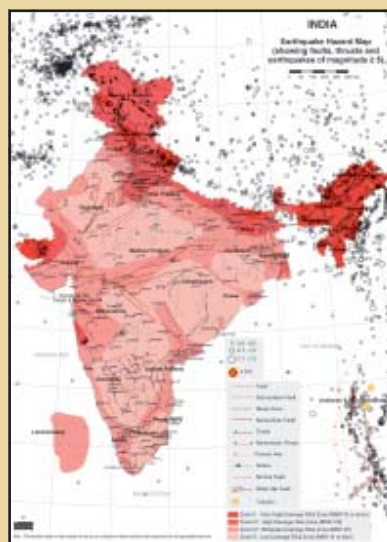




Guidelines

Improving Earthquake Resistance of Housing

2010



bmtpc

**Building Materials & Technology Promotion Council
Ministry of Housing & Urban Poverty Alleviation
Government of India, New Delhi**

Guidelines

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ISBN: 81-86930-17-5

PRICE: Rs.350/-

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Photo courtesy: NICEE, IIT Kanpur, CBRI Roorkee, IIT Roorkee

Published by:

Building Materials & Technology Promotion Council,

Ministry of Housing & Urban Poverty Alleviation,

Government of India, New Delhi

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FOREWORD

I have great pleasure and pride in bringing out the BMTPC's latest publication entitled *Improving Earthquake Resistance of Housing: Guidelines* for the benefit of all the stakeholders involved in Earthquake risk management and mitigation. The publication is the updated version of BMTPC's earlier version with the same title which was drafted by Padmashree Prof. Anand S. Arya with the approval of expert group. The publication came in 2001. However, since then lot of changes have taken place as regards the strategy of Indian subcontinent is concerned towards combating earthquake risk. The Ministry of Home Affairs took over on Disaster related issues from Ministry of Agriculture and we have recognized that 3 Ps i.e. Prevention, Preparedness and Planning are more apt than being 3 Rs i.e. Reactive, Rescue and Recovery. Also, thanks to recurrent earthquakes in urban centers of India in last two decades, our knowledge in the area of earthquake resistant design and construction has increased manifold and several new concepts, technologies and tools have come up to understand the ever so complex behavior of structures under random earthquake loading. As a result, Indian standards have also gone through subtle changes such as obliterating Zone I (*now, we have only four zones starting from Zone II to Zone V*), bringing in more simplicity and new sections on irregularities, ductility, categorization of buildings etc. Therefore, it was felt obligatory to bring out newer version of our earlier published guidelines. The guidelines incorporate all the modifications being incorporated in Indian Standards. A separate annexure is added on Confined Masonry Technology as an alternative to the masonry construction reinforced at critical point being practiced in India for earthquake safe construction. This document would serve as an explanatory handbook on the various clauses of Indian Standards on Earthquakes which are important from the point of view of designing new buildings or improving resistance of existing building stock. The guidelines are in particular written keeping in mind that the major stock of buildings in India comprise of masonry buildings made up of mud burnt/un-burnt bricks and blocks & stones which are yet seldom designed for gravity and earthquake loads. Also, through these guidelines, we wish to pass on knowledge and expertise to our planners, engineers and architects and above all the common people of India to whom we owe, what have been learnt through all these menacing earthquakes. It has been endeavor of BMTPC to educate the masses and disseminate the knowledge in comprehensible lingo through its publication.

I place on record my deep and humble appreciation for Dr. Arya, Prof. Emeritus, IIT, Roorkee to take up the challenge and prepare the updated version of guidelines.

Let us build India as Earthquake Resilient Society.

8th Day of May, 2010
New Delhi

Dr. Shailesh Kr. Agrawal
Executive Director, BMTPC

PREFACE

The earthquake hazard has been well addressed by Committee CED:39 of Bureau of Indian Standards and the following standards are already printed:

1. IS:1983-(Part I) 2002 "Criteria for Earthquake Resistant Design of Structures (Fifth Revision)" 2002.
2. IS:13920-1993 "Ductile Detailing of Reinforced Concrete Structures subjected to Seismic Forces - Code of Practice" November 1993*.
3. IS:4326-1993 "Earthquake Resistant Design and Construction of Buildings - Code of Practice (Second Revision)" October 1993*.
4. IS:13828-1993 "Improving Earthquake Resistance of Low Strength Masonry Buildings - Guidelines" August 1993.
5. IS:13827-1993 "Improving Earthquake Resistance of Earthen Buildings - Guidelines", October 1993.
6. IS:13935-1993 "Repair and Seismic Strengthening of Buildings - Guidelines", November 1993.*

**Presently under revision may be reprinted by end of 2010.*

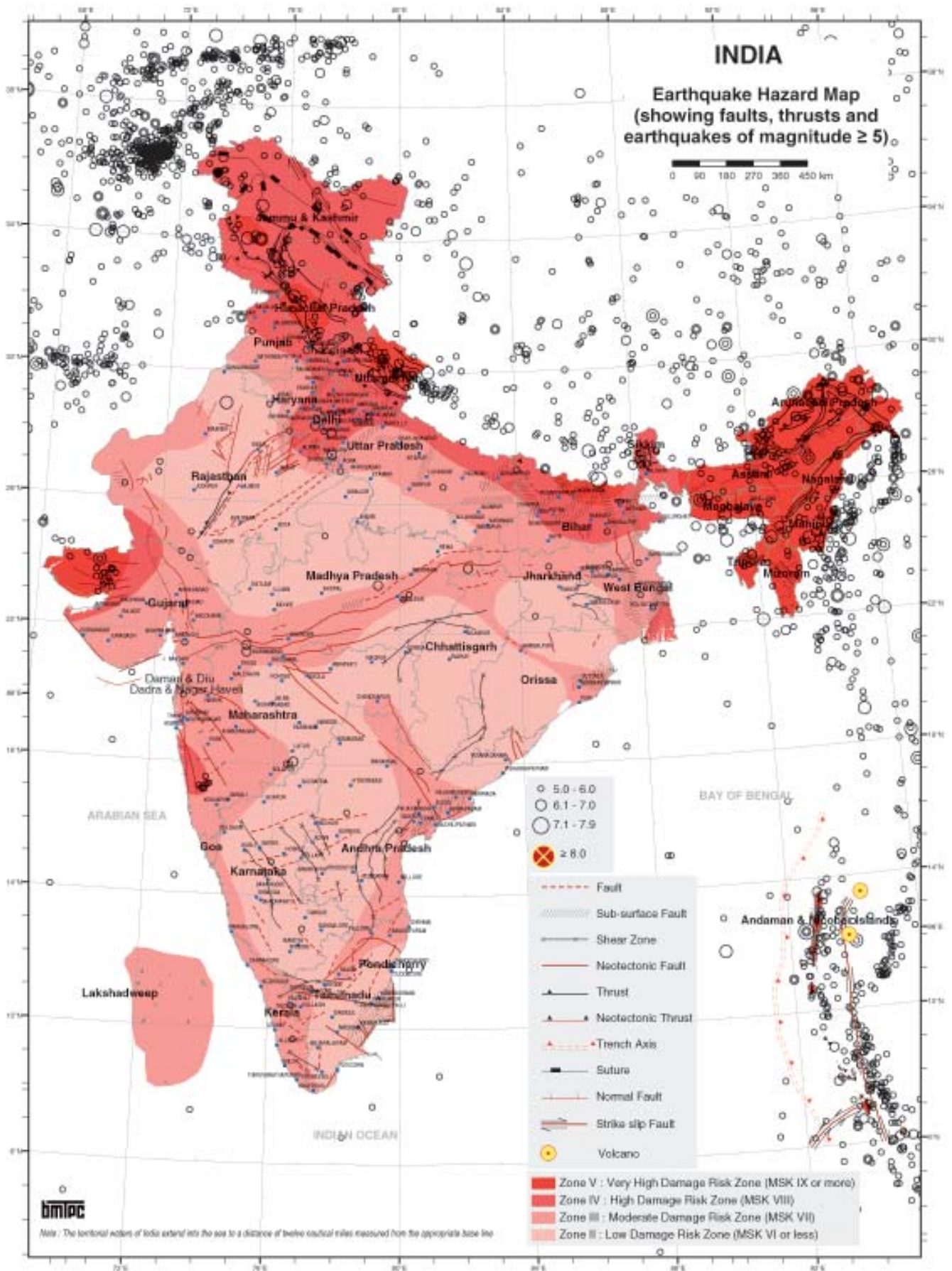
These standards taken together cover the professional design and construction requirements of buildings quite adequately. BMTPC, however, considered the need to prepare a brief guideline to explain the terms and principles underlying the occurrence of earthquakes, their effects on ground and buildings, and highlight the minimum safety provisions in buildings of various types commonly used for housing and built by people without involvement of engineering design and supervision. Obviously, the recommendations have to be made in line with those in the above standards and proper reference to them has to be made as necessary. Accordingly, these guidelines had first been prepared in 1998 and published in 1999-2002 for use by the people particularly those using the Vulnerability Atlas of India.

During the period 1999 to 2006, three major damaging earthquakes occurred in India namely, Chamoli (Uttanchal) 1999, Bhuj (Gujrat) 2001, and Kupwada (Jammu and Kashmir) 2005, as a result of which the main earthquake Code, IS: 1893 underwent major revision. The seismic zoning map was amended to reduce the number of Zones from 5 to 4 with many changes in the design seismic forces. Also, the categorization of the buildings was accordingly changed in IS: 4326. This first revision of the BMTPC guidelines incorporates all such modifications as a measure of updation. Besides, an earthquake safe construction technology, called as Confined Masonry Construction, has been included as an annexure, taking into view that inclusion of this technology is under consideration in the revision of IS: 4326.

Acknowledgement : These Guidelines were initially drafted by and now revised by the author. He will like to acknowledge heartily the assistance provided by the BMTPC staff in general and Dalip Kumar in particular. He feels indebted to Shri T.N. Gupta, the then E. D., and Dr. Shailesh Agrawal, the present Executive Director, BMTPC for providing the opportunity and the facilities of BMTPC for carrying out this work in the service of the people.

May 25, 2010

Dr. Anand S. Arya
Professor Emeritus, IIT Roorkee



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