भारतीय मानक

बाँधों में दीर्घा और अन्य खुलावों की रीति संहिता

भाग 1 सामान्य अपेक्षाएँ

Indian Standard

CODE OF PRACTICE FOR GALLERIES AND OTHER OPENINGS IN DAMS

PART 1 GENERAL REQUIREMENTS

UDC 627·824·7

© BIS 1992

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

April 1992

Price Group 2

FOREWORD

This standard (Part 1) was adopted by the Bureau of Indian Standards, after the draft finalized by Dams (Overflow and Non-overflow) Sectional Committee had been approved by the River Valley Division Council.

A large number of galleries and other openings are provided in all gravity dams for different purposes.

Other openings include all types of sluices, penstock openings, shafts, adits and chambers, stair/lift wells, drainage holes, air vents, conduits, formed drains, porous concrete drains, etc.

The structural design of such galleries and other opening provided in gravity dams is covered in IS 12966 (Part 2) : 1990 'Code of practice for galleries and other openings in dams : Part 2 Structural design'.

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 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

CODE OF PRACTICE FOR GALLERIES AND OTHER OPENINGS IN DAMS

PART 1 GENERAL REQUIREMENTS

1 SCOPE

1.1 This standard (Part 1) covers the general requirements for which galleries and other openings are provided in gravity dams.

2 REFERENCES

2.1 The following Indian Standards are necessary adjuncts to this standard:

IS No.	*Title*
10135 : 1985	Code of practice for drainage system for gravity dams, their foundations and abutments (*first revision*)
11485 : 1985	Criteria for hydraulic design of sluices in concrete and masonry dams

3 TERMINOLOGY

3.0 For the purpose of this standard the following definitions shall apply.

3.1 Gallery

The gallery is an opening within dam which provides access into or through the dam.

3.2 Adit

A horizontal gallery connecting the gallery system in the dam with downstream face or features outside the dam such as power house or gate house. Also called 'Access Gallery' or 'Entrance Gallery'.

3.3 Chamber

When a gallery is enlarged to permit installation of equipment, it is called a chamber, e.g. hoist chamber, gate chamber, etc.

3.4 Foundation Gallery

It is a gallery which generally extends over the length of the dam near the rock profile conforming in elevation to the transverse profile of the canyon; in plan, it is near and parallel to the axis of the dam. From this gallery, holes are drilled and grouted for the main grout curtain and drainage holes are drilled for draining water seeping through the foundation in order to provide relief in uplift pressures.

3.5 Drainage Gallery

This is a supplementary gallery sometimes provided downstream at about 2/3rd the base width from the upstream face for the purpose of draining the downstream portion of the foundation.

3.6 Gate Gallery

Gallery, made in a dam to provide access to and room for, the mechanical and electrical equipment required for the operation of gates in outlet conduits, penstocks, etc.

3.7 Inspection Gallery

Gallery made in a dam to provide access to the interior mass of the dam in order to inspect the structure and study the structural behaviour of the dam after completion. Foundation, drainage gate and grouting galleries also serve as inspection galleries.

4 PURPOSE

4.1 The need for galleries varies from dam to dam. Some of the common purpose for which galleries are provided are as follows:

a) To provide drainage way for water seeping through the upstream face of the dam and from the foundations;

b) To provide space for drilling holes and grouting the foundation in order to provide a grout curtain;

c) To provide access to the interior of the dam for observing its behaviour after completion;

d) To provide access to chambers like hoist chamber, pump chamber, pump well, instrument niches, etc;

e) Visitors gallery to provide access routes for visitors.

4.2 In addition to galleries other openings are also provided in dams for different purposes.

5 LOCATION AND SIZE OF COMMON GALLERIES AND OPENINGS

5.1 Foundation Gallery

This gallery should be provided in the body of the dam where height of the dam above normal foundation level is more than 10 m (measured

up to to crest level in case of overflow portion of the dam). For lesser heads, its necessity should be left to the discretion of the designer. The purpose of this gallery is defined in **3.4, 4.1**(a) & **4.1**(b). The minimum size of gallery should be 1·5 m × 2·25 m, however a larger size of 2·0 m × 2·5 m can be provided to accommodate drilling equipment. The general details of this gallery are given in IS 10135 : 1985. It should be located at a distance of 3·0 metres or 5 percent of the reservoir head (measured from FRL to the foundation level) from the upstream face of the dam, whichever is greater and consistent with any other requirement. There should be minimum 1·5 metre concrete cover between the floor of the gallery and the foundation grade. Sometimes, depending upon the foundation grade profile and other considerations like the height of the dam from foundation grade up to the spillway crest in respect of overflow section, gallery disposition in other blocks, etc, a foundation gallery may have to be located in a trench (*see* Fig. 1). A minimum concrete cover of about 2·0 metres is generally provided in the trench.

5.1.1 *Downstream Drainage Gallery*

In high dams (greater than 100 m), a supplementary drainage gallery is sometimes provided at about 2/3rd the base width from the upstream face for draining the downstream portion of the foundation, if the tail water levels are high. The size of this gallery should, usually be 2·0 m × 2·5 m.

5.2 Inspection Galleries at Higher Levels Above Foundation Gallery

An inspection gallery should be provided above the foundation gallery so as to be about 7·0 metres below the spillway crest consistent with structural consideration in case of overflow sections having a height of about 25 metres or more measured from the spillway crest to the foundation grade so as to facilitate cleaning/reaming of the formed/porous concrete drains in the body of the dam (*see* Fig. 2). Generally intermediate inspection galleries should be provided at every 30 metres intervals (ref Fig. 3). The size of these galleries should generally be 1·5 m × 2·25 m (rectangular).

5.3 Gate Galleries and Chambers

Their size should depend upon the size of the gates, etc. However IS 11485 ; 1985 may also be referred to for their sizing.

5.4 Instrumentation Gallery

The number and location of such galleries should depend upon the extent of instrumentation provided in a dam. These galleries should generally be aligned perpendicular to the dam axis in plan. The size is generally 1·50m × 2·25m (rectangular) with minor modification necessary for instruments like plumb-line, etc.

5.5 Sump Well

They should be provided in the deepest location. Their number and size should depend upon the quantity of water seeping through the foundations and body of the dam. The seepage water collected in upstream inspection galleries provided at higher levels should, as far as possible be drained-off towards the downstream side by gravity through adits/any other suitable arrangements. Sump well may also be located outside the dam. In this case, sump pit provision and a cast iron pipe of 600 mm diameter will have to be provided from sump pit to sump well. A pump house may be housed above the sump well. This is convenient to avoid flooding of water in the gallery in case pumps get failed due to power failure or some other cause.

5.6 Pump Chamber

Pumps of suitable capacity should be provided to pump-off the water collected in the sump well. As far as possible, the pumps should be located in a chamber adjacent to an inspection gallery above the foundation gallery so that in the contingency of the foundation gallery getting flooded, the pump-chamber remains approachable (*see* Fig. 2).

5.7 Elevator Tower and Shaft

Elevator towers should generally be provided at the end of spillway portion in the NOF blocks to provide access to the galleries from top of the dam. Generally, only a lift well should be provided for which a size of 3 m × 3 m should normally suffice. Sometimes, a stair-well may

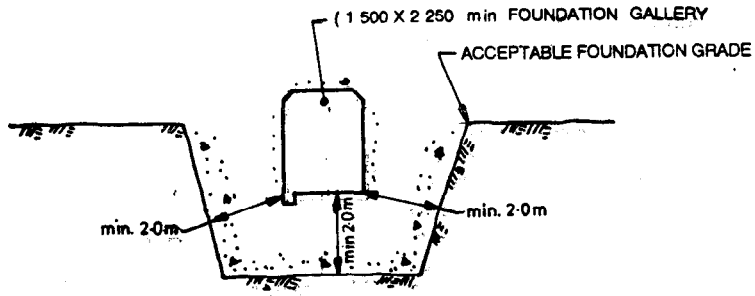

FIG. 1 FOUNDATION GALLERY IN TRENCH

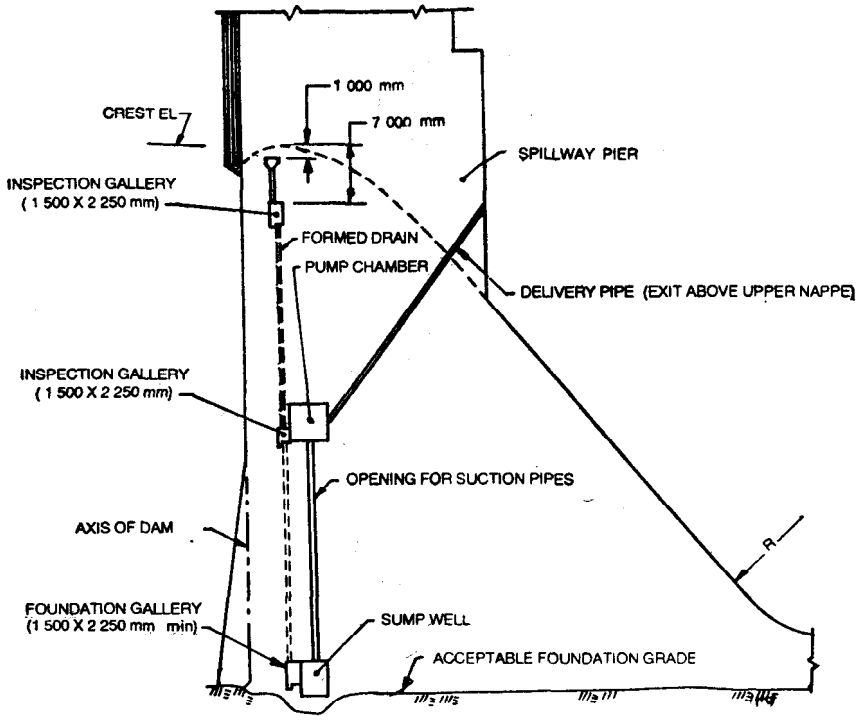

FIG. 2 LOCATION OF FOUNDATION AND INSPECTION GALLERIES IN OVER FLOW SECTION

also be provided either separately or around the lift well, if considered necessary. The size of elevator tower should accordingly be modified to include a stair-case.

5.8 Ventilation Shaft/Pipes

Generally, 300 mm diameter ventilation pipes/ holes should be provided in every alternate dam blocks from the galleries for ventilation. However, where adits are not provided, ventilation shafts (about 1 m diameter) may be provided, one each near either end of the gallery to maintain a draft of air. However in case of lengthy dams, intermediate ventilation shafts may also be provided.

5.9 Formed Drain

These drains should be located as per IS 10135 : 1985. They are spaced at approximately 3 m centres along the axis of the dam. The size of the drains is about 200 mm diameter. The lower ends of the drains extend to the gallery, or are connected to the downstream face near the fillet through a horizontal drain pipe or header system if there are no galleries. The tops of the drains (in OF section) are located about 1 m below the crest level. In NOF section, the tops are located at road level (*see* Fig. 2 and 3).

6 MISCELLANEOUS DETAILS ABOUT GALLERIES

6.1 General

Depending upon the rock profile and other conditions, a gallery can be either horizontal or on a slope. In the later case, steps with tread 250 mm and riser 200 mm may be provided. Generally, 25 steps should be provided in one flight. Hand railing along stairs should also be provided. It should normally be ensured that the steps do not cross the contraction joints between the two adjacent dam monoliths. Generally minimum horizontal length of about 1·0-1·5 metres should be kept in the gallery adjacent to the contraction joints before it is stepped.

6.2 All galleries should have gutters to carry away seepage water which gets collected into the gallery. On horizontal runs, the depth of the gutter may vary from 225 mm to 375 mm to provide a drainage slope. A slope not flatter than 1 in 1000 should be provided for drainage.

6.3 Ramps can also be provided up to 10° angles with the horizontal. However, for slopes more than 10° and up to 15° special non-slip surfaces should be necessary. Hand rails should also be provided on ramps.

6.4 In case of very steep abutments where it is not possible to follow the canyon shape by the sloping galleries (with steps) vertical shafts of about 2·0-2·5 m diameter with spiral staircase (metallic) may be provided to connect galleries at two levels.

6.5 Adits to galleries should be provided for approaching them from downstream side of the NOF dam at suitable elevation above the tail water level.

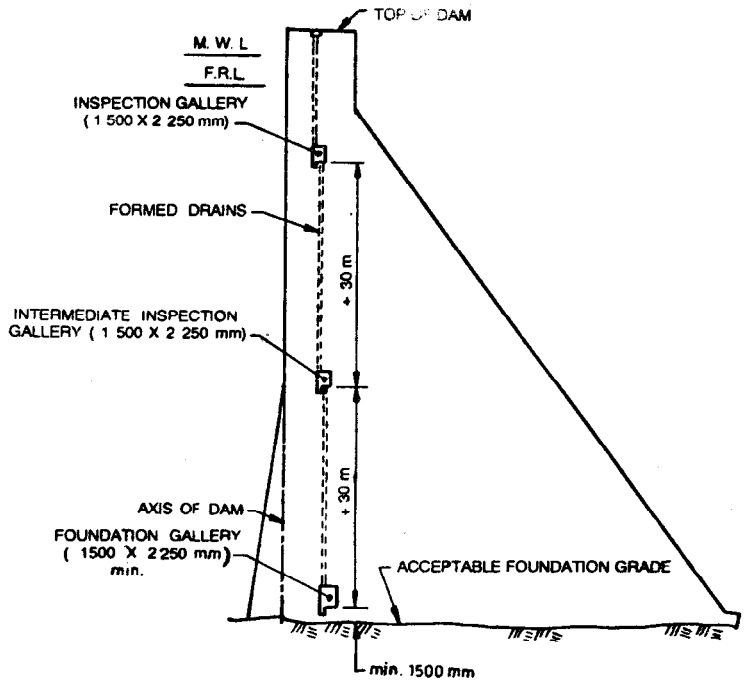

FIG. 3 LOCATION OF INTERMEDIATE INSPECTION GALLERY IN NON-OVERFLOW SECTION

6.6 Other requirements like shock proof, lighting throughout galleries and adit, grilled door near adit entrance to prevent nuisance of birds like bats, fool-proof surface drainage near adit entrance to prevent accidental rusting of rain water by landslide, chocking of catch water drains, etc, and marking R.D. figures on the wall of the galleries to be attended to.

6.7 Where separate instrumentation galleries are not provided in the dams of low height, provision may be made for accelograph inverted plump bobs, etc, by leaving suitable space (say 5 m) in the foundation gallery itself.

Standard Mark

The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act, 1986* and the Rules and Regulations made thereunder. The Standard Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well defined system of inspection, testing and quality control which is devised and supervised by BIS and operated by the producer. Standard marked products are also continuously checked by BIS for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act, 1986* to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Director (Publications), BIS.

Revision of Indian Standards

Indian Standards are reviewed periodically and revised, when necessary and amendments, if any, are issued from time to time. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition. Comments on this Indian Standard may be sent to BIS giving the following reference :

Doc : No. RVD 9 (4340)

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters :

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones : 331 01 31, 331 13 75

Telegrams : Manaksanstha
(Common to all Offices)

Regional Offices :	Telephone
Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg NEW DELHI 110002	331 01 31 331 13 75
Eastern : 1/14 C.I.T. Scheme VII M, V.I.P. Road, Maniktola CALCUTTA 700054	37 86 62
Northern : SCO 445-446, Sector 35-C, CHANDIGARH 160036	53 38 43
Southern : C.I.T. Campus, IV Cross Road, MADRAS 600113	235 0216
Western : Manakalaya, E9 MIDC, Marol, Andheri (East) BOMBAY 400093	6 32 92 95

Branches : AHMADABAD. BANGALORE. BHOPAL. BHUBANESHWAR. COIMBATORE. FARIDABAD. GHAZIABAD. GUWAHATI. HYDERABAD. JAIPUR. KANPUR. LUCKNOW. PATNA. THIRUVANANTHAPURAM.

Printed at Swatantra Bharat Press, Delhi, India