

عنوان مقاله:

Optimizing Pier Design to Mitigate Scour: A Comprehensive Review and Large Eddy Simulation Study

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نویسندگان:

A. M. Aly - Louisiana State University, ۳۲۳۰ H Patrick F Taylor Hall, Baton Rouge, LA ۷۰۸۰۳, USA

F. Khaled - Louisiana State University, ۳۲۳۰ H Patrick F Taylor Hall, Baton Rouge, LA ۷۰۸۰۳, USA

خلاصه مقاله:

Scour-induced sediment erosion poses a significant threat to the safety and longevity of infrastructure, including bridges, wind turbines, elevated buildings, and coastal infrastructure. Despite the well-known destructive consequences of scour, accurate models that capture the complexity of its dynamics remain elusive, impeding the development of effective countermeasures. We provide a comprehensive review of existing literature on scour dynamics and examine the fluid dynamics and bed shear stress surrounding bridge piers. We propose CFD (Computational Fluid Dynamics) simulations with LES (Large-Eddy Simulation). The current paper demonstrate that LES is a more effective technique than RANS (Reynolds averaged Navier-Stokes) for investigating bridge scouring. The LES simulations study local scour induced effects and compare the findings with RANS simulation results. Besides, two countermeasures are modeled, delta vane and plate footings, to decrease scour around piers. The results show that both countermeasures effectively reduce the shear stress, and we also suggest a combination of a delta vane and a plate footing as a promising solution to reduce upstream and downstream bed shear stress. The paper highlights the importance of thorough investigations on bridge scouring and the need for effective countermeasures to protect infrastructure from scour-related damage or collapse. The recommended countermeasures hold significant promise to reduce construction and maintenance costs and extend infrastructure longevity.

کلمات کلیدی:

Scouring, Bridge pier, Flood, Large eddy simulation, Hydrodynamic countermeasures

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