



Bank Station Capacity Upgrade

29 Martin Lane Heritage Statement

September 2014



Bank Station Capacity Upgrade

29 Martin Lane Heritage Statement

In support of London Underground's
Listed Building Consent Application
for protective works

September 2014

Bank Station Capacity Upgrade Project
5th Floor
10 King William Street
London EC4N 7TW

LUL Document Reference:
LUL-8798-STT-G-002117

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1 Introduction

- 1.1.1 This Statement has been prepared in support of an application for listed building consent made by London Underground Limited at 29 Martin Lane, London, EC4R 0AU. The application seeks consent for protective works in case of effects from potential settlement caused by the Bank Station Capacity Upgrade (BSCU) tunnelling works.
- 1.1.2 The protective works described within this document have been guided by the current concept design stage of the BSCU project; the further details required by the condition suggested in Section 7 will be provided on completion of detailed design.
- 1.1.3 The works for which this application seeks to gain consent are:
- Provision of temporary external bracing to bay window at basement to first floor on southern elevation to be fixed to the main elevation, and insertion of internal ties and brackets.
- 1.1.4 The location plan and listed building description for the building are provided in Appendices 1 and 2.
- 1.1.5 This application (and similar applications) for listed building consent are being submitted concurrently with an application to the Secretary of State under the Transport and Works Act (TWA) 1992 for an Order, to be known as the Bank Station Capacity Upgrade (BSCU) Order, and with a request for a direction (of deemed planning permission) under section 90(2A) of the Town and Country Planning Act 1990. The purpose of this listed building consent application is to seek the necessary approval to enable works that may be necessary to mitigate predicted damage to this listed building caused by ground settlement related to the proposed BSCU tunnelling.
- 1.1.6 The BSCU project involves a major upgrade of the Bank Monument Station Complex to provide greatly improved passenger access, circulation and interchange. It includes provision of a new passenger entrance with lifts and escalator connections; a new Northern Line passenger concourse using the existing southbound platform tunnel; a new Northern Line southbound running and platform tunnel; and new internal passenger connections between the Northern Line, the Docklands Light Railway (DLR) and the Central Line.
- 1.1.7 The new Station Entrance will open on to Cannon Street at the junction with Nicholas Lane. An entrance hall will provide circulation space, as well as accommodating staff facilities, plant rooms and associated retail space. New passenger lifts will link the entrance hall directly with the Northern Line and the DLR, providing step free access to both. Escalators will also connect the entrance hall with the Northern Line.

- 1.1.8 The existing southbound platform for the Northern Line will be converted into a new passenger concourse. A new southbound running and platform tunnel will be located to the west of the existing platform. New cross passages will connect the Northern Line concourses and platforms. New walkways and escalators will better connect the Northern Line, the DLR and the Central Line. In particular, a tunnelled passageway fitted with moving walkways and new escalators will greatly improve interchange between the Northern Line and the Central Line.
- 1.1.9 Works to divert and protect utilities and to protect listed and other buildings from ground settlement will also be undertaken. The compulsory purchase and temporary use of land, the temporary stopping up of streets, street works and ancillary works will also be required.
- 1.1.10 Appendix 3 of this document contains plans showing the proposed BSCU works.

2 Heritage Planning Policy Context

The Planning (Listed Buildings and Conservation Areas) Act 1990

- 2.1.1 Section 66 of the Act establishes a general duty for a planning authority, in considering whether to grant consent for a development which affects a listed building, to have special regard to the desirability of preserving a listed building or its setting or any features of special architectural or historical interest which it possesses. A building is listed by virtue of its special architectural or historical interest (Section 1(1)).
- 2.1.2 Section 72 of the Act establishes a duty in the exercise of any function under the Act to pay special attention to the desirability of preserving or enhancing the character or appearance of a conservation area. A conservation area is an area of local interest designated principally by the Local Planning Authority.

The National Planning Policy Framework 2012

- 2.1.3 Section 12 of the National Planning Policy Framework (NPPF) deals with the consideration of cultural heritage assets and sets out the importance of being able to assess the impact of a development on the significance of heritage assets. Significance is defined in Annex 2 as the value of an asset because of its heritage interest. This interest may be archaeological, architectural, artistic or historic and can extend to its setting. The setting of a heritage asset is defined in Annex 2 as the surroundings in which a heritage asset is experienced. Its extent is not fixed and may change as the asset and its surroundings evolve. A designated heritage asset is recognised by the NPPF to be a World Heritage Site, Scheduled Monument, Listed Building, Protected

Wreck Site, Registered Park and Garden, Registered Battlefield or Conservation Area designated under the relevant legislation.

- 2.1.4 The NPPF recognises that a balance needs to be struck between the preservation of the significance of a heritage asset and delivering public benefit. With regard to designated assets, paragraph 132 states that the more important the asset, the greater the weight should be on its conservation. Distinction is drawn between those assets of highest significance and those of a lesser significance.
- 2.1.5 The NPPF identifies harm as being either substantial or less than substantial. Paragraph 133 states that where the proposal would lead to substantial harm to the significance of a designated asset consent should be refused unless the harm or loss is necessary to achieve substantial public benefit that outweighs that harm. In cases where less than substantial harm to the significance of a designated asset is anticipated, paragraph 134 requires that this harm should be weighed against the public benefits of the proposal. In respect of non-designated assets, paragraph 135 requires a balanced judgement having regard to the scale of any harm or loss and the significance of the asset.
- 2.1.6 In accordance with the NPPF, this heritage assessment sets out the significance of buildings likely to be affected by the BSCU works. The information provided in this assessment conforms to paragraph 128 of the NPPF, thus the level of detail provided is proportionate to the significance of the affected heritage assets and no more than is sufficient to understand the potential impact of the proposal on that significance.
- 2.1.7 Guidance on the application of heritage policy within the NPPF is provided within the PPS 5 Planning Practice Guide (English Heritage, 2010) and the on-line National Planning Policy Guidance (NPPG).

Regional Policy

The London Plan 2011

- 2.1.8 Policy 7.8 of the London Plan deals with heritage assets and archaeology and identifies the contribution that designated and non-designated heritage assets make to London's world class city status. The policy seeks to ensure the sensitive management and promotion of London's heritage assets through recognition of their positive role in place shaping.
- 2.1.9 "Draft Further Alterations to the London Plan" were published in July 2014. These proposed changes contain no update to policy 7.8 of the current London Plan.

Local Policy

The Unitary Development Plan 2002

- 2.1.10 Certain sections of the Unitary Development Plan (UDP) remain in force until the adoption of the Local Plan, which is anticipated to be in 2015, including Policies ENV10 and ENV11 which are of relevance to consideration of the BSCU works.
- 2.1.11 Policies ENV10 and ENV11 relate to conservation areas and listed buildings and recognise the contribution that historic buildings make to the character and ambience of the City of London. Policy ENV11 states that proposals to demolish buildings that make a positive contribution to the character or appearance of a conservation area will be resisted.

Core Strategy Development Plan 2011

- 2.1.12 One of the over-arching objectives of the Core Strategy as exemplified by Strategic Objective 3: City Culture and Heritage, is the promotion of a high quality of architecture and street scene appropriate to the City of London's position at the historic core of London.
- 2.1.13 Policy CS12 directly relates to cultural heritage, and aims to conserve or enhance the significance of the City's heritage assets and their settings, and provide an attractive environment for the City's communities and visitors, and sets out a number of ways in which this is to be achieved.

3 Consultation

- 3.1.1 Discussions and formal consultations with English Heritage and the City of London Corporation have taken place during the design process of the BSCU project. Both have been consulted as to the scope and process of heritage and Building Damage Assessments, which are relevant to the Listed Building Consent now being sought. The approach is based on established best practice and both bodies have responded positively to the methodology of assessment of settlement impacts.
- 3.1.2 The City of London Corporation's Assistant Director (Conservation) and the English Heritage Inspector were consulted on the proposed protective measures and a draft of this Statement. Both were generally content with the proposals subject to receipt of further detail at the appropriate stage. Their comments on the draft Statement were incorporated and the list of proposed conditions refined and agreed.
- 3.1.3 The project team has been in consultation with the building owner since 2011 regarding the nature of the BSCU project and its potential interface with the building.

4 Summary Description and Statement of Significance

- 4.1.1 The statutory Listed Building Description is contained at Appendix 2 of this document. 29 Martin Lane is not in a conservation area.
- 4.1.2 29 Martin Lane is a Grade II listed building built in 1853, with a roof extension completed between 1978 and 1980. The building is occupied as solicitors' offices, and comprises five storeys plus one basement. There is a bell tower at the south-western corner. The construction is of framed cellular masonry walls, with timber floors and a mansard roof.
- 4.1.3 The main façade on Martin Lane is characterised by three bays and three storeys in Flemish bond red brick with painted stucco dressings, and has a large bracketed clock above ground floor level with a segmental pediment facing the street. There are two attic storeys. The main entrance is through a projecting arched porch in stucco, flanked by round-headed windows with stucco architraves to the left, and a red brick bell tower with painted stucco quoins to the right. Photo 1 shows this elevation (a location plan for photographs is shown in Appendix 5).



Photo 1: Main elevation to Martin Lane

- 4.1.4 The southern elevation, including the bell tower which is to the west on the Martin Lane frontage, has a canted bay window from basement through to first floor and two attic storeys within a slated mansard roof rising behind a plain parapet. Windows to the main elevation and to the southern elevation have stucco surrounds and moulded architraves. This elevation is shown in photo 2.



Photo 2: Southern elevation of 29 Martin Lane, tower to left and top of bay window to right

- 4.1.5 The building has a compact, rectangular plan with a service block hosting the original stair, lift and toilets located in the middle of the rear elevation facing north. The service block is repeated on each floor, serving all floors from basement to fourth. The original interiors have evidently been altered as few of the original finishes are still in place aside from some plaster enrichments to the ground floor, none of which are in the area of the proposed protective works. The building is currently partitioned to suit the various office activities, and there are modern suspended ceilings to most rooms.
- 4.1.6 The significance of the building lies in its architectural form, particularly the juxtaposition of the bell tower on the corner with the lower elements of the building, the clock, and the stucco architectural features to the façades. The building also retains historic significance due to its former use as a rectory and position next to the site of the former St Martin Orgar Church. Its setting is one of narrow lanes and a small garden to the south-east, the former churchyard of St Martin Orgar.

5 Predicted or possible impacts of the proposed BSCU works upon 29 Martin Lane

- 5.1.1 It is proposed that the running tunnel will pass directly beneath 29 Martin Lane, from its south-east to north-west corner. A plan showing the position of proposed and existing infrastructure in relation to 29 Martin Lane is appended at Appendix 3.
- 5.1.2 At the current concept design stage, a conservative, reasonable worst case geotechnical assessment ('Stage 2' Building Damage Assessment, contained in Appendix 4) has been undertaken, indicating that there may be a maximum predicted settlement of 10mm for the building. There will be minimal differential settlement with a calculated maximum strain of 0.004%.
- 5.1.3 The geotechnical assessment has been combined with a heritage and structural assessment, which has highlighted sensitivities in relation to the building, potentially concentrating strain around junctions between the building elevations and the bay window to the south, shown on photo 3.
- 5.1.4 Further more detailed assessment will be undertaken at a 'Stage 3' Building Damage Assessment to be completed in February 2015, which is required to verify the results of previous assessment as the BSCU design develops (detailed design), and further establish protective works design. The Stage 3 Building Damage Assessment will take into account the detailed design and refined tunnel and construction details. The process for the Stage 3 Building Damage Assessment is well established, and will include, as necessary, the following measures:
- desk top review of all available survey and structural information including previously unseen reports and measured survey plans;
 - full, detailed visual structural survey to identify weaknesses and to inform detailed analysis;
 - non-intrusive and intrusive surveys to better understand the building's sensitivities to predicted settlements and strains;
 - material sampling of interior finishes to facilitate informed repair;
 - recording of heritage features to facilitate informed repair;
 - consideration of the potential pros and cons of physical protective works;
 - protective works design; and

- formulation of a Monitoring Response Action Plan, which will detail trigger levels and appropriate actions in the event of a trigger being breached.
- 5.1.5 Method statements, specifications and full plans of protective works as found to be required will be produced following the Stage 3 Building Damage Assessment.
- 5.1.6 Whilst the strains and settlement to 29 Martin Lane are predicted to be small, the bay window to the southern elevation may be sensitive to small movements, depending on its internal construction and bonding. Areas of interest and areas to be affected are shown in Appendices 6 and 7.
- 5.1.7 A worst case assumption is that the bay's structure of mullions and lintels may be poorly bonded to the main external wall. As such, there is a possibility that settlement may cause the structure to crack at its joints and pull away from the main external wall. Further investigation of the feature will continue to be undertaken during the detailed design of the BSCU project.



Photo 3: Detail of the bay window and its stucco dressings

- 5.1.8 It is considered that the impacts of the predicted settlements are such that they could be detrimental to the heritage significance of 29 Martin Lane because of the risk of separation between the building and the bay window, and damage to the bay due to movement and distortion. Therefore, proposals for protective works are outlined within the following section, and the impacts of these protective measures discussed. Further investigation of sensitive elements, including survey and examination of survey plans, will continue to be undertaken during the detailed design of the BSCU project and the impacts and protective works reviewed and refined at that time.

6 Proposed protective works and impacts of those works

- 6.1.1 The specific interventions requiring listed building consent are described below. The proposed protective works have been designed on the basis of information available at the present concept design stage and the Stage 2 Building Damage Assessment.
- 6.1.2 Whilst the proposals are currently at concept design stage, the need to protect listed buildings from the impacts of settlement resulting from the works has been recognised. Therefore, as a precautionary measure a ‘worst case’ approach has been taken in respect of assessment of the impact from the proposed works, based on the current scheme design stage.
- 6.1.3 The next design stage will include a refined building assessment as part of the Stage 3 Building Damage Assessment. This further work may reduce or remove the need for the proposed protective works. If the protective works are required, they will be designed in detail. The detailed information required by the condition in Section 7 will be provided for approval by the Local Planning Authority.

Works that require Listed Building Consent

- 6.1.4 In the unlikely event of differential movement with the potential to have an adverse impact on the bay, temporary protective works in the form of propping is proposed. This will comprise the construction of a temporary external bracing tower, which may be fixed to the main elevation. The scaffold structure will support the bay from basement to first floor level and will be designed to have a minimal impact on the building. The structure will be fixed, where practicable, to the mortar joints of the brickwork with ties at either side of the bay. Intrusion into the stucco finishes of the bay window surrounds will be avoided where possible. There will be struts at each level which will support the structure of the bay and minimise movement away from the main wall.

- 6.1.5 The structure will remain in place until settlement relating to the tunnelling has reached an acceptable level (based on monitoring of ongoing settlements throughout and after the works), at which time internal ties and brackets will be inserted as required to tie the bay back to the main building, and repairs will be undertaken to cracked areas and areas of fixing, on a like for like basis. These works will only affect areas of modern finishes on all floors, the example shown in photo 4 being typical throughout the building.



Photo 4: Internal area to the ground floor, around the bay window, showing modern finishes.

Impact of the works

- 6.1.6 It is anticipated that the protective works will have a temporary impact on the appearance of the building when viewed from the south, and on its setting within the former churchyard. The material significance of the building will be very slightly impacted due to the need for fixing; however, this will take place within areas of brickwork and will avoid the stucco dressings of the bay window which are of high significance to the architectural value of the building. On removal of the temporary support, repair to fixing areas and cracking that has occurred during the tunnelling works will be repaired on a like for like basis, and therefore permanent impacts will be carefully concealed. The removal of the support structure will also remove the impact on the setting of the building.
- 6.1.7 The insertion of ties and brackets will have a small permanent impact on the historic building. The removal of material for opening up (i.e. localised removal of finishes such as plaster or floorboards to expose the structure behind for

inspection) and subsequent changes/additions to the structure of the bay window will have an impact on the material authenticity of the listed building. However, this will not have a permanent impact on the appearance of the building, as all external and internal finishes in the area of works would be made good on a like for like basis. Therefore, although causing a level of permanent change, the heritage value of the building will not be significantly changed.

- 6.1.8 In relation to the NPPF, the works will not have a significant effect on the significance of the building, and will result in less than substantial harm to the heritage asset. In relation to local policy, the protective works are intended to achieve the object of conserving the City's heritage assets.

Justification for the works

- 6.1.9 The BSCU project involves a major upgrade of the Bank Monument Station Complex which is currently one of the most congested on the London Underground network.
- 6.1.10 The overarching aim is that Transport for London continues to provide a fit-for-purpose public transport station complex to support the City of London. It will do this by:
- increasing the capacity of Bank Underground Station so that it is able to handle present and forecast demand, and thereby support the economic growth of the city;
 - minimising passenger journey time through the station, and thereby reduce crowding;
 - improving the quality of access, interchange and ambience, including the provision of step-free access routes from street level to Northern line trains and provide step-free interchange between Northern line and Dockland Light Railway (DLR) trains; and
 - improving emergency fire and evacuation protection measures.
- 6.1.11 The BSCU project is an important element of works planned as part of Transport for London's 10 year Investment Programme, which will contribute to the achievement of the economic growth of London as set out in the Mayor's London Plan and Transport Strategy. The significant public and economic benefit of the BSCU works as described in Section 1 and illustrated in Appendix 3 justifies the impacts outlined in this Statement.
- 6.1.12 The proposals contained within this document are intended to mitigate adverse impacts of the BSCU works related to settlement at 29 Martin Lane. The protective works proposals themselves will result in a change to historic

building fabric to a small extent. The temporary external bracing will have a temporary impact to the setting of the listed building, which is considered to contribute to its significance. However, the protective works is intended to prevent damage to the listed building and enable the building to retain its heritage significance.

- 6.1.13 It is considered that the proposed protective works will constitute less than substantial harm to the listed building. The NPPF states that “where a development proposal will lead to less than substantial harm to the significance of a designated heritage asset, this harm should be weighed against the public benefits of the proposal”. The public benefits of the BSCU are significant both locally and in the wider London context.

7 Proposed conditions

- 7.1.1 The following conditions have been agreed with City of London officers and the English Heritage Inspector:

Time Limit for Commencement of Development

1. The works shall commence not later than five years beginning with the date of this consent.

Reason: To comply with the requirements of section 18(1) of the Planning (Listed Buildings and Conservation Areas) Act 1990.

Approval of Details

2. The works shall not commence until the following details have been submitted to and approved in writing by the Local Planning Authority:
 - a) A report, including an engineering statement, detailing the results of structural assessment and investigations into the condition of the building to confirm the need for and suitability of the protective works;
 - b) Detailed survey drawings and/or photographs showing, by means of hatching and/or annotations, the areas to be affected by the protective works;
 - c) Photographic/condition survey of the relevant parts of the building; and
 - d) Details of the proposed protective works, including plans of locations and specification of methods.

Reason: To protect the listed structure and retain the aesthetic, architectural or historic significance of the listed building.

Temporary Works

3. Any temporary protective works shall be removed within six months of the monitoring data showing that ground movement has effectively ceased.

Reason: To protect the listed structure and retain the aesthetic, architectural or historic significance of the listed building and its setting.

Monitoring

4. A report summarising the ground movement effects in the vicinity of the building shall to be submitted to the Local Planning Authority within six months of the monitoring data showing that ground movement has effectively ceased.

Reason: To protect the listed structure and retain the aesthetic, architectural or historic significance of the listed building.

Making Good

5. All work of making good shall match the existing adjacent work with regard to the methods used and materials, colour, texture and profile, unless shown otherwise on the drawings or other documentation hereby approved or required by any conditions(s) attached to this permission.

Reason: To ensure a satisfactory appearance and finish to retain the aesthetic, architectural or historic significance of the listed building.

Approved Drawings

6. The works shall not be carried out other than in accordance with the approved drawings and particulars as set out in the Heritage Statement September 2014 including Appendices or as approved under conditions of this Listed Building Consent.

Reason: To ensure that the development is in compliance with details and particulars which have been approved by the Secretary of State for Transport and the Local Planning Authority.

8 Conclusion

- 8.1.1 Modelling of likely settlement of strains on the basis of concept design to date, combined with heritage and structural assessment of 29 Martin Lane has predicted potential settlement of up to 10mm and maximum tensile strain of 0.004% across the building, as a result of the new infrastructure being constructed directly below the building.

- 8.1.2 The bay window to the south elevation of the building may be sensitive to small movements, and therefore contingency protective works have been proposed.

- 8.1.3 It is acknowledged that the temporary bracing will lead to a temporary adverse impact on the significance of the building through impact on its setting, and a minor impact on historic fabric due to the fixings. Insertion of ties and brackets will have a permanent impact, but only a short term temporary aesthetic impact. These impacts will be outweighed by the benefits of the protective works which are intended to prevent substantial damage to the bay window.
- 8.1.4 All making good to the external and internal appearance of the building will follow the principle of like for like repair, and there will be no long term impact to the building beyond a small material change which will not devalue its architectural or historic significance. The impact of the works will constitute 'less than substantial harm' as defined by the NPPF.

References

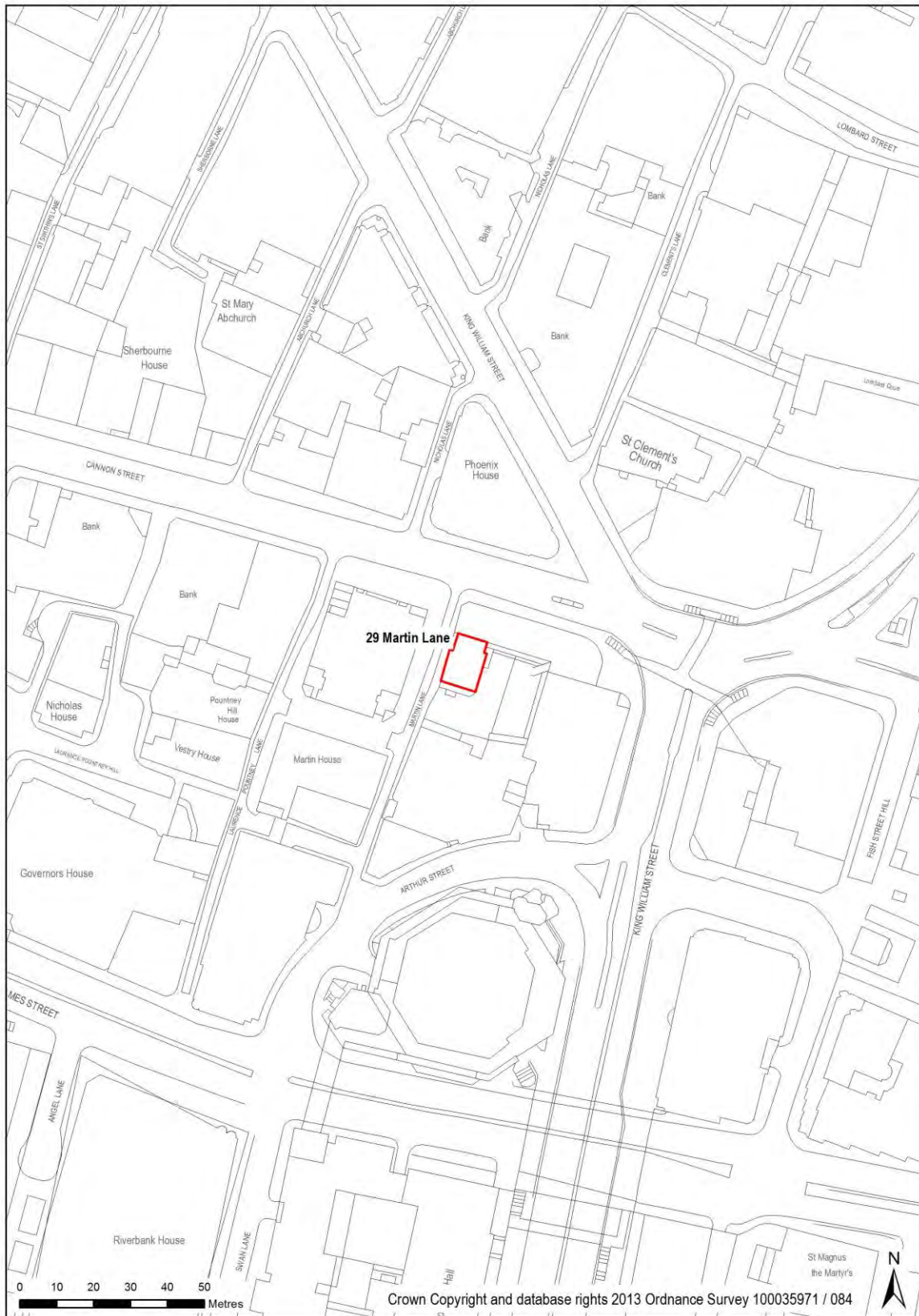
English Heritage National Heritage List

The Buildings of England, London 1: The City of London, Bradley and Pevsner, (1997) p555

Building Damage Assessment Report 'A34' (2014)

Appendices

Appendix 1: Location Plan



Appendix 2: Listed Building Description

List entry Number: 1064606

Location 29, MARTIN LANE EC4

Grade: II

Date first listed: 16-Dec-1974

UID: 199620

Details MARTIN LANE EC4 1. 5002 No 29 TQ 3280 NE 16/439 16.12.74.

2. 1853; Architect John Davies. Built on site of St Martin Orgar as rectory with tower incorporated into house. Red brick with painted stucco dressings and quoins in modified late C17/early C18 style, 3 storeys plus basement, Ground floor arched porch in stucco and round headed windows with stucco architraves. Upper floor sash windows with stucco surrounds, parapet to roof. House has 2 storey canted bay window facing churchyard with stucco dressings and pilasters carrying entablature. Tower in 3 plain stages with windows facing churchyard, crowning cornice and parapet with blocking course. Large wooden bracketed clock with segmental pediment facing Martin Lane dated 1853. Cast iron railings with spearhead finials.

Listing NGR: TQ3281280837

National Grid Reference: TQ 32812 80837

Appendix 3: Extent of BSCU works

CITY OF LONDON

Key:

- Listed Building
- Existing Infrastructure
- Proposed Infrastructure

Notes:

For clarity, drawing shows existing infrastructure at Northern line level and Central line level affected by the works. Not all existing below ground infrastructure is shown.

Temporary works are not shown.



PROJECT	BANK STATION CAPACITY UPGRADE PROJECT
PURPOSE OF ISSUE	FOR INFORMATION
TITLE	29 MARTIN LANE EXISTING AND PROPOSED INFRASTRUCTURE

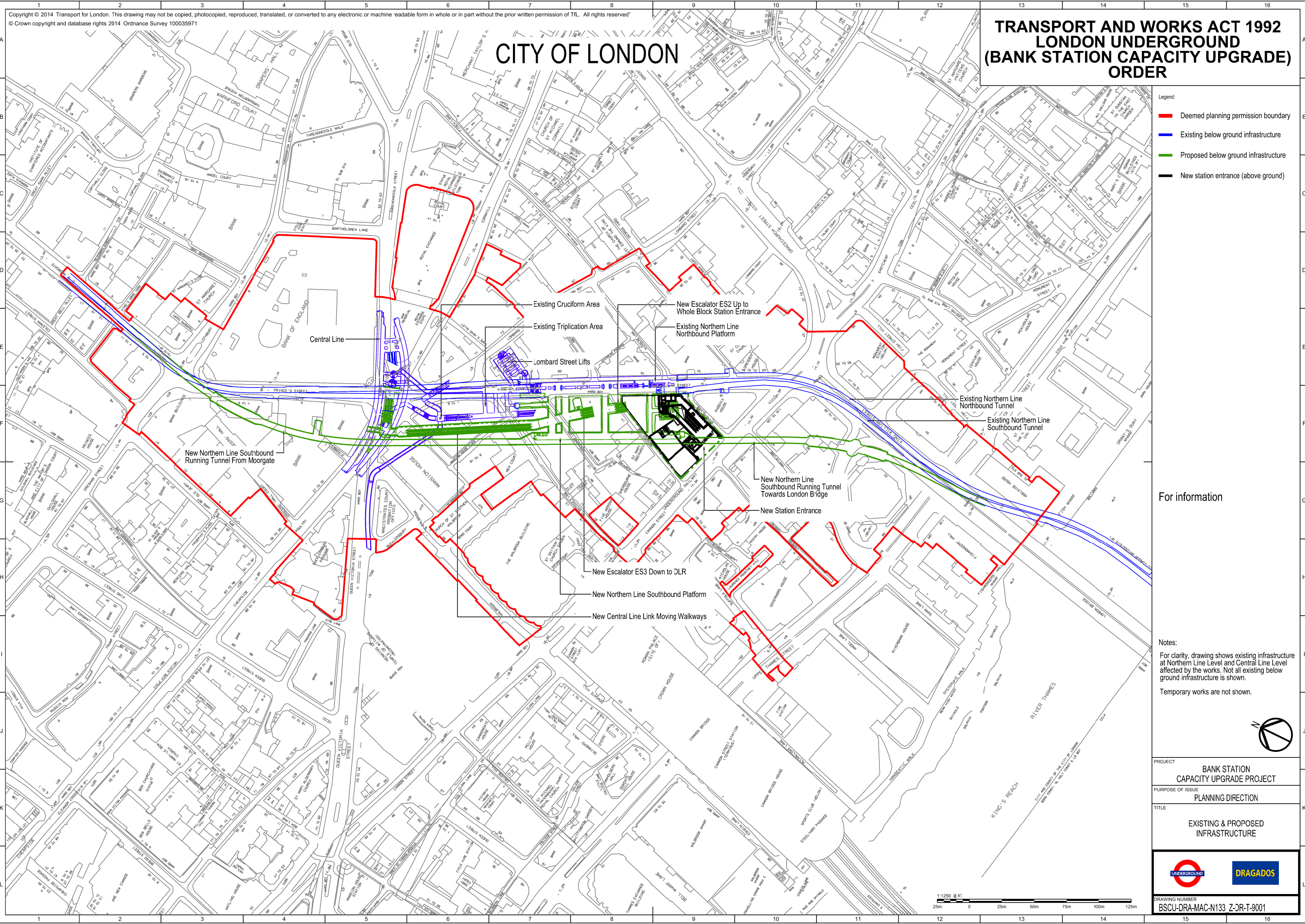
DRAWING NUMBER
BSCU-DRA-MAC-N133_Z-DR-T-0316



CITY OF LONDON

TRANSPORT AND WORKS ACT 1992 LONDON UNDERGROUND (BANK STATION CAPACITY UPGRADE) ORDER

- Legend:
- Deemed planning permission boundary
 - Existing below ground infrastructure
 - Proposed below ground infrastructure
 - New station entrance (above ground)



For information

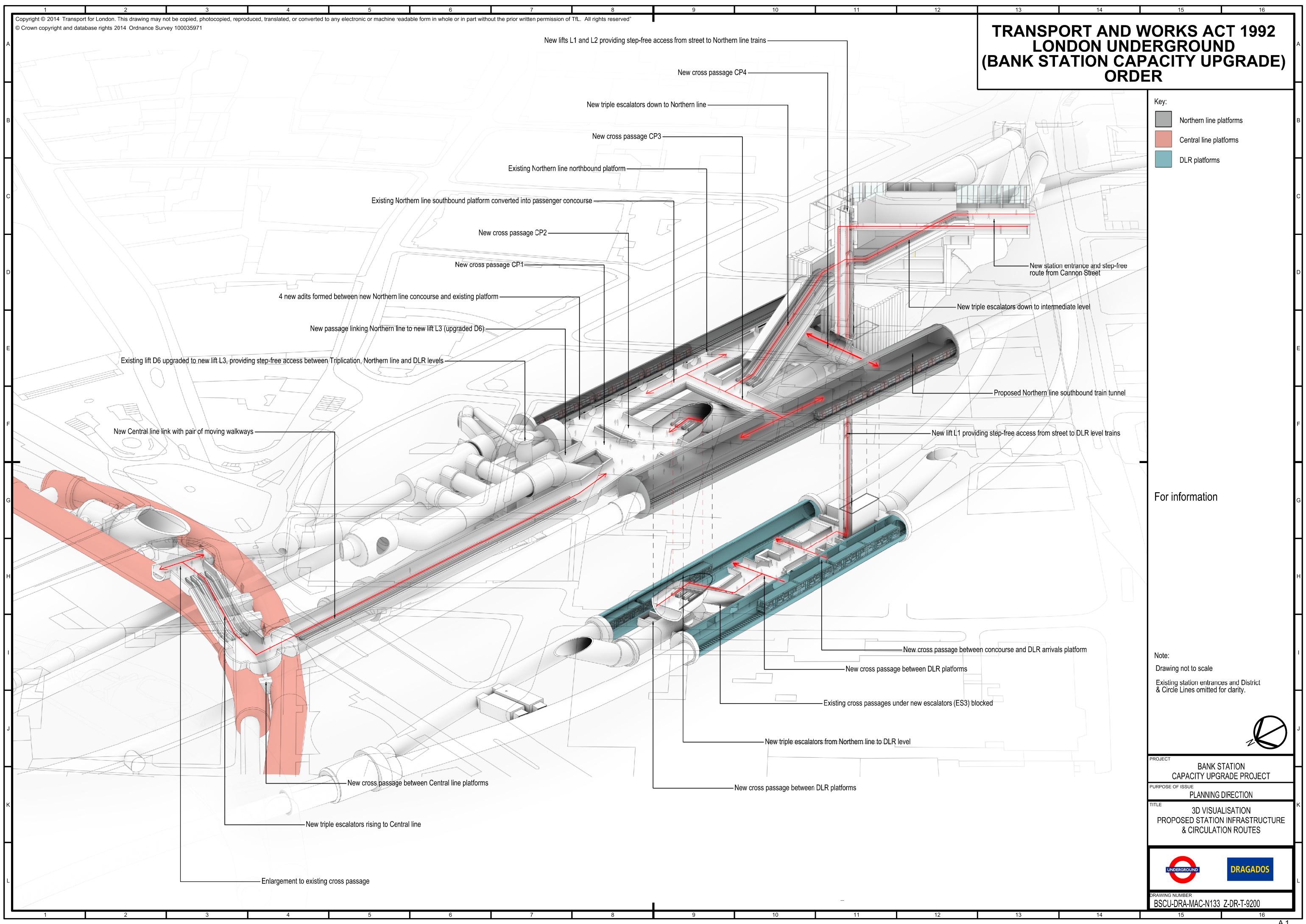
Notes:
 For clarity, drawing shows existing infrastructure at Northern Line Level and Central Line Level affected by the works. Not all existing below ground infrastructure is shown.
 Temporary works are not shown.



PROJECT	BANK STATION CAPACITY UPGRADE PROJECT
PURPOSE OF ISSUE	PLANNING DIRECTION
TITLE	EXISTING & PROPOSED INFRASTRUCTURE
DRAWING NUMBER	BSCU-DRA-MAC-N133 Z-JR-T-9001



TRANSPORT AND WORKS ACT 1992 LONDON UNDERGROUND (BANK STATION CAPACITY UPGRADE) ORDER



- Key:
- Northern line platforms
 - Central line platforms
 - DLR platforms

For information

Note:
 Drawing not to scale
 Existing station entrances and District & Circle Lines omitted for clarity.



PROJECT	BANK STATION CAPACITY UPGRADE PROJECT
PURPOSE OF ISSUE	PLANNING DIRECTION
TITLE	3D VISUALISATION PROPOSED STATION INFRASTRUCTURE & CIRCULATION ROUTES



DRAWING NUMBER
 BSCU-DRA-MAC-N133 Z-DR-T-9200




Appendix 4: Building Damage Assessment Report

Bank Station Capacity Upgrade Building Damage Assessment Report

Building A34

29 Martin Lane

URS-8798-RPT-G-001192

Prepared by:	Lisa Perkins Assistant Geotechnical Engineer		18/07/14
Checked by:	Annaliza Khoo Principal Geotechnical Engineer		18/07/14
Approved by:	John Chantler Technical Director		18/07/14

Document Owner	
Company:	URS
Role:	Designer

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Revision	Date	Summary of changes
1.0	March 2014	Issue for Heritage
2.0	April 2014	For Approval
3.0	July 2014	TWAO Issue

Consultation:

- Ela Palmer URS Heritage
- Brian Lyons Dr.Sauer
- Keith Bowers/Neil Moss/Paul Dryden London Underground
- Olly Newman Dragados

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1 Introduction

This report summarises the results of a Stage 2 damage assessment for 29 Martin Lane.

Stage 2 damage assessments are undertaken for all buildings within the Stage 1 Greenfield ground surface 1mm settlement contour induced by the construction of the Bank Station Capacity Upgrade (BSCU).

The purpose of the assessment is to determine the potential effect the works will have on the building. This report describes the engineering and heritage assessments undertaken for the building and concludes whether mitigation is likely to be needed and if a further (Stage 3) assessment is recommended in order to verify this.

2 The Building

2.1 General Information

No. 29 Martin Lane is located in the eponymous lane sloping down to the south from Cannon Street. The building has been assumed to be load bearing masonry construction, using Flemish bond red brick with some dressings. The building has a single level storey below ground with the structure likely to be founded on strip footings^[7]. General building information used in the assessment has been acquired as part of the structural desktop appraisal. This information is presented in Table 1.

Category	Building Information
BSCU Reference	A34
Location	Martin Lane
Address	29 Martin Lane
Building Type	Load bearing masonry
Construction Age	1853
No. of Storeys	5
Basements	1
Eaves Level (mATD)	131.5
Foundation Type	Strip footings (assumed)
Ground Level (mATD)	113.8
Listed	Grade II

Note: Levels given are in metres above Tunnel Datum, mATD.
Tunnel Datum is 100m below Ordnance Survey Datum at Newlyn.

Table 1: General building information

A general view of the building exterior is shown in Plate 1. A location plan showing the building in relation to the proposed BSCU works is presented in Figure 2.



Plate 1: General view

2.2 Building Description

This Grade II listed building was built in 1853, and a roof extension was completed between 1978 and 1980. The building is occupied as solicitors' offices, and comprises five storeys plus one basement. There is a bell tower at the south western corner. The construction is of framed cellular masonry walls, with timber floors and a mansard roof.

The main façade on St Martin's Lane is characterised by three bays and three storeys in Flemish bond red brick with painted stucco dressings. The main entrance is through a projecting arched porch in stucco, flanked by round-headed windows with stucco architraves to the left, and a red brick bell tower with painted stucco quoins to the right.

The west elevation, including the bell tower is characterised by a large bracketed clock with a segmental pediment facing Martin Lane, a canted bow window to first and second floors and two attic storeys within a slated mansard roof rising behind plain parapet. Windows to the main elevation and to the east elevation have stucco surrounds and moulded architraves.

The building shows a compact, rectangular plan with a service block hosting the original stair, lift and toilets located to middle of rear elevation facing north. The service block is repeated on each floor, serving all floors from basement to fourth. The original interiors have been evidently altered over the centuries as room layouts and distribution follows functional needs and few of the original finishes are still in place aside from some plaster enrichments; the building is currently partitioned to suit the various office activities, and there are suspended ceilings to most rooms.

3 Methodology

This building damage assessment is undertaken in accordance with LU Works Information WI2300^[1] and LU Civil Engineering - Common Requirements S1050^[2].

The analysis methodology applies to ground-bearing buildings which will be affected by ground movements resulting from the construction of the BSCU. The engineering assessment calculates the potential impact of ground movements and assigns a damage category to the building based on a numeric scale. Additionally, for listed buildings, a heritage assessment is carried out which considers the sensitivity of the structure and the sensitivity of its particular features; a heritage sensitivity score is assigned. The heritage sensitivity score is added to the damage category to obtain the total score. If the total score is 3 or more, a more detailed Stage 3 assessment is triggered.

Oasys Xdisp is used to analyse the Greenfield ground movement in terms of settlement and horizontal displacement. Subsurface tunnelling induced ground movement profiles are determined in accordance with the methodology described by Mair et al^[3 & 4].

Movements resulting from the Whole Block Scheme (WBS) and shaft excavations have been calculated using LU Guidance Document G0058^[5].

The building is modelled as a simple elastic beam which is conservatively assumed to follow the Greenfield ground displacements. The beam is divided into hogging and sagging segments. The tensile strains within each segment are calculated based on the distortion associated with differential settlement (which is characterised by deflection ratio) and the distortion associated with differential horizontal displacement (characterised by horizontal strain).

Xdisp provides a method for calculating the maximum tensile strain within the building superstructure associated with these movements, in accordance with the assessment methodology described by Mair et al^[4]. This strain is used to determine the damage category based on the classification system proposed by Burland^[6] and in accordance with LU Civil Engineering - Common Requirements S1050^[2]. The categories are presented in Table 2.

Damage Category	Description of Degree of Damage	Description of Typical Damage and likely forms of Repair for Typical Masonry Buildings.	Approx. Crack Width (mm)	Max. Tensile Strain %
0	Negligible	Hairline cracks.		< 0.05
1	Very slight	Fine cracks easily treated during normal redecoration. Perhaps isolated slight fracture in building. Cracks in exterior visible upon close inspection.	0.1 to 1.0	0.05 to 0.075
2	Slight	Cracks easily filled. Redecoration probably required. Several slight fractures inside building. Exterior cracks visible; some repainting may be required for weather-tightness. Doors and windows may stick slightly.	1 to 5	0.075 to 0.15
3	Moderate	Cracks may require cutting out and patching. Recurrent cracks can be masked by suitable linings. Tuck pointing and possible replacement of a small amount of exterior brickwork may be required. Doors and windows sticking. Utility services may be interrupted. Weather tightness often impaired.	5 to 15 or a number of cracks > 3	0.15 to 0.3
4	Severe	Extensive repair required involving removal and replacement of walls especially over doors and windows. Window and door frames distorted. Floor slopes noticeably. Walls lean or bulge noticeably. Some loss of bearing in beams. Utility services disrupted.	15 to 25 but also depends on number of cracks	> 0.3
5	Very severe	Major repair required involving partial or complete reconstruction. Beams lose bearing, walls lean badly and require shoring. Windows broken by distortion. Danger of instability.	Usually > 25 but depends on number of cracks	
Note: Please refer LU Civil Engineering - Common Requirements S1050 ^[2] .				

Table 2: Building damage classification

4 Input Data

The magnitude and distribution of ground movements and degree of building damage is calculated based on the following input data:

- The Xdisp model coordinates and levels are based on the 3D model (20130212DSPITT Scheme R09);
- Four construction stages are considered in accordance with the proposed programme (November 2013) as illustrated in Figure 1;
- Trough width parameter constant, $K=0.5$ is used in accordance with WI2300^[1].

The input data for the building, tunnels and shaft excavation are summarised in Table 3, Table 4 and Table 5 respectively.

Location	Foundation level (mATD)	Building Height above foundation level (m)	E/G
29 Martin Lane	109.3*	22.2	2.6
Note: Where E / G is the ratio of Young's modulus to shear modulus of the deep beam that is to represent the building. * Assumed level, 1.5m thick slab beneath floor level.			

Table 3: Building data

Tunnel Item	Level of axis (mATD)	External diameter (m)	Volume Loss (%)
Running tunnels	84.9	5.4	1.5
Square works adits	75.8 to 95.3	4.1 to 7.8	2.5
Platform enlargement	85.6	7.4 to 11.2	1.5
Escalator barrels	Inclined	8.3 to 8.4	1.5
Central Line Connection	Inclined (87.6 to 89.2)	8.6	1.5

Table 4: Tunnel data

Excavation	Excavation Base Level (mATD)
Grout Shaft at King William Street	97
Whole Block Scheme Box excavation	73
Arthur Street Shaft	81

Table 5: Excavation data

The Xdisp model filenames used to undertake this assessment are:

- A34 - Stage 4
- A34 - Stage 3
- A34 - Stage 2
- A34 - Stage 1

5 Results

5.1 Engineering Assessment

The sections through the building which have been analysed are shown on plan in Figure 3.

Assessment has been undertaken at three intermediate construction stages and at the end of construction when all major elements of the works including shaft and tunnels have been completed. The damage category assigned to the building is based on the construction stage at which the potential impact on the building is most severe.

The maximum settlement and tensile strain calculated for each of the analysis sections at the most onerous intermediate construction stage and at the end of construction are presented in Table 6 and Table 7.

Section	Maximum Settlement (mm)	Maximum Tensile Strains (%)
A34 (line 1)	10	0.003
A34 (line 2)	10	0.004
A34 (line 3)	10	0.003
A34 (line 4)	10	0.002

Table 6: Building response at most onerous intermediate stage - Construction Stage 1

Section	Maximum Settlement (mm)	Maximum Tensile Strains (%)
A34 (line 1)	10	0.003
A34 (line 2)	10	0.004
A34 (line 3)	10	0.003
A34 (line 4)	10	0.002

Table 7: Building response at end of construction – Construction stage 4

The results of the assessment show that the intermediate construction Stage 1 is the critical stage for this building where (line 1) experiences the most onerous combined tensile strain. The orientation is shown in Figure 3. The vertical and horizontal Greenfield ground movements along the section of the building are shown in Figure 4. The relative position of the building and tunnels along section (line 1) is shown in Figure 8. The calculated strains are summarised in Table 8.

Line #	Strains in section (Curvature)	Position from start (m)	Length (m)	Average* Horizontal Strain (%)	Maximum Tensile Strains (%)	Damage Category
(line 1)	Sagging	0	9.3	-0.011	0.003	Negligible
(line 2)	Sagging	0	21.2	-0.009	0.004	Negligible
(line 3)	Sagging	0	13.7	-0.009	0.003	Negligible

Note: * Tensile horizontal strains are +ve. Compressive horizontal strains are -ve.

Table 8: Section analysed, results for worst case tensile strain

A34 (line 2) examines the differential movements between this building and the adjacent building 116-126 Cannon Street (A33). It is a simplified line that represents both buildings' façades. The results along (line 2) can be seen in Figure 5 and Table 8 which shows that the area between A34 and A33 building is in a sagging mode, with very small tensile strains (negligible).

A34 (line 3) shows the movements between the façade and the bell tower. The orientation is shown in Figure 3. The vertical and horizontal Greenfield ground movements along the section of the building are shown in Figure 6. The displacement line between the building and the bell tower is in a sagging mode. The tensile strains are very small (Negligible) as shown in Table 8.

A34 (line 4) shows the façade of the bell tower that undergoes the most onerous maximum tensile strains. The tensile strains are very small (Negligible) as shown in Table 7.

The Stage 2 engineering assessment has predicted that the maximum tensile strain for the building falls within damage category 0. This corresponds to negligible damage in accordance with Table 2.

The maximum settlement of the building at foundation level is 10mm which occurs at the construction stage 1, is fairly uniform across the site.

5.2 Heritage and Structural Assessment

Following site inspection, assessment has been made using the following scoring methodology set out in Table 9.

Score	STRUCTURE Sensitivity of the structure to ground movements and interaction with adjacent buildings	HERITAGE FEATURES Sensitivity to calculated movement of particular features within the building	CONDITION Factors which may affect the sensitivity of structural or heritage features
0	Masonry buildings with lime mortar and regular openings, not abutted by other buildings, and therefore similar to the buildings on which the original Burland assessment was based.	No particular sensitive features	Good/Fair - not affecting the sensitivity of structural or heritage features
1	Buildings not complying with categories 0 or 2, but still with some sensitive structural features in the zone of settlement e.g.: cantilever stone staircases, long walls without joints or openings, existing cracks where further movements are likely to concentrate, mixed foundations	Brittle finishes, e.g. faience or tight-jointed stonework, which are susceptible to small structural movements and difficult to repair invisibly.	Poor - may change the behaviour of a building in cases of movement. Poor condition of heritage features and finishes. Evidence of previous movement.
2	Buildings which, by their structural form, will tend to concentrate all their movements in one location (e.g.: a long wall without joints and with a single opening).	Finishes which if damaged will have a significant effect on the heritage value of the building, e.g. Delicate frescos, ornate plasterwork ceilings.	Very poor – parlous condition of heritage features and finishes, severe existing damage to structure including evidence of ongoing movement. Essentially buildings where even very small movements could lead to significant damage.

Table 9: Heritage and structural scoring methodology

The results of the heritage assessment carried out for the building are summarised in Table 10.

SENSITIVITY OF THE STRUCTURE

The brick bell tower is taller and heavier than the rest of the building. If the ground is disturbed by tunnelling there is a risk that the tower will settle more than the rest of the building, crack the adjoining walls, and possibly tilt out of vertical. British Geographical Society sheet 256 indicates the outcropping stratum to be Alluvium overlying London Clay to considerable depth. For a solid foundation London Clay would be capable of carrying the building on shallow spread footings immediately below the basement. The bell tower would need a raft. Piles would not have been necessary but their use cannot be ruled out. Given the age of the tower, if piles were used they would have been timber but as such their depth would have been limited.

The three storey bay window will be sensitive to any movement; as such structures are a skeleton of mullions and lintels poorly held together by gravity and friction. Drawing nos. BSCU-DRG-CA1-N133-1-DR-C-0100 and 010 (both rev P01) show the building to be fully within the 1mm settlement contour and bracketed by two 10mm settlement contours.

There is a risk that the tower will tilt slightly, generally cracking the junctions between the tower and the adjoining walls, with racking of the bay-window elevation. Consideration should be given to the design of contingency measures such as temporary bracing of the bay window elevation during tunnelling. A methodology to ensure the building is in equilibrium before removing the bracing should be included. The bay window may crack at its joints, and pull away from the main external wall, requiring remedial strapping restraint.

Score: 2 – the building is likely to concentrate its movements in specific, sensitive locations due to its structural form

SENSITIVITY OF THE HERITAGE

This building still retains all its character to exterior elevations. The bell tower, its pediment, and bracketed clock are recognisable landmarks respectively at urban and street level. The few surviving internal features, all concentrated within east wing, are decorative cornices to rooms located to ground, first and second floor, original bay windows and sash window, plus some wooden panelling to meeting rooms. The highest heritage sensitivities are located to north east and south west corner rooms where surviving plaster cornices and bell tower are.

Other vulnerable features to exterior are the cornice to the tower, window architraves and stucco dressings, and the bay window. Should the tower tilt, the movement might throw the clock out of beat requiring its adjustment by a horologist.

Score: 1 - The overall heritage sensitivity to damage is low but elements such as plasterwork to principal office rooms, bay windows and stuccoed windows and bell tower are fragile and may react to small movements.

SENSITIVITY OF THE CONDITION

The exterior is in good condition, with no visible defects apart from ponding water in side parapet gutter, and efflorescence under grand cornice on tower. Interior condition is average, with bouncy timber floors, falling damp to ground and first floor side bay window, water damaged roof over spiral stairs, and water damaged ceiling over clock-room in tower. The external walls appear plumb and true, without cracks, or distortion of door and window openings. This indicates that the building is solidly founded and not suffering from differential settlement.

The suspended timber floors are variously rigid, bouncy, squeaky, or uneven, but not more than usual for old buildings, arising from miscellaneous causes such as notches for modern services, beetle, rot, previous structural alterations, overloading, etc.

Localised falling damp, water damage, and efflorescence are present in some walls, indicating lack of maintenance of parapet gutters and rainwater goods, due to their inaccessible locations. The basement is dry.

There was no access to the upper surfaces of the mansard roof or the tower.

Score: 0 - Building variously partitioned and refurbished with no major structural alterations. Localised dampness and general wear and tear due to lack of maintenance.

Table 10: Heritage and structural assessment

5.3 Total Score

The total score is the summation of the damage category, structural sensitivity, heritage sensitivity and condition sensitivity scores:

The damage category is 0

The structural sensitivity score is 2

The heritage sensitivity score is 1

The condition sensitivity score is 0

The total score for this building is 3

6 Conclusion

The Stage 2 engineering assessment has predicted that the maximum tensile strain falls within damage category 0 for 29 Martin Lane. However, specific heritage and structural assessment taking into account the location and extent of settlement and tensile strains indicates that there are specific areas of structural and heritage sensitivity to movement. This assessment has determined that the building has a total score of 3.

It is recommended that a Stage 3 assessment is undertaken to further consider the potential damage to the structural form.

The BSCU Environmental Statement considers the mitigation that could be needed, however, it is recommended that Stage 3 assessment is undertaken to verify how heritage finishes may respond and whether such mitigation is required.

7 References

- [1] LU Works Information WI 2300 Ground Movement version 3, 19-07-13.
- [2] LU Category 1 Standard: S1050 Civil Engineering - Common Requirements, Issue No. A7, Nov. 2013.
- [3] Mair R J, Taylor R N and Bracegirdle A (1993). Subsurface settlement profiles above tunnels in clays. *Géotechnique* 43, No. 2, pp. 315-320.
- [4] Mair R J, Taylor R N and Burland J B (1996). Prediction of ground movements and assessment of risk of building damage due to bored tunnelling. (In: *International Conference of Geotechnical Aspects of Underground Construction in Soft Ground*, London, pp. 713–718.
- [5] LU Guidance Document G0058 Civil Engineering Technical Advice Notes, Issue No. A17, Feb. 2013.
- [6] Burland J B (1995). Assessment of risk of damage to buildings due to tunnelling and excavation. *Proceedings: 1st International Conference of Earthquake Geotechnical Engineering*, IS Tokyo, 1995.
- [7] Mott MacDonald (2012). Bank Station building data sheets – A list buildings. N133-BCR-MMD-00-Z-DC-S-0003-S0-1.0.

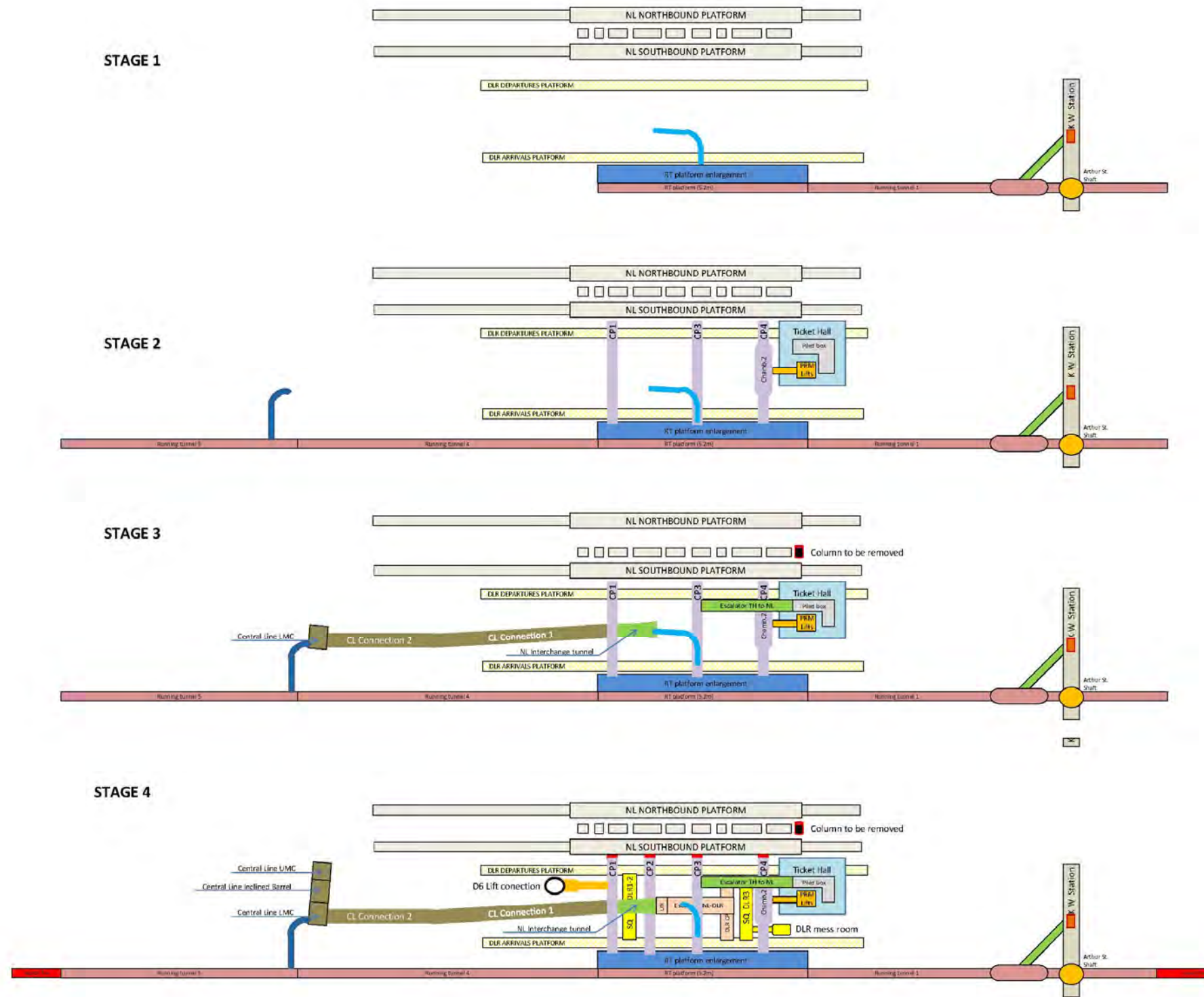


Figure 1: Construction Stage model



Figure 2: Location plan showing building location in relation to BSCU works

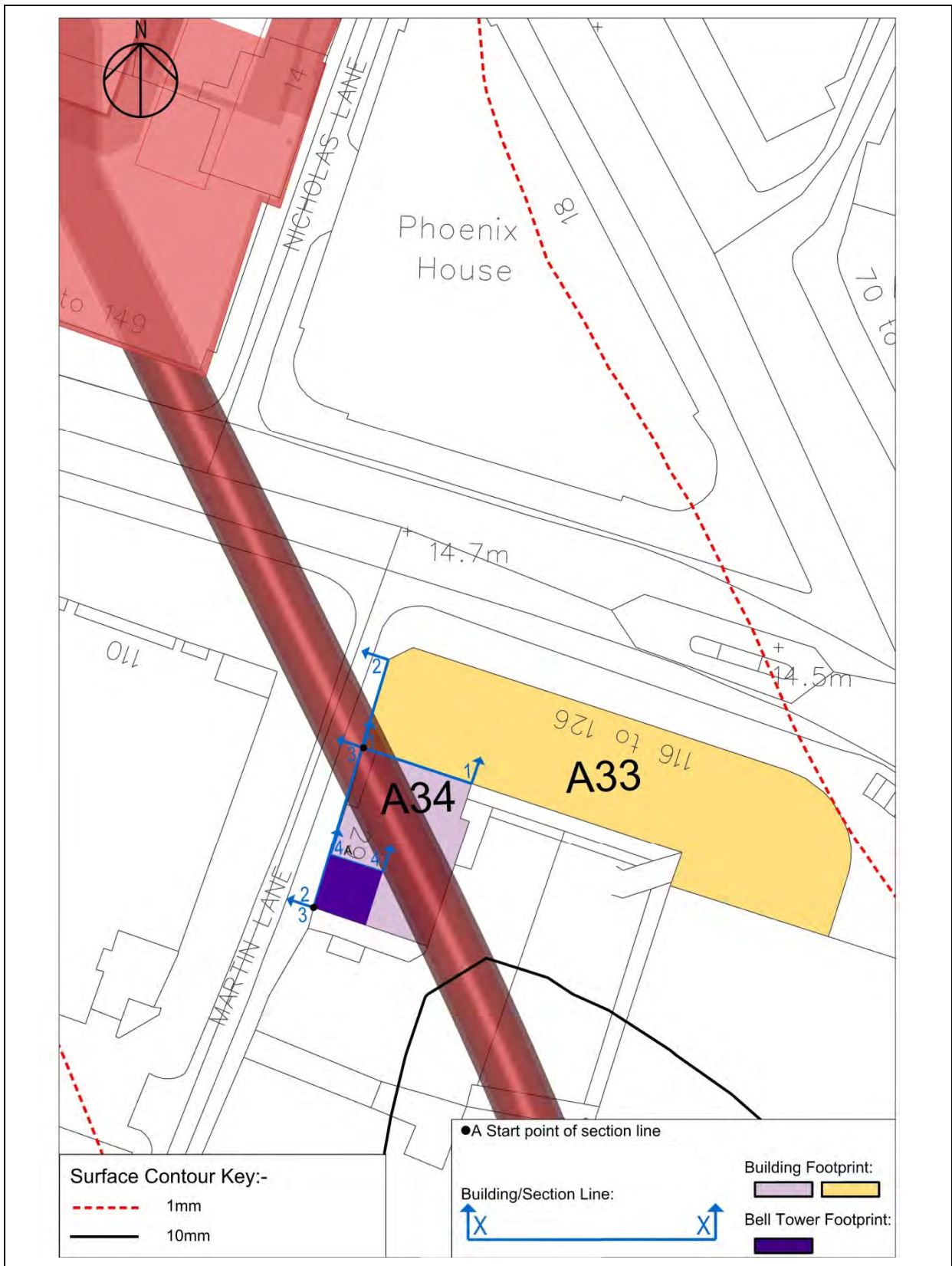
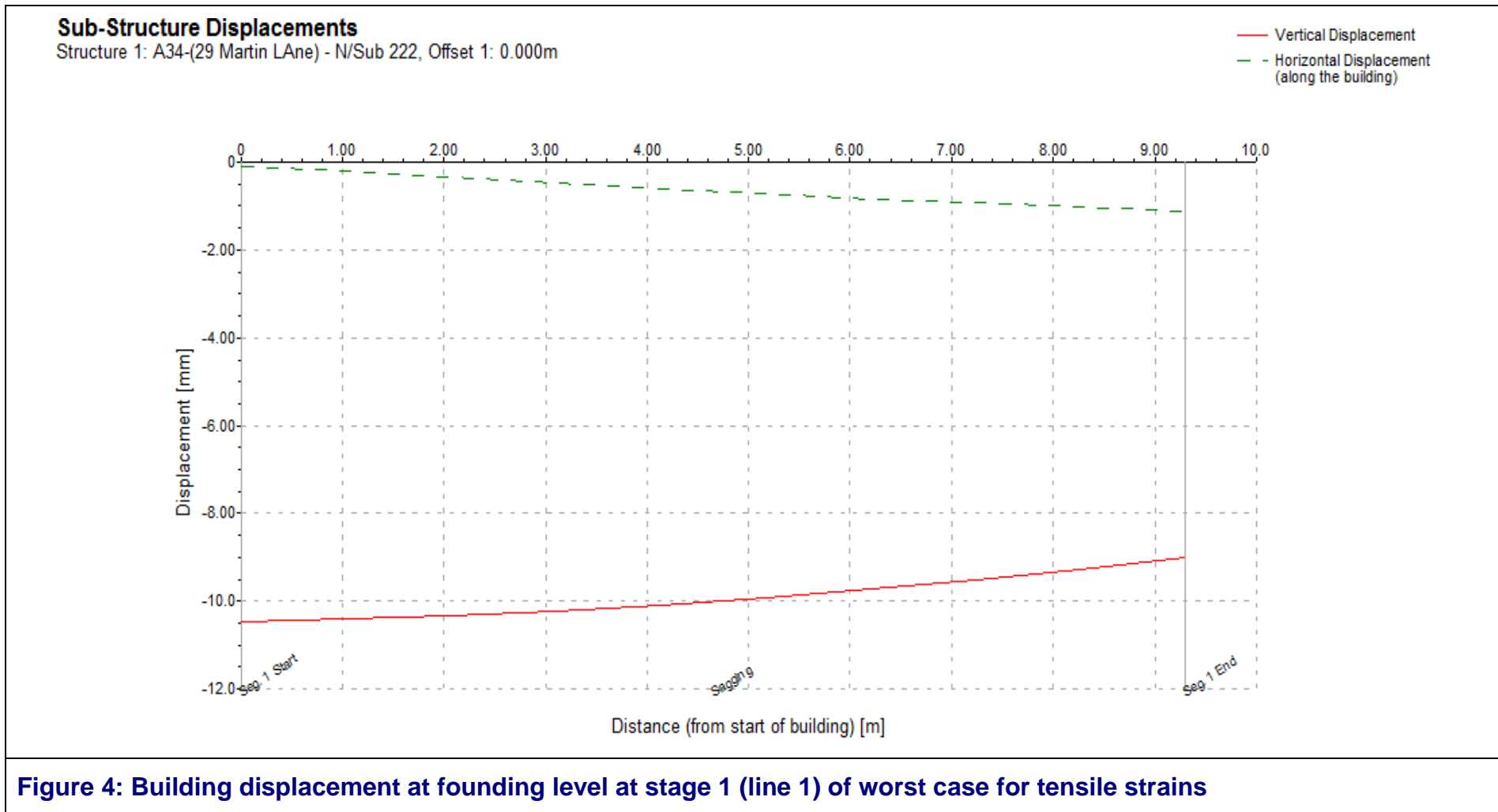
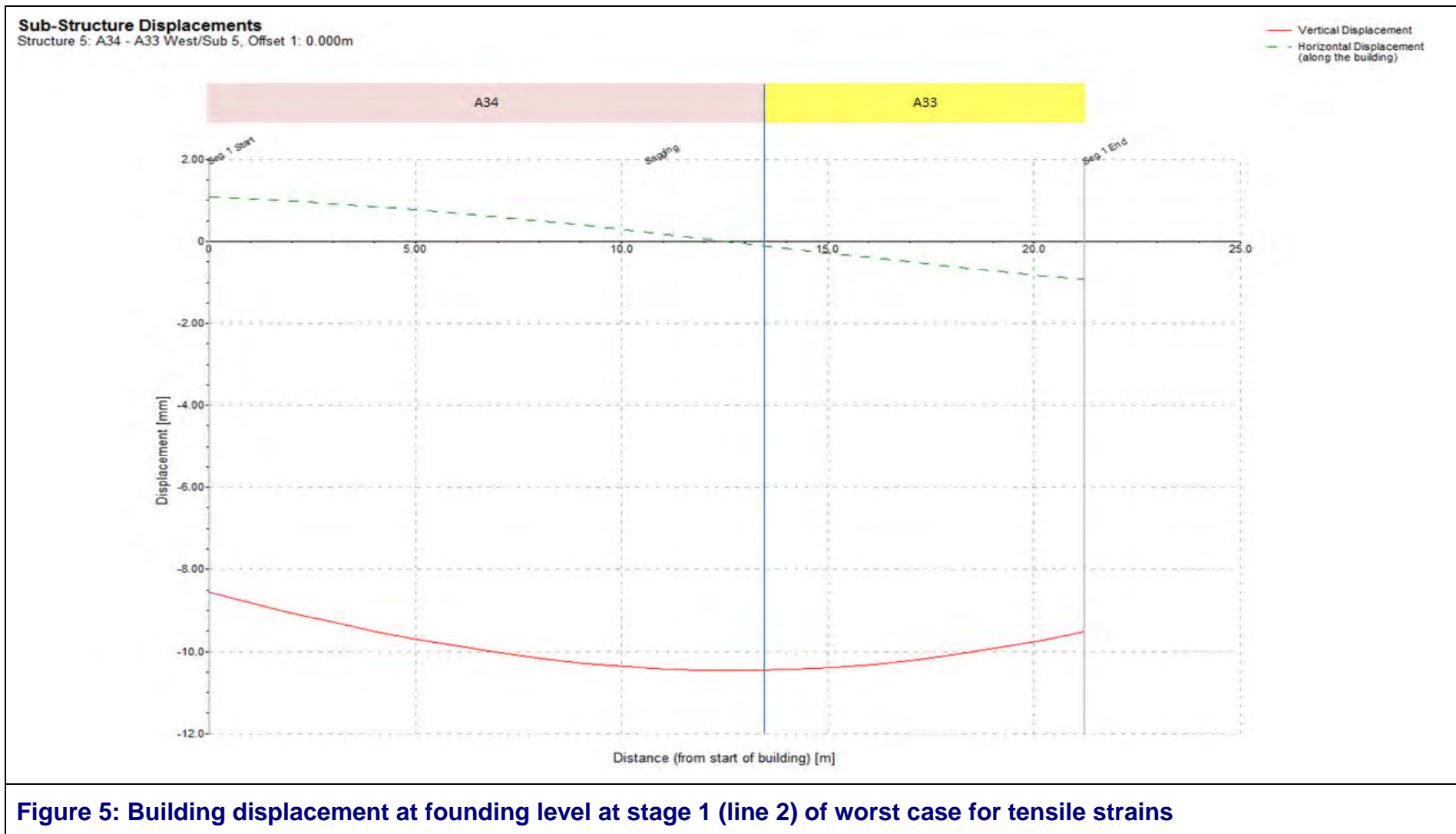


Figure 3: Building location, sections analysed and Settlement Contours at stage of worst case for tensile strains





Sub-Structure Displacements

Structure 4: A34-(29 Martin Lane) - W/Sub 225, Offset 1: 0.000m

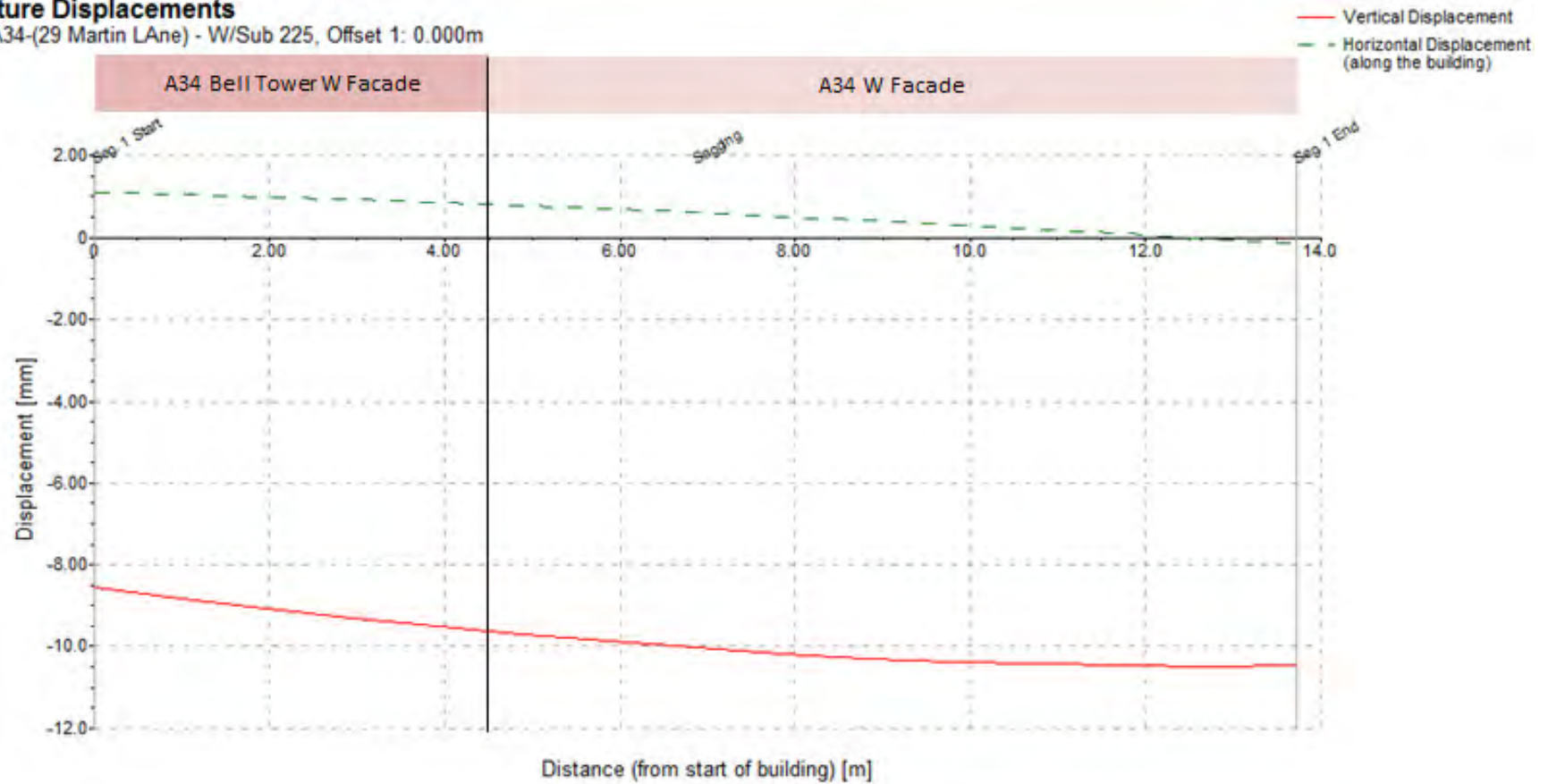


Figure 6: Building displacement at founding level at stage 1 (line 3) of worst case for tensile strains

Sub-Structure Displacements

Structure 7: A34 Bell Tower North/Sub 7, Offset 1: 0.000m

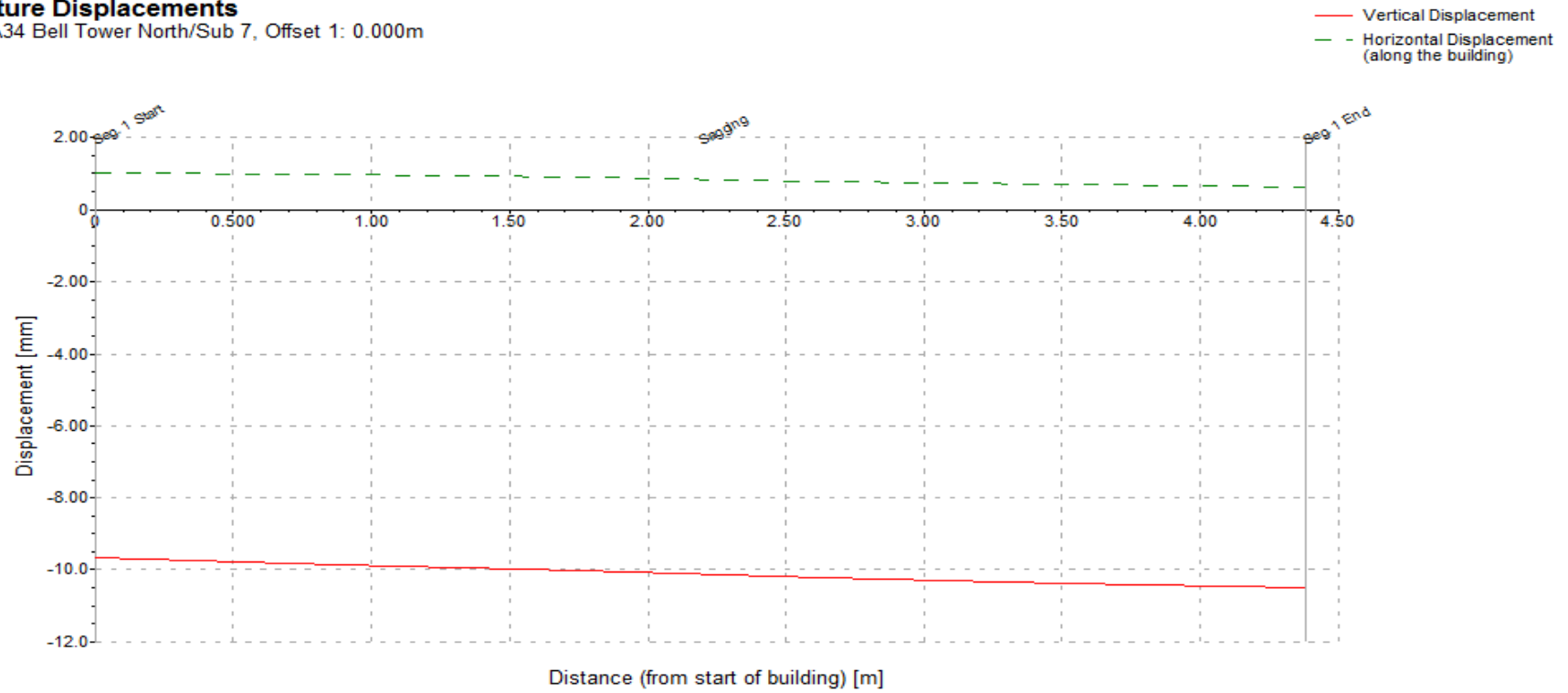


Figure 7: Building displacement at founding level (Bell Tower) at stage 1 (line 4) of worst case for tensile strains

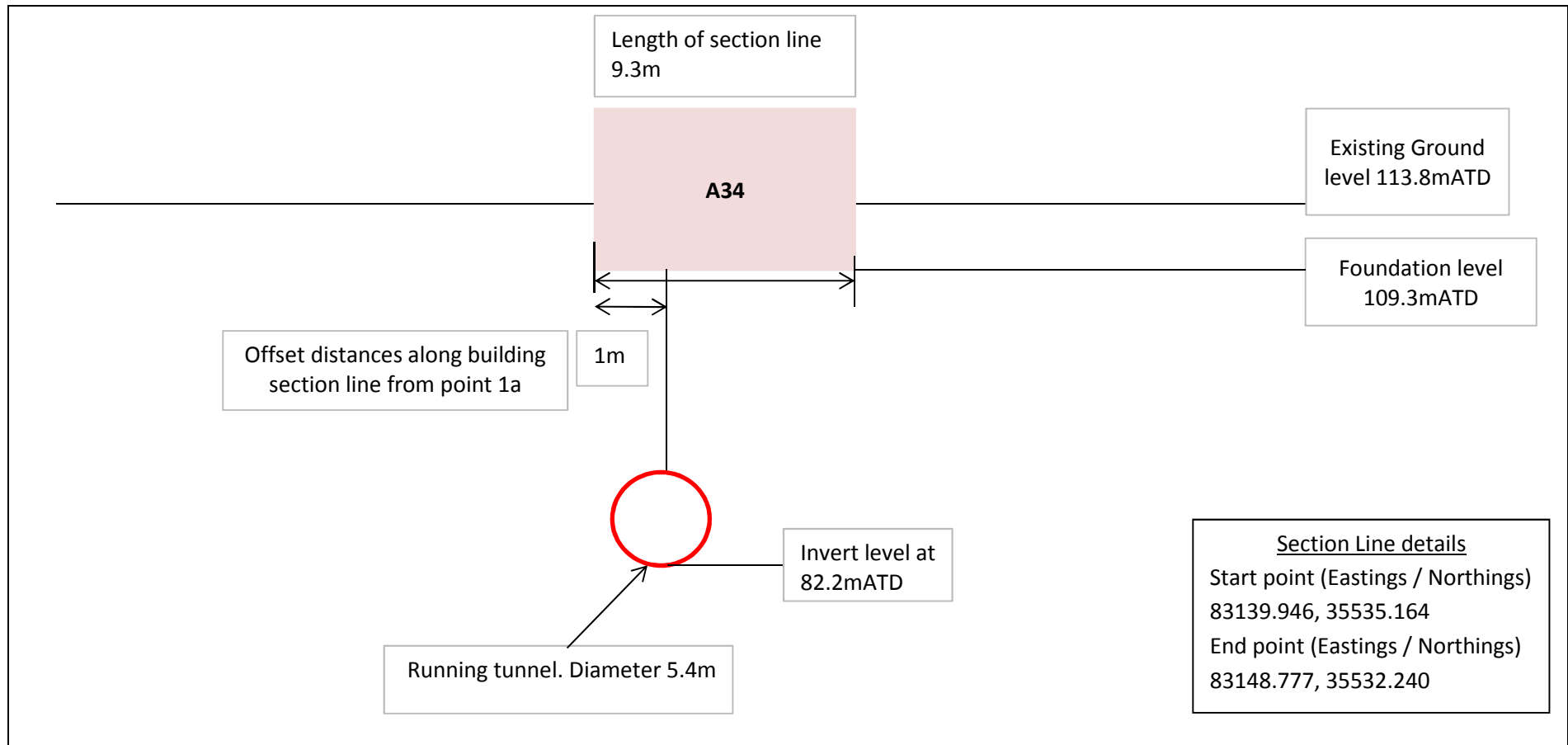
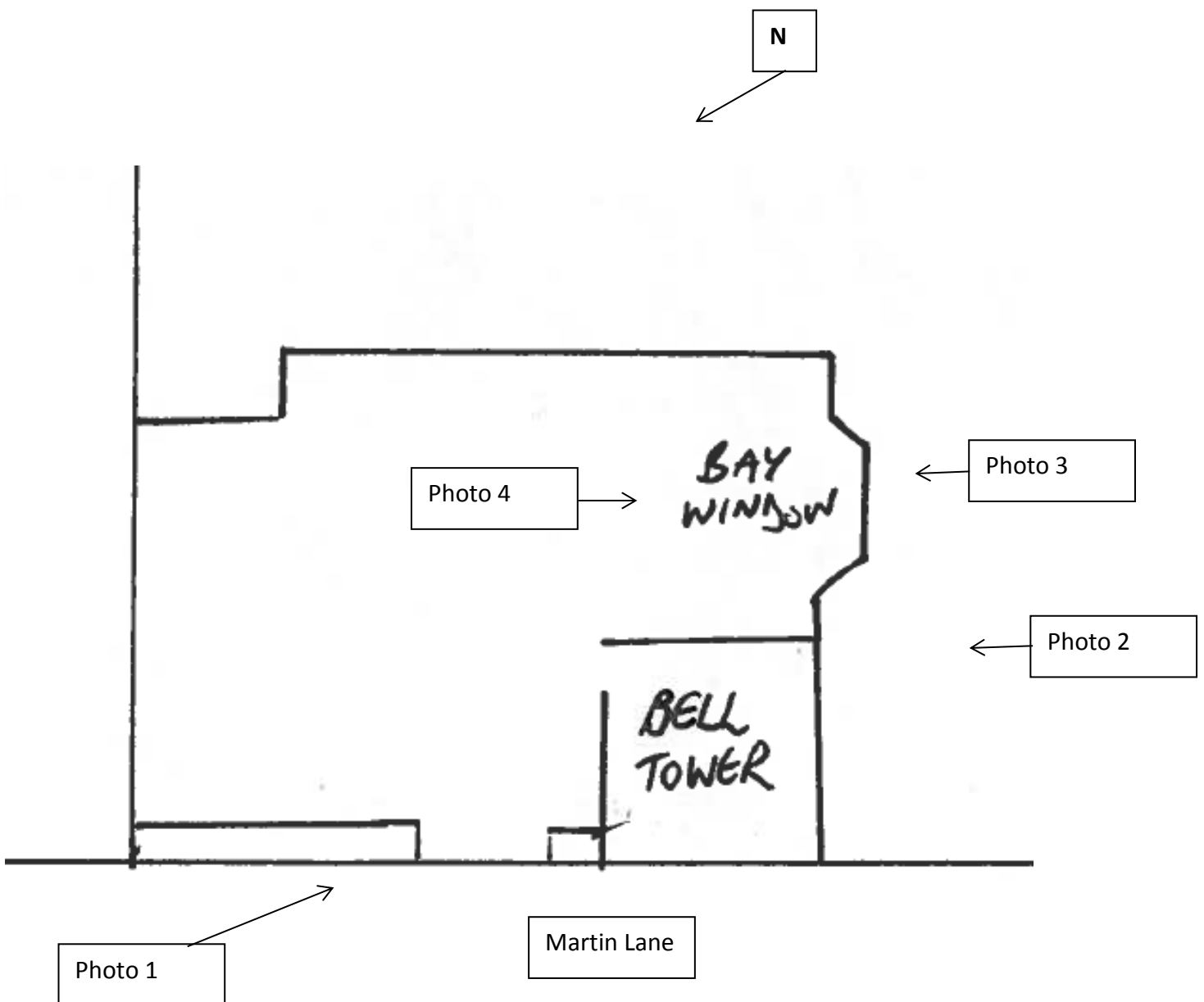


Figure 8: Diagrammatic cross-section of section (line 1) relative to tunnel position

Appendix 5: Photo Locator

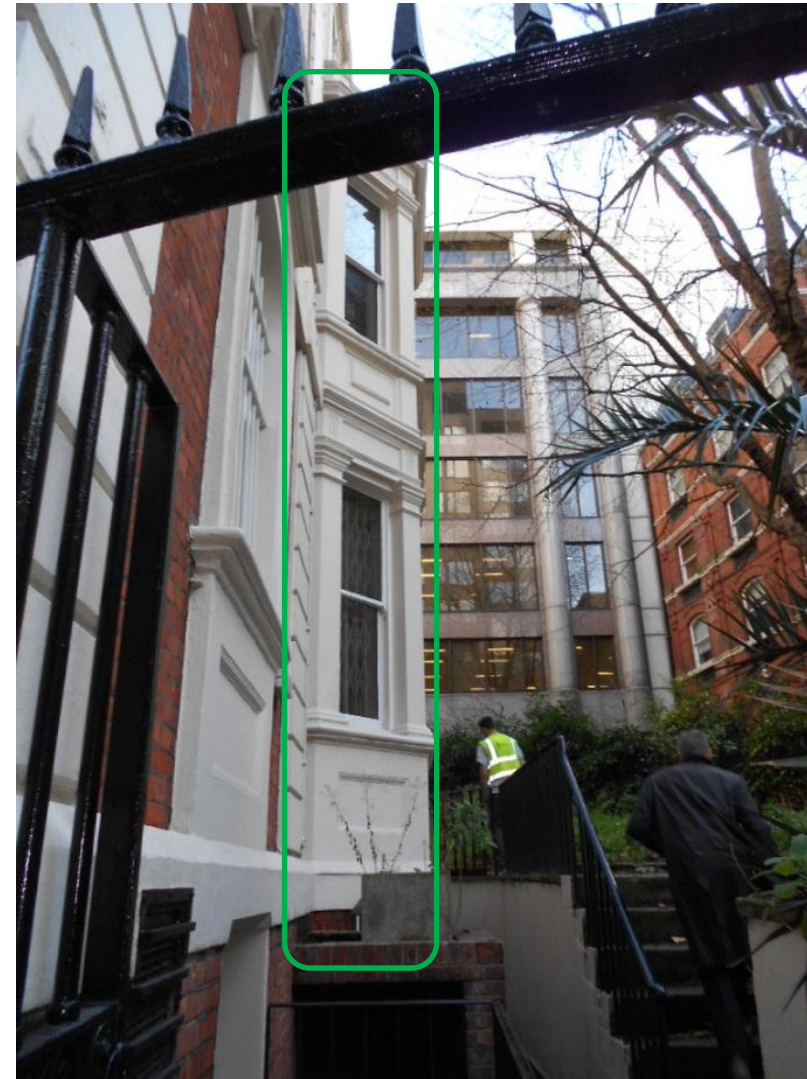
Sketch plan of 29 Martin Lane



Appendix 6: Areas of interest potentially affected by ground movement



Areas to ground and first floor on south elevation to be impacted by temporary support, with fixings to brickwork

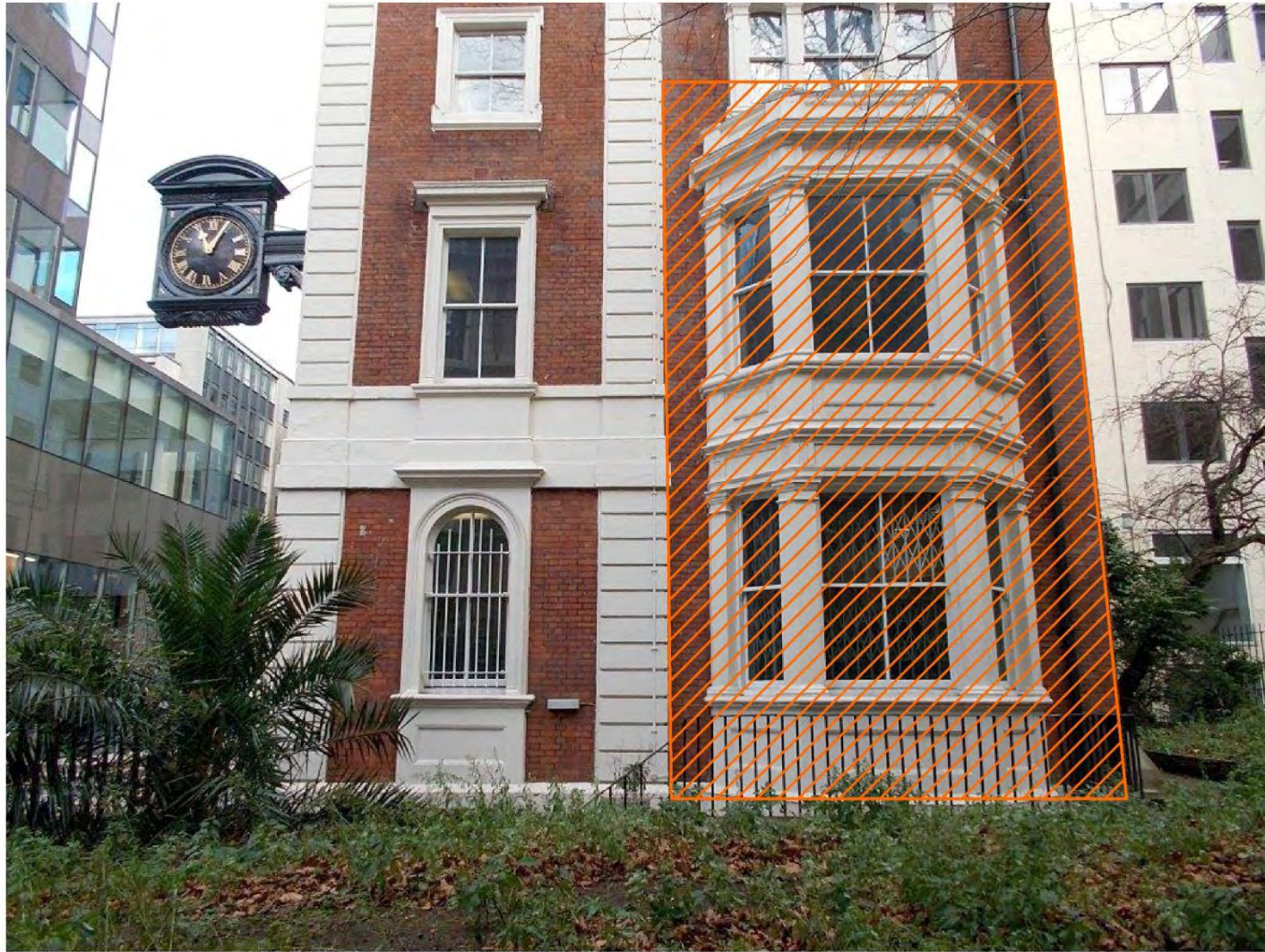


Basement external area on south elevation (viewed from west) below bow, where temporary support will be placed



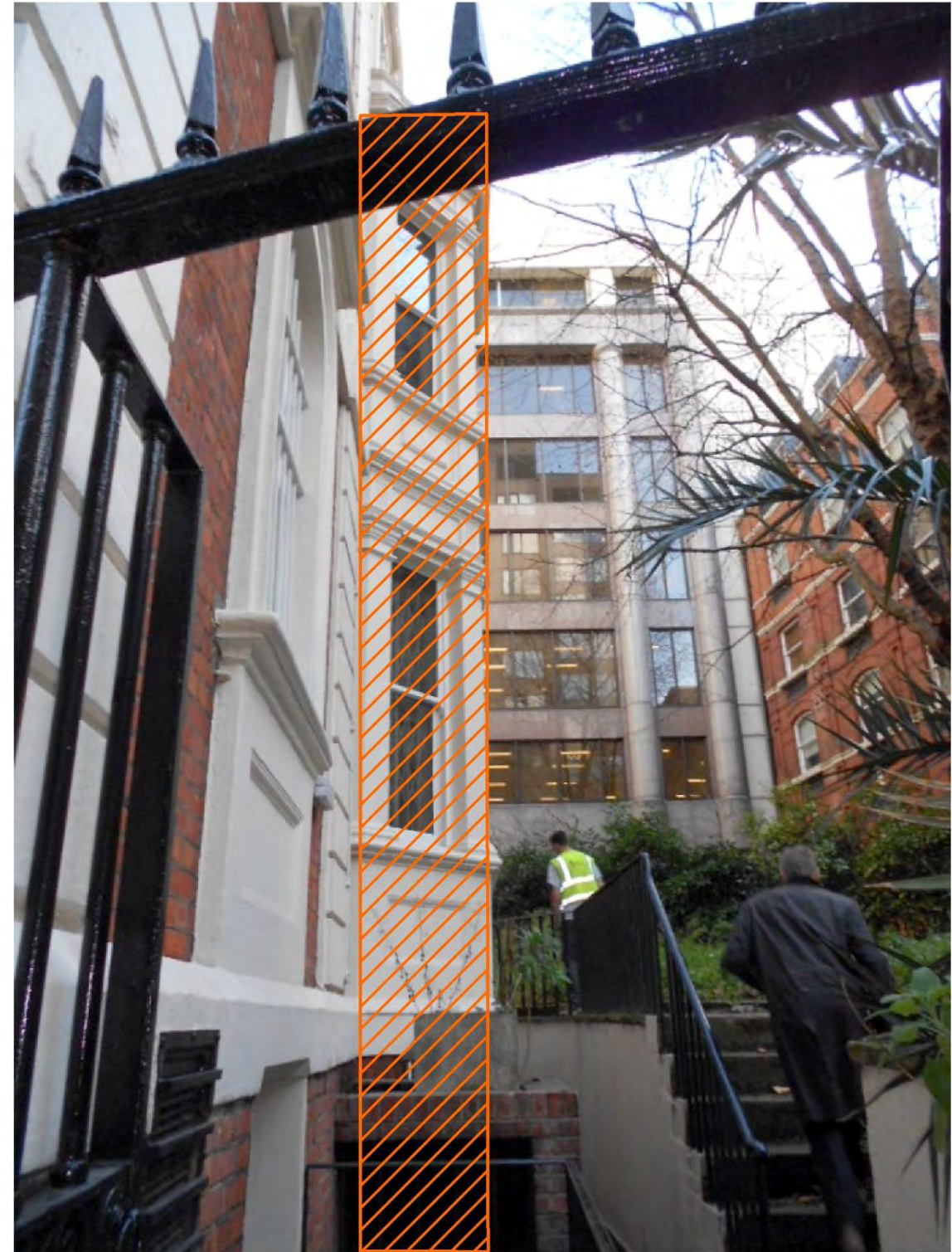
Internal view of first floor bay window

Appendix 7: Areas to be affected by protective works



Southern elevation

External areas potentially affected by protective works



Southern elevation,
photo taken from
west



Bay window internal view to the ground floor



Bay window internal view to the first floor. Note, decorative plasterwork will not be impacted by protective works

Internal areas potentially affected by protective works

