

**Reinforced concrete slab-beam systems
ultimate limit state design and its experimental motivation(*)**

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THEORY of plasticity furnished the general concepts which have led to the development of powerful computational tools for the rational analysis and design of a very wide range of structures. Over the last decade a method of strength design based on the limit state philosophy has been introduced to replace the conservative working load and allowable stress design. For structures composed of ductile materials or reinforced with ductile material the design procedure based on the ultimate limit state has gained a wide acceptance. In civil engineering the plastic design can be successfully applied to reinforced concrete systems consisting of slabs and beams. However, full implementation of the plastic method for their ultimate strength design has been hindered by the lack of comprehensive collections of effective solutions.

The paper is devoted to the flexural design of slab-beam structures of various layouts and edge conditions. The usually neglected effects of finite beam widths, *T*-beam and *L*-beam actions and the spread of slab flanges are incorporated into the analytical procedure to determine the cross-sectional moments associated with the collapse load at plastic failure. Elementary and combined models are studied to provide the best upper bound on the collapse load.

Considerable experimental evidence, including author's recent full scale tests, is also reported to confirm the viability of the approach.

Full implications and virtues of the plastic method of design for slab-beam systems are demonstrated to enable the structural engineer to design complex systems in a straightforward and efficient manner. Eight types of slab-beam systems, both orthogonal and skew, are dealt with resting on corner or edge supports and subject to uniformly distributed load. Design algorithms, numerical examples and microcomputer programs are worked out for each system. General design guidelines are also provided.

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