Name of Project:

59 Elm Avenue, Ruislip

Name of Structure:

Oak Grove Contiguous Piled Wall

Structure Reference Number:

tbc

1. HIGHWAY DETAILS:

1.1 Type of Highway:

Oak Grove – two lane carriageway with a footway on the east side

1.2 Permitted Traffic Speed:

30mph

1.3 Existing Restrictions:

None

2. SITE DETAILS:

2.1 Obstacles Crossed:

None

3. PROPOSED STRUCTURE:

3.1 Description of Structure and design working life:

A contiguous piled wall structure retaining Oak Grove as it rises from Elm Avenue over the Piccadilly and Metropolitan line tracks. The approximate length of the wall is 14m with a retained height varying from 0.0m to approximately 1.4m.
Design working life 120 years.

3.2 Structural Type:

Embedded Cantilever – Contiguous piled retaining wall

3.3 Foundation Type:

Augured Piles

3.4 Span Arrangement:

N/A

3.5 Articulation Arrangements:

N/A

3.6 Road Restraint System Type:

The new structure shall have an N1 type parapet resisting impact loading, load resulting from 1.5T vehicle impacting the barrier at 80kmph at 20 degrees. The N1 parapet will be independent and in front of the contiguous piled wall.

3.7 Proposed arrangement for Maintenance and Future inspection:

N/A

3.7.1 Traffic Management:

N/A

3.7.2 Access:

Access to the retaining wall shall be via landscaped area round the development. Access arrangements are shown on the attached plan. Access shall be maintained for the existing retaining wall. A general inspection shall take place at 2 years, 4 years with a principal inspection at 6 years intervals following completion on the site.

3.7.3 Intrusive or Further Investigations Proposed:

N/A

3.8 Environment and Sustainability:

The economic, social and environmental aspects of this project have been considered. The structure has been designed to have minimal impact to the environment and will withstand the impact of climate change with minimal maintenance. Where possible it is proposed to use materials that are locally sourced, from renewable sources, low in embodied energy, with long life expectancy and reused or recycled easily.

3.9 Durability and Materials:

Reinforced concrete is to meet the following criteria for sustainability. During construction, the material can be locally sourced/produced supporting local economies. Cement replacements and recycled concrete aggregates have been considered in accordance with BS8500-2. Concrete for capping beam is to be of min. Grade C35, 50mm min. cover to links. Concrete for piles is to be minimum RC35 with 50mm min. Cover to links.
Reinforcement is to be in accordance with BS4449:2005. Reinforcement can be recycled at the end of its life. During its life reinforced concrete is inert, requiring minimal maintenance, with low risk of contamination to groundwater for piles and capping beam.

3.10 Risks and Hazards considered for design, execution, maintenance and demolition:

The principal risk is the failure of the embankment during the works. To maintain the stability of the embankment a distance of at least 2 piles will be left before another pile is installed. Two piles will be left between concreted piles for each day of concreting.

3.11 Estimated Cost of proposed structure and alternatives considered:

Cost of the retaining structure is estimated to be £20k. Alternative arrangements considered were a sheet pile wall. Sheet piling was rejected due to constraints imposed by TfL.

3.12 Proposed arrangements for construction:

3.12.1 Construction Sequence:

a. Temporary raised piling mat installed by Main contractor (GGM Contractors).Infill crushed concrete to be used to create a level platform wide enough for safe access of the rig. No Vibration work to be carried out.

b. 350mm diameter auger bored pile installed to a designed depth of 8m

c. Piles installed in accordance with previous method statement.

d. A distance of at least 2no. piles is left before another pile is installed. Two piles will be left between concreted piles for each day of concreting.

e. Capping beam to be installed prior to any excavation works for the contiguous piled wall. Wait minimum 7 days for capping beam to cure.

f. Spoil removed by attendant excavator.

g. Upon completion the augers and piling rig will be cleaned and removed.

3.12.2 Traffic Management:

As all work will be within the site boundary and hoarding, minimal traffic management will be needed. The pavement of Oak Grove will need to blocked off for a few minutes in order to drive the machinery onto the site and again when the machinery leaves the site.

3.12.3 Service Diversions:

Not required

3.12.4 Interface with Existing Structures:

None noted

4. DESIGN/ASSESSMENT CRITERIA:

4.1 Actions

4.1.1. Permanent Actions:

Soil and Water pressure to the standards listed in 4.5

4.1.2. Snow wind and thermal actions:

N/A

4.1.3. Actions relating to normal traffic AW regulations and C&U regulations:

10kN/m2

4.1.4. Actions relating to General Order Traffic under STGO regulations:

20KN/m2, 37.5 units of HB Loading

4.1.5. Footway or Footbridge variable actions:

Actions up to the edge of the Footway 10kN/m2 for HA 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:

N/A

4.1.7. Accidental Actions:

Vehicle Impact with the Barrier. Loading Resulting from a 1.5T vehicle travelling at 80km/h impacting the barrier at 20 degrees.

4.1.8. Actions during construction:

Soil pressures

4.1.9. Any special actions not considered above:

N/A

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

N/A

4.3 Minimum Headroom Provided:

No restrictions in headroom apply, and the works do not create any restrictions.

4.4 Authorities Consulted and Special conditions required:

Hillingdon Highways consulted.

4.5 Standards and Documents listed in the Technical Approval Schedule:

British Standards Institution (1986), "BS 8004 - Code of Practice for Foundations".
British Standards Institution (1994), "BS 8002 - Code of Practice for Earth Retaining Structures".
British Standards Institution (1997), "BS 8110 - Code of Practice for the Structural Use of Concrete".
British Standards Institution (2000), "BS 5950 - Structural use of steelwork in building. Code of practice for design. Rolled and welded sections".
CIRIA (2003), "Report No. C580; Embedded Retaining Walls; Guidance for Economic Design".
CIRIA (1984), "Report No. 104 – Design of Embedded Retaining Walls in Stiff Clay".
CIRIA (1995), "Report No. 143 – The Standard Penetration Test (SPT): Methods and Use".
Institution of Civil Engineers (2007), "ICE Specification for Piling and Embedded Retaining Walls". 2nd Ed.
National House Building Council (2016), "NHBC Standards 2016".
Peck, Hanson & Thorburn (1974), "Foundation Engineering". 2nd Ed.
BD2/12 Technical Approval of Highway Structures
TD19/06 Requirements for road Restraint Systems
BD307/1 Design document

4.6 Proposed Departures relating to departures from standards given in 4.5:

N/A

4.7 Proposed Departures relating to methods for dealing with aspects not covered by standards:

N/A

5. STRUCTURAL ANALYSIS:

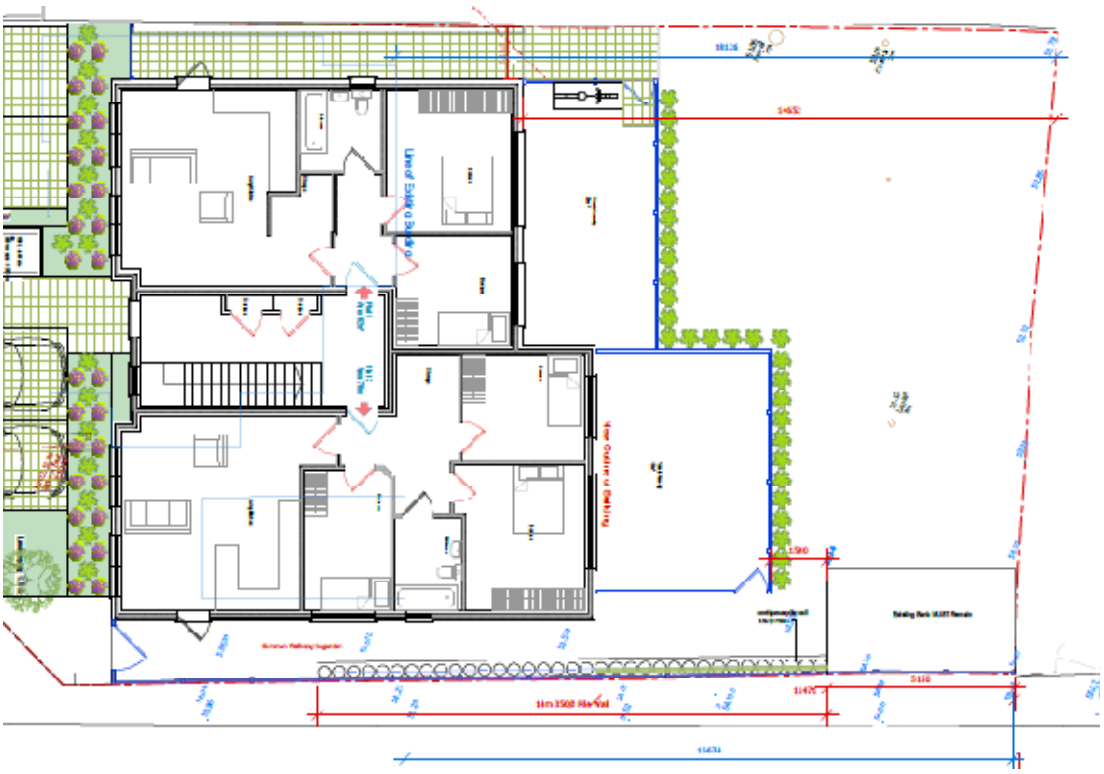
5.1 Methods of analysis for proposed structure:

Design is based on ICE SPERW (2007), Eurocode and BS8110.
Contiguous pile wall is designed to provide both temporary and permanent earth retention.
Capping beam to be installed prior to any excavation works for the contiguous piled wall.
Computer programs used: Piling contractor –CADS PWS2; Designers – RocScience FLAC3D

The Factor of Safety for overall stability is 1.9

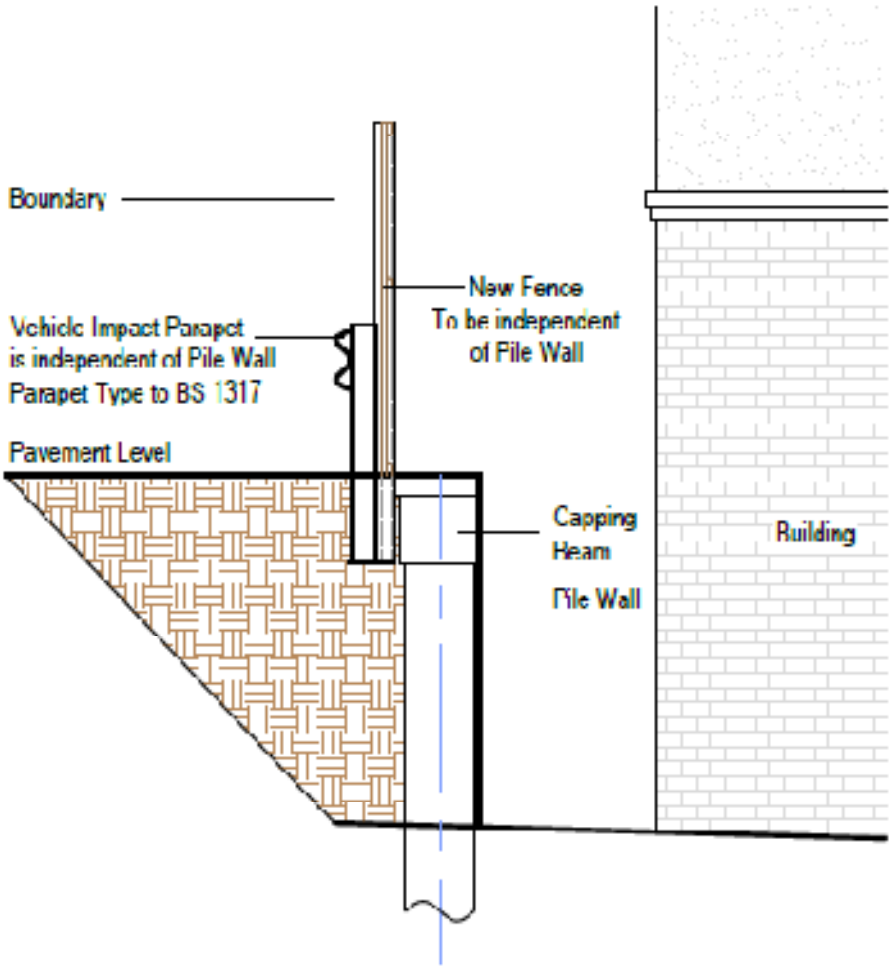
5.2 Description and diagram of idealized structure to be used for analysis:

Plan on Retaining wall:



Proposed Side Elevation to Highways Boundary:

Proposed Cross Section at Top of Embankment, N1 Barrier:



Cross Section Showing Impact Parapet

5.3 Assumptions intended for calculation of structural element stiffness:

The stiffness of elements has been calculated using classical analysis.
Wall moment of inertia – 147324 cm4/m
Wall Youngs modulus – 27000000 KN/m2

5.4 Proposed range of soil parameters to be used in the design/assessment of the structure:

SOIL LAYER	N_{spt}	γ(kN/m^3)	ϕ'(°)	C' (kPa)	C_u(kPa)	E_u	E'(kPa)
Made Ground	-	18	25	0	-	-	25000
Firm Clay	10to50at 17m	20(10sub)	27	0	50at2m to250at 17m		30000

6. GEOTECHNICAL CONDITIONS:

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

6.2 Summary of design for highway structure in Geotechnical Design Report.

The geotechnical design involved three stages, which are summarised below;

(i) Ultimate Limit State (ULS) Analysis – This involves the use of factored soil parameters to estimate the required embedment of the wall, for overall stability to be maintained. This analysis has been carried out with the 'CADS PWS2' geostructural modelling programme. Analysis also provides information on ultimate bending moments, shear forces and if applicable, ultimate loads on the struts.

(ii) Serviceability Limit State (SLS) Analysis – This involves the use of unfactored soil parameters to estimate the lateral displacement of the wall, as well as service bending moments, shear forces and if applicable, service loads on the struts. The analysis has been carried out with the 'CADS PWS2' geostructural modelling programme.

(iii) Wall Capacity under Vertical Axial Loading – This is based on the traditional bearing capacity approach for axially loaded piles. However, the wall is assumed to act as a continuous deep strip footing below basement formation level, surrounded by a block of soil, with the assumption of a block type failure mechanism in the ultimate state. In addition, the bearing capacity factor Nc in the London clay is reduced with a reduction factor "f", to account for the existence gaps between piles in the wall.

The reduction factor “f” is expressed as;

$$f = \frac{\pi D}{4S}$$

Where D = pile diameter and S = pile centre to centre spacing. This approach produces an estimate of the axial capacity of the wall per metre run. Multiplying this value by the centre to centre spacing of the piles yields the vertical capacity of an individual pile. See Adekunte (2014) for more detailed information on this methodology.

6.3 Differential Settlement to be allowed for in the design/assessment of structure:

Settlements should be lessthan10mm. All foundation design allows for this, where possible deviations should be mitigated or designed out.

6.4 Geotechnical Investigation:

The Geotechnical Investigation report is appended to this report.

7. CHECK:

7.1 Proposed Category:

Category 2

7.2 Proposed Independent Checker:

Fernhurst Design Limited

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

N/A

8. DRAWINGS AND DOCUMENTS:

8.1 List of Drawings (including numbers) and documents accompanying the submission:

I. Pile Design for 59 Elm Avenue
II. STM – Geotechnical Ground Investigation – 59 Elm Avenue – FINAL
III. ALL EXISTING AND PROPOSED PLANS 26TH JAN 2022

9. THE ABOVE IS SUBMITTED FOR ACCEPTANCE:

We confirm that the details of the temporary works design will be passed on to the permanent works designers for review

Signed: 

Name: C. Chrysostomu
Design Team Leader

Engineering Qualification: BEng (Hons) CEng MIStructE

Name of Organisation:

Fernhurst Design Limited

Date:

28th October 2022

10. THE ABOVE IS AGREED SUBJECT TO THE AMENDMENTS AND CONDITIONS SHOWN BELOW:

Name:

Engineering Qualification:

Date: