

ANALYSIS OF EFFECT OF LIGHTWEIGHT CONCRETE USE
IN SEISMIC-RESISTANT MULTISTOREY BUILDINGS (5-94)

by

A.M. Paramzin^I, I.G. Gorovits^{II}

A computer analysis has been made of design intensity 9 seismic load and force distribution in framework elements of 5- to 18-storey framed buildings, with ordinary heavy concrete being fully replaced by ceramsite concrete of equal strength and of 1200 to 1800 kg/m³ volume weight in all structural and non-structural elements - in columns, beams, floors, walls, and partitions. The analysis has been carried out on the basis of earthquake resistance dynamic theory in conformity with the USSR seismic code, with the use of a building design scheme as a cantilever system with concentrated masses the number of which is equal to the number of storeys.

The following basic results have been obtained:

- building self-induced vibration periods increase by up to 30% mainly due to the half elastic modulus of the ceramsite concrete;
- lateral displacements of buildings increase disproportionately to the number of storeys by between 49% for 5-storey buildings and 108% for 15-storey buildings;
- in connection with the dynamic coefficient value limit within 0.8 and 3.0 specified in the USSR code, its effect on the seismic load value becomes apparent only for buildings of less than twelve storeys, and for 5-storey buildings this effect reaches 30%;
- effect of lesser weight building mode shape on design seismic load is negligible and independent of the number of storeys;
- total reduction of design seismic loads of the fundamental mode is about 30% for 5-storey buildings, 22% for 9-storey buildings, and 15% for 12- to 18-storey buildings;
- decrease of longitudinal forces in columns reaches from 18 to 36%, of bending moments - from 11% to 38% in columns and from 11% to 28% in trimmer beams; with a decrease in the volume weight of the high-strength ceramsite concrete, the forces in the members are considerably reduced;
- consumption of reinforcing steel is reduced in columns by up to 20%, in trimmer beams between 15 and 35%;
- replacement of heavy concrete by ceramsite concrete contributes to the improvement of the earthquake resistance of buildings with simultaneous reduction of the cost of construction.

^I Head of Laboratory, MSc (techn.), Kazakh Polytechnical Institute after V.I. Lenin, Alma-Ata, USSR.

^{II} Senior Scientific Worker, Kazakh Research Institute of Industrial Construction, Gosstroy of the USSR, Alma-Ata, USSR.

DISCUSSION

G.P. Saha (India)

The authors have shown that with the use of light weight concrete in a building there can be a reduction of seismic load and hence the replacement of heavy concrete by ceramic concrete contributes to the improvement of the earthquake resistance of buildings with simultaneous reduction of the cost of construction.

Usually concrete with light weight aggregate undergoes very high creep and additional reinforcement is required to limit the deflection due to creep of a member. Moreover the light weight concrete usually has lesser strength compared with the heavy concrete and the light weight concrete is more expensive than the heavy concrete. It will be interesting to know if there will be an overall economy even after considering the aforesaid effects.

Author's Closure

Not received.