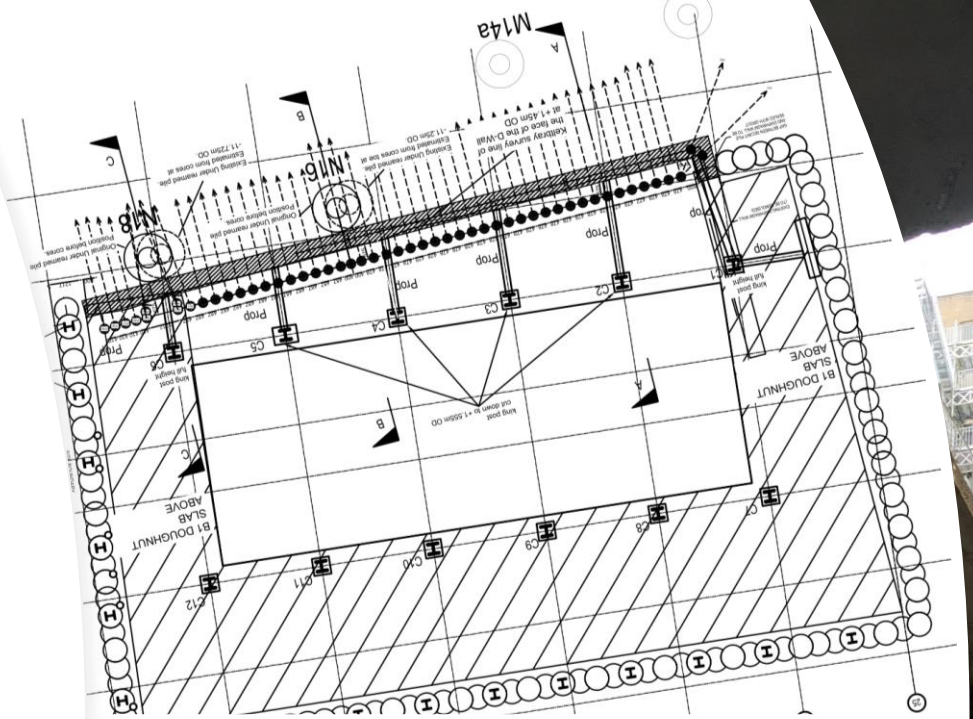
Design, construction and performance of a basement Pali Radice contiguous minipiled retaining wall beneath at The Berkeley Hotel, Knightsbridge, London

Piling 2020 Conference

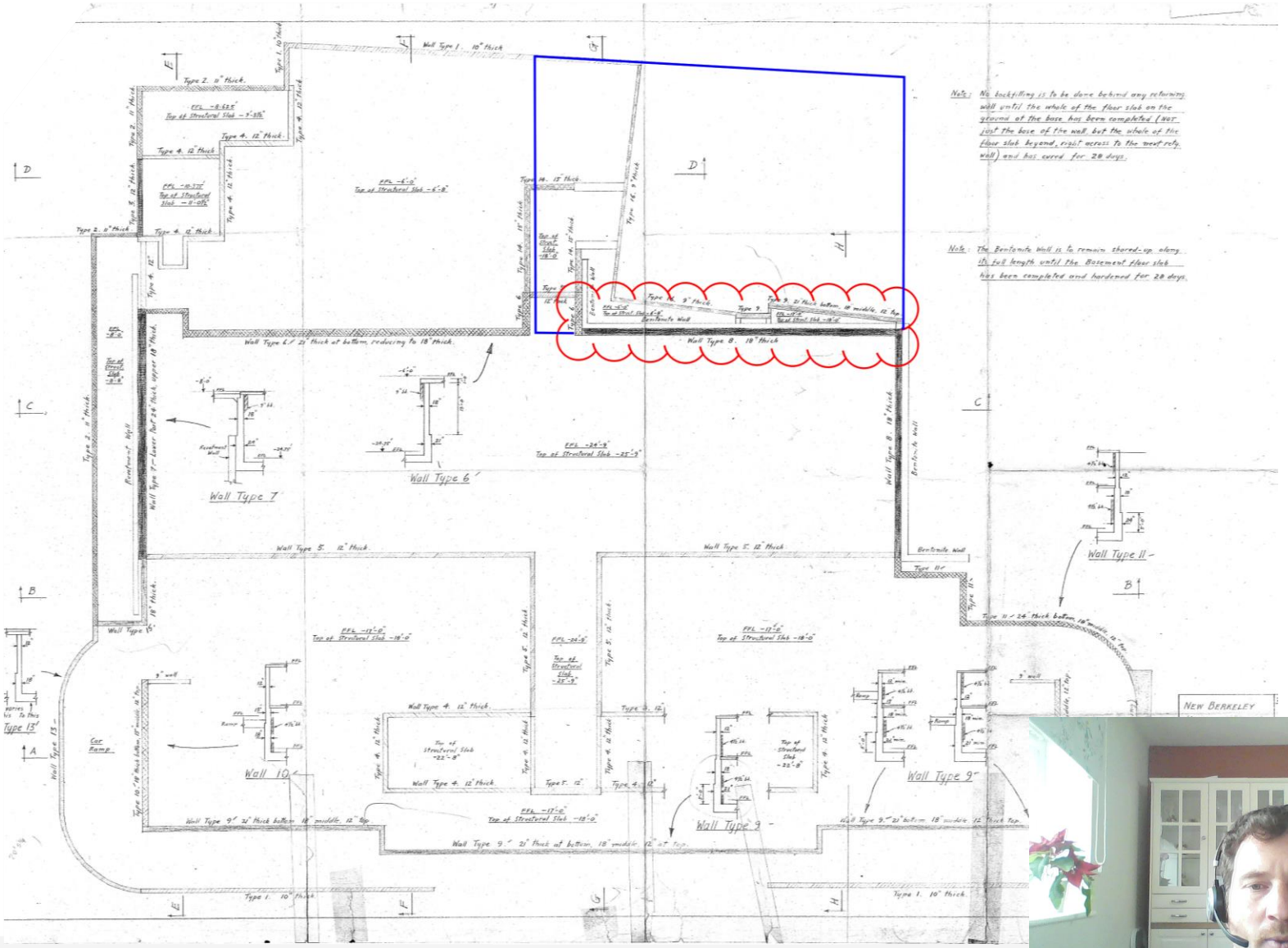
F. Pero (Presenting Author)
S. Vaughan
K. Xu
D. Schutt

The Berkeley Hotel extension



Existing diaphragm wall

- Base of the D-wall from coring ≈ -3.7m OD.
- New basement formation level at -8.4m OD (5.0m to 5.5m below the base of the wall
- Excavation depth around 20m from ground level at 11.5m OD.



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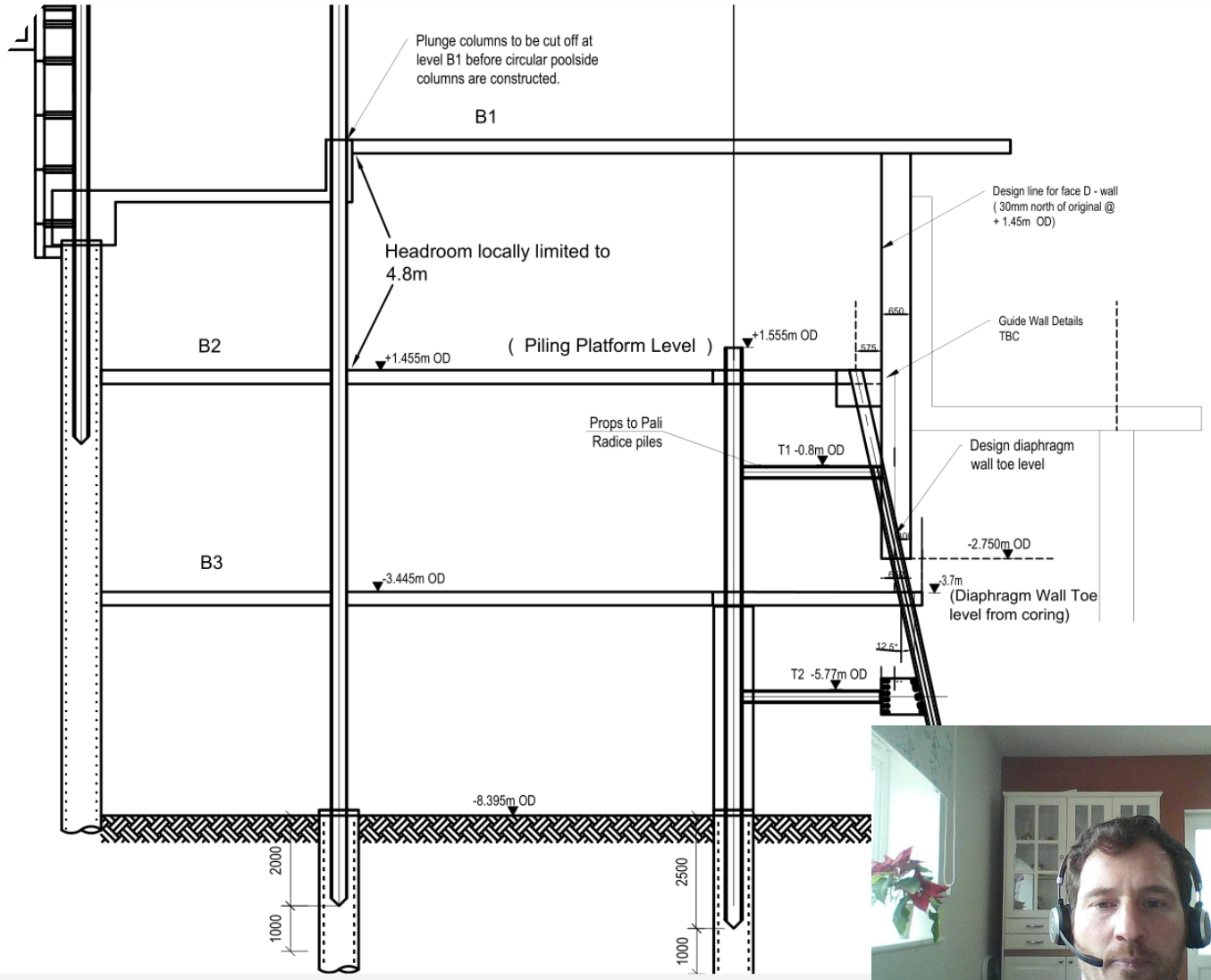
Excavation support proposals

Initial proposal

- Traditional underpin and propping the D-wall during excavation
- The D-wall was supporting loads. The Hotel was sensitive to vertical settlement of the D-wall
- Underpinning delaying the programme
- Two under-reamed piles adjacent to the wall

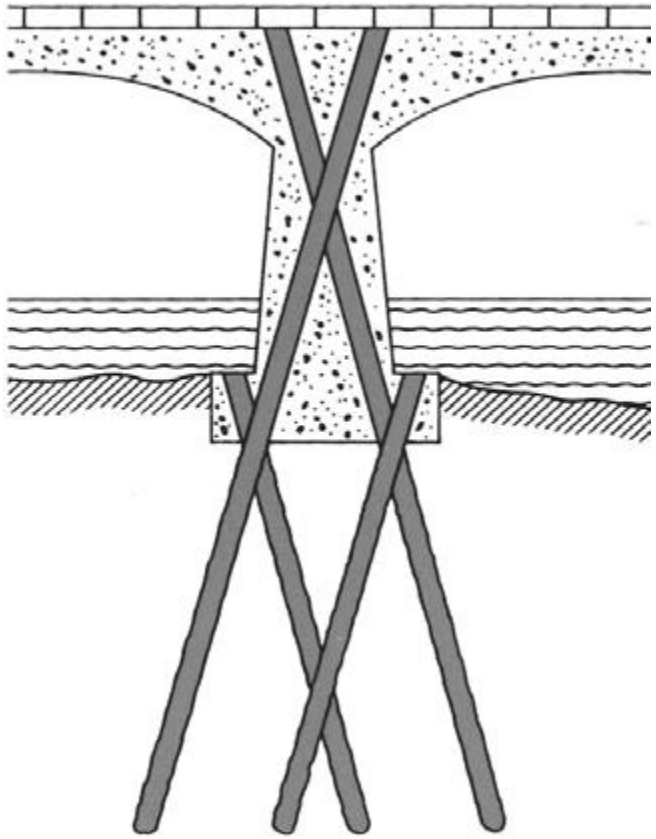
Alternative proposal

- Keller proposed at to install 12.5° raked Pali Radice wall with a temporary propping system in addition to permanent floor slab support.
- Pali Radice were to be bored through and directly permanently bonded to the D-wall acting as a contiguous wall providing vertical and horizontal support



Pali Radice system

- Pali Radice (Root Piles) technique were introduced by Dr F. Lizzi in the 1950’s in Italy
- Pali Radice can be installed through and bonded to existing structures
- The system can bore directly through materials such as reinforced concrete, timber, cast-iron, granite, etc., obviating the necessity for advanced probing at pile positions.



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Pali Radice system

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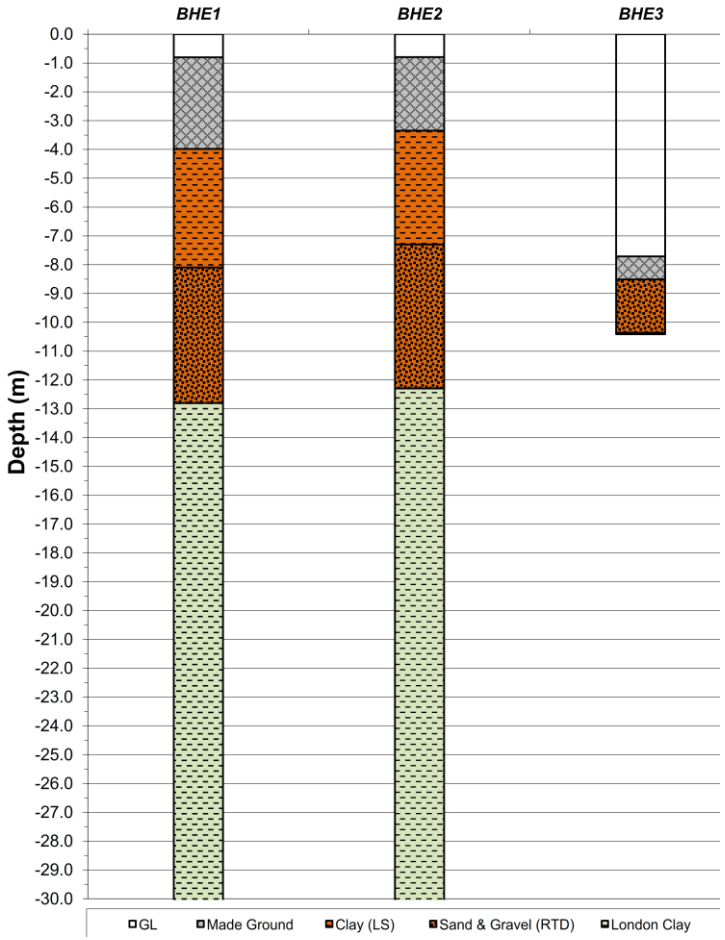
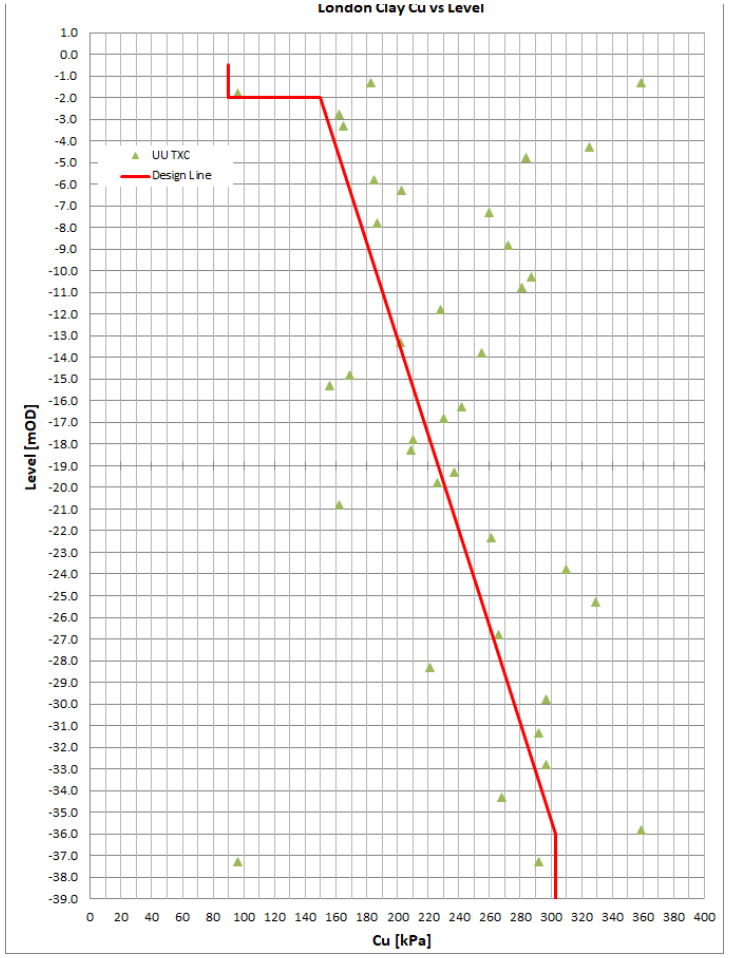
Ground conditions

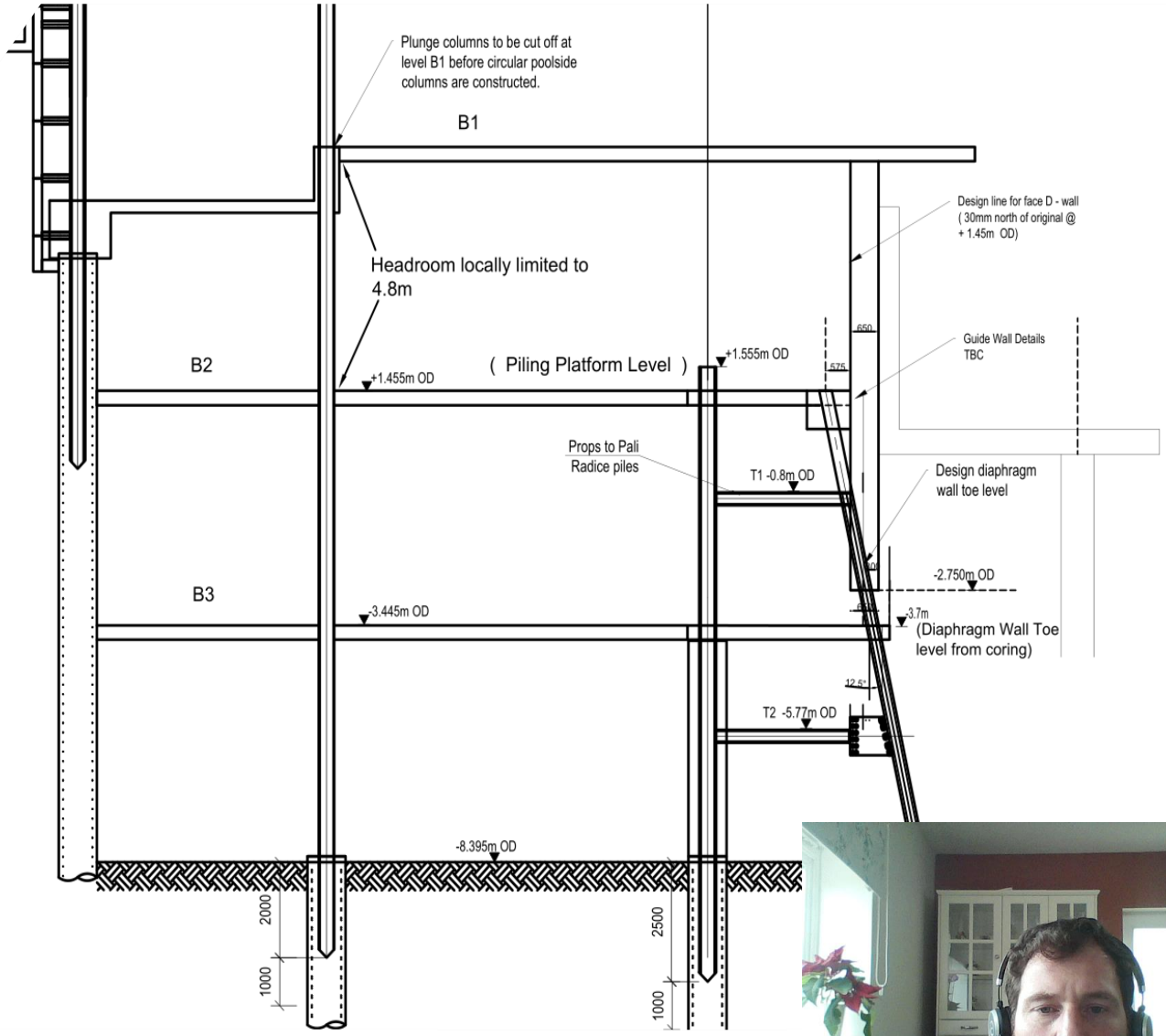




- Made ground overlying in turn Langley Silt, River Terrace Deposits and the London Clay Formation
- Piling commencement level 1.5m above the London Clay Formation

Construction Sequence

- Install plunged at piling platform level (Street level)
- Excavate to underside of B1 slab level at and cast B1 slab
- Excavate to underside of B2 slab level at +1.155m OD
- Install Guide wall for Pali-Radice piles and cast part of B2
- Install Pali-Radice piles from 1.455m OD
- Cast B2 slab.
- Excavate to -0.9 m OD.
- Install temporary props T1 at -0.8m OD and monitoring points on the steel walling beam
- Excavate to underside of B3 slab level at -3.745 m OD
- Cast B3 slab, B2-B3 liner wall and infill between liner wall and Pali-Radice wall. Install monitoring points on B3 level
- Excavation to -6.0m OD
- Install prop and RC waling at -5.77m OD.
- Excavate to final formation level -8.395m OD. Local excavation to core area
- Cast B4 slab

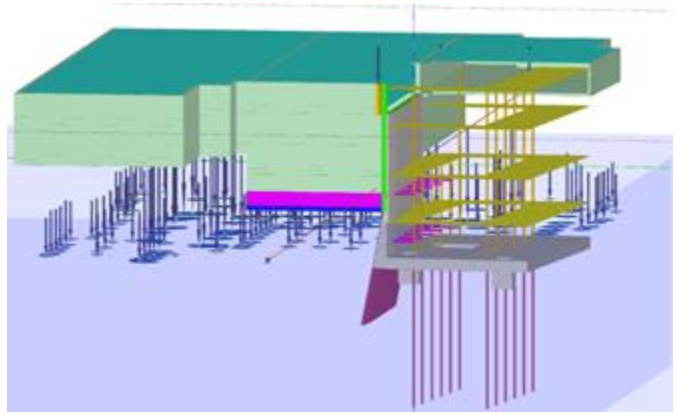


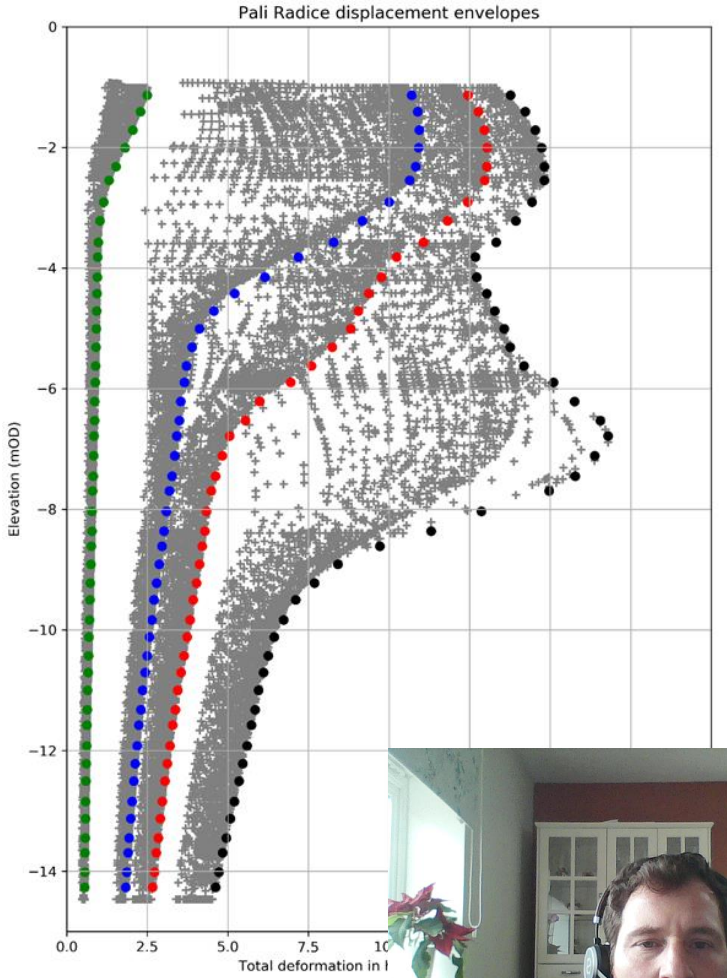
Soil structure interaction

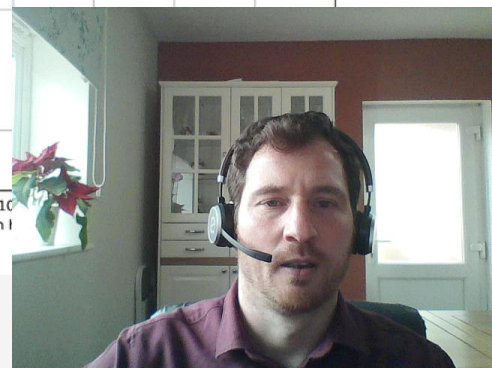
A 3D finite element model was developed to capture the staged construction of the proposed basement substructure and underpinning, with a view to incorporate the complex constraints and assess:

- SLS and ULS-DA1 C1 and C2 propping forces. Partial factors were applied to the soil shear strength characteristic parameters or the C2 analysis.
- ground and pile displacements
- structural forces acting on the Pali Radice
- factor of safety on global stability

The finite element model was developed using the commercially available software, Plaxis 3D (2017)







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Movement monitoring

Monitoring survey points for the Pali Radice wall were installed at

- T1 temporary prop level
- B3 slab level
- T2 temporary prop level
- Displacement of the wall were recorded during excavation between September and November 2019.

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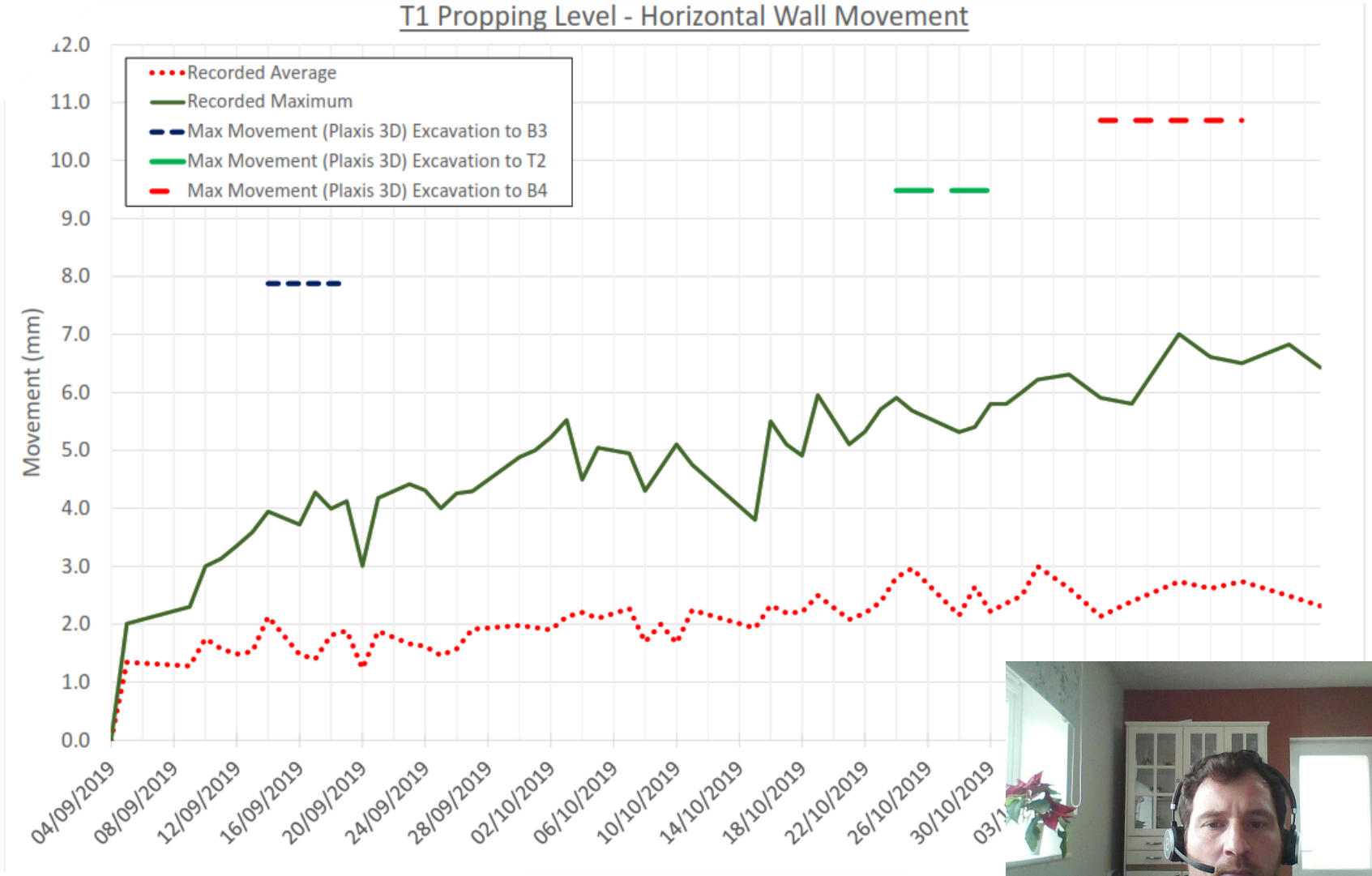
Lateral displacement of the Pali Radice wall

T1 level movement

- Recorded average lateral movement ranges between 1.2mm and 3mm during excavation
- The lateral displacement of contiguous wall and the excavated depth calculated from T1 was only 0.092% indicating that a high lateral support stiffness have been provided to the wall.



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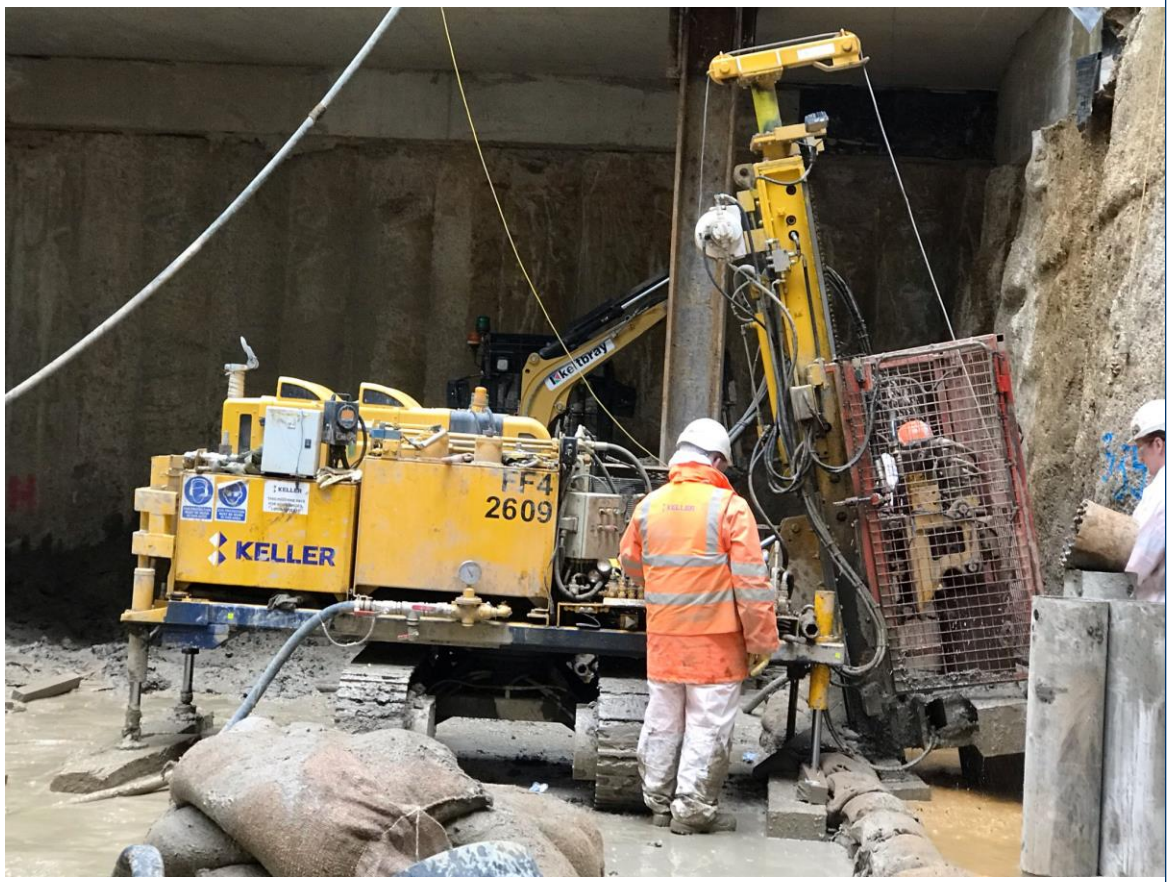

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Questions ?