ATKINS

Corkscrew Ride Replacement, Alton Towers

Noise Impact Assessment

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Plan Design Enable

Corkscrew Ride Replacement, Alton Towers

Noise Impact Assessment

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EXECUTIVE SUMMARY

Measurements of a similar coaster at Thorpe Park have been used to model and predict noise levels from the proposed replacement for the Corkscrew ride. The proposed ride is partly enclosed in the location of the existing Corkscrew ride, with lengths of track weaving through the well-wooded area to the southwest of the Corkscrew site.

Previous ambient noise level surveys, conducted at representative locations around the Park, show that levels have changed little over the last 15 or so years. Distant screams, coaster track running noise and the Corkscrew lift motor are variously noticeable, but generally not measurable, depending principally upon receiver location, the wind speed and its direction.

Standard noise modelling techniques have been used to predict L_{Amax} and octave band noise levels from the new coaster. The acoustic characteristics of the ride are similar to those of rides already in operation in the Park. Noise in the lowest frequency bands may be occasionally audible, although the overall L_{Amax} levels will be well below existing L_{A90} background levels. Replacement of the Corkscrew ride will eliminate the characteristic motor whine associated with the lift.

BS 4142, which is unique to the UK, uses a comparative noise level approach which was developed for use in the assessment of industrial-type noise. Applying a BS 4142-type analysis (using L_{Amax} rather than the lower L_{Aeq} levels), shows that justifiable noise complaints will not occur from even the closest area of Alton Village.

Irrespective of the doubt regarding the applicability of the BS 4142 method for assessing ride noise, the use of absolute noise level criteria as recommended by the WHO, shows that noise levels from the proposed ride will satisfy even the most stringent WHO target level. This absolute noise level approach is adopted for general noise planning in this country (via PPG24) and is applied by the local authority to the Heide Theme Park in Germany.

1. INTRODUCTION

1.1 Alton Towers requested Atkins Noise and Vibration to investigate and report upon the likely noise effects associated with a planned new coaster to replace the existing Corkscrew ride, towards the southern side of the Park. The new ride will be partially enclosed within a building, with sections of the running track weaving through the well-wooded area to the southwest of the Corkscrew site.

1.2 For the purposes of assessing the potential noise impact of the new ride, noise levels have been predicted in the Castle Hill Road area of Alton Village (approximately 470 metres to the south), Cliff Farm Cottage (670 m to the southeast) and at Farley House, approximately 1 km to the northwest.

1.3 Noise levels at scattered properties located about 500 metres to the west of the new coaster location, such as Pink Lodge and Pine Trees (approximately 150 m AOD), have not been assessed as their current noise levels are strongly influenced by traffic on Farley Lane. They are also closer to a number of major rides located in the adjacent area of the Park and are well screened from the new coaster by the intervening hill, on top of which are "The Towers" buildings.

2. ASSESSMENT OF NOISE INTRUSION

2.1 There is no specific published advice on the assessment of community responses to Theme Park noise. However, in general a noise may provoke complaints if its level exceeds, by a certain margin, that of the pre-existing background noise; or when it attains a certain absolute level.

2.2 British Standard 4142, 1997 "Method for Rating Industrial Noise affecting mixed Residential and Industrial areas" gives a method for assessing the likelihood that an industrial noise source may give rise to complaints. The method consists of determining the "Specific Noise Level" (that due to the industrial noise source, expressed in terms of dBL_{Aeq}) at the assessment location, applying a +5 dB correction, if appropriate, to derive the "Rating Level" and comparing that with the "Background Level" (dBL_{A90}, exceed for 90% of the assessment period). The +5 dB correction is applied if the noise from the new industrial noise source contains a distinguishable, discrete, continuous note (whine, hiss, screech, hum, etc.) or the noise contains distinct impulses (bangs, clicks, clatters or thumps) or the noise is irregular enough to attract attention. There is an implicit assumption that the "new noise" source will be distinguishable from existing noise sources.

2.3 The likelihood of complaints is assessed by subtracting the Background Level from the Rating Level. The greater the difference in noise levels, the greater the likelihood of complaints. A difference of around +10 dB or more indicates that complaints are likely. A difference of around +5 dB is of marginal significance. If the Rating Level is more than 10 dB below the Background Level then this is a positive indication that complaints are unlikely.

2.4 The World Health Organisation recommends that, in order to minimise noise annoyance in outside recreational spaces such as gardens and patio areas, L_{Aeq} noise levels should not exceed 50 to 55 dB. The WHO recognises that these target levels are already exceeded in many urbanised areas and near roads.

3. SOURCE NOISE LEVELS AND NOISE PROPAGATION

REPLACEMENT COASTER NOISE LEVELS

3.1 Noise from the planned new coaster was modelled on a similar one located at Thorpe Park. The Thorpe park ride, "No Way Out" is totally enclosed within a metal framed/clad building. Octave band measurements were conducted on 5 November 2008 using a calibrated Norsonics type 2218 precision grade sound level meter, tripod mounted at a height of 1.5 m above ground level. The microphone was located in the reverberant sound field within the enclosure, with the meter programmed to record the octave band and overall dB(A) levels in terms of the L_{eq} and L_{max} levels recorded over a 40-minute period. Throughout this recording period there were 4 trains of riders on the track.

3.2 The "reverberant" sound pressure levels were converted to sound power levels using standard calculations that take account of the internal surface area of the enclosure and the frequency-dependent absorption coefficients of the walls. These sound power levels were then used, again using the standard calculation method, to predict outdoor "free-field" sound pressure levels from the external areas of the proposed replacement coaster. Listening tests at Thorpe Park indicated total inaudibility of the ride noise external to the building.

3.3 The derived free-field dBL_{max} noise levels at 10 m the track are shown in Table 3.1.

Table 3.1 – L_{max} Noise Levels at 10m from Running Track (Thorpe Park)

Octave Band Mid Frequency (Hz)							dB(A)
63	125	250	500	1k	2k	4k	
88	81	78	66	64	62	58	74

3.4 Table 3.1 shows that the ride noise spectra of fully laden trains are broad band with no pronounced noise peak.

NOISE PROPAGATION

3.5 Several factors affect the propagation of noise, especially when the distance between the noise source and receiver is in excess of a few hundred metres. The main factor is distance. Due to hemispherical spreading of the sound waves from a point source, the noise level attenuates at a rate of 6 dB for every doubling of distance. A level of, say, 76 dB(A) at 10 metres would therefore reduce to 70 dB(A) at 20 metres, 64 dB(A) at 40 metres, and so on.

3.6 In addition to attenuation due to hemispherical spreading, the travelling sound wave may also be partially absorbed by the ground surface, depending upon the type of ground cover and the average height of noise propagation above the ground. For noise sources well above ground level, the effect becomes minimal.

3.7 Additional attenuation may be brought about by the presence of woodland planting. The rate of attenuation of noise depends upon such factors as the overall planting density, the depth of the tree belt, the amount of low level shrub cover and the height and type of trees. The excess attenuation is also frequency dependent, increasing with increasing frequency, as shown in Table 3.2.

Table 3.2 – Attenuation per 100 metres Through Woodland

	Octave Band Mid Frequency (Hz)						
Woodland Type	63	125	250	500	1k	2k	4k
"Average" Woodland	2	3	3	4	5	8	11
General Forest	4	5	6	8	10	13	16
Bare Deciduous	0	0	0	0	0	3	6
ISO 9613 (dense foliage)	2	3	4	5	6	8	9

3.8 The "General Forest" and "Bare Deciduous" data in Table 3.2 are derived from The Noise Advisory Council's "A guide to Measurement and Prediction of the Equivalent Continuous Sound Level L_{eq}", 1978 and the "Average Woodland" figures as the average of these two. Table 3.2 also includes the attenuation rates suggested in ISO 9613 ("Attenuation of sound during propagation outdoors", 1996) for densely foliated woodland. The ISO data assumes that both the noise source and receiver are outside the woodland so that, with an adverse (downwind) wind direction, a maximum of only 200 m of woodland is effective, irrespective of its actual depth. The ISO figures approximate well to those shown for "Average" Woodland.

3.9 Landforms, buildings, walls or any other solid obstruction that cuts the line of sight between the source of noise and receiver has the potential to reduce the noise. The effectiveness of the "barrier" depends upon its height and its location relative to the source and receiver. The attenuation is frequency dependent, being related to the path difference, expressed in terms of wavelength, between the "direct" sound wave and that "diffracted" over the top of the barrier. As the frequency increases (shorter wavelength) so does the barrier attenuation. Table 3.3 shows the thin barrier attenuation for various path differences (in metres) between the direct and diffracted sound waves. It will be seen that a barrier that just cuts the sight line between the source of noise and the receiver produces a reduction of 5 dB across the entire frequency spectrum.

Table 3.3 – Frequency Dependent Thin Barrier Attenuation

Path Difference	Octave Band Mid Frequency (Hz)(and wavelength (m))						
(m)	63 (5.4)	125 (2.7)	250 (1.4)	500 (0.7)	1k (0.3)	2k (0.2)	4k (0.1)
0	5	5	5	5	5	5	5
0.1	6	7	8	9	12	14	17
0.2	7	8	9	12	14	17	20
0.5	8	10	12	15	18	21	24
1.0	10	12	15	18	21	24	27
1.5	11	14	17	20	23	26	29
2.0	13	15	18	21	24	27	30

3.10 The data in Table 3.3 applies to barriers whose thickness is less than the wavelength of sound in each frequency band (also shown in the Table). For "thick" barriers such as buildings or land forms, the equivalent thin barrier height and location may be derived by the intersection of two straight lines both just grazing the nearest top edges of the thick barrier, one drawn from the receiver and the other drawn from the source.

3.11 Atmospheric effects include air absorption, wind speed and direction and temperature gradients. Air absorption depends upon frequency, air temperature and relative humidity, as well as the distance between the noise source and the receiver. Table 3.4 gives values for air absorption per 100 metres of the propagation path, extracted from ISO 9613 which reproduces data from the American National Standards Institute.

Table 3.4 – Air Absorption per 100 metres

Temperature (°C)	Relative Humidity (%)	Octave Band Mid Frequency (Hz)						
		63	125	250	500	1k	2k	4k
15	40	0.02	0.05	0.12	0.22	0.45	1.31	4.57
	60	0.01	0.04	0.12	0.23	0.41	0.95	3.03
20	40	0.02	0.05	0.14	0.26	0.47	1.12	3.61
	60	0.01	0.04	0.12	0.28	0.48	0.93	2.54
25	40	0.01	0.05	0.15	0.32	0.54	1.07	3.01
	60	0.01	0.03	0.12	0.32	0.60	1.02	2.32

3.12 Various models have been developed to asses the effects of vector winds and temperature gradients. One such model (CONCAWE Report 4/81) makes use of Pasquill Stability Categories which describe the general atmospheric stability, relating primarily to time of day and extent of cloud cover. These Categories have been combined with vector wind speeds to define six Meteorological Categories. Categories 1 to 3 represent conditions under which noise levels are reduced relative to the neutral Category 4 and generally relate to upwind conditions. Categories 5 and 6 represent enhancement of the noise, relative to Category 4, and are most often associated with downwind propagation. During daytime hours weather conditions usually relate to Meteorological Categories 3, 4 or 5. Table 3.5 shows, for distances relevant to Alton Towers, that octave band noise levels are generally within about 5 dB of those associated with neutral conditions.

Table 3.5 – Effect of Atmospheric Conditions on Noise Levels

Distance (m)	Met Category	Octave Band Mid Frequency (Hz)						
		63	125	250	500	1k	2k	4k
500	3	-1	-1	-4	-4	-6	-5	-4
	4	0	0	0	0	0	0	0
	5	+1	+2	+4	+4	+5	+3	+4
1000	3	-2	-1	-4	-4	-6	-5	-5
	4	0	0	0	0	0	0	0
	5	+1	+3	+5	+5	+5	+3	+5
2000	3	-3	-2	-4	-4	-6	-5	-5
	4	0	0	0	0	0	0	0
	5	+2	+4	+6	+6	+5	+3	+5

3.13 For typical coaster noise spectra this table translates into an increase of about 5 dB(A) for downwind propagation and a decrease of about 5 dB(A) for upwind propagation, relative to neutral conditions.

4. EXISTING NOISE CONDITIONS

4.1 Previous noise level surveys, conducted in various areas around Alton Towers, were partly updated during the weekends of Saturday/Sunday 5-6 July 2003 and 14-15 August 2004. The Park was open and all rides operating normally. Weather conditions were dry and generally sunny with wind speeds of no more than about 1 ms^{-1}.

4.2 Representative measurement locations were chosen to characterise housing areas and individual isolated properties potentially affected by noise from Alton Towers. The measurement locations most relevant to this study of the Corkscrew replacement coaster are described in Table 4.1.

Table 4.1 – Noise Level Survey Locations

Location	Site Description/Notes
Alton Village	Cemetery/ramparts area to the north of Castle Hill Road houses
Cliff Farm Cottage	Grass verge by track to Crumpwood Farm, immediately east of the Cottage
Farley Area	2 measurement locations: junction of roads to Cote Farm/Haybank Farm and in field to side of Farley House

4.3 A summary of the 2003/2004 measured levels is given in Table 4.2. The currently experienced background levels are in generally good agreement with those measured in previous years except that noise levels at Cliff Farm Cottage had not previously been measured, as at the time of the earlier surveys the Cottage had appeared to be uninhabited.

Table 4.2 – Typical Measured Existing Noise Levels, July 2003/August 2004

Location	Unit	Octave Band Mid Frequency (Hz)							dB(A)	Comments
		63	125	250	500	1k	2k	4k		
Alton Village, Cemetery area	L_{90}	47	42	40	40	37	31	24	43	Distant traffic. Birds. Corkscrew lift motor, distant screams and some ride noise occasionally audible. Occasional music/tannoy announcements just audible.
	L_{10}	53	51	48	46	45	39	29	49	
	L_1	57	56	52	50	50	45	36	54	
	L_{max}	61	60	56	57	55	54	48	62	
	L_{eq}	52	50	46	45	42	37	29	47	
Cliff Farm Cottage	L_{90}	46	42	38	40	36	29	20	42	River valley recreational noise. Birds. Corkscrew lift motor, distant screams and some ride noise clearly audible. Occasional music/tannoy announcements just audible.
	L_{10}	53	52	50	51	45	38	35	51	
	L_1	59	59	54	56	49	44	43	55	
	L_{max}	65	63	59	62	55	52	50	61	
	L_{eq}	51	50	47	48	42	36	32	48	
Farley Area	L_{90}	46	38	33	30	31	27	21	37	Birds. Distant and local traffic on Farley Lane. Distant screams and some ride noise variously audible during lulls in traffic noise.
	L_{10}	56	48	40	36	36	33	33	44	
	L_1	62	54	47	42	42	40	41	50	
	L_{max}	67	60	53	51	53	50	51	60	
	L_{eq}	54	46	38	35	35	32	32	42	

4.4 From the comments columns in Table 4.2, it is clear that distant screams, some of the ride running noise and the Corkscrew lift motor are variously audible at all the measurement locations considered.

4.5 Noise levels in the remoter parts of Alton Village are also influenced by traffic through the village and on the steep-hilled sections of Farley Lane, as well as by the noise from general village activities. Although noise surveys have not been conducted during weekday playtimes at the nearby school, it is possible that the noise of children screaming is a fairly regular feature of this area of the village.

4.6 Apart from general countryside noises, including the recreational use of the Churnet Valley, the noise environment at Cliff Farm Cottage is also influenced by distant screams and mechanical noise from Alton Towers.

4.7 Noise from within Alton Towers is variously audible in the Farley area, depending upon the prevalence of uncharacteristic wind directions, such as those from the southeast. The noise environment in this area is also influenced by traffic on Farley Lane.

4.8 All the existing noise level measurements were conducted under near still air conditions. As wind speeds increase, from whatever direction, the background noise levels also increase due to the movement of trees and bushes. This effect is especially important when trees are in close proximity to properties, such as at Farley and in the Castle Hill Road area of Alton village. Low wind speed background noise levels therefore represent probably the most stringent circumstance against which to compare noise levels from the planned replacement coaster.

5. FUTURE NOISE CONDITIONS

MODELLING PROCEDURE

5.1 As the footprint dimensions of the new ride are small compared to the distances to the nearest noise-sensitive receivers, the whole ride has been modelled as a "point" source of noise. The frequency-dependent and other propagation factors described in Chapter 3 were then applied and the resultant noise levels calculated at each receiver. This procedure was conducted for each of the 7 octave bands between 63 Hz and 4 kHz, the appropriate A-weighting corrections were applied and the A-weighted octave band levels logarithmically summed to give the corresponding L_{Amax} level. As insufficient definitive information was available regarding ride timings, it was not possible to derive corresponding L_{eq} levels. The assessment of potential noise impacts has therefore been based solely upon dBL_{Amax} levels and is likely to overestimate these impacts.

CORRECTION FACTORS

5.2 The effect of additional ground absorption (see paragraph 3.6) has been ignored in the predictions. This omission is unlikely to have a material effect upon predicted noise levels at Alton Village and Cliff Farm Cottage because of the relatively large average height of noise propagation across and along the Churnet Valley. Although the omission of ground absorption will be more relevant in the Farley area, it is unlikely to result in significant over prediction of the dB(A) levels at these properties.

5.3 The "Average" woodland attenuation figures given in Table 3.2 have been used in the modelling. As the woodland is mixed deciduous and evergreen and the Park is not fully open during the winter months (November to February), the use of "Average" woodland represents a reasonable approximation to the situation when the Park is operational.

5.4 The propagation distance through woodlands has been limited to 100 m. The use of this conservative assumption may lead to an over prediction of noise levels, especially in the mid to higher frequency octave bands which are most influential in determining the overall dB(A) levels. These possible over predictions are most relevant at Alton Village and Cliff Farm Cottage, but are unlikely to affect predicted levels in the Farley area.

5.5 Barrier screening (see paragraph 3.9) has been ignored, so leading to potential over prediction of noise levels at some noise sensitive receivers. These over predictions are most relevant for the Farley area, but are unlikely to be materially important at Cliff Farm Cottage and in the Alton Village area.

5.6 Noise attenuation due to air absorption (Table 3.4) was based upon a summer air temperature of 20°C and relative humidity of 60%.

PREDICTED NOISE LEVELS

5.7 The predicted L_{max} levels at each receiver location are shown in Table 5.1. The table also includes, for comparative purposes, the measured existing noise levels shown in Table 4.2.

Table 5.1 – Comparison of Ride L_{max} and Ambient Noise Levels

Location	Unit	Octave Band Mid Frequency (Hz)							dB(A)
		63	125	250	500	1k	2k	4k	
Alton Village	Ride L_{max}	53	44	36	30	23	15	2	34
	Existing L_{90}	47	42	40	40	37	31	24	43
	Existing L_{10}	53	51	48	46	45	39	29	49
	Existing L_1	57	56	52	50	50	45	36	54
	Existing L_{max}	61	60	56	57	55	54	48	62
	Existing L_{eq}	52	50	46	45	42	37	29	47
Cliff Farm Cottage	Ride L_{max}	50	41	32	25	19	10	<0	30
	Existing L_{90}	46	42	38	40	36	29	20	42
	Existing L_{10}	53	52	50	51	45	38	35	51
	Existing L_1	59	59	54	56	49	44	43	55
	Existing L_{max}	65	63	59	62	55	52	50	61
	Existing L_{eq}	51	50	47	48	42	36	32	48
Farley Area	Ride L_{max}	47	37	29	21	14	3	<0	26
	Existing L_{90}	46	38	33	30	31	27	21	37
	Existing L_{10}	56	48	40	36	36	33	33	44
	Existing L_1	62	54	47	42	42	40	41	50
	Existing L_{max}	67	60	53	51	53	50	51	60
	Existing L_{eq}	54	46	38	35	35	32	32	42

5.8 Table 5.1 shows that the L_{Amax} levels from the ride will be approximately 10 dB(A) lower than the existing L_{A90} (background) levels in the Castle Hill Road area of Alton Village, in the vicinity of Cliff Farm Cottage and in the Farley area. Predicted ride noise L_{max} levels may, however, be above or comparable to the existing background L_{90} levels in the 63 and 125 Hz octave bands respectively. Although these lower frequency octave bands are primarily associated with track running noise, general environmental noise, such as that due to distant traffic and aircraft, shows wide variability in this frequency region.

NOISE IMPACT ASSESSMENT

5.9 The BS 4142 method for assessing the likelihood of noise complaints was outlined in Chapter 2 of this report. It should be remembered that the method is strictly only applicable to noise sources of an industrial nature, so may not be applicable to coaster running noise and screams – neither of which could be described as "industrial". The use of the +5 dB "character correction", which should only be applied in those areas where the noise is actually audible, is also debateable when the existing noise environment has similar acoustic characteristics – the new coaster has no noise characteristics that would distinguish it from many other rides in the Park, unlike the motor whine associated with the Corkscrew coaster that it will replace.

5.10 In view of the uncertainties associated with the use of BS 4142 and hence the weight that should be placed upon its conclusions, the "absolute" noise level criteria recommended by the World Health Organisation should not be disregarded.

5.11 Table 5.2 gives BS 4142-type assessments, but using the predicted L_{Amax}, rather than L_{Aeq} levels from the ride. For many coaster rides, the L_{Aeq} level is at least 10 dB(A) lower than the L_{Amax} level.

Table 5.1 – BS 4142 Assessments

	Location		
	Alton Village	Cliff Farm Cottage	Farley Area
Specific level (L_{Amax}/L_{Aeq})	34	30	26
Rating level	<34	<30	<26
Background (L_{A90})	43	42	37
Rating level – L_{A90}	-9	-12	-11
Complaints Likely?	positive indication that complaints are unlikely		

5.12 Table 5.1 shows that the predicted ride noise levels in Alton Village, at Cliff Farm Cottage and in the Farley area are well below the lowest target level of 50 dBL_{Aeq} recommended by the WHO. These conclusions relate to neutral atmospheric conditions.

5.13 Atmospheric effects increase downwind noise levels by typically about 5 dB(A) and decrease upwind levels by the same amount (Table 3.5). At 45° to the direction of airflow the increase is approximately 3 dB(A), with reductions of about 2 dB(A) at 90° and 3 dB(A) at 135°. Table 5.3 shows the approximate effect of wind direction upon noise levels from the location of the Corkscrew replacement ride.

Table 5.2 – Approximate Effect of Wind Direction on dB(A) Noise Levels

Wind Direction from:	Location		
	Alton Village	Cliff Farm Cottage	Farley Area
N	+5	0	-4
NE	+3	-2	-2
E	-2	-4	0
SE	-3	-4	+4
S	-5	-2	+4
SW	-3	0	0
W	-2	+4	-2
NW	+3	+4	-4

5.14 Although the Specific noise levels shown in Table 5.2 will, at each receiver, increase with specific wind directions (and decrease with others), the background levels will also increase (whatever the wind direction) due to the movement of trees and bushes both local to the receiver and within the well-wooded Churnet Valley. The background levels in Table 5.2 will therefore increase from those measured under the near-zero wind speeds present during the ambient noise level surveys. Even if a +5 dB(A) correction were applied to the predicted Rating Levels in Table 5.2, those levels would still remain below the background levels, with little or no likelihood of justifiable noise complaints. The BS 4142 analyses shown in Table 5.2 (using L_{Amax} rather than L_{Aeq} levels) represent a likely worst case in terms of the difference between the Rating and Background levels and hence the likelihood of complaints.

5.15

6. SUMMARY AND CONCLUSIONS

6.1 Octave band reverberant noise level measurements within the building enclosing the "No Way Out" coaster at Thorpe Park have been used as the basis for modelling and predicting the noise levels from the proposed replacement for the Corkscrew ride at Alton Towers. The reverberant levels were used to predict the frequency-dependent sound power levels of the ride and hence sound pressure levels in the open air.

6.2 As the dimensions of the new ride footprint are small compared to the distance to the nearest residential area, the new ride was treated as a point source of noise. Noise propagation corrections were applied to predict the octave band L_{max} and hence L_{Amax} levels at each receiver location.

6.3 Previous ambient noise level surveys in surrounding areas showed that there had been no consistent noise level changes in the last 15 years, apart from some subjective noise reduction due to the removal of Thunderlooper. Distant screams, ride running noise and the Corkscrew lift motor were variously audible from most measurement locations. Replacement of the Corkscrew Ride will clearly eliminate this source of audible noise.

6.4 The predicted octave band L_{max} noise levels from the ride were compared to the measured background levels to determine the extent to which the new coaster might be audible. These comparisons showed that track running noise may, on occasions, be audible in the lowest frequency bands, although the overall L_{Amax} levels were well below existing L_{A90} background levels. Noise levels in this frequency region are particularly variable (compared to the higher frequency bands), being strongly influenced by environmental noise sources such as distant traffic and aircraft.

6.5 The BS 4142 method for assessing the impact of industrial-type noise was then applied in order to give an indication of the likelihood of justifiable noise complaints. The applicability of this method is questionable in respect of Theme Park noise, which has few similarities with industrial noise. There is also debate over the addition of a 5 dB "Character Correction" to the level generated by a new noise source when that new source has the same broad band acoustic characteristics as the existing noise environment. It is understood that the new coaster will have no noise characteristics that would distinguish it from other coaster rides in the Park.

6.6 The BS 4142-type analysis, using L_{Amax} rather than L_{Aeq} source noise levels, gave a positive indication that justifiable noise complaints should not arise.

6.7 The WHO absolute noise level criteria approach has been adopted by the rest of Europe and in this country for all types of noise source, other than industrial. Noise levels due to the proposed new coaster are predicted to be less than about 35 dBL_{Aeq} at the nearest residential area in Alton Village – 15 dBL_{Aeq} lower (less than half as loud) than the most stringent target level recommended by the WHO.