| V & D | Project | Job Ref. | Job Ref. | | | | | |
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| | 14 R | 14 ROSECROFT AVE., LONDON. NW3 7QB | | | | | | |
| | Section | | | | Sheet no./rev | Sheet no./rev. | | |
| | PRELI | MINARY STRUC | TURAL CALCU | ILATIONS | | 1 | | |
| FRIMLEY GREEN | Calc. by | Date | Chk'd by | Date | App'd by | Date | | |
| SURREY GU16 6PT | TV | 18/02/2016 | | | | | | |
| | | | | | | | | |
| PITCHED ROOF | KN/m ² | <u>C</u> | EILING | | KN/m² | | | |
| Tiles | 0.70 | C | eiling Joists | | 0.10 | | | |
| Felt & battens | 0.05 | P | lasterboard | | <u>0.15</u> | | | |
| Rafters | <u>0.10</u> | D | . L. | | 0.25 KN/m² | | | |
| | <u>0.85</u> | Ι. | L. where applic | able | <u>0.25</u> KN/m² | | | |
| 45º on plan load D. L. | 1.20 KN/m ² | | | | 0.50 KN/m² | | | |
| 45 ⁰ Imposed Load | <u>0.38 </u> KN/m ² | | | | | | | |
| | 1.58 KN/m ² | | | | | | | |
| FLAT ROOF | KN/m ² | I | IMBER FLOOR | S | KN/m² | | | |
| Felt | 0.25 | В | oards | | 0.20 | | | |
| Boards | 0.25 | J | oists | | 0.10 | | | |
| Joists & firrings | 0.15 | C | eiling | | <u>0.20</u> | | | |
| Ceiling | <u>0.15</u> | D | . L. | | 0.50 KN/m² | | | |
| D. L. | 0.80 KN/m ² | Ι. | L. | | <u>1.50</u> KN/m² | | | |
| I .L. | <u>0.75</u> KN/m ² | | | : | 2.00 KN/m ² | | | |
| | 1.55 KN/m ² | | | | | | | |
| MASONRY | KN/m ² | | | | | | | |
| 102 Brick | 2.20 KN/m ² | | | | | | | |
| 100 lt. wt blk + (1 x plaster) | 1.10 KN/m ² | | | | | | | |
| 100 lt. wt blk + (2 x plaster) | 1.35 KN/m ² | | | | | | | |
| 100 dense blk + (1 x plaster) | 1.85 KN/m ² | | | | | | | |
| 215 BRICK + PLASTER | 4.60KN/m ² | | | | | | | |
| 330 BRICK + PLASTER | 6.80KN/m ² | | | | | | | |

DESIGN PHILOSOPHY

Walls to be Underpinned

New concrete walls below the property are designed as propped cantilevers in reinforced concrete, the lower ground floor slab acting as a lateral at the base prop at base level. The walls will be designed using the soil parameters relative to the site. The walls will be designed for a water table at 1.0m below ground level.

The surcharge load allowed on the external walls of the property will be 10KN/m². The party wall bounding will have a surcharge load of 10.00KN/m² for adjoining floor and partition wall construction and will also take into account any loads from adjoining foundations.

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| | PRELIM | IINARY STRUC | TURAL CALCU | LATIONS | | 2 |
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The basement slab will be formed in reinforced concrete. It will be designed for uplift due to water pressure below, and as a clear span under finish and imposed load, it will be protected by any uplift due to heave from Cordek. The basement slab will act as a lateral prop to the base of the basement walls.

Final super structure design is subject to soft strip of the existing building to expose existing floor spans etc. Calculations for the proposed revised super structure elements as well as the new ground floor concrete slab and steel beams will not form part of this preliminary set of calculations.

<u>KEY PLAN</u>



| | Project | ROSECROF | T AVE., LONI | DON. NW3 7QB | Job Ref. | |
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| | PREL | IMINARY S | TRUCTURAL | CALCULATIONS | | 3 |
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| | | | | | | |
| WALL A | | | | | | |
| WALL | 11.5 X 6.8 | = | 78.20 | | | |
| ROOF DL | 1.2 X 2 | = | 2.40 | | | |
| ROOF IL | 0.4 X 2 | = | | <u>0.80</u> | | |
| | | | 80.60KN/m | 0.80KN/m | | |
| WALL B | | | | | | |
| ROOF DL | 1.2 X 3 | = | 3.60 | | | |
| ROOF IL | 0.4 X 3 | = | | 1.20 | | |
| FLR DL | 2 X 0.6 X 2 | = | 2.40 | | | |
| FLR IL | 2 X 1.5 X 2 | = | | 6.00 | | |
| WALL | 7 X 6.8 X 85% | = | 40.50 | | | |
| | | | 47.5KN/m | 7.2KN/m | | |
| WALL C | | | | | | |
| WALL | 8.5 X 6.8 | = | 57.80KN/m | | | |
| WALL D | | | | | | |
| WALL | 7 X 6.8 X 60% | = | 29.00KN/m | | | |
| WALLS E & G | | | | | | |
| ROOF DL | 2.5 X 1.2 | = | 3.00 | | | |
| ROOF IL | 2.50 X 0.5 | = | | 1.25 | | |
| WALL | 7.5 X 4.6 | = | 34.50 | | | |
| FLRS DL | 2 X 2 X 0.6 | = | 2.40 | | | |
| FLRS IL | 2 X 2X 1.5 | = | | <u>6.00</u> | | |
| | | | 39.40KN/m | 7.25KN/m | | |
| WALL F | | | | | | |
| \A/ALI | 75X46X05 | _ | 17 25KN/m | | | |

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| LAKESIDE COUNTRY CLUB | PRELIM | INARY STRUC | JLATIONS | | 4 | |
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| | | 000 | | | | |
| WALLS AND BASES TO LOV | | LOOK | | | | |
| | | | | | | |
| $\frac{WALL A - PARITWALL}{DL}$ | | | | | | |
| DL = 80.6 KN/111, 1L = 0.6 KN/111 | | | | | | |
| RETAINING WALL ANAL | YSIS & DES | IGN (BS80) | 12) | | | |
| | | | <u>, </u> | | | |
| | | | | | | |
| RETAINING WALL ANALYSIS | S (BS 8002:1994 |) | | | | |
| | | | | | TEDDS calculatio | n version 1.2.01.06 |
| | | 1965 | → | | | |
| | 4 | 1800 | > 4375→ ନ୍ତି 4_ | | | |
| | | | 81 kN/m | 10 kN/m² | | |
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| | | | | | | |
| | | 2325 | | | | |
| | | | | | | |
| Wall details | | | | | | |
| Retaining wall type | Cantilever | | | | | |
| Height of wall stem | h _{stem} = 3200 mn | ı | Wall stem thic | kness | t _{wall} = 375 mr | n |
| Length of toe | I _{toe} = 1800 mm | | Length of heel | | l _{heel} = 150 mr | n |
| Overall length of base | l _{base} = 2325 mm | | Base thicknes | S | t _{base} = 400 m | m |
| Height of retaining wall | h _{wall} = 3600 mm | | | | | |
| Depth of downstand | d _{ds} = 0 mm | | Thickness of c | lownstand | t _{ds} = 400 mm | I |
| Position of downstand | l _{ds} = 1830 mm | | | | | |
| Depth of cover in front of wall | d _{cover} = 0 mm | | Unplanned ex | cavation depth | d _{exc} = 200 m | m |
| Height of ground water | h _{water} = 2600 mr | n | Density of wat | er . | γ _{water} = 9.81 | ⟨N/m³ |
| Density of wall construction | Ywall = 23.6 kN/m | 1 ³ | Density of bas | e construction | Vhase = 23.6 k | N/m ³ |
| Angle of soil surface | $\beta = 0.0 \text{ deg}$ | - | Effective beight | t at back of wall | ho# - 3600 m | |
| Mobilisation factor | p – 0.0 069 M – 1 5 | | | I at back of wall | | |
| Moist dopoity | $\mathbf{U} = \mathbf{I} \cdot \mathbf{J}$ | | Coturotod do- | city | W _ 01 0 LNV | m ³ |
| | $\gamma_m = 18.0 \text{ KIV}/\text{M}^3$ | | | Sity | $\gamma_{\rm S} = 21.0$ KIN/ | 111~ |
| Design shear strength | φ' = 24.2 deg | | Angle of wall f | riction | ð = U.O deg | |
| Design shear strength | φ'ь = 24.2 deg | | Design base f | riction | $\delta_{\rm b} = 18.6 {\rm deg}$ | 9 |

Allowable bearing

Pbearing = 125 kN/m²

Moist density

 $\gamma_{mb} = 18.0 \text{ kN/m}^3$



| 14 ROSECROF I AVE., LONDON, NV3 708VINCENT & RYMILL LAKESDE COUNTRY CLUB FRIMELY ORESNStreet no./rev.PRELIMINARY STRUCTURAL CALCULATIONS6PRELIMINARY STRUCTURAL CALCULATIONSConstant colspan="2">Applie to constant colspan="2">Applie to constant colspan="2">The EDIS calculation version 1TOT 13 8/0Constant colspan="2">Constant colspan="2">Constant colspan="2">Constant colspan="2">Constant colspan="2">Constant colspan="2">Strength of constant colspan="2">Constant colspan="2" <th co<="" th=""><th>V&R</th><th>Project</th><th></th><th></th><th></th><th>Job Ref.</th><th></th></th> | <th>V&R</th> <th>Project</th> <th></th> <th></th> <th></th> <th>Job Ref.</th> <th></th> | V&R | Project | | | | Job Ref. | |
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| MINCENT & RYMILL Levession Country CLUB Section PRELIMINARY STRUCTURAL CALCULATIONS 6 Cells, by manuary care entry TV 18/02/2016 Date April by Date BETAINING WALL DESIGN (BS 8002:1984) TEDDS calculation version 1 Utimate limit state load factors TEDDS calculation version 1 Dead load factor γ $e = 1.4$ Live load factor $\gamma_1 = 1.6$ Earth pressure factor $\gamma_{1,x} = 1.4$ Live load factor $\gamma_1 = 1.6$ Basic and reinforced concrete retaining wall toe (BS 8002:1994) Material properties Minimum reinforcement $r_y = 500$ N/mm² Strength of concrete $r_{cm} = 40$ N/mm² Strength of reinforcement ($r_y = 500$ N/mm² Date properties Strength of concrete $r_{m} = 40$ N/mm² Strength of reinforcement ($r_y = 500$ N/mm² Date properties Strength of concrete $r_{m} = 40$ N/mm² Strength of reinforcement ($r_y = 500$ N/mm² Date properties Strength of concrete $r_{m} = 40$ N/mm² Area provided A_{n} to $r_{m} = 2011$ mm Design of retaining wall toe Jame of 100 mm centres Area provided A_{n} to $r_{m} = 5.00$ N/mm² PASS - Design shear stress Voan = 0.462 N/mm² Allowable | VINCENT & RYMILL | 14 RO | SECROFT AV | E., LONDON. N | W3 7QB | Shaat is - /iii | | |
| LAKESBE COUNTRY CLUB Instant of the Count of the | VINCENT & RYMILL | | | | | Sneet no./rev. | | |
| SUBREY CUTE BYTTV18/02/2016TEEDIS calculation version 1TEEDIS calculation version 1TEEDIS calculation version 1Utimate limit state load factorsTEEDIS calculation version 1Daad load factor $y_{1,0} = 1.4$ Calculate propping forcePropping force $F_{prop} = 38.7 \text{ kN/m}$ Design of reinforced concrete retaining wall toe (BS 3002:1994)Material propertiesStrength of concrete $f_{ev} = 40 \text{ N/mm}^2$ Strength of reinforcement $k = 0.13$ %Cover in toe $C_{000} = 50 \text{ mm}$ Design of retaining wall toeDesign of retaining wall toeBase detailsMinimum reinforcement $k = 0.13 \%$ Cover in toe $C_{000} = 50 \text{ mm}$ Design of retaining wall toeDesign of retaining wall toeDesign of retaining wall toeBase detailsMoment at heel $M_{00} = 199.7 \text{ kNm/m}$ Concrete in bendingReinforcement provided16 mm dia.bars @ 100 mm centresArea required $A_{0,0e,-prov =} 2011 \text{ mm}$ PASS - Design shear stress $V_{oon =} 5.000 \text{ N/mm}^2$ Design of reinforced concrete retaining wall heel (BS 8002:1994)Material propertiesStrength of reinforcement $f_v = 500 \text{ N/mm}^2$ Value = 0.644 N/mm²Strength of reinforcement $f_v = 500$ | LAKESIDE COUNTRY CLUB ERIMI EY GREEN | Calc. by | Date | Chk'd by | Date | App'd by | Date | |
| TEEDIS calculation version 1 TEEDIS calculation version 1 Utimate limit state load factors Dead load factor $\gamma_{1,0} = 1.4$ Live load factor $\gamma_{1,1} = 1.6$ Earth pressure factor $\gamma_{1,0} = 1.4$ Calculate propping force Propoing force Propping force $F_{prop} = 38.7 \text{ kN/m}$ Design of reinforced concrete relatining wall toe (BS 8002:1994) Material properties Strength of concrete $f_w = 40 \text{ N/mm}^2$ Strength of reinforcement $f_y = 500 \text{ N/mm}^2$ Base details Minimum reinforcement $k = 0.13 \%$ Cover in toe $O_{lose} = 50 \text{ mm}$ Design of retaining wall toe Design of retaining wall toe Design of retaining wall toe Cover in toe $O_{lose} = 50 \text{ mm}$ Design of retaining wall toe Cover in toe Olice = 50 mm Design of retaining wall toe Pass of retaining wall toe Cover in toe Olice = 50 mm Design of retaining wall toe Cover in toe Cover = 2011 mm | SURREY GU16 6PT | TV | 18/02/2016 | | | | | |
| TEDDS calculation version 1 Utimate limit state load factor $\gamma_{L,0} = 1.4$ Live load factor $\gamma_{L,0} = 1.6$ Calculate propping force $\gamma_{L,0} = 1.4$ Calculate propping force $F_{prop} = 38.7 kN/m$ Design of reinforced concrete relating wall toe (BS 8002:1994) Material properties Strength of concrete $f_{col} = 40 N/mm^2$ Strength of reinforcement is not reinforcement provided Allowable shear stress $v_{acm} = 2011 mm^2$ Reinforcement provided As_{Lob_0,000} = 2011 mm^2 PASS - Design shear stress $v_{acm} = 5.00 N/mm^2$ Concrete shear stress $v_{acm} = 0.644 $ | RETAINING WALL DESIGN (| BS 8002:1994) | | | | | | |
| Ultimate limit state load factor $y_{1,0} = 1.4$ Dead load factor $y_{1,0} = 1.4$ Live load factor $y_{1,1} = 1.6$ Calculate propping force Propping force $F_{prop} = 38.7$ kN/m Dead load retinforced concrete retaining wall toe (BS 8002:1994) Material properties Strength of centrete retaining wall toe (BS 8002:1994) Material properties Base details Minimum reinforcement k = 0.13 % Cover in toe $\alpha_{eo} = 50$ mm Design of retaining wall toe Strength of reinforcement $f_v = 500$ N/mm? Base details Moment at heel Move = 199.7 kNm/m Cover in toe Cover = 500 mm Design of retaining wall toe Strength of reinforcement is not read Cover in toe Adve_tow_mm? Adve_tow_mm? Adve_tow_mm? Cover in toe Adve_tow_mm? PASS - Design shear stress Vactor Vactor Vactor Vactor Vact | | | | | | TEDDS calculation | on version 1.2.0 | |
| Dead lactor $\gamma_{1,e} = 1.4$ Live load factor $\gamma_{1,i} = 1.6$ Earth pressure factor $\gamma_{1,e} = 1.4$ Live load factor $\gamma_{1,i} = 1.6$ Calculate propping force Propping force Propping force Propping force Propping force $F_{prop} = 38.7 \text{ kN/m}$ Design of reinforced concrete retaining wall toe (BS 8002:1994) Material properties Strength of concrete $f_{out} = 40 \text{ N/mm}^2$ Strength of reinforcement $f_y = 500 \text{ N/mm}^2$ Base details Minimum reinforcement k = 0.13 % Cover in toe $C_{000} = 50 \text{ mm}$ Design of retaining wall toe Base details More = 199.7 kNm/m <i>Compression reinforcement is not rev</i> Check toe in bending Reinforcement provided 16 mm dia.bars @ 100 mm centres As toe prove = 2011 mm Reinforcement provided 16 mm dia.bars @ 100 mm centres As toe prove = 2011 mm PASS - Reinforcement provided at the retaining wall toe is ade Design shear stress $v_{0:e} = 0.462 \text{ N/mm}^2$ Allowable shear stress Vastm = 5.000 N/mm² Design of reinforced concrete retaining wall theel (BS 6002:1994) Material properties Vastm = 5.00 N/mm² Strength of concrete foor = 40 N/mm² Strength of reinforce | Ultimate limit state load fact | ors | | | | | | |
| Earth pressure factor $\gamma_{L,0} = 1.4$ Calculate propping force $P_{prop} = 38.7 \text{ kN/m}$ Design of reinforced concrete retaining wall toe (BS 8002:1994) Material properties Strength of concrete $f_{ou} = 40 \text{ N/mm}^2$ Strength of reinforcement $f_y = 500 \text{ N/mm}^2$ Base details Minimum reinforcement $k = 0.13$ %. Cover in toe $c_{000} = 50 \text{ mm}$ Design of retaining wall toe Shear at heel $V_{cov} = 158.0 \text{ kN/m}$ Moment at heel $M_{cov} = 199.7 \text{ kNm/m}$ Compression reinforcement is not reinforcement is not reinforcement provided $A_{a, 100, 100} = 2011 \text{ mm}$ PASS - Reinforcement provided $A_{a, 100, 100} = 2011 \text{ mm}^2$ PASS - Reinforcement provided at the retaining wall toe is add Check shear resistance at toe Design of reinforced concrete retaining wall heel (SS 8002:1994) Material properties Strength of concrete $f_{cu} = 40 \text{ N/mm}^2$ Strength of reinforcement $f_y = 500 \text{ N/mm}^2$ Base details Minimum reinforcement $k = 0.13$ %. Cover in heel $m_{exc} = 5000 \text{ N/mm}^2$ PASS - Design shear stress is less than maximum shear. Concrete shear stress $v_{c_100} = 0.462 \text{ N/mm}^2$ Strength of reinforcement $f_y = 500 \text{ N/mm}^2$ Base details Minimum reinforcement $k = 0.13$ %. Cover in heel $m_{exc} = 50 \text{ mm}$ Design of reinforced concrete retaining wall heel (SS 8002:1994) Material properties Strength of concrete $f_{cu} = 40 \text{ N/mm}^2$ Strength of reinforcement $f_y = 500 \text{ N/mm}^2$ Base details Minimum reinforcement $k = 0.13$ %. Cover in heel $m_{exc} = 50 \text{ mm}$ Design of retaining wall heel Shear at heel $V_{meel} = 14.1 \text{ kN/m}$ Moment at heel $M_{hoel} = 3.4 \text{ kNm/m}$ PASS - Reinforcement provided at the retaining wall heel is add Check shear resistance at heel Design shear stress $v_{c_{100}} = 520.0 \text{ mm}^2$ Allowable shear stress $v_{adm} = 5.000 \text{ N/mm}^2$ PASS - Design shear stress $v_{adm} = 5.000 \text{ N/mm}^2$ PASS - Design shear stress $v_{adm} = 5.000 \text{ N/mm}^2$ PASS - Design shear stress $v_{adm} = 5.000 \text{ N/mm}^2$ PASS - Design shear s | Dead load factor | $\gamma_{f_d} = 1.4$ | | Live load facto | r | $\gamma_{f_{-}I} = 1.6$ | | |
| Calculate propping force Propping force $F_{prop} = 38.7 \text{ kN/m}$ Design of reinforced concrete retaining wall toe (BS 8002:1994) Material properties Strength of concrete $f_{os} = 40 \text{ N/mm}^2$ Strength of reinforcement $f_y = 500 \text{ N/mm}^2$ Base details Minimum reinforcement k = 0.13 % Cover in toe $C_{000} = 50 \text{ mm}$ Design of retaining wall toe Strength of concrete More = 199.7 kN/m More = 199.7 kN/m/m Concretes the in bending Reinforcement provided 16 mm dia.bars @ 100 mm centres Area provided A summary and the is add Area required As_instance = 1413.3 mm²/m Area provided A summary and the is add PASS - Reinforcement provided A summary and the is add Concrete shear stress vos = 0.462 N/mm² Allowable shear stress vadm = 5.000 N/mm² Design shear stress vadm = 5.000 N/mm² Concrete shear stress vos = 0.644 N/mm² Vus < v_{e,toe"} - No shear reinforcement ret Design of reinforced concrete retaining wall heel (BS 8002:1994) Material properties Strength of concrete for = 50 mm <td>Earth pressure factor</td> <td>γ_{f_e} = 1.4</td> <td></td> <td></td> <td></td> <td></td> <td></td> | Earth pressure factor | γ _{f_e} = 1.4 | | | | | | |
| Propping force $F_{prop} = 38.7 \text{ kN/m}$ Design of reinforced concrete retaining wall toe (BS 8002:1994) Material properties Strength of concrete $f_{ou} = 40 \text{ N/mm}^2$ Strength of reinforcement $f_y = 500 \text{ N/mm}^2$ Base details Minimum reinforcement $k = 0.13 \%$ Cover in toe $O_{toe} = 50 \text{ mm}$ Design of retaining wall toe Strength of reinforcement is not recomment provided 16 mm dia.bars @ 100 mm centres Reinforcement provided 16 mm dia.bars @ 100 mm centres Action_prov = 2011 mm Reinforcement provided 16 mm dia.bars @ 100 mm centres Value Strength of reinforce at the retaining wall toe is ade Check toe in bending Reinforcement provided As_toe_prov = 2011 mm PASS - Reinforcement provided at the retaining wall toe is ade Check shear resistance at toe Pass - Design shear stress Voor = 0.462 N/mm^2 Allowable shear stress is less than maximum shear Concrete shear stress Voor = 0.464 N/mm^2 Strength of reinforcement fy = 500 N/mm^2 Base details Material properties Strength of reinforcement fy = 500 N/mm^2 Base details Minimum reinforcement k = 0.13 % Cover in heel Cherel = 50 mm Design | Calculate propping force | | | | | | | |
| Design of reinforced concrete retaining wall toe (BS 8002:1994) Material properties Strength of concrete $f_{cu} = 40$ N/mm ² Base details Minimum reinforcement k = 0.13 % Cover in toe $C_{core} = 50$ mm Design of retaining wall toe Strength of concrete Shear at heel $V_{toe} = 158.0$ kN/m Moment at heel $M_{ove} = 199.7$ kNm/m Check toe in bending Reinforcement provided Reinforcement provided 16 mm dia.bars @ 100 mm centres Area required $A_{a_{a_{a_{a_{a_{a_{a_{a_{a_{a_{a_{a_{a_$ | Propping force | F _{prop} = 38.7 kN/r | n | | | | | |
| Material properties Strength of concrete $f_{cu} = 40 \text{ N/mm}^2$ Strength of reinforcement $f_y = 500 \text{ N/mm}^2$ Base details Minimum reinforcement k = 0.13 % Cover in toe $c_{loc} = 50 \text{ mm}$ Design of retaining wall toe Shear at heel More = 158.0 kN/m Moment at heel $M_{co} = 199.7 \text{ kNm/m}$ Check toe in bending Reinforcement provided 16 mm dia.bars @ 100 mm centres C Area required $A_{s_1 oe_ree} = 1413.3 \text{ mm}^2/m$ Area provided $A_{s_1 be_r pow} = 2011 \text{ mm}$ PASS - Reinforcement provided at the retaining wall toe is ade C C C Check shear resistance at toe PASS - Design shear stress $v_{adm} = 5.000 \text{ N/mm}^2$ PASS - Design shear stress is less than maximum shear Concrete shear stress $v_{c_1 toe} = 0.644 \text{ N/mm}^2$ Allowable shear stress is less than maximum shear PASS - Design shear stress is less than envinum shear Design of reinforced concrete retaining wall heel (BS 3002:1994) Material properties Pase = 40 N/mm^2 Strength of reinforcement fy = 500 N/mm^2 Base details Minimum reinforcement k = 0.13 % Cover in heel Cheel = 50 mm Compression reinforcement is not rec Cheel = 50 mm Des | Design of reinforced concre | te retaining wall | toe (BS 8002: ⁻ | <u>1994)</u> | | | | |
| Strength of concrete f_{ou} = 40 N/mm ² Strength of reinforcement f_y = 500 N/mm ² Base details Minimum reinforcement k = 0.13 % Cover in toe c_{loce} = 50 mm Design of retaining wall toe Shear at heel V_{loc} = 158.0 kN/m Moment at heel M_{loce} = 199.7 kNm/m Check toe in bending Reinforcement provided 16 mm dia.bars @ 100 mm centres Area required $A_{a_toe_prov}$ = 2011 mm Area required $A_{a_toe_rea}$ = 1413.3 mm ² /m Area provided $A_{a_toe_prov}$ = 2011 mm PASS - Reinforcement provided at the retaining wall toe is ade Check shear resistance at toe Pass - Design shear stress v_{com} = 0.462 N/mm ² Design of reinforced concrete retaining wall heel (BS 8002:1994) Material properties Vice < vc_toe - No shear reinforcement retorement retore Design of retaining wall heel Strength of reinforcement f_y = 500 N/mm ² Base details Minimum reinforcement k = 0.13 % Cover in heel Cheel = 50 mm Design of retaining wall heel Base details Minimum reinforcement f_y = 500 N/mm ² Minimum reinforcement k = 0.13 % Cover in heel Cheel = 50 mm Design of retaining wall heel Neei = 1 | Material properties | | | | | | | |
| Base details Minimum reinforcement k = 0.13 % Cover in toe $c_{toe} = 50 \text{ mm}$ Design of retaining wall toe Moment at heel $M_{toe} = 199.7 \text{ kNm/m}$ Check toe in bending $Compression reinforcement is not reaction to the tot is not reactis not reactis not reaction to the tot is not reaction tototot to$ | Strength of concrete | $f_{cu} = 40 \text{ N/mm}^2$ | | Strength of rei | nforcement | f _y = 500 N/m | 1m² | |
| Minimum reinforcement k = 0.13 % Cover in toe $c_{toe} = 50 \text{ mm}$ Design of retaining wall toe Shear at heel $V_{toe} = 158.0 \text{ kN/m}$ Moment at heel $M_{toes} = 199.7 \text{ kNm/m}$ Compression reinforcement is not reinforcement provided 16 mm dia.bars @ 100 mm centres Compression reinforcement is not reinforcement provided Area required $A_{a_{a_1}toe_a,req} = 1413.3 \text{ mm}^2/m$ Area provided $A_{a_{a_1}bee_a,req} = 2011 \text{ mm}^2$ PASS - Reinforcement provided at the retaining wall toe is ade Check shear resistance at toe Voice = 0.462 N/mm ² Allowable shear stress $v_{adm} = 5.000 \text{ N/mm^2}$ Concrete shear stress $v_{c_1oe} = 0.644 \text{ N/mm^2}$ Voice < $V_{c_1oe} - No$ shear reinforcement Design of reinforced concrete retaining wall heel (BS 8002:1994) Material properties Strength of reinforcement fy = 500 N/mm ² Base details Minimum reinforcement k = 0.13 % Cover in heel Cheel = 50 mm Design of retaining wall heel Voice = 14.1 kN/m Moment at heel Mheel = 3.4 kNm/m Check heel in bending PASS - Reinforcement provided at the retaining wall heel is ade Check heel in be | Base details | | | | | | | |
| Design of retaining wall toe Noe = 158.0 kN/m Moment at heel Moe = 199.7 kNm/m Compression reinforcement is not reinforcement provided 16 mm dia.bars @ 100 mm centres Compression reinforcement is not reinforcement provided Area required As_toe_req = 1413.3 mm²/m Area provided As_toe_prov = 2011 mm' PASS - Reinforcement provided at the retaining wall toe is add PASS - Reinforcement provided at the retaining wall toe is add Check shear resistance at toe PASS - Design shear stress Vadm = 5.000 N/mm² Design shear stress Vice = 0.462 N/mm² Allowable shear stress is less than maximum shear. Concrete shear stress Vice = 0.644 N/mm² Vice < Ve_tree - No shear reinforcement retorement retore | Minimum reinforcement | k = 0.13 % | | Cover in toe | | Ctoe = 50 mn | ı | |
| Shear at heel $V_{toe} = 158.0$ kN/m Moment at heel $M_{toe} = 199.7$ kNm/m Compression reinforcement is not recommend to represent the relationary of the second term of term of the second term of term o | Design of retaining wall toe | | | | | | | |
| Compression reinforcement is not rei Check toe in bending Reinforcement provided 16 mm dia.bars @ 100 mm centres Area required $A_{stoetreq} = 1413.3 mm^2/m$ Area provided $A_{stoeprov} = 2011 mm$ PASS - Reinforcement provided at the retaining wall toe is ade Check shear resistance at toe vadm = 5.000 N/mm^2 Design shear stress $v_{toe} = 0.462 N/mm^2$ Allowable shear stress is less than maximum shear Concrete shear stress is less than maximum shear Concrete shear stress $v_{ctoe} = 0.644 N/mm^2$ Vroe < $v_{ctoe} - No$ shear reinforcement reinforcement reinforcement reinforcement reinforcement reinforcement reinforcement reinforcement for the stress is less than maximum shear Material properties Strength of reinforcement $f_y = 500 N/mm^2$ Base details Minimum reinforcement $k = 0.13 \%$ Cover in heel Cheel = 50 mm Design of retaining wall heel Son reinforcement is not reinforcement is not reinforcement reinforcement is not reinforcement reinforcement is not reinforcement reinforcement is not reinforcement is not reinforcement provided A_{s.heel.req} = 520.0 mm^2 m Base details Minimum reinforcement $k = 0.13 \%$ Cover in heel Meel = 3.4 kNm/m Design of retaining wall heel Neel = 14.1 kN/m Moment at heel | Shear at heel | V _{toe} = 158.0 kN/ | m | Moment at hee | el | Mtoe = 199.7 | ′ kNm/m | |
| Check toe in bending Reinforcement provided 16 mm dia.bars @ 100 mm centres Area required $A_{s_toe_req} = 1413.3 \text{ mm}^2/\text{m}$ Area provided $A_{s_toe_prov} = 2011 \text{ mm}$ PASS - Reinforcement provided at the retaining wall toe is ade Check shear resistance at toe vadm = 5.000 N/mm^2 Design shear stress $v_{toe} = 0.462 \text{ N/mm}^2$ Allowable shear stress $v_{adm} = 5.000 \text{ N/mm}^2$ Concrete shear stress $v_{toe} = 0.644 \text{ N/mm}^2$ Allowable shear stress is less than maximum shear Concrete shear stress $v_{c_toe} = 0.644 \text{ N/mm}^2$ $v_{toe} < v_{c_toe} - No$ shear reinforcement reading wall heel (BS 3002:1994) Material properties Strength of concrete $f_{cu} = 40 \text{ N/mm}^2$ Strength of reinforcement $f_y = 500 \text{ N/mm}^2$ Base details Minimum reinforcement $k = 0.13 \%$ Cover in heel $c_{heel} = 50 \text{ mm}$ Design of retaining wall heel Shar at heel $V_{heel} = 14.1 \text{ kN/m}$ Moment at heel $M_{heel} = 3.4 \text{ kNm/m}$ Check heel in bending Reinforcement provided 12 mm dia.bars @ 150 mm centres As_heel_prov = 754 mm^2 PASS - Reinforcement provided 12 mm dia.bars @ 150 mm centres As_heel_prov = 754 mm^2 PASS - Reinforcement provided at the retaining wall | | | | C | Compression r | reinforcement | is not requ | |
| Reinforcement provided 16 mm dia.bars @ 100 mm centres Area required $A_{s_toe_req} = 1413.3 \text{ mm}^2/\text{m}$ Area provided at the retaining wall toe is add PASS - Reinforcement provided at the retaining wall toe is add Design shear stress $v_{toe} = 0.462 \text{ N/mm}^2$ Design shear stress $v_{toe} = 0.462 \text{ N/mm}^2$ Allowable shear stress $v_{adm} = 5.000 \text{ N/mm}^2$ Concrete shear stress $v_{to_{_toe}} = 0.644 \text{ N/mm}^2$ $V_{toe} < v_{c_toe} - No$ shear reinforcement reference Design of reinforced concrete retaining wall heel (BS 8002:1994) Material properties $v_{toe} < v_{c_toe} - No$ shear reinforcement reference Design of reinforced concrete retaining wall heel (BS 8002:1994) Material properties $v_{toe} < v_{c_toe} - No$ shear reinforcement reference Base details $f_{ou} = 40 \text{ N/mm}^2$ Strength of reinforcement $f_y = 500 \text{ N/mm}^2$ Base details Minimum reinforcement $k = 0.13 \%$ Cover in heel $c_{heel} = 50 \text{ mm}$ Design of retaining wall heel Steen theel Mheel = 3.4 kNm/m Compression reinforcement is not reference Design of retaining wall heel 12 mm dia.bars @ 150 mm centres As_heel_prov = 754 mm^2 PASS - Reinforcement provided As_heel_prov = 754 mm^2 Area required As_heel_req = 520.0 mm^ | Check toe in bending | | | | | | | |
| Area required $A_{e_toe_req} = 1413.3 \text{ mm}^2/\text{m}$ Area provided $A_{e_toe_prov} = 2011 \text{ mm}$ PASS - Reinforcement provided at the retaining wall toe is add Check shear resistance at toe PASS - Design shear stress $v_{adm} = 5.000 \text{ N/mm}^2$ Design shear stress $v_{toe} = 0.462 \text{ N/mm}^2$ Allowable shear stress $v_{adm} = 5.000 \text{ N/mm}^2$ Concrete shear stress $v_{o_toe} = 0.644 \text{ N/mm}^2$ PASS - Design shear stress is less than maximum shear Concrete shear stress $v_{o_toe} = 0.644 \text{ N/mm}^2$ $v_{toe} < v_{e_toe} - No$ shear reinforcement recomment recomment of $v_{e_toe} - No$ shear reinforcement recomment of $v_{e_toe} - No$ shear reinforcement recomment of $v_{e_toe} - No$ shear reinforcement for $v_{e_toe} - No$ shear reinforcement for $v_{e_toe} - No$ shear reinforcement for $v_{e_toe} - No$ shear stress Base details $N_{eu} = 40 \text{ N/mm}^2$ Strength of reinforcement for $v_{y} = 500 \text{ N/mm}^2$ Base details $N_{eu} = 40 \text{ N/mm}^2$ Cover in heel $n_{heel} = 50 \text{ mm}$ Design of retaining wall heel $N_{heel} = 14.1 \text{ kN/m}$ Moment at heel $M_{heel} = 3.4 \text{ kNm/m}$ Check heel in bending Reinforcement provided $A_{e_theel_req} = 520.0 \text{ mm}^2/m$ PASS - Reinforcement provided at the retaining wall heel is addee the retaining wall heel is addee the retaining wall heel is addee the stress $V_{adm} = 5.000 \text{ N/mm}^2$ | Reinforcement provided | 16 mm dia.bars | a @ 100 mm c | entres | | | | |
| PASS - Reinforcement provided at the retaining wall toe is add Check shear resistance at toe Design shear stress $v_{toe} = 0.462 \text{ N/mm}^2$ Allowable shear stress $v_{adm} = 5.000 \text{ N/mm}^2$ Concrete shear stress $v_{o_{a}toe} = 0.644 \text{ N/mm}^2$ Vice < $v_{c_atoe} - No$ shear reinforcement red Design of reinforced concrete retaining wall heel (BS 8002:1994) Material properties Strength of concrete $f_{ou} = 40 \text{ N/mm}^2$ Strength of reinforcement $f_y = 500 \text{ N/mm}^2$ Base details Minimum reinforcement k = 0.13 % Cover in heel Cheel = 50 mm Design of retaining wall heel Shear at heel Vheel = 14.1 kN/m Moment at heel Mheel = 3.4 kNm/m Compression reinforcement is not red Allowable shear stress PASS - Reinforcement provided Allowable shear stress Vade = 5200 N/mm ² PASS - Reinforcement provided at the retaining wall heel is add Check heel in bending Reinforcement provided 12 mm dia.bars @ 150 mm centres Allowable shear stress | Area required | As_toe_req = 1413 | .3 mm²/m | Area provided | | As_toe_prov = | 2011 mm²/n | |
| Check shear resistance at toe Design shear stress $v_{toe} = 0.462 \text{ N/mm}^2$ Allowable shear stress $v_{adm} = 5.000 \text{ N/mm}^2$ PASS - Design shear stress is less than maximum shear Concrete shear stress $v_{o_{-}toe} = 0.644 \text{ N/mm}^2$ Vree < $v_{c_{-}tee} - No$ shear reinforcement ref Design of reinforced concrete retaining wall heel (BS 8002:1994) Material properties Strength of reinforcement $f_y = 500 \text{ N/mm}^2$ Base details Minimum reinforcement k = 0.13 % Cover in heel Cheel = 50 mm Design of retaining wall heel Strength of reinforcement $f_y = 500 \text{ N/mm}^2$ Base details Minimum reinforcement k = 0.13 % Cover in heel Cheel = 50 mm Design of retaining wall heel Shear at heel Vheel = 14.1 kN/m Moment at heel Mheel = 3.4 kNm/m Compression reinforcement is not red Allowable shear stress Nate = 0.48 N/mm^2 PASS - Reinforcement provided $A_{s_nheel_nprov} = 754 \text{ mm}^2$ PASS - Design shear stress Vadm = 5.000 N/mm^2< | | | PASS - Rei | nforcement pro | ovided at the r | etaining wall t | oe is adequ | |
| Design shear stress $v_{toe} = 0.462 \text{ N/mm}^2$ Allowable shear stress $v_{adm} = 5.000 \text{ N/mm}^2$ PASS - Design shear stress is less than maximum shear PASS - Design shear stress is less than maximum shear PASS - Design shear stress is less than maximum shear Concrete shear stress $v_{c_toe} = 0.644 \text{ N/mm}^2$ $v_{toe} < v_{c_toe} - No shear reinforcement reinforcement reinforced concrete retaining wall heel (BS 8002:1994)$ | Check shear resistance at to | be | | | | | | |
| PASS - Design shear stress is less than maximum shear Concrete shear stress $v_{c_toe} = 0.644$ N/mm ² Vroe < $v_{c_toe} - No$ shear reinforcement real Design of reinforced concrete retaining wall heel (BS 8002:1994) Material properties Strength of concrete $f_{ou} = 40$ N/mm ² Strength of reinforcement $f_y = 500$ N/mm ² Base details Minimum reinforcement k = 0.13 % Cover in heel Cheel = 50 mm Design of retaining wall heel Strength of reinforcement thell Mheel = 3.4 kNm/m Check heel in bending Reinforcement provided 12 mm dia.bars @ 150 mm centres PASS - Reinforcement provided As_heel_req 520.0 mm ² /m Area required As_heel_req 520.0 mm ² /m Area provided As_heel_prov = 754 mm ² Design shear stress Value = 0.041 N/mm ² Allowable shear stress Value = 5.000 N/mm ² PASS - Design shear stress is less than maximum shear stress Concrete shear stress Value = 0.043 N/mm ² | Design shear stress | v _{toe} = 0.462 N/m | m ² | Allowable shea | ar stress | Vadm = 5.000 | N/mm ² | |
| Concrete shear stress $v_{c_toe} = 0.644 \text{ N/mm}^2$ Viore < $v_{c_toe} - No$ shear reinforcement rei Design of reinforced concrete retaining wall heel (BS 8002:1994) Material properties Strength of concrete $f_{cu} = 40 \text{ N/mm}^2$ Strength of reinforcement $f_y = 500 \text{ N/mm}^2$ Base details Minimum reinforcement $k = 0.13 \%$ Cover in heel $c_{heel} = 50 \text{ mm}$ Design of retaining wall heel Shear at heel Vheel = 14.1 kN/m Moment at heel Mheel = 3.4 kNm/m Check heel in bending Reinforcement provided 12 mm dia.bars @ 150 mm centres Area provided $A_{s_heel_prov} = 754 \text{ mm}^2$ Area required $A_{s_heel_req} = 520.0 \text{ mm}^2/m$ Area provided at the retaining wall heel is ade Check shear resistance at heel Design shear stress $v_{adm} = 5.000 \text{ N/mm}^2$ PASS - Design shear stress $v_{adm} = 5.000 \text{ N/mm}^2$ Concrete shear stress $v_{c_heel} = 0.463 \text{ N/mm}^2$ Allowable shear stress is less than maximum shear stress | | | PASS | - Design shear | stress is less | than maximu | m shear sti | |
| Vice < Vo_toe - No Shear reinforcement reinforcement reinforcement reinforcement Design of reinforced concrete retaining wall heel (BS 8002:1994) Material properties Strength of concrete $f_{cu} = 40 \text{ N/mm}^2$ Strength of reinforcement $f_y = 500 \text{ N/mm}^2$ Base details Minimum reinforcement $k = 0.13 \%$ Cover in heel $c_{heel} = 50 \text{ mm}$ Design of retaining wall heel Shear at heel Vheel = 14.1 kN/m Moment at heel $M_{heel} = 3.4 \text{ kNm/m}$ Compression reinforcement is not reinforcement is not reinforcement provided PASS - Reinforcement provided As_heel_prov = 754 mm ² PASS - Reinforcement provided at the retaining wall heel is ade Check shear resistance at heel Design shear stress $v_{heel} = 0.041 \text{ N/mm}^2$ Allowable shear stress $v_{adm} = 5.000 \text{ N/mm}^2$ PASS - Design shear stress is less than maximum shear stress Concrete shear stress $v_{c_hheel} = 0.463 \text{ N/mm}^2$ | Concrete shear stress | v _{c_toe} = 0.644 N/ | mm ² | | | | | |
| Design of reinforced concrete retaining wall heel (BS 8002:1994) Material properties Strength of concrete $f_{cu} = 40 \text{ N/mm}^2$ Strength of reinforcement $f_y = 500 \text{ N/mm}^2$ Base details Minimum reinforcement $k = 0.13 \%$ Cover in heel $c_{heel} = 50 \text{ mm}$ Design of retaining wall heel Stear at heel Vheel = 14.1 kN/m Moment at heel $M_{heel} = 3.4 \text{ kNm/m}$ Compression reinforcement is not reaction Compression reinforcement is not reaction Compression reinforcement is not reaction Reinforcement provided 12 mm dia.bars @ 150 mm centres Area required $A_{s_heel_req} = 520.0 \text{ mm}^2/m$ Area provided at the retaining wall heel is addeen to be addeen the stress of the stress is less than maximum shear stress value = 0.463 N/mm^2 | | | | Vtoe | e < Vc_toe - NO S | shear reinforce | ement requ | |
| Material propertiesStrength of concrete $f_{cu} = 40 \text{ N/mm}^2$ Strength of reinforcement $f_y = 500 \text{ N/mm}^2$ Base detailsMinimum reinforcementk = 0.13 %Cover in heel $C_{heel} = 50 \text{ mm}$ Design of retaining wall heelShear at heelV_{heel} = 14.1 kN/mMoment at heelM_{heel} = 3.4 kNm/mCompression reinforcement is not readCheck heel in bendingReinforcement provided12 mm dia.bars @ 150 mm centresArea required $A_{s_heel_req} = 520.0 \text{ mm}^2/m$ Area provided at the retaining wall heel is adeCheck shear resistance at heelDesign shear stress $v_{heel} = 0.041 \text{ N/mm}^2$ Allowable shear stress $v_{adm} = 5.000 \text{ N/mm}^2$ PASS - Design shear stress is less than maximum shear stress $v_{c_heel} = 0.463 \text{ N/mm}^2$ $v_{heel} = No shear reinforcement red$ | Design of reinforced concre | te retaining wall | heel (BS 8002 | <u>:1994)</u> | | | | |
| Strength of concrete $f_{cu} = 40 \text{ N/mm}^2$ Strength of reinforcement $f_y = 500 \text{ N/mm}^2$ Base details Minimum reinforcement k = 0.13 % Cover in heel $C_{heel} = 50 \text{ mm}$ Design of retaining wall heel Stear at heel Vheel = 14.1 kN/m Moment at heel Mheel = 3.4 kNm/m Shear at heel Vheel = 14.1 kN/m Moment at heel Mheel = 3.4 kNm/m Check heel in bending Exercise Exercise Exercise Reinforcement provided 12 mm dia.bars @ 150 mm centres Area required As_heel_req = 520.0 mm²/m Area provided at the retaining wall heel is addered at the retain the | Material properties | | | | | | | |
| Base details Minimum reinforcement k = 0.13 % Cover in heel $c_{heel} = 50 \text{ mm}$ Design of retaining wall heel Noment at heel Meel = 3.4 kNm/m Shear at heel Vheel = 14.1 kN/m Moment at heel Mheel = 3.4 kNm/m Compression reinforcement is not read Check heel in bending Reinforcement provided 12 mm dia.bars @ 150 mm centres Area required $A_{s_heel_req} = 520.0 \text{ mm}^2/m$ Area provided at the retaining wall heel is adde PASS - Reinforcement provided at the retaining wall heel is adde PASS - Reinforcement provided at the retaining wall heel is adde Check shear resistance at heel PASS - Design shear stress $v_{adm} = 5.000 \text{ N/mm}^2$ PASS - Design shear stress is less than maximum shear stress $v_{adm} = 0.463 \text{ N/mm}^2$ Concrete shear stress $v_{c_heel} = 0.463 \text{ N/mm}^2$ | Strength of concrete | $f_{cu} = 40 \text{ N/mm}^2$ | | Strength of rei | nforcement | f _y = 500 N/m | 1m² | |
| Minimum reinforcement k = 0.13 % Cover in heel cheel = 50 mm Design of retaining wall heel Shear at heel Vheel = 14.1 kN/m Moment at heel Mheel = 3.4 kNm/m Shear at heel Vheel = 14.1 kN/m Moment at heel Mheel = 3.4 kNm/m Compression reinforcement is not reaction Compression reinforcement is not reaction Check heel in bending 12 mm dia.bars @ 150 mm centres Area required 12 mm dia.bars @ 150 mm centres Area required As_heel_req = 520.0 mm²/m Area provided at the retaining wall heel is adder PASS - Reinforcement provided at the retaining wall heel is adder PASS - Design shear stress Vadm = 5.000 N/mm² Concrete shear stress Vheel = 0.041 N/mm² Allowable shear stress is less than maximum shear stress PASS - Design shear stress is less than maximum shear stress Concrete shear stress Vc_heel = 0.463 N/mm² Vheel < Vc heel - No shear reinforcement reter | Base details | | | | | | | |
| Design of retaining wall heel Vheel = 14.1 kN/m Moment at heel Mheel = 3.4 kNm/m Shear at heel Vheel = 14.1 kN/m Moment at heel Mheel = 3.4 kNm/m Compression reinforcement is not real Check heel in bending Reinforcement provided 12 mm dia.bars @ 150 mm centres Area required As_heel_req = 520.0 mm²/m Area provided at the retaining wall heel is ade Check shear resistance at heel Design shear stress Vheel = 0.041 N/mm² Allowable shear stress is less than maximum shear stress is less than maximum shear stress is less than maximum shear stress Concrete shear stress vc_heel = 0.463 N/mm² | Minimum reinforcement | k = 0.13 % | | Cover in heel | | Cheel = 50 mi | m | |
| Shear at heel $V_{heel} = 14.1 \text{ kN/m}$ Moment at heel $M_{heel} = 3.4 \text{ kNm/m}$ Compression reinforcement is not realCheck heel in bendingReinforcement provided12 mm dia.bars @ 150 mm centresArea required $A_{s_heel_req} = 520.0 \text{ mm}^2/\text{m}$ Area provided $A_{s_heel_prov} = 754 \text{ mm}^2$ Check shear resistance at heelDesign shear stress $v_{heel} = 0.041 \text{ N/mm}^2$ Allowable shear stress $v_{adm} = 5.000 \text{ N/mm}^2$ Concrete shear stress $v_{c_heel} = 0.463 \text{ N/mm}^2$ Vheel < V_c heel - No shear reinforcement red | Design of retaining wall hee | I | | | | | | |
| Compression reinforcement is not real Check heel in bending Reinforcement provided 12 mm dia.bars @ 150 mm centres Area required As_heel_req = 520.0 mm²/m Area provided As_heel_prov = 754 mm² Area required As_heel_req = 520.0 mm²/m Area provided at the retaining wall heel is adde PASS - Reinforcement provided at the retaining wall heel is adde Check shear resistance at heel Design shear stress vheel = 0.041 N/mm² Allowable shear stress vadm = 5.000 N/mm² PASS - Design shear stress is less than maximum shear PASS - Design shear stress is less than maximum shear PASS - Design shear stress is less than maximum shear | Shear at heel | V _{heel} = 14.1 kN/r | n | Moment at hee | el | M _{heel} = 3.4 k | Nm/m | |
| Check heel in bending Reinforcement provided 12 mm dia.bars @ 150 mm centres Area required As_heel_req = 520.0 mm²/m Area provided As_heel_prov = 754 mm² PASS - Reinforcement provided at the retaining wall heel is added Check shear resistance at heel Design shear stress vheel = 0.041 N/mm² Allowable shear stress vadm = 5.000 N/mm² Concrete shear stress vc_heel = 0.463 N/mm² Vheel < Vc heel - No shear reinforcement red | | | | C | Compression r | einforcement | is not requ | |
| Reinforcement provided 12 mm dia.bars @ 150 mm centres Area required As_heel_req = 520.0 mm²/m Area provided As_heel_prov = 754 mm² PASS - Reinforcement provided at the retaining wall heel is adde Check shear resistance at heel Design shear stress vheel = 0.041 N/mm² Allowable shear stress vadm = 5.000 N/mm² PASS - Design shear stress is less than maximum shear stress vc_heel = 0.463 N/mm² Vneel < Vc_heel - No shear reinforcement red | Check heel in bending | | | | | | | |
| Area required $A_{s_heel_req} = 520.0 \text{ mm}^2/\text{m}$ Area provided $A_{s_heel_prov} = 754 \text{ mm}^2$ PASS - Reinforcement provided at the retaining wall heel is addedCheck shear resistance at heelDesign shear stress $v_{heel} = 0.041 \text{ N/mm}^2$ Allowable shear stress $v_{adm} = 5.000 \text{ N/mm}^2$ PASS - Design shear stress is less than maximum shear stressConcrete shear stress $v_{c_heel} = 0.463 \text{ N/mm}^2$ Vheel < Vc heel - No shear reinforcement red | Reinforcement provided | 12 mm dia.bars | a @ 150 mm c | entres | | | | |
| PASS - Reinforcement provided at the retaining wall heel is added Check shear resistance at heel Design shear stress vheel = 0.041 N/mm² Allowable shear stress vadm = 5.000 N/mm² PASS - Design shear stress is less than maximum shear stress Concrete shear stress vc_heel = 0.463 N/mm² Vheel < Vc_heel - No shear reinforcement red | Area required | $A_{s_heel_req} = 520.$ | 0 mm²/m | Area provided | | $A_{s_heel_prov} =$ | 754 mm²/m | |
| Check shear resistance at hell Vheel = 0.041 N/mm² Allowable shear stress Vadm = 5.000 N/mm² Design shear stress Vadm = 0.041 N/mm² Allowable shear stress is less than maximum shear stress is less than maximum shear stress Concrete shear stress Vc_heel = 0.463 N/mm² Vheel < Vc heel - No shear reinforcement resident stress | | | PASS - Rein | forcement prov | vided at the re | taining wall he | eel is adequ | |
| Design shear stress $v_{heel} = 0.041 \text{ N/mm}^2$ Allowable shear stress $v_{adm} = 5.000 \text{ N/mm}^2$ PASS - Design shear stress is less than maximum shearConcrete shear stress $v_{c_heel} = 0.463 \text{ N/mm}^2$ Vheel = 0.463 N/mm^2Vheel < Vc_heel - No shear reinforcement red | Check shear resistance at h | eel | | | | | | |
| PASS - Design shear stress is less than maximum shear Concrete shear stress vc_heel = 0.463 N/mm² Vheel < Vc heel - No shear reinforcement red | Design shear stress | v _{heel} = 0.041 N/n | nm² | Allowable shea | ar stress | Vadm = 5.000 | N/mm ² | |
| Concrete shear stress $v_{c_heel} = 0.463 \text{ N/mm}^2$ $v_{heel} < v_{c_heel} - No shear reinforcement red$ | | | PASS | - Design shear | stress is less | than maximu | m shear sti | |
| Vheel < Vc heel - No shear reinforcement red | Concrete shear stress | Vc_heel = 0.463 N | /mm² | | | | _ | |
| | | | | Vheel | < Vc_heel - NO S | shear reinforce | ement requ | |
| | | | | | | | | |

| V & D | Project | | | | Job Ref. | |
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| | Section | | | | Sheet no./rev. | |
| VINCENT & RYMILL LAKESIDE COUNTBY CLUB | PRELIM | IINARY STRUC | TURAL CALCU | LATIONS | | 7 |
| FRIMLEY GREEN | Calc. by | Date | Chk'd by | Date | App'd by | Date |
| SURREY GU16 6PT | TV | 18/02/2016 | | | | |
| | | | | | | I |
| Design of reinforced concrete | e retaining wall | stem (BS 8002 | <u>:1994)</u> | | | |
| Material properties | | | | | | |
| Strength of concrete | $f_{cu} = 40 \ N/mm^2$ | f _{cu} = 40 N/mm ² | | nforcement | fy = 500 N/mm | 1 ² |
| Wall details | | | | | | |
| Minimum reinforcement | k = 0.13 % | | | | | |
| Cover in stem | C _{stem} = 75 mm | | Cover in wall | | Cwall = 50 mm | |
| Design of retaining wall stem | | | | | | |
| Shear at base of stem | V _{stem} = 36.4 kN/ | V _{stem} = 36.4 kN/m | | Moment at base of stem | | kNm/m |
| | | | Compression reinforcement is not requ | | | |
| Check wall stem in bending | | | | | | |
| Reinforcement provided | 20 mm dia.bar | s @ 100 mm ce | entres | | | |
| Area required | As stem reg = 126 | 7.6 mm²/m | Area provided | | As stem prov = 3 | 142 mm²/m |
| · | | PASS - Reinfe | orcement provi | ded at the retai | ning wall sten | n is adequate |
| Check shear resistance at wa | ll stem | | | | | |
| Design shear stress | $V_{\rm stom} = 0.126 {\rm N}/{\rm stom}$ | mm ² | Allowable shea | r stress | $V_{adm} = 5000$ | J/mm ² |
| Dough choar choos | | PASS | - Design shear | stress is less ti | han maximum | shear stress |
| Concrete shear stress | Vc. stem = 0.823 | N/mm ² | 2001gil olioui v | | | |
| | | | Vstem < | < Vc stem - No sh | ear reinforcen | nent required |
| Chock rotaining wall deflection | n | | | | | |
| Max span/depth ratio | ratio 11 25 | | Actual span/de | oth ratio | ratio 11 0 | 2 |
| | | | Actual span/de | PASS - Span f | a depth ratio | s is accontablo |
| | | | | , A00 - Opan i | | |
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| VI&D | Project | | | | Job Ref. | |
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| | Section | | | | Sheet no./rev. | |
| LAKESIDE COUNTRY CLUB | PRELIM | | 9 | | | |
| FRIMLEY GREEN | Calc. by | Date | Chk'd by | Date | App'd by | Date |
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WALL B

SIDE WALL

DL = 47.5KN/m, IL = 7.2KN/m

RETAINING WALL ANALYSIS & DESIGN (BS8002)

RETAINING WALL ANALYSIS (BS 8002:1994)

Wall details

| Retaining wall type | Cantilever | | |
|---------------------------------|---|----------------------------------|---|
| Height of wall stem | h _{stem} = 3200 mm | Wall stem thickness | t _{wall} = 375 mm |
| Length of toe | I _{toe} = 1800 mm | Length of heel | l _{heel} = 150 mm |
| Overall length of base | l _{base} = 2325 mm | Base thickness | t _{base} = 400 mm |
| Height of retaining wall | h _{wall} = 3600 mm | | |
| Depth of downstand | d _{ds} = 0 mm | Thickness of downstand | t _{ds} = 400 mm |
| Position of downstand | l _{ds} = 1900 mm | | |
| Depth of cover in front of wall | d _{cover} = 0 mm | Unplanned excavation depth | d _{exc} = 200 mm |
| Height of ground water | h _{water} = 2600 mm | Density of water | $\gamma_{water} = 9.81 \text{ kN/m}^3$ |
| Density of wall construction | γ _{wall} = 23.6 kN/m ³ | Density of base construction | $\gamma_{\text{base}} = 23.6 \text{ kN/m}^3$ |
| Angle of soil surface | $\beta = 0.0 \text{ deg}$ | Effective height at back of wall | h _{eff} = 3600 mm |
| Mobilisation factor | M = 1.5 | | |
| Moist density | $\gamma_{m} =$ 18.0 kN/m ³ | Saturated density | $\gamma_{s} = 21.0 \text{ kN/m}^{3}$ |
| Design shear strength | φ' = 24.2 deg | Angle of wall friction | $\delta = \textbf{0.0} \text{ deg}$ |
| Design shear strength | φ' _b = 24.2 deg | Design base friction | $\delta_{\text{b}} = \textbf{18.6} \text{ deg}$ |
| Moist density | $\gamma_{mb} = $ 18.0 kN/m ³ | Allowable bearing | $P_{\text{bearing}} = 125 \text{ kN/m}^2$ |
| Using Coulomb theory | | | |
| Active pressure | Ka = 0.419 | Passive pressure | Kp = 4.187 |
| At-rest pressure | $K_0 = 0.590$ | | |

TEDDS calculation version 1.2.01.06



| V&R | Project | | | | Job Ref. | | |
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| VINCENT & RYMILL | | | | | Sheet no./rev. | | |
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| <u>RETAINING WALL DESIGN (</u> | <u>BS 8002:1994)</u> | | | | TEDDS calculation | version 1 2 01 0 | |
| Ultimate limit state load fact | ors | | | | | | |
| Dead load factor | γ _{f d} = 1.4 | | Live load factor | r | γ _{f I} = 1.6 | | |
| Earth pressure factor | γ _{f_e} = 1.4 | | | | • = | | |
| Calculate propping force | | | | | | | |
| Propping force | F _{prop} = 49.8 kN/ | m | | | | | |
| Design of reinforced concre | te retaining wall | toe (BS 8002:1 | <u>994)</u> | | | | |
| Material properties | | | | | | | |
| Strength of concrete | f _{cu} = 40 N/mm ² | | Strength of reir | nforcement | f _y = 500 N/mn | n ² | |
| Base details | | | | | | | |
| Minimum reinforcement | k = 0.13 % | | Cover in toe | | C _{toe} = 50 mm | | |
| Design of retaining wall toe | | | | | | | |
| Shear at heel | V _{toe} = 140.0 kN/ | ′m | Moment at hee | 9 | Mtoe = 201.3 | ۸m/m | |
| | | | Compression rei | | inforcement is not require | | |
| Check toe in bending | | | | | | | |
| Reinforcement provided | 16 mm dia.bars | s @ 125 mm co | entres | | | | |
| Area required | As_toe_req = 1424 | .8 mm²/m | Area provided | | $A_{s_toe_prov} = 16$ | 508 mm²/m | |
| | | PASS - Rei | nforcement pro | vided at the re | taining wall to | e is adequate | |
| Check shear resistance at to | e | | | | | | |
| Design shear stress | v _{toe} = 0.409 N/m | | Allowable shea | ar stress atraca in lage t | Vadm = 5.000 M | N/mm² | |
| Concrete shear stress | $V_{c,top} = 0.563 \text{ N/}$ | /mm ² | - Design shear | 511855 15 1855 1 | | Silear Siles | |
| | | | Vtoe | < Vc_toe - No sh | near reinforcen | nent required | |
| Design of reinforced concre | te retaining wall | heel (BS 8002 | 1994) | | | | |
| Material properties | le returning wan | | | | | | |
| Strength of concrete | f _{cu} = 40 N/mm ² | | Strength of reir | nforcement | f _v = 500 N/mn | n ² | |
| Base details | | | etterigti er ten | | ., | | |
| Minimum reinforcement | k = 0.13 % | | Cover in heel | | Cheel = 50 mm | | |
| Design of retaining wall heel | | | | | | | |
| Shear at heel | V _{heel} = 17.9 kN/i | m | Moment at hee | 9 | Mheel = 4.9 kN | lm/m | |
| | | | C | ompression re | inforcement is | not require | |
| Check heel in bending | | | | | | ~ | |
| Reinforcement provided | B785 mesh | | | | | | |
| Area required | $A_{s_heel_req} = 520.$ | .0 mm²/m | Area provided | | $A_{s_heel_prov} = 7$ | 85 mm²/m | |
| | | PASS - Rein | forcement prov | rided at the reta | aining wall hee | el is adequate | |
| Check shear resistance at he | eel | | | | | | |
| Design shear stress | v _{heel} = 0.052 N/r | mm² | Allowable shea | ar stress | Vadm = 5.000 | N/mm ² | |
| Congrato chaor atraca | V 0 460 M | PASS | - Design shear | stress is less t | han maximum | shear stres | |
| Concrete shear stress | vc_heel = U.468 N | N/111111- | Vhart | < Va haal - No ch | near reinforcer | nent require | |
| | | | v neel · | ≺ vc_neei - NU SI | | nem required | |
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| | Project | | | | Job Ref. | | |
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| | Section | | | | Sheet no./rev. | | |
| | PRELIM | IINARY STRUC | TURAL CALCU | LATIONS | | 12 | |
| FRIMLEY GREEN | Calc. by | Date | Chk'd by | Date | App'd by | Date | |
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| | | | | I | | | |
| Design of reinforced concrete | retaining wall | stem (BS 8002 | <u>:1994)</u> | | | | |
| Material properties | | | | | | | |
| Strength of concrete | _{cu} = 40 N/mm ² | | Strength of rein | forcement | f _y = 500 N/mm | 1 ² | |
| Wall details | | | | | | | |
| Minimum reinforcement | k = 0.13 % | | | | | | |
| Cover in stem | c _{stem} = 75 mm | | Cover in wall | | Cwall = 50 mm | | |
| Design of retaining wall stem | | | | | | | |
| Shear at base of stem | V _{stem} = 20.8 kN/ | m | Moment at base of stem | | M _{stem} = 151.5 kNm/m | | |
| | | | Compression reinforcement is not re | | | not required | |
| Check wall stem in bending | | | | | | | |
| Reinforcement provided | 16 mm dia.bars | s @ 100 mm ce | entres | | | | |
| Area required | As_stem_req = 125 | 8.0 mm²/m | Area provided | | $A_{s_stem_prov} = 2$ | 2011 mm²/m | |
| | | PASS - Reinfo | orcement provided at the retaining wall stem is adequate | | | | |
| Check shear resistance at wal | l stem | | | | | | |
| Design shear stress | v _{stem} = 0.071 N/ | mm² | Allowable shea | r stress | Vadm = 5.000 N | N/mm ² | |
| | | PASS | - Design shear | stress is less tl | nan maximum | shear stress | |
| Concrete shear stress | Vc_stem = 0.706 N | √mm² | | | | | |
| | | | Vstem < | : Vc_stem - No she | ear reinforcen | nent required | |
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| V&R | Project | | | | Job Ref. | |
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| | Section | | | Sheet no./rev. | | |
| | PRELIM | IINARY STRUC | TURAL CALCU | LATIONS | | 14 |
| FRIMLEY GREEN | Calc. by | Date | Chk'd by | Date | App'd by | Date |
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| <u>WALLS E AND G</u> DL = 39.4KN/m, IL = 7.25KN/m ETAINING WALL ANAL | YSIS & DES | IGN (BS80 | <u>02)</u> | | | |
| <u>RETAINING WALL ANALYSIS</u> | | 2 1980 1800 | → → 4375→ 였 4- 47 kN/m ↓ ↓ ↓ ↓ ↓ | 10 kN/m ² | TEDDS calculation | version 1.2.01.06 |
| Wall details Retaining wall type Height of wall stem Length of toe Overall length of base Height of retaining wall Depth of downstand Position of downstand Depth of cover in front of wall Height of ground water | ← Cantilever h _{stem} = 3200 mm l _{toe} = 1800 mm l _{base} = 2325 mm h _{wall} = 3600 mm d _{ds} = 0 mm l _{ds} = 1850 mm d _{cover} = 0 mm h _{water} = 2600 mr | 2325 1 n | Wall stem thick Length of heel Base thickness Thickness of do Unplanned exc Density of wate | ness ownstand avation depth er | $t_{wall} = 375 \text{ mm}$ $l_{heel} = 150 \text{ mm}$ $t_{base} = 400 \text{ mm}$ $t_{ds} = 400 \text{ mm}$ $d_{exc} = 200 \text{ mm}$ $\gamma_{water} = 9.81 \text{ kl}$ | ı 1 V/m ³ |
| Angle of soil surface Mobilisation factor Moist density Design shear strength Design shear strength | $\gamma_{wall} = 23.6 \text{ KIV/m}$ $\beta = 0.0 \text{ deg}$ M = 1.5 $\gamma_m = 18.0 \text{ kN/m}^3$ $\phi' = 24.2 \text{ deg}$ $\phi'_b = 24.2 \text{ deg}$ | 3 | Saturated dens Angle of wall fri Design base fri | t at back of wall ity iction ction | $\gamma_{base} = 23.6$ KN h _{eff} = 3600 mm $\gamma_s = 21.0$ kN/m $\delta = 0.0$ deg $\delta_b = 18.6$ deg | n n 1 ³ |
| woist density | γmb = Ι δ. υ KIN/M | - | Allowable bear | шg | T bearing = 125 | NN/111 |
| Using Coulomb theory Active pressure At-rest pressure | K _a = 0.419 K ₀ = 0.590 | | Passive pressu | ire | Kp = 4.187 | |



| V & R | Project | | | | Job Ref. | |
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| VINCENT & RYMILL | 14 RC | DSECROFT AV | E., LONDON. N | N3 7QB | | |
| VINCENT & RYMILL | | | | | Sneet no./rev. | 16 |
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| | | | | | | |
| RETAINING WALL DESIGN (| <u>BS 8002:1994)</u> | | | | | version 1.2.01.0 |
| Illtimate limit state load fast | ore | | | | TEDDS calculation | version 1.2.01.0 |
| Dead load factor | ∿u ⊒ – 1 4 | | Live load factor | r | va ⊢ 1 6 | |
| Earth pressure factor | γ _{1_u} = 1.4 | | | | <u>1-</u> 1 - 110 | |
| Calculate propping force | <u>1</u> _0 | | | | | |
| Propping force | Fprop = 52.6 kN/ | 'n | | | | |
| Design of usinforced concern | | | 1004) | | | |
| Design of reinforced concre | te retaining wall | toe (BS 8002:1 | <u>1994)</u> | | | |
| Material properties | f 40 N1/mm2 | | | | f 500 NI/aaa | - 2 |
| Strength of concrete | $T_{cu} = 40 \text{ N/mm}^2$ | | Strength of reir | norcement | Ty = 500 N/mn |]- |
| Base details | | | a | | | |
| winimum reinforcement | к = 0.13 % | | Cover in toe | | Ctoe = 50 mm | |
| Design of retaining wall toe | | | | | | |
| Shear at heel | V _{toe} = 129.2 kN | /m | Moment at hee | | Mtoe = 196.1 | «Nm/m |
| | | | C | ompression re | Inforcement is | not required |
| Check toe in bending | 10 | 105 | | | | |
| Reinforcement provided | | s @ 125 mm co | Area provided | | A 10 | 00 mm ² /m |
| Area required | $As_{toe_req} = 1307$ | PASS - Rei | nforcement pro | vided at the re | As_toe_prov = 10 | e is adequate |
| Check shear resistance at to | 0 | | | | | |
| Design shear stress | v _{toe} = 0.378 N/n | nm² | Allowable shea | ır stress | Vadm = 5.000 | N/mm ² |
| | | PASS | - Design shear | stress is less t | han maximum | shear stress |
| Concrete shear stress | v _{c_toe} = 0.598 N | /mm² | | | | |
| | | | Vtoe | < Vc_toe - No sh | ear reinforcen | nent required |
| Design of reinforced concre | te retaining wall | heel (BS 8002 | :1994 <u>)</u> | | | |
| Material properties | | | | | | |
| Strength of concrete | f _{cu} = 40 N/mm ² | | Strength of reir | nforcement | f _y = 500 N/mn | 1 ² |
| Base details | | | | | | |
| Minimum reinforcement | k = 0.13 % | | Cover in heel | | Cheel = 50 mm | |
| Design of retaining wall heel | | | | | | |
| Shear at heel | V _{heel} = 17.9 kN/ | m | Moment at hee | 1 | M _{heel} = 4.9 kN | m/m |
| | | | С | ompression re | inforcement is | not require |
| Check heel in bendina | | | | | | |
| Reinforcement provided | B785 mesh | | | | | |
| Area required | As_heel_req = 520 | .0 mm²/m | Area provided | | $A_{s_heel_prov} = 7$ | 85 mm²/m |
| | | PASS - Rein | forcement prov | ided at the reta | aining wall hee | el is adequate |
| Check shear resistance at he | eel | | | | | |
| Design shear stress | Vheel = 0.052 N/ | mm² | Allowable shea | ir stress | Vadm = 5.000 | N/mm² |
| | | PASS | - Design shear | stress is less t | han maximum | shear stres |
| Concrete shear stress | Vc_heel = 0.463 N | N/mm² | | | | |
| | | | Vheel | < Vc_heel - No sh | ear reinforcen | nent required |
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| | Section | | | | Sheet no./rev. | |
| | PRELIM | IINARY STRUC | TURAL CALCU | LATIONS | | 17 |
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| | | | | | | - |
| Design of reinforced concrete | e retaining wall | stem (BS 8002 | <u>::1994)</u> | | | |
| Material properties | | | | | | |
| Strength of concrete | $f_{cu} = 40 \text{ N/mm}^2$ | | Strength of reinforcement | | fy = 500 N/mn | 1 ² |
| Wall details | | | | | | |
| Minimum reinforcement | k = 0.13 % | | | | | |
| Cover in stem | C _{stem} = 75 mm | | Cover in wall | | Cwall = 50 mm | |
| Design of retaining wall stem | | | | | | |
| Shear at base of stem | V _{stem} = 17.0 kN/ | 'n | Moment at bas | e of stem | M _{stem} = 151.5 | kNm/m |
| | | Compression reinforcen | | | | |
| Check wall stem in bending | | | | | | |
| Reinforcement provided | 16 mm dia.bars | s @ 100 mm ce | entres | | | |
| Area required | As_stem_req = 125 | 8.0 mm²/m | Area provided | | As_stem_prov = 2 | 011 mm²/m |
| | | PASS - Reinf | orcement provi | ded at the retai | ning wall sten | n is adequate |
| Check shear resistance at wa | ll stem | | | | | |
| Design shear stress | vstem = 0.058 N/ | mm² | Allowable shea | r stress | Vadm = 5.000 N | N/mm² |
| | | PASS | - Design shear | stress is less tl | han maximum | shear stress |
| Concrete shear stress | Vc_stem = 0.706 | N/mm² | | | | |
| | | | Vstem < | : Vc_stem - No she | ear reinforcen | nent required |
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| VINCENT & RYMILL | PRELI | MINARY STRUC | TURAL CALC | CULATIONS | | 18 |
| FRIMLEY GREEN | Calc. by | Date | Chk'd by | Date | App'd by | Date |
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| Indicative retaining wall reinf | orcement diag | ram | | | | |
| Toe bars - 16 mm dia.@ 125 m Heel mesh - B785 - (785 mm²/r Stem bars - 16 mm dia.@ 100 | ement am centres - (16 m) mm centres - (2 | 08 mm²/m) 011 mm²/m) | | Stem reinfor | cement | |

| VI & D | Project | | | | Job Ref. | |
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| | PRELIM | INARY STRUC | TURAL CALCU | LATIONS | | 19 |
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WALL F

DL = 17.25KN/m

RETAINING WALL ANALYSIS & DESIGN (BS8002)

RETAINING WALL ANALYSIS (BS 8002:1994)



TEDDS calculation version 1.2.01.06

Wall details

| Retaining wall type | Cantilever | | |
|---------------------------------|---|----------------------------------|---|
| Height of wall stem | h _{stem} = 3200 mm | Wall stem thickness | t _{wall} = 375 mm |
| Length of toe | I _{toe} = 1800 mm | Length of heel | l _{heel} = 150 mm |
| Overall length of base | l _{base} = 2325 mm | Base thickness | t _{base} = 400 mm |
| Height of retaining wall | h _{wall} = 3600 mm | | |
| Depth of downstand | d _{ds} = 0 mm | Thickness of downstand | t _{ds} = 400 mm |
| Position of downstand | l _{ds} = 1050 mm | | |
| Depth of cover in front of wall | d _{cover} = 500 mm | Unplanned excavation depth | d _{exc} = 200 mm |
| Height of ground water | h _{water} = 0 mm | Density of water | $\gamma_{water} = 9.81 \text{ kN/m}^3$ |
| Density of wall construction | γ _{wall} = 23.6 kN/m ³ | Density of base construction | $\gamma_{\text{base}} = 23.6 \text{ kN/m}^3$ |
| Angle of soil surface | $\beta = 0.0 \text{ deg}$ | Effective height at back of wall | h _{eff} = 3600 mm |
| Mobilisation factor | M = 1.5 | | |
| Moist density | $\gamma_{m} =$ 18.0 kN/m ³ | Saturated density | $\gamma_{s} = 21.0 \text{ kN/m}^{3}$ |
| Design shear strength | φ' = 24.2 deg | Angle of wall friction | $\delta = \textbf{0.0} \text{ deg}$ |
| Design shear strength | φ' _b = 24.2 deg | Design base friction | $\delta_{\text{b}} = \textbf{18.6} \text{ deg}$ |
| Moist density | $\gamma_{mb} = $ 18.0 kN/m ³ | Allowable bearing | $P_{bearing} = 125 \text{ kN/m}^2$ |
| Using Coulomb theory | | | |
| Active pressure | Ka = 0.419 | Passive pressure | Kp = 4.187 |
| At-rest pressure | $K_0 = 0.590$ | | |



| V&R | Project | | | | Job Ref. | |
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| RETAINING WALL DESIGN (| <u>BS 8002:1994)</u> | | | | TEDDS calculation | n version 1.2.01.0 |
| Ultimate limit state load facto | ors | | | | | |
| Dead load factor | $\gamma_{f_d} = 1.4$ | | Live load factor | r | $\gamma_{f_{-}I} = 1.6$ | |
| Earth pressure factor | $\gamma_{f_e} = 1.4$ | | | | | |
| Calculate propping force | | | | | | |
| Propping force | F _{prop} = 26.6 kN/ | m | | | | |
| Design of reinforced concret | te retaining wall | toe (BS 8002:1 | <u> 994)</u> | | | |
| Material properties | | | | | | |
| Strength of concrete | f _{cu} = 40 N/mm ² | | Strength of reir | forcement | f _y = 500 N/m | m² |
| Base details | | | | | | |
| Minimum reinforcement | k = 0.13 % | | Cover in toe | | C _{toe} = 50 mm | |
| Design of retaining wall toe | | | | | | |
| Shear at heel | V _{toe} = 10.2 kN/n | n | Moment at hee | I | M _{toe} = 11.3 k | Nm/m |
| | | | С | ompression re | inforcement i | s not require |
| Check toe in bending | | | | | | |
| Reinforcement provided | 16 mm dia.bar | s @ 150 mm ce | entres | | | |
| Area required | $A_{s_toe_req} = 520.$ | 0 mm²/m | Area provided | | $A_{s_toe_prov} = 1$ | 340 mm²/m |
| | | PASS - Rei | nforcement pro | vided at the rel | taining wall to | e is adequat |
| Check shear resistance at to | e | 0 | | | | |
| Design shear stress | v _{toe} = 0.030 N/n | nm² DASS | Allowable shea | ir stress stress is loss t | Vadm = 5.000 | N/mm² S shoar stras |
| Concrete shear stress | Vc toe = 0.563 N | /mm ² | - Design shear | 311033 13 1033 1 | nan maximun | i Sileai Siles |
| | | | Vtoe | < Vc_toe - No sh | ear reinforce | ment require |
| Design of reinforced concret | e retaining wall | heel (BS 8002) | :1994) | | | |
| Material properties | | | | | | |
| Strength of concrete | f _{cu} = 40 N/mm ² | | Strenath of reir | forcement | f _v = 500 N/m | n² |
| Base details | | | 5 | | , | |
| Minimum reinforcement | k = 0.13 % | | Cover in heel | | Cheel = 50 mm | 1 |
| Design of retaining wall heel | | | | | | |
| Shear at heel | V _{heel} = 16.5 kN/ | m | Moment at hee | 1 | M _{heel} = 4.6 kl | Nm/m |
| | | | С | ompression re | inforcement i | s not require |
| Check heel in bending | | | | | | |
| Reinforcement provided | B785 mesh | | | | | |
| Area required | $A_{s_heel_req} = 520$ | .0 mm²/m | Area provided | | $A_{s_heel_prov} = 7$ | 785 mm²/m |
| | | PASS - Rein | forcement prov | ided at the reta | aining wall he | el is adequat |
| Check shear resistance at he | eel | 2 | | | | N1(2 |
| Design snear stress | Vheel = U.U48 N/I | יווחי <i>סגככ</i> | Allowable shea | ir stress stress is loss t | Vadm = 5.000 | N/MM ² |
| Concrete shear stress | Vc heel = 0.468 N | /mm ² | - Desiyii siledî | 311533 13 1888 l | nan maximun | i silear sties |
| | | | Vheel | < Vc_heel - No sh | ear reinforce | ment require |
| | | | | | - | |
| | | | | | | |
| | | | | | | |

| V&D | Project | | Job Ref. | | | | | |
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| | PRELIM | IINARY STRUC | CTURAL CALCULATIONS | | 22 | | | |
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| Design of reinforced concrete | Design of reinforced concrete retaining wall stem (BS 8002:1994) | | | | | | | |
| Material properties | - | | | | | | | |
| Strength of concrete | f _{cu} = 40 N/mm ² | | Strength of rein | forcement | f _y = 500 N/mm | 1 ² | | |
| Wall details | | | | | | | | |
| Minimum reinforcement | k = 0.13 % | | | | | | | |
| Cover in stem | C _{stem} = 75 mm | | Cover in wall | | c _{wall} = 50 mm | | | |
| Design of retaining wall stem | | | | | | | | |
| Shear at base of stem | V _{stem} = 28.3 kN/ | m | Moment at base | e of stem | $M_{stem}=\textbf{150.8}$ | kNm/m | | |
| | | | C | ompression reil | nforcement is | not required | | |
| Check wall stem in bending | | | | | | | | |
| Reinforcement provided | 16 mm dia.bars | s @ 100 mm ce | entres | | | | | |
| Area required | As_stem_req = 125 | 2.2 mm²/m | Area provided | | $A_{s_stem_prov} = 2$ | 011 mm²/m | | |
| | | PASS - Reinfe | orcement provi | ded at the retair | ning wall sten | n is adequate | | |
| Check shear resistance at wal | l stem | | | | | | | |
| Design shear stress | vstem = 0.097 N/ | mm² | Allowable shea | r stress | Vadm = 5.000 N | √mm² | | |
| | | PASS | - Design shear | stress is less th | an maximum | shear stress | | |
| Concrete shear stress | Vc_stem = 0.706 N | N/mm² | | | | | | |
| | | | Vstem < | < Vc_stem - No she | ear reinforcen | nent required | | |
| | | | | | | | | |
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| | PRELIM | INARY STRUC | TURAL CALC | ULATIONS | | 23 |
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| Indicative retaining wall rein | forcement diagr | am | | | | |
| Toe bars - 16 mm dia.@ 150 m Heel mesh - B785 - (785 mm²/ Stem bars - 16 mm dia.@ 100 | ement im centres - (134 m) mm centres - (20 | 40 mm²/m) 11 mm²/m) | | Stem reinforce | ement | |

| V & D | Project | | | | Job Ref. | |
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LIGHT WELLS

RETAINING WALL ANALYSIS & DESIGN (BS8002)

RETAINING WALL ANALYSIS (BS 8002:1994)



Wall details

| Retaining wall type | Cantilever | | |
|---------------------------------|---|----------------------------------|--|
| Height of wall stem | h _{stem} = 3200 mm | Wall stem thickness | t _{wall} = 375 mm |
| Length of toe | I _{toe} = 2300 mm | Length of heel | I _{heel} = 150 mm |
| Overall length of base | l _{base} = 2825 mm | Base thickness | t _{base} = 400 mm |
| Height of retaining wall | h _{wall} = 3600 mm | | |
| Depth of downstand | d _{ds} = 0 mm | Thickness of downstand | t _{ds} = 400 mm |
| Position of downstand | l _{ds} = 1900 mm | | |
| Depth of cover in front of wall | d _{cover} = 0 mm | Unplanned excavation depth | d _{exc} = 200 mm |
| Height of ground water | h _{water} = 2600 mm | Density of water | $\gamma_{water} = 9.81 \text{ kN/m}^3$ |
| Density of wall construction | γ _{wall} = 23.6 kN/m ³ | Density of base construction | $\gamma_{\text{base}} = 23.6 \text{ kN/m}^3$ |
| Angle of soil surface | $\beta = 0.0 \text{ deg}$ | Effective height at back of wall | h _{eff} = 3600 mm |
| Mobilisation factor | M = 1.5 | | |
| Moist density | $\gamma_{m} =$ 18.0 kN/m ³ | Saturated density | $\gamma_{s} = 21.0 \text{ kN/m}^{3}$ |
| Design shear strength | φ' = 24.2 deg | Angle of wall friction | $\delta = \textbf{0.0} \text{ deg}$ |
| Design shear strength | φ' _b = 24.2 deg | Design base friction | $\delta_b = 18.6 \text{ deg}$ |
| Moist density | γ_{mb} = 18.0 kN/m ³ | Allowable bearing | $P_{\text{bearing}} = 100 \text{ kN/m}^2$ |
| Using Coulomb theory | | | |
| Active pressure | K _a = 0.419 | Passive pressure | K _p = 4.187 |



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| | | | • | | | |
| <u>RETAINING WALL DESIGN (</u> | <u>BS 8002:1994)</u> | | | | TEDDS calculation | version 1.2.01.0 |
| Ultimate limit state load fact | ors | | | | | |
| Dead load factor | γ _{f d} = 1.4 | | Live load factor | r | γ _{f I} = 1.6 | |
| Earth pressure factor | $\gamma_{f_e} = 1.4$ | | | | | |
| Calculate propping force | | | | | | |
| Propping force | F _{prop} = 55.0 kN/ | m | | | | |
| Design of reinforced concre | te retaining wall | toe (BS 8002:1 | <u>1994)</u> | | | |
| Material properties | | | | | | |
| Strength of concrete | f _{cu} = 40 N/mm ² | | Strength of reir | nforcement | f _y = 500 N/mr | n² |
| Base details | | | | | | |
| Minimum reinforcement | k = 0.13 % | | Cover in toe | | C _{toe} = 50 mm | |
| Design of retaining wall toe | | | | | | |
| Shear at heel | V _{toe} = 68.3 kN/n | n | Moment at hee | 9 | M _{toe} = 165.4 | kNm/m |
| | | | С | ompression re | inforcement is | s not require |
| Check toe in bending | | | | | | |
| Reinforcement provided | 16 mm dia.bar | s @ 150 mm c | entres | | | |
| Area required | $A_{s_toe_req} = 1170$ |).4 mm²/m | Area provided | | $A_{s_toe_prov} = 13$ | 340 mm²/m |
| | | PASS - Rei | nforcement pro | vided at the re | taining wall to | e is adequat |
| Check shear resistance at to | e | | | | | |
| Design shear stress | v _{toe} = 0.200 N/n | | Allowable shea | ar stress | Vadm = 5.000 | N/mm² |
| Concrete shear stress | $V_{0,too} = 0.563 \text{ N}$ | /mm ² | - Design snear | stress is less t | nan maximun | i snear stres |
| | | | Vtoe | < Vc toe - No sh | near reinforcei | ment require |
| Design of reinforced concre | le retaining wall | heel /BS 8002 | -1004) | - | | |
| Meterial preparties | te retaining wan | | .1334) | | | |
| Strength of concrete | f _{ou} – 40 N/mm² | | Strength of reir | oforcement | f. – 500 N/mr | n ² |
| Base deteile | | | ottengti of fell | noroement | | |
| Minimum reinforcement | k = 0 13 % | | Cover in heel | | $C_{bool} = 50 \text{ mm}$ | 1 |
| Design of rotaining wall boo | | | | | | |
| Shear at heel | Vhool = 16 7 kN/ | m | Moment at hee | 4 | $M_{\text{bool}} = 4.6 \text{ kN}$ | lm/m |
| | | | C | ompression re | inforcement is | s not require |
| Check heel in bending | | | - | | | |
| Reinforcement provided | B785 mesh | | | | | |
| Area required | As_heel_req = 520 | .0 mm²/m | Area provided | | $A_{s_heel_prov} = 7$ | ′85 mm²/m |
| | | PASS - Rein | forcement prov | rided at the reta | aining wall hee | el is adequat |
| Check shear resistance at he | eel | | | | | |
| Design shear stress | Vheel = 0.048 N/I | mm² | Allowable shea | ar stress | Vadm = 5.000 | N/mm² |
| | | PASS | - Design shear | stress is less t | han maximun | n shear stres |
| Concrete shear stress | Vc_heel = U.468 N | n/mm∸ | Vi. · | - Vo hard - No of | near reinforce | nent require |
| | | | Vheel | < vc_neel - INU SI | icai ieiiii0iCei | nem require |
| | | | | | | |
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| | | | | | | |
| Design of reinforced concrete | e retaining wall | stem (BS 8002 | <u>:1994)</u> | | | |
| Material properties | | | | | | |
| Strength of concrete | $f_{cu}=\textbf{40}~N/mm^2$ | | Strength of reinforcement | | f _y = 500 N/mn | 1 ² |
| Wall details | | | | | | |
| Minimum reinforcement | k = 0.13 % | | | | | |
| Cover in stem | C _{stem} = 75 mm | | Cover in wall | | c _{wall} = 50 mm | |
| Design of retaining wall stem | | | | | | |
| Shear at base of stem | V _{stem} = 4.9 kN/n | า | Moment at bas | e of stem | M _{stem} = 124.3 kNm/m | |
| | | | C | ompression reil | nforcement is | not required |
| Check wall stem in bending | | | | | | |
| Beinforcement provided | 16 mm dia bar | s @ 125 mm ce | ontres | | | |
| Area required | As stom reg = 102 | 9 9 mm ² /m | Area provided | | As stom prov = 1 | 608 mm ² /m |
| | ris_stell_leq - ior | PASS - Reinfo | orcement provi | ded at the retail | ning wall ster | n is adequate |
| Ohaali ahaay yaajatayaa at wa | ll atam | | | | | |
| | | | | r atraga | . E 000 M | 1/22/22 |
| Design shear stress | Vstem = U.UI / IN/ | | Allowable shea | ir stress | Vadm = 5.000 I | |
| Concrete chear stress | V 0.656 N | PA35 · | - Design snear | stress is less th | an maximum | snear stress |
| Concrete siteal sitess | Vc_stem = 0.030 1 | N/11111 | Vatam | Ve dem - No she | ar reinforcer | nent required |
| | | | vstem < | | | ient required |
| | | | | | | |
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| | | | | | | | |
| Outer steel resisting sa | gging A _{sx_prov} = | 785 mm²/m | | | | | |
| | | - 0/ | | Area of outer | steel provide | d (sagging) Of | |
| inner steel resisting sag | Iging A _{sy_prov} = I | '1 mm²/m | 1 | han min avaa | of innovatori | | |
| | | | Less | nan min area (| of inner steel | (sagging) FAII | |
| CONCRETE SLAB DEFLECTION | ON CHECK (C | L 3.5.7) | | | | | |
| Slab span length $I_x = 3$. | 000 m | | | | | | |
| Design ultimate momer | it in shorter spa | n per m width m | _{sx} = 27 kNm/m | | | | |
| Depth to outer tension s | steel d _x = 145 m | m | | | | | |
| Tension steel | | | | | | | |
| Area of outer tension re | inforcement pro | vided $A_{sx_prov} = $ | 785 mm²/m | | | | |
| Area of tension reinforc | ement required | A _{sx_req} = 452 mn | n²/m | | | | |
| Moment Redistribution | Factor $\beta_{bx} = 1.0$ | 0 | | | | | |
| Modification Factors | | | | | | | |
| Basic span / effective depth rati | o (Table 3.9) ra | tiOspan_depth = 20 | | | | | |
| The modification factor for span | s in excess of 1 | 0m (ref. cl 3.4.6 | .4) has not beer | n included. | | | |
| $f_{s} = 2 \times f_{y} \times A_{sx_req} \ / \ (3 \times A_{sx_prov}$ | ×β _{bx}) = 192.1 Ν | N/mm² | | | | | |
| factor _{tens} = min (2 , 0.55 + (477 | ′ N/mm² - f _s) / (| 120 	imes (0.9 N/m | m² + m _{sx} / d _x ²))) | = 1.634 | | | |
| Calculate Maximum Span | | | | | | | |
| This is a simplified approach an 3.4.6.4 and 3.4.6.7. | d further attenti | on should be giv | en where speci | al circumstance | es exist. Refer | to clauses | |
| Maximum span I _{max} = r | atio _{span_depth} $	imes$ fa | $ctor_{tens} \times d_x = 4.$ | 74 m | | | | |
| Check the actual beam span | | | | | | | |
| Actual span/depth ratio | l _x / d _x = 20.69 | | | | | | |
| Span depth limit ratiospa | $n_{depth} 	imes factor_{ter}$ | ns = 32.69 | | | | | |
| | | | | Spar | /Depth ratio | check satisfie | |
| | (SACCINC) | /DC0110.DT 1 - | | | | | |
| CHECK OF NOMINAL COVER | (SAGGING) - | (DJOIIU.FII, | IADLE 3.4) | | | | |
| Stab (HICKHESS II = 200 | nnn mautar tanaian | rainfaraamant d | 145 0 mm | | | | |
| | | remorcement a | x = 145.0 mm | | | | |
| Diameter of tension rai | oforcomont D _ | 10 mm | | | | | |
| Diameter of links L | | | | | | | |
| Cover to outer tension reinforce | mont | | | | | | |
| $c_{\text{term}} = h_{\text{c}} d_{\text{term}} D_{\text{c}} / 2 = 5$ | | | | | | | |
| Nominal cover to links steel | | | | | | | |
| |) mm | | | | | | |
| $G_{nomx} = G_{tenx} - L_{diax} = 50.$ | | aroomant (Table | 2 1) | | | | |
| | cover to all reini | orcement (Table | : 3.4) | | | | |
| | | | | Coverave | r staal raaiati | na saaaina Ol | |
| | | | | Cover ove | ı sleel resisti | ng saggina Ur | |

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2 LAYERS A393 FABRIC TOP 50 COVER

2. FOR VERTICAL LOAD

DESIGN LOAD = (6.8 X 1.4) + (1.5 X 1.6) = 11.90KN/m²

BM = 11.9 X 3² / 8 = 13.4KN.m

RC SLAB DESIGN (BS8110)

RC SLAB DESIGN (BS8110:PART1:1997)

TEDDS calculation version 1.0.04

CONCRETE SLAB DESIGN (CL 3.5.3 & 4)

SIMPLE ONE WAY SPANNING SLAB DEFINITION

Overall depth of slab h = 200 mmCover to tension reinforcement resisting sagging $c_b = 50 \text{ mm}$ Trial bar diameter $D_{tryx} = 10 \text{ mm}$ Depth to tension steel (resisting sagging) $d_x = h - c_b - D_{tryx}/2 = 145 \text{ mm}$ Characteristic strength of reinforcement $f_y = 500 \text{ N/mm}^2$

Characteristic strength of concrete $f_{cu} = 35 \text{ N/mm}^2$



One-way spanning slab (simple)

ONE WAY SPANNING SLAB (CL 3.5.4)

MAXIMUM DESIGN MOMENTS IN SPAN

Design sagging moment (per m width of slab) $m_{sx} = 13.4 \text{ kNm/m}$

CONCRETE SLAB DESIGN - SAGGING - OUTER LAYER OF STEEL (CL 3.5.4)

Design sagging moment (per m width of slab) $m_{sx} = 13.4 \text{ kNm/m}$

Moment Redistribution Factor $\beta_{bx} = 1.0$

Area of reinforcement required

 $K_x = abs(m_{sx}) / (d_x^2 \times f_{cu}) = 0.018$

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| K' _x = min (0.156 , (0.4 | $02 	imes (\beta_{bx} - 0.4))$ - | · (0.18 × (β _{bx} - 0.4 | ↓) ²)) = 0.156 | ; | | |
| | | | Outer con | npression steel | not required to | resist saggin |
| <u>One-way Spanning Slab reg</u> $z_x = \min((0.95 \times d_y))$ | <u>uiring tension s</u> (d _* ×(0.5+√(0.25-ł | <u>steel only (saggi</u> {√0 9)))) = 138 m | ing) - mesh Im | | | |
| Neutral axis depth xx | = (d _x - z _x) / 0.45 = | = 16 mm | | | | |
| Area of tension steel required | | | | | | |
| $A_{ex} reg = abs(m_{ex}) / (1/2)$ | $v_{\rm ms} \times f_{\rm v} \times z_{\rm v} = 22$ | 2 4 mm²/m | | | | |
| Tension steel | 1m3 ··· · y ··· = xy == | | | | | |
| Use A393 Mesh | | | | | | |
| A _{sx_prov} = A _{sl} = 393 mr | m²/m A _{sy_prov} = A _s | _{st} = 393 mm²/m | | | | |
| $D_x = d_{sl} = 10 \text{ mm } D_y =$ | dst = 10 mm | | | | | |
| | | A | Area of tens | ion steel provide | ed sufficient to | resist saggin |
| Check min and max areas o | of steel resisting | sagging | | | | |
| Total area of concrete $A_c = h$ | = 200000 mm²/m | 1 | | | | |
| Minimum % reinforce | ment k = 0.13 % | | | | | |
| $A_{st_min} = k \times A_c = \textbf{260}$ | mm²/m | | | | | |
| $A_{st_max} = 4 \% \times A_c = 8$ | 000 mm²/m | | | | | |
| Steel defined: | | | | | | |
| Outer steel resisting s | agging A _{sx_prov} = | 393 mm²/m | | | | |
| | | | | Area of oute | r steel provide | d (sagging) O |
| Inner steel resisting s | agging $A_{sy_prov} =$ | 393 mm²/m | | | | |
| | | | | Area of inne | r steel provide | d (sagging) O |
| CONCRETE SLAB DEFLEC | TION CHECK (C | CL 3.5.7) | | | | |
| Slab span length I _x = | 3.000 m | | | | | |
| Design ultimate mome | ent in shorter spa | an per m width m | sx = 13 kNm/ | /m | | |
| Depth to outer tension | n steel d _x = 145 n | nm | | | | |
| Tension steel | | | | | | |
| Area of outer tension | reinforcement pr | ovided A _{sx_prov} = | 393 mm²/m | | | |
| Area of tension reinfo | rcement required | A _{sx_req} = 224 mr | n²/m | | | |
| Moment Redistributio | n Factor $\beta_{bx} = 1.0$ | 00 | | | | |
| Modification Factors | | | | | | |
| Basic span / effective depth ra | atio (Table 3.9) ra | atio _{span_depth} = 20 | | | | |
| The modification factor for spa | ans in excess of | 10m (ref. cl 3.4.6 | .4) has not b | been included. | | |
| $f_s = 2 \times f_y \times A_{sx_req} / (3 \times A_{sx_pro})$ | $\beta_{\text{bv}} \times \beta_{\text{bx}}$) = 189.8 | N/mm ² | | | | |
| factor _{tens} = min (2 , 0.55 + (4 | 77 N/mm² - fs)/ | (120 × (0.9 N/m | m² + m _{sx} / d | x ²))) = 2.000 | | |
| Calculate Maximum Span | | | | | | |
| This is a simplified approach a 3.4.6.4 and 3.4.6.7. | and further attent | ion should be giv | ven where sp | pecial circumstand | ces exist. Refer | to clauses |
| Maximum span I _{max} = | $ratio_{span_depth} 	imes factors for the second s$ | $actor_{tens} \times d_x = 5.$ | 80 m | | | |
| Chock the actual beam ena | , | | | | | |

| V & K | 1 10,000 | | | | | Job Ref. | |
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| Actual span/depth rati | o l _x / d _x = 20.69 | | | | | | |
| Span depth limit ratio | non donth x factor | $t_{cons} = 40.00$ | | | | | |
| opan dopin mini railos | | iens – 40.00 | | Crea | n/Donth ratio | abaak aatiafia | |
| | | | | Spai | n/Depth ratio | CHECK Satistie | |
| CHECK OF NOMINAL COVE | R (SAGGING) · | - (BS8110:PT 1, | <u>TABLE 3.4)</u> | | | | |
| Slab thickness h = 20 | 0 mm | | | | | | |
| Effective depth to bott | om outer tensio | n reinforcement c | l _x = 145.0 mr | n | | | |
| | | | | | | | |
| Diameter of tension re | einforcement D _x | = 10 mm | | | | | |
| Diameter of links Ldiax | = 0 mm | | | | | | |
| Cover to outer tension reinford | ement | | | | | | |
| c _{tenx} = h - d _x - D _x / 2 = | 50.0 mm | | | | | | |
| Nominal cover to links steel | | | | | | | |
| $C_{nomy} = C_{teny} - 1 diay = 50$ |).0 mm | | | | | | |
| Pormiccoblo minimum nomino | l covor to all roi | nforcomont (Tabl | 0 2 1) | | | | |
| | | | 6 3.4) | | | | |
| C _{min} = 50 mm | | | | | | | |
| | | | | Cover ove | er steel resisti | ing sagging Ol | |
| | | | | | | | |
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HEAVE OF OVER CONSOLIDATED CLAYS.

DUE TO THE EXCAVTION WHICH RESULTS IN OVER BURDEN RELIEF TO THE OVER CONSOLIDATED LODON CLAYS BELOW <u>PEAK</u> HEAVE PRESSURES OF APPROXIMATELY 3.6 X 20 = 72KN/m² ARE LIKELY TO OCCUR. THESE PEAK PRESSURE WILL DISSIPATE LOCALLY AT UNDER PIN POSITIONS THEN WHOLLY AS BULK EXCAVTION PROCEEDS, A LIKELY RESULTING HEAVE PRESSURE AT SLAB CONSTRUCTION WILL BE APPROXIMATELY 50% OF THE ABOVE, i.e. 36KN/m². THIS DISSIPATING FURTHER AS THE CLAY CAN HEAVE AGAINST AND INTO THE CORDEK BELOW THE 200 SLABS. BEARING PRESSURES BELOW THE BASES ARE GENERALLY HIGHER THAN THE 36KN/m² THUS RESISTING THE HEAVE FORCES.