CONSTRUCTION METHOD STATEMENT

PROJECT Eastern Green Link 2

CUSTOMER EGL2 – Eastern Green Link 2

Customer Reference	5WMIFK-PTDOPS-XX-XXX-XX-MS-PM-000002
Prysmian Reference	PPL21054-HSE-PLN-028-C01
Document Version	C04
Security Code	

Document Control Log

Version	Date	Issued by	Approved by
C01	29.10.24	Ubaid Nehvi	Dan Fox
C02	31.01.25	Ubaid Nehvi	Dan Fox
C03	11.03.25	Ubaid Nehvi	Dan Fox
C04	10.04.25	Ubaid Nehvi	Dan Fox

Revision history

Revision no.	Date	Chapter	Main updates
C01	29.10.24		First issue
C02	31.01.25		Amended to BB and Arcadis review comments
C03	11.03.25		Amended to PPL review comments
C04	10.04.25		Amended to reflect EGL2 comments.

Contents

1 Project Overview

1.1 Project description

The Project, referred to as EGL2, is one of several developments required to increase the capability of the existing GB (Great Britain) transmission network from the North-East of Scotland to the North of England. The increase is required to facilitate the growth in flows of renewable generation in the North to centres of demand in the South; helping to ensure the UK can meet its target of enabling 40GW of renewable energy by 2030 and achieving a 'Net Zero economy' by 2050.

The Project is the construction of a HVDC (High Voltage Direct Current) Link between Peterhead, Aberdeenshire, Scotland to Drax, North Yorkshire, England. Development works undertaken thus far have resulted in a requirement that the link shall be 2GW VSC (Voltage Source Converter) in a rigid bi-pole arrangement operating at 525 kV. It comprises approximately 505 km of subsea and onshore underground HVDC cables, between new Converter Stations at each end of the electricity transmission link. These in turn are connected to the high voltage electricity transmission networks via Peterhead 400 kV substation and Drax 400 kV substation by 400 kV AC cable circuits.

The English Onshore Project has been consented via two planning applications to East Riding of Yorkshire Council (Application 22/01990/STPLFE), and variation (Application 24/00310/STVAR) which allows for an alternative route in the Skerne Barn area which runs approximately 60 m to the south, in an adjacent agricultural field. The works in North Yorkshire have been consented by one planning application to North Yorkshire Council (Application 2022/0711/EIA).

Please note: Balfour Beatty (BB) are the Contractor, working on behalf of Prysmian who are the Principal Contractor and responsible for both Onshore and Offshore schemes. Prysmian are working on behalf of EGL2, the Client.

1.2 Scope of works

To assist with managing the construction works efficiently BB have divided the route into 5 sections in England.

Section	From – To	Chainage: From – To
Section 1	Transition Joint Bay – B1249	0m – 14,564m
Section 2	B1249 – B1248	14,564m – 26,250m
Section 3	B1248 – A1034	26,250m – 39,923m
Section 4	A1034 – A614	39,923m – 54,942m
Section 5	A614 – Converter Station	54,942m – 68,096m

The works within the administrative boundary of East Riding of Yorkshire Council will consist of:

- Transition Joint Bay (TJB) which will connect the offshore HVDC cables to the onshore cables, at a landfall located landward of the existing headland at Fraisthorpe, East Yorkshire.

- Approximately 67 km of two underground HVDC cables (and fibre optic cable(s) for performance monitoring) between the TJB and the River Ouse – (within North Yorkshire these continue to the proposed converter station immediately east of the existing Drax Substation). The cable will be installed in an open cut trench, excavated in sections along the route. Not all the cable route will be open cut, some sections of cable will be installed using Horizontal Directional Drills, for example; underneath rivers, ditches and roads.

- 67km of haul road will be installed along the route, adjacent to the cable trench, this will be approximately 5m wide with passing places.

- Compounds: to enable construction activities there will be a requirement for associated temporary construction areas referred to as compounds, laydown and storage areas. These temporary construction areas are typically utilized for the storage of plant and machinery and stockpiling materials, as well as the provision of site management offices, welfare facilities for staff (kitchen facilities, storerooms, toilet facilities), parking, and plant and material storage. Construction compounds in East Riding will consist of:

    - One landfall-specific compound provided for HDD installation across the intertidal area. This area will also accommodate the TJP to join marine and terrestrial cables together. (This is outside the scope of the Balfour Beatty works).
    - Three primary major cable compounds.
    - Nine secondary construction compounds (S1-7, including S2a &b and S3a and b)
    - Four tertiary construction compounds (T1-4).

- Cable joint bays will be approximately at every 1.5 km along the route. These joint bays will be 25m long with a depth of 2.1 m approx. Joint bays will be installed with stack boxes as well which will be required for the FO cable jointing. The base of the joint bays will have a concrete pad which will be used to support the jointing cabin during HVDC cable jointing process. A transition joint bay will be constructed at the Landfall at Fraisethorpe which will have two foundations built at each end of the joint bays to a suitable depth to anchor the HVDC cables.

- Other works will include:
    - Bellmouth creation – to enable access to compounds and haul roads.
    - Drainage attenuation and compensation works.
    - Landscaping enhancements.

The works within North Yorkshire Council will consist of:

- Approximately 2 km of two underground HVDC cables (and fibre optic cable(s) for performance monitoring) between the River Ouse and the proposed converter station immediately east of the existing Drax Power Station. The converter station will be connected to the existing Drax Substation by approximately 500m of HVAC cable. The cable will be installed in an open cut trench, excavated in sections along the route. Not all the cable route will be open cut, some sections of cable will be installed using Horizontal Directional Drills, for example; underneath rivers, ditches and roads.

- 2km of haul road will be installed along the route, adjacent to the cable trench, this will be approximately 5m wide with passing places.

- Compounds in North Yorkshire will consist of:
  - one primary major cable compound near Drax (P3).
  - one secondary construction compound (S8).

- Other works will include:
  - Bellmouth creation – to enable access to compounds and haul roads.
  - Drainage attenuation and compensation works.
  - Landscaping enhancements.

1.3 Scope of this document

This document has been prepared to support the discharge of conditions for the above planning applications in relation to the HVDC cable.

1.4 Purpose of this document

This document has been prepared to support the discharge of conditions 8 (of East Riding of Yorkshire Application 22/01990/STPLFE and variation Application 24/00310/STVAR and 32 (of North Yorkshire Application 2022/0711/EIA). The planning condition wording states that the HVDC Cable Development shall not take place until a Construction Method Statement (CMS) for that phase has been submitted to and approved in writing by the Local Planning Authority. This CMS defines the construction and installation methods including crossing methods for the HVDC Cable Development. The HVDC Cable Development shall be carried out in strict accordance with the approved CMS unless otherwise agreed in writing with the Local Planning Authority.

2 Overall Planning Strategy

Prior to the main construction works, a period of pre-construction activities will take place. To facilitate these pre-construction works Balfour Beatty has established a temporary pre-construction office at Albion Mills Willerby (HU10 6DN). This office is to be used by Balfour Beatty, Prysmian and the client as required.

During these pre-construction activities all relevant consents & approvals from the relevant Local Authorities, Regulatory Bodies and Stakeholders will be obtained prior to the main construction works commencing in each phase (refer to the Construction Phasing Plan for details). The pre-construction phase works will involve surveys and investigation work including the following elements:

- Ecology surveys.
- Topography and Pre-condition surveys.
- Archaeological trenching.
- Hedgerow Removal (taking the ecological calendar into consideration).
- Land drainage pre & post-construction designs.
- Dewatering designs.
- Trenchless solution bore hole works & designs.
- Ground Investigation works involving: trial holes, window sample bore holes & soil sampling .
- Temporary works designs.
- Cable route optimization & installation designs.
- Highways access/Bellmouth designs.
- Abnormal Indivisible Load surveys for cable drum movements .
- Contamination surveys.
- Trial holes for proving the route and bellmouth locations.

Ecology surveys and Archaeological trial holes will be carried out in a logical sequence along the cable route. However, this will be subject to landowner accesses agreed via EGL2 and the approval of a Written Scheme of Investigation (WSI) with the local authority archaeologist.

During the pre-construction & main construction phases, the works in the five construction sections listed above will be completed in a sequential method along the cable route starting in section 1. The pre-construction phase is defined as the phase or period prior to the discharge of all planning consents in which all the planning, survey and design activities commence (as listed above).

Primary Compound 2 will be the first compound constructed as this will be used as the construction site office for use by Balfour Beatty, Prysmian and EGL2, for the duration of project. See Figure 1 below:

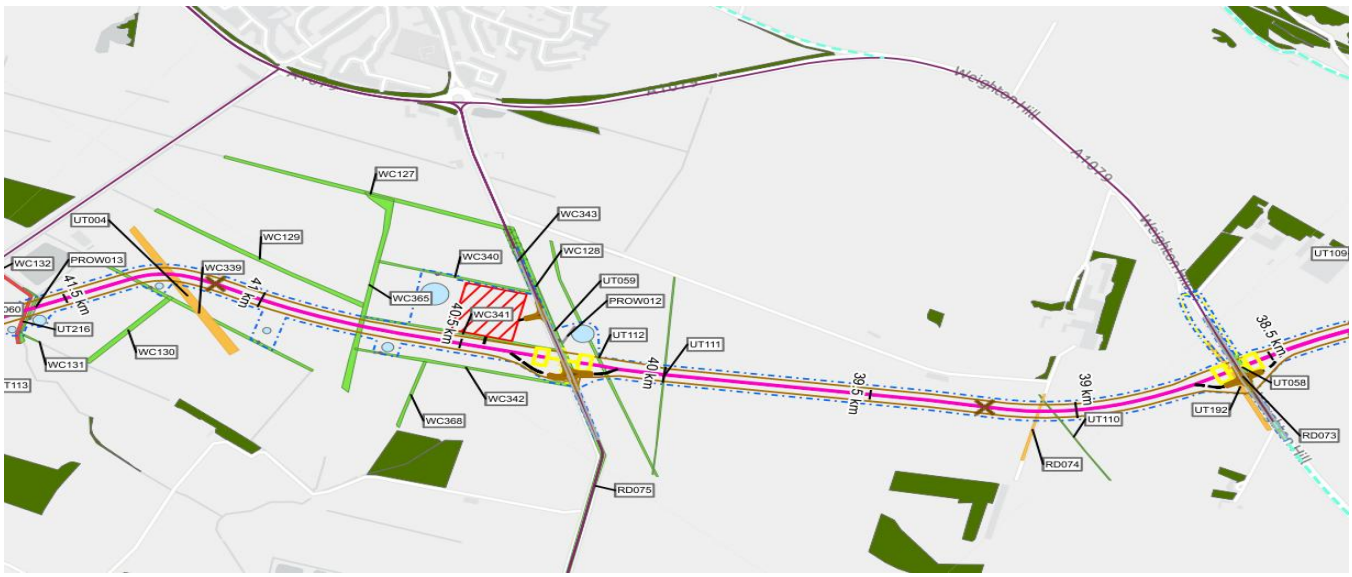


Figure 1 P2 Compound Location

The main construction works in each section will commence with the construction of bellmouths and compounds; these compounds will be used for welfare and the storage of material. They will also assist with limiting traffic movement on the local highways by using haul roads. These will be constructed in some areas from the compounds along the cable corridor to the adjoining Temporary Construction Compounds (TCC's).

The haul roads will be of varying configurations dependent on the existing ground make-up and requirement for use e.g. cable drum transportation. They will be constructed at strategic locations to allow trenchless solution works, cable drum movements, cable installation and jointing works to take place. To ensure that access to the cable corridor is always available within the five sections the construction works will be further sectionalized from TCC to TCC with the haul road installed as required between each TCC.

We have also, where possible, looked at the use of temporary trackway matting for short duration works which can be transported around the project to suit demands and reduce the amount of aggregate required.

During construction, the haul road and cable route will be required to cross several obstacles and items of infrastructure to enable completion. Underground services, large drains, water crossings, railway lines, roadways, and selected planning consent areas along the route will be crossed using an trenchless solution. Where a trenchless solution is utilised, all necessary consents will be obtained from the relevant landowners or asset owners prior to works taking place. All other cable crossings, such as minor services, land drains, farm tracks and minor un-adopted roads will be crossed using an open cut solution. Crossing methods at all locations remain under review as the project design develops and a suitable solution is confirmed and agreed with Local Planning Authority.

During the design and installation of the haul road, obstacles will be managed using suitable technical solutions such as culverts and, in some instances, temporary bridges. The final requirements for temporary bridges will be confirmed following survey activity during the pre-construction period, as further explained in Section 7.10.

Highway bellmouth accesses at TCCs and highway crossing points along the haul road route will be crossed in line with NRSWA regulations and in liaison with the local authority and any relevant asset

owner. Where bellmouths are to be constructed over existing buried third-party utility apparatus, and following surveys, consultation will be held with the asset owner and relevant mitigations / protection arrangements agreed prior to works commencing. This will include carrying out surface loading calculations and designs.

The cable installation solution will also require a comprehensive scheme of pre and post construction drainage works to provide asset protection for the landowners who are intensively farming the area. The management and implementation of temporary drainage systems will be described and agree through Condition 10 (East Riding of Yorkshire Council) and Condition 38 (North Yorkshire Council).

Balfour Beatty have produced a Geotechnical Interpretative Report (GIR) based on the information provided by EGL2 and from historical GI information. More detail on the dewatering requirements for the project can be found in the dewatering section of this document.

As part of the main scope of works, once all the ducts have been installed on each relevant section, joint bays will be excavated including the transition joint bay (TJB) at landfall, and the cables installed. Included within the cable installation works is the transportation of the cable drums from the cable drum storage facility storage facility to the pulling location.

To facilitate this, Balfour Beatty will utilise a suitable cable drum transportation trailer. The unit is capable for use in the cable installation activity as well as the transportation. This negates the requirement for extra ancillary plant & equipment associated with the on and off-loading activities at joint bay locations for installation, as well as reducing the plant movement interfaces.

Once all cable installation works, jointing and backfilling works are complete in each section, the haul road and culverts will be removed, and the post-construction drainage will be installed. The topsoil will be replaced, and the compounds will then be removed, allowing land remediation works to commence to bring the land back to its original condition for handover to the owners.

All reinstatement works will be carried out in line with the project's Land Restoration Plan (Document Reference 5WMIFK-PTDOPS-XX-XXX-XX-MS-HS-000058); which will be produced during the preconstruction phase.

2.1 Detailed Planning Strategy

Within each of the five main sections joint bay locations have been fixed based on a standard average section length of 1,500m. Where joint bays positions have fallen on or near to trenchless solution, they have been moved back sufficiently to ensure cable creep-age back towards the trenchless solution (which could have a detrimental impact on the joints) does not occur. This has given rise to 47 intermediate joint bays and 1 transition joint bay in total.

Key to our planning strategy is minimising the joint bay locations where the cable drum transportation wagon needs to access. To achieve this, at certain joint bay locations we have planned to pull cable in both directions. To facilitate this our ducted solution offers the ability to pull cable in either direction, eliminating the requirement for the cable drum transportation wagon to access adjacent joint bays.

Our planning strategy has also taken into consideration the requirements for all the compounds regarding accesses required for trenchless solution and cable installation activities. At this stage Balfour Beatty believe that all the compounds listed are required however, following pre-construction surveys and route optimisation the number and sizes of the compounds may be

reduced. Working areas will be fenced and signage employed to prevent encroachment by vehicles, machinery and construction personnel onto adjacent habitat to avoid any unauthorised access.

3 Consents Management

Balfour Beatty have engaged a specialist Consents Planning Subcontractor (Arcadis). Arcadis will be the main point of contact for Balfour Beatty for all matters relating to consents. Arcadis will work closely with Balfour Beatty, the client Consent Manager/Lead and the Local Planning Authority to ensure that all consents are discharged in line with the key programme dates and milestones.

The responsibilities of Arcadis will include but are not limited to the following activities.

- The co-ordination of consent related workloads of the technical disciplines leading to the preparation of accurate and fully reviewed consent documents.
- Work alongside the Balfour Beatty Programme Planner to ensure consents activities are accurately incorporated into the programme and allowing the known maximum duration of the Consent review stages and approval periods.
- To support the client in managing and maintaining collaborative relationships with the consent granting bodies (Local Planning Authority and Highway Authorities), ensuring presence and input at external meetings.
- Attend regular consent progress meetings when required or to be agreed with the client.
- Produce and Review the Consent related documentation before being sent to Client and Local Planning Authority (LPA).
- Report any breaches of consent compliance to the client putting forward a strategy in which to overcome and resolve.
- Submit all consents applications and supporting information to the client for review.
- To assist with the process, Balfour Beatty will produce a detailed consents program which captures the client requirements to obtain the approvals from the Local Planning Authorities prior to works commencing. It will also capture the statutory process in which planning conditions are usually discharged by the Local Planning Authority (LPA).

4 Ecological and Archaeological Surveys and Proposed Mitigations

4.1 Ecological Surveys

A preliminary ecological assessment of the whole route has been carried out. Species specific surveys and any associated mitigation is included in the Construction Environmental Management Plan (CEMP), Document Reference 5WMIFK-PTDOPS-XX-XXX-XX-PL-PM-000003.

4.2 Archaeological Surveys and Mitigations

We have planned and started the delivery of archaeological trial trenches as a part of pre-construction phase outlined in the Written Scheme of Investigation (Document Reference 5WMIFK-PTDOPS-XX-XXX-XX-RP-TP-000001). An Archaeological Clerk of Works (AcoW) will oversee the works and liaise between the stakeholders like the client, county Archaeologist and the contractor. A mitigation programme will be developed based on the results of the Archaeological Trial Trenching. A separate WSI will be developed, forming the Archaeological Mitigation Strategy and will be signed off by the local planning Archaeologists for East Riding and North Yorkshire Councils. Once these are agreed and completed to the satisfaction of the Local Planning Authority (LPA), construction works will be able to commence in the Archaeological risk areas.

5 Proposals for Managing, Remedying and Measuring the Impact of the Construction Works on Public and Private Roads

5.1 Managing and Remedying

During works on each of the five sections, agreed Primary, Secondary and Tertiary compounds (TCCs) will be constructed with haul roads constructed from these compounds along the cable corridor to the next TCC. These Primary, Secondary and Tertiary compounds will also act as strategic store locations for holding bulk stock of materials. This approach will limit the number of deliveries required to the TCC's and subsequently the number of traffic movements required on public and private roads. By implementing this strategy, a large volume of traffic movement can be taken off the public and private roads by utilising the haul road within the construction corridor.

The CTMP (Construction Traffic Management Plan) will be discharged ahead of Construction and considers the planning of all access associated with work activities, the impact of the vehicle movements associated with work activities and how these impacts will be managed. Examples of how this will be managed are:

- Programme specific activities to take place during non-rush hour periods e.g., cable drum transportation, road closures for open cut crossing which require traffic diversions etc.
- Where possible wagons delivering stone will also take away spoil instead of leaving site empty. All vehicles entering and leaving the site are covered (sheeted) to prevent escape of materials during transport, in accordance with the Dust Management Plan.
- Maximise the load capacity of the delivery vehicles by not splitting loads unnecessarily.
- Restrict deliveries and other vehicle movements required on public and private roads to non-rush hour times.
- Use of a minimum number of plant suppliers so that the maximum number of plant items can be delivered in one delivery.
- Involve plant supplier representatives in weekly planning meeting to agree delivery arrangements and routes.
- Where possible utilise, temporary trackway matting to reduce the quantity of aggregate required for delivery to site .
- All approach roads to the TCCs will be monitored daily by the supervising personnel responsible for the relevant section of works to ensure that mud/ debris from the construction works is not creating a hazard. Where this is found to be the case road sweepers shall be deployed at the earliest opportunity.

Further to the above, the CTMP also considers wheel washing arrangements, access points, speed limits etc. For the transportation of the cable drums to site from the Cable Contractor's storage facility, the CTMP identifies the specific routes for each cable drum delivery and the constraints which may be imposed for each route by Highways England and the relevant local authorities along with any other stakeholders or asset owners who may be affected. Other tools such as the Department for Transport data base; Electronic Service Delivery for Abnormal Loads (ESDAL) will also be utilised.

5.2 Managing Construction Traffic

To assist with the Management of construction traffic Balfour Beatty will be producing and submitting for approval a Construction Traffic Management Plan, document reference 5WMIFK-PTDOPS-XX-XXX-XX-PL-PM-000006.

All the traffic will be managed in accordance with the CTMP. All material and plant suppliers engaged by Balfour Beatty shall be provided with route access maps to the TCC's and a briefing document advising on restricted routes and areas.

These documents will be provided to suppliers during the procurement process with suppliers and the restriction laid out within the documents will form part of that contract or order agreement. To ensure that Balfour Beatty can monitor the movements of suppliers and subcontractors' vehicles, all suppliers and subcontractors engaged shall be required to operate a telematics system in all delivery vehicles. Interface points between the TCC and project stakeholders, in particular residents in the vicinity of the TCC, will be logged, tracked, and controlled in the interface register. Any communication that may be required will be logged in our communications plan but may take the form of face-to-face meetings, newsletters and door knocking. All communication will be undertaken in conjunction with the Employer and managed by Balfour Beatty's Communication's Manager.

All commercial vehicles operated by Balfour Beatty, together with its subcontractors, will utilise a vehicle tracker system. Dashboard reports from these trackers will then be reviewed weekly by the Project Engineers to identify any speeding vehicles or vehicles using non designated roads. Persistent offenders will be reported to the Project Manager and may be removed from the project.

5.3 Land Use

During the preconstruction and route optimization phase, Balfour Beatty will take into consideration the minimization of both land use and damage to land that will be used. This will be included reducing the number of site compounds where possible and the use of temporary trackway as opposed to aggregate haul roads which will reduce the volume of topsoil required to be stripped.

The exact cable route within the easement corridor will be finalised during the detailed design stage (pre-construction & early construction) and will take into consideration the cable system design requirements i.e., maximum cable bending radius of D.C Cable, joint bay locations, fibre pit locations, access requirements, etc. and will be agreed with Prysmian, Employer & landowners.

The site easement will be designed to limit the working width, allowing the haul road, trenches, and numerous spoil stockpiles to fit and conform to the installation requirements. The easement will then be marked out by Balfour Beatty Engineers using GPS equipment with pegs installed along the boundaries at regular intervals. Demarcation fencing will be erected along this pegged out line and no deviation will be allowed outside this without prior agreement from EGL 2.

Where small sections of agricultural land are locked out due to demarcation of the construction swathe, crossing points will be provided for landowners to maintain access for the duration of the project.

6 Pre-construction Sequence of Works

Prior to any intrusive entry onto the land a precondition survey will be completed by the Balfour Beatty Agricultural Liaison Officers (ALO's Or Balfour Beatty's specialist contractors). Site specific precondition surveys will also be completed for each entry point off the existing highway network or private access track complete with photographic evidence.

In conjunction with the precondition surveys above, an overhead line survey will be completed to identify any issues along the cable route such as low sagging spans or poles which may be within the cable easement and require diverting. Should any overhead lines be identified as an issue then the assets owner will be contacted to discuss the best solution.

Following the ecology works, archaeological works will commence which could involve trial trenching and will follow in a logical sequence along each relevant section. However, this will be subject to landowner accesses agreed via EGL2 and the approval of a Written Scheme of Investigation (WSI) with the local authority archaeologist.

The trial trenches will typically be 50m in length x 2m wide and will typically be to a depth of 500-600mm depending on any archaeology which may be present.

Where archaeology has been identified, archaeological teams will aim to trial trench the joint bay locations first to a typical depth of 500-600mm. Balfour Beatty will then follow behind to complete the trial hole to a depth of 1.2m to prove the joint bay locations and subsequently prove cable section lengths. In the event archaeological trial trenching has not been completed to facilitate the trial trenching programme of works, an Archaeological Clerk of Works will attend site for these trial hole activities and witness the works in the form of a watching brief. In the event archaeological finds are discovered, works will be stopped until archaeological teams have excavate and assessed the area .

Soil samples and information will also be gathered from these trial holes to check the thermal resistivity for the cable system design and ground type to assist with excavation construction designs. EGL2 will complete a soil resource report, capturing pH samples, etc, as part of the pre-construction works, to measure any change post-construction. Bore hole works will also be taking place at suitable locations along trenchless solution profiles to prove the ground conditions to finalising the designs required to inform the cable installation designs.

7 Construction Sequence of Works

7.1 Enabling Works

During early enabling works (prior to the discharge of planning consents), temporary welfare will be mobilised to a safe location within the easement area, or on privately owned land. A self-contained towable ground-hog style unit as shown below in Figure 2 is a typical example of welfare that will be utilised on the project.

Figure 2 Self-contained tow-along groundhog-style welfare unit layout

7.2 Arboriculture Management Works

Prior to civil works commencing along the working width and at compound locations, all arboriculture works will be carried out. These works will be discussed with the relevant local authority tree officers to establish whether the planned works are in areas with tree preservation orders (or other restrictions). If protected trees are to be impacted, alternatives will be discussed with the Local Authority or consent will be applied for to remove.

The Project Ecologist will also carry out bat roost potential surveys along the route and further tree inspections where trees are thought to have a high potential in addition to nesting bird surveys. If arboriculture works are to take place during nesting season, these locations will be identified during the project design stage and prevention measures will be implemented. These could include removal of trees & hedgerows outside of nesting season in advance of works or having works witnessed by an Ecologist. Any trees or hedgerows that require removal will be done in accordance with the CEMP, Land Restoration Plan and the Tree & Hedgerow Protection Strategy.

All works to trees and hedgerows will be carried out in a sympathetic manner and will only be completely removed if necessary, and when other techniques are not reasonably practicable.

Tree protection measures will be put in place where required along the cable corridor. The actual measures to be employed will be developed during the detailed design and pre-construction phase, however the default position, as set out by BS5837:2012 (Ref:1-1), is that retained trees would be

protected from construction operations with the erection of demarcation or protective fencing (see Figure 3) positioned on the outer edge of the RPA or crown spread (whichever is greatest). All site operations would be restricted to the area outside of tree demarcation or protection fencing and this area would form a Construction Exclusion Zone (CEZ) unless agreed otherwise.

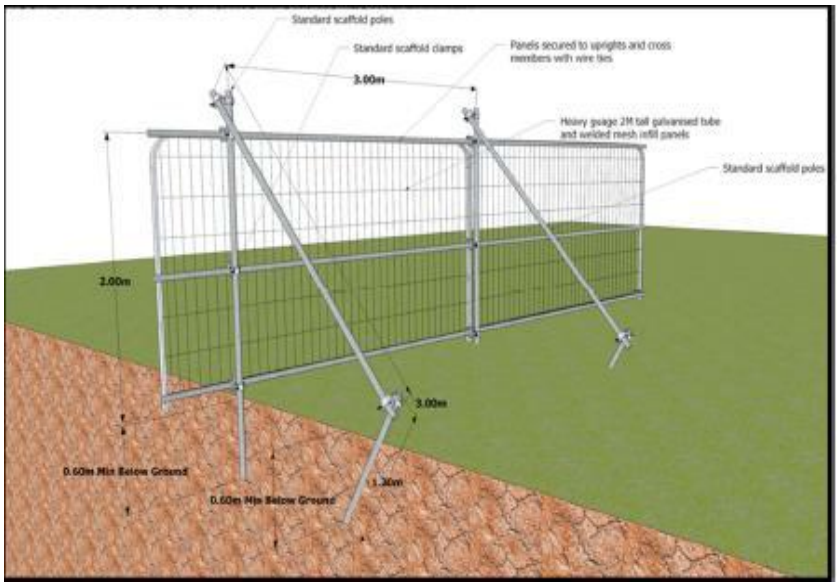


Figure 3 Default specification for outline tree protection fencing

Pre-condition surveys will be done to identify the plant type and species, and a replanting schedule will be produced. Remediation works will take place once civil works are complete. All works will endeavour to take place during the optimal planting season (e.g., October – March) to facilitate the speed of reinstatement. Where trees or hedgerows have been removed, they will be reinstated in accordance with the agreed replanting schedule and the Land Restoration Plan (Document Reference 5WMIFK-PTDOPS-XX-XXX-XX-MS-HS-000058). Any trees identified for replacement will be planted a minimum of 10m away from the DC cable trench to ensure future root growth does not affect the system.

7.3 Highways Access Works

Works to allow access from the main highway to the working width for construction activities will commence with the highways access works. Before the works commence highways, access drawings will be produced by Balfour Beatty and submitted to the relevant authority for approval in line with the consents requirements and the New Roads and Street Works Act (NRSWA) along with traffic management plans required for access and construction. The Figure 4 below shows an example road

access point from the ITN documentation that will be further developed by Balfour Beatty as part of the secondary consent process.

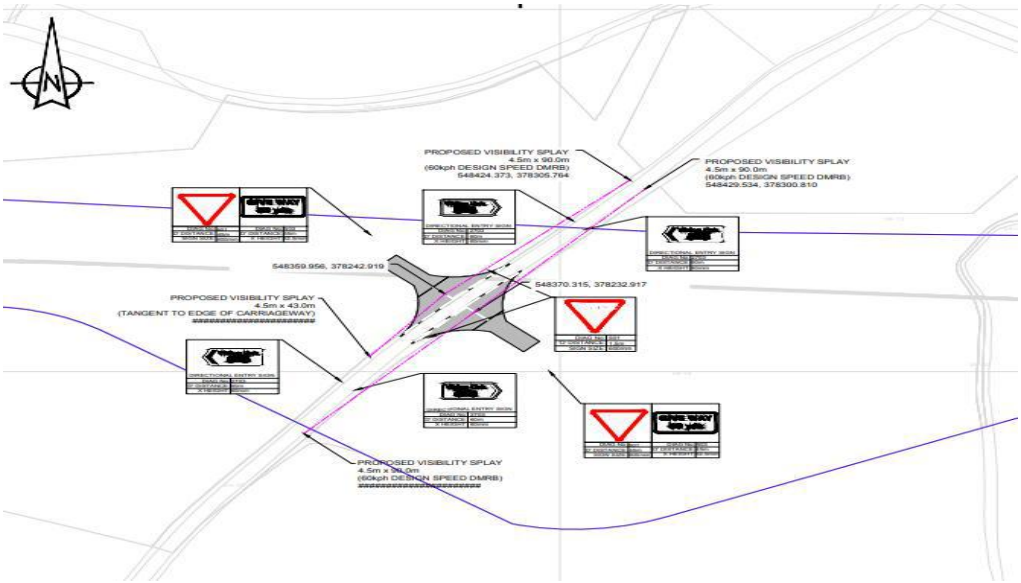


Figure 4 Example Road access point configuration

Once approved and ready for installation the traffic management will be set out by NRSWA-trained and where required Lantra-qualified personnel. During the pre-construction period a detailed overhead line (OHL) survey will be completed to identify lines which may pose an issue for access and to also ensure that all OHL have been identified on the crossing schedule. In line with HSE GS6 guidance goalpost system will be installed prior to entry onto the land where required, these will be installed to protect against impact with any overhead lines (OHL) within the accesses and compound areas. (see Figure 5)

Figure 5 New GS6 Overhead Protection System

7.4 Compound Establishment

Any existing services in the highway verge and/or within the TCC area will be identified and protected using approved methods from prior liaison with the relevant service provider(s). All TCC's that require bell mouth accesses from the highway will be installed.

TCC's will then be constructed from the bell mouths with pre-construction drainage for the compound areas installed at the same time. During the construction and throughout the life of the TCC's the area will be appropriately fenced or demarcated.

Before any excavation works commence, the relevant inductions, permits and RAMS will be issued to the relevant operatives. The fully briefed workforce will then attend site to take delivery of all the required plant & materials. All plant will be delivered to the site using a low loader and offloaded at a safe location utilising the bell mouths installed during the Section 184 Highways Access Work.

Stone will be delivered to site in 20t rigid 8-axle wagons and tipped into a stockpile in a safe designated location. Other materials such as geotextile and geogrids will be delivered by lorry and offloaded by site plant or Moffat Mountie/tail lift as required. Materials will then be transported around the site using dumper trucks.

The design & thickness for each individual compound will be dependent on the site-specific California Bearing Readings (CBR's) for each compound location. Dependent on these CBR values the compound hardstanding area will be installed to the one of the four Balfour Beatty's temporary works design drawings**.**

Stone will be distributed to the required thickness using dumper truck offloads and excavator movements. Geotextile will be placed directly on top of the subsoil and the Geogrid will be installed at the correct layer, such to ensure correct hard standing construction and strength to match the design. As the compound area is installed the stone will be compacted with suitably sized rollers in layers.

Primary Compound 2 which is to be used by both the Employer, Prysmian and Balfour Beatty will have a finished tarmac running surface, and car charging points installed, along with a barrier entry system. Once the compound area is installed to the correct design, the cabins (single storey) will be delivered. Any further equipment or materials required for the haul road and other ongoing construction works will also be delivered. This will be done in a logical sequence depending on the ongoing works and progression of other site activities. These activities will be required to allow the smooth advancement of the installation of the boundary fencing and pre-construction drainage along the cable corridor to take place and subsequently to enable the main construction programme to progress once begun. On some occasions, tasks identified as pre-construction enabling works can and may extend into the main construction phase.

7.5 Storage and Protection of the Sub-soil and Topsoil

During the compound establishment works and main construction activities the following soil management plan shall be implemented and this will explain the protocols to be followed. These will include storing sub-soil and top-soil separately and avoiding the mixing of different strata of soil.

Before any soil stripping begins, all mitigation measures pertaining to protected species and other environmental issues will be in place and an approved Soil Management Plan (Document Reference 5WMIFK-PTDOPS-XX-XXX-XX-PL-PM-000015) will be followed.

7.6 Demarcation Fence Installation Works

Before any works commence along the working width, the easement will be pegged out demarcation fencing will be erected along the edge of the easement.

In arable land this will consist of post and wire fencing consisting of 2 No. 2.5mm LT mild steel galvanised wire fixed to softwood round posts 1.65x50-75mm diameter, driven at 4 metre centres. Grazing land and locations where pastoral stock will be present during the works will have Stock Proof Fencing installed consisting of L8/80/15 wire mesh fixed to softwood posts 1.65x50-75mm diameter driven at 4 metre centres and secured at boundaries and road crossings by gating where requested by the Landowner.

Due to the field configuration, or where required by the landowners, culverts at main access points between fields will have been installed to allow the fencing works to progress ahead of the construction works. At track crossing points suitable access gating will be installed where necessary to allow access across the easement. The fencing will typically be completed using equipment such as tractors and trailers or tracked excavators with a mounted post driver (as shown in Figure 6 below). These can move easily about the route depending on the requirements of the main programme of construction works.

Until the permanent welfare units have been installed all welfare facilities will comprise of mobile units such as tow-along ground-hog style units or welfare vans. (as shown above in Figure 5) localised to the work areas.

Figure 6 Example of Tracked excavator & tractor-mounted post driver

7.7 Pre-construction Drainage

During the pre-construction phase Balfour Beatty will appoint a drainage contractor to complete drainage surveys. The Drainage Contractor (DC), the Balfour Beatty Agricultural Liaison Officer (ALO) and the client lands' team will establish an agreement with the landowners regarding the extent of the current drainage, the design of the pre-construction drainage and what will be installed for the post-construction drainage. Where required, culverts at main accesses points will have been installed to allow the drainage works to progress ahead of the compound establishment works.

Figure 7 Land drain installation

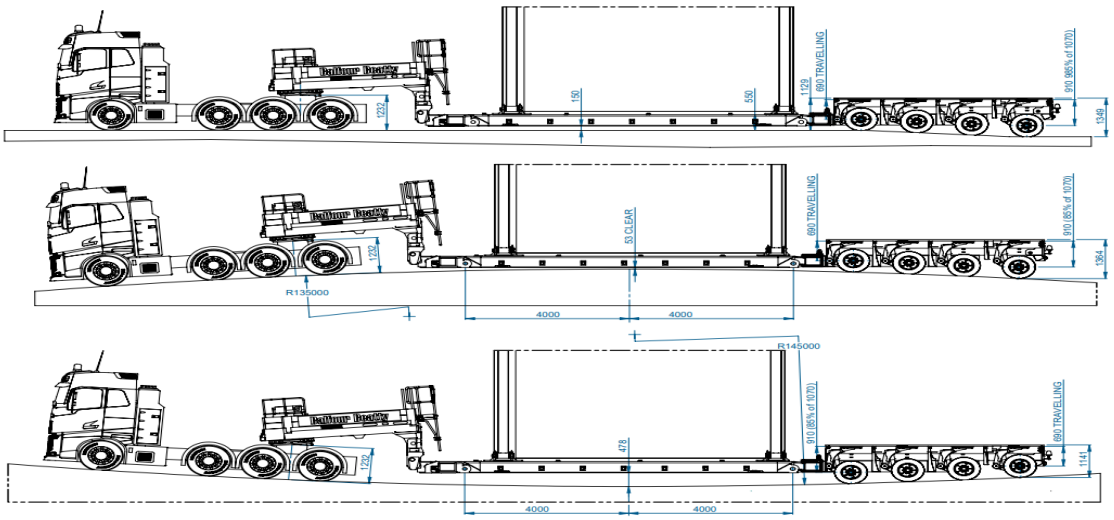
The drainage will be installed using a tracked chain trencher (like that shown above in Figure 7) to lay the drainage pipe to an accurate line and level controlled by GPS. Tracked gravel trailers will be used to feed drainage gravel to the correct specification into the trencher's hopper.

The lateral drains will either be connected into existing mains where applicable, or laid to an adjacent drain, where an outfall will be installed with a prefabricated headwall built into the bank. All necessary consents will be in place prior to the installation of drainage outfalls and all outfalls will be installed in accordance with the CEMP. A tractor mounted angled blade will follow the drainage machine to backfill the trench and level any remaining spoil.

7.8 Haul Road Installation

To reduce the disturbance to agricultural land (or similar) that the cable route crosses, and to protect as much as possible the integrity of the soil structure, a temporary haul road will be installed along a large percentage of the cable route for much of the construction period. This will also ensure that work can generally continue throughout the year in a safe and controlled manner, regardless of the weather conditions. Final haul road designs will be dependent on the California Bearing Readings (CBR's) results for each specific location and the requirements for the cable drum transportation vehicle. Dependent on these requirements the haul road will be installed to the one of the four Balfour Beatty's temporary works design drawings provided.

The haul roads to be utilised by the cable drum transportation vehicle shall be designed in line with the BB cable drum transportation trailer shown below in Figure 8 below and will also take into consideration the cable drum weight. Swept path analysis to identify sufficient turning and manoeuvring areas to this haul road design will also be required at joint bay locations where cable pulling activities are to take place to allow access and egress for the cable drum transportation vehicle.



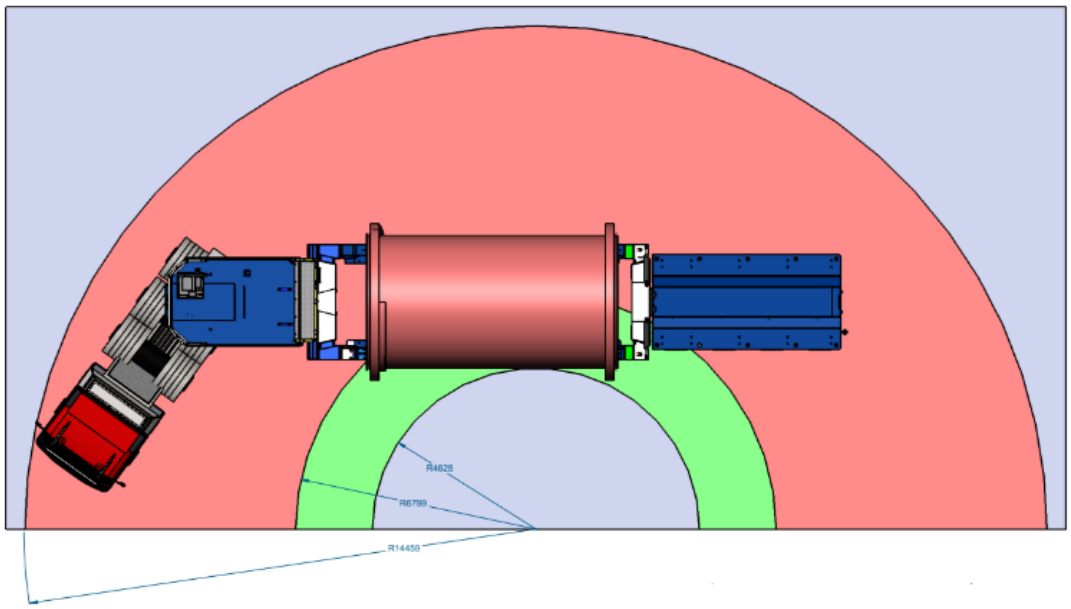


Figure 8 Typical dimensions of the cable drum transportation vehicle

Transportation of the cable drum to the joint bay locations is the critical design case for the haul road. Where there are no cable drums to be transported along the haul road, aggregate savings could be made by changing the haul road thickness to meet normal construction vehicle access requirements dependent on the CBR values. In some locations, trackway only may be appropriate. This will be dependent on the direction of the cable pull.

The construction of the haul road is scheduled to commence as soon as possible at the start of the construction period. Topsoil will be stripped (as prescribed above under the Storage and Protection of the Sub-soil and Topsoil) from the working width and stockpiled above the pre-construction land drain. This stockpile, which will be located to one side of the stripped area within the easement, will be consistently dimensioned and trimmed along its length to allow drainage and avoid erosion. The

stockpiled topsoil will be well managed and cared for to not adversely affect its condition upon replacement.

Once stripped, the CBR value of the subsoil will be assessed, and the depth of the road determined based on the design parameters. Once confirmed, the haul road will be installed to the relevant temporary works design. Stone will be delivered to the main compound locations or direct to the working area over constructed haul road accesses in 20t rigid 8-axel wagons (or similar) and tipped into a stockpile in a safe designated location (either for storage or immediate use). If necessary, the materials will be transported around the site using dumper trucks. Other materials such as geotextile and geogrids will be delivered by lorry and offloaded by site plant or Moffat Mountie/tail lift as required to the compound storage areas.

Geotextile separation membrane will be placed on the sub soil surface. Stone to the required grade will be distributed using dumper truck offloads and bladed to the required thickness. Geogrid will be installed at the relevant layer to ensure correct haul road construction and strength to match the design. Passing areas along the haul road will be installed where required. As the haul road is installed the stone will be compacted with suitably sized rollers in layers. During the construction period provision will be made to monitor and maintain the road as required.

7.9 Installation of Culverts for Haul Roads

Where required all ditches and drains crossed by the haul road will have culverts installed. These temporary ditch crossings comprising of pipes, granular fill and baulk timber or rip rap edge protection will enable construction traffic to access each field and cross tracks and road crossings which have drains running adjacent to them.

All ditches or drains which have either standing or flowing water will be dammed and over pumped in accordance with Internal Drainage Board (IDB) guidelines and in agreement with the landowners. The Agricultural Liaison Officer (ALO) and Consent Manager will establish relationships with the IDBs, and the landowners affected during the pre-construction phase to agree the correct methodology, consents and appropriate engineering designs required for these culverts, as per the Construction Drainage Plan.

This work will be carried out using 360-tracked excavators and forward tipping dumpers. The exact methodology for the ditch works will be determined following site surveys and detailed design, but will involve the following typical operations:

- Clear vegetation and install Geotextile (Teram).
- Pipe installation.
- Import and place fill to the required specification.
- Install baulk timber edge protection.

Some culvert installation works may need to take place before the main construction period (post discharge of planning conditions) to develop site access and to facilitate early construction demarcation fencing & drainage works. Agreed localised access may have to be used in this instance. These will be limited to only those required to reduce the scale of the early construction activities. These works will continue into the main construction phase in conjunction with the haul road

construction. The culvert size, design and installation will depend on the individual drain size and flow, and any IDB requirements to be considered. These requirements will be designed in the pre-construction phase in liaison with landowners, tenants and any affected IDBs. Figure 9 below shows a typical example of a culvert crossing, previously installed by Balfour Beatty on a previous project which we will look to install on EGL 2. Edge protection will be installed along the Culvert crossing to reduce the risk of falling from height and reduce the risk associated with surface water runoff.

Figure 9 Example of a culvert crossing

7.10 Temporary Bridge Crossings

Where it is impractical to install a culvert or where agreements with the IDBs or EA do not allow the watercourse to be culverted, temporary bridges may be erected over the obstacle to allow the haul road and access works to progress. These Bridges may have a potential to be swapped with culverts after discussions and agreement with the relevant stakeholders.

Bridge Crossing Ref	Crossing Type	Name / Description	Required Span (m)
Bridge 1	Stream	WC446 - Kelk Beck	TBC
Bridge 2	Drain	WC439 - Nafferton Drain	TBC
Bridge 3	Drain	WC435 - Nafferton Drain	TBC
Bridge 4	Stream	WC331 – Weighton Canal	TBC

Bridge 5	Stream	WC302 – Ouse and Humber drainage Board	TBC

Table 1 – Temporary bridge crossings

Table 1 above shows the temporary bridge crossing locations Balfour Beatty has identified during our planning methodology. However, it may be possible to eliminate some of these if access permits or if culvert crossing methodology is sufficient.

Kelk Beck lies within the SSSI area, a 15m buffer will be ensured from the riverbank (set out with fencing). It will be ensured that the working areas and associated construction activities for the cable drilling are entirely set back from the SSSI boundary and sited within arable habitats to either side of the River Hull and Kelk Beck. Prior to construction near the SSSI the Contractor will prepare an Environment Agency consent application and accompanying Scheme of Ecological Mitigation and Reinstatement setting out the mitigation methods to be employed and a methodology for the reinstatement of bank top habitats. If a temporary bridge is required at Kelk Beck, it will be designed in accordance with the design principles set out within the CEMP (Document Reference 5WMIFK-PTDOPS-XX-XXX-XX-PL-PM-000003).

During the pre-construction design period Balfour Beatty's temporary bridge partner will develop designs for each specific bridge location. These designs will be done in conjunction with the Balfour Beatty in house temporary works civils department who will produce the relevant foundation designs required. These foundations will be produced utilising pre-cast LEGATO blocks to support temporary bridges at the abutments removing the need for onsite concrete pouring in proximity to water courses; Figure 10 below shows a typical GA Abutment layout for a bridge cross section.

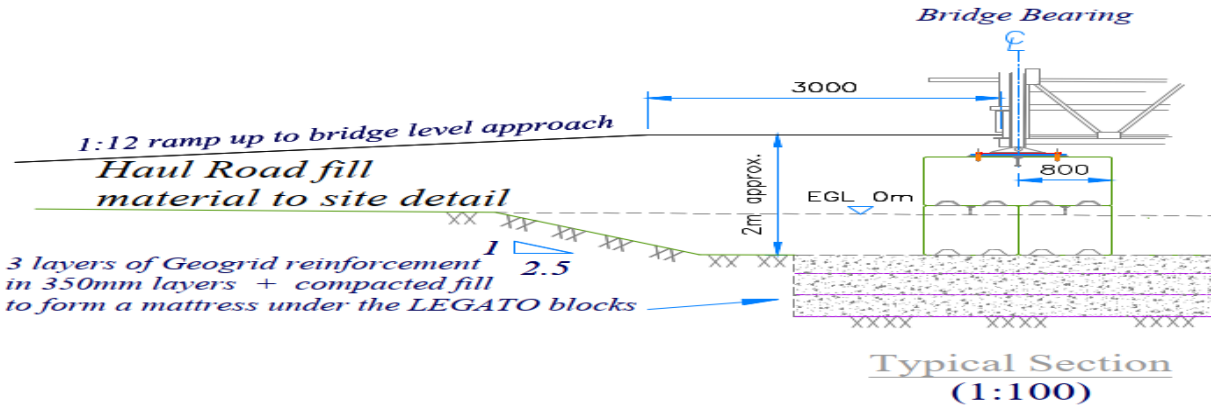


Figure 10 Example LEGARTO Bridge Abutment

At some locations, reinforced concrete foundations may not be required, e.g., where the cable drum transportation wagon does not need access, and the drain embankments are of sufficient stability. Figures 11 and 12 below show examples of both types of temporary bridges Balfour Beatty are intending to install on the project.

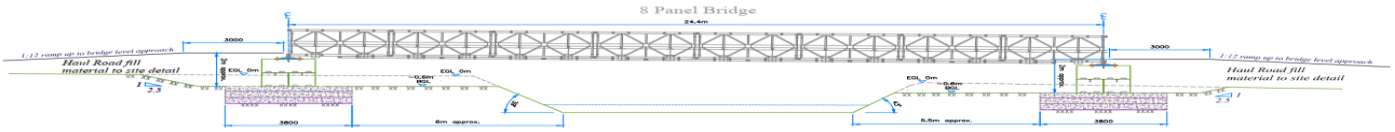


Figure 11 Example of Temporary Bridge with foundations

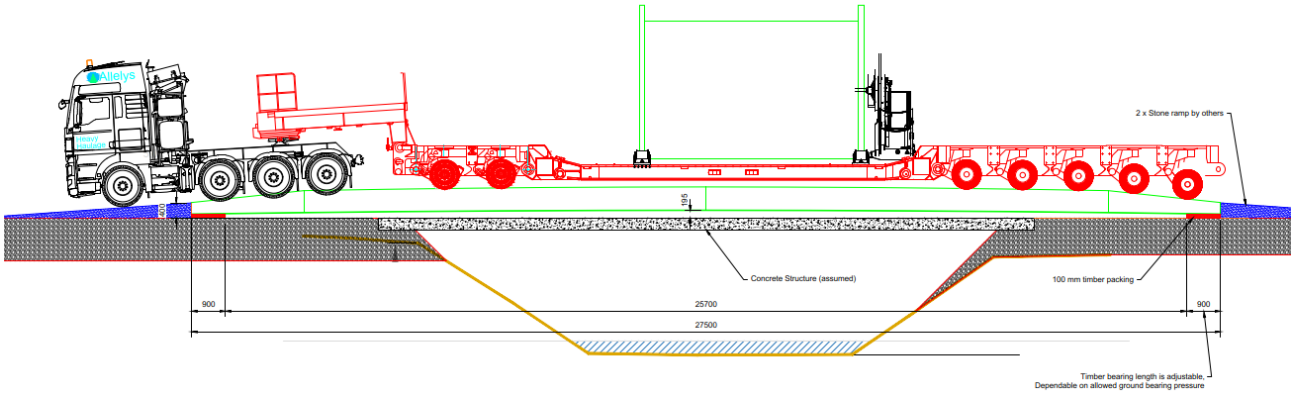


Figure 12 Example of Temporary Bridge without the need for foundations

A bridge installation gang will be operating across the route at strategic locations, in line with the programme requirements and other on-going access works in the early enabling phase. Where required, the foundations will be dug out using a 360-tracked excavator. A layer of geogrid will be installed on top of the formation to stabilise the sub-soil prior to placement of the foundations. The foundations will then be installed as per the relevant design.

The bridges will be delivered direct to the bridge location using the haul roads and TCC access points. Where necessary, crane platforms will be constructed as part of the haul road installation to facilitate the lifting of the bridge from the delivery wagons for assembly and then once assembled lifted onto the foundations.

The lifting plant, accessories, method of slinging, slewing, and placing of the load shall be outlined in the site-specific lift plan. The exact type of plant (360-tracked excavator / mobile crane / crawler crane) and lifting accessories will be confirmed once the exact bridge specification is known. A crane supervisor will coordinate all lifting operations and brief the lift plan to the personnel involved with lifting operations.

A competent slinger/signaller will attach lifting accessories to the bridge in line with the methods outlined in the lifting plan. Modular bridge sections will be lifted off the wagon and placed on top of the working platform. A competent plant & vehicle marshal will oversee and coordinate safe movement of plant and delivery wagons.

Modular bridge sections will be assembled on top of the working platform to form a complete structure in accordance with the drawings. A Balfour Beatty Engineer will mark out the exact position of the bridge bearing and resin anchor bolts on top of the reinforced concrete abutments. Resin holding down bolts will be installed by drill and fix method at the required positions to accept the bridge connection points.

A crane supervisor will coordinate bridge installation and brief the lift plan to the workforce. The bridge will be lifted off the working platform and placed on top of the abutments in line with the design details. Once the bridge is fully supported by the foundations the slinger/signaller will detach the lifting accessories, and the lifting equipment shall be demobilised. To complete installation the Balfour Beatty operative will secure the nuts over the anchor bolts. Approaches to the bridge will be backfilled with Class 6F5 aggregate or similar using a 360 tracked excavator.

Appropriate environmental protection measures will be put place in line with the project's Construction Environmental Management Plan and Environmental Risk Assessment if required. This will include measures such as geotextile material installed on the drain embankments, silt barriers and control run off to prevent sediments and leachate from polluting watercourses. Further, all necessary consents will be in place prior to construction of all temporary bridges.

7.11 De-watering

Based on the information provided by the employer in the Chapter 10 Geology & Hydrogeology, Balfour Beatty has compiled a detailed Geotechnical Interpretative Report (GIR).

The Geological and Hydrogeology report provides information from the environmental database ('Geo-insight' and 'Enviro-insight' Groundsure data 'Groundsure GIS'), publicly available online resources (e.g., British Geological Survey, Coal Authority, and 'MAGIC' online mapping). Records and geo-environmental data held by Local Planning Authorities (LPAs) relating to current and historical contaminative land uses, including waste sites. Records and geo- environmental data held by the Local Planning Authority (LPA) relating to Regionally Important Geological Sites (RIGS) and quarrying/mining sites. Records held by the Local Planning Authority (LPA) of water abstractions and private drinking water supplies. Information from site walkovers undertaken by AECOM on the 6th and 7th December 2021 of areas of interest such as potential sources of contamination including various unspecified pits and heaps, former and current chalk pits, former railways and associated infrastructure and a former inert landfill and existing GI information.

From this information it is highlighted there are number of Drinking water Safeguard zones which will be encountered in sections 1, 2 & 3. Groundwater is highlighted across the route as medium risk, to manage this anticipated ground water during the construction works significant dewatering may be required.

Balfour Beatty's specialist dewatering provider has extensive experience of carrying out dewatering works on pipeline projects nationwide and have advised that Wellpoint Dewatering would be the best methodology to manage the ground water along the cable route. These works will be undertaken with close coordination with our environmental team to ensure the appropriate abstraction licences have been agreed with the EA.

Wellpoint Dewatering is a simple yet efficient method of lowering the water table for excavation works to create a dry and stable working environment. A WellPoint dewatering system consists of a series of shallow wells, known as wellpoints, which are installed at a pre-determined depth and

appropriate spacing as per the design requirements around the area where an excavation is to take place.

The wellpoints are connected to the surface, via a riser pipe, and in turn, connected to a common header main pipe through a flex bow. This flex bow incorporates an adjustable push fit valve which allows the control of air and water entering the system, known as trimming, to give a clear view of what is being pumped. The header main pipe is connected to a wellpoint dewatering pump and then discharged to the designated point. Figure 13 below shows the system installed recently on the Balfour Beatty project.

Figure 13 Wellpoint Dewatering System Installed Recently on the Balfour Beatty Project

Due to the limited site-specific ground investigation information available at present, to confirm the extent of dewatering required, Balfour Beatty are proposing to carry out trial holes every 250-500m and at every joint bay location during the pre-construction activities. A hydrological assessment is being undertaken by a specialist consultant, as further described in the Construction Drainage Plan.

7.11.1 Unsuitable Existing Ground Conditions for Trench & Joint Bay Support

The Balfour Beatty Ground Impact Report (GIR) may also highlight areas where existing very soft to soft and very loose to loose tidal flat deposits may not be able to support the trench considering consolidation over time. Once the trial hole works referenced above have been taken to confirm the site-specific ground conditions the general trench and joint bay designs may need to be modified to support the trench and joint bay construction over time e.g., increase the thickness of CBS or any suitable low thermal resistivity material like fly ash in the bottom of the trench, increase steel in joint bay floors etc.

7.12 Description of Cable Trench Construction

7.12.1 Direct Buried Duct Specification

The direct buried power cable & fibre optic duct specifications on the EGL2 project shall comply with ENATS 12-24 industry standard.

7.12.2 Cable Trench Construction

In line with the Balfour Beatty Excavation Procedure, trench excavations may be dug to a maximum depth of 1.2m without the need for shoring designs (dependent on suitable ground conditions). As advised in the EGL2 Technical Specification a general agricultural trench depth of between 900mm and 1.2m to protection tile level is required; this gives an overall burial depth of 1.5m. Please see the trench cross section Drawing in figure 14 below.

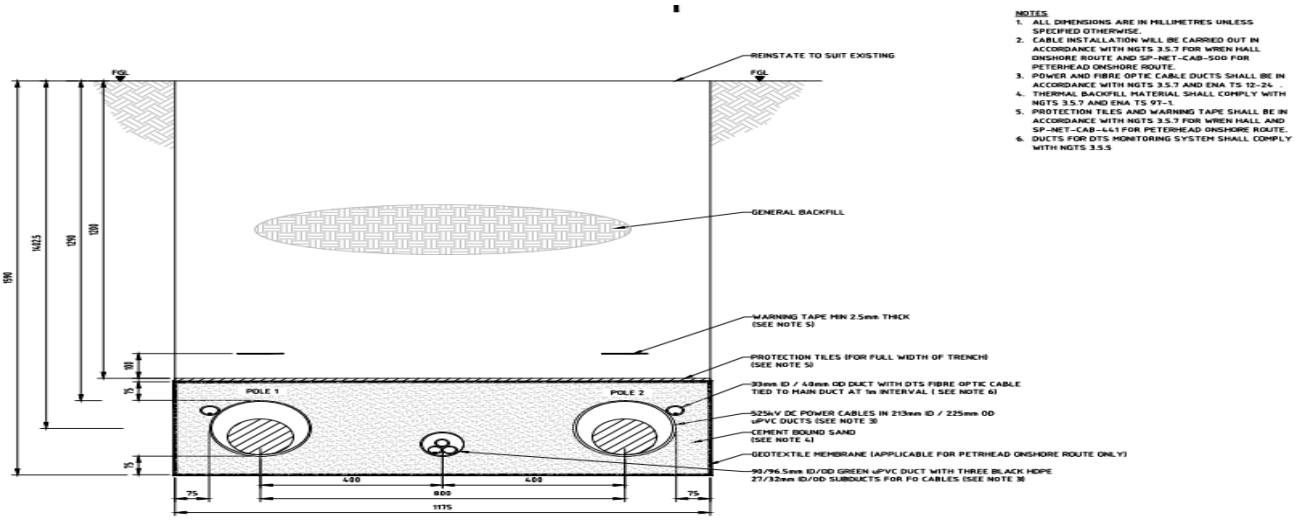


Figure 14 Trench Cross Section from Drawing

In good cohesive ground and assuming 400mm or more of topsoil will already have been stripped to create the working width, the maximum trench excavation depth of 1.2m can be achieved potentially without the need for shoring using our current methodology of utilising a standard type trenching bucket.

Should the trench depth specification of 1.2m increase or if less then 400mm of topsoil is stripped, the sub soil on either side of the trench will need to be stepped back to the relevant depth to allow excavation to 1.2m potentially without the need for shoring. Temporary work design is required if the trench depth is more than 1.2m deep.

Where ground water is encountered both methods previously given above may not be practical, therefore, to manage this the gradient on the trench sides may need to be increased which can be achieved by battering back or utilising a bespoke designed swivel or `V' type trenching bucket, see Figure 16 below. Significant de-watering will also be required which is explained in more detail in the Dewatering section of this document.

The battering back method *shown in* Figure 15 which was recently used by Balfour Beatty on a project in Lincolnshire

Figure 15 Battering back method implemented by Balfour Beatty on a project in Lincolnshire

Figure 16 Typical Swivel or `V' type trenching bucket

The decision on which specific trench design to be adopted for each location will be decided by the

Temporary Works Design Engineer and will be dependent on the ground condition identified during the bore hole & trial hole works and whether dewatering is required. Should conditions change during the works taking place the works will stop until the Temporary Works Design Engineer has evaluated the conditions and provided a design solution for the condition encountered.

The excavation process will be carried out with 360 tracked excavator assembly as shown below in Figure 17, these assemblies eliminate the requirement for the Banksman to assist the machine operator with changing attachments reducing the Plant and people interface.

Figure 17 Excavator Bucket

In soft ground conditions specialised load bearing 360bog master excavators with wide tracks will be used to limit soil damage as shown below in Figure 18:

Figure 18 Wide Track Load Bearing Bog Master 360 Excavator

The excavators will be accompanied by a Plant Vehicle Marshall (PVM) who will monitor the operation and act as a banksman and spotter for the excavator driver. These two parties will be in

constant communication to ensure that the excavator is operating within the limits of the plant and people hierarchy. The excavated subsoil will be located within the stripped easement at a suitable distance from the excavation to allow the subsequent elements of the trench installation to take place.

Should poorly ground condition be encountered whereby the open cut methodology is unachievable then the Temporary Works Design Engineer will consider alternative options such as HDD/ trenchless solution installations techniques as referenced above.

7.12.3 Duct and Engineered Backfill Installation

The power cable and fibre optic ducts will be strung out and connected via spigot and collar on top of the trench bankside. The power ducts will have a chamfered de-burr spigot to allow the cable to be pulled in either direction.

The fibre optic ducts will be connected directly to the outside of the power cable ducts at 1m intervals. Consideration will be given as to how the fibre optic duct will be maintained in position so as to avoid it slipping under the power duct and subsequently becoming crushed during the back-filling process.

7.12.4 Automated Conveyor CBS Installation

For the installation of cement-bound sand (CBS)or any low thermal resistivity suitable material for cable bedding and surround, we are proposing to use a Magnum conveyor when installing.

The Magnum is built for this type of fast linear work and allows the CBS to be delivered straight into the conveyor via 20tonne HGV tippers. The machine is stopped while the tipper empties the load into the transfer conveyor and, once the unit is full the magnum resumes its belts and travel speed to lay the material once again into the trench. Figure 19 below demonstrates the Magnum Conveyor in operation.

Figure 19 CBS Installation via Magnum Conveyor in Operation

The use of the Magnum creates a safer working environment as it reduces the number of operatives required to carry out the work; besides the truck operators hauling the material, only one operator

is required, and no persons are required in the trench. Each cycle starts when the tipper begins unloading into the reloading conveyor and ending when the next tipper begins loading takes on average about 6 minutes. By using one of these units, the equipment can stay back away from the trench so as not to trench collapse.

A 75mm compacted layer of CBS will be installed into the bottom of the trench. The ducts will then be slung and mechanically lowered into the trench with the assistance of a 2nd tracked 360 excavators, before the top layer of CBS is installed the banksman shall ensure that the DTS duct is in its correct position to avoid it from being crushed during the backfilling operation. The final compacted layer of CBS will then be installed and compacted to a depth of 75mm above the duct.

7.12.5 Trench Backfilling

The Stokboard cable protection tile will then be installed directly on top of the compacted CBS layer. This operation will be independent from the compaction and backfill operations and will run between these two operations at the required rate of progress. Balfour Beatty working in conjunction with our supply partner Centriforce have developed protection tile on a roll as opposed to metre long sections. As well as speeding up production the protection tile doing well reduces the time operatives are required in the trench and reduces the risk of gaps being left between connections during installation (see Figure 20).

Figure 20 Protection Tile on a Roll

A tracked excavator will then install 100mm of subsoil above the Stokboard tile where another 2.5mm thick warning tape will be installed above each duct. The tracked excavator will then continue to grade the subsoil from the stockpile and move it in layers into the trench reinstating the ground level to the stripped top of subsoil level. The excavator operator and PVM will be working in conjunction with one another to maintain constant communication and to ensure that the excavator is operating within the limits of the plant and people hierarchy.

Maximising a ‘no man entry’ approach as much as possible during the subsoil compaction operations, a remotely operated compaction unit will be driven along the length of the trench to ensure compaction during the backfilling process, see Figure 21 below. The operator and compaction unit will work with the excavator at a reasonable distance to ensure correct plant people interface controls are maintained. Any excess sub soil will be graded out across the working width via agreement between the Balfour Beatty ALO and relevant landowner.

Figure 21 A typical remote operated compaction unit

7.12.6 Description of Trenched Road Crossing Construction

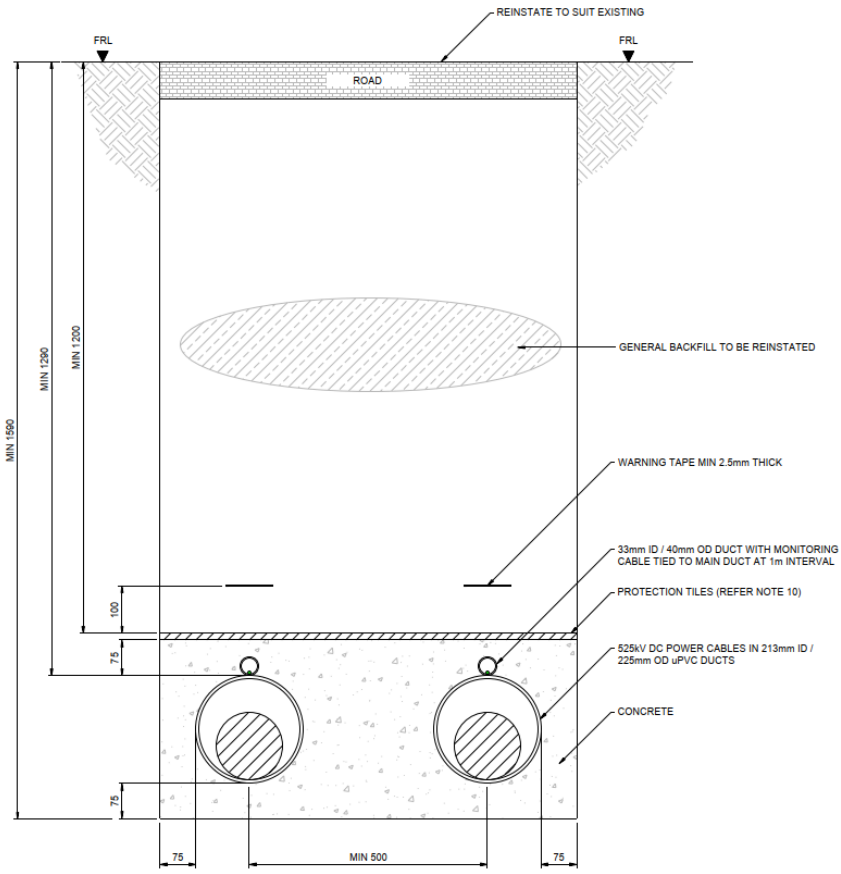
During the project pre-construction phase meetings will take place with Highways Authorities to agree key dates, methodologies, and the notification process under the New Road & Street Works Act. Typically, notifications will be processed under Section 50's which permits a company to install new apparatus in the highway. The EGL2 Technical Specification shows 75mm cover to the top of the protection tile for installations in the fields and roads.

Once approval has been granted by the Highways Authorities and the commencement date of works agreed, traffic management will be put in place. In the case of narrow roads this could be in the form of a road closure with diversion routes, which will be agreed prior with the Highways Authorities. All setting out and maintenance of traffic management will be carried out by a Balfour Beatty qualified LANTRA subcontractor.

When the works are ready to commence, the following sequence of works will commence:

- Third party utility plans will be reviewed and the area to be excavated will be scanned with a CAT & Genny and any third-party apparatus will be marked up.
- A Balfour Beatty permit to dig (AWNES) will then be issued by the Site Engineer to a qualified receiver.
- Trench will be marked out on the tarmac black top and cut with a diamond bladed floor saw.
- A 360 excavator with a hydraulic breaker attachment will then break the hard top. The excavator will be always accompanied by a Plant Vehicle Marshall (PVM) who will monitor the operation and act as a banksman and spotter for the excavator driver.
- Once completed the breaker will be changed to a trenching bucket and the road excavated to the required deign depth. The excavated soil will be loaded directly onto a tipper wagon and transported from site to a licenced waste recycling location.
- 75mm of CBSC40 concrete will then be placed in the bottom of the trench and the ducts (power, FO and communication) will then be placed on top of this and connected to existing ducts.

- A further 75mm of C40 concrete will then be installed around and on top of the ducts to form a duct block. The concrete will then be left to cure over night.
- Alternatively, a precast duct block cast off site with the correct ducts/duct spacing will be delivered to site and installed to prevent the need for onsite concrete pouring or man entry into the excavation.
- Once cured/installed the cable protection tile will be placed directly on top across the full width of the trench to ensure it overlaps the ducts.
- The concrete duct block will be installed across the full width of the road and extend 2m beyond the road, or hedge boundary if present.
- 100mm of hard-core aggregate will then be installed and compacted and cable waring tape installed directly above each of the power ducts.
- Hard-core aggregate will then be installed in layers and compacted in-line with HAUC specification.
- The tarmac black top will then be laid to the HAUC road classification specification (Figure 22).



DEPTH vs SPACING		
DEPTH TO TOP OF TILE mm	DEPTH TO TOP OF POWER CABLE DUCT mm	MINIMUM POLE SPACING mm
≤1200	≤1290	500
≤1300	≤1390	700
≤1400	≤1490	800
≤1500	≤1590	900
≤1600	≤1690	1000
≤1700	≤1790	1100
≤1800	≤1890	1200
≤1900	≤1990	1300
≤2000	≤2090	1400
≤2100	≤2190	1600
≤2200	≤2290	1700
≤2300	≤2390	1900
≤2400	≤2490	2000

Notes:THOUGH MINIMUM DEPTH AT ROAD CROSSING IS 840mm (TO THE TOP OF DUCT), TO AVOID TOO MANY VERTICAL BENDS CABLES SHALL BE INSTALLED AT STANDARD DEPTH OF 1290mm (TO THE TOP OF DUCT)

Figure 22 Typical Road crossing trench section

7.12.7 Description of Crossing Third Party Assets via Open Trench

During the pre-construction period surveys and detailed design of each asset crossing will be undertaken to gain the relevant consents required to cross the asset.

The Balfour Beatty Cable Design Engineer will produce a specific cross-section trench design for each asset that is crossed by the cable route. This design will be based on the cable operating perimeters and take into consideration the depth versus spacing requirements. This design will be submitted to the relevant authority, e.g. Internal Drainage Board, and Utility Assets Owners for approval. Work will only commence once consents from each relevant asset owner has been granted formally.

Where deep excavation is identified the Balfour Beatty Temporary Works Design Engineer shall produce specific shoring designs for each location taking into consideration, the cross-section trench design, location specific civil engineering issues such as ground conditions, surrounding structures, and confined space access and egress.

In line with the Balfour Beatty safe digging procedure and HSG47, a pre-defined exclusion zone will be implemented either side of the utility and hand excavation only shall take place within this exclusion zone. The distance of the exclusion zone from either side of the utility will be dependent on the type of utility. The exclusion zone distance will be identified on the Balfour Beatty Permit to Dig (AWNES).(see Figure 23 below).

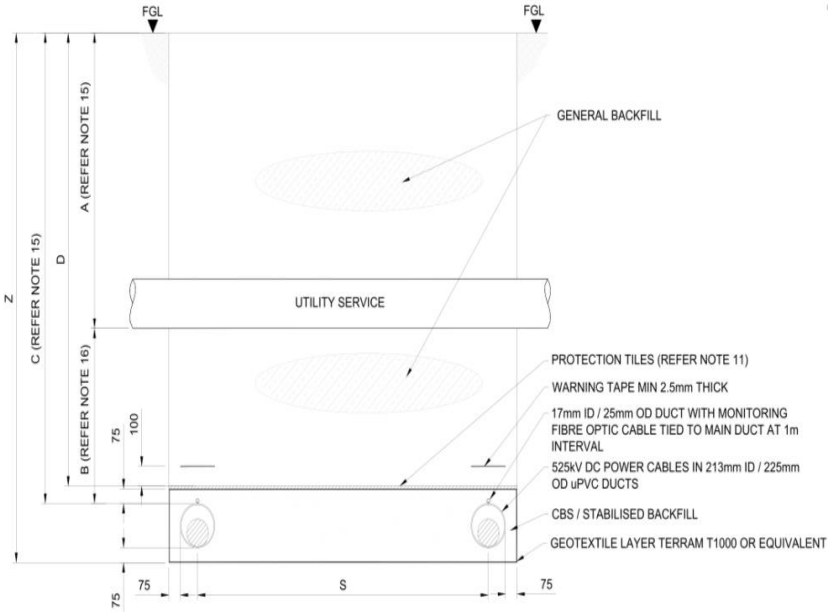


TABLE-1

DEPTH vs SPACING

DEPTH TO TOP OF TILE (D) mm	DEPTH TO TOP OF POWER CABLE DUCT (C) mm	MINIMUM POLE SPACING (S) mm	OVERALL DEPTH OF TRENCH (Z) mm
≤1300	≤1390	725	1690
≤1400	≤1490	800	1790
≤1500	≤1590	900	1890
≤1600	≤1690	1000	1990
≤1700	≤1790	1100	2090
≤1800	≤1890	1200	2190
≤1900	≤1990	1300	2290
≤2000	≤2090	1400	2390
≤2100	≤2190	1600	2490
≤2200	≤2290	1700	2590
≤2300	≤2390	1900	2690
≤2400	≤2490	2000	2790

15. DEPTH TO TOP OF POWER CABLE DUCT (C) = DEPTH OF BOTTOM OF SERVICE(A)+CLEARANCE FROM BOTTOM OF SERVICE TO TOP OF POWER CABLE DUCT(B).

Figure 23 Typical utility crossing trench cross section

7.13 Description of Trenchless Road and Asset Crossing Construction

Balfour Beatty will work with their relevant HDD subcontractor's during the pre-construction period to ensure that detailed design of each asset crossing is in place for the construction phase of the project. This will include the Network Rail HDD.

The HDD subcontractor's will be responsible for carrying out the relevant surveys, bore holes and producing designs for approval as part of their scope of works under their contract with Balfour Beatty. This will include any revision to designs to gain consent and approval from the relevant regulatory authority and stakeholders, e.g. Highways, Network Rail, Internal Drainage Board, Canals & Rivers Trust, Environment Agency, and Local Authorities. Work will only commence once consents from each relevant asset owner has been formally granted. Some of these approvals may extend into the construction phase of the project e.g. Network Rail.

Where HDD's cross third-party utility apparatus, detailed design of each asset crossing will be undertaken, and the utility asset owner will be consulted with to ensure that the designs meet with their clearance specification and that the methodology of the works is formally approved by them.

Where permissible trial holes will be taken to physically expose and identify the depth of the utility asset prior to any drilling activities. Where trail holes cannot be taken GPR surveys will be carried out to identify the depth of the utility asset.

The crossing design will be supported with design calculations including (but not limited to) settlement calculation, topographical surveys, drill profile drawings, mud pressures, drilling torque, pull back calculations and steering co-ordinates, as well as identification of any services to be crossed or adjacent to the working area. HDD at watercourses will be agreed with the LLFA, EA and IDB. A full construction pack will be prepared for each crossing including inductions, permits, design, fluid calculations, pipe welding parameters, pull back calculations, method statement environmental management plan, emergency plans, and location specific site layout plans.

7.14 HDD Mobilisation

For the HDD installations, the equipment will be transported along the haul road accessed from the nearest TCC. Localised access may also be used to start early HDDs. For the smaller crossings, the rigs will sit to one side of the haul road with the drilling equipment adjacent and will be supplied from the haul road/localised access. The hard standing areas for the smaller HDDs will predominantly be trackway matting. Allowances will be made for additional hard standings for the larger HDD crossings which require the heavier rigs, e.g. the river crossings and landfall drill.

It is proposed that the HDD rigs utilised on the project will all be self-contained tracked machines and readily able to access the drilling location. Any ancillary equipment would be loaded at the haul road end point and transported together with the rig. For the larger of the HDDs the rig will arrive in a number of sections, each by low loader, and a dedicated HDD working, and compound area will be installed as part of the haul road and easement construction at the drill location.

The HDPE pipe strings will be welded on site by a separate pipe welding crew using fully automatic butt fusion welding equipment. The 6m HDPE pipe lengths will be strung out to the required length on the exit side of the HDD and positioned in the welding machine for jointing. The HDPE pipe used will have a fused filament fabrication (FFF), each weld will be videoed and formally recorded in the

relevant Inspection and Test Plan (ITP). The welds will be continued until all of the required pipes are complete and ready for the pullback operation (See Figure 24).

Figure 24 Butt fusion welding and completed pipe string

Water will be drawn from designated hydrants or drains and transported to site via tankers or bowsers. Where water extractions from drains is required, consent will be applied for in advance. The movement frequency of the tankers or bowsers is largely dependent on the formation and density of the ground conditions.

A launch pit for the entry of the drill string will be excavated and if required it will be battered to ensure the integrity of the excavation for the duration of the drilling. A similar pit at the exit point of the drill will be excavated to allow the drill head to emerge and heads to be swapped during various drilling and reaming passes. These pits shall be restricted to no-man entry. Once the pits are excavated the drill rig will be positioned with the correct tooling above the entry pit and the pilot bore can commence.

7.14.1 HDD Pilot Hole Drilling

One pilot hole will be drilled for each section of product pipe. Each pilot hole will be drilled typically with 2.38” drill pipes and 4” jetting assembly using standard walkover drilling techniques. For the larger drill crossings such as the River Ouse a GPS guiding system such as Wire Lines will be utilised.

Slurry is pumped through the centre of the drill pipe to provide a hydraulic cutting action. The slurry jets from the bit lubricate the hole and moving cuttings. During the pilot operation a down-hole pressure tool will be fitted in line of the drill string to continuously monitor the pressure down-hole reducing the risk of drilling fluid frack out. Should the down-hole pressure exceed the recommended calculation within the ground formations being drilled then the drill string will be retracted releasing the excessive pressure, and the pilot drill will recommence.

The position of the drill is monitored by directional guidance equipment positioned in the jetting assembly. The signal is then radiated to the control unit positioned at the surface. This data combined with accurate record keeping on site allow simple mathematical computations to be made and to record the progress and position of the pilot drill. The down-hole assembly has an

angled steering shoe to give the drill a bias in one direction. By rotating the drill string, the tool face of the down-hole drilling bit is rotated, altering the drilling bias, and so altering the drilling direction. In this way the direction of the drill can be controlled. (See Figure 25 below.)

Figure 25 Typical HDD rig

A mud/slurry return line may be used to transfer drill slurry and cuttings from the pipe side back to the rig side to be recycled before being re-used down hole. The slurry return line will consist of two 4" pumps positioned in series with 4" hose and bowser connections. The return line will then be connected to the mud lagoons using 100mm diameter rigid hose with Bauer type couplings to complete the recycling loop from exit to entry side. Where the slurry returns lines crossroad ways, waterways etc. a tractor and tanker will be utilised to transfer slurry and cuttings as site conditions dictate. This will not be required for the shorter ditch crossings.

7.14.2 HDD Reaming

After the main pilot hole has been completed it will be necessary to enlarge the pilot hole sufficiently to receive the product pipe. This is achieved by removing the pilot drill and by attaching a reaming tool to the drill string. The drill string and reamer are then rotated and drawn back towards the drilling rig, cutting the hole as it progresses. This process is repeated with larger diameter reamers until the required diameter is reached to allow safe passage of the product pipes. Drilling fluid is jetted through the reamer to lubricate during cutting and to enable the lining of the hole to remain stable. The hole is typically cut to a size 25% to 50% larger than the pipe(s) it has to carry. This is to facilitate the passage of soil cuttings as well as the pipe and allow for any clay expansion that may occur during the pulling process. The drilling fluid is a slurry or "mud" produced by mixing ground and refined bentonite or polymer to fresh water, which reduces drilling torque, imparts lubrication to the pipe and provides annular flushing of the freshly cut borehole soil debris and gives support to the bored hole.

7.14.3 HDD Duct Specification

The HDD power cable and fibre optic duct specifications proposed for installation on the EGL2 project by Balfour Beatty is:

- Power cable HDD - 255/315 SDR11 HDPE Duct.
- Fibre Optic HDD - 50/63mm SDR 11 HDPE Duct.

7.14.4 HDD Duct Installation

The HDPE pipes will be welded together using a welding machine keeping the HDD length in consideration. The welding area will be covered with a waterproof tent to avoid any weather impacts during the welding process. After the welding is complete the pipes will be moved towards the exit pit using cable rollers. The pipe pulling heads are attached to the pipe string and are attached to the reamer via a swivel and universal joint. The pipe pullback operation will be coordinated by the Guidance Technician. Before pulling commences the Guidance Technician shall check that the area is clear and instruct the drill operator to commence the pull. Pullback will proceed and joints of drill line will be pulled and removed at the rig. In the event of increased pullback pressure (which is continuously monitored) the process will be stopped, the pipe pulled out and further pre reaming will take place. The ducts will be proved by blowing a suitable brush or pig through to prove their integrity. A CCTV survey will then be carried out following this and records kept which shall include the following:

1. Date of test.
2. Chainage(s).
3. Identification of the duct.
4. Confirmation that the duct is free from foreign matter and water.
5. Direction that the test is carried out in.

Cap ends will then be installed at either end of the duct to maintain cleanliness in preparation for the cable installation. (see Figure 26).

Figure 26 Pipe prepared with pulling heads

7.14.5 Grouting HDD Ducts with Bentonite

Where thermal resistivity cable ratings dictate that due to the depth of the HDD, Bentonite fluid is required, this shall be pumped in after the cables have been installed. In order to achieve this, while maintaining a full ducted system, a grout plug method which creates the seal between the duct and cable, will be implemented.

This method comprises of six stages, two of which are pre-cable installation and four which are post-cable installation.

Pre- Cable Installation	
Stage 1	Using a 2" hole cutter, cut through the HPPE Duct approx. 250mm from each end of the HPPE Duct.
Stage 2	Install Electrofusion 63mm Tapping Saddles approx. 500mm from each end of the HPPE Duct and tap through (see figure 47 below).
Post-Cable Installation	
Stage 3	Using a mix of grout and cement install a plug through the pre-formed 2" hole packing the plug into the duct bore to ensuring the plug is completely around the Cable.
Stage 4	Allow the plugs to set for 24 hours prior to bentonite grout pumping.
Stage 5	Pump in the bentonite grout via a 2" injection pipe connected to the 63mm Electrofusion Tapping Saddle at one end and purge out of a venting pipe connected to the 63mm Electrofusion Tapping Saddle at the other end.
Stage 6	Allow the bentonite grout to cure for 24 hours then seal off the injection and venting pipework allowing excavation to be backfilled.

The works will be carried out in a logical sequence with a typical three-man bentonite installation team working alongside the cable installation teams. Where aggregate haul road has not been installed during the enabling works, trackway matting will be installed to access the point of works. (see Figure 27).

Figure 27 Electrofusion 63mm tapping saddle

7.14.6 HDD and Construction Works at the Rail Crossing

Prior to works commencing the relevant designs will have been produced and the consents approved with Network Rail during the pre-construction phase and early construction phase. Post line monitoring will also have been carried out prior to any works commencing. During the drilling operations Network Rail may insist that the works are not carried out while the railway is live. If this is the case a possession
may be required to allow the drilling works to be carried out while trains are not operating.

There are 2 Railway crossings identified on the project:

1. Howden Railway crossing (Under ERYC).
2. Hutton Railway crossing (Under ERYC).

The main drilling compound will be established, and duct delivery will be via the haul road to the adjacent side of the rail line where the ducts will be strung out and welded. Hardstanding areas will be established both directly north and south of the rail line at a distance agreed with Network Rail. The drilling methodology for this HDD will be similar to that already mentioned above however, during the drilling operation line monitoring will be carried out. Once the pipes have been installed line monitoring will continue to be carried out by for a set period as required by Network Rail from the completion of the works to ensure that there is no settlement on the line.

7.14.7 Trenchless solution-HDD Water crossings

The use of HDD technology to cross watercourses will be agreed with Canals & Rivers Trust, LLFA, EA and/or the relevant IDB. All the main water crossings will be crossed by HDD. The drilling methodology for main water crossings will be similar to that already mentioned above however the River Ouse drilling will be done by using the wireline method instead of the walkovers to monitor the pilot. In this a wire will run from the beacon fitted inside the pilot to the machine which will be connected to a computer to monitor the depth during drilling operations. When working in close proximity to Local Nature Reserve sites we will ensure that the extent of the planning application boundary is clearly demarcated (with fencing and signage) and that protection buffers are put in place in order to ensure that direct disturbance of these LWSs is entirely avoided. This applies to crossings of Hudson's Way Local Nature Reserve site. In our projects we have identified the following water crossing locations, set out in Table 2 below:

Name	Description / Stakeholder Reference	Type Water Course: (Small Ditch, Large Ditch, River, Pond/Lake)
Auburn Beck	*East Riding of Yorkshire Council/Canal and River Trust*	*River / Canal*
-	*East Riding of Yorkshire Council*	*Small Ditch*
The Earl's Dike	*East Riding of Yorkshire Council / Beverley & North Holderness IDB*	*Ditch*
Burton Drain	*East Riding of Yorkshire Council / East Riding of Yorkshire Council / Beverley & North Holderness IDB*	*Ditch*
-	*East Riding of Yorkshire Council*	*Small Ditch*

Name	Description / Stakeholder Reference	Type Water Course: (Small Ditch, Large Ditch, River, Pond/Lake)
Gransmoor Drain	*Beverley & North Holderness IDB East Riding of Yorkshire Council*	*Ditch*
Kelk Beck	*East Riding of Yorkshire Council / East Riding of Yorkshire Council /Environment Agency/ Canal and River Trust*	*River / Canal*
Warren Hill Drain	*East Riding of Yorkshire Council / East Riding of Yorkshire Council /Beverley & North Holderness IDB/*	*Ditch*
Drain	*East Riding of Yorkshire Council / East Riding of Yorkshire Council /Beverley & North Holderness IDB/*	*Ditch*
White Dike Branch	*East Riding of Yorkshire Council / East Riding of Yorkshire Council /Beverley & North Holderness IDB*	*Ditch*
White Dike	*East Riding of Yorkshire Council / East Riding of Yorkshire Council /Beverley & North Holderness IDB/ Canal and River Trust*	*Ditch*
-	*East Riding of Yorkshire Council / East Riding of Yorkshire Council /Beverley & North Holderness IDB/ Canal and River Trust*	*Small Ditch*
Nafferton Drain	*East Riding of Yorkshire Council / East Riding of Yorkshire Council /Environment Agency/ Canal and River Trust*	*Canal*
-	*East Riding of Yorkshire Council / East Riding of Yorkshire Council /Beverley & North Holderness IDB*	*Small Ditch*
-	*East Riding of Yorkshire Council / East Riding of Yorkshire Council /Beverley & North Holderness IDB*	*Small Ditch*
Nafferton Beck	*East Riding of Yorkshire Council / East Riding of Yorkshire Council /Environment Agency/ Canal and River Trust*	*River / Canal*
-	*East Riding of Yorkshire Council / East Riding of Yorkshire Council /Beverley & North Holderness IDB*	*Small Ditch*
Driffield Canal	*East Riding of Yorkshire Council / East Riding of Yorkshire Council /Environment Agency/ Canal and River Trust*	*River / Canal*
-	*East Riding of Yorkshire Council / East Riding of Yorkshire Council /Beverley & North Holderness IDB*	*Small Ditch*
River Hull	*East Riding of Yorkshire Council / East Riding of Yorkshire Council /Environment Agency/ Canal and River Trust*	*River / Canal*
-	*East Riding of Yorkshire Council / East Riding of Yorkshire Council /Beverley & North Holderness IDB*	*Small Ditch*
-	*East Riding of Yorkshire Council / East Riding of Yorkshire Council /Beverley & North Holderness IDB*	*Small Ditch*
-	*East Riding of Yorkshire Council / East Riding of Yorkshire Council*	*Small Ditch*

Name	Description / Stakeholder Reference	Type Water Course: (Small Ditch, Large Ditch, River, Pond/Lake)
-	*East Riding of Yorkshire Council / East Riding of Yorkshire Council / Beverley & North Holderness IDB*	*Small Ditch*
-	*East Riding of Yorkshire Council / East Riding of Yorkshire Council / Beverley & North Holderness IDB*	*Small Ditch*
-	*East Riding of Yorkshire Council / East Riding of Yorkshire Council / Beverley & North Holderness IDB*	*Medium Ditch*
Knorka Dike	*East Riding of Yorkshire Council / East Riding of Yorkshire Council / Beverley & North Holderness IDB/ Canal and River Trust*	*River / Canal*
Northfield Beck	*East Riding of Yorkshire Council / East Riding of Yorkshire Council / Beverley & North Holderness IDB/ Canal and River Trust*	*River / Canal*
-	*East Riding of Yorkshire Council / East Riding of Yorkshire Council*	*Small Ditch*
-	*East Riding of Yorkshire Council / East Riding of Yorkshire Council*	*Small Ditch*
Drain	*East Riding of Yorkshire Council / East Riding of Yorkshire Council / Ouse & Humber Drainage Board/*	*Ditch*
Drain	*East Riding of Yorkshire Council / East Riding of Yorkshire Council / Ouse & Humber Drainage Board/*	*Ditch*
Back Delfin / Market Weighton Canal Main River	*East Riding of Yorkshire Council / East Riding of Yorkshire Council / Environment Agency/ Canal and River Trust*	*River / Canal*
Egremont Drain	*East Riding of Yorkshire Council / East Riding of Yorkshire Council / Ouse & Humber Drainage Board/*	*Ditch*
Main Drain	*East Riding of Yorkshire Council / East Riding of Yorkshire Council / Ouse & Humber Drainage Board/*	*Ditch*
-	*East Riding of Yorkshire Council / East Riding of Yorkshire Council / Ouse & Humber Drainage Board*	*Small Ditch*
-	*East Riding of Yorkshire Council / East Riding of Yorkshire Council / Ouse & Humber Drainage Board*	*Small Ditch*
River Foulness	*East Riding of Yorkshire Council / East Riding of Yorkshire Council / Ouse & Humber Drainage Board/ Canal and River Trust*	*River / Canal*
Bishopsoil Drain / Featherbed Drain	*East Riding of Yorkshire Council / East Riding of Yorkshire Council / Ouse & Humber Drainage Board/*	*Ditch*
-	*East Riding of Yorkshire Council / East Riding of Yorkshire Council / Ouse & Humber Drainage Board*	*Medium Ditch*
Black Dyke	*East Riding of Yorkshire Council / East Riding of Yorkshire Council / Ouse & Humber Drainage Board*	*Ditch*

Name	Description / Stakeholder Reference	Type Water Course: (Small Ditch, Large Ditch, River, Pond/Lake)
-	*East Riding of Yorkshire Council / East Riding of Yorkshire Council / Ouse & Humber Drainage Board*	*Small Ditch*
New Drain	*East Riding of Yorkshire Council / East Riding of Yorkshire Council / Ouse & Humber Drainage Board*	*Ditch*
Asselby Marsh Drain	*East Riding of Yorkshire Council / East Riding of Yorkshire Council / Ouse & Humber Drainage Board*	*Ditch*
Asselby Marsh Lane Drain	*East Riding of Yorkshire Council / East Riding of Yorkshire Council / Ouse & Humber Drainage Board*	*Ditch*
Lowfield Drain	*East Riding of Yorkshire Council / East Riding of Yorkshire Council / Ouse & Humber Drainage Board*	*Ditch*
Bankfield Lane Drain	*East Riding of Yorkshire Council / East Riding of Yorkshire Council / Ouse & Humber Drainage Board*	*Ditch*
-	*East Riding of Yorkshire Council / East Riding of Yorkshire Council / Ouse & Humber Drainage Board*	*Small Ditch*
River Ouse	*North Yorkshire/ North Yorkshire/ Environment Agency/ Canal and River Trust*	*River / Canal*
Black Tom Drain	*North Yorkshire/ North Yorkshire/ Selby Area IDB*	*Ditch*
Back Lane Drain	*North Yorkshire/ North Yorkshire/ Selby Area IDB*	*Ditch*

Table 2 Water crossing locations

7.14.8 HDD Demobilisation

Upon completion of each of the HDD drilling activities, all equipment will be demobilised from the site and the waste drill fluids collected and where possible transported to the next HDD location for reuse, or off-site for disposal. The as-drilled profile data and plan will be collected for the as built records, and any welding & videography records collated into the quality file.

7.15 Alternative Installation Options

Where Horizontal Directional Drilling cannot be achieved due to unsuitable ground conditions, where an asset owner may object to the methodology or where open cut has been discounted due to space constraints (or otherwise), another trenchless solution such as Augur Bore or pipe Jacking methodology may be considered. Should this issue arise specific designs will be produced by the specialist contractor employed to carry out the Augur Bore works. Directional Auger Boring is a technique whereby the ducts are installed between two prepared shafts, usually manholes. The auger boring rig is set up in the launch shaft and the laser guided probe is then jacked through the ground to the reception exit shaft. Assisted by pilot rods equipped with optical passage, steering head, and theodolite with CCD camera and monitor. Open-guided auger boring can be carried out in displaceable ground. The pilot pipe is pushed through the ground towards the target shaft. The

direction is monitored by the CCD camera throughout the whole process. The direction of the head is adjusted by rotating the pilot pipes to guide the steering head on the crosshair image on the guidance monitor.

Dependent on the length of the bore, torque problems may arise in wet or compacted cohesive soils. Bohrtec developed a double-walled pilot rod. The double pilot rod allows the internal rod to turn the steering head; whilst the outer steel sleeve takes all the ground friction. The precision-guided bore made by the pilot pipe; this is then followed by the steel cased auger section which enlarges the bore to the same size as the product pipes. The product pipes are then jacked through whilst the casings are being retrieved in the reception pit. Figure 28 below demonstrates the typical stage by stage activities of Auger Bore works.

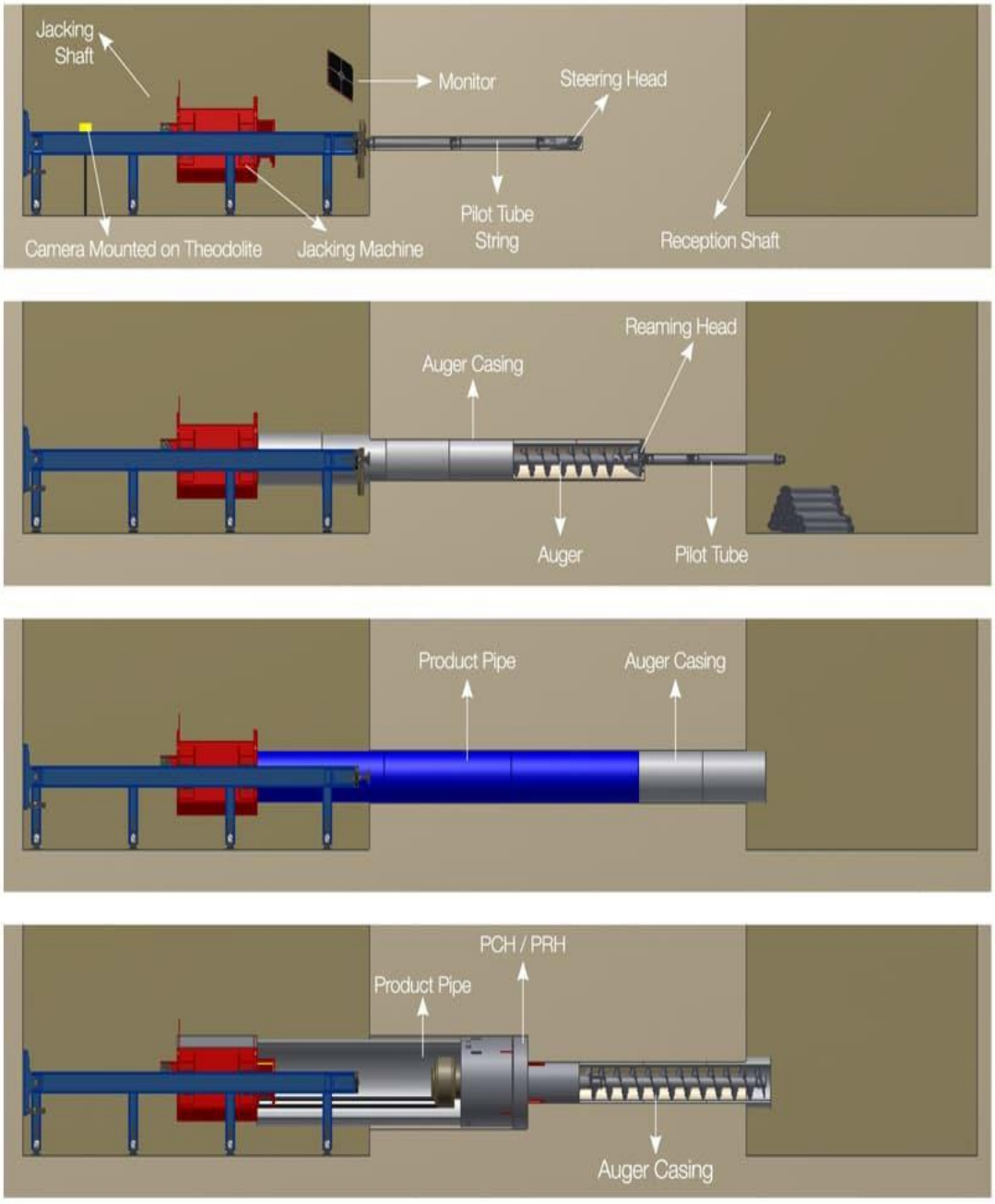


Figure 28 - Typical Stage by Stage Activities of Auger Bore Works

7.16 Intermediate Joint Bay Construction

During the pre-construction phase Balfour Beatty will develop Intermediate joint bay designs for all types of ground condition anticipated from our GIR for acceptance. The designs will have been completed in conjunction with the Cable Contractor, and they will also consider the arrangements for earthing, snaking, joint box protection, fibre pit location and engineered backfill.

Temporary works designs to allow for construction in all types of ground conditions will also have been produced and accepted. These designs will also identify the joint bay locations which will require dewatering during the construction, jointing & backfilling activities.

Prior to the Cable Contractor taking over acceptance of any joint bays constructed by Balfour Beatty a specific joint bay Handover standard form will be completed and countersigned by both parties. In line with the civil scope of works Balfour Beatty will provide a hardstanding area for cable drum vehicle delivery manoeuvres and welfare facilities at the joint bay location. Figure 29 below shows an indicative layout area of a joint bay location.

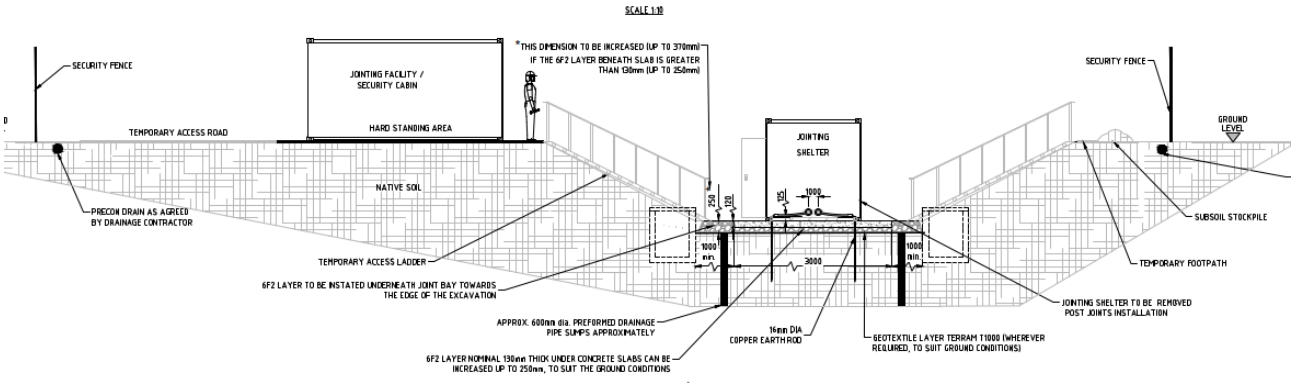
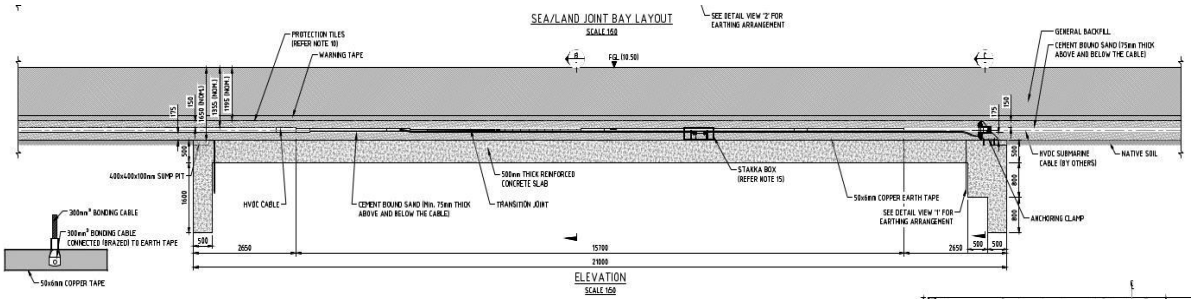


Figure 29 Indicative joint bay area layout

7.16.1 Transition Joint Bay Civils

Balfour Beatty are required to develop an approved Transition Joint Bay design in conjunction with Prysmian during the detailed design phase of the project. This design will consider the ground conditions anticipated from our GIR, temporary works designs for construction will include for any dewatering required during the construction, jointing and backfilling activities. The designs will also consider the arrangements for the position of the subsea Anchor clamp (for subsea cable installation) earthing, snaking, joint box protection, fibre pit location and the engineered backfill.

In line with the civil scope of works Balfour Beatty will provide a hardstanding area for welfare and storage facilities during the transition jointing works. Like the intermediate joint bays, the transition joint bay will be excavated using a 360 tracked excavator in line with the temporary works designs. Where the design dictates deep concrete anchors for the subsea slab sheet piling will be used to allow formation of the excavation for installation of rebar and concrete pour. Rebar reinforcement will be installed, and concrete poured to form the slab. An earth mat arrangement (designed in agreement between the Land Cable Contractor & Subsea Cable Contractor) shall also be installed by Balfour Beatty. (see Figure 30).



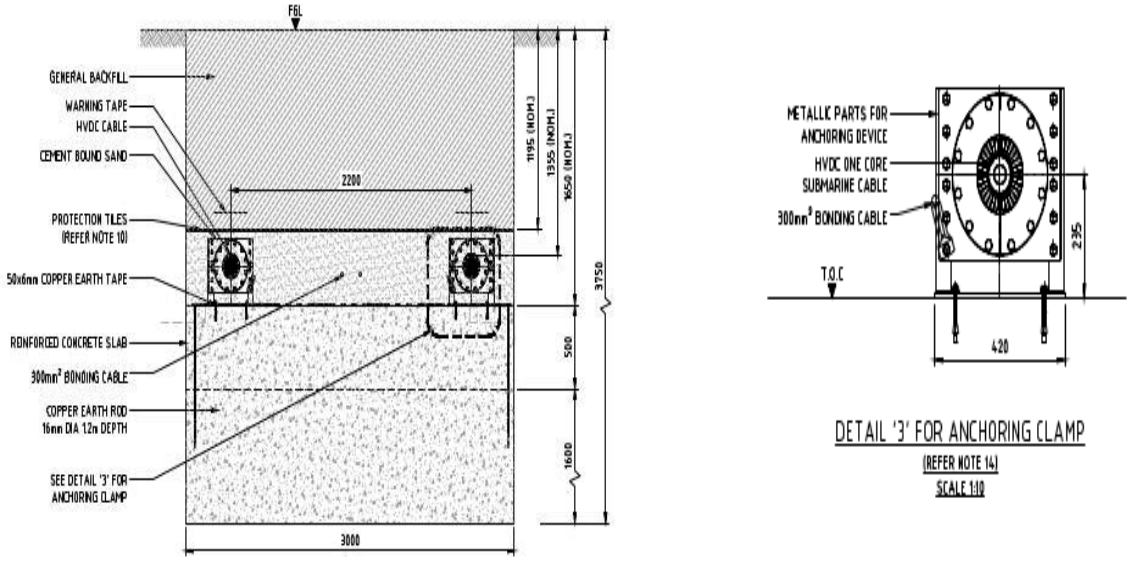


Figure 30 Indicative subsea anchor clamp at TJB

7.17 Cable Drum Collection & Transportation

7.17.1 Abnormal Indivisible Load Survey for Cable Drum Transportation

Balfour Beatty will carry out detailed site surveys on the potential transportation routes during the pre-construction phase of works from the drum storage location at the Port to the compound access points. The surveys will take into consideration:

- Road width.
- Camber.
- Construction type.
- Current condition
- Traffic flow.
- Street furniture.
- Existing OHL crossings.
- Parking restrictions.

- General navigability & accessibility.

Following completion of the surveys, liaison with the appropriate stakeholders will commence to define any further activities to facilitate the movement of plant, equipment and materials e.g. road upgrades, utility diversions and/or street furniture removal.

7.17.2 Collection & Transportation

As part of the civil scope of works Balfour Beatty shall be responsible for the management, collection, and transportation of the cable drums from the Cable Contractor Store facility to the pulling location.

Cable Drum deliveries will be delivered using our specialist drum transportation vehicles. Any permits or special arrangements required to facilitate the transportation of the cable drums to site will be made and obtained in time to facilitate the installation programme along with any necessary upgrading of roads or facilities including, removal and replacement of street furniture and diversion of third-party utilities required because of this activity. Figure 31 below shows an example of the cable drum transportation trailer used by Balfour Beatty.

Figure 31 Example of cable drum transportation trailer

To ensure the cable collection and transportation activity is successfully co-ordinated, Balfour Beatty shall provide the Local Authorities with a drum delivery programme and share information as required with any other associated works contractors and stakeholders.

Balfour Beatty shall receive the cable drum(s) at the agreed date from Prysmian, in line with the drum delivery programme from the Cable drum storage depot. Balfour Beatty shall be responsible for loading the cable drum(s) on the trailer and both parties (Prysmian & Balfour Beatty) shall visually inspect the drum once loaded onto the transportation vehicle. Once inspected a cable drum acceptance form shall be counter signed by both parties, below at Figure 32 is an example of the Balfour Beatty Cable Drum Acceptance form.

Balfour Beatty

CABLE DRUM ACCEPTANCE FORM
Standard Form: OPS-SF-5503e-CAB

Scheme Name :-		Scheme Number :-			Weather conditions:-		
Location:							
Date of Delivery:-		Time of Delivery:-		Method of Delivery:-		Accepted by:-	
Date of Unloading:-		Time of Unloading:-		Method of Unloading:-		Unloaded by:-	
Cable Drum Number:-				SK Length Number:			
The following checks are to be carried out whilst the cable drum is on the trailer BEFORE it is offloaded.							
Is the Cable Drum secured to trailer correctly with chains	YES	NO	Comments				
Is there any visible damage to the drum (welds, spindle hole etc)?	YES	NO	Comments				
Is there any visible warping to the drum?	YES	NO	Comments				
Is there any visible damage to the batons?	YES	NO	Comments				
Have date stamped photographs of the drum been taken before offloading and attached to this document?	YES	NO	Comments				
The following checks are to be carried out once the cable drum has been offloaded by the Cable Drum Handler							
Is there any visible damage to any welds?	YES	NO	Comments				
Is there any visible damage to the body of the drum?	YES	NO	Comments				
Are all timber batons in place with no visible signs of damage	YES	NO	Comments				
Are there sufficient wooden chocks in place upon the drum?	YES	NO	Comments				
Have date stamped photographs of the drum been taken after the drum has been offloaded and attached to this document?	YES	NO	Comments				
The following checks are to be carried out once the cable protection barrier has been removed from the Cable Drum							
Is there any visible damage to the cable?	YES	NO	Comments				
Is the cable dressed neatly on the cable drum?	YES	NO	Comments				
Is the cable pulling eye fixed correctly?	YES	NO	Comments				
Supplier Signature :		Print Name:		Date .		Comments .	
Delivery Signature :		Print Name:		Date .		Comments .	
Delivered by:				Vehicle Registration:			
Balfour Beatty Signature :		Print Name:		Date .		Comments .	
Note: Please ensure that all photographs and supporting documentation MUST be attached to this form and are placed in the office file AND placed on the shared access drive							

Figure 32 Example of Balfour Beatty Cable Drum Acceptance Form

A sheath test shall then be carried out by the Balfour Beatty immediately before the cable drum is transported. Any drums of cable that fail the electrical testing, and/or visual inspections prior to transportation to site shall be clearly identified and be subject to further investigations in accordance with the Cable Contractor's Quality Management System. Any resulting Non-Conformance/Deviation/Incident shall be resolved to the satisfaction of the Employer before the drum can leave the Cable Contractor Store facility for transportation to site.

Once the drum has been transported to the pulling location, the batons and cladding will be removed from the cable drum and Balfour Beatty and the Client representative shall again countersign the cable drum acceptance form to confirm that no damage has occurred during transportation. Balfour Beatty will then carry out another sheath test after the Cable installation activity taking place which will be witnessed by the Client representative. After the cable has been installed, Balfour Beatty shall transport the empty drums back to the storage facility for disposal.

7.17.3 Cable Pulling Methodology

Preparation, Inspection, Testing and Certification of Ducts

Prior to cable installation the ducts will be tested to ensure they are clean and clear of any burrs which could damage the sheath of the DC Cable. Representatives from both Prysmian and NGET/SSEN will be invited to witness these tests. The test will involve connecting in the HDD sections to the open trench ducted sections with the correct sized chamfered deburr transition collars to allow for cables to be pulled in either direction. A sealed section will then have a foam pig attached to the steel bond of an Auxiliary Winch blown through using a compressor. To assist with the blowing of this steel bond Balfour Beatty has developed a specialised blowing gun tool shown below in Figure 34.

Figure 33 Auxiliary winch

Figure 34 Specialised blowing gun

A larger winch bond will then be attached to the smaller Auxiliary Winch bond via a brush & solid mandrel assembly with a diameter of 10% less than the duct diameter and pulled back to ensure the cleanliness of the ducts. Following duct cleaning CCTV will then be carried out to check the cleanliness and integrity of ducts. To carry out this activity a motorised camera

unit will be used with an umbilical cord long enough to complete the survey of the cable section length. Where required lubrication/duct cleaning pits will be used to provide midpoint entry into the cable section. Records of the CCTV survey will be kept which shall include the following:

- Date of test.
- Chainage(s).
- Identification of the duct.
- Confirmation that the duct is free from foreign matter.
- Location of the test and pole the duct relates to.
- Direction that the test is carried out in.

Once all the above Inspections & Testing have been completed the Quality Inspection and Test Plan document will be signed by Balfour Beatty and Prysmian representatives who will have been given the opportunity to witness the testing. Following completion of the CCTV surveys a 6mm polypropylene rope will be left in the ducts to facilitate bond installation and a final pig/brush of ducts ahead of cable installation.

7.17.4 Cable Installation

The cable installation activities shall be in line with the cable installation and Cable Contractor's Quality Management Plan, to enable supervision by the Cable Contractor and witnessed by the appropriate parties.

During the pre-construction phase Balfour Beatty shall perform the necessary engineering designs and cable pulling calculations, to verify that the cables will not be exposed to forces above their design limit, as specified by the Cable Contractor.

The method of cable installation will be dictated by the system design, as the cables are installed within ducts, the installation proposal is for using winches equipped with a dynamometer to nose- pull the cables. Caterpillar pushing engines may be required on some more difficult pulls located at the cable drum end of the pull or periodically along the cable pull where ducts have not been installed again, this will be determined by the detailed design and cable pulling tension calculations.

During the duct preparation the drum site will be set up by moving the drums into place and any required caterpillar engines will also be installed at this point. A 18t Balfour Beatty Tesmec winch or similar cable installation winch fit with a Kevlar bond will be positioned at the opposite end of the pull along with any required rollers to facilitate adequate positioning of the cable through the ducting. Any bellmouths, lube pits or rollers required will be positioned and installed before the pull, the ducted section will be lubricated by a lubricated bell mouth roller at the cable duct entry.

The winch will be anchored appropriately in line with the relevant temporary works specifications. All winches will have field drain earths attached to eliminate the risk of induced/impressed voltage during the cable installation process. The winch will have a

calibrated dynamometer to measure and record the tension in the bond during pulling. Before commencing winching operations, the following checks will be carried out by the operative responsible for winching:

- Check that field drain earths have been connected.
- Check that the winch is suitably anchored.
- Check oil fuel levels of winch as necessary.
- Check test certificate of the cable bond.
- Check pressure gauge calibration.
- Check maximum pulling force is set.
- Check that the cable pulling eye swivel has been correctly installed.
- Check that bell mouths and funnels where required are installed at appropriate points of deflection.
- Check that personnel are suitably located along the route and communication is operational via radio communication.
- Check that radios and communications channels are free and open, and all equipment is charged and in full working order.
- Temperature of the cable to be installed.

Cable installation must only take place when both cables and ambient temperature have been recorded at or above the minimum temperature advised by the cable manufacture. If the measured temperature shows that the cable is below the minimum, laying will be deferred until the temperature has been raised.

The maximum permitted cable pulling tensions for the cable system will be set on the winch prior to installation and a print-out will be provided for each section showing exact length and maximum force applied for quality and guarantee purposes.

The 6mm polypropylene rope will be attached to an 8mm Kevlar bond fit to a 2t capstan winch, the main 18t winch will be used to pull the 8mm rope to the winch position. Once received the Kevlar bond of the 18t Tesmec Balfour Beatty winch will be attached to a foam pig and duct brush and pulled through the ducts by the 2t capstan winch and pulled back to the cable drum ensuring the ducts receive a final clean prior to cable install. The cable will then be attached to the 18t Tesmec winch bond via a swivel which will be connected to the pulling eye, this will have been factory fitted to the end of the cable during manufacturing.

During the cable installation, any anomalies or defects shall be advised to Prysmian and NGET/SSEN and recorded with references to the meter mark on the outer sheath, in line with Balfour Beatty's Quality Management Plan. Where rollers are used, they shall be inspected to ensure they have no sharp projecting metal parts liable to damage the cable. During the pulling and installation activities Balfour Beatty shall record all pulling measurements. The pulling measurements shall include, but not be limited to; ambient temperature, where

precautions have been made to raise the temperature, and pulling tensions. All waste from the cable installation activity shall be disposed of by Balfour Beatty.

Following the installation of the cable, spare cable is to be removed from the cable drum. The cable pulling head and caps shall remain in place, to be removed by the Cable Contractor at the time of joint works. Balfour Beatty shall perform a sheath test directly after cable installation to confirm that no damage has occurred to the cable during the installation process. Both Prysmian and NGET/SSEN shall be invited to witness the sheath testing.

7.17.5 Fibre Optic Cable Installation & Jointing

During the detailed design phase, the location of the termination cubicles within the Converter Station control room will have been agreed between the Converter Station Contractor, Balfour Beatty, Prysmian & NGET/SSEN. A termination wiring diagram will also have been agreed between Balfour Beatty, Prysmian and NGET/SSEN. Designs for buried fibre jointing & pulling pit will also have been agreed.

During the design stage & construction of the joint bays, fibre optic jointing chambers will have been allowed for and installed at each intermediate joint bay location including the TJB. However, where section lengths can be optimised the configuration of the Fibre Optic design may require pulling through a joint bay. Where this is envisaged the Fibre ducting will be complete through the joint bay. Pulling pits will also be installed at strategic location to assist with pulling the longer lengths.

On arrival of the fibre optic cable drums to site Balfour Beatty will carry out optical tests to confirm length and quality of each fibre against the factory test delivery document. Once the power cables have been installed on each relevant section the Fibre Optic cable will be installed. On some of the more difficult sections it may be necessary to locate the cable drum at a pulling pit at the halfway point and pull the cable one way to the next pit, the rest of the cable would be then flaked off and pulled in the opposite direction.

During cable installation remake loops will be left in each jointing pit should they be needed for future make offs. Following the installation of each section and prior to intermediate jointing on each section Optical Time Domain Reflectometer (OTDR) testing will be carried out. Intermediate jointing will then be carried out and the pit sealed ready for backfilling. The location of the pit will be recorded via GPS and marked up on the As-Built records.

Once all fibre cable has been installed and intermediate jointing complete between the TJB and Converter Station control room a final end to end ODTR test will be carried out prior to termination works. Once the end-to-end testing is complete the fibre cables will be terminated into the cubicles at the Converter Station. During D.C Cable transition jointing Balfour Beatty will then carry out the transition jointing of the land installed fibre optic cable to the subsea fibre optic cable.

7.17.6 Jointing Methodology

The jointing methodology to be used on the project will be above ground jointing whereby the cables are lifted of the joint bay floor during the jointing process. A fully self-contained

jointing solution sees all jointing operations undertaken at ground level, in a fully controllable environment, with the joints being lowered into their final position below once technical operations are completed.

Benefits of this solution include:

- Reduced cost for dewatering and reduction in flood/water ingress.
- Increased cable length utilisation and reduced cable wastage.
- Enhanced quality levels and reduced failure rates for all jointing works undertaken.

Figure 35 below shows an example of the self-contained unit in place over a joint bay with cables installed and ready for jointing.

Figure 35 Jointing container

The joint bays will be excavated using 360 tracked excavators, and dependent on the temporary works designs, shoring shall be installed along with a concrete base. An earth mat arrangement (designed in conjunction with the Cable Contractor) shall also be installed by Balfour Beatty. To reduce the requirement of having operatives in the joint bay excavation during construction activities a bespoke concert installation bucket will be fitted to the 360 excavators to install the concrete for the base. These concrete installation buckets operate similar to a hopper and can install the concrete evenly eliminating time required for operatives to be in the excavation and reduce the plant & people interface.

7.17.7 Intermediate Joint Bay

Should the above ground joint option mentioned above be adopted, following cable installation a jointing container with a detachable floor and large pads extending on either side to spread the load onto the ground via steel road plates will be installed over the bay by the Cable Contractor. Contained within the jointing container are also all required lifting apparatus, heat, light and power, alongside all necessary tooling and equipment required by the jointing teams. Figure 35 above shows a typical example of the jointing container being

lowered into position over the bay. During the jointing activities Balfour Beatty shall provide the necessary pumps and resource to maintain the joint bays dry of ground water.

Once the jointing works are completed (and dependent on the type of jointing methodology carried out) the Cable Contractor will lower the joints into the bay and snake the excess cable into pits which will have been excavated at either end of the bay. Balfour Beatty will then cleat the cables in position in the snaking pits via U channel which will be bolted to the concrete floor of the snaking pit.

Figure 36 below shows a typical layout for the DC Intermediate Land Joints.

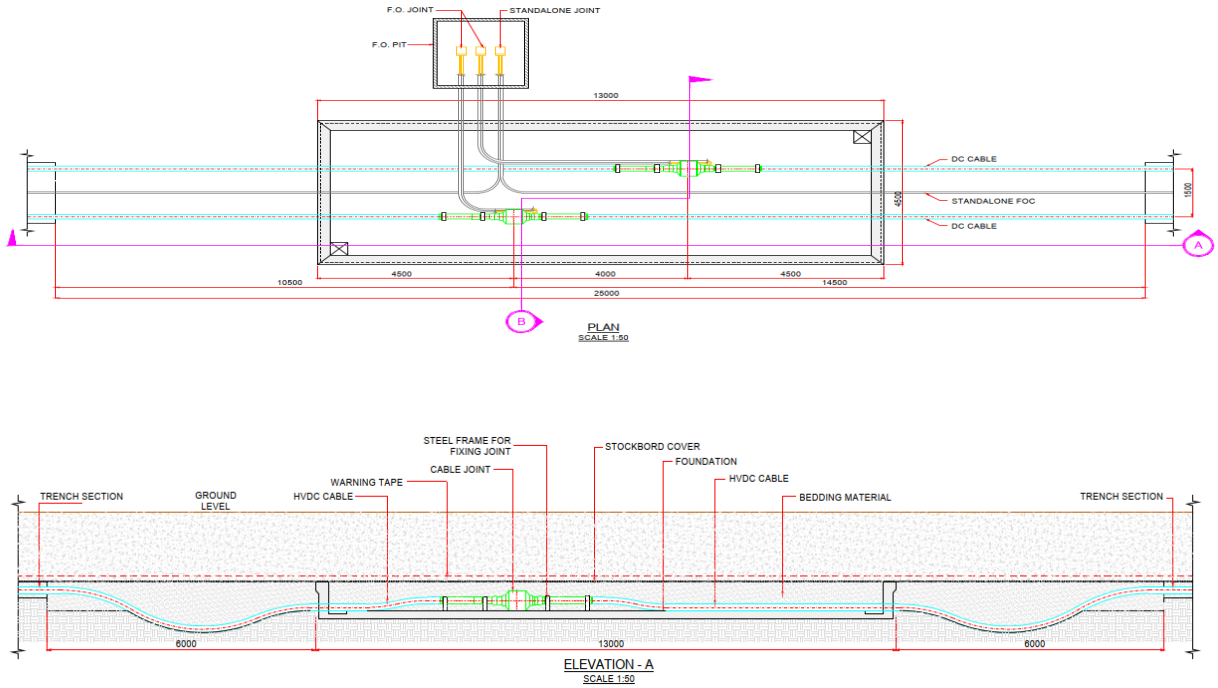


Figure 36 Typical layout for the DC Intermediate Land Joints

7.17.8 Transition Joint Bay

Like the intermediate joint bays, a jointing container with a detachable floor will be installed over the bay by the Cable Contractor in preparation for jointing works. Once the jointing works are completed, and again dependent on the type of jointing methodology carried out, the Cable Contractor will lower the joints into the bay and snake the excess cable into a pit which will have been excavated at the land cable end of the bay. Again, Balfour Beatty will then cleat the cables in position in the snaking pit via U channel which will be bolted to the concrete floor of the snaking pit.

Figure 37 below shows a typical layout for the DC Cable Transition Joint Bay.

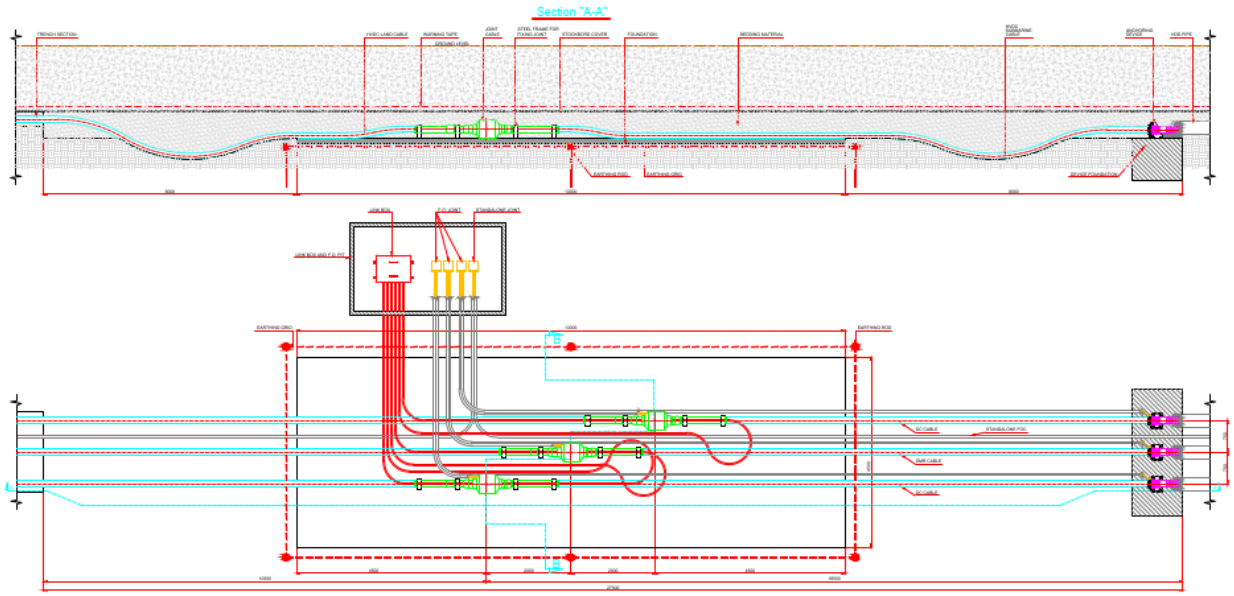


Figure 37 Typical layout for the DC Cable transition Land Joints

7.18 Reinstatement and Demobilisation

All reinstatement works will be completed in line with the land restoration plans which will be agreed with the relevant local planning authority before works commence.

7.18.1 Haul Road Removal and Demobilisation

Upon completion of the works in a section and where the haul road is no longer required, it will be removed, and all site equipment demobilised and removed. This will be a logical process starting from the end of a haul road and working backwards towards the relevant compound. All culverts and other temporary infrastructure will be removed as required. Temporarily relocated hedges will be reinstated, and the topsoil will be replaced where this will not impact on the post-construction drainage installation.

Imported aggregates, geogrid and geotextile shall be removed following completion of cable installation and all associated works. The aggregate will be lifted by 360-tracked excavators and transported to the TCC's by road haulage vehicles and / or dump trucks. Disposal of aggregate shall be carried out in line with the Site Waste Management Plan (SWMP) with appropriately certificated organisations.

7.18.2 Culvert Removal

Ditch reinstatement will follow the reverse process of the installation. The aggregate will be removed and transported to the TCC's by road haulage vehicles and/or dump trucks. Disposal of aggregate shall be carried out in line with the material management plan. Used geotextile (Teram) will be removed and taken off site to a recycling plant in line with the SWMP (Document reference: 5WMIFK-PTDOPS-XX-XXX-XX-PL-PM-000011). The pipes will be removed, and the ditch embankments graded back to their original condition and seeded where required.

7.18.3 Post-Construction Drainage

Following the removal of the haul road, the post-construction drainage team will move into the area to install the post construction drainage in accordance with the agreed design. The methodology for final drain installation will be similar as the pre-construction drainage installation method.

7.18.4 Topsoil Reinstatement

All topsoil replacement works shall be carried out in line with the Soil Management Plan. Prior to top soiling, where required, ripping of the subsoil will be carried out to improve the soil structure. The storage bunds for the stripped topsoil will be carefully excavated and the material spread over the stripped easement. Following distribution, the topsoil shall be prepared and seeded where required using an appropriate seed mix or returned to arable cultivation.

The exact requirements will be outlined during the detailed design stage and will follow on from the liaison undertaken by the ALOs. This will ensure that agricultural fields shall be restored to their previous levels, captured by our surveyors who will record as-built information in-line with the requirements of the landowner and/or tenant(s).

7.18.5 Compound Removal and Highway Access Point Reinstatement

Once all cabins, offices and welfare facilities have been removed and utility connections decommissioned at the TCC's, the compound areas will also be reinstated using the method given above in the Topsoil Reinstatement section.

Where required temporary welfare units will be mobilised to site for use by the civil teams deployed to reinstate the Highways Access points to their original condition. Where requested by landowners and under agreement with the relevant the local authority, access points may be left in-situ for future use by the landowner.