



Universidad de Concepción
Dirección de Postgrado
Facultad de Ingeniería -Programa de Magíster en Ciencias de la Ingeniería, Mención
Ingeniería Civil

**Socavación Local y Sedimentación alrededor de Cepas de
Puente durante Crecidas**
(Local Scour and Deposition at Bridge Piers during Floods)

Tesis para optar al grado de Magíster en Ciencias de la Ingeniería con
mención en Ingeniería Civil

MARCELO JAVIER GARCÍA MEDEL
CONCEPCIÓN-CHILE
2018

Profesor Guía: Oscar Link Lazo
Dpto. de Ingeniería Civil, Facultad de Ingeniería
Universidad de Concepción

ABSTRACT

A better understanding of the bridge pier scour caused by flood waves is expected to allow a different design approach based on the expected scour depth caused by one hydrological event in combination with appropriate monitoring and maintenance of pier foundations, having risk levels of comparable magnitude to the current approach, which considers a worst case scenario represented by the hundred years recurrence discharge over a theoretically infinite duration.

The present Thesis aims at investigating the effects of different flow and sediment regimes (regulated and unregulated discharges with or without excess sediment supply) on local scour at a bridge pier. Concurrent field measurements of maximum scour depth, flow depth, and flow velocity were performed during six days at the Rapel bridge, over the Rapel river, located in Central Chile. During the measurements, river discharge was regulated by the operation of a hydropower plant, with hydropeaking. A model of scour and deposition is proposed, and field measurements are used to estimate optimal model parameters and to evaluate model performance. The model was applied to pre and post-dam scenarios to compare expected scour caused by a natural flow regime and by hydropeaking considering different excess sediment supply.

Results show that a single measurement of scour evolution during one flood was enough for estimation of optimal model parameters. The calibrated model reproduced measured scour and deposition in a verification case with high precision. The model application showed that scour and deposition are very sensitive to the excess sediment supply: after two years, scour resulted higher in the pre-dam scenario than in the post-dam scenario when no sediment deposition or equilibrium conditions occurred, while it was lower in case of excess sediment supply. However, in the pre-dam scenario with excess sediment supply the highest scour depths were of comparable magnitude as those after the two years, and occurred only briefly around the peak discharges before sediment deposition, illustrating the complex interactions between flow and sediment in time, with important consequences for monitoring of bridge pier scour in the field and for forensic analyses.