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# GLOSSARY OF TERMS RELATING TO RIVER VALLEY PROJECTS

## PART XV CANAL STRUCTURES

### Section 1 General Terms

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BUREAU OF INDIAN STANDARDS
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# *Indian Standard*

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## PART XV CANAL STRUCTURES

## Section 1 General Terms

Terminology Relating to River Valley Projects
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# GLOSSARY OF TERMS RELATING TO RIVER VALLEY PROJECTS

## PART XV CANAL STRUCTURES

### Section 1 General Terms

## 0. FOREWORD

**0.1** This Indian Standard (Part XV/Sec 1) was adopted by the Indian Standards Institution on 13 April 1973, after the draft finalized by the terminology relating to River Valley Projects Sectional Committee had been approved by the Civil Engineering Division Council.

**0.2** A number of Indian Standards has already been printed covering various aspects of river valley projects and a large number of standards is in the process of formulation. These standards include technical terms, the precise definitions of which are required to avoid ambiguity in their interpretation. To achieve this end, the Institution is bringing out 'IS:4410 Indian Standard glossary of terms relating to river valley projects' which is being published in part.
standard so far published

**0.3** Part XV covers the important field of canal structures and in view of the vastness of this subject, it is proposed to cover it in different sections. Other sections in the series will be the following:

| | |
|---|---|
| Section 2 | Transitions |
| Section 3 | Flumes |
| Section 4 | Regulating works |
| Section 5 | Cross drainage works |
| Section 6 | Other structures |

**0.4** In the formulation of this standard due weightage has been given to international co-ordination among the standards and practices prevailing in different countries in addition to relating it to the practices in the field in this country. This has been met by deriving assistance from the following publications:

UNITED NATIONS. ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST. Glossary of hydrologic terms used in Asia and the Far East. 1956. Bangkok.

INDIA. INTERNATIONAL COMMISSION ON IRRIGATION AND DRAINAGE. Multilingual technical dictionary on irrigation and drainage. 1967.

INDIA. CENTRAL BOARD OF IRRIGATION AND POWER. Glossary of irrigation and hydro-electric terms and standard notations used in India. 1954. Manager of Publications, Delhi.

Nomenclature for hydraulics. 1962. American Society of Civil Engineers. New York.

**0.4.1** All the definitions taken from 'Multilingual technical dictionary on irrigation and drainage' are marked with an asterisk (*) in the standard.

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## 1. SCOPE

**1.1** This standard (Part XV/Sec 1) covers the definitions of general terms relating to canal structures.

## 2. GENERAL TERMS

**2.1 Access Structure** — Structures which provide communication across irrigation canals or drains and means of access to all parts of the distribution system.

**2.2 Air Entrainment*** — The phenomenon of entraining appreciable percentage of air by the sheet of flow passing with high velocities over chutes or spillways.

**2.3 Bottle-Neck*** — A contracted section of a canal or structure or constricted section of a closed conduit with a minimum flow section which is always less than the normal cross-section.

**2.4 Bowing of Bed** — A small concave curvature in the bed of a canal section (*see* Fig. 1).


FIG. 1 BOWING OF BED

**2.5 Bowing of Flow** — A phenomenon of unstable and non-uniform water surface in the cross-section of a channel, having a flat and non-erodible bed, due to unstable streamlines set up by some change in flow (such as a transition). The water surface has tendency to swing from one side to another due to which it is, sometimes, referred to as 'swinging of flow'

**2.6 Bowing of Jump** — A phenomenon of formation of curved water surface of the hydraulic jump in transverse direction due to variation in flow intensity on a flat bed.

**2.7 Branch Staunch*** — A wall off-shooting from a staunching wall, usually at right angles to it.

**2.8 Bulking of Flow** — Swelling of flow due to air entrainment resulting in increase in downstream water depth in chute at the entrance to the stilling pool.

**2.9 Celerity*** — Velocity of propagation of gravity waves or surges over the water surface in an open channel.

**2.10 Cistern** — A pool of water maintained to take the impact of water overflowing a dam, chute, drop, or other spillway structures. A cistern provided to maintain water seal at the end of lower leg of a siphon is also referred to as water cistern.

**2.11 Coefficient of Contraction*** — Ratio between the decreased length, area of section, or volume and the original length, area of section, or volume.

**2.12 Coefficient of Discharge** — A coefficient by which the theoretical discharge of water through orifices, weirs or other hydraulic structures, must be multiplied to obtain the actual discharge.

**2.13 Communication Structure** — *See* **2.1**.

**2.14 Constriction** — A short length of a closed conduit/open channel with a flow section less than the cross-section of the main conduit/open channel, in the form of a partition or diaphragm or a throat, with the cross-section varying along the conduit/open channel axis.

**2.15 Constriction Rate-of-Flow Meter*** — A constriction fitted with an instrument indicating the instantaneous rate of flow.

**2.16 Constriction Water Meter*** — A constriction connected with an instrument which integrates the volume of water flowing through the constriction.

**2.17 Contraction*** — The extent to which the cross-section area of a jet, nappe or stream is decreased after passing an orifice, weir or notch.

**2.18 Conveyance Structure*** — Structures built in a canal system to help provide general control and conveyance of water to a location of final control, usage, or disposal.

**2.19 Crest** — The line or area of the spillway, weir or other regulation structures in a canal system to which water shall rise before passing over the structure.

**2.20 Crest Length** — In case of weirs, spillways, overflow dams across rivers and side spillways in rivers and canals, it is the linear measurement of the crest at right angles to the direction of flow. In case of other irrigation and drainage structures, it is the linear measurement of the crest in the direction of flow over the crest. In case of flumed structure, it is equivalent to throat length (*see also* **2.49**).

**2.21 Crest Width** — In case of weirs, spillways, overflow dams across rivers and side spillways in rivers and canals, it is the linear measurement of the crest in the direction of flow. In case of other irrigation and drainage structures, it is the linear measurement of the crest at right angles to the direction of flow over the crest. In case of flumed structure, it is equivalent to throat width (*see also* **2.93**).

**2.22 Curtain Wall** — A cross wall built under the floor of a hydraulic structure with the object of dividing the work into suitable compartments, or to provide cut-offs. A wall placed at the top of the inlet and extending into the water to ward off ice and drift, usually with coarse rack, is also referred to as curtain wall.

**2.23 Cut-Off** — A transverse thin wall, collar or other structure to reduce percolation water under surfaces of a structure or through porous strata.

**2.24 Cut-Off Wall** — *See* **2.23.**

**2.25 Discharge Intensity*** — Discharge per unit width of a waterway.

**2.26 Efficiency of Hydraulic Jump*** — The ratio of the specific energy after the jump to that before the jump.

**2.27 Energy Gradient Line** — A line joining the elevation of the energy head of a stream. The stream line is above the hydraulic gradient line a distance equivalent to the velocity head at each section along the stream.

**2.28 Energy Line** — *See* **2.27.**

**2.29 Energy Loss in Hydraulic Jump*** — The difference in specific energies before and after the jump.

**2.30 Entrance Head*** — The head required to cause flow into a conduit or other structure; it includes both entrance loss and velocity head.

**2.31 Entrance Loss** — The energy lost when a stream of water passes into a hydraulic structure the loss being caused by eddies at the inlet.

**2.32 Entry Head*** — *See* **2.30.**

**2.33 Flow Constriction*** — A constriction inserted between the inlet and outlet sections of a closed conduit.

**2.34 Freeboard** — The vertical distance between the maximum flow line including afflux and top of bank. The clearance between the lowest point

of the super-structure (springing level in case of arched structures) and the maximum water level, including afflux, is also referred to as free-board.

**2.35 Friction Slope*** — The friction head or loss per unit length of conduit. For most conditions of flow the friction slope coincides with the energy gradient, but where a distinction is made between energy losses due to bends, expansions, impacts, etc, a distinction must also be made between the friction slope and the energy gradient. Friction slope is equal to the bed surface slope only for uniform flow in open channels.

**2.36 Gradual Hydraulic Drop*** — A gradual change, not a local phenomenon in the water surface from subcritical to supercritical state of flow.

**2.37 Height of Hydraulic Jump*** — The difference between depth of water downstream and upstream of the jump.

**2.38 Hurdling*** — The action of water flowing over the top of a baffle or baffles with a high velocity, like a horse taking a fence.

**2.39 Hydraulic Bore** — A standing wave which advances upstream in an open conduit from a point where the flow has suddenly been stopped. The flowing water piles up in the channel against the obstruction that caused the stoppage, and as it reaches a height above the normal water surface, approximately its velocity head, the increased depth of water moves upstream in a wavelike shape.

**2.40 Hydraulic Drop*** — A local phenomenon in which a rapid change in the state of flow from subcritical to supercritical, resulting a steep depression in the water surface, is caused by an abrupt change in the channel slope or cross section.

**2.41 Hydraulic Friction** — A force resisting flow which is exerted on contact surface between a stream and its containing channel. It usually includes the normal eddies and cross-currents attendant upon turbulent flow occasioned by the roughness character of the boundary surface, moderate curvature, and normal channel variations.

**2.42 Hydraulic Jump*** — The sudden and usually turbulent passage of water under free flow conditions from low level below critical depth to high level above critical depth during which the velocity passes from supercritical to subcritical. It represents the limiting condition of the surface curve wherein it tends to become perpendicular to the stream bed (*see also* **2.75**)

**2.43 Inflow Constriction*** — A constriction inserted at the inlet to a closed conduit.

**2.44 Intensity of Flow*** — *See* **2.25.**

**2.45 Invert*** — The lowest portion in the internal cross-section of an artificial channel or pipe or component of a hydraulic structure.

**2.46 Kinetic Flow Factor*** — A factor defined by twice the ratio of the kinetic energy head to the potential energy head. It measures the degree of rapidity or tranquility of flow and obtains, in general, a standard by means of which the state of flow may be qualified numerically.

**2.47 Kineticity*** — Ratio of the kinetic energy head to the potential energy head.

**2.48 Length of Hydraulic Jump*** — The distance measured from the front face of the jump to a point on the surface immediately downstream from the roller.

**2.49 Length of Throat*** — Length of the throat section measured along the axis or centre line of the structure or the conduit.

**2.50 Line Throat*** — A throat having no length ( *see* Fig. 2 ).

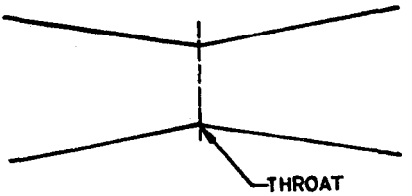


FIG. 2 POINT THROAT OR LINE THROAT

**2.51 Long Throat** — A throat having an appreciable linear dimension in the direction of flow.

**2.52 Loss of Head** — The energy of a given flow that is lost ( converted into heat and, therefore, useless ), as a result of friction, eddies and impact expressed as a heat, that is as the height through which that flow would have to fall to produce an equivalent amount of energy.

**2.53 Measuring Constriction*** — A constriction inserted into a closed conduit in order to produce a pressure drop for measuring the rate of flow.

**2.54 Modularity Point** — It is the point on the curve drawn between upstream and downstream water depths for a fall, weir, overflow dam or like structure at which the linear relation between the two depths ends.

**2.55 Navigation Structures** — Structures built in canals or navigable waterways where headway and other facilities exist or are provided for the direct passage of vessels and boats.

**2.56 Neutral Depth** — The depth of water in an open conduit that corresponds to uniform velocity for a given flow. It is the hypothetical depth under conditions of steady non-uniform flow; the depth for which the surface and bed are parallel. Also called 'normal depth'.

**2.57 Normal Depth** — *See* **2.56**.

**2.58 Normal Flow*** — Uniform flow at normal depth. The flow which prevails the greatest portion of the time; the mean flow or the average flow.

**2.59 Oblique Jump** — When a supercritical flow is deflected inward in the course of the flow by a vertical boundary, the depth of flow will increase abruptly along a wave front which extends out from the point of boundary discontinuity at a wave angle $\beta$ that depends in magnitude on the angle of deflection $\theta$ of the boundary. This phenomenon resembles a normal hydraulic jump but with the change in depth occurring along an oblique front ( *see* Fig. 3 )

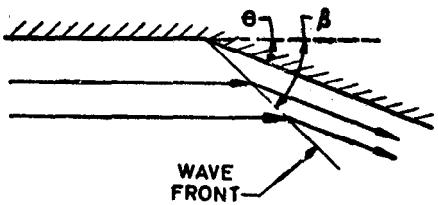


FIG. 3 OBLIQUE JUMP

**2.60 Oscillating Jump** — A type of hydraulic jump in which the oscillating jet enters the jump bottom to surface and back again with no periodicity. The Froude number of the incoming flow in this case is between 2·5 and 4·5.

**2.61 Outflow Constriction*** — A constriction inserted at the outlet of a closed conduit or reservoir.

**2.62 Pitching** — A protective covering of properly packed or built in materials on the earthern surface slopes (side pitching) and beds (bed pitching) of irrigation canals, drainage channels, and river banks, etc, to protect them from the action of water.

**2.63 Point Throat*** — *See* **2.50**.

**2.64 Protective Structures** — Structures to protect the canal system from storm or drainage water.

**2.65 Recovery of Head** — A phenomenon associated with the flow at outlet ends or at expansions by which the water surface rises due to reduction in velocity head.

**2.66 Regulation Structures** — Structures built in/across canals to provide specific control and measurement of water during conveyance to a location of usage or disposal.

**2.67 Relative Height of Hydraulic Jump*** — Ratio of the height of hydraulic jump and the specific energy of flow upstream of the jump.

**2.68 Relative Initial Depth of Hydraulic Jump*** — Ratio of the depth of flow and the specific energy of flow both upstream of the jump.

**2.69 Relative Sequent Depth of Hydraulic Jump*** — Ratio of the depth of flow downstream of the jump and the specific energy of flow upstream of the jump.

**2.70 Return Wall*** — Walls, carried transverse to the centre line of the stream, starting off either from the abutment directly or from any type of wing walls, whether in line with the current, splayed, curved, or straight.

**2.71 Ribbed Pitching*** — Pitching having a system of regular projections to offer greater friction to the flow.

**2.72 Skew Throat*** — A throat whose inlet end, or outlet end, or both are skew to the flow.

**2.73 Specific Energy** — The energy of stream per unit weight referred to its bed; namely, depth plus velocity head corresponding to mean velocity.

**2.74 Splitter Wall*** — Longitudinal walls provided in canals or basin expansions, for recovery of head and equalization of outlet velocity or reduction in expansion length.

**2.75 Standing Wave**

a) A wave formed on the surface of a body of water when a stream enters such a body at a high velocity. The energy of the entering stream is dissipated by turbulence and by maintaining the water comprising the wave at the higher elevation above the normal surface of the body of water.

b) A sudden rise in the water surface, generally fixed in position, such as a hydraulic jump; a standing wave may exist, however, where the hydraulic jump is not involved.

c) A type of wave in which the surface of the water oscillates vertically between fixed nodes without progressing. The points of maximum vertical rise and fall are antinodes or loops. It may be the result of two equal progressive waves travelling through each other, but in opposite directions.

**2.76 Staunching Forks*** — A pattern of staunching branches emanating from the abutment in a fork-like manner.

**2.77 Staunching Wall** — Walls projecting from abutment into the embankment to intercept seepage.

**2.78 Steady Jump** — A type of hydraulic jump in which the downstream extremity of the surface roller and the point at which the high velocity jet tends to leave the flow, occurs at practically the same vertical section. The action and position of this jump are least sensitive to variation in tailwater depth. The jump is well balanced and the performance is at its best. The Froude number of the incoming flow in this case is between 4·5 and 9·0.

**2.79 Strong Jump** — A type of hydraulic jump in which the high velocity jet grabs intermittent slugs of water rolling down the front face of the jump generating waves downstream, and a rough surface can prevail. The Froude number of the incoming flow in this case is more than 9·00.

**2.80 Super Contraction** — An excess contraction imposed on the throat of a flume more than required.

**2.81 Surge** — A momentary increase in flow or elevation which passes longitudinally along the channel as a wave resulting from sudden opening or closing of the gates controlling the flow in the channel.

**2.82 Theoretical Recovery of Head*** — The computed reduction in velocity head at outlets or expansions.

**2.83 Throat*** — *See* **2.3**.

**2.84 Toe Wall*** — A shallow wall constructed below the bed or floor level to provide footing for the sloped pitching or the face of an embankment.

**2.85 Undular Jump** — A type of hydraulic jump in which the water surface shows undulations. The Froude number of incoming flow in this case is between 1 and 1·7.

**2.86 Velocity Head** — The distance a body shall fall freely under the force of gravity to acquire the velocity it possesses.

**2.87 Velocity Head Ratio*** — *See* **2.47**.

**2.88 Velocity of Approach*** — The mean velocity in the conduit or stream immediately upstream of a hydraulic structure.

**2.89 Velocity of Retreat*** — The mean velocity immediately downstream of a structure.

**2.90 Warped Pitching*** — Pitching on the upstream or downstream sides of hydraulic structures having warped surfaces.

**2.91 Water Cushion** — *See* **2.10.**

**2.92 Weak Jump** — A type of hydraulic jump in which a series of small rollers develop on the surface of the jump, but the downstream water surface remains smooth. The velocity throughout is fairly uniform, and the energy loss is low. The Froude number of the incoming flow in this case is between 1·7 and 2·5.

**2.93 Width of Throat*** — The minimum contracted/constricted width of the throat section of a structure or open conduit/closed conduit.

**2.94 Wing Walls*** — Walls joining the abutments of a structure to an earth dike or the banks to retain and protect the backfill and provide a longer path of percolation around the end of structure and/or to improve flow conditions upstream and downstream of the controlling section.

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