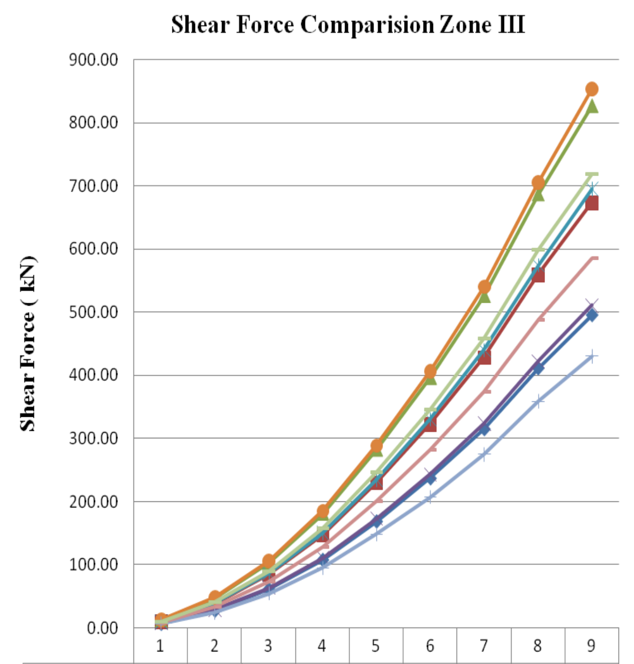

	1	2	3	4	5	6	7	8	9
FLS Soil 1	7.03	28.12	62.01	108.2	169.0	237.1	314.9	411.2	495.2
FLS Soil 2	9.56	38.24	84.34	147.1	229.9	322.5	428.2	559.3	673.5
FLS Soil 3	11.74	46.95	103.6	180.7	282.3	396.0	525.8	686.8	827.0
FLP Soil1	7.16	28.63	63.27	110.6	172.7	242.9	323.2	422.1	510.9
FLP Soil2	9.73	38.94	86.04	150.3	234.9	330.3	439.6	574.1	694.8
FLP Soil3	11.95	47.82	105.7	184.6	288.5	405.6	539.7	705.0	853.1
GS Soil1	6.17	24.69	54.36	94.77	148.1	207.3	275.0	359.1	430.7
GS Soil2	8.39	33.57	73.94	128.9	201.4	281.9	374.0	488.4	585.7
GS Soil3	10.31	41.22	90.79	158.3	247.3	346.1	459.2	599.8	719.3

(d)

Abbreviation used:
FLS –Flat Slab System
FLP – Flat Plate System
GS – Grid Slab

6. Conclusion

Conclusions from graphs (a to c)

1) All graphs clearly show that drift of flat plate is maximum than grid floor slab and flat slab. Grid slab has less drift compared to others. Drift of top storey of flat plate slab is about 18 % more than that of top storey of grid slab, and for flat slab it is about 8% more than that of grid slab. Drift or relative displacement of a storey is the ratio of base shear experienced by that storey to total stiffness of columns at that storey. Since stiffness of columns for a given storey is same for all three types of slabs, maximum drift indicates maximum base shear for flat plate slab.
2) Drifts of flat slabs and grid slabs are approximately equal up to storey 4.
3) All slabs deflect within the limit when strata is of type one i.e. rock, or hard soil.
4) Comparing strata conditions, building on soft soil (Type 3) deflects more.
5) Storey four and seven experiences maximum drift. Storey four has the largest displacement. This shows that column stiffness requirement of storey four and seven is greater than that of remaining stories.

Conclusions from graphs (d)

1) Flat plate experiences maximum shear force, whereas grid slab experiences less shear force. Shear force experienced by flat plate is 17 % higher and that of flat slab is 14 % higher than that of grid slab for all soil conditions.
2) There is definite correlation between increase in shear force and storey drift with change in soil condition for particular type of slab. For e.g. Flat slab building in medium soil condition experiences 36 % more drift and 36 % more shear force than building located on harder strata, where as for Flat slab building on soft soil condition both of them are 67 % more. Similar is the case for Grid slab and Flat plate building.

References

[1] Hyun-Su Kim1, Dong-Guen Lee2, “Efficient Seismic Analysis of Flat Plate System Structures” (13th World Conference on Earthquake Engineering Vancouver, B.C., Canada August 1-6, 2004 Paper No. 680) (2004)
[2] Suzanne King, Norbert J. Delette (February, 2004) "Collapse of 2000 Commonwealth Avenue: Punching Shear Case study" journal of performance of constructed facilities
[3] Carla M. Ghannoum, “Effect Of High-Strength Concrete On The Performance Of Slab-Column Specimens” Department of Civil Engineering and Applied Mechanics, McGill University Montréal, Canada (November 1998)
[4] Simon Brown1, Walter Dilger2, “Design Of Slab-Column Connections To Resist Seismic Loading” (13th World Conference on Earthquake Engineering Vancouver, B.C., Canada August 1-6, 2004 Paper No. 680) (2014)
[5] H. S. Kirn, D. G. Lee (October, 2005) "Efficient analysis of flat slab structures subjected to lateral loads", Engineering structures 27
[6] Megally, S. and Ghali, A, 2000. "Seismic Behavior of Slab-column Connections", Canadian Journal of Civil Engineering, Vo1.27, No.l, pp. 84-100.
[7] E. K. Jones & J. Morison (April, 2005) "flat slab design: past, present & future" structures & buildings 158 issue SB2
[8] U. Prawatwong, C.H. Tandian and P. Warnitchai “Tests Of Interior Flat Slab-Column Connections Transferring Shear Force And Moment”
[9] IS 1893 (Part 1):2002 Criteria For Earthquake Resistant Design Of Structures
[10] IS 456: 2000 Plain & reinforced concrete code of practice
[11] IS 4326 : 1993 (Reaffirmed 2003) Edition 3.3 (2005-01)
[12] Illustrated Design of Reinforced concrete Buildings - Karve & Shah
[13] P. Agarwal and M. Shrikhande – Earthquake Resistant Design of Structures, Prentice- Hall Publications.