BOOK REVIEWS

Handbook of Corrosion Protection for Steel Pile Structures in Marine Environments

Reviewed by H. E. Townsend, Supervisor, Corrosion and Coatings Research Section, Bethlehem Steel Corp., Bethlehem, PA. Member of ASTM Committee G-1.


Marine structures such as bulkheads and wharves are generally anchored in place by steel, wood, or concrete piles. Steel piles in the form of H-sections, pipe, or sheet are widely used because of a favorable combination of properties and cost that facilitates economical construction of durable structures. The service life of steel piles exposed to aggressive marine environments may be limited by corrosion.

This book is intended to familiarize civil engineers and others involved in the design of new, and rehabilitation of existing, structures with the complex subject of corrosion and the various means of corrosion protection that are available to prolong the life of steel piles. It comprises a collection of ten sections and six appendices that were assembled by the Steel Pile Subcommittee of the Committee on Construction Codes and Standards of the American Iron and Steel Institute that is intended to provide a convenient state-of-the-art reference. Readers will find the handbook to be written in a clear straightforward style, well organized, amply illustrated, and with a useful subject index.

Section 1 by H. E. Preiser, "Factors to be Considered in the Use of Steel Piling in Marine Structures," gives a brief discussion of the factors involved in determining whether a particular structure will require some form of corrosion protection.

Section 2 by H. E. Preiser, "Fundamentals of Steel Corrosion," introduces the basic concepts and phenomena of steel corrosion in marine environments. In particular, it describes the different environmental zones typically encountered by steel piles: atmospheric, splash, tidal, submerged, and soil.

Section 3, "Economics of Corrosion Control," by A. W. Peabody and W. F. Gundaker, is concerned with calculating the cost of corrosion control measures taken into account taxes and the time value of money. The methods are amply illustrated with examples.

The four basic approaches to corrosion control of steel piling are described by H. S. Preiser in Section 4, "Design and Fabrication Practices;" Section 5, "Steel Selection;" Section 6, "Jacketing and Coating;" and Section 7, "Cathodic Protection." Because, as noted in the book's preface, the sections by Preiser were authored in 1970 to 1971, most of the references provided predate that time. To help remedy this situation, the editors have added two more recent key references to the Jacketing and Coatings Section. Readers may also be interested in the portions on steel contained in the review by W. K. Boyd and F. W. Fink, Corrosion of Metals in Marine Environments, MCIC 78-37, Metals and Ceramics Information Center, Battelle Laboratories, Columbus, OH, March 1978.

Practical considerations in applying one or a combination of the four basic corrosion-control methods are given along with detailed examples of specific systems and associated costs in Section 8, "Compatibility of Combination Methods of Corrosion Control," and Section 9, "Technical and Practical Approaches to the Design of Corrosion Control Methods," by A. W. Peabody and W. F. Gundaker.

Section 10, "Rehabilitation of Steel Piles in Waterfront Structures," by T. D. Dismuke, deals with the evaluation, repair, and addition of corrosion protection to existing structures.

The glossary of corrosion terms given by S. K. Coburn in Appendix A will be useful to newcomers to the subject of corrosion, although it is not as extensive as that found in ASTM Definitions of Terms Relating to Corrosion and Corrosion Testing (G 15).

Appendix B, "Discussion of Corrosion Testing and Behavior of Steels in Marine Environments," and Appendix C, "Properties of Natural Waters," by S. K. Coburn, add to the subjects treated earlier in Sections 2 and 5. It is hoped that future editions of the handbook will be revised to combine all information on a given subject in a single section, thus omitting these appendices.

On page 185 of Appendix B, carbon steel is referred to as steel with less than 0.04% copper. It should be noted that in terms of corrosion resistance, carbon steel is usually defined as steel containing less than 0.02% copper.

Both Appendix B and Section 5 give data on the corrosion resistance of ASTM A517(F) (Unified Numbering System [UNS] K11576) steel. Recognizing that A517(F): (1) is a pressure-vessel plate grade that is not normally used for piling applications, (2) is a high-alloy version of A517 that does not have corrosion resistance representative of all 15 possible A517 compositions, and (3) is a high-strength steel that may be susceptible to cracking in the presence of certain environmental contaminants such as hydrogen sulfide, I believe these data should have been omitted.

Appendices D and E give dimensions and design properties for H, sheet, and pipe piles. Appendix F is a collection of ASTM Specifications for Structural Steel (A 36), Welded and Seamless Steel Pipe Piles (A 252), Steel Sheet Piling (A 328), High-Strength Low-Alloy Columbium-Vanadium Steels of Structural Quality (A 572), and High-Strength Low-Alloy Steel H-Piles and Sheet Piling for Use in Marine Environments (A 690).

This book will serve well as a convenient reference for engineers wanting to become conversant with the practical aspects of corrosion and the usual methods used to protect steel piles in marine environments.