



Bank Station Capacity Upgrade

1 Princes Street Heritage Statement

September 2014

MAYOR OF LONDON



**TRANSPORT
FOR LONDON**
EVERY JOURNEY MATTERS



Bank Station Capacity Upgrade

1 Princes 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-002112

Limitations

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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.

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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.

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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 1 Princes Street, London, EC2R 8BP. 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:
- Strengthening of fixings to statuary at attic level on the south-eastern corner elevation, including temporary removal of the statues to safe storage.
- 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. Its site is bounded by Princes Street to the east and Mansion House Street to the south; the building is irregular in shape, with a cut corner to Bank junction at the south-east.



Photo 1: General view of 1 Princes Street

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- 4.1.3 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.
- 4.1.4 Built in 1929 as the headquarters of the National Westminster Bank, 1 Princes Street was designed by Sir Edwin Cooper in the classical style. The five storey Portland stone elevations include a Doric frieze and cornice above the ground floor. The corner elevation incorporates a group of statues by Ernest Gillick. A plaque records that Mrs Elizabeth Fry (1780-1845), Prison Reformer, lived at the site from 1800 to 1809.
- 4.1.5 To the centre of the building is a retained domed banking hall, which contains square marble columns and statuary, and plaster decorative elements. This historic section of the interior, together with the Portland stone façade, is of heritage significance.
- 4.1.6 The building was partially demolished and rebuilt in 1997 and the façades and structure to ground level, together with the internal dome and support structure retained. Otherwise the building has been stripped of historic features, and shows predominantly modern finishes with dropped ceilings and partitions.
- 4.1.7 Reports of the time state that “A new raft foundation of 1.2m thick reinforced concrete was provided below basement 3 to supplement the original. The raft is founded in the London Clay”. No mention is made of the caissons to a depth of 55 feet which are reported by A.E Richardson in 1932 (The National Provincial Bank, Princes Street and Mansion House Street, London. Architectural Review paper). Appendix 4 contains a copy of this article, which provides a comprehensive description of the original form of the building.
- 4.1.8 1 Princes Street has a predominantly architectural and artistic significance relating to the façade detail and sculpture, and its role 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. The retained elements of the interior of the original building are also significant. There is no significance attached to the 1990s modernisation. Finally, the site has historic significance as the former home of Elizabeth Fry, though the present building does not have a connection with her or her former residence.

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

- 5.1.1 It is proposed that the new platform tunnel and a temporary access tunnel will be constructed directly beneath 1 Princes Street, to its western side from south to north. A plan showing the position of existing and proposed infrastructure in relation to 1 Princes Street is included at 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 made which indicates that there may be a maximum predicted settlement of 26mm to the building, with the greatest settlement concentrated on the southern (Mansion House Street) elevation. Maximum predicted settlement to the western and south-eastern (corner) elevation is 23mm and the calculated maximum tensile strain is 0.057%.
- 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 predicted differential settlement of over 20mm across the building raises the potential of damage to façades. The greatest settlement is on the southern elevation reducing to between 4 and 3mm on the northern elevation. It is considered that building movements may concentrate at the weak points of elevations. This may be exacerbated should the building façades be differently founded to the majority of the building, which is on a modern raft foundation.
- 5.1.4 Further more detailed assessment will be undertaken during 'Stage 3' Building Damage Assessment due to be complete 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 elevations of 1 Princes Street have large discontinuities, for example large openings under heavy cornices. The south-eastern (corner) elevation is especially sensitive due to the group of statues at attic level above a large opening. Should strain concentrate at this area, there is a small possibility that cracking to the cornice beneath the statues may result in movement of the statues, loss of fixing stability, and damage to carved detail. This is indicated in photo 2 (a plan showing locations of photographs can be found at Appendix 6).



Photo 2: Predicted concentration of strains to 1 Princes Street elevation

5.1.7 It is considered that the impacts of the predicted settlements are such that they could be detrimental to the heritage significance of 1 Princes 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 close survey and the results of the Stage 3 Building Damage Assessment, the group of statues may require the provision of additional fixings by the insertion of steel brackets or ties. This may require temporary removal of the statues. The location of the statue group is shown in photograph 3. An annotated plan and photograph of the area where works will take place is included at Appendices 7 and 8.
- 6.1.5 These additional fixing brackets or ties would be permanent works; the removal of statues would be temporary and short term for the duration of the works.



Photo 3: Group of statues proposed for examination and temporary removal
Impact of the works

- 6.1.6 The proposed protective works involving the temporary removal of the statues will have a short term impact on the significance of the listed building as well as a temporary impact on the setting of adjacent buildings to which it is a contributor. There will be a short term impact on the Bank Conservation Area resulting from the protective works.
- 6.1.7 The material impact from the proposed strengthening of fixings will be focussed on a small area of the listed building. The temporary removal of statues necessary to strengthen the fixings will have an impact on the architectural integrity of the building; however, this will be resolved when the proposed additional fixings are constructed and the statues reinstated. Any making good will be on a like for like basis, reducing the aesthetic impact, so that the temporary removal of fabric does not have a long term effect on the heritage significance of the building.
- 6.1.8 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 will achieve the objective 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. 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 Princes Street. The protective works proposals themselves will result in a change to historic building fabric to a small extent, and a temporary impact to its setting. 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 Stage 2 Building Damage Assessment modelling of likely horizontal and vertical strains combined with heritage and structural assessment of 1 Princes Street predicts potential settlement of up to 26mm to the southern and western elevations of the building and maximum 0.057% tensile strain, as a result of the new infrastructure being constructed directly below the building.
- 8.1.2 It is considered that specific areas of discontinuity in the Portland stone façades may be sensitive to the predicted settlement, and therefore protective works are proposed to provide additional support to the group of statues at attic level on the southern elevation. The detailed design of these works will be informed by non-invasive survey.
- 8.1.3 It is acknowledged that these works will lead to a temporary adverse impact on the significance 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 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 statue 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, p580

Building Damage Assessment Report: 'A5' (2014)

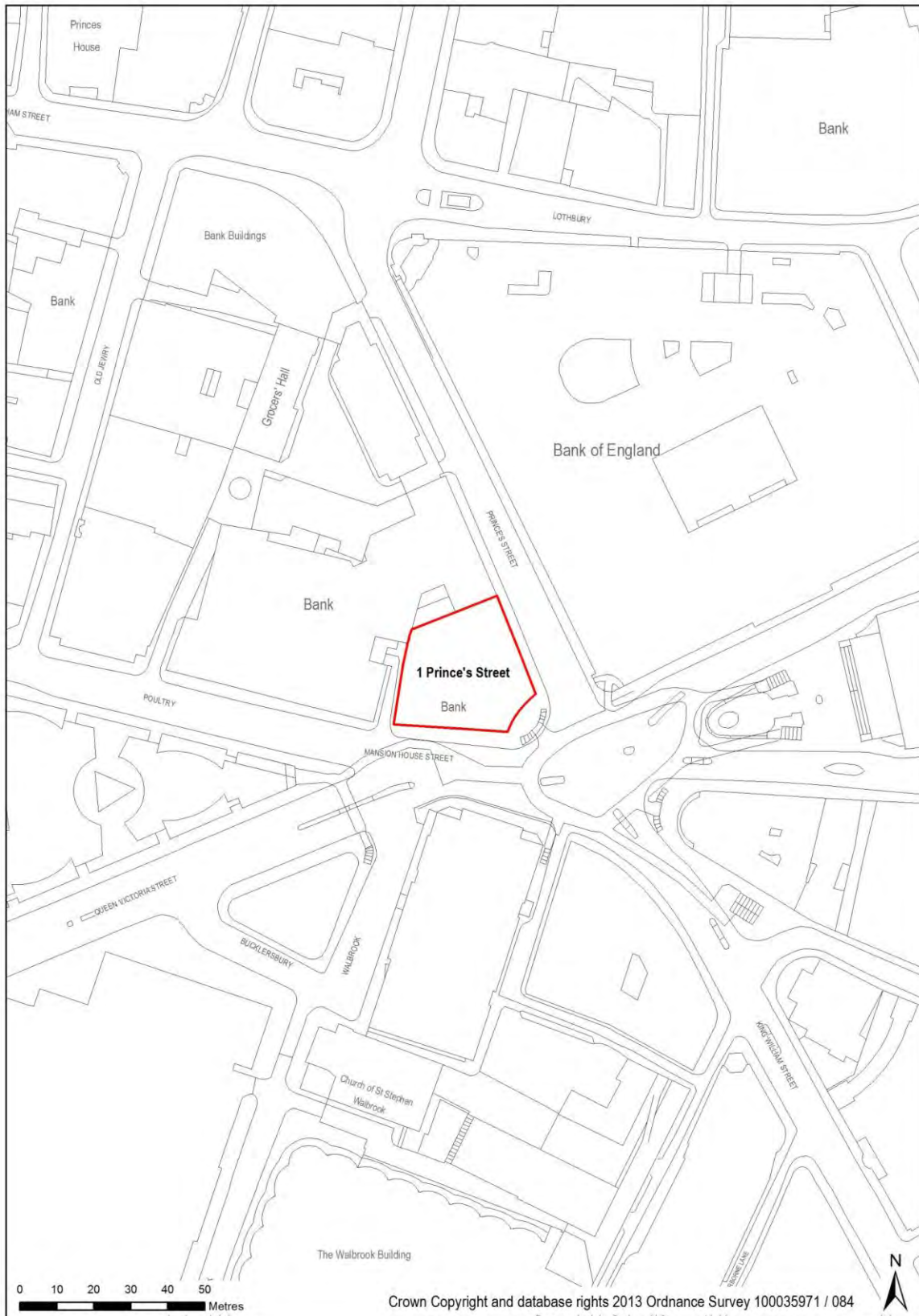
Bank Station Heritage Building Gazetteer by Alan Baxter Associates and Mott MacDonald (2013)

The National Provincial Bank, Princes' Street and the Mansion House – Professor AE Richardson, Architectural Review (1932)

The National Provincial Bank, The Builder (1932)

Appendices

Appendix 1: Location Plan



Appendix 2: Listed Building Description

Name: NATIONAL WESTMINSTER BANK

List entry Number: 1064599

Location: NATIONAL WESTMINSTER BANK, 1, PRINCE'S STREET EC2

Grade: II

Date first listed: 10-Nov-1977

PRINCE'S STREET EC2 1. 5002 (West Side) No 1 (National Westminster Bank) TQ
3281 SE 10/N/36

II GV

1929 by Sir Edwin Cooper. Classical, stone, 5 storeys and 2 attics, the upper one recessed. High channelled base with Doric frieze and cornice; large round-headed vermiculated openings with big scrolled keystones, rectangular niches with statues. Mezzanine above cornice. 5 storey channelled antae over, recessed 5-bay centres between with giant detached Corinthian columns, bracketed cornice over. Plain attic storey with simple parapet. High recessed upper attic with band of swag decoration and simple coping. Corner of Prince's Street and Mansion House Street, statuary group of 5 figures. Corner of St Mildred's Court, City Corporation plaque, "Mrs Elizabeth Fry 1780-1845 Prison Reformer lived here 1800-1809".

Listing NGR: TQ3266981136

National Grid Reference: TQ 32671 81138

Appendix 3: Extent of BSCU works

CITY OF LONDON

- Key:
- Listed Building
 - Existing Infrastructure
 - Proposed Infrastructure

Notes:

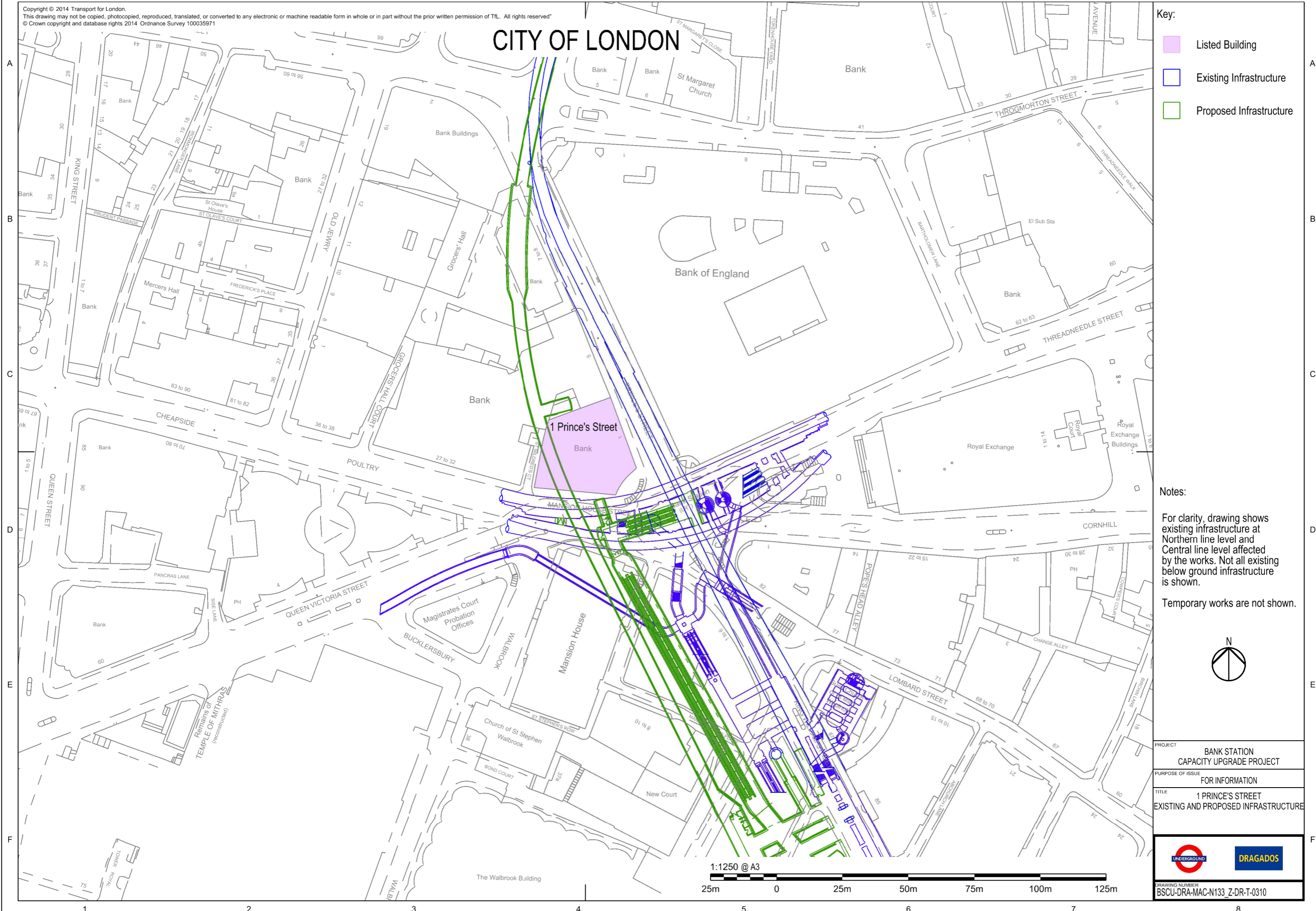
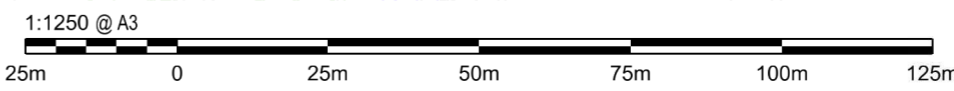
For clarity, drawing shows existing infrastructure at Northern line level and Central line level affected by the works. Not all existing below ground infrastructure is shown.

Temporary works are not shown.



PROJECT	BANK STATION CAPACITY UPGRADE PROJECT
PURPOSE OF ISSUE	FOR INFORMATION
TITLE	1 PRINCE'S STREET EXISTING AND PROPOSED INFRASTRUCTURE

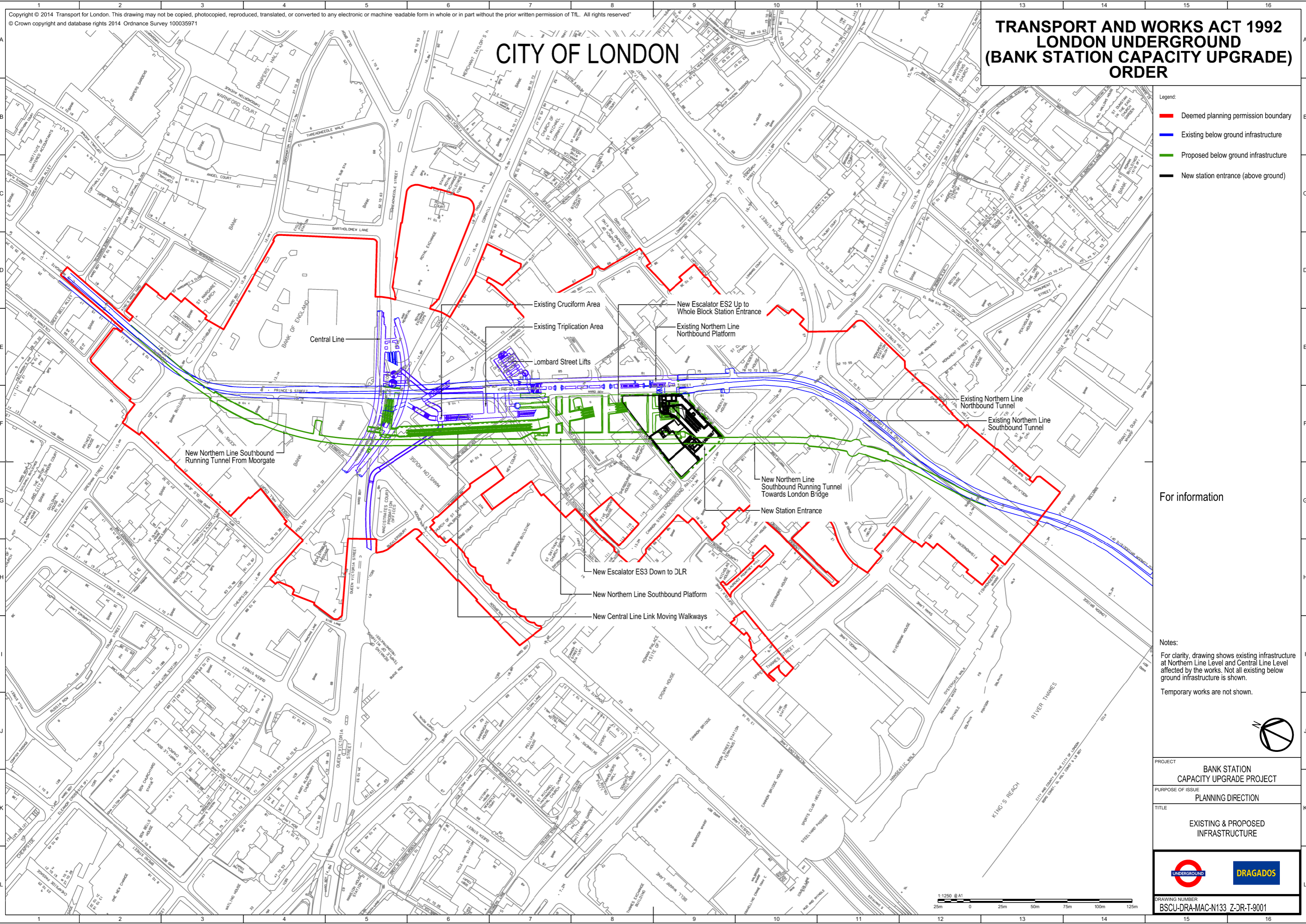
DRAWING NUMBER
BSCU-DRA-MAC-N133_Z-DR-T-0310



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.



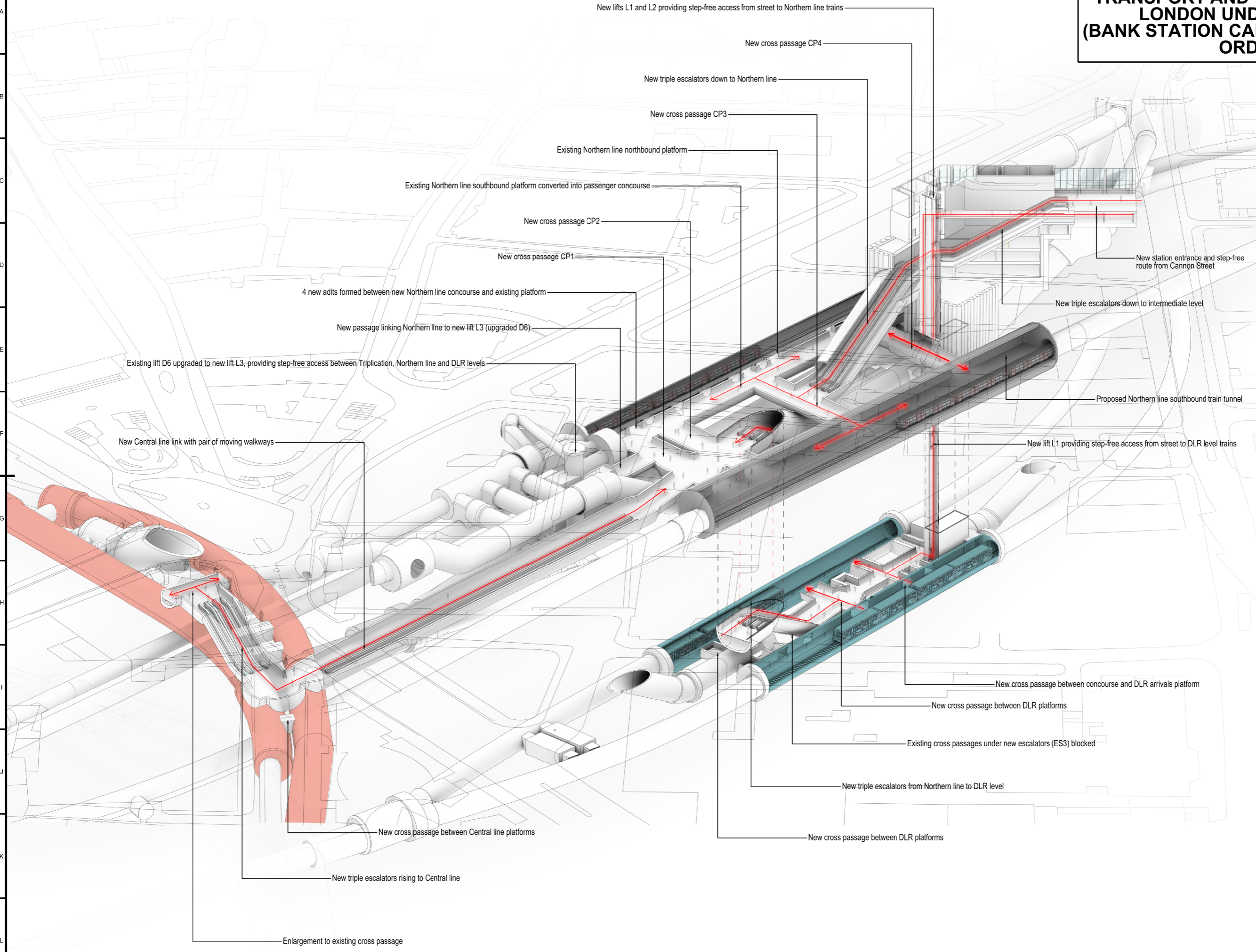
PROJECT	BANK STATION CAPACITY UPGRADE PROJECT
PURPOSE OF ISSUE	PLANNING DIRECTION
TITLE	EXISTING & PROPOSED INFRASTRUCTURE

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**

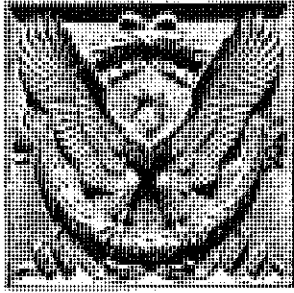
PURPOSE OF ISSUE
PLANNING DIRECTION

TITLE
**3D VISUALISATION
 PROPOSED STATION INFRASTRUCTURE
 & CIRCULATION ROUTES**

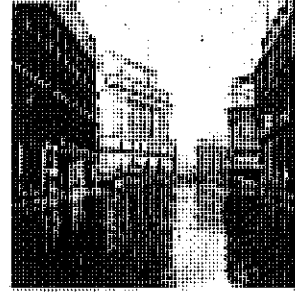


DRAWING NUMBER
BSCU-DRA-MAC-N133 Z-DR-T-9200

**Appendix 4: Article:
The National Provincial Bank, Princes' Street and
Mansion House Street', 1932**



The
National Provincial
Bank, *Princes' Street and
Mansion House Street, London.*
Sir Edwin Cooper, Architect.



By Professor A. E. Richardson

With photographs by WALTER INGLE

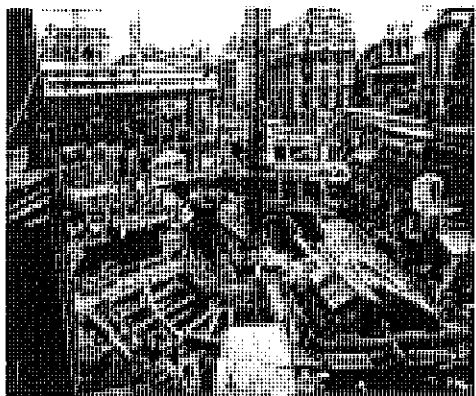
THE history of modern banking in this country begins with the founding of the Bank of England. But before the circulation of money was controlled officially, Cheapside and Lombard Street were recognized centres for financial transactions. Time has since decreed that financial headquarters should be grouped at the very heart of the City. In this way sites adjacent to the Royal Exchange have risen in value and many magnificent banks have been built. In the present case the directors are to be congratulated on securing a fine building; equal praise is due to the architect and all concerned for the able interpretation of very intricate conditions. Before describing the building in detail it will be as well to state that certain factors determine the style and character of all additions to the civic amenities. And as the external conditions are not generally known, it will be useful to state what they imply. It is understood, perhaps vaguely, that the City in its inner formation perpetuates the ancient mediæval thoroughfares. It is clear, also, that since the Great Fire of 1666 there has been little opportunity for formal street planning in the grand manner. For this reason architects are faced with difficulties which are almost insuperable. It is indeed a tribute to their skill that the newer buildings in the City of London are complementary in outward appearance. Regarding London bank premises it is agreed that the conditions of planning are dissimilar to those that exist in any other country. This precludes the possibility of any but the broadest comparison between, say, a modern bank in New York, Paris, or Berlin, and the latest expression in the vicinity of Threadneedle Street. For such reasons the new Princes' Street Office of the National Provincial Bank must be viewed as belonging to London. Those who appreciate technical considerations know that the plan of a building is the very basis of its right to be. If the plan is good it reveals the skill of the architect no less than the foresight of the promoters. To be brief, the plan of the National Provincial Bank deserves very high praise indeed.

Under the stress of modern civilization finance has become an involved science, money the chief part of the circulating capital of a vast Empire. The specific problem before the architect in the case of the new National Provincial Bank was to express the organization of a business house giving employment to over six hundred officials. He has been faced with a limited site having three main frontages. His task has been to co-ordinate different departments internally and to blend the fabric into external harmony. To the casual observer a City bank may appear to be solely an affair of elevational treatment and external perspective. The smoothing over of difficulties, the selection of a theme

for pictorial treatment, and the presentation of interesting detail and ornament, are often thought to belong to that vague artistry which for convenience is called architecture. The real work—namely, the devisement of the building, from the foundations, into horizontal and vertical compartments, and the apportioning of exact cubical volume to each internal division—is apt to be overlooked. For reasons such as the above, and the regard paid to structural integrity, Sir Edwin Cooper's plan must be praised. He has contrived to change the three-sided site into one having a fourth side. The original outline of the site has been transformed into one with a definite silhouette, as illustrated. It is open on all but one side, and that the least important. The symmetry thus achieved on the horizontal plane became valuable to the vertical expression. No matter from what vantage point the building is viewed, it presents a striking uniformity. The fan shape of the plan in turn led to dual entrances, with a central hall allowing easy circulation on the ground floor while keeping the clerical departments free. The introduction of a domed lantern over the centre of the banking hall, solved the problem of adequate natural lighting to all floors. The master touch has been the introduction of the secondary staircase and lift at the base of the inner court. This integral feature provides vertical circulation for officials. To the critic no less than the tyro the plan nucleus embodies a brilliant idea, and one which, in its economy, is evidence of structural geometry.

One might be permitted to express the view that the attribute of internal perspective is due to the close observance of structural laws. The great height of the supports to the banking hall not only allowed a galleried treatment, but afforded space for extra accommodation. From the pictorial standpoint this adds interest to the interior. Reference to the photograph which illustrates the works in progress, shows the constructive skill necessary in carrying out the work. I have learned that the major building operations were conducted under the personal direction of the architect; namely, the sinking of the caissons and the formation of the points of support. Sir Edwin Cooper arranged for a branch of his office to be on the site, and for additional working drawings to be prepared as required. It should be realized that space was needed below the pavement level for boiler rooms, electrical plant, engineer's shop, staff rooms and lavatories, and that the strong rooms and safe-deposit rooms had to be kept imperforate. The site also imposed limitations for handling material, therefore the plan below ground required much preliminary arrangement. It will be agreed that from the level of the lower basement, to the roof terraces, the planning is very sound. Not a fraction of unoccupied space has been left; and yet the symmetry of

THE NATIONAL PROVINCIAL BANK



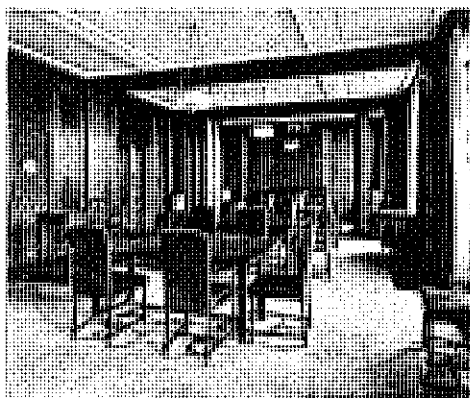
THE FOUNDATIONS IN PROGRESS. Three sectional iron caissons 40 feet in diameter were sunk in the centre of the site, to a depth of about 55 feet, and in these, large stanchion bases were constructed and the stanchions placed in position. Small borings were then made between the caissons and the outer walls, and the cross steelwork was threaded through and the whole of the steel frame structure completed.

the building internally and externally is preserved. This achievement can be traced back to the brilliance of the plan in its early stages. At the ground level the banking hall is the main theme. Lesser offices and the main staircase form, conjointly, a frame on two of the upper sides of the fan. Viewed from the public space the architect's scheme can be seen in articulation. On the principal upper floors are managers' rooms, committee rooms, and various private offices. Whole floors are given up to departments, the existence of which is not disclosed to ordinary spectators. Another important consideration has been the comfort of the staff. The spacious kitchen and dining-rooms at the top of the building must be seen to be appreciated.

The plan in its details epitomizes the main facts of a great London bank in operation. Such a plan is the result of prolonged discussion and organization. The architect's task, however, did not end with the planning. Not only was it demanded of him that the building should be convenient and pleasant to work in, and that the accommodation should be adequate for increasing business, but he has been called upon by the promoters to make a contribution to the dignity of the City. The bank authorities, realizing the importance of the scheme upon which they had embarked, no less than the prominence of the site, determined that the building should be of high quality. It is permissible to state the reasons for the adoption of a classical type. In the course of the last quarter of a century the tradition of bank building took a definite line in favour of classicity. A distinctive treatment for bank exteriors, the result of experience, has been gradually developed. There are many variations of this classical treatment, based upon academic study of the older, and to some extent smaller, buildings of the Renaissance in Italy, France, and England. The foregoing theory has its limitations, but the adoption of strong classical motives, such as the order with recognized proportions for doors, windows, and arched openings, has at least resulted in a co-ordination of character for buildings of specific and semi-official purpose, such as the bank now under discussion. In explanation, it can be said that the classic point of view has arisen from a desire to emulate the spirit, rather than the letter, of the famous exemplars of other days. The architect's chief difficulty in this instance has been to reconcile this classical expression with the main structural lines of the plan. There has also been the task of complementing the character of neighbouring buildings which are landmarks in the narrow streets of the City.

Reference to the photographs will show how the conditions have

been met. The main lines of the vast building are direct in statement. In actuality it is best viewed from the corner of King William Street. The main divisions from the pavement level to the main cornice are three. One part is apportioned to the basement storey, another to the first floor, which forms a podium to the order storey, and the third to the order storey. Above the main cornice is an attic storey, and above this is a second attic. The lines of the silhouette are strong and unbroken. The angle is broad and subtly curved. Dark contrasting shadows are produced by the vertical lines of the Corinthian columns. In general, the theme is a twentieth-century version of the more academic moods of the Renaissance. Contrast between the two main vertical groupings has been gained by the introduction of rusticated arcuations and square headed niches in the basement storey, the latter providing space for sculptured figures. The classic ordonnance, thus superposed, is carried through five bays on either flank, with two columns, in antis, at the angle. The lines of the composition are broad and dignified. Sculptured ornament is placed on the wide masses of masonry at the level of the capitals, to continue the sequence of rich detail. There is a preponderance of solid over void without undue sacrifice of internal lighting. Given definite conditions for the evolution of a classical building, which has to be in sympathy with the style of similar institutions already created, or building, in the vicinity, the new bank has surprising character. Its success can be attributed to the individuality of the architect who for many years has given his care to some of the largest official buildings in London. Sir Edwin Cooper has adhered to the classic point of view from the beginning of his active and distinguished career. His is the disinterested search for perfection, the desire for reasonableness and order; a zest, almost amounting to passion, for buildings of permanent stamp. He has set himself to compete with the assured academic qualities of the old masters, and he prefers to be consistent rather than competitive in his work. The audience he has reached consists of two sections: one, the promoters of official and semi-official buildings; and secondly, a very large branch of the public. His work expresses opinions and beliefs which may not be shared by younger architects, but these personal opinions are the outcome of years of experience and have been pursued regardless of warring technical differences. As an onlooker one is privileged to inquire into the meaning of every type of building. It is wise to pass over surface differences and to inquire whether a building does more than fulfil its function as a useful piece of engineering. The questions one asks are, Does the building show disciplined emotion, character, and scholarship? Is the work related to the main trend of public opinion? Can it be associated with similar works? Further, Does the building inherit some of the nobility and part of the attributes of the



The **DINING-ROOM** on the seventh floor. The walls are panelled in oak. The furniture was designed by the architect.

The Architectural Review, April 1932.

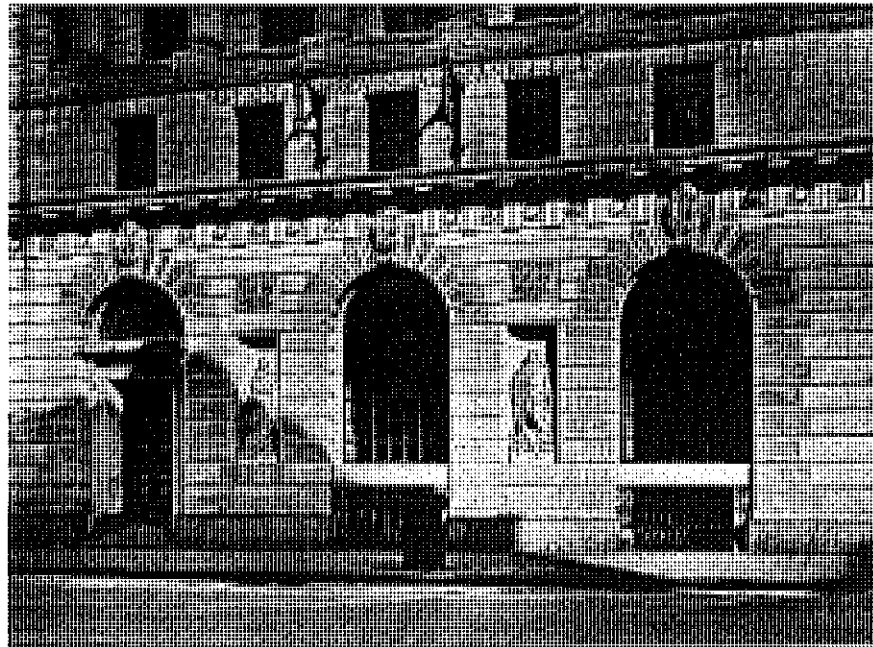


THE BANK FROM THE ROYAL EXCHANGE

THE NATIONAL PROVINCIAL BANK



THE MANSION HOUSE STREET FRONT. The building is in Portland stone. The figures in the niches on the ground floor represent *Security* and *Integrity*, and are carved in Portland stone. Enlarged reproductions of the figures are given on page 145.



A detail of the MANSION HOUSE STREET façade.

great works of the past? Hazlitt once remarked, "comparisons are not only odious but impertinent." A glance at many of the new City banks will show that regard for permanency has been the aim not only of the architects but the expressed wish of the promoters.

Today there are many cross-currents of opinion regarding architectural expression. The older school inclines to the vitalization of tradition, with invention; the newer to a "modernity" which will make its own laws. In discussing the National Provincial Bank I have avoided such controversial issues, preferring contrariwise to discuss the building on its merits as an example of individual rather than modern international technique. Sir Edwin Cooper has without doubt reasoned in his work, "there are all the traditions to study; those of our own time are few." He recognizes the arts ancillary to building, and he has provided work for some of the best craftsmen of the day. In my opinion he has aimed at interpreting the classic idiom in architecture and its adaptation to the embellishment of ordinary structure. Something akin to this was attempted twenty-five years ago in America, and it is significant that many new buildings in Denmark and Sweden are based upon classical study. There is abundant testimony to this principle just as there is abundant evidence of "functionalism" and "expressionalism" in other directions. Under present conditions universality of idea is not within range. I prefer, therefore, in this brief appreciation of a distinguished architect's work, not to challenge the selection of detail and ornament, which is the usual method of a critic, but to review the building as a whole, and with this in view I have followed the architect's mind stage by stage. From a study of the working drawings and perspective sketches, it is clear that one mind has been at work; that every detail has been considered, and the material chosen with due regard to artistic quality. Sir Edwin Cooper's personal sketches for the interiors afford the best index to his grasp of pictorial and stylistic effects. His version of the classic theme for the banking hall has caught the colour of Piranesi's etchings. His aim evidently has been to provide interest, light and

shade, variety of form and beauty of workmanship. There is an abundance of rich detail to contrast with the simple lines of counters and panelling. Yet, notwithstanding the variegated points of minor interest, there is no decrease of major volume in the ensemble. Directors' room, managers' rooms, private offices and dining-rooms, each and several, are proof of the pursuit of an ideal which never swerves from its objective. Where carving is introduced it is of the most exquisite workmanship; locks and ironmongery, fittings and floor coverings, are the best that craft and skill can command. All the furniture has been designed by the architect to harmonize with the different rooms. There is no denying the thoughtful detail which enriches the interiors.

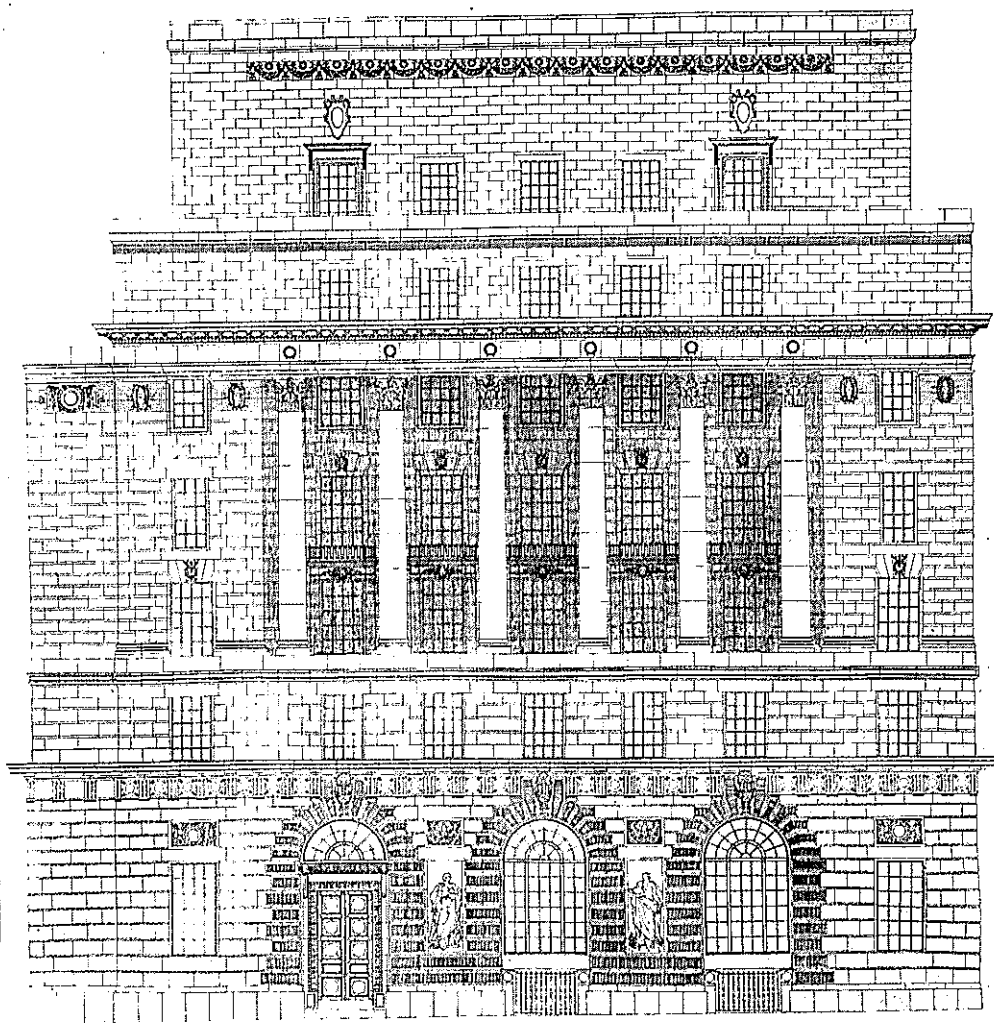
Apart from considerations of architectural embellishment, there are many specimens of the art of the sculptor; for example, the fine figures, *Prosperity, Courage, Security, Integrity*, the work of Mr. C. L. J. Doman. These, and the fine symbolical group by Mr. Ernest Gillick, belong to the academic school which, in the history of British sculpture, had its beginnings under the chisel of Sir Robert Taylor in the tympanum of the Mansion House, a style developed later by Bacon and Carlini at Somerset House.

It is almost impossible within the scope of a short article to do more than touch upon the many points of the new building. It has been my aim to transmit impressions received when privileged to inspect it. There is yet one more consideration, and that concerns the contractor, who has carried out the architect's instructions so well and who has left the work so perfect.

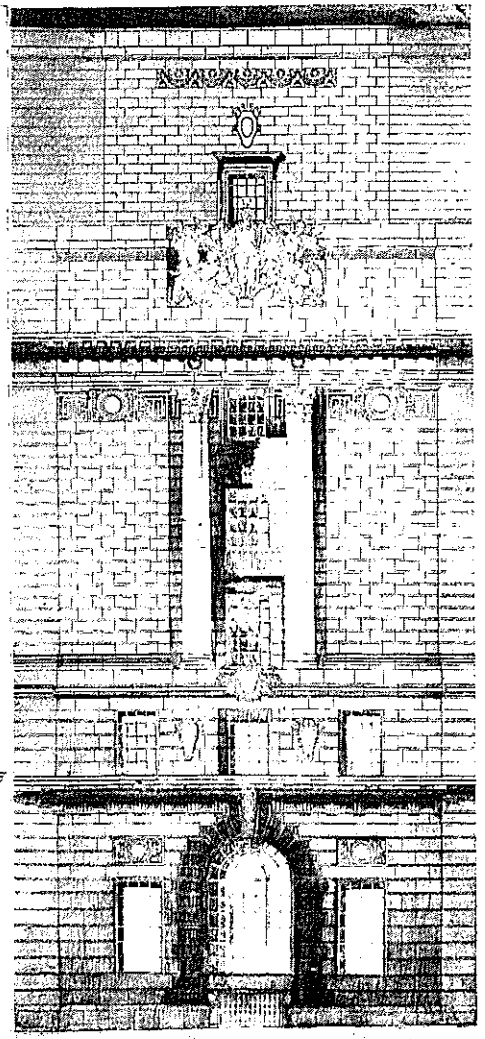
The general effect of the building is that of magnificence. There is none of the severity which is akin to baldness; contrariwise there is evidence of a desire to interest and to capture the richness of life. Only a classicist could have attempted a classicism modified and appropriate to a banking house. Here is a composition which is pictorial, yet academic, severe yet subtly rich, respectful to tradition yet consistently inventive in arrangement. It is the conservative element which is the most telling feature of the architect's work.



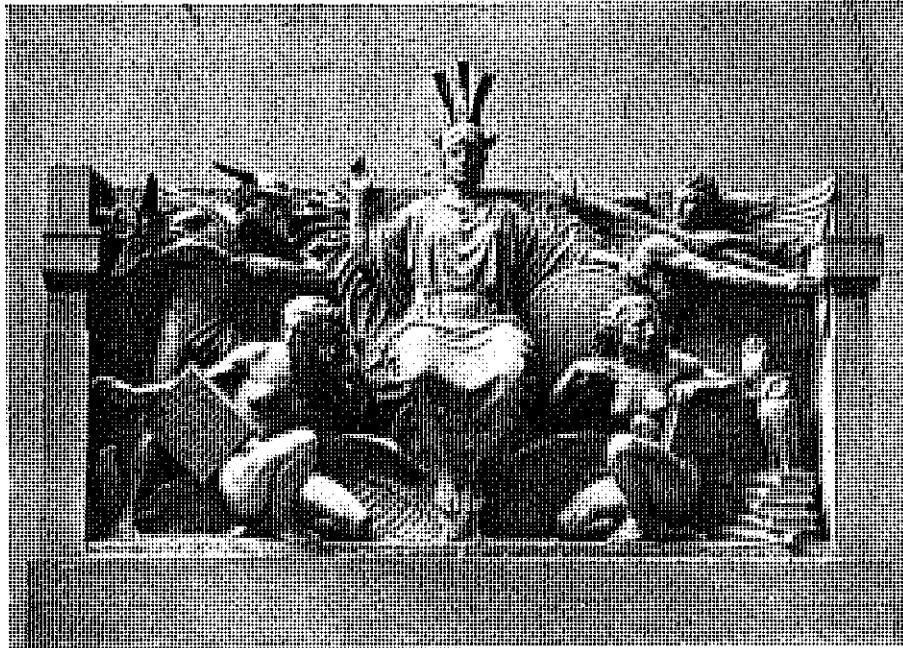
THE BANK FROM THE ROYAL EXCHANGE. A drawing by William Walcot.



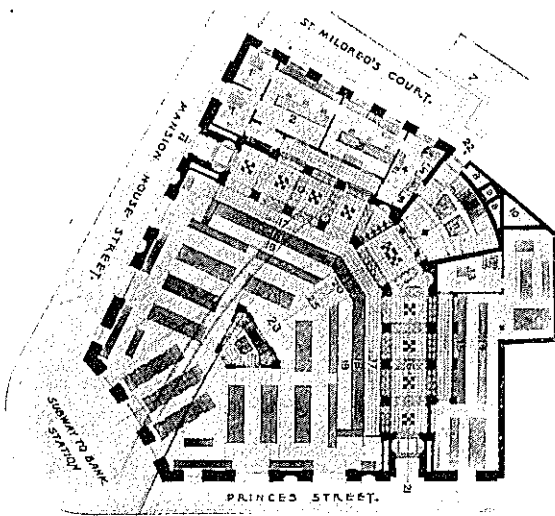
The elevation to MANSON HOUSE STREET.



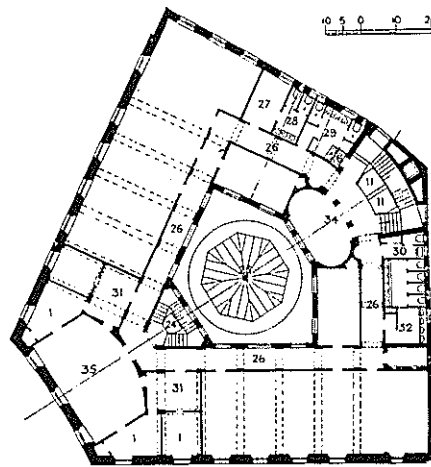
The elevation of the ANGLE TO MANSON HOUSE STREET AND PRINCES STREET.



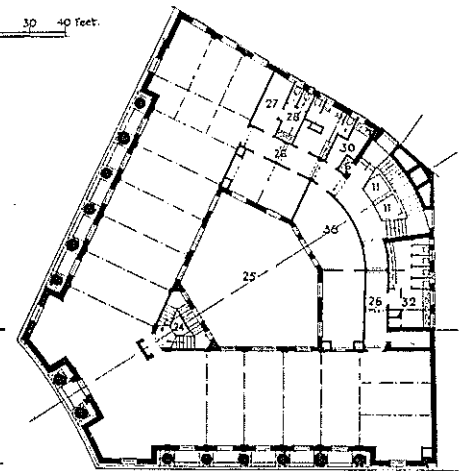
A GROUP OF SCULPTURE at the exterior angle of the building, by E. Gillick.



The GROUND-FLOOR PLAN.



The FIRST-FLOOR PLAN.

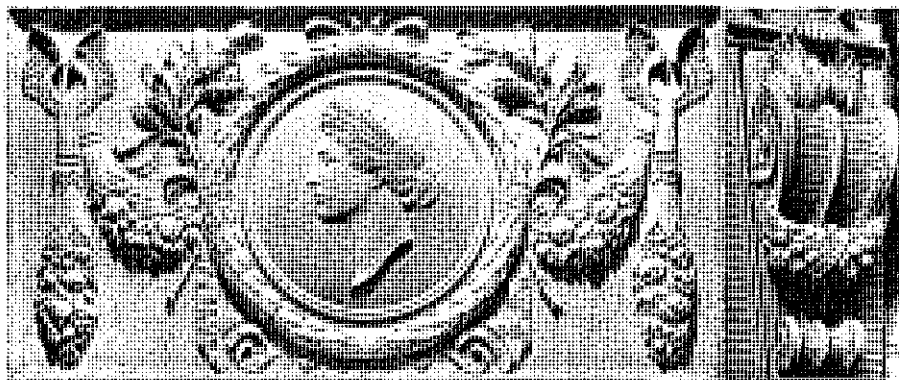


The SECOND-FLOOR PLAN.

The rooms indicated by numbers on the plans are as follows:—

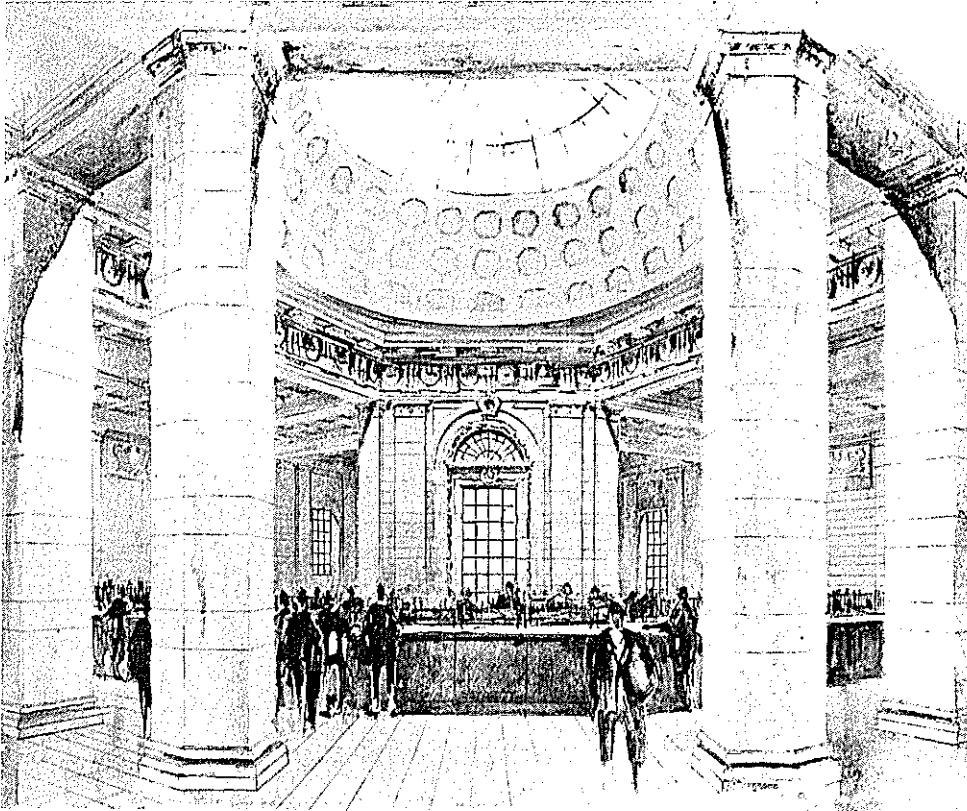
(1) Consulting Rooms, (2) Managers' Room, (3) Assistant Managers' Room, (4) Waiting Room, (5) Telephone Boxes, (6) Service Lift, (7) Area, (8) Exhaust Ducts, (9) Smoke Stack, (10) Fresh Air Intake, (11) Public Lifts, (12) Securities Lift, (13) Examination Rail, (14) Securities Department, (15) Counter, (16) Public Space, (17) Banking Space, (18) Counters,

(19) Cashiers, (20) Statements, (21) Entrances, (22) Staff Entrance, (23) Banking Hall, (24) Staff Lift, (25) Dome Light over, (26) Corridors, (27) Women's Retiring Rooms, (28) Lavatories, (29) Chief's Lavatory, (30) Cleaners, (31) Waiting Room, (32) Men's Staff Lavatories, (34) Landing, (35) Managers' Room, (36) Cables.

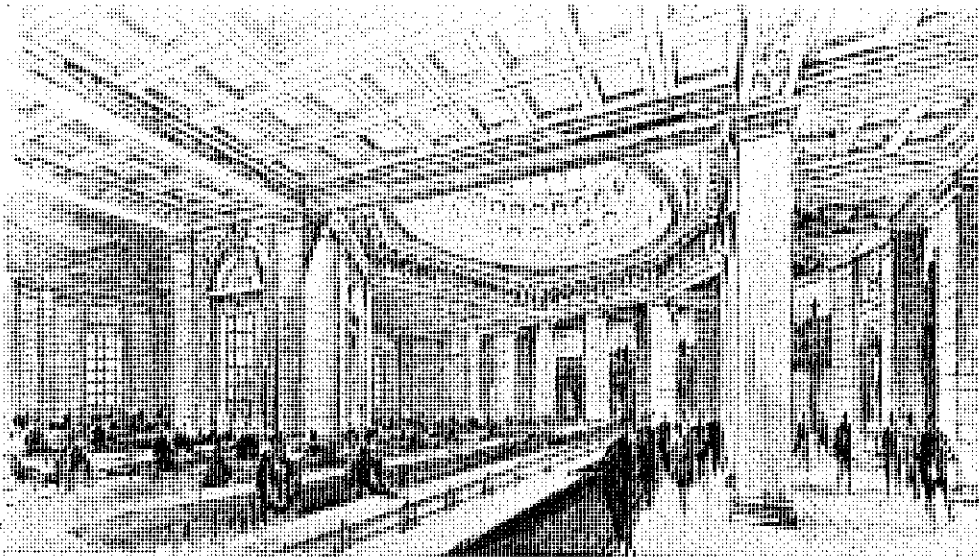


Left.—A stone carved PANEL in the Banking Hall. Right.—A KEYSTONE to the exterior arches.

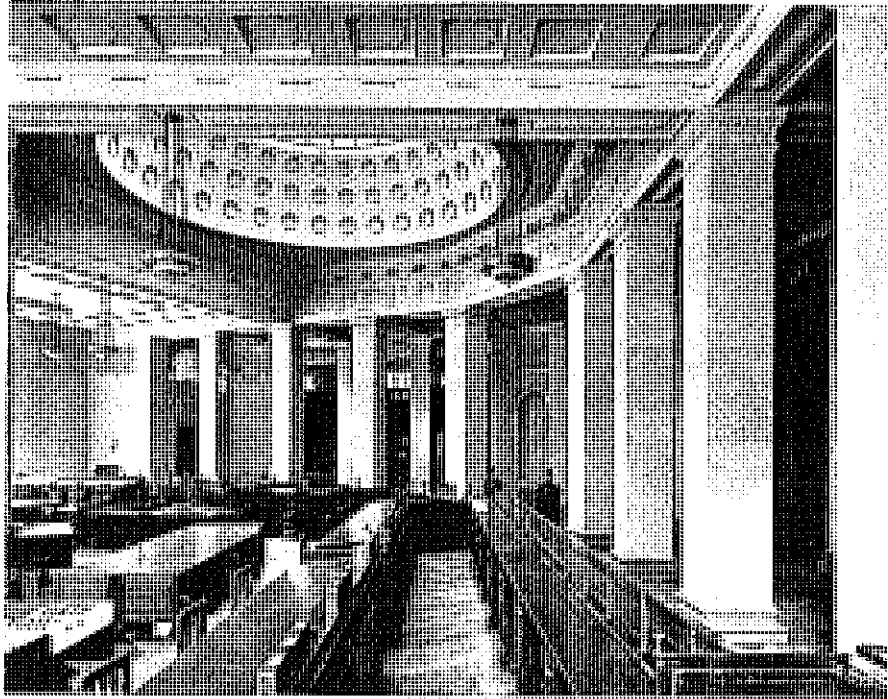
THE NATIONAL PROVINCIAL BANK



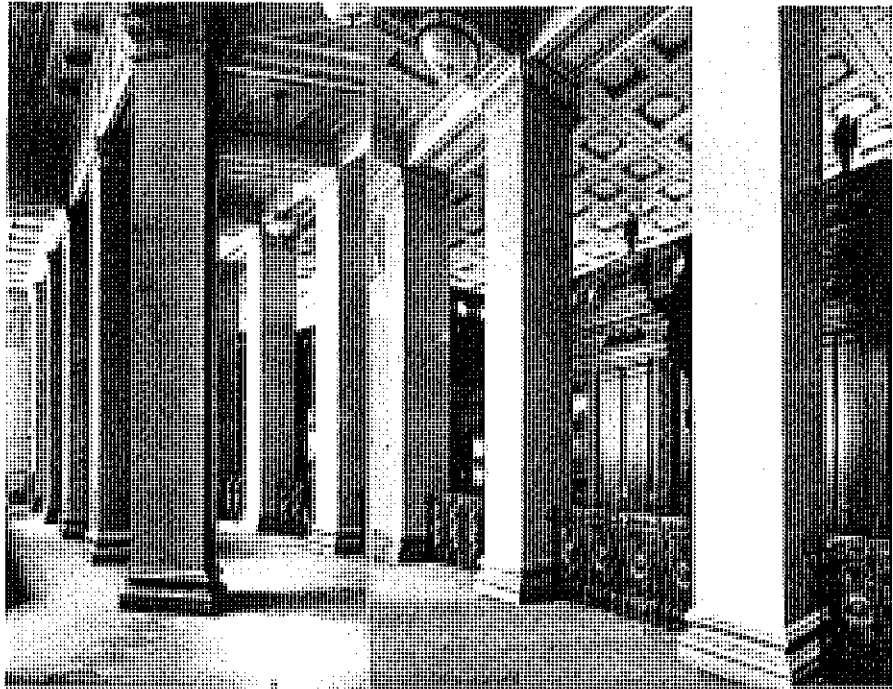
Looking from the public space across the dome of the *BANKING HALL* towards the lift-and-staircase feature, triangular on plan, and towards the apex of the site.



The *BANKING HALL* from just inside the entrance from Princes' Street. The colonnade indicates the extent of the public space. The axis of the hall runs through the centre of the dome and the lift-shaft, which is seen to its left.



THE BANKING HALL.—The walls and columns are built of Subiaco marble. The floor is in Roman stone and the ceiling in fibrous plaster. The counter is made of teak with a Sienna marble and bronze front. The desks are in teak.



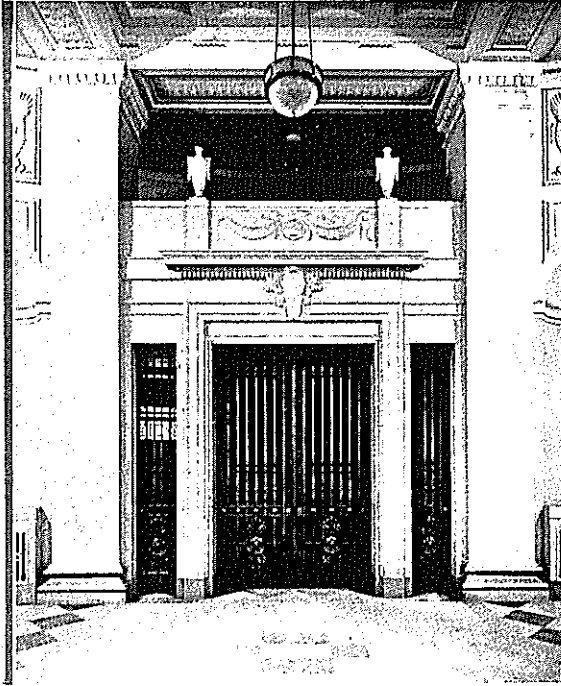
The PUBLIC SPACE in the Banking Hall.

Looking towards the managers' rooms from the Banking Hall. The gates are of bronze.

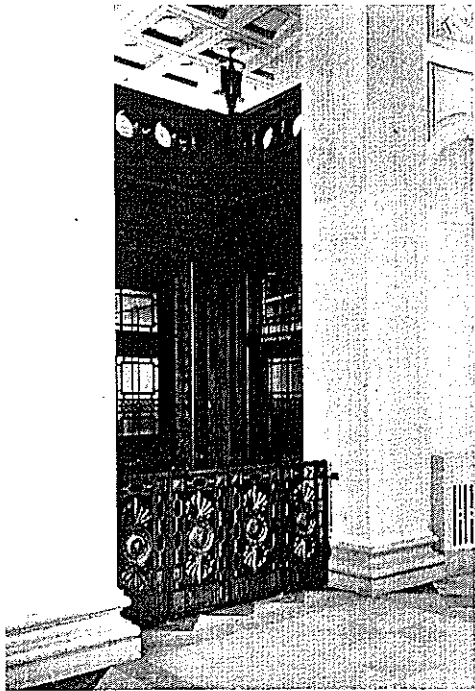
THE NATIONAL PROVINCIAL BANK



The *ENTRANCE DOORS*.—The doors are in oak and bronze and the fanlight is bronze.



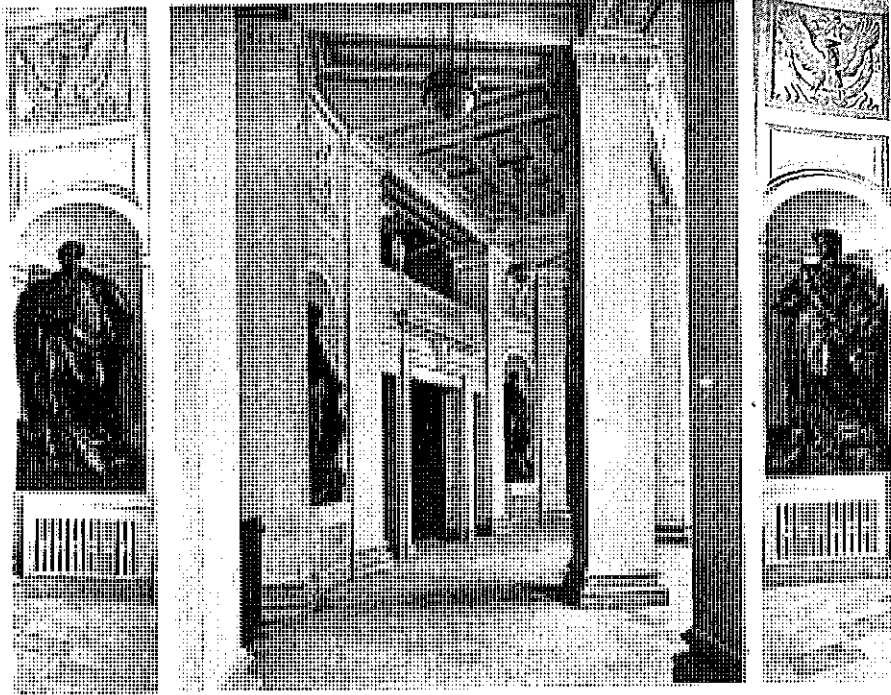
The bronze *GATES* leading to the staircase.



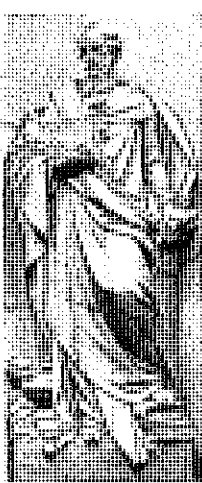
The bronze *GATES* in the Banking Hall.



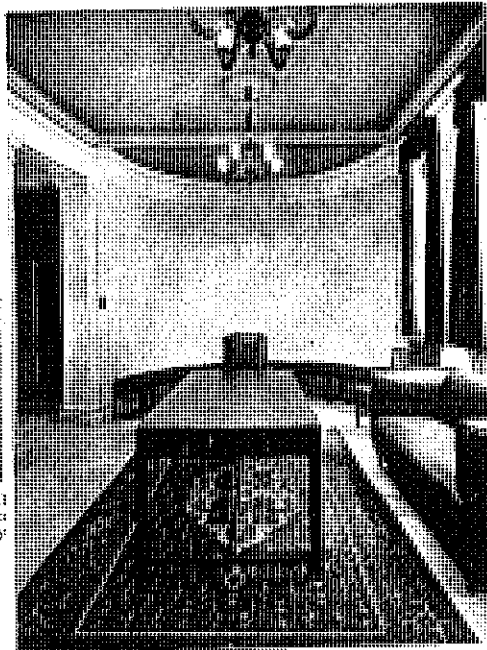
A *LETTER-BOX* in walnut in the Banking Hall.



Centre. *THE BANKING HALL*, looking towards the staircase. The sculptural figures (*left and right*) are *INTEGRITY* and *PROSPERITY* in bronze, by C. L. J. Doman.



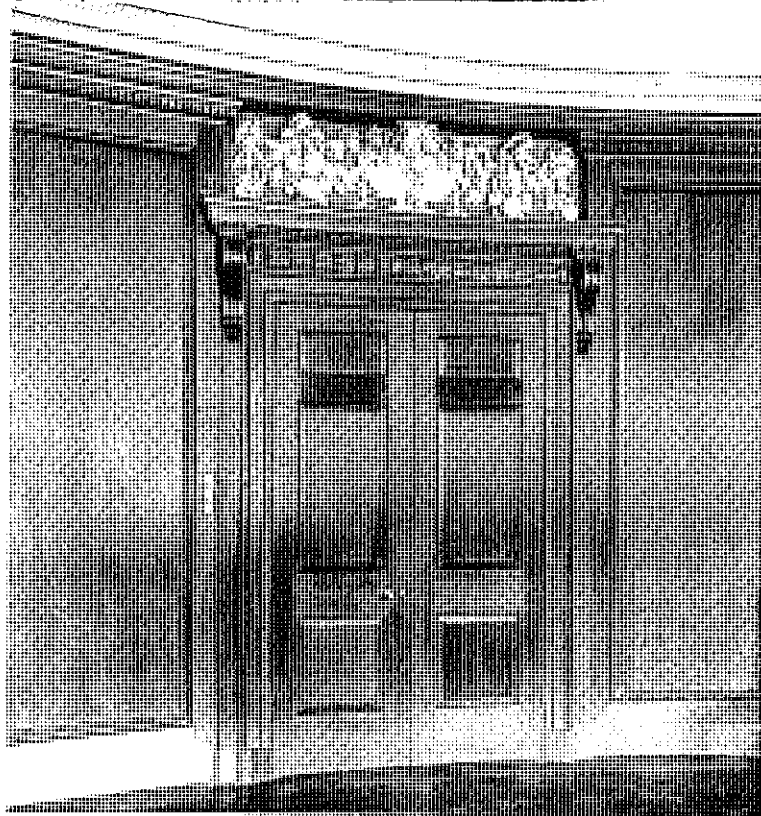
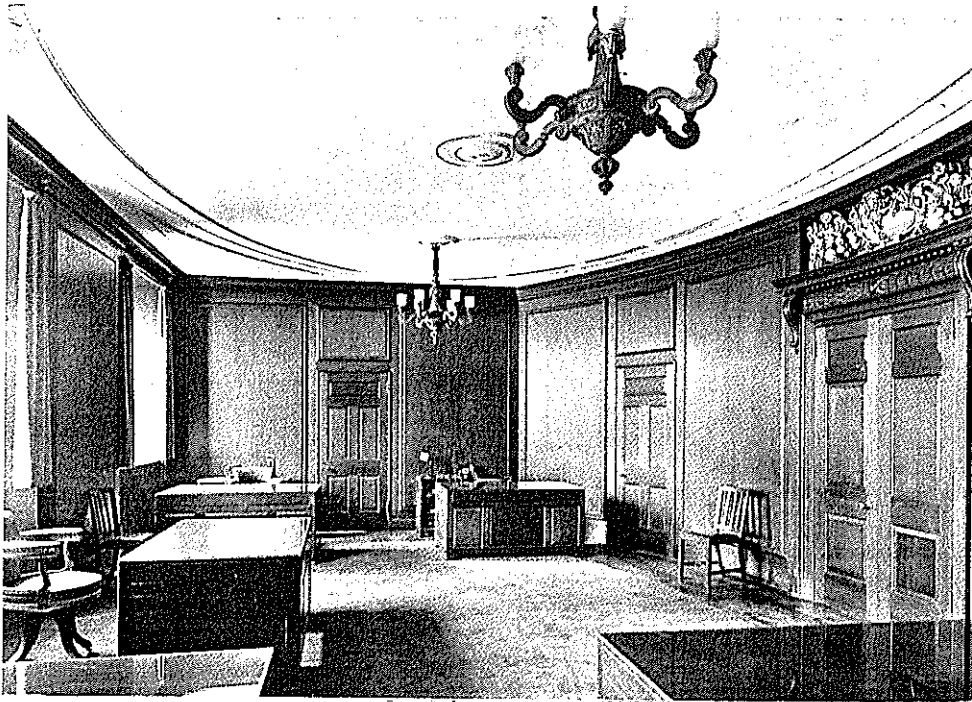
INTEGRITY. A sculptural figure on the façade to Mansion House Street, by C. L. J. Doman.



THE WAITING-ROOM on the first floor. The walls are of stone. The furniture was designed by the architect, and is in oak and hickory.

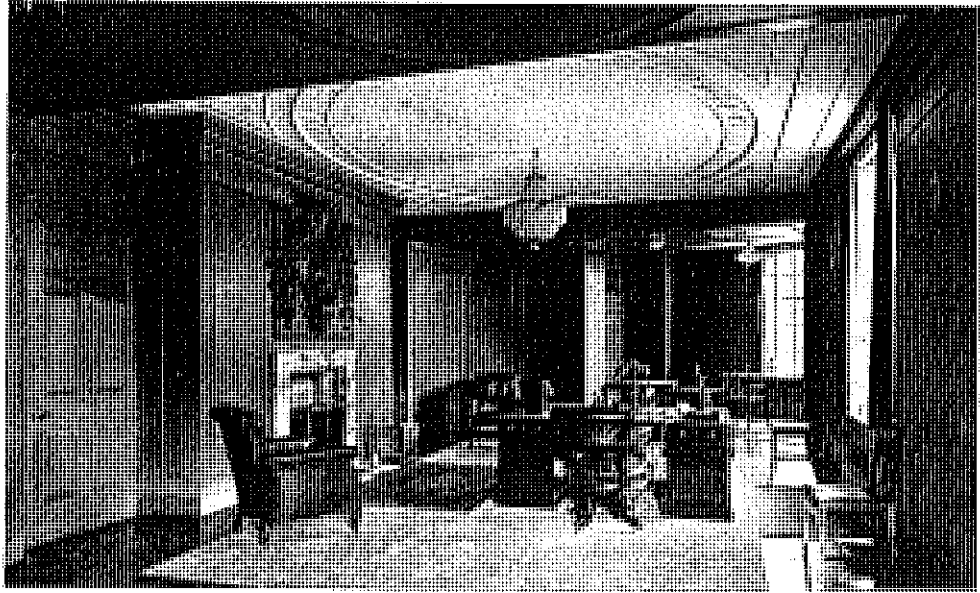


SECURITY. A sculptural figure on the façade to Mansion House Street, by C. L. J. Doman.

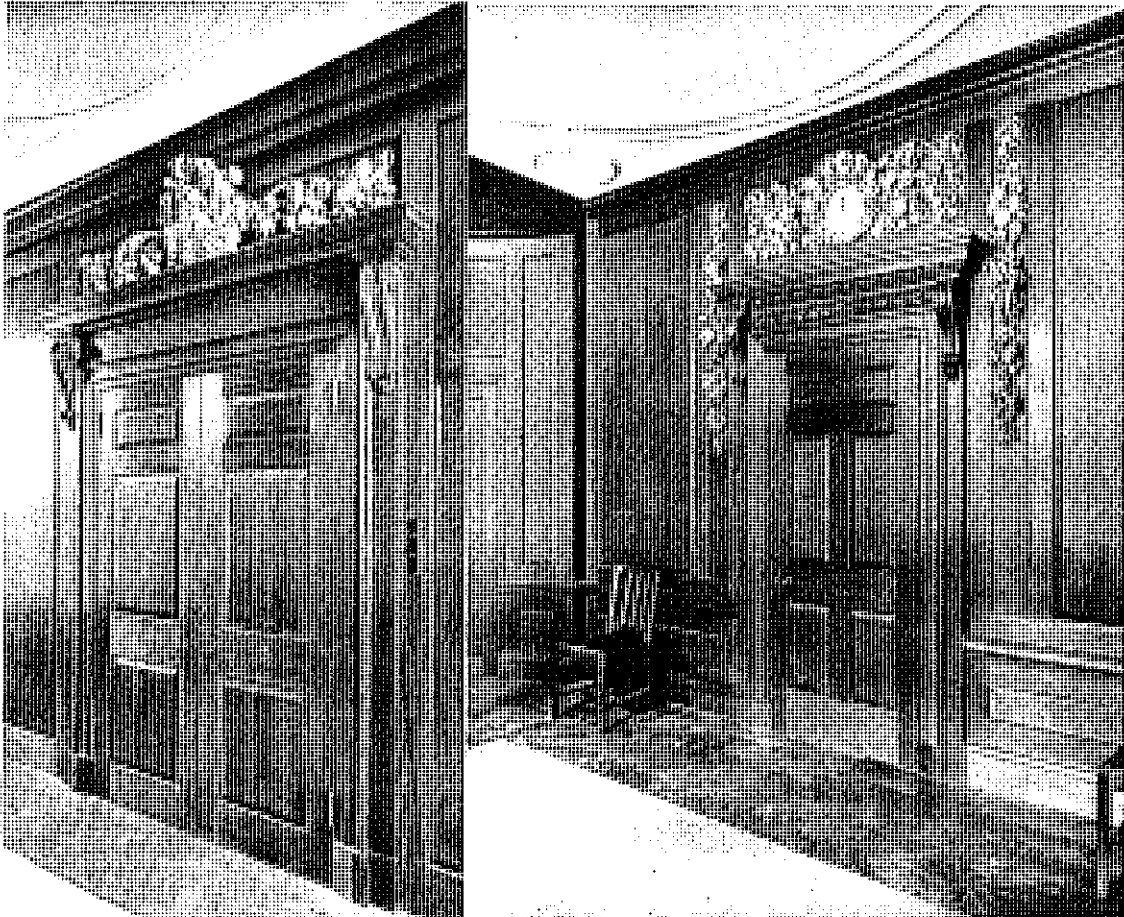


Above. THE OVERSEAS MANAGERS' ROOM on the first floor. The walls are paneled in oak. Right. THE ENTRANCE DOOR, the carving over which is in lim wood

The Architectural Review, April 1932.

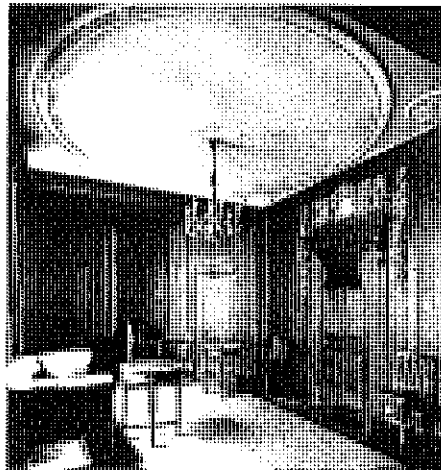


Above. The *DIRECTORS' ROOM* on the third floor. The walls are paneled in pine. *Left.* The *FIREPLACE* in the Directors' Room. The surround is in PavanaZZa marble.



The entrance door to the *DINING-ROOM* on the sixth floor. The door is in oak and the carving above it in limewood.

The entrance door to the *RECEPTION-ROOM* on the sixth floor. The carving over the door is in limewood.



THE RECEPTION-ROOM. — The walls are paneled in oak and the floor is laid with wood blocks.

Appendix 5: Building Damage Assessment Report


Bank Station Capacity Upgrade


Building Damage Assessment Report


Building A5

1 Princes Street

URS-8798-RPT-G-001169

Prepared by: Lisa Perkins
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Document Owner	
Company:	URS
Role:	Designer

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Consultation:

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- 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 1 Princes Street, Ref A5.

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. 1 Princes Street is located at the junction between Princes street and Mansion House Street. 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	A5
Location	Princes street
Address	1 Princes street
Building Type	Steel framed
Construction Age (Refurbished 1994-1997)	1929-32
No. of Storeys	8
Basements	3
Top Level (mATD)	142.3
Foundation Type	3 No. caissons / raft
Ground Level (mATD)	113.3
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

A paper by Richardson^[9] mentions three caissons being sunk to 55 feet below the site level. For the purpose of this assessment, given that the site level is unknown, it is assumed at ground level (113.3mATD) which implies a founding level of 96.5mATD. This is deeper than would be indicated by three levels of basement and an allowance of 1.5m for a raft (102.8mATD). Due to the uncertainty as to the existence of the caissons and their effect on the settlement the assessment has been carried out at 96.5mATD to be conservative.

The building was partially demolished and rebuilt in 1997 and the facades and structure to ground level together with an internal dome and support structure were retained. “A new raft foundation of 1.2m thick reinforced concrete was provided below basement 3 to supplement the original. The raft is founded in the London Clay”. No mention is made of the caissons and a brochure from structural engineers NYL does not show them in a diagrammatic cross section.

The building was designed by Sir Edwin Cooper and is classical in style, with a five storey Portland stone elevation that includes a Doric frieze and cornice above the ground floor and incorporates a group of statues. A plaque records that Mrs Elizabeth Fry (1780-1845), Prison Reformer, lived here 1800-1809. Internally, the building has been stripped of historic features, and shows predominantly modern finishes with dropped ceilings and partitions. To the centre of the building is a retained domed banking hall, which contains square marble columns and statuary, and plaster decorative elements. This historic section of the interior, together with the Portland stone façade, retains much heritage value.

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 and 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 for traditional masonry structures 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) and Central line temporary tunnel BSCU-DRA-DTT-N133_Z-M3-Y-8000;
- 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 W12300^[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 Princes Street	96.5*	45.8	12.5
Note: Where E / G is the ratio of Young's modulus to shear modulus of the deep beam representing the building. * Base level of caissons ^[9]			

Table 3: Building data

Tunnel Item	Level of axis (mATD)	External diameter (m)	Volume Loss (%)
Running tunnels	Varies	5.4	1.5
Temporary access tunnel	Inclined (82.3 to 89.2)	5.0	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 distance of building 1 Princes Street (A5) relative to the excavation elements listed in Table 5 is sufficiently large that this building should not be affected by their construction.

The Xdisp model filenames used to undertake this assessment are:

- A5 – 14.4.14 Stage 4
- A5 – 14.4.14 Stage 3
- A5 – 14.4.14 Stage 2
- A5 – 14.4.14 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)	Max Tensile Strain (%)
A5 (line 1)	26	0.035
A5 (line 2)	24	0.009
A5 (line 3)	24	0.025
A5 (line 4)	2	0.001
A5 (line 5)	15	0.046

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

Section	Maximum Settlement (mm)	Max Tensile Strain (%)
A5 (line 1)	26	0.026
A5 (line 2)	24	0.009
A5 (line 3)	24	0.026
A5 (line 4)	2	0.001
A5 (line 5)	19	0.057

Table 7: Building response at end of Construction

The results of the assessment show that construction stage 4 is the critical stage for this building, where line 5 experiences the most onerous combined tensile strain (0.057%) on the short southern end of the building. This façade is very short and the

analysed strains are therefore not likely to be correct. Further comment is made below about the behaviour of the building. The vertical Greenfield ground movements along the section line 1 and line 5 are shown in Figure 4 and Figure 5 respectively. The relative position of the building and tunnels along section line 1 and section line 5 are shown in Figure 6 and Figure 7 respectively. The calculated strains are summarised in Table 8.

Strains in section (Curvature)	Position from start (m)	Length (m)	Average* Horizontal Strain (%)	Maximum Tensile Strains (%)	Damage Category
Sagging (Stage 3 line1)	0.0	24.5	-0.031	0.035	Negligible
Hogging (Stage 3 line1)	24.5	6.5	0.003	0.003	Negligible
Hogging (Stage 4 line 5)	0.0	12.8	0.041	0.057	Very Slight

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

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

The Stage 2 engineering assessment has predicted that the maximum tensile strain falls within damage category 1. This corresponds to Very Slight damage in accordance with Table 2.

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

There is some doubt over the exact details of the 1930's foundations and how the raft added in the 1997 refurbishment relates to the caissons described in historic documents. The description provided by the Engineers to the 1997 refurbishment (Campbell Reith Hill) makes no reference to the caissons described in historic documents, but does describe a new 1.2m raft provided below basement level 3.

The refurbishment works resulted in the demolition and replacement of much of the building's structure. The basement retaining walls (2.4m thick), main columns up to underside of first floor, the plate transfer beams at second floor and much of the steel framed and stone clad facades were retained. The new steel frame and concrete floor decks take support from the original steel framed façade. This arrangement fixes the retained façade to the new internal structure, without a movement joint being provided. It is noted that the 1.2m raft and the original basement retaining walls are founded at approximately the same level, however if the raft interacts with the caissons then some differential movement may occur.

The elevations to Princes Street and Mansion House Street include a large set back above second floor level extending to the underside of the cornice at sixth floor level. This set back will have the effect of concentrating all movement on these elevations to either end of the cornice, as indicated in the image below, where red lines indicate areas of stress concentration.



Plate 2: Stress Concentration in Elevations

Score: 2 - The inset elements of the façade will effectively act as large openings, leaving the narrow cornice to prop the two ends of the opening. This will lead to a stress concentration at each end of the setback, focusing all movement in these locations.

SENSITIVITY OF THE HERITAGE

Following a redevelopment during the 1990s, only the façade and the banking hall which is located to the centre of the building through the entrance from Princes Street, are of heritage interest.

The octagonal banking hall has a large glazed central dome, which is now roofed over with a concrete structure. The hall is double height and has marble columns up to a balustraded balcony with statuary. There is decorative plasterwork to the balcony, walls, cornices and around the neck of the dome. Both the marble and plasterwork elements of the interior would be susceptible to damage from differential settlements, particularly the marble which would be difficult to repair when cracked.

The Portland stone façade is fine jointed and would not be tolerant to large movements. The façade features heavy decorative detail including cornices and statuary, as well as fine jointed window surrounds and large openings where movement may be concentrated. Cracking through the Portland stone features may damage the heritage value of the building.

Score: 1 – the building incorporates brittle and tightly jointed surfaces which may be susceptible to damage in the event of differential settlement

SENSITIVITY OF THE CONDITION

The elevations appear to be in good structural condition and were extensively repaired and restored during the 1997 refurbishment.

Score: 0 – The condition of the building will not exacerbate the structural or heritage sensitivities.

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 1

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 4

6 Conclusion

1 Princes Street has sensitive structural elements to its façade, where movements may be concentrated in specific areas. There are also high value heritage features which are brittle and may be damaged by differential settlement.

The Stage 2 engineering assessment has predicted that the maximum tensile strain falls within damage category 1 for 1 Princes Street. However, specific heritage and structural assessment taking into account the location and extent of settlement and tensile strains, alongside uncertainty over the extent of caisson foundations, indicates that the building could have a high level of structural and heritage sensitivity to movement. This assessment has determined that the building has a total score of 4.

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

In particular, the Stage 3 assessment should examine the implications of previous alterations to the building, including investigation of the foundations and further assessment of the brittle interior and façade finishes.

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 features 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.
- [8] Mott MacDonald (2012). Bank Station building data sheets – A list buildings. N133-BCR-MMD-00-Z-DC-S-0003-S0-1.0.
- [9] Richardson. A.E (1932). The National Provincial Bank, Princes Street and Mansion House Street, London. Architectural Review paper.

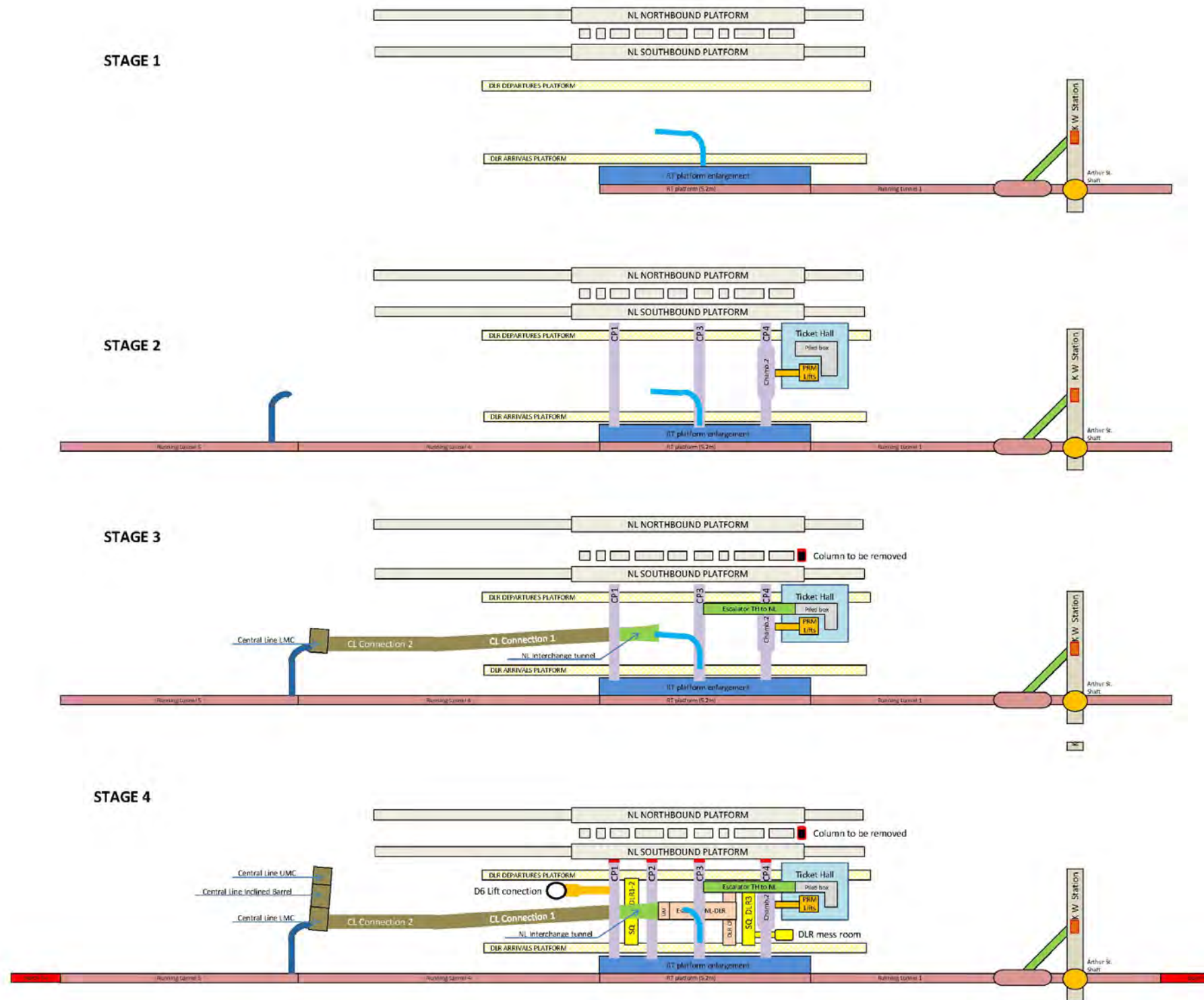


Figure 1: Construction Stage model

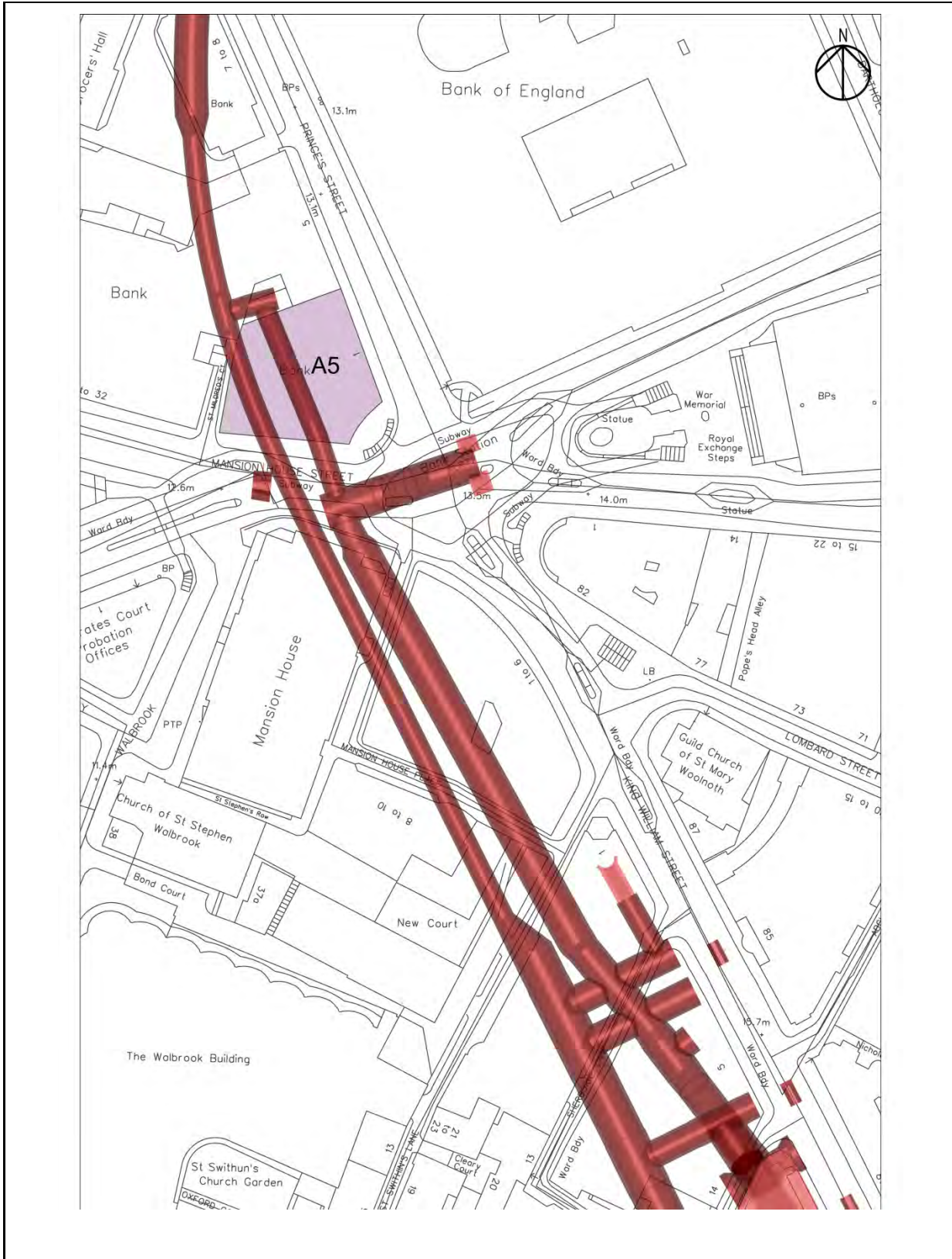


Figure 2: Location plan showing building location in relation to BSCU works

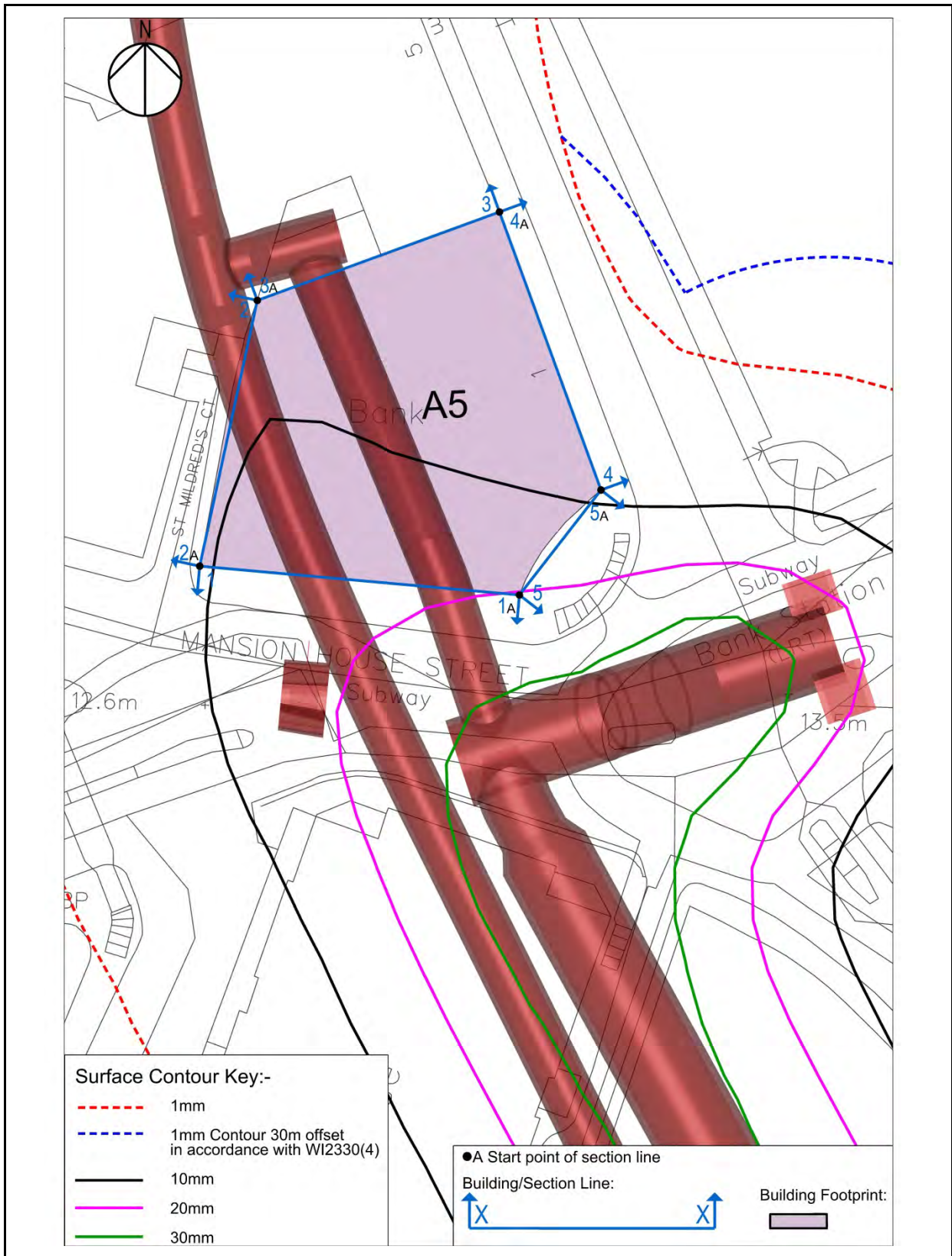
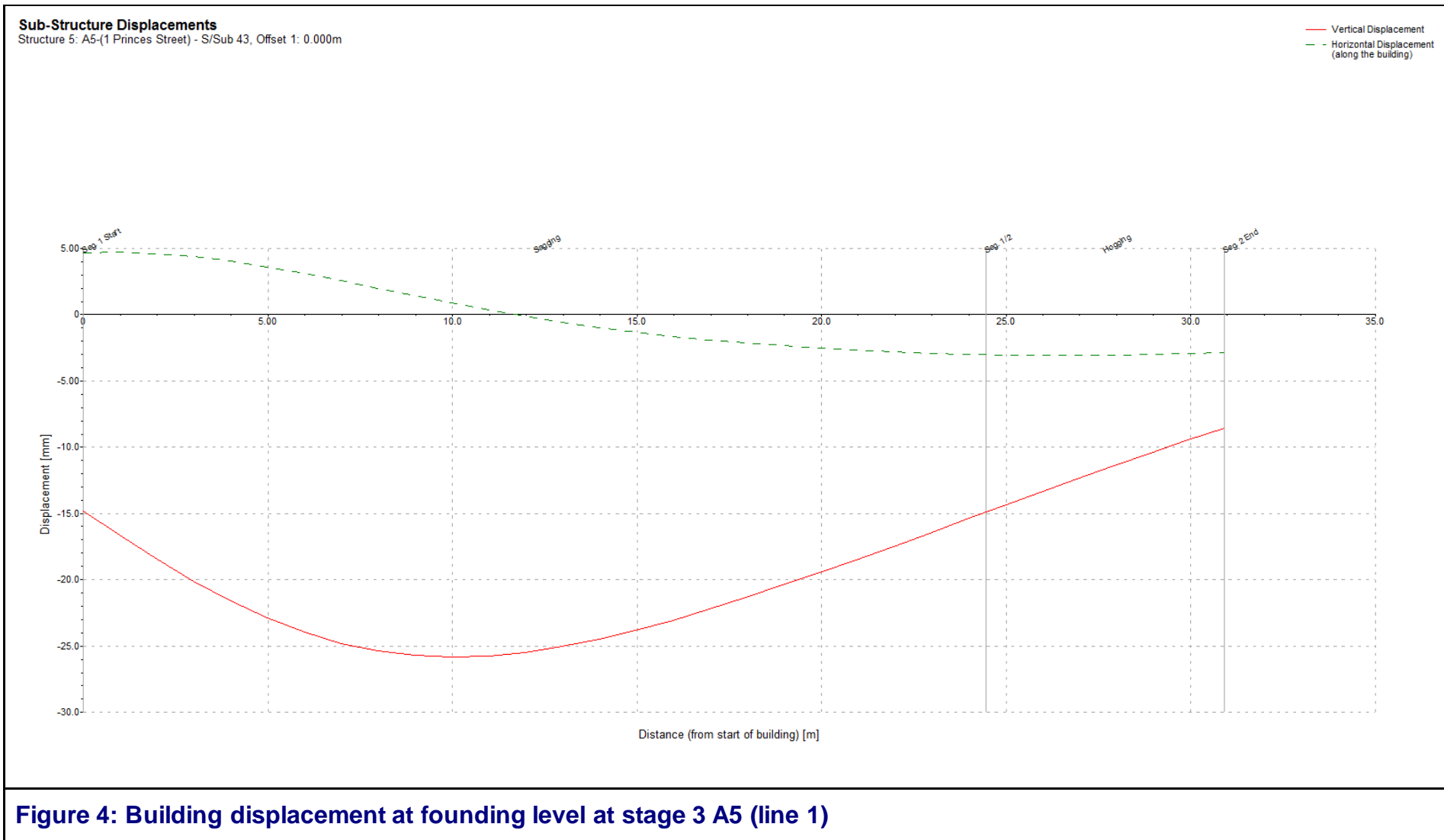
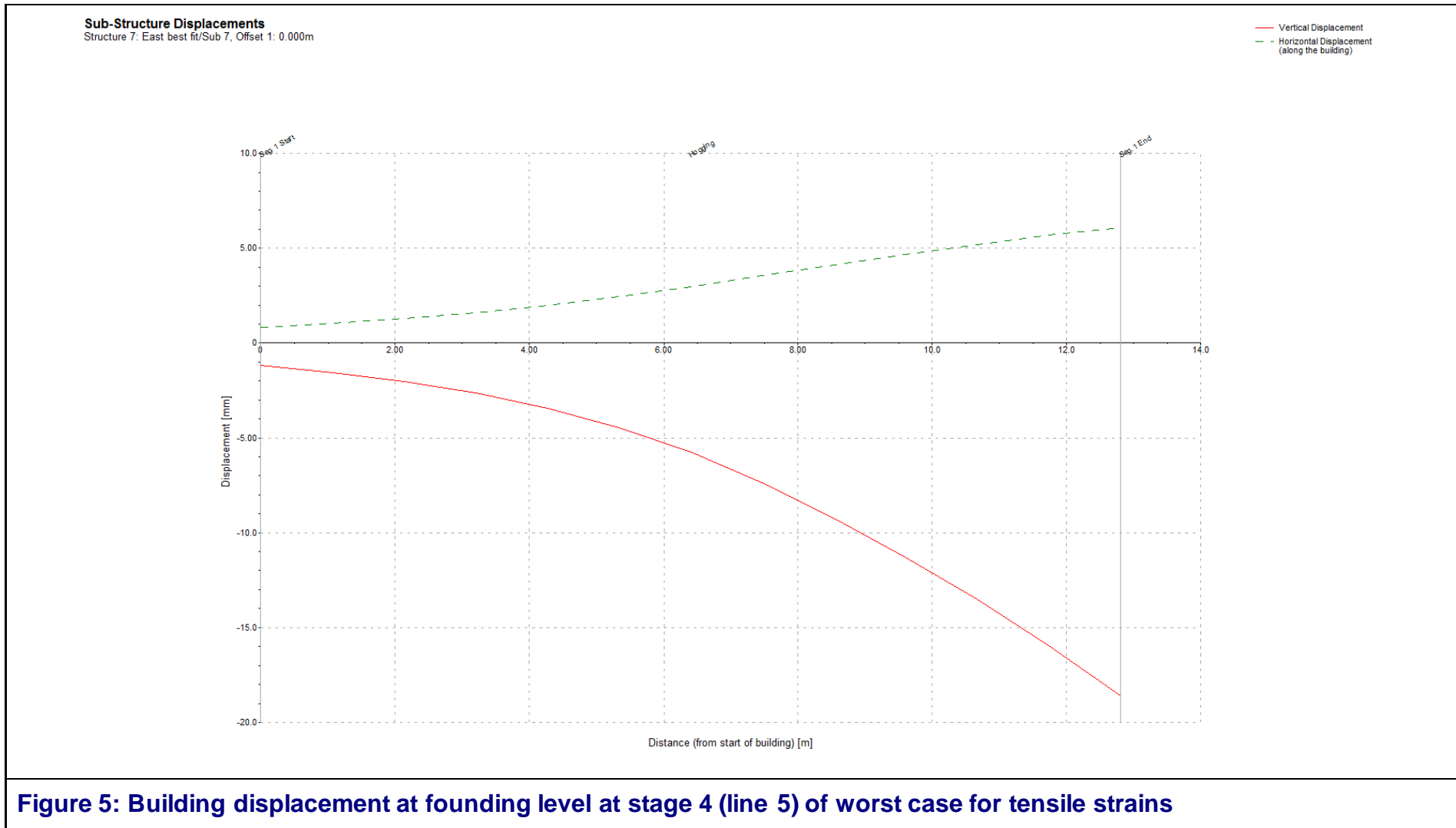
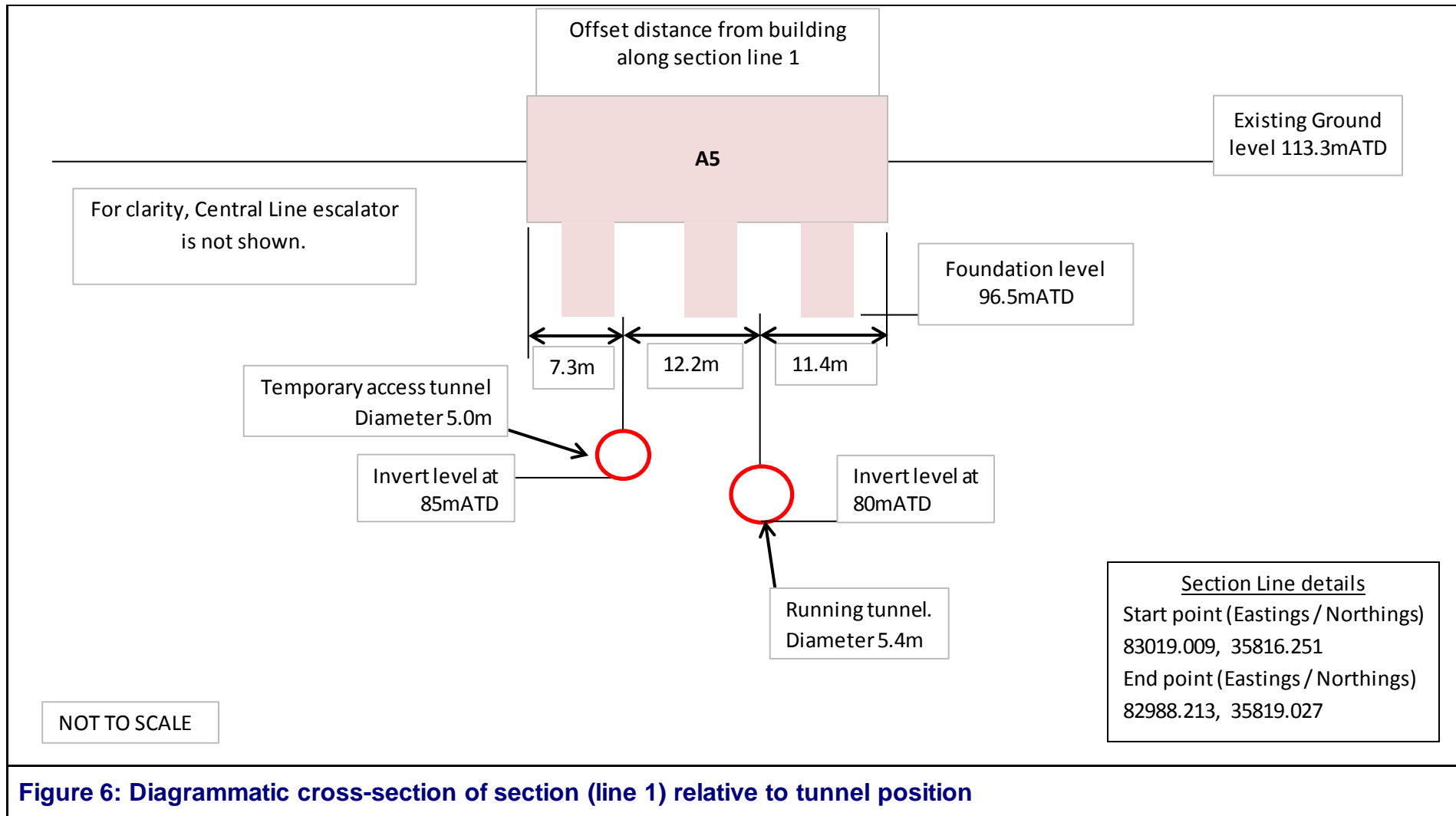
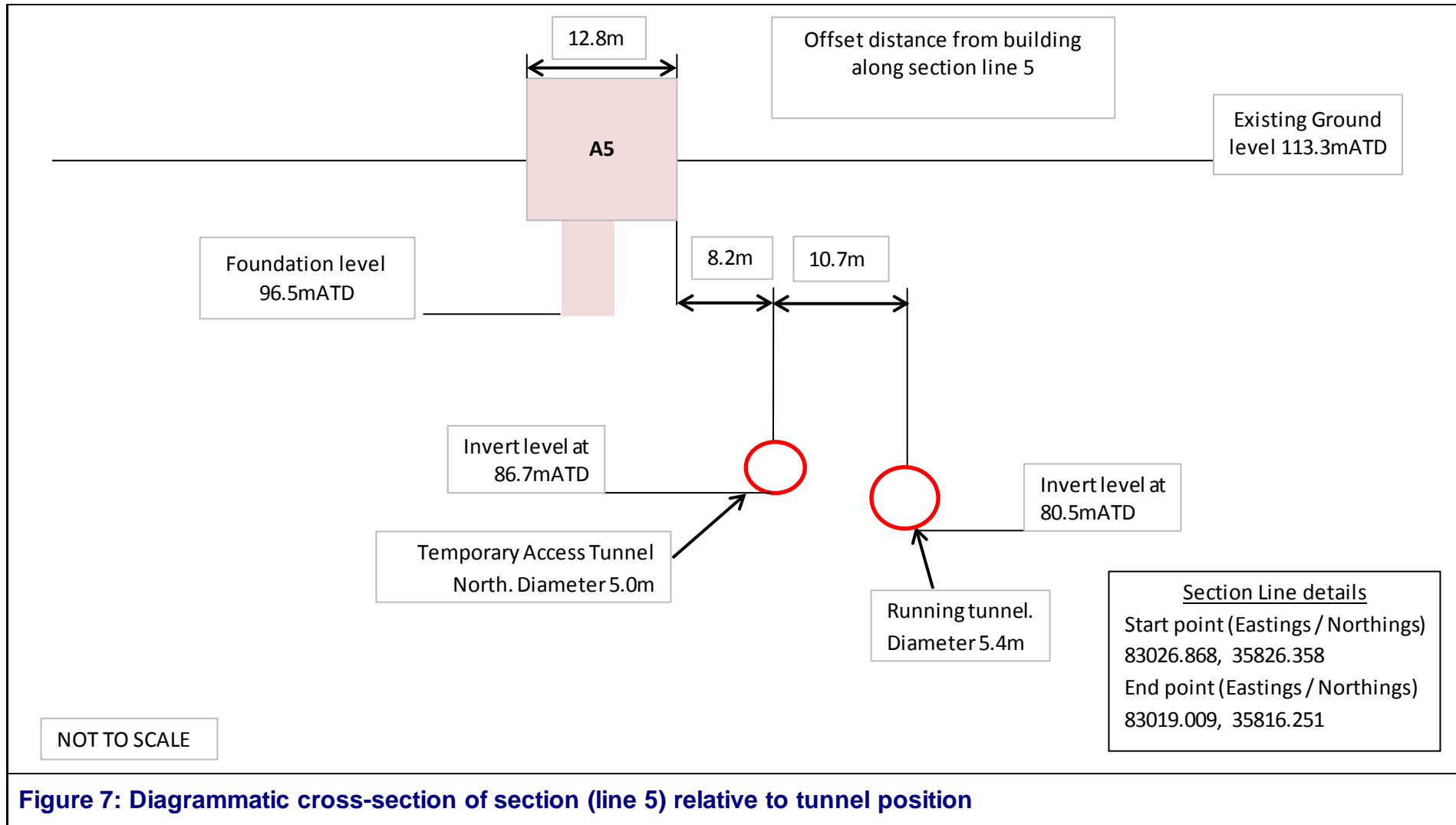


Figure 3: Building location, sections analysed and Settlement Contours at stage of worst case for tensile strains



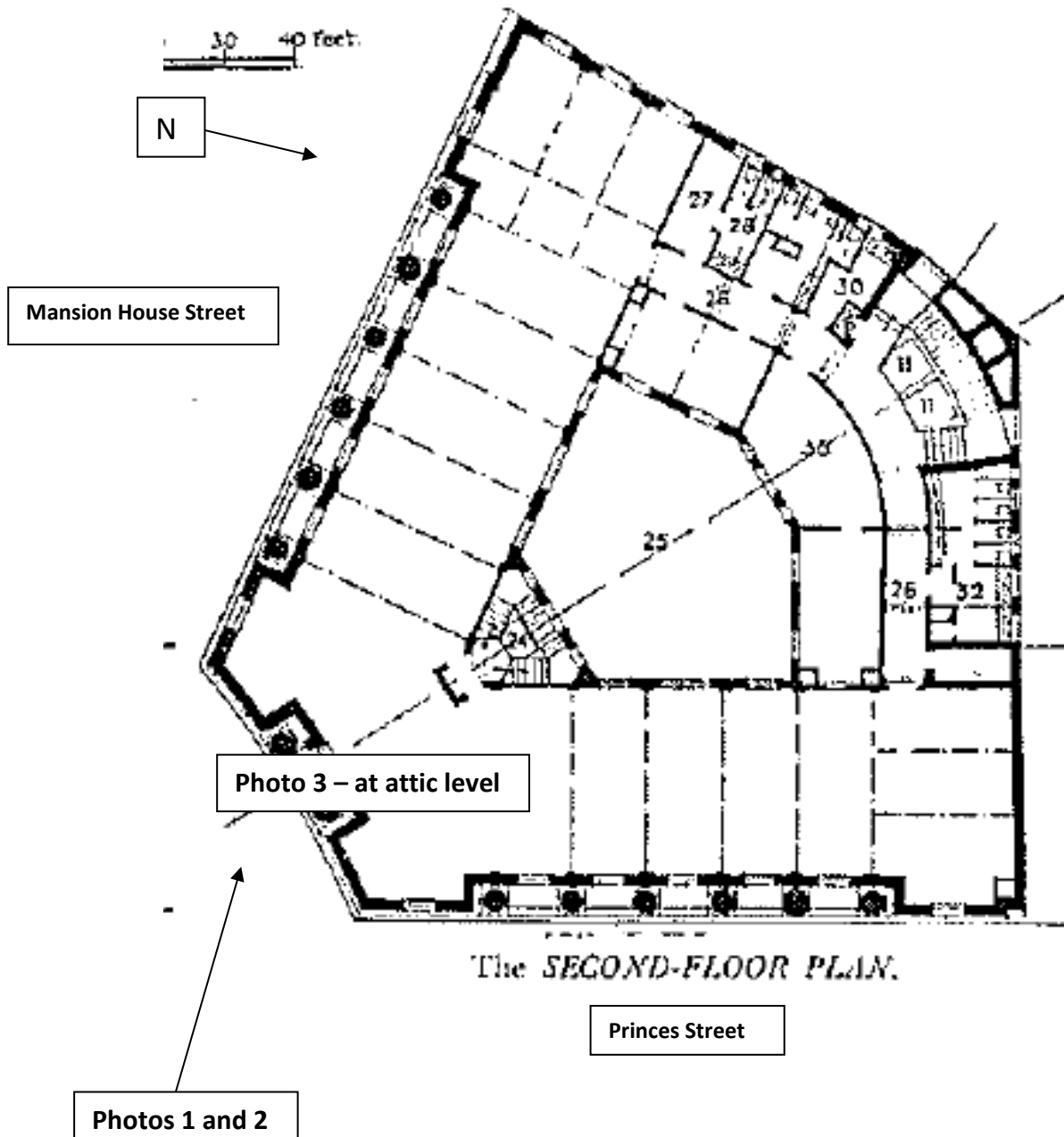




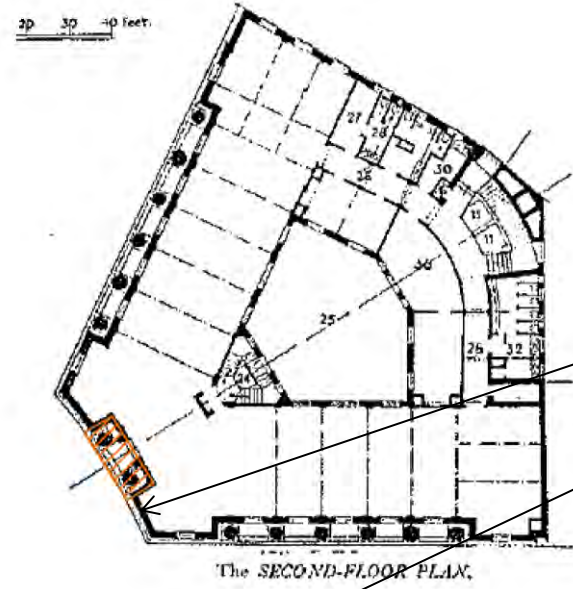


Appendix 6: Photo Locator

Plan taken from A.E Richardson, 'The National Provincial Bank, Princes' Street and Mansion House Street', Architectural Review, 1932



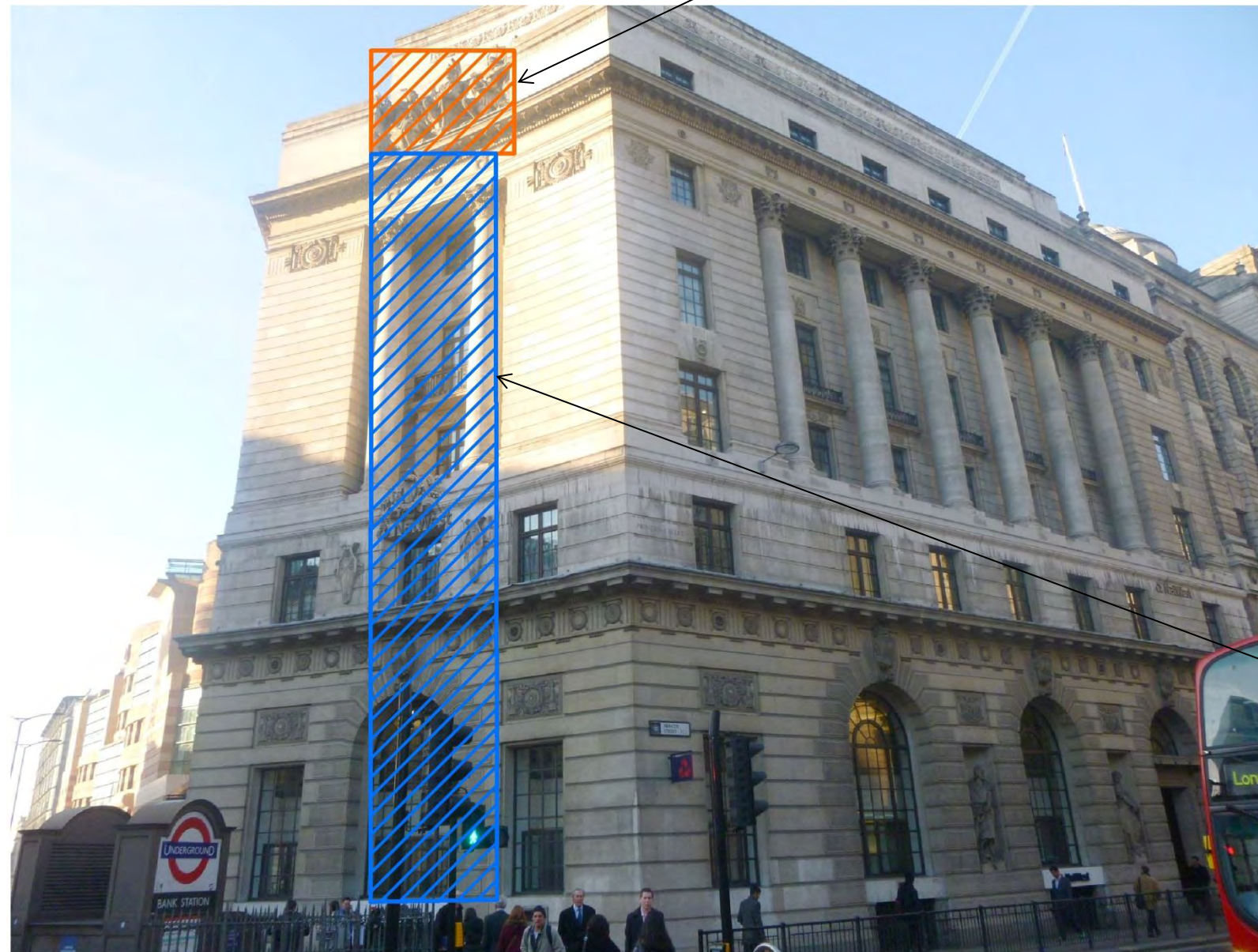
Appendix 7: Areas of interest



Location of corner elevation; statues at attic (sixth) floor



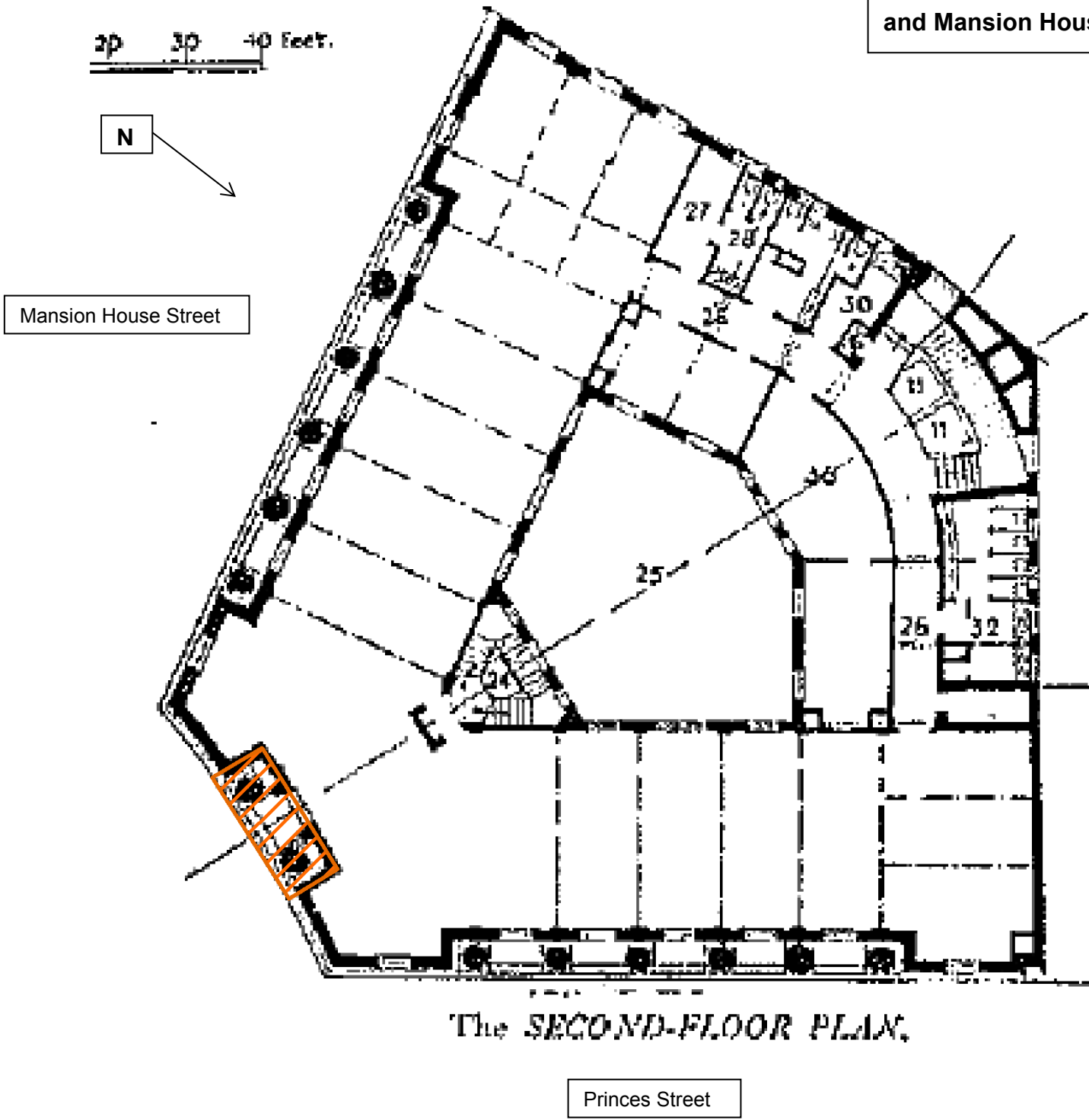
Group of statues to the corner elevation of 1 Princes Street



Area where strain is predicted to be concentrated in the event of ground movement to 1 Princes Street

Appendix 8: Areas to be affected by protective works

Plan taken from A.E. Richardson, 'The National Provincial Bank, Princes' Street and Mansion House Street', Architectural Review, 1932



Location of statues to attic storey



