D/o Water Resources, RD & GR
National Dam Safety Authority
NDSA Secretariat

****

Sub: 3rd meeting of the National Committee on Dam Safety (NCDS) constituted as per Dam Safety Act, 2021-Minutes of meeting-reg.

Sir,

I am directed to forward herewith a copy of approved minutes of the third meeting of the National Committee on Dam Safety (NCDS) held on 05th December, 2023 at CWC, HQ, Sewa Bhawan, New Delhi.

Yours Sincerely,

Encl: Copy of approved Minutes

Signed by Shiv Dutta Sharma
Date: 20-12-2023 11:12:19
Reason: Approved

(S D Sharma)
Member (Policy & Research)
Phone: 011-26104083

To,

As per list attached.

Copy along with enclosures for kind information to:

1. PPS to Hon'ble Union Minister of Jal Shakti. [Email: minister- jalshakti@gov.in]
2. PPS to Hon'ble Minister of State for Jal Shakti & Food Processing Industries. [Email: mosmdws@gov.in]
3. PPS to Hon'ble Minister of State for Jal Shakti & Tribal Affairs. [Email: mos-mowr@nic.in]
4. PPS to Secretary, DoWR, RD & GR, Ministry of Jal Shakti. [Email: secy-mowr@nic.in]
5. All Members of NDSA.
6. All Regional Directors of NDSA.

List of addressees

(A) Members of NCDS

1. Chairman, Central Water Commission, Ministry of Jal Shakti, Govt. of India. [Email: chairman-cwc@nic.in]
2. Chairman, National Dam Safety Authority (NDSA), New Delhi. [Email: chmn-ndsa@gov.in]
3. Member (Design & Research), Central Water Commission, Ministry of Jal Shakti, Govt. of India. [Email: memberdr-cwc@nic.in]
4. Member (Hydro), Central Electricity Authority, Ministry of Power, Govt. of India. [Email: member.he@cea.nic.in]
5. Joint Secretary (RD & PP) DoWR, RD&GR, Ministry of Jal Shakti, Govt. of India. [Email: jsrd-dowr@gov.in]
6. Member Secretary NDMA, Ministry of Home Affairs, Govt. of India. [Email: secretary@ndma.gov.in]
7. Secretary, Ministry of Environment, Forest and Climate Change, Govt. of India. [Email: secy-moef@nic.in]
8. Director General, India Meteorological Department, Ministry of Earth Science. [Email: directorgeneral.imd@imd.gov.in; m.mohapatra@imd.gov.in]
9. Director General, Geological Survey of India, Ministry of Mines, Govt. of India. [Email: dg.gsi@gov.in]
10. Director, National Remote Sensing Centre, Department of Space, Indian Space Research Organisation, Govt. of India. [Email: director@nrsc.gov.in]
11. Director, National Geophysical Research Institute, Ministry of Science and Technology, Govt. of India. [Email: director@ngri.res.in, rakashk@ngri.res.in]
12. Principal Secretary (WR), Govt. of Andhra Pradesh. [E-mail: psdwrap15@gmail.com; splcs-wrd@ap.gov.in]
13. Secretary (Jal Shakti), Govt. of Himachal Pradesh. [E- mail: iphsecy-hp@nic.in]
14. Secretary, (WR), Govt. of Arunachal Pradesh. [E- mail: secretarywrd6@gmail.com; geyumpaduce@hotmail.com]
15. Commissioner-cum-Secretary, Water Resources Department, Govt. of Manipur. [E-mail: trsingh13@yahoo.co.in]
16. Secretary (WR), Govt. of Bihar. [E-mail: wrd-bih@nic.in]
17. Secretary (WR), Govt. of Gujarat. [E-mail: secwr@gujarat.gov.in]
18. Secretary (WR), Govt. of Rajasthan. [E-mail: pswrdraj@rajasthan.gov.in; osdwrd@gmail.com]
19. Sh DK Sharma, Chairman, Himachal Pradesh Electricity Regulatory Commission- Specialist in dam safety aspects. [Email: dks.shimla@gmail.com]
20. Prof CVR Murty, P S Rao Institute Chair Professor, Department of Engineering, IIT Madras- Specialist in dam safety aspects. [Email: cvrm@iitm.ac.in]

(B) States/UTs

1. Principal Secretary (WR), Government of Assam. [E-mail: secyirrigassam@yahoo.com; wrd.assam@hotmail.com]
2. Secretary (WR), Government of Chhattisgarh. [E-mail: secy-wrd.cg@gov.in; anbalagan.p@gov.in]
3. Secretary (WR), Government of Goa. [E-mail: secpanchsect.goa@nic.in]
4. Secretary (Irrigation & WR), Government of Haryana. [E-mail: secretaryirrigation43@gmail.com]
5. Secretary (MPP& Power), Govt. of Himachal Pradesh. [Email: powersecy-hp@nic.in]
6. Secretary (WR), Government of Jharkhand. [E-mail: sec-wrd-jhr@nic.in]
7. Secretary (WR- Minor Irrigation), Government of Karnataka. [E-mail: secytechwr@karnataka.gov.in; prs-wr@karnataka.gov.in]
8. Secretary (WR), Government of Kerala. [E-mail: secy.wrd@kerala.gov.in]
9. Additional Chief Secretary (WR), Government of Madhya Pradesh. [E- mail: pswrd@mp.gov.in]
10. Secretary (WR), Government of Maharashtra. [E-mail: psecwr.wrd@maharashtra.gov.in]
11. Principal Secretary (WR), Government of Meghalaya. [E-mail: drshakilp@rediffmail.com; dwahlang@yahoo.com]
12. Secretary (WR), Government of Mizoram. [E-mail: agrdepmiz2021@gmail.com]
13. Secretary (WR), Government of Nagaland. [E-mail: secyirrig-ngl@nic.in; commnsecyifc@gmail.com]
14. Additional Chief Secretary (WR), Government of Odisha. [E-mail: wrsec.or@nic.in]
15. Additional Chief Secretary (WR), Government of Punjab. [E-mail: psi@punjab.gov.in]
16. Secretary (WR), Government of Sikkim. [E-mail: cs-skm@hub.nic.in; kpsh42egmai1.com]
17. Additional Chief Secretary (WR) Government of Tamil Nadu. [E-mail: wrdsec@tn.gov.in]
18. Spl. Chief Secretary (Irrigation & CAD), Govt. of Telangana. [E- mail: secy-irg@telangana.gov.in]
19. Secretary (PWD), Government of Tripura. [E-mail: splsecyudd@gmail.com, kirangitteias@gmail.com]
20. Secretary (Irrigation), Government of Uttarakhand. [E-mail: secy.pr.uk@gmail.com]
21. Principal Secretary (Irrigation & WR), Govt. of Uttar Pradesh. [E- mail: ps.irrup@gmail.com; psag71@gmail.com]
22. Principal Secretary, (Irrigation & Waterways Deptt.), Govt. of West Bengal. [E-mail: iwd.prsecy@gmail.com]
23. Secretary (PWD), Government of Andaman & Nicobar Island. [E-mail: Secretary.shipping.pwd.201@gmail.com]
24. Secretary (Irrigation & Flood Control Deptt.), Government of Jammu & Kashmir. [E-mail: jkirrigationandfloodcontrol@gmail.com]
25. Commissioner Secretary, Public Health Engineering/Irrigation & Flood

Control, Civil Secretariat, Leh, Ladakh. [E-mail: pstocomsecutl@gmail.com]

(C) SCDS of States/UTs

1. Chairman, State Committee on Dam Safety, Andhra Pradesh. [Email: encirrigationap@gmail.com]
2. Chairman, State Committee on Dam Safety, Arunachal Pradesh. [Email: cewrdplan@gmail.com, cewrditanagar@gmail.com]
3. Chairman, State Committee on Dam Safety, Assam. [Email: bibhu.bhuyan@apgcl.org]
4. Chairman, State Committee on Dam Safety, Bihar. [Email: eicirrwrdbihar@gmail.com]
5. Chairman, State Committee on Dam Safety, Chhattisgarh. [Email: enc@cgwrd.in, osd.encwrd@gmail.com]
6. Chairman, State Committee on Dam Safety, Goa. [Email: ce- wrd.goa@nic.in]
7. Chairman, State Committee on Dam Safety, Gujarat. [Email: secwr@gujarat.gov.in]
8. Chairman, State Committee on Dam Safety, Haryana. [Email: hodspecial@yahoo.com]
9. Chairman, State Committee on Dam Safety, Himachal Pradesh. [Email: ceenergy09@gmail.com]
10. Chairman, State Committee on Dam Safety, Jharkhand. [Email: eicl-wrd- jhr@nic.in]
11. Chairman, State Committee on Dam Safety, Karnataka. [Email: secytech-wr@karnataka.gov.in, prs-r@karnataka.gov.in]
12. Chairman, State Committee on Dam Safety, Kerala. [Email: ceirrgn@yahoo.co.in]
13. Chairman, State Committee on Dam Safety, Madhya Pradesh. [Email: encwrbpl@mp.nic.in]
14. Chairman, State Committee on Dam Safety, Maharashtra. [Email: psec.cad@maharashtra.gov.in]
15. Chairman, State Committee on Dam Safety, Manipur. [Email: ceifcdmanipur@yahoo.com; r.alimmei22@gmail.com]
16. Chairman, State Committee on Dam Safety, Meghalaya. [Email: msshangpliang@gmail.com, pce_meecl@yahoo.in]
17. Chairman, State Committee on Dam Safety, Mizoram. [Email: cephed.hqrs@gmail.com, eincphedmz@rediffmail.com]
18. Chairman, State Committee on Dam Safety, Nagaland. [Email: encesttbranch@gmail.com]
19. Chairman, State Committee on Dam Safety, Odisha. [Email: eic- wr.od@nic.in]
20. Chairman, State Committee on Dam Safety, Punjab. [Email: cesdsopb@gmail.com]
21. Chairman, State Committee on Dam Safety, Rajasthan. [Email: ceswrpdlo@rediffmail.com, ceswrpd.wr@rajasthan.gov.in]
22. Chairman, State Committee on Dam Safety, Sikkim. [Email: secypower.sikkim@gmail.com]
23. Chairman, State Committee on Dam Safety, Tamil Nadu.

[Email: eicwrdtn@gmail.com]
24. Chairman, State Committee on Dam Safety, Telangana.
[Email: encgeneralts.irr@gmail.com]
25. Chairman, State Committee on Dam Safety, Tripura.
[Email: cetripura@yahoo.com]
26. Chairman, State Committee on Dam Safety, Uttarakhand.
[Email: hodcamp.id@gmail.com]
27. Chairman, State Committee on Dam Safety, Uttar Pradesh.
[Email: eincididuplu-up@nic.in, engineerinchiefidup@gmail.com]
28. Chairman, State Committee on Dam Safety, West Bengal .
[Email:secretary.iwdept@gmail.com]
29. Chairman, UT Committee on Dam Safety, A&N Island.
[Email: sepbcc2021@gmail.com]
30. Chairman, UT Committee on Dam Safety, Jammu & Kashmir.
[Email: edciviljkspdc2@gmail.com]
31. Chairman, UT Committee on Dam Safety, Ladakh.
[Email: cepheifcladakh@gmail.com]

(D) SDSO of States/UTs

1. Chairman, State Dam Safety Organisation, Andhra Pradesh.
[Email: ce_hydrology@ap.gov.in]
2. Chairman, State Dam Safety Organisation, Arunachal Pradesh.
[Email: samanronrang@gmail.com]
3. Chairman, State Dam Safety Organisation, Andaman & Nicobar.
[Email: ceapwd@and.nic.in]
4. Chairman, State Dam Safety Organisation, Assam.
[Email: saurav.saikia@apgcl.org]
5. Chairman, State Dam Safety Organisation, Bihar. [Email: sdsobihar@gmail.com]
6. Chairman, State Dam Safety Organisation, Chhattisgarh.
[Email: cemrp@cgwrd.in, rakeshnagaria@gmail.com]
7. Chairman, State Dam Safety Organisation, Goa.
[Email: ankush.gaunker@gmail.com]
8. Chairman, State Dam Safety Organisation, Gujarat.
[Email: ce-ng-nwrws@gujarat.gov.in]
9. Chairman, State Dam Safety Organisation, Haryana.
[Email: mahadev395@gmail.com]
10. Chairman, State Dam Safety Organisation, Himachal Pradesh.
[Email: djjayin@gmail.com]
11. Chairman, State Dam Safety Organisation, Jammu & Kashmir.
[Email: babbisharma803@gmail.com]
12. Chairman, State Dam Safety Organisation, Jharkhand.
[Email: cedesign-wrd-jhr@nic.in]
13. Chairman, State Dam Safety Organisation, Karnataka.
[Email: cedsobengaluru@gmail.com]
14. Chairman, State Dam Safety Organisation, Kerala.
[Email: cedamsafety@gamil.com]
15. Chairman, State Dam Safety Organisation, Ladakh.
[Email:cepheifcladakh@gmail.com]
16. Chairman, State Dam Safety Organisation, Madhya Pradesh.
[Email: sdso_bhopal@yahoo.co.in, encwrbpl@mp.nic.in]
17. Chairman, State Dam Safety Organisation, Maharashtra.
[Email: cehpswnasik@gmail.com]
18. Chairman, State Dam Safety Organisation, Manipur.

[Email: drip.manipur@gmail.com]
19. Chairman, State Dam Safety Organisation, Meghalaya.
    [Email: bloomingwahlang@gmail.com]
20. Chairman, State Dam Safety Organisation, Mizoram.
    [Email: chhetryanup@gmail.com]
21. Chairman, State Dam Safety Organisation, Nagaland.
    [Email: addlcec.kohima@gmail.com]
22. Chairman, State Dam Safety Organisation, Odisha.
    [Email: cedamsafety.odisha@gmail.com]
23. Chairman, State Dam Safety Organisation, Punjab. [Email:cesdsopb@gmail.com]
24. Chairman, State Dam Safety Organisation, Rajasthan.
    [Email: ceswrpd.wr@rajasthan.gov.in]
25. Chairman, State Dam Safety Organisation, Sikkim. [Email: rabi2006@gmail.com]
26. Chairman, State Dam Safety Organisation, Tamil Nadu.
    [Email: ceomwro@gmail.com]
27. Chairman, State Dam Safety Organisation, Telangana.
    [Email: sdsotelangana2022@gmail.com]
28. Chairman, State Dam Safety Organisation, Tripura.
    [Email: managing.director@tsecl.in]
29. Chairman, State Dam Safety Organisation, Uttar Pradesh.
    [Email: cedesigniduplu-up@nic.in, ce.sdsoidup-lu@up.gov.in]
30. Chairman, State Dam Safety Organisation, Uttarakhand.
    [Email: ce.ddn.id@gmail.com]
31. Chairman, State Dam Safety Organisation, West Bengal.
    [Email: ce-dr@wbiwd.gov.in]

(E) Central PSUs

1. CMD, NHPC, NHPC Office Complex, Sector-33, Faridabad .
   [Email: cmd@nhpc.nic.in]
2. CMD, NTPC, NTPC Bhawan, SCOPE Complex, Institutional Area, Lodhi Road, New Delhi —110003. [Email: ntpccc@ntpc.nic.in]
3. Chairman, BBMB, Sector 19-B, Madhya Marg, Chandigarh-160019.
   [Email: cman@bbmb.nic.in]
4. CMD, SJVNL, Shakti Sadan, Corporate Head Quarter, Shanan, Shimla, HP.
   [Email: sectt.cmd@sjvn.nic.in]
5. CMD, THDC, Corporate Office, Rishikesh, Pragatipuram, By Pass Road, Rishikesh-249201. [Email:cmd@thdc.co.in]
6. Company Secretary and Nodal Officer, Hindustan Zinc Limited Yashad Bhawan Udaipur, Rajasthan. [Email: rajendra.pandwaI@vedanta.co.in]
7. CMD, Kudremukh Iron Ore Company Limited. [Email: cmd@kioclltd.com]
8. Chairman & Managing Director - additional charge NEEPCO Ltd., Lower New Colony, Shillong-793003. [Email: cmdneepco@neepco.co.in]
9. Chairman DVC, DVC Headquarter, VIP Road Kolkata .
   [Email chairman@dvc.gov.in]

सत्यमेव जयते

Dam Safety Act, 2021

National Committee on Dam Safety

Minutes of the 3rd Meeting

5th December 2023
14:30 – 18:30 hours
209, 2nd Floor Conference Room
Central Water Commission, New Delhi

Ministry of Jal Shakti
Government of India
NDSA Secretariat
New Delhi

Minutes of Meeting

The 3rd meeting of National Committee on Dam Safety (NCDS) was held on 5th December, 2023 under the chairmanship of Sh. Kushvinder Vohra, Chairman, CWC & NCDS. The meeting was attended by members the National Committee. The list of participants who attended the meeting is attached as **Annexure-I**.

At the outset of the meeting, Chairman, NCDS and CWC welcomed all the participants in the 3rd meeting of NCDS. Chairman of the committee informed the committee members that the main agenda for today's meeting will be finalization of nine (9) draft regulations and approval of constitution of two (2) sub-committees, and the other agenda points will be deliberated after these agenda points. Thereafter, Chairman of the committee asked Member Secretary, NCDS to take up the agenda points. Accordingly, Member (Policy & Research), NDSA and Member Secretary, NCDS presented the power-point presentation on the agenda points stated as per below: -

3.0 Confirmation of minutes of 2nd meeting of NCDS

Member Secretary, NCDS informed that the minutes of the 2nd meeting of NCDS were circulated vide letter no. T-20078/3/2023-DSD-2 dated 30.06.2023. He told that no comments on the minutes have been received from members of the committee, therefore, the minutes may be considered approved. Accordingly, the minutes of 2nd meeting were approved the committee.

3.1 Formation of Rules and Regulations under section 54 of Dam Safety Act, 2021

Member Secretary informed that in the 2nd meeting of NCDS, 7 regulations prepared under section 54 (2) (c), (d), (e), (g), (h), (o), and (q) were finalized and approved by the committee. Accordingly, these regulations were forwarded to the PR wing, DoWR for further action. The detail of these regulations is enclosed as **Annexure-II**.

He further informed that in addition to above, 9 draft regulations as per section 54 (2) (a), (i), (j), (k), (l), (m), (n), (p), and (r) were prepared and shared with NCDS/NDSA members and State WRDs for comments. The comments were received from SDSOs of Karnataka, Uttarakhand, Keral State Electricity Board (KSEB), Prof CVR Murty (expert member NCDS), Sh. D.K. Sharma (expert member NCDS), Members of NDSA, NDMA and IMD. Accordingly, these draft regulations were modified, incorporating the suggestions/comments received from various agencies/experts and were placed before committee for approval.

Accordingly, the above cited 9 regulations were deliberated in detail, and of which 7 regulations were approved by the committee. The deliberations and decision taken on the 9 regulations are given below as:

A*. *<u>Regulations require revision</u>

1. *54 (2) (a) "the guidelines, standards and other directions for achieving the satisfactory level of dam safety assurance under sub-section (1) of section 16".*

<u>Deliberations held</u>: -

The draft content of the regulation was presented before the committee members. On reviewing the content, following suggestions were instructed to be incorporated in the content:

(a) <u>Keep perpetual surveillance</u>

It was observed that surveillance is not explicitly defined and how operation & maintenance of the dam is linked with surveillance of dam. JS (RD & PP), DoWR advised to define surveillance clearly and enquired whether this surveillance shall be manual or instrument based. Sh. D. K. Sharma, Expert Member informed that surveillance is carried out to observe three major anomalies i.e. crack in the body of the dam or abutment, unusual seepage and deflection in the dam body, therefore, these aspects needs to be consider while defining surveillance. He also suggested that as these regulations will be tabled before Parliament, therefore, these should be published in public domain for their opinion. In response to this, Member Secretary informed that these regulations have been finalized after taking suggestions from all stakeholders. Also, Chairman NCDS opined that these regulations are of technical nature, hence, do not require public opinion. However, in case it is felt that these should be shared in public domain, it will be taken care.

Chairman NCDS advised that the content of this part need to be modified and it should be clearly stated as to what are the critical aspects which are to be kept in mind by the dam owners while carrying out surveillance.

(b) <u>Carry out inspection</u>

Similar to the above, Chairman NCDS suggested that the content of this aspect may be seen again and any natural event like major flood etc. should be explicitly defined. He also said that in the last meeting of NCDS, one regulation pertaining to inspection of dam was approved, therefore, the same regulation may be linked with the content of this also.

(c) Monitoring the operation and maintenance

Chairman NCDS further mentioned that narration of this aspect needs revision and opined that guidelines for preparation of Operation & Maintenance manual shall be referred here for preparing this document and these manuals should be approved by concerned Dam Safety Unit (DSU).

Decision taken:

Chairman of the committee after detailed deliberations decided that the content of this regulation need to be re-looked and may be put up in next meeting of the committee for approval.

2. 54 (2) *(k) The data requirements of hydro-meteorological stations in the vicinity of specified dams under sub-section (1) of section 33;*

Deliberations held: -

Sh. D. K. Sharma, NCDS Expert Member pointed out that time interval (10 years) kept for sedimentation survey of dam is kept on higher side, so, it needs revision. There is possibility that in 10 years interval, the dam storage may get reduced considerably due to siltation.

Chairman of the committee pointed out that the content of the regulation does not spell out the density of instruments to be installed in the catchment/dam vicinity. Also, the regulation does not speak about the already installed instruments in the catchment by State/Central Government agencies. Also, the vicinity is not defined in the content of the regulation, which need to be explicitly defined.

Sh. PV Raju, Group Director, NRSC suggested that vicinity in the regulation may be defined as the direct catchment which feeding to the dam. This will assist in gathering of data and understanding the inflows into the dams. To this, Sh. D. K. Sharma informed that considering complete catchment for dam in many cases could be very expensive process. For example, catchment area of Bhakra dam is very large and if go for installation of instruments in its catchment, it would be expensive. In response to Sh. D. K. Sharma comments, Group Director NRSC informed that already there will be instruments existing in the catchment area, we just need to fill the vacant portion of the catchment so that exact inflow can be assessed. So, this aspect can be looked into while framing the regulation.

Joint Secretary (RD & PP), DoWR also advised that the regulation should define the number of instruments for a catchments area and that area need to be quantified.

Decision taken: -

Chairman of the committee directed that the regulation may be re-looked and modifications required to be incorporated in the draft. Accordingly, the regulation may be put up in the next meeting of the committee for approval.

B. Regulations approved by the committee

The following regulations were discussed in detail by the committee members: -

1. **54 *(2) (i)*** *The minimum number of set of instrumentations in the specified dams and the manner of their installation under sub-section (1) of section 32;*

2. **54 (2) (j)** "the form, manner and time interval for forwarding the analysis of readings to the State Dam Safety Organization under sub-section (2) of section 32";

3. **54 (2) (l)** "the data requirements of seismological stations in the vicinity of specified dams under sub-section (1) of section 34";

4. **54 (2) (m**) "the suitable location and manner of collection, compliance, process and storage of data under sub-section (2) of section 34";

5. **54 (2) (n)** "the time interval of risk assessment studies to be carried out under sub-section (2) of section 35";

6. **54 (2) (p)** "the time interval for the comprehensive safety evaluation of specified dams under sub-section (1) of section 38";

7. **54 (2) (r)** "the mandatory site-specific seismic parameter studies of existing specified dams under clause (c) of sub-section (2) of section 38".

After the detailed and in-length deliberations, the above seven regulations were approved by the committee with slight modifications. The final content of the approved regulations is enclosed as **Annexure-III**.

3.12 Constitution of sub-committee

It was informed that in the last meeting of NCDS two sub-committees namely were "*Structural Engineering & Earthquake Safety of Dams*" and "*Capacity Development*" and accordingly, its constitution order along with Terms of Reference (ToR) were issued vide order dated 18.10.2023.

Member Secretary, NCDS further informed that draft constitution of two additional sub-committees namely *"Dam Safety Management" and "Monitoring and Instrumentation"* have been proposed with following composition for the consideration and approval of the committee:

A. Composition of sub-committees on "Dam Safety Management"

1.	Dr. R K Gupta, Formerly Chairman, CWC	Chairman
2.	Representative of NIH (Sh Sanjay Jain, Sc-F, NIH Roorkee)	Member
3.	Representative of IIT (Prof S K Mishra, Dept. of WRD & Management, IIT Roorkee)	Member
4.	Representative of State (Sh Vivek Kapadia, CE, WRD, Gujarat)	Member
5.	Representative of NHPC (Sh Y K Chaube, Formerly ED, NHPC)	Member
6.	Director NDSA	Member Secretary

B. Composition of sub-committee on "Monitoring and Instrumentation"

1.	Sh. J C Iyer, Formerly Chairman, CWC	Chairman
2.	Representative of CSMRS (Sh S L Gupta, Formerly Director, CSMRS/ Sh Hari Dev, Scie-E, CSMRS)	Member
3.	NDSA Expert (Prof. Samit Ray Chaudhuri, Dept. of Civil Engg., IIT Kanpur)	Member
4.	Representative of CWPRS (Sh PD Kamalasekaran, Scientist-E, CWPRS, Pune)	Member
5.	Representative from AIMIL/NIRM	Member
6.	Director NDSA	Member-Secretary

Deliberations held: -

Sub-committees on "Dam Safety Management":

Chairman, NCDS opined that the sub-committees should be constituted by considering representation from any State/PSU instead of proposing name. The name of experts should be taken from the Department/Agency proposed in the committee. He also advised that since State of Maharashtra is having maximum number of specified dams in the country, their representation in the proposed sub-committee may be kept. It was also deliberated that representation from BBMB shall also be taken in the proposed sub-committee.

Sub-committees on "Monitoring and Instrumentation":

Similarly, to the above, it was suggested that the composition of this sub-committee shall also be revised and representation of agency/department should be kept instead of name of expert. Also, it was advised to keep representation of NIRM for the sub-committee.

Decision taken: -

The two sub-committee(s) namely *"Dam Safety Management" and "Monitoring and Instrumentation"* were approved by the committee members with minor proposed modifications along with proposed Terms of Reference (ToR). The final approved composition of both the sub-committees and ToR is given below: -

A. Approved composition of Sub-committees on "Dam Safety Management"

1.	Dr. R K Gupta, Formerly Chairman, CWC	Chairman
2.	Representative of NIH	Member
3.	Representative of IIT Delhi	Member
4.	Representative of State of Maharashtra	Member
5.	Representative of NHPC	Member
6.	Representative of BBMB	Member
7.	Director NDSA	Member Secretary

ToR of the sub-committee: -

1. Review and update the guidelines on Dam Inspection.
2. Review and update guideline on Emergency Action Plan (EAP).
3. Prepare guideline on Risk Classification.
4. Review and update draft regulation as per section 54(2)(a) of the Dam Safety Act-2021: "The guidelines, standards and other directions for achieving the satisfactory level of dam safety assurance under sub-section (1) of section 16".
5. Render technical advice on any other related matter as & when referred to it by NCDS.

B. Approved composition of Sub-committees on "Monitoring and Instrumentation"

1.	Sh. J C Iyer, Formerly Chairman, CWC	Chairman
2.	Representative of CSMRS	Member
3.	Representative of IIT Kanpur	Member
4.	Representative of CWPRS	Member
5.	Representative of NIRM	Member
6.	Director NDSA	Member-Secretary

ToR of the sub-committee: -

1. To prepare guideline for Monitoring and Instrumentation of dams.
2. Review and update the regulation as per section 54(2) of the Dam Safety Act-2021 on the "the minimum number of set of instrumentations in the specified dams and the manner of their installation under sub-section (1) of section 32";
3. Render technical advice on any other related matter as & when referred to it by NCDS.

Closing remarks by Chairman NCDS

At the end of the meeting, Chairman NCDS appreciated the contribution of the committee members in finalization of seven (7) regulations and two sub-committees. He further stated that due to exhaustive discussions/deliberations on the regulations, other agenda points could not be taken up during the proceedings of the meeting because of the paucity of time. He mentioned that all the left out agenda points will be taken up for discussion in the next committee meeting along with new agenda items, if any.

The meeting ended with vote of thanks to the Chair.

****

Annexure-I

List of Participants

S.no.	Name	Designation
Chairman NCDS		
1.	Sh. Kushvinder Vohra	Chairman CWC & Ex-Officio Secretary to the Govt. of India
Representative of Central Government		
2.	Sh. Sanjay Kumar Sibal	Chairman, NDSA & Member (D&R), CWC
3.	Sh. Anand Mohan	JS (RD& PP), DoWR, RD & GR
4.	Sh. Safi Ahsan Rizvi	Advisor (Mitigation), NDMA
5.	Sh. Sharvan Kumar	Chief Engineer (HPA), CEA
6.	Dr. P.V. Raju	Group Director, NRSC
7.	Ms. Neetu Chauhan	Director, GSI
8.	Dr. Prakash Kumar	Director, CSIR-NGRI
9.	Dr. S K Manik	Scientist D, IMD
10.	Dr. Saurabh Upadhyay	Scientist C, MoEF &CC
State Government/agencies		
11.	Sh. K. A. Patel	Secretary Water Resource, Gujarat
12.	Sh. M. D. Patel	Chief Engineer, Gujarat WRD
13.	Sh. Rakesh Kumar	Engineer-in- Chief, Irrigation Creation, WRD Bihar
14.	Sh. T. V. N. A. R. Kumar	Chief Engineer, Hydrology & SDSO, Andhra Pradesh
15.	Sh. Remmei Alimmei	Chief Engineer, WRD, Manipur
16.	Sh. Deepak Jasrotia	Dy. Chief Engineer, Power Deptt., Himachal Pradesh
17.	Sh. Manish Parihar	Director Dam, ID&R unit, Jaipur, Rajasthan
18.	Sh. Sunil Gupta	EE, ERD-1, ID&R, Jaipur, Rajasthan
Specialists in Dam Safety and allied fields		
19.	Sh. D. K. Sharma	Chairman, HPERC
Special Invitees		
20.	Sh. Anil Jain	Member (Disaster & Resilience), NDSA
21.	Sh. Vivek Tripathi	Member (Technical), NDSA
22.	Sh. S.D. Sharma	Member (Regulation), NDSA
Member Secretary		
23.	Sh. Vijai Saran	Member (Policy & Research), NDSA

Annexure-II

07 regulations approved in 2nd meeting of NCDS

1. 54 (2) (c) "the details and form pertaining to the maintenance of log books or database under sub-section (1) of section 18";
2. 54 (2) (d) "the qualifications, experience and training of the individuals responsible for safety of specified dams under section 23";
3. 54 (2) (e) "the employment of competent engineers and their qualifications and experience for the purpose of investigation, design and construction of specified dams under sub-section (3) of section 26";
4. 54 (2) (g) "the level of competent engineers for the dam safety units under section 30";
5. 54 (2) (h) "the guidelines and check-lists for inspection of specified dams under clause (a) of sub-section (3) of section 31";
6. 54 (2) (o) "time interval for updating the emergency action plan under clause (b) of sub-section (1) of section 36";
7. 54 (2) (q) "the mandatory review of design flood of existing specified dams under clause (b) of sub-section (2) of section 38".

Annexure-III

07 regulations under Section 54 (2) of Dam Safety Act, 2021 approved by NCDS during 3rd meeting held on 05.12.2023

54 (2) (i) ***The minimum number of set of instrumentations in the specified dams and the manner of their installation under sub-section (1) of section 32;***

Section 32. (1) Every owner of a specified dam shall have a minimum number of such instrumentations at each specified dam, and installed in such manner as may be specified by the regulations for monitoring the performance of such dam.

Minimum number of set instrumentation for monitoring the performance of specified dam:

Type	**Feature**	**Movements**	**Uplift and pore pressure**	**Water levels**	**Seepage/Leakage flows**	**Temperature**	**Crack and joint movement**	**Stress-strain**
Embankment Dams	Upstream slope	–	–	●	–	–	–	–
	Downstream slope	●	●	–	●	●	●	–
	Abutments	●	●	–	●	●	–	–
	Crest	●	●	–	–	–	●	–
	Internal drainage system	–	●	–	●	●	–	–
	Relief Well	–	●	–	●	–	–	–
	Riprap and other slope protection	–	–	–	–	–	–	–
Concrete and Masonry Dams	Upstream slope	●	–	●	–	●	●	●
	Downstream slope	●	●	–	–	●	●	●
	Abutments	●	●	–	●	–	–	●
	Crest	●	●	–	–	●	●	●
	Internal drainage system	–	–	–	●	–	–	–
	Drainage Holes	–	●	–	●	–	–	–
	Intermediate Galleries	●	–	–	●	–	●	●
	Foundation Gallery	●	●	–	●	–	●	●
	Stilling basin	–	●	●	–	–	–	–
Barrages	Upstream of the barrage axis	–	–	●	–	–	–	–
	Downstream of the barrage axis	–	–	●	–	–	–	–
	Joints between the toe of abutments and the first and last barrage bay floor	●	–	–	–	–	–	–

Note:

- The minimum set of required instruments as specified above shall be applicable. However, since each dam is unique, the additional instruments, if required shall be installed considering site conditions and using engineering judgement.
- The re-instrumentation in the existing dams should be done as governed by the site requirement, feasibility and local conditions without causing damage to the structure.
- The instruments shall be installed in a way that the same does not become non-functional due to construction activity.
- For seismic instruments location and number, regulation 54 (2) (l) - "the data requirements of seismological stations in the vicinity of specified dams under sub-section (1) of section 34" may be referred.

Manner of installation of instruments:

- Installation of instrumentation shall be done in consultation and coordination of Designers/Engineering consultants with instrument manufacturers or suppliers who will provide assistance with instrument selection, installation, calibration, maintenance and future troubleshooting.
- Supplier/Manufacturer shall provide the necessary training/demonstration related to installation, operation and maintenance of the instruments to those persons responsible for data monitoring to ensure that the Instrumentation fulfil its mandated purpose.
- Technical documentation shall include the technical requirements of the instruments, calibration requirements, installation report, servicing requirements and methods.
- The Installation report shall contain the following basic information:
    - Details of location of instruments
    - Serial numbers/ Identification number of installed instruments
    - Initial calibration readings Initial field readings with associated data (e.g. headwater and tail-water elevations, temperature, antecedent rainfall, weather conditions etc.)
    - Plans and sections sufficient to show instrument numbers and locations
    - Appropriate surface and sub-surface strata graphic and geotechnical data
    - Descriptions of instruments and readout units including manufacturer's literature and performance specifications (photographs are often helpful)
    - Details of calibration procedures
    - Details of installation procedures (photographs are often helpful) as well as the steps necessary for operation (i.e. troubleshooting concerns, connection to data loggers, etc)
    - Initial readings of the installed instruments.

54 (2) (j) ***The form, manner and time interval for forwarding the analysis of readings to the State Dam Safety Organisation under sub-section (2) of section 32;***

Section 32. (2) Every owner of the specified dam shall maintain a record of readings of the instrumentations referred to in sub-section (1) and forward the analysis of such readings to the State Dam Safety Organisation, in the form, manner and at such interval as may be specified by the regulations.

Record of readings of the instrumentations to be maintained by owners of specified dams:

a) Manual readings collected from instruments or standalone data loggers :

- Readings shall be recorded either in a field book or on specially prepared field data sheets.
- Project name, instrument type, date, time, observer name, readout unit number, instrument number, readings, remarks, weather, temperature, construction activity, and any other factors that might possibly influence the readings may be clearly indicated in the format for collection of readings.
- The latest readings shall be compared immediately with previous readings so that changes can be verified as real or as errors caused by misreading or instrument malfunction.
- Registers of records for all instruments shall be properly indexed, indicating page numbers and maintained at safe location with responsible project personnel.
- All the instrumentation data recorded manually, shall be digitized for storage, analysis and retrieval.
- The digitized raw data shall be maintained at multiple locations to guard against loss.
- The raw data shall be analyzed for any errors and necessary corrections shall be made. The processed data shall also be stored at multiple locations in digital format along with raw data.

After proper certification of the stored digital data of its accuracy, the manual records can be destroyed.

b) Automatic Data Acquisition System:

The frequency of data acquisition shall be set as per requirement of each data set. The frequency of data acquisition may be reviewed to incorporate any abnormal/abrupt changes in the concerned parameters. This data shall also be stored at multiple locations to prevent data loss. Wherever needed both manually and automatically collected data shall be suitably merged while storing in digital form.

The form and manner of readings/data:

The data/analyses of data shall be made available to the SDSOs in the format prescribed by them.

Interval to forward the analysis of such readings to the State Dam Safety Organisation (SDSO):

a) Existing dams: An interpretation report based on the analyses of instrumentation data may be prepared by the dam unit containing the data plots for all the instrumentation of the dam indicating variations and possible causes thereof on a half yearly basis, preferably along with the pre and post monsoon inspection. However, in case of an emergent situation, when there are abnormalities in the observed data or otherwise, calling for an immediate action/remedial measure, the SDSO may be reported immediately, and on real time basis, thereafter.

b) Under Construction dams: For these dams, the frequency of forwarding of analysis may be according to monitoring schedule governed by the design & construction requirement and stage of the project.

In this case also, if there is sudden change or abnormality in the observed data or otherwise, which may require an immediate attention, the frequency of observation shall be increased as per the field requirement, depending on the emergency condition.

Note: It is advised that automation of instrumentation is to be preferred wherever possible and shall be done as per feasibility in the existing dams. In case of new dams all instrumentation should be fully automated.

54 (2) (l) The data requirements of seismological stations in the vicinity of specified dams under sub-section (1) of section 34;

Section 34. (1): In the case of every specified dam, having a height of thirty metres or above or falling under such seismic zone, as may be specified by the regulations, the owner of the specified dam shall establish a seismological station in the vicinity of each such dam for recording micro and strong motion earthquakes and such other data as may be specified by the regulations.

Strong-motion accelerographs (SMA) for recording potentially destructive ground shaking and resulting dam vibrations; and seismographs for determining the local seismicity are required to be installed at each specified dams as described below:

S. No.	**Seismic Zone (as per IS code 1893 (Part-1) 2016)**	**Dam Ht. (H) in meters**	**No. of Strong Motion Accelerograph (SMA)**	**No. of Seismograph**
1.	**II and III**	30<H<100	At least four (4) nos. instruments as mentioned below. One at foundation gallery/ a location at the d/s toe of the dam (if the foundation gallery is not present) and the other at the top of the dam and one in the free-field (3-4 times dam height i.e. H from dam body or base, preferably on the upstream side) and one on either abutment have to be installed.	
		H≥100	All dams with H≥100 m should be instrumented comprehensively as per the schemes indicated in the Figure 1 (Arch dam – 9 nos.), Figure 2a (Gravity dam – 6 nos.) & Figure 3a (Embankment dam –6 nos.), below for Arch, Gravity &Embankment dams respectively.	A single station near vicinity of the dam (nearest possible location, if possible, within 1 Km from dam). If at least 25 events with magnitude above 2.5 are recorded within 50 km distance and within a year, a local network as prescribed by NCSDP guidelines shall be provided. However, a network of at least 3 stations should be operated for at least three years. These observations will have to be continued if such seismic events with similar frequency observed even after three years.
2.	**IV and V**	30≤H<100	At least four (4) nos. instruments as mentioned below. One at foundation gallery/ a location at the d/s toe of the dam (if the foundation gallery is not present) and the other at the top of the dam and one in the free-field (3-4 times dam height i.e. H from dam body or base, preferably on the upstream side) and one on	

			either abutment have to be installed.	
		H≥ 100	For dams of height more than 100 m, at least one spillway monolith of greatest height should be chosen. If there are any special foundation conditions with concerns of sliding/ slope instability, such locations should also be provided with one SMA at the base of the slope/ at the foundation feature. All dams with H≥100 m should be instrumented comprehensively as per the schemes indicated in the Figure 1 (Arch dam – 9 nos.), Figure 2b (Gravity dam – 10 nos.) & Figure 3b (Embankment dam – 9 nos.) below for Arch, Gravity& Embankment dams respectively.	A single station near vicinity of the dam (nearest possible location, if possible, within 1 Km from dam). If at least 100 events with magnitude above 2.5 are recorded within 50 km distance and within a year, a local network as prescribed by NCSDP guidelines shall be provided. However, a network of at least 3 stations should be operated for at least three years. These observations will have to be continued if such seismic events with similar frequency observed even after three years.

For Composite dams:
In the case of composite dams, the instrumentation requirement for embankment and concrete/masonry part of the dam shall be as specified for embankment and concrete gravity dams.

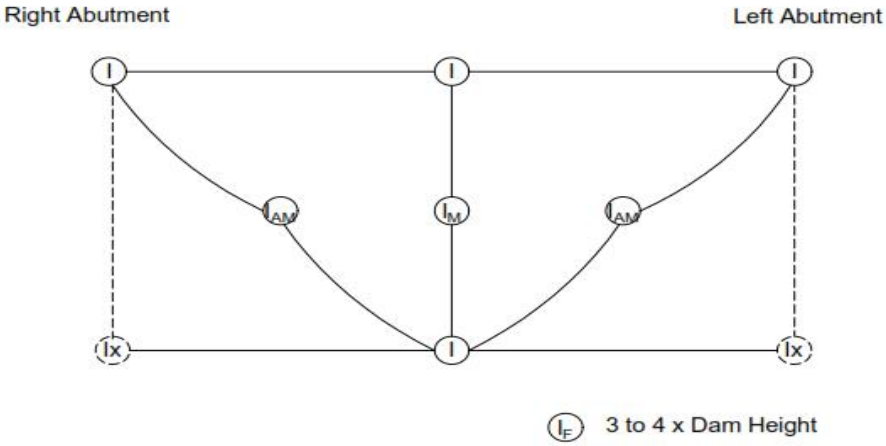
General:
For planning of instruments in the dam above table may be referred. However, if length of the dam is more than 500m then additional instrument may be installed as described below:

(i) For every 500m increase in length of the dam one additional Strong Motion Accelerographs (SMAs) may be installed on dam top and correspondingly one more Strong Motion Accelerographs (SMAs) may be installed in gallery.

In such cases, wherein the dam layout comprises of independent dams of different types across multiple channels with intervening abutments, then each of them should be considered as independent dams for applicability of provisions according to the criteria specified above.

1.1 Arch dams

Instrumentation schemes: **Strong Motion Accelerographs (**SMAs**)** instruments as shown in Figure 1 for Arch dams.

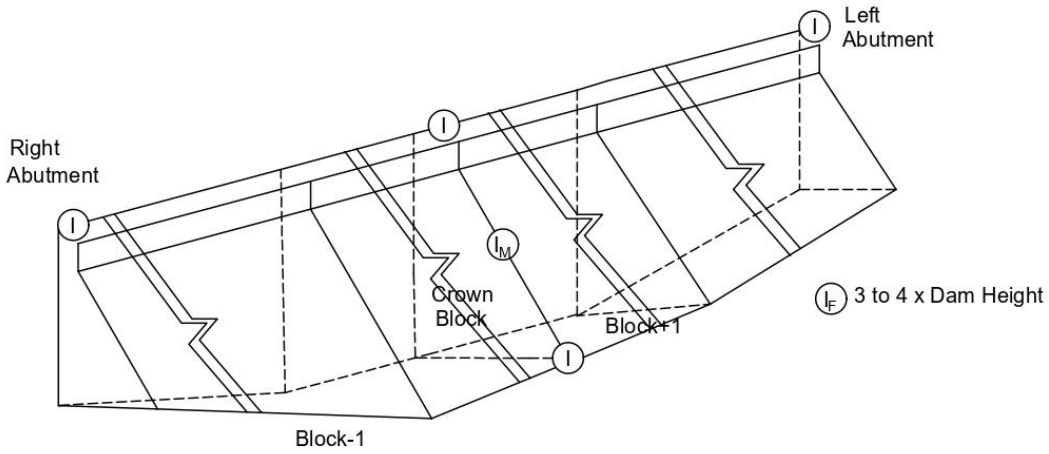


I: Strong Motion Accelerographs (SMA)
Ix:Strong Motion Accelerographs (SMA) either on left abutment side or right abutment side
I_F: Free Field Motion Strong Motion Accelerographs (SMA), to be placed at 3 to 4 times of Dam Height (H) from Dam body or base
I_M: Strong Motion Accelerographs (SMA), to be placed in the middle height portion of Dam (preferably having deepest section)
I_{AM}: Strong Motion Accelerographs (SMA), to be placed in the middle height portion of Dam Abutment

Figure- 1. Accelerograph arrays for arch dams (Downstream View)

1.2 Gravity dams

Instrumentation schemes: **Strong Motion Accelerographs (**SMAs**)** instruments as shown in Figure 2a and 2b for Gravity dams.

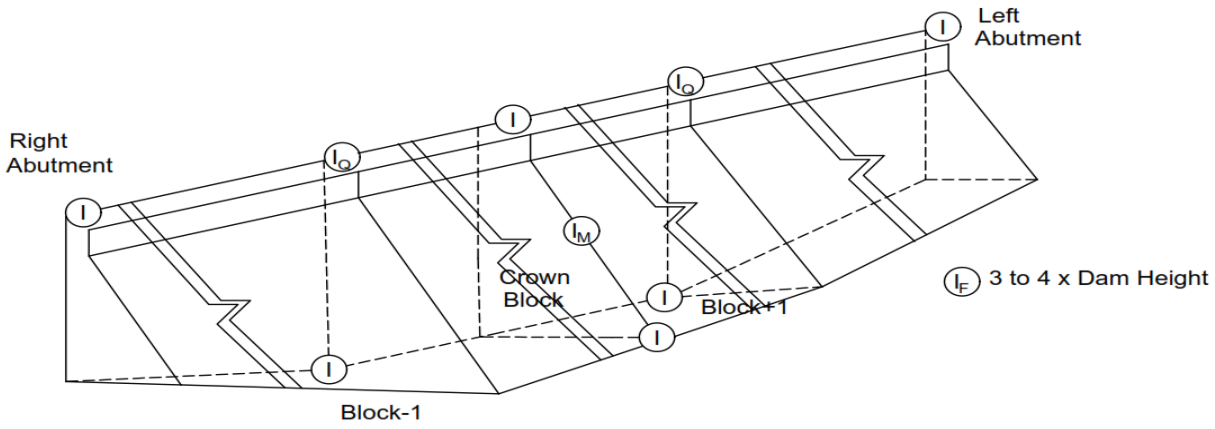


I: Strong Motion Accelerographs (SMA)

I_F: Free Field Motion Strong Motion Accelerographs (SMA), to be placed at 3 to 4 times of Dam Height (H) from Dam body or base

I_M: Strong Motion Accelerographs (SMA), to be placed in the middle height portion of deepest block

Figure 2a Accelerograph arrays for Gravity dams Seismic Zone II & III



I: Strong Motion Accelerographs (SMA)

I_F: Free Field Motion Strong Motion Accelerographs (SMA), to be placed at 3 to 4 times of Dam Height (H) from Dam body or base

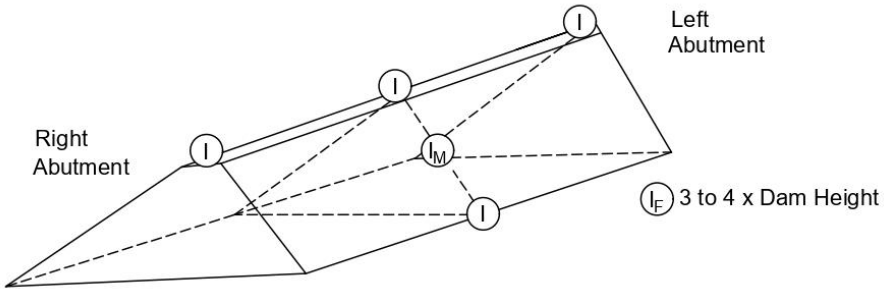
I_Q: Strong Motion Accelerographs (SMA), to be placed at quarter block (symmetrical to the central block)

I_M: Strong Motion Accelerographs (SMA), to be placed in the middle height portion of deepest block

Figure 2b Accelerograph arrays for Gravity dams Seismic Zone IV & V

1.3 Embankment dams:

Instrumentation (schemes): **Strong Motion Accelerographs (**SMAs**)** instruments as shown in Figure 3a and 3b for embankment dams.

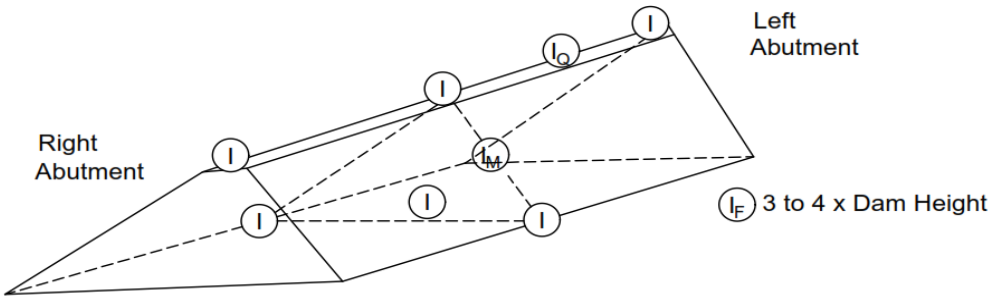


I: Strong Motion Accelerographs (SMA)

I_F: Free Field Motion Strong Motion Accelerographs (SMA), to be placed at 3 to 4 times of Dam Height (H) from Dam body or base

I_M: Strong Motion Accelerographs (SMA), to be placed in the middle height portion of Dam (preferably having deepest section)

Figure 3a Accelerograph arrays for Embankment dams for Seismic Zone II & III



I: Strong Motion Accelerographs (SMA)

I_F: Free Field Motion Strong Motion Accelerographs (SMA), to be placed at 3 to 4 times of Dam Height (H) from Dam body or base

I_Q: Strong Motion Accelerographs (SMA), to be placed at quarter point either from Left Abutment or Right Abutment

I_M: Strong Motion Accelerographs (SMA), to be placed in the middle height portion of Dam (preferably having deepest section)

Figure 3b Accelerograph arrays for Embankment dams Seismic Zone IV & V

Care should be taken while installing the Strong Motion Accelerographs (SMAs) and Seismographs to ensure that they are installed in a room having proper ventilation and low moisture conditions.

In case of free field, a ventilated room must be made as given in Figure 4 & Figure 5 below. The Strong Motion Accelerographs (SMAs) /Seismographs should be properly bolted to a concrete slab. Proper water proofing of roof and wall must be carried out to avoid moisture inside room. Provision of conduit pipe is to be kept for wiring, if any required.

In case of dam top a ventilated room must be made as given in Figure 6 & Figure 7 below. The Strong Motion Accelerographs (SMAs) should properly be bolted to a concrete slab. Proper water proofing of roof and wall must be carried out to avoid moisture inside room. Provision of conduit pipe is to be kept for wiring, if any required.

For installation of Strong Motion Accelerographs (SMAs) in foundation gallery, the SMAs should be placed in sealed environment so that they could be protected from humidity in gallery. The SMAs should be placed at such height so that they are protected from the flooding.

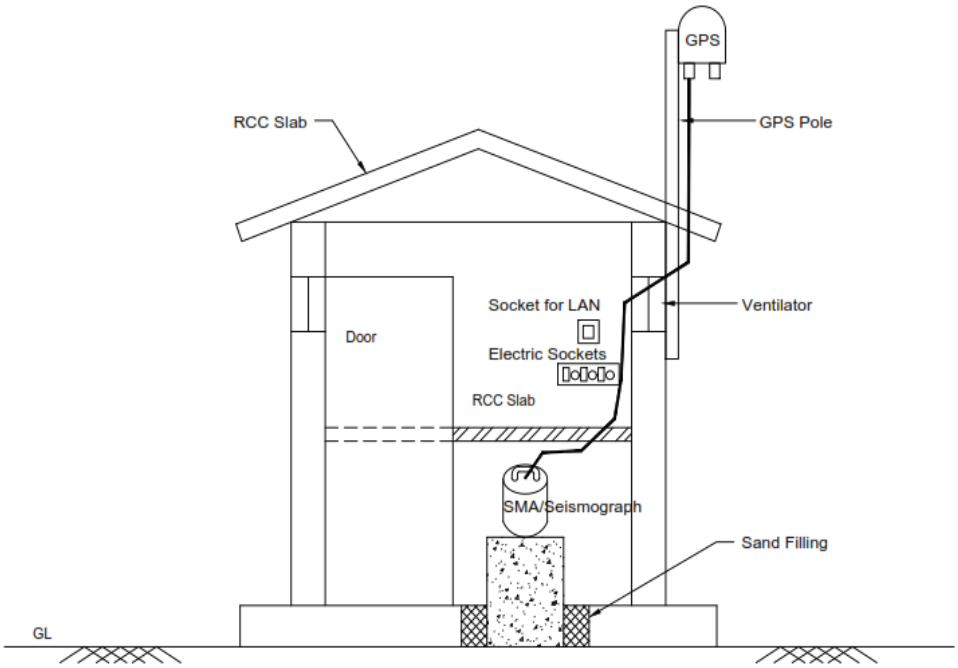


Figure 4
Sectional View
For Free Field Accelerograph/Seismograph Room

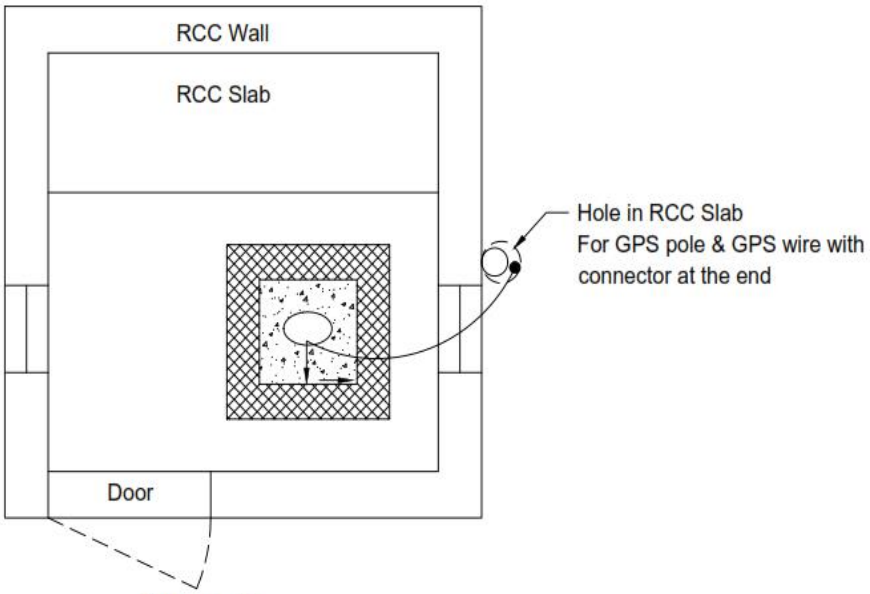


Figure 5
Plan View
For Free Field Accelerograph/Seismograph Room

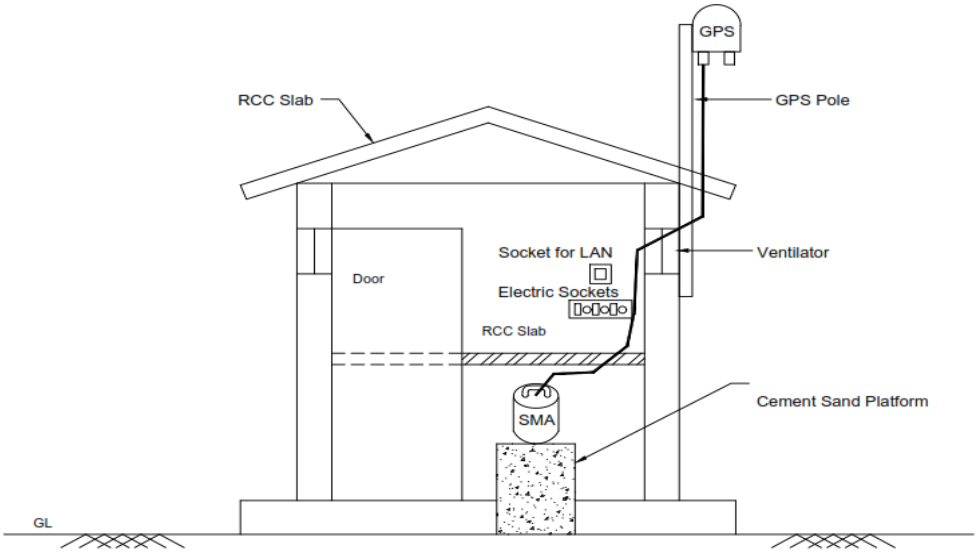


Figure 6
Sectional View
For Dam Top Accelerograph Room

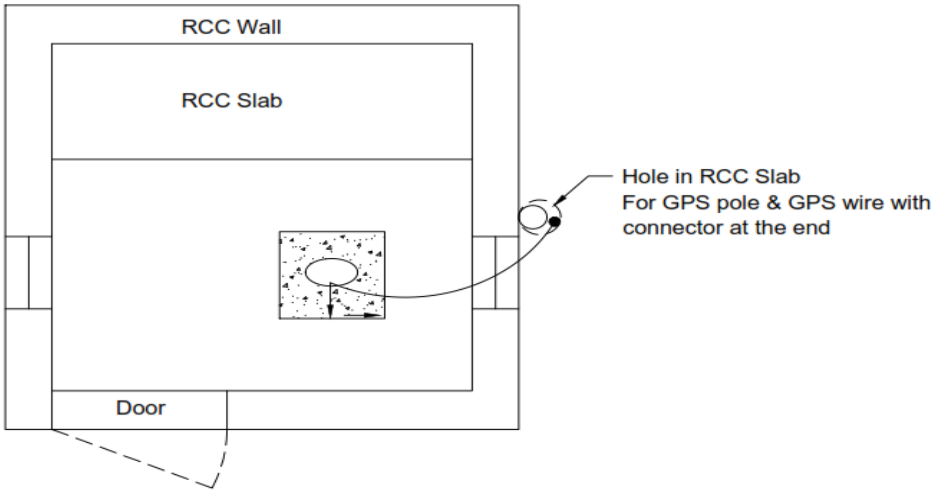


Figure 7
Plan View
For Dam Top Accelerograph Room

54 (2) (m) The suitable location and manner of collection, compliance, process and storage of data under sub-section (2) of section 34;

Section 34 (2): Every owner of a specified dam shall collect, compile, process and store data referred to in sub-section (1) at such suitable location and in such manner as may be specified by the regulations.

1. Suitable Location

The regulation 54 (2) (l) - "the data requirements of seismological stations in the vicinity of specified dams under sub-section (1) of section 34" may be referred for number and location of instrument to be installed.

2. Manner of seismic data collection

The Strong Motion Accelerographs (SMAs), and Seismographs should be connected to a central recording station for real time monitoring and data storage. All the Strong Motion Accelerographs (SMAs) and Seismograph shall be GPS enabled.

The control room shall have facilities for communication (broadband or network connection), GPS with provision for 24 x 7 uninterrupted power supply with adequate power backup.

3. Data processing:

The raw data recorded by the **Strong Motion Accelerographs (**SMAs**)** and **Seismograph** needs to be corrected for the Scaling Error, Random Error in Time and Acceleration Records, Baseline Errors, and Band Passed Filtering. The raw data of acceleration, velocity time histories obtained from above instruments needs to be processed for getting final output respectively. Then, the displacement time history can be evaluated from the final output of acceleration &velocity time histories, if required.

4. Data Storage:

The Strong Motion Accelerographs (SMAs) and Seismograph should be operated in continuous data acquisition mode. The seismic data shall be stored in digital format at multiple locations and the storage media size should be sufficient to store it.

<u>54 (2) (n)</u> ***The time interval of risk assessment studies to be carried out under sub-section (2) of section 35;***

Section 35 (2): Every owner of a specified dam, for each of its dam shall, carry out risk assessment studies at such interval as may be specified by the regulations and the first such study shall be made within five years from the date of commencement of this Act.

The first risk assessment study of each specified dam shall be carried out within 5 years from the date of commencement of the Dam Safety Act, 2021. Thereafter, this study shall be carried out at every 10 years interval or earlier as may be directed by NDSA/SDSO for each specified dam.

<u>54 (2) (p)</u> ***The time interval for the comprehensive safety evaluation of specified dams under sub-section (1) of section 38;***

Section 38. (1) The owner of a specified dam shall make or cause to be made comprehensive dam safety evaluation of each specified dam through an independent panel of experts constituted as per regulations for the purpose of determining the conditions of the specified dam and its reservoir:

Provided that the first comprehensive dam safety evaluation for each existing specified dam shall be conducted within five years from the date of commencement of this Act, and thereafter the comprehensive dam safety evaluation of each such dam shall be carried out at regular intervals as may be specified by the regulations.

The first Comprehensive safety evaluation of each existing specified dam shall be carried out within 5 years from the date of commencement of the Dam Safety Act, 2021 as mandated vide section 38 of the act.

Thereafter, the Comprehensive safety evaluation of each existing specified dam shall be carried out at every 10 years interval or earlier as may be directed by NDSA/SDSO.

54 (2) (r) The mandatory site-specific seismic parameter studies of existing specified dams under clause (c) of sub-section (2) of section 38;

Section 38 sub-section (2) (c) general assessment of seismic safety of specified dam with mandatory site-specific seismic parameters study in certain cases as specified by the regulations;

General Assessment:

1. The specified dam including its hydro-mechanical parts shall be assessed under Design Basis Earthquake (DBE) condition (1 in 475 years return period) for their its structural performance i.e. it should have strength to resist seismic forces without damage; capability to absorb high seismic forces by inelastic deformations (opening of joints and cracks in concrete dams; movements of joints in the foundation rock; inelastic deformation characteristics of embankment materials) and stability against sliding and overturning stability. The dam structure shall serve its intended purpose safely like following the Rule curves and various operational guidelines after the DBE. The seismic assessment of the specified dam shall be assessed based on the guidelines of National Committee on Seismic Design Parameters (NCSDP).

2. There may be multiple types of dams forming a common reservoir. In such case, each such dam reach should be evaluated separately and safety assured. For dams of same type but spanning across separate abutments for a common reservoir, each dam will be assessed independently of each other for seismic safety.

3. Interfaces especially between rigid structures like masonry/ concrete and soils/ rocks are vulnerable to the separation and damage which may prove hazardous. It is necessary that integrity of such interfaces should also be evaluated for the seismic safety assessment of the dam(s).

4. A number of old dams have been provided with composite structures in which the masonry wall is deriving stability through a earth/ rockfill backing on downstream. Alternately a number of old dams have been strengthened through provision of buttresses/ backing of masonry or concrete. The safety of interface integrity in the event of a design seismic event should be ensured.

5. For the above purpose it is important to ensure following for its safety monitoring:
   a. strong motion instrumentation of dam and foundation
   b. visual observations and inspection after an earthquake
   c. data analysis and interpretation
   d. post-earthquake safety assessment

6. For Maximum Credible Earthquake (MCE) condition (1in 2475 years return period earthquake) seismic stability of the specified dam shall be assessed following NCSDP guidelines.

Mandatory site-specific seismic studies:

The site-specific seismic studies need to be carried out in respect of all such specified dams where:

I. Any extreme seismic event having potential to affect/damage structure is observed (i.e., an event with magnitude of Peak Ground Acceleration (PGA) greater than the PGA values (Seismic Zone Factor(z)) as stated in clause 6.4.2 (Table 3) of IS:1893-2016 (Part-I) for each zone.)
II. Dam re-sectioning is proposed/carried to the original structure or in design criteria.
III. Major geological activity reported by Geological Survey of India (GSI) for the region e.g. identification of new faults or movement in existi9ng faults.

The site-specific seismic studies shall be carried out only for those existing specified dams where risk assessment study warrants so. The site-specific seismic studies shall be carried out following NCSDP guidelines provisions.