STUDY ON THE MECHANICS OF RIPRAP FAILURE AT BRIDGE PIER

by

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A Report Submitted to the School of Engineering
in Partial Fulfillment of the Requirements for the
award
of Bachelor of Civil Engineering (Hons)

November 1996

Acknowledgments

Producing a report of this nature requires the cooperation and effort of many people and institutions. The author would like to thank all those who had help directly or indirectly to make this study a success.

First and foremost, the author would like to convey her gratitude to the Project Supervisor, En. Mohamad Shani Haji Awalluddin for his guidance towards the completion of this report.

The author would also like to thank Jabatan Kerja Raya, Jabatan Perparitan dan Saliran and Institution of Engineers Malaysia for information and assistance. All friends that have been very helpful.

Lastly, the author would like to extend her appreciation to her family for their patience, encouragement and inspiration throughout the duration of the study.

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Abstract

One of the engineering method to protect bridge pier is placing riprap stones around the bridge pier. This study aims to investigate the stability of the riprap layer around a cylindrical bridge pier. Experiments was conducted in the Hydraulic Laboratory, MARA Institute of Technology, Shah Alam. A series of flume experiment was conducted to simulate the effect of scour to the bridge pier and hence looks at the effectiveness of riprap as protection.

The experimental data shows three mode of failure, they are riprap shear failure, riprap winnowing failure and riprap edge failure. The study shows the modes of mechanical failure of the riprap layer have a relationship with the riprap thickness and cover.

1.1 General

Riprap may be described as a layer, facing, or protective mound of different size stones placed randomly to prevent scour or erosion. Examples of slope protection and cylindrical pier using riprap are as shown in Plate 1. and Plate 2. The use of granular materials as riprap for scour protection has a long tradition in both river and coastal engineering. Riprap continue to be the most widely used method for protection of erodible channel boundary. The large quantity of riprap used requires design guidance that addresses the effects of gradation, layer thickness, side slope angle and channel bends.

The use of a stone riprap blanket as a scour protection method on river beds, stream banks and around hydraulic structures such as bridge piers is still popular. The formation of scour hole around bridge piers is common in rivers and canals. The scour hole can seriously affect the stability and integrity of the bridge foundation, sometimes leading to failure of the bridge. A water body flowing past a bridge pier will exert a hydrodynamic force on the pier. In fully turbulent flow, the force is generated from a combination of the shear stress against the pier face and the pressure differential caused by flow separation at the pier tail. The occurrence of rapidly varied flow through a nonprismatic section, such as bridge piers, is not unusual in the study of open-channel hydraulics. For example, broad-crested weirs, sharp-crested weirs and critical flow flumes, in all these channel appurtances that involve rapidly varied flow through a