

**GOVERNMENT OF INDIA
SCIENCE AND TECHNOLOGY
LOK SABHA**

UNSTARRED QUESTION NO:2321
ANSWERED ON:11.03.2015
RESEARCH ON EARTHQUAKE RESISTANT BUILDINGS
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Will the Minister of SCIENCE AND TECHNOLOGY be pleased to state:

- (a) Whether any research work has been initiated by different research laboratories/institutes for construction of earthquake resistant buildings;
- (b) if so, the details of institutes engaged in the said research work;
- (c) the progress made in this regard; and
- (d) the other steps being taken by Government for construction of earthquake resistant buildings on the basis of scientific studies?

Answer

MINISTER OF SCIENCE AND TECHNOLOGY AND MINISTER OF EARTH SCIENCES (Dr. HARSH VARDHAN)

(a) Yes, Madam.

(b) Three constituent Laboratories of Council of Scientific and Industrial Research (CSIR) namely 'CSIR-Central Building Research Institute (CSIR- CBRI), Roorkee', 'CSIR-National Geophysical Research Institute (CSIR-NGRI), Hyderabad', and 'CSIR-Structural Engineering Research Centre (CSIR-SERC), Chennai' are involved in research related to earthquake resistant buildings. These laboratories/ institutes are pursuing R&D activities for designing & building earthquake resistant buildings as well as for strengthening/ retrofitting of existing buildings to make them earthquake resistant.

(c) Details of the progress made in this regard are at Annexure-1.

(d) Details are at Annexure-2.

Annexure-1

Progress made by CSIR towards development of Earthquake-resistant buildings

CSIR-National Geophysical Research Institute (CSIR-NGRI) is involved in monitoring the earthquake activity by deploying seismic networks in various earthquake affected regions of India like Koyna (Maharashtra), Jorhat (North-East India) and Kachchh (Gujarat). It has prepared seismic hazard map of India which provides useful information to engineers and seismologists to prepare seismic zoning map. CSIR-NGRI has been carrying out research projects related to ground motion modelling. This helps engineers to construct better earthquake resistant buildings that could withstand the predicted maximum Peak Ground Acceleration (PGA) for a maximum expected magnitude at a particular site. CSIR-NGRI has also been involved in carrying out site response studies in important earthquake affected regions in India like Kachchh (Gujarat), Jorhat (Assam) Jabalpur (Central India) and Bengaluru city.

CSIR-Central Building Research Institute (CSIR-CBRI) and CSIR-Structural Engineering Research Centre (CSIR-SERC) have executed various projects which include: Seismic damage (semi-active and passive) control strategies for structures; Assessment of methodologies and procedures for seismic performance evaluation of structures; Vulnerability analysis of buildings and structures for earthquakes; Development of damage diagnostic methods for constructed facilities; and Seismic performance evaluation of buildings. Through these projects the endeavour is to enhance and improve our country's capacity and capability in the area of design, construction, rehabilitation through appropriate retrofit of structures and buildings.

Following paragraphs provides some of the important expertise developed by CSIR laboratories/ institutes:

A. CSIR-CBRI

The Activities include:

- # Seismic evaluation of reinforced concrete frames and retrofitting measures under quasi-static condition;
- # Improving seismic resistance of cultural heritage buildings;
- # Response prediction of building structure subjected to earthquake motions using artificial neural network;

Seismic evaluation of a 3S prefabricated system (2-storied building) under quasi-static condition;

Seismic vulnerability assessment of masonry buildings and its remedial measures; and

3 Behavior of confined masonry buildings under seismic loading.

B. CSIR-SERC

The Focus is on:

Probabilistic Seismic Hazard Analysis (PSHA) of India at a fine grid of $0.2^{\circ} \times 0.2^{\circ}$ at type "A" rock level;

Seismic design of multi-storied RC frames with natural rubber isolators;

Guidelines for assessment of strength and performance of existing buildings and recommendation for retrofitting schemes to ensure resistance to earthquake;

Dynamic characteristics of natural rubber based seismic isolators under bi-axial loading;

Seismic studies on fluid-structure interaction;

Seismic evaluation of a model earthquake-resistant unreinforced brick masonry house and gypcrete building panel, using shake table; and

Establishment of an Advanced Seismic Testing and Research Laboratory (A-STaR Lab) with the aim of developing solutions to problems arising out of seismic loadings on buildings and structures and structural components, and to study the response.

Annexure-2

CSIR-Central Building Research Institute (CSIR-CBRI) and CSIR-Structural Engineering Research Centre (CSIR-SERC) impart training to the practicing engineers through advance courses, seminars and workshops aimed at providing: knowledge newer vital concepts developed; methodologies developed to construct earthquake resistant houses, buildings, and structures; and information on best practices for the field applications depending on microzonation atlas for India and with particular reference to peninsular India.

Scientists of CSIR-SERC/CSIR-CBRI are also represented in Committees of Bureau of Indian Standards (BIS), National Disaster Mitigation Authority (NDMA), National Institute of Disaster Management (NIDM), Ministry of Home Affairs (MHA), Building Materials & Technology Promotion Council (BMTPC) and other agencies who are engaged in the formulation of guidelines for building design and seismic resistant building designs and codal provisions. For Code 1893 Parts I to V of BIS, CSIR-SERC has contributed significantly in terms of improved and efficient design methodologies.