

A4.1 Construction Information

1 Introduction

- 1.1 This appendix provides an overview of a potential construction scenario for the construction of the proposed Scheme. This information was prepared based on the Design Manual for Road and Bridges (DMRB) Stage 3 design to provide a set of assumptions for the purposes of assessing potential construction impacts as reported in this Environmental Statement (ES).
- 1.2 It should be noted that the detailed design of the proposed Scheme, and the construction programme and methodology, would be determined by the appointed Design and Build (D&B) contractor, within the constraints of the contract and the requirements of this ES (i.e. to achieve the stated residual impacts).
- 1.3 Information is set out under the following headings:
- General Site Operations;
 - Construction Programme and Phasing;
 - Typical Construction Methods;
 - Land Requirements; and
 - Public Access, Site Access, and Traffic Management.
- 1.4 The construction of the proposed Scheme is expected to use plant that are typical for infrastructure projects of this type. These include:
- excavators;
 - piling rigs;
 - tracked vehicles, bulldozers and dump trucks;
 - Heavy Goods Vehicles (HGVs) and concrete wagons;
 - hand-operated machinery including compacting plant;
 - portable generators for temporary lighting, pumps and similar;
 - cranes and other lifting equipment; and
 - motorised graders and pavement (road surface) rollers.

2 General Site Operations

Site Layout

- 2.1 For construction purposes, it has been assumed that the site would be broken down into three sections:
- from the Seafield roundabout, near Raigmore, to the point where the proposed Scheme crosses the existing A96 at Kerrowaird (referred to as the west section);
 - from Kerrowaird to the point where the proposed Scheme crosses the Aberdeen to Inverness Railway Line at Moss-side (referred to as the central section); and
 - from Moss-side to Hardmuir (referred to as the east section).

Safety and Security

- 2.2 Throughout the course of the works the contractor would manage the Health and Safety of the site in accordance with the requirements and principles of all current applicable Health and Safety legislation, including the Construction (Design and Management) Regulations 2015, the Health and

Safety at Work etc. Act 1974, the Management of Health and Safety at Work Regulations 1999, and the Workplace (Health, Safety and Welfare) Regulations 1992. This would ensure the safety of the public, site personnel, site operators, and visitors.

Working Hours

- 2.3 Anticipated 'typical' working hours of the contractor would be agreed with Transport Scotland and the Environmental Health Officer (EHO) from The Highland Council, but for the purposes of assessment are assumed to be as set out below:
- 07:30 to 18:00 on weekdays (Monday to Friday);
 - 08:00 to 13:00 on Saturdays; and
 - no Sunday working.
- 2.4 The above range applies to summer hours, when it is expected to be necessary to maximise the available good weather conditions for carrying out earthworks activities (as poor weather can adversely affect the condition of the material being used and the condition of haul routes). Winter hours would generally be shorter, due to the seasonal restriction on activities that can be carried out efficiently and the length of daylight available.
- 2.5 It is anticipated that some work would be required outside the normal working hours for exceptional activities (such as those that can only take place when traffic flows are low), subject to agreement with Transport Scotland and The Highland Council, including:
- weekend work to complete critical phases of road construction and surfacing;
 - overnight closures for placing of bridge beams over existing carriageways; and
 - implementing changes to temporary traffic management layouts.

Site Lighting

- 2.6 Temporary site lighting during construction would generally be required:
- at the contractor's compounds for security and safe movement of staff during winter mornings and evenings;
 - along temporary access roads;
 - at locations where there is currently no lighting, but lighting is required as a safety measure under temporary traffic management (e.g. at carriageway crossovers, contraflows); and
 - for night time activities or winter afternoon activities.
- 2.7 Maintenance of road lighting at locations where the layout is to be changed would be provided by mobile lighting towers or by the use of columns in temporary locations.

3 Construction Programme and Phasing

Construction Programme

- 3.1 It is anticipated that construction would not commence before 2019 (subject to completion of statutory procedures) and the overall construction period is expected to be between 36 and 48 months.
- 3.2 The indicative construction programme is broken down into three phases to reduce the impact on road users and neighbouring communities. The anticipated phasing of the construction works is as follows:
- Phase 1 - Mobilisation and Enabling Works. This would include: office and stores setup; additional ground investigation; planning and consents preparation; creation and signposting of temporary site access locations; temporary diversions, or traffic management; temporary

fencing; and habitat creation. Diversion of statutory utilities would also take place as far as practicable during the enabling works.

- Phase 2 - Site Clearance, Ground Improvement, Earthworks and Structures. These are intensive long duration activities that would take place predominantly offline from the existing A96.
- Phase 3: Drainage, Road Pavement and Roadworks Finishes, including tie in works to the existing roads.

4 Typical Construction Methods

Establishment of Construction Compounds

- 4.1 Preliminary activities include the setting up of the site compounds and offices, cabins, stores, welfare facilities and car parking. The contractor would determine the location of the main site compound and seek all necessary approvals for its design and construction. Due to the length of the proposed Scheme, other smaller offices including welfare facilities and compounds are expected to be established along the route.
- 4.2 Preparatory works for the temporary site establishments would involve some site clearance work, minor earthworks operations to level the site, drainage and pavement works for the car park and services installation (e.g. electrical, communications, water and sewerage). The site compounds would be erected, maintained and subsequently removed in a manner to avoid or reduce impacts on the locality.
- 4.3 The initial activities would involve the construction of site access and egress points. Wherever practicable, haul routes would also be established to ensure that construction traffic is contained within the confines of the site, as far as possible. However, since the route intersects main roads, local roads and other obstructions, the limited use of other public roads is expected to be required and approval for this would be sought by the contractor with the relevant authorities.

Temporary and Permanent Fencing

- 4.4 The land area to be occupied by the construction works would be identified accurately on the ground, by surveying and installing appropriate pegs and posts, prior to the works commencing. This would include the land acquired for the permanent works and any other areas that the contractor has acquired by agreement to facilitate construction of the works.
- 4.5 Temporary fencing would be erected where it is not possible to install the permanent fence.
- 4.6 Any permanent fencing required to denote the permanent road boundary would generally be a timber post and rail fence and would be subject to agreement with the landowner. There may be sections of fencing designed to a higher specification for the exclusion of wildlife where required. Environmental fencing extends below ground level and therefore requires an element of excavation which would be undertaken using a small excavator or by hand digging.
- 4.7 Other specific fencing that may be required temporarily would include higher security fences at compounds or where additional security of the works is required.

Site Clearance and Demolition

- 4.8 Site clearance and demolition works typically include the following:
- general clearance;
 - demolition of buildings, walls and bridges;
 - removal of pipelines, public and privately owned services or supplies; and
 - tree felling and removal of stumps, removal of fencing, hedges, bushes and undergrowth.

- 4.9 Any material to be reused in the permanent works would be stockpiled or taken to store. Surplus and unsuitable materials arising from the site clearance operations would be recycled, or, if they cannot be recycled, disposed of at an appropriate, approved disposal facility in the area. Burning of materials on site would not be permitted, except when specifically required for which approvals would be required.
- 4.10 Materials for off-site recycling or disposal would be transported in appropriate wagons along prescribed main road routes, which are expected to include the A96 and A9. Prescribed routes would be included in the main construction contract documents and the contractor would seek approval from the relevant authority if they need to use any other routes.
- 4.11 The contractor would be responsible for the timing of demolition and site clearance activities and would be required to take account of seasonal restrictions, such as bird breeding seasons and relocation of any species in the works programme. The detailed timetable for ecological constraints would comply with any requirements of this ES.

Contaminated Materials

- 4.12 The treatment of any hazardous materials encountered in site clearance would comply with specific contract requirements and would require an assessment in accordance with current health and safety regulations including the Control of Substances Hazardous to Health Regulations (COSHH) Regulations 2002. Contaminated materials may have to be disposed of at licensed sites.

Temporary and Permanent Surface Water Outfalls

- 4.13 Temporary arrangements would be made to control surface water runoff during construction, where surface water could affect the works or the environmental performance of mitigation measures. Measures implemented may include temporary settlement ponds, which would allow sediment to settle before clean water is discharged via a temporary outfall pipe or ditch to receiving watercourses.
- 4.14 During the construction period, and particularly the earthworks construction phase, water would be directed to the temporary settlement ponds using temporary cut off ditches. Construction of the ponds would involve earthworks operations including excavation, placement of fill and compaction. Temporary ponds would be required to be maintained to remove sediment and silt for example, and ensure that the ponds operate as intended.
- 4.15 Other options for disposal of water include discharging to sewers if they have sufficient capacity, or taking water off-site in bowsers or tankers for disposal. It is expected that the permanent Sustainable Drainage System (SUDS) e.g. Basin and Pond (hereafter referred to as SUDS) would be constructed and used during construction. These would be cleaned and maintained following the main construction works for incorporation into the final drainage network.
- 4.16 Works would be undertaken following guidance provided within the Scottish Environment Protection Agency (SEPA) publication Engineering in the Water Environment Good Practice Guide: Temporary Construction Methods (SEPA 2009) and also in more detail within the Construction Industry Research and Information Association (CIRIA) publication Control of Water Pollution from Linear Construction Projects: Technical Guide C648 and Site Guide C649 (CIRIA 2006a and 2006b).

Service Diversions

- 4.17 It is possible that some service diversions would be undertaken in advance of the main construction works, or during the enabling works phase. However, other diversions are only expected to be possible once construction has reached a certain stage.
- 4.18 Existing services may require temporary diversions as a result of disruption to apparatus during the construction of the works. These temporary diversions would be in place to minimise any disruption to the services being affected by the proposed Scheme.

- 4.19 Services are either located above or below ground. For works above ground, posts or towers would be delivered to the site and constructed. This would involve the transport of materials and some excavation and concrete works for foundations or footings.

Topsoil Stripping and Storage

- 4.20 Where appropriate, topsoil would be stripped from the full area occupied by the roads, cuttings, embankments and associated structures to depths defined for each particular location. The topsoil would be removed from site if surplus to requirements or stockpiled outwith working areas, until such time as it is required for reuse. Measures such as cut-off ditches may be required around stockpiles to transfer any contaminated runoff to temporary settlement ponds.
- 4.21 The plant potentially used for topsoil stripping includes rubber-tyred motorised scrapers and excavators; although more controlled procedures may be required in environmentally sensitive zones using smaller plant. Limits would be imposed on the maximum distance from the zone of excavation to the point of deposition of the topsoil to control invasive plant species and ensure that topsoil is reused close to the location it was stripped.

Pre-Earthworks Drainage

- 4.22 Pre-earthworks drainage generally comprises excavation of unlined or lined ditches, or filter drains constructed at the top of cutting slopes or at the toe of embankments where required by the design to prevent surface or ground water entering the works. Surface water carried by the pre-earthworks drainage is considered to be suitable for direct discharge to a receiving watercourse and can be transferred directly to watercourses unless the rate of discharge has to be controlled first.
- 4.23 The material arising from the excavation of the pre-earthwork drainage would be transported for reuse within the works or off-site for disposal. It should be noted that some ditches would have to be lined depending on the nature of the subsoil to prevent erosion of the ditch. Other options in this instance would also include the use of filter drains.

Earthworks

- 4.24 The principal earthworks process involves layered excavations of soils in cuttings and transportation of the excavated soil to neighbouring zones where embankments are required. Deposition in the fill areas would be built up by depositing the material and using bulldozers to place it in layers which are then compacted by rollers. This process is repeated until embankments are built to the road formation level.
- 4.25 Generally, it is preferred to achieve a cut/fill balance and have short haul distances to minimise transport of earthworks materials along the site between cuttings where they are excavated and embankments where they are placed. However, as a result of the many environment and engineering constraints within the road corridor the road alignment is formed on embankment of varying heights for the majority of its length. As such there are few cuttings where fill material can be won for the construction of the embankments, and therefore the earthworks are not balanced and imported materials is required to fulfil the embankment material volume requirement. Indicative import and export volumes are shown in Table 1, along with the total and daily average lorry loads and the length of the main earthworks activity.

Table 1: Earthworks Construction

Parameter	Estimate
Potential Import (m3)	2,887,000
Potential Disposal (m3)	90,000
Potential Total Lorry Loads	145,000
Potential Length of Main Earthworks Activities (months)	36
Estimated Daily Average Lorry Loads	167

- 4.26 The undulating topography of the site and alignment standards to be provided complicate the

achievement of an earthworks quantities balance and long hauls of material may be required. Excavations in cutting would include the removal of the top layers of material which are expected to be unacceptable for use in the main road embankments and this material would be transported to stockpiles to be reused as landscaping earthworks mitigation at a later date. The lower layers of the cuttings are expected to comprise material that is more acceptable for use in the main road embankments and this would be transported and compacted as described in paragraph 4.1.24.

- 4.27 Some excavations would encounter rock which is harder to excavate. In some instances, rock may be ripped using a bulldozer with a blade attached to the rear. Another option, where ripping of rock material is not feasible, includes using a hydraulic breaker (also known as a rock hammer or pecker). Blasting is not expected to be used for the removal of rock.

Drainage, Service Ducts and Chambers

- 4.28 Construction of carriageway drainage would involve laying filter drains, carrier drains and outfalls to transport surface water runoff from side slopes, carriageways and other paved areas. Drainage products would include pipes, gully pots, cover gratings, graded gravel for pipe bedding, gravel filter material and other stone pieces for balancing ponds and open channels. Manholes and chambers would be built with in situ concrete bases, precast concrete ring or brickwork walls and iron cover on precast concrete caps.
- 4.29 Construction of carriageway drainage would involve excavation of the drain, with material being deposited adjacent to the drain in the road verge or transported for reuse or disposal. Gravel bedding and filter material (crushed rock) would be delivered to the works from either a local quarry or a source on-site if extracted rock quality is suitable. The bedding material would be placed at the bottom of the excavated trench and the drainage pipes placed on top before being covered with the filter material. Some filter drains also have a geotextile surround to prevent sediment ingress into the filter material, and if the drainage pipe crosses the road carriageway, it would have a concrete surround which would be transported to the site and placed around the pipe in the trench.
- 4.30 The permanent treatment and attenuation facilities as part of the SUDS would be constructed in a similar manner to the temporary settlement ponds. An outflow pipe would transfer runoff from the carriageway drainage network to the SUDS and to the receiving watercourse following treatment/attenuation. If a piped outfall is proposed, a headwall would be required at the point it discharges to the receiving watercourse. Headwalls are expected to be in situ concrete although they may have a stone facing or other finish applied. Headwall construction may require temporary diversion or damming of the watercourse.
- 4.31 Service ducts and chambers are constructed in a similar manner as carriageway drainage and catchpits/manholes. However, service chambers may be brick built involving transport of materials and on-site manufacture and use of mortar.

Topsoiling and Seeding

- 4.32 Topsoiling and seeding would be undertaken as soon as possible after earthworks construction is completed. This would enable the subsoil to be sealed preventing sediment runoff. Topsoil would have been stripped and stored adjacent to the works. The topsoil would be transported from the topsoil storage locations to the works and would be placed by a tracked excavator. Grass seeding may be spread by hand or by machine spreading, undertaken in the relevant areas specified in the landscape design.

Pavement Construction

- 4.33 Pavement construction involves building the road pavement up in layers.
- 4.34 The bottom layer (sub-base) is a crushed rock aggregate which would be delivered to the site from local quarries or crushed and graded on-site from excavated rock. Indicative daily lorry loads required for pavement construction are shown in Table 2, along with details of the estimated total of pavement and length of the construction activity. The material is placed using road paving machines and then compacted by motorised rollers.

- 4.35 The upper pavement layers would be specified in accordance with the requirements of the contract and would involve transport of material to the site either from local sources or from a batching plant on-site.

Table 2: Pavement Construction

Parameter	Estimate
Estimated Total (m ³)	507,000
Potential Length of Pavement Construction Activities (months)	24 months
Estimated Daily Average Lorry Loads	40

Roadworks Finishes

- 4.36 Following pavement construction, safety barriers would be installed. Posts and barriers would be delivered to the site and installed by driving steel posts into the ground or by excavating small footings and placing concrete into which the posts are set. The barriers would be bolted to the posts and fixed to small concrete anchorages.
- 4.37 Sign installation would involve the excavation for the concrete foundations, setting the posts and fixing the sign faces to the sign posts. Some signs may be lit and would require cabling to be passed through service ducts.
- 4.38 Road markings would be applied to the road surface using specialist lorry-mounted equipment.

Accommodation Works

- 4.39 Accommodation works would include access roads, fences and walls or other ancillary items agreed with landowners. Construction methods would be similar to those described for these types of items in this appendix.

Structures

- 4.40 Typical construction methods for bridges and retaining walls are described below.

Overbridges

- 4.41 An overbridge typically carries a minor road over the mainline and incorporates a deck, supported on piers and/or abutments which are supported by foundations. Abutments support the ends of the bridge deck, whilst piers support the deck on multi span structures. These would be constructed from concrete cast on-site (in situ). The main deck elements can be steel or concrete or combinations of these. Concrete can be cast on-site (in situ) or the bridge can include precast units which are transported to the site. The exact form and materials used on each bridge for the proposed Scheme would be dependent on the detailed design and is specific to individual locations depending on the nature of the bridge, the alignment of road it carries and span lengths.
- 4.42 The road surface on the bridge deck is normally a bituminous bound pavement laid on a waterproofing coat. Bridge deck waterproofing can either be a spray applied or sheet membrane system, and a metal (steel or aluminium) parapet is fixed to each side of the bridge deck.
- 4.43 Typical bridge construction procedures are summarised below.

Bridge Foundations

- 4.44 Foundations are required to support the abutments and piers. Foundations can be either concrete pad or piled with a pile cap.

- 4.45 Pad footings require excavation to a suitable founding soil strata, and then laying a concrete layer reinforced with steel rods/caging. Once abutments or piers have been cast, excavations are backfilled with acceptable material.
- 4.46 Piled foundations require preliminary excavations at foundation locations, and then installing foundation piles to a suitable load bearing soil strata; this can either be by driving precast concrete/steel piles to the required depth with a pile driver, or by using a boring machine to create the void for the pile. Piles are then trimmed to the required level and a reinforced concrete pile cap is constructed to provide a base for piers or abutments.

Bridge Piers and Abutments

- 4.47 Bridge piers and abutments would be constructed of reinforced concrete, and are usually precast and then transported to their installation location. Exposed surfaces are treated and a waterproof membrane applied.

Underbridges

- 4.48 Underbridges accommodate roads or watercourses which pass below the mainline. These can be open structures (similar in appearance to overbridges), or underpasses which are more box-shaped. Both underbridges and underpasses are constructed in a similar manner as overbridges, requiring foundation construction, abutment, pier and wall construction, deck construction and finishes.

5 Land Requirements

Land Required During Construction

- 5.1 Land required during construction may be in addition to that required for the footprint of the permanent works. The main requirements are described below.

Site Compounds for the Contractor and Others

- 5.2 Where possible site compounds would be located close to the proposed works where there is suitable access. They would be used to accommodate offices for the contractor as well as workshops, stores, welfare facilities, etc. and parking for cars and plant.

Additional Works Areas

- 5.3 Land may be required to allow the contractor to gain safe access to the permanent works. This is usually where access is very restricted or where the works are adjacent to a live carriageway, such as when carrying out online widening works.

Temporary Diversions

- 5.4 In order to maintain traffic flows when undertaking works on the existing road, such as a new bridge or carriageway tie-ins, it may be necessary to provide temporary diversions.

Other Works

- 5.5 Other works requiring a licence, off-site planting etc. would require temporary land and would be identified as the detailed design is developed.

- 5.6 Clearance of Site on Completion

- 5.7 Clearance of the site on completion of the works would normally involve small dumpers, excavator/loaders and lorries to gather up and dispose of surplus material and generally tidy up.

Permanent Land

- 5.8 The main requirements for permanent land are as follows:
- land taken by footprint of the proposed Scheme, including earthworks (i.e. land required to build embankments or excavate cuttings);
 - land to allow adequate drainage of the road and the area through which it passes, including land required for diversion of watercourses, drainage outfalls and SUDS features, arrangements for maintenance access, and any compensatory storage areas to accommodate potential watercourse flood events; and
 - land required for other environmental mitigation, such as landscape planting.
- 5.9 Other land not required for the permanent works may also be permanently acquired by the Scottish Ministers due to it becoming unusable or impractical to use as a direct result of the works.

6 Public Access, Site Access and Traffic Management

Access Routes for Construction Traffic

- 6.1 The proposed works are generally located close to the main road network, so most construction traffic would be able to use the main routes without restriction. However, the contractor would be restricted as to the extent and purpose that they could use other roads for construction purposes. While it is desirable that all construction related access should be via the A96 Aberdeen to Inverness Trunk Road, it would be necessary to provide some access from the local road network. Routes not available to the contractor would be as agreed with the relevant authority and stipulated in the contract.

Traffic Management Requirements

Introduction

- 6.2 During construction, temporary traffic management would be required to undertake the works, whilst minimising disruption to users of the active road network.
- 6.3 Temporary traffic management would be put in place during construction at works close to or on existing roads, and at site access and egress points. Examples of measures include traffic cones, temporary signs and lighting, temporary speed restrictions, and temporary diversions.

Lane Requirements

- 6.4 Construction phasing and temporary traffic management proposals would be prepared on the basis of keeping at least one lane in each direction available on the existing A96 at all times except for very specific short term restrictions. Where considered appropriate, the contractor would be required to provide a vehicle recovery service to promptly remove any broken down vehicles within the temporary traffic management areas.
- 6.5 For the main routes, traffic would be kept on the normal carriageways, wherever possible, and if necessary using narrow lanes. A 40mph temporary speed limit would also be adopted through the main works areas.

Works Restrictions

- 6.6 The network connection works would be constructed within the typical working hours as set out in Section 2 (Working Hours), with no requirement or intention for prolonged late night or 24 hour working. The only exceptions to this would be for activities such as the installation of beams on new bridges which could only be carried out during an overnight closure of the carriageways being spanned, or for critical tie-in works between existing and new carriageways. Alternative diversion routes would be set up during such night time closures, together with advance warning and publicity to help drivers to avoid these locations/dates if possible.

- 6.7 Road closures and diversions are expected to require a Temporary Traffic Order and would be subject to approval by Transport Scotland, Police Scotland, and the Maintaining Authority.
- 6.8 Where night work is required in the vicinity of residential areas, methods of construction would be adopted that keep noise levels to a practicable minimum.

Temporary or Permanent Road Closures or Diversions

- 6.9 Temporary road closures and diversions would be arranged through the Overseeing Organisation following discussions with Transport Scotland, The Highland Council, Police Scotland and the Maintaining Agents. A Temporary Traffic Order giving the requisite notice would be prepared and a statutory notice placed in local newspapers.
- 6.10 Permanent road closures that occur as a consequence of the phasing for the construction of the proposed Scheme, supported by the appropriate legal Orders, would be implemented following discussions with relevant parties and agreement of any temporary traffic arrangements.

Temporary Carriageway

- 6.11 Under the traffic management proposals, there may be a requirement to construct some sections of temporary carriageway. The need for these would be dependent on the contractor's detailed design and the construction and traffic management methodology. Appropriate geometric and pavement construction standards for the design of temporary diversions would be set out in the contract.

Approvals

- 6.12 The contractor's detailed proposals for traffic management would be confirmed after discussions with Transport Scotland, Police Scotland and the Maintaining Agents.
- 6.13 The contractor would appoint a Traffic Safety Officer who would submit traffic management layout drawings, method statements, etc. within the requisite notice period for discussion at regular traffic management meetings. The Traffic Safety Officer would be responsible for ensuring that temporary traffic management operations are monitored and maintained.

7 References

Reports and Documents

Scottish Environment Protection Agency (SEPA) (2009) Engineering in the Water Environment Good Practice Guide: Temporary Construction Methods.

Construction Industry Research and Information Association (CIRIA) (2006a).Control of water pollution from linear construction projects: Technical Guide C648.

Construction Industry Research and Information Association (CIRIA) (2006b).Control of water pollution from linear construction projects: Technical Guide C649.

EU Directives and National Legislation

Construction (Design and Management) Regulations 2015

Health and Safety at Work etc. Act 1974

Management of Health and Safety at Work Regulations 1999

Workplace (Health, Safety and Welfare) Regulations 1992

Control of Substances Hazardous to Health Regulations (COSHH) Regulations 2002.