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Annex A1b

Model form of Approval in Principle for the design/ assessment[1] of bridges and other highway structures where UK National Standards (Non-Eurocodes) are used

Name of Project: Shaftesbury Theatre
Name of Structure: Proposed Basement Extension
Structure Ref No.: n/a

1. HIGHWAY DETAILS

1.1 Type of highway

Pedestrianised, future highway loading.

1.2 Permitted traffic speed

30mph

1.3 Existing Restrictions

None at present

2. SITE DETAILS

2.1 Obstacles crossed

Not applicable

3. PROPOSED STRUCTURE

3.1 Description of structure and design working life

A proposed new single storey basement will extend from the external elevation of Shaftesbury Theatre along two sides currently named Bloomsbury Street and High Holborn.

3.2 Structural type

In-situ reinforced concrete slabs, beams wall and columns to form the envelope of the basement extension.

3.3 Foundation type

Reinforced concrete raft.

3.4 Span arrangements

Maximum slab span- 3.025m
Secondary beam span- 5.3m
Primary beam span- 3.6m
RC Retaining wall- 3.5m
Note: Spans will be shorter on the High Holborn elevation of the basement.

3.5 Articulation arrangements

The slab will be designed to span continuously over the secondary beams. The secondary beams will have a pinned connection to the top of the sheet pile wall and will be simply supported by the primary beam. The primary beam will be designed as simply supported. The RC will have a fixed base and will be propped by the ground floor slab.

3.6 Road restraint systems requirements

Not applicable

3.7 Proposed arrangements for future maintenance and inspection/Inspection for Assessment1

All structure will be buried. All internal faces will be covered with permanent linings.

3.7.1 Traffic management

Not applicable

3.7.2 Arrangements for future maintenance and inspection of structure.

The soffit of the slab and the internal walls will have permanent fixed lining to the Bloomsbury Street basement. Sections of the High Holborn basement will be exposed concrete.

3.7.3A Intrusive or further investigations proposed

Not applicable

3.8 Environment and sustainability

No proposals as of yet. More information will be available from the contractor upon request.

3.9 Durability. Materials and finishes/Materials strengths assumed and basis of assumptions14

Minimum proposed concrete strength C40. Reinforcement fy= 500N/mm2.

3.10 Risks and hazards considered for design, execution, maintenance and demolition.
Consultation with and/or agreement from CDM co-ordinator [5]

Risks considered: Excavation close to an adjacent building, potential for high water table, localised ground movement during construction, safe operation of the venue during construction work. The risks and hazards involved with construction will be identified in task specific risk assessments and method statements. A revised basement impact assessment is being carried out to include the revised construction methodology.

3.11D Estimated cost of proposed structure, together with other structural forms considered (including where appropriate proprietary manufactured structure), and the reasons for their rejection (including comparative whole life costs with dates of estimates)

£3,028,223 including fit out.

Alternative construction methods considered were a "top down" gravity retaining wall solution, bored cast in-situ piles with in-situ concrete slabs solution and potential use of precast concrete to form the roof slab.

Sir Robert McAlpine (Special Projects) have been appointed as the principle contractor for the project. As a result of their involvement, the construction methodology and structural design of the basement has evolved.

3.12D Proposed arrangements for construction

3.12.1 Construction of structure

It is now proposed to install a sheet pile wall around the perimeter of the proposed basement. This will be designed by the piling contractor and is to be unpropped. The piles will be pushed into the ground to reduce vibration around existing structures. The ground behind the sheet piles will be excavated down to formation level. A 500mm thick reinforced concrete (RC) concrete raft foundation will be cast against the ground. RC walls will then be cast up against the sheet pile wall which will vary in thickness from 250mm up to approximately 700mm where the concrete is cast into the profile of the piles. The sheet piles will be left in-situ upon completion. Temporary formwork will be installed prior to casting of the columns and ground floor/roof slab and beams. The temporary works designer will submit a separate temporary works AIP.

3.12.2 Traffic management

The section of the A400 (Bloomsbury Street) immediately in front of Shaftesbury Theatre will be permanently closed as part of the West End Project. The footpath on High Holborn will be widened as part of the West End Project. The work to form the basement will coincide with the West End Project.

3.12.3 Service diversions

A full utilities survey has been carried out and multiple diversions are required. The services diversions are currently ongoing and will be completed upon commencement of the basement works. The utility diversions will be managed by Source who are a specialist in this field.

3.12.4 Interface with existing structures

The proposed basement is to be constructed alongside Shaftesbury Theatre. There is a Crossrail tunnel running below High Holborn, adjacent to the theatre. Crossrail have been consulted and the location of their asset has been identified. All work is to be carried out outside of the Crossrail exclusion zone.

3.13A Year of construction

2020

3.14A Reason for assessment

Not applicable

3.15A Part of structure to be assessed

Not Applicable

4. DESIGN/ASSESSMENT[1] CRITERIA

4.1 Actions

4.1.1 Permanent actions

Slab dead load, road build up and paving

4.1.2 Snow, Wind and Thermal actions

Snow load as BS5400-2 . No wind Load.

4.1.3 Actions relating to normal traffic under AW regulations and C&U regulations [6]

HA loading.

4.1.4 Actions relating to General Order traffic under STGO regulations [7]

HB Loading (25 Units).

4.1.5 Footway or footbridge variable actions

10kN/m^2 general loading.

4.1.6 Actions relating to Special Order traffic, provision for exceptional abnormal indivisible loads including location of vehicle track on deck cross-section [8]

Not applicable

4.1.7 Accidental actions

Not applicable

4.1.8 Actions during construction

Construction delivery vehicles and crane loads will be considered as part of the temporary retaining structure design which will be carried out by a specialist consultant.

4.1.9 Any special action not covered above [9]

Not Applicable

4.2 Heavy or high load route requirements and arrangements being made to preserve the route, including any provision for future heavier loads or future widening

Not Applicable

4.3 Minimum headroom provided

Not Applicable

4.4 Authorities consulted and any special conditions required

The following organisations have been consulted as part of the design process:
Crossrail
Utility companies
Camden Council

4.5 Standards and documents listed in the Technical Approval Schedule

~~BS 5268; Part 2; 2002 Structural Use of Timber~~
BS 5400 Steel concrete and composite bridges
Part 1, 1988 General Statement (see BD1)
Part 2; 1978 Specification for loads (see BD1)
~~Part 3; 2000 CP for design of steel bridges (see BD1)~~
~~Part 4; 1990 CP for design of concrete bridges (see BD2)~~
~~Part 5; 1979 CP for design of composite bridges (see BD16)~~
~~Part 9; 1983 Bridge bearings (see BD20)~~
~~Part 10; 1980 CP for fatigue (see BD9)~~

BS 5628; Part 1; 1992 Unreinforced Masonry
BS 5930; 1999 Site Investigations
BS 6031; 1981 Earthworks
BS 8002; 1994 Earth retaining structures
BS 8004; 1986 Foundations
~~BS 8118; 1991 The structural use of aluminium~~

4.6 Proposed Departures relating to departures from standards given in 4.5
None

4.7 Proposed Departures relating to methods for dealing with aspects not covered by standards in 4.5
None

5. STRUCTURAL ANALYSIS

5.1 Methods of analysis proposed for superstructure, substructure and foundations

The ground floor slab, secondary beams, primary beams, columns and retaining wall will be analysed in a 3D structural analysis software and element design will be carried out by hand calculation. The raft foundation will be analysed using a finite element analysis package to assess the bearing stresses and the stresses within the slab. Sheet piles and other temporary works will be carried out by the contractor responsible for that element of the works.

5.2 Description and diagram of idealised structure to be used for analysis

The sheet pile designer will provide details of their design in an addendum to this document once appointed. The slab supporting the road will span approximately 1.3m continuously between secondary beams. The secondary beam will have a pinned connection to the top of the retaining wall where it will coincide with a narrow capping beam. The secondary beam will be designed as being simply supported by the primary beam which is also simply supported between in-situ columns down to the floor of the basement. The slab will be designed for HA loading and HB loading as set out in BS5400.

The columns will be supported on a raft slab which will distribute load into the ground bearing strata.

5.3 Assumptions intended for calculation of structural element stiffness

Element Stiffness for concrete members will be derived in accordance with BS5400 Part 4 Clause 4.4, using full elastic uncracked member cross-sections ignoring the presence of reinforcement.

5.4 Proposed range of soil parameters to be used in the design/assessment of earth retaining elements [13]

Density : 20kN/m^3
Safe GBP (Net): 225kN/m^2

6. GEO TECHNICAL CONDITIONS

6.1 Acceptance of recommendations of the Geotechnical Design Report to be used in the design/assessment[1] and reasons for any proposed changes

Net ground bearing pressures to be adopted due to release of overburden from existing ground.

6.2 Summary of design for highway structure in Geotechnical Design Report

Not Applicable

6.3 Differential settlement to be allowed for in the design/assessment[1] of the structure

None

6.4[D] If the Geotechnical Design Report is not yet available, state when the results are expected

and list the sources of information used to justify the preliminary choice of foundations

Geotechnical reports indicate Lynch Hill Gravel over London Clay. Safe GBPs are reported to be in the range of 120kN/m^2 to 150kN/m^2 when the effects of the gravel layer are discounted. Plate bearing test will be carried out once the ground is excavated to foundation level to confirm safe GBPs.

7. CHECK

7.1 Proposed Category

Category 1 check in accordance with BD2/12

7.2 If Category 3, name of proposed independent Checker

Not applicable

7.3$_D$ Erection proposals or temporary works for which Types S and P Proposals will be required, listing structural parts of the permanent structure affected with reasons

Not applicable

8. DRAWINGS AND DOCUME NTS

8.1 List of drawings (including numbers) and documents accompanying the submission [15]

Appendix A: Drawings
2714-1004-T1-Ground Bearing RC Slab GA
2714-1005-T1-Ground Bearing Slab GA
2714-1006-T1-Basement Box Roof Slab GA
2714-1007-T-Pavement light Supports GA
2714-1008-T1-Slab and Reinforcement Details
2714-1009-T1-Section X-X
2714-1010-T1-Section Y-Y
2714-1011-T1- Sheet Pile Capping Beam RC GA
2714-1012-T- Retaining Wall Elevations & Details
2714-1013-T-Typical RC Section Through Basement
2714-1014-T-Basement Box RC Shear Wall & Column GA
2714-1015-T1-High Holborn RC GA and Sections
2714-1016-T1 -Steps 1&2 to from New Opening in Existing Wall
2714-1017-T1- Steps 3&4 to from New Opening in Existing Wall
2714-1018-T1- Steps 5 to from New Opening in Existing Wall
2714-1019-T1-Section Through Existing Opening
2714-1020-T- Notes
2714-1040-T-Existing Foundation Underpinning Detail
2714-10050 Trial Pit Locations GA
2714-1051-T1 Trial Pit Sections and Details

Appendix B: Idealised Structure

Sketch 2714-IST-02

Appendix C:

Factual Site Investigation Report 25th Jan 2013
Site Investigation Report 29 January 2018
Borehole logs-24/11/2019-02/12/2019- Strata Geotechnics
Site Investigation Report 05/12/2019 G184804- Strata Geotechnics

8.2A List of construction and record drawings (including numbers) to be used in the assessment

Not applicable

8.3A List of pile driving or other construction records [19]

Not applicable

8.4A List of previous inspection and assessment reports

Not applicable

9. THE ABOVE IS SUBMITTED FOR ACCEPTANCE

We confirm that details of the temporary works design ~~will be~~/have been[1] passed to the permanent works Designer for review.[16]

Signed GAM
Name G. A. DAWES
Design/Assessment[1] Team Leader
Engineering Qualifications MISTRUCTE CENG [17]
Name of Organisation M. J. CONSULTING.
Date 12/03/2020

10. THE ABOVE IS REJECTED/AGREE D[1] SUBJECT TO THE AME NDME NTS AND CONDITIONS SHOWN BELOW[18]

Signed _____
Name _____
Position held _____
Engineering Qualifications _____ [17]
TAA _____
Date _____

Notes

D. Indicates clauses to be used in Design AIP only.
A. Indicates clauses to be used in Assessment AIP only.
1. Delete as appropriate.
2. For a bridge, give over and/or under.
3. Include weight, height, width and any environmental restrictions at or adjacent to the bridge.
4. In cases of design, give applicable exposure classes for particular concrete structural elements. In cases of assessment, give material
strengths from record drawings or intrusive investigation. For all material strengths given, list the relevant codes/standards.
5. Designers should name the CDM co-ordinator and confirm that the CDM co-ordinator has reviewed the risks and hazards identified
in the AIP and is satisfied. Also see clause 2.12(i), (ii) and (iii).
6. e.g. HA Loading.
7. e.g. HB or SV Loading.
8. e.g. Individual vehicle which includes the following information as applicable:
a) Gross weight of the vehicle in tonnes and vehicle type and number.
b) Axle load and spacing (longitudinally and transversely).
c) Air cushion in tonnes over area applied (in metres, longitudinally and transversely).
d) Single or twin tyres and wheel contact areas.
9. e.g. seismic loading, atmospheric icing, floating debris etc.
10. If in doubt, the heavy or high load route requirements should be confirmed by the relevant administration e.g. Abnormal Indivisible
Load team in HA. Initial indication can be found from the route maps which are available from Circular Roads No 61/72 – Routes for
heavy and high abnormal loads, and also from the website
http://www.esdal.com or in Scotland http://www.transportscotland.gov.uk/reports/road/j12054-00.htm
11. List the main structural elements for superstructure, substructure and foundation. If the designs of the superstructure, substructure
and/or foundation are carried out by different teams, refer to cl. 2.22 and 2.42.
12. Factors of Safety are required where limit state design codes for bridges are not used. See 4.17(e).
13. Where no such geotechnical information is available, suggested earth pressure coefficient values given in relevant DMRB parts
should be used instead.
14. When the results of the ground investigation become available, an addendum to the AIP, covering section 6, must be submitted to
the TAA. The addendum must have its own sections 8, 9 and 10 to provide a list of drawings, documents and signatures
15. Include, without limitation:
a) Technical Approval Schedule (TAS).
b) General Arrangement Drawing.
c) Relevant extracts from the Geotechnical Design Report, Inspection Report, Intrusive Investigation Report, Previous Assessment Report (or reference for Report).
d) Departures.
e) Relevant correspondence and documents from consultations.
16. This statement is applicable to temporary works design AIP only.
17. CEng, MICE, MIStructE or equivalent.
18. AIP is valid for three years after the date of agreement by the TAA. If the construction has not yet commenced within this period,
the AIP must be re-submitted to the TAA for review.
19. Include details of previous structural maintenance and/or strengthening works.