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PRINCIPLES OF SEDIMENTATION AND EROSION ENGINEERING IN RIVERS, ESTUARIES AND COASTAL SEAS

Leo C. van Rijn

Professor Fluid Mechanics and Sand transport
Department of Physical Geography
University of Utrecht, The Netherlands

Senior Hydraulic Engineer, Delft Hydraulics
Delft, The Netherlands

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For those who like solving morphological problems

CONTENTS

7. SEDIMENTATION OF SAND AND MUD IN RESERVOIRS IN RIVERS

8. EROSION CONTROL MEASURES ALONG COASTS

11. DREDGING AND DUMPING OF SEDIMENT DEPOSITS

Preface

The prediction of sedimentation and erosion volumes near engineering works in rivers, estuaries and coastal seas is a delicate task requiring a profound knowledge of the hydro and sediment dynamics involved.
To solve this problem, various tools are at our disposal, being: databases, laboratory scale models and mathematical morphological models. Nowadays, the morhological models ranging from simple 1D models to sophisticated 3D models are the most popular tools available, because they are relatively easy to operate and can model the problem at full scale. It should be realized, however, that these models are still relatively crude tools, as our knowledge of sediment transport processes is rather limited, particularly in coastal waters where the interaction of currents and waves is the basic driving force. Despite our limited knowledge of sediment transport processess, engineers confronted with sedimentation and erosion problems have to apply the available models to evaluate the morphological consequences of engineering works. When dealing with these problems, three basic rules should always be kept in mind:

1. try to understand the physical system based on available data;
2. try to estimate the morphological effects of engineering works based on simple methods (rules of thumb, simplified models, analogy models, i.e. comparison with similar cases elsewhere);
3. use detailed models for fine-tuning and determination of uncertainties (sensitivity study trying to find the most influencial parameters).

The need for simple models for a first quick assessment has inspired the author throughout his career to develop a morphological toolkit (available on CD-ROM) consisting of easy to use Excel files and Fortran models. Although the toolkit is easy to use, it requires a sharp engineering eye to schematize a complicated real world problem into a simple idealized case and to obtain meaningful results.
Depending on the scale and impact of the problem, much more refined 2DH and 3D models should be considered for use to obtain more detailed and accurate results of not only bulk volumes but also of detailed morphological patterns, which simpler models can not produce.
Increasing computer power has greatly enhanced and improved our capabilities. Now, really big models can be run over a long time. The detailed computed morphological patterns can be studied over and over again by running the output animations to obtain a better view of the processes in time. The interpretation of these detailed patterns and processes will undoutedly initiate a learning process improving the skills of the ‘morphological’ engineers. This all will make our profession so much more interesting and mature and it brings me to a remark of the great Chinese Philosopher Confusius:

> “To learn and from time to time to apply what one has learned; is n’t that a pleasure?”

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