

New Jersey Department of Transportation
Bureau of Research

Technical Brief



Design and Evaluation of Scour for Bridges Using HEC-18

This project developed a new approach for evaluating erosive scour at New Jersey bridges over non-tidal waterways. The main deliverable was the Scour Evaluation Model (SEM), which offers new analysis procedures, while still retaining the applicable parts of HEC-18. The overall goal is to improve public safety and to expend bridge repair funds more strategically.

Background

Prevention of bridge scour has been a national priority for nearly three decades. Beginning in the 1990s, the New Jersey Department of Transportation (NJDOT) launched a robust Plan of Action to identify scour critical bridges and to perform corrective work. In carrying out the plan, the Department decided to develop New Jersey’s own modified method of scour analysis that reflects the State’s unique geology and hydrology. This was the genesis of the current study and the development of the Scour Evaluation Model (SEM).

		Geotechnical Risk		
		High	Medium	Low
Hydrologic/Hydraulic Risk	High	Scour Priority 1	Scour Priority 2	Scour Priority 3
	Medium	Scour Priority 2	Scour Priority 3	Scour Priority 4
	Low	Scour Priority 4	Scour Priority 4	Scour Priority 4

Research Objectives and Approach

The study commenced with a web-based survey of scour practice within the U.S. and a literature review of predictive scour models. A number of key geotechnical, hydrologic, and hydraulic parameters were identified as the best indicators of scour performance, and these were integrated into the New Jersey SEM. Improved protocols were also developed for erosion classification of sediments, reconnaissance investigation, field inspection, and determination of maximum historic stream flow. During the course of the study, SEM was validated and calibrated by analyzing more than 30 bridges on the State’s Scour Critical List.

Findings

New Jersey SEM will help assure that scour evaluations of existing bridges are performed in a uniform manner and are based on sound engineering practice. In keeping with the Federal Highway Administration’s (FHWA’s) latest technical guidance,

SEM is risk-based and considers a bridge’s past performance. The model has five interconnected modules as described below:

- Module 1 - Geotechnical Evaluation: The soil and rock materials at the bridge are characterized by reconnaissance study and field investigation. The model utilizes a new SEM classification system that reflects the erosion resistance of the stream bed. This results in a geotechnical risk rating of low, medium, or high.
- Module 2 – Hydrologic/Hydraulic Evaluation: A study is performed to determine whether or not the bridge has experienced a 100-year storm, and if it has, how did it perform. A field check determines whether substantial field scour is present. This results in a hydrologic/hydraulic risk rating of low, medium, or high.
- Module 3 – Risk Decision Matrix: The above risk ratings are inputted into a two-dimensional, Risk Decision Matrix (see inset). The matrix generates a Scour Priority Rating for the bridge, which can range from 1 thru 4. Priority 1 corresponds to a high risk scour condition that demands prompt repair or replacement, while a Priority 4 rating means the bridge is recommended for removal from the Scour Critical List.
- Module 4 – Bridge Importance Analysis: The importance of the bridge is evaluated by considering average daily traffic, bridge length, detour length, and other factors. The Scour Priority Rating determined above is adjusted as necessary.
- Module 5 – Recommended Actions: The final module links the Scour Priority Rating with specific recommended actions. The actions are graduated according to risk level, and they may range from priority installation of protective countermeasures to removal of the bridge from the Scour Critical List.

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A final report is available online at: <http://www.state.nj.us/transportation/refdata/research/>. If you would like a copy of the full report, send an e-mail to: Research.Bureau@dot.state.nj.us.

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