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Seismic Academy: What is your input on our Indian building codes with respect to speculations about impending earthquakes in India?

Sanjay Pant : India is a disaster-prone country with 59% of its land mass susceptible to earthquake events. The Bureau of Indian Standards (BIS), as the National Standards Body of the country, therefore, initiated the standardization activity in this area quite early with first standard on Criteria for earthquake resistant design of structures along with the seismic zoning map of India brought out as early as in 1962. Subsequently, the above standard was revised and updated number of times to absorb the latest knowledge and developments and the experience gained in the use of preceding versions of the standard. The latest version is IS 1893 (Part 1): 2016 dealing with 'General provisions and buildings' and other parts of this standard similarly detail provisions for seismic safety for Liquid Retaining Structures, Bridges and Retaining Walls, Industrial and Stack like structures, etc. The standard divides the country into 4 seismic zones, namely Zone II, III, IV and V, the Zone II being least vulnerable and Zone V the most.

BIS has also brought out a series of other associated standards on earthquake resistant design and construction of masonry buildings (IS 4326), ductile design and detailing of reinforced concrete structures (IS 13920), improving earthquake resistance of earthen buildings (IS 13827) and improving earthquake resistance of low strength masonry buildings (IS 13828). Also, standards have been developed for improving seismic performance of masonry and RC buildings, namely seismic evaluation, repair and strengthening of masonry buildings (IS 13935) and seismic evaluation and strengthening of existing reinforced concrete buildings (IS 15988).

The structures designed and maintained as per the aforementioned standards will be able to withstand the expected seismic forces in the respective zones with no damage or with collapse prevention of the buildings / structures.

Seismic Academy: Taking in view the recent global catastrophes, what is your advisory to the government bodies, engineers and architects in terms of maintaining structural integrity of buildings?

Sanjay Pant: It is important to not only construct the buildings as per the stipulations of the relevant Indian Standards but also ensure their maintenance for the sustained structural performance during the life of the buildings. Also, those buildings which are found to be structurally deficient need to be immediately retrofitted to improve their seismic performance. The National Building Code of India, 2016 (NBC 2016) also recommends periodic renewal certification of high rise and special buildings by the authority from structural safety, fire safety, electrical safety and health safety point of view. As mentioned earlier, BIS has formulated IS 13935 on seismic evaluation, repair and strengthening of masonry buildings and IS15988 on seismic evaluation and strengthening of existing reinforced concrete buildings. Provisions of these standards should be utilized by the authorities and building professionals in examination and strengthening of buildings.

Seismic Academy: How is BIS planning to introduce newer amendments in the existing norms for making resilient structures?

Sanjay Pant: The work in this area is done by the Earthquake Engineering Sectional Committee, CED 39 of BIS. This standing technical committee regularly reviews and updates existing standards and

develops required new standards in this field. CED 39 has already taken up revision of IS 1893 (Part 1) along with the seismic zoning map of India which would now be based on Probabilistic Seismic Hazard Analysis (PSHA). New standards have also since been brought out on Base Isolated Buildings [IS 1893 (Part 6)] and on Confined Masonry (IS 17848). While the standards on seismic evaluation and strengthening are under revision, newer standards on criteria for earthquake resistant design of steel buildings and pipelines are on the anvil. R&D for development of new standards on performance based design of RC buildings has been carried out and draft standard is under progress. A new standard on post-earthquake safety assessment of buildings is also under development.

Seismic Academy: What as per your opinion should be done to ensure enforcement of the developed standards at all level?

Sanjay Pant: In order to ensure safety of structures, an effective implementation of Indian Standards in their planning, design and construction is very important. It requires a multi-pronged strategy particularly as construction is a state subject under the Constitution of India. These standards should be implemented through their mandatory reference for compliance in the building regulations by the state / local bodies, by the government construction departments / agencies in their construction programmes, by the private construction agencies / builders / developers / contractors in their works, by the building professionals like architects, civil engineers and structural engineers in their professional practice, by the building material and technology manufacturers / suppliers in their manufacturing / applications, by the research institutions in their R&D for product and technology development activities, and by the faculty members and students of technical education in their curriculum so that we bring out future professionals duly trained in earthquake engineering aspects.

As already mentioned above, the implementation is to be effected through a multi-pronged strategy. It is here worth mentioning that BIS has also formulated the National Building Code of India 2016 (NBC 2016) which not only covers earthquake resistant design of buildings based on the above Indian standards on earthquake engineering but also covers the administrative provisions for implementing the entire stipulations on planning, design, construction and maintenance of buildings. NBC 2016 is an instrument which helps in regulating the building construction activity across the length and breadth of the country. It is utilized for revising and revamping the building regulations by the states / local bodies where it should be ensured to give copious reference to its various provisions for ensuring orderly, safe, robust, accessible and sustainable buildings and built environment.

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Seismic Academy: How are you planning to disseminate the knowledge about new standards to practicing engineers?

Sanjay Pant: BIS has been approaching all the State / UT governments and their local bodies for effective implementation of NBC 2016 and earthquake engineering standards. BIS has been regularly organizing awareness and implementation workshops in various cities across the country, for state regulatory authorities like town and country planning departments, municipal corporations, municipalities, development authorities; government departments like PWDs, housing boards, housing corporations; builders / developers / contractors; building professionals like town planners, architects, urban designers, civil and structural engineers, etc who have been attending these events in large numbers. But India is a vast country with so many departments and professionals working in this field of built environment. This dissemination is, therefore, being aggressively pursued in different parts of the country with good results. In addition, BIS has also initiated a training programme covering capsule courses on NBC 2016 and especially on the structural design aspects covering earthquake resistant design of structures at the National Institute of Training for Standardization (NITS), Noida, the popular training arm of BIS. All departments and professionals are invited to join these courses.