

STATE-OF-THE-ART REPORT ON PARTIALLY- PRESTRESSED CONCRETE EARTHQUAKE-RESISTANT BUILDING STRUCTURES FOR HIGHLY-SEISMIC REGION

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Abstract

Prestressed concrete has long been accepted in statically loaded structures. Thus, for many years now we have seen the construction of prestressed concrete bridges, dams, pipelines, reservoirs and various structures including more recently atomic reactor pressure vessels. These stand as irrefutable proof of engineers' confidence as to the integrity of this new material. In recent years prestressed concrete has been used in seismic resistant structures. Just like any other new material, it will attract criticism and comment, sometimes by people who may not have had the opportunity of full investigation of the material in question. Furthermore, today engineers are more critical of any new material or technique and will seldom accept them unless conclusive evidence of their performance can be produced. This is as it should be. The purpose of this paper is to observe the application of prestressed concrete to seismic resistant multi-storey structures. However, this paper should be read bearing in mind the fact that the widest application of prestressed concrete (to bridge and kindred structures) has been in the countries subject to earthquake and with operative seismic codes. In the paper, the latest seismic design procedure for prestressed concrete buildings in Indonesia is introduced. The current design method is based on the latest Indonesian Building Code for Structural Concrete and Seismic Code, namely SNI 2847:2013 and SNI 1726:2012, respectively. The design method itself is not a novelty to those who are familiar with the capacity design developed for years. This paper is also intended to bring the attention of structural designers and other engineers to the option of using partially-prestressed concrete in buildings. Some advantages of prestressed concrete buildings over ordinary reinforced concrete buildings are illustrated. Comparisons between prestressed concrete and ordinary reinforced concrete buildings are discussed with regard to design seismic load and the performance of beam-column joints under reversed cyclic loading. The results of several tests are summarised. The results of an investigation into the seismic resistance of partially-prestressed concrete frames are described. The experimental part of the project involved the testing of three near full scale beam-interior column assemblies under static cyclic loading to obtain information for seismic design.

Keywords : cyclic loading; earthquake-resistant building structures; highly-seismic region; Indonesian Building Codes; Indonesian National Standards; partially-prestressed concrete.