

## **Appendix A5.1: Construction Information**

### **1 Introduction**

- 1.1.1 This appendix provides an overview of a potential construction scenario for the construction of the proposed scheme. This information was prepared based on the DMRB Stage 3 design to provide a set of assumptions for the purposes of assessing potential construction impacts as reported in this ES, and takes into account the outline constructability review that has been undertaken as part of the DMRB Stage 3 work.
- 1.1.2 It should be noted that the detailed design of the proposed scheme, and the construction programme and methodology, will be determined by the appointed design & build (D&B) Contractor, within the constraints of the contract and the requirements of the ES (i.e. to achieve the stated residual impacts).
- 1.1.3 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.
- 1.1.4 Plant likely to be involved in the construction of the proposed scheme are typical for infrastructure projects of this type, and are likely to include:
- excavators;
  - piling rigs;
  - tracked vehicles, bulldozers and dump trucks;
  - 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**

#### **Safety and Security**

- 2.1.1 Throughout the course of the works the Contractor will 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, and will ensure the safety of the public, site personnel, site operators, and visitors.

#### **Working Hours**

- 2.1.2 Anticipated 'typical' working hours of the Contractor will be agreed with Transport Scotland and the Perth & Kinross Council Environmental Health Officer (EHO), 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.

2.1.3 The above range applies to summer hours, when it is likely 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 will generally be shorter, due to the seasonal restriction on activities that can be carried out efficiently and the length of daylight available.

2.1.4 It is anticipated that some work will 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 Perth & Kinross Council. These include:

- weekend work to complete critical phases of road construction and surfacing;
- overnight closures for placing of bridge beams over existing carriageways
- overnight work to facilitate temporary traffic management layouts; and
- non-disruptive railway possessions to complete structures, pipe boring and blasting operations.

### **Site Lighting**

2.1.5 Temporary site lighting during construction will generally be required as follows:

- 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 etc); and
- for night time activities or winter afternoon activities.

2.1.6 Maintenance of road lighting at locations where the layout of construction areas is to be changed will be provided by mobile lighting towers or by use of columns in temporary locations.

## **3 Construction Programme and Phasing**

### **Construction Programme**

3.1.1 Construction of the proposed scheme is anticipated to commence in 2019 at the earliest, with the works expected to take approximately 3 to 3.5 years.

3.1.2 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 – Set-up initial traffic management and construction of the sections of new carriageway that can be completed adjacent to the existing A9, including the Pitlochry South Junction and Pitlochry North Junction.
- Phase 2 – Change traffic management to work on online sections of carriageway including the Pitlochry South Junction and Pitlochry North Junction. All work to structures will be completed as part of phase 2.
- Phase 3 – Set-up traffic management and complete remaining roadworks.

## **4 Typical Construction Methods**

### **Establishment of Construction Compounds**

- 4.1.1 Preliminary activities include the setting up of the site compounds and offices. This also includes cabins, stores, welfare facilities and car parking. The Contractor will determine the location of the main site compounds and seek all necessary approvals for its design and construction. Due to the length of the proposed scheme and proposed structures to be constructed, other smaller offices including welfare facilities and compounds are likely to be established along the route.
- 4.1.2 Preparatory works for the temporary site establishments will 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 will be erected, maintained and subsequently removed in a manner that will aim to avoid or reduce impacts on the locality.
- 4.1.3 The initial actions will involve the construction of site access and egress points. Wherever practicable, haul routes will also be established to ensure that construction traffic is contained within the confines of the Compulsory Purchase Order (CPO), as far as possible. However, since the route intersects main roads, local roads and other obstructions, the limited use of other public roads is likely to be required and approval for this will be sought by the Contractor with the relevant authorities.

### **Temporary and Permanent Fencing**

- 4.1.4 The land area to be occupied by the construction works will be identified accurately on the ground, by surveying and installing appropriate pegs and posts, prior to the works commencing. The area defined will be the land acquired for the permanent works and any other areas that the Contractor has acquired by agreement to facilitate construction of the works.
- 4.1.5 Any permanent fencing required to denote the permanent highway boundary will generally be a timber post and wire fence. There may however be sections of fencing designed to a higher specification for the exclusion of otters (see paragraph below), badgers and other wildlife where required.
- 4.1.6 Where required, temporary fencing will be erected where it is not possible to install the permanent fence (e.g. areas where land will be returned to agriculture following completion of the works).
- 4.1.7 Other specific fencing that may be required temporarily will include higher security fences at compounds or where additional security of the works is required. Environmental fencing (e.g. otter fencing) extends below ground level and therefore requires an element of excavation which will be undertaken using a small excavator or by hand digging.

### **Site Clearance and Demolition**

- 4.1.8 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.

- 4.1.9 Any material to be reused in the permanent works will be stockpiled or taken to store. Surplus and unsuitable materials arising from the site clearance operations will be recycled, or, if they cannot be recycled, disposed of at an appropriate, approved disposal facility in the area. Burning of materials on site will not be permitted, except when specifically required for which approvals will be required.
- 4.1.10 Materials for off-site recycling or disposal will be transported in appropriate wagons along prescribed main road routes, which are likely to include the A9, A90 and M90. Prescribed routes will be included in the main construction contract documents. The Contractor will be required to seek approval from the relevant authority should they wish to use any other routes.
- 4.1.11 The Contractor will be responsible for the timing of demolition and site clearance activities and will 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 will comply with any requirements of the ES and the Report to Inform an Appropriate Assessment for the River Tay SAC.

### **Contaminated Materials**

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

### **Temporary Construction Drainage / SuDS**

- 4.1.13 Temporary drainage measures, including temporary Sustainable Drainage Systems (SuDS), will be employed to control, treat and dispose of surface water runoff during construction works. The development of the construction drainage strategy will be the responsibility of the appointed Contractor; however, the typical drainage methods are discussed below. It is intended that the temporary construction SuDS will be separate from the proposed operational SuDS to reflect natural drainage patterns at the outset of construction and the likely requirement to treat significantly higher volumes of suspended sediment.
- 4.1.14 Clean or greenfield surface water runoff that has not passed over disturbed construction ground will be separated from construction drainage through the installation of upslope pre-earthwork drains. Temporary interception ditches will convey the potentially contaminated runoff from the construction area to the natural catchment low points. Treatment will be provided by silt traps during conveyance, and settlement ponds or soakaways prior to discharge.
- 4.1.15 Unlike operational pre-earthwork drains and SuDS, temporary pre-earthworks drains and construction SuDS will not discharge directly to watercourses as a vegetated filter strip (10m where practicable) would be provided between the outfall and any watercourse. This is intended to provide a final level of treatment to remove any remaining suspended sediment prior to discharge. Erosion within cut-off and interception ditches will be avoided by minimising the gradient of these ditches, installing regular check dams / silt traps, and using geotextile membrane liners.
- 4.1.16 Temporary SuDS measures, as described above, will be constructed prior to any significant site stripping activities. Construction of the temporary SuDS will involve earthworks operations including excavation, placement of fill and compaction. Temporary SuDS measures will likely have to be modified and adapted as the work progresses, with drainage patterns likely to be altered by earthworks and operational SuDS becoming available. Maintenance of temporary SuDS will be required to remove accumulated sediment and ensure that they operate as intended.
- 4.1.17 The land that may be required for temporary construction SuDS has been assessed by reviewing indicative drainage catchments areas, estimating attenuation and treatment volume requirements and providing potential drainage solutions on a catchment-by-catchment basis. The land requirements for construction SuDS have been included within the Compulsory Purchase Orders (CPO) for the proposed scheme.

### **Service Diversions**

- 4.1.18 It is possible that some service diversions will be undertaken in advance of the main construction works. However, other diversions are only likely to be possible once construction has reached a certain stage.
- 4.1.19 Existing services may require temporary diversions as a result of disruption to apparatus during the construction of the works. These temporary diversions will be in place to minimise any disruption to the services being affected by the proposed scheme.
- 4.1.20 Services are either located above or below ground. For works above ground, posts, towers or pylons will have to be delivered to the site and constructed. This will involve transport of materials and some excavation and concrete works for foundations or footings.

### **Topsoil Stripping and Storage**

- 4.1.21 Topsoil will be stripped off areas to be occupied by the proposed roads, cuttings, embankments and associated structures to depths defined for each particular location in phases as required by the Construction Programme. The areas of topsoil strip will be undertaken in phases to limit areas of exposed soil. The topsoil will be removed if surplus to requirements or stockpiled outwith working areas, until such time as it is required for reuse. SuDS measures will be constructed prior to any significant site stripping activities. In addition, measures such as cut-off ditches and silt fencing will be required around stockpiles to prevent erosion and allow conveyance of any contaminated runoff to temporary SuDS ponds.
- 4.1.22 The plant potentially used for topsoil stripping includes rubber-tyred motorised scrapers, excavators etc, though more controlled procedures may be required in environmentally sensitive zones using smaller plant. Limits will 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. During topsoil stripping, turves will be maintained, carefully handled and stored separately from subsoil to allow their utilisation for site restoration.

### **Pre-Earthworks Drainage**

- 4.1.23 Pre-earthworks drainage generally comprises excavation of unlined ditches, or filter drains constructed at the top of cutting slopes or toe of embankments where required by the design. They are excavated prior to construction of the cutting or the embankment to prevent surface or ground water entering the works. Existing pre-earthworks ditches are known to exist at the top of existing cuttings and these will be cleared of any excess vegetation or other identified blockages as part of the site clearance works to ensure that they prevent run-off entering the construction works below. When placed at the top of cuttings, surface water carried by the pre-earthworks drainage can be transferred directly to watercourses unless the rate of discharge has to be controlled. When placed at the toe of embankments, surface water carried by the pre-earthworks drainage may contain sediment from runoff from the embankments being constructed and will be required to discharge water to temporary settlement ponds or enlarged cut-off ditches prior to it being discharged to a watercourse.
- 4.1.24 The material arising from the excavation of the pre-earthwork drainage will be transported for reuse within the works or off-site, or ultimately disposal off-site. It should be noted that some ditches will have to be lined depending on the nature of the subsoil to prevent erosion of the ditch. Other options in this instance would include use of filter drains.

**Earthworks**

- 4.1.25 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 will be undertaken 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.
- 4.1.26 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. Indicative lorry loads for volumes of cut, fill and import materials are shown in Table 5.1.

**Table 5.1: Indicative Lorry Loads – Earthworks\***

Parameter	Estimate
Total Acceptable Cut Available (excl. Topsoil) (m <sup>3</sup> )	734,800
Total Fill Required (excl. Topsoil) (m <sup>3</sup> )	886,800
Potential import (m <sup>3</sup> )	152,000
Potential export(m <sup>3</sup> )	107,100
Potential Total Lorry Loads	131,500
Potential length of main earthworks activities (months)	15
Estimated weekly average lorry loads during main earthworks activities	2190

\*This is based on preliminary ground investigations indicating that material is likely to have 90% suitability for reuse.

- 4.1.27 The undulating topography of the site and alignment standards to be provided complicate achievement of an earthworks quantities balance and long hauls of material may be required. Excavations in cutting will include the removal of the top layers of material which are likely to be unacceptable for use in the main road embankments. This material will likely be transported to stock piles to be reused as landscaping earthworks mitigation at a later date. The lower layers of the cuttings are likely to comprise material that is more acceptable for use in the main road embankments and this will be transported and compacted as described above.
- 4.1.28 Some excavations will encounter rock and this 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). Alternatively, fragmentation blasting and/or pre-split blasting may also be required for areas of rock excavations. The proposed realignment at Pitlochry North Junction and construction of Rob Roy Way Underpass requires construction of new rock cuttings and available ground investigation information indicates that blasting is likely. The appointed Contractor shall be responsible for the blasting design and compliance with any restrictions resulting from blasting operations. The blasting operation will include suitable protection measures, establishment of exclusion zones and temporary road and rail closures as necessary.

**Operational Drainage / SuDS, Service Ducts and Chambers**

- 4.1.29 Construction of carriageway drainage will involve laying filter drains, carrier drains, drainage channels and outfalls to transport surface water run-off from side slopes, carriageways and other paved areas. Drainage products will 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 will be built with in-situ concrete bases, precast concrete rings or brickwork walls and iron cover on precast concrete caps.

- 4.1.30 Construction of carriageway drainage will 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) is delivered to the works from either a local quarry or a source on site if extracted rock quality is suitable. The bedding material is placed at the bottom of the excavated trench and the drainage pipes are 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 will have a concrete surround which will be transported to the site and placed around the pipe in the trench.
- 4.1.31 The construction of SuDS basins will require earthworks in a similar manner to the temporary ponds described previously. An outflow pipe or ditch will transfer runoff from the carriageway drainage network to the permanent ponds, and to the receiving watercourse following treatment/attenuation. If a piped outfall is proposed, a headwall will be required at the point it discharges to the receiving watercourse. Headwalls are likely 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 during construction works. There are locations where the area is constrained and provision of a SuDS basin is not possible. In these instances, the carriageway drainage will typically be diverted into propriety SuDS systems to include vortex separator chambers and may also include geocellular storage.
- 4.1.32 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**

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

**Pavement Construction**

- 4.1.34 Pavement construction involves building the pavement up in layers.
- 4.1.35 The bottom layer (sub-base) is a crushed rock aggregate which will be delivered to the site from local quarries or crushed and graded on site from excavated rock, as described previously. Indicative lorry loads required for pavement construction are shown in Table 5.2. The material is deposited and then pushed into place and compacted.
- 4.1.36 The upper pavement layers will be specified in accordance with the requirements of the contract and will involve transport of material to the site either from local sources or from a batching plant on site.

**Table 5.2: Pavement Construction**

Parameter	Estimate
Estimated total lorry loads	14,500
Potential length of pavement construction activities (months)	12
Estimated weekly average lorry loads during pavement construction	300

**Roadworks Finishes**

- 4.1.37 Following pavement construction, safety barriers will be installed. Posts and barriers are delivered to the site and safety barrier installation then involves driving steel posts into the ground or excavating small footings and placing concrete into which the posts are set. The barriers are bolted to the posts and fixed to small concrete anchorages.

- 4.1.38 Sign installation will involve excavation for the concrete foundations, and setting the posts. The sign faces are then fixed to the sign posts. Some signs may be lit and will require cabling to be passed through the service ducts installed as described previously.
- 4.1.39 Variable message signs (VMS) and CCTV camera installation will involve excavation for the concrete foundations and these concrete foundations will extend above ground level in the case of the VMS. The supporting column is then fixed to the concrete foundation and the VMS display box is then attached to the supporting column. The CCTV cameras are typically mounted on a lattice support which is connected to the foundation. Associated cabinets and hard standing areas will be constructed at ground level at each location.
- 4.1.40 Road markings will be applied to the road surface using specialist lorry-mounted equipment.

### **Accommodation Works**

- 4.1.41 Accommodation works will include access roads, fences and walls or other ancillary items agreed with landowners. Construction methods will be similar to those described for these items in this outline methodology.

### **Structures**

- 4.1.42 Typical construction methods for bridges and retaining walls are described below and apply to most bridges and retaining walls to be constructed as part of the proposed scheme.

#### Retaining Walls

- 4.1.43 The DMRB Stage 3 design incorporates a number of retaining walls. These retaining walls are required to support soil where differences in ground levels are needed.
- 4.1.44 Retaining walls may be constructed by excavating to the required level whilst temporarily supporting the material to be retained. The retaining walls may comprise pre-cast or cast in-situ concrete panel walls supporting reinforced earth walls. Alternatively, contiguous piles may be installed to form the retaining wall before excavation to the required level.

#### Underbridges

- 4.1.45 Underbridges accommodate roads or watercourses which pass below the mainline. These can be open structures, or underpasses which are more box-shaped. Both underbridges and underpasses are constructed in a similar manner, requiring foundation construction; abutment, pier and wall construction; deck construction; and finishes.
- 4.1.46 There are two underbridges as part of the proposed scheme that cross the River Tay SAC including; Tummel Underbridge and Clunie Underbridge. The HRA for the proposed scheme therefore provides more detail on the general arrangement and construction methods for these structures which is summarised below.
- 4.1.47 A number of alternative forms of structure were considered at the location of the River Tummel crossing. Options considered either retained the existing structure to form the southbound carriageway with a new structure forming the northbound carriageway, or considered the full replacement of the crossing. The design of the proposed scheme retains the existing A9 crossing of the River Tummel as the southbound carriageway, while a new bow string arch structure would be used as the northbound carriageway. The bow string arch bridge has the following advantages over the other options considered:
- no need for demolition of the existing structure;
  - the bow string arch allows for the deck to be relatively slender, reducing the visual impact;
  - no piers constructed in the channel of the SAC; and
  - neutral impact on flood risk with the lowest loss of floodplain

- 4.1.48 Further north, the existing A9 structure crossing Loch Faskally would be retained as the northbound carriageway, while the proposed new structure, Clunie Underbridge would be constructed to accommodate southbound traffic. This new structure will mirror the form and dimensions of the existing bridge.

*Tummel Underbridge*

- 4.1.49 Two options have been considered for the construction of the Tummel Underbridge:
- Option 1: slide the bridge into place on a temporary launching system; and
  - Option 2: lift the bridge in pieces onto temporary supports.
- 4.1.50 Both options require temporary support systems and additional detail is provided below. In both cases the temporary support would be located outwith the main channel of the River Tummel, but would be positioned within the terrestrial (high-flow) area of the River Tummel within the River Tay SAC boundary, in an area of shingle, to the south of the existing Tummel Underbridge.
- 4.1.51 The temporary supports would comprise a large concrete foundation with a steel supporting system for the arch. The foundation blocks would be constructed *in-situ* prior to the construction of the support system and would be removed once construction was complete. The existing shingle would be removed to create a firm footing for the supports. To limit the risk to these temporary structures, their construction and use would most likely take place during the period of lower flows in the River Tummel i.e. the summer months. It is likely that some form of bunding would be required to protect the foundations during their construction from inundation during high water events. However, this would be removed once works are completed.
- The construction of the new 'bowstring' arch structure would be of the order of 21 months' duration, with approximately a further three months for the refurbishment of the existing bridge, following transfer of traffic to the new structure.
  - The temporary support pier on the south side will be sited within an area of 0.33ha of the SAC, and not in the water at normal flows. The actual footprint of the temporary support is likely to be less than this in the order of 100-200m<sup>3</sup>, but the worst case scenario has been assumed for the assessment.
  - All works will be undertaken outwith the watercourse at normal flows. The temporary support structure may require sheet piling for scour protection due to its location in the SAC.

*Tummel Crossing – Construction Option 1*

- 4.1.52 The first construction option is illustrated on Figure 1. The areas with the red vertical/horizontal hatching are indicative footing areas. The construction sequence for the first option is likely to be:
1. excavation for abutments;
  2. structural fill (if required below foundations);
  3. abutment foundations (reinforcement, formwork, concrete);
  4. abutment stems (reinforcement, formwork, concrete);
  5. abutment wingwalls (reinforcement, formwork, concrete);
  6. backfill to abutments;
  7. fabricate truss steelwork offsite;
  8. fabricate temporary launch girders and temporary supports offsite;
  9. excavate for temporary supports;
  10. cast footings for temporary supports;
  11. deliver temporary support steelwork to site and install on footings;
  12. deliver temporary launch girders to site and complete fabrication in temporary works area;

13. deliver permanent steelwork to site and complete arch fabrication in new carriageway footprint to west of river;
14. install launch runway and jacking system;
15. lift pairs of launch girders to positions 1 and 2 (refer to Figure 1 for details);
16. brace pairs of launch girders together;
17. slide into position for launch;
18. launch;
19. lower arches onto bearings and lower launch girders;
20. slide launch girders back to start and dismantle;
21. remove launch runway and jacking system;
22. remove temporary support steelwork and reinstate footing areas;
23. construct concrete deck slab (formwork, reinforcement, concrete); and
24. finishes (parapets, waterproofing, verges, surfacing).

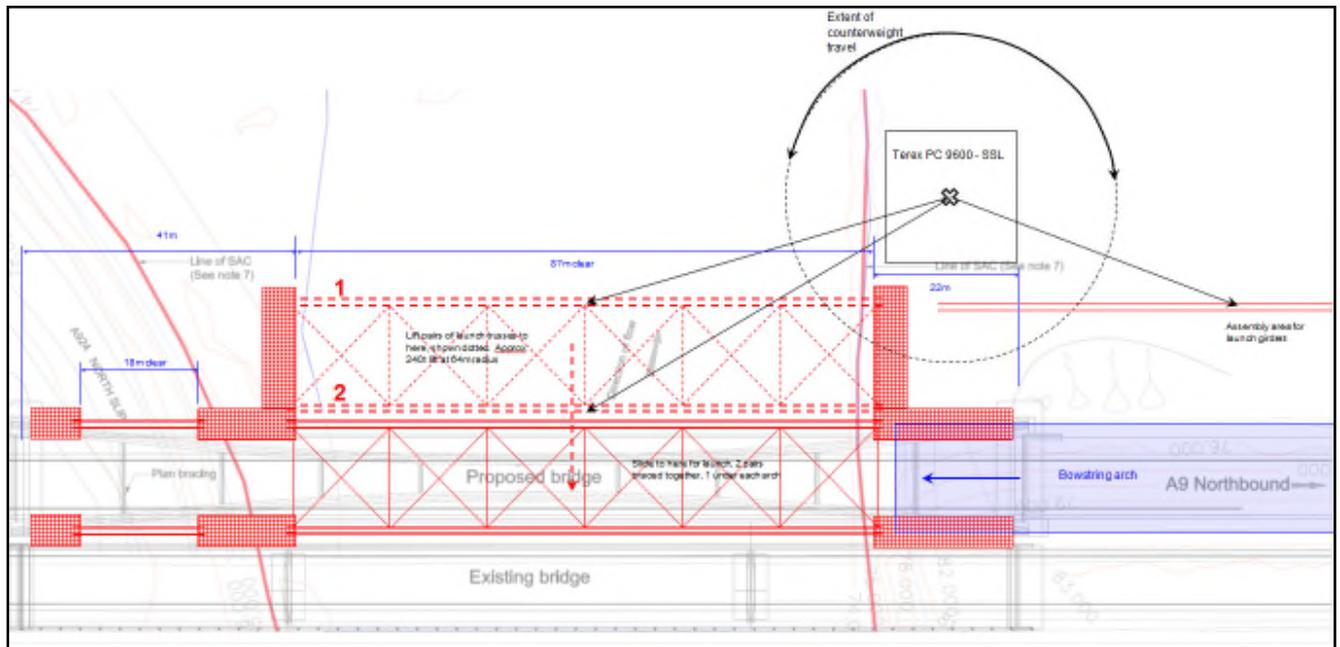
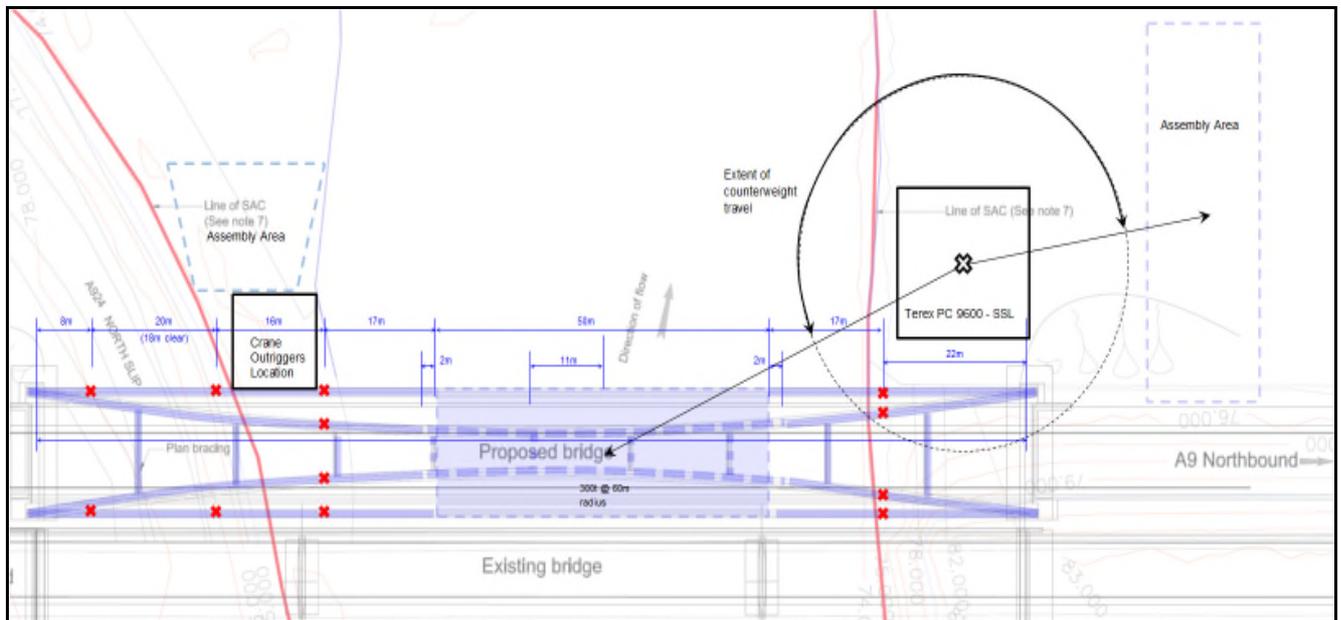


Figure 1: Option 1 for Construction of Tummel Underbridge (Indicative). Red hatching shows indicative footing areas.

*Tummel Crossing – Construction Option 2*

4.1.53 The second option is the option to lift the bridge in pieces and the red crosses shown on Figure 2 are indicative vertical support positions. Sizeable foundations will be needed below each of these points. In detail, the construction sequence for the second option is likely to be:

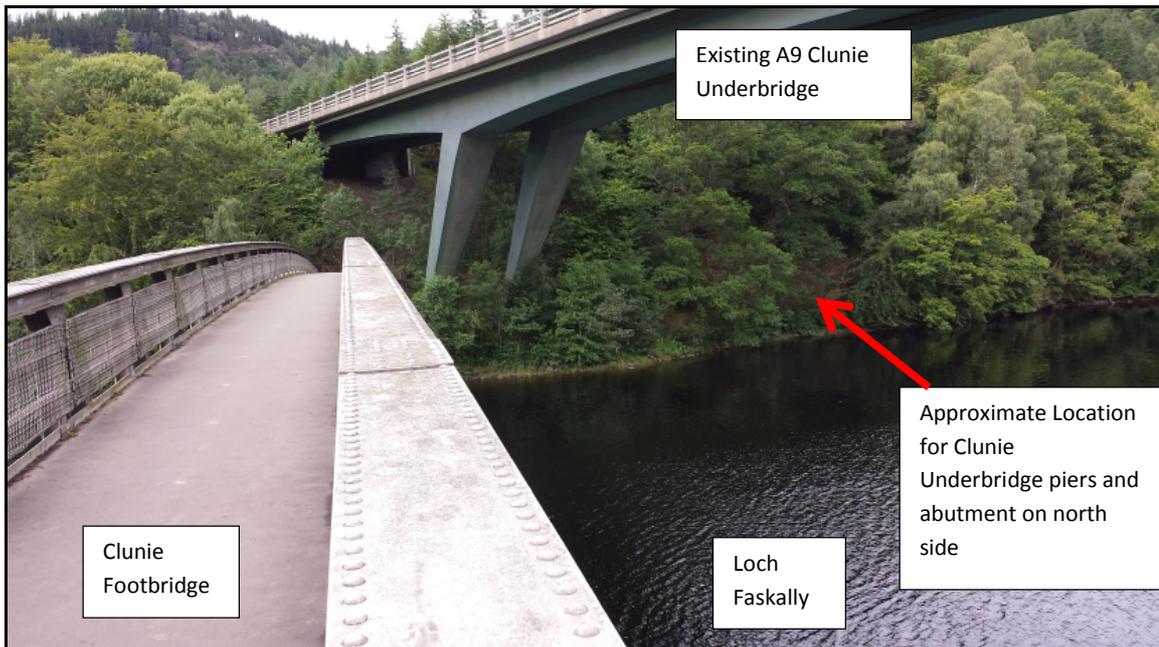
- 1) excavation for abutments;
- 2) structural Fill (if required below foundations);
- 3) abutment foundations (reinforcement, formwork, concrete);
- 4) abutment stems (reinforcement, formwork, concrete);
- 5) abutment wingwalls (reinforcement, formwork, concrete);
- 6) backfill to abutments;
- 7) fabricate truss steelwork offsite;
- 8) fabricate temporary supports offsite;
- 9) excavate for temporary supports;
- 10) cast footings for temporary supports;
- 11) deliver temporary support steelwork to site and install on footings;
- 12) deliver permanent steelwork to site and complete fabrication of arch sections in new carriageway footprint to west or east of river (depending upon lifting position);
- 13) place bottom chords to 17m beyond support frames with raking tie back to support frame;
- 14) place top chords to 15m beyond support frames;
- 15) lift middle deck section into position; 300t including permanent formwork;
- 16) lift middle top chord section into position; 300t;
- 17) place hangers;
- 18) remove temporary support steelwork and reinstate footing areas;
- 19) construct concrete deck slab (reinforcement, concrete); and
- 20) finishes (parapets, waterproofing, verges, surfacing).



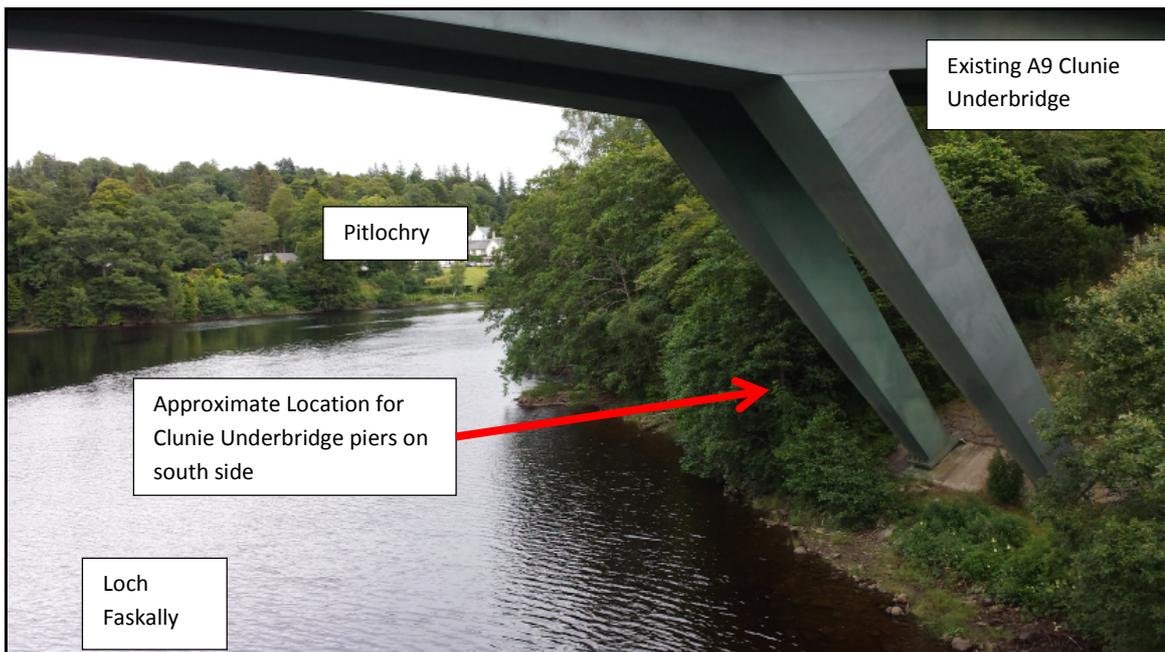
**Figure 2: Option 2 for Construction of Tummel Underbridge (Indicative). Red crosses are indicative vertical support positions.**

*Clunie Underbridge*

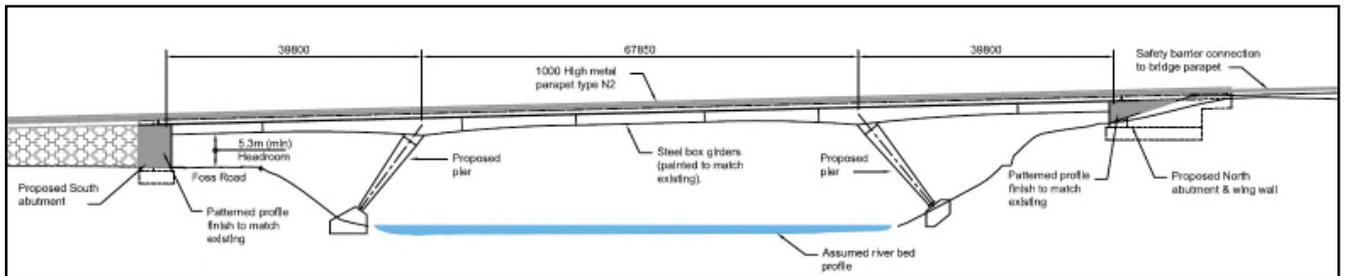
- 4.1.54 At Clunie Underbridge, where the proposed scheme crosses Loch Faskally, the existing crossing will be retained as the northbound carriageway, and a new crossing constructed adjacent to it to accommodate the southbound carriageway. The piers will align with those of the existing structure, and will be within the terrestrial part of the River Tay SAC on the northern side, refer to Photograph 1 and 2 and Figure 3.
- 4.1.55 To protect the River Tay SAC from contaminated runoff during the construction of the Clunie Underbridge, a number of options could be adopted the Contractor. Due to the topographic constraints, the most feasible option will likely be a series of sumps or settlement tanks constructed at a suitable location to capture, treat and attenuate surface water that has either been pumped from the excavations for the abutments or collected from the upslope drainage catchment. When the sumps or settlement tanks require emptying, the collected surface water would be pumped and discharged over a suitable vegetated area and at a distance of >10m from Loch Faskally. The following indicative measures would be adopted to maximise treatment and prevent erosion at the location of discharge:
- construction of small soakaways, level spreaders or infiltration trenches (parallel to contours) to spread flows diffusely over the discharge area;
  - installation of silt fencing at discharge locations and along the perimeter of Loch Faskally; and
  - use of an outfall pipe that can be moved daily or a perforated pipe system that will similarly spread flows diffusely over the discharge area.
- 4.1.56 Mitigation measures required to protect the River Tay SAC and associated protected species are described in Chapter 12 (Ecology and Nature Conservation) and Chapter 11 (Road Drainage and Water Environment) of this ES.



**Photograph 1: Approximate location for piers and abutment for Clunie Underbridge on north side**



**Photograph 2: Approximate location for piers and abutment for Clunie Underbridge on south side**



**Figure 3: Clunie Underbridge Elevation**

- 4.1.57 The size of the pier foundations for the new structure cannot be finalised at this stage of the project however, the structure is expected to be similar in nature to the existing structure's pier foundations, but wider to accommodate the wider deck, the dimensions would be of the order of 60m<sup>2</sup> (north abutment, within the SAC) and 90m<sup>2</sup> (south abutment, outwith the SAC).
- 4.1.58 The proposed south abutment of Clunie Underbridge will be located adjacent to the existing abutment. Once sheet piles are placed into the ground the abutment will be constructed towards the Clunie-Foss Road. Temporary traffic lights will be in operation, reducing traffic from two lanes to one lane only. HGVs may need to wait until construction on the abutment ceases for the day so that traffic management can be rearranged to ensure there is sufficient space for HGVs to pass safely. It is estimated that it will take 5months to construct the south abutment though it is only when construction nears the pinch point that restrictions would be placed on HGVs.
- 4.1.59 Access for construction of the abutment foundations on the northern side are anticipated to be taken from the mainline. The proposed abutment is likely to be as deep as the existing abutment. Primary access will be taken from the mainline with a secondary access/haul route anticipated parallel to the mainline from the A924. This access would be constructed prior to widening the mainline and eventually become bedded into the mainline earthworks slope. This track would then be removed following completion of Clunie Underbridge.
- 4.1.60 It is likely that the installation of the steelwork would be undertaken in discrete sections, with site connections needed to link these together. The Contractor could position a crane behind the abutments to lift the proposed piers into place, where they would be held by cable stays. From the same position, the crane could lift the first two steel box girders sections into position. The first two steel girders are likely to have been fixed together before the lift and then spliced to the proposed piers. The steel sections in the middle of the bridge would likely be lifted into place by a smaller crane positioned on the existing structure. Once the steelwork is installed, the deck construction and finishes can be completed. On completion of the new structure, traffic would be switched to the new bridge and the existing bridge would be refurbished as required.

Bridge Foundations

- 4.1.61 Foundations are required to support the abutments and piers. Foundations can be either concrete pad or piled with a pile cap.
- 4.1.62 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.
- 4.1.63 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 required level and a reinforced concrete pile cap is constructed to provide a base for piers or abutments.

#### Bridge Piers and Abutments

- 4.1.64 Bridge piers and abutments will be constructed of reinforced concrete, and are usually pre-cast and then transported to their installation location. Exposed surfaces are treated and a waterproof membrane applied.

## **5 Land Requirements**

### **Land Required During Construction**

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

#### Site Compounds for the Contractor and Others

- 5.1.2 Where possible these 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

- 5.1.3 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

- 5.1.4 In order to maintain traffic flows when undertaking works on the existing highway, such as a new bridge or carriageway tie-ins, the outline constructability review undertaken on the proposed scheme anticipates minor temporary diversions of traffic would be carried out on the existing A9 carriageway and none of the major roads are expected to require closures during construction, other than for activities such as the installation of beams on new bridges over roads. It is expected that both the Pitlochry South and North Junctions will generally remain operational throughout construction with minor diversions but no bypasses required.

#### Other Works

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

### **Clearance of Site on Completion**

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

### **Permanent Land**

- 5.1.7 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 proposed scheme and the area through which it passes. This includes 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;
  - land required for other environmental mitigation, such as landscape and ecological planting.

- 5.1.8 Other land not required for the permanent works may also be permanently acquired by the highway authority 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**

- 6.1.1 The proposed works are generally located on the main road network, so most construction traffic will be able to use the main highway network without restriction. However, the Contractor will be restricted as to the extent and purpose that the Contractor can use other roads for construction purposes. While it is desirable that all construction related access should be via the A9 it will be necessary to provide some access from the side road network. Routes not available to the Contractor will be as agreed with the relevant authority and stipulated in the contract.

### **Traffic Management Requirements**

#### Introduction

- 6.1.2 During construction, temporary traffic management will be required to undertake the works, whilst minimising disruption to users of the active road network.
- 6.1.3 Temporary traffic management will 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, temporary diversions and contraflows.

#### Lane Requirements

- 6.1.4 In general, construction phasing and temporary traffic management proposals have been prepared on the basis of keeping at least one lane in each direction available on the A9 at all times except for very specific short term restrictions. Where considered appropriate, the Contractor will be required to provide a vehicle recovery service to promptly remove any broken down vehicles within the temporary traffic management areas.
- 6.1.5 For the main routes, it is proposed to keep traffic on the normal carriageways, wherever possible, and if necessary using narrow lanes. It is also proposed to adopt a 40mph temporary speed limit through the main works areas.
- 6.1.6 It is generally proposed that other routes including slip roads at major junctions be kept open during construction of the proposed works. This will, in some cases require construction of extensive temporary alignments. The proposals in this appendix have been prepared on the basis of keeping all routes and accesses open throughout the works wherever feasible.

#### Working Restrictions

- 6.1.7 It is generally proposed that the network connection works be constructed within the typical working hours as set out in Section 1.2, with no requirement or intention for prolonged late night or 24 hour working. The only likely 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 or construction of structures adjacent to the railway requiring railway possessions to complete structures or undertake blasting operations. Alternative diversion routes will be set up during such night time closures, together with advance warning and publicity to help drivers to avoid these locations/dates if possible.
- 6.1.8 Road closures and diversions are likely to require a Temporary Traffic Order and be subject to approval by Transport Scotland, Police Scotland, and the Maintaining Authority.
- 6.1.9 Where night work is required in the vicinity of residential areas, methods of construction should be adopted that keep noise levels to a practicable minimum.

Temporary or Permanent Road Closures or Diversions

- 6.1.10 Temporary road closures and diversions will be arranged through the relevant traffic authority following discussions with Transport Scotland, Perth & Kinross Council, Police Scotland and the Maintaining Agents. A Temporary Traffic Order giving the requisite notice will be prepared and a statutory notice placed in local newspapers.
- 6.1.11 Permanent road closures that occur as a consequence of the phasing for the construction of the proposed scheme, supported by the appropriate legal Orders, will be implemented following discussions with relevant parties and agreement of any temporary traffic arrangements.

Temporary Carriageway

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

Approvals

- 6.1.13 The Contractor's detailed proposals for traffic management will only be confirmed after discussions with Transport Scotland, Police Scotland and the Maintaining Agents.
- 6.1.14 The Contractor will be required to appoint a Traffic Safety Officer who be responsible for submitting traffic management layout drawings, method statements, etc. within the requisite notice period for discussion at regular traffic management meetings. The Traffic Safety Officer will be responsible for ensuring that temporary traffic management operations are monitored and maintained.