SIMPLIFIED DESIGN GUIDELINES ON UPPER FLOOR SLABS OF TWO-STOREYED HOUSES

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BY

SAMITHA NIROSHANA JAYASINGHE, B.Sc.Eng. (Hons).

SUPERVISED BY

PROF. S.R. De S. CHANDRAKEERTHY

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ABSTRACT

The two-storeyed house is very popular now and its usage has overflown from Colombo and suburbs, to most provincial towns and their suburbs. It has come to stay because of: (a) escalating land prices due to increased demand and scarcity of buildable land; (b) higher social status it bestows on its owners and occupants; (c) imposing dominance of the surrounding environment with attractive views; and (d) possibility of construction at a higher but affordable cost even in relatively poor soil conditions. However, structural designs of two-storeyed houses are rarely referred to structural engineers probably because: (i) Local Authorities do not ask for structural details when plans are approved; and (ii) Clients prefer to make a saving on professional charges of structural engineers. One way to overcome this is to develop simplified design methods so that design office time and hence the cost of a structural engineer can be reduced. It will also help the new initiative taken by the institution of Engineers, Sri Lanka to get structural engineers to Design or check two-storeyed house designs. This concept is gradually gaining ground in developed countries with the provision of simplified design codes such as BS 8103: Structural design of low rise buildings. Further, upper floor slab is a very costly element in a two-storeyed house. Hence an investigation on development of a simplified design method for upper floor concrete slabs of two-storeyed houses was considered beneficial and timely.

The investigation consisted of a literature survey, a survey on frequency of occurrence of various slab configurations in typical two-storeyed houses, and a design study. The literature survey highlighted the importance of structural optimization in developing simplified design methods and the methodologies adopted by various researchers to formulate simplified design methods. The survey on typical two–storeyed houses popular in Sri Lanka covered 30 such houses focussing on dimensional variations as well as different end conditions, dealing with 217 distinctly different floor slabs. The design study consisted of over 3800 repetitive designs giving rise to 495 optimally designed reinforced concrete slabs, and 270 optimally designed slabs for studying sensitivity of optimal designs to variations in cost. To facilitate the conduct of repetitive designs, the structural design process was computerized by developing an EXCEL computer programme.

The investigation concluded that; (a) In all the designed solutions developed, the competition for the structurally optimized designs was always between 150mm and 125mm overall slab thicknesses; (b) The primary result of the structural optimization process was the overall slab thickness, as steel reinforcement areas get generated

automatically independent of slab bending moments as governing design criterion is cracking; (c) The two design recommendations were developed for selection by the user called the "preferred method" and the "alternative method"; and (d) All slabs had nominal reinforcements corresponding to the effective depth derived from the respective overall slab thickness.

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S. N. Jayasinghe

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