



Section 3.0 – Noise and Vibration Management Plan

Guidance Notes:

Details of control measures in respect of noise and vibration are contained within this section.

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1.0 INTRODUCTION TO THE PROJECT

Graham Construction have been awarded the FIFE ITS project as part of the overall scheme to provide the new Forth Road Crossing. This design and build contract will comprise the provision of an Intelligent Transport System (ITS) on the northbound and southbound carriageways of the M90 between Junction 1 (Admiralty) and Junction 3 (Halbeath) and on the associated road connections.

The project involves the provision and installation of approximately eighteen gantries, including foundations and associated maintenance lay-bys. The gantries will support ITS equipment and direction signing. Associated with the gantries is the provision of hard landscaping, ducting, cabling and carriageway resurfacing.

2.0 NOISE AND VIBRATION POLICY

GRAHAM Construction is committed to avoiding unnecessary noise and vibration and mitigating noise and vibration levels during construction of the Fife ITS project through the adoption of Best Practicable Means as defined in Section 72 of the Control of Pollution Act, 1974. GRAHAM construction recognises the importance of good planning in achieving these goals and ensuring that best practicable means are employed.

3.0 INTRODUCTION TO REPORT

This document has been developed to provide information on the measures to be implemented to control and mitigate noise and vibration during construction. It will also provide details of the monitoring systems that will be used during the construction phase.

GRAHAM Construction recognises the need to undertake an assessment of predicted noise and vibration levels for all activities carried out during the construction phase in order to maintain the health and well being of the personnel and stakeholders involved in the Project, as well as local commercial and residential communities.

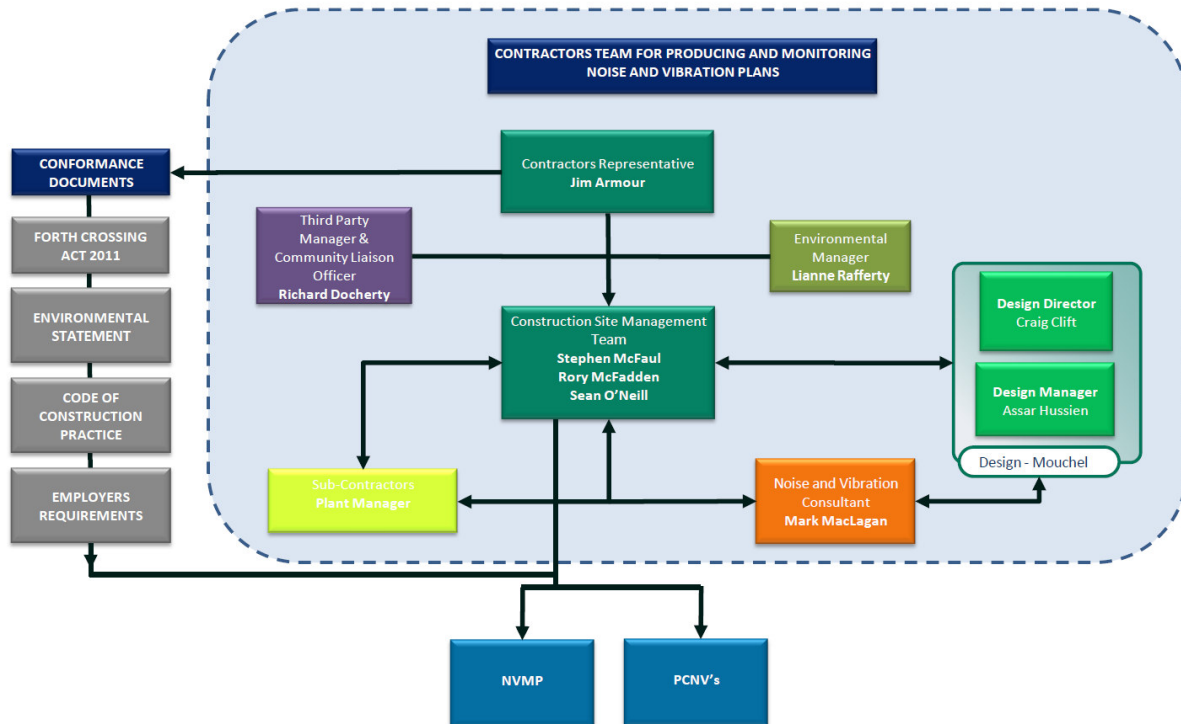
The NVMP has been completed in accordance with the Code of Construction Practice, Appendix 1/9 of the specification, the Environmental Statement for the scheme and BS5228. Operations such as Piling, Earthworks and general site operations have the potential to cause nuisance noise and vibration if they are not managed properly.

Due to the nature of the project there is potential for noise and vibration disturbance. Examples of which are vibrating machinery, vehicle warning alarms, movement of plant and haulage vehicles and piling works. However through careful planning and by ensuring works are completed using 'best practicable means' before the works commence, the noise and vibration effects can be minimised. An example of 'best practicable means' may be the mandatory use of 'broadband white noise' reversing alarms as opposed to standard warning alarms on vehicles used on the project.

4.0 THE MANAGEMENT TEAM

GRAHAM Construction has worked in liaison with a Specialist Noise & Vibration Consultant to develop the overall Noise and Vibration Management Plan for the project. Along with the GRAHAM team the consultant will assist in developing and implementing individual PCNV's for the various works items. This plan has been compiled in accordance with the appropriate documents to satisfy the Employer, stakeholders and the Noise Liaison Group.

Fig.1: Organisation Structure for completion of NVMP & PCNV's



As can be seen from Figure 1 above the contractor's team for producing and monitoring noise and vibration plans, comprises of a number of different individuals and groups. Sections 4.2.1 to 4.2.5 below give a brief description of each of their input's into the process and how they are managed, integrated and involved in the process.

4.1.1 Contractors Representative.

The contractor's representative is a senior manager, responsible for strategic high level decision making within the project. Responsible for co-ordination of the head office support team (CLO and Environmental Manager), and ensures appropriate input from support team. He is responsible for management of the construction site management team and for ensuring that they have access to all resources that they may need.

4.1.2 Community Liaison Officer (CLO)/3rd party manager.

The CLO will liaise with local stakeholders and community groups keeping them updated on any noise and vibration matters that might affect them. This will include and not be limited to: notification of commencement of works, attendance of community group meetings and notification of any out of hours work which has been granted by Fife Council and the NLG.

4.1.3 Construction Site Management Team.



The construction site management team will be responsible for developing and submitting the NVMP and PCNV's. They will take input from and liaise closely with the CLO, Environmental manager, Mouchel design team, N&V Consultant and Sub-contractors plant manager, to ensure that best practicable means is being used at all times. They will ensure the noise and vibration management plan (NVMP) is completed in line with the conformance documents as listed above in figure 1.

The construction site management team will work with the designer and sub-contractors to identify construction methods and plant which are best practicable means. From these discussions any noise and vibration mitigation measures which can be put in place will be identified.

The construction site management team is also responsible for managing the implementation of the control measures which have been detailed in the NVMP and each PCNV. This will be carried out through review of sub-contractor method statements, communication of method statements to operatives, communication of toolbox talks and daily task briefings to operatives.

The construction site management team will also attend and participate in regular meetings with the Noise Liaison Group (NLG). At these meetings the contractor will consult with, and demonstrate to the NLG that the construction works are planned and executed in accordance with Appendix 1/9, the CoCP and the Environmental Statement for the project. Figure 1 in particular of Appendix 1/9 will be followed to manage the production of this NVMP & the particular PNCV's. See Appendix B for a copy of Figure 1.

4.1.4 Mouchel Design team.

The Mouchel design team has worked closely with GRAHAM through the project tender stage and have an extensive knowledge of the project. They will work with GRAHAM and the N&V consultants to ensure that the Best Practicable Means design is used and carried through to the construction stage.

4.1.5 Noise and Vibration Consultant.

The Noise and Vibration Consultant will liaise closely with the construction site management team in the development of the NVMP and PCNV's. They will carry out baseline noise and vibration monitoring at sensitive receptors near to works locations. They will then use the baseline data collected to identify noise and vibration threshold levels at the receptors, using guidance given in BS5228:2009 and will ensure that the N&V thresholds that are set are consistent with the FRC Environmental Statement Method. Information on plant and construction methodology will be provided to the N&V consultant from the construction site management team and sub-contractors and will be used to predict noise and vibration levels at the identified receptors, which result from the construction works. If necessary the N&V consultant will work with the construction site management team to develop a N&V monitoring programme for areas where there is a potential for the threshold levels identified, to be exceeded. The N&V consultant will monitor N&V levels when work is being carried out (compliance monitoring), to ensure compliance with individual PCNV's which set out the BPM to be employed.

5.0 LOCAL AUTHORITY CONSENT

GRAHAM will undertake assessments of the construction activities and their likely noise and vibration impacts, in the form of a PCNV. The site management team will undertake all construction activity to ensure the best practicable means are employed at all times to minimise noise and vibration.

If it is predicted from the assessments, that the impacts which result from the construction activities, are in exceedance of those set out in the Forth Replacement Crossing Environmental Statement, approval of the PCNV will be sought from the Employers representative and the NLG. In such cases it



will then be necessary for GRAHAM to demonstrate in the PCNV application that best practicable means have been used and that everything has been done which is reasonably practicable to ensure that the N&V effects are not worse than those identified in the Forth Replacement Crossing Environmental Statement. GRAHAM will also be required to give details of why the threshold levels may be exceeded and why they believe that the works do not constitute a N&V effect that is worse than those identified in the Forth Replacement Crossing Environmental Statement.

Following approval from these two bodies GRAHAM will seek local authority consent for the works to proceed. This application for local authority consent will be submitted at least 28 days before the programmed start of the relevant construction activity.

The application will demonstrate that 'best practicable means' have been used in the selection of construction methods and plant. It will also set out the mitigation measures the contractor intends to use to control or limit noise and vibration during construction and show that all the alternative methods and means have been explored.

6.0 NOISE AND VIBRATION CONSULTANT

An Institute Of Acoustics registered consultancy has been employed to provide professional services to GRAHAM when completing the PCNV's. GRAHAM has appointed the Waterman Group to provide these services and also to complete any onsite N&V monitoring that is required. Approval of the subcontractors key staff has been sought from the Employer and will be in place prior to any construction activities being undertaken onsite.

Waterman Group will identify those areas which are at risk from noise and vibration generated by the works. Where risks are identified a programme of noise and vibration monitoring will be developed in accordance with the CoCP, Environmental Statement and the Employers Specification. The process for determining risk and what risk comprises are included in Section 8.7 of this NVMP. As a result of the risk assessment, and in conjunction with the construction programme for the works, it has been possible to develop a programme for PCNV submittal. This takes into account the additional development and review period which is needed for higher risk PCNV's. Appropriate monitoring equipment will be established and a monitoring plan submitted for approval, as part of the PCNV.

A Waterman Group noise and vibration consultant will attend the NLG meetings where possible to provide technical information on noise and vibration management.

The N&V consultant and subcontractors for the various work activities will be integrated into the PCNV development process. The subcontractors will provide data sheets on noise and vibration outputs on the various items of plant being used and where available, any previous recorded noise and vibration data relating to the items of plant.

7.0 DESCRIPTION OF WORKS ON THE PROJECT WHICH HAVE POTENTIAL TO CAUSE N&V

The main works in the project which have the potential to produce Noise and Vibration involve the following operations;

7.1.1 Earthworks including excavation and compaction

Small quantities of earthworks will be required at each of the gantry locations to facilitate the construction of the bases of the gantries. This will involve the use of excavators, haulage lorries and also compaction equipment. These works are small with a relatively short duration in each location.

7.1.2 Piling Works - CFA Piles

Each gantry base will have two CFA (Continuous Flight Auger) piles installed as part of the design. CFA piles are formed by carefully drilling to the required depth using a hollow stem continuous flight auger, there is no percussion involved. When the auger reaches the designed depth, a high slump concrete is then pumped through the hollow stem. While the concrete is being pumped, the auger is withdrawn at a controlled rate, removing the soil and forming a shaft of fluid concrete extending to ground level. CFA Piles offer advantages over more conventional techniques including; that they are quiet & quick to install with minimum vibrations through most ground conditions. As with the earthworks, and all items of construction, these works will have a relatively short duration at each gantry location.

7.1.3 Soil Nailing

Soil nailing is a method of stabilising embankment slopes by drilling slender hollow steel tubes into the embankment and injecting grout into the annulus. This method of construction is completed by a specialist and it creates less noise, vibration and haulage movements than traditional construction methods. Soil nailing will be carried out on a small number of locations throughout the scheme.

7.1.4 Erection of Gantries

In order to erect the gantries the M90 motorway must be shut to traffic. Subject to approval of a PCNV for the works, it may be necessary for this operation to take place during night time closures. Plant involved in this operation will include delivery lorries, cranes and Mobile Elevated Work Platforms (MEWP'S).

7.1.5 Resurfacing Works

Subject to approval of a PCNV the resurfacing of the southbound carriageway may also need to be carried out under carriageway closures. It has been programmed for this work to be carried out over a period of three consecutive weekends, from a Friday evening to a Monday morning. This work will involve various types of machinery including haulage Lorries, surface planners, and surfacing laying and compaction equipment.

8.0 IDENTIFICATION OF PCNV's FOR THE PROJECT

The location of the Intelligent Transport System project is on the M90 Motorway North of the existing Forth Road Bridge between the Admiralty Junction and Halbeath Interchange. See Appendix A for the overall layout plan for the works. The sketch in Appendix A (FRC-ITS-GC-SK-01) shows the overall scheme layout and includes location of gantries, resurfacing operations & works at Pitreavie Roundabout.



The scheme consists of approx 20 individual sites between these locations where gantry's or lay-by's are to be constructed. Appendix C shows a sketch of each works location, Sketches FRC-ITS-GC-SK-01A to L.

Due to the requirements of the scheme and the alignment of the existing road the works locations are now fixed and cannot be altered. Each individual work site is quite small with minimal works taking place in each location. The duration at each individual location will also be relatively short. The durations for each work activity are shown in the Construction Programme. This programme includes anticipated durations for the various elements of work at each location.

Under the terms set out in appendix 1/9, a PCNV must be completed for each of the construction activities to be undertaken on the project. In order to minimise the number of PCNV's to be submitted, GRAHAM has decided to employ a Risk Assessment Approach in assessing the N&V potential of each activity, grouping similar activities together into one PCNV.

It is a requirement of the contract that any works programmed to take place outside the normal working hours set out in the CoCP, should have separate PCNV's completed for them.

The other requirements of PCNV's which will be adhered to are set out in Appendix 1/9 of the Specification

Please refer to Table 1 in the PCNV Risk Assessment, FRC/FITS/JG/PCNV/RA/0001, which shows the PCNV Risk Assessment which has been completed for the programmed works. When completing the PCNV Risk Assessment each construction activity has been assessed in terms of its proximity to N&V sensitive receptors, the hours of work and the nature of the work to be completed. The activity is then given a risk potential rating of either low, medium or high. Using these ratings and grouping similar activities together the schedule of PCNV's has been formed.

In relation to Table 1 in the PCNV Risk Assessment, FRC/FITS/JG/PCNV/RA/0001, it should be noted that the list of PCNV's identified is not exhaustive and may be subject to change as construction progresses. If the list of PCNV's was to change, a revised list of PCNV's would be submitted to the employer for review at the earliest opportunity.

9.0 PRODUCING THE PCNV's

The main elements required to produce the PCNV's in the first instance are detailed below;

- Identification of the location of the particular element of work.
- Identification of possible Noise & Vibration (N&V) sensitive receptors.
- In conjunction with sub-contractors select construction methodologies and plant to ensure best practicable means are used.
- Identify construction plant sound power and vibration levels.
- Identify durations for each element of work
- Identify times that works will be carried out, i.e. weekday, weekend, night.
- Carry out N&V risk assessment for each activity.

- Carry out baseline N&V monitoring at/near receptors which have been identified. (inc. community engagement)
- Carry out prediction of construction N&V levels at receptors including specific LAmax risks.
- Identify N&V mitigation measures which could be put in place. (See section 10)
- Identify N&V monitoring programme to be put in place. (See section 11)

The process to produce the PCNV's commences with GRAHAM and the appointed N&V consultant identifying the location of each construction element of work to be undertaken as part of the project.

Possible N&V sensitive receptors could include residential dwellings including gardens, places of worship, places of education, hospital or similar institutions or any other sensitive property likely to be adversely affected by an increase in noise and vibration levels.

The GRAHAM site management team in conjunction with their N&V Consultant and sub-contractors will select construction methodologies and plant to ensure best practicable means are used.

Consideration will be given to any alternative construction methods and plant which could be used and result in less N&V being produced.

Following consultation with the N&V specialist and sub-contractors, a list of plant and machinery to be used on site will be compiled. Using BS5228 and data sheets for the plant, sound power levels and vibration data for the particular items of plant will be obtained.

An outline N&V risk assessment is then carried out for these areas by the GRAHAM site management team and the N&V consultant. Each activity is then categorised in terms of potential N&V risk. This risk is identified taking into account the distance to receptors, the nature of the work to be carried out and the hours of work.

The contract programme is then referenced to identify the order of priority for the completion of PCNV's. They will generally be completed in the order that the works commence onsite. The programme also identifies the duration for each construction activity at each location, and this information will be used in the preparation of the PCNV.

Baseline N&V motoring will be carried out, at or as near to as possible to, the N&V sensitive receptors which have been identified. This monitoring will consist of daytime, evening and night-time monitoring of each location on a minimum of two separate days, in order to form accurate baseline data.

The N&V consultant will then use the information available on the proposed plant and works locations to predict the level of noise and vibration onsite and at the previously identified closest receptors using guidance given in BS5228. Details of the calculations and predictions will be provided as part of the PCNV's. These N&V predictions will identify the need for further review of the construction processes and equipment to be used, to ensure BPM are used, along with the identification of any further mitigation measures which could be implemented. This review will be carried out by the construction site management team and the N&V consultant in conjunction with sub-contractors and suppliers. This assessment and review process may require several iterations before the final BPM methods are arrived at.

Following completion of the above exercise there would be two potential outcomes as set out below:

- When the N&V effects arising from the works have been assessed using Best Practicable Means, the likely levels of disturbance and the sensitivity of receptors and they are considered to be no worse than the residual impacts set out in the Forth Replacement Crossing Environmental Statement, the contractor suggests that attended monitoring be completed at the start of each new phase of work, as it is a requirement of the contract under section 3.4.4.18 of Appendix 1/9. Once this a attended monitoring is completed and the N&V levels are proven to be no worse than the predicted N&V levels, it is suggested that further monitoring should not be completed at similar sites where the work activities are repeated.
- The predicted noise and vibration levels for the works show that there is a potential for the N&V threshold levels to be exceeded. In such cases it will then be necessary for GRAHAM to demonstrate in the PCNV application that best practicable means have been used and that everything has been done which is reasonably practicable to ensure that the N&V effects are not worse than those identified in the Forth Replacement Crossing Environmental Statement. GRAHAM will also be required to give details of why the threshold levels may be exceeded and why they believe that the works do not constitute a N&V effect that is worse than those identified in the Forth Replacement Crossing Environmental Statement.

Following completion of the PCNV the predicted noise levels presented would be adopted as threshold levels to ensure compliance. Noise and vibration monitoring, as discussed below, will be undertaken to ensure compliance with the PCNVs. Noise limits would be set in term of $L_{Aeq,T}$ and $L_{Amax,F}$.

10.0 CONTROLS TO BE PUT IN PLACE TO MINIMISE N&V

The mitigation measures detailed in this section will be further developed in each separate PCNV to ensure that they are specific for each site and activity.

Following on from the two possible outcomes from the analysis identified in item 9.10 above, controls may be put in place to reduce the noise and vibration levels where required. Possible noise reduction measures will be developed between GRAHAM, the N&V consultant and sub-contractors to ensure that they are tangible. These will include;

- Increasing the distance between the item of plant and the possible receptors. This can be beneficial as often distance is the most effective method of controlling noise. This will only be possible with certain items of machinery, e.g. lighting towers, generators, etc.
- Revisiting the proposed items of plant and machinery used in the N&V prediction process to determine if they are in fact the most suitable items of machinery for the works to be undertaken. The desktop analysis can be carried out to determine if the use of different items of plant reduces the level of the N&V to a suitable level.

- Where it has been identified as part of the PCNV development process that there is a potential for N&V threshold levels to be exceeded despite the use of best practicable means, additional mitigation measures will be provided adjacent to nearby sensitive receptors. In such cases, the construction site management team and the N&V consultant will work together with equipment suppliers to establish the most suitable N&V mitigation measures that could be provided. Once these mitigation measures have been established, consultation will take place with the local residents informing them of the work which will take place, the mitigation measures which will be put in place and where required, the residents' permission to access their land and install the mitigation measures.
- It is envisaged mobile noise screens will be used at different locations throughout the site as work progresses. These locations will be identified as part of the individual PCNV development process.
- The extent to which acoustic barrier or surrounds can be used will depend on the nature of the proposed plant and their ventilation requirements.

GRAHAM Construction use the services supplied by a company called Rent-a-Vent to establish the most suitable type of acoustic screen or curtain to use if the risk assessment deems these are necessary. A full list of Rent-a-Vent services and equipment can be found on their website, www.rentavent.co.uk

- Where there is to be environmental noise barriers to be constructed on the project as part of the permanent works these will be erected at the earliest opportunity to reduce the impact of N&V.
- In areas where additional mitigation measures have been provided, an inspection and maintenance programme will be implemented. In such instances the mitigation measures ie. acoustic barriers, screens and bunds, will be inspected at the start of each working day by the site engineer responsible for the section of works. The inspections will ensure that the mitigation measures have not been removed/moved, damaged or interfered with since the previous shift. If it is identified that the measures have been interfered with work will not commence until the measures have been re-instated/replaced to the condition/location that they were originally installed.
- The construction programme may be revisited to see can additional resources be appointed to the tasks to ensure they take as short a duration as possible.
- The mandatory use of 'broadband white noise' reversing alarms as opposed to standard warning alarms on vehicles used for night-time works on the project.

The following good practices will also be implemented onsite to help reduce any impacts of N&V at all times;



- All plant and machinery will be properly maintained and serviced. This will be controlled by the plant operators completing daily check sheets on their particular items of plant which should identify any issues which need to be addressed, e.g. loose exhaust cover.
- Plant and machinery will be positioned onsite to reduce the emission of noise to the neighbourhood and site personnel.
- If items of plant are known to emit higher levels of noise in one direction, they should be orientated so that the noise is directed away from noise sensitive areas.
- Unnecessary noise will be avoided by the operatives when carrying out manual operations and when operating plant & equipment.
- Plant and machinery will be switched off or throttled back where practical. Acoustic covers to all plant must remain closed when the plant is operating.
- Tools and materials should be lowered and not dropped, particularly items which are metal on metal.

The above items will be communicated to the site operatives via method statements and toolbox talks and task briefings where required.

11.0 MEASURING NOISE AND VIBRATION

A regime of noise and vibration monitoring has been will be implemented with the purpose of identifying noise and vibration impacts, demonstrating the Best Practicable Means are adhered to, investigating complaints and generally assisting with the control of noise and vibration.

A combination of unattended continuous noise and vibration monitoring and attended noise and vibration monitoring has been will be implemented for each phase of the works. It should be noted that the selected monitoring locations are would be semi-permanent only and the equipment would be regularly relocated so as to best represent each phase of works. Where possible, it is intended that monitoring will be undertaken externally to minimise uncertainty that can arise from measurements taken internally.

Monitoring locations will be selected so as to be representative of the closest sensitive receptors to the works and as a minimum would include:

- Craig Street
- Park Lea
- Properties on Masterton Road
- Woodland Cottages
- Duloch House
- Properties on Beauly Crescent



- Duloch
- Properties on Westfield Grove

In addition to the above attended monitoring will be undertaken at the beginning of each phase of works and as needed throughout the works period in order to ensure compliance with BPM.

Appendix 19.2 of the FRC Environmental statement has been consulted and it has been found that none of the sensitive receptors listed in Tables 1.1 and 2.1 are within 300m of any works locations.

Noise levels in terms of LAeq,11 hour LAeq, 1 hour and LAmax,F will be recorded at each monitoring location with vibration being recorded in terms of PPV and VDV. Monitoring will continue throughout each phase of works. All monitoring equipment will be fitted with an SMS transmitter. When the adopted threshold level for noise in terms of LAeq,T and LAmax,F and vibration in terms of PPV and VDV as defined in the PCNV is being approached an SMS message will be sent to the both the Waterman Noise and Vibration team member and the site manager. The monitored noise and vibration levels will be compared against the criteria set out in the PCNV for each phase of works to ensure compliance.

All monitoring will be undertaken by competent and experienced staff, which will be given the requisite health and safety training and site access when required. Competent staff will normally be Corporate Members of the Institute of Acoustics or Association of Noise Consultants. Waterman Energy, Environment & Design will be responsible for managing the acquisition of noise and vibration measurements. Waterman Energy Environment & Design will manage the monitoring though will not be based on site on a permanent basis. It is envisaged that regular visits will be made according to the demand on the on-going construction works.

With regards to noise monitoring, this will be undertaken at an appropriate height depending on the property. Specific monitoring heights will be provided in each PCNV. The microphone would be orientated towards the works and would be fitted with an appropriate wind shield at all times. The equipment would be calibrated both before and after each survey period and any drift in the calibration level identified.

When considering LAmax,F all equipment would be fitted with audio recording software where, an exceedance of the adopted LAmax,F criteria is experienced a review of the recordings will be made to identify if the occurrence was as a result of site works. Where an exceedance of the LAmax,F criteria is attributed to the works, works will be halted and alternative working practices or additional mitigation measures explored. Where it is known that regular impulsive works would take place a member of the noise and vibration team would be on site at all times in order to allow any potential exceedances to be identified.

Vibration monitoring in terms of PPV and VDV will be undertaken simultaneously in 3 orthogonal axes and an alert will be issued in the event that a PPV or VDV threshold is exceeded.

Monitoring will be carried out during working hours and the data will be downloaded weekly. Results from the noise and vibration monitoring will be reported using reports, the format of which should be agreed with the Noise Liaison Group (NLG) and be submitted within 5 working days after completion of the survey.

It is acknowledged that, for assessing human response to vibration, monitoring should be undertaken at the point of entry to the human body with buildings. However, for this monitoring strategy, vibration measured either close to or at the base of the building will be used and transfer function



applied where necessary to ensure that the measured vibration levels are representative of actual exposure.

When monitoring both noise and vibration trigger level will be set at 80% of the adopted threshold levels. Where the trigger levels are reached and the results of the noise and vibration monitoring indicate that construction noise and vibration levels are in danger of exceeding the adopted threshold levels and where this is confirmed to be as a result of site works the site foreman will be informed immediately and works halted whilst the reasons for the exceedence are explored and additional mitigation measures put in place where required.

Should the adopted threshold levels be exceeded or a specific complaint received GRAHAM Construction will follow the complaints procedure which is detailed in section 15.8 of this NVMP.

Where measured levels indicate an exceedence of any conditions imposed on a PCNV, the contractor will respond to the incident as per the procedures set out in section 15.8 of this NVMP and in line with the Contractor’s pollution Incident Response Plan, which can be found in Section 11 of the Contractor’s Environmental Management Plan.

Where measured levels are identified as exceeding, or being likely to exceed, the predicted noise levels presented within the PCNV or where the adopted vibration threshold levels are likely to be exceeded a further review of the best practicable means for the activity to minimise the noise will take place. If this occurs at night an investigation will take place and the findings presented to the Employer’s Representative, along with any further mitigation measures which are identified, as soon as reasonably practical.

Where any exceedence coincides with a noise complaint, mitigation measures will be implemented before the same operation is carried out again.

In addition to N&V compliance monitoring, monitoring will also be undertaken by the N&V team and Construction Site Management team to ensure that work is being carried out in accordance with the method statements and PCNV’s which have been approved.

12.0 MONITORING EQUIPMENT

The sound level meter used shall be a Class 1 integrating sound level meter, complying with BS EN 61672:2003. The field calibrator shall comply with BS EN 60942:2003. The meter and calibrator will have been calibrated in a UKAS accredited laboratory; the sound meter and the calibrator will be calibrated every year.

The exact locations of each of the semi-permanent monitoring stations will be identified in the PCNV’s completed for the works. Timescales and dates for the monitoring will be identified in the Construction Programme and agreed in advance of the monitoring taking place.

MONITORING EQUIPMENT

Instrument				
Meter Model	Rion NL-32	Rion NA-28	Profound Vibra +	Vibroch V901
Serial Number	01174892	01170649	VIB01434	VIB65792
Calibrator				

Calibrator Model	NC-74	-	-
Serial Number	35173533	-	-
Calibration Level (dB)	94 dB	-	-
Microphone / Geophone			
Microphone Type	UC- 59	UC-59	Geophone
Microphone Serial Number	00741	00741	TDA00749
Date of Last Calibration	30/08/2011	06/08/2011	31/07/2011

Before any works commence onsite the construction site management team will check that all equipment to be used by the monitoring specialist has a valid calibration certificate. Where additional monitoring equipment is required this would be sourced from a reputable supplier (ANV Measurement Systems or Vibrock Ltd) and full calibration details provided.

13.0 LOCATIONS FOR N&V MONITORING

Baseline noise and vibration surveys will be undertaken at 10 locations across the proposed works area. Baseline monitoring locations have been selected to be representative of the closest potentially sensitive receptors to each phase of works.

The baseline monitoring has been completed in line with the guidance provided in BS 5228:2009. Further details with regards to the proposed baseline monitoring programme and selected monitoring locations are provided as Appendix D.

The baseline noise surveys will commence as soon as possible after agreement of this document and the exact locations agreed with the employer and the relevant local authority.

The baseline surveys will cover those periods when works are likely to be taking place on site including but not limited to weekday & night and weekend day & night. The results of these surveys will be submitted to the Employer and Local Authority as part of the PCNV process for review.

In addition a plan for the Park Lea area showing where we would ideally like to place the long term compliance monitors is included in Appendix E. Monitoring at these locations would enable representative noise and vibration effects at neighbouring noise sensitive receptors to be monitored. These locations will be agreed through consultation with Fife council and local residents.

14.0 SITE WORKING HOURS

The site working hours will be in accordance limitations as set out within the CoCP. These will be Monday to Friday 0800 to 1900 and Saturday 0800 to 1800 hours with a 30 minute start-up/close-down period at the beginning and end of each day. No heavy machinery will be operated within the start up/close down periods.

The majority of the work on the project will be completed within the normal site working hours defined in the CoCP, however there will be exceptions where night time working will be required due to traffic management restrictions. Prior to any out of hours working taking place, GRAHAM will submit a specific PCNV which will demonstrate to the Employer, the Noise Liaison Group and Fife Council that the reasons for the out of hours working are justified and that best practicable means are being used.



Below is a list activities which will require night-time out of hours working:

- Setup of traffic management.
- Southbound carriageway pavement testing.
- Carriageway resurfacing works.
- Piling works at Gantry G01F.
- Installation of gantries.
- Widening of hard shoulder at admiralty junction southbound on-slip.

GRAHAM wishes to stress that this is not an exhaustive list and other activities not on this list may require out of hours working. If/when any other night-time works are identified, Table 1 in the PCNV Risk Assessment, FRC/FITS/JG/PCNV/RA/0001, will be revised, submitted to the employer and a PCNV completed and submitted for the works.

15.0 RESIDENTS AND COMMERCIAL NEIGHBOURS

GRAHAM Construction will ensure that best Practicable means are employed at all times to minimise the noise and vibration generated by construction work. The construction site management team, N&V consultant, sub-contractors and designers will all work together to identify activities with a potential to create excess noise and vibration and employ best practicable means to ensure the effects are minimised.

Noise sensitive receptors near to where the works are being carried out will be identified prior to construction work commencing.

The project Stakeholder Manager/Community Liaison Officer (CLO) will engage with community representatives on a regular basis. He will be the point of contact for interested parties and his contact details will be made available to all interested parties.

GRAHAM Construction is committed to the 'Engaging with Communities' strategy that has been adopted by the Employer as part of the project. As part of this GRAHAM recognise the need to:

- Maintain effective community engagement throughout the construction period and build on existing relationships with the communities.
- Consult with and inform affected communities in advance of the relevant construction works commencing about how the effects of construction activities will be mitigated and the timetable of the construction works
- Provide information on the enquiry and complaints procedures.

The contractor's site management team and CLO shall attend quarterly community forum meetings. The focus of these meeting will be to:



- Share information with the community and enable the community groups to advise of any concerns they may have, so these may be considered and addressed as appropriate, by the contractor.
- Engage the community through constructive consultation, to minimise complaints and ensure that any complaints are dealt with efficiently and effectively.
- Inform the community regarding the proposed mitigation measures that will be provided, to allow informed and timely consultation on these measures and the opportunity for review.

The contractor will notify occupiers of nearby properties and adjacent or affected community councils a minimum of two weeks in advance of construction work commencing. They will be made aware of the nature and anticipated duration of planned construction works that may affect them, including both principal and ancillary works. It is planned that the contractor will carry out letter drops, together with providing information on the works in local community centre's.

GRAHAM will register the project onto the Considerate Constructors Scheme.

A 'Complaints and Compliments' system has been setup for dealing with enquiries and complaints from the public. As part of this the contractor will provide:

- A dedicated free-phone telephone hotline that is staffed by personnel from the contractor's community liaison team 24 hours a day.
- Contact numbers, email and postal addresses for the enquiries and complaints system. These will be displayed on signs and will be published on the website and newsletters.

When an enquiry or complaint has been received the following system for dealing with it will be followed to ensure that it is dealt with efficiently and effectively:

- The enquiry or complaint will be logged into the compliments and complaints register as soon as it is received.
A CLO will then be assigned the enquiry/complaint and will deal with it appropriately and sensitively.
- In the event that a CLO cannot deal with a particular enquiry/complaint, they will ensure that it is passed to the correct person for review and appropriate action.
- The enquiry/complaint will then be acted upon accordingly ensuring that it is resolved swiftly.
- Within 48 hours of the enquiry/complaint being received the complainant will be contacted by the contractor's team to advise them of the progress being made and then again following any actions/remedial measures taken to resolve the complaint.
- In the event that a complaint is received which relates to work which was carried out as part of night-time works, the contractor is committed to resolving the complaint before the next night-time works take place.

- If it is the case that a complaint is due to N&V caused by the contractors working practices, the source of the particular N&V will be investigated and the particular operation generating the N&V will be halted, assessed and if necessary re-planned to minimise the N&V produced.
- In the event that GRAHAM feels that it cannot deal with/address a particular complaint, it will be referred to the Employer's Representative who will consider the complaint and any action that can be taken.
- If a complaint is not resolved within 48 hours, the contractor will provide a weekly update to the complainant of any progress/actions that have been taken in progressing with the complaint.
- In the unlikely event that the contractor or Employer's Representative are not able to deal with a complaint, an explanation of why this is the case will be provided to the complainant.

A 'Complaints and Compliments' register has been setup by the contractor and will be made available to the local authority for review. This register may include the following:

- The number of enquiries and complaints (including a monthly summary).
- The geographic area from where the enquiries and complaints originated.
- The topics of enquiries and complaints.
- The measures taken to investigate, deal with or address enquiries and complaints.
- The timescale taken to respond to or address enquiries and complaints.

16.0 CONSTRUCTION PLANT AND EQUIPMENT TO BE USED

A range of construction plant and equipment will be used to complete the works involved on the project. The main items of construction plant include excavators, lorries, compaction equipment, piling rig and cranes. Plant and equipment are regularly serviced and maintained and will be fitted, where reasonably practicable, with noise suppression equipment to reduce noise emissions.

GRAHAM Construction will demonstrate that they have procedures in place to ensure all plant is in good working order. This will take the form of a daily plant inspection sheet which is to be completed by the operator and checked by the site management team. This will highlight any issues with the machinery which the site management team can then commence organising the servicing or replacement of the item in question. Any items of plant which are not in good working order will be immediately substituted for a similar item of plant.

Since work has commenced on site, a measurement programme has been implemented to confirm whether the sound power levels for plant, used in the PCNV applications, are correct under representative operating conditions. In order to confirm the sound power levels, a member of the

N&V monitoring team will attend site, set up N&V monitoring equipment, typically a handheld sound level meter and a vibration meter (details of which can be found in section 12.3 of this NVMP), and monitor the item of plant whilst it is working. The results are recorded and made available to the client, NLG and FC for review. This monitoring programme is carried out for each item of plant that is to be used on site. If anomalies are found between the figures used in the PCNV and the measured figures, then a revision to the PCNV will be required. For this a PCNV dispensation/modification form, found in Appendix 1/9, will be used and submitted to the Employer for review and approval.

All operators are briefed in the correct use of hearing protection and proper use of machinery with respect to minimising noise and vibration.

17.0 EXPOSURE OF SITE OPERATIVES TO N&V

It is a policy of GRAHAM construction to complete 'Noise' and 'Hand and Arm Vibration' (HAV) risk assessments for N&V producing activities prior to the works taking place. These risk assessments will determine the maximum time an operative can work on/in/around an area when a particular construction activity is taking place.

As a result of the N&V risk assessments, the construction site management team will be able to implement site rules regarding the use of N&V producing plant and equipment. These rules will set out whom, where and for how long operatives may be allowed to use certain items of plant and equipment each day and over the course of a week.

These site rules are reinforced using daily task briefings, tool-box talks and method statements which are communicated to all operatives.

GRAHAM realise that exposure to noise from unprotected ears can be a serious hazard to health and cause permanent damage to hearing. Likewise, the use of vibrating machinery for prolonged periods can cause HAVS (Hand Arm Vibration Syndrome).

The workforce can be exposed to N&V through the use of plant and power tools. This risk is reduced by limiting the exposure of the workforce to harmful levels of both noise and vibration. Information on the noise and vibration of particular plant is obtained and held on file onsite for reference.

The procurement department will ensure that information on HAV is available for hired plant and will trial new items of plant which reduce the workforce exposure to HAV.

Noise control at source is always regarded as the number one means of affording proper protection to the employees from risks to hearing. Where circumstances arise where this is not possible, the staff will be supplied with suitable ear protection for the particular task.

In areas where the workforces are wearing ear protection, suitable warning signals should be used to alert them to danger. The ear protection, as with all PPE issued, should be regularly inspected and replaced when worn or damaged.

Any new items of plant onsite are checked by the site engineer to ensure that the noise levels that are produced are in line with that set out in the manufacturer's specification. If this not the case the items of plant is changed for a compliant item of plant.



For more information on the contractor's procedures for monitoring and preventing operative's exposure to N&V, please consult the contractor's Construction Phase Health and Safety Plan which complies with the requirements of the Control of Noise at Work regulations.

18.0 EXPECTED LEVELS OF NOISE AND VIBRATION

A desktop analysis has been carried out to determine the noise sensitive locations of work and individual PCNV's are drafted for these locations with agreed noise mitigation measures to be implemented where necessary.

Vibration is not considered to be a defining feature of this project due to the proposed methodology of the works. The key issue in terms of vibration is piling works and as previously described bored piles are being used as opposed to driven piles. This removes the significant vibration issue which is normally associated with piling techniques. The N&V consultant who has been engaged will carry out assessments of the risk of vibration as part of the individual PCNV's for the project. Any estimated vibration is compared against site measurements in to ensure that the actual vibrations are in line with the PPV and VDV limits set out in the CoCP.

A list of proposed machinery is populated complete with the Sound Level Data as part of the PCNV's for each location. This information is obtained from the technical data sheet for the item of plant in particular. The table below shows a list of plant which will be used on the project. Source noise levels will be obtained from BS5228:2009 or Watermans Extensive in house database of monitored noise levels. The contractor wishes to stress that this list is not exhaustive and may be subject to change. Any additional items of plant not included in the table below will be included in activity specific PCNV's.

Plant Description	Sound Power Level L_{WA} (dB) (from BS & Historical Data)	Source	Source of Noise
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20T 360 TRACKED EXCAVATOR	107	BS5228:2009	Engine
2 NO. 9T ALL TERRAIN FRONT TIPPING DUMPERS	107	BS5228:2009	Engine
CHAINSAW & WOOD CHIPPER	107/101	Waterman Noise Database	Engine
HIAB LORRY	91	Waterman Noise Data base	Engine (offloading value given)
35T MOBILE CRANE	97	BS5228:2009	Engine
OXY/ACETYLENE CUTTING	96	BS5228:2009	Cutting torch
WELDER EQUIPMENT	101	BS5228:2009	Genset
TIPPERS LORRIES X 7 No.	103	BS5228:2009	Engine, reversing sensors (Only those with Broadband White noise sensors allowed onsite)
SURFACING PAVER	105	BS5228:2009	Engine
1200 ROLLER	102	BS5228:2009	Engine/vibratory action
CFA PILING RIG	112	BS5228:2009	Engine/auger
CONCRETE READY MIX LORRIES	100	BS5228:2009	Cleaning of drum
80CFM COMPRESSOR	102	Waterman Noise Database	Engine
100T MOBILE CRANE	109	BS5228:2009	Engine
FLAT BED LORRIES	112	Waterman Noise Database	Engine
BOREHOLE BORING RIG	112	Waterman Noise Database	Engine/auger
GROUT MIXER AND PUMP	108	Manufacturers Information	Engine/drum mixing
SUPER SILENCED 150KVA GENERATOR	73	Manufacturers Information	Engine

With regards to maximum noise levels these are sourced from information provided in BS 5228:2009, Waterman's extensive in house source noise levels database and manufacturers information where available.

Noise and vibration levels generated by each phase of works including maximum noise levels in terms of L_{Amax} at each work site will be predicted in line with the guidance provided in BS 5228:2009. The calculations will take into account source noise levels, existing topography and distance between the noise / vibration source and the sensitive receptor. Predicted noise levels will be completed for the following locations as a minimum.

- Craig Street



- Park Lea
- Properties on Masterton Road
- Woodland Cottages
- Duloch House
- Properties on Beaulieu Crescent
- Duloch
- Properties on Westfield Grove

Appendix 19.2 of the FRC Environmental statement has been consulted and it has been found that none of the sensitive receptors listed in Tables 1.1 and 2.1 are within 300m of any works locations.

The calculated noise and vibration results are assessed against the BS 5228:2009 assessment criteria and the findings of the Forth Replacement Crossing ES. Where exceedences of adopted limit levels are identified a detailed review of plant and working practices will be undertaken to ensure that best practicable means are being adopted and identify where alternative working practices may be available.

19.0 COMMUNICATION OF INFORMATION

The process for approval of the NVMP is as set out in the Employers Requirements, Part 2 of the Appendix 1/9 Control of Construction Noise and Vibration, Figure 1. The PCNV will also be completed in accordance with Figure 1.

Initially a draft Noise and Vibration Monitoring Plan was sent to the employer for review. Once any comments are addressed the Final draft of the plans are submitted to the Employer and the Noise Liaison Group for further review. Following this review, the report is then redrafted, if required, and submitted as final to the employer to go through the formal review procedure.

This Noise and Vibration Management Plan is to be read in conjunction with the Construction Phase Health and Safety Plan, the GRAHAM Environmental Management Plan for the project and its subsidiary documents.