ISSN 0967-859X
THE SOCIETY FOR EARTHQUAKE AND CIVIL ENGINEERING DYNAMICS

NEWSLETTER

Volume 17 No 2
September 2003

Standing Tall

Torre Mayor - Mexico's tallest building.
By Ahmad Rahimian and Enrique Martinez Romero.

Torre Mayor is a recently completed 57-story office tower in Mexico City. The $250-million project reaches a height of 225m above ground and when completed it was the tallest building in Mexico and South America. The seismic design approach utilized in this project offers an innovative concept in absorption of seismic energy for tall buildings. Soil-structure interaction analysis and site-specific spectral analysis were performed to obtain realistic information with respect to seismicity and building response. A three-dimensional computer model using non-linear viscous supplemental damping elements was created to obtain structure response to time history ground excitation as well as spectral analysis.

Nine above-ground parking levels are provided in addition to four below-ground parking levels. The tower is designed according to the Mexico City Building Code (MCBC), and its seismic provisions are among the most stringent requirements worldwide. It also complies with the Uniform Building Code-1994 , and several of the latest FEMA-267 provisions proposed after the Northridge Earthquake in California.

The building has an 80mx80m footprint at below-grade levels and it reduces to an 80mx65m-footprint from the fourth level to the 10^{th} level. Above the 10^{th} level the tower plan is further reduced to its typical tower size of 48mx36m. The tower floor plate is a geometrical combination of a rectangle merged with an arch segment at the south side of the building, forming a curved façade at the south face. Office floors are located at levels 11 to 53. The tower also houses a heliport at the main roof.

Seismic forces are obtained according to the MCBC regulations for site seismicity Zone II/III and building classification Type B. Zone III is the MCBC's most severe seismic zone. A site-specific spectral analysis and soil-structure analysis were performed at the Instituto de Ingenieria (UNAM). The final seismic design of the building was according to the Site Specific Response Spectra, developed in compliance with the MCBC .

Contents

Structural System

The building's superstructure is primarily a steel structure. The columns at the interior and perimeter of the tower are encased in reinforced concrete for the lower half of the tower for added stiffness, strength, and economy.

Typical floor framing is comprised of 3"-deep composite metal deck with 2-1/2" of concrete supported on steel framing connected via shear studs. Thicker slabs are used at mechanical floors and ceiling to carry higher loads and to improve sound insulation. Electrified metal deck is specified for electrical wiring. A special detail at the trench header was required to ensure adequate diaphragm action in this weakened zone. The tower's steel columns are encased in concrete up to the 30th floor at the perimeter and up to the 35th floor in the core area.

The project has a four-story under ground parking structure, placing the lowest level 15m below grade. A flat slab system with reinforced concrete and composite columns (steel columns encased in concrete) is utilized for the below grade structure.

Special Features

A special floor diaphragm system was designed at the 10th level where the structure's footprint increases to include the low rise parking structure. The floor plates below level 10 are set back to allow for an open space plaza and lobby entrance at the South side of the building. This is done in such a way as to form an arch with its apex at the 10th level. The free standing columns and beams in this zone were sized to maintain a similar stiffness and strength to the floors above and the frame at the north face of the tower.

Foundation

The foundation for the tower is a combination caisson/mat system. The building is founded on caissons of up to 1.2m in diameter reaching 40m down to the hard rock layer of "depositos profundos" existing below the soft deposit layers typically found in Mexico City.

The reinforced concrete mat system connects all the caissons and a 800mm foundation wall at the lowest basement level. The design incorporates a degree of redundancy to ensure uniform action under the most severe earthquake forces. The concrete mat thickness varies from 1.0m to 2.5m thick under the tower core columns where load concentration is the highest. Slurry foundation walls are specified for the project due to the poor soil condition and high water table. The 600mm slurry walls are to be placed prior to the site excavation and are augmented by a 200mm concrete liner wall to be placed during the construction of the underground structure.

Lateral System

The lateral system selected for this project evolved from a series of studies of alternate structural concepts. More than 25 different structural systems were studied during the preliminary phase of the project in order to establish the merits of each structural system under the severe seismic conditions of Mexico City.

The selected structural system is based on a redundant multiple system, which is a further enhancement of the "Dual" concept recommended by seismic codes worldwide. This is accomplished by introducing a "Dual" conventional (deflection sensitive) lateral force resisting system in combination with a supplemental damping system (velocity sensitive). In effect, a "Trio" system is provided to respond to the seismic energy from an earthquake.

The "Trio" system is composed of a primary super braced frame at the perimeter of the tower coupled with a perimeter moment frame forming a tube system, and a trussed tube at the core of the building. The bracing connecting the composite core columns creates a structural spine in the building core. The perimeter frame and the powerful super-diagonal system create an efficient tube structure joining the spine in resisting the seismic forces. This system is augmented by a series of supplemental viscous dampers placed in North-South and East-West directions.

Various studies were performed for the selection of the dampers with respect to the type of damper as well as the capacity and location of the dampers. In the North-South direction, a total of 72 dampers are placed within the core truss system. A total of 24 dampers are placed as part of the perimeter bracing system. In the East-West direction dampers are placed at the North and South perimeter of the tower. Dampers are placed in such a configuration as to optimize their performance. This optimization attempts to improve the effectiveness of the dampers by increasing the dampers differential velocity for a given inter-story sway and velocity. This is accomplished by reversing the orientation of axial velocity of the columns adjacent to the dampers. This increases the net differential velocity of the damper. This could be physically achieved by modifying the placement of the dampers by placing them between two lateral systems comprised of truss system, frame system or wall system or any combination of them. This unique application resulted in a US Patent grant.

The selected structural system incorporates supplemental damping devices that are highly effective in reducing the impact of seismic motion on the structure as well as on the non-structural elements (i.e. architectural and mechanical components). The supplemental damping reduces the overall and inter-story sway of the tower, as well as the vibration and the seismic forces of the structural elements.

The damping elements reduce the building response by absorbing and dissipating a significant portion of the seismic energy transmitted to the building and consequently reducing the ductility demand on the steel framing. They also add to occupants' comfort level against sway perception, during either high wind or moderate levels of earthquake shaking.

The stiffness and load carrying capacity of the tower columns is enhanced by encasing them in concrete up to mid-height of the tower where demands on strength and stiffness are higher. The concrete encasement of core columns extends five floors above the perimeter columns in order not to create a sudden change in inter-story floor stiffness.

Supplemental Damping

During the schematic phase, the structure was studied with and without the supplemental damping system in order to ascertain quantitatively the advantages of the supplemental damping system with respect to building performance, under a seismic event. For example, designers studied the sway response of the tower under a seismic excitation with Richter magnitude of 8.2 for the structure with and without the supplemental damping system.

Viscous damping units made by Taylor Device, Inc. were selected after studying various damping systems for this project. The structure using the supplemental viscous damping elements produces equivalent damping ratios (as percentage of critical damping) of 8.5 percent in the North-South and 12 percent in the East-West direction for the fundamental modes of vibration.

Time history analysis, using impulse excitation, was used to evaluate the equivalent damping of the system. Damping ratios were obtained by evaluating the decay function of the response time history, such as the response of the tower to an impulse loading in both primary directions. As a crosscheck, the damping calibration was verified by comparing time history responses of the structure with dampers with that of a system with equivalent modal damping.

Bracing of the structure follows a Super-X configuration at the East and West faces where the X covers the entire width of the tower. At North and South faces two sets of Super-X's were introduced. No bracing is placed within the two center bays, except at three locations where a set of diagonals forms a diamond shape connecting the Super-X systems. The dampers in the North and South faces are placed at these diamond-bracing locations. This in effect enhances the damping system's performance by creating a damped link between the Super-X systems. Additional fine-tuning of the secondary link element was necessary to emphasize the basic concept of damped link element.

Ahmad Rahimian, is a design principal at Cantor Seinuk Group. **Enrique Martinez Romero**, is the general director of engineering firm Enrique Martinez Romero.

Some Developments in Structural Dynamics

SECED's reporter on Civil Engineering Dynamics, **Tianjian Ji** of UMIST, provides a brief overview.

Walking Loads - Since the London Millennium Bridge

The design criteria for structures subject to periodical human loading were given in BS6399 Part 1: Loadings for Buildings, which states that any structure that might be subjected to this form of loading should be designed in one of two ways: *to withstand the anticipated dynamic loads* or *to avoid significant resonance effects*.

Although it is unlikely that the characteristics of walking can be altered, it is possible to try to avoid potential resonance by knowing the frequencies of walking loads. It is well known that the frequency of walking loads in the lateral direction (side to side) is half that in the vertical direction. A recent study of frequency ranges of human walking on footbridges showed that 388 of 400 people walked at frequencies between 1.6 and 2.1 Hz, with an average of 1.83 Hz in the vertical direction.

The problem with the Millennium Bridge led to a significant interest in the horizontal loads generated by walking and the possibility of coordinated movement of groups of people if prompted by sufficient lateral movement of the bridge. A symposium Footbridge 2002 was held in Paris in November 2002 and included many papers on bridge dynamics.

The largest loads generated by walking are vertical and work on walking loads has been undertaken for many years at many institutions. At UMIST we have looked at load models for individuals and crowds, walking frequencies and floor response, and hope to develop simple and reasonable methods for engineers to assess whether their structure would suffer excessive vibration induced by walking.

Work on Grandstands

The dynamic behaviour of grandstands, especially permanent cantilevered decks, has attracted considerable interest in the UK. A joint ISE/DCMS/DTLR working group was set up in 2000 to consider dynamic loading of seating decks. *The group consists of designers, owners and researchers. The members of the Group have conducted much of the research relating to grandstands in the UK. The Group produced a document,* Dynamic Performance Requirements for Permanent Grandstands Subject to Crowd Action, - Interim guidance for assessment and design, in November 2001. As an interim measure the Working Group suggested limits for vertical frequencies of 3.5 Hz for new grandstands for normal, non-rhythmic loading but 6 Hz for those where pop concerts could be held

The Group will hold a two-day conference which should provide a summary of the current state-of-knowledge in this area. The conference *Dynamic crowd action on grandstand seating decks: performance and new approaches to design* will be at the IStructE between 25 and 26 March 2004. The conference will cover many issues relating to design of grandstands, including crowd loading, modelling structures for analysis, testing and performance of structures in service, tolerance of motion, current approaches and limitations, design criteria, performance based design and implementation.

Human-Structure Interaction

Human-structure interaction is a relatively new topic in structural dynamics. The topic becomes significant as the spans of building floors become longer and they have lower natural frequencies, and human expectations for the quality of working environment and of life become greater.

There were several experimental investigations reporting how dynamic behaviour of a structure is altered due to human involvement, although the modal mass, damping ratio and natural frequency of a human whole-body have yet to be established. An understanding of the dynamic characteristics of a human whole-body becomes important in the study of human-structure interaction. At UMIST we have been investigating the measurability of human-structure interaction, dynamic characteristics of a human whole-body and models of human-structure interaction, and hope to develop reasonable methods to predict human body response to structural vibration.

EURODYN Conferences

The triennial European Conference on Structural Dynamics was held in Munich in September 2002. Although this major conference attracted a large audience from around the world, the UK contingent was small. Whether this was due to the European Earthquake Conference organised by SECED in the same month is unclear, but the EURODYN conferences are certainly worth considering in future years.

The next EURODYN conference will be held in Paris, 4-7 September 2005. The previous five conferences were held in Bochum (1990), Trondheim (1993), Florence (1996), Prague (1999) and Munich (2002).

This conference is devoted to theoretical, numerical, experimental developments and applications of structural dynamics to all types of structures, dynamical systems and structural materials, including the development of new methods, analytical and numerical methods, measurement techniques and computational simulations.

Further information about the conference can be found from the following website:
http://www.univ-mlv.fr/universite/actualite/eurodyn2005/welcome.htm

Trading Off Uncertainty

The UK’s approach to seismic hazard assessment is examined by **Gordon Woo** of Risk Management Solutions Ltd.

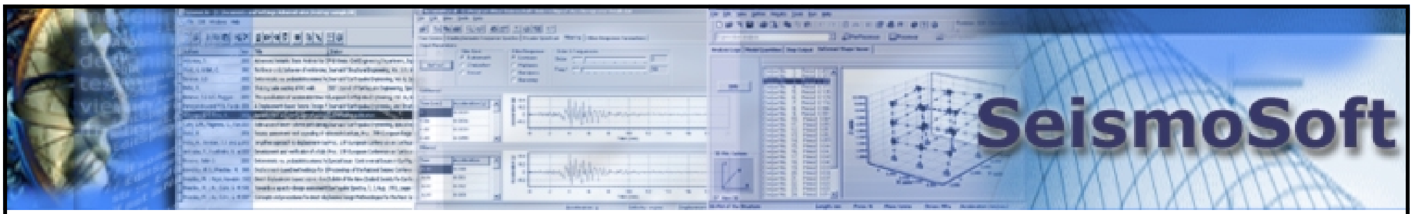
Within any regulatory framework where specific risk limits are expressed in probabilistic terms, the question of confidence in the results arises. The grandest and technically most elaborate probabilistic risk analysis conducted in Britain so far has been for underground radioactive waste disposal. The Department of the Environment stipulates a probabilistic upper tolerance bound for cancer risk stemming from human exposure to the release of radioactivity from a repository to the biosphere. However demanding the effort required to demonstrate compliance, satisfying this constraint is not the end of the matter. In the internal probabilistic risk analysis conducted on behalf of the Department of the Environment, considerable resources were directed towards estimating statistical confidence bounds on the probabilistic risk results.

For UK seismic hazard to nuclear facilities, the standard benchmark for peak ground acceleration has been that having an annual exceedance probability of one in ten thousand. Traditionally, confidence limits on this peak ground acceleration have been calculated using a logic-tree formalism, but it is the mean value that has been the focus of regulatory attention, and the motivation for demonstrable conservatism in the seismic hazard analysis procedure. A notable factor in model conservatism has been the standard deviation in the attenuation relation for peak ground acceleration. Sensitivity studies show that this parameter has a marked escalating effect at low annual exceedance probabilities. Large earthquakes are rare in Britain; one way in which high levels of shaking might arise is if they were generated by a more common moderate magnitude event.

The attenuation standard deviation, derived statistically from a regression analysis of strong-motion records, is comprised of three terms: one is earthquake-specific; the second is site-specific; and the third is the record-specific residue. Historically, homogeneous strong-motion datasets have been too small to permit decomposition of the standard deviation. Ideally, a dataset should include accelerograms from a good many stations, each of which has records from multiple earthquakes. Taiwan is an obvious source of such data, and so it is commendable that a standard deviation study has been carried out there, using 424 Taiwanese records from 48 earthquakes and 45 stations. This study by Y.H. Chen and C.P. Tsai is reported in the June 2002 issue of the Bulletin of the Seismological Society of America. They find that the site-specific contribution to the attenuation standard deviation is about 15%.

In any site-specific seismic hazard study, the site is fixed. Thus, the site-specific variability in attenuation is redundant, and should be omitted. Hence the attenuation standard deviation is justifiably reducible. However, in the absence of adequate local knowledge of attenuation around the site in question, site-specific variability reappears in the uncertainty as to the choice of attenuation relation appropriate for a given site. In other words, the confidence limits around the mean hazard curve are broadened.

Given this uncertainty trade-off between the hazard curve itself and the confidence limits around it, the existing conservative standard deviation values may be retained as a pragmatic option. However, site-specific attenuation studies, for example using empirical Green’s function methods, hold the promise of tailoring attenuation relations to individual UK sites, allowing a reduced standard deviation value to be used in seismic hazard computation.



An overview of analytical tools available free from SeismoSoft's website, by **Rui Pinho**.

Founded in the Autumn of 2002, SeismoSoft has been created with the aim of providing engineers, researchers and students with facilitated access (both financially- and technically-wise) to powerful and state-of-the-art analytical tools in the field of earthquake engineering and engineering seismology. Hence, and within this framework, all of SeismoSoft software products are provided for free and feature a smooth learning curve. The latter is achieved by means of a fully graphical user interface that guarantees a seamless integration with the Windows environment, together with the presence, on all applications, of a technical Help System that provides both beginners and advanced users with the required guidance and technical background. Currently, three computer packages are available: SeismoStruct, SeismoSignal, SeismoCite.

SeismoStruct is a finite element package capable of predicting the large displacement behaviour of space frames under static or dynamic loading, taking into account both geometric nonlinearities and material inelasticity. Concrete and steel material models are available, together with a large library of 3D elements that may be used with a wide variety of pre-defined steel, concrete and composite section configurations. The spread of inelasticity along the member length and across the section depth is explicitly modelled, allowing for accurate estimation of damage distribution. Coupled with the program's numerical stability and accuracy at high strain levels, it enables the precise determination of the inelastic response and the collapse load of any frame-type structural configuration. SeismoStruct accepts static (forces and displacements) as well as dynamic (accelerations) actions and has the ability to perform eigenvalue, nonlinear static pushover (conventional and adaptive), nonlinear static time-history analysis, nonlinear dynamic analysis and incremental dynamic analysis.

In addition, SeismoStruct's processor features real-time plotting of displacement curves and deformed shape of the structure, together with the ability of pausing and re-starting the analysis. Deformation-based performance criteria can also be set, allowing the user to identify the instants at which different performance limit states (e.g. non-structural damage, structural damage, collapse) are reached. In this manner, the sequence of cracking, yielding and failure of members throughout the structure can be readily obtained. Advanced post-processing facilities, including the ability to custom-format all derived plots and the creation of movie files to better illustrate the sequence of structural deformation, are also available.

SeismoSignal constitutes an easy and efficient way to process strong-motion data, featuring a user-friendly visual interface and the capability of deriving a number of strong-motion parameters often required by engineer seismologists and earthquake engineers. These include elastic and constant-ductility inelastic response spectra, Fourier amplitude spectra, effective duration, Arias Intensity, and many others. The program is able to read accelerograms defined in both single- and multiple-values per line formats (the two most popular formats used by strong-motion databases), and can apply baseline correction and filtering prior to time-integration of the signal (to obtain velocity and displacement time-histories).

SeismoCite is a simple, yet efficient, reference manager software. The program features the ability to connect to the NISEE Earthquake Engineering Abstracts Database that includes the entire world literature in earthquake engineering and engineering seismology since 1971. SeismoCite performs advanced searches of authors, titles, keywords and/or years of publication, downloads all the appropriate data and inserts them as entries to the open database. Moreover, it is capable of outputting either all or selected entries of the databases in appropriately formatted lists, ready to be used in the preparation of journal, conference and any other type of publications.

All three software applications described above can be freely downloaded from SeismoSoft website (www.seismosoft.com), where a wealth of additional information is also available. Suggestions for improvements and modifications as well as requests for addition of technical features to any of the programs (e.g. material models, element types, numerical algorithms, etc.) are welcome. It is noted also that a number of additional applications (e.g. SeismoSection, SeismoArtif and SeismoRisk) are being presently developed, and should be released in the near future.

Dr. Rui Pinho, European School for Advanced Studies in Reduction of Seismic Risk (ROSE), Collegio Alessandro Volta, Via Ferrata, 27100 Pavia, Italy.

ISET Trifunac Award 2002

The Indian Society of Earthquake Technology Trifunac Award 2002, for significant contributions in strong motion earthquake studies, has been conferred on Professor F.J. Sánchez-Sesma of Mexico. Extracts from ISET's citation follow.

Dr. Francisco José Sánchez-Sesma, a native of Mexico, is one of the leading world experts in seismic wave propagation and site effects on strong earthquake ground motion. Currently he is a Professor of the Engineering Institute of the National Autonomous University of Mexico (UNAM), and since 1999 has also been the Director of the Institute.

Dr. Sánchez-Sesma's research involves mostly theoretical, but also experimental and practical aspects of elastic wave propagation, in particular understanding and modelling the effects of the local soil conditions and geology on the characteristics of seismic ground motion. He is the author or a co-author of many papers, abstracts and technical reports. He is also an active member of the professional community and is current President of the Mexican Society of Earthquake Engineering (SMIS). His work is original and has had a significant impact on the field (both in science and engineering).

Most original of his contributions are probably his elegant analytical solutions for: (1) wave propagation in a wedge; (2) analytic Green's functions for an inhomogeneous medium with a constant variation of velocity with depth; and (3) scattering of waves from a finite 2D crack, which provide insight in the physical nature of the associated phenomena and are used by others for validation of results using other methods.

He has made most impact on the field by developing several methods for numerical simulation of elastic wave propagation in alluvial basins and scattering from surface topographies. Of practical significance is his work on seismic wave propagation in Mexico City Valley, motivated by the 1985 Michoacán earthquake (M8.1), that caused extensive damage to the city in spite of the fact that the earthquake was about 400 km away.

Dr. José Sánchez-Sesma, who got all of his formal education in Mexico, is also an example that, with some resources and organisation, it is possible to form in the developing world scientists of world calibre.

In recognition of the outstanding work and contributions of Prof. Francisco José Sánchez-Sesma in the field of 'Strong Motion Earthquake Studies', the Indian Society of Earthquake Technology feels greatly honoured to confer Prof. Sánchez-Sesma with this award for the year 2002. We pray God to bless him with good health and long life. We wish him success in all his efforts.

Vinay K Gupta, Professor of Civil Engineering, Indian Institute of Technology, Kanpur-208016, INDIA

MCEER Appoint New Director

Michel Bruneau, a leading expert on earthquake-resistant design and retrofit of buildings and infrastructure, has been named director of the Multidisciplinary Center for Earthquake Engineering Research (MCEER) headquartered at the University at Buffalo. MCEER is a National Science Foundation "Center of Excellence" in earthquake engineering.

Bruneau, who has served as MCEER deputy director since 1998, succeeds George Lee, who served 11 years as director. Mark H. Karwan, SEAS dean, said Bruneau's appointment "assures that MCEER will build upon the reputation for excellence that George Lee worked so hard to establish. Under Bruneau, MCEER will forge ahead in developing new knowledge and technologies to improve seismic resiliency, and will pursue application of its expertise within related areas, such as design of blast-resistant buildings and improvement of emergency-response systems."

As director, Bruneau assumes overall stewardship of MCEER and its major research, education, and industry-outreach initiatives. These include projects that involve research and development of tools and technologies that strengthen the nation's built environment and improve emergency response and recovery activities following earthquakes.

Bruneau is a professor within UB's School of Engineering and Applied Sciences (SEAS). He is author and co-author of numerous research articles and one book on earthquake-engineering principles, and he has participated in several reconnaissance visits to assess structural damage caused by earthquakes and other disasters around the world, including the structural damage to buildings near the World Trade Center towers after their collapse on Sept. 11.

For more information about MCEER, go to http://mceer.buffalo.edu.

NOTABLE EARTHQUAKES MAY - JULY 2003

Reported by British Geological Survey

YEAR	DAY	MON	TIME UTC	LAT	LON	DEP KM	MAGNITUDES ML	MW	MB	LOCATION
2003	**1**	**MAY**	**00:27**	**39.01N**	**40.46E**	**10**			**6.4**	**EASTERN TURKEY**
At least 177 people were killed in the Bingol area and at least 521 people were injured.										
2003	**4**	**MAY**	**15:44**	**39.43N**	**77.22E**	**10**			**5.6**	**S XINJIANG,CHINA**
One person died and three people were injured. Approximately 1,600 houses were destroyed and several thousand buildings were damaged.										
2003	**21**	**MAY**	**18:44**	**36.97N**	**3.63E**	**12**			**6.9**	**ALGERIA**
At least 2,266 people were killed, 10,261 people were injured and approximately 150,000 people were left homeless.										
2003	**26**	**MAY**	**09:24**	**38.89N**	**141.57E**	**68**		**7**		**HONSHU,JAPAN**
Approximately 140 people were injured and at least 720 buildings and roads were damaged.										
2003	**26**	**MAY**	**19:23**	**2.35N**	**128.86E**	**31**			**7.1**	**HALMAHERA**
One person was killed and 7 people were injured on Morotai. At least 28 houses were destroyed and 20 houses were damaged at Berebere.										
2003	**27**	**MAY**	**17:11**	**36.94N**	**3.56E**	**8**			**5.5**	**N ALGERIA**
At least 9 people were killed and 200 people were injured.										
2003	**20**	**JUN**	**06:44**	**56.17N**	**4.42W**	**5**	**3**			**ABERFOYLE,CENTRAL**
Felt with intensities of 3 EMS.										
2003	**20**	**JUN**	**06:53**	**56.18N**	**4.44W**	**5**	**2.8**			**ABERFOYLE,CENTRAL**
Felt with intensities of 3 EMS.										
2003	**20**	**JUN**	**09:03**	**56.17N**	**4.43W**	**4**	**2.5**			**ABERFOYLE,CENTRAL**
Felt with intensities of 3 EMS.										
2003	**20**	**JUN**	**13:30**	**30.61S**	**71.64W**	**33**			**6.8**	**CHILE**
One person was injured in San Juan, Argentina. Some buildings were damaged and utilities were disrupted at Ovalle.										
2003	**24**	**JUN**	**13:01**	**32.93N**	**49.48E**	**33**		**4.6**		**WESTERN IRAN**
One person was killed in the Aligudarz area and a landslide killed 85 livestock.										
2003	**25**	**JUN**	**11:53**	**56.16N**	**4.43W**	**3**	**1.4**			**ABERFOYLE,CENTRAL**
Felt with intensities of 2 EMS.										
2003	**27**	**JUN**	**02:09**	**56.17N**	**4.44W**	**5**	**2.8**			**ABERFOYLE,CENTRAL**
Felt with intensities of 3 EMS.										
2003	**27**	**JUN**	**02:11**	**56.17N**	**4.45W**	**3**	**1.3**			**ABERFOYLE,CENTRAL**
Felt with intensities of 2 EMS.										
2003	**10**	**JUL**	**17:06**	**28.35N**	**54.16E**	**10**			**5.5**	**SOUTHERN IRAN**
One person was killed, 25 people were injured and at least 3,500 homes were destroyed in the southern Fars province.										
2003	**21**	**JUL**	**15:16**	**25.97N**	**101.32E**	**10**			**6**	**YUNNAN,CHINA**
At least 16 people were killed, 584 people were injured and 24,000 houses collapsed.										
2003	**25**	**JUL**	**15:13**	**38.48N**	**140.96E**	**33**		**5.5**		**E HONSHU,JAPAN**
At least 421 people were injured.										
2003	**26**	**JUL**	**08:36**	**38.00N**	**28.88E**	**10**			**5.2**	**TURKEY**
Ten people were injured and houses were damaged in the Buldan area.										
2003	**26**	**JUL**	**23:18**	**22.82N**	**92.32E**	**10**		**5.5**		**INDIA**
Located on the India-Bangladesh border region. Two people were killed, at least 25 people were injured and approximately 500 houses were damaged.										

Issued by: Bennett Simpson, British Geological Survey, August 2003.

SECED Election Results

SECED are pleased to announce that the following people have been elected to the committee for the period April 2003 to April 2006.

Piroozan Aminossehe (Taylor Woodrow); Andy Campbell (BNFL); Paul Doyle (Babtie Group) (re-elected).

Forthcoming Events

28 October 2003
Blast and Impact
(Jointly with IStructE North Thames).
ICE 6.15pm

26 November 2003
Tsunami

28 January 2004
Seabed Liquefaction

25 February 2004
Rail Induced Vibration

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,
Scott Wilson,
Scott House,
Basingstoke,
Hants,
RG21 4JG,
UK.

Email: john.sawyer@scottwilson.com

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 Geological 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:
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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