

8618167

Bradley, Jeffrey Brent

HYDRAULICS AND BED MATERIAL TRANSPORT AT HIGH FINE
SUSPENDED SEDIMENT CONCENTRATIONS

Colorado State University

PH.D. 1986

University
Microfilms
International 300 N. Zeeb Road, Ann Arbor, MI 48106



TABLE OF CONTENTS

<u>Chapter</u>	<u>Page</u>
LIST OF TABLES	viii
LIST OF FIGURES	ix
LIST OF SYMBOLS	xi
 I	
INTRODUCTION	1
1.1 Problem Statement	1
1.2 Study Description	3
1.3 Limitations	4
 II	
REVIEW OF LITERATURE AND THEORETICAL DEVELOPMENT	6
2.1 Description and Classification of High Concentration Flow	6
2.2 Fluid Mechanics at High Concentrations	13
2.3 Fluid Properties and Rheology of High Concentration Flows	18
2.4 Velocity and Concentration Distributions	24
2.5 Channel Resistance at High Concentrations	31
2.6 Sediment Transport	35
 III	
EXPERIMENTAL DATA COLLECTION AND OBSERVED FLOW PHENOMENA	39
3.1 Flume Study	39
3.1.1 Equipment	40
3.1.2 Bed Material and Fine Sediment	40
3.1.3 General Procedure	43
3.1.4 Basic Data	44
3.2 Observed Flow Phenomena	59
3.3 Effect of Fine Sediment on Fall Velocity (Visual Accumulation Tube Tests)	65
3.4 Prototype Data	67
 IV	
ANALYSIS OF DATA AND DISCUSSION OF RESULTS	69
4.1 General	69
4.2 Fluid Properties	69
4.3 Classification of High Concentration Flows	74
4.4 Resistance to Flow	75
4.4.1 Laminar and Turbulent Resistance to Flow and the Laminar-Turbulent Transition	76
4.4.1.1 Laminar-turbulent transition	79
4.4.2 Form Resistance	81
4.5 Velocity Profile	90
4.5.1 Laminar Velocity Profiles	93
4.5.2 Turbulent Velocity Profiles	98

<u>Chapter</u>	<u>Page</u>
4.6 Concentration Profiles	101
4.6.1 von Kármán's Constant	109
4.7 Sediment Transport Equations	117
V SUMMARY, CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE STUDY	122
5.1 Summary	122
5.2 Conclusions	124
5.2.1 Fluid Properties	124
5.2.2 Classification	125
5.2.3 Laminar-Turbulent Transition	125
5.2.4 Velocity Profiles	126
5.2.5 Flow Resistance	126
5.2.6 Concentration Profiles	127
5.2.7 von Kármán's Constant	128
5.2.8 Sediment Transport Equations	129
5.3 Recommendations for Future Study	130
5.3.1 Viscosity and Fall Velocity	130
5.3.2 Laminar-Turbulent Transition	130
5.3.3 Bed Form Prediction	130
5.3.4 Concentration Distributions	131
5.3.5 Sediment Transport Equations	131
5.3.6 Nonuniform and Unsteady Flows	131
5.3.7 Flow Routing	133
BIBLIOGRAPHY	134