

**Report on International Symposium on
“Advances in Earthquake Science-2011”**

Held at

**Institute of Seismological Research,
Raisan, Gandhinagar**

January 22-24, 2011

**Institute of Seismological Research
Department of Science & Technology
Government of Gujarat
Raisan, Gandhinagar-382 009**

**Report on International Symposium on
“Advances in Earthquake Science-2011”
January 22-24, 2011**

This report is about an International Symposium on “Advances in Earthquake Science (AES-2011)” organized at Institute of Seismological Research, Raisan, Gandhinagar during January 22-24, 2011. The report has following sections:

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1. INAUGURAL FUNCTION

An International Symposium on “Advances in Earthquake Science (AES-2011)” was organized at Institute of Seismological Research, Raisan, Gandhinagar during January 22 -24, 2011. The main objective of the Symposium was to foster better understanding of earthquake phenomenon that may help in reduction of loss of life and property due to earthquakes worldwide. This Symposium was organized by Indian Society of Earthquake Science (ISES) and Institute of Seismological Research (ISR). The Symposium was sponsored by Ministry of Earth-Sciences (MoES), Gujarat State Disaster Management Authority (GSDMA), International Union of Geodesy and Geophysics (IUGG), National Geophysical Research Institute (NGRI) and National Power Corporation of India Limited (NPCIL). Travel of several foreign and Indian delegates was supported for a special session on Archeoseismology under the framework of the International Geosciences Programme IGCP567.

A copy of Invitation card and Minute-to-Minute Programmes are attached (Annexure 1 and 2).

The Hon’ble Chief Minister of the Gujarat state, Shri Narendra Modi dedicated the Institute of Seismological Research (ISR) to the nation and inaugurated the International Symposium on “Advances in Earthquake Sciences-2011” on January 22, 2011. Shri Narendra Modi also dedicated a one megawatt (1 MW) solar plant to the nation.

Following dignitaries were also present on the Dias:

Smt. Anandiben Patel, Honorable State Revenue Minister

Shri B. Bhattacharjee, Member National Disaster Management Authority

Dr. S.K. Jain, Chairman and Managing Director of Nuclear Power Corporation of India Ltd.

Shri D.J. Pandian, Principle Secretary, Energy and Petrochemicals Department

Sri Ishwar M. Bhavsar, Chairman, Gujarat Energy Development Authority

Sri Ashok Bhavsar, Chairman, Gandhinagar Urban Development Authority (GUDA)

Dr. Paritosh Banik, Director General of Pandit Deendayal Petroleum University

The Inaugural Function was held in the auditorium of Pandit Deendayal Petroleum University while the symposium was held at ISR. Shri Narendra Modi, while dedicating the institute said that the ISR is a world-class institute and with the help of its research in earthquake science it will find ways to safeguard people from the dangers of monstrous hazard of earthquake. While welcoming the experts at the Conference, Sri Modi said that in the time of just three years of the earthquake hitting Gujarat in 2001, the state had finished the rehabilitation process and with the establishment of the world class institute like ISR in the state, Gujarat has shown the metal it possesses to the world. He also recalled that long back he had dreamt of setting up of an institute like ISR which was unfortunately not been materialized due to Central Government indifference. But Government of Gujarat has successfully turned the dream into reality. The Chief Minister encouraged youths to pursue PhD and utilize their brain for the good of the society and he

assured that the state government will provide them residence and scholarship support during their two-year research period. He also informed that with the help of ISR the state government has information of earthquake within minutes of its arrival and he also appreciated some important projects of ISR like Seismic Hazard Assessment of Dholera SIR, GIFT City and Mundra LNG Port Terminal. Speaking at the event, Shri Modi said that he aims to make Gandhinagar a Solar City. He said that the state is working on rooftop electricity generation policy and soon Gandhinagar residents will be producing electricity on their rooftops and State Government will buy the electricity.

On this occasion of dedication of ISR to the nation and inauguration of the International Symposium, AES-2011, Honorable State Revenue Minister, Smt. Anandiben Patel said that soon ISR will become a major centre for the seismological studies and its researches will be useful in meeting with the natural disaster of earthquakes.

Shri B. Bhattacharjee, member of National Disaster Management Authority told that Gujarat has become a role model for other states in the area of Disaster Management and Preparedness

Dr. B. K. Rastogi, Director General of ISR emphasized on the importance of seismic study in Gujarat by informing that Gujarat is the only region in the country where seismic activity is seen in Stable Continental Region. A lot of frontier research has been done for such earthquakes in India as a whole and Gujarat in particular which the world is keen to understand first hand by coming to Gujarat.

2. ABOUT THE DELEGATES

A total of 16 foreign delegates from USA, Russia, Germany, France, Italy, Hungary, Japan, Korea, Bangladesh etc and 150 Indian delegates from different parts of the country attended the Symposium. An annexure of foreign and Indian delegates is attached (Annexure-3 and 4).

3. SCIENTIFIC PROGRAM

3.1 ABSTRACTS

Out of 200 abstracts submitted, total 140 papers were presented in 16 sessions among which 94 were oral and 35 poster. An abstract volume was published. Eleven special lectures were also arranged. To accommodate huge number of paper presentations, parallel sessions had to be arranged. Each session consisted of Keynote Speeches, Invited talks and Contributed Talks. An annexure carrying the statistical detail of each session is attached (Annexure-5).

3.2 ISES LECTURE AND SPECIAL LECTURES

Special Lectures were delivered by dignitaries on various topics of relevance. Following table shows the topics of Special Lectures and their corresponding speakers.

ISES Lecture	Program on study of earthquake precursors in India Harsh Gupta, Panikkar Professor National Geophysical Research Institute, Hyderabad
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Special-1	India's tsunami warning system: A success story Harsh Gupta, Panikkar Professor, National Geophysical Research Institute, Hyderabad
Special-2	Time-varying Tsunami Characteristics in Wavelet Domain V.P. Dimri, Distinguished Scientist, NGRI, Hyderabad
Special-3	Making of probabilistic seismic hazard map of India for the Bureau of Indian Standards B.K. Rastogi, Director General Institute of Seismological Research, Gandhinagar
Special-4	New probabilistic seismic hazard map of India R.N. Iyengar Center of Disaster Mitigation, Jain University, Bangalore -Kanakapura Road, Jakkasandra
Special-5	Nuclear power program of India and seismic safety of Nuclear Power Plants S K Jain CMD, NPCIL, Mumbai
Special-6	Structure, tectonics & active faults of Kutch rift basin, Gujarat, Western India S. K. Biswas Formerly: Director, KD Malviya Institute Petroleum Exploration, ONGC, Dehradun
Special-7	A testable model for intraplate earthquakes Pradeep Talwani Dept. of Earth and Ocean Sciences, University of South Carolina, Columbia, USA
Special-8	Space inputs in disaster monitoring, mitigation and early warning. A. S. Rajawat Head Geo-science division, SAC, ISRO, Ahmedabad
Special-9	The road to seismic safety Sudhir Jain Director, IIT Gandhinagar.
Special-10	Bhuj earthquake and role of CEPT University in post disaster scenario V. R. Shah (H.O.D Structural Design Department, CEPT University, Ahmedabad

On the first day of the Symposium, on 22nd January, 2011, **Dr. H. K. Gupta of NGRI, Hyderabad delivered ISES Lecture-2011 on “Program on study of earthquake precursors in India”.** He presented the idea of earthquake prediction and identification of precursory changes. He highlighted study of identifiable pattern of precursory seismicity and physical

changes in properties of rocks. He also informed that to capture and identify such precursory changes the DST/GOI identified 4-5 seismogenic (earthquake producing) zones and setup a programme of deploying a dense network of monitors. Those include seismographs to locate and identify patterns of seismicity in real time- now made possible by advances in digital recording of seismicity at a central location. He also informed that changes in physical properties include the increase in radon concentration with a relatively short half life. Other precursory changes that can be detected are in the changes in the water content, release of gases, changes in ambient natural electric fields. Suitably located sensors can detect and record these changes in real time.

In his Special Lecture-1 on “India’s Tsunami Warning System: A Success Story”, Dr. H. K. Gupta of NGRI, Hyderabad said that the recent Indian Ocean Tsunami (December 26, 2004), is now established to be the strongest in the world over the past 40 years. It resulted in devastations amounting to national calamities in several parts of the Indian Ocean. As compared to the most severe Tsunamis of the past, the loss of lives in the Indian Ocean Tsunami has been higher by an order of magnitude, thereby calling for development of Tsunami Warning System on a war-footing.

Dr. V.P. Dimri, Distinguished Scientist, NGRI, Hyderabad delivered Special Lecture-2 on “Time-varying Tsunami Characteristics in Wavelet Domain”. He discussed about the wavelet domain analysis. Also he said that wavelet theory provides different methodologies to understand the signal behavior and interpretation in space scale domain. He presented a methodology which had been tested for Andaman –Sumatra and some other region as well.

Dr. B.K. Rastogi, Director General, ISR, Gandhinagar delivered Special Lecture-3 on “Making of probabilistic seismic hazard map of India for the Bureau of Indian Standards”. He announced the completion of PSHA Map for India and submitted to Bureau of Indian Standards (BIS) for their recommendation to users.

Dr. R. N. Iyengar of Centre for Disaster Mitigation, Jain University delivered Special Lecture -4 on “New Probabilistic Seismic Hazard Map of India”. In this talk the new PSHA map of India developed for NDMA, Govt. of India was presented. The talk highlights how the source, path, site paradigm has been used to estimate surface level hazard at hard rock sites. All known data about past earthquakes and mapped faults are considered to characterize the seismic activity. Based on the tectonic setting of the country and disposition of faults, he highlighted thirty-two source zones. He discussed an earthquake catalogue ($M_w > 4$) from the remote past till the end of year 2008 and also discussed on issues related to completeness and recurrence relations.

He told that the country is structured into seven geological provinces with differing quality factors. He talked about Standard PSHA which has been carried out covering the whole country on a grid size of $0.2^\circ \times 0.2^\circ$. He informed that application of the PSHA results is illustrated by working out the design response spectra as per IBC-2009 for the four metropolitan cities, Delhi, Mumbai, Kolkata and Chennai.

Dr. S. K. Jain of CMD, NPCIL, Mumbai delivered Special Lecture -6 on “Nuclear power program of India and seismic safety of Nuclear Power Plants”. He discussed on various aspects of future programme of nuclear power generation.

Dr. S. K. Biswas, Formerly: Director, KD Malviya Institute Petroleum Exploration, Dehradun delivered Special Lecture-7 on “Structure, Tectonics and Active Faults of Kutch Rift Basin, Western India”. Dr. Biswas discussed about Kutch basin and discussed in details all the faults and other structural features of the whole region. Also he explained subsurface basement ridge – Median High which is acting as a hinge. He talked about the evolution of the Kutch basin and reactivation of the primordial faults. Then he described about present tectonic scenario. He pointed out causative fault of the Bhuj as well as Anjar earthquakes. Based on his study and the detailed depth wise analysis of aftershock data, a conceptual domino-listric model of Kutch rift was presented.

Dr. Pradeep Talwani delivered Special lecture-8 on “A Testable Model For Intraplate Earthquakes”. He informed that 98% of the total seismic moment release associated with intraplate earthquakes (IPE) occurs in former rifts and taphrogens. He quoted many past studies about stress field. Modeling results have shown that when rifted sedimentary basins which had been formed under extension, with a priori weaknesses, are inverted under compression, the results are weak conjugate and boundary faults with up-welled lower crust, identified as rift pillows. These characteristic features of stress inversion are associated with local elevated strain rates and then he suggested a testable model. He illustrated these ideas with data from Kutch and Sea of Japan earthquakes.

Dr. A. S. Rajawat of SAC, ISRO, Ahmedabad presented Special Lecture -9 on “Space inputs in disaster monitoring, mitigation and early warning”. He elaborated different schemes of ISRO and its Earth Science Division. He talked on current and future research programmes. Also, he discussed national and international collaborations.

Dr. Sudhir Jain, Director, IIT Gandhinagar presented Special Lecture-10 on “The road to seismic safety”. He emphasized on implementation of mandatory rules for construction of earthquake resistant buildings.

Prof. V. R. Shah, H.O.D., Structural Design department, CEPT University, Ahmedabad delivered Special Lecture-11 on “Bhuj earthquake and role of CEPT University in post disaster scenario”. He highlighted CEPT University and its role in post disaster work. He told that the institute also took a lead role in reconstruction of villages and public buildings, conducting training programs for capacity building of architects, engineers and skilled workers. To involve its students into these activities, the institute re-oriented its academic program for the semester and the students got the first hand experience of architectural design of reconstruction, planning of villages and towns and participation in capacity building programmes.

3.3 TECHNICAL SESSIONS

Papers were categorized in each session according to the themes of the Symposium. Following were the themes of the Symposium:

- S1: Bhuj Earthquake and Aftershock Studies
- S2: Intraplate Seismicity
- S3: Seismicity and Earthquake Source Processes
- S4 : Paleoseismology and Historical Seismology
- S5: Earthquake Precursors and Prediction Studies
- S6 : Seismic Wave propagation, Amplification and Basin Effect
- S7 : Real Time Seismology, Loss Reduction and Early Warning
- S8 : Earthquake Ground Motion and Damaging Earthquakes
- S9: Seismic Hazard Assessment / Microzonation
- S10 : Tectonics and Crustal Movements
- S11 : Earth's interior , structure & dynamics
- S12: Remote Sensing, GPS & InSAR
- S13: Exploration for Oil and Crustal Structure
- S14: Ground Response Studies for Nuclear Power Plants
- S15: Tsunami Modeling
- S16: IGCP Session on Archaeoseismology

The short and long programs of presentations are attached (**Annexure 6**). Papers presented in the Poster Session are listed in **Annexure 8**.

3.4 KEYNOTE LECTURES

Following are the details of the keynote speeches (arranged date wise):

22nd January:

- S1: Dr. Prabhas Pande of GSI on “Geoseismological investigation of 26 January 2001 Bhuj earthquake”
- S16: Dr. Pradeep Talwani of University of South Carolina, Columbia on “Archaeoseismology and the role of tectonics in the demise of the Indus Valley Civilization”
- S1: Dr. Prantik Mandal of NGRI, Hyderabad on “Delineation of crustal and lithospheric structures below the Kachchh region”
- S1: Dr. J R Kayal of ISM, Dhanbad on Seismic source of the 2001 Bhuj earthquake and aftershock studies

23rd January:

- S2: Dr. D. C. Mishra of NGRI, Hyderabad on “Seismotectonics of Bhuj earthquake of 2001 based on gravity and magnetic signatures.....”
- S4: Dr. A.K. Singhvi of PRL, Ahmedabad on “Luminescence dating in paleoseismology and neotectonics: an overview”

24th January:

- S7: Dr.R.S.Dattatrayam of IMD, Delhi on “Current trends in seismic instrumentation and earthquake monitoring in India”

3.5 SUMMARY OF TECHNICAL SESSIONS

In the technical session **S1: Bhuj Earthquake and Aftershock Studies**, there were a total of three keynote papers. Dr. Prabhas Pande chaired the session. In the first keynote presentation, Dr. Pande drew attention toward the damages to civil structures, secondary ground deformations and death toll caused by the 2001 Bhuj earthquake. He also proposed, based on ground deformation study, a seismo-tectonic model consisting of four tectonic blocks below the main epicentral zone that might have resulted in generating the 2001 Bhuj mainshock. In the next keynote presentation, Dr. Prantik Mandal proposed a model for the continued occurrence of the aftershock activity of the 2001 Bhuj mainshock. He presented the crustal and lithospheric structures below the Kachchh seismic zone, which were delineated by the local earthquake tomography, inversion of teleseismic receiver functions and joint inversion of receiver functions and surface wave group velocity dispersion studies. His study delineated the coincidence of the area of the major aftershock activity and the Moho (~4-7 km) as well as asthenospheric (~6-12 km) upwarping beneath the central Kachchh rift zone, which suggests the presence of patches of CO₂ rich lherzolite melts below the region that could also provide a high input of volatiles containing CO₂ into the lower crust resulting in generating continued aftershock activity in the region. In the last keynote presentation, Dr. Kayal’s study could delineate, based on results of local earthquake tomography, 3-D mapping of b-value and fractal dimensions, two distinct NE and NW trending tectonic arms of the V-shape aftershock zone of the 2001 Bhuj mainshock. Based on the large estimated fractal dimension (~2.28) for the entire aftershock zone, he proposed a fractal 3-D structure of the 2001 Bhuj earthquake source zone.

The **Session S2: Intraplate Seismicity**, was chaired by Dr. O.P. Mishra and co-chaired by Dr. Bijendra Singh. Several important ideas were presented and thoroughly discussed about seismotectonics of different regions in Stable Continental Region (SCR) of India. Dr. D.C. Mishra and Bijendra Singh presented the model of crustal structure in Kachchh based on gravity and magnetic surveys. Dr. O.P. Pandey explained the prevalent seismicity in SCR India due to shallow surfacing of mafic crust. In a poster presentation, A.P. Singh, O.P. Mishra and B.K. Rastogi suggested fluid-filled rock matrix in the hypocentral zone of 2001 mainshock by 3D tomography of velocity structure, Poisson’s ratio structure and b-value.

In the technical **Session S3: Seismicity and Earthquake Source Processes**, there were one invited and 8 contributed papers. The session was chaired by Prof. J.R. Kayal and co-chaired by Dr. Prantik Mandal. Dr. Kayal presented the Invited paper of Prof. Mona Lisa on seismic hazard assessment of Karachi. In the first contributed paper, Dr. Manisha presented the estimated source parameters, site amplifications and attenuation parameters from the acceleration data of an earthquake of M4.7 that took place in 2007 in the Delhi region. She also reported a 3-4 times site amplification for a younger alluvium site in the trans Yamuna region while smaller site amplification values are found to be associated with the older alluvium sites. In the second contributed paper, Dr. Sivaram drew attention toward the importance of source parameters in designing earthquake source scaling for small earthquakes in Kumaon Himalaya. He also presented source parameters of 30 Kumaon earthquakes (M 3.4-4.6), which were estimated using spectral analysis of P and S waves. In the third contributed paper, Dr. Basab Mukhopadhyay pointed towards importance of statistics in constraining earthquake source zones based on clustering. Based on statistics, he also suggested that the magnitudes for Himalayan earthquakes derived from the rupture lengths are generally underestimated. Based on his study, he proposed several locales for the future Himalayan earthquakes, which were characterized by the intersections of major Himalayan faults and transverse features. In the next paper, Dr. Yadav focused toward the importance of stress patterns estimated using the stress inversion of focal mechanism data of earthquakes occurring in the Kangra-Chambra region of NW Himalaya. Their results of stress inversion of focal mechanism data of 47 earthquakes of M 2.5-5.0 revealed a dominance of thrust to strike slip faulting with SW-NE compression at 0-10 km depths while this dominance changes to normal faulting with SW-NE extension at 10 –40 km depths. He also commented that this type of depth-wise variation of stress pattern could be attributed to the stresses induced by regional plate tectonic forces and local structures like faults/lineaments. In the next talk, Dr. Mandal presented site amplifications and earthquake source parameters estimated using the generalized inversion of S-wave spectra from strong motion data of earthquakes occurring in the Kachchh seismic zone, Gujarat. He also demonstrated that site amplification in Kachchh is highly site dependent, the geological contacts and sediment thickness being major influencing factors. In the next paper, Dr. Gahalaut drew attention toward the important role played by different factors in triggering earthquakes occurring in the Koyna-Warna region. In the next presentation, Dr. Rajesh Prakash presented the fault plane solution of the 2007 ML 4.3 Delhi earthquakes based on first P-motion data, which was estimated to be a south-dipping thrust faulting with a minor strike-slip component coinciding with the trend of Delhi-Saroda ridge. In the last presentation, Dr. Mohapatra presented earthquake source parameters for the earthquakes occurring in NE India, which were estimated using body wave spectra.

In the technical **Session S4: Paleoseismology and Historical Seismology**, four papers were presented. Dr. Singhvi explained that luminescence dating of sediments is found to yield reliable ages and has proved to be an important tool for paleoseismological and neotectonic study. Dr. V. C. Thakur informed about rates of deformation in Himalaya. Dr. Pradeep Talwani explained the effects of earthquakes on Archeoseismology. He highlighted that Archeoseismology is a nascent

forensic science where archaeologists are beginning to appreciate the role of earthquakes in the destruction of structures and earth scientists are beginning to decipher archaeological ruins to fill gaps in their knowledge of prehistoric earthquake sand and improve seismic hazard assessment in a region. He presented case-history of Indus Valley Civilization.

In the technical **Session S5: Earthquake Precursors and Prediction studies**, twelve papers were presented including nine oral presentations and three posters. Dr. B R Arora told that space-time pattern in micro-seismicity, seismic swarms, seismic wave velocity change, 'b' value, RTL algorithm in a given seismic zone show promise in identifying precursors to earthquakes. He talked about MPGOs set-up by Wadia Institute of Himalayan Geology, Dehradun. He talked about environmental factors that may affect precursory signals. Dr. Vivek Walia of National Center for Research on Earthquake Engineering, NARL, Taiwan delivered seminar on the topic "Soil-gas Geochemistry for Earthquake Monitoring and Fault Studies in Taiwan". He talked about the tectonics of Taiwan. His study is proposed to investigate geochemical variations of soil-gas composition in the vicinity of the geological fault zones and determination of the influence of such formations on the enhanced concentrations of different gases in soil to monitor the tectonic activity in the region. S.K. Mondal from ISM, Dhanbad presented his study on "Fractal correlation dimension analysis to identify precursory pattern prior to 15th July 2009...".

Papers were presented on Seismoelectromagnetism, geochemical parameters, helium ewan in different parts of the country. H. N. Dutta suggested deployment of acoustic sounder to monitor atmospheric thermal structure and gravity waves.

In the technical **Session S6: Seismic Wave propagation, Amplification and Basin Effect**, Fumio Kaneko explained why some localities of Anjar are heavily damaged in 1819 and 2001 earthquakes. According to him, Shear-wave velocity is a good criterion for assessing damage potential. A portion of reclaimed area is found to be maximum damaged. Students of T.G. Sitharam explained their estimates of dynamic properties and liquefaction potential of Lucknow soil.

In the technical **Session S7: Real Time Seismology, Loss Reduction and Early Warning**, R. S. Dattarayam informed about the Indian network of the earthquake monitoring station. Chandra Bhakuni informed the method of loss assessment for schools due to earthquakes. E. Hohnecker informed on early warning system for transportation lines. R. Pradeep Kumar presented following three lectures:

1. Performance analysis of Mundra Panipat pipeline crossing Kachchh Mainland Fault...
2. Earthquake vulnerability assessment of buildings and installations in Gujarat ports.
3. Rapid visual survey of existing buildings in Gandhidham and Adipur cities of Kachchh.

In the technical **Session S8: Earthquake Ground Motion and Damaging Earthquakes**, Satish C. Singh presented the great Sumatra earthquakes: Results from recent marine studies. Kojiro IRIKURA discussed about a method for predicting strong ground motions for inland mega fault earthquakes. Sumer Chopra presented estimates damage to various types of buildings in Gujarat from a future large earthquake. Kapil Mohan explained strong motion simulation of great earthquake in the central seismic gap...

In the technical **Session S9: Seismic Hazard Assessment / Microzonation**, Fumio Kaneko presented the results of Seismic Microzonation of Gandhidham area. Peresan described new methods of pattern recognition techniques and Deterministic Seismic Hazard Assessment. Students of T.G. Sitharam informed about a Probabilistic Seismic Hazard Assessment Map of India prepared at IISC Bangalore, Soil classification of Lucknow and study of site effects in Karnataka and Seismic Hazard Assessment of Gujarat. Imtiyaz Parvez illustrated the Ground Motion at Bedrock level in Delhi. Praveen Malhotra presented a new scheme of Hazard Map including population exposure level. Results of site response in Kolkata and Andaman and Nicobar Islands. Lalliana Mualchin cautioned about uncertainties in the data and interpretation.

In the technical Session S10: Tectonics and Crustal Movements, P. Mahesh discussed about Seismotectonics and velocity structure of the Kumaon - Garhwal Himalaya. M.V.Rodkin talked on new evidence of the involvement of the low density fluid phase in the deep crust seismicity. Rashmi Pradhan explained seismotectonic studies of Kachchh basin using gravity surveys after 2001 Bhuj earthquake. B.K. Rastogi discussed about Stress pulse migration by viscoelastic process for long - distance delayed triggering of

In the technical **Session S11: Earth's interior, structure & dynamics**, four papers were presented. Babita Sharma presented paper on Spatial distribution of scatterers in the crust of Kachchh region, Western India by inversion analysis of coda... G. Mohan talked about Seismic signatures of volcanism in the upper mantle beneath NW DVP. N. Purnachandra Rao discussed about Surface wave tomography across the Indian shield, Indo-Gangetic plains and the Himalayan region based on ambient vibrations which is a frontier research. Narendra Kumar explained Anisotropy of the Indian crust from splitting of Ps phases from the Moho.

In the technical **Session S12: Remote Sensing, GPS & InSAR**, six papers were presented. Arun K. Saraf discussed about SAR Interferometry detects post-seismic ground deformations related with 2001 Bhuj earthquake. C.D. Reddy discussed about Ten years of GPS observations after 2001 Bhuj earthquake... R. K. Sukhtankar explained Studies on seismic behaviour and associated topographic changes in NE India based.... K. M. Sreejith discussed Crustal deformation mapping in Kachchh, India using InSAR and GPS: Initial results. Swapnamita C. Vaideswaran and Ajay Paul presented studies on The Tehri Dam, Uttarakhand: crustal strain and implications in case of reservoir induced Rajesh S discussed about Satellite altimeter derived geoid / gravity and the lithospheric density anomaly ...

In the technical **Session S13: Exploration for Oil and Crustal Structure**, three papers were presented. T. Harinarayana of NGRI presented the findings about geological structures in Gujarat by integrating several types of geophysical surveys through GIS. P. B. Pandey, Basin Manager, ONGC, Vadodara presented a talk on structures and prospects of oil in petroliferous basins of Gujarat. Sandip K. Roy of IITb presented on "Impact of tectonics, sedimentation process and evolving trap style in Andaman Island etc..." and talked on oil prospects in Andaman arc region.

In the technical **Session S14: Ground Response Studies for Nuclear Power Plants**, five papers were presented. Dr. STG Raghukanth presented paper on Strong Motion simulation for 2001 Bhuj Earthquake. C.V.R. Murthy discussed about design of structures to account for displacement. Rupen Goswami talked about design of bridges for displacement loading. Apurba Mondal presented paper on seismic analysis for Nuclear Power Plant. Faisal Dastageer discussed about strong motion effects on nuclear power plants and various appurtenant structures.

In the technical **Session S15: Tsunami Modeling**, two papers were presented. Akhilesh K. Verma and William K. Mohanty discussed on Development of paleo-tsunami database and hazard assessment for Indian subcontinent... V. M. Patel presented lecture on Tsunami effect On Porbandar, Western Gujarat coast.

In the technical **Session S16: IGCP Session on Archeoseismology**. Evidences of Paleo-earthquakes and Active Faults were presented by various speakers in the regions of Allahbund and Dholavira of Kachchh, Barreilly, Southern Peninsular India, NW Himalaya, Bangladesh, Thailand and Korea.

4. COLLATERAL ACTIVITIES DURING THE SYMPOSIUM

1. Preparation of Abstract Volume, containing 137 pages
2. ISR Brochure, containing 32 pages
3. CD of press/media interviews of delegates.
4. Post-symposium comments and suggestions by delegates (Annexure 9)
5. Preparation of a Movie showing ISR activities
6. The ISR Implementation Committee Members list is attached as Annexure 10.
7. Press Interviews of a number of Delegates recorded in two CDs

During the Symposium, wide media coverage was arranged (clippings attached as Annexure 12). Photographs taken during the events are attached (Annexure 14).

5. PRE- AND POST-SYMPOSIUM EXCURSIONS

5.1 PRE-SYMPOSIUM EXCURSION

More than 50 delegates viewed Sound & Light Water Show at Akshar Dham on 21 Jan 2011

5.2 FIELD-TRIP TO DHOLAVIRA

For formulation of future research works in Paleoseismology and Archaeoseismology, a team consisting of 8 delegates was sent to Dholavira, Kachchh and other MPMGO sites of ISR during January 25-26, 2011. The team consisted of 6 foreign and 2 Indian delegates. A report of the trip to Dholavira is attached as Annexure 13. For follow-up activities discussions are going on with Director General, Archaeological Survey of India for collaborative works.

5.3 LOCAL-SITE SEEING TRIP

Local site seeing was arranged: A bus load of foreign and Indian delegates were sent to visit local sites around Ahmedabad and Gandhinagar. Places visited are: Adalaj Step-well, Hathisingh ka dera, Science City, Gandhi Ashram, Akshardham Temple etc. Some delegates were sent with separate vehicles independently for visit to local places of their interest.

Certificates are being given to the participants of the Symposium as below:



6. FOLLOW-UP ACTIONS

6.1 MEMORANDUM OF UNDERSTANDING

Five MoUs were signed for collaborative work with the following agencies:

1. Aichi Institute of Technology & Kyoto University, Toyota, Aichi, Japan
2. Department of Earth Sciences, University of Trieste, Trieste, Italy
3. Directeur de recherche au CNRS (émérite), Maison de
4. Department of Palaeontology, Eotvos University, Hungary
5. Department of Geophysics, Kurukshetra University, Haryana

Some more MoUs will be signed later. ISR already has MoUs with PDPU, Gandhinagar, NGRI, Hyderabad, Colorado University, VelTech Univ., Chennai, Charotar Institute of Technology-Changa, and National Center of Earthquake Engineering Research, Taipei, Taiwan.

By the end of the Concluding Session, suggestions/comments were asked from the delegates and following two very important suggestions were given by:

6.2 TOWARDS ESTABLISHMENT OF AN EARTHQUAKE MUSEUM

Dr. Harsh Gupta suggested establishment of Earthquake Museum in Planet Earth at Science City, Ahmedabad similar to Museum of Chi-Chi Earthquake in Taiwan. The idea can be implemented as ISR already has collaborative project going on with Taiwan. In connection with the implementation of the museum, one person from ISR and one from Sc. City can be sent to Taiwan.

6.3 MISSION-MODE PROJECTS

Dr. A.K. Singhvi emphasized to pursue Mission Mode projects under which salaries and research grants can be obtained from DST, Govt. of India. This will also be implemented.

6.4 NEW PROJECT ON ARCHAEOSEISMOLOGY

After the field trip to Dholavira by 6 foreign delegates and former Addl. DG, ASI, it was recommended to start a project on Archaeoseismology in Gujarat. At the first instance Dholavira is recommended to be taken up. Discussions have been initiated with Director General, Archaeological Survey of India for collaborative work on Archaeoseismology in Dholavira.

6.5 ADVISE ON LIGHT RAIL AND MONO RAIL ETC. RAPID TRANSPORT SYSTEM FOR AHMEDABAD:

One of the delegates, Prof. E. Hohnacker, Department of Railway Systems, Karlsruhe Institute of Technology, Germany is world renowned expert on Rapid Transport System and has designed many such projects worldwide along with Mrs. Rachna Gangwar, his Ph.D. student and DG, ISR discussed with Mr. Gautam, Municipal Commissioner, Ahmedabad about the planning and designing of light rail and rapid transport plans of Ahmedabad on 25/01/2011.

6.6 A preliminary survey done for Dholavira Harappan site for Archeoseismological investigations. Report is attached as Annexure 13.

Photographs of Day 1 of the Symposium are attached.

Annexure-1

Invitation

Dedication of
1 MW SOLAR POWER PLANT
&
INSTITUTE OF SEISMOLOGICAL RESEARCH
to the nation
and
Inaugural Ceremony of
**INTERNATIONAL SYMPOSIUM ON
ADVANCES IN EARTHQUAKE SCIENCE (AES 2011)**

INSTITUTE OF SEISMOLOGICAL RESEARCH
Department of Science & Technology, Government of Gujarat
www.isr.gujarat.gov.in

GUJARAT POWER CORPORATION LIMITED
Energy & Petrochemicals Department, Government of Gujarat
www.gpcmltd.com

PROGRAM

Dedication of
**1 MW Solar Power Plant at PDPU &
Institute of Seismological Research**

**Inauguration of International Symposium on
Advances in Earthquake Science (AES-2011)**

Chief Guest:
Shri Narendra Modi
Hon'ble Chief Minister of Gujarat

Guest of Honour:
Smt. Anandiben Patel
Hon'ble Revenue Minister of Gujarat

High Tea and Interaction with Scientists by
Hon'ble Chief Minister of Gujarat

Ravi Saxena, IAS
Additional Chief Secretary,
Department of Science & Technology,
Government of Gujarat

Dr. B K Rastogi
Director General,
Institute of Seismological
Research (ISR),
Government of Gujarat

Institute of Seismological Research (ISR)
Department of Science & Technology, Government of Gujarat
is pleased to invite you to the
Inaugural Ceremony on 22 January 2011

**INTERNATIONAL
SYMPOSIUM**
on
Advances in Earthquake Science (AES 2011)
(22-24 January 2011)

The symposium will be declared opened by
Shri Narendra Modi
Hon'ble Chief Minister of Gujarat

Date 22 January 2011	Time 9:30 AM
Venue Pandit Deendayal Petroleum University Raisan, Gandhinagar-382009, Gujarat, India	

Site Map of ISR
(not to scale)

Invitation

Dedication of
1 MW SOLAR POWER PLANT
&
INSTITUTE OF SEISMOLOGICAL RESEARCH
to the nation
and
Inaugural Ceremony of
**INTERNATIONAL SYMPOSIUM ON
ADVANCES IN EARTHQUAKE SCIENCE (AES 2011)**
22 JANUARY 2011

Contact Details for International Symposium
Dr. B K Rastogi
Director General, Institute of Seismological Research (ISR),
Near P. Deendayal Petroleum University, Raisan, Gandhinagar-382009, Gujarat, INDIA
Phone No. : +91-79-46729001 (O)
 +91-79-46729020 (R)
 +91-9979407515 (M)
Fax No. : +91-79-46729015
e-mail : shri.isr2011@gmail.com

Minute-to-Minute Program: Annexure-2

Inauguration of 1 MW Solar Power Plant and International Symposium

On “Advances in Earthquake Sciences”

And Dedication of

Institute of Seismological Research, Gandhinagar

To the Nation by

Hon’ble Chief Minister Shri Narendra Modi

on

22nd January 2011, Saturday at 09:30 hrs

INAUGURAL FUNCTION :

9:30 hrs	Arrival of Hon’ble Chief Minister Shri Narendra Modi at Solar Power Plant
9:30-9:45 hrs	Inauguration of 1 MW Solar Power Demonstration Plant
9:45-10:10 hrs	Unveiling Ceremony of the plaque of ISR , Visit to Data Centre and Geo-Tech lab
10:20-10:30 hrs	Welcoming the Dignitaries to the Dias and presentation of flowers
10:30 -10:35 hrs	Welcome Address: Shri Ravi Saxena (IAS),ACS,Deptt.of Sci.& Tech.
10:35-10:45 hrs	Introduction to the Symposium, Dr. Bal Krishna Rastogi, DG,ISR
10:45-11.00 hrs	Audio & video on ISR
11:00 -11:10 hrs	Lighting of the lamp and Release of Abstract volume by Hon. CM and other Dignitaries
11:10 -11:15hrs	Address by Smt.Anandiben Patel, Hon’ble Revenue Minister
11:15-11:35 hrs	Address by Hon’ble Chief Minister Shri Narendra Modi
11:35 -11:40 hrs	Vote of Thanks: Shri.D.J.Pandian.(IAS),Principal Secretary,E & PD
11:40-11:43 hrs	National Anthem.
11:45-12:00 hrs	Tea and Interaction with Scientists.
12:30- hrs onwards	The International Symposium On “Advances in Earthquake Sciences” carried out at ISR Auditorium

Dias Plan

DG, ISR	Chairman, GEDA	CMD, NPCIL	Member NDMA B.Bhattacharji	CM	Revenue Minister, Anandiben Patel	CS	ACS	PS
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Annexure-3

Brief profiles of some delegates

Foreign Delegates

1. Dr. Kojiro IRIKURA
Aichi Institute of Technology & Kyoto University , Toyota , Japan
2. Prof. E. Hohnecker
Karlsruhe Institute of Technology, 76131 Karlsruhe, Germany
3. Dr.PradeepTalwani
University of South Carolina,Columbia, SC, 29208, USA
4. Dr. A. Peresan, Research Scientist
Area of work-Time-dependent seismic hazard assessments
Department of Earth Sciences, University of Trieste, 34127 Trieste, Italy & ICTP, Italy
5. Dr. Satish C. Singh
Institut de Physique du Globe de Paris , France
6. Dr. Miklos Kazmer
Department of Palaeontology, Eotvos University , Hungary
7. Dr. Praveen K. Malhotra
StrongMotions Inc., Sharon, MA, USA.
8. Dr. Bruno Helly
Directeur de recherche au CNRS (émérite), Université de Lyon, 7, rue Raulin, France
9. Dr. Lalliana Mualchin
Retired Chief Seismologist, Office of Earthquake Engineering, California Dept. of
Transportation, Sacramento, California and Seismic Consultant to the Govt. of Mizoram,
India, Disaster Mangement & Rehabilitation Dept., Govt. of Mizoram, Aizawl)
10. Dr. M.V.Rodkin
International Institute of Earthquake Prediction Theory and Mathematical Geophysics,
Russian Academy of Science, Profsoyznaya Str. 84/32, 117997, Moscow, Russia,
11. Dr. Vivek Walia
National Center for Research on Earthquake Engineering, Taiwan
12. Fumio Kaneko
Chief Engineer, Oyo International Corporation, Japan.
13. Prof. Young-Seog Kim
Dept. of Geosciences, Pukyong National University, Korea

14. Jin-Hyuck Choi
Pukyong National University, Busan 608-737, Korea
15. M. Lee
Pukyong National University, Busan 608-737, Korea
16. Md. Nayeem-Al-Noman
Department of Civil Engineering
Bangladesh University of Engineering and Technology (BUET), Dhaka, Bangladesh

Indian Delegates

1. Padmashree Prof. Harsh K Gupta
 - Panikker Professor, NGRI, Hyderabad
 - Former Director, NGRI, Hyderabad
 - Former Advisor, Dept of Sc. &Tech, New Delhi
 - Former Secretary, Dept of Ocean Development, Ministry of S&T, New Delhi
 - Former Director, Centre of Earth Sc Studies, Tiruannanthpuram
 - Former Vice Chancellor, Cochin University
2. Padmashree Dr. Vijay Prasad Dimri
 - Distinguished Scientist, NGRI, Hyderabad
 - Former Director, NGRI, Hyderabad
 - Former Director, GERMI, Gandhinagar
3. Padmashree Dr. B Bhattacharjee
 - Hon'ble Member, NDMA, New Delhi
 - Former Director BARC, Mumbai
4. R N Iyengar
 - Professor, Centre for Disaster Mitigation, Jain University, Bangalore
 - Former Head, Dept of Civil Engineering, IISc Bangalore
 - Former Director, CBRI, Roorkee
5. Prof J N Goswami
Director PRL, Ahmedabad

6. Dr. Shreyas Kr Jain
Chairman and Managing Director, NPCIL, Mumbai
 - Setting up Nuclear Power Plants in Gujarat and India
7. Dr. Ravindra S Bisht
Former Joint Director General, Archaeological Survey of India
8. Dr. S K Biswas
 - Advisor, ISR
 - Formerly Director, KDMIPE, ONGC, Dehradun
 - Formerly Visiting Prof, IIT Bombay
9. Prof. V. R. Shah
H.O.D Structural Design Dept, CEPT University, Ahmedabad
10. Prof. V C Thakur
Emeritus Professor, WIHG, Dehradun
11. Prof. Baldev Raj Arora
Advisor, WIHG, Dehradun
12. Dr. B K Bansal
Head Seismology, MoES, New Delhi
13. Prof. A K Singhvi
Outstanding Scientist, PRL, Ahmedaba

Annexure-4

LIST OF REGISTERED DELEGATES

Name	Organisation
1 A. Sarkar	Pandit Deen Dayal Petroleum University, Gandhinagar, India
2 A. S. Rajawat	SAC(ISRO), Ahmedabad, India
3 A. Joshi	IIT-Roorkee,INDIA
4 Akash Advani	ISM, Dhanbad, India
5 A. K. Singhvi	PRL-Ahmedabad, India
6 A. Peresan	University of Trieste and ICTP Italy
7 Apurba Mandal	NPCIL, Mumbai, India
8 A.G. Chhatre	NPCIL, Mumbai, India
9 A. K. Mohapatra	IIT-Kharagpur,India
10 Anshuman Singh	NPCIL, Mumbai, India
11 Arjun Tiwari	ISM, Dhanbad, India
12 Arun Bapat	MERI, Nashik, India
13 Arun K. Saraf	IIT-Roorkee,INDIA
14 Avishek Kumar	IISc,Bangalore, India
15 B. Bhattacharjee	NDMA, New Delhi, India
16 B. K. Bansal	MoES, New Delhi, India
17 B. R. Arora	WIHG, Dehradun, India
18 B. S. Gera	REMTI,Roorkee, India
19 B. Santosh	NPCIL, Mumbai, India
20 Babita Sharma	MoES, New Delhi, India
21 Basab Mukhopadhyay	GSI, Kolkata, India
22 Bhuvan Vikrama	ASI,Agra,India
23 Bijendra Singh	NGRI, Hyderabad, India
24 Biju John	NIRM, India
25 Bruno Helly	Université de Lyon, France
26 C. V. R. Murty	IIT- Madras, India
27 C.D. Reddy	IIG, Mumbai, India
28 Chandra Bhakuni	QuakeSchool Consulting Pvt. Ltd., Ahmedabad, India
29 Chintan Pathak	Padit Deen Dayal Petroleum University, Gandhinagar, India
30 D. C. Mishra	NGRI, Hyderabad, India
31 Dinesh Modi	Gujarat State Archeology Deptt., India

32	D.T. Rao	NIRM, India
33	D.V. Reddy	NGRI, Hyderabad, India
34	Debasis Ghose	VECC, Kolkata
35	Deepak Kumar	Kurukshetra University, India
36	Dilip Yadav	WIHG, Dehradun, India
37	Dinesh Kumar	Kurukshetra University, India
38	Faisal Dastageer	NPCIL, Mumbai, India
39	Fumio Kaneko	Oyo International, Japan
40	G. Mohan	IIT-Bombay, India
41	G. P. Karmakar	Padit Deen Dayal Petroleum University, Gandhinagar, India
42	Ganpat Surve	IIG, Allahabd, India
43	GunjanDhiman	Kurukshetra University, India
44	Hanumant Rao	NPCIL, Mumbai, India
45	Harish	Ultra Technologies Pvt. Ltd., New Delhi, India
46	Harsh Gupta	NGRI, Hyderabad, India
47	Hirday Dutta	REMTI,Roorkee, India
48	H. N. Srivastava	IMD, New Delhi, India
49	H. S. Mandal	IMD, New Delhi, India
50	Imtiyaz A. Parvez	CMMACS, Bangalore, India
51	Indrajit Ghosh	
52	J. R. Kayal	ISM, Dhanbad, India
53	Javed Malik	IIT-Kanpur,INDIA
54	Jin-Hyok Choi	Pukyong National University,Korea
55	Kaushik Rawal	Padit Deen Dayal Petroleum University, Gandhinagar, India
56	K.Sushini	NGRI, Hyderabad, India
57	K. M. Sreejith	SAC(ISRO), Ahmedabad, India
58	K.P.Singh	Ultra Technologies Pvt. Ltd., New Delhi, India
59	K.P.Vinodkumar	NPCIL, Mumbai, India
60	K. Siva Ram	NGRI, Hyderabad, India
61	K.S Vipin	IISc,Bangalore, India
62	Kavita Rani	Kurukshetra University, India
63	Kirit Yajnik	CMMACS, Bangalore, India
64	Kojiro Irikura	Aichi Institute of Technology & Kyoto University,Japan
65	Lalliana Mualchin	California

66	Mahesh N. Srivastava	IIT Bombay
67	M. V. Rodkin	Russian Academy of Science, Russia
68	M. Ravi Kumar	NGRI, Hyderabad, India
69	Manisha Sandhu	Kurukshetra University, India
70	Miklos Kazmer	Eotvos University, Hungary
71	Minjung lee	Pukyong National University, Korea
72	Md. Nayeem-Al-Noman	BUET, Bangladesh
73	Monika Wadhawan	Kurukshetra University, India
74	N.Y. Bhat	M.G. Science Institute, Ahmedabad, India
75	Narendra Kumar	NGRI, Hyderabad, India
76	Naveen James	IISc, Bangalore, India
77	Neeraj Chadha	Ultra Technologies Pvt. Ltd., New Delhi, India
78	O. P. Pandey	NGRI, Hyderabad, India
79	O. P. Mishra	GSI, Kolkata, India
80	Parul Trivedi	Saurashtra University, Gujarat, India
81	P. K. Khan	ISM, Dhanbad, India
82	P. Mahesh	NGRI, Hyderabad, India
83	P. S. Sunil	IIG, Mumbai, India
84	P. K. Malhotra	StrongMotions Inc., Sharon, MA, USA
85	P. M. Solanki	M.G. Science Institute, Ahmedabad, India
86	Pinki Hazarika	NGRI, Hyderabad, India
87	Prabhas Pande	GSI, Kolkata, India
88	Pradeep Talwani	University of South Carolina, USA.
89	Prantik Mandal	NGRI, Hyderabad, India
90	Prof. E. Hohnecker	Karlsruhe Institute of Technology, Germany
91	R. D. Shah	M.G. Science Institute, Ahmedabad, India
92	R. K. Sukhtankar	Pune University, Pune, India
93	R. N. Iyengar	Jain University, Bangalore, India
94	R. S. Bisht	Archeological Society of India (ASI), India
95	R. S. Dattatrayam	IMD, New Delhi, India
96	Rahul Mittal	NPCIL, Mumbai, India
97	Rajesh Mishra	BARC, Mumbai, India
98	Rajesh Prakash	IMD, New Delhi, India
99	Rajesh S	WIHG, Dehradun, India
100	Ramancharla Pradeep Kumar	IIIT, Hyderabad, India

101	RenuYadav	Kurukshetra University, India
102	Rupen Goswami	IIT- Madras, India
103	Siddharth Prizomwala	M.S. University, Gujarat, India
104	S. K. Jain	NPCIL, Mumbai, India
105	S. K. Mondal	ISM, Dhanbad, India
106	S. M. Patil	IISc,Bangalore, India
107	S. Mohanty	ISM, Dhanbad, India
108	S. S. Teotia	Kurukshetra University, India
109	S. T. G. Raghukanth	IIT- Madras, India
110	S. Sravanthi	IIT-Kanpur,INDIA
111	S.K. Biswas	Mumbai, India
112	S.K. Roy	IIT-Bombay, India
113	S.M. Ingole	NPCIL, Mumbai, India
114	Sambit	IIT-Kanpur,INDIA
115	Santiswarup Sahoo	IIT-Kanpur,INDIA
116	Santosh Khandwe	NPCIL, Mumbai, India
117	Satish Singh	Institut de Physique du Globe de Paris, France and University of Cambridge, UK
118	Seevalsa Kolathayar	IISc,Bangalore, India
119	Srijayanthi	NGRI, Hyderabad, India
120	Sudhir Jain	IIT Gandhinagar, India
121	Sumer Chopra	MoES, New Delhi, India
122	Sushmita	ISM, Dhanbad, India
123	Swapnamita C. Vaideswaran	WIHG, Dehradun, India
124	T. Harinarayana	NGRI, Hyderabad, India
125	U.P.Singh	NPCIL, Mumbai, India
126	Uma Maheshwari	Pune University, Pune, India
127	V. C. Thakur	WIHG, Dehradun, India
128	Vikram M. Patel	Ganpat University, Gujarat, India
129	V P. Dimri	NGRI, Hyderabad, India
130	V. K. Gahalaut	NGRI, Hyderabad, India
131	V. M. Patel	Ganpat University, Gujarat, India
132	Vandana Chaudhary	MoES, New Delhi, India
133	Vinod Kushwah	HCST, Mathura,INDIA
134	Vivek Walia	National Center for Research on Earthquake Engineering, NARL,Taiwan

135	W. K. Mohanty	IIT-Kharagpur, India.
136	Yogesh Arora	ISM, Dhanbad, India
137	Y.S. Kim	Pukyong National University, Korea
138	A.P.Singh	ISR, India
139	Ashish Bhandari	ISR, India
140	B. Sairam	ISR, India
141	B.K. Rastogi	ISR, India
142	Gagan Bhatia	ISR, India
143	Girish Ch. Kothiyari	ISR, India
144	Girish Patel	ISR, India
145	Jaina Patel	ISR, India
146	Janki Desai	ISR, India
147	K. Madhusudana Rao	ISR, India
148	Kapil Mohan	ISR, India
149	Ketan S. Roy	ISR, India
150	Kishan Zala	ISR, India
151	Luangmei Limpou	ISR, India
152	M.S.B.S. Prasad	ISR, India
153	Sarda Sarda	ISR, India
154	Mehul Jagad	ISR, India
155	Mukesh Chauhan	ISR, India
156	Nagabhushana Rao	ISR, India
157	Pallabee Choudhury	ISR, India
158	Pooja Ramanuj	ISR, India
159	Rakesh Dumka	ISR, India
160	R.K.Singh	ISR, India
161	Ranjana Noarem	ISR, India
162	Sandeep Aggarwal	ISR, India
163	Santosh Kumar	ISR, India
164	Siddharth Dimri	ISR, India
165	Sunita Devi	ISR, India
166	Surya Prakash	ISR, India
167	Vandana Patel	ISR, India
168	Vishwa Joshi	ISR, India
169	T J Majumdar	ISR, India

Annexure-5:

Session-wise number of papers presented:

Session	Title	Chairperson	Paper presented		
			Oral	Poster	Total
S1	Bhuj Earthquake and Aftershock Studies	Prabhas Pande	3	2	5
S2	Intraplate Seismicity	O P Mishra	9	3	12
S3	Seismicity and Earthquake Source Processes	J R Kayal & Prantik Mandal	9	3	12
S4	Paleoseismology and Historical Seismology	V C Thakur and Javed Malik	4	1	5
S5	Earthquake Precursors and Prediction studies	B R Arora	9	3	12
S6	Seismic Wave Propagation , Amplification and Basin Effect	Praveen Malhotra	3	2	5
S7	Real Time Seismology Loss Reduction and Early Warning	R S Dattatrayam	4	0	4
S8	Earthquake Ground Motion and Damaging Earthquakes	Kijiro Irikura & Sumer Chopra	4	1	5
S9	Seismic Hazard Assessment / Microzonation	A Peresan & Imtiyaz A Parvez	11	5	16
S10	Tectonics and Crustal Movements	H N Srivastava	4	1	5
S11	Earth's Interior , Structure & Dynamics	M Ravi Kumar	4	5	9
S12	Remote sensing, GPS & InSAR	V K Gahalaut	6	1	7
S13	Exploration for Oil and Crustal Structure	S K Biswas	4	4	8
S14	Ground Response Studies for Nuclear Power Plants	A G Chhatre	7	3	10
S15	Tsunami Modeling	V P Dimri	2	1	3
S16	IGCP Session on Archeoseismology	Javed Malik	11	0	11
	TOTAL		94	35	129
	ISES lecture & Special lecture		11		11
	TOTAL		105	35	140

Annexure 6

AES-2011 PROGRAM

21st January, 2011			
<i>Time</i>	<i>Program</i>		
15:00 – 18:00	Registration		
18:30 – 19:30	Light & Sound show at Akshar Dham		
20:00 – 21:00	Icebreaker		
22nd January, 2011			
08:00 – 10:00	Registration		
09:30 – 11:00	Inauguration		
11:00 – 12:00	High Tea		
<i>Time</i>	<i>Session</i>	<i>Subject</i>	<i>Place</i>
12:00 – 13:00	ISES Lecture & Special Lecture 1		Auditorium
13:00 – 14:00	Lunch		
14:00-16:00	Special Lectures(2,3,4,5,6,7)		Auditorium
16:00-18:00	S1-5 Papers	Bhuj Earthquake and Aftershock Studies	Conference Room No-2
15:00-18:30	S16-12 Papers	IGCP Session on Archeoseismology	Conference Room No-1
16:00-18:30	Poster session in Display Area		
19:00 – 21:00	Gala Dinner		
23rd January, 2011			
08:00 – 8 :30	Registration		
08:30 – 09:30	Special Lectures(8,9)		Auditorium
09:30 – 10:30	S4-5 Papers	Paleoseismology and Historical Seismology	Conference Room No-1
10:30 – 11:00	Tea		
11:00 – 13:00	S14-7 Papers	Ground Response Studies for Nuclear Power Plants	Auditorium
	S12-7 Papers	Remote Sensing, GPS & InSAR	Conference Room No-2
	S4-5 Papers(continued)	Paleoseismology and Historical Seismology	Conference Room No-1
13:00 – 14:00	Lunch		
14:00 – 17:00	S3-9 Papers	Seismicity and Earthquake Source Processes	Auditorium
	S9-12 Papers	Seismic Hazard Assessment / Microzonation	Conference Room No-1
	S2-10 Papers	Intraplate Seismicity	Conference Room No-2
17:00 –17:30	Tea/Snacks		
17:30 –18:30	Special Lecture 10		Auditorium
18:30 –19:30	Poster session in Display area		
20:00 – 21:00	Dinner		

24th January, 2011

<i>Time</i>	<i>Session</i>	<i>Subject</i>	<i>Place</i>
08:30 – 10:30	S11-6 Papers	Earth's Interior, Structure & Dynamics	Conference Room No-1
	S5-17 Papers	Earthquake Precursors and Prediction Studies	Auditorium
	S8-6 Papers	Earthquake Ground Motion and Damaging Earthquakes	Conference Room No-2
10:30 – 11:00	Tea		
11:00 – 13:00	S7-6 Papers	Real Time Seismology, Early Warning & Loss Assessment	Conference Room No-1
	S5-17 Papers(continued)	Earthquake Precursors and Prediction Studies	Auditorium
	S15-4 Papers	Tsunami Modeling	Conference Room No-2
13:00 – 14:00	Lunch		
14:00 – 15:00	<i>Special Lectures (11, 12, 13)</i>		Auditorium
15:00 – 17:00	S6-4 Papers	Seismic Wave Propagation, Amplification and Basin Effect	Auditorium
	S10-6 Papers	Tectonics and Crustal Movements	Conference Room No-1
	S13-4 Papers	Exploration for Oil and Crustal Structure	Conference Room No-2
17:00 – 17:30	Tea		
17:30 – 18:30	Concluding Session		
20:00 – 21:00	Dinner		

Annexure 7

LIST OF ORAL PAPERS

S1: Bhuj Earthquake and Aftershock Studies	
Session Chairman: Prabhas Pande	
Session Date: 22nd January, 2011, Session Time: 16:00 – 18:00	
S1_Kn1	Geoseismological investigation of 26 January 2001 Bhuj earthquake <i>Prabhas Pande</i> Geological Survey of India
S1_Kn2	Delineation of crustal and lithospheric structures below the Kachchh..... <i>Prantik Mandal</i> National Geophysical Research Institute (CSIR), Hyderabad, India
S1_Kn3	Seismic source of the 2001 Bhuj earthquake..... <i>J R Kayal</i> Indian School of Mines, Dhanbad.

S2: Intraplate Seismicity	
Session Chairman: O. P. Mishra Co-Chairman: Bijendra Singh	
Session Date: 23rd January, 2011 Session Time: 14:00 – 17:00	
S2_Kn1	Seismotectonics of Bhuj earthquake of 2001 based on gravity and magnetic signatures..... <i>D. C. Mishra</i> National Geophysical Research Institute (CSIR), Hyderabad
S2_I1	Geodynamics of the Kachchh Basin: Gravity- Magnetic Perspective <i>D.V. Chandrasekhar and B. Singh</i> National Geophysical Research Institute (CSIR), Hyderabad 500 007)
S2_C1	Geodetic crustal strain patterns over the Satpura mountain belt.... <i>S. Mohanty</i> Department of Applied Geology, Indian School of Mines, Dhanbad , India
S2_C2	Mafic crust and earthquake activity in the high velocity Indian shield. <i>O.P. Pandey</i> National Geophysical Research Institute, Uppal Road, Hyderabad
S2_C3	An intraplate earthquake and the study of ground response analysis..... <i>H.S.Mandal</i> Earthquake Risk Evaluation Centre, India Meteorological Department, New Delhi
S2_C5	Assessing the intraplate origin for subduction zone mega-thrust earthquake... <i>Prosanta K. Khan</i> Department of Applied Geophysics, Indian School of Mines, Dhanbad
S2_C6	Crustal strain pattern over a part of southern India and its implication for seismotectonics <i>Arijit Barik and S. Mohanty</i> Department of Applied Geology, Indian School of Mines, Dhanbad , India
S2_C7	Intermittent micro-seismic activity in the vicinity of Nanded city of west central India <i>Md. Babar Shaikh, Maharashtra</i>
S2_C8	Structural controls on the intraplate seismicity of the Kachchh region, India. <i>Sushmita Sinha and S. Mohanty</i> Department of Applied Geology, Indian School of Mines, Dhanbad, India

S2_C9	Improved Seismicity Trends in the Koyna-Warna Region through Earthquake Relocation using hypoDD. <i>G. Srijayanthi et al.</i> National Geophysical Research Institute, Hyderabad
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S3: Seismicity and Earthquake Source Processes	
Session Chairman: J R Kayal Co-Chairman: Prantik Mandal	
Session Date: 23rd January, 2011 Session Time: 14:00 – 17:00	
S3_C1	A study of source parameters, site amplification functions and attenuation parameter <i>Manisha, Dinesh Kumar and S.S. Teotia</i> Department of Geophysics, Kurukshetra University Kurukshetra, India
S3_C2	Source parameters and scaling relations for small earthquakes in Kumaon Himalaya <i>K. Sivaram et al.</i> National Geophysical Research Institute, Hyderabad India
S3_C3	Apatial statistics: a technique to constrain earthquake cluster..... <i>Basab Mukhopadhyay</i> Geological Survey of India
S3_C4	Estimation of seismic source parameters in northeast (NE) India from body wave spectra <i>Alok Kumar Mohapatra and William Kumar Mohanty</i> Department of Geology and Geophysics, Indian Institute of Technology, Kharagpur
S3_C6	Stress pattern in the Kangra-Chamba region of Northwest Himalaya.... <i>Dilip Kr Yadav et al.</i> Wadia Institute of Himalayan Geology, Dehradun-248001, India.
S3_C7	Estimation of earthquake source parameters and site response..... <i>Prantik Mandal and Utpal Dutta</i> National Geophysical Research Institute (CSIR), Hyderabad, India
S3_C9	Triggering is fine but what causes earthquakes in Koyna-Warna region? <i>V.K. Gahalaut and Kalpna Gahalaut</i> National Geophysical Research Institute, Uppal Road, Hyderabad
S3_C10	Source characteristics of Delhi earthquake (ML:4.3) of 25th Nov., 2007 <i>Rajesh Prakash, A. K. Shukla and R. K. Singh</i> India Meteorological Department, New Delhi

S4 : Paleoseismology and Historical Seismology	
Session Chairman: V C Thakur Co-Chairman: Javed Malik	
Session Date: 23rd January, 2011, Session Time: 09:30 – 10:30 & 11:00-13:00	
S4_Kn1	Luminescence dating in paleoseismology and neotectonics: an overview <i>A.K. Singhvi et al.</i> Physical Research Laboratory, Ahmedabad , India
S4_I1	An archeo-seismological investigation in the epicentral area of the 1886 Charleston, South Carolina earthquake <i>Pradeep Talwani</i> Dept. of Earth and Ocean Ciencies, University of South Carolina, Columbia
S4_C1	Partitioning of convergence in Northwest sub Himalaya..... <i>V.C. Thakur et al.</i> Wadia Institute of Himalayan Geology, Dehradun-248001, India.

S4_C2	Paleoseismic investigations in the Kopili Lineament Zone, Northeast India. <i>Devender Kumar et al.</i> National Geophysical Research Institute, Uppal Road, Hyderabad
S4_C4	Active fault mapping using high resolution geophysical field investigation in Kachchh... <i>A. K. Gupta et al.</i> Institute of Seismological Research, Gandhinagar , Gujarat, India

S5: Earthquake Precursors and Prediction Studies	
Session Chairman: B R Arora	
Session Date: 24th January, 2011, Session Time: 08:30 – 10:30 & 11:00-13:00	
S5_I1	Changing Scenario of earthquake precursory research <i>B. R. Arora</i> Wadia Institute of Himalayan Geology, 33 GMS Road, Dehradun, India
S5_C1	Soil-gas geochemistry for earthquake monitoring and fault studies in Taiwan. <i>Vivek Walia et al.</i> National Center for Research on Earthquake Engineering, Taiwan,
S5_C2	Fractal correlation dimension analysis to identify precursory pattern prior to 15th July 2009... <i>S.K. Mondal, R. Meena and P. N. S. Roy</i> Department of Applied Geophysics, Indian School of Mines, Dhanbad-826004, Jharkhand,
S5_C3	Investigations of anomalous signals prior to large earthquakes..... <i>WenBin Shen et al.</i> Department of Geophysics, School of Geodesy and Geomatics, Wuhan University, Chin
S5_C5	Application of acoustic sounding in earthquake precursor detection lessons from Bhuj.... <i>H.N. Dutta and B.S. Gera</i> Roorkee Engineering & Management Technology Institute, Shamli.
S5_C6	Anomalous changes in groundwater and soil-gas radon concentrations..... <i>R.C. Ramola and Sushil Kumar</i> Wadia Institute of Himalaya Geology, Dehra ,India
S5_C8	Signature of seismo-electromagnetic signals (ses) in prediction of earthquakes <i>Vinod Kumar Kushwah</i> Department of Physics, Hindustan College of Science & Technology, Farah, Mathura
S5_C9	Precursory Earthquake Studies in Maharashtra, especially in Koyna Region <i>Arun Bapat¹ and M.A.Ghatpande²</i> ¹ 1/11, Tara Residency, 20/2, Kothrud, Pune- 411038, ² Formerly from MERI, Nashik
S5_C10	Earthquake pre-cursory studies in Koyna-Warna region, India: some vital observations <i>D.V. Reddy and P. Nagabhushanam</i> National Geophysical Research Institute ,Hyderabad
S5_C12	Seismic Acoustic Emission (SAE) as an earthquake precursor <i>G. Suresh and R. S. Dattatrayam</i> India Meteorological Department, New Delhi
S5_C13	Study of multi-parameter gas-geochemical precursor signals of a distant earthquake..... <i>H. Chaudhuri et al.</i> Variable Energy Cyclotron Centre, 1/AF Bidhannagar, Kolkata , India.
S5_C14	Predictability of valsad earthquake swarms Gujarat, India <i>H.N.Srivastava,</i> Formerly in India Meteorological Department
S5_C16	Multi-parametric geophysical observations at Ghuttu, Garhwal Himalaya: Radon component <i>V.M.Choubey</i> Wadia Institute of Himalayan Geology

S6 : Seismic Wave propagation, Amplification and Basin Effect	
Session Chairman: Praveen Malhotra	
Session Date: 24th January, 2011 Session Time: 15:00 – 17:00	
S6_C1	A possibility of site effects due to the past earthquakes at Anjar, Gujarat state, India. <i>Fumio Kaneko et al.</i> Oyo internation Corporation
S6_C3	Estimation of dynamic properties of Lucknow soil <i>T.G. Sitharam, S. M .Patil.</i> Professor, Department of Civil Engineering, Indian Institute of Science, Bangalore, India
S6_C4	Liquefaction susceptibility of lucknow soil <i>T.G. Sitharam et al.</i> Professor, Department of Civil Engineering, Indian Institute of Science, Bangalore, India.

S7 : Real Time Seismology, Loss Reduction and Early Warning	
Session Chairman: R.S.Dattatrayam Co-Chairman: E. Hohnecker	
Session Date: 24th January, 2011 Session Time: 11:00 – 13:00	
S7_Kn1	Current trends in seismic instrumentation and earthquake monitoring in India <i>R.S.Dattatrayam et al.</i> India Meteorological Department, Ministry of Earth Sciences, Lodi Road, New Delhi
S7_C1	Seismic loss reduction/estimation technique for use in educational spaces <i>Chandra Bhakuni</i> QuakeSchool Consulting Pvt. Ltd., Navrangpura, Ahmedabad, Gujarat, India
S7_C3	Early warning system for transportation lines <i>E. Hohnecker et al.</i> Department of Railway Systems, Karlsruhe Institute of Technology, Germany.
S7_C5	Earthquake vulnerability assessment of Gujarat port sites viz-a-viz seismic disturbances <i>Terala Srikanth et al.</i> Earthquake Engineering Research Centre, IIIT Hyderabad, Gachibowli, Hyderabad, India.
S7_C6	Performance analysis of mundra panipat pipeline crossing Kachhach mainland fault... <i>Vasudeo Govind Choudhary and Ramancharla Pradeep Kumar</i> Earthquake Engineering Research Centre, IIIT Hyderabad, Gachibowli, Hyderabad, India.
S7_C7	Rapid visual survey of existing buildings in Gandhidham and Adipur cities, Kachchh, Gujarat <i>Terala Srikanth et al.</i> Earthquake Engineering Research Centre, IIIT Hyderabad, Gachibowli, Hyderabad, India.

S8 : Earthquake Ground Motion and Damaging Earthquakes	
Session Chairman: Kojiro Irikura Co-Chairman: Sumer Chopra	
Session Date: 24th January, 2011 Session Time: 08:30 – 10:30	
S8_I1	The great Sumatra earthquakes: Results from recent marine studies <i>Satish C. Singh.</i> Institut de Physique du Globe de Paris, France and University of Cambridge, UK
S8_C2	Ground motion parameters of Shillong plateau: One of the most seismically active zones..... <i>Saurabh Baruah et al.</i> Geoscience Division, North-East Institute of Science and Technology (CSIR), Assam, India

S8_C3	Characterization of seismic regime in NW Himalaya: Persistent and high seismicity in..... <i>Naresh Kumar et al.</i> Wadia Institute of Himalayan Geology, 33 GMS Road, Dehradun, India
S8_C5	Recipe for predicting strong ground motions for inland mega fault earthquakes <i>Kojiro IRIKURA and Susumu KRAHASHI</i> Aichi Institute of Technology & Kyoto University, Toyota, Aichi, Japan
S8_C6	Estimation of damage to various types of buildings in Gujarat from a future large earthquake <i>Sumer Chopra, Dinesh Kumar and B.K.Rastogi</i> Institute of Seismological Research, Gandhinagar
S8_C7	Strong motion simulation of great earthquake in the central seismic gap... <i>Kapil Mohan and A. Joshi</i> Institute of Seismological Research, Gandhinagar, Gujarat(India)

S9: Seismic Hazard Assessment / Microzonation	
Session Chairman: A. Peresan	
Co-Chairman 1: T G Sitharam Co-Chairman 2: Imtiaz Parvez	
Session Date: 23 rd January, 2011 Session Time: 14:00 – 17:00	
S9_I1	Seismic hazard assessment for Gandhidham; Kutch; Gujarat <i>Fumio Kaneko et al.</i> OYO International Corporation
S9_I4	Neo-deterministic seismic hazard assessment <i>Peresan and Panza</i> Department of Earth Sciences, University of Trieste, Trieste,
S9_I5	Ground motion at bedrock level in Delhi city from different earthquake scenarios <i>Imtiaz A Parvez et al.</i> (CMMACS), NAL Belur Campus, Bangalore, India
S9_I6	Probabilistic seismic hazard macrozonation of India <i>Prof. T.G. Sitharam, Mr.Sreevals Kolathayar and Dr. K.S. Vipin</i> Department of Civil Engineering, Indian Institute of Science, Bangalore
S9_I7	Study of the local site effects on seismic hazard using deterministic and probabilistic approaches: A case.... <i>Prof. T.G. Sitharam, Mr. Naveen James, and Dr. K.S Vipin</i> Department of Civil Engineering, Indian Institute of Science
S9_C3	Probabilistic seismic hazard analysis for mitigating societal risk from earthquakes <i>Dr. Praveen K. Malhotra, P.E.</i> StrongMotions Inc., Sharon, MA, USA
S9_C4	Influence of source and epicentral distance on local seismic response in Kolkata city, India. <i>William K. Mohanty et al.</i> Department of Geology and Geophysics, Indian Institute of Technology, Kharagpur
S9_C5	Neo-deterministic seismic hazard and pattern recognition techniques... <i>Peresan et al.</i> Department of Earth Sciences, University of Trieste, Trieste,
S9_C6	Evaluation of site classification for soils in Lucknow urban centre <i>Abhishek Kumar et al.</i> Department of Civil Engineering, Indian Institute of Science, Bangalore, India.
S9_C7	Site response studies in the Andaman and Nicobar islands <i>K Sushini et al.</i> National Geophysical Research Institute ,Uppal Road, Hyderabad

S9_C9	Seismic hazard assessment of Gujarat. <i>K. S. Vipin et al.</i> Department of Civil Engineering, Indian Institute of Science (IISc), Bangalore
S9_C10	Earthquake hazard assessment for public safety <i>Lalliana Mualchin</i> Retired Chief Seismologist, Office of Earthquake Engineering, California Dept. of Transportation, Sacramento, California and Seismic Consultant to the Govt. of Mizoram, India, Disaster Management & Rehabilitation Dept., Govt. of Mizoram, Aizawl)

S10 : Tectonics and Crustal Movements	
Session Chairman: H N Srivastava Co-Chairman: Y S Kim	
Session Date: 24th January, 2011, Session Time: 15:00 – 17:00	
S10_I1	Seismotectonics and velocity structure of the Kumaon - Garhwal Himalaya <i>P. Mahesh et al.</i> National Geophysical Research Institute (CSIR), Hyderabad, India
S10_I2	New evidence of the involvement of the low density fluid phase in the deep crust seismicity <i>M.V.Rodkin</i> International Institute of Earthquake Prediction Theory and Mathematical Geophysics, Russia,
S10_C1	Seismotectonic studies of kachchh basin using gravity surveys after 2001 Bhuj earthquake <i>Rashmi Pradhan et al.</i> Institute of Seismological Research, Gandhinagar
S10_C4	Stress pulse migration by viscoelastic process for long - distance delayed triggering of <i>B.K. Rastogi</i> Institute of Seismological Research, Gandhinagar, India

S11 : Earth's interior , structure & dynamics	
Session Chairman: M. Ravi Kumar	
Session Date: 24th January, 2011 Session Time: 08:30 – 10:30	
S11_C1	Spatial distribution of scatterers in the crust of Kachchh region, Western India by inversion analysis of coda... <i>Babita Sharma et al.</i> Institute of Seismological Research, Raisan, Gandhinagar, India
S11_C3	Seismic signatures of volcanism in the upper mantle beneath NW DVP <i>G. Mohan</i> Department of Earth Sciences, Indian Institute of Technology Bombay, Powai, Mumbai.
S11_C6	Surface wave tomography across the Indian shield, Indo-Gangetic plains and the Himalayan.... <i>N. Purnachandra Rao et al.</i> National Geophysical Research Institute, Uppal Road, Hyderabad
S11_C7	Anisotropy of the Indian crust from splitting of Ps phases from the Moho <i>Narendra Kumar et al.</i> NGRI, Hyderabad.

S12: Remote Sensing, GPS & InSAR	
Session Chairman: V.K. Gahalaut	
Session Date: 23rd January, 2011 Session Time: 11:00 – 13:00	
S12_C1	SAR Interferometry detects post-seismic ground deformations related with 2001 Bhuj earthquake. <i>Arun K. Saraf</i> Department of Earth Sciences, Indian Institute of Technology Roorkee, ROORKEE, INDIA
S12_C2	Ten years of GPS observations after 2001 Bhuj earthquake... <i>C.D. Reddy et al.</i> Indian Institute of Geomagnetism, New Panvel, Navimumbai, India.
S12_C3	Studies on seismic behaviour and associated topographic changes in NE India based.... <i>R. K. Sukhtankar et al.</i> Department of Atmospheric and Space Sciences, Pune University, Pune
S12_C4	Crustal deformation mapping in Kachchh, India using InSAR and GPS: Initial results <i>K. M. Sreejith et al.</i> Geosciences Division, Marine, Space Applications Centre (ISRO), Ahmedabad
S12_C5	The Tehri Dam, Uttarakhand: crustal strain and implications in case of reservoir induced <i>Swapnamita C. Vaideswaran and Ajay Paul</i> Wadia Institute of Himalayan Geology, Dehradun
S12_C6	Satellite altimeter derived geoid / gravity and the lithospheric density anomaly ... <i>Rajesh S et al.</i> Geophysics Group, Wadia Institute of Himalayan Geology, Dehradun

S13: Exploration for Oil and Crustal Structure	
Session Chairman: S.K. Biswas	Co-Chairman: Satish Singh
Session Date: 24th January, 2011 Session Time: 15:00 – 17:00	
S13_I2	Integration of geophysical data for exploration of hydrocarbons - GIS application <i>T. Harinarayana et al.</i> NGRI, Uppal Road, Hyderabad, India
S13_I3	Impact of tectonics, sedimentation process and evolving trap styles in Andaman island arc <i>Sandip K Roy,</i> IIT, Bombay
S13_I4	Geology of the Barmer – Cambay Rift Zone with Special Reference to Structure and Hydrocarbon Plays <i>P. B. Pandey</i> Basin Manager, Western Onshore Basin, ONGC, Vadodara

S14: Ground Response Studies for Nuclear Power Plants	
Session Chairman: A.G. Chhatre Co-Chairman: CVR Murty	
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S14_I1	Near-field ground motion simulation for the 26th January 2001 Gujarat earthquake <i>STG Raghukanth and B. Bhanu Teja</i> Dept. of Civil Engineering, IIT Madras-600036
S14_I2	Displacement-based Design of Structures: a consistent framework of limiting-strain based design method <i>C. V. R. Murty</i> Department of Civil Engineering, Indian Institute of Technology Madras, Chennai
S14_I3	Seismic Design of Bridges for Displacement Loading <i>Rupen Goswami</i> Department of Civil Engineering, Indian Institute of Technology Madras
S14_I4	Earthquake Experience based performance of civil structures, piping systems, cable trays, ducting and mechanical, electrical, instrumentation & control equipment from industries in India <i>Faisal Dastageer et. al</i> NPCIL, Mumbai
S14_I5	Seismic Analysis of a typical Nuclear Power Plant structure <i>Apurba Mondal et. al</i> Nuclear Power Corporation of India Ltd., Mumbai, India
S14_C1	Design of distribution systems, viz., piping, cable trays and ducting. <i>Faisal Dastageer et al.</i> NPCIL, Mumbai
S14_C2	Earthquake ground motion generation for nuclear power plant. <i>Faisal Dastageer et al.</i> NPCIL, Mumbai

S15: Tsunami Modeling	
Session Chairman: V.P. Dimri	
Session Date: 24th January, 2011 Session Time: 11:00 – 13:00	
S15_C3	Development of paleo-tsunami database and hazard assessment for Indian subcontinent... <i>Akhilesh K. Verma and William K. Mohanty</i> Department of Geology and Geophysics, Indian Institute of Technology, Kharagpur, India.
S15_C4	Tsunami effect On Porbandar, Western Gujarat coast <i>V. M. Patel et al.</i> Ganpat University, GanpatVidyanagar, Mehsana-384002, Gujarat, India.

S16: IGCP Session on Archeoseismology	
Session Chairman: Javed Malik Co-Chairman: M Kazmer	
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S16_Kn1	Archeoseismology and the role of tectonics in the demise of the Indus Valley Civilization <i>Pradeep Talwani,</i> Dept. of Earth and Ocean Sciences, University of South Carolina, Columbia, SC, USA.
S16_I1	Major Earthquake Occurrences in Archaeological Strata of Harappan Settlement at Dholavira (Kachchh, Gujarat), <i>Ravindra Singh Bisht</i> Former Joint Director General, Archaeological Survey of India, Ghaziabad
S16_C1	Archaeological evidences for a 12th -14th century earthquake at Ahichhatra, Barreilly (U.P.), India, <i>Bhuvan Vikrama et al.</i> Archaeologist, Archaeological Survey of India, Agra.
S16_C2	Active fault influence on the evolution of landscape and drainage..... <i>Javed N. Malik</i> Department of Civil Engineering, Indian Institute of Technology Kanpur, Uttar Pradesh, India.
S16_C3	Signatures of active faulting in Southern peninsular India. <i>Biju John et al.</i> National Institute of Rock Mechanics, Kolar Gold Fields, India
S16_C4	Macroseismic intensity assessment of 1885 AD historical earthquake of NW Kashmir Himalaya.. <i>Bashir Ahmad et al.</i> Department of Education, J&K, Srinagar, India
S16_C5	Fault segmentation and propagation characteristics based on rupture patterns <i>Jin-Hyuck Choi et al.</i> GSGR, Dept. of Earth Environmental Sciences, Pukyong National University, Busan , Korea
S16_C6	Preliminary study on active faults around Mandi region, NW Himalaya, India <i>Javed N. Malik and Santiswarup Sahoo</i> Department of Civil Engineering, Indian Institute of Technology, Kanpur, India.
S16_C7	Archaeology of earthquakes at Mahasthanghar (Province of Bogra, Bangladesh) <i>Bruno Helly et al.</i> Directeur de recherche au CNRS (émérite), Maison de
S16_C8	Archeoseismology of the A.D. 1545 earthquake in Chiang Mai, northern Thailand. <i>Miklos Kazmer and Kamol Sanittham</i> Department of Palaeontology, Eotvos University, Hungary
S16_C10	Archaeo seismological approach based on stone heritages in Gyeongju, SE Korea. <i>M. Lee and Y.-S. Kim</i> Dept. of Geosciences, Pukyong National University, Busan, Korea.
S16_C12	Paleo-earthquake evidence from archaeological site in mesoseismal zone of 1819 Allah Bund event, Great Rann of Kachchh, Gujarat, Western India <i>Malik J N et al.</i> Department of Civil Engineering, Indian Institute of Technology Kanpur

Annexure 8

LIST OF PAPERS FOR POSTER SESSION

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S1_P2	Seismicity monitoring of Bhuj aftershocks <i>Santosh Kumar et al.</i> Institute of Seismological Research, Gandhinagar
S2_P1	Unusually large number of earthquake sequences in Saurashtra since 2006..... <i>B.K. Rastogi et al.</i> Institute of Seismological Research, Gandhinagar
S2_P2	Spatiotemporal complexity of intraplate seismicity: a reverie and its multifarious... <i>Arjun Tiwari</i> Applied Geophysics, Indian School of Mines Dhanbad
S2_P3	New insight into crustal heterogeneity beneath the 2001 Bhuj earthquake ... <i>A. P. Singh et al.</i> Institute of Seismological Research (ISR), Raisan, Gandhinagar, Gujarat
S3_P1	Waveform inversion of local earthquakes using broadband data of Koyna.... <i>D. Shashidhar et al.</i> National Geophysical Research Institute, Uppal Road, Hyderabad
S3_P2	Remotely triggered seismicity due to the 2001 Bhuj earthquake <i>G. Surve and G. Mohan</i> Dr. K. S. Krishnan Geomagnetic Research Laboratory (I.I.G), Leelapur Road, Chamanganj, Allahabad
S3_P3	Evidence for transverse tectonics in Sikkim Himalaya from seismicity.... <i>Pinki Hazarika et al.</i> National Geophysical Research Institute, Uppal Road, Hyderabad
S3_P4	Evidence for right lateral strike slip environment in Kutch rift..... <i>Ch. Nagabhushana Rao et al.</i> Institute of Seismological Research, Raisan, Gandhinagar, Gujarat 382018, India.
S4_P1	Morphotectonic control on drainage network evolution in the Upper Narmada Valley... <i>Girish Ch. Kothiyari and B. K. Rastogi</i> Institute of Seismological Research, Raisan, Gandhinagar, Gujarat India
S8_P1	Attenuation relations for the Kumaon and Garhwal Himalaya, Uttarakhand, India... <i>A. Joshi et al.</i> Department of Earth Science, Indian Institute of Technology Roorkee, Roorkee, India.
S8_P2	Prediction of strong ground motion in the coastal and economically important regions..... <i>Kapil Mohan</i> Institute of Seismological Research, Gandhinagar, Gujarat (India)
S9_P1	Geo-informatics based conceptualization of earthquake disaster management system <i>Ajeet P. Pandey, R.K. Singh and A.K. Shukla</i> Earthquake Risk Evaluation Center, India Meteorological Department, New Delhi
S9_P2	Probability of occurrence of largest earthquakes in Jharkhand and nearby region..... <i>Akash Adwani et al.</i> Dept. of Applied Geophysics, Indian School of Mines, Dhanbad (India).

S9_P3	Preliminary site characterization through integration of geophysical and geotechnical data at GIFT ... <i>B.K. Rastogi et al.</i> Institute of Seismological Research (ISR), Raisan, Gandhinagar, Gujarat, India
S9_P4	Preliminary site characterization through integration of geophysical and geotechnical data at Dholera <i>B.K. Rastogi et al.</i> Institute of Seismological Research (ISR), Raisan, Gandhinagar, Gujarat, India
S9_P5	Estimation of liquefaction potential of Dholera region based on SPT N-values <i>Sarda Maibam et al.</i> Institute of Seismological Research, Raisan Village, Gandhinagar
S9_P6	Vs30 and site amplification studies in Dholera SIR Region, Gujarat, India <i>B. Sairam et al.</i> Institute of Seismological Research, Raisan, Gandhinagar
S12_P1	Post-seismic deformation associated with the 2001 Bhuj earthquake <i>Pallabee Choudhury et al.</i> Institute of Seismological Research, Raisan, Gandhinagar
S14_P1	Estimation of spectral decay parameter kappa, seismic moment, stress drop, source dimension..... <i>Santosh Kumar et al.</i> Institute of Seismological Research, Gandhinagar
S14_P2	Seismotectonic study to characterize the seismic sources in Gulf of Khambhat and prediction of strong ... <i>Sandeep Kumar Aggarwal et al.</i> Institute of Seismological Research, Gandhinagar.
S14_P3	Site characterization using Vs30 and site amplification in Gujarat, India <i>B. Sairam et al.</i> Institute of Seismological Research, Raisan, Gandhinagar

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S5_P4	Foreshock clustering as precursory pattern for the Kachchh earthquakes in Gujarat, India <i>Sandeep Kumar Aggarwal et al</i> Institute of Seismological Research, Village Raisan, Gandhinagar- 382007
S5_P5	Status of superconducting gravimeter and MPM network of Kachchh <i>Arun Gupta, Rashmi Pradhan, M.S.B.S. Prasad and B.K. Rastogi</i> Institute of Seismological Research, Raisan, Gandhinagar, Gujarat
S6_P1	Attenuation of coda waves of local earthquakes in the Northeastern India <i>Alok Kumar Mohapatra, William Kumar Mohanty</i> Department of Geology and Geophysics, Indian Institute of Technology, Kharagpur
S6_P2	Spectral decay parameter (?) using the accelerograms of the earthquakes in Himalaya <i>Renu Yadav, Kavita Rani, Gunjan Dhiman and Deepak Kumar</i> Department of Geophysics, Kurukshetra University Kurukshetra, India
S6_P3	Estimation of coda-Q using a non-linear (Gauss-Newton) regression <i>Savita Singh, Sumedha, Monika Wadhawan and Vandana</i> Department of Geophysics, Kurukshetra University Kurukshetra, India
S10_P1	Active deformation and lithotectonic model of Saurashtra Horst, Gujarat, India <i>Girish Ch. Kothiyari et al.</i> Institute of Seismological Research, Gandhinagar, Gujarat, India

S11_P1	A comparative study on seismic wave attenuation characteristics of Koyna, Chamoli And Gujarat regions <i>Babita Sharma et al.</i> Institute of Seismological Research, Raisan, Gandhinagar, India.
S11_P2	Inversion of seismic intensity data for the determination of three-dimensional attenuation structures.... <i>Babita Sharma et al.</i> Institute of Seismological Research, Gandhinagar.
S11_P3	Seismic evidences for underplating and uplifted crust beneath the Northwestern deccan volcanic province.... <i>K. Madhusudana Rao et al.</i> Institute of Seismological Research, India.
S11_P4	Shear wave splitting beneath the northwestern deccan volcanic province..... <i>K. Madhusudana Rao et al.</i> Institute of Seismological Research, India.
S11_P5	Evaluation of the crustal structure of the Indus Block up to Saurashtra using GA inversion ... <i>Vishwa Joshi et al.</i> ISR, Gandhinagar.
S11_P6	Shield like lithosphere of the lower Indus basin evaluated from observations of surface wave dispersion. <i>Mukesh Chauhan et al.</i> Institute of Seismological Research, Raisan, Gandhinagar, India
S13_P1	2D-geolectric subsurface structure in the surroundings of the epicenter zone of 2001..... <i>Kapil Mohan et al.</i> Institute of Seismological Research, Raisan, Gandhinagar, Gujarat, India
S13_P2	Identification of shallow geological features in the Wagad area (Kachchh) using 2D electrical survey <i>Kapil Mohan et al.</i> Institute of Seismological Research, Raisan, Gandhinagar, Gujarat (India)
S13_P3	2D electrical imaging survey to identify the shallow subsurface layer in the Gujarat international.... <i>Kapil Mohan et al.</i> Institute of Seismological Research, Raisan, Gandhinagar, Gujarat (India)
S13_P4	Passive Seismic Imaging of Petroleum Reservoir <i>Mr.Sunjay,</i> Exploration Geophysics,BHU, Varanasi,India.
S15_P1	Numerical modeling of Arabian Sea tsunami propagation and its effect on the Gujarat..... <i>A. P. Singh and B. K. Rastogi</i> Institute of seismological research (ISR), Raisan, Gandhinagar, Gujarat (India)
M_P2	Environmental studies using Electrical Resistivity Method <i>Sunita Devi & Rupal Malik</i> Institute of Seismological Research, Gandhinagar

Annexure 9

Letter & Messages from some delegates and others

Prof. J. R. Kayal, M. Sc., AISM, Ph. D. (NZ)

Former Deputy Director General (Geophysics), GSI,

Ex Visiting Professor, ERI, University of Tokyo, Japan

Presently: CSIR Emeritus Scientist, Jadavpur University, Kolkata,

Adjunct Professor: Indian School of Mines, Dhanbad,

Tezpur University, Assam, & Manipur University, Imphal,

Guest Faculty: UNESCO Training Courses, South Asia

To
Dr B K Rastogi,
Director General
ISR, Gandhinagar

February 1, 2011

Dear Dr Rastogi,

It was a great pleasure to attend the AES-2011 Symposium organized by the ISR Gandhinagar, January 22-27. As one of the senior most seismologists of the country, I have the following comments about the Symposium and about the ISR:

- i) This is one of the best organized International Symposium/Conference I have ever attended in terms of organization, technical sessions, invited renowned speakers, discussion/interaction, field trip, infrastructure facility, and participation of students, young and renowned scientists from all parts of India and abroad. I must congratulate you, your team, and above all the Gujarat Government for the great success!!
- ii) A Seismological Institute in the country was a long dream to the seismologist community in India since the devastating 1993 Killari earthquake. You and your state Government have shown how to make it, and how to bring it to the International standard. When I landed to your great Institute, I was just overwhelmed, and during my 5-day stay I experienced it to be one of the best Seismological Research Institutes in the world!
- iii) To make it a more prestigious and more International, I have, however, a few humble suggestions: (a) Number of permanent Scientist positions should be enhanced to at least 50 within two years, (b) Ph D/research scholars are the main strength for carrying out research work, and the fellowship need to be enhanced to a respectable standard, at least at per with the CSIR fellowship (Rs18,000-20,000 per month) if not more, and for the foreign scholar no less than \$1000 a month.

I look forward to seeing more and more success of your Institute in terms of quality research, research publications and similar stimulating Symposium/brain storming sessions in near future.

Best regards,



(J R KAYAL)

Res: 73B, Thakurpukur Road, Kolkata 700 063. Tel.: 91-33-24380606, Mobile: 91-9830675424

E-mail: jr.kayal@gmail.com / jr_kayal@yahoo.com

1. Message from D.C. Mishra

30.1.2011

Dear Dr. Rastogi,

Thanks for providing this opportunity to attend and interact with various scientists working on this topic. It was one of the best organized symposium where several new data sets were presented and old ideas were re-evaluated based on new data sets. The best part of this symposium was interaction between young workers and senior scientists. It was also heartening to see the evolution of ISR with several young workers working in different fields. I must congratulate and compliment you for this.

Dr. D. C. Mishra

Emeritus Scientist

National Geophysical Research Institute

Uppal Road

Hyderabad 500 007

Andhra Pradesh, India.

Phone:91-040-23434670(Office)

91-040-27170423(Residence)

Fax no:91-040-23434651

e-mail: dcm_ngri@yahoo.co.in

2. Messages from JR Kayal written to some foreign scientists

To HOD, Dept Appl. Geophys., ISM, Dhanbad

1. It was an excellent International Seminar AES 11 at the ISR Gandhinagar, Jan 22-27, with distinguished gathering, field trip etc. The ISR has taken a shape of any world International Institute standard with infrastructure facility, state of art instruments etc.

To Walter Mooney, US Geological Survey

2. The ISR, Gandhinagar Seminar went excellent because of Dr Rastogi's (ISM '63) cool and dynamic performances with fantastic infrastructure facilities that he has developed within such a short time, in hardly five years. We all enjoyed there.

JR KAYAL,
CSIR Emeritus Scientist and
formerly Addl. DG, GSI

3. To Frank Roth roth@gfz-potsdam.de

Dear Frank

The seminar at ISR (Institute of Seismological Research), Gandhinagar, Jan 22-27, was too good to believe. You must visit the ISR at the earliest opportunity. Its an International Institute now....., and I look forward to seeing you there to study the GPS data of the Kutch Rift basin that produced the 2001 [Bhuj EQ, M 7.7](#).

Best regards,

JR Kayal

3. Message from Utpal Bhatt

Respected Sir,

First of all hearty congratulations for the super success of your dream symposium 'AES-2011'!

TV Asia's weekly news showed inauguration of symposium for quite a long time on Saturday (Jan 29). I was so happy to see you on TV here and also could tell others that you are my boss! I also read news about AES-2011 in other news papers here (I will send scanned images later).

Congrats to all ISR team members.

Sincerely,

Utpal

4. Messages from Indrajit Ghosh

Dear Dr. Rastogi,

ISR arranged a most wonderful Conference/Symposium last week and it was extremely well organised. The credit goes to you and your staff and students. I appreciate your cordial invitation to attend the symposium, and sincerely thank you. I enjoyed the symposium and benefitted a lot. The attached file reflects my thoughts on the symposium. I will try my best to attend in the future.

My wife, Ira, and I also thank you for inviting us to your residence to meet your wife. Unfortunately, as you know, we could not do that because of pre-arranged transportation from ISR. If you are in town and free, we will try to come and see you and your wife coming weekend (February 5 or 6).

Thanking you once again,

Indra Ghosh

SOME THOUGHTS ON ISR SYMPOSIUM, JAN 22 - 24, 2011

By Indrajit Ghosh

Having worked for many years in nuclear power and waste treatment plants as a Civil/Structural engineer, and associated with the American Society of Civil Engineers for many years, I have attended many conferences in the USA. Those conferences were mostly on civil and structural engineering topics. But I developed a keen interest in earthquake engineering long time ago since earthquakes played a very important role in the design of nuclear plants. When I found out about the symposium on earthquake science in Gandhinagar in a local newspaper in Ahmedabad, I knew immediately that this symposium would be a worthwhile conference that I had been waiting to attend ever since I got involved in the nuclear structural design. Without

waiting, I tried to find out the kind of papers to be presented. I made several phone calls in vain to the Institute of Seismological Research (ISR), and surfing the Internet for some time, which also proved futile*. Then I called a dear friend who requested none other than the Director General of ISR to send me information on this symposium. A barrage of information poured into my email inbox in no time, and my interest in attending the symposium was whetted. This was because of the program details which seemed very appropriate for my interest and the very cordial invitation from the director himself! My heart was stolen instantly, and very eagerly I was wondering how to attend as many sessions as possible and gain the most knowledge in earthquake and other disaster related topics.

Being a structural engineer, I decided to shy away from the structural engineering sessions in the symposium. I wanted to grasp the opportunity to learn other sciences that provide input to structural engineering design – especially for the nuclear structures. So I attended many sessions on seismicity, zonal mapping, tectonics, and ground motion during the three-day symposium. The symposium selected the papers and categorized them to cover the basic science and progressively culminating into the latest and up to date development. The papers were presented by the students, practitioners, researchers and scientists. All the papers were presented with enthusiasm, and authority.

I met several speakers and talked with them about their papers, their careers and aspirations. Their sincerity, especially of the students, in their field of work, can not be measured with a common yardstick. Their knowledge and eagerness to advance is great and very evident. I met with many presenters in the US, but I did not find the soundness of knowledge very often as the presenters at this symposium. The symposium kept a very high standard in selecting the papers.

The Director's leadership has led the ISR to a new height within a few years of its inception. I do not know how the western seismological institutions are, but I have no doubt that ISR has everything that a progressive institution needs to have. The topics they cover in this institute and their affiliations with scientific institutions will become a beacon in the field of seismology and natural disaster prediction.

I cannot help mentioning the break times - tea/coffee and lunch during recesses and dinner at the end of each day, provided everyone an opportunity to relish wonderful snacks and tasty dishes, and also to mix and mingle, and make new friends. I certainly made some new friends with whom I intend to continue friendship and exchange ideas.

I thank ISR for giving me an opportunity to attend this symposium, and widening my horizon on seismology. I left the symposium with a strong feeling that our scientific world may be far superior to the west, and if we can overcome certain obstacles and practices, we could be the leader in science and technology, if not so already.

*Note from ISR: All the information was available at a link to our website.

5. Message from Harsh Gupta

Dear Dr. Rastogi,

This is a belated letter of thanks and appreciation for conducting a very useful and successful Symposium at ISR last week.

Thanks to Kanchan for taking care and hospitality.

Best wishes,
Harsh Gupta

--

Prof. Harsh Gupta
Panikkar Professor,
President, Geological Society of India
President, AOGS
Vice President, IUGG
National Geophysical Research Institute
Hyderabad-500 007, INDIA
Tel: +91-40-23434669
Tel/Fax:+91-40-23434666

6. Messages from Ratnesh Pandey

30.1.2011

Respected Rastogi Sir,

First of all thank you very much Sir. I am remembering your speech which you addressed to all of us on the occasion of last year Republic Day (26 January 2010). Sir that day you have said two statements:

The first statement was- "Sometime for the short term gain people quit their long term achievement and that particular time people do not know what they are quitting and what they are achieving but in the future one day people will realize this truth that short term is not the right way"

And the seconds statement was- "The foundation of ISR is based on HIGH QUALITY VALUE and due to that ISR will be recognized not only by India but worldwide scenario also".

Sir you were 100% right that time.

Sir when I saw ISR International symposium news on Peace TV / Press TV / CCTV News / Sky News (ISR News was flashed on said channel in Africa by the courtesy of Indian channel) , that day suddenly your speech which was delivered by you on last year Republic day occasion, triggered my brain, my heart and my soul. I was totally speechless and emotional.

In Africa a lot of Indian community staying as citizens of Africa, among those Gujaratie's are too much. Gujaratie's are well established and settled in Africa and they are more cautious about India and Gujarat news. Gujaratie's having their own library in Africa where latest and updated news of India and mainly about Gujarat are available. The Hindi news of ISR International Symposium was provided by African Gujarati library by the curtsy of Amar Ujala news paper of India.

Sir this is true and everybody knows that ISR has sound reputation in scientific community and when researcher and scientist searching ISR Website that time they are thinking that a huge number of manpower and scientific staff are involved behind ISR achievement but when they came to know that all finished project and ongoing prestigious projects and work mentioned in ISR website is run by single handed "Dr.B.K Rastogi" by utilizing a very small man power (can count on finger), people becoming surprised.

With Thanks & Regards

Your's faithfully

Ratnesh Pandey

Cell No: +255683713860

Tue, January 25, 2011 6:47:30 PM

Heartiest congratulation

Respected Rastogi Sir,

Please accept my heartiest congratulation for wonderful success of International Symposium in ISR in your admired supervision.

I just reached 4 days before Africa from [Canada](#) and was stay in [Kilimanjaro](#) hotel. Yesterday I just switched on my room Television. There is a local channel very famous in Africa called Peace Channel. In that channel International ISR symposium news was the main sparking news and was telecast by the courtesy of Indian channel.

When I saw ISR campus in Peace Television, it was extremely emotional moment for me. My eyes were full of tears. I was feeling proud on me that I am also a small particle of ISR and have worked under your beloved supervision.

It is you Sir, who has spread ISR fame not only in [India](#) but worldwide also.

With Thanks and Regards

Your's

Ratnesh Pandey

Cell No:+255683713860

Geo_ratnesh@yahoo.co.in

7. Message from Sumer Chopra

27.1.2011

R/Sir,

I must congratulate you and your team for wonderfully organizing the international symposium. Everybody praised everything. Everybody was satisfied and the flexibility ISR showed is found nowhere. Yourself and Pallabee worked very hard all these days but in the end everything went in a copybook precision. Your hardwork at this age always inspired us to do more everytime. I am extremely happy to see the ISR's progress under your leadership. ISR will certainly scale new heights in coming years.

Please note my new mail ID

sumer.chopra@nic.in

Missing ISR....

regards

Dr. Sumer Chopra

Scientist-E

Ministry of Earth Sciences

Government of India

New Delhi

8. Message from Lalliana Mualchin

27.1.2011

Dear Rastogi,

Many thanks for inviting me at the symposium and providing institutional support for my participation. I take a special note on your gracious verbal gesture of welcoming me to your institute any time and providing me basic needs. If I could be of any value to your institute, I will gladly do it for you.

It is a real joy to see your success and achievement to create ISR - perhaps you are in the most prosperous and dynamic states in India.

I thoroughly enjoyed meeting people whose papers I read, and also interacting with younger workers who seemed to enjoy immensely hearing my story and ideas. As they are our future, I felt so great to be able to encourage and share them my passion in this field!

I wish you continued productivity for many more years, until you are ready to take it easy.

My wife really like your kindness and generosity!

Sincerely,

Liana <mualchin@hotmail.com>

Lalliana Mualchin

9. Message from Arun Bapat

Dr. Arun Bapat, former Joint Director CWPRS, Pune thanks a million times for successful AES-2011. The entire credit of success of Conference goes to you. I was extremely happy to see your organizational skill.

10. Messages from Chandra Bhakuni , Visiting Faculty, CEPT, dt. 03/02/2011

Dr. Rastogi,

Please accept my congratulations on the success of the workshop. It was diverse, and I could make a great use of it in updating my knowledge of the work happening in this sector.

I would also like to express my sincere regards and thanks for creating an opportunity of technical learning made available to common people. We look forward to more from you.

Best wishes,

Chandra

Implementation Committee of ISR- Annexure - 10

A	<u>CHAIRMAN OF ALL COMMITTEES:</u>	-	H	<u>LASER SHOW MANAGEMENT:</u>	
	Dr. B. K. RASTOGI	99784 07515		Dr. KAPIL MOHAN	90990 34451
				MAHESH VALEKAR	96017 73863
B	<u>COORDINATION TEAM:</u>	-			
	K.M.RAO	99784 06331	I	<u>HOSPITAL & MEDICAL COMMITTEE:</u>	
	SANTOSH KUMAR	99252 43646		SAI RAM	90990 34453
	PALLABI CHAUDHURY	90990 34460		GAURANG BHAKHARIYA	98986 03487
B2	<u>Host-Guide:-</u>				
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	GIRISH PATEL	97254 82598	J	<u>HALL ARRANGEMENT:[Auditorium]</u>	
	GAGAN BHATIA	97268 52626		GANPAT PARMAR	90990 34457
	Ms. SANTOSH	9377765864		GAGAN	97268 52626
	JIGNESH PATEL [T.A.]	99255 95948		GIRISH PATEL	97254 82598
	MR. Kiran M.				
C	<u>TRANSPORT COMMITTEE:</u>	-			
	MUKESH CHAUHAN	99250 74167	K	<u>HALL MANAGEMENT:[Conf room-1 & 2]</u>	
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C1	<u>ALL DRIVERS</u>			JAYESH PARMAR	98244 69547
	MAHENDRA S. CHAVDA	90990 34482			
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	JATIN M. VAGHANA	90990 34494			
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	GAGAN	97268 52626			
	KISHAN ZALA	98794 31888	N	<u>ACCOMODATION COMMITTEE:</u>	
D1	<u>Delegates:</u>			A. P. SINGH	9099034461
	OM BEHARI	96876 06531		VANDANA P. -GH	9428003403
	SANDEEP AGRAWAL	90990 44477		NEHAL CHAUHAN	9925538633
	UTPAL BHATT	97129 07779		ASHISH BHANDARI	9601685966
E	<u>REGISTRATION COMMITTEE:</u>	-		R.K SINGH	9429030066
	<u>Dr. Kapil Mohan</u>	<u>9099034451</u>		<u>GUIDES FOR VISITS TO LABS.OF ISR:</u>	
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	POOJA	97250 98346	O	SIDDHARTH DIMRI - Gravity & Mag.	8905229598
	JAINA	94271 14052		SURYA PRAKASH - GEOTECH	81407 62131
	SUNITA	90172 67076		SHREECHAND PRAJAPATI- GPS	90990 34470
	DAKSHA PARMAR	90990 34495		VANDANA -DATA CENTRE	99095 23030
F	<u>STAGE MANAGEMENT:</u>	-		GAURAV -DATA CENTRE	93759 01299
	JANKI DESAI	99094 31325			
	VISHWA	98983 15738		<u>Poster:</u>	
	FALGUNI	99099 81328		ASHISH BHANDARI	9601685966
G	<u>ACCOUNTS COMMITTEE:</u>	-	P	MOHAR SINGH	9228699855
	SHRI P.H. CHARAN	98357 30654		MEHUL JAGAD	9601556435
	SHRI BHARAT SHAH	90999 54097		VANADANA-data centre	9428003403
	GIRIRAJSIKH CHAVDA	97140 00541	Q	<u>Airport:</u>	
	DHARMENDRA	9904852917		K.M.RAO SANTOSH KUMAR	9978406331 9925243646
				KAPIL MOHAN, SANDEEP A.	9099034451 9099034477
				RAKESH DUMKA Puja, Vishwa	8000137268,
				GAGAN B., PUJA R. GIRISH P., VISHWA J.	97268 52626 9725482598

Annexure 11: Field Trip Guide

International Symposium on “The 2001 Bhuj Earthquake and Advances in Earthquake Science (AES-2010)”

Field Trip Guide to Kachchh

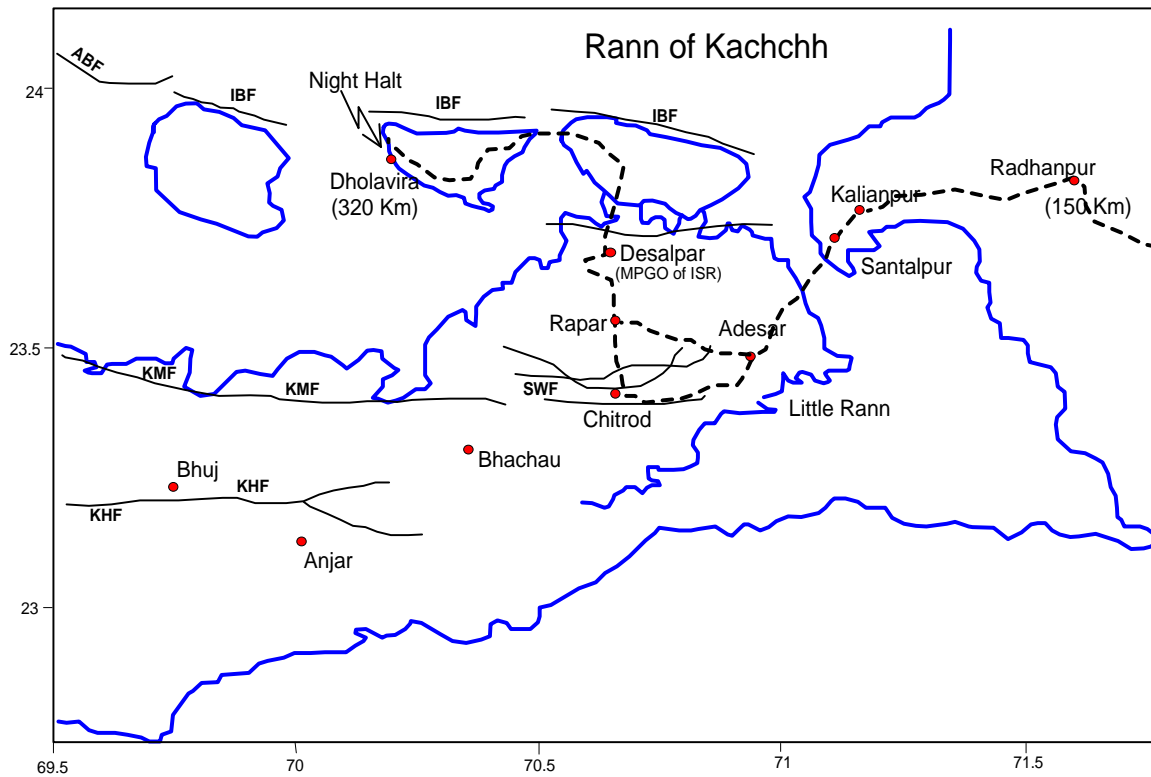
25-26 January 2011

Prepared By: **Dr. B.K. Rastogi**, Director General, Institute of Seismological Research, Gandhinagar, India

Organizer: **ISES and ISR, Gandhinagar, Gujarat**

Field Guides:

1. **Rakesh K. Dumka**, Scientist B, ISR Gandhinagar, India
2. **Dr. R.S. Bisht**, Former Director, Archeological Survey of India



Post symposium Field Tour to Kachchh (25-26 January 2011)

Day	Time	Description
Day 1 25/01/2011	6.00 Hrs	Departure from Gandhinagar by road for Kachchh
	9.00–9.30Hrs	Breakfast at Santalpur and Geological discussion of the site including Radhanpur Arch
	9.30Hrs	Departure for Dholavira Harappan site on the way we will cross the little Rann of Kachchh
	13.00 -13.30 Hrs	Lunch at Rapar
	13.30 – 15.00 Hrs	After Lunch departure for Dholavira with a glimpse of Gedi Fault and Great Rann of Kachchh
	15.00 – 18.00 Hrs	Visit of Dholavira Harappan site, guided by Dr. R.S. Bisht
Night stay at Dholavira		
Day2 26/01/2011	8.00 – 13.00 Hrs	After breakfast departure for a look of IBF towards north of Dholavira
	13.00 – 13.30 Hrs	Lunch at Dholavira
	13.30 – 16.00 Hrs	Archeoseismological study of Dholavira Harappan site, guided by Prof. P. Talwani and Dr. R. S. Bisht
	16.00 – 18.30 Hrs.	Departure from Dholavira to Gandhinagar, on the way a visit of MPGO site of Desalpar
	18.30 – 23.30	Desalpar to Gandhinagar

Introduction

The Kachchh peninsula is one of the most seismically active regions of northward drifting Indian plate which fall in zone V outside the Himalayan belt (Figure 1). The basic structural framework of Kachchh represents a rift basin, which dates back to Late Triassic-Early Jurassic, exhibiting the longest record of the Mesozoic succession in the western India (Biswas, 1987). This rift basin is now under the influence of compressional stress regime resulted due to the collision of Indian and Eurasian plates. The landscape of Kachchh shows a complex structural pattern marked by uplifts (Kachchh Mainland) and low-lying residual depression (Great Rann-Banni plains). Uplifts are confined along the major sub-parallel E-W striking longitudinal faults (Figure 1), e.g. the Katrol Hill Fault-KHF, Kachchh Mainland Fault-KMF, Banni Fault-BF, Island Belt Fault-IBF and Allah Bund Fault-ABF (Biswas and Deshpande, 1970; Biswas, 1980). Geomorphologically, the Kachchh can be categorized into three major E-W trending zones (1) Kachchh Mainland and Wagad uplift forming the central portion of rocky uplands, (2) Banni-Plains marked by raised mud flats and (3) Great Rann in north and Little Rann in the east comprising vast saline-waste land. The boundaries of these geomorphic zones are bounded by major faults (Figure 1).

The Kachchh region has experienced several large to moderate magnitude earthquakes during last 300 years. These events are 1668 Indus Delta (M7); 1819 Allah Bund (M7.7±0.2), 1956 Anjar earthquake (Ms6.1), and the recent 2001 Bhuj earthquake (Mw7.6) Bilham, 1999). Earthquakes with magnitude more than Mw 7.0 are generally accompanied by surface rupture.

However, out of these earthquakes, only 1819 Allah Bund earthquake has been reported to have accompanied with 80-90 km long surface rupture and uplift resulting into formation of about 5-6 m high scarp (Quittmeyer and Jacob, 1979; Johnstan and Kanter, 1990). Whereas, other events likewise the 2001 Bhuj event showing no evidences of surface faulting, suggest movements on blind fault (Figure 1). The 2001 main shock occurred at a depth of 23km along a reverse fault causing upliftment of its southern side in an area north of Kachchh Mainland Fault. About 14,000 people were killed due to this earthquake. The maximum damage occurred around Bhachau (in a NE-SW trending area of 40 km x 20 km).

This indicates that large earthquakes in Kachchh region are not only generated by active faults, but also by blind faults, and this makes the seismic hazard assessment most difficult and complex task.

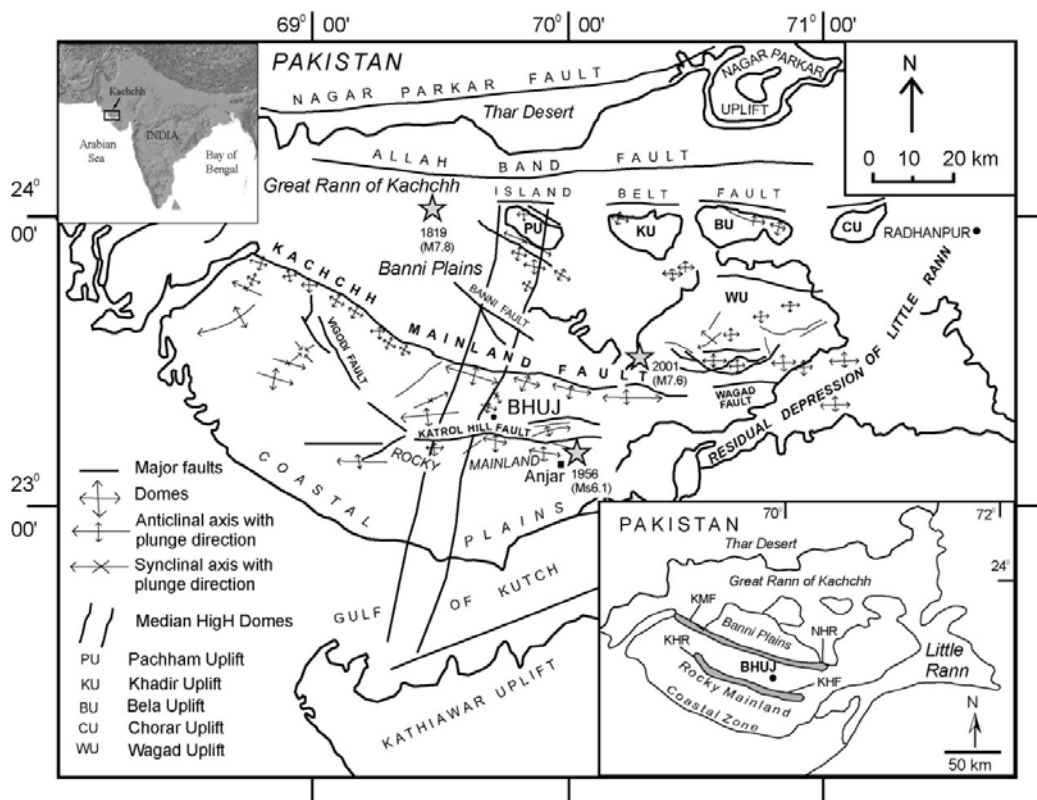


Figure 1. Generalized structural map of Kachchh region (after Biswas and Deshpande, 1970) along with location of major earthquakes. Inset at the left top show DEM of India highlight the location of Kachchh peninsula. Inset at the lower right shows major geomorphic zones of Kachchh. NHR- Northern Hill Range, KHR- Katrol Hill Range, KMF- Kachchh Mainland Fault and KHF- Katrol Hill Fault.

Summary

Paleoseismology, Geomorphology and dating of recent tectonic features will establish return periods of earthquakes and help in forecasting of earthquakes by determining ages of pre-historic earthquakes in Kachchh and rates of movements along geological faults. For this study, after due observation of land by satellite stereo images and then ground combing in earthquake stricken area of Kachchh, samples have been collected from trenches. Analysis of these

samples is done in OSL Lab for determining the ages of the sediments and how they were formed. Paleoseismological studies in more than 15 trenches along with geophysical investigations such as GPR and MASW survey, leveling measurements were carried out along Katrol Hill, Kachchh Mainland and Allah Bund Faults. The study revealed, for the first time in India, clear evidences of neotectonic activity and pre-historic earthquakes and an active fault map of Kachchh has been prepared (Figure. 2). The highlight of the study was first to identify pressure ridges along faults by stereo images and then go for trenching. This tremendously increased chances of finding neotectonic features.

Kachchh Mainland: Pressure ridges were observed with 2-3 m height extending in E-W direction near Lodai village on KMF (NNE of Bhuj). In a trench, the Quaternary deposits were observed to be widely deformed and three small faults were identified indicating three seismic events with a net slip of about 60-70cm. These are typical reverse faults with dip of 10°-60° inclined to south.

At Jhura on KMF (NNW of Bhuj) truncation was identified in the fan deposits of Kaila River from Satellite data. Trenching showed two events on a fault with 70 cm slip for each event. From this a slip of 6 m can be inferred for hard rock at depth. Some 12 m south an older fault indicates similar slip.

An active fault trace demarcating boundary between Katrol Hill and fluvial terrace is observed near Wandhay village. A warping scarp was observed on the terrace. A trench was excavated across this scarp. Three major fault strands were identified in the trench. Three seismic events were inferred along these. The northern fault strand displaces the terrace deposits along all units of the younger sequence except top layer.

The eastern part of KHF is suggested as inactive. The NE-SW extending Bhuj fault at Wandhay village is the active foreland migration of KHF. A trench across the Bhuj fault indicated one event. The fault displaced all sedimentary succession in the trench from Mesozoic rocks to thin channel deposits except the top soil cover

Allah-Bund: Indications of pre 1819 uplift along western segment of Allah-Bund were observed. Numerous paleo-channels recognized from satellite data were found to have uplifted on ground checking. These uplifts are 40 cm to 290 cm and might have occurred < 2ka [Existence of paleo-channels was pointed out to us by Roger Bilham].

Around Vigukot, 10 km north of the western segment of ABF, three events were identified in two trenches on the basis of cross-cutting of liquefaction features. A few small or distant events are envisaged on the basis of small sand blows. Dating of charcoal and sediments is in progress.

Satellite imageries for the eastern segment of Allah-Bund SSE of Karimsahi indicated younger drainage south of scarp (which is normally not expected). Leveling indicated abrupt slope change (20cm uplift) for a 70 m length. A trench exhibited > 2m upthrusting from north. In the easternmost section of the Allah-Bund (8 km west of Dharamsala) numerous sand blows and dykes were observed for lengths of 70-80m which are seen to extend to shallow depths in trenches.

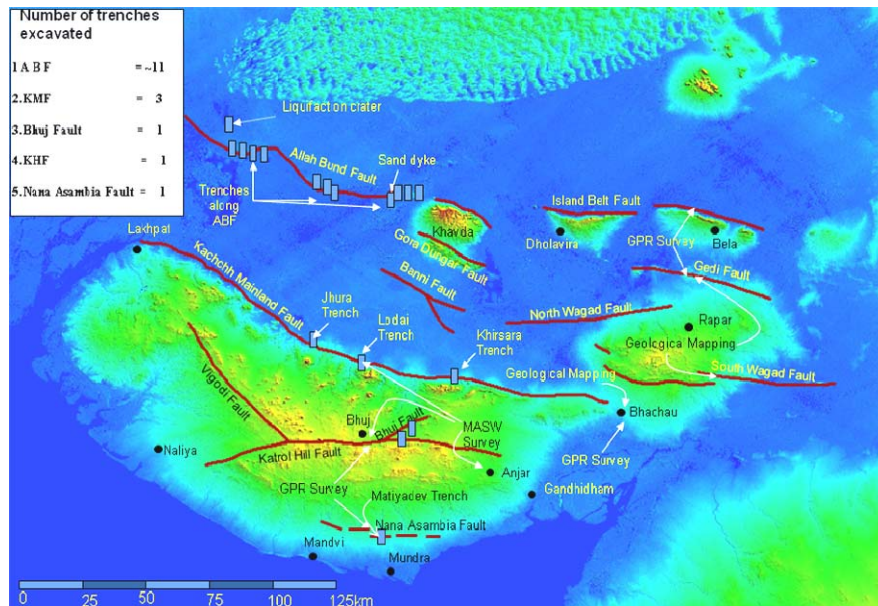


Figure 2. Active fault map of Kachchh region showing location of trench investigation carried out on three major faults of the area.

Multiparametric Geophysical Observatories (MPGO):

ISR has established three Multiparametric Observatories in Kachchh for earthquake prediction research at Badargadh, Vamka and Desalpar (Figure 3) the one at Desalpar is being sponsored by Ministry of Earth Science while the other two area sponsored by GSDMA and state Government of Gujarat. These Observatories have been equipped with BBS, SMA, GPS, and Radon detectors. Flux-gate magnetometer and super conducting gravimeter have been installed at Badargadh. Water level recorders are being installed. Three number borehole Strain meters have been procured and are to be installed. Orerhauser Magnetometer, Declination/Inclination Magnetometer, ULV&VLF magnetometer and helium recorders



Figure: 3 Photo plate of Multiparametric Geophysical Observatory (MPGO)

Description of Faults in Kachchh

Katrol Hill Fault (KHF):

A faulted contact of Jumara Formation (Jurassic Shale beds) and Bhuj Formation (Cretaceous Sandstone) was observed in central part of KHF south of Bhuj city (see Figure 4 a). It is interpreted that Jumara Formation is brought in contact with Bhuj Sandstone due to reverse faulting along KHF. Jumara Formation is standing like a E-W ridge to the south of bounding fault forming a dome of dimensions 1.5 km × 1 km.



(a)

(b)

Figure 4(a) Faulting along KHF has brought Jurassic Shale in contact with Cretaceous Sandstone; Location: near Wala Khawas Talai south of Bhuj, Photograph by Dr. B. K. Rastogi. (b) Steeply north dipping beds north of KMF. Location: east of Nara village, Photograph by Gadhavi. M. S.



(c)

(d)

Figure 4(c) Contact between Jurassic and Eocene rocks north of KMF is steep in the east. Location: Guneri village, Photograph by Dr. B. K. Rastogi. (d) In the west the KMF has gently north dipping Eocene limestone. Location: Lakhpat, Photograph by Gadhavi MS.

Kachchh Mainland Fault (KMF):

Investigations were carried out in parts of KMF near villages Nara, Guneri and Lakhpat. Steeply north dipping beds of Jhuran Formation (Upper Jurassic) abutting against the Banni Plains and Rann of Kachchh are typical of the KMF. In Figure 4 b. beds of Jhuran Formation are seen dipping 45° due north towards Banni Plains. Relic outcrops of north dipping Jurassic rocks scattered in a linear E-W trend projecting out from flat Banni Plains are conspicuous in the area.

Near Guneri village vertical beds of Upper Jurassic age are observed resting beside the north dipping beds of Eocene age (see Figure .4c). Similarly gently north dipping Eocene limestone is observed to the north of Lakhpat Fort (See Figure. 4d). Lakhpat Fort is positioned over a dome of dimensions 1.7 km x 0.7 km. These structures represent reverse faulting along KMF. According to S. K. Biswas domal structures observed along KHF and KMF are outcome of strike-slip movement along these faults.

Gedi Fault (GF):

Structural studies were carried out around Gedi and Desalpar villages. Few dykes intruded along small scale faults were encountered in the area. It was found that Desalpar village is surrounded by three faults of few kilometers length, trending E-W, NW-SE and NE-SW (see Figure. 2), nature of the faulting is not yet been established. Faults and dykes are characterized by strong fracturing of surrounding rocks, mainly sandstone. South of Desalpar village steeply south dipping beds are observed. These beds are interpreted as consequence of a north dipping reverse fault. An easterly plunging anticline is recorded north of Desalpar.

Island Belt Fault (IBF)

The area (Figure. 2) is characterized by presence of thick Quaternary cover over the Mesozoic rocks. Great Rann, north of Bela Island is characterized by presence of an E-W trending Island Belt Fault (IBF) and NW-SE to NE-SW trending transverse fracture pattern. The IBF is steeply south dipping reverse fault along which the Bela Island got uplifted and developed the island morphology (Biswas; 1974 & 1980). Compressional tectonics in the strike-slip environment produced transpressional faults.

1.2 Radhanpur Arch

The Kachchh rift basin is terminated in the east against a transverse subsurface basement ridge named as Radhanpur Arch. This Arch is the western shoulder of the adjacent N-S oriented Cambay rift. The Radhapur arch acts as a ramp for eastward movements which is creating additional strain in eastern part of the Kachchh basin (Biswas, 2003).

1.3 Dholavira Harrappan site

Dholavira, an ancient city, and locally known as *Kotada Timba Prachin Mahanagar Dholavira*, is one of the largest and most prominent archaeological sites in India, belonging to the [Indus Valley Civilization](#). It is located on the *Khadir bet* island in the [Kutch Desert Wildlife Sanctuary](#), [Great Rann of Kutch](#), [Kachchh district](#) of [Gujarat](#), [India](#). The site is surrounded by water in the monsoon season.^[1] The site was occupied from c.2650 BCE, declining slowly after about 2100 BCE. It was briefly abandoned and reoccupied until c.1450 BCE. The site was discovered in 1967-8 by J.P. Joshi and is the fifth largest [Harappan](#) site in the Indian subcontinent, and has been under excavation almost continuously since 1990 by the [Archaeological Survey of India](#). Eight large urban centers have been discovered: [Harappa](#), [Mohenjo Daro](#), [Ganeriwala](#), [Rakhigarhi](#), [Kalibangan](#), [Rupar](#), Dholavira, and [Lothal](#). The ancient site at Dholavira, is flanked by two storm water channels; the Mansar in the north, and the Manhar in the south. Excavation was initiated in 1989 by the Archaeological Survey of India under the direction of R. S. Bisht. The excavation brought to light the sophisticated urban planning and architecture, and unearthed large numbers of antiquities such as seals, beads, animal bones, gold, silver,

terracotta ornaments and vessels linked to [Mesopotamia](#). Archaeologists believe that Dholavira was an important centre of trade between settlements in south [Gujarat](#), [Sindh](#) and [Punjab](#) and Western Asia (Figure 5).

Estimated to be older than the port-city of [Lothal](#), the city of Dholavira has a rectangular shape and organization, and is spread over 100 hectares. The area measures 771.10 metres in length, and 616.85 metres in width. Like [Harappa](#) and [Mohenjo-daro](#), the city is composed to a pre-existing geometrical plan, of three divisions - the [citadel](#), the middle town and the lower town. The acropolis and the middle town had been further furnished with their own defence-work, gateways, built-up areas, street system, wells and large open spaces. The acropolis is the most carefully guarded as well as impressive and imposing complex in the city of which it appropriates the major portion of the southwestern zone. The towering "castle" stands majestically in fair insulation and defended by double ramparts. Next to this stands a place called 'bailey' where important officials lived. The city within the general fortification accounts for 48 hectares. There are extensive structure-bearing areas though outside yet intimately integral to the fortified settlement. Beyond the walls, yet another settlement has been found. The most striking feature of the city is that all of its buildings, at least in their present state of preservation, are built out of stone, whereas most other Harappan sites, including Harappa itself and Mohenjo-daro, are almost exclusively built out of brick (Figure 5). Estimated to be older than the port-city of [Lothal](#), the city of Dholavira has a rectangular shape and organization, and is spread over 100 hectares. The area measures 771.10 metres in length, and 616.85 metres in width. Like [Harappa](#) and [Mohenjo-daro](#), the city is composed to a pre-existing geometrical plan, of three divisions - the [citadel](#), the middle town and the lower town. The acropolis and the middle town had been further furnished with their own defence-work, gateways, built-up areas, street system, wells and large open spaces. The acropolis is the most carefully guarded as well as impressive and imposing complex in the city of which it appropriates the major portion of the southwestern zone. The towering "castle" stands majestically in fair insulation and defended by double ramparts. Next to this stands a place called 'bailey' where important officials lived. The city within the general fortification accounts for 48 hectares. There are extensive structure-bearing areas though outside yet intimately integral to the fortified settlement. Beyond the walls, yet another settlement has been found. The most striking feature of the city is that all of its buildings, at least in their present state of preservation, are built out of stone, whereas most other Harappan sites, including Harappa itself and Mohenjo-daro, are almost exclusively built out of brick. One of the unique features of Dholavira is the sophisticated water conservation system of channels and reservoirs, the earliest found anywhere in the world and completely built out of stone, of which three are exposed. They were used for storing the fresh water brought by rains or to store the water diverted from a nearby rivulet. This probably came in wake of the desert climate and conditions of Kutch, where several years may pass without rainfall. The inhabitants of Dholavira created sixteen or more reservoirs of varying size during Stage III. Some of these took advantage of the slope of the ground within the large settlement, a drop of 13 m from northeast to northwest. Other reservoirs were excavated, some into living rock. Recent work has revealed two large reservoirs, one to the east of the castle and one to its south. Reservoirs are cut through stones vertically (Figure 5). They are about 7 meter deep and 79 meter long. Reservoirs skirted the city while citadel and bath are centrally located on raised ground. A large well with a stone-cut trough to connect the drain meant for conducting water to a storage tank also found. Bathing tank had steps descending inwards.



Figure. 5 Field- photo of Dholavira Harrappan site



Figure 6. (a) Clockwise rotation of a pillar due to an earthquake 1500 years back at Dholavira Pillar was cracked also, (b) Tilting of walls of Citadel at Dholavira due to earthquake (red arrow) Walls constructed by younger civilization (green arrow)

Acknowledgement:

The study reported in this field guide was a part of the project sponsored by Gujarat State Disaster Management Authority (GSDMA). The work was carried out by M. Morino of Oyo International Corporation and Javed Malik of Indian Institute of Technology, Kanpur along with ISR scientists.

Powerful quake hits Pak, ripples felt in Delhi

QUETTA, PAKISTAN: A powerful earthquake in Pakistan that rocked buildings in India, Afghanistan and the United Arab Emirates damaged several hundred mud-brick homes close to the epicentre, but caused no casualties or other damage, officials said on Wednesday.

The 7.2 magnitude quake struck at 1.30 am local time on Wednesday in a remote area some 200 miles (320 km) southwest of the Baluchistan provincial capital of Quetta, not far from the Afghan border. It sent thousands running from their homes in panic.

The tremors were felt in Delhi, Jaipur, Barmer, Jaisalmer and Ganganagar, parts of Haryana and west-

ern UP. Slight tremors were also felt in Kashmir, the Met office in Srinagar said.

Delhi police, the city's Disaster Management Authority (DDMA) and the fire department said there were no reports of any damage and loss of life due to the quake.

"It was a shallow earthquake which struck at a depth of 5 RPT 5 km," an IMD official said.

A DDMA official said they have received a report that a person sustained injuries when he jumped off his second floor residence in Laxmi Nagar area after the quake. But he said he could not verify whether the man had jumped because of the tremor.

AGENCIES

Divya Bhaskar

New seismic map ready to intimate about earthquakes in advance

નવા નકશામાં ફક્ત દક્ષિણ કચ્છ જોખમી ગણાતાં ઝોન-પમાંથી બાકાત

ભૂકંપની વધુ સચોટ આગાહી માટે નવો સિસ્મિક નકશો તૈયાર

ઇન્સ્ટિટ્યૂટ ઓફ સિસ્મોલોજિકલ રિસર્ચ દ્વારા નવો ઝોનિંગ મેપ તૈયાર કરાયો

ભાસ્કર ન્યૂઝ. ગાંધીનગર

ઇન્સ્ટિટ્યૂટ ઓફ સિસ્મોલોજિકલ રિસર્ચ (આઈએસઆર) દ્વારા દેશનો નવો સિસ્મિક ઝોન મેપ (નકશો) તૈયાર કરાયો છે, જે દેશના ચોક્કસ વિસ્તારોમાં ભૂકંપની સંભાવના અને તેની તીવ્રતા અંગેનું વધુ ચોક્કસ ચિત્ર રજૂ કરે છે. હાલના નકશામાં સમગ્ર કચ્છને ઝોન-પ (સૌથી ખતરનાક)માં ગણાવાયું છે, જ્યારે નવા નકશામાં દક્ષિણ કચ્છને ઝોન-પમાં ગણવામાં આવ્યું નથી.

આઈએસઆરના ડિરેક્ટર જનરલ બી. કે. રસ્તોગીએ કહ્યું હતું કે, 'બ્યુરો ઓફ ઇન્ડિયન સ્ટાન્ડર્ડ્સ (બીઆઈએસ)ના ભૂકંપની

નવો નકશો બાંધકામ ઉદ્યોગ માટે ઉપયોગી

બી. કે. રસ્તોગીએ જણાવ્યું હતું કે આ નવો નકશો મહત્વના ઇન્સ્ટ્રુક્શન માટે ખુબ જ મદદરૂપ બનશે. કારણ કે, આવા ઇન્સ્ટ્રુક્શનનું આયુષ્ય ૫૦ વર્ષથી પણ વધુ હોય છે. આ ઉપરાંત બાંધકામ ઉદ્યોગ માટે પણ તે મહત્વનો સાબિત થશે. કારણ કે, તે કોઈ પણ બિલ્ડિંગની સલામતી માટે જરૂરી ચોક્કસ પગલાં અંગે તેમને વાકેફ કરશે.

શક્યતાવાળા વિસ્તારોના વર્તમાન નકશામાં ભારતને ચાર ભાગમાં વિભાજિત કરાયું છે, જ્યારે આ નવા નકશા દ્વારા ભૂકંપ અંગે વધુ ચોક્કસ અને સ્પષ્ટ આગાહી કરી શકાશે, કારણ કે તે ચોક્કસ તીવ્રતાના ભૂકંપની સંભાવના દર્શાવશે.

રસ્તોગીએ કહ્યું કે, 'બે વર્ષથી વધુ સમયના સંશોધન દ્વારા અમે તૈયાર કરેલો આ નવો નકશો ન્યૂક્લીયર પાવર પ્લાન્ટ, ડેમ અને ઉદ્યોગો સ્થાપવાના નિર્ણયમાં ખૂબ મહત્વનો બનશે.'

બીઆઈએસનો હાલનો જે સિસ્મિક ઝોનિંગ મેપ છે તેમાં દેશને ચાર ભાગમાં વહેંચી દેવાયો છે, જેને બેથી પાંચનો ક્રમ અપાયો છે. ઝોન-પ ભૂકંપની દૃષ્ટિએ સૌથી ખતરનાક ગણાવાયો છે અને તે હિમાલયન ફોલ્ટની બહાર છે. હાલના નકશામાં એક માત્ર ગુજરાતનો કચ્છ જિલ્લો ઝોન-પ અંતર્ગત આવે છે, જ્યારે બાકીના ભાગ બેથી ચાર ક્રમના ઝોનમાં વહેંચાયેલા છે.

રસ્તોગીએ કહ્યું કે, બીઆઈએસ નવો નકશો તૈયાર કરવા માટે છેક

૧૯૯૭થી એટલે કે ૧૩ વર્ષથી પ્રયાસ કરી રહ્યું હતું. અંતે બીઆઈએસએ ત્રણ વર્ષ પહેલાં આઈએસઆરનો સંપર્ક કર્યો હતો. ત્યાર બાદ બે વર્ષથી વધુ સમયના સખત પ્રયાસ પછી આ નવો ઝોનિંગ મેપ તૈયાર કરાયો છે. તે માટે ભારતમાં અને આસપાસમાં અનુભવાયેલા ૩૫,૦૦૦ જેટલા ભૂકંપના ડેટાનો અભ્યાસ કરાયો છે. આ ઉપરાંત ભારતમાં રહેલી ફોલ્ટલાઈનનો પ્રણ ગહન અભ્યાસ કરાયો હતો, જેને કારણે ચોક્કસ વિસ્તારમાં ભૂકંપ ડેટલી તીવ્રતાનો આવશે તેની પણ આગાહી થઈ શકશે.

નવો નકશો બ્યુરો ઓફ ઇન્ડિયન સ્ટાન્ડર્ડ્સ (બીઆઈએસ)ને સુપરત કરી દેવાયો છે. અર્ને હવે તેનો કઈ રીતે ઉપયોગ કરવો તેનો નિર્ણય તેના ઈજનેરો કરશે.

GSJ OFFICIAL PRABHAS PANDE SAYS DAMAGE IN CITY BY PAST QUAKES IS HIGH

'A'bad should be reclassified as seismic zone 4'

Paras K Jha GANDHINAGAR

Many of us would have wondered why Ahmedabad, in spite of falling under seismic zone III where the damage risk is moderate, was badly affected in the January 2001 earthquake though the epicenter was near Bhuj, about 400 km away. Experts say that even in the past, when severe earthquakes occurred in very high damage risk zones like Kutch, cities like Ahmedabad, Bharuch, Surat and Vadodara had suffered significant damage.

Prabhas Pande, additional director-general of Geological Survey of India (GSI), says that Ahmedabad, Vadodara and Bharuch should be reclassified as zone 4 cities keeping in mind the damage that these cities have suffered during earthquakes. Pande was in Gandhinagar for the

'International Symposium on Advances in Earthquake Science' organised by Institute of Seismological Research, Gandhinagar.

"There is nothing wrong in the present classification. However, we should rethink on it because cities like Ahmedabad, Vadodara, Surat and Bharuch have suffered serious damage in past earthquakes, which is more than expected of the moderate damage risk zone," said Pande.

He presented a paper on 'Geo-seismological Studies of January 26, 2001 Bhuj Earthquake' at the symposium. "Gujarat is the only state in the country which has four different types of earthquake risk zones - from low damage risk to very high damage risk zones," he said. Talking to DNA, he said: "The 2001



Prabhas Pande

CAMBAY BASIN TO BLAME

Cities like Ahmedabad, Vadodara, Surat and Bharuch should be re-classified as zone 4 cities on the basis of past records of earthquake severity.

These cities are located on the Cambay basin, which has thick soil. Because of this, the amplification of wave effects of earthquakes in Kutch region has increased in these cities.

Bhuj earthquake is a very recent one and we know that there were around 800 casualties and a large number of buildings were damaged in Ahmedabad. A similar kind of damage was caused during the 1819 earthquake, which occurred in Kutch. However, that happened in the evening time. Most of the people in Ahmedabad were out of their homes, so there were no human casualties, but the damage suffered by the buildings was significantly high."

He further said, "Cities like Ahmedabad, Vadodara, Bharuch and Surat are located on the Cambay basin, which has thick soil. Due to that, the amplification of wave effects of earthquakes in Kutch region has increased in these regions. So it is my personal opinion that we should be extra cautious and though these cities are in moderate damage risk zone, some sort of study should be undertaken for the re-classification of this area."



Seismologists meet to discuss quake science at ISR

3-day international symposium on 'Advances on Earthquake Science' will deliberate the scientific methods to mitigate dangers of disasters

Paras K Jha GANDHINAGAR

This January 26, it will be a decade since the devastating earthquake struck Gujarat. And given the fact that Gujarat falls under various seismic zones, Institute of Seismological Research (ISR), Gandhinagar, is organising a three-day international symposium on 'Advances on Earthquake Science'.

Seismologists from India and abroad are participating in the event that was inaugurated by chief minister Narendra Modi on Saturday. The symposium will deliberate on the scientific methods to mitigate dangers of disasters like earthquake. The 2001 earthquake in Bhuj will also be the focus of discussion.

Experts from National Geophysical Research Institute, Hyderabad, Indian School of Mines, Dhanbad, Geological Survey of India, Indian Institute of Technology, Kharagpur are participating in the event. Talking about the symposium, Dr BK Rastogi, Director General of ISR said, "Gujarat is the only region in the country where the seismic activity is

happening in a stable continental region. So the world wants to know and understand the seismic activity in this stable continental region."

Speaking at the event Modi emphasised the need for seismological research. "It is a decade since the 2001 Bhuj earthquake. Now we need to study earthquakes and world-class institutes like ISR will provide the platform for research in the field which will help us in the future."

He also invited young research scholars to enroll for PhD with the institute and also promised them government support. He didn't miss the opportunity to take potshots at the UPA government. Modi said that the NDA government had announced Rs200 crore for setting up of institutes like ISR but the UPA did not sanction the project on the ground that the state did not need one.

State revenue minister Anandiben Patel, B Bhattacharjee, member of National Disaster Management Authority, SK Jain, Chairman and Managing Director of Nuclear Power Corporation of India Limited were the other dignitaries present on the occasion. Modi also dedicated a one megawatt solar plant to the nation and inaugurated an international conference on earthquake science at the conference room of PDP.

Photo: Dhaval Bhavsard/DNA



NDMA calls Guj a role model in disaster mgmt

Paras K Jha GANDHINAGAR

"Gujarat has become a role model for other states in the area of disaster management and preparedness," said B Bhattacharjee, member of National Disaster Management Authority (NDMA) on Saturday at the international symposium on earthquake science organised by the Institute of Seismological Research (ISR), Gandhinagar.

Bhattacharjee is former director of Bhabha Atomic Research Centre. Talking to DNA on the sidelines of the symposium he said, "There are structural and non structural issues involved in disaster management. Structural issues include rebuilding of disaster affected buildings while non structural issues include how strong the government is in enforcing building codes? How is the government gearing up its machinery for a disaster situation? In the end how much awareness has been brought at the community level is the most important thing."

He further said that communities should be taken into confidence, while making the disaster management plans and the approach should be bottom-up one. "Gujarat has followed and implemented the guidelines of NDMA for disaster management impressively; we recommend other states to see Gujarat's disaster management work," he said. Talking about NDMA's future plans, Bhattacharjee said, "NDMA has got Rs1500 crore from the World Bank for capacity development of professionals like engineers and masons through training under disaster mitigation program. The proposal for the same has been put to the cabinet secretary for final approval."

"We are also taking up school safety project with Rs48 crore fund. We will be taking 2 schools each from 22 states falling under the high seismic risk zones, Gujarat is one of them. We will help them in retrofitting. The third project is of Rs 100 crore for cyclone-effect mitigation, where we will be setting up cyclone shelters and early warning systems."

Member of National Disaster Management Authority B Bhattacharjee (R) praised Gujarat's implementation of NDMA guidelines

TOP STORY

Will G'nagar be state's first solar city?

Paras K Jha GANDHINAGAR



A rooftop policy for electricity generation through solar power has been undertaken by the state govt.

A rooftop policy for electricity generation through solar power has been undertaken by the state government. Chief minister Narendra Modi has indicated that the policy aims to make Gandhinagar a solar city. He also declared allotment of one MW of solar electricity plant at Raigan, Gandhinagar.

"The state is working on a rooftop electricity generation policy. The policy will enable Gandhinagar residents to produce electricity on their rooftops which the state government will buy," he said.

Talking about the one MW solar electricity plant, Modi said, "This plant has been commissioned within 105 days and at a cost of Rs15 crore. It will generate 15 lakh unit of power per year, reduce the carbon emission by 1500T and supply solar power to 1500 houses with air conditioners." The government is planning to make Gandhinagar a solar city and Gujarat will become the solar capital of the world. DJ Pandian, principal secretary to state energy and petrochemical department informed that the project will be under the public private partnership.

Initially 5000 houses in Gandhinagar will be covered under the project. Solar panels fitted on the rooftops of the houses will generate electricity since seven in the morning till four in the evening. House owners will be given two meters, one will measure the solar energy generated through solar panels while the other will measure the household electricity consumption. The first phase aims to generate 40 MW of solar electricity under the rooftop solar electricity generation project in Gandhinagar.

Builders yet to learn from '01 quake

Says Japanese expert Fumio Kaneko; urges govt to frame laws for quake-proof structures

Prashant Thakor

Fumio Kaneko, renowned seismological engineer from Japan, is worried by the designs of new buildings coming up in Ahmedabad. He says there are many structural flaws in the buildings which could make them vulnerable to earthquakes.

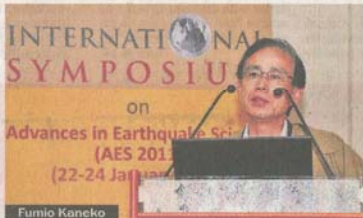
"I saw a similar building with a similar design come up in the same place where an 8-storied building had collapsed during the 2001 quake," Kaneko said on Sunday on the sidelines of the international symposium on earthquake sciences being held at the Institute of Seismological Research, Gandhinagar.

During his lecture at the symposium, Kaneko gave a seismic hazard assessment for Gandhidham in Kutch district. He said that the tectonic plates on which Kutch was located were similar to those of the Japanese city, Kobe. In 1995, Kobe was devastated by a major earthquake which had killed thousands.

"The two quakes were similar in nature," he said, comparing the Kobe temblor



Arun Saraf



Seismological experts Prof Saraf and (below) Kaneko, seismological engineer from Japan, address the international symposium held at ISR on Sunday

with the Bhuj quake of 2001. He further said that such high intensity earthquakes

happen once in a thousand years but when they do occur, they cause havoc as was

seen in Kutch in 2001.

Kaneko is the chief engineer of the Japanese company, OYO International, and has been working on post-quake reconstruction work in the Kutch region for the last 10 years.

Talking to DNA he said that the government and the people must recognise the risk of quakes that exist in the state and added that more effort is needed in this direction by the government, people as well as the builders.

When asked about choosing between 'prediction' and 'prevention' of earthquakes, he had no hesitation in opting for 'prevention'.

"You can't predict earthquakes," Kaneko said. "Japan has already given up after spending billions on this. Now we focus more on prevention which includes disaster management."

He said the government should come up with stringent laws to ensure that only quake-proof structures are built in the state. "I see many flaws in the buildings coming up all around. We shouldn't take the threat of quakes lightly," Kaneko said.

Earthquakes are like heart attacks: Experts

Prashant Thakor

Seismology experts from all over the world presented their research papers on the second day of international symposium, organised at the recently inaugurated Institute of Seismological Research, Gandhinagar. Experts talked on the topic '2001 Bhuj earthquake and advances in earthquake science.'

Prof Arun K Saraf from IIT Roorkee threw light on the post seismic ground deformation after 2001 earthquake in Bhuj. Apart from this, CD Reddy of Indian Institute of Geomagnetism- Panvel and KM Sreejith of Space Application center -ISRO, Ahmedabad discussed the use of GPS system in understanding earth patterns and results acquired through modern technology.

According to KM Sreejith, the seismic region is now expanding towards Saurashtra from Kutch, which can be a cause of concern. Saraf showed detail maps of a project conducted by IIT Roorkee to understand the patterns of deformation of land around Bhuj after the earthquake. The project was conducted between 2003 and 2005. Through this project,

They were speaking at the second day of the international symposium at ISR

a clear uplift of land was noticed in many villages of Kutch. "The land got uplifted by almost 8 centimetre, which shows the kind of activity going on beneath the surface," said Saraf.

He added that the data for such project was collected from European Space Agency, because India doesn't have such advanced satellites. "We didn't have enough data till now. So to fulfil this need, India will soon launch its own microwave satellite to monitor seismic activity," said Saraf.

On the mysterious explosions heard through out the region, Prof Saraf said that it is a result of activity beneath the earth's crust. "It is good thing. This means energy is getting released in small pockets without harming anyone," said Saraf.

He compared the earthquake prediction to predicting heart attacks. "Just like you can't predict the time of a heart attack, you cannot predict when earthquake will strike," he said.

Pak quake tremors recorded in Bhuj

But few people experienced them as the quake occurred at midnight

DV Maheshwari BHUJ

The massive earthquake measuring 7.4 on the Richter scale that hit southwestern Pakistan at midnight on Tuesday caused mild tremors at several places in Gujarat's Kutch district, including the district headquarters Bhuj. However, in Bhuj, there are not many people who remember feeling the tremors as nearly everybody was asleep at the time.

"Even we did not feel the tremors," an official of the Bhuj seismological office told DNA on Wednesday morning. "We came to know of it only when we saw it recorded on our Global Seismographic Network. Then we confirmed it from our headquarters in Delhi." The official said on the condition of anonymity that the tremors felt in Kutch could not be called an aftershock.

A government official, Bhaskar Leuva, said he was awake when the tremors were recorded in Bhuj. "I had gone to answer nature's call," he said. "But I did not notice or feel any tremors. I came to know about it when I heard people talking about it on the

basis of TV news reports."

Ketty and Saina, two young researchers from the US who have been here for their projects for the past few months, also denied experiencing the tremors. "We are associated with local organizations which had done a lot of rehabilitation work in Kutch after the quake of 2001. So we have an idea what an earthquake feels like," they said.

Even seismological officials in Bhuj said that they did not feel the tremor

Experts say that people of Kutch are so familiar with 'tremors and aftershocks' that even the illiterate are able to recognise them. After the devastating earthquake of 2001, more than 1,500 tremors of different intensity have been felt in Kutch over the last 10 years.

The people here are not scared by aftershocks but they are worried about another major quake striking the region as the 2001 quake had also occurred in January on Republic Day.

Next major quake may split Banni from Kutch, says expert

Paras K Jha GANDHINAGAR

The earthquake that shook Gujarat on January 26, 2001, caused maximum damage in Kutch district where towns like Bhuj, Anjar and Bhachau were virtually flattened. But what few people know is that if the same quake, which had the power of 400 atom bombs of the size that destroyed Hiroshima and Nagasaki, were to strike again, it could physically split Kutch asunder.

One such area of the district which could get physically separated from its adjoining landmass is Banni, the greenest region of Kutch.

This is indicated by the research done by RK Singh, senior scientist

at Institute of Seismological Research (ISR), Gandhinagar, and his team, to determine the geological changes caused in this quake-prone district by the 2001 temblor. Singh presented a paper on his findings at the international symposium on earthquake sciences that concluded at ISR on January 24.

His study has revealed that the 2001 quake was so powerful that it had created new fault-lines and re-oriented several faults that already existed beneath the earth's surface in Kutch.

"After the 2001 earthquake, many changes occurred at the sub-surface level and it is these changes which are causing aftershocks to this day, 10 years after the quake," Singh said.

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ready lifting upwards.

The massive breach created by the quake of 2001 lies between these two fault-lines and it is this breach which, in the eventuality of another powerful quake, may impact Banni and split it from the southern part of Kutch. A study on this issue has also been conducted by international seismologists and both the studies agree on this lurking threat to Banni.

"In fact, the whole of the earth beneath Kutch needs to be studied properly and re-mapped," Singh said. "The Kharoi-Manfara-Chobari Fault was badly affected by the 2001 Bhuj earthquake. The latest study suggests that the block is rotating because of two parallel forces working in opposite directions. These two forces, which are yet to be named, were activated by 2001 quake." Singh further said that the quake had also changed the direction of the two Wagad faults.

Next major

"It has been estimated that the energy released during the 2001 quake was equivalent to about 400 atom bombs of the same power as the weapons that destroyed Hiroshima and Nagasaki." Singh's research has revealed that the 2001 quake was so powerful that it created, beneath the earth, a 22-km wide breach between the North Wagad Fault and the South Wagad Fault. The two fault-lines run east-to-west, with the North Wagad Fault passing by Rapar and the South Wagad Fault crossing near Bachau. Banni lies north-west of the North Wagad Fault and is al-

NGRI, ISR join hands for better assessment of seismic threat to Gujarat

Prashant Thakor

Hyderabad-based National Geophysical Research Institute (NGRI) and Gandhinagar-based Institute of Seismological Research (ISR) will work together to have a better understanding of how earthquakes are caused. The two institutes agreed to use data collected by ISR's highly sensitive equipment to arrive at a better understanding of the earth's structure beneath Gujarat and more accurate 'geodynamic models' for the state.

To facilitate mutual cooperation, NGRI and ISR signed an MoU for joint scientific research on Monday, the last day of the international symposium on earthquake sciences being held at ISR. The collaboration between the two institutes will provide new models of the earth's structure and a better assessment of the seismic threat to Gujarat.

On the final day of the symposium, experts from all over the world came up with new ideas on how to predict earthquakes, particularly in the Kutch region.

Speaking on the occasion, ISR director-general Dr BK Rastogi thanked all the participants for sharing their knowledge. He also announced that a book containing all the research papers presented by experts during the symposium would be published. He also promised to publish these papers in the internationally-reputed journal 'Natural Hazard'.

Sudhir K Jain, director of IIT Gandhinagar; Fumio Kaneko, chief engineer of OYO International Corporation, Prof VR Shah of CEPT and Pradeep Kumar of IIT Hyderabad presented papers during the conference.

Pradeep Kumar from the Earthquake Engineering Research Centre of IIT-Hyderabad came up with a unique idea to prevent buildings from collapsing during an earthquake. He suggested a

cost-effective 'retrofitting technology' called PP Bond which was invented in Tokyo in 2007 for this purpose.

"This is a very inexpensive method to prevent a house from collapsing and it can be used in areas like Kutch," Kumar said.

He said an IIT-Hyderabad team had conducted research and surveyed nearly 16,000 homes in Kutch, including towns like Kandla and Bhuj.



The two institutes signed an MoU for this on the last day of international symposium on earth sciences at G'nagar

Prof VR Shah of CEPT University focused on the role of an education institute like CEPT in post-earthquake reconstruction work. He recalled the work done by CEPT students during the 2001 earthquake. Dr Sudhir K Jain of IIT-Gandhinagar stressed on the need to implement stringent laws for safer buildings. He also advocated the retrofitting of buildings rather than prediction of earthquakes.

Prof VM Patel, head of department of civil engineering, Ganpat University, stressed on the need to recognize the threat of tsunami to coastal areas of Gujarat. International dignitaries from Mexico, France, Japan, Taiwan and Russia also participated in the symposium.

GANPAT UNIVERSITY PROFESSOR VM PATEL WHO HAS DONE EXTENSIVE RESEARCH ON SUCH A PROBABILITY SAYS...

'Possibility of a tsunami hitting Gujarat coast cannot be ruled out'

Prashant Thakor

Prof VM Patel, head of civil engineering department, Ganpat University, Mehsana, and who has been engaged in assessing the probability of a tsunami in Gujarat, says that due to a fault-line under the Arabian Sea, the possibility cannot be ruled out of tidal waves like ones that had hit Indonesia in 2004, wreaking havoc on Gujarat coasts.

al Symposium on Earthquake Science at Institute of Seismological Research (ISR), Gandhinagar, Prof. Patel said, because of the Makran Subduction Zone (MSZ), there is a risk of a devastating tsunami on the coast line of Gujarat. "MSZ is an active fault area which may cause a high magnitude earthquake under the sea leading to a tsunami," Prof. Patel said. To counter such a scenario effectively, we need to build tsunami resistant

structures in coastal towns, he suggested. The three-day symposium at ISR concluded on Monday with experts, including Prof. Patel, discussing new techniques to predict and prevent disasters like earthquakes. Prof. Patel, who has done research on effects of tsunami and buildings of these towns from possible tsunami that may be triggered by an earthquake under sea. He started his research on cause and subsequent effects of tsunami four years back and also taken help of ISR in it. The only tsunami recorded in Gujarat dates back to 1945, when an earthquake of



The Makran Subduction Zone is an active fault area which may cause a high magnitude earthquake under the sea leading to a tsunami.

—Prof Patel, HOD, Ganpat University

8.5 magnitude under the sea had led to tidal waves. That quake was named after Makran fault-line, which is 650 km away from Porbandar under the Arabian Sea bed. Two-meter high waves had hit coastal Gujarat back then. "Due to the activity of Makran fault, same can be repeated. So, it's important to build tsunami resistant structures on these coasts," said the professor who is concerned about Dwarka temple, as well as other ports

of Gujarat. Prof Patel said that should an earthquake happen under the Arabian Sea, tsunami waves can hit the Gujarat coast within 140 minutes. "Both Dwarka and Porbandar are historically important towns, and we have only that much time to prevent widespread damage," he said. To avoid such a Tamil Nadu-like situation in Gujarat, Prof. Patel has given many suggestions to Gujarat State Disaster Management

Authority. They include the erection of a sea wall to protect Dwarka temple. "It is widely used in Japan and many European countries. This wall will protect heritage structures as well as thousands of pilgrimage places," said the professor. Prof. Patel has also suggested building a few tsunami resistant buildings in each of these towns. "These five storied buildings can be used as shelters for residents of these cities," he said.

અણુમથક માટે જમીન આપનારને નફામાં હિસ્સો મળશે

જે ગ્રામવાસીઓની જમીન ન્યુક્લિયર પ્લાન્ટ માટે સંપાદિત કરાશે તેમને કંપનીના ભાગીદાર બનાવાશે: NPCIL

વૃદ્ધિમાં હિસ્સેદારી

- વડોદરામાં ન્યુક્લિયર પ્લાન્ટની ભૂમિ આપનાર ગ્રામવાસીઓને નફામાં હિસ્સો મળશે.
- ભરૂચમાં ન્યુક્લિયર પ્લાન્ટની ભૂમિ આપનાર ગ્રામવાસીઓને નફામાં હિસ્સો મળશે.
- સુરતમાં ન્યુક્લિયર પ્લાન્ટની ભૂમિ આપનાર ગ્રામવાસીઓને નફામાં હિસ્સો મળશે.

અમે પ્લાન્ટ સામે બંધીસું જવાને દરેકને લાગે છે તે પ્લાન્ટ તેમની પોતાનો છે. અમને વિશ્વાસ છે કે અમે દરેકને સમજાવીને તેનું કારી ચકીસું. અને મીટી વિરેડી પ્રોજેક્ટ માટે પ્રક્રિયા શરૂ કરી દીધી છે. **એસ કે જેલ**, ન્યુક્લિયર પાવર કોર્પોરેશન ઓફ ઇન્ડિયા લિ. ના વડા.

ના પાવર સ્વપર્ણ રચા છે ત્યાં લિમિટેડ અમ્બાઇ વાઇ પેરી રીલી છે. એનપીસીઆઈએના સ્ટ્રોએમટી જેને જણાવ્યું હતું કે, "આર એન આર (સીસી એન રિસિમિલિટિંગ) આયોજન તેવા કારણ એનપીસીઆઈને લિમિટ્ડ કારણ તેઓ લિમિટ્ડ ગ્રામ પંચાયતો સાથે મહત્વાકાંક્ષી છે. દુકાન સમૂહમાં આર એન આર આયોજન નક્કી થઈ જશે."

આયોજન આને આગળી ડિલિવરિંગ સાથે કિસ્મોલોજિકલ ડિવેલપ્મેન્ટ સાથે મળી રહેલા આંતરરાષ્ટ્રીય પોસિવિટા પ્રોજેક્ટ જેને ડીડીને જણાવ્યું હતું કે, "આર એન આર આયોજન એક વખતમાં નાણાં વૃદ્ધિના પુનઃ મૂલ્યાંકન નીચે રહે. અમારી વાદ નવા વિચારો છે. પાવર પ્લાન્ટ પ્રકારે ત્યાં નવા નવા કોર્પોરેશન ડેવલપમેન્ટ ટ્રસ્ટના આયોજનમાં વિરોધ થઈ છે. એનપીસીઆઈએને હાલ અને પુનઃમૂલ્યાંકન (આર એન આર)ની પ્રક્રિયા શરૂ કરી છે અને કુલ ૪ લાખ કરોડના ખર્ચ સાથે પ્લાન્ટ

નહી. છેલ્લા કેટલાક વર્ષોમાં ભારતનું જિલ્લાઓની મીટી વિરેડી નજીક આવેલા ગ્રામજનો ન્યુક્લિયર પાવર પ્લાન્ટ સાથે વિરોધ નોંધાવી રહ્યા છે. જુલોજીકલ દુષ્ટિએ જ્યાં અને અસહાયતા ભવન પન્થે લોડે તેના વિતરણમાં પાવર ની ઉભાતા તેથી જ રીટે મહત્વાકાંક્ષી જેલ્ટર ખાતે સ્થપાઈ રહેલા ૯૮૦૦ મેગાવોટના પાવર સાથે પ્લાન્ટની ગ્રામવાસીઓનો વિરોધ ઊભો છે. મીટી વિરેડી અને જેલ્ટર પ્રોજેક્ટનો ભારતમાં સ્થપાઈ રહેલા છે લાઈટ વોટર રિએક્ટર્સ (મેઇક્રોબલ્યુઆર)માં સંખ્યાએ થાય છે. અન્ય સ્થપાઈ રહેલા એલબલ્યુઆરમાં કોનેક્ટિવિટી (દરિયાવાળા) જમખત્તર (મંબાપરદેશ), કોલ્લા પ્રક્રિયા શરૂ કરી તેથી છે. અને કારિપુર (પશ્ચિમ આંધ્રપ્રદેશ) અને સ્કંદેશી ગ્રામવાસીઓ સાથે લાગતા મહત્વાકાંક્ષી પ્રક્રિયામાં છે. પ્રકારકાંક્ષી રેલી વોટર રિએક્ટર (પોનેરબલ્યુઆર) અને કોસ્ટ વોટર રિએક્ટર્સ (એફપીઆર) સાથેના આ

વિસ્તારમાં ન્યુક્લિયર પાવરનો સ્થાપિત ઉત્પાદન ભવન વર્ષથી ૯૩,૦૦૦ મેગાવોટ કરશે જે હવે ૪,૩૦૦ મેગાવોટની છે. દેશમાં વેદા થતી જ્યાં વોજીમાં ન્યુક્લિયર ઊર્જાનો વોલ્યુમ માત્ર ૩ ટકા છે. ૨૦ સપ્ટેમ્બર ન્યુક્લિયર પ્લાન્ટ ૪.૮ મિલિયોન ઊર્જાનું ઉત્પાદન કરી રહ્યા છે. એનપીસીઆઈએના વડાએ જણાવ્યું હતું કે આયોજિત પ્રોજેક્ટને માટે કોઈ કંઈપણ જમીન સંપાદન નથી કરાય જેને જવારે દરદારને લાગે કે તે પાવર તેમના પોતાનો છે. અપને વિશ્વાસ છે કે અમે દરેકને સમજાવીને જમીનની શક્તિ, અમે ભારતનરમાં મીટી વિરેડી પ્રોજેક્ટ માટે પ્રક્રિયા શરૂ કરી તેથી છે. અમે વિશ્વાસ સાધવાન પવનના ભાગરૂપે તેમના ગ્રામવાસીઓ સાથે લાગતા મહત્વાકાંક્ષી પ્રક્રિયામાં છે."

વિસ્તારમાં ન્યુક્લિયર પાવર પ્લાન્ટ આવેલી રહ્યા છે તે વિસ્તારના ગ્રામવાસીઓને હાલના સ્થિતિ ન્યુક્લિયર રેક્ટિફિકેટીનો મુલાકાત કરવાઈ છે. આ કામગીરીને ઊંચે સલામતી અને તેમની સ્વાસ્થ્ય રૂકાવાનો છે. તેમના મતમાં જે પલ ઓકા કે ભય સાંપ છે અપારી સમજ રૂકા કરવા અને અમ્બાડા કેટલાક કાર્પોરેશન પાવરની ગ્રામજનોનો વો વાદ છે. આ પન્થા સાથે સમજ રહ્યા હતા. "સમજાવવામાં છે. જણાવ્યું હતું કે પાવર પ્લાન્ટ કિસ્મોલોજિકલ અમ્બાઇ શરૂ થઈ ગયા છે. આ પાવરમાં કાર્ગી કિસ્મિટ એકન પાવર દર્શા. તેમને લેવેને હતાં હતું કે. "આમણી ન્યુક્લિયર રેક્ટિફિકેટી ઉત્પાદન ન્યૂક, સુનામી, પુન, વાવાઝોડ જેવી તમામ આજ આતંકોને આનમાં સાંપીને તેવા કરાઈ છે."

જેને જણાવ્યું હતું કે, "કિસ્મોલોજિકલ અમ્બાઇ માટે હવે ઊનિવર્સિટી ઓફ કિસ્મોલોજિકલ રિસર્ચને પણ સામેલ કરવામાં આવે છે." અન્નાર્ નેશનલ ડિપાર્ટમેન્ટ ઓફ કોસ્ટ ગાર્ડ ઓફ ઇન્ડિયા આ અમ્બાઇ સાથે પેરી રહ્યા છે.

ISR's new seismic map to predict quake probability

AHMEDABAD: The Institute of Seismological Research (ISR) has prepared a new seismic zone map of India which gives a more accurate picture along with probability and magnitude estimate of possible earthquakes in specific areas of the country. "The present earthquake zoning map of the Bureau of Indian Standards (BIS) has divided India into four zones, but our map, after a research work of over two years, will be more accurate and will be distinct as it will give probability of occurrences of quakes of certain magnitudes," ISR Director General B K Rastogi said.

ગાંધીનગર સોલાર સિટી બનવાનું છે : મુખ્યમંત્રી

રાયસણ પાસે એક મેગાવોટ સોલાર પાવર પ્રોજેક્ટ માત્ર ૧૦૬ દિવસમાં રૂ. ૧૫ કરોડના ખર્ચે પાંચ એકરમાં સૂર્ય ઊર્જાથી વીજળી ઉત્પન્ન કરતો સૌર ઊર્જા પ્લાન્ટ : ૧૫૦૦ ઘરોને વીજળી મળશે

ગાંધીનગર, તા. ૨૨ મુખ્ય મંત્રી શ્રી નરેન્દ્રભાઈ મોદીએ ભૂકંપ જેવી વિનાશક આપત્તિથી માનવજાતને સલામત રાખવા માટેના પરતીકંપ અંગેના વૈજ્ઞાનિક સંશોધનોની વિશ્વકોશની સંસ્થા ઈન્સ્ટીટ્યુટ ઓફ સિસ્મોલોજીકલ રિસર્ચ (ઈસસી) અને એક મેગાવોટનો સોલાર પાવર પ્રોજેક્ટ રાષ્ટ્રને આજે સમર્પિત કર્યો હતો. સને ૨૦૦૧ના વિનાશક ભૂકંપની આઠતમે અવસરમાં પહોંચીને ગુજરાત સરકારે ગાંધીનગર નજીક ૧૫ એકરમાં ભૂકંપ સંશોધન સંસ્થાન તરીકે ISIR નું નિર્માણ કર્યું છે અને ગુજરાતની પરતી ઉપરથી ભારત જ નહીં માનવજાતને ભૂકંપની આઠતમાં ભવિષ્યમાં રચાણકિત્તિનું કવચ મળે તે માટેનો સંશોધનનો અને માનવશક્તિની ભયના-નિર્માણનો માગ અપનાવ્યો છે, એમ તેમણે જણાવ્યું હતું. કચ્છ ગુજરાતના ભીષણ ભૂકંપની દશમી વરસીએ આજે પંડિત દીનદયાળ પેટ્રોલિયમ યુનિવર્સિટીના સભાકક્ષમાં 'પરતીકંપ વિજ્ઞાનના સંશોધનો' વિષયક આંતરરાષ્ટ્રીય પરિસંવાદનું પણ ત્વર અને સોલાર પાવર પ્રોજેક્ટના લોકાર્પણની સાથેસાથ મુખ્ય મંત્રીશ્રીએ ઉદઘાટન કર્યું હતું. આ આંતરરાષ્ટ્રીય પરિસંવાદમાં પાંચ દિવસ સુધી વિષયના ૨૪ દેશોના વૈજ્ઞાનિકો, તજજ્ઞો સહિત ભારતમાંથી ૧૫૦ નિષ્ણાંતો ભૂકંપ જેવી આઠતોમાંથી

સોલાર સિટી બનવાનું છે

● અનુસંધાન પહેલાનું સાહુ આપત્તિ નિવારણ અંગેના વૈજ્ઞાનિક ઉપાયોનું સામૂહિક મંચન કરવાના છે તેમને ગુજરાતની પરતી ઉપર આવકારતાં મુખ્ય મંત્રીશ્રીએ જણાવ્યું કે, ગુજરાત એકમાત્ર એવું રાજ્ય છે જેણે વિનાશકારી પરતીકંપ પછી માત્ર ત્રણ જ વર્ષમાં રાજ્યમાં આપત્તિ પુનર્વસનનું વિરાટ કાર્ય સંપન્ન કરીને વિકાસના માર્ગે ગતિશીલ બનાવી દીધું એટલું જ નહીં, ત્વજેવી ભૂકંપ સંશોધન સંસ્થાનું નિર્માણ શ્રાવે જ કરીને ગુજરાતના પુનર્નિર્માણની અસીમ ભયતાનું પ્રમાણ દેશ અને દુનિયાને આપી દીધું છે. આ સંદર્ભમાં મુખ્ય મંત્રીશ્રીએ એ હકિકતોનો દુઃખપૂર્વક ઉલ્લેખ કર્યો હતો કે, ભૂકંપ પછી પુનર્વસનની ભગીરથ કામગીરી સાથે તેમણે ભવિષ્યની સુરક્ષા માટે ત્વજેવી સંસ્થાનું નિર્માણ કરવા તત્કાલિન એન.ટી.એ.ના પ્રધાન મંત્રી શ્રી અટલબિહારી વાજપેયે સમક્ષ રજૂઆત કરેલી અને તે માટે રૂ. ૨૦૦ કરોડ કેન્દ્રીય સહાયરૂપે કાળવવાની જાહેરાત પ્રધાનમંત્રીશ્રીએ તત્કાલિન કેન્દ્ર સરકારમાં કરેલી પરંતુ દેશનું દુર્ભાગ્ય એ છે કે, એન.ટી.એ.ની પછી આવેલી યુપીએ સરકારે ગુજરાતમાં આવી સંસ્થાની જરૂર નથી એમ કહીને આ પ્રોજેક્ટને મંજૂરી આપી નહોતી, પરંતુ ગુજરાત સરકારે તો ભારત સરકારની રાહ જોયા વગર આજે ત્વજું નિર્માણ કરીને રાષ્ટ્રને સમર્પિત કરી દીધું છે.

મુખ્ય મંત્રીશ્રીએ દેશ અને દુનિયાના વૈજ્ઞાનિકો અને તજજ્ઞોને ગુજરાતની ભયતા-નિર્માણ શક્તિની ઓળખ માટે આમંત્રણ આપ્યું હતું. આંતરરાષ્ટ્રીય પરિસંવાદના ઉદઘાટન પુર્વે મુખ્ય મંત્રીશ્રીએ એક મેગાવોટના સોલાર પાવર પ્રોજેક્ટ રાષ્ટ્રને અર્પણ કરીને તેની વિશેષતાઓ અને ત્વની જીઓ-ટેક લેખ સહિત સંકુલનું એક ક્લાસ સુધી નિરૂપણ કર્યું હતું.

સોલાર પાવર પ્લાન્ટનું લોકાર્પણ : આ સોલાર પાવર પ્લાન્ટ ગાંધીનગર નજીક રાયસણમાં પાંચ એકર વિસ્તારમાં રૂ. ૧૫ કરોડના ખર્ચે માત્ર ૧૦૬ દિવસમાં જ તૈયાર કરીને રાષ્ટ્રને સમર્પિત કર્યો છે. તેનો ચોરસાકાર ઉલ્લેખ કરી શ્રી નરેન્દ્રભાઈ મોદીએ જણાવ્યું કે, સોલાર પીવી ટેકનોલોજીની આધુનિકતા સુવિધા સાથેનો આ ઝોનો-સ્ટ્રેન પાવરનો સોલાર પ્રોજેક્ટ રાજ્યમાં પ્રથમવાર શરૂ કર્યો છે. પરંતુ તેનાથી દર વર્ષે ૧૫ લાખ યુનિટ વીજળી પેદા થશે, ૧૫૦૦ ૨૫ કામન ડ્રાયોક્સાઇડનું પ્રદૂષિત ઉત્પાદન અટકશે, ૧૫૦૦ ઘરોને

સૂર્યશક્તિથી વીજળી મળશે. મુખ્ય મંત્રીશ્રીએ ગાંધીનગરને સોલાર સિટી બનાવવાની દિશામાં રાજ્ય સરકાર આગળ વધી રહી હોવાનું જણાવી ઉત્તર ગુજરાતના રાજકોટ સહિત વિશાળ સોલાર પાર્ક પણ નિર્માણાધિન છે તેની રૂપરેખા આપી હતી અને જણાવ્યું હતું કે, ગુજરાત વિશ્વવિદ્યાલય સૌર-વીજળી શક્તિનું સોલાર કેમ્પીટલ બનાવવાનું છે.

અતિથિવિશેષ પદે ઉપસ્થિત રહેલા રાજ્યના મહેસુલ મંત્રી શ્રીમતી આનંદીબેન પટેલે જણાવ્યું હતું કે, ક્લાઈમેન્ટ ચેન્જ વિભાગની રચના કરી ગુજરાતે આ ભેજની ચિંતા કરવાની શરૂઆત કરી છે. પાટણ જિલ્લાના ચારણક ગામે ૫૦૦ મે.વો.ના સોલાર પાવર પ્લાન્ટની શરૂઆત માટેનો નિશ્ચય ક્લાઈમેન્ટ ચેન્જની અસરનો સામનો કરવાનો ગુજરાતનો બેઠ પ્રયાસ છે. તેમણે જણાવ્યું હતું કે, કુદરતી પ્રકોપના સામના ભેગે વિચારતા કે લાચારીને બદલે પુનર્વસન અને મનેજમેન્ટ દ્વારા ગુજરાતે યોત્નાની ખમીરી બતાવી છે.

મહેસુલ મંત્રીશ્રીએ જણાવ્યું હતું કે, માનવીય ક્રંદગી અને સંપત્તિના નુકશાનને ઓછામાં ઓછું કરવા ગુજરાતે પુરુષાર્થ કર્યો છે. પ્રત્યેક જિલ્લામાં ઈમરજન્સી સેન્ટરો શરૂ કર્યાં છે. મહાનગરોમાં આગ કે પૂર સામે રક્ષણ આપના યંત્રો પુરા પડ્યા છે, મલ્ટી રેક્યુ ઓપરેટસીથી મંડી અન્ય સાધનો માટે ૨૫૦ કરોડ રૂપિયાથી વધુનો ખર્ચ રાજ્ય સરકારે કર્યો છે એટલું જ નહીં, આ અંગેની તાલીમ પણ આપવામાં આવી છે. શ્રીમતી આનંદીબેન પટેલે આ ઈન્સ્ટીટ્યુટને ભારતભરની આવા પ્રકારની એક માત્ર સંસ્થા ગણાવી હતી. આઈ.એસ.આર. ભૂકંપકીય અભ્યાસોનું પ્રદર્શનું કેન્દ્ર બની રહેશે અને ભૂકંપ જેવી કુદરતી આઠતોનો સભમ બની સામનો કરી શકાય તે માટે આ સંશોધનો ઉપયોગી થશે, તેમ પણ તેમણે જણાવ્યું હતું.

ઈન્સ્ટીટ્યુટ ઓફ સિસ્મોલોજીકલ રીસર્ચના ડિરેક્ટર જનરલ ડૉ. બી. કે. રસ્તોગીએ એડવાન્સીસ ઈન અંધકવેક સાયન્સ વિષયક ઈ-ટરનેશનલ સિમ્પોઝીયમની ભૂમિકા આપી હતી. વિજ્ઞાન ટેકનોલોજી વિભાગના અધિક મુખ્ય સચિવ શ્રી રવિ સહસ્રનાએ આવકાર પ્રવચન કર્યું હતું. આ પ્રસંગે નુકસીબર પાવર કોર્પોરેશનના મેનેજિંગ ડિરેક્ટર શ્રી એસ. કે. જેન, પંડિત દીનદયાળ પેટ્રોલિયમ યુનિવર્સિટીના ડિરેક્ટર જનરલ પ્રો. પી. કે. બનીક, ગુડાના અધ્યક્ષ શ્રી અશોક ભાવસાર, જડાના ચેરમેન શ્રી ઈશ્વરભાઈ ભાવસાર, અન્ન સચિવ શ્રી ડી. જે. પાડિયન તેમજ દેશ અને વિદેશના સિસ્મોલોજીકલ વૈજ્ઞાનિકો ઉપસ્થિત રહ્યા હતા.

ગુજરાતમાં વિનાશક ભૂકંપની શક્યતા નહીંવત: હળવા આંચકાઓ વીશકે: રસ્તોગી

ગાંધીનગર, તા. ૧૯: ગુજરાતને દક્ષિણ-પશ્ચિમ પાકિસ્તાનનાં રણમાં આવેલા ભૂકંપની અસર ઠેક અમદાવાદ સુધી વર્તાઈ હતી. જોકે, ગુજરાતમાં વિનાશક ભૂકંપ આવવાની શક્યતા નહીંવત છે, તેમ ઈન્સ્ટી. ઓફ સિસ્મોલોજીકલ રિસર્ચના ડાયરેક્ટર જનરલ ડૉ. બી.કે. રસ્તોગીએ જણાવ્યું હતું. ડૉ. રસ્તોગીએ જણાવ્યું હતું કે, દિલ્હીમાં અનુભવાયેલા ૭.૪ના આંચકાની અમદાવાદમાં અસર થઈ છે પણ કોઈ નુકસાની થી. આ ઝટકાથી ગભરાવાની જરૂર નથી કારણ કે, તેનું ઓપી સેન્ટર પાકિસ્તાનના રિમોટ એરિયામાં છે. આ પ્લેટ ભારતને અસર કરે છે પણ ભૂકંપની તીવ્રતા ઘણી ઓછી થાય તેમ છે. ગત મધ્યરાતે બે વાગ્યે આવેલા આંચકા અંગે પૂછતાં ડૉ. રસ્તોગીએ જણાવ્યું હતું કે, વિશ્વમાં આવી રહેલા ભૂકંપનો એક વિશ્વસ્તરનો અભ્યાસ ૨૨મી જાન્યુઆરીથી ગાંધીનગરમાં યોજાઈ રહ્યો છે. આ સેમિનારમાં દેશના ૧૫૦ અને વિદેશના ૨૫ જેટલા સિસ્મોલોજીકલ સાયન્ટીસ્ટ સિસ્મો લઈ રહ્યા છે. તેઓ કચ્છના ૨૦૦૧ના ભૂકંપ અંગે પણ સંશોધન કરવાના છે. ઓકટર શોકની માત્રા હોવા છતાં હાલ આ પ્લેટ શાંત છે, જે નજીકના ભવિષ્યમાં કોઈ મોટી જાનહાનિ સર્જ શકે તેમ નથી. સાઈથ વેસ્ટ પાકિસ્તાનના રણમાં નોંધાયેલા એપી સેન્ટરના આંચકાની અસર નવી દિલ્હી, હરિયાણા અને રાજસ્થાનમાં જોવા મળી હતી, પાકિસ્તાનમાં દિવાલ પડતાં એકના મોત સિવાય બીજી કોઈ જાનહાનિ નથી. ઉત્તરીય પાકિસ્તાનમાં ૨૦૦૮ના ઓકટોબર માસમાં આવેલા ૭.૬ની તીવ્રતાના ભૂકંપના કારણે પાક. ઉપરાંત જમ્મુ-કાશ્મીરમાં હજારોના મોત થયાં હતાં. ગુજરાતના કચ્છ અને સૌરાષ્ટ્રની ભૂમિ ઉપર ૧૧ થી ૧૯ જાન્યુઆરી દરમિયાન ભૂકંપના કુલ ૪૨ આંચકા નોંધાયા છે, જેની તીવ્રતા ૧.૨ થી ૩.૨ સુધીની રહી છે. સૌથી મોટો ૩.૨ નો આંચકો ૧૩મી જાન્યુઆરીએ સૌરાષ્ટ્રના લાલપુરમાં આવ્યો હતો. મંગળવારે રાત્રે ૧૨ વાગે અને બુધવારે સવારે ૮ વાગે કચ્છના ભચાઉમાં બે આંચકા નોંધાયા છે, જે ૧.૮ અને ૧.૯ની માત્રા ધરાવે છે. હાલ ભચાઉ સ્થિત પ્લેટ થોડી ડિસ્ટર્બ જણાય છે પણ તેનાથી ગભરાવાની કોઈ જરૂર નથી.

આગામી ૨૨ મીથી ગાંધીનગરમાં ભૂકંપ સંદર્ભે વિશ્વસ્તરનો અભ્યાસ સેમિનાર યોજાશે, જેમાં દેશ-વિદેશના ૧૭૫ જેટલા નિષ્ણાંતો ભાગ લેશે

ગાંધીનગરના રાયસણ નજીક રરમીથી ઈન્ડિયન સિસ્મોલોજી રિસર્ચનો ત્રિદિવસીય સેમિનાર યોજાયો

અમદાવાદ, તા.૨૦ પાટનગર ગાંધીનગરની નજીક રાયસણ ખાતે સિસ્મોલોજી રિસર્ચ સેન્ટર બનાવવામાં આવ્યું છે એનું ઉદઘાટન તા. ૨૨મી જાન્યુઆરીને શનિવારના રોજ મુખ્યમંત્રી નરેન્દ્ર મોદીના હસ્તે કરાશે. આ પરિષદમાં જાપાન સહિત ૧૫ દેશોના ૨૫ જેટલા સિસ્મોલોજીસ્ટ ભાગ લઈને તેમના સંશોધનપત્રો રજૂ કરશે. ભૂકંપ પહેલા અને પછીની સ્થિતિ અંગે પણ ચર્ચા કરવામાં આવશે. ભૂકંપ ક્યાં અને ક્યારે આવવાનો છે તેની આગોતરી માહિતી મેળવી શકાતી નથી. પણ જમીનની ઊંડાઈએ જે પ્લેટો

સકીય બની છે તેની જાણકારી મેળવીને એકશન પ્લાન તૈયાર કરી શકાય છે. ગુજરાતમાં ઊર્જા માટે ન્યુક્લીયર પ્લાન્ટ અને કલ્પસર યોજના સાકાર થવાની છે ત્યારે સિસ્મોલોજી રિસર્ચથી વધુ જાણકારી મળી શકશે. સુત્રોના કહેવા મુજબ તા. ૨૨મીને શનિવારે મુખ્યમંત્રી નરેન્દ્ર મોદીના હસ્તે સિસ્મોલોજી રિસર્ચ સેન્ટરનું ઉદઘાટન કરાશે ત્યાર બાદ રાયસણ નજીક ૧ મેગાવોટના સોલારપાર્કનું પણ મુખ્યમંત્રી ઉદઘાટન કરશે. ઉપરાંત દીનદયાલ પેટ્રોલીયમ યુનિ.ના કોનવોકેશન હોલનું પણ મુખ્યમંત્રી ઉદઘાટન કરશે.

‘ભૂકંપ સંશોધન વિજ્ઞાન’ વિષયક આંતરરાષ્ટ્રીય પરિષદનો પ્રારંભ અને સોલાર પ્રોજેક્ટ રાષ્ટ્રને અર્પણ

ગાંધીનગર, તા. ૨૨: નરેન્દ્રભાઈ મોદીએ ભૂકંપ જેવી વિનાશક આપત્તિથી માનવજાતને સલામત રાખવા માટેના પરતીકંપ અંગેના વૈજ્ઞાનિક સંશોધનોની વિષયક આંતરરાષ્ટ્રીય સિસ્મોલોજીકલ રિસર્ચ (ISR) અને એક મેગાવોટનો સોલાર પાવર પ્રોજેક્ટ રાષ્ટ્રને અર્પણ સમર્પિત કર્યો હતો. સને ૨૦૦૧ના વિનાશક ભૂકંપની આફતને અવસરમાં પલટાવીને ગુજરાત સરકારે ગાંધીનગર નજીક ૧૫ એકરમાં ભૂકંપ સંશોધન સંસ્થાન તરીકે ISR નું નિર્માણ કર્યું છે અને ગુજરાતની પરતી ઉપરથી ભારત જ નહીં માનવજાતને ભૂકંપની આફતમાં ભવિષ્યમાં રક્ષાશક્તિનું કવચ મળે તે માટેનો સંશોધનનો અને માનવશક્તિની ક્ષમતા-નિર્માણનો માર્ગ અપનાવ્યો છે, એમ તેમણે જણાવ્યું હતું.

કચ્છ ગુજરાતના ભીષણ ભૂકંપની દશમી વરસીએ આજે પડિત દીનદયાલ પેટ્રોલિયમ યુનિવર્સિટીના સભાકક્ષમાં ‘પરતીકંપ વિજ્ઞાનના સંશોધનો’ વિષયક આંતરરાષ્ટ્રીય પરિસંવાદનું પણ ISR અને સોલાર પાવર પ્રોજેક્ટના લોકાર્પણની સાથોસાથ મુખ્ય મંત્રીએ ઉદઘાટન કર્યું હતું.

આ આંતરરાષ્ટ્રીય પરિસંવાદમાં પાંચ દિવસ સુધી વિજ્ઞાનના રજ દેશોના વૈજ્ઞાનિકો, તજજ્ઞો સહિત ભારતમાંથી ૧૫૦ નિષ્ણાંતો ભૂકંપ જેવી આફતોમાંથી આપત્તિ-નિવારણ અંગેના વૈજ્ઞાનિક ઉપાયોનું સામૂહિક મંથન કરવાના છે તેમને ગુજરાતની પરતી ઉપર આવકારતા મુખ્ય મંત્રીએ જણાવ્યું કે, ગુજરાત એકમાત્ર એવું રાજ્ય છે જેણે વિનાશકારી પરતીકંપ પછી માત્ર ત્રણ જ વર્ષમાં

રાજ્યમાં આપત્તિ પુનર્વસનનું વિરાટ કાર્ય સંપન્ન કરીને વિકાસના માર્ગે ગતિશીલ બનાવી દીધું એટલું જ નહીં, ISR જેવી ભૂકંપ સંશોધન સંસ્થાનું નિર્માણ જાતે જ કરીને ગુજરાતના પુન:નિર્માણની અસીમ ક્ષમતાનું પ્રમાણ દેશ અને દુનિયાને આપી દીધું છે.

ISR જેવી ભૂકંપ સંશોધન સંસ્થામાં પીએચડી ડિગ્રી મેળવીને માનવ વિજ્ઞાને માટે પોતાની બૌદ્ધિક શોધ સંપદાનું યોગદાન આપવા તેમણે દેશ-વિદેશની યુનિવર્સિટીઓના યુવાનોને આહવાન કર્યું હતું અને જણાવ્યું હતું કે, બે વર્ષ સુધીના આ સંશોધન અભ્યાસ માટે વિદ્યાર્થીને આવાસ અને

શિષ્યવૃત્તિની સુવિધા પણ તેમની રાજ્ય સરકાર આપશે.

વિજ્ઞાન ભૂકંપ સંશોધન નિષ્ણાંતોને ISRની સંશોધન ભૂમિકાનું મહત્વ દર્શાવતાં મોદીએ જણાવ્યું કે, ભૂકંપશાસ્ત્રના સંશોધન માટે ગુજરાતે જાતે પહેલ કરી છે. ગુજરાતનો ૫૦ ટકા ભૂભાગ ભૂકંપ સંવેદનશીલ છે અને ગુજરાત દેશનું ભૂકંપનો ભોગ બનતું રાજ્ય ગણાય છે. માત્ર ત્રણ જ વર્ષમાં ISRનું વૈજ્ઞિક સંશોધન સંસ્થાન તરીકે નિર્માણ કરીને ગુજરાતે ભૂકંપના આંચકાના મેટ્રોટ્યુડ અને ભૂકંપના એપી સેન્ટર લોકેશનની માહિતી ગણતરીની ક્ષણોમાં તંત્રને મળી જાય તેવું નેટવર્ક વિકસાવ્યું છે.

International Symposium on ‘Advanced Earthquakes Science’ begins and solar project deicated to country

भूकंप की सही भविष्यवाणी के लिए नया सिस्मिक नक्शा तैयार

गांधीनगर। इंस्टीट्यूट ऑफ सिस्मोलॉजिकल रिसर्च (आईएसआर) द्वारा देश का नया सिस्मिक जोन मैप (नक्शा) तैयार किया गया है, जो देश के विशेष क्षेत्रों में भूकंप की संभावना और उसकी तीव्रता संबंधी सही और स्पष्ट चित्र प्रस्तुत करता है। वर्तमान के नक्शे में समग्र कच्छ को जोन-5 (सबसे खतरनाक) में माना जाता है, जबकि नए नक्शे में दक्षिण कच्छ को जोन-5 में नहीं माना गया। आईएसआर के डायरेक्टर जनरल बीके रस्तोगी ने कहा कि ब्यूरो ऑफ इंडियन स्टैंडर्ड्स (बीआईएस) के भूकंप के संभावित क्षेत्रों के वर्तमान नक्शे में भारत को चार भागों में विभाजित किया गया है, जबकि इस नए नक्शे द्वारा भूकंप संबंधी सही और स्पष्ट भविष्यवाणी की जा सकेगी, क्योंकि यह सही तीव्रता के भूकंप की संभावना प्रदर्शित करेगा। रस्तोगी ने कहा कि दो वर्ष से अधिक समय के अनुसंधान द्वारा हमारे द्वारा तैयार किया गया यह नया नक्शा न्यूक्लीयर पावर प्लांट, डैम एवं उद्योग स्थापित करने के निर्णय में बहुत महत्वपूर्ण साबित होगा। बीआईएस का वर्तमान का जो सिस्मिक जोनिंग मैप है, उसमें देश को चार भागों में विभाजित किया गया है, जिसे दो से पांच का क्रम दिया गया है। जोन-5 भूकंप की दृष्टि से सबसे खतरनाक माना गया है तथा वह हिमालयन फॉल्ट के बाहर है। वर्तमान के नक्शे में एक मात्र गुजरात का कच्छ जिला जोन-5 के अंतर्गत आता है, जबकि शेष भाग दो से चार क्रम के जोन में विभाजित हैं। रस्तोगी ने यह भी बताया कि बीआईएस नया नक्शा तैयार करने के लिए वर्ष 1997 में बीआईएस ने तीन वर्ष पूर्व आईएसआर का संपर्क किया था। उसके बाद दो वर्ष से अधिक समय के सख्त प्रयास के बाद यह नया जोनिंग मैप तैयार किया गया है। इसके लिए भारत और आसपास में महसूस किए गए 3.5 हजार भूकंप के डेटा का अध्ययन किया गया है। इसके उपरांत भारत में रही फॉल्ट लाइन का भी गहन अध्ययन किया गया था, जिसके कारण संभावित क्षेत्र में भूकंप कितनी तीव्रता का आएगा, उसकी भविष्यवाणी हो सकेगी। नया नक्शा ब्यूरो ऑफ इंडियन स्टैंडर्ड्स (बीआईएस) को सौंप दिया गया है तथा अब इसका किस प्रकार उपयोग करना है, उसका निर्णय इसके इंजीनियर करेंगे।

The Hindustan Times

HOW TO SAVE A LIFE

Are you prepared? Follow these simple guidelines in the event of an earthquake.

- Drop to the ground, take cover by hiding under a sturdy table or piece of furniture and hold on until the shaking stops.
- Stay away from glass, windows, doors and walls, and anything that could fall, such as lighting fixtures.
- Stay in bed if you are there when the earthquake strikes. Hold on and protect your head with a pillow, unless you are under a heavy light fixture, window or anything else that could fall. In that case, move to the nearest safe place.
- Stay inside until the shaking stops. Research into past incidents has shown that most injuries occur when people inside buildings attempt to move to a different location.
- Be aware that the electricity may go out or the

PAKISTAN
Balochistan
INDIA

An earthquake measuring 7.2 on the Richter scale hit a remote area of southwestern Pakistan. It shook the ground from Delhi to Dubai, damaging about 200 structures.

Seismic zones in India

- Zone 1: Least active
- Zone 2: Least to moderate
- Zone 3: Moderate
- Zone 4: High
- Zone 5: Highest

High-rise danger

- If you are in a restaurant, get under the table.
- If you are outside, move away from buildings, streetlights and utility wires.
- If you are driving a car, stop in an open area and stay in the vehicle. Proceed cautiously once the tremors have stopped.
- According to developers in Gurgaon, swaying of high-rise towers during an earthquake is normal and technically allowed, to accommodate tremors and wind pressure. Some suspension gaps are left in all such buildings; these gaps are filled with concrete.
- Developers also claim buildings are constructed with varied structural changes as per technical specifications.

'Jurassic era rift zones behind Kutch quakes'

AHMEDABAD: Earthquakes in Kutch are on account of the rift zones formed in the Jurassic era 18 crore years ago, and quakes take place along the geological fault lines formed during rifting, experts said at the concluding day of the seminar, 'Advances in earthquake science — AES 2011', at the Institute of Seismological Research in Gandhinagar today.

They said after ISR placed large number of state-of-the-art digital seismographs, some new faults like the North Wagad Fault and Samkhyali Fault have been found to be formed. Some known faults like the South Wagad Fault, Island Belt Fault, Gedi Fault and Banni Fault have been found to be alive after 2001.

"The seismologists have found a deep platonitic body at depths of 10 to 40 km north-west of Bhachau in the epicentral zone of the 2001 earthquake. This platonitic body having higher density concentrates the stress around it to cause earthquakes," said ISR Director General B K Rastogi. *ENS*

Jaihind

Seminar of Indian Seismology from Saturday

ગાંધીનગર નજીક ત્રિદિવસીય

ઇન્ડિયન સિસ્મોલોજીનો શનિવારથી સેમિનાર

અમદાવાદ, તા. ૨૦
પાટનગર ગાંધીનગરની નજીક
રાયસણ કાંતે સિસ્મોલોજી રિસર્ચ
સેન્ટર બનાવવામાં આવ્યું છે એનું
ઉદઘાટન તા. ૨૨મી જાન્યુઆરીને
શનિવારના રોજ મુખ્યમંત્રી
નરેન્દ્રભાઈ મોદીના હસ્તે કરાશે.
આ પ્રસંગે ત્રિદિવસીય ઇન્ડિયન
સિસ્મોલોજી રિસર્ચનો સેમિનારનો
પ્રારંભ થશે. સૂત્રોના જણાવ્યા મુજબ
પાટનગર ગાંધીનગર નજીક આવેલા
રાયસણ ખાતે સિસ્મોલોજી કેન્દ્ર
ખાતે ઇન્ડિયન સિસ્મોલોજી
રિસર્ચની ત્રિદિવસીય પરિષદનો તા.
૨૨મીને શનિવારથી પ્રારંભ થશે.
આ પરિષદમાં જાપાન સહિત ૧૫
દેશોના ૨૫ જેટલા સિસ્મોલોજીસ્ટ
ભાગ લઈને તેમના સંશોધનપત્રો
રજૂ કરશે. ભૂકંપ પહેલા અને
પછીની સ્થિતિ અંગે પણ ચર્ચા

કરવામાં આવશે. ભૂકંપ ક્યાં અને
ક્યારે આવવાનો છે તેની આગોતરી
માહિતી મેળવી શકાતી નથી. પણ
જમીનની ઊંડાઈએ જે પ્લેટો સક્રીય
બની છે તેની જાણકારી મેળવીને
એક્શન પ્લાન તૈયાર કરી શકાય છે.
ગુજરાતમાં ઊર્જા માટે
ન્યુક્લીયર પ્લાન્ટ અને કલ્પસર
યોજના સાકાર થવાની છે ત્યારે
સિસ્મોલોજી રિસર્ચથી વધુ જાણકારી
મળી શકશે. સૂત્રોના કહેવા મુજબ
તા. ૨૨મીને શનિવારે મુખ્યમંત્રી
નરેન્દ્રભાઈ મોદીના હસ્તે
સિસ્મોલોજી રિસર્ચ સેન્ટરનું
ઉદઘાટન કરાશે ત્યાર બાદ રાયસણ
નજીક ૧ મેગાવોટના સોલારપાર્કનું
પણ મુખ્યમંત્રી ઉદઘાટન કરશે.
ઉપરાંત દીનદયાલ પેટ્રોલીયમ
યુનિ.ના કોનવોકેશન હોલનું પણ
મુખ્યમંત્રી ઉદઘાટન કરશે.

કચ્છમાં ઈન્સ્ટી.ઓફ સિસ્મોલોજીકલ રિસર્ચ અને સોલાર પ્રોજેક્ટનું લોકાર્પણ

ગાંધીનગરને સોલાર સીટી બનાવશે-મુખ્યમંત્રી

ભુજ, તા.૨૨

મુખ્યમંત્રી નરેન્દ્રભાઈ મોદીએ ભૂકંપ જેવી વિનાશક આપત્તિથી માનવજાતને સલામત રાખવા માટેના ધરતીકંપ અંગેના વૈજ્ઞાનિક સંશોધનોની વિશ્વકક્ષાની સંસ્થા ઈન્સ્ટીટ્યુટ ઓફ સિસ્મોલોજીકલ રિસર્ચ (આઈએસઆર) અને એક મેગાવોટનો સોલાર પાવર પ્રોજેક્ટ રાષ્ટ્રને આજે સમર્પિત કર્યો હતો.

સને ૨૦૧૧ના વિનાશક ભૂકંપની આફતને અવસરમાં પહ્લાવીને ગુજરાત સરકારે ગાંધીનગર નજીક ૧૫ એકરમાં ભૂકંપ સંશોધન સંસ્થા તરીકે આઈએસઆરનું નિર્માણ કર્યું છે અને ગુજરાતની ધરતી ઉપરથી ભારત જનહી માનવજાતને ભૂકંપની આફતમાં ભવિષ્યમાં રક્ષાશક્તિ તનું કવચ મળે તે માટેનો સંશોધનનો અને માનવશક્તિ તની ક્ષમતા નિર્માણનો માર્ગ અપનાવ્યો છે એમ તેમણે જણાવ્યું હતું.

કચ્છ ગુજરાતના ભીષણ ભૂકંપની દશમી વરસીએ આજે પંડિત દીનદયાળ પેટ્રોલિયમ યુનિવર્સિટીના સભાકક્ષમાં ધરતીકંપ વિજ્ઞાનના સંશોધનો વિષયક આંતરરાષ્ટ્રીય પરિસંવાદનું પણ આઈએસઆર અને સોલાર પાવર પ્રોજેક્ટના લોકાર્પણની સાથોસાથ મુખ્યમંત્રીએ ઉદ્ઘાટન કર્યું હતું.

આ આંતરરાષ્ટ્રીય પરિસંવાદમાં પાંચ દિવસ સુધી વિશ્વના ૨૪ દેશોના વૈજ્ઞાનિકો, તજજ્ઞો સહિત ભારતમાંથી ૧૫૦ નિષ્ણાંતો ભૂકંપ જેવી આફતોમાંથી આપત્તિ નિવારણ અંગેના વૈજ્ઞાનિક ઉપાયોનું સામૂહિક મંથન કરવાના છે તેમને ગુજરાતની ધરતી ઉપર આવકારના મુખ્યમંત્રીએ જણાવ્યું કે, ગુજરાત એકમાત્ર એવું રાજ્ય છે જેણે વિનાશકારી ધરતીકંપ પછી માત્ર ત્રણ જ વર્ષમાં રાજ્યમાં આપત્તિ પુનર્વસનનું વિરાટ કાર્ય સંપન્ન કરીને વિકાસના માર્ગે ગતિશીલ બનાવી દીધું એટલું જ નહીં આઈએસઆર જેવી ભૂકંપ સંશોધન સંસ્થાનું નિર્માણ જાતે જ કરીને ગુજરાતના પુનઃનિર્માણની અસીમ ક્ષમતાનું પ્રમાણ દેશ અને દુનિયાને આપી દીધું છે.

આ સંદર્ભમાં મુખ્યમંત્રીએ એ હકિકતનો દુઃખપૂર્વક ઉદ્ઘેષ કર્યો હતો કે, ભૂકંપ પછી પુનર્વસનની ભગીરથ કામગીરી સાથે તેમણે ભવિષ્યની સુરક્ષા વાજપેથી સમક્ષ રજૂઆતો કરેલી છે તે માટે રૂ. ૨૦૦ કરોડ કેન્દ્રીય સહાયરૂપે ફાળવવાની અહરરાત પ્રધાનમંત્રીએ તત્કાલીન કેન્દ્ર સરકારમાં કરેલી પરંતુ દેશનું કુભાગ્ય એ છે કે, એનડીએની પછી આવેલી યુપીએ સરકારે ગુજરાતમાં વી સંસ્થાની જરૂર નથી એમ કહીને આ પ્રોજેક્ટને મંજૂરી આપી નહોતી. પરંતુ ગુજરાત સરકારે તો ભારત

સરકારની રાહ એવા વગર આજે આઈએસઆરનું નિર્માણ કરીને રાષ્ટ્રને સમર્પિત કરી દીધું છે.

વિશ્વના ભૂકંપ સંશોધન નિષ્ણાંતોને આઈએસઆરની સંશોધન ભૂમિકાનું મહત્વ દર્શાવતા નરેન્દ્રભાઈ મોદીએ જણાવ્યું કે, ભૂકંપશાસ્ત્રના સંશોધન માટે ગુજરાતે જાતે પહેલ કરી છે. ગુજરાતનો ૫૭ ટકા ભૂભાગ ભૂકંપ સંવેદનશીલ છે અને ગુજરાત દેશનું ભૂકંપનો ભોગ બનતું રાજ્ય ગણાય છે. માત્ર ત્રણ જ વર્ષમાં આઈએસઆરનું વૈશ્વિક સંશોધન સંસ્થા તરીકે નિર્માણ કરીને ગુજરાતે ભૂકંપના આંચકાના મેટ્રીટ્યુડ અને ભૂકંપના અંપી સેન્ટર લોકેશનની માહિતી ગણતરીની ક્ષણોમાં તંત્રને મળ જાય તેવું નેટવર્ક વિકસાવ્યું છે.

સોલાર પાવર પ્લાન્ટનું લોકાર્પણ

આ સોલાર પાવર પ્લાન્ટ ગાંધીનગર નજીક રાયસણમાં પાંચ એકર વિસ્તારમાં રૂ. ૧૫ કરોડના ખર્ચે માત્ર ૧૦૬ દિવસ જ તૈયાર કરીને રાષ્ટ્રને સમર્પિત કર્યો છે. તેનો ગોરવપૂર્વક ઉદ્ઘેષ કરી નરેન્દ્રભાઈ મોદીએ જણાવ્યું કે, સોલાર પીવી ટેકનોલોજીની આધુનિકતમ સુવિધા સાથેનો આ ડેમોન્સ્ટ્રેશન પાવરનો સોલાર પ્રોજેક્ટ રાજ્યમાં પ્રથમવાર શરૂ કર્યો છે. પરંતુ તેનાથી દર વર્ષે ૧૫ લાખ યુનિટ વીજળી પેદા થાય છે. ૧૫૦૦ ટન કાર્બન ડાયોક્સાઈડનું પ્રદૂષિત ઉત્પાદન અટકશે, ૧૫૦૦ ઘરોને સૂર્યશક્તિ તથી વીજળી મળશે.

મુખ્યમંત્રીએ ગાંધીનગરના સાલાર સીટી બનાવવાની દિશામાં રાજ્ય સરકાર આગળ વધી રહી હોવાનું જણાવી ઉત્તર ગુજરાતના રણકાંઠે વિશ્વનો સૌથી મોટો સોલાર પાર્ક પણ નિર્માણાધિન છે તેની રૂપરેખા આપી હતી અને જણાવ્યું હતું કે, ગુજરાત વિશ્વની સૌરઉર્જા શક્તિનું સોલાર કેપિટલ બનાવવાનું છે.

અતિથિવિશેષ પદે ઉપસ્થિત રહેલા રાજ્યના મહેસુલમંત્રી શ્રીમતી આનંદીબેન પટેલે જણાવ્યું હતું કે, કલાઈમેન્ટ ચેઈન્જ વિભાગની રચના કરી ગુજરાતે આ ક્ષેત્રની ચિંતા કરવાની શરૂઆત કરી છે. પાટણ જિલ્લાના ચારણકા ગામે ૫૦૦ મે. વારે. ના સોલાર પાવર પ્લાન્ટની શરૂઆત માટેનો નિર્ણય કલાઈમેન્ટ ચેઈન્જ અસરનો સામનો કરવાનો ગુજરાતનો શ્રેષ્ઠ પ્રયાસ છે. તેમણે જણાવ્યું હતું કે, કુલ્લતી પ્રકોષના સામના ક્ષેત્રે વિવશતા કે લાચારીને બદલે પુનર્વસન અને મેનેજમેન્ટ દ્વારા ગુજરાતે પોતાની ખમીરી બતાવી છે. ઈન્સ્ટીટ્યુટ ઓફ સિસ્મોલોજીકલ રિસર્ચના ડિરેક્ટર ભરલ ડો. બી. કે. રત્નોગીએ એડવાન્સીસ ઈન અર્થકવેક સાયન્સ વિષયક ઈન્ટરનેશનલ સિમ્પોઝીયમની ભૂમિકા આપી હતી.

ભૂકંપ પુનર્વસન ક્ષેત્રે સંશોધનનું આહ્વાન

ઇન્સ્ટિટ્યૂટ ઓફ સિસ્મોલોજિકલ રિસર્ચ અને સૌર
ઊર્જા પ્રોજેક્ટનું લોકાર્પણ કરતા મોદી : ધરતીકંપ
વિજ્ઞાનની આંતરરાષ્ટ્રીય પરિષદનો આરંભ

ગાંધીનગર, તા. ૨૨
(અમારા પ્રતિનિધિ તરફથી) :
મુખ્યમંત્રી નરેન્દ્રભાઈ મોદીએ
ભૂકંપ જેવી વિનાશક આપત્તિથી
માનવજાતને સલામત રાખવા
માટેના ધરતીકંપ અંગેના વૈજ્ઞાનિક
સંશોધનોની વિશ્વકક્ષાની સંસ્થા
ઇન્સ્ટિટ્યૂટ ઓફ સિસ્મોલોજિકલ
રિસર્ચ અને ૧ મેગાવોટનો સોલાર
પાવર પ્રોજેક્ટ રાષ્ટ્રને સમર્પિત
કરતા દેશ-વિદેશની
યુનિવર્સિટીઓના વિદ્યાર્થીઓને
ગુજરાતમાં ભૂકંપ પછી
પુનઃસ્થાપન ટેકનોલોજીમાં
પીએચ.ડી. કરવા આહવાન કર્યું
હતું. મુખ્યમંત્રીએ જાહેર કર્યું હતું
કે, બે વર્ષ સુધીના આ સંશોધન

અભ્યાસ માટે વિદ્યાર્થીને આવાસ
અને શિષ્યવૃત્તિની સુવિધાનો ખર્ચ
રાજ્ય સરકાર ઉઠાવશે.
કચ્છના ભૂકંપની ૧૦મી
વરસી નિમિત્તે આજે ગાંધીનગર
નજીક રાયસરણ ખાતે પંડિત
દિનદયાળ પેટ્રોલિયમ યુનિવર્સિટી
ખાતે ધરતીકંપ વિજ્ઞાનના
સંશોધનો વિષયક આંતરરાષ્ટ્રીય
પરિસંવાદનું ઉદ્ઘાટન કરતાં શ્રી
મોદીએ જણાવ્યું હતું કે,
૨૦૦૧ના વિનાશક ભૂકંપની
આફતને અવસરમાં પલટાવીને
સરકારે ગાંધીનગર નજીક ૧૫
એકર જમીનમાં ભૂકંપ સંશોધન
સંસ્થા તરીકે ઇન્સ્ટિટ્યૂટ ઓફ



ભૂકંપ સંશોધન માટેના ઇન્સ્ટિટ્યૂટ ઓફ સિસ્મોલોજિકલ રિસર્ચ સેન્ટર
ખાતે અઘતન ઉપરકરણો નિહાળી રહેલા મુખ્યમંત્રી નરેન્દ્ર મોદી.

ઇન્સ્ટિટ્યૂટ ઓફ સિસ્મોલોજિકલ રિસર્ચના તજજ્ઞો લાલબત્તી ઘરે છે

સાવધાન ! કચ્છમાં અનેક ફોલ્ટ સક્રિય

**૨૦૦૬ બાદ
દક્ષિણ વાગડ
અને ગેડી ફોલ્ટ
ઉપરાંત જૂનો
અને જોખમી
અલાહબંધ
પણ પુનઃ
સક્રિય થયો છે**

ત્રણિવેશ વ્યાસ તરફથી
ગાંધીનગર, તા. ૨૨ : ગુજરાતમાં ૮ મેગિટ્યુડ સુધીના ભૂકંપના
આંચકાની શક્યતા ધરાવતા ઝોન પમાં
આવતા કચ્છમાં વર્ષ ૨૦૦૧માં ૭.૬ની
તીવ્રતા ધરાવતો આંચકો આવ્યા બાદ વર્ષ
૨૦૦૬થી સાઉથ વાગડ અને ગેડી ફોલ્ટ
ફરી એક્ટિવ થયો છે. એટલું જ નહીં વર્ષ
૨૦૦૮ પછી અલાહબંધ ફોલ્ટ પણ
એક્ટિવ થયો છે ! જે સરહદી જિલ્લા માટે
એક લાલબત્તી સમાન છે.
ઇન્સ્ટિટ્યૂટ ઓફ સિસ્મોલોજિકલ
રિસર્ચના સુત્રોના જણાવ્યા પ્રમાણે, હિમાલય રેન્જની બહાર આવતું ગુજરાત
એક માત્ર એવું રાજ્ય છે કે, જે ભૂકંપ ઝોન ૩, ૪ અને ૫માં આવ્યું છે.
કચ્છને ૮ મેગિટ્યુડના ભૂકંપના આંચકાની શક્યતા ધરાવતા ઝોન ૫માં

મૂકવામાં આવ્યું છે, જ્યારે તેની ૭ મેગિટ્યુડના ભૂકંપના આંચકાની
શક્યતામાં આજુબાજુનો ૬૦થી ૮૦ કિલોમીટરનો પટ્ટો ઝોન ૪માં મૂકવામાં
આવ્યો છે અને ૬ મેગિટ્યુડના ભૂકંપના
આંચકાની શક્યતા ધરાવતા ઝોન ૩માં
ગુજરાતના અન્ય ભાગોને મૂકવામાં આવ્યા છે.
ભૂકંપની આગાહી કરવી એ હજુ
સંશોધનનો વિષય છે પરંતુ માનવ જીવનને
બચાવી શકાય તે માટે ભૂકંપની તકલીફોને
ધ્યાને રાખીને આક્રિટિકો, બિલ્ડરો અને ઇજનેરો
ભૂકંપપ્રૂફ ઇમારતોના ડિઝાઇન બનાવે તે જરૂરી
છે. આ માટે બ્યુરો ઓફ ઇન્ડિયન સ્ટાન્ડર્ડ
(બીઆઈએસ) મુજબ ભૂકંપની શક્યતાવાળા નકશાઓ તૈયાર કરવામાં
આવ્યા છે. સ્ટ્રક્ચરલ ઇજનેરોને આ નકશાઓને ધ્યાને લેવા આદેશ
આપવામાં આવ્યો છે. ભૂકંપની અતિ તીવ્રતા ધરાવતા

કચ્છમાં આવેલા ભૂકંપના આંચકા		
મેગિટ્યુડ	વર્ષ ૨૦૦૧ પછીના આંચકાઓ (૯ વર્ષ)	વર્ષ ૨૦૦૧ પહેલા આંચકાઓ (૨૦૦ વર્ષ)
૩.૫-૩.૯	૪૬	૬૫૩
૪.૦-૪.૯	૨૫	૨૬૨
૫.૦ કે તેથી વધુ	૧૦	૨૦

ઘરતીકંપની દસમી વરસી પૂર્વે ગાંધીનગરમાં સંશોધન કેન્દ્રની સ્થાપના

મુખ્ય પ્રધાને કાર્ય લોકાર્પણ: ગુજરાતનો ૫૭ ટકા ભાગ ભૂકંપની સંભાવનાવાળો



ગાંધીનગર : વર્ષ ૨૦૦૧ના વિનાશક ભૂકંપની આફતને અવસરમાં પલટાવીને ગુજરાત સરકારે ગાંધીનગર નજીક ૧૫ એકરમાં ભૂકંપ સંશોધન સંસ્થાન તરીકે આઈએસઆરનું નિર્માણ કર્યું છે અને ગુજરાતની ધરતી ઉપરથી ભારત નહીં સમગ્ર વિશ્વની માનવજાતને આ પ્રકારની આફતમાં રક્ષાશક્તિનું કવચ મળે તે માટેનો સંશોધનનો માર્ગ રાજ્ય સરકારે અપનાવ્યો હોવાનું મુખ્ય પ્રધાન નરેન્દ્ર મોદીએ જણાવ્યું હતું. આજે ગાંધીનગરમાં આઈએસઆર અને એક મેગાવોટ સોલાર પાવર પ્રોજેક્ટનું લોકાર્પણ કરવાની સાથે સાથે 'ધરતીકંપ વિજ્ઞાનના સંશોધનો'

વિષયક આંતરરાષ્ટ્રીય પરિસંવાદનું ઉદ્ઘાટન કરતા નરેન્દ્ર મોદીએ વધુમાં જણાવ્યું હતું કે, ભૂકંપ પછી ભવિષ્યની સુરક્ષા માટે આઈએસઆર જેવી સંસ્થા સ્થાપવા તત્કાલિન એનડીએ સરકારે મંજૂરી આપી રૂા. ૨૦૦ કરોડની ફાળવણી કરી હતી પરંતુ ત્યારબાદ સત્તા પર આવેલી યુપીએ સરકારે ગુજરાતમાં આવી સંસ્થાની જરૂર નથી એમ કહીને આ પ્રોજેક્ટને મંજૂરી આપી નહોતી. પરંતુ ગુજરાત સરકારે કેન્દ્રની રાહ જોયા વગર આજે આઈ.એસ.આર.નું નિર્માણ કરીને રાષ્ટ્રને સમર્પિત કરી દીધું છે. ગુજરાત દેશનું ધરતીકંપગ્રસ્ત રાજ્ય છે. અહીંનો ૫૭ ટકા ભાગ એ રીતે સંવેદનશીલ છે ત્યારે માત્ર ત્રણ જ વર્ષમાં સંશોધન સંસ્થાનું નિર્માણ કરીને ગુજરાતે ભૂકંપના આંચકાના મેગ્નીટ્યૂટ એપી સેન્ટરની માહિતી ગણતરીની ક્ષણોમાં તંત્રને મળી જાય તેવું નેટવર્ક વિકસાવ્યું છે. દરમિયાન મુખ્ય પ્રધાને ગાંધીનગર નજીક રાયસણમાં લઘુકક્ષાના સોલાર પાવર પ્લાન્ટનું પણ આ સાથે લોકાર્પણ કર્યું છે.

Naya Padkar

રિસર્ચ અને સોલાર પ્રોજેક્ટ રાષ્ટ્રને સમર્પિત કરતું ગુજરાત

ગાંધીનગર, તા. ૨૨
મુખ્યમંત્રી નરેન્દ્ર મોદીએ ભૂકંપ જેવી વિનાશક આપત્તિથી માનવજાતને સલામત રાખવા માટેના ધરતી કંપ અંગેના વૈજ્ઞાનિક સંશોધનોની વિશ્વકક્ષાની સંસ્થા ઈન્સ્ટીટ્યુટ ઓફ સિમ્મોલોજીકલ રિસર્ચ (આઈએસઆર) અને એક મેગાવોટનો સોલાર પાવર પ્રોજેક્ટ રાષ્ટ્રને આજે સમર્પિત કર્યો હતો.

કચ્છ ગુજરાતના ભીષણ ભૂકંપની દસમી વરસીએ આજે પંડિત દિનદયાળ પેટ્રોલિયમ યુનિવર્સિટી સભાક્ષમાં ધરતી કંપ વિજ્ઞાનના સંશોધનો વિષયક આંતરરાષ્ટ્રીય પરિસંવાદનું પણ આઈએસઆર અને સોલાર પાવર પ્રોજેક્ટના લોકાર્પણની સાથે સાથે મુખ્યમંત્રીશ્રી ઉદ્ઘાટન કર્યું હતું આ પરિસંવાદમાં પાંચ દિવસ સુધી વિશ્વના ૨૪ દેશોના

વૈજ્ઞાનિક, તજજ્ઞો, સહિત ભારતભરમાંથી ૧૫૦ નિષ્ણાંતો ભૂકંપ જેવી આફતોમાંતી આપત્તિ નિવારણ અંગેના વૈજ્ઞાનિક ઉપાયોનું સામૂહિક મંથક કરવાના ચે.

મુખ્યમંત્રીએ એ હકીકતનો દુઃખપૂર્વક ઉલ્લેખ કર્યો હતો કે ભૂકંપ પછી પુર્નવસનની ભગીરથ કામગીરી સાથે તેમણે ભવિષ્યની સુરક્ષા આઈએસઆર જેવી સંસ્થાના નિર્માણ માટે એનડીએના વડાપ્રધાન અટલબિહારી બાજપાઈએ ૨૦૦ કરોડ કેન્દ્રીય સહાય રૂપે ફાળવાની જાહેરાત કરી હતી જ્યારે તે પછીની યુપીએ સરકારે આવી સંસ્થાની જરૂર નથી એમ કહી પ્રોજેક્ટને મંજૂરી આપી નહતી આ સોલાર પાવર પ્લાન્ટ ગાંધીનગર નજીક રસાયણમાં પાંચ એકર વિસ્તારમાં ૧૫ કરોડના ખર્ચે માત્ર ૧૦૬ દિવસમાં જ તૈયાર કરીને રાષ્ટ્રને સમર્પિત કર્યો છે.

ગુજરાતમાં વિનાશક ભૂકંપની શક્યતા નહિવત છે: ડૉ. બી.કે. રસ્તોગી

■ અમદાવાદ, તા. ૧૯
ગુજરાતમાં વિનાશક ભૂકંપની શક્યતા નહિવત હોવાનો નિર્દેશ આપતાં ઈન્સ્ટીટ્યુટ ઓફ સિસ્મોલોજીકલ રિસર્ચના ડાયરેક્ટર જનરલ ડૉ. બી.કે. રસ્તોગીએ જણાવ્યું હતું કે દિલ્લીમાં અનુભવાયેલા ૭.૩ના આંચકાની અમદાવાદમાં અસર થઈ છે પણ કોઈ નુકસાની નથી. આ ઝટકાથી ગભરાવાની જરૂર નથી કારણ કે તેનું એપિસેન્ટર પાકિસ્તાનના રિમોટ એરિયામાં છે. આ પ્લેટ ભારતને અસર કરે છે પણ ભૂકંપની તીવ્રતા ઘણી ઓછી થાય તેમ છે. મધરાતે બે વાગ્યે આવેલા આંચકા અંગે પૂછતાં ડૉ. રસ્તોગીએ કહ્યું હતું કે વિશ્વમાં આવી રહેલા ભૂકંપને કઈ વિષયસ્તરનો અભ્યાસ ૨૨મી જાન્યુઆરી થી ગોળીનગરમાં યોજાઈ રહ્યો છે. આ સેમિનારમાં દેશના ૧૫૦ અને વિદેશના ૨૫ જેટલા સિસ્મોલોજીકલ સાયન્ટીસ્ટ હિસ્સો લઈ રહ્યાં છે. તેઓ કચ્છના ૨૦૦૧ના ભૂકંપ અંગે પણ સંશોધન કરવાના છે. આક્ટર રોહની માયા હોવા છતાં હાલ આ પ્લેટ ચાંત છે, જે નજીકના ભવિષ્યમાં કોઈ મોટી જનહાનિ સર્જી શકે તેમ નથી.

સાઉથ વેસ્ટ પાકિસ્તાનના રણમાં નોંધાયેલા એપિસેન્ટરના આંચકાની અસર નવી દિલ્લી, હરિયાણા અને રાજસ્થાનમાં જોવા મળી હતી પરંતુ પાકિસ્તાનમાં દિવાલ પડતાં એકના મોત સિવાય બીજા કોઈ જાનહાનિ નથી. તોચેન પાકિસ્તાનમાં ૨૦૦૮ના ઓક્ટોબર માસમાં આવેલા ૭.૬ની તીવ્રતાના ભૂકંપના કારણે પાક ઉપરાંત જમ્મુ-કાશ્મીરમાં હજારોના મોત થયાં હતા.

ગુજરાતના કચ્છ અને સોરાષ્ટ્રની ભૂમિ ઉપર ૧૧ થી ૧૮ જાન્યુઆરી દરમ્યાન ભૂકંપના કુલ ૪૨ આંચકા નોંધાય છે જેની તીવ્રતા ૧.૨ થી ૩.૨ મેગનીટ્યુડ સુધીની રહી છે. સૌથી મોટો ૩.૨નો આંચકો ૧૩મી જાન્યુઆરીએ સોરાષ્ટ્રના લાલપુરમાં આવ્યા હતા.

મંજલવારે રાત્રે ૧૨.૦૦ વાગ્યે અને બુધવારે સવારે ૮.૦૦ વાગ્યે કચ્છના ભચાઉમાં બે આંચકા નોંધાયા છે, જે ૧.૮ અને ૧.૯ની માત્રા ધરાવે છે. હાલ ભચાઉ સ્થિત પ્લેટ થોડી ડિસ્ટર્બ જણાય છે પણ તેનાથી ગભરાવાની કોઈ જરૂર નથી.

૨૦૦૧ની સાલમાં કચ્છ સહિત સમગ્ર ગુજરાતમાં આવેલા વિનાશક ભૂકંપ બાદ આવી રહેલા આક્ટર સોડ સિસ્મોલોજી વિભાગમાં રેકર્ડ થયેલા છે. આમ એક દાયકો વીતવા આવ્યો હોવા છતાં હજુ આક્ટર સોડ શાંક ચાલુ જ જોવાયા છે. જેમાં ૩થી ૩.૯ની માત્રામાં આ દાયકા દરમિયાન ૨૧૫૪ આંચકા, ૪થી ૪.૯ની તીવ્રતા વાળા ૨૭૧ ૩થી ઓછી માત્રાના ૧૫૪૪ આંચકા નોંધાયા છે.

જ્યારે કચ્છમાં આવેલા મોટા ભૂકંપનો તારીખવાર ઇતિહાસ જોઈએ તો ૨૬મી જાન્યુઆરી, ૨૦૦૧ના રોજ ૭.૫ની તીવ્રતા હતી, જેનું એપિસેન્ટર વાગડ ડોલ્લાઈન હતું, ત્યારબાદ ૧૬મી એપ્રિલ, ૨૦૦૧ના રોજ ૫.૬ની તીવ્રતાનું એપિસેન્ટર ભચાઉથી ઉત્તરે ડોલ્લાઈન, ૨૦૦૬માં ૫.૭ની તીવ્રતાનું એપિસેન્ટર અલ્લાબંધ ડોલ્લાઈન, ૯મી નવેમ્બર, ૨૦૦૬માં ૪.૩ની તીવ્રતાના આંચકાનું એપિસેન્ટર બનીની ડોલ્લાઈન જોવાઈ હતી. જ્યારે ૫મી ડિસેમ્બરના રોજ ૩ની તીવ્રતાનો ભૂકંપનો આંચકો આવ્યો હતો. જેનું એપિસેન્ટર ગોરા ડુંગર ડોલ્લાઈન જોવા મળી હતી. આમ, કચ્છ-ભુજમાં આવેલા ભૂકંપના આંચકાઓમાં ડોલ્લાઈન ખલલાતી રહી છે અને આઠ ડોલ્લાઈન જોવા મળી છે.

૧૫ એકર જમીનમાં ૧૫ કરોડના ખર્ચે ૧ મેગાવાટ સોલર પાવર પ્લાન્ટ તૈયાર

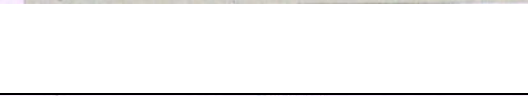
આ પ્લાન્ટ અને ઈન્સ્ટીટ્યુટ ઓફ સિસ્મોલોજીકલ રિસર્ચ સંસ્થા રાજ્યને સમર્પિત કરવા બુધવારે...



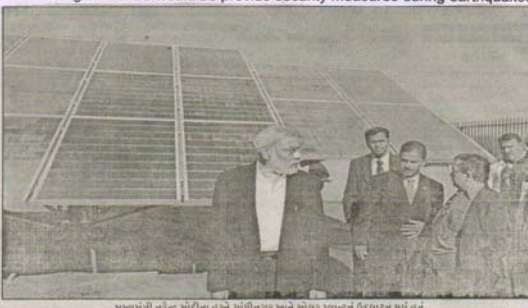
Phulchhab
Edition: Rajkot | Date: January 26, 2011 | Page No: 09 | Category: ISR
In order to inform people about early earthquake ISR to develop an early warning system

ભૂકંપથી લોકોને સચેત કરવા માટે અર્થકેન્દ્ર અહીં વોર્નિંગ સિસ્ટમ વિકસાવશે

રાજકોટ-અમદાવાદ સહિતના મહાનગરોમાં હાઈટ્રાઈઝ વિલ્ડીંગો ઉપર લેગવવાનું આયોજન...



Prabhat
Edition: Ahmedabad | Date: January 23, 2011 | Page No: 08 | Category: ISR
Seismological centre would be provide security measures during earthquakes: M



સિસ્મોલોજીકલ સેન્ટર ભૂકંપની આપત્તિમાં સલામતી માટેના સંશોધનોથી ઉપયોગી બનશે: મોદી ૧૫ કરોડના ખર્ચે સુર્ય ઊર્જાથી વીજ ઉત્પન્ન કરતો સૌર પ્રોજેક્ટ

સુર્ય ઊર્જાના વીજ ઉત્પન્ન કરતો સૌર પ્રોજેક્ટ...

Modi flays UPA for not granting quake funds

RATHIN DAS ■ AHMEDABAD

On the eve of 10th anniversary of the deadly earthquake, Chief Minister Narendra Modi has trained his guns on the UPA Government at the Centre for not sanctioning a grant for starting a seismological institute.



Inaugurating a five-day international seminar on earthquake science at the Pandit Deendayal Petroleum University (PDPU) on Saturday, Modi said that Gujarat had set a record by finishing the rehabilitation work within three years of the quake hitting the State on January 26, 2001.

He recalled that the NDA Government led by Prime Minister Atal Behari Vajpayee had announced ₹200-crore grant for setting up a seismological institute but the UPA Government that came to power later did not sanction the money on the pretext that Gujarat did not need such an institute.

More than 150 scientists and other experts from 24 countries would deliberate on methods to mitigate the dangers from disasters like earthquakes.

Government would support a Ph.D programme at the Institute of Seismological Research (ISR) to study earthquake and Gujarat model of rehabilitation. He added that the two-year Ph.D project is open to students from Gujarat as also from outside.

The Institute of Seismological Research would undertake world class research in the field of earthquake science and explore ways to safeguard people from dangers of the natural calamity.

Modi also used the occasion to announce that the State Government would support a Ph.D programme at the Institute of Seismological Research (ISR) to study earthquake and Gujarat model of rehabilitation.

ગાંધીનગર નજીક ત્રિદિવસીય

ઇન્ડિયન સિસ્મોલોજીનો
શનિવારથી સેમિનાર

અમદાવાદ, તા. ૨૦ પાટનગર ગાંધીનગરની નજીક રાયસણ કાંટે સિસ્મોલોજી રિસર્ચ સેન્ટર બનાવવામાં આવ્યું છે એનું ઉદઘાટન તા. ૨૨મી જાન્યુઆરીને શનિવારના રોજ મુખ્યમંત્રી નરેન્દ્રભાઈ મોદીના હસ્તે કરાશે. આ પ્રસંગે ત્રિદિવસીય ઇન્ડિયન સીસ્મોલોજી રિસર્ચનો સેમિનારનો પ્રારંભ થશે. સૂત્રોના જણાવ્યા મુજબ પાટનગર ગાંધીનગર નજીક આવેલા રાયસણ ખાતે સિસ્મોલોજી કેન્દ્ર ખાતે ઇન્ડિયન સિસ્મોલોજી રિસર્ચની ત્રિદિવસીય પરિષદનો તા. ૨૨મીને શનિવારથી પ્રારંભ થશે. આ પરિષદમાં જાપાન સહિત ૧૫ દેશોના ૨૫ જેટલા સિસ્મોલોજીસ્ટ ભાગ લઈને તેમના સંશોધનપત્રો રજુ કરશે. ભૂકંપ પહેલા અને પછીની સ્થિતિ અંગે પણ ચર્ચા કરવામાં આવશે. ભૂકંપ ક્યાં અને ક્યારે આવવાનો છે તેની આગોતરી માહિતી મેળવી શકાતી નથી. પણ જમીનની ઊંડાઈએ જે પ્લેટો સક્રીય બની છે તેની જાણકારી મેળવીને એક્શન પ્લાન તૈયાર કરી શકાય છે. ગુજરાતમાં ઊર્જા માટે ન્યુક્લીયર પ્લાન્ટ અને કલ્પસર યોજના સાકાર થવાની છે ત્યારે (અનુસંધાન સાતમા પાને)

ઇન્ડિયન

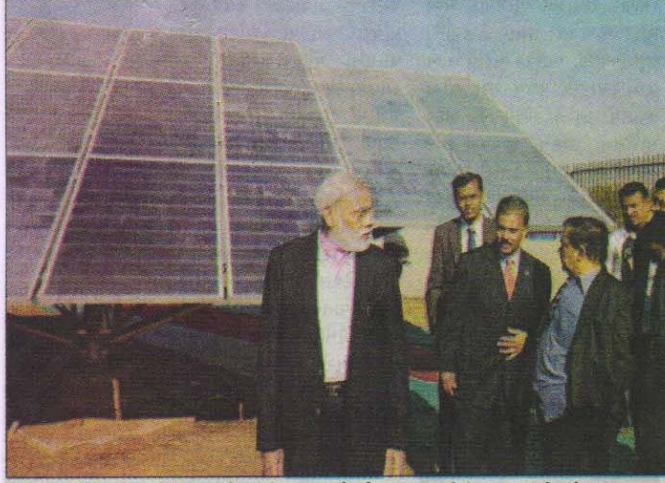
સિસ્મોલોજી રિસર્ચથી વધુ જાણકારી મળી શકશે. સૂત્રોના કહેવા મુજબ તા. ૨૨મીને શનિવારે મુખ્યમંત્રી નરેન્દ્રભાઈ મોદીના હસ્તે સિસ્મોલોજી રિસર્ચ સેન્ટરનું ઉદઘાટન કરાશે ત્યાર બાદ રાયસણ નજીક ૧ મેગાવોટના સોલારપાર્કનું પણ મુખ્યમંત્રી ઉદઘાટન કરશે. ઉપરાંત દીનદયાલ પેટ્રોલીયમ યુનિ.ના કોનવોકેશન હોલનું પણ મુખ્યમંત્રી ઉદઘાટન કરશે.

Rakhewal

Edition: Mehsana | Date: January 23, 2011 | Page No: 04 | Category: ISR
Institute of Seismological Research to host 3-day International Symposium on
Advanced Earthquake Science

આવતીકાલે મુખ્યમંત્રી નરેન્દ્ર મોદી ગાંધીનગરમાં
'ઇન્સ્ટીટ્યુટ ઓફ સિસ્મોલોજીકલ રિસર્ચ'નું લોકાર્પણ કરશે
આધુનિક ભૂકંપ વિજ્ઞાન. વિષયે ત્રણ દિવસનું
આંતરરાષ્ટ્રિય સિમ્પોઝિયમ શરૂ થશે

ગાંધીનગર શનિવારે ગુજરાતના મા. મુખ્યપ્રધાન શ્રી નરેન્દ્ર મોદી ગાંધીનગરમાં ઇન્સ્ટીટ્યુટ ઓફ સિસ્મોલોજીકલ રિસર્ચ રાષ્ટ્રને સમર્પિત કરશે. આ પ્રસંગે શ્રી નરેન્દ્ર મોદી પંડિત દિનદયાળ પેટ્રોલીયમ યુનિવર્સિટી નજીક એક મે.વોટનો સોલાર પ્લાન્ટ પણ સમર્પિત કરશે. સઆધુનિક ભૂકંપ વિજ્ઞાન. અંગેના એક સેમિનારનો પણ આ પ્રસંગે ગાંધીનગરમાં ઇન્સ્ટીટ્યુટ ઓફ સિસ્મોલોજીકલ રિસર્ચ ખાતે પ્રારંભ થશે. અંદાજે ૨૪ વિદેશી વેજ્ઞાનિકો તથા દેશના ૧૫૦ સિસ્મોલોજીસ્ટ ગાંધીનગરમાં આ ત્રણ દિવસ દરમ્યાન એકઠા મળીને ભૂકંપ સંબંધિત વિવિધ વિષયો અંગે તથા આફ્ટર શોક અંગે તેમજ ઇન્ટરપ્લેટ સિસ્મીસીટી અને સિસ્મીક માર્શકોઓનેશન અંગે ચર્ચા કરશે. ગુજરાત સરકારના વિજ્ઞાન અને ટેકનોલોજી વિભાગના અધિક મુખ્ય સચિવ, આઈએએસ શ્રી રવિ સક્સેનાએ જણાવ્યું હતું કે, આ સેમિનારમાંથી સિસ્મોલોજીકલના નિષ્ણાતોને ભૂકંપ વિજ્ઞાનની ચર્ચા કરશે તથા ધોળાવીરાની હડપ્પન સંસ્કૃતિ સાઈટ એઈએસ ૨૦૧૧ના સ્થળ અંગે પણ પરામર્શ કરશે..



મુખ્યમંત્રી નરેન્દ્ર મોદીના હસ્તે ગાંધીનગર ખાતે સોલાર પ્લાન્ટનું ઉદઘાટન થયું હતું.

ભૂકંપની આપત્તિમાં સલામતી માટેના સંશોધનો ઉપયોગી થશે

**મુખ્યમંત્રીએ ભૂકંપ
વિજ્ઞાનના પરિસંવાદનું
ઉદઘાટન કર્યું :ગાંધીનગર
સોલાર સિટી બનશે :
નરેન્દ્ર મોદીની ખાતરી**

ગાંધીનગર મુખ્યમંત્રી નરેન્દ્રભાઈ મોદીએ ભૂકંપ જેવી વિનાશક આપત્તિથી માનવજાતને સલામત રાખવા માટેના ધરતીકંપ અંગેના વૈજ્ઞાનિક સંશોધનોની વિશ્વકક્ષાની સંસ્થા ઈન્સ્ટીટ્યુટ ઓફ સિસ્મોલોજીકલ રિસર્ચ અને એક મેગાવોટનો સોલાર પાવર પ્રોજેક્ટ રાષ્ટ્રને આજે સમર્પિત કર્યાં હતાં.

સને ૨૦૦૧ના વિનાશક ભૂકંપની આફતને અવસરમાં પલટાવીને ગુજરાત સરકારે ગાંધીનગર નજીક ૧૫ એકરમાં ભૂકંપ સંશોધન સંસ્થાન તરીકે આઈએસઆરનું નિર્માણ કર્યું છે. અને ગુજરાતની ધરતી ઉપરથી ભારત જ નહીં માનવજાતને ભૂકંપની આફતમાં ભવિષ્યમાં રક્ષાશક્તિનું કવચ મળે તે માટેનો સંશોધનનો અને માનવશક્તિની ક્ષમતા-નિર્માણનો માર્ગ અપનાવ્યો છે, એમ તેમણે જણાવ્યું હતું.

કચ્છ ગુજરાતના ભીષણ ભૂકંપની દશમી વરસીએ આજે પંડિત દીનદયાળ પેટ્રોલિયમ યુનિવર્સિટીના સભાકક્ષમાં 'ધરતીકંપ વિજ્ઞાનના સંશોધનો' વિષયક આંતરરાષ્ટ્રીય પરિસંવાદનું પણ આઈએસઆર અને સોલાર

પાવર પ્રોજેક્ટના લોકાર્પણની સાથોસાથ મુખ્યમંત્રીએ ઉદઘાટન કર્યું હતું.

આ આંતરરાષ્ટ્રીય પરિસંવાદમાં પાંચ દિવસ સુધી વિશ્વના ૨૪ દેશોના વૈજ્ઞાનિકો, તજજ્ઞો સહિત ભારતમાંથી ૧૫૦ નિષ્ણાતો ભૂકંપ જેવી આફતોમાંથી આપત્તિ-નિવારણ અંગેના વૈજ્ઞાનિક ઉપાયોનું સામૂહિક મંથન કરવાના છે.

તેમને ગુજરાતની ધરતી ઉપર આવકાતાં મુખ્યમંત્રીએ જણાવ્યું કે ગુજરાત એકમાત્ર એવું રાજ્ય છે જેણે વિનાશકારી ધરતીકંપ પછી માત્ર ત્રણ જ વર્ષમાં રાજ્યમાં આપત્તિ પુનર્વસનનું વિરાટ કાર્ય સંપન્ન કરીને વિકાસના માર્ગે ગતિશીલ બનાવી દીધું એટલું જ નહીં,

અનુસંધાન પાના નં.૬

ભૂકંપની આપત્તિમાં

પાના નં. ૧ યાલુ

આઈએસઆર જેવી ભૂકંપ સંશોધન સંસ્થાનું નિર્માણ જાતે જ કરીને ગુજરાતના પુન:નિર્માણની અસીમ ક્ષમતાનું પ્રમાણ દેશ અને દુનિયાને આપી દીધું છે.

આ સંદર્ભમાં મુખ્યમંત્રીએ એ હકિકતનો દુ:ખપૂર્વક ઉલ્લેખ કર્યો હતો કે, ભૂકંપ પછી પુનર્વસનની ભગીરથ કામગીરી સાથે તેમણે ભવિષ્યની સુરક્ષા માટે આઈએસઆર જેવી સંસ્થાનું નિર્માણ કરવા તત્કાલિન એન.ડી.એ.ના પ્રધાન મંત્રી અટલબિહારી વાજપેયે સમક્ષ રજૂઆત કરેલી અને તે માટે રૂા. ૨૦૦ કરોડ કેન્દ્રીય સહાયરૂપે લાગુવવાની જાહેરાત પ્રધાનમંત્રીએ તત્કાલિન કેન્દ્ર સરકારમાં કરેલી પરંતુ દેશનું દુ:ખગિય એ છે કે એન.ડી.એની પછી આવેલી પુષ્પાંગે સરકારે ગુજરાતમાં આવી સંસ્થાની જરૂર નથી એમ કહીને આ પ્રોજેક્ટને મંજૂરી આપી નહોતી.

આ સોલાર પાવર પ્લાન્ટ ગાંધીનગર નજીક રાષ્ટ્રસભામાં પાંચ એકર વિસ્તારમાં રૂા. ૧૫ કરોડના ખર્ચે માત્ર ૧૦૬ દિવસમાં જ તૈયાર કરીને રાષ્ટ્રને સમર્પિત કર્યો છે. તેનો ગૌરવપૂર્વક ઉલ્લેખ કરી નરેન્દ્રભાઈ મોદીએ જણાવ્યું કે સોલાર પીવી ટેકનોલોજીની આધુનિકતમ સુવિધા સાથેનો આ રેમોન્ટેશન પાવરનો સોલાર પ્રોજેક્ટ રાજ્યમાં પ્રથમવાર થરૂં કર્યો છે. પરંતુ તેનાથી દર વર્ષે ૧૫ લાખ યુનિટ વીજળી પેદા થશે. ૧૫૦૦ ટન કાર્બન ડાયોક્સાઈડનું પ્રદૂષિત ઉત્પાદન અટકશે, ૧૫૦૦ ઘરોને સુરક્ષાક્તિથી વીજળી મળશે.

મુખ્યમંત્રીએ ગાંધીનગરને સોલાર સિટી બનાવવાની દિશામાં રાજ્ય સરકાર આગળ વધી રહી હોવાનું જણાવી ઉત્તર ગુજરાતના રણકાંઠે વિશ્વનો સૌથી મોટો સોલાર પાર્ક પણ નિર્માણધન છે તેની રૂપરેખા આપી હતી અને જણાવ્યું હતું કે, ગુજરાત વિશ્વની સૌર-ઉર્જા શક્તિનું સોલાર કેપીટલ બનવાનું છે.

सिस्मो. रिसर्च इंस्टीट्यूट का लोकार्पण 22 को

विश्व भर के वैज्ञानिक
आएंगे

का.सं. @ गांधीनगर

भू-विज्ञान क्षेत्र में गुजरात में विश्व स्तरीय अनुसंधान संभव होने लगे हैं। गांधीनगर के निकट स्थित रायसण में सिस्मोलॉजिकल रिसर्च इंस्टीट्यूट, 1 मेगावाट के सोलर पावर प्लांट और पंडित दीनदयाल पेट्रोलियम विश्वविद्यालय के कन्वेंशन सेंटर का 22 जनवरी को मुख्यमंत्री नरेन्द्र मोदी लोकार्पण करेंगे।

संस्थान के प्रमुख डॉ. बालकृष्ण रस्तोगी ने बताया कि 20 मई, 2007

को मोदी ने संस्थान भवन का शिलान्यास किया था। 15 एकड़ भूमि पर निर्मित संस्थान भवन के निर्माण पर 20 से 22 करोड़ की लागत आई है।

इस संस्थान के प्रांभ अवसर पर विश्व भर के वैज्ञानिक तीन दिन के लिए गांधीनगर आएंगे। ये वैज्ञानिक शुकवार को गांधीनगर पहुंच जाएंगे। शनिवार को लोकार्पण समारोह के बाद सभी वैज्ञानिक आफ्टर शोक और भूकम्प पर अपने शोध पत्र प्रस्तुत करेंगे। आईआईटी-गांधीनगर के निदेशक सुधीर जैन, रोड सिस्मिक सेफ्टी पर तथा डॉ. रस्तोगी सिस्मिक हेजार्ड मैप ऑफ इंडिया पर शोधपत्र प्रस्तुत करेंगे।

Sandesh

Roadmap of development will be decided on the basis of seismology centre's report

सिस्मोलोजी सेन्टरना रिपोर्टने आधारे विकासनो नकशो घडाशे

■ शनिवार मुध्यमंत्री द्वारा
रायसणमा सिस्मोलोजी
संकुलनु उद्घाटन

गांधीनगर, ता. 20

१० वर्ष पहले गुजरातमा संशोधन पंथीय संस्था के द्वारा गांधीनगर पास अलायड्ड लूकप संशोधन केन्द्र शुरु कियुं छुं. वर्ष २००७मा रायसण प्वाते शुरु करवामा आवेखुं छिन्धियन सिस्मोलोजी रिसर्च सेन्टरमा अन्तार वैश्विक स्तरनी यंत्र सामग्री आने नेटवर्कनु सज्जन करवामा आव्युं छे. जेनु उद्घाटन आगामी शनिवार मुध्यमंत्री नरेन्द्र मोदी करशे. शनिवारथी आ केन्द्रमा त्रस्र दिवसनो सेमिनार शुरु थशे. जेमां लूकप, सुनामी सहित पृथ्वीना घेटाणमां सतत थरी रहेलां परिवर्तनो अंगे १५ देशना २५ जेटला लूकपशास्त्रीओ, वैज्ञानिको मंथन करशे, रिसर्च पेपरनु प्रेजन्टेशन करशे. जेना आधारे

भविष्यमां भारतमां क्यो केवा प्रकारनुं ईन्फ्रास्ट्रक्चर डेवलप थरी शके ते अंगेनो रोडमैप तैयार करवामां आवशे. रायसण स्थित १५ अेकर जमीनमां विस्तरस्र पामेला छिन्धियन रिसर्च सेन्टरना जनरल डायरेक्टर अने देशना वरिष्ठ सिस्मोलोजिस्ट डो. बालकृष्ण के.

१५ देशना २५
सिस्मोलोजिस्टनो त्रस्र
दिवसीय सेमिनार
लूकप, सुनामी सहित
लूकपनीय डिलचाल अंगे
हाथ धरानारो अभ्यास

रस्तोगीअे कलुं छतुं के, भारतमां अन्ये कौठी पस्र जग्याअे आ प्रकारनुं अलग सेन्टर नथी. विशमां पस्र नथी. वर्ष २००९मां कच्छना लूकप बाद गु-जरात सरकारना सायन्स अने टेकनोलोजी विभागे ३.२२ करोडना पर्ये अत्याधुनिक यांत्रिक व्यवस्था साथे

भारतमां युनिक कही शक्य तेवुं सिस्मोलोजी रिसर्च सेन्टर तैयार कियुं छे. जेनु उद्घाटन मुध्यमंत्री करशे. साथे ज २२मी जन्धुआरीथी त्रस्र दिवस माटे अली, लूकप, सुनामी, लूकपनीय डिलचाल जेवां क्षेत्रोमां विश्वभरमांथी प्वाति पामेला अने सङ्ग वैज्ञानिकनो सेमिनारनुं पस्र आयोजन करवामां आव्युं छे. आ सेमिनारमां भारतीय उपभंड विशेपत: दक्षिण अेशियाना लू-भागमां सतत थरी रहेला डेरकारो अंगे थथेला रिसर्स पेपरनुं प्रेजन्टेशन करवामां आवशे. साथे ज देशना विविध विस्तारनी भौगोलिक स्थितिने आधारे क्यो केवा प्रकारना औद्योगिक विस्तारो, परिवहन माटेनां संसाधनो, बंध, डार्डराईज रेसिडेन्सियल टाउनशिप, न्युक्लियर पावर स्ेशन, पेट्रो रिफायनरी जेवा अनेकविध ईन्फ्रास्ट्रक्चर संबंधित प्रोजेक्ट विकासववा माटे सानुकूलता छे के केम ते अंगेनो अेकशन प्लान तैयार करवामां आवशे.

વીજળીને ગૃહઉદ્યોગ બનાવવાની ગુરુચાવી

અમદાવાદઃ મુખ્યપ્રધાન નરેન્દ્ર મોદીએ આજે ગાંધીનગર નજીક રાયસાહ ખાતે એક મેગાવોટ સોલાર પાવર પ્લાન્ટનું અને ભૂકંપના સંશોધન માટેની રાષ્ટ્ર ક્ષાત્રી ઇન્સ્ટિટ્યુટ ઓફ સિસ્મોલોજિકલ રિસર્ચ સંસ્થાનું લોકાર્પણ કર્યું છે. સોલાર ક્ષેત્રે તેમણે ગાંધીનગરના નાગરિકોને વધારાની આવક મેળવવાનો ગુરુમંત્ર આપતાં કહ્યું છે કે, "આવનારા સમયમાં ગાંધીનગરના નાગરિકો પોતાના પરની છાત પર વીજળી પેદા કરશે અને વધારાની વીજળી રાજ્ય સરકારને વેચીને વધારાની આવક મેળવી શકશે. એક મેગાવોટ સોલાર પાવર ડારા દર વર્ષે ૧૫ લાખ યુનિટ વીજળી પેદા થશે, જે એસી પરાવતના ૧,૫૦૦ ઘરને વીજળી પૂરી પાડી શકવાની ક્ષમતા ધરાવે છે."

આવનારા સમયમાં ગાંધીનગરના નાગરિકો વધારાની સૌરઊર્જા વેચીને આવકમાં વધારો કરી શકશે

તેમણે આ પ્રસંગે અત્યંત દુઃખ સાથે કેન્દ્રની વતનામ યુપીએ સરકારનો ઉલ્લેખ કરીને કહ્યું કે, "૨૦૦૧માં કચ્છના ભૂકંપ બાદ એનડીએની સરકારે ગુજરાતમાં ભૂકંપના સંશોધન અને આગાહી માટે અતિ આધુનિક સંસ્થા સ્થાપવા રૂ. ૨૦૦ કરોડ આપવાનો નિર્ણય કર્યો હતો, પરંતુ કેન્દ્રમાં સરકાર બદલાયા બાદ ગુજરાતને આ

નાણાં મળ્યાં નથી." તેમણે એમ પણ કહ્યું કે, "તેમણે યુપીએ સરકારને એમ કહ્યું કે જલ તમે ગુજરાતમાં આવી સંસ્થા ન સ્થાપો, જ્યાં કોંગ્રેસની સરકાર છે તે રાજ્યમાં સ્થાપો પણ માનવજાત માટે આવી સંસ્થા સ્થાપવી અનિવાર્ય છે. ગુજરાતે વિશ્વ બેન્કની સહાયથી આ પ્રકારની સંસ્થા સ્થાપી છે, જે ભવિષ્ય પેઢી અને સમગ્ર માનવજાત માટે ઉપયોગી નીવડશે."

તેમણે દેશ અને દુનિયાની યુનિવર્સિટીના વિદ્યાર્થીઓને ગુજરાતના ભૂકંપ પછી, પુનઃસ્થાપન ટેકનીલોજી વર્ગેમાં પીએચડી કરવાનું આમંત્રણ આપવાની સાથે એમ પણ કહ્યું કે, "આ પીએચડી અને વિદ્યાર્થીઓનો રહેવાનો તમામ ખર્ચ રાજ્ય સરકાર વહન કરશે, કેમ કે આ પીએચડી સંશોધનો સમગ્ર માનવજાત

વિશ્વની યુનિવર્સિટીઓને ગુજરાતના ભૂકંપ અને પુનઃસ્થાપન અંગે પીએચડી કરવા આમંત્રણ

માટે ઉપયોગી નીવડશે." તેમણે એમ પણ કહ્યું કે, "વિશ્વ બેન્કનો રિપોર્ટ છે કે સમૂદ્ર દેશોને ભૂકંપની પરિસ્થિતિમાંથી બહાર આવતાં સાત વર્ષનો સમય લાગે છે, જ્યારે ગુજરાતમાં કચ્છના મહાવિનાશકારી ભૂકંપના ત્રણ વર્ષમાં જ ગુજરાત દોડતું થયું છે."



મુખ્યમંત્રી નરેન્દ્ર મોદીના હસ્તે ગાંધીનગર ખાતે સોલાર પ્લાન્ટનું ઉદઘાટન થયું હતું.

ભૂકંપની આપત્તિમાં સલામતી માટેના સંશોધનો ઉપયોગી થશે

મુખ્યમંત્રીએ ભૂકંપ વિજ્ઞાનના પરિસંવાદનું ઉદઘાટન કર્યું ગાંધીનગર સોલાર સિટી બનશે: નરેન્દ્ર મોદીની ખાતરી

ગાંધીનગર, તા. ૨૨ મુખ્યમંત્રી નરેન્દ્ર મોદીએ ભૂકંપ જેવી વિનાશક આપત્તિથી માનવજાતને સલામત રાખવા માટેના પરતીકંપ અને નાગરિક સંશોધનોની વિચારવાની સંસ્થા ઇન્સ્ટિટ્યુટ ઓફ સિસ્મોલોજિકલ રિસર્ચ અને એક મેગાવોટની સોલાર પાવર પ્લાન્ટનું આજે સમર્પિત કર્યું હતું. સને ૨૦૦૧ના વિનાશક ભૂકંપની આક્રમને અનસરમાં ધલદલીને ગુજરાત સરકારે ગાંધીનગર નજીક ૧૫ એકરમાં ભૂકંપ સંશોધન સંસ્થાન તરીકે આઈએસઆરનું નિર્માણ કર્યું છે. અને ગુજરાતની પહેલી ઉપરથી ભારત જ નહીં માનવજાતને ભૂકંપની આપત્તિમાં અવિચલ મંથા રક્ષાક્ષિત્તું કાચ મળે તે માટેનો સંશોધનનો અને માનવજાતની કષ્ટના નિર્માણનો માર્ગ અપનાવ્યો છે. અમ તમણે જણાવ્યું હતું.

કચ્છ ગુજરાતના ભૂકંપને ભૂકંપની દશમી વરસીએ આજે પંચમ દિનકલ્યાણ પેટ્રોલિયમ યુનિવર્સિટીના સભાકક્ષમાં "રેલીકેપ વિજ્ઞાનના સંશોધનો" વિષયક આંતરરાષ્ટ્રીય પરિસંવાદનું પણ આઈએસઆર અને સોલાર પાવર પ્રોજેક્ટના યોજાવેલીની સભાકક્ષ મુખ્યમંત્રીએ ઉદઘાટન કર્યું હતું.

આ આંતરરાષ્ટ્રીય પરિસંવાદમાં પાંચ દિવસ સુધી વિજ્ઞાન રજૂ કરવાના વેકાબિન્દો, તજજ્ઞો સહિત ભારતમાંથી ૧૫૦ નિષ્ણાનો ભૂકંપ જેવી આપત્તિમાં આપત્તિ-નિવારણ અને વેકાબિન્દો ઉપાયોનું સંમુદિક મેળવ કરવાના છે.

ISR to map economic zones in state

Research On Seismic Activities To Help Set Building Norms

Ahmedabad: The Institute of Seismological Research (ISR) is profiling all economic zones in the state to predict their future sustainability. Suggestions given by the Raisan-based institute will help the state government and the Gujarat State Disaster Management Authority (GSDMA) formulate construction policies. It is one of the most extensive seismological studies in the country. The state is divided into various zones and each is evaluated individually to help predict earthquakes and determine a suitable structure for the zones concerned.



B K Rastogi, director general, Institute of Seismological Research

B K Rastogi, director general, ISR told TOI that the maps for major zones are already being drawn. "Outside the Himalayan region, Gujarat is the only state with high probability of earthquakes. Thus, the state had approached us for micro-zoning of GIFT city (Gandhinagar), Gandhidham, Ahmedabad and Dholera region. The entire area in these places will be divided into zones of 500 metres and predictions will be made about seismic activities," he said on the sidelines of the three-day international conference of seismologists, which ended on Mon-

day. "The research will make the state and country a safer place. Our website puts up reports at regular intervals on the latest seismic activities and condition of fault lines," added Rastogi. Two independent projects, in Surat and Bharuch, have been taken up for economic and residential zones in collaboration with the Geological Survey of India. Next on the ISR list for mapping is Jamnagar, where major industries of Reliance and Essar are housed. Various international agencies, impressed by the work put forth by the institute, are joining hands for a number of studies. A project with a Japanese agency is in pipeline, said ISR officials.

VIBRANT VIBRATIONS

TIMES CITY 10 YEARS AFTER EARTHQUAKE A VALIANT GUJARATI FIGHTBACK

January 26, 2001, 8.46 am: Patriotism was peaking on the 52nd Republic Day. Suddenly, the world came crashing down. Those 40 seconds changed the way Gujarat remembers this day

Rising from the RUBBLE



United by Mother Earth

Saeed Khan | TNN
Raydhanagar (Bhu): When memories of the dead began to return to most Kutchis, Robin celebrated his third birthday. Robin is the son of Kishoragar and Pooja Goswami, survivors of the January 26, 2001, quake. Both had lost their spouses and family members in the quake and married each other. Robin's birthday last week is the backdrop of the five garlanded pictures on the wall of the Goswami home is the story of how Kutchis have put the past behind. Kishoragar Goswami (69) is a priest in this village temple and also runs local cable network in the settlement of some 300 households. He lost his wife, a son and a daughter during the quake and was left with two other daughters, who had a miraculous escape.



Four years after the tragedy, Goswami's family members forced him to re-marry so that the daughters could be looked after. He met Pooja (60) from Anjar, who had lost her husband and one son during the quake. The boy died with 181 children who were marching in Khatri Chowk with flags to celebrate Republic Day and got buried under the Kishoragar and Pooja Goswami with Robin

TOTAL RECALL

► Magnitude **7.7** on Richter scale
► Epicentre **Lodai village**, Bhachau taluka, Kutch district
► This was the **biggest recorded quake in India** since the great Calcutta quake of 1737 which claimed 3,00,000 lives
► United States Geological Survey

MASSIVE LOSS

DEAD	13,811
Kutch: 12,221 Ahmedabad: approx. 500	
INJURED	1,67,000
VILLAGES WIPED OFF	450
PRODUCTION LOSS	Over 10,000 small and medium industrial units shut
DESTROYED	2,22,035 Homes 300 Hospitals 1,000 Health clinics 12,000 Schools

Learning to manage disasters better

Rajiv Shah | TNN
When a 7.2 magnitude quake shook Pakistan on Wednesday, Gujarat got a jolt of 1.4, the website of the Institute of Seismological Research (ISR), Gandhinagar, said. Ten years ago, authorities had to depend on outdated equipment, foreign websites and a communication system that had snapped because of the tremor; to decide how big was the quake, where was the epicentre and where to rush aid. Call it a product of the quake, the state government today has a prompt disaster management authority to handle natural calamities and set up relief camps. In 2001 when the Bhuji Civil hospital collapsed, patients were treated on an open ground. This may not happen now.

ISR and the Gujarat Disaster Management Authority, conceived and established after January 26, 2001, cover all the emergency operations in the state and have units in every district and city. Chief executive officer of Gujarat State Disaster Management Authority (GSDMA) Ranjit Banerji told TOI, "Today if an earthquake happens we can set up a relief camp in half the time compared to 2001." He refused to estimate if casualty could be contained. "Quakes cannot be predicted, while tsunamis and cyclones can," he said. GSDMA was made permanent by an act of 2003, with legal and regulatory powers to manage and mitigate the effects of disasters, provide emergency relief during and after disasters, and implement, monitor and coordinate



Bhuji Civil Hospital was completely destroyed, killing 142 people, including 11 staff, it was rebuilt as an ultra-modern hospital with Rs. 100 crore from the PM's relief fund. Temporary premises of Sardar Patel Institute for Public Administration, Ahmedabad.

ISR continuously monitors seismic activity in the state as a major portion of Gujarat lies in seismic zones V, IV and III and is prone to earthquakes. ISR is involved in pure and applied research in the field of seismology and networks centres across the world for research and sharing of best practices. It has established 22 seismological observatories and 40 strong motion accelerographs across the state for continuous monitoring of the seismic activity. The data collected is transmitted to a central data analysis centre, located at ISR through VSAT linkage using optical fibre. The data is analysed and used for pure and applied research in seismology. Anybody who survived the quake 10 years ago in Gujarat knows that if a glass of water rattles on the table, it might be the earth shaking. Today, if a Gujarati buys a home in an multi-story building, the first question is — "Is it quake proof?"

COMPLETE LEVEL OF LOSS

Bhuji, Bhachau, Anjar & Rapar

REHABILITATION

REPAIR	2,02,343 Homes 3,763 Public buildings
REPAIR	140 Government schools
REPAIR	9,08,751 Homes 192 health centres
REPAIR	6 General hospitals 94 Community health centres

Fresh tremors in S'rashtra, Kutch

Rajkot: Fresh tremors continued to be felt in Saurashtra and Kutch. Ten tremors were reported from the two regions on Wednesday and Thursday. According to the Institute of Seismological Research (ISR), on Thursday, three tremors were reported in the Kutch region. On Wednesday, two tremors were recorded in Saurashtra and five in Kutch. These tremors mainly jarred Bhachau and Vanka areas of the Kutch district and Surendranagar district of Saurashtra.

Disaster management plan to curb lift crashes

Mumbai: The state government, worried by the spurt in lift mishaps, is considering modification in existing laws to curb such incidents.

At a recent meeting of the state disaster management authority, which is headed by the chief minister, it was also decided that an expert panel comprising scientists and personnel with expertise in handling different kinds of natural and man-made disasters would be set up to assist it. Six companies of especially trained State Reserve Police Force will be deployed in six vulnerable cities. The meeting, presided over chief secretary Ratnakar Gaikwad, was attended by senior officials from the health, relief and rehabilitation, finance and home department.

A special disaster training centre will be set up in Nagpur. TNN

ISR to map economic zones

Predictions About Seismic Activities To Help Set Building Norms

Parth Shastri | TNN

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Suggestions given by the Raisan-based institute will help the state government and the Gujarat State Disaster Management Authority (GSDMA) formulate construction policies. It is one of the most extensive seismological studies in the country. The state is divided into various zones and each is evaluated individually to help predict earthquakes and determine a suitable structure for the zones concerned.

BK Rastogi, director general, ISR told TOI that the maps for major zones are already being drawn. "Outside the Himalayan region, Gujarat is the only state with high probability of earthquakes. Thus, the state had approached us for micro-zoning of GIFT city (Gandhinagar), Gandhidham, Ahmedabad and Dholera



B K Rastogi, director, Institute of Seismological Research

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"The research will make the state and country a safer place. Our website puts up

ISR will undertake micro-zoning of GIFT city and Dholera. The entire area in these places will be divided into zones of 500 metres and predictions will be made about seismic activities

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10 tremors in two days rock Kutch

TIMES NEWS NETWORK

Bhuj/Rajkot: Tremors of the powerful 7.2 magnitude earthquake in Pakistan were felt in Bhuj and Kutch too, bringing back the grim reminder of the devastating earthquake of 2001. Residents of Lakhpat, Abdassa and Khavda rushed out of their houses at 2 am.

"I rushed outside just like I did during 2001 earthquake," said Jayantilal Thacker. This was the most powerful earthquake after Bhuj quake and as such more aftershocks are likely, said Mahesh Thacker, a senior geologist. However, according to Institute of Seismological Research (ISR) data, all the 10 tremors have been reported be-



Buildings damaged in 2001 earthquake in Bhuj fort area (file pic)

tween 1.1 and 2.4 magnitudes on the Richter scale.

The epicentres of all these tremors were reported near Bhachau, Khavda,

Chobari, Suvai, Vamka and Deshalpar in Kutch district.

At least 10 tremors have been reported in Kutch region in the last two days. According to ISR, government of Gujarat, there were total eight earthquake tremors reported on Tuesday and two were reported on Wednesday in Kutch region.

The terrible tremor was felt in Khavda near Indo-Pakistan international border, which is geographically very near to Badin, Larkhana and Mirpurkhas in Pakistan. Hasan Amad of Fazal Vandh and Sama Issak of Dinara village near Khavda said that the tremor was so powerful that no one could sleep after 2 am on Wednesday. "We were out of our homes and were scared," they said.

Jurassic era rift zones behind Kutch quakes

Ahmedabad, Earthquakes in Kutch are on account of the rift zones formed in the Jurassic era 18 crore years ago, and quakes take place along the geological fault lines formed during rifting, experts said at the concluding day of the seminar, 'Advances in earthquake science 00 AES 2011', at the Institute of Sociological Research in Gandhinagar today.

They said after ISR placed large number of state-of-the-art digital seismograph, some new faults like the North Wagad Fault and

Samkhyali Fault have been found to be formed. Some known faults like the South Wagad Fault, Island Belt Fault, Gedi Fault and Banni Fault have been found to be alive after 2001.

"The seismologists have found a deep platonitic body at depths of 10 to 40 km northwest of Bhachau in the epicentral zone of the 2001 earthquake. This platonitic body having higher density concentrates the stress around it to cause earthquakes," said ISR Director General B K Rastogi.

ISR to map economic zones

Ahmedabad, The Institute of Seismological Research (ISR) is profiling all economic zones in the state to predict their future

sustainability. Suggestions given by the Raisan-based institute will help the state government and the Gujarat State Disaster Management Authority (GSDMA) formulate construction policies. It is one of the most extensive seismological studies in the country. The state is divided into various zones

and each is evaluated individually to help predict earthquakes and determine a suitable structure for the zones concerned. B K Rastogi, director general, ISR told that the maps for major zones are already being drawn. "Outside the Himalayan region, Gujarat is the only state with high probability of earthquakes.



Gujarat Chief Minister Narendra Modi dedicated to the nation 1 M.W Solar Power Plant & Institute of Seismological research , at the inaugural of three- day International symposium at Gandhinagar. UNI

Gujarat to become a solar capital of world: Modi

Gandhinagar, Gujarat Chief Minister Narendra Modi has said the state is all set to become a solar capital of the world and Gandhinagar a solar city.

While dedicating a one MW solar power plant to the nation at Pandit Deendayal Petroleum University near here yesterday, Mr Modi said the plant was commissioned in just 105 days at an estimated cost of Rs 15 crore. He said the plant would generate around 15 lakh unit of power per year. It would lessen the carbon emission by 1500 T and would supply solar

power to about 1,500 houses.

"There will be a time when a person in Gandhinagar with his house would be able to generate solar power on his roof top, and the government will be there to buy it. This would help to earn extra income for the people of Gandhinagar," he said. He said this project would generate 15 lakh unit power annually. The human kind would be saved from generation of 1,500 ton carbon dioxide annually due to usage of this plant. This facility can provide power to 1,500 plus air conditioned

houses, he said.

"Our dream is to make Gandhinagar a solar city. We are going ahead in that direction. There will be a time when each person would be able to generate power on roof top and the government would buy it. This will be an extra income for the people of Gandhinagar," Mr Modi said.

While stating the importance of the project, he said it is an example of generating solar power in Indian condition, which would be helpful for human resource development.

Modi rises from quake rubbles

Ahmedabad,

The killer earthquake of 2001, that changed lives of many in Gujarat, also re-wrote politics of the commercially inclined state. Post-quake developments saw the rise of Narendra Modi, who is heading the state for about a decade, after BJP stalwart Keshubhai Patel had to step down in the wake of allegations of laxity in the rehabilitation work. In a way, Mr Modi rose from the rubble of the earthquake that caused massive devastation, killing over 13,000 people and destruction of several thousand buildings.

Despite Keshubhai Patel's attempt to instal a successor of his choice, Mr Modi, BJP General Secretary that time, emerged a front-runner and was sworn in on October 7, 2001 as the new Chief Minister of Gujarat. Mr Modi steered the state and the party clear of debris of quake and its political aftermath, though he had to face flak over the 2002 communal riots. He had to face marathon interrogation by the Supreme Court-appointed special investigation team probing into 10 major cases during the post-Godhra riots.

In the 2003 and 2008 Assembly elections, Mr Modi led BJP to stunning victories, virtually decimating main opposition Congress in the state.

Post-quake relief and rehabilitation operations also opened up another face of corruption. Among many officials, Mr Pradeep Sharma, the then District Collector of Kutch, had fallen favour with the government and was sent to jail for irregular allotment of land to earthquake victims.

Interestingly, his brother and senior IPS officer Kuldeep Sharma, a claimant for DGP post, was also sent to jail after the political establishment dug up a more than two decade old fake encounter case against him.

Jurassic era rifts caused Kutch quake: experts

Ahmedabad,

The earthquakes in Gujarat's Kutch region are due to the fact that it is in rift zone formed in Jurassic era 18 crore years back when dinosaurs ruled the Gondwana land, seismological experts reported. The earthquakes are along the geological fault lines formed during rifting, revealed scientists at the international symposium on "Advances in earthquake Sciences", organised by the Institute of Seismological Research, Gandhinagar during last two days. Several seismologists from India and the United States, including Prof Pradeep Talwani from USA and also Dr S K Biswas, Dr B K Rastogi and Dr Prantik Mandal, explained their findings about why large earthquakes happen in Kutch. In recent times, the major earthquake to hit Kutch and other areas in Gujarat happened in the morning on January 26, 2001, with its epicentre 20 KM north-east of Bhuj, killing over 12,000 people in Kutch alone and a total of 13,805 in Gujarat and injuring over one lakh people. After the Institute of Seismological Research put large number of state-of-art digital seismographs, some new faults have been formed like the North Wagad Fault and Samkhyali Fault. Some known faults are found to be alive after 2001 like South Wagad Fault, Island Belt Fault, Gedi Fault and Banni Fault, the experts said, adding however, it is not

possible to say that these faults will result into large earthquakes in near future or not. "The seismologists have found a deep plutonic body at depths of 10 to 40 km depth north-west of Bhachau in the epicentral zone of 2001 earthquakes. This plutonic body having higher density and seismic velocity concentrates the stress around it to cause earthquakes along different faults", said Dr B K Rastogi, Director General of ISR, Gandhinagar. ISR and ISRO scientists have found very small horizontal deformation and earthquakes are found to be generated by large vertical deformation as measured by GPS and INSAR measurements, he added.

Modi dedicates Seismological institute to nation

Gandhinagar,

Gujarat Chief Minister Narendra Modi dedicated 'Institute of Seismological Research (ISR)' to the country.

While dedicating the institute yesterday, Mr Modi said the world-class institute will make research in the field of earthquake science and will find ways to safeguard people from the dangers of this monstrous hazard.

The Chief Minister also inaugurated an international conference on earthquake science at the conference room of Pandit Dindayal Petroleum University.

The five-day international seminar will see participation from scientists and experts from around 24 countries including 150 experts from India. Experts will deliberate on the scientific methods to mitigate dangers of disasters like earthquake.

While welcoming the experts at the conference, Mr Modi said that in the time of just three years of the earthquake hitting Gujarat in 2001,

the state had finished the rehabilitation process and started marching on the growth-route with even more vigour. With the establishment of the world-class institute like ISR in the state, Gujarat has shown the metal it possesses to the world.

He recalled that the Atal Bihari Vajpayee-led NDA government at the Centre had announced Rs 200-crore for the setting up of the institute like ISR but the UPA government, which took over from NDA, did not sanction the project saying that Gujarat did not need such institute.

The Chief Minister, on the occasion, called upon youths to take Phd degree from the institute and to give their brain for the good of humanity, and assured them the state government will provide residence and scholarship to them during their two years' research period.

He said that around 57 per cent of the land of Gujarat is considered as earthquake sensitive. With the setting up of ISR, the state govern-

ment has established a network that will provide the details like the magnitude of shock, location of epicenter of the earthquake and others just in the time of minutes.

He said that ISR has already begun 15 stations that will make research in the field of earthquake. Places like SIR at Dholera, GIFT city and Mundra LNG port terminal have already been assessed for the seismological dangers, he added.

Speaking on the occasion, Revenue Minister Ms Anandiben Patel said that ISR will become a major centre for the seismological studies and its researches will become useful in meeting with the natural disasters like earthquake.

She informed that the state government has started emergency centers in every district with a view to minimize the losses occurred due to natural calamities.

State government has provided various instruments and multi-rescue operators worth Rs 250-crore, she added.

આઈએસઆર અને આઈએમડબલ્યુ સોલાર પાવર પ્રોજેક્ટ રાષ્ટ્રને સમર્પિત કરતા મુખ્યમંત્રી

આઈએસઆરમાં દેશ વિદેશની યુનિ. ઓના યુવાલોને રિસર્ચ સ્ટડી કરવા મુખ્યમંત્રીનું આમંત્રણ: ભેળવેલો ખર્ચ સરકાર ઉઠાવશે: મુખ્યમંત્રી

એનડીએ સરકારે રૂ. ૨૦૦ કરોડની કેન્દ્રીય સહાય આઈએસઆર સ્થાપવા માટે કરેલી જેને યુપીએ સરકાર ફગાવી

ગાંધીનગર, આંધ્રપ્રદેશ સરકાર પાસે ૧ મેના બોટ સોલાર પાવર પ્લાન્ટ તથા ભૂકંપ સંશોધન માટેની રાષ્ટ્ર કક્ષાની ઈન્સ્ટીટ્યુટ ઓફ સિસ્મોલોજિકલ એન્ડ રિસર્ચ સંસ્થાનું લોકાર્પણ કરતા મુખ્યમંત્રીએ દેશ વિદેશ યુનિ. વિદ્યાર્થીઓને ગુજરાતના ભૂકંપ પછી, પુનઃસ્થાપન ટેકનોલોજીમાં પીએચડી કરવા આહવાન કર્યું હતું. સાથેસાથ તેમના બે વર્ષ સુધીના સંશોધન અભ્યાસ માટે આવાસ અને શિષ્યવૃત્તિની સુવિધાનો ખર્ચ સરકાર ઉઠાવશે એવી જાહેરાત કરી હતી.

કચ્છના ભોખણ ભૂકંપની દશમી વર્ષીએ આજે પંડિત દિનંદયાલ પેટ્ટોલિયમ યુનિ. માટે ૫૨તીકંપ વિશાલના સંશોધન વિષયક આંતરરાષ્ટ્રીય પરિસંવાદનું પણ ઉદ્ઘાટન કરવા સરકારના મુખ્યમંત્રી નરેન્દ્રભાઈ મોદીએ જણાવ્યું હતું કે વર્ષ ૨૦૦૧ના વિનાશક ભૂકંપની આફતને અવસરમાં પહોંચાવીને

સરકારે ગાંધીનગર નજીક ૧૫ એકર જમીનમાં ભૂકંપ સંશોધન સંસ્થા તરીકે ઈન્સ્ટીટ્યુટ ઓફ સિસ્મોલોજિકલ રિસર્ચનું નિર્માણ કર્યું છે. ગુજરાતની ૫૨તી ઉપરથી ભારત જ નહીં માનવજાતને ભૂકંપની આફતમાં ભવિષ્યમાં રક્ષાનું કવચ મળે તે માટેના સંશોધનો અને માનવશક્તિની ભક્ષતા નિરમાણનો માર્ગ અપનાવ્યો છે. વિનાશકારી ભૂકંપના ત્રણ વર્ષમાં જ રાજ્યમાં આપતિ પુનઃવસનનું કાવં સોંપ કરીને ગુજરાતમાં વિકાસ માગેને ગતિશીલ બનાવી દીધું છે.

ભૂકંપ પછી પુનઃવસનની કામગીરી સામે ભવિષ્યની સુરક્ષા માટે આઈએસઆર જેવી સંસ્થાના નિર્માણ કરવા તંત્રાલીન એનડીએના પ્રધાનમંત્રી સમક્ષ રજૂઆ કરી હતી. અને રૂ. ૨૦૦ કરોડ કેન્દ્રીય સહાય રૂપે કાળવવાની જાહેરાત પ્રધાનમંત્રીએ તંત્રાલીન કેન્દ્ર સરકારે કરેલી પરંતુ તેમણે દુખ સાથે જણાવ્યું હતું કે એનડીએ પછી આવેલ યુપી સરકારે ગુજરાતમા આવી સંસ્થાની

જરૂર નથી એમ કહીને પ્રોજેક્ટને મંજૂરી આપી ન હતી અને કેન્દ્રની સહ જોવા વગર આજે રાજ્ય સરકારે જ આઈએસઆરનું નિર્માણ કરીને રાષ્ટ્રને સમર્પિત કરી દીધું છે.

વર્ષ ૨૦૦૧થી વર્ષ ૨૦૧૦નો ૨૧મી સદીનો દશક ગુજરાત માટે વિશ્વકક્ષાની સંસ્થાઓના વિશિષ્ટ નિર્માણનો રહ્યો છે. તેનો અભ્યાસ પણ થવો જોઈએ. ગુજરાતનો ૫૭ ટકા ભૂભાગ સંવેદનશીલ છે. અને ભૂકંપનો ભોગ બનતા રાજ્યે માત્ર ત્રણ વર્ષમાં જ આઈએસઆરનું વૈશ્વિક સંશોધન સંસ્થાનિર્માણ કરીને ગુજરાતે ભૂકંપના અંધકાના મૅગ્નિટ્યુડ અને એપી સેન્ટરની માહિતી ગણતરીની શક્તિમાં મળી જાય તેનું નેટવર્ક વિકસાવ્યું છે. માત્ર કચ્છ જિલ્લામાં ભૂકંપ સંશોધનના ૧૫ સ્ટેશનો આઈએસઆર દ્વારા શરૂ કરી દેવામાં આવ્યા છે. તેમ જ ભૂકંપ માઈક્રો-ગેરેશન દ્વારા ચાર અને પાંચ કક્ષમાં મૂકીને વ્યાંબ ગણાના આપતિ જોખમોનું નિવારણ કરવાના ઉપાયો

માટે પણલા લેવામાં આવ્યા છે. મુખ્યમંત્રીએ વધુમાં જણાવ્યું હતું કે આઈએસઆર દ્વારા પોલેરા સર જિફ્ટ સિટી મુદ્ત એલએનજી પોર્ટ ટર્મિનલ જેવા વિકાસશીલ વિસ્તારોનું ભૂકંપલક્ષી જોખમ અંગે અભ્યાસ સંશોધન કરી દેવામાં આવ્યા છે આ ઉપરાંત રૂ. ૧૫ કરોડના ખર્ચે માત્ર ૧૦૯ દિવસમાં તૈયાર થયેલ સોલાર પાવર પ્લાન્ટ તેમને રાષ્ટ્રને સમર્પિત કર્યો હતો અને સોલાર ઊર્જા ઉત્પન્ન થતા ૧૫૦૦ ટન કાર્બન ડાયોક્સાઈડનું પ્રદૂષિત ઉત્પાદન અટકશે. ૧૫૦૦ ધરાને સૂર્યશક્તિથી વીજળી મળશે.

આ પ્રસંગે અતિથિ વિશેષ પદે ઉપસ્થિત મહંસુલ મંત્રી આનંદીબેન પટેલે જણાવ્યું હતું કે કુદરતી પ્રકોપના સામના ભેરૂ વિવશતા કે લાચારીના બદલે પુનઃસન અને મેનેજમેન્ટ દ્વારા ગુજરાતને પોતાની ખુમારી બતાવી છે. પ્રત્યેક જિલ્લાઓમાં રૂ. ૨૫૦ કરોડના ખર્ચે મહત્તી રેસ્ક્યુ એપરેટસ તથા તેના સાધનોની સુવિધા ઉપલબ્ધ

બનાવાઈ છે. નેશનલ ડિઝાસ્ટર મેનેજમેન્ટ ઓથોરિટીના સભ્ય બી. ભટ્ટાચાર્યે જણાવ્યું કે જીએસડીએમએ એ આપતિ વ્યવસ્થાપનનું એક આદર્શ રોલ મોડલ સમગ્ર દેશને પૂરું પાડ્યું છે આફતને અવસરમાં પહોંચાવીને સમાજ શક્તિની ભક્ષતા નિર્માણનું સંવર્ધન કરવામા જ નહીં પરંતુ ભવિષ્યની આફતની વિનાશક અસરોનું નિવારણ કરવાની આગોતરા અભિગમ માટે ગુજરાતે પહેલ કરી છે અને માનવ જાતને નવો રાહ બતાવ્યો છે જ્યારે આઈએસઆરના ડિરેક્ટર જનરલ ડી. બી. કે. રસ્તોગીએ એડવાન્સ ઈન અર્થકનેટ સાયન્સ વિષયક ઈન્ટરનેશનલ સિમ્પોઝિયમની ભૂમિકા આપતા જણાવ્યું હતું કે આ પરિસ્થિતિમાં પાંચ દિવસ સુધી વિશ્વના ૨૪ દેશોના વૈજ્ઞાનિકો તજજ્ઞો સંમિત ભારતમાંથી ૧૫૦ વિજ્ઞાનો ભૂકંપ જેવી આફતોમાંથી આપતિ નિવારણ અંગેના વૈજ્ઞાનિક ઉપાયોનું સામૂહિક મંથન કરશે.

૧૦૬ દિવસમાં ૧૫ એકર જમીનમાં રૂ. ૧૫ કરોડના ખર્ચે તૈયાર થયેલ ૧ એમડબલ્યુ સોલાર પાવરપ્લાન્ટ

Annexure 13

Preliminary survey of Dholavira Harappan site for Archeoseismological investigation

25-26 January 2011

Conducated by

Institute of Seismological Research, Raisan Gandhinagar

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Background:

Kachchh rift basin in the north is bounded by the Nagar Parkar Fault and in the south by the North Kathiawar Fault. In the south basin consist of uplifted Kachchh Mainland, towards NE by Wagad uplift and towards north by Great Rann (Biswas, 1987, Malik et al., 1999 and GSI, 2000). Six major uplifts Pachcham, Khadir and Bela islands, Chorarahills, Wagad upliftment and Mainland Kachchh occur along the E-W trending faults.

To know the present tectonic status of the Khadir Island a preliminary survey has been conducted in the Harappan settlement of Dholavira (Fig. 1). One of the most prominent and largest archeological site of Dholavira belong to the Indus Valley Civilization. This Island is surrounded by the Rann of Kachchh. The Harappan site was occupied in different stages from 2650 BCE to 1450 BCE. Excavation of site was initiated in 1990 by Archeological Survey of India under the direction of Dr. R. S. Bisht. The excavation brought to light the sophisticated urban planning and architecture, and unearthed large numbers of antiquities such as seals, beads, animal bones, gold, silver, terracotta ornaments and vessels linked to Mesopotamia. Excavation of site during 1990- 2005 has proved that during the third millennium BCE area has visited by at least three major seismic episodes. These seismic events supposed to be the responsible for the changes in the planning as well as in cultural form and finally for the abandon of the settlement (Fig. 2).



Figure 1. (a); location of study area, (b); Excavated plan of Harappan settlment.

Archeoseismological Status

It is well known that a major earthquake struck in the region of Kachchh, Gujarat on 26th January 2001 causing wide spread devastation of life and property. Similar large magnitude earthquake had also occurred during the historic past in 1819. Harrappan site of Dholavira is the one of the most beautiful site excavated and preserved by ASI. Geologically the site is located almost on the top of active Island Belt Fault (IBF). Archeological record also reveals 3 major earthquakes, which brought out extensive damage to the Harrappan civilization. According to the Dr. R. S. Bisht first earthquake occurred towards the close of the cultural Stage II, possibly sometime after 2900 BCE.

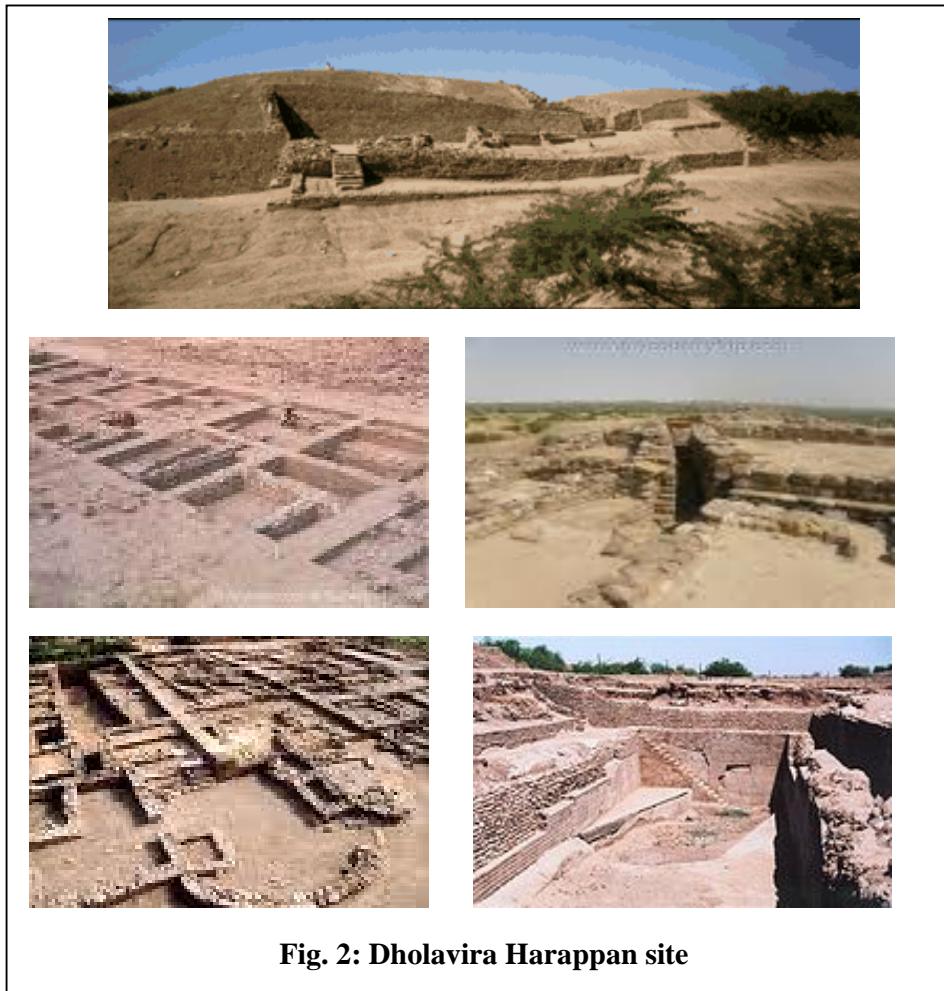


Fig. 2: Dholavira Harappan site

Earthquake signatures are found in the occupational strata, deposited against the fortification wall of the first two stages, second earthquake was far more devastating. It brought about end of Stage IIIA, sometime around 2700 BCE, when the mature Harappans were yet to arrive on the scene. A large chunk, measuring 7.60 m wide, of which 2.80 m height, collapsed and slipped away and third earthquake resulted in the end of the mature Harappan's stay at the site, somewhere during 2100-2000 BCE. It caused tremendous damage to the gates of the castle. Particularly, the north gate retained the impact in the form of tilting and arching of the enormously thick inner walls while the outer ones seem to have collapsed at the first tremor itself.

Geological observations:

Dholavira is situated on the Khadir Island and towards north is separated from the Great Rann of Kachchh by E - W trending south dipping Island Belt Fault. It has been found that the northern part of this island is uplifted along the IBF and it is represented by east west trending hill ranges (Fig. 3). Structurally the Harappan site of Dholavira is situated on the hanging wall of IBF and faulting is visible through the north facing escarpments (Fig. 4a, b). While lithologically, this part is occupied by the presence of gently south dipping Jurassic sandstone (Fig. 4c).



Figure3: upliftment along the IBF is represented by E–W trending hill range

The rocks are highly fractured towards the northern part in the investigated area and showing 2 to 3 sets of joint pattern (Fig. 4d), indicating the fault zone of IBF. Joint one (J1) is showing N- S trend, joint 2 (J2) is showing NW-SE trend and joint 3 (J3) is showing E-W trend. Based upon these joint patterns a detail structural mapping of the area can reveal the stress pattern of the area.



Figure 4: (a) and (b); Photographs show north facing escarpment of IBF, (c); gently south dipping bed of Jurassic sandstone, (d); three sets of joint pattern clearly visible towards the fault zone of IBF.

Observations at Harappan site:

During the present preliminary survey of the area it has been found that there are many signatures present, which can be used for the archeoseismological study of the site. These are as follows:

- a. **North Gate:** the north gate of citadel is showing clockwise rotation of pillars, which may be caused by the earthquake. The signature of earthquake in the gate clearly visible and indicated by the tilting of gate (Fig. 5). Interestingly the adjoining wall of this gate also showing the cracks in the wall (Fig. 6) and according to the persons (working at Dholavira site) that these cracks are widening (Fig.7). During the investigation it has been suggested that a GPR survey of this site will provide a better sub-surface picture and also that would be helpful to check that the tilting and cracks are present beneath or not. The movement or widening of cracks can be monitored with the help of a local GPS survey.



Figure 5: Signature of past earthquake is visible in the form of tilting and rotation of pillars in the North gate of citadel.



Figure 6: widening of cracks on the wall of north gate.

b. East Gate: During the preliminary survey of the citadel it has been found that the mid stone on the south wall of the east gate is showing some kind of sinking towards the centre. The bricks of western side of this stone are showing tilting towards east while the bricks of eastern side are showing dipping towards west (Fig. 7). Although, the north wall of this gate is showing bulging and tilting, this is matching with the trend of south wall of this gate. This clearly reveals some movement towards centre of the stone.

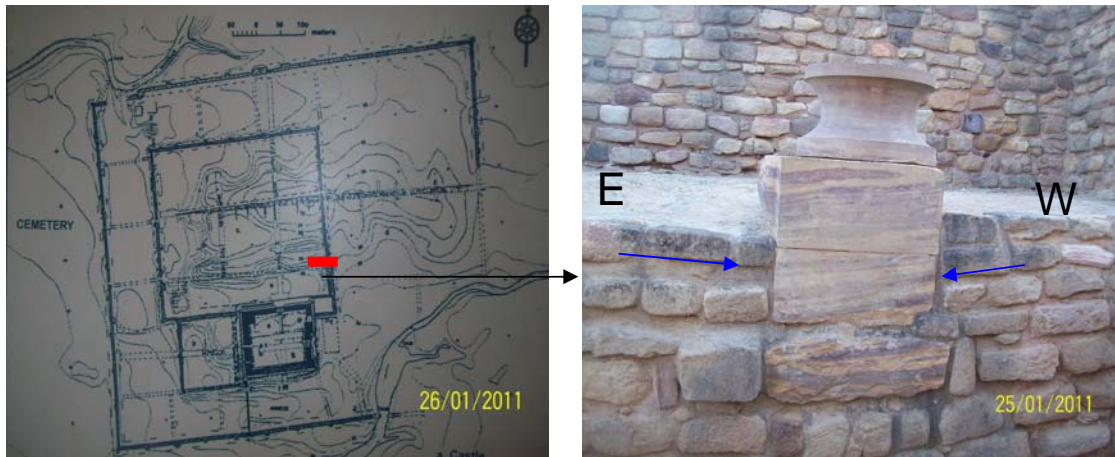


Figure 7: (a); location of east gate in the excavated plan and (b); tilting of bricks towards the mid-stone of the wall.

- c. Near water tank in the south:** the wall of water tank is showing bulging kind of nature, in this place according to the Dr. R. S. Bisht during the excavation he found vertical cracks in the deposited sediment and these cracks were showing a linear trend. During the survey it has been found that the overlying quaternary sediment is showing tilting of gravels (Fig. 8). This site is covered by a 10 – 15 m. thick cover of quaternary sediment and it is suggested that trenching after the GPR survey can reveals the details. The alignment of gravels indicating some tectonic movement is responsible for the tilting and vertical cracks at site. A fresh north – south oriented trench will provide the better understanding of this linear trend. The OSL dating of the sediment of this trench will exactly provide the date of event.



Figure 8: tilting and alignment of gravels suggest some tectonic correlation of the site.

On the basis of this preliminary survey of the Khadir Island and Harappan site it has been suggested that a detail structural mapping of the area is needed. This mapping will be helpful to calculate the stress pattern of the area. Along with a total station survey a local GPS survey of the Khadir Island is helpful to know the local movement of the Island and also provide the present bulging and tilting rate of the citadel. The palaeoseismological investigation through trenching will also be helpful to exactly date the event.

Photographs Annexure 14







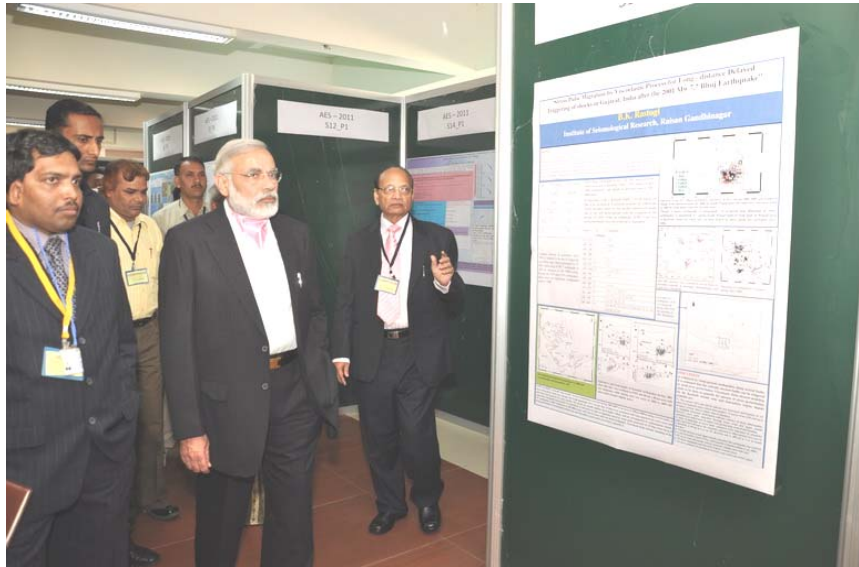






















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