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DTIC

New Coastal Engineering Manual (CEM)  
Part VI: Coastal Structure Design

Final Technical Report

by

Hans F. Burcharth

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U of Aalborg

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## 1. Contract period

The contract period originally covered the three fiscal years FY-93, FY-94, and FY-95, terminating 1. June 1996. By contract modification the work period of 36 months was prolonged to 48 month terminating 1. June 1997.

## 2. Scope of Work

The main scope of my involvement in the CEM work was to author some chapters in Part 6, and to review parts of the CEM manuscripts. Besides this, giving advice on the outline and contents of chapters was also included in the scope.

The work done can be classified as follows:

- a. Preparatory work
- b. Literature study
- c. Meetings/workshops
- d. Authoring of selected sections of Part 6
- e. Review of selected parts of the CEM manuscripts

## 3. Activities

The activities can be summarized as follows:

### 3a. Preparatory work

- Study of the general background information including the CERC "Guide for preparation of the CEM".
- Review on alternative organization philosophies as presented by Dr. S. Hughes.
- Review of the latest edition of the CERC Shore Protection Manual with regard to updating of subjects related to Coastal Structures and Design Wave Climate.

- Review and commenting on various proposals for the detailed Outline of Part 6.
- Preparation of input to the CEM Technical Workshop held at CERC, February 1994.

### **3b. Literature study**

Lists of potential literature references have been produced for the following areas:

- Design Sea States
- Risk Analysis and Reliability in Designs
- Materials
- Fundamentals of Design

### **3c. Meetings/workshops**

The following meetings were held during the three years:

- Start up meeting with Dr. S. Hughes at CERC. Initial discussions on basic principles for the outline of the CEM. (January 1993)
- Meetings in April 1993 at Aalborg University with Dr. C. Linwood Vincent, CERC, for detailed discussion related to the outline of the part of the CEM dealing with Design Wave Climate. Production of a proposal for chapter outline.
- Participation in the CEM Technical Workshop at CERC, February 1994.
- Visit to CERC September 1995 for coordination meetings with Dr. S. Hughes and detailed discussion on the contents of Part VI. Some part of Chapter VI-2-1 was written during the stay at CERC.
- Meeting at CERC September 1996 with Dr. S. Hughes for detailed discussion of my manuscripts for chapters in VI-2, and for discussion of future work.

### 3d. Authoring of selected sections of Part VI

The following chapters within Chapter VI-2 "Types and Functions of Coastal Structures" have been completed:

- Chapter VI-2-1 : Applications , 9 pages.
- Chapter VI-2-2 : Typical Cross Sections and Layouts , 23 pages and 23 figures.
- Chapter VI-2-3 : Main Types of Concrete Armor Units , 3 pages and 1 figure.
- Chapter VI-2-4 : Failure Modes for Various Structure Types, part b Sloping Front Structures and part c Vertical Front Structures, 43 pages and 37 figures.

Preparatory work to form part of the basis for authoring has been performed related to the following chapters:

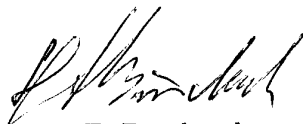
- Chapter VI-4 : Reliability Based Design.  
Methods for implementation of safety in designs have been investigated
- Chapter VI-5 : Concrete.  
Information on in-situ strength of concrete in armour units has been obtained. Fatigue simulations have been completed. Information on deterioration due to solar heating has been obtained.
- Chapter VI-6-2 : Wave-Structure interactions.  
Selection of reliable formulae has been completed.
- Chapter VI-6-4 : Foundation Loads.  
Bearing capacity formulae for monolithic structures have been investigated in order to identify the most critical foundation failure modes.
- Chapter VI-6-6a : Impact Forces.  
Diagrams for estimation of dynamic response of monolithic structure to impact forces have been produced, but evaluation has not been completed.
- Chapter VI-7-2 and 3 : Examples of Sloping Front and Vertical Front Structures.  
Some design examples have been selected.

- Chapter VI-8-2 : Reliability of Existing Structures.  
Rubble mound breakwaters and caisson breakwaters have been studied.

**3e. Review of selected sections of Part VI.**

- Chapter VI-3 : Site Specific Design Conditions

Aalborg 25. May 1997



Hans F. Burcharth  
Prof., dr.techn., dr. h.c.