DESIGNING PORT INFRASTUCTURE FOR SEA LEVEL CHANGE: A SURVEY OF ENGINEERS

Benjamin Sweeney, University of Rhode Island, benjaminsweeney@uri.edu
Dr. Austin Becker, University of Rhode Island, abecker@uri.edu

INTRODUCTION

This work will implement an online survey to gauge the North American port and marine infrastructure engineering community's attitude and approach to planning for sea level change (SLC) for large-scale port engineering projects in their practice. Results will identify how engineers consider SLC in the design of marine infrastructure and address such questions as: For which types of projects do port and marine infrastructure engineers incorporate SLC considerations into their design? Where does the incentive to add a SLC design component to a project originate from? What levels of SLC do port and marine infrastructure engineers design for? How do the lifespan expectations and time horizons of maritime projects affect SLC considerations? Answers to these questions will provide baseline data that can be used to determine the role that the American Society of Civil Engineers (ASCE) and others can play to best provide assistance to the engineering community, as well as for tracking how firms change their approach to incorporating SLC into their designs over time.

BACKGROUND

Marine structures, such as wharves, docks, piers, and revetments, are vulnerable to SLC due to their coastal location (Asoriotis & Benamara, 2012). Observational data and calculated predictions confirm that sea level is changing, and therefore, engineers of marine infrastructure projects need to design structures to be more resilient by considering SLC. Despite the need for more resilient marine structures, there is currently little understanding of how SLC is incorporated into the design of these structures. This can be a challenging task for engineers due to the uncertainty of SLC projections as well as differing guidelines and recommendations for managing SLC, especially at the local level (Becker, Toilliez & Mitchell, 2015). Furthermore, incorporating SLC considerations in port engineering structures is especially critical, as these projects tend to have long working lifespans, in some case exceeding 100 years (Savonis, Potter & Snow, 2014).

In some parts of the nation, port authorities are requiring the design and redesign of port infrastructure to consider SLC. For example, the Port Authority of New York and New Jersey (PANYNJ) sent out an RFP for the replacement of its waterfront structures across its five port facilities: Port Newark, Elizabeth Port Authority Marine Terminal, Jersey Port Authority Marine Terminal, Howland Hook Marine Terminal and Brooklyn Port Authority Marine Terminal (PANYNJ, 2018). The RFP requires the hired consultant to identify vulnerabilities of the wharfs related to sea level rise, and provide best practice wharf design concepts that take into account sea level rise.

To better understand how engineers are incorporating SLC into the design of large-scale maritime infrastructure, an online survey will be distributed to port and marine infrastructure engineers who are members of the Coasts, Oceans, Ports, and Rivers Institute (COPRI) of ASCE. COPRI will distribute the survey by email to its membership, which is estimated to include 4,200 members who work on port infrastructure projects and represent at least 20 different consulting firms. The results of the survey will identify what is driving the decision to incorporate SLC into a design, and if a project does not incorporate SLC into the design, what is the barrier that prevents that? Results will indicate how SLC guidelines and recommendations are being used and how that determination is affected by the long time horizons of maritime projects.

Figure 1: PANYNJ (Photo: E. McLean)

There are strong incentives to provide resilience against sea level change and other climate conditions due to the economic potential and social influence of seaports (Becker, Toilliez & Mitchell, 2015). Engineers and designers play an important role and have a responsibility to be proactive about future flood risk (Toilliez, 2018). The inadequate design of port infrastructure can have consequences for all stakeholders including physical damage to infrastructure and indirect damage to the supply chain of goods and services (Becker et al., 2013).

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