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# GUIDELINES FOR DATA REQUIRED FOR DESIGN OF TEMPORARY RIVER DIVERSION WORKS

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# GUIDELINES FOR DATA REQUIRED FOR DESIGN OF TEMPORARY RIVER DIVERSION WORKS

## 0. FOREWORD

**0.1** This Indian Standard was adopted by the Indian Standards Institution on 29 February 1980, after the draft finalized by the Diversion Work Sectional Committee had been approved by the Civil Engineering Division Council.

**0.2** Prior to the commencement of actual construction of any work in the bed of a natural river, it becomes obligatory in most cases, to exclude temporarily the river flow from the proposed work area during the construction period, so as to permit the work to be done in the dry areas. An efficient scheme of diverting the river flow away from the work area should be capable of limiting the seepage into the work area to a minimum so that the work area can be kept dry with minimum pumping capacity. The diversion of river flow, though of a preliminary and temporary nature, more than often presents difficult and complex problems and becomes a major construction work in itself.

**0.3** A temporary river diversion scheme essentially consists of:

a) coffer dam(s) built across a part or full width of the river to divert the flowing water away from the work area; and

b) works to transfer the diverted water from upstream to the downstream of the work area without affecting the same, such as:

1) Diversion through ( construction ) sluices in the main work,

2) Diversion by one or more tunnels along the side of the main work area,

3) Diversion through low level blocks of the main structure left for the purpose or through channels excavated outside the main structure, and

4) Secluding part of the whole work area for construction and allowing the river to flow through the remaining work area.

**0.4** In case of the temporary diversion works, economy considerations weigh more heavily and the importance of collecting minimum basic field data after requisite investigation of local conditions, therefore, cannot be over-emphasized. The data collected for the permanent structure may be used for the design of temporary diversion works.

**0.5** For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS:2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

## 1. SCOPE

**1.1** This standard covers the investigations and observations in respect of collection of basic data prior to the commencement of planning and design of works for temporary river diversion, after preliminary selection of site of diversion works has been made.

## 2. DATA REQUIRED

**2.0** The following data are required to enable planning and design of works for temporary river diversion:

### 2.1 Topographical Survey

**2.1.1** An index map on a suitable scale shall be prepared showing the main work proposed to be taken up, the entire scheme of river diversion and other important works affected by the proposed scheme, road, railway, habitation, cultivated land, other public utilities and places of religious and antique interest.

**2.1.2** A contour plan of the area around the proposed site of the main work extending well beyond the proposed sites of the river diversion works shall be prepared with contour intervals of 0·5 to 1·0 m (depending upon the magnitude of the work) up to an elevation of at least 2·5 m above the design flood level for the diversion structure. The survey should be plotted to a suitable scale and should show all the salient features like firm banks, rock outcrops, deep channels, large shoals and islands, deep pools, important land marks, etc.

**2.1.3** Cross-sections of the river shall be observed at intervals of up to 200 m (the spacing may be at closer intervals, if site conditions so require) covering the entire area of the works of the diversion scheme and extended up to at least 600 m beyond on either side. The cross-sections should be extended on both banks up to about 2·5 m above the design flood level. All the cross-sections should indicate the highest observed flood level at the site.

*Rules for rounding off numerical values (*revised*).

**2.1.4** Longitudinal section of the river with water levels along the deep current shall be surveyed for a distance 1 km upstream and 600 m downstream beyond the area covered by the entire scheme of diversion works.

**2.1.5** Erosion characteristics of the river should be observed and marked on the plan and cross-sections.

**2.2 Hydrological Data**

a) Daily rainfall recorded at different rainfall gauging stations in and around the catchment area and data regarding storms in respect of successive positions of the centre of the storm on the catchment shall be collected for as many years as possible. The storms causing peak discharges should be separated for unit hydrograph analysis. Pattern of rainfall in the area in previous years with durations of dry and wet spells in general should also be studied to help in forming an idea as to the periods available for construction without interruption as well as with short duration interruption;

b) Flood hydrographs for isolated rain storms shall be observed for working out unit hydrograph;

c) Peak flow data separately for monsoon and non-monsoon periods shall be collected for the river for as many years as possible for frequency analysis;

d) Information regarding high flood level shall be collected from flood marks and local enquiry at site of works, so as to estimate the maximum flood by slope area method in accordance with IS:2912-1964*; and

e) Data for gauge discharge relationship ( *see* IS:2914-1964† ) shall be collected from suitable sites, at least one from upstream and one from downstream of the permanent work.

**2.3 Sediment and Boulder Studies** — The data regarding quality and quantity of bed and suspended sediment and boulders carried by the river, specially during the flood season, should be collected. For measurement of suspended sediment, IS:4890-1968‡ may be referred.

**2.4 Timber Survey**

**2.4.1** A detailed survey shall be carried out to collect information about the size and quantities of timber sleepers and wooden logs floating down

*Recommendation for liquid flow measurement in open channels by slope-area method ( approximate method ).

†Recommendations for estimation of discharges by establishing stage-discharge relation in open channels.

‡Methods for measurement of suspended sediment in open channels.

the river in various months of the year at the site of work. The data shall be used for studying proposals for passing wooden sleepers and logs through/over diversion works or for planning timber collection and extraction devices from the river upstream of the diversion works.

## 2.5 Surface and Subsurface Investigations

**2.5.1** Subsurface investigation should be carried out in accordance with IS:6955-1973*. Bore-holes should be driven at specified intervals and bore legs be prepared in accordance with IS:4464-1967†, covering the entire area of the diversion scheme. The location of borings shall be correctly marked and numbered on the survey sheets. These borings should be carried to hard rock level or to a depth 15 to 25 m below the deepest river bed level depending upon the strata and the component structure of the diversion scheme (coffer-dam, conduit or an open diversion channel). Trial pits may be excavated to determine the nature and characteristics of overburden and loose deposits. In case of diversion through tunnels, drill holes should preferably penetrate the tunnel alignment. Drifts of size 1·8 m × 1·5 m minimum should be driven at suitable locations to determine the properties along diversion tunnel alignment.

**2.5.2** Where the nature of rocks warrants and the diversion tunnels are to be used as permanent structures, it is desirable to conduct one or all of the following tests:

a) Plate-bearing tests (both horizontal and vertical) (*see* IS:1888-1971‡);

b) Flat jack test in 3 directions (*see* IS:7292-1974§);

c) Rock shear tests at site are also necessary which may be carried out in open foundation. These tests will be useful in finding shear characteristics of rocks necessary to design structures on rock and also in design of tunnels (*see* IS:7746-1975||); and

d) Uniaxial jacking tests (*see* IS:7317-1974¶).

**2.5.3** The following further investigations should be done in case of alluvial reaches of the river:

a) For sandy foundations of works for river diversion, dynamic and static penetration tests should be performed to estimate bearing

*Code of practice for subsurface exploration for earth and rockfill dams.

†Code of practice for presentation of drilling information and core description in foundation investigation.

‡Method of load tests on soils (*first revision*).

§Code of practice for *in situ* determination of rock properties by flat jack.

||Code of practice for *in situ* shear test on rock.

¶Code of practice for uniaxial jacking test for deformation modulus of rock.

pressures, likely settlements, etc (*see* IS:2131-1963* and IS:5249-1977† ). A few bore-holes may also be drilled to find out the strata of the foundation;

b) In case of clayey and silty foundations, undisturbed sampling should be done and tests conducted for determination of unconfined compressive strength and consolidation characteristics; and

c) Soil classification (*see* IS:1498-1970‡ ), unit weight of soil [*see* IS:2720 (Part XIV)-1968§ ] angle of internal friction of soil [*see* IS:2720 (Part XXX)-1968|| ] void ratio [*see* IS:2720 (Part XIV)-1968§ ] and specific gravity [*see* IS:2720 (Part III)-1964¶ ] should be determined.

**2.5.4** Bore holes should be drilled for a minimum depth of 2 m into fresh rock in the foundations (for rock foundations at shallow depth ) to ascertain the depth to weathered zones, extent of joints and fissures and to determine the necessity or otherwise of grouting to minimize seepage into the main work area.

**2.5.5** Field permeability tests should be carried out to estimate the amount of seepage through the diversion works required to be pumped out from main working pit.

**2.5.6** Observations of water table in the region adjacent to the diversion scheme area should be carried out.

## 2.6 Construction Materials

**2.6.1** Survey of availability of construction materials in the near vicinity with leeds and lifts is necessary to decide upon the type of works to be adopted for temporary river diversion. Laboratory and field tests should be carried out to determine the engineering properties of the construction materials including their permeability values.

## 2.7 Other Miscellaneous Studies

**2.7.1** *Type of Construction of Main Work* — This should be decided before hand to help in realistic planning of the scheme of temporary river diversion. When the river diversion works include passing of floods over the partly built main structure, suitable measures should be adopted in the design of permanent structure consistent with the construction programme to allow the flow over the structure without causing damage.

*Method for standard penetration test for soils.

†Method of test for the determination of dynamic properties of soil (*first revision*).

‡Classification and identification of soils for general engineering purposes (*first revision*).

§Methods of test for soils: Part XIV Determination of density index (relative density) of cohesionless soils.

||Methods of test for soils: Part XXX Laboratory vane shear test.

¶Methods of test for soils: Part III Determination of specific gravity.

**2.7.2** *Period and Scheme of Construction* — If the period of construction of the main work is to extend over more than one working season, the total period and the scheme of construction should be studied to enable deciding the magnitude of maximum discharge required to be handled for diversion as also the duration for which this discharge is to be handled.

**2.7.3** In the case of major diversion work, hydraulic model tests should be done for finalizing the design.