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Precast Core Wall System for High-Rise Buildings

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1 Abstract

The design of high-rise buildings is usually governed by lateral forces (e.g., wind or seismic). One of the most efficient structural systems to resist lateral loads is the core wall system. Traditionally high-rise concrete cores have been constructed using cast-in-place concrete, however precast systems offer an attractive alternative to cast-in-place construction. A precast concrete core wall system has been developed for high-rise buildings and will be presented in this paper. The main components of the system are the core walls, which are composed of multiple precast panels. The panel layout is determined based on the geometry of the tower and the capacity of the transportation and lifting equipment, while the wall thickness, concrete strength, and reinforcement are determined to satisfy strength and serviceability requirements. Several methods for connecting the panels have been developed, including combinations of embedded steel shapes, bolts, welds, and continuous reinforcing bars or post-tensioning. An application of the system to a 296 m (972 feet) tower in New York City is presented in this paper. This application demonstrates that the precast core wall system is an attractive and viable alternative to cast-in-place construction, capable of resisting the large forces associated with high-rise buildings, and with several advantages, including speed of erection, cost, as well as the high quality of precast concrete.

Keywords: Precast concrete; precast panels; core wall systems; high-rise buildings.

2 Introduction

The design of high-rise buildings is typically controlled by lateral force effects, for example wind. Core systems are one of the most efficient structural systems to resist lateral loads, and are have been typically constructed using reinforced concrete walls or structural steel bracing systems. Concrete cores provide certain advantages compared to structural steel bracing core systems. Concrete cores have higher structural damping than steel cores, therefore reducing the amount of sway and drift due to wind loads. Furthermore, concrete cores provide increased isolation for fire stairs, standpipes, and communications systems. Because of these reasons, following the events of September 11, 2001, there has been even more emphasis on the use of concrete cores.

Traditionally high-rise concrete core wall systems have been constructed using cast-in-place reinforced concrete. On these systems, formwork and rebar cages are initially placed and then the concrete is cast. In certain markets, hybrid core wall systems are also used, incorporating structural steel

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