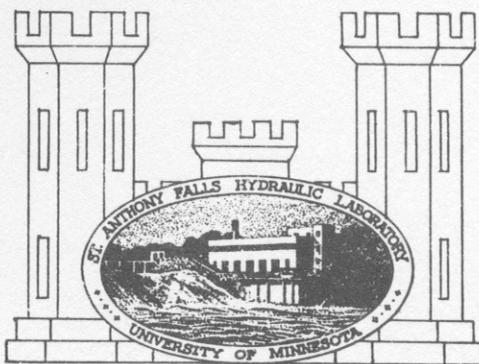


TERMINAL REPORT ON
TRANSPORTATION CHARACTERISTICS
MISSOURI RIVER SEDIMENT

By

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APRIL 1954

UNIVERSITY OF MINNESOTA
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Minneapolis, Minnesota

in cooperation
with

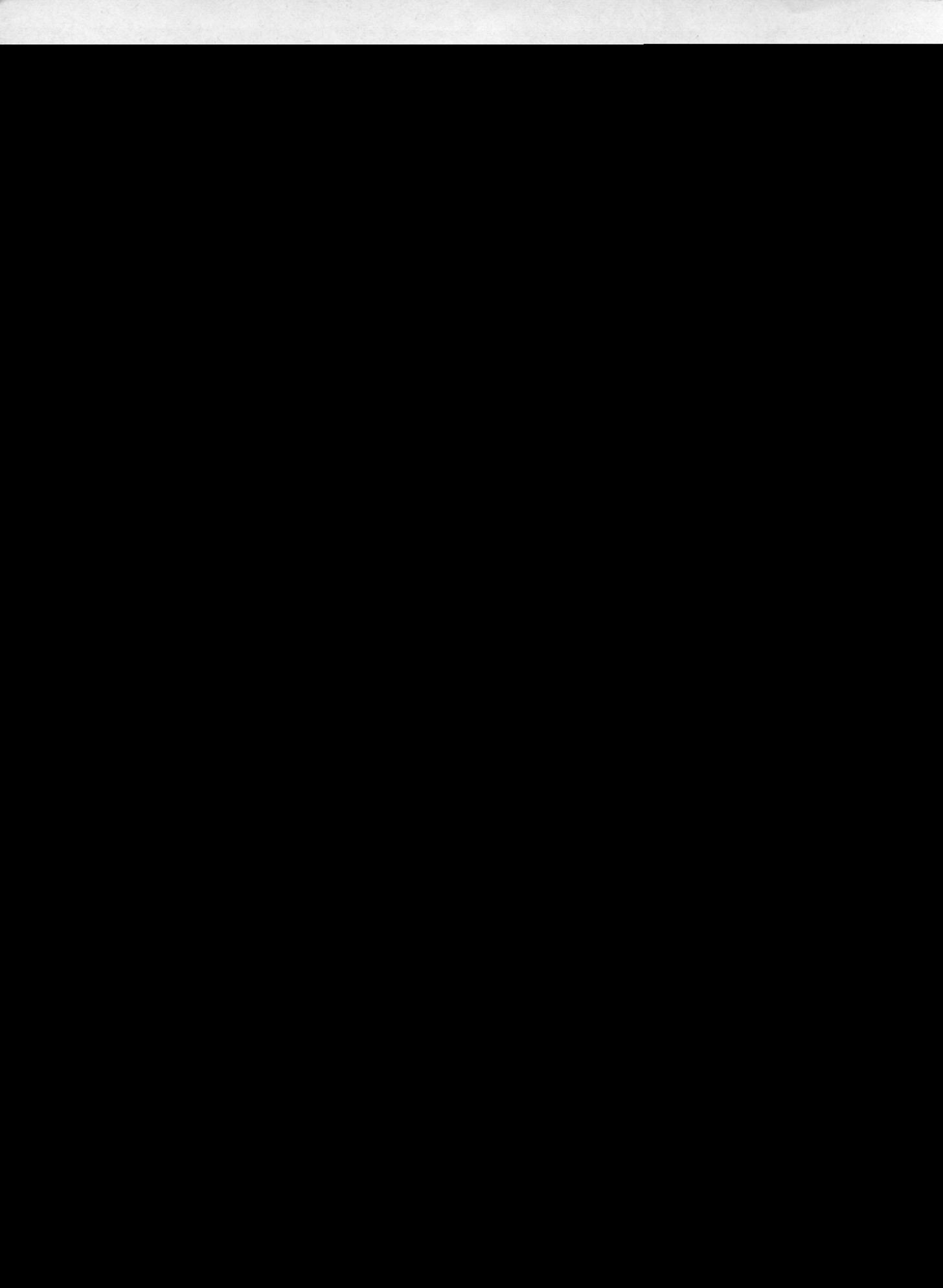
THE MISSOURI RIVER DIVISION
CORPS OF ENGINEERS
U. S. ARMY

Terminal Report on
TRANSPORTATION CHARACTERISTICS
MISSOURI RIVER SEDIMENT

Prepared for
MISSOURI RIVER DIVISION
CORPS OF ENGINEERS, U. S. ARMY
OMAHA, NEBRASKA

Submitted by
Lorenz G. Straub

April 1954
Minneapolis, Minnesota



PREFACE

This report describes the results of studies of transportation characteristics of Missouri River sediment performed under Contract No. DA 25-075-eng-437. Three types of experiments were carried out: (1) Relation of rate of transportation to tractive force; (2) Relation of constant rate of transportation to tractive force for various discharges; and (3) Effect of temperature on the suspended load concentration.

The experiments indicated that the relation between rate of transportation and the tractive force agreed with the analytical equation developed by Straub. It was also demonstrated that within the range of discharges used, the tractive force for a given rate of transportation is independent of discharge when the increased suspended load that results from increases in discharge is taken into account. Supplementary experiments performed in a circulating channel to study the effect of temperature of the water on the concentration of suspended load indicated that the suspended load was approximately doubled when the water temperature was reduced by about 40° F.

The experimental program was carried out at the St. Anthony Falls Hydraulic Laboratory under the supervision of Lorenz G. Straub, Director, with the assistance of E. Roy Tinney through most of the experiments. Clarence W. Carpenter aided in the early experiments on rate of transportation. Alvin G. Anderson assisted in supervising the first of the test series and prepared the part of the report concerning these tests; the report material on the second and third series was prepared by Tinney. Others of the St. Anthony Falls Hydraulic Laboratory staff also contributed to the study.

TRANSPORTATION CHARACTERISTICS OF MISSOURI RIVER SEDIMENT

I. INTRODUCTION

This report describes some experiments performed to determine some of the transportation characteristics of a typical Missouri River sediment. Three types of experiments were performed. The transportation characteristics of this sediment when transported as bed load were studied to establish the relationship of the rate of transportation to the hydraulic characteristics of the flow, particularly as regards the so-called tractive force or boundary shear -- the force available to transport the sediment. A second set of experiments was performed in a wider channel in which the discharge was varied for a constant rate of transportation to establish the constancy of the tractive force for a given rate of transportation. In some of these experiments the suspended load was measured in order to study the relation of suspended load to bed load, and for various depths of flow. A third type of experiment involved the effect of temperature on the concentration of suspended load and the measurement of the suspended load in a recirculating channel. The results and analysis of these three sets of experiments are described separately in the following sections.

The sediment used in these experiments was obtained from the Missouri River in the vicinity of Garrison Dam by personnel of the Garrison District of the Corps of Engineers. The size distribution curve indicating the percentage by weight of the various grain sizes is given in Figure 1. The mean or 50 per cent size is approximately 0.18 mm.