Acoustic Associates
PETERBOROUGH

Environmental Noise Assessment
Cambourne to Cambridge options

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SUMMARY

An environmental noise assessment was carried out to compare the noise impact of the proposed Cambourne to Cambridge busway on local residents of different proposed bus routes.

It includes attended noise monitoring, predictive noise modelling, assessment of the results and consideration of mitigation measures.

The assessment concludes that the impact is *"negligible"* at most of the dwellings affected according to relevant significance criteria given in the Design Manual for Roads and Bridges. The most affected are on Hall Road at the south of Highfield for "green" and "red" routes where the impact is estimated to be *"moderate".*

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1 OBJECTIVES

1.1 To carry out a *noise assessment of the different proposed bus routes proposed between Cambourne and Cambridge to assist the council in choosing a route.

1.2 To recommend solutions to any problems identified by the assessment.

2 CONCLUSIONS

2.1 Nine receptors were chosen for the assessment and these are shown in Figure 2. Using criteria chosen for this assessment, the relative noise impact at each is shown for each route below.

Assessment Location	Significance of noise impact using criteria from		
	Green	Blue	Red
1 - Bourn Airfield	Slight	Negligible	Slight
2 - Highfields North	Negligible	Negligible	Negligible
3 - Highfields South	Negligible	Negligible	Negligible
4 - Highfields South - Hall Drive	Moderate	Negligible	Negligible
5 - South Hardwick	Moderate	Negligible	Perceptible
6 - Long Road Jagaards Farm	Perceptible	Negligible	Perceptible
7 - West of Park and Ride	Negligible	Negligible	Negligible
8 - NE Coton	Negligible	Perceptible	Negligible
9 - Stacey Lane	Negligible	Negligible	Slight

Table 1 - Significance of Impacts at the assessment locations over an 18 hour day

There are considerable uncertainties in these estimations and they are based on “worst-case” assumptions of bus movements. This is discussed further in the body of the report.

3 RECOMMENDATIONS

3.1 If the red or green routes are selected then noise mitigation measures should be considered for residents in Hall Drive and South Hardwick.

*** see Appendix 1 for a Glossary of Terms**

4 BACKGROUND

Cambridge County Council are giving consideration to four options for the proposed Cambourne to Cambridge busway. The first option to be considered will run entirely on road whilst the other three will run partly on roads and partly on new purpose built tracks as guided busway. The proposal will also include construction of a new park and ride facility at Madingley.

Before deciding on the appropriate option, the council wish to consider the noise impact which the proposals will have on the local residents and Acoustic Associates (Peterborough) have been contracted to carry out an assessment of this. Figure 2 shows the four options graphically.

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5 CRITERIA AND METHODOLOGY

5.1 Design Manual for Road and Bridges

The Highways Agency (HA) Design Manual for Roads and Bridges (DMRB – Reference 1) provides guidance on the assessment of noise impacts from roads and contains guidance for assessing the likely impact on amenity of noise generated by road traffic in the short and the long term. The criteria from DMRB long term effects are presented below in Table 2.

Change in noise level $L_{A10,18hr}$	Magnitude of impact
0 dB	No change
0.1–2.9 dB	Negligible
3–4.9 dB	Minor
5–9.9 dB	Moderate
10 dB or more	Major

Table 2 – DMRB Criteria – Long - term effects

These criteria relate to $L_{A10,18h}$ whereas the assessment is for $L_{Aeq,18h,}$ however the two metrics are closely related for traffic noise.

5.2 Noise Assessment

Given the above, in order to determine the noise impact at a particular receptor it is necessary to do the following:

a) Estimate the existing ambient noise levels;

b) Establish the likely noise level at the receptors following opening of the busroute.

The difference between the two is regarded as the “noise impact” at a receptor. In addition to this the assessment also considers the noise impact at the locations during the most noise-sensitive time of the day when the buses may run i.e. 6 am in the morning and midnight.

6 NOISE ASSESSMENT

6.1 Ambient Noise Measurements

Noise monitoring was carried out by 10 dB Acoustics at 7 locations close to the proposed bus routes during February 2017 in order to establish the existing ambient noise in the area. The monitoring locations are shown in Figure 1, the equipment used is shown in Appendix 2 and the monitoring is described in Appendix A3.1

6.2 Specific Noise

Several locations along the existing bus site were visited during February and March 2017 and noise measurements were taken of the existing buses in transit both on and off the guided busway. The equipment use is documented in Appendix 2 and the monitoring is described in Appendix A3.2.

6.3 Traffic noise data

The following traffic noise data was used in carrying out the assessment

- Major roads (A14, A1303, A429, M11) – The noise data was taken from the Department for Transport website;
- Minor roads – Noise data was supplied by Atkins on behalf of the local authority.

This noise data is listed in Appendix A3.3.

6.4 Assessment Locations

Nine residential locations which were deemed sensitive to noise were chosen for the assessment. They are shown in Figure 1 and described below.

Number	Receptor	Description
1	Bourn Airfield	20 metres west of Broadway
2	Highfields North	100 metres south of St Neots Road
3	Highfields South	20 metres west of Highfields Road
4	Highfields South - Hall Drive	10 metres south of Hall Drive
5	South Hardwick	20 metres north of “green” route in South Hardwick
6	Jagaards Road	70 metres south of the green and red route locations
7	Madingley Road – Southeast	Residential location 20 metres west of proposed new park and ride facility
8	North-east Coton	20 metres south of blue bus route
9	Stacey Lane	30 metres north of Stacey Lane

Table 3 – Residential Assessment Locations

6.5 Predictive noise model

A computer noise model of the site and surrounding area was generated using Woelfel IMMI Computer Noise Modelling Software (Reference 2) which uses the methods given in ISO 9613 – 2 (Reference 3) to calculate noise levels given a topographical model of the site.

Noise sources were set up into the model to represent the major roads and their sound levels set up using the traffic noise data (see section 6.3). This allowed the existing ambient noise levels at the receptors to be estimated.

In additions noise sources were set up to represent the three major proposed bus routes. Each noise source was calibrated with the results of the monitoring on site. It was assumed that 10 single-decker and 10 double-decker buses would be travelling per hour on all parts of the routes at an average speed of 70 kph (which is a pessimistic assumption).

The park and ride was modelled as an “area” source with 500 bays each experiencing a vehicle movement approximately once every 3 hours.

7 RESULTS

7.1 Ambient noise levels

The ambient noise at seven measurement locations was estimated by 2 methods

a) Noise measurements (see section 6.1);

b) Predictive modelling using traffic noise data (see sections 6.2 and section 6.3).

The table below compares the results of the two methods and Figure 2 shows noise contours created using the second method.

Measurement Location	Measured level $L_{Aeq\ 1hour}$ dB(A)			Average noise level predicted by computer model $L_{Aeq,18\ hours}$ dB(A)
	Early morning	Daytime	Night-time	
CBW1	53.2	50.4	44.4	48.8
CBW2	61.7	52.5	54.0	59.5
CBW3	44.8	53.5	42.2	54.2
CBW4	48.0	53.1	47.7	55.0
CBW5	43.3	51.2	53.1	57.3
CBW6	49.6	60.3	52.1	56.9
CBW7	41.9	47.7	43.5	49.5

Table 4 – Average noise levels

As can be seen there is a significant variation in the levels measured at different times of the day and night and also between the measured levels and those predicted by computer modelling using traffic data.

7.2 Noise levels due to operations

The computer model was run to estimate the noise level during bus operations at the nearest receptors and the results are listed below.

Assessment Location	*Predicted noise level $L_{Aeq,18h}$ dB(A)		
	Green	Blue	Red
1 - Bourn Airfield	51.5	41.2	51.5
2 - Highfields North	46.0	44.2	46.1
3 - Highfields South	49.0	32.0	34.9
4 - Highfields South - Hall Drive	52.9	29.6	33.3
5 - South Hardwick	51.4	28.1	47.5
6 - Long Road Jagaards Farm	46.0	33.3	46.2
7 - West of Park and Ride	44.5	47.0	45.9
8 - NE Coton	47.0	51.1	46.5
9 - Stacey Lane	41.0	37.8	49.0

Table 5 – Predicted noise levels at receptors due to proposed bus operations

*(Assuming 10 single decker and 10 double decker bus movements each hour)

Noise contours for bus operations are shown in Figure 3, 4 and 5.

7.3 Noise impact

The following table shows the predicted noise levels after operations in columns 2-4 for each bus route and the increase from current levels in columns 5-8. Columns 9 – 11 show the assessed significance of the increase according to the DMRB criteria used by this assessment.

Assessment Location	Overall predicted noise level from bus route and existing road traffic $L_{Aeq,18\ hour}$ dB(A)			Increase in noise due to bus operations dB			Significance of noise impact using criteria from		
	Green	Blue	Red	Green	Blue	Red	Green	Blue	Red
1 - Bourn Airfield	51.5	41.2	51.5	4.9	0.8	4.9	Slight	Negligible	Slight
2 - Highfields North	46.0	44.2	46.1	0.6	0.4	0.6	Negligible	Negligible	Negligible
3 - Highfields South	49.0	32.0	34.9	0.9	0.0	0.1	Negligible	Negligible	Negligible
4 - Highfields South - Hall Drive	52.9	29.6	33.3	7.9	0.1	0.2	Moderate	Negligible	Negligible
5 - South Hardwick	51.4	28.1	47.5	4.9	0.1	2.7	Moderate	Negligible	Perceptible
6 - Long Road Jagaards Farm	46.0	33.3	46.2	2.3	0.2	2.3	Perceptible	Negligible	Perceptible
7 - West of Park and Ride	44.5	47.0	45.9	0.7	1.1	0.9	Negligible	Negligible	Negligible
8 - NE Coton	47.0	51.1	46.5	0.8	1.9	0.8	Negligible	Perceptible	Negligible
9 - Stacey Lane	41.0	37.8	49.0	0.7	0.4	3.2	Negligible	Negligible	Slight

Table 6 - Assessment of noise impact over 18 hours of bus operations (0600-0000)

The following table repeats this exercise but compares the lowest hourly measured noise level from the 10dB survey with the level following the start of bus operations. This therefore represents the “worst-case” hour that residents may be exposed to.

Assessment Location	Nearest measurement location to the assessment location	Assumed ambient noise levels $L_{Aeq,,1hour}$ dB(A)	Overall predicted noise level from bus route and existing road traffic $L_{Aeq,18\ hour}$ dB(A)			Increase in noise due to bus operations dB		
			Green	Blue	Red	Green	Blue	Red
1 - Bourn Airfield	CBW4	47.7	53	48.6	53	5.3	0.9	5.3
2 - Highfields North	CBW5	43.3	47.8	46.8	47.9	4.5	3.5	4.6
3 - Highfields South	CBW3	42.2	49.8	42.6	42.9	7.6	0.4	0.7
4 - Highfields South - Hall Drive	CBW3	42.2	53.3	42.4	42.7	11.1	0.2	0.5
5 - South Hardwick	CBW3	42.2	51.9	42.4	48.6	9.7	0.2	6.4
6 - Long Road Jagaards Farm	CBW3	42.2	47.5	42.7	47.6	5.3	0.5	5.4
7 - West of Park and Ride	CBW6	49.6	50.8	51.5	51.1	1.2	1.9	1.5
8 - NE Coton	CBW1	44.4	48.9	51.9	48.6	4.5	7.5	4.2
9 - Stacey Lane	CBW7	41.9	44.5	43.3	49.8	2.6	1.4	7.9

Table 7 **– Assessment of noise impact over bus operations during the quietest time of the day.**

There are no criteria to describe this in the same way there are for $L_{Aeq,18hour}$ impacts shown in Table 6 though clearly it must be regarded as an adverse effect that some residents may experience levels $L_{Aeq,,1hour}$ 10 dB higher at a quiet time of the day/night.

7.4 Uncertainties

There are significant uncertainties in the ambient noise levels at the receptors as shown by Table 5.

The estimate of 10 single decker and 10 double decker buses passing all sections of the track at 70 kph is also likely to be pessimistic.

REFERENCES

1. *Design Manual for Roads and Bridges;* DMRB, 2010;, Volume 11, Section 3, Part 7 HD 213/11 Noise and Vibration.
2. *Wolfel IMMI Computer Noise Modelling Software. ;* www.woelfel.de, 2014.
3. *ISO 9613-2 Acoustics of sound during propagation outdoors, Part 2: General method of calculation;* ISO, 1996.

Appendix 1 – Glossary of terms

Sound Pressure	The variation of ambient pressure that is detected by the ear as sound.
Noise	Unwanted sound
deciBel (dB)	Ten times the logarithm of the square of the ratio of the Sound Pressure to a reference pressure (20 micro-Pascal's).
Sound Pressure Level (Lp)	The decibel version of the Sound Pressure.
A-Weighting	A frequency weighting which simulates the response of the ear. An A-Weighted Sound Pressure Level is denoted by L_{pA} and has units of dB(A)
$L_{Aeq,T}$	The value of the A-weighted sound pressure level, in decibels [dB(A)], of a continuous steady sound that within a specified time interval (T), for example 16 hours, has the same mean-square sound pressure as a sound that varies with time. Therefore, the average over a 16 hour period would be denoted as $L_{Aeq,16h}$
$L_{Amax,T}$	The maximum A-Weighted sound pressure level that was encountered during the measurement period.
$L_{A90,T}$	The A-Weighted sound pressure level that is exceeded for 90% of the time (T). This is usually used a measure of background noise.
Free Field	Where noise can propagate freely without any reflections from buildings etc.
Octave Band	A band of frequencies the upper limit of which is twice the lower limit. They are known by their centre frequency, e.g., 63, 125, 250, 500, 1000, 2000

Appendix 2 – Noise instrumentation

Type	Manufacturer	Description	Serial Number	Last Calibration Date	Calibration Certificate No.
Svan 957	Svantek	Sound level meter	27591	21/07/2016	67857
GA 607	Castle	Sound level calibrator	043194	20/05/2016	160696
Svan 957	Svantek	Sound level meter	27517	03/02/2016	159050
GA 607	Castle	Sound level calibrator	039873	03/02/2016	159049

The calibration of the instrumentation was checked at the start and end of the tests and there was no significant drift.

Appendix 3 – Noise measurement data

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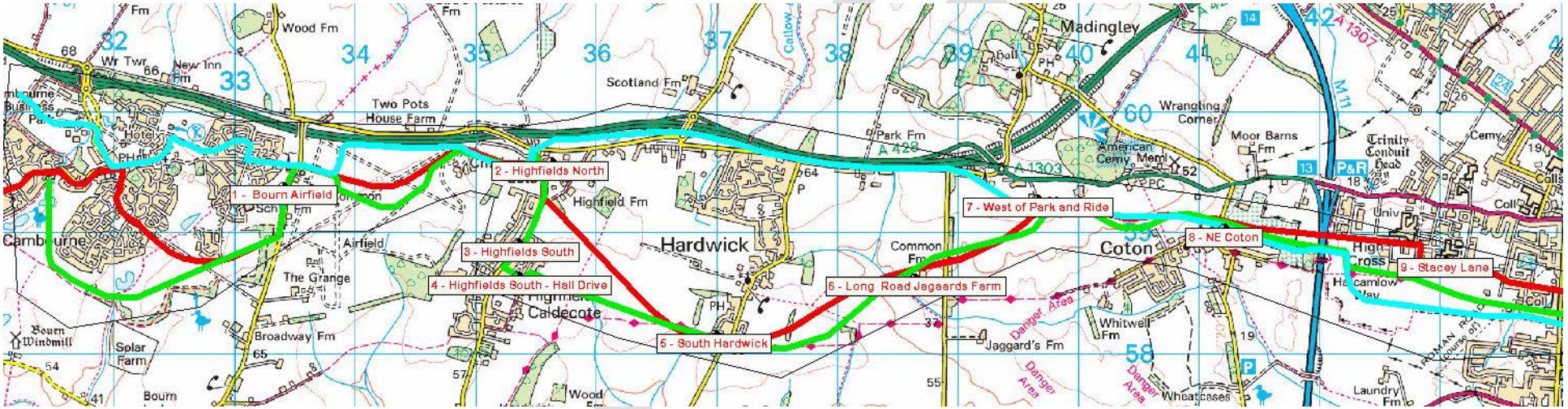
Figure 1 – Cambourne to Cambridge showing noise measurement locations

Figure 2 – Map showing proposed bus routes and Assessment Locations



Figures 3-9 Noise contours

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