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A Simple Estimation Diagram for Deposition Configurations of Earth/Sand Dumped from Barges

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ABSTRACT

Soil removed by dredging has generally been disposed of by dumping at sea in an unplanned manner. However, the London Convention 1972 and the 1996 Protocol call for assessments of the environmental impact of dredged soil disposal at dumping sites. Compliance with the Protocol will require techniques for predicting the deposition configuration of dredging sludge dumped from barges. As part of the present study, a quantitative model for estimating the spatial deposition of earth and sand dumped from barges is developed. The accuracy of this model is then verified through laboratory and field experiments. Based on these results, this study proposes a simple calculation diagram capable of predicting the shape of the deposit that results when dredged soil is dumped at sea.

KEY WORDS:
London Convention; dredge soil; deposition configuration; barge; environmental assessment

INTRODUCTION

Sediment must be dredged from ports, harbors, marinas, and inland waterways to keep shipping lanes clear. Although much of the material removed is disposed of at sea, both the dredging and the disposal of the dredged material pose environmental impact risks. The London Convention 1972 and the 1996 Protocol call for assessments of the disposal of dredged material to prevent ocean pollution resulting from waste dumping. "The guidelines for assessment of waste or other matters that may be associated with dumping" are intended for use by national authorities responsible for regulating waste dumping and embody mechanisms for guiding national authorities in evaluating methods of waste dumping in a manner consistent with the provisions.

Hopper and split barges are often used in such disposal. One advantage offered by barges is speed: They are capable of carrying large volumes of dredged material. To enable effective planning for assessments of the disposal of dredged material to prevent ocean pollution resulting from waste dumping, there must be some way to forecast the shape of the deposits of earth and sand dumped from the barges before actual dumping occurs.

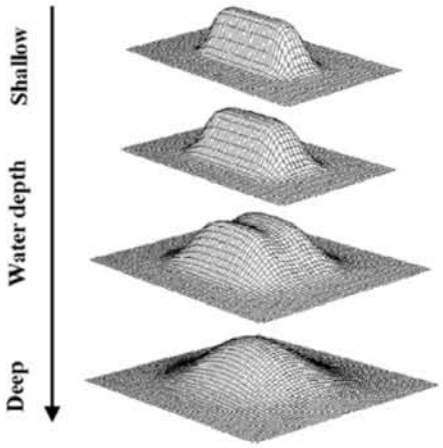

Figure 1 Schematic diagrams on the changes in earth/sand mound shape with water depth.

The study initially develops a quantitative model for estimating the spatial deposition configuration of earth/sand dumped from barges, then proposes a calculation diagram capable of rapidly estimating the deposition configuration of dredged material from detailed calculations based on this model.

PREDICTION MODEL

A previous study (Matsumi and Kimura, 1992) proposed a stochastic model for simulating the spatial geometry of rubble mounds discharged from barges. This model, which applies the Markov chain to the probability distribution of rubble settling positions, was capable of evaluating the spatial geometry of rubble mounds formed by a single-discharge site with sufficient accuracy. But as shown in Fig. 1, for earth/sand, field measurements and observations clearly show that the depth of the water in which the material is deposited affects deposition