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TECHNICAL COMMUNICATION

Economic Aspects of Backpassing: New-type Profiling by New-type Equipment

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ABSTRACT

BRUUN, P., 1993. Economic aspects of backpassing: New-type profiling by new-type equipment. *Journal of Coastal Research*, 9(4), 1106–1109. Fort Lauderdale (Florida), ISSN 0749-0208.

This brief communication is written in continuation of the paper on "Bypassing and Backpassing at Harbors, Navigation Channels, and Tidal Entrances: Use of Shallow-Water Draft Hopper Dredgers with Pump-out Capabilities", published by the *Journal of Coastal Research*, 8(4), 972–978. It explains the economic advantages of the operation of shallow-water draft hopper dredgers combined with profile-nourishment. For reasons of clarity, the writer uses two schematics explaining essential facts about the operation.

ADDITIONAL INDEX WORDS: *Shallow water draft hopper dredger, profile nourishment, economic aspects of nourishments of shores.*

INTRODUCTION

This brief note is written in continuation of the paper on "Bypassing and Backpassing at Harbors, Navigation Channels, and Tidal Entrances: Use of Shallow-Water Draft Hopper Dredgers with Pump-out Capabilities", published by the *Journal of Coastal Research,* 8(4), 972–978.

The paper elaborates the economic aspects with particular reference to backpassing techniques. In the following, this has been done by combining the economic results on unit prices shown in Figure 4 of BRUUN and WILLIKES (1992) with technical aspects concerning profiling of the fill dumped on the beach and on the nearshore bottom.

Present decades-old practices in the United States may be classified as "institutional" following "the law of inertia". They have their advantages and disadvantages. Improvements include technical and economical aspects related to new types of equipment as described by BRUUN and WILLIKES (1992). Combination of the two is dealt with in some detail.

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FILL GEOMETRIES AND ECONOMICS

Figure 1 is a schematic showing the berm (NP = normal profile) and the shallow water draft hopper dredger profiles (SWH). For reasons of demonstration, Figure 1 presents a severe case of erosion with an initial beach width of only 20 meters to be expanded to 70 meters. The berm-profile (NP) has a berm width of 15 meters at elevation 3 meters, a straight slope (1 in 15) to the bottom or to the lower beach. The dot-and-dash profile has a berm of 20 meters at elevation 2 meters and a 1 in 25 slope down to minus 1 meters, from thereon curving to 1 in 35 to the bottom. These two profiles have the same width of beach at the 0 = MSL-level and the same quantity of material in the nourished profile. In the case of storms and high tides, the berm-profile is going to lose material from the berm and the steeper slope faster than the other (SWH) profile (LARSON and KRAUS, 1991), but its beach will remain higher than the SWH-profile for the period of time preceding the storms which will damage the berm and the slope. What happened was that one exchanged a higher stability for a time-limited advantage for recreational use of the beach. On exposed shores, such

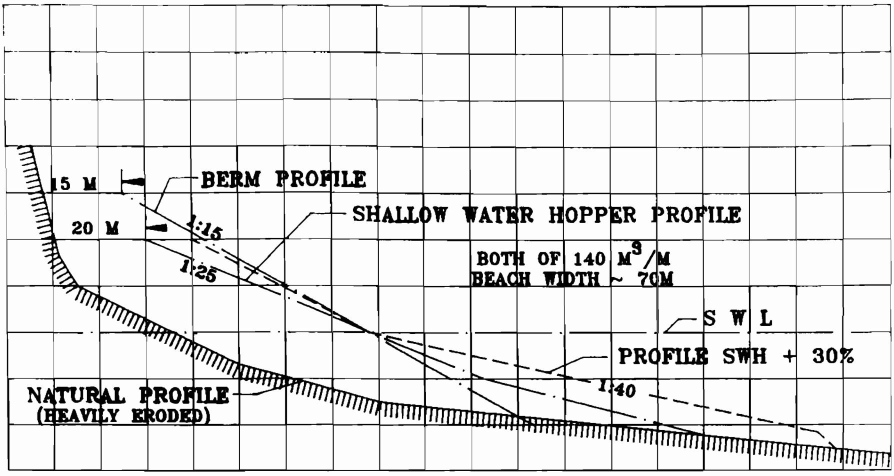

Figure 1. Various geometries for nourishment of beach and nearshore bottom.

an advantage may prove to be very small, if anything at all.

By increasing fill quantities for the SWH-profile by 30%, one arrives at the profile shown by the dotted lines in Figure 1. Its berm-width is now 30 meters at 2 meters elevation or twice as wide as the berm-profile at elevation 3 meters. The underwater slope may be 1 in 40 as shown, compared to 1 in 15 for the berm-profile. This profile, of course, is more stable than the berm-profile, but it also includes about 30% more material. If unit costs for fills to produce the two different profiles were the same, the SWH-profile would be 30% more costly than the berm-profile. That would be what you had to pay for the added stability. Realities, however, may be different due to the different kinds of equipment used to produce the two different profiles.

The berm-profile is built by conventional equipment, that is, either by a hydraulic pipeline dredge or by a larger hopper dredge discharging to shore through a buoy or barge station connected to shore by a pipeline. That in itself is a fairly rigid system including considerable work in moving pipelines on the beach and along the beach.

The SWH-profile is produced by a shallow water hopper dredge with—probably—discharge through a jet-pontoon directly on and along the beach. Costs for the two kinds of operations are different, however. Figure 2A was abstracted from Figure 1 and from Figure 4 of the earlier paper. Figure 2B is based on the results by LARSON and KRAUS (1991) for the relative stability of the two kinds of profiles where RQ in the ordinate represents the relative quantity left above MSL during project life-times from two to six years. The SWH values, of course, are subject to variances, but Figure 2B reveals a definite trend correctly (LARSON and KRAUS, 1991).

Figure 2C shows the unit price over the relative quantity factor, UP/RQ, in relation to years of performance of the fill. It has two values for UP/RQ, one for the same fill quantity in both profiles and another with 30% added to the SWH-profile for equal quantity in order to produce a more stable profile, shown with dotted lines in Figure 1 including a wide berm at elevation 2 meters.

From Figure 2C, it may be noted that, regardless of the increased quantity for the SWH + 30% profile, the UP/RQ factors vary from 1.6 after two years to 1.25 after six years. This clearly demonstrates the superiority of the SWH method of nourishment compared to the conventional berm method. The above figures are, of course, site specific and subject to variances.

IS EQUIPMENT AVAILABLE FOR THE SWH METHOD IN THE UNITED STATES?

The answer to that is that for a decade such equipment has been available in Europe and in Australia, *but not in the U.S.* The "Jones Act" (1906–1920) prohibits the import of foreign equipment to the U.S. as well as the operation of

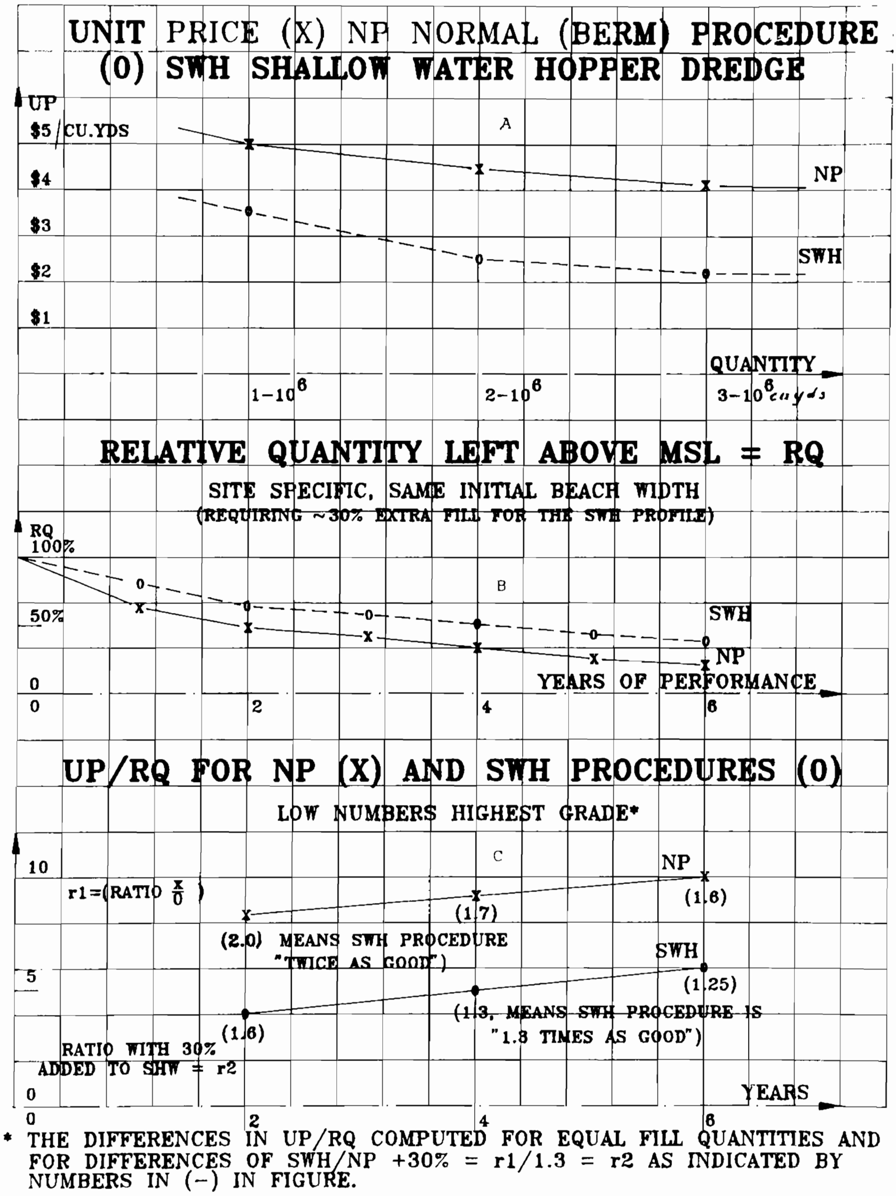

Figure 2. Schematics comparing unit prices (2A), stabilities (2B), and combined unit prices and stabilities (2C) for the two kinds of operations assuming fill quantities from 1 to 3 million yards^3/year.

foreign dredging companies in the United States.* There is, however, now some reason to believe that the American dredging industry is going to respond positively to a demand which can no longer be ignored. *Our budgets will deserve primary interest in the future.*

* Reference is made to the Editorial of Journal of Coastal Research, 9(1), 1993.

CONCLUSION

The costs of backpassing (artificial nourishment) can be reduced at the same time as advantages for beach stabilities can be obtained by the introduction of the shallow water draft hopper dredger combined with new and more practical procedures for the placement of fills on the beach and on the nearshore bottom.

LITERATURE CITED

BRUUN, P. and WILLIKES, G., 1992. Bypassing and backpassing at harbors, navigation channels and tidal entrances: Use of shallow water draft hopper dredgers with pump-out capabilities. *Journal of Coastal Research,* 8(4), 972–977.

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