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## Hydrometry — Methods of measurement of bedload discharge

*Hydrométrie — Méthodes de mesurage du débit des matériaux  
charriés sur le fond*





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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: [Foreword - Supplementary information](#).

The committee responsible for this document is ISO/TC 113, *Hydrometry*, Subcommittee SC 6, *Sediment transport*.

This third edition cancels and replaces the second edition (ISO/TR 9212:2006), which has been technically revised.

## Introduction

The knowledge of the rate of sediment transport in a stream is essential in the solution of practically all problems associated with the flow in alluvial channels. The problems include river management, such as design and operation of flood control works, navigation channels and harbours, irrigation reservoirs and canals, and hydroelectric installations. The bedload and suspended load broadly constitute total sediment load. The bedload is the material transported on or near the bed by rolling or sliding (contact load) and the material bouncing along the bed, or moving directly or indirectly by the impact of bouncing particles (saltation load). Knowledge of the bedload-transport rate is necessary in designing reservoir capacity because virtually 100 % of all bedload entering a reservoir accumulates there. Bedload should not enter canals and distributaries and diversion structures should be designed to minimize the transfer of bedload from rivers to canals.

The bedload-transport rate can be measured either as mass per unit time or volume per unit time. Volume measurements should be converted to a mass rate. Measurements of mass rate of movement are made during short time periods (seconds, minutes), whereas measurements of volume rates of movement are measured over longer periods of time (hours, days). Regardless of whether the mass or volume rate is measured, the average particle-size distribution of moving material should be determined. Knowledge of particle-size distribution is needed to estimate the volume that the bedload material will occupy after it has been deposited. Knowledge of particle-size distribution also assists in the estimation of bedload-transport rates in other rivers transporting sediment.

The movement of bedload material is seldom uniform across the bed of a river. Depending upon the river, hydraulic, and sediment properties (size and gradation), the bedload may move in various forms, such as ripples, dunes, or narrow ribbons. Its downstream rate of movement is also extremely variable. It is difficult to actually sample the rate of movement in a river cross-section or to determine and verify theoretical methods of estimation.



# Hydrometry — Methods of measurement of bedload discharge

## 1 Scope

This Technical Report reviews the current status of direct and indirect bedload-measurement techniques. The methods are mainly based on grain size distribution of the bedload, channel width, depth, and velocity of flow. This Technical Report outlines and explains several methods for direct and indirect measurement of bedload in streams, including various types of sampling devices.

The purposes of measuring bedload-transport rates are to

- a) increase the accuracy of estimating total sediment load in rivers and deposition in reservoirs,
- b) gain knowledge of bedload transport that cannot be completely measured by conventional suspended-sediment collection methods,
- c) provide data to calibrate or verify theoretical transport models, and
- d) provide information needed in the design of river diversion and entrainment structures.

NOTE The units of measurement used in this Technical Report are SI units.

## 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 772, *Hydrometry — Vocabulary and symbols*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 772 apply.

## 4 Measurement of bedload

### 4.1 General

Bedload can be measured by direct measuring bedload samplers or by indirect methods.

### 4.2 Direct measurement methods

- a) Bedload samplers

In this method, a mechanical device or sampler is required for measuring the bedload-transport rate. The bedload sampler is designed so that it can be placed directly on the channel bed in the flow, to collect a sample of the bedload over a specific time interval. A sample thus obtained represents a time-averaged mass per unit width per unit time.