Bank Station Capacity Upgrade

1 King William Street Heritage Statement

September 2014

MAYOR OF LONDON

TRANSPORT FOR LONDON

EVERY JOURNEY MATTERS

Bank Station Capacity Upgrade

1 King William Street
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-002115

Limitations

URS Infrastructure & Environment UK Limited ("URS") has prepared this report for the use of Dragados and London Underground Limited in accordance with the Agreement under which our services were performed. No other warranty, expressed or implied, is made as to the professional advice included in this Report or any other services provided by URS.

Where the conclusions and recommendations contained in this report are based upon information provided by others it is upon the assumption that all relevant information has been provided by those parties from whom it has been requested and that such information is accurate. Information obtained by URS has not been independently verified by URS, unless otherwise stated in the Report.

The methodology adopted and the sources of information used by URS in providing its services are outlined in this Report. The work described in this Report was undertaken during May 2014 and is based on the conditions encountered and the information available during the said period of time. The scope of this Report and the services are accordingly factually limited by these circumstances.

Where assessments of works or costs identified in this Report are made, such assessments are based upon the information available at the time and where appropriate are subject to further investigations or information which may become available.

Certain statements made in the Report that are not historical facts may constitute estimates, projections or other forward-looking statements and even though they are based on reasonable assumptions as of the date of the Report, such forward-looking statements by their nature involve risks and uncertainties.

Table of Contents

1 Introduction

1.1.1 This Statement has been prepared to provide information in support of an application for listed building consent made by London Underground Limited at 1 King William Street, London, EC4. The application seeks consent for protective works to mitigate the effects of 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:

> Adjustment of existing internal façade fixings and insertion of additional ties and brackets to the Sherborne Lane elevation.

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 DLR providing step free access. 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.

The City of London Corporation Supplementary Planning Documents (SPDs)

2.1.14 The City of London Corporation has prepared a number of SPDs including those that have been prepared in respect of some of the City of London's conservation areas including that prepared for the *Bank Conservation Area* in 2012.

2.1.15 The document provides detailed analysis of the development and architectural character of the conservation area as well as highlighting significant streets and buildings that contribute to the character of the conservation area and the setting of specific heritage assets.

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 reproduced in Appendix 2 of this document.

4.1.2 This Grade II listed building is located within the Bank Conservation Area, which encompasses the heart of the City. The Bank Conservation Area is characterised as an area where buildings and streets are harmonised by their predominant use of solid masonry façades with regular punched openings, enriched by abundant classical modelling and surface detail. The area is also defined by the design and use of buildings for banking and associated commercial activities.

Photo 1: General view of 1 King William Street

4.1.3 1 King William Street is a banking and commercial building, built between 1921 and 1922 to designs by William Campbell-Jones and Alex Smithers for the London Assurance Company. Built of Portland stone which is channelled at ground floor and ashlar to the upper storeys, the main façade has five bays in a classical style, incorporating details such as giant pilasters, and cornices to the fourth floor and the eaves. The main entrance is to the north, at the corner of the building shown in photo 1 (location plan of photographs is provided in Appendix 7). The façade returns along Sherborne Lane and St Swithin's Lane, beyond which is a modern façade.

4.1.4 The building is viewed as part of a group including 5 King William Street and 1-6 Lombard Street, all of a similar scale and use. An elevation drawing of the King William Street façade, at Appendix 4, shows the classical detailing of the building.

4.1.5 Internally, historic features are retained to the King William Street side of the building, comprising a ground floor foyer with marble columns and plaster detail to the ceilings, and a third floor room with fine timber panelling which has been supplemented with inferior panelling. This section of the building has hollow clay tiles to its ceilings. Otherwise, the building had been subject to a façade retention scheme, and there are no further surviving internal heritage features.

4.1.6 1 King William Street is architecturally significant as an integral part of the historic townscape of prominent stone commercial and public buildings beginning at Bank Junction and flowing down King William Street. As such its setting incorporates Bank Junction and King William Street and these areas contribute positively to its significance.

5 Predicted or possible impacts of proposed BSCU works upon 1 King William Street

5.1.1 It is proposed that the new platform tunnel, Central Line link tunnel, and cross passages will be constructed directly beneath 1 King William Street. A plan showing the position of proposed and existing infrastructure in relation to 1 King William Street is included in Appendix 3.

5.1.2 At the current concept design stage, a conservative, reasonable worst case geotechnical assessment ('Stage 2' Building Damage Assessment included at Appendix 5) has been undertaken, indicating that there may be a maximum settlement of 79mm to the building, with the greatest displacement occurring towards the south-east at the Sherborne Lane elevation shown in photo 2.

5.1.3 The geotechnical assessment has been combined with a heritage and structural assessment, which has highlighted sensitivities in relation to the building. The differential settlement of almost 30mm across the building raises the potential for shear and strain (calculated maximum tensile strain of 0.069%) across the Sherborne Lane elevation in particular and the possibility of cracking to the King William Street façade.

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 modelling and analysis;
- modelling and analysis of soil structure interaction to refine assessment of settlements and building strains;
- 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 The Stage 2 Building Damage Assessment report concluded that predicted settlement is high along the Sherborne Lane elevation, with differential movements. It is likely that cracks will be concentrated at joints, junctions and openings, and the cracking may cause a permanent impact to the historic fabric. This may damage the material and aesthetic significance of the building.

Photo 2: Section of Sherborne Lane elevation in the location of the largest predicted settlement

Photo 3: Remaining historic interior - decorative plaster to the ceiling in the foyer

5.1.7 The decorative plasterwork to the ceiling in the foyer (shown in photo 3) is also sensitive to small movements, however this is in good condition and fine cracking would be easily repairable.

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 1 King William Street. Therefore, proposals for protective works are outlined within the following section and the impacts of these protective measures are discussed. Further investigations of sensitive elements, including survey and examination of survey plans, will continue to be undertaken during detailed design of the BSCU project.

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 refined geotechnical modelling and 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 Subject to investigation by intrusive survey, the Sherborne Lane façade may require the adjustment or enhancement of existing fixings in areas where the largest movements are predicted to occur. This would be achieved by opening up to the internal finishes of the building, and insertion of additional ties and brackets to the façade. The locations where strengthening is expected to be required are shown in Appendix 8.

Impact of the works

6.1.5 The level of material impact from the proposed adjustment and insertion of façade fixings is dependent on the location of the works. Detailed design will be focused on opening up i.e. localised removal of internal finishes (plaster or floorboards) to expose the structure behind for inspection in areas where there is minimal historic internal fabric, for instance to rooms with modern finishes. The area of the building with potential to be impacted is shown in Appendix 8.

6.1.6 Assuming that this can be achieved to integrate a useful pattern of strengthening, the impact on the building will be minimal as the modern fabric will be made good around the fixing areas on a like for like basis. In the event that it becomes necessary for historic fabric to be disturbed, opening up will avoid detailed decorative plaster finishes. Again, making good will be on a like for like basis, reducing aesthetic impact, so that the temporary removal of fabric does not have a long term effect on the heritage significance of the building.

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

Justification for the protective works

6.1.8 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.

6.1.9 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 shall 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 DLR trains; and
- improving emergency fire and evacuation protection measures.

6.1.10 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.

6.1.11 The proposals contained within this document are intended to mitigate adverse impacts of the BSCU works related to settlement at 1 King William Street. The protective works proposals themselves will result in a change to historic building fabric to a small extent. However, the protective works are intended to prevent damage to the listed building and enable the building to retain its heritage significance.

6.1.12 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 and strains on the basis of the concept design stage to date, combined with Stage 2 Building Damage Assessment of 1 King William Street predicts potential settlement of up to 79mm and maximum 0.069% tensile strain to the south-east of the building, as a result of the new infrastructure being constructed directly below the building.

8.1.2 It is considered that the Portland stone façade on Sherborne Lane may be sensitive to the predicted settlement, and therefore protective works are proposed to provide additional fixings of the façade.

8.1.3 It is acknowledged that these protective works will lead to a temporary adverse impact on the significance of the building but that this impact will be outweighed by the benefits of the protective works in providing structural support and preventing substantial damage to the remaining historic elements of the building.

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 to the façade fixings which will not devalue its aesthetic, 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) p526

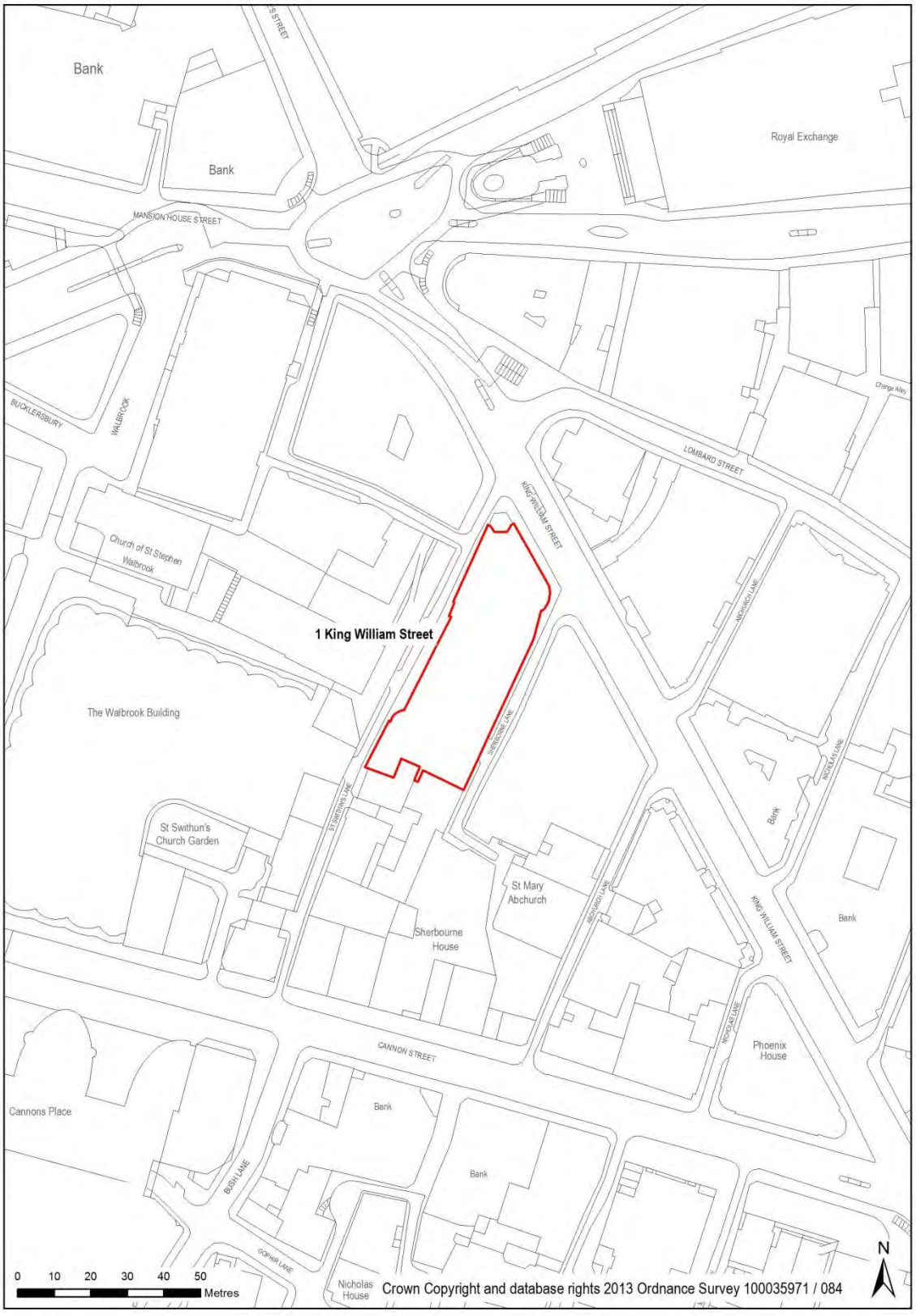
Building Damage Assessment Report ‘A11’ (2014)

Alan Baxter Associates ‘Gazetteer’ (2012)

Structural Investigation by Sandberg Consulting Engineers (2013)

Appendices

Appendix 1: Location Plan



Appendix 2: Listed Building Description

List entry Number: 1252015

Location 1, KING WILLIAM STREET

Grade: II

Date first listed: 15-May-1990

UID: 434936

Details KING WILLIAM STREET TQ 3281 SE 10/331 No 1

II GV

Bank with offices over. 1921-2 by William Campbell-Jones and Alex Smithers for the London Assurance Co. Portland stone, chanelled at ground floor, ashlar to upper, facing a steel frame with staircases and vaults in reinforced concrete. Slated mansard roof with stepped dormers. 5 storeys, attics and semi-basement. Main facade 5 windows. Classical style on a triangular site. Semi-basement with large metal framed windows of frosted square panes with margins at edges and centre a top frieze of small rectangular panes; fronted by cast iron railings having simplified urn finials. Ground floor openings architraved with festooned console keystones; recessed metal framed windows with margin glazing. Plain band at first floor level supporting giant pilasters, with cartouche capitals, at angles which carry the main entablature with projecting bracketed cornice at 4th floor level and continued around the building. Smaller first floor windows giving mezzanine effect, each with balustraded balcony and separated by pilasters with wreaths terminating with entablature above 2nd floor windows, each with alternating cornice or pediment on console brackets. 3rd floor windows architraved, 4th floor attic storey plain; moulded eaves cornice.

Main entrance at right hand angle being 4 storeys running into the building on an axis canted at an angle to the St Swithins have elevation. Hexagonal ante- porch with openings on 3 sides having plain surrounds with console brackets supporting aedicules over; steps within, ceiling with sunken dome; doorway altered. Left hand angle curved with 3 windows; 2nd floor centre opening, a round-arched niche enriched with a festoon. At roof level, a pilastered 2-storey rotunda with copper dome resting on enriched copper brackets.

The shape of the site was exploited to create interestingly shaped rooms, in particular on the 1st and 2nd floor. Planning on an axial line took full advantage of the pen area on the south. The battered ground floor allowed more light into the building. No 1 forms a group with Nos 3-7 King William Street and Nos 1-6 Lombard Street.

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.

N

1:1250 @ A3

25m 0 25m 50m 75m 100m 125m

PROJECT
BANK STATION
CAPACITY UPGRADE PROJECT

PURPOSE OF ISSUE
FOR INFORMATION

TITLE
1 KING WILLIAM STREET
EXISTING AND PROPOSED INFRASTRUCTURE

DRAWING NUMBER
BSCU-DRA-MAC-N133_Z-DR-T-0313

A3

CITY OF LONDON

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

Existing Cruciform Area

Existing Triplication Area

Central Line

Lombard Street Lifts

New Escalator ES2 Up to Whole Block Station Entrance

Existing Northern Line Northbound Platform

Existing Northern Line Northbound Tunnel

Existing Northern Line Southbound Tunnel

New Northern Line Southbound Running Tunnel From Moorgate

New Northern Line Southbound Running Tunnel Towards London Bridge

New Station Entrance

New Escalator ES3 Down to DLR

New Northern Line Southbound Platform

New Central Line Link Moving Walkways

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.

1:1250 @ A1

25m 0 25m 50m 75m 100m 125m

PROJECT
BANK STATION
CAPACITY UPGRADE PROJECT

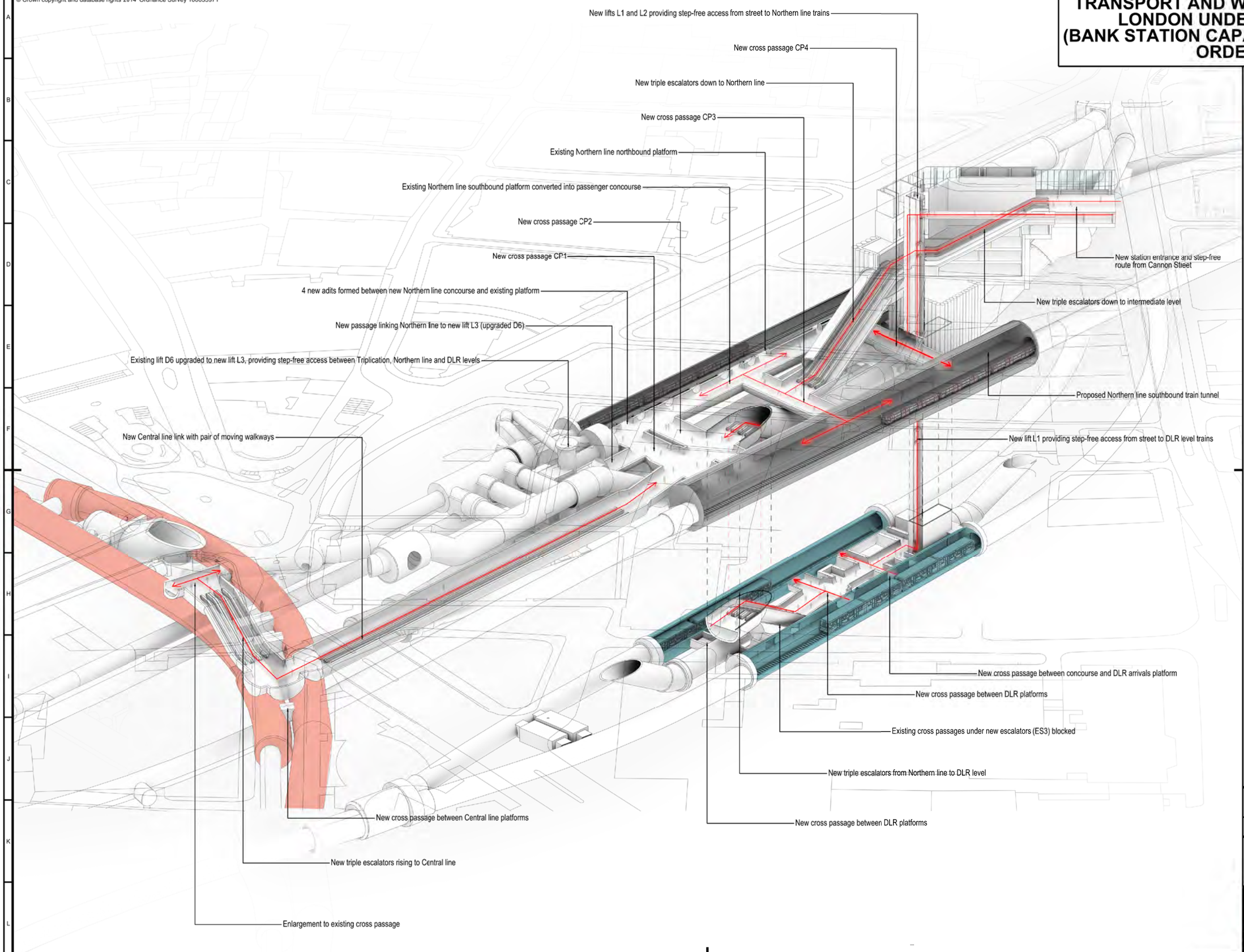
PURPOSE OF ISSUE
PLANNING DIRECTION

TITLE
EXISTING & PROPOSED
INFRASTRUCTURE

DRAWING NUMBER
BSCU-DRA-MAC-N133_Z-DR-T-9001

A 1

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

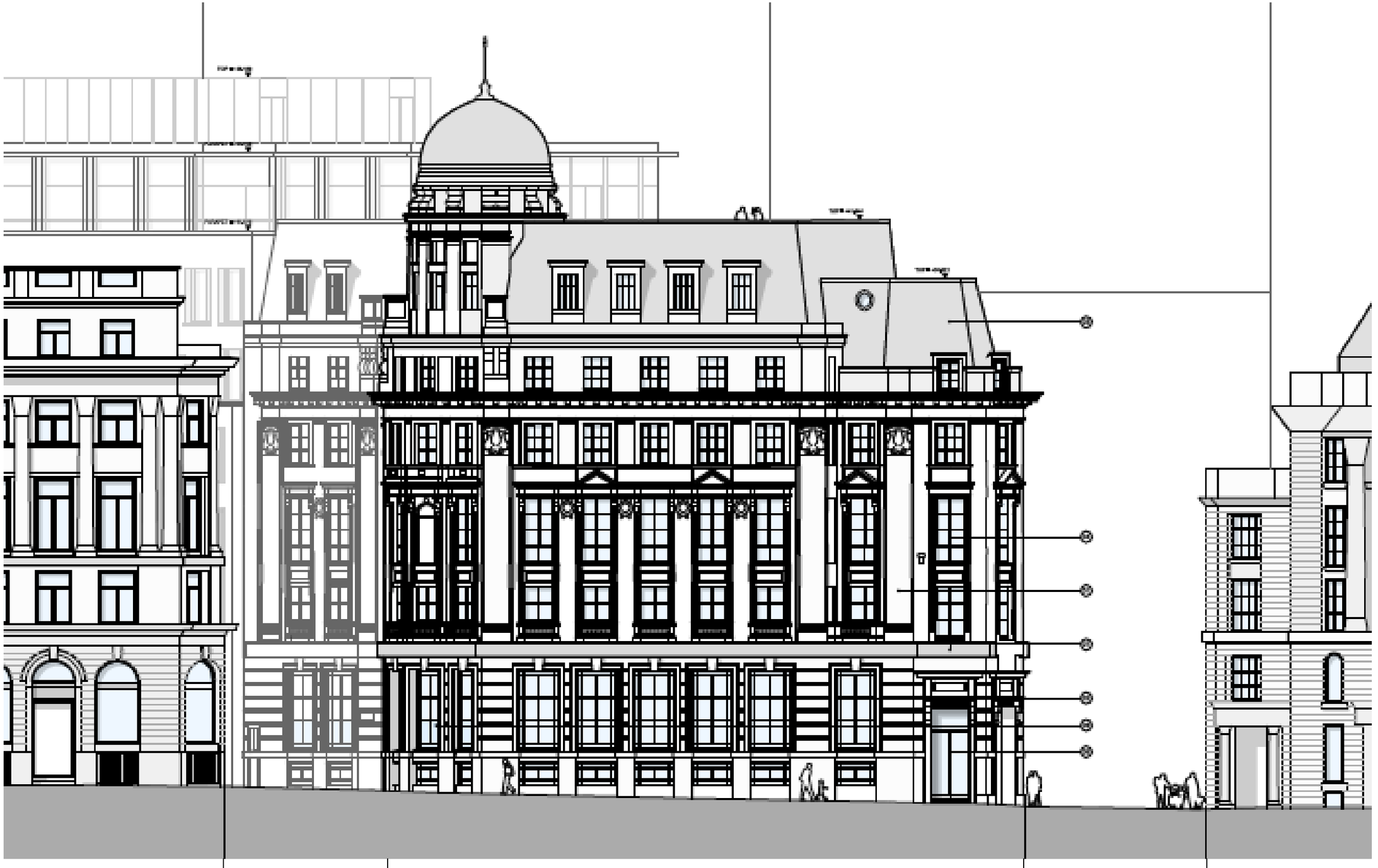
TITLE
3D VISUALISATION
PROPOSED STATION INFRASTRUCTURE
& CIRCULATION ROUTES

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

A1

Appendix 4:

Drawn elevation, King William Street façade



5 King William Street

1 King William Street, Sherborne Lane elevation

1 King William Street, King William Street elevation

1-6 Lombard Street

Appendix 5: Building Damage Assessment Report

LUL Bank Project Office
10 King William Street
London EC4 N7TW

Bank Station Capacity Upgrade

Building Damage Assessment Report

Building A11

1 King William Street

URS-8798-RPT-G-001175

Prepared by:	Lisa Perkins Assistant Geotechnical Engineer	L. Perkins	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

Document History

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

For the status of this document, please refer to the Building Damage Assessment Report Register (URS-8798-RGT-001229)

Consultation:

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

Contents

FIGURES

TABLES

Introduction

This report summarises the results of a Stage 2 damage assessment for 1 King William Street, Ref A11.

Stage 2 damage assessments are undertaken for all listed 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 updated engineering 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..

1 The Building

1.1 General Information

No. 1 King William Street is at the junction of St Swithin's Lane and King William Street. The building was originally designed by Campbell Jones , Son and Smithers (1921-22) before undergoing redevelopment by architect GMW Partnership (1996). This extended the building South between St Swithins lane and Sherbourne Lane.

The building is a seven storey structure with three levels below ground. The building was redeveloped in the 1990s retaining the Portland stone façade and the internal steel framed column elements. The building is confirmed as steel framed with a raft foundation. 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	A11
Location	King William Street
Address	1 King William Street
Building Type	Steel / concrete framed
Construction Age	1921-22 (Refurbished 1996-1998)
No. of Storeys	7
Basements	3
Eaves Level (mATD)	135.3
Foundation Type	Raft
Ground Level (mATD)	114.4
Listed Grade	II
Note: Levels given are in metres above Tunnel Datum, m ATD. 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

1.2 Building Description

1 King William Street is a bank and commercial building, built between 1921 and 1922 to designs by William Campbell-Jones and Alex Smithers for the London Assurance Company. Built of Portland stone which is channelled at ground floor and ashlar to the upper storeys, the main façade has five bays in a classical style, incorporating details such as giant pilasters to the first floor, and cornices to the fourth floor and the eaves. The main entrance is to the north, at the corner of the building. The historic façade returns for approximately six bays along Sherborne Lane and St Swithin's Lane, beyond which is a modern façade.

Internally, historic features are retained to the King William Street side of the building, comprising a ground floor foyer with marble columns and plaster detail to the ceilings, and a third floor room with fine timber panelling which has been supplemented with inferior panelling. This section of the building also has hollow clay tiles to its ceilings. Otherwise, the building had been subject to a façade retention scheme, and there are no further internal heritage features.

There are areas under the building with two and three levels of basement.

2 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]. The assessment has been conservatively carried out assuming the whole building is founded at the third basement level since this will indicate higher movements.

An additional displacement line (line 3) was drawn to assess movements between this building and the adjacent building A10, as shown in Figure 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).

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

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. This strain is used to determine the damage category based on the classification system proposed by Burland[6] and in accordance with S1050 Civil Engineering – Common Requirements[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

3 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, K=0.5 is used in accordance with LU Works Information 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
1 King William Street	101.27*	34	12.5
Note: Where E / G is the ratio of Young's modulus to shear modulus of the deep beam representing 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	83.5	5.4	1.5
Square works adits	75.8 to 95.3	4.1 to 7.8	2.5
Platform enlargement	85.5	9.64*	1.5
Escalator barrels	Inclined	8.3 to 8.4	1.5
Tunnel to D6 lift	86.2	5.9	1.5
NL Interchange tunnel	86.5	8.4	1.5
Central Line Connection	Inclined (87.6 to 89.2)	8.6	1.5
Note: * Cross section of the tunnel is oval in shape. Presented diameter is for equivalent circular area. Low Level Sewer 2 passes beneath the building. The sewer comprises a 3m diameter cast iron pipe with an invert level of ~94.7mATD.			

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 Arthur St shaft is remote and its construction will not contribute to ground movements at this building

The Xdisp model filenames used to undertake this assessment are:

- A11 - Stage 4
- A11 - Stage 3
- A11 - Stage 2
- A11 - Stage 1

4 Results

4.1 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 (%)
A11 (line 1)	61	0.054
A11 (line 2)	50	0.053
A11 (line 3)	63	0.057*
Note * This is strain from an extended line which is not applicable to the building		

Table 6: Building response at most onerous intermediate stage - Construction Stage 3

Section	Maximum Settlement (mm)	Maximum Tensile Strains (%)
A11 (line 1)	79	0.069
A11 (line 2)	51	0.053
A11 (line 3)	79	0.070*
Note * This is strain from an extended line which is not applicable to the building		

Table 7: Building response at end of construction stage

The results of the assessment show that the construction Stage 4 is the critical stage for this building. At this stage, section A11 line 1 experiences the most onerous combined tensile strain (0.069%). The orientation is shown in Figure 3. The vertical and horizontal Greenfield ground movements along section line 1 are shown in Figure 4.

Figure 5 and Table 8 show the strains between the two adjacent buildings are in hogging mode. This could induce cracking at the junction between the two buildings. The maximum tensile strains in this area (line 3) (0.070%) result in a very slight damage category.

The relative position of the building and tunnels along section line 1 is shown in Figure 6. 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)	Hogging	0.0	10.6	0.026	0.030	Negligible
	Sagging	10.6	36.8	-0.049	0.069	Very Slight
	Hogging	47.5	13	0.025	0.029	Negligible
(Line 3)	Hogging	0.0	10.5	0.026	0.030	Negligible
	Sagging	10.5	36.0	-0.051	0.070	Very Slight
	Hogging	46.6	48.9	0.019	0.051**	Very Slight

Note: * Tensile horizontal strains are +ve. Compressive horizontal strains are –ve.
** This is strain from an extended line which is not applicable to the building

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

It may be noted that the results presented above indicate that the tensile strain is towards the top end of the range for Very Slight classification, and within 10% of the Slight range. Given the lack of absolute certainty on the building characteristics and the potential for minor changes to BSCU works through the Detailed Design phase, it is necessary to take a conservative view on the building damage classification. As such the classification for this building is adjusted to Slight and damage category 2 in accordance with Table 2.

The maximum settlement of the building at foundation level (line 1) occurs at the end of construction and is 79mm.

4.2 Heritage and Structural Assessment

Following site inspection, assessment has been made using the 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 original northern part of the building on King William Street, built in the 1920's, consists of a steel frame with hollow-pots slabs. The façade is original and consists of steel columns built into the solid brick external walls. There is stone cladding fixed to the outside. During the 1990's development some of the internal structure to this part of the building was replaced with new steel beams/columns and holorib slabs. It also appears that some internal masonry walls have been replaced with steel cross bracing. The southern part of the building (1990's) is a reinforced concrete frame with holorib slabs and a steel mansard roof. The steel and reinforced concrete frames have an inherent degree of flexibility and should be able to cope with the expected movement without significant damage to the primary structure or any reduction in load carrying capacity. Due to the high magnitude of the predicted settlements it is likely that some cracking will occur to the masonry façade. The stone cladding fixings should be investigated to ensure they remain secure throughout the works. Also the foundations are unknown at this time and should be investigated to determine the foundation type and depth.
Score: 0 - The frame itself is not considered particularly sensitive but the magnitude of movement may cause cracking in ashlar of the façade, concentrated on openings and joints.
Sensitivity of the heritage
Due to the loss of most of the heritage features of this building, heritage sensitivities are concentrated on the stonework of the façade, particularly decorative elements, and the plasterwork of the ground floor foyer. The plasterwork of the foyer, as one of the few remaining heritage features of the building, is sensitive to the predicted crack widths as they may cause loss of historic fabric. The Portland stone façade is finely jointed, with low tolerance of the level of settlement predicted on the Sherborne Lane elevation. Cracking is likely to be concentrated at joints, but where these cannot accommodate the movements, cracks across stone panels, or in areas of decoration, may have a permanent aesthetic impact once repaired. In extreme cases, cracking may cause failure of elements of the stonework or its fixings to the internal structure.
Score: 1 – The brittle and finely jointed finishes of the building may be susceptible to damage due to the predicted settlements, and at worst case some loss of historic fabric may occur.
Sensitivity of the condition
It is expected that following the current refurbishment scheme taking place within the building, all elements will be in good condition at the time of the BSCU Works.
Score: 0 – the condition of the building will not exacerbate potential structural or heritage sensitivities

Table 10: Heritage and structural assessment

4.3 Total Score

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

The damage category is 2

The structural sensitivity score is 0

The heritage sensitivity score is 1

The condition sensitivity score is 0

The total score for this building is 3

5 Conclusion

The Stage 2 engineering assessment has predicted that the maximum tensile strain falls within damage category 2 for 1 King William Street. Specific heritage and structural assessment taking into account the location and extent of settlement and tensile strains indicates that the building may be sensitive to the predicted movements. 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 form of the building.

The predicted settlement is high along the Sherborne Lane elevation, with steep differential movements. It is likely that cracks will be concentrated at joints, junctions and openings, and the damage may cause a permanent impact to the historic fabric. The internal plasterwork to the foyer is also sensitive to small movements.

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 and the historic fabric may respond and whether such mitigation is required.

6 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] Selemetas.D et al (2005). The response of full scale piles to tunnelling. Geotechnical aspects of underground construction in soft ground (Bakker et al (eds)) pp.763-769.

[8] New B M and Bowers K H (1994). Ground movement model validation at the Heathrow Express trial tunnel. Proc. Tunnelling 1994. IMM, London, pp 301-327

LUL Bank Project Office
10 King William Street
London EC4 N7TW

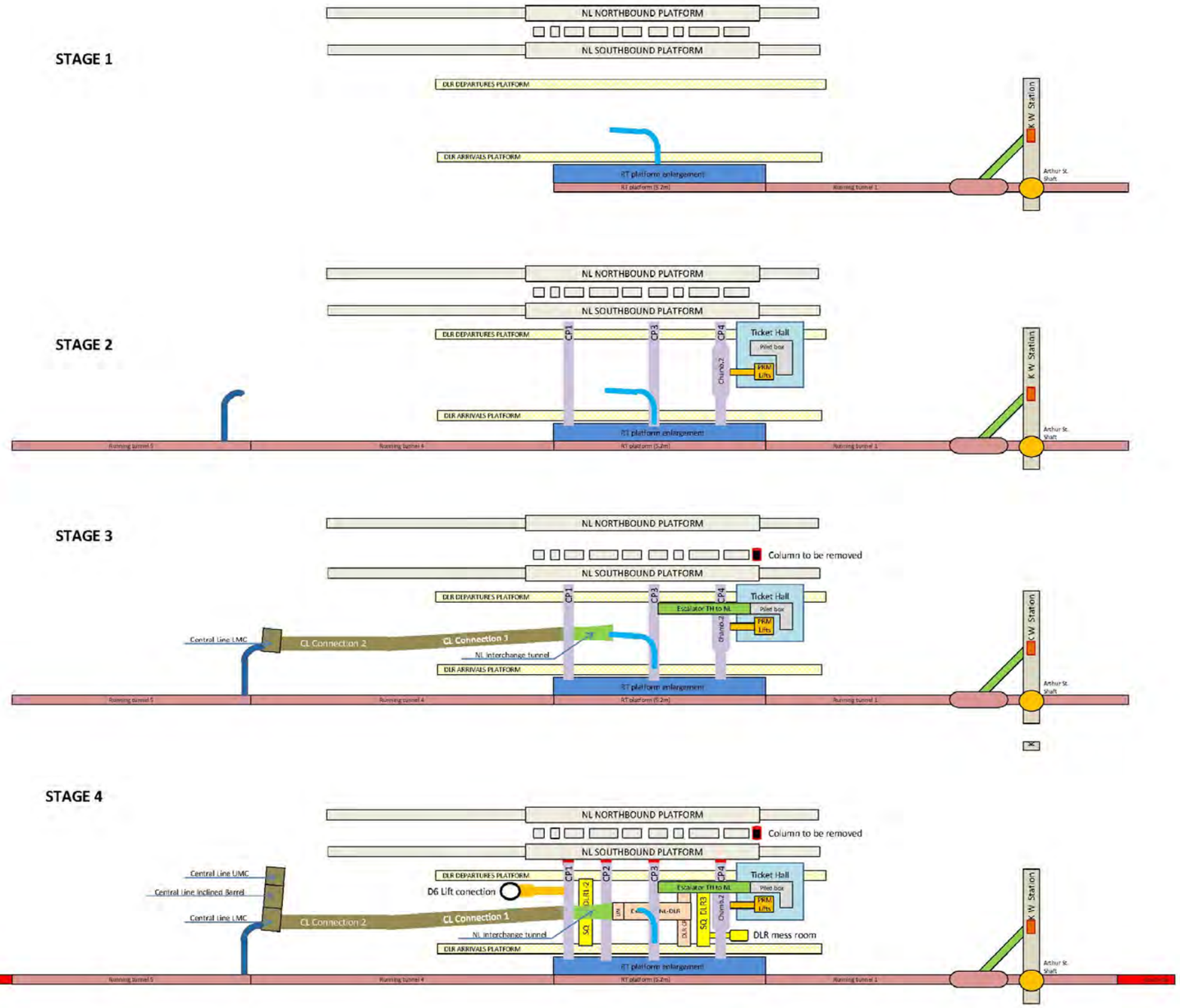


Figure 1: Construction Stage model

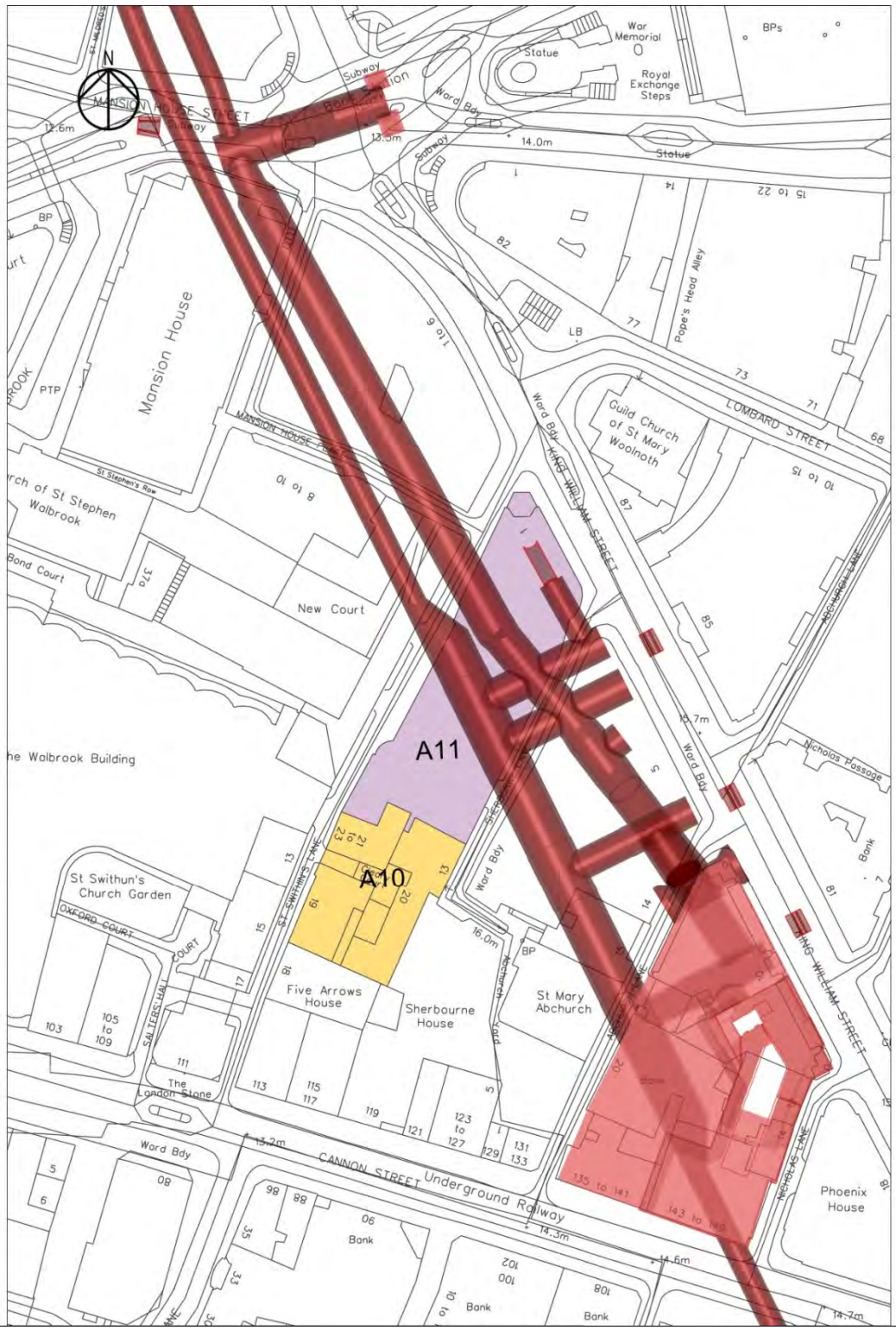


Figure 2: Location plan showing building location in relation to BSCU works

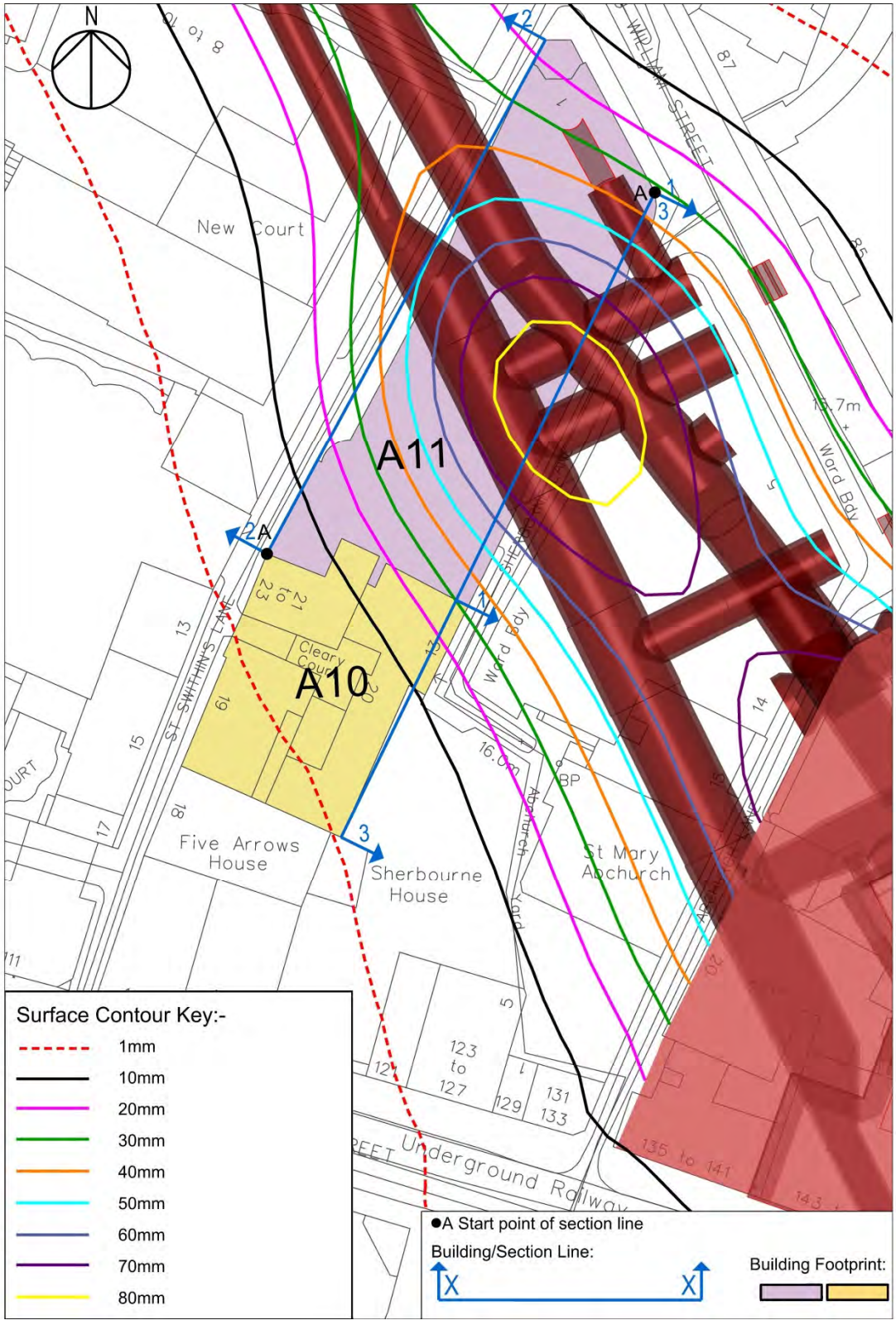


Figure 3: Building location, sections analysed and Settlement Contours at stage of worst case for tensile strains

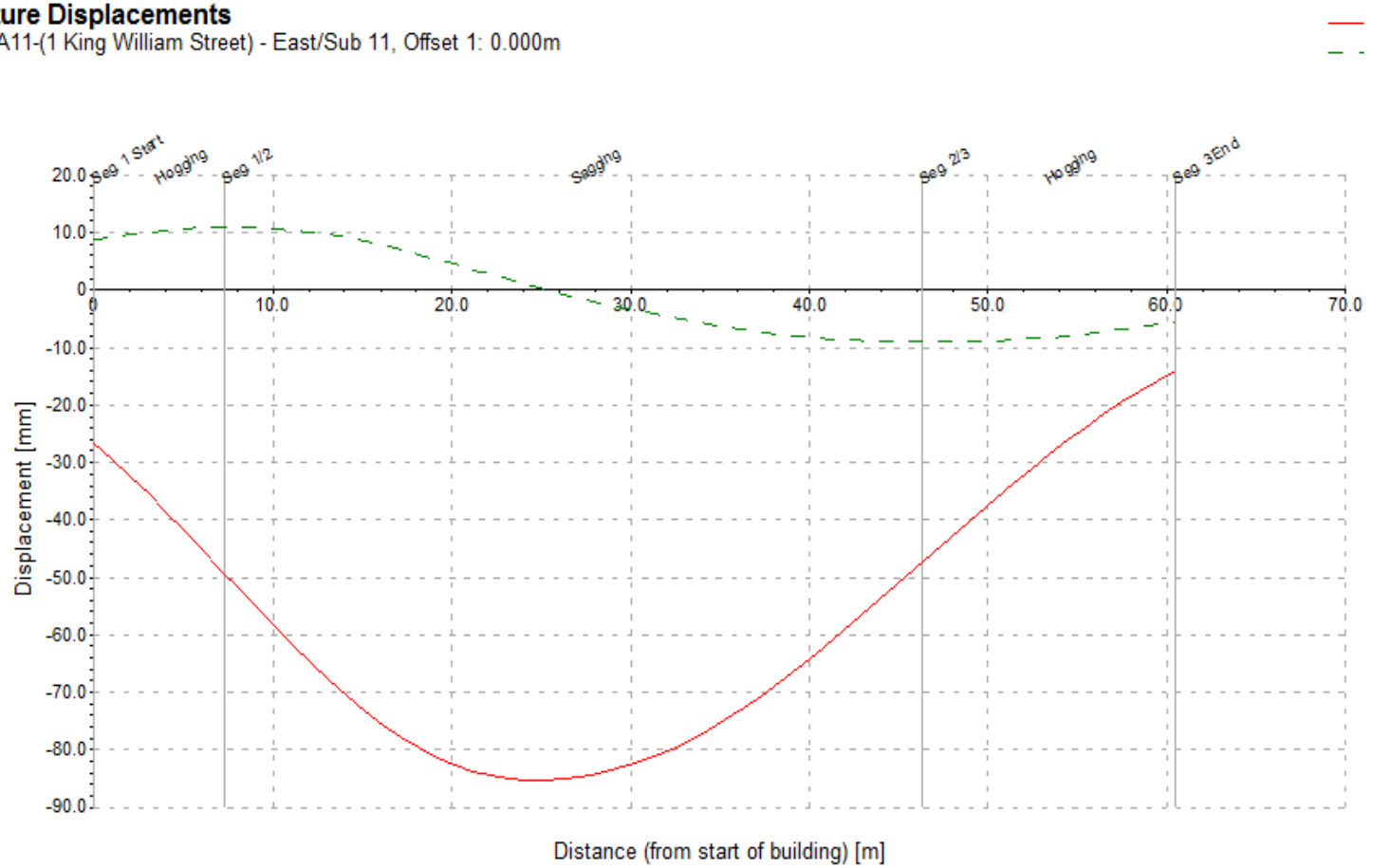


Figure 4: Building displacement at founding level of (line 1) at stage 4 of worst case for tensile strains

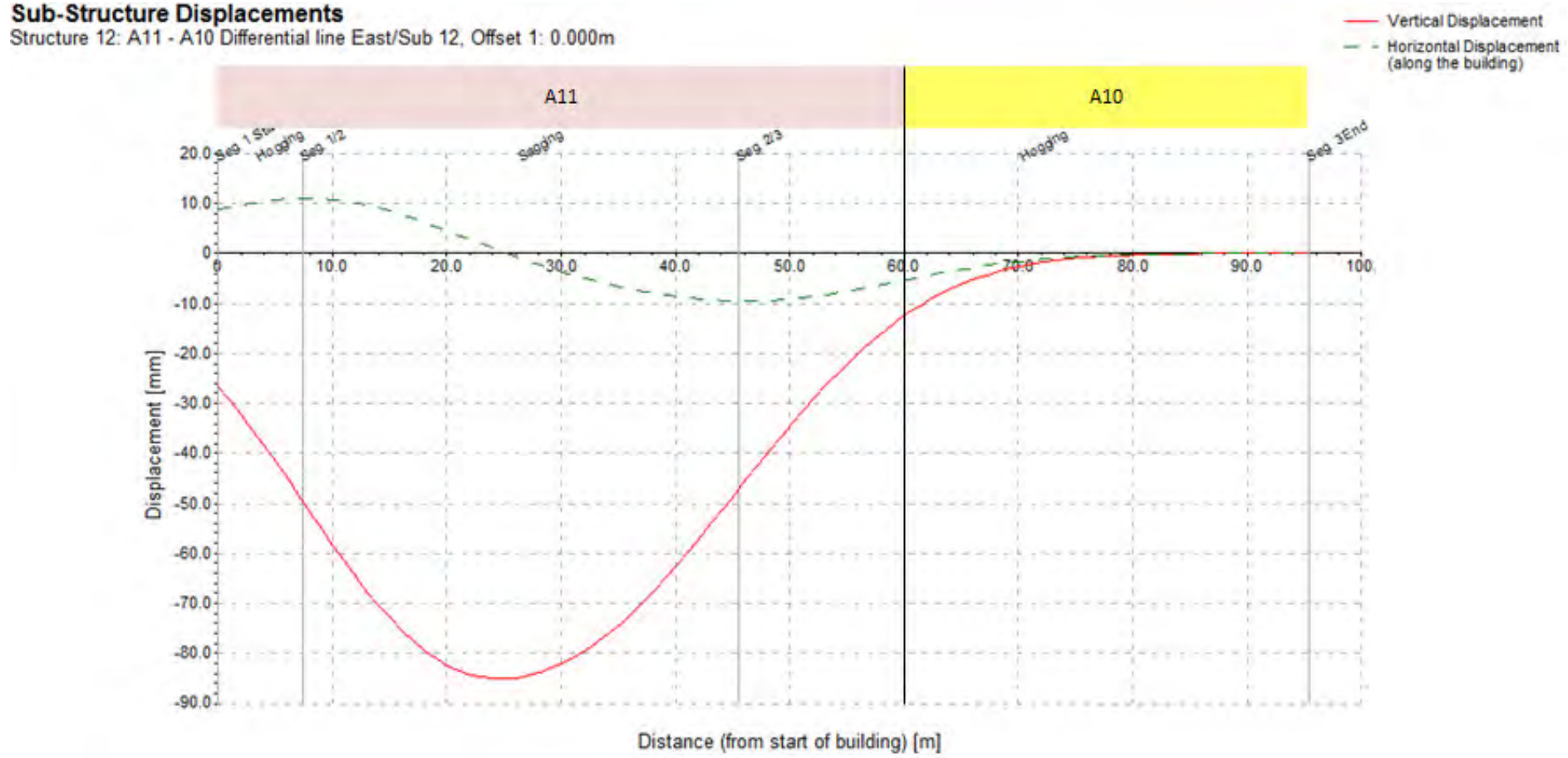


Figure 5: Building displacement at founding level of (line 3) at stage 4 of worst case for tensile strains

LUL Bank Project Office
10 King William Street
London EC4 N7TW

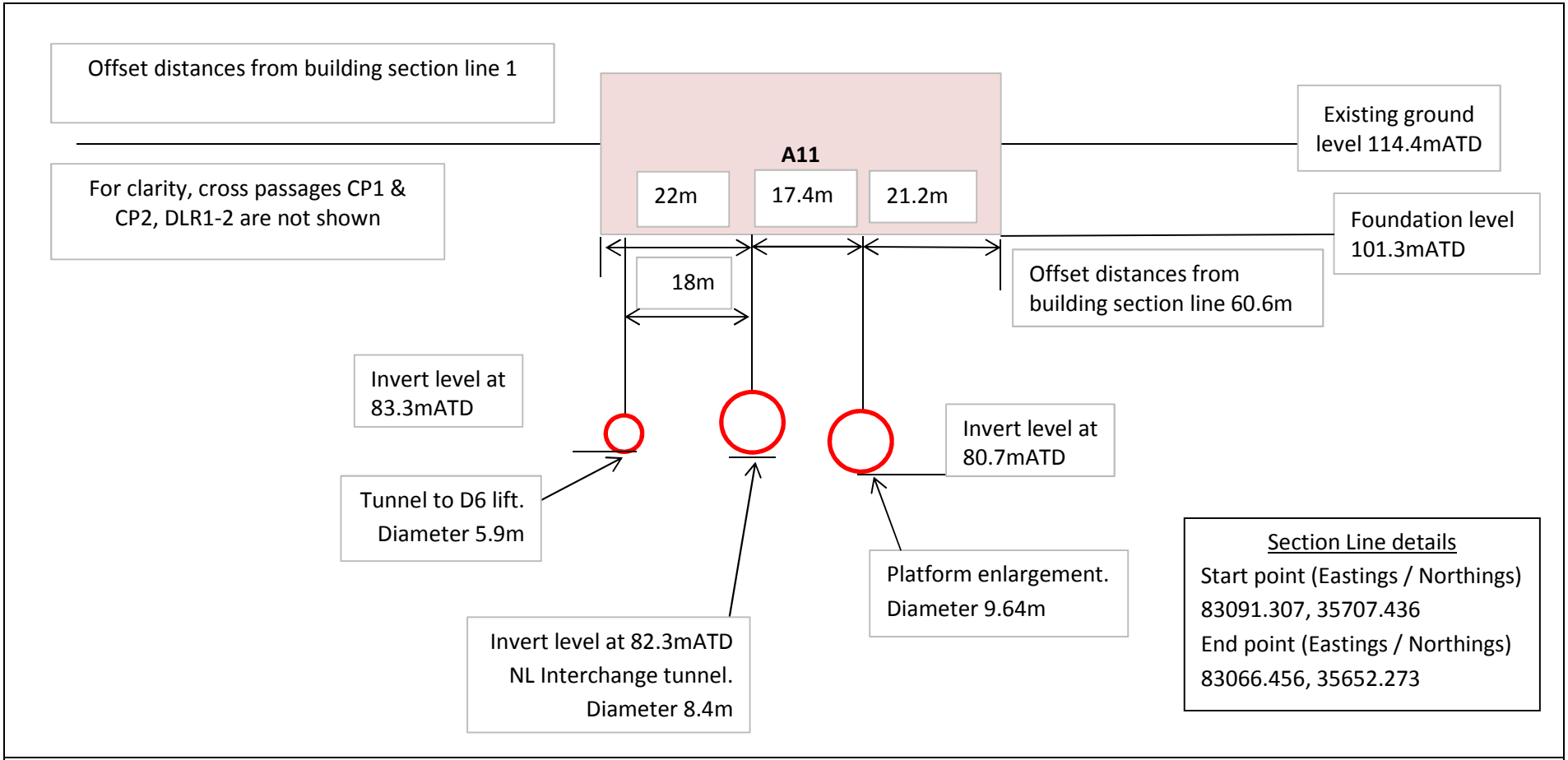
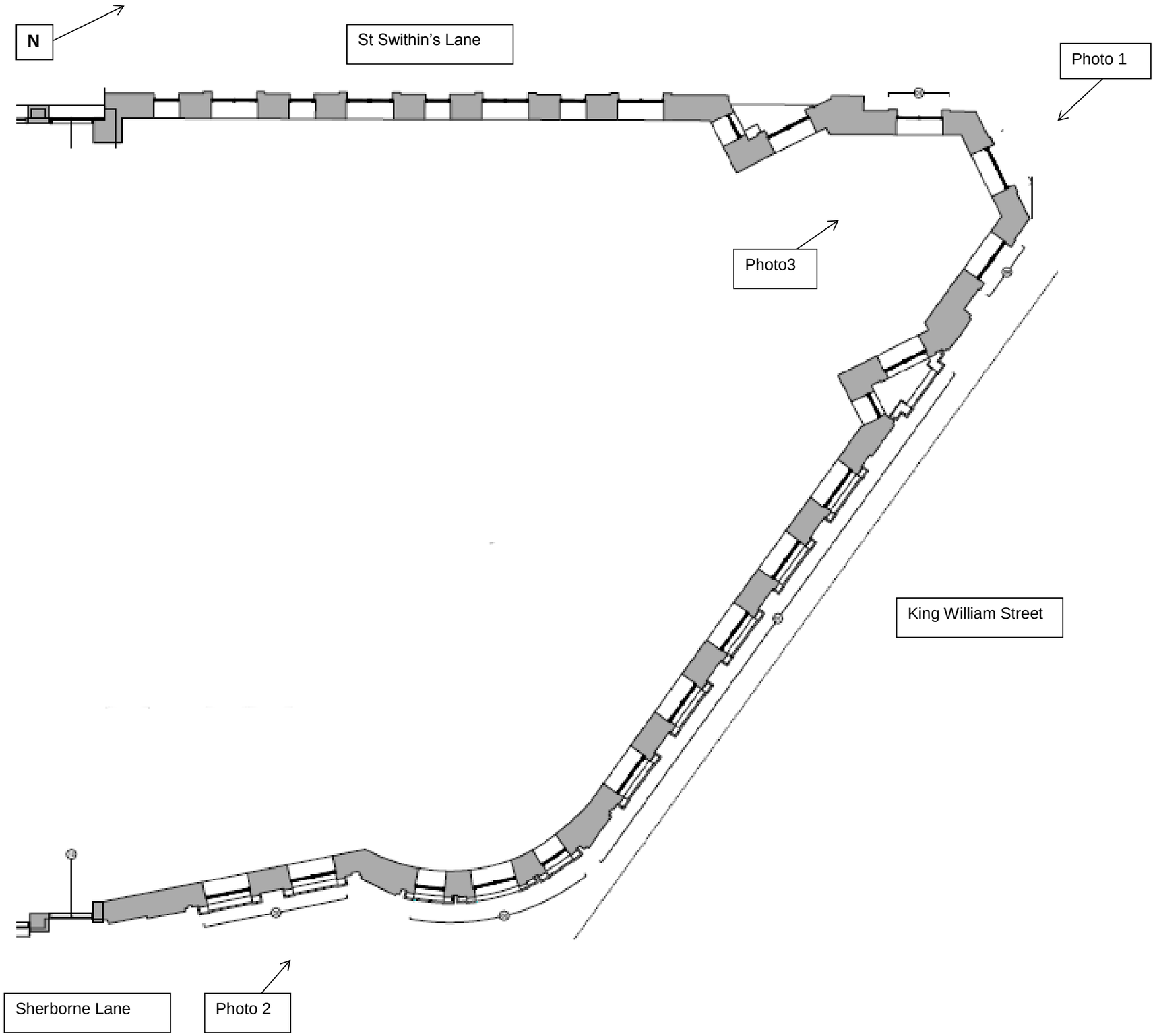
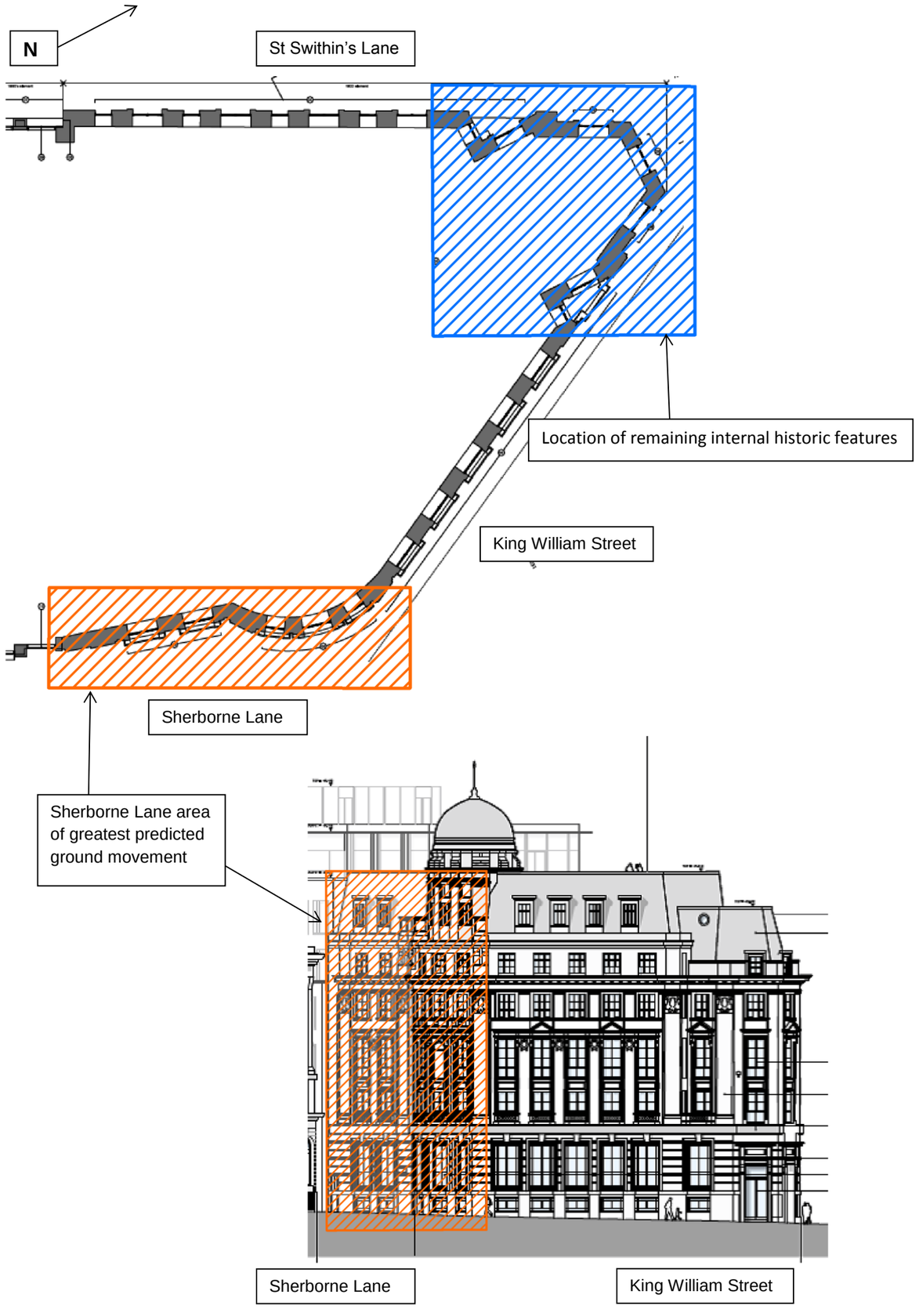


Figure 6: Diagrammatic cross-section of section (line 1) relative to tunnel position

Appendix 6: Photo Locator

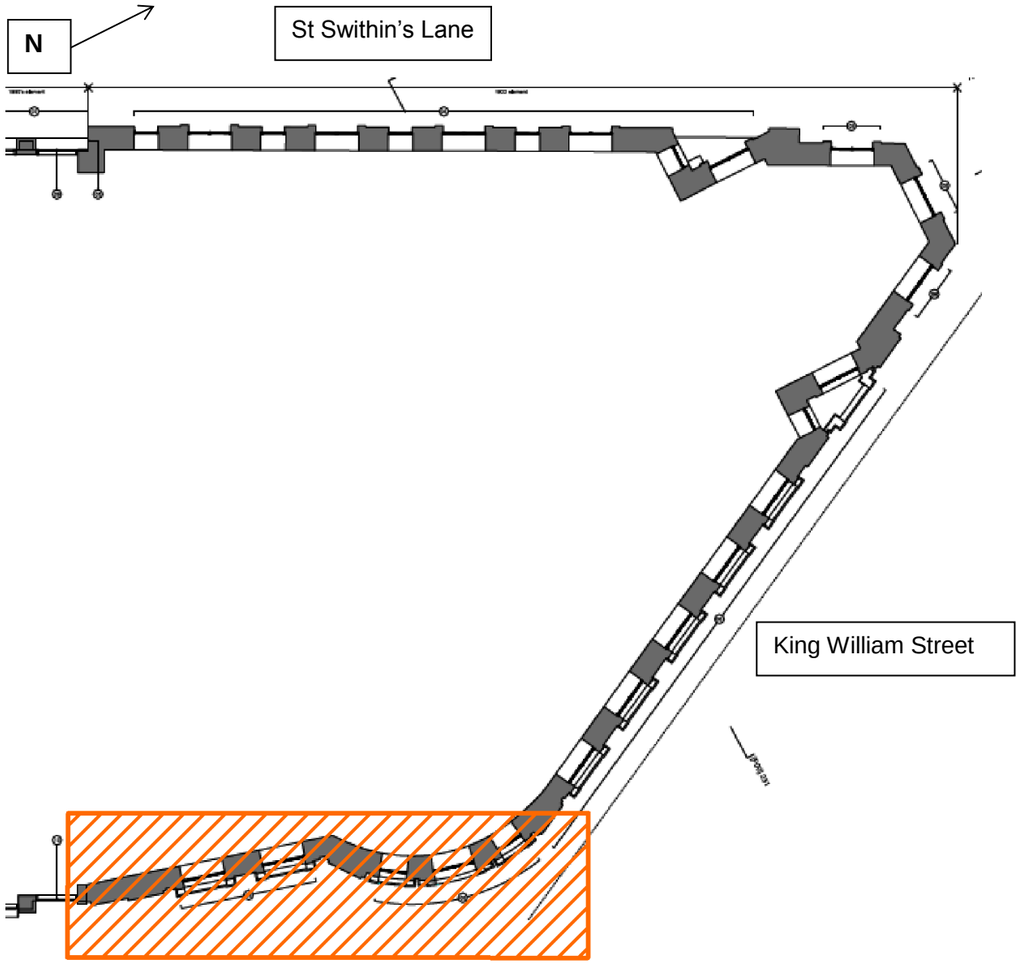

N
St Swithin's Lane
Photo 1
Photo3
King William Street
Sherborne Lane
Photo 2

Appendix 7: Areas of interest



Current typical interior finish in area of proposed strengthening works, showing masonry external wall behind opened-up plaster during works undertaken by others

Appendix 8: Areas to be affected by protective works



Note: Protective works will only affect internal areas of the building behind the historic elevation