Hurst Peirce + Malcolm LLP
CONSULTING CIVIL & STRUCTURAL ENGINEERS

# *Chester Terrace Retaining Wall – Scheme Proposals and Pricing Summary Document*

## ***HPM DOC 24509-210301(REV05)***

Project No. 24509/DMC/JRH
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| Scheme Reference | Foundations | Balustrade Works | Programme |
|---|---|---|---|
| **Option 1** | **As Existing** | **Cosmetic Repairs** | **20 year programme** |
| *Option 1A* | *As Existing* | *Repair and Pin* | *20 year programme* |
| **Option 2** | **Ground Anchors & Ad-hoc Screw Fast Piles** | **New** | **20 year programme** |
| *Option 2A* | *Ground Anchors & Ad-hoc Screw Fast Piles* | *Repair and Pin* | *20 year programme* |
| **Option 3** | **Ground Anchors & Screw Fast Piles** | **New** | **One Visit** |
| *Option 3A* | *Ground Anchors & Screw Fast Piles* | *Repair and Pin* | *One Visit* |
| **Option 4** | **Concrete Retaining Wall & Piling** | **New** | **One Visit** |
| *Option 4A* | *Concrete Retaining Wall & Piling* | *Repair and Pin* | *One Visit* |

## SCHEME PROPOSALS

## *DOCUMENT NOTES:*

- The following document should be read in conjunction with HPM report: “RP201117 Chester Terrace Balustrade Addendum Report Issue 01”.
- This document is a summary of the schemes and proposals within that report. The limitations, conclusions and recommendations within that report also apply to this document.
- This document outlines the scheme proposals, produced by HPM, and the subsequent costs provided by Buildt Quantity Surveyors.
- The Buildt pricing document should be referred to for a breakdown of the costing (Spreadsheet version: CostPlanFeb2021r3). That document includes various important assumptions and exclusions in each of the Options. The costings in this document should be understood in the context of those assumptions and exclusions plus that none of the Options have yet been designed.

## Contents

# CEPC – Chester Terrace Retaining Wall

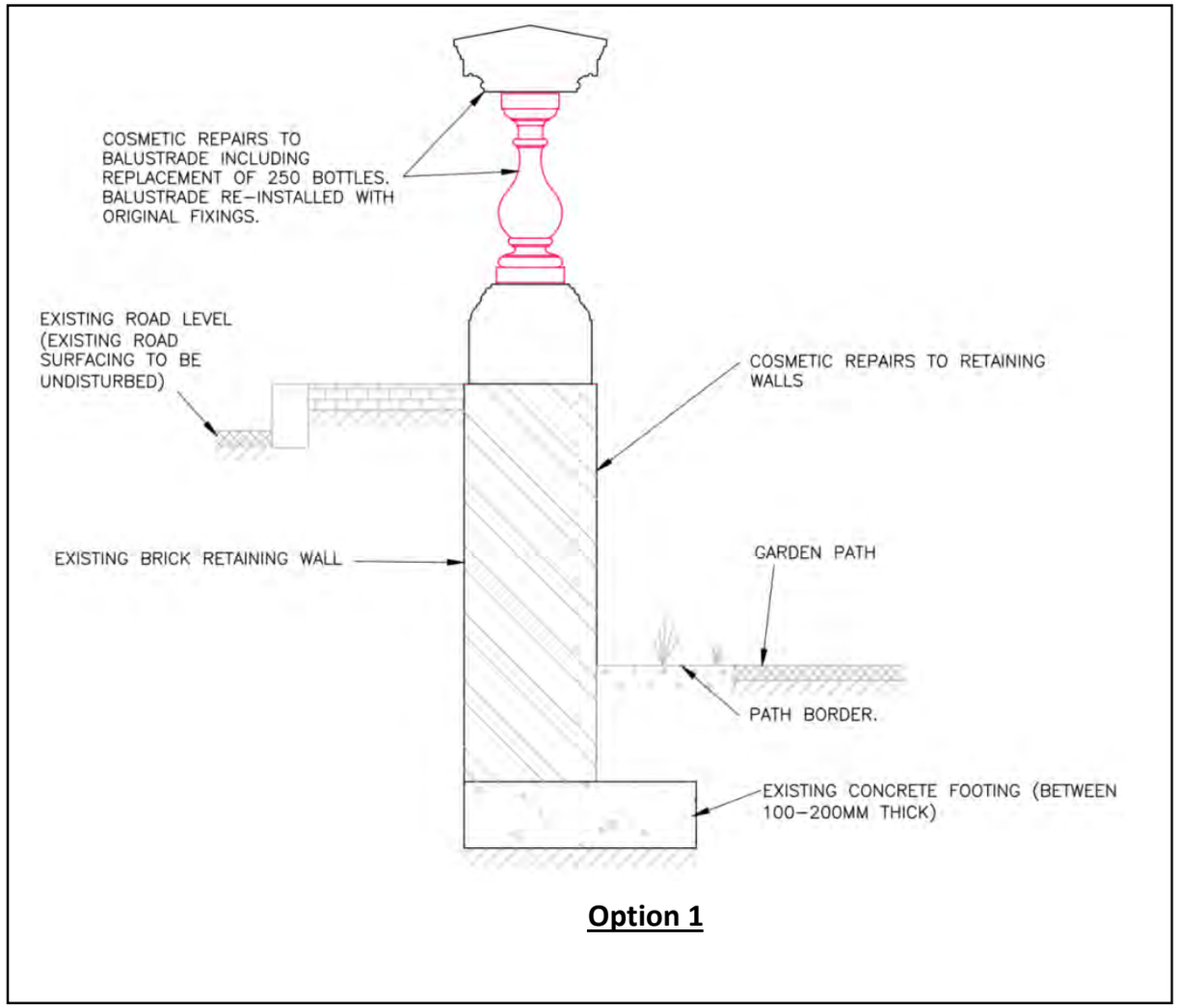
## *Option 1*

| Scheme Reference | Foundations | Balustrade Works | Programme |
|---|---|---|---|
| **Option 1** | **As Existing** | **Cosmetic Repairs** | **20 year programme** |

***Summary:***
Cosmetic repairs to balustrade including replacement of 250 bottles. Balustrade re-installed with original fixings. Works carried out as and when required, assuming completion over 20 years.

| Positives | Negatives |
|---|---|
| The cost of Repair Scenario 1 is the lowest. | Following the repairs, the balustrades can be as strong as when they were originally constructed. As established in our original report, the balustrades will however not have sufficient strength to resist contemporary lateral loads. |
| The vegetation and trees in the garden will not be affected. | The retaining walls and foundations will be subject to ongoing movement as a result of inadequately sized foundations, foundations being founded on made ground, tree root action on the clay type ground and lateral loading arising from surcharge on the road. Therefore, ongoing repairs will be required. |

**Pros vs Cons**




**Option 1**

| Years | Retaining Wall & Foundation | Balustrade Works | **Anticipated Cost** |
|---|---|---|---|
| Year 1 | £8,066 | £425,799 | **£433,865** |
| Years 2-20 | £9,884 | £549,744 | **£559,628** |
| Total | £17,950 | £975,543 | **£993,493** |

**Cost Analysis**

| Weeks on Site | Duration |
|---|---|
| **60 Weeks** | **20 Years** |

**Project Duration**

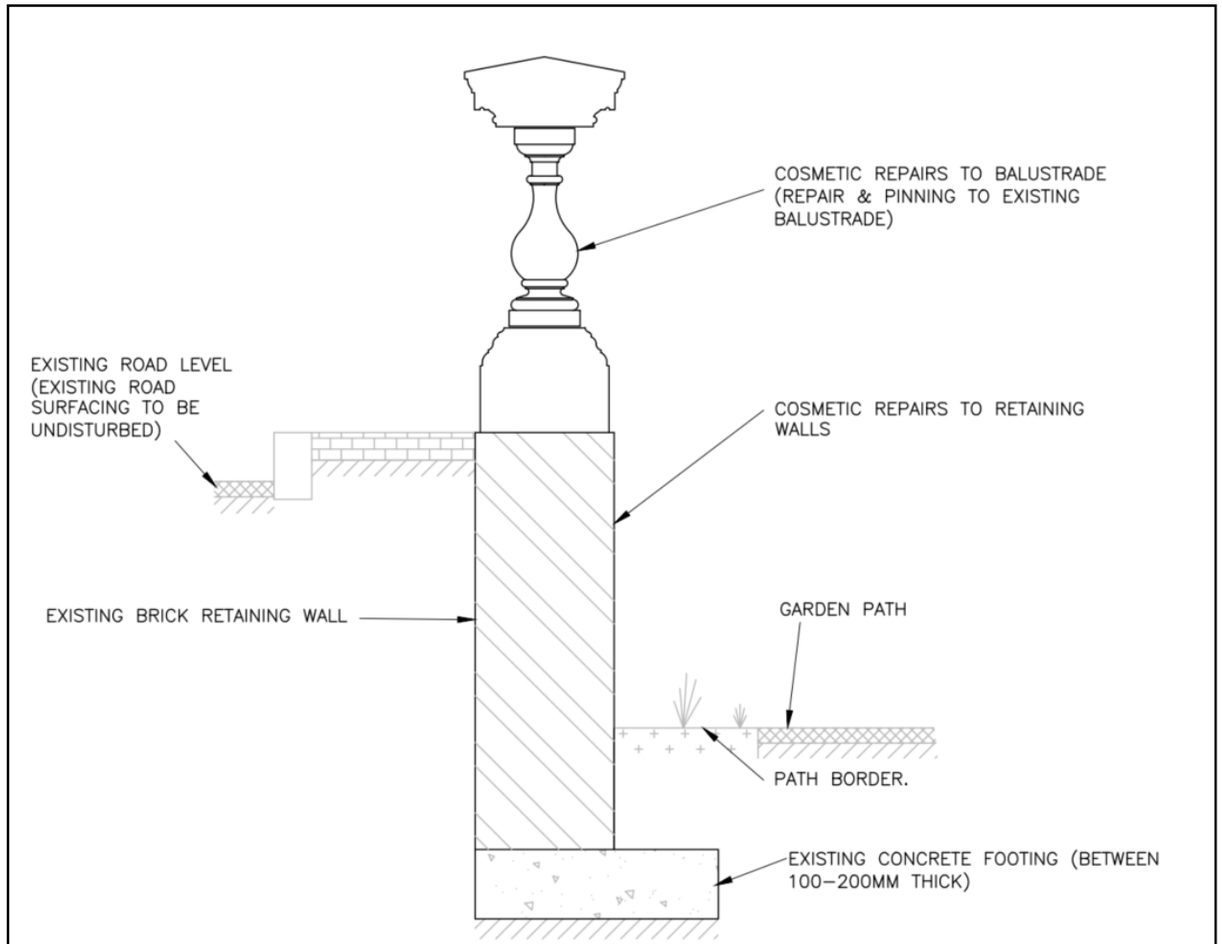
# TOTAL COST OVER 20 YEARS: £993,493

| Scheme Reference | Foundations | Balustrade Works | Programme |
|---|---|---|---|
| *Option 1A* | *As Existing* | *Repair and Pin* | *20 year programme* |

***Summary:***
Repair and pinning to balustrade. Works carried out as and when required, assuming completion over 20 years.

| Positives | Negatives |
|---|---|
| The vegetation and trees in the garden will not be affected. | Following the repairs, the balustrades can be as strong as when they were originally constructed. As established in our original report, the balustrades will however not have sufficient strength to resist contemporary lateral loads. |
| | The retaining walls and foundations will be subject to ongoing movement as a result of inadequately sized foundations, foundations being founded on made ground, tree root action on the clay type ground and lateral loading arising from surcharge on the road. Therefore, ongoing repairs will be required. |

**Pros vs Cons**




**Option 1A**

| Years | Retaining Wall & Foundation | Balustrade Works | **Anticipated Cost** |
|---|---|---|---|
| Year 1 | £8,066 | £457,334 | **£465,400** |
| Years 2-20 | £9,489 | £594,964 | **£604,453** |
| Total | £17,555 | £1,052,298 | **£1,069,853** |

**Cost Analysis**

| Weeks on Site | Duration |
|---|---|
| **80 Weeks** | **20 Years** |

**Project Duration**

# TOTAL COST OVER 20 YEARS: £1,069,853

| Scheme Reference | Foundations | Balustrade Works | Programme |
|---|---|---|---|
| **Option 2** | **Ground Anchors & Ad-hoc Screw Fast Piles** | **New** | **20 year programme** |

| Positives | Negatives |
|---|---|
| The balustrades will be strong enough to resist lateral loads | Vertical movement of the retaining walls and balustrades will be ongoing and will need to be dealt with by underpinning as and when required. |
| The retaining walls will be strong enough to resist sliding and overturning | Partial underpinning is likely to lead to differential settlement between the underpinned and non-underpinned sections |
| | Damage may occur to the new balustrades, which will be stiffer than the current ones. Ongoing repairs may therefore be required. |
| | If significant portions of the retaining walls need to be underpinned and/or damage occurs to the balustrades, the overall cost could end up being higher than Repair Scenarios 3 and 4. |
| | There is a risk element associated with the use of ground anchors and the presence of services and extents of vaults in Chester Terrace. Further surveys will be required. |
| | Damage to trees and vegetation is likely. |

**Pros vs Cons**

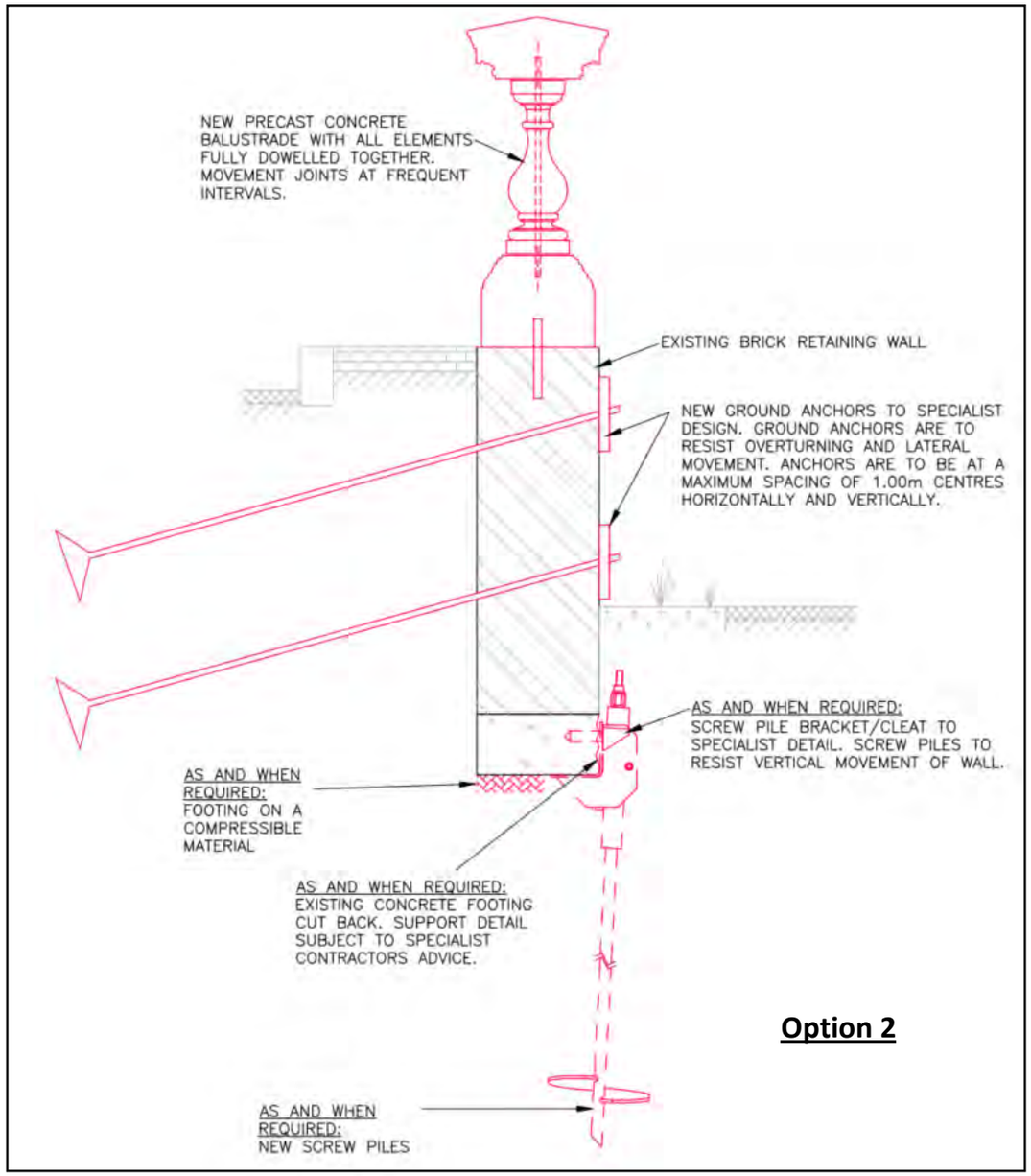
| Years | Retaining Wall & Foundation | Balustrade Works | **Anticipated Cost** |
|---|---|---|---|
| Year 1 | £518,402 | £614,739 | **£1,133,141** |
| Years 2-20 | £999,961 | £674,277 | **£1,674,238** |
| Total | £1,518,363 | £1,289,016 | **£2,807,379** |

**Cost Analysis**

| Weeks on Site | Duration |
|---|---|
| **80 Weeks** | **20 Years** |

**Project Duration**

***Summary:***
Repair and pinning to balustrade. Works carried out as and when required, assuming completion over 20 years.




**Option 2**

# TOTAL COST OVER 20 YEARS: £2,807,379

| Scheme Reference | Foundations | Balustrade Works | Programme |
|---|---|---|---|
| *Option 2A* | *Ground Anchors & Ad-hoc Screw Fast Piles* | *Repair and Pin* | *20 year programme* |

| Positives | Negatives |
|---|---|
| The retaining walls will be strong enough to resist sliding and overturning | Vertical movement of the retaining walls and balustrades will be ongoing and will need to be dealt with by underpinning as and when required. |
| | Partial underpinning is likely to lead to differential settlement between the underpinned and non-underpinned sections |
| | Damage may occur to the new balustrades, which will be stiffer than the current ones. Ongoing repairs may therefore be required. |
| | If significant portions of the retaining walls need to be underpinned and/or damage occurs to the balustrades, the overall cost could end up being higher than Repair Scenarios 3 and 4. |
| | There is a risk element associated with the use of ground anchors and the presence of services and extents of vaults in Chester Terrace. Further surveys will be required. |
| | Damage to trees and vegetation is likely. |

**Pros vs Cons**

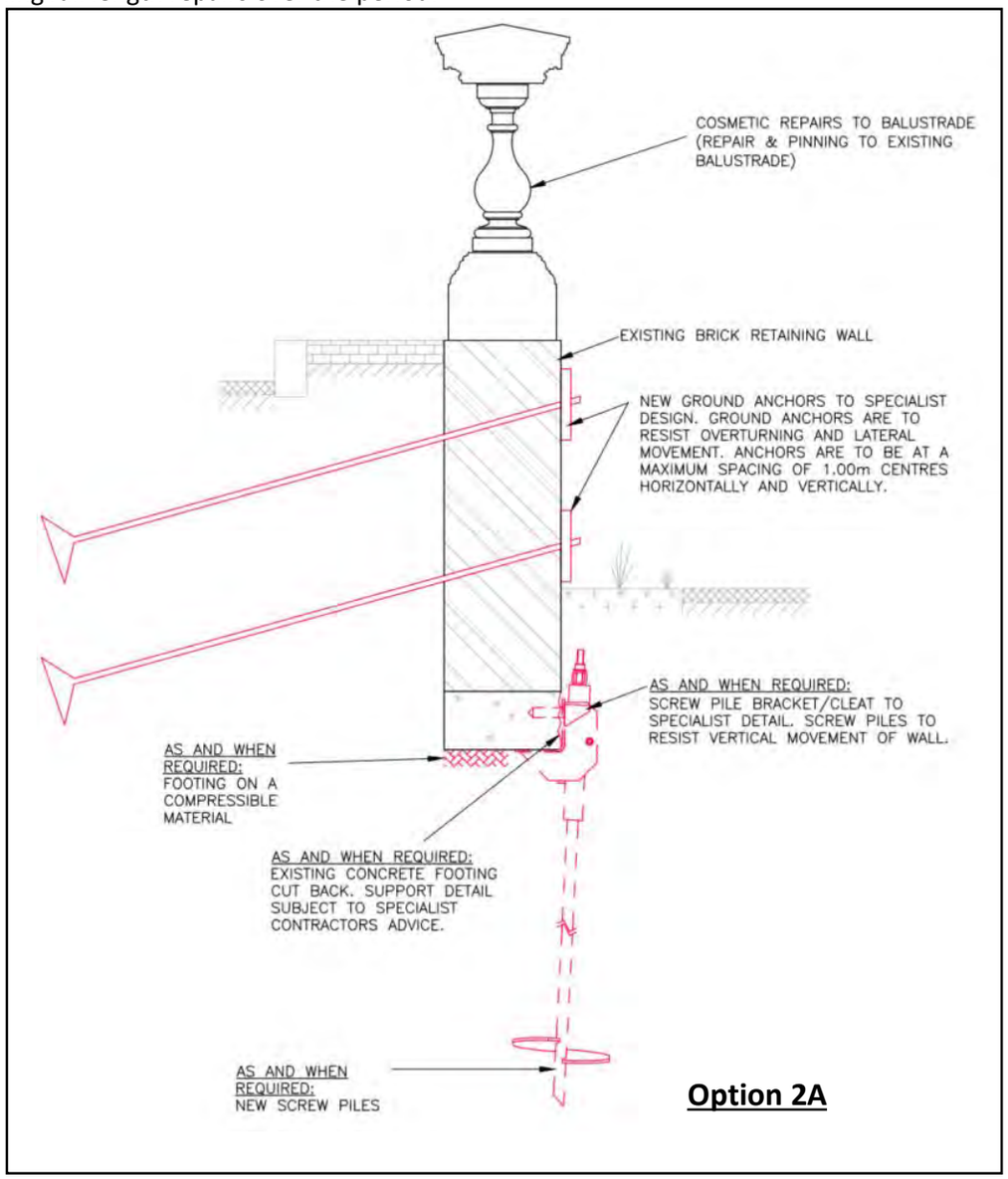
| Years | Retaining Wall & Foundation | Balustrade Works | **Anticipated Cost** |
|---|---|---|---|
| Year 1 | £610,227 | £560,157 | **£1,170,384** |
| Years 2-20 | £1,003,638 | £726,743 | **£1,730,381** |
| Total | £1,613,865 | £1,286,900 | **£2,900,764** |

**Cost Analysis**

| Weeks on Site | Duration |
|---|---|
| **90 Weeks** | **20 Years** |

**Project Duration**

***Summary:***
Existing balustrade repaired and pinned and ground anchors installed during initial visit. Underpinning works completed as and when required, assuming 10% average every other year for 20 years. Includes allowance for ongoing repair of balustrade and retaining wall, assuming full length repairs over the period.




**Option 2A**

# TOTAL COST OVER 20 YEARS: £2,900,764

| Scheme Reference | Foundations | Balustrade Works | Programme |
|---|---|---|---|
| **Option 3** | **Ground Anchors & Screw Fast Piles** | **New** | **One Visit** |

***Summary:***
New balustrade. Ground anchors and underpinning to existing.

| Positives | Negatives |
|---|---|
| The balustrades will be strong enough to resist lateral loads | There is a risk element associated with the use of ground anchors and the presence of services and extents of vaults in Chester Terrace. Further surveys will be required. |
| The retaining walls will be strong enough to resist sliding and overturning | Damage to trees and vegetation is likely |
| The foundations will be underpinned and will not be susceptible to vertical movement or differential movement. | |
| Compared with Repair Scenario 4, this scenario will require less intervention on the road side of the balustrades. | |

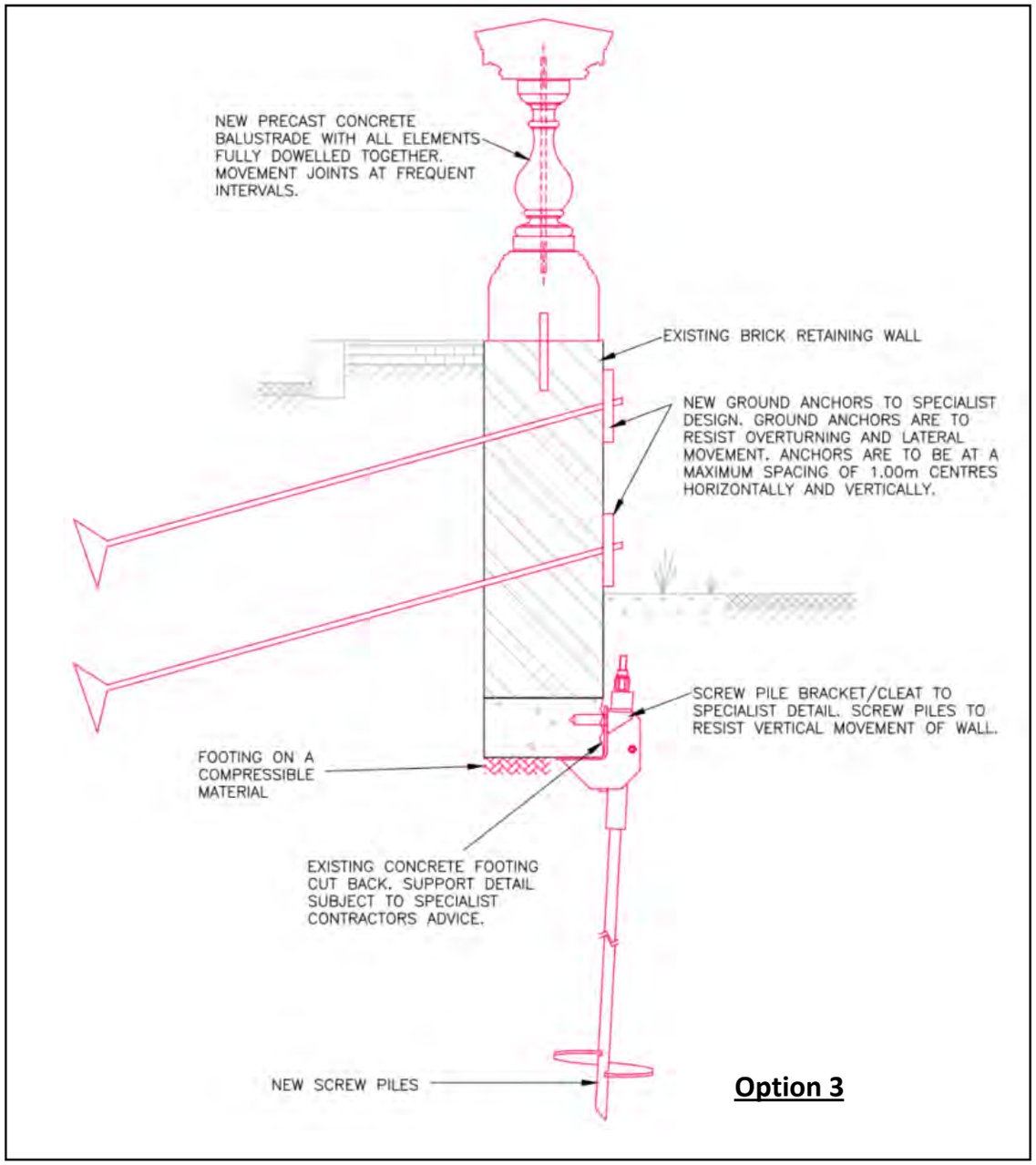
**Pros vs Cons**

| Retaining Wall & Foundation | Balustrade Works | **Anticipated Cost** |
|---|---|---|
| £1,046,299 | £629,125 | **£1,675,424** |

**Cost Analysis**

| Weeks on Site | Duration |
|---|---|
| **30 Weeks** | **One Visit** |

**Project Duration**




**Option 3**

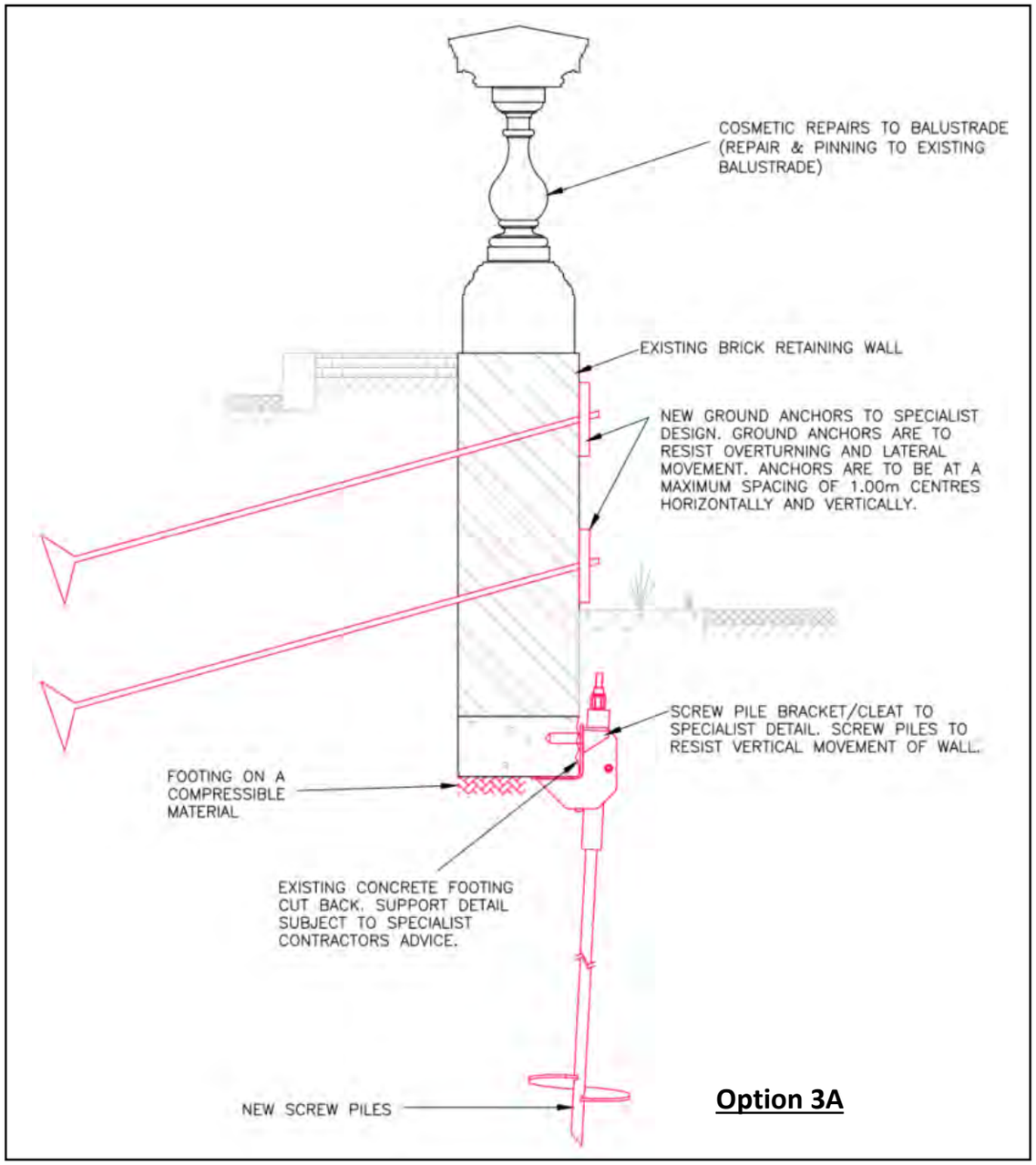
# TOTAL: £1,675,424

| Scheme Reference | Foundations | Balustrade Works | Programme |
|---|---|---|---|
| *Option 3A* | *Ground Anchors & Screw Fast Piles* | *Repair and Pin* | *One Visit* |

***Summary:***
Repairs and pinning to existing balustrade, ground anchors and underpinning to existing foundations.

| Positives | Negatives |
|---|---|
| The retaining walls will be strong enough to resist sliding and overturning | There is a risk element associated with the use of ground anchors and the presence of services and extents of vaults in Chester Terrace. Further surveys will be required. |
| The foundations will be underpinned and will not be susceptible to vertical movement or differential movement. | Damage to trees and vegetation is likely |
| Compared with Repair Scenario 4, this scenario will require less intervention on the road side of the balustrades. | |

**Pros vs Cons**




**Option 3A**

| Retaining Wall & Foundation | Balustrade Works | **Anticipated Cost** |
|---|---|---|
| £1,058,717 | £573,026 | **£1,631,742** |

**Cost Analysis**

| Weeks on Site | Duration |
|---|---|
| **35 Weeks** | **One Visit** |

**Project Duration**

# TOTAL: £1,631,742

| Scheme Reference | Foundations | Balustrade Works | Programme |
|---|---|---|---|
| **Option 4** | **Concrete Retaining Wall & Piling** | **New** | **One Visit** |

| Positives | Negatives |
|---|---|
| The balustrades will be strong enough to resist lateral loads | This repair scenario is the most intrusive, both on the trees and vegetation in the garden and the footpath along Chester Terrace. |
| The retaining walls will be strong enough to resist sliding and overturning | |
| With this solution, the installation of new elements means that any future maintenance requirement will be minimal compared with the other ones. | |

**Pros vs Cons**

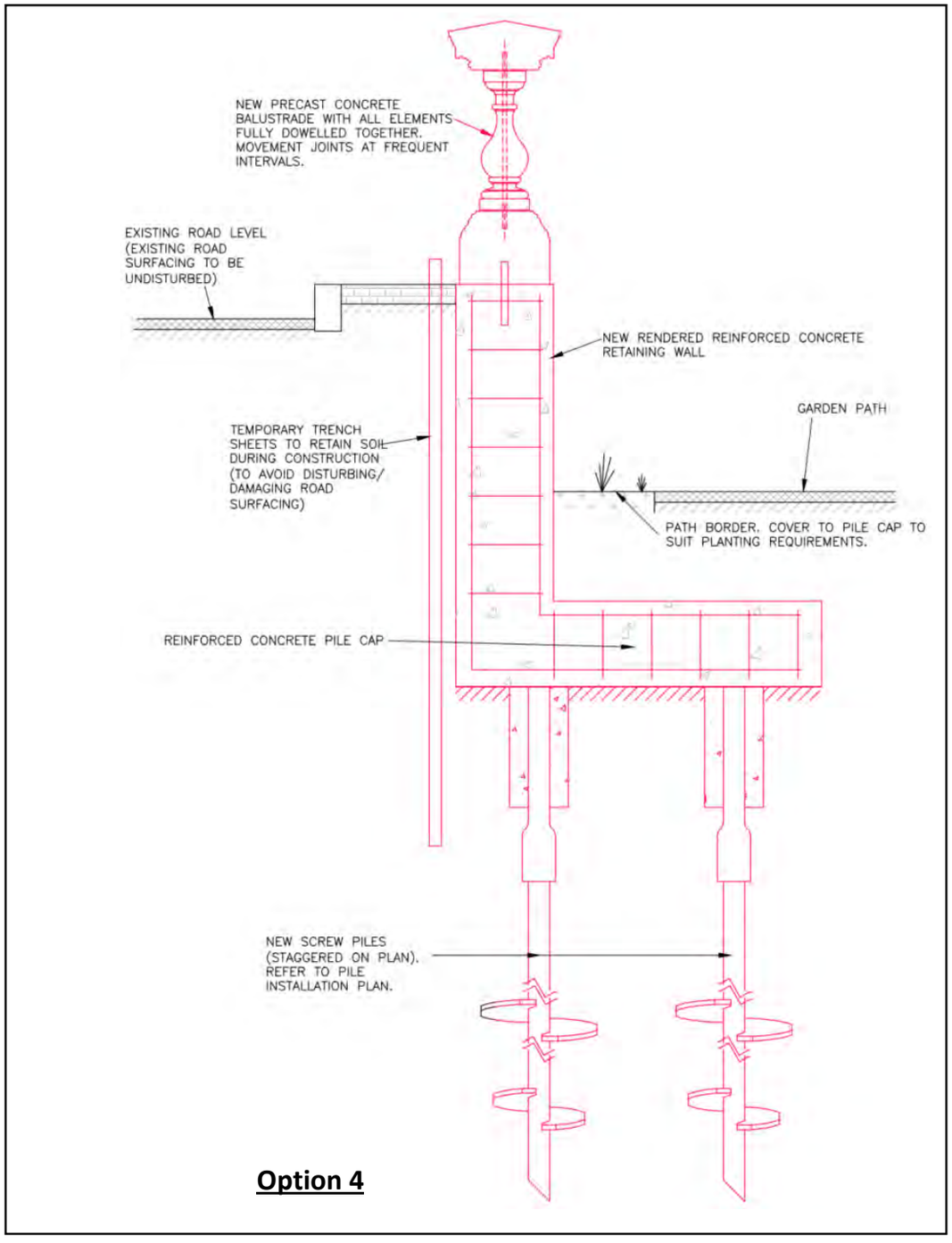
| Retaining Wall & Foundation | Balustrade Works | **Anticipated Cost** |
|---|---|---|
| £1,160,062 | £635,604 | **£1,795,666** |

**Cost Analysis**

| Weeks on Site | Duration |
|---|---|
| **40 Weeks** | **One Visit** |

**Project Duration**

***Summary:***
Complete replacement of foundations and balustrade.




**Option 4**

# TOTAL: £1,795,666

| Scheme Reference | Foundations | Balustrade Works | Programme |
|---|---|---|---|
| *Option 4A* | *Concrete Retaining Wall & Piling* | *Repair and Pin* | *One Visit* |

| Positives | Negatives |
|---|---|
| The retaining walls will be strong enough to resist sliding and overturning | This repair scenario is the most intrusive, both on the trees and vegetation in the garden and the footpath along Chester Terrace. |
| With this solution, the installation of new elements means that any future maintenance requirement will be minimal compared with the other ones. | |

**Pros vs Cons**

| Retaining Wall & Foundation | Balustrade Works | **Anticipated Cost** |
|---|---|---|
| £1,159,963 | £570,329 | **£1,730,292** |

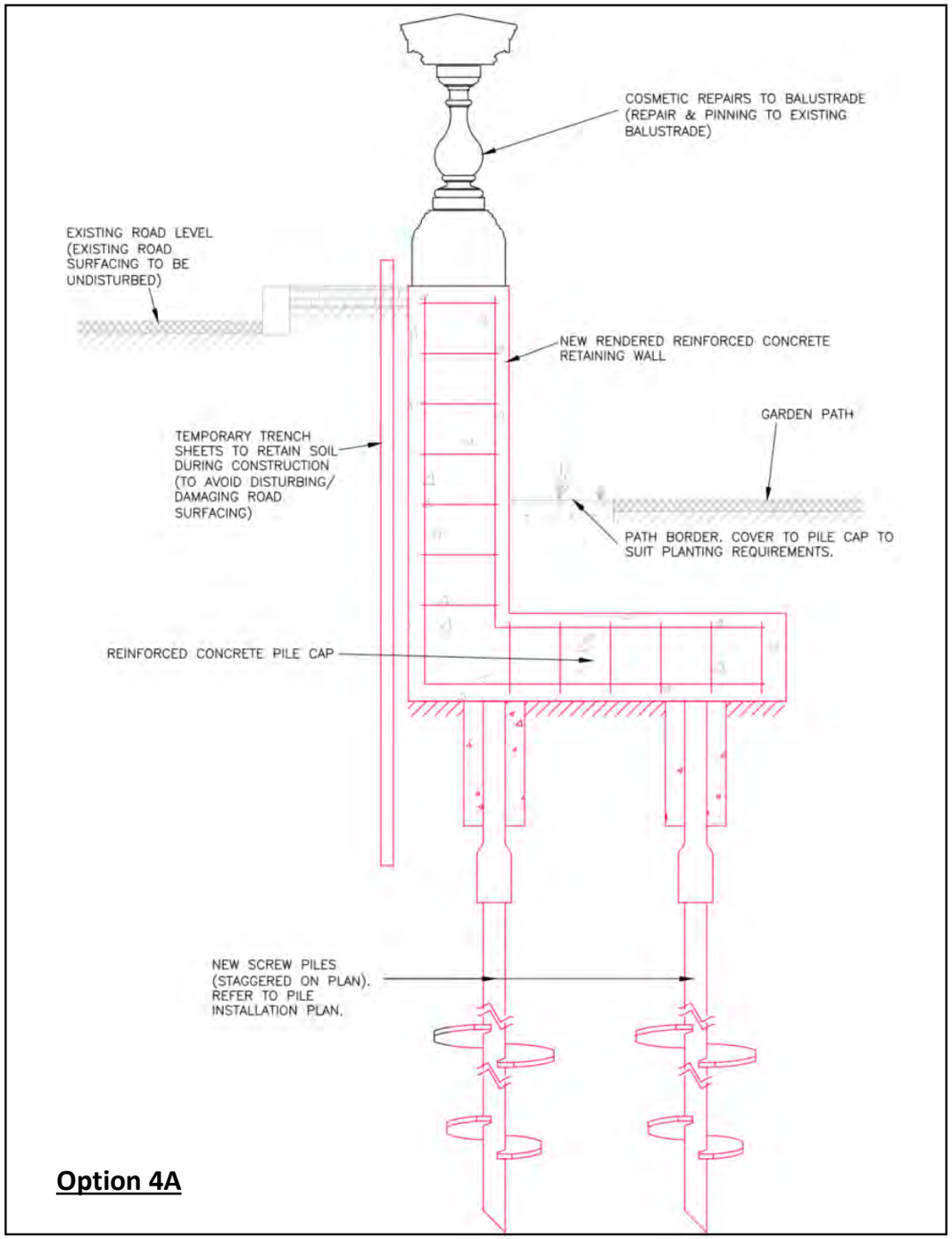
**Cost Analysis**

| Weeks on Site | Duration |
|---|---|
| **45 Weeks** | **One Visit** |

**Project Duration**

***Summary:***

Replacement of foundations. Repair and pinning to existing balustrade.



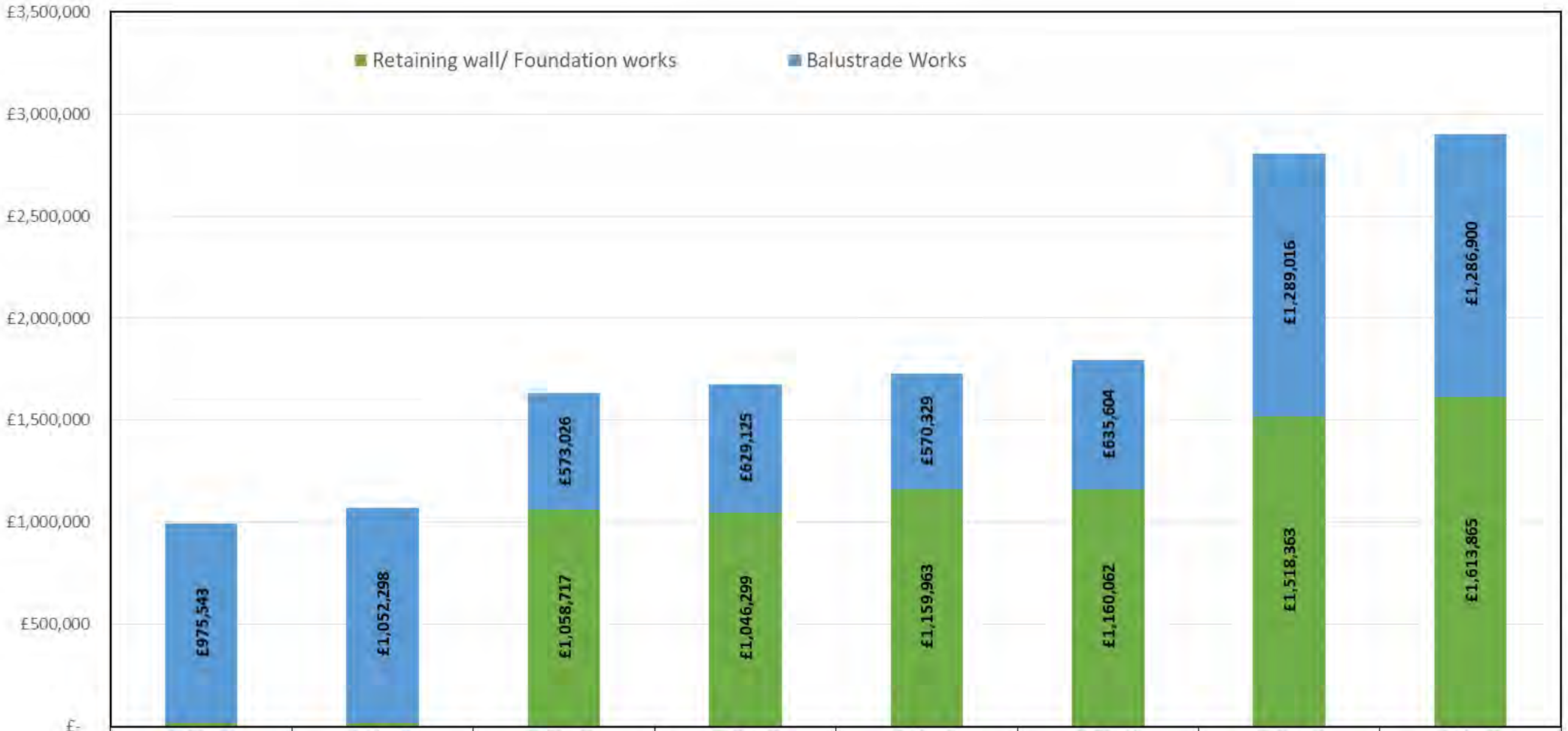

**Option 4A**

# TOTAL: £1,730,292

# CEPC – Chester Terrace Retaining Wall

## *Summary Table*

| Scheme Reference | Foundations | Balustrade Works | Programme | Weeks on Site | Retaining Wall/Foundation Works Cost | Balustrade Works Cost | Total Estimated Cost | Structural Condition (Relative to Current Standards) | Movement | Project Risk & Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Option 1** | **As Existing** | **Cosmetic Repairs** | **20 year** | **60** | **Year 1: £8,066 Years 2-20: £9,884** | **Year 1: £425,799 Years 2-20: £549,744** | **£993,493** | **Foundations & balustrade structurally inadequate for loading** | **Subject to ongoing movement** | **Inherent risks** |
| *Option 1A* | *As Existing* | *Repair and Pin* | *20 year* | *80* | *Year 1: £8,066 Years 2-20: £9,489* | *Year 1: £457,334 Years 2-20: £594,964* | *£1,069,853* | *Foundations & balustrade structurally inadequate for loading* | *Subject to ongoing movement* | *Inherent risks* |
| **Option 2** | **Ground Anchors & Ad-hoc Screw Fast Piles** | **New** | **20 year** | **80** | **Year 1: £518,402 Years 2-20: £999,961** | **Year 1: £614,739 Years 2-20: £674,277** | **£2,807,379** | **Only when works the are completed are the foundations & balustrade structurally adequate for lateral loadings.** | **Subject to ongoing movement & differential settlement.** | **Ground anchors clashing with services & vaults.** |
| *Option 2A* | *Ground Anchors & Ad-hoc Screw Fast Piles* | *Repair and Pin* | *20 year* | *90* | *Year 1: £610,227 Years 2-20: £1,003,638* | *Year 1: £560,157 Years 2-20: £726,743* | *£2,900,764* | *Balustrade structurally Inadequate for lateral loadings. Foundations adequate when works completed.* | *Subject to ongoing movement & differential settlement.* | *Ground anchors clashing with services & vaults. Balustrade inadequate.* |
| **Option 3** | **Ground Anchors & Screw Fast Piles** | **New** | **One Visit** | **30** | **Year 1: £8,066 Years 2-20: £9,884** | **Year 1: £425,799 Years 2-20: £549,744** | **£1,675,424** | **Foundations and balustrade structurally adequate for loadings.** | **No ongoing movement as a result of works.** | **Ground anchors clashing with services & vaults.** |
| *Option 3A* | *Ground Anchors & Screw Fast Piles* | *Repair and Pin* | *One Visit* | *35* | *£1,058,717* | *£573,026* | *£1,631,742* | *Balustrade structurally Inadequate for lateral loadings. Foundations adequate when works completed.* | *No ongoing movement from foundations. Balustrade will be subject to movement.* | *Ground anchors clashing with services & vaults. Balustrade inadequate.* |
| **Option 4** | **Concrete Retaining Wall & Piling** | **New** | **One Visit** | **40** | **£1,160,062** | **£635,604** | **£1,795,666** | **Foundations and balustrade structurally adequate for loadings.** | **No ongoing movement as a result of works.** | **Most intrusive works.** |
| *Option 4A* | *Concrete Retaining Wall & Piling* | *Repair and Pin* | *One Visit* | *45* | *£1,159,963* | *£570,329* | *£1,730,292* | *Balustrade structurally Inadequate for lateral loadings. Foundations adequate when works completed.* | *No ongoing movement from foundations. Balustrade will be subject to movement.* | *Most intrusive works & Balustrade inadequate.* |




| | Option 1<br>60 Weeks<br>(20 years) | Option 1a<br>80 Weeks<br>(20 years) | Option 3a<br>35 Weeks<br>(One Visit) | Option 3<br>30 Weeks<br>(One Visit) | Option 4a<br>45 Weeks<br>(One Visit) | Option 4<br>40 Weeks<br>(One Visit) | Option 2<br>80 Weeks<br>(20 years) | Option 2a<br>90 Weeks<br>(20 years) |
|---|---|---|---|---|---|---|---|---|
| Balustrade Works | £975,543 | £1,052,298 | £573,026 | £629,125 | £570,329 | £635,604 | £1,289,016 | £1,286,900 |
| Retaining wall/ Foundation works | £17,950 | £17,555 | £1,058,717 | £1,046,299 | £1,159,963 | £1,160,062 | £1,518,363 | £1,613,865 |

| **Scheme** | Option 1 | Option 1a | Option 3a | **Option 3** | Option 4a | **Option 4** | Option 2 | Option 2a |
|---|---|---|---|---|---|---|---|---|
| **Total Cost** | £993,493 | £1,069,853 | £1,631,742 | **£1,675,424** | £1,730,292 | **£1,795,666** | £2,807,379 | £2,900,764 |
| **Foundations** | Cosmetic | Cosmetic | Structural | **Structural** | Structural | **Structural** | Structural | Structural |
| **Balustrade** | Cosmetic | Cosmetic | Cosmetic | **Structural** | Cosmetic | **Structural** | Structural | Cosmetic |
| **Structural Condition** | Inadequate | Inadequate | Inadequate | **Adequate** | Inadequate | **Adequate** | Adequate | Inadequate |
| **Movement** | Yes | Yes | Yes | **No** | Yes | **No** | No | Yes |
| **Project Risk & Notes** | Inherent | Inherent | Ground anchor clash & balustrade inadequate. | **Ground anchor clash** | Intrusive works & balustrade inadequate. | **Intrusive works** | Ground anchor clash | Ground anchor clash & balustrade inadequate. |