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### Woody debris trapping phenomena evaluation in bridge piers: A Bayesian perspective

- [Luis Horacio Martínez-Martínez<sup>a</sup>](#),
- [David Joaquín Delgado-Hernández<sup>a, \\*</sup>](#),
- [David de-León-Escobedo<sup>a</sup>](#),
- [Jhonnatan Flores-Gomora<sup>a</sup>](#),
- [Juan Carlos Arteaga-Arcos<sup>b</sup>](#)

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#### Highlights

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This research deals with masonry bridge piers and consequences of trapping phenomena.

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The use of NPN and MCS could lead to the development of a management decision tool.

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The results may be used for ranking investments in maintenance actions.

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#### Abstract

A flood occurs when water and other materials such as woody debris overflow dry areas. If there is infrastructure present, woody fragments could be transported downstream and eventually trapped, leading to increments in the hydrodynamic forces over, say, a bridge. Moreover, local scour can be developed in the structure piers. The purpose of this research is to investigate

the bridge pier scour phenomena induced by woody debris from a probabilistic point of view. A Non Parametric Bayesian Belief Network comprising seven nodes has consequently been developed. They are: water level, Froude number, blockage amount, drag force, scour depth, damage and overturning. Through both Monte Carlo Simulation and data from a real structure, the nodes' non parametric probability distributions have been established, an area that has, to date, received very little attention in the literature. By combining the variables under study, it was possible to determine their interaction and dependencies, showing that the depth of the approaching flow is correlated with two nodes: damage and overturning. The results are useful for bridge managers willing to rank investments in maintenance actions within the industry, and to develop optimal risk based strategies for efficiently employing the scarce resources used to that end.

### Keywords

- Bayesian Net;
- Bridge;
- Damage;
- Pier;
- Scour;
- Model;
- Non-parametric;
- Overturning

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