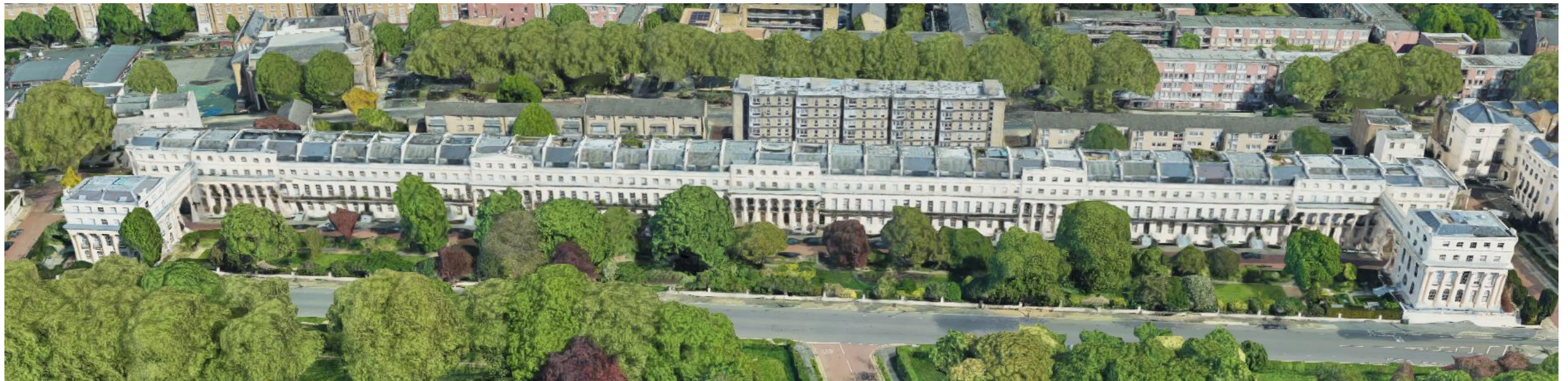


Hurst Peirce + Malcolm LLP
 CONSULTING CIVIL & STRUCTURAL ENGINEERS

Chester Terrace Retaining Wall and Balustrade
Design and Access Statement (REV01)



Project No. 24509/JRH/DMC
 28th November 2022

Authors:

Senior Engineer: Jack R. Harrold MEng (Hons), CEng, M.I.StructE, M.I.C.E.

Partner: D. Michael Chung M.A. (Cantab), CEng, F.I.StructE, F.I.C.E.

Hurst Peirce & Malcolm LLP
 Celtic House
 33 John's Mews
 London
 WC1N 2QL

Tel: 020 7242 3593
 Fax: 020 7405 5274

Email: enquiries@hurstpm.co.uk
www.hurstpm.co.uk

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INTRODUCTION

- This Design and Access Statement has been prepared to support the application for the proposed alterations at:

Chester Terrace, Regent's Park, London, NW1 4ND.

- The application seeks permission to conduct structural remedial works to a retaining wall and replacement of a balustrade that sits on the retaining wall.
- Project Team:
 - Client: Crown Estate Paving Commission (CEPC)
 - Project Manager and Principle Designers: Hurst, Peirce + Malcolm (HPM)
 - Heritage and Planning Consultant: Philip Davies [Heritage and Planning] Ltd.
 - Landscape Architect and Consultant: Todd Longstaffe-Gown Landscape (TLG)
 - Arborist: Tim Moya Associates (TMA)
- This document is to be read in conjunction with the following supplementary documentation:
 - Heritage and Design Statement (by Philip Davies [Heritage and Planning] Ltd.).
 - Arboricultural Report (by Tima Moya Associates).
 - Landscape and Arboricultural Heritage Report (Todd Longstaffe-Gowan Landscape).
 - Method Statement (by Hurst, Peirce + Malcolm).
 - Structural Drawings (by Hurst, Peirce + Malcolm).
 - Summary of Findings from HPM Condition Survey in May 2020 (by Hurst, Peirce + Malcolm).
- Contents:
 - Location
 - Site and Existing Building
 - Balustrade and Wall Assessment Summary
 - Design Proposals
 - Alternative Schemes Reviewed
 - Access Statement
 - Conclusion
 - Appendix



General View from Road Side of Balustrade



General View from Garden Side of Balustrade

LOCATION

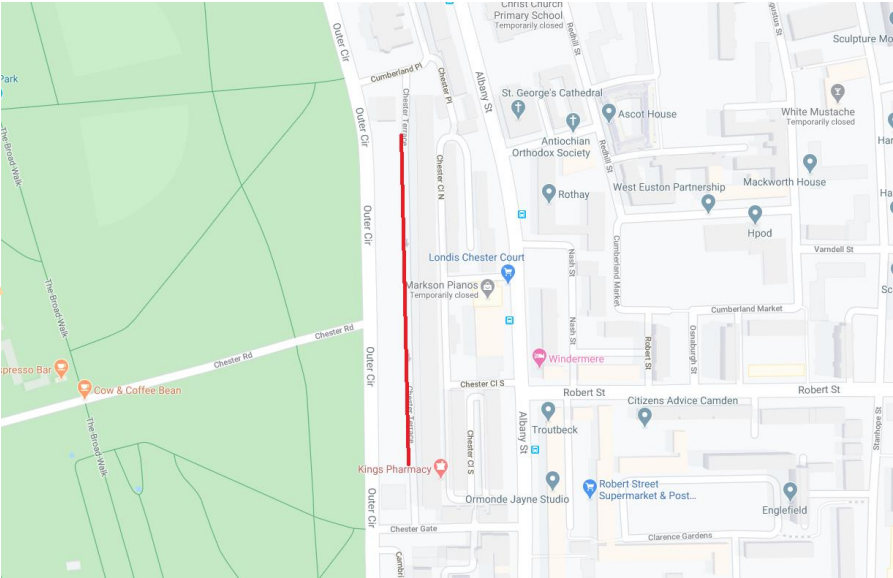


Baker Street

Regent's Park Tube Station

Great Portland Street Tube Station

Aerial View of Regent's Park



Location of Chester Terrace (highlighted)

Site and Existing Structure

- On Chester Terrace there is a 215 metre long retaining wall that supports a pre-cast concrete balustrade. The retaining wall separates the Chester Terrace road carriageway from the garden that adjoins the Outer Circle.
- The balustrade retaining wall to the garden at Chester Terrace is grade II listed adjoining the Chester Terrace houses which are grade I listed. Chester Terrace falls within the boundaries of the Regent's Park Conservation Area.
- The existing structure is not original. It is a post-war replacement (post 1950's) following bomb damage and a period of neglect.
- The balustrade has had no significant alterations since its construction.
- The road level is between 0.3 to 0.8 metres higher than that of the garden – resulting in the retaining wall.
- The balustrade consists of precast concrete elements, namely the coping stones, which are supported by bottles, in turn supported by plinths. Generally, after every 10 to 12 bottles is a rectangular di block. The balustrade has 3 number gates that provide access down into the garden.
- The retaining walls beneath the balustrades consist of a mixture of brickwork and concrete. Along the southern side and the middle of the length of the balustrade, the retaining walls are of brickwork on shallow concrete strip footings. Towards the northern end, the retaining walls are of concrete, also on shallow foundations.
- The balustrades are generally in a poor condition and have a number of defects across its whole length. The balustrade itself shows signs of movement under the application of body weight and it significantly displaced in locations. The balustrade has a scaffold temporary support in locations and is currently fully closed off from the public. Damage to the balustrade has been caused by foundation movement as well as thermal expansion (as a result of the balustrade having no movement joints).
- The existing balustrade and retaining wall has suffered significant structural damage since their post-war reconstruction. They have been deemed unsafe and require to be replaced. The retaining wall has been damaged by:
 - Settlement of the made ground.
 - Expansion and contraction of soils (as a result of seasonal climate changes)
 - Tree roots direct physical damage (from growth) and tree root action.



Typical Photo of Balustrade Prior to Temporary Protection



Typical Photo of Balustrade with Fencing Installed to Stop Pedestrian Access



Typical Photo of Balustrade Spalling



Typical Photo of Balustrade with Scaffold Support and Protective Fencing



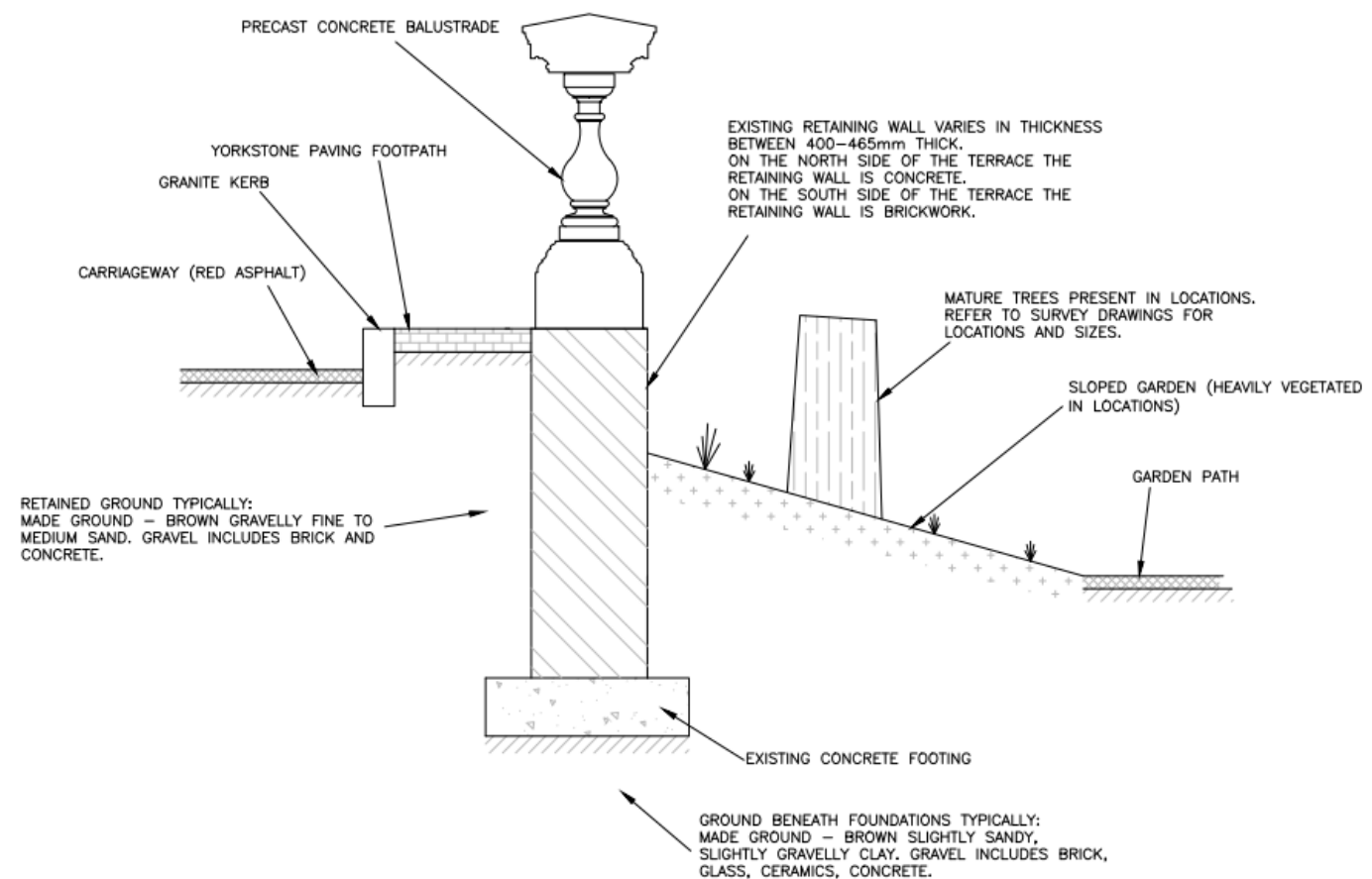
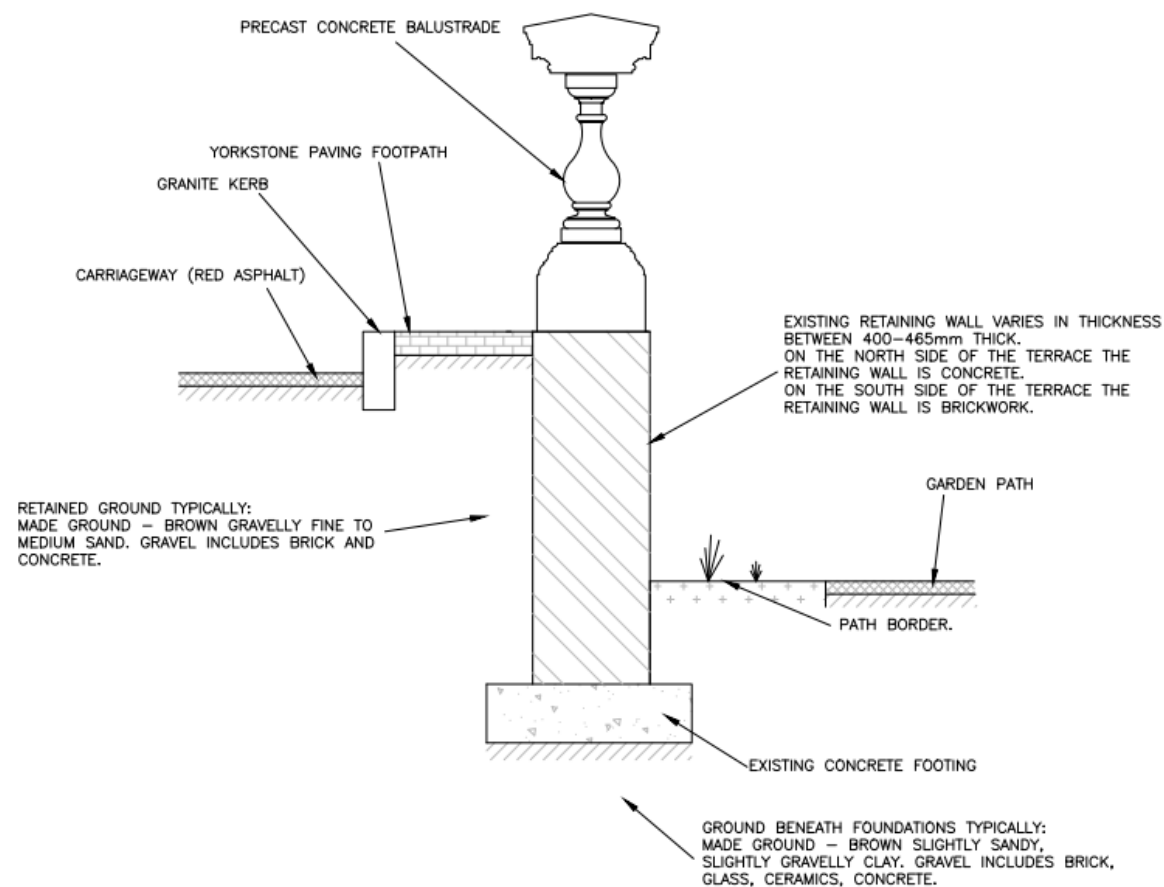
Typical Photo of Brick Retaining Wall



Typical Photo of Brick Retaining Wall Showing Signs of Movement

Site and Existing Structure

- The balustrade has been structurally analysed and has been proved to be short of contemporary loading requirements. The minimum required loading capacity of 1.5 kN/m run with the assessed values, the balustrades only has about 40% of the required strength if in perfect condition and 20% of the required strength where the mortar joints have been dislodged. In most cases, the actual strength of a particular section of the balustrades is likely to lie somewhere between these two figures.
- The retaining wall is currently founded on undersized, shallow foundations that are founded on made ground. The structural assessment of the retaining walls and foundations indicates that the retaining walls have insufficient resistance to sliding and overturning stability. The existing foundation bearing pressures are also over the advised bearing capacities from the soil investigations.
- From the above assessment it was deemed that the retaining wall and balustrade are unsafe and hence need to be replaced.



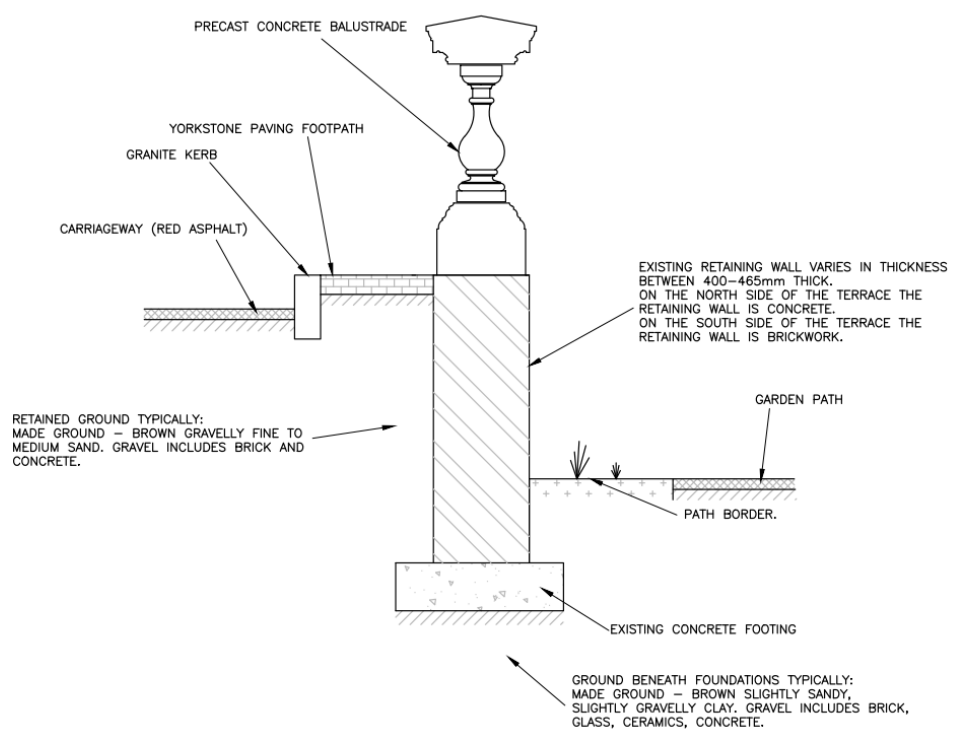
Typical Sections Through Existing Retaining Wall

Balustrade and Wall Assessment Summary

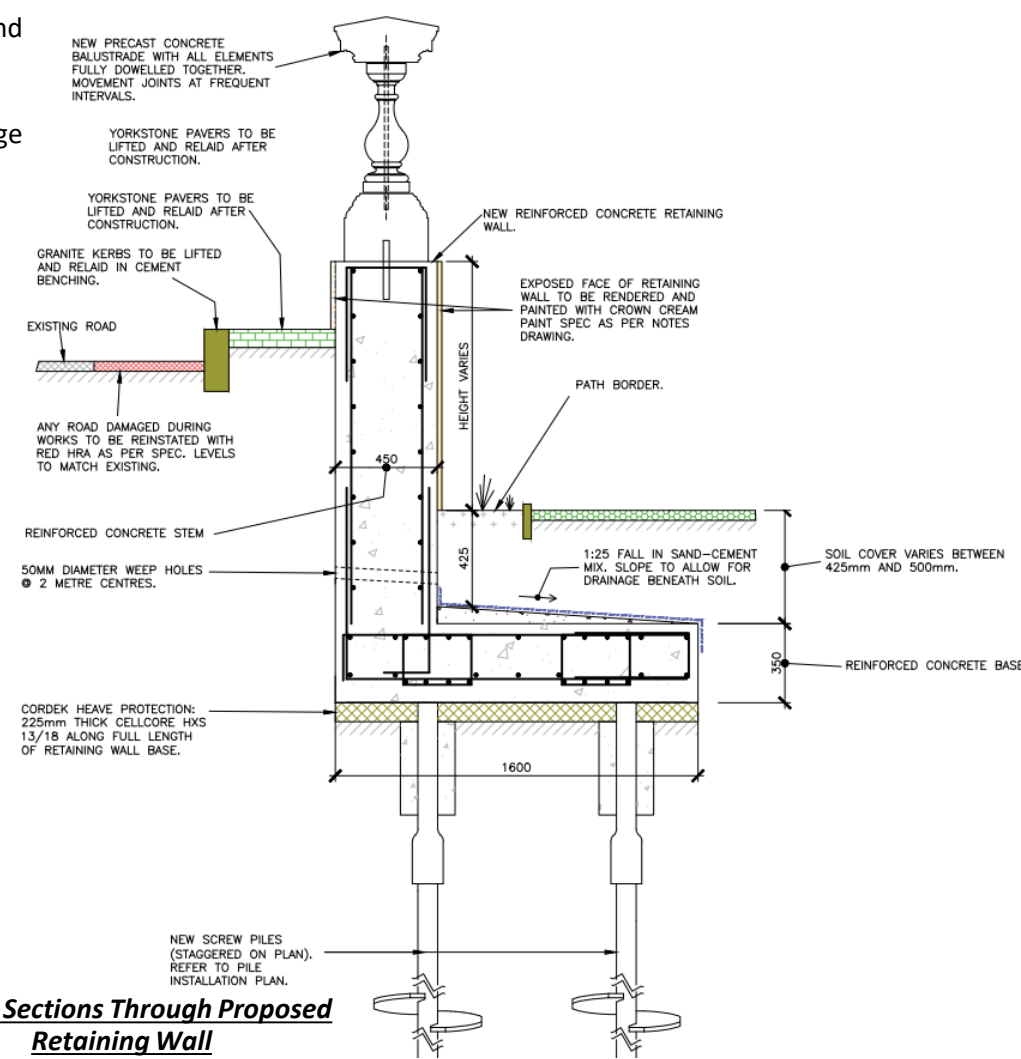
- The scheme that has been proposed is the final iteration of many design solutions that have been considered and analysed. Below is a summary of the assessments that led to the design proposal.
- Hurst, Peirce + Malcolm (HPM) conducted initial inspections of the balustrades in January 2020 followed by a detailed condition survey in May 2020. The condition survey noted the below (refer to document “Summary of Findings from HPM Condition Survey” for a summary of defects noted):
 - The balustrade has been subject to movement. The movement can be seen in the undulations in the alignment of the coping, as well as the gaps between the coping stones and in the plinths and above and below the bottles. In the worst cases, the individual pieces have been dislodged completely and the balustrades can be pushed with slight application of forces.
 - The retaining walls and their foundations have been subject to movement. The movement can be seen in the cracking and lean of the retaining walls and in the movement of the balustrades that sit directly on the retaining walls.
 - The movement in the balustrade, and consequently the damage to it, is a result of retaining wall movement and thermal expansion/contraction. There are no movement/expansion joints in the existing balustrade. Therefore any movement results in pressures being relieved in cracking or displacement of the balustrade.
- Ground investigations were conducted by Listers Geotechnics in June 2020.
- Concrete testing, of the existing balustrade, was conducted by Sandberg Consulting Engineers in June 2020. Sandberg testing along with HPM surveys concluded:
 - Cover to the reinforcement of the existing precast balustrade varied between 7mm and 62mm. This demonstrates a variation in quality control within the 1950’s balustrade.
 - Spalling and cracking of the existing concrete bottles was evident in approximately 44% of the bottles.
 - The carbonation testing by Sandberg proved that the depth of carbonation is somewhat lower than the cover to reinforcement. Therefore, where the bottles have not suffered from damage already, it is likely that they will have a reasonable lifespan moving forward.
- In July 2020, Hurst Peirce + Malcolm (HPM) issued a detailed structural appraisal report concluding the findings of the tests/investigations and the detailed structural analysis conducted by HPM. It concluded:
 - HPM undertook a visual inspection of the Chester Terrace balustrades and produced a record of the individual defects. In addition, we noted that the balustrades, retaining walls and foundations have suffered from movement.
 - Listers undertook the site investigations and established that the retaining walls are founded on shallow foundations, which bear in the made ground stratum. The foundations have therefore been subject to movement resulting from differential settlement in variable made ground and from tree root action as well as seasonal fluctuations in the underlying clay.
 - Sandberg undertook the concrete testing of the bottles and established there are large variations in the reinforcement cover and depth of carbonation. Where the bottles are intact, the depth of carbonation is lower than the reinforcement cover, indicating that intact bottles have a reasonable lifespan left.
 - The structural assessment of the balustrades indicates that they are not able to resist contemporary design standard loadings.
 - The structural assessment of the retaining walls and foundations indicates that the retaining walls have insufficient resistance to sliding and overturning stability.
- The report was independently reviewed by a separate consulting engineer under the instruction of the client. The independent review agreed with the conclusions made by HPM.
- Following the structural appraisal the client and designers analysed potential solutions for the identified issues. Less intrusive solutions were explored to resolve these. Schemes with differing degrees of cosmetic intervention and localised repairs were produced in order to retain as much of the existing balustrade as possible. However, these were discounted as they did not attempt to deal with the structural engineering issues. The repaired balustrades would not have sufficient strength to resist the lateral loading and the retaining walls and foundations would still be subject to ongoing movement as a result of being founded on made ground, seasonal fluctuations in the underlying clay and of tree root action.
- It was identified that in order to provide a structurally safe long term solution for the balustrade – the ongoing movement of the retaining wall needed to be eliminated. The client therefore produced the following project aim to “eliminate the issues of ongoing movement to wall/foundations and balustrade in an efficient manner and in a style appropriate to the high heritage value of the area”.
- In order to resolve any safety issues and achieve the clients aim, a number of structural intervention solutions were produced. The first solutions explored were ones that retained as much of the existing structure as possible. Options to underpin and ground anchor the existing wall were explored and discounted, as discussed on page 9. Following this it was therefore concluded that a new retaining wall would need to be constructed. Multiple schemes were reviewed and the scheme presented for planning on page 8 is that which was the most aesthetically, structurally and environmentally appropriate.
- Page 8 describes the final solution that is being offered for planning and page 9 briefly describes a couple of alternatives reviewed.

Design Proposal

- The scope of the project is to “eliminate the issues of ongoing movement to wall/foundations and balustrade in an efficient manner and in a style appropriate to the high heritage value of the area”.
- This application seeks permission to replace the existing, unsafe, retaining wall and balustrade with a new retaining wall and balustrade that are to contemporary structural standards. The replaced length of the wall is approximately 215 metres long.
- The replacement will consist of a reinforced concrete retaining wall on a piles. The piles will be steel screw piles.
- A 425mm minimum soil cover to the concrete base to allow for flexibility in the future planting and landscaping for in front of the wall.
- The new balustrade will be a precast concrete balustrade which has been designed to ensure it is both structurally sound and aesthetically appropriate. The new balustrade will be designed with movement joints to allow for the thermal expansion in the balustrade components. The bottles, di block, piers and coping stones will match the existing profiles. The plinth will follow the profile of that approved on Cumberland Terrace – as advised within the “Heritage and Design Statement”.
- The wall and balustrade will both be painted with the Regent Park Crown Estate Cream (providing a more appropriate finish than the existing exposed concrete).
- The proposals have been overseen by a heritage conservation specialist who has advised on the aesthetics to ensure the replacement is fitting for area and that it is an enhancement of the special interest of the Grade I listed Chester Terrace.
- For further information on the context, aesthetic & heritage assessment of the proposals please refer to Philip Davies “Heritage and Design Statement”.
- For further information on the proposed landscaping please refer to TLG Landscapes “Landscape and Arboricultural Heritage Report”.



Typical Sections Through Existing Retaining Wall



Typical Sections Through Proposed Retaining Wall

Alternative Schemes Reviewed

- To achieve the aim of the project “eliminate the issues of ongoing movement to wall/foundations and balustrade in an efficient manner and in a style appropriate to the high heritage value of the area” there were multiple schemes that have been produced, reviewed and discounted.
- Below are 2 of the alternative schemes that were discounted.

Description and Comments	Sketch
<p>Alternative Scheme 2: Underpinning & Ground Anchors (DISCOUNTED)</p> <p>Description of Works:</p> <ul style="list-style-type: none">Retain the existing brick retaining wall. Eliminate vertical movement by underpinning the wall with screw piles. Eliminate horizontal movement by using ground anchors fixed through the retaining wall into the soil beyond.Install a new precast concrete balustrade onto existing brick balustrade. <p>Positives:</p> <ul style="list-style-type: none">Provides a structural solution that is suitable for contemporary design standards.Eliminates movement of balustrade.Requires limited intervention from the road side of the retaining wall (e.g. minimal disturbance to residents). <p>Negatives:</p> <ul style="list-style-type: none">Although future vegetation would of still be able to grow between the screw piles – the trees would still be required to be removed for the construction phase of the project.Clashes with existing services and coal vaults, within road way, when installing ground anchors. <p>Reason for Discounting:</p> <ul style="list-style-type: none">The ground anchors would clash with the vaults of the adjoining properties in Chester Terrace and services within the adjoining road at Chester Terrace. Therefore, the scheme could not be taken forward due to the use of ground anchors being infeasible.	
<p>Alternative Scheme 3: Foundation Down to London Clay Formation (DISCOUNTED)</p> <p>Description of Works:</p> <ul style="list-style-type: none">Install a new reinforced concrete retaining wall. Instead of using screw piles, use a mass concrete fill to take the load of the retaining wall down to the London Clay formation.Install a new precast concrete balustrade onto new retaining wall. <p>Positives:</p> <ul style="list-style-type: none">Provides a structural solution that is suitable for contemporary design standards.Eliminates movement of balustrade.No specialist input for design of screw piles.Reduced risk of discoveries in the ground causing delay to project (screw piles are sensitive to presence of rubble & thick tree roots). <p>Negatives:</p> <ul style="list-style-type: none">Due to size of excavation required for construction of mass fill – this would be the most damaging for existing vegetation.Future vegetation would be limited in growth due to presence of concrete hard spot down to clay formation. <p>Reason for Discounting:</p> <ul style="list-style-type: none">This scheme was discounted due to its future limitation on vegetation growth and its removal of trees during the construction process. It also uses an excessive amount of concrete and requires the removal of significantly more spoil from the site compared with the selected scheme, a factor making such a solution lower in sustainability terms. Screw piling is also far less disruptive.	

Access Statement

- The garden is currently accessed through 3 gated segments of the balustrade.
- 2 of these gates lead onto steps that go down to the garden. 1 of the gates opens up to a level section of the garden.
- The access to the gardens will be positively impacted by the works. The proposed works will enhance the existing stepped access to provide risers & treads of appropriate dimensions. The gates will be removed and refurbished to ensure they are working properly.
- During the works any displacement of residential parking from Chester Terrace will be managed by the Crown Estate Paving Commission (CEPC). The CEPC will ensure that residents are provided with places to park on the adjoining Terraces on CEPC managed roads.
- During the works tracking mats will be laid over the existing road carriageway in order to protect it from any construction vehicle damage. In areas where the road becomes damaged it will be replaced with a matching red tarmac.
- In order to install the screw piles, a piling rig (21 tonne excavator) will need to access the garden. A section of the balustrade will be removed and the ground ramped to allow for the rig to access the garden. Appropriate tree protection measures, as detailed in the Tree Impact Assessment, will be followed in order to mitigate any damage to trees or tree roots.
- The development will ensure the same number of car parking spaces are available after the development as there are currently on the Terrace.

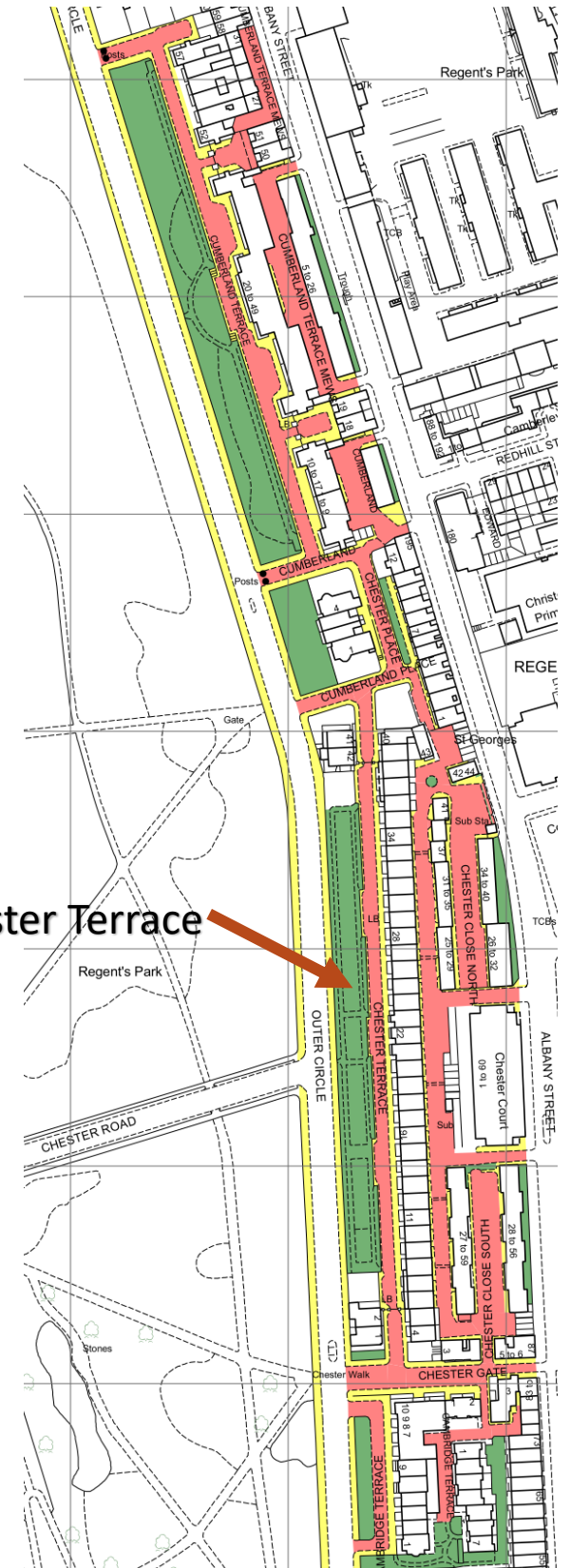


Photo of Stepped Access to the Garden



Photo of Gated Access to Garden

Chester Terrace



Plan Showing Roads Managed by CEPC
around Chester Terrace.

Summary

- The following guidelines have been taken into account during the development of the proposals:
 - *National Planning Policy Framework*
 - *National Planning Policy Guidance*
 - Historic England: *Conservation Principles*
 - Historic England: *Good Practice Advice in Planning 2 (GPA2)*
 - Mayor of London: *The London Plan 2021*
 - Camden Council: *Local Plan 2017*
 - CEPC: *A Total Work of Architectural and Landscape Art: A Vision for Regent's Park*
 - CEPC: *Regent's Park: Streetscape: A Special Precinct*
 - CEPC: *Chester Terrace Management Vision*

- The application seeks permission to conduct structural remedial works to a retaining wall and replacement of a balustrade that sits on the retaining wall.

- The final design proposal, that is being submitted for planning, is the final iteration of a 2 year design period. Within that design period many alternative options have been reviewed and discounted.

- The design has been reviewed and overseen by a specialist heritage consultant.

- The proposals seek to provide a safe and long-term solution for the retaining wall and balustrade whilst also enhancing the special interest and historical value of Chester Terrace.