

# STRUCTURAL DESIGN

One of the biggest challenges which faces Structural Engineers today is of keeping up with the latest design guidance. There is an abundance of discussion about this fact, but every Structural Engineer knows that it is easier to produce design calculations when in possession of a relevant design example. (Every Structural Engineer is also well aware of the dangers of taking that example too literally when the new design is more complex than, or just different to the example). Having an example to start from always helps 'though.

This page can be ed and changed by you as much as you like, and used for your reference. Maybe Structural Engineers could help other Structural Engineers, and in turn maybe other Structural Engineers can help you, by using this Wiki to develop reliable design examples from the available design guidance.

## **CONCRETE:-**

Pamphlets on how to design concrete structures using Eurocode 2 and others codes have been published and distributed with the Structural Engineer magazine. If you are able to put some numbers into that guidance, develop examples in accordance with that guidance, and add them here like the one(s) on this page, that would be a really good use of this page.

Examples to previous guidance are as useful as those to current guidance, perhaps a building design was started before the latest version of BS8110 was published, and requires amendment for some reason. Here is the obvious one:-

'DESIGN OF A CONCRETE BEAM TO BS8110-1:1997 INC AMD 1 & 2 27  
MAY 2002'

$M = 200 \text{ kNm}$   $b = 300 \text{ mm}$   $d = 500 - 25 - 10 - 16 / 2 = 457 \text{ mm}$   $f_{cu} = 45 \text{ N/mm}^2$   $f_y = 460 \text{ N/mm}^2$

$k = M \times 10^6 / b \times d^2 \times f_{cu} = 0.0709$   $z = d \{0.5 + \text{SQR}(0.25 - k/0.9)\} = 0.91 d = 417 \text{ mm}$   
 $A_s = M \times 10^6 / 0.95 \times f_y \times z = 1097 \text{ mm}^2$   $3T25 = 1470 \text{ mm}^2 > A_s$  so  
 OK. Deflection not critical, (see below)

$L = 10100 \text{ mm}$  Basic  $L/d = 20$   $A_s' = 2T16 = 402 \text{ mm}^2$   $d' = 20 + 10 + 16 / 2 = 38 \text{ mm}$

$f_s = 2 \times f_y \times A_{s \text{ req}} / 3 \times A_{s \text{ prov}} = 228 \text{ N/mm}^2$   $M \times 10^6 / b \times d^2 = 3.19$   $0.55 + \{(477 - f_s) / 120 \times (0.9 + M \times 10^6 / b \times d^2)\} = 1.057$   $100 \times A_s' / b \times d = 0.29322$   
 $1 + \{0.29322 / (3 + 0.29322)\} = 1.089$   $20 \times 1.057 \times 1.089 \times 10 / 10.1 = 22.7$   $L / d = 22.1$

$V = 79 \text{ kN max}$ ,  $71 \text{ kN}$  at  $d$  from face of support  $f_{yv} = 460 \text{ N/mm}^2$

$v = V \times 10^3 / b \times d = 0.517 \text{ N/mm}^2$  at  $d$  from face of support  $100 \times A_s / b \times d = 1.07$   
 $v_c = [0.79 \times \{1.07^{(1/2)} \times 1\} / 1.25] \times (40/25)^{(1/4)} = 1.150 \text{ N/mm}^2$   $v < 0.5 v_c$ , but provide minimum links in this member of major structural importance; For  
 $A_{sv} = 2T10 = 157 \text{ mm}^2$   $s_v = 157 \times 0.95 \times f_{yv} / 0.4 b = 571 \text{ mm}$

Provide a 500 deep by 300 wide 10.1m long simply supported beam in C35/45 concrete, with 25 mm cover to bottom and sides, 20 mm cover to top, 2T16 top, 3T25 bottom, detailed in accordance with BS8110-1 fig 3.24b), with 2 legs of T10 link at 300 centres throughout.

An article relating to this subject, entitled “Eurocodes – an opportunity to review your spreadsheets?”, was published in The Structural Engineer, volume 84, number 13, 4 July 2006, written by TEDDS Product Development Manager CSC (UK) Ltd. The article explains that CSC is making available a software programme called TEDDS Lite, which can be downloaded for free, from [www.cscworld.com](http://www.cscworld.com)[1]. By selecting TEDDS, then TEDDS Lite on [www.cscworld.com](http://www.cscworld.com), we are presented with the opportunity to download the software. Design examples available for download include:-

(UK / Asia) Beam Torsion Design, Thermal crack widths.

(USA) Corbel design.

(Australia) Pad footing design.

## **STEELWORK:-**

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(USA) Beam in torsion.

Using this free version of TEDDS, the article explains, that a case study of development of content, is in progress at [www.access-steel.com](http://www.access-steel.com). Meanwhile, searching for “Design examples” on [www.access-steel.com](http://www.access-steel.com)[3], will provide you with 10 basic steelwork design examples to Eurocode 3.

The CSC website explains further that TEDDS Lite for Access Steel is a special version of TEDDS Lite commissioned for the Access Steel project and is a separate product from TEDDS Lite.

TEDDS Lite for Access Steel allows you to use Interactive Worked Examples to the Eurocodes that were developed for the access steel project. Visit [www.access-steel.com](http://www.access-steel.com) to download TEDDS Lite for Access Steel and the Interactive Worked Examples.

### **MASONRY:-**

To be advised.

### **TIMBER:-**

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(UK / Asia) Joist design.

## **STRUCTURAL LOADINGS, PARTIAL FACTORS ETC ETC ETC:-**

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