National Committee on Seismic Design Parameters (NCSDP) for River Valley Projects

MINUTES OF 24th MEETING (15th March, 2013)

(Special meeting to discuss the site specific seismic design parameters of Subansiri Lower Project, Assam-Arunachal Pradesh)

Secretariat

Foundation Engineering & Special Analysis (FE&SA) Directorate
Central Water Commission
New Delhi

Minutes of the 24th Meeting of National Committee on Seismic Design Parameters (NCSDP) for River Valley Projects held on 15th March, 2013 in CWC, New Delhi

General:

The 24th meeting of the National Committee on Seismic Design Parameters (NCSDP) for River Valley Projects was held on 15th March at 1500 hrs in the Conference Room, Central Water Commission, New Delhi. Sh. A.B. Pandya, Member (D&R), CWC and Chairman, NCSDP chaired the meeting. The list of Members, project representatives and invitees who attended the meeting is given at **Annexure I**.

Meeting commenced with Chairman welcoming the participants of the meeting. He then briefly underlined the issue of Site Specific Seismic Earthquake Design Parameters of Subansiri Lower Project (SLP) for which the special meeting of NCSDP was called for, and thereafter requested Member Secretary to take up the agenda item for discussion.

24.1 Confirmation of the minutes of the last meeting

Member Secretary informed that the Minutes of the 23rd meeting of NCSDP held on 20th November, 2013 was circulated to the Members of the Committee; and no observation/ comment on the circulated Minutes have been received by the Secretariat. **The Committee confirmed the minutes of the 23rd meeting as circulated.**

24.2 Review of site specific seismic design parameters for Subansiri Lower Project (SLP), Assam-Arunachal Pradesh (Special agenda item)

Inviting attention of members to the circulated agenda note (**Annexure-II**), Member Secretary briefed the Committee about earlier decision of NCSDP on the Site Specific Seismic Earthquake Design Parameters of SLP with PGA(h) values of 0.38g for MCE and 0.19g for DBE conditions. He then requested the project authorities to elaborate on the reasons for request made to NCSDP for review of its earlier decision with suggestive enhancement of PGA(h) value to 0.5g for MCE condition.

The project authorities made a comprehensive presentation before the Committee covering aspects of Site Specific Seismic Design Parameters Studies made by DEQ-IITR (which was earlier approved by NCSDP), analysis & design approach adopted by the project authorities, present status of dam work, background of the formation of Expert Group (EG) and their observations, response of IITR on EG's comments, background of the formation of Technical Expert Committee (TEC) and its observations leading to reference for NCSDP-review made by the Dam Design Review Panel (DDRP) under Chairman CWC. The presentation also highlighted the expert comments given on the issue by Dr. J.R. Kayal (Ex DDG, GSI), Dr. A.S. Arya (Prof Emeritus, IIT Roorkee) and Dr. I.D. Gupta (Director, CWPRS). Project authorities also informed that the natural period of dam structure is 0.66 seconds, corresponding to which design acceleration is much lower than the peak acceleration indicated by response spectra. On a specific query from Member Secretary concerning TEC view, project authorities pointed out that TEC has

underlined the absence of probabilistic approach in the IITR study. They further stated that the TEC had viewed that there is uncertainty and unpredictability of ways for determining seismic coefficient for earthquakes. Project authorities also pointed out the conclusion/ recommendation of the TEC that "*While 0.38g recommended by IIT Roorkee might be based on judiciously selected data, though subjective, Expert Group (EG) recommended PGA value of 0.5g can not be side-stepped unless so proven by scientific assessment*".

Dr. M.L. Sharma (IITR) informed the Committee that they have now carried out the site specific seismic parameters study by probabilistic approach as well. Making a brief presentation of the spectral acceleration estimation (**Annexure-III**) arrived by IITR using the Probabilistic Seismic Hazard Assessment (PSHA) approach, Dr. Sharma stated that PGA(h) values for both MCE and DBE conditions arrived through PSHA are lower than the earlier approved values arrived through Deterministic Seismic Hazard Assessment (DSHA) approach. He further said that the outcome of 2D seismic reflection survey and Paleoseismological investigations also do not indicate any impact on the earlier agreed parameters, which are on the conservative side.

Dr. I.D. Gupta (CWPRS) was of the opinion that suggested PGA value of 0.5g can be arrived at by presenting PGA in terms of median plus one standard deviation value; and he added that meeting the requirement 0.5g in this manner will have no engineering significance. He was also in agreement with the conclusion drawn by IITR that the analysis by probabilistic approach gives lower PGA values than the earlier approved values. Dr. Gupta was also of the view that in light of probabilistic study, and going by the provisions of the new guidelines, the earlier approved seismic design parameters of SLP do not call for any change.

Dr. M.L. Sharma was of the view that too much emphasis has been placed by Expert Group on the suggested PGA value of o.5g, ignoring in entirety the local conditions and relevance of response spectra which have greater bearings on the design outcome. Supporting this view point, Dr A.S. Arya (Prof Emeritus, IITR) pointed out that an earthquake of certain magnitude at certain depth can occur only if sufficient volume of rock mass is available at that depth. He also informed that the value of 0.38g itself is on the conservative side also on account of 'free surface correction' which basically accounts for the difference in the reflection and refraction of waves at free surface and at the boundary of two mediums within the earth. Pointing out that there would be about 0.15 times reduction in PGA value for 9m depth of SLP dam foundation, Prof. Arya said that the 0.38g value could be further reduced to 0.32g.

Shri Niroj Kumar Sarkar (GSI) said that in light of discussion the emphasis on PGA may not be of much significance for the design of dam structure, but it may have bearing on the ground deformation. He pointed out possibilities of effects of 1950 Assam earthquake evident from the formation of prominent vertical scraps adjoining to the project periphery. Responding to this, Dr. Gupta said that indicated effect may not be the outcome of single earthquake that happened 240 km away from the project site. Shri Sarkar was also of the view that the uncertainties and difficulties of determining the exact seismic parameters should be kept in mind in selection of attenuation relationships giving due emphasis on local conditions of rock strata, debris etc. Dr. Gupta was of the view that these issues have been adequately

addressed in the new guidelines. Responding to discussion, Chairman said that true assessment of seismic effects at project site cannot be made with full certainty, and hence we have to go by collective experiences and practices followed elsewhere. He added that no structure can be made with absolute zero risk, but our endeavor should be to minimize risks to maximum extent.

In view of above discussion and in light of the outcome of IITR's new seismic parameters study using probabilistic approach, the Committee decided that further revisions in the approved seismic design parameters of SLP (as approved by NCSDP in its 14th meeting held on 29-04-2004) may not be required.

The meeting ended with a vote of thanks to the chair.

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Annexure –I

24th Meeting of National Committee on Seismic Design Parameters (NCSDP) on River Valley Projects

Date: 15.03.2013
Attendance

Sl.No	Name & Address	Designation	Deptt./ Org.	Status/ Representative
I. Committee Members				
1.	Sh. A.B.Pandya	Member (D&R)	CWC, New Delhi	Chairman, NCSDP
2.	Sh. Pradeep Kumar	Commissioner (Project)	MoWR, New Delhi	Member
3.	Sh. L.A.V. Nathan	Chief Engineer (DSO)	CWC, New Delhi	Member
4.	Dr. A.S. Arya	Ex Pro Vice Chancellor	University of Roorkee	Non Official Member
5.	Dr. I. D. Gupta	Director	CWPRS, Pune	Member
6.	Dr. M.L. Sharma	Professor & Head Deptt. of Earthquake Engg.	DEQ, IIT Roorkee,	Member
7.	Sh. Niroj Kumar Sarkar	Superintending Geologist	GSI, Shillong	Representative of GSI
8.	Sh. P.R. Baidya	Scientist 'E'	IMD Delhi	Representative of IMD
9.	Dr. Shovan Lal Chattoraj	Scientist, Geo Science Division	Indian remote sensing (IIRS), Dehradun	Representative of IIRS
10.	Sh. Ravindra Kumar	Superintending Surveyor, Geodetic & Research branch,	Survey of India, Dehradun	Representative of Survey of India
11	Dr. B. R. K. Pillai	Director, FE&SA	CWC, New Delhi	Member-Secy. NCSDP
II. Special Invitees and other officials				
12.	Sh. S.K. Sibal	Director, CMDD (NW&S)	CWC, New Delhi	CWC, New Delhi
13.	Dr. Manish Srikhande	Assoc. Professor	DEQ, IIT Roorkee	IIT Roorkee
14.	Dr. J.D. Das	Scientist	DEQ, IIT Roorkee	IIT Roorkee
15.	Sh. O.P. Gupta	Deputy Director	CWC	NCSDP Secretariat
16.	Sh. Saurabh	Asst. Director	CWC	"
17	Sh. G. Sanjeeva Reddy	Asst. Director II	CWC	"
18	Sh. C.L. Premi	Head Draftsman	CWC	"
III. Project Representatives				
19.	Sh. Anil K. jain	Chief Engineer D&E Division	NHPC	Subansiri Lower Project
20.	Sh. P.K. Gupta	Chief (Geology)	NHPC	-Do-
21.	Sh. S.L. Kapil	Chief (Geophysics)	NHPC	
22.	Sh. R.M.A Khan	Manager (Civil)	NHPC	-Do-
23	Sh. Prashant Rai	Asst. manager (Geology)	NHPC	-Do-

Annexure-II

National Committee on Seismic Design Parameters (NCSDP) for River Valley Projects

AGENDA FOR 24th MEETING

(Special meeting to discuss the site specific seismic design parameters of Subansiri Lower Project, Assam-Arunachal Pradesh)

Date: 15th March, 2013
Time: 15:00 Hrs
Venue: Conference Room, 525(N),Sewa Bhawan, New Delhi

Secretariat

Foundation Engineering & Special Analysis (FE&SA) Directorate
Central Water Commission
New Delhi

AGENDA FOR THE 24th MEETING

Item 24.1 Confirmation of the Minutes of the 23rd meeting

The minutes of the 23rd meeting of National Committee on Seismic Design Parameters (NCSDP) on River Valley Projects held on 20 November 2012 were circulated to all the members of the committee vide letter No. 2/2/2010 (Vol-II)/FE&SA/961-973 dated 28.12.2012.

No comments have been received.

***The Committee may like to confirm the minutes*.**

Item 24.2 Review of site specific seismic design parameters for Subansiri Lower Project (SLP), Assam-Arunachal Pradesh (Special agenda item)

Subansiri Lower Project (SLP) is one of the key projects in the Subansiri sub-basin of river Brahmaputra, is under construction through NHPC. The project consists of (i) 123 m high concrete dam above deepest foundation level (ii) a powerhouse with an installed capacity of 8 units of 250 MW each (i.e. 2000 MW). The project site lies in Seismic zone V.

Earlier submission of the study report and its approval by NCSDP

Site specific design earthquake parameters for SLP had been carried out by Department of Earthquake Engineering (DEQ) IIT-Roorkee in Dec. 2001 and presented earlier for approval of NCSDP.

- The study was first presented for discussion in XII meeting of NCSDP held on 13th August 2002. In the minutes of the meeting it is recorded that "the earthquake magnitude of 7.5 associated with the Main Boundary Thrust which has been considered for determination of peak ground acceleration is considered low. The Committee recommended that earthquake magnitude of 7.5 may be increased to M=8 and the site specific seismic study revised accordingly.

- In the XIII meeting of NCSDP held on 18th December, 2003 after detailed discussion and deliberations, the Committee has suggested that in place of assigning the earthquake magnitude of 7.5 to MBT, the earthquake magnitude of 8.0 may be assigned to the detachment surface. The site specific seismic studies may be revised accordingly.

- The project authority submitted necessary revision in report vide letter no. DEQ/NHPC/LOWERSUB/238 dated April 16, 2004 of Department of Earthquake Engineering IIT Roorkee. **In the revised report, it was indicated that only Table II is to be replaced with modified Table II in the report. There were no changes to be made in the report since governing parameters were the same as given in the earlier report.**

- In the XIV meeting of NCSDP held on 29.04.2004 the Committee approved seismic design parameters with revisions as per details below:

Project Authority	M/s NHPC Limited		Dam Height	133 m (above deepest foundation) (*now 123 m*)					
Name of Consultant	IIT, Roorkee		Purpose	Power Generation (8x250 MW)		Dam Type	Concrete Dam		
Latitude/Longitude	37°33'15"N/94°15'30"E			Zone	V	River	Subansiri		
Maximum Credible Earthquake Magnitude	7.5		Distance to tip of rupture (km)	10.4		Epicentral distance (km)	10		
PGA (h)	MCE	0.38 g	PGA (v)	MCE		2/3rd of the corresponding horizontal values			
	DBE	0.19g		DBE					
Study Report Reference	EQ 2001-14 Project No. P-2001-01 of December, 2001 read with letter no. DEQ/NHPC/LOWERSUB/238 dated April 16, 2004 of Department of Earthquake Engineering IIT Roorkee.								

Present proposal for review by NCSDP

Now as per decision of Dam Design Review Panel (DDRP) taken in its 1st meeting held on 6th February, 2013 under the chairmanship of Chairman CWC/DDRP, the seismicity issues have been referred to NCSDP for review and comments. Accordingly, project authority vide letter no. NH/EG/SLP/DDRP/2013/98 dated 18.02.2013 has submitted a background note on site specific earthquake design parameters of Subansiri Lower Project (SLP) for consideration of the Committee. The background note as submitted by the project authority was circulated amongst the Members of the Committee vide this office letter No. 2/2/2012 Vol-I)/FE&SA/107-117 dated 18.02.2013 and it included the following:

- Views of Expert Group (EG), Report on Paleo-seismological studies and 2D Seismic Studies as suggested by EG (constituted to assess downstream impact of the project),

- Views & Comments of DEQ, IIT Roorkee after submission of Expert Group's report,

- Views of Professor J.R. Kayal, Former DYDG (GSI),
- Views of Prof. A.S. Arya, Prof. Emeritus, Earthquake Engineering, IIT Roorkee
- Views of Technical Expert Committee (TEC),
- Comments of CWPRS, Pune on site specific design parameters
- Review & comments of DEQ IIT Roorkee on 2D seismic Reflection Survey & Paleo-Seismic Report,
- MEQ studies- Discussion and conclusion part of MEQ Data Processing, Interpretation and Report preparation for MEQ data collected during Dec 2006 to Nov. 2007 for study of seismogenic sources around the Subansiri Lower HE Project

The Committee may like to deliberate and decide on the necessity of revision, and if so, the approach to be adopted for revision of the site specific seismic design parameters for Subansiri Lower Project (SLP).

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Annexure-III

Probabilistic Seismic Hazard Assessment (PSHA) Approach:

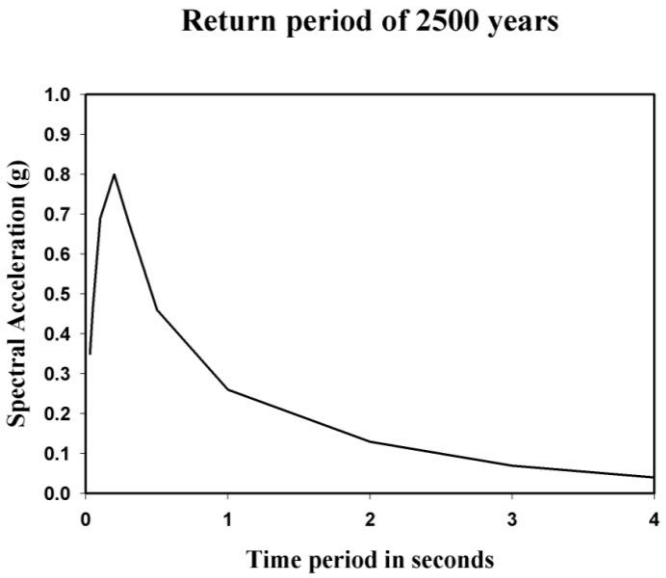

Fig (1) PSHA estimate for MCE

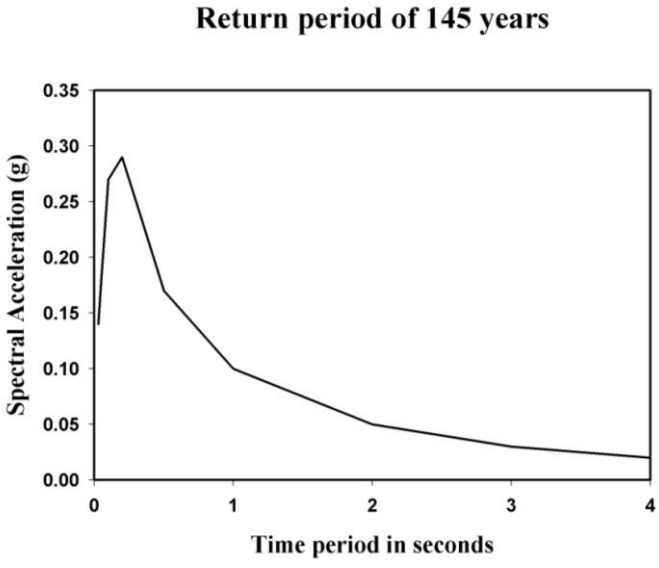

Fig (2) PSHA estimate for DBE