

REINFORCED CONCRETE-I

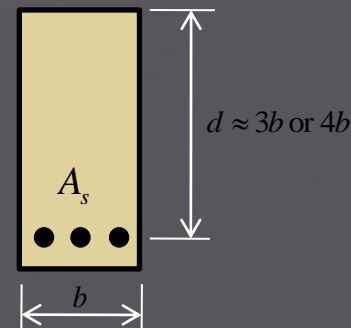
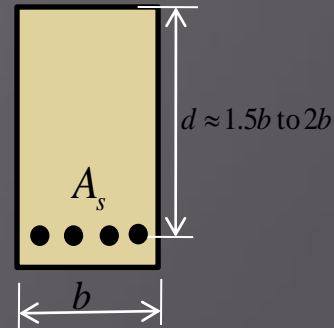
(Design of Rectangular Beams-Introduction)

Design of Rectangular Beams

- ▣ Before the design of an actual beam is attempted, several miscellaneous topics need to be discussed. These include the following:
 1. Beam proportions
 2. Deflections
 3. Estimated beam weight
 4. Selection of bars
 5. Cover
 6. Minimum spacing of bars

BeamProportions

- The most economical beam sections are usually obtained for shorter beams (up to 6 or 7.5 m in length), when the ratio of d to b is in the range of 1.5 to 2.
- For longer spans, better economy is usually obtained if deep, narrow sections are used. The depths may be as large as 3 or 4 times the widths.
- The overall beam dimensions are selected to multiples of 25 mm. This is done for simplicity in constructing forms or for the rental of forms which are usually available in 25 or 50 mm increments.
- Beam widths are often selected in multiples of 50 mm or 75 mm).
- Shallow beams are required to reduce floor heights.



Deflections

- The SBC/ACI code provides minimum thicknesses of beams and one way slabs for which deflections calculations are not required.

Minimum Thickness, h				
Member	Simply supported	One end continuous	Both ends continuous	Cantilever
Solid one-way slabs	$l / 20$	$l / 24$	$l / 28$	$l / 10$
Beams or ribbed one-way slabs	$l / 16$	$l / 18.5$	$l / 21$	$l / 8$

- If deflections are computed for members of lesser thicknesses than those listed above, and are found to be satisfactory, it is not necessary to abide by the thickness rules.

How to Assume..

- ▣ **Overall Depth h :** Assume a minimum overall depth h equal to the minimum depth specified by the code if deflections are not to be calculated.
- ▣ **Beam Width b :** Then the beam width can be roughly estimated equal to about one-half of the assumed value of h .
- ▣ **Beam self weight:** $b \times h \times L(=1) \times$ unit weight of concrete

How to finalize the section..

- ▣ *After M_u is determined for all the loads, including estimated beam weight, the section is selected.*
- ▣ *If the dimensions of this section are significantly different from those initially assumed, it will be necessary to recalculate the weight and M_u and repeat the beam selection.*
- ▣ *If initially calculated M_u and actual M_u (after beam selection) do not differ by more than say 1% or 1.5% no need to redo the calculations.*

Selection of bars

- ▣ After the required reinforcing area is calculated, select the bars that provide the necessary area.
- ▣ It is usually convenient to use bars of one size only in a beam, although occasionally two sizes are also used.
- ▣ Bars for compression steel and stirrups are usually of a different size. Otherwise the workmen may become confused.

Cover

- ▣ The reinforcing for concrete members must be protected from the surrounding environment; such as fire and corrosion.
- ▣ The reinforcing is located at certain minimum distance from the surface of the concrete so that a protective layer of concrete, called cover, is available.