



Crossrail - Bond Street and Tottenham Court Road Ground Investigation

How much does the soil matter?

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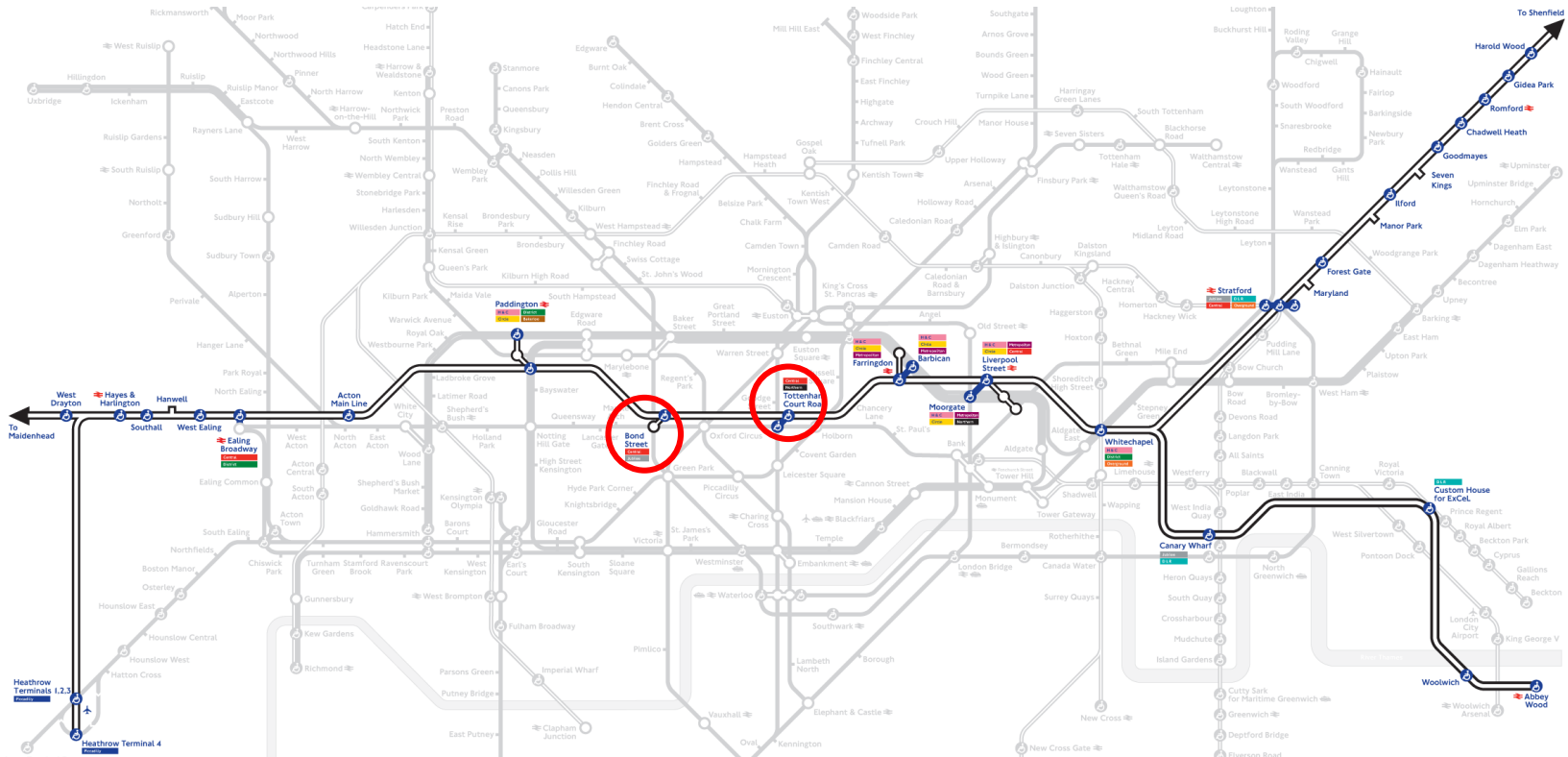
Outline

- Crossrail Project overview
- Ground investigation challenges
- Issues to consider
- Summary

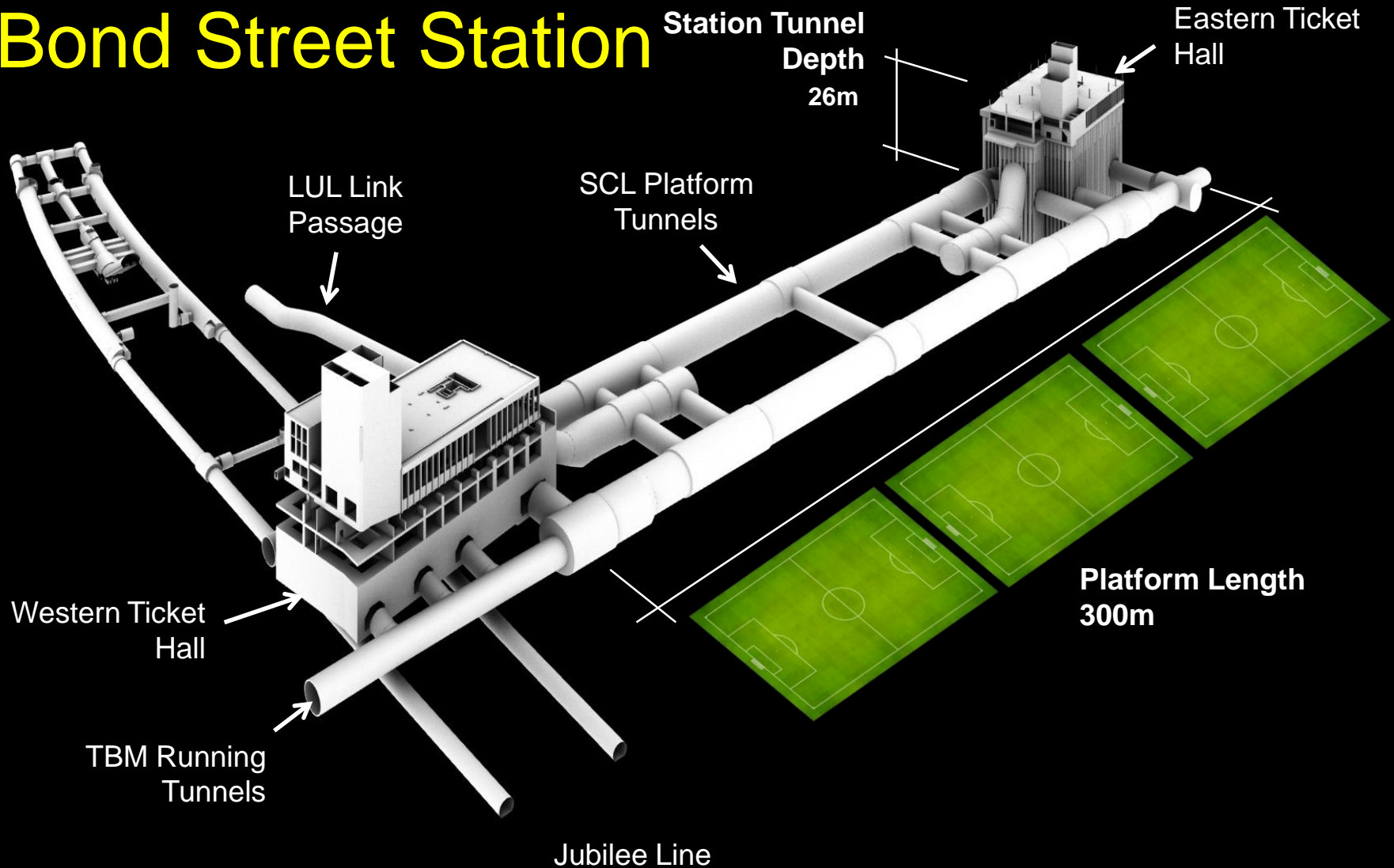
Crossrail Project Overview

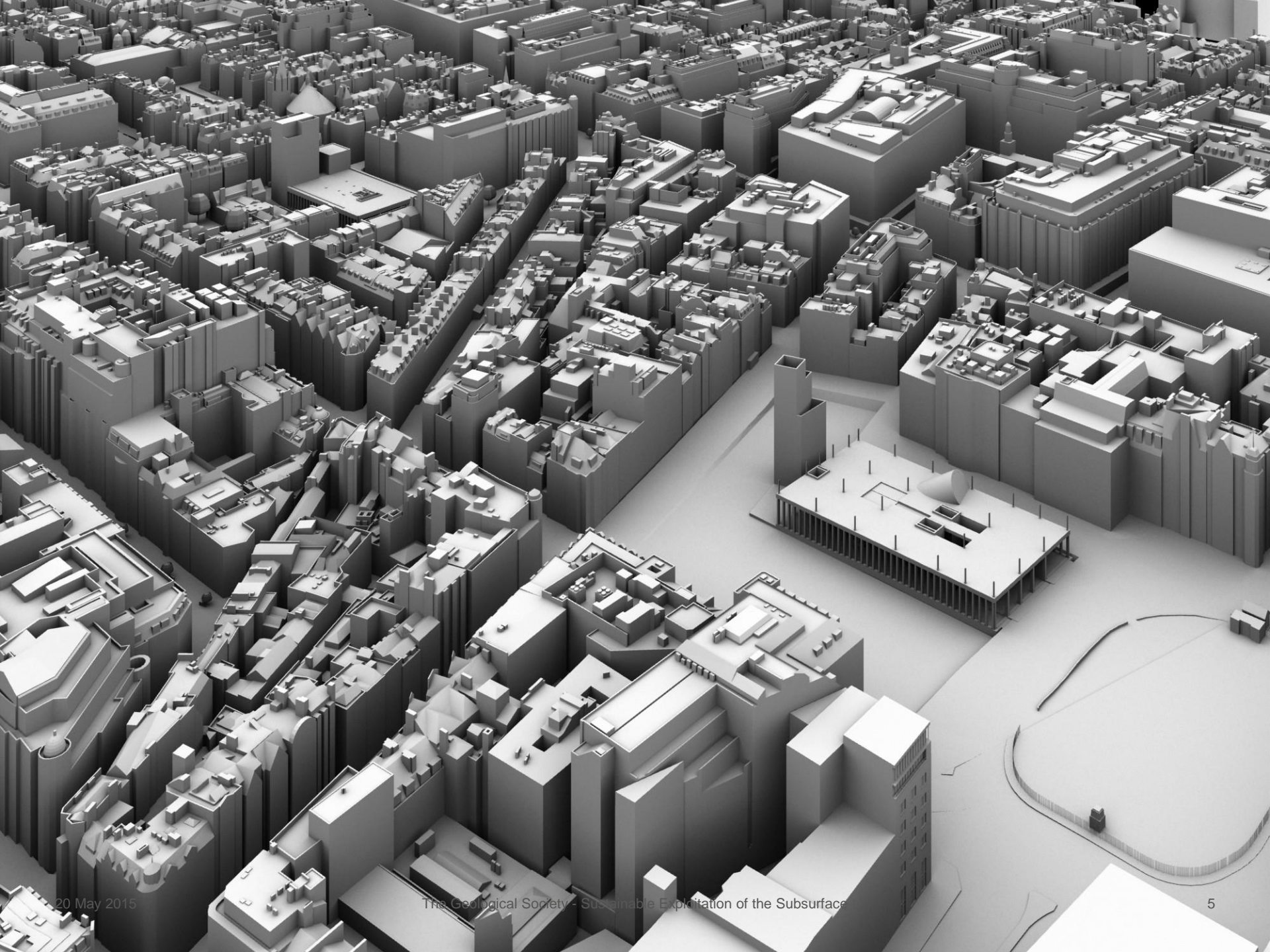


- Largest infrastructure project in Europe
- Connecting the east and the west through London
- 8 new underground stations; including BOS and TCR



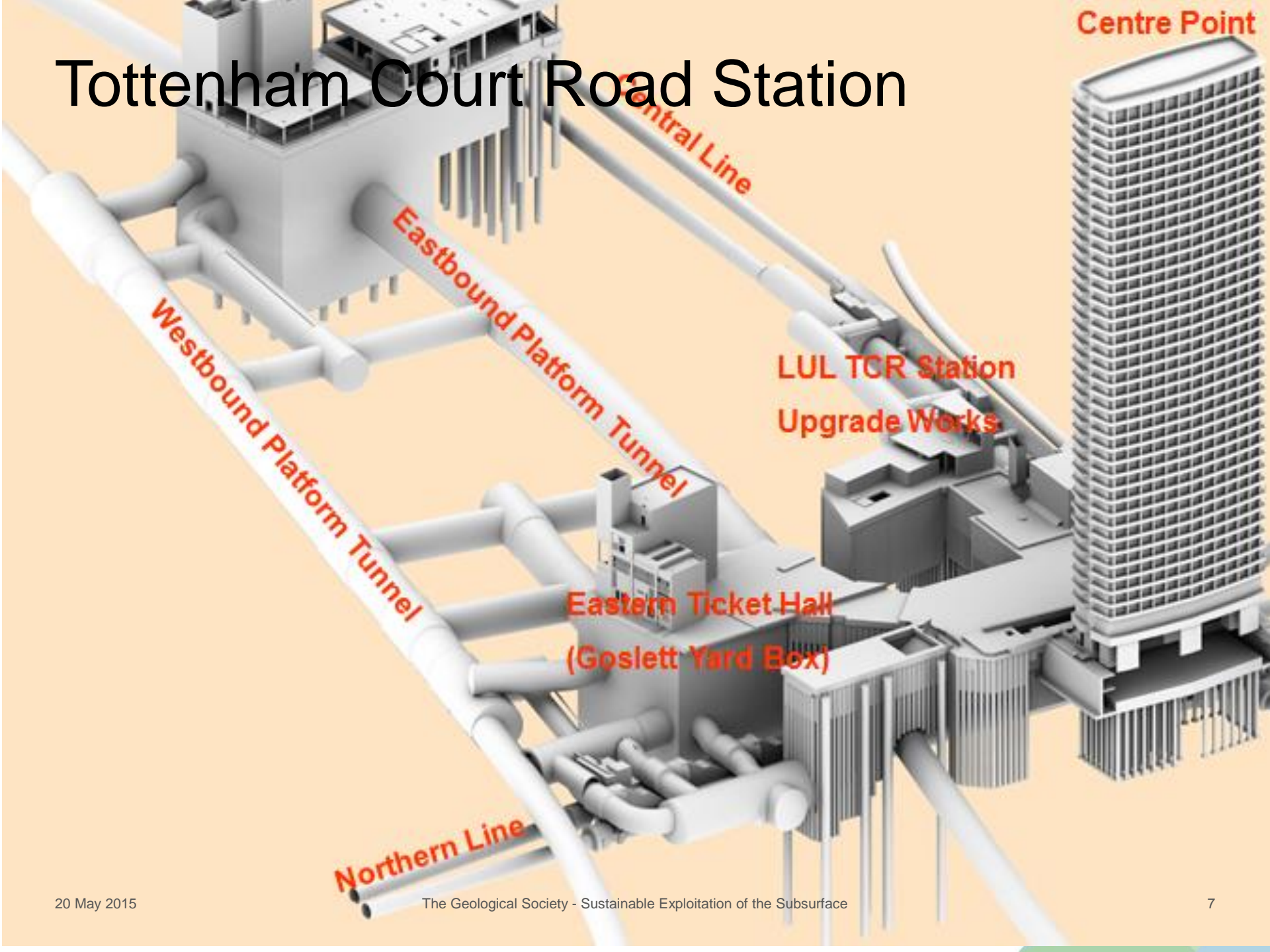
Bond Street Station







Tottenham Court Road Station



Ground Investigation Challenges

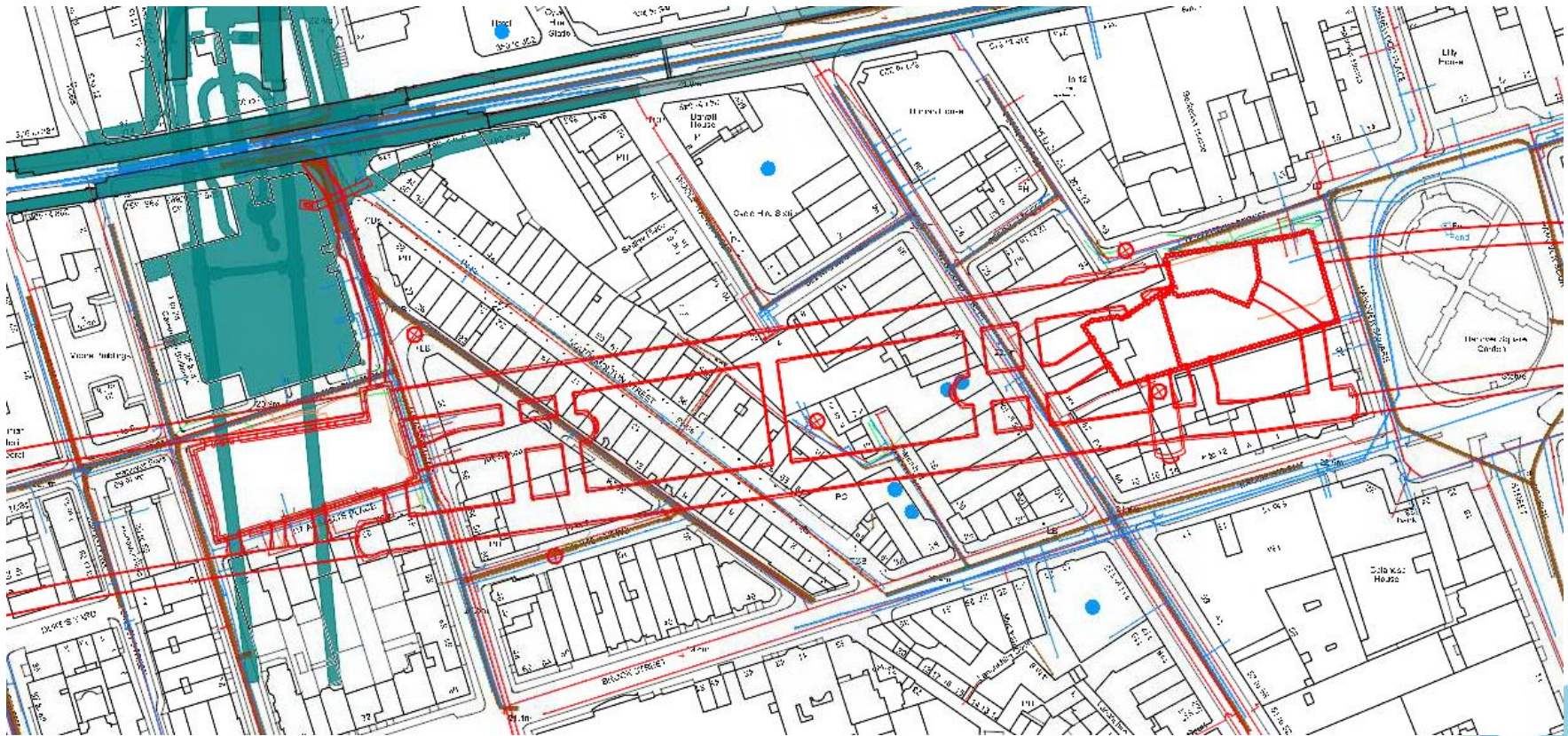
- By project nature, intensive GI required
- Lessons from previous major projects: need for high quality GI; with detailed testing and description
- Finding locations for boreholes, drilling rigs and SI compounds
- Unknown features and/or obstructions

BOS Station: Subsurface assets

- Utilities, tunnels, wells, underground structures

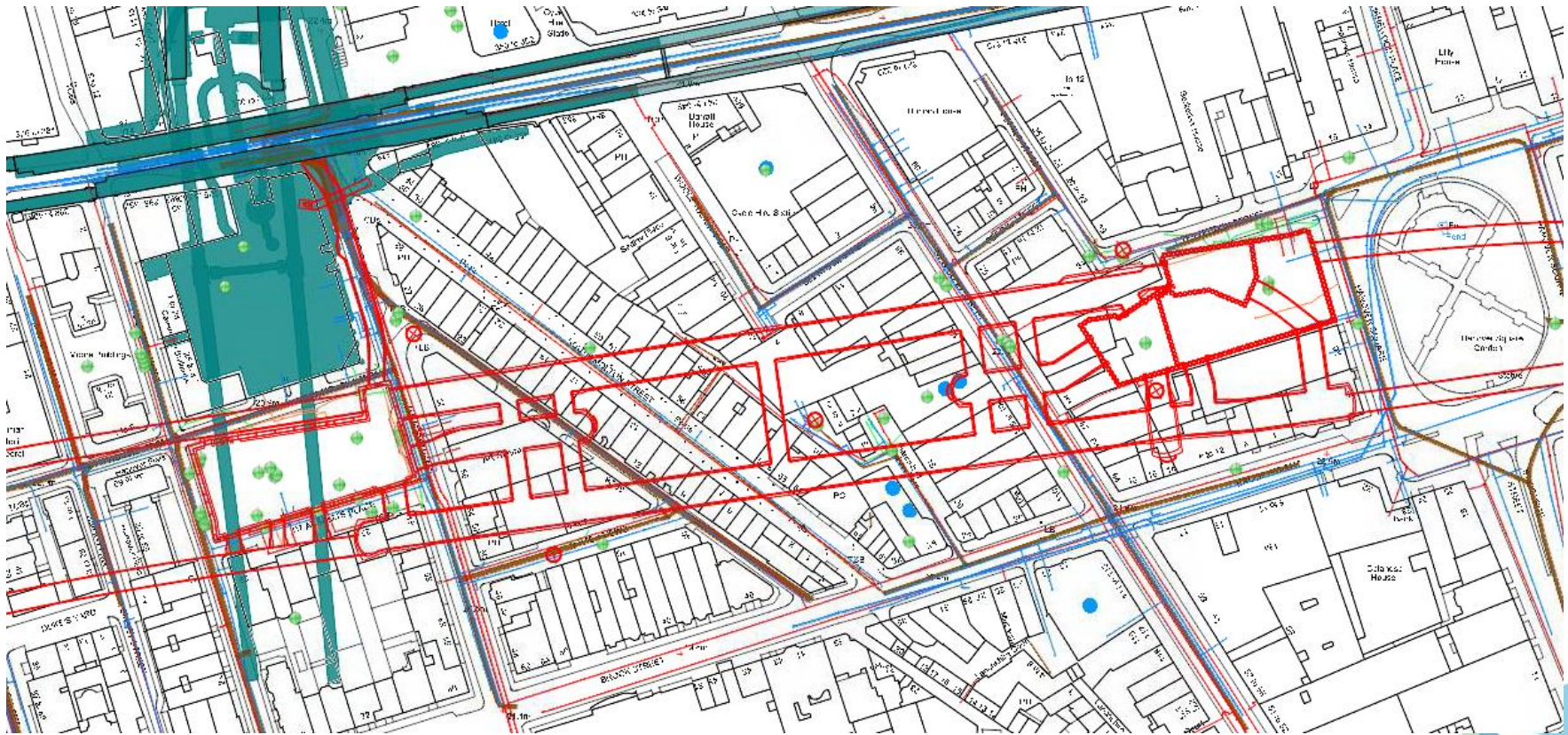


BOS Station: Crossrail works



BOS Station: Ground investigation

- Location, location, location!
- Boreholes, drilling rigs, SI compounds



TCR Station: Existing buildings



TCR Station: Subsurface assets

- Utilities, tunnels, wells, underground structures



TCR Station: Crossrail works



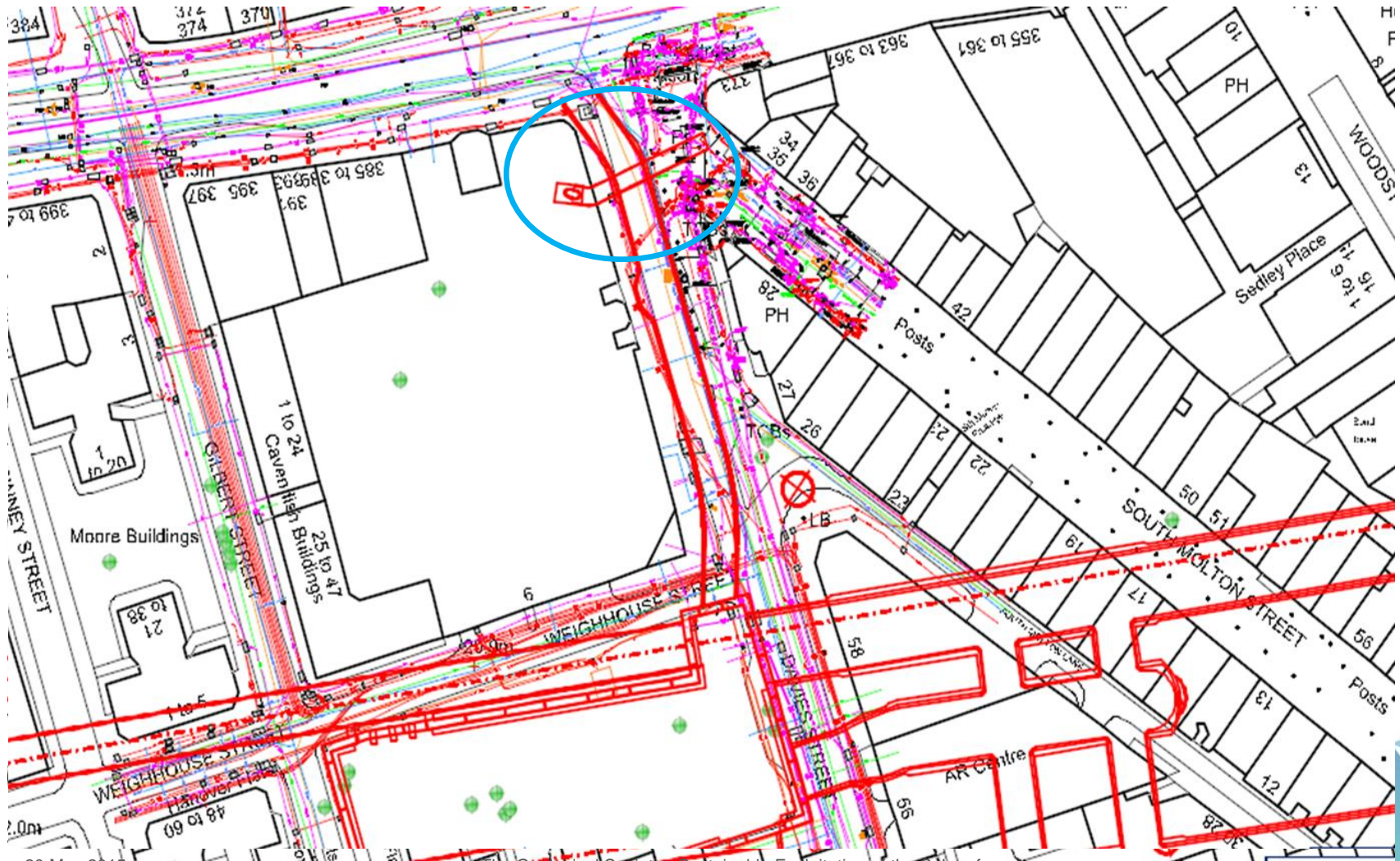
TCR Station: Ground investigation

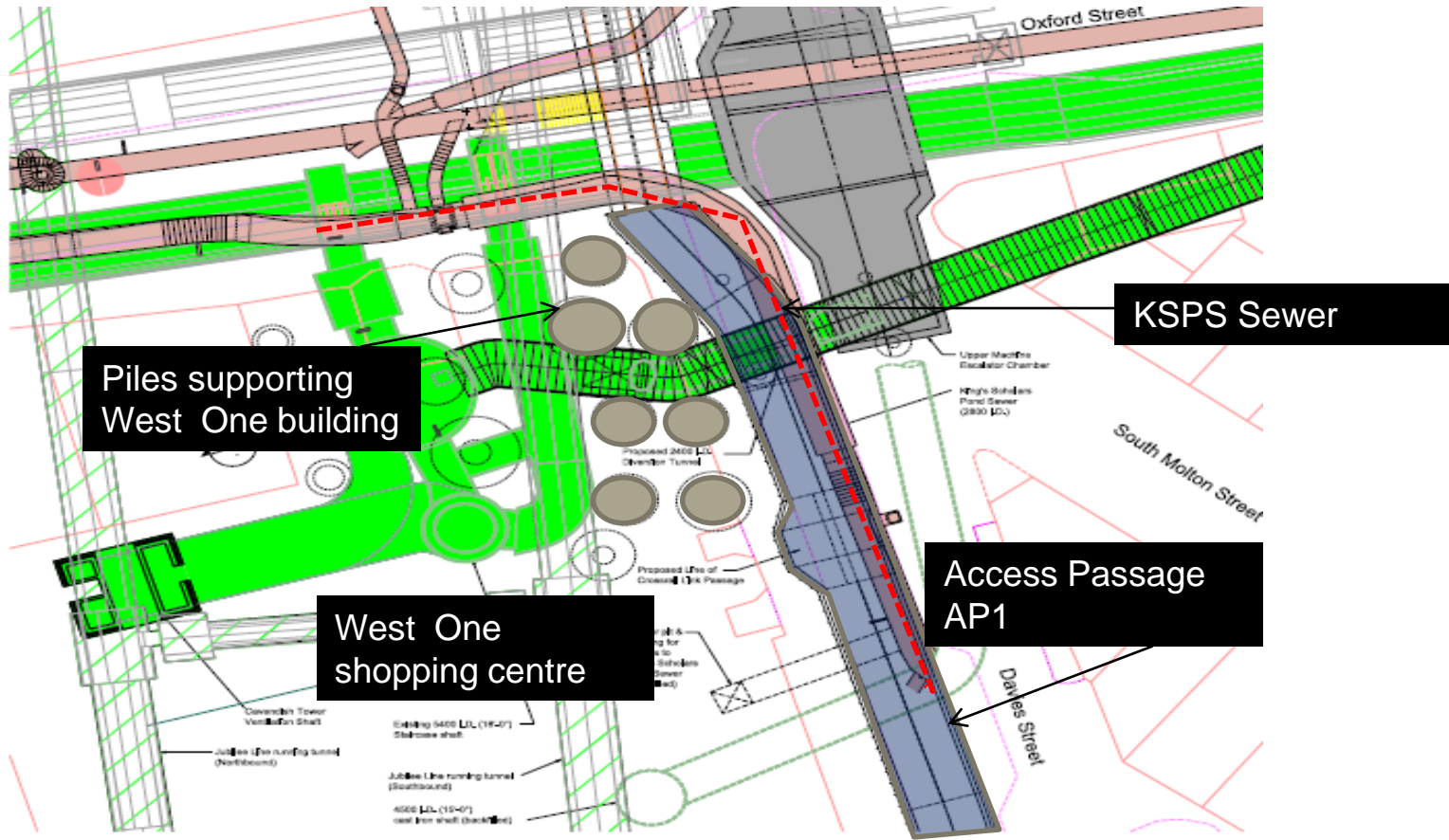
- Location, location, location!
- Boreholes, drilling rigs, SI compounds



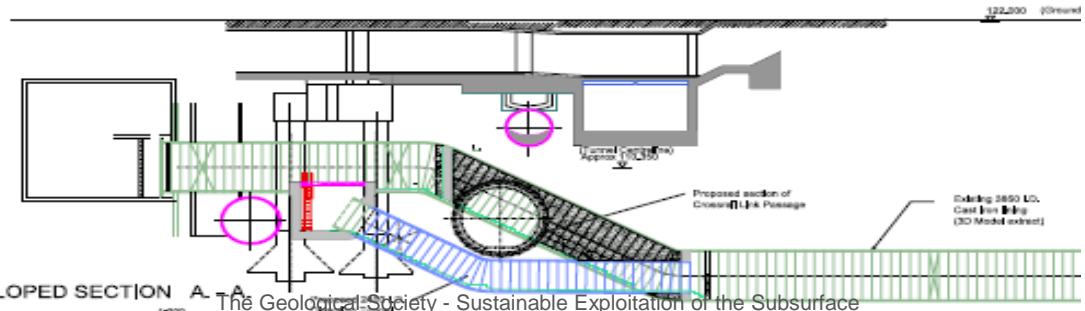
BOS Station: Vent tunnel diversion

- Subsurface!



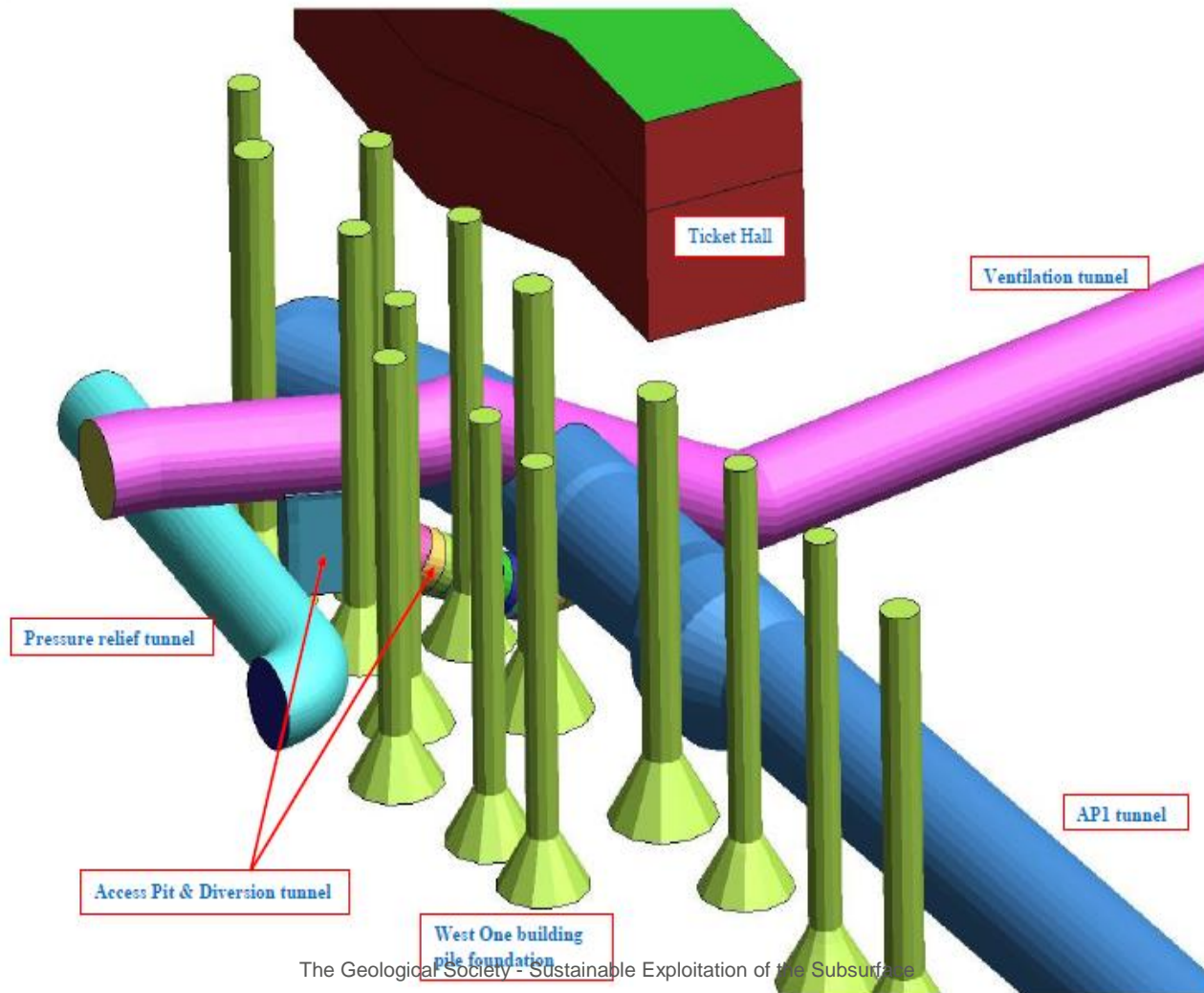


PLAN 1:200



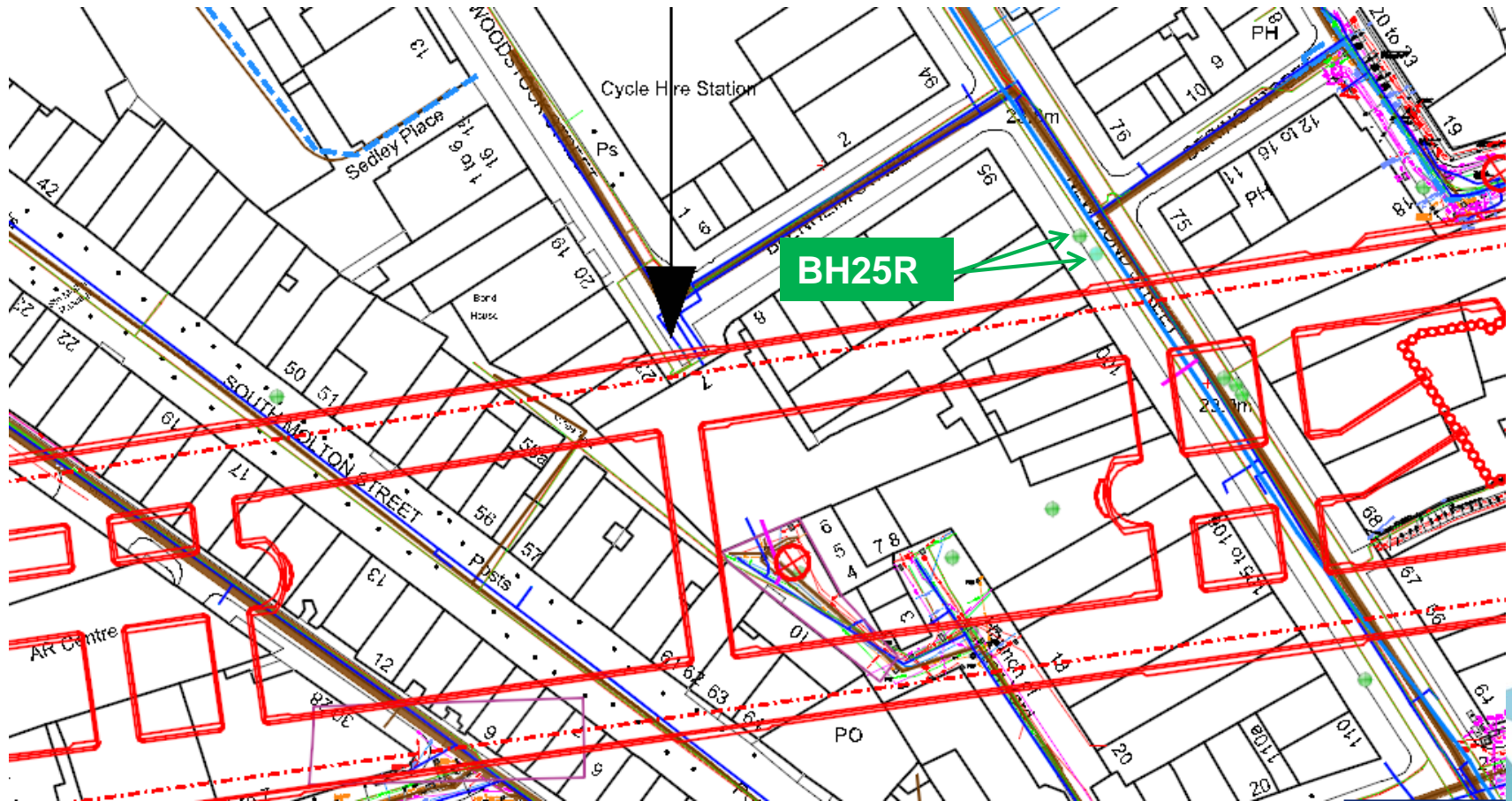
BOS Station: Vent tunnel diversion

- Works ongoing, but ... no movement!



BOS Station: New Bond Street

- Borehole abandoned ... twice!



BOS Station: New Bond Street

Void encountered during investigation. Borehole was abandoned.

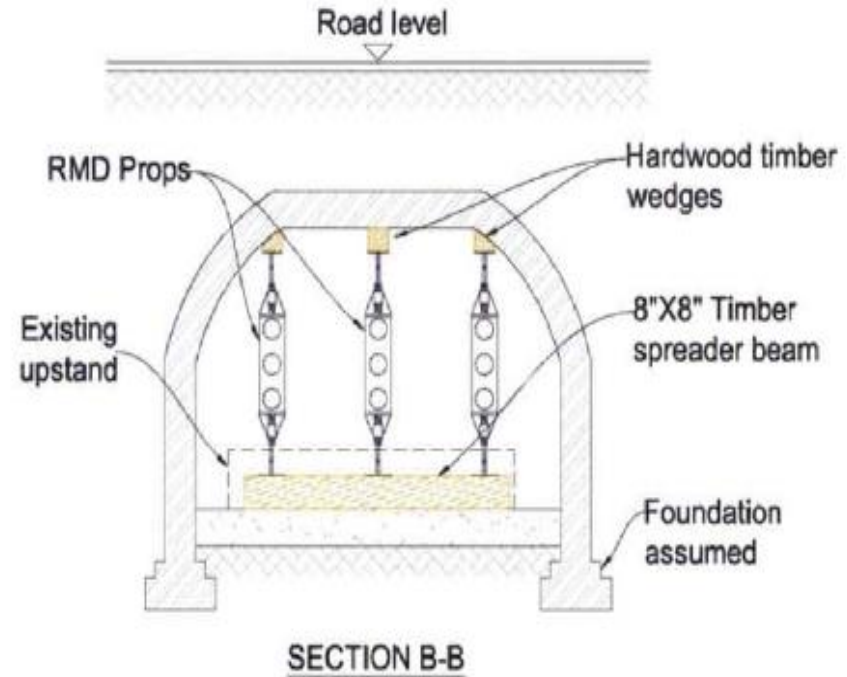
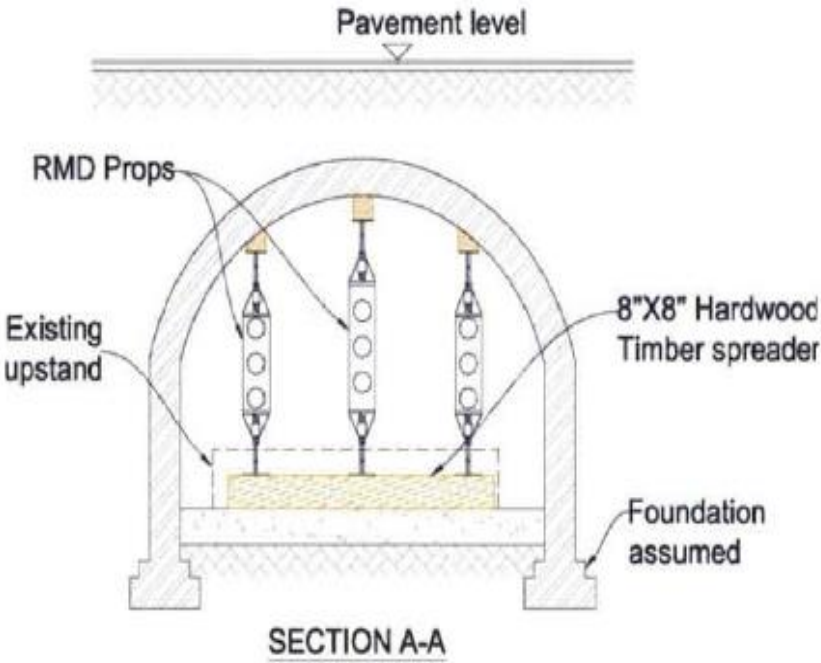
Adjacent location was drilled but was also abandoned due to presence of brick arches.

Obstruction was a vault of a building, extending underneath the road and in a very poor condition.

Vault had to be propped to enable the works to progress.



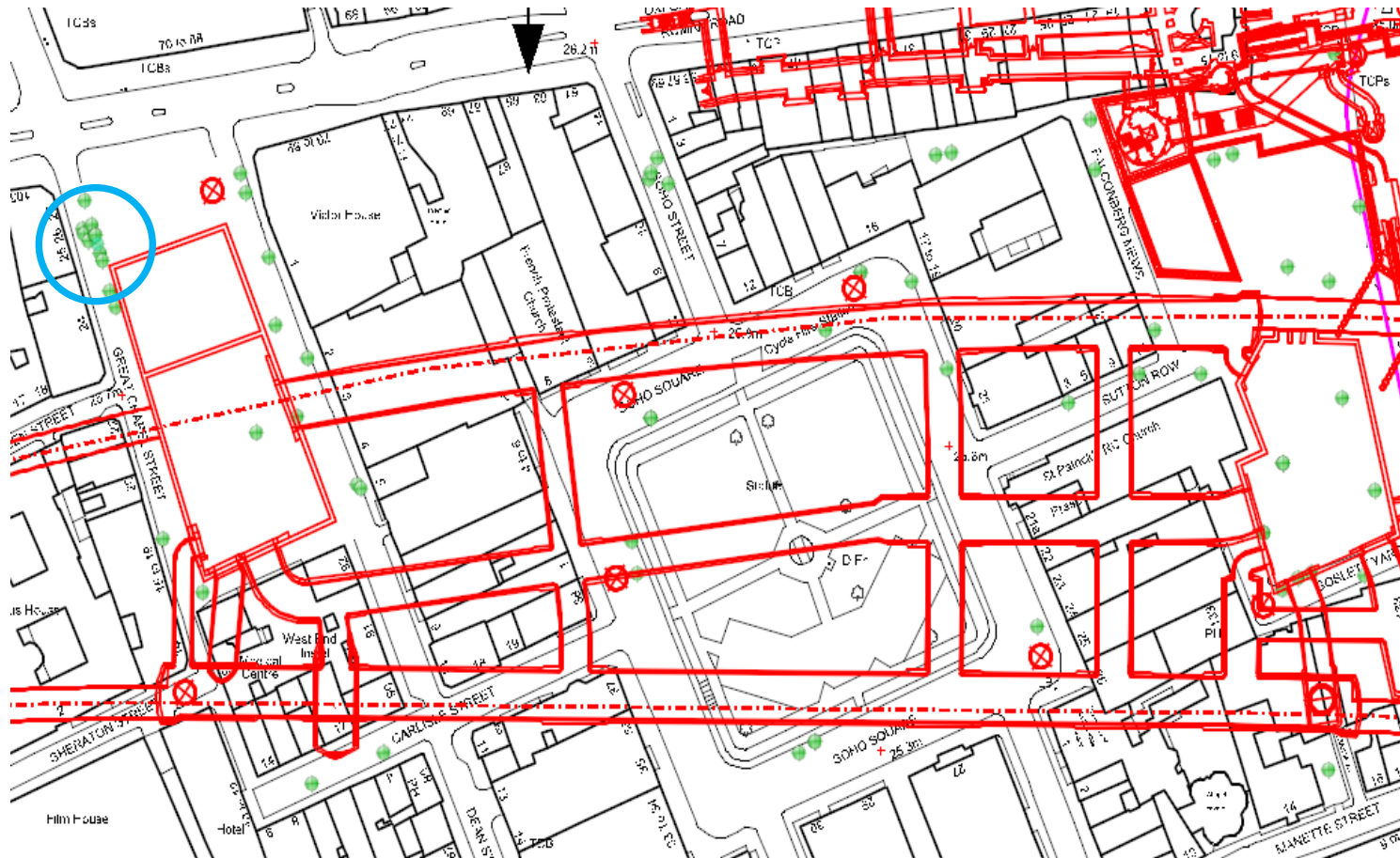
BOS Station: New Bond Street



Repairs to Vault

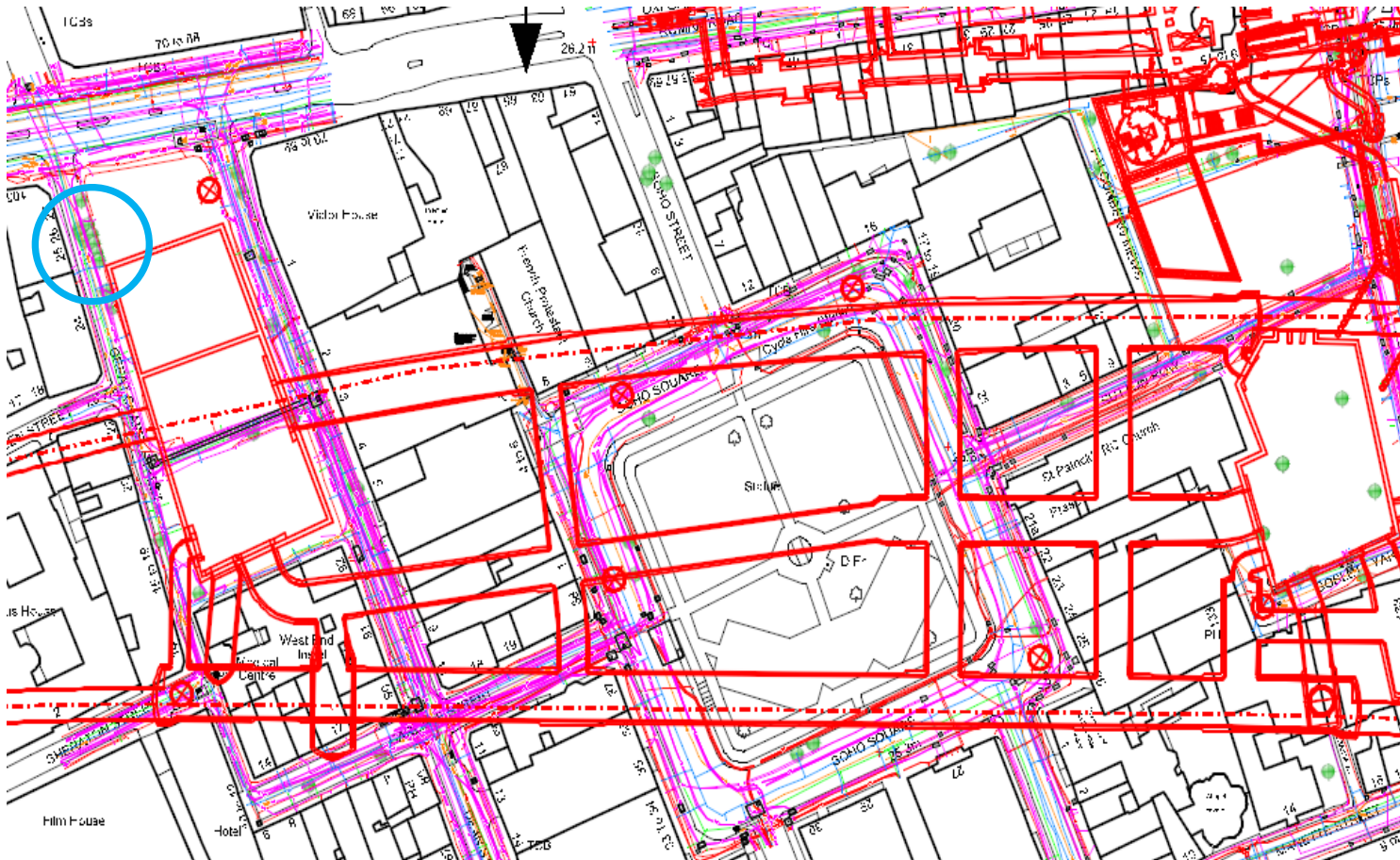
TCR Station: Great Chapel Street

- Brick obstruction encountered
- A number of trial pits excavated to define the extent of it



TCR Station: Great Chapel Street

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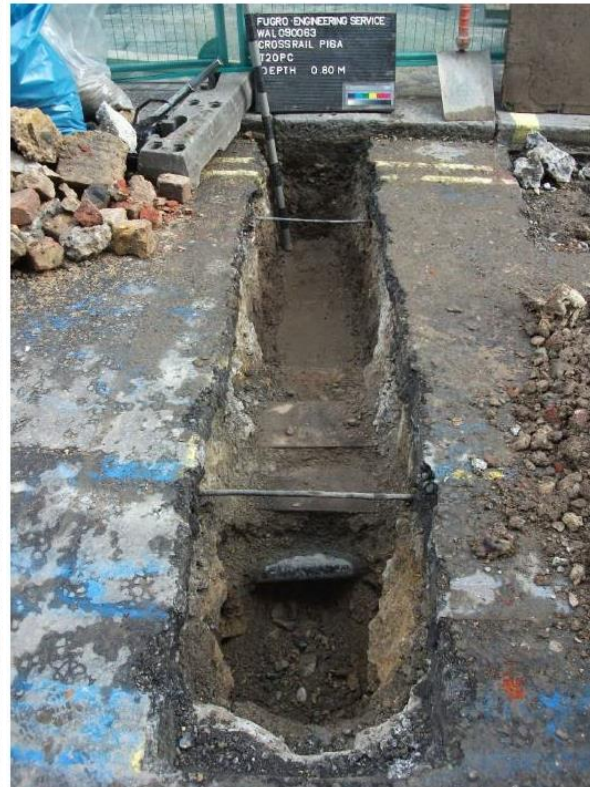


TCR Station: Great Chapel Street

- Obstruction found to be an old basement



T20A Western Pit – View to the east



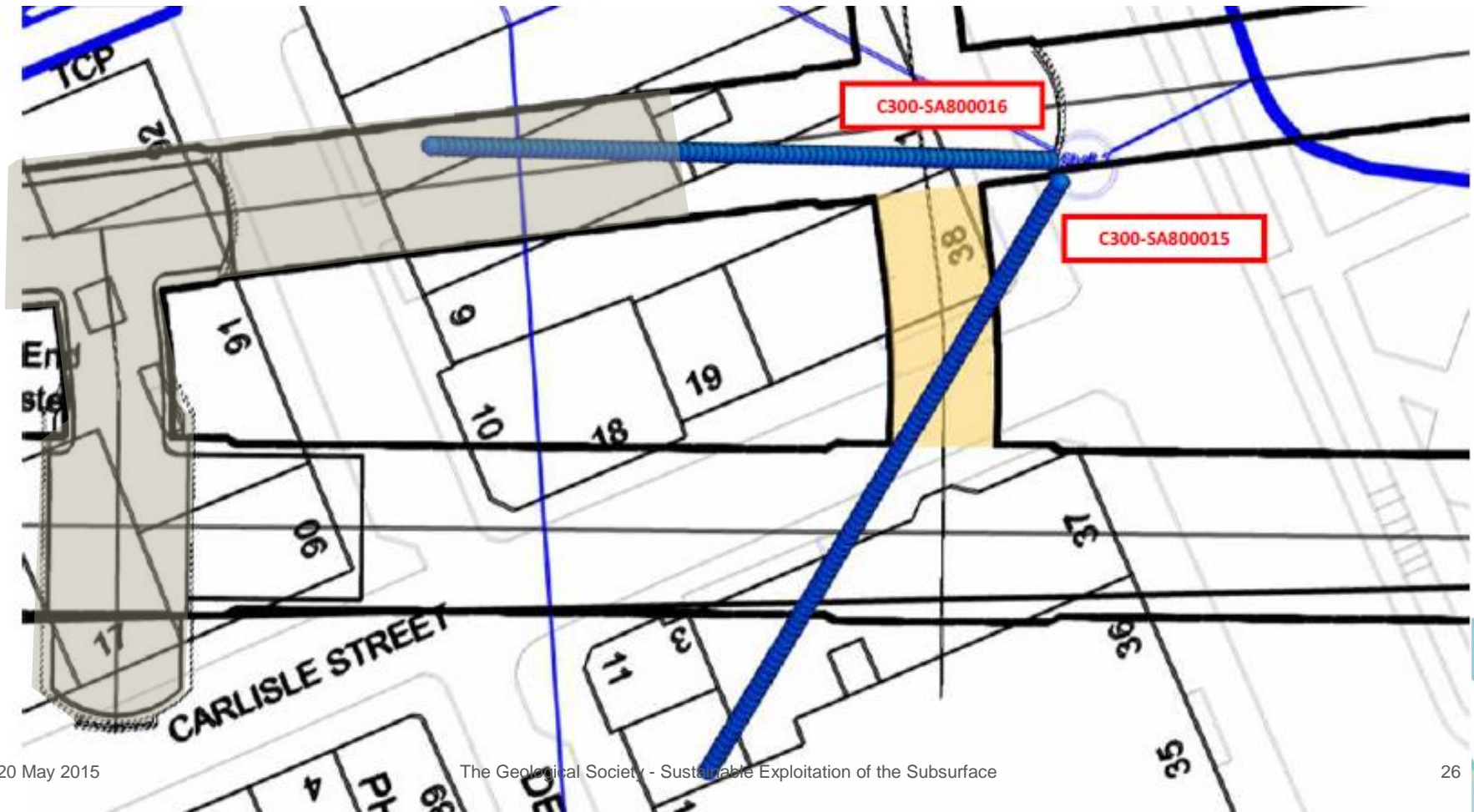
T20E and T20F – View to the east



T20I – View to the east

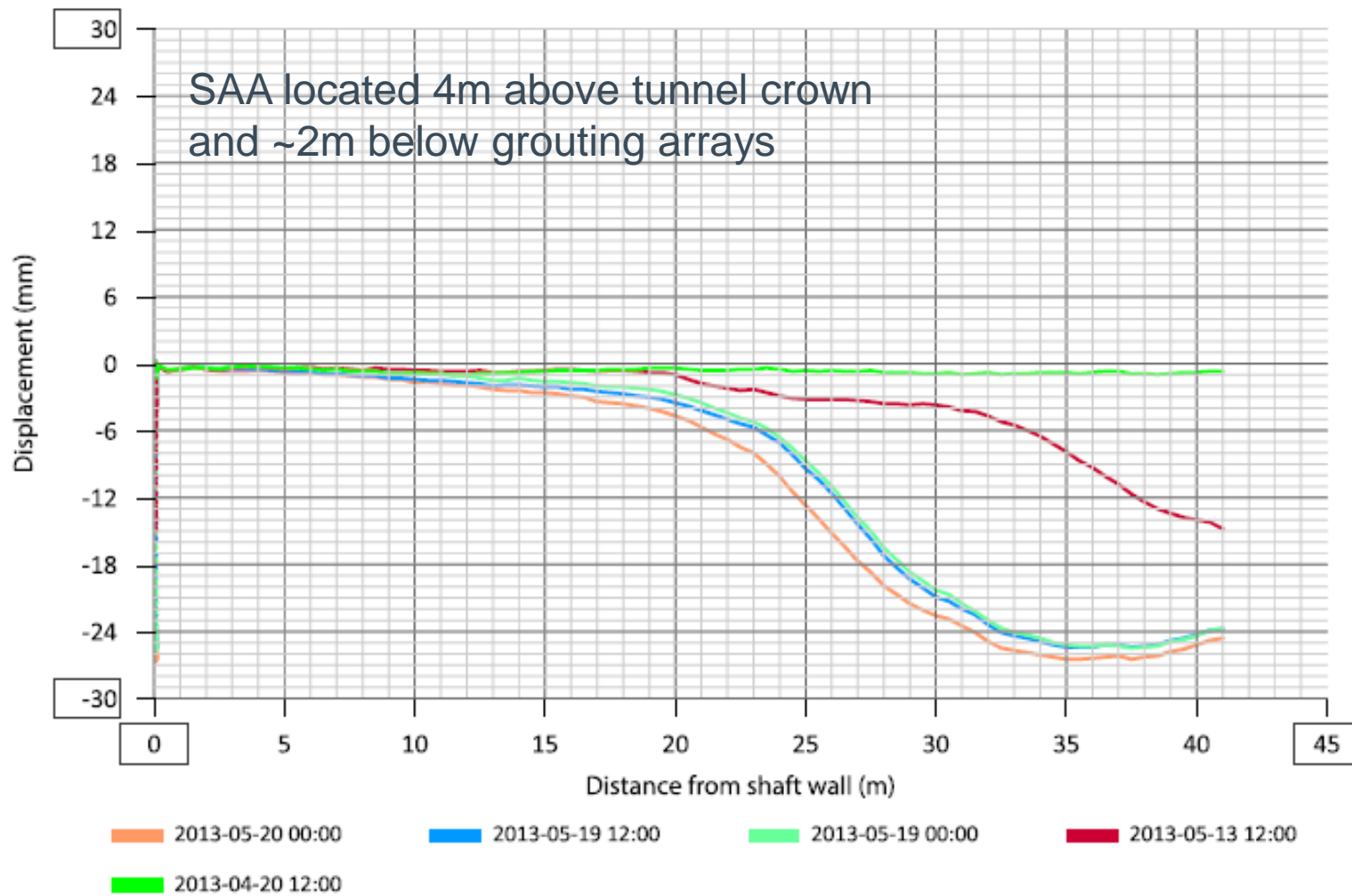
TCR Station: Horizontal Shape Accel Arrays

- No space for extensometers and inclinometers!
- Horizontal SAAs installed instead (from grout shafts)



Movement of Horizontal SAAs

C300-SAA800016



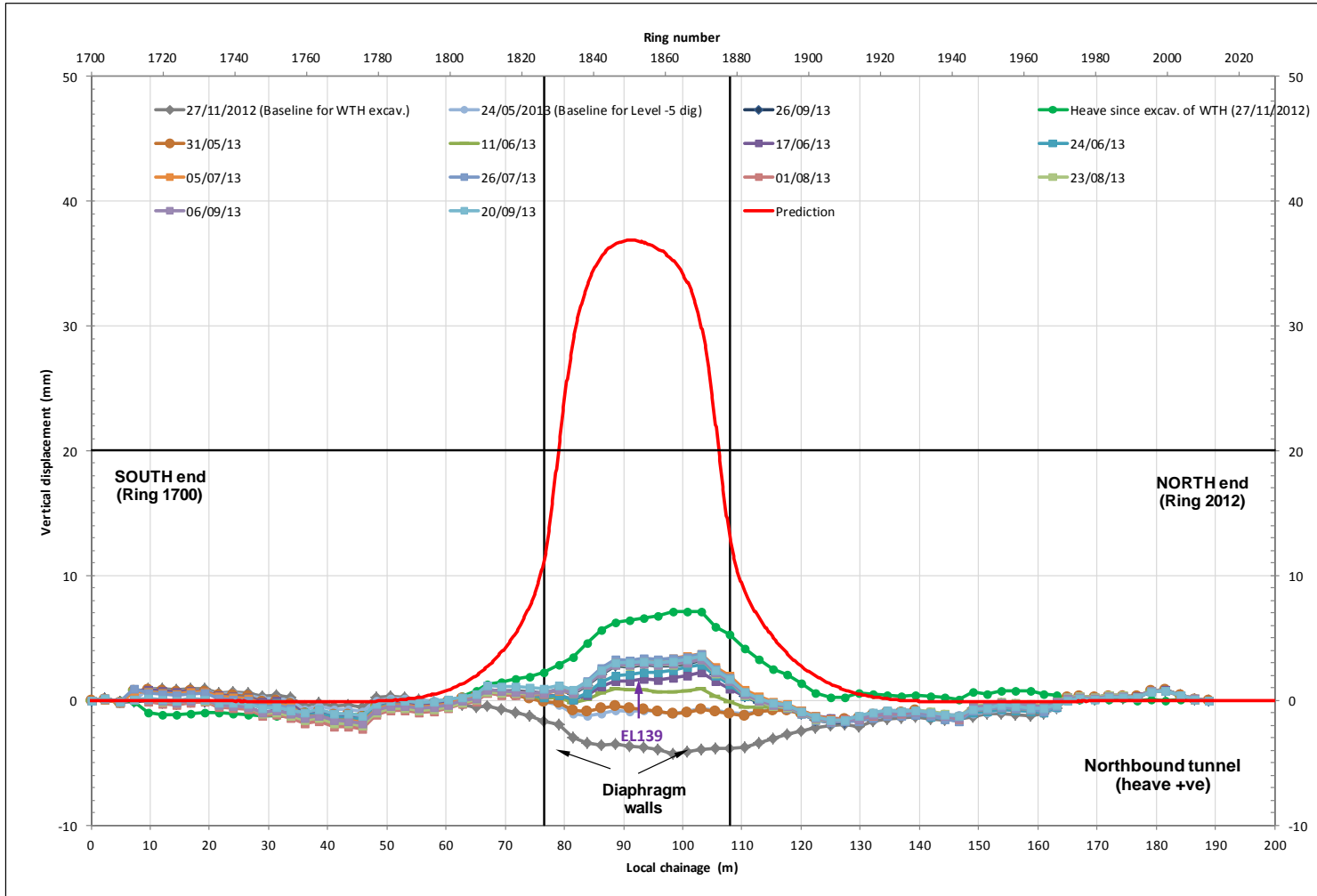
BOS Station: Jubilee Line tunnels

- Water and sand ingress issues discovered within the Jubilee Line tunnels
- Mitigation measures included grouting and dewatering



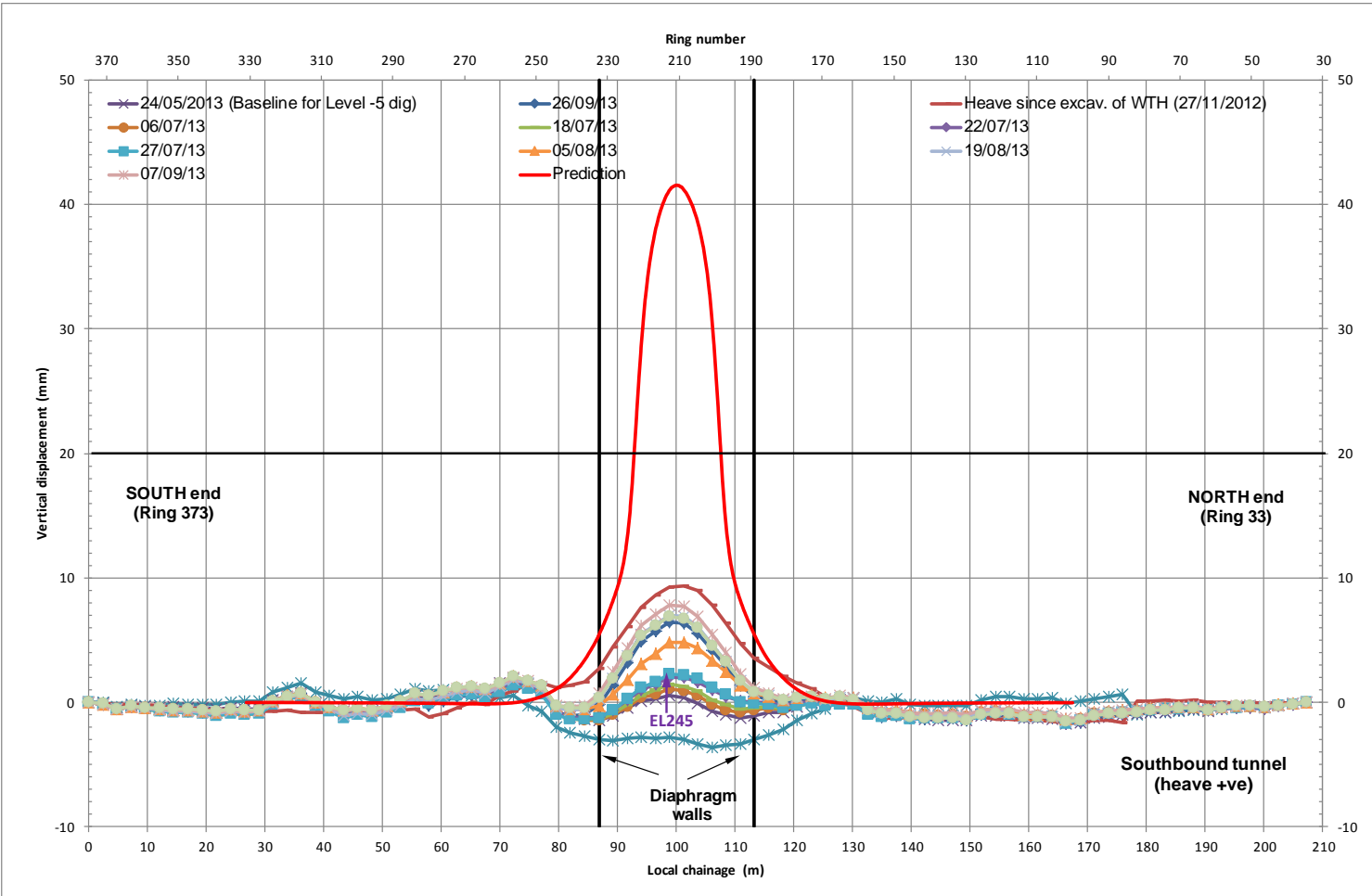
BOS Station: Jubilee Line NB Tunnel

- Impact of employed mitigation measures on GI-based predicted movements



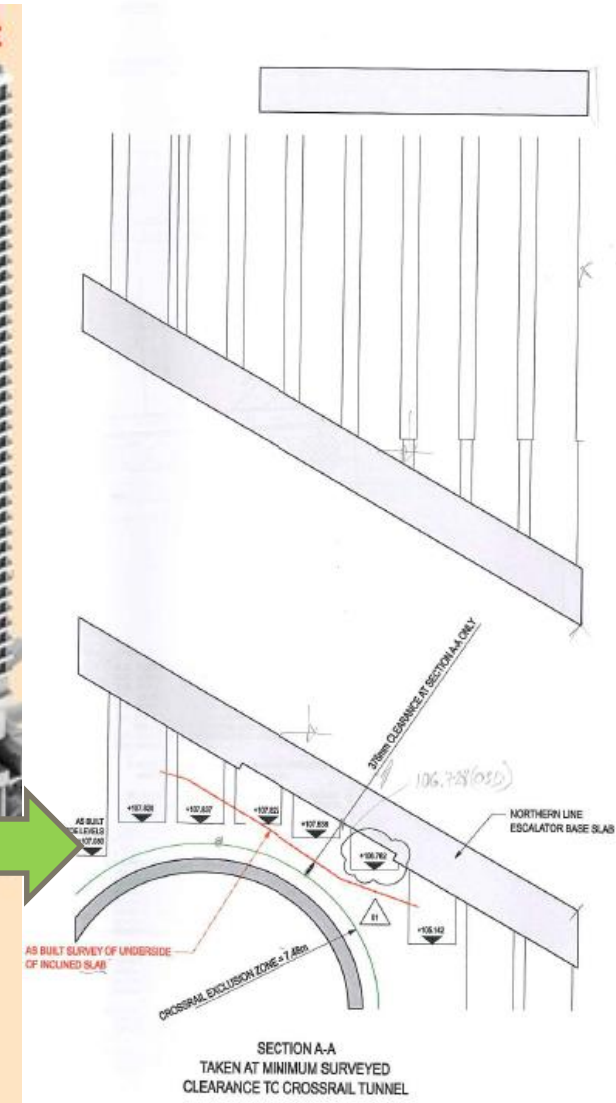
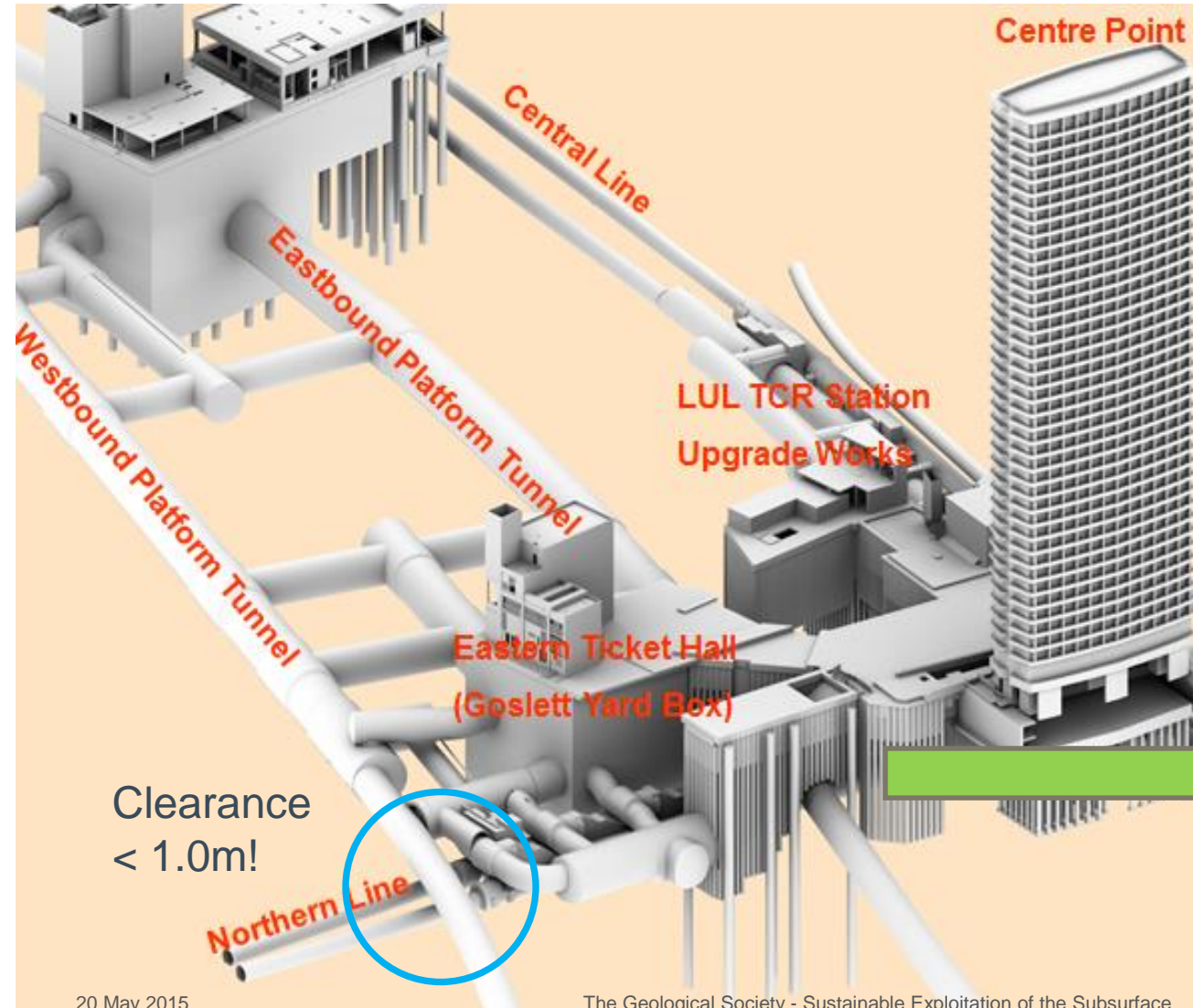
BOS Station: Jubilee Line SB Tunnel

- Impact of employed mitigation measures on GI-based predicted movements



TCR Station: Northern Line

- How much does the GI matter?



Issues to consider

- Is the GI always representative of the soil behaviour in urban conditions?
- How does the existence of subsurface and deep structures change the ground behaviour?
- How to interpret the GI results under such circumstances?

Summary

- Expect anything in highly urbanised conditions!
- GI remains essential, but it is important to understand what other factors may affect the ground behaviour.
- The stiffness of existing structures influences the ground response.
- A balance between GI and the observational method is important for successfully predicting and monitoring the ground and assets behaviour.
- Employing the BIM techniques is essential to understand and use the vast amount of information generated.

Acknowledgement

The Authors are grateful to Crossrail Ltd for their permission to present the information from Bond Street and Tottenham Court Road stations.

The Crossrail jobs included in this presentation are not all carried out or supervised by Atkins.

Thank you

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