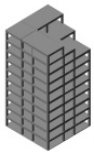

# Abstract

This study focuses on a new displacement based methodology for the seismic design of 3D frame structures, based on different levels of performance. A 10 storey R/C building was considered which was irregular in elevation (setbacks in both horizontal directions) according to the requirements of the EC8 (EN 1998-1: 2004). The former was also used for an additional (to the methodology) design of the structure for two different ductility classes (M and H according to the code).

According to the proposed methodology the members of the structure were designed on the basis of the required level of their inelastic behaviour taking into account the desired failure mechanism ,namely a flexular based one, followed by the exclusion of possible brittle failures and the formation of a global mechanism (soft storey). Hence, the beams and the bases of the columns (were dissipation of the seismic energy is expected to take place by means of flexural mechanisms) were designed for the serviceability (or damage limitation) performance level (50%50yrs), while the life safety performance level (10%50yrs), was considered for the design of the non dissipative members, namely the columns.

The places were energy dissipation takes place were designed for reduced bending moments with respect to those calculated on the basis of spectrum analysis. This reduction is a function of the required inelastic rotations which are expressed as a function of the elastic ones.

It was found that the proposed methodology makes no difference as far as the longitudinal reinforcement is concerned while the reduced amount of the transverse reinforcement clearly highlights the superiority of the proposed method in comparison to the code prescribed one.

The methodology designed structures were then assessed by subjecting the structures to a suite of strong ground motions, carrying out inelastic time history analysis. It was found that the structures performed quite well with respect to both the design and the survival earthquake.