PRECAST CONCRETE FOUNDATIONS

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INTRODUCTION

Foundations are used:

- To transfer the loads of structures into the bearing soils they sit upon.
- To resist uplift forces caused by wind.
- To enclose basements and crawlspaces, and to resist lateral earth and hydrostatic pressures.

INTRODUCTION

Types of foundations – residential, light commercial

- **Continuous footings**
  - Basement
  - Crawlspace
  - Slab on ground
- **Thickened slab**

INTRODUCTION

Materials used to build foundations

- Masonry (CMUs)
- Cast-in-place concrete
- Wood
- Precast concrete

INTRODUCTION

Masonry

- Built on site, labor intensive
- High site impact (approx. 5-10 days)
- Construction impacted by weather
- Moderate permeability
- f'm = 2,500 psi

OVERVIEW

Cast-in-place concrete

- Formed and cast on site
- High site impact (5-8 days)
- Construction impacted by weather
- Low Permeability
- Monolithically cast = cracks
- f'c = 3,500 psi

OVERVIEW

Wood

- Can be built on site or off site
- Moderate site impact (3-4 days)
- High permeability
- f'c = 7,000 psi, buckling is a concern

OVERVIEW

Precast concrete

- Built off site
- Lowest site impact (0.5-1.0 days)
- Negligible impact by weather
- Panelized = joints for expansion and contraction
- Low permeability
- f'c = 5,000 psi

OVERVIEW

Many precast concrete foundation systems employ thin-wall/thin-shell designs.

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CODES AND STANDARDS

Foundations fall under the International Residential Code (IRC)

- Precast concrete foundations entered the IRC in 2003, Chapter 4.
- However, they are not well defined; the IRC lacks direction and details for building officials.

CODES AND STANDARDS

IRC development

- NPCA has submitted code changes to better define the use of precast concrete foundations (IRC 2007 supplementary code cycle).

CODES AND STANDARDS

Precast concrete foundations are pre-engineered systems manufactured in a controlled environment; therefore code submissions are performance-based.

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CODES AND STANDARDS

Masonry, cast-in-place and wood are field-built systems whose design must be specified in the code in order for building officials to inspect them; these are prescriptive-based.

CODES AND STANDARDS

Proposed minimum material requirements:

- f'c = 5,000 psi @ 28days.
- Rebar must meet ASTM 615, A706, A996 with a minimum cover of 5/8".
- Panel-to-panel connections shall be Grade II, if bolted.
- Fibers must conform to ASTM C 1116.
- Grout must conform to ASTM C 1107.

CODES AND STANDARDS

Design:

- System design by a P.E.
- Components of the system do not require a PE stamp every time they are used.
- Manufacturers must have third-party inspection and QA program.

CODES AND STANDARDS

Proposed minimum design criteria:

- Total uniform load applied = 5,300 lbs/ft (this correlates with new footing table @ 3-story height).
- Lateral earth pressure = 60 lbs/ft^2/ft.
- Accommodate concentrated loads in excess of the uniform loads.

CODES AND STANDARDS

Since precast concrete foundations are pre-engineered, such as a truss or joist, their capacities or limits must be communicated to the purchaser.

CODES AND STANDARDS

Information that must be conveyed to the purchaser:

- Soil bearing capacity (psf).
- Footing design and material.
- Max. allowable uniform load (lbs/ft).
- Concentrated loads and their points of application.

DESIGN

Suggested procedure to design with a precast concrete foundation

- Calculate all live and dead loads from floors, roofs and walls.
- Calculate applicable snow, wind and seismic loads.
- Calculate and determine locations of concentrated loads, such as from floor beams or girders.

DESIGN

Suggested procedure to design with a precast concrete foundation

- Determine soil type and bearing capacity.
- Check to ensure that a precast concrete foundation system can safely support all calculated loads – work with manufacturer.
- Design footing, IRC chapter 4.
- Check for uplift.

INSTALLATION

- Footings should be installed on undisturbed soil.
- Panels are set into place on leveled, compacted crushed stone or cast-in-place continuous footing.
- Joints are sealed in accordance with manufacturers instructions, commonly during panel-to-panel installation.
- Backfill may not commence until walls are braced at top and bottom.

INSTALLATION

Windows and doors are easily included to meet ingress and egress requirements.

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ADVANTAGES

Precast concrete foundations:

- Are cast off site in a controlled environment with stringent quality control.
- Are stronger and lighter than most competing materials.

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ADVANTAGES

Precast concrete foundations:

- Minimize construction period.
  - *Installed quicker*
  - *Less weather dependency*
  - *Reduced coordination of trades*
- Are leak resistant and have little to no cracking.

ADVANTAGES

Precast concrete foundations:

- Can have a variety of architectural finishes.
- Are environmentally friendly and can qualify for LEED credits.

ADVANTAGES

Precast concrete foundations:

- Reduce the overall costs for builders and homeowners.
- Are the best material choice for residential and light commercial foundations.

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