Impact of New Design Codes on Assessment and Redesign of Reinforced Concrete Existing Structures in Seismic Regions

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Summary

Theoretical aspects on the risk assessment of the reinforced concrete structures are presented. The earthquake capacity ratio is analysed for reinforced concrete framed structure. More attention is paid to the seismic shear force capacity and some new procedures are introduced to estimate the earthquake capacity of existing structures.

The present seismic design and assessment of existing structures are done in Romania by using new codes in agreement with the Eurocodes. The impact of these new design codes in comparison with the previous codes is presented for reinforced concrete structures.

The assessment and rehabilitation were performed on a office building RC framed structure built in 1971. The assessment of in-situ conditions showed up the main problems of the RC structure which consisted of inadequate concrete strength at some columns. The strengthening solution consisted in transversal confinement with composite fibre reinforced polymers of the columns.

Keywords: existing reinforced concrete structures; design codes at seismic action; assessment and rehabilitation; structural analysis; CFRP strengthening.

1. Introduction

The assessment of the protection level of structures, generally and particularly of reinforced concrete structures, has become a constant preoccupation of many specialists involved in design, execution and monitoring of structures. For achieving this goal it is necessary to estimate quantitatively two parameters: durability and safety – principal components of construction quality.

The structure durability may be defined as the time period during which the construction preserves its own normal characteristics of function. The structural safety has to take into account the effect of all possible actions, ordinary loads and extreme loads: permanent, variable and extreme actions and the environmental factors.

The vulnerability of existing structures under seismic motions may be due to structural system weaknesses and specific detailing [1-4]. Structural weaknesses are characterised by various irregularities and discontinuities or by general structural vulnerabilities:

1. Irregularities in the vertical direction of the buildings: irregular distributions of the stiffness; strength discontinuities; mass irregularities; vertical load discontinuities.
2. Irregularities in the building layout: horizontal irregularities of masses, stiffness and strength, which all produce torsion effects; unfavourable plan layouts; slab discontinuities due to holes or weaknesses of the connections in some zones.
3. General structural vulnerabilities: the indirect transfer of strong forces by beam-on-beam supports or columns supported on beams; cantilever horizontal members with large spans and / or high loads; weak column / strong beam: eccentricities; finite service life due to deterioration of component parts of a building.

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