Design Guide for Economical Reinforced Concrete Structures

A guide to assist design professionals in achieving overall economy in the design and detailing of reinforced concrete structures.

First Edition
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CHAPTER 1

Introduction

1.1 Overview

One of the main advantages of reinforced concrete is the ability to mold it into essentially any shape or form. There are no inherent restrictions that limit imagination and creativity when it comes to the aesthetic design of a reinforced concrete structure. Along with the freedom of shape and form comes the reality of cost. A finite budget is the norm on the vast majority of projects that are undertaken and the cost of a structure can be needlessly larger than it has to be if there is not a basic understanding of what it takes to achieve overall economy in a reinforced concrete structure.

The purpose of this Guide is twofold:

- To present information on how to select an economical reinforced concrete floor system.
- To present requirements and guidelines on how to size, design, and detail reinforced concrete structural members that, where implemented, will result in an economical reinforced concrete structure.

The emphasis here is on building structures, but some of the information that is presented can be used in the design of bridges and other nonbuilding structures.

It is assumed that the reader has a basic understanding of the design and detailing of reinforced concrete structural members for combinations of gravity and lateral loads in accordance with the requirements of ACI 318, Building Code Requirements for Structural Concrete. This Guide is not a comprehensive design guide on the fundamentals of reinforced concrete design. Rather, the information that is presented here is to be used by a design professional that will help in achieving overall economy in a reinforced concrete structure.

1.2 Scope

Chapter 2 of this Guide contains general guidelines and information on how to select an economical reinforced concrete floor system. In particular, wide-module joist, flat plate, flat slab, and two-way joist systems are covered. Tables are provided that give relative cost indices of floor systems for various span and load conditions. This information can help in determining the most economical system for a given set of constraints.

Chapters 3 through 9 present requirements and guidelines for sizing, designing, and detailing the following structural members:

- One-way slabs
- Two-way slabs
- Beams
- Columns
- Walls
- Diaphragms
- Foundations

Included in the discussion for each member type are the specific design and detailing requirements that are applicable to structures in areas of high seismic risk, that is, structures assigned to seismic design category (SDC) D, E, or F. Emphasis is placed on constructability, which has a direct link to economy.

The references that are cited in this Guide can be found in Chapter 10.

Throughout the chapters, reference is made to the provisions of the 2014 edition of ACI 318, Building Code Requirements for Structural Concrete (Reference 1). For example, reference to Section 8.3 in ACI 318-14 is denoted here as ACI 8.3. A similar designation is provided for tables and figures from that document.