Environmental Noise Assessment – Proposed Retail Development at New St, Barnsley

Barnsley Retail Partnership

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EXECUTIVE SUMMARY

A noise measurement survey and desk-based noise impact assessment were conducted with respect to the proposed siting of a food-store on land off New street, Barnsley.

The assessment examined noise impacts associated with the movements of vehicles on the car park closest to residential properties, on the petrol filling station forecourt, and on the service yard access road off wood Street and within the service yard.

The assessment showed that potentially major adverse noise impacts of greater than 10 dB would occur for some of the adjacent residential properties. Mitigation measures were recommended in the form of barriers or walls, with a 4 metre-high wall along the southern edge of the petrol filling station and a 2 metre-high wall at the top of the cutting where the service yard adjoins Heelis Street.

These measures reduced the impacts for some properties but potentially significant adverse noise impacts were still predicted for some properties, particularly at night. However, in the context of the existing relatively noisy environment, it was inferred that the slight excess of noise associated with the operation of the food store would not be a cause for significant disturbance in this location, affected as it is by the existing noise of vehicles accelerating hard up the incline of Wood Street, shouting from the town centre and other noise events which occur at all hours of the day.

Notwithstanding these considerations, various best practice operational measures were recommended to minimise the likelihood of night time noise disturbance from the service yard.

Assessment of fixed plant equipment noise was not possible and it was recommended that a suitable receptor noise level for the equipment be agreed with the local authority Environmental Health Department. It was noted that siting of any such equipment on the northern or north-western aspect of the food-store, facing the town centre, would be best.

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1. INTRODUCTION AND SITE DESCRIPTION

1.1. Echo Acoustics Ltd was commissioned to undertake a noise assessment for a proposed new food-store use at New Street, Barnsley. This document reports the results of a noise measurement survey and subsequent assessment of potential noise impacts arising from the operation of a potential food-store on the site.

1.2. The site is a former industrial use which is currently partly derelict, the majority of the previous buildings having been demolished, with only a few smaller commercial premises remaining.

1.3. The site is located close to the centre of Barnsley and is subject to considerable road traffic noise from Westway, the town centre bypass, including frequent emergency vehicle siren noise, with contributions from general urban noise and from the nearby Morrison's food-store, including night time delivery noise. More distant freight rail noise was noted to be a contributor to the night time noise environment. Significant additional noise contributions during the night arise from people using and leaving the local clubs and bars, with frequent shouting, singing and arguing clearly audible until the dawn.

1.4. The site is approximately rectangular, aligned southwest-northeast, sloping down from the southeast to the northwest towards the city centre, such that the eastern/south eastern site boundary overlooks Westway and the town centre from an elevated position; this has a significant effect on the existing ambient noise situation adjacent to the site. The site is delineated by: New street and Upper New Street to the northwest, beyond which are the Morrison's food-store and NHS health centre; to the southwest by Wood Street, beyond which is residential housing; to the southeast by Heelis Street, beyond which is residential housing; to the north east by commercial uses beyond which lies Westway and the town centre.

1.5. Significantly, Wood Street is relatively steeply inclined with the result that numerous vehicles accelerate hard as they travel southeast *up* the road away from New Street. It was also noted during the noise survey that numerous private hire taxis use Heelis street as a holding location whilst awaiting pick-up calls.

1.6. A glossary of acoustic terminology is presented at Appendix A.

2. GUIDANCE

2.1. There is no specific guidance in the UK by which the potential impacts of the general operation of a new food-store, in proximity to existing housing, might be assessed.

2.2. There are, however, several guidance documents whose principal elements can be adapted o provide an indication of potential noise impacts.

2.3. One such document is British Standard (BS) 4142: 1997 *Method for rating industrial noise affecting mixed residential and industrial areas* (BSI, 1997). The Standard provides a method for comparing the background noise (dB L_{A90}) at sensitive receptors, in the absence of any industrial noise, with an industrial site's 'rating' noise level (dB $L_{Ar,Tr}$); the rating noise level comprises the 'specific' noise of the site (dB L_{Aeq}) to which is added a +5 dB 'character correction' if the industrial noise contains a distinctive character which might

make it more intrusive. Where a site's rating noise level exceeds the background noise level by 10 dB, the Standard suggests that complaints of noise disturbance are "likely"; an excess of rating level against background of 5 dB is described as being of "marginal" significance whilst a rating level 10 dB below the background is a "positive indication that complaints are unlikely".

2.4. Whist the Standard is not directly applicable to the majority of the food-store's operation as it is not an industrial activity, it does provide a framework for a conservative, comparative noise level assessment which can be generically applied to this assessment, comparing existing 'background' (dB L_{A90}) noise levels with predicted operational store activity noise levels (dB L_{Aeq}), generally those activities taking outside the food-store building i.e. car park, petrol filling station, service yard. Noise break-out from within the food-store is not a significant factor and was not assessed.

2.5. The Standard *can* be applied to the operation of mechanical plant equipment, such as externally-mounted air handling equipment which might be located on the food-store. At this time, however, details of the location and specification of such equipment is not known and detailed predictive assessment was not possible; this assessment therefore makes recommendations for permissible receptor noise levels, based on the results of the noise measurement survey and the guidance given in BS 4142.

2.6. Additional guidance with respect to the potential *acceptability* of noise is given in British Standard (BS) 8233:1999 *Sound insulation and noise reduction for buildings – Code of practice* (BSI, 1999) which provides recommended internal noise levels for "*good*" or "*reasonable*" resting/sleeping conditions. The standard suggests that internal noise levels should not exceed 30 dB L_{Aeq} ("*Good*" conditions) to 40 dB L_{Aeq} ("*Reasonable*" conditions) in living rooms and 30 dB L_{Aeq} ("*Good*") to 35 dB L_{Aeq} ("*Reasonable*") in bedrooms. The standard suggests that any window, when partially open, will provide 10 to 15 dB of sound attenuation from outside to inside. Thus good resting and sleeping conditions, with windows open, would be achieved with external noise levels of 45 dB L_{Aeq}.

2.7. The various guidance documents, therefore, provide a framework within which an assessment of potential noise impacts from operation of the food-store might be assessed, utilizing a combination of quantitative, defined noise *limit values* and comparative assessment relative to existing ambient noise levels. Existing ambient noise is an important consideration as it is illogical to simply assess relative to defined noise limits where those limits are currently exceeded by the ambient noise and the existing nature of the existing environment was considered carefully in this assessment.

3. METHODOLOGY

Background noise survey

3.1. A background noise survey was conducted during the night time between Sunday 6 and Monday 7 November 2011, and during the afternoon of Wednesday 16 November 2011, prior to the peak traffic period. The purpose of the survey was to quantify and describe the existing noise in proximity to potentially noise sensitive residential receptors surrounding the location of the proposed food-store.

3.2. The survey utilized a Norsonic type 118, Class 1, integrating, averaging, logging sound level meter, mounted on a tripod at a height of approximately 1.3 metres above ground level; photographs of the meters in position are provided at Appendix B (Figures 2 to 4). Calibration certificates are available for inspection on request.

3.3. The survey measurements comprised multiple 15-minute day time and 5-minute night time measurement at the three locations identified in Figure 1 at Appendix B. The measurement data included the A-weighted decibel (dB[A]) equivalent continuous noise level (L_{eq}), the 10^{th} and 90^{th} percentile noise level (L_{90}) and the minimum and maximum noise levels (L_{min} and L_{max}). The weather conditions during both surveys was dry and cold with negligible wind.

3.4. The measured (quantitative) noise data were supplemented by qualitative observation of the general noise situation and the survey data along with the observations made during the survey are presented in Table C1 at Appendix C.

Source noise data and noise propagation calculations

3.5. Source noise data for the operational food-store were historic measured noise data from the database of Echo Acoustics, obtained at similar-sized food-stores. The data principally comprise a car drive-by, a car reverse manoeuvring, a car accelerating, a car door slam and delivery vehicle arrival, departure and manoeuvring noise. This data was applied to both the food-store car park and the petrol filling station, the nature of the noise sources being very similar in both situations, as well as to the service yard. Data regarding proposed externally-mounted air-handling equipment, and the possible location of this equipment on the building, are not currently available.

3.6. It was conservatively assumed that the food-store will operate 24 hours per day between Monday and Saturday with restricted opening hours on Sunday, in line with many such food-stores in the UK at this time.

3.7. Calculation of noise levels at nearby potentially noise sensitive receptors was undertaken using a conventional distance-attenuation calculation, assuming hemispherical propagation of noise over a hard surface. The current food-store and associated car park layout is such that properties on Wood Street will generally be level with the car park. The properties on Heelis Street, however, would be well-screened from the car area due to the relative differences in level, with the food-store footprint cut into the sloping ground creating a vertical wall at least 10 metres in height where the food-store footprint meets Heelis Street. The service yard is only slightly higher than the car park with a cut-out wall of at least 8 metres height where on its eastern side.

3.8. The plans also indicate the presence of a wall along the southern side of the petrol filling station (PFS) of 1.1 metres in height, in addition to which, the PFS forecourt level will be approximately 2 metres below the level of properties on Wood Street west of Fleming Place, providing an effective barrier height of 3.1 metres, and the car park closest to properties on Wood St east of Fleming Place will be approximately 5 metres below the level of the properties.

3.9. Detailed barrier calculations were undertaken to assess the potential sound attenuation provided by these features.

Assessment of noise impact 'significance'

3.10. In attempting to assign significance to any predicted noise impacts, there are no standardised significance criteria within any UK guidance or Regulation; partly, this is due to the dependence of any impact upon the nature and character of the noise in the area where an impact has been predicted, and partly it is due to the significant variability in qualitative perception of noise by local residents; residents in tranquil rural areas, for example, may be more significantly disturbed by a noise which would cause little adverse comment in residents living in a noisier urban environment.

3.11. Conventionally, environmental noise assessments use indicative or guideline values by which to derive potential significance criteria, based on historic noise research, which indicated that 3 dB may be the least audible change in a steady noise level that can be perceived by the average listener, whilst a 5 change would be clearly audible. A 10 dB change in a steady noise would be perceived by most listeners as a doubling of loudness. These indicative limit values are picked up in other guidance documents such as the Design Manual for Roads and Bridges, Volume 11, Section 3, Part 7 *Noise and vibration*, and in the draft IoA/IEMA *Guidelines for noise impact assessment*. It is also generally accepted that a sudden change in noise levels may mean that changes as low as 1 dB may be perceived, but in this instance, the highly variable character of the existing town centre noise suggests that such small changes in noise level are unlikely to be perceptible to the average listener.

3.12. Therefore, the criteria presented in Table 1 were used in this assessment to assign a level of significance associated with a given change in noise levels.

Table 1: Derived noise impact significance criteria

Change in noise level (dB)	Potential significance
<3	Negligible
3 to 4.9	Minor
5 to 9.9	Moderate
>10	Major

4. SURVEY AND ASSESSMENT RESULTS AND DISCUSSION

Background noise survey

4.1. The noise character at the measurement locations varies quite considerably:

- At location 1, the ambient noise during the day time is dominated by the movements of vehicles, including local buses and some heavy goods vehicles, along New Street and Wood Street, with Wood Street being a, relatively, very busy road at all times of the day and night. Most significantly, as Wood Street climbs steeply away from New Street, vehicles tend to accelerate to climb the hill, some accelerating much harder than others. The night time noise situation comprises a mixture of vehicle noise, including numerous taxis, and noise from the town centre, including the noise of shouting from the local bars and clubs as well on the street. The bars and clubs tend to stay open very late, and on the night of the survey (Sunday night into Monday morning) there was a lull in bar/club noise until approximately 3:30 when the noise of

shouting in the streets increased. Shouting from the western end of the town centre was clearly audible at all measurement locations.

- At Location 2, less traffic travels along the road and this was the quietest of the three measurement locations. The ambient noise during the day comprises a mixture of road traffic noise from Wood Street and New Street, general urban noise, the movement of taxis along Heelis Street, many of which use the street as a convenient location to park-up between fares, bird song, and occasional banging noise from the A&P Garage (it is presumed that this premises will be removed should the site be fully redeveloped). Night time noise was a mixture of traffic noise as during the day, but much reduced, general urban noise with traffic noise from Westway more clearly audible. There were also noise contributions from deliveries to Morrison's food-store on New Street. Occasional bar/club-related noise was occasionally audible, including music with a low-level but clearly audible bass-beat.
- At Location 3, the noise situation during the day is dominated by road traffic noise from Westway, including numerous emergency vehicle sirens, as well as general town centre traffic noise, traffic noise from Morrison's food-store car park and New Street, with contributions from taxis and their drivers, who occasionally park up and converse quite loudly in the street. The night time noise situation is dominated by traffic noise from Westway, including emergency vehicle sirens, bar/club noise, including bass-heavy music, shouting in the streets and occasional movements of taxis along Heelis Street itself. At one point the noise from a distant freight train could be clearly heard, and the noise continued for several minutes as the train moved along the line; eventually the train came to a stop and the idling of its diesel engines was clearly audible at this location.
- As a result of the very mixed urban character of the noise, the noise levels at all three locations are quite variable, comprising a relatively even mix of periods of very low noise interrupted by elevated noise from vehicles, emergency vehicle sirens, shouting etc; this is evident in the noise measurement data obtained, as presented in Table 1. Note that the data in Table 1 are presented rounded to the nearest whole value; the reason for this is that the variability of environmental noise combined with the margin of error of a Class 1 sound level meter (+/- 1.5 dB) is such that describing environmental noise down to the level of centiBels suggests an unrealistic level of measurement accuracy. The raw measurement data, given to one decimal place, are presented in Table C2 at Appendix C.

Table 2: Measured existing noise levels

Location	Period	Time	dB L_{Amin}	dB L_{A90}	dB L_{Aeq}	dB L_{A10}	dB L_{Amax}
1: Junction of Wood St and New St	Day	12:15	43	51	**63**	67	79
		12:34	42	51	**65**	68	80
		14:57	47	54	**65**	68	85
	Night	00:29	39	40	**50**	54	65
		00:35	39	41	**52**	55	69
		01:09	39	41	**49**	49	68
		01:15	39	41	**53**	57	67
		02:30	36	38	**47**	46	66
		02:36	37	39	**42**	44	57
		03:17	35	37	**49**	53	68
		03:24	36	38	**41**	43	49
2: Towards south end of Heelis St	Day	12:53	42	45	**58**	59	80
		13:08	41	44	**57**	57	76
		13:25	41	43	**53**	53	70
		15:17	41	43	**57**	55	77
	Night	00:57	42	43	**48**	50	60
		01:02	40	42	**45**	47	51
		02:44	37	40	**44**	47	54
		02:51	35	37	**44**	47	61
		03:33	38	41	**44**	47	52
		01:24	37	40	**44**	46	54
		01:30	39	41	**44**	47	53
3: North end of Heelis St	Day	14:00	47	49	**55**	56	72
		14:19	50	52	**55**	55	70
		14:37	46	48	**53**	55	69
		15:34	45	49	**55**	58	69
	Night	00:43	40	42	**46**	49	54
		00:49	40	43	**48**	51	56
		01:39	39	42	**47**	51	55
		01:46	37	40	**46**	49	58
		02:58	35	37	**44**	48	53
		03:03	38	41	**46**	49	57
		03:09	38	41	**45**	48	56
		03:41	36	38	**43**	46	50

4.2. To summarise, the data in Table 1 indicate that:

- At location 1, Wood Street, the daytime **ambient** noise lies within the range of 63 to 65 dB L_{Aeq} and night time ambient noise lies within the range of 41 to 53 dB L_{Aeq}. '**Background**' noise lies within the range 51 to 54 dB L_{A90} during the day and 37 to

41 dB L_{A90} at night. The **maximum** noise level recorded was 85 dB L_{Amax} during the day and 69 dB L_{Amax} at night.

- At location 2, south end of Heelis Street, the daytime **ambient** noise lies within the range of 53 to 58 dB L_{Aeq} and night time ambient noise lies within the range of 44 to 48 dB L_{Aeq}; the night time ambient noise levels at this location are less variable than at Location 1 and tend to be predominantly around 44 dB L_{Aeq}. **Background** noise lies within the range 43 to 45 dB L_{A90} during the day and 37 to 43 dB L_{A90} at night. The **maximum** noise level recorded was 80 dB L_{Amax} during the day and 61 dB L_{Amax} at night.
- At location 3, north end of Heelis Street, the daytime **ambient** noise lies within the range of 53 to 55 dB L_{Aeq} and night time ambient noise lies within the range of 43 to 48 dB L_{Aeq}, with more variability than at location 2 due to the relative proximity to Westway. **Background** noise lies within the range 48 to 52 dB L_{A90} during the day, higher than at Location 2, and 37 to 43 dB L_{A90} at night, the same as at location 2 although, qualitatively, the noise at location 3 contains more audible noise from Westway and the town centre. The **maximum** noise level recorded was 72 dB L_{Amax} during the day and 58 dB L_{Amax} at night.

4.3. With respect to noise impact assessment, conventionally, the lowest value of the 90th percentile noise level (dB L_{A90}) is used to describe the 'background' noise along with the (logarithmic) average of the more variable continuous equivalent (L_{Aeq}) noise level. The data from Table 1 were, therefore, refined to provide the data for use in the subsequent assessment; this data is presented in Table 2.

Table 3: Key summarised noise measurement survey data

Location	Period	Lowest dB L_{A90}	Average dB L_{Aeq}	dB L_{Amax}
1: Junction of Wood St and New St	Day	51	64	79
	Night	37	49	69
2: Towards south end of Heelis St	Day	43	57	80
	Night	37	45	61
3: North end of Heelis St	Day	48	54	69
	Night	37	46	58

Operational food-store calculations

4.4. The current proposed food-store layout is presented in Figure 2. It indicates that the store is to be located at first floor level with under-storey parking for customers.

4.5. The current layout of the store footprint is such that:

- Existing residential properties on Wood Street will be approximately 25 metres from the location at which heavy goods vehicles (HGVs) would refuel at the petrol filling station (PFS), 35 metres from the location of cars refuelling at the PFS, approximately 30 metres from the closest area of car parking at the south eastern end of the food-store car park, 15 metres from the entrance to the service-yard ramp off Wood Street and approximately 110 metres from the area in which vehicle unloading would take place within the service yard. The current plans also indicate the presence of a low wall, of 1.1 metres in height, along the southern edge of the

store car park and PFS where it abuts Wood Street. The proposed layout and local topography are such that the PFS forecourt and car park areas would be 2 metres below the level of the residential properties on Wood Street.

- Existing residential properties on Heelis street, *south of Joseph Street*, will be approximately 23 metres from the closest area of the food-store car park, but which will be set at considerably lower than Heelis Street and therefore entirely screened from view, and 20 metres from the service yard, which will be obscured by an 8-metre cutting on its eastern side and therefore entirely screened from the residential properties on Heelis Street.
- Existing residential properties on Heelis street, *north of Joseph Street*, will be approximately 30 metres from the closest area of the food-store car park, set at a lower level and entirely screened from view of the under-storey car park and delivery service yard due to the significant difference in levels. The distance between the properties and the service yard will be approximately 45 metres.

4.6. The source noise data for use in the assessment are presented in Table 3, taken from the database of previously measured noise levels of Echo Acoustics.

Table 4: Predictive assessment source noise data measured at 10 metres from source

Source Description	L_{Aeq}	L_{Amax}
Car Pass-by	46	66
Car Reversing Manoeuvre	48	69
Car Accelerating	50	72
1 Door Slam	47	71
HGV arriving	78	80
Unloading	75	83
HGV leaving	77	74
LGV arriving	60	71
LGV departing	58	67

4.7. Tables 4 to 7 present the results of the predictive receptor noise impact calculations, with exceedences of existing measured noise levels highlighted in red.

Table 5: Predicted noise impacts at Wood Street associated with operation of petrol filling station

Activity	Operational receptor noise			Existing measured noise		Impact (dB)	
	Distance (m)	Event L_{Aeq}	Event L_{Amax}	dB L_{A90}	dB L_{Amax}	Measured L_{A90} v predicted L_{Aeq}	Measured v predicted L_{Amax}
day time							
Car Pass-by	35	24 (13)	47 (41)	51	79	-27 (-38)	-32 (-38)
Car Accelerating	35	28 (17)	52 (45)			-23 (-34)	-27 (-34)
1 Door Slam	35	25 (14)	52 (46)			-26 (-37)	-27 (-33)
HGV arriving	25	51 (50)	47 (46)			0 (-1)	-32 (-33)
HGV leaving	25	50 (49)	41 (40)			-1 (-2)	-38 (-39)
LGV arriving	35	30 (27)	43 (40)			-21 (-24)	-36 (-39)
LGV departing	35	28 (25)	39 (37)			-23 (-26)	-40 (-42)
Night time							
Car Pass-by	35	24 (13)	47 (41)	37	69	-13 (-24)	-22 (-28)
Car Accelerating	35	28 (17)	52 (45)			-9 (-20)	-17 (-24)
1 Door Slam	35	25 (14)	52 (46)			-12 (-23)	-17 (-23)
HGV arriving	25	51 (50)	47 (46)			14 (13)	-22 (-23)
HGV leaving	25	50 (49)	41 (40)			13 (12)	-28 (-29)
LGV arriving	35	30 (27)	43 (40)			-7 (-10)	-26 (-29)
LGV departing	35	28 (25)	39 (37)			-9 (-12)	-30 (-32)

4.8. The data in Table 4 indicate that relative to existing measured background (dB L_{A90}) noise levels, potentially major adverse night time noise were predicted as a result of the movement of heavy goods vehicles (HGVs) on the petrol filling station forecourt.

Table 6: Predicted noise impacts at Wood Street with use of car park and service yard access road

Activity	Operational receptor noise			Existing associated measured noise		Impact (dB)	
	Distance (m)	Event L_{Aeq}	Event L_{Amax}	dB L_{A90}	dB L_{Amax}	Measured L_{A90} v predicted L_{Aeq}	Measured v predicted L_{Amax}
day time							
Car Pass-by	30	20 (13)	44 (40)	51	79	-31 (-38)	-35 (-39)
Car Reversing Manoeuvre	30	22 (15)	46 (42)			-29 (-36)	-33 (-37)
Car Accelerating	30	25 (18)	48 (44)			-26 (-33)	-31 (-35)
1 Door Slam	30	21 (14)	48 (45)			-30 (-37)	-31 (-34)
HGV arriving	15	74	76			23	-3
HGV Unloading	110	54	62			3	-17
HGV leaving	15	73	70			22	-9
LGV arriving	15	56	67			5	-12
LGV departing	15	54	63			3	-16
Night time							
Car Pass-by	30	20 (13)	44 (40)	37	69	-17 (-24)	-25 (-29)
Car Reversing Manoeuvre	30	22 (15)	46 (42)			-15 (-22)	-23 (-27)
Car Accelerating	30	25 (18)	48 (44)			-12 (-19)	-21 (-25)
1 Door Slam	30	21 (14)	48 (45)			-16 (-23)	-21 (-24)
HGV arriving	15	74	76			37	7
HGV Unloading	110	54	62			17	-7
HGV leaving	15	73	70			36	1
LGV arriving	15	56	67			19	-2
LGV departing	15	54	63			17	-6

4.9. The data in Table 6 indicate that major adverse day time noise impacts were predicted for these properties, associated with the arrival and departure of HGVs from the service yard access road, minor noise impacts from the unloading of HGVs and minor to moderate impacts associated with the arrival and departure of LGVs. Major, adverse night time impacts were predicted as a result of the movement of HGVs and LGVs arriving and departing from the service yard access road and from the unloading of HGVs.

Table 7: Predicted noise impacts on Heelis Street (south of Jacob St) associated with use of car park and activities in service yard

Activity	Operational receptor noise			Existing measured noise		Impact (dB)	
	Distance (m)	Event L_{Aeq}	Event L_{Amax}	dB L_{A90}	dB L_{Amax}	Measured L_{A90} v predicted L_{Aeq}	Measured v predicted L_{Amax}
day time							
Car Pass-by	23	16	39	43	80	-27	-41
Car Reversing Manoeuvre	23	18	40			-25	-40
Car Accelerating	23	20	43			-23	-37
1 Door Slam	23	17	44			-26	-36
HGV arriving	20	50	44			7	-36
HGV Unloading	20	47	47			4	-33
HGV leaving	20	49	38			6	-42
LGV arriving	20	32	39			-11	-41
LGV departing	20	30	35			-13	-45
Night time							
Car Pass-by	23	16	39	37	61	-21	-22
Car Reversing Manoeuvre	23	18	40			-19	-20
Car Accelerating	23	20	43			-17	-18
1 Door Slam	23	17	44			-20	-17
HGV arriving	20	50	44			13	-17
HGV Unloading	20	47	47			10	-14
HGV leaving	20	49	38			12	-23
LGV arriving	20	32	39			-5	-22
LGV departing	20	30	35			-7	-26

4.10. The data in Table 7 indicate that moderate adverse day time noise impacts were predicted, for properties on Heelis Street south of Jacob Street, as a result of the arrival departure of HGVs in the service yard, with minor noise impacts predicted for unloading of HGVs. Major adverse night time noise impacts were predicted, associated with the arrival, departure and unloading of HGVs.

Table 8: Predicted noise impacts on Heelis Street (north of Jacob St) associated with use of car park and activities in service yard

Activity	Operational receptor noise			Existing measured noise		Impact (dB)	
	Distance (m)	Event L_{Aeq}	Event L_{Amax}	dB L_{A90}	dB L_{Amax}	Measured L_{A90} v predicted L_{Aeq}	Measured v predicted L_{Amax}
day time							
Car Pass-by	30	14	40	48	69	-34	-29
Car Reversing Manoeuvre	30	16	42			-32	-27
Car Accelerating	30	18	44			-30	-25
1 Door Slam	30	15	45			-33	-24
HGV arriving	45	43	45			-5	-24
HGV Unloading	45	40	49			-8	-20
HGV leaving	45	42	39			-6	-30
LGV arriving	45	25	41			-23	-28
LGV departing	45	23	38			-25	-31
Night time							
Car Pass-by	30	14	40	37	58	-23	-18
Car Reversing Manoeuvre	30	16	42			-21	-16
Car Accelerating	30	18	44			-19	-14
1 Door Slam	30	15	45			-22	-13
HGV arriving	45	43	45			6	-13
HGV Unloading	45	40	49			3	-9
HGV leaving	45	42	39			5	-19
LGV arriving	45	25	41			-12	-17
LGV departing	45	23	38			-14	-20

4.2 The data in Table 8 indicate that moderate to adverse night time noise impacts were predicted, for properties on Heelis Street north of Jacob Street, as a result of the arrival and departure of HGVs in the service yard, with minor noise impacts associated with the unloading of HGVs.

4.3 The assessment undertaken has indicated that the following aspects of the site's operation may require further mitigation measures:

- Night time movement of HGVs on the petrol filling station forecourt, principally affecting properties on to the western end of Wood Street.
- Day and night time deliveries to the service yard, associated with both HGVs and LGVs affecting properties on Wood Street adjacent to the service yard access road and properties on Heelis Street south of Jacob Street.
- Night time deliveries to the service yard, associated only with HGVs, affecting properties on Heelis Street north of Jacob Street.

4.4 Suggested additional noise control measures and the respective attenuated noise levels are discussed in Section 5.

4.5 It was not possible to assess potential noise impacts associated with externally-mounted plant equipment, but as this type of equipment can operate continually, it may be necessary to agree a suitable noise limit at nearby residential receptors, with the local authority Environmental Health Department.

4.6 Care should be taken in the siting of any such equipment to minimise the potential for adverse noise effects at nearby residential properties; the equipment would be best located on the northern or north-western side of the building and facing the town centre.

5 NOISE CONTROL REQUIREMENTS

5.1 The most suitable form of noise control, for the majority of the predicted potential adverse noise effects identified, makes use of solid barriers to attenuate noise, generally solid masonry walls in this instance. Some elements of the site, such as the petrol filling station, already have walls of 1.1 metres in height within the current design and these were simply increased in height to 4 metres to more effectively block the line of sight of the receptors from the noise sources.

5.2 The service yard benefits from a significant physical barrier created by the cutting on its eastern side where it adjoins Heelis Street. However, the relative proximity of the residential properties and high noise levels associated with service yard activities suggests that further noise mitigation measures would be required. An additional 2 metre-high barrier was 'modelled' at the top of the cutting to increase the effective height of the wall; detailed barrier calculations found that this is the optimum height of the wall as increasing the height further does not add significantly to the sound attenuation provided but would increase the potential visual intrusion of the barrier for residents on Heelis Street.

5.3 The results of these sound attenuation measures is presented in Table 9. Note that there were no predicted exceedences of the measured maximum noise level for these activities.

Table 9: Summary of relevant noise impacts with implementation of noise mitigation

Activity	Operational receptor noise		Existing measured noise	Un-mitigated impact (dB)	Mitigated impact (dB)
	Distance (m)	Event L_{Aeq}	dB L_{A90}		
(Table 5 – Wood Street PFS noise - night time) [4m barrier]					
HGV arriving	25	51	37	14 (13)	9 (8)
HGV leaving	25	50		13 (12	8 (7)
(Table 7 – Heelis Street S service yard noise - day time) [2m barrier]					
HGV arriving	20	50	43	7	5
HGV Unloading	20	47		4	2
HGV leaving	20	49		6	4
(Table 7 – Heelis Street S service yard noise - night time) [2m barrier]					
HGV arriving	20	50	37	13	11
HGV Unloading	20	47		10	8
HGV leaving	20	49		12	10
(Table 8 – Heelis Street N - night time) [2m barrier]					
HGV arriving	45	43	37	6	4
HGV Unloading	45	40		3	1
HGV leaving	45	42		5	3

5.4 The assessment of mitigated receptor noise levels predicted that there would still be adverse impacts of (just) up to major adverse significance during the night.

5.5 With regard to properties on Wood street opposite the petrol filling station, external night time noise levels of 45 to 46 dB L_{Aeq} were predicted. However, the acceleration of vehicles up the road, even during the night, as well as frequent shouting from the town centre, causes occasional significant noise increases and it is reasonable to infer that the local residents are acclimatised to these occasional noise events and most likely keep windows facing Wood Street closed at night; it was noted during the survey that no windows were open onto Wood Street during the night. The properties are also bungalows and it is

reasonable to infer that most residents would keep their windows closed at night for security reasons. A closed window will provide at least 30 dB of sound attenuation which would result in internal noise levels of 15 to 16 dB L_{Aeq}, considerably below the 30 dB L_{Aeq} internal noise level suggested by BS 8233 as being necessary for "good" sleeping conditions. An open window, conservatively assuming 10 dB of sound attenuation, would result in "reasonable" internal noise levels for sleep (35 to 36 dB L_{Aeq}) relative to the 35 dB L_{Aeq} level suggested by BS 8233. Were residents to keep windows open it is more likely that they would be disturbed by the frequent hard acceleration of vehicles up Wood Street, or by the frequent shouting from the town centre, than by the occasional movement of HGVs on the petrol filling station forecourt. In view of these 'contextual' considerations, it is judged unlikely that occasional noise events on the filling station forecourt during the night would be a significant cause for disturbance in this location.

5.6 The minor to moderate daytime noise events for properties at the southern end of Heelis Street are also judged unlikely to be a cause for significant disturbance in the context of the existing environment. Although quieter than other locations, the properties here appear to have their main outdoor/garden areas to the rear of the properties, away from Heelis Street. The properties are also currently subjected to intermittent banging and hammering from the garage unit, none of which was measured during the survey. With potential internal noise levels (through an open window) below the 40 dB L_{Aeq} noise level suggested by BS 8233 as being necessary for "reasonable" resting conditions, and in the context of the existing environment, it is judged unlikely that occasional day time noise from the service yard would cause significant disturbance.

5.7 With regard to night time noise from the service yard affecting properties at the southern end of Heelis Street, the same considerations with regard to context of the existing environment and internal noise levels can be applied. This location still suffers from the noise of people shouting in the town centre and vehicles moving on the adjacent streets, sometimes at speed or accelerating hard up the incline of Wood Street. These properties are also bungalows and, for security reasons, it is unlikely that windows facing the town centre and Heelis Street are kept open at night, in which case very good internal noise levels would be expected. With windows open, internal noise levels would be above those required for "reasonable" sleeping conditions according to the criteria in BS 8233. In view of these considerations, it is judged unlikely that significant adverse noise disturbance would occur due to the occasional activities in the service yard.

5.8 Similar considerations apply to the properties at the northern end of Heelis Street. Existing noise here includes more contributions from traffic on Westway and the town centre, greater than for those at the southern end of the street and the noise impacts of the food-store were predicted to be much lower due to the greater distance from the service yard. Even with windows open, internal night time noise levels for these properties would be commensurate with "good" conditions for sleep using the criteria presented in BS 8233.

5.9 Notwithstanding these considerations, it would be expected that night time service operations would be undertaken using the following best practice measures to minimise the potential for disturbance:

- Refrigeration units should be turned off 5 minutes before arriving at the store and should remain off until 5 minutes after leaving the service yard.

- Delivery vehicles should not stand for long periods with engines running, on the streets leading to the service yard.
- Vehicle movements, where possible, should be undertaken considerately with a minimum of hard engine revving.
- Vehicle horns should not be sounded except in emergency and, where practicable, vehicle reversing alarms should be turned off; the food-store may need to implement a policy that restricts movement of personnel within the service yard whilst delivery vehicles are manoeuvring.
- Radios and other personal audio devices should be turned off prior to arrival at the store, or reduced to very low levels, and should remain so until 5 minutes after leaving the service yard.
- The delivery entrances into the food-store should be fitted with flexible curtains where the delivery vehicles reverse up to the store entrance/unloading area, to minimise noise escape from this area as cages are wheeled out.
- The floor area and connection between the food-store and delivery vehicles should be designed to avoid drops, gaps or other discontinuities which might cause significant noise as cages are manoeuvred over these areas.

5.10 Significant night time noise impact was predicted for properties on Wood Street close to the service yard access road, associated with the movement of delivery vehicles entering and leaving the service yard access road; there are no physical mitigation measures that can be applied. However, as with the consideration of noise affecting properties on Wood Street opposite the petrol filling station, it is important to consider the context and setting of these receptors in addition to consideration of the quantitative predicted noise impacts. The predicted noise impacts relate to external areas and the frequent elevated levels of traffic noise at night due to fast-moving cars on Wood Street, accelerating hard up the incline, giving rise to existing ambient noise levels of 49 dB L_{Aeq} and 69 dB L_{Amax}, as well as security considerations, suggest that it is unlikely local residents have windows facing Wood Street open during the night and, if they do, may be relatively well-acclimatised to the noise. With windows closed, and assuming a minimum sound attenuation through closed standard double-glazed windows of 30 dB, internal noise levels from the occasional arrival of a HGV at the service yard access road would be in the region of 44 dB L_{Aeq}. In a rural setting this would be considered excessive but in this town centre environment, with elevated noise events occurring throughout the night, it is judged that this would not be an unusual noise in this situation and would be unlikely to be a significant cause for sleep disturbance.

6 SUMMARY

6.1 The assessment predicted potentially major adverse noise impacts for residential properties adjacent to the proposed development site.

6.2 Appropriate mitigation measures were discussed, including the construction of a 4 metre-high wall or barrier along the site boundary between the petrol filling station and Wood Street, and a 2 metre-high barrier at the top of the cutting between the service yard and Heelis Street.

6.3 The results of these measures, with additional consideration of the nature of the existing noise affecting the receptors in this location close to Barnsley town centre, was that no likelihood of significant disturbance was identified.

6.4 Night time delivery noise due to the arrival and departure of delivery vehicles at the service yard access road on wood Street, in close proximity to existing residential properties, resulted in potentially significant quantitative noise impacts when assessed relative to the lowest existing background (dB L_{A90}) noise level. However, in the context of the frequent passage of vehicles accelerating hard up the incline of Wood street and other significant night time noise events, such a shouting, from the town centre, it was inferred that residents are likely to be relatively acclimatised to elevated noise events and were unlikely to sleep with windows facing Wood Street open. In which case, internal noise levels would be above those suggested by BS 8233 as being required for “reasonable” sleeping conditions but would not be unusual in this environment nor a cause for disturbance.

6 APPENDICES

Appendix A: glossary of acoustic terminology

Decibel (dB): a unit of level derived from the logarithm of the ratio between the value of a quantity and a reference value. It is used to describe the level of many different quantities. For sound pressure level the reference quantity is 20 micro-Pascals (µPa), the threshold of normal hearing is in the region of 0 dB, and 140 dB is the threshold of pain. A change of 1 dB is only perceptible under controlled conditions.

dB(A) / A-weighting: decibels measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB(A) broadly agree with people's assessment of loudness. A change (in steady noise) of 3 dB(A) is the minimum perceptible under normal conditions and a change of 10 dB(A) corresponds roughly to halving or doubling the *loudness* of a sound. The background noise level in a living room may be about 30 dB(A); normal conversation about 60 dB(A) at 1 metre; heavy road traffic about 80 dB(A) at 10 metres; between 2 running diesel generators (600 rpm) about 100 dB(A). An un-weighted, or Z-weighted, value has not been filtered to allow for human perception of noise and hence presents the sound level in its 'true' form.

Hertz (Hz): unit of frequency, equal to one cycle per second. Frequency is related to the pitch of a sound.

$L_{Aeq.T}$: the equivalent continuous sound level - the sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period (T). L_{Aeq} is used to describe many types of noise and can be measured directly with an integrating sound level meter.

L_{Amax}: the highest A weighted noise level recorded during a noise event. The time weighting used (F or S) should be stated.

L_{A90}: the 90^{th} percentile noise level i.e. the noise level exceeded for 90% of the measurement period. A statistical value often used, in UK noise assessments, to define "background" noise conditions.

Noise: any audible sound, often defined as unwanted sound. Can be damaging to hearing if it is too loud or can be just annoying if it interferes with the normal enjoyment of others.

Sound / sound pressure: a fluctuation in air pressure over the static ambient pressure.

Sound pressure level: the sound pressure relative to a standard reference pressure of 20 µPa (20×10^{-6}) on the decibel scale.

Appendix B: Figure 1 and photographs of measurement locations

Figure 1: Measurement survey locations



Figure 2: Location 1, western end of Wood Street

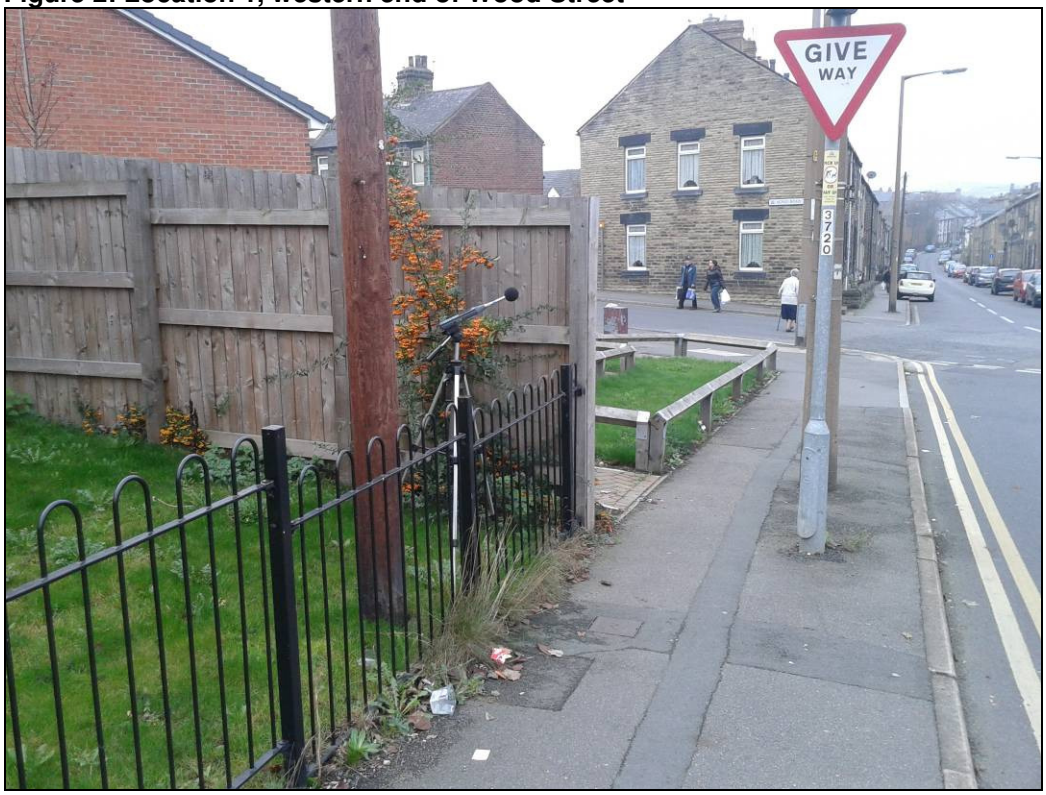


Figure 3: Location 2, south end of Heelis Street



Figure 4: Location 3, north end of Heelis Street



Appendix C: Detailed survey measurement data and observations

Location	Period	Time	$L_{AF\ min}$	L_{A90}	L_{Aeq}	L_{A10}	$L_{AF\ max}$	Observations
1	Day	12:15:40	42.9	51.0	63.0	66.7	79.3	Busy, lots of traffic on Wood St inc buses
		12:34:55	41.6	50.7	64.5	68.0	79.8	As previous.
		14:57:29	47.4	54.1	65.3	67.6	85.0	Still v busy, lots of traffic on Wood St, vehs accelerating hard up incline and across junction. Lots of pedestrians and voices.
		Average:		51.9	64.4			
	Night	00:29:18	38.5	40.0	50.2	54.3	64.8	Distant road noise. 3 cars pass close by. Occasional shouts and raised voices from bars in town centre. No club music.
		00:35:50	39.2	41.1	51.8	54.8	69.2	Raised voices in town – do not affect measured noise level significantly.
		01:09:49	39.1	41.0	48.6	49.3	67.6	Just audible generator hum/Voices and music beat from bars/clubs beyond Morrisons. General road noise audible. Delivery truck at Morrisons.
		01:15:55	38.7	40.7	52.6	56.8	66.5	As previous, but 4 cars pass-by.
		02:30:32	35.9	37.7	47.2	46.2	65.6	Night club noise has stopped. Noticeably quieter. Some birdsong. Less road noise but still dominant. Some occasional raised voices in town centre. 1 car pass-by. Lots of birdsong but not close by.
		02:36:03	37.0	39.1	42.0	44.0	56.6	Noise level generally 2-4 dB lower. Gentle breeze. More distant voices in town. No cars
		03:17:41	35.2	36.5	49.2	52.5	67.7	Train noise audible. Much quieter, SPL down to 36 when no cars. Some v distant shouting, 4 cars pass-by.
		03:24:33	36.1	37.8	40.7	42.7	48.6	Little bird song, no cars. Distant shouting.
		Average:		39.2	49.3			
2	Day	12:53:00	42.2	44.6	58.1	58.6	80.0	Relatively quiet, distant road noise from Westway & occasional passing cars. Some banging noise and voices from adjacent garage. Also birdsong.
		13:08:31	41.1	43.9	56.9	57.2	76.4	Birdsong, esp numerous starlings. Local resident shouting near SLM.
		13:25:15	40.5	43.3	53.1	53.3	69.9	Local noise inc voices of parked up taxi drivers 30m away. Some building works on Wood St.
		15:17:59	40.8	43.2	57.4	55.2	76.9	As previous.
		Average:		43.8	56.7			
	Night	00:57:00	41.9	43.4	48.0	50.4	60.4	Town centre traffic noise still very evident. Some birdsong from nearby trees. Occasional taxis on access road on lower car park area. Taxi pass-by.
		01:02:09	39.9	41.7	44.6	47.4	51.2	Audible noise from air handling unit on corner shop. Some banging and clanking from delivery truck at Morrisons. Raised voices from town centre. No cars pass.
		02:44:51	37.4	39.5	43.8	46.7	53.5	As before.
		02:51:09	34.8	37.0	44.1	47.1	60.8	Still lots of town centre traffic noise, especially fast moving vehs on Westway (tyre noise). No cars pass, distant voices.
		03:33:21	37.8	40.5	44.3	47.2	51.6	Some birdsong, on car pass-by on Wood St. Bird in nearby tree causes SPL up to 57 dB(A).

Location	Period	Time	$L_{AF\ min}$	L_{A90}	L_{Aeq}	L_{A10}	$L_{AF\ max}$	Observations
		01:24:54	37.2	39.9	43.7	46.0	53.8	Lots of traffic on Westway, no cars on adjacent roads. Still occasional distant shouting, arguing, screaming.
		01:30:43	38.8	40.7	44.1	46.6	52.5	Lots of road noise on Westway.
			Average:	40.4	44.9			
3	Day	14:00:43	46.7	49.1	55.2	56.3	72.4	Lots of road noise from Westway. Starlings!! Occasional voices, town ctr noise v clearly audible. Fire engine on Westway.
		14:19:45	50.2	51.8	54.5	54.9	70.3	As previous.
		14:37:41	45.9	48.4	53.1	54.6	69.4	Ass previous.
		15:34:55	45.2	48.5	54.6	57.5	69.2	Lots of fire engine noise.
			Average:	49.5	54.4			
	Night	00:43:32	39.6	41.5	46.2	49.3	53.6	Elevated position overlooking town. Road noise from Westway very evident. Occasional shouting from town centre. Bus & HGV is very evident. No cars passing.
		00:49:00	40.2	43.3	48.1	50.9	55.6	Blare of car horn from town centre. Lots of shouting in town centre at one point.
		01:39:38	39.3	41.5	47.3	50.7	55.2	Distant alarm/reversing alarm, just audible. Music noise/beat from club in town centre, becoming louder but no observable effect on measured noise level.
		01:46:08	37.0	40.0	45.8	48.9	58.0	Lots of traffic noise from Westway. Occasional very clearly audible music noise/beat from clubs. Very light westerly breeze developing.
		02:58:05	35.2	37.0	43.8	47.6	53.0	As before, gentle breeze. 1 taxi pass-by.
		03:03:35	37.7	40.7	46.2	49.4	57.1	Much less noise from town ctr, occasional raised voices. Audible movement of HGV in town. Someone whistling, audible and birdsong in trees nearby. Lots of traffic movement on Westway. N o cars on Heelis St.
		03:09:12	38.3	40.7	45.1	47.6	55.6	Lots of road noise on Westway. Distant shouting. Noisy HGV on Westway. Audible freight train noise from N? No cars on Heelis St.
		03:41:07	35.9	38.2	42.6	46.1	50.4	Distant train noise? Marked increase in road noise from Westway after 3AM. Some singing in town! Squealing veh fan belt, engine revving, from lower car park area.
			Average:	40.4	45.9			