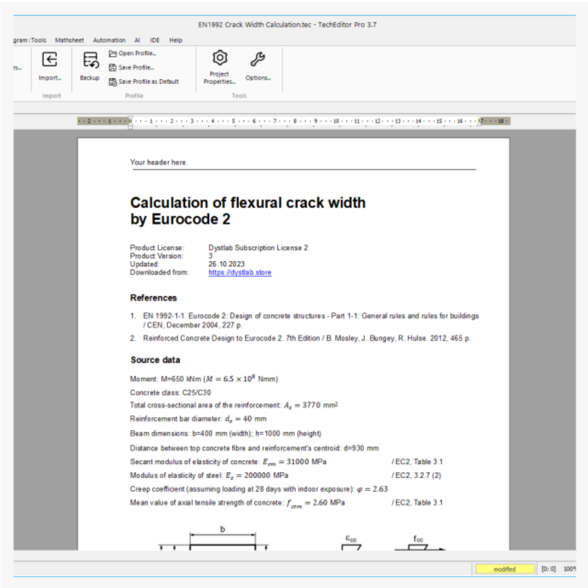
0017. Розрахунок ширини розкриття тріщин за Єврокодом 2. Готовий звіт з автоматичним розрахунком



Вступ
Ready-to-use technical report with text, formulas, images, references, and **in-built mathematical automation**.

{module 347}

Опис
Ready-to-use technical report with text, formulas, images, references, and **in-built mathematical automation**.

All calculations are provided in accordance with EN 1992-1-1 (Eurocode 2: Design of concrete structures - Part 1-1: General rules and rules for buildings).

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Відео

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Завантаження

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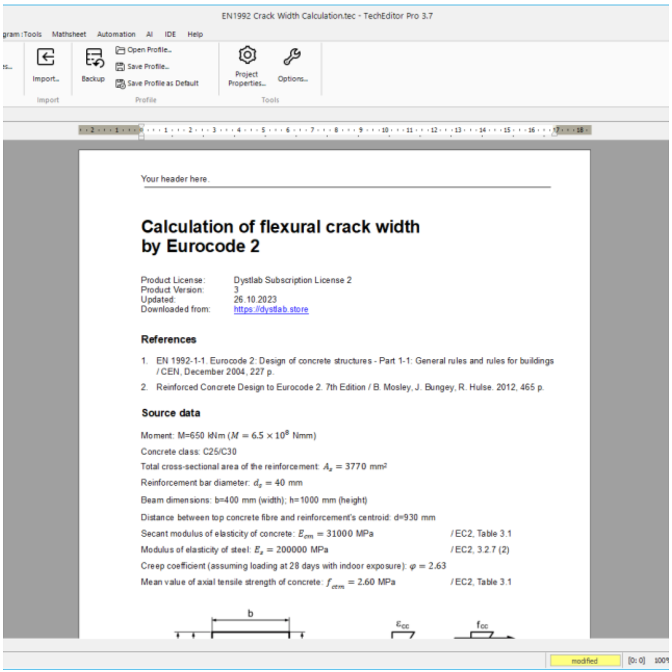
Специфікація

Загальні	
Мова	english
Файли	
Розмір файлу (МБ)	0..20
Умови отримання	
План підписки	paid
Інженерні	
Матеріал	reinforced concrete
Стандарти / Норми	Eurocode

Product Gallery



Calculation of flexural crack width by Eurocode 2

Product License: Dystlab Subscription License 2
Product Version: 3
Updated: 26.10.2023
Downloaded from: https://dystlab.store

References

1. EN 1992-1-1. Eurocode 2: Design of concrete structures - Part 1-1: General rules and rules for buildings / CEN, December 2004, 227 p.
2. Reinforced Concrete Design to Eurocode 2. 7th Edition / B. Mosley, J. Bungey, R. Hulse. 2012, 465 p.

Source data

Moment: M=650 kNm ($M = 6.5 \times 10^8$ Nmm)

Concrete class: C25/C30

Total cross-sectional area of the reinforcement: $A_s = 3770$ mm²

Reinforcement bar diameter: $d_s = 40$ mm

Beam dimensions: b=400 mm (width); h=1000 mm (height)

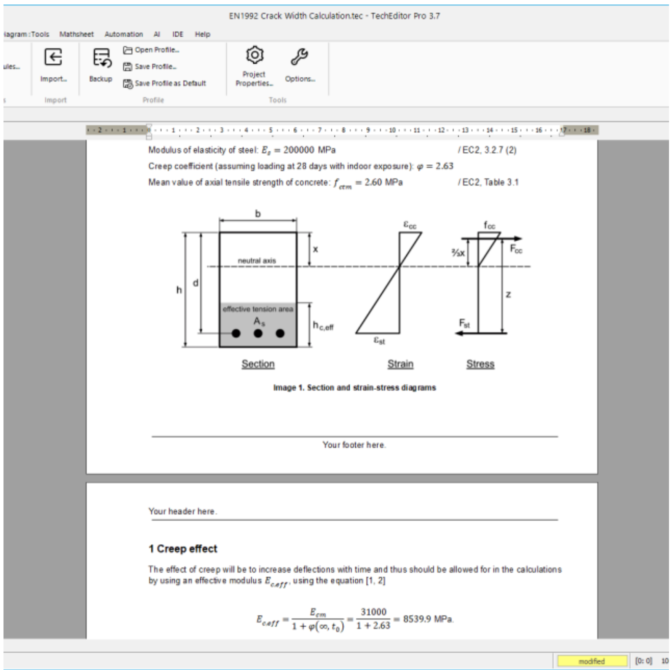
Distance between top concrete fibre and reinforcement's centroid: d=930 mm

Secant modulus of elasticity of concrete: $E_{cm} = 31000$ MPa / EC2, Table 3.1

Modulus of elasticity of steel: $E_s = 200000$ MPa / EC2, 3.2.7 (2)

Creep coefficient (assuming loading at 28 days with indoor exposure): $\varphi = 2.63$

Mean value of axial tensile strength of concrete: $f_{ctm} = 2.60$ MPa / EC2, Table 3.1



Modulus of elasticity of steel: $E_s = 200000$ MPa / EC2, 3.2.7 (2)

Creep coefficient (assuming loading at 28 days with indoor exposure): $\varphi = 2.63$

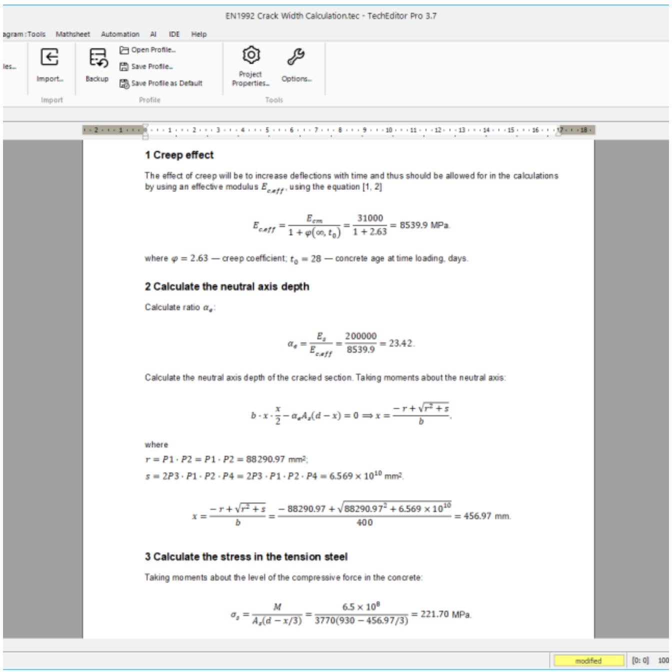
Mean value of axial tensile strength of concrete: $f_{ctm} = 2.60$ MPa / EC2, Table 3.1

Image 1. Section and strain-stress diagrams

1 Creep effect

The effect of creep will be to increase deflections with time and thus should be allowed for in the calculations by using an effective modulus $E_{c,eff}$, using the equation [1, 2]

$$E_{c,eff} = \frac{E_{cm}}{1 + \varphi(\infty, t_0)} = \frac{31000}{1 + 2.63} = 8539.9 \text{ MPa.}$$



1 Creep effect

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where $\varphi = 2.63$ — creep coefficient; $t_0 = 28$ — concrete age at time loading, days.

2 Calculate the neutral axis depth

Calculate ratio α_e:

$$\alpha_e = \frac{E_s}{E_{c,eff}} = \frac{200000}{8539.9} = 23.42.$$

Calculate the neutral axis depth of the cracked section. Taking moments about the neutral axis:

$$b \cdot x \cdot \frac{x}{2} - \alpha_e A_s (d - x) = 0 \Rightarrow x = \frac{-r + \sqrt{r^2 + s}}{b},$$

where

$r = P1 \cdot P2 = P1 \cdot P2 = 88290.97$ mm²;

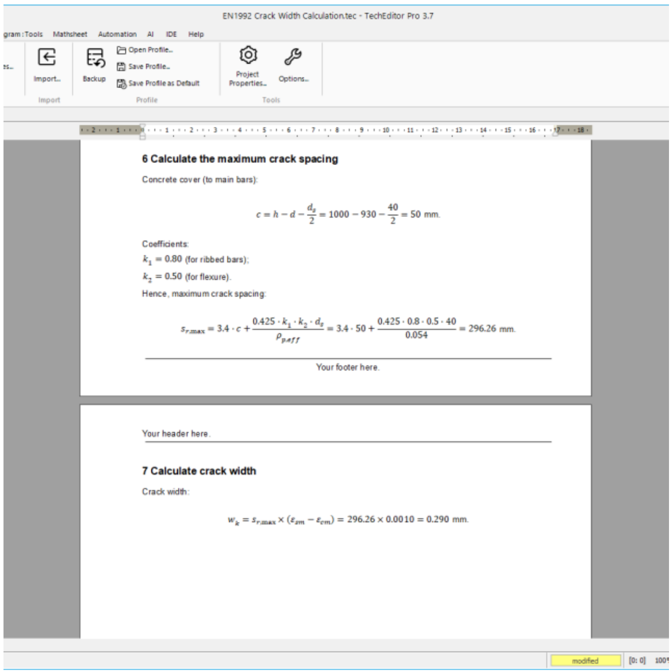
$s = 2P3 \cdot P1 \cdot P2 \cdot P4 = 2P3 \cdot P1 \cdot P2 \cdot P4 = 6.569 \times 10^{10}$ mm².

$$x = \frac{-r + \sqrt{r^2 + s}}{b} = \frac{-88290.97 + \sqrt{88290.97^2 + 6.569 \times 10^{10}}}{400} = 456.97 \text{ mm.}$$

3 Calculate the stress in the tension steel

Taking moments about the level of the compressive force in the concrete:

$$\sigma_s = \frac{M}{A_s(d - x/3)} = \frac{6.5 \times 10^8}{3770(930 - 456.97/3)} = 221.70 \text{ MPa.}$$



6 Calculate the maximum crack spacing

Concrete cover (to main bars):

$$c = h - d - \frac{d_s}{2} = 1000 - 930 - \frac{40}{2} = 50 \text{ mm.}$$

Coefficients:

$k_1 = 0.80$ (for ribbed bars);

$k_2 = 0.50$ (for flexure).

Hence, maximum crack spacing:

$$s_{r,max} = 3.4 \cdot c + \frac{0.425 \cdot k_1 \cdot k_2 \cdot d_s}{\rho_{p,eff}} = 3.4 \cdot 50 + \frac{0.425 \cdot 0.8 \cdot 0.5 \cdot 40}{0.054} = 296.26 \text{ mm.}$$

7 Calculate crack width

Crack width:

$$w_k = s_{r,max} \times (\varepsilon_{sm} - \varepsilon_{cm}) = 296.26 \times 0.0010 = 0.290 \text{ mm.}$$