

ΕΛΛΗΝΙΚΗ ΔΗΜΟΚΡΑΤΙΑ
ΙΟΝΙΟ ΠΑΝΕΠΙΣΤΗΜΙΟ
ΔΙΕΥΘΥΝΣΗ ΤΕΧΝΙΚΩΝ ΥΠΗΡΕΣΙΩΝ

ΕΡΓΟ :

**ΚΤΙΡΙΟ ΤΜΗΜΑΤΟΣ ΜΟΥΣΙΚΩΝ
ΣΠΟΥΔΩΝ ΣΤΟ ΟΙΚΟΠΕΔΟ Ε.Α.Σ.Κ.**

ΘΕΣΗ ΕΡΓΟΥ :

**9η ΠΑΡΟΔΟΣ Δ.ΘΕΟΤΟΚΗ,
ΠΕΡΙΟΧΗ ΠΑΛΛΑΔΑ - Ο.Τ. 379, ΚΕΡΚΥΡΑ**

ΣΤΑΔΙΟ ΜΕΛΕΤΗΣ :

ΜΕΛΕΤΗ ΕΦΑΡΜΟΓΗΣ ΑΝΤΙΣΤΗΡΙΞΗΣ

ΠΑΡΑΡΤΗΜΑ - ΤΕΥΧΟΣ II Β

| ΑΡΧΙΤΕΚΤΟΝΙΚΗ ΜΕΛΕΤΗ | ΣΤΑΤΙΚΗ ΜΕΛΕΤΗ | ΜΕΛΕΤΗ Η/Μ ΕΓΚΑΤΑΣΤΑΣΕΩΝ | ΗΜΕΡΟΜΗΝΙΑ |
|---|---------------------------------------|---|----------------|
| Δ. ΒΑΣΙΛΟΠΟΥΛΟΣ & ΣΥΝΕΡΓΑΤΕΣ Ε.Ε. ΣΥΝΕΡΓΑΤΕΣ ΑΡΧΙΤΕΚΤΟΝΕΣ : Σ. ΚΟΛΟΒΟΥ | ΑΡΤΕΜΙΣ ΣΥΜΒΟΥΛΟΙ ΜΗΧΑΝΙΚΟΙ Ε.Π.Ε. | Η-Μ ΣΧΕΔΙΑΣΜΟΣ Κ. ΓΕΩΡΓΑΚΟΠΟΥΛΟΣ- Σ. ΤΣΑΝΤΕΣ & ΣΙΑ Ε.Ε. | ΟΚΤΩΒΡΙΟΣ 2019 |
| ΣΥΜΒΟΥΛΟΣ ΑΚΟΥΣΤΙΚΗΣ ΜΕΛΕΤΗΣ: Ι. ΜΑΡΙΝΟΣ | ΓΕΩΤΕΧΝΙΚΗ ΜΕΛΕΤΗ: Ν. ΔΕΡΕΚΑΣ | | |

ΣΦΡΑΓΙΔΕΣ ΥΠΟΓΡΑΦΕΣ

ΔΕΡΕΚΑΣ ΣΠ. ΝΙΚΟΛΑΟΣ
ΓΕΩΛΟΓΟΣ
Γ. ΠΑΠΑΝΔΡΕΟΥ 18 - ΙΩΑΝΝΙΝΑ
ΑΦΜ: 070650757 - ΔΟΥ: Β' ΙΩΑΝΝΙΝΩΝ
ΤΗΛ: 2651075650 / email: info@geotefarmogi.gr

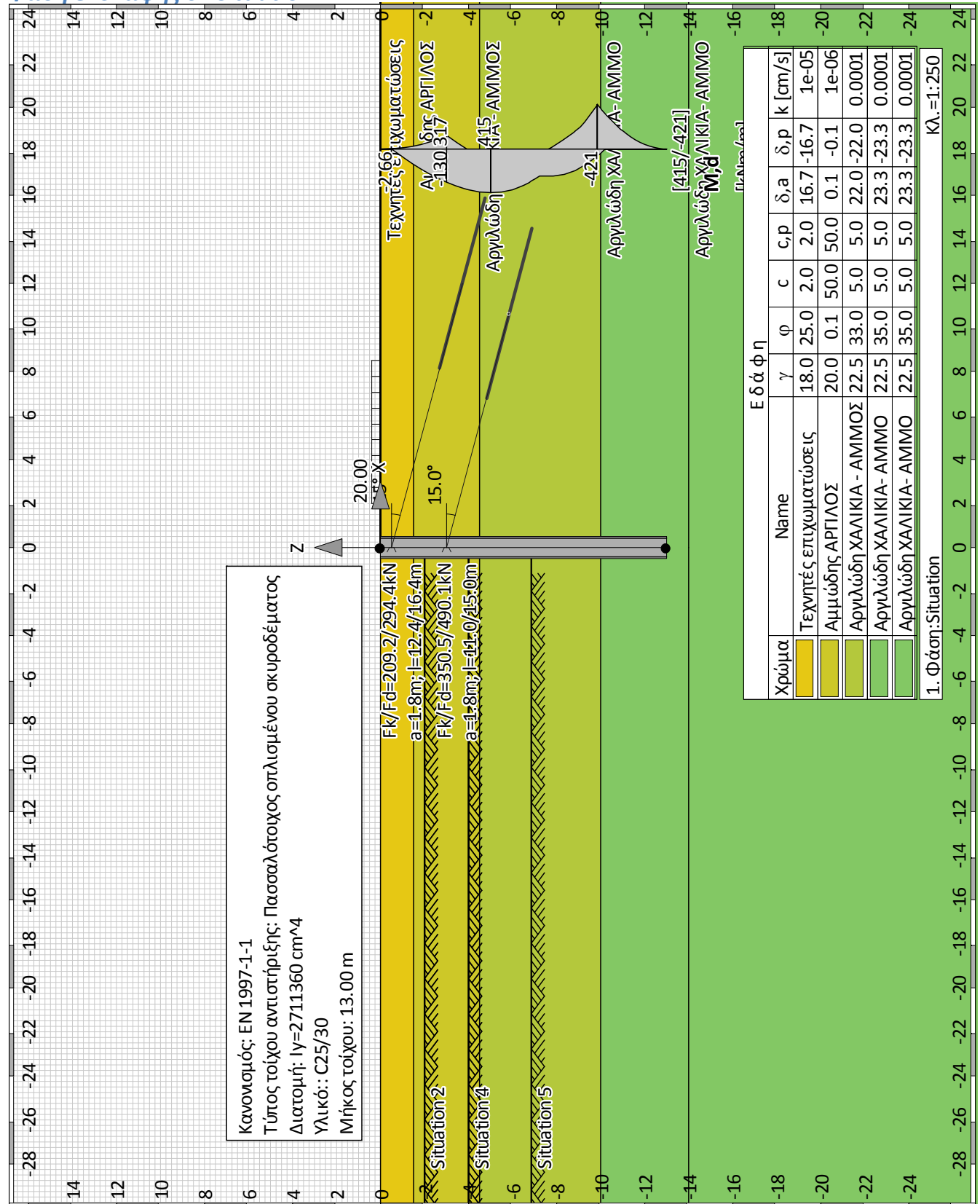
| Κεφ. | Υποκ. | Παρ. | ΠΕΡΙΕΧΟΜΕΝΑ |
|------|-------|-------|--|
| 8. | | | ΠΑΡΑΡΤΗΜΑ – ΤΕΥΧΟΣ ΙΙ Β |
| | | 8.5.3 | Έλεγχος θραύσης πυθμένα |
| | | | i) Αντιστηριζόμενο ύψος 6,10m |
| | | | ii) Αντιστηριζόμενο ύψος 7,80m |
| | | | iii) Αντιστηριζόμενο ύψος 9,70m |
| | 8.6 | | <i>Διαστασιολόγηση Φρεατοπασσάλων</i> |
| | | | i) Αντιστηριζόμενο ύψος 6,10m |
| | | | ii) Αντιστηριζόμενο ύψος 7,80m |
| | | | iii) Αντιστηριζόμενο ύψος 9,70m |
| | | | iv) Αντιστηριζόμενο ύψος 3,60m |
| | 8.7 | | <i>Διαστασιολόγηση Αγκυρίων και Δοκού Ισορροπίας</i> |
| | | | i) Αντιστηριζόμενο ύψος 6,10m |
| | | | ii) Αντιστηριζόμενο ύψος 7,80m |
| | | | iii) Αντιστηριζόμενο ύψος 9,70m |

ΠΑΡΑΡΤΗΜΑ

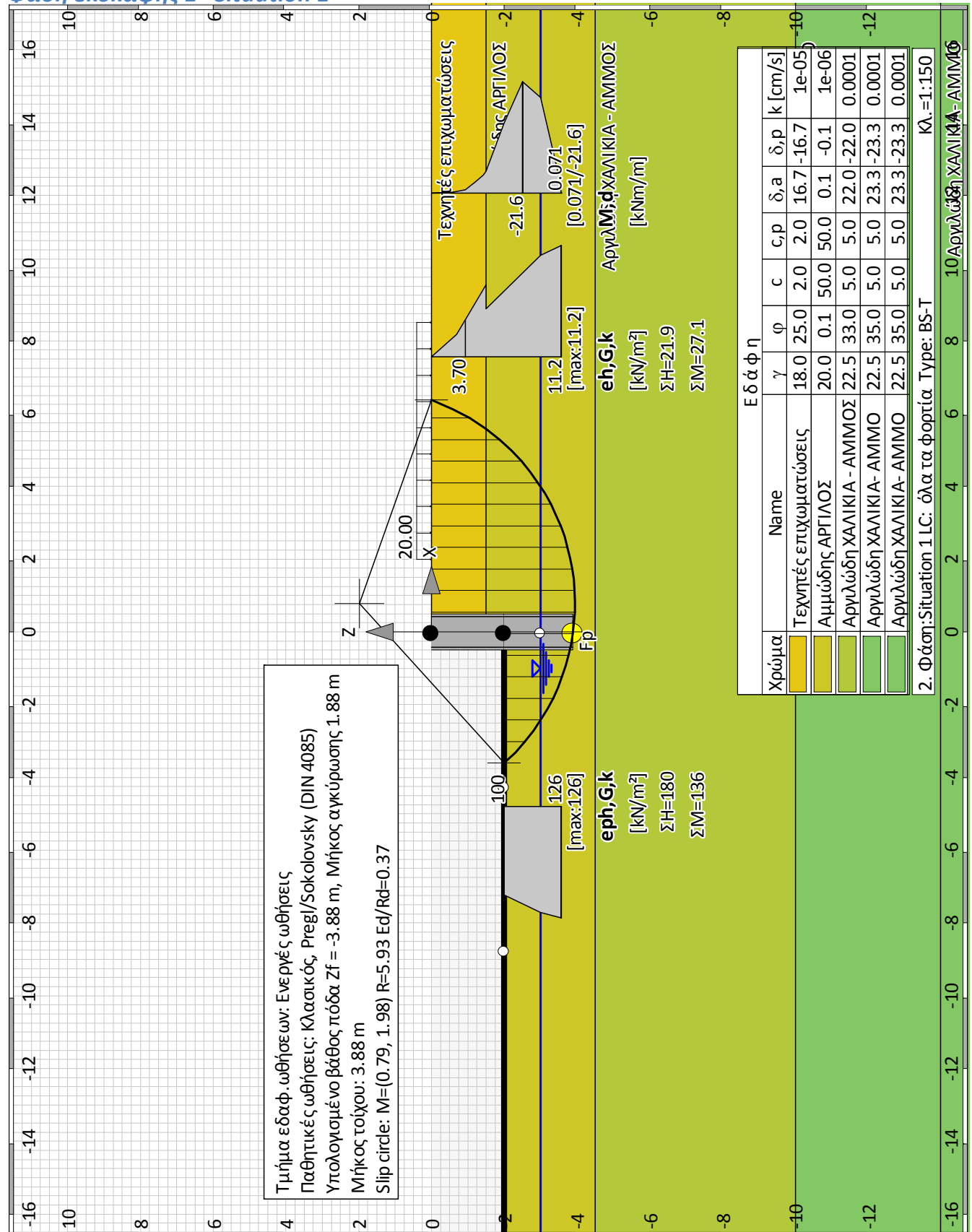
8.5 Αποτελέσματα ανάλυσης

8.5.3 Έλεγχος θραύσης πυθμένα

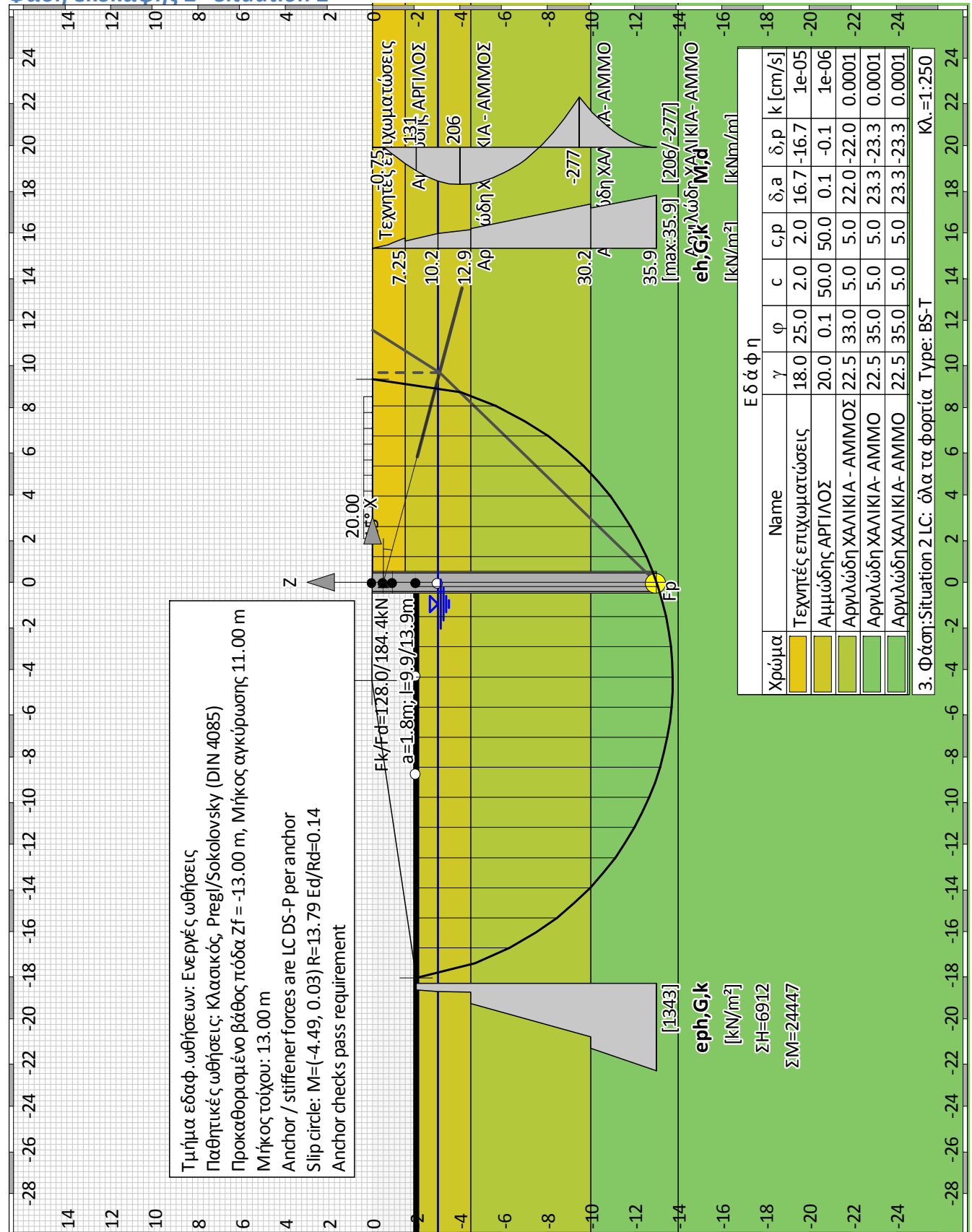
- i) Αντιστηριζόμενο ύψος 6,10m

Summary of all stages**Φάση εκσκαφής 0 "Situation"**

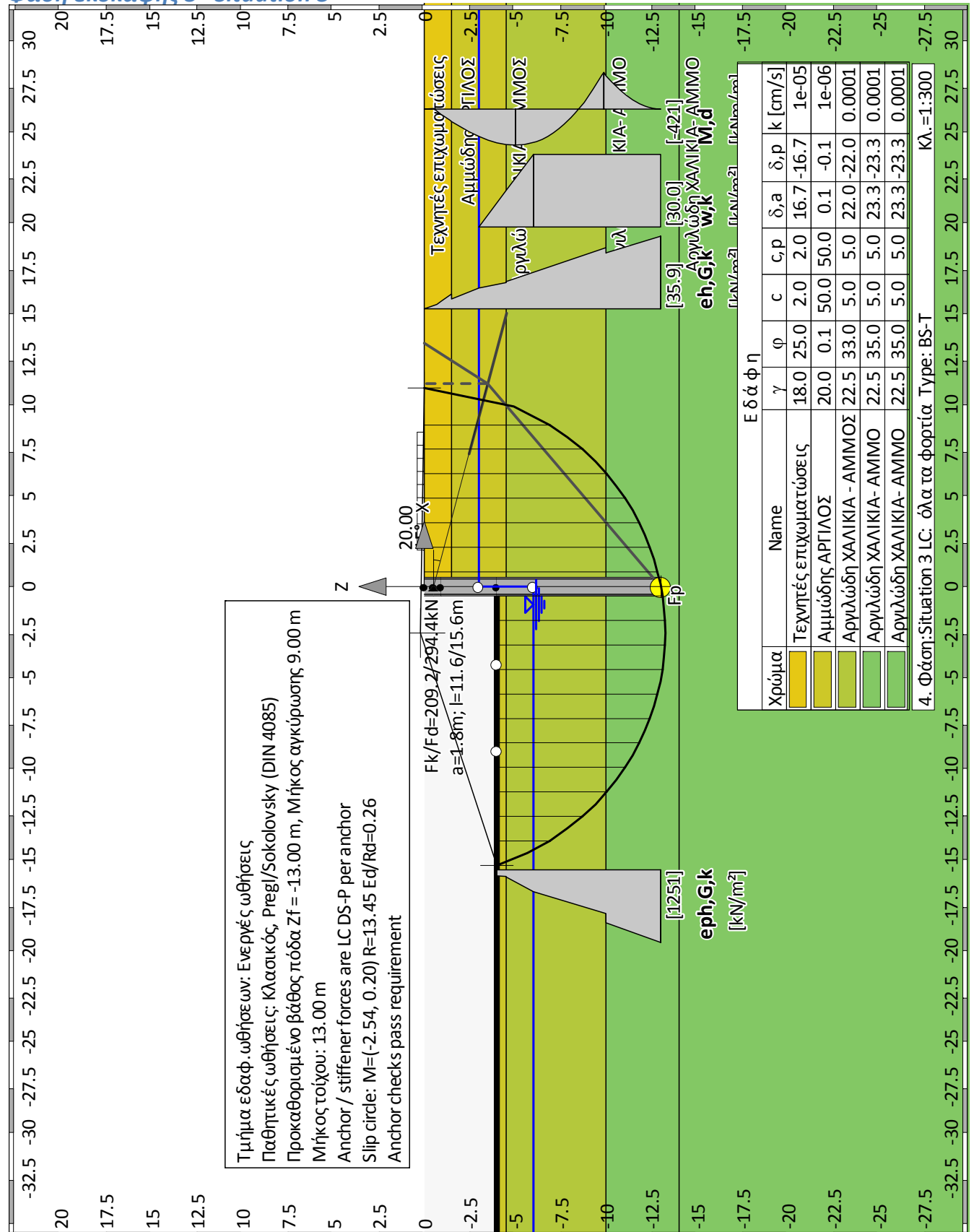
Φάση εκσκαφής 1 "Situation 1"



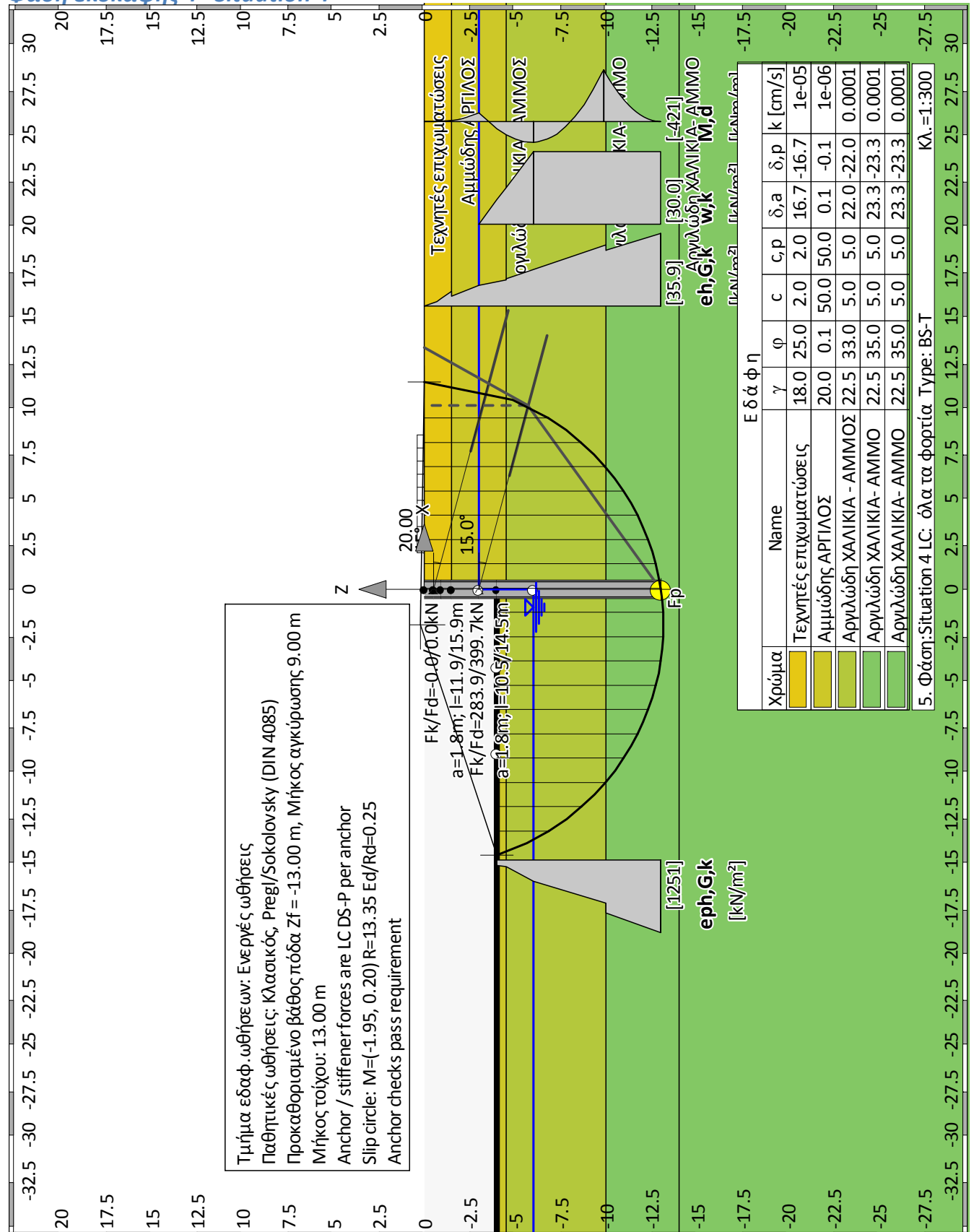
Φάση εκσκαφής 2 "Situation 2"



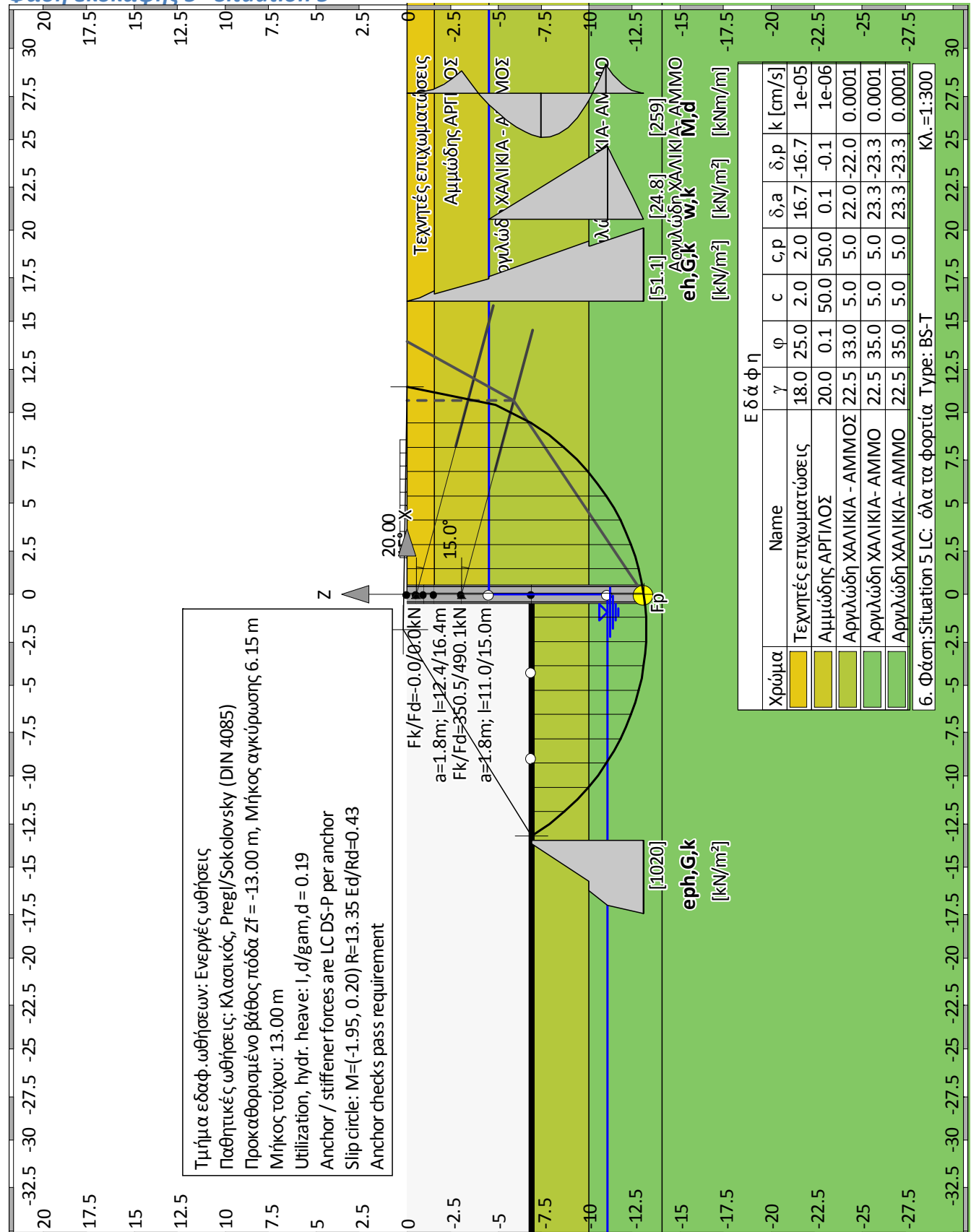
Φάση εκσκαφής 3 "Situation 3"



Φάση εκσκαφής 4 "Situation 4"



Φάση εκσκαφής 5 "Situation 5"



| | | | | | |
|------------|--|------------------|----------------------|----------|------------------|
| Author: | FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | | | | Job No.: |
| Program: | WALLS-Retain. | | Version 2017.046 | | |
| Structure: | info@fides-dvp.de | www.fides-dvp.de | Tel:++49/89/143829-0 | ASB Nr.: | Date: 08.10.2018 |

Κανονισμός για Ανάλυση και Διαστασιολόγηση

Διαστασ. ωπλισμ.σκυροδ.: EN 1992-1-1
Γεωτεχν.Κανονισμός : EN 1997 (rev.12)_user
National Annex: EN 1997-1

Safety factors:

Earth pressure onto wall: [GEO] A1 M1 R2

| γ- | G,dst | E0G | G,stb | Q,dst | Q,stb | phi | coe | cu | g |
|--------|-------|-------|-------|-------|-------|-----|-----|----|---|
| BS-P | 1.350 | 1.350 | 1 | 1.500 | 0 | 1 | 1 | 1 | 1 |
| BS-T | 1.350 | 1.350 | 1 | 1.500 | 0 | 1 | 1 | 1 | 1 |
| BS-T/A | 1.350 | 1.350 | 1 | 1.500 | 0 | 1 | 1 | 1 | 1 |
| BS-E | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 |

ΚΕ-μηχανισμός: [GEO] A2 M2 R3

| γ- | G,dst g | G,stb a,t | W a,p | Q,dst Gt | Q,stb N | phi | coe | cu |
|--------|------------|--------------|----------|-------------|------------|-------|-------|-------|
| BS-P | 1 | 1 | 1 | 1.300 | 0 | 1.250 | 1.400 | 1.400 |
| BS-T | 1 | 1 | 1 | 1.300 | 0 | 1.250 | 1.400 | 1.400 |
| BS-T/A | 1 | 1 | 1 | 1.300 | 0 | 1.250 | 1.250 | 1.400 |
| BS-E | 1 | 1 | 1 | 1 | 0 | 1.250 | 1.400 | 1.400 |
| | 1 | 1 | 1 | 1 | 1 | | | |

Θραύση εδάφους: [GEO] A1 M1 R2

| γ- | G,dst cu | E0G g | W Re | G,stb | Q,dst | Q,stb | phi | coe |
|--------|-------------|----------|---------|-------|-------|-------|-----|-----|
| BS-P | 1.350 | 1.350 | 1.350 | 1 | 1.500 | 0 | 1 | 1 |
| | 1 | 1 | 1.400 | | | | | |
| BS-T | 1.350 | 1.350 | 1.350 | 1 | 1.500 | 0 | 1 | 1 |
| | 1 | 1 | 1.400 | | | | | |
| BS-T/A | 1.350 | 1.350 | 1.350 | 1 | 1.500 | 0 | 1 | 1 |
| | 1 | 1 | 1.400 | | | | | |
| BS-E | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 |
| | 1 | 1 | 1 | | | | | |

Ολίσθηση: [GEO] A1 M1 R2

| γ- | G,dst cu | E0G g | W Rh | G,stb | Q,dst | Q,stb | phi | coe |
|--------|-------------|----------|---------|-------|-------|-------|-----|-----|
| BS-P | 1.350 | 1.350 | 1.350 | 1 | 1.500 | 0 | 1 | 1 |
| | 1 | 1 | 1.100 | | | | | |
| BS-T | 1.350 | 1.350 | 1.350 | 1 | 1.500 | 0 | 1 | 1 |
| | 1 | 1 | 1.100 | | | | | |
| BS-T/A | 1.350 | 1.350 | 1.350 | 1 | 1.500 | 0 | 1 | 1 |
| | 1 | 1 | 1.100 | | | | | |
| BS-E | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 |
| | 1 | 1 | 1 | | | | | |

Θραύση εδάφους: [GEO] A1 M1 R2

| γ- | G,dst cu | E0G g | W Rv | G,stb | Q,dst | Q,stb | phi | coe |
|--------|-------------|----------|---------|-------|-------|-------|-----|-----|
| BS-P | 1.350 | 1.350 | 1.350 | 1 | 1.500 | 0 | 1 | 1 |
| | 1 | 1 | 1.400 | | | | | |
| BS-T | 1.350 | 1.350 | 1.350 | 1 | 1.500 | 0 | 1 | 1 |
| | 1 | 1 | 1.400 | | | | | |
| BS-T/A | 1.350 | 1.350 | 1.350 | 1 | 1.500 | 0 | 1 | 1 |
| | 1 | 1 | 1.400 | | | | | |
| BS-E | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 |
| | 1 | 1 | 1 | | | | | |

| | | | |
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| Part: | Please specify project informations. | Page: 7 | Archive No.: |
| Block: | | | |
| Record: | | | |

Κύκλος ολίσθησης: [GEO] A2 M2 R3

| γ- | G,dst g | G,stb Re | Q,dst a,t | Q,stb a,p | W Gt | phi N | coe | cu |
|--------|------------|-------------|--------------|--------------|---------|----------|-------|-------|
| BS-P | 1 | 1 | 1.300 | 0 | 1 | 1.250 | 1.400 | 1.400 |
| | 1 | 1 | 1 | 1 | 1 | 1 | | |
| BS-T | 1 | 1 | 1.300 | 0 | 1 | 1.250 | 1.400 | 1.400 |
| | 1 | 1 | 1 | 1 | 1 | 1 | | |
| BS-T/A | 1 | 1 | 1.300 | 0 | 1 | 1.250 | 1.250 | 1.400 |
| | 1 | 1 | 1 | 1 | 1 | 1 | | |
| BS-E | 1 | 1 | 1 | 0 | 1 | 1.250 | 1.400 | 1.400 |
| | 1 | 1 | 1 | 1 | 1 | 1 | | |

Hydraulic heave: [HYD] A1 M1 R1

| γ- | G,dst | G,stb | Q,dst | H |
|--------|-------|-------|-------|-------|
| BS-P | 1.350 | 0.900 | 1.500 | 1.800 |
| BS-T | 1.350 | 0.900 | 1.500 | 1.600 |
| BS-T/A | 1.350 | 0.900 | 1.500 | 1.500 |
| BS-E | 1 | 1 | 1 | 1 |

Failure of structural elements: [STR] A1 M1 R1

| γ- | M | Gtf | cd | N |
|--------|-------|-------|-------|-------|
| BS-P | 1.150 | 1.400 | 1.400 | 1.150 |
| BS-T | 1.150 | 1.300 | 1.300 | 1.150 |
| BS-T/A | 1.150 | 1.250 | 1.250 | 1.150 |
| BS-E | 1 | 1 | 1 | 1 |

Stability: [EQU] A1 M1 R1

| γ- | G,dst | G,stb | Q,dst | Q,stb | phi | coe | cu | g |
|--------|-------|-------|-------|-------|-------|-------|-------|---|
| BS-P | 1 | 0.900 | 1.500 | 0 | 1.250 | 1.250 | 1.400 | 1 |
| BS-T | 1 | 0.900 | 1.500 | 0 | 1.250 | 1.250 | 1.400 | 1 |
| BS-T/A | 1 | 0.900 | 1.500 | 0 | 1.250 | 1.250 | 1.400 | 1 |
| BS-E | 1 | 1 | 1 | 0 | 1.250 | 1.400 | 1.400 | 1 |

γ,Re,red (EAB EB14-3): Να, η=0.80

γ,Re,red (EAB EB22-6): Να, E0h > 0%: η = 0.60 / 0.80

System values**Τοίχος**

Τύπος τοίχου αντιστήριξης: Πασσαλότοιχος οπλισμένου σκυροδέματος

Διατομή: Iy=2711360 cm⁴

Υλικό: C25/30

Ίδιο βάρος: 25.000 [kN/m³]**Σημεία τοίχου**

| z | d | E | Iy | E*Iy | A |
|--------|-------|----------------------|----------------------|---------------------|----------------------|
| [m] | [m] | [MN/m ²] | [cm ⁴ /m] | [MNm ²] | [cm ² /m] |
| 0.00 | 100.0 | 31500.0 | 2711360 | 854.1 | 8400 |
| -13.00 | 100.0 | 31500.0 | 2711360 | 854.1 | 8400 |

| | | | | |
|------------|--|------------------|-------------------------------|------------------|
| Author: | FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | | | Job No.: |
| Program: | WALLS-Retain. Version 2017.046 | | | |
| Structure: | info@fides-dvp.de | www.fides-dvp.de | Tel:++49/89/143829-0 ASB Nr.: | Date: 08.10.2018 |

Φάση εκσκαφής 1 "[1] Situation 1"

LC: όλα τα φορτία Type: BS-T

Εδαφικό σύστημα με 5 Στρώσεις

| Name | Τεχνητές επιχωματώσεις | Αμμόδης ΑΡΓΙΛΟΣ | Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ | |
|-------------|------------------------|-----------------|--------------------------|-----------|
| γ | [kN/m3] | 18 | 20 | 22.5 |
| γ,R | [kN/m3] | 18 | 20 | 22.5 |
| γ' | [kN/m3] | 8 | 10 | 12.5 |
| γ,p | [kN/m3] | 18 | 20 | 22.5 |
| γ,R,passive | [kN/m3] | 18 | 20 | 22.5 |
| γ,pw | [kN/m3] | 8 | 10 | 12.5 |
| φ | [°] | 25 | 0.1 | 33 |
| c | [kN/m2] | 2 | 50 | 5 |
| c,u | [kN/m2] | 10 | 50 | 5 |
| c παθητικό | [kN/m2] | 2 | 50 | 5 |
| δ,a | [°] | 16.66667 | 0.06666667 | 22 |
| δ,p | [°] | -16.66667 | -0.06666667 | -22 |
| δ,c | [°] | 8.333333 | 0.03333333 | 11 |
| k,agh | [-] | 0.3456501 | 0.9955057 | 0.2452023 |
| K,ach | [-] | 1.043051 | 1.994195 | 0.8549058 |
| K,0h | [-] | 0.5773817 | 0.9982547 | 0.455361 |
| K,pgh | [-] | 3.908103 | 1.004519 | 7.495617 |
| K,pch | [-] | 5.180327 | 2.00583 | 8.599509 |
| τ,gr | [kN/m2] | 110 | 110 | 110 |
| Ψ,A,max | [°] | 90 | 90 | 90 |
| k | [cm/s] | 10e-06 | 1e-06 | 100e-06 |

| Name | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ |
|-------------|------------------------|------------------------|
| γ | [kN/m3] 22.5 | 22.5 |
| γ,R | [kN/m3] 22.5 | 22.5 |
| γ' | [kN/m3] 12.5 | 12.5 |
| γ,p | [kN/m3] 22.5 | 22.5 |
| γ,R,passive | [kN/m3] 22.5 | 22.5 |
| γ,pw | [kN/m3] 12.5 | 12.5 |
| φ | [°] 35 | 35 |
| c | [kN/m2] 5 | 5 |
| c,u | [kN/m2] 5 | 5 |
| c παθητικό | [kN/m2] 5 | 5 |
| δ,a | [°] 23.33333 | 23.33333 |
| δ,p | [°] -23.33333 | -23.33333 |
| δ,c | [°] 11.66667 | 11.66667 |
| k,agh | [-] 0.2244207 | 0.2244207 |
| K,ach | [-] 0.8126539 | 0.8126539 |
| K,0h | [-] 0.4264236 | 0.4264236 |
| K,pgh | [-] 9.146943 | 9.146943 |
| K,pch | [-] 10.104 | 10.104 |
| τ,gr | [kN/m2] 110 | 110 |
| Ψ,A,max | [°] 90 | 90 |
| k | [cm/s] 100e-06 | 100e-06 |

Πορεία πρανούς:

x [m] 0.00 0.00
z [m] -2.00 0.00

Πορεία ανώτερου 2. στρώματος Αμμόδης ΑΡΓΙΛΟΣ:

x [m] 0.00 0.00
z [m] -2.00 -1.50

Πορεία ανώτερου 3. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ:

z= -4.50

Πορεία ανώτερου 4. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟΣ:

z= -10.00

| | | | |
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| Part: | Please specify project informations. | Page: 9 | Archive No.: |
| Block: | | | |
| Record: | | | |

| | | |
|--|------------------|-------------------------------|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | | Job No.: |
| Program: WALLS-Retain. Version 2017.046 | | |
| Structure: info@fides-dvp.de | www.fides-dvp.de | Tel:++49/89/143829-0 ASB Nr.: |
| | | Date: 08.10.2018 |

Πορεία ανώτερου 5. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ:
z= -14.00

Επιφ. φορτία:

Φορτία

| | | | | | | | | | |
|------|------|------|------|------|-------|------|-------|-----|----------------|
| xA | zA | xE | zE | PxA | PzA | PxE | PzE | Typ | LC-description |
| [m] | [m] | [m] | [m] | [| kN/m² | |] | | Name |
| 2.00 | 0.00 | 8.50 | 0.00 | 0.00 | 20.00 | 0.00 | 20.00 | q | 1 |

Κατανομή εδαφ.πιέσεων

| | |
|----------------------------|------|
| Κατανομή εδαφ.πιέσεων | Name |
| Rectangular within a layer | |

Στάθμη νερού:

x [m] 0.00
z [m] -3.00

Παράμετροι υπολογισμού

Earth pressure options

Τμήμα εδαφ.ωθήσεων: Ενεργές ωθήσεις.
Angle of slip plane: DIN 4085.
Split block loads into 1 sections.
Consideration of minimum earth pressure: φ,min = 40.000.
Negative earth pressure fractions are set to zero.

Redistribution of earth pressure

Shape of redistribution: No redistribution of earth pressure.
The earth pressure is getting redistrib. to: Excavation level
The earth pressure below the excavation acts without redistrib.
The earth pressure from variable loads will be included in redistribution.

Παθητικές ωθήσεις

Method of calculation: Κλασικός, Pregl/Sokolovsky (DIN 4085).

Options for water pressure

Στήριξη πόδα

Πακτωμένη στήριξη κατά Blum

Earth pressure coefficients kh

| | | | | | | | | | |
|------|-----|-----|-------|------|-------|-------|-------|---------|--------------------------|
| φ | α | β | δ | k0gh | kagh | kach | kpgh | kpch | |
| 0.1 | 0.0 | 0.0 | -0.1 | -- | -- | -- | 1.005 | -2.006 | Τεχνητές επιχωματώσεις |
| 25.0 | 0.0 | 0.0 | 16.7 | -- | 0.346 | 1.043 | -- | -- | " |
| 0.1 | 0.0 | 0.0 | -0.1 | -- | -- | -- | 1.005 | -2.006 | Αμμώδης ΑΡΓΙΛΟΣ |
| 0.1 | 0.0 | 0.0 | 0.1 | -- | 0.996 | 1.994 | -- | -- | " |
| 33.0 | 0.0 | 0.0 | -22.0 | -- | -- | -- | 7.496 | -8.600 | Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ |
| 33.0 | 0.0 | 0.0 | 22.0 | -- | 0.245 | 0.855 | -- | -- | " |
| 35.0 | 0.0 | 0.0 | -23.3 | -- | -- | -- | 9.147 | -10.104 | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ |
| 35.0 | 0.0 | 0.0 | 23.3 | -- | 0.224 | 0.813 | -- | -- | " |
| 35.0 | 0.0 | 0.0 | -23.3 | -- | -- | -- | 9.147 | -10.104 | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ |
| 35.0 | 0.0 | 0.0 | 23.3 | -- | 0.224 | 0.813 | -- | -- | " |

Μήκος τοίχου

N: 1 Z: -3.000 M,Στήριξη πόδα,d: 18.43. Wall too short? Ναι
N: 2 Z: -6.000 M,Στήριξη πόδα,d: -467.02. Wall too short? Όχι
N: 3 Z: -3.990 M,Στήριξη πόδα,d: -24.59. Wall too short? Όχι
N: 4 Z: -3.327 M,Στήριξη πόδα,d: 9.81. Wall too short? Ναι
N: 5 Z: -3.771 M,Στήριξη πόδα,d: -10.67. Wall too short? Όχι
N: 6 Z: -3.473 M,Στήριξη πόδα,d: 4.18. Wall too short? Ναι
N: 7 Z: -3.673 M,Στήριξη πόδα,d: -5.26. Wall too short? Όχι
N: 8 Z: -3.539 M,Στήριξη πόδα,d: 1.30. Wall too short? Ναι
N: 9 Z: -3.629 M,Στήριξη πόδα,d: -2.99. Wall too short? Όχι
N: 10 Z: -3.569 M,Στήριξη πόδα,d: -0.07. Wall too short? Όχι
Foot depth for statics: zf = -3.569

| | | |
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| Part: | | Archive No.: |
| Block: | Please specify project informations. | Page: 10 |
| Record: | | |

Stress analysis**Earth pressure, horizontal**

Pressures characteristic, no redistribution, continuous wall

0.00-0.69

2.23

-1.50

7.25

5.76

-2.00

-100.3

15.2

-3.00

-120.4

10.2

-3.57

-126.1

11.2

15.2

z

eph,G+PG,k

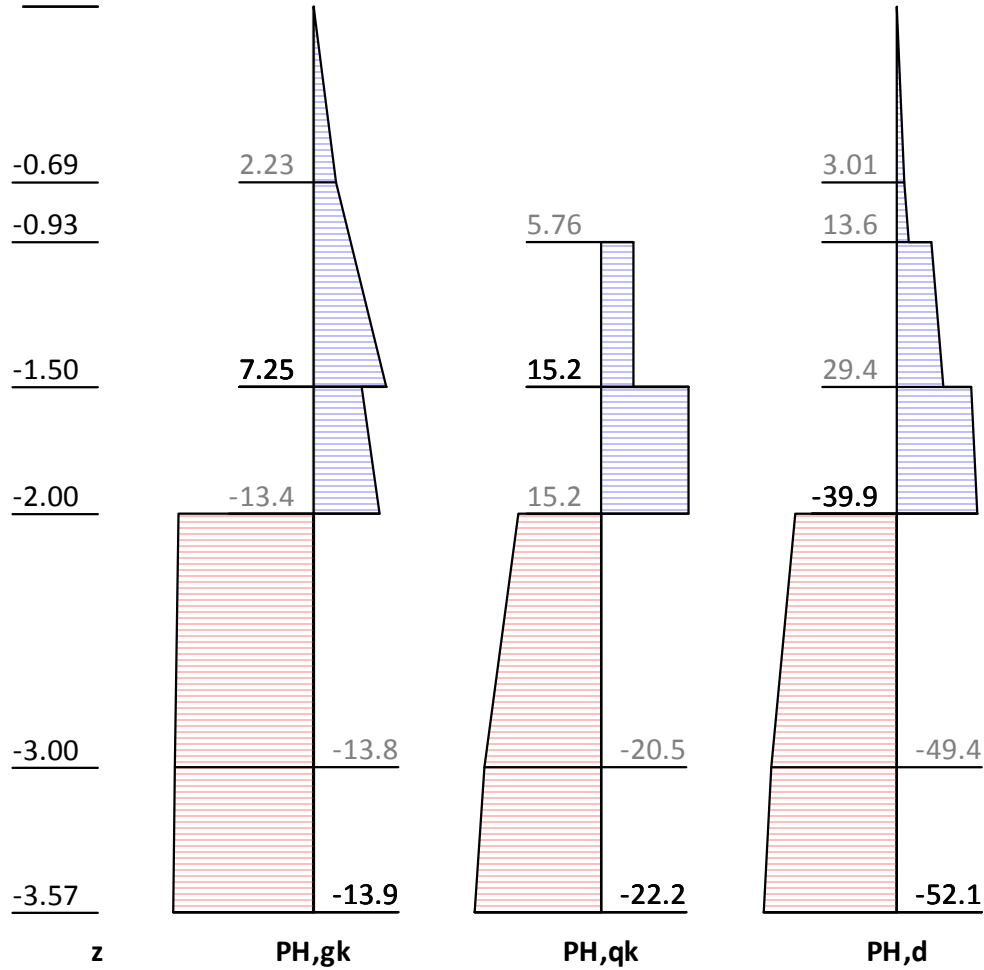
eah,G,k

eah,PQ,k

| z [m] | eph,G,k [kN/m2] | eah,G,k [kN/m2] | eah,PQ,k [kN/m2] | eah,d [kN/m2] |
|----------|--------------------|--------------------|---------------------|------------------|
| 0.00 | | 0.00 | | 0.00 |
| -0.93 | | 3.72 | 0.00 | 5.00 |
| -0.93 | | 3.72 | 5.76 | 13.64 |
| -1.50 | | 7.25 | 5.76 | 18.43 |
| -1.50 | | 4.82 | 15.23 | 29.36 |
| -2.00 | -0.00 | 6.61 | 15.23 | 31.77 |
| -2.00 | -100.29 | 6.61 | 15.23 | 31.77 |
| -3.57 | -126.10 | 11.20 | 15.23 | 37.96 |

Eph,G,k: -180.43, Eph,PG,k: 0.00 [kN/m]

Eah,G,k: 21.92, Eah,PG,k: 0.00, Eah,PQ,k: 34.80, Eah,d: 81.80

H-pressure on static systemLevel of mobilization: $E_{p,gk}$ 19.9, $E_{p,qk}$ 29.6, $E_{p,d}$ 100.0 [%]0.00

| z [m] | PH,gk [kN/m ²] | PH,qk [kN/m ²] | PH,d [kN/m ²] |
|----------|-------------------------------|-------------------------------|------------------------------|
| 0.00 | 0.00 | | 0.00 |
| -0.93 | 3.72 | 0.00 | 5.00 |
| -0.93 | 3.72 | 5.76 | 13.64 |
| -1.50 | 7.25 | 5.76 | 18.43 |
| -1.50 | 4.82 | 15.23 | 29.36 |
| -2.00 | 6.61 | 15.23 | 31.77 |
| -2.00 | -13.38 | -14.50 | -39.87 |
| -3.57 | -13.93 | -22.15 | -52.10 |

V-pressure on static system**Internal forces: Permanent, characteristically**0.00-0.0307-0.50-0.0672-0.402-0.0244-0.69-0.179-0.774-0.0219-1.19-0.975-2.67-0.0157-1.50-2.07-4.59-0.012-2.00-5.05-7.45-0.00648-2.50-7.09-0.708-0.00246-3.00-5.736.14-432.8e-06-3.5714**z****M,gk****V,gk****u,gk**

| z [m] | H,g,k [kN/m2] | M,g,k [kN/m2] | V,g,k [kN/m2] | N,g,k [kN/m2] | u,g,k [mm] |
|----------|------------------|------------------|------------------|------------------|---------------|
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -0.03 |
| -1.50 | 7.25 | -2.07 | -4.59 | -33.13 | -0.01 |
| -1.50 | 4.82 | -2.07 | -4.59 | -33.13 | -0.01 |
| -2.00 | 6.61 | -5.05 | -7.45 | -43.63 | -0.01 |
| -2.00 | -13.38 | -5.05 | -7.45 | -43.63 | -0.01 |
| -2.50 | -13.60 | -7.09 | -0.71 | -54.12 | -0.00 |
| -2.55 | -13.62 | -6.95 | -0.00 | -55.21 | -0.00 |
| -3.57 | -13.93 | 0.00 | 14.03 | -71.77 | -0.00 |
| -3.57 | -13.93 | 0.00 | 14.03 | -71.77 | 0.00 |

Internal forces: Variable, characteristicallyMethod EB 82-4 ($Q = [G+Q] - G$).

0.00

-0.50

-0.69

-0.93

-1.19

-1.43

-2.00

-2.50

-3.00

-3.57

z

M,qk

0.118

-0.544

-0.668

-4.48

-8

-7.14

0.194

-1.71

-2.83

-10.9

-2.91

6.58

V,qk

18.7

-0.0332

-0.0268

-0.0243

-0.0212

-0.0179

-0.0148

-0.00784

-0.00308

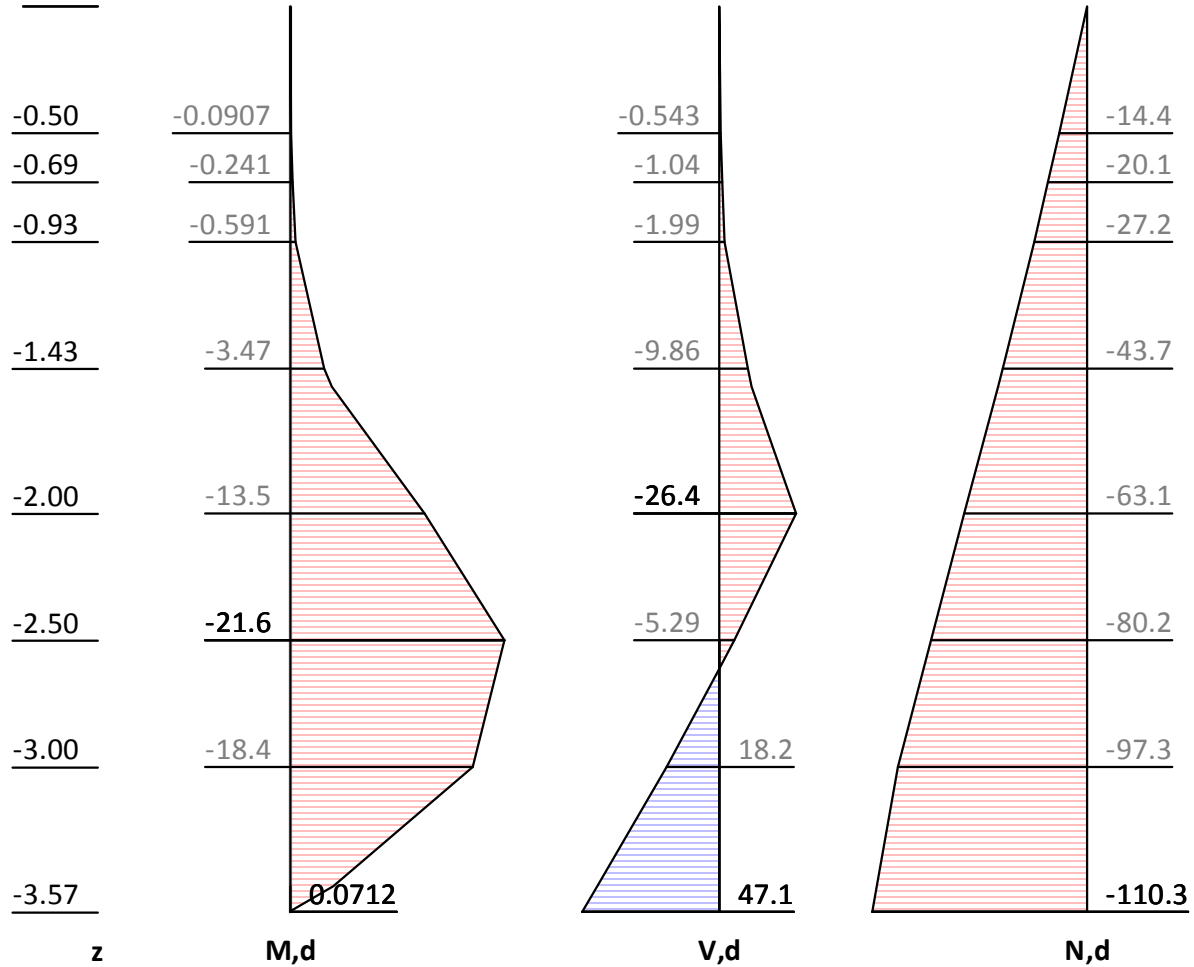
-559.8e-06

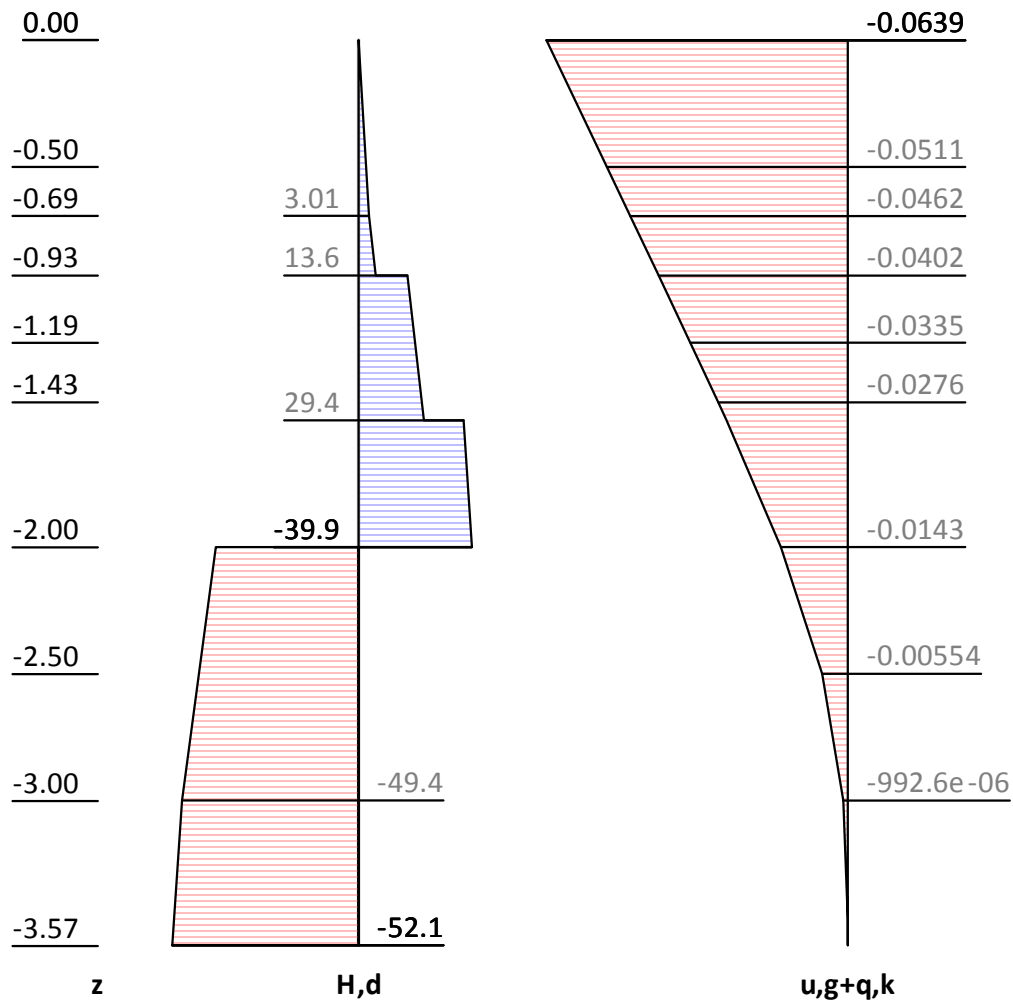
u,qk

| z [m] | H, q, k [kN/m2] | M, q, k [kN/m2] | V, q, k [kN/m2] | N, q, k [kN/m2] | u, q, k [mm] |
|----------|--------------------|--------------------|--------------------|--------------------|-----------------|
| 0.00 | | 0.00 | 0.00 | | -0.03 |
| -0.69 | | 0.00 | -0.00 | 0.00 | -0.02 |
| -0.69 | | -0.00 | 0.00 | 0.00 | -0.02 |
| -0.93 | 0.00 | 0.12 | 0.19 | 0.05 | -0.02 |
| -0.93 | 5.76 | 0.12 | 0.19 | 0.05 | -0.02 |
| -0.95 | 5.76 | 0.06 | 0.02 | 0.00 | -0.02 |
| -0.96 | 5.76 | 0.05 | -0.00 | -0.00 | -0.02 |
| -0.98 | 5.76 | 0.00 | -0.14 | -0.04 | -0.02 |
| -1.50 | 5.76 | -0.94 | -3.28 | -0.85 | -0.01 |
| -1.50 | 15.23 | -0.94 | -3.28 | -0.85 | -0.01 |
| -2.00 | 15.23 | -4.48 | -10.90 | -2.81 | -0.01 |
| -2.00 | -14.50 | -4.48 | -10.90 | -2.81 | -0.01 |
| -2.50 | -17.48 | -8.00 | -2.91 | -4.76 | -0.00 |
| -2.65 | -18.39 | -7.73 | -0.00 | -5.36 | -0.00 |
| -3.57 | -22.15 | -0.00 | 18.69 | -8.92 | -0.00 |
| -3.57 | -22.15 | 0.00 | 18.69 | -8.92 | 0.00 |

Internal forces: Design

0.00

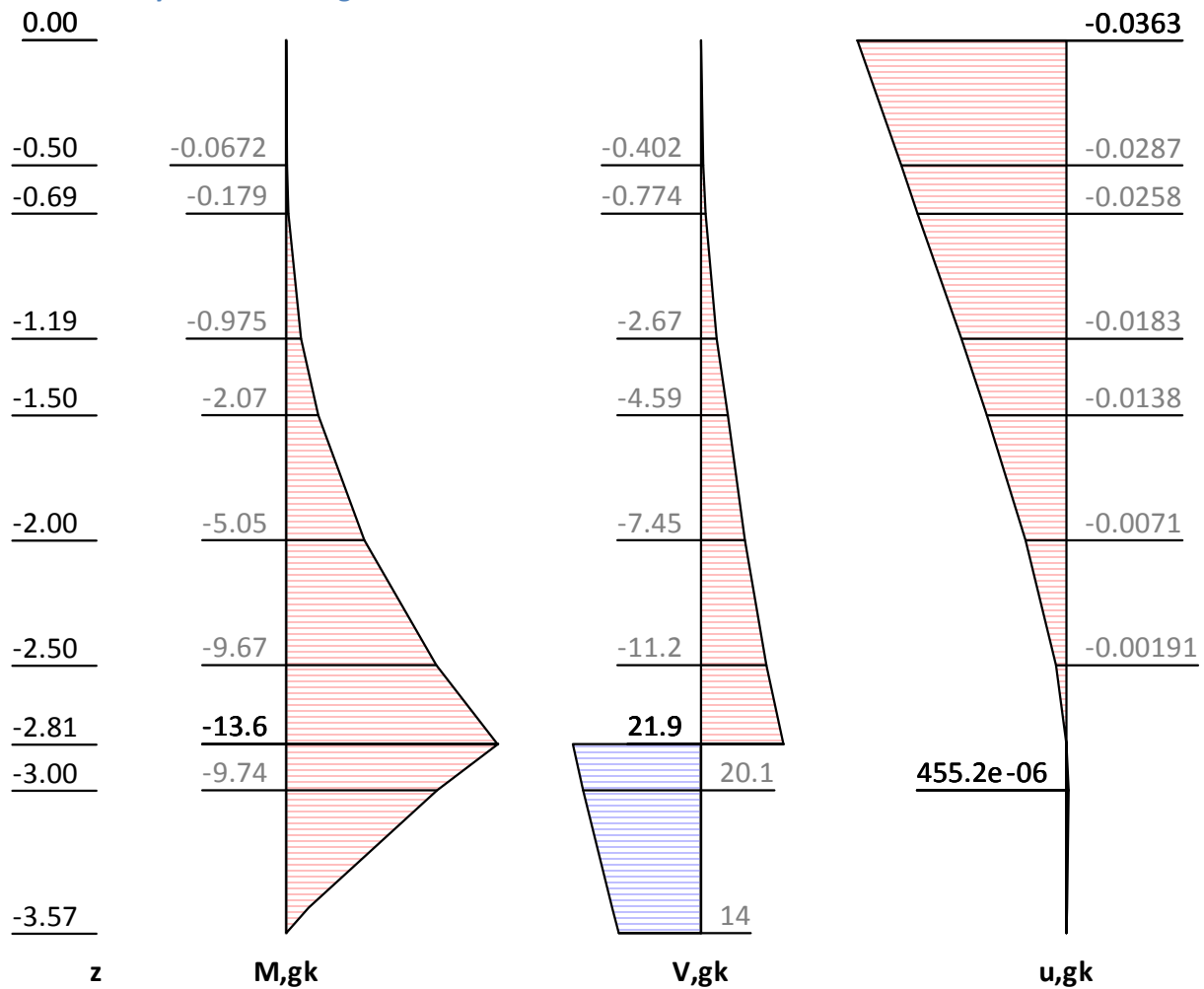




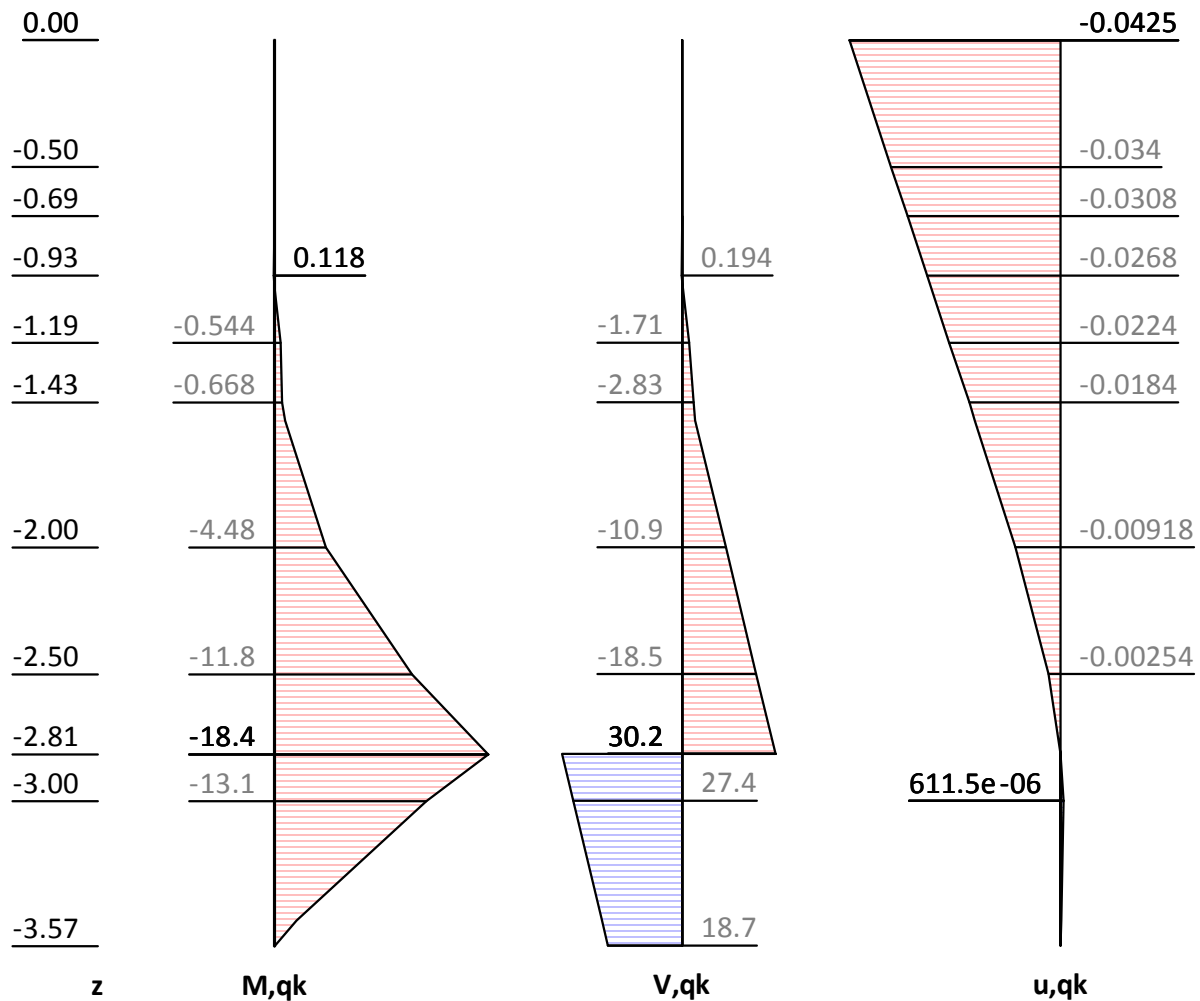
| z [m] | H,d [kN/m ²] | M,d [kN/m ²] | V,d [kN/m ²] | N,d [kN/m ²] | $u,g+q,k$ [mm] |
|------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------|
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -0.06 |
| -0.93 | 5.00 | -0.59 | -1.99 | -27.21 | -0.04 |
| -0.93 | 13.64 | -0.59 | -1.99 | -27.21 | -0.04 |
| -1.50 | 18.43 | -4.20 | -11.13 | -45.99 | -0.03 |
| -1.50 | 29.36 | -4.20 | -11.13 | -45.99 | -0.03 |
| -2.00 | 31.77 | -13.53 | -26.41 | -63.12 | -0.01 |
| -2.00 | -39.87 | -13.53 | -26.41 | -63.12 | -0.01 |
| -2.50 | -44.63 | -21.56 | -5.29 | -80.21 | -0.01 |
| -2.61 | -45.68 | -20.87 | -0.00 | -83.97 | -0.00 |
| -3.57 | -52.10 | -0.00 | 47.00 | -110.24 | -0.00 |
| -3.57 | -52.10 | 0.07 | 47.08 | -110.27 | 0.00 |

Checks of earth statics

Substitute system according to Blum



| z [m] | M, g, k [kN/m ²] | V, g, k [kN/m ²] | N, g, k [kN/m ²] | u, g, k [kN/m ²] |
|----------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| 0.00 | 0.00 | 0.00 | 0.00 | -0.04 |
| -2.81 | -13.63 | -14.02 | -60.75 | -0.00 |
| -2.81 | -13.63 | -14.02 | -60.75 | 0.00 |
| -2.81 | -13.63 | 21.94 | -60.75 | 0.00 |
| -3.00 | -9.74 | 20.11 | -64.64 | 0.00 |
| -3.57 | 0.00 | 14.03 | -71.82 | 0.00 |



| z [m] | M,q,k [kN/m²] | V,q,k [kN/m²] | N,q,k [kN/m²] | u,q,k [kN/m²] |
|----------|------------------|------------------|------------------|------------------|
| 0.00 | 0.00 | 0.00 | 0.00 | -0.04 |
| -0.69 | -0.00 | -0.00 | 0.00 | -0.03 |
| -0.69 | 0.00 | 0.00 | 0.00 | -0.03 |
| -0.93 | 0.12 | 0.19 | 0.05 | -0.03 |
| -0.95 | 0.06 | 0.02 | 0.00 | -0.03 |
| -0.96 | 0.05 | 0.00 | -0.00 | -0.03 |
| -0.98 | -0.00 | -0.14 | -0.04 | -0.03 |
| -2.81 | -18.42 | -23.31 | -6.02 | 0.00 |
| -2.81 | -18.42 | 30.18 | -6.02 | 0.00 |
| -3.00 | -13.10 | 27.36 | -6.74 | 0.00 |
| -3.57 | 0.00 | 18.69 | -8.98 | 0.00 |

Bh,gk = -35.96; Ch,gk = 14.03 [kN/m]
 Bh,qk = -53.49; Ch,qk = 18.69 [kN/m]
 Bh,d = -128.78; Ch,d = 46.99 [kN/m]

| | |
|--|-------------------------|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | Job No.: |
| Program: WALLS-Retain. | Version 2017.046 |
| Structure: info@fides-dvp.de www.fides-dvp.de Tel:++49/89/143829-0 ASB Nr.: | Date: 08.10.2018 |

Check of C-force (foot support)

$$z(C) = -3.57 \text{ [kN/m]}$$

$$G,k = \sum(\gamma \cdot h) = 62.69 \text{ [kN/m]}$$

$$P,k = \sum(Pz,k(x= 0.1)) = 0.00 \text{ [kN/m]}$$

$$kpgh,C(\phi_i= 0.1; \delta,C= 0.0^\circ) = 1.002 \text{ [-]}$$

$$kpch,C = 2.003 \text{ [-]}$$

$$eph,C,gk = (G,k+P,k) \cdot kpgh,C+2 \cdot c \cdot \sqrt{kpch,C} = 204.34 \text{ [kN/m}^2\text{]}$$

$$= (62.69+0.00) \cdot 1.002 + 2 \cdot 50.0 \cdot 1.415$$

$$Ed = Ch,d = 46.99 \text{ [kN/m}^2\text{]}$$

$$\delta,t,EAU = Ed / (2 \cdot eph,C,d) = 0.16 \text{ [m]}$$

$$\delta,t,EAB = 0.20 \cdot t = 0.31 \text{ [m]}$$

$$\delta,t = \delta,t,EAB = 0.31 \text{ [m]}$$

$$Rd = 2 \cdot \delta,t \cdot eph,C,gk / \gamma,Re = 2 \cdot 0.31 \cdot 204.34 / 1.4 = 91.59 \text{ [kN/m}^2\text{]}$$

$Ed/Rd = 0.513 \text{ [-]}. \text{ Passes requirement}$

Check or earth support

Check: Mobilizable earth resistance is sufficient for earth support force.

z: -2.81 m

$Rd = Eph,k / \gamma,Re = 180.43 / 1.400 = 128.88 \text{ [kN/m]}$

$Ed(Bh,d) / Rd = 128.78 / 128.88 = 0.999 \text{ [-]}. \text{ Passes requirement}$

Sum of H and V forces, (G)

Forces up to depth z:-3.57

| Pos. | H | V |
|---|--------|-------------|
| <hr style="border-top: 1px dashed black;"/> | | |
| H/V pressure G+P+W,k | 21.92 | 1.65 |
| Wall weight | | 74.12 |
| H/V pressure passive | | 0.00 |
| Bh,g,k z=-2.81 | -35.96 | |
| Bv,g,k = Bh,k * tan($\delta,p=-0.07^\circ$) | | -0.04 |
| Ch,g | 14.03 | |
| Cv,g = Ch*tan($\delta,C=0.0^\circ$) | | 0.01 |
| <hr style="border-top: 1px dashed black;"/> | | |
| Σ | -0.00 | 75.74 |
| | | (downwards) |

Simple check, EAB R 9-3a

$Vk \geq Bvk: 75.78 \geq 0.04 \text{ Passes requirement}$

Sum of H and V forces, (G+Q)

Forces up to depth z:-3.57

| Pos. | H | V |
|---|--------|-------------|
| <hr style="border-top: 1px dashed black;"/> | | |
| H/V pressure G+P+W,k | 56.72 | 10.63 |
| Wall weight | | 74.12 |
| H/V pressure passive | | 0.00 |
| Bh,g,k z=-2.81 | -35.96 | |
| Bv,g,k = Bh,k * tan($\delta,p=-0.07^\circ$) | | -0.04 |
| Bh,q,k z=-2.81 | -53.49 | |
| Bv,q,k = Bh,k * tan($\delta,p=-0.07^\circ$) | | -0.06 |
| Ch,g | 14.03 | |
| Cv,g = Ch*tan($\delta,C=0.0^\circ$) | | 0.01 |
| Ch,q | 18.69 | |
| Cv,q = Ch*tan($\delta,C=0.0^\circ$) | | 0.01 |
| <hr style="border-top: 1px dashed black;"/> | | |
| Σ | 0.00 | 84.66 |
| | | (downwards) |

| | |
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| Part: Block: Please specify project informations. Record: | Archive No.: |
|---|--------------|

Page: 19

Vk >= Bvk: 84.77 >= 0.10 Passes requirement

LC: $\delta\alpha$ τα φορτία Type: BS-T (combination: [GEO] A2 M2 R3, BS-T)
Vertical variable loads only act if they are outside of $R \cdot \sin(\phi)$.
The automatic slip circle optimization only considers circles that intersect the surface with an area of at least 0.25 m².
The slip circle calculation only accepts circles including the wall.
The slipcircle calculation only allows circular failure planes (no vertical tangents will occur).

Γεωμετ.κύκλου (μήκη και συντεταγμ. σε (m))
Κέντρο = (0.79, 1.98), Ακτίνα = 5.93
Αρχ.σημ. = (-3.61, -2.00), Τελ.σημ. = (6.37, 0.00)

| No | x | Width b | dxM | Weight | Load z-κατ. [kN/m] | Water- φορτ. [kN/m] | u*b | φ | c | θ |
|----|-------|------------|-------|--------|--------------------------|---------------------------|--------|-------|----------------------|--------|
| | [m] | [m] | [m] | [kN/m] | | [kN/m] | [kN/m] | [°] | [kN/m ²] | [°] |
| 1 | -3.31 | 0.59 | -4.09 | 3.6 | 0.0 | 0.0 | -0.0 | 0.08 | 35.71 | -43.68 |
| 2 | -2.72 | 0.59 | -3.50 | 9.5 | 0.0 | 0.0 | -0.0 | 0.08 | 35.71 | -36.20 |
| 3 | -2.12 | 0.59 | -2.91 | 14.0 | 0.0 | 0.0 | -1.0 | 0.08 | 35.71 | -29.38 |
| 4 | -1.53 | 0.59 | -2.32 | 17.5 | 0.0 | 0.0 | -2.8 | 0.08 | 35.71 | -22.99 |
| 5 | -0.94 | 0.59 | -1.72 | 20.0 | 0.0 | 0.0 | -4.0 | 0.08 | 35.71 | -16.89 |
| 6 | -0.34 | 0.59 | -1.13 | 21.8 | 0.0 | 0.0 | -4.9 | 0.08 | 35.71 | -10.99 |
| 7 | 0.25 | 0.59 | -0.54 | 42.9 | 0.0 | 0.0 | -5.4 | 0.08 | 35.71 | -5.20 |
| 8 | 0.84 | 0.59 | 0.06 | 45.0 | 0.0 | 0.0 | -5.6 | 0.08 | 35.71 | 0.54 |
| 9 | 1.43 | 0.59 | 0.65 | 44.6 | 0.0 | 0.0 | -5.3 | 0.08 | 35.71 | 6.28 |
| 10 | 2.03 | 0.59 | 1.24 | 43.4 | 8.4 | 0.0 | -4.8 | 0.08 | 35.71 | 12.09 |
| 11 | 2.62 | 0.59 | 1.83 | 41.5 | 15.4 | 0.0 | -3.8 | 0.08 | 35.71 | 18.02 |
| 12 | 3.21 | 0.59 | 2.43 | 38.8 | 15.4 | 0.0 | -2.5 | 0.08 | 35.71 | 24.17 |
| 13 | 3.81 | 0.59 | 3.02 | 35.2 | 15.4 | 0.0 | -0.8 | 0.08 | 35.71 | 30.63 |
| 14 | 4.40 | 0.59 | 3.61 | 30.4 | 15.4 | 0.0 | -0.0 | 0.08 | 35.71 | 37.55 |
| 15 | 4.99 | 0.59 | 4.21 | 24.2 | 15.4 | 0.0 | -0.0 | 0.08 | 35.71 | 45.19 |
| 16 | 5.58 | 0.59 | 4.80 | 16.0 | 15.4 | 0.0 | -0.0 | 20.46 | 1.43 | 54.04 |
| 17 | 6.13 | 0.49 | 5.34 | 5.2 | 12.8 | 0.0 | -0.0 | 20.46 | 1.43 | 64.28 |

| No | Weight | $G \cdot \sin(\theta)$ | $(G \cdot u^*b) \cdot \tan(\varphi) + c^*b$ | $\mu^* \sin(\theta) \cdot \tan(\varphi) + \cos(\theta)$ | T |
|----|--------|------------------------|---|---|--------|
| | [kN/m] | [kN/m] | [kN/m] | [-] | [kN/m] |
| 1 | 3.61 | -2.49 | 21.18 | 0.722903 | 29.30 |
| 2 | 9.49 | -5.60 | 21.19 | 0.806677 | 26.26 |
| 3 | 14.02 | -6.88 | 21.19 | 0.871145 | 24.33 |
| 4 | 17.48 | -6.83 | 21.19 | 0.920369 | 23.03 |
| 5 | 20.03 | -5.82 | 21.20 | 0.956702 | 22.15 |
| 6 | 21.77 | -4.15 | 21.20 | 0.981574 | 21.59 |
| 7 | 42.92 | -3.89 | 21.23 | 0.995843 | 21.31 |
| 8 | 44.99 | 0.42 | 21.23 | 0.999960 | 21.23 |
| 9 | 44.57 | 4.88 | 21.23 | 0.994052 | 21.35 |
| 10 | 51.84 | 10.86 | 21.24 | 0.977933 | 21.72 |
| 11 | 56.96 | 17.62 | 21.25 | 0.951084 | 22.34 |
| 12 | 54.25 | 22.21 | 21.25 | 0.912555 | 23.28 |
| 13 | 50.60 | 25.78 | 21.24 | 0.860778 | 24.68 |
| 14 | 45.85 | 27.94 | 21.24 | 0.793159 | 26.78 |
| 15 | 39.66 | 28.13 | 21.23 | 0.705148 | 30.11 |
| 16 | 31.40 | 25.41 | 12.56 | 0.698375 | 17.98 |
| 17 | 18.00 | 16.22 | 7.42 | 0.557759 | 13.30 |
| | | ----- | | | ----- |
| | | 143.82 | | | 390.74 |

| | | | |
|---|--------------------------------------|------------------|-------------------------------|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | | | Job No.: |
| Program: WALLS-Retain. Version 2017.046 | | | |
| Structure: | info@fides-dvp.de | www.fides-dvp.de | Tel:++49/89/143829-0 ASB Nr.: |
| | | | Date: 08.10.2018 |
| <div>Δράση Ed = (143.8*5.93)</div> <div>Αντίσταση Rd = (390.7*5.93 +0.0)</div> <div>SLIP-CIRCLE $\mu = Ed/Rd = 0.37 < 1.0$: Έλεγχος εκπληρώθηκε.</div> <div></div> | | | |
| Part: | | | Archive No.: |
| Block: | Please specify project informations. | | Page: 21 |
| Record: | | | |

| | | |
|------------|--|------------------|
| Author: | FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | Job No.: |
| Program: | WALLS-Retain. Version 2017.046 | |
| Structure: | info@fides-dvp.de www.fides-dvp.de Tel:++49/89/143829-0 ASB Nr.: | Date: 08.10.2018 |

Φάση εκσκαφής 2 "[2] Situation 2"

LC: όλα τα φορτία Type: BS-T

Εδαφικό σύστημα με 5 Στρώσεις

| Name | Τεχνητές επιχωματώσεις Αμμόδης ΑΡΓΙΛΟΣ Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ | | | |
|-------------|---|-----------|-------------|-----------|
| γ | [kN/m3] | 18 | 20 | 22.5 |
| γ,R | [kN/m3] | 18 | 20 | 22.5 |
| γ' | [kN/m3] | 8 | 10 | 12.5 |
| γ,p | [kN/m3] | 18 | 20 | 22.5 |
| γ,R,passive | [kN/m3] | 18 | 20 | 22.5 |
| γ,pw | [kN/m3] | 8 | 10 | 12.5 |
| φ | [°] | 25 | 0.1 | 33 |
| c | [kN/m2] | 2 | 50 | 5 |
| c,u | [kN/m2] | 10 | 50 | 5 |
| c παθητικό | [kN/m2] | 2 | 50 | 5 |
| δ,a | [°] | 16.66667 | 0.06666667 | 22 |
| δ,p | [°] | -16.66667 | -0.06666667 | -22 |
| δ,c | [°] | 8.333333 | 0.03333333 | 11 |
| k,agh | [-] | 0.3456501 | 0.9955057 | 0.2452023 |
| K,ach | [-] | 1.043051 | 1.994195 | 0.8549058 |
| K,0h | [-] | 0.5773817 | 0.9982547 | 0.455361 |
| K,pgh | [-] | 3.908103 | 1.004519 | 7.495617 |
| K,pch | [-] | 5.180327 | 2.00583 | 8.599509 |
| τ,gr | [kN/m2] | 110 | 110 | 110 |
| Ψ,A,max | [°] | 90 | 90 | 90 |
| k | [cm/s] | 10e-06 | 1e-06 | 100e-06 |

| Name | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ |
|-------------|------------------------|------------------------|
| γ | [kN/m3] 22.5 | 22.5 |
| γ,R | [kN/m3] 22.5 | 22.5 |
| γ' | [kN/m3] 12.5 | 12.5 |
| γ,p | [kN/m3] 22.5 | 22.5 |
| γ,R,passive | [kN/m3] 22.5 | 22.5 |
| γ,pw | [kN/m3] 12.5 | 12.5 |
| φ | [°] 35 | 35 |
| c | [kN/m2] 5 | 5 |
| c,u | [kN/m2] 5 | 5 |
| c παθητικό | [kN/m2] 5 | 5 |
| δ,a | [°] 23.33333 | 23.33333 |
| δ,p | [°] -23.33333 | -23.33333 |
| δ,c | [°] 11.66667 | 11.66667 |
| k,agh | [-] 0.2244207 | 0.2244207 |
| K,ach | [-] 0.8126539 | 0.8126539 |
| K,0h | [-] 0.4264236 | 0.4264236 |
| K,pgh | [-] 9.146943 | 9.146943 |
| K,pch | [-] 10.104 | 10.104 |
| τ,gr | [kN/m2] 110 | 110 |
| Ψ,A,max | [°] 90 | 90 |
| k | [cm/s] 100e-06 | 100e-06 |

Πορεία πρανούς:

x [m] 0.00 0.00
z [m] -2.00 0.00

Πορεία ανώτερου 2. στρώματος Αμμόδης ΑΡΓΙΛΟΣ:

x [m] 0.00 0.00
z [m] -2.00 -1.50

Πορεία ανώτερου 3. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ:

z= -4.50

Πορεία ανώτερου 4. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟΣ:

z= -10.00

| | | |
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| Part: | | Archive No.: |
| Block: | Please specify project informations. | Page: 22 |
| Record: | | |

| | | |
|---|------------------|--|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | | Job No.: |
| Program: WALLS-Retain. Version 2017.046 | | |
| Structure: info@fides-dvp.de | www.fides-dvp.de | Tel:++49/89/143829-0 ASB Nr.: Date: 08.10.2018 |

Πορεία ανώτερου 5. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ:
z= -14.00

Επιφ. φορτία:

Φορτία

| xA | zA | xE | zE | PxA | PzA | PxE | PzE | Typ | LC-description |
|------|------|------|------|------|-------|------|-------|-----|----------------|
| [m] | [m] | [m] | [m] | [| kN/m² | |] | | Name |
| 2.00 | 0.00 | 8.50 | 0.00 | 0.00 | 20.00 | 0.00 | 20.00 | q | 1 |

Κατανομή εδαφ.πιέσεων

| Κατανομή εδαφ.πιέσεων | Name |
|----------------------------|------|
| Rectangular within a layer | |

Στάθμη νερού:

x [m] 0.00
z [m] -3.00

Αγκύρια

| z[m] | min.l[m] | Alpha[°] | C-H[kN/m] | P0[kN] | u0[m] |
|-------|----------|----------|-----------|--------|--------|
| -0.50 | 0.00 | 15.00 | αόρισ. | 0.00 | 0.0000 |

Παράμετροι υπολογισμού

Earth pressure options

Τμήμα εδαφ.ωθήσεων: Ενεργές ωθήσεις.
Angle of slip plane: DIN 4085.
Split block loads into 1 sections.
Consideration of minimum earth pressure: $\varphi_{min} = 40.000$.
Negative earth pressure fractions are set to zero.

Redistribution of earth pressure

Shape of redistribution: Trapezoid.
The earth pressure is getting redistb. to: Excavation level
The earth pressure below the excavation acts without redistrb.
Levels of redistribution Z1: 0.000, Z2: -1.000 [m].
The earth pressure from variable loads will be included in redistribution.

Παθητικές ωθήσεις

Method of calculation: Κλασικός, Pregl/Sokolovsky (DIN 4085).

Options for water pressure

Στήριξη πόδα

Πόδας οριζοντίως μετακινούμενος

Αγκύρια

Anchor checks (lower failure plane): Ναι
Anchor forces with safety level of DS-P: Ναι
Verification of grout body pull out forces: Ναι
δ,a,Anchoring wall : used from soil layer.
δ,p,Anchoring wall : used from soil layer.

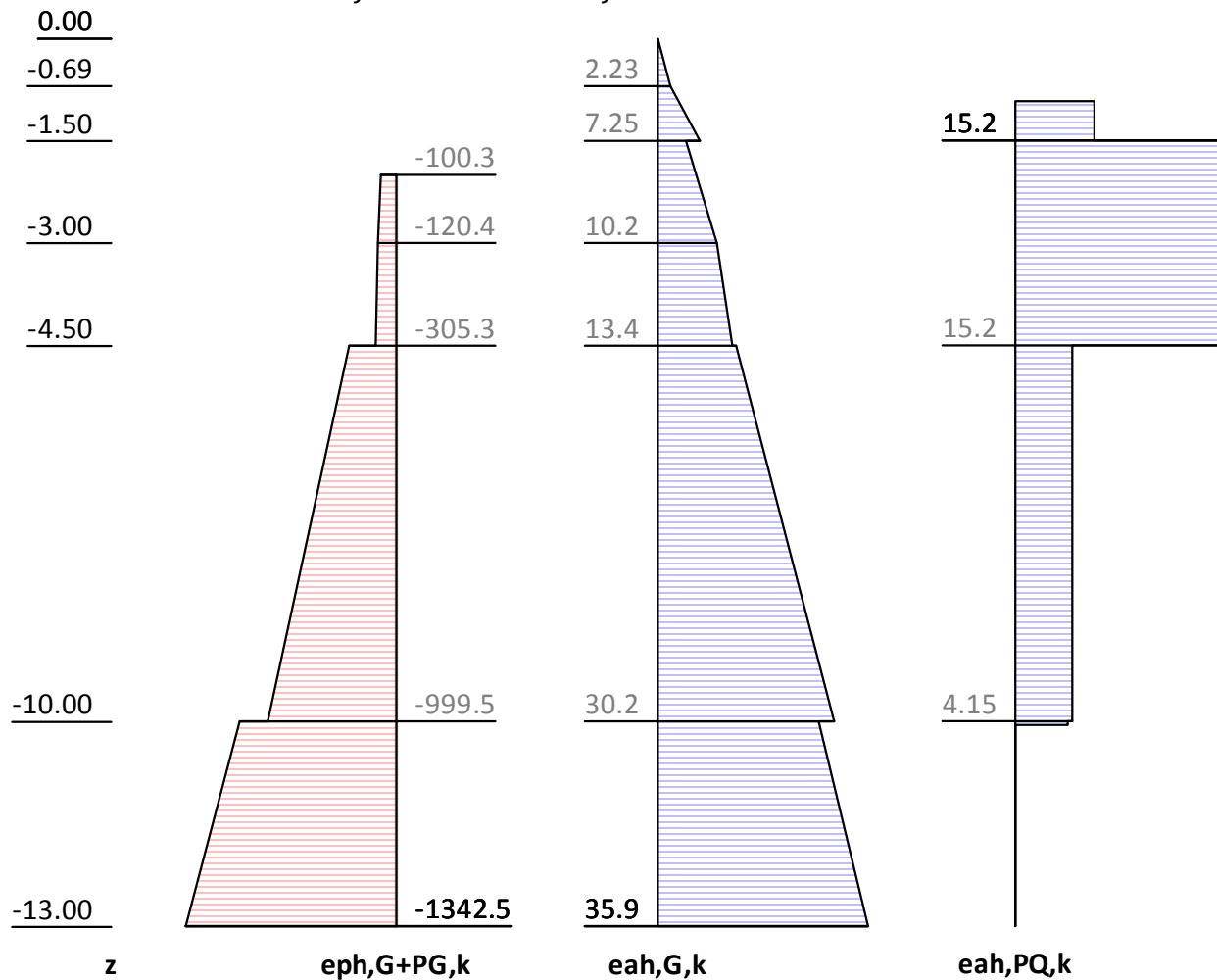
Earth pressure coefficients kh

| φ | α | β | δ | k0gh | kagh | kach | kpgh | kpch | |
|------|-----|-----|-------|------|-------|-------|-------|---------|--------------------------|
| 0.1 | 0.0 | 0.0 | -0.1 | -- | -- | -- | 1.005 | -2.006 | Τεχνητές επιχωματώσεις |
| 25.0 | 0.0 | 0.0 | 16.7 | -- | 0.346 | 1.043 | -- | -- | " |
| 0.1 | 0.0 | 0.0 | -0.1 | -- | -- | -- | 1.005 | -2.006 | Αμμόδης ΑΡΓΙΛΟΣ |
| 0.1 | 0.0 | 0.0 | 0.1 | -- | 0.996 | 1.994 | -- | -- | " |
| 33.0 | 0.0 | 0.0 | -22.0 | -- | -- | -- | 7.496 | -8.600 | Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ |
| 33.0 | 0.0 | 0.0 | 22.0 | -- | 0.245 | 0.855 | -- | -- | " |
| 35.0 | 0.0 | 0.0 | -23.3 | -- | -- | -- | 9.147 | -10.104 | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ |
| 35.0 | 0.0 | 0.0 | 23.3 | -- | 0.224 | 0.813 | -- | -- | " |
| 35.0 | 0.0 | 0.0 | -23.3 | -- | -- | -- | 9.147 | -10.104 | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ |
| 35.0 | 0.0 | 0.0 | 23.3 | -- | 0.224 | 0.813 | -- | -- | " |

| | | |
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| Part: | | Archive No.: |
| Block: | Please specify project informations. | Page: 23 |
| Record: | | |

Μήκος τοίχουFoot depth for statics: $z_f = -13.000$ **Stress analysis****Earth pressure, horizontal**

Pressures characteristic, no redistribution, continuous wall



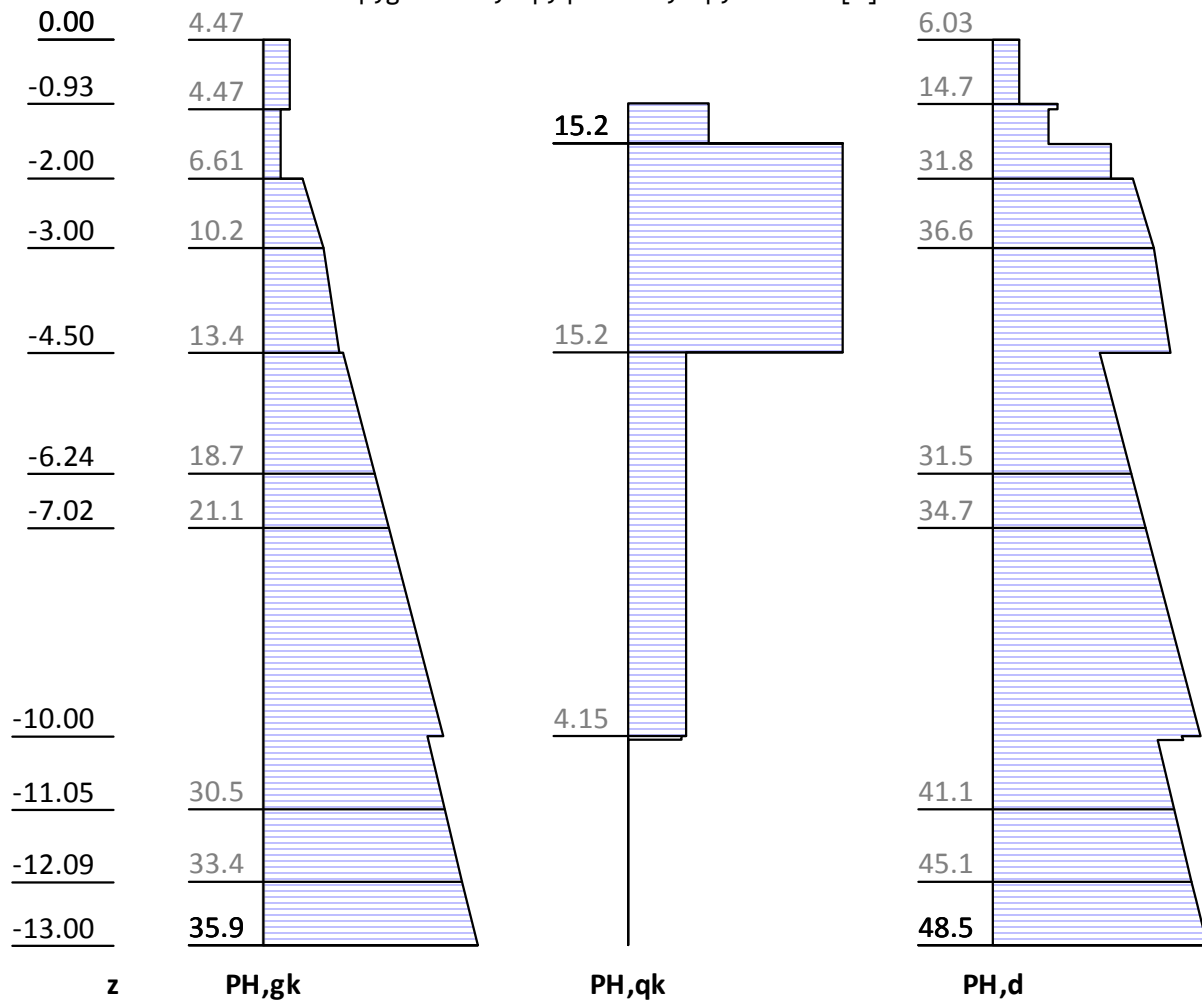
| z [m] | eph, G, k [kN/m ²] | eah, G, k [kN/m ²] | eah, PQ, k [kN/m ²] | eah, d [kN/m ²] |
|------------|-------------------------------------|-------------------------------------|--------------------------------------|----------------------------------|
| 0.00 | | 0.00 | | 0.00 |
| -0.93 | | 3.72 | 0.00 | 5.00 |
| -0.93 | | 3.72 | 5.76 | 13.64 |
| -1.50 | | 7.25 | 5.76 | 18.43 |
| -1.50 | | 4.82 | 15.23 | 29.36 |
| -2.00 | -0.00 | 6.61 | 15.23 | 31.77 |
| -2.00 | -100.29 | 6.61 | 15.23 | 31.77 |
| -4.50 | -135.45 | 12.86 | 15.23 | 40.21 |
| -4.50 | -305.34 | 13.38 | 4.15 | 24.29 |
| -10.00 | -820.67 | 30.24 | 4.15 | 47.05 |
| -10.00 | -999.52 | 27.52 | 3.81 | 42.87 |
| -10.06 | -1006.38 | 27.69 | 3.81 | 43.10 |
| -10.06 | -1006.38 | 27.69 | 0.00 | 37.38 |
| -13.00 | -1342.53 | 35.94 | 0.00 | 48.52 |

Eph, G, k: -6911.80, Eph, PG, k: 0.00 [kN/m]

Eah, G, k: 248.27, Eah, PG, k: 0.00, Eah, PQ, k: 72.04, Eah, d: 443.22

H-pressure on static system

Level of mobilization: Ep,gk 100.0, Ep,qk 100.0, Ep,d 100.0 [%]



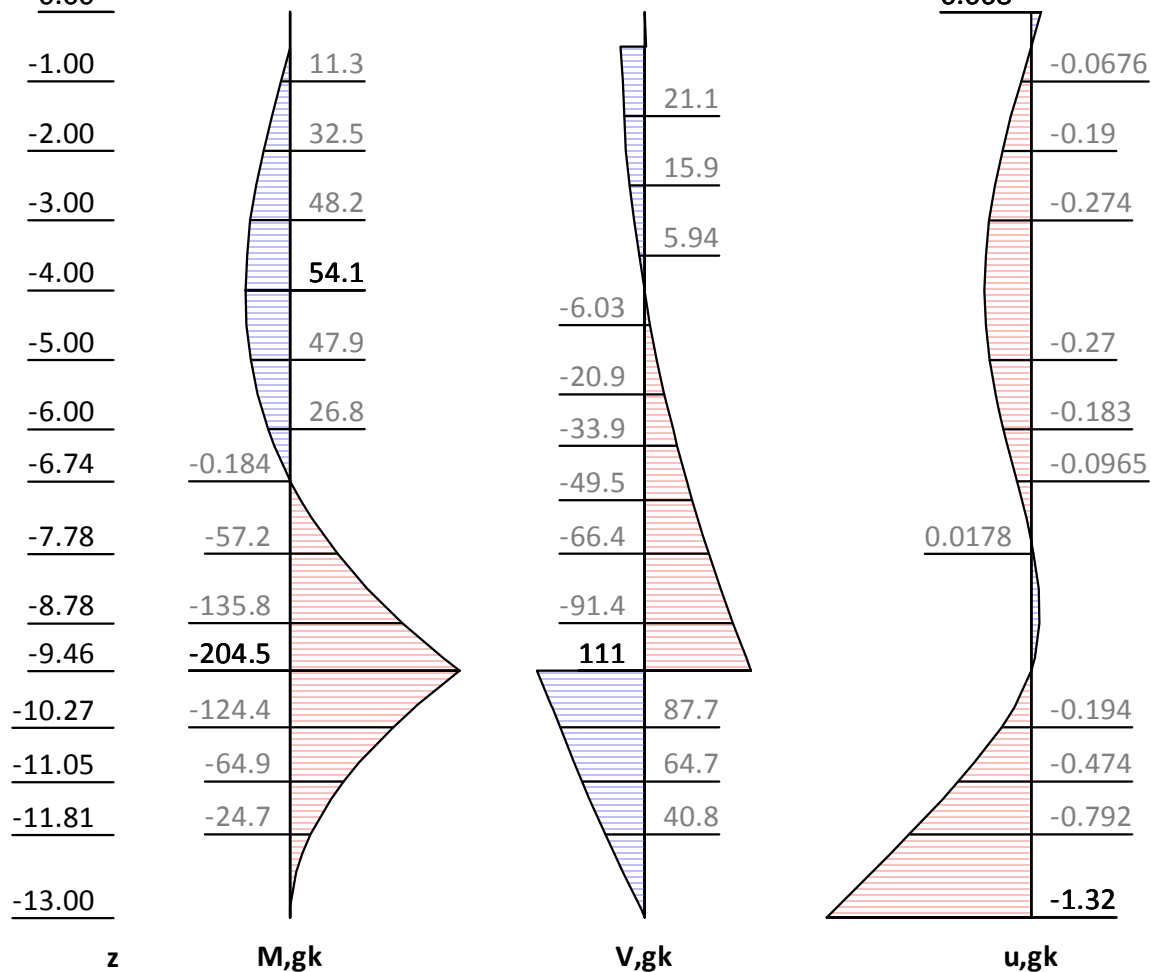
| z [m] | PH,gk [kN/m²] | PH,qk [kN/m²] | PH,d [kN/m²] |
|----------|------------------|------------------|-----------------|
| 0.00 | 4.47 | | 6.03 |
| -0.93 | 4.47 | 0.00 | 6.03 |
| -0.93 | 4.47 | 5.76 | 14.68 |
| -1.00 | 4.47 | 5.76 | 14.68 |
| -1.00 | 2.98 | 5.76 | 12.67 |
| -1.50 | 2.98 | 5.76 | 12.67 |
| -1.50 | 2.98 | 15.23 | 26.88 |
| -2.00 | 2.98 | 15.23 | 26.88 |
| -2.00 | 6.61 | 15.23 | 31.77 |
| -4.50 | 12.86 | 15.23 | 40.21 |
| -4.50 | 13.38 | 4.15 | 24.29 |
| -10.00 | 30.24 | 4.15 | 47.05 |
| -10.00 | 27.52 | 3.81 | 42.87 |
| -10.06 | 27.69 | 3.81 | 43.10 |
| -10.06 | 27.69 | 0.00 | 37.38 |
| -13.00 | 35.94 | 0.00 | 48.52 |

V-pressure on static system**Internal forces: Permanent, characteristically**

z= -0.500. Fx= -27.099 kN/m Support

z= -9.463. Fx=-221.169 kN/m Support

0.00

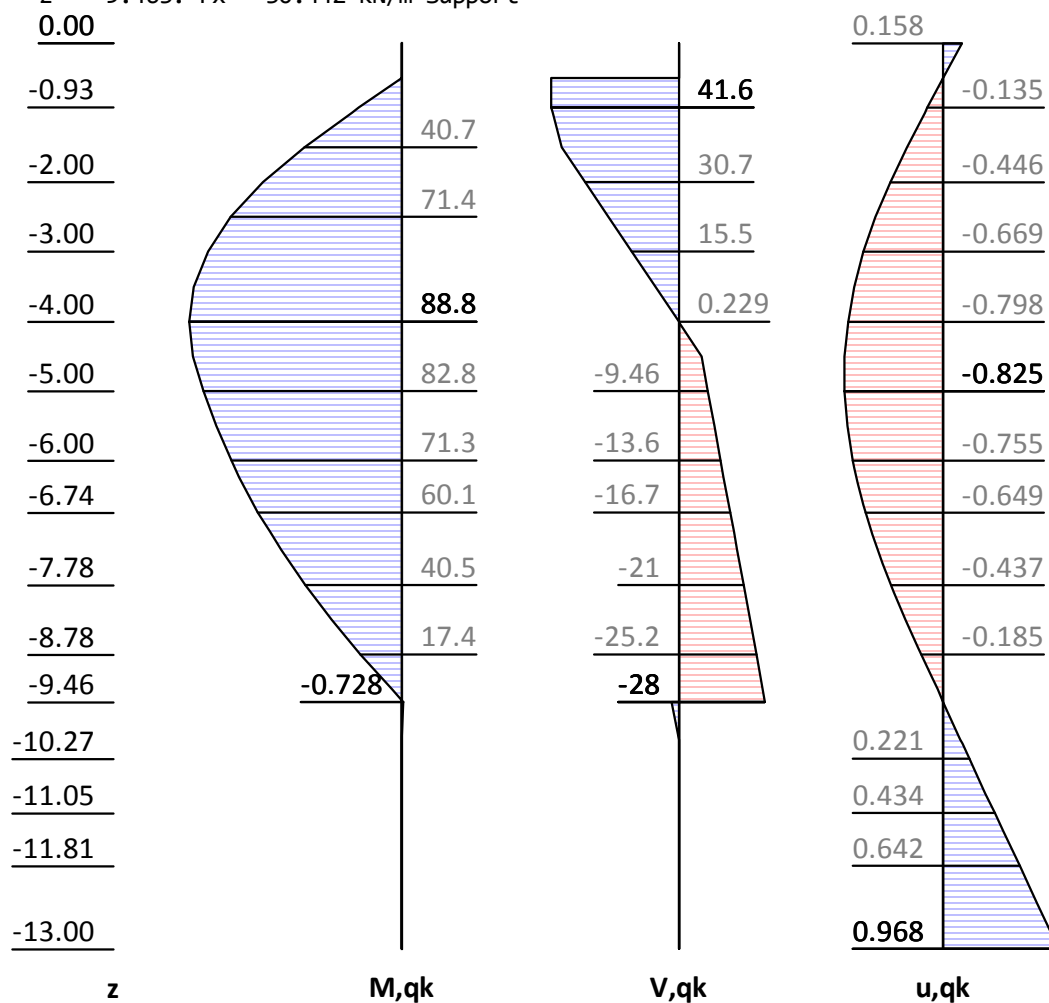


| z [m] | H, g, k [kN/m ²] | M, g, k [kN/m ²] | V, g, k [kN/m ²] | N, g, k [kN/m ²] | u, g, k [mm] |
|----------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|-----------------|
| 0.00 | 4.47 | 0.00 | -0.00 | 0.00 | 0.07 |
| -0.50 | 4.47 | -0.56 | -2.23 | -10.91 | 0.00 |
| -0.50 | 4.47 | -0.56 | -2.23 | -10.91 | -0.00 |
| -0.50 | 4.47 | -0.56 | 24.86 | -18.17 | -0.00 |
| -0.52 | 4.47 | -0.00 | 24.76 | -18.69 | -0.00 |
| -1.00 | 4.47 | 11.31 | 22.63 | -29.09 | -0.07 |
| -1.00 | 2.98 | 11.31 | 22.63 | -29.09 | -0.07 |
| -2.00 | 2.98 | 32.45 | 19.65 | -50.64 | -0.19 |
| -2.00 | 6.61 | 32.45 | 19.65 | -50.64 | -0.19 |
| -4.00 | 11.97 | 54.06 | 0.18 | -84.27 | -0.30 |
| -4.01 | 11.99 | 54.02 | -0.00 | -84.45 | -0.30 |
| -4.50 | 12.86 | 52.62 | -6.03 | -90.57 | -0.29 |
| -4.50 | 13.38 | 52.62 | -6.03 | -90.57 | -0.29 |
| -6.74 | 20.23 | 0.00 | -43.59 | -133.92 | -0.10 |
| -7.60 | 22.89 | -46.50 | -62.42 | -152.47 | 0.00 |
| -8.78 | 26.50 | -135.80 | -91.37 | -178.98 | 0.06 |
| -9.46 | 28.58 | -204.51 | -110.18 | -195.19 | 0.00 |
| -9.46 | 28.58 | -204.51 | 110.99 | -195.19 | 0.00 |
| -9.46 | 28.58 | -204.51 | 110.99 | -195.19 | -0.00 |
| -10.00 | 30.24 | -149.11 | 95.20 | -208.34 | -0.12 |
| -10.00 | 27.52 | -149.11 | 95.20 | -208.34 | -0.12 |
| -13.00 | 35.94 | 0.00 | 0.00 | -287.20 | -1.32 |

Internal forces: Variable, characteristicallyMethod EB 82-4 ($Q = [G+Q] - G$).

z= -0.500. Fx= -41.597 kN/m Support

z= -9.463. Fx= -30.442 kN/m Support

0.00

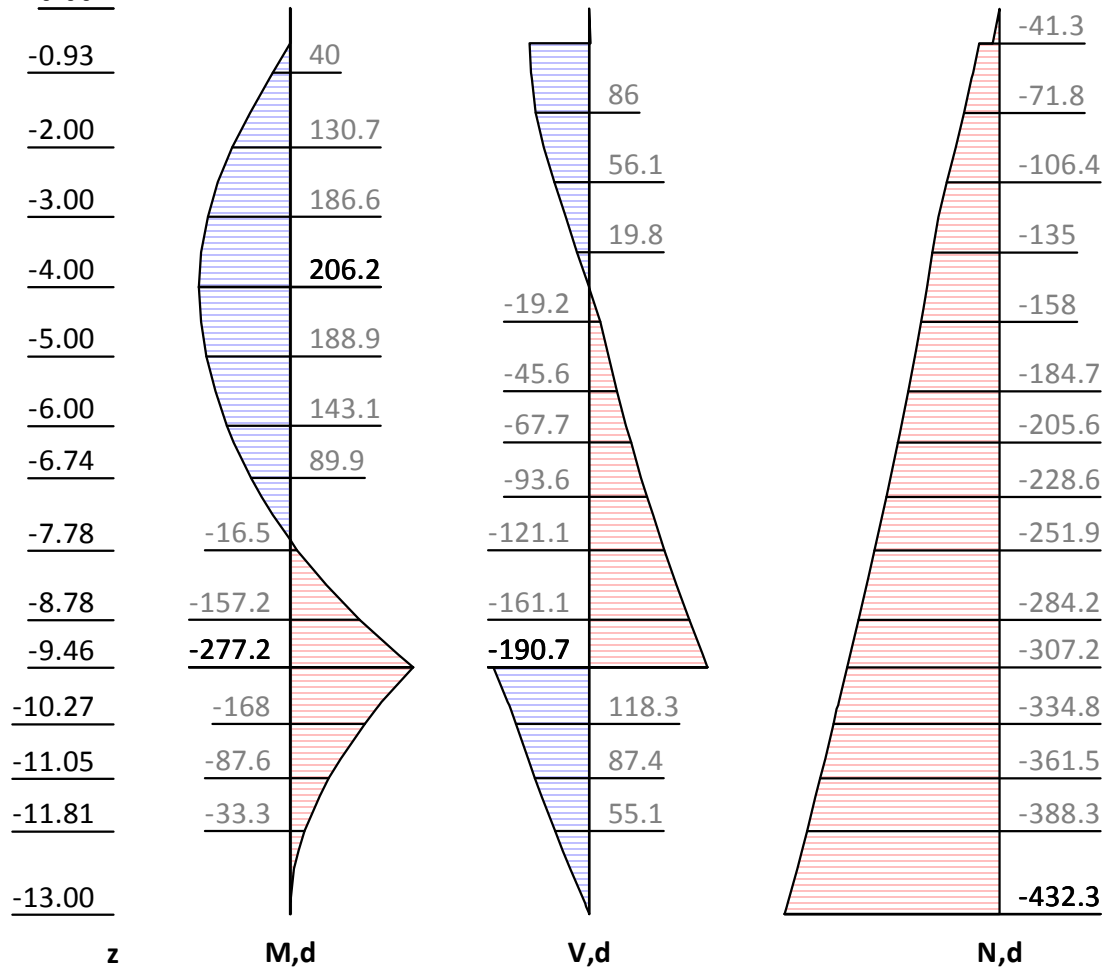
| z [m] | H, q, k [kN/m²] | M, q, k [kN/m²] | V, q, k [kN/m²] | N, q, k [kN/m²] | u, q, k [mm] |
|----------|--------------------|--------------------|--------------------|--------------------|-----------------|
| 0.00 | | 0.00 | 0.00 | 0.00 | 0.16 |
| -0.50 | | 0.00 | 0.00 | 0.00 | 0.00 |
| -0.50 | | 0.00 | 0.00 | 0.00 | -0.00 |
| -0.50 | | 0.00 | 41.60 | -11.15 | -0.00 |
| -0.93 | 0.00 | 17.95 | 41.60 | -11.15 | -0.13 |
| -0.93 | 5.76 | 17.95 | 41.60 | -11.15 | -0.13 |
| -1.50 | 5.76 | 40.66 | 38.31 | -11.99 | -0.31 |
| -1.50 | 15.23 | 40.66 | 38.31 | -11.99 | -0.31 |
| -4.00 | 15.23 | 88.83 | 0.23 | -21.82 | -0.80 |
| -4.02 | 15.23 | 88.77 | -0.00 | -21.88 | -0.80 |
| -4.50 | 15.23 | 87.05 | -7.39 | -23.79 | -0.82 |
| -4.50 | 4.15 | 87.05 | -7.39 | -23.79 | -0.82 |
| -5.00 | 4.15 | 82.83 | -9.46 | -24.32 | -0.82 |
| -9.43 | 4.15 | 0.00 | -27.88 | -29.07 | -0.01 |
| -9.46 | 4.15 | -0.73 | -27.98 | -29.10 | 0.00 |
| -9.46 | 4.15 | -0.73 | 2.46 | -29.10 | 0.00 |
| -10.00 | 4.15 | -0.01 | 0.23 | -29.68 | 0.15 |
| -10.00 | 3.81 | -0.01 | 0.23 | -29.68 | 0.15 |
| -10.00 | 3.81 | 0.00 | 0.22 | -29.68 | 0.15 |
| -10.06 | 3.81 | 0.18 | 0.02 | -29.73 | 0.16 |
| -10.06 | 0.00 | 0.18 | 0.02 | -29.73 | 0.16 |

| z [m] | H, q, k [kN/m2] | M, q, k [kN/m2] | V, q, k [kN/m2] | N, q, k [kN/m2] | u, q, k [mm] |
|----------|--------------------|--------------------|--------------------|--------------------|-----------------|
| -10.27 | 0.00 | 0.00 | -0.00 | -29.74 | 0.22 |
| -11.31 | 0.00 | 0.00 | -0.00 | -29.74 | 0.51 |
| -12.09 | 0.00 | 0.00 | -0.00 | -29.74 | 0.72 |
| -12.88 | 0.00 | -0.00 | -0.00 | -29.74 | 0.94 |
| -13.00 | 0.00 | -0.00 | -0.00 | -29.74 | 0.97 |

Internal forces: Design

z= -0.500. Fx= -98.979 kN/m Support

z= -9.463. Fx=-344.242 kN/m Support

0.00

| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | | | | | Job No.: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|-------------------|------------------|----------------------|----------|------------------------------|---|-----|-----|-----|-----|---------|-----|---------|---------|---------|---------|------|------|------|------|-------|------|------|-------|------|------|-------|-------|------|-------|------|-------|-------|--------|------|-------|------|------|-------|--------|-------|-------|------|-------|-------|--------|-------|-------|-------|-------|-------|--------|-------|-------|-------|-------|-------|--------|-------|-------|-------|-------|-------|--------|-------|-------|-------|-------|-------|--------|-------|-------|-------|-------|-------|--------|-------|-------|-------|--------|-------|--------|-------|-------|-------|--------|-------|--------|-------|-------|-------|--------|------|---------|-------|-------|-------|--------|-------|---------|-------|-------|-------|--------|--------|---------|-------|-------|-------|--------|--------|---------|-------|-------|-------|-------|---------|---------|-------|-------|-------|---------|---------|---------|------|-------|-------|---------|--------|---------|------|--------|-------|---------|--------|---------|------|--------|-------|---------|--------|---------|------|--------|-------|---------|--------|---------|------|--------|-------|---------|--------|---------|------|--------|-------|---------|--------|---------|------|--------|-------|-------|------|---------|-------|--------|-------|-------|-------|---------|-------|
| Program: WALLS-Retain. Version 2017.046 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Structure: | info@fides-dvp.de | www.fides-dvp.de | Tel:++49/89/143829-0 | ASB Nr.: | Date: 08.10.2018 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <div> <div> <div>0.00</div> <div>6.03</div> <div> </div> </div> <div> <div>0.226</div> <div> </div> </div> </div> <table border="1"> <thead> <tr> <th>z</th><th>H,d</th><th>M,d</th><th>V,d</th><th>N,d</th><th>u,g+q,k</th></tr> <tr> <th>[m]</th><th>[kN/m2]</th><th>[kN/m2]</th><th>[kN/m2]</th><th>[kN/m2]</th><th>[mm]</th></tr> </thead> <tbody> <tr><td>0.00</td><td>6.03</td><td>0.00</td><td>-0.00</td><td>0.00</td><td>0.23</td></tr> <tr><td>-0.00</td><td>6.03</td><td>0.00</td><td>-0.00</td><td>-0.00</td><td>0.23</td></tr> <tr><td>-0.50</td><td>6.03</td><td>-0.75</td><td>-3.02</td><td>-14.73</td><td>0.00</td></tr> <tr><td>-0.51</td><td>6.03</td><td>0.00</td><td>95.91</td><td>-41.49</td><td>-0.00</td></tr> <tr><td>-0.93</td><td>6.03</td><td>39.95</td><td>93.37</td><td>-53.93</td><td>-0.19</td></tr> <tr><td>-0.93</td><td>14.68</td><td>39.95</td><td>93.37</td><td>-53.93</td><td>-0.19</td></tr> <tr><td>-1.00</td><td>14.68</td><td>46.45</td><td>92.34</td><td>-56.15</td><td>-0.22</td></tr> <tr><td>-1.00</td><td>12.67</td><td>46.45</td><td>92.34</td><td>-56.15</td><td>-0.22</td></tr> <tr><td>-1.50</td><td>12.67</td><td>91.04</td><td>86.01</td><td>-71.81</td><td>-0.44</td></tr> <tr><td>-1.50</td><td>26.88</td><td>91.04</td><td>86.01</td><td>-71.81</td><td>-0.44</td></tr> <tr><td>-2.00</td><td>26.88</td><td>130.68</td><td>72.57</td><td>-89.30</td><td>-0.64</td></tr> <tr><td>-2.00</td><td>31.77</td><td>130.68</td><td>72.57</td><td>-89.30</td><td>-0.64</td></tr> <tr><td>-4.00</td><td>39.00</td><td>206.22</td><td>0.59</td><td>-146.49</td><td>-1.10</td></tr> <tr><td>-4.01</td><td>39.04</td><td>206.09</td><td>-0.00</td><td>-146.83</td><td>-1.10</td></tr> <tr><td>-4.50</td><td>40.21</td><td>201.61</td><td>-19.22</td><td>-157.95</td><td>-1.12</td></tr> <tr><td>-4.50</td><td>24.29</td><td>201.61</td><td>-19.22</td><td>-157.95</td><td>-1.12</td></tr> <tr><td>-7.63</td><td>37.25</td><td>-0.00</td><td>-115.73</td><td>-247.40</td><td>-0.47</td></tr> <tr><td>-9.46</td><td>44.81</td><td>-277.18</td><td>-190.72</td><td>-307.16</td><td>0.00</td></tr> <tr><td>-9.46</td><td>44.81</td><td>-277.18</td><td>153.53</td><td>-307.16</td><td>0.00</td></tr> <tr><td>-10.00</td><td>47.05</td><td>-201.30</td><td>128.86</td><td>-325.77</td><td>0.03</td></tr> <tr><td>-10.00</td><td>42.87</td><td>-201.30</td><td>128.86</td><td>-325.77</td><td>0.03</td></tr> <tr><td>-10.06</td><td>43.10</td><td>-193.65</td><td>126.28</td><td>-327.85</td><td>0.03</td></tr> <tr><td>-10.06</td><td>37.38</td><td>-193.65</td><td>126.28</td><td>-327.85</td><td>0.03</td></tr> <tr><td>-10.64</td><td>39.60</td><td>-127.27</td><td>103.69</td><td>-347.53</td><td>0.00</td></tr> <tr><td>-13.00</td><td>48.52</td><td>-0.00</td><td>0.00</td><td>-432.33</td><td>-0.35</td></tr> <tr><td>-13.00</td><td>48.52</td><td>-0.00</td><td>-0.00</td><td>-432.33</td><td>-0.35</td></tr> </tbody> </table> | | | | | | z | H,d | M,d | V,d | N,d | u,g+q,k | [m] | [kN/m2] | [kN/m2] | [kN/m2] | [kN/m2] | [mm] | 0.00 | 6.03 | 0.00 | -0.00 | 0.00 | 0.23 | -0.00 | 6.03 | 0.00 | -0.00 | -0.00 | 0.23 | -0.50 | 6.03 | -0.75 | -3.02 | -14.73 | 0.00 | -0.51 | 6.03 | 0.00 | 95.91 | -41.49 | -0.00 | -0.93 | 6.03 | 39.95 | 93.37 | -53.93 | -0.19 | -0.93 | 14.68 | 39.95 | 93.37 | -53.93 | -0.19 | -1.00 | 14.68 | 46.45 | 92.34 | -56.15 | -0.22 | -1.00 | 12.67 | 46.45 | 92.34 | -56.15 | -0.22 | -1.50 | 12.67 | 91.04 | 86.01 | -71.81 | -0.44 | -1.50 | 26.88 | 91.04 | 86.01 | -71.81 | -0.44 | -2.00 | 26.88 | 130.68 | 72.57 | -89.30 | -0.64 | -2.00 | 31.77 | 130.68 | 72.57 | -89.30 | -0.64 | -4.00 | 39.00 | 206.22 | 0.59 | -146.49 | -1.10 | -4.01 | 39.04 | 206.09 | -0.00 | -146.83 | -1.10 | -4.50 | 40.21 | 201.61 | -19.22 | -157.95 | -1.12 | -4.50 | 24.29 | 201.61 | -19.22 | -157.95 | -1.12 | -7.63 | 37.25 | -0.00 | -115.73 | -247.40 | -0.47 | -9.46 | 44.81 | -277.18 | -190.72 | -307.16 | 0.00 | -9.46 | 44.81 | -277.18 | 153.53 | -307.16 | 0.00 | -10.00 | 47.05 | -201.30 | 128.86 | -325.77 | 0.03 | -10.00 | 42.87 | -201.30 | 128.86 | -325.77 | 0.03 | -10.06 | 43.10 | -193.65 | 126.28 | -327.85 | 0.03 | -10.06 | 37.38 | -193.65 | 126.28 | -327.85 | 0.03 | -10.64 | 39.60 | -127.27 | 103.69 | -347.53 | 0.00 | -13.00 | 48.52 | -0.00 | 0.00 | -432.33 | -0.35 | -13.00 | 48.52 | -0.00 | -0.00 | -432.33 | -0.35 |
| z | H,d | M,d | V,d | N,d | u,g+q,k | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| [m] | [kN/m2] | [kN/m2] | [kN/m2] | [kN/m2] | [mm] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.00 | 6.03 | 0.00 | -0.00 | 0.00 | 0.23 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -0.00 | 6.03 | 0.00 | -0.00 | -0.00 | 0.23 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -0.50 | 6.03 | -0.75 | -3.02 | -14.73 | 0.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -0.51 | 6.03 | 0.00 | 95.91 | -41.49 | -0.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -0.93 | 6.03 | 39.95 | 93.37 | -53.93 | -0.19 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -0.93 | 14.68 | 39.95 | 93.37 | -53.93 | -0.19 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -1.00 | 14.68 | 46.45 | 92.34 | -56.15 | -0.22 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -1.00 | 12.67 | 46.45 | 92.34 | -56.15 | -0.22 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -1.50 | 12.67 | 91.04 | 86.01 | -71.81 | -0.44 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -1.50 | 26.88 | 91.04 | 86.01 | -71.81 | -0.44 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -2.00 | 26.88 | 130.68 | 72.57 | -89.30 | -0.64 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -2.00 | 31.77 | 130.68 | 72.57 | -89.30 | -0.64 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -4.00 | 39.00 | 206.22 | 0.59 | -146.49 | -1.10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -4.01 | 39.04 | 206.09 | -0.00 | -146.83 | -1.10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -4.50 | 40.21 | 201.61 | -19.22 | -157.95 | -1.12 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -4.50 | 24.29 | 201.61 | -19.22 | -157.95 | -1.12 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -7.63 | 37.25 | -0.00 | -115.73 | -247.40 | -0.47 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -9.46 | 44.81 | -277.18 | -190.72 | -307.16 | 0.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -9.46 | 44.81 | -277.18 | 153.53 | -307.16 | 0.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -10.00 | 47.05 | -201.30 | 128.86 | -325.77 | 0.03 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -10.00 | 42.87 | -201.30 | 128.86 | -325.77 | 0.03 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -10.06 | 43.10 | -193.65 | 126.28 | -327.85 | 0.03 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -10.06 | 37.38 | -193.65 | 126.28 | -327.85 | 0.03 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -10.64 | 39.60 | -127.27 | 103.69 | -347.53 | 0.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -13.00 | 48.52 | -0.00 | 0.00 | -432.33 | -0.35 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -13.00 | 48.52 | -0.00 | -0.00 | -432.33 | -0.35 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Part: Block: Please specify project informations. Record: | | | | | Archive No.: Page: 29 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Anchor forces with safety level of DS-P

| z[m] | A,d[kN] | Fx,d[kN/m] |
|-------|---------|------------|
| -0.50 | 184.4 | -99.0 |

Checks of earth statics**Check of earth support**

Check: Mobilizable earth resistance is sufficient for earth support force.

z: -9.46 m

$R_d = E_{ph,k}/\gamma, R_e = 6911.80 / 1.400 = 4937.00 \text{ [kN/m]}$

$E_d(U_h,d)/R_d = 344.24 / 4937.00 = 0.070 \text{ [-]}. \text{ Passes requirement}$

Sum of H and V forces, (G)

Forces up to depth z:-13.00

| Pos. | H | V |
|---|---------|-----------------------|
| H/V pressure G+P+W,k | 248.27 | 90.93 |
| Wall weight | | 189.01 |
| H/V pressure passive | | 0.00 |
| Support z: -0.50 | -27.10 | 7.26 |
| B _{h,g,k} z=-9.46 | -221.17 | |
| B _{v,g,k} = B _{h,k} * tan($\delta, p=-22.00^\circ$) | | -89.36 |
| Σ | -0.00 | 197.84 (downwards) |

Average anchor inclination $\alpha, A = 15.00^\circ \geq 15^\circ$.

Verification of vertical forces due to EAB R 9 not required (R 9-5).

Check EAB R 9-1

Vertical component of earth resistance is less than the downwards pointing vertical forces.

$V_k \geq B_{vk}: 287.20 \geq 89.36 \text{ Passes requirement}$

Sum of H and V forces, (G+Q)

Forces up to depth z:-13.00

| Pos. | H | V |
|---|---------|-----------------------|
| H/V pressure G+P+W,k | 320.31 | 109.52 |
| Wall weight | | 189.01 |
| H/V pressure passive | | 0.00 |
| Support z: -0.50 | -68.70 | 18.41 |
| B _{h,g,k} z=-9.46 | -221.17 | |
| B _{v,g,k} = B _{h,k} * tan($\delta, p=-22.00^\circ$) | | -89.36 |
| B _{h,q,k} z=-9.46 | -30.44 | |
| B _{v,q,k} = B _{h,k} * tan($\delta, p=-22.00^\circ$) | | -12.30 |
| Σ | 0.00 | 215.28 (downwards) |

Average anchor inclination $\alpha, A = 15.00^\circ \geq 15^\circ$.

Verification of vertical forces due to EAB R 9 not required (R 9-5).

Check EAB R 9-1

Vertical component of earth resistance is less than the downwards pointing vertical forces.

$V_k \geq B_{vk}: 316.94 \geq 101.66 \text{ Passes requirement}$

Anchor verification

| | |
|--|------------------|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | Job No.: |
| Program: WALLS-Retain. Version 2017.046 | |
| Structure: info@fides-dvp.de www.fides-dvp.de Tel:++49/89/143829-0 ASB Nr.: | Date: 08.10.2018 |

Anchor - Stability of lower failure plane

Περίπτ.Φόρτισης: όλα τα φορτία BS-P
 Αυτόμ. υπολογ. μήκους αγκυρίων:
 All anchors are extended (if necessary)
 Favourable variable loads in main failure body are not being considered.
 Bottom of lower failure plane: z=-13.00 m

Iteration of failure mechanisms:
 lA: Length of anchor from head to center of grout body.
 W,k: Res. force from dead weight, loads, cohesion, ...
 Q,k: Force in lower failure plane.
 Ea1,k.....: Earth pressure onto vertical separation plane.
 Ea2,k.....: Earth pressure between wall and main failure body.
 Ra_cal,d: Dimesioning force of the resistance from the equilibrium of forces.
 Ra_cal,d corresponds to the max. possible anchor force of the force polygon.
 Sum(A,d): Acting anchor forces along the grout body fractions within the failure body. Sum(A,d) is gained from the anchor pull forces of the wall analysis.

| z | θ1 | θ2 | lA | W,k | Q,k | Ea1,k | Ea2,k | Ra_cal,d | Sum(A,d) | Ed/Rd |
|-------|------|------|------|--------|--------|--------|--------|----------|----------|-------|
| [m] | [°] | [°] | [m] | [kN/m] | [kN/m] | [kN/m] | [kN/m] | [kN/m] | [kN/m] | [-] |
| -0.50 | 46.0 | 57.5 | 9.94 | 1138.8 | 1027.6 | 4.4 | 338.5 | 102.6 | 102.5 | 1.00 |

Decisive failure body:
Γεωμετρία:
 Foot point of lower failure plane x/z = 0.01/-13.00 m
 Intersection lower/upper slid. plane x/z = 9.60/ -3.07 m
 Intersection upper slid. plane/surface x/z = 11.56/ 0.00 m
 Intersection separation plane/surface x/z = 9.60/ 0.00 m
 Inclination lower failure plane θ1 = 45.98°
 Inclination upper failure plane θ2 = 57.50°
 Inclination separation plane θ12 = 90.00°

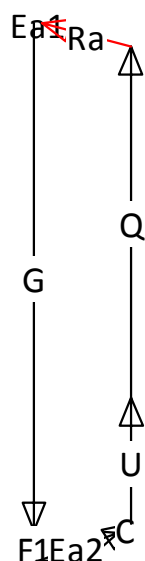
Loads / forces (char.)

| | | Fx | Fz | F | |
|------------------------------------|-----------|--------|---------|--------|---------|
| | | [kN/m] | [kN/m] | [kN/m] | |
| Weight of main failure body | G,k: | 0.0 | -1600.4 | 1600.4 | |
| Area loads on/in main failure body | F1,k: | 0.0 | -130.0 | 130.0 | |
| Cohesion of lower failure plane | C,k: | 110.0 | 113.8 | 158.3 | |
| Pore water pressure on main body | U,k: | -0.0 | 483.2 | 483.2 | |
| Earth pres. on separation plane | Ea1,k: | -4.4 | -0.0 | 4.4 | δ= 0.0° |
| Earth pr. between wall<->main body | Ea2,k: | 320.3 | 109.5 | 338.5 | |
| Force in lower failure plane | Q,k: | -287.1 | 986.7 | 1027.6 | |
| Sum = possible anchor forces: | Ra_cal,k: | 138.8 | -37.2 | 143.7 | |

Force polygon

| | |
|--|--------------|
| Part: Block: Please specify project informations. Record: | Archive No.: |
|--|--------------|

Page: 31



Acting anchor forces $E_d: \sum(A,d) = 102.5 \text{ kN/m}$
 Possible anchor forces $R_d: R_{a_cal,d} = 143.7/1.400 = 102.6 \text{ kN/m}$
 Verif. of lower failure plane $E_d/R_d = 1.00 < 1.0$: Έλεγχος εκπληρώθηκε.

Check of steel tension

l_{tot} ...[m]: Total length of anchor incl. excess length at head
 A_s [mm²]: X-section area of steel member
 $R_{i,d}$...[kN]: Ultimate strength of tension member ($\gamma, M=1.15$)
 $A_{,d}$ [kN]: Dimensioning force of the anchor from wall analysis

| z[m] | Anchor type | l_{tot} | A_s | $R_{i,d}$ | $A_{,d}$ |
|-------|----------------------------|-----------|-------|-----------|--------------------|
| -0.50 | Strand; 3x0.60"; 1570/1770 | 13.94 | 420 | 573.4 | 184.4 |
| | | | | | Passes requirement |

Check of steel tension: Passes requirement

Check of anchor's soil friction

l_{Vk} : Length of grout body
 D_{mVk} : Diameter of grout body
 $\tau_{Gr,k}$: Average applied skin friction along the grout body (from soil parameters)
 $R_{a,k}$: Charact. pullout resistance of the anchor
 γ_A : Partial safety factor of anchor pullout
 $R_{a,d}$: $R_{a,k} / \gamma_A$
 $A_{,d}$: Dimensioning force of the anchor from wall analysis

| z | l_{Vk} | D_{mVk} | $\tau_{Gr,k}$ | $R_{a,k}$ | γ_A | $R_{a,d}$ | $A_{,d}$ | $A_{,d}/R_{a,d}$ |
|-------|----------|-----------|----------------------|-----------|------------|-----------|----------|------------------|
| [m] | [m] | [mm] | [kN/m ²] | [kN] | [-] | [kN] | [kN] | [-] |
| -0.50 | 8.00 | 318 | 110 | 879.1 | 1.100 | 799.2 | 184.4 | 0.2 |

Check of anchor's soil friction: Passes requirement

Υπολογ. κύκλου ολίσθησης

LC: όλα τα φορτία Type: BS-T (combination: [GEO] A2 M2 R3, BS-T)
 Vertical variable loads only act if they are outside of $R \cdot \sin(\phi)$.
 The automatic slip circle optimization only considers circles that intersect the surface with an area of at least 0.25 m².
 The slip circle calculation only accepts circles including the wall.
 The slipcircle calculation only allows circular failure planes (no vertical tangents will occur).

Γεωμετ. κύκλου (μήκη και συντεταγμ. σε (m))
 Κέντρο = (-4.49, 0.03), Ακτίνα = 13.79
 Αρχ.σημ. = (-18.13, -2.00), Τελ.σημ. = (9.30, 0.00)

Γεωμετρία λωρίδων:

| No | x | Width b | dxM | Weight | Load z-κατ. | Water- φορτ. | u*b | φ | c | θ |
|----|--------|------------|--------|--------|----------------|-----------------|--------|-------|---------|---------|
| | [m] | [m] | [m] | [kN/m] | [kN/m] | [kN/m] | [kN/m] | [°] | [kN/m²] | [°] |
| 1 | -17.44 | 1.38 | -12.95 | 75.4 | 0.0 | 0.0 | -22.6 | 27.45 | 3.57 | -31.27* |
| 2 | -16.06 | 1.38 | -11.57 | 161.2 | 0.0 | 0.0 | -60.2 | 27.45 | 3.57 | -31.27* |
| 3 | -14.68 | 1.38 | -10.19 | 216.6 | 0.0 | 0.0 | -85.5 | 27.45 | 3.57 | -31.27* |
| 4 | -13.30 | 1.38 | -8.81 | 257.5 | 0.0 | 0.0 | -104.0 | 29.26 | 3.57 | -30.37* |
| 5 | -11.92 | 1.38 | -7.44 | 288.8 | 0.0 | 0.0 | -118.0 | 29.26 | 3.57 | -30.37* |
| 6 | -10.54 | 1.38 | -6.06 | 312.9 | 0.0 | 0.0 | -128.8 | 29.26 | 3.57 | -26.05 |
| 7 | -9.17 | 1.38 | -4.68 | 331.0 | 0.0 | 0.0 | -136.9 | 29.26 | 3.57 | -19.82 |
| 8 | -7.79 | 1.38 | -3.30 | 343.9 | 0.0 | 0.0 | -142.6 | 29.26 | 3.57 | -13.83 |
| 9 | -6.41 | 1.38 | -1.92 | 352.2 | 0.0 | 0.0 | -146.3 | 29.26 | 3.57 | -8.00 |
| 10 | -5.03 | 1.38 | -0.54 | 356.0 | 0.0 | 0.0 | -148.0 | 29.26 | 3.57 | -2.24 |
| 11 | -3.65 | 1.38 | 0.84 | 355.6 | 0.0 | 0.0 | -147.8 | 29.26 | 3.57 | 3.49 |
| 12 | -2.27 | 1.38 | 2.22 | 350.8 | 0.0 | 0.0 | -145.7 | 29.26 | 3.57 | 9.26 |
| 13 | -0.89 | 1.38 | 3.60 | 341.5 | 0.0 | 0.0 | -141.6 | 29.26 | 3.57 | 15.12 |
| 14 | 0.49 | 1.38 | 4.98 | 371.1 | 0.0 | 0.0 | -135.3 | 29.26 | 3.57 | 21.16 |
| 15 | 1.87 | 1.38 | 6.36 | 359.2 | 14.5 | 0.0 | -126.7 | 29.26 | 3.57 | 27.45 |
| 16 | 3.25 | 1.38 | 7.74 | 333.7 | 35.9 | 0.0 | -115.3 | 29.26 | 3.57 | 34.12 |
| 17 | 4.63 | 1.38 | 9.12 | 300.6 | 35.9 | 0.0 | -100.4 | 29.26 | 3.57 | 41.37 |
| 18 | 6.01 | 1.38 | 10.49 | 257.1 | 35.9 | 0.0 | -80.7 | 27.45 | 3.57 | 49.54 |
| 19 | 7.39 | 1.38 | 11.87 | 197.1 | 35.9 | 0.0 | -53.1 | 27.45 | 3.57 | 59.42 |
| 20 | 8.69 | 1.23 | 13.18 | 95.6 | 11.0 | 0.0 | -16.3 | 0.08 | 35.71 | 72.83 |

*** Σημείωση: Στις λωρίδες σημειωμένες με '*'
περιορίστηκε το theta στο 45°-Phi/2.

Συνεισφ. κατακόρυφων φορτίων:

| No | Weight | G*sin(θ) | (G-u*b)*tan(φ) + c*b | μ*sin(θ)* tan(φ)+cos(θ) | T |
|--------|--------|----------|-------------------------|----------------------------|---------|
| | [kN/m] | [kN/m] | [kN/m] | [-] | [kN/m] |
| 1 | 75.43 | -70.83 | 32.36 | 0.817724 | 39.57 |
| 2 | 161.17 | -135.24 | 57.41 | 0.817724 | 70.21 |
| 3 | 216.65 | -160.12 | 73.04 | 0.817724 | 89.32 |
| 4 | 257.54 | -164.59 | 90.95 | 0.823931 | 110.38 |
| 5 | 288.83 | -155.71 | 100.62 | 0.823931 | 122.12 |
| 6 | 312.89 | -137.39 | 108.06 | 0.864722 | 124.97 |
| 7 | 331.00 | -112.24 | 113.67 | 0.914713 | 124.27 |
| 8 | 343.94 | -82.23 | 117.69 | 0.952636 | 123.54 |
| 9 | 352.20 | -48.99 | 120.25 | 0.979598 | 122.75 |
| 10 | 356.03 | -13.92 | 121.44 | 0.996234 | 121.90 |
| 11 | 355.56 | 21.66 | 121.29 | 1.002821 | 120.95 |
| 12 | 350.78 | 56.44 | 119.81 | 0.999327 | 119.89 |
| 13 | 341.53 | 89.11 | 116.94 | 0.985400 | 118.67 |
| 14 | 371.13 | 133.95 | 137.03 | 0.960318 | 142.69 |
| 15 | 373.73 | 172.26 | 143.32 | 0.922844 | 155.31 |
| 16 | 369.57 | 207.30 | 147.39 | 0.870953 | 169.23 |
| 17 | 336.44 | 222.36 | 137.16 | 0.801222 | 171.19 |
| 18 | 292.95 | 222.91 | 115.18 | 0.703054 | 163.82 |
| 19 | 232.98 | 200.58 | 98.38 | 0.570076 | 172.58 |
| 20 | 106.61 | 101.86 | 44.01 | 0.295323 | 149.02 |
| ----- | | | | | ----- |
| 347.16 | | | | | 2532.36 |

Συνεισφ. αγκυρίων: Αθρ. ροπών ανατροπής : 0.0 kN*m/m
" " resisting : 0.0 kN*m/m

Καμία συνεισφορά αγκυρίων.

Δράση $E_d = (347.2 * 13.79)$

Αντίσταση $R_d = (2532.4 * 13.79 + 0.0)$

SLIP-CIRCLE $\mu = E_d / R_d = 0.14 < 1.0$: Έλεγχος εκπληρώθηκε.

Φάση εκσκαφής 3 "[3] Situation 3"

LC: όλα τα φορτία Type: BS-T

Εδαφικό σύστημα με 5 Στρώσεις

| Name | Τεχνητές επιχωματώσεις | Αμμόδης ΑΡΓΙΛΟΣ | Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ | |
|-------------|------------------------|-----------------|--------------------------|-----------|
| γ | [kN/m3] | 18 | 20 | 22.5 |
| γ,R | [kN/m3] | 18 | 20 | 22.5 |
| γ' | [kN/m3] | 8 | 10 | 12.5 |
| γ,p | [kN/m3] | 18 | 20 | 22.5 |
| γ,R,passive | [kN/m3] | 18 | 20 | 22.5 |
| γ,pw | [kN/m3] | 8 | 10 | 12.5 |
| φ | [°] | 25 | 0.1 | 33 |
| c | [kN/m2] | 2 | 50 | 5 |
| c,u | [kN/m2] | 10 | 50 | 5 |
| c παθητικό | [kN/m2] | 2 | 50 | 5 |
| δ,a | [°] | 16.66667 | 0.06666667 | 22 |
| δ,p | [°] | -16.66667 | -0.06666667 | -22 |
| δ,c | [°] | 8.333333 | 0.03333333 | 11 |
| k,agh | [-] | 0.3456501 | 0.9955057 | 0.2452023 |
| K,ach | [-] | 1.043051 | 1.994195 | 0.8549058 |
| K,0h | [-] | 0.5773817 | 0.9982547 | 0.455361 |
| K,pgh | [-] | 3.908103 | 1.004519 | 7.495617 |
| K,pch | [-] | 5.180327 | 2.00583 | 8.599509 |
| τ,gr | [kN/m2] | 110 | 110 | 110 |
| Ψ,A,max | [°] | 90 | 90 | 90 |
| k | [cm/s] | 10e-06 | 1e-06 | 100e-06 |

| Name | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ | |
|-------------|------------------------|------------------------|-----------|
| γ | [kN/m3] | 22.5 | 22.5 |
| γ,R | [kN/m3] | 22.5 | 22.5 |
| γ' | [kN/m3] | 12.5 | 12.5 |
| γ,p | [kN/m3] | 22.5 | 22.5 |
| γ,R,passive | [kN/m3] | 22.5 | 22.5 |
| γ,pw | [kN/m3] | 12.5 | 12.5 |
| φ | [°] | 35 | 35 |
| c | [kN/m2] | 5 | 5 |
| c,u | [kN/m2] | 5 | 5 |
| c παθητικό | [kN/m2] | 5 | 5 |
| δ,a | [°] | 23.33333 | 23.33333 |
| δ,p | [°] | -23.33333 | -23.33333 |
| δ,c | [°] | 11.66667 | 11.66667 |
| k,agh | [-] | 0.2244207 | 0.2244207 |
| K,ach | [-] | 0.8126539 | 0.8126539 |
| K,0h | [-] | 0.4264236 | 0.4264236 |
| K,pgh | [-] | 9.146943 | 9.146943 |
| K,pch | [-] | 10.104 | 10.104 |
| τ,gr | [kN/m2] | 110 | 110 |
| Ψ,A,max | [°] | 90 | 90 |
| k | [cm/s] | 100e-06 | 100e-06 |

Πορεία πρανούς:

x [m] 0.00 0.00
z [m] -4.00 0.00

Πορεία ανώτερου 2. στρώματος Αμμόδης ΑΡΓΙΛΟΣ:

x [m] 0.00 0.00
z [m] -4.00 -1.50

Πορεία ανώτερου 3. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ:

z= -4.50

Πορεία ανώτερου 4. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟΣ:

z= -10.00

| | | |
|---|------------------|-------------------------------|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | | Job No.: |
| Program: WALLS-Retain. Version 2017.046 | | |
| Structure: info@fides-dvp.de | www.fides-dvp.de | Tel:++49/89/143829-0 ASB Nr.: |
| | | Date: 08.10.2018 |

Πορεία ανώτερου 5. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ:
 z= -14.00

Επιφ. φορτία:

Φορτία

| xA | zA | xE | zE | PxA | PzA | PxE | PzE | Typ | LC-description |
|------|------|------|------|------|-------|------|-------|-----|----------------|
| [m] | [m] | [m] | [m] | [| kN/m² | |] | | Name |
| 2.00 | 0.00 | 8.50 | 0.00 | 0.00 | 20.00 | 0.00 | 20.00 | q | 1 |

Κατανομή εδαφ.πιέσεων

| Κατανομή εδαφ.πιέσεων | Name |
|----------------------------|------|
| Rectangular within a layer | |

Στάθμη νερού:

| | | |
|-------|-------|-------|
| x [m] | 0.00 | 0.00 |
| z [m] | -6.00 | -3.00 |

Αγκύρια

| z[m] | min.l[m] | Alpha[°] | C-H[kN/m] | P0[kN] | u0[m] |
|-------|----------|----------|-----------|--------|--------|
| -0.50 | 0.00 | 15.00 | αόρισ. | 0.00 | 0.0000 |

Παράμετροι υπολογισμού

Earth pressure options

Τμήμα εδαφ.ωθήσεων: Ενεργές ωθήσεις.
 Angle of slip plane: DIN 4085.
 Split block loads into 1 sections.
 Consideration of minimum earth pressure: $\varphi_{min} = 40.000$.
 Negative earth pressure fractions are set to zero.

Redistribution of earth pressure

Shape of redistribution: Trapezoid.
 The earth pressure is getting redistb. to: Excavation level
 The earth pressure below the excavation acts without redistrb.
 Levels of redistribution Z1: 0.000, Z2: -2.000 [m].
 The earth pressure from variable loads will be included in redistribution.

Παθητικές ωθήσεις

Method of calculation: Κλασικός, Pregl/Sokolovsky (DIN 4085).

Options for water pressure

Στήριξη πόδα

Πόδας οριζοντίως μετακινούμενος

Αγκύρια

Anchor checks (lower failure plane): Ναι
 Anchor forces with safety level of DS-P: Ναι
 Verification of grout body pull out forces: Ναι
 δ,a,Anchoring wall : used from soil layer.
 δ,p,Anchoring wall : used from soil layer.

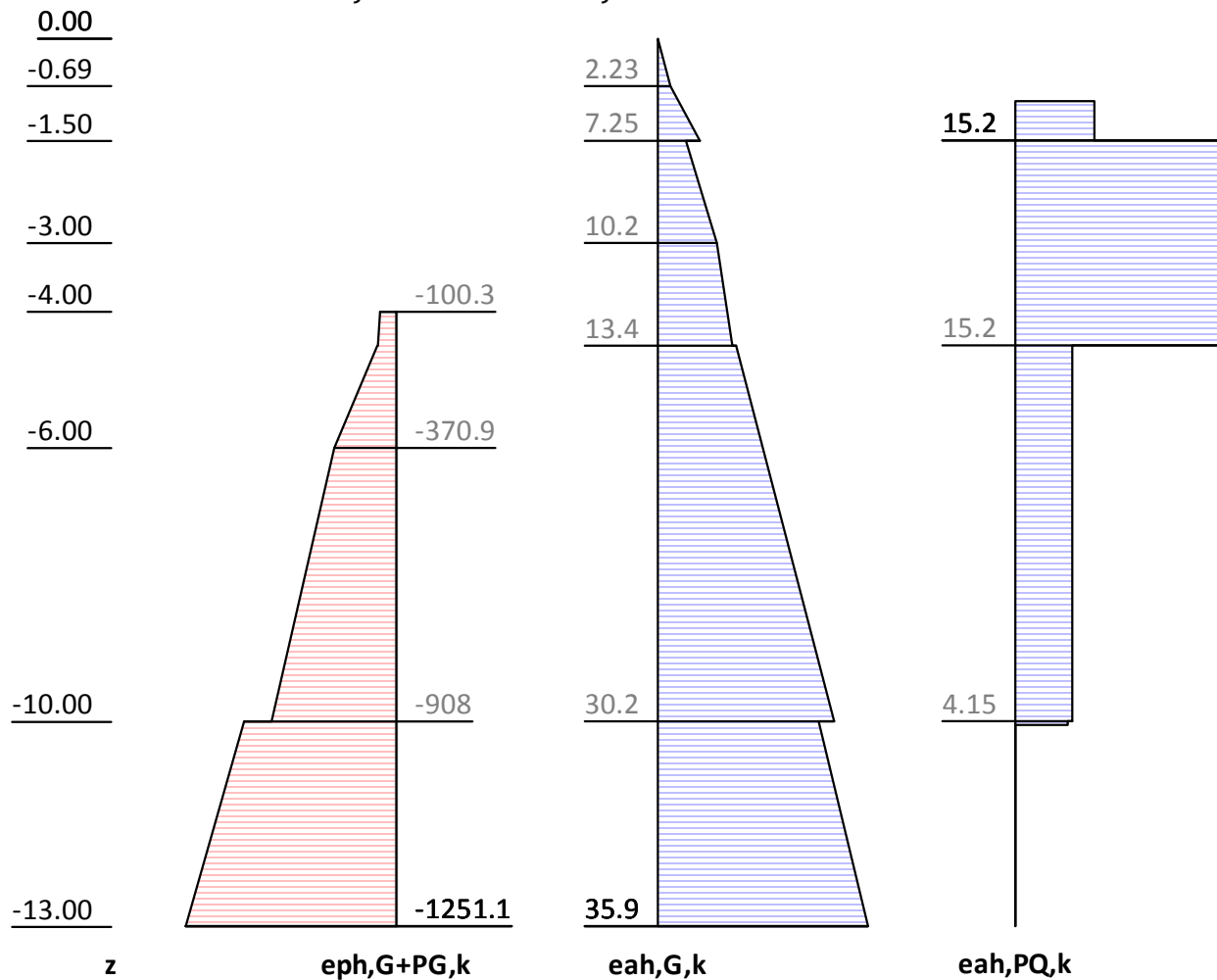
Earth pressure coefficients kh

| φ | α | β | δ | k0gh | kagh | kach | kpgh | kpch | |
|------|-----|-----|-------|------|-------|-------|-------|---------|--------------------------|
| 0.1 | 0.0 | 0.0 | -0.1 | -- | -- | -- | 1.005 | -2.006 | Τεχνητές επιχωματώσεις |
| 25.0 | 0.0 | 0.0 | 16.7 | -- | 0.346 | 1.043 | -- | -- | " |
| 0.1 | 0.0 | 0.0 | -0.1 | -- | -- | -- | 1.005 | -2.006 | Αμμόδης ΑΡΓΙΛΟΣ |
| 0.1 | 0.0 | 0.0 | 0.1 | -- | 0.996 | 1.994 | -- | -- | " |
| 33.0 | 0.0 | 0.0 | -22.0 | -- | -- | -- | 7.496 | -8.600 | Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ |
| 33.0 | 0.0 | 0.0 | 22.0 | -- | 0.245 | 0.855 | -- | -- | " |
| 35.0 | 0.0 | 0.0 | -23.3 | -- | -- | -- | 9.147 | -10.104 | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ |
| 35.0 | 0.0 | 0.0 | 23.3 | -- | 0.224 | 0.813 | -- | -- | " |
| 35.0 | 0.0 | 0.0 | -23.3 | -- | -- | -- | 9.147 | -10.104 | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ |
| 35.0 | 0.0 | 0.0 | 23.3 | -- | 0.224 | 0.813 | -- | -- | " |

| | | |
|---|----------|--------------|
| Part: Block: Please specify project informations. Record: | Page: 35 | Archive No.: |
|---|----------|--------------|

Μήκος τοίχουFoot depth for statics: $z_f = -13.000$ **Stress analysis****Earth pressure, horizontal**

Pressures characteristic, no redistribution, continuous wall



| z [m] | eph,G,k [kN/m ²] | eah,G,k [kN/m ²] | eah,PQ,k [kN/m ²] | eah,d [kN/m ²] |
|----------|---------------------------------|---------------------------------|----------------------------------|-------------------------------|
| 0.00 | | 0.00 | | 0.00 |
| -0.93 | | 3.72 | 0.00 | 5.00 |
| -0.93 | | 3.72 | 5.76 | 13.64 |
| -1.50 | | 7.25 | 5.76 | 18.43 |
| -1.50 | | 4.82 | 15.23 | 29.36 |
| -4.00 | -0.00 | 11.97 | 15.23 | 39.00 |
| -4.00 | -100.29 | 11.97 | 15.23 | 39.00 |
| -4.50 | -110.34 | 12.86 | 15.23 | 40.21 |
| -4.50 | -117.95 | 13.38 | 4.15 | 24.29 |
| -10.00 | -745.71 | 30.24 | 4.15 | 47.05 |
| -10.00 | -908.05 | 27.52 | 3.81 | 42.87 |
| -10.06 | -914.91 | 27.69 | 3.81 | 43.10 |
| -10.06 | -914.91 | 27.69 | 0.00 | 37.38 |
| -13.00 | -1251.06 | 35.94 | 0.00 | 48.52 |

Eph,G,k: -5891.26, Eph,PG,k: 0.00 [kN/m]

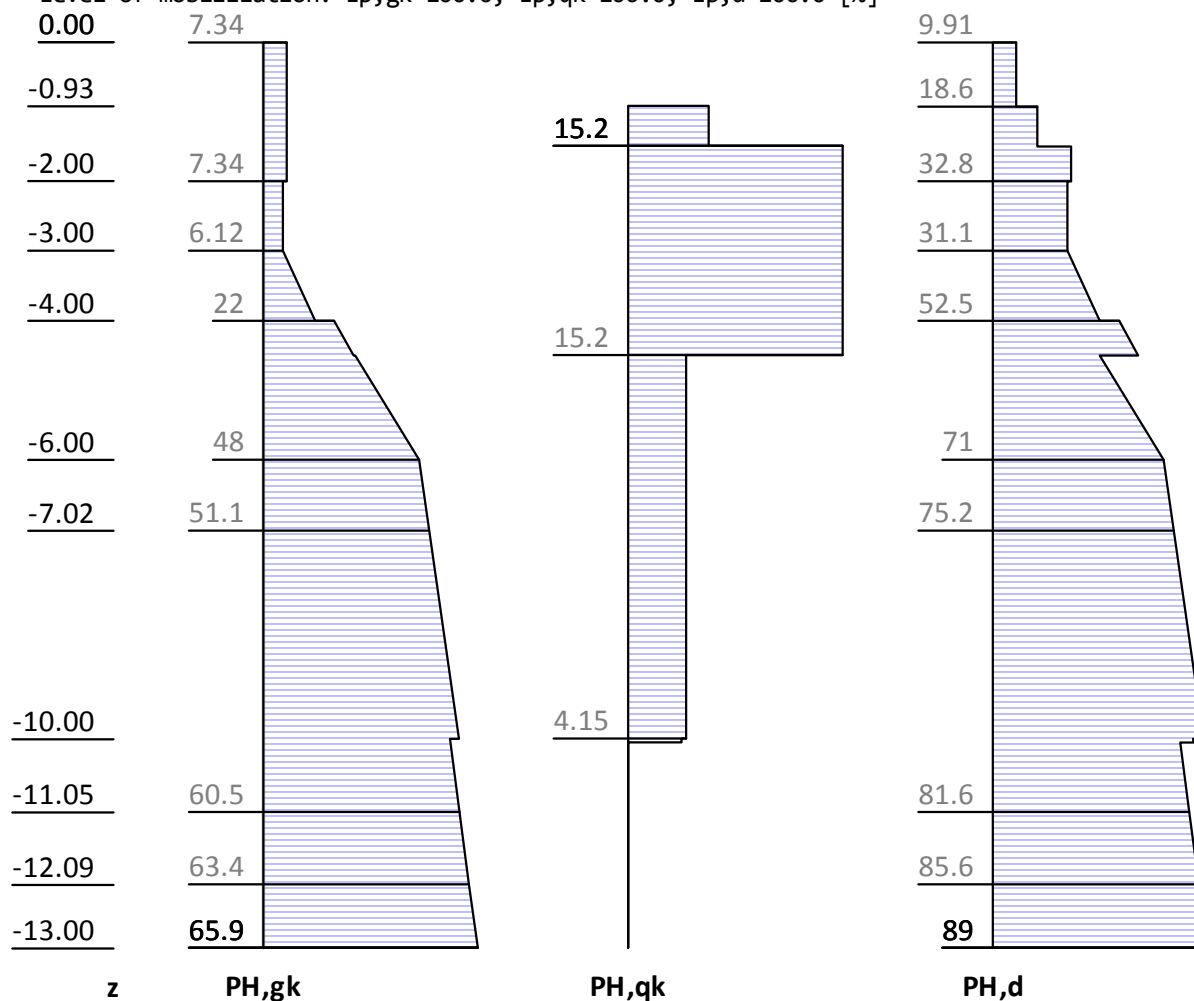
Eah,G,k: 248.27, Eah,PG,k: 0.00, Eah,PQ,k: 72.04, Eah,d: 443.22

Πίεση νερού

| z [m] | Wp,k [kN/m2] | Wa,k [kN/m2] | W,k [kN/m2] |
|----------|-----------------|-----------------|----------------|
| -3.00 | | 0.00 | 0.00 |
| -6.00 | 0.00 | 30.00 | 30.00 |
| -6.24 | -2.40 | 32.40 | 30.00 |
| -13.00 | -70.00 | 100.00 | 30.00 |

H-pressure on static system

Level of mobilization: Ep,gk 100.0, Ep,qk 100.0, Ep,d 100.0 [%]

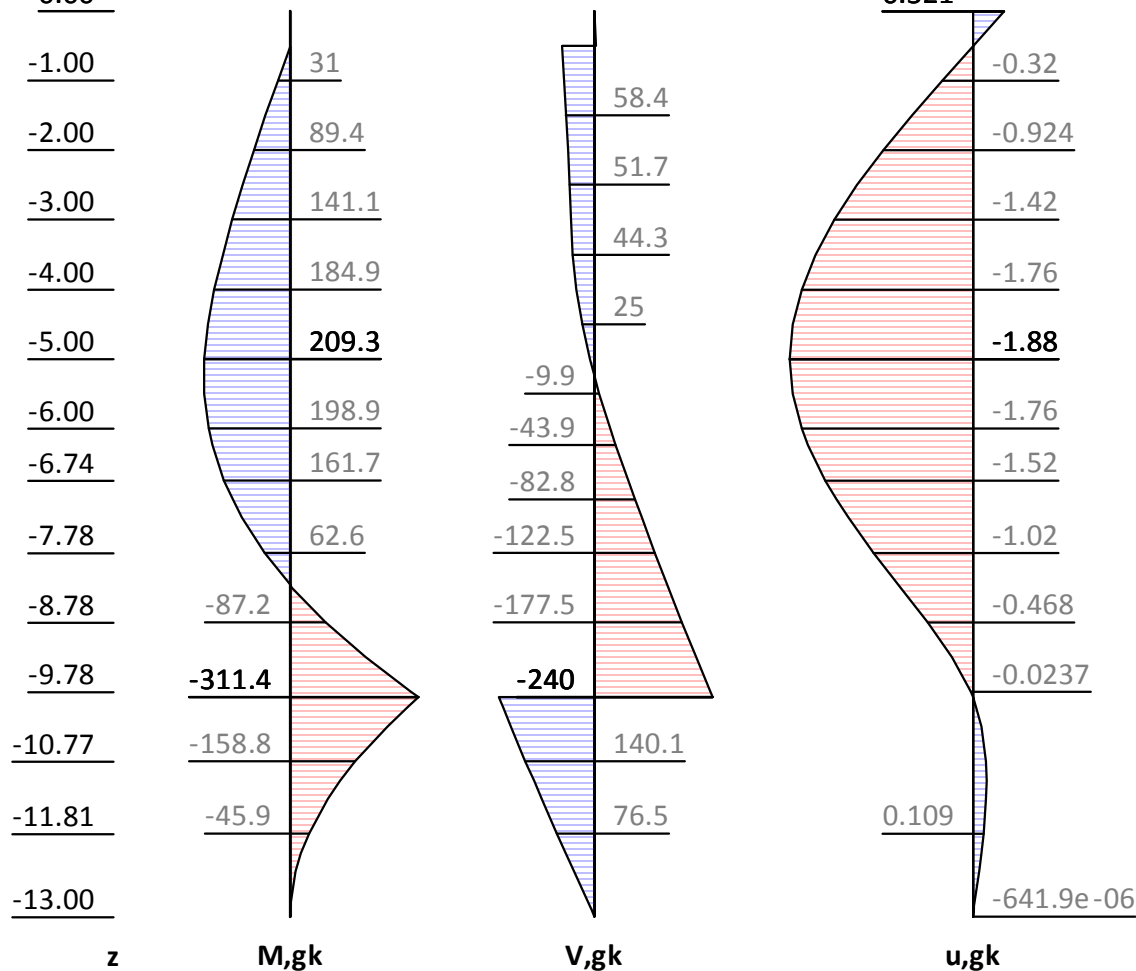


| z [m] | PH,gk [kN/m2] | PH,qk [kN/m2] | PH,d [kN/m2] |
|----------|------------------|------------------|-----------------|
| 0.00 | 7.34 | | 9.91 |
| -0.93 | 7.34 | 0.00 | 9.91 |
| -0.93 | 7.34 | 5.76 | 18.56 |
| -1.50 | 7.34 | 5.76 | 18.56 |
| -1.50 | 7.34 | 15.23 | 32.76 |
| -2.00 | 7.34 | 15.23 | 32.76 |
| -2.00 | 6.12 | 15.23 | 31.11 |
| -4.00 | 16.12 | 15.23 | 44.61 |
| -4.00 | 21.97 | 15.23 | 52.50 |
| -4.50 | 27.86 | 15.23 | 60.46 |
| -4.50 | 28.38 | 4.15 | 44.54 |
| -10.00 | 60.24 | 4.15 | 87.55 |
| -10.00 | 57.52 | 3.81 | 83.37 |
| -10.06 | 57.69 | 3.81 | 83.60 |
| -10.06 | 57.69 | 0.00 | 77.88 |
| -13.00 | 65.94 | 0.00 | 89.02 |

V-pressure on static system**Internal forces: Permanent, characteristically**

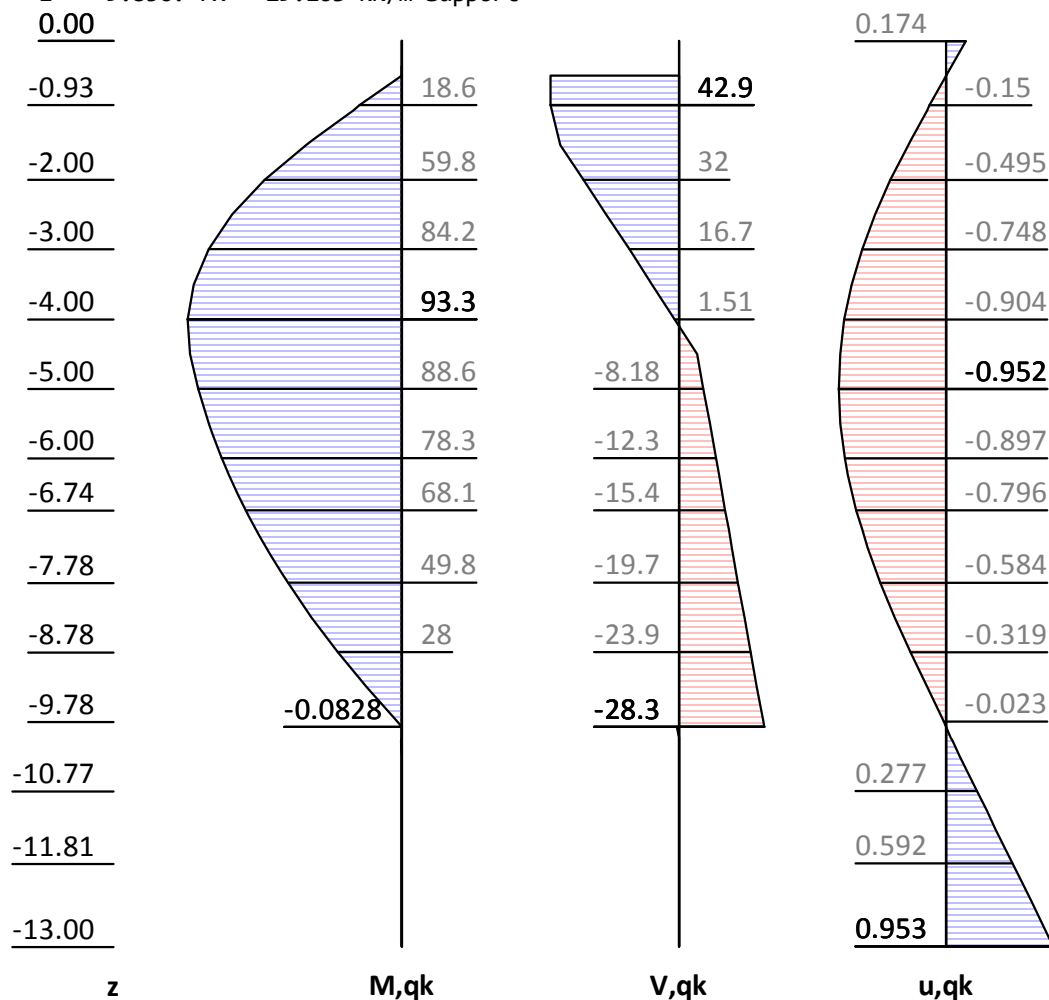
z= -0.500. Fx= -69.393 kN/m Support

z= -9.856. Fx=-433.875 kN/m Support

0.00

| z [m] | H, g, k [kN/m2] | M, g, k [kNm] | V, g, k [kN] | N, g, k [kN] | u, g, k [mm] |
|----------|--------------------|------------------|-----------------|-----------------|-----------------|
| 0.00 | 7.34 | -0.00 | 0.00 | 0.00 | 0.32 |
| -0.00 | 7.34 | -0.00 | 0.00 | -0.00 | 0.32 |
| -0.50 | 7.34 | -0.92 | -3.67 | -10.69 | 0.00 |
| -0.50 | 7.34 | -0.92 | -3.67 | -10.69 | -0.00 |
| -0.50 | 7.34 | -0.92 | 65.72 | -29.29 | -0.00 |
| -0.51 | 7.34 | -0.00 | 65.62 | -29.59 | -0.01 |
| -2.00 | 7.34 | 89.40 | 54.71 | -61.36 | -0.92 |
| -2.00 | 6.12 | 89.40 | 54.71 | -61.36 | -0.92 |
| -4.00 | 16.12 | 184.92 | 37.48 | -104.00 | -1.76 |
| -4.00 | 21.97 | 184.92 | 37.48 | -104.00 | -1.76 |
| -4.50 | 27.86 | 200.67 | 25.02 | -114.51 | -1.85 |
| -4.50 | 28.38 | 200.67 | 25.02 | -114.51 | -1.85 |
| -5.00 | 34.91 | 209.34 | 9.19 | -123.67 | -1.88 |
| -5.24 | 38.06 | 209.32 | 0.00 | -128.22 | -1.87 |
| -8.24 | 54.84 | -0.00 | -147.44 | -190.52 | -0.76 |
| -9.86 | 59.81 | -311.40 | -240.04 | -228.71 | 0.00 |
| -9.86 | 59.81 | -311.40 | 193.84 | -228.71 | 0.00 |
| -10.00 | 60.24 | -284.11 | 185.20 | -232.27 | 0.04 |
| -10.00 | 57.52 | -284.11 | 185.20 | -232.27 | 0.04 |
| -11.05 | 60.47 | -121.90 | 123.25 | -258.64 | 0.14 |
| -12.99 | 65.92 | -0.02 | 0.43 | -310.95 | 0.00 |

| z [m] | H, g, k [kN/m ²] | M, g, k [kN/m ²] | V, g, k [kN/m ²] | N, g, k [kN/m ²] | u, g, k [mm] |
|----------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|-----------------|
| -13.00 | 65.94 | 0.00 | 0.00 | -311.14 | -0.00 |

Internal forces: Variable, characteristicallyMethod EB 82-4 ($Q = [G+Q] - G$).z= -0.500. $F_x = -42.876$ kN/m Supportz= -9.856. $F_x = -29.163$ kN/m Support**0.00**

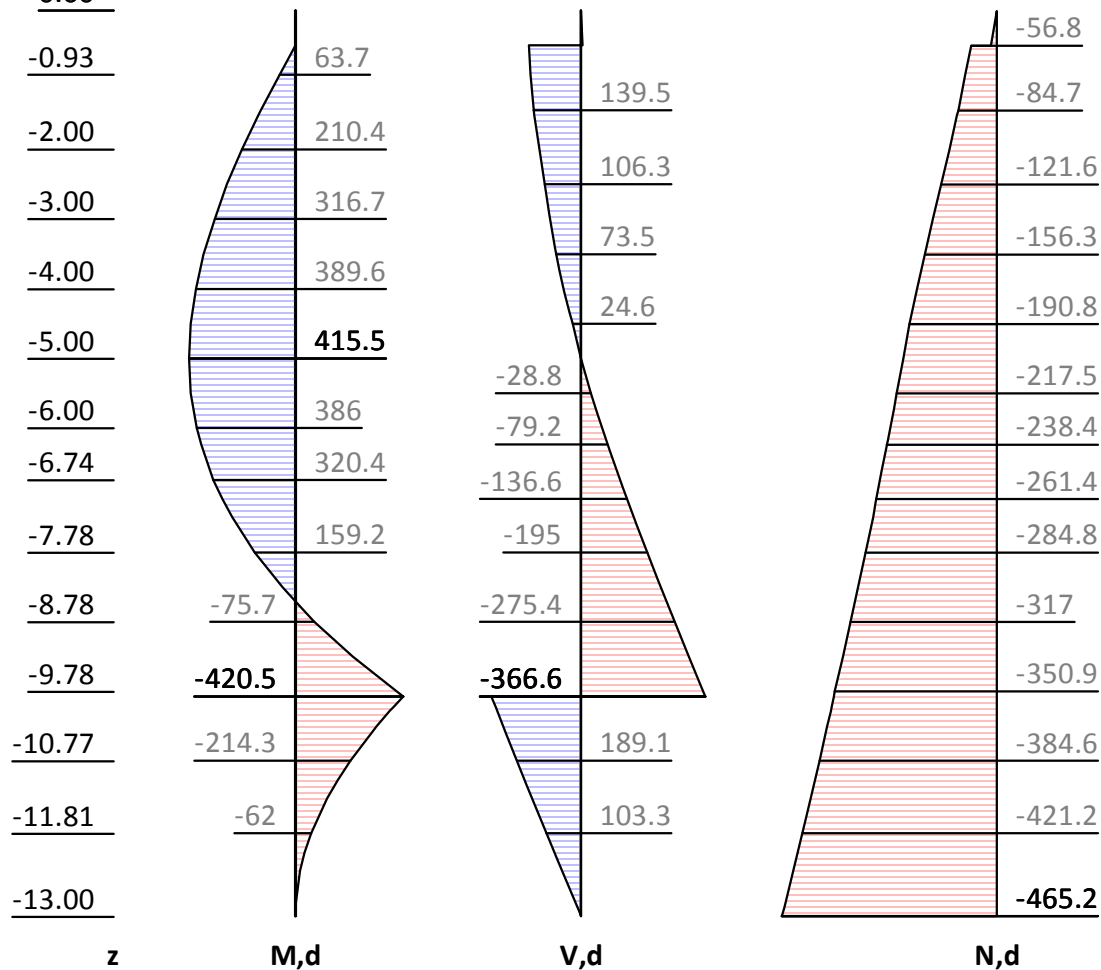
| z [m] | H, q, k [kN/m ²] | M, q, k [kN/m ²] | V, q, k [kN/m ²] | N, q, k [kN/m ²] | u, q, k [mm] |
|----------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|-----------------|
| 0.00 | | 0.00 | -0.00 | 0.00 | 0.17 |
| -0.38 | | 0.00 | -0.00 | 0.00 | 0.04 |
| -0.50 | | -0.00 | -0.00 | 0.00 | 0.00 |
| -0.50 | | -0.00 | 42.88 | -11.49 | -0.00 |
| -0.93 | 0.00 | 18.55 | 42.88 | -11.49 | -0.15 |
| -0.93 | 5.76 | 18.55 | 42.88 | -11.49 | -0.15 |
| -1.50 | 5.76 | 41.94 | 39.59 | -12.34 | -0.34 |
| -1.50 | 15.23 | 41.94 | 39.59 | -12.34 | -0.34 |
| -4.00 | 15.23 | 93.31 | 1.51 | -22.16 | -0.90 |
| -4.10 | 15.23 | 93.09 | 0.00 | -22.55 | -0.91 |
| -4.50 | 15.23 | 92.16 | -6.11 | -24.13 | -0.94 |
| -4.50 | 4.15 | 92.16 | -6.11 | -24.13 | -0.94 |
| -5.00 | 4.15 | 88.59 | -8.18 | -24.66 | -0.95 |
| -9.86 | 4.15 | -0.00 | -28.32 | -29.86 | -0.00 |
| -9.86 | 4.15 | -0.08 | -28.34 | -29.87 | 0.00 |
| -9.86 | 4.15 | -0.08 | 0.83 | -29.87 | 0.00 |
| -10.00 | 4.15 | -0.01 | 0.23 | -30.02 | 0.04 |
| -10.00 | 3.81 | -0.01 | 0.23 | -30.02 | 0.04 |

| z [m] | H, q, k [kN/m ²] | M, q, k [kN/m ²] | V, q, k [kN/m ²] | N, q, k [kN/m ²] | u, q, k [mm] |
|----------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|-----------------|
| -10.00 | 3.81 | -0.00 | 0.22 | -30.02 | 0.04 |
| -10.06 | 3.81 | 0.36 | 0.02 | -30.07 | 0.06 |
| -10.06 | 0.00 | 0.36 | 0.02 | -30.07 | 0.06 |
| -10.27 | 0.00 | 0.00 | 0.00 | -30.08 | 0.13 |
| -11.05 | 0.00 | 0.00 | -0.00 | -30.08 | 0.36 |
| -11.31 | 0.00 | 0.00 | -0.00 | -30.08 | 0.44 |
| -12.88 | 0.00 | -0.00 | -0.00 | -30.08 | 0.92 |
| -12.90 | 0.00 | -0.00 | -0.00 | -30.08 | 0.92 |
| -12.97 | 0.00 | -0.00 | 0.00 | -30.08 | 0.94 |
| -13.00 | 0.00 | 0.00 | 0.00 | -30.08 | 0.95 |

Internal forces: Design

z= -0.500. Fx=-157.995 kN/m Support

z= -9.856. Fx=-629.476 kN/m Support

0.00

| | | | | | |
|---|-------------------|------------------|----------------------|----------|------------------|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | | | | | Job No.: |
| Program: WALLS-Retain. Version 2017.046 | | | | | |
| Structure: | info@fides-dvp.de | www.fides-dvp.de | Tel:++49/89/143829-0 | ASB Nr.: | Date: 08.10.2018 |

0.00

-0.93

-2.00

-3.00

-4.00

-5.00

-6.00

-6.74

-7.78

-8.78

-9.78

-10.77

-11.81

-13.00

z

9.91

18.6

32.8

31.1

52.5

71

75.2

81.6

85.6

89

H,d

0.496

-0.425

-1.42

-2.17

-2.66

-2.83

-2.66

-2.32

-1.6

-0.787

-0.0467

0.416

0.701

0.952

u,g+q,k

| z [m] | H,d [kN/m2] | M,d [kN/m2] | V,d [kN/m2] | N,d [kN/m2] | u,g+q,k [mm] |
|----------|----------------|----------------|----------------|----------------|-----------------|
| 0.00 | 9.91 | 0.00 | 0.00 | 0.00 | 0.50 |
| -0.00 | 9.91 | -0.00 | 0.00 | -0.00 | 0.50 |
| -0.50 | 9.91 | -1.24 | -4.96 | -14.43 | 0.00 |
| -0.51 | 9.91 | 0.00 | 152.96 | -57.01 | -0.01 |
| -0.93 | 9.91 | 63.65 | 148.78 | -69.18 | -0.42 |
| -0.93 | 18.56 | 63.65 | 148.78 | -69.18 | -0.42 |
| -1.50 | 18.56 | 145.44 | 138.20 | -86.91 | -0.97 |
| -1.50 | 32.76 | 145.44 | 138.20 | -86.91 | -0.97 |
| -2.00 | 32.76 | 210.44 | 121.82 | -104.29 | -1.42 |
| -2.00 | 31.11 | 210.44 | 121.82 | -104.29 | -1.42 |
| -4.00 | 44.61 | 389.61 | 52.85 | -173.64 | -2.66 |
| -4.00 | 52.50 | 389.61 | 52.85 | -173.64 | -2.66 |
| -4.50 | 60.46 | 409.15 | 24.61 | -190.78 | -2.79 |
| -4.50 | 44.54 | 409.15 | 24.61 | -190.78 | -2.79 |
| -5.00 | 53.36 | 415.49 | 0.13 | -203.94 | -2.83 |
| -5.00 | 53.40 | 415.45 | 0.00 | -204.00 | -2.83 |
| -8.48 | 81.27 | -0.00 | -251.21 | -307.31 | -1.03 |
| -9.86 | 86.97 | -420.51 | -366.55 | -353.56 | 0.00 |
| -9.86 | 86.97 | -420.51 | 262.92 | -353.56 | 0.00 |
| -10.00 | 87.55 | -383.55 | 250.36 | -358.60 | 0.08 |
| -10.00 | 83.37 | -383.55 | 250.36 | -358.60 | 0.08 |
| -10.06 | 83.60 | -368.68 | 245.35 | -360.67 | 0.11 |
| -10.06 | 77.88 | -368.68 | 245.35 | -360.67 | 0.11 |
| -13.00 | 89.02 | -0.00 | -0.00 | -465.15 | 0.95 |

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| Part: | | Archive No.: |
| Block: | Please specify project informations. | Page: 41 |
| Record: | | |

Anchor forces with safety level of DS-P

| z[m] | A,d[kN] | Fx,d[kN/m] |
|-------|---------|------------|
| -0.50 | 294.4 | -158.0 |

Checks of earth statics**Check of earth support**

Check: Mobilizable earth resistance is sufficient for earth support force.

z: -9.86 m

$R_d = E_{ph,k}/\gamma, R_e = 5891.26 / 1.400 = 4208.04 \text{ [kN/m]}$

$E_d(U_h,d)/R_d = 629.48 / 4208.04 = 0.150 \text{ [-]}. \text{ Passes requirement}$

Sum of H and V forces, (G)

Forces up to depth z:-13.00

| Pos. | H | V |
|---|---------|-----------------------|
| H/V pressure G+P+W,k | 503.27 | 90.93 |
| Wall weight | | 201.61 |
| H/V pressure passive | | 0.00 |
| Support z: -0.50 | -69.39 | 18.59 |
| B _{h,g,k} z=-9.86 | -433.87 | |
| B _{v,g,k} = B _{h,k} * tan($\delta, p=-22.00^\circ$) | | -175.30 |
| Σ | -0.00 | 135.84 (downwards) |

Average anchor inclination $\alpha, A = 15.00^\circ \geq 15^\circ$.

Verification of vertical forces due to EAB R 9 not required (R 9-5).

Check EAB R 9-1

Vertical component of earth resistance is less than the downwards pointing vertical forces.

$V_k \geq B_{vk}: 311.14 \geq 175.30 \text{ Passes requirement}$

Sum of H and V forces, (G+Q)

Forces up to depth z:-13.00

| Pos. | H | V |
|---|---------|-----------------------|
| H/V pressure G+P+W,k | 575.31 | 109.52 |
| Wall weight | | 201.61 |
| H/V pressure passive | | 0.00 |
| Support z: -0.50 | -112.27 | 30.08 |
| B _{h,g,k} z=-9.86 | -433.87 | |
| B _{v,g,k} = B _{h,k} * tan($\delta, p=-22.00^\circ$) | | -175.30 |
| B _{h,q,k} z=-9.86 | -29.16 | |
| B _{v,q,k} = B _{h,k} * tan($\delta, p=-22.00^\circ$) | | -11.78 |
| Σ | -0.00 | 154.14 (downwards) |

Average anchor inclination $\alpha, A = 15.00^\circ \geq 15^\circ$.

Verification of vertical forces due to EAB R 9 not required (R 9-5).

Check EAB R 9-1

Vertical component of earth resistance is less than the downwards pointing vertical forces.

$V_k \geq B_{vk}: 341.21 \geq 187.08 \text{ Passes requirement}$

Anchor verification

| | | | | | | |
|--|--|--|--|--|-------------------------|--|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | | | | | Job No.: | |
| Program: WALLS-Retain. | | | | | Version 2017.046 | |
| Structure: info@fides-dvp.de www.fides-dvp.de Tel:++49/89/143829-0 ASB Nr.: | | | | | Date: 08.10.2018 | |

Anchor - Stability of lower failure plane

Περίπτ.Φόρτισης: όλα τα φορτία BS-P
 Αυτόμ. υπολογ. μήκους αγκυρίων:
 All anchors are extended (if necessary)
 Favourable variable loads in main failure body are not being considered.
 Bottom of lower failure plane: z=-13.00 m

Iteration of failure mechanisms:
 lA: Length of anchor from head to center of grout body.
 W,k: Res. force from dead weight, loads, cohesion, ...
 Q,k: Force in lower failure plane.
 Ea1,k.....: Earth pressure onto vertical separation plane.
 Ea2,k.....: Earth pressure between wall and main failure body.
 Ra_cal,d: Dimesioning force of the resistance from the equilibrium of forces.
 Ra_cal,d corresponds to the max. possible anchor force of the force polygon.
 Sum(A,d): Acting anchor forces along the grout body fractions within the failure body. Sum(A,d) is gained from the anchor pull forces of the wall analysis.

| z | θ1 | θ2 | lA | W,k | Q,k | Ea1,k | Ea2,k | Ra_cal,d | Sum(A,d) | Ed/Rd |
|-------|------|------|-------|--------|--------|--------|--------|----------|----------|-------|
| [m] | [°] | [°] | [m] | [kN/m] | [kN/m] | [kN/m] | [kN/m] | [kN/m] | [kN/m] | [-] |
| -0.50 | 40.5 | 57.5 | 11.55 | 1367.3 | 1211.1 | 4.4 | 338.5 | 164.2 | 163.6 | 1.00 |

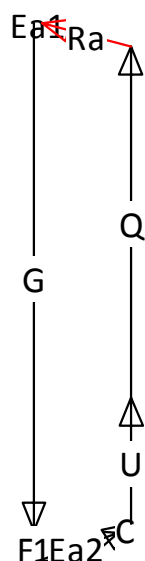
Decisive failure body:
Γεωμετρία:
 Foot point of lower failure plane x/z = 0.01/-13.00 m
 Intersection lower/upper slid. plane x/z = 11.16/ -3.49 m
 Intersection upper slid. plane/surface x/z = 13.38/ 0.00 m
 Intersection separation plane/surface x/z = 11.16/ 0.00 m
 Inclination lower failure plane θ1 = 40.47°
 Inclination upper failure plane θ2 = 57.50°
 Inclination separation plane θ12 = 90.00°

Loads / forces (char.)

| | | Fx | Fz | F | |
|------------------------------------|-----------|--------|---------|--------|---------|
| | | [kN/m] | [kN/m] | [kN/m] | |
| Weight of main failure body | G,k: | 0.0 | -1910.7 | 1910.7 | |
| Area loads on/in main failure body | F1,k: | 0.0 | -130.0 | 130.0 | |
| Cohesion of lower failure plane | C,k: | 109.0 | 93.0 | 143.3 | |
| Pore water pressure on main body | U,k: | -0.0 | 584.7 | 584.7 | |
| Earth pres. on separation plane | Ea1,k: | -4.4 | -0.0 | 4.4 | δ= 0.0° |
| Earth pr. between wall<->main body | Ea2,k: | 320.3 | 109.5 | 338.5 | |
| Force in lower failure plane | Q,k: | -202.9 | 1194.0 | 1211.1 | |
| Sum = possible anchor forces: | Ra_cal,k: | 222.0 | -59.5 | 229.8 | |

Force polygon

| | | |
|---------|--------------------------------------|--------------|
| Part: | | Archive No.: |
| Block: | Please specify project informations. | |
| Record: | Page: 43 | |



Acting anchor forces $E_d: \sum(A,d) = 163.6 \text{ kN/m}$
 Possible anchor forces $R_d: R_{a_cal,d} = 229.8/1.400 = 164.2 \text{ kN/m}$
 Verif. of lower failure plane $E_d/R_d = 1.00 < 1.0$: Έλεγχος εκπληρώθηκε.

Check of steel tension

l_{tot} ...[m]: Total length of anchor incl. excess length at head
 A_s [mm²]: X-section area of steel member
 $R_{i,d}$...[kN]: Ultimate strength of tension member ($\gamma, M=1.15$)
 $A_{d,d}$ [kN]: Dimensioning force of the anchor from wall analysis

| z[m] | Anchor type | l_{tot} | A_s | $R_{i,d}$ | $A_{d,d}$ |
|-------|----------------------------|-----------|-------|-----------|--------------------|
| -0.50 | Strand; 3x0.60"; 1570/1770 | 15.55 | 420 | 573.4 | 294.4 |
| | | | | | Passes requirement |

Check of steel tension: Passes requirement

Check of anchor's soil friction

l_{Vk} : Length of grout body
 D_{mVk} : Diameter of grout body
 $\tau_{Gr,k}$: Average applied skin friction along the grout body (from soil parameters)
 $R_{a,k}$: Charact. pullout resistance of the anchor
 γ_A : Partial safety factor of anchor pullout
 $R_{a,d}$: $R_{a,k} / \gamma_A$
 $A_{d,d}$: Dimensioning force of the anchor from wall analysis

| z | l_{Vk} | D_{mVk} | $\tau_{Gr,k}$ | $R_{a,k}$ | γ_A | $R_{a,d}$ | $A_{d,d}$ | $A_{d,d}/R_{a,d}$ |
|-------|----------|-----------|----------------------|-----------|------------|-----------|-----------|-------------------|
| [m] | [m] | [mm] | [kN/m ²] | [kN] | [-] | [kN] | [kN] | [-] |
| -0.50 | 8.00 | 318 | 110 | 879.1 | 1.100 | 799.2 | 294.4 | 0.4 |

Check of anchor's soil friction: Passes requirement

Υπολογ. κύκλου ολίσθησης

LC: όλα τα φορτία Type: BS-T (combination: [GEO] A2 M2 R3, BS-T)
 Vertical variable loads only act if they are outside of $R \cdot \sin(\phi)$.
 The automatic slip circle optimization only considers circles that intersect the surface with an area of at least 0.25 m².
 The slip circle calculation only accepts circles including the wall.
 The slipcircle calculation only allows circular failure planes (no vertical tangents will occur).

Γεωμετ. κύκλου (μήκη και συντεταγμ. σε (m))
 Κέντρο = (-2.54, 0.20), Ακτίνα = 13.45
 Αρχ.σημ. = (-15.32, -4.00), Τελ.σημ. = (10.91, 0.00)

Γεωμετρία λωρίδων:

| No | x | Width b | dxM | Weight | Load z-κατ. | Water- φορτ. | u*b | φ | c | θ |
|----|--------|------------|--------|--------|----------------|-----------------|--------|-------|---------|---------|
| | [m] | [m] | [m] | [kN/m] | [kN/m] | [kN/m] | [kN/m] | [°] | [kN/m²] | [°] |
| 1 | -14.65 | 1.35 | -12.11 | 48.7 | 0.0 | 0.0 | -6.0 | 27.45 | 3.57 | -31.27* |
| 2 | -13.30 | 1.35 | -10.76 | 115.5 | 0.0 | 0.0 | -24.1 | 27.45 | 3.57 | -31.27* |
| 3 | -11.96 | 1.35 | -9.42 | 162.0 | 0.0 | 0.0 | -45.2 | 27.45 | 3.57 | -31.27* |
| 4 | -10.61 | 1.35 | -8.07 | 196.9 | 0.0 | 0.0 | -60.9 | 29.26 | 3.57 | -30.37* |
| 5 | -9.27 | 1.35 | -6.73 | 223.8 | 0.0 | 0.0 | -73.0 | 29.26 | 3.57 | -30.00 |
| 6 | -7.92 | 1.35 | -5.38 | 244.4 | 0.0 | 0.0 | -82.2 | 29.26 | 3.57 | -23.58 |
| 7 | -6.58 | 1.35 | -4.04 | 259.6 | 0.0 | 0.0 | -89.0 | 29.26 | 3.57 | -17.46 |
| 8 | -5.23 | 1.35 | -2.69 | 270.2 | 0.0 | 0.0 | -93.7 | 29.26 | 3.57 | -11.54 |
| 9 | -3.89 | 1.35 | -1.35 | 276.3 | 0.0 | 0.0 | -96.4 | 29.26 | 3.57 | -5.74 |
| 10 | -2.54 | 1.35 | 0.00 | 278.4 | 0.0 | 0.0 | -97.3 | 29.26 | 3.57 | 0.00 |
| 11 | -1.20 | 1.35 | 1.35 | 276.3 | 0.0 | 0.0 | -96.4 | 29.26 | 3.57 | 5.74 |
| 12 | 0.15 | 1.35 | 2.69 | 333.5 | 0.0 | 0.0 | -113.8 | 29.26 | 3.57 | 11.54 |
| 13 | 1.50 | 1.35 | 4.04 | 363.2 | 0.0 | 0.0 | -129.3 | 29.26 | 3.57 | 17.46 |
| 14 | 2.84 | 1.35 | 5.38 | 348.0 | 0.0 | 0.0 | -122.5 | 29.26 | 3.57 | 23.58 |
| 15 | 4.19 | 1.35 | 6.73 | 327.4 | 35.0 | 0.0 | -113.3 | 29.26 | 3.57 | 30.00 |
| 16 | 5.53 | 1.35 | 8.07 | 300.5 | 35.0 | 0.0 | -101.3 | 29.26 | 3.57 | 36.87 |
| 17 | 6.88 | 1.35 | 9.42 | 265.6 | 35.0 | 0.0 | -85.6 | 27.45 | 3.57 | 44.43 |
| 18 | 8.22 | 1.35 | 10.76 | 219.1 | 24.7 | 0.0 | -64.5 | 27.45 | 3.57 | 53.13 |
| 19 | 9.90 | 2.02 | 12.44 | 194.1 | 0.0 | 0.0 | -39.2 | 27.45 | 3.57 | 67.66 |

*** Σημείωση: Στις λωρίδες σημειωμένες με '*'
περιορίστηκε το theta στο 45°-Phi/2.

Συνεισφ. κατακόρυφων φορτίων:

| No | Weight | G*sin(θ) | (G-u*b)*tan(φ) + c*b | μ*sin(θ)* tan(φ)+cos(θ) | T |
|--------|--------|----------|-------------------------|----------------------------|---------|
| | [kN/m] | [kN/m] | [kN/m] | [-] | [kN/m] |
| 1 | 48.66 | -43.80 | 26.99 | 0.784767 | 34.39 |
| 2 | 115.49 | -92.39 | 52.28 | 0.784767 | 66.62 |
| 3 | 161.97 | -113.38 | 65.47 | 0.784767 | 83.43 |
| 4 | 196.94 | -118.16 | 80.99 | 0.789322 | 102.61 |
| 5 | 223.82 | -111.91 | 89.31 | 0.793409 | 112.56 |
| 6 | 244.38 | -97.75 | 95.68 | 0.858422 | 111.46 |
| 7 | 259.62 | -77.88 | 100.40 | 0.910370 | 110.28 |
| 8 | 270.15 | -54.03 | 103.67 | 0.950750 | 109.04 |
| 9 | 276.34 | -27.63 | 105.58 | 0.980465 | 107.69 |
| 10 | 278.38 | 0.00 | 106.22 | 1.000002 | 106.22 |
| 11 | 276.34 | 27.64 | 105.58 | 1.009513 | 104.59 |
| 12 | 333.51 | 66.71 | 127.85 | 1.008845 | 126.73 |
| 13 | 363.21 | 108.97 | 135.82 | 0.997512 | 136.16 |
| 14 | 347.97 | 139.19 | 131.09 | 0.974612 | 134.51 |
| 15 | 362.39 | 181.20 | 144.32 | 0.938645 | 153.75 |
| 16 | 335.50 | 201.30 | 136.01 | 0.887143 | 153.31 |
| 17 | 300.53 | 210.38 | 116.49 | 0.808431 | 144.09 |
| 18 | 243.78 | 195.03 | 97.97 | 0.707756 | 138.42 |
| 19 | 194.12 | 179.55 | 87.70 | 0.504691 | 173.77 |
| ----- | | | | | ----- |
| 573.04 | | | | | 2209.63 |

Συνεισφ. αγκυρίων: Αθρ. ροπών ανατροπής : -1.4 kN*m/m
" " resisting : 1.3 kN*m/m

Δράση $E_d = (573.0 * 13.45 - 1.4)$

Αντίσταση $R_d = (2209.6 * 13.45 + 1.3)$

$SLIP-CIRCLE \mu = E_d/R_d = 0.26 < 1.0$: Έλεγχος εκπληρώθηκε.

| | | | | |
|------------|--|------------------|-------------------------------|------------------|
| Author: | FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | | | Job No.: |
| Program: | WALLS-Retain. Version 2017.046 | | | |
| Structure: | info@fides-dvp.de | www.fides-dvp.de | Tel:++49/89/143829-0 ASB Nr.: | Date: 08.10.2018 |

Φάση εκσκαφής 4 "[4] Situation 4"

LC: όλα τα φορτία Type: BS-T

Εδαφικό σύστημα με 5 Στρώσεις

| Name | Τεχνητές επιχωματώσεις | Αμμόδης ΑΡΓΙΛΟΣ | Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ | |
|-------------|------------------------|-----------------|--------------------------|-----------|
| γ | [kN/m3] | 18 | 20 | 22.5 |
| γ,R | [kN/m3] | 18 | 20 | 22.5 |
| γ' | [kN/m3] | 8 | 10 | 12.5 |
| γ,p | [kN/m3] | 18 | 20 | 22.5 |
| γ,R,passive | [kN/m3] | 18 | 20 | 22.5 |
| γ,pw | [kN/m3] | 8 | 10 | 12.5 |
| φ | [°] | 25 | 0.1 | 33 |
| c | [kN/m2] | 2 | 50 | 5 |
| c,u | [kN/m2] | 10 | 50 | 5 |
| c παθητικό | [kN/m2] | 2 | 50 | 5 |
| δ,a | [°] | 16.66667 | 0.06666667 | 22 |
| δ,p | [°] | -16.66667 | -0.06666667 | -22 |
| δ,c | [°] | 8.333333 | 0.03333333 | 11 |
| k,agh | [-] | 0.3456501 | 0.9955057 | 0.2452023 |
| K,ach | [-] | 1.043051 | 1.994195 | 0.8549058 |
| K,0h | [-] | 0.5773817 | 0.9982547 | 0.455361 |
| K,pgh | [-] | 3.908103 | 1.004519 | 7.495617 |
| K,pch | [-] | 5.180327 | 2.00583 | 8.599509 |
| τ,gr | [kN/m2] | 110 | 110 | 110 |
| Ψ,A,max | [°] | 90 | 90 | 90 |
| k | [cm/s] | 10e-06 | 1e-06 | 100e-06 |

| Name | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ | |
|-------------|------------------------|------------------------|-----------|
| γ | [kN/m3] | 22.5 | 22.5 |
| γ,R | [kN/m3] | 22.5 | 22.5 |
| γ' | [kN/m3] | 12.5 | 12.5 |
| γ,p | [kN/m3] | 22.5 | 22.5 |
| γ,R,passive | [kN/m3] | 22.5 | 22.5 |
| γ,pw | [kN/m3] | 12.5 | 12.5 |
| φ | [°] | 35 | 35 |
| c | [kN/m2] | 5 | 5 |
| c,u | [kN/m2] | 5 | 5 |
| c παθητικό | [kN/m2] | 5 | 5 |
| δ,a | [°] | 23.33333 | 23.33333 |
| δ,p | [°] | -23.33333 | -23.33333 |
| δ,c | [°] | 11.66667 | 11.66667 |
| k,agh | [-] | 0.2244207 | 0.2244207 |
| K,ach | [-] | 0.8126539 | 0.8126539 |
| K,0h | [-] | 0.4264236 | 0.4264236 |
| K,pgh | [-] | 9.146943 | 9.146943 |
| K,pch | [-] | 10.104 | 10.104 |
| τ,gr | [kN/m2] | 110 | 110 |
| Ψ,A,max | [°] | 90 | 90 |
| k | [cm/s] | 100e-06 | 100e-06 |

Πορεία πρανούς:

x [m] 0.00 0.00
z [m] -4.00 0.00

Πορεία ανώτερου 2. στρώματος Αμμόδης ΑΡΓΙΛΟΣ:

x [m] 0.00 0.00
z [m] -4.00 -1.50

Πορεία ανώτερου 3. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ:

z= -4.50

Πορεία ανώτερου 4. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟΣ:

z= -10.00

| | | |
|---------|--------------------------------------|--------------|
| Part: | | Archive No.: |
| Block: | Please specify project informations. | Page: 46 |
| Record: | | |

| | |
|--|------------------|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | Job No.: |
| Program: WALLS-Retain. Version 2017.046 | |
| Structure: info@fides-dvp.de www.fides-dvp.de Tel:++49/89/143829-0 ASB Nr.: | Date: 08.10.2018 |

Πορεία ανώτερου 5. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ:
 z= -14.00

Επιφ. φορτία:

Φορτία

| xA | zA | xE | zE | PxA | PzA | PxE | PzE | Typ | LC-description |
|------|------|------|------|------|-------|------|-------|-----|----------------|
| [m] | [m] | [m] | [m] | [| kN/m² | |] | | Name |
| 2.00 | 0.00 | 8.50 | 0.00 | 0.00 | 20.00 | 0.00 | 20.00 | q | 1 |

Κατανομή εδαφ.πιέσεων

| Κατανομή εδαφ.πιέσεων | Name |
|----------------------------|------|
| Rectangular within a layer | |

Στάθμη νερού:

| | | |
|-------|-------|-------|
| x [m] | 0.00 | 0.00 |
| z [m] | -6.00 | -3.00 |

Αγκύρια

| z[m] | min.l[m] | Alpha[°] | C-H[kN/m] | P0[kN] | u0[m] |
|-------|----------|----------|-----------|--------|--------|
| -0.50 | 0.00 | 15.00 | 0.00 | 0.00 | 0.0000 |
| -3.00 | 0.00 | 15.00 | αόρισ. | 0.00 | 0.0000 |

Παράμετροι υπολογισμού

Earth pressure options

Τμήμα εδαφ.ωθήσεων: Ενεργές ωθήσεις.
 Angle of slip plane: DIN 4085.
 Split block loads into 1 sections.
 Consideration of minimum earth pressure: φ,min = 40.000.
 Negative earth pressure fractions are set to zero.

Redistribution of earth pressure

Shape of redistribution: Triangle (perpend. to wall).
 The earth pressure is getting redistrib. to: Excavation level
 The earth pressure below the excavation acts without redistrib.
 Levels of redistribution Z1: -0.500, Z2: -3.000 [m].
 The earth pressure from variable loads will be included in redistribution.

Παθητικές ωθήσεις

Method of calculation: Κλασικός, Pregl/Sokolovsky (DIN 4085).

Options for water pressure

Στήριξη πόδα

Πόδας οριζοντίως μετακινούμενος

Αγκύρια

Anchor checks (lower failure plane): Ναι
 Anchor forces with safety level of DS-P: Ναι
 Verification of grout body pull out forces: Ναι
 δ,a,Anchoring wall : used from soil layer.
 δ,p,Anchoring wall : used from soil layer.

Earth pressure coefficients kh

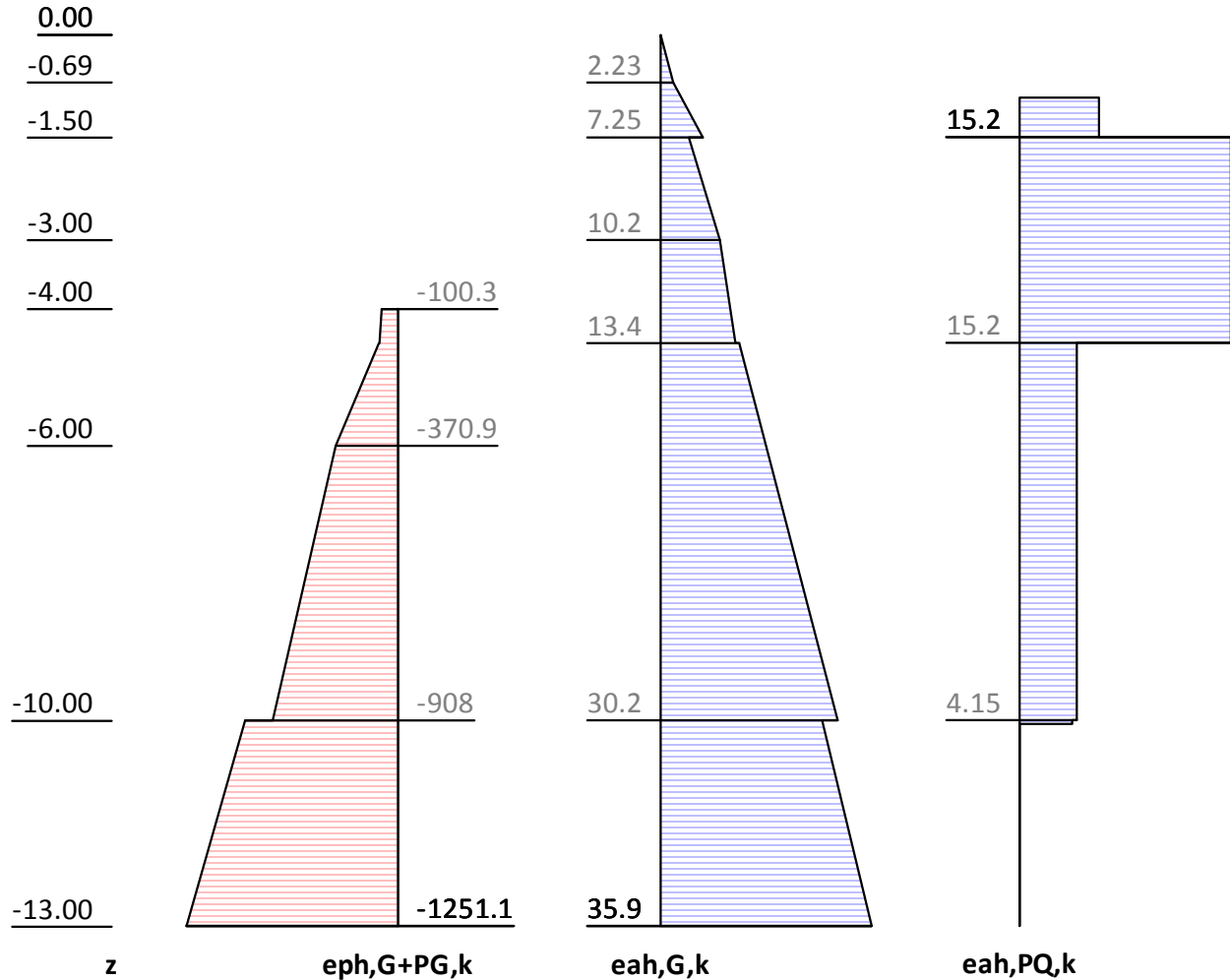
| φ | α | β | δ | k0gh | kagh | kach | kpgh | kpch | |
|------|-----|-----|-------|------|-------|-------|-------|---------|--------------------------|
| 0.1 | 0.0 | 0.0 | -0.1 | -- | -- | -- | 1.005 | -2.006 | Τεχνητές επιχωματώσεις |
| 25.0 | 0.0 | 0.0 | 16.7 | -- | 0.346 | 1.043 | -- | -- | " |
| 0.1 | 0.0 | 0.0 | -0.1 | -- | -- | -- | 1.005 | -2.006 | Αμμώδης ΑΡΓΙΛΟΣ |
| 0.1 | 0.0 | 0.0 | 0.1 | -- | 0.996 | 1.994 | -- | -- | " |
| 33.0 | 0.0 | 0.0 | -22.0 | -- | -- | -- | 7.496 | -8.600 | Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ |
| 33.0 | 0.0 | 0.0 | 22.0 | -- | 0.245 | 0.855 | -- | -- | " |
| 35.0 | 0.0 | 0.0 | -23.3 | -- | -- | -- | 9.147 | -10.104 | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ |
| 35.0 | 0.0 | 0.0 | 23.3 | -- | 0.224 | 0.813 | -- | -- | " |
| 35.0 | 0.0 | 0.0 | -23.3 | -- | -- | -- | 9.147 | -10.104 | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ |
| 35.0 | 0.0 | 0.0 | 23.3 | -- | 0.224 | 0.813 | -- | -- | " |

| | |
|---|--------------|
| Part: Block: Please specify project informations. Record: | Archive No.: |
|---|--------------|

Page: 47

Μήκος τοίχουFoot depth for statics: $z_f = -13.000$ **Stress analysis****Earth pressure, horizontal**

Pressures characteristic, no redistribution, continuous wall



| z [m] | eph, G, k [kN/m ²] | eah, G, k [kN/m ²] | eah, PQ, k [kN/m ²] | eah, d [kN/m ²] |
|----------|-----------------------------------|-----------------------------------|------------------------------------|--------------------------------|
| 0.00 | | 0.00 | | 0.00 |
| -0.93 | | 3.72 | 0.00 | 5.00 |
| -0.93 | | 3.72 | 5.76 | 13.64 |
| -1.50 | | 7.25 | 5.76 | 18.43 |
| -1.50 | | 4.82 | 15.23 | 29.36 |
| -4.00 | -0.00 | 11.97 | 15.23 | 39.00 |
| -4.00 | -100.29 | 11.97 | 15.23 | 39.00 |
| -4.50 | -110.34 | 12.86 | 15.23 | 40.21 |
| -4.50 | -117.95 | 13.38 | 4.15 | 24.29 |
| -10.00 | -745.71 | 30.24 | 4.15 | 47.05 |
| -10.00 | -908.05 | 27.52 | 3.81 | 42.87 |
| -10.06 | -914.91 | 27.69 | 3.81 | 43.10 |
| -10.06 | -914.91 | 27.69 | 0.00 | 37.38 |
| -13.00 | -1251.06 | 35.94 | 0.00 | 48.52 |

Eph, G, k: -5891.26, Eph, PG, k: 0.00 [kN/m]

Eah, G, k: 248.27, Eah, PG, k: 0.00, Eah, PQ, k: 72.04, Eah, d: 443.22

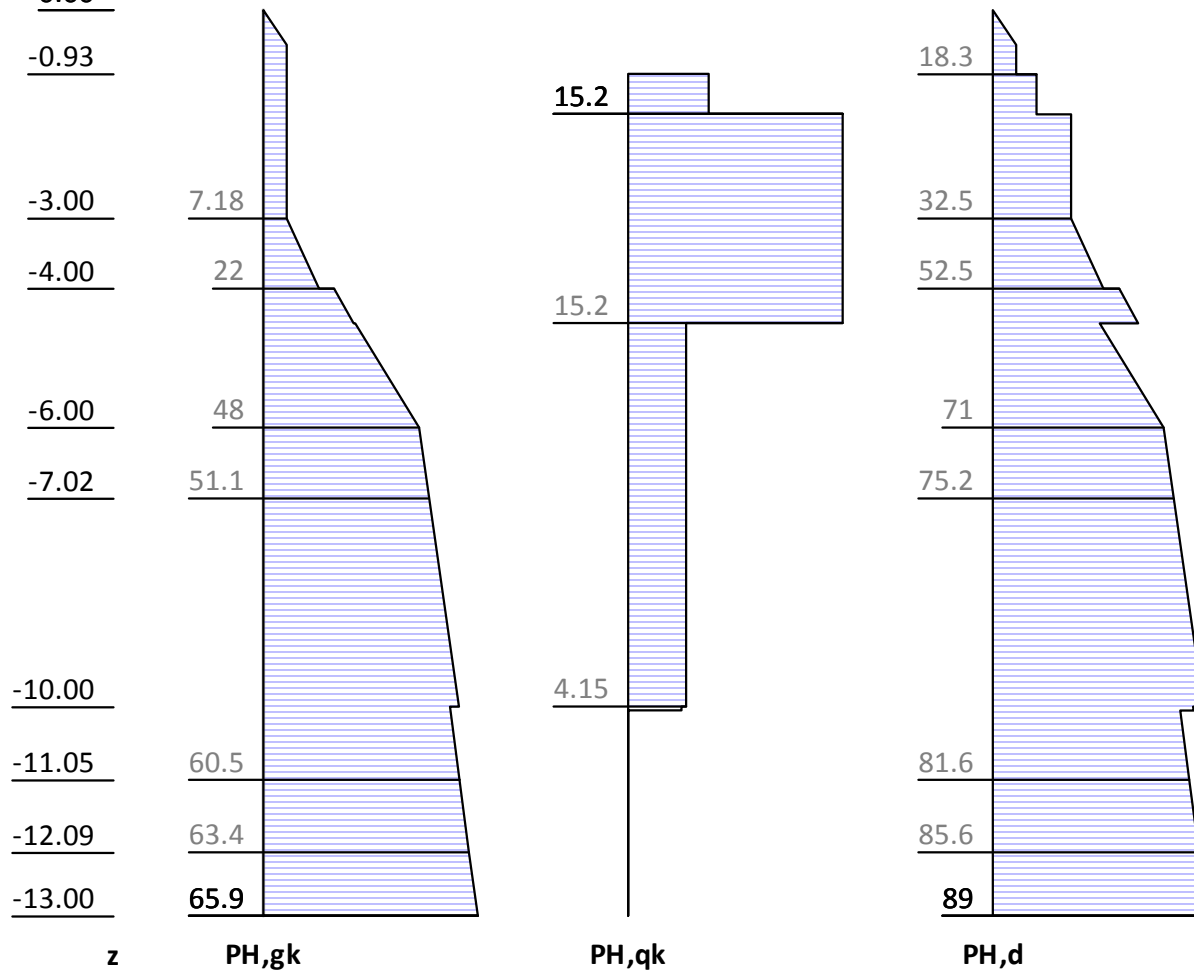
Πίεση νερού

| z [m] | Wp,k [kN/m2] | Wa,k [kN/m2] | W,k [kN/m2] |
|----------|-----------------|-----------------|----------------|
| -3.00 | | 0.00 | 0.00 |
| -6.00 | 0.00 | 30.00 | 30.00 |
| -6.24 | -2.40 | 32.40 | 30.00 |
| -13.00 | -70.00 | 100.00 | 30.00 |

H-pressure on static system

Level of mobilization: Ep,gk 100.0, Ep,qk 100.0, Ep,d 100.0 [%]

0.00



| z [m] | PH,gk [kN/m2] | PH,qk [kN/m2] | PH,d [kN/m2] |
|----------|------------------|------------------|-----------------|
| 0.00 | 0.00 | | 0.00 |
| -0.93 | 7.18 | 0.00 | 9.69 |
| -0.93 | 7.18 | 5.76 | 18.33 |
| -1.50 | 7.18 | 5.76 | 18.33 |
| -1.50 | 7.18 | 15.23 | 32.54 |
| -4.00 | 17.18 | 15.23 | 46.04 |
| -4.00 | 21.97 | 15.23 | 52.50 |
| -4.50 | 27.86 | 15.23 | 60.46 |
| -4.50 | 28.38 | 4.15 | 44.54 |
| -10.00 | 60.24 | 4.15 | 87.55 |
| -10.00 | 57.52 | 3.81 | 83.37 |
| -10.06 | 57.69 | 3.81 | 83.60 |
| -10.06 | 57.69 | 0.00 | 77.88 |
| -13.00 | 65.94 | 0.00 | 89.02 |

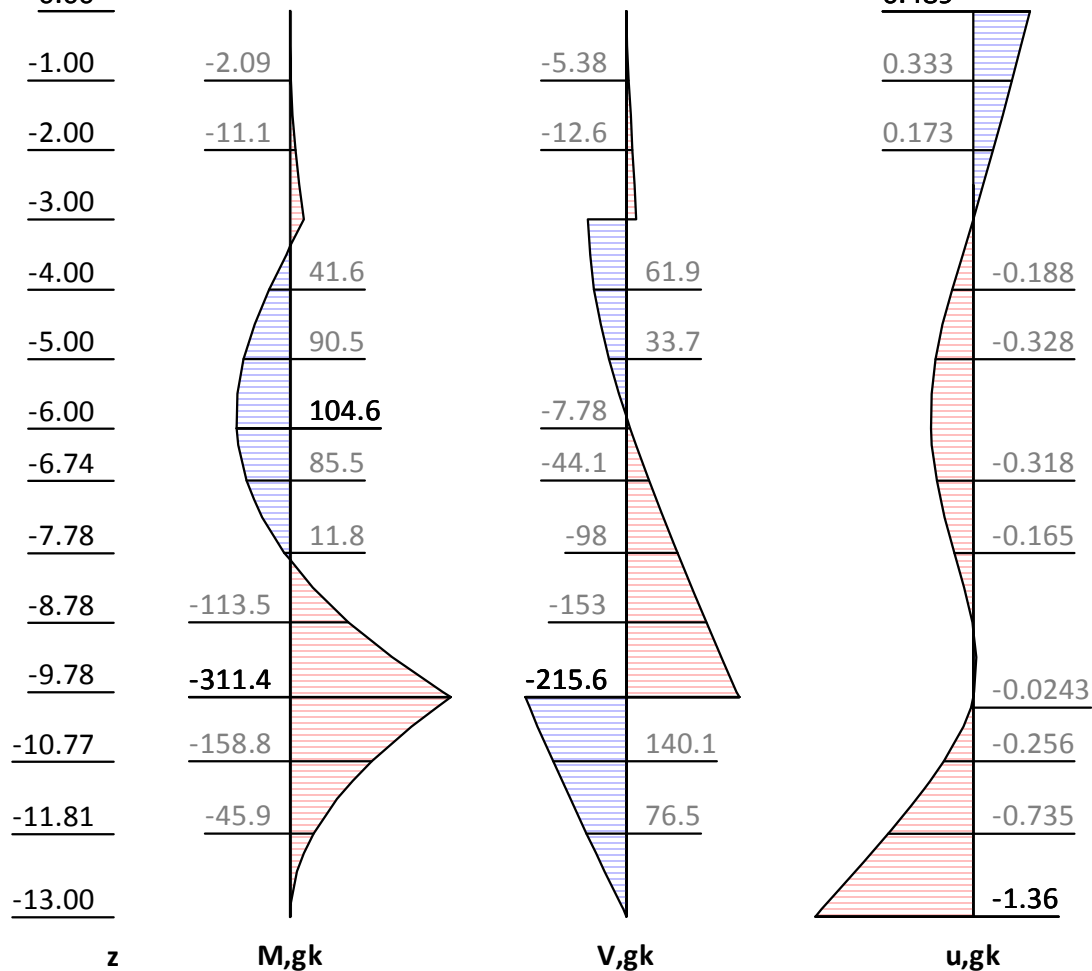
V-pressure on static system**Internal forces: Permanent, characteristically**

z= -0.500. Fx= -0.000 kN/m Support

z= -3.000. Fx= -93.860 kN/m Support

z= -9.856. Fx=-409.408 kN/m Support

0.00



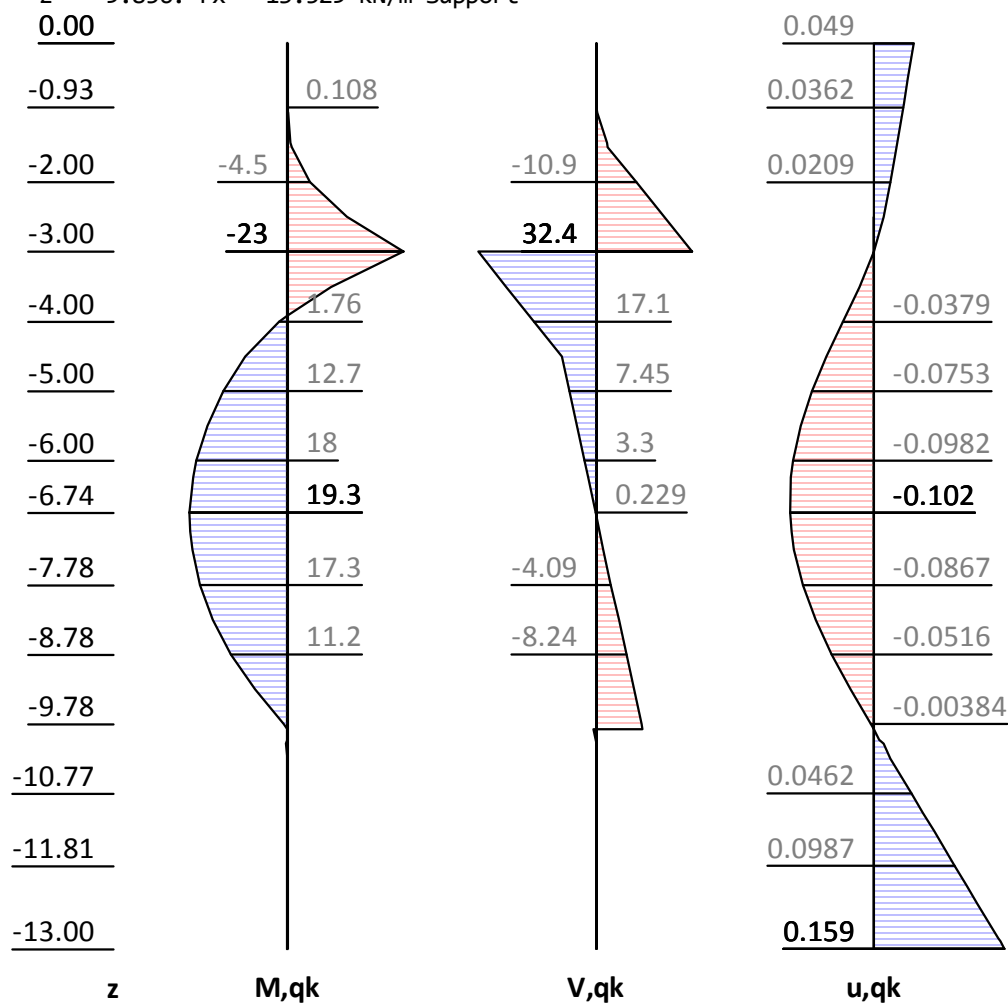
| z [m] | H,g,k [kN/m2] | M,g,k [kN/m2] | V,g,k [kN/m2] | N,g,k [kN/m2] | u,g,k [mm] |
|----------|------------------|------------------|------------------|------------------|---------------|
| 0.00 | 0.00 | -0.00 | 0.00 | -0.00 | 0.49 |
| -0.00 | 0.00 | -0.00 | 0.00 | -0.00 | 0.49 |
| -3.00 | 7.18 | -27.22 | -19.74 | -64.03 | -0.00 |
| -3.00 | 7.18 | -27.22 | 74.12 | -89.18 | -0.00 |
| -3.38 | 10.96 | 0.00 | 70.46 | -97.27 | -0.07 |
| -4.00 | 17.18 | 41.65 | 61.94 | -110.55 | -0.19 |
| -4.00 | 21.97 | 41.65 | 61.94 | -110.55 | -0.19 |
| -4.50 | 27.86 | 69.63 | 49.49 | -121.06 | -0.27 |
| -4.50 | 28.38 | 69.63 | 49.49 | -121.06 | -0.27 |
| -5.83 | 45.70 | 103.93 | -0.00 | -146.06 | -0.37 |
| -6.00 | 47.98 | 104.58 | -7.78 | -149.46 | -0.37 |
| -7.89 | 53.76 | 0.00 | -103.77 | -189.15 | -0.15 |
| -8.90 | 56.85 | -132.99 | -159.67 | -212.22 | 0.00 |
| -9.28 | 58.03 | -197.17 | -181.64 | -221.28 | 0.03 |
| -9.86 | 59.81 | -311.40 | -215.57 | -235.27 | 0.00 |
| -9.86 | 59.81 | -311.40 | 193.84 | -235.27 | 0.00 |
| -10.00 | 60.24 | -284.11 | 185.20 | -238.83 | -0.02 |
| -10.00 | 57.52 | -284.11 | 185.20 | -238.83 | -0.02 |
| -13.00 | 65.94 | -0.00 | 0.00 | -317.69 | -1.36 |
| -13.00 | 65.94 | 0.00 | 0.00 | -317.69 | -1.36 |

Internal forces: Variable, characteristicallyMethod EB 82-4 ($Q = [G+Q] - G$).

z= -0.500. Fx= 0.000 kN/m Support

z= -3.000. Fx= -58.511 kN/m Support

z= -9.856. Fx= -13.529 kN/m Support

0.00

| z [m] | H, q, k [kN/m ²] | M, q, k [kN/m ²] | V, q, k [kN/m ²] | N, q, k [kN/m ²] | u, q, k [mm] |
|----------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|-----------------|
| 0.00 | | 0.00 | 0.00 | 0.00 | 0.05 |
| -0.50 | | 0.00 | 0.00 | 0.00 | 0.04 |
| -0.93 | 0.00 | 0.11 | 0.00 | 0.00 | 0.04 |
| -0.93 | 5.76 | 0.11 | 0.00 | -0.00 | 0.04 |
| -0.95 | 5.76 | -0.00 | -0.14 | -0.04 | 0.04 |
| -1.50 | 5.76 | -0.94 | -3.28 | -0.85 | 0.03 |
| -1.50 | 15.23 | -0.94 | -3.28 | -0.85 | 0.03 |
| -3.00 | 15.23 | -23.00 | -26.13 | -6.74 | -0.00 |
| -3.00 | 15.23 | -23.00 | 32.38 | -22.42 | -0.00 |
| -3.92 | 15.23 | -0.00 | 18.42 | -26.02 | -0.03 |
| -4.50 | 15.23 | 8.42 | 9.53 | -28.32 | -0.06 |
| -4.50 | 4.15 | 8.42 | 9.53 | -28.32 | -0.06 |
| -6.74 | 4.15 | 19.35 | 0.23 | -30.72 | -0.10 |
| -6.80 | 4.15 | 19.33 | 0.00 | -30.78 | -0.10 |
| -9.85 | 4.15 | 0.00 | -12.67 | -34.05 | -0.00 |
| -9.86 | 4.15 | -0.08 | -12.70 | -34.05 | 0.00 |
| -9.86 | 4.15 | -0.08 | 0.83 | -34.05 | 0.00 |
| -10.00 | 4.15 | -0.01 | 0.23 | -34.21 | 0.01 |
| -10.00 | 3.81 | -0.01 | 0.23 | -34.21 | 0.01 |
| -10.00 | 3.81 | -0.00 | 0.22 | -34.21 | 0.01 |
| -10.06 | 3.81 | 0.36 | 0.02 | -34.26 | 0.01 |

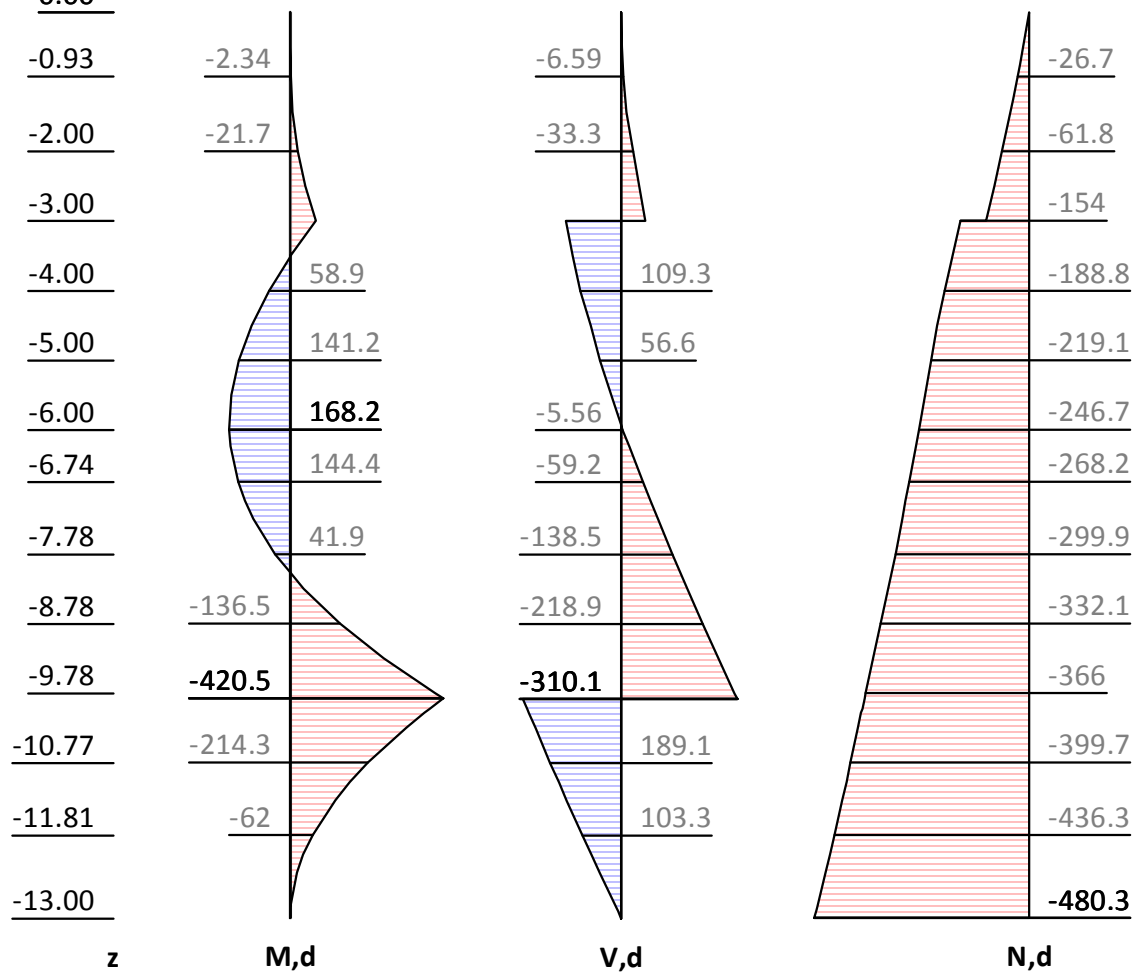
| z [m] | H, q, k [kN/m2] | M, q, k [kN/m2] | V, q, k [kN/m2] | N, q, k [kN/m2] | u, q, k [mm] |
|----------|--------------------|--------------------|--------------------|--------------------|-----------------|
| -10.06 | 0.00 | 0.36 | 0.02 | -34.26 | 0.01 |
| -10.27 | 0.00 | 0.00 | 0.00 | -34.27 | 0.02 |
| -11.05 | 0.00 | -0.00 | 0.00 | -34.27 | 0.06 |
| -11.81 | 0.00 | -0.00 | 0.00 | -34.27 | 0.10 |
| -12.09 | 0.00 | -0.00 | 0.00 | -34.27 | 0.11 |
| -12.85 | 0.00 | -0.00 | 0.00 | -34.27 | 0.15 |
| -12.90 | 0.00 | -0.00 | 0.00 | -34.27 | 0.15 |
| -13.00 | 0.00 | -0.00 | -0.00 | -34.27 | 0.16 |

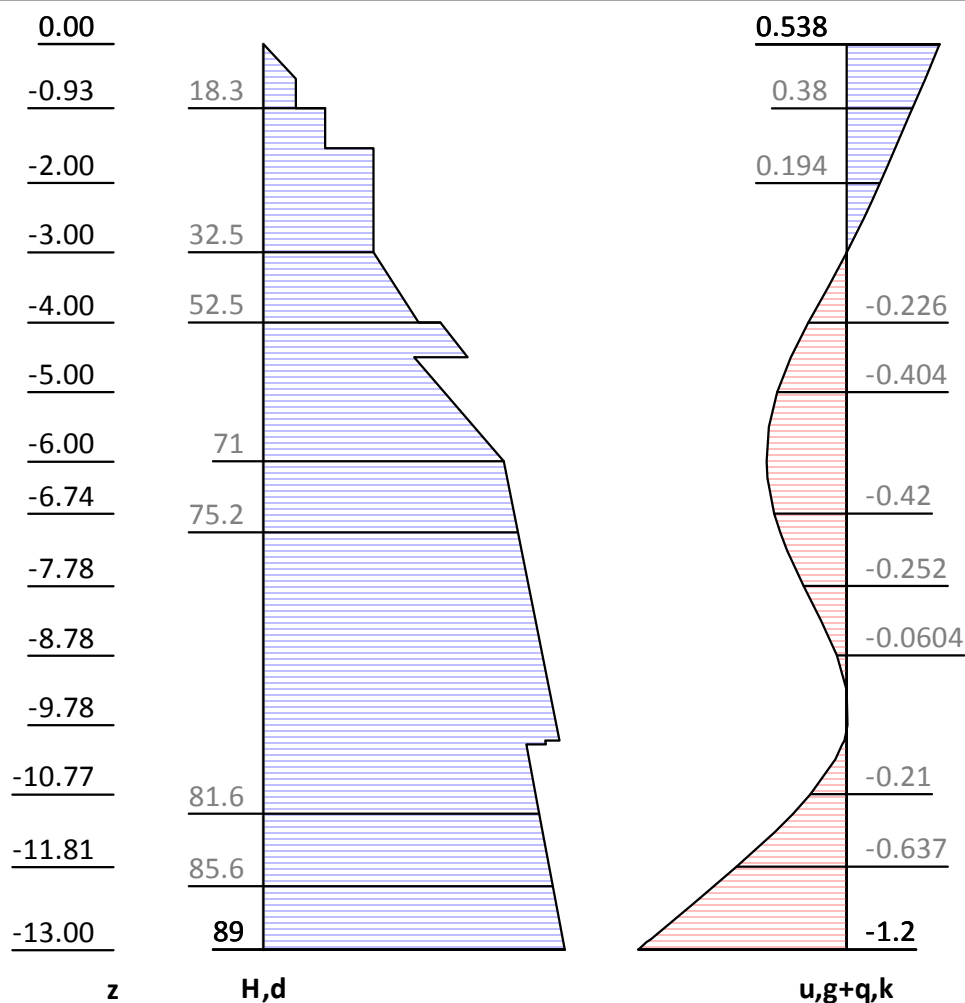
Internal forces: Design

z= -0.500. Fx= -0.000 kN/m Support

z= -3.000. Fx=-214.476 kN/m Support

z= -9.856. Fx=-572.994 kN/m Support

0.00



| z [m] | H,d [kN/m²] | M,d [kN/m²] | V,d [kN/m²] | N,d [kN/m²] | u,g+q,k [mm] |
|----------|----------------|----------------|----------------|----------------|-----------------|
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.54 |
| -0.00 | 0.00 | -0.00 | 0.00 | -0.00 | 0.54 |
| -0.93 | 9.69 | -2.34 | -6.59 | -26.71 | 0.38 |
| -0.93 | 18.33 | -2.34 | -6.59 | -26.71 | 0.38 |
| -1.50 | 18.33 | -9.08 | -17.04 | -44.43 | 0.28 |
| -1.50 | 32.54 | -9.08 | -17.04 | -44.43 | 0.28 |
| -3.00 | 32.54 | -71.24 | -65.85 | -96.56 | -0.00 |
| -3.00 | 32.54 | -71.24 | 148.63 | -154.03 | -0.00 |
| -3.51 | 39.43 | -0.00 | 130.21 | -171.77 | -0.12 |
| -4.00 | 46.04 | 58.86 | 109.33 | -188.78 | -0.23 |
| -4.00 | 52.50 | 58.86 | 109.33 | -188.78 | -0.23 |
| -4.50 | 60.46 | 106.63 | 81.09 | -205.91 | -0.33 |
| -4.50 | 44.54 | 106.63 | 81.09 | -205.91 | -0.33 |
| -5.92 | 69.52 | 167.29 | 0.00 | -244.33 | -0.46 |
| -6.00 | 70.99 | 168.25 | -5.56 | -246.66 | -0.46 |
| -8.04 | 79.46 | -0.00 | -159.51 | -308.33 | -0.20 |
| -9.28 | 84.55 | -255.39 | -260.34 | -348.75 | 0.00 |
| -9.78 | 86.64 | -397.38 | -303.49 | -366.05 | 0.01 |
| -9.86 | 86.97 | -420.51 | -310.07 | -368.69 | 0.00 |
| -9.86 | 86.97 | -420.51 | 262.92 | -368.69 | 0.00 |
| -10.00 | 87.55 | -383.55 | 250.36 | -373.73 | -0.02 |
| -10.00 | 83.37 | -383.55 | 250.36 | -373.73 | -0.02 |
| -10.06 | 83.60 | -368.68 | 245.35 | -375.80 | -0.03 |
| -10.06 | 77.88 | -368.68 | 245.35 | -375.80 | -0.03 |
| -13.00 | 89.02 | -0.00 | 0.00 | -480.29 | -1.20 |
| -13.00 | 89.02 | 0.00 | 0.00 | -480.29 | -1.20 |

Anchor forces with safety level of DS-P

| z[m] | A,d[kN] | F _{x,d} [kN/m] |
|-------|---------|-------------------------|
| -0.50 | 0.0 | -0.0 |
| -3.00 | 399.7 | -214.5 |

Checks of earth statics**Check of earth support**

Check: Mobilizable earth resistance is sufficient for earth support force.

z: -9.86 m

Rd = Eph,k/γ,Re = 5891.26 / 1.400 = 4208.04 [kN/m]

Ed(Uh,d)/Rd = 572.99 / 4208.04 = 0.136 [-]. Passes requirement

Sum of H and V forces, (G)

Forces up to depth z:-13.00

| Pos. | H | V |
|----------------------------------|---------|-----------------------|
| H/V pressure G+P+W,k | 503.27 | 90.93 |
| Wall weight | | 201.61 |
| H/V pressure passive | | 0.00 |
| Support z: -0.50 | | 0.00 |
| Support z: -3.00 | -93.86 | 25.15 |
| Bh,g,k z=-9.86 | -409.41 | |
| Bv,g,k = Bh,k * tan(δ,p=-22.00°) | | -165.41 |
| Σ | 0.00 | 152.28 (downwards) |

Average anchor inclination α,A = 15.00° >= 15°.

Verification of vertical forces due to EAB R 9 not required (R 9-5).

Check EAB R 9-1

Vertical component of earth resistance is less than the downwards pointing vertical forces.

Vk >= Bvk: 317.69 >= 165.41 Passes requirement

Sum of H and V forces, (G+Q)

Forces up to depth z:-13.00

| Pos. | H | V |
|----------------------------------|---------|-----------------------|
| H/V pressure G+P+W,k | 575.31 | 109.52 |
| Wall weight | | 201.61 |
| H/V pressure passive | | 0.00 |
| Support z: -0.50 | | 0.00 |
| Support z: -3.00 | -152.37 | 40.83 |
| Bh,g,k z=-9.86 | -409.41 | |
| Bv,g,k = Bh,k * tan(δ,p=-22.00°) | | -165.41 |
| Bh,q,k z=-9.86 | -13.53 | |
| Bv,q,k = Bh,k * tan(δ,p=-22.00°) | | -5.47 |
| Σ | -0.00 | 181.08 (downwards) |

Average anchor inclination α,A = 15.00° >= 15°.

Verification of vertical forces due to EAB R 9 not required (R 9-5).

Check EAB R 9-1

Vertical component of earth resistance is less than the downwards pointing vertical forces.

Vk >= Bvk: 351.96 >= 170.88 Passes requirement

Anchor verification

| | | | | | |
|--|--|--|--|-------------------------|--|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | | | | Job No.: | |
| Program: WALLS-Retain. | | | | Version 2017.046 | |
| Structure: info@fides-dvp.de www.fides-dvp.de Tel:++49/89/143829-0 ASB Nr.: | | | | Date: 08.10.2018 | |

Anchor - Stability of lower failure plane

Περίπτωση φόρτισης: όλα τα φορτία BS-P
 Αυτόμ. υπολογ. μήκους αγκυρίων:
 All anchors are extended (if necessary)
 Favourable variable loads in main failure body are not being considered.
 Bottom of lower failure plane: z=-13.00 m

Iteration of failure mechanisms:
 lA: Length of anchor from head to center of grout body.
 W,k: Res. force from dead weight, loads, cohesion, ...
 Q,k: Force in lower failure plane.
 Ea1,k.....: Earth pressure onto vertical separation plane.
 Ea2,k.....: Earth pressure between wall and main failure body.
 Ra_cal,d: Dimensioning force of the resistance from the equilibrium of forces.
 Ra_cal,d corresponds to the max. possible anchor force of the force polygon.
 Sum(A,d): Acting anchor forces along the grout body fractions within the failure body. Sum(A,d) is gained from the anchor pull forces of the wall analysis.

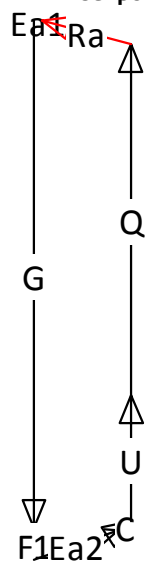
| z [m] | θ1 [°] | θ2 [°] | lA [m] | W,k [kN/m] | Q,k [kN/m] | Ea1,k [kN/m] | Ea2,k [kN/m] | Ra_cal,d [kN/m] | Sum(A,d) [kN/m] | Ed/Rd [-] |
|----------|-----------|-----------|-----------|---------------|---------------|-----------------|-----------------|--------------------|--------------------|--------------|
| -0.50 | 40.0 | 57.5 | 11.71 | 1389.9 | 1229.4 | 4.4 | 338.5 | 171.0 | 170.4 | 1.00 |
| -3.00 | 35.9 | 60.7 | 10.45 | 1432.7 | 1242.5 | 26.0 | 338.5 | 222.3 | 222.0 | 1.00 |

Decisive failure body:
Γεωμετρία:
 Foot point of lower failure plane x/z = 0.01/-13.00 m
 Intersection lower/upper slid. plane x/z = 10.10/ -5.71 m
 Intersection upper slid. plane/surface x/z = 13.29/ 0.00 m
 Intersection separation plane/surface x/z = 10.10/ 0.00 m
 Inclination lower failure plane θ1 = 35.87°
 Inclination upper failure plane θ2 = 60.74°
 Inclination separation plane θ12 = 90.00°

Loads / forces (char.)

| | | Fx [kN/m] | Fz [kN/m] | F [kN/m] | |
|------------------------------------|-----------|--------------|--------------|-------------|---------|
| Weight of main failure body | G,k: | 0.0 | -1979.2 | 1979.2 | |
| Area loads on/in main failure body | F1,k: | 0.0 | -130.0 | 130.0 | |
| Cohesion of lower failure plane | C,k: | 50.4 | 36.5 | 62.2 | |
| Pore water pressure on main body | U,k: | 0.0 | 640.9 | 640.9 | |
| Earth pres. on separation plane | Ea1,k: | -26.0 | -0.0 | 26.0 | δ= 0.0° |
| Earth pr. between wall<->main body | Ea2,k: | 320.3 | 109.5 | 338.5 | |
| Force in lower failure plane | Q,k: | -44.1 | 1241.7 | 1242.5 | |
| Sum = possible anchor forces: | Ra_cal,k: | 300.6 | -80.6 | 311.2 | |

| | | |
|---------|--------------------------------------|--------------|
| Part: | | Archive No.: |
| Block: | Please specify project informations. | |
| Record: | Page: 55 | |

Force polygon

Acting anchor forces $E_d: \sum(A,d) = 222.0 \text{ kN/m}$
 Possible anchor forces $R_d: R_{a_cal,d} = 311.2/1.400 = 222.3 \text{ kN/m}$
 Verif. of lower failure plane $E_d/R_d = 1.00 < 1.0$: Έλεγχος εκπληρώθηκε.

Check of steel tension

l_{tot} ...[m]: Total length of anchor incl. excess length at head
 A_s [mm²]: X-section area of steel member
 $R_{i,d}$...[kN]: Ultimate strength of tension member ($\gamma, M=1.15$)
 $A_{d,d}$...[kN]: Dimensioning force of the anchor from wall analysis

| z[m] | Anchor type | l_{tot} | A_s | $R_{i,d}$ | $A_{d,d}$ |
|-------|--------------------------|-----------|-------|-----------|-----------|
| -0.50 | Strand;3x0.60";1570/1770 | 15.86 | 420 | 573.4 | 0.0 |
| -3.00 | Strand;3x0.60";1570/1770 | 14.45 | 420 | 573.4 | 399.7 |

Check of steel tension: Passes requirement

Check of anchor's soil friction

$l_{V,k}$: Length of grout body
 $D_{mV,k}$: Diameter of grout body
 $\tau_{Gr,k}$: Average applied skin friction along the grout body (from soil parameters)
 $R_{a,k}$: Charact. pullout resistance of the anchor
 γ_A : Partial safety factor of anchor pullout
 $R_{a,d}$: $R_{a,k} / \gamma_A$
 $A_{d,d}$: Dimensioning force of the anchor from wall analysis

| z | $l_{V,k}$ | $D_{mV,k}$ | $\tau_{Gr,k}$ | $R_{a,k}$ | γ_A | $R_{a,d}$ | $A_{d,d}$ | $A_{d,d}/R_{a,d}$ |
|-------|-----------|------------|----------------------|-----------|------------|-----------|-----------|-------------------|
| [m] | [m] | [mm] | [kN/m ²] | [kN] | [-] | [kN] | [kN] | [-] |
| -0.50 | 8.00 | 318 | 110 | 879.1 | 1.100 | 799.2 | 0.0 | 0.0 |
| -3.00 | 8.00 | 318 | 110 | 879.1 | 1.100 | 799.2 | 399.7 | 0.5 |

Check of anchor's soil friction: Passes requirement

Υπολογ. κύκλου ολίσθησης

LC: όλα τα φορτία Type: BS-T (combination: [GEO] A2 M2 R3, BS-T)
 Vertical variable loads only act if they are outside of $R \cdot \sin(\phi)$.
 The automatic slip circle optimization only considers circles that intersect the surface with an area of at least 0.25 m².
 The slip circle calculation only accepts circles including the wall.
 The slipcircle calculation only allows circular failure planes (no vertical tangents will occur).

Author:
FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München

Job No.:

Program:
WALLS-Retain.
Version 2017.046

Structure:
info@fides-dvp.de
www.fides-dvp.de
Tel:++49/89/143829-0
ASB Nr.:

Date: 08.10.2018

Γεωμετ.κύκλου (μήκη και συντεταγμ. σε (m))
Κέντρο = (-1.95, 0.20), Ακτίνα = 13.35
Αρχ.σημ.= (-14.62, -4.00), Τελ.σημ. = (11.40, 0.00)

Γεωμετρία λωρίδων:

| No | x | Width | dxM | Weight | Load | Water- | u*b | φ | c | θ |
|----|--------|-------|--------|--------|--------|--------|--------|-------|---------|---------|
| | [m] | b | [m] | [kN/m] | z-κατ. | φορτ. | [kN/m] | [°] | [kN/m²] | [°] |
| | | | | | [kN/m] | [kN/m] | | | | |
| 1 | -13.96 | 1.34 | -12.01 | 47.6 | 0.0 | 0.0 | -5.7 | 27.45 | 3.57 | -31.27* |
| 2 | -12.62 | 1.34 | -10.67 | 113.3 | 0.0 | 0.0 | -23.3 | 27.45 | 3.57 | -31.27* |
| 3 | -11.29 | 1.34 | -9.34 | 158.9 | 0.0 | 0.0 | -44.1 | 27.45 | 3.57 | -31.27* |
| 4 | -9.95 | 1.34 | -8.00 | 193.3 | 0.0 | 0.0 | -59.5 | 29.26 | 3.57 | -30.37* |
| 5 | -8.61 | 1.34 | -6.67 | 219.8 | 0.0 | 0.0 | -71.4 | 29.26 | 3.57 | -29.95 |
| 6 | -7.28 | 1.34 | -5.33 | 240.0 | 0.0 | 0.0 | -80.4 | 29.26 | 3.57 | -23.53 |
| 7 | -5.94 | 1.34 | -4.00 | 255.0 | 0.0 | 0.0 | -87.1 | 29.26 | 3.57 | -17.41 |
| 8 | -4.61 | 1.34 | -2.66 | 265.3 | 0.0 | 0.0 | -91.7 | 29.26 | 3.57 | -11.49 |
| 9 | -3.27 | 1.34 | -1.33 | 271.4 | 0.0 | 0.0 | -94.4 | 29.26 | 3.57 | -5.69 |
| 10 | -1.94 | 1.34 | 0.01 | 273.3 | 0.0 | 0.0 | -95.3 | 29.26 | 3.57 | 0.04 |
| 11 | -0.60 | 1.34 | 1.35 | 276.4 | 0.0 | 0.0 | -114.4 | 29.26 | 3.57 | 5.78 |
| 12 | 0.73 | 1.34 | 2.68 | 368.0 | 0.0 | 0.0 | -131.7 | 29.26 | 3.57 | 11.58 |
| 13 | 2.07 | 1.34 | 4.02 | 357.6 | 0.0 | 0.0 | -127.1 | 29.26 | 3.57 | 17.50 |
| 14 | 3.40 | 1.34 | 5.35 | 342.5 | 0.0 | 0.0 | -120.3 | 29.26 | 3.57 | 23.63 |
| 15 | 4.74 | 1.34 | 6.69 | 322.2 | 34.7 | 0.0 | -111.3 | 29.26 | 3.57 | 30.05 |
| 16 | 6.08 | 1.34 | 8.02 | 295.7 | 34.7 | 0.0 | -99.4 | 29.26 | 3.57 | 36.93 |
| 17 | 7.41 | 1.34 | 9.36 | 261.2 | 34.7 | 0.0 | -83.8 | 27.45 | 3.57 | 44.49 |
| 18 | 8.75 | 1.34 | 10.69 | 215.3 | 11.0 | 0.0 | -63.0 | 27.45 | 3.57 | 53.20 |
| 19 | 10.41 | 1.99 | 12.36 | 189.5 | 0.0 | 0.0 | -38.0 | 27.45 | 3.57 | 67.72 |

*** Σημείωση: Στις λωρίδες σημειωμένες με '*'
περιορίστηκε το theta στο 45°-Phi/2.

Συνεισφ. κατακόρυφων φορτίων:

| No | Weight | G*sin(θ) | (G-u*b)*tan(φ) + c*b | μ*sin(θ)* tan(φ)+cos(θ) | T |
|--------|--------|----------|-------------------------|----------------------------|---------|
| | [kN/m] | [kN/m] | [kN/m] | [-] | [kN/m] |
| 1 | 47.64 | -42.84 | 26.57 | 0.786926 | 33.76 |
| 2 | 113.26 | -90.52 | 51.49 | 0.786926 | 65.43 |
| 3 | 158.95 | -111.14 | 64.46 | 0.786926 | 81.91 |
| 4 | 193.33 | -115.85 | 79.72 | 0.791588 | 100.71 |
| 5 | 219.77 | -109.71 | 87.90 | 0.796200 | 110.40 |
| 6 | 239.98 | -95.81 | 94.16 | 0.860657 | 109.40 |
| 7 | 254.96 | -76.29 | 98.80 | 0.912063 | 108.33 |
| 8 | 265.30 | -52.85 | 102.01 | 0.951910 | 107.16 |
| 9 | 271.36 | -26.93 | 103.89 | 0.981098 | 105.89 |
| 10 | 273.34 | 0.21 | 104.50 | 1.000109 | 104.49 |
| 11 | 276.36 | 27.85 | 95.48 | 1.009095 | 94.62 |
| 12 | 368.00 | 73.89 | 137.13 | 1.007899 | 136.05 |
| 13 | 357.59 | 107.55 | 133.90 | 0.996034 | 134.43 |
| 14 | 342.53 | 137.28 | 129.23 | 0.972591 | 132.88 |
| 15 | 356.95 | 178.75 | 142.39 | 0.936069 | 152.12 |
| 16 | 330.41 | 198.50 | 134.19 | 0.883985 | 151.80 |
| 17 | 295.88 | 207.35 | 114.93 | 0.804869 | 142.79 |
| 18 | 226.22 | 181.15 | 89.56 | 0.703506 | 127.31 |
| 19 | 189.46 | 175.31 | 85.80 | 0.499963 | 171.61 |
| ----- | | | | | ----- |
| 565.92 | | | | | 2171.11 |

Συνεισφ. αγκυρίων: Αθρ. ροπών ανατροπής : -207.4 kN*m/m
" " resisting : 257.7 kN*m/m

Δράση Ed = (565.9*13.35-207.4)
Αντίσταση Rd = (2171.1*13.35+257.7)

SLIP-CIRCLE μ = Ed/Rd = 0.25 < 1.0: Έλεγχος εκπληρώθηκε.

Part:
Block:
Please specify project informations.
Record:

Page: 57

Archive No.:

| | | |
|------------|--|------------------|
| Author: | FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | Job No.: |
| Program: | WALLS-Retain. Version 2017.046 | |
| Structure: | info@fides-dvp.de www.fides-dvp.de Tel:++49/89/143829-0 ASB Nr.: | Date: 08.10.2018 |

Φάση εκσκαφής 5 "[5] Situation 5"

LC: όλα τα φορτία Type: BS-T

Εδαφικό σύστημα με 5 Στρώσεις

| Name | Τεχνητές επιχωματώσεις | Αμμόδης ΑΡΓΙΛΟΣ | Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ | |
|-------------|------------------------|-----------------|--------------------------|-----------|
| γ | [kN/m3] | 18 | 20 | 22.5 |
| γ,R | [kN/m3] | 18 | 20 | 22.5 |
| γ' | [kN/m3] | 8 | 10 | 12.5 |
| γ,p | [kN/m3] | 18 | 20 | 22.5 |
| γ,R,passive | [kN/m3] | 18 | 20 | 22.5 |
| γ,pw | [kN/m3] | 8 | 10 | 12.5 |
| φ | [°] | 25 | 0.1 | 33 |
| c | [kN/m2] | 2 | 50 | 5 |
| c,u | [kN/m2] | 10 | 50 | 5 |
| c παθητικό | [kN/m2] | 2 | 50 | 5 |
| δ,a | [°] | 16.66667 | 0.06666667 | 22 |
| δ,p | [°] | -16.66667 | -0.06666667 | -22 |
| δ,c | [°] | 8.333333 | 0.03333333 | 11 |
| k,agh | [-] | 0.3456501 | 0.9955057 | 0.2452023 |
| K,ach | [-] | 1.043051 | 1.994195 | 0.8549058 |
| K,0h | [-] | 0.5773817 | 0.9982547 | 0.455361 |
| K,pgh | [-] | 3.908103 | 1.004519 | 7.495617 |
| K,pch | [-] | 5.180327 | 2.00583 | 8.599509 |
| τ,gr | [kN/m2] | 110 | 110 | 110 |
| Ψ,A,max | [°] | 90 | 90 | 90 |
| k | [cm/s] | 10e-06 | 1e-06 | 100e-06 |

| Name | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ |
|-------------|------------------------|------------------------|
| γ | [kN/m3] 22.5 | 22.5 |
| γ,R | [kN/m3] 22.5 | 22.5 |
| γ' | [kN/m3] 12.5 | 12.5 |
| γ,p | [kN/m3] 22.5 | 22.5 |
| γ,R,passive | [kN/m3] 22.5 | 22.5 |
| γ,pw | [kN/m3] 12.5 | 12.5 |
| φ | [°] 35 | 35 |
| c | [kN/m2] 5 | 5 |
| c,u | [kN/m2] 5 | 5 |
| c παθητικό | [kN/m2] 5 | 5 |
| δ,a | [°] 23.33333 | 23.33333 |
| δ,p | [°] -23.33333 | -23.33333 |
| δ,c | [°] 11.66667 | 11.66667 |
| k,agh | [-] 0.2244207 | 0.2244207 |
| K,ach | [-] 0.8126539 | 0.8126539 |
| K,0h | [-] 0.4264236 | 0.4264236 |
| K,pgh | [-] 9.146943 | 9.146943 |
| K,pch | [-] 10.104 | 10.104 |
| τ,gr | [kN/m2] 110 | 110 |
| Ψ,A,max | [°] 90 | 90 |
| k | [cm/s] 100e-06 | 100e-06 |

Πορεία πρανούς:

x [m] 0.00 0.00
z [m] -6.85 0.00

Πορεία ανώτερου 2. στρώματος Αμμόδης ΑΡΓΙΛΟΣ:

x [m] 0.00 0.00
z [m] -6.85 -1.50

Πορεία ανώτερου 3. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ:

x [m] 0.00 0.00
z [m] -6.85 -4.50

Πορεία ανώτερου 4. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟΣ:

z= -10.00

| | | |
|---------|--------------------------------------|--------------|
| Part: | | Archive No.: |
| Block: | Please specify project informations. | Page: 58 |
| Record: | | |

| | | |
|---|------------------|--|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | | Job No.: |
| Program: WALLS-Retain. Version 2017.046 | | |
| Structure: info@fides-dvp.de | www.fides-dvp.de | Tel:++49/89/143829-0 ASB Nr.: Date: 08.10.2018 |

Πορεία ανώτερου 5. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ:
z= -14.00

Επιφ. φορτία:

Φορτία

| xA | zA | xE | zE | PxA | PzA | PxE | PzE | Typ | LC-description |
|------|------|------|------|------|-------|------|-------|-----|----------------|
| [m] | [m] | [m] | [m] | [| kN/m² | |] | | Name |
| 2.00 | 0.00 | 8.50 | 0.00 | 0.00 | 20.00 | 0.00 | 20.00 | q | 1 |

Κατανομή εδαφ.πιέσεων

| Κατανομή εδαφ.πιέσεων | Name |
|----------------------------|------|
| Rectangular within a layer | |

Στάθμη νερού:

x [m] 0.00 0.00
z [m] -11.00 -4.50

Αγκύρια

| z[m] | min.l[m] | Alpha[°] | C-H[kN/m] | P0[kN] | u0[m] |
|-------|----------|----------|-----------|--------|--------|
| -0.50 | 0.00 | 15.00 | 0.00 | 0.00 | 0.0000 |
| -3.00 | 0.00 | 15.00 | αόρισ. | 0.00 | 0.0000 |

Παράμετροι υπολογισμού

Earth pressure options

Τμήμα εδαφ.ωθήσεων: Ενεργές ωθήσεις.
Angle of slip plane: DIN 4085.
Split block loads into 1 sections.
Consideration of minimum earth pressure: φ,min = 40.000.
Negative earth pressure fractions are set to zero.

Redistribution of earth pressure

Shape of redistribution: Trapezoid.
The earth pressure is getting redistrib. to: Excavation level
The earth pressure below the excavation acts without redistrib.
Levels of redistribution Z1: 0.000, Z2: -3.000 [m].
The earth pressure from variable loads will be included in redistribution.

Παθητικές ωθήσεις

Method of calculation: Κλασικός, Pregl/Sokolovsky (DIN 4085).

Options for water pressure

Additional water and earth pressure from ground water flow is calculated.
Negative flow pressure is set to zero.
The proof of the basic hydraulic heave is performed.

Στήριξη πόδα

Πόδας οριζοντίως μετακινούμενος

Αγκύρια

Anchor checks (lower failure plane): Ναι
Anchor forces with safety level of DS-P: Ναι
Verification of grout body pull out forces: Ναι
δ,a,Anchoring wall : used from soil layer.
δ,p,Anchoring wall : used from soil layer.

Earth pressure coefficients kh

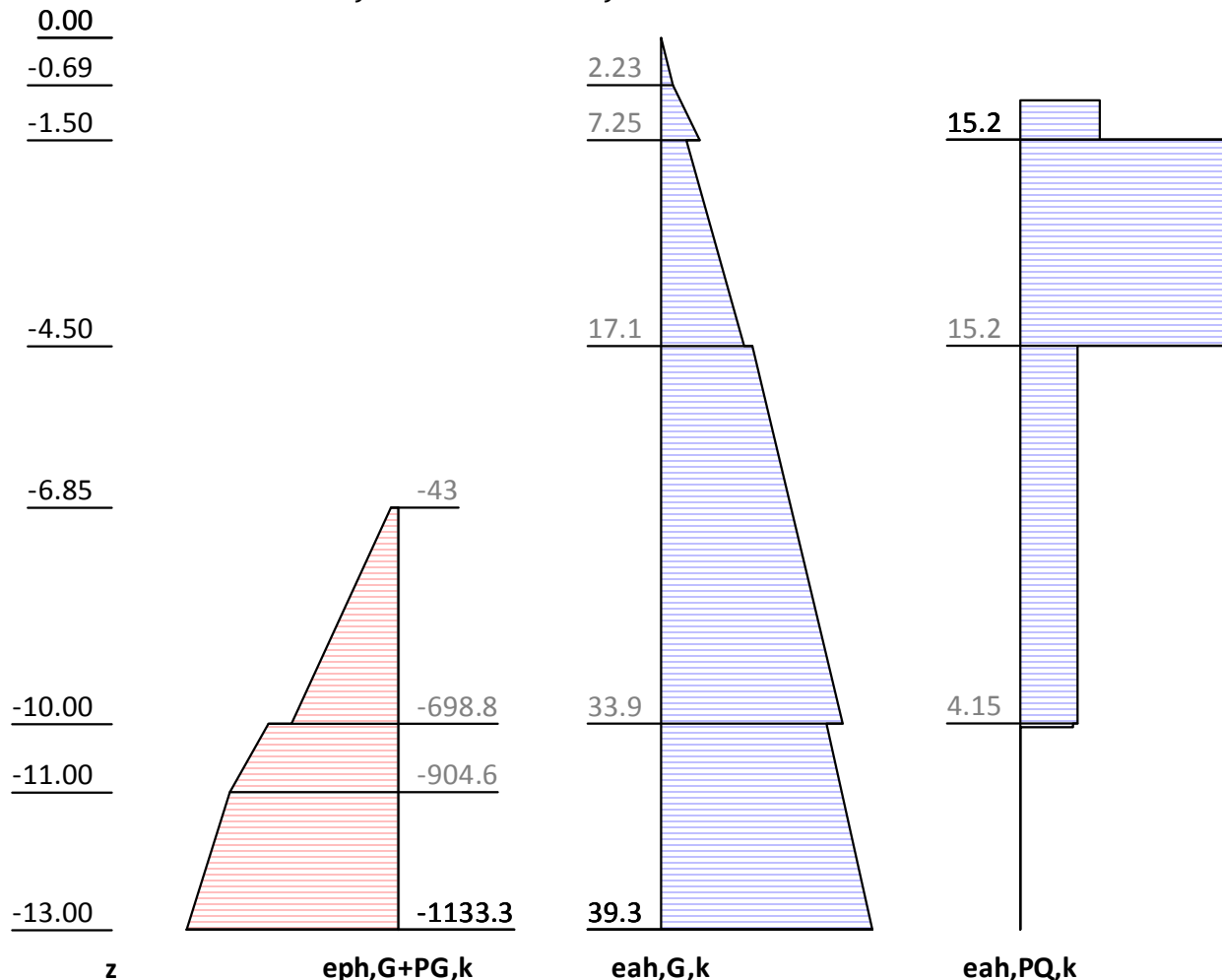
| φ | α | β | δ | k0gh | kagh | kach | kpgh | kpch | |
|------|-----|-----|-------|------|-------|-------|-------|---------|--------------------------|
| 33.0 | 0.0 | 0.0 | -22.0 | -- | -- | -- | 7.496 | -8.600 | Τεχνητές επιχωματώσεις |
| 25.0 | 0.0 | 0.0 | 16.7 | -- | 0.346 | 1.043 | -- | -- | " |
| 0.1 | 0.0 | 0.0 | 0.1 | -- | 0.996 | 1.994 | -- | -- | Αμμώδης ΑΡΓΙΛΟΣ |
| 33.0 | 0.0 | 0.0 | -22.0 | -- | -- | -- | 7.496 | -8.600 | Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ |
| 33.0 | 0.0 | 0.0 | 22.0 | -- | 0.245 | 0.855 | -- | -- | " |
| 35.0 | 0.0 | 0.0 | -23.3 | -- | -- | -- | 9.147 | -10.104 | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ |
| 35.0 | 0.0 | 0.0 | 23.3 | -- | 0.224 | 0.813 | -- | -- | " |
| 35.0 | 0.0 | 0.0 | -23.3 | -- | -- | -- | 9.147 | -10.104 | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ |

| | |
|---|--------------|
| Part: | Archive No.: |
| Block: Please specify project informations. | Page: 59 |
| Record: | |

| φ | α | β | δ | k_{0gh} | k_{agh} | k_{ach} | k_{pgh} | k_{pch} |
|-----------|----------|---------|----------|-----------|-----------|-----------|-----------|-----------|
| 35.0 | 0.0 | 0.0 | 23.3 | -- | 0.224 | 0.813 | -- | -- |

Μήκος τοίχουFoot depth for statics: $z_f = -13.000$ **Stress analysis****Earth pressure, horizontal**

Pressures characteristic, no redistribution, continuous wall



| z [m] | $e_{ph,G,k}$ [kN/m ²] | $e_{ah,G,k}$ [kN/m ²] | $e_{ah,PQ,k}$ [kN/m ²] | $e_{ah,d}$ [kN/m ²] |
|------------|--------------------------------------|--------------------------------------|---------------------------------------|------------------------------------|
| 0.00 | | 0.00 | | 0.00 |
| -0.93 | | 3.72 | | 5.00 |
| -0.93 | | 3.72 | 0.00 | 13.64 |
| -1.50 | | 7.25 | 5.76 | 18.43 |
| -1.50 | | 4.82 | 15.23 | 29.36 |
| -4.50 | | 15.54 | 15.23 | 43.83 |
| -4.50 | | 17.06 | 4.15 | 29.25 |
| -6.85 | -0.00 | 24.26 | 4.15 | 43.79 |
| -6.85 | -43.00 | 24.26 | 4.15 | 43.79 |
| -10.00 | -574.25 | 33.92 | 4.15 | 63.28 |
| -10.00 | -698.81 | 30.89 | 3.81 | 57.73 |
| -10.06 | -711.16 | 31.06 | 3.81 | 58.07 |
| -10.06 | -711.16 | 31.06 | 0.00 | 52.36 |
| -13.00 | -1133.29 | 39.31 | 0.00 | 69.01 |

Eph,G,k: -3811.78, Eph,PG,k: 0.00 [kN/m]

Eah,G,k: 280.61, Eah,PG,k: 0.00, Eah,PQ,k: 72.04, Eah,d: 557.26

Earth pressure from water flow

Pressures characteristic, no redistribution, continuous wall

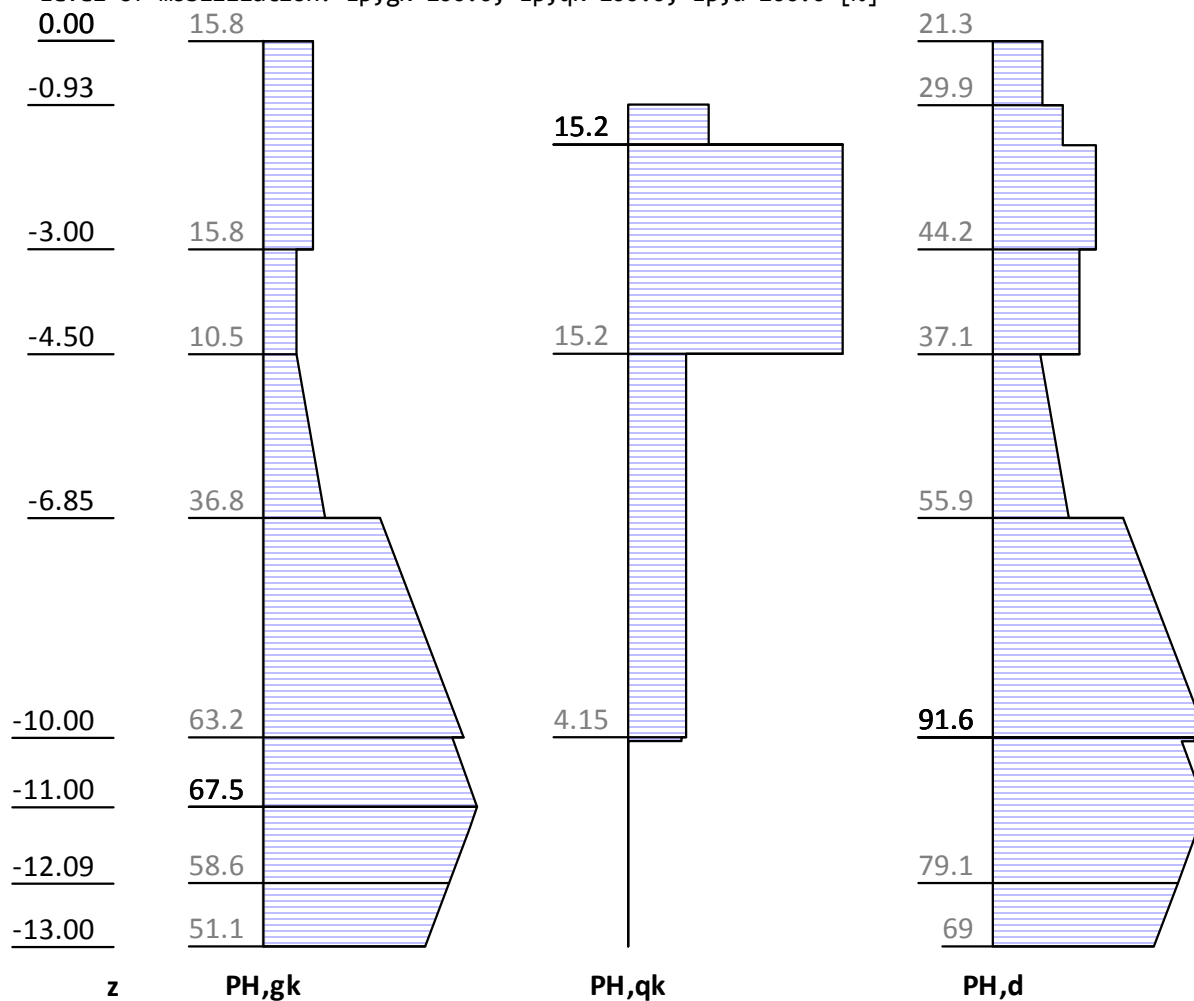
| z [m] | eph,dynW,k [kN/m ²] | eph,dynW+G+PG,k [kN/m ²] | eah,dynW,k [kN/m ²] | eah,dynW+G+PG,k [kN/m ²] | Ip [-] | Ia [-] |
|----------|------------------------------------|---|------------------------------------|---|-----------|-----------|
| -0.34 | | | 0.00 | | | |
| -1.50 | | | 0.00 | | | |
| -4.50 | | | 0.00 | | | |
| -6.85 | 0.00 | 0.00 | 3.57 | 0.00 | | 0.62 |
| -6.85 | 0.00 | -43.00 | 3.57 | -43.00 | | 0.62 |
| -10.00 | 0.00 | -574.25 | 8.35 | -574.25 | | 0.62 |
| -10.00 | 0.00 | -698.81 | 7.64 | -698.81 | | 0.62 |
| -11.00 | 0.00 | -904.62 | 9.03 | -904.62 | | 0.62 |
| -13.00 | 113.25 | -1020.04 | 11.81 | -1020.04 | 0.62 | 0.62 |

Πίεση νερού

| z [m] | Wp,st,k [kN/m ²] | Wa,st,k [kN/m ²] | Wp,dyn,k [kN/m ²] | Wa,dyn,k [kN/m ²] | W,tot,k [kN/m ²] |
|----------|---------------------------------|---------------------------------|----------------------------------|----------------------------------|---------------------------------|
| -4.50 | | 0.00 | | 0.00 | 0.00 |
| -11.00 | 0.00 | 65.00 | 0.00 | -40.24 | 24.76 |
| -13.00 | -20.00 | 85.00 | -12.38 | -52.62 | 0.00 |

H-pressure on static system

Level of mobilization: Ep,gk 100.0, Ep,qk 100.0, Ep,d 100.0 [%]



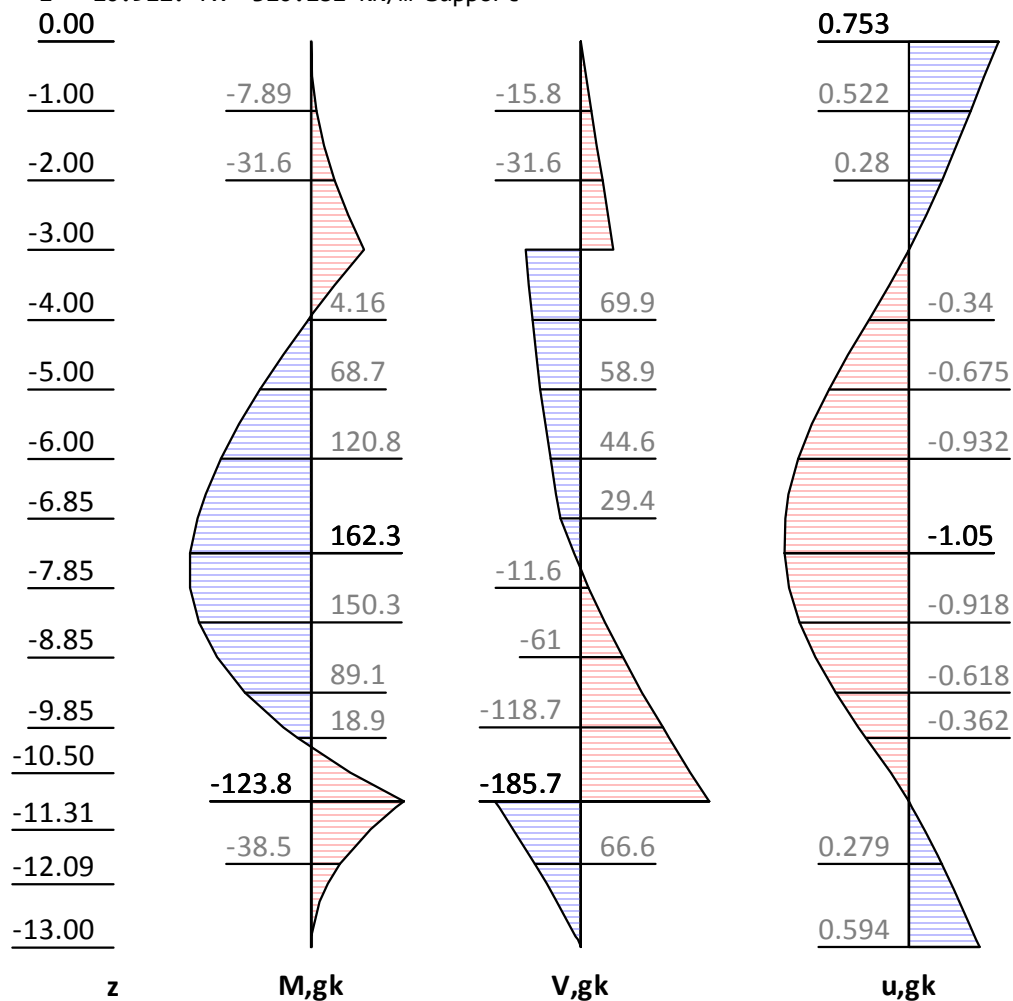
| z [m] | PH,gk [kN/m ²] | PH,qk [kN/m ²] | PH,d [kN/m ²] |
|----------|-------------------------------|-------------------------------|------------------------------|
| 0.00 | 15.78 | | 21.31 |
| -0.93 | 15.78 | 0.00 | 21.31 |
| -0.93 | 15.78 | 5.76 | 29.95 |
| -1.50 | 15.78 | 5.76 | 29.95 |
| -1.50 | 15.78 | 15.23 | 44.16 |
| -3.00 | 15.78 | 15.23 | 44.16 |
| -3.00 | 10.53 | 15.23 | 37.06 |
| -4.50 | 10.53 | 15.23 | 37.06 |
| -4.50 | 10.53 | 4.15 | 20.44 |
| -6.85 | 19.48 | 4.15 | 32.52 |
| -6.85 | 36.78 | 4.15 | 55.88 |
| -10.00 | 63.22 | 4.15 | 91.57 |
| -10.00 | 59.48 | 3.81 | 86.02 |
| -10.06 | 59.96 | 3.81 | 86.67 |
| -10.06 | 59.96 | 0.00 | 80.95 |
| -11.00 | 67.49 | 0.00 | 91.11 |
| -13.00 | 51.11 | 0.00 | 69.01 |

V-pressure on static system**Internal forces: Permanent, characteristically**

z= -0.500. Fx= -0.000 kN/m Support

z= -3.000. Fx=-127.795 kN/m Support

z= -10.912. Fx=-310.181 kN/m Support

0.00

| | | | | | |
|--|-------------------|------------------|----------------------|----------|------------------|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | | | | | Job No.: |
| Program: WALLS-Retain. Version 2017.046 | | | | | |
| Structure: | info@fides-dvp.de | www.fides-dvp.de | Tel:++49/89/143829-0 | ASB Nr.: | Date: 08.10.2018 |

| z [m] | H, g, k [kN/m2] | M, g, k [kN/m2] | V, g, k [kN/m2] | N, g, k [kN/m2] | u, g, k [mm] |
|----------|--------------------|--------------------|--------------------|--------------------|-----------------|
| 0.00 | 15.78 | -0.00 | 0.00 | 0.00 | 0.75 |
| -0.00 | 15.78 | -0.00 | 0.00 | -0.00 | 0.75 |
| -3.00 | 15.78 | -71.02 | -47.35 | -75.24 | 0.00 |
| -3.00 | 15.78 | -71.02 | -47.35 | -75.24 | -0.00 |
| -3.00 | 10.53 | -71.02 | 80.45 | -109.49 | -0.00 |
| -3.94 | 10.53 | 0.00 | 70.53 | -131.85 | -0.32 |
| -6.85 | 19.48 | 152.45 | 29.40 | -200.82 | -1.04 |
| -6.85 | 36.78 | 152.45 | 29.40 | -200.82 | -1.04 |
| -7.35 | 40.98 | 162.31 | 9.95 | -216.84 | -1.05 |
| -7.58 | 42.91 | 162.14 | -0.00 | -224.14 | -1.03 |
| -10.00 | 63.22 | 18.88 | -128.09 | -298.34 | -0.36 |
| -10.00 | 59.48 | 18.88 | -128.09 | -298.34 | -0.36 |
| -10.13 | 60.54 | 0.00 | -136.19 | -302.25 | -0.31 |
| -10.91 | 66.77 | -123.78 | -185.70 | -325.76 | 0.00 |
| -10.91 | 66.77 | -123.78 | 124.48 | -325.76 | 0.00 |
| -11.00 | 67.49 | -113.14 | 118.60 | -328.47 | 0.03 |
| -13.00 | 51.11 | -0.00 | -0.00 | -394.15 | 0.59 |

Internal forces: Variable, characteristically

Method EB 82-4 (Q = [G+Q] - G).

z= -0.500. Fx= 0.000 kN/m Support

z= -3.000. Fx= -60.317 kN/m Support

z= -10.912. Fx= -11.722 kN/m Support

0.00

<

| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | | | | | Job No.: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|--------------------|--------------------|--------------------|--------------------|------------------|----------|--------------------|--------------------|--------------------|--------------------|-----------------|------|--|------|------|--|------|-------|--|------|------|------|------|-------|------|------|-------|-------|------|-------|------|------|------|-------|------|-------|------|------|-------|-------|------|-------|------|-------|-------|-------|------|-------|------|-------|-------|-------|------|-------|-------|-------|-------|-------|------|-------|-------|--------|--------|-------|------|-------|-------|--------|--------|-------|-------|-------|-------|--------|-------|--------|-------|-------|-------|------|-------|--------|-------|-------|-------|-------|-------|--------|-------|-------|------|-------|-------|--------|-------|-------|------|-------|------|--------|-------|-------|------|-------|------|--------|-------|-------|------|-------|-------|--------|-------|--------|------|-------|--------|--------|-------|--------|------|-------|--------|--------|-------|--------|------|-------|--------|--------|-------|--------|------|-------|--------|--------|-------|--------|------|------|--------|--------|-------|--------|------|------|--------|--------|-------|--------|------|------|--------|--------|------|--------|------|------|------|--------|------|--------|------|------|------|--------|------|--------|------|------|-------|--------|------|--------|------|------|-------|--------|------|--------|------|------|-------|--------|------|
| Program: WALLS-Retain. Version 2017.046 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Structure: info@fides-dvp.de www.fides-dvp.de Tel:++49/89/143829-0 ASB Nr.: | | | | | Date: 08.10.2018 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <table border="1"> <thead> <tr> <th>z [m]</th> <th>H, q, k [kN/m2]</th> <th>M, q, k [kN/m2]</th> <th>V, q, k [kN/m2]</th> <th>N, q, k [kN/m2]</th> <th>u, q, k [mm]</th> </tr> </thead> <tbody> <tr><td>0.00</td><td></td><td>0.00</td><td>0.00</td><td></td><td>0.13</td></tr> <tr><td>-0.50</td><td></td><td>0.00</td><td>0.00</td><td>0.00</td><td>0.11</td></tr> <tr><td>-0.93</td><td>0.00</td><td>0.24</td><td>-0.00</td><td>-0.00</td><td>0.10</td></tr> <tr><td>-0.93</td><td>5.76</td><td>0.24</td><td>0.00</td><td>-0.00</td><td>0.10</td></tr> <tr><td>-0.93</td><td>5.76</td><td>0.24</td><td>-0.00</td><td>-0.00</td><td>0.10</td></tr> <tr><td>-0.96</td><td>5.76</td><td>-0.00</td><td>-0.17</td><td>-0.04</td><td>0.09</td></tr> <tr><td>-1.50</td><td>5.76</td><td>-0.94</td><td>-3.28</td><td>-0.85</td><td>0.07</td></tr> <tr><td>-1.50</td><td>15.23</td><td>-0.94</td><td>-3.28</td><td>-0.85</td><td>0.07</td></tr> <tr><td>-3.00</td><td>15.23</td><td>-23.00</td><td>-26.13</td><td>-6.74</td><td>0.00</td></tr> <tr><td>-3.00</td><td>15.23</td><td>-23.00</td><td>-26.13</td><td>-6.74</td><td>-0.00</td></tr> <tr><td>-3.00</td><td>15.23</td><td>-23.00</td><td>34.18</td><td>-22.91</td><td>-0.00</td></tr> <tr><td>-3.84</td><td>15.23</td><td>0.00</td><td>21.33</td><td>-26.22</td><td>-0.06</td></tr> <tr><td>-4.50</td><td>15.23</td><td>11.13</td><td>11.33</td><td>-28.80</td><td>-0.10</td></tr> <tr><td>-4.50</td><td>4.15</td><td>11.13</td><td>11.33</td><td>-28.80</td><td>-0.10</td></tr> <tr><td>-6.85</td><td>4.15</td><td>26.30</td><td>1.58</td><td>-31.32</td><td>-0.19</td></tr> <tr><td>-7.23</td><td>4.15</td><td>26.51</td><td>0.00</td><td>-31.73</td><td>-0.19</td></tr> <tr><td>-7.35</td><td>4.15</td><td>26.57</td><td>-0.50</td><td>-31.85</td><td>-0.19</td></tr> <tr><td>-10.00</td><td>4.15</td><td>10.69</td><td>-11.49</td><td>-34.69</td><td>-0.07</td></tr> <tr><td>-10.00</td><td>3.81</td><td>10.69</td><td>-11.49</td><td>-34.69</td><td>-0.07</td></tr> <tr><td>-10.06</td><td>3.81</td><td>10.80</td><td>-11.62</td><td>-34.73</td><td>-0.07</td></tr> <tr><td>-10.06</td><td>0.00</td><td>10.80</td><td>-11.62</td><td>-34.73</td><td>-0.07</td></tr> <tr><td>-10.50</td><td>0.00</td><td>4.00</td><td>-11.83</td><td>-34.78</td><td>-0.03</td></tr> <tr><td>-10.56</td><td>0.00</td><td>4.81</td><td>-11.64</td><td>-34.73</td><td>-0.03</td></tr> <tr><td>-10.91</td><td>0.00</td><td>0.00</td><td>-11.72</td><td>-34.75</td><td>0.00</td></tr> <tr><td>-10.91</td><td>0.00</td><td>0.00</td><td>0.00</td><td>-34.75</td><td>0.00</td></tr> <tr><td>-11.00</td><td>0.00</td><td>0.00</td><td>0.00</td><td>-34.75</td><td>0.01</td></tr> <tr><td>-11.31</td><td>0.00</td><td>0.00</td><td>-0.00</td><td>-34.75</td><td>0.03</td></tr> <tr><td>-12.09</td><td>0.00</td><td>0.00</td><td>-0.00</td><td>-34.75</td><td>0.09</td></tr> <tr><td>-13.00</td><td>0.00</td><td>0.00</td><td>-0.00</td><td>-34.75</td><td>0.17</td></tr> </tbody> </table> | | | | | | z [m] | H, q, k [kN/m2] | M, q, k [kN/m2] | V, q, k [kN/m2] | N, q, k [kN/m2] | u, q, k [mm] | 0.00 | | 0.00 | 0.00 | | 0.13 | -0.50 | | 0.00 | 0.00 | 0.00 | 0.11 | -0.93 | 0.00 | 0.24 | -0.00 | -0.00 | 0.10 | -0.93 | 5.76 | 0.24 | 0.00 | -0.00 | 0.10 | -0.93 | 5.76 | 0.24 | -0.00 | -0.00 | 0.10 | -0.96 | 5.76 | -0.00 | -0.17 | -0.04 | 0.09 | -1.50 | 5.76 | -0.94 | -3.28 | -0.85 | 0.07 | -1.50 | 15.23 | -0.94 | -3.28 | -0.85 | 0.07 | -3.00 | 15.23 | -23.00 | -26.13 | -6.74 | 0.00 | -3.00 | 15.23 | -23.00 | -26.13 | -6.74 | -0.00 | -3.00 | 15.23 | -23.00 | 34.18 | -22.91 | -0.00 | -3.84 | 15.23 | 0.00 | 21.33 | -26.22 | -0.06 | -4.50 | 15.23 | 11.13 | 11.33 | -28.80 | -0.10 | -4.50 | 4.15 | 11.13 | 11.33 | -28.80 | -0.10 | -6.85 | 4.15 | 26.30 | 1.58 | -31.32 | -0.19 | -7.23 | 4.15 | 26.51 | 0.00 | -31.73 | -0.19 | -7.35 | 4.15 | 26.57 | -0.50 | -31.85 | -0.19 | -10.00 | 4.15 | 10.69 | -11.49 | -34.69 | -0.07 | -10.00 | 3.81 | 10.69 | -11.49 | -34.69 | -0.07 | -10.06 | 3.81 | 10.80 | -11.62 | -34.73 | -0.07 | -10.06 | 0.00 | 10.80 | -11.62 | -34.73 | -0.07 | -10.50 | 0.00 | 4.00 | -11.83 | -34.78 | -0.03 | -10.56 | 0.00 | 4.81 | -11.64 | -34.73 | -0.03 | -10.91 | 0.00 | 0.00 | -11.72 | -34.75 | 0.00 | -10.91 | 0.00 | 0.00 | 0.00 | -34.75 | 0.00 | -11.00 | 0.00 | 0.00 | 0.00 | -34.75 | 0.01 | -11.31 | 0.00 | 0.00 | -0.00 | -34.75 | 0.03 | -12.09 | 0.00 | 0.00 | -0.00 | -34.75 | 0.09 | -13.00 | 0.00 | 0.00 | -0.00 | -34.75 | 0.17 |
| z [m] | H, q, k [kN/m2] | M, q, k [kN/m2] | V, q, k [kN/m2] | N, q, k [kN/m2] | u, q, k [mm] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.00 | | 0.00 | 0.00 | | 0.13 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -0.50 | | 0.00 | 0.00 | 0.00 | 0.11 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -0.93 | 0.00 | 0.24 | -0.00 | -0.00 | 0.10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -0.93 | 5.76 | 0.24 | 0.00 | -0.00 | 0.10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -0.93 | 5.76 | 0.24 | -0.00 | -0.00 | 0.10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -0.96 | 5.76 | -0.00 | -0.17 | -0.04 | 0.09 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -1.50 | 5.76 | -0.94 | -3.28 | -0.85 | 0.07 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -1.50 | 15.23 | -0.94 | -3.28 | -0.85 | 0.07 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -3.00 | 15.23 | -23.00 | -26.13 | -6.74 | 0.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -3.00 | 15.23 | -23.00 | -26.13 | -6.74 | -0.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -3.00 | 15.23 | -23.00 | 34.18 | -22.91 | -0.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -3.84 | 15.23 | 0.00 | 21.33 | -26.22 | -0.06 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -4.50 | 15.23 | 11.13 | 11.33 | -28.80 | -0.10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -4.50 | 4.15 | 11.13 | 11.33 | -28.80 | -0.10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -6.85 | 4.15 | 26.30 | 1.58 | -31.32 | -0.19 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -7.23 | 4.15 | 26.51 | 0.00 | -31.73 | -0.19 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -7.35 | 4.15 | 26.57 | -0.50 | -31.85 | -0.19 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -10.00 | 4.15 | 10.69 | -11.49 | -34.69 | -0.07 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -10.00 | 3.81 | 10.69 | -11.49 | -34.69 | -0.07 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -10.06 | 3.81 | 10.80 | -11.62 | -34.73 | -0.07 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -10.06 | 0.00 | 10.80 | -11.62 | -34.73 | -0.07 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -10.50 | 0.00 | 4.00 | -11.83 | -34.78 | -0.03 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -10.56 | 0.00 | 4.81 | -11.64 | -34.73 | -0.03 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -10.91 | 0.00 | 0.00 | -11.72 | -34.75 | 0.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -10.91 | 0.00 | 0.00 | 0.00 | -34.75 | 0.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -11.00 | 0.00 | 0.00 | 0.00 | -34.75 | 0.01 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -11.31 | 0.00 | 0.00 | -0.00 | -34.75 | 0.03 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -12.09 | 0.00 | 0.00 | -0.00 | -34.75 | 0.09 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -13.00 | 0.00 | 0.00 | -0.00 | -34.75 | 0.17 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Part: Block: Please specify project informations. Record: | | | | | Archive No.: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

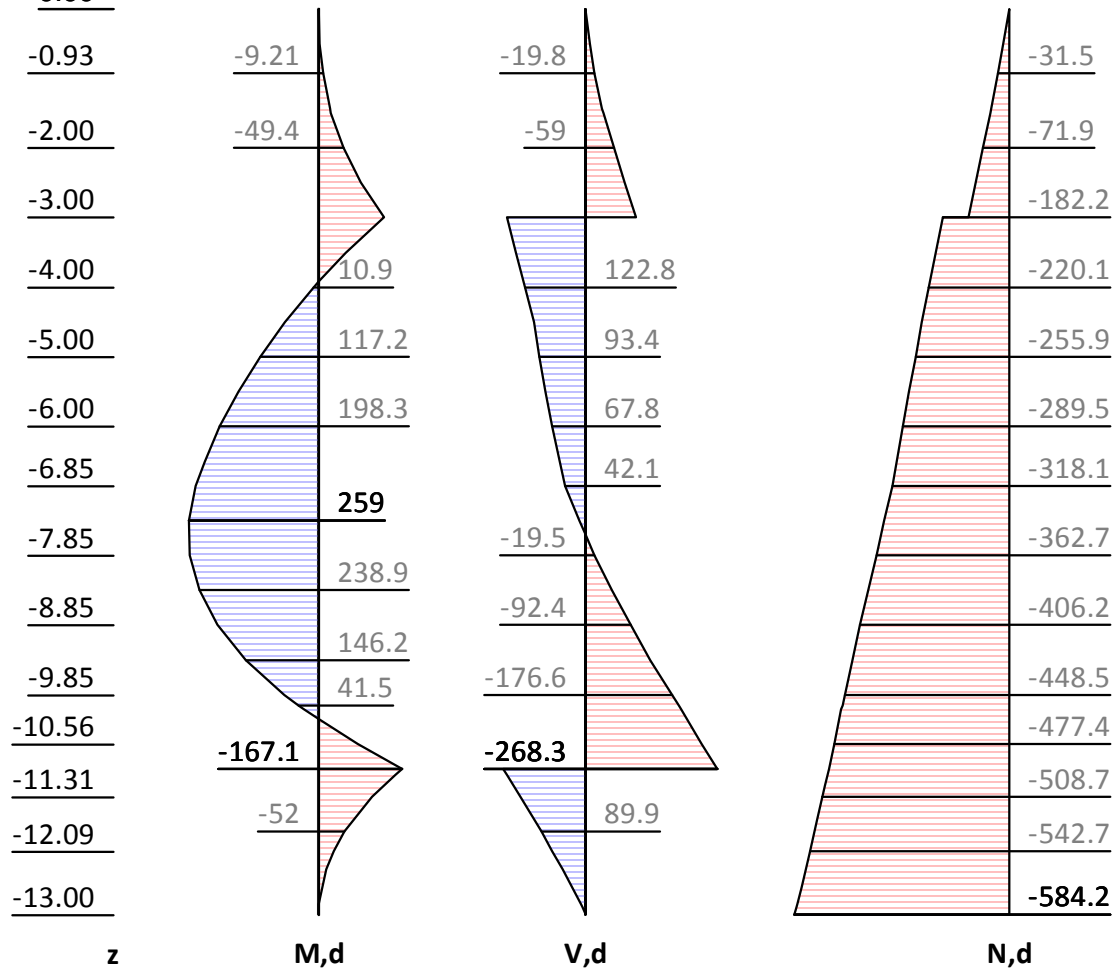
Page: 64

Internal forces: Design

z= -0.500. Fx= -0.000 kN/m Support

z= -3.000. Fx=-262.999 kN/m Support

z= -10.912. Fx=-436.328 kN/m Support

0.00

| | | | | | |
|---|-------------------|------------------|----------------------|----------|------------------|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | | | | | Job No.: |
| Program: WALLS-Retain. Version 2017.046 | | | | | |
| Structure: | info@fides-dvp.de | www.fides-dvp.de | Tel:++49/89/143829-0 | ASB Nr.: | Date: 08.10.2018 |

0.00

21.3

z

0.887

0.633

0.33

-0.406

-0.805

-1.11

-1.24

-1.09

-0.733

-0.433

0.35

0.76

u,g+q,k

| z [m] | H,d [kN/m2] | M,d [kN/m2] | V,d [kN/m2] | N,d [kN/m2] | u,g+q,k [mm] |
|----------|----------------|----------------|----------------|----------------|-----------------|
| 0.00 | 21.31 | 0.00 | 0.00 | 0.00 | 0.89 |
| -0.00 | 21.31 | 0.00 | -0.00 | -0.00 | 0.89 |
| -0.93 | 21.31 | -9.21 | -19.81 | -31.49 | 0.63 |
| -0.93 | 29.95 | -9.21 | -19.81 | -31.49 | 0.63 |
| -1.50 | 29.95 | -25.37 | -36.89 | -52.06 | 0.47 |
| -1.50 | 44.16 | -25.37 | -36.89 | -52.06 | 0.47 |
| -3.00 | 44.16 | -130.38 | -103.12 | -111.70 | 0.00 |
| -3.00 | 44.16 | -130.38 | -103.12 | -111.70 | -0.00 |
| -3.00 | 37.06 | -130.38 | 159.88 | -182.17 | -0.00 |
| -3.92 | 37.06 | -0.00 | 125.89 | -216.94 | -0.37 |
| -4.50 | 37.06 | 67.75 | 104.29 | -239.05 | -0.61 |
| -4.50 | 20.44 | 67.75 | 104.29 | -239.05 | -0.61 |
| -6.85 | 32.52 | 245.27 | 42.06 | -318.08 | -1.23 |
| -6.85 | 55.88 | 245.27 | 42.06 | -318.08 | -1.23 |
| -7.35 | 61.54 | 258.97 | 12.69 | -340.51 | -1.24 |
| -7.55 | 63.78 | 258.32 | 0.00 | -349.24 | -1.22 |
| -10.00 | 91.57 | 41.52 | -190.17 | -454.80 | -0.43 |
| -10.00 | 86.02 | 41.52 | -190.17 | -454.80 | -0.43 |
| -10.06 | 86.67 | 29.95 | -195.35 | -457.26 | -0.40 |
| -10.06 | 80.95 | 29.95 | -195.35 | -457.26 | -0.40 |
| -10.20 | 82.45 | 0.00 | -206.94 | -462.84 | -0.34 |
| -10.91 | 90.14 | -167.11 | -268.28 | -491.90 | 0.00 |
| -10.91 | 90.14 | -167.11 | 168.05 | -491.90 | 0.00 |
| -11.00 | 91.11 | -152.75 | 160.11 | -495.56 | 0.04 |
| -13.00 | 69.01 | -0.00 | 0.00 | -584.23 | 0.76 |
| -13.00 | 69.01 | 0.00 | -0.00 | -584.23 | 0.76 |

| | | | |
|---------|--------------------------------------|----------|--------------|
| Part: | Please specify project informations. | Page: 66 | Archive No.: |
| Block: | | | |
| Record: | | | |

Anchor forces with safety level of DS-P

| z[m] | A,d[kN] | F _{x,d} [kN/m] |
|-------|---------|-------------------------|
| -0.50 | 0.0 | -0.0 |
| -3.00 | 490.1 | -263.0 |

Checks of earth statics**Check of earth support**

Check: Mobilizable earth resistance is sufficient for earth support force.

z: -10.91 m

Rd = Eph,k/γ,Re = 3698.53 / 1.400 = 2641.81 [kN/m]

Ed(Uh,d)/Rd = 436.33 / 2641.81 = 0.165 [-]. Passes requirement

Sum of H and V forces, (G)

Forces up to depth z:-13.00

| Pos. | H | V |
|----------------------------------|---------|-----------------------|
| H/V pressure G+P+W,k | 437.98 | 125.33 |
| Wall weight | | 228.91 |
| H/V pressure passive | | 0.00 |
| Support z: -0.50 | | 0.00 |
| Support z: -3.00 | -127.80 | 34.24 |
| Bh,g,k z=-10.91 | -310.18 | |
| Bv,g,k = Bh,k * tan(δ,p=-23.33°) | | -133.80 |
| Σ | 0.00 | 254.68 (downwards) |

Average anchor inclination α,A = 15.00° >= 15°.

Verification of vertical forces due to EAB R 9 not required (R 9-5).

Check EAB R 9-1

Vertical component of earth resistance is less than the downwards pointing vertical forces.

Vk >= Bvk: 388.48 >= 133.80 Passes requirement

Sum of H and V forces, (G+Q)

Forces up to depth z:-13.00

| Pos. | H | V |
|----------------------------------|---------|-----------------------|
| H/V pressure G+P+W,k | 510.02 | 143.92 |
| Wall weight | | 228.91 |
| H/V pressure passive | | -0.00 |
| Support z: -0.50 | | 0.00 |
| Support z: -3.00 | -188.11 | 50.40 |
| Bh,g,k z=-10.91 | -310.18 | |
| Bv,g,k = Bh,k * tan(δ,p=-23.33°) | | -133.80 |
| Bh,q,k z=-10.91 | -11.72 | |
| Bv,q,k = Bh,k * tan(δ,p=-23.33°) | | -5.06 |
| Σ | -0.00 | 284.37 (downwards) |

Average anchor inclination α,A = 15.00° >= 15°.

Verification of vertical forces due to EAB R 9 not required (R 9-5).

Check EAB R 9-1

Vertical component of earth resistance is less than the downwards pointing vertical forces.

Vk >= Bvk: 423.23 >= 138.86 Passes requirement

| | |
|--|------------------|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | Job No.: |
| Program: WALLS-Retain. Version 2017.046 | |
| Structure: info@fides-dvp.de www.fides-dvp.de Tel:++49/89/143829-0 ASB Nr.: | Date: 08.10.2018 |

Hydraulic heave

Safety factors: [HYD]
 γ, G, stb : 0.900
 γ, H : 1.600

Stream length $l, tot = 10.50$ m. $Sum(h, i/k, i) = 105000.00$ 1/100s.

Στρώμα "Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ" z: -11.00 / -13.00, h= 2.00m
 $Ed = \Sigma(\gamma_w * h * i) * \gamma, H = 12.38 * 1.600 = 19.81$ (i=0.619)
 $Rd = \Sigma(\gamma * h) * \gamma, G, stb = 118.38 * 0.900 = 106.54$
 $Ed/Rd = 0.186$ [-]

Anchor verification

Anchor - Stability of lower failure plane

Περίπτ.Φόρτισης: όλα τα φορτία BS-P
 Αυτόμ. υπολογ. μήκους αγκυρίων:
 All anchors are extended (if necessary)
 Favourable variable loads in main failure body are not being considered.
 Bottom of lower failure plane: z=-13.00 m

Iteration of failure mechanisms:
 l_A : Length of anchor from head to center of grout body.
 W, k : Res. force from dead weight, loads, cohesion, ...
 Q, k : Force in lower failure plane.
 $Ea1, k$: Earth pressure onto vertical separation plane.
 $Ea2, k$: Earth pressure between wall and main failure body.
 $Ra_{cal, d}$: Dimesioning force of the resistance from the equilibrium of forces.
 $Ra_{cal, d}$ corresponds to the max. possible anchor force of the force polygon.
 $Sum(A, d)$: Acting anchor forces along the grout body fractions within the failure body. $Sum(A, d)$ is gained from the anchor pull forces of the wall analysis.

| z [m] | $\vartheta 1$ [°] | $\vartheta 2$ [°] | l_A [m] | W, k [kN/m] | Q, k [kN/m] | $Ea1, k$ [kN/m] | $Ea2, k$ [kN/m] | $Ra_{cal, d}$ [kN/m] | $Sum(A, d)$ [kN/m] | Ed/Rd [-] |
|----------|----------------------|----------------------|--------------|------------------|------------------|--------------------|--------------------|-------------------------|-----------------------|----------------|
| -0.50 | 38.5 | 57.5 | 12.19 | 1632.3 | 1444.7 | 4.4 | 373.2 | 202.8 | 202.3 | 1.00 |
| -3.00 | 33.9 | 60.9 | 11.02 | 1674.6 | 1452.8 | 35.0 | 373.2 | 272.9 | 272.2 | 1.00 |

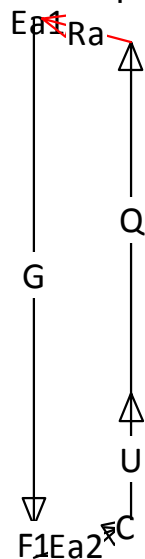
Decisive failure body:
Γεωμετρία:
 Foot point of lower failure plane $x/z = 0.01/-13.00$ m
 Intersection lower/upper slid. plane $x/z = 10.64/ -5.85$ m
 Intersection upper slid. plane/surface $x/z = 13.90/ 0.00$ m
 Intersection separation plane/surface $x/z = 10.64/ 0.00$ m
 Inclination lower failure plane $\vartheta 1 = 33.92^\circ$
 Inclination upper failure plane $\vartheta 2 = 60.90^\circ$
 Inclination separation plane $\vartheta 12 = 90.00^\circ$

Loads / forces (char.)

| | | F_x [kN/m] | F_z [kN/m] | F [kN/m] | |
|------------------------------------|-----------------|-----------------|-----------------|---------------|----------------------|
| Weight of main failure body | G, k : | 0.0 | -2103.2 | 2103.2 | |
| Area loads on/in main failure body | $F1, k$: | 0.0 | -130.0 | 130.0 | |
| Cohesion of lower failure plane | C, k : | 53.2 | 35.7 | 64.1 | |
| Pore water pressure on main body | U, k : | -0.1 | 523.7 | 523.7 | |
| Earth pres. on separation plane | $Ea1, k$: | -35.0 | -0.0 | 35.0 | $\delta = 0.0^\circ$ |
| Earth pr. between wall<->main body | $Ea2, k$: | 352.6 | 122.1 | 373.2 | |
| Force in lower failure plane | Q, k : | -1.7 | 1452.8 | 1452.8 | |
| Sum = possible anchor forces: | $Ra_{cal, k}$: | 369.0 | -98.9 | 382.0 | |

| | |
|---|--------------|
| Part: Block: Please specify project informations. Record: | Archive No.: |
|---|--------------|

Page: 68

Force polygon

Acting anchor forces $E_d: \sum(A, d) = 272.2 \text{ kN/m}$
 Possible anchor forces $R_d: R_{a, cal, d} = 382.0/1.400 = 272.9 \text{ kN/m}$
 Verif. of lower failure plane $E_d/R_d = 1.00 < 1.0$: Έλεγχος εκπληρώθηκε.

Check of steel tension

l_{tot} ...[m]: Total length of anchor incl. excess length at head
 A_s [mm²]: X-section area of steel member
 $R_{i, d}$...[kN]: Ultimate strength of tension member ($\gamma, M=1.15$)
 A, d [kN]: Dimensioning force of the anchor from wall analysis

| z[m] | Anchor type | l_{tot} | A_s | $R_{i, d}$ | A, d |
|-------|----------------------------|-----------|-------|------------|--------|
| -0.50 | Strand; 3x0.60"; 1570/1770 | 16.43 | 420 | 573.4 | 0.0 |
| -3.00 | Strand; 3x0.60"; 1570/1770 | 15.02 | 420 | 573.4 | 490.1 |

Check of steel tension: Passes requirement

Check of anchor's soil friction

$l_{V, k}$: Length of grout body
 $D_{m, V, k}$: Diameter of grout body
 $\tau_{Gr, k}$: Average applied skin friction along the grout body (from soil parameters)
 $R_{a, k}$: Charact. pullout resistance of the anchor
 γ_A : Partial safety factor of anchor pullout
 $R_{a, d}$: $R_{a, k} / \gamma_A$
 A, d : Dimensioning force of the anchor from wall analysis

| z | $l_{V, k}$ | $D_{m, V, k}$ | $\tau_{Gr, k}$ | $R_{a, k}$ | γ_A | $R_{a, d}$ | A, d | $A, d / R_{a, d}$ |
|-------|------------|---------------|----------------------|------------|------------|------------|--------|-------------------|
| [m] | [m] | [mm] | [kN/m ²] | [kN] | [-] | [kN] | [kN] | [-] |
| -0.50 | 8.00 | 318 | 110 | 879.1 | 1.100 | 799.2 | 0.0 | 0.0 |
| -3.00 | 8.00 | 318 | 110 | 879.1 | 1.100 | 799.2 | 490.1 | 0.6 |

Check of anchor's soil friction: Passes requirement

Υπολογ. κύκλου ολίσθησης

LC: όλα τα φορτία Type: BS-T (combination: [GEO] A2 M2 R3, BS-T)
 Vertical variable loads only act if they are outside of $R \cdot \sin(\phi)$.
 The automatic slip circle optimization only considers circles that intersect the surface with an area of at least 0.25 m².
 The slip circle calculation only accepts circles including the wall.
 The slip circle calculation only allows circular failure planes (no vertical tangents will occur).

Γεωμετ. κύκλου (μήκη και συντεταγμ. σε (m))

Κέντρο = $(-1.95, 0.20)$, Ακτίνα = 13.35

Αρχ.σημ. = (-13.29, -6.85), Τελ.σημ. = (11.40, 0.00)

Γεωμετρία λωρίδων:

| No | x | Width b | dxM | Weight | Load z-κατ. | Water- φορτ. | u*b | φ | c | θ |
|----|--------|------------|--------|--------|----------------|-----------------|--------|-------|----------------------|---------|
| | [m] | [m] | [m] | [kN/m] | [kN/m] | [kN/m] | [kN/m] | [°] | [kN/m ²] | [°] |
| 1 | -12.62 | 1.34 | -10.67 | 29.3 | 0.0 | 0.0 | -0.0 | 27.45 | 3.57 | -31.27* |
| 2 | -11.29 | 1.34 | -9.34 | 75.0 | 0.0 | 0.0 | -0.0 | 27.45 | 3.57 | -31.27* |
| 3 | -9.95 | 1.34 | -8.00 | 109.4 | 0.0 | 0.0 | -0.0 | 29.26 | 3.57 | -30.37* |
| 4 | -8.61 | 1.34 | -6.67 | 135.8 | 0.0 | 0.0 | -4.9 | 29.26 | 3.57 | -29.95 |
| 5 | -7.28 | 1.34 | -5.33 | 156.0 | 0.0 | 0.0 | -13.6 | 29.26 | 3.57 | -23.53 |
| 6 | -5.94 | 1.34 | -4.00 | 171.0 | 0.0 | 0.0 | -20.3 | 29.26 | 3.57 | -17.41 |
| 7 | -4.61 | 1.34 | -2.66 | 181.3 | 0.0 | 0.0 | -24.9 | 29.26 | 3.57 | -11.49 |
| 8 | -3.27 | 1.34 | -1.33 | 187.4 | 0.0 | 0.0 | -27.6 | 29.26 | 3.57 | -5.69 |
| 9 | -1.94 | 1.34 | 0.01 | 189.4 | 0.0 | 0.0 | -28.5 | 29.26 | 3.57 | 0.04 |
| 10 | -0.60 | 1.34 | 1.35 | 196.5 | 0.0 | 0.0 | -71.0 | 29.26 | 3.57 | 5.78 |
| 11 | 0.73 | 1.34 | 2.68 | 368.0 | 0.0 | 0.0 | -111.7 | 29.26 | 3.57 | 11.58 |
| 12 | 2.07 | 1.34 | 4.02 | 357.6 | 0.0 | 0.0 | -107.0 | 29.26 | 3.57 | 17.50 |
| 13 | 3.40 | 1.34 | 5.35 | 342.5 | 0.0 | 0.0 | -100.3 | 29.26 | 3.57 | 23.63 |
| 14 | 4.74 | 1.34 | 6.69 | 322.2 | 34.7 | 0.0 | -91.2 | 29.26 | 3.57 | 30.05 |
| 15 | 6.07 | 1.34 | 8.02 | 295.7 | 34.7 | 0.0 | -79.3 | 29.26 | 3.57 | 36.93 |
| 16 | 7.41 | 1.34 | 9.36 | 261.2 | 34.7 | 0.0 | -63.8 | 27.45 | 3.57 | 44.49 |
| 17 | 8.75 | 1.34 | 10.69 | 215.3 | 11.0 | 0.0 | -43.0 | 27.45 | 3.57 | 53.20 |
| 18 | 10.41 | 1.99 | 12.36 | 189.5 | 0.0 | 0.0 | -23.1 | 27.45 | 3.57 | 67.72 |

*** Σημείωση: Στις λωρίδες σημειωμένες με '*'
περιορίστηκε το theta στο 45°-Phi/2.

Συνεισφ. κατακόρυφων φορτίων:

| No | Weight | $G \cdot \sin(\theta)$ | $(G - u \cdot b) \cdot \tan(\varphi) + c \cdot b$ | $\mu \cdot \sin(\theta) \cdot \tan(\varphi) + \cos(\theta)$ | T |
|--------|--------|------------------------|---|---|---------|
| | [kN/m] | [kN/m] | [kN/m] | [-] | [kN/m] |
| 1 | 29.29 | -23.41 | 19.99 | 0.738170 | 27.08 |
| 2 | 74.98 | -52.43 | 43.72 | 0.738170 | 59.23 |
| 3 | 109.36 | -65.53 | 66.03 | 0.740387 | 89.18 |
| 4 | 135.80 | -67.80 | 78.11 | 0.745640 | 104.76 |
| 5 | 156.02 | -62.29 | 84.53 | 0.820224 | 103.05 |
| 6 | 170.99 | -51.17 | 89.17 | 0.881758 | 101.13 |
| 7 | 181.33 | -36.13 | 92.38 | 0.931733 | 99.15 |
| 8 | 187.40 | -18.60 | 94.26 | 0.971048 | 97.07 |
| 9 | 189.38 | 0.15 | 94.87 | 1.000186 | 94.86 |
| 10 | 196.51 | 19.80 | 75.07 | 1.019299 | 73.65 |
| 11 | 368.00 | 73.88 | 148.35 | 1.028231 | 144.28 |
| 12 | 357.59 | 107.55 | 145.12 | 1.026493 | 141.38 |
| 13 | 342.54 | 137.28 | 140.45 | 1.013178 | 138.63 |
| 14 | 356.95 | 178.75 | 153.62 | 0.986783 | 155.67 |
| 15 | 330.41 | 198.50 | 145.41 | 0.944827 | 153.90 |
| 16 | 295.89 | 207.35 | 125.33 | 0.870691 | 143.95 |
| 17 | 226.23 | 181.16 | 99.97 | 0.778723 | 128.38 |
| 18 | 189.47 | 175.32 | 93.56 | 0.586878 | 159.42 |
| ----- | | | | | ----- |
| 902.40 | | | | | 2014.76 |

Συνεισφ. αγκυρίων: Αθρ. ροπών ανατροπής : -291.4 kN*m/m
 " " resisting : 314.7 kN*m/m

Δράση $E_d = (902.4 \cdot 13.35 - 291.4)$

Αντίσταση $R_d = (2014.8 \cdot 13.35 + 314.7)$

SLIP-CIRCLE $\mu = Ed/Rd = 0.43 < 1.0$: Έλεγχος εκπληρώθηκε.

ΠΑΡΑΡΤΗΜΑ

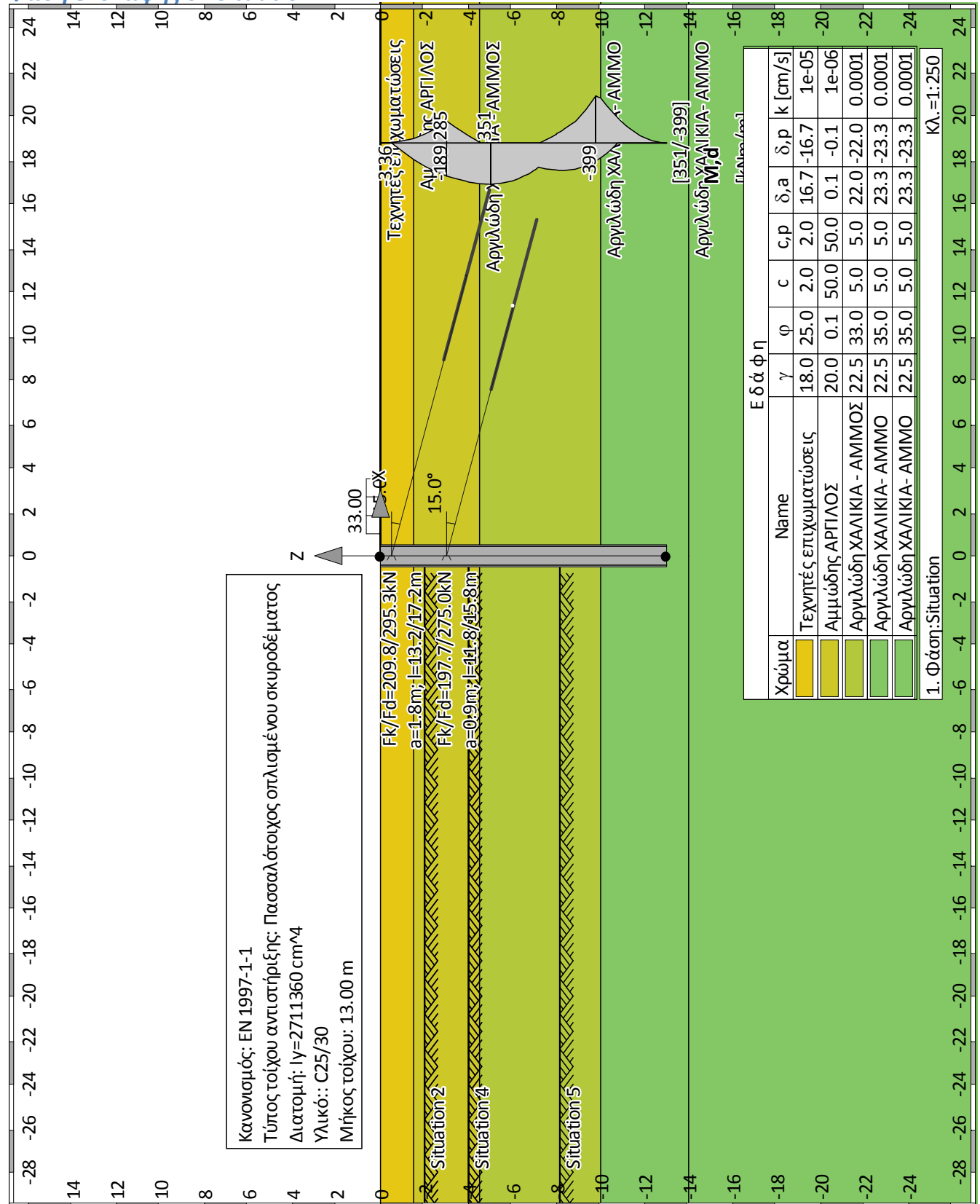
8.5 Αποτελέσματα ανάλυσης

8.5.3 Έλεγχος θραύσης πυθμένα

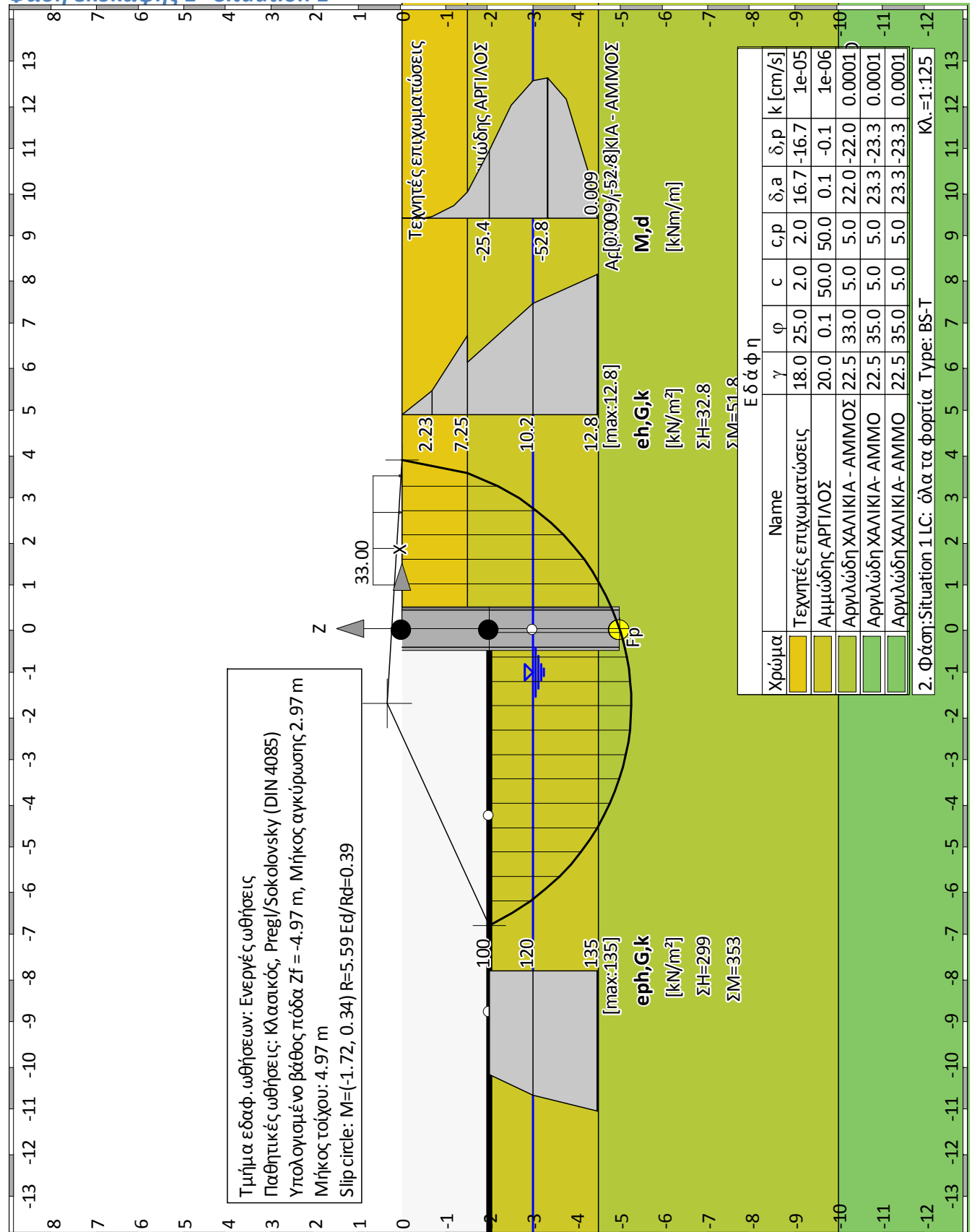
- i) Αντιστηριζόμενο ύψος 7,80m

Summary of all stages

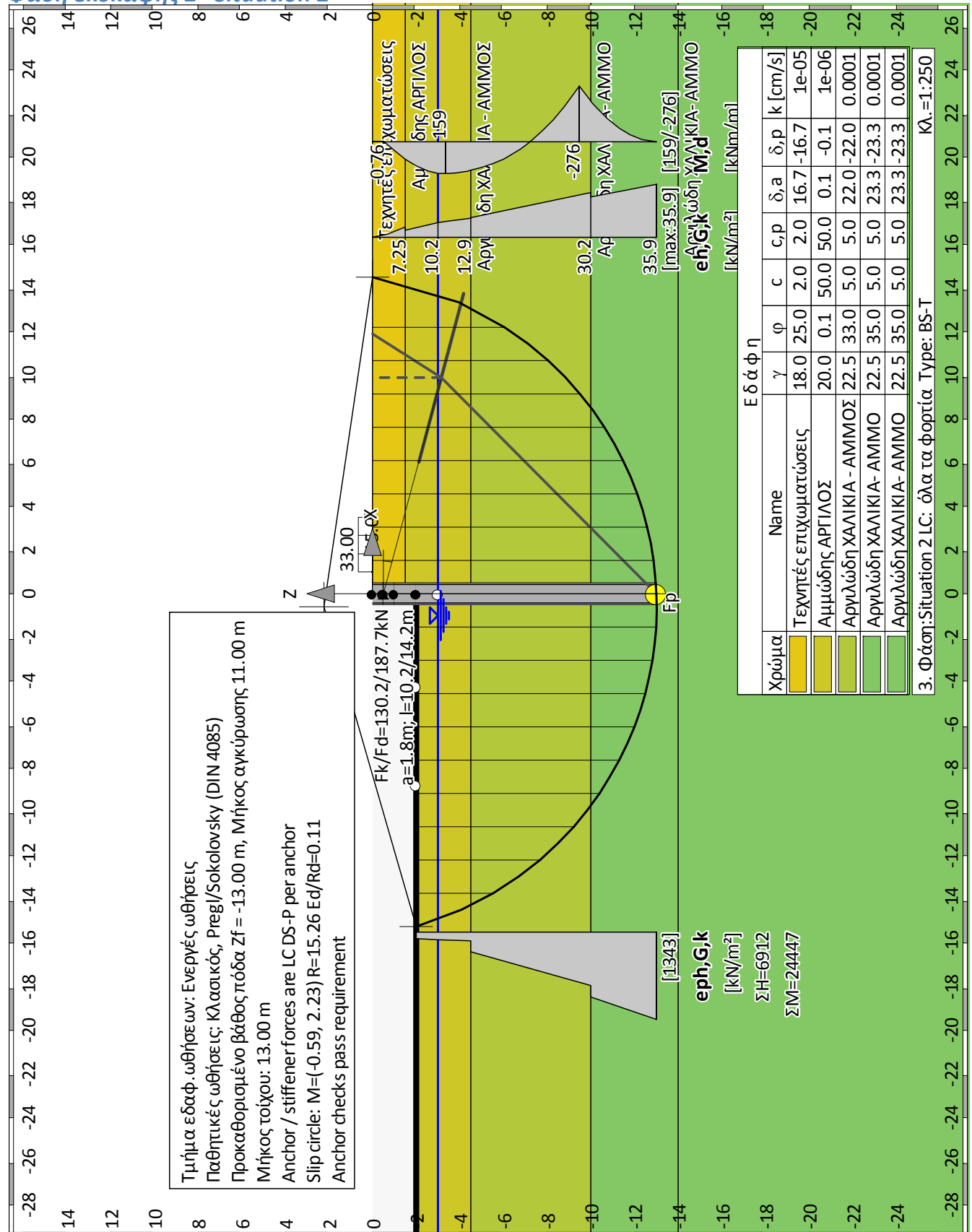
Φάση εκσκαφής 0 "Situation"



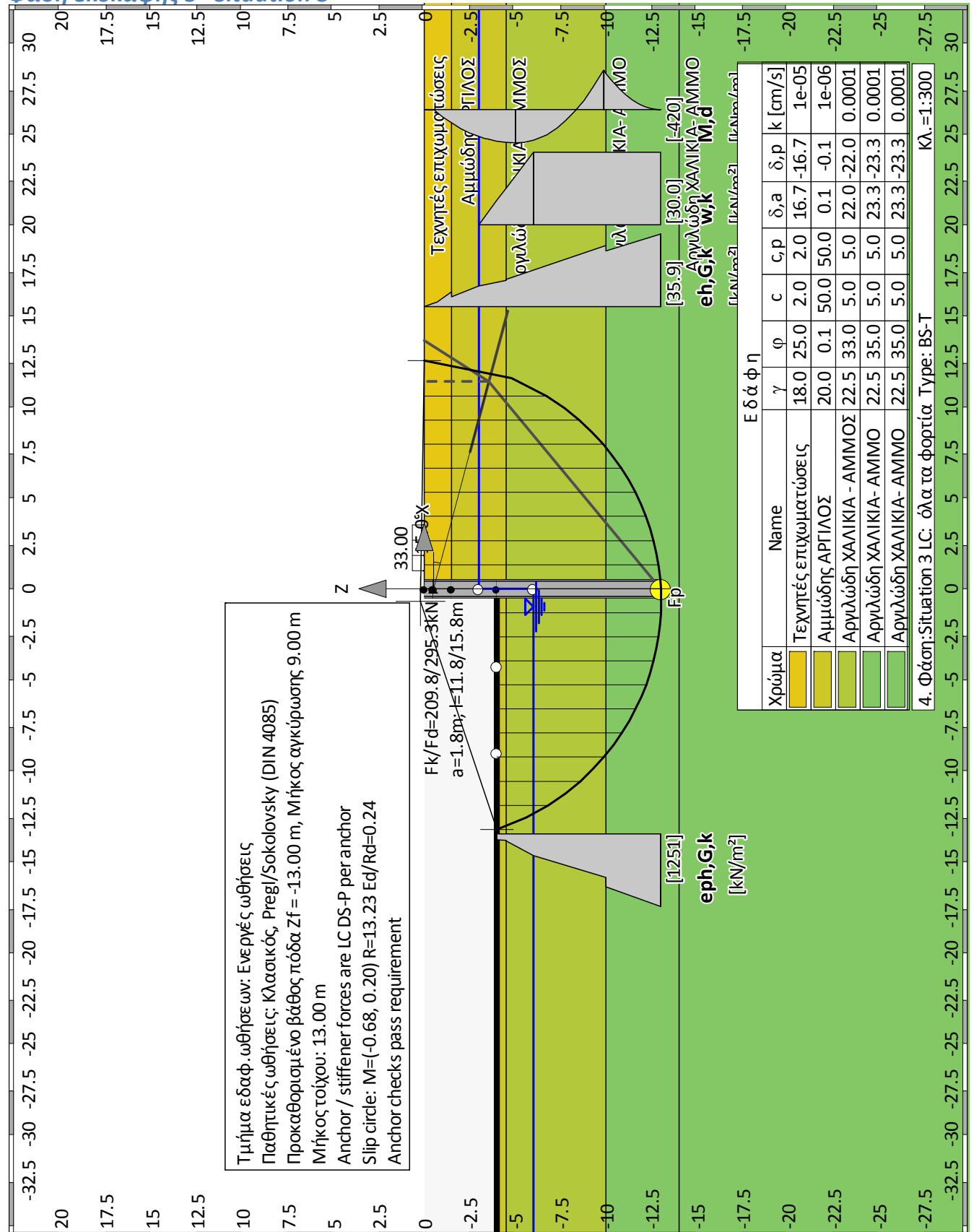
Φάση εκσκαφής 1 "Situation 1"



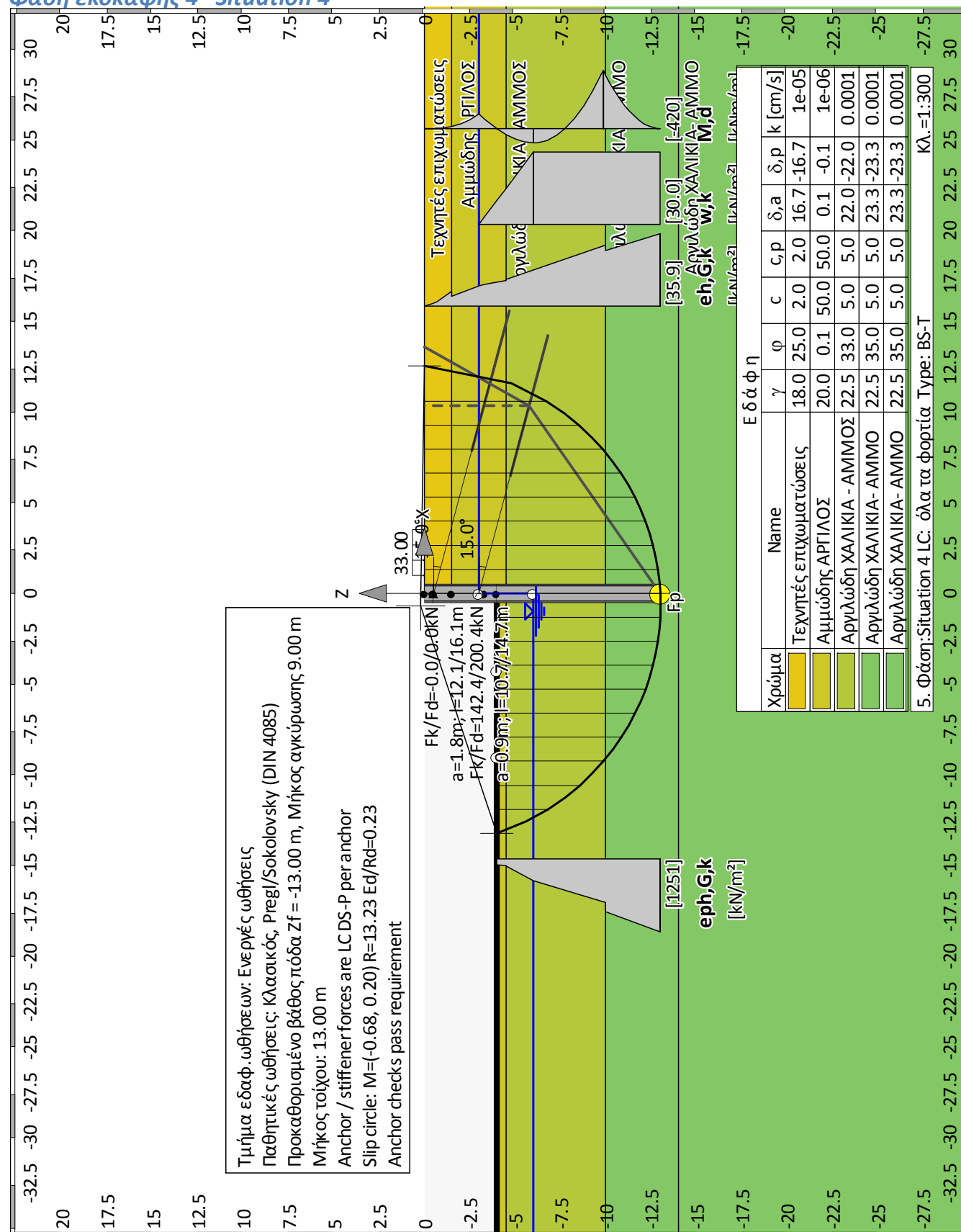
Φάση εκσκαφής 2 "Situation 2"



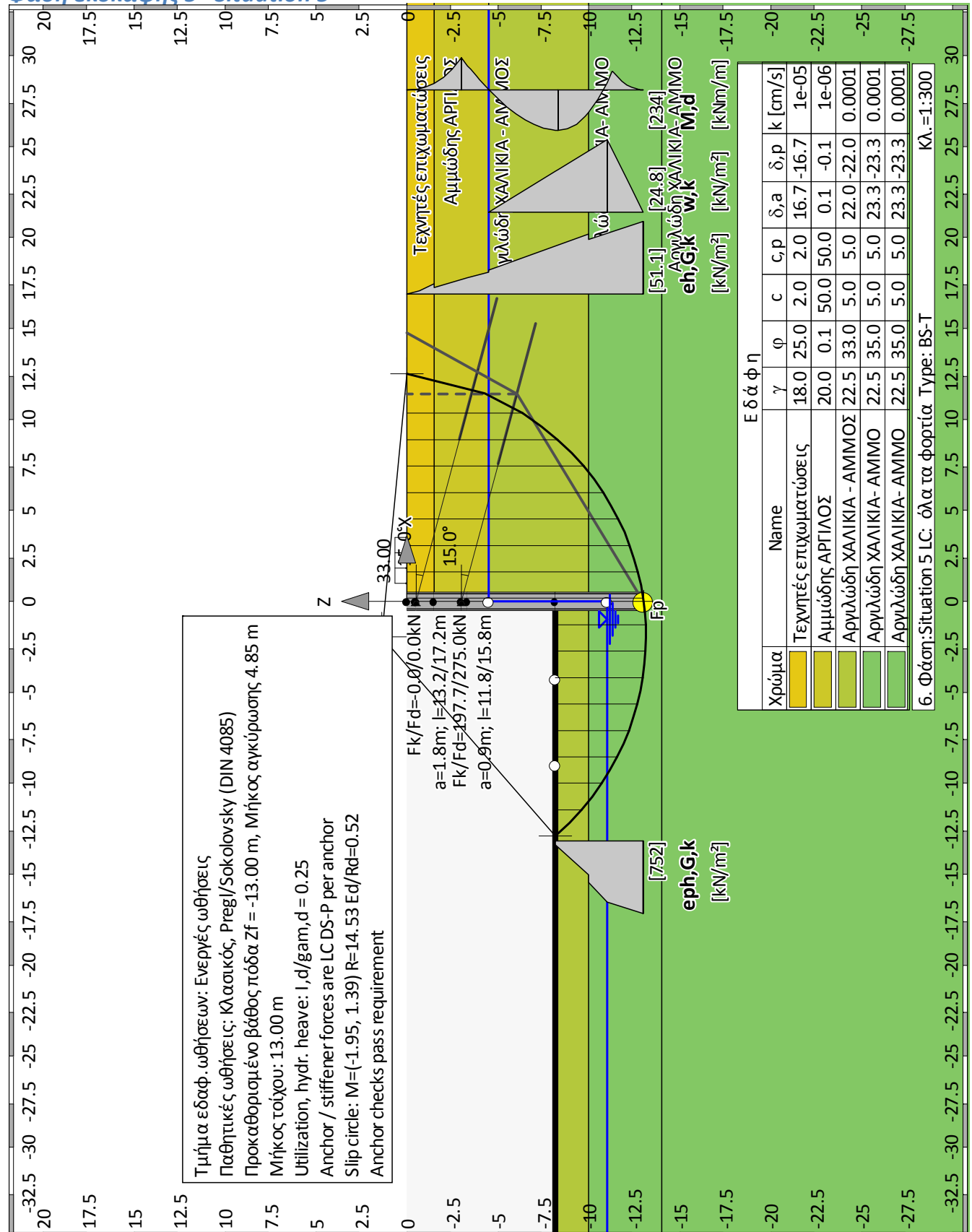
Φάση εκσκαφής 3 "Situation 3"



Φάση εκσκαφής 4 "Situation 4"



Φάση εκσκαφής 5 "Situation 5"



| | | | | | |
|------------|--|------------------|----------------------|----------|------------------|
| Author: | FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | | | | Job No.: |
| Program: | WALLS-Retain. | | Version 2017.046 | | |
| Structure: | info@fides-dvp.de | www.fides-dvp.de | Tel:++49/89/143829-0 | ASB Nr.: | Date: 08.10.2018 |

Κανονισμός για Ανάλυση και Διαστασιολόγηση

Διαστασ. ωπλισμ.σκυροδ.: EN 1992-1-1
Γεωτεχν.Κανονισμός : EN 1997 (rev.12)_user
National Annex: EN 1997-1

Safety factors:

Earth pressure onto wall: [GEO] A1 M1 R2

| γ- | G,dst | E0G | G,stb | Q,dst | Q,stb | phi | coe | cu | g |
|--------|-------|-------|-------|-------|-------|-----|-----|----|---|
| BS-P | 1.350 | 1.350 | 1 | 1.500 | 0 | 1 | 1 | 1 | 1 |
| BS-T | 1.350 | 1.350 | 1 | 1.500 | 0 | 1 | 1 | 1 | 1 |
| BS-T/A | 1.350 | 1.350 | 1 | 1.500 | 0 | 1 | 1 | 1 | 1 |
| BS-E | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 |

ΚΕ-μηχανισμός: [GEO] A2 M2 R3

| γ- | G,dst g | G,stb a,t | W a,p | Q,dst Gt | Q,stb N | phi | coe | cu |
|--------|------------|--------------|----------|-------------|------------|-------|-------|-------|
| BS-P | 1 | 1 | 1 | 1.300 | 0 | 1.250 | 1.400 | 1.400 |
| BS-T | 1 | 1 | 1 | 1.300 | 0 | 1.250 | 1.400 | 1.400 |
| BS-T/A | 1 | 1 | 1 | 1.300 | 0 | 1.250 | 1.250 | 1.400 |
| BS-E | 1 | 1 | 1 | 1 | 0 | 1.250 | 1.400 | 1.400 |
| | 1 | 1 | 1 | 1 | 1 | | | |

Θραύση εδάφους: [GEO] A1 M1 R2

| γ- | G,dst cu | E0G g | W Re | G,stb | Q,dst | Q,stb | phi | coe |
|--------|-------------|----------|---------|-------|-------|-------|-----|-----|
| BS-P | 1.350 | 1.350 | 1.350 | 1 | 1.500 | 0 | 1 | 1 |
| | 1 | 1 | 1.400 | | | | | |
| BS-T | 1.350 | 1.350 | 1.350 | 1 | 1.500 | 0 | 1 | 1 |
| | 1 | 1 | 1.400 | | | | | |
| BS-T/A | 1.350 | 1.350 | 1.350 | 1 | 1.500 | 0 | 1 | 1 |
| | 1 | 1 | 1.400 | | | | | |
| BS-E | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 |
| | 1 | 1 | 1 | | | | | |

Ολίσθηση: [GEO] A1 M1 R2

| γ- | G,dst cu | E0G g | W Rh | G,stb | Q,dst | Q,stb | phi | coe |
|--------|-------------|----------|---------|-------|-------|-------|-----|-----|
| BS-P | 1.350 | 1.350 | 1.350 | 1 | 1.500 | 0 | 1 | 1 |
| | 1 | 1 | 1.100 | | | | | |
| BS-T | 1.350 | 1.350 | 1.350 | 1 | 1.500 | 0 | 1 | 1 |
| | 1 | 1 | 1.100 | | | | | |
| BS-T/A | 1.350 | 1.350 | 1.350 | 1 | 1.500 | 0 | 1 | 1 |
| | 1 | 1 | 1.100 | | | | | |
| BS-E | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 |
| | 1 | 1 | 1 | | | | | |

Θραύση εδάφους: [GEO] A1 M1 R2

| γ- | G,dst cu | E0G g | W Rv | G,stb | Q,dst | Q,stb | phi | coe |
|--------|-------------|----------|---------|-------|-------|-------|-----|-----|
| BS-P | 1.350 | 1.350 | 1.350 | 1 | 1.500 | 0 | 1 | 1 |
| | 1 | 1 | 1.400 | | | | | |
| BS-T | 1.350 | 1.350 | 1.350 | 1 | 1.500 | 0 | 1 | 1 |
| | 1 | 1 | 1.400 | | | | | |
| BS-T/A | 1.350 | 1.350 | 1.350 | 1 | 1.500 | 0 | 1 | 1 |
| | 1 | 1 | 1.400 | | | | | |
| BS-E | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 |
| | 1 | 1 | 1 | | | | | |

| | | | |
|---------|--------------------------------------|---------|--------------|
| Part: | Please specify project informations. | Page: 7 | Archive No.: |
| Block: | | | |
| Record: | | | |

Κύκλος ολίσθησης: [GEO] A2 M2 R3

| γ- | G,dst g | G,stb Re | Q,dst a,t | Q,stb a,p | W Gt | phi N | coe | cu |
|--------|------------|-------------|--------------|--------------|---------|----------|-------|-------|
| BS-P | 1 | 1 | 1.300 | 0 | 1 | 1.250 | 1.400 | 1.400 |
| | 1 | 1 | 1 | 1 | 1 | 1 | | |
| BS-T | 1 | 1 | 1.300 | 0 | 1 | 1.250 | 1.400 | 1.400 |
| | 1 | 1 | 1 | 1 | 1 | 1 | | |
| BS-T/A | 1 | 1 | 1.300 | 0 | 1 | 1.250 | 1.250 | 1.400 |
| | 1 | 1 | 1 | 1 | 1 | 1 | | |
| BS-E | 1 | 1 | 1 | 0 | 1 | 1.250 | 1.400 | 1.400 |
| | 1 | 1 | 1 | 1 | 1 | 1 | | |

Hydraulic heave: [HYD] A1 M1 R1

| γ- | G,dst | G,stb | Q,dst | H |
|--------|-------|-------|-------|-------|
| BS-P | 1.350 | 0.900 | 1.500 | 1.800 |
| BS-T | 1.350 | 0.900 | 1.500 | 1.600 |
| BS-T/A | 1.350 | 0.900 | 1.500 | 1.500 |
| BS-E | 1 | 1 | 1 | 1 |

Failure of structural elements: [STR] A1 M1 R1

| γ- | M | Gtf | cd | N |
|--------|-------|-------|-------|-------|
| BS-P | 1.150 | 1.400 | 1.400 | 1.150 |
| BS-T | 1.150 | 1.300 | 1.300 | 1.150 |
| BS-T/A | 1.150 | 1.250 | 1.250 | 1.150 |
| BS-E | 1 | 1 | 1 | 1 |

Stability: [EQU] A1 M1 R1

| γ- | G,dst | G,stb | Q,dst | Q,stb | phi | coe | cu | g |
|--------|-------|-------|-------|-------|-------|-------|-------|---|
| BS-P | 1 | 0.900 | 1.500 | 0 | 1.250 | 1.250 | 1.400 | 1 |
| BS-T | 1 | 0.900 | 1.500 | 0 | 1.250 | 1.250 | 1.400 | 1 |
| BS-T/A | 1 | 0.900 | 1.500 | 0 | 1.250 | 1.250 | 1.400 | 1 |
| BS-E | 1 | 1 | 1 | 0 | 1.250 | 1.400 | 1.400 | 1 |

$\gamma_{Re,red}$ (EAB EB14-3): N_{a1} , $\eta=0.80$

$\gamma_{Re,red}$ (EAB EB22-6): N_{a1} , $E0h > 0\%$: $\eta = 0.60 / 0.80$

System values**Τοίχος**

Τύπος τοίχου αντιστήριξης: Πασσαλότοιχος οπλισμένου σκυροδέματος

Διατομή: $I_y=2711360 \text{ cm}^4$

Υλικό: C25/30

Ίδιο βάρος: $25.000 \text{ [kN/m}^3]$

Σημεία τοίχου

| z | d | E | Iy | E*Iy | A |
|--------|-------|----------------------|----------------------|---------------------|----------------------|
| [m] | [m] | [MN/m ²] | [cm ⁴ /m] | [MNm ²] | [cm ² /m] |
| 0.00 | 100.0 | 31500.0 | 2711360 | 854.1 | 8400 |
| -13.00 | 100.0 | 31500.0 | 2711360 | 854.1 | 8400 |

| | | |
|------------|--|------------------|
| Author: | FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | Job No.: |
| Program: | WALLS-Retain. Version 2017.046 | |
| Structure: | info@fides-dvp.de www.fides-dvp.de Tel:++49/89/143829-0 ASB Nr.: | Date: 08.10.2018 |

Φάση εκσκαφής 1 "[1] Situation 1"

LC: όλα τα φορτία Type: BS-T

Εδαφικό σύστημα με 5 Στρώσεις

| Name | Τεχνητές επιχωματώσεις Αμμόδης ΑΡΓΙΛΟΣ Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ | | | |
|-------------|---|-----------|-------------|-----------|
| γ | [kN/m3] | 18 | 20 | 22.5 |
| γ,R | [kN/m3] | 18 | 20 | 22.5 |
| γ' | [kN/m3] | 8 | 10 | 12.5 |
| γ,p | [kN/m3] | 18 | 20 | 22.5 |
| γ,R,passive | [kN/m3] | 18 | 20 | 22.5 |
| γ,pw | [kN/m3] | 8 | 10 | 12.5 |
| φ | [°] | 25 | 0.1 | 33 |
| c | [kN/m2] | 2 | 50 | 5 |
| c,u | [kN/m2] | 10 | 50 | 5 |
| c παθητικό | [kN/m2] | 2 | 50 | 5 |
| δ,a | [°] | 16.66667 | 0.06666667 | 22 |
| δ,p | [°] | -16.66667 | -0.06666667 | -22 |
| δ,c | [°] | 8.333333 | 0.03333333 | 11 |
| k,agh | [-] | 0.3456501 | 0.9955057 | 0.2452023 |
| K,ach | [-] | 1.043051 | 1.994195 | 0.8549058 |
| K,θh | [-] | 0.5773817 | 0.9982547 | 0.455361 |
| K,pgh | [-] | 3.908103 | 1.004519 | 7.495617 |
| K,pch | [-] | 5.180327 | 2.00583 | 8.599509 |
| τ,gr | [kN/m2] | 110 | 110 | 110 |
| Ψ,A,max | [°] | 90 | 90 | 90 |
| k | [cm/s] | 10e-06 | 1e-06 | 100e-06 |

| Name | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ |
|-------------|------------------------|------------------------|
| γ | [kN/m3] 22.5 | 22.5 |
| γ,R | [kN/m3] 22.5 | 22.5 |
| γ' | [kN/m3] 12.5 | 12.5 |
| γ,p | [kN/m3] 22.5 | 22.5 |
| γ,R,passive | [kN/m3] 22.5 | 22.5 |
| γ,pw | [kN/m3] 12.5 | 12.5 |
| φ | [°] 35 | 35 |
| c | [kN/m2] 5 | 5 |
| c,u | [kN/m2] 5 | 5 |
| c παθητικό | [kN/m2] 5 | 5 |
| δ,a | [°] 23.33333 | 23.33333 |
| δ,p | [°] -23.33333 | -23.33333 |
| δ,c | [°] 11.66667 | 11.66667 |
| k,agh | [-] 0.2244207 | 0.2244207 |
| K,ach | [-] 0.8126539 | 0.8126539 |
| K,θh | [-] 0.4264236 | 0.4264236 |
| K,pgh | [-] 9.146943 | 9.146943 |
| K,pch | [-] 10.104 | 10.104 |
| τ,gr | [kN/m2] 110 | 110 |
| Ψ,A,max | [°] 90 | 90 |
| k | [cm/s] 100e-06 | 100e-06 |

Πορεία πρανούς:

x [m] 0.00 0.00
z [m] -2.00 0.00

Πορεία ανώτερου 2. στρώματος Αμμόδης ΑΡΓΙΛΟΣ:

x [m] 0.00 0.00
z [m] -2.00 -1.50

Πορεία ανώτερου 3. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ:

z= -4.50

Πορεία ανώτερου 4. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟΣ:

z= -10.00

| | | |
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| Part: | | Archive No.: |
| Block: | Please specify project informations. | Page: 9 |
| Record: | | |

| | |
|--|------------------|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | Job No.: |
| Program: WALLS-Retain. Version 2017.046 | |
| Structure: info@fides-dvp.de www.fides-dvp.de Tel:++49/89/143829-0 ASB Nr.: | Date: 08.10.2018 |

Πορεία ανώτερου 5. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ:
 z= -14.00

Επιφ. φορτία:

Φορτία

| xA | zA | xE | zE | PxA | PzA | PxE | PzE | Typ | LC-description |
|------|------|------|------|------|-------|------|-------|-----|----------------|
| [m] | [m] | [m] | [m] | [| kN/m² | |] | | Name |
| 1.00 | 0.00 | 3.50 | 0.00 | 0.00 | 33.00 | 0.00 | 33.00 | q | 1 |

Κατανομή εδαφ.πιέσεων

| | |
|----------------------------|------|
| Κατανομή εδαφ.πιέσεων | Name |
| Rectangular within a layer | |

Στάθμη νερού:

x [m] 0.00
 z [m] -3.00

Παράμετροι υπολογισμού

Earth pressure options

Τμήμα εδαφ.ωθήσεων: Ενεργές ωθήσεις.
 Angle of slip plane: DIN 4085.
 Split block loads into 1 sections.
 Consideration of minimum earth pressure: φ,min = 40.000.
 Negative earth pressure fractions are set to zero.

Redistribution of earth pressure

Shape of redistribution: No redistribution of earth pressure.
 The earth pressure is getting redistrib. to: Excavation level
 The earth pressure below the excavation acts without redistrib.
 The earth pressure from variable loads will be included in redistribution.

Παθητικές ωθήσεις

Method of calculation: Κλασικός, Pregl/Sokolovsky (DIN 4085).

Options for water pressure

Στήριξη πόδα

Πακτωμένη στήριξη κατά Blum

Earth pressure coefficients kh

| φ | α | β | δ | k0gh | kagh | kach | kpgh | kpch | |
|------|-----|-----|-------|------|-------|-------|-------|---------|--------------------------|
| 0.1 | 0.0 | 0.0 | -0.1 | -- | -- | -- | 1.005 | -2.006 | Τεχνητές επιχωματώσεις |
| 25.0 | 0.0 | 0.0 | 16.7 | -- | 0.346 | 1.043 | -- | -- | " |
| 0.1 | 0.0 | 0.0 | -0.1 | -- | -- | -- | 1.005 | -2.006 | Αμμώδης ΑΡΓΙΛΟΣ |
| 0.1 | 0.0 | 0.0 | 0.1 | -- | 0.996 | 1.994 | -- | -- | " |
| 33.0 | 0.0 | 0.0 | -22.0 | -- | -- | -- | 7.496 | -8.600 | Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ |
| 33.0 | 0.0 | 0.0 | 22.0 | -- | 0.245 | 0.855 | -- | -- | " |
| 35.0 | 0.0 | 0.0 | -23.3 | -- | -- | -- | 9.147 | -10.104 | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ |
| 35.0 | 0.0 | 0.0 | 23.3 | -- | 0.224 | 0.813 | -- | -- | " |
| 35.0 | 0.0 | 0.0 | -23.3 | -- | -- | -- | 9.147 | -10.104 | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ |
| 35.0 | 0.0 | 0.0 | 23.3 | -- | 0.224 | 0.813 | -- | -- | " |

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| Part: Block: Please specify project informations. Record: | Archive No.: |
|---|--------------|

Page: 10

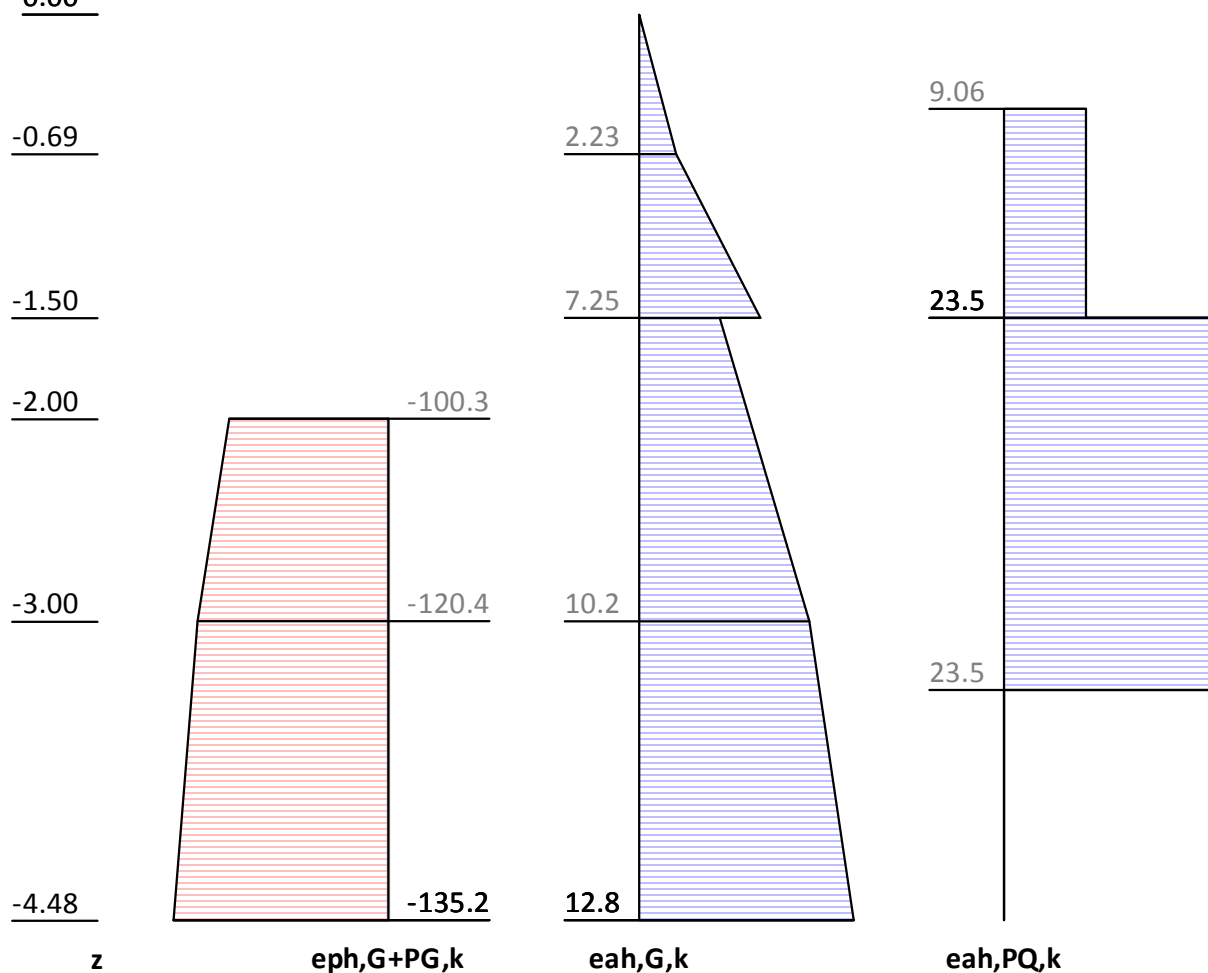
Μήκος τοίχου

| | | | | | |
|---|-----------|---------------------|----------|-----------------|-----|
| N: 1 | Z: -3.000 | M, Στήριξη πόδα, d: | 51.74. | Wall too short? | Ναι |
| N: 2 | Z: -6.000 | M, Στήριξη πόδα, d: | -401.07. | Wall too short? | Όχι |
| N: 3 | Z: -3.990 | M, Στήριξη πόδα, d: | 34.70. | Wall too short? | Ναι |
| N: 4 | Z: -5.337 | M, Στήριξη πόδα, d: | -155.60. | Wall too short? | Όχι |
| N: 5 | Z: -4.434 | M, Στήριξη πόδα, d: | 3.70. | Wall too short? | Ναι |
| N: 6 | Z: -5.039 | M, Στήριξη πόδα, d: | -82.64. | Wall too short? | Όχι |
| N: 7 | Z: -4.634 | M, Στήριξη πόδα, d: | -16.37. | Wall too short? | Όχι |
| N: 8 | Z: -4.500 | M, Στήριξη πόδα, d: | -13.22. | Wall too short? | Όχι |
| N: 9 | Z: -4.456 | M, Στήριξη πόδα, d: | 1.79. | Wall too short? | Ναι |
| N: 10 | Z: -4.486 | M, Στήριξη πόδα, d: | -0.87. | Wall too short? | Όχι |
| N: 11 | Z: -4.466 | M, Στήριξη πόδα, d: | 0.92. | Wall too short? | Ναι |
| N: 12 | Z: -4.479 | M, Στήριξη πόδα, d: | -0.27. | Wall too short? | Όχι |
| N: 13 | Z: -4.470 | M, Στήριξη πόδα, d: | 0.53. | Wall too short? | Ναι |
| N: 14 | Z: -4.476 | M, Στήριξη πόδα, d: | -0.01. | Wall too short? | Όχι |
| Foot depth for statics: z _f = -4.476 | | | | | |

Stress analysis**Earth pressure, horizontal**

Pressures characteristic, no redistribution, continuous wall

0.00



| z [m] | eph, G, k [kN/m ²] | eah, G, k [kN/m ²] | eah, PQ, k [kN/m ²] | eah, d [kN/m ²] |
|----------|-----------------------------------|-----------------------------------|------------------------------------|--------------------------------|
| 0.00 | | 0.00 | | 0.00 |
| -0.47 | | 1.52 | 0.00 | 2.04 |
| -0.47 | | 1.52 | 9.06 | 15.62 |
| -1.50 | | 7.25 | 9.06 | 23.37 |
| -1.50 | | 4.82 | 23.48 | 41.73 |
| -2.00 | -0.00 | 6.61 | 23.48 | 44.14 |

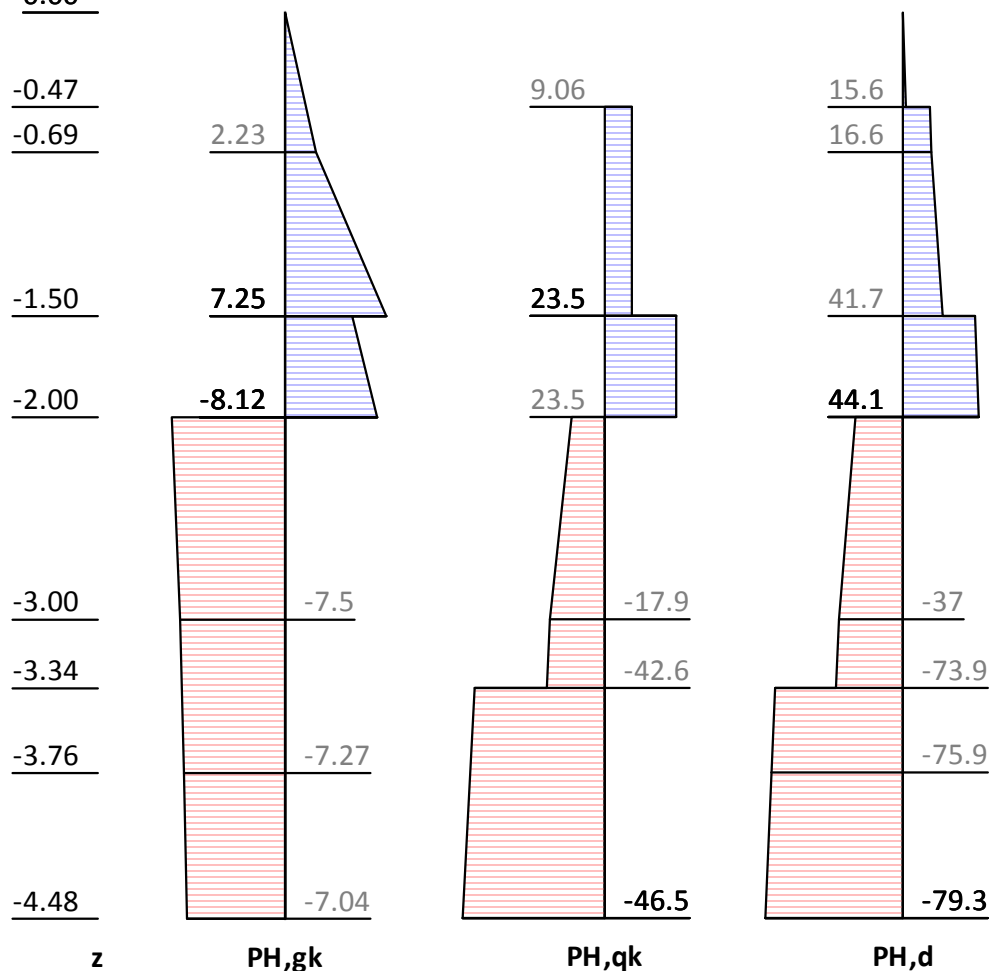
| z [m] | eph,G,k [kN/m2] | eah,G,k [kN/m2] | eah,PQ,k [kN/m2] | eah,d [kN/m2] |
|----------|--------------------|--------------------|---------------------|------------------|
| -2.00 | -100.29 | 6.61 | 23.48 | 44.14 |
| -3.34 | -123.79 | 10.79 | 23.48 | 49.78 |
| -3.34 | -123.79 | 10.79 | 0.00 | 14.56 |
| -4.48 | -135.21 | 12.82 | 0.00 | 17.30 |

Eph,G,k: -298.99, Eph,PG,k: 0.00 [kN/m]

Eah,G,k: 32.82, Eah,PG,k: 0.00, Eah,PQ,k: 52.53, Eah,d: 123.10

H-pressure on static system

Level of mobilization: Ep,gk 14.7, Ep,qk 34.4, Ep,d 100.0 [%]

0.00

| z [m] | PH,gk [kN/m2] | PH,qk [kN/m2] | PH,d [kN/m2] |
|----------|------------------|------------------|-----------------|
| 0.00 | 0.00 | 0.00 | 0.00 |
| -0.47 | 1.52 | 0.00 | 2.04 |
| -0.47 | 1.52 | 9.06 | 15.62 |
| -1.50 | 7.25 | 9.06 | 23.37 |
| -1.50 | 4.82 | 23.48 | 41.73 |
| -2.00 | 6.61 | 23.48 | 44.14 |
| -2.00 | -8.12 | -11.02 | -27.50 |
| -3.34 | -7.40 | -19.10 | -38.64 |
| -3.34 | -7.40 | -42.58 | -73.86 |
| -4.48 | -7.04 | -46.51 | -79.28 |

V-pressure on static system**Internal forces: Permanent, characteristically**0.00-0.0611-0.50-0.0672-0.402-0.0504-1.19-0.975-2.67-0.0358-1.50-2.07-4.59-0.0294-2.00-5.05-7.45-0.0197-2.50-7.77-3.47-0.0114-3.00-8.540.36-0.00531-3.50-7.434.07-0.0017-3.76-6.125.97-704.5e-06-4.26-2.239.57-21.3e-06-4.4811.1**z****M,gk****V,gk****u,gk**

| z [m] | H,g,k [kN/m2] | M,g,k [kN/m2] | V,g,k [kN/m2] | N,g,k [kN/m2] | u,g,k [mm] |
|----------|------------------|------------------|------------------|------------------|---------------|
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -0.06 |
| -1.50 | 7.25 | -2.07 | -4.59 | -33.13 | -0.03 |
| -1.50 | 4.82 | -2.07 | -4.59 | -33.13 | -0.03 |
| -2.00 | 6.61 | -5.05 | -7.45 | -43.63 | -0.02 |
| -2.00 | -8.12 | -5.05 | -7.45 | -43.63 | -0.02 |
| -2.95 | -7.53 | -8.47 | 0.00 | -63.64 | -0.01 |
| -3.00 | -7.50 | -8.54 | 0.36 | -64.62 | -0.01 |
| -4.48 | -7.04 | -0.00 | 11.10 | -83.21 | -0.00 |
| -4.48 | -7.04 | 0.00 | 11.10 | -83.21 | 0.00 |

Internal forces: Variable, characteristicallyMethod EB 82-4 ($Q = [G+Q] - G$).0.00-0.47-0.69-1.19-1.50-2.00-2.50-3.00-3.34-3.76-4.26-4.48

z

M,qk

-0.227

-2.37

-4.8

-12.4

-21.4

-26.8

-28.2

-24.3

-9.79

0.00755

-2.03

-6.55

-9.33

-21.1

-14.7

-6.59

-0.29

17.9

40.3

50.3

V,qk

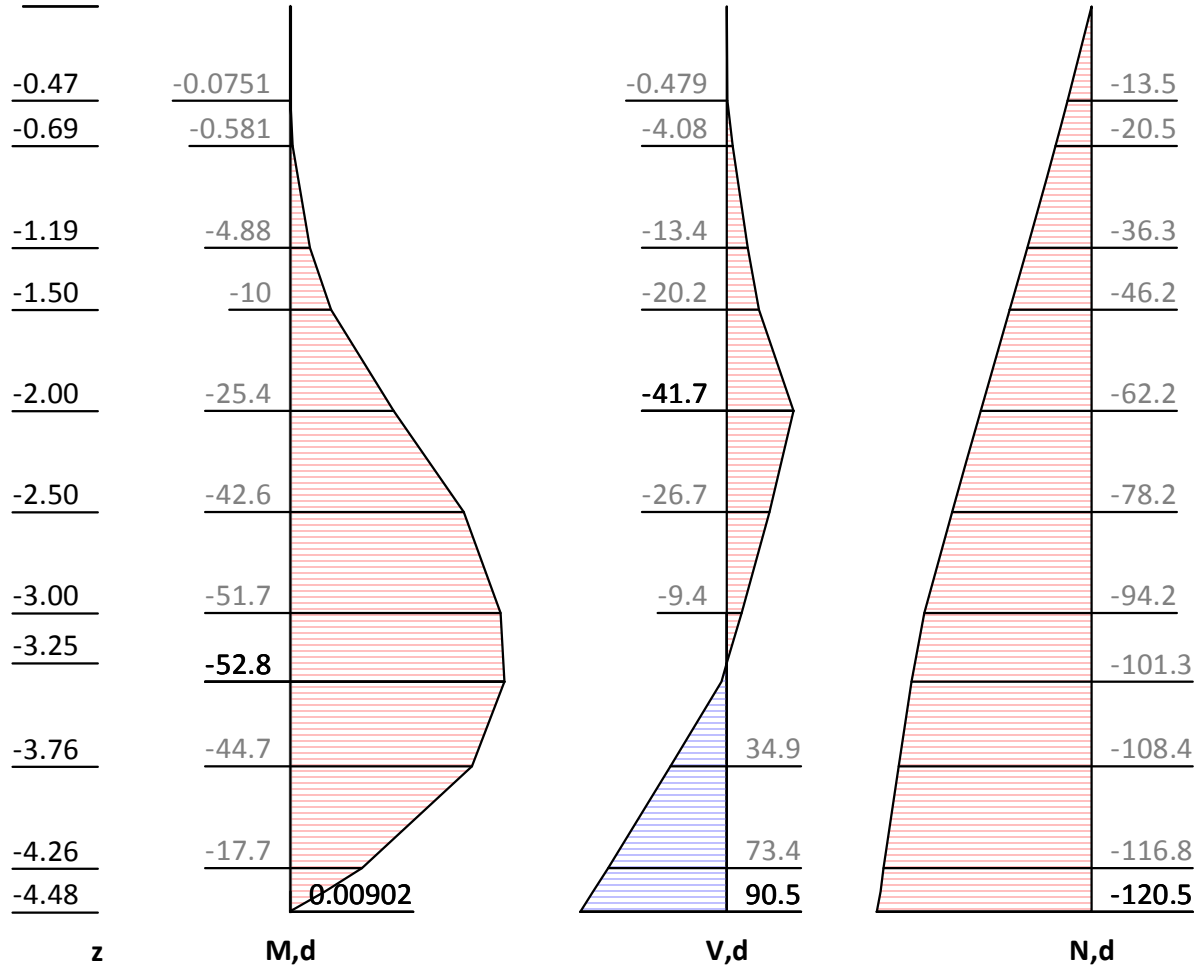
-0.202-0.171-0.156-0.122-0.102-0.0706-0.0428-0.0211-0.0104-0.00302-95.3e-06

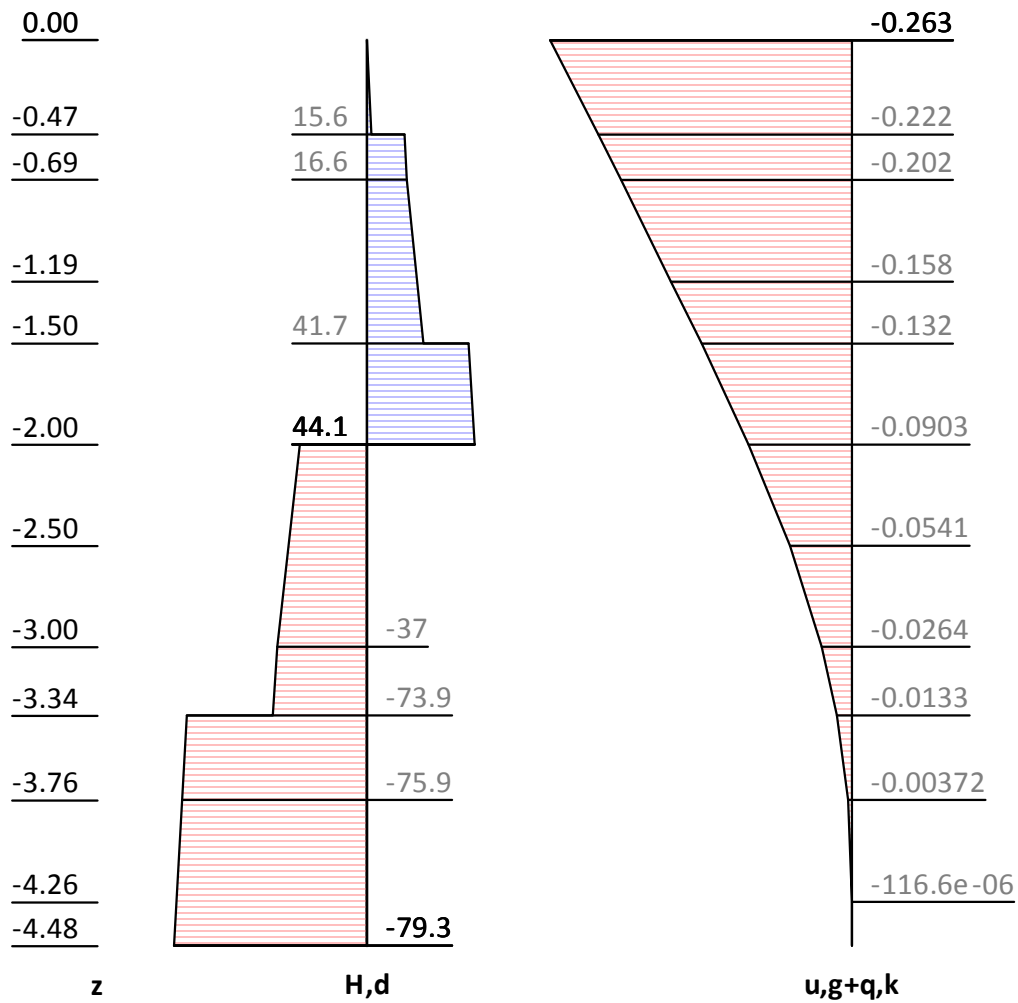
u,qk

| z [m] | H, q, k [kN/m2] | M, q, k [kN/m2] | V, q, k [kN/m2] | N, q, k [kN/m2] | u, q, k [mm] |
|----------|--------------------|--------------------|--------------------|--------------------|-----------------|
| 0.00 | | 0.00 | 0.00 | 0.00 | -0.20 |
| -0.47 | 0.00 | 0.01 | 0.02 | 0.01 | -0.17 |
| -0.47 | 9.06 | 0.01 | 0.02 | 0.01 | -0.17 |
| -0.48 | 9.06 | -0.00 | -0.05 | 0.00 | -0.17 |
| -1.50 | 9.06 | -4.80 | -9.33 | -0.99 | -0.10 |
| -1.50 | 23.48 | -4.80 | -9.33 | -0.99 | -0.10 |
| -2.00 | 23.48 | -12.40 | -21.07 | -2.23 | -0.07 |
| -2.00 | -11.02 | -12.40 | -21.07 | -2.23 | -0.07 |
| -3.34 | -19.10 | -28.20 | -0.29 | -5.50 | -0.01 |
| -3.34 | -42.58 | -28.20 | -0.29 | -5.50 | -0.01 |
| -3.35 | -42.61 | -28.12 | -0.00 | -5.50 | -0.01 |
| -4.48 | -46.51 | 0.00 | 50.32 | -5.44 | -0.00 |
| -4.48 | -46.51 | 0.00 | 50.32 | -5.44 | 0.00 |

Internal forces: Design

0.00

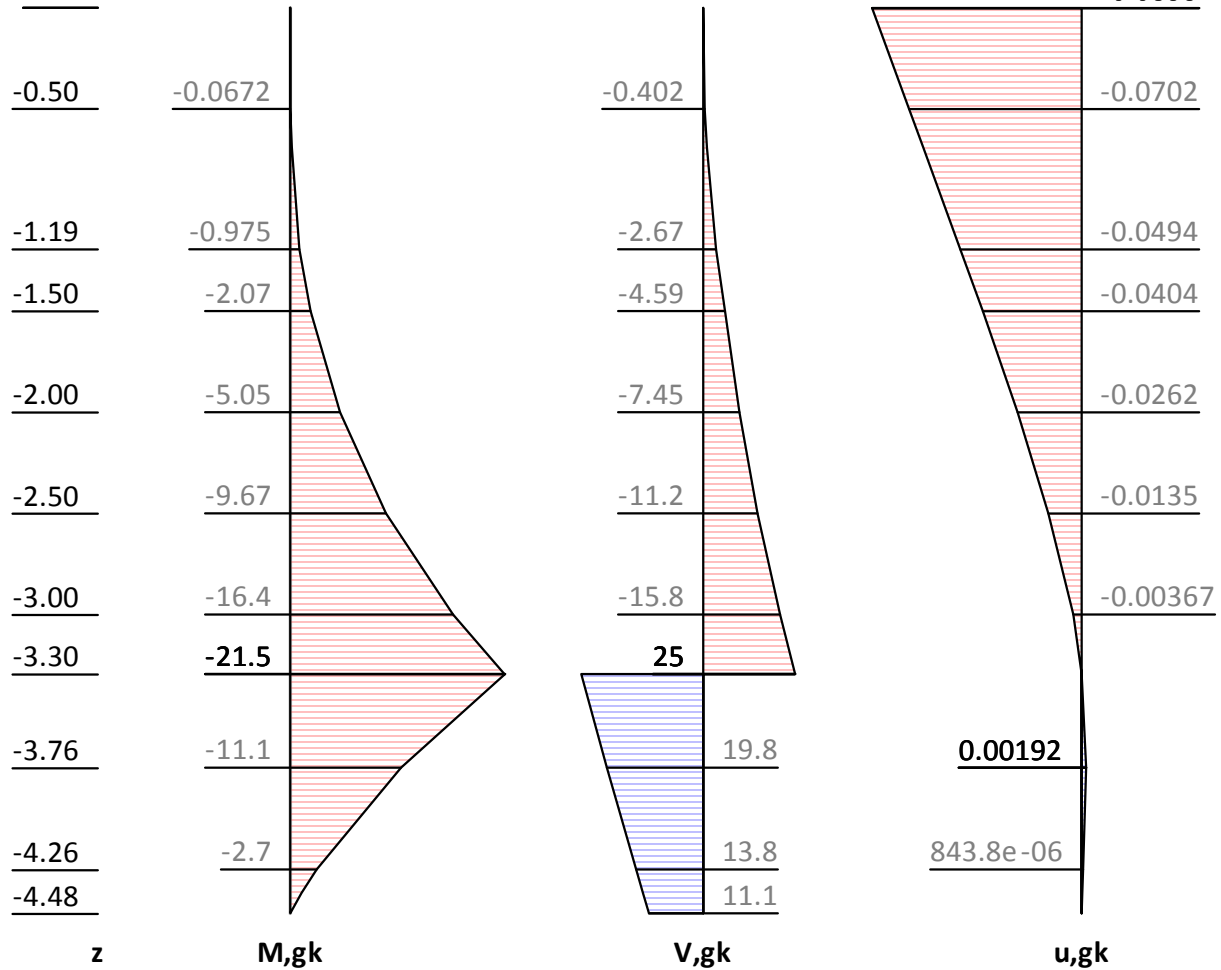




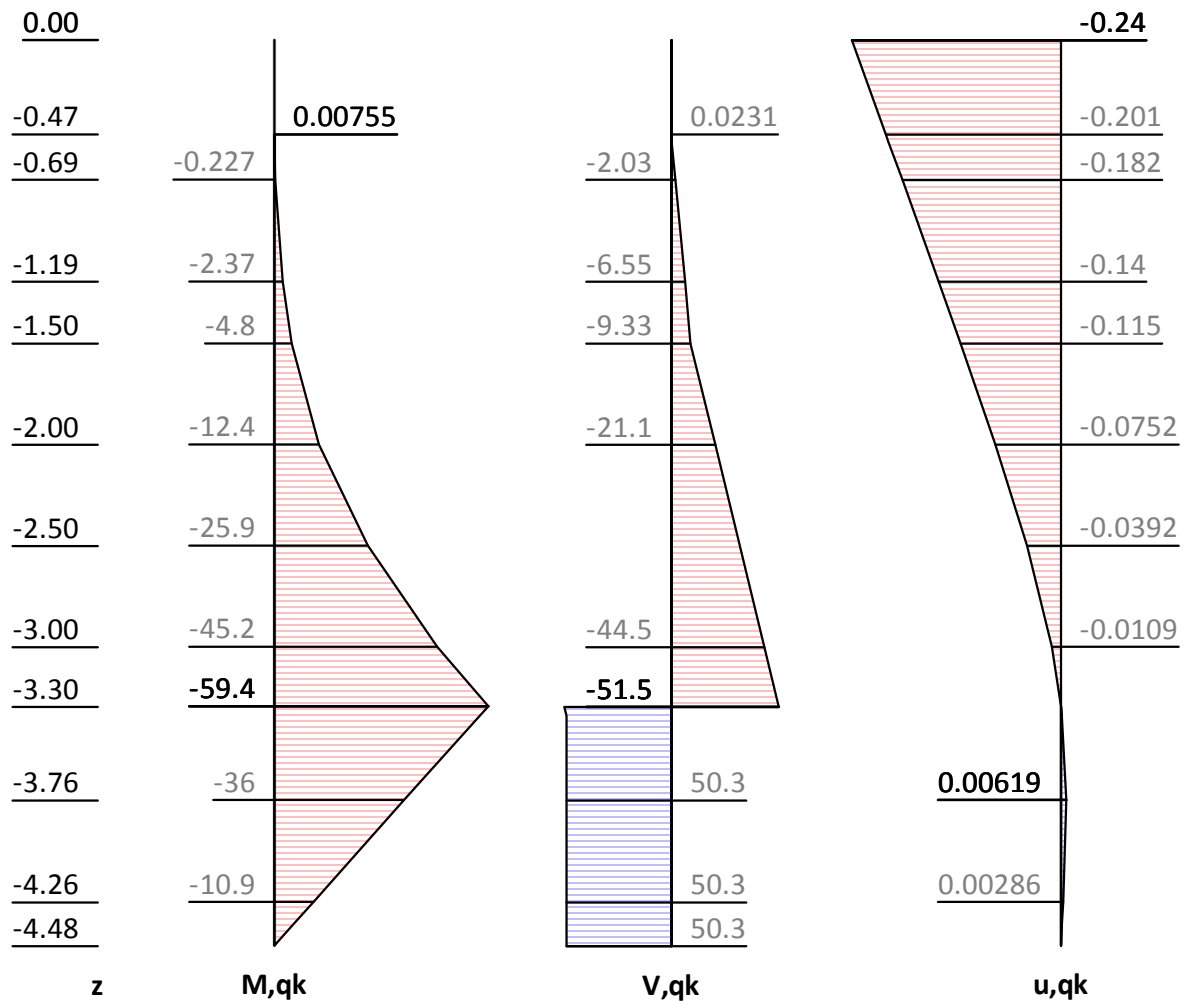
| z [m] | H,d [kN/m ²] | M,d [kN/m ²] | V,d [kN/m ²] | N,d [kN/m ²] | u,g+q,k [mm] |
|----------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------|
| 0.00 | 0.00 | 0.00 | -0.00 | 0.00 | -0.26 |
| -0.47 | 2.04 | -0.08 | -0.48 | -13.54 | -0.22 |
| -0.47 | 15.62 | -0.08 | -0.48 | -13.54 | -0.22 |
| -1.50 | 23.37 | -10.00 | -20.19 | -46.20 | -0.13 |
| -1.50 | 41.73 | -10.00 | -20.19 | -46.20 | -0.13 |
| -2.00 | 44.14 | -25.42 | -41.66 | -62.25 | -0.09 |
| -2.00 | -27.50 | -25.42 | -41.66 | -62.25 | -0.09 |
| -3.34 | -38.64 | -52.77 | 3.46 | -101.27 | -0.01 |
| -3.34 | -73.86 | -52.77 | 3.46 | -101.27 | -0.01 |
| -4.48 | -79.28 | 0.00 | 90.45 | -120.49 | -0.00 |
| -4.48 | -79.28 | 0.01 | 90.46 | -120.49 | 0.00 |

Checks of earth statics

Substitute system according to Blum

0.00

| z [m] | M, g, k [kN/m ²] | V, g, k [kN/m ²] | N, g, k [kN/m ²] | u, g, k [kN/m ²] |
|----------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| 0.00 | 0.00 | 0.00 | 0.00 | -0.09 |
| -3.30 | -21.54 | -18.93 | -68.37 | 0.00 |
| -3.30 | -21.54 | 24.98 | -68.37 | 0.00 |
| -3.76 | -11.12 | 19.82 | -74.23 | 0.00 |
| -4.48 | 0.00 | 11.10 | -83.26 | 0.00 |



| z [m] | M,q,k [kN/m ²] | V,q,k [kN/m ²] | N,q,k [kN/m ²] | u,q,k [kN/m ²] |
|----------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|
| 0.00 | 0.00 | 0.00 | 0.00 | -0.24 |
| -0.47 | 0.01 | 0.02 | 0.01 | -0.20 |
| -0.48 | -0.00 | -0.05 | -0.00 | -0.20 |
| -3.30 | -59.42 | -51.50 | -5.45 | 0.00 |
| -3.30 | -59.42 | 51.35 | -5.45 | 0.00 |
| -3.76 | -36.04 | 50.32 | -5.56 | 0.01 |
| -4.48 | 0.00 | 50.32 | -5.56 | 0.00 |

Bh,gk = -43.91; Ch,gk = 11.10 [kN/m]

Bh,qk = -102.85; Ch,qk = 50.32 [kN/m]

Bh,d = -213.56; Ch,d = 90.45 [kN/m]

| | |
|--|-------------------------|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | Job No.: |
| Program: WALLS-Retain. | Version 2017.046 |
| Structure: info@fides-dvp.de www.fides-dvp.de Tel:++49/89/143829-0 ASB Nr.: | Date: 08.10.2018 |

Check of C-force (foot support)

$$z(C) = -4.48 \text{ [kN/m]}$$

$$G,k = \sum(\gamma \cdot h) = 71.76 \text{ [kN/m]}$$

$$P,k = \sum(Pz,k(x= 0.1)) = 0.00 \text{ [kN/m]}$$

$$kpgh,C(\phi_i= 0.1; \delta,C= 0.0^\circ) = 1.002 \text{ [-]}$$

$$kpch,C = 2.003 \text{ [-]}$$

$$eph,C,gk = (G,k+P,k) \cdot kpgh,C+2 \cdot c \cdot \sqrt{kpch,C} = 213.44 \text{ [kN/m}^2\text{]}$$

$$= (71.76+0.00) \cdot 1.002+2 \cdot 50.0 \cdot 1.415$$

$$Ed = Ch,d = 90.45 \text{ [kN/m}^2\text{]}$$

$$\delta,t,EAU = Ed/(2 \cdot eph,C,d) = 0.30 \text{ [m]}$$

$$\delta,t,EAB = 0.20 \cdot t = 0.50 \text{ [m]}$$

$$\delta,t = \delta,t,EAB = 0.50 \text{ [m]}$$

$$Rd = 2 \cdot \delta,t \cdot eph,C,gk/\gamma,Re$$

$$= 2 \cdot 0.50 \cdot 213.44/1.4$$

$$= 151.00 \text{ [kN/m}^2\text{]}$$

$Ed/Rd = 0.599 \text{ [-]}. \text{ Passes requirement}$

Check or earth support

Check: Mobilizable earth resistance is sufficient for earth support force.

z: -3.30 m

$$Rd = Eph,k/\gamma,Re = 298.99 / 1.400 = 213.57 \text{ [kN/m]}$$

$Ed(Bh,d)/Rd = 213.56 / 213.57 = 1.000 \text{ [-]}. \text{ Passes requirement}$

Sum of H and V forces, (G)

Forces up to depth z:-4.48

| Pos. | H | V |
|---|--------|-------------|
| | | |
| H/V pressure G+P+W,k | 32.82 | 1.66 |
| Wall weight | | 87.84 |
| H/V pressure passive | | 0.00 |
| Bh,g,k z=-3.30 | -43.91 | |
| Bv,g,k = Bh,k * tan($\delta,p=-0.07^\circ$) | | -0.05 |
| Ch,g | 11.10 | |
| Cv,g = Ch*tan($\delta,C=0.0^\circ$) | | 0.01 |
| | | |
| Σ | 0.00 | 89.46 |
| | | (downwards) |

Simple check, EAB R 9-3a

$V_k \geq Bvk: 89.51 \geq 0.05 \text{ Passes requirement}$

Sum of H and V forces, (G+Q)

Forces up to depth z:-4.48

| Pos. | H | V |
|---|---------|-------------|
| | | |
| H/V pressure G+P+W,k | 85.35 | 7.22 |
| Wall weight | | 87.84 |
| H/V pressure passive | | 0.00 |
| Bh,g,k z=-3.30 | -43.91 | |
| Bv,g,k = Bh,k * tan($\delta,p=-0.07^\circ$) | | -0.05 |
| Bh,q,k z=-3.30 | -102.85 | |
| Bv,q,k = Bh,k * tan($\delta,p=-0.07^\circ$) | | -0.12 |
| Ch,g | 11.10 | |
| Cv,g = Ch*tan($\delta,C=0.0^\circ$) | | 0.01 |
| Ch,q | 50.32 | |
| Cv,q = Ch*tan($\delta,C=0.0^\circ$) | | 0.03 |
| | | |
| Σ | -0.00 | 94.93 |
| | | (downwards) |

| | |
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| Part: Block: Please specify project informations. Record: | Archive No.: |
|---|--------------|

Page: 19

| | | | | | | | | | | |
|--|--------|------------------|----------------|----------------------|--------------|----------|------------------|-------|---------|---------|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | | | | | Job No.: | | | | | |
| Program: WALLS-Retain. | | Version 2017.046 | | | | | | | | |
| Structure: info@fides-dvp.de | | www.fides-dvp.de | | Tel:++49/89/143829-0 | | ASB Nr.: | Date: 08.10.2018 | | | |
| Simple check, EAB R 9-3a | | | | | | | | | | |
| V _k >= B _{vk} : 95.10 >= 0.17 Passes requirement | | | | | | | | | | |
| Υπολογ. κύκλου ολίσθησης | | | | | | | | | | |
| LC: όλα τα φορτία Type: BS-T (combination: [GEO] A2 M2 R3, BS-T) | | | | | | | | | | |
| Vertical variable loads only act if they are outside of R*sin(phi). | | | | | | | | | | |
| The automatic slip circle optimization only considers circles that intersect the surface with an area of at least 0.25 m2. | | | | | | | | | | |
| The slip circle calculation only accepts circles including the wall. | | | | | | | | | | |
| The slipcircle calculation only allows circular failure planes (no vertical tangents will occur). | | | | | | | | | | |
| Γεωμετ.κύκλου (μήκη και συντεταγμ. σε (m)) | | | | | | | | | | |
| Κέντρο = (-1.72, 0.34), Ακτίνα = 5.59 | | | | | | | | | | |
| Αρχ.σημ.= (-6.79, -2.00), Τελ.σημ. = (3.86, 0.00) | | | | | | | | | | |
| Γεωμετρία λωρίδων: | | | | | | | | | | |
| No | x | Width | dxM | Weight | Load | Water- | u*b | φ | c | θ |
| | [m] | b | [m] | [kN/m] | z-κατ. | φορτ. | [kN/m] | [°] | [kN/m²] | [°] |
| | | [m] | | | [kN/m] | [kN/m] | | | | |
| 1 | -6.51 | 0.56 | -4.80 | 5.9 | 0.0 | 0.0 | -0.0 | 0.08 | 35.71 | -44.96* |
| 2 | -5.96 | 0.56 | -4.24 | 14.6 | 0.0 | 0.0 | -1.7 | 0.08 | 35.71 | -44.96* |
| 3 | -5.40 | 0.56 | -3.68 | 20.9 | 0.0 | 0.0 | -4.8 | 0.08 | 35.71 | -41.18 |
| 4 | -4.84 | 0.56 | -3.12 | 25.7 | 0.0 | 0.0 | -7.2 | 0.08 | 35.71 | -33.95 |
| 5 | -4.28 | 0.56 | -2.56 | 29.6 | 0.0 | 0.0 | -9.1 | 27.45 | 3.57 | -27.29 |
| 6 | -3.72 | 0.56 | -2.00 | 32.7 | 0.0 | 0.0 | -10.5 | 27.45 | 3.57 | -21.01 |
| 7 | -3.16 | 0.56 | -1.44 | 35.0 | 0.0 | 0.0 | -11.5 | 27.45 | 3.57 | -14.98 |
| 8 | -2.60 | 0.56 | -0.89 | 36.5 | 0.0 | 0.0 | -12.1 | 27.45 | 3.57 | -9.12 |
| 9 | -2.04 | 0.56 | -0.33 | 37.3 | 0.0 | 0.0 | -12.5 | 27.45 | 3.57 | -3.35 |
| 10 | -1.49 | 0.56 | 0.23 | 37.3 | 0.0 | 0.0 | -12.5 | 27.45 | 3.57 | 2.38 |
| 11 | -0.93 | 0.56 | 0.79 | 36.7 | 0.0 | 0.0 | -12.2 | 27.45 | 3.57 | 8.14 |
| 12 | -0.37 | 0.56 | 1.35 | 35.3 | 0.0 | 0.0 | -11.6 | 27.45 | 3.57 | 13.98 |
| 13 | 0.19 | 0.56 | 1.91 | 50.5 | 0.0 | 0.0 | -10.7 | 27.45 | 3.57 | 19.97 |
| 14 | 0.75 | 0.56 | 2.47 | 50.8 | 1.2 | 0.0 | -9.3 | 27.45 | 3.57 | 26.20 |
| 15 | 1.31 | 0.56 | 3.03 | 47.1 | 24.0 | 0.0 | -7.5 | 0.08 | 35.71 | 32.79 |
| 16 | 1.87 | 0.56 | 3.58 | 42.5 | 24.0 | 0.0 | -5.2 | 0.08 | 35.71 | 39.91 |
| 17 | 2.42 | 0.56 | 4.14 | 36.5 | 24.0 | 0.0 | -2.2 | 0.08 | 35.71 | 47.86 |
| 18 | 2.98 | 0.56 | 4.70 | 28.3 | 24.0 | 0.0 | -0.2 | 0.08 | 35.71 | 57.30 |
| 19 | 3.56 | 0.60 | 5.28 | 16.0 | 10.2 | 0.0 | -0.0 | 20.46 | 1.43 | 70.88 |
| *** Σημείωση: Στις λωρίδες σημειωμένες με '*' περιορίστηκε το theta στο 45°-Phi/2. | | | | | | | | | | |
| Συνεισφ. κατακόρυφων φορτίων: | | | | | | | | | | |
| No | Weight | G*sin(θ) | (G-u*b)*tan(φ) | μ*sin(θ)* | T | | | | | |
| | [kN/m] | [kN/m] | + c*b | tan(φ)+cos(θ) | [kN/m] | | | | | |
| | | | [kN/m] | [-] | | | | | | |
| 1 | 5.93 | -5.09 | 19.96 | 0.707211 | 28.23 | | | | | |
| 2 | 14.60 | -11.07 | 19.97 | 0.707211 | 28.24 | | | | | |
| 3 | 20.90 | -13.76 | 19.98 | 0.752238 | 26.56 | | | | | |
| 4 | 25.70 | -14.35 | 19.98 | 0.829212 | 24.10 | | | | | |
| 5 | 29.58 | -13.56 | 12.66 | 0.794707 | 15.93 | | | | | |
| 6 | 32.72 | -11.73 | 13.56 | 0.860042 | 15.77 | | | | | |
| 7 | 35.01 | -9.05 | 14.22 | 0.913023 | 15.57 | | | | | |
| 8 | 36.51 | -5.79 | 14.65 | 0.954871 | 15.34 | | | | | |
| 9 | 37.27 | -2.18 | 14.87 | 0.986300 | 15.08 | | | | | |
| 10 | 37.33 | 1.55 | 14.89 | 1.007651 | 14.77 | | | | | |
| 11 | 36.69 | 5.19 | 14.70 | 1.018951 | 14.43 | | | | | |
| 12 | 35.31 | 8.53 | 14.31 | 1.019913 | 14.03 | | | | | |
| 13 | 50.54 | 17.26 | 22.71 | 1.009894 | 22.49 | | | | | |
| 14 | 52.06 | 22.98 | 24.20 | 0.987773 | 24.50 | | | | | |
| 15 | 71.04 | 38.47 | 20.04 | 0.840984 | 23.83 | | | | | |
| 16 | 66.44 | 42.63 | 20.04 | 0.767457 | 26.11 | | | | | |
| 17 | 60.44 | 44.82 | 20.04 | 0.671336 | 29.85 | | | | | |
| 18 | 52.28 | 43.99 | 20.03 | 0.540685 | 37.04 | | | | | |
| Part: | | | | | Archive No.: | | | | | |
| Block: Please specify project informations. | | | | | Page: 20 | | | | | |
| Record: | | | | | | | | | | |

Author: **FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München**

Job No.:

Program: **WALLS-Retain.**

Version 2017.046

Structure: info@fides-dvp.de

www.fides-dvp.de

Tel:++49/89/143829-0

ASB Nr.:

Date: 08.10.2018

| No | Weight | $G \cdot \sin(\theta)$ | $(G-u \cdot b) \cdot \tan(\varphi) + c \cdot b$ | $\mu \cdot \sin(\theta) \cdot \tan(\varphi) + \cos(\theta)$ | T |
|----|--------|------------------------|---|---|--------|
| | [kN/m] | [kN/m] | [kN/m] | [-] | [kN/m] |
| 19 | 26.20 | 24.75 | 10.62 | 0.466572 | 22.77 |
| | | ----- | | | ----- |
| | | 163.60 | | | 414.63 |

Δράση $E_d = (163.6 \cdot 5.59)$

Αντίσταση $R_d = (414.6 \cdot 5.59 + 0.0)$

SLIP-CIRCLE $\mu = E_d/R_d = 0.39 < 1.0$: Έλεγχος εκπληρώθηκε.

Part:

Block: Please specify project informations.

Record:

Page: 21

Archive No.:

| | | | | |
|------------|--|------------------|-------------------------------|------------------|
| Author: | FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | | | Job No.: |
| Program: | WALLS-Retain. Version 2017.046 | | | |
| Structure: | info@fides-dvp.de | www.fides-dvp.de | Tel:++49/89/143829-0 ASB Nr.: | Date: 08.10.2018 |

Φάση εκσκαφής 2 "[2] Situation 2"

LC: όλα τα φορτία Type: BS-T

Εδαφικό σύστημα με 5 Στρώσεις

| Name | Τεχνητές επιχωματώσεις Αμμόδης ΑΡΓΙΛΟΣ Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ | | | |
|-------------|---|-----------|-------------|-----------|
| γ | [kN/m3] | 18 | 20 | 22.5 |
| γ,R | [kN/m3] | 18 | 20 | 22.5 |
| γ' | [kN/m3] | 8 | 10 | 12.5 |
| γ,p | [kN/m3] | 18 | 20 | 22.5 |
| γ,R,passive | [kN/m3] | 18 | 20 | 22.5 |
| γ,pw | [kN/m3] | 8 | 10 | 12.5 |
| φ | [°] | 25 | 0.1 | 33 |
| c | [kN/m2] | 2 | 50 | 5 |
| c,u | [kN/m2] | 10 | 50 | 5 |
| c παθητικό | [kN/m2] | 2 | 50 | 5 |
| δ,a | [°] | 16.66667 | 0.06666667 | 22 |
| δ,p | [°] | -16.66667 | -0.06666667 | -22 |
| δ,c | [°] | 8.333333 | 0.03333333 | 11 |
| k,agh | [-] | 0.3456501 | 0.9955057 | 0.2452023 |
| K,ach | [-] | 1.043051 | 1.994195 | 0.8549058 |
| K,0h | [-] | 0.5773817 | 0.9982547 | 0.455361 |
| K,pgh | [-] | 3.908103 | 1.004519 | 7.495617 |
| K,pch | [-] | 5.180327 | 2.00583 | 8.599509 |
| τ,gr | [kN/m2] | 110 | 110 | 110 |
| Ψ,A,max | [°] | 90 | 90 | 90 |
| k | [cm/s] | 10e-06 | 1e-06 | 100e-06 |

| Name | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ | |
|-------------|------------------------|------------------------|-----------|
| γ | [kN/m3] | 22.5 | 22.5 |
| γ,R | [kN/m3] | 22.5 | 22.5 |
| γ' | [kN/m3] | 12.5 | 12.5 |
| γ,p | [kN/m3] | 22.5 | 22.5 |
| γ,R,passive | [kN/m3] | 22.5 | 22.5 |
| γ,pw | [kN/m3] | 12.5 | 12.5 |
| φ | [°] | 35 | 35 |
| c | [kN/m2] | 5 | 5 |
| c,u | [kN/m2] | 5 | 5 |
| c παθητικό | [kN/m2] | 5 | 5 |
| δ,a | [°] | 23.33333 | 23.33333 |
| δ,p | [°] | -23.33333 | -23.33333 |
| δ,c | [°] | 11.66667 | 11.66667 |
| k,agh | [-] | 0.2244207 | 0.2244207 |
| K,ach | [-] | 0.8126539 | 0.8126539 |
| K,0h | [-] | 0.4264236 | 0.4264236 |
| K,pgh | [-] | 9.146943 | 9.146943 |
| K,pch | [-] | 10.104 | 10.104 |
| τ,gr | [kN/m2] | 110 | 110 |
| Ψ,A,max | [°] | 90 | 90 |
| k | [cm/s] | 100e-06 | 100e-06 |

Πορεία πρανούς:

x [m] 0.00 0.00
z [m] -2.00 0.00

Πορεία ανώτερου 2. στρώματος Αμμόδης ΑΡΓΙΛΟΣ:

x [m] 0.00 0.00
z [m] -2.00 -1.50

Πορεία ανώτερου 3. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ:

z= -4.50

Πορεία ανώτερου 4. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟΣ:

z= -10.00

| | | | |
|---------|--------------------------------------|--|--------------|
| Part: | | | Archive No.: |
| Block: | Please specify project informations. | | Page: 22 |
| Record: | | | |

| | | |
|---|------------------|-------------------------------|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | | Job No.: |
| Program: WALLS-Retain. Version 2017.046 | | |
| Structure: info@fides-dvp.de | www.fides-dvp.de | Tel:++49/89/143829-0 ASB Nr.: |
| | | Date: 08.10.2018 |

Πορεία ανώτερου 5. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ:
 z= -14.00

Επιφ. φορτία:

Φορτία

| xA | zA | xE | zE | PxA | PzA | PxE | PzE | Typ | LC-description |
|------|------|------|------|------|-------|------|-------|-----|----------------|
| [m] | [m] | [m] | [m] | [| kN/m² | |] | | Name |
| 1.00 | 0.00 | 3.50 | 0.00 | 0.00 | 33.00 | 0.00 | 33.00 | q | 1 |

Κατανομή εδαφ.πιέσεων

| Κατανομή εδαφ.πιέσεων | Name |
|----------------------------|------|
| Rectangular within a layer | |

Στάθμη νερού:

x [m] 0.00
 z [m] -3.00

Αγκύρια

| z[m] | min.l[m] | Alpha[°] | C-H[kN/m] | P0[kN] | u0[m] |
|-------|----------|----------|-----------|--------|--------|
| -0.50 | 0.00 | 15.00 | αόρισ. | 0.00 | 0.0000 |

Παράμετροι υπολογισμού

Earth pressure options

Τμήμα εδαφ.ωθήσεων: Ενεργές ωθήσεις.
 Angle of slip plane: DIN 4085.
 Split block loads into 1 sections.
 Consideration of minimum earth pressure: $\varphi_{min} = 40.000$.
 Negative earth pressure fractions are set to zero.

Redistribution of earth pressure

Shape of redistribution: Trapezoid.
 The earth pressure is getting redistb. to: Excavation level
 The earth pressure below the excavation acts without redistrb.
 Levels of redistribution Z1: 0.000, Z2: -1.000 [m].
 The earth pressure from variable loads will be included in redistribution.

Παθητικές ωθήσεις

Method of calculation: Κλασικός, Pregl/Sokolovsky (DIN 4085).

Options for water pressure

Στήριξη πόδα

Πόδας οριζοντίως μετακινούμενος

Αγκύρια

Anchor checks (lower failure plane): Ναι
 Anchor forces with safety level of DS-P: Ναι
 Verification of grout body pull out forces: Ναι
 δ,a,Anchoring wall : used from soil layer.
 δ,p,Anchoring wall : used from soil layer.

Earth pressure coefficients kh

| φ | α | β | δ | k0gh | kagh | kach | kpgh | kpch | |
|------|-----|-----|-------|------|-------|-------|-------|---------|--------------------------|
| 0.1 | 0.0 | 0.0 | -0.1 | -- | -- | -- | 1.005 | -2.006 | Τεχνητές επιχωματώσεις |
| 25.0 | 0.0 | 0.0 | 16.7 | -- | 0.346 | 1.043 | -- | -- | " |
| 0.1 | 0.0 | 0.0 | -0.1 | -- | -- | -- | 1.005 | -2.006 | Αμμόδης ΑΡΓΙΛΟΣ |
| 0.1 | 0.0 | 0.0 | 0.1 | -- | 0.996 | 1.994 | -- | -- | " |
| 33.0 | 0.0 | 0.0 | -22.0 | -- | -- | -- | 7.496 | -8.600 | Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ |
| 33.0 | 0.0 | 0.0 | 22.0 | -- | 0.245 | 0.855 | -- | -- | " |
| 35.0 | 0.0 | 0.0 | -23.3 | -- | -- | -- | 9.147 | -10.104 | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ |
| 35.0 | 0.0 | 0.0 | 23.3 | -- | 0.224 | 0.813 | -- | -- | " |
| 35.0 | 0.0 | 0.0 | -23.3 | -- | -- | -- | 9.147 | -10.104 | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ |
| 35.0 | 0.0 | 0.0 | 23.3 | -- | 0.224 | 0.813 | -- | -- | " |

| | | |
|---|----------|--------------|
| Part: Block: Please specify project informations. Record: | Page: 23 | Archive No.: |
|---|----------|--------------|

Μήκος τοίχουFoot depth for statics: $z_f = -13.000$ **Stress analysis****Earth pressure, horizontal**

Pressures characteristic, no redistribution, continuous wall

0.00-0.69-1.50-3.00-4.50-10.00-13.00**z****eph,G+PG,k****eah,G,k****eah,PQ,k**

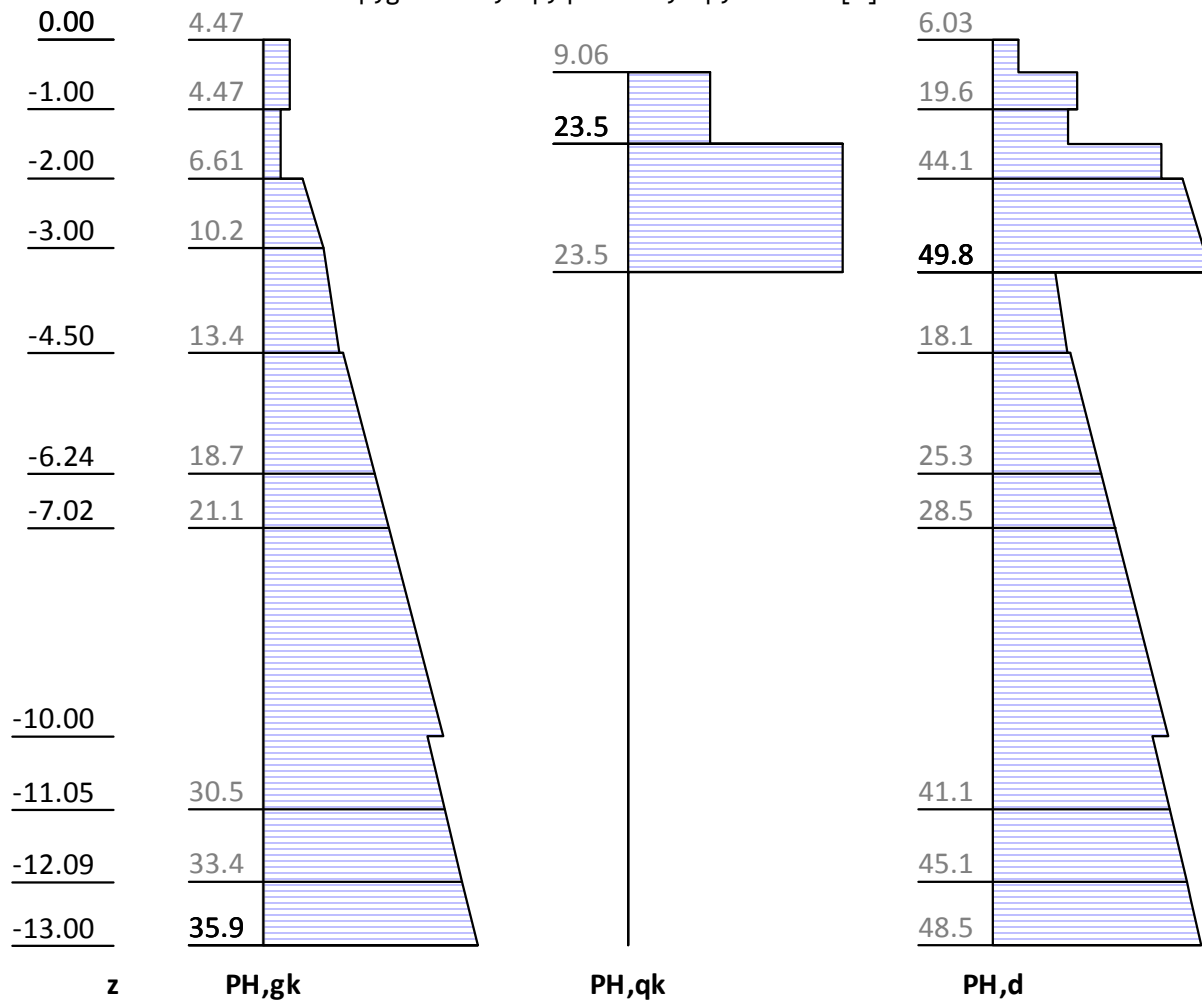
| z [m] | eph,G,k [kN/m ²] | eah,G,k [kN/m ²] | eah,PQ,k [kN/m ²] | eah,d [kN/m ²] |
|----------|---------------------------------|---------------------------------|----------------------------------|-------------------------------|
| 0.00 | | 0.00 | | 0.00 |
| -0.47 | | 1.52 | 0.00 | 2.04 |
| -0.47 | | 1.52 | 9.06 | 15.62 |
| -1.50 | | 7.25 | 9.06 | 23.37 |
| -1.50 | | 4.82 | 23.48 | 41.73 |
| -2.00 | -0.00 | 6.61 | 23.48 | 44.14 |
| -2.00 | -100.29 | 6.61 | 23.48 | 44.14 |
| -3.34 | -123.80 | 10.79 | 23.48 | 49.78 |
| -3.34 | -123.80 | 10.79 | 0.00 | 14.56 |
| -4.50 | -135.45 | 12.86 | 0.00 | 17.36 |
| -4.50 | -305.34 | 13.38 | 0.00 | 18.06 |
| -10.00 | -820.67 | 30.24 | 0.00 | 40.82 |
| -10.00 | -999.52 | 27.52 | 0.00 | 37.16 |
| -13.00 | -1342.53 | 35.94 | 0.00 | 48.52 |

Eph,G,k: -6911.80, Eph,PG,k: 0.00 [kN/m]

Eah,G,k: 248.27, Eah,PG,k: 0.00, Eah,PQ,k: 52.53, Eah,d: 413.96

H-pressure on static system

Level of mobilization: Ep,gk 100.0, Ep,qk 100.0, Ep,d 100.0 [%]



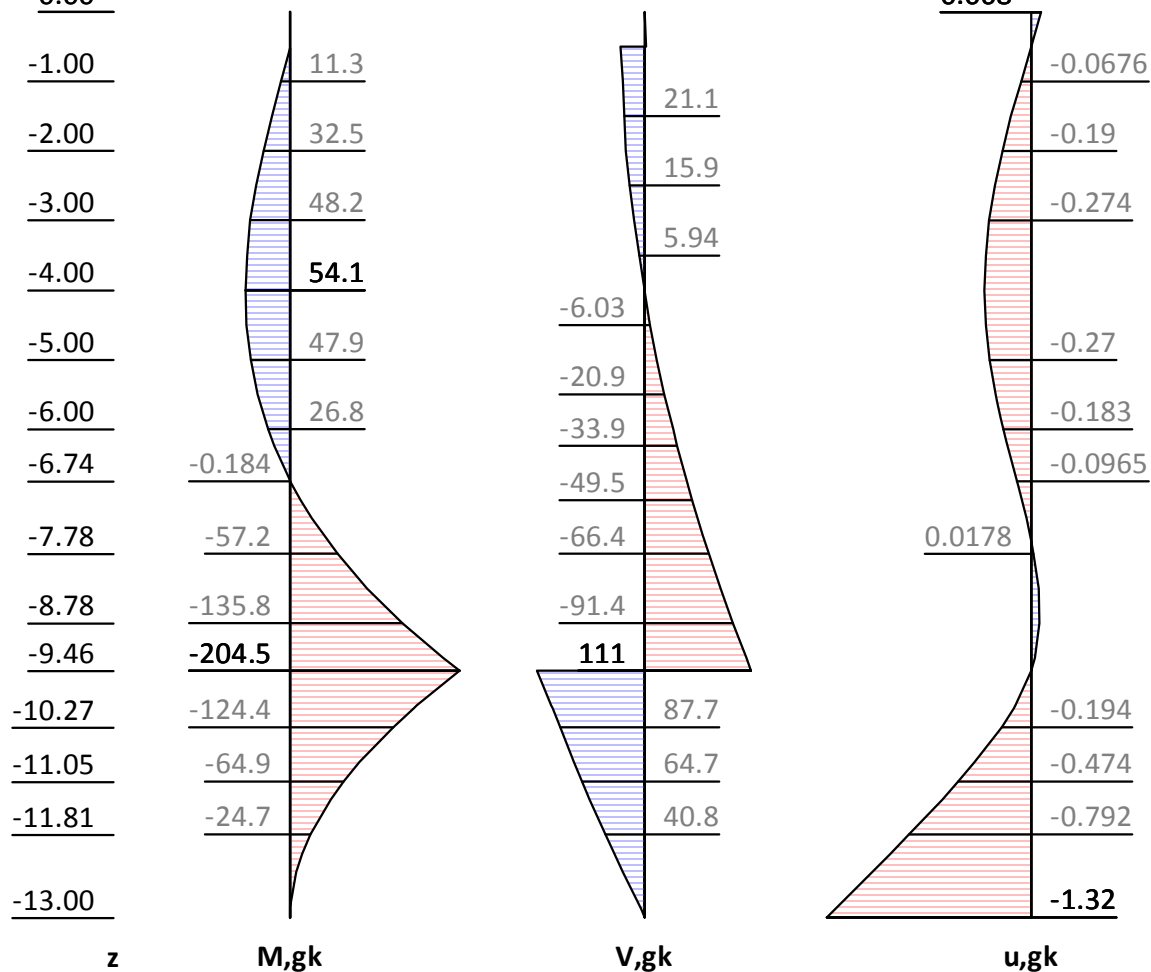
| z [m] | PH,gk [kN/m ²] | PH,qk [kN/m ²] | PH,d [kN/m ²] |
|----------|-------------------------------|-------------------------------|------------------------------|
| 0.00 | 4.47 | | 6.03 |
| -0.47 | 4.47 | 0.00 | 6.03 |
| -0.47 | 4.47 | 9.06 | 19.62 |
| -1.00 | 4.47 | 9.06 | 19.62 |
| -1.00 | 2.98 | 9.06 | 17.61 |
| -1.50 | 2.98 | 9.06 | 17.61 |
| -1.50 | 2.98 | 23.48 | 39.25 |
| -2.00 | 2.98 | 23.48 | 39.25 |
| -2.00 | 6.61 | 23.48 | 44.14 |
| -3.34 | 10.79 | 23.48 | 49.78 |
| -3.34 | 10.79 | 0.00 | 14.56 |
| -4.50 | 12.86 | 0.00 | 17.36 |
| -4.50 | 13.38 | 0.00 | 18.06 |
| -10.00 | 30.24 | 0.00 | 40.82 |
| -10.00 | 27.52 | 0.00 | 37.16 |
| -13.00 | 35.94 | 0.00 | 48.52 |

V-pressure on static system**Internal forces: Permanent, characteristically**

z= -0.500. Fx= -27.099 kN/m Support

z= -9.463. Fx=-221.169 kN/m Support

0.00

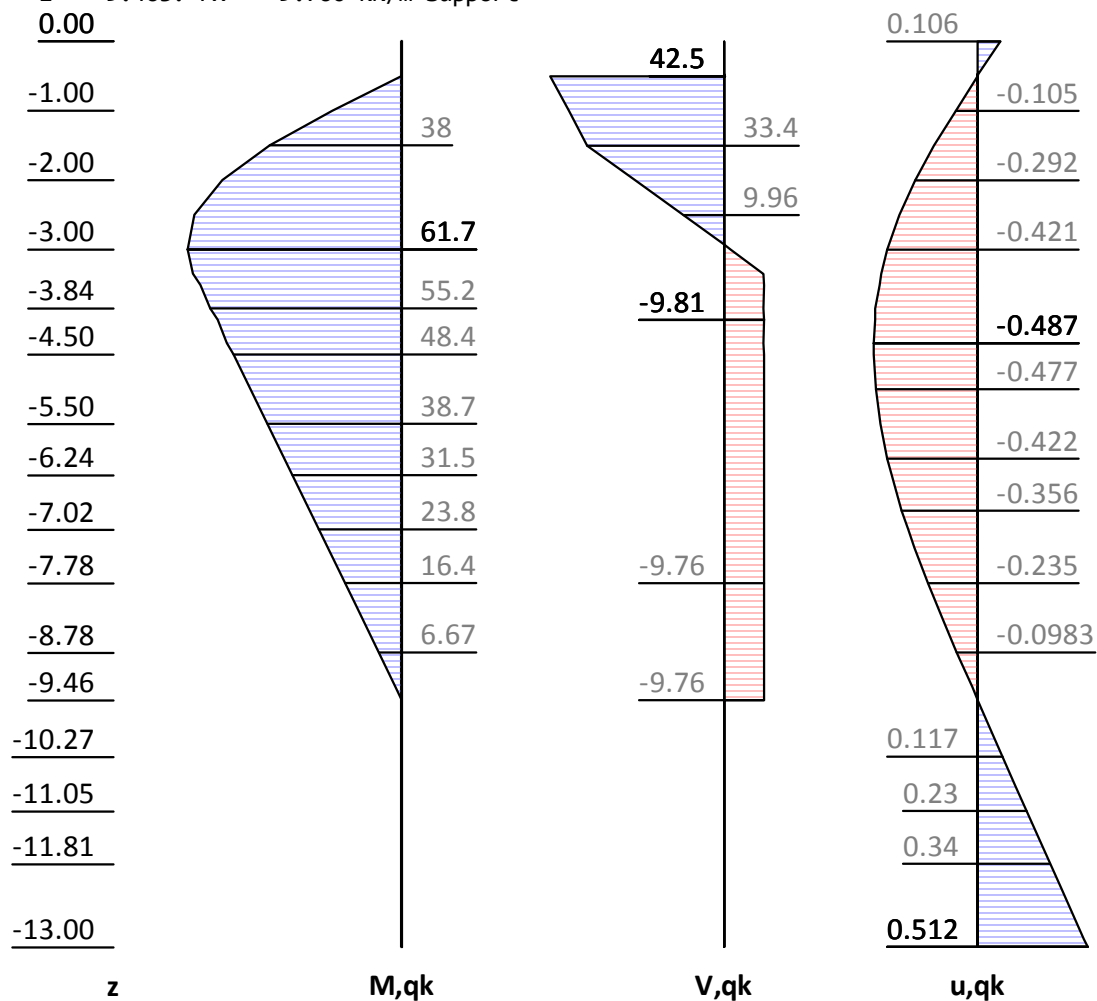


| z [m] | H, g, k [kN/m ²] | M, g, k [kN/m ²] | V, g, k [kN/m ²] | N, g, k [kN/m ²] | u, g, k [mm] |
|----------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|-----------------|
| 0.00 | 4.47 | 0.00 | -0.00 | 0.00 | 0.07 |
| -0.50 | 4.47 | -0.56 | -2.23 | -10.91 | 0.00 |
| -0.50 | 4.47 | -0.56 | -2.23 | -10.91 | -0.00 |
| -0.50 | 4.47 | -0.56 | 24.86 | -18.17 | -0.00 |
| -0.52 | 4.47 | -0.00 | 24.76 | -18.69 | -0.00 |
| -1.00 | 4.47 | 11.31 | 22.63 | -29.09 | -0.07 |
| -1.00 | 2.98 | 11.31 | 22.63 | -29.09 | -0.07 |
| -2.00 | 2.98 | 32.45 | 19.65 | -50.64 | -0.19 |
| -2.00 | 6.61 | 32.45 | 19.65 | -50.64 | -0.19 |
| -4.00 | 11.97 | 54.06 | 0.18 | -84.27 | -0.30 |
| -4.01 | 11.99 | 54.02 | -0.00 | -84.45 | -0.30 |
| -4.50 | 12.86 | 52.62 | -6.03 | -90.57 | -0.29 |
| -4.50 | 13.38 | 52.62 | -6.03 | -90.57 | -0.29 |
| -6.74 | 20.23 | 0.00 | -43.59 | -133.92 | -0.10 |
| -7.60 | 22.89 | -46.50 | -62.42 | -152.47 | 0.00 |
| -8.78 | 26.50 | -135.80 | -91.37 | -178.98 | 0.06 |
| -9.46 | 28.58 | -204.51 | -110.18 | -195.19 | 0.00 |
| -9.46 | 28.58 | -204.51 | 110.99 | -195.19 | 0.00 |
| -9.46 | 28.58 | -204.51 | 110.99 | -195.19 | -0.00 |
| -10.00 | 30.24 | -149.11 | 95.20 | -208.34 | -0.12 |
| -10.00 | 27.52 | -149.11 | 95.20 | -208.34 | -0.12 |
| -13.00 | 35.94 | 0.00 | 0.00 | -287.20 | -1.32 |

Internal forces: Variable, characteristicallyMethod EB 82-4 ($Q = [G+Q] - G$).

z= -0.500. Fx= -42.773 kN/m Support

z= -9.463. Fx= -9.760 kN/m Support

0.00

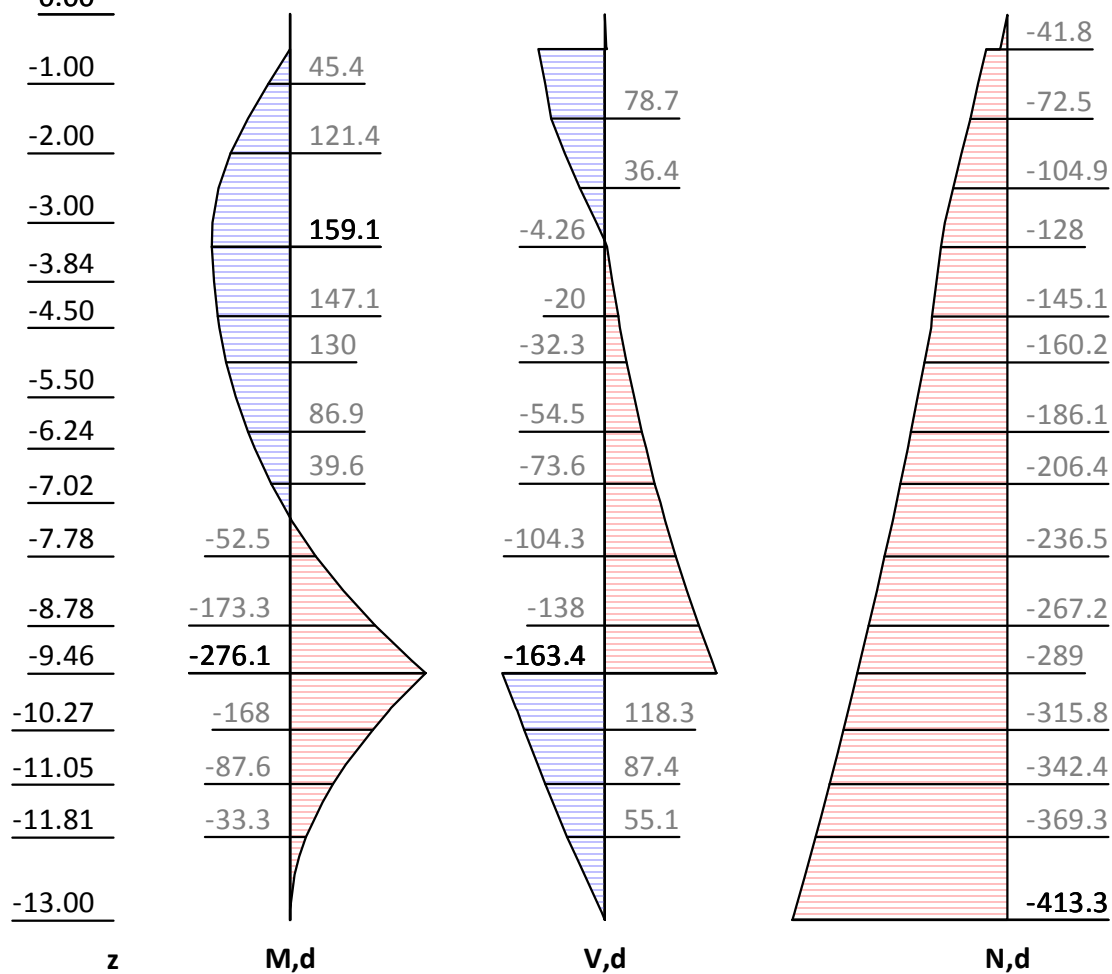
| z [m] | H, q, k [kN/m²] | M, q, k [kN/m²] | V, q, k [kN/m²] | N, q, k [kN/m²] | u, q, k [mm] |
|----------|--------------------|--------------------|--------------------|--------------------|-----------------|
| 0.00 | | 0.00 | -0.00 | 0.00 | 0.11 |
| -0.47 | 0.00 | 0.03 | -0.00 | 0.00 | 0.01 |
| -0.47 | 9.06 | 0.03 | 0.00 | -0.00 | 0.01 |
| -0.47 | 9.06 | 0.03 | -0.00 | -0.00 | 0.01 |
| -0.50 | 9.06 | 0.00 | -0.24 | -0.03 | 0.00 |
| -0.50 | 9.06 | 0.00 | 42.50 | -11.49 | -0.00 |
| -1.50 | 9.06 | 37.97 | 33.44 | -12.45 | -0.20 |
| -1.50 | 23.48 | 37.97 | 33.44 | -12.45 | -0.20 |
| -2.92 | 23.48 | 61.41 | 0.00 | -15.99 | -0.41 |
| -3.00 | 23.48 | 61.72 | -1.78 | -16.17 | -0.42 |
| -3.34 | 23.48 | 60.05 | -9.71 | -17.02 | -0.45 |
| -3.34 | 0.00 | 60.05 | -9.71 | -17.02 | -0.45 |
| -3.50 | 0.00 | 57.90 | -9.81 | -17.02 | -0.46 |
| -3.84 | 0.00 | 55.20 | -9.71 | -17.02 | -0.48 |
| -4.00 | 0.00 | 52.99 | -9.81 | -17.02 | -0.48 |
| -4.34 | 0.00 | 50.34 | -9.71 | -17.02 | -0.49 |
| -4.50 | 0.00 | 48.44 | -9.76 | -17.02 | -0.49 |
| -5.00 | 0.00 | 43.56 | -9.76 | -17.02 | -0.48 |
| -6.00 | 0.00 | 33.80 | -9.76 | -17.02 | -0.42 |
| -6.24 | 0.00 | 31.46 | -9.76 | -17.02 | -0.40 |
| -6.74 | 0.00 | 26.58 | -9.76 | -17.02 | -0.36 |

| z [m] | H, q, k [kN/m2] | M, q, k [kN/m2] | V, q, k [kN/m2] | N, q, k [kN/m2] | u, q, k [mm] |
|----------|--------------------|--------------------|--------------------|--------------------|-----------------|
| -7.02 | 0.00 | 23.84 | -9.76 | -17.02 | -0.33 |
| -9.46 | 0.00 | 0.00 | -9.76 | -17.02 | -0.00 |
| -9.46 | 0.00 | -0.00 | -9.76 | -17.02 | 0.00 |
| -9.46 | 0.00 | -0.00 | 0.00 | -17.02 | 0.00 |
| -10.27 | 0.00 | -0.00 | 0.00 | -17.02 | 0.12 |
| -12.09 | 0.00 | -0.00 | 0.00 | -17.02 | 0.38 |
| -12.35 | 0.00 | -0.00 | 0.00 | -17.02 | 0.42 |
| -12.90 | 0.00 | -0.00 | 0.00 | -17.02 | 0.50 |
| -13.00 | 0.00 | -0.00 | -0.00 | -17.02 | 0.51 |

Internal forces: Design

z= -0.500. Fx=-100.742 kN/m Support

z= -9.463. Fx=-313.218 kN/m Support

0.00

| | | | | | |
|--|-------------------|------------------|----------------------|----------|------------------|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | | | | | Job No.: |
| Program: WALLS-Retain. Version 2017.046 | | | | | |
| Structure: | info@fides-dvp.de | www.fides-dvp.de | Tel:++49/89/143829-0 | ASB Nr.: | Date: 08.10.2018 |

0.00

6.03

19.6

44.1

49.8

18.1

25.3

28.5

41.1

45.1

48.5

0.174

-0.173

-0.482

-0.696

-0.747

-0.605

-0.452

-0.217

-0.0401

-0.0776

-0.244

-0.453

-0.809

z

H,d

u,g+q,k

| z | H, d | M, d | V, d | N, d | u, g+q, k |
|--------|---------|---------|---------|---------|-----------|
| [m] | [kN/m2] | [kN/m2] | [kN/m2] | [kN/m2] | [mm] |
| 0.00 | 6.03 | 0.00 | -0.00 | 0.00 | 0.17 |
| -0.47 | 6.03 | -0.67 | -2.84 | -13.85 | 0.01 |
| -0.47 | 19.62 | -0.67 | -2.84 | -13.85 | 0.01 |
| -0.50 | 19.62 | -0.76 | -3.42 | -14.78 | 0.00 |
| -0.51 | 19.62 | -0.00 | 97.16 | -42.03 | -0.00 |
| -1.00 | 19.62 | 45.45 | 87.51 | -57.22 | -0.17 |
| -1.00 | 17.61 | 45.45 | 87.51 | -57.22 | -0.17 |
| -1.50 | 17.61 | 87.00 | 78.70 | -72.49 | -0.34 |
| -1.50 | 39.25 | 87.00 | 78.70 | -72.49 | -0.34 |
| -2.00 | 39.25 | 121.44 | 59.08 | -88.90 | -0.48 |
| -2.00 | 44.14 | 121.44 | 59.08 | -88.90 | -0.48 |
| -3.25 | 49.58 | 158.71 | 0.00 | -126.26 | -0.73 |
| -3.34 | 49.78 | 159.06 | -4.26 | -128.05 | -0.74 |
| -3.34 | 14.56 | 159.06 | -4.26 | -128.05 | -0.74 |
| -4.34 | 16.97 | 147.12 | -20.03 | -145.07 | -0.78 |
| -4.50 | 17.36 | 143.70 | -22.77 | -147.80 | -0.78 |
| -4.50 | 18.06 | 143.70 | -22.77 | -147.80 | -0.78 |
| -7.23 | 29.36 | 0.00 | -87.54 | -220.41 | -0.34 |
| -9.46 | 38.59 | -276.09 | -163.38 | -289.03 | 0.00 |
| -9.46 | 38.59 | -276.09 | 149.84 | -289.03 | 0.00 |
| -10.00 | 40.82 | -201.29 | 128.51 | -306.78 | -0.04 |
| -10.00 | 37.16 | -201.29 | 128.51 | -306.78 | -0.04 |
| -13.00 | 48.52 | -0.00 | 0.00 | -413.25 | -0.81 |

Anchor forces with safety level of DS-P

| z[m] | A, d[kN] | Fx, d[kN/m] |
|-------|----------|-------------|
| -0.50 | 187.7 | -100.7 |

| | | |
|---------|--------------------------------------|--------------|
| Part: | | Archive No.: |
| Block: | Please specify project informations. | Page: 29 |
| Record: | | |

Checks of earth statics

Check of earth support

Check: Mobilizable earth resistance is sufficient for earth support force.

z: -9.46 m

$R_d = E_{ph,k}/\gamma_{Re} = 6911.80 / 1.400 = 4937.00 \text{ [kN/m]}$

$E_d(U_h,d)/R_d = 313.22 / 4937.00 = 0.063 \text{ [-]}. \text{ Passes requirement}$

Sum of H and V forces, (G)

Forces up to depth z:-13.00

| Pos. | H | V |
|--|---------|-----------------------|
| H/V pressure G+P+W,k | 248.27 | 90.93 |
| Wall weight | | 189.01 |
| H/V pressure passive | | 0.00 |
| Support z: -0.50 | -27.10 | 7.26 |
| B _{h,g,k} z=-9.46 | -221.17 | |
| B _{v,g,k} = B _{h,k} * tan(δ,p=-22.00°) | | -89.36 |
| Σ | -0.00 | 197.84 (downwards) |

Average anchor inclination α,A = 15.00° >= 15°.

Verification of vertical forces due to EAB R 9 not required (R 9-5).

Check EAB R 9-1

Vertical component of earth resistance is less than the downwards pointing vertical forces.

$V_k \geq B_{vk}$: 287.20 >= 89.36 Passes requirement

Sum of H and V forces, (G+Q)

Forces up to depth z:-13.00

| Pos. | H | V |
|--|---------|-----------------------|
| H/V pressure G+P+W,k | 300.80 | 96.49 |
| Wall weight | | 189.01 |
| H/V pressure passive | | 0.00 |
| Support z: -0.50 | -69.87 | 18.72 |
| B _{h,g,k} z=-9.46 | -221.17 | |
| B _{v,g,k} = B _{h,k} * tan(δ,p=-22.00°) | | -89.36 |
| B _{h,q,k} z=-9.46 | -9.76 | |
| B _{v,q,k} = B _{h,k} * tan(δ,p=-22.00°) | | -3.94 |
| Σ | -0.00 | 210.92 (downwards) |

Average anchor inclination α,A = 15.00° >= 15°.

Verification of vertical forces due to EAB R 9 not required (R 9-5).

Check EAB R 9-1

Vertical component of earth resistance is less than the downwards pointing vertical forces.

$V_k \geq B_{vk}$: 304.22 >= 93.30 Passes requirement

Anchor verification

| | | | | | | |
|--|--|--|--|--|-------------------------|--|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | | | | | Job No.: | |
| Program: WALLS-Retain. | | | | | Version 2017.046 | |
| Structure: info@fides-dvp.de www.fides-dvp.de Tel:++49/89/143829-0 ASB Nr.: | | | | | Date: 08.10.2018 | |

Anchor - Stability of lower failure plane

Περίπτ.Φόρτισης: όλα τα φορτία BS-P
 Αυτόμ. υπολογ. μήκους αγκυρίων:
 All anchors are extended (if necessary)
 Favourable variable loads in main failure body are not being considered.
 Bottom of lower failure plane: z=-13.00 m

Iteration of failure mechanisms:
 lA: Length of anchor from head to center of grout body.
 W,k: Res. force from dead weight, loads, cohesion, ...
 Q,k: Force in lower failure plane.
 Ea1,k.....: Earth pressure onto vertical separation plane.
 Ea2,k.....: Earth pressure between wall and main failure body.
 Ra_cal,d: Dimesioning force of the resistance from the equilibrium of forces.
 Ra_cal,d corresponds to the max. possible anchor force of the force polygon.
 Sum(A,d): Acting anchor forces along the grout body fractions within the failure body. Sum(A,d) is gained from the anchor pull forces of the wall analysis.

| z | θ1 | θ2 | lA | W,k | Q,k | Ea1,k | Ea2,k | Ra_cal,d | Sum(A,d) | Ed/Rd |
|-------|------|------|-------|--------|--------|--------|--------|----------|----------|-------|
| [m] | [°] | [°] | [m] | [kN/m] | [kN/m] | [kN/m] | [kN/m] | [kN/m] | [kN/m] | [-] |
| -0.50 | 44.9 | 57.5 | 10.24 | 1133.0 | 1028.2 | 4.4 | 315.9 | 104.4 | 104.3 | 1.00 |

Decisive failure body:
Γεωμετρία:
 Foot point of lower failure plane x/z = 0.01/-13.00 m
 Intersection lower/upper slid. plane x/z = 9.89/ -3.15 m
 Intersection upper slid. plane/surface x/z = 11.90/ 0.00 m
 Intersection separation plane/surface x/z = 9.89/ 0.00 m
 Inclination lower failure plane θ1 = 44.91°
 Inclination upper failure plane θ2 = 57.50°
 Inclination separation plane θ12 = 90.00°

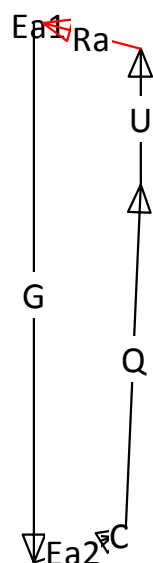
Loads / forces (char.)

| | | Fx | Fz | F | |
|------------------------------------|-----------|--------|---------|--------|---------|
| | | [kN/m] | [kN/m] | [kN/m] | |
| Weight of main failure body | G,k: | 0.0 | -1656.6 | 1656.6 | |
| Area loads on/in main failure body | F1,k: | 0.0 | -82.5 | 82.5 | |
| Cohesion of lower failure plane | C,k: | 110.3 | 110.0 | 155.8 | |
| Pore water pressure on main body | U,k: | -0.1 | 501.4 | 501.4 | |
| Earth pres. on separation plane | Ea1,k: | -4.4 | -0.0 | 4.4 | δ= 0.0° |
| Earth pr. between wall<->main body | Ea2,k: | 300.8 | 96.5 | 315.9 | |
| Force in lower failure plane | Q,k: | -265.5 | 993.4 | 1028.2 | |
| Sum = possible anchor forces: | Ra_cal,k: | 141.1 | -37.8 | 146.1 | |

Force polygon

| | | |
|--|--|--------------|
| Part: | | Archive No.: |
| Block: Please specify project informations. | | |
| Record: | | |

Page: 31



Acting anchor forces $E_d: \sum(A,d) = 104.3 \text{ kN/m}$
 Possible anchor forces $R_d: R_{a_cal,d} = 146.1/1.400 = 104.4 \text{ kN/m}$
 Verif. of lower failure plane $E_d/R_d = 1.00 < 1.0$: Έλεγχος εκπληρώθηκε.

Check of steel tension

l_{tot} ...[m]: Total length of anchor incl. excess length at head
 A_s [mm²]: X-section area of steel member
 $R_{i,d}$...[kN]: Ultimate strength of tension member ($\gamma, M=1.15$)
 $A_{d,d}$ [kN]: Dimensioning force of the anchor from wall analysis

| z[m] | Anchor type | l_{tot} | A_s | $R_{i,d}$ | $A_{d,d}$ |
|-------|----------------------------|-----------|-------|-----------|--------------------|
| -0.50 | Strand; 3x0.60"; 1570/1770 | 14.24 | 420 | 573.4 | 187.7 |
| | | | | | Passes requirement |

Check of steel tension: Passes requirement

Check of anchor's soil friction

$l_{V,k}$: Length of grout body
 $D_{mV,k}$: Diameter of grout body
 $\tau_{Gr,k}$: Average applied skin friction along the grout body (from soil parameters)
 $R_{a,k}$: Charact. pullout resistance of the anchor
 γ_A : Partial safety factor of anchor pullout
 $R_{a,d}$: $R_{a,k} / \gamma_A$
 $A_{d,d}$: Dimensioning force of the anchor from wall analysis

| z | $l_{V,k}$ | $D_{mV,k}$ | $\tau_{Gr,k}$ | $R_{a,k}$ | γ_A | $R_{a,d}$ | $A_{d,d}$ | $A_{d,d}/R_{a,d}$ |
|-------|-----------|------------|----------------------|-----------|------------|-----------|-----------|-------------------|
| [m] | [m] | [mm] | [kN/m ²] | [kN] | [-] | [kN] | [kN] | [-] |
| -0.50 | 8.00 | 318 | 110 | 879.1 | 1.100 | 799.2 | 187.7 | 0.2 |

Check of anchor's soil friction: Passes requirement

Υπολογ. κύκλου ολίσθησης

LC: όλα τα φορτία Type: BS-T (combination: [GEO] A2 M2 R3, BS-T)
 Vertical variable loads only act if they are outside of $R \cdot \sin(\phi)$.
 The automatic slip circle optimization only considers circles that intersect the surface with an area of at least 0.25 m².
 The slip circle calculation only accepts circles including the wall.
 The slip circle calculation only allows circular failure planes (no vertical tangents will occur).

Γεωμετ. κύκλου (μήκη και συντεταγμ. σε (m))
 Κέντρο = (-0.59, 2.23), Ακτίνα = 15.26
 Αρχ. σημ. = (-15.25, -2.00), Τελ. σημ. = (14.50, 0.00)

Γεωμετρία λωρίδων:

| No | x | Width b | dxM | Weight | Load z-κατ. [kN/m] | Water- φορτ. [kN/m] | u*b [kN/m] | φ [°] | c [kN/m ²] | θ [°] |
|----|--------|------------|--------|--------|--------------------------|---------------------------|---------------|----------|---------------------------|----------|
| | [m] | [m] | [m] | [kN/m] | [kN/m] | [kN/m] | [kN/m] | [°] | [kN/m ²] | [°] |
| 1 | -14.49 | 1.53 | -13.89 | 63.1 | 0.0 | 0.0 | -19.3 | 0.08 | 35.71 | -44.96* |
| 2 | -12.96 | 1.53 | -12.37 | 151.7 | 0.0 | 0.0 | -54.9 | 27.45 | 3.57 | -31.27* |
| 3 | -11.44 | 1.53 | -10.84 | 213.5 | 0.0 | 0.0 | -83.0 | 27.45 | 3.57 | -31.27* |
| 4 | -9.91 | 1.53 | -9.32 | 259.8 | 0.0 | 0.0 | -103.9 | 27.45 | 3.57 | -31.27* |
| 5 | -8.38 | 1.53 | -7.79 | 295.3 | 0.0 | 0.0 | -119.8 | 29.26 | 3.57 | -30.37* |
| 6 | -6.86 | 1.53 | -6.27 | 322.6 | 0.0 | 0.0 | -132.0 | 29.26 | 3.57 | -24.25 |
| 7 | -5.33 | 1.53 | -4.74 | 342.9 | 0.0 | 0.0 | -141.0 | 29.26 | 3.57 | -18.10 |
| 8 | -3.81 | 1.53 | -3.21 | 357.0 | 0.0 | 0.0 | -147.3 | 29.26 | 3.57 | -12.16 |
| 9 | -2.28 | 1.53 | -1.69 | 365.6 | 0.0 | 0.0 | -151.2 | 29.26 | 3.57 | -6.36 |
| 10 | -0.76 | 1.53 | -0.16 | 369.0 | 0.0 | 0.0 | -152.6 | 29.26 | 3.57 | -0.61 |
| 11 | 0.77 | 1.53 | 1.36 | 423.1 | 0.0 | 0.0 | -151.7 | 29.26 | 3.57 | 5.12 |
| 12 | 2.29 | 1.53 | 2.89 | 415.8 | 0.0 | 0.0 | -148.4 | 29.26 | 3.57 | 10.91 |
| 13 | 3.82 | 1.53 | 4.41 | 402.8 | 0.0 | 0.0 | -142.6 | 29.26 | 3.57 | 16.81 |
| 14 | 5.35 | 1.53 | 5.94 | 383.9 | 0.0 | 0.0 | -134.2 | 29.26 | 3.57 | 22.91 |
| 15 | 6.87 | 1.53 | 7.46 | 358.3 | 0.0 | 0.0 | -122.7 | 29.26 | 3.57 | 29.29 |
| 16 | 8.40 | 1.53 | 8.99 | 324.6 | 0.0 | 0.0 | -107.6 | 29.26 | 3.57 | 36.11 |
| 17 | 9.92 | 1.53 | 10.52 | 281.0 | 0.0 | 0.0 | -88.0 | 27.45 | 3.57 | 43.57 |
| 18 | 11.45 | 1.53 | 12.04 | 223.1 | 0.0 | 0.0 | -61.8 | 27.45 | 3.57 | 52.12 |
| 19 | 13.35 | 2.29 | 13.95 | 173.7 | 0.0 | 0.0 | -35.0 | 0.08 | 35.71 | 66.10 |

*** Σημείωση: Στις λωρίδες σημειωμένες με '*'
περιορίστηκε το theta στο 45°-Phi/2.

Συνεισφ. κατακόρυφων φορτίων:

| No | Weight | $G \cdot \sin(\theta)$ | $(G \cdot u \cdot b) \cdot \tan(\varphi) + c \cdot b$ | $\mu \cdot \sin(\theta) \cdot \tan(\varphi) + \cos(\theta)$ | T |
|--------|--------|------------------------|---|---|---------|
| | [kN/m] | [kN/m] | [kN/m] | [-] | [kN/m] |
| 1 | 63.07 | -57.44 | 54.54 | 0.707491 | 77.10 |
| 2 | 151.70 | -122.98 | 55.72 | 0.824848 | 67.56 |
| 3 | 213.50 | -151.74 | 73.23 | 0.824848 | 88.78 |
| 4 | 259.78 | -158.65 | 86.46 | 0.824848 | 104.82 |
| 5 | 295.33 | -150.83 | 103.79 | 0.831413 | 124.83 |
| 6 | 322.57 | -132.48 | 112.22 | 0.886298 | 126.62 |
| 7 | 342.85 | -106.53 | 118.51 | 0.931237 | 127.26 |
| 8 | 357.02 | -75.23 | 122.90 | 0.964482 | 127.42 |
| 9 | 365.55 | -40.47 | 125.55 | 0.986987 | 127.20 |
| 10 | 368.98 | -3.95 | 126.67 | 0.999278 | 126.76 |
| 11 | 423.13 | 37.78 | 157.52 | 1.001542 | 157.27 |
| 12 | 415.75 | 78.69 | 155.23 | 0.993658 | 156.22 |
| 13 | 402.83 | 116.53 | 151.22 | 0.975180 | 155.07 |
| 14 | 383.91 | 149.45 | 145.36 | 0.945254 | 153.77 |
| 15 | 358.26 | 175.29 | 137.41 | 0.902461 | 152.26 |
| 16 | 324.64 | 191.31 | 127.01 | 0.844463 | 150.41 |
| 17 | 280.95 | 193.66 | 105.70 | 0.764129 | 138.32 |
| 18 | 223.11 | 176.10 | 89.26 | 0.659417 | 135.37 |
| 19 | 173.70 | 158.80 | 81.89 | 0.405287 | 202.04 |
| ----- | | | | | ----- |
| 277.29 | | | | | 2499.08 |

Συνεισφ. αγκυρίων: Αθρ. ροπών ανατροπής : -10.5 kN*m/m
" " resisting : 0.1 kN*m/m

Δράση $E_d = (277.3 \cdot 15.26 - 10.5)$
Αντίσταση $R_d = (2499.1 \cdot 15.26 + 0.1)$

SLIP-CIRCLE $\mu = Ed/Rd = 0.11 < 1.0$: Έλεγχος εκπληρώθηκε.

| | | |
|------------|--|------------------|
| Author: | FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | Job No.: |
| Program: | WALLS-Retain. Version 2017.046 | |
| Structure: | info@fides-dvp.de www.fides-dvp.de Tel:++49/89/143829-0 ASB Nr.: | Date: 08.10.2018 |

Φάση εκσκαφής 3 "[3] Situation 3"

LC: όλα τα φορτία Type: BS-T

Εδαφικό σύστημα με 5 Στρώσεις

| Name | Τεχνητές επιχωματώσεις | Αμμόδης ΑΡΓΙΛΟΣ | Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ | |
|-------------|------------------------|-----------------|--------------------------|-----------|
| γ | [kN/m3] | 18 | 20 | 22.5 |
| γ,R | [kN/m3] | 18 | 20 | 22.5 |
| γ' | [kN/m3] | 8 | 10 | 12.5 |
| γ,p | [kN/m3] | 18 | 20 | 22.5 |
| γ,R,passive | [kN/m3] | 18 | 20 | 22.5 |
| γ,pw | [kN/m3] | 8 | 10 | 12.5 |
| φ | [°] | 25 | 0.1 | 33 |
| c | [kN/m2] | 2 | 50 | 5 |
| c,u | [kN/m2] | 10 | 50 | 5 |
| c παθητικό | [kN/m2] | 2 | 50 | 5 |
| δ,a | [°] | 16.66667 | 0.06666667 | 22 |
| δ,p | [°] | -16.66667 | -0.06666667 | -22 |
| δ,c | [°] | 8.333333 | 0.03333333 | 11 |
| k,agh | [-] | 0.3456501 | 0.9955057 | 0.2452023 |
| K,ach | [-] | 1.043051 | 1.994195 | 0.8549058 |
| K,0h | [-] | 0.5773817 | 0.9982547 | 0.455361 |
| K,pgh | [-] | 3.908103 | 1.004519 | 7.495617 |
| K,pch | [-] | 5.180327 | 2.00583 | 8.599509 |
| τ,gr | [kN/m2] | 110 | 110 | 110 |
| Ψ,A,max | [°] | 90 | 90 | 90 |
| k | [cm/s] | 10e-06 | 1e-06 | 100e-06 |

| Name | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ |
|-------------|------------------------|------------------------|
| γ | [kN/m3] 22.5 | 22.5 |
| γ,R | [kN/m3] 22.5 | 22.5 |
| γ' | [kN/m3] 12.5 | 12.5 |
| γ,p | [kN/m3] 22.5 | 22.5 |
| γ,R,passive | [kN/m3] 22.5 | 22.5 |
| γ,pw | [kN/m3] 12.5 | 12.5 |
| φ | [°] 35 | 35 |
| c | [kN/m2] 5 | 5 |
| c,u | [kN/m2] 5 | 5 |
| c παθητικό | [kN/m2] 5 | 5 |
| δ,a | [°] 23.33333 | 23.33333 |
| δ,p | [°] -23.33333 | -23.33333 |
| δ,c | [°] 11.66667 | 11.66667 |
| k,agh | [-] 0.2244207 | 0.2244207 |
| K,ach | [-] 0.8126539 | 0.8126539 |
| K,0h | [-] 0.4264236 | 0.4264236 |
| K,pgh | [-] 9.146943 | 9.146943 |
| K,pch | [-] 10.104 | 10.104 |
| τ,gr | [kN/m2] 110 | 110 |
| Ψ,A,max | [°] 90 | 90 |
| k | [cm/s] 100e-06 | 100e-06 |

Πορεία πρανούς:

x [m] 0.00 0.00
z [m] -4.00 0.00

Πορεία ανώτερου 2. στρώματος Αμμόδης ΑΡΓΙΛΟΣ:

x [m] 0.00 0.00
z [m] -4.00 -1.50

Πορεία ανώτερου 3. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ:

z= -4.50

Πορεία ανώτερου 4. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟΣ:

z= -10.00

| | | |
|---------|--------------------------------------|--------------|
| Part: | | Archive No.: |
| Block: | Please specify project informations. | Page: 34 |
| Record: | | |

| | | |
|---|------------------|-------------------------------|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | | Job No.: |
| Program: WALLS-Retain. Version 2017.046 | | |
| Structure: info@fides-dvp.de | www.fides-dvp.de | Tel:++49/89/143829-0 ASB Nr.: |
| | | Date: 08.10.2018 |

Πορεία ανώτερου 5. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ:
 z= -14.00

Επιφ. φορτία:

Φορτία

| xA | zA | xE | zE | PxA | PzA | PxE | PzE | Typ | LC-description |
|------|------|------|------|------|-------|------|-------|-----|----------------|
| [m] | [m] | [m] | [m] | [| kN/m² | |] | | Name |
| 1.00 | 0.00 | 3.50 | 0.00 | 0.00 | 33.00 | 0.00 | 33.00 | q | 1 |

Κατανομή εδαφ.πιέσεων

| Κατανομή εδαφ.πιέσεων | Name |
|----------------------------|------|
| Rectangular within a layer | |

Στάθμη νερού:

| | | |
|-------|-------|-------|
| x [m] | 0.00 | 0.00 |
| z [m] | -6.00 | -3.00 |

Αγκύρια

| z[m] | min.l[m] | Alpha[°] | C-H[kN/m] | P0[kN] | u0[m] |
|-------|----------|----------|-----------|--------|--------|
| -0.50 | 0.00 | 15.00 | αόρισ. | 0.00 | 0.0000 |

Παράμετροι υπολογισμού

Earth pressure options

Τμήμα εδαφ.ωθήσεων: Ενεργές ωθήσεις.
 Angle of slip plane: DIN 4085.
 Split block loads into 1 sections.
 Consideration of minimum earth pressure: $\varphi_{min} = 40.000$.
 Negative earth pressure fractions are set to zero.

Redistribution of earth pressure

Shape of redistribution: Trapezoid.
 The earth pressure is getting redistb. to: Excavation level
 The earth pressure below the excavation acts without redistrb.
 Levels of redistribution Z1: 0.000, Z2: -2.000 [m].
 The earth pressure from variable loads will be included in redistribution.

Παθητικές ωθήσεις

Method of calculation: Κλασικός, Pregl/Sokolovsky (DIN 4085).

Options for water pressure

Στήριξη πόδα

Πόδας οριζοντίως μετακινούμενος

Αγκύρια

Anchor checks (lower failure plane): Ναι
 Anchor forces with safety level of DS-P: Ναι
 Verification of grout body pull out forces: Ναι
 δ,a,Anchoring wall : used from soil layer.
 δ,p,Anchoring wall : used from soil layer.

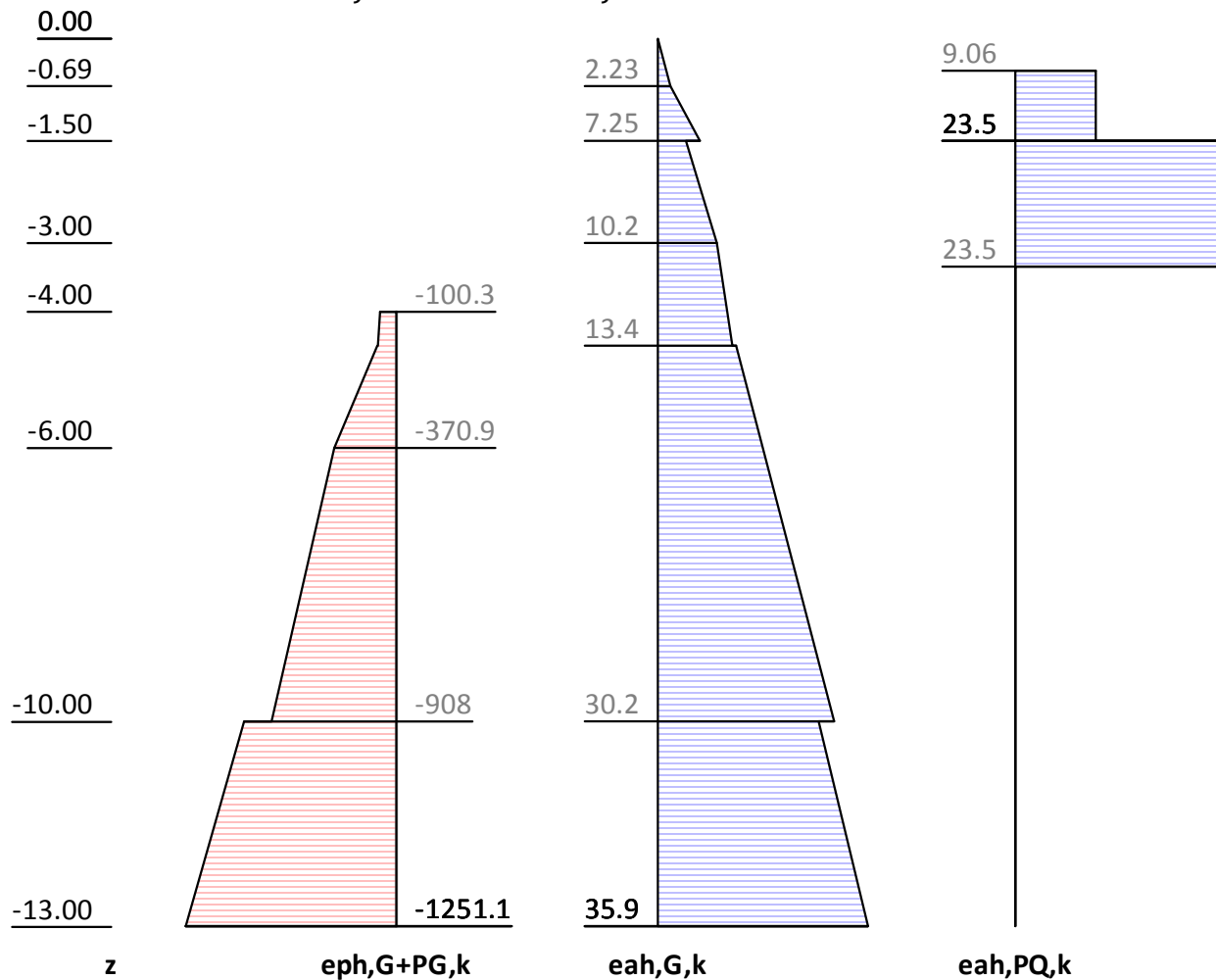
Earth pressure coefficients kh

| φ | α | β | δ | k0gh | kagh | kach | kpgh | kpch | |
|------|-----|-----|-------|------|-------|-------|-------|---------|--------------------------|
| 0.1 | 0.0 | 0.0 | -0.1 | -- | -- | -- | 1.005 | -2.006 | Τεχνητές επιχωματώσεις |
| 25.0 | 0.0 | 0.0 | 16.7 | -- | 0.346 | 1.043 | -- | -- | " |
| 0.1 | 0.0 | 0.0 | -0.1 | -- | -- | -- | 1.005 | -2.006 | Αμμόδης ΑΡΓΙΛΟΣ |
| 0.1 | 0.0 | 0.0 | 0.1 | -- | 0.996 | 1.994 | -- | -- | " |
| 33.0 | 0.0 | 0.0 | -22.0 | -- | -- | -- | 7.496 | -8.600 | Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ |
| 33.0 | 0.0 | 0.0 | 22.0 | -- | 0.245 | 0.855 | -- | -- | " |
| 35.0 | 0.0 | 0.0 | -23.3 | -- | -- | -- | 9.147 | -10.104 | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ |
| 35.0 | 0.0 | 0.0 | 23.3 | -- | 0.224 | 0.813 | -- | -- | " |
| 35.0 | 0.0 | 0.0 | -23.3 | -- | -- | -- | 9.147 | -10.104 | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ |
| 35.0 | 0.0 | 0.0 | 23.3 | -- | 0.224 | 0.813 | -- | -- | " |

| | | |
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| Part: Block: Please specify project informations. Record: | Page: 35 | Archive No.: |
|---|----------|--------------|

Μήκος τοίχουFoot depth for statics: $z_f = -13.000$ **Stress analysis****Earth pressure, horizontal**

Pressures characteristic, no redistribution, continuous wall



| z [m] | eph, G, k [kN/m²] | eah, G, k [kN/m²] | eah, PQ, k [kN/m²] | eah, d [kN/m²] |
|----------|----------------------|----------------------|-----------------------|-------------------|
| 0.00 | | 0.00 | | 0.00 |
| -0.47 | | 1.52 | 0.00 | 2.04 |
| -0.47 | | 1.52 | 9.06 | 15.62 |
| -1.50 | | 7.25 | 9.06 | 23.37 |
| -1.50 | | 4.82 | 23.48 | 41.73 |
| -3.34 | | 10.79 | 23.48 | 49.78 |
| -3.34 | | 10.79 | 0.00 | 14.56 |
| -4.00 | -0.00 | 11.97 | 0.00 | 16.15 |
| -4.00 | -100.29 | 11.97 | 0.00 | 16.15 |
| -4.50 | -110.34 | 12.86 | 0.00 | 17.36 |
| -4.50 | -117.95 | 13.38 | 0.00 | 18.06 |
| -10.00 | -745.71 | 30.24 | 0.00 | 40.82 |
| -10.00 | -908.05 | 27.52 | 0.00 | 37.16 |
| -13.00 | -1251.06 | 35.94 | 0.00 | 48.52 |

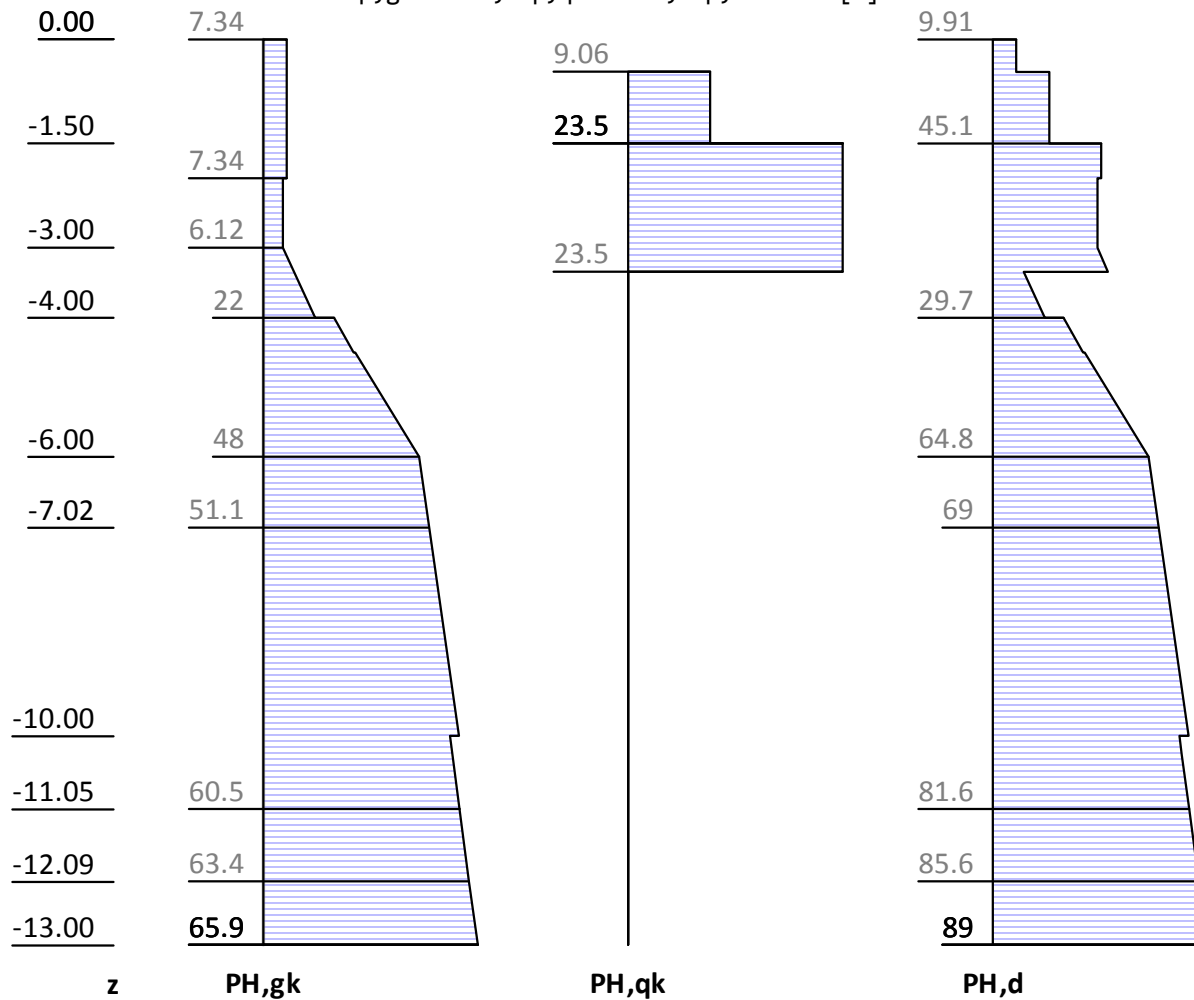
Eph, G, k: -5891.26, Eph, PG, k: 0.00 [kN/m]
 Eah, G, k: 248.27, Eah, PG, k: 0.00, Eah, PQ, k: 52.53, Eah, d: 413.96

Πίεση νερού

| z [m] | Wp, k [kN/m2] | Wa, k [kN/m2] | W, k [kN/m2] |
|----------|------------------|------------------|-----------------|
| -3.00 | | 0.00 | 0.00 |
| -6.00 | 0.00 | 30.00 | 30.00 |
| -6.24 | -2.40 | 32.40 | 30.00 |
| -13.00 | -70.00 | 100.00 | 30.00 |

H-pressure on static system

Level of mobilization: Ep,gk 100.0, Ep,qk 100.0, Ep,d 100.0 [%]

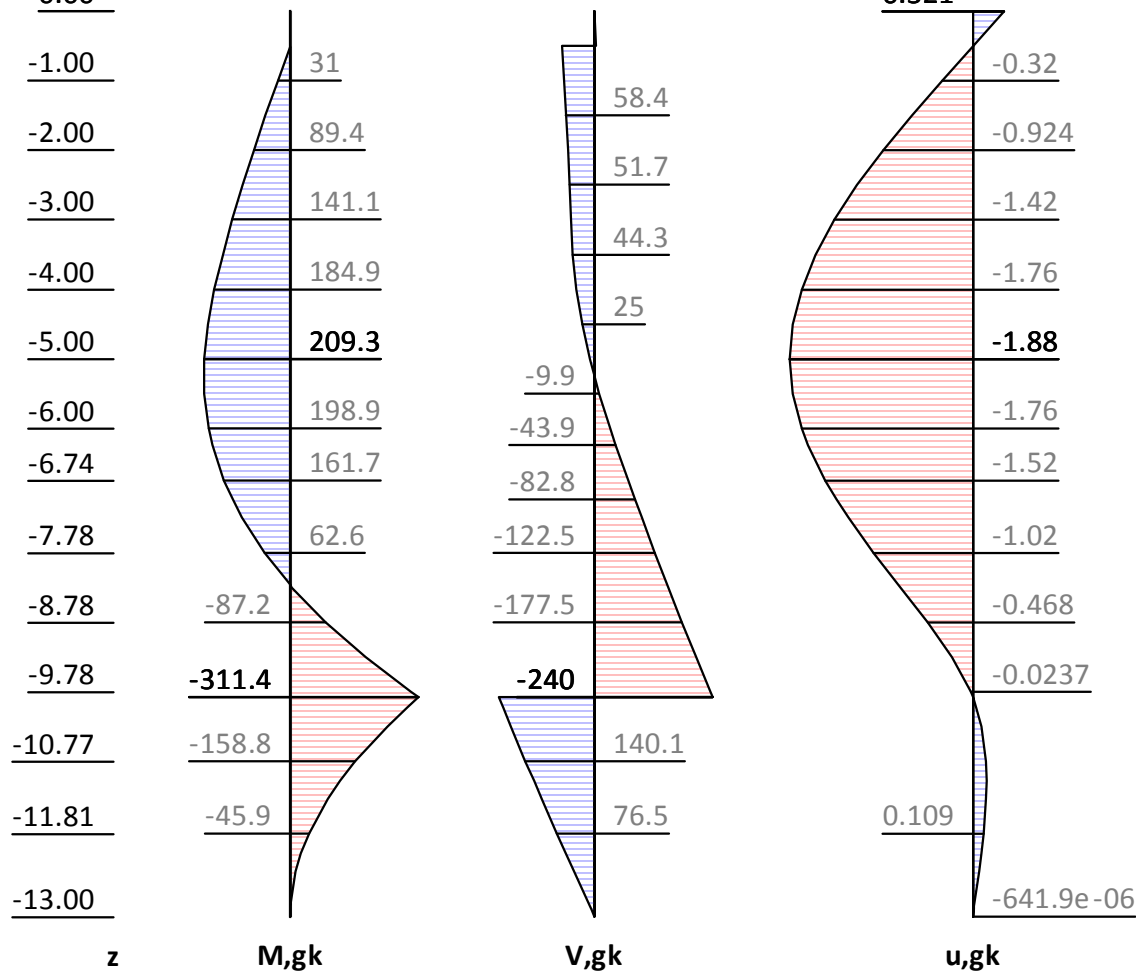


| z [m] | PH,gk [kN/m2] | PH,qk [kN/m2] | PH,d [kN/m2] |
|----------|------------------|------------------|-----------------|
| 0.00 | 7.34 | | 9.91 |
| -0.47 | 7.34 | 0.00 | 9.91 |
| -0.47 | 7.34 | 9.06 | 23.50 |
| -1.50 | 7.34 | 9.06 | 23.50 |
| -1.50 | 7.34 | 23.48 | 45.13 |
| -2.00 | 7.34 | 23.48 | 45.13 |
| -2.00 | 6.12 | 23.48 | 43.48 |
| -3.34 | 9.52 | 23.48 | 48.07 |
| -3.34 | 9.52 | 0.00 | 12.85 |
| -4.00 | 16.12 | 0.00 | 21.76 |
| -4.00 | 21.97 | 0.00 | 29.65 |
| -4.50 | 27.86 | 0.00 | 37.61 |
| -4.50 | 28.38 | 0.00 | 38.31 |
| -10.00 | 60.24 | 0.00 | 81.32 |
| -10.00 | 57.52 | 0.00 | 77.66 |
| -13.00 | 65.94 | 0.00 | 89.02 |

V-pressure on static system**Internal forces: Permanent, characteristically**

z= -0.500. Fx= -69.393 kN/m Support

z= -9.856. Fx=-433.875 kN/m Support

0.00

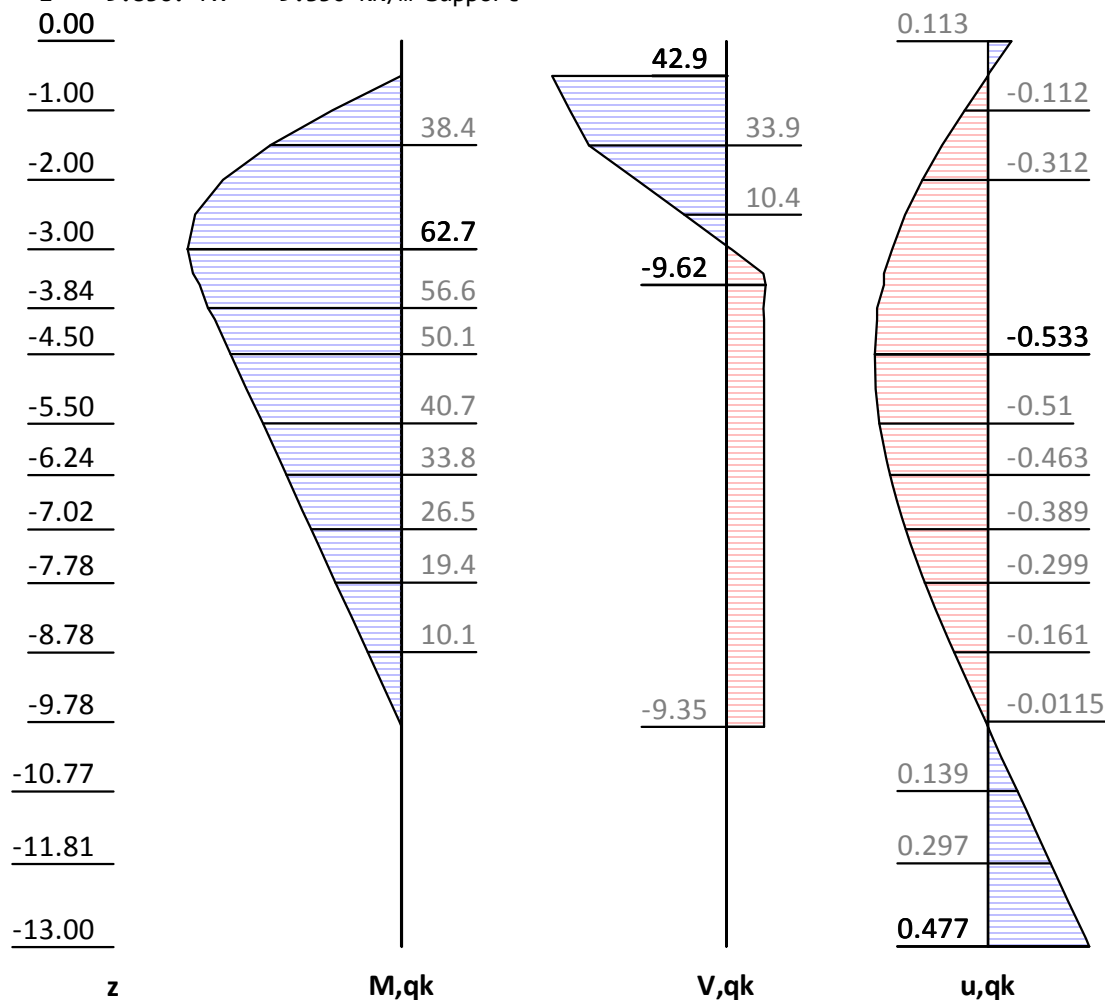
| z [m] | H,g,k [kN/m2] | M,g,k [kN/m2] | V,g,k [kN/m2] | N,g,k [kN/m2] | u,g,k [mm] |
|----------|------------------|------------------|------------------|------------------|---------------|
| 0.00 | 7.34 | -0.00 | 0.00 | 0.00 | 0.32 |
| -0.00 | 7.34 | -0.00 | 0.00 | -0.00 | 0.32 |
| -0.50 | 7.34 | -0.92 | -3.67 | -10.69 | 0.00 |
| -0.50 | 7.34 | -0.92 | -3.67 | -10.69 | -0.00 |
| -0.50 | 7.34 | -0.92 | 65.72 | -29.29 | -0.00 |
| -0.51 | 7.34 | -0.00 | 65.62 | -29.59 | -0.01 |
| -2.00 | 7.34 | 89.40 | 54.71 | -61.36 | -0.92 |
| -2.00 | 6.12 | 89.40 | 54.71 | -61.36 | -0.92 |
| -4.00 | 16.12 | 184.92 | 37.48 | -104.00 | -1.76 |
| -4.00 | 21.97 | 184.92 | 37.48 | -104.00 | -1.76 |
| -4.50 | 27.86 | 200.67 | 25.02 | -114.51 | -1.85 |
| -4.50 | 28.38 | 200.67 | 25.02 | -114.51 | -1.85 |
| -5.00 | 34.91 | 209.34 | 9.19 | -123.67 | -1.88 |
| -5.24 | 38.06 | 209.32 | 0.00 | -128.22 | -1.87 |
| -8.24 | 54.84 | -0.00 | -147.44 | -190.52 | -0.76 |
| -9.86 | 59.81 | -311.40 | -240.04 | -228.71 | 0.00 |
| -9.86 | 59.81 | -311.40 | 193.84 | -228.71 | 0.00 |
| -10.00 | 60.24 | -284.11 | 185.20 | -232.27 | 0.04 |
| -10.00 | 57.52 | -284.11 | 185.20 | -232.27 | 0.04 |
| -11.05 | 60.47 | -121.90 | 123.25 | -258.64 | 0.14 |
| -12.99 | 65.92 | -0.02 | 0.43 | -310.95 | 0.00 |

| z [m] | H, g, k [kN/m ²] | M, g, k [kN/m ²] | V, g, k [kN/m ²] | N, g, k [kN/m ²] | u, g, k [mm] |
|----------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|-----------------|
| -13.00 | 65.94 | 0.00 | 0.00 | -311.14 | -0.00 |

Internal forces: Variable, characteristicallyMethod EB 82-4 ($Q = [G+Q] - G$).

z= -0.500. Fx= -43.183 kN/m Support

z= -9.856. Fx= -9.350 kN/m Support

0.00

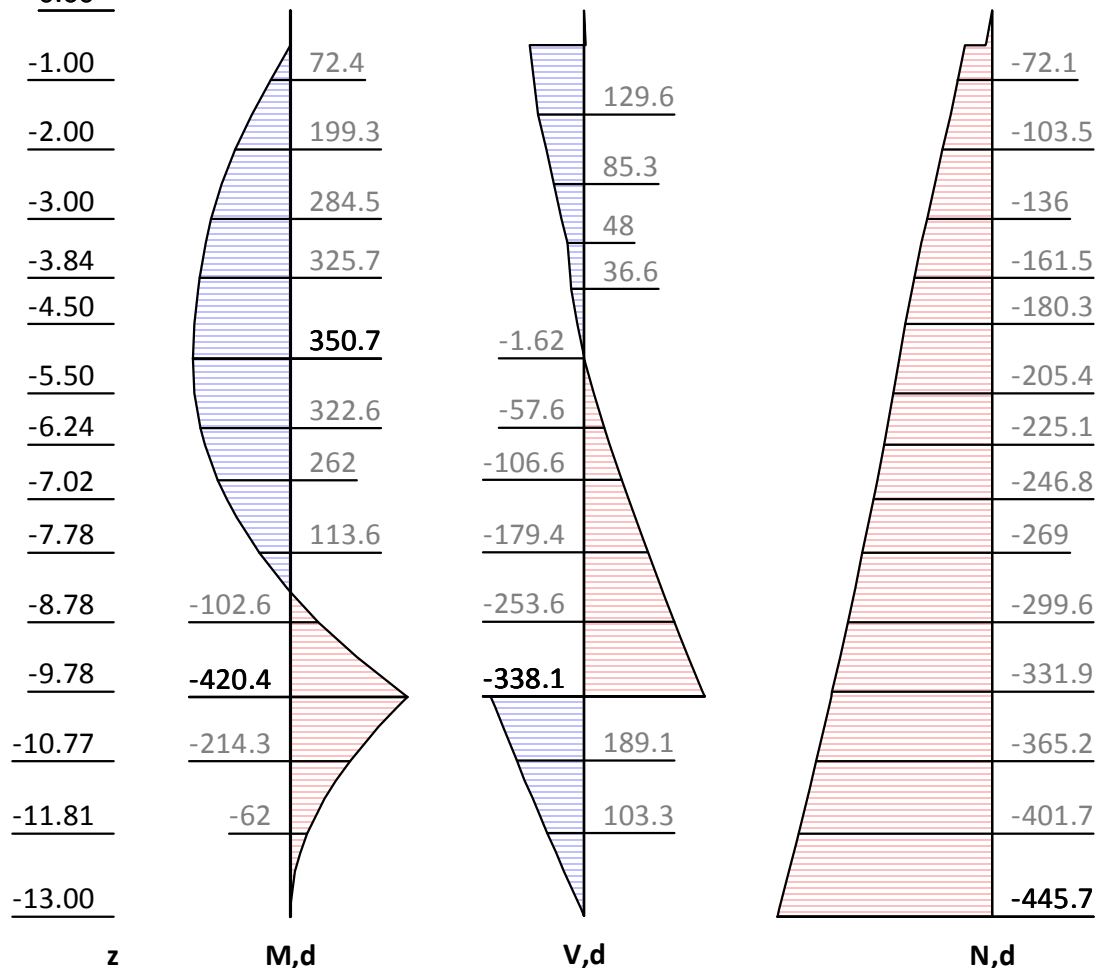
| z [m] | H, q, k [kN/m ²] | M, q, k [kN/m ²] | V, q, k [kN/m ²] | N, q, k [kN/m ²] | u, q, k [mm] |
|----------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|-----------------|
| 0.00 | | 0.00 | -0.00 | 0.00 | 0.11 |
| -0.47 | 0.00 | 0.05 | -0.00 | 0.00 | 0.01 |
| -0.47 | 9.06 | 0.05 | -0.00 | -0.00 | 0.01 |
| -0.50 | 9.06 | -0.00 | -0.25 | -0.03 | 0.00 |
| -0.50 | 9.06 | -0.00 | 42.91 | -11.60 | -0.00 |
| -1.50 | 9.06 | 38.38 | 33.85 | -12.56 | -0.22 |
| -1.50 | 23.48 | 38.38 | 33.85 | -12.56 | -0.22 |
| -2.94 | 23.48 | 62.48 | 0.00 | -16.14 | -0.45 |
| -3.00 | 23.48 | 62.74 | -1.37 | -16.28 | -0.45 |
| -3.34 | 23.48 | 61.17 | -9.08 | -17.13 | -0.49 |
| -3.34 | 0.00 | 61.17 | -9.08 | -17.13 | -0.49 |
| -3.50 | 0.00 | 59.11 | -9.62 | -17.13 | -0.49 |
| -3.84 | 0.00 | 56.63 | -9.08 | -17.13 | -0.52 |
| -4.00 | 0.00 | 54.75 | -9.35 | -17.13 | -0.52 |
| -4.50 | 0.00 | 50.08 | -9.35 | -17.13 | -0.53 |
| -5.00 | 0.00 | 45.40 | -9.35 | -17.13 | -0.53 |
| -6.00 | 0.00 | 36.05 | -9.35 | -17.13 | -0.48 |
| -6.24 | 0.00 | 33.81 | -9.35 | -17.13 | -0.46 |

| z [m] | H, q, k [kN/m2] | M, q, k [kN/m2] | V, q, k [kN/m2] | N, q, k [kN/m2] | u, q, k [mm] |
|----------|--------------------|--------------------|--------------------|--------------------|-----------------|
| -7.28 | 0.00 | 24.08 | -9.35 | -17.13 | -0.36 |
| -8.28 | 0.00 | 14.74 | -9.35 | -17.13 | -0.23 |
| -9.86 | 0.00 | -0.00 | -9.35 | -17.13 | -0.00 |
| -9.86 | 0.00 | -0.00 | -9.35 | -17.13 | 0.00 |
| -9.86 | 0.00 | -0.00 | -0.00 | -17.13 | 0.00 |
| -10.00 | 0.00 | -0.00 | -0.00 | -17.13 | 0.02 |
| -10.27 | 0.00 | -0.00 | -0.00 | -17.13 | 0.06 |
| -11.05 | 0.00 | -0.00 | -0.00 | -17.13 | 0.18 |
| -11.31 | 0.00 | -0.00 | 0.00 | -17.13 | 0.22 |
| -12.09 | 0.00 | -0.00 | 0.00 | -17.13 | 0.34 |
| -12.35 | 0.00 | -0.00 | -0.00 | -17.13 | 0.38 |
| -12.90 | 0.00 | -0.00 | -0.00 | -17.13 | 0.46 |
| -12.96 | 0.00 | -0.00 | 0.00 | -17.13 | 0.47 |
| -13.00 | 0.00 | 0.00 | 0.00 | -17.13 | 0.48 |

Internal forces: Design

z= -0.500. Fx=-158.455 kN/m Support

z= -9.856. Fx=-599.756 kN/m Support

0.00

| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | | | | | Job No.: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|-------------------|------------------|----------------------|----------------|---|----------|----------------|----------------|----------------|----------------|-----------------|------|------|------|-------|------|------|-------|------|-------|-------|------|------|-------|------|-------|-------|--------|------|-------|-------|-------|-------|--------|------|-------|-------|-------|-------|--------|------|-------|-------|-------|--------|--------|-------|-------|-------|--------|--------|--------|-------|-------|-------|--------|--------|--------|-------|-------|-------|--------|--------|---------|-------|-------|-------|--------|--------|---------|-------|-------|-------|--------|-------|---------|-------|-------|-------|--------|-------|---------|-------|-------|-------|--------|-------|---------|-------|-------|-------|--------|-------|---------|-------|-------|-------|--------|-------|---------|-------|-------|-------|--------|-------|---------|-------|-------|-------|--------|-------|---------|-------|-------|-------|--------|-------|---------|-------|-------|-------|------|---------|---------|-------|-------|-------|---------|---------|---------|------|-------|-------|---------|--------|---------|------|--------|-------|---------|--------|---------|------|--------|-------|---------|--------|---------|------|--------|-------|-------|------|---------|------|--------|-------|------|------|---------|------|
| Program: WALLS-Retain. Version 2017.046 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Structure: | info@fides-dvp.de | www.fides-dvp.de | Tel:++49/89/143829-0 | ASB Nr.: | Date: 08.10.2018 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <div> <div> <div>0.00</div> <div>-1.00</div> <div>-2.00</div> <div>-3.00</div> <div>-3.84</div> <div>-4.50</div> <div>-5.50</div> <div>-6.24</div> <div>-7.02</div> <div>-7.78</div> <div>-8.78</div> <div>-9.78</div> <div>-10.77</div> <div>-11.81</div> <div>-13.00</div> </div> <div> <div>9.91</div> <div>45.1</div> <div>29.7</div> <div>64.8</div> <div>69</div> <div>81.6</div> <div>85.6</div> <div>89</div> </div> <div> <div>0.434</div> <div>-0.431</div> <div>-1.24</div> <div>-1.88</div> <div>-2.23</div> <div>-2.41</div> <div>-2.24</div> <div>-1.94</div> <div>-1.32</div> <div>-0.629</div> <div>-0.0352</div> <div>0.277</div> <div>0.406</div> <div>0.477</div> </div> </div> <div> <div>z</div> <div>H,d</div> <div>u,g+q,k</div> </div> <table> <tr> <th>z [m]</th><th>H,d [kN/m2]</th><th>M,d [kN/m2]</th><th>V,d [kN/m2]</th><th>N,d [kN/m2]</th><th>u,g+q,k [mm]</th></tr> <tr><td>0.00</td><td>9.91</td><td>0.00</td><td>-0.00</td><td>0.00</td><td>0.43</td></tr> <tr><td>-0.00</td><td>9.91</td><td>-0.00</td><td>-0.00</td><td>0.00</td><td>0.43</td></tr> <tr><td>-0.47</td><td>9.91</td><td>-1.09</td><td>-4.66</td><td>-13.57</td><td>0.03</td></tr> <tr><td>-0.47</td><td>23.50</td><td>-1.09</td><td>-4.66</td><td>-13.57</td><td>0.03</td></tr> <tr><td>-0.50</td><td>23.50</td><td>-1.25</td><td>-5.36</td><td>-14.48</td><td>0.00</td></tr> <tr><td>-0.51</td><td>23.50</td><td>-0.00</td><td>152.89</td><td>-57.19</td><td>-0.01</td></tr> <tr><td>-1.50</td><td>23.50</td><td>140.10</td><td>129.59</td><td>-87.24</td><td>-0.85</td></tr> <tr><td>-1.50</td><td>45.13</td><td>140.10</td><td>129.59</td><td>-87.24</td><td>-0.85</td></tr> <tr><td>-2.00</td><td>45.13</td><td>199.25</td><td>107.03</td><td>-103.54</td><td>-1.24</td></tr> <tr><td>-2.00</td><td>43.48</td><td>199.25</td><td>107.03</td><td>-103.54</td><td>-1.24</td></tr> <tr><td>-3.34</td><td>48.07</td><td>303.55</td><td>47.99</td><td>-147.09</td><td>-2.04</td></tr> <tr><td>-3.34</td><td>12.85</td><td>303.55</td><td>47.99</td><td>-147.09</td><td>-2.04</td></tr> <tr><td>-4.00</td><td>21.76</td><td>331.77</td><td>36.57</td><td>-166.09</td><td>-2.28</td></tr> <tr><td>-4.00</td><td>29.65</td><td>331.77</td><td>36.57</td><td>-166.09</td><td>-2.28</td></tr> <tr><td>-4.50</td><td>37.61</td><td>346.02</td><td>19.75</td><td>-180.27</td><td>-2.38</td></tr> <tr><td>-4.50</td><td>38.31</td><td>346.02</td><td>19.75</td><td>-180.27</td><td>-2.38</td></tr> <tr><td>-4.96</td><td>46.46</td><td>350.35</td><td>-0.00</td><td>-191.70</td><td>-2.41</td></tr> <tr><td>-5.00</td><td>47.13</td><td>350.71</td><td>-1.62</td><td>-192.64</td><td>-2.41</td></tr> <tr><td>-8.34</td><td>74.46</td><td>0.00</td><td>-220.72</td><td>-286.06</td><td>-0.93</td></tr> <tr><td>-9.86</td><td>80.74</td><td>-420.39</td><td>-338.07</td><td>-334.45</td><td>0.00</td></tr> <tr><td>-9.86</td><td>80.74</td><td>-420.39</td><td>261.68</td><td>-334.45</td><td>0.00</td></tr> <tr><td>-10.00</td><td>81.32</td><td>-383.54</td><td>250.01</td><td>-339.26</td><td>0.06</td></tr> <tr><td>-10.00</td><td>77.66</td><td>-383.54</td><td>250.01</td><td>-339.26</td><td>0.06</td></tr> <tr><td>-13.00</td><td>89.02</td><td>-0.00</td><td>0.00</td><td>-445.73</td><td>0.48</td></tr> <tr><td>-13.00</td><td>89.02</td><td>0.00</td><td>0.00</td><td>-445.73</td><td>0.48</td></tr> </table> | | | | | | z [m] | H,d [kN/m2] | M,d [kN/m2] | V,d [kN/m2] | N,d [kN/m2] | u,g+q,k [mm] | 0.00 | 9.91 | 0.00 | -0.00 | 0.00 | 0.43 | -0.00 | 9.91 | -0.00 | -0.00 | 0.00 | 0.43 | -0.47 | 9.91 | -1.09 | -4.66 | -13.57 | 0.03 | -0.47 | 23.50 | -1.09 | -4.66 | -13.57 | 0.03 | -0.50 | 23.50 | -1.25 | -5.36 | -14.48 | 0.00 | -0.51 | 23.50 | -0.00 | 152.89 | -57.19 | -0.01 | -1.50 | 23.50 | 140.10 | 129.59 | -87.24 | -0.85 | -1.50 | 45.13 | 140.10 | 129.59 | -87.24 | -0.85 | -2.00 | 45.13 | 199.25 | 107.03 | -103.54 | -1.24 | -2.00 | 43.48 | 199.25 | 107.03 | -103.54 | -1.24 | -3.34 | 48.07 | 303.55 | 47.99 | -147.09 | -2.04 | -3.34 | 12.85 | 303.55 | 47.99 | -147.09 | -2.04 | -4.00 | 21.76 | 331.77 | 36.57 | -166.09 | -2.28 | -4.00 | 29.65 | 331.77 | 36.57 | -166.09 | -2.28 | -4.50 | 37.61 | 346.02 | 19.75 | -180.27 | -2.38 | -4.50 | 38.31 | 346.02 | 19.75 | -180.27 | -2.38 | -4.96 | 46.46 | 350.35 | -0.00 | -191.70 | -2.41 | -5.00 | 47.13 | 350.71 | -1.62 | -192.64 | -2.41 | -8.34 | 74.46 | 0.00 | -220.72 | -286.06 | -0.93 | -9.86 | 80.74 | -420.39 | -338.07 | -334.45 | 0.00 | -9.86 | 80.74 | -420.39 | 261.68 | -334.45 | 0.00 | -10.00 | 81.32 | -383.54 | 250.01 | -339.26 | 0.06 | -10.00 | 77.66 | -383.54 | 250.01 | -339.26 | 0.06 | -13.00 | 89.02 | -0.00 | 0.00 | -445.73 | 0.48 | -13.00 | 89.02 | 0.00 | 0.00 | -445.73 | 0.48 |
| z [m] | H,d [kN/m2] | M,d [kN/m2] | V,d [kN/m2] | N,d [kN/m2] | u,g+q,k [mm] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.00 | 9.91 | 0.00 | -0.00 | 0.00 | 0.43 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -0.00 | 9.91 | -0.00 | -0.00 | 0.00 | 0.43 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -0.47 | 9.91 | -1.09 | -4.66 | -13.57 | 0.03 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -0.47 | 23.50 | -1.09 | -4.66 | -13.57 | 0.03 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -0.50 | 23.50 | -1.25 | -5.36 | -14.48 | 0.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -0.51 | 23.50 | -0.00 | 152.89 | -57.19 | -0.01 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -1.50 | 23.50 | 140.10 | 129.59 | -87.24 | -0.85 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -1.50 | 45.13 | 140.10 | 129.59 | -87.24 | -0.85 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -2.00 | 45.13 | 199.25 | 107.03 | -103.54 | -1.24 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -2.00 | 43.48 | 199.25 | 107.03 | -103.54 | -1.24 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -3.34 | 48.07 | 303.55 | 47.99 | -147.09 | -2.04 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -3.34 | 12.85 | 303.55 | 47.99 | -147.09 | -2.04 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -4.00 | 21.76 | 331.77 | 36.57 | -166.09 | -2.28 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -4.00 | 29.65 | 331.77 | 36.57 | -166.09 | -2.28 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -4.50 | 37.61 | 346.02 | 19.75 | -180.27 | -2.38 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -4.50 | 38.31 | 346.02 | 19.75 | -180.27 | -2.38 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -4.96 | 46.46 | 350.35 | -0.00 | -191.70 | -2.41 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -5.00 | 47.13 | 350.71 | -1.62 | -192.64 | -2.41 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -8.34 | 74.46 | 0.00 | -220.72 | -286.06 | -0.93 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -9.86 | 80.74 | -420.39 | -338.07 | -334.45 | 0.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -9.86 | 80.74 | -420.39 | 261.68 | -334.45 | 0.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -10.00 | 81.32 | -383.54 | 250.01 | -339.26 | 0.06 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -10.00 | 77.66 | -383.54 | 250.01 | -339.26 | 0.06 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -13.00 | 89.02 | -0.00 | 0.00 | -445.73 | 0.48 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -13.00 | 89.02 | 0.00 | 0.00 | -445.73 | 0.48 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Part: Block: Please specify project informations. Record: | | | | | Archive No.: <div>Page: 41</div> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Anchor forces with safety level of DS-P

| z[m] | A,d[kN] | Fx,d[kN/m] |
|-------|---------|------------|
| -0.50 | 295.3 | -158.5 |

Checks of earth statics**Check of earth support**

Check: Mobilizable earth resistance is sufficient for earth support force.

z: -9.86 m

$R_d = E_{ph,k}/\gamma, R_e = 5891.26 / 1.400 = 4208.04 \text{ [kN/m]}$

$E_d(U_h,d)/R_d = 599.76 / 4208.04 = 0.143 \text{ [-]}. \text{ Passes requirement}$

Sum of H and V forces, (G)

Forces up to depth z:-13.00

| Pos. | H | V |
|---|---------|-----------------------|
| H/V pressure G+P+W,k | 503.27 | 90.93 |
| Wall weight | | 201.61 |
| H/V pressure passive | | 0.00 |
| Support z: -0.50 | -69.39 | 18.59 |
| B _{h,g,k} z=-9.86 | -433.87 | |
| B _{v,g,k} = B _{h,k} * tan($\delta, p=-22.00^\circ$) | | -175.30 |
| Σ | -0.00 | 135.84 (downwards) |

Average anchor inclination $\alpha, A = 15.00^\circ \geq 15^\circ$.

Verification of vertical forces due to EAB R 9 not required (R 9-5).

Check EAB R 9-1

Vertical component of earth resistance is less than the downwards pointing vertical forces.

$V_k \geq B_{vk}: 311.14 \geq 175.30 \text{ Passes requirement}$

Sum of H and V forces, (G+Q)

Forces up to depth z:-13.00

| Pos. | H | V |
|---|---------|-----------------------|
| H/V pressure G+P+W,k | 555.80 | 96.49 |
| Wall weight | | 201.61 |
| H/V pressure passive | | 0.00 |
| Support z: -0.50 | -112.58 | 30.16 |
| B _{h,g,k} z=-9.86 | -433.87 | |
| B _{v,g,k} = B _{h,k} * tan($\delta, p=-22.00^\circ$) | | -175.30 |
| B _{h,q,k} z=-9.86 | -9.35 | |
| B _{v,q,k} = B _{h,k} * tan($\delta, p=-22.00^\circ$) | | -3.78 |
| Σ | -0.00 | 149.19 (downwards) |

Average anchor inclination $\alpha, A = 15.00^\circ \geq 15^\circ$.

Verification of vertical forces due to EAB R 9 not required (R 9-5).

Check EAB R 9-1

Vertical component of earth resistance is less than the downwards pointing vertical forces.

$V_k \geq B_{vk}: 328.26 \geq 179.07 \text{ Passes requirement}$

Anchor verification

| | | | | | | |
|--|--|--|--|--|-------------------------|--|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | | | | | Job No.: | |
| Program: WALLS-Retain. | | | | | Version 2017.046 | |
| Structure: info@fides-dvp.de www.fides-dvp.de Tel:++49/89/143829-0 ASB Nr.: | | | | | Date: 08.10.2018 | |

Anchor - Stability of lower failure plane

Περίπτ.Φόρτισης: όλα τα φορτία BS-P
 Αυτόμ. υπολογ. μήκους αγκυρίων:
 All anchors are extended (if necessary)
 Favourable variable loads in main failure body are not being considered.
 Bottom of lower failure plane: z=-13.00 m

Iteration of failure mechanisms:
 lA: Length of anchor from head to center of grout body.
 W,k: Res. force from dead weight, loads, cohesion, ...
 Q,k: Force in lower failure plane.
 Ea1,k.....: Earth pressure onto vertical separation plane.
 Ea2,k.....: Earth pressure between wall and main failure body.
 Ra_cal,d: Dimesioning force of the resistance from the equilibrium of forces.
 Ra_cal,d corresponds to the max. possible anchor force of the force polygon.
 Sum(A,d): Acting anchor forces along the grout body fractions within the failure body. Sum(A,d) is gained from the anchor pull forces of the wall analysis.

| z | θ1 | θ2 | lA | W,k | Q,k | Ea1,k | Ea2,k | Ra_cal,d | Sum(A,d) | Ed/Rd |
|-------|------|------|-------|--------|--------|--------|--------|----------|----------|-------|
| [m] | [°] | [°] | [m] | [kN/m] | [kN/m] | [kN/m] | [kN/m] | [kN/m] | [kN/m] | [-] |
| -0.50 | 39.7 | 57.5 | 11.80 | 1356.2 | 1209.7 | 4.4 | 315.9 | 164.2 | 164.0 | 1.00 |

Decisive failure body:
Γεωμετρία:
 Foot point of lower failure plane x/z = 0.01/-13.00 m
 Intersection lower/upper slid. plane x/z = 11.40/ -3.55 m
 Intersection upper slid. plane/surface x/z = 13.66/ 0.00 m
 Intersection separation plane/surface x/z = 11.40/ 0.00 m
 Inclination lower failure plane θ1 = 39.67°
 Inclination upper failure plane θ2 = 57.50°
 Inclination separation plane θ12 = 90.00°

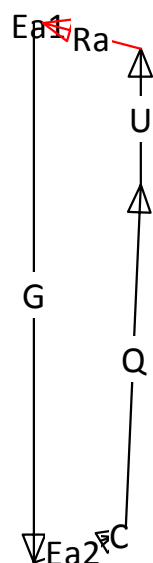
Loads / forces (char.)

| | | Fx | Fz | F | |
|------------------------------------|-----------|--------|---------|--------|---------|
| | | [kN/m] | [kN/m] | [kN/m] | |
| Weight of main failure body | G,k: | 0.0 | -1960.2 | 1960.2 | |
| Area loads on/in main failure body | F1,k: | 0.0 | -82.5 | 82.5 | |
| Cohesion of lower failure plane | C,k: | 108.3 | 89.8 | 140.6 | |
| Pore water pressure on main body | U,k: | -0.1 | 601.0 | 601.0 | |
| Earth pres. on separation plane | Ea1,k: | -4.4 | -0.0 | 4.4 | δ= 0.0° |
| Earth pr. between wall<->main body | Ea2,k: | 300.8 | 96.5 | 315.9 | |
| Force in lower failure plane | Q,k: | -182.5 | 1195.8 | 1209.7 | |
| Sum = possible anchor forces: | Ra_cal,k: | 222.1 | -59.5 | 229.9 | |

Force polygon

| | | |
|---|--|--------------|
| Part: | | Archive No.: |
| Block: Please specify project informations. | | |
| Record: | | |

Page: 43



Acting anchor forces $E_d: \sum(A,d) = 164.0 \text{ kN/m}$
 Possible anchor forces $R_d: R_{a_cal,d} = 229.9/1.400 = 164.2 \text{ kN/m}$
 Verif. of lower failure plane $E_d/R_d = 1.00 < 1.0$: Έλεγχος εκπληρώθηκε.

Check of steel tension

l_{tot} ...[m]: Total length of anchor incl. excess length at head
 A_s [mm²]: X-section area of steel member
 $R_{i,d}$...[kN]: Ultimate strength of tension member ($\gamma, M=1.15$)
 $A_{d,d}$ [kN]: Dimensioning force of the anchor from wall analysis

| z[m] | Anchor type | l_{tot} | A_s | $R_{i,d}$ | $A_{d,d}$ |
|-------|----------------------------|-----------|-------|-----------|--------------------|
| -0.50 | Strand; 3x0.60"; 1570/1770 | 15.80 | 420 | 573.4 | 295.3 |
| | | | | | Passes requirement |

Check of steel tension: Passes requirement

Check of anchor's soil friction

$l_{V,k}$: Length of grout body
 $D_{mV,k}$: Diameter of grout body
 $\tau_{Gr,k}$: Average applied skin friction along the grout body (from soil parameters)
 $R_{a,k}$: Charact. pullout resistance of the anchor
 γ_A : Partial safety factor of anchor pullout
 $R_{a,d}$: $R_{a,k} / \gamma_A$
 $A_{d,d}$: Dimensioning force of the anchor from wall analysis

| z | $l_{V,k}$ | $D_{mV,k}$ | $\tau_{Gr,k}$ | $R_{a,k}$ | γ_A | $R_{a,d}$ | $A_{d,d}$ | $A_{d,d}/R_{a,d}$ |
|-------|-----------|------------|----------------------|-----------|------------|-----------|-----------|-------------------|
| [m] | [m] | [mm] | [kN/m ²] | [kN] | [-] | [kN] | [kN] | [-] |
| -0.50 | 8.00 | 318 | 110 | 879.1 | 1.100 | 799.2 | 295.3 | 0.4 |

Check of anchor's soil friction: Passes requirement

Υπολογ. κύκλου ολίσθησης

LC: όλα τα φορτία Type: BS-T (combination: [GEO] A2 M2 R3, BS-T)
 Vertical variable loads only act if they are outside of $R \cdot \sin(\phi)$.
 The automatic slip circle optimization only considers circles that intersect the surface with an area of at least 0.25 m².
 The slip circle calculation only accepts circles including the wall.
 The slip circle calculation only allows circular failure planes (no vertical tangents will occur).

Γεωμετ. κύκλου (μήκη και συντεταγμ. σε (m))
 Κέντρο = (-0.68, 0.20), Ακτίνα = 13.23
 Αρχ. σημ. = (-13.22, -4.00), Τελ. σημ. = (12.55, 0.00)

Γεωμετρία λωρίδων:

| No | x | Width b | dxM | Weight | Load z-κατ. | Water- φορτ. | u*b | φ | c | θ |
|----|--------|------------|--------|--------|----------------|-----------------|--------|-------|---------|---------|
| | [m] | [m] | [m] | [kN/m] | [kN/m] | [kN/m] | [kN/m] | [°] | [kN/m²] | [°] |
| 1 | -12.56 | 1.32 | -11.88 | 46.4 | 0.0 | 0.0 | -5.3 | 27.45 | 3.57 | -31.27* |
| 2 | -11.24 | 1.32 | -10.56 | 110.5 | 0.0 | 0.0 | -22.4 | 27.45 | 3.57 | -31.27* |
| 3 | -9.91 | 1.32 | -9.24 | 155.2 | 0.0 | 0.0 | -42.6 | 27.45 | 3.57 | -31.27* |
| 4 | -8.59 | 1.32 | -7.91 | 188.8 | 0.0 | 0.0 | -57.8 | 29.26 | 3.57 | -30.37* |
| 5 | -7.27 | 1.32 | -6.59 | 214.7 | 0.0 | 0.0 | -69.4 | 29.26 | 3.57 | -29.88 |
| 6 | -5.95 | 1.32 | -5.27 | 234.5 | 0.0 | 0.0 | -78.2 | 29.26 | 3.57 | -23.47 |
| 7 | -4.62 | 1.32 | -3.95 | 249.1 | 0.0 | 0.0 | -84.7 | 29.26 | 3.57 | -17.35 |
| 8 | -3.30 | 1.32 | -2.62 | 259.2 | 0.0 | 0.0 | -89.3 | 29.26 | 3.57 | -11.43 |
| 9 | -1.98 | 1.32 | -1.30 | 265.1 | 0.0 | 0.0 | -91.9 | 29.26 | 3.57 | -5.64 |
| 10 | -0.65 | 1.32 | 0.02 | 267.6 | 0.0 | 0.0 | -112.6 | 29.26 | 3.57 | 0.10 |
| 11 | 0.67 | 1.32 | 1.35 | 366.9 | 0.0 | 0.0 | -131.5 | 29.26 | 3.57 | 5.84 |
| 12 | 1.99 | 1.32 | 2.67 | 360.8 | 0.0 | 0.0 | -128.8 | 29.26 | 3.57 | 11.64 |
| 13 | 3.31 | 1.32 | 3.99 | 350.5 | 0.0 | 0.0 | -124.2 | 29.26 | 3.57 | 17.56 |
| 14 | 4.64 | 1.32 | 5.31 | 335.7 | 0.0 | 0.0 | -117.6 | 29.26 | 3.57 | 23.69 |
| 15 | 5.96 | 1.32 | 6.64 | 315.7 | 0.0 | 0.0 | -108.7 | 29.26 | 3.57 | 30.12 |
| 16 | 7.28 | 1.32 | 7.96 | 289.6 | 0.0 | 0.0 | -97.0 | 29.26 | 3.57 | 37.00 |
| 17 | 8.61 | 1.32 | 9.28 | 255.7 | 0.0 | 0.0 | -81.7 | 27.45 | 3.57 | 44.57 |
| 18 | 9.93 | 1.32 | 10.61 | 210.5 | 0.0 | 0.0 | -61.2 | 27.45 | 3.57 | 53.30 |
| 19 | 11.57 | 1.96 | 12.25 | 183.6 | 0.0 | 0.0 | -36.5 | 27.45 | 3.57 | 67.79 |

*** Σημείωση: Στις λωρίδες σημειωμένες με '*'
περιορίστηκε το theta στο 45°-Phi/2.

Συνεισφ. κατακόρυφων φορτίων:

| No | Weight | G*sin(θ) | (G-u*b)*tan(φ) + c*b | μ*sin(θ)* tan(φ)+cos(θ) | T |
|----|--------|----------|-------------------------|----------------------------|---------|
| | [kN/m] | [kN/m] | [kN/m] | [-] | [kN/m] |
| 1 | 46.36 | -41.64 | 26.04 | 0.790608 | 32.94 |
| 2 | 110.47 | -88.18 | 50.50 | 0.790608 | 63.88 |
| 3 | 155.17 | -108.34 | 63.19 | 0.790608 | 79.92 |
| 4 | 188.81 | -112.95 | 78.13 | 0.795456 | 98.22 |
| 5 | 214.69 | -106.96 | 86.13 | 0.800723 | 107.57 |
| 6 | 234.47 | -93.37 | 92.26 | 0.864275 | 106.75 |
| 7 | 249.12 | -74.30 | 96.80 | 0.914795 | 105.82 |
| 8 | 259.23 | -51.39 | 99.94 | 0.953768 | 104.78 |
| 9 | 265.14 | -26.04 | 101.77 | 0.982088 | 103.63 |
| 10 | 267.61 | 0.47 | 91.56 | 1.000234 | 91.54 |
| 11 | 366.86 | 37.34 | 136.55 | 1.008355 | 135.42 |
| 12 | 360.80 | 72.80 | 134.68 | 1.006292 | 133.83 |
| 13 | 350.54 | 105.78 | 131.49 | 0.993551 | 132.35 |
| 14 | 335.72 | 134.88 | 126.90 | 0.969223 | 130.93 |
| 15 | 315.75 | 158.43 | 120.71 | 0.931795 | 129.55 |
| 16 | 289.63 | 174.29 | 112.64 | 0.878775 | 128.17 |
| 17 | 255.66 | 179.42 | 95.10 | 0.799043 | 119.01 |
| 18 | 210.47 | 168.75 | 82.28 | 0.696617 | 118.11 |
| 19 | 183.62 | 170.00 | 83.41 | 0.492248 | 169.45 |
| | | ----- | | ----- | |
| | | 498.98 | | | 2091.87 |

Συνεισφ. αγκυρίων: Αθρ. ροπών ανατροπής : -25.0 kN*m/m
" " resisting : 0.8 kN*m/m

Δράση $E_d = (499.0 * 13.23 - 25.0)$

Αντίσταση $R_d = (2091.9 * 13.23 + 0.8)$

SLIP-CIRCLE $\mu = E_d / R_d = 0.24 < 1.0$: Έλεγχος εκπληρώθηκε.

| | | |
|------------|--|------------------|
| Author: | FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | Job No.: |
| Program: | WALLS-Retain. Version 2017.046 | |
| Structure: | info@fides-dvp.de www.fides-dvp.de Tel:++49/89/143829-0 ASB Nr.: | Date: 08.10.2018 |

Φάση εκσκαφής 4 "[4] Situation 4"

LC: όλα τα φορτία Type: BS-T

Εδαφικό σύστημα με 5 Στρώσεις

| Name | Τεχνητές επιχωματώσεις | Αμμόδης ΑΡΓΙΛΟΣ | Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ | |
|-------------|------------------------|-----------------|--------------------------|-----------|
| γ | [kN/m3] | 18 | 20 | 22.5 |
| γ,R | [kN/m3] | 18 | 20 | 22.5 |
| γ' | [kN/m3] | 8 | 10 | 12.5 |
| γ,p | [kN/m3] | 18 | 20 | 22.5 |
| γ,R,passive | [kN/m3] | 18 | 20 | 22.5 |
| γ,pw | [kN/m3] | 8 | 10 | 12.5 |
| φ | [°] | 25 | 0.1 | 33 |
| c | [kN/m2] | 2 | 50 | 5 |
| c,u | [kN/m2] | 10 | 50 | 5 |
| c παθητικό | [kN/m2] | 2 | 50 | 5 |
| δ,a | [°] | 16.66667 | 0.06666667 | 22 |
| δ,p | [°] | -16.66667 | -0.06666667 | -22 |
| δ,c | [°] | 8.333333 | 0.03333333 | 11 |
| k,agh | [-] | 0.3456501 | 0.9955057 | 0.2452023 |
| K,ach | [-] | 1.043051 | 1.994195 | 0.8549058 |
| K,0h | [-] | 0.5773817 | 0.9982547 | 0.455361 |
| K,pgh | [-] | 3.908103 | 1.004519 | 7.495617 |
| K,pch | [-] | 5.180327 | 2.00583 | 8.599509 |
| τ,gr | [kN/m2] | 110 | 110 | 110 |
| Ψ,A,max | [°] | 90 | 90 | 90 |
| k | [cm/s] | 10e-06 | 1e-06 | 100e-06 |

| Name | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ |
|-------------|------------------------|------------------------|
| γ | [kN/m3] 22.5 | 22.5 |
| γ,R | [kN/m3] 22.5 | 22.5 |
| γ' | [kN/m3] 12.5 | 12.5 |
| γ,p | [kN/m3] 22.5 | 22.5 |
| γ,R,passive | [kN/m3] 22.5 | 22.5 |
| γ,pw | [kN/m3] 12.5 | 12.5 |
| φ | [°] 35 | 35 |
| c | [kN/m2] 5 | 5 |
| c,u | [kN/m2] 5 | 5 |
| c παθητικό | [kN/m2] 5 | 5 |
| δ,a | [°] 23.33333 | 23.33333 |
| δ,p | [°] -23.33333 | -23.33333 |
| δ,c | [°] 11.66667 | 11.66667 |
| k,agh | [-] 0.2244207 | 0.2244207 |
| K,ach | [-] 0.8126539 | 0.8126539 |
| K,0h | [-] 0.4264236 | 0.4264236 |
| K,pgh | [-] 9.146943 | 9.146943 |
| K,pch | [-] 10.104 | 10.104 |
| τ,gr | [kN/m2] 110 | 110 |
| Ψ,A,max | [°] 90 | 90 |
| k | [cm/s] 100e-06 | 100e-06 |

Πορεία πρανούς:

x [m] 0.00 0.00
z [m] -4.00 0.00

Πορεία ανώτερου 2. στρώματος Αμμόδης ΑΡΓΙΛΟΣ:

x [m] 0.00 0.00
z [m] -4.00 -1.50

Πορεία ανώτερου 3. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ:

z= -4.50

Πορεία ανώτερου 4. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟΣ:

z= -10.00

| | | |
|---------|--------------------------------------|--------------|
| Part: | | Archive No.: |
| Block: | Please specify project informations. | Page: 46 |
| Record: | | |

| | |
|--|------------------|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | Job No.: |
| Program: WALLS-Retain. Version 2017.046 | |
| Structure: info@fides-dvp.de www.fides-dvp.de Tel:++49/89/143829-0 ASB Nr.: | Date: 08.10.2018 |

Πορεία ανώτερου 5. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ:
 z= -14.00

Επιφ. φορτία:
Φορτία

| xA | zA | xE | zE | PxA | PzA | PxE | PzE | Typ | LC-description |
|------|------|------|------|------|-------|------|-------|-----|----------------|
| [m] | [m] | [m] | [m] | [| kN/m² | |] | | Name |
| 1.00 | 0.00 | 3.50 | 0.00 | 0.00 | 33.00 | 0.00 | 33.00 | q | 1 |

Κατανομή εδαφ.πιέσεων

| | |
|----------------------------|------|
| Κατανομή εδαφ.πιέσεων | Name |
| Rectangular within a layer | |

Στάθμη νερού:

| | | |
|-------|-------|-------|
| x [m] | 0.00 | 0.00 |
| z [m] | -6.00 | -3.00 |

Αγκύρια

| z[m] | min.l[m] | Alpha[°] | C-H[kN/m] | P0[kN] | u0[m] |
|-------|----------|----------|-----------|--------|--------|
| -0.50 | 0.00 | 15.00 | 0.00 | 0.00 | 0.0000 |
| -3.00 | 0.00 | 15.00 | αόρισ. | 0.00 | 0.0000 |

Παράμετροι υπολογισμού
Earth pressure options
 Τμήμα εδαφ.ωθήσεων: Ενεργές ωθήσεις.
 Angle of slip plane: DIN 4085.
 Split block loads into 1 sections.
 Consideration of minimum earth pressure: φ,min = 40.000.
 Negative earth pressure fractions are set to zero.

Redistribution of earth pressure
 Shape of redistribution: Triangle (perpend. to wall).
 The earth pressure is getting redistrib. to: Excavation level
 The earth pressure below the excavation acts without redistrib.
 Levels of redistribution Z1: -0.500, Z2: -3.000 [m].
 The earth pressure from variable loads will be included in redistribution.

Παθητικές ωθήσεις
 Method of calculation: Κλασικός, Pregl/Sokolovsky (DIN 4085).

Options for water pressure
Στήριξη πόδα
 Πόδας οριζοντίως μετακινούμενος

Αγκύρια
 Anchor checks (lower failure plane): Ναι
 Anchor forces with safety level of DS-P: Ναι
 Verification of grout body pull out forces: Ναι
 δ,a,Anchoring wall : used from soil layer.
 δ,p,Anchoring wall : used from soil layer.

Earth pressure coefficients kh

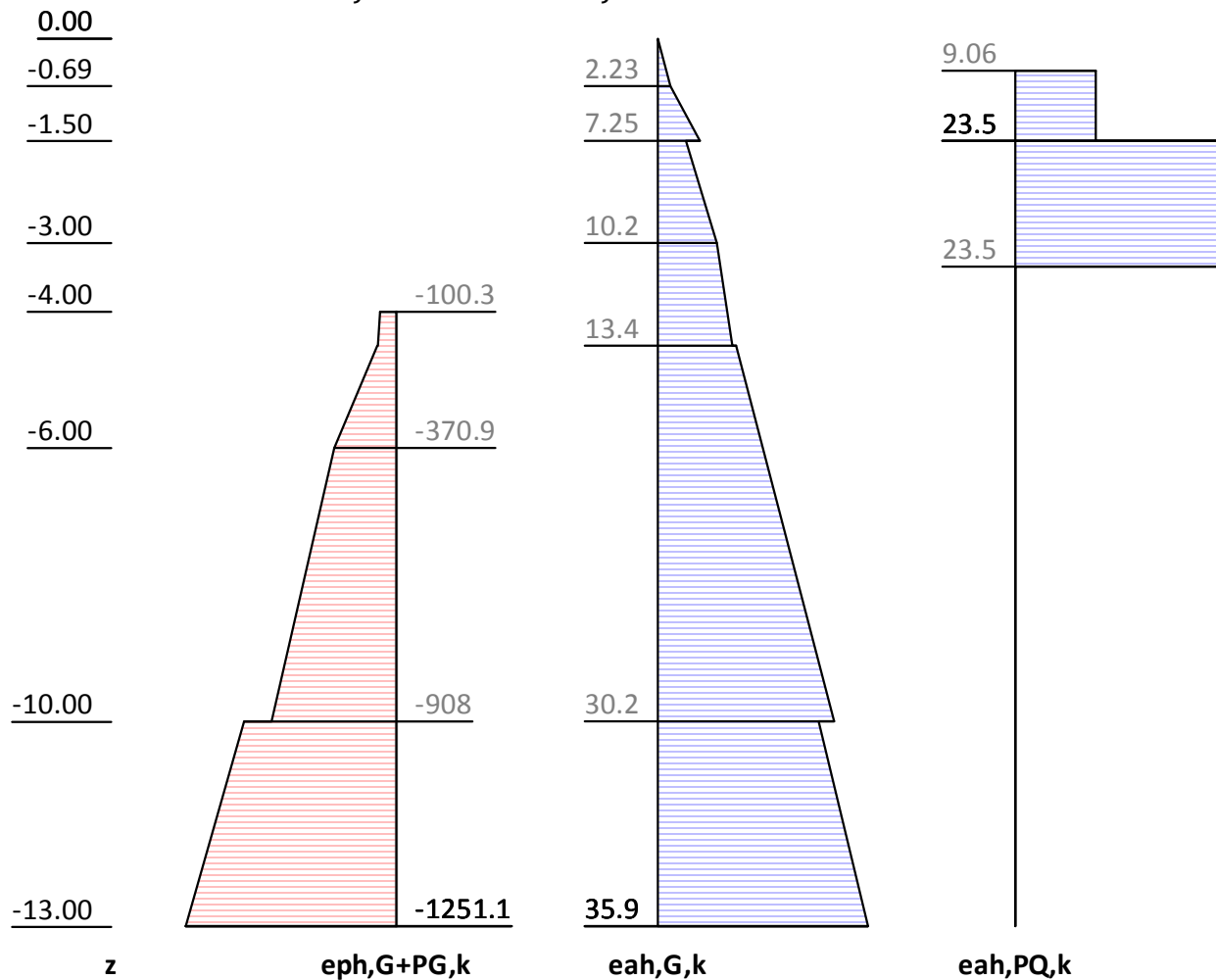
| φ | α | β | δ | k0gh | kagh | kach | kpgh | kpch | |
|------|-----|-----|-------|------|-------|-------|-------|---------|--------------------------|
| 0.1 | 0.0 | 0.0 | -0.1 | -- | -- | -- | 1.005 | -2.006 | Τεχνητές επιχωματώσεις |
| 25.0 | 0.0 | 0.0 | 16.7 | -- | 0.346 | 1.043 | -- | -- | " |
| 0.1 | 0.0 | 0.0 | -0.1 | -- | -- | -- | 1.005 | -2.006 | Αμμώδης ΑΡΓΙΛΙΟΣ |
| 0.1 | 0.0 | 0.0 | 0.1 | -- | 0.996 | 1.994 | -- | -- | " |
| 33.0 | 0.0 | 0.0 | -22.0 | -- | -- | -- | 7.496 | -8.600 | Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ |
| 33.0 | 0.0 | 0.0 | 22.0 | -- | 0.245 | 0.855 | -- | -- | " |
| 35.0 | 0.0 | 0.0 | -23.3 | -- | -- | -- | 9.147 | -10.104 | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ |
| 35.0 | 0.0 | 0.0 | 23.3 | -- | 0.224 | 0.813 | -- | -- | " |
| 35.0 | 0.0 | 0.0 | -23.3 | -- | -- | -- | 9.147 | -10.104 | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ |
| 35.0 | 0.0 | 0.0 | 23.3 | -- | 0.224 | 0.813 | -- | -- | " |

| | |
|---|--------------|
| Part: Block: Please specify project informations. Record: | Archive No.: |
|---|--------------|

Page: 47

Μήκος τοίχουFoot depth for statics: $z_f = -13.000$ **Stress analysis****Earth pressure, horizontal**

Pressures characteristic, no redistribution, continuous wall



| z [m] | eph,G,k [kN/m ²] | eah,G,k [kN/m ²] | eah,PQ,k [kN/m ²] | eah,d [kN/m ²] |
|----------|---------------------------------|---------------------------------|----------------------------------|-------------------------------|
| 0.00 | | 0.00 | | 0.00 |
| -0.47 | | 1.52 | 0.00 | 2.04 |
| -0.47 | | 1.52 | 9.06 | 15.62 |
| -1.50 | | 7.25 | 9.06 | 23.37 |
| -1.50 | | 4.82 | 23.48 | 41.73 |
| -3.34 | | 10.79 | 23.48 | 49.78 |
| -3.34 | | 10.79 | 0.00 | 14.56 |
| -4.00 | -0.00 | 11.97 | 0.00 | 16.15 |
| -4.00 | -100.29 | 11.97 | 0.00 | 16.15 |
| -4.50 | -110.34 | 12.86 | 0.00 | 17.36 |
| -4.50 | -117.95 | 13.38 | 0.00 | 18.06 |
| -10.00 | -745.71 | 30.24 | 0.00 | 40.82 |
| -10.00 | -908.05 | 27.52 | 0.00 | 37.16 |
| -13.00 | -1251.06 | 35.94 | 0.00 | 48.52 |

Eph,G,k: -5891.26, Eph,PG,k: 0.00 [kN/m]

Eah,G,k: 248.27, Eah,PG,k: 0.00, Eah,PQ,k: 52.53, Eah,d: 413.96

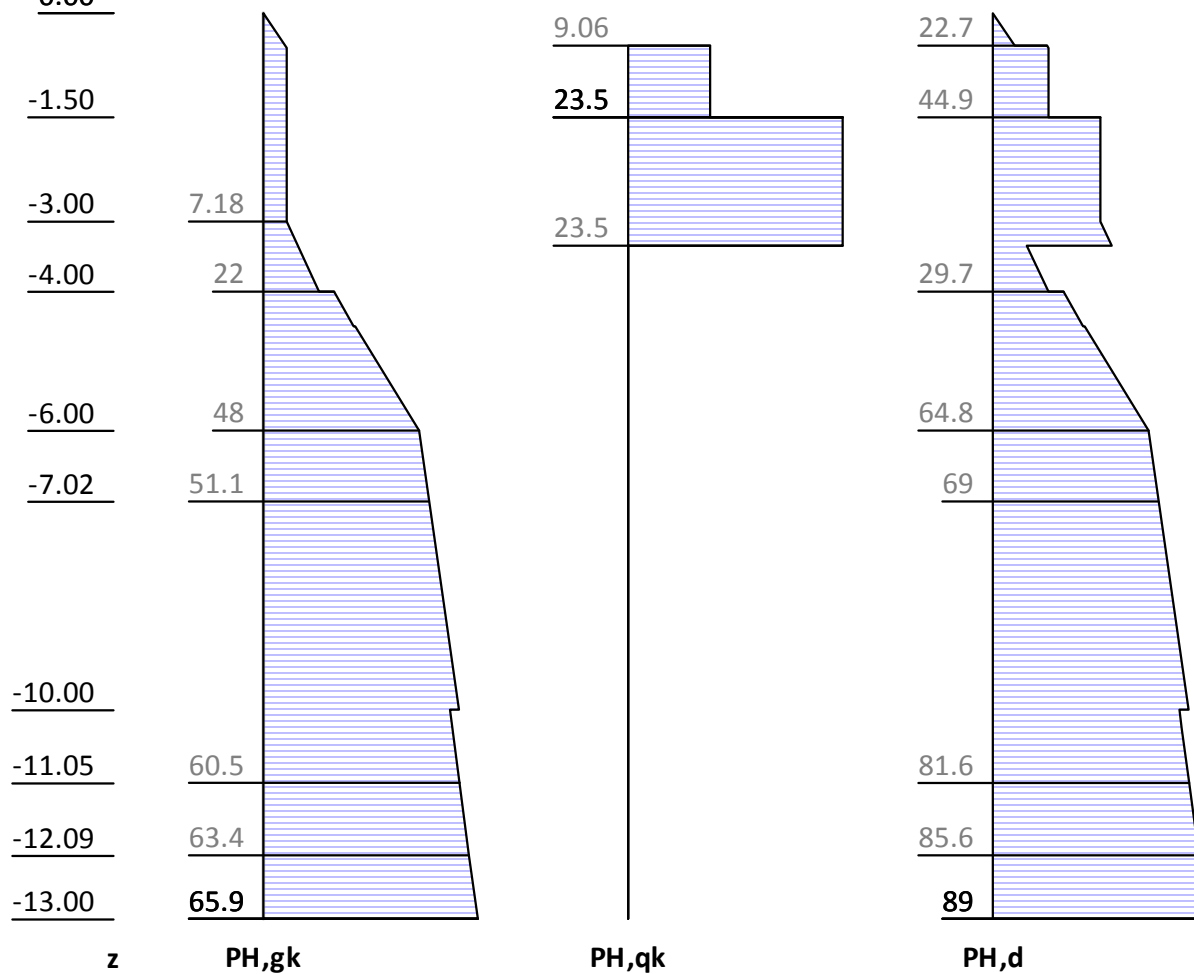
Πίεση νερού

| z [m] | Wp, k [kN/m2] | Wa, k [kN/m2] | W, k [kN/m2] |
|----------|------------------|------------------|-----------------|
| -3.00 | | 0.00 | 0.00 |
| -6.00 | 0.00 | 30.00 | 30.00 |
| -6.24 | -2.40 | 32.40 | 30.00 |
| -13.00 | -70.00 | 100.00 | 30.00 |

H-pressure on static system

Level of mobilization: Ep,gk 100.0, Ep,qk 100.0, Ep,d 100.0 [%]

0.00



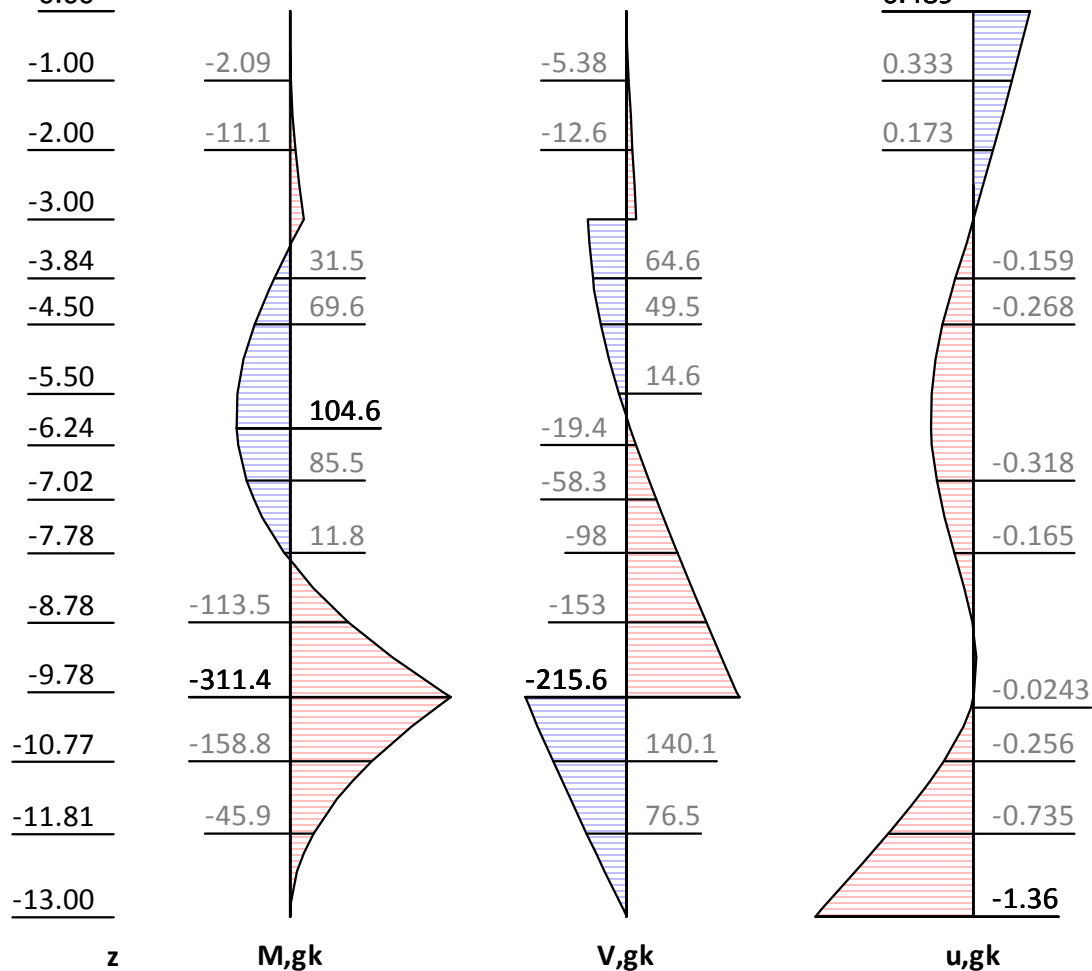
| z [m] | PH,gk [kN/m2] | PH,qk [kN/m2] | PH,d [kN/m2] |
|----------|------------------|------------------|-----------------|
| 0.00 | 0.00 | 0.00 | 0.00 |
| -0.47 | 6.75 | 0.00 | 9.11 |
| -0.47 | 6.75 | 9.06 | 22.69 |
| -1.50 | 7.18 | 9.06 | 23.28 |
| -1.50 | 7.18 | 23.48 | 44.91 |
| -3.34 | 10.58 | 23.48 | 49.50 |
| -3.34 | 10.58 | 0.00 | 14.28 |
| -4.00 | 17.18 | 0.00 | 23.19 |
| -4.00 | 21.97 | 0.00 | 29.65 |
| -4.50 | 27.86 | 0.00 | 37.61 |
| -4.50 | 28.38 | 0.00 | 38.31 |
| -10.00 | 60.24 | 0.00 | 81.32 |
| -10.00 | 57.52 | 0.00 | 77.66 |
| -13.00 | 65.94 | 0.00 | 89.02 |

V-pressure on static system**Internal forces: Permanent, characteristically**

z= -0.500. Fx= -0.000 kN/m Support

z= -3.000. Fx= -93.860 kN/m Support

z= -9.856. Fx=-409.408 kN/m Support

0.00

| z [m] | H, g, k [kN/m2] | M, g, k [kN/m2] | V, g, k [kN/m2] | N, g, k [kN/m2] | u, g, k [mm] |
|----------|--------------------|--------------------|--------------------|--------------------|-----------------|
| 0.00 | 0.00 | -0.00 | 0.00 | 0.00 | 0.49 |
| -0.00 | 0.00 | -0.00 | 0.00 | -0.00 | 0.49 |
| -3.00 | 7.18 | -27.22 | -19.74 | -64.03 | 0.00 |
| -3.00 | 7.18 | -27.22 | -19.74 | -64.03 | -0.00 |
| -3.00 | 7.18 | -27.22 | 74.12 | -89.18 | -0.00 |
| -3.38 | 10.94 | -0.00 | 70.62 | -97.23 | -0.07 |
| -4.00 | 17.18 | 41.65 | 61.94 | -110.55 | -0.19 |
| -4.00 | 21.97 | 41.65 | 61.94 | -110.55 | -0.19 |
| -4.50 | 27.86 | 69.63 | 49.49 | -121.06 | -0.27 |
| -4.50 | 28.38 | 69.63 | 49.49 | -121.06 | -0.27 |
| -5.83 | 45.70 | 103.93 | -0.00 | -146.06 | -0.37 |
| -6.00 | 47.98 | 104.58 | -7.78 | -149.46 | -0.37 |
| -7.89 | 53.76 | 0.00 | -103.77 | -189.15 | -0.15 |
| -8.90 | 56.85 | -132.99 | -159.67 | -212.22 | 0.00 |
| -9.28 | 58.03 | -197.17 | -181.64 | -221.28 | 0.03 |
| -9.86 | 59.81 | -311.40 | -215.57 | -235.27 | 0.00 |
| -9.86 | 59.81 | -311.40 | 193.84 | -235.27 | 0.00 |
| -10.00 | 60.24 | -284.11 | 185.20 | -238.83 | -0.02 |
| -10.00 | 57.52 | -284.11 | 185.20 | -238.83 | -0.02 |
| -13.00 | 65.94 | -0.00 | -0.00 | -317.69 | -1.36 |
| -13.00 | 65.94 | 0.00 | -0.00 | -317.69 | -1.36 |

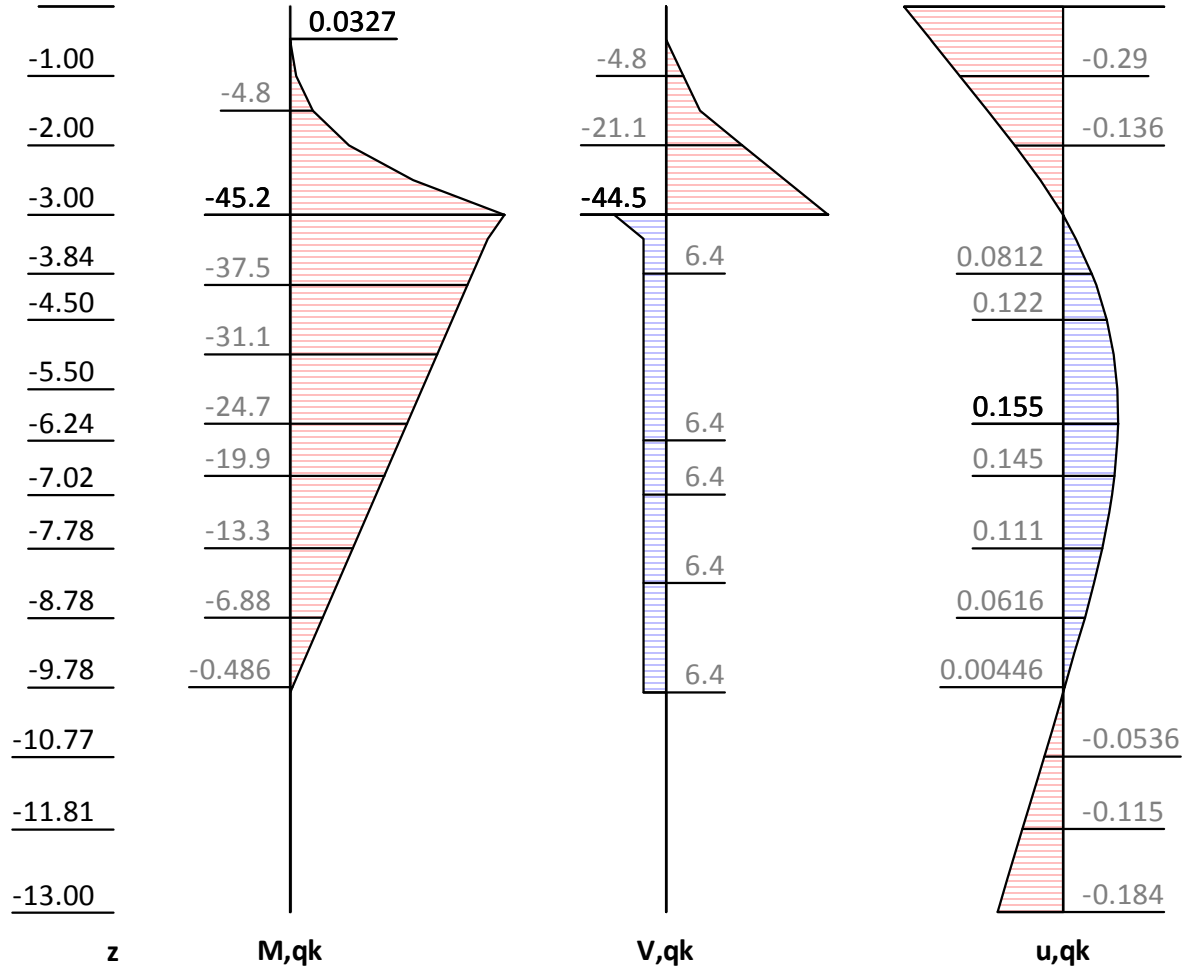
Internal forces: Variable, characteristicallyMethod EB 82-4 ($Q = [G+Q] - G$).

z= -0.500. Fx= 0.000 kN/m Support

z= -3.000. Fx= -58.929 kN/m Support

z= -9.856. Fx= 6.397 kN/m Support

0.00



| z [m] | H, q, k [kN/m ²] | M, q, k [kN/m ²] | V, q, k [kN/m ²] | N, q, k [kN/m ²] | u, q, k [mm] |
|----------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|-----------------|
| 0.00 | | 0.00 | -0.00 | 0.00 | -0.45 |
| -0.00 | | 0.00 | -0.00 | 0.00 | -0.45 |
| -0.47 | 0.00 | 0.03 | 0.10 | 0.01 | -0.37 |
| -0.47 | 9.06 | 0.03 | 0.10 | 0.01 | -0.37 |
| -0.48 | 9.06 | 0.02 | -0.00 | -0.00 | -0.37 |
| -0.50 | 9.06 | -0.00 | -0.23 | -0.02 | -0.37 |
| -1.50 | 9.06 | -4.80 | -9.33 | -0.99 | -0.21 |
| -1.50 | 23.48 | -4.80 | -9.33 | -0.99 | -0.21 |
| -3.00 | 23.48 | -45.21 | -44.55 | -4.71 | -0.00 |
| -3.00 | 23.48 | -45.21 | 14.38 | -20.50 | -0.00 |
| -3.00 | 23.48 | -45.21 | 14.38 | -20.50 | 0.00 |
| -3.34 | 23.48 | -41.68 | 6.40 | -21.35 | 0.04 |
| -3.34 | 0.00 | -41.68 | 6.40 | -21.35 | 0.04 |
| -3.84 | 0.00 | -38.48 | 6.40 | -21.35 | 0.08 |
| -4.50 | 0.00 | -34.26 | 6.40 | -21.35 | 0.12 |
| -5.00 | 0.00 | -31.06 | 6.40 | -21.35 | 0.14 |
| -5.50 | 0.00 | -27.86 | 6.40 | -21.35 | 0.15 |
| -6.00 | 0.00 | -24.67 | 6.40 | -21.35 | 0.15 |
| -7.02 | 0.00 | -18.14 | 6.40 | -21.35 | 0.14 |
| -9.86 | 0.00 | -0.00 | 6.40 | -21.35 | 0.00 |

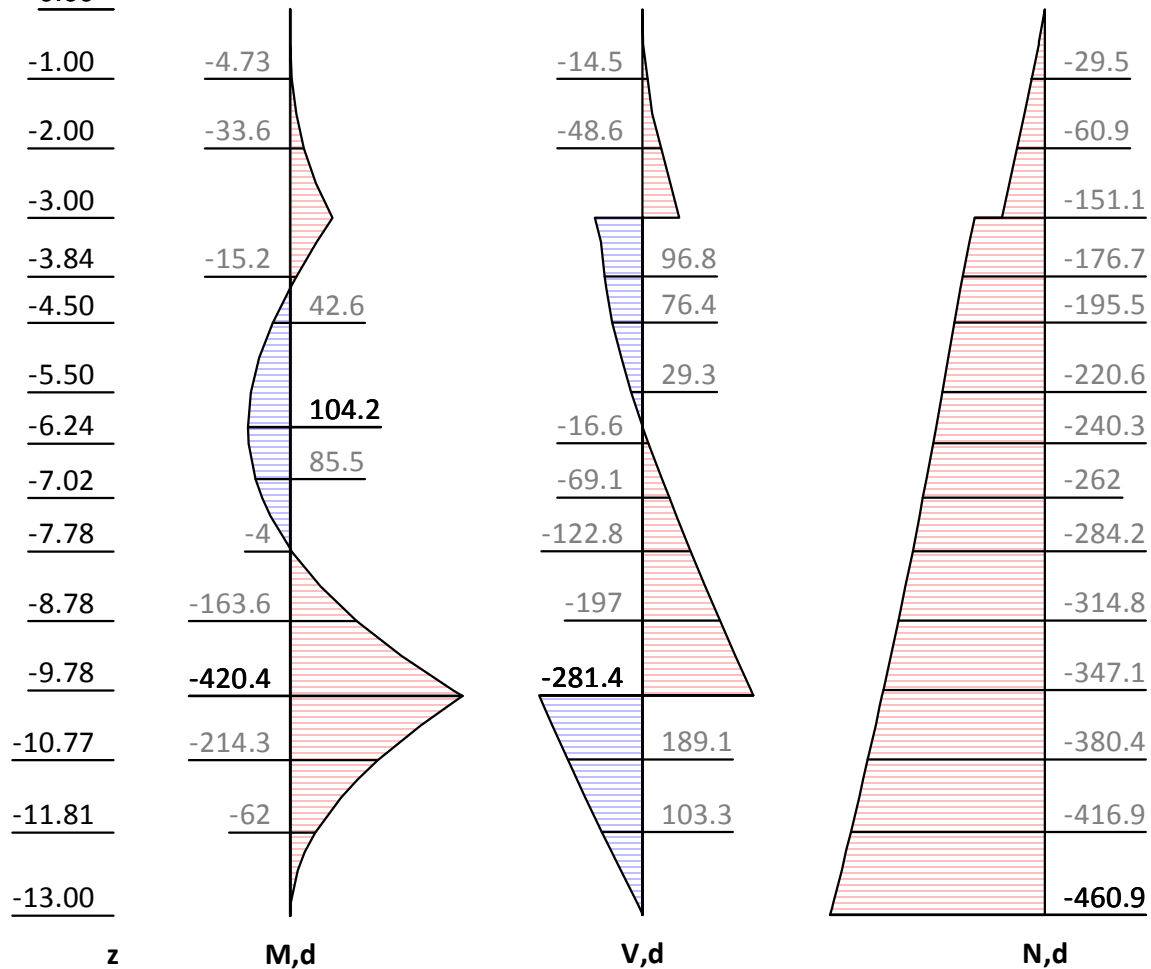
| z [m] | H, q, k [kN/m2] | M, q, k [kN/m2] | V, q, k [kN/m2] | N, q, k [kN/m2] | u, q, k [mm] |
|----------|--------------------|--------------------|--------------------|--------------------|-----------------|
| -9.86 | 0.00 | -0.00 | 0.00 | -21.35 | 0.00 |
| -11.05 | 0.00 | -0.00 | 0.00 | -21.35 | -0.07 |
| -11.31 | 0.00 | -0.00 | 0.00 | -21.35 | -0.09 |
| -12.09 | 0.00 | -0.00 | 0.00 | -21.35 | -0.13 |
| -12.85 | 0.00 | 0.00 | 0.00 | -21.35 | -0.18 |
| -12.90 | 0.00 | 0.00 | 0.00 | -21.35 | -0.18 |
| -12.98 | 0.00 | 0.00 | -0.00 | -21.35 | -0.18 |
| -13.00 | 0.00 | -0.00 | -0.00 | -21.35 | -0.18 |

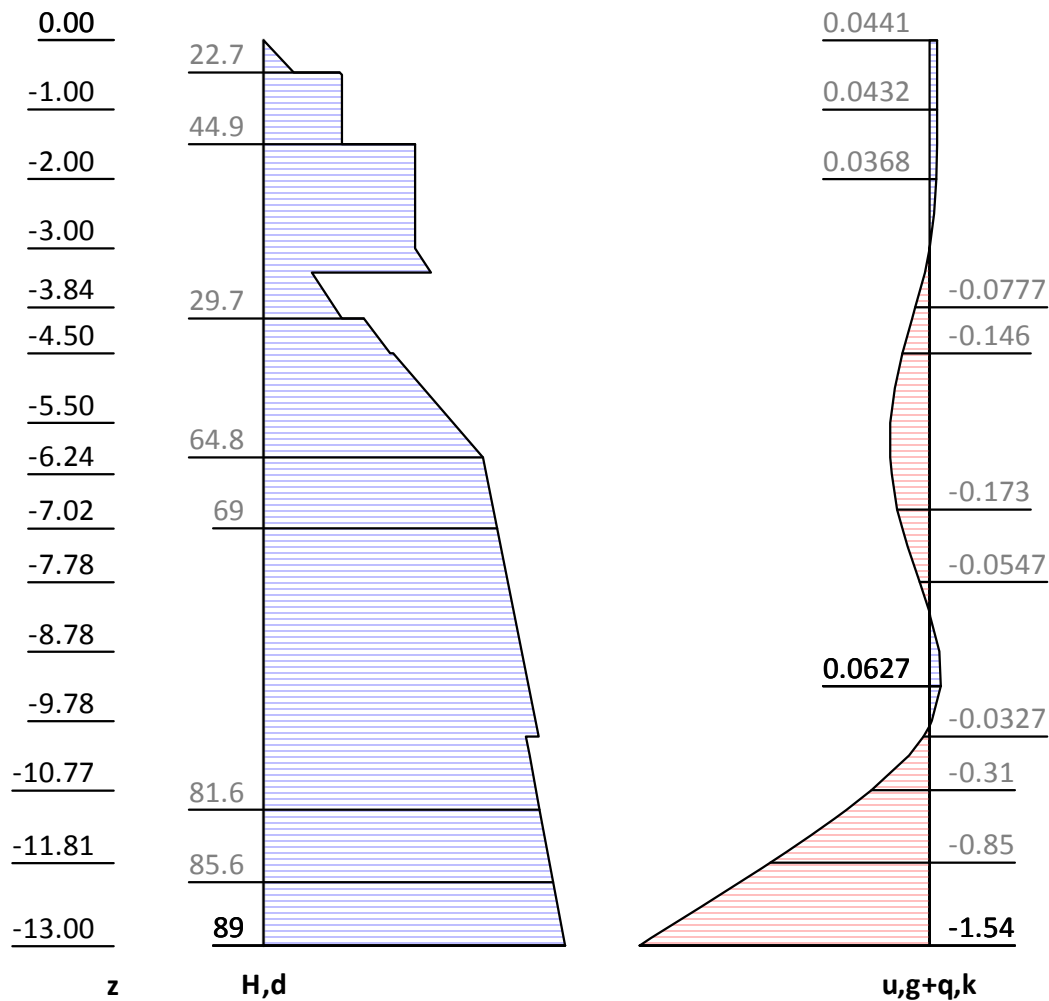
Internal forces: Design

z= -0.500. Fx= -0.000 kN/m Support

z= -3.000. Fx=-215.104 kN/m Support

z= -9.856. Fx=-543.107 kN/m Support

0.00



| z [m] | H,d [kN/m²] | M,d [kN/m²] | V,d [kN/m²] | N,d [kN/m²] | u,g+q,k [mm] |
|----------|----------------|----------------|----------------|----------------|-----------------|
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 |
| -0.47 | 9.11 | -0.34 | -2.14 | -13.44 | 0.04 |
| -0.47 | 22.69 | -0.34 | -2.14 | -13.44 | 0.04 |
| -1.50 | 23.28 | -14.88 | -26.11 | -44.64 | 0.04 |
| -1.50 | 44.91 | -14.88 | -26.11 | -44.64 | 0.04 |
| -3.00 | 44.91 | -104.56 | -93.47 | -93.51 | 0.00 |
| -3.00 | 44.91 | -104.56 | -93.47 | -93.51 | -0.00 |
| -3.00 | 44.91 | -104.56 | 121.63 | -151.15 | -0.00 |
| -3.34 | 49.50 | -65.89 | 105.58 | -162.22 | -0.03 |
| -3.34 | 14.28 | -65.89 | 105.58 | -162.22 | -0.03 |
| -4.00 | 23.19 | 0.00 | 93.22 | -181.26 | -0.09 |
| -4.00 | 23.19 | 0.04 | 93.22 | -181.27 | -0.09 |
| -4.00 | 29.65 | 0.04 | 93.22 | -181.27 | -0.09 |
| -4.50 | 37.61 | 42.61 | 76.40 | -195.45 | -0.15 |
| -4.50 | 38.31 | 42.61 | 76.40 | -195.45 | -0.15 |
| -5.98 | 64.50 | 103.96 | 0.00 | -233.40 | -0.21 |
| -6.00 | 64.77 | 104.18 | -0.91 | -233.80 | -0.21 |
| -7.74 | 71.98 | -0.00 | -120.05 | -283.06 | -0.06 |
| -8.22 | 73.97 | -66.40 | -155.13 | -297.55 | 0.00 |
| -9.28 | 78.34 | -271.71 | -235.62 | -330.75 | 0.06 |
| -9.86 | 80.74 | -420.39 | -281.42 | -349.63 | 0.00 |
| -9.86 | 80.74 | -420.39 | 261.68 | -349.63 | 0.00 |
| -10.00 | 81.32 | -383.54 | 250.01 | -354.44 | -0.03 |
| -10.00 | 77.66 | -383.54 | 250.01 | -354.44 | -0.03 |
| -13.00 | 89.02 | -0.00 | 0.00 | -460.90 | -1.54 |
| -13.00 | 89.02 | -0.00 | -0.00 | -460.90 | -1.54 |

Anchor forces with safety level of DS-P

| z[m] | A,d[kN] | Fx,d[kN/m] |
|-------|---------|------------|
| -0.50 | 0.0 | -0.0 |
| -3.00 | 200.4 | -215.1 |

Checks of earth statics**Check of earth support**

Check: Mobilizable earth resistance is sufficient for earth support force.

z: -9.86 m

$R_d = E_{ph,k}/\gamma, R_e = 5891.26 / 1.400 = 4208.04 \text{ [kN/m]}$

$E_d(U_h,d)/R_d = 543.11 / 4208.04 = 0.129 \text{ [-]}. \text{ Passes requirement}$

Sum of H and V forces, (G)

Forces up to depth z:-13.00

| Pos. | H | V |
|---|---------|-----------------------|
| H/V pressure G+P+W,k | 503.27 | 90.93 |
| Wall weight | | 201.61 |
| H/V pressure passive | | 0.00 |
| Support z: -0.50 | | 0.00 |
| Support z: -3.00 | -93.86 | 25.15 |
| B _{h,g,k} z=-9.86 | -409.41 | |
| B _{v,g,k} = B _{h,k} * tan($\delta, p=-22.00^\circ$) | | -165.41 |
| Σ | 0.00 | 152.28 (downwards) |

Average anchor inclination $\alpha, A = 15.00^\circ \geq 15^\circ$.

Verification of vertical forces due to EAB R 9 not required (R 9-5).

Check EAB R 9-1

Vertical component of earth resistance is less than the downwards pointing vertical forces.

$V_k \geq B_{vk}: 317.69 \geq 165.41 \text{ Passes requirement}$

Sum of H and V forces, (G+Q)

Forces up to depth z:-13.00

| Pos. | H | V |
|---|---------|-----------------------|
| H/V pressure G+P+W,k | 555.80 | 96.49 |
| Wall weight | | 201.61 |
| H/V pressure passive | | 0.00 |
| Support z: -0.50 | | 0.00 |
| Support z: -3.00 | -152.79 | 40.94 |
| B _{h,g,k} z=-9.86 | -409.41 | |
| B _{v,g,k} = B _{h,k} * tan($\delta, p=-22.00^\circ$) | | -165.41 |
| B _{h,q,k} z=-9.86 | 6.40 | |
| B _{v,q,k} = B _{h,k} * tan($\delta, p=-22.00^\circ$) | | 2.58 |
| Σ | -0.00 | 176.21 (downwards) |

Average anchor inclination $\alpha, A = 15.00^\circ \geq 15^\circ$.

Verification of vertical forces due to EAB R 9 not required (R 9-5).

Check EAB R 9-1

Vertical component of earth resistance is less than the downwards pointing vertical forces.

$V_k \geq B_{vk}: 339.04 \geq 162.83 \text{ Passes requirement}$

Anchor verification

| | |
|--|------------------|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | Job No.: |
| Program: WALLS-Retain. Version 2017.046 | |
| Structure: info@fides-dvp.de www.fides-dvp.de Tel:++49/89/143829-0 ASB Nr.: | Date: 08.10.2018 |

Anchor - Stability of lower failure plane

Περίπτ.Φόρτισης: όλα τα φορτία BS-P
 Αυτόμ. υπολογ. μήκους αγκυρίων:
 All anchors are extended (if necessary)
 Favourable variable loads in main failure body are not being considered.
 Bottom of lower failure plane: z=-13.00 m

Iteration of failure mechanisms:
 lA: Length of anchor from head to center of grout body.
 W,k: Res. force from dead weight, loads, cohesion, ...
 Q,k: Force in lower failure plane.
 Ea1,k.....: Earth pressure onto vertical separation plane.
 Ea2,k.....: Earth pressure between wall and main failure body.
 Ra_cal,d: Dimesioning force of the resistance from the equilibrium of forces.
 Ra_cal,d corresponds to the max. possible anchor force of the force polygon.
 Sum(A,d): Acting anchor forces along the grout body fractions within the failure body. Sum(A,d) is gained from the anchor pull forces of the wall analysis.

| z | θ1 | θ2 | lA | W,k | Q,k | Ea1,k | Ea2,k | Ra_cal,d | Sum(A,d) | Ed/Rd |
|-------|------|------|-------|--------|--------|--------|--------|----------|----------|-------|
| [m] | [°] | [°] | [m] | [kN/m] | [kN/m] | [kN/m] | [kN/m] | [kN/m] | [kN/m] | [-] |
| -0.50 | 39.3 | 57.5 | 11.91 | 1372.1 | 1222.8 | 4.4 | 315.9 | 169.0 | 168.6 | 1.00 |
| -3.00 | 34.9 | 60.8 | 10.72 | 1424.1 | 1246.1 | 27.4 | 315.9 | 222.8 | 222.7 | 1.00 |

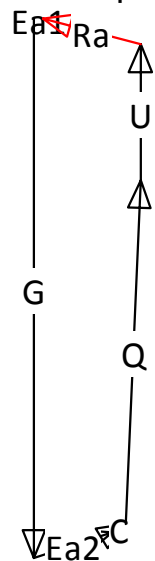
Decisive failure body:
Γεωμετρία:
 Foot point of lower failure plane x/z = 0.01/-13.00 m
 Intersection lower/upper slid. plane x/z = 10.35/ -5.77 m
 Intersection upper slid. plane/surface x/z = 13.58/ 0.00 m
 Intersection separation plane/surface x/z = 10.35/ 0.00 m
 Inclination lower failure plane θ1 = 34.93°
 Inclination upper failure plane θ2 = 60.78°
 Inclination separation plane θ12 = 90.00°

Loads / forces (char.)

| | | Fx | Fz | F | |
|------------------------------------|-----------|--------|---------|--------|---------|
| | | [kN/m] | [kN/m] | [kN/m] | |
| Weight of main failure body | G,k: | 0.0 | -2037.5 | 2037.5 | |
| Area loads on/in main failure body | F1,k: | 0.0 | -82.5 | 82.5 | |
| Cohesion of lower failure plane | C,k: | 51.7 | 36.1 | 63.1 | |
| Pore water pressure on main body | U,k: | 0.0 | 660.7 | 660.7 | |
| Earth pres. on separation plane | Ea1,k: | -27.4 | -0.0 | 27.4 | δ= 0.0° |
| Earth pr. between wall<->main body | Ea2,k: | 300.8 | 96.5 | 315.9 | |
| Force in lower failure plane | Q,k: | -23.7 | 1245.9 | 1246.1 | |
| Sum = possible anchor forces: | Ra_cal,k: | 301.4 | -80.7 | 312.0 | |

| | |
|--|--------------|
| Part: Block: Please specify project informations. Record: | Archive No.: |
|--|--------------|

Page: 55

Force polygon

Acting anchor forces $E_d: \sum(A,d) = 222.7 \text{ kN/m}$
 Possible anchor forces $R_d: R_{a_cal,d} = 312.0/1.400 = 222.8 \text{ kN/m}$

Verif. of lower failure plane $E_d/R_d = 1.00 < 1.0$: Έλεγχος εκπληρώθηκε.

Check of steel tension

l_{tot} ...[m]: Total length of anchor incl. excess length at head

A_s [mm²]: X-section area of steel member

$R_{i,d}$...[kN]: Ultimate strength of tension member ($\gamma, M=1.15$)

$A_{d,d}$ [kN]: Dimensioning force of the anchor from wall analysis

| z[m] | Anchor type | l_{tot} | A_s | $R_{i,d}$ | $A_{d,d}$ |
|-------|--------------------------|-----------|-------|-----------|--------------------|
| -0.50 | Strand;3x0.60";1570/1770 | 16.13 | 420 | 573.4 | 0.0 |
| | | | | | Passes requirement |
| -3.00 | Strand;3x0.60";1570/1770 | 14.72 | 420 | 573.4 | 200.4 |
| | | | | | Passes requirement |

Check of steel tension: Passes requirement

Check of anchor's soil friction

$l_{V,k}$: Length of grout body

$d_{mV,k}$: Diameter of grout body

$\tau_{Gr,k}$: Average applied skin friction along the grout body (from soil parameters)

$R_{a,k}$: Charact. pullout resistance of the anchor

γ_A : Partial safety factor of anchor pullout

$R_{a,d}$: $R_{a,k} / \gamma_A$

$A_{d,d}$: Dimensioning force of the anchor from wall analysis

| z | $l_{V,k}$ | $d_{mV,k}$ | $\tau_{Gr,k}$ | $R_{a,k}$ | γ_A | $R_{a,d}$ | $A_{d,d}$ | $A_{d,d}/R_{a,d}$ |
|-------|-----------|------------|----------------------|-----------|------------|-----------|-----------|-------------------|
| [m] | [m] | [mm] | [kN/m ²] | [kN] | [-] | [kN] | [kN] | [-] |
| -0.50 | 8.00 | 318 | 110 | 879.1 | 1.100 | 799.2 | 0.0 | 0.0 |
| -3.00 | 8.00 | 318 | 110 | 879.1 | 1.100 | 799.2 | 200.4 | 0.3 |

Check of anchor's soil friction: Passes requirement

Υπολογ. κύκλου ολίσθησης

LC: όλα τα φορτία Type: BS-T (combination: [GEO] A2 M2 R3, BS-T)

Vertical variable loads only act if they are outside of $R \cdot \sin(\phi)$.

The automatic slip circle optimization only considers circles that intersect the surface with an area of at least 0.25 m².

The slip circle calculation only accepts circles including the wall.

The slipcircle calculation only allows circular failure planes (no vertical tangents will occur).

Author:
FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München

Job No.:

Program:
WALLS-Retain.
Version 2017.046

Structure:
info@fides-dvp.de
www.fides-dvp.de
Tel:++49/89/143829-0
ASB Nr.:

Date: 08.10.2018

Γεωμετ.κύκλου (μήκη και συντεταγμ. σε (m))
Κέντρο = (-0.68, 0.20), Ακτίνα = 13.23
Αρχ.σημ.= (-13.22, -4.00), Τελ.σημ. = (12.55, 0.00)

Γεωμετρία λωρίδων:

| No | x | Width | dxM | Weight | Load | Water- | u*b | φ | c | θ |
|----|--------|-------|--------|--------|--------|--------|--------|-------|---------|---------|
| | [m] | b | [m] | [kN/m] | z-κατ. | φορτ. | [kN/m] | [°] | [kN/m²] | [°] |
| | | | | | [kN/m] | [kN/m] | | | | |
| 1 | -12.56 | 1.32 | -11.88 | 46.4 | 0.0 | 0.0 | -5.3 | 27.45 | 3.57 | -31.27* |
| 2 | -11.24 | 1.32 | -10.56 | 110.5 | 0.0 | 0.0 | -22.4 | 27.45 | 3.57 | -31.27* |
| 3 | -9.91 | 1.32 | -9.24 | 155.2 | 0.0 | 0.0 | -42.6 | 27.45 | 3.57 | -31.27* |
| 4 | -8.59 | 1.32 | -7.91 | 188.8 | 0.0 | 0.0 | -57.8 | 29.26 | 3.57 | -30.37* |
| 5 | -7.27 | 1.32 | -6.59 | 214.7 | 0.0 | 0.0 | -69.4 | 29.26 | 3.57 | -29.88 |
| 6 | -5.95 | 1.32 | -5.27 | 234.5 | 0.0 | 0.0 | -78.2 | 29.26 | 3.57 | -23.47 |
| 7 | -4.62 | 1.32 | -3.95 | 249.1 | 0.0 | 0.0 | -84.7 | 29.26 | 3.57 | -17.35 |
| 8 | -3.30 | 1.32 | -2.62 | 259.2 | 0.0 | 0.0 | -89.3 | 29.26 | 3.57 | -11.43 |
| 9 | -1.98 | 1.32 | -1.30 | 265.1 | 0.0 | 0.0 | -91.9 | 29.26 | 3.57 | -5.64 |
| 10 | -0.65 | 1.32 | 0.02 | 267.6 | 0.0 | 0.0 | -112.6 | 29.26 | 3.57 | 0.10 |
| 11 | 0.67 | 1.32 | 1.35 | 366.9 | 0.0 | 0.0 | -131.5 | 29.26 | 3.57 | 5.84 |
| 12 | 1.99 | 1.32 | 2.67 | 360.8 | 0.0 | 0.0 | -128.8 | 29.26 | 3.57 | 11.64 |
| 13 | 3.31 | 1.32 | 3.99 | 350.5 | 0.0 | 0.0 | -124.2 | 29.26 | 3.57 | 17.56 |
| 14 | 4.64 | 1.32 | 5.31 | 335.7 | 0.0 | 0.0 | -117.6 | 29.26 | 3.57 | 23.69 |
| 15 | 5.96 | 1.32 | 6.64 | 315.7 | 0.0 | 0.0 | -108.7 | 29.26 | 3.57 | 30.12 |
| 16 | 7.28 | 1.32 | 7.96 | 289.6 | 0.0 | 0.0 | -97.0 | 29.26 | 3.57 | 37.00 |
| 17 | 8.61 | 1.32 | 9.28 | 255.7 | 0.0 | 0.0 | -81.7 | 27.45 | 3.57 | 44.57 |
| 18 | 9.93 | 1.32 | 10.61 | 210.5 | 0.0 | 0.0 | -61.2 | 27.45 | 3.57 | 53.30 |
| 19 | 11.57 | 1.96 | 12.25 | 183.6 | 0.0 | 0.0 | -36.5 | 27.45 | 3.57 | 67.79 |

*** Σημείωση: Στις λωρίδες σημειωμένες με '*'
περιορίστηκε το theta στο 45°-Phi/2.

Συνεισφ. κατακόρυφων φορτίων:

| No | Weight | G*sin(θ) | (G-u*b)*tan(φ) + c*b | μ*sin(θ)* tan(φ)+cos(θ) | T |
|--------|--------|----------|-------------------------|----------------------------|---------|
| | [kN/m] | [kN/m] | [kN/m] | [-] | [kN/m] |
| 1 | 46.36 | -41.64 | 26.04 | 0.792733 | 32.85 |
| 2 | 110.47 | -88.18 | 50.50 | 0.792733 | 63.71 |
| 3 | 155.17 | -108.34 | 63.19 | 0.792733 | 79.71 |
| 4 | 188.81 | -112.95 | 78.13 | 0.797687 | 97.95 |
| 5 | 214.69 | -106.96 | 86.13 | 0.802922 | 107.28 |
| 6 | 234.47 | -93.37 | 92.26 | 0.866033 | 106.53 |
| 7 | 249.12 | -74.30 | 96.80 | 0.916111 | 105.67 |
| 8 | 259.23 | -51.39 | 99.94 | 0.954643 | 104.68 |
| 9 | 265.14 | -26.04 | 101.77 | 0.982521 | 103.58 |
| 10 | 267.61 | 0.47 | 91.56 | 1.000226 | 91.54 |
| 11 | 366.86 | 37.34 | 136.55 | 1.007906 | 135.48 |
| 12 | 360.80 | 72.80 | 134.68 | 1.005401 | 133.95 |
| 13 | 350.54 | 105.78 | 131.49 | 0.992220 | 132.53 |
| 14 | 335.72 | 134.88 | 126.90 | 0.967450 | 131.17 |
| 15 | 315.75 | 158.43 | 120.71 | 0.929580 | 129.86 |
| 16 | 289.63 | 174.29 | 112.64 | 0.876119 | 128.56 |
| 17 | 255.66 | 179.42 | 95.10 | 0.796170 | 119.44 |
| 18 | 210.47 | 168.75 | 82.28 | 0.693336 | 118.67 |
| 19 | 183.62 | 170.00 | 83.41 | 0.488459 | 170.76 |
| ----- | | | | | ----- |
| 498.98 | | | | | 2093.92 |

Συνεισφ. αγκυρίων: Αθρ. ροπών ανατροπής : -190.3 kN*m/m
" " resisting : 203.2 kN*m/m

Δράση Ed = (499.0*13.23-190.3)
Αντίσταση Rd = (2093.9*13.23+203.2)

SLIP-CIRCLE μ = Ed/Rd = 0.23 < 1.0: Έλεγχος εκπληρώθηκε.

Part:
Block:
Please specify project informations.
Record:

Page: 57

Archive No.:

| | | |
|------------|--|------------------|
| Author: | FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | Job No.: |
| Program: | WALLS-Retain. Version 2017.046 | |
| Structure: | info@fides-dvp.de www.fides-dvp.de Tel:++49/89/143829-0 ASB Nr.: | Date: 08.10.2018 |

Φάση εκσκαφής 5 "[5] Situation 5"

LC: όλα τα φορτία Type: BS-T

Εδαφικό σύστημα με 5 Στρώσεις

| Name | Τεχνητές επιχωματώσεις | Αμμόδης ΑΡΓΙΛΟΣ | Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ | |
|-------------|------------------------|-----------------|--------------------------|-----------|
| γ | [kN/m3] | 18 | 20 | 22.5 |
| γ,R | [kN/m3] | 18 | 20 | 22.5 |
| γ' | [kN/m3] | 8 | 10 | 12.5 |
| γ,p | [kN/m3] | 18 | 20 | 22.5 |
| γ,R,passive | [kN/m3] | 18 | 20 | 22.5 |
| γ,pw | [kN/m3] | 8 | 10 | 12.5 |
| φ | [°] | 25 | 0.1 | 33 |
| c | [kN/m2] | 2 | 50 | 5 |
| c,u | [kN/m2] | 10 | 50 | 5 |
| c παθητικό | [kN/m2] | 2 | 50 | 5 |
| δ,a | [°] | 16.66667 | 0.06666667 | 22 |
| δ,p | [°] | -16.66667 | -0.06666667 | -22 |
| δ,c | [°] | 8.333333 | 0.03333333 | 11 |
| k,agh | [-] | 0.3456501 | 0.9955057 | 0.2452023 |
| K,ach | [-] | 1.043051 | 1.994195 | 0.8549058 |
| K,0h | [-] | 0.5773817 | 0.9982547 | 0.455361 |
| K,pgh | [-] | 3.908103 | 1.004519 | 7.495617 |
| K,pch | [-] | 5.180327 | 2.00583 | 8.599509 |
| τ,gr | [kN/m2] | 110 | 110 | 110 |
| Ψ,A,max | [°] | 90 | 90 | 90 |
| k | [cm/s] | 10e-06 | 1e-06 | 100e-06 |

| Name | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ |
|-------------|------------------------|------------------------|
| γ | [kN/m3] 22.5 | 22.5 |
| γ,R | [kN/m3] 22.5 | 22.5 |
| γ' | [kN/m3] 12.5 | 12.5 |
| γ,p | [kN/m3] 22.5 | 22.5 |
| γ,R,passive | [kN/m3] 22.5 | 22.5 |
| γ,pw | [kN/m3] 12.5 | 12.5 |
| φ | [°] 35 | 35 |
| c | [kN/m2] 5 | 5 |
| c,u | [kN/m2] 5 | 5 |
| c παθητικό | [kN/m2] 5 | 5 |
| δ,a | [°] 23.33333 | 23.33333 |
| δ,p | [°] -23.33333 | -23.33333 |
| δ,c | [°] 11.66667 | 11.66667 |
| k,agh | [-] 0.2244207 | 0.2244207 |
| K,ach | [-] 0.8126539 | 0.8126539 |
| K,0h | [-] 0.4264236 | 0.4264236 |
| K,pgh | [-] 9.146943 | 9.146943 |
| K,pch | [-] 10.104 | 10.104 |
| τ,gr | [kN/m2] 110 | 110 |
| Ψ,A,max | [°] 90 | 90 |
| k | [cm/s] 100e-06 | 100e-06 |

Πορεία πρανούς:

x [m] 0.00 0.00
z [m] -8.15 0.00

Πορεία ανώτερου 2. στρώματος Αμμόδης ΑΡΓΙΛΟΣ:

x [m] 0.00 0.00
z [m] -8.15 -1.50

Πορεία ανώτερου 3. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ:

x [m] 0.00 0.00
z [m] -8.15 -4.50

Πορεία ανώτερου 4. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟΣ:

z= -10.00

| | | |
|---------|--------------------------------------|--------------|
| Part: | | Archive No.: |
| Block: | Please specify project informations. | Page: 58 |
| Record: | | |

| | |
|--|------------------|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | Job No.: |
| Program: WALLS-Retain. Version 2017.046 | |
| Structure: info@fides-dvp.de www.fides-dvp.de Tel:++49/89/143829-0 ASB Nr.: | Date: 08.10.2018 |

Πορεία ανώτερου 5. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ:
 z= -14.00

Επιφ. φορτία:
Φορτία

| xA | zA | xE | zE | PxA | PzA | PxE | PzE | Typ | LC-description |
|------|------|------|------|------|-------|------|-------|-----|----------------|
| [m] | [m] | [m] | [m] | [| kN/m² | |] | | Name |
| 1.00 | 0.00 | 3.50 | 0.00 | 0.00 | 33.00 | 0.00 | 33.00 | q | 1 |

Κατανομή εδαφ.πιέσεων

| | |
|----------------------------|------|
| Κατανομή εδαφ.πιέσεων | Name |
| Rectangular within a layer | |

Στάθμη νερού:

| | | |
|-------|--------|-------|
| x [m] | 0.00 | 0.00 |
| z [m] | -11.00 | -4.50 |

Αγκύρια

| z[m] | min.l[m] | Alpha[°] | C-H[kN/m] | P0[kN] | u0[m] |
|-------|----------|----------|-----------|--------|--------|
| -0.50 | 0.00 | 15.00 | 0.00 | 0.00 | 0.0000 |
| -3.00 | 0.00 | 15.00 | αόρισ. | 0.00 | 0.0000 |

Παράμετροι υπολογισμού
Earth pressure options
 Τμήμα εδαφ.ωθήσεων: Ενεργές ωθήσεις.
 Angle of slip plane: DIN 4085.
 Split block loads into 1 sections.
 Consideration of minimum earth pressure: φ,min = 40.000.
 Negative earth pressure fractions are set to zero.

Redistribution of earth pressure
 Shape of redistribution: Trapezoid.
 The earth pressure is getting redistrib. to: Excavation level
 The earth pressure below the excavation acts without redistrib.
 Levels of redistribution Z1: 0.000, Z2: -3.000 [m].
 The earth pressure from variable loads will be included in redistribution.

Παθητικές ωθήσεις
 Method of calculation: Κλασικός, Pregl/Sokolovsky (DIN 4085).

Options for water pressure
 Additional water and earth pressure from ground water flow is calculated.
 Negative flow pressure is set to zero.
 The proof of the basic hydraulic heave is performed.

Στήριξη πόδα
 Πόδας οριζοντίως μετακινούμενος

Αγκύρια
 Anchor checks (lower failure plane): Ναι
 Anchor forces with safety level of DS-P: Ναι
 Verification of grout body pull out forces: Ναι
 δ,a,Anchoring wall : used from soil layer.
 δ,p,Anchoring wall : used from soil layer.

Earth pressure coefficients kh

| φ | α | β | δ | k0gh | kagh | kach | kpgh | kpch | |
|------|-----|-----|-------|------|-------|-------|-------|---------|--------------------------|
| 33.0 | 0.0 | 0.0 | -22.0 | -- | -- | -- | 7.496 | -8.600 | Τεχνητές επιχωματώσεις |
| 25.0 | 0.0 | 0.0 | 16.7 | -- | 0.346 | 1.043 | -- | -- | " |
| 0.1 | 0.0 | 0.0 | 0.1 | -- | 0.996 | 1.994 | -- | -- | Αμμώδης ΑΡΓΙΛΟΣ |
| 33.0 | 0.0 | 0.0 | -22.0 | -- | -- | -- | 7.496 | -8.600 | Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ |
| 33.0 | 0.0 | 0.0 | 22.0 | -- | 0.245 | 0.855 | -- | -- | " |
| 35.0 | 0.0 | 0.0 | -23.3 | -- | -- | -- | 9.147 | -10.104 | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ |
| 35.0 | 0.0 | 0.0 | 23.3 | -- | 0.224 | 0.813 | -- | -- | " |
| 35.0 | 0.0 | 0.0 | -23.3 | -- | -- | -- | 9.147 | -10.104 | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ |

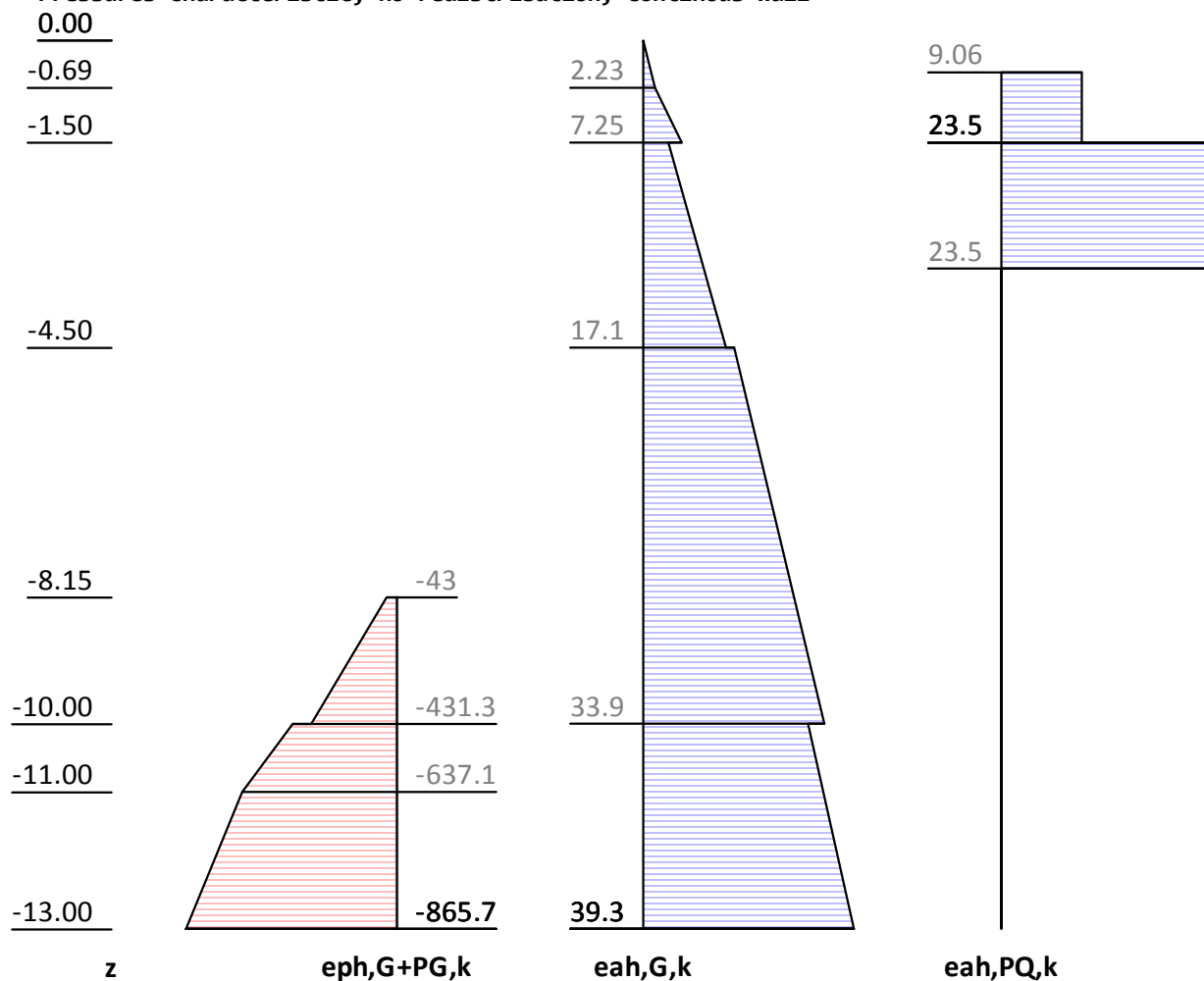
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| Part: Block: Please specify project informations. Record: | Archive No.: |
|---|--------------|

Page: 59

| φ | α | β | δ | k_{0gh} | k_{agh} | k_{ach} | k_{pgh} | k_{pch} |
|-----------|----------|---------|----------|-----------|-----------|-----------|-----------|-----------|
| 35.0 | 0.0 | 0.0 | 23.3 | -- | 0.224 | 0.813 | -- | -- |

Μήκος τοίχουFoot depth for statics: $z_f = -13.000$ **Stress analysis****Earth pressure, horizontal**

Pressures characteristic, no redistribution, continuous wall



| z [m] | eph, G, k [kN/m2] | eah, G, k [kN/m2] | eah, PQ, k [kN/m2] | eah, d [kN/m2] |
|----------|----------------------|----------------------|-----------------------|-------------------|
| 0.00 | | 0.00 | | 0.00 |
| -0.47 | | 1.52 | 0.00 | 2.04 |
| -0.47 | | 1.52 | 9.06 | 15.62 |
| -1.50 | | 7.25 | 9.06 | 23.37 |
| -1.50 | | 4.82 | 23.48 | 41.73 |
| -3.34 | | 11.39 | 23.48 | 50.60 |
| -3.34 | | 11.39 | 0.00 | 15.38 |
| -4.50 | | 15.54 | 0.00 | 20.98 |
| -4.50 | | 17.06 | 0.00 | 23.03 |
| -8.15 | -0.00 | 28.25 | 0.00 | 45.61 |
| -8.15 | -43.00 | 28.25 | 0.00 | 45.61 |
| -10.00 | -355.00 | 33.92 | 0.00 | 57.06 |
| -10.00 | -431.26 | 30.89 | 0.00 | 52.02 |
| -13.00 | -865.74 | 39.31 | 0.00 | 69.01 |

Eph, G, k: -2405.12, Eph, PG, k: 0.00 [kN/m]

Eah, G, k: 280.61, Eah, PG, k: 0.00, Eah, PQ, k: 52.53, Eah, d: 528.00

Earth pressure from water flow

Pressures characteristic, no redistribution, continuous wall

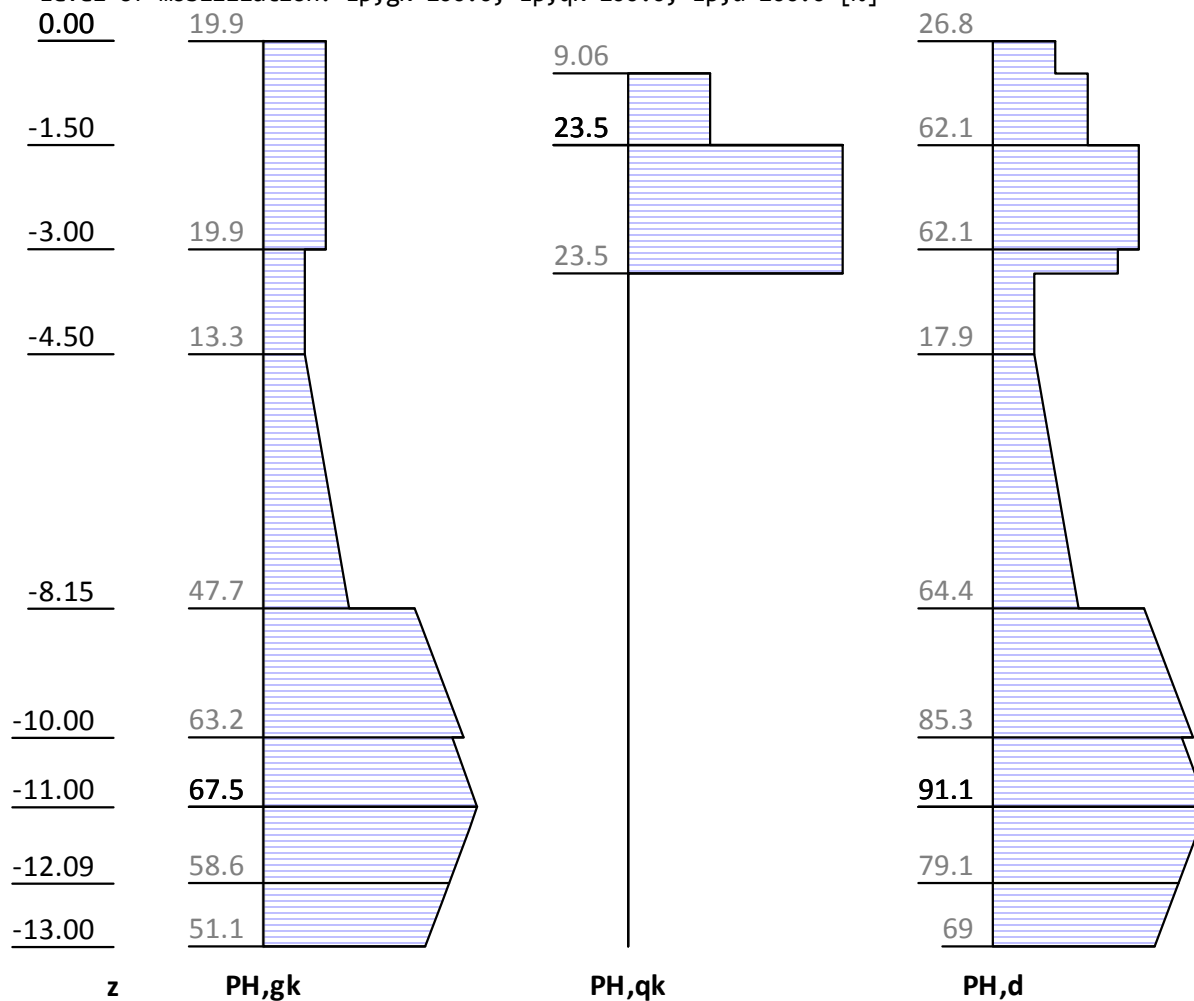
| z [m] | eph,dynW,k [kN/m2] | eph,dynW+G+PG,k [kN/m2] | eah,dynW,k [kN/m2] | eah,dynW+G+PG,k [kN/m2] | Ip [-] | Ia [-] |
|----------|-----------------------|----------------------------|-----------------------|----------------------------|-----------|-----------|
| -0.34 | | | 0.00 | | | |
| -1.50 | | | 0.00 | | | |
| -4.50 | | | 0.00 | | | |
| -8.15 | 0.00 | 0.00 | 5.54 | 0.00 | | 0.62 |
| -8.15 | 0.00 | -43.00 | 5.54 | -43.00 | | 0.62 |
| -10.00 | 0.00 | -355.00 | 8.35 | -355.00 | | 0.62 |
| -10.00 | 0.00 | -431.26 | 7.64 | -431.26 | | 0.62 |
| -11.00 | 0.00 | -637.07 | 9.03 | -637.07 | | 0.62 |
| -13.00 | 113.25 | -752.49 | 11.81 | -752.49 | 0.62 | 0.62 |

Πίεση νερού

| z [m] | Wp,st,k [kN/m2] | Wa,st,k [kN/m2] | Wp,dyn,k [kN/m2] | Wa,dyn,k [kN/m2] | W,tot,k [kN/m2] |
|----------|--------------------|--------------------|---------------------|---------------------|--------------------|
| -4.50 | | 0.00 | | 0.00 | 0.00 |
| -11.00 | 0.00 | 65.00 | 0.00 | -40.24 | 24.76 |
| -13.00 | -20.00 | 85.00 | -12.38 | -52.62 | 0.00 |

H-pressure on static system

Level of mobilization: Ep,gk 100.0, Ep,qk 100.0, Ep,d 100.0 [%]



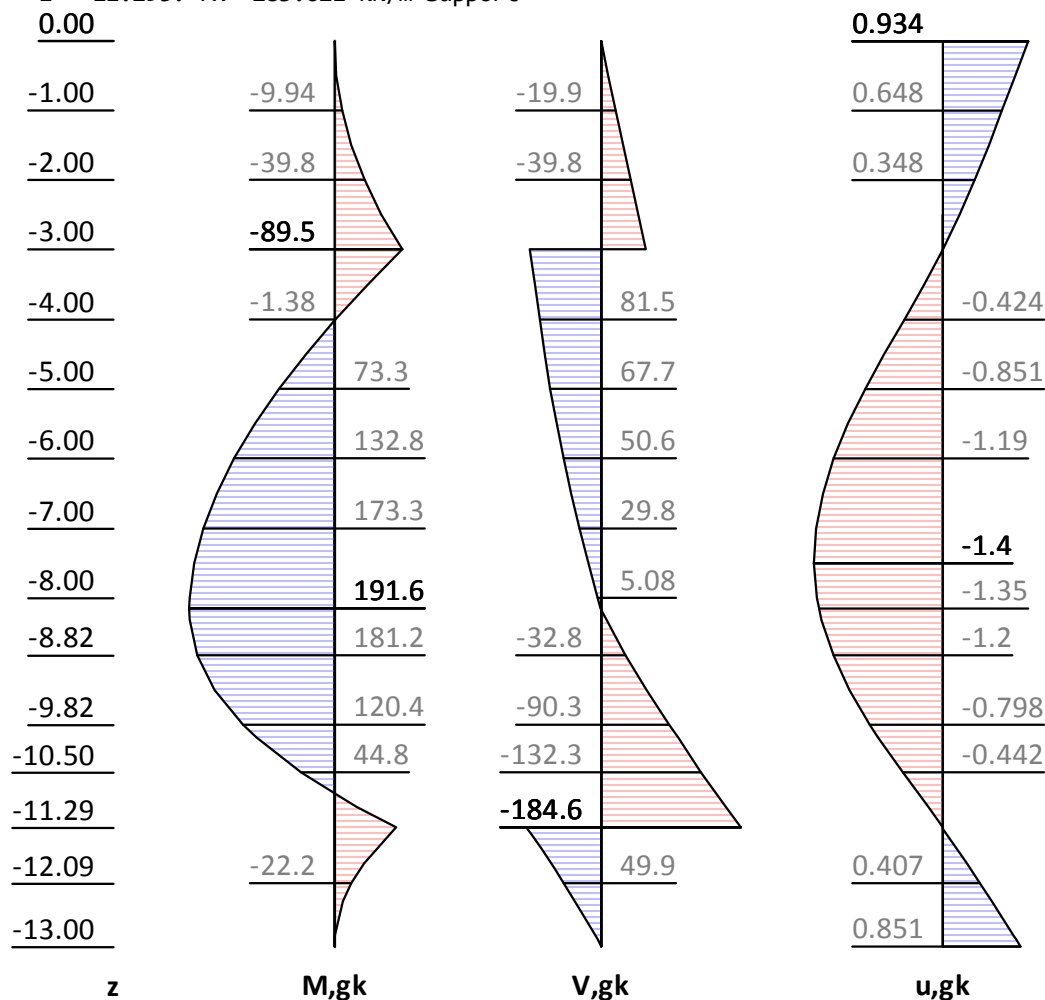
| z [m] | PH,gk [kN/m ²] | PH,qk [kN/m ²] | PH,d [kN/m ²] |
|----------|-------------------------------|-------------------------------|------------------------------|
| 0.00 | 19.88 | | 26.84 |
| -0.47 | 19.88 | 0.00 | 26.84 |
| -0.47 | 19.88 | 9.06 | 40.42 |
| -1.50 | 19.88 | 9.06 | 40.42 |
| -1.50 | 19.88 | 23.48 | 62.06 |
| -3.00 | 19.88 | 23.48 | 62.06 |
| -3.00 | 13.26 | 23.48 | 53.12 |
| -3.34 | 13.26 | 23.48 | 53.12 |
| -3.34 | 13.26 | 0.00 | 17.90 |
| -8.15 | 27.16 | 0.00 | 36.67 |
| -8.15 | 47.69 | 0.00 | 64.38 |
| -10.00 | 63.22 | 0.00 | 85.34 |
| -10.00 | 59.48 | 0.00 | 80.30 |
| -11.00 | 67.49 | 0.00 | 91.11 |
| -13.00 | 51.11 | 0.00 | 69.01 |

V-pressure on static system**Internal forces: Permanent, characteristically**

z= -0.500. Fx= -0.000 kN/m Support

z= -3.000. Fx=-154.355 kN/m Support

z= -11.295. Fx=-283.621 kN/m Support

0.00

| | | | | | |
|---|--------------------|--------------------|--------------------|--------------------|------------------|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | | | | | Job No.: |
| Program: WALLS-Retain. Version 2017.046 | | | | | |
| Structure: info@fides-dvp.de www.fides-dvp.de Tel:++49/89/143829-0 ASB Nr.: | | | | | Date: 08.10.2018 |
| z [m] | H, g, k [kN/m2] | M, g, k [kN/m2] | V, g, k [kN/m2] | N, g, k [kN/m2] | u, g, k [mm] |
| 0.00 | 19.88 | -0.00 | 0.00 | 0.00 | 0.93 |
| -0.00 | 19.88 | -0.00 | 0.00 | -0.00 | 0.93 |
| -3.00 | 19.88 | -89.46 | -59.64 | -81.14 | -0.00 |
| -3.00 | 13.26 | -89.46 | 94.72 | -122.50 | -0.00 |
| -4.02 | 13.26 | 0.00 | 81.23 | -147.97 | -0.43 |
| -7.50 | 24.69 | 185.28 | 17.89 | -224.78 | -1.40 |
| -8.15 | 27.16 | 191.63 | 1.06 | -236.09 | -1.35 |
| -8.15 | 47.69 | 191.63 | 1.06 | -236.09 | -1.35 |
| -8.17 | 47.87 | 191.57 | 0.00 | -236.66 | -1.35 |
| -10.00 | 63.22 | 103.12 | -101.53 | -287.82 | -0.71 |
| -10.00 | 59.48 | 103.12 | -101.53 | -287.82 | -0.71 |
| -10.80 | 65.90 | -0.00 | -152.01 | -311.87 | -0.27 |
| -11.00 | 67.49 | -29.49 | -165.02 | -317.95 | -0.16 |
| -11.29 | 65.11 | -81.06 | -184.57 | -327.18 | 0.00 |
| -11.29 | 65.11 | -81.06 | 99.05 | -327.18 | 0.00 |
| -13.00 | 51.11 | -0.00 | 0.00 | -383.63 | 0.85 |
| -13.00 | 51.11 | 0.00 | 0.00 | -383.63 | 0.85 |

Internal forces: Variable, characteristically
 Method EB 82-4 ($Q = [G+Q] - G$).
 z= -0.500. Fx= 0.000 kN/m Support
 z= -3.000. Fx= -57.819 kN/m Support
 z= -11.295. Fx= 5.287 kN/m Support
0.00

0.14
 -4.8
-45.2
 -39.1
 -35.9
 -30.6
 -25.4
 -20.1
 -16.6
 -13.1
 -7.8

-4.8
 -21.1
-44.5
 5.29
 5.29
 5.29
 5.29

-0.519
 -0.339
 -0.161
 0.102
 0.159
 0.21
0.227
 0.213
 0.191
 0.16
 0.101
 0.0559
 -0.0564
 -0.121

z
M,qk
V,qk
u,qk

Part:

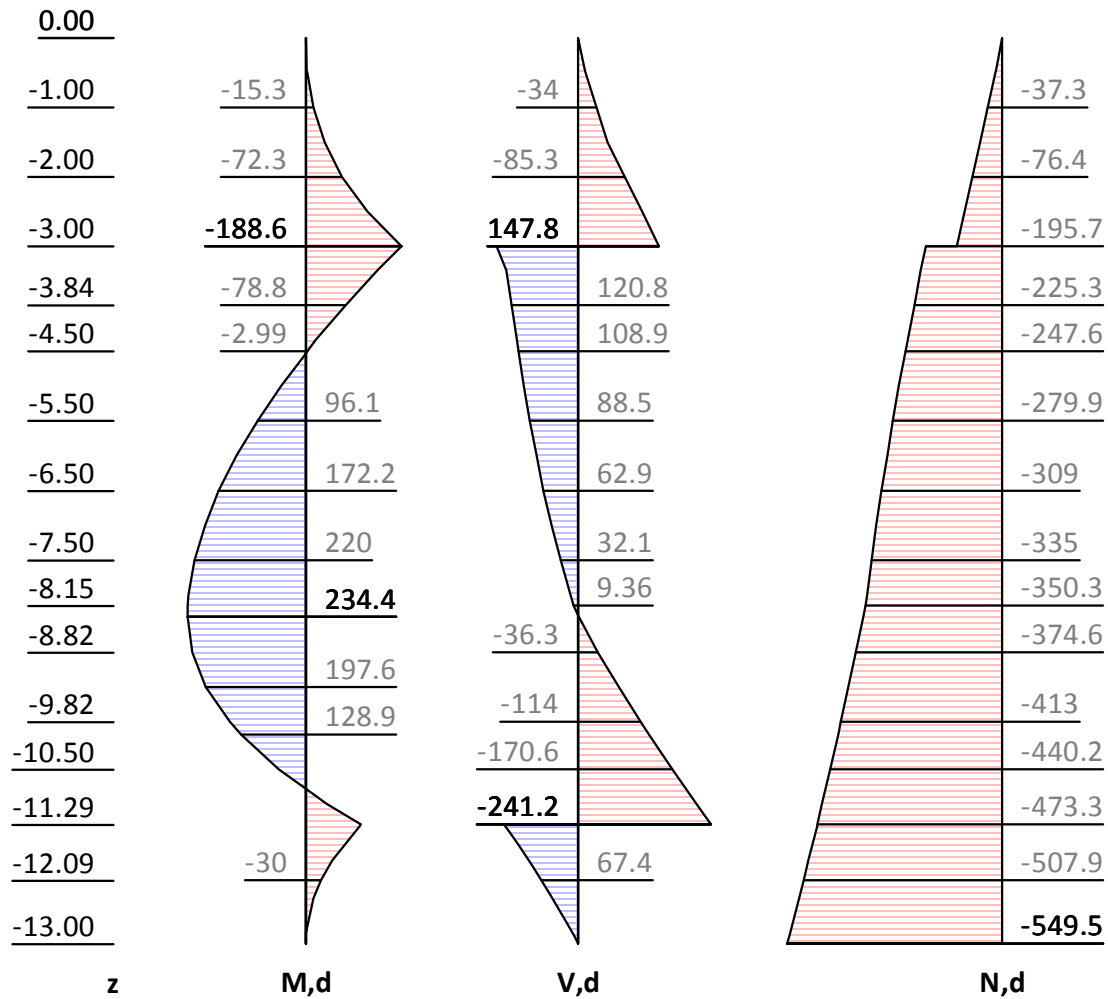
Block: Please specify project informations.

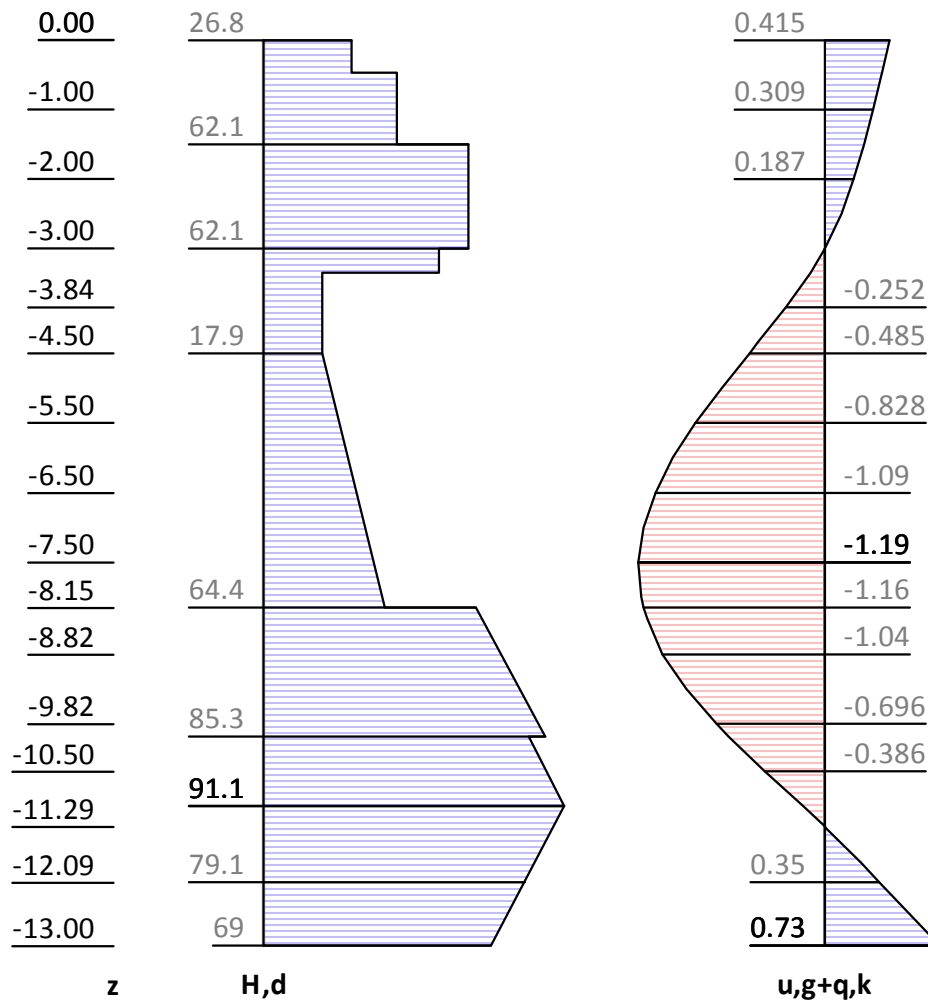
Record:

Page: 63

Archive No.:

z= -0.500. Fx= -0.000 kN/m Support
z= -3.000. Fx=-295.109 kN/m Support
z= -11.295. Fx=-374.958 kN/m Support





| z [m] | H,d [kN/m²] | M,d [kN/m²] | V,d [kN/m²] | N,d [kN/m²] | u,g+q,k [mm] |
|----------|----------------|----------------|----------------|----------------|-----------------|
| 0.00 | 26.84 | 0.00 | -0.00 | 0.00 | 0.41 |
| -0.47 | 26.84 | -2.96 | -12.61 | -17.16 | 0.37 |
| -0.47 | 40.42 | -2.96 | -12.61 | -17.16 | 0.37 |
| -1.50 | 40.42 | -37.40 | -54.25 | -56.25 | 0.25 |
| -1.50 | 62.06 | -37.40 | -54.25 | -56.25 | 0.25 |
| -3.00 | 62.06 | -188.58 | -147.33 | -116.60 | 0.00 |
| -3.00 | 62.06 | -188.58 | -147.33 | -116.60 | -0.00 |
| -3.00 | 53.12 | -188.58 | 147.77 | -195.68 | -0.00 |
| -3.34 | 53.12 | -141.41 | 129.71 | -208.44 | -0.09 |
| -3.34 | 17.90 | -141.41 | 129.71 | -208.44 | -0.09 |
| -4.53 | 18.05 | 0.00 | 108.40 | -248.58 | -0.49 |
| -7.50 | 33.33 | 220.03 | 32.09 | -335.03 | -1.19 |
| -8.15 | 36.67 | 233.76 | 9.36 | -350.29 | -1.16 |
| -8.15 | 64.38 | 233.76 | 9.36 | -350.29 | -1.16 |
| -8.29 | 66.00 | 234.31 | -0.00 | -355.40 | -1.14 |
| -8.32 | 66.31 | 234.41 | -1.75 | -356.35 | -1.14 |
| -10.00 | 85.34 | 128.94 | -129.14 | -420.13 | -0.62 |
| -10.00 | 80.30 | 128.94 | -129.14 | -420.13 | -0.62 |
| -10.78 | 88.74 | 0.00 | -195.49 | -451.76 | -0.25 |
| -11.00 | 91.11 | -42.15 | -214.84 | -460.80 | -0.14 |
| -11.29 | 87.90 | -109.44 | -241.24 | -473.26 | 0.00 |
| -11.29 | 87.90 | -109.44 | 133.72 | -473.26 | 0.00 |
| -13.00 | 69.01 | 0.00 | 0.00 | -549.47 | 0.73 |

Anchor forces with safety level of DS-P

| z[m] | A,d[kN] | F _{x,d} [kN/m] |
|-------|---------|-------------------------|
| -0.50 | 0.0 | -0.0 |
| -3.00 | 275.0 | -295.1 |

Checks of earth statics**Check of earth support**

Check: Mobilizable earth resistance is sufficient for earth support force.

z: -11.29 m

Rd = Eph,k/γ,Re = 2291.88 / 1.400 = 1637.05 [kN/m]

Ed(Uh,d)/Rd = 374.96 / 1637.05 = 0.229 [-]. Passes requirement

Sum of H and V forces, (G)

Forces up to depth z:-13.00

| Pos. | H | V |
|----------------------------------|---------|-----------------------|
| H/V pressure G+P+W,k | 437.98 | 125.33 |
| Wall weight | | 228.91 |
| H/V pressure passive | | 0.00 |
| Support z: -0.50 | | 0.00 |
| Support z: -3.00 | -154.36 | 41.36 |
| Bh,g,k z=-11.29 | -283.62 | |
| Bv,g,k = Bh,k * tan(δ,p=-23.33°) | | -122.34 |
| Σ | 0.00 | 273.25 (downwards) |

Average anchor inclination α,A = 15.00° >= 15°.

Verification of vertical forces due to EAB R 9 not required (R 9-5).

Check EAB R 9-1

Vertical component of earth resistance is less than the downwards pointing vertical forces.

Vk >= Bvk: 395.60 >= 122.34 Passes requirement

Sum of H and V forces, (G+Q)

Forces up to depth z:-13.00

| Pos. | H | V |
|----------------------------------|---------|-----------------------|
| H/V pressure G+P+W,k | 490.51 | 130.88 |
| Wall weight | | 228.91 |
| H/V pressure passive | | 0.00 |
| Support z: -0.50 | | 0.00 |
| Support z: -3.00 | -212.17 | 56.85 |
| Bh,g,k z=-11.29 | -283.62 | |
| Bv,g,k = Bh,k * tan(δ,p=-23.33°) | | -122.34 |
| Bh,q,k z=-11.29 | 5.29 | |
| Bv,q,k = Bh,k * tan(δ,p=-23.33°) | | 2.28 |
| Σ | -0.00 | 296.58 (downwards) |

Average anchor inclination α,A = 15.00° >= 15°.

Verification of vertical forces due to EAB R 9 not required (R 9-5).

Check EAB R 9-1

Vertical component of earth resistance is less than the downwards pointing vertical forces.

Vk >= Bvk: 416.64 >= 120.06 Passes requirement

| | |
|--|------------------|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | Job No.: |
| Program: WALLS-Retain. Version 2017.046 | |
| Structure: info@fides-dvp.de www.fides-dvp.de Tel:++49/89/143829-0 ASB Nr.: | Date: 08.10.2018 |

Hydraulic heave

Safety factors: [HYD]
 γ, G, stb : 0.900
 γ, H : 1.600

Stream length $l, tot=10.50$ m. $Sum(h, i/k, i)=105000.00$ 1/100s.

Στρώμα "Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ" z: -11.00 / -13.00, h= 2.00m
 $Ed=\Sigma(\gamma_w \cdot h \cdot i) \cdot \gamma, H = 12.38 \cdot 1.600 = 19.81$ (i=0.619)
 $Rd=\Sigma(\gamma \cdot h) \cdot \gamma, G, stb = 89.13 \cdot 0.900 = 80.21$
Ed/Rd = 0.247 [-]

Anchor verification

Anchor - Stability of lower failure plane

Περίπτ.Φόρτισης: όλα τα φορτία BS-P
 Αυτόμ. υπολογ. μήκους αγκυρίων:
 All anchors are extended (if necessary)
 Favourable variable loads in main failure body are not being considered.
 Bottom of lower failure plane: z=-13.00 m

Iteration of failure mechanisms:
 lA: Length of anchor from head to center of grout body.
 W,k: Res. force from dead weight, loads, cohesion, ...
 Q,k: Force in lower failure plane.
 Ea1,k.....: Earth pressure onto vertical separation plane.
 Ea2,k.....: Earth pressure between wall and main failure body.
 Ra_cal,d: Dimesioning force of the resistance from the equilibrium of forces.
 Ra_cal,d corresponds to the max. possible anchor force of the force polygon.
 Sum(A,d): Acting anchor forces along the grout body fractions within the failure body. Sum(A,d) is gained from the anchor pull forces of the wall analysis.

| z | $\vartheta 1$ | $\vartheta 2$ | lA | W,k | Q,k | Ea1,k | Ea2,k | Ra_cal,d | Sum(A,d) | Ed/Rd |
|-------|---------------|---------------|-------|--------|--------|--------|--------|----------|----------|-------|
| [m] | [°] | [°] | [m] | [kN/m] | [kN/m] | [kN/m] | [kN/m] | [kN/m] | [kN/m] | [-] |
| -0.50 | 36.9 | 57.5 | 12.72 | 1672.1 | 1486.3 | 4.4 | 350.5 | 219.9 | 218.9 | 1.00 |
| -3.00 | 31.3 | 61.0 | 11.81 | 1674.8 | 1455.3 | 40.3 | 350.5 | 306.3 | 305.4 | 1.00 |

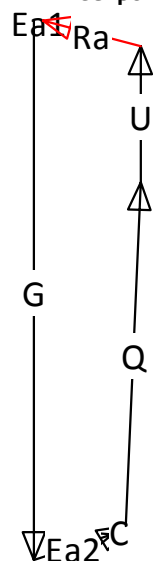
Decisive failure body:
Γεωμετρία:
 Foot point of lower failure plane x/z = 0.01/-13.00 m
 Intersection lower/upper slid. plane x/z = 11.41/ -6.06 m
 Intersection upper slid. plane/surface x/z = 14.77/ 0.00 m
 Intersection separation plane/surface x/z = 11.41/ 0.00 m
 Inclination lower failure plane $\vartheta 1 = 31.34^\circ$
 Inclination upper failure plane $\vartheta 2 = 60.97^\circ$
 Inclination separation plane $\vartheta 12 = 90.00^\circ$

Loads / forces (char.)

| | | Fx [kN/m] | Fz [kN/m] | F [kN/m] | |
|------------------------------------|-----------|--------------|--------------|-------------|----------------------|
| Weight of main failure body | G,k: | 0.0 | -2281.9 | 2281.9 | |
| Cohesion of lower failure plane | C,k: | 57.0 | 34.7 | 66.7 | |
| Pore water pressure on main body | U,k: | -0.1 | 573.3 | 573.3 | |
| Earth pres. on separation plane | Ea1,k: | -40.3 | -0.0 | 40.3 | $\delta = 0.0^\circ$ |
| Earth pr. between wall<->main body | Ea2,k: | 333.1 | 109.0 | 350.5 | |
| Force in lower failure plane | Q,k: | 64.4 | 1453.8 | 1455.3 | |
| Sum = possible anchor forces: | Ra_cal,k: | 414.2 | -111.0 | 428.9 | |

| | |
|---|--------------|
| Part: Block: Please specify project informations. Record: | Archive No.: |
|---|--------------|

Page: 68

Force polygon

Acting anchor forces $E_d: \sum(A,d) = 305.4 \text{ kN/m}$
 Possible anchor forces $R_d: R_{a_cal,d} = 428.9/1.400 = 306.3 \text{ kN/m}$

Verif. of lower failure plane $E_d/R_d = 1.00 < 1.0$: Έλεγχος εκπληρώθηκε.

Check of steel tension

l_{tot} ...[m]: Total length of anchor incl. excess length at head

A_s [mm²]: X-section area of steel member

$R_{i,d}$...[kN]: Ultimate strength of tension member ($\gamma, M=1.15$)

$A_{d,d}$ [kN]: Dimensioning force of the anchor from wall analysis

| z[m] | Anchor type | l_{tot} | A_s | $R_{i,d}$ | $A_{d,d}$ |
|-------|--------------------------|-----------|-------|-----------|-----------|
| -0.50 | Strand;3x0.60";1570/1770 | 17.22 | 420 | 573.4 | 0.0 |
| -3.00 | Strand;3x0.60";1570/1770 | 15.81 | 420 | 573.4 | 275.0 |

Check of steel tension: Passes requirement

Check of anchor's soil friction

$l_{V,k}$: Length of grout body

$d_{mV,k}$: Diameter of grout body

$\tau_{Gr,k}$: Average applied skin friction along the grout body (from soil parameters)

$R_{a,k}$: Charact. pullout resistance of the anchor

γ_A : Partial safety factor of anchor pullout

$R_{a,d}$: $R_{a,k} / \gamma_A$

$A_{d,d}$: Dimensioning force of the anchor from wall analysis

| z | $l_{V,k}$ | $d_{mV,k}$ | $\tau_{Gr,k}$ | $R_{a,k}$ | γ_A | $R_{a,d}$ | $A_{d,d}$ | $A_{d,d}/R_{a,d}$ |
|-------|-----------|------------|----------------------|-----------|------------|-----------|-----------|-------------------|
| [m] | [m] | [mm] | [kN/m ²] | [kN] | [-] | [kN] | [kN] | [-] |
| -0.50 | 8.00 | 318 | 110 | 879.1 | 1.100 | 799.2 | 0.0 | 0.0 |
| -3.00 | 8.00 | 318 | 110 | 879.1 | 1.100 | 799.2 | 275.0 | 0.3 |

Check of anchor's soil friction: Passes requirement

Υπολογ. κύκλου ολίσθησης

LC: όλα τα φορτία Type: BS-T (combination: [GEO] A2 M2 R3, BS-T)

Vertical variable loads only act if they are outside of $R \cdot \sin(\phi)$.

The automatic slip circle optimization only considers circles that intersect the surface with an area of at least 0.25 m².

The slip circle calculation only accepts circles including the wall.

The slipcircle calculation only allows circular failure planes (no vertical tangents will occur).

Γεωμετ. κύκλου (μήκη και συντεταγμ. σε (m))

Κέντρο = $(-1.95, 1.39)$, Ακτίνα = 14.53

Αρχ.σημ. = (-12.91, -8.15), Τελ.σημ. = (12.51, 0.00)

Γεωμετρία λωρίδων:

| No | x | Width b | dxM | Weight | Load z-κατ. [kN/m] | Water- φορτ. [kN/m] | u*b | φ | c | θ |
|----|--------|------------|--------|--------|--------------------------|---------------------------|--------|-------|----------------------|---------|
| | [m] | [m] | [m] | [kN/m] | | [kN/m] | [kN/m] | [°] | [kN/m ²] | [°] |
| 1 | -12.18 | 1.45 | -10.23 | 25.4 | 0.0 | 0.0 | -0.0 | 27.45 | 3.57 | -31.27* |
| 2 | -10.73 | 1.45 | -8.78 | 66.6 | 0.0 | 0.0 | -0.0 | 29.26 | 3.57 | -30.37* |
| 3 | -9.28 | 1.45 | -7.33 | 98.3 | 0.0 | 0.0 | -4.0 | 29.26 | 3.57 | -30.29 |
| 4 | -7.82 | 1.45 | -5.87 | 122.6 | 0.0 | 0.0 | -12.7 | 29.26 | 3.57 | -23.85 |
| 5 | -6.37 | 1.45 | -4.42 | 140.6 | 0.0 | 0.0 | -20.8 | 29.26 | 3.57 | -17.72 |
| 6 | -4.92 | 1.45 | -2.97 | 153.1 | 0.0 | 0.0 | -26.4 | 29.26 | 3.57 | -11.79 |
| 7 | -3.46 | 1.45 | -1.52 | 160.6 | 0.0 | 0.0 | -29.7 | 29.26 | 3.57 | -5.99 |
| 8 | -2.01 | 1.45 | -0.06 | 163.1 | 0.0 | 0.0 | -30.8 | 29.26 | 3.57 | -0.25 |
| 9 | -0.56 | 1.45 | 1.39 | 189.4 | 0.0 | 0.0 | -77.1 | 29.26 | 3.57 | 5.49 |
| 10 | 0.89 | 1.45 | 2.84 | 399.7 | 0.0 | 0.0 | -121.2 | 29.26 | 3.57 | 11.28 |
| 11 | 2.35 | 1.45 | 4.29 | 387.6 | 0.0 | 0.0 | -115.8 | 29.26 | 3.57 | 17.20 |
| 12 | 3.80 | 1.45 | 5.75 | 370.1 | 0.0 | 0.0 | -108.0 | 29.26 | 3.57 | 23.31 |
| 13 | 5.25 | 1.45 | 7.20 | 346.4 | 0.0 | 0.0 | -97.4 | 29.26 | 3.57 | 29.71 |
| 14 | 6.71 | 1.45 | 8.65 | 315.4 | 0.0 | 0.0 | -83.5 | 29.26 | 3.57 | 36.56 |
| 15 | 8.16 | 1.45 | 10.11 | 275.1 | 0.0 | 0.0 | -65.4 | 27.45 | 3.57 | 44.08 |
| 16 | 9.61 | 1.45 | 11.56 | 221.6 | 0.0 | 0.0 | -41.1 | 27.45 | 3.57 | 52.71 |
| 17 | 11.43 | 2.18 | 13.37 | 180.2 | 0.0 | 0.0 | -20.3 | 0.08 | 35.71 | 67.00 |

*** Σημείωση: Στις λωρίδες σημειωμένες με '*'
περιορίστηκε το theta στο 45°-Phi/2.

Συνεισφ. κατακόρυφων φορτίων:

| No | Weight | $G \cdot \sin(\theta)$ | $(G \cdot u^*b) \cdot \tan(\varphi) + c^*b$ | $\mu^* \sin(\theta) \cdot \tan(\varphi) + \cos(\theta)$ | T |
|----|--------|------------------------|---|---|------------------|
| | [kN/m] | [kN/m] | [kN/m] | [-] | [kN/m] |
| 1 | 25.35 | -17.86 | 18.36 | 0.713407 | 25.73 |
| 2 | 66.61 | -40.26 | 42.50 | 0.714382 | 59.49 |
| 3 | 98.32 | -49.59 | 58.01 | 0.715470 | 81.08 |
| 4 | 122.59 | -49.57 | 66.73 | 0.795925 | 83.84 |
| 5 | 140.62 | -42.80 | 72.31 | 0.863230 | 83.77 |
| 6 | 153.13 | -31.30 | 76.19 | 0.918917 | 82.92 |
| 7 | 160.56 | -16.76 | 78.50 | 0.963908 | 81.44 |
| 8 | 163.15 | -0.71 | 79.30 | 0.998707 | 79.40 |
| 9 | 189.37 | 18.11 | 68.08 | 1.023480 | 66.52 |
| 10 | 399.68 | 78.19 | 161.20 | 1.038088 | 155.28 |
| 11 | 387.63 | 114.59 | 157.46 | 1.042060 | 151.10 |
| 12 | 370.11 | 146.43 | 152.03 | 1.034514 | 146.95 |
| 13 | 346.43 | 171.70 | 144.69 | 1.013984 | 142.70 |
| 14 | 315.43 | 187.88 | 135.10 | 0.978057 | 138.14 |
| 15 | 275.13 | 191.39 | 114.15 | 0.907735 | 125.76 |
| 16 | 221.65 | 176.35 | 98.97 | 0.822336 | 120.36 |
| 17 | 180.15 | 165.84 | 77.95 | 0.391345 | 199.19 |
| | | ----- 1001.62 | | | ----- 1823.66 |

Συνεισφ. αγκυρίων: Αθρ. ροπών ανατροπής : -491.0 kN*m/m
" " resisting : 349.9 kN*m/m

Δράση $E_d = (1001.6 \cdot 14.53 - 491.0)$

Αντίσταση $R_d = (1823.7 \cdot 14.53 + 349.9)$

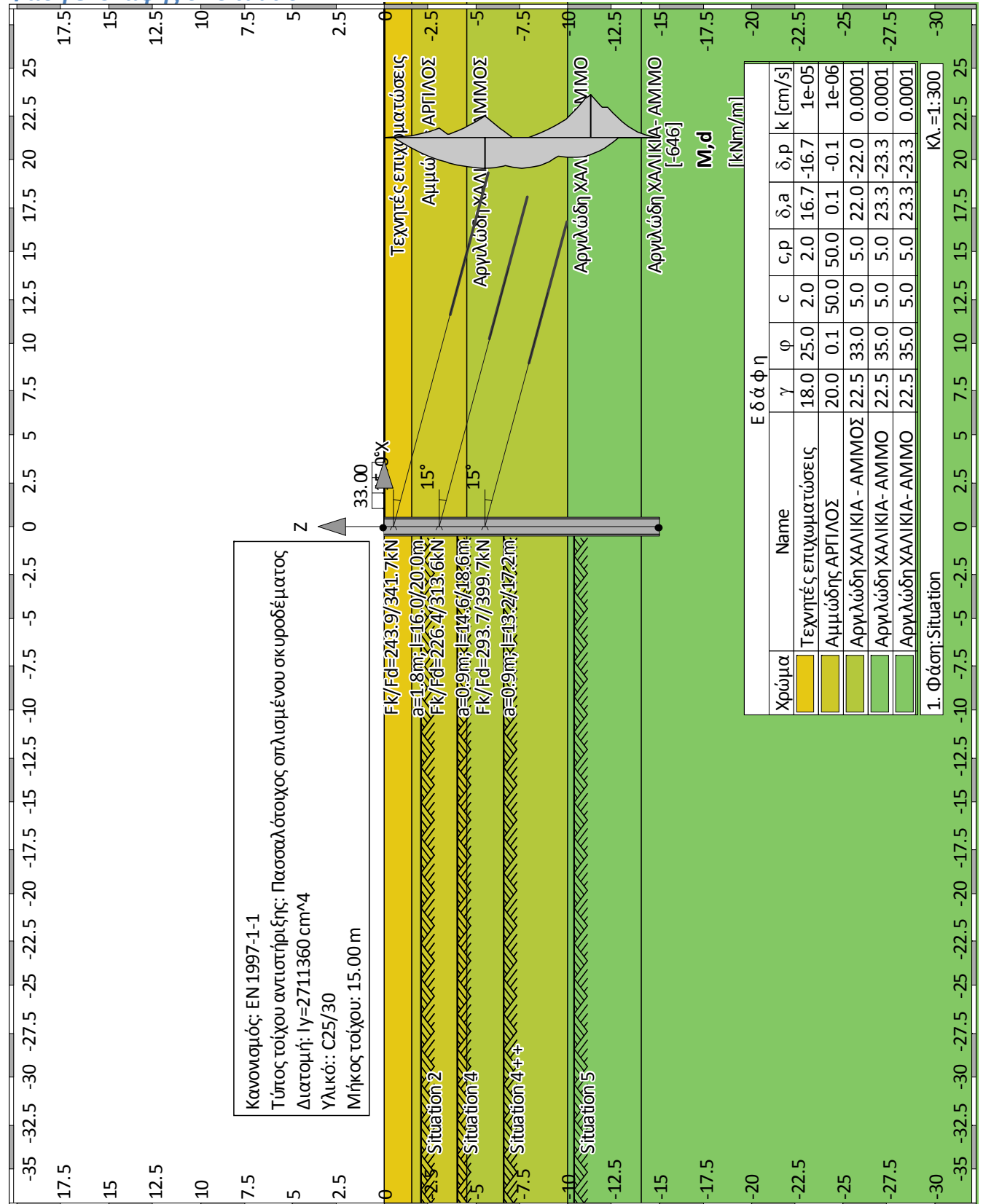
SLIP-CIRCLE $\mu = E_d/R_d = 0.52 < 1.0$: Έλεγχος εκπληρώθηκε.

ΠΑΡΑΡΤΗΜΑ

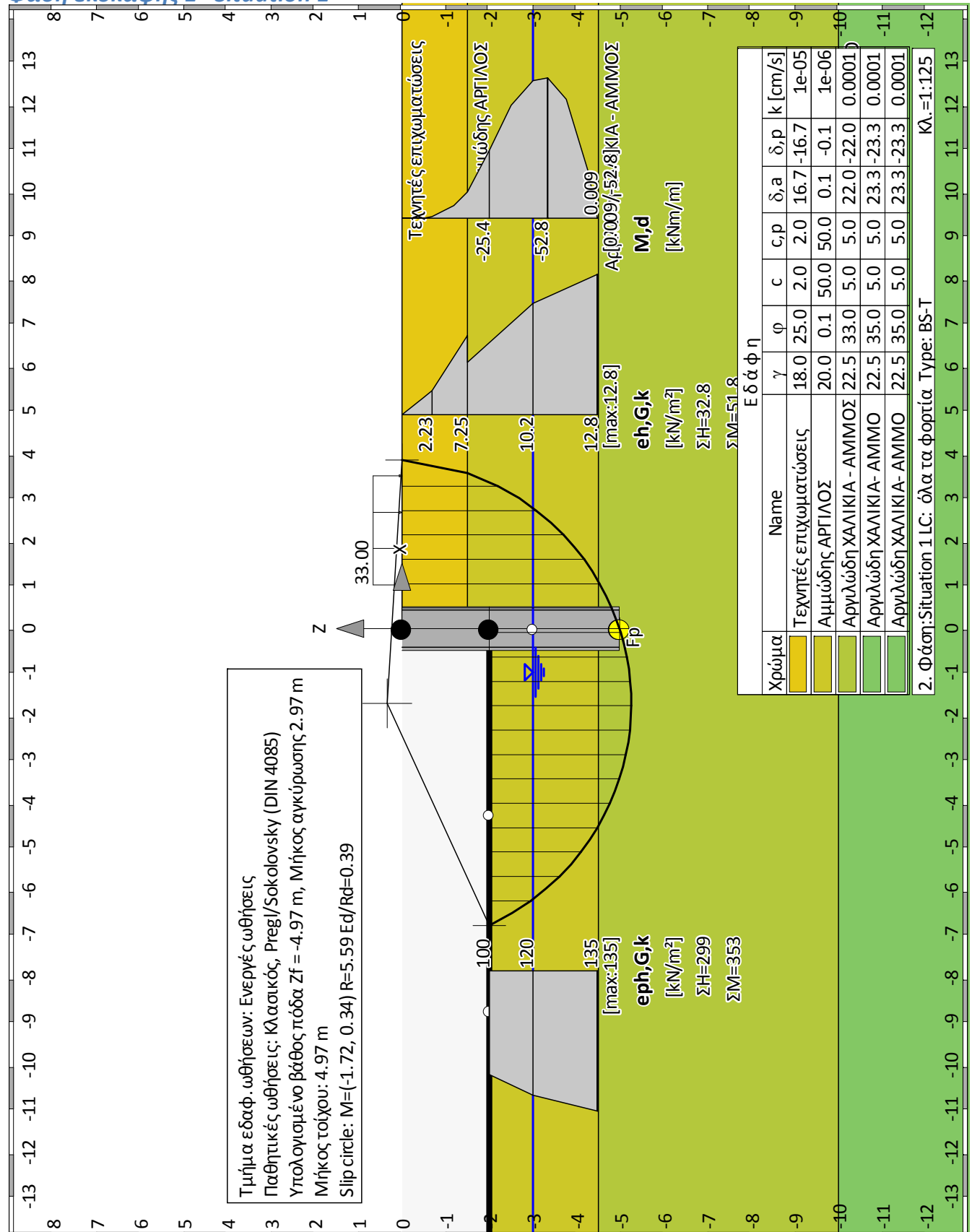
8.5 Αποτελέσματα ανάλυσης

8.5.3 Έλεγχος θραύσης πυθμένα

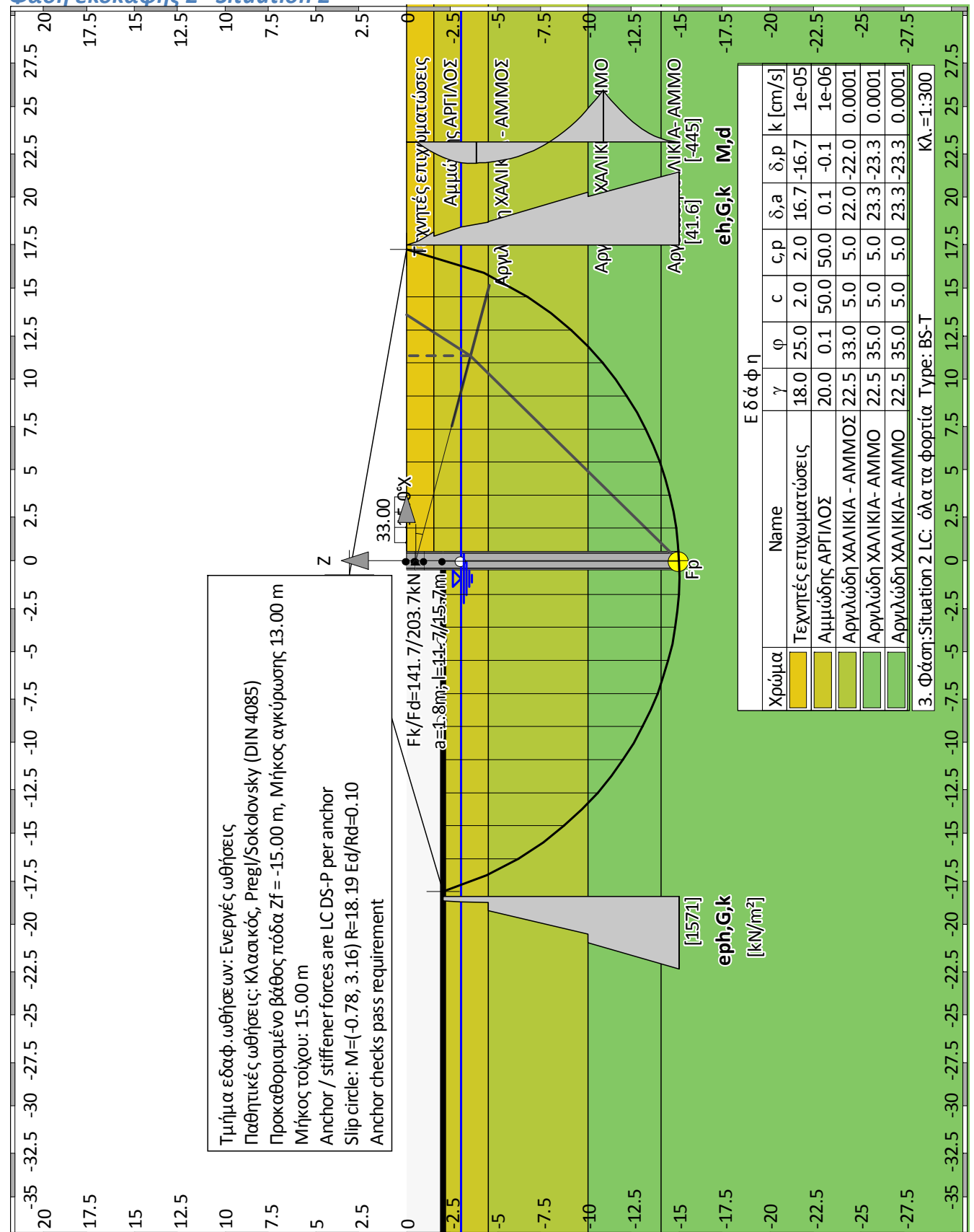
- i) Αντιστηριζόμενο ύψος 9,70m

Summary of all stages**Φάση εκσκαφής 0 "Situation"**

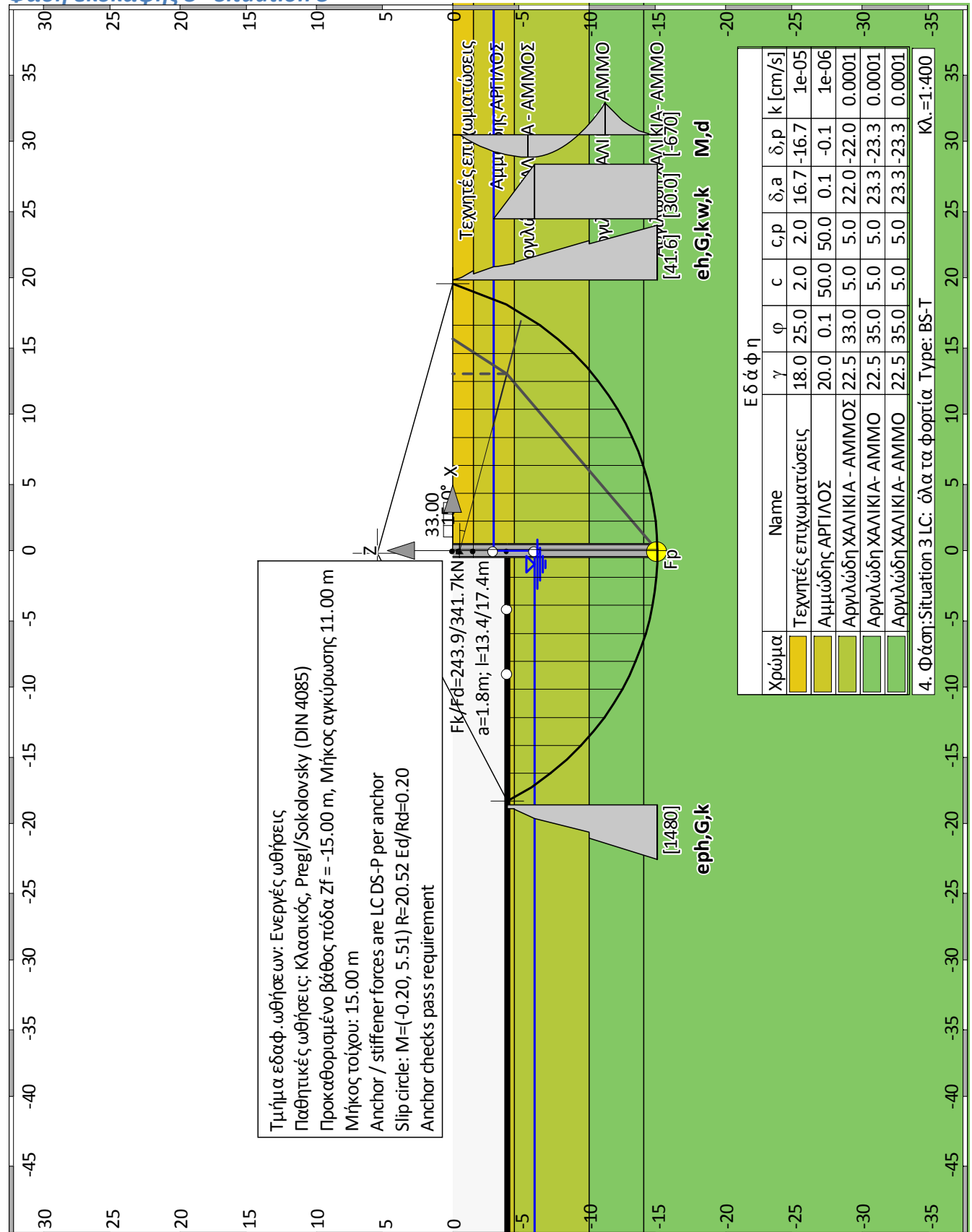
Φάση εκσκαφής 1 "Situation 1"



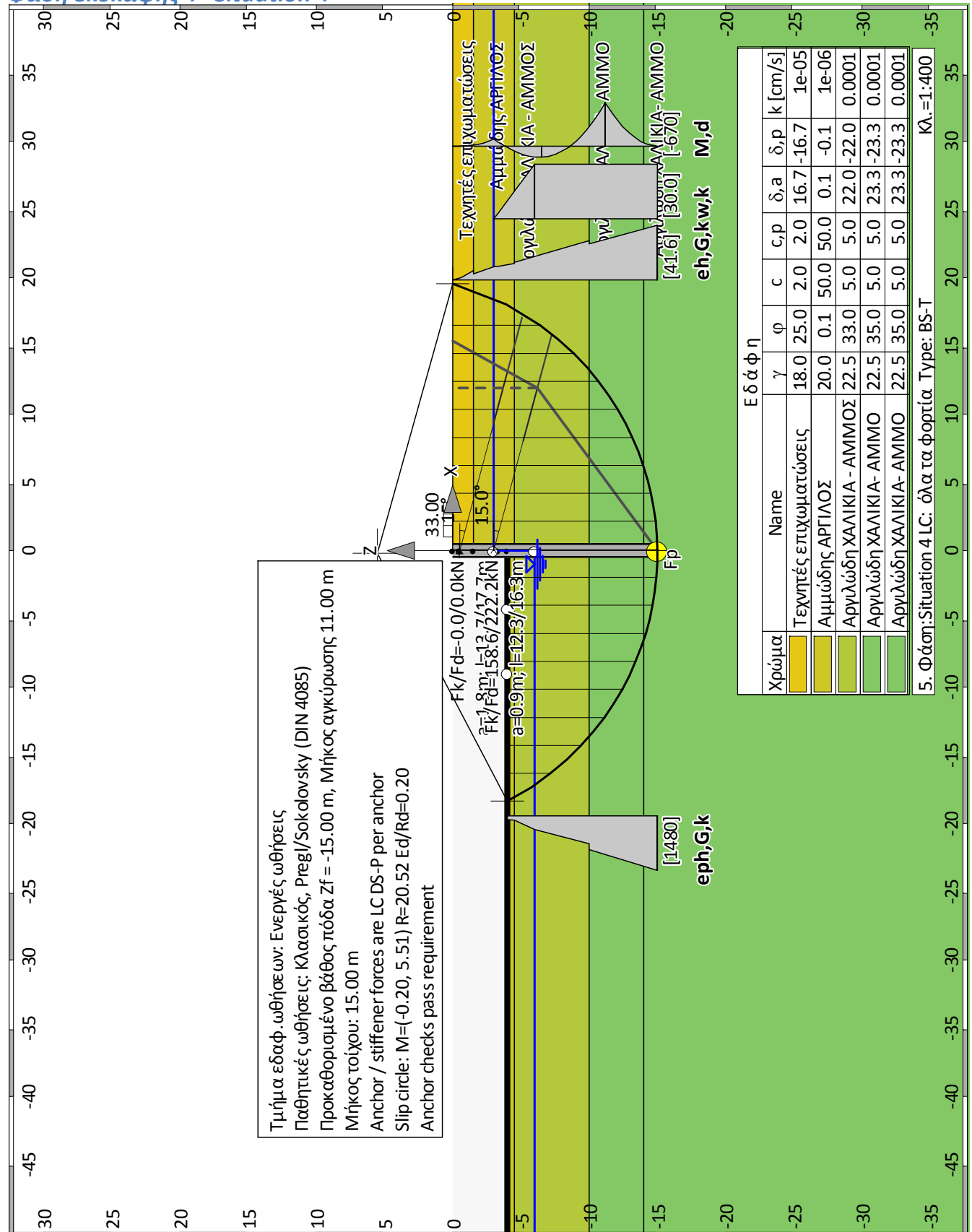
Φάση εκσκαφής 2 "Situation 2"



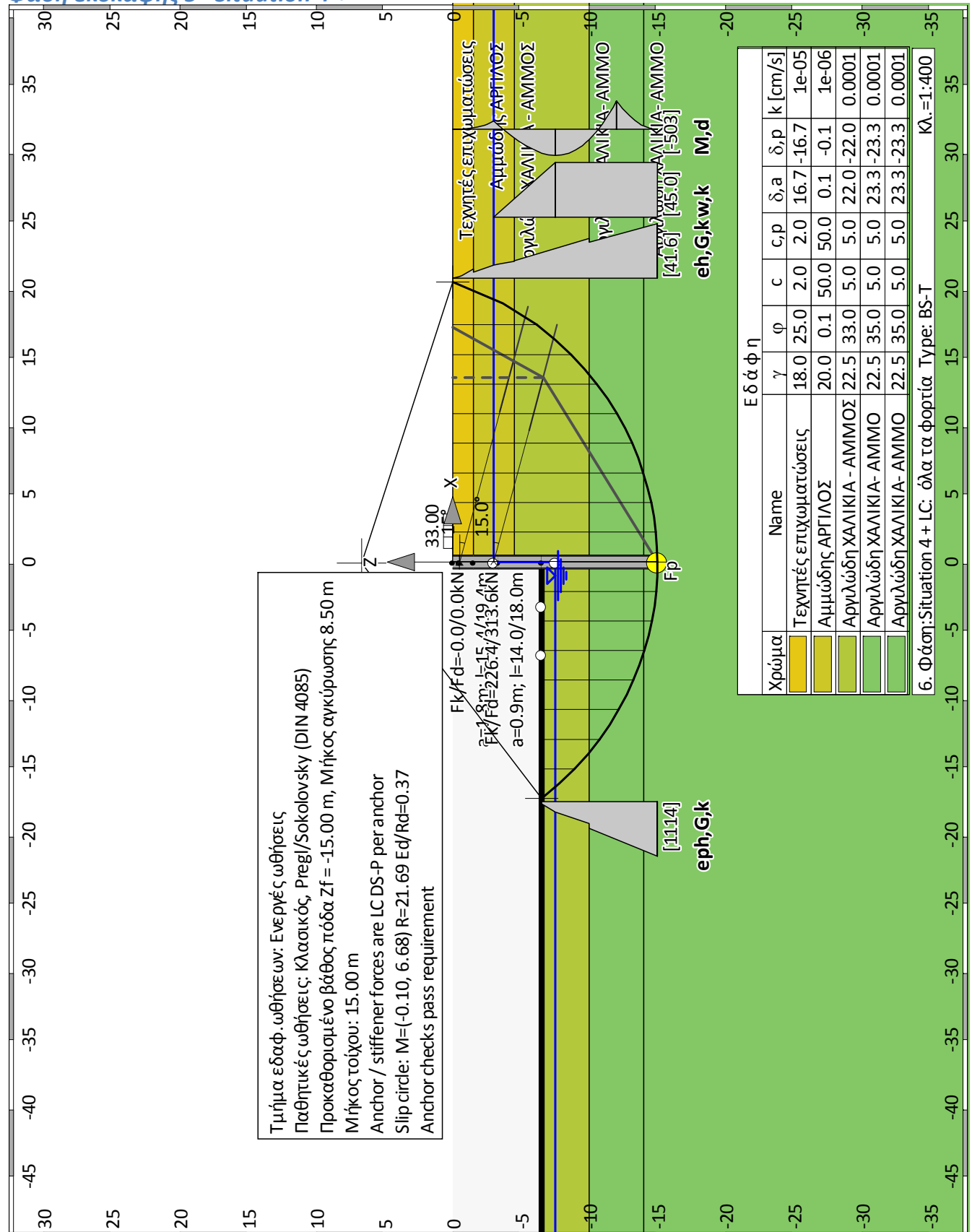
Φάση εκσκαφής 3 "Situation 3"



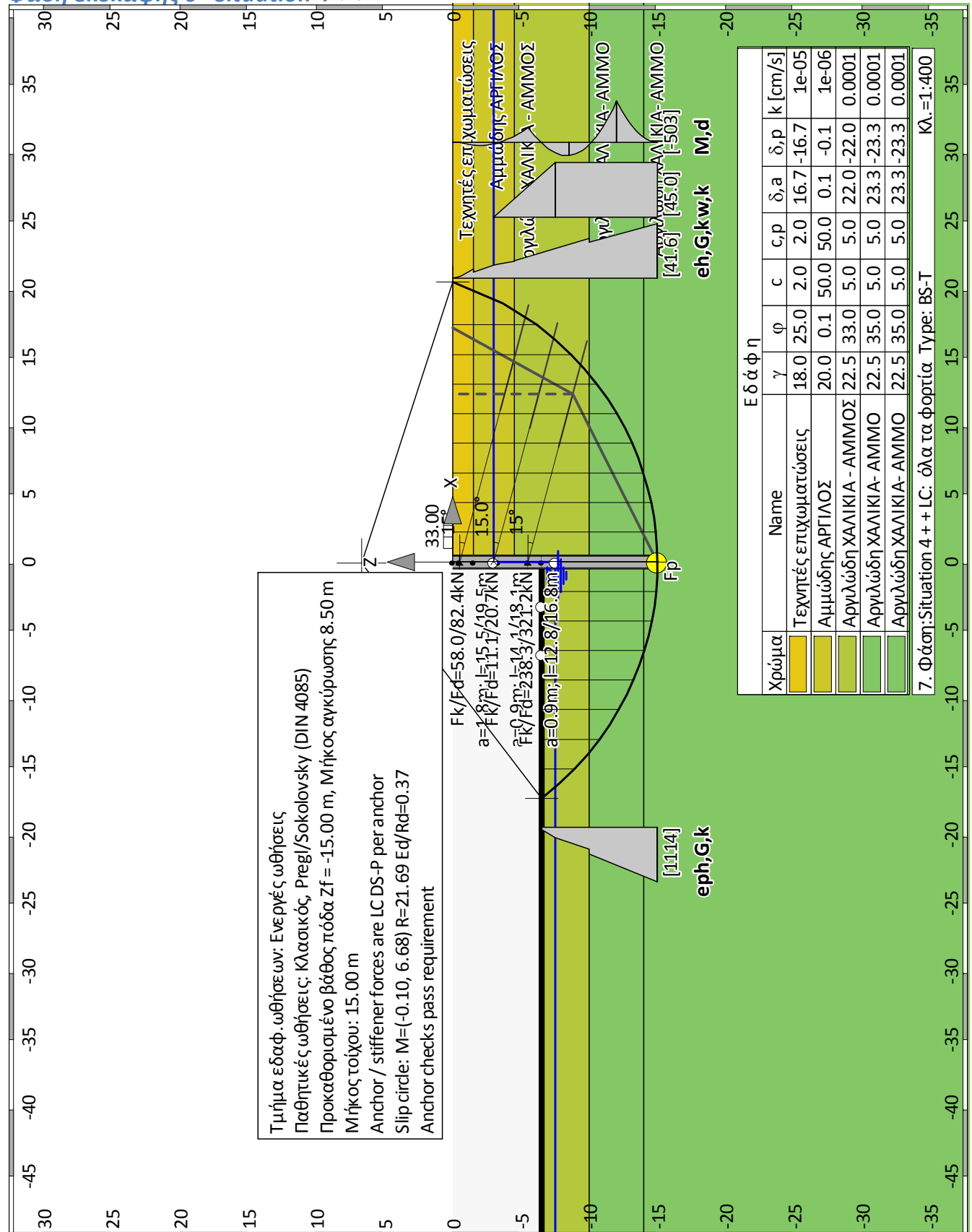
Φάση εκσκαφής 4 "Situation 4"



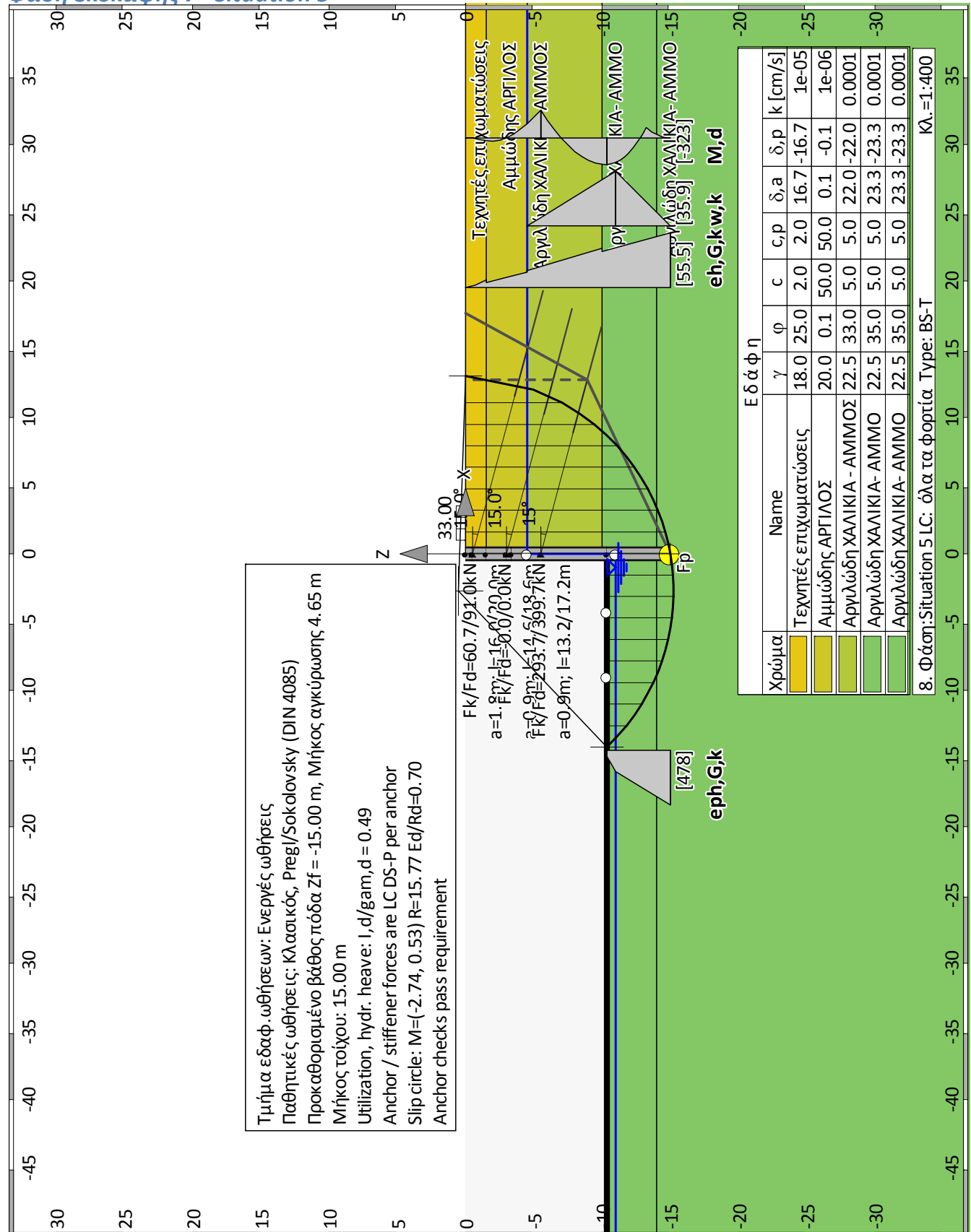
Φάση εκσκαφής 5 "Situation 4 +"



Φάση εκσκαφής 6 "Situation 4 + +"



Φάση εκσκαφής 7 "Situation 5"



Κανονισμός για Ανάλυση και Διαστασιολόγηση

Διαστασ. ωπλισμ.σκυροδ.: EN 1992-1-1

Γεωτεχν.Κανονισμός : EN 1997 (rev.12)_user

National Annex: EN 1997-1

Safety factors:**Earth pressure onto wall: [GEO] A1 M1 R2**

| γ- | G,dst | E0G | G,stb | Q,dst | Q,stb | phi | coe | cu | g |
|--------|-------|-------|-------|-------|-------|-----|-----|----|---|
| BS-P | 1.350 | 1.350 | 1 | 1.500 | 0 | 1 | 1 | 1 | 1 |
| BS-T | 1.350 | 1.350 | 1 | 1.500 | 0 | 1 | 1 | 1 | 1 |
| BS-T/A | 1.350 | 1.350 | 1 | 1.500 | 0 | 1 | 1 | 1 | 1 |
| BS-E | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 |

ΚΕ-μηχανισμός: [GEO] A2 M2 R3

| γ- | G,dst g | G,stb a,t | W a,p | Q,dst Gt | Q,stb N | phi | coe | cu |
|--------|------------|--------------|----------|-------------|------------|-------|-------|-------|
| BS-P | 1 | 1 | 1 | 1.300 | 0 | 1.250 | 1.400 | 1.400 |
| BS-T | 1 | 1 | 1 | 1.300 | 0 | 1.250 | 1.400 | 1.400 |
| BS-T/A | 1 | 1 | 1 | 1.300 | 0 | 1.250 | 1.250 | 1.400 |
| BS-E | 1 | 1 | 1 | 1 | 0 | 1.250 | 1.400 | 1.400 |

Θραύση εδάφους: [GEO] A1 M1 R2

| γ- | G,dst cu | E0G g | W Re | G,stb | Q,dst | Q,stb | phi | coe |
|--------|-------------|----------|---------|-------|-------|-------|-----|-----|
| BS-P | 1.350 | 1.350 | 1.350 | 1 | 1.500 | 0 | 1 | 1 |
| BS-T | 1.350 | 1.350 | 1.350 | 1 | 1.500 | 0 | 1 | 1 |
| BS-T/A | 1.350 | 1.350 | 1.350 | 1 | 1.500 | 0 | 1 | 1 |
| BS-E | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 |

Ολίσθηση: [GEO] A1 M1 R2

| γ- | G,dst cu | E0G g | W Rh | G,stb | Q,dst | Q,stb | phi | coe |
|--------|-------------|----------|---------|-------|-------|-------|-----|-----|
| BS-P | 1.350 | 1.350 | 1.350 | 1 | 1.500 | 0 | 1 | 1 |
| BS-T | 1.350 | 1.350 | 1.350 | 1 | 1.500 | 0 | 1 | 1 |
| BS-T/A | 1.350 | 1.350 | 1.350 | 1 | 1.500 | 0 | 1 | 1 |
| BS-E | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 |

Θραύση εδάφους: [GEO] A1 M1 R2

| γ- | G,dst cu | E0G g | W Rv | G,stb | Q,dst | Q,stb | phi | coe |
|--------|-------------|----------|---------|-------|-------|-------|-----|-----|
| BS-P | 1.350 | 1.350 | 1.350 | 1 | 1.500 | 0 | 1 | 1 |
| BS-T | 1.350 | 1.350 | 1.350 | 1 | 1.500 | 0 | 1 | 1 |
| BS-T/A | 1.350 | 1.350 | 1.350 | 1 | 1.500 | 0 | 1 | 1 |
| BS-E | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 |

Κύκλος ολίσθησης: [GEO] A2 M2 R3

| γ- | G,dst g | G,stb Re | Q,dst a,t | Q,stb a,p | W Gt | phi N | coe | cu |
|--------|------------|-------------|--------------|--------------|---------|----------|-------|-------|
| BS-P | 1 | 1 | 1.300 | 0 | 1 | 1.250 | 1.400 | 1.400 |
| | 1 | 1 | 1 | 1 | 1 | 1 | | |
| BS-T | 1 | 1 | 1.300 | 0 | 1 | 1.250 | 1.400 | 1.400 |
| | 1 | 1 | 1 | 1 | 1 | 1 | | |
| BS-T/A | 1 | 1 | 1.300 | 0 | 1 | 1.250 | 1.250 | 1.400 |
| | 1 | 1 | 1 | 1 | 1 | 1 | | |
| BS-E | 1 | 1 | 1 | 0 | 1 | 1.250 | 1.400 | 1.400 |
| | 1 | 1 | 1 | 1 | 1 | 1 | | |

Hydraulic heave: [HYD] A1 M1 R1

| γ- | G,dst | G,stb | Q,dst | H |
|--------|-------|-------|-------|-------|
| BS-P | 1.350 | 0.900 | 1.500 | 1.800 |
| BS-T | 1.350 | 0.900 | 1.500 | 1.600 |
| BS-T/A | 1.350 | 0.900 | 1.500 | 1.500 |
| BS-E | 1 | 1 | 1 | 1 |

Failure of structural elements: [STR] A1 M1 R1

| γ- | M | Gtf | cd | N |
|--------|-------|-------|-------|-------|
| BS-P | 1.150 | 1.400 | 1.400 | 1.150 |
| BS-T | 1.150 | 1.300 | 1.300 | 1.150 |
| BS-T/A | 1.150 | 1.250 | 1.250 | 1.150 |
| BS-E | 1 | 1 | 1 | 1 |

Stability: [EQU] A1 M1 R1

| γ- | G,dst | G,stb | Q,dst | Q,stb | phi | coe | cu | g |
|--------|-------|-------|-------|-------|-------|-------|-------|---|
| BS-P | 1 | 0.900 | 1.500 | 0 | 1.250 | 1.250 | 1.400 | 1 |
| BS-T | 1 | 0.900 | 1.500 | 0 | 1.250 | 1.250 | 1.400 | 1 |
| BS-T/A | 1 | 0.900 | 1.500 | 0 | 1.250 | 1.250 | 1.400 | 1 |
| BS-E | 1 | 1 | 1 | 0 | 1.250 | 1.400 | 1.400 | 1 |

$\gamma_{Re,red}$ (EAB EB14-3): N_{a1} , $\eta=0.80$

$\gamma_{Re,red}$ (EAB EB22-6): N_{a1} , $E0h > 0\%$: $\eta = 0.60 / 0.80$

System values**Τοίχος**

Τύπος τοίχου αντιστήριξης: Πασσαλότοιχος οπλισμένου σκυροδέματος

Διατομή: $I_y=2711360 \text{ cm}^4$

Υλικό: C25/30

Ίδιο βάρος: $25.000 \text{ [kN/m}^3\text{]}$

Σημεία τοίχου

| z | d | E | Iy | E*Iy | A |
|--------|-------|----------------------|----------------------|---------------------|----------------------|
| [m] | [m] | [MN/m ²] | [cm ⁴ /m] | [MNm ²] | [cm ² /m] |
| 0.00 | 100.0 | 31500.0 | 2711360 | 854.1 | 8400 |
| -15.00 | 100.0 | 31500.0 | 2711360 | 854.1 | 8400 |

| | | | | | |
|------------|--|------------------|----------------------|----------|------------------|
| Author: | FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | | | | Job No.: |
| Program: | WALLS-Retain. | | Version 2017.046 | | |
| Structure: | info@fides-dvp.de | www.fides-dvp.de | Tel:++49/89/143829-0 | ASB Nr.: | Date: 08.10.2018 |

Φάση εκσκαφής 1 "[1] Situation 1"

LC: όλα τα φορτία Type: BS-T

Εδαφικό σύστημα με 5 Στρώσεις

| Name | Τεχνητές επιχωματώσεις | Αμμόδης ΑΡΓΙΛΟΣ | Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ | |
|-------------|------------------------|-----------------|--------------------------|-----------|
| γ | [kN/m3] | 18 | 20 | 22.5 |
| γ,R | [kN/m3] | 18 | 20 | 22.5 |
| γ' | [kN/m3] | 8 | 10 | 12.5 |
| γ,p | [kN/m3] | 18 | 20 | 22.5 |
| γ,R,passive | [kN/m3] | 18 | 20 | 22.5 |
| γ,pw | [kN/m3] | 8 | 10 | 12.5 |
| φ | [°] | 25 | 0.1 | 33 |
| c | [kN/m2] | 2 | 50 | 5 |
| c,u | [kN/m2] | 10 | 50 | 5 |
| c παθητικό | [kN/m2] | 2 | 50 | 5 |
| δ,a | [°] | 16.66667 | 0.06666667 | 22 |
| δ,p | [°] | -16.66667 | -0.06666667 | -22 |
| δ,c | [°] | 8.333333 | 0.03333333 | 11 |
| k,agh | [-] | 0.3456501 | 0.9955057 | 0.2452023 |
| K,ach | [-] | 1.043051 | 1.994195 | 0.8549058 |
| K,0h | [-] | 0.5773817 | 0.9982547 | 0.455361 |
| K,pgh | [-] | 3.908103 | 1.004519 | 7.495617 |
| K,pch | [-] | 5.180327 | 2.00583 | 8.599509 |
| τ,gr | [kN/m2] | 110 | 110 | 110 |
| Ψ,A,max | [°] | 90 | 90 | 90 |
| k | [cm/s] | 10e-06 | 1e-06 | 100e-06 |

| Name | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ |
|-------------|------------------------|------------------------|
| γ | [kN/m3] 22.5 | 22.5 |
| γ,R | [kN/m3] 22.5 | 22.5 |
| γ' | [kN/m3] 12.5 | 12.5 |
| γ,p | [kN/m3] 22.5 | 22.5 |
| γ,R,passive | [kN/m3] 22.5 | 22.5 |
| γ,pw | [kN/m3] 12.5 | 12.5 |
| φ | [°] 35 | 35 |
| c | [kN/m2] 5 | 5 |
| c,u | [kN/m2] 5 | 5 |
| c παθητικό | [kN/m2] 5 | 5 |
| δ,a | [°] 23.33333 | 23.33333 |
| δ,p | [°] -23.33333 | -23.33333 |
| δ,c | [°] 11.66667 | 11.66667 |
| k,agh | [-] 0.2244207 | 0.2244207 |
| K,ach | [-] 0.8126539 | 0.8126539 |
| K,0h | [-] 0.4264236 | 0.4264236 |
| K,pgh | [-] 9.146943 | 9.146943 |
| K,pch | [-] 10.104 | 10.104 |
| τ,gr | [kN/m2] 110 | 110 |
| Ψ,A,max | [°] 90 | 90 |
| k | [cm/s] 100e-06 | 100e-06 |

Πορεία πρανούς:

x [m] 0.00 0.00
z [m] -2.00 0.00

Πορεία ανώτερου 2. στρώματος Αμμόδης ΑΡΓΙΛΟΣ:

x [m] 0.00 0.00
z [m] -2.00 -1.50

Πορεία ανώτερου 3. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ:

z= -4.50

Πορεία ανώτερου 4. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟΣ:

z= -10.00

| | | | |
|---------|--------------------------------------|----------|--------------|
| Part: | Please specify project informations. | Page: 11 | Archive No.: |
| Block: | | | |
| Record: | | | |

Πορεία ανώτερου 5. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ:
z= -14.00

Επιφ. φορτία:

Φορτία

| xA | zA | xE | zE | PxA | PzA | PxE | PzE | Typ | LC-description |
|------|------|------|------|------|-------------------|------|-------|-----|----------------|
| [m] | [m] | [m] | [m] | [| kN/m ² | |] | | Name |
| 1.00 | 0.00 | 3.50 | 0.00 | 0.00 | 33.00 | 0.00 | 33.00 | q | 1 |

Κατανομή εδαφ.πιέσεων

| Κατανομή εδαφ.πιέσεων | Name |
|----------------------------|------|
| Rectangular within a layer | |

Στάθμη νερού:

| | |
|-------|-------|
| x [m] | 0.00 |
| z [m] | -3.00 |

Παράμετροι υπολογισμού

Earth pressure options

Τμήμα εδαφ.ωθήσεων: Ενεργές ωθήσεις.
Angle of slip plane: DIN 4085.
Split block loads into 1 sections.
Consideration of minimum earth pressure: $\varphi_{\min} = 40.000$.
Negative earth pressure fractions are set to zero.

Redistribution of earth pressure

Shape of redistribution: No redistribution of earth pressure.
The earth pressure is getting redistrib. to: Excavation level
The earth pressure below the excavation acts without redistrib.
The earth pressure from variable loads will be included in redistribution.

Παθητικές ωθήσεις

Method of calculation: Κλασικός, Pregl/Sokolovsky (DIN 4085).

Options for water pressure

Στήριξη πόδα

Πακτωμένη στήριξη κατά Blum

Earth pressure coefficients kh

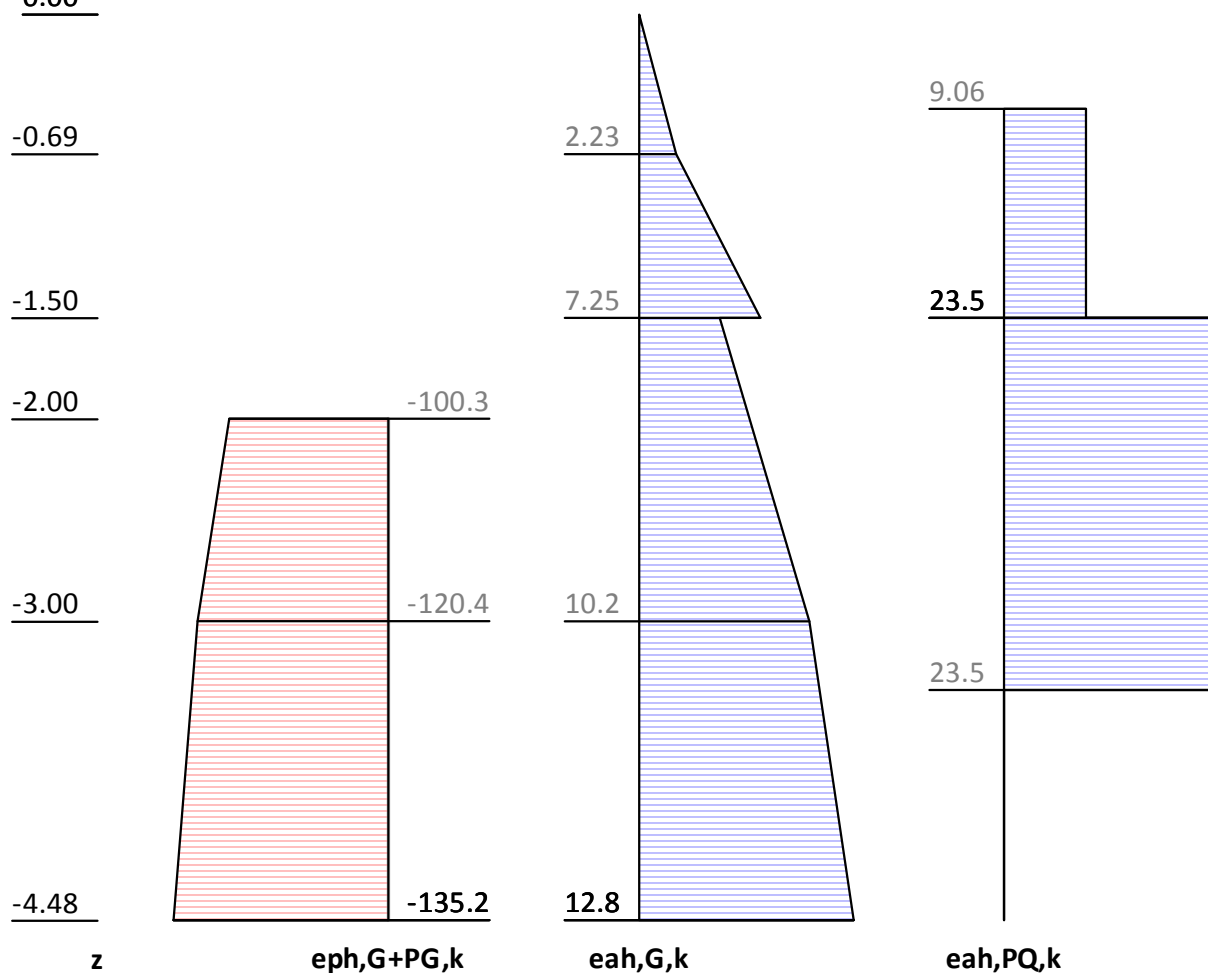
| φ | α | β | δ | k0gh | kagh | kach | kpgh | kpch | |
|-----------|----------|---------|----------|------|-------|-------|-------|---------|--------------------------|
| 0.1 | 0.0 | 0.0 | -0.1 | -- | -- | -- | 1.005 | -2.006 | Τεχνητές επιχωματώσεις |
| 25.0 | 0.0 | 0.0 | 16.7 | -- | 0.346 | 1.043 | -- | -- | " |
| 0.1 | 0.0 | 0.0 | -0.1 | -- | -- | -- | 1.005 | -2.006 | Αμμώδης ΑΡΓΙΛΟΣ |
| 0.1 | 0.0 | 0.0 | 0.1 | -- | 0.996 | 1.994 | -- | -- | " |
| 33.0 | 0.0 | 0.0 | -22.0 | -- | -- | -- | 7.496 | -8.600 | Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ |
| 33.0 | 0.0 | 0.0 | 22.0 | -- | 0.245 | 0.855 | -- | -- | " |
| 35.0 | 0.0 | 0.0 | -23.3 | -- | -- | -- | 9.147 | -10.104 | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ |
| 35.0 | 0.0 | 0.0 | 23.3 | -- | 0.224 | 0.813 | -- | -- | " |
| 35.0 | 0.0 | 0.0 | -23.3 | -- | -- | -- | 9.147 | -10.104 | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ |
| 35.0 | 0.0 | 0.0 | 23.3 | -- | 0.224 | 0.813 | -- | -- | " |

Μήκος τοίχου

| | | | | | |
|---|-----------|---------------------|----------|-----------------|-----|
| N: 1 | Z: -3.000 | M, Στήριξη πόδα, d: | 51.74. | Wall too short? | Ναι |
| N: 2 | Z: -6.000 | M, Στήριξη πόδα, d: | -401.07. | Wall too short? | Όχι |
| N: 3 | Z: -3.990 | M, Στήριξη πόδα, d: | 34.70. | Wall too short? | Ναι |
| N: 4 | Z: -5.337 | M, Στήριξη πόδα, d: | -155.60. | Wall too short? | Όχι |
| N: 5 | Z: -4.434 | M, Στήριξη πόδα, d: | 3.70. | Wall too short? | Ναι |
| N: 6 | Z: -5.039 | M, Στήριξη πόδα, d: | -82.64. | Wall too short? | Όχι |
| N: 7 | Z: -4.634 | M, Στήριξη πόδα, d: | -16.37. | Wall too short? | Όχι |
| N: 8 | Z: -4.500 | M, Στήριξη πόδα, d: | -13.22. | Wall too short? | Όχι |
| N: 9 | Z: -4.456 | M, Στήριξη πόδα, d: | 1.79. | Wall too short? | Ναι |
| N: 10 | Z: -4.486 | M, Στήριξη πόδα, d: | -0.87. | Wall too short? | Όχι |
| N: 11 | Z: -4.466 | M, Στήριξη πόδα, d: | 0.92. | Wall too short? | Ναι |
| N: 12 | Z: -4.479 | M, Στήριξη πόδα, d: | -0.27. | Wall too short? | Όχι |
| N: 13 | Z: -4.470 | M, Στήριξη πόδα, d: | 0.53. | Wall too short? | Ναι |
| N: 14 | Z: -4.476 | M, Στήριξη πόδα, d: | -0.01. | Wall too short? | Όχι |
| Foot depth for statics: z _f = -4.476 | | | | | |

Stress analysis**Earth pressure, horizontal**

Pressures characteristic, no redistribution, continuous wall

0.00

| z [m] | eph, G, k [kN/m ²] | eah, G, k [kN/m ²] | eah, PQ, k [kN/m ²] | eah, d [kN/m ²] |
|----------|-----------------------------------|-----------------------------------|------------------------------------|--------------------------------|
| 0.00 | | 0.00 | | 0.00 |
| -0.47 | | 1.52 | 0.00 | 2.04 |
| -0.47 | | 1.52 | 9.06 | 15.62 |
| -1.50 | | 7.25 | 9.06 | 23.37 |
| -1.50 | | 4.82 | 23.48 | 41.73 |
| -2.00 | -0.00 | 6.61 | 23.48 | 44.14 |

| | | | | |
|--|-------------------|------------------|-------------------------------|------------------|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | | | | Job No.: |
| Program: WALLS-Retain. | | Version 2017.046 | | |
| Structure: | info@fides-dvp.de | www.fides-dvp.de | Tel:++49/89/143829-0 ASB Nr.: | Date: 08.10.2018 |

| z [m] | eph,G,k [kN/m2] | eah,G,k [kN/m2] | eah,PQ,k [kN/m2] | eah,d [kN/m2] |
|----------|--------------------|--------------------|---------------------|------------------|
| -2.00 | -100.29 | 6.61 | 23.48 | 44.14 |
| -3.34 | -123.79 | 10.79 | 23.48 | 49.78 |
| -3.34 | -123.79 | 10.79 | 0.00 | 14.56 |
| -4.48 | -135.21 | 12.82 | 0.00 | 17.30 |

Eph,G,k: -298.99, Eph,PG,k: 0.00 [kN/m]
Eah,G,k: 32.82, Eah,PG,k: 0.00, Eah,PQ,k: 52.53, Eah,d: 123.10

H-pressure on static system

Level of mobilization: Ep,gk 14.7, Ep,qk 34.4, Ep,d 100.0 [%]

0.00

V-pressure on static system**Internal forces: Permanent, characteristically**0.00-0.0611-0.50-0.0672-0.402-0.0504-1.19-0.975-2.67-0.0358-1.50-2.07-4.59-0.0294-2.00-5.05-7.45-0.0197-2.50-7.77-3.47-0.0114-3.00-8.540.36-0.00531-3.50-7.434.07-0.0017-3.76-6.125.97-704.5e-06-4.26-2.239.57-21.3e-06-4.4811.1**z****M,gk****V,gk****u,gk**

| z [m] | H,g,k [kN/m2] | M,g,k [kN/m2] | V,g,k [kN/m2] | N,g,k [kN/m2] | u,g,k [mm] |
|----------|------------------|------------------|------------------|------------------|---------------|
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -0.06 |
| -1.50 | 7.25 | -2.07 | -4.59 | -33.13 | -0.03 |
| -1.50 | 4.82 | -2.07 | -4.59 | -33.13 | -0.03 |
| -2.00 | 6.61 | -5.05 | -7.45 | -43.63 | -0.02 |
| -2.00 | -8.12 | -5.05 | -7.45 | -43.63 | -0.02 |
| -2.95 | -7.53 | -8.47 | 0.00 | -63.64 | -0.01 |
| -3.00 | -7.50 | -8.54 | 0.36 | -64.62 | -0.01 |
| -4.48 | -7.04 | -0.00 | 11.10 | -83.21 | -0.00 |
| -4.48 | -7.04 | 0.00 | 11.10 | -83.21 | 0.00 |

Internal forces: Variable, characteristicallyMethod EB 82-4 ($Q = [G+Q] - G$).0.00-0.47-0.69-1.19-1.50-2.00-2.50-3.00-3.34-3.76-4.26-4.48

z

M,qk

-0.227

-2.37

-4.8

-12.4

-21.4

-26.8

-28.2

-24.3

-9.79

0.00755

-2.03

-6.55

-9.33

-21.1

-14.7

-6.59

-0.29

17.9

40.3

50.3

V,qk

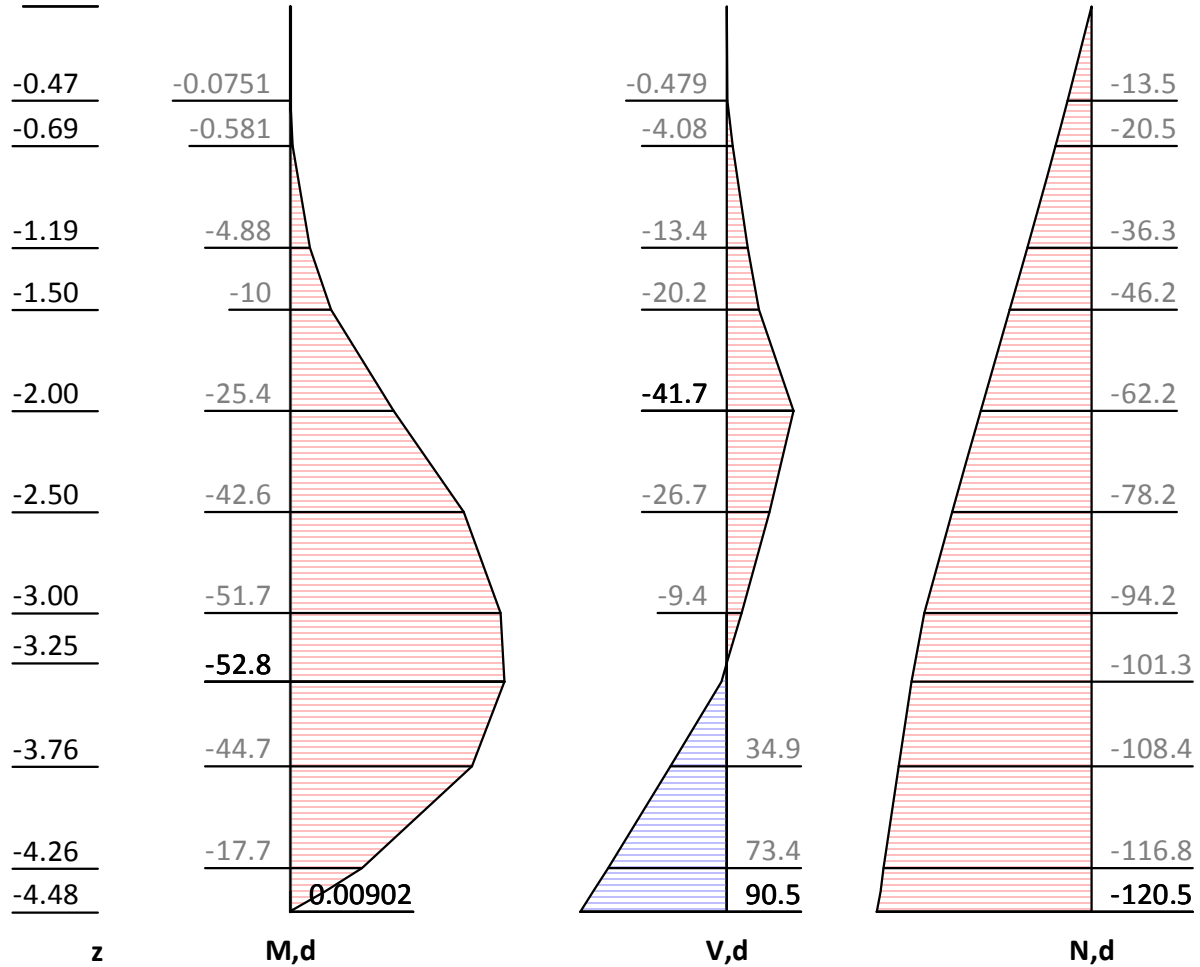
-0.202-0.171-0.156-0.122-0.102-0.0706-0.0428-0.0211-0.0104-0.00302-95.3e-06

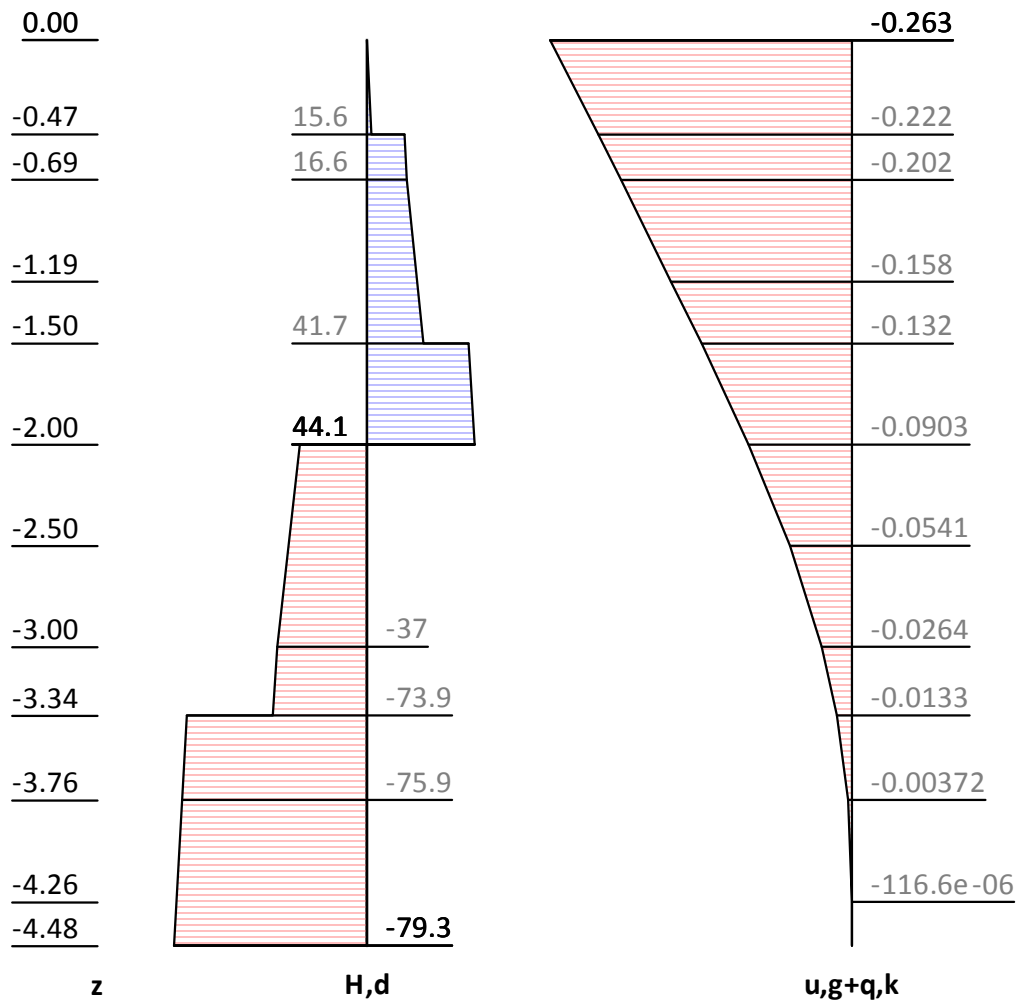
u,qk

| z [m] | H, q, k [kN/m2] | M, q, k [kN/m2] | V, q, k [kN/m2] | N, q, k [kN/m2] | u, q, k [mm] |
|----------|--------------------|--------------------|--------------------|--------------------|-----------------|
| 0.00 | | 0.00 | 0.00 | 0.00 | -0.20 |
| -0.47 | 0.00 | 0.01 | 0.02 | 0.01 | -0.17 |
| -0.47 | 9.06 | 0.01 | 0.02 | 0.01 | -0.17 |
| -0.48 | 9.06 | -0.00 | -0.05 | 0.00 | -0.17 |
| -1.50 | 9.06 | -4.80 | -9.33 | -0.99 | -0.10 |
| -1.50 | 23.48 | -4.80 | -9.33 | -0.99 | -0.10 |
| -2.00 | 23.48 | -12.40 | -21.07 | -2.23 | -0.07 |
| -2.00 | -11.02 | -12.40 | -21.07 | -2.23 | -0.07 |
| -3.34 | -19.10 | -28.20 | -0.29 | -5.50 | -0.01 |
| -3.34 | -42.58 | -28.20 | -0.29 | -5.50 | -0.01 |
| -3.35 | -42.61 | -28.12 | -0.00 | -5.50 | -0.01 |
| -4.48 | -46.51 | 0.00 | 50.32 | -5.44 | -0.00 |
| -4.48 | -46.51 | 0.00 | 50.32 | -5.44 | 0.00 |

Internal forces: Design

0.00

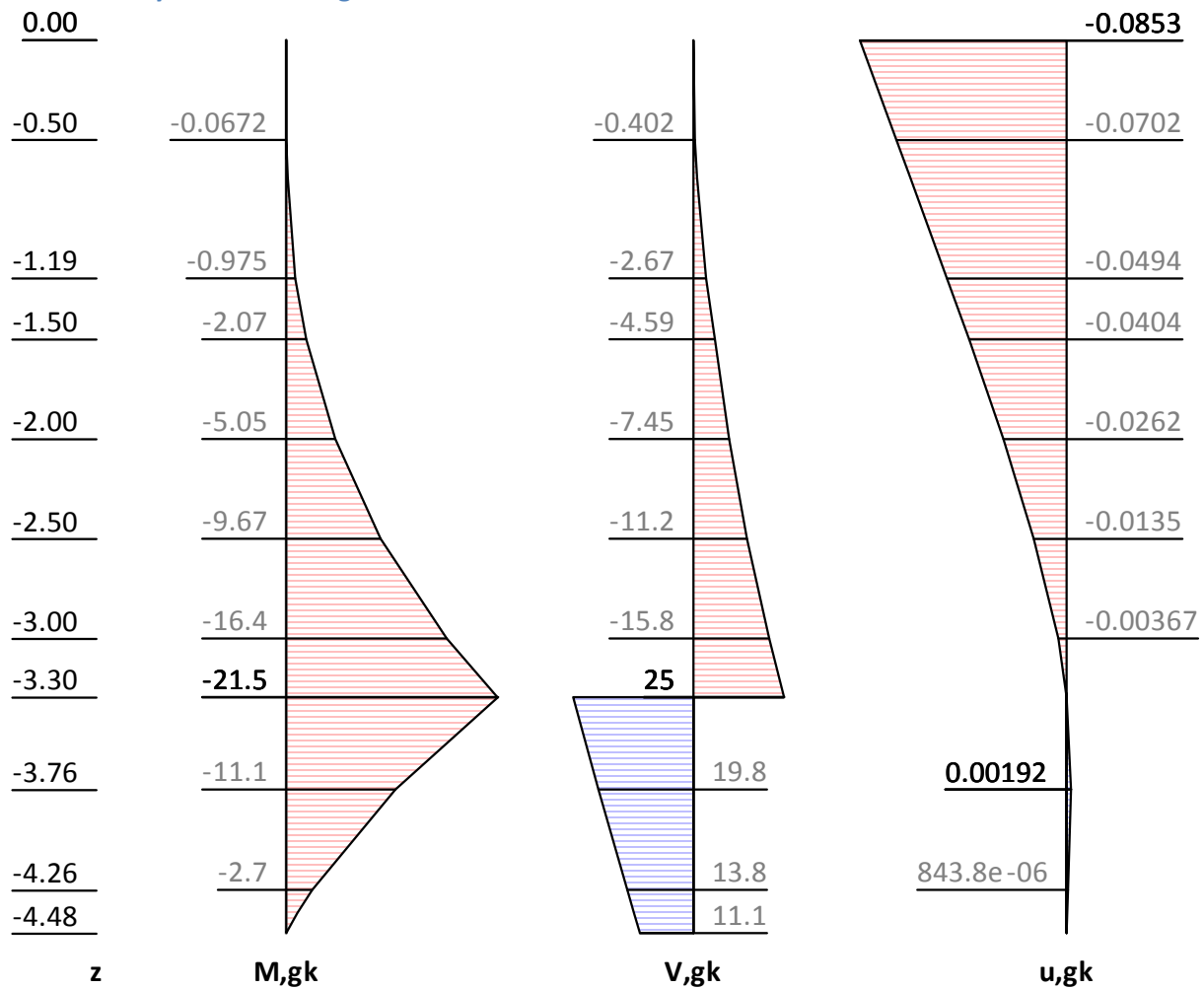




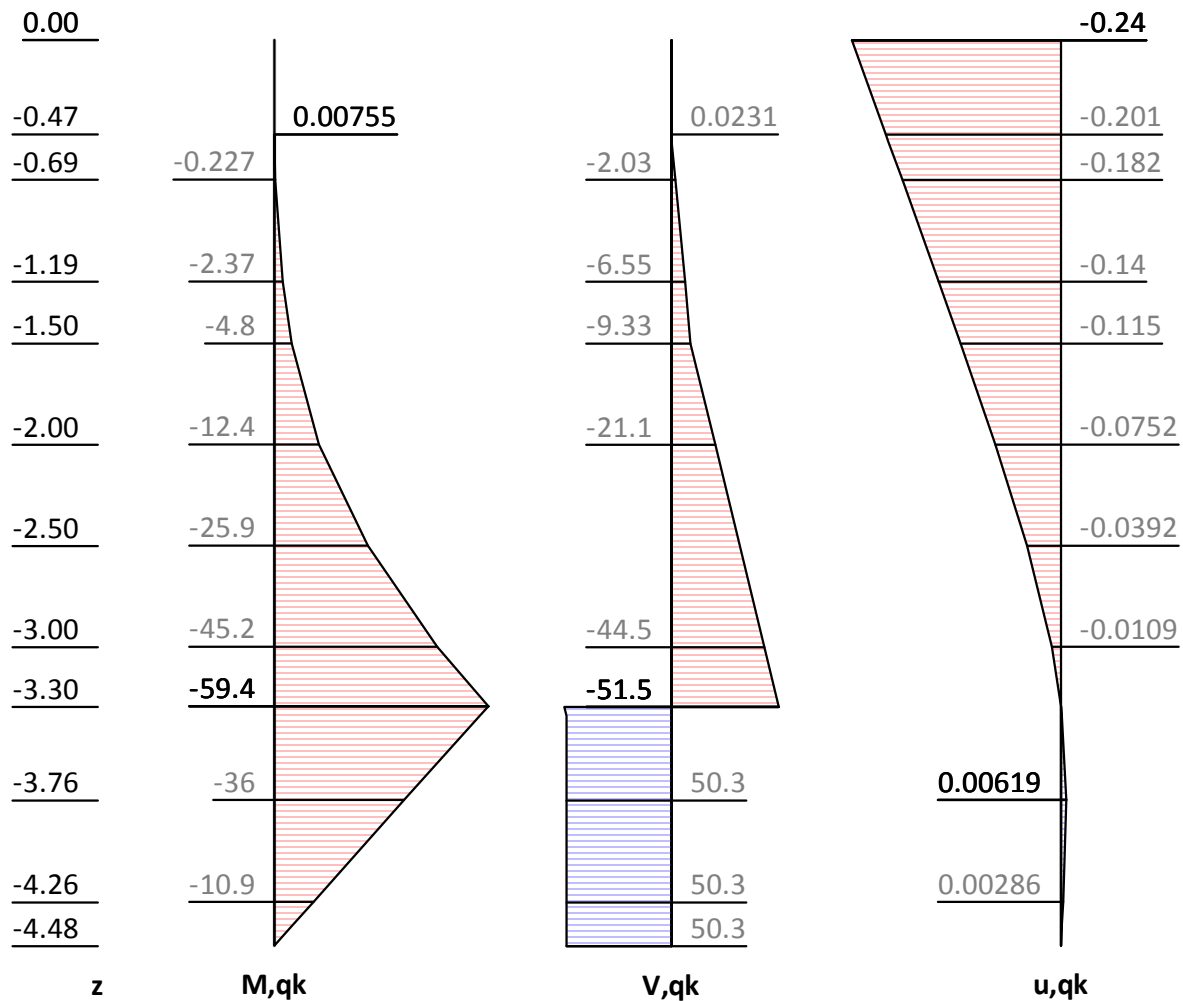
| z [m] | H,d [kN/m²] | M,d [kN/m²] | V,d [kN/m²] | N,d [kN/m²] | u,g+q,k [mm] |
|----------|----------------|----------------|----------------|----------------|-----------------|
| 0.00 | 0.00 | 0.00 | -0.00 | 0.00 | -0.26 |
| -0.47 | 2.04 | -0.08 | -0.48 | -13.54 | -0.22 |
| -0.47 | 15.62 | -0.08 | -0.48 | -13.54 | -0.22 |
| -1.50 | 23.37 | -10.00 | -20.19 | -46.20 | -0.13 |
| -1.50 | 41.73 | -10.00 | -20.19 | -46.20 | -0.13 |
| -2.00 | 44.14 | -25.42 | -41.66 | -62.25 | -0.09 |
| -2.00 | -27.50 | -25.42 | -41.66 | -62.25 | -0.09 |
| -3.34 | -38.64 | -52.77 | 3.46 | -101.27 | -0.01 |
| -3.34 | -73.86 | -52.77 | 3.46 | -101.27 | -0.01 |
| -4.48 | -79.28 | 0.00 | 90.45 | -120.49 | -0.00 |
| -4.48 | -79.28 | 0.01 | 90.46 | -120.49 | 0.00 |

Checks of earth statics

Substitute system according to Blum



| z [m] | M,g,k [kN/m ²] | V,g,k [kN/m ²] | N,g,k [kN/m ²] | u,g,k [kN/m ²] |
|----------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|
| 0.00 | 0.00 | 0.00 | 0.00 | -0.09 |
| -3.30 | -21.54 | -18.93 | -68.37 | 0.00 |
| -3.30 | -21.54 | 24.98 | -68.37 | 0.00 |
| -3.76 | -11.12 | 19.82 | -74.23 | 0.00 |
| -4.48 | 0.00 | 11.10 | -83.26 | 0.00 |



| z [m] | M,q,k [kN/m ²] | V,q,k [kN/m ²] | N,q,k [kN/m ²] | u,q,k [kN/m ²] |
|----------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|
| 0.00 | 0.00 | 0.00 | 0.00 | -0.24 |
| -0.47 | 0.01 | 0.02 | 0.01 | -0.20 |
| -0.48 | -0.00 | -0.05 | -0.00 | -0.20 |
| -3.30 | -59.42 | -51.50 | -5.45 | 0.00 |
| -3.30 | -59.42 | 51.35 | -5.45 | 0.00 |
| -3.76 | -36.04 | 50.32 | -5.56 | 0.01 |
| -4.48 | 0.00 | 50.32 | -5.56 | 0.00 |

Bh,gk = -43.91; Ch,gk = 11.10 [kN/m]

Bh,qk = -102.85; Ch,qk = 50.32 [kN/m]

Bh,d = -213.56; Ch,d = 90.45 [kN/m]

| | |
|--|-------------------------|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | Job No.: |
| Program: WALLS-Retain. | Version 2017.046 |
| Structure: info@fides-dvp.de www.fides-dvp.de Tel:++49/89/143829-0 ASB Nr.: | Date: 08.10.2018 |

Check of C-force (foot support)

$$z(C) = -4.48 \text{ [kN/m]}$$

$$G,k = \sum(\gamma \cdot h) = 71.76 \text{ [kN/m]}$$

$$P,k = \sum(Pz,k(x= 0.1)) = 0.00 \text{ [kN/m]}$$

$$kpgh,C(\phi_i= 0.1; \delta,C= 0.0^\circ) = 1.002 \text{ [-]}$$

$$kpch,C = 2.003 \text{ [-]}$$

$$eph,C,gk = (G,k+P,k) \cdot kpgh,C+2 \cdot c \cdot \sqrt{kpch,C} = 213.44 \text{ [kN/m}^2\text{]}$$

$$= (71.76+0.00) \cdot 1.002+2 \cdot 50.0 \cdot 1.415$$

$$Ed = Ch,d = 90.45 \text{ [kN/m}^2\text{]}$$

$$\delta,t,EAU = Ed/(2 \cdot eph,C,d) = 0.30 \text{ [m]}$$

$$\delta,t,EAB = 0.20 \cdot t = 0.50 \text{ [m]}$$

$$\delta,t = \delta,t,EAB = 0.50 \text{ [m]}$$

$$Rd = 2 \cdot \delta,t \cdot eph,C,gk/\gamma,Re$$

$$= 2 \cdot 0.50 \cdot 213.44/1.4$$

$$= 151.00 \text{ [kN/m}^2\text{]}$$

$Ed/Rd = 0.599 \text{ [-]}. \text{ Passes requirement}$

Check or earth support

Check: Mobilizable earth resistance is sufficient for earth support force.

z: -3.30 m

$$Rd = Eph,k/\gamma,Re = 298.99 / 1.400 = 213.57 \text{ [kN/m]}$$

$Ed(Bh,d)/Rd = 213.56 / 213.57 = 1.000 \text{ [-]}. \text{ Passes requirement}$

Sum of H and V forces, (G)

Forces up to depth z:-4.48

| Pos. | H | V |
|---|--------|-------------|
| <hr style="border-top: 1px dashed black;"/> | | |
| H/V pressure G+P+W,k | 32.82 | 1.66 |
| Wall weight | | 87.84 |
| H/V pressure passive | | 0.00 |
| Bh,g,k z=-3.30 | -43.91 | |
| Bv,g,k = Bh,k * tan($\delta,p=-0.07^\circ$) | | -0.05 |
| Ch,g | 11.10 | |
| Cv,g = Ch*tan($\delta,C=0.0^\circ$) | | 0.01 |
| <hr style="border-top: 1px dashed black;"/> | | |
| Σ | 0.00 | 89.46 |
| | | (downwards) |

Simple check, EAB R 9-3a

$V_k \geq Bvk: 89.51 \geq 0.05 \text{ Passes requirement}$

Sum of H and V forces, (G+Q)

Forces up to depth z:-4.48

| Pos. | H | V |
|---|---------|-------------|
| <hr style="border-top: 1px dashed black;"/> | | |
| H/V pressure G+P+W,k | 85.35 | 7.22 |
| Wall weight | | 87.84 |
| H/V pressure passive | | 0.00 |
| Bh,g,k z=-3.30 | -43.91 | |
| Bv,g,k = Bh,k * tan($\delta,p=-0.07^\circ$) | | -0.05 |
| Bh,q,k z=-3.30 | -102.85 | |
| Bv,q,k = Bh,k * tan($\delta,p=-0.07^\circ$) | | -0.12 |
| Ch,g | 11.10 | |
| Cv,g = Ch*tan($\delta,C=0.0^\circ$) | | 0.01 |
| Ch,q | 50.32 | |
| Cv,q = Ch*tan($\delta,C=0.0^\circ$) | | 0.03 |
| <hr style="border-top: 1px dashed black;"/> | | |
| Σ | -0.00 | 94.93 |
| | | (downwards) |

| | |
|---|--------------|
| Part: Block: Please specify project informations. Record: | Archive No.: |
|---|--------------|

Page: 21

| | | | | | | | | | | |
|--|--------|----------|----------------------|------------------------|---------------|------------------|--------|-------|---------|---------|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | | | | | | Job No.: | | | | |
| Program: WALLS-Retain. Version 2017.046 | | | | | | | | | | |
| Structure: info@fides-dvp.de www.fides-dvp.de Tel:++49/89/143829-0 ASB Nr.: | | | | | | Date: 08.10.2018 | | | | |
| Simple check, EAB R 9-3a | | | | | | | | | | |
| V _k >= B _{vk} : 95.10 >= 0.17 Passes requirement | | | | | | | | | | |
| Υπολογ. κύκλου ολίσθησης | | | | | | | | | | |
| LC: όλα τα φορτία Type: BS-T (combination: [GEO] A2 M2 R3, BS-T) | | | | | | | | | | |
| Vertical variable loads only act if they are outside of R*sin(phi). | | | | | | | | | | |
| The automatic slip circle optimization only considers circles that intersect the surface with an area of at least 0.25 m2. | | | | | | | | | | |
| The slip circle calculation only accepts circles including the wall. | | | | | | | | | | |
| The slipcircle calculation only allows circular failure planes (no vertical tangents will occur). | | | | | | | | | | |
| Γεωμετ.κύκλου (μήκη και συντεταγμ. σε (m)) | | | | | | | | | | |
| Κέντρο = (-1.72, 0.34), Ακτίνα = 5.59 | | | | | | | | | | |
| Αρχ.σημ.= (-6.79, -2.00), Τελ.σημ. = (3.86, 0.00) | | | | | | | | | | |
| Γεωμετρία λωρίδων: | | | | | | | | | | |
| No | x | Width | dxM | Weight | Load | Water- | u*b | φ | c | θ |
| | [m] | b | [m] | [kN/m] | z-κατ. [kN/m] | φορτ. [kN/m] | [kN/m] | [°] | [kN/m²] | [°] |
| 1 | -6.51 | 0.56 | -4.80 | 5.9 | 0.0 | 0.0 | -0.0 | 0.08 | 35.71 | -44.96* |
| 2 | -5.96 | 0.56 | -4.24 | 14.6 | 0.0 | 0.0 | -1.7 | 0.08 | 35.71 | -44.96* |
| 3 | -5.40 | 0.56 | -3.68 | 20.9 | 0.0 | 0.0 | -4.8 | 0.08 | 35.71 | -41.18 |
| 4 | -4.84 | 0.56 | -3.12 | 25.7 | 0.0 | 0.0 | -7.2 | 0.08 | 35.71 | -33.95 |
| 5 | -4.28 | 0.56 | -2.56 | 29.6 | 0.0 | 0.0 | -9.1 | 27.45 | 3.57 | -27.29 |
| 6 | -3.72 | 0.56 | -2.00 | 32.7 | 0.0 | 0.0 | -10.5 | 27.45 | 3.57 | -21.01 |
| 7 | -3.16 | 0.56 | -1.44 | 35.0 | 0.0 | 0.0 | -11.5 | 27.45 | 3.57 | -14.98 |
| 8 | -2.60 | 0.56 | -0.89 | 36.5 | 0.0 | 0.0 | -12.1 | 27.45 | 3.57 | -9.12 |
| 9 | -2.04 | 0.56 | -0.33 | 37.3 | 0.0 | 0.0 | -12.5 | 27.45 | 3.57 | -3.35 |
| 10 | -1.49 | 0.56 | 0.23 | 37.3 | 0.0 | 0.0 | -12.5 | 27.45 | 3.57 | 2.38 |
| 11 | -0.93 | 0.56 | 0.79 | 36.7 | 0.0 | 0.0 | -12.2 | 27.45 | 3.57 | 8.14 |
| 12 | -0.37 | 0.56 | 1.35 | 35.3 | 0.0 | 0.0 | -11.6 | 27.45 | 3.57 | 13.98 |
| 13 | 0.19 | 0.56 | 1.91 | 50.5 | 0.0 | 0.0 | -10.7 | 27.45 | 3.57 | 19.97 |
| 14 | 0.75 | 0.56 | 2.47 | 50.8 | 1.2 | 0.0 | -9.3 | 27.45 | 3.57 | 26.20 |
| 15 | 1.31 | 0.56 | 3.03 | 47.1 | 24.0 | 0.0 | -7.5 | 0.08 | 35.71 | 32.79 |
| 16 | 1.87 | 0.56 | 3.58 | 42.5 | 24.0 | 0.0 | -5.2 | 0.08 | 35.71 | 39.91 |
| 17 | 2.42 | 0.56 | 4.14 | 36.5 | 24.0 | 0.0 | -2.2 | 0.08 | 35.71 | 47.86 |
| 18 | 2.98 | 0.56 | 4.70 | 28.3 | 24.0 | 0.0 | -0.2 | 0.08 | 35.71 | 57.30 |
| 19 | 3.56 | 0.60 | 5.28 | 16.0 | 10.2 | 0.0 | -0.0 | 20.46 | 1.43 | 70.88 |
| *** Σημείωση: Στις λωρίδες σημειωμένες με '*' περιορίστηκε το theta στο 45°-Phi/2. | | | | | | | | | | |
| Συνεισφ. κατακόρυφων φορτίων: | | | | | | | | | | |
| No | Weight | G*sin(θ) | (G-u*b)*tan(φ) + c*b | μ*sin(θ)*tan(φ)+cos(θ) | T | | | | | |
| | [kN/m] | [kN/m] | [kN/m] | [-] | [kN/m] | | | | | |
| 1 | 5.93 | -5.09 | 19.96 | 0.707211 | 28.23 | | | | | |
| 2 | 14.60 | -11.07 | 19.97 | 0.707211 | 28.24 | | | | | |
| 3 | 20.90 | -13.76 | 19.98 | 0.752238 | 26.56 | | | | | |
| 4 | 25.70 | -14.35 | 19.98 | 0.829212 | 24.10 | | | | | |
| 5 | 29.58 | -13.56 | 12.66 | 0.794707 | 15.93 | | | | | |
| 6 | 32.72 | -11.73 | 13.56 | 0.860042 | 15.77 | | | | | |
| 7 | 35.01 | -9.05 | 14.22 | 0.913023 | 15.57 | | | | | |
| 8 | 36.51 | -5.79 | 14.65 | 0.954871 | 15.34 | | | | | |
| 9 | 37.27 | -2.18 | 14.87 | 0.986300 | 15.08 | | | | | |
| 10 | 37.33 | 1.55 | 14.89 | 1.007651 | 14.77 | | | | | |
| 11 | 36.69 | 5.19 | 14.70 | 1.018951 | 14.43 | | | | | |
| 12 | 35.31 | 8.53 | 14.31 | 1.019913 | 14.03 | | | | | |
| 13 | 50.54 | 17.26 | 22.71 | 1.009894 | 22.49 | | | | | |
| 14 | 52.06 | 22.98 | 24.20 | 0.987773 | 24.50 | | | | | |
| 15 | 71.04 | 38.47 | 20.04 | 0.840984 | 23.83 | | | | | |
| 16 | 66.44 | 42.63 | 20.04 | 0.767457 | 26.11 | | | | | |
| 17 | 60.44 | 44.82 | 20.04 | 0.671336 | 29.85 | | | | | |
| 18 | 52.28 | 43.99 | 20.03 | 0.540685 | 37.04 | | | | | |
| Part: | | | | | | Archive No.: | | | | |
| Block: Please specify project informations. | | | | | | Page: 22 | | | | |
| Record: | | | | | | | | | | |

Author: **FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München**

Job No.:

Program: **WALLS-Retain.**

Version 2017.046

Structure: info@fides-dvp.de

www.fides-dvp.de

Tel:++49/89/143829-0

ASB Nr.:

Date: 08.10.2018

| No | Weight | $G \cdot \sin(\theta)$ | $(G - u \cdot b) \cdot \tan(\varphi) + c \cdot b$ | $\mu \cdot \sin(\theta) \cdot \tan(\varphi) + \cos(\theta)$ | T |
|----|--------|------------------------|---|---|--------|
| | [kN/m] | [kN/m] | [kN/m] | [-] | [kN/m] |
| 19 | 26.20 | 24.75 | 10.62 | 0.466572 | 22.77 |
| | | ----- | | | ----- |
| | | 163.60 | | | 414.63 |

Δράση $E_d = (163.6 \cdot 5.59)$

Αντίσταση $R_d = (414.6 \cdot 5.59 + 0.0)$

SLIP-CIRCLE $\mu = E_d / R_d = 0.39 < 1.0$: Έλεγχος εκπληρώθηκε.

Part:

Block: Please specify project informations.

Record:

Page: 23

Archive No.:

Φάση εκσκαφής 2 "[2] Situation 2"

LC: όλα τα φορτία Type: BS-T

Εδαφικό σύστημα με 5 Στρώσεις

| Name | Τεχνητές επιχωματώσεις | Αμμόδης ΑΡΓΙΛΟΣ | Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ | |
|-------------|------------------------|-----------------|--------------------------|-----------|
| γ | [kN/m3] | 18 | 20 | 22.5 |
| γ,R | [kN/m3] | 18 | 20 | 22.5 |
| γ' | [kN/m3] | 8 | 10 | 12.5 |
| γ,p | [kN/m3] | 18 | 20 | 22.5 |
| γ,R,passive | [kN/m3] | 18 | 20 | 22.5 |
| γ,pw | [kN/m3] | 8 | 10 | 12.5 |
| φ | [°] | 25 | 0.1 | 33 |
| c | [kN/m2] | 2 | 50 | 5 |
| c,u | [kN/m2] | 10 | 50 | 5 |
| c παθητικό | [kN/m2] | 2 | 50 | 5 |
| δ,a | [°] | 16.66667 | 0.06666667 | 22 |
| δ,p | [°] | -16.66667 | -0.06666667 | -22 |
| δ,c | [°] | 8.333333 | 0.03333333 | 11 |
| k,agh | [-] | 0.3456501 | 0.9955057 | 0.2452023 |
| K,ach | [-] | 1.043051 | 1.994195 | 0.8549058 |
| K,0h | [-] | 0.5773817 | 0.9982547 | 0.455361 |
| K,pgh | [-] | 3.908103 | 1.004519 | 7.495617 |
| K,pch | [-] | 5.180327 | 2.00583 | 8.599509 |
| τ,gr | [kN/m2] | 110 | 110 | 110 |
| Ψ,A,max | [°] | 90 | 90 | 90 |
| k | [cm/s] | 10e-06 | 1e-06 | 100e-06 |

| Name | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ | |
|-------------|------------------------|------------------------|-----------|
| γ | [kN/m3] | 22.5 | 22.5 |
| γ,R | [kN/m3] | 22.5 | 22.5 |
| γ' | [kN/m3] | 12.5 | 12.5 |
| γ,p | [kN/m3] | 22.5 | 22.5 |
| γ,R,passive | [kN/m3] | 22.5 | 22.5 |
| γ,pw | [kN/m3] | 12.5 | 12.5 |
| φ | [°] | 35 | 35 |
| c | [kN/m2] | 5 | 5 |
| c,u | [kN/m2] | 5 | 5 |
| c παθητικό | [kN/m2] | 5 | 5 |
| δ,a | [°] | 23.33333 | 23.33333 |
| δ,p | [°] | -23.33333 | -23.33333 |
| δ,c | [°] | 11.66667 | 11.66667 |
| k,agh | [-] | 0.2244207 | 0.2244207 |
| K,ach | [-] | 0.8126539 | 0.8126539 |
| K,0h | [-] | 0.4264236 | 0.4264236 |
| K,pgh | [-] | 9.146943 | 9.146943 |
| K,pch | [-] | 10.104 | 10.104 |
| τ,gr | [kN/m2] | 110 | 110 |
| Ψ,A,max | [°] | 90 | 90 |
| k | [cm/s] | 100e-06 | 100e-06 |

Πορεία πρανούς:

x [m] 0.00 0.00
z [m] -2.00 0.00

Πορεία ανώτερου 2. στρώματος Αμμόδης ΑΡΓΙΛΟΣ:

x [m] 0.00 0.00
z [m] -2.00 -1.50

Πορεία ανώτερου 3. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ:

z= -4.50

Πορεία ανώτερου 4. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟΣ:

z= -10.00

Πορεία ανώτερου 5. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ:
z= -14.00

Επιφ. φορτία:

Φορτία

| x _A [m] | z _A [m] | x _E [m] | z _E [m] | P _{xA} [kN/m ²] | P _{zA} [kN/m ²] | P _{xE} [kN/m ²] | P _{zE} [kN/m ²] | Typ | LC-description Name |
|-----------------------|-----------------------|-----------------------|-----------------------|---|---|---|---|-----|------------------------|
| 1.00 | 0.00 | 3.50 | 0.00 | 0.00 | 33.00 | 0.00 | 33.00 | q | 1 |

Κατανομή εδαφ.πιέσεων

| Κατανομή εδαφ.πιέσεων | Name |
|----------------------------|------|
| Rectangular within a layer | |

Στάθμη νερού:

x [m] 0.00
z [m] -3.00

Αγκύρια

| z [m] | min.l [m] | Alpha [°] | C-H [kN/m] | P0 [kN] | u0 [m] |
|-------|-----------|-----------|------------|---------|--------|
| -0.50 | 0.00 | 15.00 | αόρισ. | 0.00 | 0.0000 |

Παράμετροι υπολογισμού

Earth pressure options

Τμήμα εδαφ.ωθήσεων: Ενεργές ωθήσεις.
Angle of slip plane: DIN 4085.
Split block loads into 1 sections.
Consideration of minimum earth pressure: $\varphi_{min} = 40.000$.
Negative earth pressure fractions are set to zero.

Redistribution of earth pressure

Shape of redistribution: Trapezoid.
The earth pressure is getting redistrib. to: Excavation level
The earth pressure below the excavation acts without redistrib.
Levels of redistribution Z1: 0.000, Z2: -1.000 [m].
The earth pressure from variable loads will be included in redistribution.

Παθητικές ωθήσεις

Method of calculation: Κλασικός, Pregl/Sokolovsky (DIN 4085).

Options for water pressure

Στήριξη πόδα

Πόδας οριζοντίως μετακινούμενος

Αγκύρια

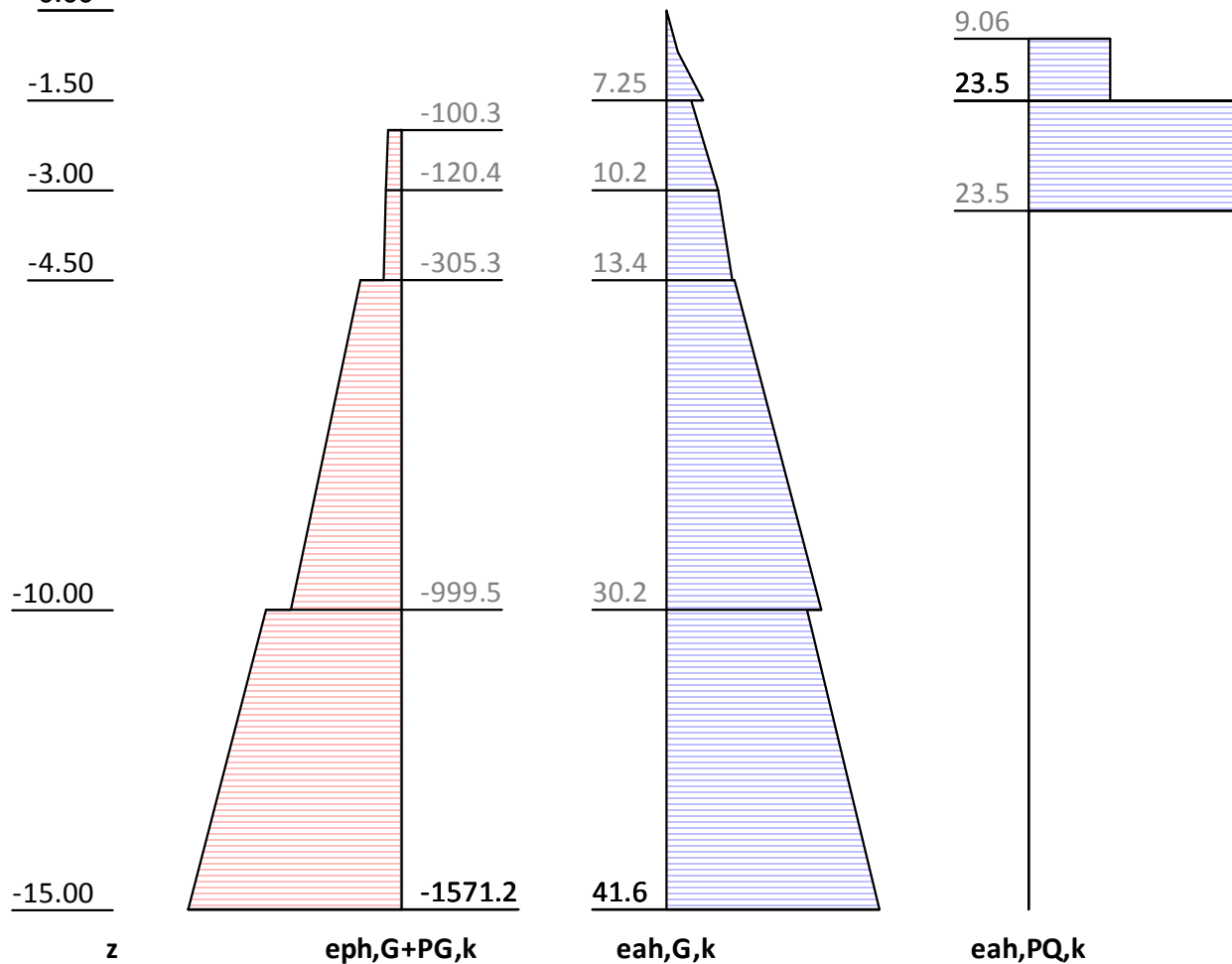
Anchor checks (lower failure plane): Ναι
Anchor forces with safety level of DS-P: Ναι
Verification of grout body pull out forces: Ναι
δ,a,Anchoring wall : used from soil layer.
δ,p,Anchoring wall : used from soil layer.

Earth pressure coefficients kh

| φ | α | β | δ | k0gh | kagh | kach | kpgh | kpch | |
|------|-----|-----|-------|------|-------|-------|-------|---------|--------------------------|
| 0.1 | 0.0 | 0.0 | -0.1 | -- | -- | -- | 1.005 | -2.006 | Τεχνητές επιχωματώσεις |
| 25.0 | 0.0 | 0.0 | 16.7 | -- | 0.346 | 1.043 | -- | -- | " |
| 0.1 | 0.0 | 0.0 | -0.1 | -- | -- | -- | 1.005 | -2.006 | Αμμόδης ΑΡΓΙΛΟΣ |
| 0.1 | 0.0 | 0.0 | 0.1 | -- | 0.996 | 1.994 | -- | -- | " |
| 33.0 | 0.0 | 0.0 | -22.0 | -- | -- | -- | 7.496 | -8.600 | Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ |
| 33.0 | 0.0 | 0.0 | 22.0 | -- | 0.245 | 0.855 | -- | -- | " |
| 35.0 | 0.0 | 0.0 | -23.3 | -- | -- | -- | 9.147 | -10.104 | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ |
| 35.0 | 0.0 | 0.0 | 23.3 | -- | 0.224 | 0.813 | -- | -- | " |
| 35.0 | 0.0 | 0.0 | -23.3 | -- | -- | -- | 9.147 | -10.104 | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ |
| 35.0 | 0.0 | 0.0 | 23.3 | -- | 0.224 | 0.813 | -- | -- | " |

Μήκος τοίχουFoot depth for statics: $z_f = -15.000$ **Stress analysis****Earth pressure, horizontal**

Pressures characteristic, no redistribution, continuous wall

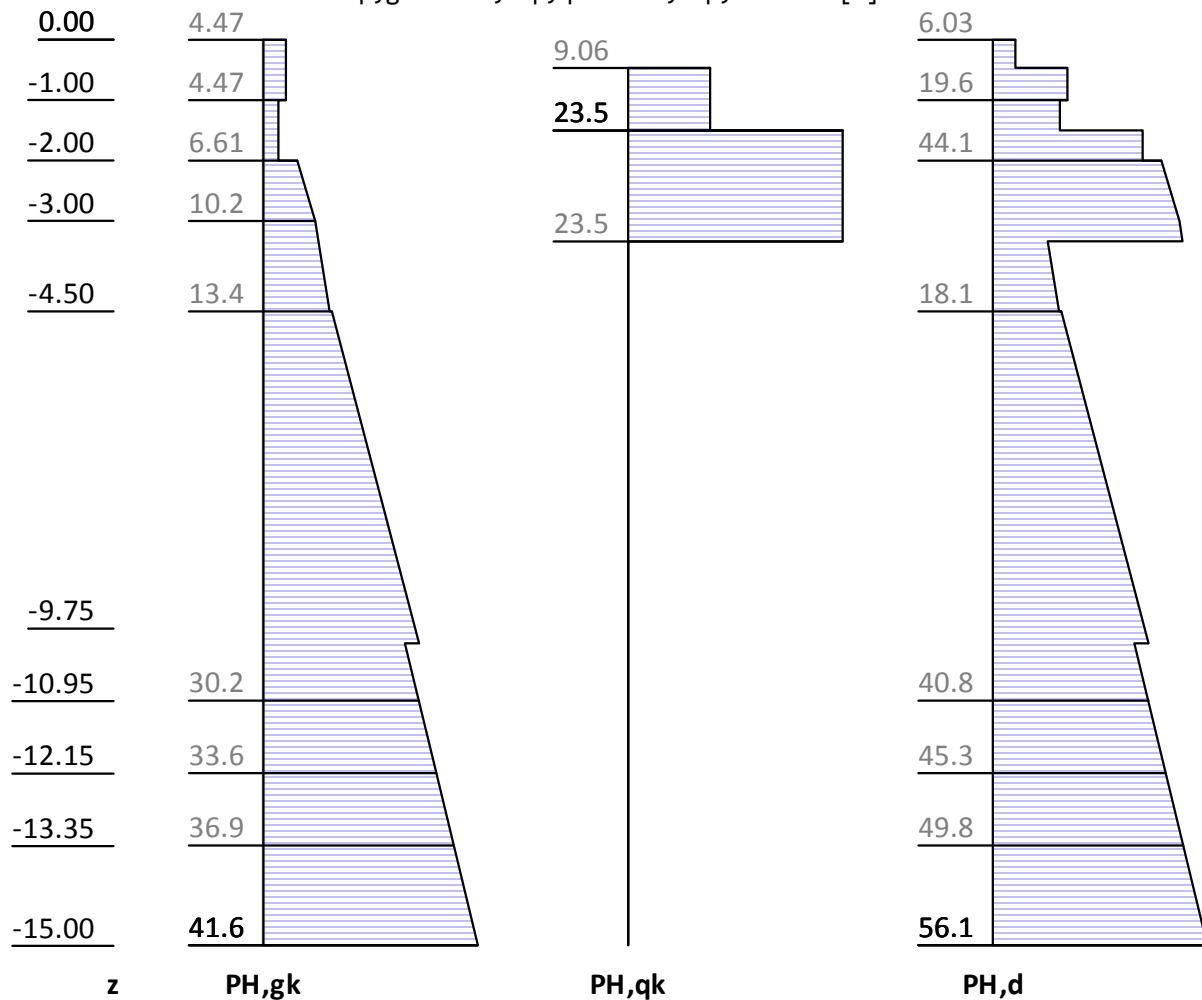
0.00

| z [m] | eph, G, k [kN/m ²] | eah, G, k [kN/m ²] | eah, PQ, k [kN/m ²] | eah, d [kN/m ²] |
|------------|-------------------------------------|-------------------------------------|--------------------------------------|----------------------------------|
| 0.00 | | 0.00 | | 0.00 |
| -0.47 | | 1.52 | 0.00 | 2.04 |
| -0.47 | | 1.52 | 9.06 | 15.62 |
| -1.50 | | 7.25 | 9.06 | 23.37 |
| -1.50 | | 4.82 | 23.48 | 41.73 |
| -2.00 | -0.00 | 6.61 | 23.48 | 44.14 |
| -2.00 | -100.29 | 6.61 | 23.48 | 44.14 |
| -3.34 | -123.80 | 10.79 | 23.48 | 49.78 |
| -3.34 | -123.80 | 10.79 | 0.00 | 14.56 |
| -4.50 | -135.45 | 12.86 | 0.00 | 17.36 |
| -4.50 | -305.34 | 13.38 | 0.00 | 18.06 |
| -10.00 | -820.67 | 30.24 | 0.00 | 40.82 |
| -10.00 | -999.52 | 27.52 | 0.00 | 37.16 |
| -15.00 | -1571.20 | 41.55 | 0.00 | 56.09 |

Eph, G, k : -9825.53, Eph, PG, k : 0.00 [kN/m]
 Eah, G, k : 325.76, Eah, PG, k : 0.00, Eah, PQ, k : 52.53, Eah, d : 518.57

H-pressure on static system

Level of mobilization: Ep,gk 100.0, Ep,qk 100.0, Ep,d 100.0 [%]



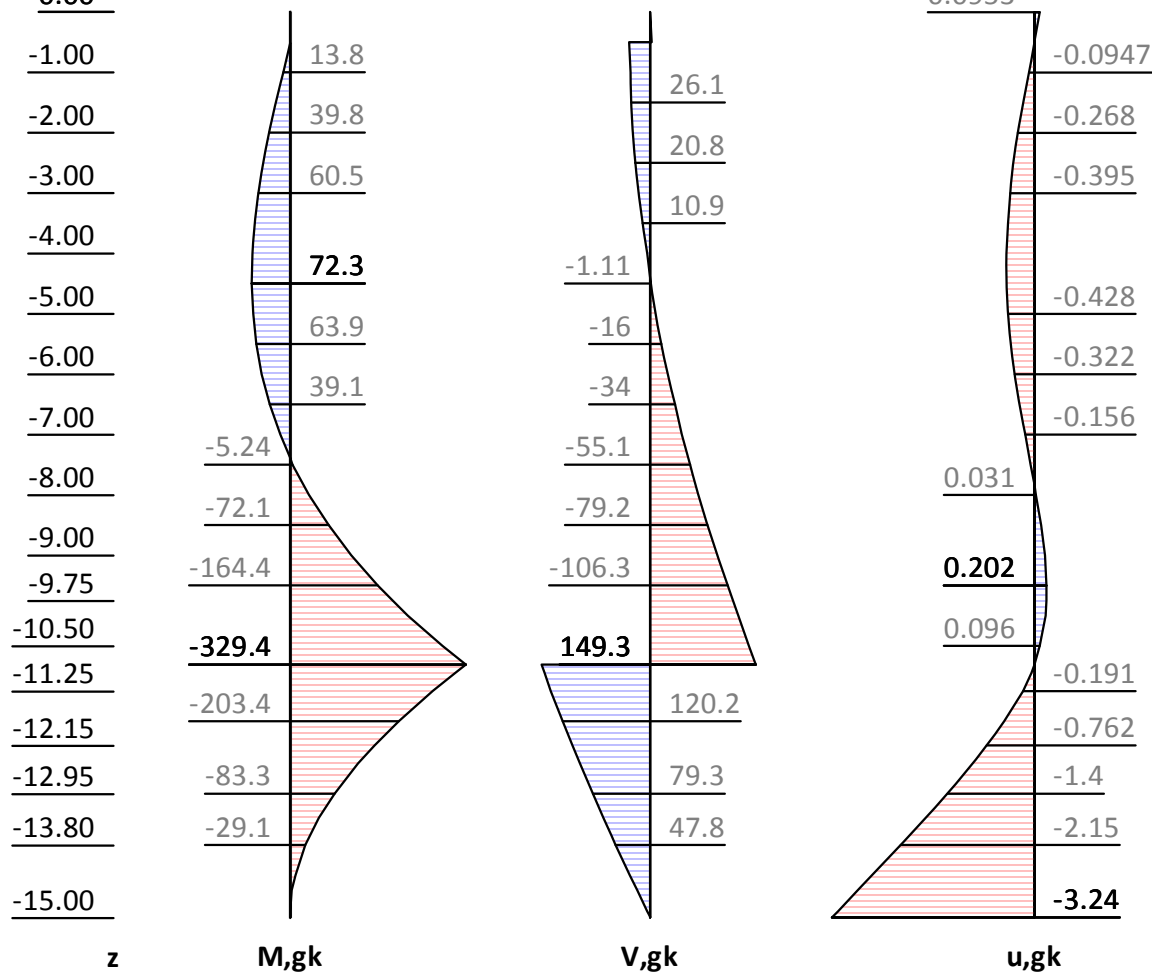
| z [m] | PH,gk [kN/m²] | PH,qk [kN/m²] | PH,d [kN/m²] |
|----------|------------------|------------------|-----------------|
| 0.00 | 4.47 | | 6.03 |
| -0.47 | 4.47 | 0.00 | 6.03 |
| -0.47 | 4.47 | 9.06 | 19.62 |
| -1.00 | 4.47 | 9.06 | 19.62 |
| -1.00 | 2.98 | 9.06 | 17.61 |
| -1.50 | 2.98 | 9.06 | 17.61 |
| -1.50 | 2.98 | 23.48 | 39.25 |
| -2.00 | 2.98 | 23.48 | 39.25 |
| -2.00 | 6.61 | 23.48 | 44.14 |
| -3.34 | 10.79 | 23.48 | 49.78 |
| -3.34 | 10.79 | 0.00 | 14.56 |
| -4.50 | 12.86 | 0.00 | 17.36 |
| -4.50 | 13.38 | 0.00 | 18.06 |
| -10.00 | 30.24 | 0.00 | 40.82 |
| -10.00 | 27.52 | 0.00 | 37.16 |
| -15.00 | 41.55 | 0.00 | 56.09 |

V-pressure on static system**Internal forces: Permanent, characteristically**

z= -0.500. Fx= -32.013 kN/m Support

z= -10.816. Fx=-293.745 kN/m Support

0.00



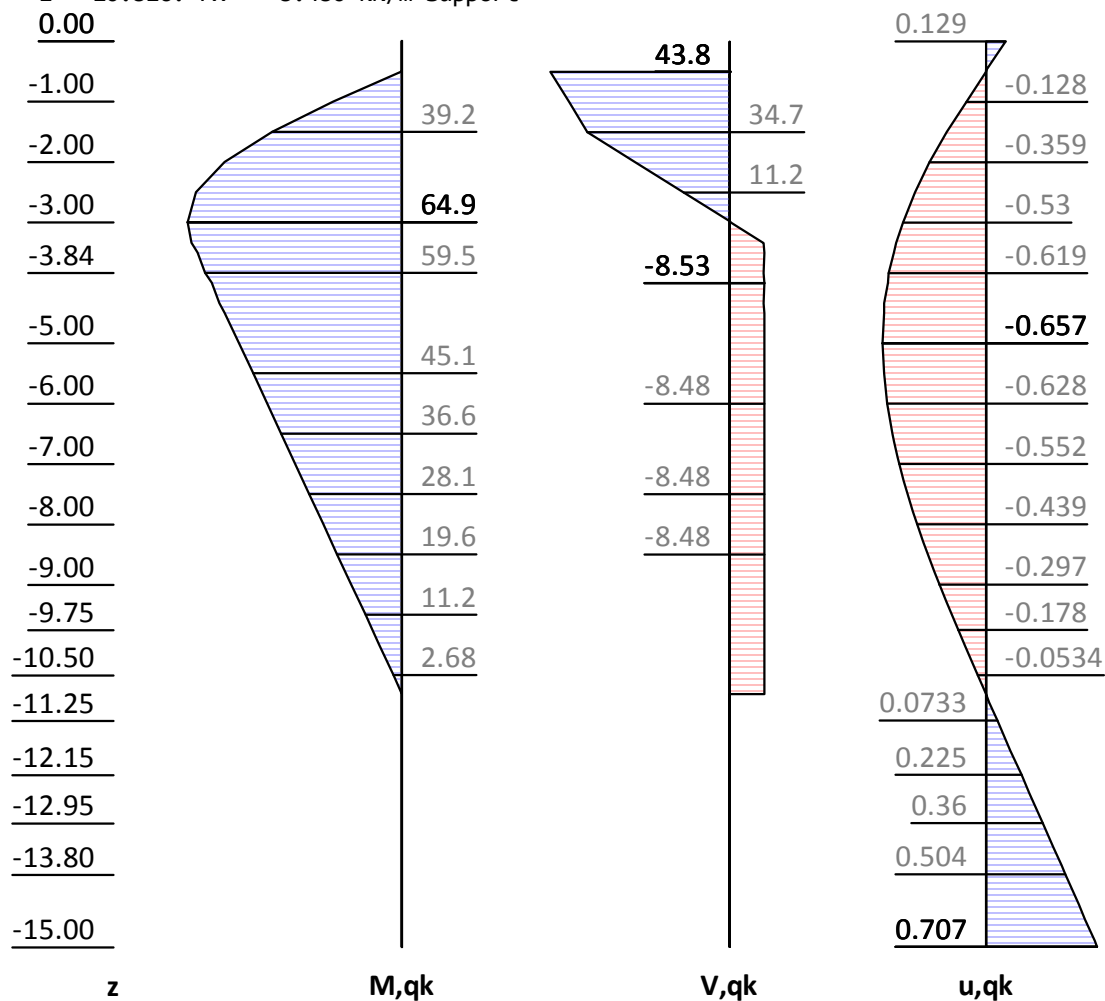
| z [m] | H, g, k [kN/m ²] | M, g, k [kN/m ²] | V, g, k [kN/m ²] | N, g, k [kN/m ²] | u, g, k [mm] |
|----------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|-----------------|
| 0.00 | 4.47 | 0.00 | -0.00 | 0.00 | 0.10 |
| -0.50 | 4.47 | -0.56 | -2.23 | -10.99 | 0.00 |
| -0.50 | 4.47 | -0.56 | -2.23 | -10.99 | -0.00 |
| -0.50 | 4.47 | -0.56 | 29.78 | -19.57 | -0.00 |
| -0.52 | 4.47 | -0.00 | 29.69 | -20.00 | -0.00 |
| -1.00 | 4.47 | 13.77 | 27.54 | -30.56 | -0.09 |
| -1.00 | 2.98 | 13.77 | 27.54 | -30.56 | -0.09 |
| -2.00 | 2.98 | 39.82 | 24.56 | -52.21 | -0.27 |
| -2.00 | 6.61 | 39.82 | 24.56 | -52.21 | -0.27 |
| -4.00 | 11.97 | 71.26 | 5.09 | -85.83 | -0.45 |
| -4.41 | 12.70 | 72.10 | -0.00 | -91.01 | -0.45 |
| -4.50 | 12.86 | 72.28 | -1.11 | -92.14 | -0.45 |
| -4.50 | 13.38 | 72.28 | -1.11 | -92.14 | -0.45 |
| -7.39 | 22.25 | 0.00 | -52.76 | -149.48 | -0.08 |
| -7.83 | 23.60 | -25.49 | -62.84 | -159.08 | 0.00 |
| -9.50 | 28.71 | -164.42 | -106.33 | -197.66 | 0.20 |
| -10.00 | 30.24 | -221.19 | -121.06 | -209.91 | 0.18 |
| -10.00 | 27.52 | -221.19 | -121.06 | -209.91 | 0.18 |
| -10.82 | 29.82 | -329.42 | -144.46 | -230.28 | 0.00 |
| -10.82 | 29.82 | -329.42 | 149.29 | -230.28 | 0.00 |
| -10.82 | 29.82 | -329.42 | 149.29 | -230.28 | -0.00 |
| -15.00 | 41.55 | -0.00 | -0.00 | -347.40 | -3.24 |

Internal forces: Variable, characteristicallyMethod EB 82-4 ($Q = [G+Q] - G$).

z= -0.500. Fx= -44.053 kN/m Support

z= -10.816. Fx= -8.480 kN/m Support

0.00



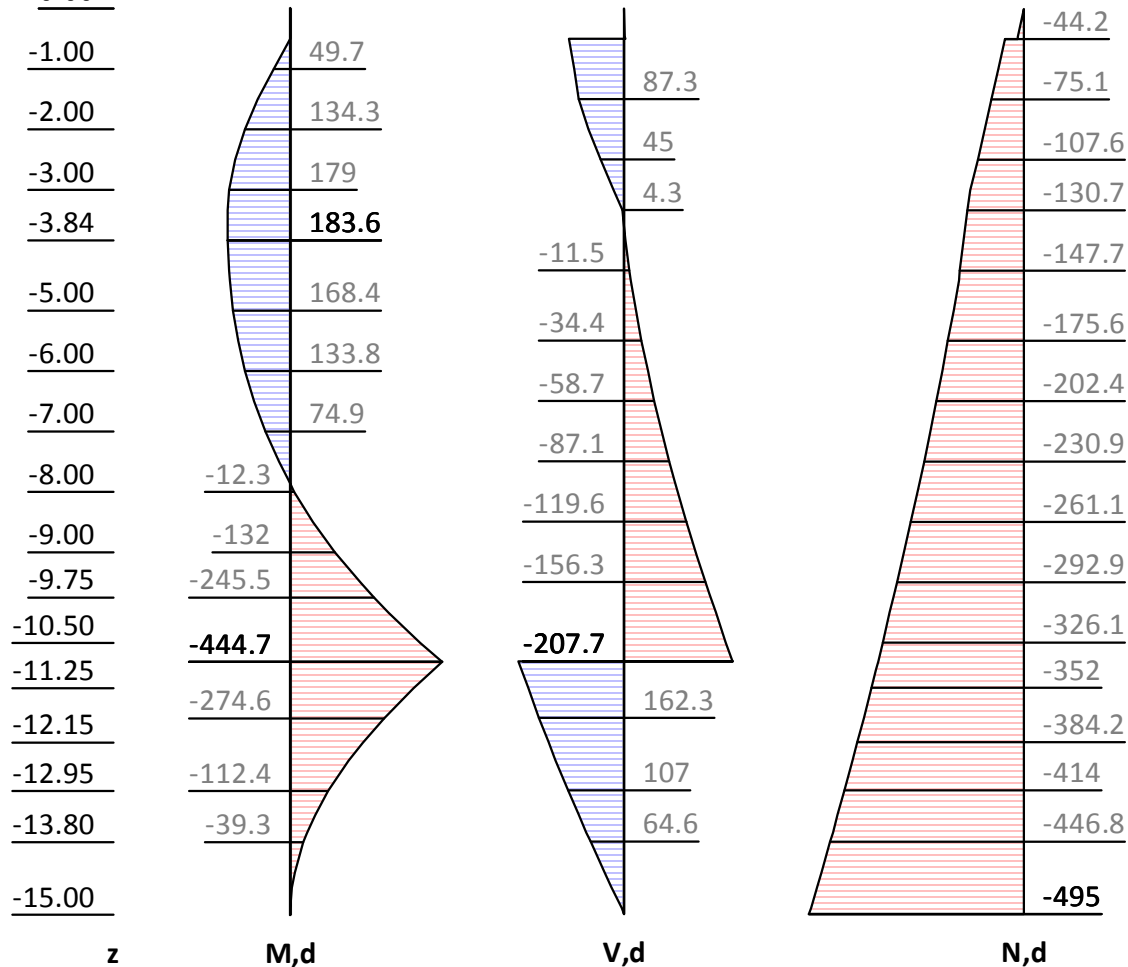
| z [m] | H, q, k [kN/m ²] | M, q, k [kN/m ²] | V, q, k [kN/m ²] | N, q, k [kN/m ²] | u, q, k [mm] |
|----------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|-----------------|
| 0.00 | | -0.00 | -0.00 | 0.00 | 0.13 |
| -0.00 | | 0.00 | -0.00 | 0.00 | 0.13 |
| -0.47 | 0.00 | 0.03 | -0.00 | 0.00 | 0.01 |
| -0.47 | 9.06 | 0.03 | -0.00 | -0.00 | 0.01 |
| -0.50 | 9.06 | 0.00 | -0.24 | -0.03 | 0.00 |
| -0.50 | 9.06 | 0.00 | 43.78 | -11.83 | -0.00 |
| -1.50 | 9.06 | 39.25 | 34.72 | -12.79 | -0.25 |
| -1.50 | 23.48 | 39.25 | 34.72 | -12.79 | -0.25 |
| -2.98 | 23.48 | 64.81 | -0.00 | -16.46 | -0.53 |
| -3.00 | 23.48 | 64.92 | -0.50 | -16.52 | -0.53 |
| -3.34 | 23.48 | 63.69 | -8.43 | -17.36 | -0.57 |
| -3.34 | 0.00 | 63.69 | -8.43 | -17.36 | -0.57 |
| -3.50 | 0.00 | 61.74 | -8.53 | -17.36 | -0.58 |
| -4.00 | 0.00 | 57.47 | -8.53 | -17.36 | -0.62 |
| -5.00 | 0.00 | 49.32 | -8.48 | -17.36 | -0.66 |
| -10.00 | 0.00 | 6.92 | -8.48 | -17.36 | -0.14 |
| -10.82 | 0.00 | 0.00 | -8.48 | -17.36 | 0.00 |
| -10.82 | 0.00 | 0.00 | -0.00 | -17.36 | 0.00 |
| -10.95 | 0.00 | 0.00 | -0.00 | -17.36 | 0.02 |
| -12.15 | 0.00 | 0.00 | -0.00 | -17.36 | 0.23 |
| -13.80 | 0.00 | 0.00 | -0.00 | -17.36 | 0.50 |

| z [m] | H, q, k [kN/m2] | M, q, k [kN/m2] | V, q, k [kN/m2] | N, q, k [kN/m2] | u, q, k [mm] |
|----------|--------------------|--------------------|--------------------|--------------------|-----------------|
| -14.55 | 0.00 | 0.00 | -0.00 | -17.36 | 0.63 |
| -14.84 | 0.00 | 0.00 | -0.00 | -17.36 | 0.68 |
| -14.90 | 0.00 | -0.00 | -0.00 | -17.36 | 0.69 |
| -14.94 | 0.00 | -0.00 | 0.00 | -17.36 | 0.70 |
| -15.00 | 0.00 | 0.00 | 0.00 | -17.36 | 0.71 |

Internal forces: Design

z= -0.500. Fx=-109.297 kN/m Support

z= -10.816. Fx=-409.275 kN/m Support

0.00

| | | | | | |
|---|-------------------|------------------|----------------------|----------|------------------|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | | | | | Job No.: |
| Program: WALLS-Retain. Version 2017.046 | | | | | |
| Structure: | info@fides-dvp.de | www.fides-dvp.de | Tel:++49/89/143829-0 | ASB Nr.: | Date: 08.10.2018 |

0.00

z

6.03

H,d

0.224

u,g+q,k

| z [m] | H,d [kN/m2] | M,d [kN/m2] | V,d [kN/m2] | N,d [kN/m2] | u,g+q,k [mm] |
|----------|----------------|----------------|----------------|----------------|-----------------|
| 0.00 | 6.03 | 0.00 | -0.00 | 0.00 | 0.22 |
| -0.00 | 6.03 | 0.00 | -0.00 | -0.00 | 0.22 |
| -0.47 | 6.03 | -0.67 | -2.84 | -13.95 | 0.01 |
| -0.47 | 19.62 | -0.67 | -2.84 | -13.95 | 0.01 |
| -0.50 | 19.62 | -0.76 | -3.42 | -14.88 | 0.00 |
| -0.51 | 19.62 | -0.00 | 105.72 | -44.40 | -0.00 |
| -1.00 | 19.62 | 49.72 | 96.06 | -59.72 | -0.22 |
| -1.00 | 17.61 | 49.72 | 96.06 | -59.72 | -0.22 |
| -1.50 | 17.61 | 95.55 | 87.26 | -75.05 | -0.43 |
| -1.50 | 39.25 | 95.55 | 87.26 | -75.05 | -0.43 |
| -2.00 | 39.25 | 134.28 | 67.64 | -91.53 | -0.63 |
| -2.00 | 44.14 | 134.28 | 67.64 | -91.53 | -0.63 |
| -3.34 | 49.78 | 183.36 | 4.30 | -130.68 | -1.00 |
| -3.34 | 14.56 | 183.36 | 4.30 | -130.68 | -1.00 |
| -3.62 | 15.25 | 183.51 | 0.00 | -135.50 | -1.04 |
| -3.84 | 15.77 | 183.63 | -3.29 | -139.19 | -1.07 |
| -4.50 | 17.36 | 177.92 | -14.22 | -150.43 | -1.10 |
| -4.50 | 18.06 | 177.92 | -14.22 | -150.43 | -1.10 |
| -7.87 | 32.01 | -0.00 | -98.73 | -241.91 | -0.45 |
| -9.61 | 39.20 | -222.78 | -160.54 | -296.46 | -0.00 |
| -10.00 | 40.82 | -288.22 | -176.15 | -309.42 | 0.04 |
| -10.00 | 37.16 | -288.22 | -176.15 | -309.42 | 0.04 |
| -10.82 | 40.26 | -444.71 | -207.74 | -336.92 | 0.00 |
| -10.82 | 40.26 | -444.71 | 201.54 | -336.92 | 0.00 |
| -15.00 | 56.09 | 0.00 | 0.00 | -495.03 | -2.53 |

| | | | |
|---------|--------------------------------------|----------|--------------|
| Part: | Please specify project informations. | Page: 31 | Archive No.: |
| Block: | | | |
| Record: | | | |

Anchor forces with safety level of DS-P

| z[m] | A,d[kN] | Fx,d[kN/m] |
|-------|---------|------------|
| -0.50 | 203.7 | -109.3 |

Checks of earth statics**Check of earth support**

Check: Mobilizable earth resistance is sufficient for earth support force.

z: -10.82 m

$R_d = E_{ph,k}/\gamma, R_e = 9825.53 / 1.400 = 7018.24 \text{ [kN/m]}$

$E_d(U_h,d)/R_d = 409.27 / 7018.24 = 0.058 [-]$. Passes requirement

Sum of H and V forces, (G)

Forces up to depth z:-15.00

| Pos. | H | V |
|---|---------|-----------------------|
| H/V pressure G+P+W,k | 325.76 | 124.61 |
| Wall weight | | 214.21 |
| H/V pressure passive | | 0.00 |
| Support z: -0.50 | -32.01 | 8.58 |
| B _{h,g,k} z=-10.82 | -293.74 | |
| B _{v,g,k} = B _{h,k} * tan($\delta, p=-23.33^\circ$) | | -126.71 |
| Σ | 0.00 | 220.69 (downwards) |

Average anchor inclination $\alpha, A = 15.00^\circ \geq 15^\circ$.

Verification of vertical forces due to EAB R 9 not required (R 9-5).

Check EAB R 9-1

Vertical component of earth resistance is less than the downwards pointing vertical forces.

$V_k \geq B_{vk}$: 347.40 \geq 126.71 Passes requirement

Sum of H and V forces, (G+Q)

Forces up to depth z:-15.00

| Pos. | H | V |
|---|---------|-----------------------|
| H/V pressure G+P+W,k | 378.29 | 130.17 |
| Wall weight | | 214.21 |
| H/V pressure passive | | 0.00 |
| Support z: -0.50 | -76.07 | 20.38 |
| B _{h,g,k} z=-10.82 | -293.74 | |
| B _{v,g,k} = B _{h,k} * tan($\delta, p=-23.33^\circ$) | | -126.71 |
| B _{h,q,k} z=-10.82 | -8.48 | |
| B _{v,q,k} = B _{h,k} * tan($\delta, p=-23.33^\circ$) | | -3.66 |
| Σ | 0.00 | 234.39 (downwards) |

Average anchor inclination $\alpha, A = 15.00^\circ \geq 15^\circ$.

Verification of vertical forces due to EAB R 9 not required (R 9-5).

Check EAB R 9-1

Vertical component of earth resistance is less than the downwards pointing vertical forces.

$V_k \geq B_{vk}$: 364.76 \geq 130.37 Passes requirement

Anchor verification

| | | | | | | |
|--|--|--|--|--|-------------------------|--|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | | | | | Job No.: | |
| Program: WALLS-Retain. | | | | | Version 2017.046 | |
| Structure: info@fides-dvp.de www.fides-dvp.de Tel:++49/89/143829-0 ASB Nr.: | | | | | Date: 08.10.2018 | |

Anchor - Stability of lower failure plane

Περίπτ.Φόρτισης: όλα τα φορτία BS-P
 Αυτόμ. υπολογ. μήκους αγκυρίων:
 All anchors are extended (if necessary)
 Favourable variable loads in main failure body are not being considered.
 Bottom of lower failure plane: z=-15.00 m

Iteration of failure mechanisms:
 lA: Length of anchor from head to center of grout body.
 W,k: Res. force from dead weight, loads, cohesion, ...
 Q,k: Force in lower failure plane.
 Ea1,k.....: Earth pressure onto vertical separation plane.
 Ea2,k.....: Earth pressure between wall and main failure body.
 Ra_cal,d: Dimesioning force of the resistance from the equilibrium of forces.
 Ra_cal,d corresponds to the max. possible anchor force of the force polygon.
 Sum(A,d): Acting anchor forces along the grout body fractions within the failure body. Sum(A,d) is gained from the anchor pull forces of the wall analysis.

| z | θ1 | θ2 | lA | W,k | Q,k | Ea1,k | Ea2,k | Ra_cal,d | Sum(A,d) | Ed/Rd |
|-------|------|------|-------|--------|--------|--------|--------|----------|----------|-------|
| [m] | [°] | [°] | [m] | [kN/m] | [kN/m] | [kN/m] | [kN/m] | [kN/m] | [kN/m] | [-] |
| -0.50 | 45.5 | 57.5 | 11.67 | 1466.8 | 1331.5 | 4.4 | 400.0 | 113.2 | 113.2 | 1.00 |

Decisive failure body:
Γεωμετρία:
 Foot point of lower failure plane x/z = 0.01/-15.00 m
 Intersection lower/upper slid. plane x/z = 11.27/ -3.52 m
 Intersection upper slid. plane/surface x/z = 13.52/ 0.00 m
 Intersection separation plane/surface x/z = 11.27/ 0.00 m
 Inclination lower failure plane θ1 = 45.54°
 Inclination upper failure plane θ2 = 57.50°
 Inclination separation plane θ12 = 90.00°

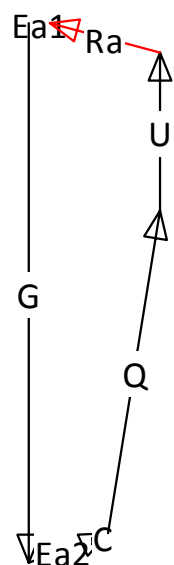
Loads / forces (char.)

| | | Fx | Fz | F | |
|------------------------------------|-----------|--------|---------|--------|---------|
| | | [kN/m] | [kN/m] | [kN/m] | |
| Weight of main failure body | G,k: | 0.0 | -2187.6 | 2187.6 | |
| Area loads on/in main failure body | F1,k: | 0.0 | -82.5 | 82.5 | |
| Cohesion of lower failure plane | C,k: | 99.6 | 101.5 | 142.1 | |
| Pore water pressure on main body | U,k: | -0.5 | 705.2 | 705.2 | |
| Earth pres. on separation plane | Ea1,k: | -4.4 | -0.0 | 4.4 | δ= 0.0° |
| Earth pr. between wall<->main body | Ea2,k: | 378.3 | 129.9 | 400.0 | |
| Force in lower failure plane | Q,k: | -319.8 | 1292.5 | 1331.5 | |
| Sum = possible anchor forces: | Ra_cal,k: | 153.1 | -41.0 | 158.5 | |

Force polygon

| | | |
|--|--|--------------|
| Part: | | Archive No.: |
| Block: Please specify project informations. | | |
| Record: | | |

Page: 33



Acting anchor forces $E_d: \text{Sum}(A,d) = 113.2 \text{ kN/m}$
 Possible anchor forces $R_d: R_{a_cal,d} = 158.5/1.400 = 113.2 \text{ kN/m}$
 Verif. of lower failure plane $E_d/R_d = 1.00 < 1.0$: Έλεγχος εκπληρώθηκε.

Check of steel tension

l_{tot} ...[m]: Total length of anchor incl. excess length at head
 A_s [mm²]: X-section area of steel member
 $R_{i,d}$...[kN]: Ultimate strength of tension member ($\gamma, M=1.15$)
 A,d [kN]: Dimensioning force of the anchor from wall analysis

| z[m] | Anchor type | l_{tot} | A_s | $R_{i,d}$ | A,d |
|-------|----------------------------|-----------|-------|-----------|--------------------|
| -0.50 | Strand; 3x0.60"; 1570/1770 | 15.67 | 420 | 573.4 | 203.7 |
| | | | | | Passes requirement |

Check of steel tension: Passes requirement

Check of anchor's soil friction

l_{vk} : Length of grout body
 $d_{m,vk}$: Diameter of grout body
 $\tau_{Gr,k}$: Average applied skin friction along the grout body (from soil parameters)
 $R_{a,k}$: Charact. pullout resistance of the anchor
 γ_A : Partial safety factor of anchor pullout
 $R_{a,d}$: = $R_{a,k} / \gamma_A$
 A,d : Dimensioning force of the anchor from wall analysis

| z | l_{vk} | $d_{m,vk}$ | $\tau_{Gr,k}$ | $R_{a,k}$ | γ_A | $R_{a,d}$ | A,d | $A,d/R_{a,d}$ |
|-------|----------|------------|----------------------|-----------|------------|-----------|-------|---------------|
| [m] | [m] | [mm] | [kN/m ²] | [kN] | [-] | [kN] | [kN] | [-] |
| -0.50 | 8.00 | 318 | 110 | 879.1 | 1.100 | 799.2 | 203.7 | 0.3 |

Check of anchor's soil friction: Passes requirement

Υπολογ. κύκλου ολίσθησης

LC: όλα τα φορτία Type: BS-T (combination: [GEO] A2 M2 R3, BS-T)
 Vertical variable loads only act if they are outside of $R \cdot \sin(\phi)$.
 The automatic slip circle optimization only considers circles that intersect the surface with an area of at least 0.25 m².
 The slip circle calculation only accepts circles including the wall.
 The slip circle calculation only allows circular failure planes (no vertical tangents will occur).

| | | | | | | | | |
|--|--|--|--|--|--|--|------------------|--|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | | | | | | | Job No.: | |
| Program: WALLS-Retain. Version 2017.046 | | | | | | | | |
| Structure: info@fides-dvp.de www.fides-dvp.de Tel:++49/89/143829-0 ASB Nr.: | | | | | | | Date: 08.10.2018 | |

Γεωμετ.κύκλου (μήκη και συντεταγμ. σε (m))
 Κέντρο = (-0.78, 3.16), Ακτίνα = 18.19
 Αρχ.σημ.= (-18.22, -2.00), Τελ.σημ. = (17.13, 0.00)

Γεωμετρία λωρίδων:

| No | x | Width | dxM | Weight | Load | Water- | u*b | φ | c | θ |
|----|--------|-------|--------|--------|--------|--------|--------|-------|---------|---------|
| | [m] | b | [m] | [kN/m] | z-κατ. | φορτ. | [kN/m] | [°] | [kN/m²] | [°] |
| | | | | | [kN/m] | | | | | |
| 1 | -17.31 | 1.82 | -16.53 | 88.2 | 0.0 | 0.0 | -28.7 | 0.08 | 35.71 | -44.96* |
| 2 | -15.50 | 1.82 | -14.71 | 215.1 | 0.0 | 0.0 | -80.4 | 27.45 | 3.57 | -31.27* |
| 3 | -13.68 | 1.82 | -12.89 | 302.4 | 0.0 | 0.0 | -120.1 | 27.45 | 3.57 | -31.27* |
| 4 | -11.86 | 1.82 | -11.08 | 367.9 | 0.0 | 0.0 | -149.5 | 29.26 | 3.57 | -30.37* |
| 5 | -10.04 | 1.82 | -9.26 | 418.2 | 0.0 | 0.0 | -172.1 | 29.26 | 3.57 | -30.37* |
| 6 | -8.22 | 1.82 | -7.44 | 456.7 | 0.0 | 0.0 | -189.3 | 29.26 | 3.57 | -24.13 |
| 7 | -6.40 | 1.82 | -5.62 | 485.4 | 0.0 | 0.0 | -202.1 | 29.26 | 3.57 | -17.99 |
| 8 | -4.58 | 1.82 | -3.80 | 505.4 | 0.0 | 0.0 | -211.0 | 29.26 | 3.57 | -12.06 |
| 9 | -2.76 | 1.82 | -1.98 | 517.4 | 0.0 | 0.0 | -216.4 | 29.26 | 3.57 | -6.25 |
| 10 | -0.94 | 1.82 | -0.16 | 521.8 | 0.0 | 0.0 | -218.3 | 29.26 | 3.57 | -0.51 |
| 11 | 0.88 | 1.82 | 1.66 | 584.8 | 0.0 | 0.0 | -217.0 | 29.26 | 3.57 | 5.23 |
| 12 | 2.70 | 1.82 | 3.48 | 575.4 | 0.0 | 0.0 | -212.2 | 29.26 | 3.57 | 11.02 |
| 13 | 4.51 | 1.82 | 5.30 | 556.9 | 0.0 | 0.0 | -204.0 | 29.26 | 3.57 | 16.93 |
| 14 | 6.33 | 1.82 | 7.12 | 529.8 | 0.0 | 0.0 | -191.9 | 29.26 | 3.57 | 23.03 |
| 15 | 8.15 | 1.82 | 8.93 | 493.1 | 0.0 | 0.0 | -175.5 | 29.26 | 3.57 | 29.42 |
| 16 | 9.97 | 1.82 | 10.75 | 445.1 | 0.0 | 0.0 | -154.0 | 29.26 | 3.57 | 36.24 |
| 17 | 11.79 | 1.82 | 12.57 | 382.7 | 0.0 | 0.0 | -125.9 | 27.45 | 3.57 | 43.72 |
| 18 | 13.61 | 1.82 | 14.39 | 300.0 | 0.0 | 0.0 | -88.4 | 27.45 | 3.57 | 52.29 |
| 19 | 15.83 | 2.61 | 16.61 | 214.7 | 0.0 | 0.0 | -48.0 | 0.08 | 35.71 | 65.92 |

*** Σημείωση: Στις λωρίδες σημειωμένες με '*'
 περιορίστηκε το theta στο 45°-Phi/2.

Συνεισφ. κατακόρυφων φορτίων:

| No | Weight | G*sin(θ) | (G-u*b)*tan(φ) + c*b | μ*sin(θ)* tan(φ)+cos(θ) | T |
|----|--------|----------|-------------------------|----------------------------|---------|
| | [kN/m] | [kN/m] | [kN/m] | [-] | [kN/m] |
| 1 | 88.17 | -80.13 | 65.05 | 0.707504 | 91.94 |
| 2 | 215.06 | -173.95 | 76.47 | 0.828416 | 92.31 |
| 3 | 302.43 | -214.38 | 101.23 | 0.828416 | 122.19 |
| 4 | 367.89 | -224.00 | 128.81 | 0.835160 | 154.24 |
| 5 | 418.20 | -212.81 | 144.37 | 0.835160 | 172.86 |
| 6 | 456.73 | -186.74 | 156.30 | 0.890276 | 175.56 |
| 7 | 485.40 | -149.92 | 165.18 | 0.934246 | 176.81 |
| 8 | 505.38 | -105.56 | 171.38 | 0.966543 | 177.31 |
| 9 | 517.38 | -56.32 | 175.10 | 0.988114 | 177.21 |
| 10 | 521.77 | -4.62 | 176.47 | 0.999477 | 176.56 |
| 11 | 584.77 | 53.29 | 212.52 | 1.000814 | 212.35 |
| 12 | 575.38 | 109.98 | 209.92 | 0.991998 | 211.61 |
| 13 | 556.86 | 162.12 | 204.17 | 0.972575 | 209.93 |
| 14 | 529.79 | 207.22 | 195.78 | 0.941685 | 207.91 |
| 15 | 493.13 | 242.19 | 184.43 | 0.897893 | 205.40 |
| 16 | 445.10 | 263.11 | 169.57 | 0.838841 | 202.15 |
| 17 | 382.67 | 264.48 | 139.88 | 0.757716 | 184.61 |
| 18 | 299.97 | 237.31 | 116.39 | 0.651694 | 178.60 |
| 19 | 214.72 | 196.03 | 93.54 | 0.408200 | 229.15 |
| | | ----- | | | ----- |
| | | 327.31 | | | 3358.70 |

Δράση Ed = (327.3*18.19)
 Αντίσταση Rd = (3358.7*18.19 +0.0)

SLIP-CIRCLE μ = Ed/Rd = 0.10 < 1.0: Έλεγχος εκπληρώθηκε.

| | | |
|--|--|--------------|
| Part: | | Archive No.: |
| Block: Please specify project informations. | | |
| Record: | | |

Page: 35

| | | | | |
|------------|--|------------------|-------------------------------|------------------|
| Author: | FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | | | Job No.: |
| Program: | WALLS-Retain. Version 2017.046 | | | |
| Structure: | info@fides-dvp.de | www.fides-dvp.de | Tel:++49/89/143829-0 ASB Nr.: | Date: 08.10.2018 |

Φάση εκσκαφής 3 "[3] Situation 3"

LC: όλα τα φορτία Type: BS-T

Εδαφικό σύστημα με 5 Στρώσεις

| Name | Τεχνητές επιχωματώσεις | Αμμόδης ΑΡΓΙΛΟΣ | Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ | |
|-------------|------------------------|-----------------|--------------------------|-----------|
| γ | [kN/m3] | 18 | 20 | 22.5 |
| γ,R | [kN/m3] | 18 | 20 | 22.5 |
| γ' | [kN/m3] | 8 | 10 | 12.5 |
| γ,p | [kN/m3] | 18 | 20 | 22.5 |
| γ,R,passive | [kN/m3] | 18 | 20 | 22.5 |
| γ,pw | [kN/m3] | 8 | 10 | 12.5 |
| φ | [°] | 25 | 0.1 | 33 |
| c | [kN/m2] | 2 | 50 | 5 |
| c,u | [kN/m2] | 10 | 50 | 5 |
| c παθητικό | [kN/m2] | 2 | 50 | 5 |
| δ,a | [°] | 16.66667 | 0.06666667 | 22 |
| δ,p | [°] | -16.66667 | -0.06666667 | -22 |
| δ,c | [°] | 8.333333 | 0.03333333 | 11 |
| k,agh | [-] | 0.3456501 | 0.9955057 | 0.2452023 |
| K,ach | [-] | 1.043051 | 1.994195 | 0.8549058 |
| K,0h | [-] | 0.5773817 | 0.9982547 | 0.455361 |
| K,pgh | [-] | 3.908103 | 1.004519 | 7.495617 |
| K,pch | [-] | 5.180327 | 2.00583 | 8.599509 |
| τ,gr | [kN/m2] | 110 | 110 | 110 |
| Ψ,A,max | [°] | 90 | 90 | 90 |
| k | [cm/s] | 10e-06 | 1e-06 | 100e-06 |

| Name | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ |
|-------------|------------------------|------------------------|
| γ | [kN/m3] 22.5 | 22.5 |
| γ,R | [kN/m3] 22.5 | 22.5 |
| γ' | [kN/m3] 12.5 | 12.5 |
| γ,p | [kN/m3] 22.5 | 22.5 |
| γ,R,passive | [kN/m3] 22.5 | 22.5 |
| γ,pw | [kN/m3] 12.5 | 12.5 |
| φ | [°] 35 | 35 |
| c | [kN/m2] 5 | 5 |
| c,u | [kN/m2] 5 | 5 |
| c παθητικό | [kN/m2] 5 | 5 |
| δ,a | [°] 23.33333 | 23.33333 |
| δ,p | [°] -23.33333 | -23.33333 |
| δ,c | [°] 11.66667 | 11.66667 |
| k,agh | [-] 0.2244207 | 0.2244207 |
| K,ach | [-] 0.8126539 | 0.8126539 |
| K,0h | [-] 0.4264236 | 0.4264236 |
| K,pgh | [-] 9.146943 | 9.146943 |
| K,pch | [-] 10.104 | 10.104 |
| τ,gr | [kN/m2] 110 | 110 |
| Ψ,A,max | [°] 90 | 90 |
| k | [cm/s] 100e-06 | 100e-06 |

Πορεία πρανούς:

x [m] 0.00 0.00
z [m] -4.00 0.00

Πορεία ανώτερου 2. στρώματος Αμμόδης ΑΡΓΙΛΟΣ:

x [m] 0.00 0.00
z [m] -4.00 -1.50

Πορεία ανώτερου 3. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ:

z= -4.50

Πορεία ανώτερου 4. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟΣ:

z= -10.00

| | | | |
|---------|--------------------------------------|----------|--------------|
| Part: | Please specify project informations. | Page: 36 | Archive No.: |
| Block: | | | |
| Record: | | | |

| | | |
|---|------------------|-------------------------------|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | | Job No.: |
| Program: WALLS-Retain. Version 2017.046 | | |
| Structure: info@fides-dvp.de | www.fides-dvp.de | Tel:++49/89/143829-0 ASB Nr.: |
| | | Date: 08.10.2018 |

Πορεία ανώτερου 5. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ:
 z= -14.00

Επιφ. φορτία:

Φορτία

| xA | zA | xE | zE | PxA | PzA | PxE | PzE | Typ | LC-description |
|------|------|------|------|------|-------|------|-------|-----|----------------|
| [m] | [m] | [m] | [m] | [| kN/m² | |] | | Name |
| 1.00 | 0.00 | 3.50 | 0.00 | 0.00 | 33.00 | 0.00 | 33.00 | q | 1 |

Κατανομή εδαφ.πιέσεων

| Κατανομή εδαφ.πιέσεων | Name |
|----------------------------|------|
| Rectangular within a layer | |

Στάθμη νερού:

| | | |
|-------|-------|-------|
| x [m] | 0.00 | 0.00 |
| z [m] | -6.00 | -3.00 |

Αγκύρια

| z[m] | min.l[m] | Alpha[°] | C-H[kN/m] | P0[kN] | u0[m] |
|-------|----------|----------|-----------|--------|--------|
| -0.50 | 0.00 | 15.00 | αόρισ. | 0.00 | 0.0000 |

Παράμετροι υπολογισμού

Earth pressure options

Τμήμα εδαφ.ωθήσεων: Ενεργές ωθήσεις.
 Angle of slip plane: DIN 4085.
 Split block loads into 1 sections.
 Consideration of minimum earth pressure: $\varphi_{min} = 40.000$.
 Negative earth pressure fractions are set to zero.

Redistribution of earth pressure

Shape of redistribution: Trapezoid.
 The earth pressure is getting redistb. to: Excavation level
 The earth pressure below the excavation acts without redistrb.
 Levels of redistribution Z1: 0.000, Z2: -2.000 [m].
 The earth pressure from variable loads will be included in redistribution.

Παθητικές ωθήσεις

Method of calculation: Κλασικός, Pregl/Sokolovsky (DIN 4085).

Options for water pressure

Στήριξη πόδα

Πόδας οριζοντίως μετακινούμενος

Αγκύρια

Anchor checks (lower failure plane): Ναι
 Anchor forces with safety level of DS-P: Ναι
 Verification of grout body pull out forces: Ναι
 δ,a,Anchoring wall : used from soil layer.
 δ,p,Anchoring wall : used from soil layer.

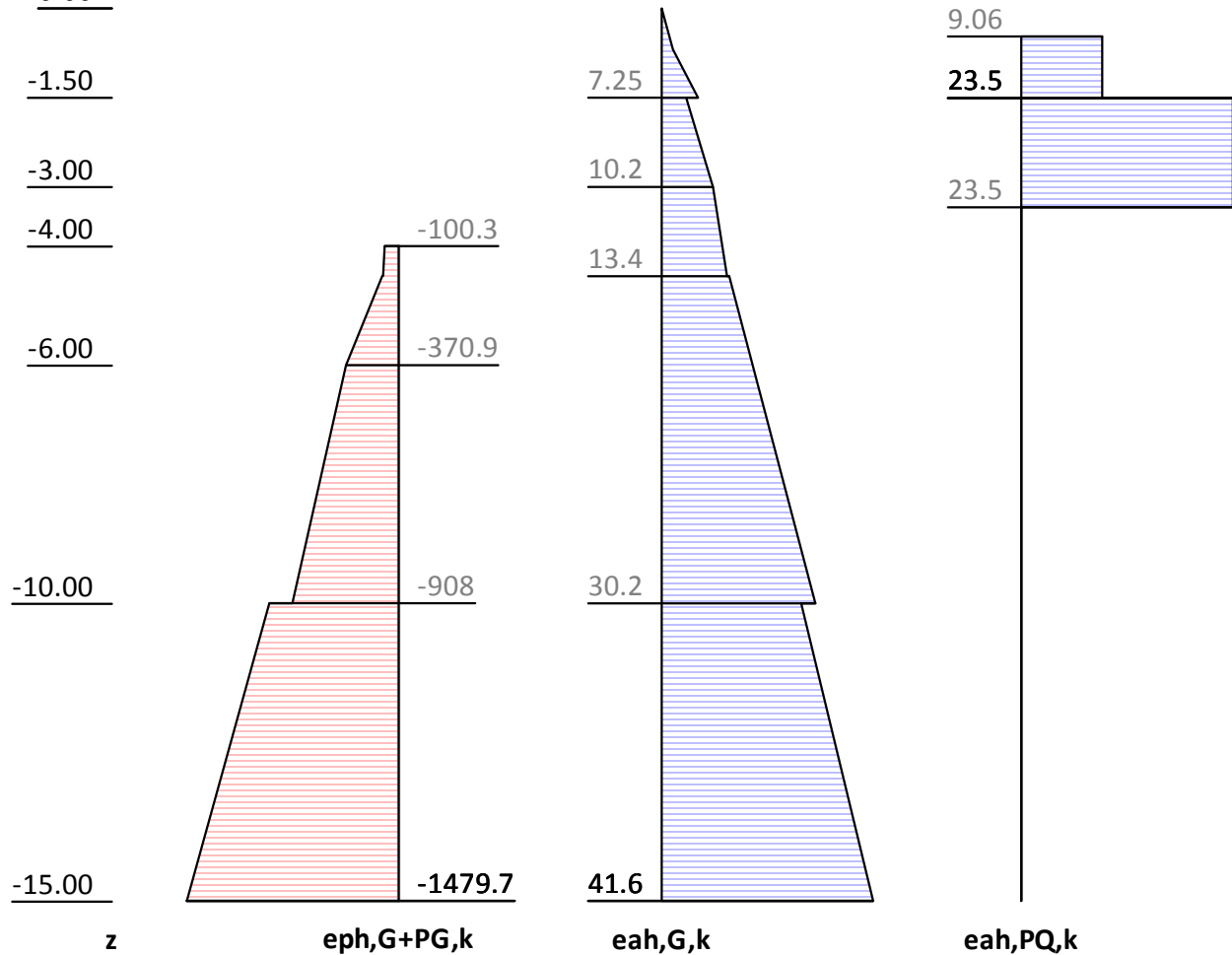
Earth pressure coefficients kh

| φ | α | β | δ | k0gh | kagh | kach | kpgh | kpch | |
|------|-----|-----|-------|------|-------|-------|-------|---------|--------------------------|
| 0.1 | 0.0 | 0.0 | -0.1 | -- | -- | -- | 1.005 | -2.006 | Τεχνητές επιχωματώσεις |
| 25.0 | 0.0 | 0.0 | 16.7 | -- | 0.346 | 1.043 | -- | -- | " |
| 0.1 | 0.0 | 0.0 | -0.1 | -- | -- | -- | 1.005 | -2.006 | Αμμόδης ΑΡΓΙΛΟΣ |
| 0.1 | 0.0 | 0.0 | 0.1 | -- | 0.996 | 1.994 | -- | -- | " |
| 33.0 | 0.0 | 0.0 | -22.0 | -- | -- | -- | 7.496 | -8.600 | Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ |
| 33.0 | 0.0 | 0.0 | 22.0 | -- | 0.245 | 0.855 | -- | -- | " |
| 35.0 | 0.0 | 0.0 | -23.3 | -- | -- | -- | 9.147 | -10.104 | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ |
| 35.0 | 0.0 | 0.0 | 23.3 | -- | 0.224 | 0.813 | -- | -- | " |
| 35.0 | 0.0 | 0.0 | -23.3 | -- | -- | -- | 9.147 | -10.104 | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ |
| 35.0 | 0.0 | 0.0 | 23.3 | -- | 0.224 | 0.813 | -- | -- | " |

| | |
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| Part: | Archive No.: |
| Block: Please specify project informations. | Page: 37 |
| Record: | |

Μήκος τοίχουFoot depth for statics: $z_f = -15.000$ **Stress analysis****Earth pressure, horizontal**

Pressures characteristic, no redistribution, continuous wall

0.00

| z [m] | eph, G, k [kN/m²] | eah, G, k [kN/m²] | eah, PQ, k [kN/m²] | eah, d [kN/m²] |
|----------|----------------------|----------------------|-----------------------|-------------------|
| 0.00 | | 0.00 | | 0.00 |
| -0.47 | | 1.52 | 0.00 | 2.04 |
| -0.47 | | 1.52 | 9.06 | 15.62 |
| -1.50 | | 7.25 | 9.06 | 23.37 |
| -1.50 | | 4.82 | 23.48 | 41.73 |
| -3.34 | | 10.79 | 23.48 | 49.78 |
| -3.34 | | 10.79 | 0.00 | 14.56 |
| -4.00 | -0.00 | 11.97 | 0.00 | 16.15 |
| -4.00 | -100.29 | 11.97 | 0.00 | 16.15 |
| -4.50 | -110.34 | 12.86 | 0.00 | 17.36 |
| -4.50 | -117.95 | 13.38 | 0.00 | 18.06 |
| -10.00 | -745.71 | 30.24 | 0.00 | 40.82 |
| -10.00 | -908.05 | 27.52 | 0.00 | 37.16 |
| -15.00 | -1479.73 | 41.55 | 0.00 | 56.09 |

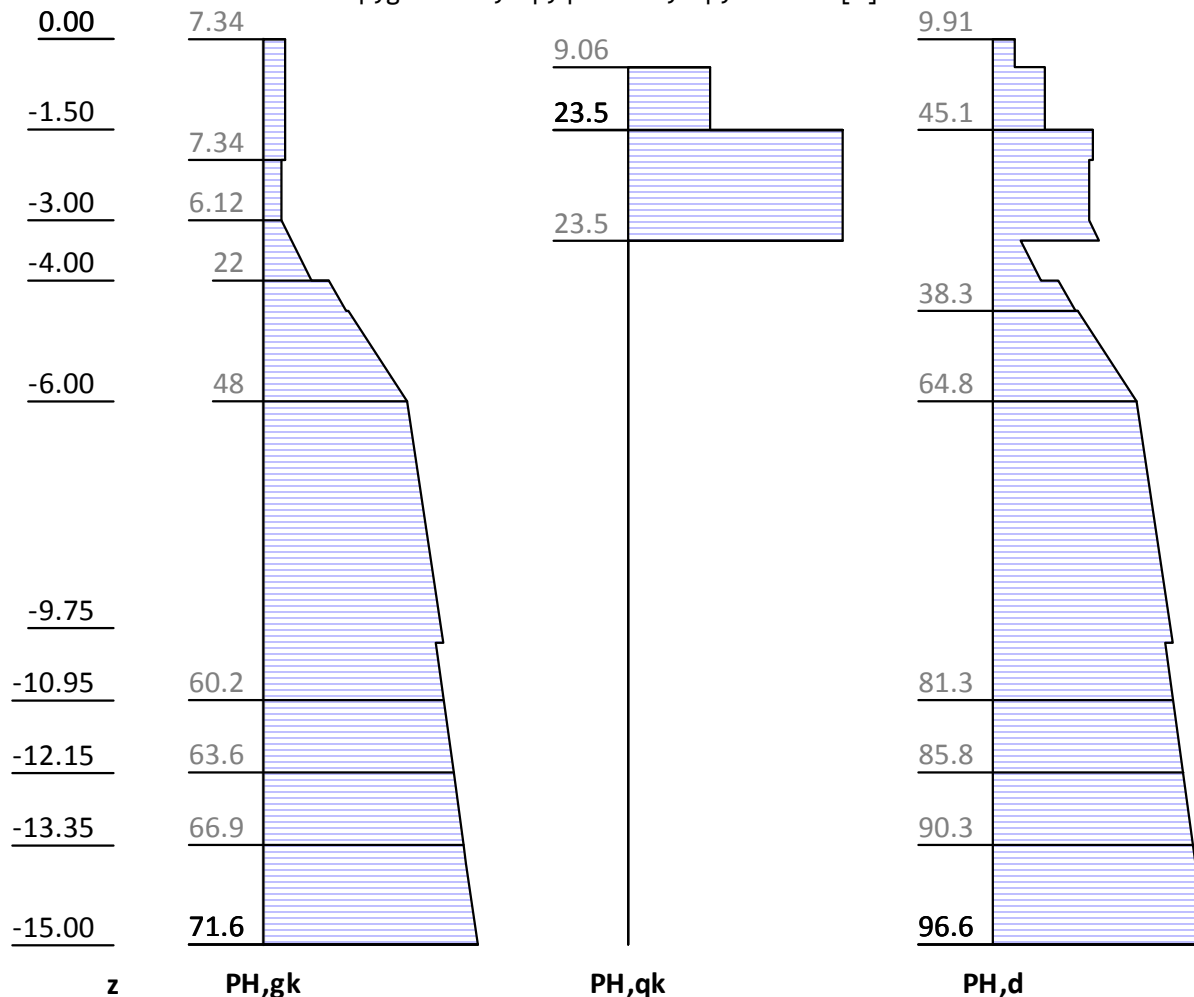
Eph, G, k: -8622.04, Eph, PG, k: 0.00 [kN/m]
 Eah, G, k: 325.76, Eah, PG, k: 0.00, Eah, PQ, k: 52.53, Eah, d: 518.57

Πίεση νερού

| z [m] | Wp,k [kN/m ²] | Wa,k [kN/m ²] | W,k [kN/m ²] |
|----------|------------------------------|------------------------------|-----------------------------|
| -3.00 | | 0.00 | 0.00 |
| -6.00 | 0.00 | 30.00 | 30.00 |
| -15.00 | -90.00 | 120.00 | 30.00 |

H-pressure on static system

Level of mobilization: Ep,gk 100.0, Ep,qk 100.0, Ep,d 100.0 [%]



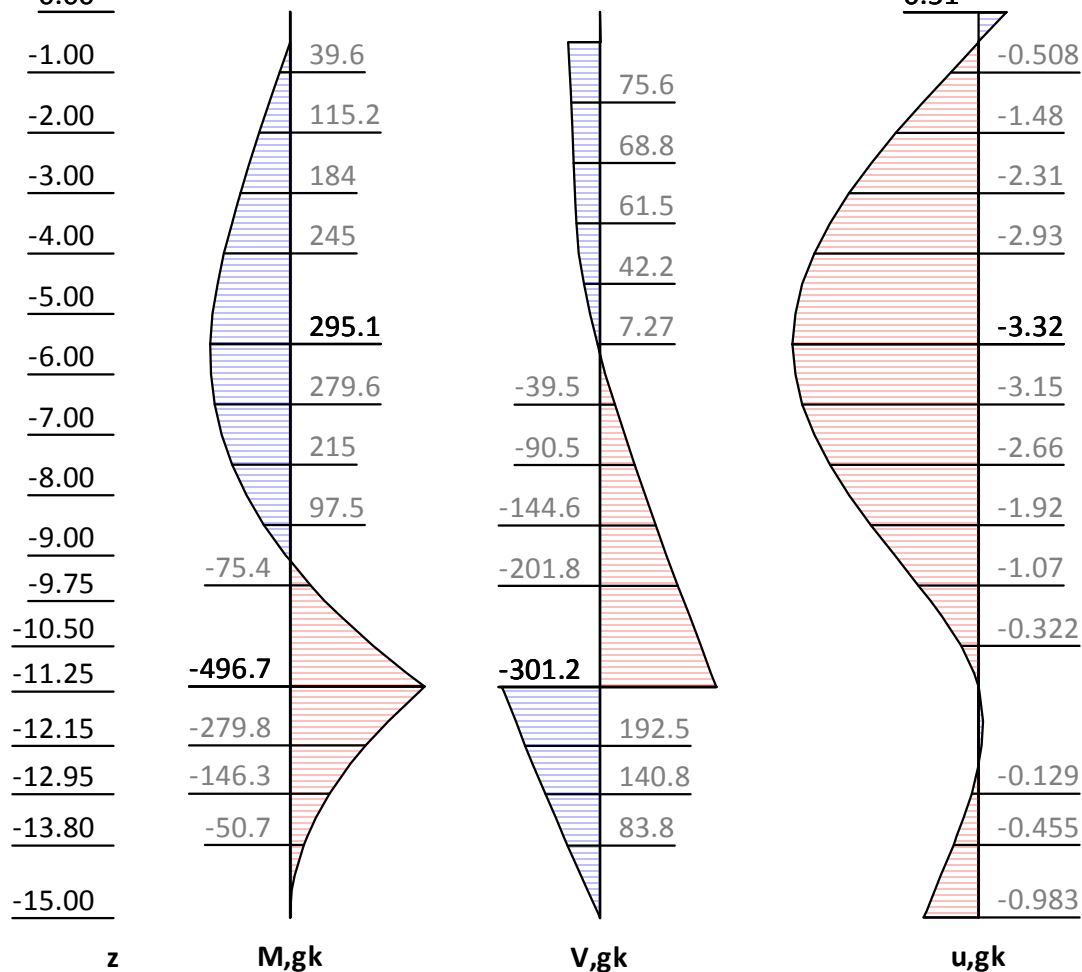
| z [m] | PH,gk [kN/m ²] | PH,qk [kN/m ²] | PH,d [kN/m ²] |
|----------|-------------------------------|-------------------------------|------------------------------|
| 0.00 | 7.34 | | 9.91 |
| -0.47 | 7.34 | 0.00 | 9.91 |
| -0.47 | 7.34 | 9.06 | 23.50 |
| -1.50 | 7.34 | 9.06 | 23.50 |
| -1.50 | 7.34 | 23.48 | 45.13 |
| -2.00 | 7.34 | 23.48 | 45.13 |
| -2.00 | 6.12 | 23.48 | 43.48 |
| -3.34 | 9.52 | 23.48 | 48.07 |
| -3.34 | 9.52 | 0.00 | 12.85 |
| -4.00 | 16.12 | 0.00 | 21.76 |
| -4.00 | 21.97 | 0.00 | 29.65 |
| -4.50 | 27.86 | 0.00 | 37.61 |
| -4.50 | 28.38 | 0.00 | 38.31 |
| -10.00 | 60.24 | 0.00 | 81.32 |
| -10.00 | 57.52 | 0.00 | 77.66 |
| -15.00 | 71.55 | 0.00 | 96.59 |

V-pressure on static system**Internal forces: Permanent, characteristically**

z= -0.500. Fx= -86.564 kN/m Support

z= -11.177. Fx=-554.194 kN/m Support

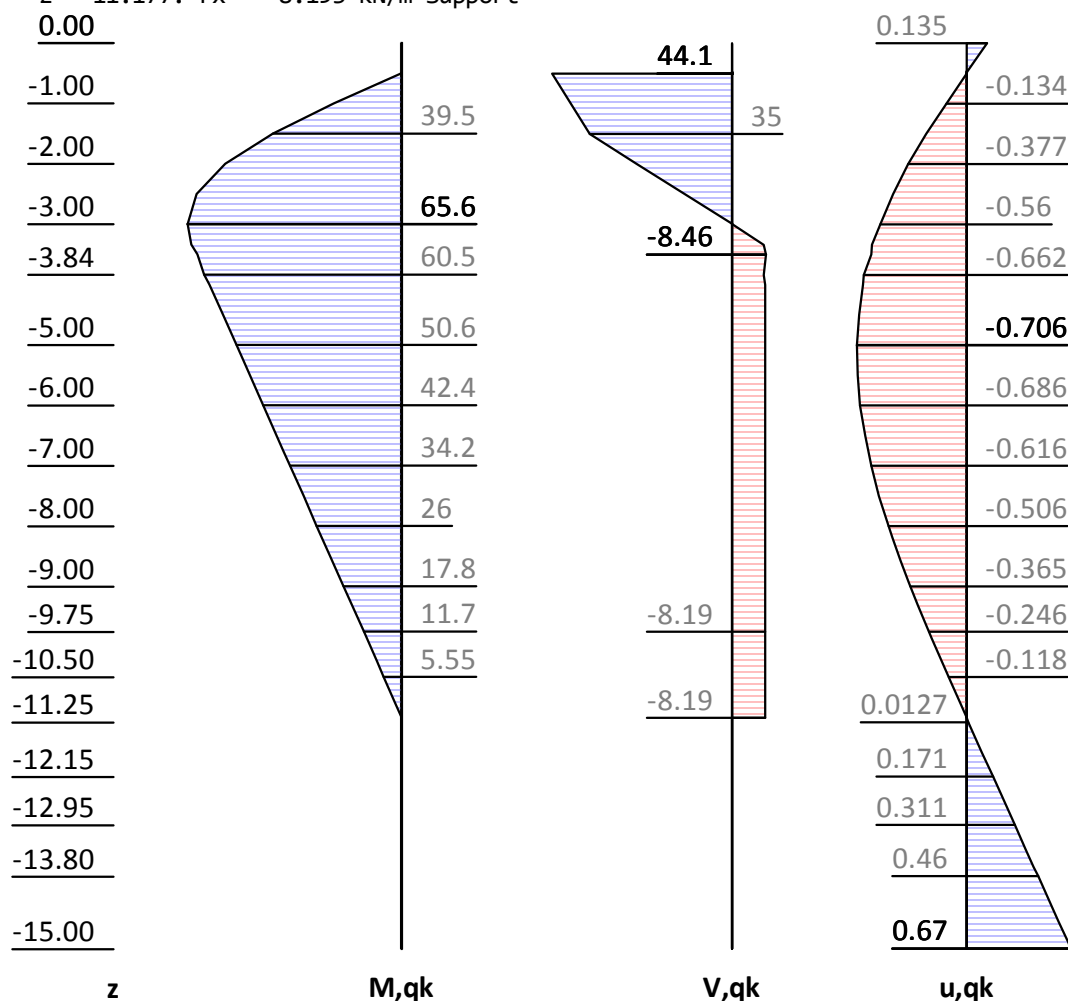
0.00



| z [m] | H,g,k [kN/m ²] | M,g,k [kN/m ²] | V,g,k [kN/m ²] | N,g,k [kN/m ²] | u,g,k [mm] |
|----------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|---------------|
| 0.00 | 7.34 | -0.00 | -0.00 | 0.00 | 0.51 |
| -0.50 | 7.34 | -0.92 | -3.67 | -10.73 | 0.00 |
| -0.50 | 7.34 | -0.92 | -3.67 | -10.73 | -0.00 |
| -0.50 | 7.34 | -0.92 | 82.89 | -33.92 | -0.00 |
| -0.51 | 7.34 | -0.00 | 82.81 | -34.16 | -0.01 |
| -2.00 | 7.34 | 115.16 | 71.88 | -66.10 | -1.48 |
| -2.00 | 6.12 | 115.16 | 71.88 | -66.10 | -1.48 |
| -4.00 | 16.12 | 245.02 | 54.65 | -108.85 | -2.93 |
| -4.00 | 21.97 | 245.02 | 54.65 | -108.85 | -2.93 |
| -4.50 | 27.86 | 269.35 | 42.19 | -119.36 | -3.14 |
| -4.50 | 28.38 | 269.35 | 42.19 | -119.36 | -3.14 |
| -5.50 | 41.45 | 295.15 | 7.27 | -137.99 | -3.32 |
| -5.66 | 43.57 | 294.57 | 0.00 | -141.17 | -3.30 |
| -9.10 | 57.47 | -0.00 | -178.50 | -215.27 | -1.42 |
| -10.00 | 60.24 | -183.47 | -231.51 | -237.12 | -0.67 |
| -10.00 | 57.52 | -183.47 | -231.51 | -237.12 | -0.67 |
| -11.18 | 60.83 | -496.66 | -301.18 | -266.78 | 0.00 |
| -11.18 | 60.83 | -496.66 | 253.02 | -266.78 | 0.00 |
| -11.75 | 62.43 | -361.83 | 217.72 | -281.81 | 0.09 |
| -12.49 | 64.50 | -219.02 | 170.91 | -301.75 | 0.00 |
| -15.00 | 71.55 | -0.00 | -0.00 | -374.62 | -0.98 |

Internal forces: Variable, characteristicallyMethod EB 82-4 ($Q = [G+Q] - G$).z= -0.500. $F_x = -44.340$ kN/m Supportz= -11.177. $F_x = -8.193$ kN/m Support

0.00



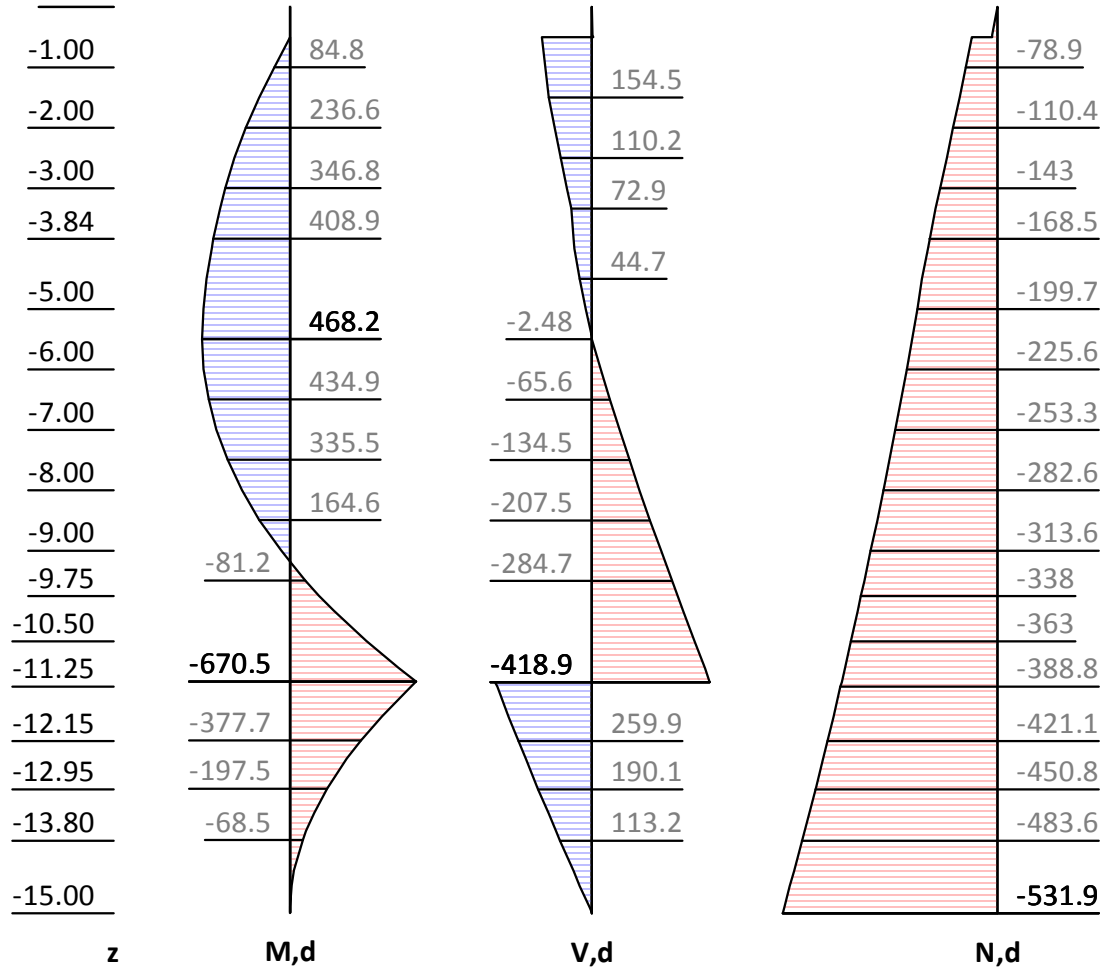
| z [m] | H, q, k [kN/m²] | M, q, k [kN/m²] | V, q, k [kN/m²] | N, q, k [kN/m²] | u, q, k [mm] |
|----------|--------------------|--------------------|--------------------|--------------------|-----------------|
| 0.00 | | 0.00 | -0.00 | 0.00 | 0.13 |
| -0.47 | 0.00 | 0.05 | -0.00 | 0.00 | 0.01 |
| -0.47 | 9.06 | 0.05 | 0.00 | -0.00 | 0.01 |
| -0.47 | 9.06 | 0.05 | -0.00 | -0.00 | 0.01 |
| -0.50 | 9.06 | -0.00 | -0.25 | -0.03 | 0.00 |
| -0.50 | 9.06 | 0.00 | 44.07 | -11.91 | -0.00 |
| -1.50 | 9.06 | 39.54 | 35.01 | -12.87 | -0.26 |
| -1.50 | 23.48 | 39.54 | 35.01 | -12.87 | -0.26 |
| -2.99 | 23.48 | 65.59 | -0.00 | -16.57 | -0.56 |
| -3.00 | 23.48 | 65.64 | -0.21 | -16.59 | -0.56 |
| -3.34 | 23.48 | 64.45 | -7.92 | -17.44 | -0.61 |
| -3.34 | 0.00 | 64.45 | -7.92 | -17.44 | -0.61 |
| -3.50 | 0.00 | 62.58 | -8.46 | -17.44 | -0.61 |
| -3.84 | 0.00 | 60.49 | -7.92 | -17.44 | -0.66 |
| -4.50 | 0.00 | 54.71 | -8.19 | -17.44 | -0.69 |
| -5.00 | 0.00 | 50.61 | -8.19 | -17.44 | -0.71 |
| -6.00 | 0.00 | 42.42 | -8.19 | -17.44 | -0.69 |
| -7.00 | 0.00 | 34.22 | -8.19 | -17.44 | -0.62 |
| -8.00 | 0.00 | 26.03 | -8.19 | -17.44 | -0.51 |
| -9.50 | 0.00 | 13.74 | -8.19 | -17.44 | -0.29 |
| -10.95 | 0.00 | 1.86 | -8.19 | -17.44 | -0.04 |
| -11.18 | 0.00 | -0.00 | -8.19 | -17.44 | -0.00 |

| z [m] | H, q, k [kN/m2] | M, q, k [kN/m2] | V, q, k [kN/m2] | N, q, k [kN/m2] | u, q, k [mm] |
|----------|--------------------|--------------------|--------------------|--------------------|-----------------|
| -11.18 | 0.00 | -0.00 | -8.19 | -17.44 | 0.00 |
| -11.18 | 0.00 | -0.00 | 0.00 | -17.44 | 0.00 |
| -11.25 | 0.00 | -0.00 | 0.00 | -17.44 | 0.01 |
| -13.65 | 0.00 | -0.00 | 0.00 | -17.44 | 0.43 |
| -13.80 | 0.00 | -0.00 | -0.00 | -17.44 | 0.46 |
| -14.92 | 0.00 | -0.00 | 0.00 | -17.44 | 0.66 |
| -15.00 | 0.00 | 0.00 | 0.00 | -17.44 | 0.67 |

Internal forces: Design

z= -0.500. Fx=-183.371 kN/m Support

z= -11.177. Fx=-760.451 kN/m Support

0.00

| | | | | | |
|---|-------------------|------------------|----------------------|----------|------------------|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | | | | | Job No.: |
| Program: WALLS-Retain. Version 2017.046 | | | | | |
| Structure: | info@fides-dvp.de | www.fides-dvp.de | Tel:++49/89/143829-0 | ASB Nr.: | Date: 08.10.2018 |

0.00

z

H,d

0.644

u,g+q,k

| z [m] | H,d [kN/m2] | M,d [kN/m2] | V,d [kN/m2] | N,d [kN/m2] | u,g+q,k [mm] |
|----------|----------------|----------------|----------------|----------------|-----------------|
| 0.00 | 9.91 | 0.00 | 0.00 | 0.00 | 0.64 |
| -0.00 | 9.91 | -0.00 | -0.00 | -0.00 | 0.64 |
| -0.47 | 9.91 | -1.09 | -4.66 | -13.61 | 0.04 |
| -0.47 | 23.50 | -1.09 | -4.66 | -13.61 | 0.04 |
| -0.50 | 23.50 | -1.25 | -5.36 | -14.52 | -0.00 |
| -0.51 | 23.50 | -0.00 | 177.84 | -63.88 | -0.01 |
| -1.50 | 23.50 | 165.01 | 154.51 | -94.05 | -1.27 |
| -1.50 | 45.13 | 165.01 | 154.51 | -94.05 | -1.27 |
| -2.00 | 45.13 | 236.63 | 131.94 | -110.40 | -1.86 |
| -2.00 | 43.48 | 236.63 | 131.94 | -110.40 | -1.86 |
| -3.34 | 48.07 | 374.31 | 72.90 | -154.06 | -3.16 |
| -3.34 | 12.85 | 374.31 | 72.90 | -154.06 | -3.16 |
| -4.00 | 21.76 | 418.98 | 61.48 | -173.11 | -3.60 |
| -4.00 | 29.65 | 418.98 | 61.48 | -173.11 | -3.60 |
| -4.50 | 37.61 | 445.68 | 44.67 | -187.29 | -3.84 |
| -4.50 | 38.31 | 445.68 | 44.67 | -187.29 | -3.84 |
| -5.45 | 55.10 | 467.70 | -0.00 | -211.21 | -4.01 |
| -5.50 | 55.95 | 468.22 | -2.48 | -212.44 | -4.02 |
| -9.19 | 77.99 | -0.00 | -260.78 | -319.88 | -1.67 |
| -10.00 | 81.32 | -233.21 | -324.83 | -346.27 | -0.87 |
| -10.00 | 77.66 | -233.21 | -324.83 | -346.27 | -0.87 |
| -11.18 | 82.13 | -670.49 | -418.88 | -386.30 | 0.00 |
| -11.18 | 82.13 | -670.49 | 341.57 | -386.30 | 0.00 |
| -12.15 | 85.80 | -377.68 | 259.91 | -421.08 | 0.23 |
| -13.82 | 92.12 | -66.64 | 111.31 | -484.42 | 0.00 |
| -15.00 | 96.59 | 0.00 | 0.00 | -531.89 | -0.31 |
| -15.00 | 96.59 | 0.00 | -0.00 | -531.89 | -0.31 |

| | | |
|---------|--------------------------------------|--------------|
| Part: | | Archive No.: |
| Block: | Please specify project informations. | Page: 43 |
| Record: | | |

Anchor forces with safety level of DS-P

| z[m] | A,d[kN] | F _{x,d} [kN/m] |
|-------|---------|-------------------------|
| -0.50 | 341.7 | -183.4 |

Checks of earth statics**Check of earth support**

Check: Mobilizable earth resistance is sufficient for earth support force.

z: -11.18 m

$R_d = E_{ph,k}/\gamma_{Re} = 8622.04 / 1.400 = 6158.60 \text{ [kN/m]}$

$E_d(U_{h,d})/R_d = 760.45 / 6158.60 = 0.123 \text{ [-]}. \text{ Passes requirement}$

Sum of H and V forces, (G)

Forces up to depth z:-15.00

| Pos. | H | V |
|--|---------|-----------------------|
| H/V pressure G+P+W,k | 640.76 | 124.61 |
| Wall weight | | 226.81 |
| H/V pressure passive | | 0.00 |
| Support z: -0.50 | -86.56 | 23.19 |
| B _{h,g,k} z=-11.18 | -554.19 | |
| B _{v,g,k} = B _{h,k} * tan(δ,p=-23.33°) | | -239.06 |
| Σ | 0.00 | 135.56 (downwards) |

Average anchor inclination α,A = 15.00° >= 15°.

Verification of vertical forces due to EAB R 9 not required (R 9-5).

Check EAB R 9-1

Vertical component of earth resistance is less than the downwards pointing vertical forces.

$V_k \geq B_{vk}: 374.62 \geq 239.06 \text{ Passes requirement}$

Sum of H and V forces, (G+Q)

Forces up to depth z:-15.00

| Pos. | H | V |
|--|---------|-----------------------|
| H/V pressure G+P+W,k | 693.29 | 130.17 |
| Wall weight | | 226.81 |
| H/V pressure passive | | 0.00 |
| Support z: -0.50 | -130.90 | 35.08 |
| B _{h,g,k} z=-11.18 | -554.19 | |
| B _{v,g,k} = B _{h,k} * tan(δ,p=-23.33°) | | -239.06 |
| B _{h,q,k} z=-11.18 | -8.19 | |
| B _{v,q,k} = B _{h,k} * tan(δ,p=-23.33°) | | -3.53 |
| Σ | 0.00 | 149.46 (downwards) |

Average anchor inclination α,A = 15.00° >= 15°.

Verification of vertical forces due to EAB R 9 not required (R 9-5).

Check EAB R 9-1

Vertical component of earth resistance is less than the downwards pointing vertical forces.

$V_k \geq B_{vk}: 392.05 \geq 242.59 \text{ Passes requirement}$

Anchor verification

| | | | | | | |
|--|--|--|--|--|-------------------------|--|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | | | | | Job No.: | |
| Program: WALLS-Retain. | | | | | Version 2017.046 | |
| Structure: info@fides-dvp.de www.fides-dvp.de Tel:++49/89/143829-0 ASB Nr.: | | | | | Date: 08.10.2018 | |

Anchor - Stability of lower failure plane

Περίπτ.Φόρτισης: όλα τα φορτία BS-P
 Αυτόμ. υπολογ. μήκους αγκυρίων:
 All anchors are extended (if necessary)
 Favourable variable loads in main failure body are not being considered.
 Bottom of lower failure plane: z=-15.00 m

Iteration of failure mechanisms:
 lA: Length of anchor from head to center of grout body.
 W,k: Res. force from dead weight, loads, cohesion, ...
 Q,k: Force in lower failure plane.
 Ea1,k.....: Earth pressure onto vertical separation plane.
 Ea2,k.....: Earth pressure between wall and main failure body.
 Ra_cal,d: Dimesioning force of the resistance from the equilibrium of forces.
 Ra_cal,d corresponds to the max. possible anchor force of the force polygon.
 Sum(A,d): Acting anchor forces along the grout body fractions within the failure body. Sum(A,d) is gained from the anchor pull forces of the wall analysis.

| z | θ1 | θ2 | lA | W,k | Q,k | Ea1,k | Ea2,k | Ra_cal,d | Sum(A,d) | Ed/Rd |
|-------|------|------|-------|--------|--------|--------|--------|----------|----------|-------|
| [m] | [°] | [°] | [m] | [kN/m] | [kN/m] | [kN/m] | [kN/m] | [kN/m] | [kN/m] | [-] |
| -0.50 | 40.4 | 57.5 | 13.44 | 1749.3 | 1561.9 | 4.4 | 400.0 | 190.4 | 189.8 | 1.00 |

Decisive failure body:
Γεωμετρία:
 Foot point of lower failure plane x/z = 0.01/-15.00 m
 Intersection lower/upper slid. plane x/z = 12.98/ -3.98 m
 Intersection upper slid. plane/surface x/z = 15.51/ 0.00 m
 Intersection separation plane/surface x/z = 12.98/ 0.00 m
 Inclination lower failure plane θ1 = 40.36°
 Inclination upper failure plane θ2 = 57.50°
 Inclination separation plane θ12 = 90.00°

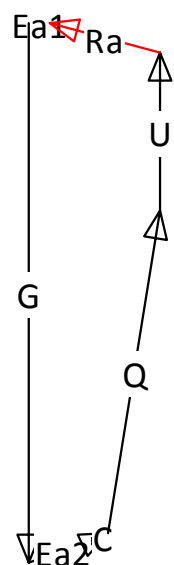
Loads / forces (char.)

| | | Fx | Fz | F | |
|------------------------------------|-----------|--------|---------|--------|---------|
| | | [kN/m] | [kN/m] | [kN/m] | |
| Weight of main failure body | G,k: | 0.0 | -2584.5 | 2584.5 | |
| Area loads on/in main failure body | F1,k: | 0.0 | -82.5 | 82.5 | |
| Cohesion of lower failure plane | C,k: | 92.5 | 78.6 | 121.4 | |
| Pore water pressure on main body | U,k: | -0.5 | 841.6 | 841.6 | |
| Earth pres. on separation plane | Ea1,k: | -4.4 | -0.0 | 4.4 | δ= 0.0° |
| Earth pr. between wall<->main body | Ea2,k: | 378.3 | 129.9 | 400.0 | |
| Force in lower failure plane | Q,k: | -208.4 | 1548.0 | 1561.9 | |
| Sum = possible anchor forces: | Ra_cal,k: | 257.4 | -69.0 | 266.5 | |

Force polygon

| | | |
|--|--|--------------|
| Part: | | Archive No.: |
| Block: Please specify project informations. | | |
| Record: | | |

Page: 45



Acting anchor forces $E_d: \text{Sum}(A,d) = 189.8 \text{ kN/m}$
 Possible anchor forces $R_d: R_{a_cal,d} = 266.5/1.400 = 190.4 \text{ kN/m}$
 Verif. of lower failure plane $E_d/R_d = 1.00 < 1.0$: Έλεγχος εκπληρώθηκε.

Check of steel tension

l_{tot} ...[m]: Total length of anchor incl. excess length at head
 A_s [mm²]: X-section area of steel member
 $R_{i,d}$...[kN]: Ultimate strength of tension member ($\gamma, M=1.15$)
 $A_{,d}$ [kN]: Dimensioning force of the anchor from wall analysis

| z[m] | Anchor type | l_{tot} | A_s | $R_{i,d}$ | $A_{,d}$ |
|-------|----------------------------|-----------|-------|-----------|--------------------|
| -0.50 | Strand; 3x0.60"; 1570/1770 | 17.44 | 420 | 573.4 | 341.7 |
| | | | | | Passes requirement |

Check of steel tension: Passes requirement

Check of anchor's soil friction

l_{vk} : Length of grout body
 $d_{m,vk}$: Diameter of grout body
 $\tau_{Gr,k}$: Average applied skin friction along the grout body (from soil parameters)
 $R_{a,k}$: Charact. pullout resistance of the anchor
 γ_A : Partial safety factor of anchor pullout
 $R_{a,d}$: = $R_{a,k} / \gamma_A$
 $A_{,d}$: Dimensioning force of the anchor from wall analysis

| z | l_{vk} | $d_{m,vk}$ | $\tau_{Gr,k}$ | $R_{a,k}$ | γ_A | $R_{a,d}$ | $A_{,d}$ | $A_{,d}/R_{a,d}$ |
|-------|----------|------------|----------------------|-----------|------------|-----------|----------|------------------|
| [m] | [m] | [mm] | [kN/m ²] | [kN] | [-] | [kN] | [kN] | [-] |
| -0.50 | 8.00 | 318 | 110 | 879.1 | 1.100 | 799.2 | 341.7 | 0.4 |

Check of anchor's soil friction: Passes requirement

Υπολογ. κύκλου ολίσθησης

LC: όλα τα φορτία Type: BS-T (combination: [GEO] A2 M2 R3, BS-T)
 Vertical variable loads only act if they are outside of $R \cdot \sin(\phi)$.
 The automatic slip circle optimization only considers circles that intersect the surface with an area of at least 0.25 m².
 The slip circle calculation only accepts circles including the wall.
 The slip circle calculation only allows circular failure planes (no vertical tangents will occur).

| | | | | | | | |
|--|--|--|--|--|--|------------------|--|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | | | | | | Job No.: | |
| Program: WALLS-Retain. Version 2017.046 | | | | | | | |
| Structure: info@fides-dvp.de www.fides-dvp.de Tel:++49/89/143829-0 ASB Nr.: | | | | | | Date: 08.10.2018 | |

Γεωμετ.κύκλου (μήκη και συντεταγμ. σε (m))
 Κέντρο = (-0.20, 5.51), Ακτίνα = 20.52
 Αρχ.σημ.= (-18.38, -4.00), Τελ.σημ. = (19.57, 0.00)

Γεωμετρία λωρίδων:

| No | x | Width | dxM | Weight | Load | Water- | u*b | φ | c | θ |
|----|--------|-------|--------|--------|--------|--------|--------|-------|---------|---------|
| | [m] | b | [m] | [kN/m] | z-κατ. | φορτ. | [kN/m] | [°] | [kN/m²] | [°] |
| | | | | | [kN/m] | | | | | |
| 1 | -17.35 | 2.05 | -17.16 | 78.1 | 0.0 | 0.0 | -12.0 | 27.45 | 3.57 | -31.27* |
| 2 | -15.30 | 2.05 | -15.11 | 199.6 | 0.0 | 0.0 | -47.1 | 27.45 | 3.57 | -31.27* |
| 3 | -13.25 | 2.05 | -13.05 | 289.4 | 0.0 | 0.0 | -87.6 | 29.26 | 3.57 | -30.37* |
| 4 | -11.20 | 2.05 | -11.00 | 358.1 | 0.0 | 0.0 | -118.4 | 29.26 | 3.57 | -30.37* |
| 5 | -9.15 | 2.05 | -8.95 | 410.9 | 0.0 | 0.0 | -142.0 | 29.26 | 3.57 | -25.86 |
| 6 | -7.09 | 2.05 | -6.90 | 450.7 | 0.0 | 0.0 | -159.8 | 29.26 | 3.57 | -19.64 |
| 7 | -5.04 | 2.05 | -4.85 | 479.0 | 0.0 | 0.0 | -172.4 | 29.26 | 3.57 | -13.66 |
| 8 | -2.99 | 2.05 | -2.79 | 497.0 | 0.0 | 0.0 | -180.4 | 29.26 | 3.57 | -7.83 |
| 9 | -0.94 | 2.05 | -0.74 | 512.0 | 0.0 | 0.0 | -214.9 | 29.26 | 3.57 | -2.07 |
| 10 | 1.11 | 2.05 | 1.31 | 661.9 | 0.0 | 0.0 | -245.1 | 29.26 | 3.57 | 3.66 |
| 11 | 3.17 | 2.05 | 3.36 | 651.0 | 0.0 | 0.0 | -240.2 | 29.26 | 3.57 | 9.43 |
| 12 | 5.22 | 2.05 | 5.41 | 630.2 | 0.0 | 0.0 | -231.0 | 29.26 | 3.57 | 15.30 |
| 13 | 7.27 | 2.05 | 7.47 | 598.9 | 0.0 | 0.0 | -216.9 | 29.26 | 3.57 | 21.34 |
| 14 | 9.32 | 2.05 | 9.52 | 555.7 | 0.0 | 0.0 | -197.7 | 29.26 | 3.57 | 27.64 |
| 15 | 11.37 | 2.05 | 11.57 | 498.8 | 0.0 | 0.0 | -172.2 | 29.26 | 3.57 | 34.32 |
| 16 | 13.43 | 2.05 | 13.62 | 424.9 | 0.0 | 0.0 | -139.0 | 27.45 | 3.57 | 41.59 |
| 17 | 15.48 | 2.05 | 15.67 | 327.9 | 0.0 | 0.0 | -95.2 | 27.45 | 3.57 | 49.80 |
| 18 | 18.04 | 3.07 | 18.23 | 230.3 | 0.0 | 0.0 | -52.4 | 0.08 | 35.71 | 62.69 |

*** Σημείωση: Στις λωρίδες σημειωμένες με '*'
 περιορίστηκε το theta στο 45°-Phi/2.

Συνεισφ. κατακόρυφων φορτίων:

| No | Weight | G*sin(θ) | (G-u*b)*tan(φ) + c*b | μ*sin(θ)* tan(φ)+cos(θ) | T |
|----|--------|----------|-------------------------|----------------------------|---------|
| | [kN/m] | [kN/m] | [kN/m] | [-] | [kN/m] |
| 1 | 78.06 | -65.27 | 41.63 | 0.799733 | 52.05 |
| 2 | 199.63 | -146.95 | 86.56 | 0.799733 | 108.24 |
| 3 | 289.39 | -184.09 | 120.38 | 0.805038 | 149.54 |
| 4 | 358.13 | -192.01 | 141.62 | 0.805038 | 175.92 |
| 5 | 410.94 | -179.23 | 157.97 | 0.850080 | 185.83 |
| 6 | 450.67 | -151.49 | 170.28 | 0.903431 | 188.48 |
| 7 | 479.01 | -113.12 | 179.07 | 0.944756 | 189.54 |
| 8 | 496.98 | -67.66 | 184.64 | 0.975144 | 189.35 |
| 9 | 512.02 | -18.51 | 173.78 | 0.995219 | 174.61 |
| 10 | 661.87 | 42.26 | 240.81 | 1.005249 | 239.55 |
| 11 | 651.00 | 106.67 | 237.43 | 1.005191 | 236.21 |
| 12 | 630.23 | 166.29 | 230.99 | 0.994686 | 232.23 |
| 13 | 598.87 | 217.90 | 221.27 | 0.972997 | 227.41 |
| 14 | 555.72 | 257.77 | 207.90 | 0.938870 | 221.44 |
| 15 | 498.84 | 281.27 | 190.30 | 0.890250 | 213.76 |
| 16 | 424.94 | 282.09 | 155.86 | 0.818157 | 190.51 |
| 17 | 327.86 | 250.43 | 128.22 | 0.726274 | 176.54 |
| 18 | 230.26 | 204.60 | 109.77 | 0.458995 | 239.14 |
| | | ----- | | | ----- |
| | | 690.94 | | | 3390.34 |

Δράση $E_d = (690.9 \cdot 20.52)$
 Αντίσταση $R_d = (3390.3 \cdot 20.52 + 0.0)$
 $SLIP-CIRCLE \mu = E_d/R_d = 0.20 < 1.0$: Έλεγχος εκπληρώθηκε.

| | | |
|--|--|--------------|
| Part: | | Archive No.: |
| Block: Please specify project informations. | | |
| Record: | | |

Page: 47

| | | |
|------------|--|------------------|
| Author: | FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | Job No.: |
| Program: | WALLS-Retain. Version 2017.046 | |
| Structure: | info@fides-dvp.de www.fides-dvp.de Tel:++49/89/143829-0 ASB Nr.: | Date: 08.10.2018 |

Φάση εκσκαφής 4 "[4] Situation 4"

LC: όλα τα φορτία Type: BS-T

Εδαφικό σύστημα με 5 Στρώσεις

| Name | Τεχνητές επιχωματώσεις | Αμμόδης ΑΡΓΙΛΟΣ | Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ | |
|-------------|------------------------|-----------------|--------------------------|-----------|
| γ | [kN/m3] | 18 | 20 | 22.5 |
| γ,R | [kN/m3] | 18 | 20 | 22.5 |
| γ' | [kN/m3] | 8 | 10 | 12.5 |
| γ,p | [kN/m3] | 18 | 20 | 22.5 |
| γ,R,passive | [kN/m3] | 18 | 20 | 22.5 |
| γ,pw | [kN/m3] | 8 | 10 | 12.5 |
| φ | [°] | 25 | 0.1 | 33 |
| c | [kN/m2] | 2 | 50 | 5 |
| c,u | [kN/m2] | 10 | 50 | 5 |
| c παθητικό | [kN/m2] | 2 | 50 | 5 |
| δ,a | [°] | 16.66667 | 0.06666667 | 22 |
| δ,p | [°] | -16.66667 | -0.06666667 | -22 |
| δ,c | [°] | 8.333333 | 0.03333333 | 11 |
| k,agh | [-] | 0.3456501 | 0.9955057 | 0.2452023 |
| K,ach | [-] | 1.043051 | 1.994195 | 0.8549058 |
| K,0h | [-] | 0.5773817 | 0.9982547 | 0.455361 |
| K,pgh | [-] | 3.908103 | 1.004519 | 7.495617 |
| K,pch | [-] | 5.180327 | 2.00583 | 8.599509 |
| τ,gr | [kN/m2] | 110 | 110 | 110 |
| Ψ,A,max | [°] | 90 | 90 | 90 |
| k | [cm/s] | 10e-06 | 1e-06 | 100e-06 |

| Name | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ |
|-------------|------------------------|------------------------|
| γ | [kN/m3] 22.5 | 22.5 |
| γ,R | [kN/m3] 22.5 | 22.5 |
| γ' | [kN/m3] 12.5 | 12.5 |
| γ,p | [kN/m3] 22.5 | 22.5 |
| γ,R,passive | [kN/m3] 22.5 | 22.5 |
| γ,pw | [kN/m3] 12.5 | 12.5 |
| φ | [°] 35 | 35 |
| c | [kN/m2] 5 | 5 |
| c,u | [kN/m2] 5 | 5 |
| c παθητικό | [kN/m2] 5 | 5 |
| δ,a | [°] 23.33333 | 23.33333 |
| δ,p | [°] -23.33333 | -23.33333 |
| δ,c | [°] 11.66667 | 11.66667 |
| k,agh | [-] 0.2244207 | 0.2244207 |
| K,ach | [-] 0.8126539 | 0.8126539 |
| K,0h | [-] 0.4264236 | 0.4264236 |
| K,pgh | [-] 9.146943 | 9.146943 |
| K,pch | [-] 10.104 | 10.104 |
| τ,gr | [kN/m2] 110 | 110 |
| Ψ,A,max | [°] 90 | 90 |
| k | [cm/s] 100e-06 | 100e-06 |

Πορεία πρανούς:

x [m] 0.00 0.00
z [m] -4.00 0.00

Πορεία ανώτερου 2. στρώματος Αμμόδης ΑΡΓΙΛΟΣ:

x [m] 0.00 0.00
z [m] -4.00 -1.50

Πορεία ανώτερου 3. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ:

z= -4.50

Πορεία ανώτερου 4. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟΣ:

z= -10.00

| | | |
|---------|--------------------------------------|--------------|
| Part: | | Archive No.: |
| Block: | Please specify project informations. | Page: 48 |
| Record: | | |

| | |
|--|------------------|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | Job No.: |
| Program: WALLS-Retain. Version 2017.046 | |
| Structure: info@fides-dvp.de www.fides-dvp.de Tel:++49/89/143829-0 ASB Nr.: | Date: 08.10.2018 |

Πορεία ανώτερου 5. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ:
 z= -14.00

Επιφ. φορτία:
Φορτία

| xA | zA | xE | zE | PxA | PzA | PxE | PzE | Typ | LC-description |
|------|------|------|------|------|-------|------|-------|-----|----------------|
| [m] | [m] | [m] | [m] | [| kN/m² | |] | | Name |
| 1.00 | 0.00 | 3.50 | 0.00 | 0.00 | 33.00 | 0.00 | 33.00 | q | 1 |

Κατανομή εδαφ.πιέσεων

| | |
|----------------------------|------|
| Κατανομή εδαφ.πιέσεων | Name |
| Rectangular within a layer | |

Στάθμη νερού:

| | | |
|-------|-------|-------|
| x [m] | 0.00 | 0.00 |
| z [m] | -6.00 | -3.00 |

Αγκύρια

| z[m] | min.l[m] | Alpha[°] | C-H[kN/m] | P0[kN] | u0[m] |
|-------|----------|----------|-----------|--------|--------|
| -0.50 | 0.00 | 15.00 | 0.00 | 0.00 | 0.0000 |
| -3.00 | 0.00 | 15.00 | αόρισ. | 0.00 | 0.0000 |

Παράμετροι υπολογισμού
Earth pressure options
 Τμήμα εδαφ.ωθήσεων: Ενεργές ωθήσεις.
 Angle of slip plane: DIN 4085.
 Split block loads into 1 sections.
 Consideration of minimum earth pressure: φ,min = 40.000.
 Negative earth pressure fractions are set to zero.

Redistribution of earth pressure
 Shape of redistribution: Triangle (perpend. to wall).
 The earth pressure is getting redistrib. to: Excavation level
 The earth pressure below the excavation acts without redistrib.
 Levels of redistribution Z1: -0.500, Z2: -3.000 [m].
 The earth pressure from variable loads will be included in redistribution.

Παθητικές ωθήσεις
 Method of calculation: Κλασικός, Pregl/Sokolovsky (DIN 4085).

Options for water pressure
Στήριξη πόδα
 Πόδας οριζοντίως μετακινούμενος

Αγκύρια
 Anchor checks (lower failure plane): Ναι
 Anchor forces with safety level of DS-P: Ναι
 Verification of grout body pull out forces: Ναι
 δ,a,Anchoring wall : used from soil layer.
 δ,p,Anchoring wall : used from soil layer.

Earth pressure coefficients kh

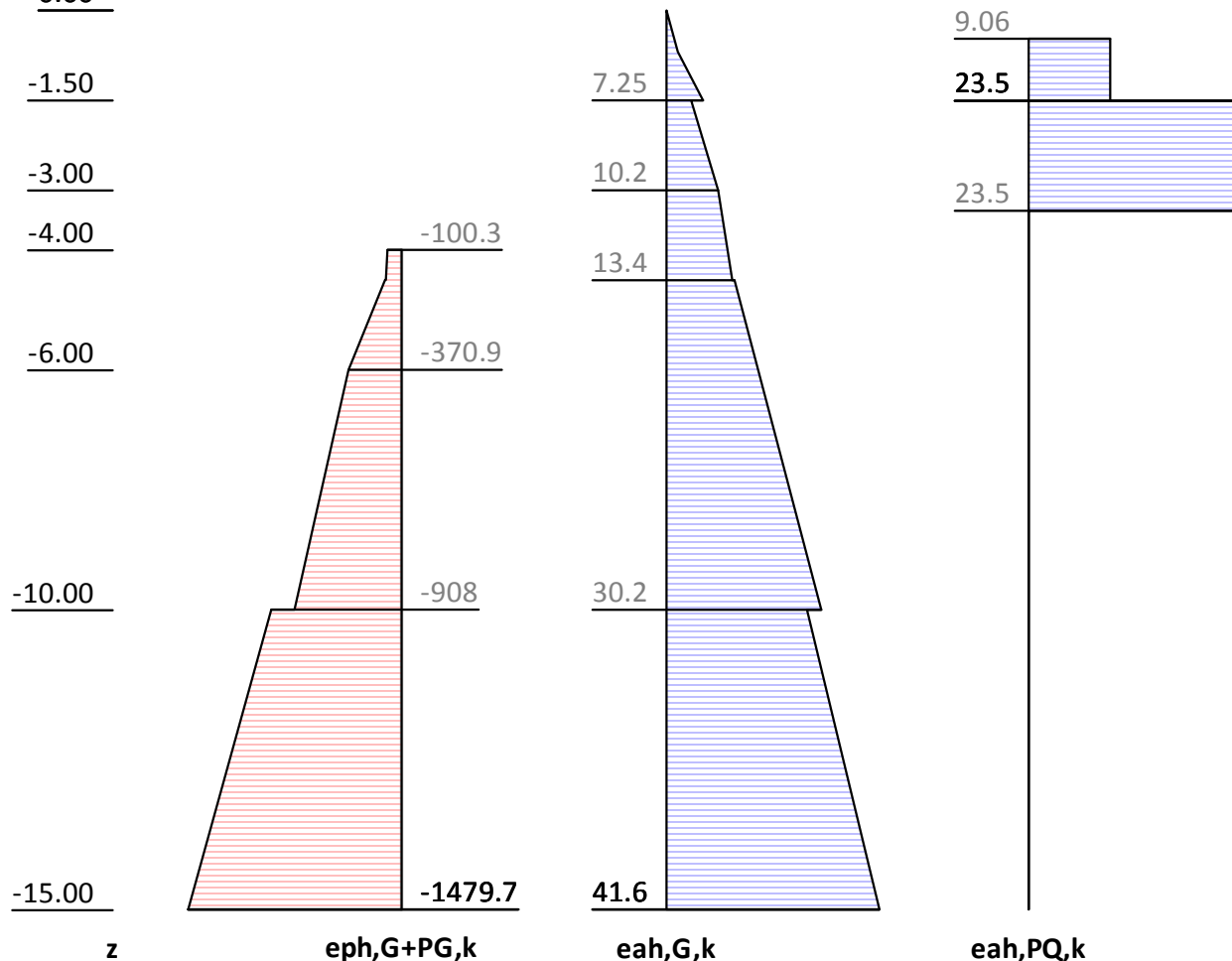
| φ | α | β | δ | k0gh | kagh | kach | kpgh | kpch | |
|------|-----|-----|-------|------|-------|-------|-------|---------|--------------------------|
| 0.1 | 0.0 | 0.0 | -0.1 | -- | -- | -- | 1.005 | -2.006 | Τεχνητές επιχωματώσεις |
| 25.0 | 0.0 | 0.0 | 16.7 | -- | 0.346 | 1.043 | -- | -- | " |
| 0.1 | 0.0 | 0.0 | -0.1 | -- | -- | -- | 1.005 | -2.006 | Αμμώδης ΑΡΓΙΛΟΣ |
| 0.1 | 0.0 | 0.0 | 0.1 | -- | 0.996 | 1.994 | -- | -- | " |
| 33.0 | 0.0 | 0.0 | -22.0 | -- | -- | -- | 7.496 | -8.600 | Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ |
| 33.0 | 0.0 | 0.0 | 22.0 | -- | 0.245 | 0.855 | -- | -- | " |
| 35.0 | 0.0 | 0.0 | -23.3 | -- | -- | -- | 9.147 | -10.104 | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ |
| 35.0 | 0.0 | 0.0 | 23.3 | -- | 0.224 | 0.813 | -- | -- | " |
| 35.0 | 0.0 | 0.0 | -23.3 | -- | -- | -- | 9.147 | -10.104 | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ |
| 35.0 | 0.0 | 0.0 | 23.3 | -- | 0.224 | 0.813 | -- | -- | " |

| | |
|--|--------------|
| Part: Block: Please specify project informations. Record: | Archive No.: |
|--|--------------|

Page: 49

Μήκος τοίχουFoot depth for statics: $z_f = -15.000$ **Stress analysis****Earth pressure, horizontal**

Pressures characteristic, no redistribution, continuous wall

0.00

| z [m] | eph, G, k [kN/m²] | eah, G, k [kN/m²] | eah, PQ, k [kN/m²] | eah, d [kN/m²] |
|------------|----------------------|----------------------|-----------------------|-------------------|
| 0.00 | | 0.00 | | 0.00 |
| -0.47 | | 1.52 | 0.00 | 2.04 |
| -0.47 | | 1.52 | 9.06 | 15.62 |
| -1.50 | | 7.25 | 9.06 | 23.37 |
| -1.50 | | 4.82 | 23.48 | 41.73 |
| -3.34 | | 10.79 | 23.48 | 49.78 |
| -3.34 | | 10.79 | 0.00 | 14.56 |
| -4.00 | -0.00 | 11.97 | 0.00 | 16.15 |
| -4.00 | -100.29 | 11.97 | 0.00 | 16.15 |
| -4.50 | -110.34 | 12.86 | 0.00 | 17.36 |
| -4.50 | -117.95 | 13.38 | 0.00 | 18.06 |
| -10.00 | -745.71 | 30.24 | 0.00 | 40.82 |
| -10.00 | -908.05 | 27.52 | 0.00 | 37.16 |
| -15.00 | -1479.73 | 41.55 | 0.00 | 56.09 |

Eph, G, k: -8622.04, Eph, PG, k: 0.00 [kN/m]
 Eah, G, k: 325.76, Eah, PG, k: 0.00, Eah, PQ, k: 52.53, Eah, d: 518.57

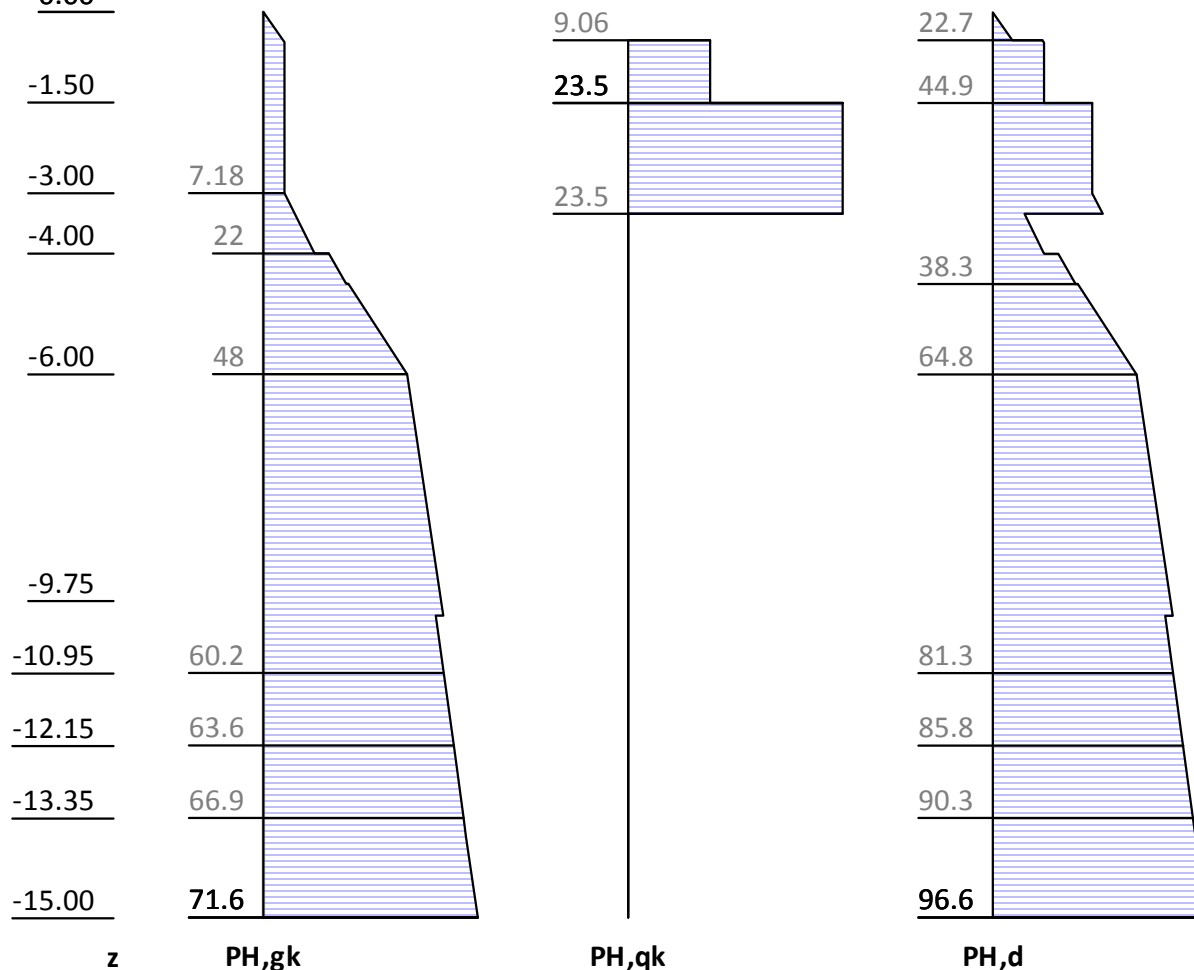
Πίεση νερού

| z [m] | Wp, k [kN/m2] | Wa, k [kN/m2] | W, k [kN/m2] |
|----------|------------------|------------------|-----------------|
| -3.00 | | 0.00 | 0.00 |
| -6.00 | 0.00 | 30.00 | 30.00 |
| -15.00 | -90.00 | 120.00 | 30.00 |

H-pressure on static system

Level of mobilization: Ep,gk 100.0, Ep,qk 100.0, Ep,d 100.0 [%]

0.00



| z [m] | PH,gk [kN/m2] | PH,qk [kN/m2] | PH,d [kN/m2] |
|----------|------------------|------------------|-----------------|
| 0.00 | 0.00 | 0.00 | 0.00 |
| -0.47 | 6.75 | 0.00 | 9.11 |
| -0.47 | 6.75 | 9.06 | 22.69 |
| -1.50 | 7.18 | 9.06 | 23.28 |
| -1.50 | 7.18 | 23.48 | 44.91 |
| -3.34 | 10.58 | 23.48 | 49.50 |
| -3.34 | 10.58 | 0.00 | 14.28 |
| -4.00 | 17.18 | 0.00 | 23.19 |
| -4.00 | 21.97 | 0.00 | 29.65 |
| -4.50 | 27.86 | 0.00 | 37.61 |
| -4.50 | 28.38 | 0.00 | 38.31 |
| -10.00 | 60.24 | 0.00 | 81.32 |
| -10.00 | 57.52 | 0.00 | 77.66 |
| -15.00 | 71.55 | 0.00 | 96.59 |

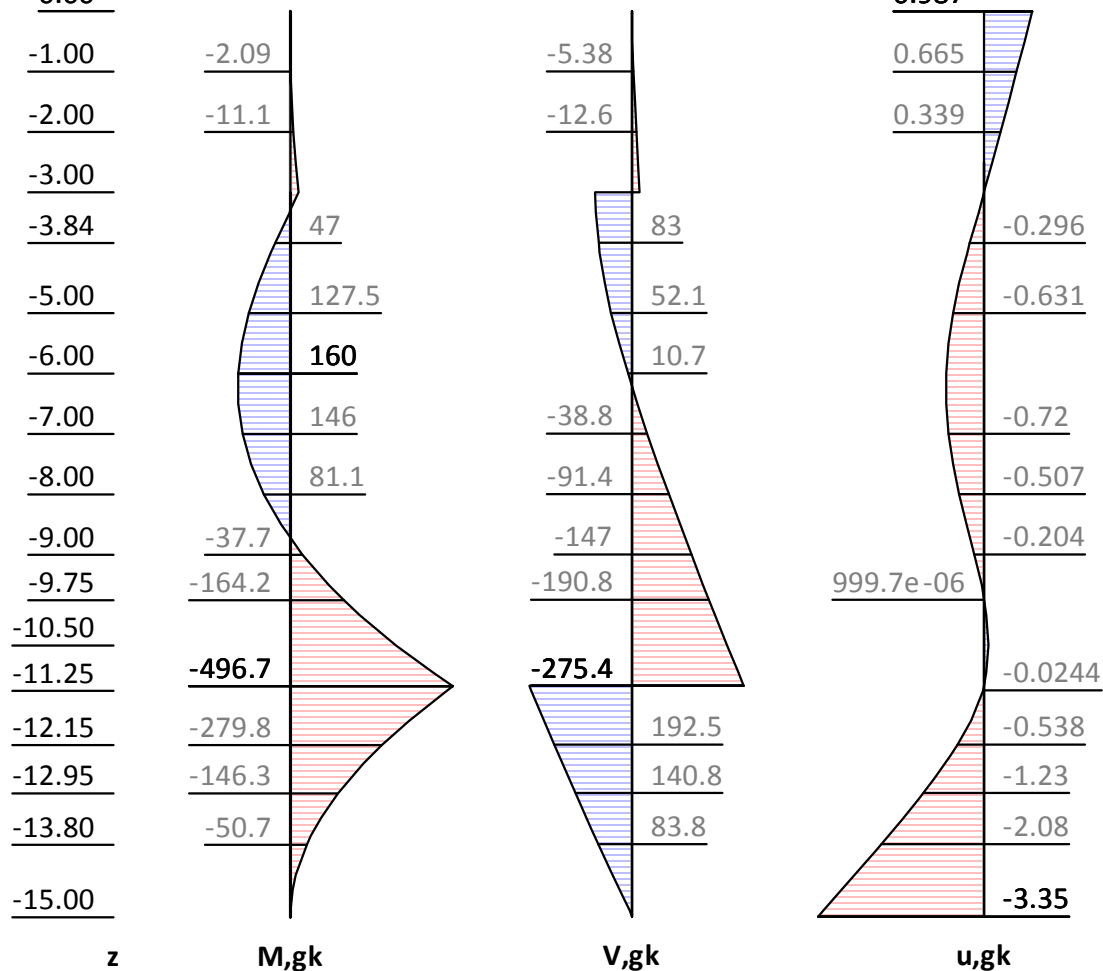
V-pressure on static system**Internal forces: Permanent, characteristically**

z= -0.500. Fx= -0.000 kN/m Support

z= -3.000. Fx=-112.326 kN/m Support

z= -11.177. Fx=-528.432 kN/m Support

0.00



| z [m] | H, g, k [kN/m ²] | M, g, k [kN/m ²] | V, g, k [kN/m ²] | N, g, k [kN/m ²] | u, g, k [mm] |
|----------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|-----------------|
| 0.00 | 0.00 | -0.00 | 0.00 | -0.00 | 0.99 |
| -0.00 | 0.00 | -0.00 | 0.00 | -0.00 | 0.99 |
| -3.00 | 7.18 | -27.22 | -19.74 | -64.03 | -0.00 |
| -3.00 | 7.18 | -27.22 | 92.59 | -94.13 | -0.00 |
| -3.30 | 10.16 | 0.00 | 89.94 | -100.51 | -0.11 |
| -4.00 | 17.18 | 60.11 | 80.41 | -115.50 | -0.35 |
| -4.00 | 21.97 | 60.11 | 80.41 | -115.50 | -0.35 |
| -4.50 | 27.86 | 97.33 | 67.95 | -126.01 | -0.50 |
| -4.50 | 28.38 | 97.33 | 67.95 | -126.01 | -0.50 |
| -6.00 | 47.98 | 159.98 | 10.68 | -154.41 | -0.77 |
| -6.22 | 48.65 | 159.58 | -0.00 | -158.83 | -0.77 |
| -8.72 | 56.30 | -0.00 | -131.01 | -212.96 | -0.29 |
| -9.75 | 59.46 | -163.49 | -190.54 | -237.51 | 0.00 |
| -10.00 | 60.24 | -213.80 | -205.75 | -243.78 | 0.05 |
| -10.00 | 57.52 | -213.80 | -205.75 | -243.78 | 0.05 |
| -10.50 | 58.93 | -323.94 | -234.86 | -256.16 | 0.10 |
| -11.18 | 60.83 | -496.66 | -275.41 | -273.43 | 0.00 |
| -11.18 | 60.83 | -496.66 | 253.02 | -273.43 | 0.00 |
| -15.00 | 71.55 | 0.00 | 0.00 | -381.27 | -3.35 |

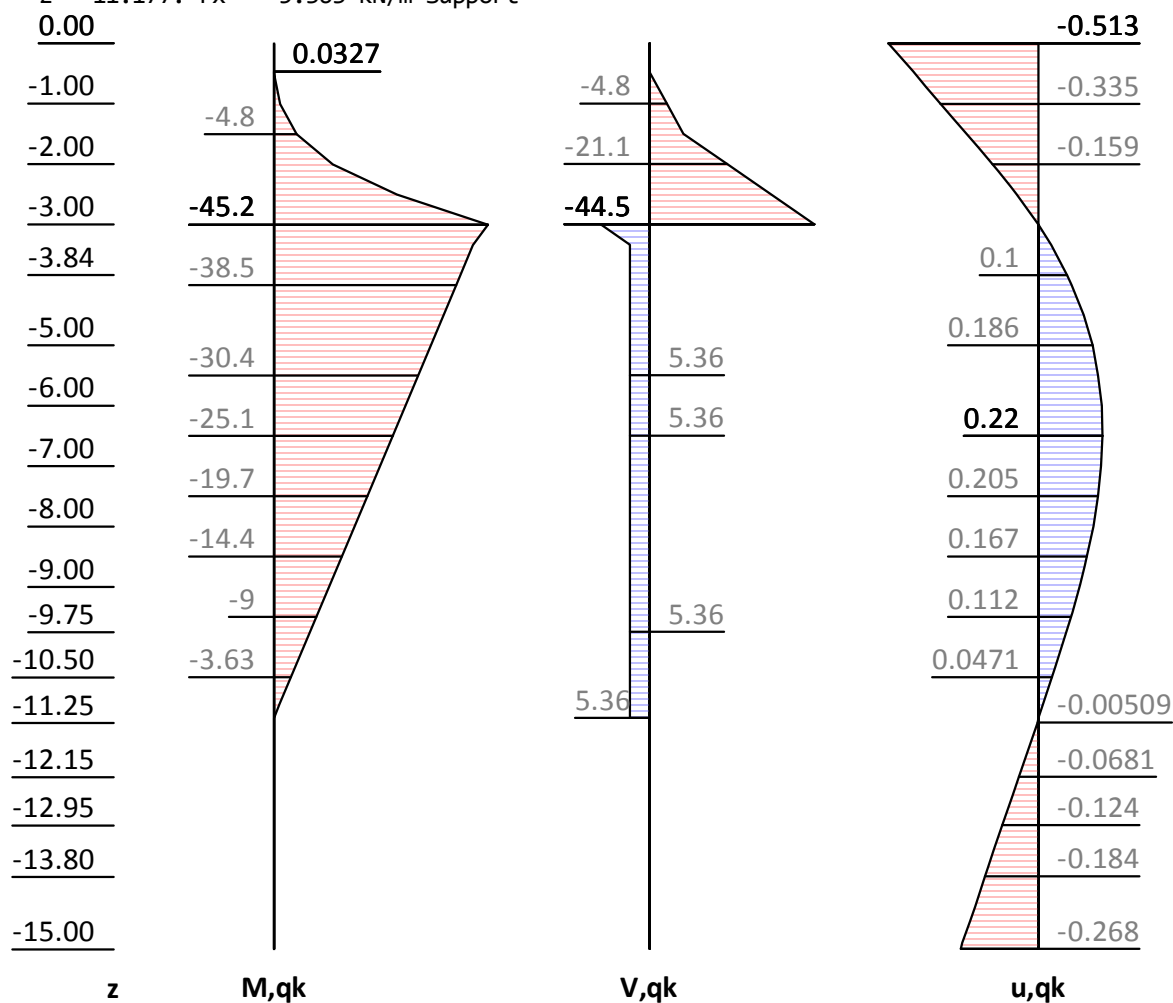
Internal forces: Variable, characteristicallyMethod EB 82-4 ($Q = [G+Q] - G$).

z= -0.500. Fx= 0.000 kN/m Support

z= -3.000. Fx= -57.895 kN/m Support

z= -11.177. Fx= 5.363 kN/m Support

0.00



| z [m] | H, q, k [kN/m ²] | M, q, k [kN/m ²] | V, q, k [kN/m ²] | N, q, k [kN/m ²] | u, q, k [mm] |
|----------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|-----------------|
| 0.00 | | 0.00 | -0.00 | 0.00 | -0.51 |
| -0.00 | | 0.00 | 0.00 | 0.00 | -0.51 |
| -0.47 | 0.00 | 0.03 | 0.10 | 0.01 | -0.43 |
| -0.47 | 9.06 | 0.03 | 0.10 | 0.01 | -0.43 |
| -0.48 | 9.06 | 0.02 | 0.00 | -0.00 | -0.43 |
| -0.50 | 9.06 | 0.00 | -0.23 | -0.02 | -0.42 |
| -1.50 | 9.06 | -4.80 | -9.33 | -0.99 | -0.25 |
| -1.50 | 23.48 | -4.80 | -9.33 | -0.99 | -0.25 |
| -3.00 | 23.48 | -45.21 | -44.55 | -4.71 | -0.00 |
| -3.00 | 23.48 | -45.21 | 13.35 | -20.23 | -0.00 |
| -3.34 | 23.48 | -42.03 | 5.36 | -21.07 | 0.04 |
| -3.34 | 0.00 | -42.03 | 5.36 | -21.07 | 0.04 |
| -3.84 | 0.00 | -39.35 | 5.36 | -21.07 | 0.10 |
| -4.50 | 0.00 | -35.81 | 5.36 | -21.07 | 0.16 |
| -5.50 | 0.00 | -30.45 | 5.36 | -21.07 | 0.21 |
| -6.50 | 0.00 | -25.08 | 5.36 | -21.07 | 0.22 |
| -7.00 | 0.00 | -22.40 | 5.36 | -21.07 | 0.22 |
| -8.00 | 0.00 | -17.04 | 5.36 | -21.07 | 0.19 |
| -9.50 | 0.00 | -9.00 | 5.36 | -21.07 | 0.11 |
| -10.95 | 0.00 | -1.22 | 5.36 | -21.07 | 0.02 |
| -11.18 | 0.00 | -0.00 | 5.36 | -21.07 | 0.00 |

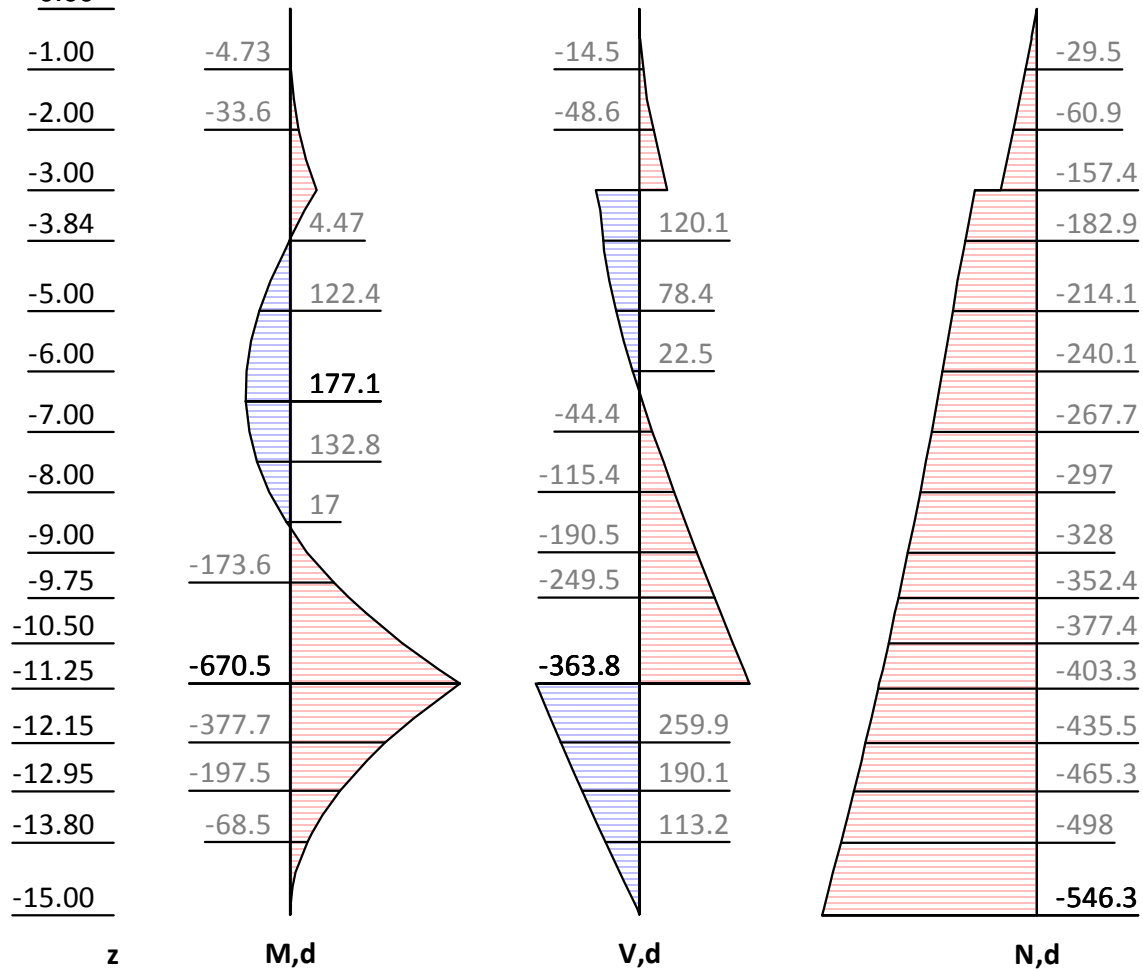
| z [m] | H, q, k [kN/m2] | M, q, k [kN/m2] | V, q, k [kN/m2] | N, q, k [kN/m2] | u, q, k [mm] |
|----------|--------------------|--------------------|--------------------|--------------------|-----------------|
| -11.18 | 0.00 | 0.00 | 5.36 | -21.07 | 0.00 |
| -11.18 | 0.00 | 0.00 | -0.00 | -21.07 | 0.00 |
| -13.80 | 0.00 | 0.00 | -0.00 | -21.07 | -0.18 |
| -14.90 | 0.00 | 0.00 | -0.00 | -21.07 | -0.26 |
| -14.94 | 0.00 | -0.00 | 0.00 | -21.07 | -0.26 |
| -15.00 | 0.00 | -0.00 | 0.00 | -21.07 | -0.27 |

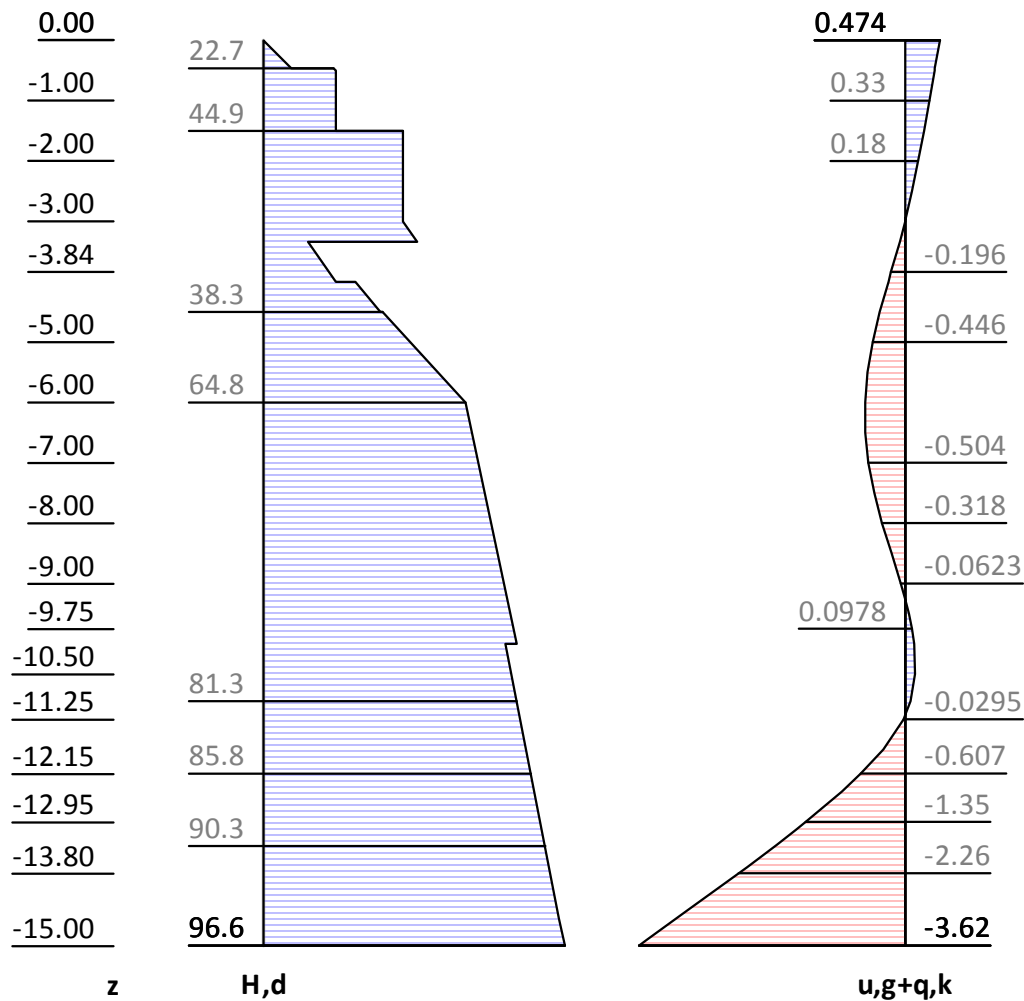
Internal forces: Design

z= -0.500. Fx= -0.000 kN/m Support

z= -3.000. Fx=-238.483 kN/m Support

z= -11.177. Fx=-705.338 kN/m Support

0.00



| z [m] | H,d [kN/m²] | M,d [kN/m²] | V,d [kN/m²] | N,d [kN/m²] | u,g+q,k [mm] |
|----------|----------------|----------------|----------------|----------------|-----------------|
| 0.00 | 0.00 | 0.00 | -0.00 | 0.00 | 0.47 |
| -0.00 | 0.00 | 0.00 | -0.00 | -0.00 | 0.47 |
| -0.47 | 9.11 | -0.34 | -2.14 | -13.44 | 0.41 |
| -0.47 | 22.69 | -0.34 | -2.14 | -13.44 | 0.41 |
| -1.50 | 23.28 | -14.88 | -26.11 | -44.64 | 0.26 |
| -1.50 | 44.91 | -14.88 | -26.11 | -44.64 | 0.26 |
| -3.00 | 44.91 | -104.56 | -93.47 | -93.51 | -0.00 |
| -3.00 | 44.91 | -104.56 | 145.01 | -157.41 | -0.00 |
| -3.34 | 49.50 | -57.94 | 128.96 | -168.49 | -0.08 |
| -3.34 | 14.28 | -57.94 | 128.96 | -168.49 | -0.08 |
| -3.80 | 20.55 | -0.00 | 120.77 | -181.88 | -0.19 |
| -4.00 | 23.19 | 23.42 | 116.60 | -187.53 | -0.23 |
| -4.00 | 29.65 | 23.42 | 116.60 | -187.53 | -0.23 |
| -4.50 | 37.61 | 77.68 | 99.78 | -201.72 | -0.35 |
| -4.50 | 38.31 | 77.68 | 99.78 | -201.72 | -0.35 |
| -6.00 | 64.77 | 174.32 | 22.47 | -240.06 | -0.55 |
| -6.34 | 66.18 | 176.23 | 0.00 | -249.36 | -0.55 |
| -6.50 | 66.84 | 177.11 | -10.45 | -253.69 | -0.55 |
| -8.60 | 75.53 | -0.00 | -159.99 | -315.46 | -0.17 |
| -9.27 | 78.31 | -125.61 | -211.74 | -336.81 | 0.00 |
| -10.00 | 81.32 | -298.10 | -269.71 | -360.70 | 0.13 |
| -10.00 | 77.66 | -298.10 | -269.71 | -360.70 | 0.13 |
| -10.50 | 79.55 | -442.76 | -309.02 | -377.43 | 0.14 |
| -11.18 | 82.13 | -670.49 | -363.77 | -400.73 | 0.00 |
| -11.18 | 82.13 | -670.49 | 341.57 | -400.73 | 0.00 |
| -15.00 | 96.59 | 0.00 | 0.00 | -546.32 | -3.62 |

Anchor forces with safety level of DS-P

| z[m] | A,d[kN] | Fx,d[kN/m] |
|-------|---------|------------|
| -0.50 | 0.0 | -0.0 |
| -3.00 | 222.2 | -238.5 |

Checks of earth statics**Check of earth support**

Check: Mobilizable earth resistance is sufficient for earth support force.

z: -11.18 m

$R_d = E_{ph,k}/\gamma, R_e = 8622.04 / 1.400 = 6158.60 \text{ [kN/m]}$

$E_d(U_h,d)/R_d = 705.34 / 6158.60 = 0.115 [-]$. Passes requirement

Sum of H and V forces, (G)

Forces up to depth z:-15.00

| Pos. | H | V |
|---|---------|-----------------------|
| H/V pressure G+P+W,k | 640.76 | 124.36 |
| Wall weight | | 226.81 |
| H/V pressure passive | | 0.00 |
| Support z: -0.50 | | 0.00 |
| Support z: -3.00 | -112.33 | 30.10 |
| B _{h,g,k} z=-11.18 | -528.43 | |
| B _{v,g,k} = B _{h,k} * tan($\delta, p=-23.33^\circ$) | | -227.94 |
| Σ | 0.00 | 153.32 (downwards) |

Average anchor inclination $\alpha, A = 15.00^\circ \geq 15^\circ$.

Verification of vertical forces due to EAB R 9 not required (R 9-5).

Check EAB R 9-1

Vertical component of earth resistance is less than the downwards pointing vertical forces.

$V_k \geq B_{vk}$: 381.27 \geq 227.94 Passes requirement

Sum of H and V forces, (G+Q)

Forces up to depth z:-15.00

| Pos. | H | V |
|---|---------|-----------------------|
| H/V pressure G+P+W,k | 693.29 | 129.92 |
| Wall weight | | 226.81 |
| H/V pressure passive | | 0.00 |
| Support z: -0.50 | | 0.00 |
| Support z: -3.00 | -170.22 | 45.61 |
| B _{h,g,k} z=-11.18 | -528.43 | |
| B _{v,g,k} = B _{h,k} * tan($\delta, p=-23.33^\circ$) | | -227.94 |
| B _{h,q,k} z=-11.18 | 5.36 | |
| B _{v,q,k} = B _{h,k} * tan($\delta, p=-23.33^\circ$) | | 2.31 |
| Σ | -0.00 | 176.71 (downwards) |

Average anchor inclination $\alpha, A = 15.00^\circ \geq 15^\circ$.

Verification of vertical forces due to EAB R 9 not required (R 9-5).

Check EAB R 9-1

Vertical component of earth resistance is less than the downwards pointing vertical forces.

$V_k \geq B_{vk}$: 402.34 \geq 225.63 Passes requirement

Anchor verification

| | |
|--|------------------|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | Job No.: |
| Program: WALLS-Retain. Version 2017.046 | |
| Structure: info@fides-dvp.de www.fides-dvp.de Tel:++49/89/143829-0 ASB Nr.: | Date: 08.10.2018 |

Anchor - Stability of lower failure plane

Περίπτ.Φόρτισης: όλα τα φορτία BS-P
 Αυτόμ. υπολογ. μήκους αγκυρίων:
 All anchors are extended (if necessary)
 Favourable variable loads in main failure body are not being considered.
 Bottom of lower failure plane: z=-15.00 m

Iteration of failure mechanisms:
 lA: Length of anchor from head to center of grout body.
 W,k: Res. force from dead weight, loads, cohesion, ...
 Q,k: Force in lower failure plane.
 Ea1,k.....: Earth pressure onto vertical separation plane.
 Ea2,k.....: Earth pressure between wall and main failure body.
 Ra_cal,d: Dimesioning force of the resistance from the equilibrium of forces.
 Ra_cal,d corresponds to the max. possible anchor force of the force polygon.
 Sum(A,d): Acting anchor forces along the grout body fractions within the failure body. Sum(A,d) is gained from the anchor pull forces of the wall analysis.

| z | θ1 | θ2 | lA | W,k | Q,k | Ea1,k | Ea2,k | Ra_cal,d | Sum(A,d) | Ed/Rd |
|-------|------|------|-------|--------|--------|--------|--------|----------|----------|-------|
| [m] | [°] | [°] | [m] | [kN/m] | [kN/m] | [kN/m] | [kN/m] | [kN/m] | [kN/m] | [-] |
| -0.50 | 40.4 | 57.5 | 13.42 | 1746.7 | 1559.8 | 4.4 | 400.0 | 189.6 | 189.2 | 1.00 |
| -3.00 | 36.5 | 60.9 | 12.32 | 1802.0 | 1582.6 | 36.3 | 400.0 | 247.9 | 246.9 | 1.00 |

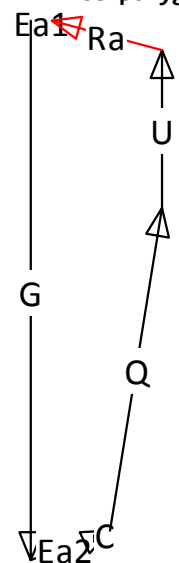
Decisive failure body:
Γεωμετρία:
 Foot point of lower failure plane x/z = 0.01/-15.00 m
 Intersection lower/upper slid. plane x/z = 11.90/ -6.19 m
 Intersection upper slid. plane/surface x/z = 15.34/ 0.00 m
 Intersection separation plane/surface x/z = 11.90/ 0.00 m
 Inclination lower failure plane θ1 = 36.53°
 Inclination upper failure plane θ2 = 60.94°
 Inclination separation plane θ12 = 90.00°

Loads / forces (char.)

| | | Fx [kN/m] | Fz [kN/m] | F [kN/m] | |
|------------------------------------|-----------|--------------|--------------|-------------|---------|
| Weight of main failure body | G,k: | 0.0 | -2665.9 | 2665.9 | |
| Area loads on/in main failure body | F1,k: | 0.0 | -82.5 | 82.5 | |
| Cohesion of lower failure plane | C,k: | 59.5 | 44.1 | 74.0 | |
| Pore water pressure on main body | U,k: | -0.5 | 903.3 | 903.3 | |
| Earth pres. on separation plane | Ea1,k: | -36.3 | -0.0 | 36.3 | δ= 0.0° |
| Earth pr. between wall<->main body | Ea2,k: | 378.3 | 129.9 | 400.0 | |
| Force in lower failure plane | Q,k: | -65.8 | 1581.2 | 1582.6 | |
| Sum = possible anchor forces: | Ra_cal,k: | 335.2 | -89.8 | 347.1 | |

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| Part: Block: Please specify project informations. Record: | Archive No.: |
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Page: 57

Force polygon

Acting anchor forces $E_d: \sum(A,d) = 246.9 \text{ kN/m}$
 Possible anchor forces $R_d: R_{a_cal,d} = 347.1/1.400 = 247.9 \text{ kN/m}$
 Verif. of lower failure plane $E_d/R_d = 1.00 < 1.0$: Έλεγχος εκπληρώθηκε.

Check of steel tension

l_{tot} ...[m]: Total length of anchor incl. excess length at head
 A_s ...[mm²]: X-section area of steel member
 $R_{i,d}$...[kN]: Ultimate strength of tension member ($\gamma, M=1.15$)
 $A_{,d}$...[kN]: Dimensioning force of the anchor from wall analysis

| z[m] | Anchor type | l_{tot} | A_s | $R_{i,d}$ | $A_{,d}$ |
|-------|--------------------------|-----------|-------|-----------|----------|
| -0.50 | Strand;3x0.60";1570/1770 | 17.70 | 420 | 573.4 | 0.0 |
| -3.00 | Strand;3x0.60";1570/1770 | 16.32 | 420 | 573.4 | 222.2 |

Check of steel tension: Passes requirement

Check of anchor's soil friction

$l_{V,k}$: Length of grout body
 $D_{mV,k}$: Diameter of grout body
 $\tau_{Gr,k}$: Average applied skin friction along the grout body (from soil parameters)
 $R_{a,k}$: Charact. pullout resistance of the anchor
 γ_A : Partial safety factor of anchor pullout
 $R_{a,d}$: = $R_{a,k} / \gamma_A$
 $A_{,d}$: Dimensioning force of the anchor from wall analysis

| z | $l_{V,k}$ | $D_{mV,k}$ | $\tau_{Gr,k}$ | $R_{a,k}$ | γ_A | $R_{a,d}$ | $A_{,d}$ | $A_{,d}/R_{a,d}$ |
|-------|-----------|------------|----------------------|-----------|------------|-----------|----------|------------------|
| [m] | [m] | [mm] | [kN/m ²] | [kN] | [-] | [kN] | [kN] | [-] |
| -0.50 | 8.00 | 318 | 110 | 879.1 | 1.100 | 799.2 | 0.0 | 0.0 |
| -3.00 | 8.00 | 318 | 110 | 879.1 | 1.100 | 799.2 | 222.2 | 0.3 |

Check of anchor's soil friction: Passes requirement

Υπολογ. κύκλου ολίσθησης

LC: όλα τα φορτία Type: BS-T (combination: [GEO] A2 M2 R3, BS-T)
 Vertical variable loads only act if they are outside of $R \cdot \sin(\phi)$.
 The automatic slip circle optimization only considers circles that intersect the surface with an area of at least 0.25 m².
 The slip circle calculation only accepts circles including the wall.
 The slipcircle calculation only allows circular failure planes (no vertical tangents will occur).

| | | | | | |
|--|--|--|--|--|------------------|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | | | | | Job No.: |
| Program: WALLS-Retain. Version 2017.046 | | | | | |
| Structure: info@fides-dvp.de www.fides-dvp.de Tel:++49/89/143829-0 ASB Nr.: | | | | | Date: 08.10.2018 |

Γεωμετ. κύκλου (μήκη και συντεταγμ. σε (m))

Κέντρο = (-0.20, 5.51), Ακτίνα = 20.52

Αρχ.σημ. = (-18.38, -4.00), Τελ.σημ. = (19.57, 0.00)

Γεωμετρία λωρίδων:

| No | x | Width | dxM | Weight | Load | Water- | u*b | φ | c | θ |
|----|--------|-------|--------|--------|------------------|-----------------|--------|-------|---------|---------|
| | [m] | [m] | [m] | [kN/m] | z-κατ. [kN/m] | φορτ. [kN/m] | [kN/m] | [°] | [kN/m²] | [°] |
| 1 | -17.35 | 2.05 | -17.16 | 78.1 | 0.0 | 0.0 | -12.0 | 27.45 | 3.57 | -31.27* |
| 2 | -15.30 | 2.05 | -15.11 | 199.6 | 0.0 | 0.0 | -47.1 | 27.45 | 3.57 | -31.27* |
| 3 | -13.25 | 2.05 | -13.05 | 289.4 | 0.0 | 0.0 | -87.6 | 29.26 | 3.57 | -30.37* |
| 4 | -11.20 | 2.05 | -11.00 | 358.1 | 0.0 | 0.0 | -118.4 | 29.26 | 3.57 | -30.37* |
| 5 | -9.15 | 2.05 | -8.95 | 410.9 | 0.0 | 0.0 | -142.0 | 29.26 | 3.57 | -25.86 |
| 6 | -7.09 | 2.05 | -6.90 | 450.7 | 0.0 | 0.0 | -159.8 | 29.26 | 3.57 | -19.64 |
| 7 | -5.04 | 2.05 | -4.85 | 479.0 | 0.0 | 0.0 | -172.4 | 29.26 | 3.57 | -13.66 |
| 8 | -2.99 | 2.05 | -2.79 | 497.0 | 0.0 | 0.0 | -180.4 | 29.26 | 3.57 | -7.83 |
| 9 | -0.94 | 2.05 | -0.74 | 512.0 | 0.0 | 0.0 | -214.9 | 29.26 | 3.57 | -2.07 |
| 10 | 1.11 | 2.05 | 1.31 | 661.9 | 0.0 | 0.0 | -245.1 | 29.26 | 3.57 | 3.66 |
| 11 | 3.17 | 2.05 | 3.36 | 651.0 | 0.0 | 0.0 | -240.2 | 29.26 | 3.57 | 9.43 |
| 12 | 5.22 | 2.05 | 5.41 | 630.2 | 0.0 | 0.0 | -231.0 | 29.26 | 3.57 | 15.30 |
| 13 | 7.27 | 2.05 | 7.47 | 598.9 | 0.0 | 0.0 | -216.9 | 29.26 | 3.57 | 21.34 |
| 14 | 9.32 | 2.05 | 9.52 | 555.7 | 0.0 | 0.0 | -197.7 | 29.26 | 3.57 | 27.64 |
| 15 | 11.37 | 2.05 | 11.57 | 498.8 | 0.0 | 0.0 | -172.2 | 29.26 | 3.57 | 34.32 |
| 16 | 13.43 | 2.05 | 13.62 | 424.9 | 0.0 | 0.0 | -139.0 | 27.45 | 3.57 | 41.59 |
| 17 | 15.48 | 2.05 | 15.67 | 327.9 | 0.0 | 0.0 | -95.2 | 27.45 | 3.57 | 49.80 |
| 18 | 18.04 | 3.07 | 18.23 | 230.3 | 0.0 | 0.0 | -52.4 | 0.08 | 35.71 | 62.69 |

*** Σημείωση: Στις λωρίδες σημειωμένες με '*'
περιορίστηκε το theta στο 45°-Phi/2.

Συνεισφ. κατακόρυφων φορτίων:

| No | Weight | G*sin(θ) | (G-u*b)*tan(φ) + c*b | μ*sin(θ)* tan(φ)+cos(θ) | T |
|----|--------|----------|-------------------------|----------------------------|---------|
| | [kN/m] | [kN/m] | [kN/m] | [-] | [kN/m] |
| 1 | 78.06 | -65.27 | 41.63 | 0.799733 | 52.05 |
| 2 | 199.63 | -146.95 | 86.56 | 0.799733 | 108.24 |
| 3 | 289.39 | -184.09 | 120.38 | 0.805038 | 149.54 |
| 4 | 358.13 | -192.01 | 141.62 | 0.805038 | 175.92 |
| 5 | 410.94 | -179.23 | 157.97 | 0.850080 | 185.83 |
| 6 | 450.67 | -151.49 | 170.28 | 0.903431 | 188.48 |
| 7 | 479.01 | -113.12 | 179.07 | 0.944756 | 189.54 |
| 8 | 496.98 | -67.66 | 184.64 | 0.975144 | 189.35 |
| 9 | 512.02 | -18.51 | 173.78 | 0.995219 | 174.61 |
| 10 | 661.87 | 42.26 | 240.81 | 1.005249 | 239.55 |
| 11 | 651.00 | 106.67 | 237.43 | 1.005191 | 236.21 |
| 12 | 630.23 | 166.29 | 230.99 | 0.994686 | 232.23 |
| 13 | 598.87 | 217.90 | 221.27 | 0.972997 | 227.41 |
| 14 | 555.72 | 257.77 | 207.90 | 0.938870 | 221.44 |
| 15 | 498.84 | 281.27 | 190.30 | 0.890250 | 213.76 |
| 16 | 424.94 | 282.09 | 155.86 | 0.818157 | 190.51 |
| 17 | 327.86 | 250.43 | 128.22 | 0.726274 | 176.54 |
| 18 | 230.26 | 204.60 | 109.77 | 0.458995 | 239.14 |
| | ----- | ----- | ----- | ----- | ----- |
| | | 690.94 | | | 3390.34 |

Δράση $E_d = (690.9 * 20.52)$

Αντίσταση $R_d = (3390.3 * 20.52 + 0.0)$

SLIP-CIRCLE $\mu = E_d / R_d = 0.20 < 1.0$: Έλεγχος εκπληρώθηκε.

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| Part: | | Archive No.: |
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| Record: | | |

Page: 59

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|------------|--|------------------|
| Author: | FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | Job No.: |
| Program: | WALLS-Retain. Version 2017.046 | |
| Structure: | info@fides-dvp.de www.fides-dvp.de Tel:++49/89/143829-0 ASB Nr.: | Date: 08.10.2018 |

Φάση εκσκαφής 5 "[5] Situation 4 +"

LC: όλα τα φορτία Type: BS-T

Εδαφικό σύστημα με 5 Στρώσεις

| Name | Τεχνητές επιχωματώσεις | Αμμόδης ΑΡΓΙΛΟΣ | Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ | |
|-------------|------------------------|-----------------|--------------------------|-----------|
| γ | [kN/m3] | 18 | 20 | 22.5 |
| γ,R | [kN/m3] | 18 | 20 | 22.5 |
| γ' | [kN/m3] | 8 | 10 | 12.5 |
| γ,p | [kN/m3] | 18 | 20 | 22.5 |
| γ,R,passive | [kN/m3] | 18 | 20 | 22.5 |
| γ,pw | [kN/m3] | 8 | 10 | 12.5 |
| φ | [°] | 25 | 0.1 | 33 |
| c | [kN/m2] | 2 | 50 | 5 |
| c,u | [kN/m2] | 10 | 50 | 5 |
| c παθητικό | [kN/m2] | 2 | 50 | 5 |
| δ,a | [°] | 16.66667 | 0.06666667 | 22 |
| δ,p | [°] | -16.66667 | -0.06666667 | -22 |
| δ,c | [°] | 8.333333 | 0.03333333 | 11 |
| k,agh | [-] | 0.3456501 | 0.9955057 | 0.2452023 |
| K,ach | [-] | 1.043051 | 1.994195 | 0.8549058 |
| K,0h | [-] | 0.5773817 | 0.9982547 | 0.455361 |
| K,pgh | [-] | 3.908103 | 1.004519 | 7.495617 |
| K,pch | [-] | 5.180327 | 2.00583 | 8.599509 |
| τ,gr | [kN/m2] | 110 | 110 | 110 |
| Ψ,A,max | [°] | 90 | 90 | 90 |
| k | [cm/s] | 10e-06 | 1e-06 | 100e-06 |

| Name | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ |
|-------------|------------------------|------------------------|
| γ | [kN/m3] 22.5 | 22.5 |
| γ,R | [kN/m3] 22.5 | 22.5 |
| γ' | [kN/m3] 12.5 | 12.5 |
| γ,p | [kN/m3] 22.5 | 22.5 |
| γ,R,passive | [kN/m3] 22.5 | 22.5 |
| γ,pw | [kN/m3] 12.5 | 12.5 |
| φ | [°] 35 | 35 |
| c | [kN/m2] 5 | 5 |
| c,u | [kN/m2] 5 | 5 |
| c παθητικό | [kN/m2] 5 | 5 |
| δ,a | [°] 23.33333 | 23.33333 |
| δ,p | [°] -23.33333 | -23.33333 |
| δ,c | [°] 11.66667 | 11.66667 |
| k,agh | [-] 0.2244207 | 0.2244207 |
| K,ach | [-] 0.8126539 | 0.8126539 |
| K,0h | [-] 0.4264236 | 0.4264236 |
| K,pgh | [-] 9.146943 | 9.146943 |
| K,pch | [-] 10.104 | 10.104 |
| τ,gr | [kN/m2] 110 | 110 |
| Ψ,A,max | [°] 90 | 90 |
| k | [cm/s] 100e-06 | 100e-06 |

Πορεία πρανούς:

x [m] 0.00 0.00
z [m] -6.50 0.00

Πορεία ανώτερου 2. στρώματος Αμμόδης ΑΡΓΙΛΟΣ:

x [m] 0.00 0.00
z [m] -6.50 -1.50

Πορεία ανώτερου 3. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ:

x [m] 0.00 0.00
z [m] -6.50 -4.50

Πορεία ανώτερου 4. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟΣ:

z= -10.00

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|---------|--------------------------------------|--------------|
| Part: | | Archive No.: |
| Block: | Please specify project informations. | Page: 60 |
| Record: | | |

| | |
|--|------------------|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | Job No.: |
| Program: WALLS-Retain. Version 2017.046 | |
| Structure: info@fides-dvp.de www.fides-dvp.de Tel:++49/89/143829-0 ASB Nr.: | Date: 08.10.2018 |

Πορεία ανώτερου 5. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ:
 z= -14.00

Επιφ. φορτία:
Φορτία

| xA | zA | xE | zE | PxA | PzA | PxE | PzE | Typ | LC-description |
|------|------|------|------|------|-------|------|-------|-----|----------------|
| [m] | [m] | [m] | [m] | [| kN/m² | |] | | Name |
| 1.00 | 0.00 | 3.50 | 0.00 | 0.00 | 33.00 | 0.00 | 33.00 | q | 1 |

Κατανομή εδαφ.πιέσεων

| | |
|----------------------------|------|
| Κατανομή εδαφ.πιέσεων | Name |
| Rectangular within a layer | |

Στάθμη νερού:

| | | |
|-------|-------|-------|
| x [m] | 0.00 | 0.00 |
| z [m] | -7.50 | -3.00 |

Αγκύρια

| z[m] | min.l[m] | Alpha[°] | C-H[kN/m] | P0[kN] | u0[m] |
|-------|----------|----------|-----------|--------|--------|
| -0.50 | 0.00 | 15.00 | 0.00 | 0.00 | 0.0000 |
| -3.00 | 0.00 | 15.00 | αόρισ. | 0.00 | 0.0000 |

Παράμετροι υπολογισμού
Earth pressure options
 Τμήμα εδαφ.ωθήσεων: Ενεργές ωθήσεις.
 Angle of slip plane: DIN 4085.
 Split block loads into 1 sections.
 Consideration of minimum earth pressure: φ,min = 40.000.
 Negative earth pressure fractions are set to zero.

Redistribution of earth pressure
 Shape of redistribution: Trapezoid.
 The earth pressure is getting redistrib. to: Excavation level
 The earth pressure below the excavation acts without redistrib.
 Levels of redistribution Z1: 0.000, Z2: -3.000 [m].
 The earth pressure from variable loads will be included in redistribution.

Παθητικές ωθήσεις
 Method of calculation: Κλασικός, Pregl/Sokolovsky (DIN 4085).

Options for water pressure
Στήριξη πόδα
 Πόδας οριζοντίως μετακινούμενος

Αγκύρια
 Anchor checks (lower failure plane): Ναι
 Anchor forces with safety level of DS-P: Ναι
 Verification of grout body pull out forces: Ναι
 δ,a,Anchoring wall : used from soil layer.
 δ,p,Anchoring wall : used from soil layer.

Earth pressure coefficients kh

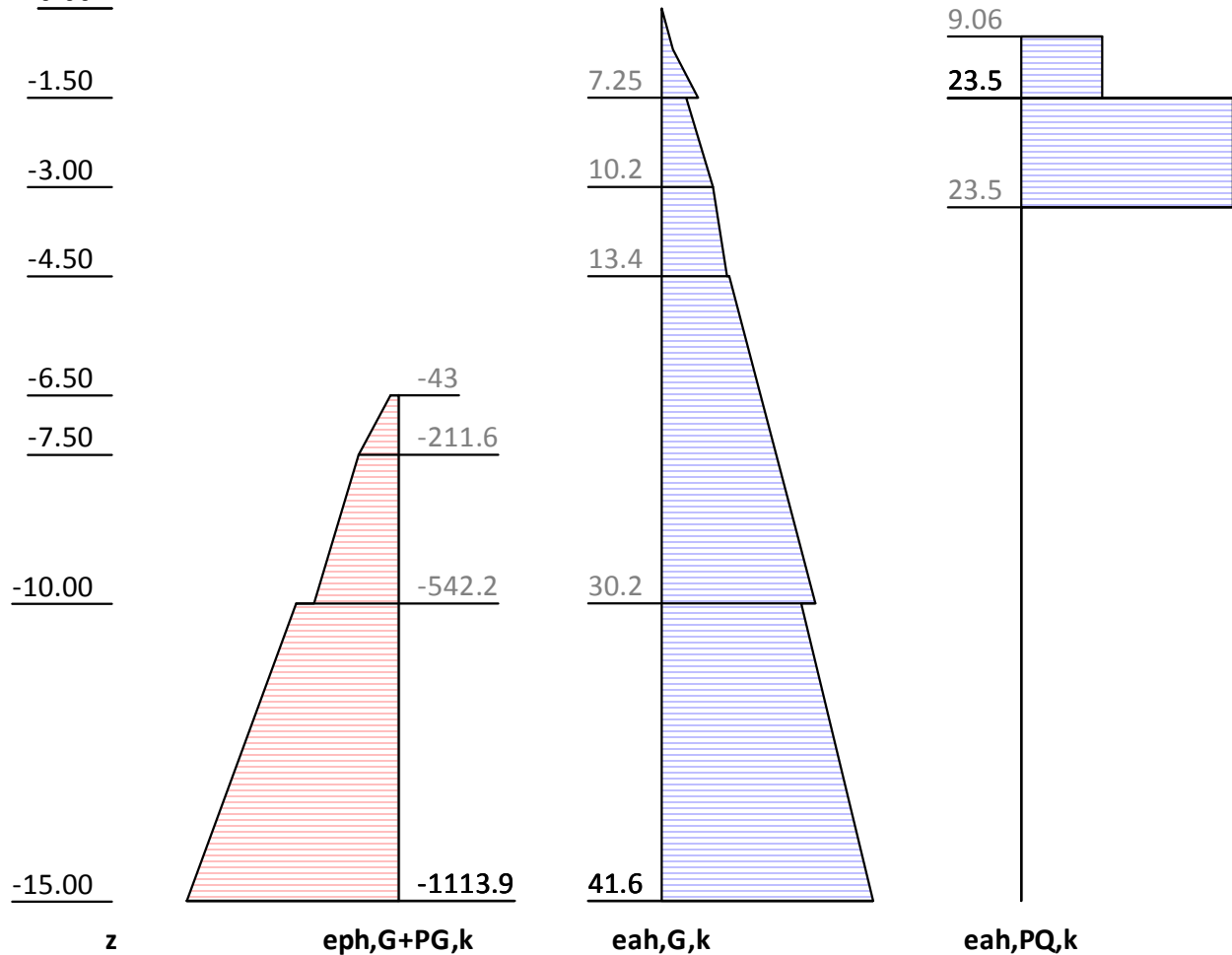
| φ | α | β | δ | k0gh | kagh | kach | kpgh | kpch | |
|------|-----|-----|-------|------|-------|-------|-------|---------|--------------------------|
| 33.0 | 0.0 | 0.0 | -22.0 | -- | -- | -- | 7.496 | -8.600 | Τεχνητές επιχωματώσεις |
| 25.0 | 0.0 | 0.0 | 16.7 | -- | 0.346 | 1.043 | -- | -- | " |
| 0.1 | 0.0 | 0.0 | 0.1 | -- | 0.996 | 1.994 | -- | -- | Αμμώδης ΑΡΓΙΛΟΣ |
| 33.0 | 0.0 | 0.0 | -22.0 | -- | -- | -- | 7.496 | -8.600 | Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ |
| 33.0 | 0.0 | 0.0 | 22.0 | -- | 0.245 | 0.855 | -- | -- | " |
| 35.0 | 0.0 | 0.0 | -23.3 | -- | -- | -- | 9.147 | -10.104 | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ |
| 35.0 | 0.0 | 0.0 | 23.3 | -- | 0.224 | 0.813 | -- | -- | " |
| 35.0 | 0.0 | 0.0 | -23.3 | -- | -- | -- | 9.147 | -10.104 | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ |
| 35.0 | 0.0 | 0.0 | 23.3 | -- | 0.224 | 0.813 | -- | -- | " |

| | |
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| Part: Block: Please specify project informations. Record: | Archive No.: |
|---|--------------|

Page: 61

Μήκος τοίχουFoot depth for statics: $z_f = -15.000$ **Stress analysis****Earth pressure, horizontal**

Pressures characteristic, no redistribution, continuous wall

0.00

| z [m] | eph, G, k [kN/m²] | eah, G, k [kN/m²] | eah, PQ, k [kN/m²] | eah, d [kN/m²] |
|----------|----------------------|----------------------|-----------------------|-------------------|
| 0.00 | | 0.00 | | 0.00 |
| -0.47 | | 1.52 | 0.00 | 2.04 |
| -0.47 | | 1.52 | 9.06 | 15.62 |
| -1.50 | | 7.25 | 9.06 | 23.37 |
| -1.50 | | 4.82 | 23.48 | 41.73 |
| -3.34 | | 10.79 | 23.48 | 49.78 |
| -3.34 | | 10.79 | 0.00 | 14.56 |
| -4.50 | | 12.86 | 0.00 | 17.36 |
| -4.50 | | 13.38 | 0.00 | 18.06 |
| -6.50 | -0.00 | 19.51 | 0.00 | 26.34 |
| -6.50 | -43.00 | 19.51 | 0.00 | 26.34 |
| -10.00 | -445.89 | 30.24 | 0.00 | 40.82 |
| -10.00 | -542.17 | 27.52 | 0.00 | 37.16 |
| -15.00 | -1113.85 | 41.55 | 0.00 | 56.09 |

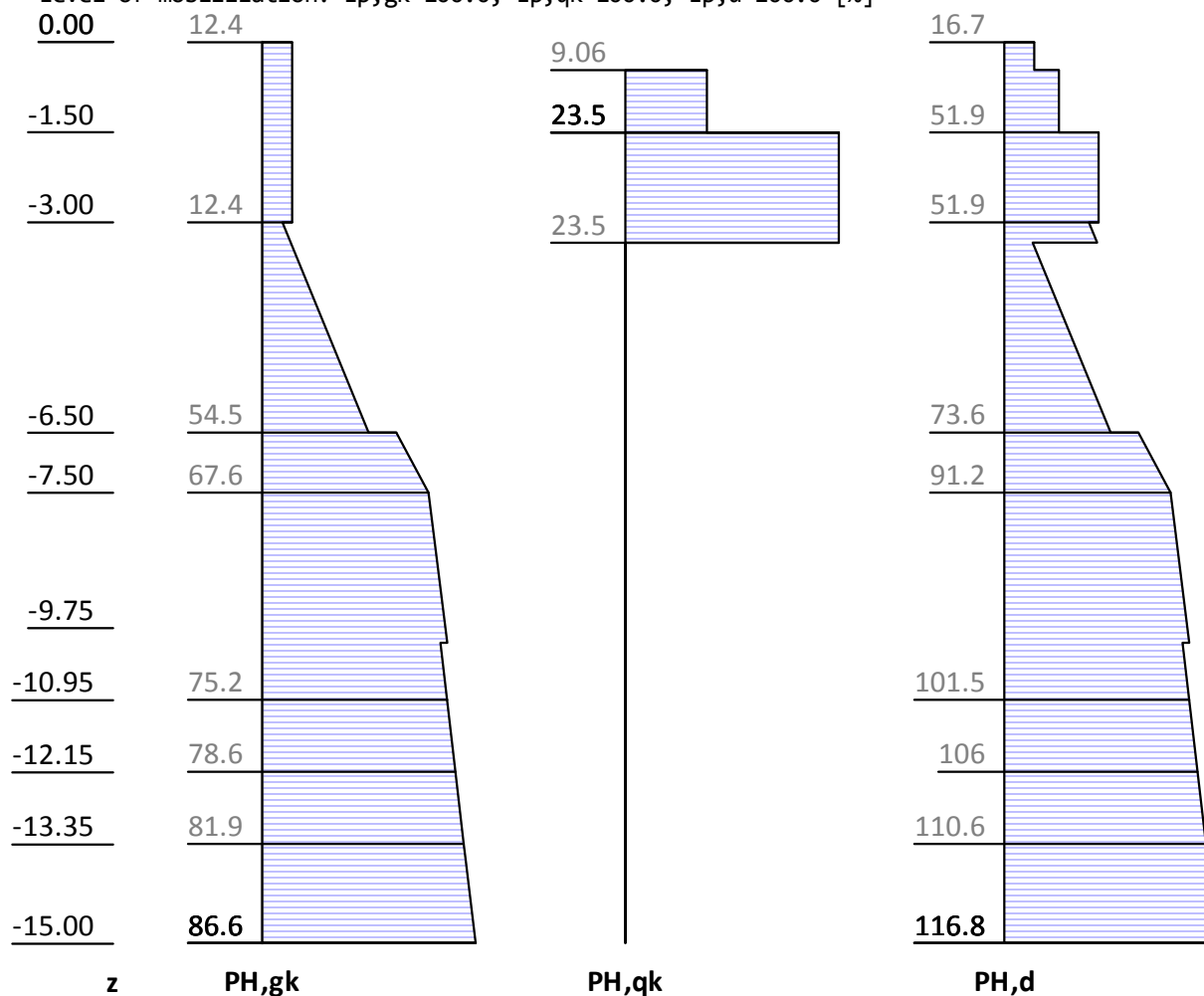
Eph, G, k: -5089.29, Eph, PG, k: 0.00 [kN/m]
 Eah, G, k: 325.76, Eah, PG, k: 0.00, Eah, PQ, k: 52.53, Eah, d: 518.57

Πίεση νερού

| z [m] | Wp,k [kN/m2] | Wa,k [kN/m2] | W,k [kN/m2] |
|----------|-----------------|-----------------|----------------|
| -3.00 | | 0.00 | 0.00 |
| -7.50 | 0.00 | 45.00 | 45.00 |
| -13.80 | -63.00 | 108.00 | 45.00 |
| -15.00 | -75.00 | 120.00 | 45.00 |

H-pressure on static system

Level of mobilization: Ep,gk 100.0, Ep,qk 100.0, Ep,d 100.0 [%]



| z [m] | PH,gk [kN/m2] | PH,qk [kN/m2] | PH,d [kN/m2] |
|----------|------------------|------------------|-----------------|
| 0.00 | 12.37 | | 16.71 |
| -0.47 | 12.37 | 0.00 | 16.71 |
| -0.47 | 12.37 | 9.06 | 30.29 |
| -1.50 | 12.37 | 9.06 | 30.29 |
| -1.50 | 12.37 | 23.48 | 51.93 |
| -3.00 | 12.37 | 23.48 | 51.93 |
| -3.00 | 8.25 | 23.48 | 46.36 |
| -3.34 | 11.65 | 23.48 | 50.95 |
| -3.34 | 11.65 | 0.00 | 15.73 |
| -6.50 | 43.25 | 0.00 | 58.39 |
| -6.50 | 54.51 | 0.00 | 73.59 |
| -10.00 | 75.24 | 0.00 | 101.57 |
| -10.00 | 72.52 | 0.00 | 97.91 |
| -15.00 | 86.55 | 0.00 | 116.84 |

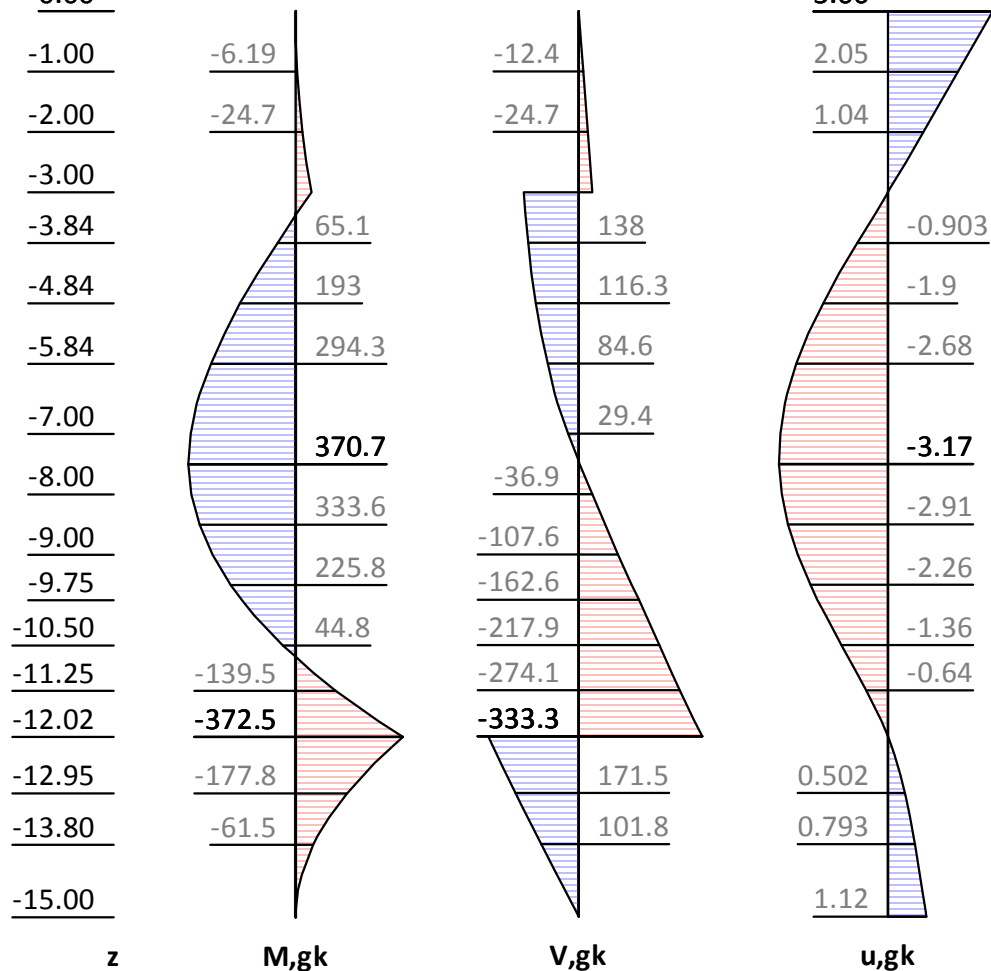
V-pressure on static system**Internal forces: Permanent, characteristically**

z= -0.500. Fx= -0.000 kN/m Support

z= -3.000. Fx=-185.554 kN/m Support

z= -12.018. Fx=-578.954 kN/m Support

0.00



| z [m] | H, g, k [kN/m2] | M, g, k [kN/m2] | V, g, k [kN/m2] | N, g, k [kN/m2] | u, g, k [mm] |
|----------|--------------------|--------------------|--------------------|--------------------|-----------------|
| 0.00 | 12.37 | -0.00 | 0.00 | -0.00 | 3.06 |
| -0.00 | 12.37 | -0.00 | 0.00 | -0.00 | 3.06 |
| -3.00 | 12.37 | -55.69 | -37.12 | -71.27 | -0.00 |
| -3.00 | 8.25 | -55.69 | 148.43 | -120.99 | -0.00 |
| -3.38 | 12.06 | 0.00 | 144.47 | -129.65 | -0.41 |
| -6.50 | 43.25 | 341.80 | 58.29 | -187.65 | -3.01 |
| -6.50 | 54.51 | 341.80 | 58.29 | -187.65 | -3.01 |
| -7.46 | 67.02 | 370.08 | -0.00 | -207.84 | -3.17 |
| -7.50 | 67.58 | 370.66 | -2.75 | -208.75 | -3.17 |
| -10.00 | 75.24 | 144.62 | -181.27 | -266.92 | -1.83 |
| -10.00 | 72.52 | 144.62 | -181.27 | -266.92 | -1.83 |
| -10.69 | 74.46 | -0.00 | -232.14 | -284.16 | -1.18 |
| -12.02 | 78.19 | -372.53 | -333.30 | -318.76 | 0.00 |
| -12.02 | 78.19 | -372.53 | 245.66 | -318.76 | 0.00 |
| -15.00 | 86.55 | -0.00 | 0.00 | -404.42 | 1.12 |
| -15.00 | 86.55 | 0.00 | 0.00 | -404.42 | 1.12 |

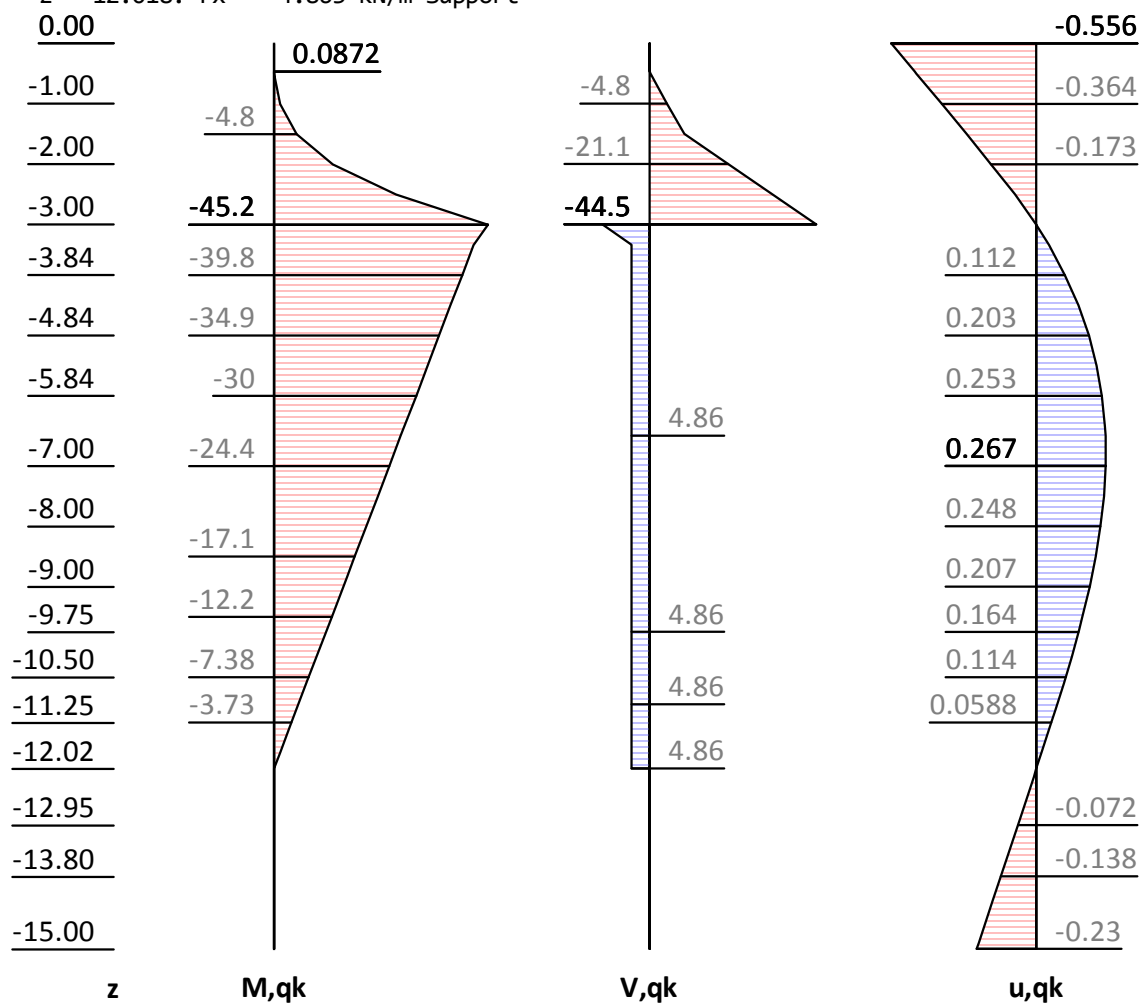
Internal forces: Variable, characteristicallyMethod EB 82-4 ($Q = [G+Q] - G$).

z= -0.500. Fx= 0.000 kN/m Support

z= -3.000. Fx= -57.396 kN/m Support

z= -12.018. Fx= 4.863 kN/m Support

0.00



| z [m] | H, q, k [kN/m ²] | M, q, k [kN/m ²] | V, q, k [kN/m ²] | N, q, k [kN/m ²] | u, q, k [mm] |
|----------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|-----------------|
| 0.00 | | 0.00 | -0.00 | 0.00 | -0.56 |
| -0.47 | 0.00 | 0.09 | -0.00 | 0.00 | -0.47 |
| -0.47 | 9.06 | 0.09 | -0.00 | 0.00 | -0.47 |
| -0.47 | 9.06 | 0.09 | -0.00 | -0.00 | -0.47 |
| -0.50 | 9.06 | -0.00 | -0.26 | -0.03 | -0.46 |
| -1.50 | 9.06 | -4.80 | -9.33 | -0.99 | -0.27 |
| -1.50 | 23.48 | -4.80 | -9.33 | -0.99 | -0.27 |
| -3.00 | 23.48 | -45.21 | -44.55 | -4.71 | -0.00 |
| -3.00 | 23.48 | -45.21 | 12.85 | -20.09 | -0.00 |
| -3.34 | 23.48 | -42.20 | 4.86 | -20.94 | 0.05 |
| -3.34 | 0.00 | -42.20 | 4.86 | -20.94 | 0.05 |
| -7.00 | 0.00 | -24.40 | 4.86 | -20.94 | 0.27 |
| -8.00 | 0.00 | -19.54 | 4.86 | -20.94 | 0.25 |
| -10.00 | 0.00 | -9.81 | 4.86 | -20.94 | 0.15 |
| -12.02 | 0.00 | -0.00 | 4.86 | -20.94 | 0.00 |
| -12.02 | 0.00 | -0.00 | 0.00 | -20.94 | 0.00 |
| -13.35 | 0.00 | -0.00 | 0.00 | -20.94 | -0.10 |
| -13.65 | 0.00 | -0.00 | 0.00 | -20.94 | -0.13 |
| -13.80 | 0.00 | -0.00 | 0.00 | -20.94 | -0.14 |
| -14.55 | 0.00 | -0.00 | 0.00 | -20.94 | -0.20 |
| -14.75 | 0.00 | -0.00 | 0.00 | -20.94 | -0.21 |

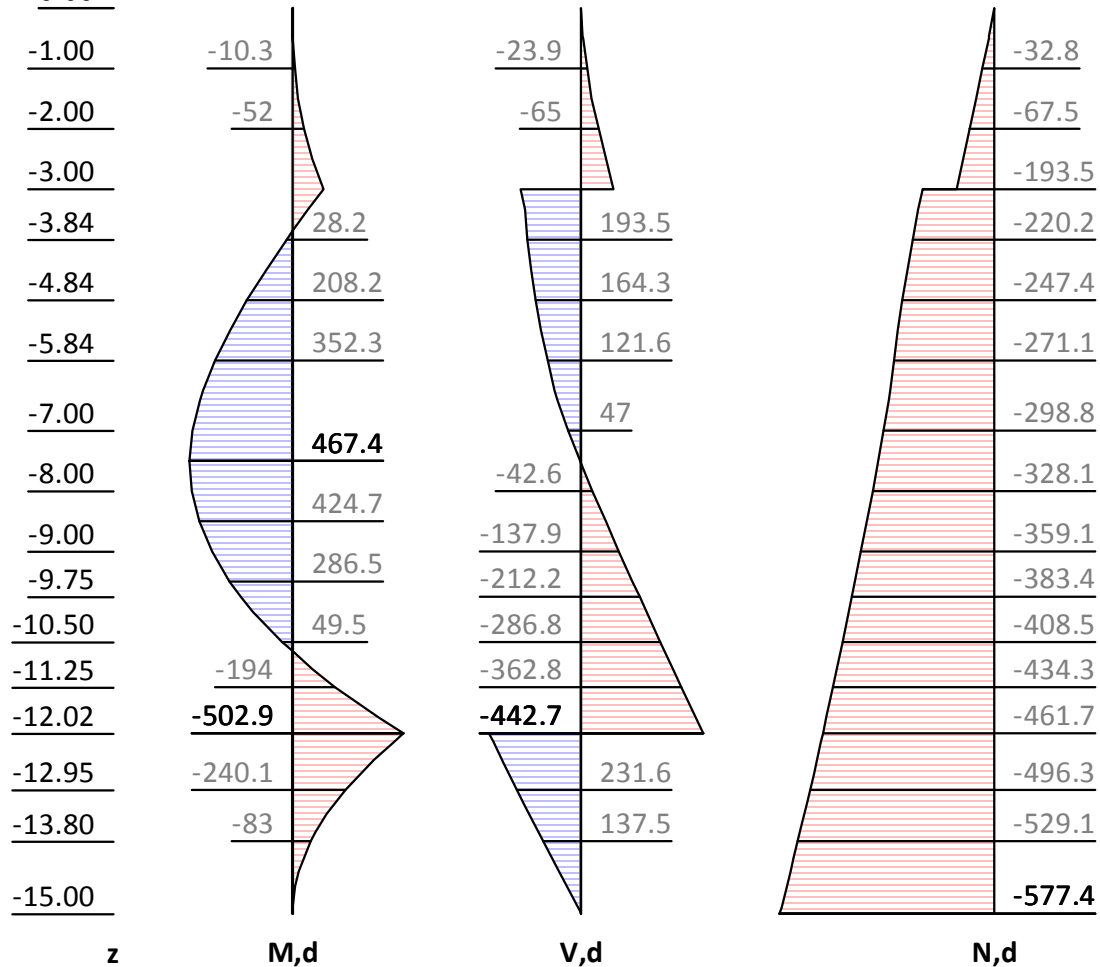
| z [m] | H, q, k [kN/m ²] | M, q, k [kN/m ²] | V, q, k [kN/m ²] | N, q, k [kN/m ²] | u, q, k [mm] |
|----------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|-----------------|
| -14.90 | 0.00 | 0.00 | 0.00 | -20.94 | -0.22 |
| -15.00 | 0.00 | -0.00 | -0.00 | -20.94 | -0.23 |

Internal forces: Design

z= -0.500. Fx= -0.000 kN/m Support

z= -3.000. Fx=-336.592 kN/m Support

z= -12.018. Fx=-774.293 kN/m Support

0.00

| | | | | | |
|---|-------------------|------------------|----------------------|----------|------------------|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | | | | | Job No.: |
| Program: WALLS-Retain. Version 2017.046 | | | | | |
| Structure: | info@fides-dvp.de | www.fides-dvp.de | Tel:++49/89/143829-0 | ASB Nr.: | Date: 08.10.2018 |

0.00

-1.00

-2.00

-3.00

-3.84

-4.84

-5.84

-7.00

-8.00

-9.00

-9.75

-10.50

-11.25

-12.02

-12.95

-13.80

-15.00

16.7

51.9

51.9

73.6

91.2

101.5

106

110.6

116.8

2.5

1.69

0.869

-0.791

-1.7

-2.42

-2.91

-2.68

-2.09

-1.25

-0.581

0.43

0.655

0.89

| z | H,d | M,d | V,d | N,d | u,g+q,k |
|--------|---------|---------|---------|---------|---------|
| [m] | [kN/m2] | [kN/m2] | [kN/m2] | [kN/m2] | [mm] |
| 0.00 | 16.71 | -0.00 | -0.00 | 0.00 | 2.50 |
| -0.47 | 16.71 | -1.85 | -7.85 | -15.07 | 2.12 |
| -0.47 | 30.29 | -1.85 | -7.85 | -15.07 | 2.12 |
| -1.50 | 30.29 | -26.00 | -39.05 | -49.59 | 1.28 |
| -1.50 | 51.93 | -26.00 | -39.05 | -49.59 | 1.28 |
| -3.00 | 51.93 | -143.00 | -116.94 | -103.28 | 0.00 |
| -3.00 | 51.93 | -143.00 | -116.94 | -103.28 | -0.00 |
| -3.00 | 46.36 | -143.00 | 219.65 | -193.47 | -0.00 |
| -3.34 | 50.95 | -71.08 | 203.11 | -205.22 | -0.32 |
| -3.34 | 15.73 | -71.08 | 203.11 | -205.22 | -0.32 |
| -3.70 | 20.57 | 0.00 | 196.25 | -215.93 | -0.66 |
| -6.50 | 58.39 | 421.18 | 85.99 | -284.73 | -2.74 |
| -6.50 | 73.59 | 421.18 | 85.99 | -284.73 | -2.74 |
| -7.50 | 91.23 | 467.43 | 3.58 | -313.22 | -2.91 |
| -7.54 | 91.39 | 466.67 | 0.00 | -314.37 | -2.91 |
| -10.00 | 101.57 | 180.52 | -237.42 | -391.75 | -1.69 |
| -10.00 | 97.91 | 180.52 | -237.42 | -391.75 | -1.69 |
| -10.66 | 100.41 | -0.00 | -302.94 | -413.95 | -1.10 |
| -12.02 | 105.56 | -502.92 | -442.66 | -461.73 | 0.00 |
| -12.02 | 105.56 | -502.92 | 331.64 | -461.73 | 0.00 |
| -15.00 | 116.84 | -0.00 | -0.00 | -577.37 | 0.89 |
| -15.00 | 116.84 | 0.00 | -0.00 | -577.37 | 0.89 |

Anchor forces with safety level of DS-P

| z[m] | A,d[kN] | Fx,d[kN/m] |
|-------|---------|------------|
| -0.50 | 0.0 | -0.0 |
| -3.00 | 313.6 | -336.6 |

| | | | |
|---------|--------------------------------------|----------|--------------|
| Part: | Please specify project informations. | Page: 67 | Archive No.: |
| Block: | | | |
| Record: | | | |

Checks of earth statics

Check of earth support

Check: Mobilizable earth resistance is sufficient for earth support force.

z: -12.02 m

$R_d = E_{ph,k}/\gamma_{Re} = 5089.29 / 1.400 = 3635.21 \text{ [kN/m]}$

$E_d(U_h,d)/R_d = 774.29 / 3635.21 = 0.213 \text{ [-]}. \text{ Passes requirement}$

Sum of H and V forces, (G)

Forces up to depth z:-15.00

| Pos. | H | V |
|--|---------|-----------------------|
| H/V pressure G+P+W,k | 764.51 | 124.36 |
| Wall weight | | 233.11 |
| H/V pressure passive | | 0.00 |
| Support z: -0.50 | | 0.00 |
| Support z: -3.00 | -185.55 | 49.72 |
| B _{h,g,k} z=-12.02 | -578.95 | |
| B _{v,g,k} = B _{h,k} * tan(δ,p=-23.33°) | | -249.74 |
| Σ | 0.00 | 157.45 (downwards) |

Average anchor inclination α,A = 15.00° >= 15°.

Verification of vertical forces due to EAB R 9 not required (R 9-5).

Check EAB R 9-1

Vertical component of earth resistance is less than the downwards pointing vertical forces.

$V_k \geq B_{vk}: 407.19 \geq 249.74 \text{ Passes requirement}$

Sum of H and V forces, (G+Q)

Forces up to depth z:-15.00

| Pos. | H | V |
|--|---------|-----------------------|
| H/V pressure G+P+W,k | 817.04 | 129.92 |
| Wall weight | | 233.11 |
| H/V pressure passive | | 0.00 |
| Support z: -0.50 | | 0.00 |
| Support z: -3.00 | -242.95 | 65.10 |
| B _{h,g,k} z=-12.02 | -578.95 | |
| B _{v,g,k} = B _{h,k} * tan(δ,p=-23.33°) | | -249.74 |
| B _{h,q,k} z=-12.02 | 4.86 | |
| B _{v,q,k} = B _{h,k} * tan(δ,p=-23.33°) | | 2.10 |
| Σ | -0.00 | 180.49 (downwards) |

Average anchor inclination α,A = 15.00° >= 15°.

Verification of vertical forces due to EAB R 9 not required (R 9-5).

Check EAB R 9-1

Vertical component of earth resistance is less than the downwards pointing vertical forces.

$V_k \geq B_{vk}: 428.12 \geq 247.64 \text{ Passes requirement}$

Anchor verification

| | |
|--|------------------|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | Job No.: |
| Program: WALLS-Retain. Version 2017.046 | |
| Structure: info@fides-dvp.de www.fides-dvp.de Tel:++49/89/143829-0 ASB Nr.: | Date: 08.10.2018 |

Anchor - Stability of lower failure plane

Περίπτ.Φόρτισης: όλα τα φορτία BS-P
 Αυτόμ. υπολογ. μήκους αγκυρίων:
 All anchors are extended (if necessary)
 Favourable variable loads in main failure body are not being considered.
 Bottom of lower failure plane: z=-15.00 m

Iteration of failure mechanisms:
 lA: Length of anchor from head to center of grout body.
 W,k: Res. force from dead weight, loads, cohesion, ...
 Q,k: Force in lower failure plane.
 Ea1,k.....: Earth pressure onto vertical separation plane.
 Ea2,k.....: Earth pressure between wall and main failure body.
 Ra_cal,d: Dimesioning force of the resistance from the equilibrium of forces.
 Ra_cal,d corresponds to the max. possible anchor force of the force polygon.
 Sum(A,d): Acting anchor forces along the grout body fractions within the failure body. Sum(A,d) is gained from the anchor pull forces of the wall analysis.

| z | θ1 | θ2 | lA | W,k | Q,k | Ea1,k | Ea2,k | Ra_cal,d | Sum(A,d) | Ed/Rd |
|-------|------|------|-------|--------|--------|--------|--------|----------|----------|-------|
| [m] | [°] | [°] | [m] | [kN/m] | [kN/m] | [kN/m] | [kN/m] | [kN/m] | [kN/m] | [-] |
| -0.50 | 37.4 | 57.5 | 14.56 | 1934.5 | 1716.2 | 4.4 | 400.0 | 250.3 | 249.9 | 1.00 |
| -3.00 | 31.8 | 61.1 | 14.00 | 1997.6 | 1741.6 | 46.1 | 400.0 | 349.1 | 348.3 | 1.00 |

Decisive failure body:
Γεωμετρία:
 Foot point of lower failure plane x/z = 0.01/-15.00 m
 Intersection lower/upper slid. plane x/z = 13.52/ -6.62 m
 Intersection upper slid. plane/surface x/z = 17.18/ 0.00 m
 Intersection separation plane/surface x/z = 13.52/ 0.00 m
 Inclination lower failure plane θ1 = 31.80°
 Inclination upper failure plane θ2 = 61.06°
 Inclination separation plane θ12 = 90.00°

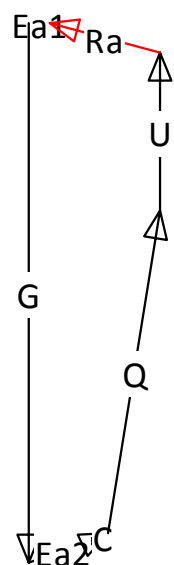
Loads / forces (char.)

| | | Fx | Fz | F | |
|------------------------------------|-----------|--------|---------|--------|---------|
| | | [kN/m] | [kN/m] | [kN/m] | |
| Weight of main failure body | G,k: | 0.0 | -3093.6 | 3093.6 | |
| Cohesion of lower failure plane | C,k: | 67.5 | 41.9 | 79.5 | |
| Pore water pressure on main body | U,k: | -0.5 | 1055.2 | 1055.2 | |
| Earth pres. on separation plane | Ea1,k: | -46.1 | -0.0 | 46.1 | δ= 0.0° |
| Earth pr. between wall<->main body | Ea2,k: | 378.3 | 129.9 | 400.0 | |
| Force in lower failure plane | Q,k: | 72.9 | 1740.1 | 1741.6 | |
| Sum = possible anchor forces: | Ra_cal,k: | 472.1 | -126.5 | 488.8 | |

Force polygon

| | |
|--|--------------|
| Part: Block: Please specify project informations. Record: | Archive No.: |
|--|--------------|

Page: 69



Acting anchor forces $E_d: \sum(A,d) = 348.3 \text{ kN/m}$
 Possible anchor forces $R_d: R_{a_cal,d} = 488.8/1.400 = 349.1 \text{ kN/m}$
 Verif. of lower failure plane $E_d/R_d = 1.00 < 1.0$: Έλεγχος εκπληρώθηκε.

Check of steel tension

l_{tot} ...[m]: Total length of anchor incl. excess length at head

A_s [mm²]: X-section area of steel member

$R_{i,d}$...[kN]: Ultimate strength of tension member ($\gamma, M=1.15$)

A,d [kN]: Dimensioning force of the anchor from wall analysis

| z[m] | Anchor type | l_{tot} | A_s | $R_{i,d}$ | A,d |
|-------|--------------------------|-----------|-------|-----------|--------------------|
| -0.50 | Strand;3x0.60";1570/1770 | 19.37 | 420 | 573.4 | 0.0 |
| | | | | | Passes requirement |
| -3.00 | Strand;3x0.60";1570/1770 | 18.00 | 420 | 573.4 | 313.6 |
| | | | | | Passes requirement |

Check of steel tension: Passes requirement

Check of anchor's soil friction

$l_{V,k}$: Length of grout body

$D_{mV,k}$: Diameter of grout body

$\tau_{Gr,k}$...: Average applied skin friction along the grout body (from soil parameters)

$R_{a,k}$: Charact. pullout resistance of the anchor

γ_A : Partial safety factor of anchor pullout

$R_{a,d}$: $R_{a,k} / \gamma_A$

A,d : Dimensioning force of the anchor from wall analysis

| z | $l_{V,k}$ | $D_{mV,k}$ | $\tau_{Gr,k}$ | $R_{a,k}$ | γ_A | $R_{a,d}$ | A,d | $A,d/R_{a,d}$ |
|-------|-----------|------------|----------------------|-----------|------------|-----------|-------|---------------|
| [m] | [m] | [mm] | [kN/m ²] | [kN] | [-] | [kN] | [kN] | [-] |
| -0.50 | 8.00 | 318 | 110 | 879.1 | 1.100 | 799.2 | 0.0 | 0.0 |
| -3.00 | 8.00 | 318 | 110 | 879.1 | 1.100 | 799.2 | 313.6 | 0.4 |

Check of anchor's soil friction: Passes requirement

Υπολογ. κύκλου ολίσθησης

LC: όλα τα φορτία Type: BS-T (combination: [GEO] A2 M2 R3, BS-T)

Vertical variable loads only act if they are outside of $R \cdot \sin(\phi)$.

The automatic slip circle optimization only considers circles that intersect the surface with an area of at least 0.25 m².

The slip circle calculation only accepts circles including the wall.

The slipcircle calculation only allows circular failure planes (no vertical tangents will occur).

Γεωμετ. κύκλου (μήκη και συντεταγμ. σε (m))

Κέντρο = $(-0.10, 6.68)$, Ακτίνα = 21.69

Αρχ.σημ. = (-17.32, -6.50), Τελ.σημ. = (20.54, 0.00)

Γεωμετρία λωρίδων:

| No | x | Width | dxM | Weight | Load | Water- | u*b | φ | c | θ |
|----|--------|-------|--------|--------|--------|--------|--------|-----------|----------------------|----------|
| | | b | | | z-κατ. | φορτ. | | | | |
| | [m] | [m] | [m] | [kN/m] | [kN/m] | [kN/m] | [kN/m] | [°] | [kN/m ²] | [°] |
| 1 | -16.24 | 2.17 | -16.14 | 63.8 | 0.0 | 0.0 | -15.5 | 27.45 | 3.57 | -31.27* |
| 2 | -14.07 | 2.17 | -13.97 | 166.4 | 0.0 | 0.0 | -51.0 | 27.45 | 3.57 | -31.27* |
| 3 | -11.90 | 2.17 | -11.80 | 244.9 | 0.0 | 0.0 | -86.1 | 29.26 | 3.57 | -30.37* |
| 4 | -9.73 | 2.17 | -9.64 | 305.2 | 0.0 | 0.0 | -113.1 | 29.26 | 3.57 | -26.37 |
| 5 | -7.56 | 2.17 | -7.47 | 350.7 | 0.0 | 0.0 | -133.4 | 29.26 | 3.57 | -20.13 |
| 6 | -5.39 | 2.17 | -5.30 | 383.3 | 0.0 | 0.0 | -148.0 | 29.26 | 3.57 | -14.13 |
| 7 | -3.23 | 2.17 | -3.13 | 404.3 | 0.0 | 0.0 | -157.4 | 29.26 | 3.57 | -8.29 |
| 8 | -1.06 | 2.17 | -0.96 | 418.1 | 0.0 | 0.0 | -210.7 | 29.26 | 3.57 | -2.53 |
| 9 | 1.11 | 2.17 | 1.21 | 700.0 | 0.0 | 0.0 | -259.2 | 29.26 | 3.57 | 3.20 |
| 10 | 3.28 | 2.17 | 3.38 | 688.7 | 0.0 | 0.0 | -254.2 | 29.26 | 3.57 | 8.96 |
| 11 | 5.45 | 2.17 | 5.55 | 666.5 | 0.0 | 0.0 | -244.2 | 29.26 | 3.57 | 14.82 |
| 12 | 7.62 | 2.17 | 7.72 | 632.4 | 0.0 | 0.0 | -229.0 | 29.26 | 3.57 | 20.84 |
| 13 | 9.79 | 2.17 | 9.89 | 585.3 | 0.0 | 0.0 | -208.0 | 29.26 | 3.57 | 27.12 |
| 14 | 11.96 | 2.17 | 12.06 | 523.1 | 0.0 | 0.0 | -180.1 | 29.26 | 3.57 | 33.77 |
| 15 | 14.13 | 2.17 | 14.23 | 442.2 | 0.0 | 0.0 | -143.8 | 27.45 | 3.57 | 40.98 |
| 16 | 16.30 | 2.17 | 16.39 | 336.2 | 0.0 | 0.0 | -96.0 | 27.45 | 3.57 | 49.10 |
| 17 | 18.96 | 3.16 | 19.06 | 222.8 | 0.0 | 0.0 | -50.0 | 0.08 | 35.71 | 61.47 |

*** Σημείωση: Στις λωρίδες σημειωμένες με '*'
περιορίστηκε το theta στο 45°-Phi/2.

Συνεισφ. κατακόρυφων φορτίων:

| No | Weight | $G \cdot \sin(\theta)$ | $(G - u \cdot b) \cdot \tan(\varphi) + c \cdot b$ | $\mu \cdot \sin(\theta) \cdot \tan(\varphi) + \cos(\theta)$ | T |
|----|--------|------------------------|---|---|------------------|
| | [kN/m] | [kN/m] | [kN/m] | [-] | [kN/m] |
| 1 | 63.84 | -47.51 | 32.84 | 0.754062 | 43.55 |
| 2 | 166.42 | -107.21 | 67.74 | 0.754062 | 89.83 |
| 3 | 244.86 | -133.25 | 96.66 | 0.757076 | 127.67 |
| 4 | 305.18 | -135.56 | 115.33 | 0.803086 | 143.61 |
| 5 | 350.66 | -120.69 | 129.42 | 0.866956 | 149.29 |
| 6 | 383.30 | -93.60 | 139.54 | 0.918686 | 151.89 |
| 7 | 404.29 | -58.29 | 146.05 | 0.959411 | 152.23 |
| 8 | 418.05 | -18.47 | 123.92 | 0.989786 | 125.20 |
| 9 | 700.03 | 39.07 | 254.69 | 1.010107 | 252.14 |
| 10 | 688.75 | 107.31 | 251.19 | 1.020355 | 246.18 |
| 11 | 666.45 | 170.48 | 244.27 | 1.020198 | 239.43 |
| 12 | 632.39 | 225.01 | 233.71 | 1.008932 | 231.64 |
| 13 | 585.30 | 266.79 | 219.12 | 0.985353 | 222.38 |
| 14 | 523.09 | 290.74 | 199.87 | 0.947488 | 210.94 |
| 15 | 442.22 | 290.01 | 162.77 | 0.882061 | 184.53 |
| 16 | 336.21 | 254.11 | 132.56 | 0.801313 | 165.43 |
| 17 | 222.80 | 195.75 | 113.02 | 0.478023 | 236.42 |
| | | ----- 1124.70 | | | ----- 2972.36 |

Συνεισφ. αγκυρίων: Αθρ. ροπών ανατροπής : -296.6 kN*m/m
" " resisting : 116.5 kN*m/m

Δράση $E_d = (1124.7 \cdot 21.69 - 296.6)$

Αντίσταση $R_d = (2972.4 \cdot 21.69 + 116.5)$

SLIP-CIRCLE $\mu = E_d/R_d = 0.37 < 1.0$: Έλεγχος εκπληρώθηκε.

Φάση εκσκαφής 6 "[6] Situation 4 + +"

LC: όλα τα φορτία Type: BS-T

Εδαφικό σύστημα με 5 Στρώσεις

| Name | Τεχνητές επιχωματώσεις | Αμμόδης ΑΡΓΙΛΟΣ | Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ | |
|-------------|------------------------|-----------------|--------------------------|-----------|
| γ | [kN/m3] | 18 | 20 | 22.5 |
| γ,R | [kN/m3] | 18 | 20 | 22.5 |
| γ' | [kN/m3] | 8 | 10 | 12.5 |
| γ,p | [kN/m3] | 18 | 20 | 22.5 |
| γ,R,passive | [kN/m3] | 18 | 20 | 22.5 |
| γ,pw | [kN/m3] | 8 | 10 | 12.5 |
| φ | [°] | 25 | 0.1 | 33 |
| c | [kN/m2] | 2 | 50 | 5 |
| c,u | [kN/m2] | 10 | 50 | 5 |
| c παθητικό | [kN/m2] | 2 | 50 | 5 |
| δ,a | [°] | 16.66667 | 0.06666667 | 22 |
| δ,p | [°] | -16.66667 | -0.06666667 | -22 |
| δ,c | [°] | 8.333333 | 0.03333333 | 11 |
| k,agh | [-] | 0.3456501 | 0.9955057 | 0.2452023 |
| K,ach | [-] | 1.043051 | 1.994195 | 0.8549058 |
| K,0h | [-] | 0.5773817 | 0.9982547 | 0.455361 |
| K,pgh | [-] | 3.908103 | 1.004519 | 7.495617 |
| K,pch | [-] | 5.180327 | 2.00583 | 8.599509 |
| τ,gr | [kN/m2] | 110 | 110 | 110 |
| Ψ,A,max | [°] | 90 | 90 | 90 |
| k | [cm/s] | 10e-06 | 1e-06 | 100e-06 |

| Name | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ | |
|-------------|------------------------|------------------------|-----------|
| γ | [kN/m3] | 22.5 | 22.5 |
| γ,R | [kN/m3] | 22.5 | 22.5 |
| γ' | [kN/m3] | 12.5 | 12.5 |
| γ,p | [kN/m3] | 22.5 | 22.5 |
| γ,R,passive | [kN/m3] | 22.5 | 22.5 |
| γ,pw | [kN/m3] | 12.5 | 12.5 |
| φ | [°] | 35 | 35 |
| c | [kN/m2] | 5 | 5 |
| c,u | [kN/m2] | 5 | 5 |
| c παθητικό | [kN/m2] | 5 | 5 |
| δ,a | [°] | 23.33333 | 23.33333 |
| δ,p | [°] | -23.33333 | -23.33333 |
| δ,c | [°] | 11.66667 | 11.66667 |
| k,agh | [-] | 0.2244207 | 0.2244207 |
| K,ach | [-] | 0.8126539 | 0.8126539 |
| K,0h | [-] | 0.4264236 | 0.4264236 |
| K,pgh | [-] | 9.146943 | 9.146943 |
| K,pch | [-] | 10.104 | 10.104 |
| τ,gr | [kN/m2] | 110 | 110 |
| Ψ,A,max | [°] | 90 | 90 |
| k | [cm/s] | 100e-06 | 100e-06 |

Πορεία πρανούς:

x [m] 0.00 0.00
z [m] -6.50 0.00

Πορεία ανώτερου 2. στρώματος Αμμόδης ΑΡΓΙΛΟΣ:

x [m] 0.00 0.00
z [m] -6.50 -1.50

Πορεία ανώτερου 3. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ:

x [m] 0.00 0.00
z [m] -6.50 -4.50

Πορεία ανώτερου 4. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟΣ:

z= -10.00

| | | |
|---|------------------|--|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | | Job No.: |
| Program: WALLS-Retain. Version 2017.046 | | |
| Structure: info@fides-dvp.de | www.fides-dvp.de | Tel:++49/89/143829-0 ASB Nr.: Date: 08.10.2018 |

Πορεία ανώτερου 5. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ:
z= -14.00

Επιφ. φορτία:

Φορτία

| xA | zA | xE | zE | PxA | PzA | PxE | PzE | Typ | LC-description |
|------|------|------|------|------|-------|------|-------|-----|----------------|
| [m] | [m] | [m] | [m] | [| kN/m² | |] | | Name |
| 1.00 | 0.00 | 3.50 | 0.00 | 0.00 | 33.00 | 0.00 | 33.00 | q | 1 |

Κατανομή εδαφ.πιέσεων

| Κατανομή εδαφ.πιέσεων | Name |
|----------------------------|------|
| Rectangular within a layer | |

Στάθμη νερού:

| | | |
|-------|-------|-------|
| x [m] | 0.00 | 0.00 |
| z [m] | -7.50 | -3.00 |

Αγκύρια

| z[m] | min.l[m] | Alpha[°] | C-H[kN/m] | P0[kN] | u0[m] |
|-------|----------|----------|-----------|--------|--------|
| -0.50 | 0.00 | 15.00 | αόρισ. | 0.00 | 0.0000 |
| -3.00 | 0.00 | 15.00 | αόρισ. | 0.00 | 0.0000 |
| -5.50 | 0.00 | 15.00 | αόρισ. | 0.00 | 0.0000 |

Παράμετροι υπολογισμού

Earth pressure options

Τμήμα εδαφ.ωθήσεων: Ενεργές ωθήσεις.
Angle of slip plane: DIN 4085.
Split block loads into 1 sections.
Consideration of minimum earth pressure: φ,min = 40.000.
Negative earth pressure fractions are set to zero.

Redistribution of earth pressure

Shape of redistribution: Triangle (perpend. to wall).
The earth pressure is getting redistrib. to: Excavation level
The earth pressure below the excavation acts without redistrib.
Levels of redistribution Z1: -3.000, Z2: -5.500 [m].
The earth pressure from variable loads will be included in redistribution.

Παθητικές ωθήσεις

Method of calculation: Κλασικός, Pregl/Sokolovsky (DIN 4085).

Options for water pressure

Στήριξη πόδα

Πόδας οριζοντίως μετακινούμενος

Αγκύρια

Anchor checks (lower failure plane): Ναι
Anchor forces with safety level of DS-P: Ναι
Verification of grout body pull out forces: Ναι
δ,a,Anchoring wall : used from soil layer.
δ,p,Anchoring wall : used from soil layer.

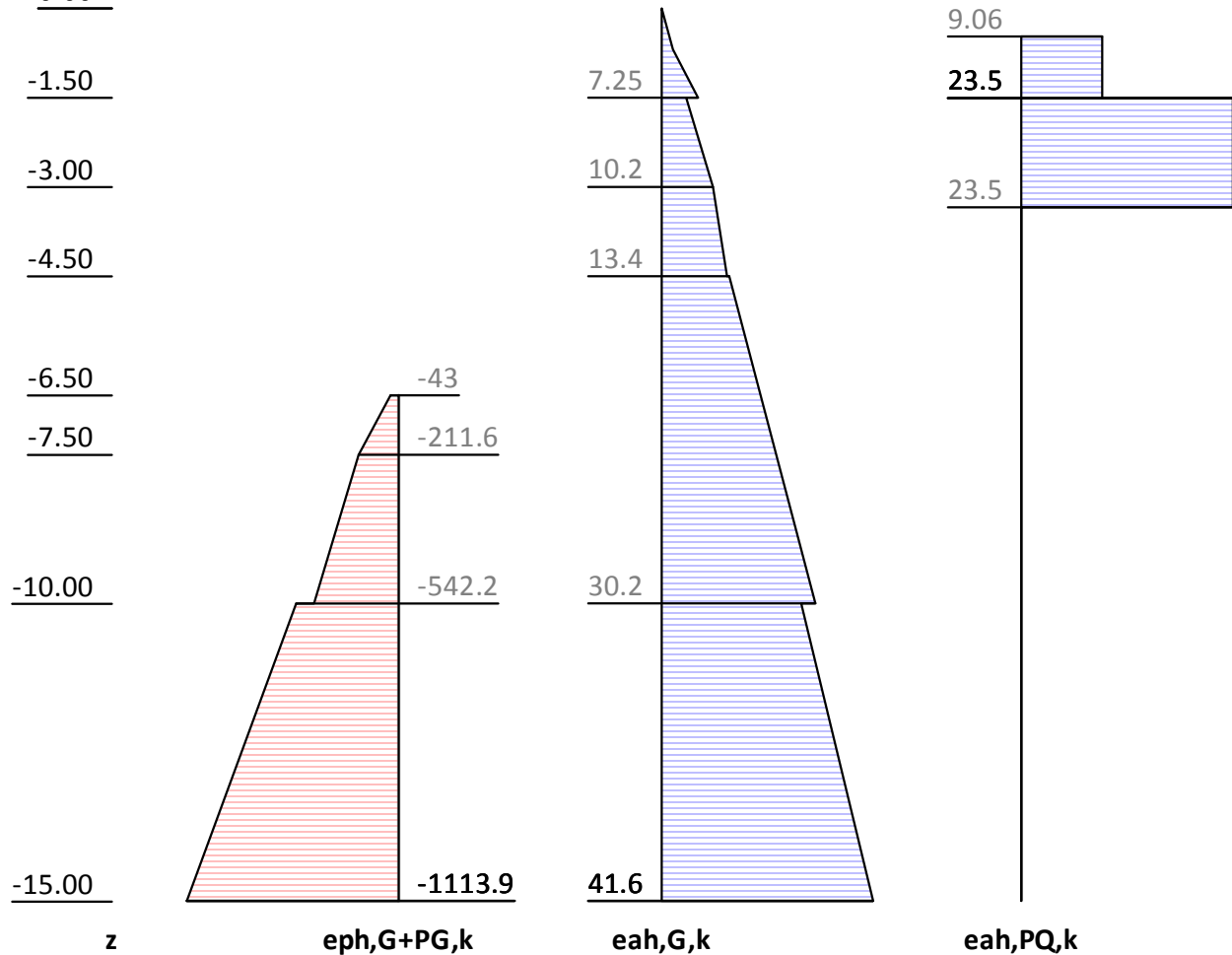
Earth pressure coefficients kh

| φ | α | β | δ | k0gh | kagh | kach | kpgh | kpch | |
|------|-----|-----|-------|------|-------|-------|-------|---------|--------------------------|
| 33.0 | 0.0 | 0.0 | -22.0 | -- | -- | -- | 7.496 | -8.600 | Τεχνητές επιχωματώσεις |
| 25.0 | 0.0 | 0.0 | 16.7 | -- | 0.346 | 1.043 | -- | -- | " |
| 0.1 | 0.0 | 0.0 | 0.1 | -- | 0.996 | 1.994 | -- | -- | Αμμώδης ΑΡΓΙΛΟΣ |
| 33.0 | 0.0 | 0.0 | -22.0 | -- | -- | -- | 7.496 | -8.600 | Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ |
| 33.0 | 0.0 | 0.0 | 22.0 | -- | 0.245 | 0.855 | -- | -- | " |
| 35.0 | 0.0 | 0.0 | -23.3 | -- | -- | -- | 9.147 | -10.104 | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ |
| 35.0 | 0.0 | 0.0 | 23.3 | -- | 0.224 | 0.813 | -- | -- | " |
| 35.0 | 0.0 | 0.0 | -23.3 | -- | -- | -- | 9.147 | -10.104 | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ |
| 35.0 | 0.0 | 0.0 | 23.3 | -- | 0.224 | 0.813 | -- | -- | " |

| | | |
|---------|--------------------------------------|--------------|
| Part: | | Archive No.: |
| Block: | Please specify project informations. | Page: 73 |
| Record: | | |

Μήκος τοίχουFoot depth for statics: $z_f = -15.000$ **Stress analysis****Earth pressure, horizontal**

Pressures characteristic, no redistribution, continuous wall

0.00

| z [m] | e_{ph}, G, k [kN/m²] | e_{ah}, G, k [kN/m²] | e_{ah}, PQ, k [kN/m²] | e_{ah}, d [kN/m²] |
|------------|---------------------------|---------------------------|----------------------------|------------------------|
| 0.00 | | 0.00 | | 0.00 |
| -0.47 | | 1.52 | 0.00 | 2.04 |
| -0.47 | | 1.52 | 9.06 | 15.62 |
| -1.50 | | 7.25 | 9.06 | 23.37 |
| -1.50 | | 4.82 | 23.48 | 41.73 |
| -3.34 | | 10.79 | 23.48 | 49.78 |
| -3.34 | | 10.79 | 0.00 | 14.56 |
| -4.50 | | 12.86 | 0.00 | 17.36 |
| -4.50 | | 13.38 | 0.00 | 18.06 |
| -6.50 | -0.00 | 19.51 | 0.00 | 26.34 |
| -6.50 | -43.00 | 19.51 | 0.00 | 26.34 |
| -10.00 | -445.89 | 30.24 | 0.00 | 40.82 |
| -10.00 | -542.17 | 27.52 | 0.00 | 37.16 |
| -15.00 | -1113.85 | 41.55 | 0.00 | 56.09 |

E_{ph}, G, k : -5089.29, E_{ph}, PG, k : 0.00 [kN/m]
 E_{ah}, G, k : 325.76, E_{ah}, PG, k : 0.00, E_{ah}, PQ, k : 52.53, E_{ah}, d : 518.57

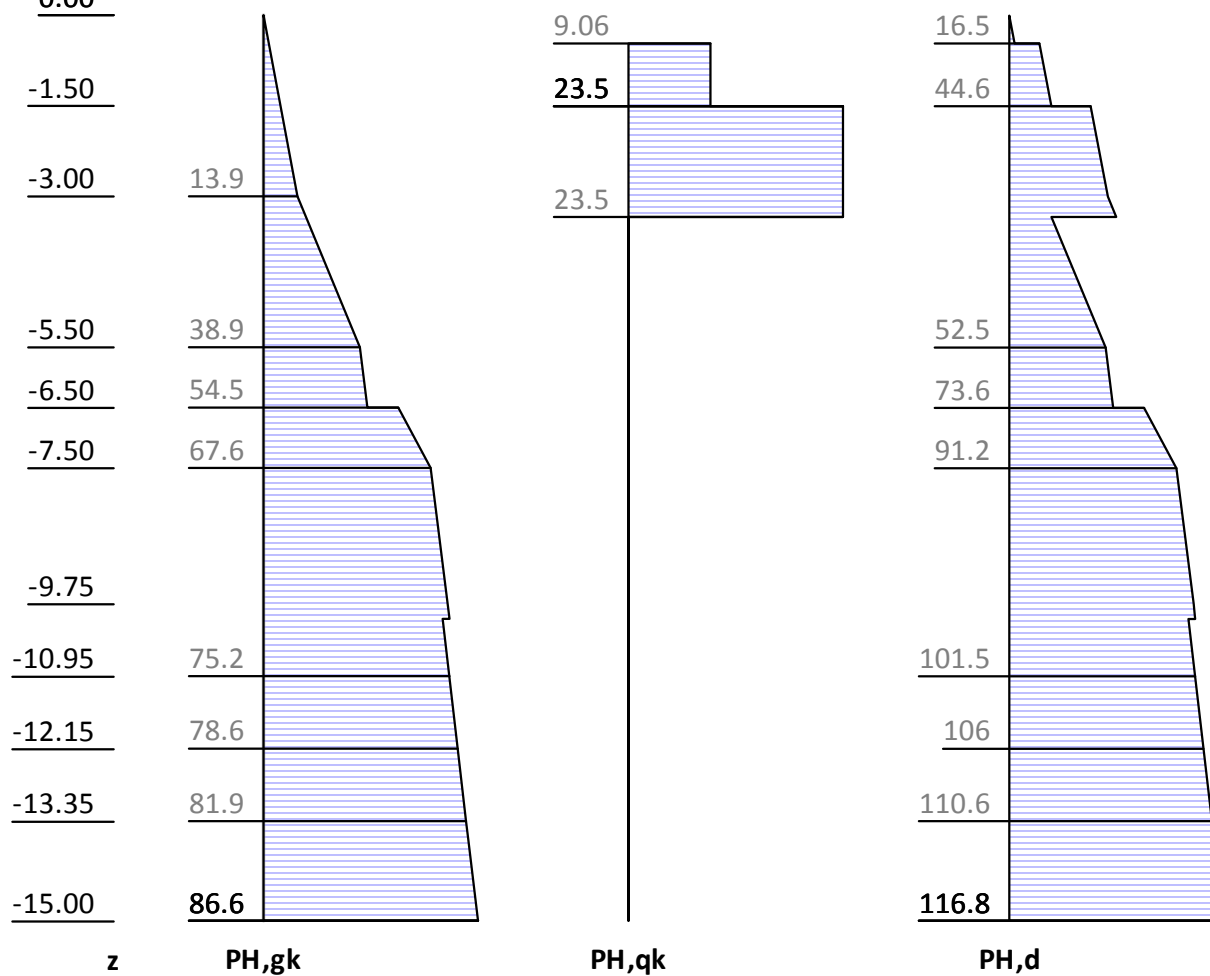
Πίεση νερού

| z [m] | Wp,k [kN/m2] | Wa,k [kN/m2] | W,k [kN/m2] |
|----------|-----------------|-----------------|----------------|
| -3.00 | | 0.00 | 0.00 |
| -7.50 | 0.00 | 45.00 | 45.00 |
| -13.80 | -63.00 | 108.00 | 45.00 |
| -15.00 | -75.00 | 120.00 | 45.00 |

H-pressure on static system

Level of mobilization: Ep,gk 100.0, Ep,qk 100.0, Ep,d 100.0 [%]

0.00



| z [m] | PH,gk [kN/m2] | PH,qk [kN/m2] | PH,d [kN/m2] |
|----------|------------------|------------------|-----------------|
| 0.00 | 0.00 | 0.00 | 0.00 |
| -0.47 | 2.18 | 0.00 | 2.94 |
| -0.47 | 2.18 | 9.06 | 16.52 |
| -1.50 | 6.95 | 9.06 | 22.97 |
| -1.50 | 6.95 | 23.48 | 44.60 |
| -3.34 | 17.30 | 23.48 | 58.57 |
| -3.34 | 17.30 | 0.00 | 23.35 |
| -6.50 | 41.95 | 0.00 | 56.63 |
| -6.50 | 54.51 | 0.00 | 73.59 |
| -10.00 | 75.24 | 0.00 | 101.57 |
| -10.00 | 72.52 | 0.00 | 97.91 |
| -15.00 | 86.55 | 0.00 | 116.84 |

V-pressure on static system**Internal forces: Permanent, characteristically**

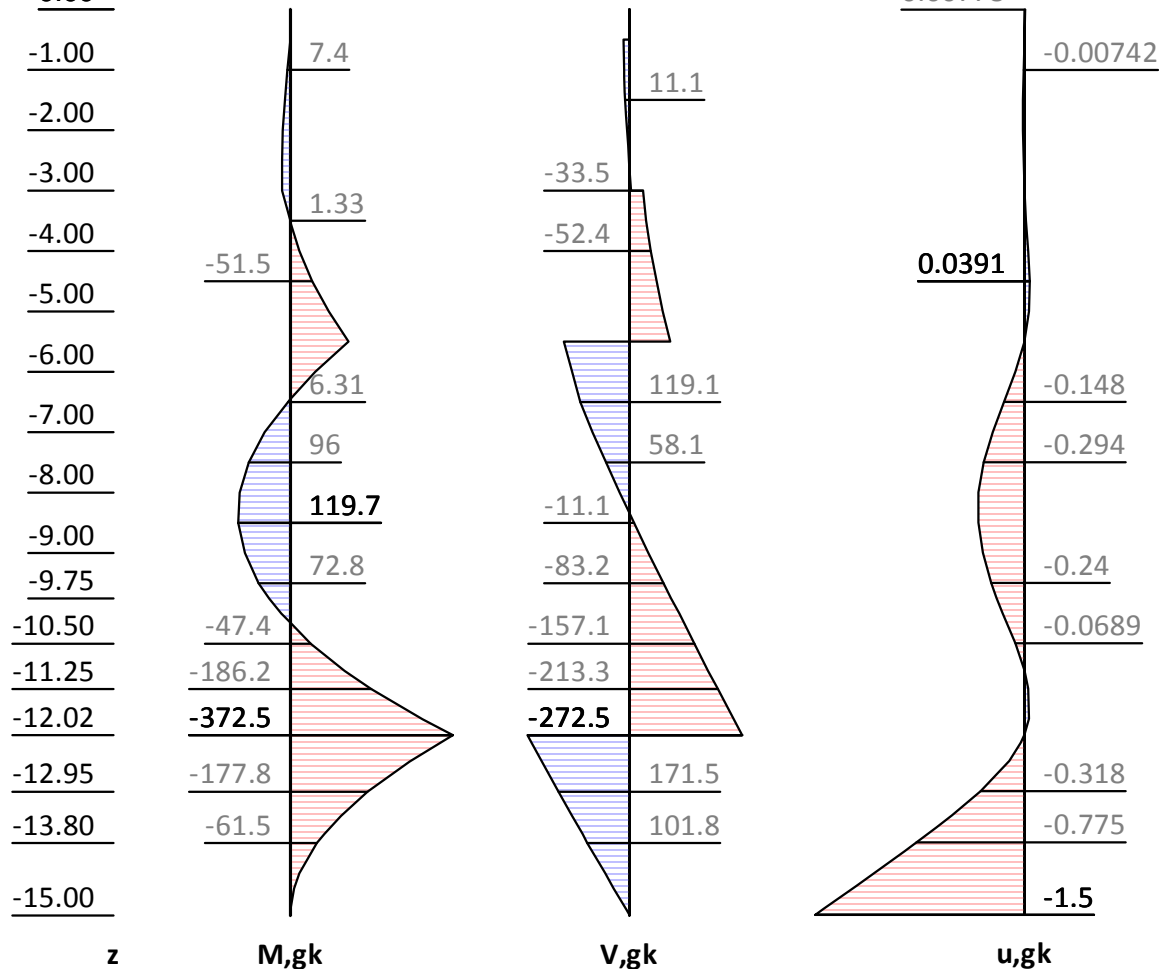
z= -0.500. Fx= -16.352 kN/m Support

z= -3.000. Fx= 29.033 kN/m Support

z= -5.500. Fx=-259.040 kN/m Support

z= -12.018. Fx=-518.149 kN/m Support

0.00



| z [m] | H, g, k [kN/m²] | M, g, k [kN/m²] | V, g, k [kN/m²] | N, g, k [kN/m²] | u, g, k [mm] |
|----------|--------------------|--------------------|--------------------|--------------------|-----------------|
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 |
| -0.00 | 0.00 | -0.00 | 0.00 | -0.00 | 0.01 |
| -0.50 | 2.32 | -0.10 | -0.58 | -10.63 | 0.00 |
| -0.51 | 2.35 | 0.00 | 15.75 | -15.15 | -0.00 |
| -2.00 | 9.27 | 18.35 | 7.09 | -48.48 | -0.01 |
| -2.50 | 11.58 | 20.64 | 1.88 | -60.16 | -0.01 |
| -2.65 | 12.26 | 20.46 | -0.00 | -63.68 | -0.01 |
| -3.00 | 13.90 | 20.03 | -4.49 | -72.10 | 0.00 |
| -3.00 | 13.90 | 20.03 | -33.53 | -64.33 | 0.00 |
| -3.53 | 19.18 | -0.00 | -42.33 | -76.59 | 0.02 |
| -4.50 | 28.90 | -51.52 | -65.62 | -96.77 | 0.04 |
| -5.50 | 38.90 | -133.26 | -99.52 | -114.20 | 0.00 |
| -5.50 | 38.90 | -133.26 | -99.52 | -114.20 | -0.00 |
| -5.50 | 38.90 | -133.26 | 159.52 | -183.60 | -0.00 |
| -6.45 | 41.80 | -0.00 | 121.10 | -197.86 | -0.14 |
| -6.50 | 41.95 | 6.31 | 119.10 | -198.57 | -0.15 |
| -6.50 | 54.51 | 6.31 | 119.10 | -198.57 | -0.15 |
| -8.34 | 70.16 | 118.63 | 0.00 | -238.43 | -0.33 |
| -8.50 | 70.64 | 119.68 | -11.06 | -242.01 | -0.33 |
| -10.00 | 75.24 | 21.95 | -120.46 | -277.84 | -0.16 |

| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | | | | | Job No.: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--------------------|-------------------------|----------------------|--------------------|------------------------------|----------|--------------------|--------------------|--------------------|--------------------|-----------------|--------|-------|-------|---------|---------|-------|--------|-------|------|---------|---------|-------|--------|-------|---------|---------|---------|-------|--------|-------|---------|---------|---------|------|--------|-------|---------|---------|---------|------|--------|-------|---------|--------|---------|------|--------|-------|-------|-------|---------|-------|-------|------|------|------|-------|-------|-------|-------|------|------|-------|-------|-------|-------|------|------|-------|-------|
| Program: WALLS-Retain. | | Version 2017.046 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Structure: | info@fides-dvp.de | www.fides-dvp.de | Tel:++49/89/143829-0 | ASB Nr.: | Date: 08.10.2018 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <table> <tr> <th>z [m]</th><th>H, g, k [kN/m2]</th><th>M, g, k [kN/m2]</th><th>V, g, k [kN/m2]</th><th>N, g, k [kN/m2]</th><th>u, g, k [mm]</th></tr> <tr><td>-10.00</td><td>72.52</td><td>21.95</td><td>-120.46</td><td>-277.84</td><td>-0.16</td></tr> <tr><td>-10.16</td><td>72.97</td><td>0.00</td><td>-132.05</td><td>-281.76</td><td>-0.13</td></tr> <tr><td>-10.96</td><td>75.20</td><td>-126.76</td><td>-191.05</td><td>-301.78</td><td>-0.00</td></tr> <tr><td>-11.75</td><td>77.43</td><td>-302.42</td><td>-251.68</td><td>-322.52</td><td>0.03</td></tr> <tr><td>-12.02</td><td>78.19</td><td>-372.53</td><td>-272.49</td><td>-329.68</td><td>0.00</td></tr> <tr><td>-12.02</td><td>78.19</td><td>-372.53</td><td>245.66</td><td>-329.68</td><td>0.00</td></tr> <tr><td>-15.00</td><td>86.55</td><td>-0.00</td><td>-0.00</td><td>-415.33</td><td>-1.50</td></tr> </table> | | | | | | z [m] | H, g, k [kN/m2] | M, g, k [kN/m2] | V, g, k [kN/m2] | N, g, k [kN/m2] | u, g, k [mm] | -10.00 | 72.52 | 21.95 | -120.46 | -277.84 | -0.16 | -10.16 | 72.97 | 0.00 | -132.05 | -281.76 | -0.13 | -10.96 | 75.20 | -126.76 | -191.05 | -301.78 | -0.00 | -11.75 | 77.43 | -302.42 | -251.68 | -322.52 | 0.03 | -12.02 | 78.19 | -372.53 | -272.49 | -329.68 | 0.00 | -12.02 | 78.19 | -372.53 | 245.66 | -329.68 | 0.00 | -15.00 | 86.55 | -0.00 | -0.00 | -415.33 | -1.50 | | | | | | | | | | | | | | | | | | |
| z [m] | H, g, k [kN/m2] | M, g, k [kN/m2] | V, g, k [kN/m2] | N, g, k [kN/m2] | u, g, k [mm] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -10.00 | 72.52 | 21.95 | -120.46 | -277.84 | -0.16 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -10.16 | 72.97 | 0.00 | -132.05 | -281.76 | -0.13 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -10.96 | 75.20 | -126.76 | -191.05 | -301.78 | -0.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -11.75 | 77.43 | -302.42 | -251.68 | -322.52 | 0.03 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -12.02 | 78.19 | -372.53 | -272.49 | -329.68 | 0.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -12.02 | 78.19 | -372.53 | 245.66 | -329.68 | 0.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -15.00 | 86.55 | -0.00 | -0.00 | -415.33 | -1.50 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Internal forces: Variable, characteristically Method EB 82-4 ($Q = [G+Q] - G$). z= -0.500. Fx= -14.747 kN/m Support z= -3.000. Fx= -40.968 kN/m Support z= -5.500. Fx= 3.332 kN/m Support z= -12.018. Fx= -0.149 kN/m Support | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <div> <div> <div>0.00</div> <div>-1.00</div> <div>-2.00</div> <div>-3.00</div> <div>-3.84</div> <div>-4.84</div> <div>-6.00</div> <div>-7.00</div> <div>-8.00</div> <div>-9.00</div> <div>-9.75</div> <div>-10.50</div> <div>-11.25</div> <div>-12.02</div> <div>-12.95</div> <div>-13.80</div> <div>-15.00</div> </div> <div> <div>14.5</div> <div>5.42</div> <div>-29.8</div> <div>-0.149</div> <div>-0.149</div> </div> <div> <div>0.00466</div> <div>-0.00694</div> <div>-0.00381</div> <div>-0.00193</div> <div>-0.0029</div> <div>-0.00264</div> <div>-0.00177</div> <div>-934e-06</div> <div>0.00115</div> <div>0.0022</div> <div>0.00368</div> </div> </div> <div> <div>z</div> <div>M,qk</div> <div>V,qk</div> <div>u,qk</div> </div> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <table> <tr> <th>z [m]</th><th>H, q, k [kN/m2]</th><th>M, q, k [kN/m2]</th><th>V, q, k [kN/m2]</th><th>N, q, k [kN/m2]</th><th>u, q, k [mm]</th></tr> <tr><td>0.00</td><td></td><td>0.00</td><td>-0.00</td><td>0.00</td><td>0.00</td></tr> <tr><td>-0.00</td><td></td><td>0.00</td><td>0.00</td><td>0.00</td><td>0.00</td></tr> <tr><td>-0.47</td><td>0.00</td><td>0.01</td><td>0.03</td><td>0.01</td><td>0.00</td></tr> <tr><td>-0.47</td><td>9.06</td><td>0.01</td><td>0.03</td><td>0.01</td><td>0.00</td></tr> <tr><td>-0.48</td><td>9.06</td><td>0.01</td><td>-0.03</td><td>-0.00</td><td>0.00</td></tr> <tr><td>-0.49</td><td>9.06</td><td>-0.00</td><td>-0.19</td><td>-0.02</td><td>0.00</td></tr> <tr><td>-0.50</td><td>9.06</td><td>-0.00</td><td>14.47</td><td>-3.98</td><td>-0.00</td></tr> <tr><td>-1.50</td><td>9.06</td><td>9.94</td><td>5.42</td><td>-4.94</td><td>-0.01</td></tr> <tr><td>-1.50</td><td>23.48</td><td>9.94</td><td>5.42</td><td>-4.94</td><td>-0.01</td></tr> <tr><td>-1.73</td><td>23.48</td><td>9.83</td><td>0.00</td><td>-5.51</td><td>-0.01</td></tr> </table> | | | | | | z [m] | H, q, k [kN/m2] | M, q, k [kN/m2] | V, q, k [kN/m2] | N, q, k [kN/m2] | u, q, k [mm] | 0.00 | | 0.00 | -0.00 | 0.00 | 0.00 | -0.00 | | 0.00 | 0.00 | 0.00 | 0.00 | -0.47 | 0.00 | 0.01 | 0.03 | 0.01 | 0.00 | -0.47 | 9.06 | 0.01 | 0.03 | 0.01 | 0.00 | -0.48 | 9.06 | 0.01 | -0.03 | -0.00 | 0.00 | -0.49 | 9.06 | -0.00 | -0.19 | -0.02 | 0.00 | -0.50 | 9.06 | -0.00 | 14.47 | -3.98 | -0.00 | -1.50 | 9.06 | 9.94 | 5.42 | -4.94 | -0.01 | -1.50 | 23.48 | 9.94 | 5.42 | -4.94 | -0.01 | -1.73 | 23.48 | 9.83 | 0.00 | -5.51 | -0.01 |
| z [m] | H, q, k [kN/m2] | M, q, k [kN/m2] | V, q, k [kN/m2] | N, q, k [kN/m2] | u, q, k [mm] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.00 | | 0.00 | -0.00 | 0.00 | 0.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -0.00 | | 0.00 | 0.00 | 0.00 | 0.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -0.47 | 0.00 | 0.01 | 0.03 | 0.01 | 0.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -0.47 | 9.06 | 0.01 | 0.03 | 0.01 | 0.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -0.48 | 9.06 | 0.01 | -0.03 | -0.00 | 0.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -0.49 | 9.06 | -0.00 | -0.19 | -0.02 | 0.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -0.50 | 9.06 | -0.00 | 14.47 | -3.98 | -0.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -1.50 | 9.06 | 9.94 | 5.42 | -4.94 | -0.01 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -1.50 | 23.48 | 9.94 | 5.42 | -4.94 | -0.01 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -1.73 | 23.48 | 9.83 | 0.00 | -5.51 | -0.01 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Part: Block: Please specify project informations. Record: | | | | | Archive No.: Page: 77 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

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|---|--------------------|--------------------|--------------------|--------------------|------------------|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | | | | | Job No.: |
| Program: WALLS-Retain. Version 2017.046 | | | | | |
| Structure: info@fides-dvp.de www.fides-dvp.de Tel:++49/89/143829-0 ASB Nr.: | | | | | Date: 08.10.2018 |
| z [m] | H, q, k [kN/m2] | M, q, k [kN/m2] | V, q, k [kN/m2] | N, q, k [kN/m2] | u, q, k [mm] |
| -2.65 | 23.48 | 0.00 | -21.60 | -7.80 | -0.00 |
| -3.00 | 23.48 | -8.34 | -29.80 | -8.66 | -0.00 |
| -3.00 | 23.48 | -8.34 | 11.17 | -19.64 | -0.00 |
| -3.00 | 23.48 | -8.34 | 11.17 | -19.64 | 0.00 |
| -3.34 | 23.48 | -5.45 | 3.45 | -20.77 | 0.00 |
| -3.34 | 0.00 | -5.45 | 3.45 | -20.77 | 0.00 |
| -3.50 | 0.00 | -5.94 | 2.91 | -20.75 | 0.00 |
| -3.84 | 0.00 | -3.75 | 3.44 | -21.27 | 0.00 |
| -4.00 | 0.00 | -4.50 | 2.90 | -21.21 | 0.00 |
| -4.34 | 0.00 | -2.03 | 3.44 | -21.64 | 0.00 |
| -4.50 | 0.00 | -3.04 | 2.90 | -21.54 | 0.00 |
| -4.84 | 0.00 | -0.29 | 3.45 | -21.89 | 0.00 |
| -4.95 | 0.00 | -1.18 | 3.07 | -21.79 | 0.00 |
| -5.00 | 0.00 | -1.59 | 2.90 | -21.74 | -0.00 |
| -5.11 | 0.00 | -0.63 | 3.07 | -21.82 | 0.00 |
| -5.18 | 0.00 | 0.00 | 3.19 | -21.87 | 0.00 |
| -5.34 | 0.00 | 1.40 | 3.44 | -21.99 | 0.00 |
| -5.50 | 0.00 | 0.97 | 3.18 | -21.91 | 0.00 |
| -5.50 | 0.00 | 0.97 | -0.15 | -21.02 | 0.00 |
| -7.00 | 0.00 | 0.75 | -0.15 | -21.02 | -0.00 |
| -7.50 | 0.00 | 0.67 | -0.15 | -21.02 | -0.00 |
| -8.50 | 0.00 | 0.52 | -0.15 | -21.02 | -0.00 |
| -9.50 | 0.00 | 0.37 | -0.15 | -21.02 | -0.00 |
| -9.75 | 0.00 | 0.34 | -0.15 | -21.02 | -0.00 |
| -10.50 | 0.00 | 0.23 | -0.15 | -21.02 | -0.00 |
| -12.02 | 0.00 | 0.00 | -0.15 | -21.02 | -0.00 |
| -12.02 | 0.00 | -0.00 | -0.15 | -21.02 | 0.00 |
| -12.02 | 0.00 | -0.00 | 0.00 | -21.02 | 0.00 |
| -12.45 | 0.00 | -0.00 | 0.00 | -21.02 | 0.00 |
| -13.35 | 0.00 | -0.00 | 0.00 | -21.02 | 0.00 |
| -13.65 | 0.00 | -0.00 | 0.00 | -21.02 | 0.00 |
| -13.76 | 0.00 | -0.00 | 0.00 | -21.02 | 0.00 |
| -13.80 | 0.00 | 0.00 | 0.00 | -21.02 | 0.00 |
| -14.90 | 0.00 | -0.00 | -0.00 | -21.02 | 0.00 |
| -14.99 | 0.00 | 0.00 | -0.00 | -21.02 | 0.00 |
| -15.00 | 0.00 | 0.00 | -0.00 | -21.02 | 0.00 |

| | | |
|----------|--------------------------------------|--------------|
| Part: | | Archive No.: |
| Block: | Please specify project informations. | |
| Record: | | |
| Page: 78 | | |

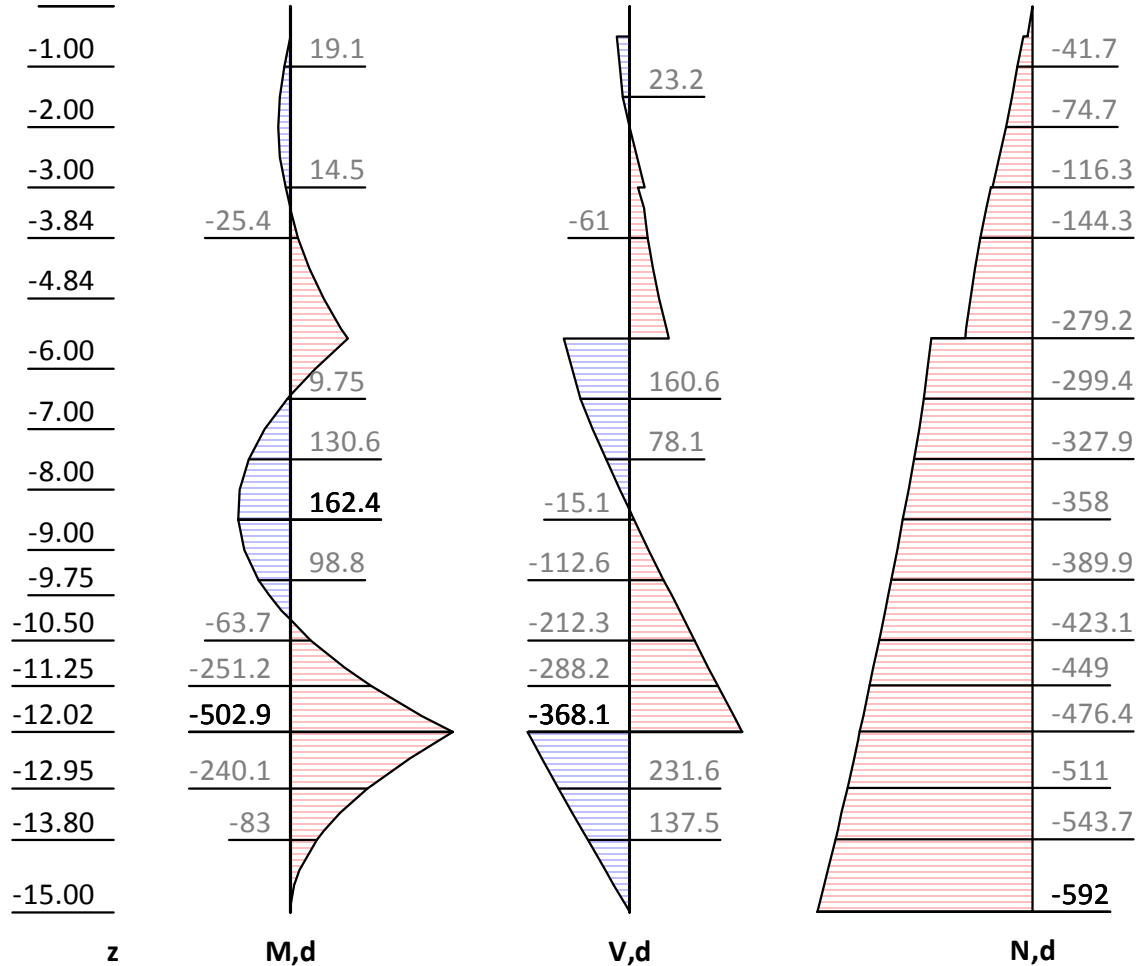
Internal forces: Design

z= -0.500. Fx= -44.196 kN/m Support

z= -3.000. Fx= -22.258 kN/m Support

z= -5.500. Fx=-344.706 kN/m Support

z= -12.018. Fx=-699.724 kN/m Support

0.00

| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | | | | | Job No.: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|----------------|----------------|----------------|----------------|------------------|----------|----------------|----------------|----------------|----------------|-----------------|------|------|------|------|-------|------|-------|------|-------|-------|--------|------|-------|-------|-------|-------|--------|------|-------|-------|-------|-------|--------|-------|-------|-------|------|-------|--------|-------|-------|-------|-------|-------|--------|-------|-------|-------|-------|-------|--------|-------|-------|-------|-------|------|--------|-------|-------|-------|-------|------|--------|-------|-------|-------|-------|--------|---------|-------|-------|-------|-------|--------|---------|-------|-------|-------|-------|--------|---------|------|-------|-------|------|--------|---------|------|-------|-------|------|--------|---------|------|-------|-------|-------|--------|---------|------|-------|-------|--------|--------|---------|------|-------|-------|---------|---------|---------|-------|-------|-------|---------|--------|---------|-------|-------|-------|-------|--------|---------|-------|-------|-------|------|--------|---------|-------|-------|-------|------|--------|---------|-------|-------|-------|--------|------|---------|-------|-------|-------|--------|--------|---------|-------|--------|--------|-------|---------|---------|-------|--------|-------|-------|---------|---------|-------|--------|-------|------|---------|---------|-------|--------|--------|---------|---------|---------|-------|
| Program: WALLS-Retain. Version 2017.046 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Structure: info@fides-dvp.de www.fides-dvp.de Tel:++49/89/143829-0 ASB Nr.: | | | | | Date: 08.10.2018 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <div> <div> <div>0.00</div> <div>-1.00</div> <div>-2.00</div> <div>-3.00</div> <div>-3.84</div> <div>-4.84</div> <div>-6.00</div> <div>-7.00</div> <div>-8.00</div> <div>-9.00</div> <div>-9.75</div> <div>-10.50</div> <div>-11.25</div> <div>-12.02</div> <div>-12.95</div> <div>-13.80</div> <div>-15.00</div> </div> <div> <div>16.5</div> <div>44.6</div> <div>52.5</div> <div>73.6</div> <div>91.2</div> <div>101.5</div> <div>106</div> <div>110.6</div> <div>116.8</div> </div> <div> <div>0.0124</div> <div>-0.0118</div> <div>0.0401</div> <div>0.0142</div> <div>-0.15</div> <div>-0.297</div> <div>-0.243</div> <div>-0.0707</div> <div>-0.317</div> <div>-0.772</div> <div>-1.5</div> </div> </div> <div> <div>z</div> <div>H,d</div> <div>u,g+q,k</div> </div> <table> <tr> <th>z [m]</th><th>H,d [kN/m2]</th><th>M,d [kN/m2]</th><th>V,d [kN/m2]</th><th>N,d [kN/m2]</th><th>u,g+q,k [mm]</th></tr> <tr><td>0.00</td><td>0.00</td><td>0.00</td><td>0.00</td><td>-0.00</td><td>0.01</td></tr> <tr><td>-0.47</td><td>2.94</td><td>-0.11</td><td>-0.69</td><td>-13.48</td><td>0.00</td></tr> <tr><td>-0.47</td><td>16.52</td><td>-0.11</td><td>-0.69</td><td>-13.48</td><td>0.00</td></tr> <tr><td>-0.50</td><td>16.71</td><td>-0.14</td><td>-1.19</td><td>-14.40</td><td>-0.00</td></tr> <tr><td>-0.50</td><td>16.73</td><td>0.00</td><td>42.94</td><td>-26.35</td><td>-0.00</td></tr> <tr><td>-1.50</td><td>22.97</td><td>33.47</td><td>23.17</td><td>-57.44</td><td>-0.02</td></tr> <tr><td>-1.50</td><td>44.60</td><td>33.47</td><td>23.17</td><td>-57.44</td><td>-0.02</td></tr> <tr><td>-2.00</td><td>47.73</td><td>39.32</td><td>0.08</td><td>-74.72</td><td>-0.02</td></tr> <tr><td>-2.00</td><td>47.74</td><td>39.30</td><td>0.00</td><td>-74.78</td><td>-0.02</td></tr> <tr><td>-3.00</td><td>53.98</td><td>14.53</td><td>-50.77</td><td>-110.34</td><td>-0.00</td></tr> <tr><td>-3.00</td><td>53.98</td><td>14.53</td><td>-28.51</td><td>-116.30</td><td>-0.00</td></tr> <tr><td>-3.00</td><td>53.98</td><td>14.53</td><td>-28.51</td><td>-116.30</td><td>0.00</td></tr> <tr><td>-3.34</td><td>58.57</td><td>1.63</td><td>-47.65</td><td>-128.65</td><td>0.01</td></tr> <tr><td>-3.34</td><td>23.35</td><td>1.63</td><td>-47.65</td><td>-128.65</td><td>0.01</td></tr> <tr><td>-3.37</td><td>23.76</td><td>-0.00</td><td>-48.45</td><td>-129.59</td><td>0.01</td></tr> <tr><td>-4.34</td><td>36.85</td><td>-59.99</td><td>-77.76</td><td>-158.62</td><td>0.04</td></tr> <tr><td>-5.50</td><td>52.51</td><td>-178.44</td><td>-129.58</td><td>-186.82</td><td>-0.00</td></tr> <tr><td>-5.50</td><td>52.51</td><td>-178.44</td><td>215.13</td><td>-279.18</td><td>-0.00</td></tr> <tr><td>-6.44</td><td>56.40</td><td>-0.00</td><td>163.66</td><td>-298.28</td><td>-0.14</td></tr> <tr><td>-6.50</td><td>56.63</td><td>9.75</td><td>160.56</td><td>-299.38</td><td>-0.15</td></tr> <tr><td>-6.50</td><td>73.59</td><td>9.75</td><td>160.56</td><td>-299.38</td><td>-0.15</td></tr> <tr><td>-8.34</td><td>94.70</td><td>160.96</td><td>0.00</td><td>-353.12</td><td>-0.34</td></tr> <tr><td>-8.50</td><td>95.36</td><td>162.35</td><td>-15.15</td><td>-358.03</td><td>-0.34</td></tr> <tr><td>-10.00</td><td>101.57</td><td>30.08</td><td>-162.85</td><td>-406.40</td><td>-0.16</td></tr> <tr><td>-10.00</td><td>97.91</td><td>30.08</td><td>-162.85</td><td>-406.40</td><td>-0.16</td></tr> <tr><td>-10.16</td><td>98.51</td><td>0.00</td><td>-178.70</td><td>-411.77</td><td>-0.13</td></tr> <tr><td>-10.97</td><td>101.57</td><td>-174.31</td><td>-259.43</td><td>-439.16</td><td>-0.00</td></tr> </table> | | | | | | z [m] | H,d [kN/m2] | M,d [kN/m2] | V,d [kN/m2] | N,d [kN/m2] | u,g+q,k [mm] | 0.00 | 0.00 | 0.00 | 0.00 | -0.00 | 0.01 | -0.47 | 2.94 | -0.11 | -0.69 | -13.48 | 0.00 | -0.47 | 16.52 | -0.11 | -0.69 | -13.48 | 0.00 | -0.50 | 16.71 | -0.14 | -1.19 | -14.40 | -0.00 | -0.50 | 16.73 | 0.00 | 42.94 | -26.35 | -0.00 | -1.50 | 22.97 | 33.47 | 23.17 | -57.44 | -0.02 | -1.50 | 44.60 | 33.47 | 23.17 | -57.44 | -0.02 | -2.00 | 47.73 | 39.32 | 0.08 | -74.72 | -0.02 | -2.00 | 47.74 | 39.30 | 0.00 | -74.78 | -0.02 | -3.00 | 53.98 | 14.53 | -50.77 | -110.34 | -0.00 | -3.00 | 53.98 | 14.53 | -28.51 | -116.30 | -0.00 | -3.00 | 53.98 | 14.53 | -28.51 | -116.30 | 0.00 | -3.34 | 58.57 | 1.63 | -47.65 | -128.65 | 0.01 | -3.34 | 23.35 | 1.63 | -47.65 | -128.65 | 0.01 | -3.37 | 23.76 | -0.00 | -48.45 | -129.59 | 0.01 | -4.34 | 36.85 | -59.99 | -77.76 | -158.62 | 0.04 | -5.50 | 52.51 | -178.44 | -129.58 | -186.82 | -0.00 | -5.50 | 52.51 | -178.44 | 215.13 | -279.18 | -0.00 | -6.44 | 56.40 | -0.00 | 163.66 | -298.28 | -0.14 | -6.50 | 56.63 | 9.75 | 160.56 | -299.38 | -0.15 | -6.50 | 73.59 | 9.75 | 160.56 | -299.38 | -0.15 | -8.34 | 94.70 | 160.96 | 0.00 | -353.12 | -0.34 | -8.50 | 95.36 | 162.35 | -15.15 | -358.03 | -0.34 | -10.00 | 101.57 | 30.08 | -162.85 | -406.40 | -0.16 | -10.00 | 97.91 | 30.08 | -162.85 | -406.40 | -0.16 | -10.16 | 98.51 | 0.00 | -178.70 | -411.77 | -0.13 | -10.97 | 101.57 | -174.31 | -259.43 | -439.16 | -0.00 |
| z [m] | H,d [kN/m2] | M,d [kN/m2] | V,d [kN/m2] | N,d [kN/m2] | u,g+q,k [mm] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.00 | 0.00 | 0.00 | 0.00 | -0.00 | 0.01 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -0.47 | 2.94 | -0.11 | -0.69 | -13.48 | 0.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -0.47 | 16.52 | -0.11 | -0.69 | -13.48 | 0.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -0.50 | 16.71 | -0.14 | -1.19 | -14.40 | -0.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -0.50 | 16.73 | 0.00 | 42.94 | -26.35 | -0.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -1.50 | 22.97 | 33.47 | 23.17 | -57.44 | -0.02 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -1.50 | 44.60 | 33.47 | 23.17 | -57.44 | -0.02 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -2.00 | 47.73 | 39.32 | 0.08 | -74.72 | -0.02 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -2.00 | 47.74 | 39.30 | 0.00 | -74.78 | -0.02 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -3.00 | 53.98 | 14.53 | -50.77 | -110.34 | -0.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -3.00 | 53.98 | 14.53 | -28.51 | -116.30 | -0.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -3.00 | 53.98 | 14.53 | -28.51 | -116.30 | 0.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -3.34 | 58.57 | 1.63 | -47.65 | -128.65 | 0.01 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -3.34 | 23.35 | 1.63 | -47.65 | -128.65 | 0.01 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -3.37 | 23.76 | -0.00 | -48.45 | -129.59 | 0.01 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -4.34 | 36.85 | -59.99 | -77.76 | -158.62 | 0.04 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -5.50 | 52.51 | -178.44 | -129.58 | -186.82 | -0.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -5.50 | 52.51 | -178.44 | 215.13 | -279.18 | -0.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -6.44 | 56.40 | -0.00 | 163.66 | -298.28 | -0.14 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -6.50 | 56.63 | 9.75 | 160.56 | -299.38 | -0.15 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -6.50 | 73.59 | 9.75 | 160.56 | -299.38 | -0.15 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -8.34 | 94.70 | 160.96 | 0.00 | -353.12 | -0.34 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -8.50 | 95.36 | 162.35 | -15.15 | -358.03 | -0.34 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -10.00 | 101.57 | 30.08 | -162.85 | -406.40 | -0.16 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -10.00 | 97.91 | 30.08 | -162.85 | -406.40 | -0.16 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -10.16 | 98.51 | 0.00 | -178.70 | -411.77 | -0.13 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -10.97 | 101.57 | -174.31 | -259.43 | -439.16 | -0.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Part: Block: Please specify project informations. Record: | | | | | Archive No.: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Page: 80 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

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|--|------------------|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | Job No.: |
| Program: WALLS-Retain. Version 2017.046 | |
| Structure: info@fides-dvp.de www.fides-dvp.de Tel:++49/89/143829-0 ASB Nr.: | Date: 08.10.2018 |

| z [m] | H,d [kN/m2] | M,d [kN/m2] | V,d [kN/m2] | N,d [kN/m2] | u,g+q,k [mm] |
|----------|----------------|----------------|----------------|----------------|-----------------|
| -11.75 | 104.53 | -408.21 | -339.99 | -466.72 | 0.03 |
| -12.02 | 105.56 | -502.92 | -368.09 | -476.38 | 0.00 |
| -12.02 | 105.56 | -502.92 | 331.64 | -476.38 | 0.00 |
| -15.00 | 116.84 | -0.00 | -0.00 | -592.02 | -1.50 |

Anchor forces with safety level of DS-P

| z[m] | A,d[kN] | Fx,d[kN/m] |
|-------|---------|------------|
| -0.50 | 82.4 | -44.2 |
| -3.00 | 20.7 | -22.3 |
| -5.50 | 321.2 | -344.7 |

Checks of earth statics

Check or earth support

Check: Mobilizable earth resistance is sufficient for earth support force.
 z: -12.02 m
 $R_d = E_{ph,k}/\gamma_{Re} = 5089.29 / 1.400 = 3635.21 \text{ [kN/m]}$
 $E_d(U_{h,d})/R_d = 699.72 / 3635.21 = 0.192 \text{ [-]}. \text{ Passes requirement}$

Sum of H and V forces, (G)

Forces up to depth z:-15.00

| Pos. | H | V |
|--|---------|-----------------------|
| ----- | | |
| H/V pressure G+P+W,k | 764.51 | 124.61 |
| Wall weight | | 233.11 |
| H/V pressure passive | | -0.00 |
| Support z: -0.50 | -16.35 | 4.38 |
| Support z: -3.00 | 29.03 | -7.78 |
| Support z: -5.50 | -259.04 | 69.41 |
| B _{h,g,k} z=-12.02 | -518.15 | |
| B _{v,g,k} = B _{h,k} * tan(δ,p=-23.33°) | | -223.51 |
| ----- | | |
| Σ | 0.00 | 200.23 (downwards) |

Average anchor inclination α,A = 15.00° >= 15°.

Verification of vertical forces due to EAB R 9 not required (R 9-5).

Check EAB R 9-1

Vertical component of earth resistance is less than the downwards pointing vertical forces.

$V_k \geq B_{vk}: 423.73 \geq 223.51 \text{ Passes requirement}$

Sum of H and V forces, (G+Q)

Forces up to depth z:-15.00

| Pos. | H | V |
|--|---------|-----------------------|
| ----- | | |
| H/V pressure G+P+W,k | 817.04 | 130.17 |
| Wall weight | | 233.11 |
| H/V pressure passive | | 0.00 |
| Support z: -0.50 | -31.10 | 8.33 |
| Support z: -3.00 | -11.94 | 3.20 |
| Support z: -5.50 | -255.71 | 68.52 |
| B _{h,g,k} z=-12.02 | -518.15 | |
| B _{v,g,k} = B _{h,k} * tan(δ,p=-23.33°) | | -223.51 |
| B _{h,q,k} z=-12.02 | -0.15 | |
| B _{v,q,k} = B _{h,k} * tan(δ,p=-23.33°) | | -0.06 |
| ----- | | |
| Σ | 0.00 | 219.75 (downwards) |

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| Part: Block: Please specify project informations. Record: | Page: 81 Archive No.: |
|---|--------------------------|

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|--|------------------|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | Job No.: |
| Program: WALLS-Retain. Version 2017.046 | |
| Structure: info@fides-dvp.de www.fides-dvp.de Tel:++49/89/143829-0 ASB Nr.: | Date: 08.10.2018 |

Average anchor inclination $\alpha_A = 15.00^\circ \geq 15^\circ$.
 Verification of vertical forces due to EAB R 9 not required (R 9-5).
Check EAB R 9-1
 Vertical component of earth resistance is less than the downwards pointing vertical forces.
 $V_k \geq B_{vk}: 443.33 \geq 223.57$ Passes requirement

Anchor verification

Anchor - Stability of lower failure plane

Περίπτωση φόρτισης: όλα τα φορτία BS-P
 Αυτόμ. υπολογ. μήκους αγκυρίων:
 All anchors are extended (if necessary)
 Favourable variable loads in main failure body are not being considered.
 Bottom of lower failure plane: $z = -15.00$ m

Iteration of failure mechanisms:

lA: Length of anchor from head to center of grout body.
 W,k: Res. force from dead weight, loads, cohesion, ...
 Q,k: Force in lower failure plane.
 Ea1,k.....: Earth pressure onto vertical separation plane.
 Ea2,k.....: Earth pressure between wall and main failure body.
 Ra_cal,d: Dimensioning force of the resistance from the equilibrium of forces.
 Ra_cal,d corresponds to the max. possible anchor force of the force polygon.
 Sum(A,d): Acting anchor forces along the grout body fractions within the failure body. Sum(A,d) is gained from the anchor pull forces of the wall analysis.

| z [m] | ϑ_1 [°] | ϑ_2 [°] | lA [m] | W,k [kN/m] | Q,k [kN/m] | Ea1,k [kN/m] | Ea2,k [kN/m] | Ra_cal,d [kN/m] | Sum(A,d) [kN/m] | Ed/Rd [-] |
|----------|----------------------|----------------------|-----------|---------------|---------------|-----------------|-----------------|--------------------|--------------------|--------------|
| -0.50 | 38.3 | 57.5 | 14.19 | 1872.3 | 1664.0 | 4.4 | 400.0 | 229.4 | 229.2 | 1.00 |
| -3.00 | 33.9 | 61.0 | 13.23 | 1869.2 | 1628.7 | 41.5 | 400.0 | 302.1 | 301.3 | 1.00 |
| -5.50 | 26.7 | 61.3 | 12.76 | 1995.6 | 1728.3 | 106.3 | 400.0 | 421.9 | 421.4 | 1.00 |

Decisive failure body:

Γεωμετρία:

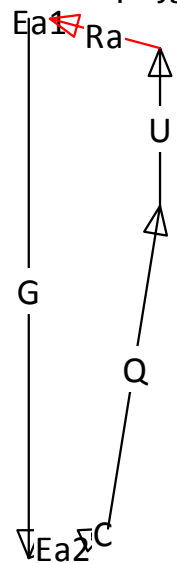
| | |
|--|--------------------------------|
| Foot point of lower failure plane | $x/z = 0.01/-15.00$ m |
| Intersection lower/upper slid. plane | $x/z = 12.32/-8.80$ m |
| Intersection upper slid. plane/surface | $x/z = 17.14/ 0.00$ m |
| Intersection separation plane/surface | $x/z = 12.32/ 0.00$ m |
| Inclination lower failure plane | $\vartheta_1 = 26.72^\circ$ |
| Inclination upper failure plane | $\vartheta_2 = 61.30^\circ$ |
| Inclination separation plane | $\vartheta_{12} = 90.00^\circ$ |

Loads / forces (char.)

| | | Fx [kN/m] | Fz [kN/m] | F [kN/m] | |
|------------------------------------|-----------|--------------|--------------|-------------|----------------------|
| Weight of main failure body | G,k: | 0.0 | -3121.6 | 3121.6 | |
| Cohesion of lower failure plane | C,k: | 61.6 | 31.0 | 68.9 | |
| Pore water pressure on main body | U,k: | -0.5 | 1096.0 | 1096.0 | |
| Earth pres. on separation plane | Ea1,k: | -106.3 | -0.0 | 106.3 | $\delta = 0.0^\circ$ |
| Earth pr. between wall<->main body | Ea2,k: | 378.3 | 129.9 | 400.0 | |
| Force in lower failure plane | Q,k: | 237.6 | 1711.9 | 1728.3 | |
| Sum = possible anchor forces: | Ra_cal,k: | 570.6 | -152.9 | 590.7 | |

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| Part: Block: Please specify project informations. Record: | Archive No.: |
|--|--------------|

Page: 82

Force polygon

Acting anchor forces $E_d: \sum(A,d) = 421.4 \text{ kN/m}$
 Possible anchor forces $R_d: R_{a_cal,d} = 590.7/1.400 = 421.9 \text{ kN/m}$
 Verif. of lower failure plane $E_d/R_d = 1.00 < 1.0$: Έλεγχος εκπληρώθηκε.

Check of steel tension

l_{tot} ...[m]: Total length of anchor incl. excess length at head
 A_s [mm²]: X-section area of steel member
 $R_{i,d}$...[kN]: Ultimate strength of tension member ($\gamma, M=1.15$)
 A,d [kN]: Dimensioning force of the anchor from wall analysis

| z[m] | Anchor type | l_{tot} | A_s | $R_{i,d}$ | A,d |
|-------|--------------------------|-----------|-------|-----------|-------|
| -0.50 | Strand;3x0.60";1570/1770 | 19.52 | 420 | 573.4 | 82.4 |
| -3.00 | Strand;3x0.60";1570/1770 | 18.14 | 420 | 573.4 | 20.7 |
| -5.50 | Strand;4x0.60";1570/1770 | 16.76 | 560 | 764.5 | 321.2 |

Check of steel tension: Passes requirement

Check of anchor's soil friction

$l_{V,k}$: Length of grout body
 $D_{mV,k}$: Diameter of grout body
 $\tau_{Gr,k}$: Average applied skin friction along the grout body (from soil parameters)
 $R_{a,k}$: Charact. pullout resistance of the anchor
 γ_A : Partial safety factor of anchor pullout
 $R_{a,d}$: $R_{a,k} / \gamma_A$
 A,d : Dimensioning force of the anchor from wall analysis

| z | $l_{V,k}$ | $D_{mV,k}$ | $\tau_{Gr,k}$ | $R_{a,k}$ | γ_A | $R_{a,d}$ | A,d | $A,d/R_{a,d}$ |
|-------|-----------|------------|----------------------|-----------|------------|-----------|-------|---------------|
| [m] | [m] | [mm] | [kN/m ²] | [kN] | [-] | [kN] | [kN] | [-] |
| -0.50 | 8.00 | 318 | 110 | 879.1 | 1.100 | 799.2 | 82.4 | 0.1 |
| -3.00 | 8.00 | 318 | 110 | 879.1 | 1.100 | 799.2 | 20.7 | 0.0 |
| -5.50 | 8.00 | 318 | 110 | 879.1 | 1.100 | 799.2 | 321.2 | 0.4 |

Check of anchor's soil friction: Passes requirement

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| Program: | WALLS-Retain. Version 2017.046 | |
| Structure: | info@fides-dvp.de www.fides-dvp.de Tel:++49/89/143829-0 ASB Nr.: | Date: 08.10.2018 |

Υπολογ. κύκλου ολίσθησης

LC: όλα τα φορτία Type: BS-T (combination: [GEO] A2 M2 R3, BS-T)
 Vertical variable loads only act if they are outside of $R \cdot \sin(\phi)$.
 The automatic slip circle optimization only considers circles that intersect the surface with an area of at least 0.25 m².
 The slip circle calculation only accepts circles including the wall.
 The slipcircle calculation only allows circular failure planes (no vertical tangents will occur).

Γεωμετ. κύκλου (μήκη και συντεταγμ. σε (m))
 Κέντρο = (-0.10, 6.68), Ακτίνα = 21.69
 Αρχ.σημ. = (-17.32, -6.50), Τελ.σημ. = (20.54, 0.00)

Γεωμετρία λωρίδων:

| No | x | Width | dxM | Weight | Load | Water- | u*b | ϕ | c | θ |
|----|--------|-------|--------|--------|------------------|-----------------|--------|--------|----------------------|----------|
| | [m] | b | [m] | [kN/m] | z-κατ. [kN/m] | φορτ. [kN/m] | [kN/m] | [°] | [kN/m ²] | [°] |
| 1 | -16.24 | 2.17 | -16.14 | 63.8 | 0.0 | 0.0 | -15.5 | 27.45 | 3.57 | -31.27* |
| 2 | -14.07 | 2.17 | -13.97 | 166.4 | 0.0 | 0.0 | -51.0 | 27.45 | 3.57 | -31.27* |
| 3 | -11.90 | 2.17 | -11.80 | 244.9 | 0.0 | 0.0 | -86.1 | 29.26 | 3.57 | -30.37* |
| 4 | -9.73 | 2.17 | -9.64 | 305.2 | 0.0 | 0.0 | -113.1 | 29.26 | 3.57 | -26.37 |
| 5 | -7.56 | 2.17 | -7.47 | 350.7 | 0.0 | 0.0 | -133.4 | 29.26 | 3.57 | -20.13 |
| 6 | -5.39 | 2.17 | -5.30 | 383.3 | 0.0 | 0.0 | -148.0 | 29.26 | 3.57 | -14.13 |
| 7 | -3.23 | 2.17 | -3.13 | 404.3 | 0.0 | 0.0 | -157.4 | 29.26 | 3.57 | -8.29 |
| 8 | -1.06 | 2.17 | -0.96 | 418.1 | 0.0 | 0.0 | -210.7 | 29.26 | 3.57 | -2.53 |
| 9 | 1.11 | 2.17 | 1.21 | 700.0 | 0.0 | 0.0 | -259.2 | 29.26 | 3.57 | 3.20 |
| 10 | 3.28 | 2.17 | 3.38 | 688.7 | 0.0 | 0.0 | -254.2 | 29.26 | 3.57 | 8.96 |
| 11 | 5.45 | 2.17 | 5.55 | 666.5 | 0.0 | 0.0 | -244.2 | 29.26 | 3.57 | 14.82 |
| 12 | 7.62 | 2.17 | 7.72 | 632.4 | 0.0 | 0.0 | -229.0 | 29.26 | 3.57 | 20.84 |
| 13 | 9.79 | 2.17 | 9.89 | 585.3 | 0.0 | 0.0 | -208.0 | 29.26 | 3.57 | 27.12 |
| 14 | 11.96 | 2.17 | 12.06 | 523.1 | 0.0 | 0.0 | -180.1 | 29.26 | 3.57 | 33.77 |
| 15 | 14.13 | 2.17 | 14.23 | 442.2 | 0.0 | 0.0 | -143.8 | 27.45 | 3.57 | 40.98 |
| 16 | 16.30 | 2.17 | 16.39 | 336.2 | 0.0 | 0.0 | -96.0 | 27.45 | 3.57 | 49.10 |
| 17 | 18.96 | 3.16 | 19.06 | 222.8 | 0.0 | 0.0 | -50.0 | 0.08 | 35.71 | 61.47 |

*** Σημείωση: Στις λωρίδες σημειωμένες με '*' περιορίστηκε το theta στο 45°-Phi/2.

Συνεισφ. κατακόρυφων φορτίων:

| No | Weight | $G \cdot \sin(\theta)$ | $(G - u \cdot b) \cdot \tan(\phi) + c \cdot b$ | $\mu \cdot \sin(\theta) \cdot \tan(\phi) + \cos(\theta)$ | T |
|---------|--------|------------------------|--|--|---------|
| | [kN/m] | [kN/m] | [kN/m] | [-] | [kN/m] |
| 1 | 63.84 | -47.51 | 32.84 | 0.756061 | 43.44 |
| 2 | 166.42 | -107.21 | 67.74 | 0.756061 | 89.59 |
| 3 | 244.86 | -133.25 | 96.66 | 0.759175 | 127.32 |
| 4 | 305.18 | -135.56 | 115.33 | 0.804930 | 143.28 |
| 5 | 350.66 | -120.69 | 129.42 | 0.868385 | 149.04 |
| 6 | 383.30 | -93.60 | 139.54 | 0.919699 | 151.73 |
| 7 | 404.29 | -58.29 | 146.05 | 0.960009 | 152.14 |
| 8 | 418.05 | -18.47 | 123.92 | 0.989970 | 125.17 |
| 9 | 700.03 | 39.07 | 254.69 | 1.009875 | 252.19 |
| 10 | 688.75 | 107.31 | 251.19 | 1.019708 | 246.33 |
| 11 | 666.45 | 170.48 | 244.27 | 1.019136 | 239.68 |
| 12 | 632.39 | 225.01 | 233.71 | 1.007454 | 231.98 |
| 13 | 585.30 | 266.79 | 219.12 | 0.983461 | 222.81 |
| 14 | 523.09 | 290.74 | 199.87 | 0.945180 | 211.46 |
| 15 | 442.22 | 290.01 | 162.77 | 0.879536 | 185.06 |
| 16 | 336.21 | 254.11 | 132.56 | 0.798402 | 166.03 |
| 17 | 222.80 | 195.75 | 113.02 | 0.478014 | 236.43 |
| ----- | | | | | ----- |
| 1124.70 | | | | | 2973.68 |

Συνεισφ. αγκυρίων: Αθρ. ροπών ανατροπής : -727.8 kN*m/m
 " " resisting : 217.8 kN*m/m

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| Part: | | Archive No.: |
| Block: | Please specify project informations. | Page: 84 |
| Record: | | |

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|---|--------------------------------------|------------------|-------------------------------|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | | | Job No.: |
| Program: WALLS-Retain. Version 2017.046 | | | |
| Structure: | info@fides-dvp.de | www.fides-dvp.de | Tel:++49/89/143829-0 ASB Nr.: |
| | | | Date: 08.10.2018 |
| <div>Δράση Ed = (1124.7*21.69-727.8)</div> <div>Αντίσταση Rd = (2973.7*21.69+217.8)</div> <div>SLIP-CIRCLE $\mu = Ed/Rd = 0.37 < 1.0$: Έλεγχος εκπληρώθηκε.</div> <div></div> | | | |
| Part: | | | Archive No.: |
| Block: | Please specify project informations. | | Page: 85 |
| Record: | | | |

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| Author: | FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | | | Job No.: |
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Φάση εκσκαφής 7 "[7] Situation 5"

LC: όλα τα φορτία Type: BS-T

Εδαφικό σύστημα με 5 Στρώσεις

| Name | Τεχνητές επιχωματώσεις | Αμμόδης ΑΡΓΙΛΟΣ | Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ | |
|-------------|------------------------|-----------------|--------------------------|-----------|
| γ | [kN/m3] | 18 | 20 | 22.5 |
| γ,R | [kN/m3] | 18 | 20 | 22.5 |
| γ' | [kN/m3] | 8 | 10 | 12.5 |
| γ,p | [kN/m3] | 18 | 20 | 22.5 |
| γ,R,passive | [kN/m3] | 18 | 20 | 22.5 |
| γ,pw | [kN/m3] | 8 | 10 | 12.5 |
| φ | [°] | 25 | 0.1 | 33 |
| c | [kN/m2] | 2 | 50 | 5 |
| c,u | [kN/m2] | 10 | 50 | 5 |
| c παθητικό | [kN/m2] | 2 | 50 | 5 |
| δ,a | [°] | 16.66667 | 0.06666667 | 22 |
| δ,p | [°] | -16.66667 | -0.06666667 | -22 |
| δ,c | [°] | 8.333333 | 0.03333333 | 11 |
| k,agh | [-] | 0.3456501 | 0.9955057 | 0.2452023 |
| K,ach | [-] | 1.043051 | 1.994195 | 0.8549058 |
| K,0h | [-] | 0.5773817 | 0.9982547 | 0.455361 |
| K,pgh | [-] | 3.908103 | 1.004519 | 7.495617 |
| K,pch | [-] | 5.180327 | 2.00583 | 8.599509 |
| τ,gr | [kN/m2] | 110 | 110 | 110 |
| Ψ,A,max | [°] | 90 | 90 | 90 |
| k | [cm/s] | 10e-06 | 1e-06 | 100e-06 |

| Name | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ |
|-------------|------------------------|------------------------|
| γ | [kN/m3] 22.5 | 22.5 |
| γ,R | [kN/m3] 22.5 | 22.5 |
| γ' | [kN/m3] 12.5 | 12.5 |
| γ,p | [kN/m3] 22.5 | 22.5 |
| γ,R,passive | [kN/m3] 22.5 | 22.5 |
| γ,pw | [kN/m3] 12.5 | 12.5 |
| φ | [°] 35 | 35 |
| c | [kN/m2] 5 | 5 |
| c,u | [kN/m2] 5 | 5 |
| c παθητικό | [kN/m2] 5 | 5 |
| δ,a | [°] 23.33333 | 23.33333 |
| δ,p | [°] -23.33333 | -23.33333 |
| δ,c | [°] 11.66667 | 11.66667 |
| k,agh | [-] 0.2244207 | 0.2244207 |
| K,ach | [-] 0.8126539 | 0.8126539 |
| K,0h | [-] 0.4264236 | 0.4264236 |
| K,pgh | [-] 9.146943 | 9.146943 |
| K,pch | [-] 10.104 | 10.104 |
| τ,gr | [kN/m2] 110 | 110 |
| Ψ,A,max | [°] 90 | 90 |
| k | [cm/s] 100e-06 | 100e-06 |

Πορεία πρανούς:

x [m] 0.00 0.00
z [m] -10.35 0.00

Πορεία ανώτερου 2. στρώματος Αμμόδης ΑΡΓΙΛΟΣ:

x [m] 0.00 0.00
z [m] -10.35 -1.50

Πορεία ανώτερου 3. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ:

x [m] 0.00 0.00
z [m] -10.35 -4.50

| | | |
|---------|--------------------------------------|--------------|
| Part: | | Archive No.: |
| Block: | Please specify project informations. | Page: 86 |
| Record: | | |

| | |
|--|------------------|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | Job No.: |
| Program: WALLS-Retain. Version 2017.046 | |
| Structure: info@fides-dvp.de www.fides-dvp.de Tel:++49/89/143829-0 ASB Nr.: | Date: 08.10.2018 |

Πορεία ανώτερου 4. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ:
 x [m] 0.00 0.00
 z [m] -10.35 -10.00

Πορεία ανώτερου 5. στρώματος Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ:
 z= -14.00

Επιφ. φορτία:
Φορτία

| xA | zA | xE | zE | PxA | PzA | PxE | PzE | Typ | LC-description |
|------|------|------|------|------|-------|------|-------|-----|----------------|
| [m] | [m] | [m] | [m] | [| kN/m² | |] | | Name |
| 1.00 | 0.00 | 3.50 | 0.00 | 0.00 | 33.00 | 0.00 | 33.00 | q | 1 |

Κατανομή εδαφ.πιέσεων

| | |
|----------------------------|------|
| Κατανομή εδαφ.πιέσεων | Name |
| Rectangular within a layer | |

Στάθμη νερού:
 x [m] 0.00 0.00
 z [m] -11.00 -4.50

Αγκύρια

| z[m] | min.l[m] | Alpha[°] | C-H[kN/m] | P0[kN] | u0[m] |
|-------|----------|----------|-----------|--------|--------|
| -0.50 | 0.00 | 15.00 | αόρισ. | 0.00 | 0.0000 |
| -3.00 | 0.00 | 15.00 | 0.00 | 0.00 | 0.0000 |
| -5.50 | 0.00 | 15.00 | αόρισ. | 0.00 | 0.0000 |

Παράμετροι υπολογισμού
Earth pressure options
 Τμήμα εδαφ.ωθήσεων: Ενεργές ωθήσεις.
 Angle of slip plane: DIN 4085.
 Split block loads into 1 sections.
 Consideration of minimum earth pressure: φ,min = 40.000.
 Negative earth pressure fractions are set to zero.

Redistribution of earth pressure
 Shape of redistribution: Triangle (perpend. to wall).
 The earth pressure is getting redistb. to: Excavation level
 The earth pressure below the excavation acts without redistrb.
 Levels of redistribution Z1: -3.000, Z2: -5.500 [m].
 The earth pressure from variable loads will be included in redistribution.

Παθητικές ωθήσεις
 Method of calculation: Κλασικός, Pregl/Sokolovsky (DIN 4085).

Options for water pressure
 Additional water and earth pressure from ground water flow is calculated.
 Negative flow pressure is set to zero.
 The proof of the basic hydraulic heave is performed.

Στήριξη πόδα
 Πόδας οριζοντίως μετακινούμενος

Αγκύρια
 Anchor checks (lower failure plane): Ναι
 Anchor forces with safety level of DS-P: Ναι
 Verification of grout body pull out forces: Ναι
 δ,a,Anchoring wall : used from soil layer.
 δ,p,Anchoring wall : used from soil layer.

| | |
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| Part: Block: Please specify project informations. Record: | Archive No.: |
|--|--------------|

Page: 87

Earth pressure coefficients kh

| φ | α | β | δ | k0gh | kagh | kach | kpg | kpch | |
|-----------|----------|---------|----------|------|-------|-------|-------|---------|--------------------------|
| 35.0 | 0.0 | 0.0 | -23.3 | -- | -- | -- | 9.147 | -10.104 | Τεχνητές επιχωματώσεις |
| 25.0 | 0.0 | 0.0 | 16.7 | -- | 0.346 | 1.043 | -- | -- | " |
| 0.1 | 0.0 | 0.0 | 0.1 | -- | 0.996 | 1.994 | -- | -- | Αμμώδης ΑΡΓΙΛΟΣ |
| 33.0 | 0.0 | 0.0 | 22.0 | -- | 0.245 | 0.855 | -- | -- | Αργιλώδη ΧΑΛΙΚΙΑ - ΑΜΜΟΣ |
| 35.0 | 0.0 | 0.0 | -23.3 | -- | -- | -- | 9.147 | -10.104 | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ |
| 35.0 | 0.0 | 0.0 | 23.3 | -- | 0.224 | 0.813 | -- | -- | " |
| 35.0 | 0.0 | 0.0 | -23.3 | -- | -- | -- | 9.147 | -10.104 | Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ |
| 35.0 | 0.0 | 0.0 | 23.3 | -- | 0.224 | 0.813 | -- | -- | " |

Μήκος τοίχου

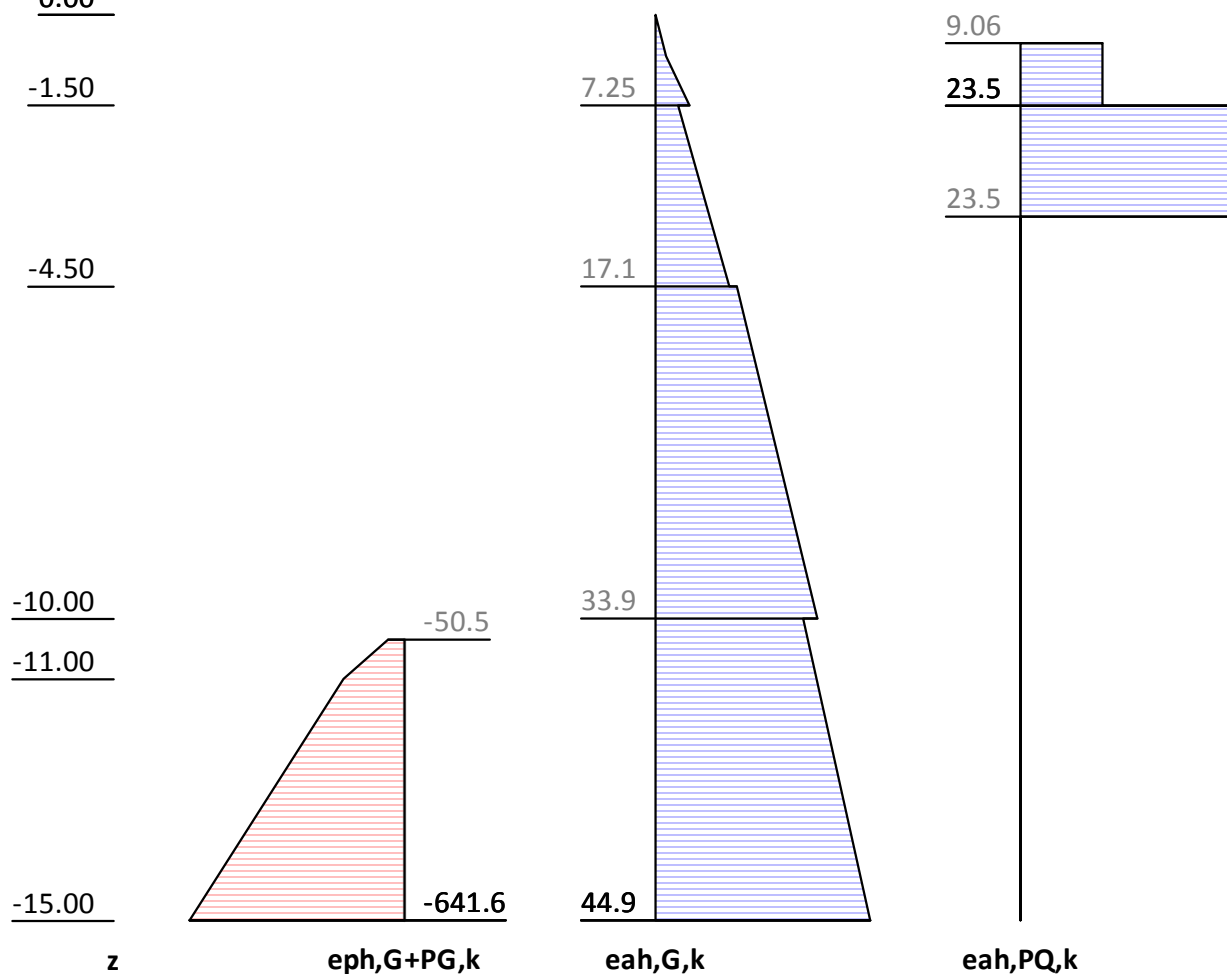
Foot depth for statics: zf = -15.000

Stress analysis

Earth pressure, horizontal

Pressures characteristic, no redistribution, continuous wall

0.00



| z [m] | eph,G,k [kN/m²] | eah,G,k [kN/m²] | eah,PQ,k [kN/m²] | eah,d [kN/m²] |
|-------|-----------------|-----------------|------------------|---------------|
| 0.00 | | 0.00 | | 0.00 |
| -0.47 | | 1.52 | 0.00 | 2.04 |
| -1.50 | | 7.25 | 9.06 | 15.62 |
| -3.34 | | 11.39 | 23.48 | 41.73 |
| -4.50 | | 15.54 | 0.00 | 20.98 |

| z [m] | eph, G, k [kN/m2] | eah, G, k [kN/m2] | eah, PQ, k [kN/m2] | eah, d [kN/m2] |
|----------|----------------------|----------------------|-----------------------|-------------------|
| -4.50 | | 17.06 | 0.00 | 23.03 |
| -10.00 | | 33.92 | 0.00 | 53.95 |
| -10.00 | | 30.89 | 0.00 | 49.17 |
| -10.35 | -0.00 | 31.87 | 0.00 | 50.97 |
| -10.35 | -50.52 | 31.87 | 0.00 | 50.97 |
| -15.00 | -641.64 | 44.92 | 0.00 | 74.90 |

Eph,G,k: -1728.19, Eph,PG,k: 0.00 [kN/m]

Eah,G,k: 364.83, Eah,PG,k: 0.00, Eah,PQ,k: 52.53, Eah,d: 648.09

Earth pressure from water flow

Pressures characteristic, no redistribution, continuous wall

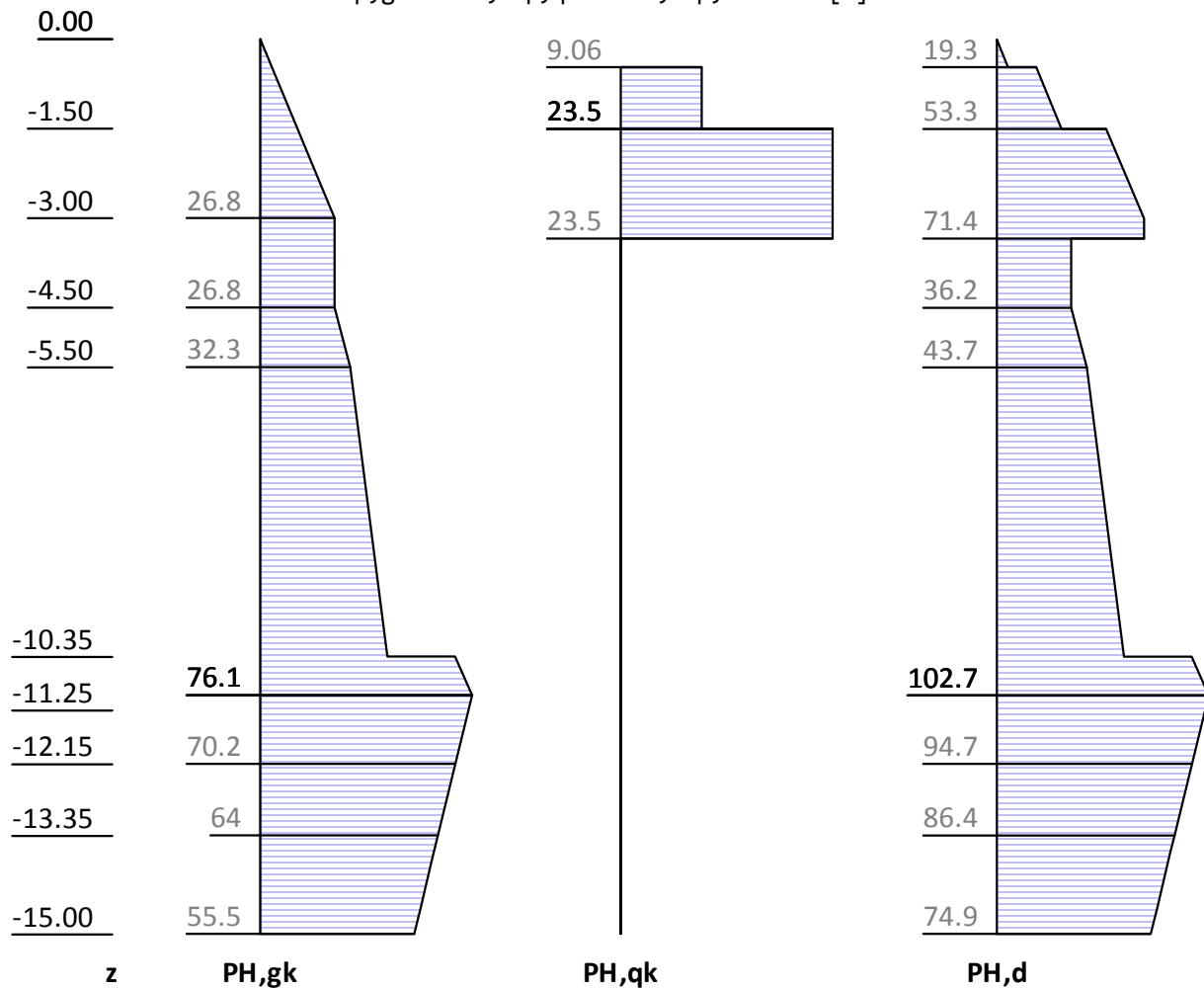
| z | eph, dynW, k | eph, dynW+G+PG, k | eah, dynW, k | eah, dynW+G+PG, k | Ip | Ia |
|--------|--------------|-------------------|--------------|-------------------|------|------|
| [m] | [kN/m2] | [kN/m2] | [kN/m2] | [kN/m2] | [-] | [-] |
| -0.34 | | | 0.00 | | | |
| -1.50 | | | 0.00 | | | |
| -4.50 | | | 0.00 | | | |
| -10.00 | | | 6.05 | | | 0.45 |
| -10.00 | | | 5.53 | | | 0.45 |
| -10.35 | 0.00 | 0.00 | 5.89 | 0.00 | | 0.45 |
| -10.35 | 0.00 | -50.52 | 5.89 | -50.52 | | 0.45 |
| -11.00 | 0.00 | -184.29 | 6.54 | -184.29 | | 0.45 |
| -14.00 | 123.01 | -404.29 | 9.56 | -404.29 | 0.45 | 0.45 |
| -15.00 | 164.01 | -477.63 | 10.56 | -477.63 | 0.45 | 0.45 |

Πίεση νερού

| z [m] | Wp, st, k [kN/m ²] | Wa, st, k [kN/m ²] | Wp, dyn, k [kN/m ²] | Wa, dyn, k [kN/m ²] | W, tot, k [kN/m ²] |
|----------|-----------------------------------|-----------------------------------|------------------------------------|------------------------------------|-----------------------------------|
| -4.50 | | 0.00 | | 0.00 | 0.00 |
| -11.00 | 0.00 | 65.00 | 0.00 | -29.14 | 35.86 |
| -15.00 | -40.00 | 105.00 | -17.93 | -47.07 | 0.00 |

H-pressure on static system

Level of mobilization: Ep,gk 100.0, Ep,qk 100.0, Ep,d 100.0 [%]



| z [m] | PH,gk [kN/m²] | PH,qk [kN/m²] | PH,d [kN/m²] |
|----------|------------------|------------------|-----------------|
| 0.00 | 0.00 | 0.00 | 0.00 |
| -0.47 | 4.20 | 0.00 | 5.67 |
| -0.47 | 4.20 | 9.06 | 19.26 |
| -1.50 | 13.42 | 9.06 | 31.70 |
| -1.50 | 13.42 | 23.48 | 53.33 |
| -3.34 | 26.83 | 23.48 | 71.44 |
| -3.34 | 26.83 | 0.00 | 36.22 |
| -10.35 | 45.69 | 0.00 | 61.68 |
| -10.35 | 70.03 | 0.00 | 94.54 |
| -11.00 | 76.10 | 0.00 | 102.73 |
| -15.00 | 55.48 | 0.00 | 74.90 |

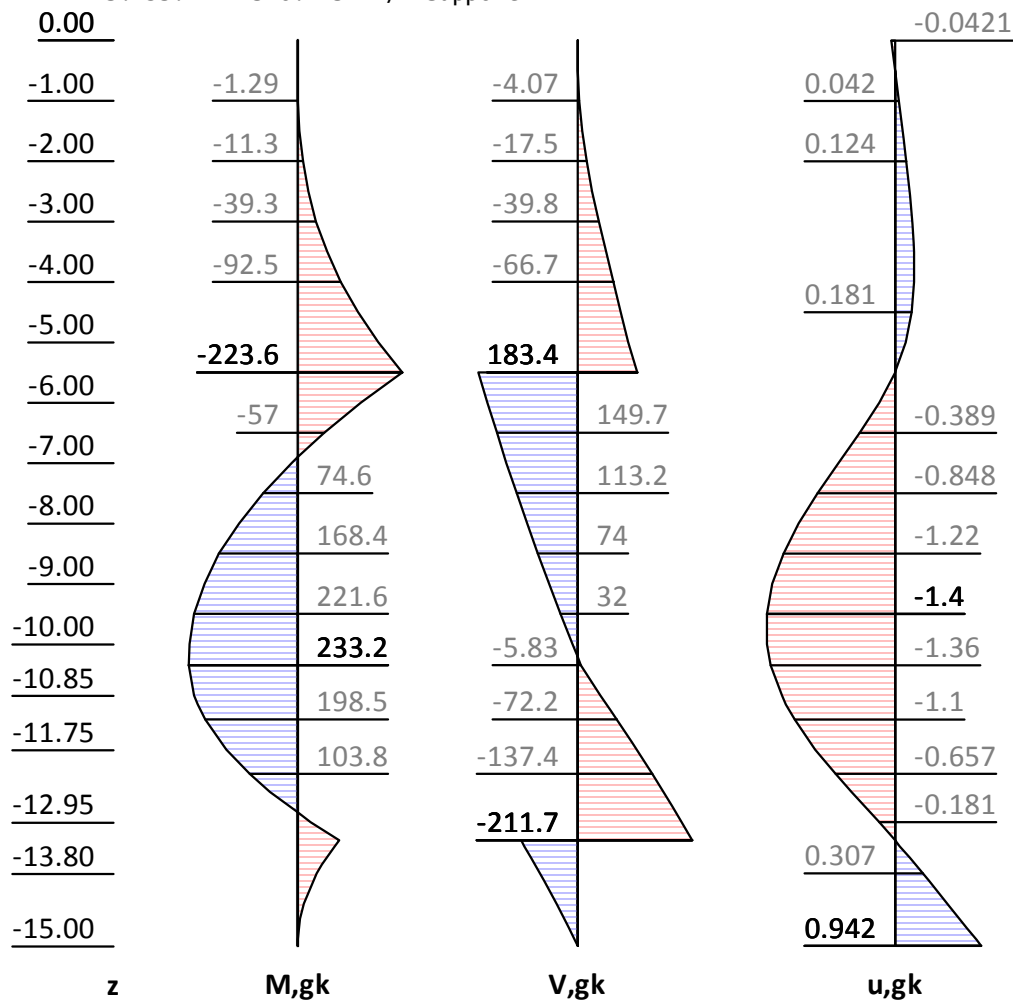
V-pressure on static system**Internal forces: Permanent, characteristically**

z= -0.500. Fx= -0.398 kN/m Support

z= -3.000. Fx= -0.000 kN/m Support

z= -5.500. Fx=-293.099 kN/m Support

z= -13.253. Fx=-316.473 kN/m Support

0.00

| z [m] | H,g,k [kN/m²] | M,g,k [kN/m²] | V,g,k [kN/m²] | N,g,k [kN/m²] | u,g,k [mm] |
|----------|------------------|------------------|------------------|------------------|---------------|
| 0.00 | 0.00 | 0.00 | -0.00 | -0.00 | -0.04 |
| -0.50 | 4.47 | -0.19 | -1.12 | -10.88 | 0.00 |
| -0.50 | 4.47 | -0.19 | -0.72 | -10.99 | 0.00 |
| -3.50 | 26.83 | -62.54 | -53.26 | -92.04 | 0.21 |
| -5.50 | 32.35 | -223.63 | -109.68 | -152.46 | 0.00 |
| -5.50 | 32.35 | -223.63 | -109.68 | -152.46 | -0.00 |
| -5.50 | 32.35 | -223.63 | 183.42 | -231.00 | -0.00 |
| -6.90 | 36.21 | -0.00 | 135.19 | -270.73 | -0.58 |
| -9.50 | 43.35 | 221.59 | 32.00 | -330.38 | -1.40 |
| -10.22 | 45.34 | 232.78 | -0.00 | -343.71 | -1.37 |
| -10.35 | 45.69 | 233.18 | -5.83 | -345.99 | -1.36 |
| -10.35 | 70.03 | 233.18 | -5.83 | -345.99 | -1.36 |
| -11.00 | 76.10 | 214.17 | -53.32 | -365.12 | -1.19 |
| -12.79 | 66.87 | -0.00 | -181.10 | -421.40 | -0.28 |
| -13.25 | 64.50 | -89.25 | -211.68 | -436.78 | 0.00 |
| -13.25 | 64.50 | -89.25 | 104.79 | -436.78 | 0.00 |
| -15.00 | 55.48 | 0.00 | 0.00 | -498.09 | 0.94 |

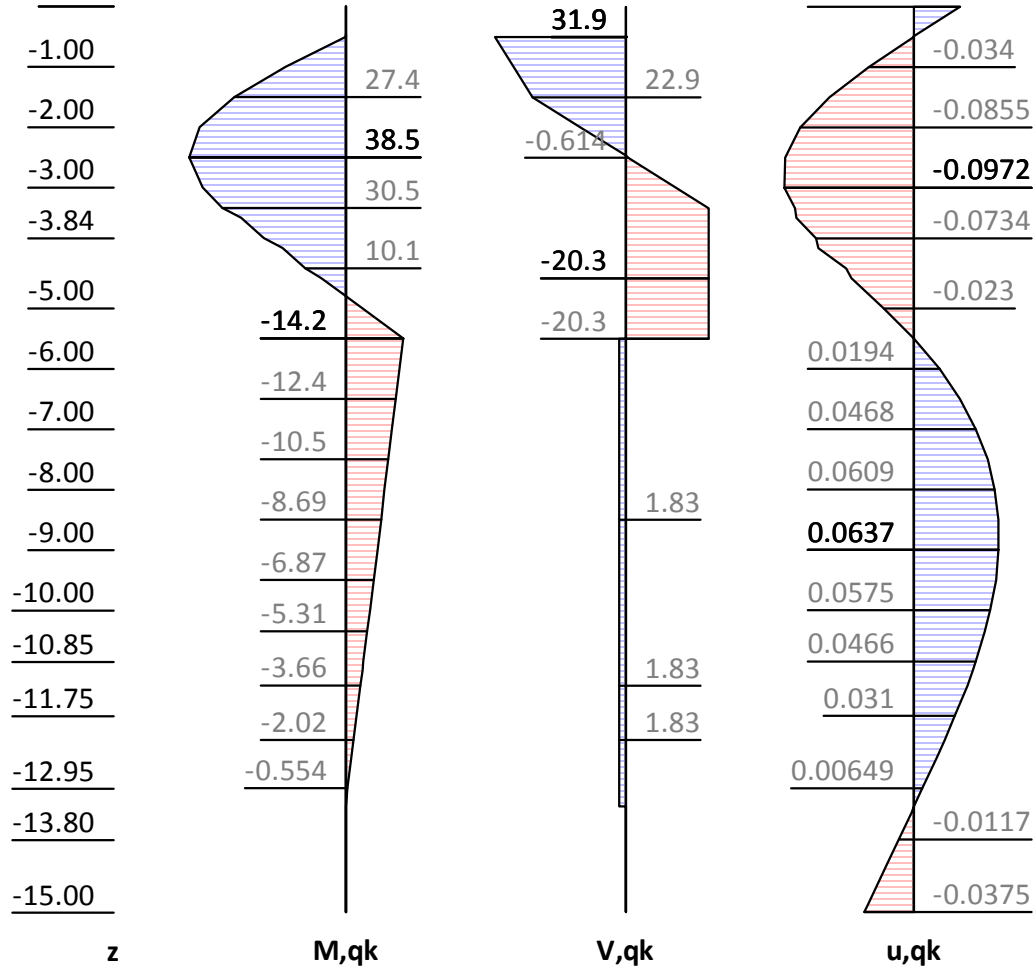
Internal forces: Variable, characteristicallyMethod EB 82-4 ($Q = [G+Q] - G$).

z= -0.500. Fx= -32.201 kN/m Support

z= -3.000. Fx= 0.000 kN/m Support

z= -5.500. Fx= -22.161 kN/m Support

z= -13.253. Fx= 1.829 kN/m Support

0.00

| z [m] | H, q, k [kN/m ²] | M, q, k [kN/m ²] | V, q, k [kN/m ²] | N, q, k [kN/m ²] | u, q, k [mm] |
|----------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|-----------------|
| 0.00 | | 0.00 | 0.00 | 0.00 | 0.03 |
| -0.47 | 0.00 | 0.02 | 0.06 | 0.02 | 0.00 |
| -0.47 | 9.06 | 0.02 | 0.06 | 0.02 | 0.00 |
| -0.48 | 9.06 | 0.02 | -0.00 | 0.01 | 0.00 |
| -0.48 | 9.06 | 0.01 | -0.08 | -0.00 | 0.00 |
| -0.50 | 9.06 | 0.00 | -0.22 | -0.02 | 0.00 |
| -0.50 | 9.06 | 0.00 | 31.93 | -8.66 | -0.00 |
| -1.50 | 9.06 | 27.40 | 22.87 | -9.61 | -0.06 |
| -1.50 | 23.48 | 27.40 | 22.87 | -9.61 | -0.06 |
| -2.47 | 23.48 | 38.36 | -0.00 | -12.04 | -0.10 |
| -2.50 | 23.48 | 38.50 | -0.61 | -12.10 | -0.10 |
| -3.00 | 23.48 | 35.29 | -12.35 | -13.34 | -0.10 |
| -3.34 | 23.48 | 30.48 | -20.33 | -14.18 | -0.09 |
| -3.34 | 0.00 | 30.48 | -20.33 | -14.18 | -0.09 |
| -4.50 | 0.00 | 6.15 | -20.33 | -14.18 | -0.05 |
| -4.80 | 0.00 | 0.00 | -20.33 | -14.18 | -0.03 |
| -5.50 | 0.00 | -14.18 | -20.33 | -14.18 | -0.00 |
| -5.50 | 0.00 | -14.18 | 1.83 | -20.12 | -0.00 |
| -5.50 | 0.00 | -14.18 | 1.83 | -20.12 | 0.00 |
| -7.50 | 0.00 | -10.52 | 1.83 | -20.12 | 0.06 |

| z [m] | H, q, k [kN/m ²] | M, q, k [kN/m ²] | V, q, k [kN/m ²] | N, q, k [kN/m ²] | u, q, k [mm] |
|----------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|-----------------|
| -8.50 | 0.00 | -8.69 | 1.83 | -20.12 | 0.06 |
| -9.00 | 0.00 | -7.78 | 1.83 | -20.12 | 0.06 |
| -9.50 | 0.00 | -6.87 | 1.83 | -20.12 | 0.06 |
| -10.35 | 0.00 | -5.31 | 1.83 | -20.12 | 0.05 |
| -13.25 | 0.00 | -0.00 | 1.83 | -20.12 | 0.00 |
| -13.25 | 0.00 | -0.00 | 0.00 | -20.12 | 0.00 |
| -13.25 | 0.00 | -0.00 | 0.00 | -20.12 | -0.00 |
| -13.35 | 0.00 | -0.00 | 0.00 | -20.12 | -0.00 |
| -13.65 | 0.00 | -0.00 | 0.00 | -20.12 | -0.01 |
| -14.30 | 0.00 | -0.00 | 0.00 | -20.12 | -0.02 |
| -14.84 | 0.00 | 0.00 | 0.00 | -20.12 | -0.03 |
| -14.90 | 0.00 | 0.00 | 0.00 | -20.12 | -0.04 |
| -14.96 | 0.00 | 0.00 | -0.00 | -20.12 | -0.04 |
| -15.00 | 0.00 | -0.00 | -0.00 | -20.12 | -0.04 |

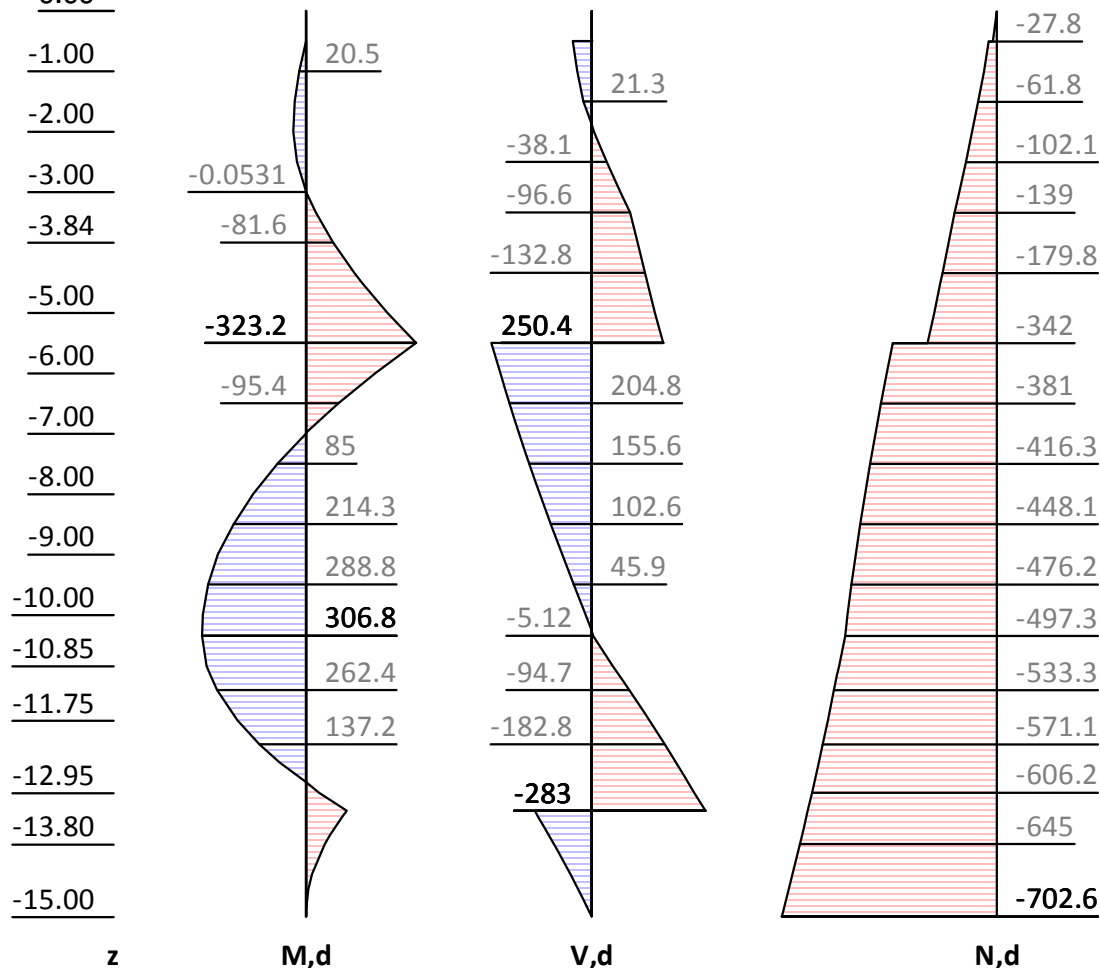
Internal forces: Design

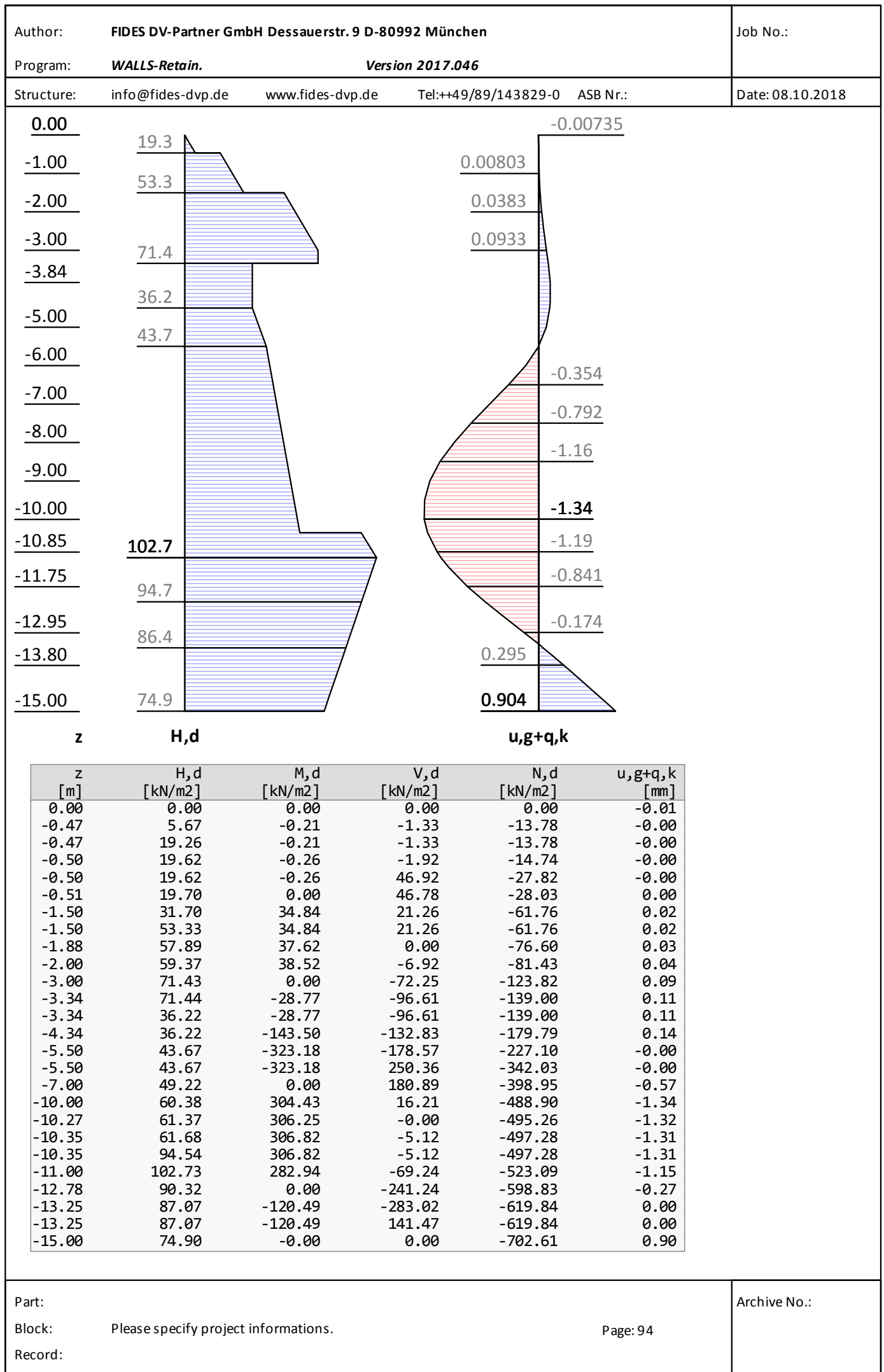
z= -0.500. Fx= -48.839 kN/m Support

z= -3.000. Fx= -0.000 kN/m Support

z= -5.500. Fx=-428.925 kN/m Support

z= -13.253. Fx=-424.494 kN/m Support

0.00



Anchor forces with safety level of DS-P

| z[m] | A,d[kN] | F _{x,d} [kN/m] |
|-------|---------|-------------------------|
| -0.50 | 91.0 | -48.8 |
| -3.00 | 0.0 | -0.0 |
| -5.50 | 399.7 | -428.9 |

Checks of earth statics**Check of earth support**

Check: Mobilizable earth resistance is sufficient for earth support force.

z: -13.25 m

$R_d = E_{ph,k}/\gamma_{Re} = 1400.16 / 1.400 = 1000.11 \text{ [kN/m]}$

$E_d(U_h,d)/R_d = 424.49 / 1000.11 = 0.424 \text{ [-]}. \text{ Passes requirement}$

Sum of H and V forces, (G)

Forces up to depth z:-15.00

| Pos. | H | V |
|--|---------|-----------------------|
| H/V pressure G+P+W,k | 609.97 | 163.87 |
| Wall weight | | 254.11 |
| H/V pressure passive | | 0.00 |
| Support z: -0.50 | -0.40 | 0.11 |
| Support z: -3.00 | | 0.00 |
| Support z: -5.50 | -293.10 | 78.54 |
| B _{h,g,k} z=-13.25 | -316.47 | |
| B _{v,g,k} = B _{h,k} * tan($\delta,p=-23.33^\circ$) | | -136.51 |
| Σ | -0.00 | 360.11 (downwards) |

Average anchor inclination $\alpha,A = 15.00^\circ \geq 15^\circ$.

Verification of vertical forces due to EAB R 9 not required (R 9-5).

Check EAB R 9-1

Vertical component of earth resistance is less than the downwards pointing vertical forces.

$V_k \geq B_{vk}$: 496.62 \geq 136.51 Passes requirement

Sum of H and V forces, (G+Q)

Forces up to depth z:-15.00

| Pos. | H | V |
|--|---------|-----------------------|
| H/V pressure G+P+W,k | 662.50 | 169.43 |
| Wall weight | | 254.11 |
| H/V pressure passive | | 0.00 |
| Support z: -0.50 | -32.60 | 8.73 |
| Support z: -3.00 | | 0.00 |
| Support z: -5.50 | -315.26 | 84.47 |
| B _{h,g,k} z=-13.25 | -316.47 | |
| B _{v,g,k} = B _{h,k} * tan($\delta,p=-23.33^\circ$) | | -136.51 |
| B _{h,q,k} z=-13.25 | 1.83 | |
| B _{v,q,k} = B _{h,k} * tan($\delta,p=-23.33^\circ$) | | 0.79 |
| Σ | 0.00 | 381.02 (downwards) |

Average anchor inclination $\alpha,A = 15.00^\circ \geq 15^\circ$.

Verification of vertical forces due to EAB R 9 not required (R 9-5).

Check EAB R 9-1

Vertical component of earth resistance is less than the downwards pointing vertical forces.

$V_k \geq B_{vk}$: 516.75 \geq 135.72 Passes requirement

| | |
|--|------------------|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | Job No.: |
| Program: WALLS-Retain. Version 2017.046 | |
| Structure: info@fides-dvp.de www.fides-dvp.de Tel:++49/89/143829-0 ASB Nr.: | Date: 08.10.2018 |

Hydraulic heave

Safety factors: [HYD]
 $\gamma_{G, stb}$: 0.900
 γ_H : 1.600

Stream length l_{tot} =14.50 m. $\sum(h_i/k_i)$ =145000.00 1/100s.

Στρώμα "Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ" z: -11.00 / -14.00, h= 3.00m
 $E_d = \sum(\gamma_w \cdot h \cdot i) \cdot \gamma_H = 13.45 \cdot 1.600 = 21.52$ (i=0.448)
 $R_d = \sum(\gamma \cdot h) \cdot \gamma_{G, stb} = 52.13 \cdot 0.900 = 46.91$

Ed/Rd = 0.459 [-]

Στρώμα "Αργιλώδη ΧΑΛΙΚΙΑ- ΑΜΜΟ" z: -14.00 / -15.00, h= 1.00m
 $E_d = \sum(\gamma_w \cdot h \cdot i) \cdot \gamma_H = 17.93 \cdot 1.600 = 28.69$ (i=0.448)
 $R_d = \sum(\gamma \cdot h) \cdot \gamma_{G, stb} = 64.63 \cdot 0.900 = 58.16$

Ed/Rd = 0.493 [-]

Anchor verification

Anchor - Stability of lower failure plane

Περίπτ.Φόρτισης: όλα τα φορτία BS-P
 Αυτόμ. υπολογ. μήκους αγκυρίων:
 All anchors are extended (if necessary)
 Favourable variable loads in main failure body are not being considered.
 Bottom of lower failure plane: z=-15.00 m

Iteration of failure mechanisms:
 lA: Length of anchor from head to center of grout body.
 W,k: Res. force from dead weight, loads, cohesion, ...
 Q,k: Force in lower failure plane.
 Ea1,k.....: Earth pressure onto vertical separation plane.
 Ea2,k.....: Earth pressure between wall and main failure body.
 Ra_cal,d: Dimesioning force of the resistance from the equilibrium of forces.
 Ra_cal,d corresponds to the max. possible anchor force of the force polygon.
 Sum(A,d): Acting anchor forces along the grout body fractions within the failure body. Sum(A,d) is gained from the anchor pull forces of the wall analysis.

| z [m] | ϑ_1 [°] | ϑ_2 [°] | lA [m] | W,k [kN/m] | Q,k [kN/m] | Ea1,k [kN/m] | Ea2,k [kN/m] | Ra_cal,d [kN/m] | Sum(A,d) [kN/m] | Ed/Rd [-] |
|----------|----------------------|----------------------|-----------|---------------|---------------|-----------------|-----------------|--------------------|--------------------|--------------|
| -0.50 | 38.0 | 57.5 | 14.31 | 2100.0 | 1867.3 | 4.4 | 441.9 | 254.0 | 252.9 | 1.00 |
| -3.00 | 33.4 | 61.1 | 13.40 | 2091.8 | 1823.7 | 51.2 | 441.9 | 336.6 | 336.0 | 1.00 |
| -5.50 | 25.5 | 61.3 | 13.21 | 2268.7 | 1969.6 | 129.6 | 441.9 | 491.3 | 490.6 | 1.00 |

Decisive failure body:
Γεωμετρία:
 Foot point of lower failure plane x/z = 0.01/-15.00 m
 Intersection lower/upper slid. plane x/z = 12.76/ -8.92 m
 Intersection upper slid. plane/surface x/z = 17.64/ 0.00 m
 Intersection separation plane/surface x/z = 12.76/ 0.00 m
 Inclination lower failure plane ϑ_1 = 25.50°
 Inclination upper failure plane ϑ_2 = 61.33°
 Inclination separation plane ϑ_{12} = 90.00°

Loads / forces (char.)

| | FX [kN/m] | Fz [kN/m] | F [kN/m] | |
|------------------------------------|--------------|--------------|-------------|--------|
| Weight of main failure body | G,k: | 0.0 | -3249.4 | 3249.4 |
| Cohesion of lower failure plane | C,k: | 63.8 | 30.4 | 70.6 |
| Pore water pressure on main body | U,k: | -0.5 | 951.2 | 951.2 |
| Earth pres. on separation plane | Ea1,k: | -129.6 | -0.0 | 129.6 |
| Earth pr. between wall<->main body | Ea2,k: | 417.4 | 145.4 | 441.9 |
| Force in lower failure plane | Q,k: | 313.4 | 1944.5 | 1969.6 |

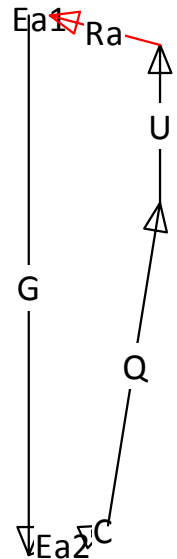
$\delta = 0.0^\circ$

| | |
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| Part: Block: Please specify project informations. Record: | Archive No.: |
|---|--------------|

Page: 96

| | | Fx [kN/m] | Fz [kN/m] | F [kN/m] |
|-------------------------------|-----------|--------------|--------------|-------------|
| Sum = possible anchor forces: | Ra_cal,k: | 664.3 | -178.0 | 687.8 |

Force polygon



| | | | |
|--|----------------|---------------|------------|
| Acting anchor forces | Ed: Sum(A,d) | = | 490.6 kN/m |
| Possible anchor forces | Rd: Ra_cal,d = | 687.8/1.400 = | 491.3 kN/m |
| Verif. of lower failure plane Ed/Rd = 1.00 < 1.0: Έλεγχος εκπληρώθηκε. | | | |

Check of steel tension

l,tot ...[m]: Total length of anchor incl. excess length at head

As[mm²]: X-section area of steel memberRi,d ...[kN]: Ultimate strength of tension member ($\gamma, M=1.15$)

A,d[kN]: Dimensioning force of the anchor from wall analysis

| z[m] | Anchor type | l,tot | As | Ri,d | A,d |
|-------|--------------------------|-------|-----|-------|-------|
| -0.50 | Strand;3x0.60";1570/1770 | 19.97 | 420 | 573.4 | 91.0 |
| -3.00 | Strand;3x0.60";1570/1770 | 18.59 | 420 | 573.4 | 0.0 |
| -5.50 | Strand;4x0.60";1570/1770 | 17.21 | 560 | 764.5 | 399.7 |

Check of steel tension: Passes requirement

Check of anchor's soil friction

lV,k: Length of grout body

DmV,k: Diameter of grout body

 $\tau_{Gr,k}$: Average applied skin friction along the grout body (from soil parameters)

Ra,k: Charact. pullout resistance of the anchor

 γ_A : Partial safety factor of anchor pulloutRa,d: = Ra,k / γ_A

A,d: Dimensioning force of the anchor from wall analysis

| z | lV,k | DmV,k | $\tau_{Gr,k}$ | Ra,k | γ_A | Ra,d | A,d | A,d/Ra,d |
|-------|------|-------|----------------------|-------|------------|-------|-------|----------|
| [m] | [m] | [mm] | [kN/m ²] | [kN] | [-] | [kN] | [kN] | [-] |
| -0.50 | 8.00 | 318 | 110 | 879.1 | 1.100 | 799.2 | 91.0 | 0.1 |
| -3.00 | 8.00 | 318 | 110 | 879.1 | 1.100 | 799.2 | 0.0 | 0.0 |
| -5.50 | 8.00 | 318 | 110 | 879.1 | 1.100 | 799.2 | 399.7 | 0.5 |

Check of anchor's soil friction: Passes requirement

| | | |
|------------|--|------------------|
| Author: | FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | Job No.: |
| Program: | WALLS-Retain. Version 2017.046 | |
| Structure: | info@fides-dvp.de www.fides-dvp.de Tel:++49/89/143829-0 ASB Nr.: | Date: 08.10.2018 |

Υπολογ. κύκλου ολίσθησης

LC: όλα τα φορτία Type: BS-T (combination: [GEO] A2 M2 R3, BS-T)
 Vertical variable loads only act if they are outside of $R \cdot \sin(\phi)$.
 The automatic slip circle optimization only considers circles that intersect the surface with an area of at least 0.25 m².
 The slip circle calculation only accepts circles including the wall.
 The slipcircle calculation only allows circular failure planes (no vertical tangents will occur).

Γεωμετ. κύκλου (μήκη και συντεταγμ. σε (m))
 Κέντρο = (-2.74, 0.53), Ακτίνα = 15.77
 Αρχ.σημ. = (-14.16, -10.35), Τελ.σημ. = (13.03, 0.00)

Γεωμετρία λωρίδων:

| No | x | Width | dxM | Weight | Load | Water- | u*b | ϕ | c | θ |
|----|--------|-------|--------|--------|--------|--------|--------|--------|----------------------|----------|
| | [m] | b | [m] | [kN/m] | z-κατ. | φορτ. | [kN/m] | [°] | [kN/m ²] | [°] |
| | | | | | [kN/m] | | | | | |
| 1 | -13.37 | 1.58 | -10.64 | 27.4 | 0.0 | 0.0 | -6.3 | 29.26 | 3.57 | -30.37* |
| 2 | -11.80 | 1.58 | -9.06 | 72.3 | 0.0 | 0.0 | -21.3 | 29.26 | 3.57 | -30.37* |
| 3 | -10.22 | 1.58 | -7.48 | 106.9 | 0.0 | 0.0 | -36.8 | 29.26 | 3.57 | -28.32 |
| 4 | -8.64 | 1.58 | -5.91 | 133.2 | 0.0 | 0.0 | -48.5 | 29.26 | 3.57 | -21.98 |
| 5 | -7.06 | 1.58 | -4.33 | 152.4 | 0.0 | 0.0 | -57.1 | 29.26 | 3.57 | -15.92 |
| 6 | -5.49 | 1.58 | -2.75 | 165.3 | 0.0 | 0.0 | -62.9 | 29.26 | 3.57 | -10.04 |
| 7 | -3.91 | 1.58 | -1.17 | 172.3 | 0.0 | 0.0 | -66.0 | 29.26 | 3.57 | -4.26 |
| 8 | -2.33 | 1.58 | 0.40 | 173.7 | 0.0 | 0.0 | -66.6 | 29.26 | 3.57 | 1.47 |
| 9 | -0.75 | 1.58 | 1.98 | 177.1 | 0.0 | 0.0 | -116.0 | 29.26 | 3.57 | 7.22 |
| 10 | 0.82 | 1.58 | 3.56 | 504.3 | 0.0 | 0.0 | -162.8 | 29.26 | 3.57 | 13.04 |
| 11 | 2.40 | 1.58 | 5.14 | 488.2 | 0.0 | 0.0 | -155.6 | 29.26 | 3.57 | 19.01 |
| 12 | 3.98 | 1.58 | 6.71 | 465.5 | 0.0 | 0.0 | -145.5 | 29.26 | 3.57 | 25.19 |
| 13 | 5.56 | 1.58 | 8.29 | 435.2 | 0.0 | 0.0 | -131.9 | 29.26 | 3.57 | 31.71 |
| 14 | 7.13 | 1.58 | 9.87 | 395.6 | 0.0 | 0.0 | -114.2 | 29.26 | 3.57 | 38.73 |
| 15 | 8.71 | 1.58 | 11.45 | 344.1 | 0.0 | 0.0 | -91.0 | 29.26 | 3.57 | 46.52 |
| 16 | 10.29 | 1.58 | 13.02 | 274.7 | 0.0 | 0.0 | -59.3 | 27.45 | 3.57 | 55.65 |
| 17 | 12.05 | 1.95 | 14.79 | 190.2 | 0.0 | 0.0 | -25.3 | 27.45 | 3.57 | 69.64 |

*** Σημείωση: Στις λωρίδες σημειωμένες με '*'
 περιορίστηκε το theta στο 45°-Phi/2.

Συνεισφ. κατακόρυφων φορτίων:

| No | Weight | $G \cdot \sin(\theta)$ | $(G - u \cdot b) \cdot \tan(\phi) + c \cdot b$ | $\mu \cdot \sin(\theta) \cdot \tan(\phi) + \cos(\theta)$ | T |
|---------|--------|------------------------|--|--|---------|
| | [kN/m] | [kN/m] | [kN/m] | [-] | [kN/m] |
| 1 | 27.42 | -18.49 | 17.48 | 0.663133 | 26.35 |
| 2 | 72.32 | -41.54 | 34.20 | 0.663133 | 51.58 |
| 3 | 106.88 | -50.70 | 44.90 | 0.693054 | 64.78 |
| 4 | 133.17 | -49.85 | 53.04 | 0.779487 | 68.04 |
| 5 | 152.40 | -41.81 | 59.00 | 0.853311 | 69.14 |
| 6 | 165.31 | -28.82 | 63.00 | 0.915848 | 68.79 |
| 7 | 172.33 | -12.81 | 65.18 | 0.967878 | 67.35 |
| 8 | 173.70 | 4.46 | 65.61 | 1.009799 | 64.97 |
| 9 | 177.10 | 22.25 | 39.86 | 1.041685 | 38.27 |
| 10 | 504.32 | 113.80 | 196.93 | 1.063301 | 185.21 |
| 11 | 488.24 | 159.00 | 191.95 | 1.074066 | 178.71 |
| 12 | 465.50 | 198.14 | 184.90 | 1.072945 | 172.33 |
| 13 | 435.16 | 228.75 | 175.51 | 1.058241 | 165.85 |
| 14 | 395.64 | 247.53 | 163.29 | 1.027126 | 158.98 |
| 15 | 344.10 | 249.70 | 147.43 | 0.974567 | 151.27 |
| 16 | 274.74 | 226.84 | 117.54 | 0.866517 | 135.65 |
| 17 | 190.17 | 178.30 | 92.62 | 0.691167 | 134.01 |
| ----- | | | | | ----- |
| 1384.74 | | | | | 1801.30 |

Συνεισφ. αγκυρίων: Αθρ. ροπών ανατροπής : -1362.0 kN*m/m
 " " resisting : 652.3 kN*m/m

| | | |
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| Part: | | Archive No.: |
| Block: | Please specify project informations. | Page: 98 |
| Record: | | |

| | | | |
|--|--------------------------------------|------------------|-------------------------------|
| Author: FIDES DV-Partner GmbH Dessauerstr. 9 D-80992 München | | | Job No.: |
| Program: WALLS-Retain. Version 2017.046 | | | |
| Structure: | info@fides-dvp.de | www.fides-dvp.de | Tel:++49/89/143829-0 ASB Nr.: |
| | | | Date: 08.10.2018 |
| <div>Δράση Ed = (1384.7*15.77-1362.0)</div> <div>Αντίσταση Rd = (1801.3*15.77+652.3)</div> <div>SLIP-CIRCLE $\mu = Ed/Rd = 0.70 < 1.0$: Έλεγχος εκπληρώθηκε.</div> <div></div> | | | |
| Part: | | | Archive No.: |
| Block: | Please specify project informations. | | Page: 99 |
| Record: | | | |

ΠΑΡΑΡΤΗΜΑ

8.6 Διαστασιολόγηση Φρεατοπασσάλων

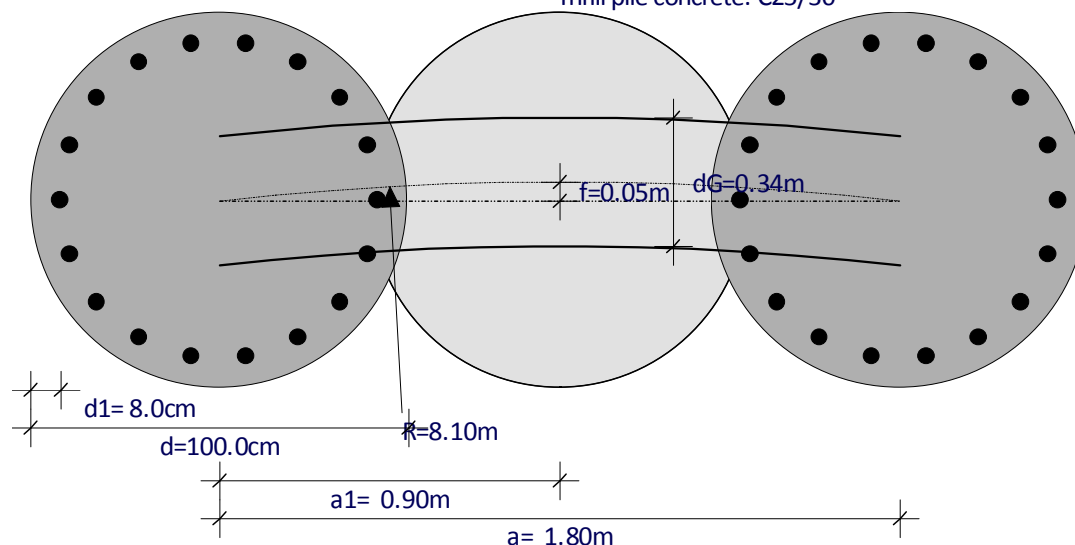
ι) Αντιστηριζόμενο ύψος 6,10m

Dimensioning results

M=1: 20.0

Reinf. pile concrete: C25/30 B500S, Layout 1-1-1

Infill pile concrete: C25/30



Pile Wall Design

System: Overlapping pile layout

Concrete design due to EC 2 (EN 1992-1-1). Material C25/30, B500S

EI = 1706.84 MNm² (per m wall)

Requirements class:

Class C

Building type:

Superstructure, engin. superstructure

Structural element:

Circular cross section

Exposure class:

XC=none

XD=none

XS=none

ULS-proof:

Min. longitudinal reinforcement No

Min. shear reinforcement No

Dimensioning of the wall as a compr. member No

SLS-proof:

Crack width proof is not preformed.

Internal forces in ULS/SLS, influence width a=1.80 [m]:

| z [m] | design [kN,m] | rare [kN,m] | freq [kN,m] | perm [kN,m] | gk [kN,m] | qk BauZ [kN,m] |
|----------|------------------|----------------|----------------|----------------|--------------|-------------------|
| -9.2 M | -396.75 | -293.58 | -293.03 | -291.36 | -290.81 | -2.78 1 |
| N | -701.88 | -513.33 | -501.48 | -465.95 | -454.11 | -59.22 |
| V | -537.87 | -396.12 | -391.98 | -379.54 | -375.40 | -20.73 |
| -6.5 M | 306.94 | 224.48 | 219.28 | 203.70 | 198.51 | 25.97 1 |
| N | -536.51 | -391.42 | -380.63 | -348.25 | -337.46 | -53.96 |
| V | -22.92 | -16.95 | -16.91 | -16.80 | -16.76 | -0.20 |

Required longitudinal reinforcements in ULS:

| | | | | | |
|-----|---------|---------|--------|--------|---------|
| z | as1 | as2 | epsS | epsC | zi BauZ |
| [m] | [cm2/m] | [cm2/m] | [o/oo] | [o/oo] | [m] |

| | | | | | | |
|------|------|------|-------|-------|------|---|
| -9.2 | 5.24 | 0.00 | -1.56 | 20.72 | 0.54 | 1 |
| -6.5 | 3.78 | 0.00 | 22.50 | -3.42 | 0.54 | 1 |

Required shear reinforcements in ULS:

| z | asw | Vsd | VRdct | VRdmax | VRd,s | rho | theta | BauZ |
|------|---------|---------|--------|--------|--------|-------|-------|------|
| [m] | [cm2/m] | [kN] | [kN] | [kN] | [kN] | [%] | [°] | |
| -9.2 | 9.10 | -537.87 | 222.01 | 955.89 | 537.87 | 0.116 | 21.8 | 1 |
| -6.5 | 0.00 | -22.92 | 206.25 | 941.76 | 0.00 | 0.000 | 45.0 | 1 |

Maximum of required reinforcements:

| z | as | $chosen$ |
|-----|-------------------------|----------|
| [m] | [cm ² /pile] | |

```
as1 (Ring):  -9.2    5.24
asw:         -9.2    9.10
```

Design of the Pile Infill(Bending, ULS)

Load due to weight of soil + wide area loads $g = 134.39 \text{ [kN/m}^2\text{]}$
 due to block loads $p = 22.85 \text{ [kN/m}^2\text{]}$

Reduction factor for g corresp. Figure EB 47-1: 1.000

Multiplication-factor H-Pressure: 1.000

Pile infill: rise f = 0.05 [m]

$$\text{span } l = a = 1.80 \text{ [m]}$$

radius of vault $R = 8.10 \text{ [m]}$

edge angle of descent $\Phi_i = 6.40 [^\circ]$

thickness of vault $dG = 0.34$ [m]

Internal forces: $\text{MaxM} = q \cdot l^2 / 8 = 157.24 \cdot 1.80^2 / 8 = 63.68 \text{ [kNm/m]}$

force along vault = $\text{Max}M/f = 63.68/0.05 = 1273.60 \text{ [kN/m]}$

Proof: max. comprehensive strength = $25 \times 0.85 / 1.80 = 11.81 \text{ [MN/m}^2\text{]} \text{ (B35)}$

comprehensive strength = $3.75 < 11.81$ [MN/m²]

Safety against slipping out = $\tan(45^\circ)/\tan(6.40^\circ) = 8.9$

ΠΑΡΑΡΤΗΜΑ

8.6 Διαστασιολόγηση Φρεατοπασσάλων

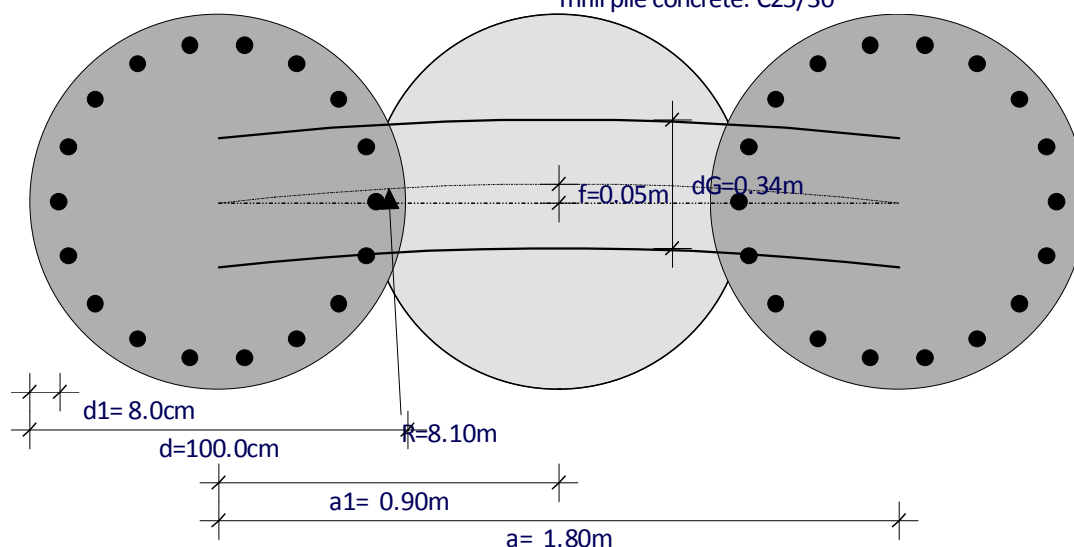
ι) Αντιστηριζόμενο ύψος 7,80m

Dimensioning results

M=1: 20.0

Reinf. pile concrete: C25/30 B500S, Layout 1-1-1

Infill pile concrete: C25/30



Pile Wall Design

System: Overlapping pile layout

Concrete design due to EC 2 (EN 1992-1-1). Material C25/30, B500S

EI = 1706.84 MNm² (per m wall)

Requirements class:

Class C

Building type:

Superstructure, engin. superstructure

Structural element:

Circular cross section

Exposure class:

XC=none

XD=none

XS=none

ULS-proof:

Min. longitudinal reinforcement No

Min. shear reinforcement No

Dimensioning of the wall as a compr. member No

SLS-proof:

Crack width proof is not preformed.

Internal forces in ULS/SLS, influence width a=1.80 [m]:

| z [m] | design [kN,m] | rare [kN,m] | freq [kN,m] | perm [kN,m] | gk [kN,m] | qk BauZ [kN,m] |
|----------|------------------|----------------|----------------|----------------|--------------|-------------------|
| -10.8 M | -652.22 | -483.12 | -483.12 | -483.12 | -483.12 | -0.00 1 |
| N | -771.02 | -566.89 | -559.29 | -536.46 | -528.86 | -38.04 |
| V | -754.04 | -559.67 | -561.68 | -567.73 | -569.74 | 10.07 |
| -7.3 M | 562.11 | 420.35 | 427.52 | 449.01 | 456.17 | -35.82 1 |
| N | -605.86 | -444.56 | -436.95 | -414.13 | -406.52 | -38.04 |
| V | -10.99 | -9.26 | -11.28 | -17.32 | -19.34 | 10.07 |

Required longitudinal reinforcements in ULS:

| | | | | | |
|-----|---------|---------|--------|--------|---------|
| z | as1 | as2 | epsS | epsC | zi BauZ |
| [m] | [cm2/m] | [cm2/m] | [o/oo] | [o/oo] | [m] |

| | | | | | | |
|-------|-------|------|-------|-------|------|---|
| -10.8 | 19.85 | 0.00 | -2.01 | 15.16 | 0.56 | 1 |
| -7.3 | 17.77 | 0.00 | 15.60 | -3.50 | 0.55 | 1 |

Required shear reinforcements in ULS:

| z | asw | Vsd | VRdct | VRdmax | VRd,s | rho | theta | BauZ |
|-------|---------|---------|--------|---------|--------|-------|-------|------|
| [m] | [cm2/m] | [kN] | [kN] | [kN] | [kN] | [%] | [°] | |
| -10.8 | 13.26 | -754.04 | 245.74 | 1049.17 | 754.04 | 0.169 | 23.0 | 1 |
| -7.3 | 0.00 | -10.99 | 218.23 | 992.58 | 0.00 | 0.000 | 45.0 | 1 |

Maximum of required reinforcements:

| z | as | $chosen$ |
|-----|------------|----------|
| [m] | [cm2/pile] | |

as1 (Ring): -10.8 19.85

```
asw: -10.8 13.26
```

Design of the Pile Infill(Bending, ULS)

Load due to weight of soil + wide area loads $g = 156.76$ [kN/m²]
 due to block loads $p = 0.00$ [kN/m²]

Reduction factor for g corresp. Figure EB 47-1: 1.000

Multiplication-factor H-Pressure: 1.000

Pile infill: rise f = 0.05 [m]

$$\text{span } l = a = 1.80 \text{ [m]}$$

radius of vault $R = 8.10 \text{ [m]}$

edge angle of descent $\Phi_i = 6.40 [^\circ]$

thickness of vault $dG = 0.34$ [m]

Internal forces: $\text{Max}M = q \cdot l^2 / 8 = 156.76 \cdot 1.80^2 / 8 = 63.49 \text{ [kNm/m]}$

force along vault = $\text{Max}M/f = 63.49/0.05 = 1269.80 \text{ [kN/m]}$

Proof: max. comprehensive strength = $25 \times 0.85 / 1.80 = 11.81 \text{ [MN/m}^2\text{]} \text{ (B35)}$

comprehensive strength = $3.73 < 11.81 \text{ [MN/m}^2\text{]}$

Safety against slipping out = $\tan(45^\circ)/\tan(6.40^\circ) = 8.9$

ΠΑΡΑΡΤΗΜΑ

8.6 Διαστασιολόγηση Φρεατοπασσάλων

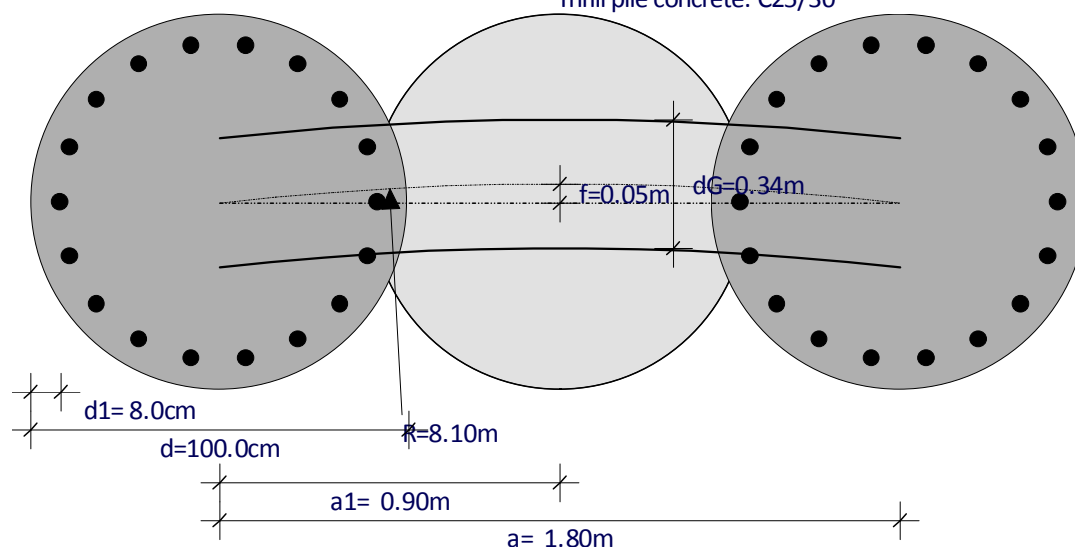
ii) Αντιστηριζόμενο ύψος 9,70m

Dimensioning results

M=1: 20.0

Reinf. pile concrete: C25/30 B500S, Layout 1-1-1

Infill pile concrete: C25/30



Pile Wall Design

System: Overlapping pile layout

Concrete design due to EC 2 (EN 1992-1-1). Material C25/30, B500S

EI = 1706.84 MNm² (per m wall)

Requirements class:

Class C

Building type:

Superstructure, engin. superstructure

Structural element:

Circular cross section

Exposure class:

XC=none

XD=none

XS=none

ULS-proof:

Min. longitudinal reinforcement No

Min. shear reinforcement No

Dimensioning of the wall as a compr. member No

SLS-proof:

Crack width proof is not preformed.

Internal forces in ULS/SLS, influence width a=1.80 [m]:

| z [m] | design [kN,m] | rare [kN,m] | freq [kN,m] | perm [kN,m] | gk [kN,m] | qk BauZ [kN,m] |
|----------|------------------|----------------|----------------|----------------|--------------|-------------------|
| -13.1 M | -532.61 | -394.53 | -394.53 | -394.53 | -394.53 | -0.00 1 |
| N | -985.07 | -725.65 | -718.40 | -696.65 | -689.40 | -36.25 |
| V | -860.88 | -638.07 | -638.75 | -640.79 | -641.47 | 3.40 |
| -9.8 M | 809.70 | 601.05 | 603.32 | 610.16 | 612.43 | -11.38 1 |
| N | -877.28 | -645.81 | -638.56 | -616.81 | -609.56 | -36.25 |
| V | 14.85 | 10.62 | 9.94 | 7.90 | 7.22 | 3.40 |

| | | | | | | | | |
|--|--|--|--|--|--|--|------------------|--|
| Author: Ihre Firma können Sie in der Datei " angeben. | | | | | | | Job No.: | |
| Program: WALLS Dimensioning | | | | | | | | |
| Structure: info@fides-dvp.de www.fides-dvp.de Tel:++49/89/143829-0 ASB Nr.: | | | | | | | Date: 18.10.2018 | |

| | | | | | | | | | |
|------|---|---------|------|------|------|------|------|------|---|
| -5.5 | M | -803.59 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1 |
| | N | -368.96 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| | V | 686.09 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |

Required longitudinal reinforcements in ULS:

| z | as1 | as2 | epsS | epsC | zi | BauZ |
|-------|---------|---------|--------|--------|------|------|
| [m] | [cm2/m] | [cm2/m] | [o/oo] | [o/oo] | [m] | |
| ----- | | | | | | |
| -13.1 | 7.26 | 0.00 | -1.94 | 16.06 | 0.55 | 1 |
| -9.8 | 28.02 | 0.00 | 11.74 | -3.50 | 0.56 | 1 |
| -5.5 | 38.49 | 0.00 | -2.04 | 14.75 | 0.56 | 1 |

Required shear reinforcements in ULS:

| z | asw | Vsd | VRdct | VRdmax | VRd,s | rho | theta | BauZ |
|-------|---------|---------|--------|---------|--------|-------|-------|------|
| [m] | [cm2/m] | [kN] | [kN] | [kN] | [kN] | [%] | [°] | |
| ----- | | | | | | | | |
| -13.1 | 19.59 | -860.88 | 262.18 | 1024.09 | 860.88 | 0.249 | 28.7 | 1 |
| -9.8 | 0.00 | 14.85 | 270.35 | 1114.58 | 0.00 | 0.000 | 45.0 | 1 |
| -5.5 | 11.35 | 686.09 | 206.59 | 1061.47 | 686.09 | 0.145 | 21.8 | 1 |

Maximum of required reinforcements:

| z | as | chosen |
|-------|------------|--------|
| [m] | [cm2/pile] | |
| ----- | | |

as1 (Ring): -5.5 38.49
asw: -13.1 19.59

Design of the Pile Infill(Bending, ULS)

Load due to weight of soil + wide area loads $g = 166.36 \text{ [kN/m}^2\text{]}$
due to block loads $p = 0.00 \text{ [kN/m}^2\text{]}$
Reduction factor for g corresp.Figure EB 47-1: 1.000
Multiplication-factor H-Pressure: 1.000
Pile infill: rise $f = 0.05 \text{ [m]}$
span $l = a = 1.80 \text{ [m]}$
radius of vault $R = 8.10 \text{ [m]}$
edge angle of descent $\Phi = 6.40 \text{ [°]}$
thickness of vault $dG = 0.34 \text{ [m]}$
Internal forces: $\text{MaxM} = q \cdot l^2 / 8 = 166.36 \cdot 1.80^2 / 8 = 67.38 \text{ [kNm/m]}$
force along vault = $\text{MaxM} / f = 67.38 / 0.05 = 1347.50 \text{ [kN/m]}$
Proof: max. comprehensive strength = $25 \cdot 0.85 / 1.80 = 11.81 \text{ [MN/m}^2\text{]}$ (B35)
comprehensive strength = $3.96 < 11.81 \text{ [MN/m}^2\text{]}$
Safety against slipping out = $\tan(45^\circ) / \tan(6.40^\circ) = 8.9$

| | | |
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| Part: Block: Please specify project informations. Record: | | Archive No.: |
|---|--|--------------|

Page: 2

ΠΑΡΑΡΤΗΜΑ

8.6 Διαστασιολόγηση Φρεατοπασσάλων

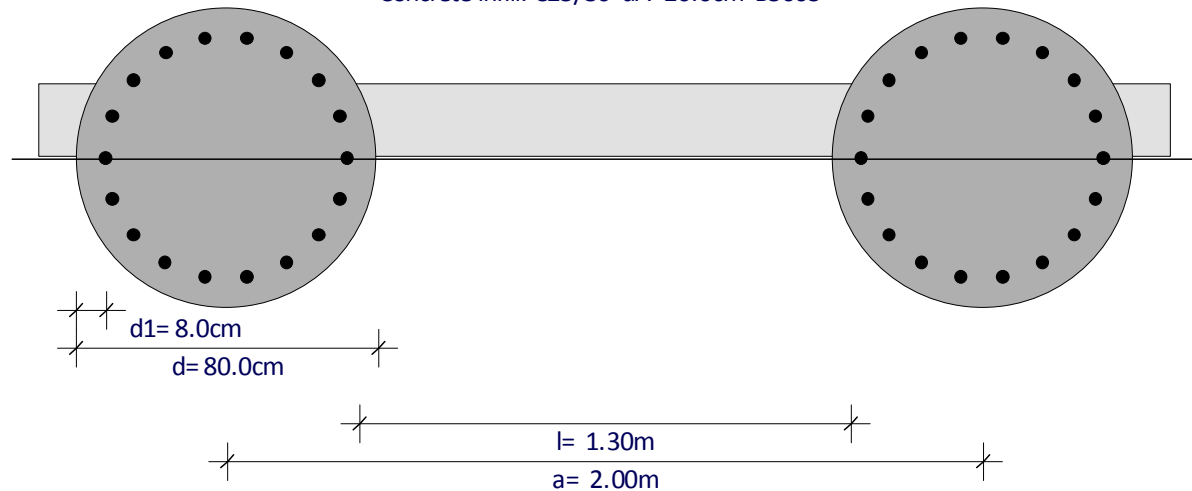
ii) Αντιστηριζόμενο ύψος 3,60m

Dimensioning results

M=1: 20.0

Pile concrete: C25/30 B500S

Concrete infill: C25/30 dA=20.0cm B500S



Design of the pile wall

System: Tangent pile layout, straight infill

Concrete design due to EC 2 (EN 1992-1-1). Material C25/30, B500S

EI = 316.43 MNm² (per m wall)

Requirements class:

Class C

Building type:

Superstructure, engin. superstructure

Structural element:

Circular cross section

Exposure class:

XC=none

XD=none

XS=none

ULS-proof:

Min. longitudinal reinforcement No

Min. shear reinforcement No

Dimensioning of the wall as a compr. member No

SLS-proof:

Crack width proof is not preformed.

Internal forces in ULS/SLS, influence width $a=2.00$ [m]:

| z [m] | design [kN,m] | rare [kN,m] | freq [kN,m] | perm [kN,m] | gk [kN,m] | qk BauZ [kN,m] |
|----------|------------------|----------------|----------------|----------------|--------------|-------------------|
| -5.7 M | 1.14 | 4.33 | 3.86 | 2.45 | 1.97 | 2.36 1 |
| N | -330.62 | -242.28 | -237.61 | -223.62 | -218.96 | -23.32 |
| V | 177.20 | 126.15 | 113.62 | 76.03 | 63.50 | 62.65 (Blum 50%) |
| -4.2 M | -223.37 | -157.35 | -143.20 | -100.73 | -86.58 | -70.77 1 |
| N | -249.64 | -182.96 | -179.48 | -169.03 | -165.55 | -17.40 |
| V | -34.41 | -23.21 | -20.72 | -13.24 | -10.75 | -12.46 |
| -5.7 M | 1.14 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 1 |
| N | -0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| V | 177.20 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 (Blum 50%) |

| | |
|--|------------------|
| Author: Ihre Firma können Sie in der Datei " angeben. | Job No.: |
| Program: WALLS Dimensioning | |
| Structure: info@fides-dvp.de www.fides-dvp.de Tel:++49/89/143829-0 ASB Nr.: | Date: 20.10.2018 |

Required longitudinal reinforcements in ULS:

| z | as1 | as2 | epsS | epsC | zi | BauZ |
|------|---------|---------|--------|--------|------|------|
| [m] | [cm2/m] | [cm2/m] | [o/oo] | [o/oo] | [m] | |
| -5.7 | 0.00 | 0.00 | 22.50 | -2.95 | 0.41 | 1 |
| -4.2 | 9.54 | 0.00 | -1.09 | 20.56 | 0.42 | 1 |
| -5.7 | 0.00 | 0.00 | 22.50 | -0.44 | 0.39 | 1 |

Required shear reinforcements in ULS:

| z | asw | Vsd | VRdct | VRdmax | VRd,s | rho | theta | BauZ |
|------|---------|--------|--------|--------|--------|-------|-------|------|
| [m] | [cm2/m] | [kN] | [kN] | [kN] | [kN] | [%] | [°] | |
| -5.7 | 3.98 | 177.20 | 148.22 | 637.63 | 177.20 | 0.079 | 21.8 | 1 |
| -4.2 | 0.00 | -34.41 | 139.87 | 657.63 | 0.00 | 0.000 | 45.0 | 1 |
| -5.7 | 4.14 | 177.20 | 114.13 | 612.06 | 177.20 | 0.082 | 21.8 | 1 |

Maximum of required reinforcements:

| z | as | chosen |
|-------------|------------|--------|
| [m] | [cm2/pile] | |
| as1 (Ring): | -4.2 | 9.54 |
| asw: | -5.7 | 4.14 |

Design of the Concrete Infill(Bending, ULS)

Structural system:

l=1.30 m

Single span beam l =1.30 [m]
 unif. distr. q = 95.17 [kN/m²]
 (q from '1' at Z=-5.69 m = 95.17 [kN/m2])

Load due to weight of the soil + wide area loads g = 142.76 [kN/m²]
 due to block loads p = 0.00 [kN/m²]

Reduction factor for g corresp.Figure EB 47-1: 0.667
 Multiplication-factor H-Pressure: 1.000

Internal forces: Max M = q*l²/8 = 95.17*1.30²/8 = 20.11 [kNm/m]
 (q from '1' at Z=-5.69 m = 95.17 [kN/m2])

Bending design: EN 1992-1-1 conc.: C25/30 dA= 0.20 co= 0.03 cu= 0.03 [m] B500S
 nec. comp. reinf.: none
 nec. tens. reinf.: As2 = 2.90 [cm²/m]

| |
|--|
| chosen: 0 Layer(s) (= 0.00 [cm²/m]) |
|--|

Infill as vault (arch, ULS)

Pile infill: rise f = 0.100 [m]
 thickness of vault dG = 0.100 [m]
 span l = a = 1.30 [m]

Internal forces: MaxM = q*l²/8 = 95.17*1.30²/8 = 20.11 [kNm/m]
 (q from '1' at Z=-5.69 m = 95.17 [kN/m2])
 force along vault = MaxM/f = 20.11/ 0.100 = 201.10 [kN/m]

Proof : max. comprehensive strength = 8.33 [MN/m²] (due to user-input)
 comprehensive strength = 2.01 < 8.33 [MN/m²]

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| Part: Block: Please specify project informations. Record: | Archive No.: |
|---|--------------|

Page: 2

ΠΑΡΑΡΤΗΜΑ

8.7 Διαστασιολόγηση Αγκυρίων και Δοκού Ισορροπίας

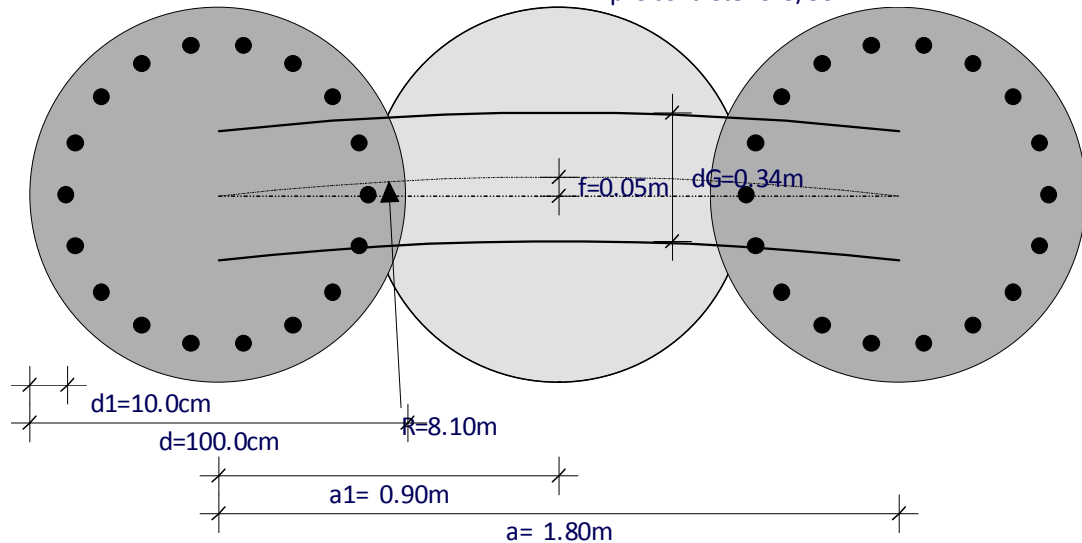
i) Αντιστηριζόμενο ύψος 6,10m

Dimensioning results

M=1: 20.0

Reinf. pile concrete: C25/30 B500S, Layout 1-1-1

Infill pile concrete: C25/30



Anchor design

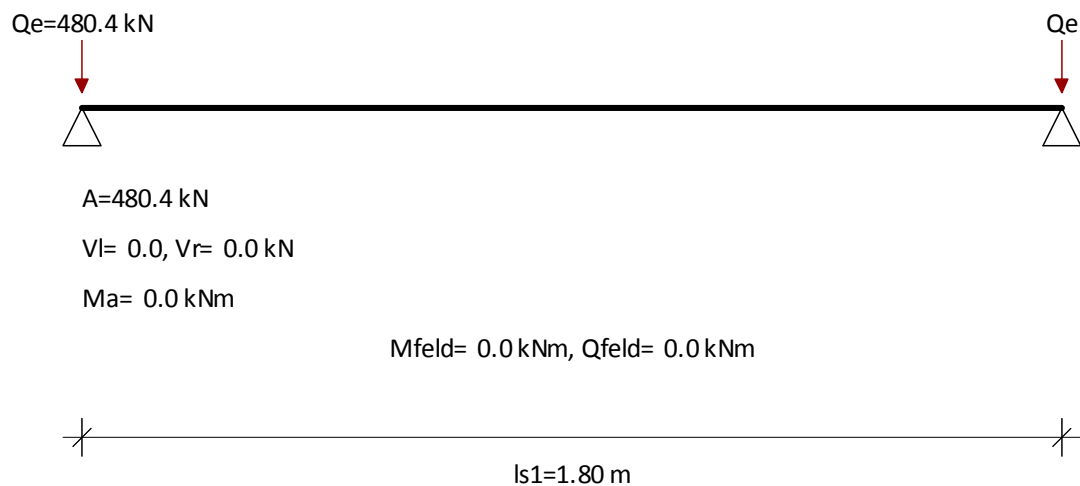
z: Anchor depth
 a: Anchor distance
 Alpha: Anchor declination
 Ah,d: Horizontal support per m wall
 Lf , gamM: Loadcase, safety-factor
 Fa,d: Anchor force (design value)
 Ri,d: Anchor force resistance
 Lvp: Length growth body
 Uebs: Additional length
 Lges: Total length of anchor (incl. Uebs + Lvp/2)

| Num | z | Alpha | a | Ah,d | Lf | gamM | Fa,d | Ri,d | Lvp | Uebs | Lges | Ok? |
|-----|-------|-------|------|--------|----|------|-------|-------|------|------|-------|-----|
| | [m] | [°] | [m] | [kN/m] | | | [kN] | [kN] | [m] | [m] | [m] | |
| 1 | -0.50 | 15.0 | 1.80 | 77.6 | 1 | 1.15 | 144.6 | 573.4 | 8.00 | 0.00 | 14.62 | Yes |
| 2 | -3.00 | 15.0 | 1.80 | 251.3 | 1 | 1.15 | 468.3 | 573.4 | 8.00 | 0.00 | 13.09 | Yes |

Num Anchor type

- 1 Strand, 3x0.60", 1570/1770
- 2 Strand, 3x0.60", 1570/1770

Dimensioning of the Waling Num. 2 Level z= -3.00 m



Load: single loads $P_e=464.04$ [kN] every at= 1.80 [m]
Inclination: 15.00 [°]
Loadfactor: 1.000 [-]
Result. Qe: $464.04 \cdot 1.000 / \cos(15.00) = 480.41$ [kN]
 (odd number, symmetrical to mid of the beam)
All loads and forces are dimensioning values.

```
Stat. system ...: Single span beam: span ls1= 1.80 [m]
                                   lk = 0.00 [m] (left)
                                   lk = 0.00 [m] (right)
```

```

Internal Forces.: Support:  A = 480.41 [kN]
                           Vl=  0.00 [kN]
                           Vr=  0.00 [kN]
                           Ma=  0.00 [kNm]
Field:                     Mf=  0.00 [kNm]
                           Vf=  0.00 [kN]

```

Normal Force N = 0.00 [kN]

Dimensioning Code: EN 1993 (EC 3)

Safety factors:

gamma,M0: 1.00, gamma,M1: 1.10

Steel cross section: (all values are per profile/s)

Distance of beams = 1.00 m

Cross section = 2 x U 220

A: 74.80 cm² I_y: 5380.00 cm⁴ W_{y,el}: 490.00 cm³ W_{y,pl}: 583.20 cm³

Steel: $E = 210000 \text{ N/mm}^2$, $f_{yk} = 275 \text{ N/mm}^2$

Cross section class = 1 ('' z=0.00: Myd=0.00, Ny=0.00

alpha=0.50 eps=0.92 psi=100000.00; cs/s=19.67; ct/t=4.96)

Shear buckling of the web (w,b): $hw/s/(72*\epsilon_s) = 195.00/9.00/72*0.92 = 32.6 \%$.

No further investg. req.

Buckling is not checked.

| Author: Ihre Firma können Sie in der Datei " angeben. | | | | | Job No.: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|----------|---------|---------|-----------------------|------------------|------|-----|-------|--|----|----|----|---------|-----------------------|--|--|--|--|--------|----------|--------|--------|------|------|------|-----|-------|----------|----------|---------|---------|-------|------|--|--|--|------|------|------|--|--|--|--|--|--|--------|--------|---------|--------|-----|-----|-----|-----|-----|------|--------|------|--------|-----|-----|--|--|--|
| Program: WALLS Dimensioning | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Structure: info@fides-dvp.de www.fides-dvp.de Tel:++49/89/143829-0 ASB Nr.: | | | | | Date: 08.10.2018 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p> Actions, Reactions: Md: Design moment, action Nd: Design normal force, action Vd: Design shear force, action M,c,Rd: Design resistance for bending moment, without any reductions. M,cRd,red: Final design resistance for bending moment N,c,Rd: Design resistance for normal force component V,c,Rd: Design resistance for shear force Ed,MN,el: Design actions for elastic M and N interaction (M/W+N/A) Rd,MN,el: Design resistance for elastic M and N interaction Ed,V,el: Design actions for elastic shear stress (V/Av) Rd,V,el: Design resistance for elastic shear force Utilizations: X,pl: Plastic utilization, if applicable X,el: Elastic util. (only critical is plastic calculation is impossible) w,b: Shear-buckling of the web MN,bk: Buckling due to moment and normal force </p> <table border="1"> <thead> <tr> <th>Md</th> <th>Nd</th> <th>Vd</th> <th>[kN, m]</th> <th colspan="5">Utilization ratios[%]</th> </tr> <tr> <th>M,c,Rd</th> <th>McRd,red</th> <th>N,c,Rd</th> <th>V,c,Rd</th> <th>M,pl</th> <th>N,pl</th> <th>V,pl</th> <th>w,b</th> <th>MN,bk</th> </tr> <tr> <th>Ed,MN,el</th> <th>Rd,MN,el</th> <th>Ed,V,el</th> <th>Rd,V,el</th> <th>MN,el</th> <th>V,el</th> <th></th> <th></th> <th></th> </tr> </thead> <tbody> <tr> <td>0.00</td> <td>0.00</td> <td>0.00</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>160.38</td> <td>160.38</td> <td>2057.00</td> <td>623.97</td> <td>0.0</td> <td>0.0</td> <td>0.0</td> <td>---</td> <td>---</td> </tr> <tr> <td>0.00</td> <td>275.00</td> <td>0.00</td> <td>275.00</td> <td>0.0</td> <td>0.0</td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p>Steel checks passed requirements</p> | | | | | | | | | | Md | Nd | Vd | [kN, m] | Utilization ratios[%] | | | | | M,c,Rd | McRd,red | N,c,Rd | V,c,Rd | M,pl | N,pl | V,pl | w,b | MN,bk | Ed,MN,el | Rd,MN,el | Ed,V,el | Rd,V,el | MN,el | V,el | | | | 0.00 | 0.00 | 0.00 | | | | | | | 160.38 | 160.38 | 2057.00 | 623.97 | 0.0 | 0.0 | 0.0 | --- | --- | 0.00 | 275.00 | 0.00 | 275.00 | 0.0 | 0.0 | | | |
| Md | Nd | Vd | [kN, m] | Utilization ratios[%] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| M,c,Rd | McRd,red | N,c,Rd | V,c,Rd | M,pl | N,pl | V,pl | w,b | MN,bk | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ed,MN,el | Rd,MN,el | Ed,V,el | Rd,V,el | MN,el | V,el | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.00 | 0.00 | 0.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 160.38 | 160.38 | 2057.00 | 623.97 | 0.0 | 0.0 | 0.0 | --- | --- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.00 | 275.00 | 0.00 | 275.00 | 0.0 | 0.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Part: | | | | | Archive No.: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Block: Please specify project informations. | | | | | Page: 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Record: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

ΠΑΡΑΡΤΗΜΑ

8.7 Διαστασιολόγηση Αγκυρίων και Δοκού Ισορροπίας

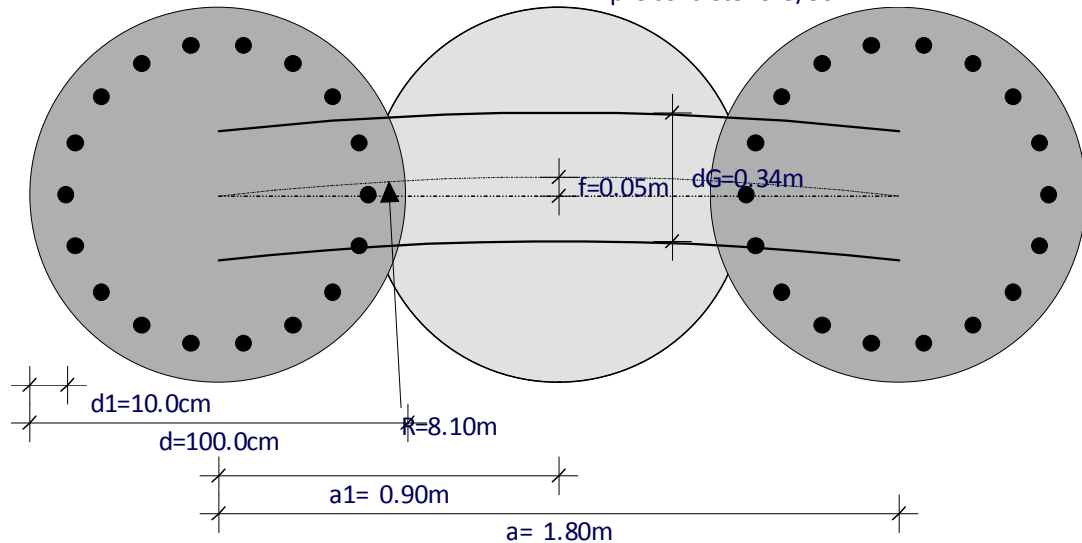
i) Αντιστηριζόμενο ύψος 7,80m

Dimensioning results

M=1: 20.0

Reinf. pile concrete: C25/30 B500S, Layout 1-1-1

Infill pile concrete: C25/30



Anchor design

z: Anchor depth
 a: Anchor distance
 Alpha: Anchor declination
 Ah,d: Horizontal support per m wall
 Lf , gamM: Loadcase, safety-factor
 Fa,d: Anchor force (design value)
 Ri,d: Anchor force resistance
 Lvp: Length growth body
 Uebs: Additional length
 Lges: Total length of anchor (incl. Uebs + Lvp/2)

| Num | z [m] | Alpha [°] | a [m] | Ah,d [kN/m] | Lf | gamM | Fa,d [kN] | Ri,d [kN] | Lvp [m] | Uebs [m] | Lges [m] | Ok? |
|-----|----------|--------------|----------|----------------|----|------|--------------|--------------|------------|-------------|-------------|-----|
| 1 | -0.50 | 15.0 | 1.80 | 82.2 | 1 | 1.15 | 153.2 | 573.4 | 8.00 | 0.00 | 15.87 | Yes |
| 2 | -3.00 | 15.0 | 0.90 | 324.1 | 1 | 1.15 | 302.0 | 573.4 | 8.00 | 0.00 | 14.27 | Yes |

Num Anchor type

- 1 Strand, 3x0.60", 1570/1770
- 2 Strand, 3x0.60", 1570/1770

$Q_e = 302.0 \text{ kN}$
 $a_t = 0.90 \text{ m}$
 $A = 453.0 \text{ kN}$
 $V_l = 0.0, V_r = 151.0 \text{ kN}$
 $M_a = 0.0 \text{ kNm}$
 $M_{\text{feld}} = 135.9 \text{ kNm}, Q_{\text{feld}} = -151.0 \text{ kNm}$
 $l_{s1} = 1.80 \text{ m}$

```
Stat. system ...: Single span beam:  span ls1= 1.80 [m]
                                     lk = 0.00 [m] (left)
                                     lk = 0.00 [m] (right)
```

Buckling is not checked.

| Author: Ihre Firma können Sie in der Datei " angeben. | | | | Job No.: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|--------|---------|--------|-----------------------|------|---|-----|-------|--|-----------------------|--|--|--|--|--|--|--|--|------|------|------|-----|-------|--|--|--|--|-------|------|--|--|--|--------|------|---------|--|--|--|--|--|--|--------|--------|---------|--------|------|-----|------|-----|-----|--------|--------|-------|--------|-------|-----|--|--|--|------|------|---------|--|--|--|--|--|--|--------|--------|---------|--------|-----|-----|------|-----|-----|------|--------|-------|--------|-----|-----|--|--|--|------|------|--------|--|--|--|--|--|--|--------|--------|---------|--------|-----|-----|------|-----|-----|------|--------|-------|--------|-----|-----|--|--|--|
| Program: WALLS Dimensioning | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Structure: info@fides-dvp.de www.fides-dvp.de Tel:++49/89/143829-0 ASB Nr.: | | | | Date: 08.10.2018 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <div> Actions, Reactions: Md: Design moment, action Nd: Design normal force, action Vd: Design shear force, action M,c,Rd: Design resistance for bending moment, without any reductions. M,cRd,red: Final design resistance for bending moment N,c,Rd: Design resistance for normal force component V,c,Rd: Design resistance for shear force Ed,MN,el: Design actions for elastic M and N interaction (M/W+N/A) Rd,MN,el: Design resistance for elastic M and N interaction Ed,V,el: Design actions for elastic shear stress (V/Av) Rd,V,el: Design resistance for elastic shear force Utilizations: X,pl: Plastic utilization, if applicable X,el: Elastic util. (only critical is plastic calculation is impossible) w,b: Shear-buckling of the web MN,bk: Buckling due to moment and normal force </div> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr style="background-color: #f2f2f2;"> <th colspan="4" style="padding: 5px;"> <div> <div>Md Nd Vd [kN, m]</div> <div>M,c,Rd McRd,red N,c,Rd V,c,Rd</div> <div>Ed,MN,el Rd,MN,el Ed,V,el Rd,V,el</div> </div> </th> <th colspan="5" style="padding: 5px;"> Utilization ratios[%] </th> </tr> <tr style="background-color: #f2f2f2;"> <th colspan="4"></th> <th style="padding: 5px;">M,pl</th> <th style="padding: 5px;">N,pl</th> <th style="padding: 5px;">V,pl</th> <th style="padding: 5px;">w,b</th> <th style="padding: 5px;">MN,bk</th> </tr> <tr style="background-color: #f2f2f2;"> <th colspan="4"></th> <th style="padding: 5px;">MN,el</th> <th style="padding: 5px;">V,el</th> <th colspan="3"></th> </tr> </thead> <tbody> <tr> <td style="padding: 5px;">135.91</td> <td style="padding: 5px;">0.00</td> <td style="padding: 5px;">-151.01</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td style="padding: 5px;">160.38</td> <td style="padding: 5px;">160.38</td> <td style="padding: 5px;">2057.00</td> <td style="padding: 5px;">623.97</td> <td style="padding: 5px;">84.7</td> <td style="padding: 5px;">0.0</td> <td style="padding: 5px;">24.2</td> <td style="padding: 5px;">---</td> <td style="padding: 5px;">---</td> </tr> <tr> <td style="padding: 5px;">277.36</td> <td style="padding: 5px;">275.00</td> <td style="padding: 5px;">38.42</td> <td style="padding: 5px;">275.00</td> <td style="padding: 5px;">101.7</td> <td style="padding: 5px;">5.9</td> <td></td> <td></td> <td></td> </tr> <tr> <td style="padding: 5px;">0.00</td> <td style="padding: 5px;">0.00</td> <td style="padding: 5px;">-151.01</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td style="padding: 5px;">160.38</td> <td style="padding: 5px;">160.38</td> <td style="padding: 5px;">2057.00</td> <td style="padding: 5px;">623.97</td> <td style="padding: 5px;">0.0</td> <td style="padding: 5px;">0.0</td> <td style="padding: 5px;">24.2</td> <td style="padding: 5px;">---</td> <td style="padding: 5px;">---</td> </tr> <tr> <td style="padding: 5px;">0.00</td> <td style="padding: 5px;">275.00</td> <td style="padding: 5px;">38.42</td> <td style="padding: 5px;">275.00</td> <td style="padding: 5px;">0.0</td> <td style="padding: 5px;">5.9</td> <td></td> <td></td> <td></td> </tr> <tr> <td style="padding: 5px;">0.00</td> <td style="padding: 5px;">0.00</td> <td style="padding: 5px;">151.01</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td style="padding: 5px;">160.38</td> <td style="padding: 5px;">160.38</td> <td style="padding: 5px;">2057.00</td> <td style="padding: 5px;">623.97</td> <td style="padding: 5px;">0.0</td> <td style="padding: 5px;">0.0</td> <td style="padding: 5px;">24.2</td> <td style="padding: 5px;">---</td> <td style="padding: 5px;">---</td> </tr> <tr> <td style="padding: 5px;">0.00</td> <td style="padding: 5px;">275.00</td> <td style="padding: 5px;">38.42</td> <td style="padding: 5px;">275.00</td> <td style="padding: 5px;">0.0</td> <td style="padding: 5px;">5.9</td> <td></td> <td></td> <td></td> </tr> </tbody> </table> | | | | | | <div> <div>Md Nd Vd [kN, m]</div> <div>M,c,Rd McRd,red N,c,Rd V,c,Rd</div> <div>Ed,MN,el Rd,MN,el Ed,V,el Rd,V,el</div> </div> | | | | Utilization ratios[%] | | | | | | | | | M,pl | N,pl | V,pl | w,b | MN,bk | | | | | MN,el | V,el | | | | 135.91 | 0.00 | -151.01 | | | | | | | 160.38 | 160.38 | 2057.00 | 623.97 | 84.7 | 0.0 | 24.2 | --- | --- | 277.36 | 275.00 | 38.42 | 275.00 | 101.7 | 5.9 | | | | 0.00 | 0.00 | -151.01 | | | | | | | 160.38 | 160.38 | 2057.00 | 623.97 | 0.0 | 0.0 | 24.2 | --- | --- | 0.00 | 275.00 | 38.42 | 275.00 | 0.0 | 5.9 | | | | 0.00 | 0.00 | 151.01 | | | | | | | 160.38 | 160.38 | 2057.00 | 623.97 | 0.0 | 0.0 | 24.2 | --- | --- | 0.00 | 275.00 | 38.42 | 275.00 | 0.0 | 5.9 | | | |
| <div> <div>Md Nd Vd [kN, m]</div> <div>M,c,Rd McRd,red N,c,Rd V,c,Rd</div> <div>Ed,MN,el Rd,MN,el Ed,V,el Rd,V,el</div> </div> | | | | Utilization ratios[%] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | M,pl | N,pl | V,pl | w,b | MN,bk | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | MN,el | V,el | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 135.91 | 0.00 | -151.01 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 160.38 | 160.38 | 2057.00 | 623.97 | 84.7 | 0.0 | 24.2 | --- | --- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 277.36 | 275.00 | 38.42 | 275.00 | 101.7 | 5.9 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.00 | 0.00 | -151.01 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 160.38 | 160.38 | 2057.00 | 623.97 | 0.0 | 0.0 | 24.2 | --- | --- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.00 | 275.00 | 38.42 | 275.00 | 0.0 | 5.9 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.00 | 0.00 | 151.01 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 160.38 | 160.38 | 2057.00 | 623.97 | 0.0 | 0.0 | 24.2 | --- | --- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.00 | 275.00 | 38.42 | 275.00 | 0.0 | 5.9 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Steel checks passed requirements. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Part: Block: Please specify project informations. Record: | | | | Archive No.: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Page: 3

ΠΑΡΑΡΤΗΜΑ

8.7 Διαστασιολόγηση Αγκυρίων και Δοκού Ισορροπίας

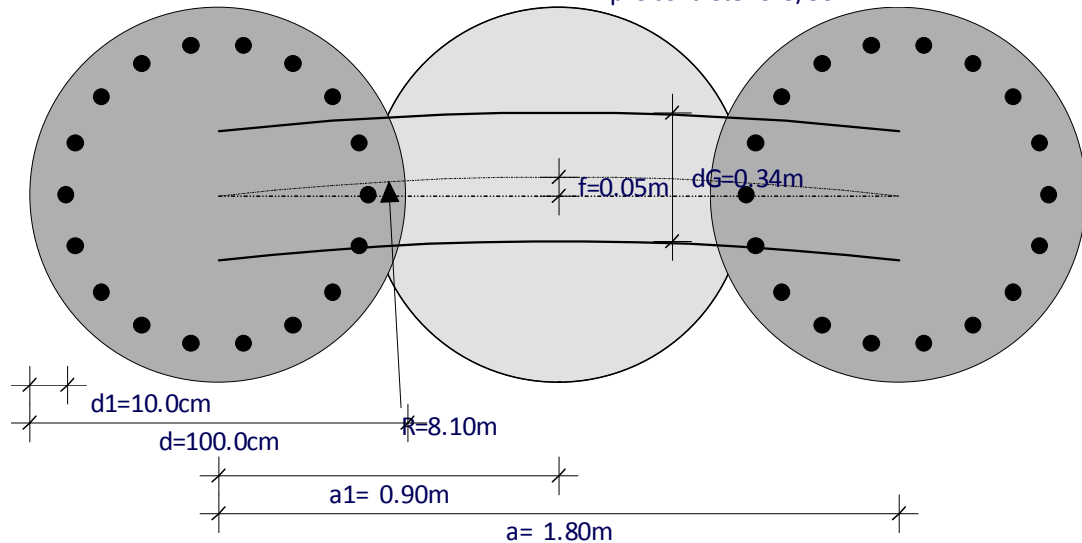
i) Αντιστηριζόμενο ύψος 9,70m

Dimensioning results

M=1: 20.0

Reinf. pile concrete: C25/30 B500S, Layout 1-1-1

Infill pile concrete: C25/30



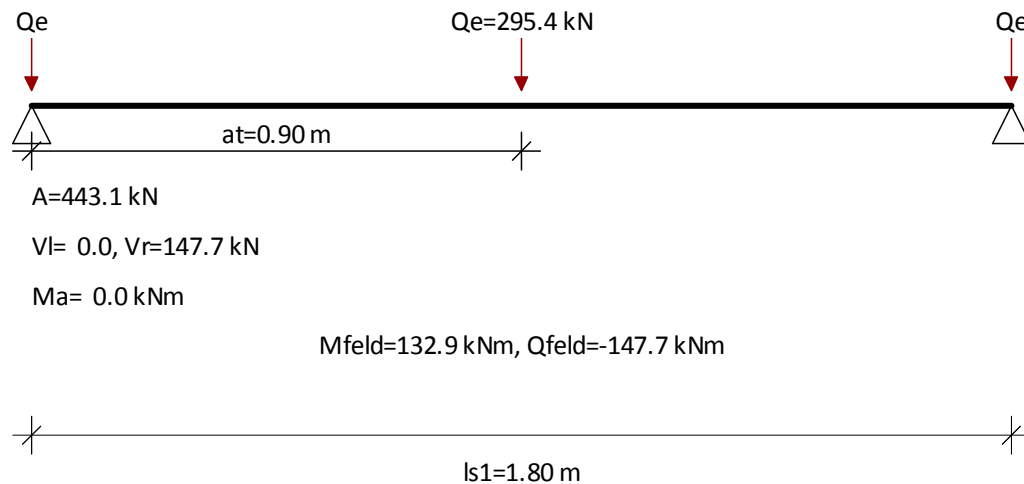
Anchor design

z: Anchor depth
 a: Anchor distance
 Alpha: Anchor declination
 Ah,d: Horizontal support per m wall
 Lf , gamM: Loadcase, safety-factor
 Fa,d: Anchor force (design value)
 Ri,d: Anchor force resistance
 Lvp: Length growth body
 Uebs: Additional length
 Lges: Total length of anchor (incl. Uebs + Lvp/2)

| Num | z [m] | Alpha [°] | a [m] | Ah,d [kN/m] | Lf | gamM | Fa,d [kN] | Ri,d [kN] | Lvp [m] | Uebs [m] | Lges [m] | Ok? |
|-----|----------|--------------|----------|----------------|----|------|--------------|--------------|------------|-------------|-------------|-----|
| 1 | -0.50 | 15.0 | 1.80 | 137.2 | 1 | 1.15 | 255.7 | 573.4 | 8.00 | 0.00 | 20.87 | Yes |
| 2 | -3.00 | 15.0 | 0.90 | 317.1 | 1 | 1.15 | 295.5 | 573.4 | 8.00 | 0.00 | 19.27 | Yes |
| 3 | -5.50 | 15.0 | 0.90 | 581.6 | 1 | 1.15 | 541.9 | 764.5 | 8.00 | 0.00 | 17.67 | Yes |

Num Anchor type

- 1 Strand, 3x0.60", 1570/1770
- 2 Strand, 3x0.60", 1570/1770
- 3 Strand, 4x0.60", 1570/1770

Dimensioning of the Waling Num. 2 Level z= -3.00 m

Load: single loads $P_e=285.36\text{ [kN]}$ every $a_t=0.90\text{ [m]}$

Inclination: 15.00 [°]

Loadfactor: 1.000 [-]

Result. Q_e : $285.36 \cdot 1.000 / \cos(15.00) = 295.43\text{ [kN]}$
(even number, symmetrical to mid of the beam)

All loads and forces are dimensioning values.

Stat. system ...: Single span beam: span $l_{s1}=1.80\text{ [m]}$

$l_k=0.00\text{ [m]}$ (left)

$l_k=0.00\text{ [m]}$ (right)

Internal Forces.: Support: $A=443.14\text{ [kN]}$

$V_1=0.00\text{ [kN]}$

$V_r=147.71\text{ [kN]}$

$M_a=0.00\text{ [kNm]}$

Field: $M_f=132.94\text{ [kNm]}$

$V_f=-147.71\text{ [kN]}$

Normal Force $N=0.00\text{ [kN]}$

Dimensioning Code: EN 1993 (EC 3)

Safety factors:

$\gamma_{M0}=1.00$, $\gamma_{M1}=1.10$

Steel cross section: (all values are per profile/s)

Distance of beams = 1.00 m

Cross section = $2 \times \text{U } 220$

$A=74.80\text{ cm}^2$ $I_y=5380.00\text{ cm}^4$ $W_{y,el}=490.00\text{ cm}^3$ $W_{y,pl}=583.20\text{ cm}^3$

Steel: $E=210000\text{ N/mm}^2$, $f_{yk}=275\text{ N/mm}^2$

Cross section class = 1 ('' $z=0.00$: $M_{yd}=132.94$, $N_y=0.00$

$\alpha=0.50$ $\epsilon_s=0.92$ $\psi=-1.00$; $c_s/s=19.67$; $c_t/t=4.96$)

Shear buckling of the web (w,b): $h_w/s/(72 \cdot \epsilon_s) = 195.00/9.00/72 \cdot 0.92 = 32.6\%$.

No further investg. req.

Buckling is not checked.

| | | |
|--|------------------|-------------------------------|
| Author: Ihre Firma können Sie in der Datei " angeben. | | Job No.: |
| Program: WALLS Dimensioning | | |
| Structure: info@fides-dvp.de | www.fides-dvp.de | Tel:++49/89/143829-0 ASB Nr.: |
| Date: 08.10.2018 | | |

Actions, Reactions:

Md: Design moment, action
 Nd: Design normal force, action
 Vd: Design shear force, action
 M,c,Rd: Design resistance for bending moment, without any reductions.
 M,cRd,red: Final design resistance for bending moment
 N,c,Rd: Design resistance for normal force component
 V,c,Rd: Design resistance for shear force
 Ed,MN,el: Design actions for elastic M and N interaction (M/W+N/A)
 Rd,MN,el: Design resistance for elastic M and N interaction
 Ed,V,el: Design actions for elastic shear stress (V/Av)
 Rd,V,el: Design resistance for elastic shear force

Utilizations:

X,pl: Plastic utilization, if applicable
 X,el: Elastic util. (only critical is plastic calculation is impossible)
 w,b: Shear-buckling of the web
 MN,bk: Buckling due to moment and normal force

| Md | Nd | Vd | [kN, m] | Utilization ratios[%] | | | | |
|----------|----------|---------|---------|-----------------------|------|------|-----|-------|
| M,c,Rd | McRd,red | N,c,Rd | V,c,Rd | M,pl | N,pl | V,pl | w,b | MN,bk |
| Ed,MN,el | Rd,MN,el | Ed,V,el | Rd,V,el | MN,el | V,el | | | |
| 132.94 | 0.00 | -147.71 | | | | | | |
| 160.38 | 160.38 | 2057.00 | 623.97 | 82.9 | 0.0 | 23.7 | --- | --- |
| 271.31 | 275.00 | 37.59 | 275.00 | 97.3 | 5.6 | | | |
| 0.00 | 0.00 | -147.71 | | | | | | |
| 160.38 | 160.38 | 2057.00 | 623.97 | 0.0 | 0.0 | 23.7 | --- | --- |
| 0.00 | 275.00 | 37.59 | 275.00 | 0.0 | 5.6 | | | |
| 0.00 | 0.00 | 147.71 | | | | | | |
| 160.38 | 160.38 | 2057.00 | 623.97 | 0.0 | 0.0 | 23.7 | --- | --- |
| 0.00 | 275.00 | 37.59 | 275.00 | 0.0 | 5.6 | | | |

Steel checks passed requirements.

Dimensioning of the Waling Num. 3 Level z= -5.50 m

Q_e
 $Q_e = 541.9 \text{ kN}$
 $at = 0.90 \text{ m}$
 $A = 812.8 \text{ kN}$
 $V_l = 0.0, V_r = 270.9 \text{ kN}$
 $M_a = 0.0 \text{ kNm}$
 $M_{feld} = 243.8 \text{ kNm}, Q_{feld} = -270.9 \text{ kNm}$
 $l_{s1} = 1.80 \text{ m}$

Load: single loads $P_e = 523.42 \text{ [kN]}$ every $at = 0.90 \text{ [m]}$
 Inclination: 15.00 [°]
 Loadfactor: 1.000 [-]
 Result. Q_e : $523.42 \cdot 1.000 / \cos(15.00) = 541.89 \text{ [kN]}$
 (even number, symmetrical to mid of the beam)
 All loads and forces are dimensioning values.

| | |
|---|--------------|
| Part: | Archive No.: |
| Block: Please specify project informations. | Page: 3 |
| Record: | |

```
Stat. system ...: Single span beam:  span ls1= 1.80 [m]
                                     lk = 0.00 [m] (left)
                                     lk = 0.00 [m] (right)
```

| | |
|----------------------------|------------------|
| Internal Forces.: Support: | A = 812.83 [kN] |
| | Vl= 0.00 [kN] |
| | Vr= 270.94 [kN] |
| | Ma= 0.00 [kNm] |
| Field: | Mf= 243.85 [kNm] |
| | Vf=-270.94 [kN] |

Normal Force N = 0.00 [kN]

Dimensioning Code: EN 1993 (EC 3)

Safety factors:

gamma,M0: 1.00, gamma,M1: 1.10

Steel cross section: (all values are per profile/s)

Distance of beams = 1.00 m

Cross section = 2 x U 280

A: 107.00 cm2 Iy: 12560.00 cm4 Wy,el: 896.00 cm3 Wy,pl: 1064.36 cm3

Steel: $E = 210000 \text{ N/mm}^2$, $f_{yk} = 275 \text{ N/mm}^2$

Cross section class = 1 ('' z=0.00: Myd=243.85, Nv=0.00

```
alpha=0.50 eps=0.92 psi=-1.00; cs/s=23.00; ct/t=5.00)
```

Shear buckling of the web (w,b): $hw/s/(72*\epsilon_s) = 250.00/10.00/72*0.92 = 37.6 \%$.

No further investg. req.

Buckling is not checked.

Actions, Reactions:

Md: Design moment, action

Nd: Design normal force, action

Vd: Design shear force, action

M_{c,Rd}: Design resistance for bending moment, without any reductions.

$M_{cRd,red}$: Final design resistance for bending moment

N,c,Rd: Design resistance for normal force component

V,c,Rd: Design resistance for shear force

Ed,MN,el: Design actions for elastic M and N interaction (M/W+N/A)

Rd,MN,el: Design resistance for elastic M and N interaction

Ed,V,el: Design actions for elastic shear stress (V/A_v)

Rd,V,el: Design resistance for elastic shear force

Utilizations:

X,pl: Plastic utilization, if applicable

X,el: Elastic util. (only critical is plastic calculation is impossible)

w, b : Shear-buckling of the web

MN,bk: Buckling due to moment and normal force

| | | | | Utilization ratios[%] | | | | |
|----------|----------|---------|---------|-----------------------|------|------|-----|-------|
| Md | Nd | Vd | [kN, m] | | | | | |
| M,c,Rd | McRd,red | N,c,Rd | V,c,Rd | M,pl | N,pl | V,pl | w,b | MN,bk |
| Ed,MN,eI | Rd,MN,eI | Ed,V,eI | Rd,V,eI | MN,eI | V,eI | | | |
| 243.85 | 0.00 | -270.94 | | | | | | |
| 292.70 | 292.70 | 2942.50 | 889.12 | 83.3 | 0.0 | 30.5 | --- | --- |
| 272.15 | 275.00 | 48.38 | 275.00 | 97.9 | 9.3 | | | |
| 0.00 | 0.00 | -270.94 | | | | | | |
| 292.70 | 292.70 | 2942.50 | 889.12 | 0.0 | 0.0 | 30.5 | --- | --- |
| 0.00 | 275.00 | 48.38 | 275.00 | 0.0 | 9.3 | | | |
| 0.00 | 0.00 | 270.94 | | | | | | |
| 292.70 | 292.70 | 2942.50 | 889.12 | 0.0 | 0.0 | 30.5 | --- | --- |
| 0.00 | 275.00 | 48.38 | 275.00 | 0.0 | 9.3 | | | |

| | | | | |
|--|-------------------|------------------|----------------------|------------------|
| Author: Ihre Firma können Sie in der Datei " angeben. | | | | Job No.: |
| Program: WALLS Dimensioning | | | | |
| Structure: | info@fides-dvp.de | www.fides-dvp.de | Tel:++49/89/143829-0 | ASB Nr.: |
| | | | | Date: 08.10.2018 |
| <p>Steel checks passed requirements.</p> | | | | |
| Part: | | | | Archive No.: |
| Block: Please specify project informations. | | | | |
| Record: | | | | |
| Page: 5 | | | | |