



M77/GSO Road Noise Survey Report 2012

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1 Introduction

1.1 Client

Scotland Transerv have been engaged by Balfour Beatty Regional Civil Engineering Northern Division – Highway Maintenance on behalf of Connect M77/GSO plc to carry out noise measurements relating to construction of the M77 extension, Malletsheugh to Fenwick, and the Glasgow Southern Orbital (GSO) link from the M77 to East Kilbride.

1.2 Survey Purpose and Background

The M77 and GSO roads were opened to traffic in April 2005. The contract documents for this project include the requirement to undertake noise surveys in accordance with the 'Memorandum on the Noise Insulation (Scotland) Regulations 1975 Regulations 3 and 6' (MNIR). These contract documents state that noise measurements should be taken 12 months after opening and further reassessments made in the 5th, 10th and 15th year following the original survey. The first noise measurement survey was carried out and reported by Mouchel Parkman Services Ltd in April 2006. This is the second noise survey report, undertaken in the 6th year after opening (deferred from the 5th year by agreement with ERC).

1.3 Location

The extents of the noise survey included the GSO road from East Kilbride to Junction 5 of the M77, from Junction 5 of the M77 to the point where the M77 terminates and the A77 near Fenwick. The location of noise survey points can be seen on East Renfrewshire Council drawing numbers 96/006/48 and 96/018/137.

Noise measurements were taken at 49 predetermined locations listed in the contract documents. A list of all measurement locations is provided in table 2 in appendix A.

2 Survey Methodology

2.1 Equipment

Measurements were taken using a Casella CEL-633A class 1 noise meter (SN: 0611332) with attached CEL-495 preamplifier (SN: 1122) and CEL-251 condenser microphone (SN: 1533). The microphone was mounted on a Velbon GEO E530 tripod using the Casella CEL-6737 weather protection system. On site calibration measurements were taken using a Casella CEL-110 Acoustic calibrator (SN: 440885). Wind speed measurements were taken using a Therman anemometer, model number 825-9158020 (SN: ET1107915).

2.2 Method

The noise measurements were undertaken on weekdays during the period 18th April 2012 – 24th May 2012. Letters were sent to each of the property owners to inform them of the survey.

The MNIR permits a shortened measurement methodology to undertake traffic noise surveys and this approach was adopted for the survey. The MNIR advises that road traffic noise measurement for periods lasting 15 minutes are sufficient at each location stating that:

‘For busy main roads it is usual to find that, apart from the morning and evening peak flows, there is a period between 10 am and 4 pm when the flow could be comparatively uniform. If in doubt in any particular case a check on traffic flow will be needed. Assuming however that this point is established a sample should be taken lasting 15 minutes and containing at least 200 readings. The L₁₀ result so obtained would normally be about 2 dB(A) above that obtained from a survey covering the period 6 am to midnight.’

This allows the 15 minute measurement to be factored to produce a L_{10 18 hour} level which is used in the Noise Insulation (Scotland) Regulations 1975.

At each measurement location the tripod mounted microphone was positioned 1 metre from the façade of the building with the microphone diaphragm aligned horizontally (grazing incidence). The weather protection system was put in place for each measurement. The microphone was calibrated to a reference tone of 94.0 dB before and after each measurement to check for drift. All calibrations were satisfactory.

The weather was conducive to noise monitoring throughout the period of survey, i.e. dry with wind speeds less than 5 m/s. Details recorded at each location including time and date, weather and notes on the local environment can be seen in table 2 in appendix A.

3 Results and Discussion

3.1 Results

L_{10} and L_{Aeq} results obtained at each location can be found in table 3 in appendix B. L_{10} results were adjusted in accordance with the MNIR by subtracting 2dB to simulate a $L_{10\ 18hour}$ noise level and these are also displayed in table 3 in appendix B as "Adjusted L_{A10} ."

3.2 Discussion

Regulation 3 of the Noise Insulation (Scotland) Regulations 1975 imposes a duty to carry out insulation work or to make grants in respect of carrying out such work where 'the use of a highway causes, or is expected to cause, noise at a level of not less than the specified level.' The specified level is stated as a $L_{10\ 18hour}$ value of 68 dB(A).

The measurement data shows that 2 corrected (-2dB) noise level measurements taken at properties are greater than or equal to the specified level set out in the regulations. The properties with recorded values above the specified level are shown in table 1 below:

Table 1 – Properties with adjusted (-2dB) L_{A10} values above the specified level

Location	L_{Aeq} (dB)	Adjusted L_{A10} (dB)
[Redacted]	69.1	70.0
[Redacted]	68.0	68.0

Regulation 3 also states that along with exceeding the specified level of 68dB (A), the relevant noise level must also be greater by at least 1dB(A) than the prevailing noise level immediately before works for the construction of a highway or an additional carriageway were begun. The regulations also set out conditions relating to the eligibility of specific buildings and state that they apply specifically to 'residential buildings' or 'other buildings used for residential purposes'.

No preconstruction noise levels were made available to Scotland Transerv and so no conclusion about eligibility under the Noise Insulation (Scotland) Regulations 1975 can be reached.

4 Conclusion and Recommendations

Two properties, [Redacted] and [Redacted] were found to have factored $L_{10_{18\text{hour}}}$ values of greater than or equal to the specified level of 68dB(A) set out in the Noise Insulation (Scotland) Regulations. It is recommended that the eligibility of these properties is further investigated in line with guidance provided in the regulations and the MNIR. Comparison should be made with preconstruction noise levels and a full 18 hour noise measurement could be used to provide more accurate results.

In line with the original contract requirements, further reassessments should be made in the 10th and 15th years following the original assessment.

5 Glossary

- 1 Decibel (dB): The range of audible sound pressures is approximately 0.00002 Pa to 200 Pa. Using decibel notation presents this range in a more manageable form, 0 dB to 140 dB.

Mathematically:

Sound pressure level (dB) = $20 \log (p_i / p_o)$

Where $p_o = 2 \times 10^{-5}$ Pa
- 2 'A' Weighting dB (A): The human ear does not respond uniformly to different frequencies. A-weighting is commonly used to simulate the frequency response of the ear.
- 3 L_{Aeq} : Equivalent Continuous sound Level. A notional steady sound level which would cause the same A-weighted sound energy to be received as that due to the actual, possibly fluctuating, sound level over a given period of time.
- 4 L_{A10} : The A-weighted noise level exceeded for 10 % of the measurement period. A unit generally used in the assessment of road traffic noise.

6 References

The Noise Insulation (Scotland) Regulations 1975 (amendment 1988)

Memorandum of Advice and Instruction (Noise Insulation (Scotland) Regulations 1975) No.1/74

[Redacted] (2006). *M77 DBFO O&M Year 1 – Traffic Noise Assessment*. Mouchel Parkman Services Ltd.

M77 (Fenwick to Malletsheugh)/Glasgow Southern Orbital DBFO Project contract documents, Schedule 4: O&M requirements.

Appendix A – Noise Measurement Location Details

Table 2 – Noise measurement location details

Station	Location	Date/Time	Weather/Wind Speed	Field Notes
M77 1	[Redacted]	03/05//2012 12:56	Sunny/dry 0.5m/s	The A77 runs between the M77 and the premises. Two vehicles also passed the survey station as they entered the farm.
M77 2	[Redacted]	04/05//2012 11:27	Dull/dry 0.8m/s	The M77 has been built next to the [Redacted]. There is a timber fence separating the hotel with the M77.
M77 3	Kilmaurs Road	03/05//2012 13:27	Sunny/dry 0.7m/s	There is a small plant hire company behind premises which were operating during the survey. The house was in close vicinity to a local road running perpendicular to the M77 which was being used by vehicular traffic during survey.
M77 4	Langside Fenwick	02/05//2012 14:55	Sunny/dry 1.4m/s	Owner wanted survey carried out at peak road use time, she also commented on the road getting much louder when wet.
M77 5	Little Fenwick	03/05//2012 15:13	Sunny/dry 0.8m/s	There was construction plant working in close vicinity of the survey
M77 6	[Redacted] Stewarton Road, Fenwick	02/05//2012 13:26	Sunny/dry 2.5m/s	The owner reported that they invested in triple glazing windows because of the noise and that the X77 bus produced the most noise according to the home owners. There was a moderately busy road for local traffic passing perpendicular to the M77 in close proximity to the house.
M77 7	Glaister Bridge	04/05//2012 11:00	Dull/dry 1m/s	The M77 is built on a high embankment, close to the house.
M77 8	[Redacted] Rysland Drive, Fenwick	03/05//2012 12:05	Sunny/dry 0.4m/s	Downward embankment between premises and the M77 with dense trees providing mitigation.
M77 9	[Redacted] Blackfauld Gardens, Fenwick	02/05//2012 14:30	Sunny/dry 1.4m/s	There were housing developers working in close proximity to the noise survey station making occasional background noise.
M77 10	Townend	02/05//2012 12:55	Sunny/dry 4m/s	Open plan fields running at a downwards gradient towards the M77 from premises.
M77 11	[Redacted]	02/05//2012 12:05	Sunny/dry 3.9m/s	Open plan landscape between back of premises and M77; the A77 was running past the front of the house.
M77 12	[Redacted]	02/05//2012 11:32	Dull/dry 2.1m/s	[Redacted] was being used as a kennels, dogs barking were occasionally heard during the noise survey
M77 13	[Redacted]	02/05//2012 11:00	Dull/dry 1.1m/s	The A77 runs between the M77 and the premises. The house owner requested the survey be carried out at peak times.
M77 14	[Redacted]	02/05//2012 10:35	Dull/dry 0.7m/s	The A77 is located between the premises and the M77. There are open fields heading in a downward gradient between the M77 and A77.

Station	Location	Date/Time	Weather/Wind Speed	Field Notes
M77 15	[Redacted]	27/04/2012 15:20	Sunny/dry 1m/s	The landscape between the premises and M77 is downward sloping with open plan fields.
M77 16	[Redacted]	27/04/2012 14:50	Sunny/dry 0.4m/s	The owner asked for the survey carried out during peak times
M77 17	[Redacted]	27/04/2012 14:14	Sunny/dry 0.8m/s	Located between the premises and the M77 is the A77 road. The M77 has been elevated on an embankment.
M77 18	[Redacted]	27/04/2012 12:22	Sunny/dry 0.2m/s	The M77 was running behind house, the A77 was running in front of the house. The M77 was located at top of an embankment with trees and a timber fence providing noise mitigation.
M77 19	[Redacted]	27/04/2012 13:00	Sunny/dry 1.9m/s	The M77 was running behind house, the A77 was running in front of the house, The M77 was located at top of the embankment with trees and a timber fence.
M77 20	[Redacted]	27/04/2012 11:32	Sunny/dry 0.3m/s	There was a quiet local road located between the premises and the M77. The M77 was built on top of an embankment
M77 21	[Redacted]	03/05//2012 10:25	Dull/dry 2.8m/s	Relatively open plan field between the house and the M77.
M77 22	[Redacted]	27/04/2012 11:01	Sunny/dry 0.4m/s	The A77 provided access into the premises. The M77 was located at the top of a shallow gradient embankment next to the premises.
M77 23	[Redacted]	27/04/2012 10:25	Sunny/dry 1.2m/s	The A77 was located at the front of the house, however the station was set-up at the back of the house. The landscape between the house and M77 had dense vegetation where land initially sloped in a downward gradient away from the house then changed to an upward gradient heading towards the M77.
M77 24	[Redacted]	20/04/2012 14:07	Sunny/dry 1.2m/s	The A77 was located in front of the premises and was carrying a moderate amount of traffic, the M77 was located next to the A77.
M77 25	[Redacted]	24/05/2012 10:10	Sunny/dry 0.3m/s	The building was located at the top of an embankment, where the M77 was located at the bottom of the embankment. Mitigation was provided by a hedge running along the length of the garden.
GSO 1	[Redacted], Mearnskirk	20/04/2012 12:50	Sunny/dry 0.3m/s	Noise mitigation was provided by a large embankment with trees growing at the top of the embankment.
GSO 2	[Redacted], M'kirk	20/04/2012 13:15	Sunny/dry 0.4m/s	There was a relatively small car park between the premises and the GSO road where occasionally cars passed the survey station.
GSO 3	[Redacted], Titwood Road	20/04/2012 10:35	Sunny/dry 0.2m/s	Quiet road running perpendicular to the GSO road beside building.
GSO 4	[Redacted], Titwood Road	20/04/2012 12:14	Sunny/dry 1.4m/s	There was a very quiet road between the house and the GSO road.

Station	Location	Date/Time	Weather/Wind Speed	Field Notes
GSO 5	[Redacted]	20/04/2012 11:08	Sunny/dry 0.5m/s	Owner commented that the noise seemed louder on the top windows of the house. The landscape between the house and GSO consisted of open plan fields with a downwards gradient heading towards the GSO road.
GSO 6	[Redacted]	19/04/2012 15:06	Dull/dry 1m/s	Hedge around perimeter of garden, then open plan fields following a downwards gradient towards the GSO road.
GSO 7	[Redacted]	19/04/2012 15:35	Dull/dry 1.5m/s	There was a goat field in the field beyond the garden perimeter making noise during survey.
GSO 8	[Redacted]	19/04/2012 13:54	Sunny/dry 1.1m/s	The landscape is mostly open plan to the GSO road.
GSO 9	[Redacted]	19/04/2012 13:14	Sunny/dry 0.9m/s	Open fields to GSO road from house, there was a small hedge located around the perimeter of the building.
GSO 10	[Redacted]	19/04/2012 12:45	Sunny/dry 0.3m/s	The GSO is located downhill from the building with open plan fields. The owner asked if the survey could be carried out at peak times.
GSO 11	[Redacted]	19/04/2012 12:05	Sunny/dry 1m/s	There were trees providing noise mitigation from the GSO. During the survey, there were birds chirping in the trees.
GSO 12	[Redacted]	19/04/2012 10:40	Sunny/dry 1.2m/s	Moderately busy road (Glasgow Road) running perpendicular to building from the Glasgow Road Roundabout on the GSO. This moderately busy road (Glasgow Road) was in close proximity to the building.
GSO 13	[Redacted]	19/04/2012 11:15	Sunny/dry 0.3m/s	There was a moderately busy road (Glasgow Road) running perpendicular to the GSO in close proximity to the building. Noise mitigation provided by the retaining wall which has elevated the moderately busy road (Glasgow Road). Other mitigation has been provided by the raised embankment on the GSO.
GSO 14	[Redacted]	19/04/2012 10:10	Sunny/dry 0.5m/s	Large back garden with trees providing cover from the GSO road.
GSO 15	[Redacted]	18/04/2012 15:22	Dull/dry 3.5m/s	There were sheep in the field between the house and GSO road which were occasionally making noise during the survey.
GSO 16	[Redacted]	-----	-----	Property has been rebuilt, no measurement taken.
GSO 17	[Redacted]	18/04/2012 14:45	Dull/dry 1m/s	There was a row of trees separating the garden of the premises with the GSO road.
GSO 18	[Redacted]	04/05//2012 10:05	Dull/dry 0.8m/s	There was open plan landscape between premises and GSO, there was a small row of trees around the perimeter of the building's garden.
GSO 19	[Redacted]	-----	-----	Replaced by row of terraced houses, no measurement taken.
GSO 20	[Redacted]	18/04/2012 13:59	Dull/dry 0.8m/s	There is a railway located near the premises where a train passed during the survey. A row of trees separated the garden perimeter of [Redacted] [Redacted]with the GSO.

Station	Location	Date/Time	Weather/Wind Speed	Field Notes
GSO 21	[Redacted]	18/04/2012 13:20	Dull/dry 0.5m/s	The building was next to the westbound GSO off ramp at Redhill.
GSO 22	[Redacted]	18/04/2012 11:51	Dull/dry 0.8m/s	A car park was located between the building and the GSO which was elevated from the GSO road.
GSO 23	[Redacted]	18/04/2012 12:42	Dull/dry 1m/s	The On-ramp for the GSO at the Philipshill Interchange was in close vicinity to the building. The [Redacted] building was between the [Redacted] and the GSO road.
GSO 24	[Redacted]	18/04/2012 10:51	Dull/dry 2.2m/s	There was a car park behind the building where cars occasionally passed the survey station during the noise survey. The property had an elevated car park between the building and GSO road and also a timber boundary fence around its perimeter.
GSO 25	[Redacted]	18/04/2012 10:10	Sunny/dry 0.3m/s	There was a car park surrounding the perimeter of the building where cars occasionally passed the survey station. A timber fence separated the building from the GSO.
GSO 26	[Redacted]	18/04/2012 11:18	Dull/dry 0.7m/s	The building had car parking nearby, where cars occasionally passed the survey station.

Appendix B – Noise Measurement Results

Table 3 – Noise measurement results

Station	Location	Sound Levels 15 Minute Measurements (dB)		
		L _{Aeq}	L _{A10}	Adjusted L _{A10}
M77 1	[Redacted]	56.8	60.5	58.5
M77 2	[Redacted]	69.1	72.0	70.0
M77 3	Kilmaurs Road	63.7	63.5	61.5
M77 4	Langside Fenwick	52.2	53.5	51.5
M77 5	Little Fenwick	49.8	54.0	52.0
M77 6	[Redacted] tewarton Road, Fenwick	58.7	61.0	59.0
M77 7	Glaister Bridge	56.9	59.5	57.5
M77 8	[Redacted] Rysland Drive, Fenwick	58.7	61.0	59.0
M77 9	[Redacted] Jackfauld Gardens, Fenwick	52.0	55.0	53.0
M77 10	Townend	55.4	57.0	55.0
M77 11	[Redacted]	59.8	62.0	60.0
M77 12	[Redacted]	55.3	57.0	55.0
M77 13	[Redacted]	57.5	59.5	57.5
M77 14	[Redacted]	65.5	67.0	65.0
M77 15	[Redacted]	48.4	49.0	47.0
M77 16	[Redacted]	53.4	55.0	53.0
M77 17	[Redacted]	64.7	65.0	63.0
M77 18	[Redacted]	57.9	58.0	56.0
M77 19	[Redacted]	54.0	58.0	56.0
M77 20	[Redacted]	59.7	61.5	59.5
M77 21	[Redacted]	53.4	56.0	54.0
M77 22	[Redacted]	50.0	52.5	50.5
M77 23	[Redacted]	54.4	56.5	54.5
M77 24	[Redacted]	68.0	70.0	68.0
M77 25	[Redacted]	71.1	66.5	64.5
GSO 1	[Redacted], Mearnskirk	50.5	53.0	51.0
GSO 2	[Redacted], M'kirk	54.1	56.0	54.0
GSO 3	[Redacted] Titwood Road	55.1	57.0	55.0
GSO 4	[Redacted] Titwood Road	50.8	53.0	51.0
GSO 5	[Redacted]	55.1	58.0	56.0
GSO 6	[Redacted]	50.2	52.5	50.5

Station	Location	Sound Levels 15 Minute Measurements (dB)		
		L _{Aeq}	L _{A10}	Adjusted L _{A10}
GSO 7	[Redacted]	48.1	51.5	49.5
GSO 8	[Redacted]	57.5	60.5	58.5
GSO 9	[Redacted]	55.0	57.5	55.0
GSO 10	[Redacted]	48.6	51.0	49.0
GSO 11	[Redacted]	51.6	55.0	53.0
GSO 12	[Redacted]	56.9	59.0	57.0
GSO 13	[Redacted]	53.6	57.5	55.5
GSO 14	[Redacted]	53.5	56.0	54.0
GSO 15	[Redacted]	59.2	62.0	60.0
GSO 16	Property has been rebuilt, no measurement taken	—	—	—
GSO 17	[Redacted]	57.1	59.5	57.5
GSO 18	[Redacted]	59.2	61.5	59.5
GSO 19	Replaced by row of terraced houses, no measurement taken	—	—	—
GSO 20	[Redacted]	51.5	53.5	51.5
GSO 21	[Redacted]	58.9	63.5	61.5
GSO 22	[Redacted]	55.5	57.5	55.5
GSO 23	[Redacted]	58.2	60.5	58.5
GSO 24	[Redacted]	53.3	55.5	53.5
GSO 25	[Redacted]	59.3	62.0	60.0
GSO 26	[Redacted]	64.8	68.0	66.0

Appendix C – Location Drawings



