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NEWSLETTER

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Non-Engineered Structures: Learning from Previous Generations

Seismic Strengthening of Non-Engineered Structures, meeting report by **Robert May**.

Why have modern non-engineered buildings been failing with such devastating consequences in recent earthquakes?

What can be learned from the non-engineered buildings of previous generations?

Can anything effective be done to strengthen non-engineered structures in seismic areas?

These are some of the questions underlying the SECED informal discussion on 18th July 2001.

A packed meeting was informed and challenged in turn by Richard Hughes, Dinesh Patel and Khimji Pindoria, Andrew Charleson and Dina D'Ayala.

Dinesh and Khimji gave a preview of the

Figure 1. 'Tractor Shake Tests' – before shaking

Figure 2. 'Tractor Shake Tests' – after shaking

repair and retrofit guide they have been writing following the Bhuj Earthquake, Andrew introduced the work of the Earthquake Hazard Centre and Dina discussed strengthening of masonry buildings in southern Europe.

Overview

Richard Hughes (Ove Arup) set the scene with a series of pertinent observations:

Most vernacular structures are not engineered in the normal sense but in seismic regions many incorporate seismic provisions derived from generations of experience. Examples of such structures are timber framed buildings with panel infills and masonry buildings with timber banding.

In most parts of the developing world the vernacular architecture is being supplanted by reinforced concrete frame structures. Irregular structural forms, large openings and inadequate structural detailing are commonplace – even in countries such as Turkey and India which have generally adequate seismic codes.

The major causes of failure of vernacular and modern non-engineering structures have known for many years.

Effective communication of this knowledge to local builders and engineers has hardly begun in many countries.

Providing advice alone is not enough, attitudes also need to change. Given appropriate advice, owners may well incorporate features which required little expense (shear steel in columns at 250 mm centres lapped into the column centre). However in many areas owners are reluctant to fund modest increases in building cost for structural improvements such as adequate moment connections between columns and beams. Changing attitudes and practices at a grass roots level presents a major challenge.

Gujarat Repair & Retrofit Guide

Dinesh Patel (Arup) and **Khimji Pindoria** (Pindoria Assoc) took up Richard's challenge giving a preview of the innovative guide they and Devraj Patel have produced to assist owner – builders in the Kutch region of NW India. Lack of access to sound advice on methods of repair and retrofitting was identified as a major problem for house owners following the Bhuj earthquake. The Guide sets out why earthquakes occur in the region, factors which affect their severity and practical measures which can be taken to repair and retrofit structures. Much effort has been put into the production of simple perspective diagrams to illustrate the advocated construction methods. Dinesh provided an overview of the types of damage caused in the Bhuj earthquake (Table 1) while Khimji described aspects of the structural repairs and retrofit measures described in the Guide.

The authors explained that, as Gujarati engineers themselves, they had an excellent network of local contacts in the Kutch region and hence had the opportunity to get information to those who most needed it. The Guide is now available to download from the SECED web site.

(www.seced.org.uk)

Structural Type	Typical Damage	Retrofit/Repair
Rubble masonry	Close to epicentre complete collapse, heavily damaged up to 50 km from epicentre. Reasons: Clay mortar has little tensile strength; inadequate through ties for walls; roofs inadequately tied to walls. Those with slab roofs were heavily damaged but did not always collapse because of good diaphragm action	Use non intrusive repairs as rubble blocks may collapse e.g. reinforce with wire mesh on both sides of walls. If sections of walls have collapsed use seismic bands to rebuild Enhanced roof to wall ties.
Cut stone masonry	Better performance than rubble masonry. Large out of plane movements occurred but walls typically 300 to 1000 mm thick generally survived. Good roof framing and modest openings for windows and doors assisted survival. Also, diaphragm action provided by floor and roof slabs	Similar to rubble masonry structures. Where corners of walls have been damaged rebuild and make sure that window openings are reduced. Construct seismic bands if possible
Reinforced concrete frames	Widespread failure of non-seismically designed structures occurred on commercial structures but domestic structures performed better. Reasons: Irregular floor plans (torsion), soft storeys, poor concrete detailing, service pipes built into in columns. Domestic buildings only survived heavy structural damage or collapse due to action of infill masonry panels acting as shear walls during earthquake. But infill panels suffered heavy damage where structural frame was OK	Seismic repairs to columns using IS standards for ductile reinforcement. Replace infill panels with cut-stone or concrete blocks and use seismic lintel/cill/roof bands. Make sure window openings are limited in area to IS guidelines.

Table 1. Structural damage and retrofitting following the Bhuj Earthquake.

Earthquake Hazard Centre

Andrew Charleson (Victoria University, Wellington NZ) described the establishment of the Earthquake Hazard Centre and its quarterly Newsletter. The EHC arose from a seminar in Hyderabad five years ago with the aim of improving the culture of earthquake design in the remoter parts of the developing world. Its newsletter is sent to interested parties and is available via the Internet (www.ehc.arch.vuw.ac.nz).

Andrew highlighted a range of measures from various parts of the world that are being used to enhance the seismic performance of vernacular and modern structures (Table 2). Each issue of the EHC Newsletter features an aspect of good seismic design practice together with reprints of relevant papers. Andrew drew attention to the 'tractor shake tests' used in parts of India to provide visual demonstration of the benefits of seismic banding (see Figures 1 and 2). He concluded with a challenge to the assembled engineers to find means of providing tensile reinforcement for non-engineered structures that is cheaper than steel reinforced concrete.

Figure 1 shows strengthened and non-strengthened model buildings on a simple shaking table. Figure 2 shows the effects of tractor-induced shaking of the table. The strengthened structure survives while the non-strengthened structure collapses. The models provide a simple but effective teaching aid.

Country of Origin	Type of Structure	Detail Strengthening Measure
India	Adobe, random rubble	Banding at lintel/roof level with mesh reinforced concrete. Through wall ties in reinforced concrete to connect inner and outer skins. Reduction of earth roof weight – partially replacing earth with polythene sheeting.
Ecuador	School with long unbraced masonry walls	Reinforced concrete portal frames at intervals (shear walls would also have been effective but would have adversely affected functionality).
Peru	Adobe, random rubble	Use of wood and steel ties Light mesh and mortar banding
Caribbean	Masonry	Ferro-cement reinforcement to main load bearing walls
Costa Rica	Reinforced concrete	Reinforced concrete shear walls created between columns

Table 2. Typical Seismic Strengthening Measures.

Strengthening Of Masonry In Southern Europe

Dr Dina D'Ayala (University of Bath) discussed the performance of strengthened southern European masonry structures including examples from the Umbria-Marche region. The latter are especially interesting having been strengthened following the 1979 earthquake and being shaken again in the 1997 event.

EMS 98 Vulnerability Classes:

Typical Structures	Class
Adobe & rubble stone	A
Simple cut stone & brick	B
Massive stone	C
Non-engineered concrete frame	C

Classes range from A to D in order of decreasing vulnerability. Good / poor construction or maintenance may raise or lower the Class. Earthquake intensity is correlated with extent of damage to buildings in each vulnerability class.

Dina discussed the assessment of structures in accordance with the European Micro-Seismic Building Categorisation – EMS 98 Vulnerability classes (see box). Well built masonry houses would classify as Class B possessing the key features of good quoin blocks, well pointed masonry, regular through wall ties for internal floors and well braced roofs. The Italian Seismic Code describes retrofit measures for such structures. These include ring beams at roof level, rafters to prevent roof spreading, anchorage of the roof trusses to the walls and through-structure wall ties. The effectiveness of these measures is dependent on appropriate application and good detailing.

Dina discussed some of the pros and cons of retrofitting options. Aesthetic considerations are important to gaining acceptance. Banding with reinforced concrete or shotcrete can have aesthetic problems. Wall plates for ties also need careful detailing. Shotcrete on mesh tends to have low durability due to rusting of the mesh and spalling.

In conclusion well assessed and implemented strengthening has been shown to increase the collapse threshold acceleration of masonry buildings subjected to 'European' earthquakes by around 0.1 g to peak ground accelerations of between 0.2 and 0.4 g.

Discussion

A lively discussion ensued covering the design and validation of seismic strengthening measures, appropriate measures for various structural forms and the dissemination of structural information to local communities in seismic regions.

Matthew Collings (Gifford) gave a short presentation on the use of discrete element modelling to identify optimum strengthening strategies for masonry structures (see separate article in SECED Newsletter).

The meeting highlighted the considerable advances that have been made in understanding the seismic behaviour of vernacular and modern non-engineered structures. Imaginative new approaches to communicating that understanding were presented. However all left conscious of the immense task that remains if the death toll and losses from the collapse of non-engineered structures in earthquakes is to be reduced.

***A**nti-**S**eismic **S**ystems **I**nternational **Soci**ety (**ASSISi**)*

New society for new technologies**, Keith Fuller** reports

Engineers involved in the research, development and application of new technologies for the protection of structures from earthquakes have felt for some time the lack of a suitable organisation to represent them at an international level. The International and European Associations for Earthquake Engineering provide general forums, and there are Associations at similar levels for those concerned with active control of structures. Such an organization is missing, however, for engineers interested in novel earthquake protection techniques such as seismic isolation or added passive damping. With the intention of remedying that situation, a group of delegates to the Seventh International Seminar on Seismic Isolation, Passive Energy Dissipation, and Active Control of Vibrations of Structures held last autumn in Assisi, Italy, led by the organisers ([Italian] Working Group on Seismic Isolation [GLIS]) and representing nine countries, held a Foundation Preparation Meeting on October 6, 2001. It was agreed to set up an International Association for Seismic Isolation and Energy Dissipation. The following objectives of the Society were agreed:

1. Organise International Conferences and Seminars

2. Promote International Cooperation for the Development and Application of Anti-seismic Technologies

3. Promote the development of International Design Guidelines and Testing Procedures.

The two officers of the Founding Committee approved are:

Dr. Alessandro Martelli (ENEA, GLIS) - Chairman
Dr. Howard H. Chung (MITEC International) - Secretary

Later it was decided to call the organisation *A*nti-*S*eismic *S*ystems *I*nternational *Soci*ety to produce the acronym *ASSISi*, and to allow the name to embrace a wider range of anti-seismic technologies.

The UK member of the Founding Committee is Keith Fuller of TARRC (formerly Malaysian Rubber Producers' Research Association). He will act as a link between SECED and *ASSISi*, and hopes to give more details about the Society in the near future.

MEETING REPORT:

"ENHANCED DAMPING OF STRUCTURES USING VISCO-ELASTIC MATERIALS"

*A report by **Tianjian Ji** on the SECED meeting, 30 January 2002*

One fascinating topic related to the dynamic behaviour of structures is the use of enhanced damping to reduce and even control structural vibration. The seminar on 30 January 2002 showed how damping materials can be effectively used to reduce the responses of an RC frame structure to earthquake loads and of a composite floor to human loads. The former was a safety problem while the latter a serviceability problem.

Dr. Keith Fuller, head of R & D at TARRC/Rubber Consultants (known as Malaysian Rubber before 1996), first showed the design of a novel visco-elastic damper, a rubber layer with a dimension of 240 x 170 x 7mm bonded to metal end-plates $330 \times 330 \times 15$ mm. The material developed had a loss factor of approximately 0.4 and a change in the shear modulus of about a factor of three between –20 and 50 ^0C. The performance of the damper was assessed experimentally, using pseudo-dynamic testing of a mock-up of a building frame.

The two-storey, two-bay long and one-bay wide, frame was 10m long, 4m wide and 5.2m high, and was built for testing at JRC, Italy. This represented a portion of a building at a scale of 2/3. The test building illustrated a non-seismic design. It was proposed that the installation of the dampers would allow the test building to respond elastically to the design level earthquake. A total of eight pairs of dampers were installed in the frame, one pair in each storey and each bay in the longer direction. Figure 1 shows the devices and their location in the frame.

For the evaluation of the performance of the visco-elastic dampers, pseudo-dynamic tests were carried out on the test building with and without the anti-seismic devices. The input motion corresponded to artificially generated earthquakes specified by EuroCode 8 and representative of medium soil conditions. The level of the earthquake corresponded to 0.3g PGA for the full-size building. The study concluded that:

a) Seismic retrofit of the RC frame with dampers reduced displacement of the frame by 80%, by increasing the stiffness by a factor of 4 and by raising equivalent damping ratio to about 15%.
b) Overall forces in the protected frame structure were similar to those for the bare frame. However, the forces supported by the RC frame were reduced by 55%, the remainder being resisted by the dampers.
c) Care should be taken in the design of the bracing and the connection details to ensure that the frame displacement was transferred to the dampers.
d) Use of few stiff devices might lead to local deformations in the structure and loss of effectiveness.

The device developed has been installed into a school in Italy, shown in Fig.2, to rehabilitate the building following damage due to an earthquake in 1997.

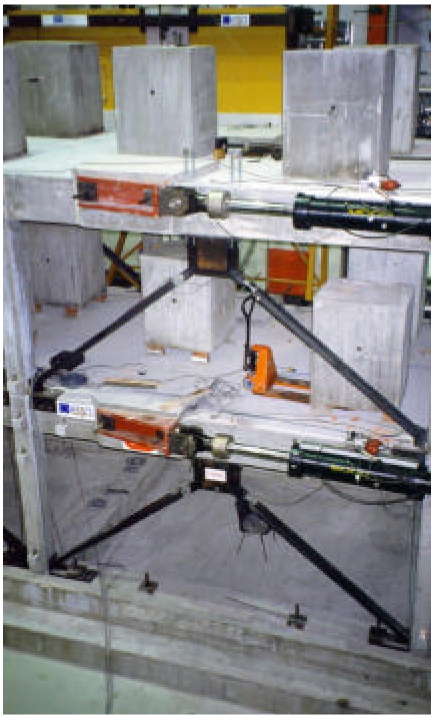

Fig.1: Damping device and locations

Mr. Hamid Ahmadi, principle engineer at TARRC/Rubber Consultants, and **Dr. Brian Ellis**, technical director at BRE, then demonstrated that visco-elastic materials could also be used to reduce small amplitude vibration of floors, a possible source of disturbance to a building's occupants. They first outlined the general characteristics of the loading produced by walking, the floor's response to such loading, and the mechanism of constrained layer damping. Then they described a concrete test floor with a layer of high damping material applied to the upper

Fig.2: The damping device used to rehabilitate a school building in Italy

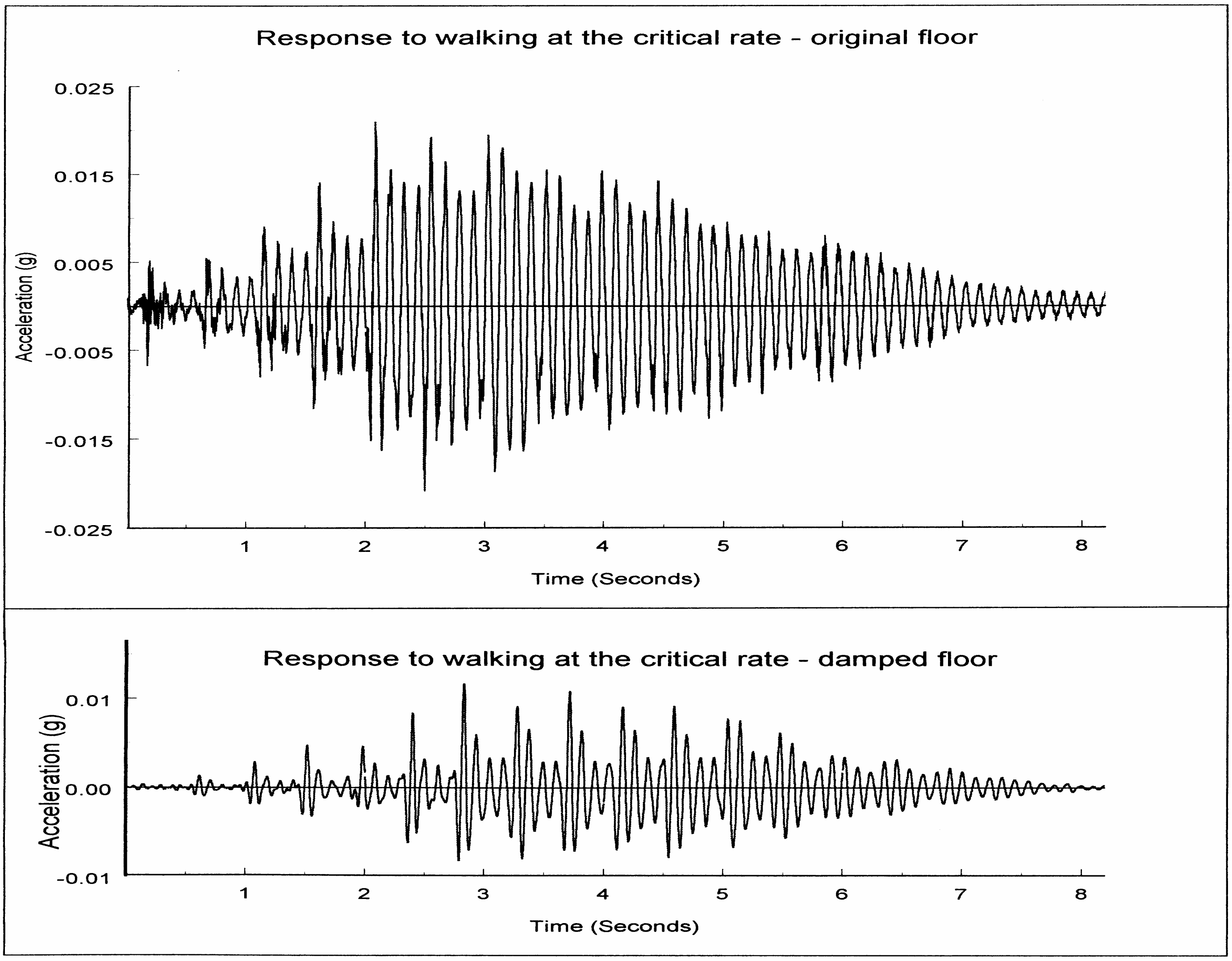

Figure 3: Floor panel tests

surface, followed by a constraining layer of concrete. During the bending of the floor induced by footfall vibrations, energy is dissipated through the shear deformation produced in the damping material by the relative deformation of the two concrete layers. The technique was originally used to damp out the vibration of aircraft fuselage panels, where the resonant frequency of the panels was over 200 Hz.

It was understood from theory and observed from experiment that damping can reduce vibration. However, Mr. Ahmadi intriguingly also demonstrated the effect of damping. He hung a small metal plate and gave a knock on the plate using a metal bar and audience heard the sound from the plate reverberated for several seconds in the lecture room. He did the same on another plate of the same size but with a layer of damping material and a constraining metal layer bonded on one side of the plate. This time only a brief dull sound was heard.

A floor panel, 6m by 9m, in the steel-frame test building at the Cardington laboratory was selected for testing. A variety of comparative experiments were conducted to assess the performance of the floor with and without the damping layer. These included heel-drop tests, forced vibration tests and walking tests at different paces (figure 3). The test measurements on the floor with and without the damping layer were showed in pairs, and the audience could easily identify the differences caused by the constrained damping layer. The measurements showed that the damping of the system was obviously increased.

Damping values are normally taken directly from either books or manufacturers in our design and analysis and there is lack of information on this topic. The three speakers gave clear presentations based on their original research work, which contributed useful information on this difficult but interesting topic.

The speakers can be reached by calling 01992 584966, 01992 584966 and 01923 664566 respectively.

Acknowledgement: All the figures are provided by the speakers

The EEFIT Field Investigation of the Bhuj Earthquake of 26th January 2001

Report by **S.P. Gopal Madabhushi & S.K. Haigh**, Cambridge University

Following the Bhuj earthquake of the 26th January 2001, the UK Earthquake Engineering Field Investigation Team (EEFIT) mounted a reconnaissance mission to Gujarat in India. The team consisted of 9 earthquake engineering specialists who visited India from 9th to 17th February and spent about 8 days in the disaster zone. EEFIT was formed in 1982 under the auspices of the Institution of Structural Engineers and has carried out field missions to most of the major earthquakes in the world since that date.

These investigations have resulted in the creation of a substantial database of structural damage levels, and in significant improvements in our understanding of seismic behaviour.

The main objectives of the field mission to India were as follows:

- To carry out a detailed technical evaluation of the performance of structures, foundations, civil engineering works and industrial plant within the affected region.
- To assess the effectiveness of earthquake protection methods, including repair and retrofit, and to make comparisons of the actual performance of structures with the expectations of designers.

Performance of Civil Engineering Structures

Geotechnical Aspects

The Kachchh was seen to be highly susceptible to liquefaction, sand boiling was observed over vast stretches with characteristic salt crustation when dried up. In the marshy regions of the Rann of Kachchh, this was to be expected due to the presence of saline water close to the ground surface that would rise to the surface following liquefaction, whereas at other places such as Lodai, previously potable water close to the surface was reported to have turned saline after the earthquake. This suggests liquefaction of deeper saline water saturated soil strata. It is

Figure 1: Lateral spreading next to the track at Navalakhi port

also possible that the increase in the ground water pressure may be due to global settlement of ground between faults rather than to the traditional excess pore water pressures generated due to volumetric strains in the soil under cyclic loading. This widespread liquefaction led to significant lateral spreading, especially at the port of Navalakhi, where a large stretch of the railway line was lost into the sea, as shown in Figure 1.

Bridges

Liquefaction played an important role in the damage to many civil engineering structures including bridges and ports. Interesting aspects of the performance of bridges with foundations located on liquefied soil were revealed by this earthquake. In particular, the Bhachau-Vondh bridge site at which there were four bridges of different age and type of construction showed the superstructural behaviour of the bridge determining the likely mechanism of failure once the foundations have liquefied. The arch bridge was vulnerable to differential settlement of the piers causing cracking of the crown blocks whilst a more modern plate girder bridge was susceptible to torsion with piers rotating about the longitudinal axis of the bridge. A new RC highway bridge was shown to be vulnerable to lateral forces imparted on the bridge deck by high approach embankments. Once the foundation soil has liquefied, the abutments could not resist these large lateral forces resulting in an axial shortening of the bridge and hence failure of the deck, see Figure 2.

Dams

Earth dams in the Kachchh region suffered severe damage during this

Fig.4 Damage to the crown blocks of the arch

Figure 2: A new road bridge: collision of deck with pier has broken

earthquake. Longitudinal cracking, failure of the up and down stream slopes and damage to appurtenant structures such as intake towers, as seen in figure 3, were observed. The reservoir levels in most of the earth dams were low at the time of the earthquake, reducing the risk of dam failure, but this highlights that the design of appurtenant structures, particularly those that will be brought into service when dam safety has to be ensured, must be carried out to withstand large earthquakes such as this. Liquefaction resistance measures also need to be undertaken at the upstream and downstream toes of dams in the region to ensure that slope failures do not occur on the scale witnessed here in future earthquakes when water levels might be much higher.

Multi-Storied Buildings
The Bhuj earthquake resulted in spectacular failures of multi-storied buildings in the cities of Ahmedabad, Bhuj and Gandhidham and in the smaller towns of Anjar and Bhachau. The modes of failure of high rise buildings and some of the causes were investigated. Poor construction and detailing combined with the presence of soft stories led to many of the failures observed in high rise buildings, as seen in figure 4. The presence of heavy structural items such as water tanks on the building tops also contributed to some of the failures. Some of the retrofitting observed in the immediate aftermath of the earthquake was either cosmetic or poorly engineered.

Socio-Economic Effects of the Earthquake

A significant number of casualties resulted from the poor performance of low rise buildings constructed using local materials. These structures were studied carefully as it is likely that such construction types are going to be used during rebuilding process. Any improvements that can make these structures more earthquake resistant and prevent their catastrophic failure will be very helpful in reducing the death toll in future earthquakes. Building damage surveys were undertaken both in Ahmedabad and in areas surrounding the city of Bhuj, these buildings were largely constructed from locally available with either tiled or RC slab roofs. Two types of masonry construction were seen, one using properly coursed stones whilst the other made use of stone rubble. The building survey indicated that the rubble walls suffered catastrophic failures whereas the properly coursed stone walls performed much better. These are essentially non-engineered structures but their poor performance significantly increased the death toll. Measures to improve these buildings' seismic performance that are effective, cheap and that can adopted with available technology need to be investigated.
A repair guide has been put together by the Gujurat Relief Engineering Advice team, including one member of the EEFIT team, Dinesh Patel.. which is freely available on the internet (see http://www.arup.com/geotechnics/HTML/Articles/DesignGuide.htm).

Recommendations

The main recommendations that were arrived at, based on the observations in the above sections are listed below:
1. The seismic zonation of the region needs to be re-evaluated with micro-zonation maps being produced for densely populated areas i.e. The cities of Ahmedabad, Bhuj, Gandhidham etc.
2. Liquefaction mitigation measures need to be employed for important bridges, ports, lifelines and industrial facilities as part of the repair and reconstruction process and for any new structures planned in this region.
3. Earth dams and their appurtenant structures need to be designed to resist earthquake damage. Liquefaction at the toes of these dams must be prevented by using available liquefaction mitigation measures.
4. Earthquake resistant design of bridges needs to be considered both as a retrofit measure for existing bridges and for any new bridges planned in the region. Planned structural redundancy must be considered.
5. Implementation of the building code regulations and quality control measures for multi-storied

Figure 3: Failure of the appurtenant structures of Rudra Matha Dam

structures need to be given a high priority. While improvements to the current Indian codes dealing with earthquake loading can be brought about, it is felt that significantly better performance of the multi-storied buildings would have resulted during this earthquake even if the exiting codes were implemented properly.
6. Structural detailing particularly near the beam-column junctions must be improved with adequate shear reinforcement being provided. Ductility must also be incorporated into the design of structures.
7. The Performance of the low-rise buildings constructed using locally available materials must be improved. This factor could lead to a significant reduction of casualties in future earthquakes.

Figure 4: Collapse of the Mansi complex in Ahmedabad: a complete block identical to the one seen in the picture has collapsed

12th European Conference on Earthquake Engineering

London September London September London September London September London September London September London September London September London September London

The largest seismic event in the UK for many years will occur in London this autumn as SECED hosts the 12th ECEE at the Barbican from 9th – 13th September 2002. With the papers now largely submitted and an excellent line up of speakers, special sessions and events we are looking forward with anticipation to a first class conference.

Our keynote speakers are drawn from the UK and across Europe. They are experts in their respective fields and are also fine presenters. Their lectures are programmed for the Monday and Wednesday mornings of the Conference and the Friday afternoon.

The Conference papers are being finalised and we are expecting the number to exceed 500. These have been subject to review at the abstract and paper submission stages leading to high standards on a broad range of earthquake topics. Drawing on feedback from previous conferences, we have sought to maximise the benefits of both the poster and oral presentations. Panel sessions will be used for the oral presentations. These will incorporate a Special Presentation, several Normal Presentations and time for discussion. Particular attention has been given to allowing sufficient time for useful oral presentations. Poster sessions will run most days between the morning and afternoon coffee breaks with plenty of time to view posters and discuss with presenters. As far as possible the panel and poster sessions will be arranged to have similar themes on the same day.

The Wednesday afternoon of the Conference has been reserved for Special Sessions. There will be a range of very interesting topics on offer including the Bhuj Earthquake, advances in European experimental studies and the EERI vulnerability encyclopaedia. Other features of the Conference will be a Technical Exhibition, the SEISMOS Awards for earthquake documentaries and a Conference Dinner at the world famous Natural History Museum – see the Conference web site for further details.

Registration for the Conference has now opened through the Conference web site www.12ecee.org.uk with reduced rates for early bookings. Further details on matters such as accommodation are also available through the web site. We warmly commend the conference to you and look forward to your participation. And finally we are looking for volunteers to help with many practical jobs associated with the Conference. If you can help please contact me at robert.e.may@jacobs.com.

Dr Robert May
Chairman of the Conference Committee

Paper Topics

Engineering Seismology

Geotechnical Engineering

Building Structures

Special Structures

Risk Assessment & Mitigation

Earthquake Field Reports

Prof. Ambraseys	Earthquake Hazard
Joe Barr	Bridge Safety
Prof. Davis	Disaster Mitigation
Prof Elnashai	Testing, Analysis & Observation
Prof Faccioli	Site Effects
Prof. Fajfar	Structural Analysis
Prof. Fardis	Code Development
Dr Pappin	Foundations & Lifelines
Prof. Sucuoglu	Repair & Strengthening

Keynote Speakers

New Civil Engineer Supplement on UK Earthquake Engineering

The hosting of the 12ECEE by SECED in September will raise the profile of the UK earthquake engineering community both in Europe and throughout the world. We should look on this as opportunity to collectively wave the flag of UK Earthquake Engineering, from which all of us, both academics and practitioners, will benefit. The combined strength of current UK research in seismology and earthquake engineering and the expertise that UK consultants offer in earthquake-resistant design, seismic assessment, earthquake loss modelling and disaster management, make the UK a leading international player in this field, despite the relatively low level of our native seismicity.

In order to present to the world the UK expertise in this field, some months ago I approached the *New Civil Engineer* with the suggestion that they produce a special supplement on "UK Earthquake Engineering", which I am happy to report that they have enthusiastically taken up. The supplement will come out during the summer and be distributed to all recipients of *New Civil Engineer* (NCE) and its international counterpart. SECED has also agreed to purchase a bulk order of the supplement to distribute copies to all Conference delegates and to key institutions and organisations in the UK and overseas, such as DfID, DTi, the British Council, UNESCO and the World Bank. In total we estimate that 85,000 copies of this statement of capabilities for the UK earthquake engineering community will be distributed and it is really important that the coverage it gives is as comprehensive as possible.

Many SECED members will have received a letter from NCE last year inviting them to submit suggestions for features and to take out advertising space, and I would encourage members to respond with ideas for articles and by taking out advertisements. The more advertisements that are taken out, the larger and more impressive the supplement will be and more feature articles can be carried.

Anyone interested in more details regarding the NCE special supplement should contact: Antony Oliver, Editor, New Civil Engineer, 151 Rosebury Avenue, London EC1R 4GB, fax: 020-7505-6667, e-mail: antony.oliver@construct.emap.com.

Julian Bommer

BRYAN SKIPP TO BE THE UKs EUROPEAN REPRESENTATIVE

Dr Bryan Skipp has been appointed as the UK National Delegate to the European Association for Earthquake Engineering, it was confirmed by SECED in February.

Bryan Skipp is a well known figure in the European earthquake engineering community who has devoted most of his working life to the study of the movement of the ground, whether man –made or natural, covering much of the field of civil engineering dynamics and earthquake engineering. In his varied subject, he has written around 70 publications including several chapters of books, and has participated in numerous committees and editorial boards.

Bryan was born and brought up in Bolton and started his career with an induction in the Lancashire coal mines. This developed his interest in mining and he consequently studied for a degree in Mining Engineering at Birmingham University. This led on to research into geophysical resistivity methods, for which he was awarded a doctorate.

In 1956, after three years back with the National Coal Board as a Directed Practical Trainee, Bryan joined Soil Mechanics Limited and was introduced to the science and art of Soil Mechanics at Imperial College. During his 37 years with Soil Mechanics he carried out much of their research and development and has been associated with many innovative ideas in the fields of soil and rock mechanics, geophysics and vibrations. His expertise ranges from geology (especially that of faults) through seismic hazard, seismicity, earthquake engineering, ground and air vibrations, foundation dynamics, demolitions, instrumentation, geophysics, hydrogeology and grouting to the more mundane routine soil and rock mechanics.

Bryan was one of the founder members of the Nuclear Electric's Seismic Hazard Working Party (SHWP) which, under various auspices has undertaken state of the art (and beyond) assessments of seismic hazard for many installations in the UK and overseas. This has given Bryan full scope for his free ranging interests, in particular the rock mechanics aspects of earthquake generation, the role of in-situ stress and the various geophysical techniques, as well as interrogation of other members of the team who put forward new ideas.

A further proportion of his time is spent on committee work. Amongst many such positions have been membership of the Parliamentary and Scientific Committee, the SECED Committee and the ICE Ground Board, the editorial board of the International Journal of Earthquake Engineering and Structural Dynamics and the Quarterly Journal of Engineering Geology. He also chairs BS525/8, the mirror body for Structural Euro Code EC8.

As well as presenting his papers at conferences, he has lectured widely in the UK and overseas and has been visiting lecturer for the postgraduate course in engineering geology at Madrid University. He also maintains close links with many British higher education establishments, acting as supervisor and external examiner for higher degrees.

He was awarded Life Membership of SECED in 1993.

Online Newsletters

The March 2002 issue of the EERI Newsletter is online at http://www.eeri.org/Publications/newsletter/current.html

The Winter 2001-2002 issue of the MCEER Bulletin can be downloaded from their web site at http://mceer.buffalo.edu/publications/bulletin/default.asp

EUROPEAN COMMUNITY - ACCESS TO RESEARCH INFRASTRUCTURES ACTION OF THE IMPROVING HUMAN POTENTIAL PROGRAMME. LARGE SHAKING TABLES AND REACTION-WALL FACILITY

The Commission has agreed to provide funded access for approved researchers to the large shaking table and reaction-wall facilities listed below. Applications for such access from nationals of a Member State or Associated State* are now invited. Applicants with interests in research in earthquake and structural dynamics engineering should apply to the Director of one of the laboratories for consideration by a Management Panel appointed by the Commission. Details should be given of the research proposed and the likely amount of access required. Approved users will receive travel and subsistence costs from the host laboratory. More precise details are available from the Director of each laboratory.

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* Bulgaria, Czech Republic, Republic of Cyprus, Estonia, Hungary, Iceland, Israel, Latvia, Liechtenstein, Lithuania, Norway, Poland, Romania, Slovakia and Slovenia

MCEER Strategic Partnerships Network Welcomes Six New Partners

The Multidisciplinary Center for Earthquake Engineering Research (MCEER) welcomes six new members to its Strategic Partnerships Network. They are: Arup, Bridgestone Corporation, Degenkolb Engineers, KPFF Consulting Engineers, SHA Coffman Engineers, and Skidmore Owings & Merrill.

Arup, Degenkolb, KPFF, and SHA Coffman Engineers, are engineering firms. Skidmore Owings & Merrill is an architectural engineering firm. Bridgestone is a manufacturer of seismic isolation bearings.

MCEER's Strategic Partnerships Network is a network of business, industry and government partners, working with Center researchers to advance common strategic goals. The program unites the entire technology "applicationchain" - manufacturers, consultants, and users of advancing technologies - in an effort to collectively advance technology applications to reduce earthquake damage and losses.

The Strategic Partnerships Network features three levels of membership: Flagship Partner, Premier Partner, and Partner, each with it's own array of Network benefits. Annual membership fees are: $10,000 for Flagship Partners; $3,500 for Premier Partners; and $1,000 for Partners.

For more information on the MCEER Strategic Partnerships Network, contact Donald J. Goralski at MCEER, University at Buffalo, Red Jacket Quadrangle, Buffalo, NY 14261; tel: 716/645-3391 ext. 108; fax: 716/645-3399; email: goralski@acsu.buffalo.edu, or visit the "Partnerships" section on the MCEER Web site at http://mceer.buffalo.edu/partnerships.

NOTABLE EARTHQUAKES APRIL - NOVEMBER 2001

Reported by British Geological Survey

YEAR	DAY	MON	TIME UTC	LAT	LON	DEP KM	MAGNITUDES ML	MB	MS	LOCATION
2001	**01**	**DEC**	**21:14**	**56.70N**	**5.15W**	**7**	**1.5**			**BALLACHULISH**
			Felt throughout the Ballachullish area with maximum intensities of 4 EMS.							
2001	**02**	**DEC**	**13:01**	**39.40N**	**141.10E**	**124**		**6.1**		**E HONSHU, JAPAN**
			Felt from southern Honshu to central and eastern Hokkaido.							
2001	**04**	**DEC**	**05:57**	**15.35S**	**72.52W**	**33**		**5.5**	**5.6**	**SOUTHERN PERU**
			Two people were killed at Puncunco, at least five people were injured at Chuquibamba and approximately 30 houses were damaged in the Condesuyos Province.							
2001	**16**	**DEC**	**13:25**	**53.68N**	**2.00W**	**10**	**2.6**			**HALIFAX,W YORKS**
			Felt throughout Halifax and Todmorden with intensities of 4 EMS.							
2001	**18**	**DEC**	**04:02**	**23.95N**	**122.73E**	**14**		**6.3**	**7.3**	**TAIWAN REGION**
			Felt strongly throughout much of northern Taiwan.							
2001	**19**	**DEC**	**20:58**	**56.24N**	**3.74W**	**5**	**2.1**			**BLACKFORD**
			Felt throughout Glendevon with maximum intensities of 4 EMS.							
2001	**22**	**DEC**	**22:52**	**9.61S**	**159.53E**	**16**		**6.2**	**7.0**	**SOLOMON ISLANDS**
			Felt throughout the Solomon Islands.							
2002	**02**	**JAN**	**17:22**	**17.60S**	**167.86E**	**21**		**6.3**	**7.5**	**VANUATU ISLANDS**
			Several people were injured, two bridges were destroyed and buildings and roads were damaged on Efate.							
2002	**03**	**JAN**	**07:05**	**36.10N**	**70.70E**	**129**		**5.8**		**HINDU KUSH REGION**
			At least one person was injured.							
2002	**10**	**JAN**	**11:14**	**3.21S**	**142.43E**	**11**		**6.0**	**6.6**	**NEW GUINEA**
			One person was killed and approximately 200 houses were destroyed in the Aitape area.							
2002	**14**	**JAN**	**15:36**	**19.38S**	**69.23W**	**33**		**5.5**	**5.2**	**NORTHERN CHILE**
			Minor damage occurred to houses in the epicentral area.							
2002	**17**	**JAN**	**20:01**	**1.68S**	**29.10E**	**15**		**4.7**		**LAKE TANGANYIKA**
			Several people were killed and at least 300 buildings were destroyed in the Gisenyi area of Rwanda. This is one of the largest of a series of earthquakes associated with the eruption of Volcan Nyiragongo.							
2002	**03**	**FEB**	**07:11**	**38.56N**	**31.11E**	**10**			**6.5**	**AFON, TURKEY**
			At least 45 people were killed and approximately 300 people were injured and hundreds of homes were destroyed.							
2002	**12**	**FEB**	**19:13**	**51.70N**	**3.25W**	**8**	**3.0**			**BARGOED**
			Felt with intensities of 4 EMS throughout the epicentral area.							

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Forthcoming Events

24 April 2002
UK Earthquakes and AGM
ICE 5.30pm

28 April – 1 May
3rd National Seismic Conference on Bridges and Highways
Portland. Oregon

29 May 2002
Plant Vibration of Structures
ICE 5.30pm

9-13 September 2002
12th European Conference on Earthquake Engineering

25 September 2002
Infilled Frames

30 October 2002
Seismic Design Guidelines for Port Structures

SECED Newsletter

The SECED Newsletter is published quarterly. Contributions are welcome and manuscripts should be sent on a PC compatible disk or directly by Email. Copy typed on one side of the paper only is also acceptable.

Diagrams should be sharply defined and prepared in a form suitable for direct reproduction. Photographs should be high quality (black and white prints are preferred). Diagrams and photographs are only returned to the authors on request. Diagrams and pictures may also be sent by Email (GIF format is preferred).

Articles should be sent to:

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Editor SECED Newsletter,
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Basingstoke,
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SECED

SECED, The Society for Earthquake and Civil Engineering Dynamics, is the UK national section of the International and European Associations for Earthquake Engineering and is an affiliated society of the Institution of Civil Engineers.

It is also sponsored by the Institution of Mechanical Engineers, the Institution of Structural Engineers, and the Geophysical Society. The Society is also closely associated with the UK Earthquake Engineering Field Investigation Team. The objective of the Society is to promote co-operation in the advancement of knowledge in the fields of earthquake engineering and civil engineering dynamics including blast, impact and other vibration problems.

For further information about SECED contact:
The Secretary,
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Great George Street,
London SW1P 3AA, UK.

SECED Website

Visit the SECED website which can be found at http://www.seced.org.uk for additional information and links to items that will be of interest to SECED members.

Email: webmaster@seced.org.uk