The Fifth International Bridge Seismic Workshop (5IBSW)
Hunan University, Changsha, China, June 5-7, 2026

INFLUENCE OF SCOUR ON THE SEISMIC RESPONSE OF CABLE-STAYED BRIDGES

P. Biju-Duval [(1)], J. Rodriguez Rodriguez [(2)]

[(1)] *Principal Structural Engineer, Finite Element Analysis Ltd. (LUSAS), paul.biju-duval@lusas.com*
[(2)] *Consultancy Manager, Finite Element Analysis Ltd. (LUSAS), jesus.rodriguez@lusas.com*

Abstract

Scour is one of the predominant causes of bridge failure worldwide, and its frequency and severity are expected to increase due to the combined effects of climate change, extreme hydrological events, and aging infrastructure. Understanding the interaction between scour and seismic loading is therefore critical for the reliable assessment and design of bridge foundations in seismically active regions. This paper presents a detailed and systematic workflow for conducting nonlinear soil-structure interaction (SSI) analyses to evaluate the effects of scour on the seismic performance of bridges. The proposed framework is illustrated through its application to a single-pylon cable-stayed bridge located in China.

The effect of scour on the natural periods of the bridge, as well as on the lateral deflections, is investigated, along with its impact on bending moment and shear distributions in the piles. The numerical models explicitly incorporate pile-soil hysteretic damping, and the seismic response is evaluated using nonlinear time-history analyses under seven representative ground motions.

The results highlight the impact of scour on foundation demand and global bridge response, demonstrating the importance of explicitly considering SSI and scour effects in seismic evaluations. The findings are intended to support bridge engineers and researchers in improving the assessment, design, and retrofit of bridges subjected to coupled scour and seismic hazards.

Keywords*: cable-stayed bridges ; soil-structure interaction ; scour ; finite element analysis ; design*