

利用粒子影像測速技術分析不同橋墩型式之 周圍流場及沖刷潛勢

Utilizing Particle Image Velocimetry to Analyze the Flow Field and Scour Potential around Different Pier Structure Shapes

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摘 要

橋墩沖刷是河道中常見的三維水理現象，若於極端降雨造成河水暴漲更可能衍生斷橋風險，探討不同橋墩設計對於減緩沖刷之影響實為工程實務方面重要議題。考量時間、金錢、人力共三重限制，決定選取實驗室直線水槽搭配橋墩模型進行水工試驗。本研究設計三種不同的沖刷防治裝置：(1)斜板；(2)凹槽；(3)穿孔柱搭配定量水流進行水理分析，並利用粒子影像測速技術探討橋墩周圍流場，透過分析不同橋墩沖刷防治裝置尋求減緩沖刷的較佳解。

關鍵詞：橋墩沖刷，水工試驗，粒子影像測速

Abstract

Pier scour is a common three-dimensional hydraulic phenomenon in river channels. During extreme rainfall events, the resulting surge in rivers can increase the risk of bridge collapse due to significant scour. Therefore, investigating the effectiveness of different pier designs for mitigating scour-related damage is a crucial topic in engineering practice. Considering the constraints of time, budget, and manpower, laboratory flume experiments using pier models were selected for this study. Three different counter-scour devices were proposed here: (1) inclined plates, (2) grooves, and (3) perforated columns. Their performance was carefully examined under the well-controlled flow conditions. Specifically, particle image

velocimetry techniques were used to measure the flow velocity field around the piers, facilitating the development of an optimal counter-scour design.

Keywords: Bridge scouring, Physical experiment, PIV