TRENDING PRACTICES IN CONSTRUCTION SECTOR FOR EARTHQUAKE RESISTING STRUCTURES

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ABSTRACT

The field of Earthquake Engineering has existed in our country for over 35 years now. Indian earthquake engineers have made significant contributions to the seismic safety of several important structures in the country. However, as the recent earthquakes have shown, the performance of normal structures during past Indian earthquakes has been less satisfactory. This is mainly due to the lack of awareness amongst most practicing engineers of the special provisions that need to be followed in earthquake resistant design and thereafter in construction. A workshop was conducted at IIT Kanpur to discuss the role of earthquake-resistant construction in Civil Engineering curriculum. The workshop also discussed the avenues for dissemination of this knowledge to the students, practicing engineers and other people. In this paper, the main recommendations of the workshop and an action plan that can be implemented in the next few years have been described.

Keywords: *Earthquake, Building Structures, Infrastructure, Building Code, Seismic design, India*

1.Introduction

Formal activities in the field of Earthquake Engineering in the country were started in the late fifties at the University of Roorkee (UOR). The first Indian code was published by the Bureau of Indian Standards in 1962. Since then, Indian earthquake engineers have handled numerous prestigious and challenging projects in high seismic regions of the country. However, it has often been felt that an average civil engineer in the country even today looks at earthquake engineering as an area of super-speciality to be handled only by researchers and professors. The cause of earthquake-disaster mitigation through constructions that can appropriately withstand earth-quakes, can be achieved only when the professional civil engineers in India take it upon themselves to ensure earthquake-resistant constructions [1]. A typical undergraduate civil engineering curriculum in the county does not include any coverage of earthquake engineering; the situation is no different in most other countries of the world. Even at the post-graduate level, only a small fraction of structural engineering students gets a chance to study earthquake engineering and design. This results in most civil engineers not receiving any formal training in earthquake engineering during the undergraduate or postgraduate studies [2]. This needs to be corrected for a country like ours with an enormous earthquake problem. A three-day workshop was held at the Indian Institute of Technology Kanpur during 10-12 October 1996 to discuss all aspects related to earthquake resistant construction in civil engineering curriculum [3]. The questions that prompted this workshop include:1. Should we continue to let earthquake-resistant constructions to be handled by specialists only, or should an average civil engineer responsible for construction be expected to know about appropriate earthquake technology for day-to-day

constructions?. Should earthquake-resistant construction be taught as a separate subject in the engineering curriculum, or should the topics related to earthquake engineering be merged with the existing courses? For instance, it may be more effective to teach students about ductile detailing of reinforced concrete structures in the regular design course on reinforced concrete, than covering all aspects of earthquake engineering in one single course.3. Should earthquake engineering maintain an identity outside the normal civil engineering industry or become a part of civil engineering industry itself. How best to achieve the following goal: professional civil engineers should be able to ensure earthquake-resistant constructions without seeking help from "earthquake engineering experts," particularly for the run-of-the-mill constructions. As a preparation towards this workshop, two questionnaires were sent to all engineering colleges in the country. These questionnaires solicited information from the colleges, regarding: (a) state of teaching curriculum at undergraduate as well as at graduate levels *vis*-à-*vis* earthquake-resistant constructions, and (b) profile of faculty members, having expertise in earthquake-resistant constructions or interested in developing expertise in earthquake-resistant constructions. Responses received during this survey were made available to the workshop participants in the form of a directory [4]. To ensure a holistic approach to addressing the above questions, a very broad agenda was prepared for the workshop. Most of the time during the workshop was spent in across-the-table discussions [5]. Participation was by invitation. This paper gives a summary of the discussions and recommendations.

2.Discussions and Recommendations

Theme 1 :: Earthquake-Resistant Constructions in India

1.1 Engineered and Non-Engineered Constructions• Most building constructions are non-engineered. However, formal education is imparted only on engineered constructions. Focus of discussions should also be placed on non-engineered constructions.

1.2 Building Material Technology and Know-How• There is a need for greater discussion on the different building materials and their utility for earthquake-resistant constructions in technical curriculum.

1.3 Division of Responsibilities between Consultants, Contractors and Owners• The consultant plays the most important role in realising earthquake resistant constructions. The consultant has to educate the owner regarding the consequences of not providing earthquake-resistant features; this may motivate the owner to incur the extra costs for safety. The responsibility of adhering to the minimum requirements specified by the design codes shall remain with the consultant. The consultant also needs to ensure that the detailing provided is fully implemented by the contractor [6].

1.4 Earthquake-Resistant Design Practice versus Traditional Design Practice• Earthquake-resistant design and detailing should be considered under normal design situations. These should be an integral part of design process, even though these may not govern the final design in all cases. This situation would then be similar to the current treatment of design for wind loads. This will d-mystify the myth of earthquake-resistant design and construction being a special requirement [7].

1.5 Code Provisions And Issues• Design codes are the minimum specifications of the society's expectations of the structures. There is a need to ensure that the codal provisions are faithfully complied with [8]. Since the building codes also fulfill a social obligation, the costs incurred by individuals involved in the code development should be provided.• The code revisions sometime require technological upgradation or other major changes in the prevailing practices. Appropriate technological innovations and developments must take place in order to help the implementation of the

difficult provisions.• The code compliance in the country is currently very poor. This can be improved through necessary regulations and legal provisions. Introduction of tender specifications and changes in the city bylaws are some strategies for this. Also, there is a need for speedy action against defaulters to encourage compliance. The professional societies should take the initiative to develop model codes or to discuss specific issues. These may be used as a basis for arriving at the practical codes. These model codes should be regularly revised based on continuous technological developments. This will greatly benefit through increased involvement of professional engineers in code development.

3.Conclusion

The workshop held intensive discussions on several important topics related to the status of earthquake engineering in India. The major conclusions that were arrived at during the discussions have been discussed in this paper. Some of the recommendations of this workshop are implementable in the short term, while the others require long-term efforts for their implementation. The authors believe that the following steps should be initiated urgently:1. Working notes and teaching aids should be developed and widely disseminated for model UG and PG curricula in Earthquake Engineering and Structural Dynamics.2. Model experiments should be developed to illustrate the concepts in earthquake engineering, using low-cost and easily available instruments. These experiments should be integrated with the theory courses to illustrate different concepts of earthquake engineering and structural dynamics.3. There is also an urgent need to develop short-term training programs in the area of earthquake-resistant constructions for structural engineering faculty of different engineering colleges.4. There is a very urgent need to d-mystify the earthquake-related design codes by developing detailed commentaries on the code provisions [9]. 5. A dedicated national-level facility needs to be established for the collection and dissemination of earthquake engineering publications and literature.6. The architecture curriculum in the country should be suitably modified to impart the basic concepts of earthquake-resistant design to architecturestudents.7. The diploma programs related to building constructions should be modified to include the essential earthquake-resistant features in buildings. Since the conduct of this workshop, based on the above recommendations several initiatives have already been taken at some of institutions. For instance, some faculty members at IIT Delhi and IIT Bombay have already incorporated earthquake-resistant construction in the regular undergraduate courses. An arrangement has been finalised and implemented between the Central Building Research Institute Roorkee (CBRI) and IIT Kanpur regarding the M. Tech. Programme, where; CBRI financially supports a few students at IIT Kanpur and the students carry out their M. Tech. Thesis in joint supervision of one CBRI scientist and one faculty member of IIT Kanpur. Also, many participants felt that such workshops should be conducted at regular intervals at different locations in the country, as these improve collaborations between participants from the different sectors and different organizations in India

4.References

[1] Barton A.H. (1969). Communities in Disaster. A Sociological Analysis of Collective Stress Situations. SI: Ward Lock

[2] Catastrophe and Culture: The Anthropology of Disaster. Susanna M. Hoffman and Anthony Oliver-Smith, Eds.. Santa Fe NM: School of American Research Press, 2002

[3] G. Bankoff, G. Frerks, D. Hilhorst (eds.) (2003). Mapping Vulnerability: Disasters, Development and People. ISBN 1-85383-964-7.

[4] D. Alexander (2002). Principles of Emergency planning and Management. Harpended: Terra publishing. ISBN 1-903544-10-6.

[5] Introduction to international disaster management by Damon P. Coppola.

[6] A Study of Seismic Assessment of a Govt. Middle School in Ganaihamam, Baramullah in J&K M A Dar, A.R Dar, A Qureshi and J Raju, International Journal of Advanced Research in Engineering & Technology, ISSN 0976 – 6480 (Print),ISSN 0976 – 6499(Online),Volume 4, Issue 6, October 2013, pp. 288-298,Journal Impact Factor (2013): 5.837.

[7] A Study of Seismic Safety of District Hospital in Baramulla in J&K M A Dar, A.R Dar, S Wani and J Raju, International Journal of Civil Engineering & Technology, ISSN 0976 – 6308 (Print),ISSN 0976 – 6316(Online),Volume 4, Issue 5, October 2013, pp. 88-98,Journal Impact Factor (2013): 5.3277.

[8] A Case Study of Seismic Safety of Masonry Buildings in J&K M A Dar, A.R Dar, S Wani and J Raju, International Journal of Civil Engineering & Applications, ISSN 2249-426X Volume 3, Number 1 (2013), pp. 21-32

[9]"Experimental Study on Seismic Capabilities of Dhajji-Dewari Frames" M A Dar, J Raju, A.R Dar and A H Shah, International Conference on Advances in Architecture and Civil Engineering (AARCV) 2012 at (M S Ramaiah Institute of Technology), India (Proceedings of International Conference on Advances in Architecture and Civil Engineering (AARCV 2012, 21st -23rd June 2012, Paper ID SAM206, vol 1)) (ISBN 978-93-82338-01-7)

