DAVE ROGERSON: ENGINEERING

PROOF OF EVIDENCE

1. QUALIFICATIONS AND EXPERIENCE

1.1 My name is Dave Rogerson and I am a Lead Transmission Engineer with National Grid Electricity Transmission Plc ("**NGET**"), specialising in Over Head Lines ("**OHL**") and High Voltage ("**HV**") Cable Technology.

1.2 My evidence relates to the engineering elements of the Cotswolds Visual Impact Provision Project ("the **Project**").

1.3 I have a Degree in Electrical Engineering combined with Power Engineering and Communications.

1.4 I have nineteen years' experience, with thirteen years in my role with NGET where I am authorised by National Grid's Business Procedure 141 (an industry recognised assessment and authorisation) for both OHL and cable design assurance. This authorisation is part of NGET's obligations to ensure the correct operation and safety of equipment on and near the electricity network.

1.5 In my role I am responsible for ensuring that:

1.5.1 NGET discharges its legal obligations concerning health, safety and environmental requirements;

1.5.2 Design is undertaken in accordance with NGET's technical policy specifications and applicable supporting documents;

1.5.3 A holistic design is integrated through all technical disciplines and is effectively specified, managed and optimised;

1.5.4 Those undertaking the design from the principal contractor organisation have the minimum skill sets in accordance with the NGET's standards;

1.5.5 The design of projects is undertaken with a demonstrable level of technical governance; and

1.5.6 The design of projects appropriately balances technical compliance, cost and operational risk.

1.6 I am currently working on approximately 132 transmission asset projects across the NGET portfolio, across both OHL and HV cable projects.

1.7 I have been working on the Project since 2018 as the Lead Cable and OHL design assurance engineer.

2. INTRODUCTION AND SCOPE OF EVIDENCE

2.1 References in my evidence to the core documents are made by the abbreviation, for example, "**CD XX**". The evidence of other witnesses is referred to by the name of the author. There is a glossary of key terms used by all the NGET witnesses at **CD F2** ("**the Glossary**") and my evidence adopts the terms defined in the glossary.

2.2 My evidence is structured as follows:

2.2.1 Section 3 provides an overview of the Project;

2.2.2 Section 4 describes the physical components and works required for the Project;

2.2.3 Section 5 provides a response to matters raised by objectors to the Order insofar as they are relevant to my evidence;

2.2.4 Section 6 provides a summary of my evidence and my conclusions; and

2.2.5 Section 7 provides my declaration.

3. OVERVIEW OF THE PROJECT

3.1 The Project comprises the undergrounding of approximately 7 kilometres of the existing OHL subsection ZF.2(B) which runs from the west of Winchcombe to the south east of Cheltenham, within the Cotswolds National Landscape.

3.2 The following are the key components of the Project:

3.2.1 the installation of approximately 7 kilometres of 400kV underground cables, comprising two circuits utilising two cables per phase (cable groups) to transmit the required power;

3.2.2 the dismantling and permanent removal of 7 kilometres of existing double circuit OHL including the net removal of 16 towers;

3.2.3 the construction of two new cable sealing end compounds ("**CSECs**") which will each require a new terminal tower in order to connect the new underground cables to the remaining existing OHL;

3.2.4 associated temporary works to facilitate the installation, including but not limited to pre and post construction drainage, temporary fencing, haul roads and temporary construction compounds;

3.2.5 a permanent cable easement with an approximate width of 40 metres; and

3.2.6 the expansion of an existing NGET substation in Melksham, Wiltshire to allow for the siting of a new shunt reactor.

4. PHYSICAL COMPONENTS AND WORKS REQUIRED TO DELIVER THE PROJECT

<u>Underground cables</u>

4.1 As mentioned above, the Project involves replacing the existing OHL with underground cables. The underground cable installation must be completed and commissioned before the OHL can be removed.

4.2 The cables forming part of this Project are 2500mm2, copper conductor, cross linked polyethylene (“**XLPE**”) insulated cable with an approximate outer dimension of 145mm. The cables are installed with 3 phases of single core cables, however to provide the required power, 2 cables per phase will need to be installed resulting in 12 power cables in total.

4.3 In addition to the power cables, telecommunication fibres will be installed to provide the operational telecommunications, replacing what is currently installed on the OHL earthwire as well as monitoring fibres installed on the centre phase of each group to monitor the temperature of the circuit against the power being transferred.

4.4 The cable installation requires a construction swathe of up to 100 metres wide along the 7-kilometre length of the cable route. This width accommodates the following, with a typical example shown in Figure 1:

4.4.1 four cable trenches with varying width from 2.6m to 4.9m each ;

4.4.2 if required, trenchless cable installation methodology which, due to the increased depth and control over stabilised backfill, could result in 8m phase spacing requiring 96m;

4.4.3 cable joint bays, connecting sections of cable together - this also includes for a working area to pull and set up the cable jointing activities;

4.4.4 a temporary construction stone haul road, providing safe access along the route;

4.4.5 storage areas for stripped topsoil and subsoil from cable trench excavation; and

4.4.6 temporary and permanent land drainage requirements.

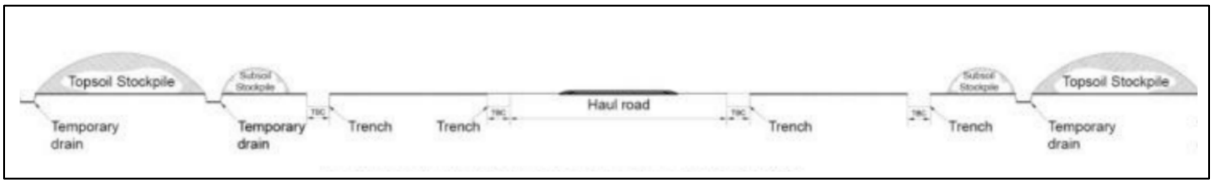

Figure 1: Typical example of a cable construction swathe

The Project has sought to minimise land take for construction, with the construction swathe representing the maximum width that might reasonably be required to provide safe and adequate working widths. The following paragraphs provide details on the considerations in developing the scope of the Project and the construction easement.

Cable Installation

4.5 Upon completion of all the associated surveys required to inform the detail design, the contractor will begin the installation works by first installing the demarcation fencing to ensure the work area is secured and the safety of the general public and work force is maintained through separation of the works.

4.6 Top soil stripping will then be carried out over the swathe to allow for the installation of pre construction drainage. The pre construction drainage work is necessary to mitigate the impact of the construction works with respect to the flow and management of water. Due to the nature of the trenching works and storage of materials above ground, the drainage design could result in outfalls away from the trench into water courses or ditches which needs to be allowed for within the swathe. The pre construction drainage also needs to take into account any of the existing land drainage.

4.7 The design and installation of the haul road then follows and this needs to have regard to the safe access requirements necessary to facilitate the installation, the vehicles being used, and the size and weight of special vehicles such as the cable drum transporter. Due to topographical changes across the route, the haul road installation must factor in gradients as well as ensuring access to the trench, which may mean a straight line approach is not possible, providing curves to reduce the gradient. This is particularly important as typically a Heavy Goods Vehicle ("**HGV**") will be required to transport the cable drums weighing approximately 55 tonnes to the cable joint bay locations to allow them to be positioned across the trench and pulled directly in. It is necessary to consider not only this but also the delivery of the vehicles required to bring in other materials; these need sufficient distance away from the edge of the trench to ensure the safety of people working within the trench and to avoid the risk of collapse. The specific requirements of the vehicles required to facilitate this will be selected by the principal contractor, and as such allowance has to be made now, in order to ensure that the installation can proceed.

4.8 Once the enabling temporary works are completed, cable trenching works can follow. A workforce will begin by excavating the cable trenches, typically working from the outside of the groups to a depth of around 1.4m for a standard trench. The trench will be excavated to the formation level required based on the system design and local topography. A sub base of Cement Bound Sand ("**CBS**") will be installed followed by the HV cable ducts set out with the required spacings detailed within the system design. The spacing between each cable is set out as part of the cable system design. As a result of the increased depth of cover, to manage the thermal interaction between the cables, the spacing will increase to ensure the required power can be transmitted. The monitoring fibre ducts and communication ducts will also be installed at the same time within the trench. Although the dimensions above are for the final cable installation requirements, the actual trench excevation may be significantly wider to allow for the safe access to the trench. This could be via benching the excevation or battering the sides to avoid the risk of collaps when people are working in the excavation to install the ducts. As a result of this, it increases the amount of sub soil to be stock piled within the easement.

4.9 Utilising a ducted installation separates the cable installation from the main civil trenching works, reducing the amount of time that cable trenches will need to be left open and exposed, improving the safety and security on the site. However, this approach requires greater phase separation and, as a result, wider trenches.

4.10 The trenches directly around the cable are then surrounded by a compacted layer of CBS to provide a stabilised thermal environment for the cables. Protective tiles and warning tapes are laid above the CBS to identify and protect the cables.

4.11 The subsoil is then installed and compacted within the trench, back up to the topsoil level.

4.12 Figure 2 below shows an indicative cross section of the cable trench for a single group.

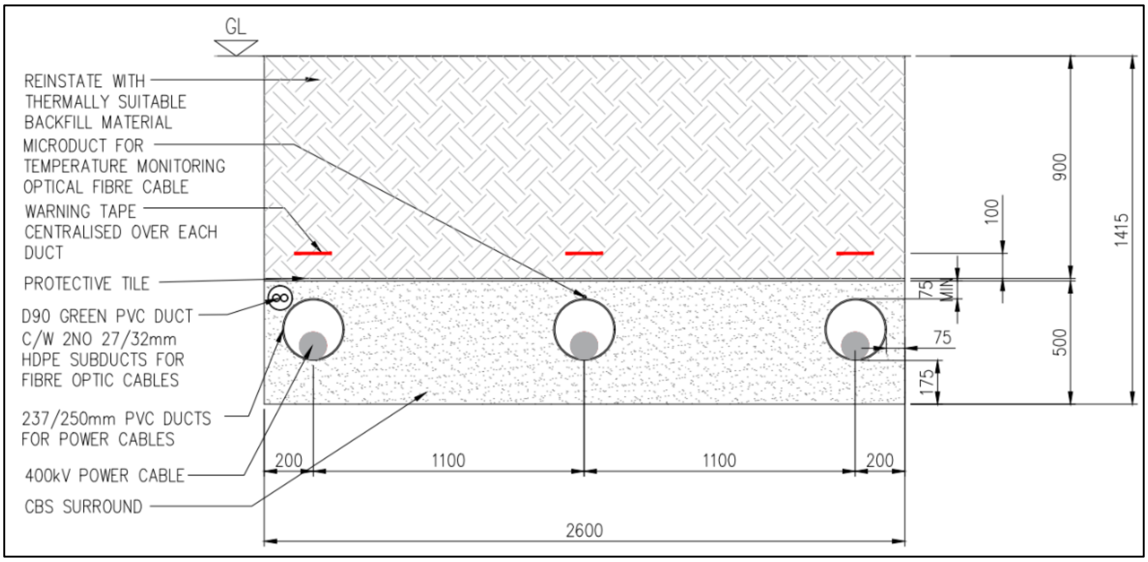

Figure 2: Typical Trench Cross Section

4.13 An alternative cable installation method may be employed depending on site conditions, namely Horizontal Directional Drilling ("**HDD**"), which is a trenchless method where a pilot hole is drilled along a predetermined path, followed by hole enlargement and then the installation of a duct. HDD is employed to minimise the disruption to surface level features such as roads, rivers etc where it would either not be possible or cause significant disturbance. However, installing cables using HDD usually means going deep to avoid the risk of settlement, vibration and failure of the drill, which results in increased phase spacing to manage the thermal impact affecting the cable rating. Initial assessment as part of the development for this scheme estimated around 8m phase spacing would be required with a total of 96m to installed cables in a HDD.

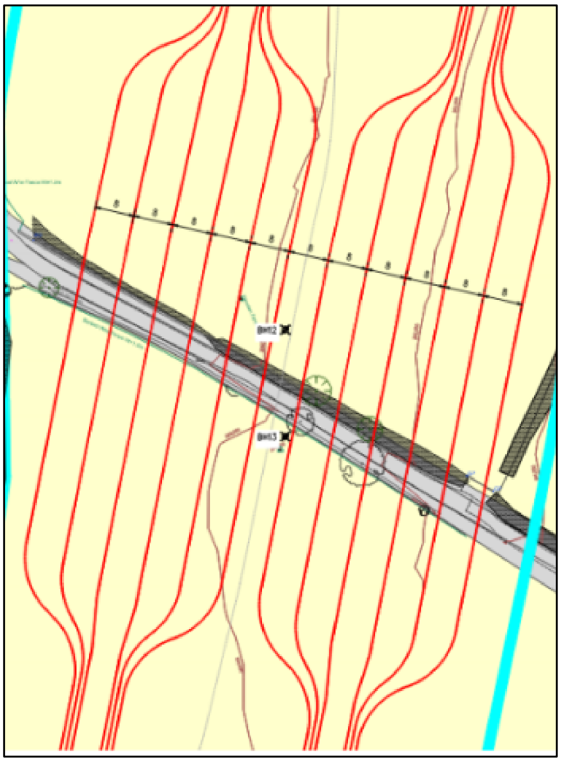

Figure 3: Typical HDD arrangement

4.14 The available space to launch the HDD from is also critical to ensure the correct drive angle of the pipe between 15 and 18 degrees. This typically involves setting up the drill back from the crossing feature to complete the installation. This distance is dependent on the required depth to be achieved under the feature.

4.15 The HDD works typically involve a drive and reception site, with the HDD drive site being approximately 30x20m to accommodate the drilling rig, pipe storage, mud bins and slurry pits required to complete the drill. At the reception site, this will be a smaller area, but needs to accommodate an area to connect the ducts together and weld them so needs to allow for the length of the crossing to set up a complete length to pull back in.

4.16 As part of the installation, cables will need to be connected together at cable joints bays. Due to transport and cable system requirements, they will be required approximately every 900 - 1000m. The cable joint will be installed underground, however above ground associated infrastructure will be installed which will include cable link boxes and chambers lids for communication fibre splice boxes. The location of the cable joints are critical for the cable installation, however as far as reasonable possible, located to minims the impact on the land use. To provide additional protection, post and rail fencing will be installed around the above ground equipment.

4.17 Once the civil works have been completed at the joint bay, which includes a concrete pad to install the cables on, the cable drums will be brought to site and set up at the required location. This typically involves an area of approximately 30m x 30m for each group. This will include the hard standing made up of stone to align the cable drum with the trench including all associated rollers and other equipment to offload the cable. The area will also be used for lifting in the jointing shelters to provide the clean room environment, welfare as well as power supplies for each cable group.

4.18 The cable ducts will be cleaned prior to installation to ensure no debris remains within the ducts which could damage the cables. A winch will be set up at the next joint bay and a bond wire pulled back though the duct to the cable drum. This will be attached to the cable and pulled under tension to complete the section. The position of the cable drum is key to minimise the tension on the cable so requires the room at each joint bay to ensure perfect alignment.

4.19 The cable joint is then completed and backfilled in a similar way to the cable trench.

4.20 Once the cables are terminated into the CSEC a high voltage test will be undertaken to demonstrate satisfactory operation of the cable this will be one of the last activities undertake after installation.

4.21 Following cable installation completion, the ground is returned to its previous use, with haul roads remove, top soil returned and any post construction drainage installed. Further detail on reinstatement is detailed in the evidence of Ms Nicky Lear.

Northern CSEC

4.22 The northern CSEC facilitates the transition from the retained OHL to the new underground cable. The compound measures approximately 80 metres by 40 metres and contains cable terminations (cable sealing ends), earth switches to facilitate maintenance, and surge arrestors to protect the electrical equipment with the associated support structures. The compound is enclosed by security fencing. A new terminal tower positioned close to the CSEC connects the overhead line to a gantry within the CSEC from which circuits lead to the underground cable.

4.23 During construction, a temporary construction compound of approximately 75m by 75m adjacent to the CSEC site will provide laydown areas, soil storage, parking, welfare facilities, waste facilities and security facilities. These temporary facilities are removed following construction completion.

4.24 The CSEC design minimises visual impact by retaining existing vegetation where possible. The access road uses a permeable surface. New native trees, woodland and scrub planting provide visual enclosure and screen views from surrounding roads and public rights of way. Further detail on this is provided in the evidence of Ms Rebecca Greatrix.

Southern CSEC

4.25 The southern CSEC serves the same function as the northern CSEC, facilitating the transition between the underground cable and retained OHL at the southern end of the route. It comprises the same components and dimensions as the northern CSEC - an 80 metre by 40 metre fenced compound containing cable terminations, electrical equipment and support structures, with an associated terminal tower and gantry system.

4.26 The same temporary construction compound arrangements and visual mitigation measures apply as described for the northern CSEC.

4.27 As the location of the CSEC is directly under the existing OHL a temporary diversion will be required to divert the OHL away to allow the construction of the CSEC to allow the compound to be built safely. Further details of the OHL works can be found in paragraphs 4.28 to 4.56.

OHL and tower installation and dismantlement

4.28 Once the cable installation has been completed, the cables will need to be connected to the OHL. This activity will be carried out during system outages allowing safe access to the circuit. At the north end, due to the location of the tower, this can be built prior to the outage. However as mentioned above, at the southern compound the OHL will need to be temporarily diverted to allow for the CSEC to be built. This will involve installing temporary OHL towers to the north of the line to allow, under system outage. Without doing this the impact to the transmission system of long duration outages would impact maintenance and other refurbishments in the area.

4.29 At the north end, existing suspension tower ZF308 will be replaced with a new terminal tower to allow for the connection into the CSEC. The existing conductor will be transferred to the new tower using a combination of cranes, bond wires and conductor containment systems. This will be done under single circuit outages to allow for the transfer of the circuits.

Construction

4.30 As explained above, there will be two new terminal towers. To construct these, tower foundation installation would take place first. Temporary working areas around the proposed new tower locations would be prepared prior to foundation excavation. Each working area would be secured to delineate the working area to ensure impacts on sensitive habitats are kept to a minimum. Consideration would be given to varying the shape of the working area at each tower to avoid constraints identified prior to construction.

4.31 To install the terminal tower foundations, an area of approximately 6m by 6m (four excavation areas will be needed for each tower leg) will be required to be excavated. Subject to detailed ground surveys either piled or pad and chimney foundations will be installed.

4.32 The steelwork required for the new terminal towers will either be erected by a crane, or with a derrick to erect the tower in small sections. Tower erection will require a large laydown and assembly area of approximately 50m x 50m for laying out and assembling the steelwork into the lifting sections. Steelwork will be delivered to site on trucks and assembled in sections around the tower base. A tractor with a light crane or tele-handler may assist in the moving of and erecting steelwork on the ground. The first panel will be lifted by the crane and manoeuvred into position over the foundation stubs and fixed into place by locating the connecting bolts.

4.33 Once in place, the panel will be stayed to hold its position. Subsequent sections will be assembled using a controlled lift via a crane and staying sequence with each panel or boxed section bolted in turn to the previous erected panel until the tower is complete and secured.

4.34 Once the towers are built, the new conductors are hung. This is known as ‘stringing’. Stringing is the method of positioning and pulling the new conductors between towers. There are two different ways to carry out this operation.

4.35 The first is non-tension pulling. This involves pulling the new conductor from the required point A to B via a tractor winch at ground level. The new conductor can be pulled over trestle tables, rather than the ground, so as to protect the new conductor as well as the underlying habitats.

4.36 Once the conductor is pulled to its required position, it is raised via a winch to its respective landing points on the tower arms.

4.37 Once the conductor is secure, a working platform can be raised to the working height point. This ensures operatives work at height safely. The conductor is then ‘sagged’ (tensioned to ensure mechanical and electrical correctness) via a winch. Once completed, the conductor is then attached to its landing point on the tower via its fittings, insulators and jumpers. This process is then repeated for each conductor

4.38 The second stringing method is called tension stringing. This method keeps the conductor off the ground entirely. Working platforms are raised at each tower and a running wheel attached to the arms of each tower.

4.39 Two hydraulic puller/tension machines are set up at each tower, one acting to pull the conductor and one acting to tension (pull back) the conductor. This enables the operatives to control the height and tension the conductor is pulled at, ensuring it is kept off the ground.

4.40 One puller tension machine is set at the base of the tower, whilst the other is positioned behind the other tower (set back by approximately 50m). If this method is used, their positions will be discussed with the ecological clerk of works as to the most appropriate positions for the tension machines, in relation to the existing habitats.

4.41 Lighter pilot rope is pulled through the puller tension machines and up to the running wheels. These will be pulled through the total span and this enables the conductor to be attached at the tension end, and the conductor to be pulled through the span without coming in to contact with the ground.

4.42 Once this is complete, the conductor is then sagged to the required tension, and secured with fittings, insulators and jumpers from the working platform.

4.43 Stringing of the downleads (between the terminal tower and overhead line gantries in the CSECs)

4.44 The conductor which runs from the new tower to the gantry within the CSECs is called a downlead. This is attached via an insulated connection. A downlead connects the OHL to the substation equipment.

4.45 The downleads are installed via two tractor winches as shown in Figure 4 below.

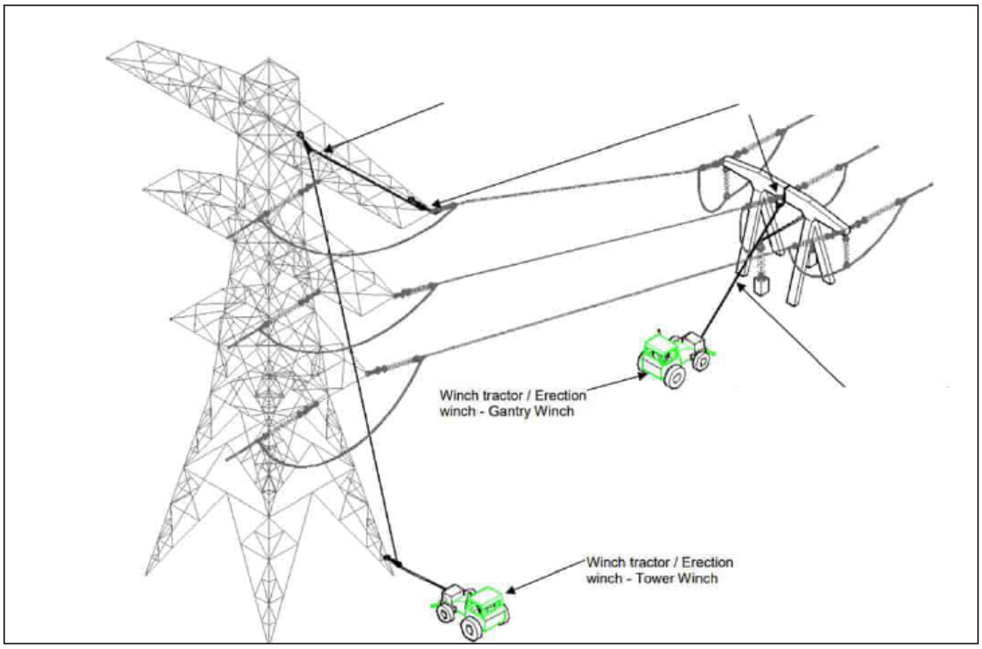

Figure 4: Installation of downleads

4.46 These will pull the conductor to its landing point. The downleads are laid out on the ground and cut to their appropriate length. They are then attached to the tractor winches.

4.47 Once pulled to position, a mobile elevated work platform is raised to working height on the tower. The downlead is then attached to its landing point on the tower via its fittings, insulators and jumpers.

Removal

4.48 The existing OHL conductors would be removed by lowering them on to trestles, rollers or wooden batons which are placed in line underneath the conductor and rolled in.

4.49 Tower dismantling and removal can be carried out using a variety of methods depending on the tower type, location and accessibility. Due to the location of these existing towers and their surrounding land uses and habitats, it is likely the towers will be dismantled via cranes.

4.50 Before the tower structures can be removed, the conductor and fittings are removed. For safety reasons it may be necessary to 'backstay' the towers. This would involve approximately three 1.2 tonne concrete blocks (2m by 1m), called 'backstays' being placed onto a sledge (via tractor) at strategic locations. The concrete blocks act as a safety device, typically placed approximately 35m back from the new tower and connected by wire rope.

4.51 The localised placement of the backstay (concrete block) positions will be discussed with the ecological clerk of works as to their most appropriate positions in relation to the existing habitats.

4.52 Once all backstays are in position, working platforms are raised to working height at the towers, and insulators and fittings are lowered to the ground via tractor and winch. Once this is completed, the conductor can then be lowered to the ground where it will rest on trestles tables, or if more suitable, tarpaulin. This process will be repeated for each conductor.

4.53 Once the conductor is lowered on to the trestle tables or tarpaulin, operatives, on foot, with handheld hydraulic cutters, cut the conductor into manageable pieces. These pieces are rolled up and carried back to a central location for pick up.

4.54 The towers are then dismantled. A large crane is positioned on a crane pad at the tower location. The crane pad will be approximately 20m x 10m constructed from plastic or metal panelling. It will take approximately one day to dismantle a tower using a crane (following advanced site preparation i.e. installation of the crane pad and progressing of advanced works on the tower prior to commencement of works with the crane). The sections of the tower will be broken up as they are lowered to the ground using a steelwork breaker/ mechanical shears fitted to an excavator. The cut sections of the tower are then placed into waste skips (which could be located within the crane pad or on temporary track way joining the crane platform) and removed from site for reuse wherever possible or recycling where not possible.

4.55 As the tower is dismantled and laid down in sections, gas torches or a hydraulic shearer mounted on a 360-degree excavator will be used to break up the tower steelwork into small sections and load into skips for reuse or recycling.

4.56 Foundations are generally removed to a minimum depth of 1m below ground level, with excavation usually no more than 0.5m by 0.5m. This work is undertaken using a tracked excavator which digs around the concrete ‘muff’ to a depth of approximately 1m. The excavator is then be used to break the concrete around the steel ‘raker’ bar within the concrete before all concrete is then removed from the excavation and the remaining steel ‘raker’ bar cut to a depth of approximately 1m. This action would then be repeated for the remaining tower legs and the land reinstated.

Shunt reactor

4.57 The Project requires expansion of the existing Melksham Substation to accommodate a new 400kV shunt reactor for voltage control in the transmission system. The underground cable installation will increase the amount of cable in the ground, causing system voltages in the South-Central region to rise, necessitating voltage control provided by the shunt reactor.

4.58 The shunt reactor will be positioned in the western part of Melksham Substation and connected by cables to the rest of the substation. The unit measures 13.9 metres in length, 6.15 metres in width and 8.3 metres in height, with a body constructed of steel and copper windings. The installation requires construction of internal roadways and extension of the perimeter fence line around the new substation extension.

4.59 Temporary construction access utilises an existing access track to the battery energy storage site located southwest of Melksham Substation, diverted around the edge of the new extension. Permanent access is provided through the existing Melksham Substation access road.

5. OBJECTIONS MADE TO THE ORDER

5.1 A total of 7 objections were initially made to the Order (**CD C5** to **C11**), but I understand that 3 objections have since been withdrawn. NGET's Statement of Case (**CD C4**) and the evidence of Mr Dominic Rees outlines the 4 relevant objections remaining at the time of writing, NGET's response to them and the status of negotiations.

5.2 I have summarised the objections below to the extent that they relate to my evidence and provided my response to them beneath the summary.

National Gas Transmission ("**NGT**") (**CD C6** and **CD E3**)

5.3 NGT has raised a holding objection concerning potential interference with their high pressure gas pipeline (Feeder 14 Wormington to Dowdeswell) from the proposed electrical infrastructure. Their concerns relate to potential AC/DC interference and the need for formal agreements before any construction activities can proceed within their pipeline easement.

5.4 The cable route has been specifically designed to avoid NGT's pipeline alignment entirely. No electrical infrastructure will be installed over or within their easement corridor, eliminating any risk of AC/DC interference.

5.5 However, a temporary crossing of the pipeline will be necessary for construction access. The crossing will be designed and constructed with consideration given to NGT's own specification T/SP/SSW22.

5.6 All construction activities will be governed by a comprehensive Construction Environmental Management Plan that will incorporate NGT's specific requirements for protective fencing, health and safety protocols, and construction monitoring. Pipeline access will be maintained throughout the construction period and beyond, with no permanent structures erected within the easement strip.

5.7 I am aware that both NGET's and National Gas Transmission's legal representatives have agreed the terms of an Asset Protection Agreement which is now being executed.

<u>Mr Jonathan Morton Stanley and Corinium Construction Limited (**CD C7** and **CD E1**)</u>

Options S5 and S6

5.8 This objection suggests that the southern CSEC should be located at Option S5 or S6.

5.9 The selection of Option S2 as the preferred southern CSEC location was based on an extensive assessment of all southern CSEC options undertaken between 2021 and 2025, as detailed in the evidence of Mr Amardeep Malhi. From an engineering perspective, this assessment evaluated technical feasibility alongside other criteria to ensure deliverable infrastructure.

5.10 Options S5 and S6 were given detailed consideration during the technical appraisal process. However, these locations presented fundamental engineering challenges that rendered them unsuitable for the Project. The primary technical constraints relate to topography, cable routing across the A40 and alignment with the proposed cable swathe to the northern CSEC.

5.11 Options S5 and S6 are located on the River Chelt valley floor, requiring underground cables to ascend approximately 60-80 metres up the escarpment over a relatively short distance to reach the existing overhead line infrastructure on the High Wold plateau. This steep gradient presents significant engineering difficulties for cable installation from a health and safety perspective relating to access. It would also need to be considered within the cable system design because of the installation depths which will be requried as a result of the changing and challenging gradients.

5.12 The cable routes from these locations would necessitate complex crossings beneath the A40 trunk road, the embankments of a dismantled railway, and the River Chelt. These crossings would require specialised construction techniques such as HDD, introducing substantial technical risk, cost implications and programme delays that would compromise Project deliverability.

5.13 The route from S5 would require at least approximately 100m to cross the A40 based on a HDD methodology otherwise significant disruption would occur due to an open cut trench. Having regard to the available space within S5, it would not be possible to build the CSEC and provide enough space to launch or receive the HDD and would result in HDDs underneath the properties both north and south of the A40 which should be avoided.

5.14 S6 presents similar challenges for cable routing south of the A40 due to there being limited space available to launch or receive a HDD, with properties on both sides of the road as well as Dowdeswell Reservoir, Dunkertons Park and other buildings and infrastructure in both directions.

5.15 The nature of the valley presents a significant challenge to any cable installation under the A40 further adding to the complication of the drive angle to get the required depth. This could introduce the requirement to dig significant pits into the banks either side to ensure the depth is achieved under the A40 to avoid any settlement. Any increase in depth as a result of this, will increase the required phase spacings, so could be larger than the 100m mentioned above in paragraph 5.13.

5.16 On the north of the A40, in addition to the challenges around the properties, reservoir and the river Chelt the gradient offers a significant challenge with access for cable trenching with approximately 100m change in level.

5.17 Due to the alignment of the cable, and routing challenges in this area, additional requirements for HDD could also be introduced to avoid losing significant vegetation / trees within and around the interface with the Cotswold way and Colgate Farm.

5.18 The confined nature of the physical sites at Options S5 and S6, bounded by the A40 to the north and Lineover Wood to the south/east, would also severely restrict construction access and working space. The delivery and installation of large electrical equipment would be extremely challenging given the limited access via narrow local roads, creating unacceptable health and safety risks during construction and raising serious concerns about long-term maintenance accessibility for the operational infrastructure including HGVs.

5.19 Due to the topography of the locations at both S5 and S6 significant cut and fill will be required to achieve a level compound for the HV equipment

5.20 To complete the circuit, and as required at S2, the OHL would also need to be turned in to connect to the cables in the CSECs. Due to the steep gradients, and the types of towers installed, this would also need significant temporary diversions to replace the existing suspension towers for terminal towers. The temporary diversion in these locations would impact on the properties south of the A40, namely the la petite Bar and Grill by oversailing the building. This would also need to cross the A40 in a temporary arrangement as well the properties to the north.

5.21 These technical constraints would introduce unacceptable engineering feasibility and complexity and risk to the Project. The engineering challenges would significantly increase construction costs and programme duration, making these options technically unfeasible. Option S2 avoids these technical constraints.

5.22 With respect to the southern CSEC configuration, the reason for selecting location South End F within S2 was to avoid having to introduce a large terminal tower with additional cross arms to divert the OHL circuit to this location due to the significant deviation from the line. The option at South End E utilises gantries within the compound to bring the overall height down to around 15m high rather than 40m-45m high and a foot print around 30mx30m for the terminal tower, which as part of the visual impact scheme was trying to avoid in this location adjacent to the Cotswold Way.

Freehold land and construction swathe

5.23 This objection also raises concerns about the extent of freehold land take for the CSEC site, the acquisition of construction compound areas, and the 100 metre construction swathe width.

5.24 The area required for permanent freehold acquisition has been determined following a thorough engineering development process. The land has been specifically selected to accommodate the essential electrical equipment within the CSEC, ensuring adequate space for construction activities and long-term maintenance access to the operational infrastructure. While the construction compounds adjacent to each CSEC site will function as temporary facilities during construction for equipment laydown and to allow for the assembly of the plant items prior to lifting into position, the facilities will be removed following completion of construction.

5.25 The 100 metre construction swathe is required based on extensive lessons learned from previous underground cable projects. A construction haul road will be established at the centre of the swathe using multiple layers of compacted stone. This is a crucial safety requirement to safely manage the interface between personnel and plant equipment during cable installation operations. The remainder of the swathe is needed for cable installation activities and the segregated storage of different soil types, with topsoil and subsoil kept in separate bunds to prevent cross-contamination and enable proper land reinstatement. Further information is included in my evidence in paragraph 4.4.

Construction standards

5.26 Concerns are also raised about the standard and quality of works proposed by NGET. All construction activities will be carried out in strict accordance with a detailed Construction Environmental Management Plan ("**CEMP**") which will specify the standard and quality of works to be undertaken. This ensures compliance with industry best practices and regulatory requirements for underground cable installation. The CEMP will require approval from the Local Planning Authority.

5.27 Paragraph 5.4 of Mr Jonathan Morton Stanley and Corinium Construction Limited's statement of case lists a number of environmental controls and mitigation measures which it says should be implemented during construction (**CD E1**). The CEMP will contain suitable construction phase protections and mitigation measures which will be implemented to mitigate environmental effects. To the extent that such measures are considered necessary and proportionate based on the detailed design and site-specific conditions, they will be included in the CEMP. I do not consider that the various measures proposed by the objector are in fact necessary and proportionate based on the information available to date, however this will ultimately be a matter resolved by the local planning authority when it comes to give final approval of the CEMP.

<u>RH Barnes and Sons (**CD C9**)</u>

5.28 RH Barnes and Sons suggest relocating the main construction compound closer to the CSEC to eliminate the need for the haul road from the proposed compound near Whalley Farm.

5.29 Relocating the main construction compound would not eliminate the necessity for the construction haul road. The local road network is not suitable or capable of managing the heavy machinery and equipment required for the Project, making a dedicated haul road essential regardless of compound location. The proposed compound location has been selected based on technical requirements including adequate space for equipment laydown, proximity to the cable route, and suitable ground conditions for heavy plant operations.

5.30 RH Barnes and Sons also question the need for a 100m construction swathe when NGET's 2015 technical guidance referenced up to 65m for direct buried cables.

5.31 The 100m construction swathe is required based on extensive lessons learned from recent underground cable projects. While the 2015 technical guidance referenced a swathe of up to 65m, this guidance has not been updated since publication and reflects earlier project experience with less complex installations. Current practice, informed by recent similar projects, demonstrates that up to 100m is necessary due to increased system requirements and for safe and efficient construction.

5.32 A construction haul road will be established at the centre of the swathe using multiple layers of compacted stone. This is a crucial safety requirement to safely manage the interface between personnel and plant equipment during cable installation operations. The remainder of the swathe is needed for cable installation activities and the segregated storage of different soil types, with topsoil and subsoil kept in separate bunds to prevent cross-contamination and enable proper land reinstatement.

5.33 Construction impacts raised in this objection including noise, dust and vibration mitigation are addressed in the evidence of Ms Nicky Lear.

<u>Mr Ivan Drake and Mrs Ann Drake (**CD C10** and **E2**)</u>

5.34 Mr Ivan Drake and Mrs Ann Drake in their objection request certain technical details, specifically the construction methodology.

5.35 The construction methodology will follow established industry practices and will be implemented by the principal contractor. The key construction stages will comprise: easement fencing; topsoil strip; haul road construction; trench excavation; duct installation; backfilling; joint bay excavation; cable pulling and jointing; testing and commissioning; haul road removal; topsoil reinstatement; and easement fencing removal. Trenchless installation methods will be utilised where required for specific locations.

5.36 The access track will be constructed using different grades of compacted stone layers with a width between 5 and 8 metres to accommodate passing points and ensure safe construction access. This stone construction approach provides the necessary structural integrity while maintaining operational flexibility for potential adjustments during construction should unforeseen circumstances arise. The stone materials can be recycled and reused post-completion.

5.37 The underground cables will be installed at a minimum depth of 900 millimetres to the protective tile in accordance with industry guidelines.

5.38 These technical specifications ensure the Project can be delivered whilst maintaining the operational integrity of the electrical infrastructure.

6. SUMMARY AND CONCLUSION

6.1 My name is Dave Rogerson and I am a Lead Transmission Engineer with National Grid Electricity Transmission Plc, specialising in Over Head Lines and High Voltage Cable Technology. I have nineteen years' experience with thirteen years in my current role with NGET where I am authorised by National Grid's Business Procedure 141 for both OHL and cable design assurance. I have been working on the Project since 2018 as the Lead Cable and OHL design assurance engineer.

6.2 The Project comprises the undergrounding of approximately 7 kilometres of the existing OHL which runs from the west of Winchcombe to the south east of Cheltenham, within the Cotswolds National Landscape.

6.3 The key components of the Project include:

6.3.1 the installation of approximately 7 kilometres of 400kV underground cables comprising 12 power cables in total;

6.3.2 the dismantling and permanent removal of 7 kilometres of existing double circuit OHL including the net removal of 16 towers;

6.3.3 the construction of two new cable sealing end compounds which will each require new terminal towers; and

6.3.4 the expansion of an existing NGET substation in Melksham to accommodate a new shunt reactor for voltage control.

6.4 The cables will comprise 2500mm2 copper conductor, XLPE insulated cable. Two cables per phase are required to provide the necessary power, resulting in 12 power cables in total, plus telecommunication and monitoring fibres.

6.5 The cable installation requires a construction swathe of up to 100 metres wide along the 7 kilometre length of the cable route. This width accommodates:

6.5.1 4 cable trenches;

6.5.2 Trenchless cable installation methodology where required;

6.5.3 Cable joint bays with working areas;

6.5.4 A temporary construction stone haul road;

6.5.5 Storage areas for topsoil and subsoil; and

6.5.6 Drainage requirements.

6.6 Installation works will begin with demarcation fencing to secure the work area, followed by topsoil stripping and pre-construction drainage installation. The haul road is designed to accommodate Heavy Goods Vehicles transporting cable drums weighing approximately 55 tonnes.

6.7 Cable trenching works excavate to a depth of around 1.4 metres for standard trenches. A sub-base of Cement Bound Sand will be installed followed by HV cable ducts. Utilising ducted installation separates cable installation from civil trenching works, reducing the time trenches are open and improving safety. Trenches are surrounded by compacted CBS to provide thermal stability, with protective tiles and warning tapes laid above before backfilling.

6.8 Horizontal Directional Drilling may be employed to minimise disruption to surface features such as roads and rivers. HDD requires increased cable spacing of around 8 metres with a total width of 96 metres, and drive sites of approximately 30 metres x 20 metres.

6.9 Cable joints are required approximately every 900 – 1000 metres. Joint bay works typically involve an area of approximately 30 metres x 30 metres for each group, including hard standing, equipment for cable offloading, jointing shelters, welfare facilities and power supplies. Following cable installation completion, the ground is returned to its previous use.

6.10 The northern and southern CSECs each measure approximately 80 metres x 40 metres and contain cable terminations, earth switches, surge arrestors and associated support structures, enclosed by security fencing. Each has an associated new terminal tower. During construction, temporary construction compounds of approximately 75 metres x 75 metres adjacent to each CSEC site will provide laydown, storage, parking welfare and security facilities.

6.11 As the southern CSEC location is directly under the existing OHL, a temporary diversion will be required to allow safe construction.

6.12 Once cable installation is completed, cables will be connected to the OHL during system outages. At the north, existing tower ZF308 will be replaced with a new terminal tower. At the south, temporary OHL towers will be installed to allow the CSEC to be built.

6.13 To construct the new terminal towers, foundation excavation of approximately 6 metres x 6 metres per tower leg is required, with piled or pad and chimney foundations installed. Steelwork is erected by crane or derrick, requiring a laydown and assembly area of approximately 50 metres x 50 metres.

6.14 New conductors are hung through stringing, using either non-tension pulling or tension stringing methods. Downleads connecting towers to CSECs are installed via tractor winches.

6.15 Existing towers are dismantled using cranes positioned on crane pads of approximately 20 metres x 10 metres. It takes approximately one day to dismantle a tower. Tower sections are broken up and placed into waste skips for reuse or recycling. Foundations are removed to a minimum depth of 1 metre below ground level and the land is reinstated.

6.16 The Project requires expansion of Melksham Substation to accommodate a new 400kV shunt reactor measuring 13.9 metres x 6.15 metres x 8.3 metres for voltage control.

6.17 Four relevant objections to the Order remain.

6.18 National Gas Transmission raised concerns about their pipeline; the cable route has been designed to avoid their pipeline alignment entirely. A temporary crossing for construction access will be designed in consideration of NGT's specifications. An Asset Protection Agreement has also been agreed between NGET's and NGT's legal representatives and is currently being executed.

6.19 Mr Jonathan Morton Stanley and Corinium Construction Limited suggest the southern CSEC should be located at Option S5 or S6. However, these options presented fundamental engineering challenges. They are located on the River Chelt valley floor, requiring cables to ascend approximately 60-80 metres up the escarpment, presenting significant difficulties and compromising thermal performance. Cable routes would necessitate complex crossings beneath the A40, railway embankments and River Chelt via HDD. Options S5 and S6 lack sufficient space to set up the CSEC and launch/receive HDD. The valley nature complicates drive angles. The gradient north of the A40 presents challenges with approximately 100 metres level change over 1 kilometre. The confined nature of these sites severely restricts construction access and working space, creating unacceptable health and safety risks. Temporary OHL diversions would impact properties and require crossing the A40 temporarily. Option S2 avoids all these technical constraints, and reduces the engineering risk of the Project very considerably.

6.20 Regarding concerns about land take and the 100 metre construction swathe: the area for permanent acquisition accommodates essential electrical equipment with adequate space for construction and maintenance access. The 100 metre swathe is required based on extensive lessons learned from previous projects. All construction activities will be carried out in accordance with a detailed Construction Environmental Management Plan.

6.21 RH Barnes and Sons suggest relocating the main construction compound to eliminate the haul road. However, the local road network cannot manage the heavy machinery required. They also question the 100 metre swathe when 2015 guidance referenced 65 metres. However, as mentioned, the 100 metre swathe is required based on recent project experience. The 2015 guidance has not been updated and reflects, earlier, less complex projects.

6.22 Mr Ivan Drake and Mrs Ann Drake request technical details requiring construction methodology. In this regard, the key construction stages comprise:

6.22.1 Easement fencing;

6.22.2 Topsoil strip;

6.22.3 Haul road construction;

6.22.4 Trench excavation;

6.22.5 Duct installation;

6.22.6 Backfilling;

6.22.7 Joint bay excavation;

6.22.8 Cable pulling and jointing;

6.22.9 Testing and commissioning;

6.22.10 Haul road removal;

6.22.11 Topsoil reinstatement; and

6.22.12 Easement fencing removal.

The access track will be 5-8 metres wide. Underground cables will be installed at a minimum depth of 900 millimetres to the protective tile.

6.23 The engineering design and methodology have been developed with rigorous technical governance, safety and environmental considerations. The proposed construction swathe, cable routing and infrastructure locations are based on engineering principles and practical considerations. Objections have been addressed with detailed technical responses, demonstrating that the selected approaches are the most feasible and least impactful options available. The Project is deliverable, safe and aligned with NGET's obligations and industry standards.

7. WITNESS DECLARATION

7.1 I confirm that the evidence prepared for this Inquiry and contained within this statement of evidence are my true and professional opinions. I confirm that I have understood and complied with my duty to the Inquiry as an Expert Witness and have provided my evidence impartially and objectively. I confirm that I have no conflicts of interest.

7.2 I confirm that artificial intelligence has not been used to produce this statement of evidence.

DAVE ROGERSON

13 OCTOBER 2025