BETON
4
LIFE

Reinforced-concrete structures

Effective depth

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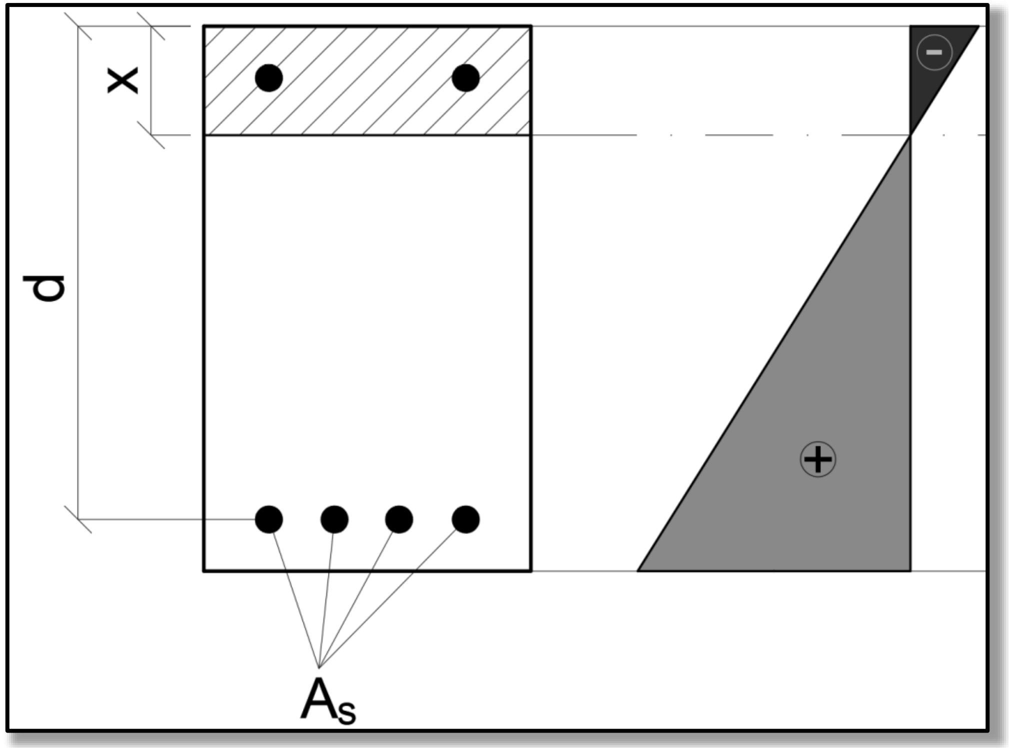
Effective depth

The effective depth is one of the **basic cross-section parameters**.

This parameter is **used in various equations**, and its **exact determination is therefore an important step** in the static calculation.

Effective depth

The effective height (d) is the distance **from the most compressed fiber** of the concrete **to the centroid of the tensile reinforcement**.

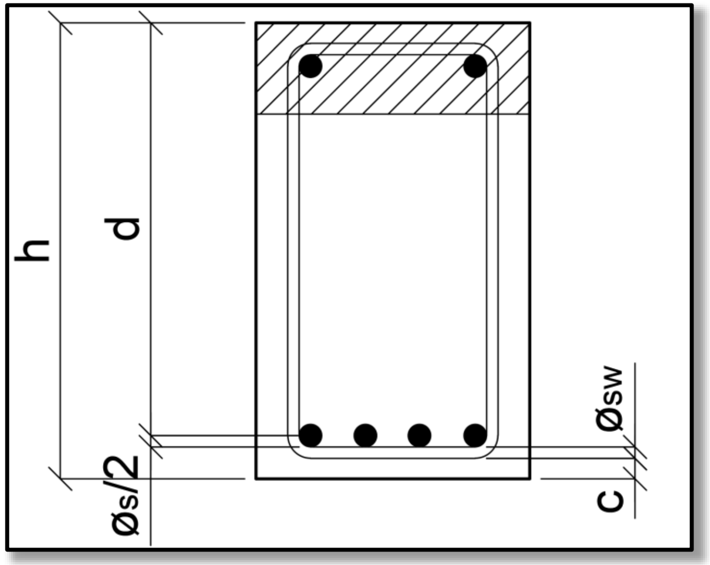


Effective depth

The effective depth is determined **from the cross-section's geometry** as

$$d = h - c - \varnothing_{sw} - \varnothing_s/2\,,$$

where h is the height of the cross-section,
c is the concrete cover,
$\varnothing_{sw}$ is the diameter of the stirrups,
$\varnothing_s$ is the diameter of the longitudinal reinforcement.



Concrete cover

The concrete cover of the reinforcement must be calculated using the procedure described in the **EN 1992-1-1 standard** (see also **this presentation**) or using some **software** (e.g., SCIA, FIN EC or KrytOn).

Stirrup diameter

If the effective height is calculated when the **stirrup diameter is not yet known**, we can preliminarily assume this diameter as **6 mm to 12 mm**.

- If we think that the **element will be only lightly loaded by shear**, we choose **6 mm to 8 mm**.
- If we think that the **element will be heavily loaded by shear**, we choose **10 mm to 12 mm**.
- If we have no idea about the shear load, **we can conservatively** (but uneconomically) **choose 12 mm***.

* If we now assume a large diameter of stirrups, we get a lower effective depth. If we later design smaller stirrups, we can (but do not have to!) recalculate the effective depth. Leaving a lower effective height is conservative, but uneconomical.

Diameter of the longitudinal reinforcement

If the effective height is calculated when the **diameter of the longitudinal reinforcement is not yet known**, we can preliminarily assume this diameter as **8 mm to 14 mm** (for slabs) and **12 to 32 mm** (for beams and columns).

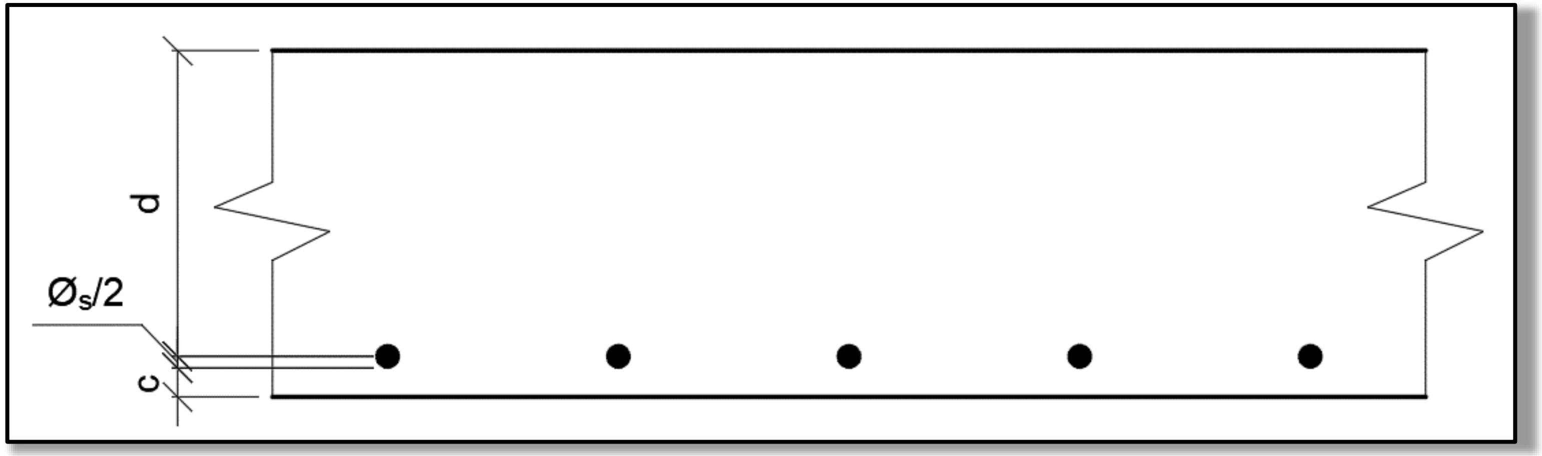
- If we think that the **element will be only lightly loaded by bending**, we choose **smaller diameters**.
- If we think that the **element will be heavily loaded by bending**, we choose **bigger diameters**.
- If we have no idea about the bending load, **we can conservatively** (but uneconomically) **choose the biggest diameter**.

Effective depth – Slab

Unlike in a beam, **we do not have stirrups in a slab**. The effective depth is, therefore, determined as

$$d = h - c - \varnothing_s/2\,,$$

where h is the height of the cross-section,
c is the concrete cover,
$\varnothing_s$ is the diameter of the longitudinal reinforcement.

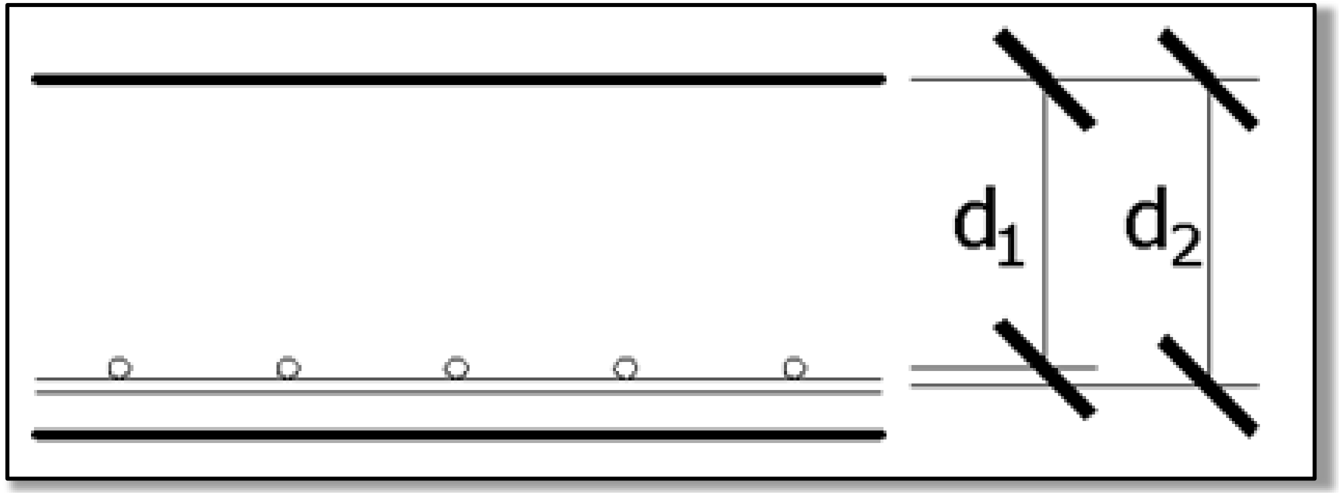


Effective depth – Slab

However, in the case of a slab, **the reinforcement can sometimes be in two directions**, and it is, therefore, always necessary to know to which reinforcement we calculate the effective height

$$d_1 = h - c - \varnothing_{s,2} - \varnothing_{s,1}/2,$$

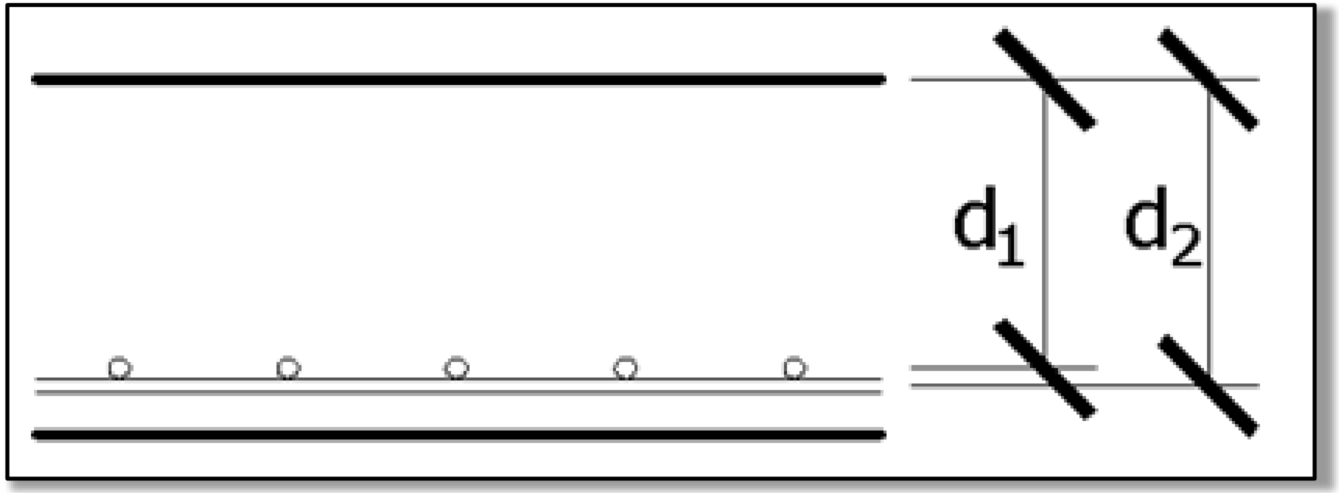
$$d_2 = h - c - \varnothing_{s,2}/2,$$



Staticky účinná výška průřezu – deska

For some calculations of two-directionally reinforced slabs (e.g., for punching shear design), we use the so-called **average effective depth**

$$d_{eff} = (d_1 + d_2)/2.$$



Thank you for your attention