Forth Replacement Crossing

Employer's Delivery Team
Construction Noise Monitoring Report

FIFE ITS Contract
(September 2012)

TRANSPORT SCOTLAND

An agency of The Scottish Government

FORTH REPLACEMENT CROSSING

FORTH REPLACEMENT CROSSING

EMPLOYER'S DELIVERY TEAM
CONSTRUCTION NOISE MONITORING REPORT

FIFE ITS CONTRACT (SEPTEMBER 2012)

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FORTH REPLACEMENT CROSSING

EMPLOYER'S DELIVERY TEAM
CONSTRUCTION NOISE MONITORING REPORT

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1. INTRODUCTION

1.1 This report sets out the results of the construction noise monitoring undertaken on the Fife ITS Contract during September 2012 as part of the Forth Replacement Crossing project.

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GRAHAM

CONSTRUCTION

FORTH REPLACEMENT CROSSING

FIFE ITS

FRC/FITS/JG/PCNV/CP/0016

NOISE COMPLIANCE MONITORING REPORT FOR INSTALLATION OF GANTRY G02F

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Fife ITS Scheme

Gantry Installation Compliance Report (FRC-FITS-JG-PCNV-009)

October 2012

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Fife ITS Scheme

Gantry Installation Compliance Report (FRC-FITS-JG-PCNV-009)

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This document has been prepared and checked in accordance with
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Issue	Date	Prepared by	Checked by	Approved by
First	October 2012	Jon Lee Senior Consultant	Mark Maclagan Associate Director	Mark Maclagan Associate Director

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1. Introduction

Waterman Energy, Environment & Design Limited (hereafter 'Waterman') was instructed by John Graham (Dromore) Limited to undertake a noise compliance assessment during installation of a new gantry which spans the southbound carriageway of the M90 at Chainage 10,070.

The noise compliance assessment was completed in line with the guidance provided in the Forth Replacement Crossing Code of Construction Practice (the CoCP) and Appendix 1/9 of the Employers Requirements (hereafter 'the Employers Requirements').

A Plan for the Control of Noise and Vibration (PCNV) was submitted and approved for the works to be undertaken during the gantry installation works (FRC-FITS-JG-PCNV-0009) which assessed the potential noise impacts in the vicinity of Chainage 10,070 associated with site operations (Gantry Site 02F).

In order to ensure compliance with Best Practicable Means (BPM) the approved PCNV, CoCP and the Employers Requirements noise monitoring was undertaken at a location representative of the closest sensitive receptor to the works. This document sets out the findings of the noise compliance monitoring exercise.

2. Site Description and Development Proposals

2.1 Works Description

The works undertaken included the installation of a new gantry over the Northbound carriageway of the M90. The sequence of works for the gantry installation is set out below:

- Set up of traffic management schemes on the carriageway; and
- Installation of new overhead gantry over a single night-time period.

2.2 Noise Sensitive Receptors

The closest noise sensitive receptors to the works were identified following a site walkover. The nearest noise sensitive receptor to the works site is described in Table 1.

Table 1 Noise Sensitive Receptors

Noise Sensitive Receptor	Name	Description	Approximate Grid Reference	Distance from Works
NSR A	Park Lea	Two story residential dwellings	312410,683958	60m

3. Noise Assessment Criteria

Section A2 of Appendix 1/9 of the Employers Requirements and The Forth Replacement Crossing Code of Construction Practice (CoCP) require that a noise consultant should be present on site during night-time works. There is not a specific requirement for noise monitoring during operations, however following best practice noise monitoring was undertaken to assess the levels of noise during the loudest period of works.

Section A2 of Appendix 1/9 of the Employers Requirements and the Forth Replacement CoCP also require that noise levels generated during the construction of any phase of works should not exceed the residual effects set out in the Forth Replacement Crossing Environmental Statement ("the ES"). This document sets out the ABC Threshold Level assessment methodology presented in Appendix E of BS5228-1:2009 as being the appropriate assessment methodology for the works.

This method defines category threshold values which are determined by the time of day and existing monitored ambient noise levels. The noise level generated by construction activities is then compared with the 'threshold value'. If the total noise level exceeds the 'threshold value', a significant effect is deemed to occur. The construction noise impact criteria are set out in Table 2.

Table 2 Construction Noise Impact Criteria

Period	Assessment Category					
	A		B		C	
	$L_{Aeq,T}$	L_{Amax}	$L_{Aeq,T}$	L_{Amax}	$L_{Aeq,T}$	L_{Amax}
Night	45	60	50	65	55	65
Evening	55	70	60	75	65	80
Day	65	80	70	85	75	90
Saturday	65	80	70	85	75	90

Note:

- Category A: are threshold values to use when ambient levels rounded to the nearest 5dB) are less than these values;
- Category B: are values to use when ambient noise levels (rounded to the nearest 5dB) are the same as the Category A values; and
- Category C: are values to use when ambient noise levels (rounded to the nearest 5dB) are greater than Category A values.

Consideration is also required to $L_{Amax,fast}$ noise levels in line with Section 5.4 of the CoCP. The Employers Requirements require the execution of the works to be limited to maximum noise levels that are 5dB lower than those defined in the CoCP and summarised in Table 2.

A baseline noise monitoring exercise was undertaken at locations representative of the closest sensitive receptors to the Fife ITS study corridor. The monitoring data is provided in full as report FRC-FTIS-JG-NVMP-BMR-0001. Following completion of the baseline monitoring exercise noise assessment category levels were set in line with the guidance provided within the CoCP and the Employers Requirements (see Table 2). The assessment category levels in terms of $L_{Aeq,T}$ and L_{Amax} are presented as Table 3.

Table 3: Summary of Noise Threshold Levels

Monitoring Location	Period	L_{Aeq} Assessment Category Level	L_{Amax} Threshold level
NSR A - Park Lea	Daytime	75	90
	Evening	65	80
	Night-time	55	65

4. Noise Monitoring Methodology

Noise monitoring was undertaken at one location throughout gantry installation on the Northbound carriageway of the M90. The monitoring location was selected to be representative of the closest sensitive receptor to the works. The monitoring location is described in full in Table 4.

Table 4: Noise Monitoring Locations

Location	Description	Notes
ML1	**Park Lea**	Noise climate dominated by road traffic on the M90. Some noise associated with local traffic was also noted.

Noise monitoring was undertaken by Jon Lee who holds corporate membership to the Institute of Acoustics and is fully competent and trained in the use of the noise monitoring equipment.

The parameters logged throughout the survey period were L_{Aeq}, L_{Amax}, L_{Amin}, L_{A90} and L_{A10}. These parameters are described in Appendix A. The L_{Aeq} level is the equivalent continuous sound pressure level over the measurement period; L_{Amax} is an indicator of the highest sound level during the measurement period; the L_{Amin} is the lowest level during the measurement period; L_{A90} is used as a descriptor of background noise levels and L_{A10} is the noise level which is achieved for 10% of the monitoring period and is often used to describe road traffic noise.

The monitoring equipment used during the survey period is described in Table 5. The sound level meter was calibrated both before and after each monitoring period; no significant drift from the reference level of 94 dB was recorded. The monitoring equipment used during the survey period is described in Table 5. The sound level meter was calibrated both before and after each monitoring period; no significant drift from the reference level of 94dB was recorded.

All measurements were unattended and undertaken under free-field conditions. However, during night-time works a member of Waterman's Noise and Vibration Team was on site at all times A wind shield was fitted to the monitoring equipment at all times.

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Table 5: Noise Monitoring Equipment

Sound Level Meter	ML1
Meter Model	Rion NL-32
Serial Number	00482656
Calibrator	
Calibrator Model	Rion NC-74
Serial Number	35173533
Calibration Level at 1000 Hz	94dB
Microphone	
Microphone Type	UC-53A

5. Noise Monitoring Results

As the works were to be undertaken over a single night-time period, short term attended noise monitoring was undertaken during the period of works and commenced on 21st September 2012. The monitoring results are presented as Graph 1. A summary of the calculated hourly results are presented as Table 6. Note as there were a number of car passes in the immediate vicinity of the noise monitor, these results have been discounted from the overall hourly results.

Graph 1 – Monitored Noise Levels Park lea

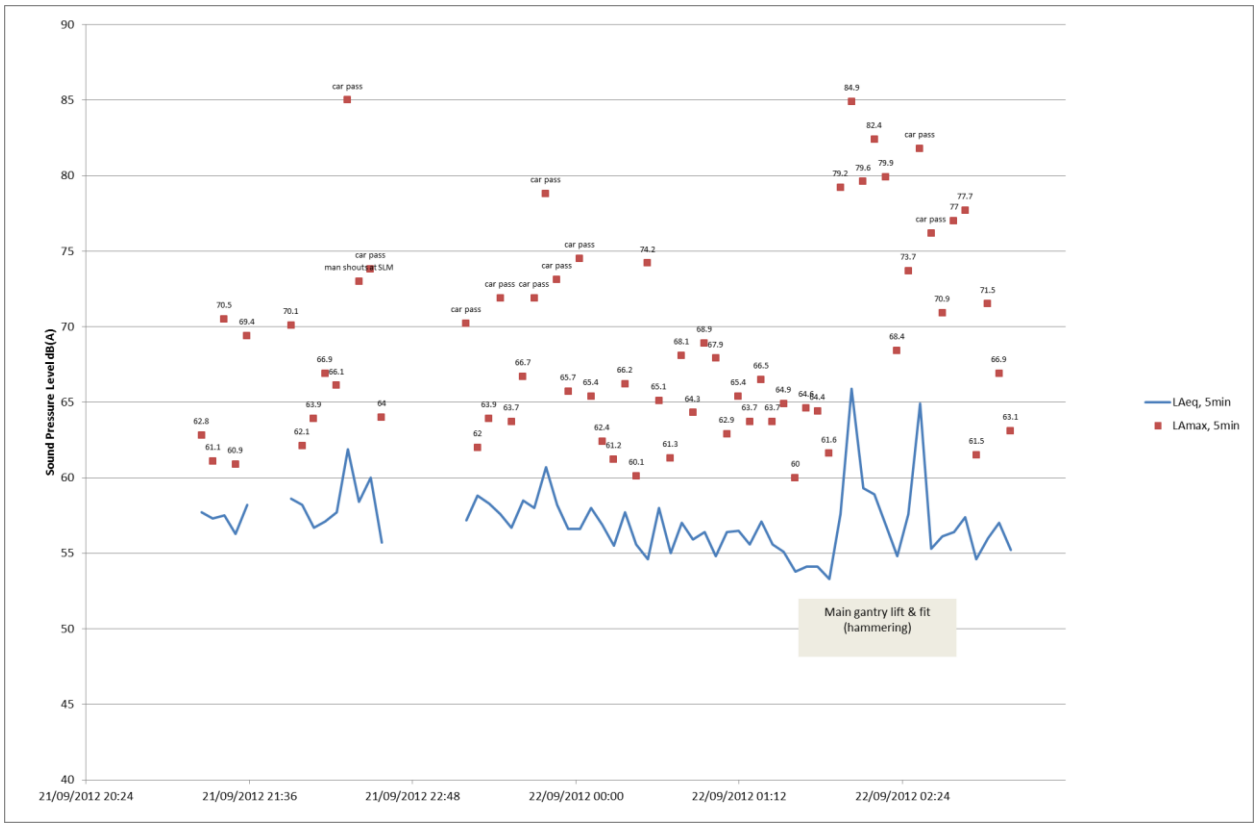

Table 6: Hourly Summary of Noise Monitoring Results

Monitoring Location	Period	$L_{Aeq,\ 1\ hour}$	L_{Amax}
NSR A - Park Lea	22:00 – 23:00	57	67
	23:00 – 00:00	58	68
	00:00 – 01:00	56	74
	01:00 – 02:00	55	79
	02:00 – 03:00	58	85

Monitored noise levels summarised in Table 6 indicate that there were exceedances of the 55dBA night-time criterion.

The L_{Amax} levels indicate exceedances of the 65dB criterion. However for the most part these exceedances were due to HGVs passing along the northern carriageway of the M90.

Notwithstanding the above, there were some identifiable exceedances due to construction works. However the following should be noted with regard to these exceedances:

- The exceedances were limited to the main lifting and fitting operation. Noise from this operation is very difficult to mitigate as this particular location due to the work being carried out at height (i.e. above the noise barrier and in close proximity to houses);
- The exceedances were almost entirely limited to the one-hour period between 02:00 and 03:00, and were due to the occasional hammering required during the fitting process;
- The rest of the operations during the monitoring period were audible however it was considered that the dominant noise source was traffic movements along the motorway;
- On-going improvements to the fitting process such as dummy fitting within the construction compound are being carried out to minimise the requirement for use of hammers to fit the gantry once on site; and
- No complaints were made during the works and none have been communicated to Waterman since.

Appendix A Acoustic Terminology

Ambient sound	The totally encompassing sound in a given situation at a given time, usually composed of sound from all sources near and far.
Assessment period	The period in a day over which assessments are made.
A-weighting	A frequency weighting applied to measured or predicted sounds levels in order to compensate for the non-linearity of human hearing.
Background noise	Background noise is the term used to describe the noise measured in the absence of the noise under investigation. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L_{90} noise level (see below).
Broadband	Containing the full range of frequencies.
Decibel [dB]	The level of noise is measured objectively using a Sound Level Meter. This instrument has been specifically developed to mimic the operation of the human ear. The human ear responds to minute pressure variations in the air. These pressure variations can be likened to the ripples on the surface of water but of course cannot be seen. The pressure variations in the air cause the eardrum to vibrate and this is heard as sound in the brain. The stronger the pressure variations, the louder the sound that is heard. The range of pressure variations associated with everyday living may span over a range of a million to one. On the top range may be the sound of a jet engine and on the bottom of the range may be the sound of a pin dropping. Instead of expressing pressure in units ranging from a million to one, it is found convenient to condense this range to a scale 0 to 120 and give it the units of decibels. The following are examples of the decibel readings of every day sounds; Four engine jet aircraft at 100m 120 dB Riveting of steel plate at 10m 105 dB Pneumatic drill at 10m 90 dB Circular wood saw at 10m 80 dB Heavy road traffic at 10m 5 dB Telephone bell at 10m 65 dB Male speech, average at 10m 50 dB Whisper at 10m 25 dB Threshold of hearing, 1000 Hz 0 dB
dB(A): **A-weighted decibels**	The ear is not as effective in hearing low frequency sounds as it is hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the 'A' filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter. The sound pressure level in dB(A) gives a close indication of the subjective loudness of the noise.
Do-Minimum	Describes a scenario under which the road scheme that is under consideration does not proceed.
Façade Noise Level	A noise level measured or predicted at the façade of a building, typically at a distance of 1m, containing a contribution made up of reflections from the façade itself (+3dB).
L_{Amax} noise level	This is the maximum noise level recorded over the measurement period.
L_{Amin} noise level	This is the lowest level during the measurement period.

$L_{Aeq,T}$ noise level	This is the 'equivalent continuous A-weighted sound pressure level, in decibels' and is defined in British Standard 7445 as the 'value of the A-weighted sound pressure level of a continuous, steady sound that, within a specified time interval, T, has the same mean square sound pressure as a sound under consideration whose level varies with time'. It is a unit commonly used to describe construction noise, noise from industrial premises and is the most suitable unit for the description of other forms of environmental noise.
L_{A90} noise level	This is the noise level that is exceeded for 90% of the measurement period and gives an indication of the noise level during quieter periods. It is often referred to as the background noise level and is used in the assessment of disturbance from industrial noise.
L_{A10} noise level	This is the noise level which is achieved for 10% of the monitoring period and is often used to describe road traffic noise
R_w	Single number rating used to describe the **laboratory** airborne sound insulation properties of a material or building element over a range of frequencies, typically 100-3150Hz.