BSDMA

KNOW DISASTER

Inaugural Issue

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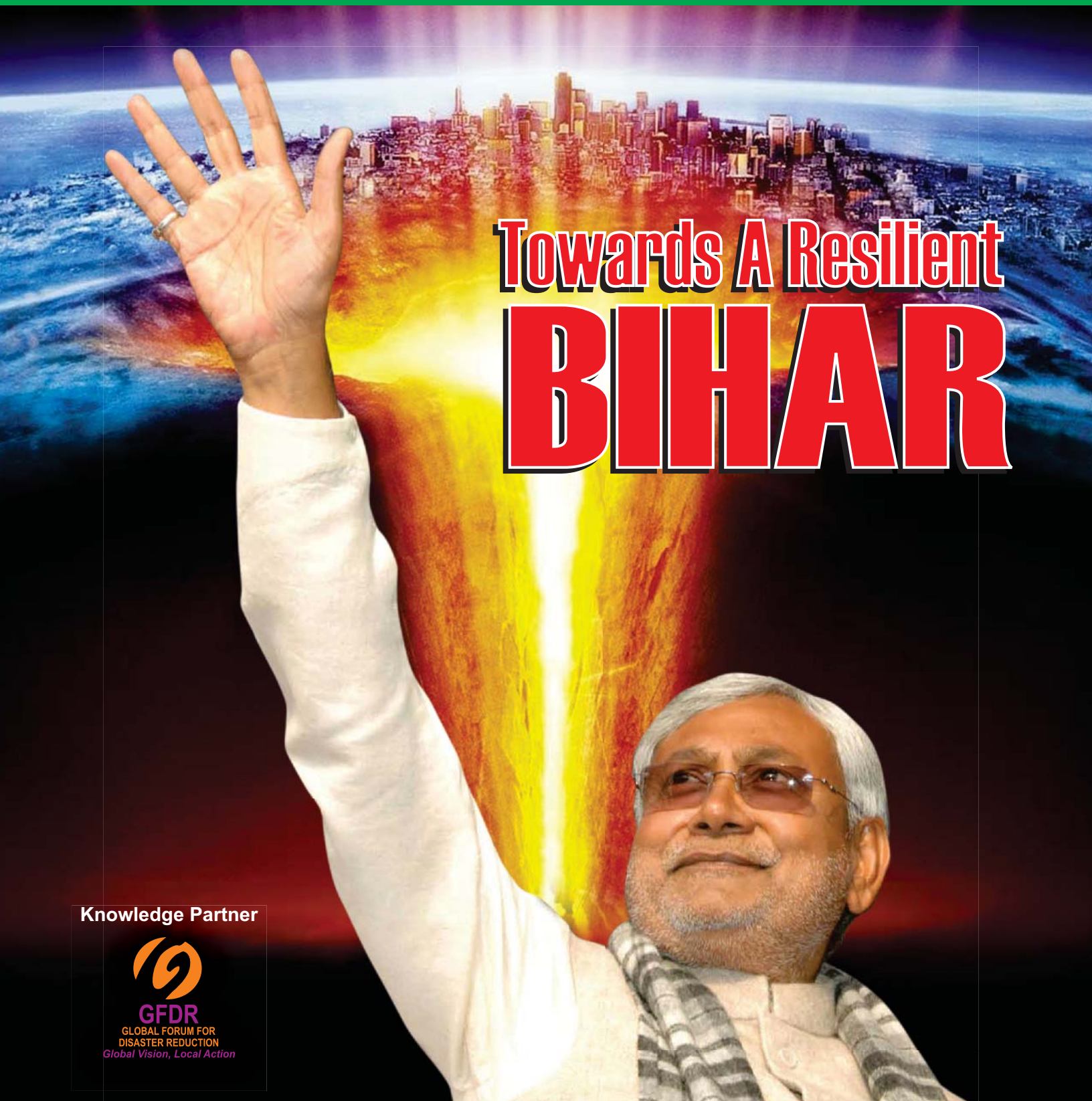
March-May 2012

SALUTING THE SPIRIT OF RESILIENCE



Towards A Resilient BIHAR

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towards resilient risk reduction...

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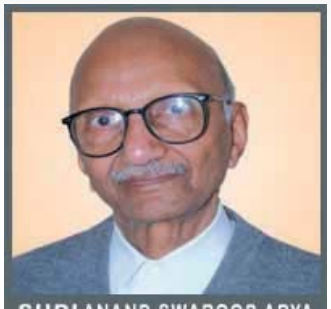

SHRI ANAND SWAROOP ARYA
MEMBER

The Team BSDMA is quite formidable; the Chief Minister as its Chairman lends dynamism. Anil Kumar Sinha, IAS, Ex-former Executive Director of the National Centre for Disaster Management, Programme Advisor & Head of Secretariat at UNDP, brings with him immense experience. Dr. Renu Kumari Kshwaha, Minister for Industry and Disaster Management, gives the organization the right direction. She wants disaster preparedness to be taught in schools like in Japan. Shiv Chandra Jha and Prof. A.S. Arya are extremely knowledgeable in the matters of disaster management. The Team BSDMA knows what its mission is; recently, BSDMA observed 'Earthquake Safety Week 2012' by organizing disaster preparedness and awareness programmes across the state. It also marked the remembrance of the worst-ever earthquake that hit Bihar and Nepal in 1934, which measured 8.0 on the Richter's Scale, killed more than 30,000 people and destroyed scores of towns and villages. The world famous Nalanda University is said to have been destroyed during one such disaster in the distant past. Against the backdrop of such a long history of disasters, Bihar's Team BSDMA's agenda is full. No wonder, Team BSDMA is on alert 24X7. ■

In This Issue

Founder Chairman
Late Shri R.K. Prasad

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New Media Communication Pvt. Ltd.
In association with BSDMA, Patna

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Printed & Published by
Satya Swaroop and Printed at: Jayant Printery 352/54, Girgaum Road, Thakurdwar, Mumbai 400002 and published from New Media House, 1 Akbar Villa, Near Old State Bank, Marol-Maroshi Road, Andheri (E), Mumbai - 400 059.

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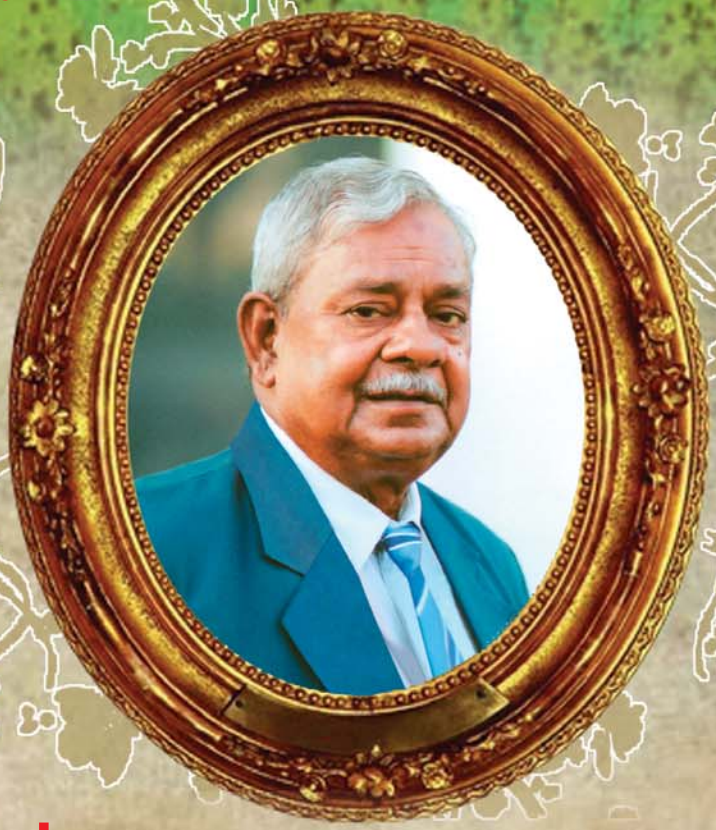


A Tribute to a Guiding Spirit

1932-2006

It has been five years since the Chairman of the New Media group Shri Ram Krishna Prasad passed into the realm of eternity on 12 October 2006. Team New Media pays a tribute to their guiding spirit.

We are forever grateful to you for your spiritual guidance and we feel your vibrant presence in our midst all the time. You have taught us that humility is the greatest virtue in this egoistic world.

Guide us to realize our collective dreams so that we could proudly watch, with our heads held high, our organisation shine like an eternal star in the global media firmament. We have never felt the void since your legacy continues to guide us in every way.

On the occasion of the launch of KNOW DISASTER magazine, we at New Media pay the most respectful tribute to Shri Prasad, reiterating our vow to cherish the values he had helped us inculcate. We pledge to continue our march towards accomplishing the goals Shri Prasad had envisioned for New Media, India's largest bilateral trade magazine publishing house.

EDITORIAL

Dear Reader,

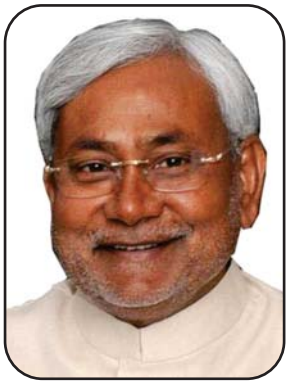
Greetings. New Media is happy to present a new magazine titled **'KNOW DISASTER'**, a bilingual magazine in English and Hindi, dedicated to the issues of disaster management, risk reduction and recovery, brought out in association with Bihar State Disaster Management Authority (BSDMA). Bihar is one of the Indian states, which is perennially affected by floods. Hence, disaster preparedness is essential to retain economic gains in a state that has just entered the path of progress after languishing in economic backwardness for decades. Bihar's Chief Minister Nitish Kumar carried out exemplary relief work when the state was hit by heavy floods in recent years. Recognizing the need for creating awareness among the public about disaster preparedness New Media has taken this initiative to publish **KNOW DISASTER**, which will disseminate information to all stakeholders across the board. The focus of the inaugural issue of **KNOW DISASTER** is on earthquakes, which revive the memories of the worst-ever such disaster in Indian history that hit the state in 1934. The issue carries the Do's and the Don'ts issued by the National Disaster Management Authority (NDMA) in the event of a disaster. The issue carries a remarkable study by Prof. Sandip Roy of the IIT – Bombay on the Bhuj earthquake that rocked Gujarat. In the same context, Rajib Shaw of Kyoto University, Japan, offers an analysis of the March 2011 earthquake-cum-tsunami that shook Japan. There is an article by Dr. Anand Swarup Arya, Professor Emeritus, IIT-Roorkee and Member, BSDMA on everything you wish to know about earthquakes. There is a report from the archives on the 1934 Bihar earthquake. Earthquakes make a deep impact upon children's psyche say the authors – N.M. Prusty, CDMASS-A Strategy Centre and Sumaiya Rafiq Zargar. There is an interesting report by Animal Relief Coalition for Haiti (ARCH), how the organization went about treating animals in the aftermath of the earthquake that devastated Haiti in January 2010. The Hindi section contains interesting, illustrated articles dealing with the issues of protection and safety in the earthquake-prone zones. There is section for the children, illustrated in the manner of a comic book to educate them on all issues concerning an earthquake. We trust the inaugural number of **KNOW DISASTER**, will serve the purpose of educating and enlightening all the stakeholders involved in disaster management and risk reduction.

Wish you happy reading

Satya Swaroop

Managing Editor

Message



सत्यमेव जयते

Nitish Kumar

Chief Minister of Bihar

I am glad to note that New Media is coming out with a magazine titled "**KNOW DISASTER**", dedicated exclusively to disaster reduction and risk recovery. As global warming and climate change are of universal concern, local issues such as floods perennially cause loss of lives and damage to property.

With regard to Bihar, I have initiated various measures to contain floods occurring in the state from time to time. Under the UNDP and UNICEF initiatives, we have also been educating the people of the state on the disaster preparedness. In this context, I feel **KNOW DISASTER** is a very timely initiative, which will help us inform and educate the public as well as enlighten the policy makers on the best practices prevailing the world over in disaster preparedness and mitigation.

I would also like to emphasize here the aspect of ensuring business continuity in the face of disasters, which if hindered, could derail the country's economic growth.

Nitish Kumar

Message

सत्यमेव जयते

Dr. Renu Kumari Kushwaha

Minister for Industry & Disaster Management

I am happy to learn that New Media is bringing out a magazine called **KNOW DISASTER**, dedicated to the issues of disaster preparedness, risk reduction and recovery. I sincerely believe that there is need for such a magazine to help create awareness among the public, especially school children.

In fact, I have been advocating the proposal to include the subject of Disaster Management as a subject in the curriculum, right from the primary schools. In fact, disaster preparedness and management, should be given the same importance as is given to activities such as NCC.

I trust the magazine – **KNOW DISASTER** – as its title indicates, will help the Bihar State Disaster Management Authority to help sensitize the public about the issues of disaster preparedness as in the case of Japan.

I commend New Media for their initiative in bringing out the magazine **KNOW DISASTER**, which I am sure will meet the expectations of its discerning readers.

Dr. Renu Kumari Kushwaha

Foreword

Dear Reader,

Greetings.

Bihar is among the most disaster prone states of India. Bihar State Disaster Management Authority (BSDMA), a statutory body headed by the Hon' ble Chief Minister, is gearing up to meet any contingency. Currently, its major focus is on creating state –wide public awareness and education among all sections of the society along with long-term capacity building and risk reduction. Many measures are being undertaken to address both structural and non-structural mitigation. With regard to floods affecting the state every year, the Bihar Government has taken up the matter with the government of India and Nepal, from where five rivers that flow into the state originate.

Against the above background, a magazine titled **KNOW DISASTER,** being brought out by New Media and dedicated exclusively to disaster risk reduction and recovery and promotion of the best practices prevailing the world over, is highly welcome.

I also note that New Media, India's largest bilateral trade magazine publishing house, also has the expertise of holding successfully global conferences on disaster management. Hence, I trust the new publication – **KNOW DISASTER**- will turn out to be a rich source of information and help assist BSDMA in spreading its message in the area of disaster recovery and risk reduction.

The Authority is glad to be associated with **KNOW DISASTER** and I wish the magazine a grand success.

Anil K. Sinha

Vice Chairman, BSDMA

For Protection Before, During & After Earthquake Shaking

National Disaster Management Authority (NDMA) as the apex body is mandated to lay down the policies, plans and guidelines for Disaster Management to ensure timely and effective response to disasters. Some time back, NDMA released its Guidelines on Management of Earthquakes. It also issued the Do's and Don't's. Following is the list.

What to Do Before an Earthquake

• Repair deep plaster cracks in ceilings and foundations. Get expert advice if there are signs of structural defects.

• Anchor overhead lighting fixtures to the ceiling.

• Follow BIS codes relevant to your area for building standards

• Fasten shelves securely to walls.

• Place large or heavy objects on lower shelves.

• Store breakable items such as bottled foods, glass, and china in low, closed cabinets with latches.

• Hang heavy items such as pictures and mirrors away from beds, settees, and anywhere people sit.

• Brace overhead light and fan fixtures.

• Repair defective electrical wiring and leaky gas connections. These are potential fire risks.

• Secure a water heater, LPG cylinder etc., by strapping it to the wall studs and bolting it to the floor.

• Store weed killers, pesticides, and flammable products securely in closed cabinets with latches and on bottom shelves.

• Identify safe places indoors and outdoors.
• Under strong dining table, bed
• Against an inside wall

• Away from where glass could shatter around windows, mirrors, pictures, or where heavy bookcases or other heavy furniture could fall over

• In the open, away from buildings, trees, telephone and electrical lines, flyovers, bridges

• Educate yourself and family members

• Know emergency telephone numbers (doctor, hospital, police, etc)

• Have a disaster emergency kit ready

• Battery operated torch
• Extra batteries
• Battery operated radio
• First aid kit and manual
• Emergency food (dry items) and water (packed and sealed)
• Candles and matches in a waterproof container
• Knife
• Chlorine tablets or powdered water purifiers
• Can opener.
• Essential medicines
• Cash and credit cards
• Thick ropes and cords
• Sturdy shoes

Develop an emergency communication plan

• In case family members are separated from one another during an earthquake (a real possibility during the day when adults are at work and children are at school), develop a plan for reuniting after the disaster.

• Ask an out-of-state relative or friend to serve as the 'family contact' After a disaster, it's often easier to call long distance. Make sure everyone in the family knows the name, address, and phone number of the contact person.

Help your community get ready

• Publish a special section in your local newspaper with emergency information on earthquakes. Localize the information by printing the phone numbers of local emergency services offices and hospitals.

• Conduct a week-long series on locating hazards in the home.

• Work with local emergency services and officials to prepare special reports for people with mobility impairments on what to do during an earthquake.

• Provide tips on conducting earthquake drills in the home.

• Interview representatives of the gas, electric, and water companies about shutting off utilities.
Work together in your community to apply your knowledge to building codes, retrofitting programmes, hazard hunts, and neighborhood and family emergency plans.

What to Do during an Earthquake

Stay as safe as possible during an earthquake. Be aware that some earthquakes are actually foreshocks and a larger earthquake might occur. Minimize your movements to a few steps to a nearby safe place and stay indoors until the shaking has stopped and you are sure exiting is safe.If indoors

• DROP to the ground; take COVER by getting under a sturdy table or other piece of furniture; and HOLD ON until the shaking stops. If there isn't a table or desk near you, cover your face and head with your arms and crouch in an inside corner of the building.

• Protect yourself by staying under the lintel of an inner door, in the corner of a room, under a table or even under a bed.

• Stay away from glass, windows, outside doors and walls, and anything that could fall, such as lighting fixtures or furniture.

• 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 that could fall. In that case, move to the nearest safe place.

• Use a doorway for shelter only if it is in close proximity to you and if you know it is a strongly supported, loadbearing doorway.

• Stay inside until the shaking stops and it is safe to go outside. Research has shown that most injuries occur when people inside buildings attempt to move to a different location inside the building or try to leave.

• Be aware that the electricity may go out or the sprinkler systems or fire alarms may turn on.

• DO NOT use the elevators.If outdoors

• Stay there.

• Move away from buildings, trees, streetlights, and utility wires.

• Once in the open, stay there until the shaking stops. The greatest danger exists directly outside buildings, at exits, and alongside exterior walls. Most earthquake-related casualties result from collapsing walls, flying glass, and falling objects.If in a moving vehicle

• Stop as quickly as safety permits and stay in the vehicle. Avoid stopping near or under buildings, trees, overpasses, and utility wires.

• Proceed cautiously once the earthquake has stopped. Avoid roads, bridges, or ramps that might have been damaged by the earthquake.If trapped under debris

• Do not light a match.

• Do not move about or kick up dust.

• Cover your mouth with a handkerchief or clothing.

• Tap on a pipe or wall so rescuers can locate you. Use a whistle if one is available. Shout only as a last resort. Shouting can cause you to inhale dangerous amounts of dust.After an earthquake

• Keep calm, switch on the radio/TV and obey any instructions you hear on it.

• Keep away from beaches and low banks of rivers. Huge waves may sweep in.

• Expect aftershocks. Be prepared.

• Turn off the water, gas and electricity.

• Do not smoke and do not light matches or use a cigarette lighter. Do not turn on switches. There may be gas leaks or short-circuits.

• Use a torch.

• If there is a fire, try to put it out. If you cannot, call the fire brigade.

• If people are seriously injured, do not move them unless they are in danger.

• Immediately clean up any inflammable products that may have spilled (alcohol, paint, etc).

• If you know that people have been buried, tell the rescue teams. Do not rush and do not worsen the situation of injured persons or your own situation.

• Avoid places where there are loose electric wires and do not touch any metal object in contact with them.

• Do not drink water from open containers without having examined it and filtered it through a sieve, a filter or an ordinary clean cloth.

• If your home is badly damaged, you will have to leave it. Collect water containers, food, and ordinary and special medicines (for persons with heart complaints, diabetes, etc.)

• Do not re-enter badly damaged buildings and do not go near damaged structures. ■

IIT Bombay: An Encounter with Earthquakes

By Prof. Sandip Roy, IIT - Bombay

What a game of chance human life is! That ought to teach men not to persecute men: for, while a few sanctimonious humbugs are burning a few fanatics, the earth opens and swallows up all alike. Voltaire, on the Great Lisbon Earthquake (1755).

26 January, 2001. Groping within our fading memories, many of us today would perhaps only recall one more day of rebirth of our republic, of tricolours fluttering in the wind, of all the pageantry, and fanfare of celebration. But a pause and a deeper look, and the earth opens up in a horrific yawn!

That's exactly what happened on that morning at 8.46 am at Bhuj as a terrible earthquake laid it to a mangled, shapeless waste within seconds. Measuring 7.7 on the Richter scale, its tremors were felt even at Kolkata and Chennai, both over 1500 kilometers away. Beyond the epicenter, it had the towns of Anjar, Bhachau, Rapar, and nearly 8000 villages of Gujarat in its grip. Nearly 4 million concrete and adobe houses were razed to the ground, and about 10 millions more were damaged. Over 20,000 lost their lives, while the count of those injured and rendered homeless surged beyond 15 millions! And eyewitness accounts of the carnage that slowly poured into the national media revealed a drama more potent than a Dantesque vision. In short, it all came as one more traumatic reminder that of all of Nature's furies that threaten human life, earthquakes remain one of the most violent and unpredictable.

Because of near total destruction of communication links with the Bhuj epicentral region, the initial relief work could only be managed by the local people. Help from governmental and other agencies arrived much later.

But following the initial shock of the encounter, assistance and donations began to pour in from across the nation, as well as from across the world. Yet, despite such a spontaneous reaction on all fronts, the progress in rescue work was slow and painful. The 'system', it seemed, had been caught off-guard once again!

IIT Bombay: The Early One

Nevertheless, pace of the rehabilitation did pick up eventually with the marshalling of expert help, and other rescue resources. The Indian Institute of Technology, Bombay, was amongst the earliest to pick up the gauntlet. Pooling in the expertise of several faculty members, it joined the recovery work immediately, to become associated with virtually all the arms of the rehabilitative task. Since then, teams of faculty from IIT Bombay have made repeated visits to the affected area in order to identify the causes behind the large-scale destruction of residential, industrial and other civil structures (such as bridges), as well as to assess the safety of those damaged partially. To revive the later back to a usable state, a number of engineering alternatives have been evaluated and employed. Complementing these, are a number of research programs for developing earthquake-resistant structures, now underway. In addition, satellite-based systems for detection of further ground motions - over the local geologic region - have been installed, and their measurements are being monitored continuously. And finally, the faculty-expertise has been enlisted

by the government authorities for guiding further improvement of the relevant design codes, and for formulation of disaster management plans. All taken together, IIT Bombay has, in its own way, contributed to the process of restoring normalcy to the quake-affected area, and returning it to productive activities. This involvement continues to date.

Of Earthquakes and Crystal balls!

The Bhuj incident has revealed once again what is one of the most quirky features of earthquakes: their unpredictability. Although it is now recognized that the cause of earthquakes is intimately related to the universal mobility of the earth's surface, our understanding of the forces responsible for it remains incomplete, making any forecasting difficult. No scientist has ever predicted an earthquake; nor, as our current understanding suggests, may it be possible in the foreseeable future. The popular belief that earthquakes can be predicted by observing changes in the behavior of animals have not been found to be reliable by scientists. Given the powers of modern science, and that the subject has compelled a great deal of systematic study, this failure might seem odd. But then, there may be nothing new in this. In all of history, in spite of its achievements, science has been shadowed by doubts about its ability to predict the future, especially of natural and social events.

During the 18th century 'Age of Reason', the grand successes of Newtonian mechanics had led to a dominant Weltanschauung that the world was both benign and - being set to a clockwork precision wholly predictable. But the great 1755 earthquake of Lisbon, which claimed nearly 60,000 lives, dealt a bitter jolt to this faith, even if temporarily. It prompted the great French writer-philosopher Voltaire to mock the 'reason' of science in his famous satire Candide. In a letter to a friend, he wrote.

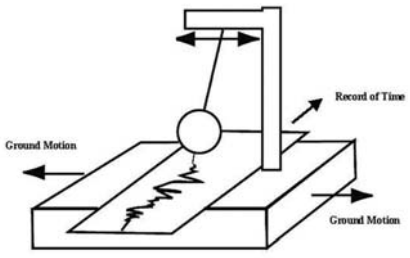
This is indeed a cruel piece of natural philosophy! We shall find it difficult to discover how the laws of movement operates in such a fearful disaster in the best of all possible worlds. Two and a half century later, despite our vastly improved understanding of earthquakes, we are still grappling with its unpredictability! Writing in a 1999 issue of Nature, Ian Main of the University of Edinburgh put the situation across in a mind-twister: 'The null hypothesis to be disproved is not that earthquakes are predictable, but that they are not.'

Nevertheless, based as it is on the mechanics of large-scale rock movements, a certain dependent nature of the earthquake process, seems evident. There are a number of crucial pointers to this. For one, earthquakes are usually localized in space, i.e., along plate boundaries (i.e. fault-lines), where they tend to recur in time. Further, the range and magnitude of the frequencies of ground vibrations induced by earthquakes do not appear to depend strongly on the scale of the latter. These features, amongst others, have been interpreted to suggest that the processes underlying earthquakes are not entirely random. Nevertheless, the exact prediction of a single earthquake event in space and time remains difficult! The emphasis of contemporary research has, thus, shifted rather towards basic understanding of the mechanism of earthquakes, and the estimation of their probable scale. The experience of the major earthquakes of the last decade for instance, that in Iran in 1990, or at Kobe in 1995 - have only reinforced doubts about our ability to predict them, and about whether such an attempt can be a realistic scientific goal at all! There is, however, a silvery lining to the cloud; based on earthquake data collected over long time in a given region, we can, at least, predict the probability of earthquakes, and therefore, achieve a certain degree of preparedness. For example, one estimate indicates that the probability of a major earthquake in the San Francisco bay area (one of the most vulnerable regions of the world), over the next 30 years is about 70%!

Dragons, Toads and Satellites

The calculation of such a chance is basically founded on our ability to detect and record earthquakes and their magnitudes. The simplest method of detection utilizes what is known as a seismometer. Such a device - which can be an amateur's delight - records patterns of ground-motions over time, yielding a seismogram. This is the basic data that scientists use to study subterranean and surface waves that are produced during earthquakes. The earliest such seismometer was invented by the Chinese philosopher Chang Heng in AD 132. This was a large urn with eight dragon-heads corresponding to the eight principle directions of the compass. During an earthquake one (or more) of the dragons released a ball(s) from its mouth into a toad-head below, suggesting the direction from which the earthquake arrived.

The beginnings of modern seismology are, of course, located in the latter



Generation of a Seismograph in a Seismometer
Source: http://earthquake.usgs.gov

half of the 19th century. Thomas Oldham, a British seismologist, and the first superintendent of the Geological Survey of India, pioneered the scientific investigation of earthquakes, with his 1883 publication, Catalogues of Indian Earthquakes from Earliest Times to the End of AD 1869. His systematic account of the great earthquake of June 12, 1897, in Assam, that was felt over 1,750,000 square miles, represent the founding exercise of modern seismology.

Today, the methods employed globally in seismic studies are varied and have attained a high degree of refinement. Amongst others, these include satellite-based techniques such as Global Positioning Systems (GPS), Electronic Distance Measuring (EDM), and Differential Synthetic Aperture radar Interferometry (SAR).These techniques, complemented by others, are being currently employed by two independent IIT Bombay teams - headed by Prof. Madhav Kulkarni and Dr K S Rao - to map and monitor deformations of the crustal layers around the Bhuj epicenter. These continued measurements would, in the long run, help detect critical surface deformations in the geologic region of Kuchchh - which has been the victim of nearly a dozen earthquakes over the last century! Suitably analyzed, such data could help forewarn the possibility of an earthquake. This may be the closest approach one could make to a prediction.

GPS instrument setup newly, Bhuj District

But one last point: the use of such a 'precursor' to anticipate a subsequent earthquake event has its own hazards, and can very well put even a well-meaning expert into the shoes of the boy who cried wolf! As one report points out, in China nearly thirty such alarms have forced costly emergency measures to be put in action prematurely and, of course falsely - in the last few years!

Softening the Blow

Because of the inescapable lacuna in exactly anticipating an earthquake, and the human impossibility of preventing it, the world over the practical emphasis in earthquake study has, thus, increasingly focused on mitigating its consequences. Such mitigation requires a multi-pronged approach involving understanding the causes of and effects of earthquakes, estimation of the probabilistic risk, improvement of earthquake-resistant design and construction techniques, and most importantly, promotion of use of earthquake-safe policies and planning.

Indeed, as recent historical experiences across the world indicate, the extent of damage wrought is directly dependent on the level of awareness and use of earthquake-safe policies within the society. The present author has himself encountered, on several occasions, a common question posed by the lay public: Why is it that earthquakes in our country seem so much more destructive than those in the western parts of the world? It is easy to dismiss this as a subjective sentiment. But it is beyond doubt today that poor design and construction of buildings, along with high population density are obvious invitations to larger loss of life and property. As Profs. Ravi Sinha and Alok Goyal, both of whom have been actively engaged in the Bhuj rehabilitative work, note in an in-house report:

The main cause of the very high death toll due to the earthquake is that most constructions in the region are non-engineered that collapsed early during the incident. In the epicentral region, several villages experienced destruction of 100% houses, all of which were made of local materials and had poor earthquake resistance. Only 10% structures in Kuchchh are engineered constructions, but most of them do not comply with IS code requirements. During this earthquake, a very large number of engineered structures, such as reinforced concrete buildings, also suffered catastrophic collapse resulting in high casualty because of their poor design and construction.

The report goes on to document and analyze the type of damage caused to each variety of construction, and links their inherent vulnerability to the lack of observance of proper standards. The situation is clearly laden with an irony given that India was among the first few countries to adopt detailed codes for earthquake-resistant designs and construction methods!

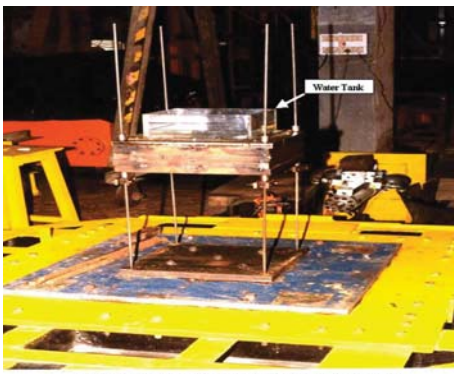
However, the reassuring part of it is that such codes are in a state of continual improvement. This is also an activity with which IIT Bombay has had a long engagement. It has involved integrating the engineering lessons from the major earthquakes, especially of the last decade; and, as Prof. Ravi Sinha observes, in translating state-of-the-art technical knowledge into practical and feasible specifications.

Mastering the 'Twist and Shake'

A positive worldwide trend today is a tightening of the governmental regulatory noose, so as to force use of

earthquake-resistant designs, and methods of construction. While this will bring cheer to the consumers, it is not always happy news for the construction business. The act of dovetailing into a changed regulation, especially during an ongoing project, can be fraught with delays and so, cost over-runs. While, in other instances, one may have to rework an existing structure in to order to comply with newer codes. Across the world, these dilemmas have compelled a search for technical solutions that are easy to adopt, and are cheap. Essentially, the aim here is to come up with techniques that can control or reduce the vibrations that earthquakes cause in buildings and eventually destroy them. Some of the research programs now underway at IIT Bombay, headed by Profs. Pradipta Banerji and R Jangid, basically makes use of variations of this principle. Such earthquake-resistant designs essentially make use of the knowledge of the amplitude, frequency-composition and the duration of the ground waves released during an earthquake.

Many systems for improving earthquake resistance of structures have been put to use, especially in Japan and the USA. But most of them are rather expensive for use here. We are trying to develop some simple systems that would be cost-effective for our country, says Prof Banerji. Some examples of these include small water tanks as liquid-dampers on buildings, and low-cost rubber bearings to isolate and dampen vibrations in bridges and other structures. In general, techniques for controlling vibrations make use of both passive and active strategies. In the former case, typically an extra structural 'appendage' is incorporated in the main, functional structure, with a design that can balance out the additional forces arising due to an earthquake. The second technique, on



Developmental Setup for Water Tank Damper

the other hand, employs a system that nullifies seismic disturbances intelligently, through changes in its shape and/or structural properties. Technically speaking, such an active response is enabled by a control algorithm. The great advantage of these new techniques is that they allow modular designs, which have wider applicability. More importantly, for the business, they provide an optimal way to adapt to evolving regulations, says Prof Banerji.

Retrofitted Home Anyone?

Currently, such earthquake-resistant design of structures remain at the center of much vigorous research and development, and encouraging their use has become part of governmental policies. Nevertheless, it is doubtful if they can provide a total immunity against earthquakes. There is always an uncertainty about the actual magnitude of the forces that may prevail during an earthquake. Also, accommodating new generation dampers in structures that are already built, or are old, is not always easy or practicable. This has led to the parallel emergence of retrofitting techniques, i.e., incorporating newly designed parts in earthquake-damaged structures to make them reusable. For the IIT Bombay group headed by Prof Abhijit Mukherjee, the Bhuj incident turned out to be almost a textbook case, crying out for a retrofitting program.

Most of the damaged structures, especially in the urban regions, were built in RCC.But apart from faulty construction, many them had been weakened considerably by age. This was yet another reason behind the endemic destruction that occurred. In rescuing those which had survived complete damage, we considered a number of alternative repair materials. And polymers reinforced with glass fibres proved ideal' says Prof Mukherjee. It is perhaps the first attempt ever in India to use this material for retrofitting, a substitute that boasts of some of the best possible structural properties that one could hope for. Moreover, the cost of such repair is less than that with conventional methods. Besides, all the new ingredients are available in this country, Prof Mukherjee adds.

Managing the Aftermath!

What a game of chance human life is! That ought to teach men not to persecute men: for, while a few sanctimonious humbugs are burning a few fanatics, the earth opens and swallows up all alike. Voltaire, on the Great Lisbon Earthquake (1755).

26 January, 2001. Groping within our fading memories, many of us today would perhaps only recall one more day of rebirth of our republic, of tricolours fluttering in the wind, of all the pageantry, and fanfare of celebration. But a pause and a deeper look, and the earth opens up in a horrific yawn!

That's exactly what happened on that morning at 8.46 am at Bhuj as a terrible earthquake laid it to a mangled, shapeless waste within seconds. Measuring 7.7 on the Richter scale, its tremors were felt even at Kolkata and Chennai, both over 1500 kilometers away. Beyond the epicenter, it had the towns of Anjar, Bhachau, Rapar, and nearly 8000 villages of Gujarat in its grip. Nearly 4

million concrete and adobe houses were razed to the ground, and about 10 millions more were damaged. Over 20,000 lost their lives, while the count of those injured and rendered homeless surged beyond 15 millions! And eyewitness accounts of the carnage that slowly poured into the national media revealed a drama more potent than a Dantesque vision. In short, it all came as one more traumatic reminder that of all of Nature's furies that threaten human life, earthquakes remain one of the most violent and unpredictable.

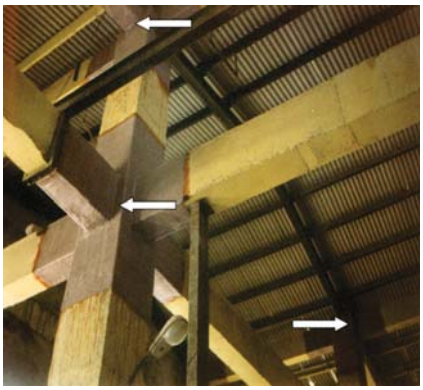
Because of near total destruction of communication links with the Bhuj epicentral region, the initial relief work could only be managed by the local people. Help from governmental and other agencies arrived much later. But following the initial shock of the encounter, assistance and donations began to pour in from across the nation, as well as from across the world. Yet, despite such a spontaneous reaction on all fronts, the progress in rescue work was slow and painful. The 'system', it seemed, had been caught off-guard once again!

IIT Bombay: The Early One

Nevertheless, pace of the rehabilitation did pick up eventually with the marshalling of expert help, and other rescue resources. The Indian Institute of Technology, Bombay, was amongst the earliest to pick up the gauntlet. Pooling in the expertise of several faculty members, it joined the recovery work immediately, to become associated with virtually all the arms of the rehabilitative task. Since then, teams of faculty from IIT Bombay have made repeated visits to the affected area in order to identify the causes behind the large-scale destruction of residential, industrial and other civil structures (such as bridges), as well as to assess the safety of those damaged partially. To revive the later back to a usable state, a number of engineering alternatives have been evaluated and employed. Complementing these, are a number of research programs for developing earthquake-resistant structures, now underway. In addition, satellite-based systems for detection of further ground motions - over the local geologic region - have been installed, and their measurements are being monitored continuously. And finally, the faculty-expertise has been enlisted by the government authorities for guiding further improvement of the relevant design codes, and for formulation of disaster management plans. All taken together, IIT Bombay has, in its own way, contributed to the process of restoring normalcy to the quake-affected area, and returning it to productive activities. This involvement continues to date.

Of Earthquakes and Crystal balls!

The Bhuj incident has revealed once again what is one of the most quirky features of earthquakes: their unpredictability. Although it is now recognized that the cause of earthquakes is intimately related to the universal mobility of the earth's surface, our understanding of the forces responsible for it remains incomplete, making any forecasting difficult. No scientist has ever predicted an earthquake; nor, as our current understanding suggests, may it be possible in the foreseeable future.



The popular belief that earthquakes can be predicted by observing changes in the behavior of animals have not been found to be reliable by scientists. Given the powers of modern science, and that the subject has compelled a great deal of systematic study, this failure might seem odd. But then, there may be nothing new in this. In all of history, in spite of its achievements, science has been shadowed by doubts about its ability to predict the future, especially of natural and social events.

During the 18th century 'Age of Reason', the grand successes of Newtonian mechanics had led to a dominant Weltanschauung that the world was both benign and - being set to a clockwork precision wholly predictable. But the great 1755 earthquake of Lisbon, which claimed nearly 60,000 lives, dealt a bitter jolt to this faith, even if temporarily. It prompted the great French writer-philosopher Voltaire to mock the 'reason' of science in his famous satire Candide. In a letter to a friend, he wrote.

This is indeed a cruel piece of natural philosophy! We shall find it difficult to discover how the laws of movement operates in such a fearful disaster in the best of all possible worlds. Two and a half century later, despite our vastly improved understanding of earthquakes, we are still grappling with its unpredictability! Writing in a 1999 issue of Nature, Ian Main of the University of Edinburgh put the situation across in a mind-twister: 'The null hypothesis to be disproved is not that earthquakes are predictable, but that they are not.'

Nevertheless, based as it is on the mechanics of large-scale rock movements, a certain dependent nature of the earthquake process, seems evident. There are a number of crucial pointers to this. For one,

earthquakes are usually localized in space, i.e., along plate boundaries (i.e. fault-lines), where they tend to recur in time. Further, the range and magnitude of the frequencies of ground vibrations induced by earthquakes do not appear to depend strongly on the scale of the latter. These features, amongst others, have been interpreted to suggest that the processes underlying earthquakes are not entirely random. Nevertheless, the exact prediction of a single earthquake event in space and time remains difficult! The emphasis of contemporary research has, thus, shifted rather towards basic understanding of the mechanism of earthquakes, and the estimation of their probable scale. The experience of the major earthquakes of the last decade for instance, that in Iran in 1990, or at Kobe in 1995 - have only reinforced doubts about our ability to predict them, and about whether such an attempt can be a realistic scientific goal at all! There is, however, a silvery lining to the cloud; based on earthquake data collected over long time in a given region, we can, at least, predict the probability of earthquakes, and therefore, achieve a certain degree of preparedness. For example, one estimate indicates that the probability of a major earthquake in the San Francisco bay area (one of the most vulnerable regions of the world), over the next 30 years is about 70%!

Dragons, Toads and Satellites

The calculation of such a chance is basically founded on our ability to detect and record earthquakes and their magnitudes. The simplest method of detection utilizes what is known as a seismometer. Such a device - which can be an amateur's delight - records patterns of ground-motions over time, yielding a seismogram. This is the basic data that scientists use to study subterranean and surface waves that are produced during earthquakes. The earliest such seismometer was invented by the Chinese philosopher Chang Heng in AD 132. This was a large urn with eight dragon-heads corresponding to the eight principle directions of the compass. During an earthquake one (or more) of the dragons released a ball(s) from its mouth into a toad-head below, suggesting the direction from which the earthquake arrived.

The beginnings of modern seismology are, of course, located in the latter half of the 19th century. Thomas Oldham, a British seismologist, and the first superintendent of the Geological Survey of India, pioneered the scientific investigation of earthquakes, with his 1883 publication, Catalogues of Indian Earthquakes from Earliest Times to the End of AD 1869. His systematic account of the great earthquake of June 12, 1897, in Assam, that was felt over 1,750,000 square miles, represent the founding exercise of modern seismology.

Today, the methods employed globally in seismic studies are varied and have attained a high degree of refinement. Amongst others, these include satellite-based techniques such as Global Positioning Systems (GPS), Electronic Distance Measuring (EDM), and Differential Synthetic Aperture radar Interferometry (SAR).These techniques, complemented by others, are being currently employed by two independent IIT Bombay teams - headed by Prof. Madhav Kulkarni and Dr K S Rao - to map and monitor deformations of the crustal layers around the Bhuj epicenter. These continued measurements would, in the long run, help detect critical surface deformations in the geologic region of Kuchchh - which has been the victim of nearly a dozen earthquakes over the last century! Suitably analyzed, such data could help forewarn the possibility of an earthquake. This may be the closest approach one could make to a prediction.

But one last point: the use of such a 'precursor' to anticipate a subsequent earthquake event has its own hazards, and can very well put even a well-meaning expert into the shoes of the boy who cried wolf! As one report points out, in China nearly thirty such alarms have forced costly emergency measures to be put in action prematurely and, of course falsely - in the last few years!

Softening the Blow

Because of the inescapable lacuna in exactly anticipating an earthquake, and the human impossibility of preventing it, the world over the practical emphasis in earthquake study has, thus, increasingly focused on mitigating its consequences. Such mitigation requires a multi-pronged approach involving understanding the causes of and effects of earthquakes, estimation of the probabilistic risk, improvement of earthquake-resistant design and construction techniques, and most importantly, promotion of use of earthquake-safe policies and planning.

Indeed, as recent historical experiences across the world indicate, the extent of damage wrought is directly dependent on the level of awareness and use of earthquake-safe policies within the society. The present author has himself encountered, on several occasions, a common question posed by the lay public: Why is it that earthquakes in our country seem so much more destructive than those in the western parts of the world? It is easy to dismiss this as a subjective sentiment. But it is beyond doubt today that poor design and construction of buildings, along

with high population density are obvious invitations to larger loss of life and property. As Profs. Ravi Sinha and Alok Goyal, both of whom have been actively engaged in the Bhuj rehabilitative work, note in an in-house report:

The main cause of the very high death toll due to the earthquake is that most constructions in the region are non-engineered that collapsed early during the incident. In the epicentral region, several villages experienced destruction of 100% houses, all of which were made of local materials and had poor earthquake resistance. Only 10% structures in Kuchchh are engineered constructions, but most of them do not comply with IS code requirements. During this earthquake, a very large number of engineered structures, such as reinforced concrete buildings, also suffered catastrophic collapse resulting in high casualty because of their poor design and construction.

The report goes on to document and analyze the type of damage caused to each variety of construction, and links their inherent vulnerability to the lack of observance of proper standards. The situation is clearly laden with an irony given that India was among the first few countries to adopt detailed codes for earthquake-resistant designs and construction methods!

However, the reassuring part of it is that such codes are in a state of continual improvement. This is also an activity with which IIT Bombay has had a long engagement. It has involved integrating the engineering lessons from the major earthquakes, especially of the last decade; and, as Prof. Ravi Sinha observes, in translating state-of-the-art technical knowledge into practical and feasible specifications.

Mastering the 'Twist and Shake'

A positive worldwide trend today is a tightening of the governmental regulatory noose, so as to force use of earthquake-resistant designs, and methods of construction. While this will bring cheer to the consumers, it is not always happy news for the construction business. The act of dovetailing into a changed regulation, especially during an ongoing project, can be fraught with delays and so, cost over-runs. While, in other instances, one may have to rework an existing structure in to order to comply with newer codes. Across the world, these dilemmas have compelled a search for technical solutions that are easy to adopt, and are cheap. Essentially, the aim here is to come up with techniques that can control or reduce the vibrations that earthquakes cause in buildings and eventually destroy them. Some of the research programs now underway at IIT Bombay, headed by Profs. Pradipta Banerji and R Jangid, basically makes use of variations of this principle. Such earthquake-resistant designs essentially make use of the knowledge of the amplitude, frequency-composition and the duration of the ground waves released during an earthquake.

Pancake collapse was common due to violation of IS code provisions

Many systems for improving earthquake resistance of structures have been put to use, especially in Japan and the USA. But most of them are rather expensive for use here. We are trying to develop some simple systems that would be cost-effective for our country, says Prof Banerji. Some examples of these include small water tanks as liquid-dampers on buildings, and low-cost rubber bearings to isolate and dampen vibrations in bridges and other structures. In general, techniques for controlling vibrations make use of both passive and active strategies. In the former case, typically an extra structural 'appendage' is incorporated in the main, functional structure, with a design that can balance out the additional forces arising due to an earthquake. The second technique, on the other hand, employs a system that nullifies seismic disturbances intelligently, through changes in its shape and/or structural properties. Technically speaking, such an active response is enabled by a control algorithm. The great advantage of these new techniques is that they allow modular designs, which have wider applicability. More importantly, for the business, they provide an optimal way to adapt to evolving regulations, says Prof Banerji.

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design of structures remain at the center of much vigorous research and development, and encouraging their use has become part of governmental policies. Nevertheless, it is doubtful if they can provide a total immunity against earthquakes. There is always an uncertainty about the actual magnitude of the forces that may prevail during an earthquake. Also, accommodating new generation dampers in structures that are already built, or are old, is not always easy or practicable. This has led to the parallel emergence of retrofitting techniques, i.e., incorporating newly designed parts in earthquake-damaged structures to make them reusable. For the IIT Bombay group headed by Prof Abhijit Mukherjee, the Bhuj incident turned out to be almost a textbook case, crying out for a retrofitting program.

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Managing the Aftermath!

The varied approaches to countering earthquake hazards reviewed here of course comprise a list that is at best partial. At IIT Bombay, as elsewhere in the world, the current research in this field makes for a veritable spectrum, ranging from complex theory to painstaking empirical explorations. A relatively random sampling of some of the research interests of the faculty at IIT Bombay would include Ground Motion Characterisation; Artificial Neural Networks in Earthquake Engineering; Vulnerability Evaluation of Structures and Facilities; Base Isolation for Earthquake-Resistant Design; Stochastic Earthquake Analysis, Space VLBI for Geodesy and Geodynamics, and Seismology.

Such studies will no doubt enrich the understanding of the 'mysteries' of earthquakes, and will continue to empower us against them. Still, in the larger domain of the practical, the inexorable reality about earthquakes cannot be forgotten: that they can, and will continue to strike us in future, without warning! Thus, once overcome by one, a process of quick recovery from it must be ensured; that should restore the essential facilities to normalcy, and minimize loss of life. Therefore, one needs to piece together a realistic plan for prompt rehabilitation, as well as keep the necessary safety-resources in a state of readiness. For instance, as a recent U.S. Geological Survey report informs, it is one of its crucial mandates 'to produce regional assessments of earthquake hazards in conjunction with state and local government to assist government and civil defense officials in planning for disaster recovery.'

While the Indian government has been involved in the process of formulating such disaster management plans for some time, the Bhuj incident has pressed in a sense of urgency. The government of Gujarat has recently enlisted the help of IIT-Bombay faculty, Profs. Ravi Sinha and Alok Goyal, to expand and strengthen such a plan. In particular, this faculty team is also advising the governmental apex bodies on framing the right kind of development policies; that takes in to account the lessons of recent earthquakes. Broadly, these involve the following: creating master plans for the damaged urban areas, evolving repair and strengthening policies for both government and privately owned structures, and imparting training to technical staff. The need for such a systematic approach is long overdue. For, as Prof Goyal points out, One of the main causes of large scale losses in any disaster in India is due to inadequacies in government policy framework for development and growth. And herein may be a comic twist to the tale though a hapless one as it is often found that government's own programs and policies significantly contribute to increasing regional vulnerability!

What lies ahead?

One of the deep-seated ironies of managing hazards either natural or man made - is that the real proof of one's commitment to reducing or controlling them is revealed only during an actual disaster! Through the performance - or its lack - of the systems designed to be counteractive. The Bhuj incident has certainly exposed our 'Achilles' heel' in restraining the effects of an upheaval of such proportions. And has thrown up an abundance of technical and administrative challenges which need to addressed with both zeal and speed.

The task ahead for the community of earthquake scientists and engineers of the country are arduous and manifold, and demands the tighter intercalation of the sciences of geology and seismology, with earthquake engineering. Although it is beyond us to be able to deflect an earthquake, we can employ the newer tools provided by science and engineering to reduce

its destructiveness. As we have seen, science can now identify, with considerable accuracy, where earthquakes are likely to occur and what forces they will produce; while, engineering provides design and construction techniques so that buildings and other structures can survive those forces. Finally, all that knowledge can be used to refine and strengthen the codes and regulations towards the greater benefit of the community.

Some Governance, Perhaps?

But beyond this lies a task daunting yet, and that is for the government to accomplish. Which is to summon its will to administer and enforce its regulations unflinchingly. Though an obvious responsibility, it is here that the lacuna is most visible! Some of the acute observations made by Profs Sinha and Goyal in their recent report (alluded to earlier) are revealing of the impasse that the government seems to be caught in: The design codes are only technical guidelines issued by the Bureau of Indian Standards of Government of India, and their compliance is not mandatory since enactment of building codes is a State subject. In most states, compliance with the IS codes is mandatory for government structures; however very few urban authorities have adopted IS codes for private constructions. Even when compliance with IS codes is mandatory, enforcement of the code specification is often found lacking and the codes are violated with impunity. The process is further complicated since, as per the prevalent development control rules in most urban areas and Council of Architect guidelines, the structural engineers do not assume any legal responsibility of their designs. As a result, there is inadequate involvement of qualified engineers in most building design and construction activity in the country, except for some major urban areas, and scant attention is paid towards structure quality and seismic safety.

Clearly then, the government will need to focus on its aims more decisively, if it is to defuse future disasters, especially of the scale of Bhuj or beyond. As it turns out, the state of seismic health of the Himalayan belt(rated as zone IV, only next to highest hazard category) as reported in a recent issue of Science, is anything but good news! Ploughing through a mass of historical data, geophysicists Roger Bilham and Peter Molnar of the University of Colorado, and Vinod Gaur of the Indian Institute for Astrophysics, concludes gloomily that, Large earthquake in the Himalayan belt, that could imperil several major cities of India (along with those of Bangaladesh, Bhutan and Nepal) are long overdue!

The Indian subcontinent was an island, which crashed into the Asian mass nearly 40 million years ago, creating the Himalayan range. The basal rock-body of the range still flexes and slides in localized, sudden lurches during large earthquakes. Newer, satellite based measurements reveal that the larger fraction of the forces produced by the regional tectonic plates pressing against each other is concentrated in a relatively small area between India and Southern Tibet. And, as the authors add ominously, Earthquakes represent the main release valve for this accumulated convergence pressure! They foresee the possibility of earthquakes of Richter magnitude 8.1-8.3, which is beyond that of the Bhuj incident. More than 20,000 lives were claimed by it. Now, nearly 50 million people live in the sub-Himalayan range. And, as historical records show, major earthquakes are capable of decimating over 10% of a region's population.

The Story of the Sliding Rock!

To risk some poetic license, it is such stupendous odds, which often seems to make all human effort against such an adversity of Nature, resemble the mythical labours of Sisyphus the king of ancient Corinth who was condemned by the gods to roll a heavy rock up a hill, only to have it roll down again as it neared the top! According to one tradition, Sisyphus was no better than a plunderous highwayman. But if one were to believe Homer, Sisyphus was the wisest and most prudent of mortals. His heroism lay in having defeated and imprisoned Death, for which the enraged gods had sent him his unique punishment. But he shouldered his task stoically, knowing that his only ally was his persistence. As the French novelist-philosopher, Albert Camus wrote:

I leave Sisyphus at the foot of the mountain! One always finds one's burden again. But Sisyphus teaches the higher fidelity that negates the gods and raises rocks. He too concludes that all is well. The struggle itself toward the heights is enough to fill a man's heart. One must imagine Sisyphus happy.

Acknowledgements: Special thanks are due to Profs Ravi Sinha and Alok Goyal whose observations were of invaluable help in composing this article. The author also thanks all other faculty members who responded to his demands with promptness and patience.

East Japan Earthquake and Tsunami: Initial Lessons

Rajib Shaw, Kyoto University, Japan

Introduction

A massive earthquake of magnitude of 9.0 occurred Friday 11 March, off the Pacific coast of the northeastern part of the Japanese main land (Tohoku Region), causing devastating damages. The Japan Meteorological Agency (JMA) named this earthquake "The 2011 off the Pacific coast of Tohoku Earthquake" (JMA, 2011). In addition, this earthquake caused the large scale of tsunami, which hit Tohoku and Kanto Region. Because of the earthquake and tsunami, more than 15,000 people were died and the number of the missing persons is more than 3,500 (NPA, 2011).

Overview of the Earthquake and Tsunami

Table 1 and 2 and Figure 1 are the overview of the earthquake and tsunami provided by JMA (2011).

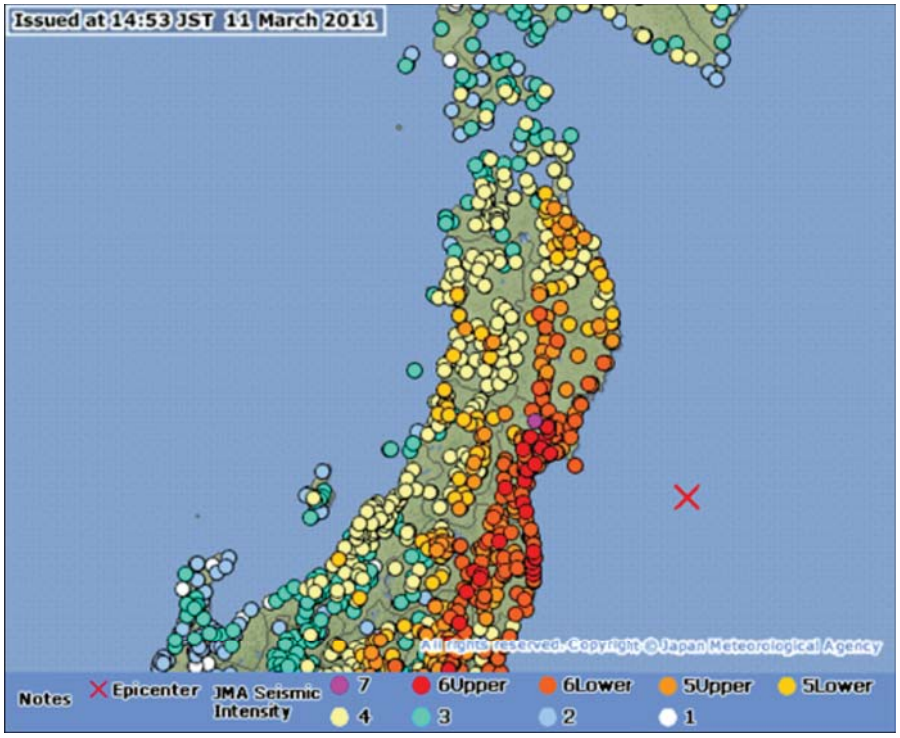


Table 1 Earthquake Details	
Date and Time	11 March 2011 14:46 JST (05:46 UTC)
Magnitude	9.0 (interim value; the largest earthquake recorded in Japan)
Hypocenter	N38.1, E142.9 (130km ESE off Ojika Peninsula) Depth 24km (interim value)
JMA Seismic Intensity (refer to Figure 1)	7 (Max): Kurihara City of Miyagi Prefecture 6+: 28 cities and towns (including Wakuya Town, Tome City, Osaki City, Natori City) in Miyagi, Fukushima, Ibaraki, and Tochigi Prefectures 6- or weaker: Observed nationwide from Hokkaido to Kyushu

Tsunami Damages

Tsunami hit the prefectures of Iwate and Miyagi in different time. The closest one was around 22 to 25 minutes from the earthquake, and the farthest was almost one hour after the earthquake. On an average, it was 30-40 minutes time lag between the earthquake and the tsunami hitting the coast. Several field surveys were conducted by the author in the affected areas. Following are some of the damages observed in selected cities during the field survey.

Iwate Prefecture
Miyako-shi (including Taro area)

Taro area was damaged by the tsunami

Table 2. Tsunami warning and advisories [Source: JMA 2011]

Date and Time	Action	Number of Areas (Total : 66 areas)		
		Warning (3m or higher)	Warning (Up to 2m)	Advisory (About 0.5m)
11 March 2011 14:49 JST (05:49 UTC)	Issued	3	5	15
11 March 2011 15:14 JST (06:14 UTC)	Increased	6	7	23
11 March 2011 15:33 JST (06:33 UTC)	Increased	10	24	11
11 March 2011 16:08 JST (07:08 UTC)	Increased	17	19	17
11 March 2011 18:47 JST (09:47 UTC)	Increased	17	19	18
11 March 2011 21:35 JST (12:35 UTC)	Increased	17	22	19
11 March 2011 22:53 JST (13:53 UTC)	Increased	18	21	19
12 March 2011 03:20 JST (18:20 UTC)	Increased	18	21	27
12 March 2011 13:50 JST (04:50 UTC)	Decreased	4	11	26
12 March 2011 20:20 JST (11:20 UTC)	Decreased	0	4	21
13 March 2011 07:30 JST (22:30 UTC)	Decreased	0	0	15
13 March 2011 17:58 JST (08:58 UTC)	Lifted	0	0	0

caused by Syowa-Sanriku Earthquake, which occurred in 1933. After the event, 10-meater dikes are built to prevent damages by future tsunami. But the area had devastating damages by the tsunami this time. Figure 3 shows the dike and damages. Figure 4 shows the buildings which survived from the tsunami because of the dikes. Most of the houses and buildings are flowed and collapsed by the tsunami. But some buildings are remained. From this result, it was identified that the dikes could not prevent tsunami damages but that they are effective to some extent.

Figure 5 and 6 show fishes which had been kept in storage. These fishes planed to be carried to other places but these were damaged because of the tsunami. Therefore, the fishes will be disposed. The survey team visited the Miyako Fishery Association to understand damages and needs on fisheries. The main works of member of the association are fishing and aquaculture. Because of the tsunami, many members lost their own fish boat. In addition, it is impossible to do aquaculture because the members lost equipments for it and many kinds of things including rubble, car, waste, and others were flowed to sea. Therefore, the members can not start their work. Other problem is insurance. All members did not purchase insurance for their own properties. If such member starts their works, they have to purchase equipments or ships by themselves. In addition, most of fisheries are elderly. According to the interview, the average age of the fisheries is around 60 years old. It was expected that it is seriously difficult to recover fishery industry in Miyako without any external help.

Kamaishi city

In Kamaishi, there are two tsunami evacuation building officially decided by the local government for evacuation. The survey team visited one of them shown in Figure 7. The number of stories of this building is

Figure 2. Tsunami hitting the Iwa te [left] and Miyagi [right]prefectures [Source: National Geographic 2011]

Figure 3. Damages by the tsunami in Taro area

Figure 4. Buildings which survived during the tsunami in Taro area

Figure 5. Damages to frozen fish in Miyako area

Figure 6. Destroyed truck is lifted from sea in Miyako

Figure 7. Evacuation building [8 storey building with evacuation more than 4th floor]

eight. The first to third floors are used for offices and fourth to eighth floors are residential spaces. There are also road near this building for evacuation in tsunami situation. One of inhabitant told the tsunami came to the third floor of this building. Local residents were evacuated in this building and the road temporally. In addition, he mentioned they had evacuation training 3rd March. It is expected that the training was effective for local people to re-realize the place for evacuation and how to do in tsunami situation.

In addition, he explained the situation after the tsunami. Kamaishi city was severely damaged (refer to Figure 8). Because of the tsunami, communication system like mobile

Figure 8. Damages by the tsunami [left: transported ship, and right: destroyed cars]

Figure 9 . Damaged local government building

Figure 10 . Damages by the tsunami

phone and internet were out of order for a week. Therefore, local government could not transfer information to outside area, and other local government or people outside could not know the situation of Kamaishi city. Japan Self-Defense Forces reached to the city one week after.

Rikuzen-Takata-city

This city was devastated. Figure 9 is the government office building and Figure 10 is the surrounding area of the building. The government office building is damaged and it is possible for the government to work there. It is expected that all of documents, facilities, and equipment were severely damaged. Around the government building, most of houses and building were flowed. It is difficult for local people even to find their own property or belongings.

Miyagi Prefecture Kesennuma-city

Kesennuma city is severely damaged. In this city, heavy oil was flow out and it was burned. Therefore, many burnt pieces of rubble are seen in the city (refer to Figure 11). The city was devastated. Train could not run in this area because rail tracks are also damaged (refer to Figure 11).

Yamamoto-town

Yamamoto town was heavily damaged by the tsunami because it is located in plane area (refer to Figure 12). But the government building was remained. In the first floor of the building, FM station was established. The roles of the FM station were similar to that of Ofunato city. The person who is in charge of management of FM station is a person who retired from TBC (Tohoku Broadcasting Campany). He moved to live in this town after his retiring. Because he was an announcer in TBC and had several connection due to his working history, he and local community could establish FM station. He has similar aims on FM station which the person in Ofunato city has. The FM station invites government persons including the town mayor and asks them to announce the current status and future plan for recovery and reconstruction (refer to Figure 13). As mentioned before, the person who is

Figure 11. Damages by tsunami and burnt areas

Figure 12 . Damages by the tsunami

Figure 13 . Town mayor giving message or explanation on the town through FM

in charge of the FM station emphasized the radio should be utilized for community development as well as prompt and appropriate recovery and reconstruction. Inviting the government persons is one of challenges to achieve it. Because of this challenge, FM station can make the linkage between local community and the government. He is considering that FM station would be able to be continued for community development if the local government understands the importance of FM station.

Key Initial Learning

Linking hard and soft measures [combination of infrastructures and education]: it is of extreme importance that the risk reduction measures need to be locally customized, and there needs to be a balance approach of soft [education, awareness] and hard [infrastructures] measures. Based on the local topography and physical features, this balanced mix is required to be customized.

Early warning system is effective when it is properly perceived: Although there was an early warning issued immediately, people underestimated the height of the tsunami due to repeated occurrences of earthquakes, and a "feel safe" mis-perception prevailed. Proper perception is required to take necessary actions.

Evacuation order and its effectiveness: Although the evacuation advisory and evacuation order are issued, people usually take their own judgment. To enhance the proper decision of people, it is required to mention the expected height of the tsunami in the evacuation order and advisory.

Providing different scenarios and reviewing disaster risk management plan: This disaster was extreme catastrophe, similar to that of Jogan Earthquake and Tsunami of 869 AD. To provide and explain 2-3 scenarios such as worst, medium, and light scenarios to residents is necessary and according to these scenarios, disaster management plans need to be

reviewed. After reviewing evacuation plans, it may require private lands to be designated for evacuation sites.

Investment in risk reduction pays: This disaster shows that the investment in risk reduction pays to save people's lives, both in terms of preventive and educative measures. Japan has been a role model for earthquake risk reduction, however, it needs to incorporate more multi-hazard risk reduction measures.

Dissemination of information to future generations: In several areas in the affected region, dissemination of past experiences through storytelling to the school children from the old people. This is considered as an important educational tool. In Natori, there was the memorial stone to explain the past tsunami. For future generation as well as current generation, the experiences this time should be shared.

Customized information sharing: Community FM was working effectively to transfer government information to community. The need of customized information sharing between the affected people and government is very important, and this can be done through need survey and provide need specific programs through radio.

Importance of the government building: If government building is survived, the government can start response and recovery works earlier. In addition, the government can spare spaces for community.

Volunteer coordinator: In case of big disasters, many volunteers come to affected area from outside. Volunteer coordinator is necessary to distribute proper volunteers to proper area. This should be considered as a full-time specialized work, with access and knowledge to different mapping tools and social networking system.

Reconstruction and community development: Several areas were completely devastated. Even if disaster did not happen, some of the local governments were in verge of declination, and several villages became marginal villages due to its higher aged population. Keeping this mind, it is necessary to integrate reconstruction and community development with new livelihood concept and looking at the far future, while serving the need of the near future.

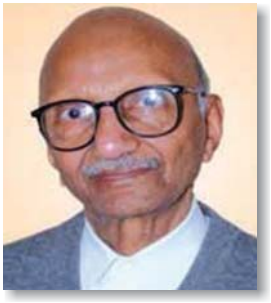
Reduction of gap between affected and non-affected people: This time, damages by earthquake is not prominent. So people in higher areas were not affected much, while the whole coastal neighborhood in the same town or village has been destroyed. In the future, it is expected that there would be a gap between the affected and non-affected people. Reconstruction process should include non-affected people as well as affected people in order to make safer and comfortable society cooperatively.

Data back up and preparedness of temporary offices of local government: If local government had data of community, they can start recovery works earlier. Local government should prepare backup data and temporally offices so that they can use when necessary.

Utilization of convenience stores: There are lots of convenience stores in Japan. We could also find several within a few kilometers distance in the remote areas of Iwate and Miyagi. We saw many people coming to buy things to the stores. The convenience stores are useful resources for exchanging information among the residents. Most people come from far places to local government offices. For some useful information for residents, it can be exchanged at convenience stores.

Sharing process of recovery and reconstruction: Many victims have lost hopes for future. This mental devastation makes people physically weak; sometimes people who had needed only a little assistance became unable to walk. The past experience of recovery and reconstruction process needs to be shown to the affected people, so that they can have some visions for future. Local governments are in difficult positions to show the steps until things are confirmed. However, precedent cases like Kobe, Niigata can be shared by the disaster experienced and non-governmental organizations which have expertise in disaster recovery and reconstruction.

Way of cooperation and understanding characters of Tohoku region: People in Tohoku (North East) region, especially Iwate Prefecture are known for reserved characters. Right after the devastated Tsunami, when evacuees who lost houses and properties, have no foods and water, they are saying to the TV camera that "there are other victims who may be worse than me, or I can survive such situation because I have experienced wars". People in the Tohoku tend not to talk much but they have firm determined idea inside. You may find them exclusiveness and cautiousness to others. This also means they have very tight relationship among themselves. Victims are helping victims. Student victims are helping the elderly. Many of those who lost parents seem to be raised by relatives, which has clear distinction from urban communities like in Kobe. The tight relationship within the relatives and communities, the silent and strong inner spirit of Tohoku need to be respected and the way of assistance from outside need to be somehow reserved and stepped back. ■



Knowing the Earthquakes

By Dr. Anand Swaroop Arya
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Member, Bihar State Disaster Management Authority

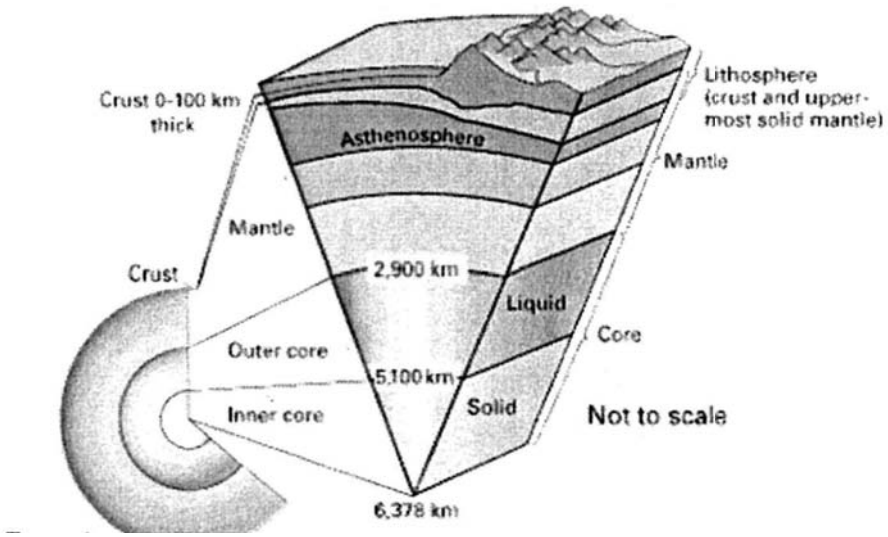
Earthquakes are one of the most destructive of natural hazards. An earthquake occurs due to sudden motion of the ground as a result of release of elastic energy in a matter of few seconds. The impact of the event is most traumatic because it affects large areas, occurs all of a sudden and is unpredictable. A major earthquake causes large scale loss of life and property and disrupts essential services such as water supply and sewerage systems, communication systems and power, as well as transport systems. Earthquakes not only destroy villages, towns and cities but the aftermath leads to destabilization of the economic and social structure of the communities.

Cause of Earthquake: An Earthquake is a series of underground shock waves and movements on the earth's surface caused by natural processes within the earth's crust. By analyzing the seismograms from many earthquakes, earth-scientists have discovered that three main layers or shells exist within the Earth (see Figure).

The Earth's outermost layer is called the **crust** which is up to about 100 km below the surface. The crust is relatively light and brittle. Most earthquakes occur within the crust.

The region just below the crust and extending all the way down to the Earth's core is called the **mantle.** The mantle, a dense, hot layer of semi-solid rock is approximately 2,900 km thick. The part of the mantle near the crust, about 50-100 km down, is especially soft and plastic. The rigid crust is thought to "float" on this layer.

Beneath the mantle is the Earth's core, which consists of a fluid **outer core and a solid inner core**. Many local circulations are taking place at different regions underneath the Earth's surface, leading to different portions of the Earth undergoing different directions of movements



along the surface.

Plate Tectonics Movements: The convective flows of Mantle material cause the Crust and some portion of the Mantle, to slide on the hot molten outer core. This sliding of Earth's mass takes place in pieces called Tectonic Plates. The surface of the Earth consists of seven major tectonic plates (North American Plate, South America Plate, Antarctic Plate, African Plate, Indo-Australian Plate, Eurasian Plate and Pacific Plate) and many smaller ones. These plates move in different directions and at different speeds from those of the neighbouring ones. Sometimes, the plate in the front is slower; then, the plate behind it comes and collides (and mountains are formed). On the other hand, sometimes two plates move away from one another by which rifts are created. In another case, two plates move side-by-side, along the same direction or in opposite directions. These three types of inter-plate interactions are the convergent, divergent and transform boundaries.

The Himalayas were formed by thrusting movements on a convergent boundary.

Elastic Rebound Theory: Rocks are made of elastic material, and so elastic strain energy is stored in them during the deformations that occur due to the tectonic plate movements. But, the material contained in rocks is also very brittle. Thus, when the rocks along a weak region in the Earth's Crust reach their crushing strength, a sudden movement takes place there on opposite sides of the fault (which is a crack in the rocks where movement has taken place). The sudden slip releases the large elastic strain energy stored in the interface rocks.

Earthquakes: The sudden slip at the fault causes a violent shaking of the Earth when large elastic strain energy is released and spreads out through seismic waves that travel through the body and along the surface of the Earth. These wave motions are called earthquakes. After the earthquake is over, the process of strain build-up at this modified interface between the rocks starts all over again causing further earthquakes over time again and again. Thus we always, live between two earthquakes.

Earthquake Vibrations: Earthquake vibrations occur in a variety of frequencies and velocities. The actual rupture process may last from a few seconds to as long as one minute for a major earthquake. Seismic waves generated by the rupture can last from several seconds to a few minutes.

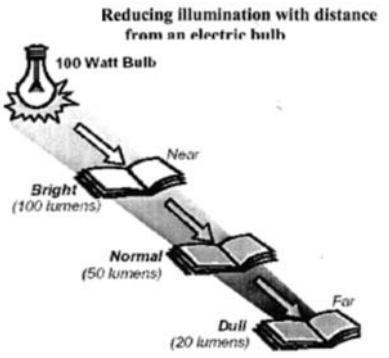
Ground shaking is caused by body waves and surface waves. **Body waves** (P and S waves) penetrate the body of the earth. Vibrating fast, P waves traveling at about 6.0 km per second, provide the initial jolt and cause buildings to vibrate in an up and down motion. S waves, traveling at about 4.0 km per second in a movement similar to a rope snapped like a whip, cause a typically sharper jolt that vibrates buildings from side to side and typically causes much greater damage. S waves are usually the most destructive. Surface waves vibrate the ground horizontally and vertically. These long-period waves cause swaying of tall buildings and slight wave motion in bodies of water even at great distances from the epicenter.

Depth of Earthquakes: Earthquake focus depth is an important factor in shaping the characteristics of the waves and the damage they inflict. The focal depth can be deep (from 300 to 700 km), intermediate (60 to 300 km) or shallow (less than 60 km). **Deep focus** earthquakes **like in Hindush area** are rarely destructive because the wave amplitude is greatly reduced by the time it reaches the surface. Shallow focus earthquakes are more common and are extremely damaging because of their close proximity to the surface.

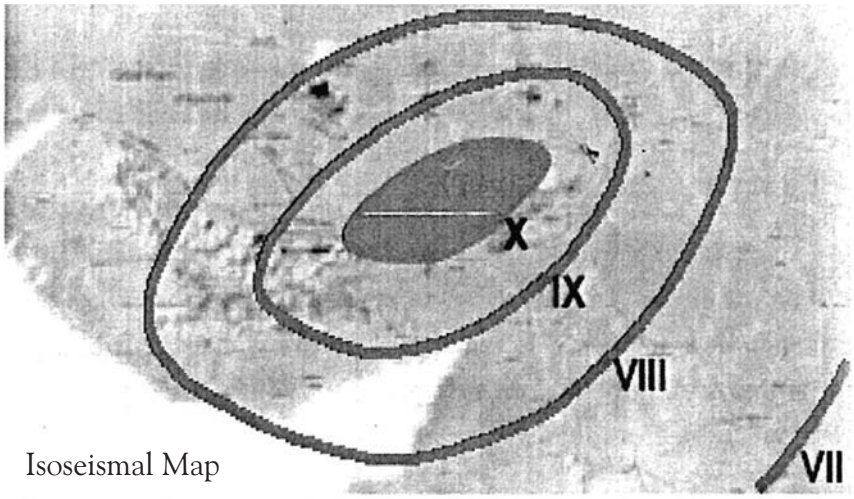
Measurement Scale: The terms focus and Epicenter define the locations of the earthquake: **Focus** is the originating earthquake source of the elastic wave inside the earth which

calls shaking of ground in all directions. **Epicenter** is the geographical point on the surface of the earth vertically above the focus of the earthquake.

Earthquakes are described by use of two distinctly different scales of measurement demonstrating **Magnitude and Intensity**. Earthquake magnitude in a measure for amount of energy released. It is determined by use of a seismograph, an instrument that continuously records ground vibrations. A scale developed by Charles Richter, a seismologist, mathematically adjusted the readings for the distance of the instrument from the **epicenter.**



Source: Earthquake Tip 3, *Learning Earthquake Design and Construction*, IITK- BMPTC.



Isoseismal Map

The **Richter scale** is logarithmic. An increase of one unit of magnitude signifies roughly an increase of 31.6 times the energy. Thus, an earthquake with a magnitude of 7.5 releases 31.6 times more energy than one with a 6.5 Magnitude, and approximately 1000 times that of a 5.5 Magnitude earthquake. A quake of Magnitude 3.0 is the smallest normally felt by humans. The largest earthquakes that have been recorded under this system are 9.25 (Alaska, 1969) 9.3 in Sumatra in 2005 and 9.5 (Chile, 1960).

Note: The energy released during the 1934, Bihar (India) earthquake of M=8.4 is about 4000 times that released by the 1945 Atom Bomb dropped on Hiroshima!

Intensity Scale: A second type of scale, the earthquake intensity scale, measures the effects of an earthquake where the effect occurs. To elaborate this distinction, consider the analogy of an electric bulb. The illumination at a location near a 100-Watt bulb is higher than that farther away from it. While the bulb releases 100 Watts of energy, the intensity of light (or illumination, measured in lumens) at a location depends on the wattage of the bulb and its distance from the bulb. Here, the size of the bulb (100-Watt) is like the Magnitude of an earthquake, and the illumination at a location is like the intensity of shaking at that location. The most widely used scale of this type is called the Modified Mercalli Scale, it expresses the intensity of earthquake effects on people, structures and the earth's surface in steps from I to XII. A second even more explicit scale, the Medvedev-Sponheuer-Karnik (MSK) Scale of 1964 is used in India.

The distribution of Intensity at different places during an earthquake is shown graphically using isoseismals, that is, lines joining places with equal seismic intensity (See Figure).

Table: Earthquakes Magnitude and Annual Occurrence

Descriptor	Magnitude	Average Annually
Great	8 and higher	1 [1]
Major	7 - 7.9	17 [2]
Strong	6 - 6.9	134 [2]
Moderate	5 - 5.9	1319 [2]
Light	4 - 4.9	13,000 (estimated)
Minor	3 - 3.9	130,000 (estimated)
Very Minor	2 - 2.9	1,300,000 (estimated)

[1] Based on observations since 1900.
[2] Based on observations since 1990.

Safety Norms for N-Power Plants to Dispel Public's Fear

Dr. P. Sekhar, Chairman, MicroTech Global Foundation & CMD, Micro Technologies India Ltd, spells out safety requirements for nuclear power plants, their long-term planning and strategy to dispel fear from the minds of the public regarding their safety. The best strategy, according to Dr. Sekhar is to take the nuclear plants below the ground or set them up in a valley to avoid any leakage of radiation.

An earthquake measuring 9.1 and a violent tsunami that hit Japan in quick succession are expected to cost the Japanese economy up to $235 billion and it will take five years for the nation to rebuild. The twin calamities of such magnitude were apparently not anticipated and the nuclear plant system was not designed to face such an eventuality. It is true that the earthquake by itself would not have caused serious damage to the reactor. Nor is it necessary that tsunami should necessarily cause such a calamity. The tsunami of 2004 caused only minor damage and short period of closure of the Kalpakkam reactor in India; nevertheless the disaster has shaken the world and raised fears and apprehensions on the planning and design of the security of nuclear power plants. The need of the hour is to think in terms of 'Confidence Building Measures' on these much needed systems. If immediate steps are not taken in this regard, we could estimate reversal of the world economic growth. If this problem is not addressed, there would be a great disillusionment among the people about nuclear power reactors and would have great psychological impact on their minds. Hence, an immediate appraisal of security standards is called for, since most of the current strategies were evolved over a period of time when understanding in this area of technology was at a nascent stage. A quick resolution of the issue will ensure that the rising chorus against use of nuclear technology is brought under control.

Survival and progress of our planet depends on the availability of safe and affordable energy. While human resources and access to raw materials for agricultural and industrial production are very crucial, it is undoubtedly the availability of energy that is most critical to progress and sustainability of the human race. The power requirements in the planet are growing exponentially and without the efficient use of safe and well regulated nuclear technology it will be difficult to meet the energy requirements of the future generations. As of 19 January 2011, in 30 countries 442 nuclear power plant units with an installed electric net capacity of about 375 GW are in operation and 65 plants with an installed capacity of 63 GW in 16 countries are under construction and this number has to increase to support future growth of the global economy.

In principle, no technology used for producing power in a large scale can be considered fully safe. Prevalent forms of power generation include hydro-electric, thermal, solar, wind, etc. Each one of them has its own bundle of problems. Unfortunately, in the case of nuclear energy the public response is clouded by the ghost of the atom bombs and constant debate of nuclear warfare scenarios. In case of nuclear safety perceptions, it is not just the total number of causalities but the very fear associated with a "nuclear holocaust mind set" that has to be met squarely.

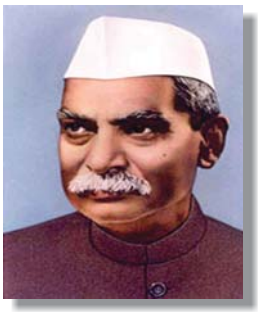
It will be totally insensitive to argue that even in the Chernobyl accident (the worst-ever nuclear disaster recorded), only twenty-eight of the emergency workers working in the most hazardous region died from acute radiation syndrome and from the general population only 15 persons who developed thyroid cancer ostensibly due to radiation inhalation died. These numbers may appear small compared to the number of persons dying in accidents or natural calamities but one cannot forget the reality that people living in affected areas are still uncertain about the

impact of radiation on their health and surroundings and are often socially and economically ostracized. It is true that is no convincing evidence of effects on human fertility and heritable diseases, nor have any effects been observed for pregnancy outcomes and on the overall health of children of exposed parents. But the social and economic impact was tremendous. Due to paucity of reliable information, people became fearful and anxious about their current and future health and perceived themselves as weak and helpless victims rather than survivors.

At the least one has to ensure that the persons in the vicinity of the nuclear plant are safe and not subjected to any direct and indirect effects of radiation. Past experience shows that these are the persons and bio species are most likely to be affected. The impact of the immediate radiation that has caused thyroid cancers will be considerably reduced if the plant is located in a valley. Most of the radiation will either be absorbed by the hills or lifted up beyond the reach of the local surroundings.

But we need to go a step further. We have to plan for minimal impact on life and property within and outside the nuclear plant environment. With dramatic development in robotics and information technology, it is imperative that operations in sensitive zones should be handled by robots remotely controlled. A more careful analysis of the post accident calamities suggests that future nuclear plans should be so designed that the critical components are deep underground. Considering the enormous cost in the design and fabrication of nuclear plants this will involve only nominal increase in the cost of the nuclear plant. Since there has been great erosion in the confidence in this blue chip and much needed technology, such additional cost will be worthwhile to bring back the public confidence in the new plants and expansion of the existing ones. Both these would ensure that any catastrophe would not lead to uncontrolled spread of radiation and the panic that follows.

We have to note that acceptance of nuclear technology by the public at large is essential for the much-needed growth and proliferation of this technology. Nuclear technology has evolved and gained through in-depth analysis of each accident and one can ensure that short falls in security management are not repeated. The International Atomic Energy Agency (IAEA) has evolved robust standards to ensure safety and shielding of the radiation and these have to be meticulously followed. But that will not be enough. Nuclear power technology can become acceptable only when it is not only safe but appears to be safe to a population tutored to look at it with fear and suspicion. This has to be achieved even if it involves additional costs which should include positioning the plants underground or in a fully surrounded valley. These may involve a fraction of the cost but the comfort it would give to the staff and civilians around would be enormous. The subsidiary effects of plants, vegetation, animals near the area and even over 100 km distance which have come under detailed scrutiny would be taken care and all the radiations even in smaller occurrence would be buried inside. The nuclear power thus generated in abundance in a safe and secure manner can boost economic growth. IAEA has to make this mandatory for new plants and for expansion of existing plants, redefining the rules as applicable to ensure their proper adherence and putting in place checks and balances and give wide publicity to remove the fear in the minds of the public through proper media exposure. ■



Recalling the Great Bihar 'Quake, 1934, that Shook India

Not many people would know that when an unprecedented earthquake hit Bihar in 1934, it was Babu Rajendra Prasad, who mobilized more relief funds for the victims than the then British rulers. This came to light during the recent Global Bihar Summit 2012, when Gopal Krishna Gandhi, grandson of the Mahatma, described Rajendra Prasad, the man who would be India's first President, as a turbine of activity during the Bihar earthquake in 1934, and raised more funds than the then Vice Roy of India.

The noted administrator and former Governor of West Bengal also recalled how Jayaprakash Narayan became a dynamo of relief during the drought of 1967 in Bihar. In the same breath, Gandhi praised Bihar Chief Minister Nitish Kumar about the way he organized relief during the unprecedented floods that paralyzed Bihar not long ago.

The 1934 Bihar earthquake was one of the worst earthquakes in India's history. Some 30,000 people were said to have died. Munger and Muzaffarpur were completely destroyed. This 8.4 magnitude earthquake occurred on 15 January 1934 at around 2:13 pm and caused widespread damage in the northern Bihar and in Nepal. The epicenter of this event was located in the eastern Nepal, about 240 km away from Kathmandu.

The areas where the most damage to life and property occurred extended from Purnea in the east to Champaran in the west - distance of nearly 320 km - and from Kathmandu in the north to Munger in the south - a distance of nearly 130 km.

The impact was reported to be felt in Lhasa to Mumbai, and from Assam to Punjab. The earthquake was so severe that in Kolkata, (around 650 km from epicenter) many buildings were damaged and the tower of St. Paul Cathedral collapsed. One noteworthy phenomenon of this earthquake was that sand and water vents appeared throughout the central vents of earthquake area. The ground around these sand fissures subsided, causing more damage.

Extensive liquefaction of the ground took place over a length of 300 km (called the Slump Belt) during 1934 Bihar-Nepal earthquake in which many structures went afloat. In Muzzafarpur, sand fissures erupted at several places in town. The wells were choked with sand while water levels in tanks became shallower due to sand deposited in the tank beds. Most of the buildings in Muzzafarpur were damaged. All the Kutcha buildings collapsed while other buildings suffered damage due to sinking and cracking of the ground.

In Sitamarhi, not a single house was left standing. In Rajnagar, near Madhubani, all the Kutcha buildings collapsed. The buildings of Darbhanga Raj, including the famous Naulakha Palace, were severely damaged. The three important towns of Nepal - Kathmandu, Bhatgaon and Patan - were severely affected and almost all the buildings collapsed. Large cracks appeared in the ground and several roads were damaged in Kathmandu. However, the temple of Pashupatinath, the guardian deity of Nepal, escaped any damage.

Mahatma Gandhi visited the state. He wrote that the Bihar earthquake was providential retribution for India's failure to eradicate untouchability. ■

Impact of Earthquakes on Children's Psyche

By NM. Prusty & Sumaiya Rafiq Zargar,
CDMASS-A, Strategy Center

Everything changes dramatically, as the seismic waves are releasing energy. Your eyes lift up above and everything starts to rumble. You move and you shiver now everything is shaking. So guess what is it? Yes! You are experiencing an earthquake!

In the human history, earthquake is ranked as a second among the deadliest natural disasters that affect humans. It has not only affected the lives of humans but also upset everything from small towns to huge metropolises. A sudden earthquake has destabilized slopes causing a landslide and in many events people have been buried alive. Some earthquakes have resulted in fires that exceeded not from simple damage to the foundation of buildings, but also reduced establishments to ash.

According to NDMA (National Disaster management Authorities) 59 percent of Indian land areas could face moderate to severe earthquakes. A recent example is an earthquake measuring 4.4 on the Richter scale that jolted Kashmir on 4 January 2012. If we go back to the period 1990 to 2006 more than 23,000 lives were lost due to six major earthquakes in India that not only affected humans or caused enormous damage to the property and public infrastructure but also caused a lot problems to the psyche of children.

During an earthquake, children in particularly find it difficult to handle the situation. The great examples are, the scandal of collapse of schools in the 2008 Sichuan earthquake in China. As many as 7,000 schoolrooms collapsed in the course of the earthquake, mostly in rural areas, reportedly leading to the death of nearly 5,000 students and injuring more than 15,000 students. Another example is the Japan earthquake in which 30 children were sitting in a classroom waiting for their parents to collect them but they were swept away by a tsunami. In Beichuan, the earthquake took 1587 students' and 214 teachers' lives from the elementary and middle schools. Similarly on 8 October 2005 About 7,669 school children died in the earthquake, According to preliminary estimates, about 18,095 students and 853 teachers and educational staff died across Pakistan's North-West Frontier Province (NWFP) and Pakistani administered Kashmir. Also super cyclone in Orissa, Gujarat earthquake, is also some of the major important events that demonstrated the mental health among the children

As a result, it is possible that they will have concerns after viewing or hearing anything about the miseries. Disasters, whether natural or man-made, cause enormous devastation and leave a trail of human agony. There is adequate knowledge amongst the professionals regarding the psycho-social and mental health consequences of disasters among the children. In fact it has been recognized that most of the disaster-affected children sitting in the class room, experience stress and emotional reaction during and after the disaster. These reactions are directly related to the psyche of a child; the greater the problem is the more severe the psychological distress and social disability.

It has been found that younger children are more susceptible to the negative consequences of multiple risks than older ones. Among children, disasters such as earthquakes, hurricanes and war, cause anxiety disorders, post traumatic

stress disorder (PTSD), panic, phobias and depression.

Two studies examined both objective and subjective impact of earthquake trauma using multivariate methods in fairly representative samples of schoolchildren, perceived threat to safety explained more variance in PTSD symptoms than objective measures of trauma severity, such as proximity to the epicenter, level of damage to home, or injury.

Studies also suggested that high prevalence of mental health problems existed among children who were directly exposed to trauma events. For example, two months after tsunami in southern Thailand, 10.5% children had PTSD and 8.4% developed depression; three months after the 1999 earthquake in Anon Louisa, Greece, 4.5% had PTSD and 13.9% had depression. Posttraumatic mental health problems in children may reach epidemic proportions, remain high for a prolonged period, and jeopardize the well-being of children populations of a large region.

It is estimated that about 90% of survivors undergo these emotional reactions immediately after the disaster. However; it reduces to 30% over a period of time with psychological reactions to stress, leading to change in behavior, relationship and physical or psycho-social situations. Continuation of the situation leads to an abnormal behavior and than to long term mental illness. Earthquake-related fears and phobic avoidance, which cause significant impairment in survivors' daily life, are pervasive in children. It has been found, over 80% of children reported fear of entering and staying in buildings, being alone, darkness, loud noises and aftershocks.

Symptoms during Earthquake

At the time earthquake, it is seen that those children who witness death and experience extreme fear had higher prevalent rates on the symptoms of anxiety; those who had physical injuries, bereavement and extreme fear had higher prevalent rates on the symptoms of depression; and those who had extreme fear had higher prevalent rates on the symptoms of PTSD.

Post Symptom after Earthquake

According to various studies social scientists have valued post disaster era as the most important phase in a disaster cycle. Symptoms like anxiety, depression and PTSD are significantly more common among students. Children who experience physical injuries and witnessed death had higher prevalence rates of anxiety symptoms, while those who had physical injuries, bereavement, witnessing death and extreme fear had higher prevalence rates on the symptoms of depression and PTS

Case Studies of PTSD.

The 8 October 2005 earthquake was one of the worst natural disasters ever to hit Kashmir by a 7.6-magnitude. The case study of a girl named Asia Shafi, 9 years old from Gharkote Odi Baramulla had witnessed the blood around her and her dead cousin. She was so terrified that the real terror of an earthquake made her unconscious. When the girl was hospitalized she was abnormal in her behavior. Later it was analyzed that the red blanket was terrifying her so much that she was assuming it as the blood of her cousin. However, she was shifted to individual room and was given treatment it took her one month to come back to normal behavior

Another case was of Yaser Habib, 11 years old of Boniyar. The boy was playing cricket and had made 98 runs. While he was batting at a score of "98" the earthquake jolted and he became unconscious. Taken to the hospital the boy was diagnosed with PTSD as he was uttering 98 all the day. It took him two months to come back to normal

Work Done by Organizations

Many organizations have extended their professional expertise and services in response to various disasters that vented their fury in the Indian subcontinent. In Lattur earthquake, Orissa super cyclone, Gujarat earthquake, Post Godhra conflict in Gujarat, South India Tsunami and the Kashmir earthquake. Government agencies like NDMA, NIDM and NIMHANS, International organizations like WHO, IFRC, CARE, UNICEF, Action Aid, Save the Children and many more national as well as local NGOs have been prompt in offering specialized psycho

social services. Based on such work over the past years several programming tools and protocols have been developed and are available for use in future such emergencies.

What is Needed Now?

Now in the country we have this proven expertise in the field of Psycho Social Care. What is needed now indeed, very importantly so, is practices and knowledge in this field should get institutionalized through government patronage. It should find a place in the government response plan and protocol, the details of agencies and experts should be inventoried and be available on public domain for use. More and more government functionaries at the state, district and block levels need to be trained and oriented on the subject. People in general should be sanitized about such mental and behavioral disorder through appropriate community awareness programs. The funding windows of the government, international development organizations, UN agencies and NGOs for capacity building initiatives should be utilized. Organizations like BSDMA should initiate proactively to bring together government non government agencies and assist and facilitate them to access the aforesaid funding windows and help the government in the institutionalization of Psycho Social Care for the benefit of the people. Institutions like NIMHANS and its Social Psychiatry faculty can be very well co-opted to such collaborative efforts. NIMHANS has the mandate to promote psycho-social well being of people in India hence they are rightly positioned to support any networked efforts in the area of psycho-social care in disasters like earthquake.

From What to be Aware

School students are most vulnerable to any disaster, because the awareness about earthquake is uncommon in many schools. It is true that number of school children have died during and after earthquakes. It indicates that our school children are not well aware of earthquakes. The prediction of time and location of earthquake is a difficult phenomenon. Since most earthquake-related injuries occur from falling objects.

So it's important to develop a safe place plan in the classroom to provide added shelter from falling debris, such as under furniture, in an interior corner or an interior hallway etc. In the event of an earthquake, it is essential that school administration and students identify and review all exits. The classroom should also be equipped with emergency supplies containing first aid supplies, blankets, flashlights, batteries, battery-powered radios, non-perishable food and bottled water is advisable. Also include plastic sheeting and duct tape for covering any openings. It is also important to keep materials like class roster, administration extensions and cell phone numbers and the emergency contact for your classroom. So that after an earthquake, an emergency contact can be done to let

Personal statement

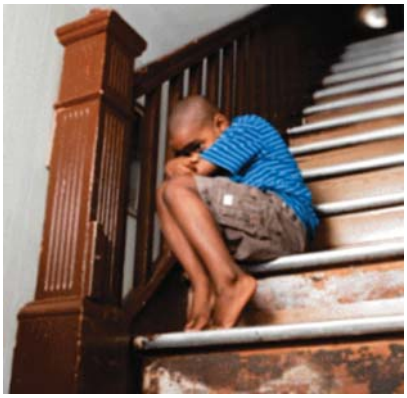
Since I am a relatively young person in a media orientated part of the world with lots of hopes from my life to achieve something big. Being young, my core aim is to increase positive outcomes for young people. So that I can be bring new prosperity, by learning to value and to attain flourishing in the formative years, kindled by positive education that the people need to choose. I have recently completed my Master in Mass Communication and also a short term course in Radio Production. Being from Kashmir I have seen lot turmoil and problems that people, mostly women, are facing. It amazes me and leads me think to do something for my land… After getting experience in media, I wanted to do something else with it. As I could not choose only media as universal form of communication to stop their sufferings and unite them, but what this something was I couldn't find, after some months my friends influenced me to work with National Development for Distarous Management and I found the possibility quite overwhelming. I am currently taking an access to work with the organization and accomplish my ambition to merge social and media sector together. Here, in this organization I am learning strategy, social responsibility and values. This job significantly is improving me in most of the areas like my communication skills, my patience, and my initiative. As a result I am trying to become more aware of my own values and beliefs whilst showing respect for all persons and their values, beliefs, cultures, goals, needs and preferences. I hope with my positive attitude and determination to improve my own quality of life I can reflect this into my practice when helping others.

Sumaiya Rafiq Zargar

them know who is in the classroom.

Enduring an Earthquake

The earthquake awareness programs should be focused to raise the level of awareness of school children more particularly during a damaging earthquake. Schools can be made safe from earthquake threats with community support, hard work, and dedication. A first step towards school earthquake safety is to educate teachers, school administrators, students. Elementary students often think that earthquakes go on for a very long time. This lesson plan demonstrates the importance of previous earthquakes for future preparedness. Therefore, it's very important to provide students a chance to learn that an earthquake only lasts from 30-60 seconds. With an activity students can estimate how long they think an earthquake really lasts by being the earthquake. Pair up students, giving one team member a stopwatch to record the time. The other teammate should start shaking



as soon as you say, "Go!" When they feel like a minute has passed, they should stop shaking and their teammate should record how long they shook. When the last person stops shaking, ask each timekeeper how long their team's "quake" lasted. Reverse roles and let the timekeepers do the shaking for their team and let the other team member record the time. See if the second "earthquake" is shorter since they had a chance to observe how long a minute really lasts.

Surviving an Earthquake

Educational institutions are a major public infrastructure, which can create long-lasting impact on future generations. Therefore, brainstorming is an important aspect that should be done with the school students as to teach them, how they would survive for a week after an earthquake occurs. For this an activity is conducted. Imagine the buildings do not buckle, but transportation and power will be interrupted. Each person should make a list of three things they must have to survive for a week. Combine the lists with the most critical items at the top. Research the resources needed to keep some people alive with no outside help for a week. Plan how much drinking water they will need and the least amount of food needed in that situation. Give your students a budget and see if they can use a grocery store advertisement to estimate how much money it would take for food, provide them with understanding and ability to map out ways to get to a hospital or other essential service providing locations within and around their respective locations. ■

BRIEF PROFILE OF N M PRUSTY
Chief Mentor-Strategy Center
Chairperson-Sphere India
Convener-Food Security Watch

In today's world of survival of the fittest, one has to be equipped with knowledge, experience, as well as ambition. Being strong believer of "People First", it has been my goal to further my knowledge and ambition and to work into different areas, so that I can contribute to my Nation.

Some 35 years ago I studied Mechanical Engineering and International Business Management. I worked as a Civil Servant (Ministry of Industry), as a Development Banker with ICICI, and then moved to NDDB to Head of Project Finance and subsequently Program Management and Market Intervention Operation. During the late eighties I was actively involved in Technology Mission initiative of the Government of India. Then after a stint in the Private sector corporate in Africa and India as a Managing Director and CEO, I changed over to the Social Development sector as a Director of CARE in India. I have also been involved in a very large number of social development initiatives in India and abroad. I initiated the emergency management program after Super cyclone in Orissa, Earthquake in Gujarat, Draught in Rajasthan, Orissa, Flooding in Bihar, West Bengal, Orissa, communal conflict in Gujarat, Tsunami in southern India and earthquake in J&K. I in the capacity of being a focal point on Food Aid and subsequently as a Member of the Sphere Project's global board contributed to the development of standards for emergency response management called "Sphere Standards". I am currently focusing on building an independent not for profit STRATEGY CENTRE for social development, disaster management and sustainable business practice through which I intend to pursue my mission to help strategize CSR and development management agenda for the future.

When the Kosi Cut Loose!

Bihar was rocked by floods in recent years. The year 2008 was considered one of the worst in the state's history. A breach in the embankment of the Kosi river near the Indo-Nepal border occurred on 18 August 2008. A human tragedy of unparalleled dimensions unleashed itself on millions residing in the seven North Bihar Districts of Supaul, Araria, Madhepura, Saharsa, Purnia, Khagaria and Katihar. Following the breach, River Kosi, often referred to as the "sorrow of Bihar", picked up a channel it had abandoned over 200 years ago, drowning towns and numerous villages coming in the way of its newly acquired course, affecting more than three million people. Still worse this altered course now cuts through an area which ever since the construction of the eastern Kosi Embankment almost five decades ago had lived in the relative comfort of being flood protected. Unlike floods, this is not calm water but an angry torrent, making relief work very difficult.

With the river virulently flowing through its new found course, lakhs of people were caught unawares. Apart from loss of land, crops, homes, human and livestock lives and massive damage to infrastructure; close to a million found themselves marooned .

In response to the disaster, widely reported as the region's worst flood in 50 years, Bihar Chief Minister Nitish Kumar met Indian Prime Minister Manmohan Singh and sought a rehabilitation package of Rs 14,500 crore from the central government for the flood ravaged Kosi region.

The Prime Minister declared a

"national calamity" on 28 August and earmarked US$230 million in aid for the region. Rescue operations were carried out by the Indian Army, National Disaster Response Force (NDRF) and non-government organizations. Indian Air Force helicopters dropped relief supplies in the worst-hit districts. Mumbai Fire Brigade sent a 22-member disaster management team to help in relief work.

Bihar is India's most flood-prone State, with 76 percent of the population in the north Bihar living under the recurring threat of flood devastation. Floods in Bihar are an annually recurring disaster affecting huge human and livestock population and causing huge damages to agricultural crops, houses and public infrastructure. Between 1979 and 2006, floods of varying intensity have ravaged Bihar on an annually recurrent basis affecting on an average an area of 1.39 million hectares, a human population of 7.71million and a livestock population of 1.55 million per annum. Crop losses have been on an average to the tune of Rs 1423.33 million per annum and that of public property to the tune of Rs 568.30 million. Loss of human lives has been on an average of 210 per annum and that of livestock at 680 per annum. ■

ARCH Way of Animal Care in 'Quake-Hit Haiti

On 12 January 2010 a massive earthquake hit Haiti killing hundreds of thousands of people and destroying the capital Port au Prince. To respond to this tragedy, the World Society for the Protection of Animals (WSPA) and the International Fund for Animal Welfare (IFAW) partnered to create and lead the Animal Relief Coalition for Haiti, or better known as ARCH, as a way to create one untied voice with a sole mandate to work with the Haitian authorities and communities in addressing animal needs as a result of the devastating disaster. The coalition consisted of 21 animal welfare groups from the US and Europe that put together a five-point plan with the Ministry of Agriculture and Natural Resources (MARDNR) supporting a variety of outcomes that would aid Haiti's recovery. By avoiding duplication of work animal needs could be assessed and targeted effectively.

Haiti is considered the poorest country in America; according to the CIA fact book, some 80 percent of the Haitian population lives under the poverty line. The country is geographically very vulnerable, lying on major tectonic fault lines and highly vulnerable to the Caribbean's hurricane season. The earthquake of the 12 January struck with a magnitude of 7.0, 15 km from the Haitian capital Port-au-prince at 17:02 local time. With over 200,000 people dead or missing and a further two million left homeless the scale of the response was almost unprecedented in a single country in recent history.

Little was known about the number of animals affected in the aftermath of the quake. From remote assessment it was determined that backyard and companion animals would be the most affected in the urban and peri-urban areas of Port au Prince. Backyard animals represent the livelihood for much of the population across Haiti; however livelihoods weren't the only concerns relating to animals caught up in the disaster. Concerns over public health in disasters are an ever increasing topic of discussion with regard to both prevention and recovery phases in disasters.

Assessment

An assessment team was put together with representatives from ARCH members. The first team were the field commanders from WSPA and IFAW along with key members of their staff. The main point of contact for the team on the ground was the WSPA Disaster Liaison Officer (DLO) Dr Franco Thomas.

With the Ministry of Agriculture as main point of contact, the assessment was carried out of the impact that the earthquake had on the animals and the communities that depend on them.

The assessment was based on animal need, related to the disaster. Based on the assessment ARCH command were able to put together a memorandum of understanding with MARNDR and present a five-point plan for approval. This five-point plan formed the basis of our one year ARCH project to help

the animals of Haiti and the communities that rely upon them.

This plan consisted of;

• running a veterinary mobile clinic with a dedicated team of clinic vets to enter into affected communities and provide veterinary care and vaccinations,

• producing a animal population survey that would give the ministry data useful for vaccination programs,

• reconstruction of 12 cold chain units used for the storage and transport of vaccinations in remote locations across the peri-urban areas of Port au Prince,

• rebuilding of three ministry labs used for disease surveillance,

• an education outreach program to bring forward animal welfare concepts in targeted schools and a public awareness campaign which used flyers; and public service announcements and radio slots to talk about family preparedness and the inclusion of animals in this.

ARCH representatives regularly attended cluster meetings in Port au Prince-such as the shelter and agriculture cluster to ensure there was continued dialogue with key field partners and to share information within these sectors. They were able to liaise with those key to the success and sustainability of the project.

Mobile Clinic

The mobile clinic was most effective way of accessing the most vulnerable and needy animals and it became one of the most visible public faces of ARCH where treatment and vaccination of animals was available to animals without access to a vet. This programme of work was also an excellent conduit for animal welfare messaging and public health protection with vaccinations (such as anthrax and rabies) protecting the wider public from health epidemics. In total over 68,000 animals were vaccinated and treated. By protecting animals from diseases such as rabies, anthrax and Newcastle's disease were able to protect many more people. The Leyland mobile clinic vehicle was handed over to MARDNR as part of the exit strategy.

Dog Population Survey

While some basic information existed on backyard and production animals in Haiti, no such information was available on companion animals. The lack of information on companion animal numbers in Port au Prince not only caused ARCH problems during the assessment phase but also caused the ministry long-term issues when it came to targeting their vaccination programmes.

A survey form was devised by ARCH in collaboration with the Ministry of Agriculture, focusing on general information about population, rabies, and information on the care offered to cats and dogs.

In the absence of resources to include every household as in a census, ARCH utilized a sampling plan to estimate the number of animals before and after the earthquake. Even with the extraordinary steps taken to ensure that a representative sample was reached, ARCH recognized that a degree of caution should be followed when attempting to generalize the data across areas outside the surveyed areas and more specifically for all of Haiti.

A total of 1,290 people were surveyed, each was assumed to represent a different household. Based on the results of the survey and Haiti´s 2003 Census (recognizing the limitations expressed above) the survey estimated some 139,000 dogs and 190,000 cats in Port au Prince. Regarding veterinary care for these companion animals, only 31 percent of the dogs had been taken to the vet in the previous year, only 22 percent of the cats. 26.7 percent of households did not feed their animals on a daily basis but over 80 percent always had water available for them.

Cold Chain

The ability to keep vaccinations in a stable temperature and to transport them is critical to successful vaccination campaigns and ultimately both animal and public health protection. Most of the existing cold chain infrastructure was destroyed by the earthquake. ARCH provided 12 cold chain units in key locations, along with around 100 smaller portable cooler boxes meant that rural vets would be able to provide necessary vaccinations. It was decided that fitting solar panels would ensure the units could be used all year round

Each cold chain unit is expected to reach around 20,000 animals per year (on average) with all 12 units reaching a potential 240,000 animals over the course of the year.

Lab Reconstruction

Representing approximately a third of the ARCH budget, the rebuilding of the national laboratory was a significant contribution to the welfare of animals and humans alike and ARCH's contribution to Haiti in this area will be appreciated and recognized for many years to come. The national laboratory will provide a wide range of diagnostic and analytical services for the assessment and surveillance of infectious, communicable, chronic diseases, and environmental health concerns, for the citizens of Haiti.

Public Awareness & Humane Education

Preparedness and prevention were not part of the Haitian government's disaster plans for people, let alone animals. As part of ARCH's assessment it was clear that people had a very low perception on their own risk and how to handle their animals during a disaster. With the help of a Haitian communications company called Publigestion a number of 'services' were produced, including public service announcements, media interaction, printed materials and a jingle. The PSA and jingle were of particular success whereby people began to recognise the characters and theme tune.

Focus groups were held at the beginning of this campaign and at the end to evaluate people's views on preparedness and their perceptions on their animals and saving them during a disaster. All participants had heard of the ARCH vaccination campaign with half of them accessing the program. Everyone in the focus group understood the need to protect their animals during disasters as a result of the campaign messaging was clear.

ARCH also recognized from the beginning that the children of Haiti held the key to effect positive changes in animal welfare. In June of 2010, ARCH organized a meeting of the Ministries of Education, Public

Health, Environment, and Agriculture (MARNDR) to identify the best way to include an animal welfare component in the national educational curriculum. It was decided to undertake a pilot project to provide an animal welfare outreach program for select private schools in Port au Prince.

The project reached 52 schools and 1,080 children. In addition to providing key animal welfare messages to the students, the project also sponsored a drawing contest for the students to demonstrate their awareness of key animal welfare concepts related to disaster preparedness, disease prevention, and animal health and well-being. The train-the-trainer model that was used for the project will ensure that an adequate number of educators are trained to develop and propagate the animal welfare curriculum well after ARCH's departure from Haiti.

Conclusion & Results

The budget set for the ARCH project came to a total of USD$1.04 million. The total over spend for the project over the course of a year was USD$22,111 which represents just under 3.0 percent of total spend. The total cost of this project came to USD$1,111,077 including exit strategy costs.

Successes from the ARCH initiative have both short and long term in impact. These key areas fall under coordination, animal welfare, preparedness and partnership with government. The project was set up in such a way that there would be maximum direct benefits for Haitian animals.

At the end of the project all assets were divided up between the ministry based on what items were detailed in the MOU, all outstanding items such as clinic equipment was donated towards the start up an animal welfare agency that the country coordinator is planning on establishing post ARCH.

Concluding Remarks

Haiti will continue to be one of the most vulnerable countries in the western hemisphere where for years to come, aid will continue to prop up some elements of social structure. Politically the country is trying to move forward but with current stalemates over the new government there is much more work to be done to rebuild Haiti into the nation it fought during the revolution to be. The countries geographical position on major fault lines and hurricane paths will continue to hamper this progress. The work that ARCH carried out in response to the January 12 earthquake has laid the building blocks for animal welfare in Haiti and by handing over this progress made to MARDNR there is the potential for animals to be considered far more at both national and community level.

At the completion of the project the director general for MARDNR stated that "the ARCH coalition worked together with us in Haiti as a strategic partner and did not try to impose a preset agenda". This illustrates the effectiveness of ARCH's ability to respectfully work with governments and authorities and not against them. This relationship was one of the major successes of the project.

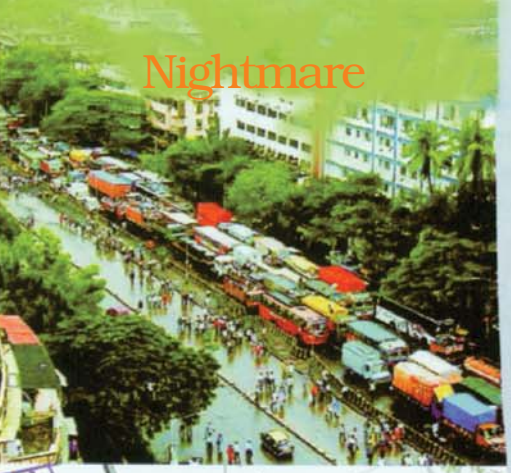
Annex 1-List of ARCH Members

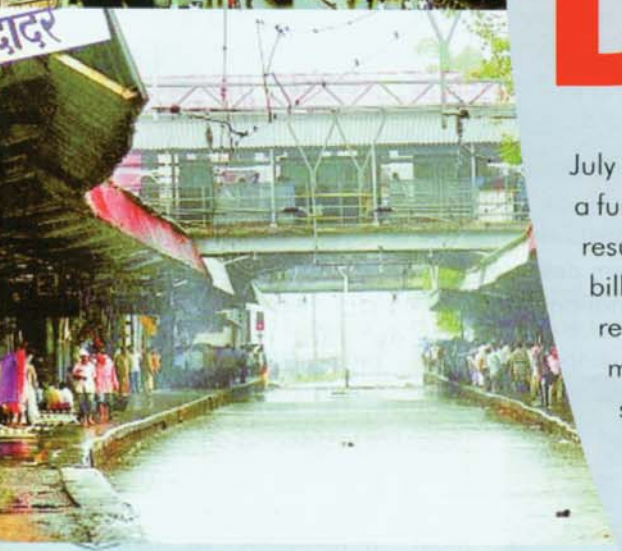
- International Fund for Animal Welfare (IFAW)
- World Society for Protection of Animals
- American Humane Association
- Best Friends Animal Society RSPCA (UK)
- In Defence of Animals
- American Veterinary Medical Association
- American Veterinary Medical Foundation
- Antigua and Barbuda Humane Society
- ASPCA
- United Animal Nations
- The Kinship Circle
- One Voice
- Swiss Animal Protection
- Palo Alto Humane Society (PAHS)
- People for the Ethical Treatment of Animals (PETA)
- Finnish Federation for Animal Welfare Associations
- Animal Welfare Care Foundation (AMCF) ■

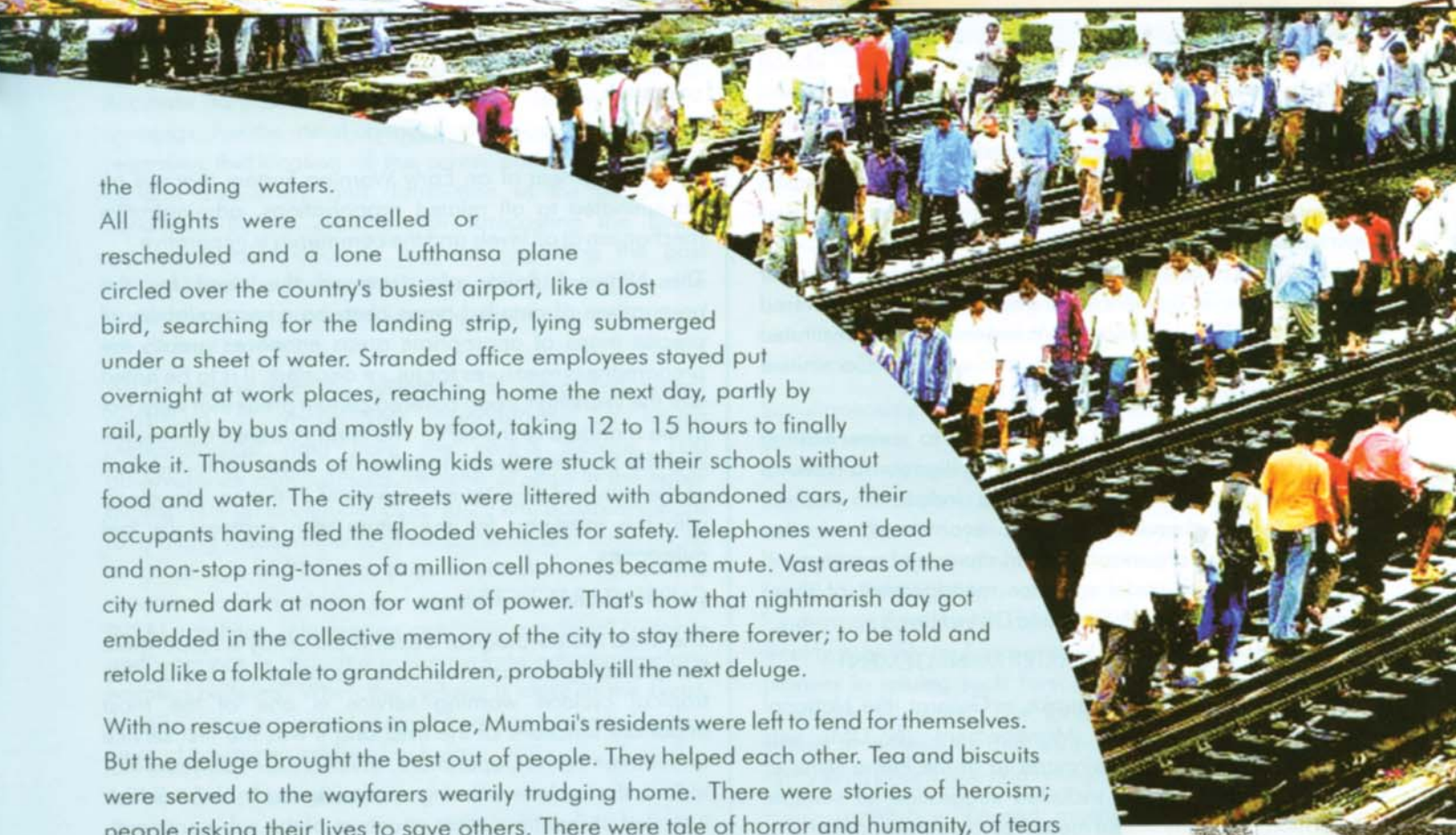
Nightmare

The great Mumbai DELUGE !

July 26, 2005 - The wettest day in Mumbai's memory. When the skies opened with a fury unheard of in a century, the city of 15 million people, nearly drowned in the resultant deluge. India's commercial capital, which contributes more than $13 billion annually to national revenue, looked helpless like a ravaged city of refugees. The people, die-hard workaholics, who normally waded through their monsoon days nonchalantly, found themselves stranded and scrambling for safety. More than 1000 people died and property losses were estimated at around Rs 15,000 crores. In terms of cold and wet statistics, 26/7 received 944.2 mm of rainfall, an all time record. The city vying for a place in the sun as another Shanghai, found its infrastructure battered and its image shattered. With the city's sewers getting clogged with urban waste, the gutters overflowed like rivers in spate, rising up to 18 feet at some places. For a while, the city became a vast sheet of swirling water. Old houses leaked and collapsed, bloated animals floated in the streets, and landslides brought down the shacks in rolling rocks and mud, burying people alive. The Arabian Sea, which cradled the city with lullaby waves at normal times, rose in high tide on that day. The suburban train service, the city's lifeline that carried daily nearly six million people to and fro, ground to a halt, at some places unable to plough through







the flooding waters.
All flights were cancelled or rescheduled and a lone Lufthansa plane circled over the country's busiest airport, like a lost bird, searching for the landing strip, lying submerged under a sheet of water. Stranded office employees stayed put overnight at work places, reaching home the next day, partly by rail, partly by bus and mostly by foot, taking 12 to 15 hours to finally make it. Thousands of howling kids were stuck at their schools without food and water. The city streets were littered with abandoned cars, their occupants having fled the flooded vehicles for safety. Telephones went dead and non-stop ring-tones of a million cell phones became mute. Vast areas of the city turned dark at noon for want of power. That's how that nightmarish day got embedded in the collective memory of the city to stay there forever; to be told and retold like a folktale to grandchildren, probably till the next deluge.

With no rescue operations in place, Mumbai's residents were left to fend for themselves. But the deluge brought the best out of people. They helped each other. Tea and biscuits were served to the wayfarers wearily trudging home. There were stories of heroism; people risking their lives to save others. There were tale of horror and humanity, of tears and joy. Everybody had a tale to tell.

There was a lesson for the urban planners to learn in this deluge. While the southern part of the city was largely unaffected, it was the overdeveloped northern suburbs that bore the brunt. Slums built on the edges of the sewers and gutters and the Mithi river that flows through the city, have resulted in the flooding. Concretization of large areas of the city and removal of mangrove marshes further aggravated the situation. Starved of space, the city could only grow vertically, imposing severe burden on the existing infrastructure.

The deluge, though unprecedented, rudely exposed Mumbai's lack of preparedness to meet a disaster. It raised more questions than the concerned authorities could answer. Why wasn't the weather alert issued? Why did the drainage system so utterly fail? Who would bring back to life those who died for no fault of theirs? Who will compensate for the loss of property? Was the disaster man-made? Is these any guarantee that the situation will not be repeated during the next monsoon?

Bihar Set to Sail Smoothly Till 2014, May Face Tension Ahead of Polls

- Noted Astrologer R.K. Narayan

Noted astrologer R. K. Narayan has predicted good times for Bihar as a state but foresees tension-filled days ahead of the 2014 elections, which will not be a cake walk for the current leadership.

Introduction

Bihar came into existence on 21 March 1912 at midnight, as a new state of India, with a promise of great potential. Bihar remained in the forefront of the Freedom Movement.

In ancient times, Bihar was the cradle of religion, science and culture. Learned sage Valmiki, who wrote Ramayana in Sanskrit was born in Bihar. Aryabhatta appeared as a great scientist in Pataliputra (present Patna) and gave the world as valuable gift his vast knowledge of space, stars and mathematics. He had set up an observatory in and around Pataliputra.

Lord Buddha came down to Gaya from Kushinagar in Nepal to seek enlightenment on which Buddhism was founded. This became a very popular religion which spread all over the world. Then came Lord Mahaveer, the great guru who propounded Jainism, propagating it as the most pious religion like Buddhism.

And then came Sikhism, propagated by Guru Govind Singh, the 10th Guru who hailed from Patna City. Bihar excelled in every field of human existence and led India in the fields of politics, religion and science.

Mahatma Gandhi started the Freedom Movement from Champaran when stalwarts like Dr. Rajedra Prasad, Dr. Shri Krishna Singh , Shri Jai Prakash Narayan and many others of the Congress party joined him in the non co-operation movement. They went to jail for disobedience and non cooperation.

After independence, Dr. Satchidanand Sinha, Dr. Rajendra Prasad, Sardar Vallabhai Patel, Baba Saheb Bhim Rao Ambedkar and others became the members of constituent Assembly. Dr. Satchidanand Sinha was the Chairman.

The Constitution of India was drafted by Dr. Ambedkar and later was approved by both the Houses. An Independent India came into being, full of vast energy and determination ready to march towards progress.

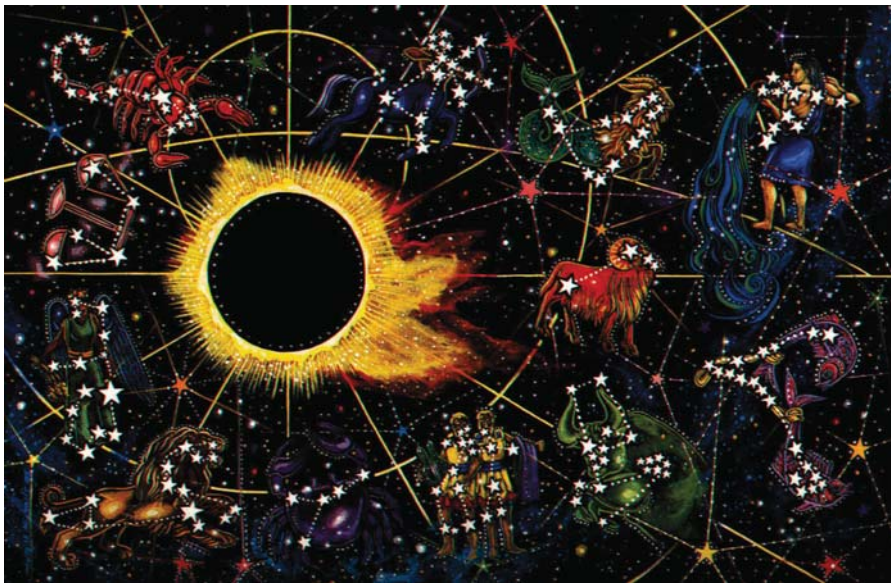
In this background, the horoscope of Bihar is being discussed .

Forecast for Near Future

Jupiter occupies lagna and is aspected by lagna lord Mars from the 7th house. Jupiter is debilitated in the 11th house. In Navamsa; Jupiter forms Neechbhanga Rajyoga with Moon in lagna. This indicates that there will be extensive progress in the field of education as well as religion. Religious tolerance and mutual aspect for other religions will bring a new era of prosperity.

Transit of Jupiter over Aries will move into Taurus on 15th May 2012. Saturn transits in Tula Rashi retrograde since February, 2012 will enter Kanya Rashi on 17th May 2012. Saturn will transit over exaltation sign in the 12th.

This is an adverse disposition for the



party in power. Opposition will be active but ruling leaders should remain in power. Since Saturn in the radical position with Rahu is in the 6th, there will be dissatisfaction amongst the under privileged. They may occasionally express their anger by committing violence like burring vehicles and erecting road blocks. Presence of Rahu in 6th with Saturn makes the situation worse. There will be plots against existing authorities even though there will be progress in the field of education, transport and law and order.

5th house has Sun, Moon and Mercury. There will be considerable activity in the field of education, sports and entertainment. Sports will claim public attention. There may be growth in the field of film and television world. There may be some prospects of government promoting the mining industry. There will be great effort on the part of government to promote women's education and employment in new areas of government. Artistic activities, education particularly in science and technology will grow creating more opportunities for growth and employment. National institutes of technology/medicine will be established at strategic places.

Venus occupies 4th house and is in Dhanu Navamsa in the 10th Venus in transit will enter Simha Rashi from 27th September, 2012. This will be in the 10th house from lagna and 7th from radical Venus and 6th from Moon. There will be celebration. There will be trade fairs. Transport and communication will function effectively. There will be financial treaties with other governments of neighboring countries. Trade relations with some other countries will be initiated.

Mars occupies 7th house lord of lagna. In Navamsa, Mars and Sun are in the 7th house. There will be a tendency towards crime against women and children. There will be an increase in unnatural deaths. Anti-social elements will raise their heads and indulge in violent crimes. There may be attempts to assassinate leaders. There may be strong opposition against ruling government. However presence of Sun in the 7th house, indicates that relations with the Central Government will not be smooth.

Ketu is in the 12th house and is 8th Navamsa, and is Vargottam causing violent crime (murder /dacoity, self–immolation). Mortality rates will be high. Floods and earthquakes may occur causing a large number of deaths and destruction.

Urenus is in the 2nd house aspected by Mars and is in the 10th from Moon. This indicates sudden and unforeseen developments in government circles requiring careful handling. Expenditure may be huge. There will be a rise in the rail and air transportation costs.

Neptune and Pluto are in the 8th house which brings political instability and attempts to overthrow the Government. This explains how in the 1960's the sudden changes in Government, which witnessed the resignation of Binodanand Jha as Chief Minister of Bihar and subsequent events following his exit.

At present Bihar is passing through Mahadasa of Saturn and Anter dasa of Rahu which started from 17 October 2010 and will end on 23 August 2013. They are in the 6th house and Saturn is debilitated. Transit of Saturn in Tula Rashi (Libra) at this time is retrograde but will be direct between last week of April and May 2012. This period will be one of tension for the government. Mars will transit over the 8th house till 18th August 2013 and thereafter in debilitation over 9th house until 15th October 2013. These two transits will have adverse effect. There may be occasional problems of law and order which will be effectively dealt with by the government.

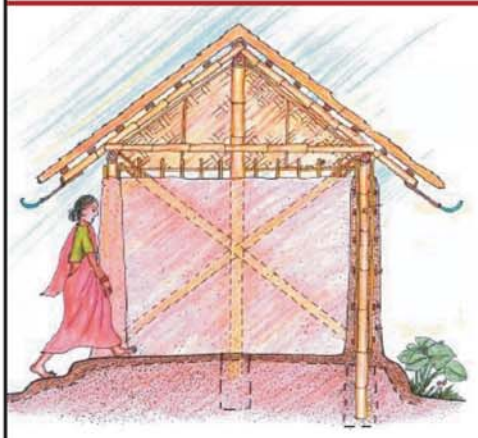
The next anter dasa of Jupiter starting from 23 August 2013 which will last till 6 March 2016 will be favorable when Jupiter will be transiting over exaltation sign Cancer 9th from radical position in the Lagna and 5th from Moon. In spite of adverse transit of Saturn, chances of the present leadership returning to power will be high but the fact remains that Government has to be more sensitive to the needs and urges of the people. Opposition will try to throw out the Government in power and so the next 2014 election may not be a cakewalk for the ruling party. ■

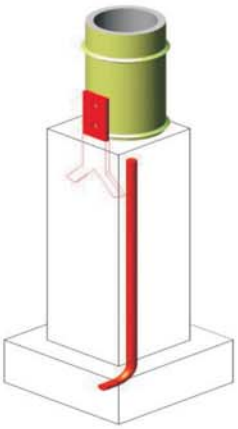
बिहार राज्य आपदा प्रबंधन प्राधिकरण

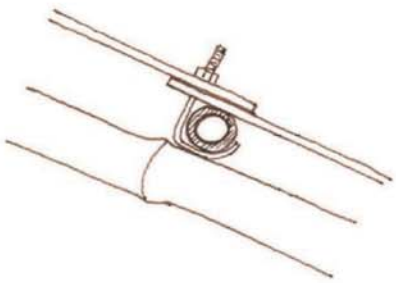
(आपदा प्रबंधन विभाग)

बिहार सरकार

बाँस निर्मित आपदारोधी (भूकम्प, तूफान एवं बाढ़ से सुरक्षित) घरों की निर्माण विधि







प्रस्तुतिः— डा. आनन्द स्वरूप आर्य, अवकाशप्राप्त प्राध्यापक, भारतीय प्राद्यौगिकी संस्थान रूड़की,
सदस्य, बिहार राज्य आपदा प्रबंधन प्राधिकार।

बरूण कान्त मिश्र, कार्यपालक अभियंता, अग्रिम योजना, भवन निर्माण विभाग, पटना,
सह माननीय सदस्य, डा. आनन्द स्वरूप आर्य के आप्त सचिव, संम्पर्क मो.—9431011010.

दिनांक 6 जून 2011

1. प्राक्कथन

बिहार राज्य में ईंटों के दाम राष्ट्रीय औसत से अधिक है। उत्तरी बिहार में प्रबलित सिमेंट कंक्रीट (आर.सी.सी) छत बनाने के लिये आवयक मोटा बालू तथा पत्थर की गिट्टी उपलब्ध नहीं है और इनके मूल्य अधिक हैं। राज्य में सभी जगह बाँस उपलब्ध है। इसलिये, ग्रामीण क्षेत्रों में बाँसों के घर बनाये जाते हैं अथवा ईंट के दीवार पर बाँसों के उपयोग से ढ़लवॉ छत बनाये जाते हैं। प्रतिवर्ष गर्मियों में, ये घर आँधी की चपेट में आ जाते हैं और बरसात में बाढ़ में बह जाते हैं। अतएव, सर्वसाधारण के लाभ के लिये, बाँस निर्मित आपदारोधी घरों की यह संक्षिप्त निर्माण विधि एक पुस्तिका के रूप में प्रकाति की जा रही है।

2. निर्माण के अति–आवयक विन्दु

1. सभी बाँस जिनका उपयोग खम्बों, कड़ी, पर्लीन अथवा दीवार बनाने में किये जाने हैं, उन सभी बाँसों के परिरक्षक रासायनिक उपचार करना चाहिए। इससे बाँसों एवं बत्तियों का दीमकों एवं कीड़ों से वचाव होगा और घर की आयु 20 से 25 वर्ष तक बढ़ जाएगी। (देखें कंडिका–4)

2. संरचना की मजबूती के लिये बाँस के खम्बे 1.5 मीटर से 1.8 मीटर की दूरी पर रखने चाहिए। (देखें कंडिका–5)

3. बाँस खम्बे के निचले सिरे को सड़ने से बचाने के लिये, जमीन में कंक्रीट खूँटे या ईंट पीलर का आधार बनाकर, बाँस खम्बे के निचले सिरे को इससे जकड़ देना चाहिए। विगत उच्चत्तम बाढ़स्तर तक बाँस के खम्बे पर कोलतार का लेप करना चाहिए। (देखें कंडिका–6)

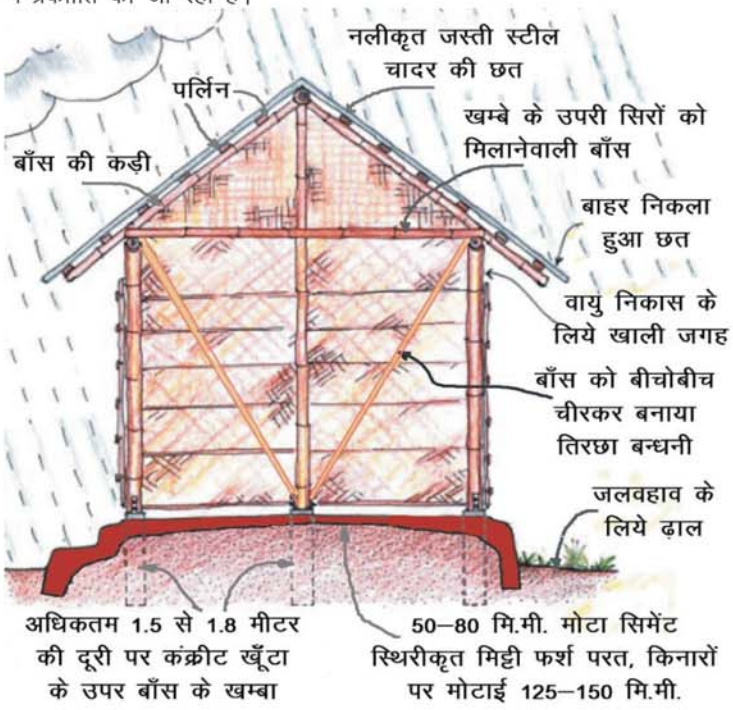
4. तूफान से वचाव के लिये, बाँस के खम्बों के बीच के बत्ती के दीवाल में तथा बाँस के छत संरचना के ढॉचे में, बाँस को बीचोबीच चीरकर तिरछा बन्धनी (cross bracing) लगाना चाहिए। सामानों की सुरक्षा हेतु, ढालवॉ छत के नीचे मचान का निर्माण करना चाहिए। (देखें कंडिका–5, 7 एवं 8)

5. बाँस के खम्बे, बाँस के दीवाल फलक, छत के पर्लीन एवं कड़ी सहित सभी अवयवों को एक दूसरे से नायलन रस्सी अथवा गैलवनीकृत तार अथवा बोल्ट से जकड़कर अच्छी तरह बॉध देना चाहिए। (देखें कंडिका–7)

6. एक तरफ ढाल या दो तरफ ढाल के बदले चारों तरफ ढालवाले ढालवॉ छत का निर्माण करना चाहिए। छत संरचना के ढॉचे को दीवार से जकड़ दें। (देखें कंडिका–8)

7. छत में उपयोग होनेवाले स्टील के जस्ती चादरों को बाँस की कड़ी में जकड़ने के लिये, उचित डामर वाार, स्टील वाार एवं नट के साथ जे J बोल्ट का उपयोग करना चाहिए। जहाँ आँधी का प्रकोप ज्यादा हो तो U बोल्ट लगायें । J एवं U बोल्ट का व्यास कम से कम 6 मि.मी. का होना चाहिए। (देखें कंडिका–8)

8. दीर्घकालीन बाढ़ सुरक्षा हेतु सिमेंट–मिट्टी मिलाकर पीट–पीट कर बनायी गयी ठोस स्थायी उँची कुरसी का निर्माण उपयोगी होगा। (देखें कंडिका–9.3)



चित्र – 1 बाँस की झोपड़ी

3. बाँस के किस्म एवं बाँसों की कटाई

3.1 बाँस के विविध किस्म एवं इसके उपयोग

किस्म	गुण	उपयोग
हरौत	मोटा छल्लावाले, मजबूत, लम्बा	खम्बे, ट्रस, छत की रीढ़
चाब	सीधा	छत की कड़ी एवं पर्लिन
मखौर	छोटा	चटाई/चचरी, दीवाल फलक

3.2. बाँसों की सुरक्षित कटाई

- X बाँस के काटने के तरीके एवं काटने के समय से इसका टिकाउपन प्रभावित होता है। बर्षा ऋतु में बाँस न काटे जायें। शरद् ऋतु में बाँस काटे जायें। बाँस के दूसरे गाँठ के नीचे या जमीन से करीब 300 मिलीमीटर उपर न काटे जायें।
- X तीन वर्ष से कम आयु के बाँस न काटे जायें। बाँसों के झुरमुट को साफ रखें, घासपात या टूटे डाल हटा दें। बाँस के गिरे पत्ते रहनें दें।
- X बाँसों के झुरमुट में कम से कम छः परिपक्व बाँस बिनकटे रहने दें। इन बाँसों के किनारे नये बाँस उगते हैं। बाँसों के झुरमुट में सँकरा रास्ता बनाते हुए बीच के परिपक्व बाँस काटें।

4 बाँसों के उपचार

बाँस के अंदर मौजूद स्टार्च कीड़ा और फफूंद को आकर्षित करता है। दीमकों एवं कीड़ों से वचाव के लिये बाँसों के उपचार किये जाते है।

4.1 बाँसों के अति साधारण उपचार

बाँस से स्टार्च को कम करने के लिये, कुछ सप्ताह बाद तक, शाखाओं एवं पत्तियों के साथ, कटे बाँस को खड़ा करके जमा करते हैं। यह प्रक्रिया दीमकों के आक्रमण से वचाव नहीं करता। दीमकों एवं कीड़ों से वचाव के लिये रासायनिक परिरक्षक का उपयोग करते हुये उपचार आवयक है। सरल रासायनिक परिरक्षक उपचार नीचे बताया गया है।

4.2 बाँसों के सरल रासायनिक परिरक्षक

4.2.1 सी.सी.बी.

- कौपर सल्फेट–क्रोम (सोडियम डाईक्रोमेट) –बोरोन का 3:1:4 के अनुपात में मिश्रण अथवा केवल बोरोन (बोरिक एसिड तथा बोरेक्स का यौगिक) का उपयोग कर सकते हैं।
- बोरोन का पानी में 10 प्रतिात घोल के लिये, 45 लीटर पानी में, 2 किलोग्राम बोरिक एसिड तथा 3 किलोग्राम बोरेक्स मिलाना है।

4.2.2 तेल

मोविल या किरासन या डिजल को क्रियोसोट (डामर/तारकोल) को मिलाकर या अकेले उपयोग कर सकते हैं।

4.2.3 बाँसों के सरल रासायनिक उपचार

बाँसों को रसायन में डुबोकर (चित्र–2) या बाँसों के गाँठों के बीच पिचकारी से रसायन डालकर (चित्र–3) अथवा पम्प के दवाव से बाँसों के अंदर रसायन डालकर (चित्र–4) उपचार की विधि बगल के तीन चित्रों में दिखाये गये हैं।

चित्र–4 में, बाँसों के जड़ वाले सिरे पर, पम्प से रसायन के घोल में 10 से 14 किलोग्राम प्रति वर्ग सेंटीमीटर का दवाव डालते हैं। बाँस के रस का प्रतिस्थापन करते हुए, रसायन बाँस के अंदर–अंदर दूसरे छोर तक पहुँच जाता है और दूसरे छोर से टपकने लगता है। यह रासायनिक परिरक्षण विधि सबसे ज्यादा प्रभावी है। बाँस के रस सूख न जायें, इसलिए बाँस 4 से 6 घंटे के अंदर कटे होने चाहिए। अधिकतम 3 दिनों तक के कटे बाँस के परिरक्षण के लिए, पानी में डुबोकर रखना चाहिए। परिरक्षण के उपरान्त उपयोग में लाने के लिए, बाँस को कुछ घंटे तक क्षैतिज अवस्था में छाया में रखें। इस पम्प को साईकिल पर भी स्थापित कर सकते हैं (चित्र–5)। कोसी क्षेत्र के सहरसा जिले में इस विधि का उपयोग हो रहा है।

4.2.4 रासायनिक उपचार में सावधानियॉ :–

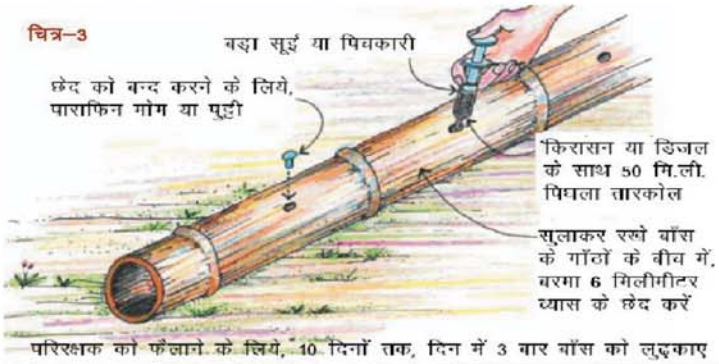
(1) प्लास्टिक दस्ताने से हाथों को ढ़क दें।
(2) आँख में रसायन जाने से बचाऐं।
(3) बच्चों एवं जानवरों को दूर रखें।
(4) इस्तेमाल किये गये रसायन कूड़ा–कचरा के निर्दिष्ट स्थान में फेंक दें।

चित्र – 2

बाँस को न्यूनतम एक सप्ताह एवं बत्तियों को तीन दिन डुबोये अंत में, बाँस को, रैक पर छाँव में, एक सप्ताह तक सूखाए

बाँस को डुबोकर रासायनिक उपचार की विधि

चित्र–3



परिरक्षक को फैलाने के लिये, 10 दिनों तक, दिन में 3 बार बाँस को लुढ़काए

हरे या सूखे बाँस के गाँठों के बीच छेद में सुई से रसायन डालकर उपचार

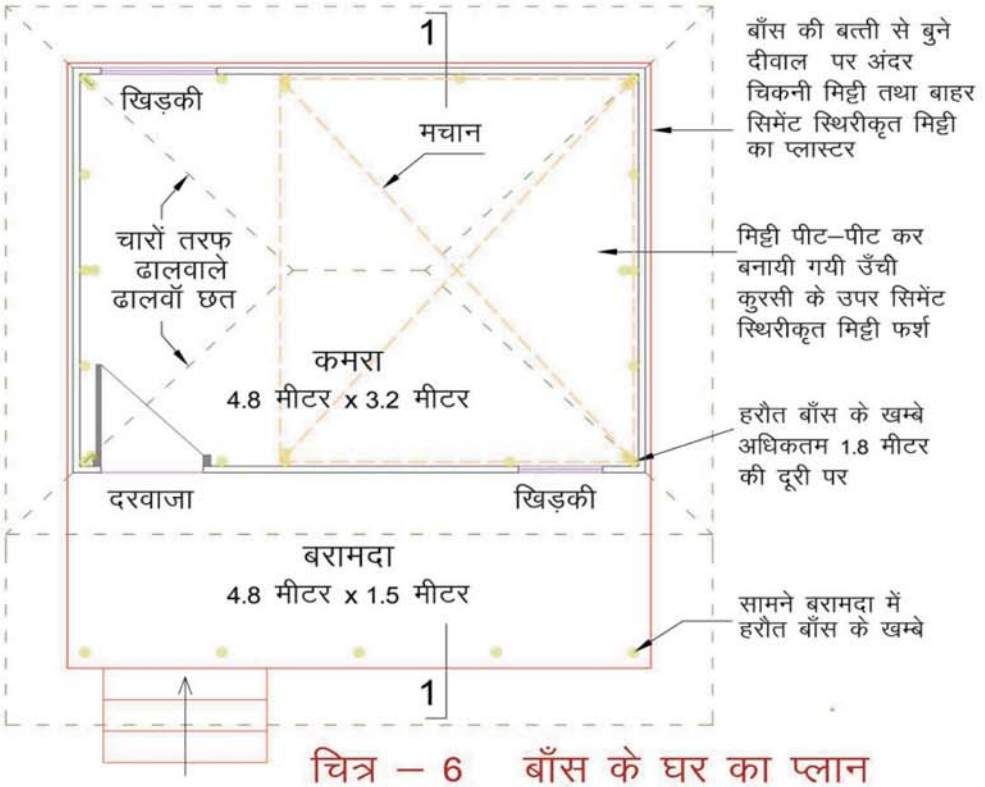
चित्र – 4

चार घंटे के अंदर कटे बाँसों के जड़ वाले सिरे पर पम्प से दवाव डालकर रासायनिक परिरक्षण

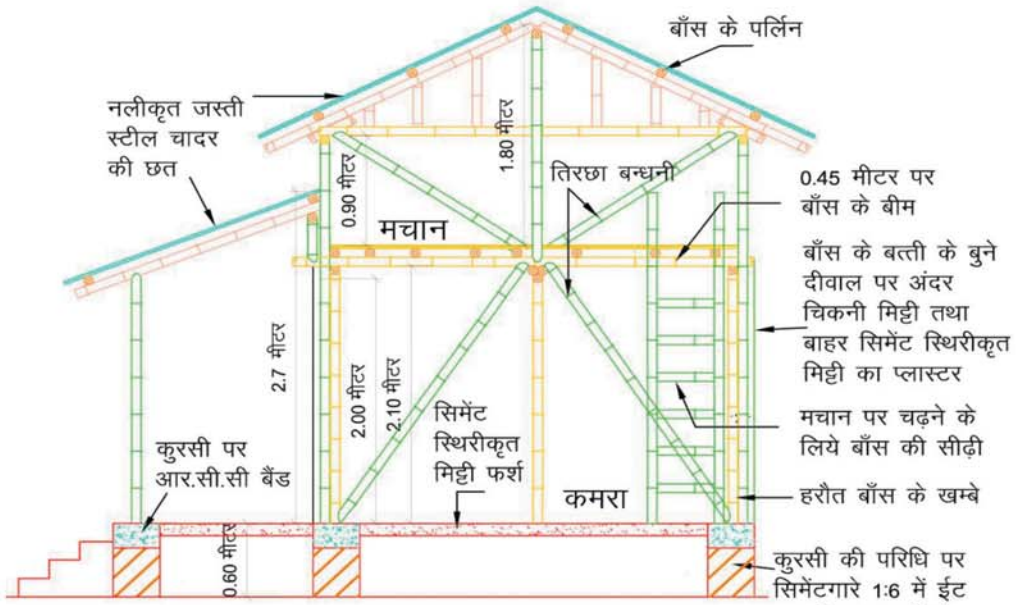
चित्र–5

5. बाँस के घर की रूपरेखा

- बाँस के घर सरल आयताकार रूपरेखा वाले हों। घर के आकार 3 a x 2a रखें। a का माप 1.5 मीटर से 1.8 मीटर हो।
- चारों तरफ ढ़ाल वाले छत बनाऐं। ढालवॉ छत के नीचे मचान बनाऐं। द्वारों के आकार सीमित रखें।
- वर्षा से सुरक्षा हेतु कुरसी की परिधि पर सिमेंटगारे 1:6 में दीवार बनाये जा सकते हैं।



चित्र – 6 बाँस के घर का प्लान



चित्र – 7 आरीकाट 1–1

6. बाँस खम्बे की नमी से सुरक्षा

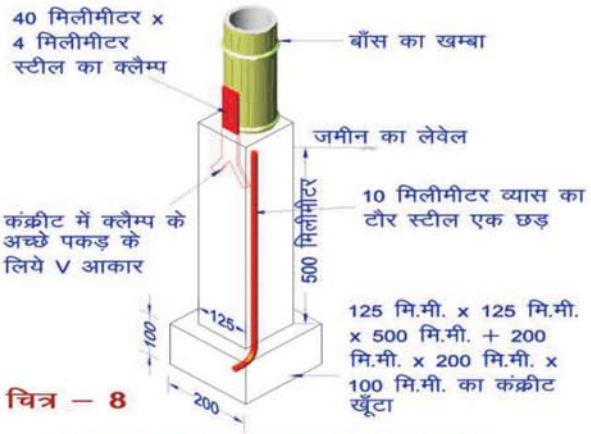
बाँस खम्बा को जमीन में नहीं गाड़ना चाहिए, जमीन की नमी से खम्बा का निचला सिरा सड़ जाता है, इससे क्षतिग्रस्त बाँस खम्बे को बार–बार बदलना पड़ता है।

6.1 बाँस खम्बे के आधार हेतु कंक्रीट खूँटा

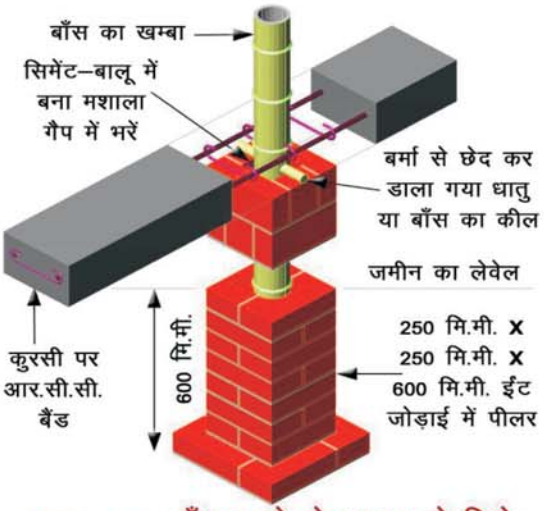
- जिन घरों की कुरसी में ईंट जोड़ाई नहीं करनी हो, बाँस खम्बे के आधार हेतु कंक्रीट खूँटे का उपयोग करना चाहिए।
- 125 x 125 x 500 मिलीमीटर माप का कंक्रीट का खूँटा जिसका निचला सिरा 200 x 200 x 100 मिलीमीटर माप का हो, पहले ही ढ़ालकर जमीन में गाड़ दें, (चित्र–8)। यह खूँटा, कंक्रीट मिश्रण 1:2:4 (1 भाग सिमेंट : 2 भाग बालू : 4 भाग अत्यधिक पके ईंट से बने 12 मिलीमीटर से 20 मिलीमीटर तक के आकार के गिट्टी) का उपयोग कर बनाया जा सकता है। खूँटे के बीच में एक 10 मिलीमीटर व्यास का स्टील टौर छड़ डाल दें।
- कंक्रीट ढ़ालने के दौरान, प्रत्येक खूँटे के उपरी सिरे पर एक 250 मिलीमीटर लम्बा x 40 मिलीमीटर चौड़ा x 4 मिलीमीटर मोटा स्टील के पत्तड़ से बना क्लैम्प डालना है, जिससे यह खूँटे के अंदर 125 मिलीमीटर जड़ा रहे।
- स्टील पत्तड़ के उपरी भाग में 10 मिलीमीटर व्यास के दो छेद होने चाहिए, जिसमे स्क्रू या 10 मिलीमीटर व्यास के बोल्ट घुसेड़कर, बाँस खम्बे को कंक्रीट खूँटे के साथ जोड़कर जकड़ दिया जाय।
- खम्बे के निचले सिरे पर इनामेल पेंट करना चाहिए।
- कीड़ा या फफूंद से वचाव के लिये बाँस खम्बा का परिरक्षक रासायनिक उपचार अवय करें।

6.2 बाँस खम्बे के आधार हेतु ईंट पीलर

- मिट्टी खोदकर, ईंट जोड़ाई में, 250 x 250 x 975 मिलीमीटर माप का पीलर बनाए, जिसका निचला आधार 375 x 375 x 75 मिलीमीटर माप का हो, (चित्र–9)। पीलर का 600 मिलीमीटर भाग जमीन के अंदर गड़ा रहे। यह पीलर 1:6 मसाला (1 भाग सिमेंट : 6 भाग बालू) में बनायी जाय।
- सभी पीलरों के उपर, कुरसी के तल पर आर.सी.सी. बैंड बनायें।
- आर.सी.सी. बैंड होकर ईंट पीलर में बाँस के खम्बे को गाड़ दें।
- बाँस खम्बे को ईंट पीलर के साथ जकड़ने के लिये, आर.सी.सी. बैंड के नीचे, धातु या बाँस से बने कील का उपयोग किया जाय, (चित्र–10)। कील डालने के लिये बाँस खम्बे में बर्मा से छेद करें।
- आर.सी.सी. बैंड एवं ईंट जोड़ाई के अंदर वाले बाँस खम्बे के निचले हिस्से को डामर या तारकोल या प्रयुक्त मोविल से पेंट करके अतिरिक्त नमीरोधक बना देना बेहतर है।
- दीमकों एवं कीड़ों से वचाव के लिये, सभी बाँस खम्बो के रासायनिक परिरक्षक उपचार किये जाने चाहिए।

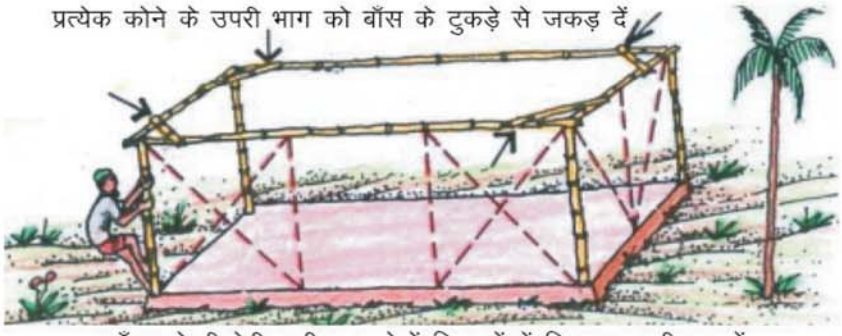


चित्र – 8 बाँस के खम्बे के आधार के लिये जमीन के अंदर कंक्रीट खूँटे का उपयोग



चित्र – 9 बाँस खम्बे के आधार के लिये ईंट जोड़ाई में बना पीलर

चित्र–10 कुरसी पर ईंट जोड़ाई में गड़े बाँस के खम्बे



चित्र – 11 बाँस के संरचना ढाँचे के स्थायित्व के लिये दीवार फलकों में खम्बों के साथ तिरछा बन्धनी का उपयोग

7. बाँस के ढ़ाँचे का निर्माण

7.1 तिरछा बन्धनी का उपयोग

- भूकम्प एवं प्रबल वायुवेग के कम्पन के विरूद्ध, बाँस ढ़ाँचा के बने घर के संरचना का स्थायित्व बढ़ाने के लिये, दीवाल फलक के साथ, बीचोबीच चीरकर, दोनों दिाओं में बाँस का तिरछा बन्धनी लगाना होगा। देखें चित्र – 11
- अगर कोई घर बाढ़ या नमी के कारण कमजोर हो जाय, तो तिरछा बन्धनी संरचना को स्थिर रखने में सहायक होता है।
- सभी दरवाजों के पास भी तिरछा बन्धनी बाँधें।
- बाँस खम्बे के उपरी सिरों को मिलानेवाली बाँस के सभी कोनों को, बाँस के टुकड़े लगाकर बांध देना चाहिए। चित्र –11 देखें।
- बाँस चीरकर बनाये गये तिरछा बन्धनी के परिरक्षक रासायनिक उपचार किये जाने चाहिए।

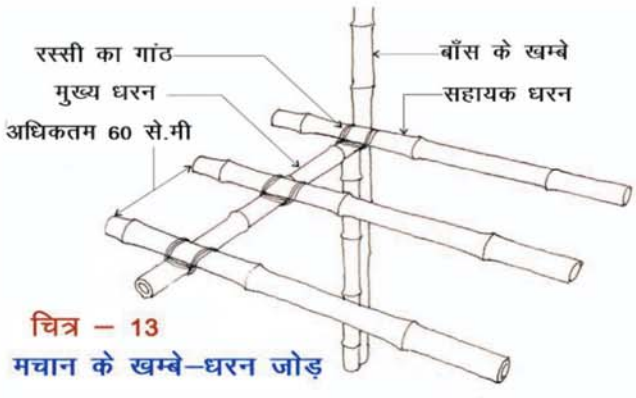
7.2 बाँस के ढ़ाँचे का बंधन

- तिरछा बन्धनी, बाँस के दीवाल फलक एवं खम्बे के उपरी सिरों को मिलानेवाली बाँस को खम्बे के साथ जकड़ दें। पर्लिन को कड़ी के साथ और कड़ी को खम्बे के उपरी सिरों को मिलानेवाली बाँस के साथ जकड़ दें।
- साधारण कील के बदले धातु पत्तर, या दोनो छोर पर छल्ला लगे बोल्ट का उपयोग करें। जूट या नारियल रस्सी के बदले अच्छे प्रकार के नायलन रस्सी अथवा गैलवनीकृत तार का उपयोग करें। चित्र – 12 देखें।
- मचान के लिये अतिरिक्त बाँस के खम्बे खड़ा करें। मचान के खम्बे और मचान के धरन का जोड़ चित्र – 13 में दिखाया गया है।

7.2 नियमित रखरखाव

- घर की चोटी एवं कोनों के आस–पास नियमित जाँच करें। कमजोर अवयवों को बदल दें। ढीले अवयवों को जकड़कर बाँध दे।

चित्र – 12 बाँस के ढ़ाँचे का बंधन



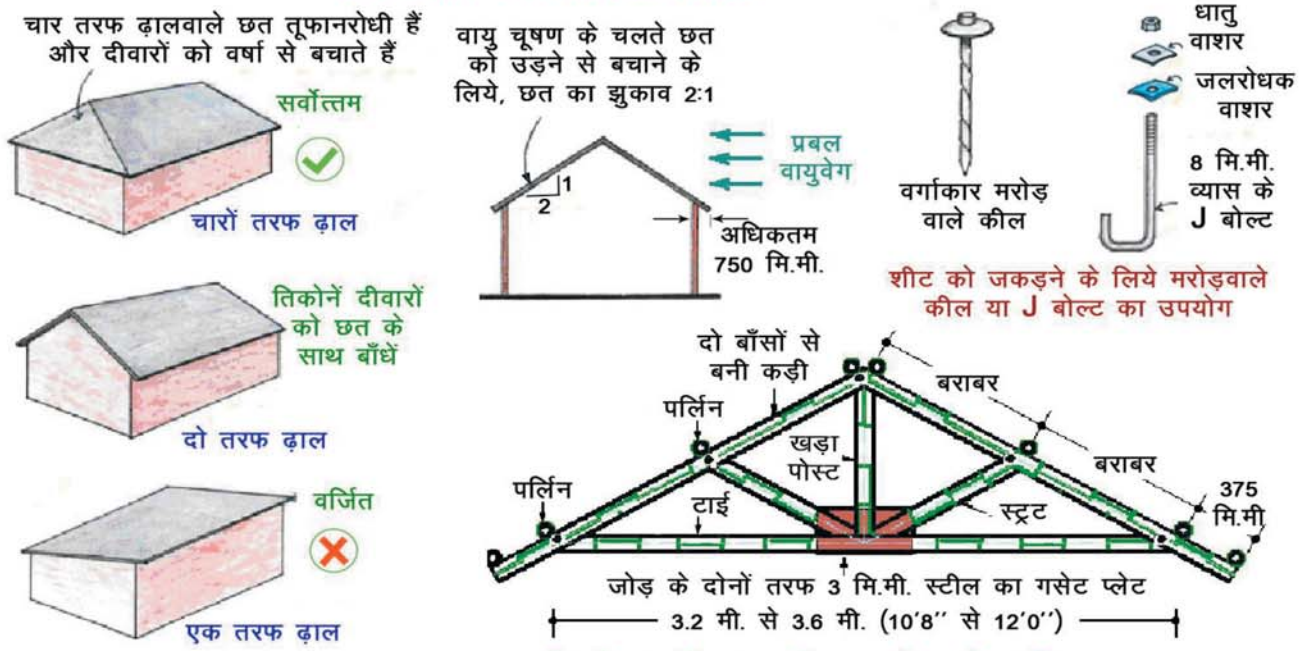
चित्र – 13
मचान के खम्बे–धरन जोड़

8. तूफानरोधी ढ़ालवाँ छत बनाने की विधि

8.1 छत संरचना ढाँचा

- दो तरफ ढाल के बदले चारों तरफ ढालवाले ढालवॉ छत बनाना चाहिए (चित्र 14)। अगर दो तरफ ढालवाले छत ही बनाने हों तो इसके दोनों तिकोने दिवाल को शेष संरचना के साथ दृढतापूर्वक बांधना है। एक ही तरफ ढालवाले छत वर्जित हैं।
- वायु चूषण एवं वायुवेग से ऊपर उठने के प्रभाव को कम करने के लिए, छत का ढ़ाल 2:1 (2 पड़े : 1 खड़े) अपनाना चाहिए।
- स्टील चादर वाली छतों के संरचना ढ़ाचे में बाँस की मुख्य कड़ी 600 मि.मी. से अधिक दूरी पर नहीं रखी जायँ। खपरैल के छतों में यह 300 मि.मी. से अधिक नहीं होना चाहिए। खपरैल के छतों में तार से तिरछा बन्धनी लगाऐं।
- केवल कड़ी के बदले बाँस के ट्रस अधिक उपयुक्त है (चित्र 14)।
- सबसे निचले पर्लिन को खम्बे के उपरी सिरों को मिलानेवाली बाँस के साथ कसकर बाँधना चाहिए।
- चारों तरफ छत कम से कम 450 मि.मी. लटकने चाहिए। छत का लटका भाग 750 मिलीमीटर से कम रखें। लटके हुए कड़ी के अंत को खम्बे के साथ बाँधना चाहिए।

छत बनाने की आवश्यक विधि



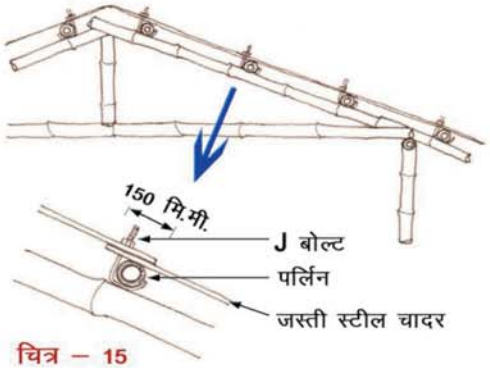
शीट को जकड़ने के लिये मरोड़वाले कील या J बोल्ट का उपयोग

चित्र – 14

कड़ी के बदले, 1.6 से 1.8 मी. की दूरी पर, 75 मि.मी. से 100 मि.मी. व्यास के हरौत बाँस के ट्रस

8.2 छत के जस्ती स्टील चादर

- नलीकृत जस्ती स्टील चादर को J बोल्ट या पेंच के सहारे पर्लिन के साथ जकड़ दें। यदि टोपीदार कील का उपयोग करना हो तो, वे इतने लम्बे हों कि कड़ी की दूसरी तरफ कील पार कराकर मोड़ा जा सके। इन कीलों अथवा J बोल्टों की परस्पर दूरी 450 मि.मी. से ज्यादा नहीं होना चाहिए।
- प्रबल वायुवेग में छत के आवरण को उड़ने से बचाने के लिए, छत के निचले भाग के उपर स्टील की बत्ती लगाकर, J बोल्ट के सहारे सबसे निचले पर्लिन के साथ बाँध सकते हैं ।(चित्र 15)।



चित्र – 15

J बोल्ट के सहारे, पर्लिन के साथ, जस्ती स्टील चादर को जकड़ देने का विवरण

9. सिमेंट के साथ बलुआही मिट्टी का स्थिरीकरण

बलुआही मिट्टी में थोड़ी मात्रा में सिमेंट मिला देने से जल अवरोधक शक्ति बढ़ जाती है। इस मिश्रण को पीटकर सघन करने की प्रक्रिया को स्थिरीकरण कहते हैं। बलुआही मिट्टी की पहचान, चिकनी मिट्टी में बालू मिलाकर बलुआही बनाने का तरीका तथा स्थिरीकरण विधि नीचे वर्णित है।

9.1 बलुआही मिट्टी की पहचान के लिये तलछट जाँच विधि

- करीब आधा लीटर के एक पारदर्शी बेलनाकार जार (या गिलास) का एक–चौथाई मिट्टी से भर दें। इसके बाद इसे पानी से भर दें, इसके मुँह बन्दकर जोर–जोर से हिलायें।
- एक घंटे तक स्थिर छोड़ने के बाद, फिर से जोर–जोर से हिलायें और स्थिर होने के लिए छोड दें।
- 45 मिनट बाद, बजरी, बालू तथा सिल्ट की तलछट उँचाई लिख लें। 8 घंटे बाद, तलछट चिकनी मिट्टी उँचाई लिख लें।
- इससे प्रत्येक परत का प्रतिशत ज्ञात कर सकते हैं।
- अनुकूल संयोजन प्राप्त करने तक बार–बार इस विधि से मिट्टी जाँच करें।

9.2 सिमेंट स्थिरीकरण के लिये मिट्टी का चयन

सिमेंट स्थिरीकरण के लिये उपयुक्त मिट्टी के अवयव		
आं	आकार (मि.मी.)	प्रतिशत
महीन बजरी	2.00–4.00	6 – 8
बालू	0.02–2.00	42 – 64
सिल्ट	0.002–0.02	16 – 24
चिकनी मिट्टी	0.002 से छोटा	16 – 24
नोट :– चिकनी मिट्टी अधिक हो तथा बालू कम हो तो, अनुकूल संयोजन के लिए, अतिरिक्त बालू मिलाऐं।		

9.3 सिमेंट– मिट्टी स्थिरीकृत फर्श परत

- 40 प्रतिशत से ज्यादा बालू के आं वाले मिट्टी में, आयतन के 5 प्रतिशत सिमेंट मिलाकर साधारणतया स्थिरीकरण किये जा सकते हैं। सिमेंट स्थिरीकृत मिट्टी का ब्लौक बनाकर जॉच लें।
- पहले मिट्टी कुचलकर महीन बनाकर छान लें और सूखी अवस्था में, सही अनुपात में, सिमेंट मिलाए।
- एक–एक परत ढ़ालकर धुरमुस, पाटा या थापी (मुंगरी) से, मिश्रण को पीटकर स्थिरीकरण करें। अंतिम परत को करनी से समतल करे।
- 3 सप्ताह तक, जूट की बोरी से ढ़ककर, नियमित अंतराल पर जल छिड़काव कर, भिंगोकर रखे।

9.4 दीवाल फलक पर प्लास्टर

- बाँस के बत्ती के बुने दीवाल फलक पर अंदर चिकनी मिट्टी का प्लास्टर कर सकते हैं।
- दीवाल फलक पर बाहर सिमेंट स्थिरीकृत बलुआही मिट्टी का प्लास्टर करें।

चित्र – 16

कुरसी फर्श परत के लिये
सिमेंट–मिट्टी स्थिरीकरण

चित्र – 17

सिमेंट स्थिरीकृत बलुआही मिट्टी का प्लास्टर

चित्र – 18

डंठल और फूस के टाट पर अंदर
चिकनी मिट्टी छोपकर दीवार का निर्माण

बिहार राज्य आपदा प्रबंधन प्राधिकरण
द्वितीय तल, पन्त भवन, बेली रोड, पटना
website-www.bsdma.org Phone: 0612-2522032, 2522284, Fax: 0612-2532311

बिहार सरकार

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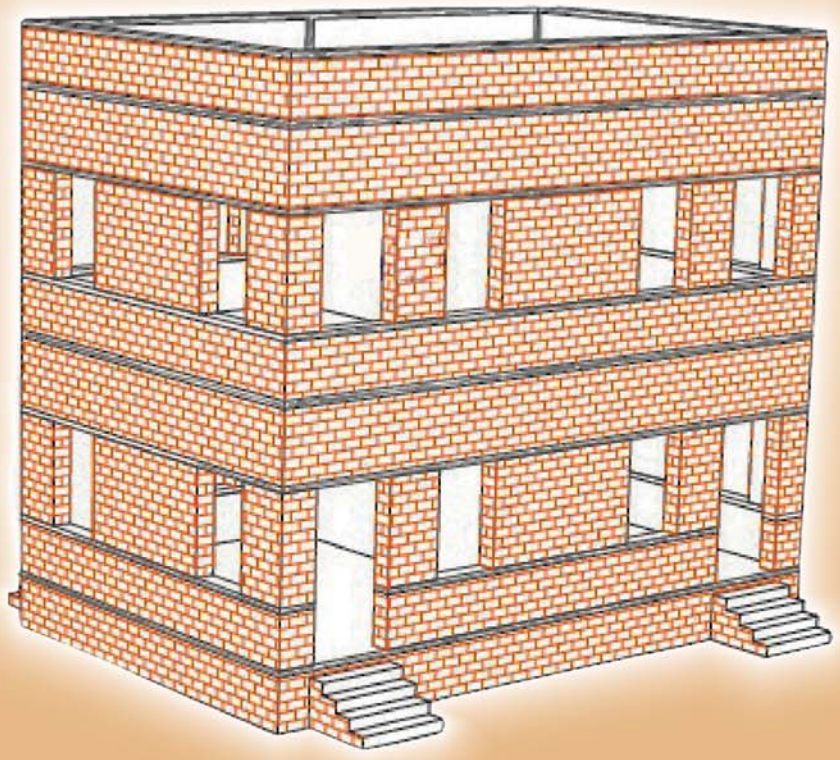
भूकम्प जोन- IV

ईट जोड़ाई पर आधारित मकानों के भूकम्प-सुरक्षित निर्माण हेतु मार्गदर्शिका



आपदा नहीं हो भारी । यदि पूरी हो तैयारी ॥

भूकम्प जोन IV

ईंट जोड़ाई पर आधारित मकानों के भूकम्प–सुरक्षित निर्माण

बिहार राज्य के जोन IV में पड़नेवाले सभी नई मकानों के लिए सरल दिशानिर्देशिका

परिचय

भूकम्प जोन मैप के अनुसार, बिहार राज्य के चौबीस जिले पूर्वी चम्पारण, पश्चिमी चम्पारण, शिवहर, छपरा, सिवान, गोपालगंज, मुजफ्फपुर, वैशाली, समस्तीपुर, बेगूसराय, खगड़िया, पूर्णियाँ, कटिहार, भोजपुर, पटना, जहानाबाद, नालन्दा, नवादा, शेखपुरा, लक्खीसराय, जमुई, मुंगेर, भागलपुर, बांका अधिक तीव्रतावाले जोन IV में आते हैं। ईंट जोड़ाई के दीवार पर छत रखकर बनाये जाने वाले भवनों को भूकम्प में ध्वस्त होने से बचाने तथा जानमाल की सुरक्षा के लिये, कम से कम खर्च पर अत्यावश्यक भूकम्परोधी निर्माण विशेषताओं को इस निर्देशिका में शामिल किया गया है। मकानों को आपदारोधी बनाने के ये बताये गये तरीके, भारतीय मानक संस्थान के IS:4326 पर आधारित हैं।

भूकम्प सुरक्षा हेतु अनिवार्य अंग

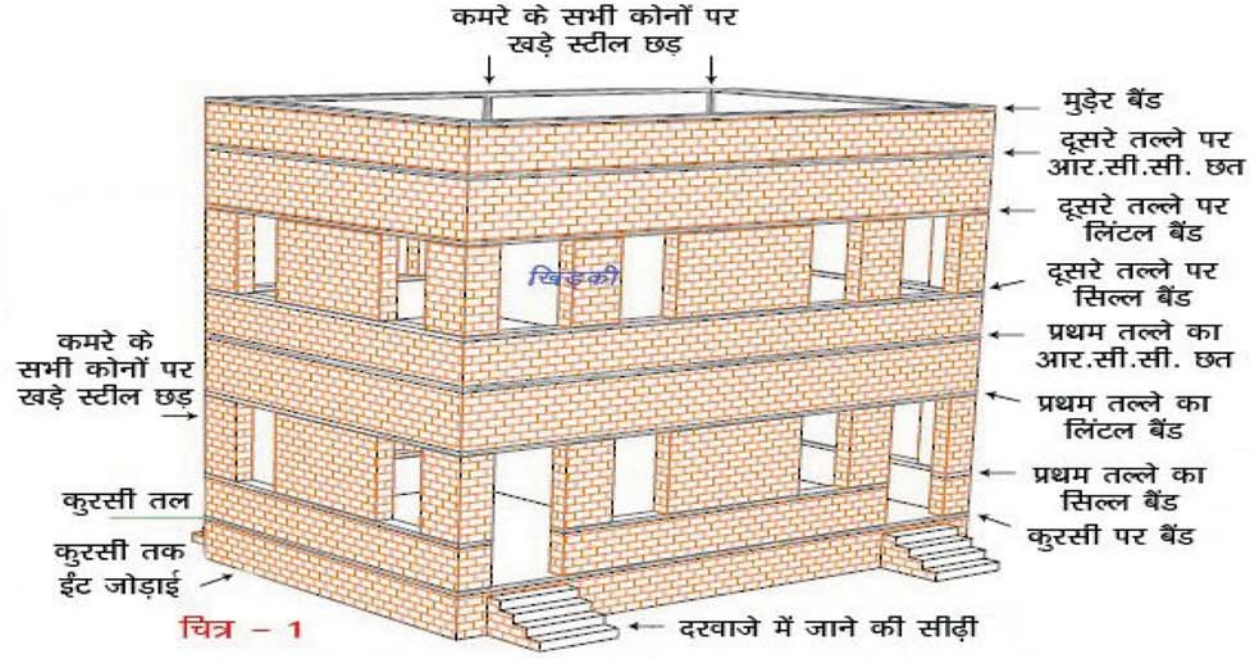
1) क्षैतिज भूकम्परोधी आर.सी.सी बैंड

- मकान के कुर्सी स्तर पर, कुर्सी–बैंड।
- दरवाजों और खिड़कियों के लिंटल के स्तर पर, लिंटल–बैंड।
- पहले ही ढ़ालकर तैयार किये गये आर.सी.सी बीम (या तख्ता) से जोड़कर बनाये गये छत के निचले स्तर पर, छत–बैंड। (जहाँ सपाट आर.सी.सी. या आर. बी. छत दीवार के उपर, दो–तिहाई मोटाई तक चढ़ती हो, छत–बैंड आवश्यक नहीं है।)

2) ईंट की दीवारों के उर्ध्वाधर भूकम्परोधी प्रबलन

- सभी कमरे के कोनों पर ईंट दीवार के अंदर टौर–स्टील के खड़े छड़।
- दरवाजों एवं खिड़कियों के दोनों तरफ कंक्रीट के अंदर खड़े छड़।

क्षैतिज भूकम्परोधी बैंड तथा दीवार के अंदर कंक्रीट में खड़े छड़ मिलकर, ईंट जोड़ाई वाली सभी दीवारों को कुर्सी से लेकर छत तक बाँध देती है। ईंट जोड़ाई पर आधारित सपाट आर.सी.सी. छत वाले मकान के आवश्यक अंग, चित्र–1 में दिखाये गये है।

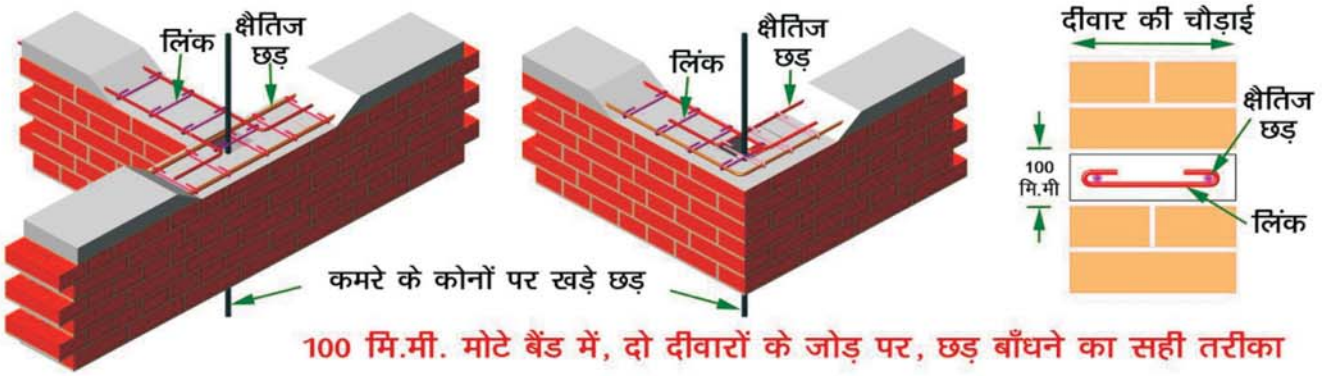


चित्र – 1

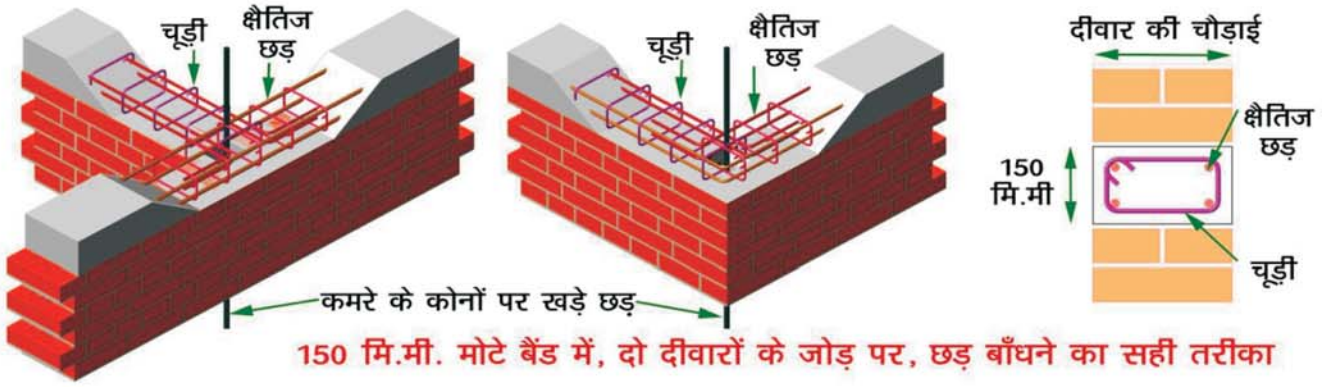
भूकम्प जोन IV

1. क्षैतिज भूकम्परोधी आर.सी.सी बैंड

100 मिलीमीटर या 150 मिलीमीटर मोटा आर.सी.सी बैंड पूरे मकान के दीवारों पर चित्र–1 में दिखाये गये स्तरों पर ढ़ाला जाता है। क्षैतिज भूकम्परोधी बैंड में स्टील छड़ बाँधने का सही तरीका चित्र–2 में दिखाया गया है।



100 मि.मी. मोटे बैंड में, दो दीवारों के जोड़ पर, छड़ बाँधने का सही तरीका



150 मि.मी. मोटे बैंड में, दो दीवारों के जोड़ पर, छड़ बाँधने का सही तरीका

चित्र – 2

दीवार की लम्बाई के अनुसार, साधारण एवं महत्वपूर्ण भवनों के लिये, भूकम्परोधी आर.सी.सी. बैंड की मोटाई तथा टौरस्टील Fe-415 के छड़ों की संख्या एवं व्यास, सारणी–1 में दिखाया गया है।

सारणी – 1 : भूकम्परोधी आर.सी.सी. बैंड की मोटाई एवं बैंड में टौरस्टील छड़

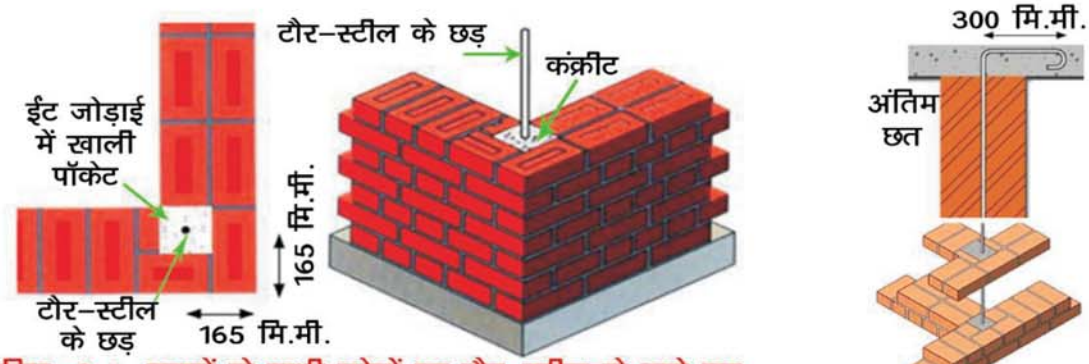
दीवार की भीतरी लम्बाई	आवासीय भवन			महत्वपूर्ण सार्वजनिक भवन (स्कूल, अस्पताल, सभाभवन, आंगनवाड़ी इत्यादि)		
	छड़ों की संख्या	छड़ों का व्यास	बैंड की मोटाई	छड़ों की संख्या	छड़ों का व्यास	आर.सी.सी. बैंड की मोटाई
5 मीटर या कम	2	8 मि.मी.	100 मि.मी.	2	10 मि.मी.	100 मि.मी.
6 मीटर	2	10 मि.मी.	100 मि.मी.	2	12 मि.मी.	100 मि.मी.
7 मीटर	4	8 मि.मी.	150 मि.मी.	4	10 मि.मी.	150 मि.मी.
8 मीटर	4	10 मि.मी.	150 मि.मी.	4	12 मि.मी.	150 मि.मी.

पेज – 2

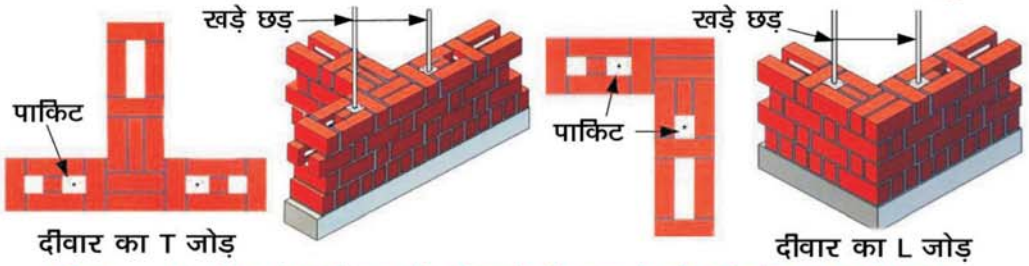
भूकम्प जोन IV

2. सभी कमरे के कोनों पर ईंट दीवार के अंदर टौर–स्टील के खड़े छड़

सभी कमरों के कोनों पर, कंक्रीट डालने के लिये, ईंट जोड़ाई में खाली पॉकेट बनायें। पॉकेट में छड़ खड़ा करके कंक्रीट ढ़ाले। ये खड़े छड़ नींव से प्रारम्भ होकर, सभी आर.सी.सी. बैंड होकर, अंतिम छत की ढ़लाई के अंदर 300 मिलीमीटर मुड़ जानी है। कमरे के कोनों पर छड़ खड़ा करने का तरीका, साधारण दीवारों के लिये चित्र–3 में तथा रैट–ट्रैप बोंड के दीवारों के लिये चित्र–4 में दिखाया गया है। विभिन्न मंजिलों पर, छड़ों की संख्या एवं छड़ों का व्यास, सारणी–2 में दिखाया गया है।



चित्र–3 : कमरों के सभी कोनों पर टौर–स्टील के खड़े छड़



चित्र – 4 : रैट ट्रैप बोण्ड के दीवारों में कमरों के कोनों पर खड़े छड़

सारणी – 2 : साधारण दीवारों में, कमरे के कोनों पर खड़े टौर स्टील के एक छड़ का व्यास

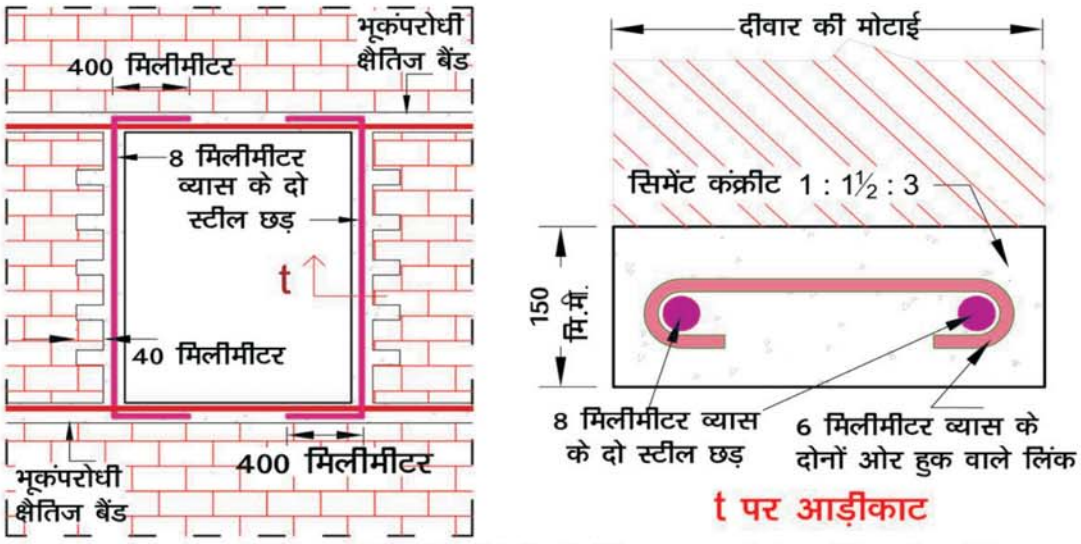
मकान के तल की संख्या	मकान का तल	आवासीय भवन	महत्वपूर्ण सार्वजनिक भवन (स्कूल, अस्पताल, सभाभवन, आंगनवाड़ी इत्यादि)
एक मंजिल	पहला मंजिल	10 मि.मी.	12 मि.मी.
दो मंजिल	दूसरा मंजिल	10 मि.मी.	12 मि.मी.
	पहला मंजिल	12 मि.मी.	16 मि.मी.
तीन मंजिल	तीसरा मंजिल	10 मि.मी.	12 मि.मी.
	दूसरा मंजिल	12 मि.मी.	16 मि.मी.
	पहला मंजिल	12 मि.मी.	16 मि.मी.
चार मंजिल	चौथा मंजिल	10 मि.मी.	भूकम्प जोन IV में, ईंट जोड़ाई पर आधारित, महत्वपूर्ण सार्वजनिक चार मंजिली मकानों की अनुमति नहीं है।
	तीसरा मंजिल	12 मि.मी.	
	दूसरा मंजिल	16 मि.मी.	
	पहला मंजिल	16 मि.मी.	

रैट–ट्रैप बोंड के दीवारों में कमरे के कोनों पर 10 मि.मी. के एक छड़ के बदले 10 मि.मी. के दो छड़ो; 12 मि.मी. के एक छड़ के बदले 10 मि.मी. के दो छड़ो एवं 16 मि.मी. के एक छड़ के बदले 12 मि.मी. के दो छड़ो का उपयोग करना चाहिए।

भूकम्प जोन IV

3. दरवाजों एवं खिड़कियों के दोनों तरफ कंक्रीट के अंदर खड़े छड़

1000 मिलीमीटर से बड़े दरवाजों एवं खिड़कियों के दोनों तरफ, कंक्रीट के अंदर टौर–स्टील के छड़ खड़ा करना चाहिए। 150 मिलीमीटर मोटा कंक्रीट डालने के लिये, ईंट जोड़ाई में जगह बना लें एवं जोड़ाई में 40 मिलीमीटर का खाँच बनाऐं। दरवाजों के दोनों तरफ, कुरसी बैंड से लिंटल बैंड तक तथा खिड़कियों के दोनों तरफ, सिल्ल बैंड से लिंटल बैंड तक छड़ खड़ा करें। खड़े छड़ को निचले एवं उपरी बैंड के अंदर 400 मिलीमीटर मोड़ दें। चित्र – 5 देखें।

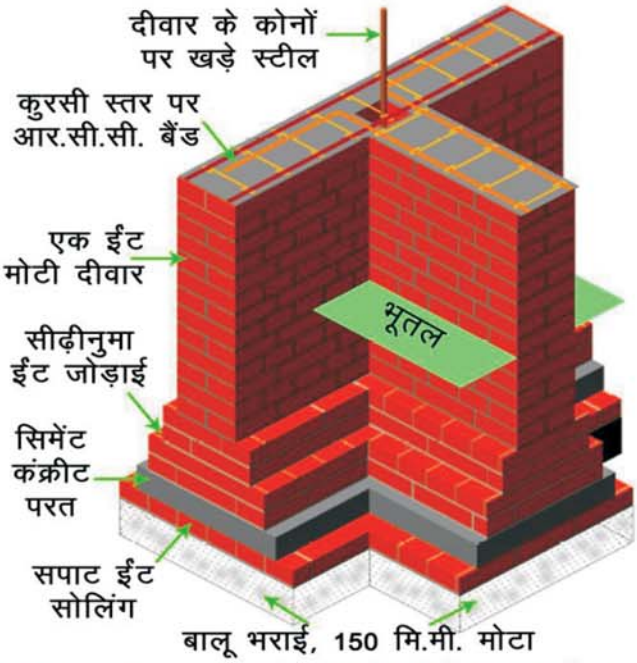


चित्र – 5 : दरवाजे एवं खिड़कियों के दोनों तरफ कंक्रीट में खड़े स्टील छड़

4. कुरसी एवं नींव की सुरक्षा

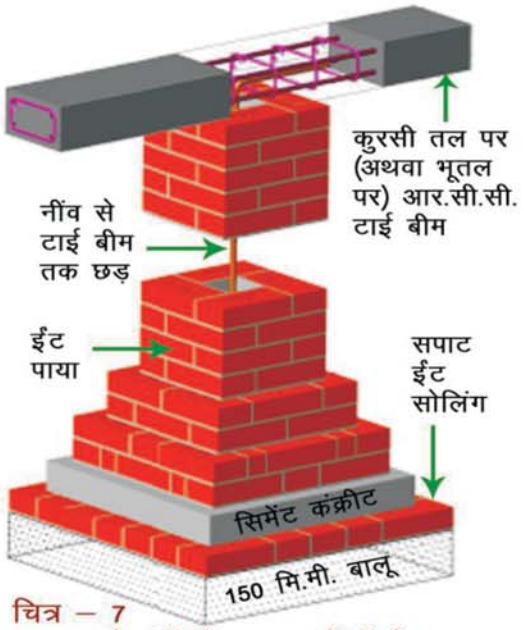
- ✓ अगर, भूतल से 0.6 मीटर नीचे ठोस मिट्टी परत उपलब्ध हो, जिसका बहते जल से कटाव न हो, साथ ही, भूकम्प में, जल संतृप्यता के चलते मिट्टी के द्रवीकरण की भी सम्भावना नहीं हो, तो, पूरे दीवार के नीचे खुला नींव (चित्र – 6) अपनाये जा सकते हैं।
- ✓ चिकनी मिट्टी, बलुआही चिकनी मिट्टी या बलुआही मिट्टी में, भूतल से कम से कम 1.5 मीटर की गहराई पर, वर्गाकार ईंट पाया नींव (चित्र – 7) या आर.सी.सी. पाया नींव (चित्र – 8) का उपयोग कर सकते हैं। यदि किसी स्थल पर बहते जल से कटाव की गहराई अधिक हो नींव की गहराई बढ़ाई जानी चाहिए।
- ✓ जहाँ, बहते जल से गहरे कटाव अथवा भूकम्प में बलुआही मिट्टी के द्रवीकरण की सम्भावना हो, वहाँ, एकमंजिले मकान के लिये, निचले भाग में एक बल्ब वाले, 3.3 मीटर गहरे आर. सी.सी पाइल नींव (चित्र – 9) का उपयोग किया जा सकता है।
- ✓ पाया नींव या पाइल नींव की आपसी दूरी 1.5 मीटर से 1.8 मीटर तक रखनी चाहिए। सभी पाया नींव या पाइल नींव के उपरी भाग को बाँधते हुए, कुरसी तल पर (अथवा भूतल पर) आर.सी.सी. टाई बीम (चित्र – 8) बनाया जाता है। अगर कुरसी तल पर आर.सी.सी. टाई बीम बनाया जाता है, तो कुरसी की मिट्टी को थामे रखने के लिए, पाये या पाइल के बीच में, टाई बीम के नीचे, ईंट की दीवार बनायी जाती है।

पेज – 4



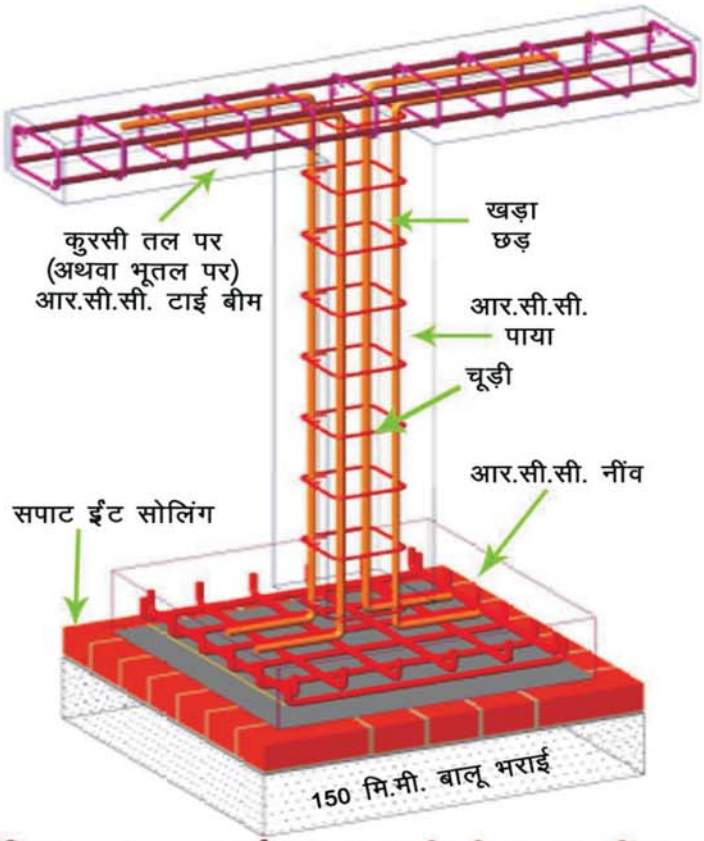
चित्र – 6 : पूरे दीवार के नीचे खुला नींव

भूकम्प जोन IV

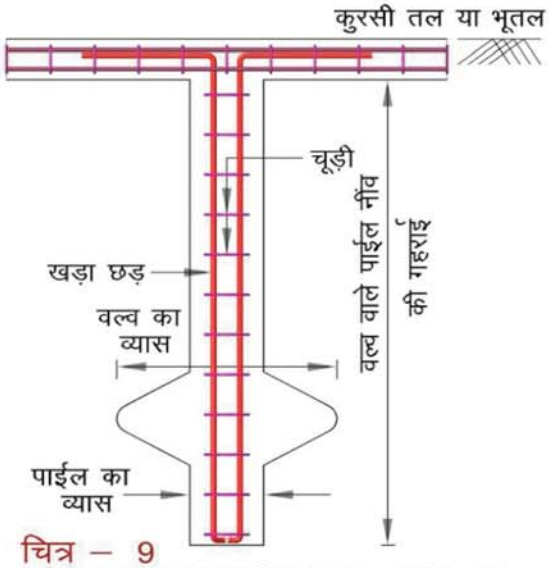


चित्र – 7

दो मंजिले मकान के लिये, 1½ ईंट X 1½ ईंट जोड़ाई का पाया नींव



चित्र – 8 वर्गाकार आर.सी.सी. पाया नींव



चित्र – 9

वल्व वाले पाईल नींव का विवरण

पेज – 5

भूकम्प जोन IV

5. निर्माण में आवश्यक सावधानियाँ

हमेशा साफ और ताजा भवन निर्माण सामग्रियों का उपयोग करें। गर्द से बचाने के लिए, बालू और स्टोनचिप्स (गिट्टी) को पोलीथीन चादर बिछाकर उसपर रखें तथा इन्हें पोलीथीन चादर से ढ़क दें।

ईंट की जोड़ाई

- दीवार निर्माण के लिये, चिमनी भट्ठे के ईंट लाल रंग के, ठीक से पके तथा एक ही आकार प्रकार के होने चाहिए।
- मसाले के जल को ईंट सोख लेता है, अतएव, इस्तेमाल से पहले ईंट को कम से कम 4 घंटे स्वच्छ जल में डुबोकर रखना अनिवार्य है।
- जोड़ाई के दौरान प्रत्येक रद्दा (लेयर) क्षैतिज समतल में रखें एवं ईंटों के छापवाले फलक उपर रखें। दीवार सही–सही उर्ध्वाधर खड़ा होना चाहिए।
- 1:4 के अनुपात में सीमेंट – बालू मिश्रित मसाला सबसे अच्छा होता है। मसाला परत की मोटाई तथा ईंटों के बीच दूरी 10 मिलीमीटर रखें, जिसे सिमेंट–बालू मसाल से पूरा पूरा भर दें। जोड़ाई के उपरान्त अगले 7 दिनों तक दीवार को स्वच्छ जल से भिंगोकर रखें।
- एकमंजिले मकानों में, आधा ईंट मोटी दीवार अथवा रैट ट्रैप बोण्ड का सुझाव दिया जाता है।

सिमेंट

सिमेंट ताजा होना चाहिए। इसे सूखे स्थान पर जमीन से उपर रखें। ईंट जोड़ाई के लिये 43 ग्रेड का सिमेंट अथवा पी.पी.सी पर्याप्त है। सिमेंट के मिश्रण में पानी मिलाने के एक घंटे के अंदर उपयोग कर लेना अनिवार्य है।

प्रबलित सिमेंट कंक्रीट (आर.सी.सी) बनाने की विधि

- टौर स्टील छड़ का जाल या पिंजरा तैयार कर, सिमेंट कंक्रीट से पूरा–पूरा ढ़क कर ढ़लाई करने से, आर.सी.सी बनता है। भूकम्परोधी आर.सी.सी. बैंड में स्थित स्टील छड़ों को जंग लगने से बचाने के लिये, कम से कम 25 मिलीमीटर कंक्रीट का आवरण रखना अनिवार्य है।
- आर.सी.सी बनाने के लिये सिमेंट, बालू, एवं स्टोनचिप्स का अनुपात 1:1.5:3 रखना चाहिए। 20 मिलीमीटर और 10 मिलीमीटर आकार के स्टोनचिप्स को 60:40 के अनुपात में मिलाने से अच्छा कंक्रीट बनता है। सिमेंट के प्रति बैग पर 25–30 लीटर पानी मिलाना चाहिए।
- कंक्रीट को पीट–पीटकर या भाईब्रेटर की सहायता से सधन करना चाहिए। सँकरे स्थानों मे एवं किनारों पर, 16 मिलीमीटर स्टील छड़ की सहायता से कंक्रीट को ठूँस–ठूँस कर सधन करना चाहिए। कंक्रीट ढलाई के उपरान्त अगले 10 दिनों तक जल से भिंगोकर रखना अनिवार्य है।

टौर स्टील छड़ (HYSD Fe 415)

दो छड़ों के जोड़पर, छड़ के व्यास के 50 गुना की दूरी तक (यथा : 12 मिलीमीटर व्यास के छड़ के लिये 600 मिलीमीटर), छड़ों को एक दूसरे पर चढ़ाकर तार से बाँध दें।

1934 तथा 1988 के भूकम्प की त्रासदी से बिहार की जनता को बचाने के लिये यह सरल दिशानिर्देशिका प्रस्तुत है, प्रस्तुतकर्ता –

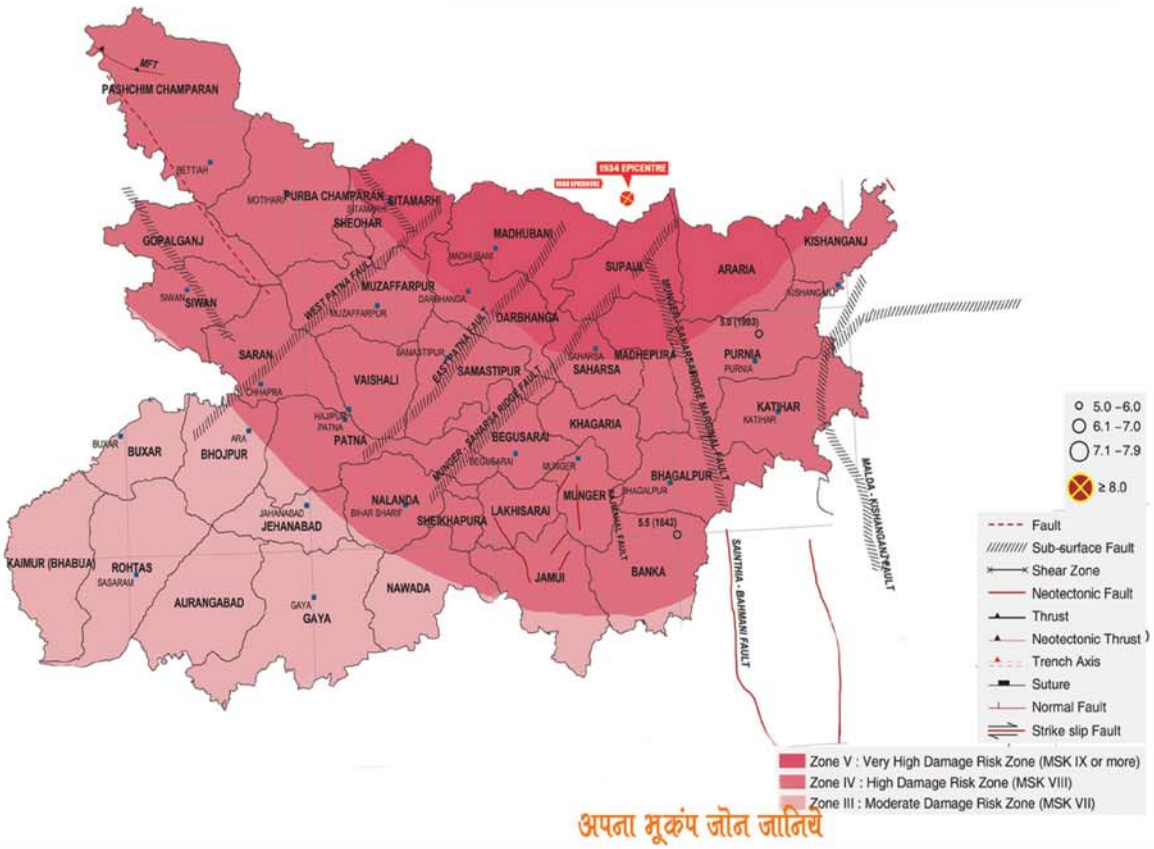
पद्मश्री, डा. आनन्द स्वरूप आर्य, अवकाशप्राप्त प्राध्यापक, भारतीय प्राद्यौगिकी संस्थान रूड़की सह सदस्य, बिहार राज्य आपदा प्रबंधन प्राधिकरण एवं

बरूण कान्त मिश्र, कार्यपालक अभियंता, पथ निर्माण विभाग, संम्पर्क 9431011010

पेज – 6

बिहार
भूकम्पीय जोन मानचित्र

(showing faults, thrusts and earthqukes of magnitude ≥5)



अपना भूकंप जोन जानिये

विकास ऐसा हो जो आफत से बचाए।
ऐसा न हो कि आफत बन जाए ।।

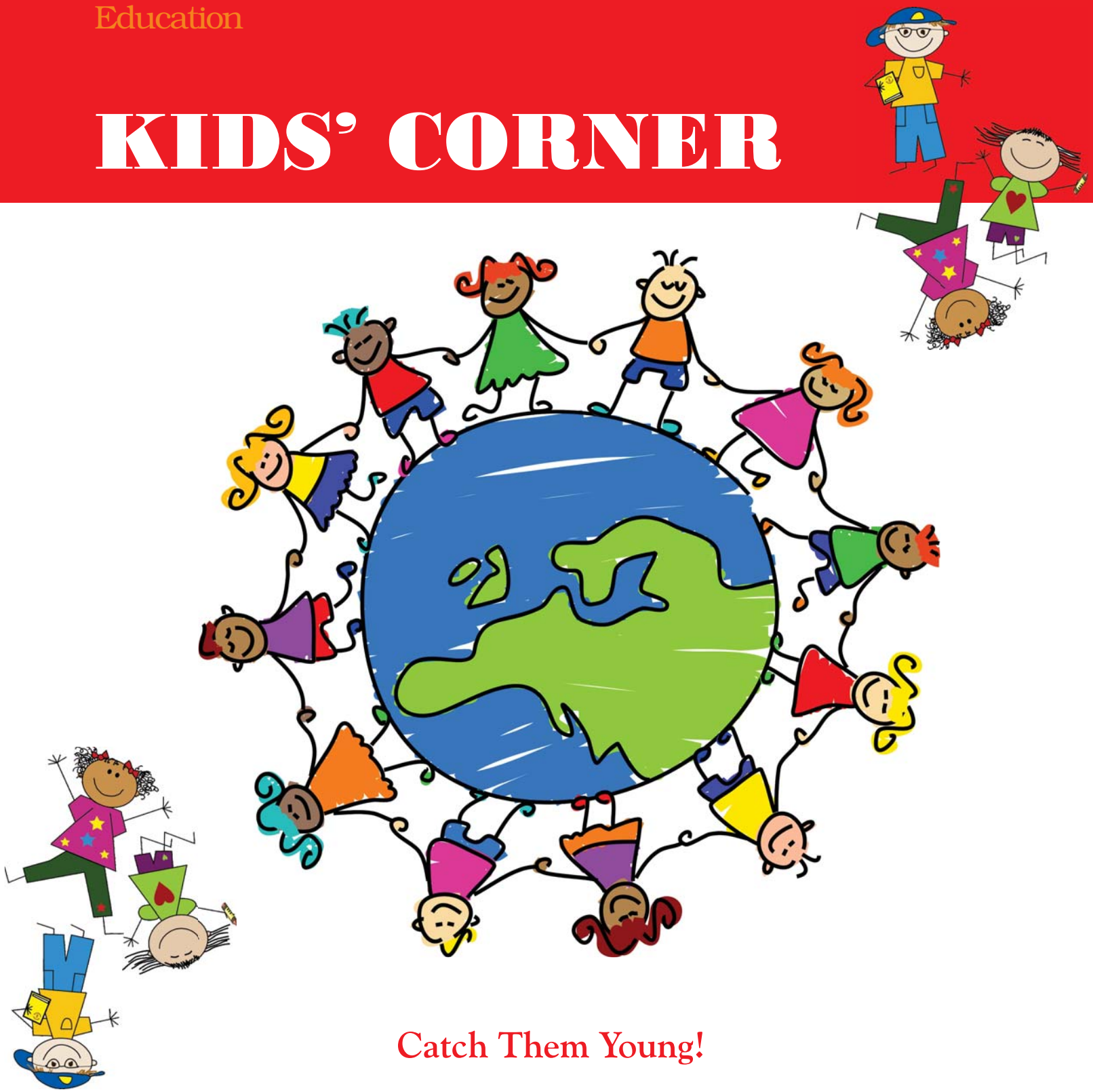
बिहार राज्य आपदा प्रबंधन प्राधिकरण

द्वितीय तल, पन्त भवन, बेली रोड, पटना

website-www.bsdma.org

Phone: 0612-2522032, 2522284, Fax: 0612-2532311

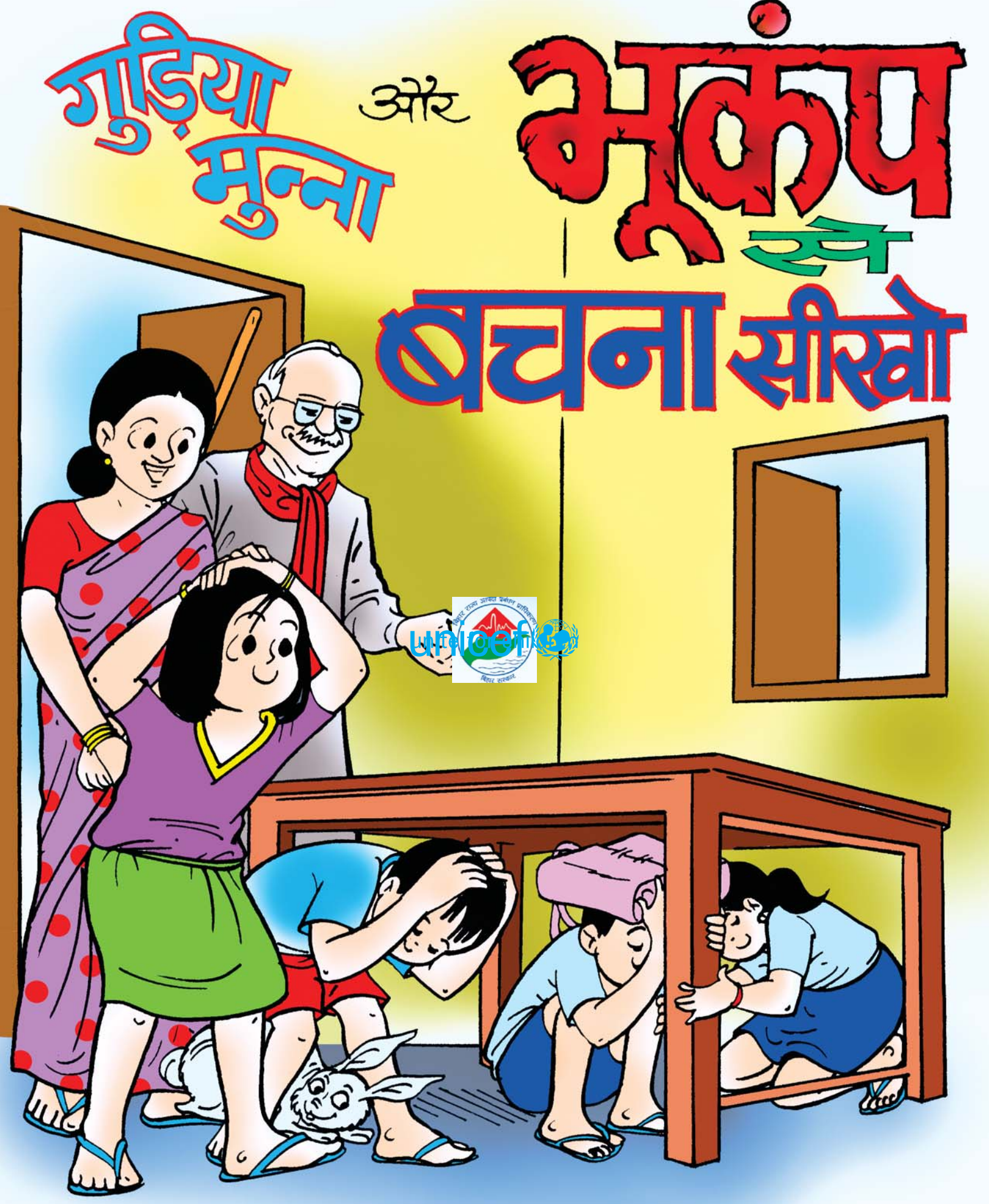
KIDS' CORNER



Catch Them Young!

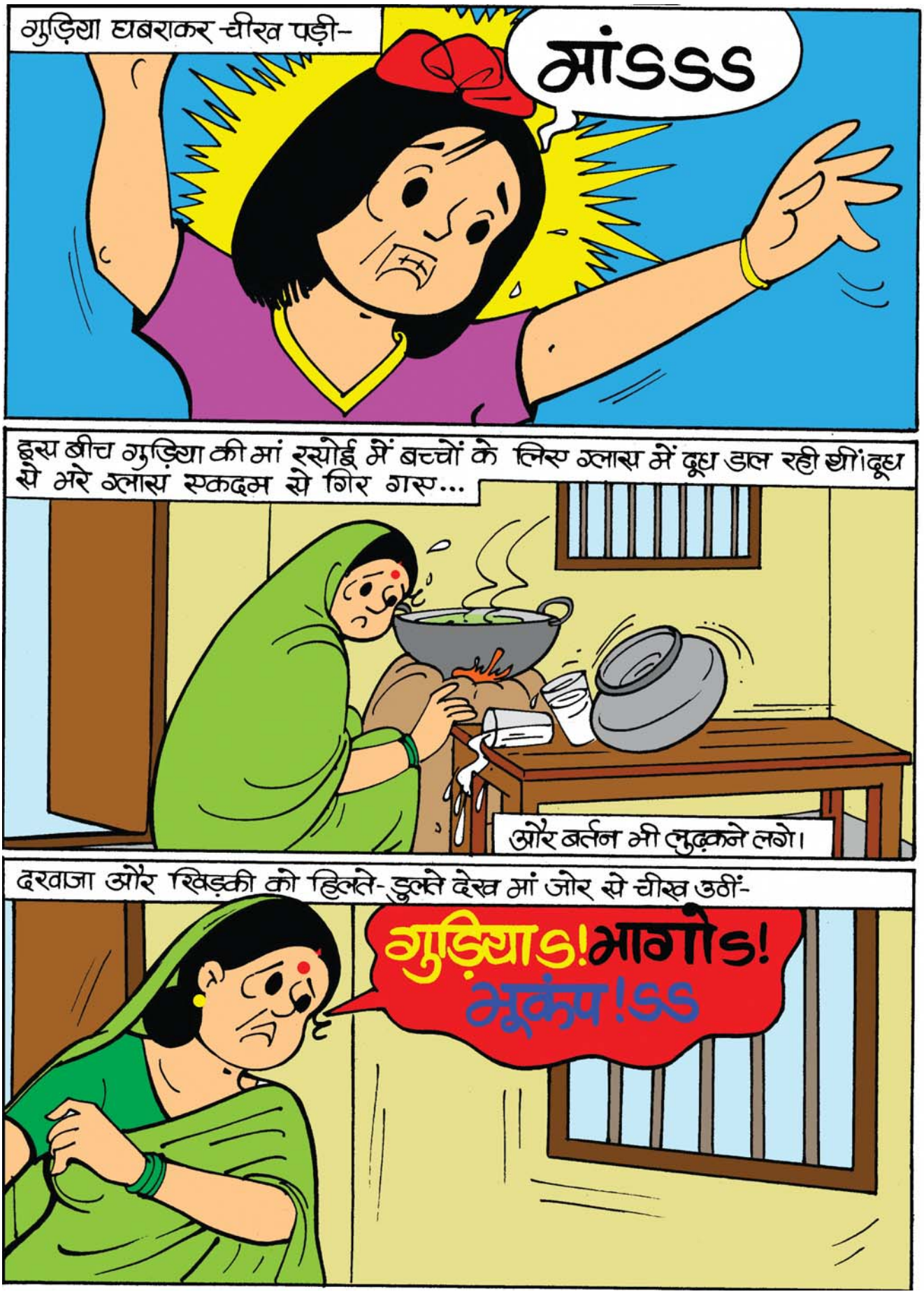
Children are quick learners. Their minds are sharper and they can be physically more alert than their elders. The Bihar State Disaster Management Authority (BSDMA) is promoting awareness about disaster preparedness among children through easy to read and understand comic and cartoon books. There is also a proposal to include disaster preparedness in school curriculum. Young minds are also the most impressionable. So, to teach them, it's better to catch them young. BSDMA knows this mantra best.

गुड़िया मुन्ना और भूकंप से बचना सीखो




गुड़िया और मुन्ना का परिवार एवं समाज
मैं हूं गुड़िया और ये मुन्ना! हम भाई-बहन और दोस्त भी हैं!
हमारे माता-पिता, सोहन लाल और सविता देवी! हमारे संरक्षक!
हमारी टीचर दीदी... हमारी सच्ची मार्गदर्शक!
हम सबके दादा जी! गांव के सबसे बुजुर्ग व्यक्ति!
हमारा दोस्त... मुनमुन खरगोश! होशियार चतुर और सदा मददगार!
तो अब शुरू करें, भूकंप से बचाव की तैयारी की कहानी...


18 सितंबर की शाम का समय था। गुड़िया होमवर्क बनाने में लगी थी और मुन्ना बाहर खेल रहा था।
अरे! यह हमारी गाय इतना शोर क्यों मचा रही है?
तभी अचानक धरती हिली, पर गुड़िया को यह बात पता न चली
ओऽहु! मेरी कॉपियां क्यों हिलने लगीं...? और चारपाई भी हिल रही है!
घबराकर गुड़िया फौरन चारपाई से उतर गई।
ओऽहु! घर भी हिल रहा है!


गुड़िया घबराकर चीख पड़ी-
मांऽऽऽ
इस बीच गुड़िया की मां रसोई में बच्चों के लिए ग्लास में दूध डाल रही थीं।दूध से भरे ग्लास एकदम से गिर गए...
और बर्तन भी लुढ़कने लगे।
दरवाजा और खिड़की को हिलते-डुलते देख मां जोर से चीख उठीं-
गुड़ियाऽ! भागोऽ! भूकंप!ऽऽ


गुड़िया का हाथ पकड़कर उसकी मां सविता देवी घर से बाहर की ओर बड़ी तेजी से भागी आईं—
ओह! बच गए! भूकंप था!
साथ में गुड़िया और मुन्ना का प्यारा दोस्त मुनमुन खरगोश भी बाहर भागा आया।
ओह! मुनमुन!
तभी मां की निगाह मुन्ना पर पड़ी। मुन्ना बाहर खेल रहा था। वह मां और गुड़िया को इस तरह घबराया देख, उनके पास भागा आया।
मां! क्या हुआ मां?!
तूने महसूस किया...? भूकंप आया था बेटा!


क्याऽऽ?! भूकंपऽऽ!?
तो क्या यह भूकंप था?... तभी मेरे हाथ से गेंद छूट गई थी!
और हम कई बच्चे अचानक 'धम्म' से गिर पड़े थे!
और चिड़िया जोर-जोर से चहचहाने लगी थीं!
हां, मम्मी ने बताया कि यह भूकंप था मुन्ना! हमने भूकंप के बारे में पढ़ा था और आज महसूस भी कर लिया!
ओ-ह! कैसा अजीब लग रहा था.. हमें तो पता ही नहीं चला!


इस बीच इलाके के सारे लोग घर के बाहर आ गए थे। सबके चेहरे पर घबराहट थी। साथ ही जान- माल बचने का संतोष भी था।
बाप रे! बच गए!
मैं तो बच्चों के लिए घबराई हुई थी...
दादा जी मुझे और मैं दादा जी को लेकर भागी!
हां!
तभी गुड़िया और मुन्ना के पिता सोहन लाल वहां साइकिल से आ पहुंचे। वह काम से शहर गए हुए थे। उन्होंने पत्नी और बच्चों को सही-सलामत पाया, तो चैन की सांस ली।
फिर उन्होंने अपने घर को सही- सलामत पाया तो बच्चों को हिदायत देने लगे–
अभी घर के भीतर नहीं जाना। भूकंप का खतरा बना रहता है। और न ही घर की दीवारों से सट कर खड़े रहना।
जी, पिता जी!

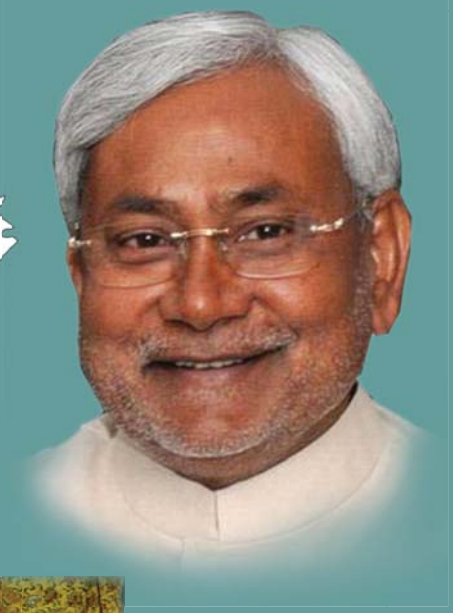

मुन्ना घर के समीप पेड़ के नीचे चबूतरे पर बैठ गया।
वहां भी नहीं बैठो। भूकंप आया, तो पेड़ तुम्हीं पर गिर जाएगा!
हां, सही बताई। पर हम बाहर खाली बैठ कर क्या करें गुड़िया?!
मुन्ना! क्यों न हम टीचर दीदी के पास चलें।
और फिर हम घर के भीतर तो जा नहीं सकते। टीचर दीदी भी बाहर ही होंगी। हम भूकंप के बारे में उनसे अपना ज्ञान बढ़ाएंगे।
तब तो ठीक है! समय भी कट जाएगा।


बच्चों को जाते देखा, तो सोहन लाल खुश होकर अपनी पत्नी से बोले-
जाओ-जाओ! टीचर जी का दिया ज्ञान हमें भी बताना।
हां जी, पढ़ाई-लिखाई का यही तो फायदा है। पड़ोस की फूली की मां अभी भी भूकंप को भूत मानती हैं। कहती हैं, यह सब हिलाना-डुलाना भूतों का काम है।
सुनकर सोहन लाल हंस पड़े-
यह तो गजब का अंधविश्वास है मुन्ना की मां।
मगर जानने के लिए अभी बहुत बाकी है। बच्चों से हमें भी सीखना चाहिए। केवल बच्चों के जानने-सीखने से काम नहीं चलेगा।
इस बीच गुड़िया, मुन्ना, नंदू, रानी और जावेद टीचर दीदी के पास पहुंच गए थे।
अरे बच्चो! तुम सब?.. क्या तुमने भूकंप महसूस किया?!


हां टीचर दीदी, बड़ा भयानक था!
मैं तो समझ ही नहीं पाया कि भूकंप है!
ओ-हो-हो-होऽऽ... मुझे तो बड़ा मजा आया!
टीचर दीदी भी नंदू की बातों पर हंस पड़ीं-
क्या, मजा आया?! हो-हो-होऽ
1988 के भूकंप में मगर मैं बहुत डर गई थी। घर के भीतर जाती ही नहीं थी।
वैसे मजा आने की बात नहीं है नंदू, मगर बहुत ज्यादा घबराने की बात भी नहीं है। बस, समझदारी और सावधानी की जरूरत है!


जैसे बेंच, चौकी, पलंग और टेबुल के नीचे घुस जाओ।
दीवार से सट कर खड़े न हो! सिर को बचाओ!
बिजली का मेन स्विच ऑफ कर दो।
अरे वाह! तुम सब तो पहले से बहुत जानते हो। फिर मेरे पास क्यों आए हो भूकंप के ज्ञानियों!?
टीचर दीदी, जो पहले से हम जानते हैं, वह भी तो हमें आपने ही बताया है!
भूकंप के बारे में और बहुत सारी बातें बताइए, जो हम नहीं जानते।
तो ठीक है, सबसे पहले तुम्हें बताती हूं, 1988 में आए भूकंप के बारे में। आज का भूकंप तो उतना खतरनाक नहीं था, पर 1988 वाले भूकंप के बारे में बताते हुए तो मेरे हाथ-पैर कांपने लगेंगे।
To be continued...

I Am Bihar



An Eternal Anthem

I Am Bihar

I am the history of India. I gave the world its first Republic.

I gave India its first President.

I ushered Buddha to enlightenment.

I gave the world its first University at Nalanda.

I am the birth place of Jain Tirthankar Mahavir.

My son Valmiki wrote Ramayan, the greatest Epic.

I gave birth to Aryabhatt, one of the greatest mathematicians.

My son Vatsayana wrote Kamasutra, the treatise of love.

I created Ashoka Chakra that adorns India's national flag.

Rishi Shushrut, the father of surgery, lived on my soil.

My son Sher Shah Suri gave India its first highway- Grand Trunk road from Howrah to Peshawar.

My son Guru Gobind was the 10th Guru of the Sikh religion.

My son Chanakya was an astute scholar of Economics and Political Science.

My son Ashoka was the greatest ruler of India.

My son, Rashtrakavi Ramdhari Singh Dinkar was the national poet of India.

Bapu Gandhi started his first Satyagraha in 1917 from Champaran, Bihar.

I am the land of festivals.

I am the Past, I am the Present, I am the Future.

I AM BIHAR.

Jai Hind!