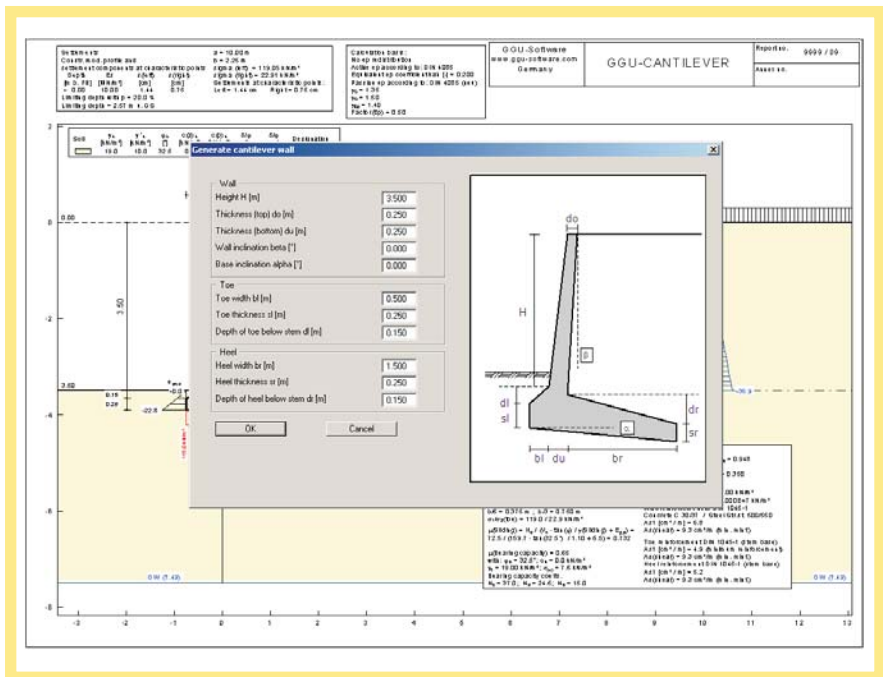
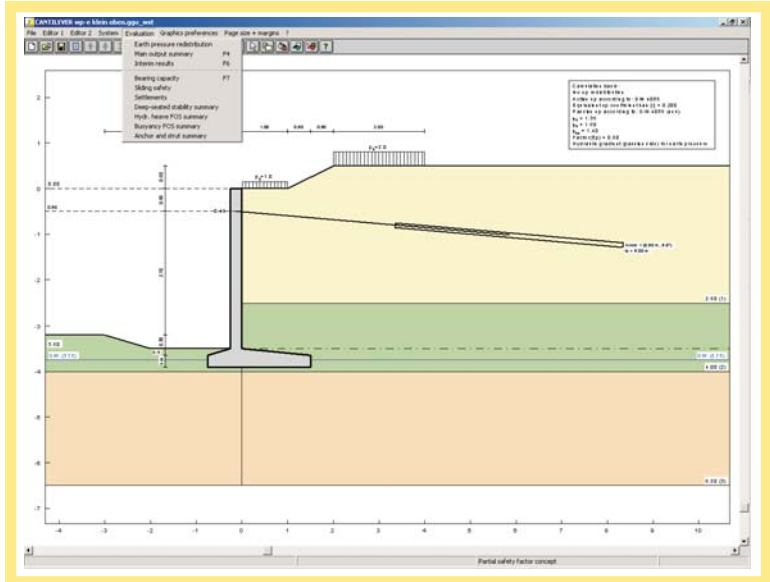


Description

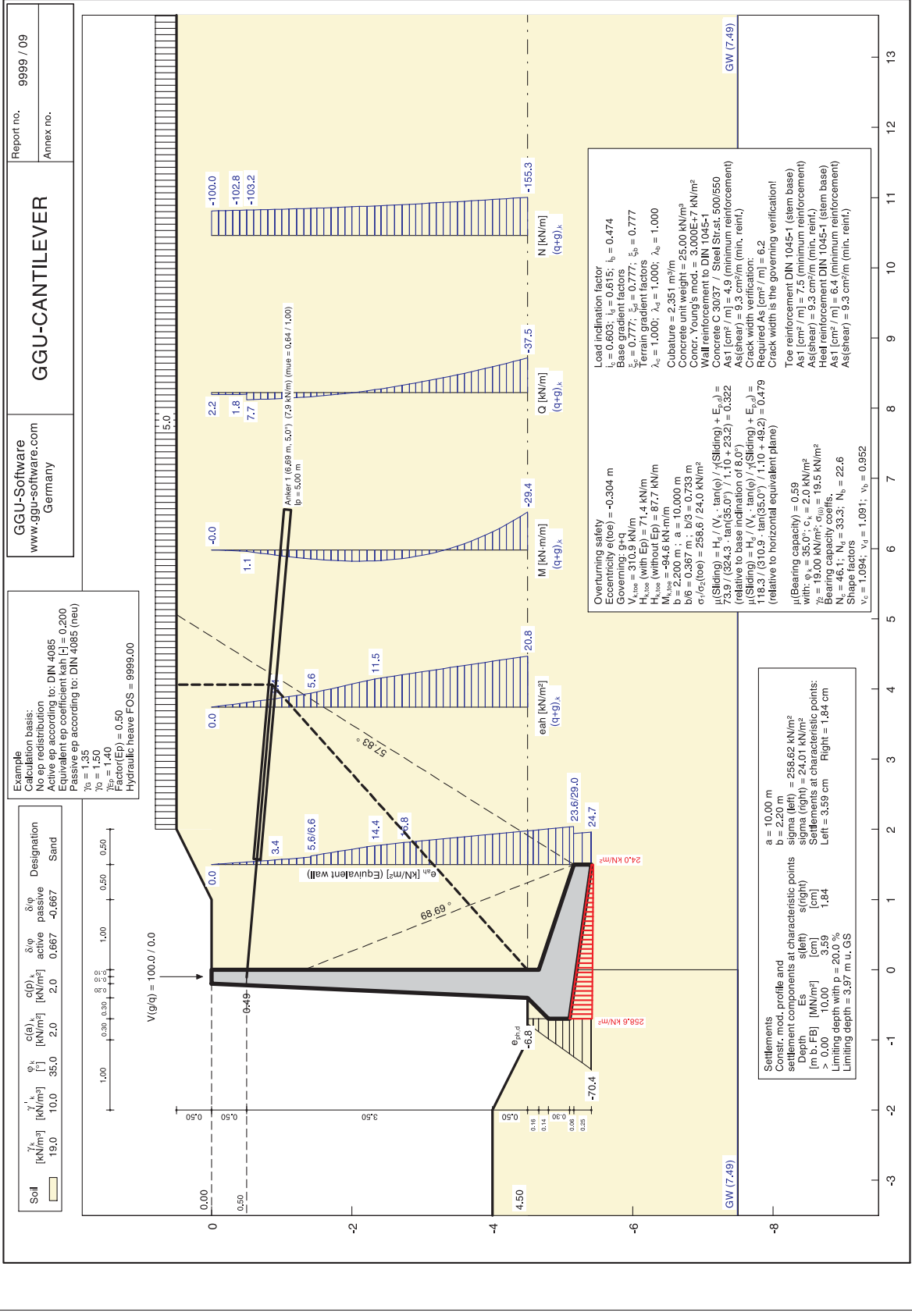
GGU-CANTILEVER - Analysis and design of cantilever walls using global and partial safety factor concepts. Among other things, the program simplifies optimisation of spur width and reinforced concrete design.

Capabilities:

- System input using absolute heights
- Berms on the active and passive sides
- Bounded and double-bounded surcharges on active and passive sides
- Analysis using active earth pressure, at-rest earth pressure or increased active earth pressure
- Active earth pressure coefficients to DIN 4085 or user-defined values
- Passive earth pressure coefficients to DIN 4085 (new), Streck, Caquot/Kerisel, DIN 4085 (old) or user-defined values
- Choice of hydraulic gradient consideration on active and the passive sides
- Analysis of overall system stability (sliding, overturning, bearing capacity)
- Analysis of hydraulic heave safety and buoyancy safety
- Examines bearing capacity 5° condition to DIN 4017
- Settlement analysis to DIN 4019
- Limiting depth analysis using p % of overburden stress, a multiple of footing width b' or a fixed value
- Consideration of anchors and struts
- Deep-seated stability analysis with optimisation of anchor lengths
- Reinforced concrete design to DIN 1045
- Crack width analysis to DIN 1045
- Anchor steel design
- Input of action and displacement boundary conditions and much more
- Choice of earth pressure redistributions (among others to EAB 1988 or EAB 2006)
- Choice of result visualisations, among others for earth pressure on equivalent wall, water pressure, moments, shear force, normal force, displacement, soil pressure, settlements
- Consideration of pre-stresses and pre-deformations
- Consideration of seismic loads
- Interface to the GGU-STABILITY program (slope failure analyses)



- User-designed output sheet
- Copy screen sections, e.g. for transfer to a word processor
- Mini-CAD system for additional annotation of graphics



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Annex no.

GGU-Software
www.ggu-software.com
Germany

GGU-CANTILEVER

Example
Calculation basis:
No ep redistribution to: DIN 4085
Active ep according to: DIN 4085
Equivalent ep coefficient $k_{ah}(\alpha) = 0.200$
Passive ep according to: DIN 4085 (neu)
 $\gamma_{so} = 1.35$
 $\gamma_{sp} = 1.50$
 $\gamma_{ep} = 1.40$
Reduction (ES) = 0.50
Hydraulic heave FOS = 9999.00

Soil	γ'_{so} [kN/m ³]	γ'_{sp} [kN/m ³]	ϕ'_{so} [°]	$c(\alpha)_{so}$ [kN/m ²]	$c(\alpha)_{sp}$ [kN/m ²]	δ'_{so} active	δ'_{sp} passive	Designation
	19.0	10.0	35.0	2.0	2.0	0.667	-0.667	Sand

Overturning safety
Eccentricity e(toe) = -0.304 m
Governing: q+q
 $V_{A, toe} = 310.9$ kN/m
 $H_{A, toe} = 71.4$ kN/m
 $H_{A, toe}$ (without Ep) = 87.7 kN/m
 $M_{A, toe} = -94.6$ kN·m/m
 $b_{1/6} = 0.36$ m; $a = 5.9$; 0.713 m
 $\sigma_1/\sigma_2(toe) = 258.6 / 24.0$ kN/m²
 $\mu(\text{Sliding}) = H_A / (V_A \cdot \tan(\phi') + E_{p, act}) = 73.9 / (324.3 \cdot \tan(35.0^\circ) + 110 + 23.2) = 0.322$
 $\mu(\text{Sliding}) = H_A / (V_A \cdot \tan(\phi') + E_{p, act}) = 118.3 / (310.9 \cdot \tan(35.0^\circ) + 110 + 49.2) = 0.479$
(relative to horizontal equivalent plane)
 $\mu(\text{Bearing capacity}) = 0.59$
with: $\phi_k = 35.0^\circ$; $c_k = 2.0$ kN/m²
 $\gamma_k = 19.00$ kN/m³; $\sigma_{1, km} = 19.5$ kN/m²
Bearing capacity coeffs.
 $N_k = 46.1$; $N_b = 33.3$; $N_d = 22.6$
Shape factors
 $V_d = 1.094$; $V_d = 1.091$; $V_b = 0.952$

Load inclination factor
 $i_s = 0.603$; $i_b = 0.615$; $i_h = 0.474$
Base gradient factors
 $s_{sp} = 0.777$; $s_{sp} = 0.777$; $s_b = 0.777$
Terrain gradient factors
 $A_s = 1.000$; $A_d = 1.000$; $A_b = 1.000$
Cubature = 2.351 m³/m
Concrete unit weight = 25.00 kN/m³
Concr. Young's mod. = 3.000E+7 kN/m²
Wall reinforcement to: DIN 1045-1
Concrete C 30/37 / Steel Str.st. 500/550
As1 [cm²/m] = 4.9 (minimum reinforcement)
Crack width verification (min. reinf.)
Required As [cm²/m] = 6.2
Crack width is the governing verification!
Too reinforcement: DIN 1045-1 (stem base)
As1 [cm²/m] = 3.2 (minimum reinforcement)
As2 [cm²/m] = 3.2 (min. reinf.)
Heat reinforcement DIN 1045-1 (stem base)
As1 [cm²/m] = 6.4 (minimum reinforcement)
As2 [cm²/m] = 9.3 (min. reinf.)

Settlements
Constr. mod. profile and settlement components at characteristic points
Depth [m below] ES s(left) s(right)
[m below] [m] [cm] [cm]
Limiting depth with $p = 20.0$ %
Limiting depth = 3.97 m u, GS

a = 10.00 m
b = 2.20 m
sigma (left) = 258.62 kN/m²
sigma (right) = 24.01 kN/m²
Settlements at characteristic points:
Left = 3.59 cm Right = 1.94 cm