# COMPANY NAME

**CALCULATION SHEET**

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|---|---|
| **Calc. No.** | CALC. NUMBER |
| **Project No.** | PROJECT NUMBER |

| **Project Title:** | **Project Name** |
|---|---|
| **Subject:** | **Reinforced Concrete Beam - Bending Moment Capacity (Eurocode 2)** |

| **Calc. By** | **Date** | **Rev.** |
|---|---|---|
| Author | today | 0 |

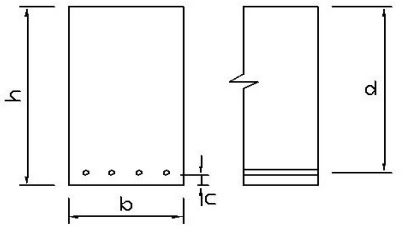
Section bending moment capacity at ultimate limit state

**Beam section dimensions**

| | | |
|---|---|---|
| h = | 400 | mm |
| b = | 300 | mm |
| Area = | 120000 | $mm^2$ |

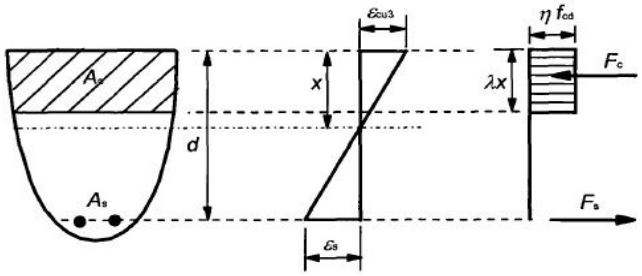
**Reinforcement**

| | | | |
|---|---|---|---|
| c = | 30 | mm | cover |




Concrete class C12/15 EN 1992-1-1:2004 Section 3 Table 3.1

| | | | | |
|---|---|---|---|---|
| $f_{ck}$ = | 12 | MPa | | concrete characteristic cylinder strength |
| $\phi$ = | 16 | 0 | 0 | mm - bars diameter |
| n = | 1 | 0 | 0 | no of bars |
| $A_s$ = | 201.1 | $mm^2$ | | tension reinf. Area |
| $p_{reinf}$ = | 0.17 | % | | % of tension reinf |




Reinforcement type S400

| | | | |
|---|---|---|---|
| $f_{yk}$ = | 400 | MPa | reinforcement yield strength |

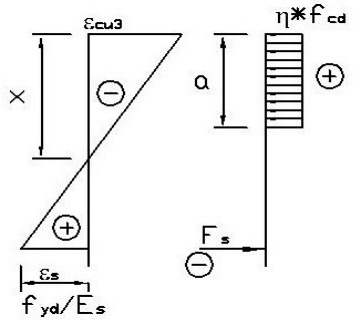
Section 3.1.7 Figure 3.5
EN 1992-1-1:2004

Partial factors for materials for ultimate limit states

| | | |
|---|---|---|
| $\gamma_c$ = | 1.5 | EN 1992-1-1:2004 |
| $\gamma_s$ = | 1.15 | Section 2 Table 2.1N |

Design compressive concrete strength

| | | | |
|---|---|---|---|
| $\alpha_{cc}$ = | 1 | | EN 1992-1-1:2004 Section 3.1.6 |
| $f_{cd}$ = | $\alpha_{cc} * f_{ck} / \gamma_c$ | | per EN 1992-1-1:2004 |
| $f_{cd}$ = | 8.00 | MPa | formula 3.15 |




Design reinforcement strength

| | | | |
|---|---|---|---|
| $f_{yd}$ = | $f_{yk} / \gamma_s$ | | EN 1992-1-1:2004 |
| $f_{yd}$ = | 347.83 | MPa | Section 3.1.7 Figure 3.8 |

| | | | |
|---|---|---|---|
| $\lambda$ = | 0.8 | | EN 1992-1-1:2004 Section 3.1.7 (3) |
| $\eta$ = | 1 | | |

A rectangular stress distribution is assumed $\lambda$, defining the effective height of the compression zone and $\eta$, defining the effective strength are derived from formulas 3.19, 3.20, 3.21 and 3.22

Bending moment capacity - Stress and strain equilibrium - pure bending

| | | | |
|---|---|---|---|
| $F_s$ = | $A_s * f_{yd}$ | = | 69.93 kN |
| $F_b$ = | $F_s$ | | |
| a = | $F_b / (\eta * b * f_{cd})$ | = | 29.1 mm |
| x = | $a / \lambda$ | = | 36.4 mm |
| **$M_{cap}$ =** | $F_b * (h - c - \phi/2 - a/2)$ | = | **24.3 kN*m** |

References:
EN 1993-1-1:2004 - Eurocode 2: Design of concrete structures - Part 1-1: General rules and rules for buildings