BUREAU OF INDIAN STANDARDS

AGENDA

Foundation and Foundation Treatment Sectional Committee, WRD 08	**26th Meeting**

Day, Date and Time	**Venue**	**Contact details**
Wednesday, 28 August 2024 11:00 AM	Virtual **Join from the meeting link:** https://bismanak.webex.com/bismanak/j.php?MTID=m1d8f6aabd833ee2bf418ac75ccb46209 **Meeting ID:** 2516 877 1924 **Meeting password:** 35pmPPhN2yd (35767746 when dialing from a video system)	wrd@bis.gov.in

CHAIRPERSON:	**MEMBER SECRETARY:**
Dr. R. Chitra, Director CSMRS	Shri Vaibhav Yadav, SC- B/ AD, WRD

ITEM 0 WELCOME BY THE CHAIRPERSON

ITEM 1. CONFIRMATION OF THE MINUTES OF THE LAST MEETING

The 25th meeting of WRD 08 was held on 21st December 2023 and the minutes duly approved by the Chairperson were circulated to members vide BIS email dated 05th February 2024. No comments have been received on the circulated minutes.

The Committee may CONFIRM the minutes as circulated.

ITEM 2. COMPOSITION OF THE COMMITTEE

2.1 The present composition along with attendance details of last three sectional committee meetings of WRD 08 is given at **ANNEX I**.

The Committee may NOTE.

2.2 During the last meeting, the Committee decided to pursue the following organizations once again for co-option. In this regard, communications were sent to the following organizations. Reply against the same is awaited.

SL. NO.	**ORGANIZATIONS**	**STATUS**
1.	SJVNL	The nominations are still awaited.
2.	Karnataka Neeravari Nigam Ltd. (KNNL)	
3.	WAPCOS	
4.	WRD, Meghalaya	

5.	IIT (ISM), Dhanbad	
6.	IIT Roorkee (Rock Mechanics Divisions)	
7.	IIT Guwahati	
8.	IIT Bombay, Mumbai	

The Committee may NOTE and DECIDE.

2.3 The Committee in the last meeting decided to contact the higher authorities of the following organizations for their nominations. In this regard, communications were sent to the below organizations for the nomination. Reply against the same is awaited.

SL. NO.	ORGANIZATIONS	STATUS
1.	Gammon Engineers and Contractors Pvt. Ltd., Mumbai	The nominations are still awaited.
2.	Uttarakhand Jal Vidyut Nigam Ltd, Uttarakhand	
3.	Water Resources Department, Govt. of Andhra Pradesh	
4.	Water Resources Department., Govt. of Madhya Pradesh	
5.	Water Resources Department, Punjab	

The Committee may NOTE and DECIDE.

2.4 The following fresh nominations have been received from member's organization:

SL. NO.	ORGANIZATION	NOMINATION
1.	Central Water Commission, New Delhi	Shri Samir Kumar Shukla, Director, FE&SA Shri Somesh Kumar, Director, Emb. (N&W) (Alternate)
2.	Hindustan Construction Company Limited, Mumbai	Monika Patil, Sr. Manager – Engineering Management Shri Praveen H Shettigar, Chief Technology Officer & Head – Tendering (Alternate)

The Committee may NOTE.

2.5 The following nomination was received for co-option in this Sectional Committee. In the last meeting it was decided to co-opt the organization to the committee however the minutes inadvertently failed to record the same. Therefore, the last meeting's minutes may be amended to read as below:

"2.4 The Committee NOTED item 2.4 of the agenda, fresh nomination has been received from new organization. The Committee further decided to co-opt the organization to the committee."

SL. NO.	ORGANIZATION	NOMINATION
1.	DMR Hydro Engineering & Infrastructures Limited, Faridabad, Haryana	Shri N. K. Mathur, Senior Vice President & Geology Head Miss Subrata Laha, Senior Engineer- Geology (Alternate)

The Committee may NOTE.

ITEM 3. TITLE, SCOPE AND ACTIVITIES OF WRD 08

3.1 Title, Scope and Programme of work of WRD 08 committee are given at **ANNEX II**.

The Committee may NOTE.

3.2 Standards National Action Plan (2022 – 27)

The following subject area has been identified to be taken up for standardization under SNAP 2022-27.

FIELD	SUBJECT AREA	PRIORITY
Hydro Structure Construction, Operation maintenance	Guidelines on Treatment of Defects in the Foundation of Masonry and Concrete Dam	Medium

The Committee may DELIBERATE and DECIDE.

ITEM 4. DRAFT STANDARDS UNDER WIDE CIRCULATION

4.1 Doc. No. WRD 08 (21401), IS 4410 (PART 19): 1996 Glossary of Terms Relating to River Valley Projects Part 19 Grouting

During the last meeting, the comments received from L & T were discussed and decision as given below was taken. Dr. Sanjay A. Burele, CWPRS, were discussed. The following comments are given below:

Sl. No.	Clause/ subclause/para/table/fig. no. commented.	Commentator/ Organization/ Abbreviation	Type of Comments (General/Editorial/ Technical)	Justification	Proposed change	Status
1.	2	L& T Construction	Technical	Included in ASCE journal of Geotechnical and Geo-environmental Engineering, Dec 2005	"Admixture: A material other than water, aggregates, or cementitious material used as grout ingredient for cement-based grouts" shall be included	Agreed
2.	2	L& T Construction	Technical	Included in ASCE journal of Geotechnical and Geo-environmental Engineering, Dec 2005	"Creep: Time-dependent deformation due to load" shall be included	Agreed
3.	--	L& T Construction	Editorial	Incorrect spelling	"VALLERY" shall be substituted by "VALLEY" in the title	Agreed

During the last meeting, the following comments received from Dr. Sanjay A. Burele, CWPRS, were discussed. The comments and the decision are placed at **ANNEX III**.

The Committee may NOTE and DECIDE.

ITEM 5. DRAFT STANDARDS UNDER REVISION

5.1 WRD 08, IS 4999: 1991 Recommendations for Grouting of pervious Soils

Following comments has been received from Basavaraj Rajashekhar, L & T Chennai.

"Page 5, IS:4999-1991 ***Clause No. 6.4 - (D85 / D15) < (1/20) is to be changed as (D85(Grout) / D15(Soil)) < (1/25)".*** This is as per Burwell Jr (1958) - Technical paper.

Further the following technical papers denote the same equation for finding out the Groutability:

1. Akbulut, S. and Saglamer, A., 2002. Estimating the groutability of granular soils: a new approach. Tunnelling and underground space technology, 17(4), pp.371-380.

2. Farhadian, H. and Maleki, Z., 2022. Groutability classification of granular soils with cement grouts. Journal of Rock Mechanics and Geotechnical Engineering.

3. Liao, K.W. and Huang, C.L., 2011, May. Estimation of groutability of permeation grouting with microfine cement grouts using RBFNN. In International Symposium on Neural Networks (pp. 475-484). Springer, Berlin, Heidelberg.

During the last meeting, the committee decided that CSMRS would review the proposed change in the equation **(D85 / D15) < (1/20)** and a final decision would be taken in the upcoming meeting.

The Committee may NOTE & DECIDE.

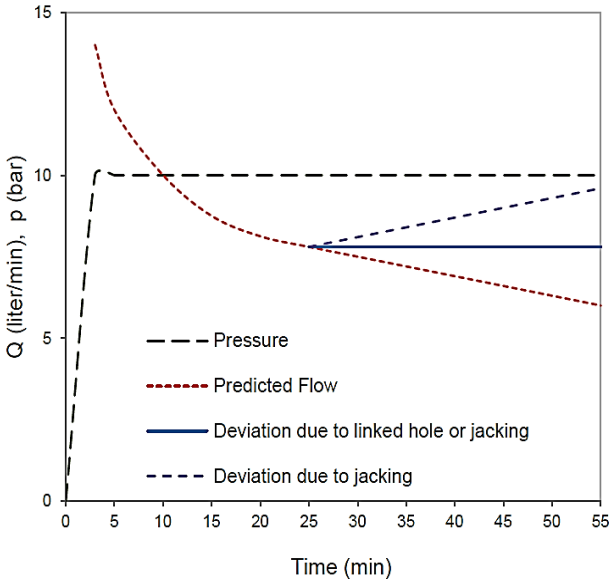
5.2 WRD 08, IS 6066: 1994 Pressure grouting of rock foundations in river valley projects – Recommendations

IS 6066: 1994 – Suggestions for Draft Document

- *The code does not talk about plasticizers except bentonite to change viscosity of grout mix in certain conditions when required. Viscosity and hardening time of grout can play a significant role in penetration. A brief section on other plasticizers can be discussed upon.*
    - *In section 11.3 it is mentioned that "a continuous flow of grout should be maintained at the desired pressure and the grouting equipment should be operated to ensure continuous and efficient performance throughout the grouting operation". It is recommended to mention "grout flow meters" in the code as a specific equipment for same purpose in Section 9 along with other equipment. Since it is not mentioned in the list of equipment, many places it is often ignored, and no proper grouting data can be recorded.*
- *Grout flow rate (Lit/minute) is very helpful in understanding the behavior of rock mass during grouting. It can enable the grouting engineer in charge to change the pressures*

or mix ratios based on flow rate. Therefore, Annexure B needs more detailing in terms of graphs and writeup (like Annexure C).

- *B-1 discusses the 3 trends on grouting operation. A typical figure can be attached in Annexure B to elaborate the trends in detail. Attaching a typical figure below based on the same, where red line shows desired grout flow, blue line shows presence of an opening or jacking in rock mass, and purple line shows that hydrofracturing has happened and grout pressure adopted need to be reduced, or mix needs to be changed. Further investigation must be done before proceeding ahead.*



- *Various analytical developments have taken place since the last revision of the code. Few analytical formulae have been developed which can tell the penetration length of grout based on grouting pressure, fracture aperture, yield stress of grout and time of grouting. Analytical volume of grout anticipated can also be calculated beforehand (We used the same in our project and found it reliable). A section discussing same can be thought upon. We can share references if needed.*
- *There are only mentions to stop grouting in certain different sections of the code, and mostly based on grout consumption criteria. There can be a specific section in detail to decide the stop criteria by engineer in charge, which can be based on (i) grout flow rate, (ii) grout consumption criteria or (iii) grouting time criteria, depending on different conditions.*
- *Is it possible that IS codes can be made coloured instead of black and white, and the decades old trend can be changed.*

During the last meeting, the Chairperson informed that she would suggest some experts and provide their contact details to invite inputs on the comments received

from Shri Basavaraj Rajashekar of L&T Construction, as well as on the preparation of the draft document. The expert nominations are awaited.

Once expert nominations are received, they may be invited to attend the next meeting and if need be, a separate working group may be constituted to take up the revision of the standard.

The Committee may NOTE & DECIDE.

5.3 WRD 08, IS 12584: 1989 Bentonite for Grouting in Civil Engineering Works

During the last meeting, the Committee reviewed the suggestions (placed at **ANNEX-IV**) provided by Shri Mahavir Bidasaria. It was decided to incorporate the definition of **Bentonite** into the document. Regarding the proposal to add a definition of **Thixotropy**, the Committee decided to discuss it further in the upcoming meeting.

The Committee may NOTE & DECIDE.

5.4 WRD 08, IS 14343: 1996 Choice of grouting materials for alluvial grouting – Guidelines

During the last meeting, the Committee decided to review the document and the suggestions provided by Shri Mahavir Bidasaria in the upcoming meeting. The document with suggestions received from Shri Mahavir Bidasaria are placed in **ANNEX-V** (*suggestions highlighted with red colour*).

The Committee may NOTE & DECIDE.

5.5 WRD 08, IS 11973: 1986 Code of practice for treatment of rock foundations, core and abutment contacts with rock, for embankment dams

During the last meeting, it was decided that this standard would be reviewed by Dr. Sanjay A. Burele from CWPRS and Er. S. Sridharan from TNWRD, as agreed upon in the last meeting. It was also decided that comments would be submitted to BIS. However, no comments have been received.

The Committee may NOTE & DECIDE.

5.6 WRD 08, IS 5050: 1992 Code of practice for design, construction and maintenance of relief wells (First Revision)

During the last meeting, it was decided that this standard would be reviewed by CSMRS and comments would be submitted to BIS. Comments are awaited.

The Committee may NOTE & DECIDE.

ITEM 6. DRAFT STANDARDS UNDER PREPARATION

6.1 Guidelines for treatment of defects in the foundation of Masonry and Concrete dams

In the last meeting, it was decided to submit the draft document prepared by CSMRS to BIS. It will then be forwarded to CWC for further input. Afterward, as a P-draft, it will be circulated among the Committee members for additional inputs.

Draft document is awaited.

The Committee may NOTE & DECIDE.

6.2 Foundation treatment for barrages on gravelly and boundary reaches

In the last meeting, the committee requested CWC and panel members to prioritize and expedite its completion. Once finalized, the draft should be submitted to BIS for further circulation among Committee members for additional inputs.

Draft document is awaited.

Composition of panel is given below:

1. Director Embankment, Central Water Commission, New Delhi (Convener)
2. Dr. Manish Gupta, CSMRS, New Delhi,
3. Shri Anirudh Bishnoi, Tehri Hydro Development Corporation, Rishikesh
4. Shri Rajesh Kumar, NHPC Ltd, Faridabad
5. Shri Dharmendra Kumar, Geological Survey of India

The Committee may NOTE & DECIDE.

ANNEX I
(*Clause 2.1*)

COMPOSITION OF FOUNDATIONS AND FOUNDATION TREATMENT SECTIONAL COMMITTEE, WRD 8

Scope: Standardization of criteria for design and construction of foundations on rocks, impermeable and permeable strata for water resource projects, including methods of foundation treatment

Last 3 meetings	**23rd meeting - 8 Oct 2021**	**24th meeting – 03 Nov 2022**	**25th meeting – 21 Dec 2023**

SL. NO.	**NAME OF THE ORGANIZATION**	**REPRESENTED BY**	**MEETINGS ATTENDED**		
			23rd	**24th**	**25th**
1.	Central Soils and Materials Research Station, New Delhi	Director Dr. R. Chitra (Chairperson)	Y	Y	Y
2.	Afcons Infrastructure Limited, Mumbai	Dr. Sunil Basarkar, General Manager (Designs) Dr. Lakshmana Rao Mantri, Assistant GM (Design) (Alternate)	Y	X	X
3.	Aimil Ltd, New Delhi	Dr Heman Manchanda, Deputy General Manager Shri Sandeep Sharma (Alternate)	Y	X	X
4.	Central Board of Irrig. & Power, New Delhi	Shri K. K. Singh, Director WR Shri Kamal Kumar, Manager WR (Alternate)	Y	Y	X
5.	Central Soil & Materials Research Station, New Delhi	Dr. Manish Gupta, Scientist E Shri P.S. Krishna Murthy (Alternate)	Y	Y	Y
6.	Central Water & Power Research Station, Pune	Shri Rizwan Ali, Scientist E Shri Sanjay A Burele, Scientist C (Alternate) Dr. Vijay Ghodake, Scientist B (Alternate)	Y	Y	Y

7.	Central Water Commission, New Delhi	Shri Sameer Kr. Shukla, Director (FE&SA) Shri Somesh Kumar, Director Embankment (N&W) (Alternate)	Y	X	Y
8.	Ferro Concrete Construction (I) Pvt. Ltd, Indore	Dr. Mahavir Bidasaria Chairman Shri Anupam Bidsaria, Managing Director (Alternate)	Y	X	X
9.	Gammon Engineers and Contractors Pvt. Ltd., Mumbai	Shri Sadashiv Nayak (Vice President- Tendering and Business Development)	X	X	X
10.	Geological Survey of India, Kolkata	Shri A. P. Thapliyal, Director Shri Dharmendra Kumar, Senior Geologist (Alternate)	Y	Y	X
11.	HCC Ltd., Mumbai	Smt. Monika Patil, Sr. Manager-Engineering Management Shri Parveen H Shettiger, Chief Technology Officer & Head-Tendering (Alternate)	Y	X	X
12.	ITD Cementation India Ltd., Mumbai	Shri S. R. Bhattacharya, Engineer	Y	Y	X
13.	L&T Construction, Chennai	Shri Basavaraj Rajashekhar, Head Edrc-II (Www Sbg) Ms. Raji V. S, Head Corporate Centre (Alternate)	Y	Y	X
14.	Maharashtra Engineering Research Institute, Nashik	Superintending Engineer, Lift Irrigation Scheme Circle Shri S M Sangale, Superintending Engineer Kukadi Irrigation Circle Pune, MKVDC Executive Engineer, Lift Irrigation Scheme Division-1 (Alternate)	X	Y	X
15.	National Hydroelectric Power Corporation Ltd, Faridabad	Shri Santosh Kumar, GM (Civil) Shri Rajesh Kumar, Gm (Civil), Ms. Anindita Chaudhari, Dy. Manager (Civil), (Alternate)	Y	Y	Y

16.	National Thermal Power Corporation Ltd., Noida	Shri Naveen Kumar Jain, Additional General Manager Shri Niraj Kumar, Sr. Manager (Hydro Engg.) (Alternate)	Y	Y	X
17.	North Eastern Electric Power Corporation Ltd., Shillong	Shri R. Rajan, Senior Manager (Geo)	Y	X	Y
18.	THDC India Ltd., Rishikesh	Shri Atul Jain, CGM (D&E Civil) Shri Avkesh Kumar, Dy. Manager (Design Civil) (Alternate)	Y	Y	Y
19.	UJVN Ltd, Uttarakhand	Nomination Awaited	X	X	X
20.	Uttarakhand Irrigation Department	Shri Dinesh Chandra, Chief Engineer Level - I Shri Naveen Singhal, Superintending Engineer Design (Alternate)	Y	X	X
21.	Water Resources Department, Govt. of Andhra Pradesh	K. Srinivas CE (CDO) V. Sudhakar Reddy EE(CDO)	X	X	Y
22.	Water Resources Deptt., Govt. of Madhya Pradesh	Chief Engineer (Bodhi) Shri H. K. Sharma (Alternate)	X	X	X
23.	Water Resources Department, Punjab	Shri Kuldip Singh Takshi Shri Jatinder Pal Singh (Alternate)	X	X	X
24.	Water Resources Organization, Public Works Deptt, Tamil Nadu	Shri Er. S. Sridharan Executive Engineer. PWD, M. Tech, Mba, Mi. E Superintending Engineer, PWD, Designs Circle, WRD (Alternate)	X	Y	Y
25.	In Personal Capacity, New Delhi	Dr. A K Dhawan	Y	Y	Y

ANNEX II
(*Item 3.1*)

PROGRAMME OF WORK

WRD 08: Foundation and Foundation Treatment:

Standardization of criteria for design and construction of foundations on rocks, impermeable and permeable strata for water resource projects, including methods of foundation treatment.

Sl. No.	IS No.	Title	Reaffirm
1.	IS 4410 (Part 19): 1996	Glossary of terms relating to river valley projects Part 19 grouting	Apr- 2021
2.	IS 4999: 1991	Recommendations for grouting of pervious soils (*First Revision)*	Mar-2023
3.	IS 5050: 1992	Code of Practice for design construction and maintenance of relief wells (*First Revision*)	Apr- 2021
4.	IS 6066: 1994	Pressure grouting of rock foundations in river valley projects - recommendations (*Second Revision*)	Mar-2023
5.	IS 8414: 2014	Guidelines for Design of under seepage control measures for earth and rockfill dams (*First Revision*)	Mar-2024
6.	IS 11293: 2018	Guidelines for the design of grout curtains for earth and rock fill dams' masonry dams and concrete gravity dams	Mar- 2024
7.	IS 11973: 1986	Code of practice for treatment of rock foundations, core and abutment contacts with rock for embankment dams	Apr- 2021
8.	IS 12584: 1989	Bentonite for grouting in civil engineering work – Specification	Mar-2023
9.	IS 14343: 1996	Choice of grouting materials for alluvial Grouting – Guidelines	Apr- 2021
10.	IS 14344: 2021	Design and construction of diaphragms for under seepage control Code of Practice (*First Revision*)	-
11.	IS 16547: 2017	Investigations for foundation of existing earth and rock fill dams — Guidelines	Dec-2022

ANNEX-III
(*Item 4.1*)

Sl. No.	TITLE	COMMENTS	STATUS
1.	**Drainage Gallery**	A passage in the gravity dam that runs parallel to the top of the dam and occupies about two-thirds of the width of the base from the upstream face. It stops water from seeping in from the water face and moves it away from the downstream face. It also allows drilling operations and drains the part of the foundation that is downhill from the water face.	During the last meeting, the Committee decided to discuss in upcoming sectional committee meeting. To be discussed.
2.	**Grouting gallery**	In these galleries, the supply, return, and vent headers of the grout pipe system can be located. The grouting gallery also houses pipes for artificially cooling the blocks.	
3.	**Inspection gallery**	A passage in the gravity dam that gives access to the inside of the dam so that the structure can be inspected and the behavior of the dam can be studied. It also helps to get rid of water that seeps into the ground. Inspection galleries can also be found in the foundation, drainage, gate, and grouting galleries.	
4.	**Cement Grouting**	**Original:** The injection of hydraulic cement-based grouts for the purpose of altering the properties of a soil or rock mass. **Corrected:** The injection of hydraulic cement-based grouts for the purpose of altering the properties of a soil or rock mass. Also, the injection of hydraulic cement consolidates the subsurface strata/PCC, etc.	Agreed in the last meeting.
5.	**Drill**	**Original:** A machine or piece of equipment designed to	Agreed in the last meeting as:

		penetrate earth or rock formations, or both, using either rotary, rotary-percussive, sonic, or driving techniques. **Corrected:** A machine or piece of equipment designed to penetrate earth or rock formations, or both, using either rotary, rotary-percussive, sonic, or driving techniques. The bit used may be of hollow or solid type.	A machine or piece of equipment designed to penetrate earth or rock formations, or both, using either rotary, rotary-percussive, sonic, or driving techniques.
6.	**Fold**	A wave-like geologic structure that forms when rocks deform by bending instead of breaking under compressional stress. Folds typically occur in anticline-syncline pairs	After deliberation, the Committee decided to request inputs form GSI. Inputs awaited.
7.	**Gate Gallery**	A passage in the gravity dam that gives access to and houses the mechanical equipment needed to open and close gates in outlet conduits, power penstocks, or spillway crests. The location and size of the gate gallery depend on the need and size of the mechanical equipment.	To be discussed.
8.	**Foundation Gallery**	A passage along most of the length of the gravity dam, close to the rock surface and parallel to the dam axis. It collects the seepage of water through the foundation of the dam. Holes are drilled to the floor of the gallery for curtain grouting in the foundation as well as the body of the dam.	