

# LEAST-COST DESIGN OF REINFORCED CONCRETE LEDGE BEAMS

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## 1. ABSTRACT

A practical least cost design of precast reinforced ledge beams is presented. The objective function is chosen to be the cost of the beams. The design variables are represented by the cross-sectional dimensions and flexural, shear, and torsion reinforcements. All structural behavior constraints are in accordance with the ultimate strength limit state design of the Egyptian Code for Design and Construction of Reinforced Concrete Structures, 1989. A rational approach is presented to overcome the discontinuities of the shear and torsional constraints. The optimization technique adopted is the Method of Feasible Directions. Different starting points and other optimization techniques are used to assess the convergence characteristics of the formulation. The technique is applied to practical problems, and conclusions are drawn.

## 2. INTRODUCTION

Cost aspect, in due proportion to safety, is of prime concern to a designer of precast concrete element where mass production is anticipated. Ledge beams of bridges are examples of such concrete elements. The unit cost of concrete, steel reinforcement and, to a lesser extent,

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