DREDGED MATERIAL RESEARCH PROGRAM

TECHNICAL REPORT D-77-1

LOW-GROUND-PRESSURE CONSTRUCTION EQUIPMENT FOR USE IN DREDGED MATERIAL CONTAINMENT AREA OPERATION AND MAINTENANCE - EQUIPMENT INVENTORY

by

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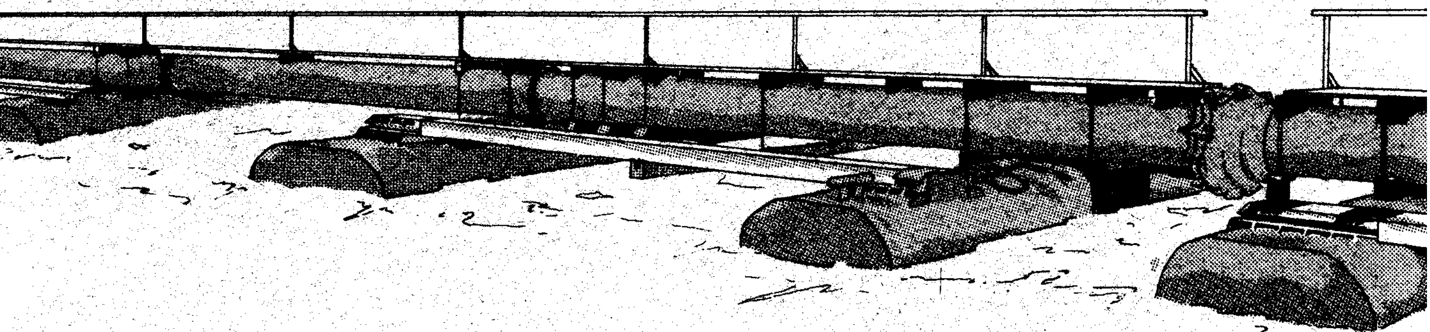

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SUBJECT: Transmittal of Technical Report D-77-1

TO: All Report Recipients

1. The technical report transmitted herewith represents the results of one of the research efforts (work units) initiated to date as part of Task 2C (Containment Area Operations) of the Corps of Engineers Dredged Material Research Program (DMRP). Task 2C is included as part of the Disposal Operations Project (DOP) of the DMRP, which among other considerations includes research into various ways of improving the efficiency and acceptability of facilities for confining dredged material on land.

2. Confining dredged material on land is a relatively recent disposal alternative to which practically no specific design or construction improvement investigations, much less applied research, have been addressed. Being a form of waste product disposal, dredged material placement on land has seldom been evaluated on other than purely economic grounds with an emphasis nearly always on lowest possible cost. There has been a dramatic increase in the last several years in the amount of land disposal necessitated by confining dredged material; hence increased attention is being directed toward improving the design, construction, and management of these containment areas.

3. DMRP work units have investigated or are currently investigating improved facility design, construction, and management for increasing facility storage capacities with both economic and environmental protection benefits. Work in and around containment areas usually requires special equipment because of the soft dredged material and foundation conditions usually associated with such areas. Consequently the total picture would be incomplete without an assessment of vehicles or equipment that can perform productive work in containment areas. To this end, the investigation reported herein was accomplished by the U. S. Army Engineer Waterways Experiment Station's Mobility and Environmental Systems Laboratory. This is the first of three studies that will provide guidance for the selection of equipment for use in and around containment areas.

4. Sixty vehicles were evaluated analytically to determine their capabilities for operating in and around confined dredged material disposal areas. The results discuss the state-of-the-art vehicles that are commercially available or have undergone recent military testing and that can operate in soft soils. The vehicles are divided into six payload classes that indirectly reflect the size of the job that the vehicles or equipment may be expected to perform. Vehicle performance is expressed in terms of "go," "no go," and traction capability on five selected soil strengths to cover the range of soil strengths measured in several dredged material disposal areas. Pertinent data are presented in catalog form for each of the vehicles. Data presented include photographs or drawings, manufacturer, general vehicle data under which performance data can be found, mechanical data that include dimensions or description of major components of the vehicle, and miscellaneous data under which such information as cost (1974) and primary uses are found. The limitations of the method used to compute vehicle performance are also discussed.

5. Caution should be exercised in selecting vehicles for use in borderline situations. The performance of the vehicles was determined analytically and the vehicles have not been field evaluated in dredged material containment areas. A second phase of the vehicle performance study (now underway) is evaluating the performance of various vehicles and identifying in more detail the operational environment and functions under which they must perform. A third report in this series will provide detailed guidance on the selection of equipment to be used in and around confined disposal areas.

JOHN L. CANNON
Colonel, Corps of Engineers
Commander and Director

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REPORT DOCUMENTATION PAGE

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18. SUPPLEMENTARY NOTES

Appendixes A and B were reproduced in microfiche and are enclosed in an envelope in the back cover of this report.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Construction equipment
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Soft soils
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Vehicles

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Sixty vehicles were evaluated to determine their capabilities for operating in and around confined dredged material disposal areas. The results represent the state of the art of vehicles that are commercially available or have undergone recent military testing and that can operate in soft soils. The vehicles were divided into six payload classes that indirectly reflect the size of the job that the vehicle or equipment may be expected to perform. Vehicle performance was expressed in terms of go-no go and (Continued)

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20. ABSTRACT (Continued).

traction capability on five selected soil strengths that cover the range of soil strengths measured in several dredged material disposal containment areas that are believed representative of many operational environments.

The soils data revealed that the operational environment of confined dredged material disposal areas can be highly variable within a given site in terms of type of material, profile strength, presence of surface and subsurface water, and vegetal cover. These factors combine to present a very harsh operational environment for vehicles or equipment.

A comparison of the computed soil strength requirements for the vehicles operating in fine-grained soils with measured soil strength data indicated that commercially available vehicles in the six categories considered can operate in all except the lowest soil strength units established.

It is suggested that before the concept of using low-ground-pressure construction equipment for dredged material containment area operations can be applied with a higher level of confidence, other studies should be conducted to identify specific missions or jobs to be performed. These should identify measures of performance, evaluate current automotive and mobility technology and focus on subject problems by modification and refinement as required, describe the operational environment in engineering terms, validate performance predictions, and develop an analytical framework to account for the pertinent construction equipment-operational environment interactions. This technological base can then be used to prepare sound equipment performance criteria and/or specifications, evaluate testable specifications in quantitative terms, and design new equipment with confidence.

Appendix A presents the methods used for computing soft-soil vehicle performance in some detail, with appropriate examples. Appendix B presents the effects of vehicle buoyancy in soft soil on the determination of the minimum soil strength required for travel. These appendixes were reproduced in microfiche and are enclosed in an envelope in the back cover of this report.

Appendix C presents pertinent vehicle data in catalog form: several photographs or drawings, manufacturer, general vehicle data under which performance data can be found, mechanical data that include dimensions or description of major components of the vehicle, and miscellaneous data under which such information as cost (1974) and primary use is found. The limitations of the methods used to compute vehicle performance are discussed.

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