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TUNNEL EVIDENCE

THE NATIONAL GRID ELECTRICITY TRANSMISSION PLC (GRAIN TO TILBURY) COMPULSORY PURCHASE ORDER 2024

SUMMARY STATEMENT OF EVIDENCE of

Timothy M. Hyett

Tunnel and Geotech Expert

for National Grid Electricity Transmission plc

SUMMARY AND CONCLUSIONS

1.3 I have more than 40 years of experience working in Tunnelling, having entered the industry as a school leaver in 1980.

1.5 I am currently working for National Grid Electricity Transmission plc as Tunnel & Geotech SME on the Project. I also work in the same capacity on NGET's Snowdonia Visual Impact Provision Cable Tunnel project crossing the Dwyryd Estuary, amongst several other assignments. I have also worked in the sector across the UK and abroad in Europe, the Middle East and North America.

3.1 The Project involves the construction of two 15m diameter deep shafts to a depth of c.40m at Tilbury and Gravesend, and 2.2km long 4.0m diameter PCC Segmental Tunnel driven beneath the river Thames.

3.2 The scope of work arose following NGET's initial engagement with proposals to upgrade the Grain-Tilbury and Kingsnorth-Tilbury 400 kV high voltage electric circuits to meet the Future Energy Scenarios and Electricity Ten Year Statement produced by the Electricity System Operator who forecast a large amount of renewable generation, including offshore wind and nuclear, together with three interconnectors from the continent to connect into the east coast of England.

4.1 NGET have an established track record building cable tunnels of this type and other complex underground infrastructure including LPT phases 1 and 2, Feeder 9 Gas Tunnel Project beneath the Humber

Estuary and Snowdonia VIP. More details are in the main body of my evidence.

5.1 NGET can demonstrate a proven track record of medium to large diameter tunnel building on such a scale using advanced, state-of-the-art TBM technology and shaft sinking capability.

5.3 The NGET delivery team for the Project have embraced CDM and key tunnel industry guidelines and looked closely at relevant past projects in an effort to mitigate project risk. The lessons learned include, amongst other things, the importance of carrying out geo-hazard risk assessments early; the importance of accurate geological data collection; correct TBM selection; rigid TBM specification; the importance of a robust Tunnel Lining design; a zero-tolerance approach to leaks and annular grouting; and a commitment to monitoring ground movement and tunnel deformation, along with quality assurance and control.

5.4 Some of the key tunnelling guidelines and standards prioritised on the Project to minimize risk are listed in the main body of my evidence. Many further tunnelling industry codes, standards and regulations have been adopted wholesale. In addition, NGET have prepared detailed in-house specifications, including for the TBM, the Tunnel Lining and the Spoil Treatment Plant - all of which elevate the national and international standards even higher - in a dedicated effort to ensure, with a high degree of certainty, that the Project is delivered safely and with the minimum disturbance to third parties, members of the public and the environment.

5.6 These procedures have influenced the planning and design of the Project and in turn helped NGET minimise site footprints required for

construction, including the compound areas either side of the river, access roads and peripheral land subject to the Order.

6.2 The new tunnel would have an internal diameter of c.4.0m and a length of approximately 2.2km to house and carry the 12 new cross-linked HV electricity cables needed as part of the upgrade to the network.

6.3 Having identified the preferred option of installing the cables in a new tunnel under the River Thames, NGET considered options for carrying out the tunnel works efficiently.

6.4 Traditional tunnel methods were unsuitable for the Project, due to either the span of the Thames, the HV cable requirements and circuit configurations, geology, bathymetry and riverbed geomorphology and/or physical geometry of the riverbanks at Tilbury and Grain.

6.5 As the Project progressed through design, it was determined that a 4.0m internal diameter structurally lined tunnel was required to accommodate the new HV infrastructure.

6.7 The *horizontal alignment* selected for the project represents the optimum route across the Thames, considering the position of the existing 2.8m cable tunnel (upstream) and the route of the proposed Lower Thames Crossing ("**LTC"**) road tunnel (downstream).

6.8 The *vertical alignment* (i.e. tunnel depth) selected for the Project represents the optimum and safest position for the tunnel beneath the riverbed, taking account of geology and glaciofluvial geomorphology (i.e. the evolution and movement of sediments in the river). In turn, this set shaft depths at circa 40m at Tilbury and Gravesend and defined a length between the shafts of 2.2km.

6.9 The selection of segmental Pre-Cast Concrete linings with an internal dia. of circa 4.0m represents the optimum and safest means of *physical support* for a tunnel in this geology, and PCC rings are the most robust structural lining for HV cable support, with a 120-year design life.

6.10 Taking account of the above, TBM represents the optimum and safest *means of excavation*. In turn, this determined shaft diameters of 15m, as this is the minimum size from which to launch a TBM of this type and size from Tilbury and recover the same at Gravesend.

6.11 The basic aim of the tunnel design discussed above is to determine precisely what construction criteria is required, establish land take requirements and identify what principal structural support materials are required to create as little disturbance as possible during the tunnelling process, and identify what is required to be added in the way of concrete or steel support in the tunnel and shafts to prevent surface movement.

6.12 NGET carried out an exhaustive review of historic ground information in this location, including research from the 2.8m cable tunnel built in the 1960s, and data from the planned LTC project situated c.500m to the east, as well as relevant Port of London Authority dredging data and bathymetry charts.

6.13 At the same time NGET commissioned a thorough project-specific geotechnical investigation the interpretation of which is an essential prerequisite of the tunnel design process.

6.14 This enabled the formulation of the *Observational Ground Model*, allowing the preliminary FEED design of the shafts and tunnel to be

progressed. In turn, this also identified the land take areas at Tilbury and Gravesend required in order to deliver the Project; and informed shaft and tunnel construction methods; TBM selection, headhouse positions and size.

6.15 Drawing upon NGET's past tunnelling experience from similar projects like LPT, Snowdonia VIP, and the Humber Pipeline Tunnel - this enabled accurate predictions regarding space proofing, shaft and compound layouts, estimates of vehicle movements as well as enabling reasonable forecasts of volumes of construction traffic, determination of access routes and potential environmental impact. It also enabled reliable identification of the land take requirements to build the Project, as well as informing how best to safely construct the shafts and tunnel and how best to handle and process excavated material while protecting the environment and minimising disruption to third parties.

6.17 In addition, NGET have selected innovative Vertical Shaft Machines for the Project. This system has been designed with a compact jobsite set-up for reliable construction of vertical shafts in restricted space conditions. VSM technology can function within a minimum surface land take.

6.19 These proposals / considerations demonstrate how NGET have sought to minimise land take and prioritise health and safety and protecting the environment.

7.2 SGN experienced some issues relating to integrity of some of its buried pipeline assets on the recent Thames Tideway Tunnel project

7.6 The 4.0m diameter TBM proposed for the project is considerably smaller than that used on the Thames Tideway project. We know from

past similar projects that TBMs of this diameter can be shipped and moved by conventional road transport from UK ports to job sites without any impact on general highway infrastructure, subject to a detailed swept path analysis, which identifies obstructions or sensitive buried utilities such as gas pipelines, water mains etc.

7.10 The TBM will be broken down in the factory in Germany into suitable sections and specific road trailers will be selected and deployed by the specialist transport company using multiple axle configurations to ensure abnormal load limits are not exceeded.

7.11 Movements of this type also require special planning and permits for safe transportation, operated by Highways England. Permission will not ordinarily be granted where there is a risk of damage to either the highway (or any buried utilities).

7.13 The concerns of SGN are duly noted, but the TBM on the Project is a fraction of the size and weight of the Tideway TBMs, and following a detailed swept path analysis, buried pipelines in proximity will be examined in detail and a structural analysis carried out to ensure abnormal vehicular loading does not interfere or adversely impact the integrity of any utility within the highway.

8.5 Whilst SGN's objections to the Order are noted, they are not fully justified, as every possible effort has been taken by NGET to minimise land take, consider third party needs, prioritise safety and protect the environment.

8.6 On this basis, in my opinion, the objection should not be upheld.

DECLARATION

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

Timothy M Hyett

12th May 2025