

19th IABSE Congress 2016

Challenges in Design and Construction of an Innovative and Sustainable Built Environment

IABSE Symposium Report

Stockholm, Sweden
21 – 23 September 2016

Part 1 of 4

Editors:

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Johan Jonsson**

ISBN: 978-1-5108-3590-0

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57 Morehouse Lane
Red Hook, NY 12571



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Concepts for an early identification of security-relevant defects in concrete bases of wind turbines in terms of Condition Monitoring Systems

Resnik, Boris ; Ribakov, Yuri ; Iskhakov, Iakov 1858

Seismic Response Analysis of Hakucho Suspension Bridge from Long-term Monitoring System

Siringoringo, Dionysius ; Fujino, Yozo 1867

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Holtberget, Simen Hellgren ; Veie, Johannes ; Jena, Parthasarathi 1890

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Wiborg, Sverre ; Vejrum, Tina ; Sundet, Erik ; Norum Larsen, Per ; Sørby, Bernt ; Vågen, Rolf Åge 1896

Crossing of Bjørnafjorden - Floating Bridge Concept

Villoria, Bruno 1904

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Design of floating bridge girders against accidental ship collision loads

Sha, Yanyan ; Amdahl, Jørgen 1935

History of the Bjørnafjorden fjord crossing project

Eidem, Mathias Egeland 1943

Proposal for a Submerged Floating Tube Bridge as part of the Bømlafjord crossing

Eidem, Mathias Egeland ; Sekse, Jorunn ; Minoretti, Arianna 1951

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Peiris, Abheetha ; Harik, Issam Elias 1956

An Economical Composite Girder Bridge Using Rolled Steel H-Section

Elmy, Mohammad Hamid ; Nakamura, Shunichi 1964

A New Structural Form Using Concrete Filled Steel I-Girder

Safi, Waheed Ahmad ; Nakamura, Shunichi 1972

Retrofitting of old steel railway truss bridges by implementing new concrete deck slab

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