Ports 2019

Port Planning and Development

Pittsburgh, Pennsylvania
September 15–18, 2019

Edited by

Pooja Jain, P.E., P.Eng., S.E.

ASCE

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PAPERS FROM SESSIONS OF THE 15TH TRIENNIAL INTERNATIONAL CONFERENCE

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SPONSORED BY

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Ports and Harbors Committee of the
Coasts, Oceans, Ports, and Rivers Institute of the
American Society of Civil Engineers

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Pooja Jain, P.E., P.Eng., S.E.
William S. Stahlman III, P.E.

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Preface

Continuing a long tradition of excellence, **PORTS '19**: "Ports: Connect. Innovate. Transform" will be the fifteenth in a series of international port and harbor development specialty conferences held on a tri-annual basis since 1977.

PORTS '19 is sponsored and organized by the Ports and Harbors Committee of the Coasts, Oceans, Ports, and Rivers Institute of the American Society of Civil Engineers, and co-sponsored by PIANC. The Ports and Harbors Committee focuses its activities on improvement of port, waterway, and facility engineering, development, and operating techniques, practices, and standards. Many of the Committee membership were actively involved in the development of the **PORTS '19** program and organization of the conference. The Conference efforts were led by:

Albert Lee Barco, IV, P.E., F. ASCE, , Chair, ASCE Ports & Harbors Committee
Elizabeth Burkhart, P.E., D.PE, Conference Chairman
Pooja Jain, P.E., P.Eng, S.E M.ASCE, Technical Committee Co-Chair
William S. Stahlman III, P.E., M. ASCE, Technical Committee Co-Chair

Approximately 251 abstracts were submitted for consideration by the Conference Technical Committee. Consisting of almost 50 individuals drawn from the Ports and Harbors Committee and the port design and development community, the Technical Committee reviewed abstracts and papers and served as Moderators for sessions. The Technical Committee chose a total of 136 papers for publication. *Ports 2016: Port Engineering,* contains 77 papers covering facilities and operations; foundations and reclamation; inspection, repair, and maintenance; and extreme events. The companion title, *Ports 2019; Port Planning and Development,* contains 58 papers covering transportation and traffic; environmental issues; navigation and waterways; port planning, operations, and design; and terminal design and planning. Together these papers reflect our industry's full diversity.

The success of this Conference, as with all **PORTS** Conferences, has relied on the contributions of the authors who submitted their work for our consideration. The preparation of **PORTS** conference abstracts, papers, and presentations is a demanding process, and our sincere thanks go out to all of those who have participated. To all those who reviewed Abstract and Papers, to the Moderators, and those who served on the Technical Committee each of which was, in so many ways, responsible for the success of the PORTS '19 Conference and who participated in reviewing and selecting Abstracts, reviewing and vetting submitted Papers, ensuring compliance with the Conference's publication rules, reviewing Presentations, and/or acting as Session Chairs at the Conference – our sincere appreciation and thanks.

Each of their individual and collective contributions and the support of their organizations are deeply appreciated.

Sincerely and with great appreciation,

Pooja Jain, P.E., P.Eng, S.E M.ASCE
Technical Committee Chairman
Moffatt & Nichol

William S. Stahlman III, P.E., M. ASCE
Technical Committee Vice Chairman
America's Central Port

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ASCE Port's & Harbor's General Committee,
The entire PORTS '19 Subcommittee,
All the more than 40 Reviewers and Moderators,
All of the 136 conference authors and presenters,
All the many authors who submitted Abstracts for consideration, ASCE, COPRI and PIANC staff.

In addition, Bill and I would like to like to thank our colleagues, families and especially our spouses for their patience, understanding and support without which we could not have sustained the energy necessary to complete this publication.

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