

HISTORY AND HERITAGE OF COASTAL ENGINEERING

EDITED BY NICHOLAS C. KRAUS





HISTORY AND HERITAGE OF COASTAL ENGINEERING

A COLLECTION OF PAPERS ON THE HISTORY OF COASTAL ENGINEERING IN COUNTRIES HOSTING THE INTERNATIONAL COASTAL ENGINEERING CONFERENCE 1950 - 1996

PREPARED UNDER THE AUSPICES OF THE COASTAL ENGINEERING RESEARCH COUNCIL OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS

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ABSTRACT:

Coastal engineering is a relatively new discipline within the field of civil engineering. The first International Coastal Engineering Conference was convened in Long Beach, California, in 1950. The theme of the twenty-fifth or "silver" ICCE held in Orlando, Florida, in September, 1996, was History and Heritage of Coastal Engineering to honor those individuals and institutions contributing to the foundations of the discipline. As part of the celebration at this premier technical conference, this volume was conceived to document the history of coastal engineering in the 15 countries which have hosted the ICCE. Coastal engineering works have been conducted for hundreds and even thousands of years for port development, coastal hazard protection, and reclamation of land from the sea. The needs of the different countries and the approaches taken are unique and document the evolution of society and its relation with the coast from 15 perspectives. The reader will be fascinated by the ingenuity and resolution of our ancestors, as well as the accomplishments made in modern times as documented in this volume rich with information, colorful anecdotes, and citations to many almost-forgotten original references worthy of re-examination.

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Cover photograph provided by Professor Robert L. Wiegel, Professor Emeritus, University of California, Berkeley, showing "field party with Dukw, Winkler, Bascom, Goodwin, and Grabber, May 7, 1947."

PREFACE

Coastal engineering emerged some 50 years ago as a distinct technical area of civil engineering. In 1950, the International Conference on Coastal Engineering series began in Long Beach, California, and, after a period of convening annually, assumed the present biennial format in 1968. The Twenty-Fifth International Coastal Engineering Conference—the *Silver Conference*—celebrated our "Coastal Engineering History and Heritage" in recognition of the important milestone that has been achieved.

As part of the celebratory theme of ICCE96, this volume was conceived to document the history of coastal engineering in the 15 countries which have hosted the conference. Coastal engineering works have been conducted for hundreds and even thousands of years for port development, coastal hazard protection, and reclamation of land from the sea. The needs and solution approaches of the various countries are unique, and the individual chapters document the activities of society and its relation with the coast from 15 perspectives.

Despite cultural differences, common themes are found. One such theme is evolution of coastal engineering practice through the three cycles of (1) exploitation and utilization of the coast, (2) development of protection from coastal hazards such as flooding and erosion, and (3) preserving and creating harmony between nature and coastal uses. Some countries have entered the final cycle of this process, whereas others are in either the first or second cycles. A fascinating theme is that of pivotal workers in the field, those who have influenced generations that followed in their own countries and, sometimes, in the world. Of course, we are also humbled to learn that wise observers and thinkers had discovered many basic processes and solutions hundreds of years before their rediscovery in modern times. A valuable aspect of this collection of papers is the plentiful citations to the original literature, the true source of our knowledge.

I would like to express my deep appreciation, gratitude, and admiration to the authors of the chapters comprising this volume. They labored as volunteers for the love of their field and the desire to hold it in the highest esteem. Their efforts document a pivotal era in coastal engineering and related sciences, one in which the pioneers are now turning over the mantle of responsibility to those who were not in direct contact with the founders. Through this volume it is my hope that this contact will be forever maintained.

Nicholas C. Kraus, editor

June 26, 1996

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HISTORY OF COASTAL ENGINEERING IN AUSTRALIA

Michael R. Gourlay¹

ABSTRACT: After brief reviews of Australia's coastal environment and its political and administrative divisions, the historical development of maritime and coastal engineering in Australia is reviewed from early times to the post second world war period. The implementation of coastal protection works and the development of coastal management in each of the five mainland states since the second world war is then considered with particular attention to the role of coastal engineers. Several significant coastal engineering projects of various kinds from different parts of the country are described. These are followed by an account of some of the coastal engineering research, as well as a brief mention of relevant marine science, undertaken in Australia. Finally the activities of The National Committee on Coastal and Ocean Engineering in providing a technical focus for coastal engineering and as a lobbying group for significant matters affecting the coast are recorded. The paper includes a wide ranging bibliography on coastal engineering in Australia.

INTRODUCTION

"The coastal zone has a special place in the lives of Australians. Most Australians want to live or take their holidays there. It is a priceless national asset." (DEST 1995)

With two thirds of the Australian continent lying in an arid zone it is not surprising that 86% of Australia's population live within its relatively well watered coastal zone. During the last 20 years there have been significant increases in population, development and tourism in this zone. About half of the total population growth during this period has occurred in regions away from the older population centres based on the state capital cities. The most rapidly developing coastal areas are the southeast and far north of Queensland, the southwest of Western Australia and the central and north

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coasts of New South Wales (DEST 1995). In such a situation coastal engineering has had and should be continuing to have a significant role in meeting the needs of the community.

The history of coastal engineering in Australia is very much a reflection of the development of this island continent nation within the constraints of its varied coastal environments and its complex political and administrative arrangements. The topic is an enormous one and it has been necessary to be selective in the presentation.

Short reviews of the Australian Coastal Environment and Political and Administrative Divisions are followed by an overview of the Historical Development of Maritime and Coastal Engineering in Australia during the nineteenth and twentieth centuries. The diverse approaches to Coastal Protection and Coastal Management in Australia are then discussed for each mainland state with the emphasis on the contribution of (coastal) engineers. Some Significant Projects or aspects of coastal engineering in Australia are then presented. These cover various kinds of works constructed in different parts of Australia during the period from the beginning of the twentieth century up to the present time. A review of Coastal Engineering Research in several defined fields follows together with a brief review of related Australian Marine Science. The paper concludes with a discussion of the role of the National Committee on Coastal and Ocean Engineering and its activities, including the Australian Coastal and Port Engineering Conferences.

As Australia is a large country and many readers may be unfamiliar with its geography, Appendix A includes a series of maps showing the location of places referred to in the text.

AUSTRALIAN COASTAL ENVIRONMENT

"Australia is an island continent with some 35 000 km of coastline, which is large by any national standard. The margins stretch from latitudes of 11 degrees to 44 degrees south and experience the complete range of sea conditions possible, except ice. They vary from almost zero tide to some of the largest in the world... The strongest swell possible impinges on our southern margins originating from distant weather systems in the southern ocean. Our coasts can experience the severest storm wave action possible as, for example, generated by fetches formed by south west winds between high pressure systems tracking across the Australian continent and low pressure systems tracking across south of the continent. The northern coastlines in latitudes less than 25 degrees experience the ravages of tropical cyclones with their associated devastating storm surges. Most of our population lives in coastal cities and towns and we depend on shipping for export of our primary mineral and secondary products and import of petroleum, specialised materials and manufactured goods. The coastal waters provide fishing grounds, recreation areas, sought after residential sites, and are exploited for undersea gas oil and minerals. This enormous range of activity is carried on by government agencies at national, state, regional and local levels, by

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AUSTRALIA

manufacturers, shipping companies, engineering firms and consultants, universities, learned societies, groups of citizens and individuals. Conflicts of interest are numerous. The need to assist in the resolution of these conflicts, and to solve the numerous problems associated with coastal development gave birth to a new species of engineer in the mid to late 1960's, the coastal engineer." (Nelson 1982).

Australian coastal engineers not only have to contend with the complete range of sea conditions possible, except ice, and with tides of varied magnitudes but also with very varied geomorphological and geological conditions as well as diverse ecosystems. Australia's climate is the driest and most variable of any of the inhabited continents. The surface of Australia is flatter than any other continent; tectonic activity is low and isostatic uplift small. Its rivers contribute relatively small quantities of sediment but relatively high loads of dissolved salts to its coasts. In few places is the sediment supply sufficient to be causing significant accretion of the coastline and with the anticipated rise in sea level in coming years most coastlines will be under threat of erosion.

The broad geographical characteristics of Australia's coasts compared with the coasts of other continents are presented by Davies (1972). More specifically the coast of Australia can be broadly classified from a geological and geomorphological viewpoint into the following eight different coastal regions (Gill, 1982)(Fig. 1).

- 1. The Great Barrier Reef coast (Queensland).
- 2. The heavy mineral sand coast (Queensland and New South Wales).
- 3. The rocky shore/inlet coast (Southeastern Australia).
- 4. The aeolianite coast (Victoria and South Australia).
- 5. The arid riverless coast (Great Australian Bight).
- 6. The coral reef/aeolianite coast (Western Australia).
- 7. The tropical Northwestern coast.
- 8. The Gulf of Carpentaria coast.

Numerous coral reefs with their diverse ecology protect a large part of the northeastern Australian coast (coast 1). Coral reefs are also very significant along portions of the coast of Western Australia (coast 6). Mangrove forests dominate estuaries in northern Australia (coasts 7 and 8) and extend with decreasing diversity around the eastern coastline from Queensland to Victoria (coasts 1, 2 and 3). Large sand dunes of Pleistocene age form barrier islands enclosing large bays in southern Queensland (coast 2) and northward alongshore transport dominates the northern New South Wales and southern Queensland coasts (coast 2). In central and southern New South Wales and