

Gravity wall analysis

Input data (Stage of construction 1)

Settings

Slovenia - EN 1997

Materials and standards

Concrete structures : EN 1992-1-1 (EC2)

Coefficients EN 1992-1-1 : standard

Masonry (stone) wall : EN 1996-1-1 (EC6)

Wall analysis

Verification methodology : according to EN 1997

Active earth pressure calculation : Coulomb

Passive earth pressure calculation : Caquot-Kerisel

Earthquake analysis : Mononobe-Okabe

Shape of earth wedge : Calculate as skew

Allowable eccentricity : 0,333

Design approach : 2 - reduction of actions and resistances

| Partial factors on actions (A) | | | | |
|--------------------------------|--------------|--------------|------------|-----|
| Permanent design situation | | | | |
| | | Unfavourable | Favourable | |
| Permanent actions : | $\gamma_G =$ | 1,35 [-] | 1,00 | [-] |
| Variable actions : | $\gamma_Q =$ | 1,50 [-] | 0,00 | [-] |
| Water load : | $\gamma_w =$ | 1,35 [-] | | |

| Partial factors for resistances (R) | | | | |
|--|--|-----------------|------|-----|
| Permanent design situation | | | | |
| Partial factor on overturning : | | $\gamma_{Rv} =$ | 1,40 | [-] |
| Partial factor on sliding resistance : | | $\gamma_{Rh} =$ | 1,10 | [-] |
| Partial factor on bearing capacity : | | $\gamma_{Re} =$ | 1,40 | [-] |

| Partial factors for variable actions | | | | |
|--------------------------------------|--|------------|------|-----|
| Permanent design situation | | | | |
| Factor for combination value : | | $\psi_0 =$ | 0,70 | [-] |
| Factor for frequent value : | | $\psi_1 =$ | 0,50 | [-] |
| Factor for quasi-permanent value : | | $\psi_2 =$ | 0,30 | [-] |

| Partial factors on actions (A) | | | | |
|--------------------------------|--------------|--------------|------------|-----|
| Seismic design situation | | | | |
| | | Unfavourable | Favourable | |
| Permanent actions : | $\gamma_G =$ | 1,10 [-] | 1,00 | [-] |
| Variable actions : | $\gamma_Q =$ | 1,10 [-] | 0,00 | [-] |
| Water load : | $\gamma_w =$ | 1,10 [-] | | |

| Partial factors for resistances (R) | | | | |
|--|--|-----------------|------|-----|
| Seismic design situation | | | | |
| Partial factor on overturning : | | $\gamma_{Rv} =$ | 1,20 | [-] |
| Partial factor on sliding resistance : | | $\gamma_{Rh} =$ | 1,00 | [-] |
| Partial factor on bearing capacity : | | $\gamma_{Re} =$ | 1,20 | [-] |

Anchors

Verification methodology : Limit states (LSD)

| Reduction coefficients | | | |
|---|--------------|------|-----|
| Reduction. coeff of steel strength : | $\gamma_s =$ | 1,35 | [-] |
| Reduction coefficient of pull out resistance (soil) : | $\gamma_e =$ | 1,35 | [-] |
| Reduction coefficient of pull out resistance (grouting) : | $\gamma_c =$ | 1,35 | [-] |

Material of structure

Unit weight $\gamma = 25,00 \text{ kN/m}^3$

Analysis of concrete structures carried out according to the standard EN 1992-1-1 (EC2).

Concrete: C 25/30

Cylinder compressive strength

$f_{ck} = 25,00 \text{ MPa}$

Tensile strength

$f_{ctm} = 2,60 \text{ MPa}$

Longitudinal reinforcement: B500B

Yield strength

$f_{yk} = 500,00 \text{ MPa}$

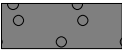



Geometry of structure

| No. | Coordinate X [m] | Depth Z [m] |
|-----|---------------------|----------------|
| 1 | 0,00 | 0,00 |
| 2 | -0,50 | 5,00 |
| 3 | -2,80 | 4,77 |
| 4 | -0,70 | 0,00 |




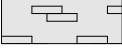
The origin [0,0] is located at the most upper right point of the wall.

Wall section area = 7,48 m².

Basic soil parameters

| No. | Name | Pattern | Φ_{ef} [°] | C_{ef} [kPa] | γ [kN/m ³] | γ_{su} [kN/m ³] | δ [°] |
|-----|--|---|--------------------|-------------------|----------------------------------|---------------------------------------|-----------------|
| 1 | Tamponsko nasutje – novo |  | 38,00 | 1,00 | 20,00 | 11,00 | 33,00 |
| 2 | Melj-glina |  | 26,00 | 4,00 | 19,00 | 10,00 | 21,00 |
| 3 | Melj-glina s prehodi v preperino trdne podlage |  | 30,00 | 10,00 | 20,00 | 11,00 | 25,00 |
| 4 | Trdna podlaga (kamnina) |  | 35,00 | 50,00 | 23,00 | 14,00 | 30,00 |

Soil parameters to compute pressure at rest

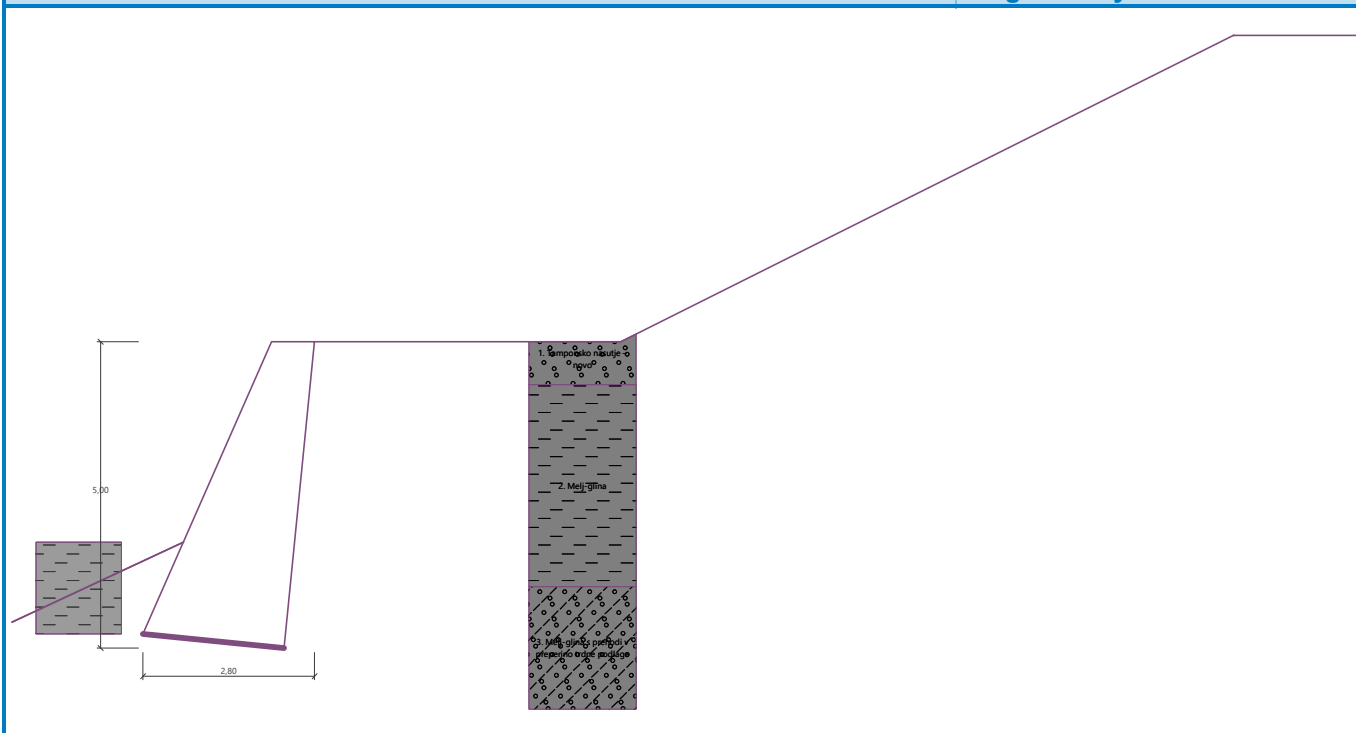
| No. | Name | Pattern | Type calculation | Φ_{ef} [°] | ν [-] | OCR [-] | K_r [-] |
|-----|--|---|---------------------|--------------------|--------------|------------|--------------|
| 1 | Tamponsko nasutje – novo |  | cohesionless | 38,00 | - | - | - |
| 2 | Melj-glina |  | cohesive | - | 0,30 | - | - |
| 3 | Melj-glina s prehodi v preperino trdne podlage |  | cohesive | - | 0,30 | - | - |
| 4 | Trdna podlaga (kamnina) |  | cohesive | - | 0,20 | - | - |

Geological profile and assigned soils

| No. | Thickness of layer t [m] | Depth z [m] | Assigned soil | Pattern |
|-----|-----------------------------|----------------|--|---------|
| 1 | 0,70 | 0,00 .. 0,70 | Tamponsko nasutje – novo | |
| 2 | 3,30 | 0,70 .. 4,00 | Melj-glina | |
| 3 | - | 4,00 .. ∞ | Melj-glina s prehodi v preperino trdne podlage | |

Name : 1

Stage - analysis : 1 - 0



Foundation

Type of foundation : soil from geological profile

Terrain profile

| No. | Coordinates x [m] | Depth z [m] |
|-----|----------------------|----------------|
| 1 | 0,00 | 0,00 |
| 2 | 5,00 | 0,00 |
| 3 | 15,00 | -5,00 |
| 4 | 16,00 | -5,00 |

Origin [0,0] is located in upper right edge of construction.
Positive coordinate +z has downward direction.

Water influence

Ground water table is located below the structure.

Resistance on front face of the structure

Resistance on front face of the structure: not considered

Soil on front face of the structure - Melj-glina

Soil thickness in front of structure $h = 1,50 \text{ m}$

Soil slope in front of structure $\beta = -25,00^\circ$

Global settings

Minimum pressure is considered as $\sigma_{a,min} = 0,20\sigma_z$

Settings of the stage of construction

Design situation : permanent

The wall is free to move. Active earth pressure is therefore assumed.

Reduction of soil/soil friction angle : do not reduce

Verification No. 1 (Stage of construction 1)

Forces acting on construction

| Name | F_{hor} [kN/m] | App.Pt. z [m] | F_{vert} [kN/m] | App.Pt. x [m] | Coeff. overtur. | Coeff. sliding | Coeff. stress |
|-----------------|---------------------|------------------|----------------------|------------------|--------------------|-------------------|------------------|
| Weight - wall | 0,00 | -1,89 | 186,92 | 1,69 | 1,000 | 1,000 | 1,350 |
| Active pressure | 51,04 | -1,45 | 12,50 | 2,46 | 1,350 | 1,350 | 1,350 |

Verification of complete wall

Check for overturning stability

Resisting moment $M_{res} = 254,64$ kNm/m

Overturning moment $M_{ovr} = 99,58$ kNm/m

Wall for overturning is **SATISFACTORY**

Check for slip

Resisting horizontal force $H_{res} = 131,05$ kN/m

Active horizontal force $H_{act} = 48,29$ kN/m

Wall for slip is **SATISFACTORY**

Overall check - WALL is **SATISFACTORY**

Maximum stress in footing bottom : 118,86 kPa

Bearing capacity of foundation soil (Stage of construction 1)

Design load acting at the center of footing bottom

| No. | Moment [kNm/m] | Norm. force [kN/m] | Shear Force [kN/m] | Eccentricity [-] | Stress [kPa] |
|-----|-------------------|-----------------------|-----------------------|---------------------|-----------------|
| 1 | -49,64 | 274,74 | 41,23 | 0,000 | 118,86 |
| 2 | -14,63 | 209,65 | 47,71 | 0,000 | 90,70 |

Service load acting at the center of footing bottom

| No. | Moment [kNm/m] | Norm. force [kN/m] | Shear Force [kN/m] |
|-----|-------------------|-----------------------|-----------------------|
| 1 | -36,77 | 203,51 | 30,54 |

Verification of foundation soil

Stress in the footing bottom : trapezoid

Eccentricity verification

Max. eccentricity of normal force $e = 0,000$

Maximum allowable eccentricity $e_{alw} = 0,333$

Eccentricity of the normal force is **SATISFACTORY**

Verification of bearing capacity

Ultimate bearing capacity of found. soil $R = 300,00$ kPa

Partial factor on bearing capacity $\gamma_{Rv} = 1,40$

Max. stress at footing bottom $\sigma = 119,45$ kPa

Allowable bearing capacity of foundation soil $R_d = 214,29$ kPa

Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Dimensioning No. 1 (Stage of construction 1)

Forces acting on construction

| Name | F_{hor} [kN/m] | App.Pt. z [m] | F_{vert} [kN/m] | App.Pt. x [m] | Coeff. moment | Coeff. norm.force | Coeff. shear for. |
|-----------------|---------------------|------------------|----------------------|------------------|------------------|----------------------|----------------------|
| Weight - wall | 0,00 | -1,96 | 180,10 | 1,69 | 1,000 | 1,000 | 1,000 |
| Active pressure | 46,66 | -1,59 | 11,40 | 2,47 | 1,350 | 1,350 | 1,350 |

Wall check at the construction joint 4,77 m from the wall crest

Cross-section depth $h = 2,32$ m

Ultimate shear force $V_{Rd} = 1566,51$ kN/m $> 62,99$ kN/m $= V_{Ed}$

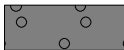


Ultimate compressive force $N_{Rd} = 28873,12$ kN/m $> 195,50$ kN/m $= N_{Ed}$

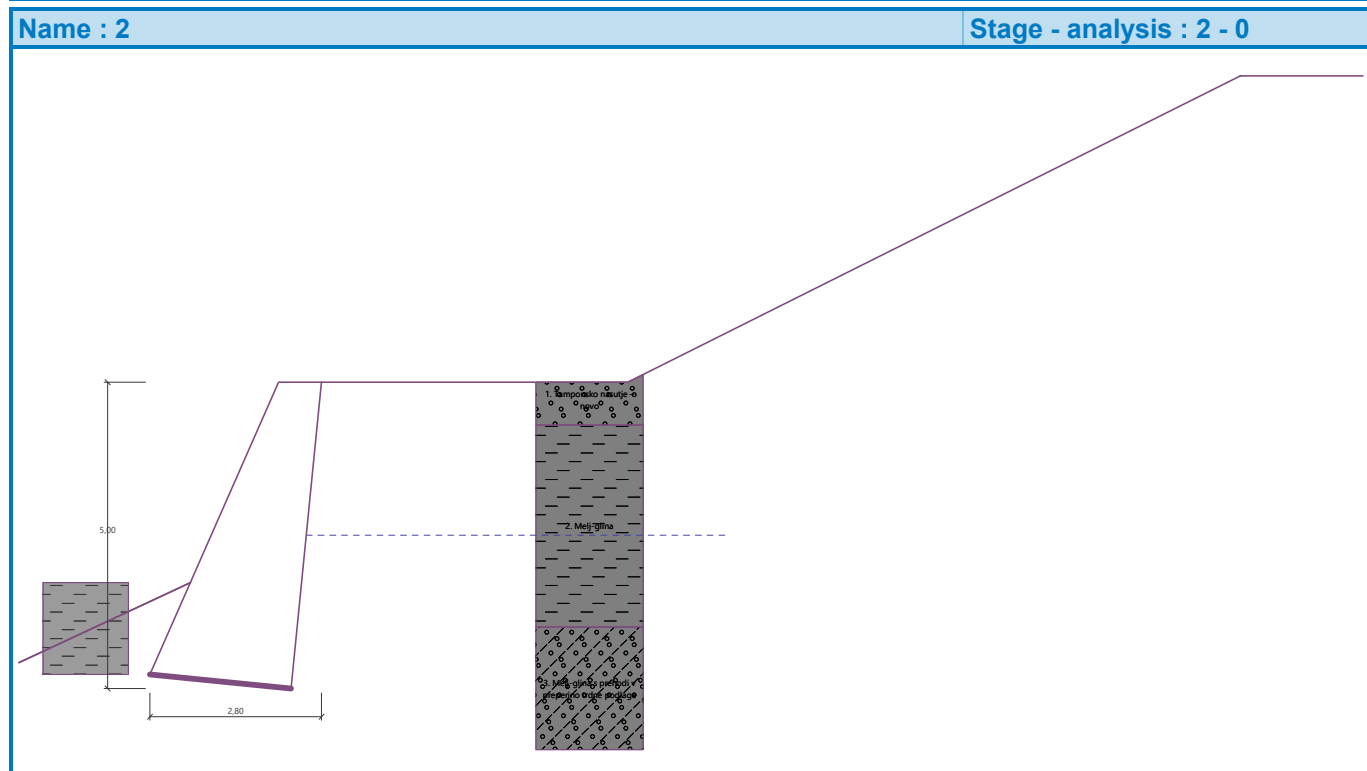
Ultimate moment $M_{Rd} = -948,04$ kNm/m $> -15,32$ kNm/m $= M_{Ed}$

Cross-section bearing capacity is SATISFACTORY

Input data (Stage of construction 2)

Geological profile and assigned soils

| No. | Thickness of layer t [m] | Depth z [m] | Assigned soil | Pattern |
|-----|-----------------------------|----------------|--|---|
| 1 | 0,70 | 0,00 .. 0,70 | Tamponsko nasutje – novo |  |
| 2 | 3,30 | 0,70 .. 4,00 | Melj-glina |  |
| 3 | - | 4,00 .. ∞ | Melj-glina s prehodi v preperino trdne podlage |  |



Foundation

Type of foundation : soil from geological profile

Terrain profile

| No. | Coordinates x [m] | Depth z [m] |
|-----|----------------------|----------------|
| 1 | 0,00 | 0,00 |
| 2 | 5,00 | 0,00 |
| 3 | 15,00 | -5,00 |
| 4 | 16,00 | -5,00 |

Origin [0,0] is located in upper right edge of construction.

Positive coordinate +z has downward direction.

Water influence

GWT behind the structure lies at a depth of 2,50 m

Uplift in foot. bottom due to different pressures is not considered.

Resistance on front face of the structure

Resistance on front face of the structure: not considered

Soil on front face of the structure - Melj-glina

Soil thickness in front of structure $h = 1,50 \text{ m}$

Soil slope in front of structure $\beta = -25,00^\circ$

Settings of the stage of construction

Design situation : permanent

The wall is free to move. Active earth pressure is therefore assumed.

Reduction of soil/soil friction angle : do not reduce

Verification No. 1 (Stage of construction 2)

Forces acting on construction

| Name | F_{hor} [kN/m] | App.Pt. z [m] | F_{vert} [kN/m] | App.Pt. x [m] | Coeff. overtur. | Coeff. sliding | Coeff. stress |
|-----------------|---------------------|------------------|----------------------|------------------|--------------------|-------------------|------------------|
| Weight - wall | 0,00 | -1,89 | 186,92 | 1,69 | 1,000 | 1,000 | 1,350 |
| Active pressure | 44,47 | -1,56 | 10,17 | 2,48 | 1,350 | 1,350 | 1,350 |
| Water pressure | 31,25 | -0,60 | -3,13 | 2,38 | 1,350 | 1,350 | 1,350 |
| Uplift pressure | 0,00 | -4,77 | 0,00 | 2,80 | 1,000 | 1,000 | 1,350 |

Verification of complete wall

Check for overturning stability

Resisting moment $M_{res} = 242,10 \text{ kNm/m}$

Overturning moment $M_{ovr} = 118,83 \text{ kNm/m}$

Wall for overturning is SATISFACTORY

Check for slip

Resisting horizontal force $H_{res} = 127,39 \text{ kN/m}$

Active horizontal force $H_{act} = 82,17 \text{ kN/m}$

Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Maximum stress in footing bottom : 117,12 kPa

Bearing capacity of foundation soil (Stage of construction 2)

Design load acting at the center of footing bottom

| No. | Moment [kNm/m] | Norm. force [kN/m] | Shear Force [kN/m] | Eccentricity [-] | Stress [kPa] |
|-----|-------------------|-----------------------|-----------------------|---------------------|-----------------|
| 1 | -17,47 | 270,73 | 74,78 | 0,000 | 117,12 |
| 2 | 17,54 | 205,63 | 81,26 | 0,037 | 96,05 |

Service load acting at the center of footing bottom

| No. | Moment [kNm/m] | Norm. force [kN/m] | Shear Force [kN/m] |
|-----|-------------------|-----------------------|-----------------------|
| 1 | -12,94 | 200,54 | 55,39 |

Verification of foundation soil

Stress in the footing bottom : trapezoid

Eccentricity verification

Max. eccentricity of normal force $e = 0,037$

Maximum allowable eccentricity $e_{alw} = 0,333$

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity

Ultimate bearing capacity of found. soil $R = 300,00 \text{ kPa}$

Partial factor on bearing capacity $\gamma_{Rv} = 1,40$

Max. stress at footing bottom $\sigma = 117,71 \text{ kPa}$

Allowable bearing capacity of foundation soil $R_d = 214,29 \text{ kPa}$

Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Dimensioning No. 1 (Stage of construction 2)

Forces acting on construction

| Name | F_{hor} [kN/m] | App.Pt. z [m] | F_{vert} [kN/m] | App.Pt. x [m] | Coeff. moment | Coeff. norm.force | Coeff. shear for. |
|-----------------|---------------------|------------------|----------------------|------------------|------------------|----------------------|----------------------|
| Weight - wall | 0,00 | -1,96 | 180,10 | 1,69 | 1,000 | 1,000 | 1,000 |
| Active pressure | 41,08 | -1,69 | 9,49 | 2,49 | 1,350 | 1,350 | 1,350 |
| Water pressure | 25,71 | -0,76 | -2,57 | 2,40 | 1,350 | 1,350 | 1,350 |
| Uplift pressure | 0,00 | -4,77 | 0,00 | 2,80 | 1,000 | 1,000 | 1,000 |

Wall check at the construction joint 4,77 m from the wall crest

Cross-section depth $h = 2,32 \text{ m}$

Ultimate shear force $V_{Rd} = 1564,57 \text{ kN/m} > 90,17 \text{ kN/m} = V_{Ed}$

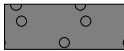

Ultimate compressive force $N_{Rd} = 28898,03 \text{ kN/m} > 189,44 \text{ kN/m} = N_{Ed}$

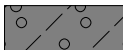
Ultimate moment $M_{Rd} = 945,70 \text{ kNm/m} > 14,66 \text{ kNm/m} = M_{Ed}$

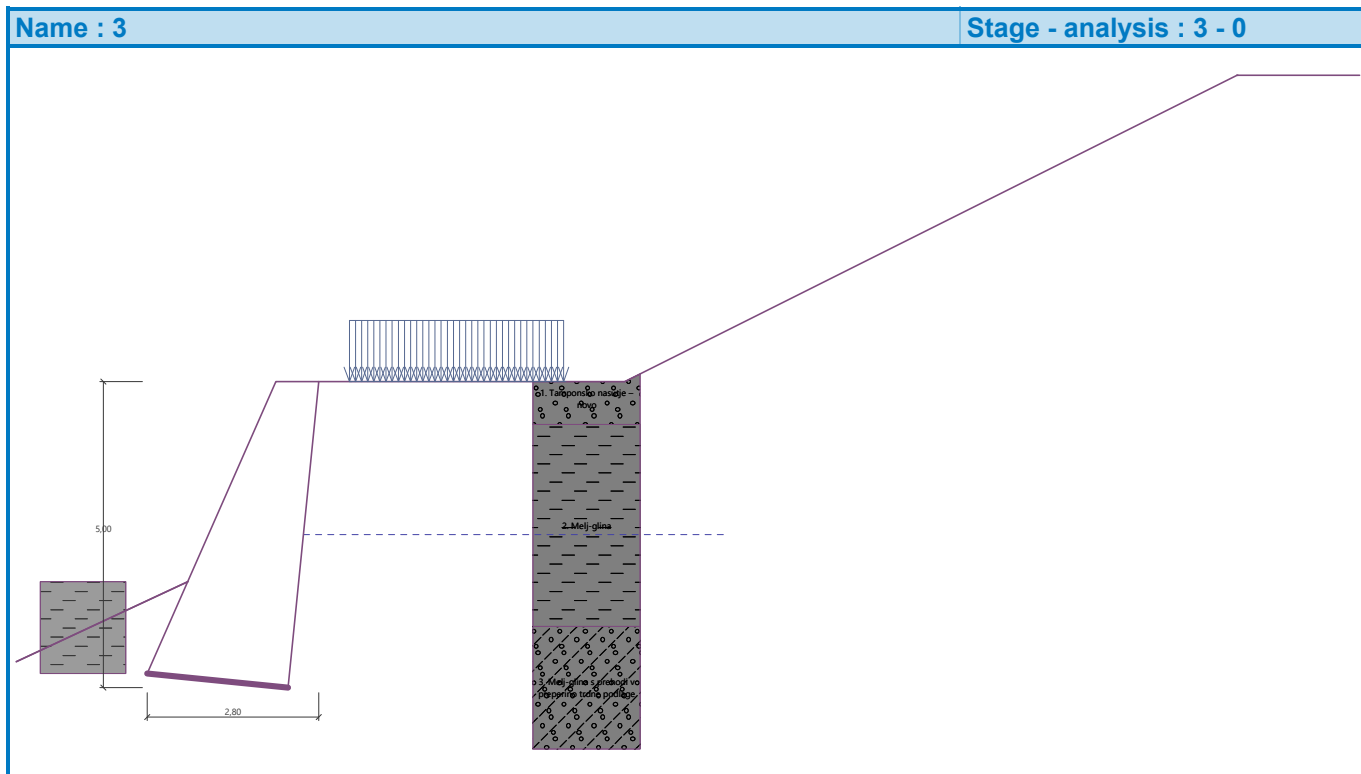
Cross-section bearing capacity is SATISFACTORY

Input data (Stage of construction 3)

Geological profile and assigned soils

| No. | Thickness of layer t [m] | Depth z [m] | Assigned soil | Pattern |
|-----|-----------------------------|----------------|--------------------------|---|
| 1 | 0,70 | 0,00 .. 0,70 | Tamponsko nasutje – novo |  |
| 2 | 3,30 | 0,70 .. 4,00 | Melj-glina |  |

| No. | Thickness of layer t [m] | Depth z [m] | Assigned soil | Pattern |
|-----|-----------------------------|----------------|--|---|
| 3 | - | 4,00 .. ∞ | Melj-glina s prehodi v preperino trdne podlage |  |



Foundation

Type of foundation : soil from geological profile

Terrain profile

| No. | Coordinates x [m] | Depth z [m] |
|-----|----------------------|----------------|
| 1 | 0,00 | 0,00 |
| 2 | 5,00 | 0,00 |
| 3 | 15,00 | -5,00 |
| 4 | 16,00 | -5,00 |

Origin [0,0] is located in upper right edge of construction.

Positive coordinate +z has downward direction.

Water influence

GWT behind the structure lies at a depth of 2,50 m

Uplift in foot. bottom due to different pressures is not considered.

Input surface surcharges

| No. | Surcharge | | Action | Mag.1 [kN/m ²] | Mag.2 [kN/m ²] | Ord.x x [m] | Length l [m] | Depth z [m] |
|-----|-----------|--------|----------|-------------------------------|-------------------------------|----------------|-----------------|----------------|
| | new | change | | | | | | |
| 1 | Yes | | variable | 14,00 | | 0,50 | 3,50 | on terrain |

| No. | Name |
|-----|------------------|
| 1 | Prometna obtežba |

Resistance on front face of the structure

Resistance on front face of the structure: not considered

Soil on front face of the structure - Melj-glina
Soil thickness in front of structure $h = 1,50 \text{ m}$
Soil slope in front of structure $\beta = -25,00^\circ$

Settings of the stage of construction

Design situation : permanent
The wall is free to move. Active earth pressure is therefore assumed.
Reduction of soil/soil friction angle : do not reduce

Verification No. 1 (Stage of construction 3)

Forces acting on construction

| Name | F_{hor} [kN/m] | App.Pt. z [m] | F_{vert} [kN/m] | App.Pt. x [m] | Coeff. overtur. | Coeff. sliding | Coeff. stress |
|------------------|----------------------------|------------------|-----------------------------|------------------|--------------------|-------------------|------------------|
| Weight - wall | 0,00 | -1,89 | 186,92 | 1,69 | 1,000 | 1,000 | 1,350 |
| Active pressure | 44,47 | -1,56 | 10,17 | 2,48 | 1,350 | 1,350 | 1,350 |
| Water pressure | 31,25 | -0,60 | -3,13 | 2,38 | 1,350 | 1,350 | 1,350 |
| Uplift pressure | 0,00 | -4,77 | 0,00 | 2,80 | 1,000 | 1,000 | 1,350 |
| Prometna obtežba | 18,82 | -2,16 | 5,61 | 2,54 | 1,500 | 1,500 | 1,500 |

Verification of complete wall

Check for overturning stability

Resisting moment $M_{\text{res}} = 257,37 \text{ kNm/m}$
Overturning moment $M_{\text{ovr}} = 179,78 \text{ kNm/m}$

Wall for overturning is **SATISFACTORY**

Check for slip

Resisting horizontal force $H_{\text{res}} = 128,94 \text{ kN/m}$
Active horizontal force $H_{\text{act}} = 109,42 \text{ kN/m}$

Wall for slip is **SATISFACTORY**

Overall check - **WALL is SATISFACTORY**

Maximum stress in footing bottom : 136,66 kPa

Bearing capacity of foundation soil (Stage of construction 3)

Design load acting at the center of footing bottom

| No. | Moment [kNm/m] | Norm. force [kN/m] | Shear Force [kN/m] | Eccentricity [-] | Stress [kPa] |
|-----|-------------------|-----------------------|-----------------------|---------------------|-----------------|
| 1 | 35,04 | 281,91 | 101,75 | 0,054 | 136,66 |
| 2 | 70,05 | 216,81 | 108,23 | 0,140 | 130,20 |

Service load acting at the center of footing bottom

| No. | Moment [kNm/m] | Norm. force [kN/m] | Shear Force [kN/m] |
|-----|-------------------|-----------------------|-----------------------|
| 1 | 22,07 | 208,00 | 73,37 |

Verification of foundation soil

Stress in the footing bottom : trapezoid

Eccentricity verification

Max. eccentricity of normal force $e = 0,140$
Maximum allowable eccentricity $e_{\text{alw}} = 0,333$

Eccentricity of the normal force is **SATISFACTORY**

Verification of bearing capacity

Ultimate bearing capacity of found. soil $R = 300,00 \text{ kPa}$
 Partial factor on bearing capacity $\gamma_{Rv} = 1,40$
 Max. stress at footing bottom $\sigma = 173,72 \text{ kPa}$
 Allowable bearing capacity of foundation soil $R_d = 214,29 \text{ kPa}$

Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Dimensioning No. 1 (Stage of construction 3)

Forces acting on construction

| Name | F_{hor} [kN/m] | App.Pt. z [m] | F_{vert} [kN/m] | App.Pt. x [m] | Coeff. moment | Coeff. norm.force | Coeff. shear for. |
|------------------|---------------------|------------------|----------------------|------------------|------------------|----------------------|----------------------|
| Weight - wall | 0,00 | -1,96 | 180,10 | 1,69 | 1,000 | 1,000 | 1,000 |
| Active pressure | 41,08 | -1,69 | 9,49 | 2,49 | 1,350 | 1,350 | 1,350 |
| Water pressure | 25,71 | -0,76 | -2,57 | 2,40 | 1,350 | 1,350 | 1,350 |
| Uplift pressure | 0,00 | -4,77 | 0,00 | 2,80 | 1,000 | 1,000 | 1,000 |
| Prometna obtežba | 18,06 | -2,25 | 5,35 | 2,55 | 1,500 | 1,500 | 1,500 |

Wall check at the construction joint 4,77 m from the wall crest

Cross-section depth $h = 2,32 \text{ m}$

Ultimate shear force $V_{Rd} = 1567,14 \text{ kN/m} > 117,25 \text{ kN/m} = V_{Ed}$

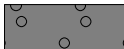


Ultimate compressive force $N_{Rd} = 22595,92 \text{ kN/m} > 197,46 \text{ kN/m} = N_{Ed}$

Ultimate moment $M_{Rd} = 948,80 \text{ kNm/m} > 61,95 \text{ kNm/m} = M_{Ed}$

Cross-section bearing capacity is SATISFACTORY

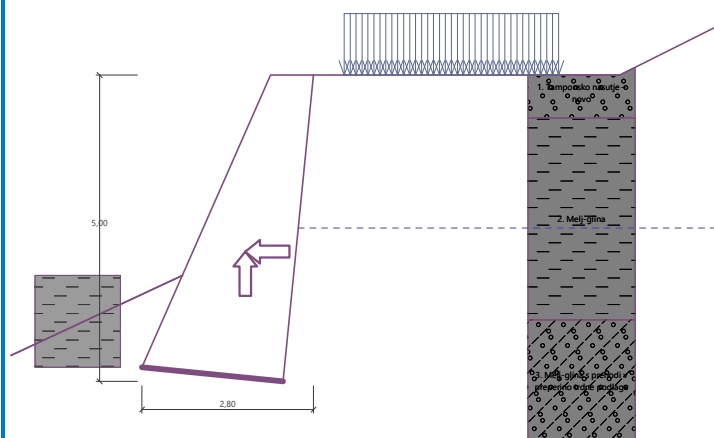
Input data (Stage of construction 4)

Geological profile and assigned soils

| No. | Thickness of layer t [m] | Depth z [m] | Assigned soil | Pattern |
|-----|-----------------------------|----------------|--|---|
| 1 | 0,70 | 0,00 .. 0,70 | Tamponsko nasutje – novo |  |
| 2 | 3,30 | 0,70 .. 4,00 | Melj-glina |  |
| 3 | - | 4,00 .. ∞ | Melj-glina s prehodi v preperino trdne podlage |  |

Name : 4

Stage - analysis : 4 - 0



Foundation

Type of foundation : soil from geological profile

Terrain profile

| No. | Coordinates x [m] | Depth z [m] |
|-----|----------------------|----------------|
| 1 | 0,00 | 0,00 |
| 2 | 5,00 | 0,00 |
| 3 | 15,00 | -5,00 |
| 4 | 16,00 | -5,00 |

Origin [0,0] is located in upper right edge of construction.

Positive coordinate +z has downward direction.

Water influence

GWT behind the structure lies at a depth of 2,50 m

Uplift in foot. bottom due to different pressures is not considered.

Input surface surcharges

| No. | Surcharge | | Action | Mag.1 [kN/m ²] | Mag.2 [kN/m ²] | Ord.x x [m] | Length l [m] | Depth z [m] |
|-----|-----------|--------|----------|-------------------------------|-------------------------------|----------------|-----------------|----------------|
| | new | change | | | | | | |
| 1 | No | No | variable | 14,00 | | 0,50 | 3,50 | on terrain |

| No. | Name |
|-----|------------------|
| 1 | Prometna obtežba |

Resistance on front face of the structure

Resistance on front face of the structure: not considered

Soil on front face of the structure - Melj-glina

Soil thickness in front of structure $h = 1,50$ m

Soil slope in front of structure $\beta = -25,00$ °

Earthquake

Factor of horizontal acceleration $K_h = 0,0200$

Factor of vertical acceleration $K_v = 0,0100$

Water below the GWT is restricted.

Settings of the stage of construction

Design situation : seismic

The wall is free to move. Active earth pressure is therefore assumed.

Reduction of soil/soil friction angle : do not reduce

Verification No. 1 (Stage of construction 4)

Forces acting on construction

| Name | F_{hor} [kN/m] | App.Pt. z [m] | F_{vert} [kN/m] | App.Pt. x [m] | Coeff. overtur. | Coeff. sliding | Coeff. stress |
|-----------------------|---------------------|------------------|----------------------|------------------|--------------------|-------------------|------------------|
| Weight - wall | 0,00 | -1,89 | 186,92 | 1,69 | 1,000 | 1,000 | 1,100 |
| Earthq.- constr. | 3,74 | -1,89 | -1,87 | 1,69 | 1,000 | 1,000 | 1,000 |
| Active pressure | 44,47 | -1,56 | 10,17 | 2,48 | 1,100 | 1,100 | 1,100 |
| Water pressure | 31,25 | -0,60 | -3,13 | 2,38 | 1,100 | 1,100 | 1,100 |
| Uplift pressure | 0,00 | -4,77 | 0,00 | 2,80 | 1,000 | 1,000 | 1,100 |
| Earthq.- act.pressure | 2,30 | -2,81 | 0,74 | 2,62 | 1,000 | 1,000 | 1,000 |
| Prometna obtežba | 18,82 | -2,16 | 5,61 | 2,54 | 0,330 | 0,330 | 0,330 |

Verification of complete wall

Check for overturning stability

Resisting moment $M_{res} = 281,67$ kNm/m

Overturning moment $M_{ovr} = 123,75$ kNm/m

Wall for overturning is **SATISFACTORY**

Check for slip

Resisting horizontal force $H_{res} = 138,75$ kN/m

Active horizontal force $H_{act} = 75,62$ kN/m

Wall for slip is **SATISFACTORY**

Overall check - WALL is **SATISFACTORY**

Maximum stress in footing bottom : 100,75 kPa

Bearing capacity of foundation soil (Stage of construction 4)

Design load acting at the center of footing bottom

| No. | Moment [kNm/m] | Norm. force [kN/m] | Shear Force [kN/m] | Eccentricity [-] | Stress [kPa] |
|-----|-------------------|-----------------------|-----------------------|---------------------|-----------------|
| 1 | 11,43 | 222,53 | 72,92 | 0,022 | 100,75 |
| 2 | 21,44 | 203,93 | 74,78 | 0,046 | 97,05 |

Service load acting at the center of footing bottom

| No. | Moment [kNm/m] | Norm. force [kN/m] | Shear Force [kN/m] |
|-----|-------------------|-----------------------|-----------------------|
| 1 | 25,68 | 205,24 | 74,04 |

Verification of foundation soil

Stress in the footing bottom : trapezoid

Eccentricity verification

Max. eccentricity of normal force $e = 0,046$

Maximum allowable eccentricity $e_{alw} = 0,333$

Eccentricity of the normal force is **SATISFACTORY**

Verification of bearing capacity

Ultimate bearing capacity of found. soil $R = 300,00 \text{ kPa}$

Partial factor on bearing capacity $\gamma_{Rv} = 1,20$

Max. stress at footing bottom $\sigma = 112,98 \text{ kPa}$

Allowable bearing capacity of foundation soil $R_d = 250,00 \text{ kPa}$

Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Dimensioning No. 1 (Stage of construction 4)

Forces acting on construction

| Name | F_{hor} [kN/m] | App.Pt. z [m] | F_{vert} [kN/m] | App.Pt. x [m] | Coeff. moment | Coeff. norm.force | Coeff. shear for. |
|-----------------------|---------------------|------------------|----------------------|------------------|------------------|----------------------|----------------------|
| Weight - wall | 0,00 | -1,96 | 180,10 | 1,69 | 1,000 | 1,000 | 1,000 |
| Earthq.- constr. | 3,60 | -1,96 | -1,80 | 1,69 | 1,000 | 1,000 | 1,000 |
| Active pressure | 41,08 | -1,69 | 9,49 | 2,49 | 1,100 | 1,100 | 1,100 |
| Water pressure | 25,71 | -0,76 | -2,57 | 2,40 | 1,100 | 1,100 | 1,100 |
| Uplift pressure | 0,00 | -4,77 | 0,00 | 2,80 | 1,000 | 1,000 | 1,000 |
| Earthq.- act.pressure | 2,07 | -2,91 | 0,67 | 2,63 | 1,000 | 1,000 | 1,000 |
| Prometna optežba | 18,06 | -2,25 | 5,35 | 2,55 | 0,330 | 0,330 | 0,330 |

Wall check at the construction joint 4,77 m from the wall crest

Cross-section depth $h = 2,32 \text{ m}$

Ultimate shear force $V_{Rd} = 1564,22 \text{ kN/m} > 85,10 \text{ kN/m} = V_{Ed}$

Ultimate compressive force $N_{Rd} = 28667,26 \text{ kN/m} > 188,35 \text{ kN/m} = N_{Ed}$

Ultimate moment $M_{Rd} = 945,27 \text{ kNm/m} > 16,21 \text{ kNm/m} = M_{Ed}$

Cross-section bearing capacity is SATISFACTORY