Understanding interfaces within a railway environment.

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as part of the MSc in Transport Engineering and Asset Management, Railway Asset Management module.

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Considerations for session 1

- Common infrastructure
- Holistic and asset specific understanding
- 3 case studies of presence and property
- A case study of protection
- Application to a specific railway environment
- Conclusion and Transferability

Common infrastructure

The environment of a railway is formed of many different types of common infrastructure...






...some are obvious...

Track

Viaducts; Public open space

Bridges; Highway

Tunnels; Earth structures

Retaining & Parapet walls; Props

Bridges; Highways; Buildings

Tunnel; Track; Signals;

Overhead line equipment; Platform; Highway

...others need further consideration.

Railway land & airspace; Adjacent land & airspace

Viaduct foundations; Airspace under arches

Height of bridge; Width of road

Open land over tunnel and adjacent to earth structures

Buildings above retaining walls; Props supporting the retaining walls

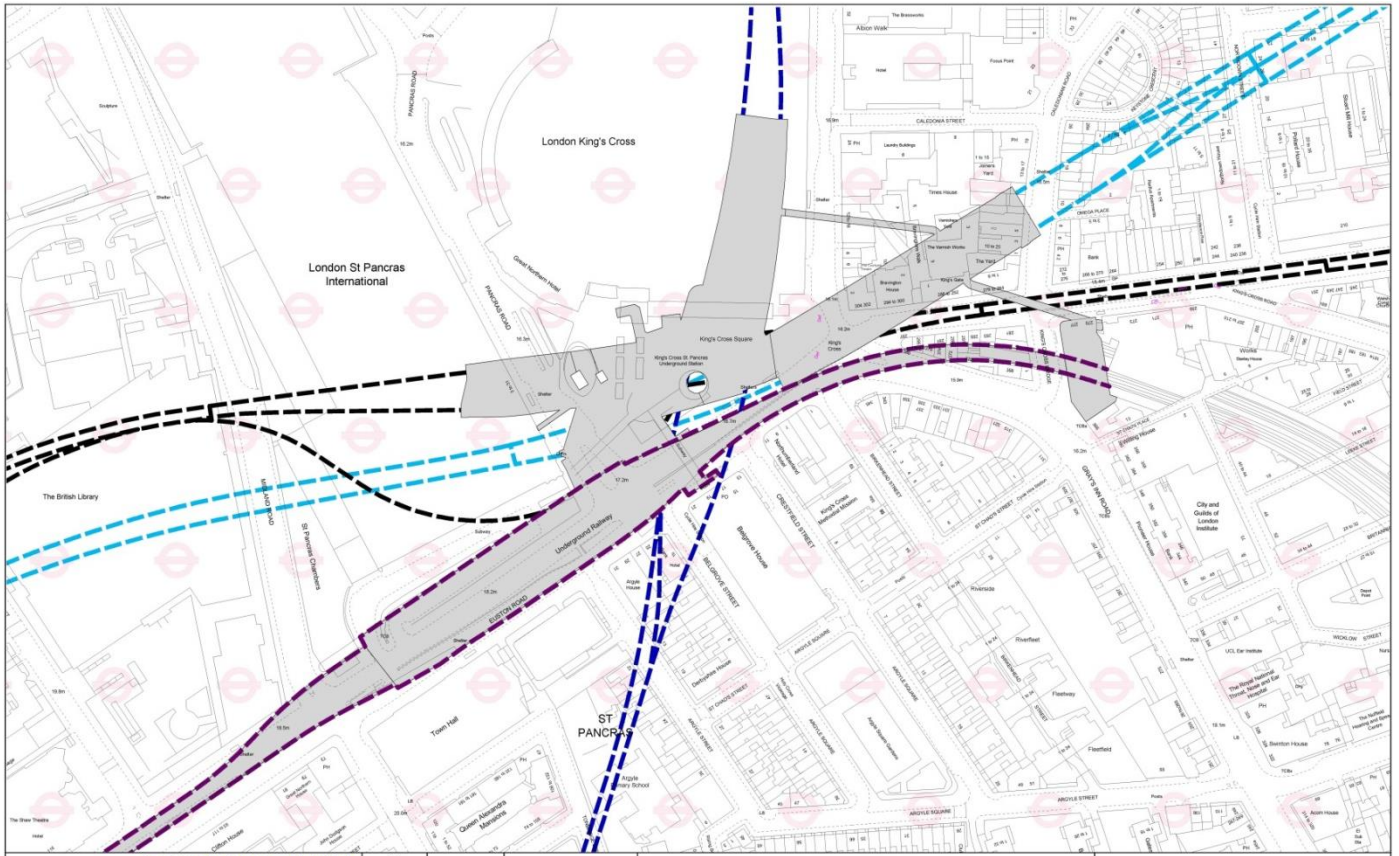
Urban environment; Props; Cutting; Tunnel; Ventilation

Utilities; Girders; Cables; Power supply

Overhead line equipment; Bridge; Lighting; Adjacent building

Holistic and asset specific understanding of:
the railway; its environment;
and their interfaces

As a railway asset manager, you *must* have a good understanding of the railway; its environment; *and* how these relate to one another, at a macro level...



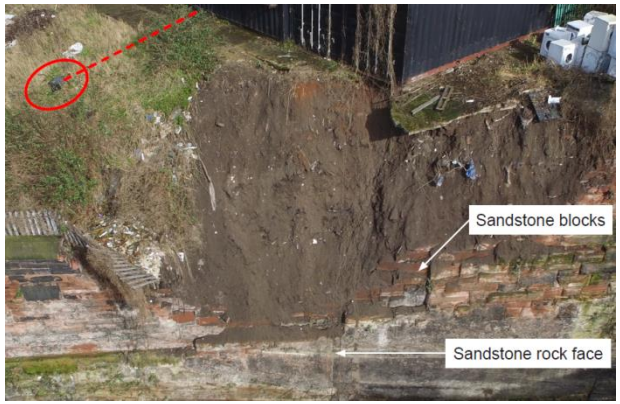
Source: London Underground Ltd.

...and a micro level...

...as well as ***within*** the track environment.

Source: Smug Mug, 2018. *A life spent chasing trains*. [online] Available at: <https://nick86235.smugmug.com/keyword/165%3Blondon%20underground> [Accessed 8 January 2018].

Failure to do so increases risk of adverse effects on the railway and its more general environment, as well as service provision...

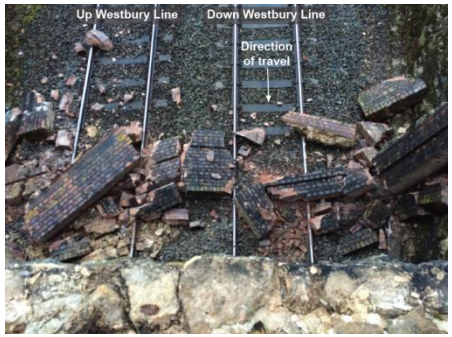


Retaining wall collapse, Liverpool 2016.
Source: RAIB, 2017b.

Tube tunnel penetration, London, 2013.
Source: RAIB, 2014.

Sewer collapse, Forest hill, 2016.
Source: BBC, 2016.

Partial bridge collapse, Barrow Upon Soar.
Source: RAIB, 2017a.



Fallen bridge parapet at Froxfield, 2015.
Source: RAIB, 2016

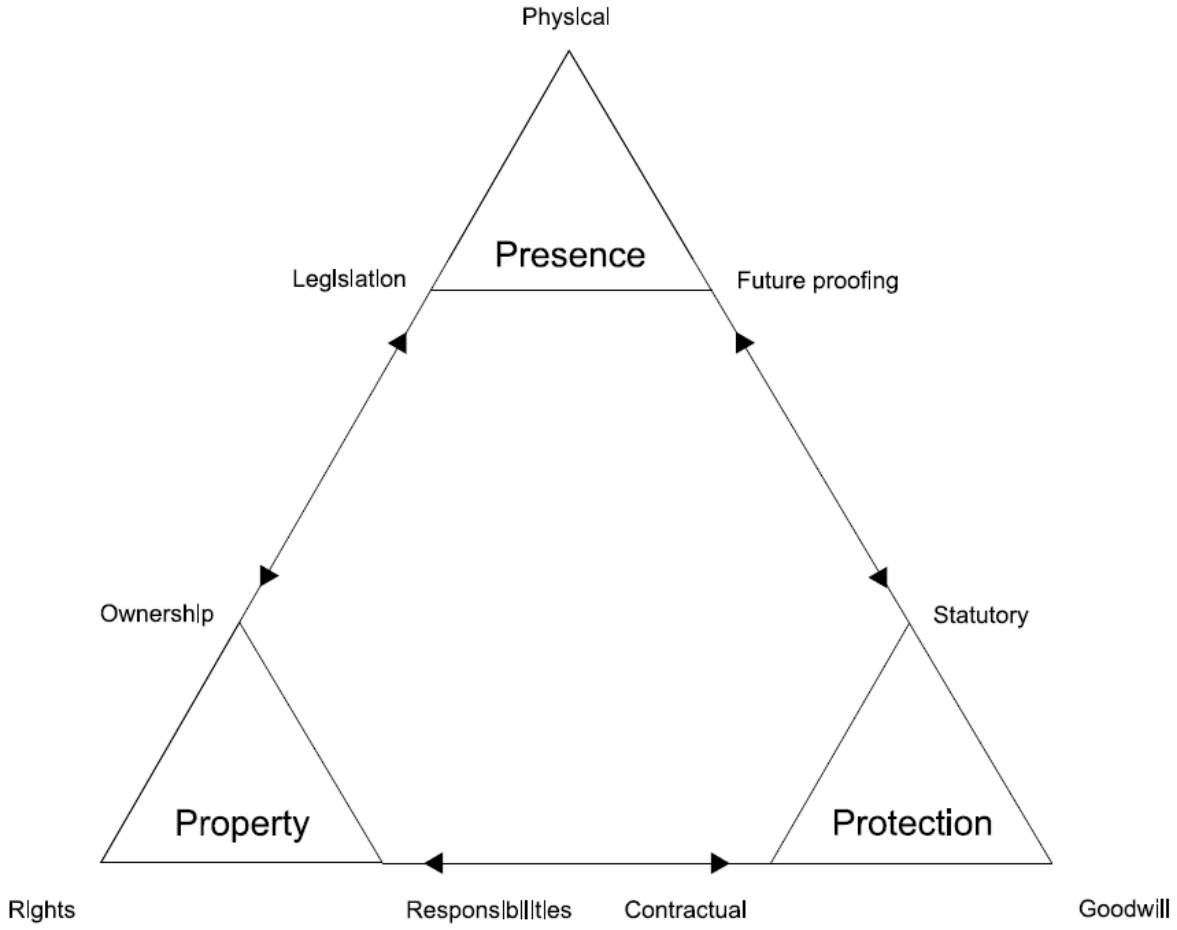
Collapsed signal post at Newbury.
Source: RAIB, 2015.

...as well as posing a serious risk to passengers and staff.

Derailment of passenger train, Wimbledon.
Source: RAIB, 2018.

Tube tunnel penetration, London, 2013.
Source: RAIB, 2014.

To understand the railway; its environment; and how these relate to one another, we therefore need to understand the interfaces involved.



Source: Darroch, N., Beecroft, M., & Nelson, J., 2016.

Every example here consists of interfaces between the railway and its environment. All are different, but all have the same principles of *presence*, *property*, and *protection*.






But what do these interfaces and their sub-interfaces/enablers mean?

- Presence:
  - What is there? (Physical)
  - What allows it to be there? (Legislation)
  - What enables its continued presence? (Standards, Contracts)

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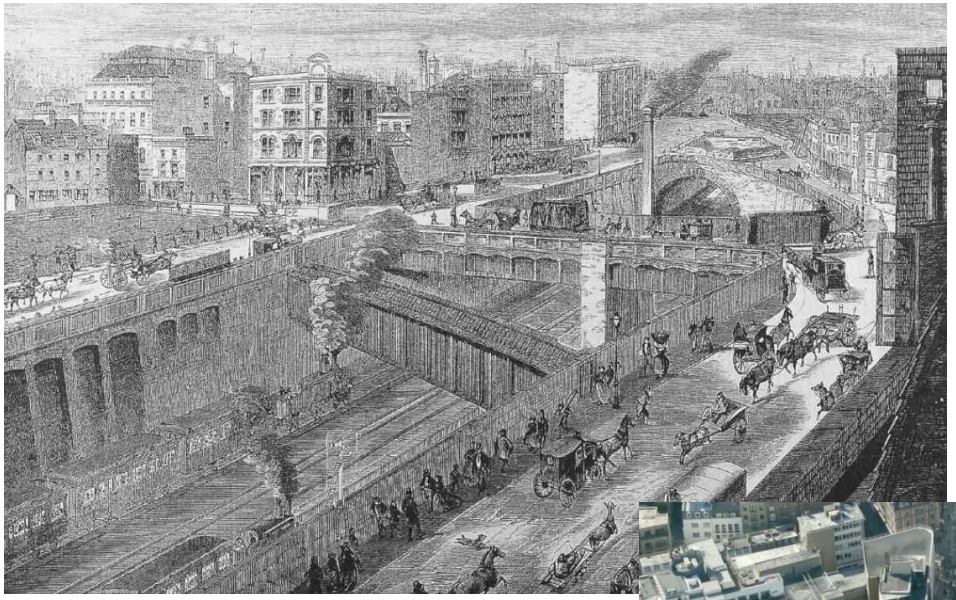
- Protection:
  - What are the proposed works? (Demolition; Excavation; Removal)
  - How will they affect the physical and legal infrastructure present?
  - How can protection be assured? (Contractual; Statutory; Goodwill)

We must also remember that the railway; its collective assets; *and* its environment change over time.



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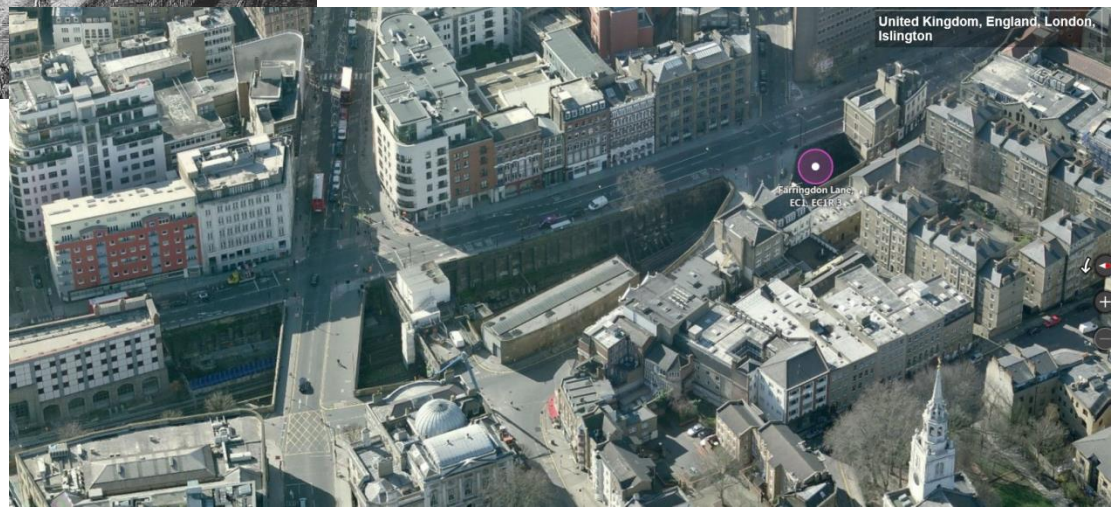
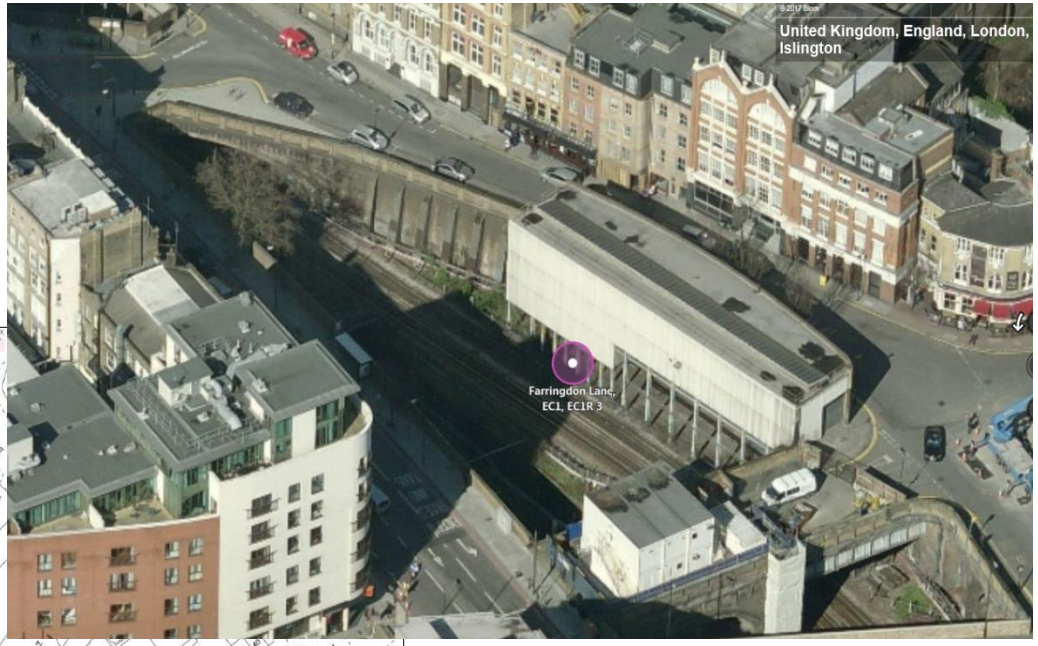


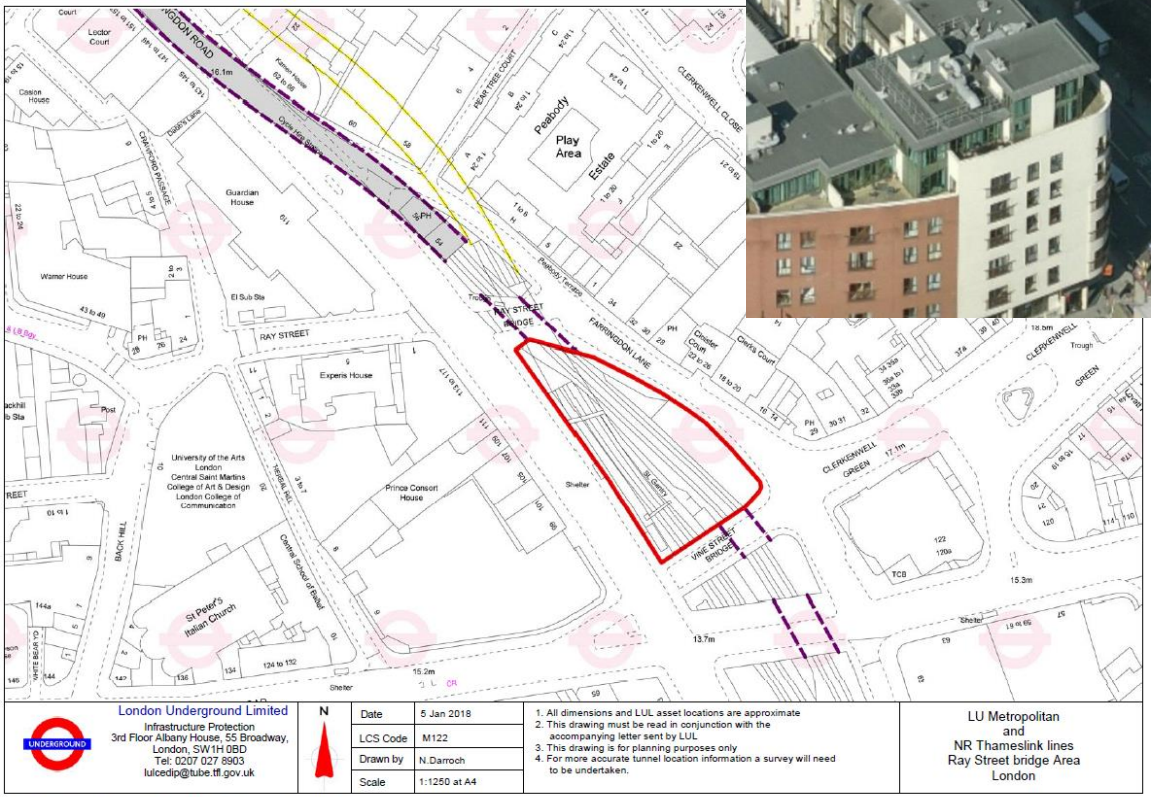
2017

Drawing: British History Online, 2017. *Farringdon Road*. [online] Available at: <http://www.britishhistory.ac.uk/survey-london/vol46/pp358-384> [Accessed 20 October 2017]; **Satellite image source:** Bing Maps, 2017.

3 case studies of presence and property

Scenario 1: Ray Street Bridge - a highway over a void over a fly under





Map source: London Underground
Satellite image source: Bing Maps, 2017

Scenario 1: Presence

Ray Street pre-existed the railways.

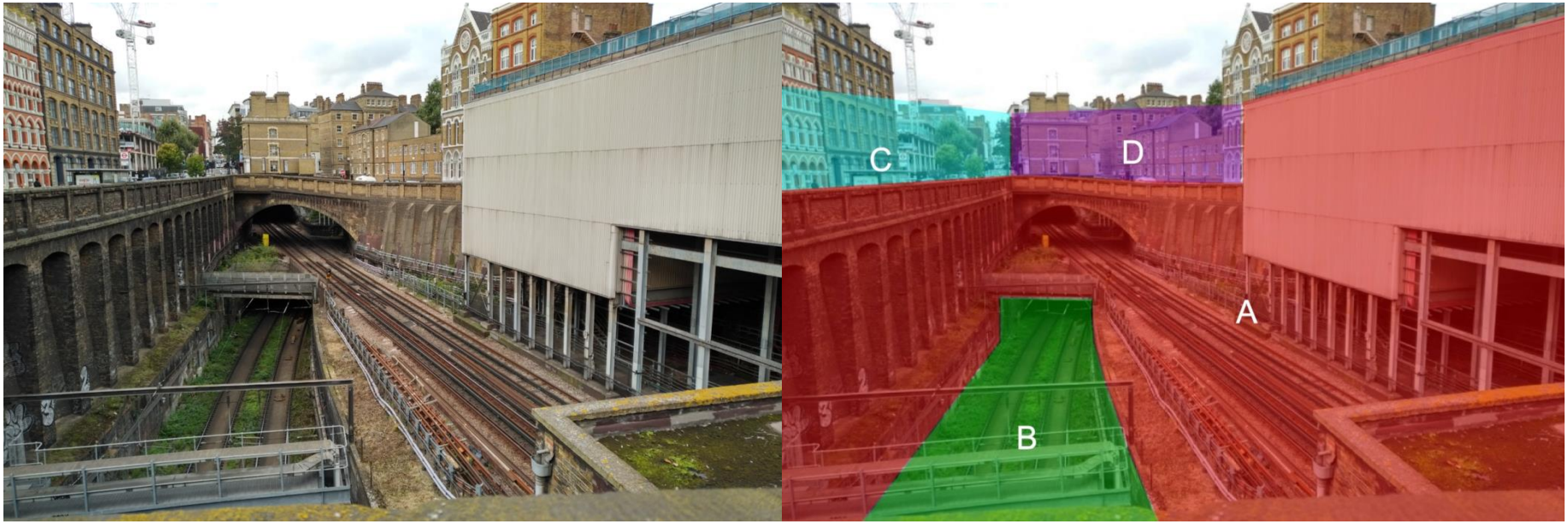
The Metropolitan railway opened in 1863.

The widened line was completed in 1867.

All are still in use today.

Source: Nathan Darroch.

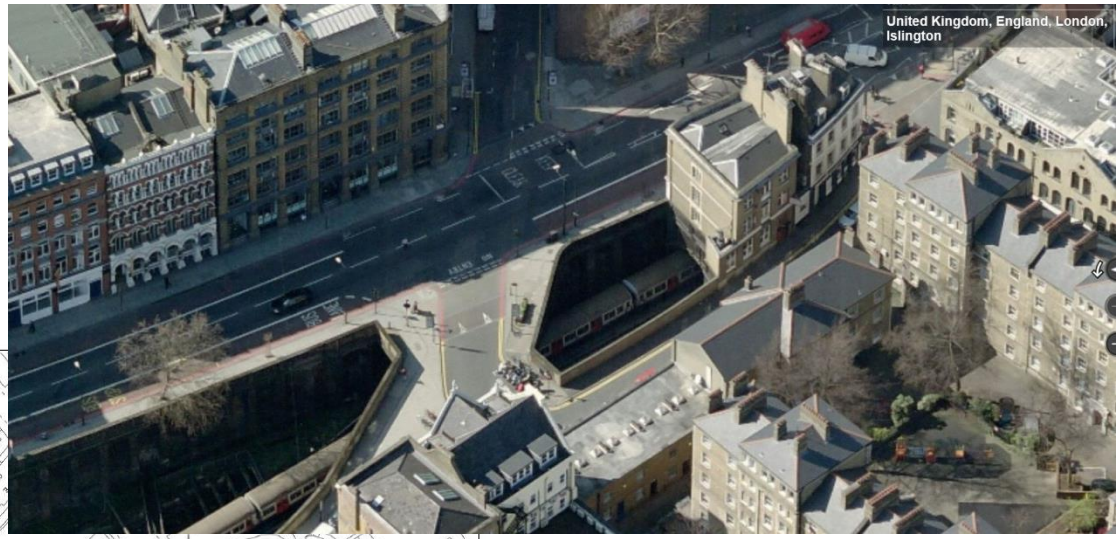
Scenario 1: Property

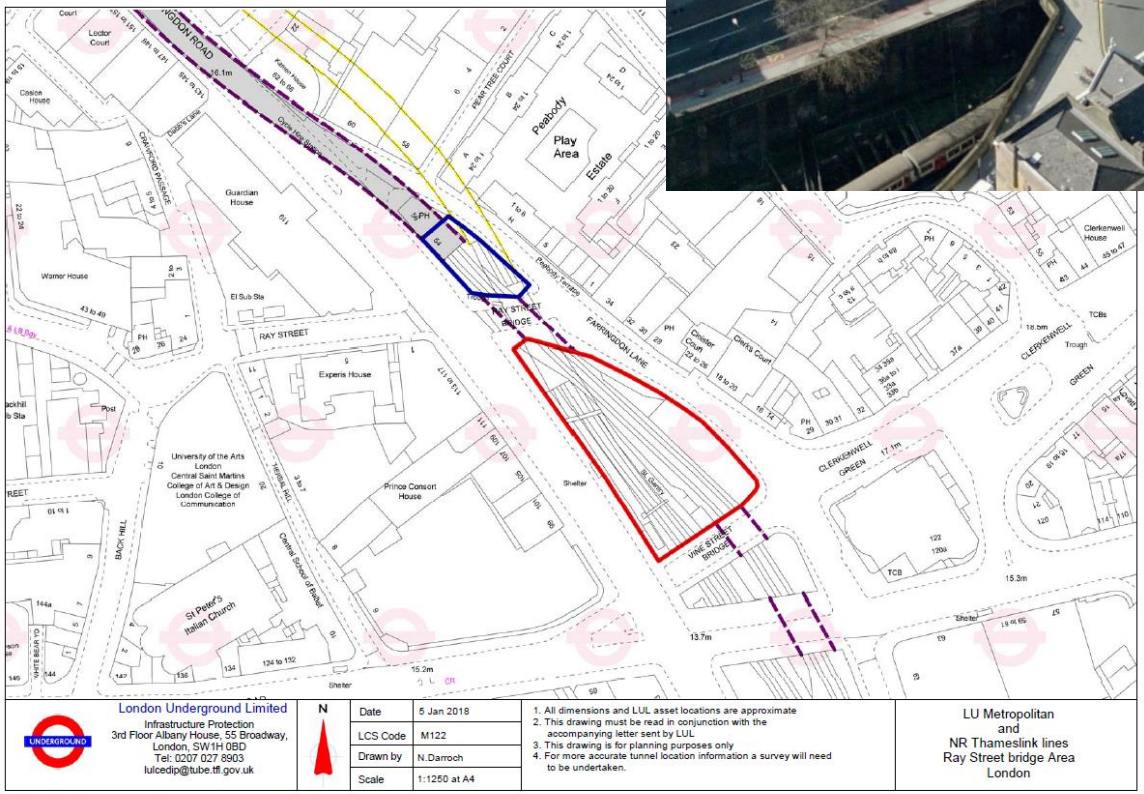


A = London Underground land and airspace
B = Network Rail land and airspace
C = TfL Streets highway
D = Local authority highway

Source: Nathan Darroch.

Scenario 2: No.54 - a building located over a tunnel adjacent to a void over a fly under





Map source: London Underground
Satellite image source: Bing Maps, 2017

Scenario 2: Presence

The Metropolitan railway opened in 1863.

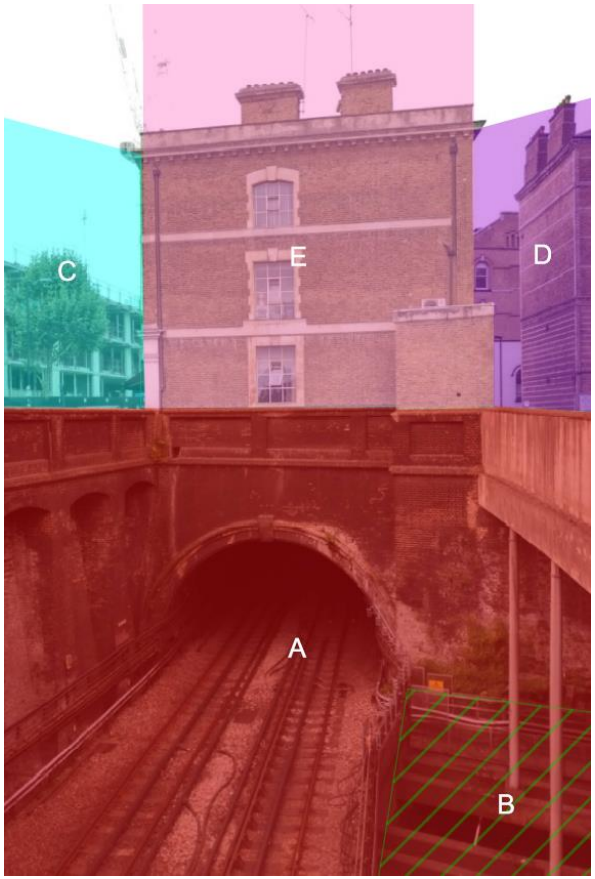
The widened line was completed in 1867.

The building was erected c.mid 1870s, post railway construction.

All are still in use today.

Source: Nathan Darroch.
For a history of the railway and its environs see British History online, 2017.

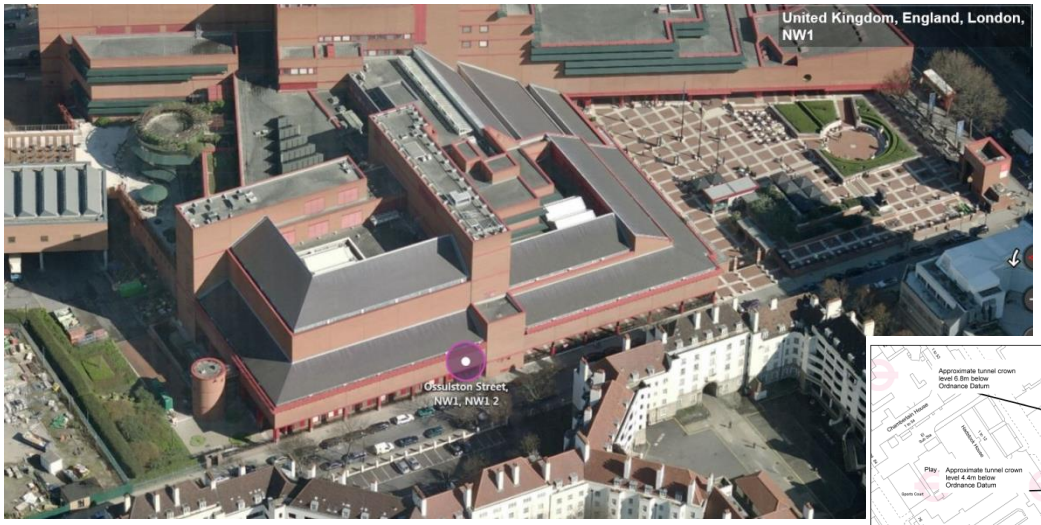
Scenario 2: Property

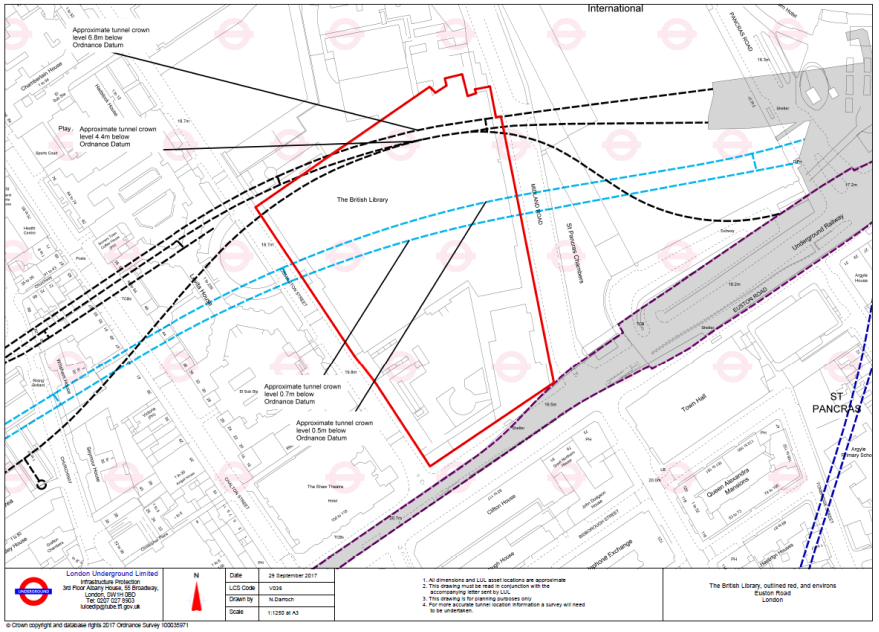


A = London Underground land and airspace
B = Network Rail land and airspace (below)
C = TfL Streets highway
D = Local authority highway
E = Building owner

Source: Nathan Darroch.

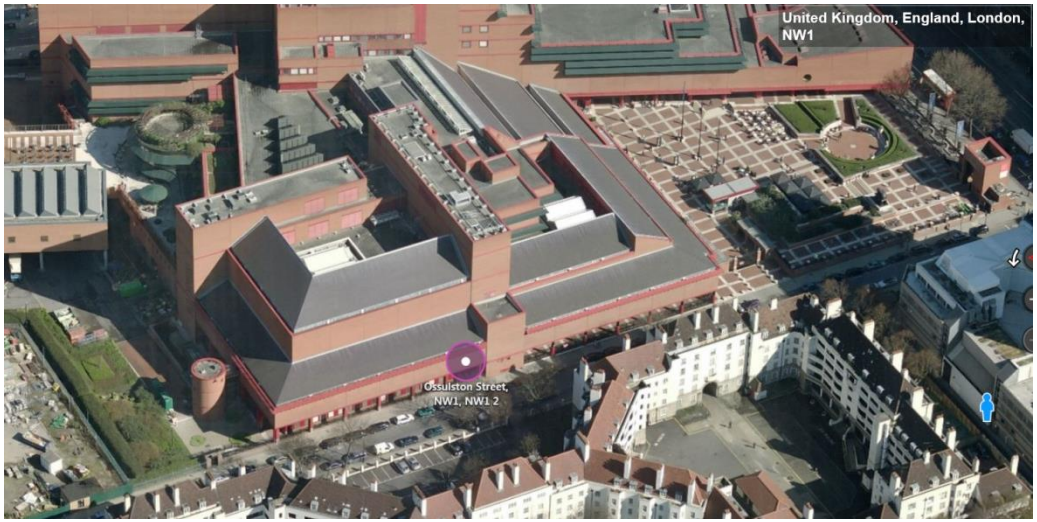
Scenario 3: The British Library – a building over tube tunnels and adjacent to a sub-surface tunnel





Map source: London Underground
Satellite image source: Bing Maps, 2017

Scenario 3: Presence - a



The current British Library was built in the 1990s.

Satellite image source: Bing Maps, 2017

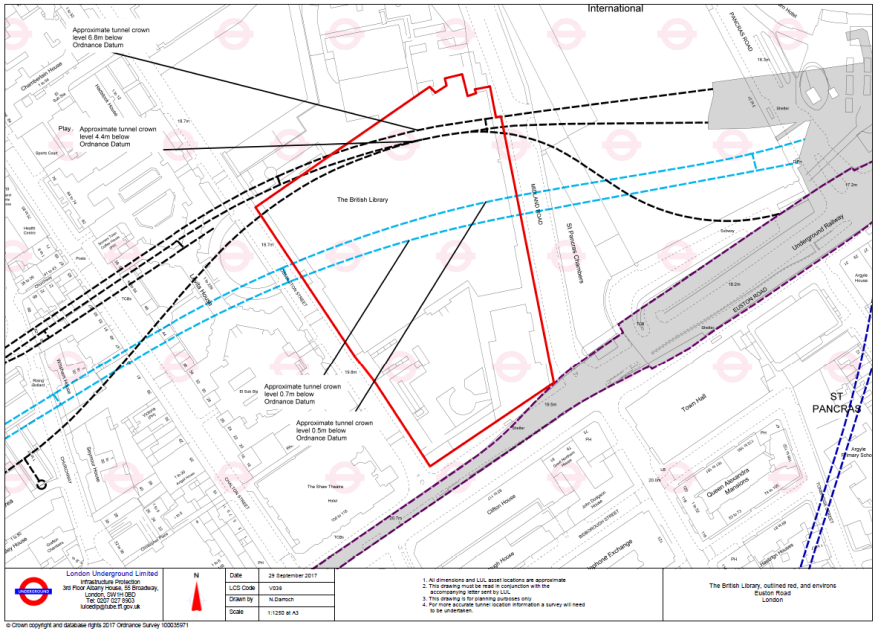
Scenario 3: Presence - b

The Metropolitan line opened in 1863.

The Northern line opened in 1907.

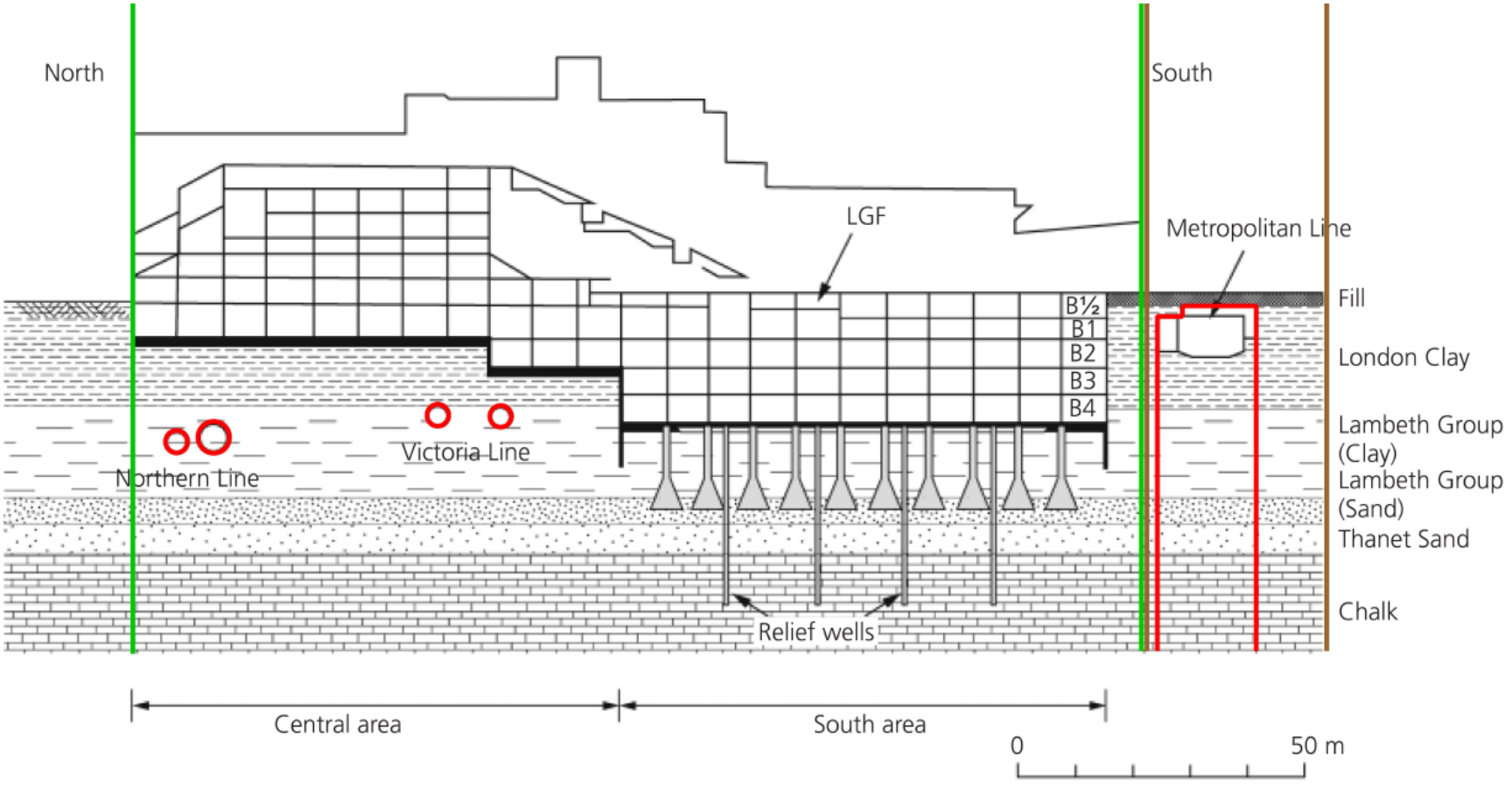
Kings Cross Metropolitan line station opened in 1941.

The Victoria line opened in 1968.



Map source: London Underground

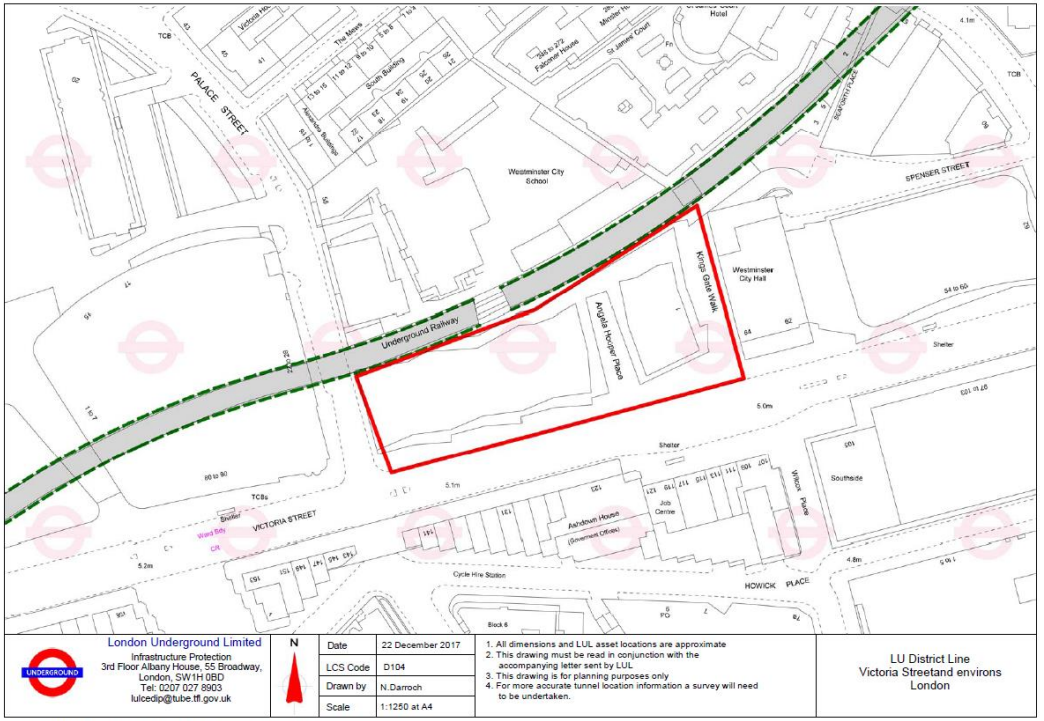
Scenario 3: The effect of Presence, Property, and Protection interfaces



Source: Simpson, B., and Vardanega, P., 2014.

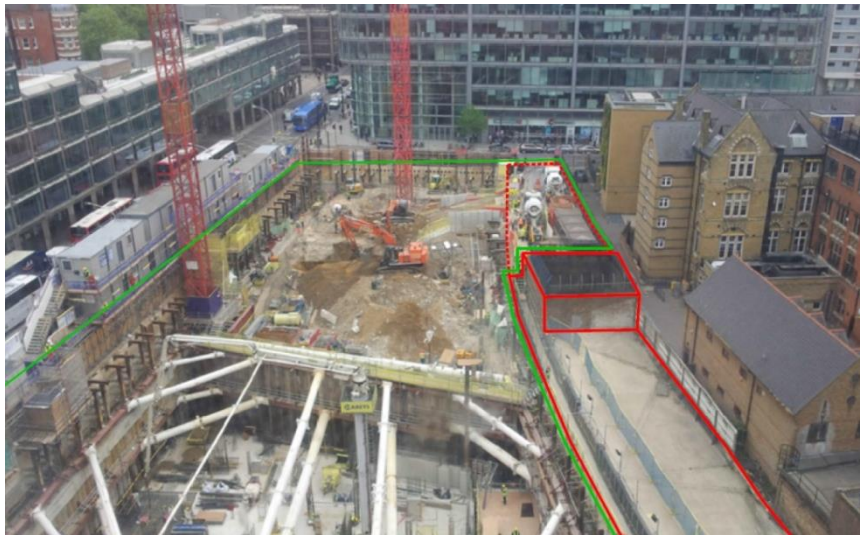
A case study of protection

Scenario 4: Kingsgate House - demolition & reconstruction



Map source: London Underground
Satellite image source: Bing Maps, 2017

Scenario 4: Protection



Located on Victoria Street, Westminster

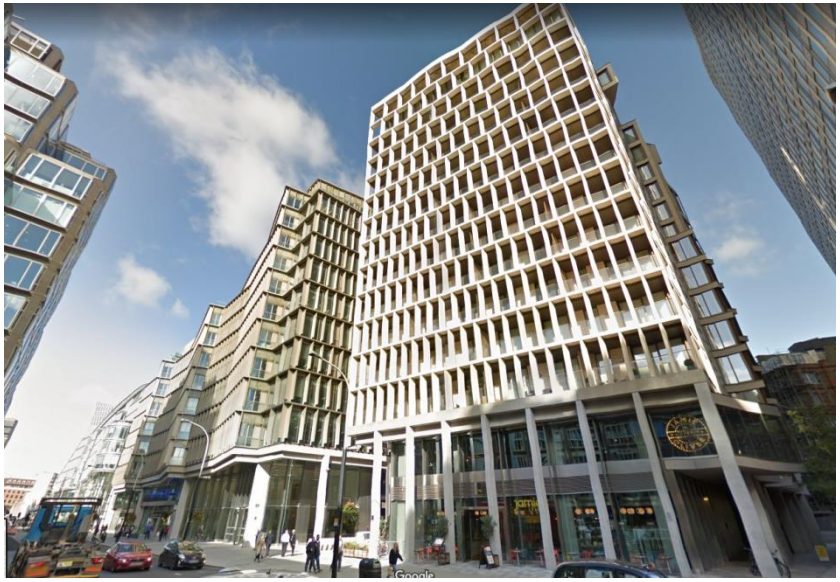
directly adjacent to the District and Circle lines

the original building was demolished and excavation undertaken to create basement levels.

Once this was completed, new buildings were erected.

Source: London Underground

Scenario 4: Protection



The new development is:

- 8 storeys below ground level, at its lowest point
- up to 14 storeys above ground level
- 22 storeys in total

directly adjacent to an underground railway.

Source: Google Maps, 2017

Conclusion

Understanding the interfaces of *presence, property,* and *protection* at macro and micro levels enables efficient management of existing assets and infrastructure to be undertaken.

This understanding also helps the planning and development of future infrastructure and its environment, and how these shape and are shaped by each other.

This understanding is essential to ensure the continued safe presence and operation of the railway; its environment; and the national economy.

Not just in the UK but globally; and not just for railway infrastructure...

...understanding the interfaces of presence, property and protection can also be applied to other transport and environmental infrastructure...

In Osaka, Japan, there is a highway that goes *through* a building.

Are the interfaces any different?

Source: Morrison, G., undated.

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