

Dzelzsbetona elementu aprēķini, izmantojot IDEA StatiCa Detail

- IDEA STATICA DZ-BETONA APRĒĶINIEM
- TEORIJA (IDEA STATICA DETAIL)
- APRĒĶINU PIEMĒRI
- DATU IMPORTĒŠANA



DETAIL



RCS



BEAM



COLUMN



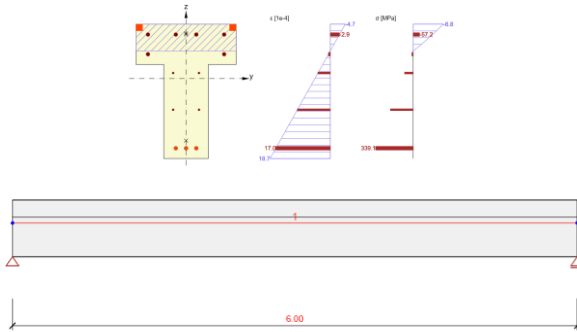
FRAME



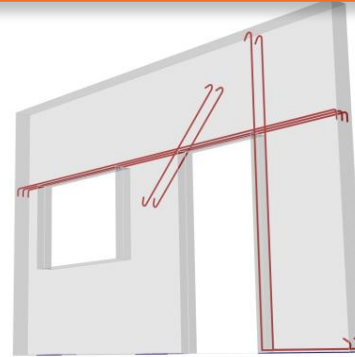
CORBEL

IDEA STATICA MONOLĪTAJAM DZ-BETONAM

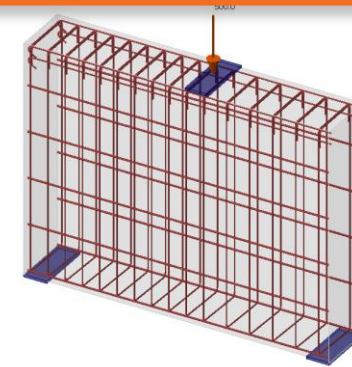
Sijas



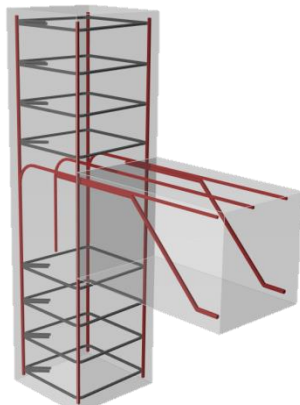
Sienas



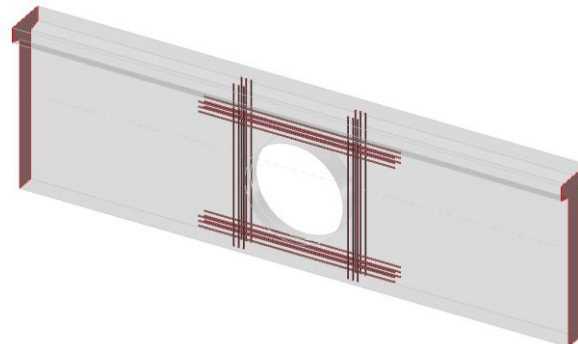
Sijas ar lielu augstumu



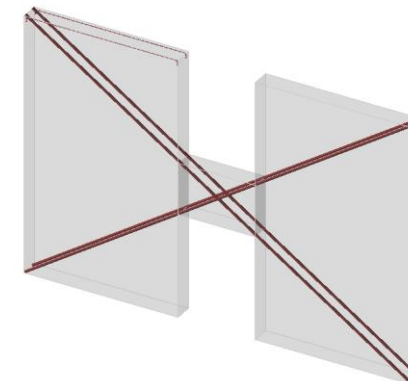
Mezgli



Atvērumi

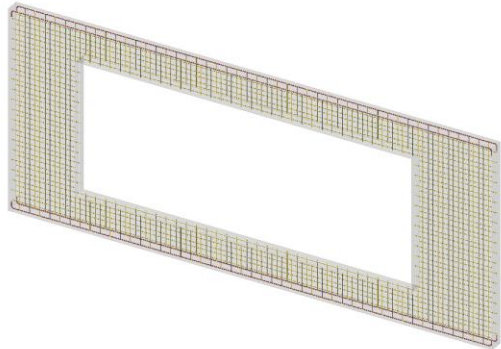


Nestandarta elementi

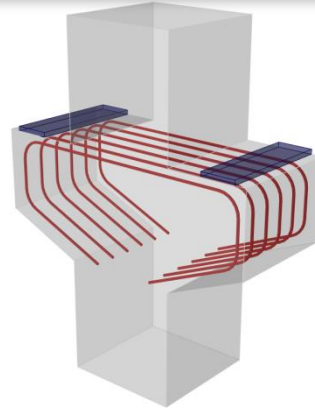


IDEA STATICA SALIEKAMAJAM DZ-BETONAM

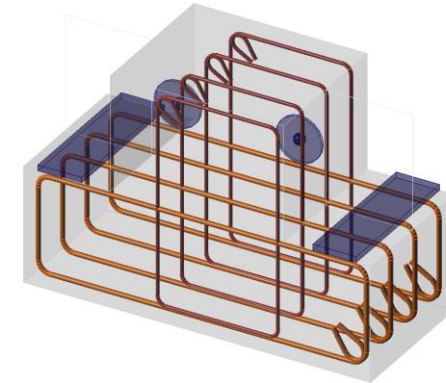
Sienas



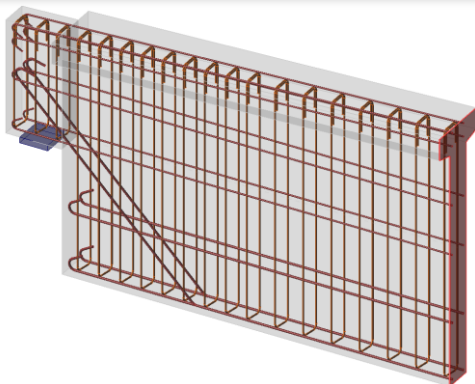
Konsoles



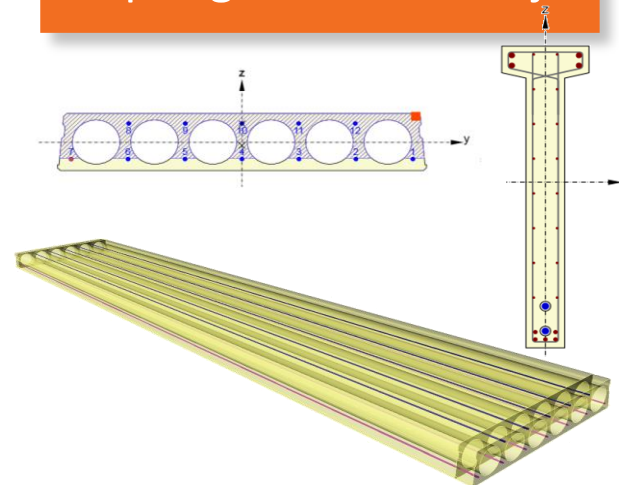
T un L veida sijas



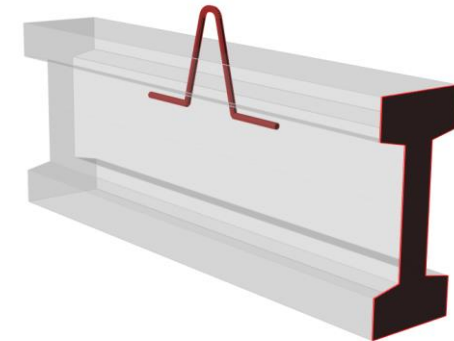
Nestandarta sijas



Saspriegtās konstrukcijas

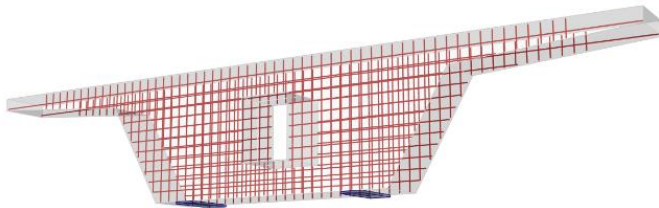


Pacelšanas elementi

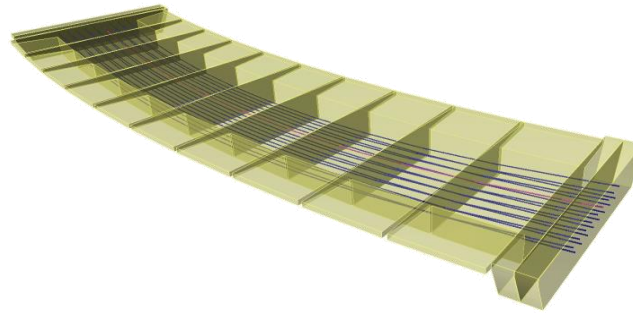


IDEA STATICA TILTU PROJEKTĒŠANĀ

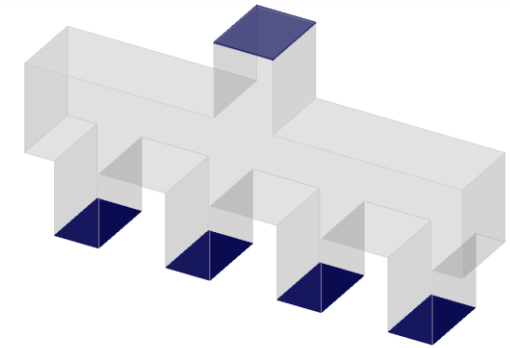
Diafragmas



Laidumi



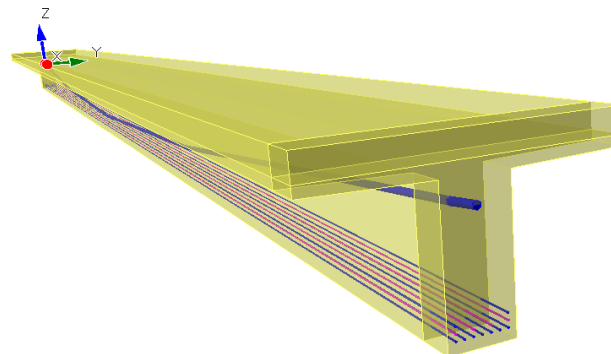
Pāļi un režģogi



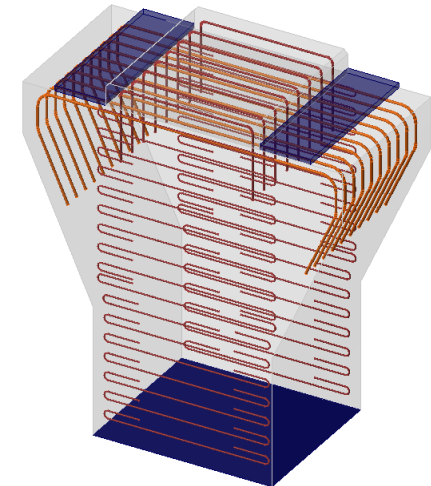
Sijas



Kopozītas sijas

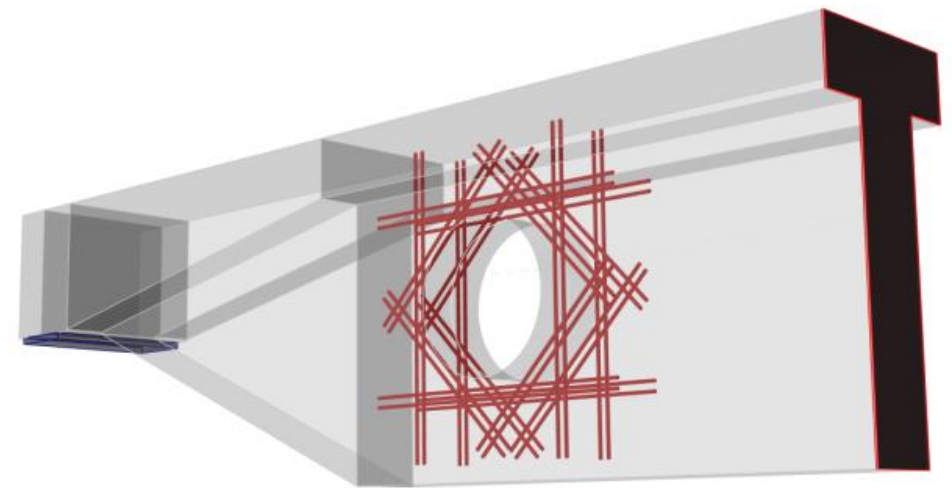
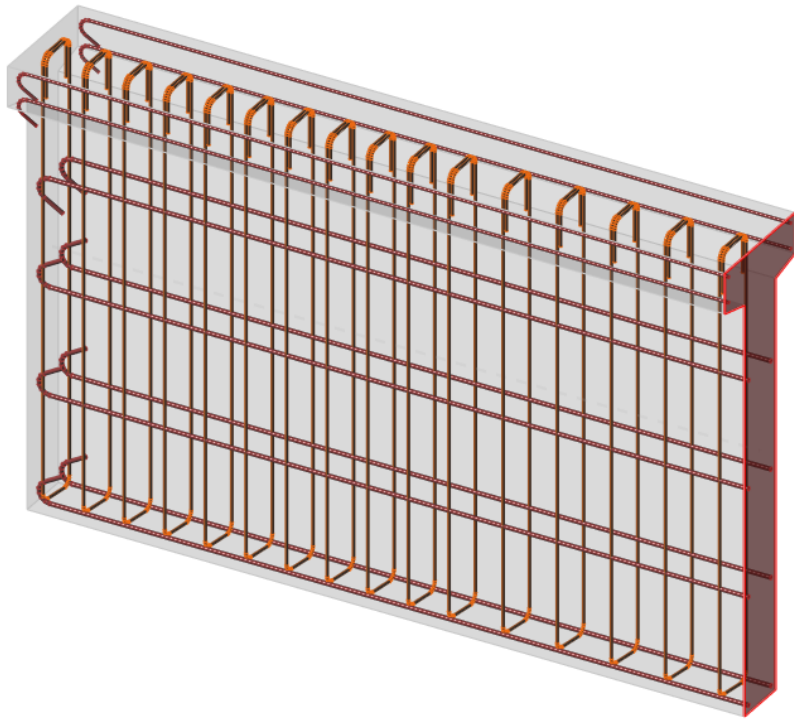


Balsti



VIENKĀRŠA SITUĀCIJA

SAREŽĢĪTA SITUĀCIJA



VIENKĀRŠA SITUĀCIJA

Standarti, rokasgrāmatas

SAREŽĢĪTA SITUĀCIJA

Sarežģīti FEM modeļi



Excel



Pieņēmumi



Izvairīties no sarežģīta
risinājuma(?)

ELEMENTU SKAITS

PATĒRĒTAIS LAIKS

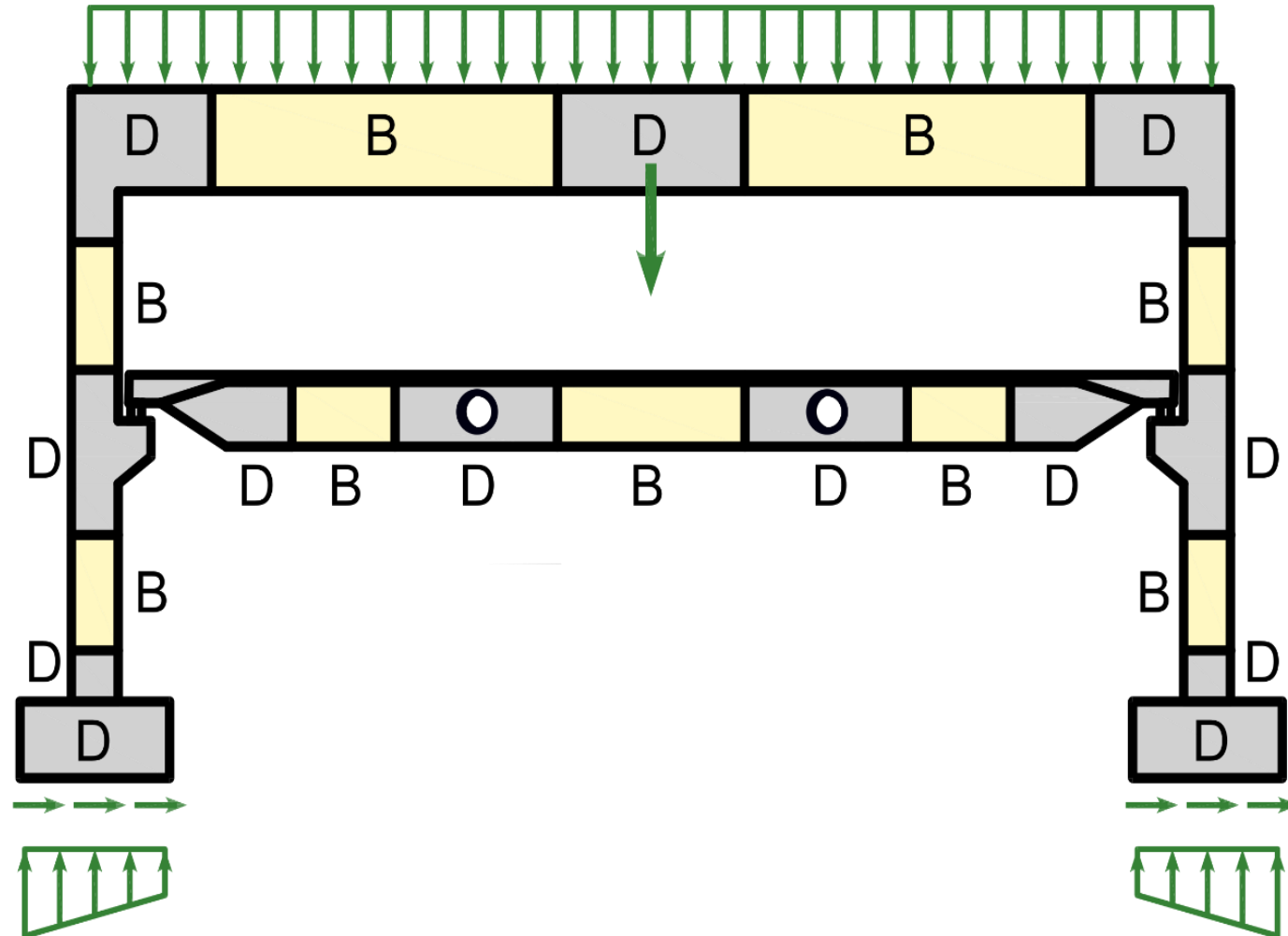
30 %
SAREŽĪTA
SITUĀCIJA

70 %
VIENKĀRŠA
SITUĀCIJA

30 %
VIENKĀRŠA
SITUĀCIJA

70 %
SAREŽĪTA
SITUĀCIJA

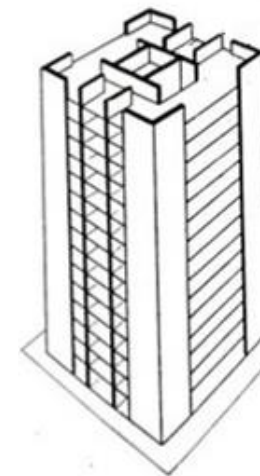
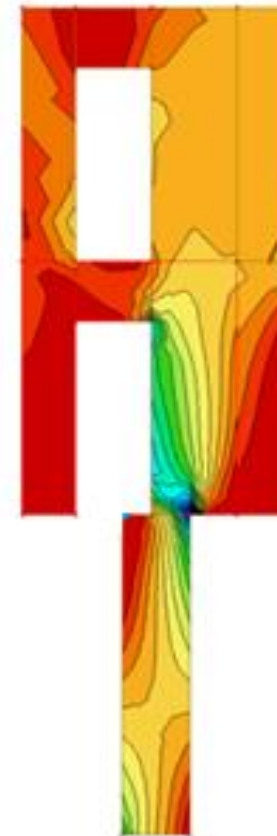
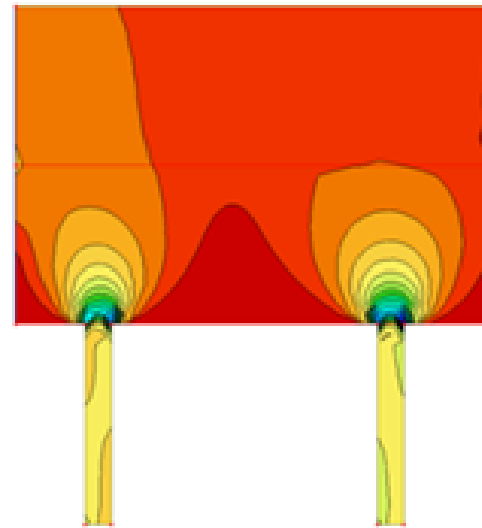
DISCONTINUITY REGIONS



SALIEKAMĀ DZ-BETONA SIENAS

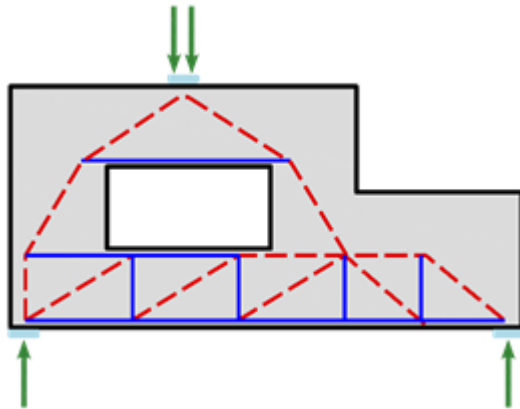


SALIEKAMĀ DZ-BETONA SIENAS



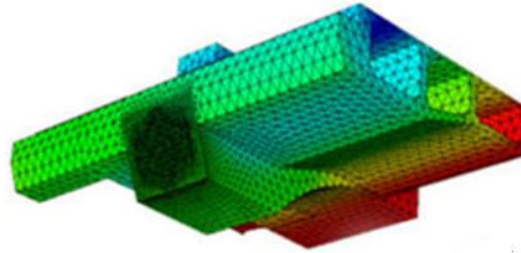
APRĒĶINU METODES

Stiepto – spiesto
stieņu metode



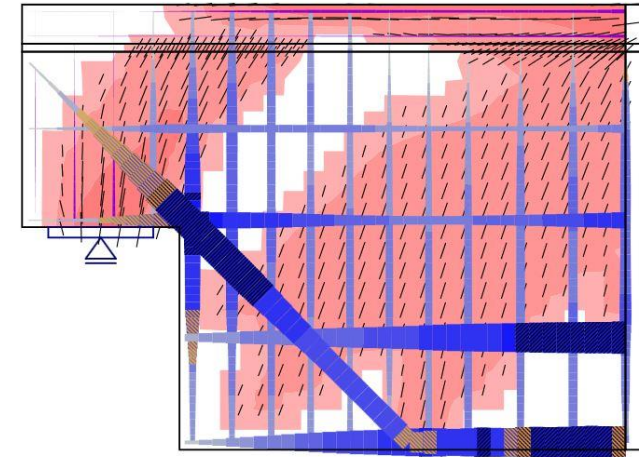
Situācija tiek
vienkāršota

Sarežģīti FEM
modeļi



Mēģinājums simulēt
realitāti

IDEA StatiCa



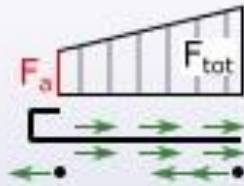
Standartos balstīts drošs un
ekonomisks projekts

CSFM – COMPATIBLE STRESS FIELD METHOD

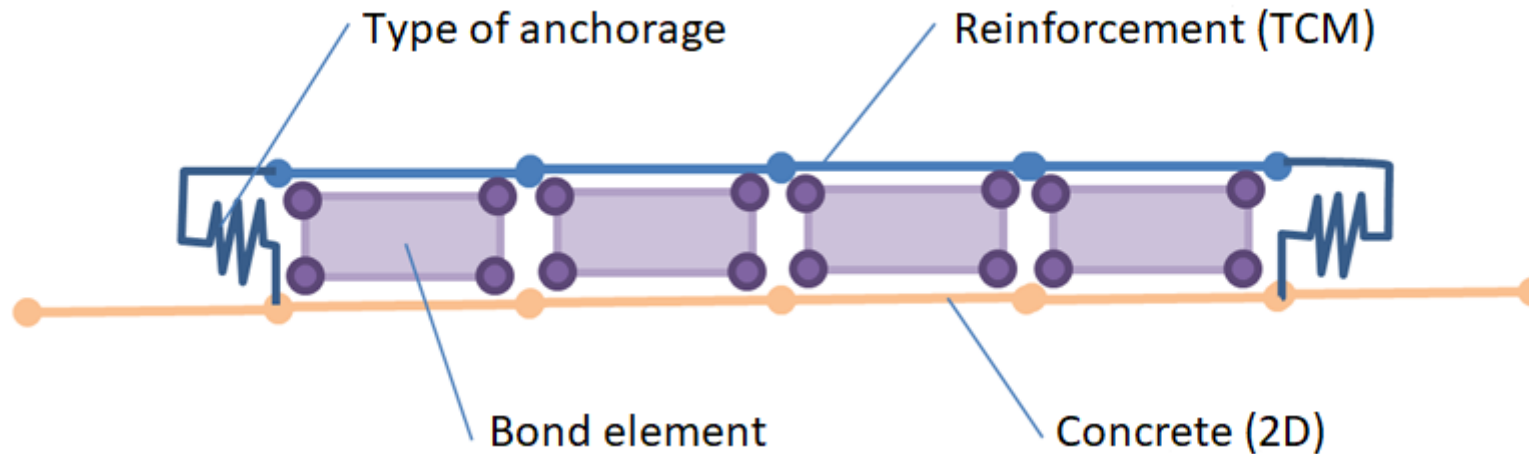
- ĻĀUJ PROJEKTĒT DROŠAS UN EKONOMISKAS KONSTRUKCIJAS.
- MATERIĀLU ĪPAŠĪBAS ATBILSTOŠI EIROKODAM.
- APRĒĶINA MODELIS SASTĀV NO BETONA UN STIEGROJUMA GALĪGAJIEM ELEMENTIEM.
- METODE VERIFICĒTA UN VALIDĒTA ETH UNIVERSITĀTĒ CĪRIHĒ

ENKUROŠANĀS UN SAISTE STARP BETONU UN STIEGROJUMU

Anchorage force



The anchorage force is displayed and for applied portion of the load. It is developed at the ends of the bars due to hooked anchorage.

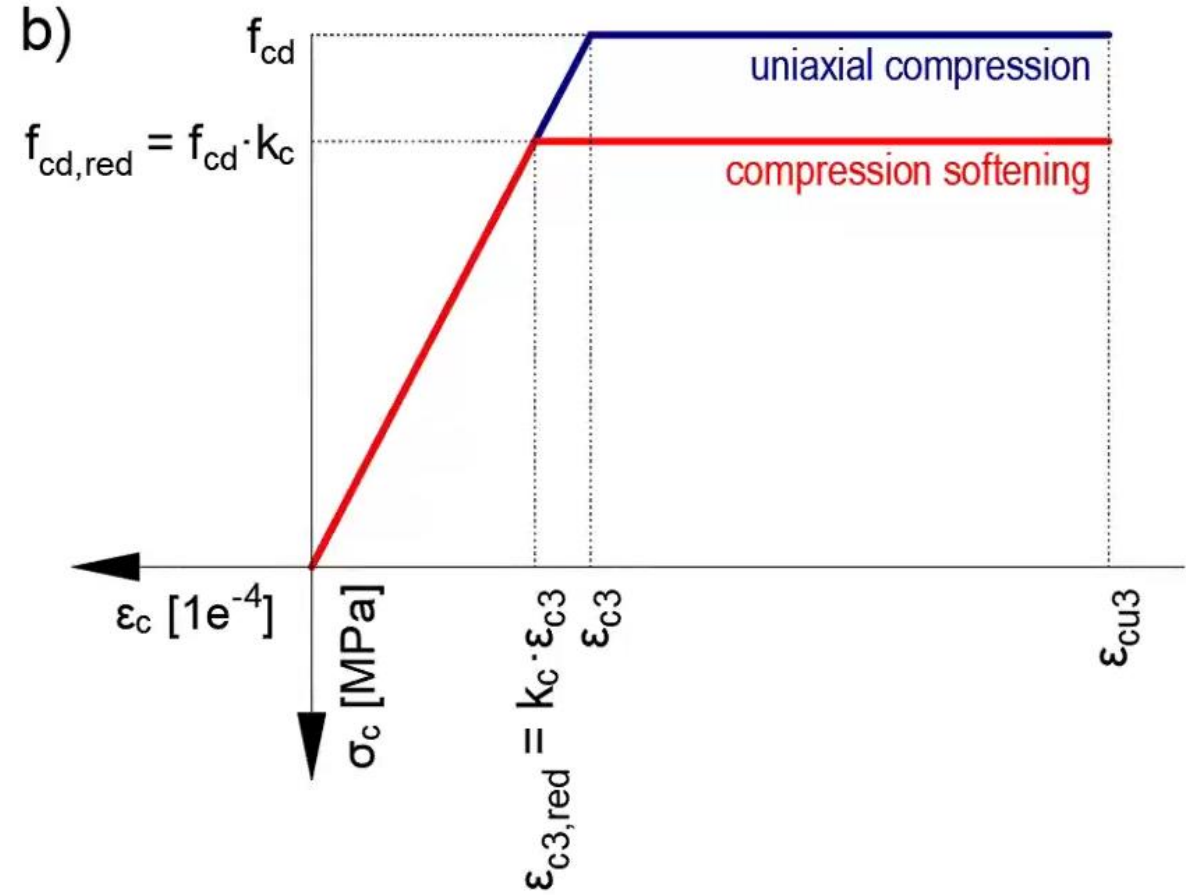
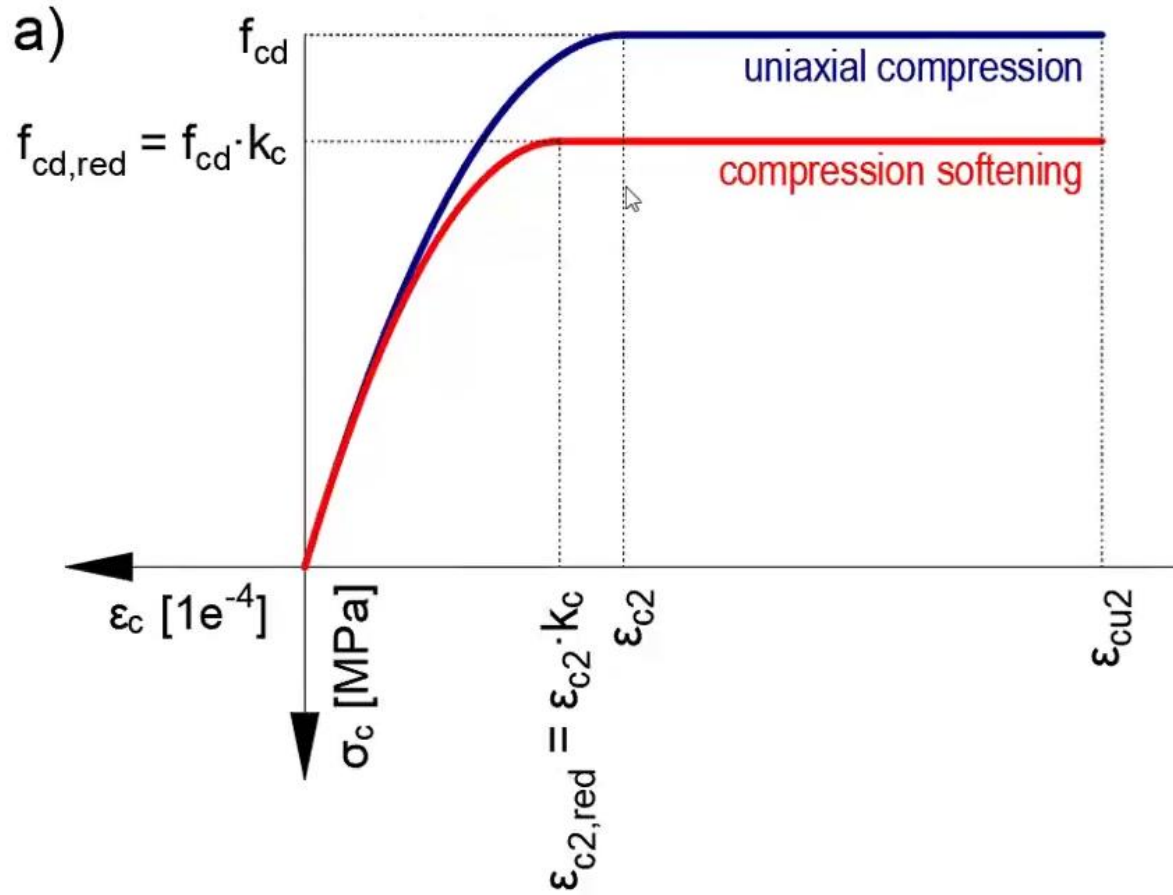


Bond stress

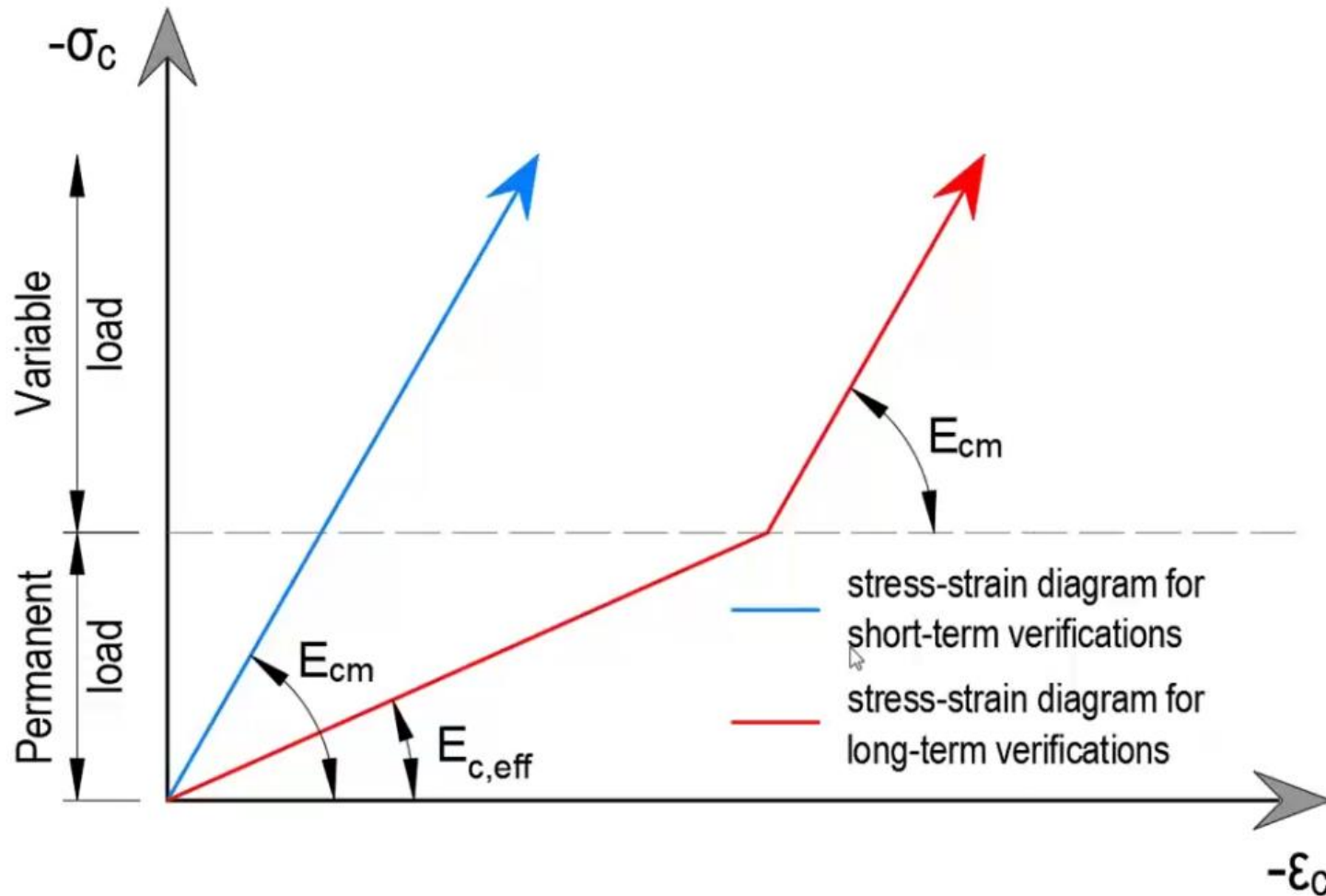


Bond stress on the surface of the bar is displayed for selected (group of) bars and applied portion of the load

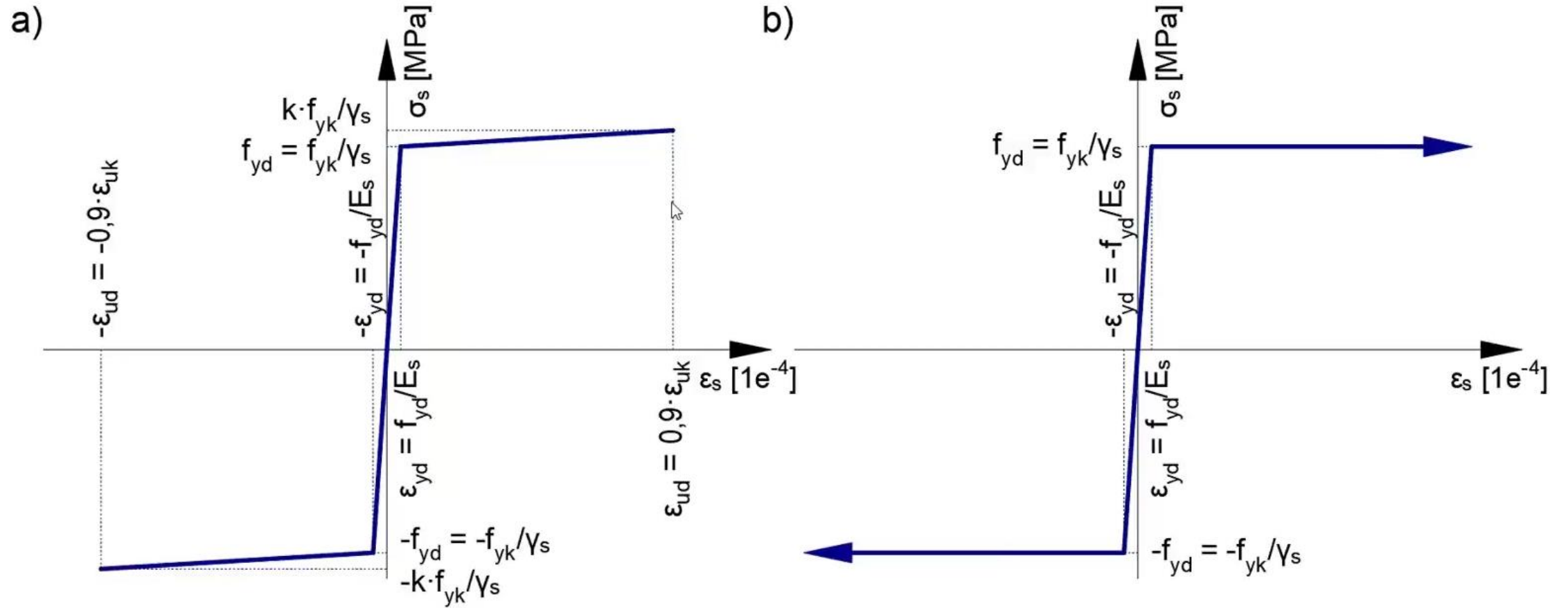
MATERIĀLU MODEĻI



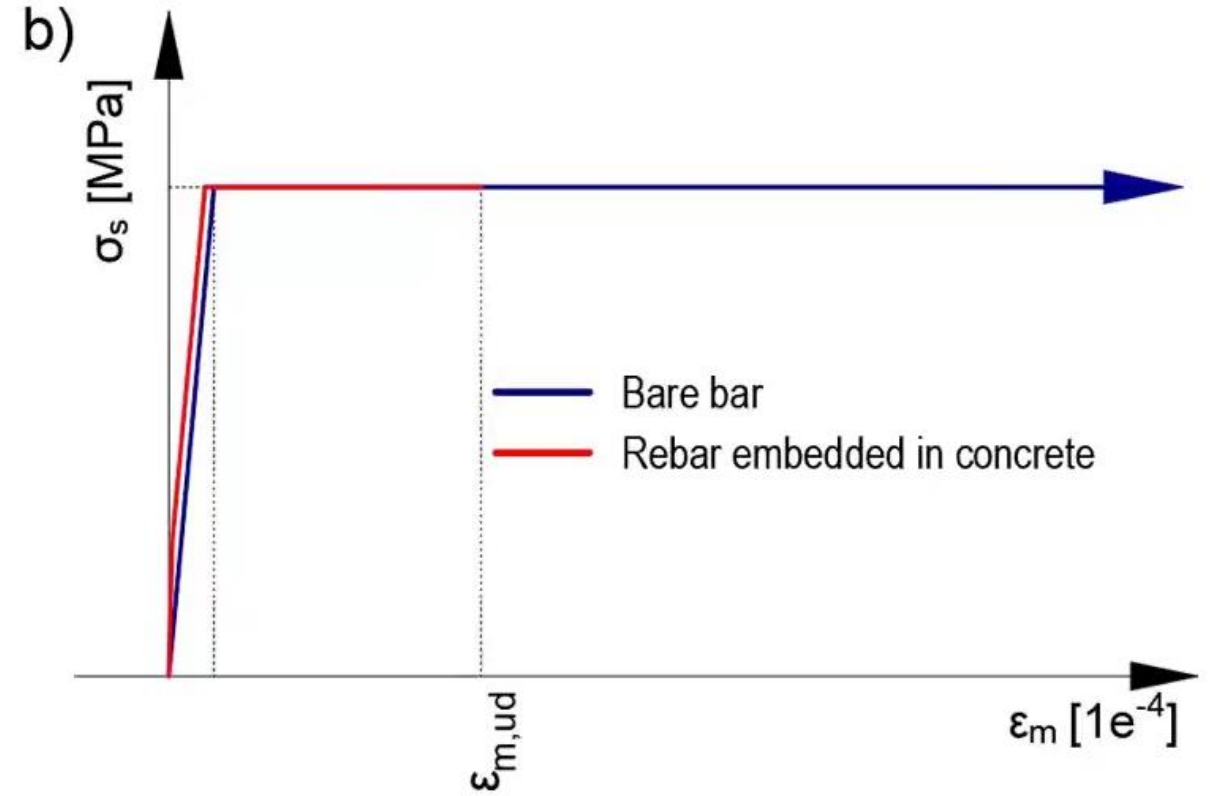
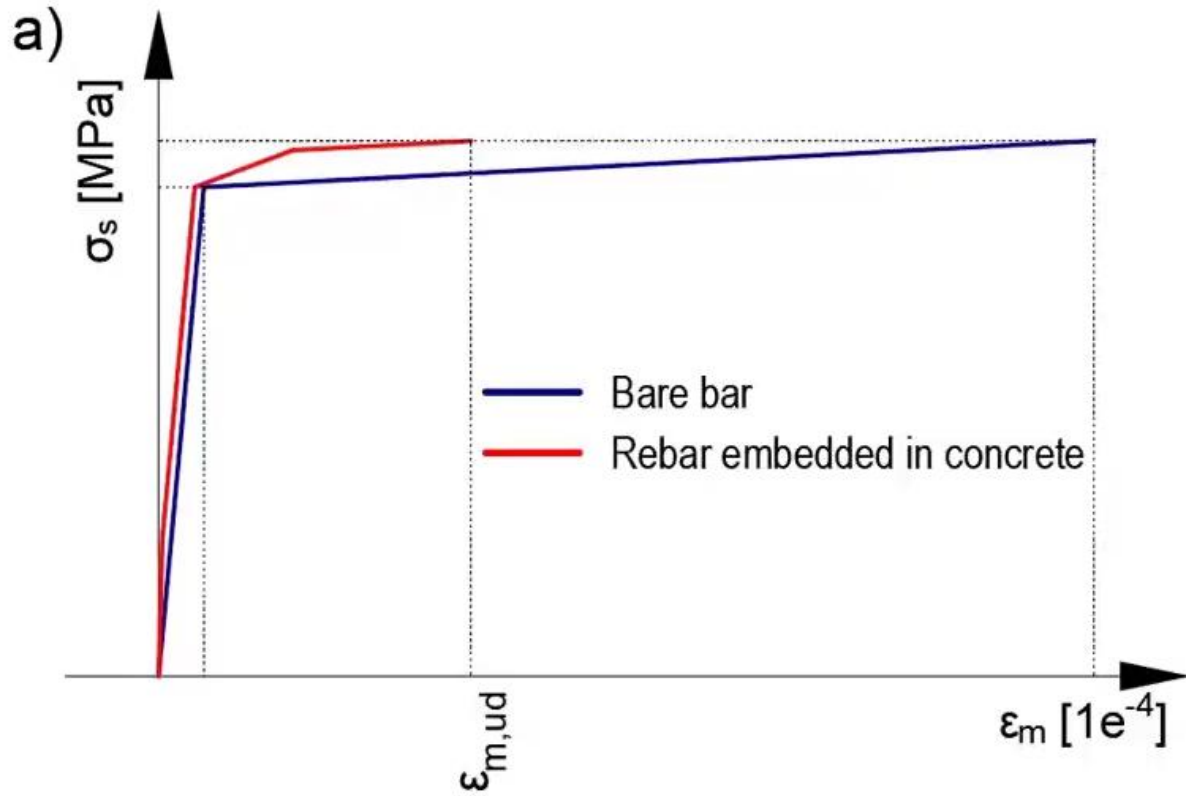
MATERIĀLU MODEĻI



MATERIĀLU MODEĻI

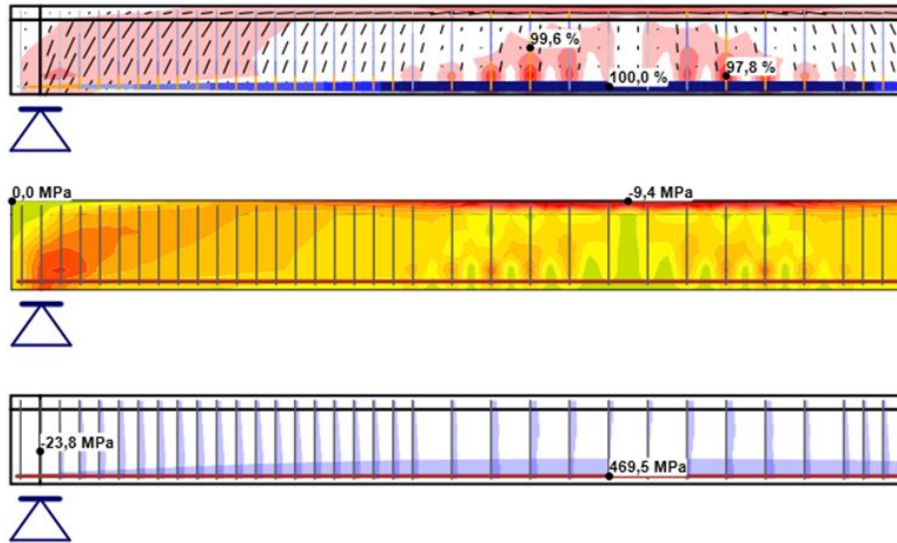


MATERIĀLU MODEĻI

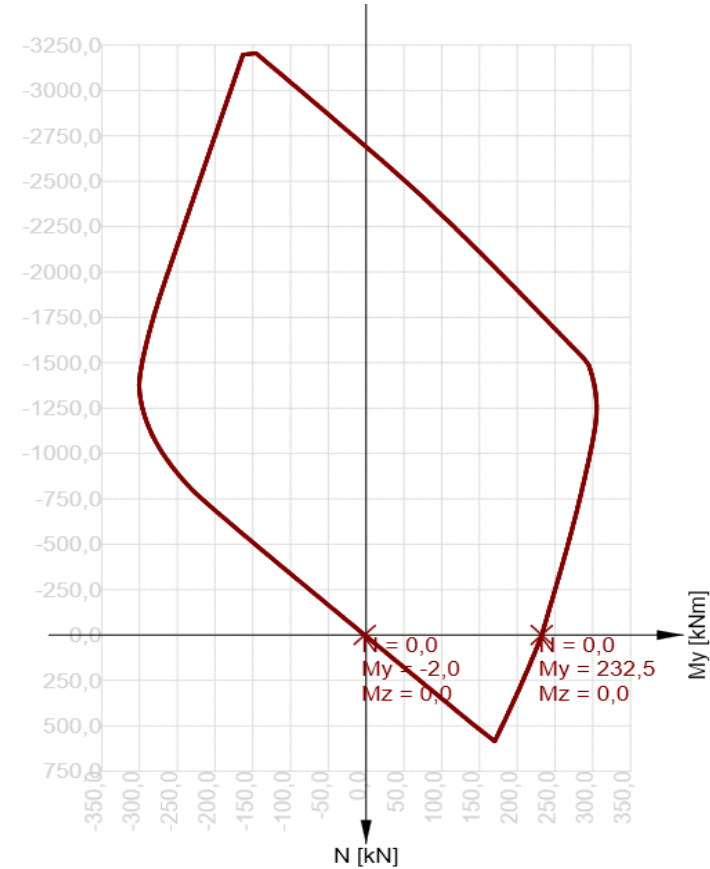


VERIFIKĀCIJA

ULS



	M_{Rd} [kNm]
Example 1.4	218,2
IDEA StatiCa RCS	232,5
IDEA StatiCa Detail	233,0



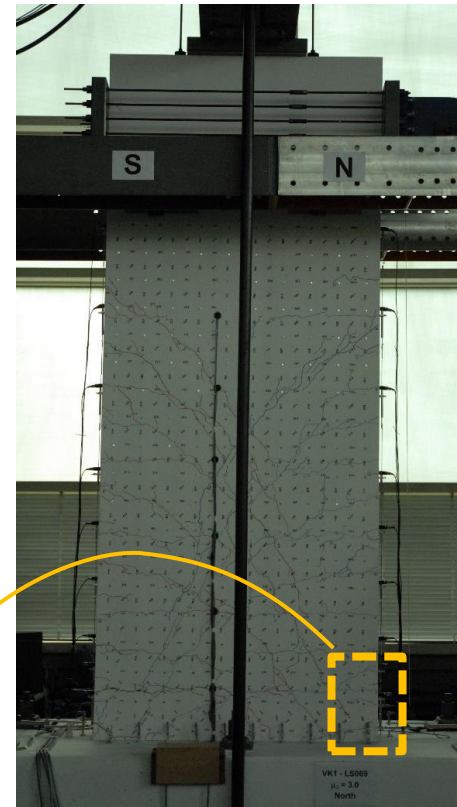
Beam – example 1.4, Procházka, J. (2009)

EKSPERIMENTĀLAS PĀRBAUDES

Bimschas et al. (2010, 2013)

Peak load

Specimen	VK1	VK3	VK6
Experiment* V_{exp} (kN)	728	876	647
DR-Design V_{calc} (kN)	730	860	650
V_{exp}/V_{calc}	1.00	1.02	1.00

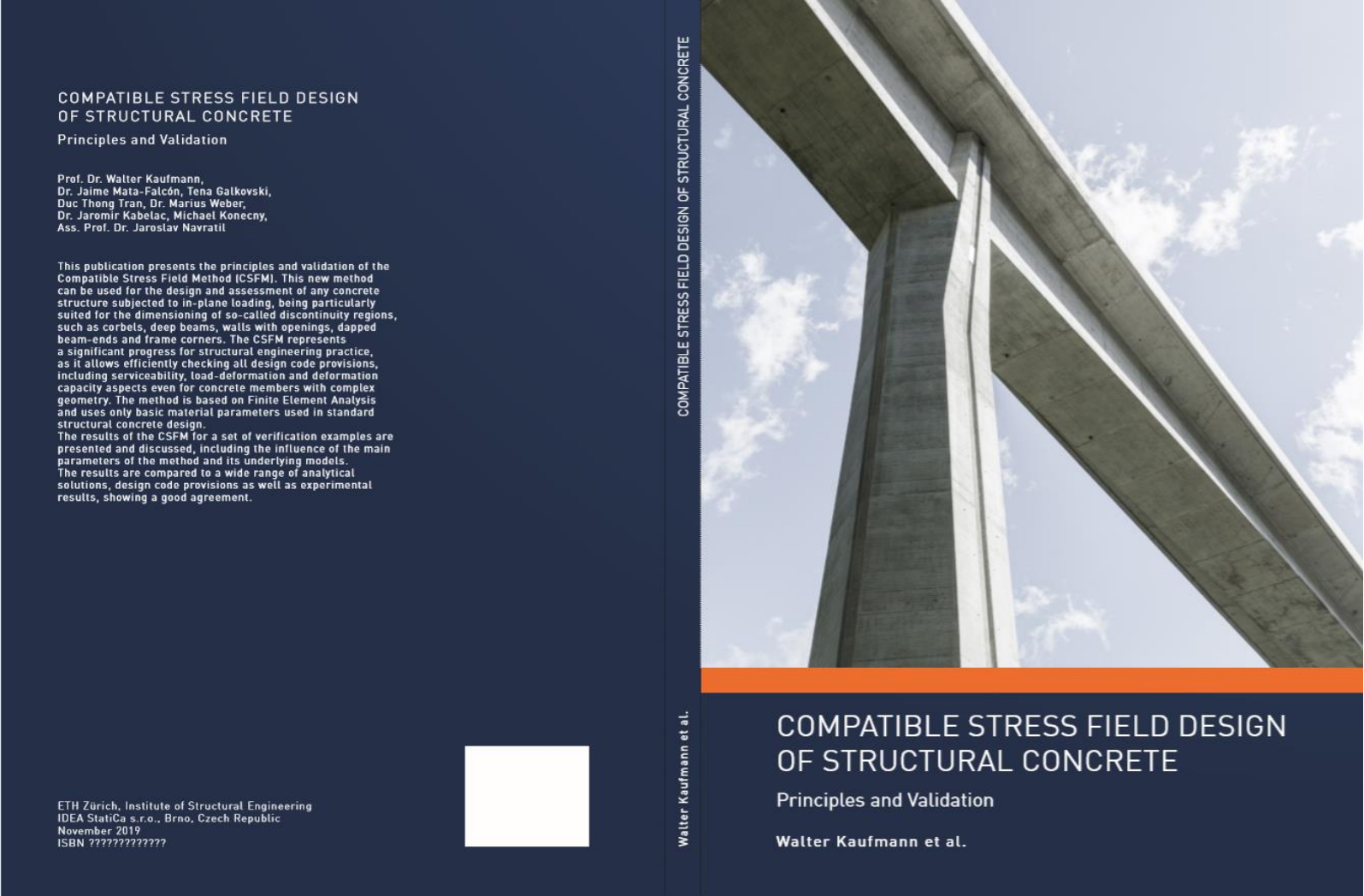


VK1: peak strength



VK1: failure

VERIFICATION BOOK – PROF. KAUFMANN



COMPATIBLE STRESS FIELD DESIGN
OF STRUCTURAL CONCRETE

Principles and Validation

Prof. Dr. Walter Kaufmann,
Dr. Jaime Mata-Falcón, Tena Galkowski,
Duc Thong Tran, Dr. Marius Weber,
Dr. Jaromir Kabelac, Michael Konecny,
Ass. Prof. Dr. Jaroslav Navratil

This publication presents the principles and validation of the Compatible Stress Field Method (CSFM). This new method can be used for the design and assessment of any concrete structure subjected to in-plane loading, being particularly suited for the dimensioning of so-called discontinuity regions, such as corbels, deep beams, walls with openings, dapped beam-ends and frame corners. The CSFM represents a significant progress for structural engineering practice, as it allows efficiently checking all design code provisions, including serviceability, load-deformation and deformation capacity aspects even for concrete members with complex geometry. The method is based on Finite Element Analysis and uses only basic material parameters used in standard structural concrete design. The results of the CSFM for a set of verification examples are presented and discussed, including the influence of the main parameters of the method and its underlying models. The results are compared to a wide range of analytical solutions, design code provisions as well as experimental results, showing a good agreement.

ETH Zürich, Institute of Structural Engineering
IDEA StatiCa s.r.o., Brno, Czech Republic
November 2019
ISBN ??????????????

COMPATIBLE STRESS FIELD DESIGN OF STRUCTURAL CONCRETE

Walter Kaufmann et al.

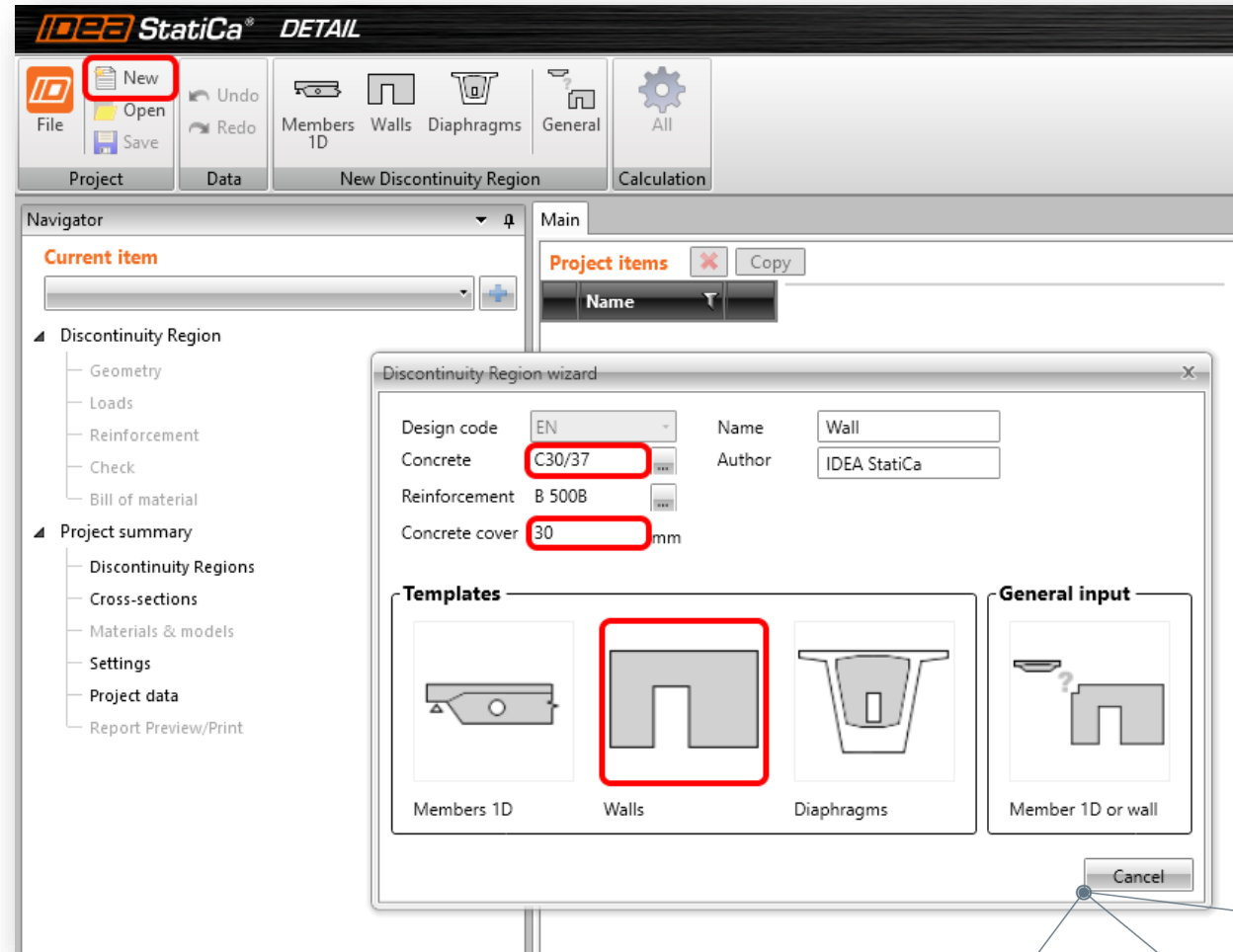
COMPATIBLE STRESS FIELD DESIGN
OF STRUCTURAL CONCRETE

Principles and Validation

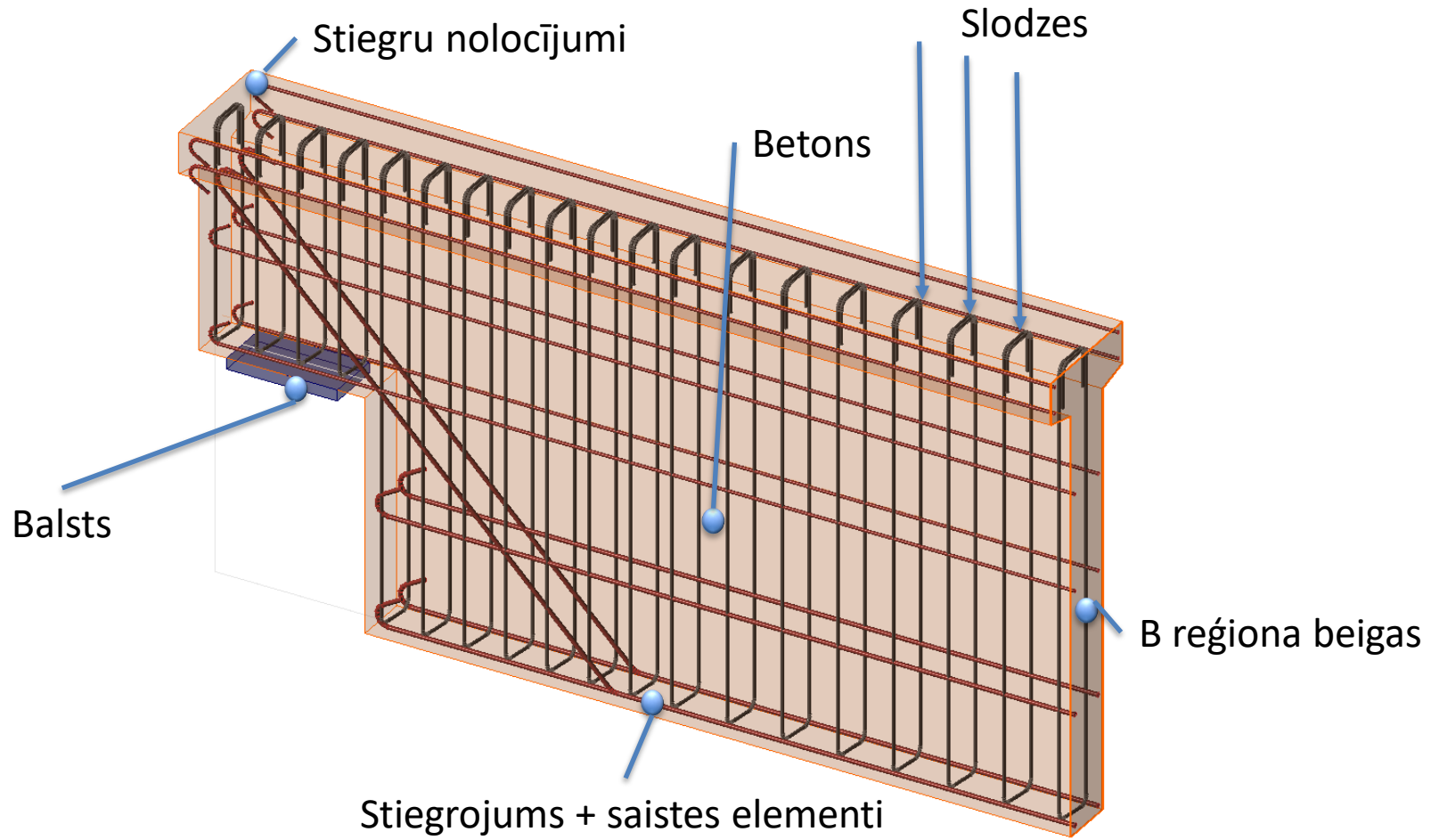
Walter Kaufmann et al.



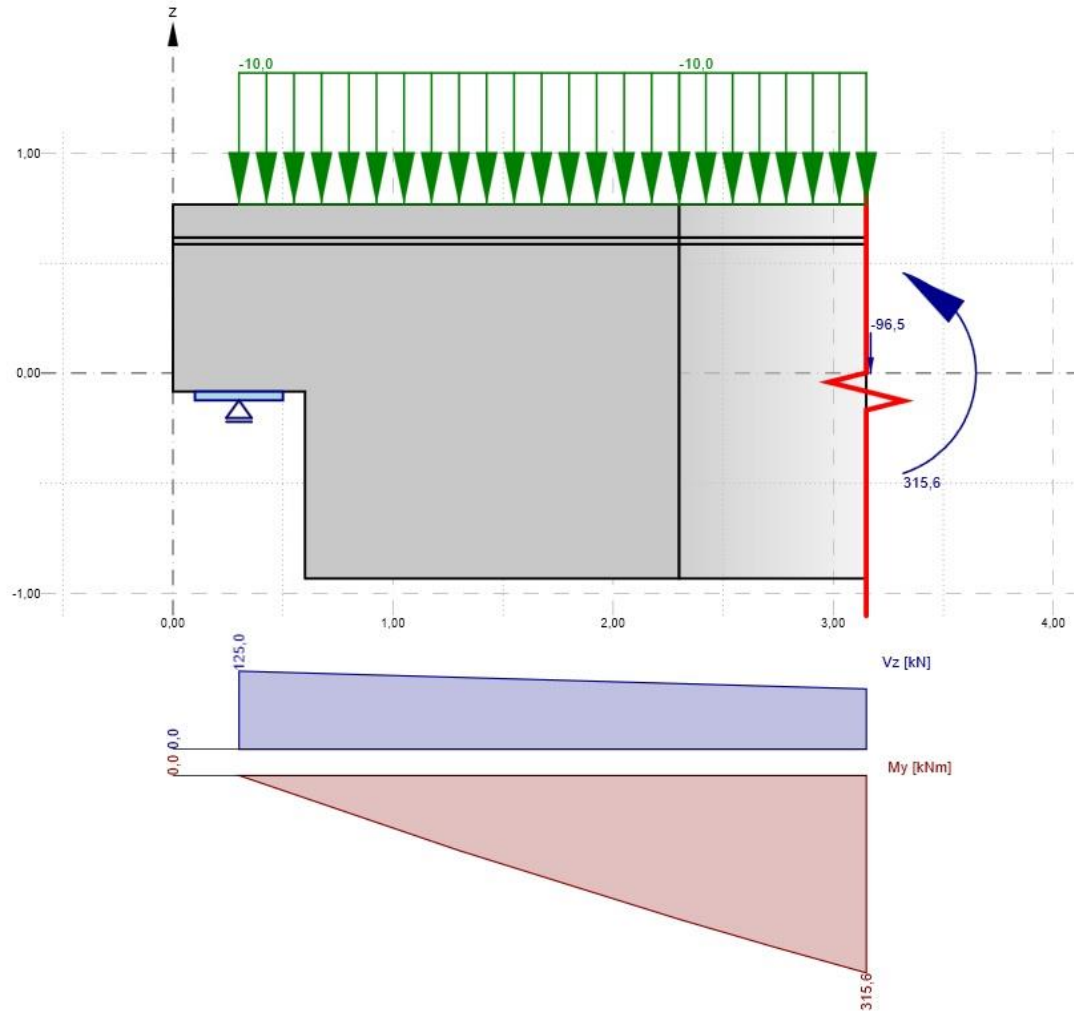
JAUNA APRĒĶINU METODE, KAS PĀRVĒRSTA ĒRTI LIETOJAMĀ PROGRAMMĀ



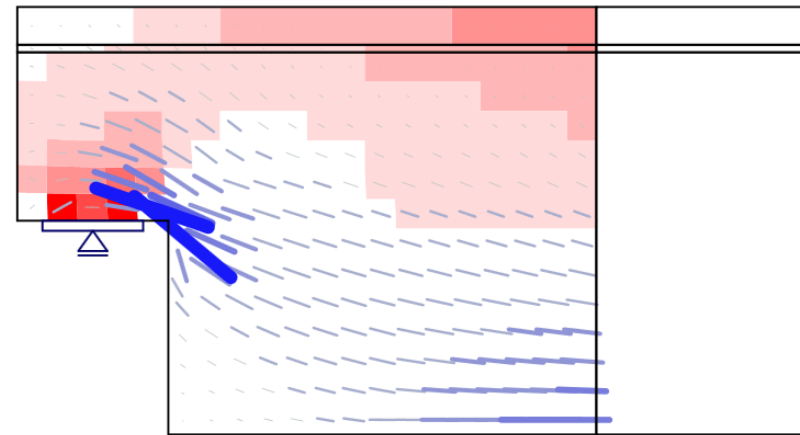
APRĒĶINU MODELIS



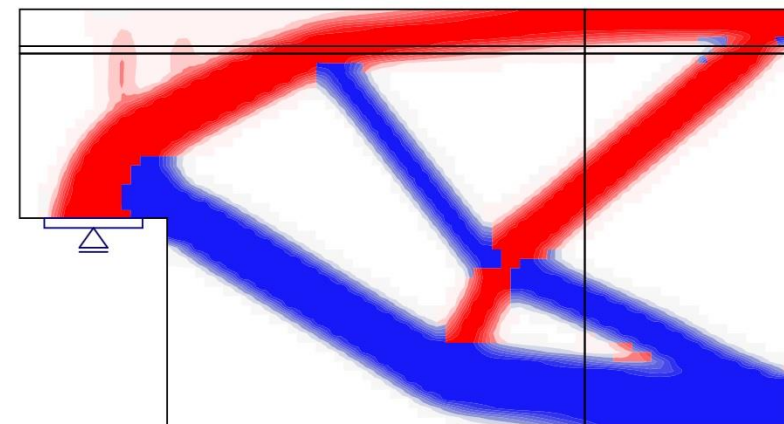
APRĒĶINS



Lineārs aprēķins

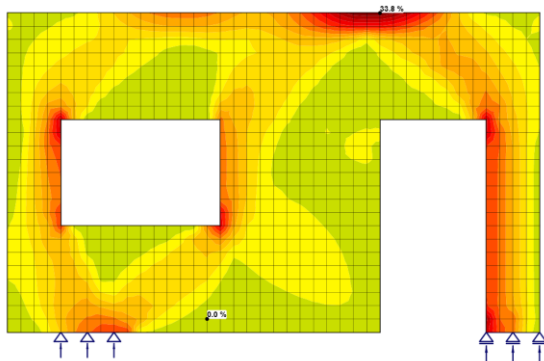


Topoloģijas optimizācija

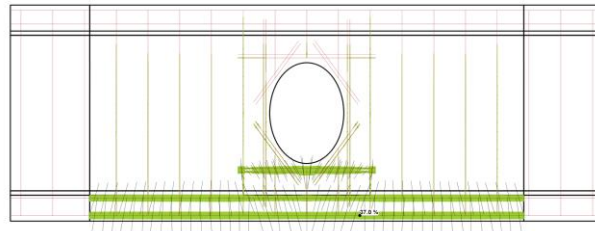


ULS/SLS PĀRBAUDES

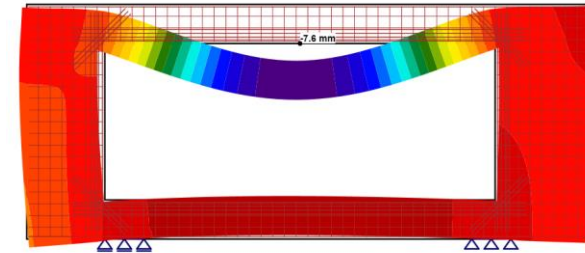
Spriegumi betonā



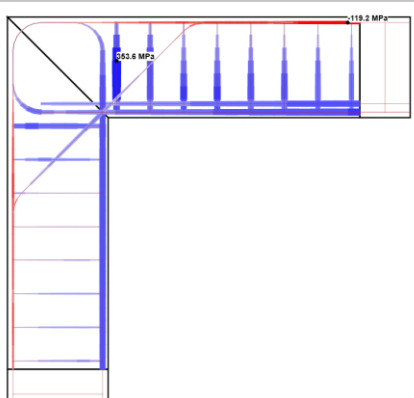
Plaisu platums



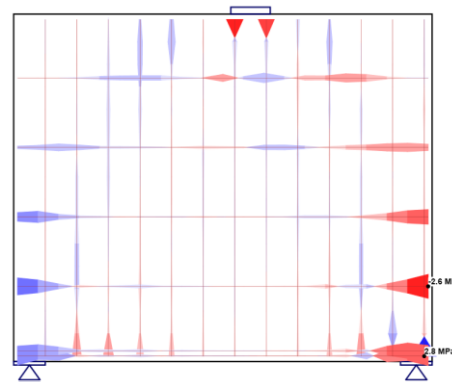
Izlieces



Spriegumi stiegrojumā



Enkurošanās



APRĒĶINU ATSKAITES

Project: Beam with opening
 Project no.: IEA StatCa
 Author: IEA StatCa

Envelopes

Internal forces, Member Extreme, Centrifugal forces

Reinforcement zones

Zone	Begin [m]	End [m]	Length [m]	Reinforcement	Check
1	0.00	1.00	1.00	A-A	Yes
2	1.00	4.50	3.50	B-B	Yes
3	4.50	6.00	1.50	A-A	Yes

Reinforcement

Name	Reinforced cross-section	Reinforcement
A-A		Reinforcement: 4B16 (S240E) (Ø S200), Z = 197 mm 2B16 (S240E) (Ø S200), Z = 109 mm 2B16 (S240E) (Ø S200), Z = 23 mm 2B16 (S240E) (Ø S200), Z = -109 mm 2B16 (S240E) (Ø S200), Z = -311 mm ØS200 ØØ (Ø S200) = 100 mm, ØØØØ, for torsion check ØØ (Ø S200) = 100 mm
B-B		Reinforcement: 4B16 (S240E) (Ø S200), Z = 197 mm 2B16 (S240E) (Ø S200), Z = 109 mm 2B16 (S240E) (Ø S200), Z = 23 mm 2B16 (S240E) (Ø S200), Z = -109 mm 2B16 (S240E) (Ø S200), Z = -311 mm ØS200 ØØ (Ø S200) = 200 mm, ØØØØ, for torsion check ØØ (Ø S200) = 200 mm

Material of reinforcement

Name	f_{yk} [MPa]	f_{td} [MPa]	E [GPa]	ρ [%]	Unit mass [kg/m ³]
B S200	500.0	540.0	200000.0	0.20	7850

$f_{yk} = 500$, $f_{td} = 540$, $E = 200000$, $\rho = 0.20$
 Fabrication: hot rolled, Diagram type: S240E, Bar surface: Ribbed, Class: B
 Fabrication: hot rolled, Diagram type: S240E, Bar surface: Ribbed, Class: B

Project: Beam with opening
 Project no.: IEA StatCa
 Author: IEA StatCa

Results

Geometry

Overview table

Check item	Combination	Increment	Item		
U.S.	C1	P100.0%, V100.0%	Strength of reinforcement		
Check item	Item	Utilization			
Strength of concrete	R01	util: 0.0%	OK		
Strength of reinforcement	R01	util: 0.0%	OK		
Change length	R01	util: 0.0%	OK		
SLS	C1.0.1	P100.0%, V100.0%	Stress limitation		
Check item	Combination <td>Increment <td>Critical check</td> <td>Item <td>Utilization</td> </td></td>	Increment <td>Critical check</td> <td>Item <td>Utilization</td> </td>	Critical check	Item <td>Utilization</td>	Utilization
Stress limitation	C1.0.1	P100.0%, V100.0%	7.05	G01	0.0%
Crack width	C1.0.1	P100.0%, V100.0%	w: 0.03	G01	0.0%

U.S. - Summary

Stress flow

SLS - Crack

Detailed crack results: C1, Load increment: P100.0%, V100.0%, $w_{lim,sm} = 0.300$ mm

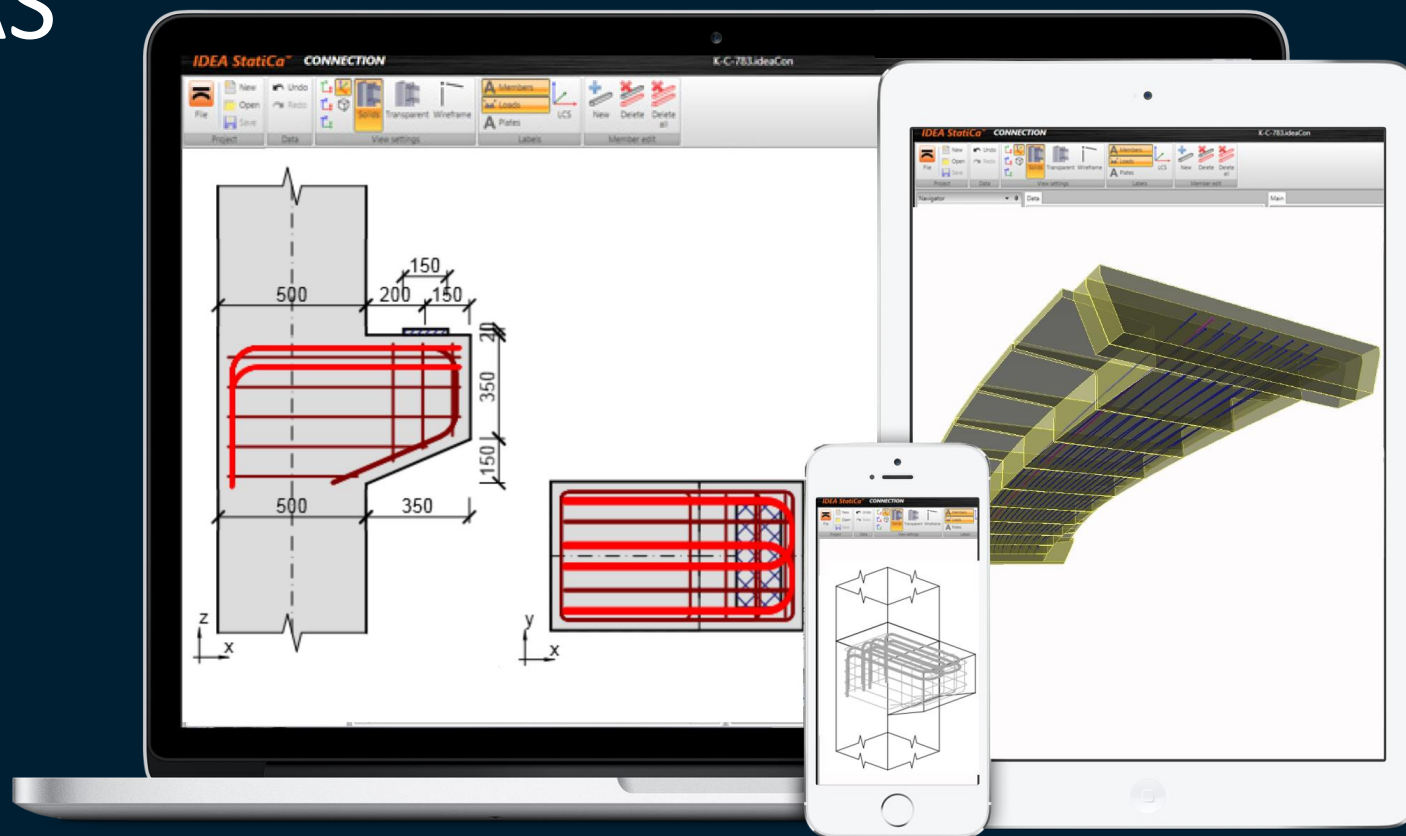
Member	X [m]	Z [m]	M_{Ed} [Nm]	M_{Ed} [Nm]	M_{Ed} [Nm]	M_{Ed} [Nm]	$w_{lim,sm}$ [mm]	OK
G01	3.21	-0.71	0.114	0.102	0.108	0.108	0.03	OK
R01	3.78	-0.71	0.107	0.114	0.114	0.108	0.03	OK
R02	2.77	-0.41	0.002	0.102	0.102	0.108	0.03	OK
G11	3.40	-0.44	0.029	0.084	0.079	0.079	0.03	OK
G12	3.40	-0.54	0.029	0.023	0.023	0.023	0.03	OK
G02	0.02	0.71	0.000	0.012	0.011	0.011	0.03	OK

Intermediate crack results

Member	Item	F_{Ed} [kN]	F_{Ed} [kN]	F_{Ed} [kN]	F_{Ed} [kN]	F_{Ed} [kN]	F_{Ed} [kN]	F_{Ed} [kN]	F_{Ed} [kN]	OK
G01	0.0	11.1	2.0	20000.0	100	18	4.16	0.114	1.52	0.00
R01	0.0	10.9	2.0	20000.0	100	18	4.16	0.114	1.52	0.00
G11	0.0	0.0	0.0	20000.0	100	18	4.16	0.114	1.52	0.00
G12	0.0	0.0	0.0	20000.0	100	18	4.16	0.114	1.52	0.00
G02	0.0	0.0	0.0	20000.0	100	18	4.16	0.114	1.52	0.00

Visi aprēķini saskaņā ar Eirokodu

JAUNAS PROGRAMMAS VERSIJAS



2 JAUNAS VERSIJAS GADĀ -
PAVASARĪ/RUDENĪ



Q/A

