ANNEX E

(*Clause* 25.2)

EFFECTIVE LENGTH OF COLUMNS

E-1 In the absence of more exact analysis, the effective length of columns in framed structures may be obtained from the ratio of effective length to unsupported length l_{ef}/l given in Fig. 26 when relative displacement of the ends of the column is prevented and in Fig. 26 when relative lateral displacement of the ends is not prevented. In the latter case, it is recommendded that the effective length ratio l_{ef}/l may not be taken to be less than 1.2.

NOTES

1 Figures 26 and 27 are reproduced from 'The Structural Engineer' No. 7, Volume 52, July 1974 by the permission of the Council of the Institution of Structural Engineers, U.K.

2 In Figs. 26 and 27, β_1 and β_2 are equal to $\frac{\Sigma K_c}{\Sigma K_c + \Sigma K_b}$

where the summation is to be done for the members framing into a joint at top and bottom respectively; and K_c and K_b being the flexural stiffness for column and beam respectively.

E-2 To determine whether a column is a no sway or a sway column, stability index Q may be computed as given below :

$$Q = \frac{\Sigma P_u \Delta_u}{H_u h_s}$$

where

ΣP_u = sum of axial loads on all column in the storey,

Δ_u = elastically computed first order lateral deflection,

H_u = total lateral force acting within the storey, and

h_s = height of the storey.

If $Q \leq 0.04$, then the column in the frame may be taken as no sway column, otherwise the column will be considered as sway columnn.

E-3 For normal usage assuming idealized conditions, the effective length l_{ef} of in a given plane may be assessed on the basis of Table 28.

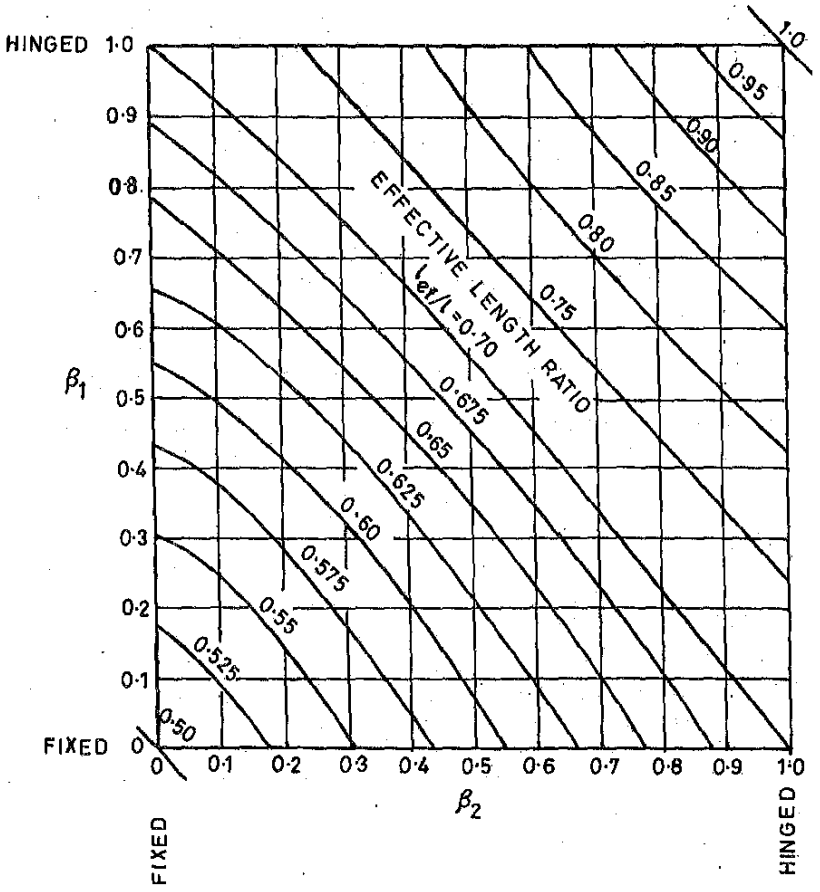


FIG. 26 EFFECTIVE LENGTH RATIOS FOR A COLUMN IN A FRAME WITH NO SWAY

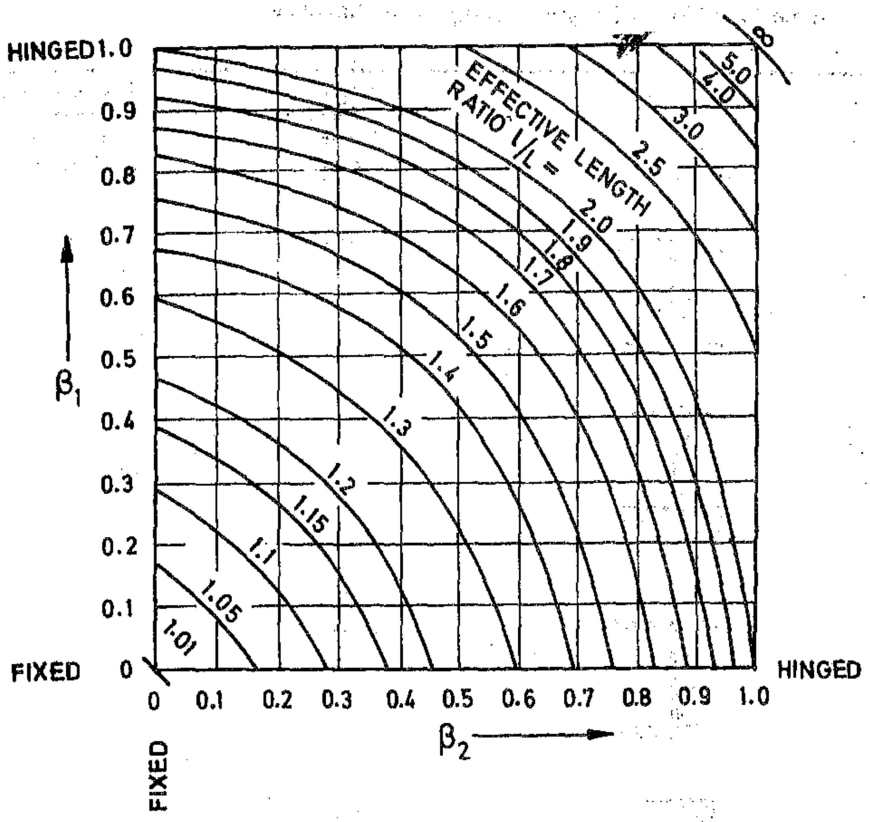
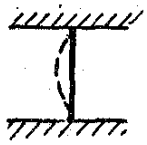
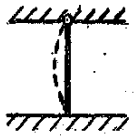
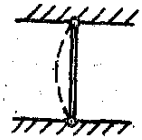
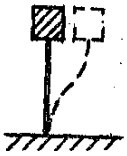
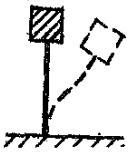
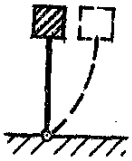
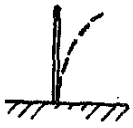


FIG. 27 EFFECTIVE LENGTH RATIOS FOR A COLUMN IN A FRAME WITHOUT RESTRAINT AGAINST SWAY

Table 28 Effective Length of Compression Members

(*Clause* E-3)

Degree of End Restraint of Compression Members	Symbol	Theoretical Value of Effective Length	Recommended Value of Effective Length
(1)	(2)	(3)	(4)
Effectively held in position and restrained against rotation in both ends		0.50 *l*	0.65 *l*
Effectively held in position at both ends, restrained against rotation at one end		0.70 *l*	0.80 *l*
Effectively held in position at both ends, but not restrained against rotation		1.00 *l*	1.00 *l*
Effectively held in position and restrained against rotation at one end, and at the other restrained against rotation but not held in position		1.00 *l*	1.20
Effectively held in position and restrained against rotation in one end, and at the other partially restrained against rotation but not held in position			1.50 *l*
Effectively held in position at one end but not restrained against rotation, and at the other end restrained against rotation but not held in position		2.00 *l*	2.00 *l*
Effectively held in position and restrained against rotation at one end but not held in position nor restrained against rotation at the other end		2.00 *l*	2.00 *l*

NOTE — *l* is the unsupported length of compression member.