



Seismic rehabilitation of buildings by reinforced concrete rocking wall-frame system

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ABSTRACT

The aim of this paper is to introduce a new earthquake resistant rocking-wall moment frame (RWMF) that is capable of damage reduction, collapse prevention, self-centering, reparability and performance control due to the strong ground motion. The function of the wall is to prevent soft-story failure, enforce uniform drift, and provide suitable supports for energy-dissipating devices. The system consists of a grade beam restrained moment frame (GBRMF), post-tensioned (PT) rigid rocking core (RRC) gap opening link beams (GOLBs) and buckling restrained braces (BRBs).

Although all results of manual linear analysis have been verified by independent computer analysis they not been confirmed by nonlinear numerical modeling or experimental data. The paper provides a comparison between Time History Analysis and long hand solutions. Then it investigates the applications of the proposed technologies for seismic rehabilitation of substandard buildings.

Keywords: Rocking-wall moment frame, collapse prevention, self-centering, performance control, uniform drift; rehabilitation

1. INTRODUCTION

Nowadays, new methods have been devised for seismic design structures, in which, in addition to preserving the safety of life, they have been considered to preserve the capital used in the building. As a result, the structure should be designed in such a way that, in addition to providing a high level of earthquake to the residents, it will not suffer a lot of irreparable damage.

Structures with low damage system are mainly self-centering and energy dissipating and repairable. The systems studied in this paper are a concrete structure with a moment frame system to be added to the reinforced concrete rocking wall. The rocking motion mechanism can reduce the earthquake energy and, as a result, reduce the base shear to the structure [1]. This will reduce the damage and repair costs by reducing the moment [2]. The rocking wall in its center is connected by a hinge to the base, which allows connecting the wall to the foundation without serious damage to them [3]. Self-centering in the system causes a few residual displacement. This property is provided under various factors such as the post-tensioned cables, the weight of the structure and so on [4]. The reinforced concrete rocking wall-frame system consists of a grade beam restrained moment frame, (GBRMF) attached to a co-planar, post-tensioned (PT) rigid rocking core (RRC) by means of gap opening link beams (GOLBs) and buckling restrained braces (BRBs) [5]. Rigid core reduces axial and shear stresses in the moment frame and also forces the composite structure to act as an integrated system in which the first mode is the prevailing seismic mode. This system has been studied in several sources. [1-11].

In this paper, first, the rigidity of the wall and the required force of the cable to reach the acceptable performance level were investigated. And then, the existing moment frame was rehabilitated by using rocking wall.

2. MODELING DETAILS