Reinforced Concrete 2011

Topics of the lectures

1. Sequence of design and check, modelling of structures, the notion of safety, the design concept of partial factors of safety, loads of r.c. structures, behaviour of r.c. structures, comparison with elastic structures, history of r.c. construction, the role of standardisation, the EUROCODE.


4. Elastic and plastic moments of statically indeterminate r.c. beams (example: two-span continuous beam, simple supported beam with fixed ends), moments of continuous beams, method of substitutive loading. Flanged beams, effective width, design and check of T-sections, brittle failure of under-reinforced sections, minimum and maximum reinforcement.

5. Reason of deflection check, loads to be applied, comparison of elastic and r.c. analysis, stiffness of cracked sections, approximate calculation, role of the cracked concrete zone. The way of simplified check of deflections. Limitation of the crack width. Characteristic crack patterns. Approximate control of the crack width.

6. Lattice model of Mörsch used to investigate shear behaviour, shear capacity of the concrete section, equilibrium along inclined section, shear capacity of links and bent-up bars, plastic lattice model, capacity of concrete compression struts. Shear design according to EUROCODE, constructional rules, steps of check and design. Torsional resistance of beams. Use of bent-up bars and "mustache-bars" in continuous beams.


8. Axially and excentrically compressed r.c. section. Basic suppositions. Exact calculation. The $M_{cr}-N_{re}$ capacity diagram. $M_{cr}-N_{re}$ capacity diagram of plane concrete sections. Simplified capacity diagram of symmetrically reinforced sections. Approximate check of sections subjected to compression with double eccentricity.


13. Structures with composite materials. Structures subjected to compression: r.c. columns with rigid steel profiles, steel tube filled with concrete, brickwork wall with r.c. columns, hollow concrete blocks filled with r.c.. Structures subjected to flexure: steel beam with monolithic r.c. slab, r.c. beams with rigid steel profiles, r.c. floors with ceramic blocks, timber and concrete floors.


18. Design theory of structures, development of the design criteria (empiric design, method of permissible stresses, method of permissible loads, limit state design, method of partial factors of safety. Statistical evaluation of loads and strengths, normal distribution curve of loads and strengths, relative occurrence, mean value, scatter and characteristic value. The design requirement. Optimal safety level for ULS and SLS. Development trends.