BUREAU OF INDIAN STANDARDS

Minutes

Panel for Loads, Forces and Effects, CED 46:P4 : Sixth Meeting

Tuesday, 23 April 2024 : 1030 h – 1400 h

In Hybrid Mode from BSB 116, Department of Civil Engineering, Indian Institute of Technology Madras, Chennai 600036

PRESENT

Convener: Professor C. V. R. Murty **Member Secretary**: Shri Arunkumar S.

NBC Officer: Shri Abhishek Pal

Members

1) Shri Manoj Kawalkar [Association of Consulting Civil Engineers (India), Bengaluru]
2) Shri Rajkumar Kacharla [Association of Consulting Civil Engineers (India), Bengaluru]
3) Shri Milind Manohar Tare [Association of Consulting Civil Engineers (India), Bengaluru]
4) Shri Badam Sundar Rao [Association of Consulting Civil Engineers (India), Bengaluru]
5) Shri Aman Deep Garg (Creative Consultants & Engineers Pvt Ltd, Ghaziabad)
6) Shri Amrendra Kumar Jalan (Central Public Works Department, New Delhi)
7) Dr Achal K. Mittal (CSIR - Central Building Research Institute, Roorkee)
8) Dr Ajay Chourasia (CSIR - Central Building Research Institute, Roorkee)
9) Dr G. S. Palani (CSIR - Structural Engineering Research Centre, Chennai)
10) Dr P. Harikrishna (CSIR - Structural Engineering Research Centre, Chennai)
11) Smt Keerthana Mohan (CSIR - Structural Engineering Research Centre, Chennai)
12) Prof A. Boominathan (Indian Geotechnical Society, New Delhi)
13) Dr Divya Priya Balasubramani (Indian Geotechnical Society, New Delhi)
14) Prof Vasant Matsagar (Indian Institute of Technology Delhi, New Delhi)
15) Prof Dipti Ranjan Sahoo (Indian Institute of Technology Delhi, New Delhi)
16) Shri V. Suresh (In Personal Capacity, Thiruvananthapuram)
17) Dr Nagesh R. Iyer (In Personal Capacity, Hubballi)
18) Shri Surya Prakash Karri (L&T Construction, Chennai)
19) Shri Krishna Somaraju (L&T Construction, Chennai)
20) Shri Praveen Kumar Rai (L&T Construction, Chennai)
21) Shri P. N. Ojha (National Council for Cement and Building Materials, Ballabgarh)
22) Shri Brijesh Singh (National Council for Cement and Building Materials, Ballabgarh)
23) Ms. Shilpi Ranjan [The Institution of Engineers (India), Kolkata]

Invitees

24) Shri Jose Kurian (Chairperson, CEDC and CED 02 of BIS)
25) Prof V. Kalayanaraman (Chairperson, CED 07 of BIS)
26) Prof Rupen Goswami (*Rep.* CED 37 of BIS)
27) Ms. Alpa Sheth (Chairperson, CED 38 of BIS)
28) Prof R. Sundarvadivelu (*Rep.* CED 47 of BIS)
29) Shri R. L. Dinesh (Tata Consulting Engineers Limited, Navi Mumbai)
30) Shri Manos De (Tata Consulting Engineers Limited, Navi Mumbai)
31) Shri Devesh Kumar Jaiswal (*Rep.* Indian Institute of Technology Madras, Chennai)
32) Shri Trishit Chandra (*Rep.* Indian Institute of Technology Madras, Chennai)

From BIS

33) Shri Shubham Chaudhary, Scientist B (Civil Engg)
34) Shri Abhishek Sharma, Scientist B (Civil Engg)

Item 0 OPENING REMARKS

The Convener, Professor C. V. R. Murty warmly welcomed all the members to the *Sixth Meeting* of the Panel for Loads, Forces and Effects, CED 46 : P4. He appreciated the enthusiasm shown by the Members in attending this meeting and solicited their active contribution in the exercise of revision of the National Building Code of India. Also, he reiterated the importance of this chapter of the NBC and particularly the current revision, considering that Part 6 of NBC has been adopted in most building byelaws in the country. Moreover, he added that this chapter of NBC provides vital information towards the essential amount of loads, forces and effects that should be used in the design of buildings and structures. Considering the growing number of high rises and dismantling of some of them followed by reconstruction of buildings, construction of foundations on filled-up soils at the same site, and climate-related temperature effects, the provisions of this chapter are fundamental to achieving resilient infrastructure. Professor Murty emphasized on the need to include the developments in the respective technical committees in BIS.

With these remarks and after a formal introduction of the members present, the Convener suggested to take up the Agenda item-wise.

Item 1 CONFIRMATION OF MINUTES OF THE LAST MEETING

1.1 There being no comments on the Minutes of the *Fifth Meeting* of the Panel held on 19 November 2015 in New Delhi that were circulated vide BIS DG letter No. CED 46:P4/A-2.5 dated 15 February 2016, and based on which NBC 2016 was published ultimately, the Panel confirmed the Minutes, as circulated.

Item 2 COMPOSITION

2.1 The Panel noted its composition as given in Annex 1 to the Agenda, reviewed the same and decided/noted as follows:

a) To recommend the **co-option** of the following organizations on the Panel:
    1) National Disaster Management Authority, New Delhi.
    2) Tata Consulting Engineers Limited, Navi Mumbai
b) To send a final request to the following organizations for their revised nominations and commitment to participation:
    1) Delhi Metro Rail Corporation, New Delhi
    2) Engineers India Limited, New Delhi
    3) Geological Survey of India, Kolkata
    4) Himachal Pradesh State Disaster Management Authority, Shimla
    5) Indian Institute of Technology Roorkee, Roorkee
    6) National Institute of Disaster Management, New Delhi
    7) National Remote Sensing Centre, Hyderabad
    8) Odisha Disaster Management Authority, Bhubaneswar
    9) Uttarakhand State Disaster Management Authority, Dehradun

10) Tandon Consultants Private Limited, New Delhi

2.2 & 2.3 The Panel noted the information regarding the structural reforms in standardization in BIS as given under the item of Agenda and the letter dated November 2023 of DG BIS addressed to all the technical committee members and the relevant information explained by the BIS Secretariat.

In particular, all the members were requested to periodically visit the Manak Online (the Standardization Portal of BIS) including its Document Repository through which the related documents (other than the Meeting Notice, Agenda, Minutes, Working Drafts, Preliminary Drafts, Wide Circulation Drafts) from BIS are being shared.

Further, the following information has been listed recently under the Document Repository:

1) BIS' Library can be accessed ONLINE
2) TA/DA Guidelines
3) Guide to using the Standardization portal
4) Guide on HOW TO WRITE A STANDARD

The Panel appreciated the initiative of BIS in forming associations with academic Institutes with special focus on research based inputs on standardization. For ready reference, the list of Institutes with whom the MoUs have been entered by BIS so far can be found HERE.

Item 3 PROJECT OF REVISION OF NBC

3.1 The Panel noted the details of the project of Revision of NBC, the contents in terms of various proposed Parts and Sections being brought out in the revised NBC as given in Annex 2 to the Agenda and the necessity to bring required coherence of this Chapter (Part 6/ Section 1) with other Chapters of the Code. Also, it noted that already at appropriate places in the working draft (shared by BIS as referred in item **3.3**) for consideration, reference to other Parts/Sections of the NBC has been made to ensure that users of this Section are given holistic information and comprehensive implementation is facilitated.

3.2 The Panel considered and noted the contents of the existing Part 6/Section 1 'Loads, Forces and Effects' as given in Annex 3 of the Agenda.

3.3 Members were requested to send their inputs/suggestions in writing (**before 15 May 2024**) – preferably in the form of draft clauses on the Working Draft of Part 6/Section 1 of NBC which was circulated by BIS from ced46@bis.gov.in through email on 19 April 2024.

3.4 Prof C. V. R. Murty briefly explained vide a PowerPoint presentation (copy attached as a separate PDF) regarding his proposal on the contents of this chapter of NBC (circulated through email dated 22 April 2024), as summarized below:

1) The following design load codes were mentioned:
    i) IS 875 (**ALL** the Parts 1 to 5) 'Code of practice for design loads (Other Than Earthquake) for buildings and structures',
    ii) IS 4991 'Criteria for blast resistant design of structures for explosions above ground', and
    iii) IS 1893 (Part 1) 'Criteria for Earthquake Resistant Design of Structures - Part 1 : General Provisions and Buildings'

2) In all the Indian Standards refer to 18 load types. Based on a review of these loading standards, it was suggested to place them under two sets, namely:
   i) Force loads
   ii) Displacement loads

   These sets further included the different types of loads covered in the Indian Standards.

3) Again, the above-mentioned 18 load types under two sets, it was suggested to place them under two categories, namely:
   i) **Natural Loads** – where Poisson statistics are relevant and the return period can be considered accordingly. The presentation had some examples included for various types of loads for calculation of return period and quantifying the demands as well.
   ii) **Manmade Loads** – where Gaussian statistics are relevant, and the same are based on the current understanding of the characteristic values. The types of loads mentioned under this category were dead load, imposed load, impact load and blast load.

4) The design standards, *i.e.,* IS 456 'Plain and reinforced concrete - Code of practice', IS 800 'General construction in steel - Code of practice' and IS 1905 'Code of practice for structural use of unreinforced masonry' also were mentioned which are utilizing the design load standards mentioned.

   For the design load combinations, the design procedures and analysis as below were suggested:
   i) In all structures – **Strength**, **Serviceability** and **Durability**;
   ii) In certain structures – **Integrity**, **Robustness** and **Restorability** as well.
   (The same are being considered in the draft revision of IS 456; wherein the buildings and structures are designed for the strength aspects and thereafter checked for the remaining five aspects).

5) The following methods of structural design were suggested for adoption:
   i) Limit State Method – for Concrete and Steel Structures.
   ii) Working Stress Method – for Masonry Structures
   (Currently, efforts are underway by the WG of CED13 to develop design procedure based on Limit State Method. If that exercise is concluded before the revised NBC is released, then the same can be admitted)

6) The following three sets of design load combinations were suggested:
   i) Basic Load Combinations;
   ii) Accidental Load Combinations; and
   iii) Extreme Load Combinations.

7) The following Method of structural analysis were proposed:
   i) Linear analysis – for designing for Strength, and checking for Serviceability, Durability and Restorability; and
   ii) Nonlinear analysis – for checking for Integrity, Robustness and Restorability.

8) At the end of the presentation, Prof C. V. R. Murty also placed clear proposals, and his recommendations. These include:

i) To not have variations in ISs and NBC, the standards prepared by the Sectional Committees alone should be included in NBC (other than the parts on administration); no **new** parallel documents should be authored by the WGs of CED46. In the long run, the WGs should be drawn up from the relevant Sectional Committees;
ii) 17 loads (namely all loads other than sea levels and earthquake shaking) be addressed by CED37, 1 load by CED47 (sea level rise) and 1 load (namely earthquake shaking) be addressed by CED39. The Blast Load, which is currently with CED39, may be moved to CED37.
iii) IS 875 should provide four aspects related to loads, namely:
    (a) Quantification of each of the 17 loads mentioned,
    (b) Partial safety factors for loads to be used in the three sets of load combinations;
    (c) Methods of structural analysis to be adopted depending on the target use of the results of structural analysis, and
    (d) Methods of structural design of the members depending on the materials.

After the presentation, the proposal was discussed, and the following observations were noted and the decisions as below were taken:

a) Shri V. Suresh appreciated the proposal and the comprehensive presentation as well as the suggestion for inclusion of different Indian Standards related to design loads to be essentially considered in this revision of NBC. Also, he appreciated the proposal for updations and modifications to the design load combinations.

b) Shri Jose Kurian appreciated the presentation. He requested Professor Murty to make this presentation during the upcoming CEDC meeting also, so that all related Sectional Committees under CEDC of BIS are aware of the changes proposed and seek their views/inputs at that time.

    Also, he shared his concerns, which Panel may take care regarding the proposal in the presentation, that there should not be any large-scale variation between the current Indian Standards and NBC. Also, considering the time frame for revising and publishing the next NBC, the four proposals suggested can be agreed to suitably carried out in standards, by way of simultaneous changes in different Indian Standards so as to avoid any variation with the current loading and design standards, which the panel agreed to.

c) Dr Nagesh R. Iyer suggested to include Tsunami effects. To this suggestion of Dr Iyer, the Earthquake Engineering Sectional Committee, CED 39 is developing a new standard on effects of tsunami in buildings and structures which may be suitably cross-referred. Also, it was suggested that the effects of water in terms of urban flood, riverine flood, coastal water level rise be included.

d) Professor A. Boominathan suggested to consider liquefaction induced loads and lateral spreading in design of foundations. It was mentioned that this is already included in the provisions of IS 1893 (Part 1) under CED39.

e) Shri R. L. Dinesh suggested to consider forces and effects exerted by expansive soils on foundation. It was agreed to review this matter under CED43.

f) Professor R. Sundarvadivelu informed that the loadings given in IS 4651 (Part 1 to 4) on "*Planning and Design of Ports and Harbours – Code of Practice*" include the quantification of tsunami water levels.

g) Professor V. Kalayanaraman suggested that the essential load combinations should be included in IS 875 (and reflected in NBC) and for the design of different buildings and structures; the respective Indian Standards can list the additional load combinations. Also, he suggested to add load combinations for composite constructions. He agreed that it necessary to re-examine the partial safety factors for loads used in the design of structures made different materials (concrete, steel, masonry, etc.).

h) Shri Krishna Somaraju mentioned that only the additional cover to concrete elements and the associated amount of steel is indicated regarding the effects of fire; this may be insufficient. Therefore, he suggested to develop provisions based on energy balance method.

i) To the suggestion regarding multiple natural hazards affecting a building or a structure, it was decided that the existing annex that lists the districts in India subjected to multiple hazards be reviewed and updated so as to enable the owner to decide depending on the importance and scale of the project (building or structure). Also, considering the effects of climate change, it was decided to introduce a new clause indicating the effects of the same and to guide the professionals for the same.

j) Considering that Part 6 of NBC has been adopted by way of cross-reference in most building byelaws in the country, the Panel observed that instead of mere reference to the respective Indian Standards in this Part 6/Sec 1, it would be prudent to reproduce the standards relevant for buildings (including the clause numbers) and by excluding provisions relevant for other structures (which be suitably indicated explicitly, say in the scope of the chapter).

k) The Panel agreed that simultaneous revision or amendments to the loading codes be carried out so as to provide unambiguous requirements to the designer and users. In this regard, it was decided to hold a meeting of the following Chairpersons of Sectional Committees under CEDC, which will aid in deciding the further course of action on this Panel:

1) Cement and Concrete Sectional Committee CED 02,
2) Structural Engineering and Structural Sections Sectional Committee, CED 07,
3) Building Construction Practices Sectional Committee, CED 13,
4) Structural Safety Sectional Committee, CED 37,
5) Special Structures Sectional Committee, CED 38,
6) Earthquake Engineering Sectional Committee, CED 39,
7) Soil and Foundation Engineering Sectional Committee, CED 43,
8) National Building Code Sectional Committee, CED 46,
9) Ports, Harbours and Offshore Installations Sectional Committee, CED 47,
10) Hill Area Development Engineering Sectional Committee, CED 56 and
11) Cyclone Resistant Structures Sectional Committee, CED 57
12) Prefabricated Construction Sectional Committee, CED 32

A meeting of the above was decided to be held at IIT Madras, preferably in the in-person mode, at the earliest and latest by May 2024.

3.5 The Panel noted the Programme of Work of the ‘‘Structural Safety Sectional Committee, CED 37’ as given in Annex 4 of the Agenda.

Item 4 COMMENTS RECEIVED ON / INPUTS RELATED TO PART 6/SEC 1 LOADS, FORCES AND EFFECTS OF SP 7 : 2016

4.1 The Panel noted that no comments were received on the Part 6/Sec 1 'Loads, Forces and Effects' chapter of NBC 2016.

Item 5 PROJECT OF PROMOTION OF USE OF NBC 2016 IN ALL STATES AND UTs OF INDIA

5.1 The BIS' Secretariat explained about the above Project that involved an exercise of Promotion of use of National Building Code of India 2016 in all States and UTs of India. The major deliverable namely the draft Standardized Development and Building Regulations aligned with the provisions of NBC 2016 and the other deliverables such as the State wise regulations, Pamphlets for awareness of general public, GUIDE TO USING THE NBC were explained to the members who appreciated the work done by the entire BIS team.

5.2 The Panel noted the information about the new special publication, **SP 73 : 2023 'Standardized Development and Building Regulations, 2023'** was also published and released, which is available for access (free download) from the BIS' website and from: https://standardsbis.bsbedge.com/

Item 6 DATE & PLACE OF THE NEXT MEETING

6.1 The Panel decided that its next meeting will be held after organizing meeting(s) of the Chairpersons of the following Committees:

1) Cement and Concrete Sectional Committee CED 02,
2) Structural Engineering and Structural Sections Sectional Committee, CED 07,
3) Building Construction Practices Sectional Committee, CED 13,
4) Prefabricated Construction Sectional Committee, CED 32,
5) Structural Safety Sectional Committee, CED 37,
6) Special Structures Sectional Committee, CED 38,
7) Earthquake Engineering Sectional Committee, CED 39,
8) Soil and Foundation Engineering Sectional Committee, CED 43,
9) National Building Code Sectional Committee, CED 46,
10) Ports, Harbours and Offshore Installations Sectional Committee, CED 47,
11) Hill Area Development Engineering Sectional Committee, CED 56 and
12) Cyclone Resistant Structures Sectional Committee, CED 57

Item 7 ANY OTHER BUSINESS

7.1 BIS appreciated and thanked the IIT Madras team and its management for arranging local hospitality and for the venue to host this meeting.

7.2 Shri Abhishek Pal and Shri Arunkumar S. thanked the Convener, Professor C. V. R. Murty, for his guidance, insights and ably conducting the meeting. Also, BIS thanked all Members and Participants for their valuable inputs and suggestions during the meeting.

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