

## Design and Construction of a Lagoon Bank Protection Structure with Precast Counterfort Wall System

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### Abstract

A precast counterfort wall system developed for bank protection structure for a large lagoon and waterfront development in Nusajaya, in the state of Johor of Malaysia is presented. The 5.25m high vertical earth retaining walls with 4.05m submerged depth below sea water level and 4500m total length of irregular layout were to be completed within 12 months together with massive cut-and-fill earthworks. Conventional in-situ reinforced concrete construction has been ruled out due to time and cost factors, and uncertainty in finished quality. A structurally efficient precast section with sloping "Tee" stiffener integrated with wall and base in manageable size was conceptualised, designed and developed with special considerations to aspect of construction. The economically viable solution adopted was a retaining wall system made of precast counterfort wall unit, strengthened with precast tie-slab and in-situ toe-beam, and finished with in-situ capping beam. Some 82.7% of concreting works were precast off-site, enabling site clearing and preparation works to commence simultaneously. The challenges of product design, manufacturing and installation are highlighted.

**Keywords:** precast concrete retaining wall; counterfort wall; lagoon bank protection.

### 1 Introduction

Retaining walls are built in the man-made environment to hold back a bank of earth to maintain a difference in elevation of the ground surface. These earth retaining structures are widely applied in the civil engineering works especially for building earth platforms, road embankments, stabilisation of slopes, riverbank protection and marine works. They can be efficiently designed to retain bulk storage of materials and temporary shoring works. The

retaining wall structures can be constructed from various materials and available in several structural forms [1] to provide wall stability and to meet serviceability requirements. With the drastic escalation of material and labour costs in recent years, more innovative approaches in design and construction of earth retaining structure are required. There is an urgent need for more efficient and industrialised construction of concrete wall to reduce the resources involved.

The major factors in evaluating a suitable retaining wall system include proposed wall height, ground