CONSTRUCT

U.PORTO

FEUP FACULDADE DE ENGENHARIA UNIVERSIDADE DO PORTO

NUMERICAL MODELING OF THE NONLINEAR BEHAVIOR OF REINFORCED CONCRETE STRUCTURES USED TO SUPPORT DEEP URBAN EXCAVATIONS.

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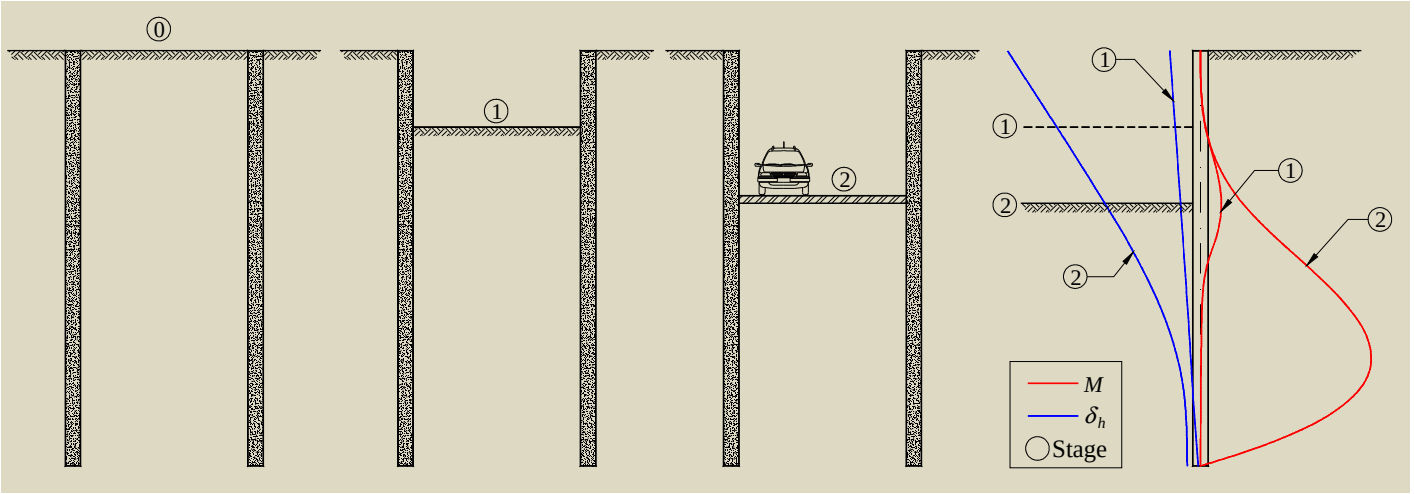
(PhD year 3)

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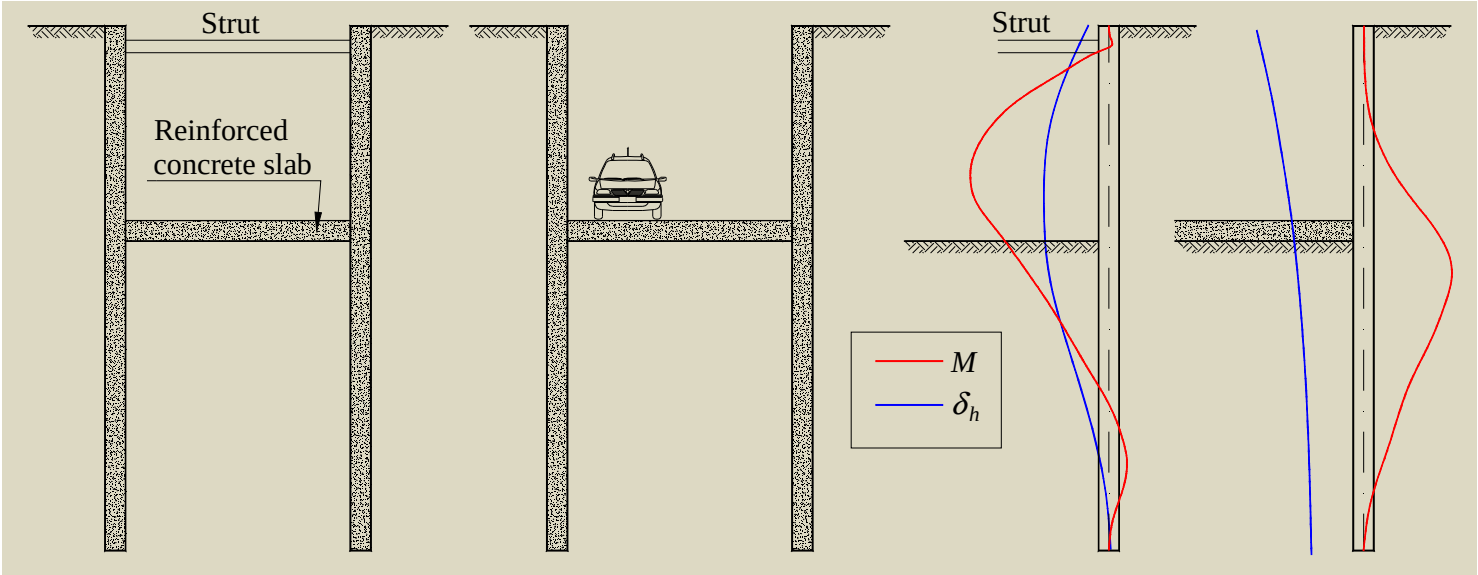
1 – MOTIVATION / OBJECTIVES

Cantiliver retaining wall





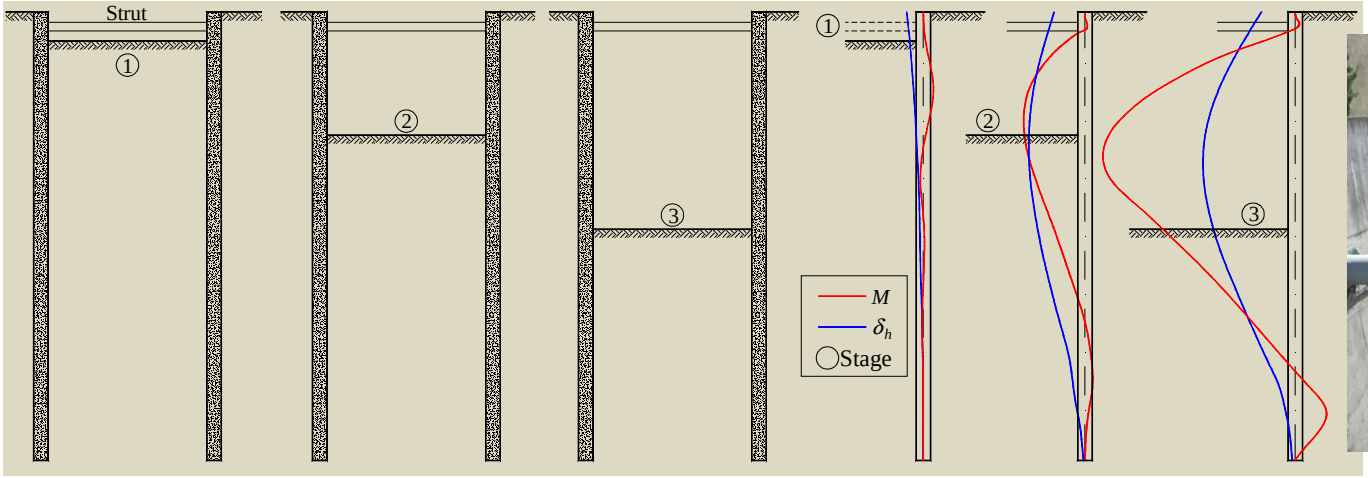
Cantiliver retaining wall in final stage and temporary support



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1 – MOTIVATION / OBJECTIVES

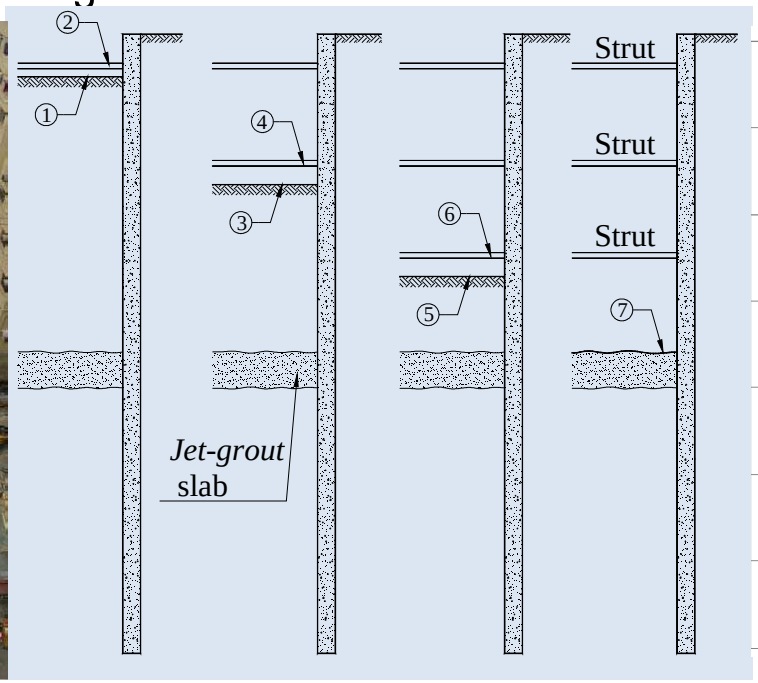
Single propped retaining walls

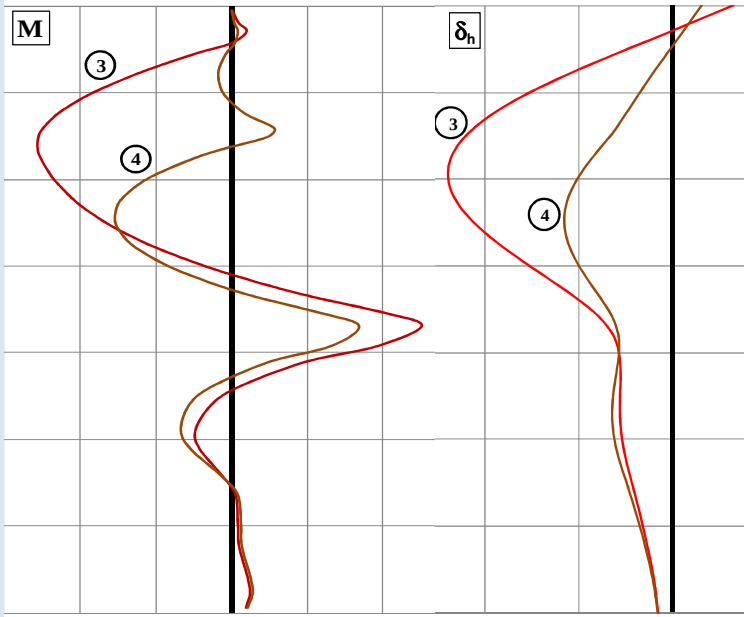




Multi-supported retaining walls





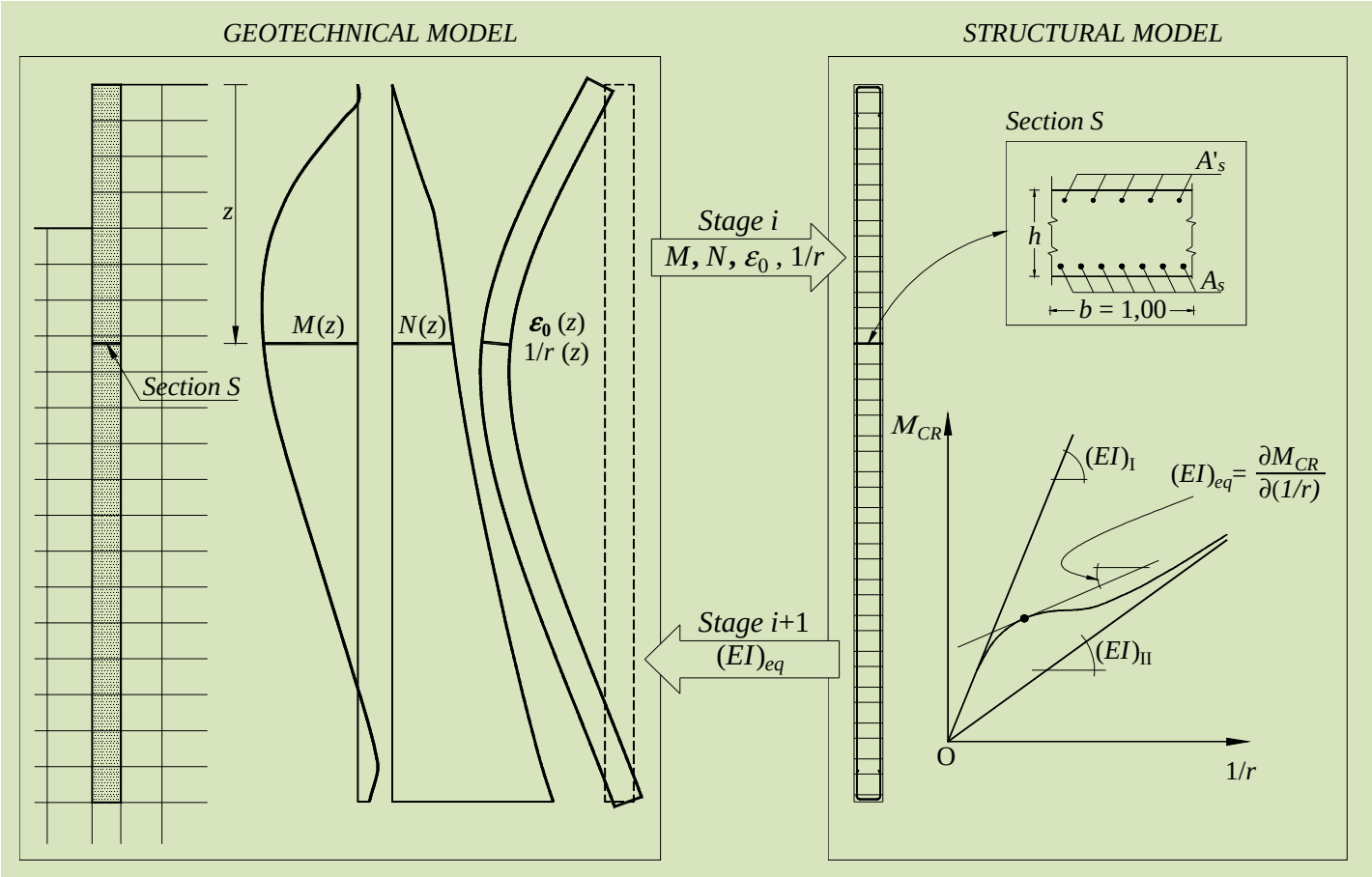


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2 – TASKS - MODEL

The interaction between the retaining wall of a deep excavation and the supported soil follows complex laws, depending on the restrain conditions, the excavation sequence and the ground properties.

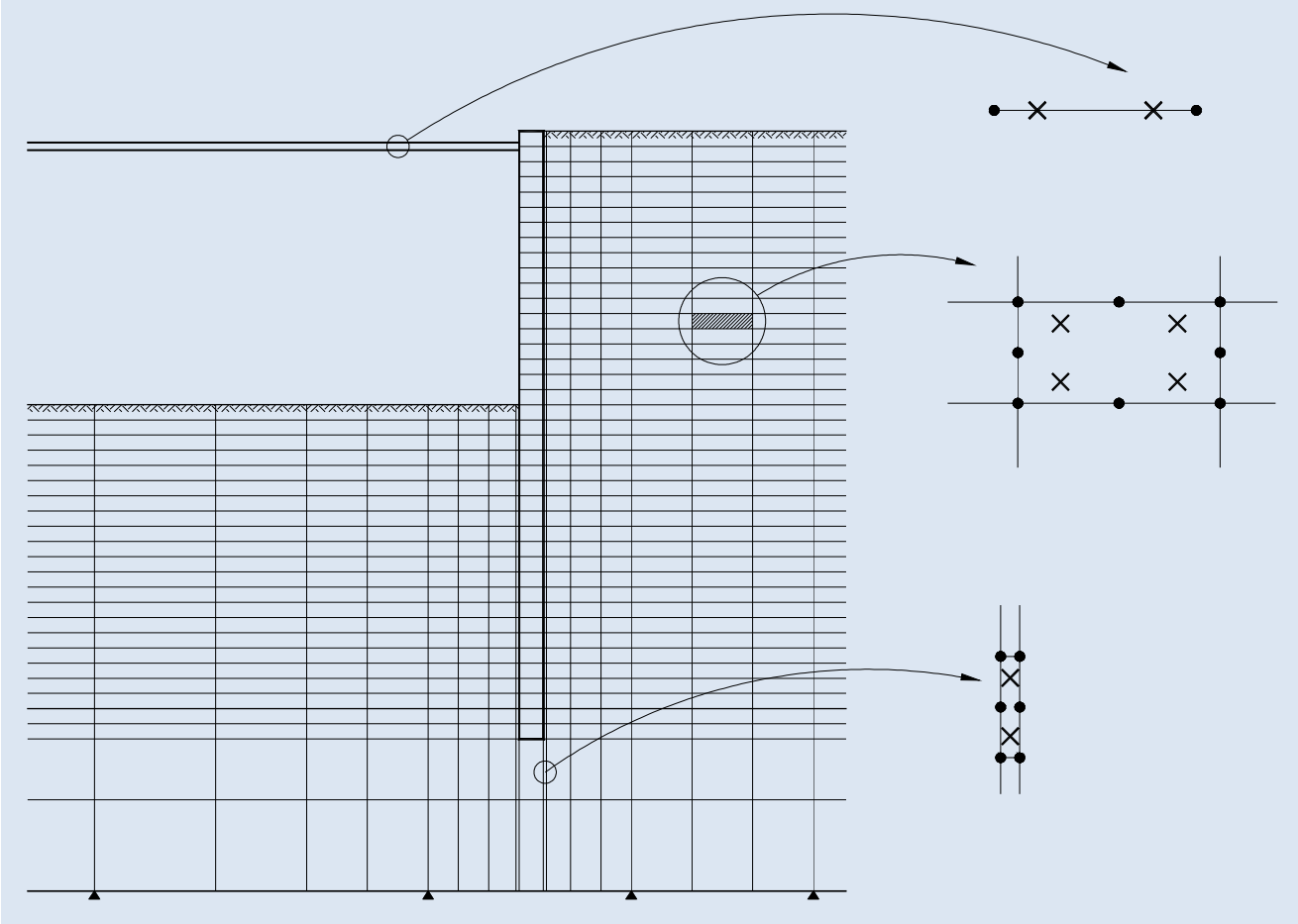
Coupling of two automatic calculation programs: one based on finite element method for geotechnical analysis with elastoplastics soil behavior models; and the other, the structural program based on the method of fibers for analysis of reinforced concrete sections.



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2 – TASKS – GEOTECHNICAL MODEL

Finite element method for geotechnical analysis



-von Mises yield criterion

-Tresca yield criterion

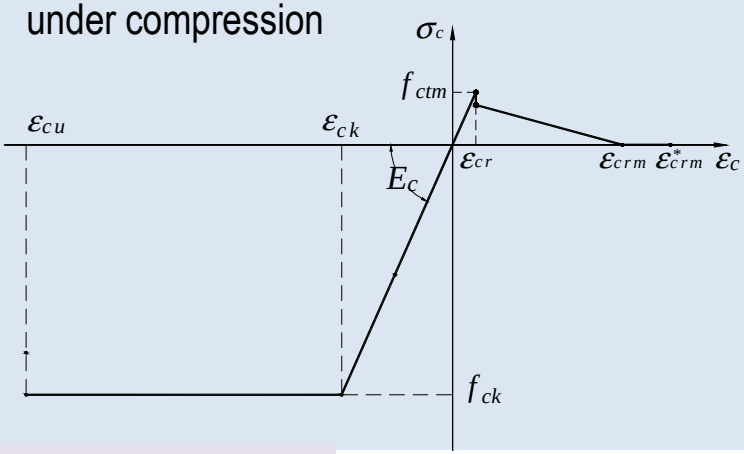
-Mohr–coulomb yield criterion

(...)

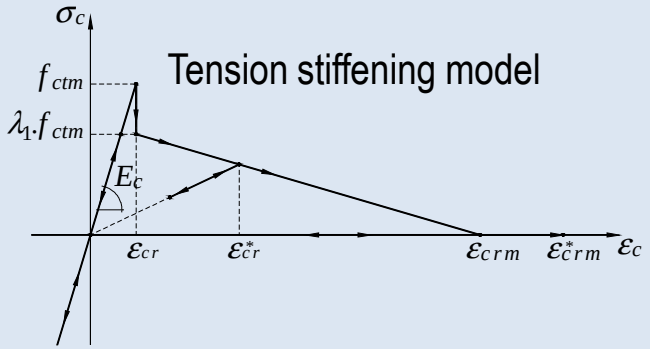
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2 – TASKS - STRUCTURAL MODEL

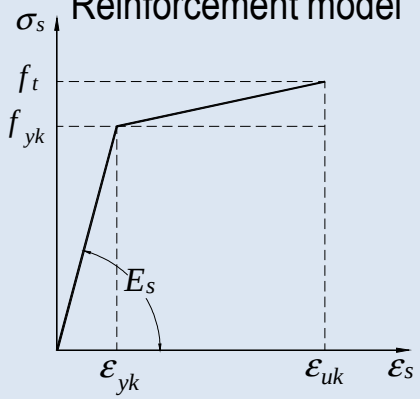
Concrete stress-strain model under compression

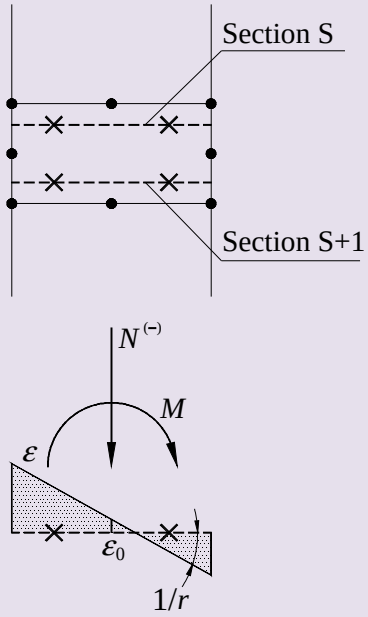


Tension stiffening model

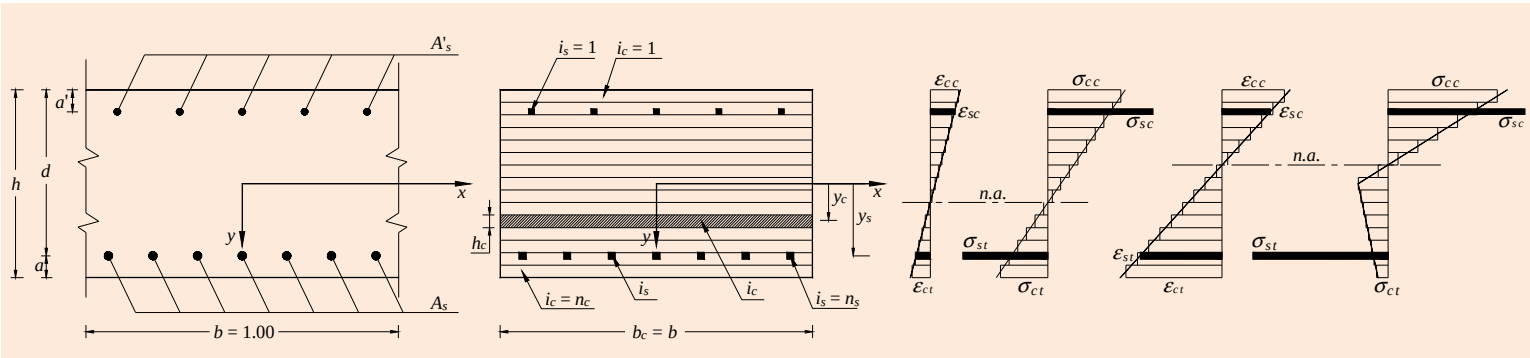


Reinforcement model





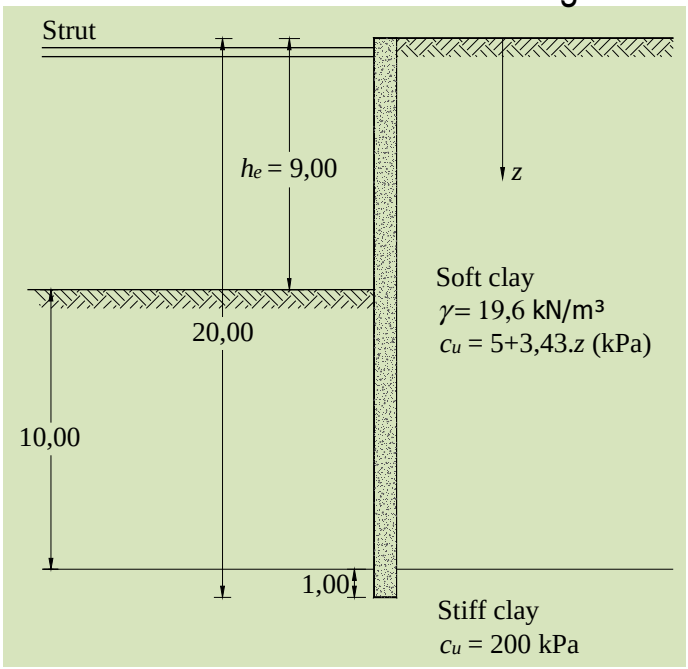
Method of fibers for analysis of reinforced concrete sections.
Reduced tensile strength (concrete) and the inevitable cracking.

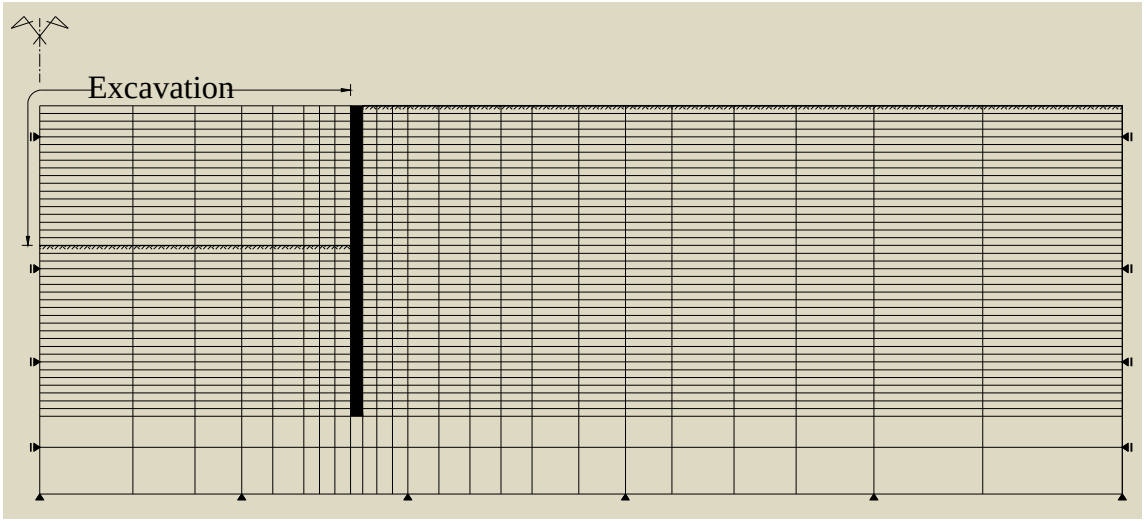


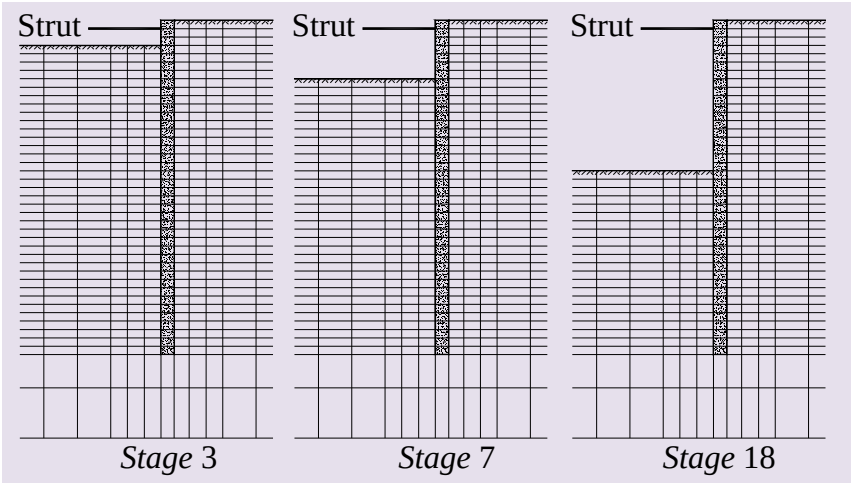
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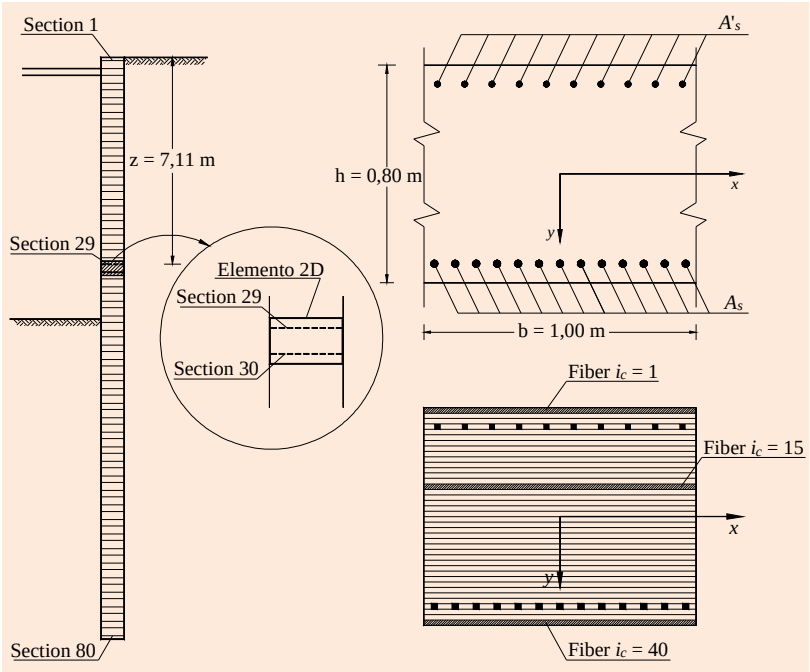
3 – RELEVANT RESULTS (WORKED EXAMPLE)

Reinforced concrete retaining wall



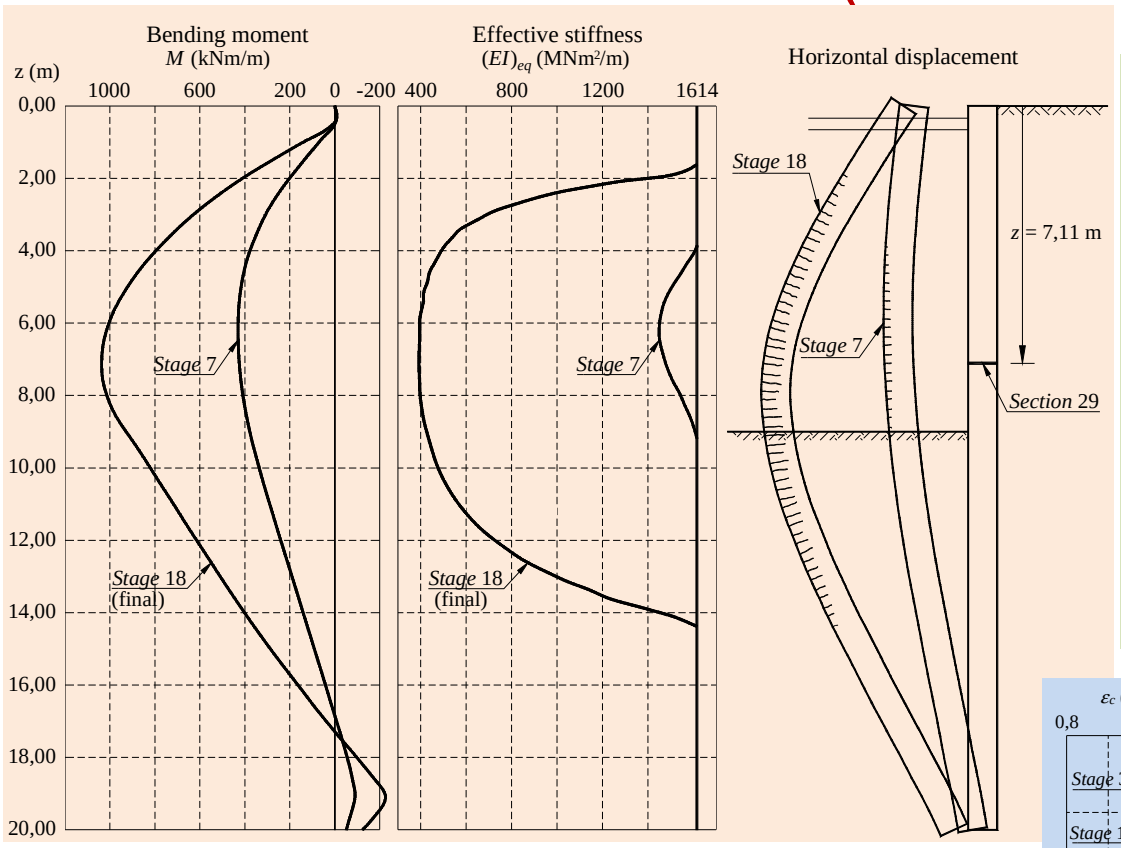


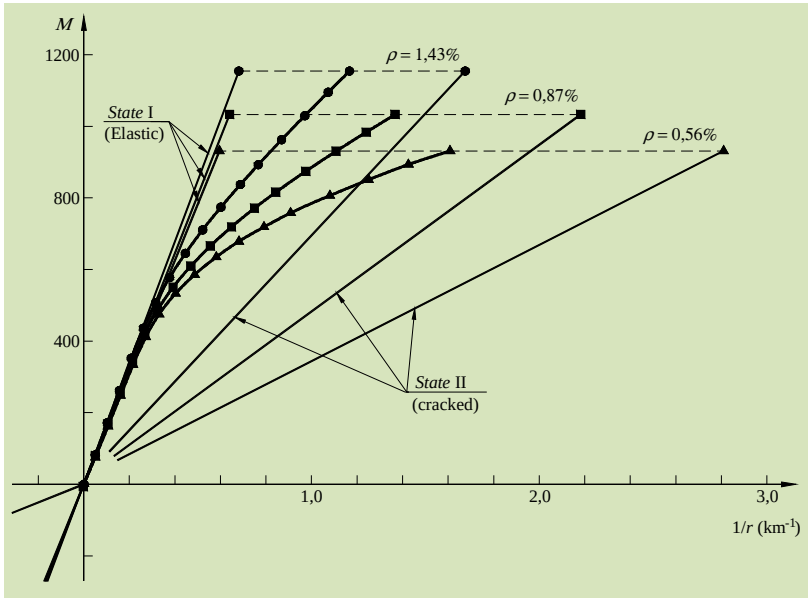


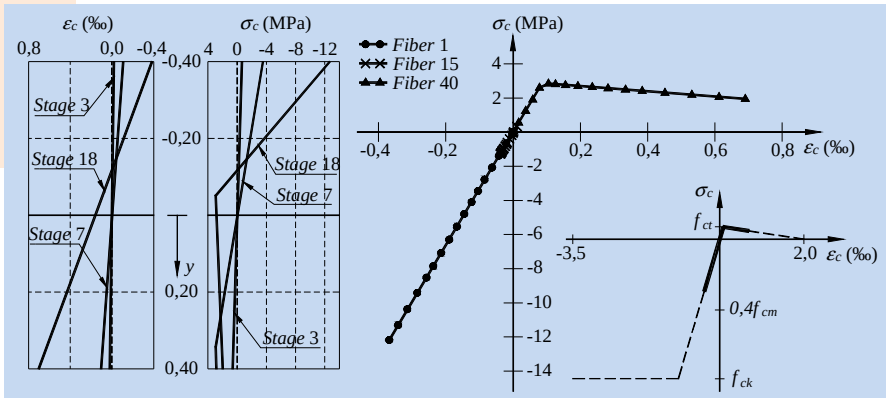


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3 – RELEVANT RESULTS (WORKED EXAMPLE)



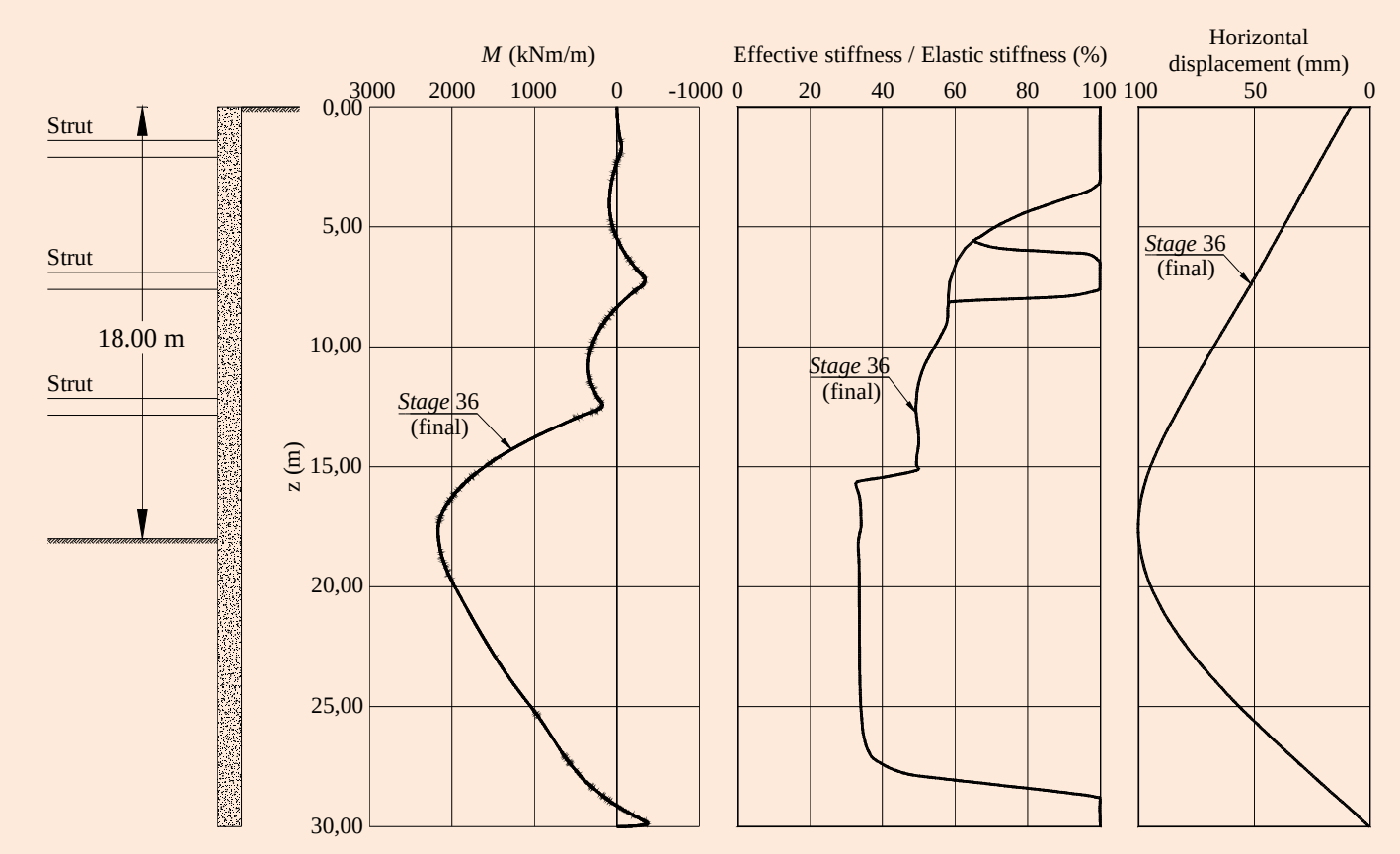




Condition		$\rho = A_s/(bd)$ (%)	EI_0 (MNm²/m)	M_{max} (+) (kNm/m)	M_{max} (-) (kNm/m)	Def. (mm)	EI_{eq}/EI_0 (%)
NL	E_c "+" E_s	0,87	1614	1035	222	54	25
NL	E_c "+" E_s	0,56	1565	934	231	57	16
NL	E_c "+" E_s	1,43	1696	1156	212	52	37
Elastic	E_c "+" E_s	0,87	1614	1414	195	48	
Elastic	50%E_c "+" E_s	0,87	908	1084	230	54	
Elastic	50%E_c	–	704	966	236	57	

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3 – RELEVANT RESULTS (WORKED EXAMPLE)



4 – CONCLUSIONS

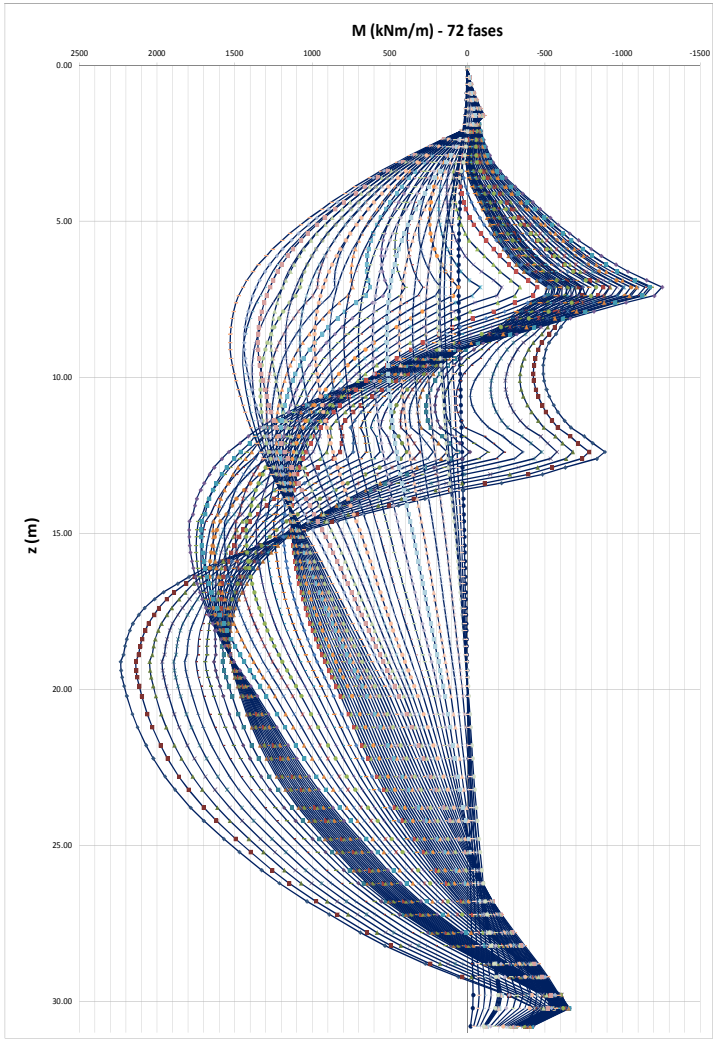
-Diaphragm walls or slurry trench walls with anchor or strut support

-Pile walls (contiguous,secant) with anchor or strut support

-Jet-grout walls (or deep/cutter soil mixing)

-Elastic analysis

-Nonlinear analysis



THANKS!