Seismic Isolation of a Suspension Bridge Anchor Block

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Summary

This paper introduces an innovative structural concept for the design of suspension bridge gravity anchorages in highly seismic regions.

The anchorage is separated into two components, a structural part which anchors the cable strands and an isolated counterweight which provides the necessary pressure to prevent sliding in-service but does not attract inertial forces during an earthquake.

The performance and benefits of this new type of anchorage is described making reference to a case study of a 1,550m main span suspension bridge.

Keywords: suspension bridge; anchorage; seismic isolation; sliding pendulum

1. Introduction

Traditionally, a suspension bridge adopts a very heavy anchorage to transfer the force of the main cable to the ground (Figure 1). This counteracts the vertical component of the cable force and gives sufficient pressure at the foundation level to assure the transfer of the horizontal component.

Such a very heavy anchorage is unfavourable during a major earthquake since the large mass will attract very large inertial forces. Therefore the efficiency of a gravity anchorage is significantly reduced and the weight must be increased to prevent sliding of the anchorage under earthquakes. Although in some locations a rock anchored alternative may be viable, in many cases rock of sufficient quality may not be present close to the surface.

Fig. 1: A traditional gravity anchorage

Seismic isolation of major bridge foundations was proven to be an effective design concept by the design of the Rion Antirion Bridge [1] which introduced isolation of the main tower foundations of a cable stayed bridge by providing a gravel interface layer beneath the gravity foundation to encourage sliding in a controlled manner under large earthquakes.

However, one would not expect that the same isolation concept could be applied to a suspension bridge anchor block since the large static horizontal force which the anchor block has to resist would inevitably result in unacceptable movements of the anchorage if it slides during an earthquake event.

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