Appendix 1: **Wilbur's Formula**

They depend on the story under evaluation [37,38].

For the first story:

$$R_1 = \frac{48E}{D_1 h_1} \quad D_1 = \frac{4h_1}{\sum K_{c1}} + \frac{h_1 + h_2}{\sum K_{t1} + \sum K_{c1}/12} \tag{1}$$

For the second story:

$$R_2 = \frac{48E}{D_2 h_2} \quad D_2 = \frac{4h_2}{\sum K_{c2}} + \frac{h_1 + h_2}{\sum K_{t1} + \sum K_{c1}/12} + \frac{h_2 + h_3}{\sum K_{t2}} \tag{2}$$

And for intermediate stories:

$$R_n = \frac{48E}{D_n h_n} \quad D_n = \frac{4h_n}{\sum K_{cn}} + \frac{h_m + h_n}{\sum K_{tm}} + \frac{h_n + h_o}{\sum K_{tn}} \tag{3}$$

Where: R_n is the lateral stiffness for the nth floor, E the Young modulus, K_{tn} and K_{cn} represent the relation I/L (Ratio between the second moment of area of the cross section and the length) for beams and columns respectively in the nth story, m, n and o are three consecutive levels and h_n is the story height. When dealing with the last level h_m must be replaced by $2h_m$ and $h_o=0$.

The assumptions underlying the development of these expressions are: i) they are valid on regular frames composed of constant inertia elements, ii) the axial deformations of the elements are neglected, iii) the columns develop points of inflection and iv) the rotation of each point as well as the shear force on the studied level and the two adjacent levels have the same value.