

# Ports 2019

## Port Planning and Development



Pittsburgh, Pennsylvania  
September 15–18, 2019

**ASCE**

Edited by

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



COASTS, OCEANS,  
PORTS AND RIVERS  
INSTITUTE

This is a preview. [Click here to purchase the full publication.](#)

# PORTS 2019

## *Port Planning and Development*

---

PAPERS FROM SESSIONS OF THE 15TH TRIENNIAL  
INTERNATIONAL CONFERENCE

---

September 15–18, 2019  
Pittsburgh, Pennsylvania

SPONSORED BY

PIANC

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

EDITED BY

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



COASTS, OCEANS,  
PORTS AND RIVERS  
INSTITUTE

Published by the American Society of Civil Engineers

This is a preview. [Click here to purchase the full publication.](#)

Published by American Society of Civil Engineers  
1801 Alexander Bell Drive  
Reston, Virginia, 20191-4382  
[www.asce.org/publications](http://www.asce.org/publications) | [ascelibrary.org](http://ascelibrary.org)

Any statements expressed in these materials are those of the individual authors and do not necessarily represent the views of ASCE, which takes no responsibility for any statement made herein. No reference made in this publication to any specific method, product, process, or service constitutes or implies an endorsement, recommendation, or warranty thereof by ASCE. The materials are for general information only and do not represent a standard of ASCE, nor are they intended as a reference in purchase specifications, contracts, regulations, statutes, or any other legal document. ASCE makes no representation or warranty of any kind, whether express or implied, concerning the accuracy, completeness, suitability, or utility of any information, apparatus, product, or process discussed in this publication, and assumes no liability therefor. The information contained in these materials should not be used without first securing competent advice with respect to its suitability for any general or specific application. Anyone utilizing such information assumes all liability arising from such use, including but not limited to infringement of any patent or patents.

ASCE and American Society of Civil Engineers—Registered in U.S. Patent and Trademark Office.

*Photocopies and permissions.* Permission to photocopy or reproduce material from ASCE publications can be requested by sending an e-mail to [permissions@asce.org](mailto:permissions@asce.org) or by locating a title in ASCE's Civil Engineering Database (<http://cedb.asce.org>) or ASCE Library (<http://ascelibrary.org>) and using the “Permissions” link.

**Errata:** Errata, if any, can be found at <https://doi.org/10.1061/9780784482629>

Copyright © 2019 by the American Society of Civil Engineers.  
All Rights Reserved.  
ISBN 978-0-7844-8262-9 (PDF)  
Manufactured in the United States of America.

## 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

## Acknowledgments

The Technical Committee would like to extend our many supporters whose contributions have led to the success and value of this material. Without their efforts, this publication would not be possible. Specifically, we would like to thank the following:

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.



# Contents

## *Environmental*

<b>A New PIANC Guideline for Managing Environmental Risks of Navigation Infrastructure Projects .....</b>	<b>1</b>
Rebecca Gardner, Burton C. Suedel, Kevin Kane, David W. Moore, Kevin Allen, John Lally, Miran Vanwonderghem, Amy Parry, and Todd S. Bridges	
<b>Bayesian Damage Prediction of Berm Breakwaters in the Arctic.....</b>	<b>12</b>
Maria Pontiki	
<b>Benefits and Challenges of Port-Sponsored Mitigation Banks.....</b>	<b>22</b>
Dan Berlin and Jack Malone	
<b>Filling a Freshwater Lake—Sediment Remediation Considering Net Environmental Benefit for Multiple Stakeholder Goals .....</b>	<b>33</b>
Jessi Massingale, Megan King, and Don Robbins	
<b>Industrial Stormwater Treatment on a 200-Acre Container Terminal .....</b>	<b>44</b>
Ellis Beckwith, Scott Adamek, and Layni Wachter	
<b>Innovative Design for New Post-Construction Stormwater Management Standards at Port of Oakland.....</b>	<b>55</b>
Ian Sequeira, Bryan Paine, and Dylan LaFrance	
<b>La Quinta Terminal Mitigation: Dredged Material Beneficial Reuse for Estuarine Habitat Creation .....</b>	<b>66</b>
Luis M. Maristany, Aaron G. Horine, and Paul D. Carangelo	
<b>Large Scale Floating Wetlands for Urban Waterfronts .....</b>	<b>78</b>
M. McCarty, A. Ravestein, C. Streb, and D. O’Heney	
<b>Port of Los Angeles Sea Level Rise Adaptation Plan.....</b>	<b>89</b>
Adrienne Fedrick Newbold, Bettina Kaes, Jeff Khouri, Richard Mast, and Justin Vandever	
<b>Predicting Long-Term Coastal Conditions in San Francisco Bay and Other Estuaries with the Use of Supervised Neural Networks .....</b>	<b>101</b>
F. Salcedo, C. Harter, and S. Fenical	
<b>Remediating a Working Waterfront, Gloucester, MA .....</b>	<b>112</b>
Matthew J. Page	

<b>Sediment Transport Analysis and Cap Design Criteria for Mission Bay Ferry Landing, San Francisco, CA.....</b>	<b>122</b>
A. Sharma, F. Salcedo, S. Fenical, K. Purcell, and J. Roman	

### *Equipment and Systems*

<b>Impacts of Implementing Zero Emission Container Handling Equipment on a Container Terminal.....</b>	<b>134</b>
Kerry Simpson, Doug Thiessen, and Pekka Ranta	

<b>Key Design Issues for Large Low Profile Container Cranes.....</b>	<b>142</b>
Kenton Lee, Michael Jordan, and Patrick McCarthy	

### *Landside Connections*

<b>The Long Beach On-Dock Rail Support Facility: An Innovative Local Plan in a Complex Environment.....</b>	<b>152</b>
Mark A. Erickson	

### *Navigation and Waterways*

<b>Analysis of Measured Marine Oil Terminal Berthing Velocities .....</b>	<b>162</b>
R. Iversen, M. L. Argo, S. C. Cortes, and J. J. Pyun	

<b>Forecasting Squat of Post Panamax Container Ships in PortMiami's Entrance Channel .....</b>	<b>173</b>
Wim van der Molen, Gordon Thomson, Jon Nitkin, David Taylor, and Doug Scott	

<b>Measuring Sea Surface Gravity Waves Using Smartphones.....</b>	<b>184</b>
Matheus de Paula Vieira and Pedro Veras Guimarães	

<b>SMART Planning Requires Smart Modeling: Getting the Most Value for Your Ship Simulation Dollar .....</b>	<b>193</b>
Dennis W. Webb, Timothy W. Shelton, and S. Keith Martin	

### *Port Infrastructure*

<b>Precast Counterfort Seawall Simplifies Road Widening Project in USVI.....</b>	<b>202</b>
V. K. Kumar, Jyotirmoy Sircar, and Justin Berglund	

<b>Port of Long Beach Pier G Terminal: Terminal Rail Operation Efficiency Enhancement and Wharf Structural Integrity Improvements .....</b>	<b>211</b>
Daniel T. Shieh and George Paulsen	

<b>Improved Access: Transforming the Port of Vancouver, USA .....</b>	<b>222</b>
Kurt W. Reichelt	

<b>Through the Deck and under the Crane at the Coast Guard Yard in Baltimore, MD.....</b>	<b>231</b>
Kirk Riden, Benjamin Cook, Thomas Ducharme, and Danielle Somma	

### *Port Planning and Operations*

<b>A New Berth for Halifax .....</b>	<b>243</b>
Thomas Ward	

<b>Decision Aid: Maintain, Partly Rebuild, or Reconstruct an Operating Facility? .....</b>	<b>256</b>
Colleen J. Ackermann and Jason Braun	

<b>Discrete Event Simulation Case Studies in Planning Advanced Container Terminals.....</b>	<b>268</b>
Jennifer Chase, Bart Vermeer, Yu (Alan) Zhang, and Trevor Humphreys	

<b>Dry Dock 3 Caisson Replacement and Seat Repairs: A Novel Approach to a Major Rehabilitation of a Continually Operated Naval Dry Dock .....</b>	<b>279</b>
Noah J. Elwood, Linn Lebel, and Eric T. Levesque	

<b>Dynamic Planning for Flexible Port Infrastructure after Panama Canal Expansion: A Real Case Study .....</b>	<b>287</b>
O. Soto Reyes, P. Taneja, B. A. Pielage, and M. van Schuylenburg	

<b>Evolution of America's Ports: Rise of Real Estate as Diversification Strategy .....</b>	<b>301</b>
M. Trowbridge, R. Sloop, and R. Nathan	

<b>Measuring Port Disruptions with Automatic Identification System Data .....</b>	<b>311</b>
Brandan M. Scully and Katherine F. Chambers	

<b>National City Marine Terminal Berth 24-10 Rehabilitation .....</b>	<b>322</b>
Frank Yang, Scott Branlund, Dante Valdez, Armando Mora, and Yeshitla Mulugeta	

<b>Port of Long Beach Land Use Study .....</b>	<b>334</b>
Hardik M. Gajjar, Tracy Fidell, Matt Plezia, and Tony Chan	

<b>Resiliency of NYC Ferry System .....</b>	<b>345</b>
Michael Grant, Victoria Christini, and Kaitlyn McGrath	

<b>Revitalizing the Providence, Rhode Island, Waterfront: The Smallest State's Showcase.....</b>	<b>356</b>
Danielle Goudreau and Ryan McCoy	

<b>San Pedro Bay Portwide Rail Planning for Today and 2040.....</b>	<b>366</b>
Michael Leue, Carlo Luzzi, Shashank Patil, Kerry Cartwright, and Ian Sequeira	



<b>U.S. West Coast Port Infrastructure Needs for Development of Floating Offshore Wind Facilities .....</b>	<b>376</b>
Aaron Porter and Shane Phillips	

<b>Using Simulation to Evaluate and Optimize a Port System—A Case Study .....</b>	<b>389</b>
Yu (Alan) Zhang, Rebeca Aguilar, and Gerardo Lazcano	

### *Project Development*

<b>Bringing Design Build Procurement to Port Development .....</b>	<b>400</b>
Nigel Nixon and Keith Abraham	

<b>How a Collaborative Design Assist Approach Supports Rebuild of a Tribe's Fishing Port While Maintaining Operations.....</b>	<b>409</b>
Ed J. DeBroeck, Donald Oates, Brian Ward, Tessa Gardener-Brown, and Jacob Zacharda	

<b>Simplified Planning Tool to Determine Staffing and Consultants' Needs .....</b>	<b>420</b>
Lincoln Lo and Ramanjit Brar	

<b>Submitting Successful Federal Grant Applications for Ports .....</b>	<b>430</b>
Jean Banker and Andrew Cairns	

### *Terminal Planning and Design*

<b>3-Dimensional Nonlinear Static Analysis for Waterfront Structures with Torsional Response under Seismic Loading.....</b>	<b>436</b>
Pooja Jain, Stuart Stringer, Jim Hogan, and Tom McCollough	

<b>A Proposed Rational Approach to Design of Fenders and Supporting Structures in the United States .....</b>	<b>448</b>
R. Iversen, W. Bruin, B. Phan, and J. Pyun	

<b>Berths 177–178 Wharf Rehabilitation and Replacement at the Port of Los Angeles .....</b>	<b>459</b>
Angel Lim, Chinh Le, Angela Ragusa, Omar Jaradat, and Arul Arulmoli	

<b>Canadian Design Requirements for Marine LNG Facilities .....</b>	<b>470</b>
M. L. Eskijian and P. Jain	

<b>Designing Port Infrastructure for Sea Level Change: A Survey of U.S. Engineers .....</b>	<b>477</b>
Benjamin R. Sweeney	

<b>Discrete Event Simulation for Oil Transshipment Facility .....</b>	<b>489</b>
Liyenita Widjaja and Cheng-Feng Tsai	

<b>Ferry Vessel Propeller Wash Effects on Scour at the Kingston Ferry Terminal, WA, USA .....</b>	<b>500</b>
Sam Kastner, Chris Stearns, Alex Horner-Devine, and Jim Thomson	

<b>Installation of 48 Inch Diameter Test Piles at the Port of Alaska .....</b>	<b>512</b>
Donald G. Anderson, Douglas R. Playter, George J. Newman, Jeff J. Bool, and Todd C. Cowles	
<b>Large Diameter Fiber Reinforced Polymer Monopile Dolphin System Revisited .....</b>	<b>524</b>
T. D. Ripley, C. Troxel, and P. S. O'Brien	
<b>New PIANC Guidelines for Oil and Gas Marine Terminal Design and Assessment.....</b>	<b>535</b>
Ron Heffron	
<b>Optimized Design Addresses Site and Constructability Challenges for Container Wharf in Iraq.....</b>	<b>543</b>
Carlos E. Ospina, V. K. Kumar, Jyotirmoy Sircar, and Victor Demspey	
<b>Overcoming Structural Design Challenges for Train Unloading Station at Coal Terminal in Colombia .....</b>	<b>553</b>
Siddharth Srivastava	
<b>Planning, Design, and Construction for Expansion of PSA's Panama Hub Port.....</b>	<b>563</b>
Ricardo McNeil, Manfred Zinserling, and David Taylor	
<b>Port Canaveral Cruise Terminal 3 Wharf Design and Construction .....</b>	<b>574</b>
Gary D. Ledford, Bill Crowe, Scott Fenical, Prem Kumar, Desiderio M. Maldonado, and Songtao Yang	
<b>Port of Hueneme Phasing Plan through Collaboration for a Wharf Deepening .....</b>	<b>586</b>
Christopher Mansour, Christina Birdsey, and Todd Graham	
<b>Reconstructed Quay Wall Serves Bulk Operations and Heavy Module Transfer .....</b>	<b>594</b>
Jyotirmoy Sircar, V. K. Kumar, Carlos E. Ospina, and Romuald Dagron	
<b>Seismic Response of Large Pile Moored Floating Structures .....</b>	<b>604</b>
Erik Soderberg, Leah Olson, and Michael Jordan	
<b>The Port of Long Beach is Big Ship Ready: Overview of Terminal Mooring and Berthing Studies.....</b>	<b>614</b>
John Chun, Cheng Lai, Omar Jaradat, and Xiuying Xing	
<b>The Super Flood Basin: A Novel Approach to Transforming a WWII Era Dry Dock to Support the Contemporary Submarine Fleet Now and into the Future .....</b>	<b>624</b>
Matthew L. Teeden, Noah J. Elwood, Linn Lebel, and Ian Bodwell	
<b>Time-Window Based Berth and Yard Allocation Planning of Container Vessels.....</b>	<b>633</b>
Jialin Xu, Sujing Wang, and Qiang Xu	
<b>Translating Automated Container Terminal Operations into Terminal Infrastructure Design.....</b>	<b>644</b>
Rob Kaptein, Ashebir Jacob, and Reza Alamir	