The Evolution of the Indian Standard IS 1893 Focusing on Base Shear Values of Seismic Forces for a Forty-Three-Storey Reinforced Concrete High-Rise Building Using the Response Spectrum Method

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Abstract

Comparative studies of the old Indian standard IS 1893:2002 and the existing IS 1893:2016 have been presented for high-rise buildings in India; however, they have not been presented for high-rise buildings in Sri Lanka. This case study compares the old and existing IS standards, as well as Australian standard AS 1170:2007, and EURO code EU 8:2004, in terms of lateral effect focusing on the base shear values of seismic forces on a 43-storey high-rise building with three basement levels located in Colombo, Sri Lanka. This project was analyzed and designed in 2006; however, only bored pile load testing and tangent pile walls were completed before the project was suspended. This comparative study of the building uses the response spectrum method, which was performed by ETABS 18,1,1. The purpose of this paper is to identify the major changes in the evolution of IS 1893, and how the revisions have made IS 1893:2016 a more reliable earthquake code than IS 1893:2002.

Keywords: IS 1893:2002; IS 1893:2016; base shear values; response spectrum method; high-rise building.

1 Introduction

The evolution of the seismic design procedure can be summarised in three main phases [1]. The historic approach was to assume the design seismic forces are proportional to the seismic mass of the structure, whereas in the conventional code, these design seismic forces are calculated as inertial forces induced by the ground acceleration. Both of these approaches are based on the force-based design concept. However, the future trend is to adopt a displacement-based design approach where the non-linear response of the structure is taken into greater consideration [2]. Based on performance analyses of structures during past seismic events, considerable advancements have been made over the years in earthquake resistant design of structures, and seismic design requirements in building codes have steadily improved. Therefore, seismic codes need revision from time to time. Buildings designed in accordance with earlier versions of codes may be checked to establish whether existing buildings are safe for carrying out recommendations made by the revised codes [3]. This study focuses on the evolution of the Indian standard IS 1893 using the response spectrum method. It compares the seismic analyses for different provisions of the old IS 1893:2002 [4], the existing IS 1893:2016 [5], EURO code EU 8:2004 [6] and the Australian standard AS 1170:2007 [7] in terms of base shear values of seismic forces. The structural model was an ordinary reinforced concrete (RC) building with shear walls (SW). The study was performed on a 43-storey high-rise RC building with three basement levels located in Colombo, Sri Lanka [8,9]. This project was analyzed and designed in 2006; however, only bored pile load testing [10,11,12,13] and tangent pile walls [14] were completed before the project was suspended (Fig. 1).

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