

Verification of reinforced masonry wall

Verification No. 1

Active pressure behind the structure - partial results

| Layer No. | Thickness [m] | α [°] | ϕ_d [°] | c_d [kPa] | γ [kN/m ³] | δ_d [°] | K_a | Comment |
|-----------|---------------|--------------|--------------|-------------|-------------------------------|----------------|-------|---------|
| 1 | 0.16 | 21.59 | 30.68 | 2.11 | 18.60 | 30.68 | 0.698 | |
| 2 | 1.84 | 21.59 | 30.68 | 2.11 | 18.60 | 30.68 | 0.698 | |
| 3 | 1.90 | 21.59 | 30.68 | 2.11 | 18.60 | 30.68 | 0.698 | |
| 4 | 0.40 | 0.00 | 30.68 | 2.11 | 18.60 | 20.16 | 0.359 | |
| 5 | 0.10 | 0.00 | 25.16 | 3.52 | 19.60 | 16.49 | 0.457 | |
| 7 | 0.30 | 0.00 | 25.16 | 3.52 | 19.60 | 16.49 | 0.457 | |

Active pressure distribution behind the structure (without surcharge)

| Layer No. | Start [m] End [m] | σ_z [kPa] | σ_w [kPa] | Pressure [kPa] | Hor. comp. [kPa] | Vert. comp. [kPa] |
|-----------|----------------------|------------------|------------------|----------------|------------------|-------------------|
| 1 | -0.19 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | -0.04 | 2.89 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2 | -0.04 | 2.89 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 1.80 | 37.02 | 0.00 | 23.83 | 14.58 | 18.85 |
| 3 | 1.80 | 37.02 | 0.00 | 23.83 | 14.58 | 18.85 |
| | 3.70 | 72.36 | 0.00 | 48.50 | 29.68 | 38.36 |
| 4 | 3.70 | 72.36 | 0.00 | 23.78 | 22.33 | 8.20 |
| | 4.10 | 79.80 | 0.00 | 26.46 | 24.84 | 9.12 |
| 5 | 4.10 | 79.80 | 0.00 | 32.22 | 30.89 | 9.14 |
| | 4.20 | 81.76 | 0.00 | 33.11 | 31.75 | 9.40 |
| 6 | 4.20 | 81.76 | 0.00 | 33.11 | 31.75 | 9.40 |
| | 4.50 | 87.64 | 0.00 | 35.80 | 34.33 | 10.16 |

Forces acting on construction

| Name | F_{hor} [kN/m] | App.Pt. Z [m] | F_{vert} [kN/m] | App.Pt. X [m] | Design coefficient |
|----------------------|------------------|---------------|-------------------|---------------|--------------------|
| Weight - wall | 0.00 | -0.92 | 72.73 | 1.49 | 0.800 |
| FF resistance | -24.42 | -0.02 | 0.00 | 0.00 | 0.800 |
| Weight - earth wedge | 0.00 | -2.15 | 94.90 | 2.08 | 0.800 |
| Active pressure | 77.90 | -1.26 | 78.97 | 2.92 | 1.250 |
| Surch.1 - surface | 14.69 | -2.06 | 16.87 | 1.96 | 1.000 |
| Base anchorage | 0.00 | 0.00 | 1.26 | 1.80 | 1.000 |

Verification of complete wall

Check for overturning stability

Resisting moment $M_{res} = 568.18$ kNm/m

Overturning moment $M_{ovr} = 150.37$ kNm/m

Wall for overturning is SATISFACTORY

Check for slip

Resisting horizontal force $H_{res} = 129.60$ kN/m

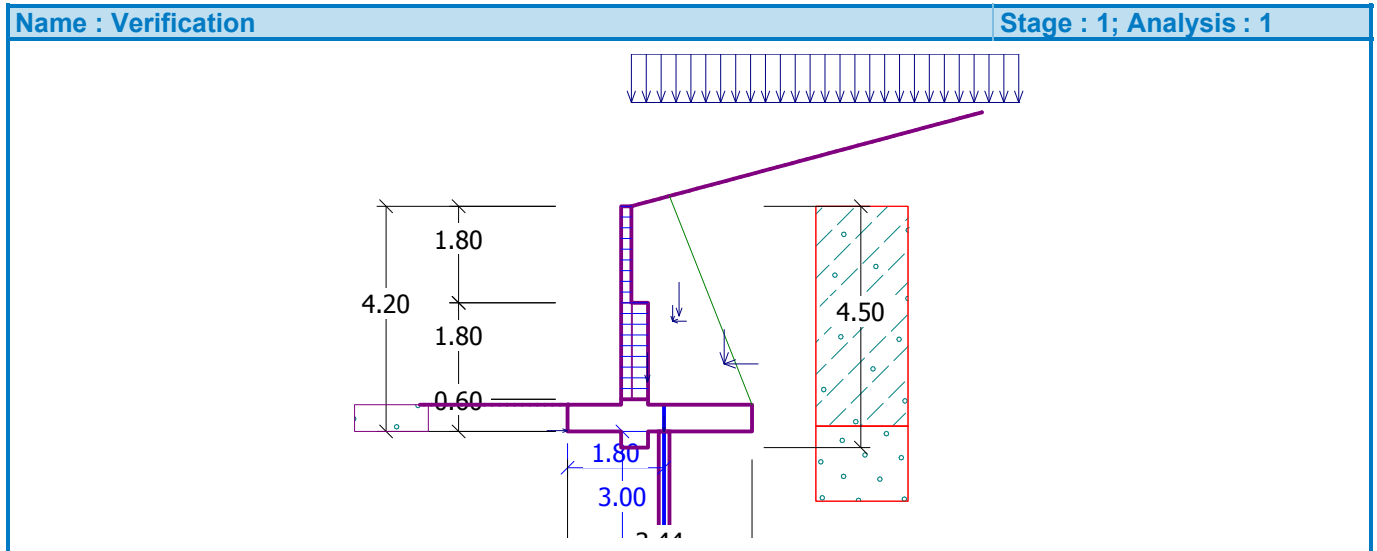
Active horizontal force $H_{act} = 92.53$ kN/m

Wall for slip is SATISFACTORY

Forces acting at the centre of footing bottom

Overall moment $M = 13.81$ kNm/m
 Normal force $N = 250.94$ kN/m
 Shear force $Q = 92.53$ kN/m

Overall check - WALL is SATISFACTORY



Bearing capacity of foundation soil

Forces acting at the centre of the footing bottom

| No. | Moment [kNm/m] | Norm. force [kN/m] | Shear Force [kN/m] | Eccentricity [m] | Stress [kPa] |
|-----|----------------|--------------------|--------------------|------------------|--------------|
| 1 | 13.81 | 250.94 | 92.53 | 0.06 | 75.36 |

Dimensioning No. 1

Active pressure behind the structure - partial results

| Layer No. | Thickness [m] | α [°] | ϕ_d [°] | c_d [kPa] | γ [kN/m ³] | δ_d [°] | K_a | Comment |
|-----------|---------------|--------------|--------------|-------------|-------------------------------|----------------|-------|---------|
| 1 | 0.16 | 21.59 | 30.68 | 2.11 | 18.60 | 30.68 | 0.698 | |
| 2 | 1.84 | 21.59 | 30.68 | 2.11 | 18.60 | 30.68 | 0.698 | |
| 3 | 1.90 | 21.59 | 30.68 | 2.11 | 18.60 | 30.68 | 0.698 | |
| 4 | 0.40 | 0.00 | 30.68 | 2.11 | 18.60 | 20.16 | 0.359 | |
| 5 | 0.10 | 0.00 | 25.16 | 3.52 | 19.60 | 16.49 | 0.457 | |
| 7 | 0.30 | 0.00 | 25.16 | 3.52 | 19.60 | 16.49 | 0.457 | |

Active pressure distribution behind the structure (without surcharge)

| Layer No. | Start [m] | End [m] | σ_z [kPa] | σ_w [kPa] | Pressure [kPa] | Hor. comp. [kPa] | Vert. comp. [kPa] |
|-----------|-----------|---------|------------------|------------------|----------------|------------------|-------------------|
| 1 | -0.19 | -0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | -0.04 | 0.00 | 2.89 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2 | -0.04 | 1.80 | 2.89 | 0.00 | 23.83 | 14.58 | 18.85 |
| | 1.80 | 3.70 | 37.02 | 0.00 | 48.50 | 29.68 | 38.36 |

| | |
|----------------|--------------|
| Company Name | Project Name |
| Project Author | Project Part |

| Layer No. | Start [m] End [m] | σ_z [kPa] | σ_w [kPa] | Pressure [kPa] | Hor. comp. [kPa] | Vert. comp. [kPa] |
|-----------|----------------------|---------------------|---------------------|-------------------|---------------------|----------------------|
| 4 | 3.70 | 72.36 | 0.00 | 23.78 | 22.33 | 8.20 |
| | 4.10 | 79.80 | 0.00 | 26.46 | 24.84 | 9.12 |
| 5 | 4.10 | 79.80 | 0.00 | 32.22 | 30.89 | 9.14 |
| | 4.20 | 81.76 | 0.00 | 33.11 | 31.75 | 9.40 |
| 6 | 4.20 | 81.76 | 0.00 | 33.11 | 31.75 | 9.40 |
| | 4.50 | 87.64 | 0.00 | 35.80 | 34.33 | 10.16 |

Forces acting on construction

| Name | F_{hor} [kN/m] | App.Pt. Z [m] | F_{vert} [kN/m] | App.Pt. X [m] | Design coefficient |
|----------------------|---------------------|------------------|----------------------|------------------|-----------------------|
| Weight - wall | 0.00 | -0.92 | 72.73 | 1.49 | 1.000 |
| FF resistance | -24.42 | -0.02 | 0.00 | 0.00 | 1.000 |
| Weight - earth wedge | 0.00 | -2.15 | 94.90 | 2.08 | 1.000 |
| Active pressure | 77.90 | -1.26 | 78.97 | 2.92 | 1.250 |
| Surch.1 - surface | 14.69 | -2.06 | 16.87 | 1.96 | 1.000 |
| Base anchorage | 0.00 | 0.00 | 1.26 | 1.80 | 1.000 |

Verification of base key

Stress at the footing bottom for wall jump dimensioning is assumed as uniform.

Reinforcement of cross section

Diameter = 10.0 mm

Number of bars = 20

Reinforcement cover = 30.0 mm

Cross-section width = 1.00 m

Cross-section depth = 0.50 m

Reinforcement ratio $\rho = 0.34 \% > 0.14 \% = \rho_{min}$

Position of neutral axis $k_u = 0.10 < 0.40$

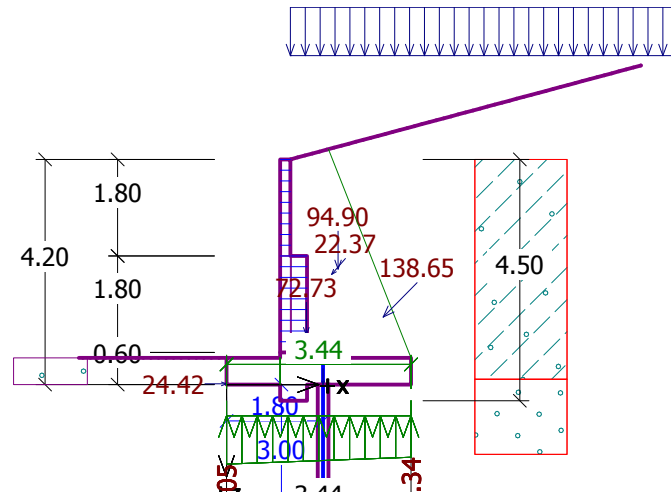
Ultimate moment $\phi M_{uo} = 277.65 \text{ kNm} > 50.69 \text{ kNm} = M_x$

Cross-section is SATISFACTORY.

Shear capacity :

Ultimate shear force $\phi V_u = 165.52 \text{ kN/m} > 93.59 \text{ kN/m} = V_x$

Cross-section is SATISFACTORY.



Dimensioning No. 2

Forces acting on construction

| Name | F_{hor} [kN/m] | App.Pt. Z [m] | F_{vert} [kN/m] | App.Pt. X [m] | Design coefficient |
|----------------------|---------------------|------------------|----------------------|------------------|-----------------------|
| Weight - wall | 0.00 | -1.40 | 28.57 | 0.21 | 1.000 |
| Weight - earth wedge | 0.00 | -2.06 | 2.26 | 0.29 | 1.250 |
| Active pressure | 36.02 | -1.16 | 20.45 | 0.42 | 1.000 |
| Surch.1 - surface | 9.29 | -1.76 | 5.86 | 0.36 | 1.000 |

Verification of the joint, 0.50 m from the top.

Back face reinforcement :

Diameter = 16.0 mm

Spacing = 400.0 mm

Cover = 57.0 mm

There is no reinforcement on the front face.

Verification of cross section in compression:

Ultimate normal force $\phi N_{uo} = 2728.01 \text{ kN/m} > 57.69 \text{ kN/m} = N$

Cross section is SATISFACTORY

Verification of cross section in bending:

Ultimate bending moment $\phi M_{uo} = 79.28 \text{ kNm/m} > 55.17 \text{ kNm/m} = M_x$

Cross section is SATISFACTORY.

Verification of cross section in shear:

Ultimate shear force $\phi V_u = 120.78 \text{ kN/m} > 45.31 \text{ kN/m} = V_x$

Cross section is SATISFACTORY.