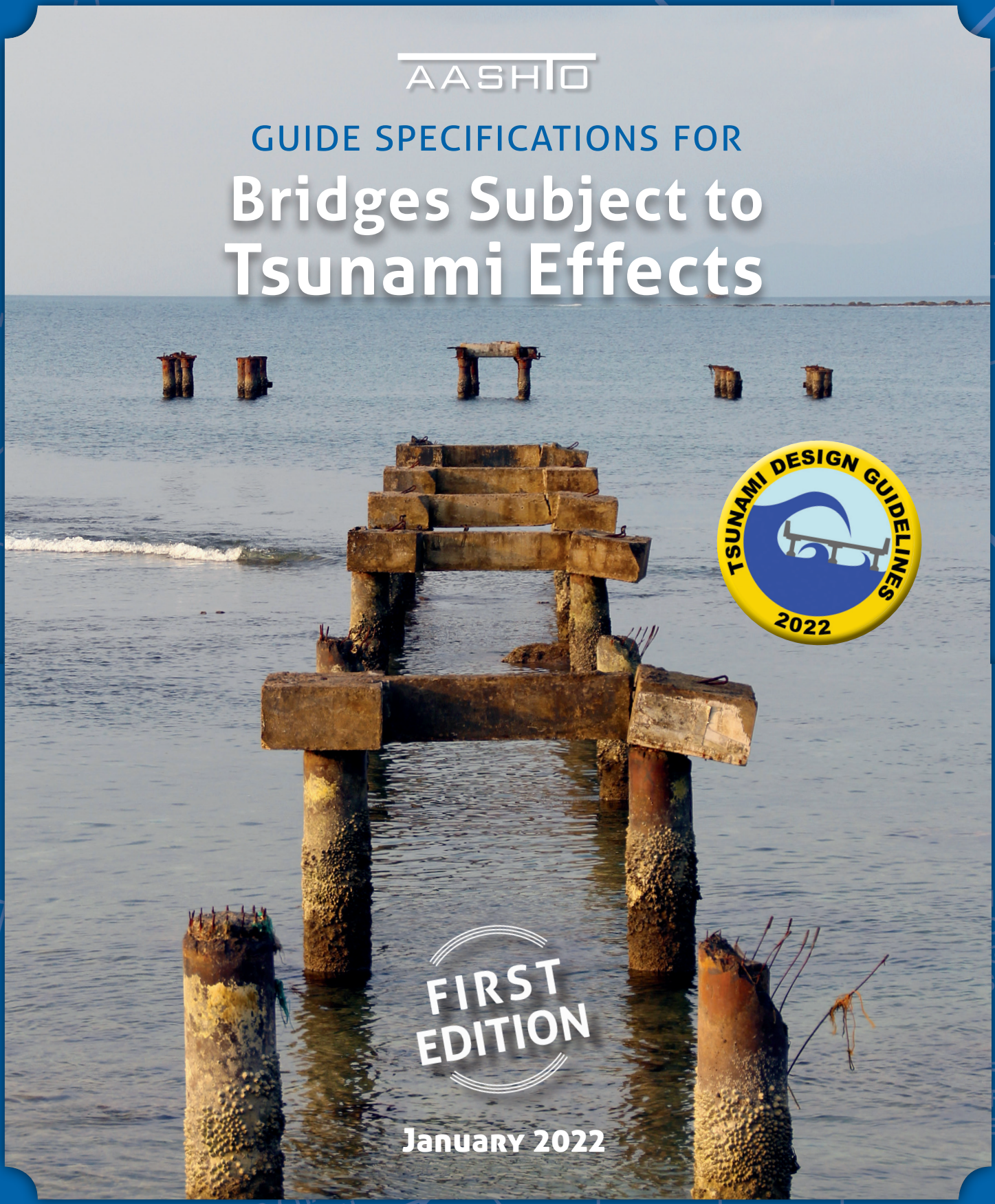
AASHTO

GUIDE SPECIFICATIONS FOR

Bridges Subject to Tsunami Effects



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SECTION 1

INTRODUCTION

1.1—BACKGROUND

The goal of these Guide Specifications is to provide Owners and Designers with methods to evaluate the hazard posed by tsunamis to a particular bridge, and to identify accepted methodologies and details to mitigate that hazard in design.

These Guide Specifications are intended for use in new bridge design, and do not directly address the retrofit of existing bridges.

C1.1

These Guide Specifications were developed as part of a Transportation Pooled Fund Study, TPF-5(307), that included the states of Alaska, California, Hawaii, Oregon, and Washington, as well as the Federal Highway Administration, and was led by Oregon. Reports of the Pooled Fund Study 5(307) have been published by ODOT (Lynett et al., 2021; Istrati and Buckle, 2021a, 2021b). The impetus for this project, and the development of these Guide Specifications, is twofold: recent damaging tsunamis such as the Japanese earthquake and tsunami of 2011 and the Indonesian tsunami of 2004 which demonstrated the potential damaging power of tsunamis, and the growing realization of the hazard posed by a potential Cascadia Subduction Zone event to a substantial portion of the west coast of the United States, as well as the hazard posed by more distant seismic events.

The December 26, 2004 Indonesian tsunami and the March, 2011 Japanese tsunami included a 70-m broken bore (i.e., wave), significant overland flows, and debris accumulation in the flow which all affected the performance of bridges. These tragedies, among others, provided graphic examples of the dangers posed by tsunamis, and the potential failure mechanisms that need to be addressed.

1.2—APPLICABILITY

These Guide Specifications are intended for the design and construction of conventional bridge structures to resist the effects of tsunamis. For the purposes of these Guide Specifications, conventional bridges are taken as those that:

- Have slab, beam, or box girder superstructures;
- Are supported by pier and abutment substructures;
- Are founded on shallow or deep foundations;
- Have minimal changes in elevation along the bridge length;
- Are straight in plan view (including skewed but not curved); and
- Have supports oriented with the direction of the tsunami flow.

C1.2

Non-conventional bridges outside the applicability of these Guide Specifications include bridges with truss, cable-stayed, or cable-suspended superstructures; bridges with tower supports; arch bridges; and culverts.

The requirement for minimal elevation change is not intended to exclude cambered girder bridges. Sloped profile grades may not have significant effects on tsunami-induced bridge superstructure forces, but can introduce moments on the superstructure. See Lynett et al. (2021) for more information.

These provisions apply to bridges with piers and abutments oriented parallel to the tsunami flow direction, whether skewed to the superstructure direction or not. For cases where the tsunami flow direction is within 20 degrees of the support orientations, the equations provided herein can be applied with an acceptable degree of accuracy. For cases where the tsunami flow direction is not parallel to the support orientation but the total tsunami flow depth is such that the superstructure is not impacted by the tsunami, these Guide Specifications are