



Design Challenges Related to Providing Lateral Load Resistance to Existing Buildings in Accordance with Current Building Codes

John F. Duntemann

Senior Principal, Wiss, Janney, Elstner Associates, Inc., Northbrook, Illinois, United States; jduntemann@wje.com

Jon F. Sfura

Senior Associate, Wiss, Janney, Elstner Associates, Inc., Northbrook, Illinois, United States; jsfura@wje.com

Pedram Hesam

Associate II, Wiss, Janney, Elstner Associates, Inc., Northbrook, Illinois, United States; phesam@wje.com

Contact: jduntemann@wje.com

Abstract

The evaluation and retrofit of existing buildings using current Building Codes can present a variety of challenges to structural engineers. There is a substantial inventory of buildings throughout the United States that predate modern Codes in regards to wind and seismic demands. The state-ofengineering practice has also evolved considerably since the time these buildings were constructed. This paper examines the existing deficiencies, the analysis of these deficiencies, and the proposed retrofit solutions for a precast reinforced concrete warehouse constructed in the mid-1950's. The building has been subjected to multiple design-level wind events during its service life, including Hurricane Katrina in 2005, and exhibited satisfactory performance. The ASCE 7-10 and 2012 IBC Building Code were the applicable standards at the time of our analysis in 2016. The Southern Building Code was the applicable building code prior to the adoption of the IBC Code. The seismic demands based on the current standards were determined to be up to ten times greater than the wind demands, which raised some compelling questions regarding the applicability of the current ASCE 7 and IBC seismic provisions in a geographical area where the design lateral loading has been historically controlled by wind. It was also observed that the connectivity between the lateral load resistant elements and structural diaphragm was poor to non-existent, which required creative solutions to connect the structural elements in a manner that produced a reliable lateral load path.

Keywords: reinforced concrete; precast; retrofit; seismic load demands; wind load demands.

1 Introduction

One of the challenges that structural engineers face is to evaluate and retrofit existing buildings based on current code-prescribed lateral loads, considering that a large percentage of the buildings throughout the United States predate modern codes regarding wind and seismic demands. This paper discusses the existing deficiencies, the analysis of those deficiencies, and the proposed