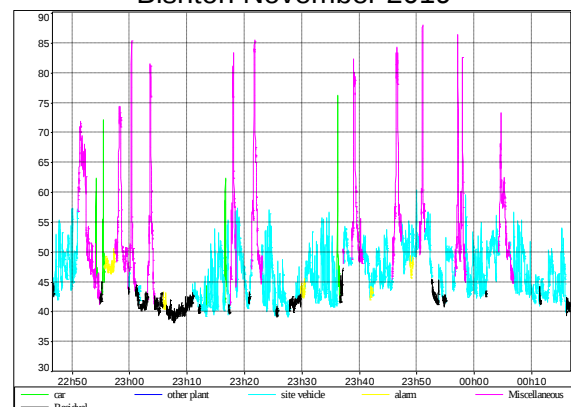


Figure 18

Operational noise levels East end of Bishton October 2017

The noise levels measured as a consequence of there being no registered site activities are, as would be expected, significantly lower than has been measured at this location previously, at between 35 and 37 dB $L_{Aeq}(15mins)$.

While, based on the figures available from this assessment, no BS4142 calculations are possible it is felt from previous monitoring exercises and the noise sources generally present in this area of the site, that the works has a significant adverse impact on the community at this location. As stated in previous reports however, this area is adjacent to a heavily used rail line with both passenger and freight use which also needs to be taken into consideration, thus lessening the potential impact from site activities.

5.5. Road to St Cadwaladr Church, Bishton Rd

5.5.1. Daytime

The noise trace obtained from the most recent monitoring exercise and those taken over the previous 3 years are presented in Figures 19 to 22. It can be seen that the noise levels are approximately 13dB lower than measured previously at ~39dB $L_{Aeq}(32mins)$ as compared for example to ~52dB $L_{Aeq}(49mins)$ in 2019. The steady baseline noise level in the area results from a combination of road noise from mainly the motorway and cooling fan noise from the site, this baseline noise level just appears lower than previously measured but is in reasonable agreement with the reduction in the background noise levels found at Whitewall.

In contrast to the daytime measurements at the east end of Bishton where there was a considerable amount of internal rail noise, this was not repeated at this location. Cooling fan noise, only limited rail activity and a repeating exhaust noise possibly from the reversed air cleaning of a cartridge filter system or similar (Figure 23) were the only noted site noises. While no tonal component was potentially present during the monitoring, a narrowband frequency analysis was carried out when only noise from the cooling fans was obvious and the frequency trace is presented in Figure 24, possibly for future reference

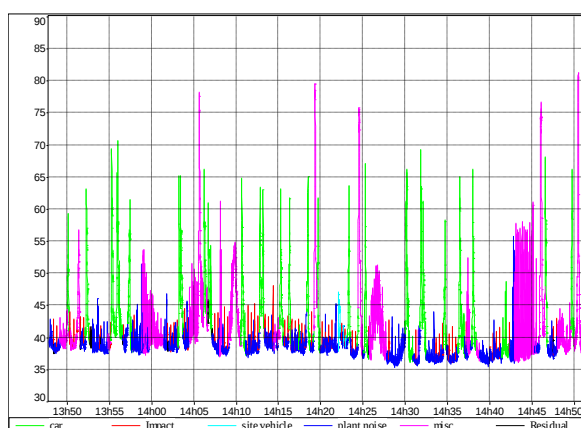


Figure 19

Noise monitoring trace taken on the road to St Cadwaladr Church 6th December 2020

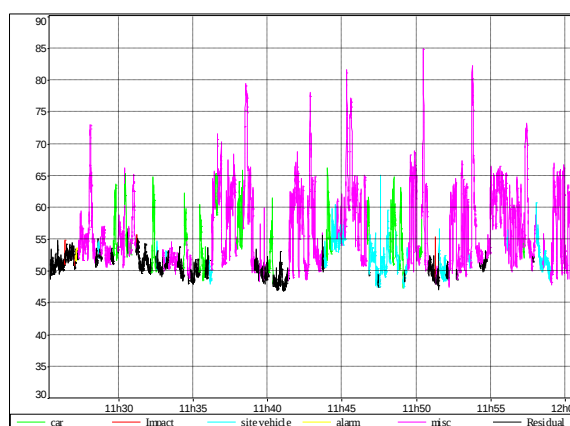


Figure 20

Sample of the noise trace taken on the road to St Cadwaladr Church November 2019

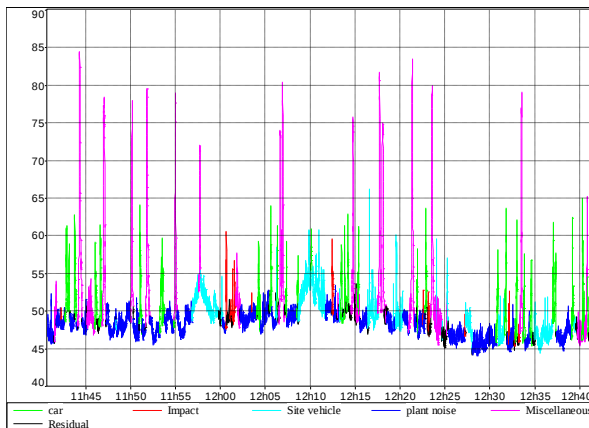


Figure 21

Operational noise levels on the Road to St Cadwaladr Church October 2018

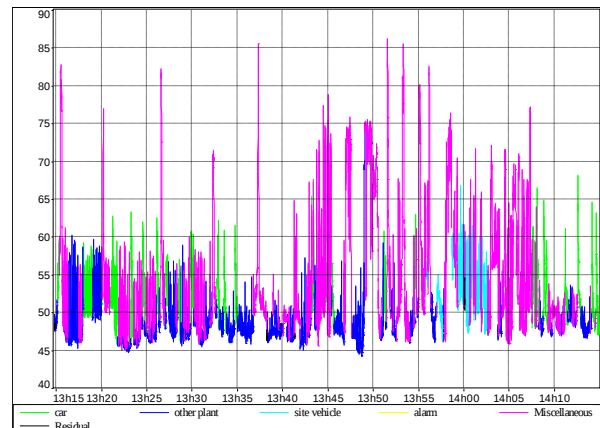


Figure 22

Operational noise levels on the Road to St Cadwaladr Church October 2017

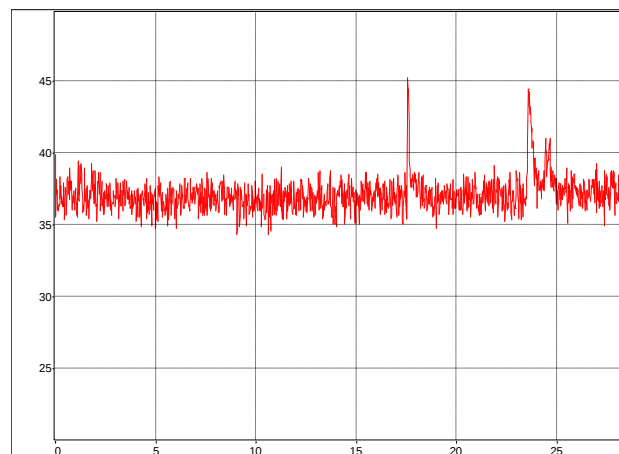


Figure 23

Noise trace of compressed air exhaust and a locomotive decoupling wagons at approximately 14:40 6th December 2020

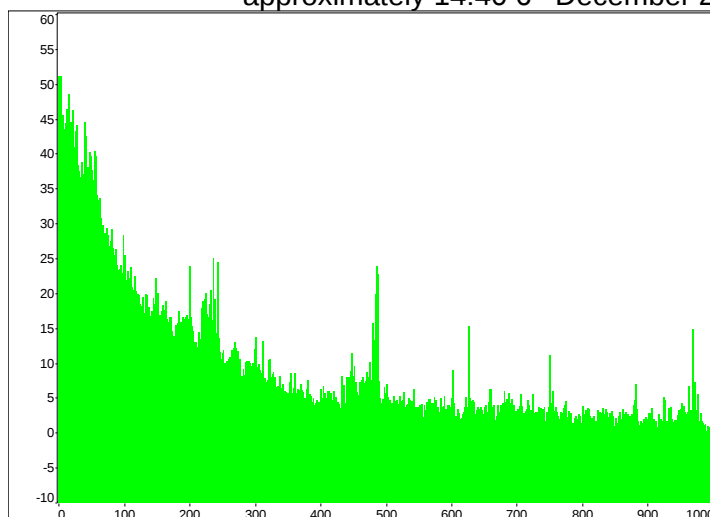


Figure 24

Narrowband Frequency analysis of audio recording of cooling tower fan noise

Narrow band frequencies peaks

200.3Hz
237.5Hz
242.8Hz
486.3Hz
626.3Hz
750.0Hz
967.8Hz

As there is little difference between the measured noise level at this location and the residual noise level measured at Whitewall on this occasion, no BS4142:2014 assessment can be undertaken.

Analysis of the impulsive noises observed indicate that this acoustic features would contribute 5dB to the acoustic feature corrections should one have been applied, indicating that activities such as the decoupling of loco wagons can be an environmental noise issue. Unfortunately previous investigations into possible noise control methods around this activity have not resulted in any suitable solutions.

5.5.2. Night-time

The night-time noise trace for measurements taken on the road to the Church of St Cadwaladr is presented in Figure 25 along with the traces for 2018 and 2019 Figures 26 and 27.

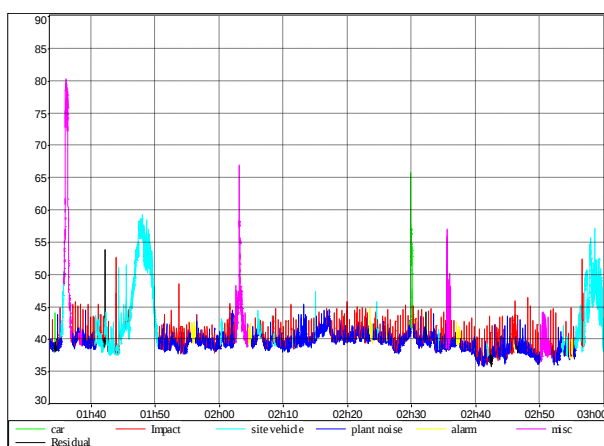


Figure 25

Night-time noise levels measured on the road to St Cadwaladr Church 7th December 2020

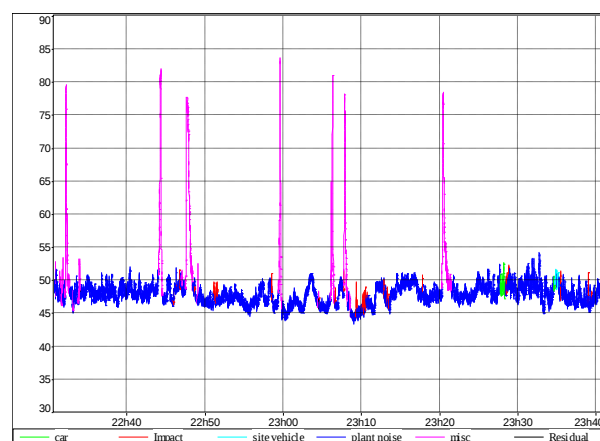


Figure 26

Operational night-time noise levels on the road to St Cadwaladr Church November 2019

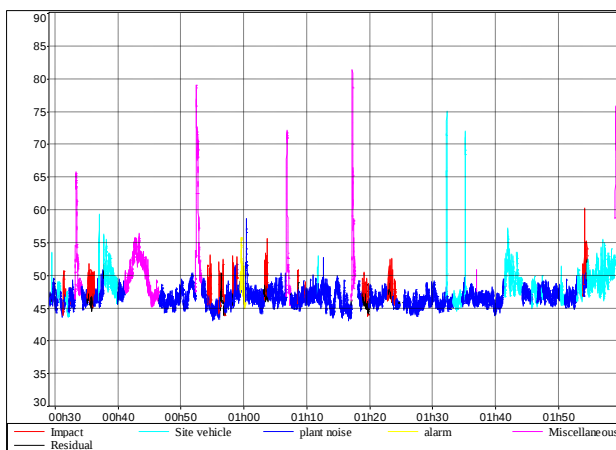


Figure 27

Operational night-time noise levels on the road to St Cadwaladr Church October 2018

It can be seen from Table 3 that there was a significant range in the $L_{Aeq(15mins)}$ values measured for this location varying from 39 to 48dB $L_{Aeq(15mins)}$. The 48dB $L_{Aeq(15mins)}$ period was associated with rail movement and is similar to the $L_{Aeq(15mins)}$ measured during 2019,

although on that occasion the noise was as a consequence of cooling fan noise in particular. The general noise level measured at this location however is significantly lower than that measured at this location over the previous number of years as can be seen in the noise traces.

As was stated in section 5.4.2, there was rail activity present on site and it became clear from the monitoring at this location that the rail activity was centred around parts of the site adjacent to the St Cadwaladr monitoring location. As examples the rail activity measured at ~01:45 (Figure 25), produced when a locomotive and wagons moved from west to east past the monitoring location and continued moving towards the east end of the site, and a rail horn sounding at 01:42 (Figure 28)

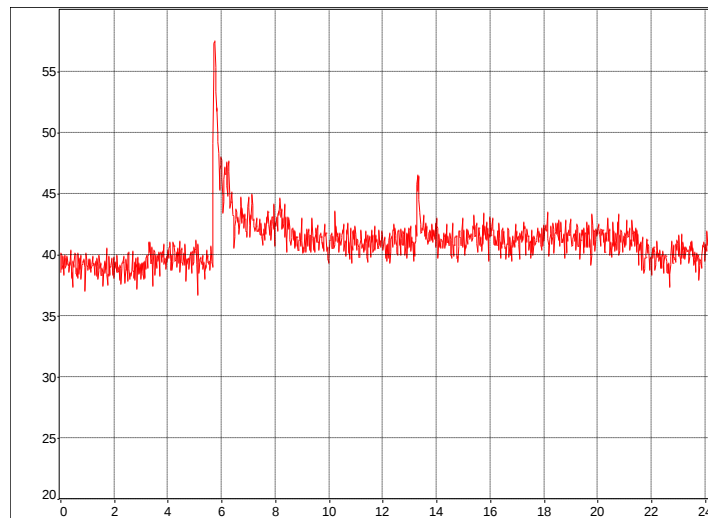


Figure 28

Noise trace of on-site Locomotive horn sounding at 01:42, 7th December 2020

It was noted there was a low frequency hum present when the diesel locomotives were in use, but when these periods were subsequently analysed they did not meet the criterion set down in BS4142 for a tone (Figure 29).

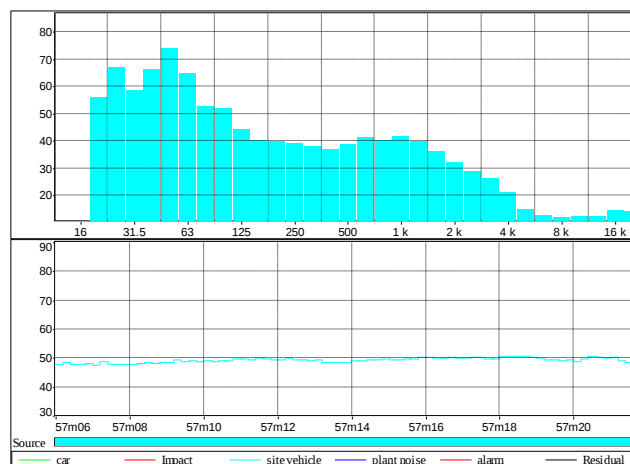


Figure 29

$\frac{1}{3}$ rd octave frequency analysis of Locomotive activity at 02:57 7th December 2020

Other than rail activity, the main site noises associated with this location are alarms (crossing and an internal alarm from Cold Mill activities) air exhausting believed to be reversed air

cleaning of cartridge filtration equipment and distant impact noise believed to be from product handling on the site.

Using the BS 4142:2014 subjective and objective methods both gave a rating value over background of +26dB, which is higher than that calculated in 2019 but lower than calculated in 2018. In both instances the feature correction applied to the specific noise level was +11dB. However where subjectively it was believed there was a just perceptible tone present resulting in a +2dB feature correction to be applied, objectively (Figure 29) this was shown not to be the case, but in contrast the loco horn which was subjectively assessed as perceptible and given a feature correction of +6dB, was on objective calculation given a value of +8dB. Thus by either method the same feature correction was applied, it was just the route to come to that value that was slightly different.

The results of the assessment indicate that the Llanwern site continues to have a significant impact on the community at this location but as has previously been stated in this report and in the previous reports, the influence of road and rail noise must also be taken into consideration, thus limiting the site's actual impact on the community.

5.6. St Mary's Church, Bishton Rd

5.6.1. Daytime

Daytime noise monitoring was significantly affected by construction work being undertaken on the hillside overlooking Llanwern village, as part of a housing development in that area. This development may in future be considered as a monitoring location, as its elevated position would overlook the works.

The ambient noise level in this area when the obvious construction noise was removed was 41 dB $L_{Aeq}(37mins)$. As there is little difference between this level and the residual noise level measured at Whitewall in 2020, no BS4142 assessment can be undertaken.

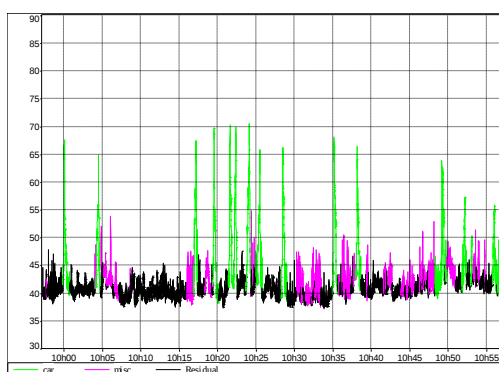


Figure 30

Daytime noise monitoring trace taken by St Mary's Church 7th December 2020

5.6.2. Night-time

The night-time noise levels measured at St Mary's church during this monitoring exercise (38dB $L_{Aeq}(15mins)$, Figure 31) were lower than were measured during the 2019 assessment (41dB $L_{Aeq}(15mins)$, Figure 32).

During the monitoring the only identified site noise was a very distant site impact noise believed to be from material handling (Figure 33) and was just audible above background but did not significantly influence the noise trace.

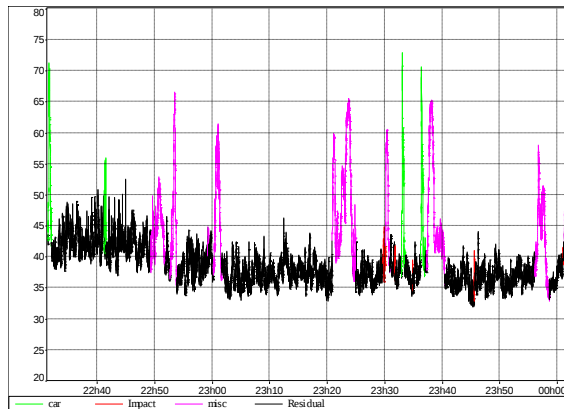


Figure 31

Night-time noise monitoring trace taken by St Mary's Church, Bishton Road December 7th, 2020

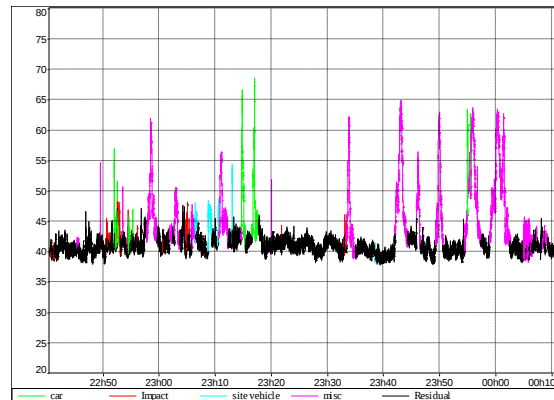


Figure 32

Operational night-time noise levels by St Mary's Church, Bishton Road November 2019

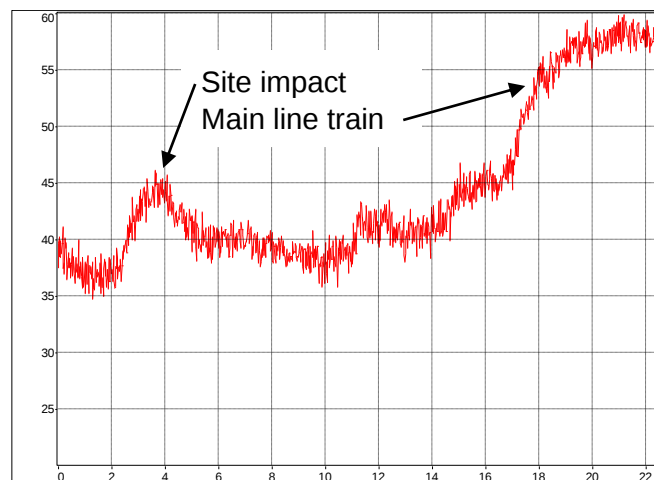


Figure 33

Potential site impact noise measured at ~23:30, 7th December 2020

A BS4142:2014 assessment at this location was not possible as the measured values and the residual value measured at Whitewall were too close together to accurately calculate the specific noise level associated with the site at this location.

5.7. Llanwern Bull Car park

5.7.1. Night-time

Since the last assessment in 2019 there has been further housing development in this area with a small Cul-de-Sac developed and now occupied running east of the entrance to the Llanwern Bull carpark.

The night-time noise monitoring undertaken to the rear of the Llanwern Bull car park is shown in Figure 34 along with the comparative measurements from 2019 (Figure 35). It had been thought that due to the Covid 19 restrictions there may be less traffic on the A4810 Queensway but this proved not to be the case, with road transport noise along the Queensway, primarily lorries, being the dominant noise source at this location

During the monitoring there were potentially two events where impact noise from site may have been detected, but their actual contribution to the overall noise level could not be determined as they were masked by the road traffic noise.

The BS4142:2014 assessment method, on consideration, cannot be applied at this location as due to distance and the multiple sites operating in the area, no true distinction can be made from any noise from Llanwern works to that produced by other industrial locations to the east of this monitoring site. While not a practical location to carry out BS4142 assessments it is felt to be still a valid monitoring area to assess the noise climate and whether there are any site noises present and the housing developments continue.

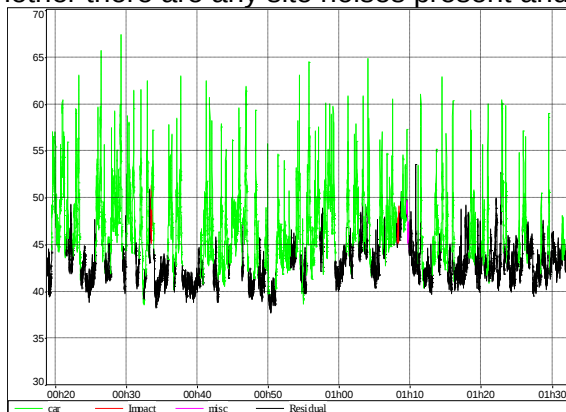


Figure 34

Night-time noise trace taken at the rear of the Llanwern Bull Public house 8th December 2020

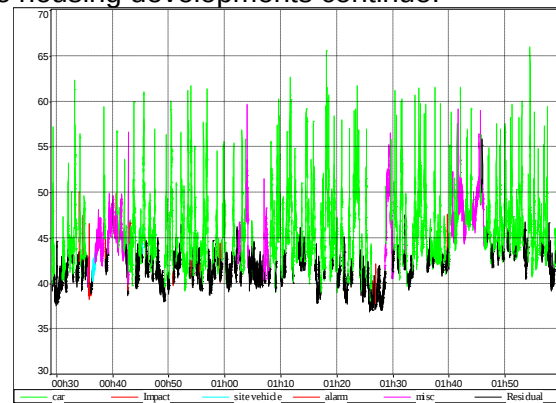


Figure 35

Night-time noise measurement trace, adjacent to the Llanwern Bull 19th November 2019

During the previous monitoring exercise a potential tone around 50Hz was identified (Figure 37) and was suspected to be electrical in nature with strong harmonics at 100 to 500Hz. This however was not identified as being present during the monitoring at this location on this occasion(Figure 36).

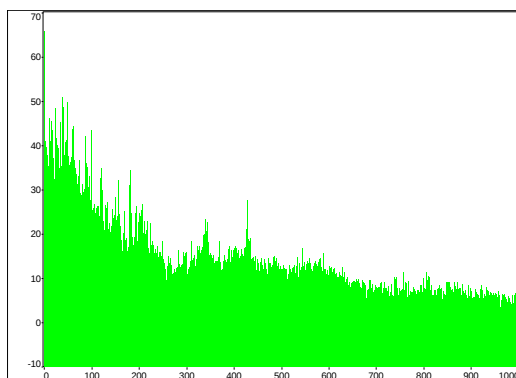


Figure 36

Narrowband frequency analysis of an audio recording taken at the rear of the Llanwern Bull public house December 2020

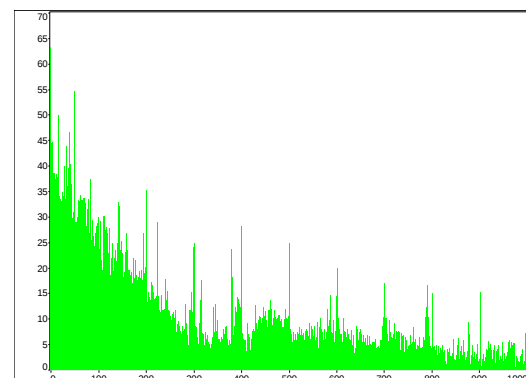


Figure 37

Narrowband analysis of Audio recording of potential tone taken at the rear of the Llanwern Bull public house 2019

5.8. Entrance to Celtic Business Park

A new industrial building is presently part constructed on the Celtic Business Park site between the monitoring location and the works boundary and may potentially act as a noise barrier for any future activities near the site boundary, adjacent to this new build. It was believed there was more activity on the Business Park than in previous years which is most likely to result from the Amazon distribution hub and the rise of on-line shopping during the Covid pandemic.

The noise traces from this year's and the previous two years' monitoring are shown in Figures 38 to 40, with the measured noise levels taken this year (44dB $L_{Aeq(36mins)}$) sitting between those measured in 2019 (49dB $L_{Aeq(36mins)}$) and (36dB $L_{Aeq(25mins)}$) measured in 2018.

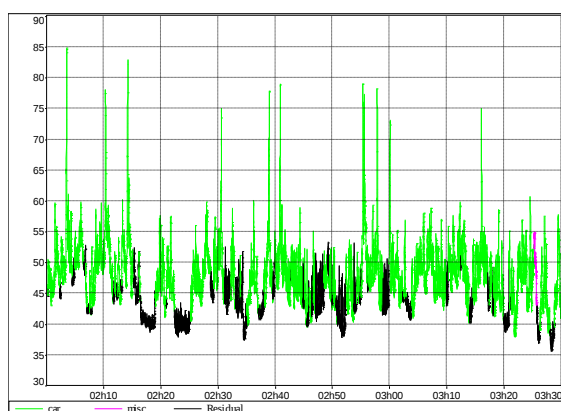


Figure 38

Night-time noise trace taken on the roadway into the Celtic business Park 8th December 2020

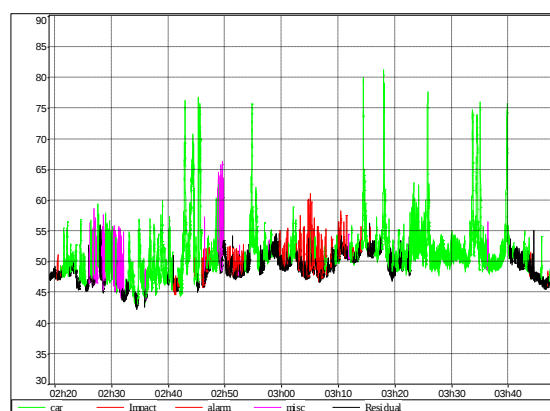


Figure 39

Noise trace from the roadway on the Celtic Business Park 19th November 2019

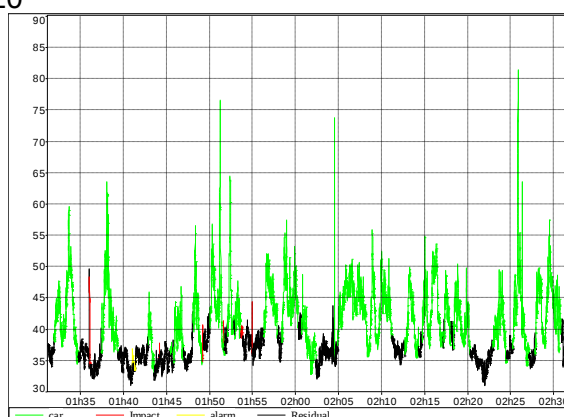


Figure 40

Noise trace from the roadway on the Celtic Business Park, October 2018

There were no obvious identifiable site noises observed at this location although there was a suggestion of a slight tone at 50Hz (Figure 41) and while there is a slight elevation in that 50Hz $\frac{1}{3}$ rd Octave band it does not meet the requirements for a tone.

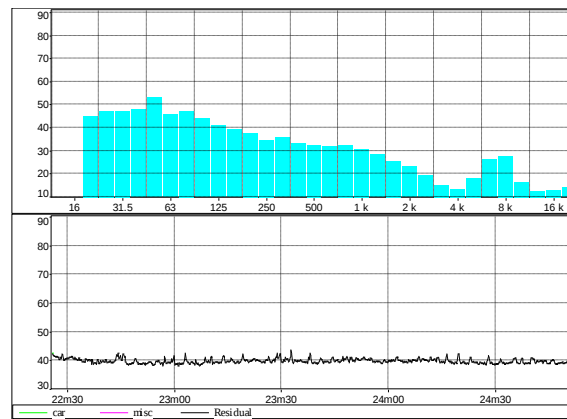


Figure 41

$\frac{1}{3}$ rd Octave frequency analysis of period of no activity at 02:22 8th December 2020

Narrowband frequency analysis undertaken on previous audio recordings have suggested the presence of a hum at around 200Hz. This however also did not appear to be present on this occasion (Figure 42).

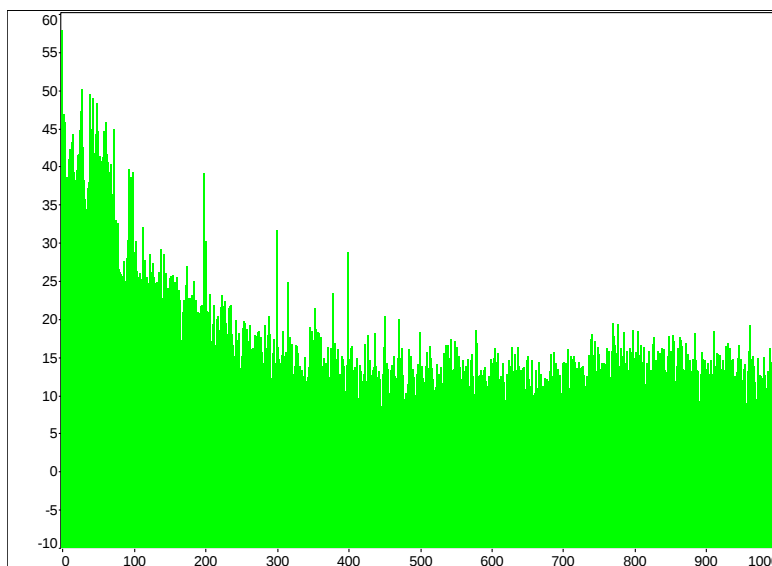


Figure 42

Narrowband frequency recording taken within the Celtic Business Park 02:02 on the 8th December 2020

Narrow band
frequencies peaks

194.7Hz
299.4Hz
399.0Hz

As with the Llanwern Bull location it is not felt appropriate to undertake a BS 4142 assessment to assess the works' noise as there are potentially multiple industrial sources present in the area which are all contributors. It is however felt reasonable to continue to monitor the noise levels at this location to ensure site noises are not significantly contributing to the overall noise level in the area.

6. Conclusions

- The daytime noise levels measured at the reference residual/background noise site at Whitewall were significantly lower than were measured in 2019, the reason for this has not been determined as while there may be a reduction in road traffic resulting

from Covid-19 it is felt this would not account for the reduction in noise level observed.

- The night-time monitoring period however was fairly similar to that measured in 2019.
- The reduced daytime noise level was also seen at the Church of St Cadwaladr location but not at the east end of Bishton monitoring site.
- A daytime BS4142 excess of rating over background was only possible at the east end of Bishton monitoring site and indicates the works operations have an adverse influence on the noise environment. When this is taken into context with the noise generated in the area from transport noise (both road and rail) the impact would be significantly lessened. Although not possible to undertake a BS4142 for the other Bishton location it is felt that works noise also has an adverse impact at this location.
- The rating over background for the night-time measurements in the Bishton area could only be undertaken at the Church of St Cadwaladr location and indicated works operations had an adverse influence on the noise environment. This was also felt to be the case for the east end of Bishton location but for the fact that no on-site activities were being carried out in this area at the time of the measurements. When the context of the area however is once again taken into account with the amount of transport noise the impact is considerably lessened.
- Of the 5 night-time noise monitoring locations only one, that at the rear of the Llanwern Bull public house may exceed the interim target value for night-time noise as set out as guidance by the WHO, this however would be wholly down to road traffic, principally along the A4810 Queensway. Site activities were potentially just audible at this location on two separate occasions and were very dull thuds from material handling noise but were only truly registered as they were being intently listened for.
- Of the site noise sources observed those involved with transport noise have the most impact on the noise environment around the site. As horns and alarms are part of site safety systems these are potentially very difficult to control having been set up to prevent potential injury. In regard to coupling/decoupling noise this as a source has been investigated previously with no suitable alternative system of control identified.

7. Recommendations

It is recommended to continue to undertake a regular assessment of the community noise levels to ensure that the present noise levels are being maintained or hopefully reduced with further attention given to the new housing development to the west of the site. An alternative background location should be sought potentially further west along the A4810 so that more representative evaluations can be carried out, although whether this could be done to BS4142 is debatable due to the other noise sources present in this area.

It had been previously suggested that an alternative location to the Llanwern Bull location be assessed but as there is housing now in this area it should remain, although a further location within the housing estate could be considered to replace St Mary's church. A location within the new housing development overlooking Llanwern Village should also be considered in the future.

Appendix 1

Health effects of noise.

Sleep Disturbance

Uninterrupted sleep is known to be a prerequisite for good physiological and mental functioning of healthy persons. The primary sleep disturbance effects from environmental noise are difficulty in falling asleep, awakenings and alterations of sleep stages or depth, especially a reduction in the proportion of REM sleep. These create secondary effects of fatigue, depressed mood and decreased performance.

Vulnerable groups for sleep disturbance are shift workers. Generally if noise is causing sleep disturbance it will produce annoyance and complaints, see later.

Cardiovascular Effects

Cardiovascular effects, e.g. hypertension, are reported in some studies for groups exposed to noise above 70 dB(A) L_{eq} . These levels are above those at receivers around UK sites.

Mental Health Effects

Environmental noise is not believed to be a direct cause of mental illness but it is assumed that it accelerates and intensifies the development of latent mental disorders. Studies undertaken to date indicate at worst only a weak linkage between noise and mental health and we are a long way from setting a dose-response curve.

Effects on Performance

It is well documented that noise adversely affects cognitive task performance, in the laboratory or the workplace, but none of the studies have studied environmental noise in the home environment.

A particularly vulnerable group are pre-school and school age children who can suffer impairment of reading abilities and a reduction in motivational capabilities. At the time of writing there is no dose-response curve defined.

Effects on Annoyance

Noise annoyance is a global phenomenon: our definition is “a feeling of displeasure associated with any agent or condition known and believed by an individual group to adversely affect them”.

In the case of environmental noise these adverse effects have been discussed above and all could lead to annoyance. The effects of noise can be evaluated by assessing the extent of annoyance (low, medium, high) among exposed individuals. The level of annoyance varies not only with acoustical characteristics but also with non-acoustical factors, these include fear, belief that the source could be controlled by third parties, individual noise sensitivity and whether noise originates from an important economic activity.

Appendix 2

BS 4142:2014 Assessments

A2.1 East end of Bishton Day

BS4142:2014

Measured noise level $L_{Aeq(40 \text{ min})} = 46\text{dB}$

Residual noise level $L_{Aeq(22\text{mins})} = 38\text{dB}$

Background level $L_{A90(22\text{min})} = 35\text{dB}$

Specific noise level = $10Lg(10^{L_a/10} - 10^{L_r/10})$

Specific noise level (45.2) = 45dB

Acoustic correction feature

Subjective:

Tonality +2dB low frequency tone from locomotives

Impulsivity +9dB highly perceivable

Intermittency +3dB

Acoustic correction feature Subjective = +14dB

Objective

Tonality +0dB tone does not meet the criterion for audible

Impulsivity +9dB

Intermittency +3dB

Acoustic correction feature Objective = +12dB

Rating level Subjective(45 + 14) dB = 59dB

Excess of rating over background (59 – 35) dB = +24dB

Rating level Objective(45 + 12) dB = 57dB

Excess of rating over background (57 – 35) dB = +22dB

BS 4142:2014 Rating – Indication of a significant adverse impact. The excess of the rating over background using either method is greater than 10dB and in this instance the uncertainty of the measurement does not have any significance to the outcome of the assessment. When the context of the noise environment is taken into consideration based on the amount of road and rail traffic the impact of site based noise would however be considerably lessened.

A2.2 East end of Bishton Night-time

BS4142:2014

Measured noise level $L_{Aeq(15 \text{ min})} = 37\text{dB}$

Residual noise level $L_{Aeq(52\text{mins})} = 37\text{dB}$

Background level $L_{A90(52\text{min})} = 33\text{dB}$

Specific noise level $= 10Lg(10^{L_a/10} - 10^{L_r/10})$

Specific noise level cannot be calculated as the measured and residual noise levels are too close to allow the calculation of the specific noise level

On this unusual situation the BS 4142:2014 Rating for the site would suggest that the works has no impact on the local environment which has not been the case previously and is highly unlikely to be the case now. It is more likely that the site has an adverse impact on the area with a rating over background greater than 10dB. It must equally be understood that when the context of the noise environment is taken into consideration with the amount of road and rail traffic the impact of the site's operational noise impact would be considerably lessened.

A2.3 St Cadwaladr Church daytime

BS4142:2014

Measured noise level $L_{Aeq(32 \text{ min})} = 39\text{dB}$

Residual noise level $L_{Aeq(22\text{mins})} = 38\text{dB}$

Background level $L_{A90(22\text{min})} = 35\text{dB}$

Specific noise level = $10Lg(10^{L_a/10} - 10^{L_r/10})$

Specific noise level cannot be calculated as the measured and residual noise levels are too close to allow the calculation of the specific noise level

Acoustic correction feature

Subjective:

Tonality +0dB

Impulsivity +6dB perceptible (Loco decoupling of wagons)

Intermittency +3dB

Acoustic correction feature Subjective = +9dB

Objective

Tonality +0dB

Impulsivity +5dB decoupling of rail wagons

Intermittency +3dB

Acoustic correction feature Objective = +8dB

BS 4142:2014 No assessment against BS4142 was possible as the specific noise level could not be calculated although it was felt useful to indicate the feature correction values that may have been applied.

When the location of the monitoring site is taken into consideration the site noise is felt to have an impact at this location but is tempered by the transport noise also present at this location.

A2.4 St Cadwaladr Church Night-time

BS4142:2014

Measured noise level $L_{Aeq(15 \text{ min})} = 48\text{dB}$

Residual noise level $L_{Aeq(52 \text{ mins})} = 37 \text{ dB}$

Background level $L_{A90(52 \text{ mins})} = 33 \text{ dB}$

Specific noise level $= 10L_g(10^{L_a/10} - 10^{L_r/10})$

Specific noise level (47.6) = 48dB

Acoustic correction feature

Subjective:

Tonality +2dB just perceptible tone from diesel locomotive

Impulsivity +6dB perceptible sounding of loco horn

Intermittency +3dB

Acoustic correction feature Subjective = +11dB

Objective

Tonality +0dB potential tone does not meet the criterion set out in BS4142

Impulsivity +8dB sounding of loco horns

Intermittency +3dB

Acoustic correction feature Objective = +11dB

Rating level Subjective(48+11) dB = 59dB

Excess of rating over background (59 – 33) dB = +26dB

Rating level Objective(48 + 11) dB = 59dB

Excess of rating over background (59 – 33) dB = +26dB

BS 4142:2014 Rating – Indication of a significant adverse impact, although transport noise is also very influential in this area and as stated previously will temper the impact of the site's noises. The excess of the rating over background using either method is greater than 10dB and in this instance the uncertainty of the measurement does not have any significance to the outcome of the assessment.

A2.5 St Mary's Church daytime

BS4142:2014

Measurements not practical due to construction noise

A2.6 St Mary's Church Night-time

BS4142:2014

Measured noise level $L_{Aeq(15 \text{ min})} = 38\text{dB}$

Residual noise level $L_{Aeq(52 \text{ mins})} = 37\text{dB}$

Background level $L_{A90(52 \text{ mins})} = 33\text{dB}$

Specific noise level $= 10Lg(10^{L_a/10} - 10^{L_r/10})$

Specific noise level cannot be calculated as the measured and residual noise levels are too close to allow the calculation of the specific noise level

Acoustic correction feature

Subjective:

Tonality +0dB

Impulsivity +3dB just perceptible

Intermittency +0dB

Acoustic correction feature Subjective = +3dB

Objective

Tonality +0dB

Impulsivity +3dB

Intermittency +0dB

Acoustic correction feature Objective = +3dB

BS 4142:2014 No assessment against BS4142 was possible as the specific noise level could not be calculated

A2.7 Llanwern Bull Night-time

BS4142:2014

Measured noise level $L_{Aeq(37 \text{ min})} = 43\text{dB}$

Residual noise level $L_{Aeq(52 \text{ mins})} = 37 \text{ dB}$

Background level $L_{A90(52 \text{ mins})} = 33 \text{ dB}$

Specific noise level $= 10Lg(10^{L_a/10} - 10^{L_r/10})$

Specific noise level (41.7) = 42dB

Acoustic correction feature

Subjective:

Tonality +0dB

Impulsivity +0dB

Intermittency +0dB

Acoustic correction feature Subjective = +0dB

Objective

Tonality +0dB

Impulsivity +0dB

Intermittency +0dB

Acoustic correction feature Objective = +0dB

Rating level Subjective (42 + 0) dB = 42dB

Excess of rating over background (42 – 33) dB = +9dB

Rating level Objective (42 + 0) dB = 42dB

Excess of rating over background (42 – 33) dB = +9dB

BS 4142:2014 Rating – The excess over background for the location adjacent to the Llanwern Bull was around 10dB, indicating the potential for a significant adverse impact. This would be a worst case scenario as it is debatable whether the Whitewall location is a realistic representation of the residual and background noise level for this area. A number of other industries in the area also will contribute to the ambient noise and will add to the uncertainty of the sites' impact at this location. Transport noise must also be taken into consideration when the context of any noise impact is under consideration.

A2.8 Celtic Business Park night-time

BS4142:2014

Measured noise level $L_{Aeq(24min)} = 44\text{dB}$

Residual noise level $L_{Aeq(52 mins)} = 37\text{ dB}$

Background level $L_{A90(52 mins)} = 33\text{ dB}$

Specific noise level $= 10Lg(10^{L_a/10} - 10^{L_r/10})$

Specific noise level (43.0) = 43dB

Acoustic correction feature

Subjective:

Tonality +2dB (~50Hz) just perceptible

Impulsivity +0dB

Intermittency +0dB

Acoustic correction feature Subjective = +2dB

Objective

Tonality +0dB does not meet the criterion for a tone according to BS4142

Impulsivity +0dB

Intermittency +0dB

Acoustic correction feature Objective = +0dB

Rating level Subjective (43 + 2) dB = 45dB

Excess of rating over background (45 – 33) dB = +12dB

Rating level Objective (43 + 0) dB = 43dB

Excess of rating over background (43 – 33) dB = +10dB

The excess over background for the location at the entrance to the Celtic Business Park indicates a significant adverse impact under the provision that this is a worst case scenario as the residual and background noise levels may not be representative. In this instance the uncertainty of the measurement has a significant impact as there are potentially alternative sources of noise which will have a significance influence on the overall level.