Quick Rule for Initial Sizing of Steel Beam Section

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The first step of preliminary / detailed design of structure is initial sizing of main structural members. This note gives quick method of selecting steel section for Beam/Girder. The design of beam requires satisfying the strength and serviceability provisions of the codes.

The Minimum Moment of Inertia of Beam Section (in cm^4) required is

I = 0.5 x Ratio x K x L x M   **(easy to remember KLM is Royal Dutch Airlines)**

Here,

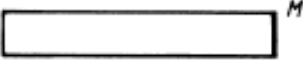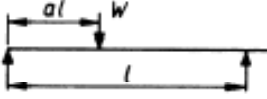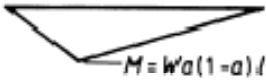M is Mid Span Beam Bending Moment in kNm

L is Span of Beam in m
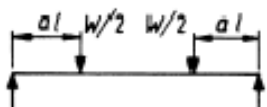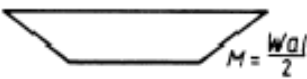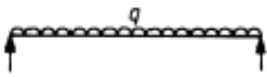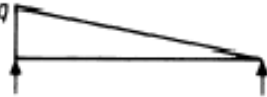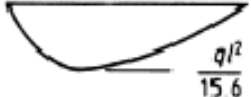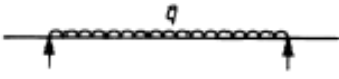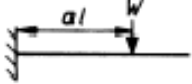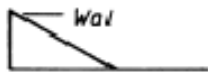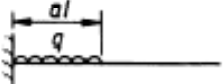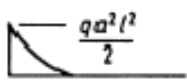
K is constant based on loading and end supports, it is based on bending moment diagram of span. The value of K is taken from Table 1. (Reference Table 3.1 of BS 8110-2:1985)

Ratio is Span / Allowable Deflection. It means Allowable Deflection = Span/Ratio

The value of "Ratio" can be 250, 360, 400, 500 or 600 based on design requirement.

Table 1 Values of K for various Bending Moment Diagram

Table 3.1 — Values of K for various bending moment diagrams

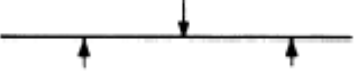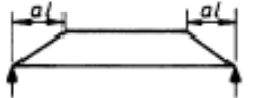| Loading	Bending moment diagram	K
M ⟷ M	M	0.125
al, W, l	$M = Wa(1-a)l$	$\dfrac{3-4a^2}{48(1-a)}$ if $a = \frac{1}{2}$ $K = \frac{1}{12}$
	M	0.0625
al, $W/2$, $W/2$, al	$M = \dfrac{Wal}{2}$	$0.125 - \dfrac{a^2}{6}$
q	$\dfrac{ql^2}{8}$	0.104
q	$\dfrac{ql^2}{15.6}$	0.102
q	M_A, M_C, M_B	$K = 0.104\left(1 - \dfrac{\beta}{10}\right)$ $\beta = \dfrac{M_A + M_B}{M_C}$
al, W	Wal	end deflection $= \dfrac{a(3-a)}{6}$ load at end $K = 0.333$
al, q	$\dfrac{qa^2l^2}{2}$	$\dfrac{a(4-a)}{12}$ if $a = l$ $K = 0.25$
	M_A, M_C, M_B	$K = 0.083\left(1 - \dfrac{\beta}{4}\right)$ $\beta = \dfrac{M_A + M_B}{M_C}$
al, al	$\dfrac{Wl^2}{24}(3 - 4a^2)$	$\dfrac{1}{80}\dfrac{(5-4a^2)^2}{3-4a^2}$

for allowable deflection = Span/400, and uniformly distributed load, The I required for Beam=0.5x400xK L M

I= 200 x 0.104 L M = 20.8 L M

I is in cm^4 unit.