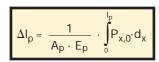## Calculation of Elongation

The stressing records are part of the structural design and serve as a basis for the stressing operation. Besides the prestressing data, they contain sequence of stressing and directions for procedures directly connected with stressing operation, such as lowering of the formwork and releasing of bearings.

Calculation of bar tendon elongation at stressing

The total elongation Δl_{tot} [mm] which the bar has to achieve during stressing should be calculated as:
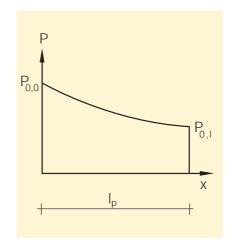
$$\Delta l_{tot} = \Delta l_p + \Delta l_c + \Delta l_{sl}$$

Δl_p = elongation of the bar tendon [mm]

$$\Delta l_p = \frac{1}{A_p \cdot E_p} \cdot \int_0^{l_p} P_{x,0} \cdot d_x$$

or in many cases it is accurate enough

$$\Delta l_p = \frac{P_{0,l} + P_{0,0}}{2 \cdot A_p \cdot E_p} \cdot l_p$$

$P_{x,0} = P_0 \cdot e^{-\mu \cdot \widehat{\gamma}x}$
$P_{x,0}$ = prestressing force immediately after stressing at any point distance x along the member [kN]
$P_{0,0}$ = stressing force at the stressing end [kN]
$P_{0,l}$ = prestressing force at the dead end
$\widehat{\gamma}_x$ = Σ angle of deflection between the stressing end and at any point distance x [rad]
$\widehat{\gamma}$ = $\frac{\pi}{180}[\sqrt{a_H^2 + a_V^2} + \beta \cdot l]$
μ = coefficient of friction (see p.36)
β = wobble angle (see p.36)
P_e = prestressing force at the stressing end after unintentional slip [kN]

Δl_c = elastic deformation of the concrete (shortening must be treated as a positive value) [mm]

$$\Delta l_c = \frac{\sigma_{cm}}{E_c} \cdot l_c$$

σ_{cm} = average stress in the concrete cross section at the centre of gravity of all tendons due to prestressing force [MN/m²]

l_c = length of the concrete member [m]

Δl_{sl} = sum of slip in the thread of the anchorages and coupler according anchorage type applied [mm]

Δl_{sl} [mm] = For allowable stresses of 0.55 f_{pk} the technical details are given in the Certificate of Approval for DYWIDAG Post-tensioning Systems, for higher stresses the values increase in proportion.