

JULY 2017
PRIME FINANCE (TUNBRIDGE WELLS) SARL

Former ABC Cinema Site, Tunbridge Wells: Wells Tunnel

REPORT FOR PLANNING



COWI

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1 Introduction

Prime Finance (Tunbridge Well) SARL (the Client) has appointed COWI UK to act as Geotechnical Engineer during the design of the proposed development at the Former ABC Cinema Site in Tunbridge Wells.

The proposed redevelopment of the site is discussed in detail in Section 3.1 but generally comprises the construction of a mixed use development.

The Wells Tunnel runs beneath the site (see Section 2.3) carrying Network Rail (NR) tracks on the Tonbridge to Hastings Line (ELR: TTH). This report has been prepared as an addition to the planning submission for the site with the objective of the report being to:

- > Summarise the proposed development in relation to the tunnel;
- > Summarise the information held about the tunnel (see appendix A);
- > Discuss the principles and procedures that will be followed during the design development to ensure minimal affect by the proposed development on the tunnel.

More detailed information and drawings of the proposals are included within the wider planning application.

1.1 Network Rail Liaison

Network Rail have been consulted at earlier phases of the project to agree the ground investigation and demolition phases of the development.

For the current phase of the project, a meeting was held on the 24th of April 2017 with Jim Fazakerley. The outline of the scheme was presented and it was advised to prepare this document, which has been set out in the basic format of a Form 001. A formal issue of a complete Form 001 will follow later in the project.

2 Project Details

2.1 Site Description

The site is located in Royal Tunbridge Wells at the junction of Mount Pleasant Road and Church Road. The site is bounded by Mount Pleasant Road to the East and Church Lane to the North. The rest of the boundary is generally bordered by buildings. Facing the site across the crossroads are the offices of Tunbridge Wells Council. The Grid Reference for the site is TQ 584 394.

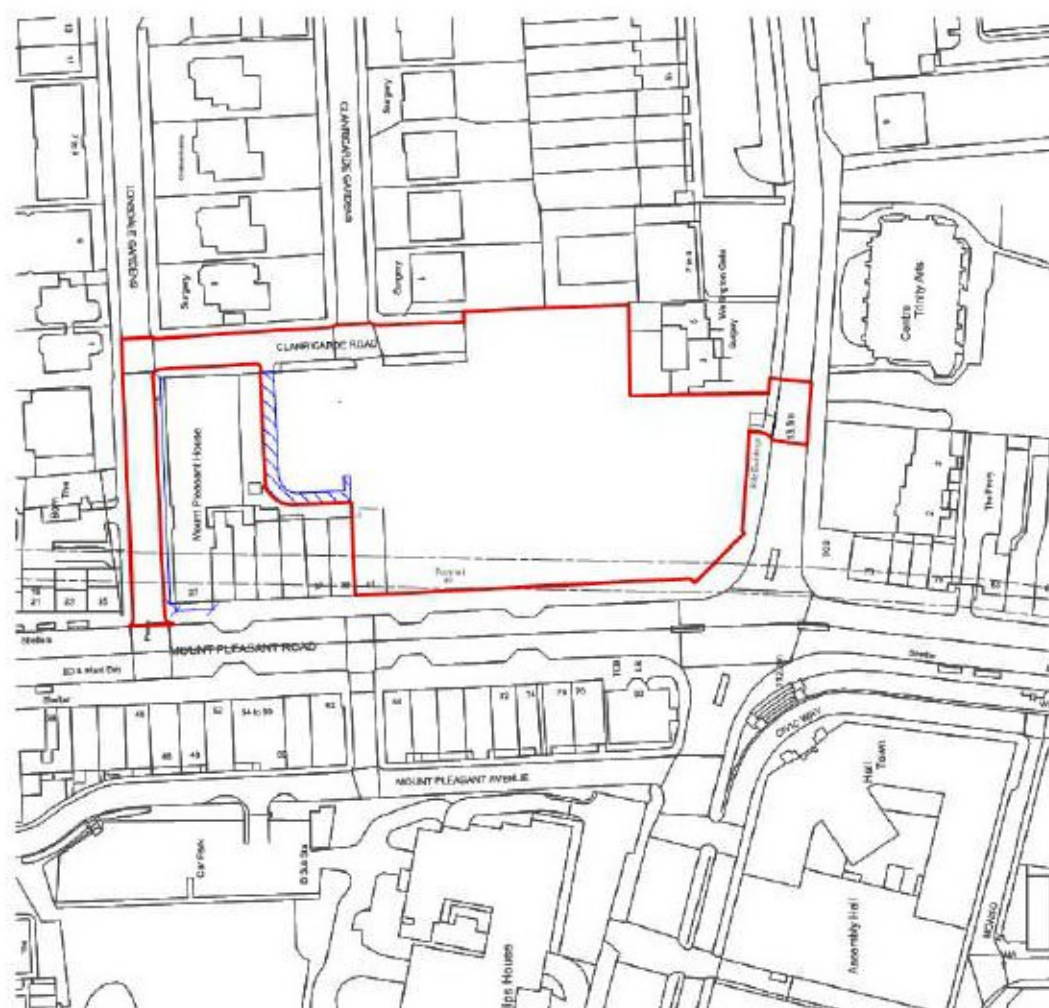


Figure 2-1 Site Location Plan

A desk study was prepared for the site by COWI (formerly Donaldson Associates Limited - DAL) in 2011, which included a review of historic maps. The maps showed that in the late 1800s, the site contained housing and shops. The site also contained a large cinema from the 1930s onwards and the some garages from the 1970s. All buildings on site were demolished in 2014.

The site lies within the Tunbridge Wells Conservation Area with a number of listed buildings close to the site.

2.2 Assets Affected

2.2.1 Tunnel Location

The main asset affected is the Wells Tunnel that runs beneath the site carrying Network Rail (NR) tracks on the Tonbridge to Hastings Line (ELR: TTH). Mileage 33 miles 1474 yards to 34 miles 523 yards. The tunnel is 740m long orientated north (High Brooms Portal) to south (Wells Portal) at Ordnance Survey Grid Reference (OSGR) TQ5860 3990 to TQ 5850 3870.

The Engineer's Line Reference (ELR) and structure number of the tunnel is TTH/17.

2.2.2 Tunnel Structure

The tunnel is a single bore and brick lined throughout, assumed to have been constructed between 1843 and 1846. The tunnel has 2 No hidden shafts and 1 No. suspected shaft, none of which underlie the site. The lining thickness along the tunnel is not known, however the face rings at both portals are 575mm thick.

The tunnel cover on site based on Donaldson Associates drawing J1025/02 Revision B 15/07/09 is approximately 8m – 13m.

The tunnel is twin tracked with third rail electrification and a permissible line speed of 50mph on both the up and down lines.

According to the Detailed Examination Report prepared by AMEY in October 2015 the tunnel required some brickwork repairs.

2.2.3 List of NR Civil Engineering Assets Affected by the Proposal

Asset No. 1:

Description	Wells Tunnel		
Location	Royal Tunbridge Wells, Kent		
ELR	TTH	Mileage	33miles 1474yards to 34miles 523yards
OS Grid Reference	TQ 584 394	Structure Number	TTH/17

3 Proposed Works

3.1 Proposed Development

The proposals for the site consist of mixed use redevelopment comprising 3,039m² Gross Internal Area (GIA) retail uses (Use Class A1/ A2), 1,895m² GIA restaurant use (Use Class A3), 1,049m² GIA cinema (Use Class D2) and 99 dwellings (Use Class C3) together with the provision of car and cycle parking, highway works, public realm improvements, and associated works, the re-alignment of Public Right of Way ref WBX17 and extinguishment of Public Right of Way ref WBX18, and either:-

(a) 9 additional dwellings (Use Class C3) and 372m² GIA office uses (Use Class B1),

or

(b) 1,144m² GIA medical centre (Use Class D1).

3.2 Geotechnical Considerations

3.2.1 Ground Investigation

A ground investigation was carried out at the site by Bam Ritchies and LBH Wembley Geotechnical and Environmental during January and February 2012. LBH Wembley provided a 'Phase 1 Land Contamination Assessment', input to and commentary on environmental testing. The following fieldwork was carried out:

- > 5No. hand dug observation pits to expose the footings of the former cinema building.
- > 4No. machine dug trial pits to provide bulk, disturbed and environmental samples.

- > 3No. cable percussive boreholes to maximum depth of 4.2mbgl (due to high rock head). Standard Penetration Tests (SPTs) were performed within the superficial deposits.
- > 3No. rotary boreholes to a maximum depth of 35.4mbgl. SPTs were performed in the superficial deposits.
- > Rising head permeability tests were carried out within each rotary borehole upon encountering groundwater.
- > 17No. window samples taking undisturbed, bulk, disturbed and environmental samples.

3.2.2 Ground Conditions

BAM Ritchies produced a Factual Report on the Ground Investigation. An interpretation of the ground conditions was contained within the Donaldson Associates input to the Stage C report produced for the site by Design Consultancy Limited in 2012.

The investigation confirmed the British Geological Survey (BGS) maps that showed the site is underlain by Made Ground over Sand & Silts, Sandstone/Mudstone and Wadhurst Clay. Sandstone rockhead was found between 0.5 and 4m below ground level (mbgl). Table 3.1 summarises the stratigraphy encountered during the investigation.

Table 3.1: Stratigraphy Encountered at ABC Cinema Site

Stratum	Top of Stratum (mAOD)	Thickness (m)	Typical Description
Made Ground	110.7 – 106.7	0.5 – 0.2	Brown sandy angular to subangular fine to coarse GRAVEL of brick and concrete. Brown slightly clayey slightly gravelly fine to coarse SAND. Gravel is angular to fine to medium of glass, brick, charcoal/ash and occasional rootlets.
Lower Tunbridge Wells Sand	109.16 – 104.4	20.2 – 16.5	Light, grey and orange clayey fine SAND. Hard SANDSTONE.
Wadhurst Clay	90.1 – 87.9	Not proven.	Dark grey thinly bedded MUDSTONE and MUDSTONE with subordinate beds of pale grey SILTSTONE.

Standpipes were installed with a response zone just above the Wadhurst Clay. These indicated a groundwater level varying between 92.0mAOD and 94.1mAOD i.e. between 13m and 18mbgl.

3.3 Substructure Design Principles

Substructure design for the development will be progressed following the grant of planning permission.

To minimise any adverse effect on the tunnel structure or utility the following foundations are envisaged:

- > Shallow foundations in areas with low rise buildings over the top of the tunnel. The loads are not anticipated to be higher than the historical loads (see BWM report).
- > Piled foundations on ground adjacent to tunnel possibly sleeved at the level of the tunnel

No basement structure is planned on this site, with the topography of the site used to accommodate car parking, servicing and operational requirements.

The above substructure will be checked during construction and long term future to minimise impacts on the tunnel and the superstructure. Table 1 summarises the deliverables required by Network Rail; this work will be carried out following the granting of planning permission.

Table 1 Summary of key forms to be submitted

Key Forms	Details included	Comment
Form 1	<ul style="list-style-type: none"> > Identify technical Parameters > Predicted design loadings > Proposed foundation type > Proposed monitoring > Short and Long term ground water impacts 	
Form 2	<ul style="list-style-type: none"> > Detail design > Impact of design on tunnels 	Separate Form 2's to be submitted for different packages as required by Network Rail and the design

Form 3	> Checking certificate	Appropriate level of checking to be agreed with Network Rail
Method Statements	> Construction Methodology	
Condition survey and monitoring	> Measurement of impact	To be informed by design process and Network Rail

All designs will be conducted to BS EN 1997- 1: Eurocode 7 – Part 1 General rules.

The Network Rail Hazard Directory will be consulted and any identified risks will be mitigated.

4 Geotechnical Risk Register

A basic risk register for tunnels is presented below to highlight the key hazards and measures to mitigate them.

Subject	Hazard	Risk	Mitigation
Demolition Complete			
	Possible water or fluid ingress to tunnels	Flooding of the tracks	GI conducted with no water ingress noted. Piles may be cased at the tunnel level.
Construction	Vibration	Damage to tunnel lining, if mortar loose it may fall out.	Piles will be installed at least 3m away from tunnel, and by rotary not driven installation.
	Loading from shallow foundations	Unacceptable deformation or damage of tunnel lining, track or signalling equipment.	Replace retail buildings with similar to the original occupying the site, therefore introducing no/limited additional loading.
	Loading from pile foundations	Unacceptable deformation or damage of tunnel lining, track or signalling equipment.	Piles may be sleeved at the tunnel level to eliminate additional loading.
	Piling activities close to tunnels	Striking of tunnels during piling	Piles to be installed at least 3m from the

			tunnel. Higher precision controls should be carried out during setting out. Tighter tolerances should be considered.
	Tunnel Lining Damage	Mortar or bricks getting loose or falling out	Condition surveys to be carried out before and potentially through foundation works

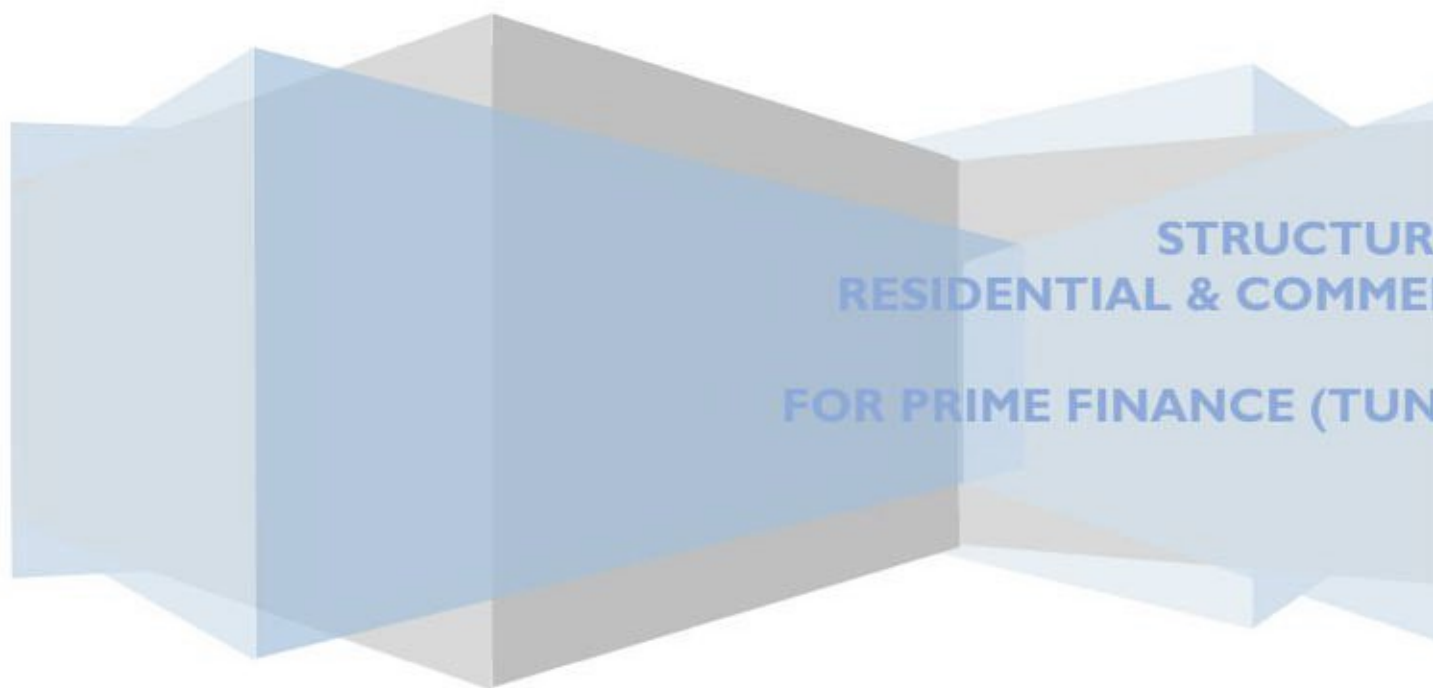
5 Conclusion & Recommendations

- > New development proposed above the tunnel with shallow foundation directly above the tunnel and piled foundation at least 3m away from the tunnel. The structural report detailing the solution is contained within Appendix B.
- > The correct Network Rail procedures will be followed.
- > The ground based risks to the tunnel will be minimised.
- > Consideration will be given to the extent of monitoring scheme.

Appendix A List of Tunnel Information

- > Point cloud survey from 2008
- > Topographical Survey from 2008
- > Structural Detailed Examination Report NR ID: 80091845; 22nd October 2017.
- > Factual Geotechnical Report on Ground Investigation by BAM Ritchies April 2012.

Appendix B BWM Structural Report



PROJECT TITLE
STRUCTURAL DESIGN SUMMARY
RESIDENTIAL & COMMERCIAL DEVELOPMENT
TUNBRIDGE WELLS
FOR PRIME FINANCE (TUNBRIDGE WELLS) SARL
JULY 2017

1.00	PROJECT DESCRIPTION
1.1	<p>The application is for a mixed use redevelopment comprising 3,039 sqm Gross Internal Area (GIA) retail uses (Use Class A1/ A2), 1,895 sqm GIA restaurant use (Use Class A3), 1,049 GIA sqm cinema (Use Class D2) and 99 dwellings (Use Class C3) together with the provision of car and cycle parking, highway works, public realm improvements, and associated works, the re-alignment of Public Right of Way ref WBX17 and extinguishment of Public Right of Way ref WBX18, and either:-</p> <p>(a) 9 additional dwellings (Use Class C3) and 372 sqm GIA office uses (Use Class B1), or (b) 1,144 sqm GIA medical centre (Use Class D1).</p>
2.00	SCHEME OVERVIEW
2.1	<p>The purpose of this report is to provide supplementary information to accompany the Planning Application. This report is included as an addendum to the COWI Report in respect of the potential impact of the development on the existing Network Rail Underground Tunnel which passes beneath the site. The information contained in this report is a preliminary overview of the structural engineering methodology that is to be adopted for the scheme, particularly in relation to new foundations adjacent/above the existing tunnel. No structural drawings have been prepared for Planning Stage. However more detailed Structural Reports, Drawings and Calculations will be submitted to Network Rail in due course as part of Technical BAPA submission for the project.</p>
3.0	SITE CONSTRAINTS/TOPOGRAPHY
3.1	<p>The Network Rail tunnel runs directly under the eastern boundary of the site adjacent to Mount Pleasant Road.</p>
3.2	<p>A tapered zone of influence (ZOI) Extends over part of the site from the rear of the footpath along Mount Pleasant Road. This ZOI measures approx. 14m at the southern boundary at retail unit 1 to approx. 7.5m at the north east boundary to retail 10 (i.e. corner of Church Road with Mount Pleasant Road).</p>

3.3	The Restaurant and Residential Elevations along Mount Pleasant Road (Blocks A & B) have been set back from the Boundary to limit the building height over the ZOI to approx. 2-3 storeys. This is in keeping with the former shop fronts that occupied this part of the site along Mount Pleasant Road, prior to demolition.
3.4	The Site topography slopes steeply from highest point at the North West corner of the site (adjacent to Pitcher & Piano) to lowest point at the South East corner of the site along Mount Pleasant Road. The overall difference in level across the site vertically is approximately 9m.
3.5	Stepped ground floor levels between units and a series of sloping walkways between buildings provides a transition between the levels. Concrete retaining walls are required between changes in ground levels.
4.0	GEOTECHNICAL REPORT
4.1	A Geotechnical Report was undertaken by BAM Ritchies for the site in April 2012. The report indicated that site contained made ground (up to 1m in depth), that overlays Lower Tunbridge Wells Sands & Slits, with bands of Sandstone and Mudstone (approximately 16m to 20m deep) that overlays Wadhurst Clay. Testing on the sandstone shows that it has weak uniaxial compressive strength, so it is proposed to adopt a sleeved rotary piled solution at all areas outside of the Network Rail Zone of Influence. A raft foundation will be adopted along Mount Pleasant Road to spread the load from the low-rise section of the building evenly over the ground. Section 5.0 below refers.
5.0	FOUNDATIONS
5.1	A concrete raft foundation solution has been adopted over the ZOI to limit the applied bearing pressure over the Network Rail tunnel to 125KN/m ² . This matches the original bearing pressure of the former shop units that were previously on the site along Mount Pleasant Road prior to demolition. Therefore there is no net increase in bearing pressure and Network Rail have confirmed they are satisfied with this methodology.
5.2	The remainder of the site outside the ZOI has a piled foundation solution supported on concrete pile caps and ground beams. The piles are a mixture of 900mm/600mm diameter concrete CFA piles depending on the vertical load capacity required. The

	<p>piles are sleeved adjacent to the ZOI to avoid any load transfer to the tunnel and they extend below the lowest point of the tunnel.</p>
5.3	<p>An Embedded secant piled retaining wall is required along the Western boundary to the car park and service yard areas to create the required levels. This can be accommodated as part of the scheme proposals.</p>
5.4	<p>All of the residential buildings, restaurant, commercial, cinema and car park are supported on the piled foundations.</p>

6.0	SUPER STRUCTURE				
6.1	The building is predominately a braced concrete frame full height. The 1 st floor slab acts as a Reinforced Concrete transfer structure to transfer the column loads from the residential layout into the ground floor columns and down to foundations. The residential level slabs at generally 225thk post tensioned flat slab structure.				
6.2	Stability is provided by Reinforced Concrete core walls at the stairwells and life shafts cores to transfer all lateral loads to foundations.				
6.3	<p>The cinema structure is a braced steel framed building off a concrete frame podium slab separating the cinema from the retail levels below. The roof to the cinema is formed using steel trusses spanning across the width of the cinema supported on internal steel columns between auditorium walls.</p> <p>Precast hollowcore slabs span between the steel roof trusses to support the roof finishes and plant.</p>				
6.4	Loadings - The super structure slabs have been designed for the following dead and imposed loading excluding the self-weight of the concrete structure:				
6.4.1	<table border="0"> <tr> <td>Residential – Dead load (finishes only)</td> <td>- 2.5kN/m²</td> </tr> <tr> <td>Imposed load</td> <td>- 2.5kN/m²</td> </tr> </table>	Residential – Dead load (finishes only)	- 2.5kN/m ²	Imposed load	- 2.5kN/m ²
Residential – Dead load (finishes only)	- 2.5kN/m ²				
Imposed load	- 2.5kN/m ²				
6.4.2	<table border="0"> <tr> <td>Restaurant – Dead load (finishes only)</td> <td>- 3.0kN/m²</td> </tr> <tr> <td>Imposed load</td> <td>- 3.0kN/m²</td> </tr> </table>	Restaurant – Dead load (finishes only)	- 3.0kN/m ²	Imposed load	- 3.0kN/m ²
Restaurant – Dead load (finishes only)	- 3.0kN/m ²				
Imposed load	- 3.0kN/m ²				
6.4.3	<table border="0"> <tr> <td>Retail – Dead load</td> <td>- 3.0kN/m²</td> </tr> <tr> <td>Imposed load</td> <td>- 4.0kN/m²</td> </tr> </table>	Retail – Dead load	- 3.0kN/m ²	Imposed load	- 4.0kN/m ²
Retail – Dead load	- 3.0kN/m ²				
Imposed load	- 4.0kN/m ²				
6.4.4	<table border="0"> <tr> <td>Cinema – Dead load</td> <td>- 3.0kN/m²</td> </tr> <tr> <td>Imposed load</td> <td>- 5.0kN/m² (at all areas)</td> </tr> </table>	Cinema – Dead load	- 3.0kN/m ²	Imposed load	- 5.0kN/m ² (at all areas)
Cinema – Dead load	- 3.0kN/m ²				
Imposed load	- 5.0kN/m ² (at all areas)				
6.4.5	<table border="0"> <tr> <td>Plant Room – Dead load</td> <td>- 3.0kN/m²</td> </tr> <tr> <td>Imposed load</td> <td>- 7.5kN/m²</td> </tr> </table>	Plant Room – Dead load	- 3.0kN/m ²	Imposed load	- 7.5kN/m ²
Plant Room – Dead load	- 3.0kN/m ²				
Imposed load	- 7.5kN/m ²				

6.4.6	Commercial Areas – Dead load Imposed load	- 3.0kN/m ² - 3.0kN/m ²
6.4.7	Car park – Dead load Imposed load	- 3.0kN/m ² - 2.5kN/m ²
6.4.8	Service Yard – Dead load Imposed load	- 3.0kN/m ² - 12kN/m ²
6.4.9	Roofs (all buildings) – Dead load Imposed load	- 3.0kN/m ² - 1.0kN/m ²
6.4.10	Courtyard at 1 st floor L01 – Dead load Imposed load	- 7.5kN/m ² - 3.0kN/m ²
7.0	CONCLUSIONS	
7.1	<p>The structural solution proposed for the construction of the building has been given detailed consideration by the Client and the Design Team. The proposal to limited the building height/loading directly over the tunnel ensures that there is no net increase in loading in this area. This matches the previous building footprint on the site prior to demolition. The sleeved piled foundation solution to the medium-rise buildings on site ensures that no additional load is transferred to the brick tunnel walls.</p> <p>The proposal has been discussed in principle with James Fazakerley (Network Rail South East Senior Construction Manager) and he is familiar with the site. Network Rail are satisfied with the initial structural methodology adopted subject to final review of the detailed drawings, reports and calculations. Detailed conditions surveys will be carried out on all properties adjacent to the site prior to any construction. Monitoring of the tunnel will be carried out a Network Rail Approved Surveyor before and during the works.</p> <p>It is estimated that detailed design for the project will commence once Planning Approval has been confirmed. Detailed design is expected to take approximately 4-6 months after which time a more detailed submission will be submitted to Network Rail for review and approval prior to commencing works on site.</p>	