

Earthquake load calculations as per IS1893-2002.- by Hemant Va

Project : Building xyz at Mumbai. Rev.Mar2003
User : hsv

Date : 16-Nov-19

- (1) TOTAL SEISMIC WEIGHT OF BUILDING (W) = 19250 TONS
- ? (2) Height of the building h (metre) = 20
- ? (3) Base dimension of the building d (metre) = 10
- ? (4) Building Type 1: Bldg. with infill 1 0.569
2 : RCC frame Bldg. without infill 0.709
3 : Steel frame Bldg. without infill 0.804
- ? (4a) Soil strata 1: Hard, 2: Medium, 3: Soft 2
- (5) Time period T ($T1 = 0.09 * h / \text{sqrt}(d)$ = 0.569 seconds
 $T2 = 0.075 * h^{0.75}$; $T3 = 0.085 * h^{0.75}$)
- ? (6) Zone factor z as per Table 2 = 0.16
- ? (7) Importance Factor I as per Table 6 = 1
- ? (8) Response Reduction Factor R as per Table 7 = 5
- (9) From Fig 2 of IS:1893-2002 Sa/g = 2.389
- (10) Design Horizontal Seismic coefficient Ah
- (11) $Ah = Z * I * Sa / (2 * R * g)$ = 0.0382
- (12) DESIGN BASE SHEAR ($Vb = Ah * W$) = 736 TONS
- ? (13) TYPICAL STOREY HEIGHT (H) = 2.9 METRES
- (14) $P_FACTOR = (Wi * hi^2) / (TOTAL(Wi * hi^2))$
- (15) $Qi = P_FACTOR * Vb$

FLOOR	Wi (TONS)	hi (MTS)	Wi*hi^2	P_FACTOR	Qi (TONS)	NO. OF JOINTS	JOINT FORCE (TONS)
ROOF	1000	79.82	6371232	0.1413	104.0	1	104.0086
25	700	76.92	4141680	0.0919	67.6	1	67.6118
24	700	74.02	3835272	0.0851	62.6	1	62.6098
23	700	71.12	3540638	0.0785	57.8	1	57.7999
22	700	68.22	3257778	0.0723	53.2	1	53.1823
21	700	65.32	2986692	0.0663	48.8	1	48.7569
20	700	62.42	2727379	0.0605	44.5	1	44.5237
19	700	59.52	2479841	0.0550	40.5	1	40.4827
18	700	56.62	2244077	0.0498	36.6	1	36.6339
17	700	53.72	2020087	0.0448	33.0	1	32.9774
16	700	50.82	1807871	0.0401	29.5	1	29.5130
15	700	47.92	1607428	0.0357	26.2	1	26.2408
14	700	45.02	1418760	0.0315	23.2	1	23.1609
13	700	42.12	1241866	0.0275	20.3	1	20.2731
12	700	39.22	1076746	0.0239	17.6	1	17.5776
11	700	36.32	923400	0.0205	15.1	1	15.0742
10	700	33.42	781827	0.0173	12.8	1	12.7631
9	700	30.52	652029	0.0145	10.6	1	10.6442
8	700	27.62	534005	0.0118	8.7	1	8.7175
7	700	24.72	427755	0.0095	7.0	1	6.9830
6	700	21.82	333279	0.0074	5.4	1	5.4407
5	700	18.92	250576	0.0056	4.1	1	4.0906
4	700	16.02	179648	0.0040	2.9	1	2.9327
3	700	13.12	120494	0.0027	2.0	1	1.9670
2	700	10.22	73114	0.0016	1.2	1	1.1936
1	700	7.32	37508	0.0008	0.6	1	0.6123
STILT	575	3.66	7702	0.0002	0.1	1	0.1257
Base	175	0.00	0	0.0000	0.0	1	0.0000

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TOTAL **19250**
(W) MT

45078687

1.0000

735.9
(Vb) MT

Approximate Seismic weight calculations :

(I)	TYPICAL FLOOR BEAM+COL SELF WT(DL) =	175.00 TONS
(II)	TYPICAL FLOOR SLAB (DEAD) LOADS =	100.00 TONS
(III)	TYPICAL FLOOR WALL (DEAD) LOADS =	400.00 TONS
(IV)	TYPICAL FLOOR SLAB (LIVE) LOADS =	100.00 TONS
(V)	ROOF FLOOR SLAB (DEAD) LOADS =	170.80 TONS
(VI)	ROOF FLOOR SLAB (LIVE) LOADS =	0.00 TONS
(VII)	GR. / PLINTH LEVEL D.L. (NO L.L.) =	575.00 TONS
(VIII)	TYPICAL FLOOR D.L. + (25%) L.L. =	700.00 TONS
(IX)	ROOF FLOOR D.L. + (25%) L.L. =	345.80 TONS

Earthquake load calculations as per IS1893-2002.

Calculation of Time period T sec

$$T=0.075h^{0.75}$$

$$T=0.085h^{0.75}$$

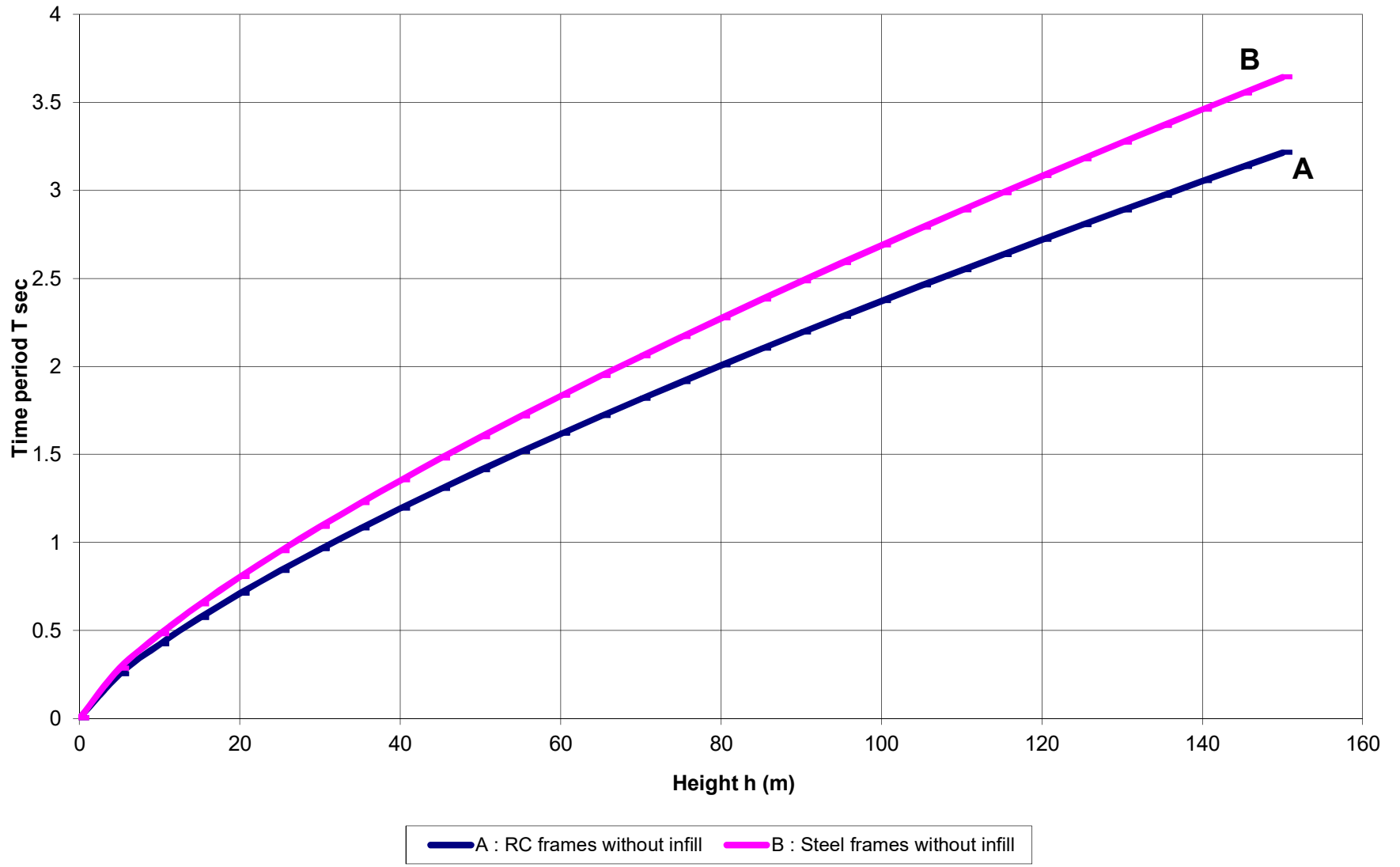
Buildings with Brick infill panels

Bldg. Height h(m)	Without Brick infill		Base dimension d (m)					
	RC frame	Steel frame	10	20	30	40	50	60
0	0	0	0	0	0	0	0	0
5	0.2507776	0.284215	0.142302	0.100623	0.082158	0.071151	0.06364	0.058095
10	0.421756	0.47799	0.284605	0.201246	0.164317	0.142302	0.127279	0.11619
15	0.5716493	0.647869	0.426907	0.301869	0.246475	0.213454	0.190919	0.174284
20	0.7093062	0.80388	0.56921	0.402492	0.328634	0.284605	0.254558	0.232379
25	0.8385255	0.950329	0.711512	0.503115	0.410792	0.355756	0.318198	0.290474
30	0.9613958	1.089582	0.853815	0.603738	0.49295	0.426907	0.381838	0.348569
35	1.0792257	1.223123	0.996117	0.704361	0.575109	0.498059	0.445477	0.406663
40	1.1929061	1.35196	1.13842	0.804984	0.657267	0.56921	0.509117	0.464758
45	1.3030787	1.476823	1.280722	0.905608	0.739425	0.640361	0.572756	0.522853
50	1.4102262	1.598256	1.423025	1.006231	0.821584	0.711512	0.636396	0.580948
55	1.5147232	1.716686	1.565327	1.106854	0.903742	0.782664	0.700036	0.639042
60	1.6168685	1.832451	1.70763	1.207477	0.985901	0.853815	0.763675	0.697137
65	1.7169051	1.945826	1.849932	1.3081	1.068059	0.924966	0.827315	0.755232
70	1.8150341	2.057039	1.992235	1.408723	1.150217	0.996117	0.890955	0.813327
75	1.9114248	2.166281	2.134537	1.509346	1.232376	1.067269	0.954594	0.871421
80	2.0062209	2.273717	2.27684	1.609969	1.314534	1.13842	1.018234	0.929516
85	2.0995463	2.379486	2.419142	1.710592	1.396693	1.209571	1.081873	0.987611
90	2.1915084	2.48371	2.561445	1.811215	1.478851	1.280722	1.145513	1.045706
95	2.2822014	2.586495	2.703747	1.911838	1.561009	1.351874	1.209153	1.1038
100	2.3717082	2.687936	2.84605	2.012461	1.643168	1.423025	1.272792	1.161895
105	2.4601027	2.788116	2.988352	2.113084	1.725326	1.494176	1.336432	1.21999
110	2.5474506	2.887111	3.130655	2.213707	1.807484	1.565327	1.400071	1.278085
115	2.6338112	2.984986	3.272957	2.31433	1.889643	1.636479	1.463711	1.336179
120	2.7192379	3.081803	3.41526	2.414953	1.971801	1.70763	1.527351	1.394274
125	2.803779	3.177616	3.557562	2.515576	2.05396	1.778781	1.59099	1.452369
130	2.8874786	3.272476	3.699865	2.6162	2.136118	1.849932	1.65463	1.510464
135	2.9703771	3.366427	3.842167	2.716823	2.218276	1.921084	1.718269	1.568558
140	3.0525114	3.459513	3.98447	2.817446	2.300435	1.992235	1.781909	1.626653
145	3.1339154	3.551771	4.126772	2.918069	2.382593	2.063386	1.845549	1.684748
150	3.2146205	3.643237	4.269075	3.018692	2.464752	2.134537	1.909188	1.742843

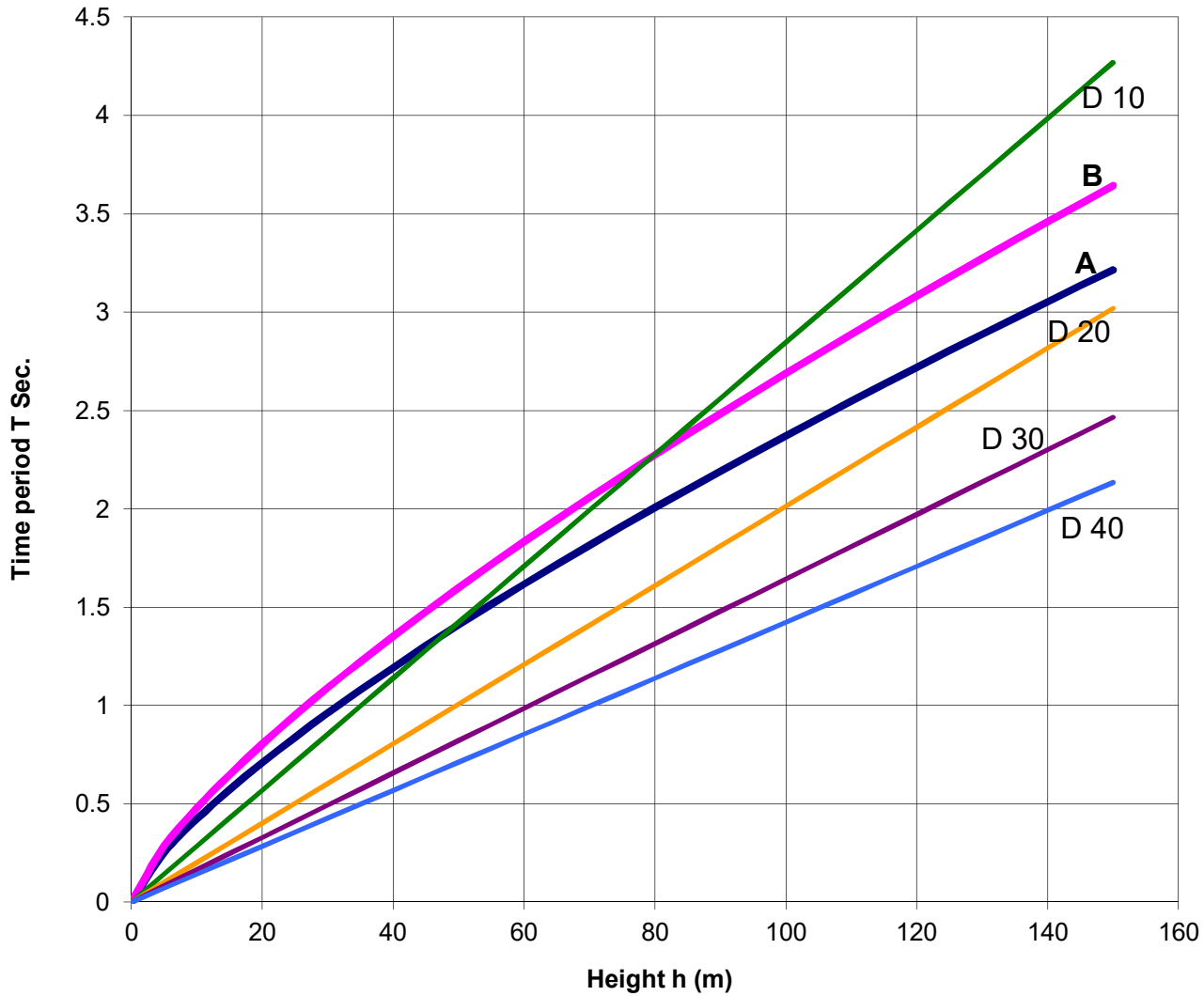
70 80

0	0
0.053785	0.050312
0.107571	0.100623
0.161356	0.150935
0.215141	0.201246
0.268926	0.251558
0.322712	0.301869
0.376497	0.352181
0.430282	0.402492
0.484068	0.452804
0.537853	0.503115
0.591638	0.553427
0.645423	0.603738
0.699209	0.65405
0.752994	0.704361
0.806779	0.754673
0.860565	0.804984
0.91435	0.855296
0.968135	0.905608
1.02192	0.955919
1.075706	1.006231
1.129491	1.056542
1.183276	1.106854
1.237062	1.157165
1.290847	1.207477
1.344632	1.257788
1.398417	1.3081
1.452203	1.358411
1.505988	1.408723
1.559773	1.459034
1.613559	1.509346

Time period v/s height



Height v/s time period



- A : RC frames without infill panels
- B: Steel frames without infill panel
- D 10 : Bldg. with infill & Base 10m
- D 20 : Bldg. with infill & Base 20m
- D 30 : Bldg. with infill & Base 30m
- D40 : Bldg with infill &Base 40m

For A : $T = 0.075 * h^{0.075}$

For B : $T = 0.085 * h^{0.075}$

For others
 $T = 0.09 * h / (d^{0.5})$

Help on the work sheet : by Hemant Vadalkar

- 1 All the cells with yellow colour are for data input.
- Numbers in blue colour are not protected & can be changed.
- 2 No macro is used in this sheet.
- 3 Earthquake base shear calculations are done as per new IS1893-2002.
- 4 Provide the required parameters like building height, base dimension, soil strata, building type, zone factor, Importance factor etc.
- 5 Program will calculate the base shear V_b for the entire structure.
To calculate the seismic weight, provide DL+appropriate fraction of LL for every floor and height of floor. This is required to calculate the distribution of EQ forces along the height of the building.
- 6 Reference may be made to IS1893-2002 for the different parameters.
- 7 Values of Zone factor Z are given at the location Col:AC Row:7 in sheet EQCalc.
- 8 At location, Column:O , Row:1, approximate column selfweight calculation can be carried out based on column sizes at different floors in sheet EQCalc.
- 9 Graphs of Time period T v/s Height H can be viewed in sheet "Chart1" for RCC and steel frames without infill panels.
Sheet named " Chart2" shows graph of T v/s H for RCC frames with infill panels for different base dimensions like 10m, 20m,30m and 40m.
- 10 For suggestions and comments contact Hemant Vadalkar at Email: vva@vsnl.com