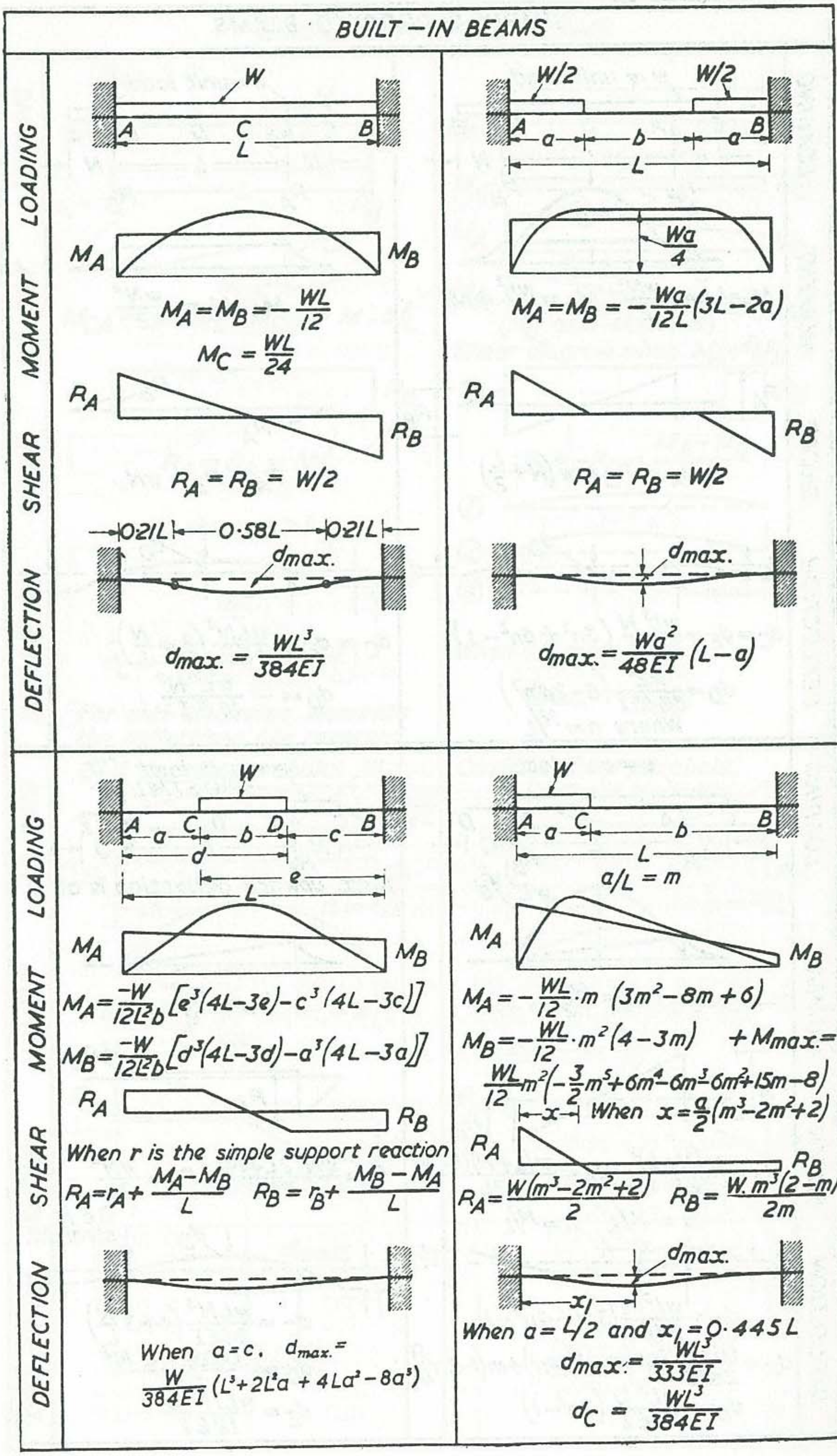
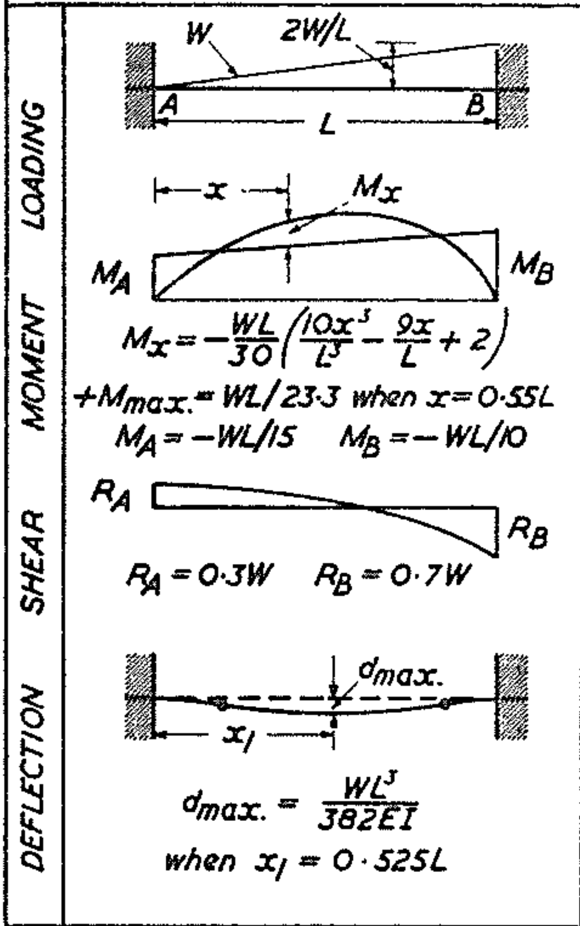

BUILT – IN BEAMS
LOADING
MOMENT
SHEAR
DEFLECTION
W
A C B
L
M_A M_B
$M_A = M_B = -\frac{WL}{12}$
$M_C = \frac{WL}{24}$
R_A R_B
$R_A = R_B = W/2$
0·21L 0·58L 0·21L
dmax.
$d_{max.} = \frac{WL^3}{384EI}$
W/2 W/2
A a b a B
L
$\frac{Wa}{4}$
$M_A = M_B = -\frac{Wa}{12L}(3L-2a)$
$R_A = R_B = W/2$
dmax.
$d_{max.} = \frac{Wa^2}{48EI}(L-a)$
W
A C D B
a b c
d
e
L
$M_A = \frac{-W}{12L^2b}[e^3(4L-3e)-c^3(4L-3c)]$
$M_B = \frac{-W}{12L^2b}[d^3(4L-3d)-a^3(4L-3a)]$
When r is the simple support reaction
$R_A = r_A + \frac{M_A - M_B}{L}$ $R_B = r_B + \frac{M_B - M_A}{L}$
When a = c, $d_{max.} = \frac{W}{384EI}(L^3+2L^2a+4La^2-8a^3)$
W
A C B
a b
L
$a/L = m$
$M_A = -\frac{WL}{12}\cdot m\,(3m^2-8m+6)$
$M_B = -\frac{WL}{12}\cdot m^2(4-3m)$
$+M_{max.} = \frac{WL}{12}m^2\left(-\frac{3}{2}m^5+6m^4-6m^3-6m^2+15m-8\right)$
x When $x = \frac{a}{2}(m^3-2m^2+2)$
$R_A = \frac{W(m^3-2m^2+2)}{2}$ $R_B = \frac{W.m^3(2-m)}{2m}$
dmax.
x_1
When $a = L/2$ and $x_1 = 0\cdot445L$
$d_{max.} = \frac{WL^3}{333EI}$
$d_C = \frac{WL^3}{384EI}$

BUILT-IN BEAMS



$$M_x = -\frac{WL}{30}\left(\frac{10x^3}{L^3} - \frac{9x}{L} + 2\right)$$

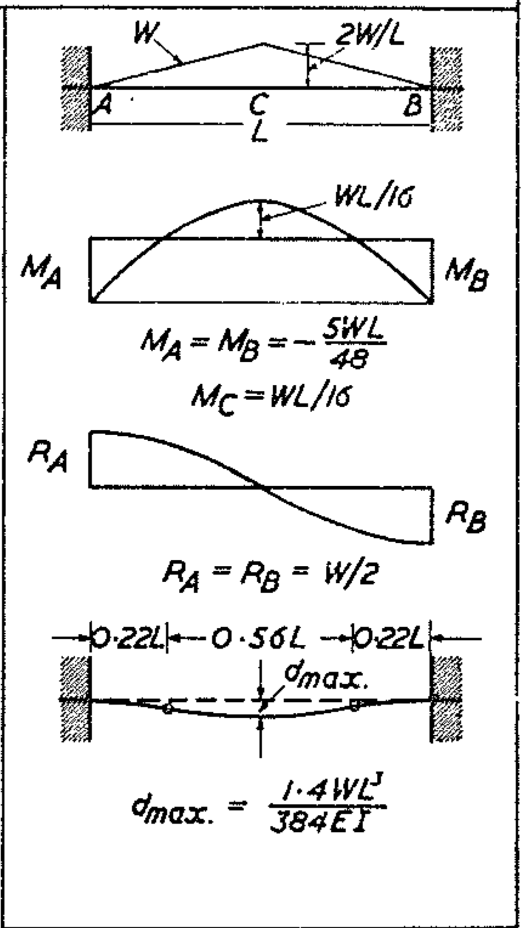
$+M_{max.} = WL/23{\cdot}3$ when $x = 0{\cdot}55L$

$M_A = -WL/15 \quad M_B = -WL/10$

$R_A = 0{\cdot}3W \quad R_B = 0{\cdot}7W$

$$d_{max.} = \frac{WL^3}{382EI}$$

when $x_1 = 0{\cdot}525L$

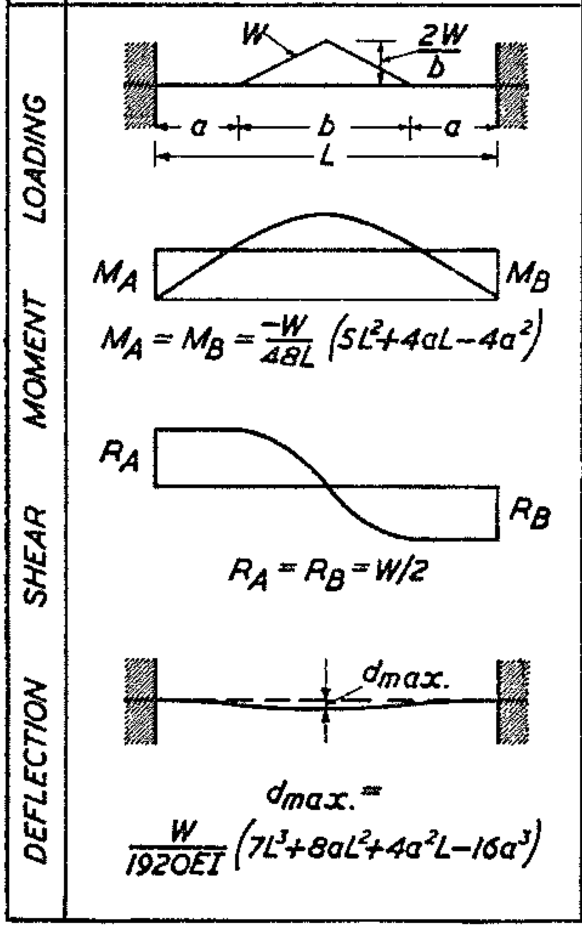


$$M_A = M_B = -\frac{5WL}{48}$$

$M_C = WL/16$

$R_A = R_B = W/2$

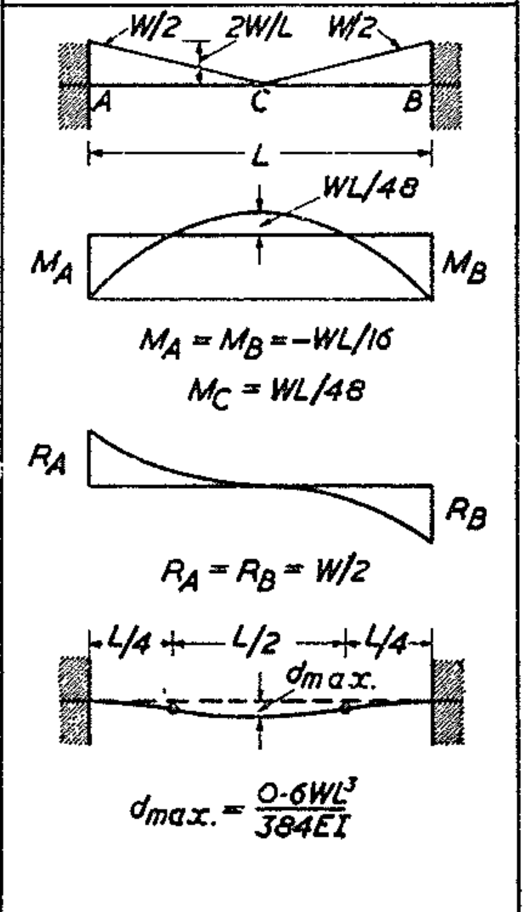
$$d_{max.} = \frac{1{\cdot}4WL^3}{384EI}$$



$$M_A = M_B = \frac{-W}{48L}\left(5L^2+4aL-4a^2\right)$$

$R_A = R_B = W/2$

$$d_{max.} = \frac{W}{1920EI}\left(7L^3+8aL^2+4a^2L-16a^3\right)$$

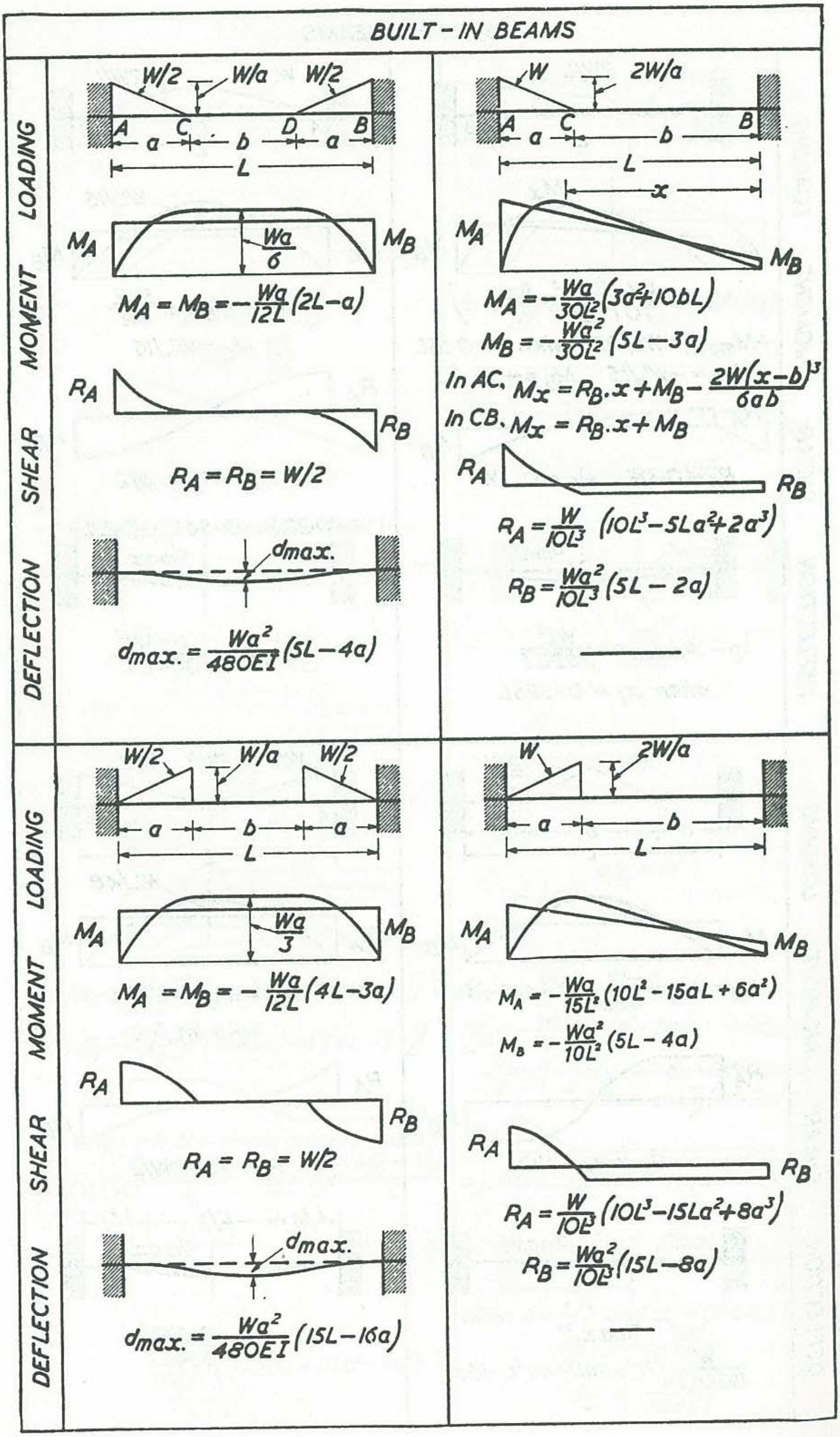


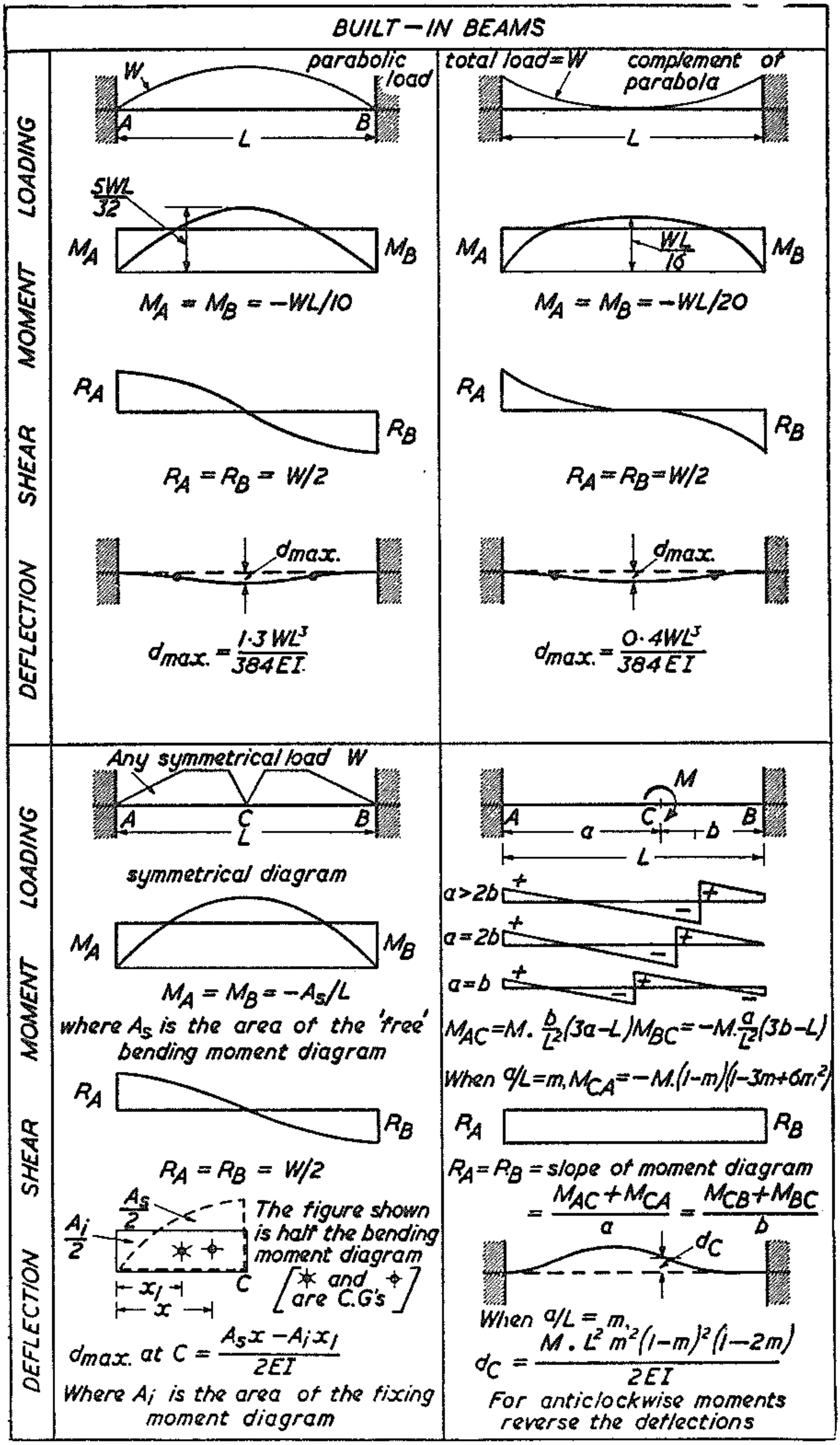
$M_A = M_B = -WL/16$

$M_C = WL/48$

$R_A = R_B = W/2$

$$d_{max.} = \frac{0{\cdot}6WL^3}{384EI}$$


BUILT-IN BEAMS
LOADING
MOMENT
SHEAR
DEFLECTION
W/2
W/a
W/2
A C D B
a b a
L
M_A
$\frac{Wa}{6}$
M_B
$M_A = M_B = -\frac{Wa}{12L}(2L-a)$
R_A
R_B
$R_A = R_B = W/2$
dmax.
$d_{max.} = \frac{Wa^2}{480EI}(5L-4a)$
W
2W/a
A C B
a b
L
x
M_A
M_B
$M_A = -\frac{Wa}{30L^2}(3a^2+10bL)$
$M_B = -\frac{Wa^2}{30L^2}(5L-3a)$
In AC, $M_x = R_B.x + M_B - \frac{2W(x-b)^3}{6ab}$
In CB, $M_x = R_B.x + M_B$
R_A
R_B
$R_A = \frac{W}{10L^3}(10L^3-5La^2+2a^3)$
$R_B = \frac{Wa^2}{10L^3}(5L-2a)$
W/2
W/a
W/2
a b a
L
M_A
$\frac{Wa}{3}$
M_B
$M_A = M_B = -\frac{Wa}{12L}(4L-3a)$
R_A
R_B
$R_A = R_B = W/2$
dmax.
$d_{max.} = \frac{Wa^2}{480EI}(15L-16a)$
W
2W/a
a b
L
M_A
M_B
$M_A = -\frac{Wa}{15L^2}(10L^2-15aL+6a^2)$
$M_B = -\frac{Wa^2}{10L^2}(5L-4a)$
R_A
R_B
$R_A = \frac{W}{10L^3}(10L^3-15La^2+8a^3)$
$R_B = \frac{Wa^2}{10L^3}(15L-8a)$


BUILT—IN BEAMS
LOADING
MOMENT
SHEAR
DEFLECTION
W
parabolic load
A
B
L
5WL/32
M_A
M_B
$M_A = M_B = -WL/10$
R_A
R_B
$R_A = R_B = W/2$
$d_{max.}$
$d_{max.} = \frac{1{\cdot}3\,WL^3}{384\,EI}$
total load = W
complement of parabola
L
WL/16
M_A
M_B
$M_A = M_B = -WL/20$
R_A
R_B
$R_A = R_B = W/2$
$d_{max.}$
$d_{max.} = \frac{0{\cdot}4\,WL^3}{384\,EI}$
Any symmetrical load W
A
C
B
L
symmetrical diagram
M_A
M_B
$M_A = M_B = -A_s/L$
where A_s is the area of the 'free' bending moment diagram
R_A
R_B
$R_A = R_B = W/2$
$\frac{A_s}{2}$
$\frac{A_i}{2}$
C
x_1
x
The figure shown is half the bending moment diagram
[✲ and ⌖ are C.G's]
$d_{max.}$ at $C = \frac{A_s x - A_i x_1}{2EI}$
Where A_i is the area of the fixing moment diagram
M
A
C
B
a
b
L
a>2b
a=2b
a=b
$M_{AC} = M.\frac{b}{L^2}(3a-L)$ $M_{BC} = -M.\frac{a}{L^2}(3b-L)$
When $a/L = m$, $M_{CA} = -M.(1-m)(1-3m+6m^2)$
R_A
R_B
$R_A = R_B$ = slope of moment diagram
$= \frac{M_{AC}+M_{CA}}{a} = \frac{M_{CB}+M_{BC}}{b}$
d_C
When $a/L = m$,
$d_C = \frac{M \cdot L^2 m^2 (1-m)^2 (1-2m)}{2EI}$
For anticlockwise moments reverse the deflections