Guide to Tilt-Up Concrete Construction

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Tilt-up concrete construction is commonly used in low- to mid-rise building construction. This guide reviews the many issues related to the planning and construction of tilt-up buildings to produce a quality tilt-up project. Major topics include preconstruction planning, foundations, special considerations for slab-on-ground construction, wall panel forming and casting, panel erection, connections and repairing, and painting. This guide also contains sections on sustainability and insulation systems, as well as references to the relevant codes and standards including updated Occupational Safety & Health Administration (OSHA) safety regulations.

Keywords: forming; finish; inserts; insulation; panel; precast; release agent; sandwich panel; site cast; sustainability; tilt-up.

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CHAPTER 1—INTRODUCTION AND SCOPE

1.1—Introduction

Tilt-up concrete construction is a unique form of site-cast precast construction where building elements commonly referred to as panels are constructed in job-site conditions and set in place within the building design. The conditions of casting location and positioning within the building design, therefore, necessitate tilt-up's own specialized set of design parameters and construction techniques. Tilt-up panels are generally handled only once. They are lifted or tilted from the casting slab and erected in their final position in one continuous operation.

ACI defines tilt-up as "a construction technique for casting concrete elements in a horizontal position at the job site and then tilting them to their final position in a structure." ACI 318 further states that tilt-up concrete construction is a form of precast concrete. Several features make the tilt-up construction method unique.

Tilt-up panels serve as many functions for building design as markets in which they are constructed. Panels, or perhaps better described as tilt-up elements are constructed with and without openings, sometimes consisting of only a grid of monolithic beams and columns. Wall panels are found flat, ribbed, curved (with broad to tight radii), and even biaxially curved. Elements have been constructed freestanding and cantilevered, simply supported, and connected in a variety of configurations. Elements have been taller than 90 ft (30 m) (Lucky Street Parking Garage, Hollywood, FL), and building façades have been stacked as high as 138 ft (42 m) (ASU Student Housing, Phoenix, AZ). Not all tilt-up elements are building panels, however. Although the majority produced annually are designed as either load- or nonload-bearing building envelope panels, tilt-up elements have also been featured as signs, monuments and art, walkways, stadium seat supports, spires, tanks, tunnels, and bridges.

1.2—Scope

This guide presents the basic concepts, techniques, and procedures used in tilt-up construction. The design of tilt-up wall panels, although not addressed in this guide, is addressed in the companion design guide ACI 551.2R, which is beneficial in content to both licensed design professionals and contractors. This guide includes a brief history of tilt-up concrete and a discussion of planning; foundation and floor slab construction; and wall panel forming, casting, and erection. It briefly describes typical connections used to attach the panels to the rest of the structure, and options for panel finishes are briefly described.

CHAPTER 2—DEFINITIONS

ACI provides a comprehensive list of definitions through an online resource, "ACI Concrete Terminology," http://www.concrete.org/Tools/ConcreteTerminology.aspx. Definitions provided herein complement that resource.

bolster strip—continuous reinforcement support device for wire mesh or mat in a concrete slab or wythe element.

cribbing—wood blocking set under crane outriggers to spread the point load over a larger area to prevent damage to the supporting surface.

densifier—chemical applied to a concrete surface to fill pores, increasing surface density.

elastomeric paint—paint consisting of a polymer with elasticity, generally having low Young's Modulus and high yield strain compared with other materials that behave as a rubber-like membrane on the concrete surface to span cracks and decrease permeability.

hygrothermal analysis—analysis of the movement of heat and moisture through buildings, particularly a building envelope, component, or system.

membrane bond breaker—nonchemically active release