Paisley Corridor Improvements (PCI) project

Undertaken under the Glasgow Airport Rail Link Act (2007):

Code of Construction Practice (CoCP)

Document Reference: C2091600		**Version: v4.2** **February 2011**
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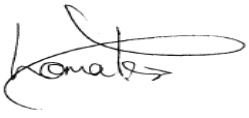
Checked by	John Gordon 	February 2011

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Document Control

Revision Number	Changes	Date
1		July 2006
2	Final Bill Stage Version	November 2006
3	Updates reflecting change of Authorised Undertaker	July 2009
4	Refinement of CoCP following cancellation of GARL branch line to increase relevance of ongoing PCI works.	April 2010
4.1	Inclusion of SEPA comments	December 2010
4.2	Document formatting	February 2011

Preface

This document is based on the **GARL Code of Construction Practice (CoCP) - Final v3 – 7 July 2009.**

It has been agreed between Transport Scotland and Network Rail Infrastructure Limited that for the purposes of the elements of the Paisley Corridor Improvement (PCI) project that are physically located on the Paisley Corridor and also within the GARL Act LOD, the works will be undertaken in accordance with the GARL Act 2007 CoCP and associated policy documents.

The CoCP is referred to in Section 45 of the Glasgow Airport Rail Link Act 2007 (the GARL Act), which sets out the requirement that the 'Authorised Undertaker' shall employ all reasonably practicable means to ensure that the authorised works are carried out in accordance with the Code of Construction Practice (CoCP).

As required by the GARL Act, the Authorised Undertaker shall seek to comply with best practice during construction of the Works and the CoCP is an important element through which this major piece of Works can be built.

It should be noted that this CoCP is a contractual document under which the Authorised Undertaker can enforce compliance by Network Rail Infrastructure Ltd (NR) and their sub-contractors with the standards and requirements in the CoCP.

It should be noted that the CoCP sets out the minimum standards that a Contractor should attain and all Contractors are required to meet these standards.

In addition, it is intended that the CoCP should be the benchmark by which the public and the contracting organisations can gauge the performance of the project implementation, and against which actual implementation can be measured.

Terminology and Acronyms

Authorised Undertaker	The Authorised Undertaker is defined in s.1 of the Glasgow Airport Rail Link Act 2007 as the body: "*authorised to construct and maintain the authorised works, namely—* *(a) the scheduled works referred to in section 2 ("the scheduled works"); and (b) the ancillary works referred to in section 3 ("the ancillary works").*" Transport Scotland is the Authorised Undertaker for the "authorised works" under the GARL Act and for reasons of consistency with the Act, Transport Scotland is referred to as the Authorised Undertaker throughout the CoCP.
BLG	Business Liaison Groups
BRE	Buildings Research Establishment
BS	British Standard
CLG	Community Liaison Groups
CoCP	Code of Construction Practice
Contract	The PCI Construction Contract(s)
Contractor	Generally refers to the Principal Contractor of the project construction Contract(s). Note that where the Contractor is required to comply with provisions of the CoCP, etc., this also applies to any Sub-Contractors engaged on the project.
ES	Environmental Statement. Written report summarising the findings of the Environmental Impact Assessment (EIA).
GARL	Glasgow Airport Rail Link
Limits (LOD and LLAU)	The 'Limits' comprise the precise boundaries of land shown on the Parliamentary plans for which powers are sought to build and maintain the rail line, comprising Limits of Deviation (LOD) and Limits of Land to be Acquired or Used (LLAU). In general, the LOD is the area over which a permanent interest in land is required for the construction and operation of the rail line. The LLAU is the area of land required, or rights over that land are required, either permanently for a specified purpose connected with the construction or operation of the rail line, or temporarily for construction purposes or access. The limits necessarily encompass a wider corridor than is necessary for the rail tracks, not only to construct the rail line, but also to maintain it.
Local Authority	Renfrewshire Council or Glasgow City Council
NR	Network Rail, owner and operator of the UK railways network infrastructure.
OLE	Overhead Line Equipment
Paisley Corridor	That part of the rail network owned and operated by Network Rail extending from Shields Junction to Paisley Gilmour Street station on the Glasgow to Ayrshire and Inverclyde line.
PCI	Paisley Corridor Improvements project

Promoter	Refers to the Strathclyde Partnership for Transport (SPT), which originally promoted the Glasgow Airport Rail Link (GARL) Private Bill in the Scottish Parliament.
Sensitive	The term “noise sensitive” is defined in Section 3.10 of BS 5228: Part 1: 1997 as: “Any occupied premises outside the site used as a dwelling (including gardens), place of worship, educational establishment, hospital or similar institution, or any other property likely to be adversely affected by an increase in noise level”.
SEPA	Scottish Environment Protection Agency
SNH	Scottish Natural Heritage
TRL	Transport Research Laboratory
WoSAS	West of Scotland Archaeology Service

1. Introduction

1.1 Background

1.1.1 This document relates to Section 45 of the Glasgow Airport Rail Link Act 2007 (the GARL Act). The contents of this document are entirely the responsibility of the Authorised Undertaker and have not been endorsed by the Scottish Parliament.

1.1.2 The GARL Bill was originally introduced in the Scottish Parliament in 2006 by Strathclyde Partnership for Transport (SPT) (the Promoter). At that time it was anticipated that SPT would construct and maintain the authorised works as the 'Authorised Undertaker' for GARL, as defined in Section 1 of the Act. However, subsequent to the Act receiving royal assent in January 2007, the position and responsibilities of the Authorised Undertaker were transferred to Transport Scotland.

1.1.3 The purpose of the Glasgow Airport Rail Link project (GARL) was to provide a fixed railway link with sufficient capacity to enable a dedicated train service to operate every 15 minutes between a new station at Glasgow Airport and Glasgow Central station, calling at Paisley Gilmour St. Parliamentary powers were sought to deliver this project and these were granted by the Scottish Parliament under the Glasgow Airport Rail Link Act 2007 (the Act).

1.1.4 It was envisaged that construction responsibilities for the project would be divided into two components:

- The GARL Main Line Works – consisting of all construction activities on the existing rail network, which is owned and operated by Network Rail, specifically those works at Glasgow Central, Elderslie, Paisley St James and the Paisley Corridor; and
- The GARL Branch Line Works – consisting of all construction activities outwith the current rail network, specifically those works extending from Murray Street, Paisley to the new station at Glasgow Airport and associated enabling works.

1.1.5 At the same time Network Rail was planning on undertaking a signalling renewal project, Paisley Corridor Resignalling (PCR) on the Paisley Corridor with some works extending west and south beyond Paisley Gilmour Street and also east beyond Shields Junction. All PCR works were associated with the existing rail network but included works both within and outwith the authorised limits of the GARL Main Line Works (but for the avoidance of doubt did not include any works on the GARL Branch Line) and did not require any powers of authorisation as the works fell within Network Rail's permitted development rights and could be undertaken in accordance with the normal railway construction rules. Given the overlap between GARL and PCR it was decided to combine these two projects.

1.1.6 To the extent that the physical locations of GARL and PCR works coincide on the Paisley Corridor, including all land within the Limits adjacent to the Paisley Corridor, it was agreed that all of the combined GARL/PCR project would be delivered in accordance with the requirements of the Code of Construction Practice (CoCP) pursuant to the GARL Act 2007 even though this had no application to the PCR works. These GARL CoCP requirements would, however, not apply to PCR activities outwith the Paisley Corridor, where construction obligations relative to normal railway works would apply.

1.1.7 On 17 September 2009, the Cabinet Secretary for Finance and Sustainable Growth announced the cancellation of the GARL Branch Line Works but confirmed that the GARL/PCR Main Line Works would still be delivered, owing to the wider capacity benefits they offer. This decision was affirmed when the Scottish Parliament approved the budget on 3 February 2010. It has been agreed that all GARL/PCR Main Line Works shall be delivered by Network Rail and this

has been incorporated into Network Rail's Delivery Plan, as amended, for its regulated activities in Control Period 4.

1.1.8 By way of clarification of the original GARL Main Line Works:

- construction activities have now been completed at Glasgow Central and Elderslie in accordance with previous versions of the GARL Code of Construction Practice and no further works originating from the GARL project are planned at these locations. Any works which will take place at this location in the future will therefore be conducted in accordance with normal railway processes and the GARL CoCP ceases to have any effect.
- No GARL Main Line works will now take place at Paisley St James due to the cancellation of the branch line, however works originating from PCR will be carried out at this location. Any works which will take place at this location in the future will therefore be conducted in accordance with normal railway processes and the GARL CoCP ceases to have any effect.

1.1.9 In summary, this means that all GARL/PCR works on the Paisley Corridor will be compliant with the CoCP regardless of whether the works originate from GARL or PCR. However no further GARL works remain to be done outwith the Paisley Corridor and all GARL/PCR works which are still to be undertaken outwith the corridor therefore originate from PCR, for which the CoCP under the GARL Act 2007 does not apply.

1.1.10 Should the decision to cancel the GARL Branch Line Works be altered in the future nothing in this document affects or changes the applicability of the CoCP to any such reinstated works in the future and a further version of the CoCP will be issued to govern construction activities for such works.

1.1.11 This document therefore is limited to the remaining GARL/PCR works on the Paisley Corridor and it has been agreed that this remaining project component shall be known as Paisley Corridor Improvements (PCI).

1.2 Objectives of the CoCP

1.2.1 This Code of Construction Practice (CoCP) has been prepared to reflect the Environmental Statement (ES) for the GARL project. In effect it is an extension to the ES as it sets out the proposed environmental mitigation measures that will be adopted during construction of the works.

1.2.2 The CoCP addresses specific legislative requirements in addition to compliance with the British Standards, Health and Safety Executive Guidance and planning conditions. In this respect it is in place to protect the interests of local residents, businesses, the general public and the surrounding environment in the immediate vicinity of the construction works. It will apply throughout the entire period of the construction works and thereafter during the works maintenance period.

1.2.3 The provisions of the CoCP are included in the Contract for the construction of the works. The Contractor, any Sub-Contractor, any agents of the Contractor or Sub-Contractor and all employees of the Contractor, any Sub-Contractor and any agents will be obliged to comply fully with the terms of the CoCP. There is a mechanism within the CoCP for the rectification of breaches of the CoCP.

1.3 Structure of the CoCP

1.3.1 The CoCP is structured as follows:

Chapter 1	Introduction – sets the context for the CoCP including the background to the GARL and PCI projects, the purpose of the CoCP and an overview of the scheme and associated construction activities.
Chapter 2	Liaison – sets out the mechanisms for liaison between the Contractor, the community, businesses and the Local Authority during construction of the PCI project.
Chapter 3	Construction Practice – discusses some general considerations associated with activities that will be employed during construction of the PCI project.
Chapter 4	General Matters Applicable Under the CoCP - covers all general aspects of construction works possibly impacting on local communities and the environment, these are identified under the topic headings listed below
• Public and private highways • Noise and hours of working • Vibration • Dust and pollution • Handling and disposal of contaminated materials • Protection of surface and groundwater resources • Ecology • Site boundaries/hoardings/temporary structures on the public highway • Archaeological remains • Built Heritage • Other Site activities	
The measures identified in this chapter are applicable to all areas of the construction works for the duration of the project.	
Chapter 5	Site Specific Requirements – covers the particular requirements relating to individual construction compounds along the route. This chapter is available should any site specific requirements be identified which should be included in the CoCP in the future.
Appendices	Presents information on, agreements and approvals, environmental intervention criteria, dust suppression measures and useful contacts.

1.4 Applicable Acts of Parliament and Statutory Regulations

1.4.1 There are numerous relevant Acts of Parliament and statutory regulations covering environmental, construction and health, safety and welfare matters which are in force at present and which will apply to the construction of the works. By the time construction is underway, a number of these acts and statutory obligations may have been repealed or amended and other statutory obligations may apply. The Contractor, any Sub-Contractor, agents and the Authorised Undertaker will be obliged to comply with all relevant acts of parliament and statutory regulations in relation to environmental, construction and health, safety and welfare matters in force during the period of construction.

2. Liaison

2.1 General

2.1.1 The general intent of the CoCP is to ensure that the impacts of Construction activities on the public and the environment are minimised where practical and that appropriate liaison is undertaken with affected parties and statutory bodies. It also sets out various standards of operation with an expectation that **all** Contractors will seek to meet these standards as a minimum.

2.2 Community

2.2.1 A liaison officer will be appointed by the Authorised Undertaker and will be responsible for all public relations, information issues and press related matters and shall undertake the role of liaison with the relevant departments of the Local Authority, members of the public, the press and the media.

2.2.2 In order to implement these measures the Authorised Undertaker will facilitate the formation and/or continuation of Community Liaison Groups (CLG) as appropriate. The purpose of the CLG will be to represent the views, concerns and comments of the larger community along the proposed route. They will provide ongoing consultation with the public on key issues associated with the route and provide a forum where regular updates will be provided to members regarding the progress of the project. Meetings with the CLG and the Authorised Undertaker and Contractor, will be held regularly throughout the pre-construction and construction period. These will be on at least a quarterly basis.

2.2.3 In addition to taking all reasonable steps to enable the public and the CLG to have the opportunity of being fully informed of the proposed programme of works (including working hours), the Authorised Undertaker will ensure that procedures are established for notifying the public a minimum of **7 days** in advance of planned works. It should also be noted that the agreed period of advanced notification will similarly apply to any alterations in the construction programme or working hours that have been agreed with the Contractor and the relevant departments of the Local Authority.

2.3 General Communication

2.3.1 The Authorised Undertaker will ensure that a complaints procedure is put in place whereby members of the public can, if necessary, make direct contact by telephone using a “hot line” facility which will be answered by a person, not an answer phone, during all hours when works, including deliveries, are taking place. A copy of the outline complaints handling procedure is included as a flowchart within Appendix F which whilst may be subject to alteration, the service level shall not be less.

2.3.2 The Authorised Undertaker will provide details of the named contacts to which all written complaints should be addressed. Furthermore, a dedicated email address to enable comments and/or complaints from the public to be communicated will also be provided.

2.3.3 The Authorised Undertaker shall make details of the relevant contacts within its organisation readily available should they be requested by members of the public. The Contractor shall provide that all site construction staff are easily identifiable to the public by use of identity cards or an equally effective system. Contractor’s staff will wear high visibility clothing and hard hats bearing the Contractor’s company logo. In addition, the Contractor shall nominate an individual to act as a point of contact for liaison with the Authorised Undertaker, the relevant departments of the Local Authority and members of the public.

2.3.4 A procedure shall be adopted in the event of an inspection by Planning Officers, Environmental Health Officers and representatives from other statutory bodies and shall be prepared by the Contractor and agreed with the Authorised Undertaker.

2.3.5 In addition to the obligations under the CoCP, a Communications Protocol shall be developed and agreed between the Authorised Undertaker and the Contractor with regard to the handling of project and wider communication issues not considered directly relating to construction works.

2.4 Monitoring and Response

2.4.1 The Authorised Undertaker will ensure that a system is introduced for the logging and recording of any complaints that will be collated and a copy made available to the Contractor. Any complaints received will be acknowledged the next working day when works, including deliveries, are taking place. The communications flowchart attached in Appendix F will be complied with and the Contractor and/or Authorised Undertaker shall undertake that all complaints receive a written response outlining the action undertaken if any such action is deemed appropriate. The Contractor shall provide the Authorised Undertaker with a monthly report that details all complaints, who they were filed by and the actions taken. The monthly report will be available to members of the public should they wish to view it.

2.5 Consultees and Approvals

2.5.1 Although the PCI project is the subject of a Scottish Parliamentary Act, which conferred the appropriate powers to the Authorised Undertaker to undertake construction of the authorised works, there are a number of areas where agreements and approvals may be required. In particular, such agreements and approvals are required for certain aspects of environmental protection during construction. Copies of such agreement and approvals will be included in Appendix A of the CoCP.

2.6 Arbitration

2.6.1 In the event that any of the provisions of the CoCP are subject to agreement or approval, unless such agreement or approval forms part of a statutory process, failure to reach such agreement shall be referred to a single arbiter either jointly appointed by the parties seeking such agreement or approval or, failing agreement on such appointment, to be appointed, on the application of any party (after notice in writing to the other), by the President for the time being of the Institution of Civil Engineers. The arbiter shall be entitled to state a case for the opinion of the Court of Session pursuant to section 3 of the Administration of Justice (Scotland) Act 1972.

3. Construction Practice

3.1 General Requirements

3.1.1 Expanding on the general description of the works provided in Section 1.1 above, the work will comprise the following elements, as detailed in the revised Network Rail CP4 Delivery Plan,:

(i) Renewal of existing signal interlockings at Shields (old), Cardonald and Paisley

(ii) Renewal of associated lineside equipment

(iii) Transferring control of the new signalling on the Paisley corridor to the West of Scotland Signalling Centre (**WSSC**) at Cowlairs

(iv) Installation of a new third (Relief) running line on the Paisley corridor from Gower Street Junction (just west of Shields Junction) to Arkleston Junction with associated remodelling of Gower Street and Cardonald (Deanside) Junctions.

(v) Remodelling of the approaches to Paisley Gilmour Street from Arkleston Junction (inclusive) through Wallneuk Junction resulting in 4 running lines between Arkleston and Wallneuk junctions. The Arkleston Up loop will be permanently removed with alternative facilities already completed at Elderslie (see below). The Arkleston Down loop will be retained, but its operational length reduced to circa 798m.

Works already completed comprise:

(vi) Provision of additional platform capacity at Glasgow Central.

(vii) Extension of the existing Up Passenger Loop at Elderslie.

3.2 Environmental Clerk of Works

3.2.1 The Planning authorities will appoint an Environmental Clerk of Works, funded by the Authorised Undertaker, for the duration of the construction period. The purpose of this appointment is to ensure that the environmental interests of areas that may be affected by the works are safeguarded. This includes ecological issues such as protected species or habitats as well as protecting the wider environment including, but not limited to noise, dust, water and waste management. The Environmental Clerk of Works will have the appropriate authority to review method statements, oversee works and recommend action as appropriate, including temporary stopping of works if required, to safeguard protected species and their habitats.

3.2.2 As required and following discussion with the Contractor regarding failure to safeguard the natural heritage interests of areas that may be affected by the works, the Environmental Clerk of Works will appoint appropriate environmental specialists, such as ecologists, as required and at the expense of the Contractor.

3.2.3 The Environmental Clerk of Works will be required to review and approve the Contractor's Method Statement (which must be submitted at least 4 weeks prior to the commencement of that phase of works) for each phase of works to ensure that natural heritage issue interests are safeguarded. The Contractor will take due cognisance of the environmental mitigation measures

included in the Environmental Statement and this CoCP and also all applicable legislation in preparing such Method Statements.

3.2.4 If the Environmental Clerk of Works considers that the detailed mitigation as proposed in the Method Statement is inadequate to deliver the environmental mitigation that the Authorised Undertaker is obliged by the Act to provide, the Environmental Clerk of Works shall consult with the local planning authorities and will seek advice from SNH and SEPA regarding these mitigation measures.

3.2.5 If during construction the Environmental Clerk of Works considers that the mitigation that is being implemented in relation to any activity or work appears to be inadequate or does not comply with the Authorised Undertaker's obligations under the Act to implement any specific requirements of the Act relating to environmental mitigation, any other legislation, the Environmental Statement, the CoCP or any relevant local construction code, the activity or works in question will be stopped and will not recommence until further mitigation has been discussed with SNH and/or SEPA and agreed with the local planning authorities.

3.3 Construction Compounds

3.3.1 As the work will take place over an extended period the Contractor will need various secure places to store plant, equipment and material and to assemble engineering components. In addition, office and messing accommodation may be provided depending on the size and duration of occupation at the compound.

3.3.2 Suitable locations for these construction compounds have been identified and the following locations, relating to which section of the scheme being worked on, are proposed.

3.3.3 Main Railway Line (west to east) Construction Compounds:

(i) Area of land immediately to the south of the Paisley viaduct between Renfrew Road and East Buchanan Street owned by NR (with access from East Buchanan Street);

(ii) Area at the junction of the dismantled Arkleston Branch to the north of the main line but within the NR boundary;

(iii) Area of land owned by NR to the south of Arkleston Road bridge next to Barshaw Golf Course (with access from Arkleston Road);

(iv) Area to the south of Fifty Pitches Road immediately to the north of Cardonald Junction (with temporary access from Fifty Pitches Road);

(v) Area of land owned by SPT to the east of the Transco Gas Holder north of the railway (with access from Broomloan Road near the junction with Paisley Road West); and

3.3.5 Additional activities to be undertaken at particular construction compounds and working areas, where these differ or augment the conditions set out below and in Section 4 of the CoCP, are discussed in more detail on Section 5 of the CoCP.

3.4 Hours of Working

3.4.1 The hours of working for the construction works will include both night and day time working as set out in the Network Rail Possession Summary.

3.4.2 Where required, an application to the Local Authority for variation to the Section 61 consent, as defined in the Control of Pollution Act 1974, as amended by the Building Scotland Act 2003 (Schedule 6 paragraph 10(c)(ii)), on noise limits for each of the work sites or Construction Compounds required for the scheme, will be made. Procedures for notifying the public of changes to working hours will be carried out in accordance with Section 2 of the CoCP.

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3.5 Delivery Routes

3.5.1 For works on the main railway line, it is intended that the majority of materials will be transported to each construction compound by rail, as these are all adjacent to the railway. However, road access will be required for some delivery of materials and for personnel to enter these sites and the local road network will be utilised in each case.

4. General Requirements

4.1 Introduction

4.1.1 This section identifies the general aspects of construction works that could impact on local communities and the environment. Activities specific to the main construction zones, construction site compounds and particularly sensitive areas are addressed in Section 5 of the CoCP.

4.2 Public and Private Highways

4.2.1 Where required the Contractor shall submit to the Authorised Undertaker a statement setting out the proposed measures to be taken with respect to traffic and safety, and which shall be approved by the statutory Roads Authority prior to the commencement of work. The statement will be prepared in consultation with the relevant departments of the Local Authority, the Police and the Authorised Undertaker. Upon commencement of the construction works the approved statement shall be implemented and complied with throughout the construction period. It is intended that measures to be taken with respect to traffic and safety will include where appropriate:

(i) Where temporary road closures and/or restrictions are required during construction the Authorised Undertaker shall, at its expense and depending on the nature of the road closure as determined by the provisions of the GARL Act, consult with the local CLG / and as appropriate consult, or obtain the consent of, the Local Authority on the arrangements relating to the making, implementation and enforcement thereof;

(ii) Use of adequate signing/lighting safety fencing wherever works are in progress to facilitate the safety of all groups of road users; and

(iii) Prior publication of the proposed programme of roadworks so that the CLG and the public are kept fully informed of proposed temporary road closures and restrictions.

4.2.2 Approved routes to the working sites and compounds will be identified and the requirement to access the site via those routes will be a condition of the Contract. In addition, the following requirements, at all times, apply to the construction works:

(i) Any temporary footways and ramps on the public highway will be of an adequate width and surfaced in materials to the reasonable satisfaction of the Local Authority. The specifications/dimensions are available as part of the Contract specification;

(ii) All openings or obstructions on the carriageway or footway will be barricaded with a continuous rail (with appropriate lighting where required) stable enough to offer appropriate resistance and remain effective should someone who is visually impaired collide with it;

(iii) All pedestrian routes diverted onto the carriageway will be clearly defined by continuous barriers, constructed to the reasonable requirements of the Local Authority. The specifications/dimensions will be available as part of the Contract specification;

(iv) So far as is reasonably practicable, all parts of the public highway including drainage systems will, at all times, be kept free from mud and loose materials arising from the

works. To comply with these requirements the Contractor shall take the following measures:-

- Provide easily-cleaned horizontal surface for vehicles entering, parking and leaving any work site. Haulage routes within the scheme limits will be surfaced;
- If required, provide wheel washing facilities at the exits from Construction Compounds and work sites, including, where reasonably practicable, mechanical wheel spinners, adequate provision for drainage via settlement tanks and regular maintenance of settlement tanks,
- If required provide an approved mechanical road sweeper to clean work sites and any mud or debris deposited by site vehicles on roads or footpaths in the vicinity of each work site,
- Ensure the adequate sheeting of each lorry carrying materials which may give rise to dust generation and to prevent spoil falling during its journey to its final destination;

(v) Vehicles entering and leaving each Construction Compound or work site will only be allowed to cross footways via properly constructed crossings;

(vi) Access which is deemed to include both the route and entrance to any work site by lorries will be as agreed with the Authorised Undertaker and the appropriate statutory body and the Police;

(vii) No daytime or overnight parking of vehicles associated with the works in the vicinity of any work sites or Construction Compounds will be allowed except where delivery or removal of materials is taking place at that location or with prior agreement with the Authorised Undertaker and the appropriate department of the Local Authority;

(viii) All parked vehicles or vehicles waiting to enter any work site or Construction Compound will be required to switch off their engines after arrival;

(ix) Road surfaces on public and private roads used as haul routes will be repaired by the Contractor, to the reasonable satisfaction of the Local Authority, to ensure that damage caused by Contractor's vehicles, delivery vehicles, plant, etc., such as rutting of surfaces, pot holes, damage to kerbs, etc., are made good as soon as possible after damage occurs. Such repair works required for damage would be agreed with the Local Authority or by the private road authority as appropriate;

(x) All street furniture and other features such as trees within the Act limits that are not required to be removed or directly affected as part of the works will be carefully protected in accordance with the reasonable requirements of the owners thereof and agreement with the Authorised Undertaker. Any damage caused by the Contractor will be made good as soon as reasonably practicable, to the satisfaction of the owner of the street furniture or other features at the Contractor's expense; and

(xi) The Contractor shall ascertain and comply with any restrictions in respect of abnormal load routes as they may affect access to any work site.

4.2.3 Proposals for the temporary closure or diversion of any public right of way, that are not identified in Schedule 3 to the Act, will be subject to consultation with the local CLG and submitted to the relevant department of the Local Authority for approval prior to commencement of any construction works.

4.3 Noise

4.3.1 The Contractor shall, as far as reasonably practicable, be required to prepare predictions of construction noise, prior to commencement of the construction works, in order to establish achievable noise levels at each specific work site or Construction Compound. These predictions shall be made in accordance with BS 5228: Part 1: 1997 Noise Control on Construction and Open Sites, and be presented to Authorised Undertaker and the relevant department of the Local Authority for comment.

4.3.2 If requested by the ECOW and the Local Authority, the Contractor shall seek agreements with the Local Authority under section 61 of the Control of Pollution Act 1974, as amended by the Building Scotland Act 2003 (Schedule 6 paragraph 10(c)(ii)), on noise limits for each of the work sites or Construction Compounds required for the scheme. For the purposes of the CoCP, Construction Compounds shall mean those locations utilised by the Contractor for the purposes of storage of plant, machinery, materials and the positioning of cabins etc., in connection with the construction works.

4.3.3 The Contract tender documents will include noise criteria as defined in Appendix B with which the successful Contractor will be required to comply. The Intervention Criteria are based on British Standard BS5228.

4.3.4 Prior to the commencement of any construction work, the Contractor will be required to demonstrate to the Authorised Undertaker that he can comply with these Intervention Criteria and/or the criteria contained within the section 61 agreements, if the latter are more stringent.

4.3.5 Where it is predicted that construction noise levels will exceed the published Intervention Criteria the Contractor will be required to implement mitigation measures in order to avoid triggering the Intervention Criteria. Examples of noise mitigation measures that may be employed by the Contractor in order to avoid triggering the Intervention Criteria include:

(i) Construction Compound to be surrounded with fencing or other barriers, where appropriate, and continuous plant to be housed in acoustic enclosures;

(ii) Use of electrical items of plant instead of diesel or petrol plant in especially sensitive locations;

(iii) Exhaust silencing and plant muffling equipment to be maintained in good working order;

(iv) Use of temporary screens at sensitive locations;

(v) All plant, whether stationary or mobile, to only have its engine running when actually in use or when being prepared for use, such as an air compressor building up pressure after being initially turned on. Covers on plant which reduce emitted noise levels shall be maintained in good condition and shall be kept in effective operation at all times when the plant's engine is running; and

(vi) Temporary cessation of works.

4.3.6 The measures listed above are not exhaustive. Further reasonable measures may be required from time to time which should be agreed between the Contractor and the Authorised Undertaker, so that noise and vibration impacts can be reassessed and appropriate mitigation measures approved on receipt of the appropriate method statement.

4.3.7 Should it be predicted that the proposed works at particular working areas or Construction Compounds will trigger the Intervention Criteria **and** that such noise levels cannot be mitigated at source, (demonstrated to the satisfaction of the ECOW) then the ECoW may stipulate that further mitigation is required. Should that be the case then the Authorised Undertaker shall make contact with owners of eligible properties and offer to provide secondary glazing or to arrange temporary re-housing, as appropriate, during such periods as defined in Appendix B.

4.3.8 Where the need for temporary housing is predicted, the Authorised Undertaker will liaise with the resident(s) affected to ensure that the provision of temporary housing is adequate and acceptable to the resident(s) and as far as possible is on a 'like for like' basis in terms of location, capacity and facilities (e.g. disabled access, etc.).

4.3.9 It should be noted, however, that those offered secondary glazing or temporary re-housing do not necessarily have to take up such offers. In addition, it should also be noted that the Authorised Undertaker would be unable to provide financial compensation in lieu of the measures set out in Appendix B.

4.3.10 If the Contractor wishes to change his proposed method of working once the construction works commence and this is predicted to trigger the Intervention Criteria, then this can only be accepted following agreement with the ECOW, Authorised Undertaker and the relevant department of the Local Authority.

4.3.12 The Contractor shall monitor background noise, for the purpose of checking compliance with the Intervention Criteria. If requested the monitoring results will be provided to the Authorised Undertaker and will include the location and frequency of monitoring. The Authorised Undertaker will pay particular attention to monitoring noise at or in the immediate vicinity of residences of objectors for whom such potential impacts is a concern. The results of such monitoring will be made available to the public.

4.3.13 Without the foregoing general stipulations, the following specific locations (for noise and vibration monitoring – see section 4.4.7 below) will be included as a minimum:

(i) Mainline access points near Fochabers Drive;

(ii) The eastern end of Cardonald Station;

(iii) At or near Urrdale Road and the M8 Underpass close to Urrdale Road; and

(iv) At Ladykirk Drive/Chirnside Road.

4.4 Vibration

4.4.1 The Contractor shall, as far as reasonably practicable, prepare predictions of construction vibration prior to commencement of the construction works in order to establish achievable vibration levels at specific work sites. Guidelines for controlling vibration are set out in Appendix C of the CoCP.

4.4.2 If requested by the ECOW and the Local Authority, the Contractor shall seek agreements with the Local Authority under section 61 of the Control of Pollution Act 1974, as amended by the Building Scotland Act 2003 (Schedule 6 paragraph 10(c)(ii)), on vibration limits for each of the work sites or Construction Compounds required for the scheme.

4.4.4 The contract tender documents will include vibration criteria as defined in Appendix C which must be complied with by the Contractor in relation to the proposed method of working, type of plant to be used, and vibration mitigation measures for each work site.

4.4.5 The Contractor shall take all reasonable measures to protect local residents, nearby property and the occupiers thereof from nuisance and physical damage that may be caused by vibration.

4.4.6 If the Contractor is proposing to use driven piles at any location, a method statement report must be provided. All methods of construction will be approved by the Authorised Undertaker in advance of work.

4.4.7 The contractor shall undertake a programme of on-site vibration monitoring by a suitably qualified practitioner. If requested the results shall be provided to the Authorised Undertaker and such a programme will include the location and frequency of readings. The Authorised Undertaker will pay particular attention to monitoring noise and vibration at or in the immediate vicinity of residences of objectors for whom such potential impacts is a concern. The results of such monitoring will be made available to the public.

4.4.8 The Contractor shall make good damage to public roads and other routes used by construction traffic to the reasonable satisfaction of the Local Authority, in order that potholes and other unevenness, which may be a source of vibration, are addressed and repaired quickly.

4.4.9 The Contractor shall carry out a risk assessment of those buildings and structures that may be vulnerable to vibration generated by the works. A two stage process would be used to identify those buildings and structures as follows:

1. The first stage would involve a review of the proximity of the buildings/structures to the proposed works. BS5228: Part 4: 1992 Code of practice for Noise and Vibration Control Applicable to Piling Operations would be used to predict the construction vibration at various distances and the potential buildings and structures would be derived from that assessment, and

2. The buildings and structures would be screened based on a range of factors including their form, type, age and sensitivity (e.g. heritage, listed etc…). Based on this and the application of guidance within BS7385, BRE and TRL research the potential buildings and structures would be derived.

In addition to the above process, the Authorised Undertaker would review any building/structure specific requests for condition surveys received from members of the public or affected parties. Based on the assessment of risk, condition surveys of buildings and structures deemed to be vulnerable will be undertaken in order to establish the ‘baseline’ condition of such buildings and structures before commencement of construction works. Copies of any Condition Survey reports will be provided to the Owner of or Authority responsible for the structure.

4.5 Dust and Air Pollution

4.5.1 The Contractor shall take necessary measures to avoid creating a dust nuisance. If requested, information shall be submitted to the Authorised Undertaker setting out the proposed measures to be taken to prevent dust nuisance. Upon commencement of the construction work, the approved statement will be implemented and complied with throughout the period of the construction work.

4.5.2 Additional control measures and site boundary monitoring may be required, depending upon the working methods employed, where land known to be contaminated is disturbed. Site boundary monitoring is to be carried out by an independent specialist at the Contractor's expense for the Authorised Undertaker in consultation with the relevant department of the Local Authority.

4.5.3 Examples of measures to prevent dust emissions to be included in the Contractor's statement are set out in Appendix D to the CoCP.

4.5.4 It should be noted that the measures referred to above are not exhaustive. Further reasonable measures may be required from time to time which should be agreed between the Contractor and the Authorised Undertaker.

4.5.5 The Contractor will be responsible for carrying out daily visual inspections of dust control measures during the currency of works. In the event of dust generation the Contractor will immediately review their dust control measures .

4.5.6 The Contractor shall take all necessary precautions as are reasonably practicable to prevent the occurrence of smoke emissions or fumes from site plant or stored fuel oils for safety reasons and to prevent, as far as is reasonably practicable, such emissions or fumes drifting into residential areas, nearby workplaces or areas of public open space. In particular, plant shall be well maintained and measures taken to prevent engines left running for long periods when not directly in use. Plant which emits visible emissions after warm-up shall be taken out of service either repaired or replaced.

4.6 Handling and Disposal of Contaminated Material (Including Waste)

4.6.1 The Contractor shall carry out the works in such a way as to prevent, contain or limit as far as reasonably practicable any adverse impacts arising from the presence of contaminated land or material during construction activities. The Contractor shall take all necessary measures to deal with noxious and toxic materials encountered. All contaminated sites and the hazards that they present will be identified in consultation with the relevant department of the Local Authority prior to the commencement of work.

4.6.2 Where contaminated material is excavated, it will be necessary to determine the concentrations of any contaminants. Once this has been carried out the results will be used to classify the materials as hazardous or not following guidance including Hazardous Waste: Interpretation of the definition and classification of hazardous waste guidance. This will allow the material to be handled and disposed of in accordance with the appropriate legislation including the Special Waste (Scotland) Regulations 1996. If concentrations of contaminants allow the waste to be utilised elsewhere on site, advice should be sought from SEPA. An exemption under the Waste Management Licensing Regulations 1994 may be required before the use of any such materials on site. Where contaminated materials require disposal, this shall be to a licensed waste disposal site and all parties will discharge their statutory obligations in relation to the waste management Duty of Care, imposed by Section 34 of the Environmental Protection Act 1990, etc. and the Special Waste (Scotland) Regulations 1996.

4.6.3 The disposal of waste, including any surplus spoil, will be managed to maximise the environmental and developmental benefits from the use of surplus material and to reduce any adverse environmental effects of disposal. Waste materials will be managed in accordance with current statutory guidance concerning the use, storage, movement and disposal of controlled wastes.

4.6.4 In the event that the Contractor wishes to arrange for any recycling of contaminated materials encountered during the construction works, then before undertaking any recycling measures he shall agree with the Authorised Undertaker, who will consult with the Local Authority, and agree to the recycling of such materials. SEPA may also have to be consulted as an exemption under the Waste Management Licensing Regulations 1994 may be required.

4.6.5 Waste generated from the construction works will be minimised by re-use and recycling where possible. Waste stored on site will be segregated according to its type to prevent cross-contamination of controlled wastes and special wastes. Separate storage facilities for waste to be recycled will also be provided by the Contractor. Dependant on the type of material being stored, the quantity of materials and the length of time the materials will be stored, an exemption under the Waste Management Licensing Regulations 1994 may be required. Discussions should be undertaken with SEPA at the earliest opportunity.

4.6.6 Waste will be stored in covered skips to prevent dust and litter being blown out and to prevent accumulation of rainwater.

4.6.7 Should invasive species (such as Japanese Knotweed, etc.) be found, the Contractor shall follow guidance from SEPA in relation to the 'On-site management of Japanese Knotweed and associated contaminated soils'. The removed material should not be reused for construction or landscaping purposes.

4.6.8 The Contractor shall make reference to the HSE publication, HSG 66 Protection of Workers and General Public during the Development of Contaminated Land 1991, for guidance on precautions required during construction on potentially contaminated sites. In particular, the Contractor shall ensure that all reasonable precautions are taken to protect workers and members of the public from exposure to any noxious or toxic chemicals. These precautions will include:

(i) Protective clothing, including overalls, hand protection, head protection, and appropriate safety footwear to be worn at all times by all authorised personnel in line with Network Rail policies;

(ii) Contact with fill materials to be avoided;

(iii) If skin contact occurs, the affected area should immediately be washed;

(iv) Footwear should be cleaned off prior to leaving the site;

(v) During prolonged dry periods, if there is the potential for significant dust generation in construction, the surface of the site should be damped down;

(vi) Entry into confined spaces and trenches should be minimised. If entry is necessary, then this will be in accordance with the Confined Space Regulations 1997 with a safe system of work established, and recorded in the relevant method statement.

(vii) If it is necessary to remove contaminated materials from site, then open lorries or skips used for that removal will be sheeted; and

(viii) Detailed records of disposal are necessary and the Contractor should discuss the content of such records with SEPA.

4.7 Protection of Surface and Groundwater Resources

4.7.1 The Contractor shall carry out the works and implement working methods devised to protect surface and groundwater from pollution and other adverse impacts including changes to flow volume, water levels and quality. All site activities will be carried out in accordance with all current legislation as well as current SEPA Pollution Prevention Guidance notes, such as:

(i) PPG01 - General Guide to the Prevention of Pollution

(ii) PPG02 - Above Ground Oil Storage Tanks

(iii) PPG05 - Works In, Near or Liable to Affect Watercourses

(iv) PPG06 - Working at Construction and Demolition Sites

(v) PPG09 - Pesticides

(vi) PPG21 - Pollution Incident Response Planning

(vii) PPG23 - Maintenance of Structures Over Water

4.7.2 The Contractor shall agree in advance with the Authorised Undertaker, SEPA, the relevant department(s) of the Local Authority and Scottish Water, any proposed drainage schemes required for the construction of the works.

4.7.3 The Contractor shall obtain the appropriate consents, authorisations or licences from the appropriate bodies including SEPA or Scottish Water for discharges to watercourses, sewers or groundwater in accordance with relevant statutory provisions. Once consents, authorisations or licences have been obtained, the Contractor shall identify and comply with any and all conditions appropriate to that consent, authorisation or licence.

4.7.4 The Contractor shall obtain the appropriate licences from SEPA for works in, or in the vicinity of watercourses in accordance with the Water Environment (Controlled Activities) (Scotland) Regulations 2005.

4.7.5 In planning and carrying out any construction works, precautions are to be taken to secure the protection of watercourses and water in underground strata against pollution. Those should include a ground investigation of sites where past use of the site has indicated the potential for contamination to ensure that suitable mitigation measures are applied where contaminated land is disturbed.

4.7.6 The Contractor shall take all reasonable steps such that all personnel are aware of the risks of infections, such as leptospirosis when working in a river environment.

4.7.7 If any pollution incident occurs, then the Contractor shall advise SEPA immediately and take prompt action to minimise the effect. A procedure will be in place to ensure an effective response to a pollution incident. This procedure will be agreed with the Authorised Undertaker in advance of the commencement of any works.

4.7.8 A common cause of pollution from sites is through vandalism. Therefore, the Contractor shall take all reasonable steps such that sites are adequately protected.

4.7.9 In order to limit pollution from silt and cement, the Contractor shall act in accordance with the following measures:

(i) Designated wash-down areas will be required for concrete mixing plant, the wash water from which must not be allowed to flow into any drain or watercourse. Washings must be contained in sealed units for disposal off site. Ready-mixed concrete lorries shall not be washed on site and must return to their bases for wash-down where practicable.

(ii) Site roads must be regularly swept or scraped and kept free from deposits in order to prevent silt, oil or other materials entering any drain or watercourse;

(iii) Any wheel wash facilities should be securely constructed with no overflow and effluent should be contained for proper treatment and disposal;

4.7.10 There is the need for excavations and working areas to be kept dry. Consequently, there may be the requirement to dewater working areas and excavations. Discharge of dirty water from excavations into water courses will be strictly prohibited. Various methods for the treatment of dirty water may be used, including but not limited to:

(i) Temporary drainage to ensure controlled management of runoff draining from the construction site shall be prepared. This shall be based on the guidance contained within CIRIA Document C521 'Sustainable Urban Drainage Systems – Design Manual for Scotland and Northern Ireland'.

(ii) Discharge to vegetated areas where the slope of the land is not towards a water course or wetland area and the distance between the discharge point and any water course or wetland area is sufficient to allow dirty water to permeate through the ground. Silt fences may be utilised to slow the water and aid settlement and sediment removal.

(iii) Discharge to settlement lagoons. Settlement lagoons will require to be constructed following best practice and be of sufficient size as to cope with the discharged flow rate.

(iv) Discharge via silt buster or other such mechanical settlement tank. Settlement tanks will require being of sufficient size to allow free sediment to settle. The discharge from the settlement tank will require being at a rate which will not result in soil erosion to the discharge points. Erosion protection will be used at discharge points where necessary.

(v) As noted in Section 4.7.3, the Contractor will be required to obtain the appropriate consents, authorisations or licences from the appropriate bodies including SEPA or Scottish Water for discharges to watercourses, sewers or groundwater in accordance with relevant statutory provisions. Once consents, authorisations or licences have been obtained, the Contractor shall identify and comply with any and all conditions appropriate to that consent, authorisation or licence.

4.7.11 In order to prevent pollution from oil, fuel and chemicals:

(i) Minimal amounts of fuels, oils and other potential contaminants etc shall be stored in site compounds. These shall be stored in secure designated storage areas and in accordance with the appropriate regulatory requirements, including COSHH Regulations 1994 and the Water Environment (Oil Storage) (Scotland) Regulations 2006. In accordance with PPG03, PPG 08 and PPG 26 any such tanks shall be sited on an impermeable base within an oil-tight bund, which shall be capable of containing 110% of the volume of the oil container. The bunded area shall be cleared regularly to limit the

build up of residues and if necessary, waste shall be disposed of through a specialised contractor.

(ii) Filling and refuelling must be strictly controlled and together with any oil storage tanks, should be confined to a location remote (at least 10m) from any watercourse or drain;

(iii) Leaking or empty drums must be removed from the site immediately;

(iv)Any tanks or drums of non oil based chemicals must be recorded and additional records kept as required by the Control of Substances Hazardous to Health Regulations 2002 (COSHH Regulations). Storage facilities should, at the very least, be secure containers or compounds which should be kept locked when not in use;

4.7.12 Prior to being discharged into any watercourse, surface water sewer or soakaway system, all surface water drainage from impermeable parking areas, roadways and hardstanding for vehicles shall be passed through an oil interceptor designed and constructed to have a capacity and details compatible with the site being drained. Roof water should not pass through such interceptors. Additional treatment such as settlement may be required prior to discharge as detailed in Section 4.7.10. Where such interceptors are provided, for example in high risk areas, these should be in addition to SUDS or equivalent system(s).

4.8 Ecology and Biodiversity

4.8.1 Prior to commencing the construction work, the Contractor shall establish a policy for dealing with trees which may be directly or indirectly affected by the works and liaise with the Local Authority as necessary. Such a policy will be consistent with BS 5837:2005 Guide for trees in relation to construction. In particular:

(i) The Contractor shall carry out all arboricultural works in accordance with BS 3998 Recommendations for tree work 1989;

(ii) The Contractor shall protect any trees or hedges which are not required to be taken down under the Contract by installing fencing or visible barriers prior to works commencing, and these will be maintained throughout the works. The protection provided by such fencing should include protection of the area occupied by the tree roots.

4.8.2 The Contractor shall comply with the provisions of the Wildlife and Countryside Act 1981, The Protection of Badgers Act 1992, Conservation (Natural Habitats, &c.) Regulations 1994 and the Nature Conservation (Scotland) Act 2004 together with any specific requirements agreed with the relevant department of the Local Authority. The Contractor shall be required to develop a specific method statement for site specific requirements. The following general principles are applied, however, it must be noted that the Contractor must implement further measures in order to comply fully with legislative requirements, including:

(i) Wherever wildlife habitats remain alongside working areas, provision shall be made by the Contractor to prevent encroachment onto valuable ecological areas that are not essentially required for construction. This shall include the provision of secure fencing where appropriate;

(ii) Harm to badgers and other wildlife should be avoided by ensuring that construction materials and structures are contained within secure compounds;

(iii) Prior to any works being carried out next to a watercourse, surveys for otters and water voles will be undertaken;

(iv) Prior to commencement of works habitat surveys will be undertaken;

(v) Measures to inspect cleared vegetation for reptiles prior to removal from site and measures to relocate any reptiles found on site will be instigated;

(vi) Prior to felling or surgery on trees over 8m height and/or 30 cm diameter, the Contractor shall commission a bat survey of the affected trees, using an appropriately licensed surveyor, and will undertake any mitigation or protective measures that may be required by Scottish Natural Heritage (SNH) should bats or their roosts be located. In addition, water storage tanks (and other containers) on site shall be sealed to prevent bat entry;

(vii) Vegetation clearance will be undertaken during September to March, outside the main breeding season for most species. The clearance will be carried out in stages to allow fauna to move from the working area. Cleared vegetation will be stockpiled for two days or more to allow fauna to escape prior to the disposal of the material;

(viii) Standards of dust and air pollution control, as set out in Section 4.5 will be applied at all work sites to protect adjacent habitats; and

(ix) Suitable precautions will be taken to prevent entry of pollutants into any bodies of water as set out in Section 4.7.

4.9 Site Boundaries/Hoarding/Temporary Structures on the Public Highway

4.9.1 The Contractor shall sufficiently and adequately secure all work sites from members of the public in order to prevent anyone straying onto the work sites. If hoardings are provided, suitable bulkhead lights will be fitted where necessary.

4.9.2 The provision of gates in the fencing or hoarding should, as far as reasonably practicable, be positioned and constructed to minimise the noise transmitted to nearby noise-sensitive receptors from the work site directly, or from plant entering or leaving the site.

4.9.3 The Contractor shall maintain security at enclosed work sites on a 24 hour basis where it is identified that such security measures are required in order to prevent unauthorised entry or exit from the work sites. Site gates will be closed and locked when there is no site activity. Any alarms provided by the Contractor should meet health, safety and nuisance requirements and be maintained in a satisfactory working condition at all times.

4.9.4 If agreed with the Authorised Undertaker, where any hoardings are provided, the Contractor paint them on the side facing away from the site in a plain uniform manner.

4.9.5 The Contractor is expressly prohibited from displaying or allowing to be displayed any advertisement, notice, etc., including illicit bill or fly posting on the hoardings. The Contractor shall also remove all graffiti or defacement to the hoardings such that they are made good as soon as reasonably practicable.

4.9.6 At each enclosed Construction Compound site an information board will be provided detailing information on the project, together with telephone contacts (including an emergency telephone number), addresses and email address for use by members of the public who wish to lodge complaints or comments.

4.9.7 Where any fenced storage areas, scaffolding gantries, loading/unloading bays, skips and other temporary structures provided by the Contractor are located on the public highway these will be maintained by the Contractor in accordance with the appropriate licence granted by the relevant department of the Local Authority.

4.9.8 The Contractor shall take appropriate steps such that construction buildings, equipment and lighting are sited so as to minimise visual intrusion, consistent with the efficient operation of each work site.

4.10 Archaeological Remains

4.10.1 Where a records search identifies existence of known archaeological remains, the Contractor, prior to commencement of any construction work, shall consult with the Authorised Undertaker, the West of Scotland Archaeology Service (WoSAS), Historic Scotland and the Authorised Undertaker's Heritage Advisor to agree a scheme for archaeological mitigation setting out the proposed measures to be taken to prevent damage to known and unknown archaeological remains. Where required, approval will be sought from Historic Scotland. Upon commencement of the construction work, the approved statement will be implemented and complied with throughout the period of the construction work.

4.10.2 Measures to be addressed in the scheme of archaeological mitigation will include field investigation and recording work. Any archaeological excavation and recording work will be required to be undertaken by the Contractor's Field Archaeologist for:

(i) The preservation of features *in-situ*;

(ii) The translocation of features to be preserved away from the route of the project;

(iii) Procedures for advance notification of works in areas where close archaeological monitoring is necessary

(iv) A methodology for the watching brief and liaison with WoSAS; and

(v) A methodology for any archaeological excavation fieldwork assessment and preparation of the cultural heritage archive.

4.10.3 The methodologies adopted for various stages of the work will conform to the Institute of Field Archaeologists Standards and Guidance documents.

4.10.4 The Contractor shall take all reasonable precautions to prevent his workmen or any other persons from removing or damaging any fossils, coins, articles of value or antiquity, structures or other remains, or any other thing of archaeological interest discovered either at the time of the archaeological excavation or during subsequent construction works except for material recovered during archaeological mitigation or for the purposes of preservation at another location.

4.11 Built Heritage

4.11.1 The Contractor shall carry out the works in such a way as to protect, conserve, enhance or minimise the impact on historic buildings (including Listed Buildings), historic areas (including Conservation Areas) and their settings. The Contractor shall submit to the Authorised Undertaker an approved statement or statements, setting out the proposed works, methods to be used and measures to be taken, with respect to historic buildings and areas on sites.

4.11.2 Upon commencement of the construction work any relevant statement will be implemented and complied with throughout the construction period. The advice given in National Planning Policy Guidance Note 18, 'Planning and the Historic Environment', Planning Advice Note 42 'Archaeology- the Planning Process and Scheduled Monument Procedures and BS 7913:1998 Guide to the Principles of Conservation of Historic Buildings should be followed.

4.11.3 The Authorised Undertaker will ensure that all necessary detailed planning approvals are obtained before the start of the relevant part of construction and that the Authorised Undertaker and Contractor comply with the requirements stipulated in any approvals and the conditions therein.

4.12 General Requirements for Construction Compounds

4.12.1 The Contractor shall meet the following general requirements in relation to the construction compounds:

(i) Smoking areas are provided at suitable locations at ground level, as far as is practicable and in compliance with relevant legislation and standards. Smoking will not be allowed at any location below ground level;

(ii) All fires are prohibited, including fires for the disposal of vegetation, packaging, or any other material.

(iii) Rubbish is removed at frequent intervals and each work site kept clean and tidy;

(iv) Adequate toilet facilities are provided and kept clean;

(v) Food waste is contained and removed at least weekly;

(vi) Wheel washing facilities are brushed clean at frequent intervals;

(vii) Detailed daily records are kept of climatic conditions including rainfall, minimum and maximum temperatures, and humidity and wind direction;

(viii) Records of construction plant used on the site shall be maintained at weekly intervals; and

(ix) All necessary measures are taken to minimise fire risks and the Contractor shall comply with the requirements of the local Fire Authority.

4.12.2 Upon completion of construction, the Contractor shall be responsible for the reinstatement of construction compounds locations.

4.12.3 Each work site may be inspected on a frequent basis by a nominated representative from the Authorised Undertaker. A mutually acceptable timescale for site inspections will be agreed between the Contractor and the Authorised Undertaker with a view to undertaking an audit no less frequently than yearly. Should the Contractor be found not to be complying in any respect with the CoCP he will be subject to the relevant conditions of the Contract which will stipulate the period by which compliance will be effected. If the Contractor fails to rectify the non-compliance the Authorised Undertaker will take remedial action.

4.12.4 The Contractor shall not allow any living accommodation on site except with the prior consent of the relevant department of the Local Authority. Portable mess rooms, locker rooms, toilets and showers will be permitted.

4.12.5 At each work site all vehicles will enter and exit in a forwards direction except where space restriction does not permit this. In that event movement will be properly controlled by a responsible person(s) observing the rear of the vehicle (a banksman).

4.12.6 The Contractor shall provide suitable lighting to the site boundaries and where appropriate with illumination sufficient for the safety of the passing public including mobility impaired people. Site lighting must be designed, positioned and directed so as not to unnecessarily intrude on passing drivers on public highways, and having due regard to residential premises neighbouring the site.

4.12.7 If site security cameras are provided by the Contractor, these must be located in positions which are not likely to cause offence to local residents or commercial business premises.

4.12.8 The Contractor shall prepare emergency procedures to be implemented in the event of an environmental incident such as an accidental spillage.

4.12.9 In compliance with Network Rail's Site Management process's the Contractor shall on completion of shifts undertake a site tidy exercise and remove from each work site all plant, surplus materials, rubbish and temporary works which is either not required and/or cannot be safely or securely left for forthcoming shifts.

4.13 Training and Monitoring the Implementation of the CoCP

4.13.1 The Contractor shall prepare and implement a training programme to ensure that all site personnel are aware of the requirements of the CoCP. The training package will be approved by the Authorised Undertaker in consultation with third parties including the relevant departments from the Local Authority, SEPA, SNH, Historic Scotland and the HSE.

4.13.2 A suitably qualified person appointed by the Contractor and approved by the Authorised Undertaker will oversee the ongoing implementation and monitoring of the CoCP. This person will be responsible for managing the continued effective implementation of the CoCP for the duration of the construction works, and undertake compliance audits against the CoCP. These audits will be included as a project KPI.

5. Site Specific Requirements

5.1 Introduction

5.1.1 This chapter sets out any site-specific requirements associated with particular working areas and Construction Compounds, over and above those discussed in the previous section. A number of proposed locations for Construction Compounds have been identified during the development of the scheme and these are listed below; however, ultimately it will be the Contractor's responsibility to select those sites that he deems most suitable to be used as Construction Compounds.

5.2 Main Railway Line

5.2.1 This section covers construction compounds adjacent to the existing railway and works on the main railway line.

5.2.2 Proposed Works in this area will comprise major reconfiguration of the railway line at and between Wallneuk and Arkleston to provide 4 main line tracks and a high speed junction at Arkleston. A new third track will installed between Arkleston Junction and Gower Street Junction (just to the west of Shields Junction) and will incorporate new signalling for the third track, new telecommunications, power and distribution supplies, OLE wire and gantry structures.

5.2.3 Associated with the installation of the new third track will be the reconfiguration of Cardonald Junction and Gower Street Junctions to provide crossovers between the existing two tracks and the new third track.

5.2.4 The Contractor shall be required to comply with all restrictions stipulated in Section 4 above.

Appendices

Appendix A: Schedule of Agreements and Approvals

(To be populated as Agreements and Approvals are made)

Appendix B: Noise Intervention Policy

CONSTRUCTION NOISE – IMPACTS TO RESIDENTIAL AREAS

Terminology

Between the quietest audible sound and the loudest tolerable sound there is a million to one ratio in sound pressure (measured in Pascals, Pa). Because of this wide range a noise level scale based on logarithms is used in noise measurement called the decibel (dB) scale. Audibility of sound covers a range of approximately 0 to 140 dB.

The human ear system does not respond uniformly to sound across the detectable frequency range and consequently instrumentation used to measure noise is weighted to represent the performance of the ear. This is known as the 'A weighting' and annotated as dB(A).

The Table B1 lists the sound pressure level (SPL) in dB(A) for common situations.

Typical Noise Level, dB(A)	Example
0	Threshold of hearing
30	Rural area at night, still air
40	Public library, Refrigerator humming at 2m
50	Quiet office, no machinery
Boiling kettle at 0.5m	
60	Normal conversation
70	Telephone ringing at 2m, Vacuum cleaner at 3m
80	General factory noise level
90	Heavy goods vehicle from pavement, powered lawnmower at operator's ear
120	Discotheque - 1m in front of loudspeaker
140	Threshold of pain

The noise level at a measurement point is rarely steady, even in rural areas, and varies over a range dependent upon the effects of local noise sources. Close to a busy motorway, the noise level may vary over a range of 5 dB(A), whereas in a suburban area this may increase up to 40 dB(A) and more due to the multitude of noise sources in such areas (cars, dogs, aircraft etc.) and their variable operation. Furthermore, the range of night-time noise levels will often be smaller and the levels significantly reduced compared to daytime levels. When considering environmental noise, it is necessary to consider how to quantify the existing noise (the ambient noise) to account for these second to second variations.

A parameter that is widely accepted as reflecting human perception of the ambient noise is the background noise level, LA90. This is the noise level exceeded for 90% of the measurement period and generally reflects the noise level in the lulls between individual noise events. Over a one hour period, the LA90 will be the noise level exceeded for 54 minutes.

The equivalent continuous A-weighted sound pressure level, L_{Aeq}, is the single number that represents the total sound energy measured over that period. L_{Aeq} is the sound level of a

notionally steady sound having the same energy as a fluctuating sound over a specified measurement period. It is commonly used to express the energy level from individual sources that vary in level over their operational cycle.

The index adopted by the Government to assess traffic noise is $L_{A10,18h}$, which is the arithmetic mean of the noise levels exceeded for 10% of the time in each of the eighteen 1-hour periods between 06:00 and 24:00. A reasonably good correlation has been shown to exist between this index and residents' perception of traffic noise over a wide range of exposures.

The $L_{Amax,fast}$ measurement parameter is the maximum instantaneous sound pressure level attained during the measurement period (30 seconds, 5 minutes etc.), measured on the 'fast' response setting of the sound level meter. It is generally used to assess potential for night-time sleep disturbance.

Most environmental noise measurements and assessments are undertaken for 'free-field', away from any existing reflecting surfaces (other than the ground). However, it is sometimes necessary to consider noise levels immediately external to a façade when considering the impact on residents inside properties and this requires the addition of 3 dB(A) to the predicted (or measured) free-field level due to noise reflection from the façade. The assessment of road traffic noise, for example, is based on a predicted (or measured) façade noise level (using the L_{A10} statistical parameter).

Human subjects, under laboratory conditions, are generally only capable of noticing changes in steady levels of no less than 3 dB(A). It is generally accepted that a change of 10 dB(A) in an overall, steady noise level is perceived to the human ear as a doubling (or halving) of the noise level. (These findings do not necessarily apply to transient or non-steady noise sources such as changes in noise due to changes in road traffic flow, or intermittent noise sources).

Construction Noise

Noise levels generated by construction activities are regulated by guidelines and subject to Local Authority control. Advice is contained within British Standard BS 5228: Part 1: 1997 'Noise and vibration control on construction and open sites', which has statutory status by way of section 60, part 4 of the Control of Pollution Act 1974.

This British Standard contains a database on the noise emission from individual items of equipment and activities and routines to predict noise from demolition and construction methods to identified receptors. The prediction method gives guidance on the effects of different types of ground, barrier attenuation and how to assess the impact of fixed and mobile plant.

The original British Standard Code of Practice on 'Noise Control on Construction and Demolition Sites' (BS 5228: 1975, now revised to BS 5228: 1997) suggested noise reference levels for construction work based on the Wilson Report recommendations (Ref. 1), but was more precise, recommending that generally at one metre outside the nearest noise-sensitive building the equivalent continuous sound level over a 12-hour period (07.00 to 19.00 hours) should not exceed 75 dB(A). This gave some flexibility, allowing periods at a high level (exceeding 75 dB(A)) compensated by extended quieter periods.

The suggested level was not mandatory and no longer forms part of the updated 1997 Standard. However it has formed the basis of noise criteria for many modern railway projects including the Channel Tunnel Rail link, the West Coast Main Line Modernisation Scheme, Docklands Light Railway and Thameslink 2000.

The Department of the Environment Advisory Leaflet 72 'Noise control on building sites' gives advice on construction noise limits applicable at residential locations during daytime hours (07.00-19.00 hours). The leaflet states that the noise level outside the nearest occupied room (a 'façade' noise level) of a receptor should not exceed:

- 75 dB(A) in urban areas near to main roads in heavy industrial areas; or
- 70 dB(A) in rural, suburban and urban areas away from main road traffic and industrial noise.

An interim guideline issued by the Greater London Council in 1974 in connection with a major road building scheme was that properties exposed to levels over 75 dB(A) for more than 10% of the time due to construction work should be provided with sound insulation.

The above criteria, however, do not include noise for night-time working, which is not usually associated with demolition and construction works, but which can be necessary with railway infrastructure works in order to minimise the disruption to train services which the railway undertakers have a statutory duty to provide.

Consequently for the Paisley Corridor Improvements the following criteria are proposed for airborne noise during the construction phase.

Assessment Period		**Construction Noise Threshold (façade)**
Day of Week	**Time of Day**	**SPL, dB $L_{Aeq,T}$**
Monday – Fridays	**07.00 – 19.00**	**75**
Saturday	**07.00 – 13.00**	**75**
Monday – Saturdays	**19.00 – 23.00**	**65**
Saturday	**13.00 – 19:00**	**70**
Sundays & Bank Holidays	**07.00 – 19.00**	**65**
	19:00 – 23:00	**60**
Each Day	**23.00 – 07.00**	**55**

Table B2 –Paisley Corridor Improvements Construction Noise Level Criteria

Where LAeq =the equivalent continuous A-weighted sound pressure level (SPL), being the single number that represents the total sound energy measured over that period; and

Where T = 1 hour for night-time periods, otherwise T = duration of period time of day.

From the above Table B2, it can be seen that for normal daytime operations (Monday to Friday) a sound pressure level threshold of 75 dB $L_{Aeq,12h}$ (façade) is recommended between the hours of 07.00 and 19.00 hours. This reduces to 65 dB $L_{Aeq,4h}$ between the hours of 19.00 and 23.00 hours. During the night time period an overall threshold level of 55 dB $L_{Aeq,1h}$ is recommended between 23.00 and 07.00 hours.

Where possible the Contractor will use best practicable means (as defined by section 72 of the Control of Pollution act 1974) to ensure that noise levels are minimised as far as is reasonably practicable. However, despite this it is possible that noise criteria in Table B2 above may be exceeded during specific periods of the construction phase of the project. This is not unusual for railway construction projects and all of the examples of such projects quoted above adopted criteria which if exceeded acted as triggers for the offer of noise insulation or temporary re-housing. Consequently, it is proposed to adopt the following triggering criteria for secondary glazing or temporary re-housing.

Noise Insulation

Where the construction of the railway causes, or is expected to cause, construction noise levels, measured or predicted at a point one metre in front of a noise sensitive facade of a dwelling, to exceed either:

(i) the criteria in Table B2 where pre-existing ambient noise levels ($L_{Aeq,T}$) do not exceed the criteria in Table B2

Or

(ii) where the pre-existing ambient noise level ($L_{Aeq,T}$) exceeds the criteria in Table B2 above, the airborne construction noise level is predicted or measured as 5 dB above the existing airborne noise level for the corresponding times of day,

And

That either for option (i) or (ii) above, the exceedence of the criteria by construction associated airborne noise is for more than a total period of 10 or more days in any 15 consecutive days or for a total of days exceeding 40 in any six-month period

Then

That property would be eligible for secondary glazing.

From Table B2, for example, it can be seen that a property where the pre-existing ambient night-time noise level is less than 55 dB $L_{Aeq,1h}$ would be eligible for noise insulation (acoustic glazing and acoustic ventilation) if the predicted or measured night-time external façade construction noise level exceeds 55 dB $L_{Aeq,1h}$ in any single night-time hourly period or if the pre-existing ambient night-time noise level exceeds 55 dB $L_{Aeq,1h}$ the airborne construction noise level exceeds this value by 5 dB(A) or more; on 10 nights in any 15 consecutive night period, or 40 days in any six month period. This property would qualify even if there was no daytime working, or if predicted noise levels did not meet any other criteria tabulated above.

Temporary Re-Housing

Specific to re-housing (where the provision of noise insulation would not provide adequate mitigation against construction noise), the following are proposed:

Where the construction of the railway causes, or is expected to cause construction noise levels, measured or predicted at a point one metre in front of a noise sensitive facade of a dwelling, to exceed whichever is the higher of either:

(i) Where pre-existing ambient noise levels (LAeq,T) do not exceed the criteria in Table B2 above, a value 10 dB above any of the noise levels in Table B2.

Or

(ii) Where the pre-existing ambient noise level (LAeq,T) exceeds the criteria in Table B2 above, a value 10 dB above the pre-existing airborne noise level for the corresponding time of day;

And

That for either option (i) or (ii) above, the exceedence of the criteria by construction associated airborne noise is for more than a total period of 10 or more days of working in any 15 consecutive days or for a total of days exceeding 40 in any six-month period

Then

Residents at that property would qualify for temporary re-housing.

For example, where the pre-existing ambient noise level is less than the values given in Table B2 above, if the predicted night-time noise level in any single night-time hour is predicted to exceed 65 dB $L_{Aeq,1h}$ or where the pre-existing ambient noise level is more than the values given in Table B2 above, the airborne construction noise exceeds the pre-existing ambient night-time noise level by more than 10 dB, for more than 10 days in any consecutive 15 day period or more than 40 days in any six month period, then residents at that property would qualify for temporary re-housing.

Section 61 Control of Pollution Act 1974 Prior Approval

Section 61 of the Control of Pollution Act 1974 allows a Contractor to apply to the Local Authority for prior approval of construction works. The application must include particulars of the proposed works and methods and the means whereby the noise will be minimised.

In deciding whether to grant or refuse approval of the proposed works and means of minimising the noise impacts, the Local Authority has to take into account whether if the works are carried out as described in the application it would serve a notice under section 60 of the Control of Pollution Act 1974 to restrict the methods or times of noisy working or the noise levels emitted from the site. Effectively, this means that only applications for prior approval that incorporate best practicable means, as defined by section 72 of the Control of Pollution Act 1974, into the works programme to minimise the impacts of noise will be granted. `

The Local Authority can apply conditions to any prior approval so that it only applies to specific work, lasts for a specified period, and requires particular steps to control and manage noise impacts to be implemented. Noise level monitoring is a typical requirement of a prior approval. This means the Contractor has to appoint independent consultants to monitor the noise levels from the most disruptive parts of the works programme and the results of the noise measurements are used to manage the noise impacts.

Typically the results of the noise monitoring are reported in real time to the works supervisor with advice whether the appropriate criteria are being exceeded and if so the works are reviewed to

determine what reasonably practicable steps can be taken to reduce the noise impacts, for example:

Once works are underway variation from the terms of a prior approval, say in the event of unforeseen matters, can be granted by the Local Authority provided the Contractor provides information to justify any variation and the steps whereby noise arising from any variation will be minimised

The main benefits of section 61 prior approvals are that:

- The noisiest components of the construction programme are identified in advance of works commencing and appropriate control measures implemented from the very beginning of the Contract; and
- Provided the Contractor complies with any prior approval granted, they can progress the works safe in the knowledge that noise complaints should not hold up the works programme.

References

1. Wilson Report, 1963, 'Committee on the Problems of Noise': Final Report', Cmnd. 2056, HMSO, London

Appendix C: Vibration

Vibration Theory

When an object is in contact with a vibrating surface it is displaced about its reference (stationary) position. Displacement (in mm) is therefore one parameter that can be used to describe the magnitude of a vibration. For sinusoidal signals, displacement, velocity (ms^{-1}) and acceleration (ms^{-2}) amplitudes are related mathematically by a function of frequency and time.

If phase is neglected (as is always the case when making time-average measurements), then the velocity can be obtained by dividing the acceleration signal by a factor proportional to frequency (measured in Hertz, Hz) and the displacement can then be obtained by dividing the acceleration signal by a factor proportional to the square of frequency. Modern electronic integrating meters are capable of providing a wide range of measurement parameters during any single vibration measurement.

For a complex acceleration signal giving rise to a complicated time history, there are several additional quantities that may be used to describe the vibration:

- The root mean square value (rms) is obtained by taking the square root of the mean of the sum of the squares of the instantaneous acceleration measured during the total measurement time (T);
- The peak value is the maximum instantaneous acceleration measured during the measurement time, T. It is a useful indicator of the magnitude of short duration shocks;
- The peak particle velocity (ppv) is the maximum instantaneous velocity of a particle at a point during a given time interval.

Vibration Perception

The limit of human perception to vibration is of the order of 0.15 mms^{-1} to 0.3 mms^{-1} ppv, in the frequency range 0.1 Hz to 1500 Hz. The human body is not equally sensitive to all frequencies of vibration and weighting curves to reflect the frequency dependency of the body have been developed and are contained within ISO Standards. The weighting gives a good correlation between the measured vibration level and the subjective feeling or impact produced by the vibration.

The weightings can be incorporated into modern vibration meters, thus enabling measurement of vibration levels that correspond to human perception. Those vibrations occurring between 1-80 Hz are of particular interest when measuring exposure to whole-body vibration.

Sensitivity to vibration is also known to be dependent on the direction of excitation and the human body responds differently when standing (longitudinal) compared to when lying down (lateral). Whole-body vibrations are measured in the directions of an orthogonal co-ordinate system having its origins at the location of the heart and day and night-time assessment routines differ to account for longitudinal (daytime) body position and lateral (night-time) body position.

Vibration Limits – Nuisance

Ground vibrations may cause reactions ranging from '*just perceptible*', through '*concern*' to '*alarm*' and '*discomfort*'. The subjective response varies widely and is a function of situation, information, time of day and duration.

British Standard BS 6472: 1992 '*Guide to evaluation of human exposure to vibration in buildings (1 Hz to 80 Hz)*' (Ref. 1) gives base curves of vibration for minimal adverse comment, and also vibration dose values (VDVs) at which complaints are probable. VDVs may be used to assess the severity of impulsive and intermittent vibration, such as experienced from blasting at quarries or from rail traffic, and steady vibration such as from a busy road or fixed plant. The adoption of the VDV parameter is based on social studies undertaken in the 1980s and early 1990s into human response to vibration. BS 6472 requires that the VDV be determined separately for the 16-hour daytime (07.00-23.00) and 8-hour night-time (23.00-07.00) periods.

The VDV is given by the fourth root of the integral of the fourth power of the acceleration after it has been frequency-weighted:

$$VDV = (\int_0^T a^4(t)dt)^{0.25}$$

where VDV is the vibration dose value (in $ms^{-1.75}$), a(*t*) is the frequency-weighted acceleration (ms^{-2}) and T is the total period of the day (in seconds) during which vibration may occur.

The VDV is measured in each of the three whole-body orthogonal axes and the maximum from the three axes used. Where the vibration conditions are constant or regularly repeated only one representative period need be measured (or predicted) and the 16-hour daytime (or 8-hour night-time) overall VDV level may be calculated from the shortened data.

Where measurement of similar installations is not possible and predictions of VDV are necessary the following formula may be used to predict the estimated vibration dose value, eVDV, knowing the likely frequency weighted rms acceleration level, a, of the source (or estimating this from the known or measured peak particle velocity) and the duration of exposure, t, in seconds:

$$eVDV = 1.4(a)(t^{0.25})$$

The predicted or measured VDV may then be compared to Table 7 in the Appendix of BS 6472, (reproduced below as Table C1), to identify the likelihood of complaint:

Table C1: Vibration Dose Values ($ms^{-1.75}$) above which various degrees of adverse comment may be expected in residential buildings (taken from BS 6472: 1992)

Place	Low probability of adverse comment	Adverse comment possible	Adverse comment probable
VDV, $ms^{-1.75}$			
Residential buildings, 16h day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings, 8h night	0.13	0.26	0.54

For example, between 0.4 and 0.8 $ms^{-1.75}$ adverse comment regarding daytime vibration levels becomes possible, or when the VDV increases above 0.54 $ms^{-1.75}$ at night adverse comment becomes probable. For office and commercial buildings the suggested daytime limits above are relaxed by a factor of up to two (Table 5 of BS 6472: 1992).

Data included in BS 6472: 1992 may therefore be used to assess the likelihood of adverse comment arising at residential property from temporary or permanent vibration sources to be introduced into a residential area (demolition, construction, new industrial premises etc.), or from

occupiers of future residential property proposed for a site subject to existing vibration (proposed residential site adjacent to railway lines, for example).

Vibration Limits – Building Damage

Buildings are reasonably resilient to ground-borne vibration and vibration-induced damage is rare; there are less than 12 confirmed instances of vibration-induced damage to buildings in the UK over the last 10 years.

Vibration-induced damage can arise in different ways, making it difficult to arrive at universal criteria that will adequately and simply indicate damage risk. Damage can occur directly due to high dynamic stresses, due to accelerated ageing or indirectly when high quasi-static stresses are induced by, for example, soil compaction.

There are currently two British Standards that offer advice on acceptable levels of vibrations in structures. British Standard BS 7385: Part 2: 1993 '*Evaluation and measurement for vibration in buildings Part 2. Guide to damage levels from ground-borne vibration*' (Ref. 2) gives guidance on the levels of vibration above which the building structures could be damaged. For the purposes of BS 7385, damage is classified as cosmetic (formation of hairline cracks), minor (formation of large cracks) or major (damage to structural elements). Guide values given in the Standard are associated with the threshold of cosmetic damage only, usually in wall and/or ceiling lining materials.

Since case-history data, taken alone, has so far not provided an adequate basis for identifying thresholds for vibration-induced damage, data using controlled vibration sources within buildings has been established to enable definition of vibration thresholds judged to give a minimal risk of vibration-induced damage.

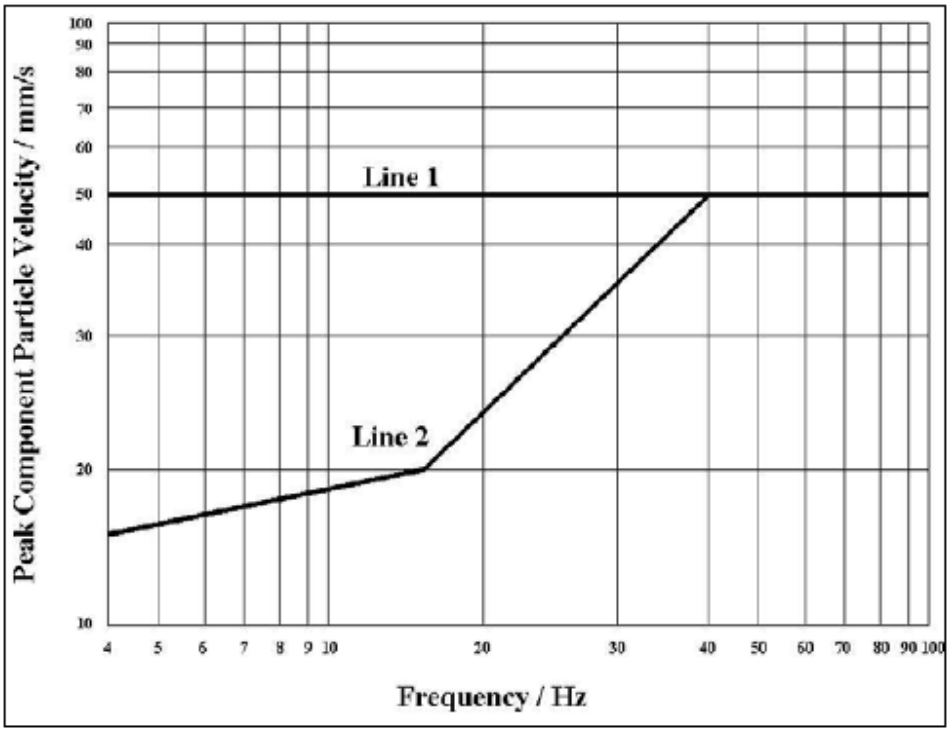
A frequency-based vibration criterion is given in the British Standard because the relative displacements associated with cracking will be reached at higher vibration magnitudes with higher frequency vibration. Limits for primarily transient vibration (from a train, for example) above which cosmetic damage could occur are reported in tabular form and graphical form in the Standard and reproduced exactly below in Table C2:

Transient vibration guide values for cosmetic damage			
Line ***(see figure below)***	**Type of building**	**Peak component particle velocity in frequency range of predominant pulse**	
		4 Hz to 15 Hz	***15 Hz and above***
1	Reinforced or framed structures. Industrial and heavy commercial buildings	50 mms^{-1} at 4 Hz and above	
2	Unreinforced or light framed structures Residential or light commercial type buildings	15 mms^{-1} at 4 Hz increasing to 20 mms^{-1} at 15 Hz to	20 mms^{-1} at 15 Hz increasing to 50 mms^{-1} at 40 Hz and above

NOTE 1. Values referred to are at the base of the building
NOTE 2. For line 2, at frequencies below 4 Hz, a maximum displacement of 0.6 mm (zero to peak) should not be exceeded.

Table C2: Transient vibration guide values for cosmetic damage (BS 7385: Part 2: 1993)

Figure C1: Summary of damage thresholds for transient vibration on domestic structures



The British Standard indicates, for example, that for a residential building (Line 2) a ppv of greater than 15 mms^{-1} at 4 Hz or greater than 50 mms^{-1} at 40 Hz or above, measured at the base of the building, may be expected to result in cosmetic damage.

Guidance on acceptable vibration levels in structures is also provided in BS 5228: Part 4: 1992 '*Code of practice for noise and vibration control applicable to piling operations*' (Ref. 3). This British Standard recommends that a conservative threshold for minor or cosmetic damage should be taken as a peak particle velocity of 10 mms^{-1} for intermittent vibration and 5 mms_{-1} for continuous vibrations to determine whether there is any risk of building damage, particularly from construction works involving piling. The criteria are not frequency-specific and apply across all frequency bands.

It is not clear why there is a discrepancy in recommended vibration limits between the two Standards.

The criteria shown in Table C3 below (compiled from paragraph 8.4.2, page 24 of BS 5228: Part 4: 1992) can be applied in the case of continuous or intermittent vibration from piling works.

Table C3: Vibration limits relating to minor or cosmetic damage to buildings from piling operations (from BS 5228: Part 4: 1992)

Building Classification	Intermittent Vibration (ppv, mms^{-1})	Continuous Vibration (ppv, mms^{-1})
Residential in generally good repair	10	5
Residential where preliminary survey reveals significant defects	5	2.5
Industrial/commercial - light and flexible structure	20	15
Industrial/commercial - heavy and stiff structure	30	15

BS 5228: Part 4: 1992 may, therefore, be used to assess the likelihood of structural damage arising from vibration associated with construction or any permanent new sources of vibration as a consequence of the development.

IMPACT PREDICTION – VIBRATION

Methodology - Vibration

The propagation of ground-borne vibration is very complex, involving combinations of shear and compressional waves, with different phase velocities. Impedance boundaries and rock within the soil structure give rise to reflections, refractions and scattering and associated interference effects. The presence of the ground surface introduces a third wave type, a surface wave known as a Rayleigh wave, which has a small wavelength compared to the sub-surface waves and suffers from a lower rate of attenuation.

There are no nationally accepted formulae for prediction of passage of vibration through ground due to the varying effects of non-uniform ground conditions, although some empirical formulae have been proposed for known ground conditions based on previously measured data.

In this instance, vibration due to construction is calculated using measured source data and the propagation relationship taken from the British Standard BS 5228: Part 4: 1992 and data included in the British Steel document '*Control of Vibration and Noise During Piling*' (Ref. 4). The Standards suggest that attenuation with distance should be calculated as the reciprocal of the root square of the source-receiver distance.

Ground to Building Transmission

There is no nationally accepted method for predicting the degree of vibration to be transmitted into a building from a ground borne source, such as for new residential development proposed close to an existing railway line, or where demolition work is proposed close to existing properties. Knowing, or predicting, the degree of vibration in the ground, the vibration level realised in practice in the building will depend on a range of factors including the design of the foundations, the floor slab, the height and the existing ground conditions. For VDV measurements taken in the earth it is necessary to consider the transmission loss into the proposed building when considering likely VDVs experienced in the proposed property at ground floor and first floor (and above) storeys.

It is known that building design and structure will give rise to different ground to building, and ground floor to first floor, transmission factors. It is generally found that massive buildings with piled foundations experience high vibration transmission losses from the neighbouring earth, but that lightweight buildings with concrete slab foundations (or timber raft) suffer higher transmission and consequently will experience higher vibration levels for the same given source than an adjacent, more massive building constructed on piled foundations.

Application to the PCI Project

It is proposed, on structural damage grounds, that ground-borne peak particle velocities (for continual vibration) at the base of existing local residential properties should not exceed the limit of **5 mms^{-2} ppv**, set in British Standard BS 5228: Part 4: 1992.

It is proposed, on vibration nuisance grounds, that at nearest residential properties a predicted VDV of **0.4 ms$^{-1.75}$** should not be exceeded for daytime use and **0.26 ms$^{-1.75}$** should not be exceeded for night-time use.

Where there are repeated and regular periods of exposure to transient vibration it is possible to assess the VDV over a shortened measurement period and calculate the expected VDV over the 16-hour day (or 8-hour night).

For on-site VDV vibration measurements taken in-earth, a transmission loss factor of 0.5 is adopted for earth to ground floor, and 1.0 for earth to first floor and above.

Whilst the Contractor will undertake as part of the Section 61 prior approval process to use best practicable means to avoid vibration levels exceeding the criteria in Annex C, if it is not reasonably practicable to prevent the criteria in Annex C being exceeded by vibration from the PCI works, the following are proposed:

Where the construction of the railway causes, or is expected to cause construction vibration levels, measured or predicted externally at the base of a vibration sensitive, to exceed the values given above:

And

(iii) the exceedence of the criteria in Annex C by construction associated vibration is for more than a total period of 10 or more days of working in any 15 consecutive days or for a total of days exceeding 40 in any six-month period

Then

Residents at that property would qualify for temporary re-housing."

REFERENCES

1 British Standard 6472: 1992 'Evaluation of human exposure to vibration in buildings (1 Hz to 80 Hz), British Standards Institution, 1992

2 British Standard 7385: Part 2: 1993 '*Evaluation and measurement for vibration in buildings Part 2. Guide to damage levels from ground-borne vibration*'

3 British Standard BS 5228: Part 4: 1992 ‘Noise control on construction and open sites’ Code of practice for noise and vibration control applicable to piling operations, British Standards Institution, 1992

4 Control of Vibration and Noise During Piling, British Steel, 1998

Appendix D: Proposed Measures to Control Dust Emissions

(i) The enclosure of Construction Compounds with solid hoardings to a height of at least 2.4m;

(ii) Where reasonably practicable, routing of vehicles and positioning of construction of plant at maximum possible distances from sensitive receptors and residential areas;

(iii) The enclosure of material stockpiles (such as sheeting) at all times and damping down of potentially dusty materials/construction sites using suitable water sprays during dry weather;

(iv) Ensuring that the surface of long term stockpiles are stable and do not shed dust;

(v) Where conveyors are used for handling spoil they shall be fitted with drop chutes. The surface of the material on the conveyor shall be sprayed with water after deposit onto the conveyor if practicable, where there is a likelihood of a dust problem;

(vi) Storage of cement and other dust generating materials in closed? Silos with appropriate filters and overfill alarms or storage in bags;

(vii) The hard surfacing of heavily used areas which are to be kept clean by regular brushing and water spraying;

(viii) All surfaced haul roads in regular use shall be regularly cleaned mechanically after being sprayed to suppress dust emission. Care shall be taken to prevent the emission of dust from the air outlets on vacuum road sweepers;

(ix) The installation and use of vehicle wheel and body washing stations at exit points of the site and public roads, combined with cleaning of public roads where necessary and practical;

(x) Enforcement of a speed limit, such limit to be displayed on appropriately designed signs, located at all entrances to each Construction Compound, for vehicles on unpaved roads and on the Construction Compound;

(xi) Additives and binders may be added to water for dust suppression subject to the approval of the Scottish Environment Protection Agency (SEPA);

(xii) The adequate sheeting of vehicles carrying spoil and other dusty materials.

(xiii) All fires are prohibited. This includes fires for the disposal of vegetation, packaging, or any other material. The use of braziers is permitted for the heating of hand held black-top-application tools; and

(xiv) Cutting or grinding equipment shall be fitted with dust extraction where reasonably practicable.

Appendix E: Useful Contacts

Organisation	Contact No.
Glasgow City Council	0141 287 9000
Historic Scotland	0131 668 8728
Network Rail	0845 748 4950
Renfrewshire Council	0141 889 7995
Scottish Water	0845 601 8855
SEPA	0800 80 70 60
SNH	0141 951 4488
Transport Scotland	0141 272 7100
West of Scotland Archaeology Service (WoSAS)	0141 287 8330

Appendix F: Communications Procedure Flowchart