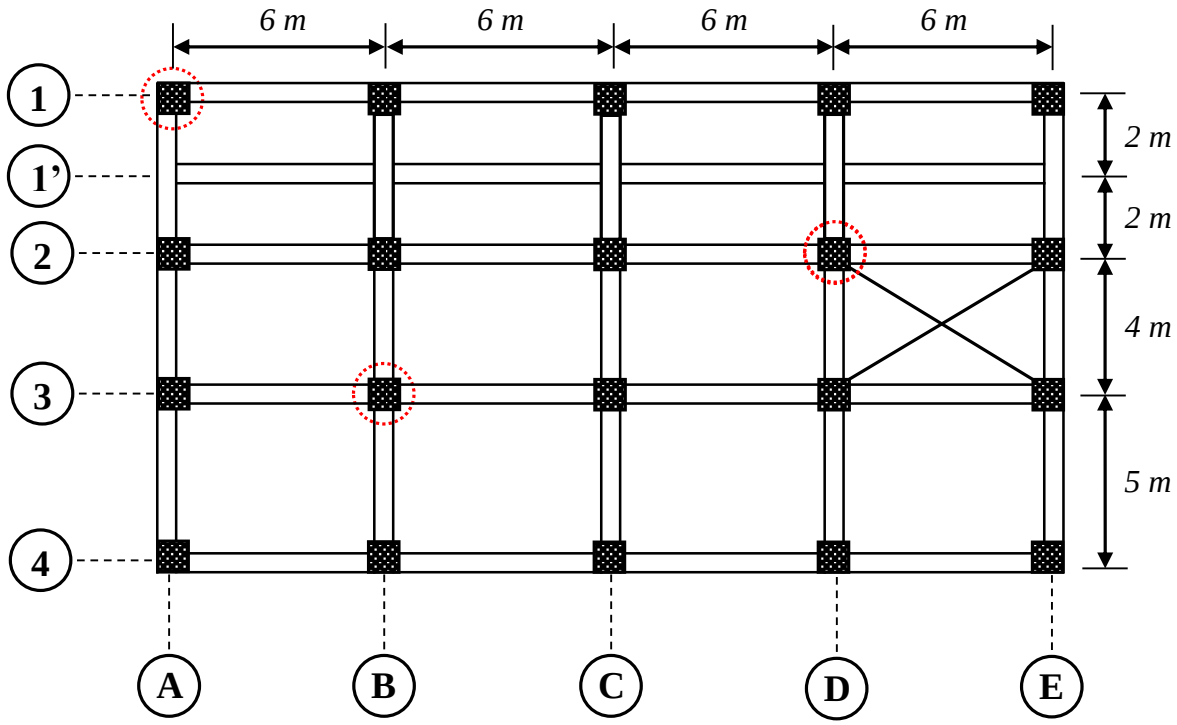
CE486 Structural Design – Concrete Structures

Period Calculation Tutorial



Slab thickness : 15cm,

Beam : 30 cm X 60 cm,

Column : 30 cm X 30 cm,

Finish work : 1.5 kN/m^2,

Office building,

Number of stories : 5

Height: 5 m

Weight of each floor is calculated and given in Table 1. SAP2000 model was used for modal analysis and the results are for T_x = 0,616 sec and T_y = 0,605 sec. In Figure 1, SAP2000 model was presented.

Table 1 Weight and Height

	weight(kN)	Height(m)
5th floor	2515,34	12,5
4th floor	2591,9	10
3rd floor	2591,9	7,5
2nd floor	2591,9	5

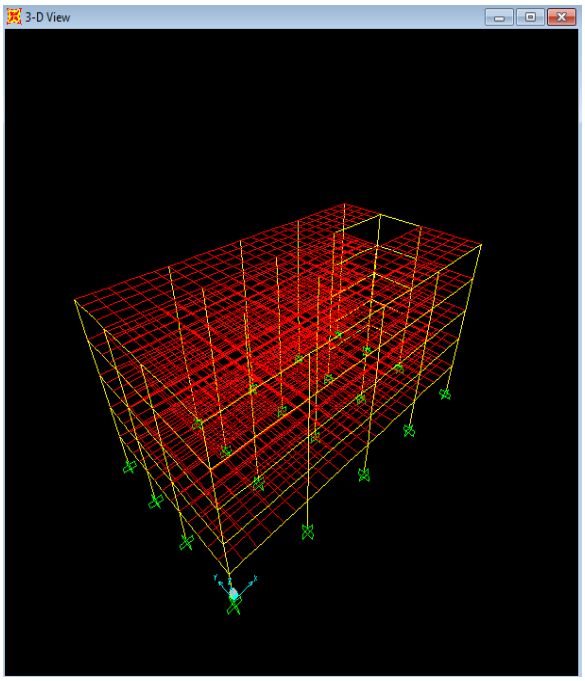


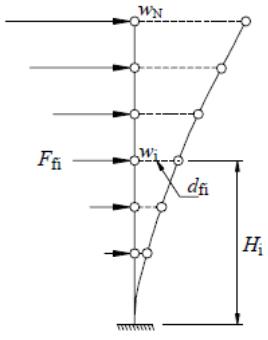
Figure 1 SAP2000 Model

<u>Fundamental period calculation according to the equation 2.11 in section 2.7.4.1 (TEC 2007) in two orthogonal directions.</u>

$$T_1 = 2\pi \left(\frac{\sum_{i=1}^{N} m_i \, d_{fi}^2}{\sum_{i=1}^{N} F_{fi} \, d_{fi}} \right)^{1/2}$$

Imaginary forces applied to the structure with the pattern of upper triangular and forces were calculated according to the TEC 2007.

$$F_{fi} = \frac{w_i H_i}{\sum_{j=1}^{N} w_j H_j}$$



Şekil 2.9

$F_{f5} = \frac{31441,75}{96239,25} = 0,327$ $F_{f4} = \frac{25919}{96239,25} = 0,269$ $F_{f3} = \frac{19439,25}{96239,25} = 0,202$

$F_{f2} = \frac{12959,5}{96239,25} = 0,135$ $F_{f1} = \frac{6479,75}{96239,25} = 0,067$

For x direction; forces applied each floor diaphragm and displacements at each story (closest to the mass center is better) was read and written in Table 2.

Table 2 Period Calculation for X direction

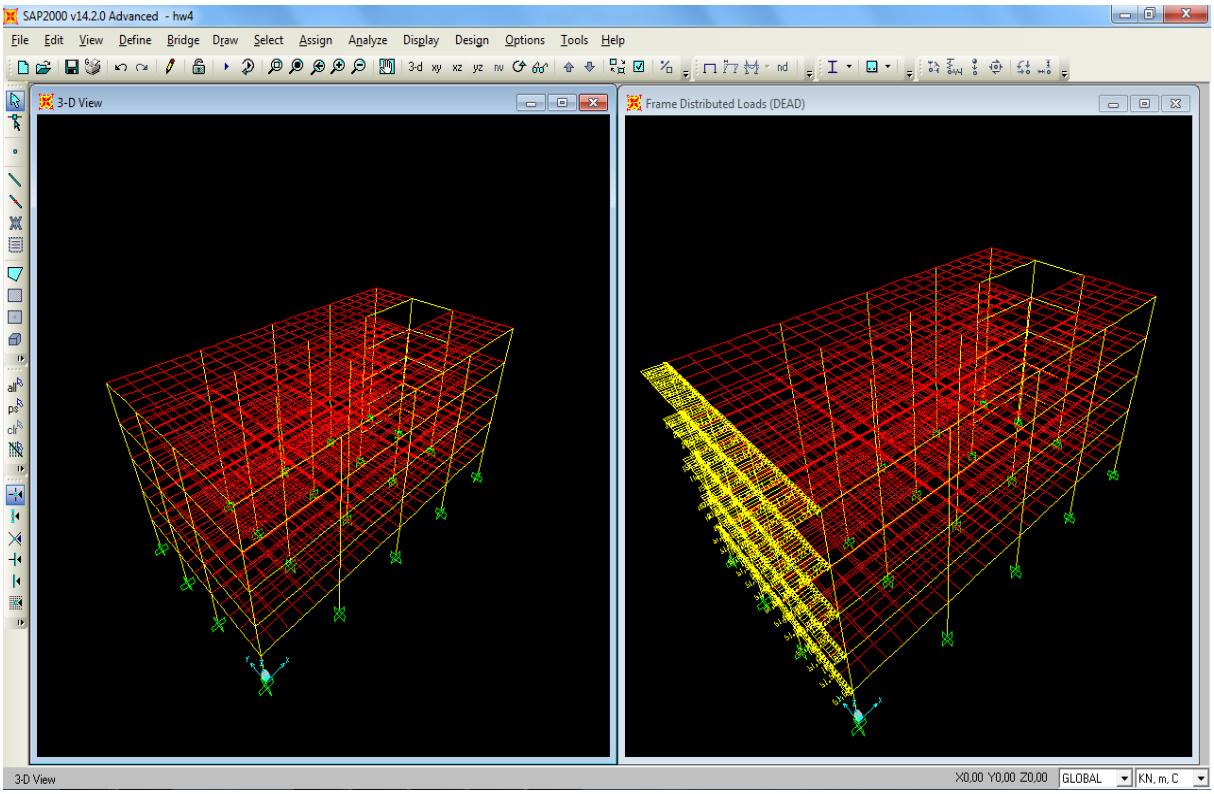
	mass(ton)	dfix	dfix^2	Ffi*(10000)	w*dfi^2	Ffi*dfi
5th floor	256,405708	0,0942	0,008874	3270	2,275252	308,034
4th floor	264,20999	0,0851	0,007242	2690	1,913411	228,919
3rd floor	264,20999	0,0689	0,004747	2020	1,25426	139,178
2nd floor	264,20999	0,0472	0,002228	1350	0,588618	63,72
1st floor	264,20999	0,0222	0,000493	670	0,130213	14,874
					6,161754	754,725

$$\frac{6,161754}{754,725} = 0,00816$$

$0,00816^{1/2} = 0,0904$

$(0,0904)*(2)*(\pi) = 0,568$

$T_x = 0,568$ sec



Same process was considered for Y direction also and results are displayed in Table 3.

Table 3Period Calculation for Y direction

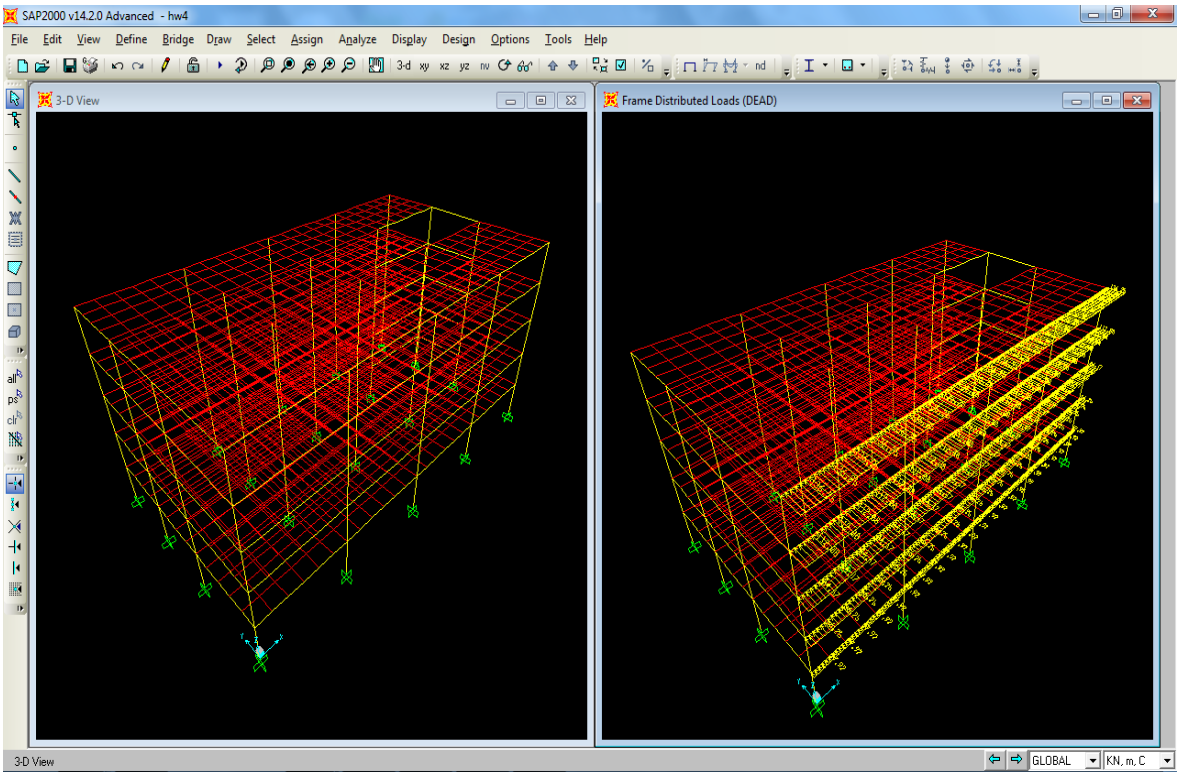
	mass(ton)	dfiy	dfiy^2	Ffi*(10000)	w*dfi^2	Ffi*dfi
5th floor	256,405708	0,0923	0,008519	3270	2,184395	301,821
4th floor	264,20999	0,0831	0,006906	2690	1,824531	223,539
3rd floor	264,20999	0,0672	0,004516	2020	1,19313	135,744
2nd floor	264,20999	0,0461	0,002125	1350	0,561502	62,235
1st floor	264,20999	0,0219	0,00048	670	0,126718	14,673
					5,890275	738,012

$$\frac{5{,}890275}{738{,}012} = 0{,}00798$$

$0{,}00798^{1/2} = 0{,}0893$

$(0{,}0893)*(2)*(\pi) = 0{,}561$

$T_y = 0{,}561$ sec



	SAP2000 Model	TEC 2007 Equation 2.11
Tx	0,616	0,568
Ty	0,605	0,561