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ΕΤΑΙΡΕΙΑ
ΕΔΑΦΟΜΗΧΑΝΙΚΗΣ
& ΓΕΩΤΕΧΝΙΚΗΣ
ΜΗΧΑΝΙΚΗΣ

Τα Νέα της Ε Ε Ε Ε Γ Μ

28

Αρ. 28 – ΦΕΒΡΟΥΑΡΙΟΣ 2010

ΣΕΙΣΜΟΣ ΣΤΗΝ ΧΙΛΗ ΣΤΙΣ 27 ΦΕΒΡΟΥΑΡΙΟΥ 2010

Δυστυχώς η νέα χρονιά ξεκίνησε άσχημα όσον αφορά στην δραστηριοποίηση του Εγκέλαδου. Μετά τον σεισμό της Αϊτής στις 12 Ιανουαρίου 2010, νέος εξαιρετικά μεγάλος σεισμός (Μ 8.8) έπληξε την δυτική πλευρά της Αμερικανικής ηπείρου – Χιλή. Μήπως έχουμε σεισμική έξαρση σε παγκόσμιο επίπεδο;

SIMSG ISSMGE

ΠΕΡΙΕΧΟΜΕΝΑ

ΕΛΛΗΝΙΚΗ ΕΠΙΣΤΗΜΟΝΙΚΗ ΕΤΑΙΡΕΙΑ ΕΔΑΦΟΜΗΧΑΝΙΚΗΣ & ΓΕΩΤΕΧΝΙΚΗΣ ΜΗΧΑΝΙΚΗΣ

ΔΙΑΛΕΞΗ

την Δευτέρα, 3 Μαΐου 2010, ώρα 19:00

στην

Αίθουσα Εκδηλώσεων της

Σχολής Πολιτικών Μηχανικών ΕΜΠ

στην Πολυτεχνειούπολη Ζωγράφου

« Σύγχρονες Εξελίξεις στον Σχεδιασμό και την Κατασκευή Στραγγιστηρίων – Χαλικοπασσάλων για τον Έλεγχο Ρευστοποίησης»

από τον

Δρ. Γεώργιο Μπουκοβάλα

Πολιτικό Μηχανικό

Καθηγητή Τομέα Γεωτεχνικής

Σχολής Πολιτικών Μηχανικών ΕΜΠ

Ο σεισμός στην Χιλή της 27ης Φεβρουαρίου 2010

Σφοδρότατος σεισμός, μεγέθους Μ 8.8 έπληξε τα ξημερώματα του Σαββάτου, 27 Φεβρουαρίου 2010, την Νότια Χιλή, προκαλώντας τον θάνατο εκατοντάδων ανθρώπων και υλικές ζημιές ύψους πολλών δισεκατομμυρίων δολαρίων. Ισχυροί μετασεισμοί, μερικοί μεγέθους έως και Μ 6.9 έπληξαν τα νότια της χώρας, επιτείνοντας τον πανικό των κατοίκων.

Ο κύριος σεισμός, που κατέστρεψε εκατοντάδες κτίρια στην πόλη Concepcion – τη δεύτερη μεγαλύτερη αστική ζώνη της χώρας με πληθυσμό 700,000 κατοίκους – προκάλεσε και παλιρροϊκό κύμα – tsunami – που έπληξε το αραιοκατοικημένο αλλά δημοφιλές το καλοκαίρι νησιωτικό σύμπλεγμα του Χουάν Φερνάντες.

Μεγάλες καταστροφές υπέστη η πόλη Curico, αλλά και κτίρια στο ιστορικό κέντρο της πρωτεύουσας Santiago. Το διεθνές αεροδρόμιο της πρωτεύουσας διέκοψε τη λειτουργία του, ενώ τμήμα αυτοκινητόδρομου της πρωτεύουσας κατέρρευσε. Μεγάλο τμήμα της πρωτεύουσας έμεινε χθες χωρίς ηλεκτρικό ρεύμα, χωρίς τηλέφωνο και μόνο οι συνδέσεις μέσω διαδικτύου παρέμειναν σε λειτουργία.

Χιλιανοί αξιωματούχοι ανέφεραν ότι η πόλη Parral στα νότια της χώρας, που βρίσκεται πιο κοντά στο επίκεντρο του κύριου σεισμού, έχει υποστεί τις μεγαλύτερες καταστροφές, ενώ, σύμφωνα με την τηλεόραση της Χιλής, μεγάλη πυρκαγιά έχει ξεσπάσει σε πετροχημικό εργοστάσιο της κωμόπολης Colina, 20 km βόρεια της πρωτεύουσας Santiago. Ο χθεσινός σεισμός έγινε ακόμη αισθητός στις επαρχίες Mendoza και San Juan της Αργεντινής.

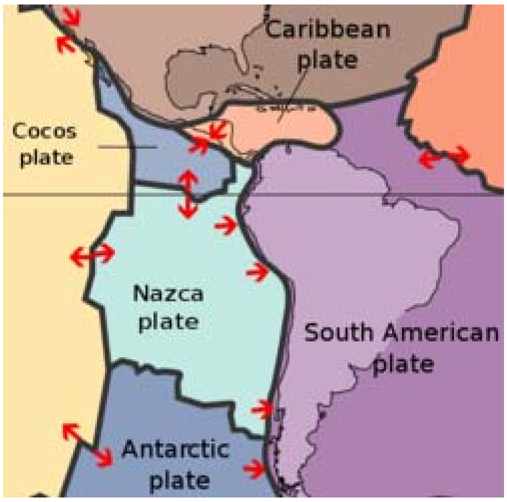
Το 1960, σεισμός μεγέθους Μ 9.5 Ρίχτερ κατέστρεψε ολοσχερώς την πόλη Valdivia της Νότιας Χιλής, προκαλώντας τον θάνατο 1,655 ανθρώπων, αλλά και tsunami που έπληξε τη Νήσο του Πάσχα, σε απόσταση 3,700 km από τις ακτές της χώρας. Πρόκειται για τον μεγαλύτερο καταγεγραμμένο σεισμό από το 1900 μέχρι σήμερα.

(στοιχεία από την εφημερίδα «Η ΚΑΘΗΜΕΡΙΝΗ» και «ΤΑ ΝΕΑ On-line»)

The **2010 Chile earthquake** occurred off the coast of the Maule Region of Chile on February 27, 2010, at 03:34 local time (06:34 UTC), rating a magnitude of 8.8 on the moment magnitude scale and lasting for about three minutes. The cities experiencing the strongest shaking—VIII (Destructive) on the Mercalli intensity scale—were Talcahuano, Arauco, Lota, Chiguayante, Cañete, and San Antonio. The earthquake was felt in the capital Santiago at Mercalli intensity scale VII (Very Strong). Tremors were felt in many Argentine cities, including Buenos Aires, Córdoba, Mendoza and La Rioja. Tremors were felt as far north as the city of Ica in southern Peru. Tsunami warnings were issued in 53 countries, and a tsunami was recorded, with amplitude of up to 2.6 m (8 ft 6 in) high, in the sea at Valparaíso, Chile. President Michelle Bachelet declared a "state of catastrophe". She also confirmed the deaths of at least 708 people. Many more have been reported missing.

The epicenter of the earthquake was offshore from the Maule Region, approximately 8 km (5.0 miles) west of Curanipe and 115 km (71 mi) north-northeast of Chile's second largest city, Concepción. The earthquake also caused seiches to occur in Lake Pontchartrain to the north of New Orleans, United States, located nearly 4,700 miles (7,600 km) from the epicenter of the quake.

The earthquake occurred along the boundary between the Nazca Plate and the South American Plate. At the location of this earthquake, the plates converge at 80 mm/year (~3 in/year). The earthquake is characterized by a thrust-faulting focal mechanism, caused by the subduction of the Nazca plate beneath the South American plate.



The Nazca Plate is subducting under the South American Plate. This movement causes seismicity and volcanism throughout Chile.

The coastal part of Chile has a history of great megathrust earthquakes originating from this plate boundary, such as the 1960 Valdivia earthquake. More recently, this plate boundary ruptured at the 2007 Antofagasta earthquake.

The segment of the fault zone that ruptured in this earthquake was estimated to be 249 km (155 mi) long, and immediately to the north of the 373 km (232 mi) segment that ruptured in the 1960 earthquake.

Aftershocks

An aftershock of 6.2 was recorded 20 minutes after the initial quake. Two more aftershocks of magnitudes 5.4 and 5.6 followed. The USGS said that "a large vigorous after-shock sequence can be expected from this earthquake". By 00:00 am UTC March 1, more than one hundred after-shocks were registered, including eight above magnitude 6.0.

A 6.9-magnitude offshore earthquake struck approximately 185 miles southwest of, and less than 90 minutes after, the initial shock; however, it is not clear if that quake is related as of February 27, 2010A separate earthquake of magnitude 6.3 occurred in Salta, Argentina, at 3:45 pm UTC on February 27, at a depth of 38.2 km (23.7 mi). Minor quakes generated by the main one could be felt as far away as São Paulo, Brazil, located about 3,000 km (1,900 mi) away from Concepción. Two were injured and one died in Salta, Argentina.

Damage and casualties

According to an Associated Press Television News camera-man, some buildings have collapsed in Santiago and there are power outages in parts of the city. A fire was reported in a chemical plant in an outskirt of Santiago and caused the evacuation of the neighborhood. Santiago's Internatio-nal Airport seems to have been damaged and the airport authority has closed off all flight operations for the next 24 hours from around 12:00 UTC. As of Sunday, Feb. 28th, the Santiago airport has reopened to incoming international flights, and flights of the national carrier Lan Airlines will land Sunday.

Santiago's national Fine Arts Museum was badly damaged. An apartment building's two-story parking lot collapsed, smashing about 50 cars. According to one health official, three hospitals in Santiago collapsed, and a dozen more south of the capital also suffered significant damage. In Talca, 167 miles south of Santiago, all but two of the local hospital's thirteen wings were in ruins. Dr. Claudio Martinez was quoted as saying, "We're only keeping the people in danger of dying." Hospital staff attempted to transport some patients to Santiago Sunday morning, but roads were blocked. At least 500,000 homes are estimated to be damaged.

Many cities in Maule region were seriously affected by the earthquake. Curanipe, only 8 km from the epicenter, was hit by tsunami after the earthquake and still remained isolated from outside as of February 28. A surfer described the tsunami "...was like the one in Thailand, a sudden rise of water. One could not estimate the dimension of the wave, because it was advancing foam. There were 10 to 15 rises, the last one being at 08:30 in the morning."[32] In Talca, the capital of Maule region, many dead were trapped in the rubble. The administrative building was uninhabitable, and the authorities had to be set up in the parade ground.

Damaged buildings and fires were reported in Concepción. Rescue teams had difficulty accessing Concepción because of the damaged infrastructure. A fourteen-storey residential building collapsed, reduced to a height equivalent to about three storeys, trapping about a hundred people; only about six months had passed since the turnover of the building, so half of the apartments were unoccupied. A 2.34 m tsu-nami wave hit Talcahuano, a port city and part of the Con-cepción conurbation. The tsunami caused serious damage to port facilities and lifted boats out of the water.

Dilapidated buildings could be seen on the streets of Temu-co, about 400 km from the epicenter. The adobe of some buildings fell. Two people were reported dead because of not having been able to escape from a discothèque. On February 27, it was reported that "to find a store open is almost impossible" ("Encontrar un negocio abierto es casi imposible").

(στοιχεία από την Wikipedia)

A bridge is left destroyed outside of Santiago after the earthquake struck Chile.

Σύμφωνα με την United States Geological Survey ο σεισμός είχε τα ακόλουθα στοιχεία:

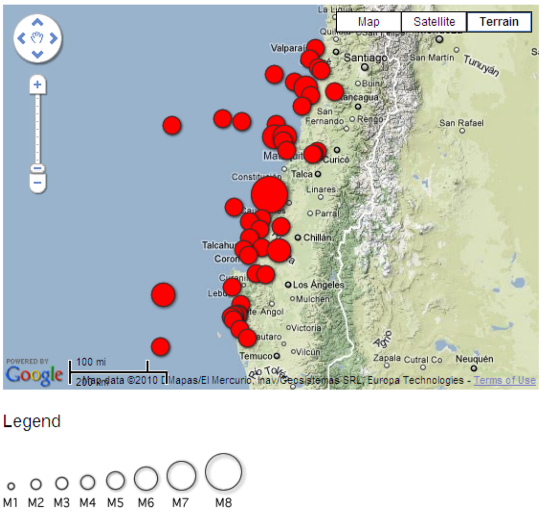
Earthquake Details

Magnitude	**8.8**
Date-Time	• **Saturday, February 27, 2010 at 06:34:14 UTC** • Saturday, February 27, 2010 at 03:34:14 AM at epicenter
Location	35.846°S, 72.719°W
Depth	35 km (21.7 miles) set by location program
Region	OFFSHORE MAULE, CHILE
Distances	100 km (60 miles) NNW of **Chillan, Chile** 105 km (65 miles) WSW of **Talca, Chile** 115 km (70 miles) NNE of **Concepcion, Chile** 325 km (200 miles) SW of **SANTIAGO, Chile**
Location Uncertainty	horizontal +/- 7.2 km (4.5 miles); depth fixed by location program
Parameters	NST=255, Nph=255, Dmin=988 km, Rmss=1.12 sec, Gp= 36°, M-type=teleseismic moment magnitude (Mw), Version=7

Tectonic Summary

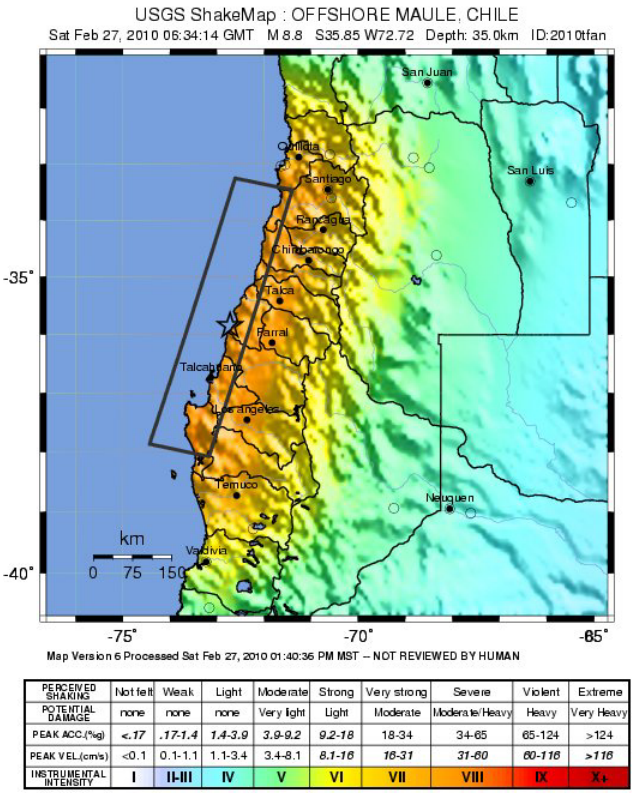
This earthquake occurred at the boundary between the Nazca and South American tectonic plates. The two plates are converging at a rate of 80 mm per year. The earthquake occurred as thrust-faulting on the interface between the two plates, with the Nazca plate moving down and landward below the South American plate.

Coastal Chile has a history of very large earthquakes. Since 1973, there have been 13 events of magnitude 7.0 or greater. The February 27 shock originated about 230 km north of the source region of the magnitude 9.5 earthquake of May, 1960 – the largest earthquake worldwide in the last 200 years or more. This giant earthquake spawned a tsunami that engulfed the Pacific Ocean. An estimated 1600 lives were lost to the 1960 earthquake and tsunami in Chile, and the 1960 tsunami took another 200 lives among Japan, Hawaii, and the Philippines. Approximately 870 km to the north of the February 27 earthquake is the source region of the magnitude 8.5 earthquake of November, 1922. This great quake significantly impacted central Chile, killing several hundred people and causing severe property damage. The 1922 quake generated a 9-meter local tsunami that inundated the Chile coast near the town of Coquimbo; the tsunami also crossed the Pacific, washing away boats in Hilo harbor, Hawaii. The magnitude 8.8 earthquake of February 27, 2010 ruptured the portion of the South American subduction zone separating these two massive historical earthquakes.

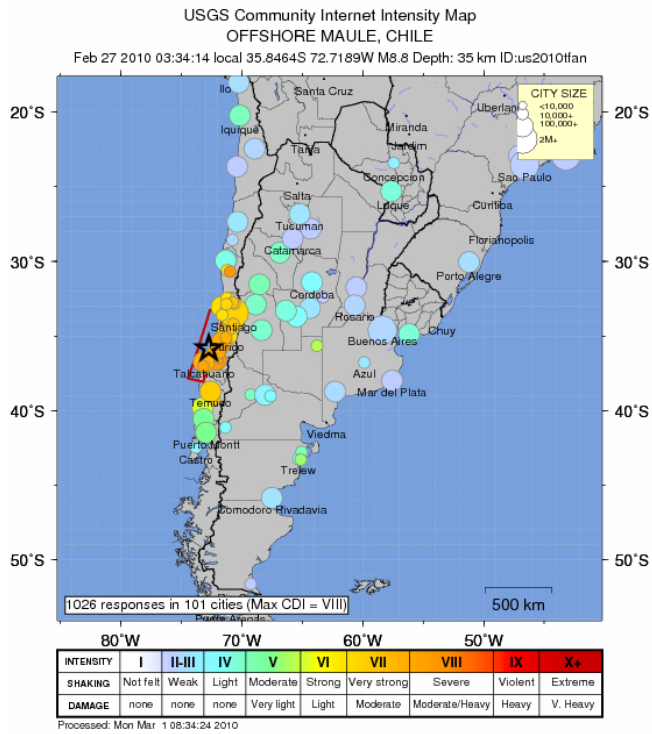


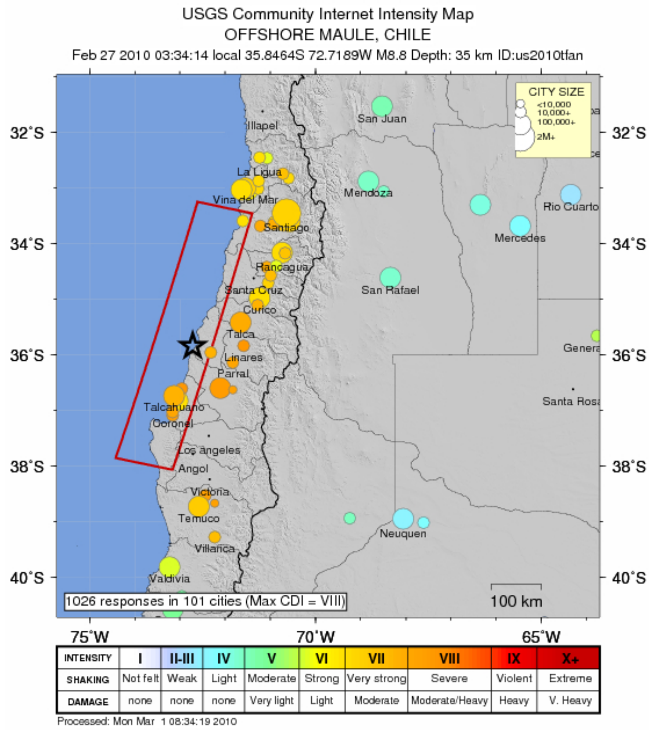
Επίκεντρα κυρίως σεισμού και μετασεισμών μέχρι τις 28 Φεβρουαρίου 2010, 05:10:06 UTC

Instrumental Intensity

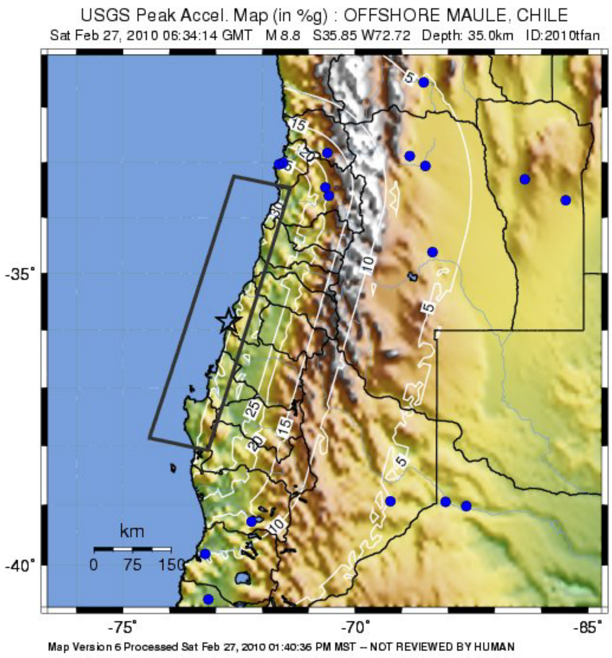


Did you feel it?

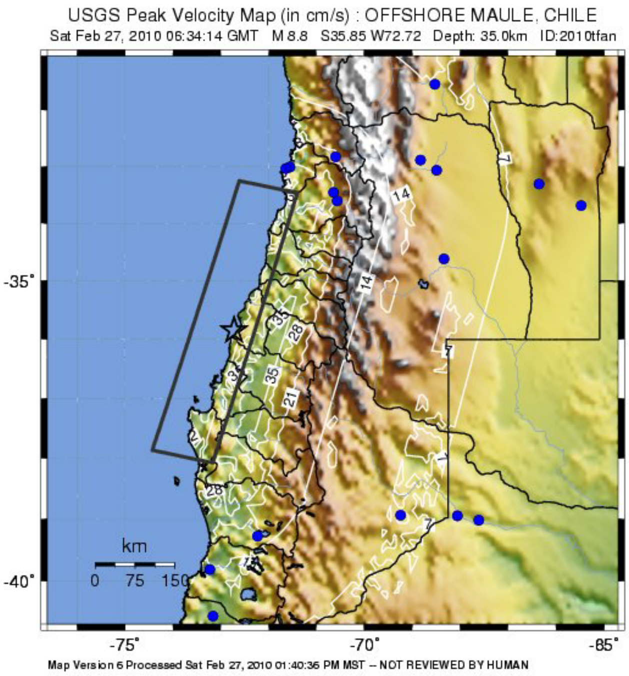


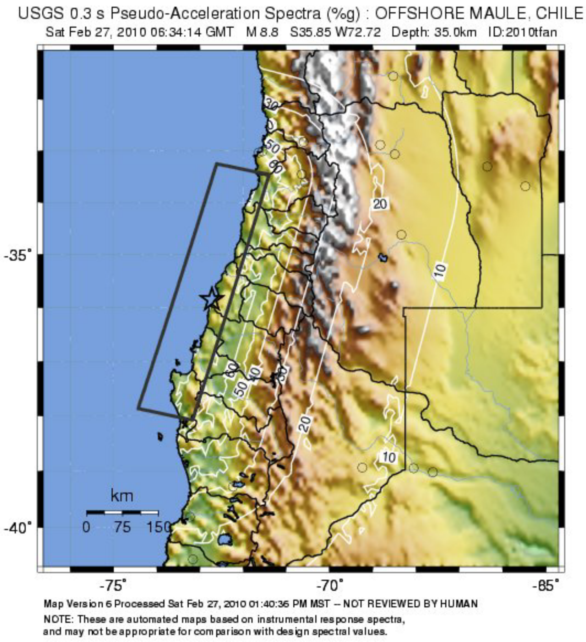


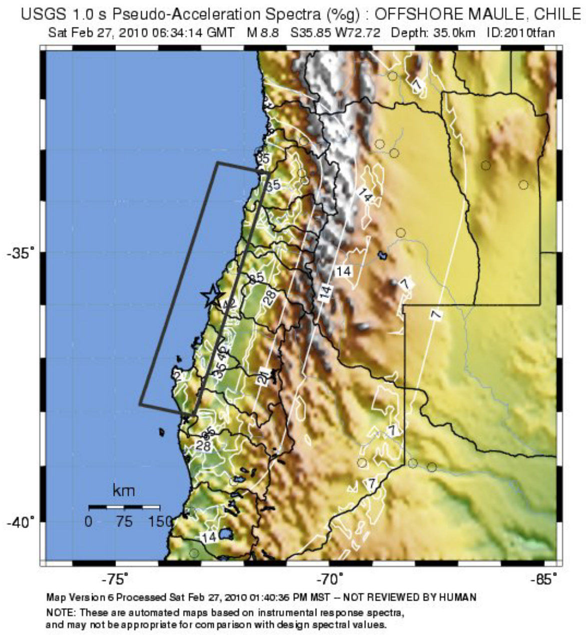
Peak Ground Acceleration

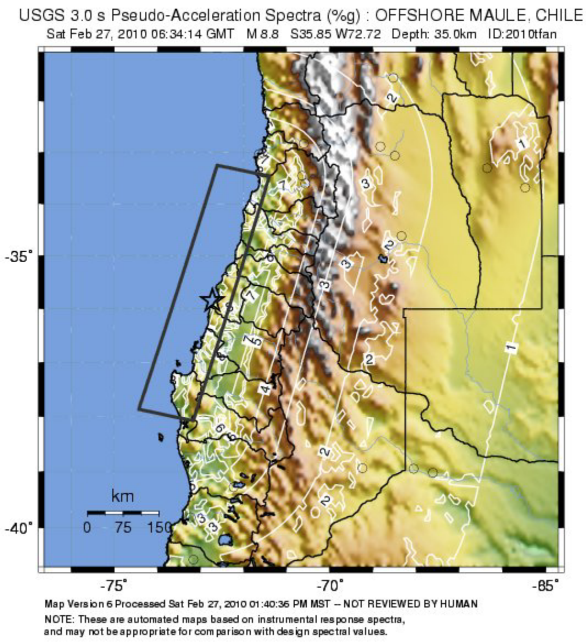


Peak Ground Velocity





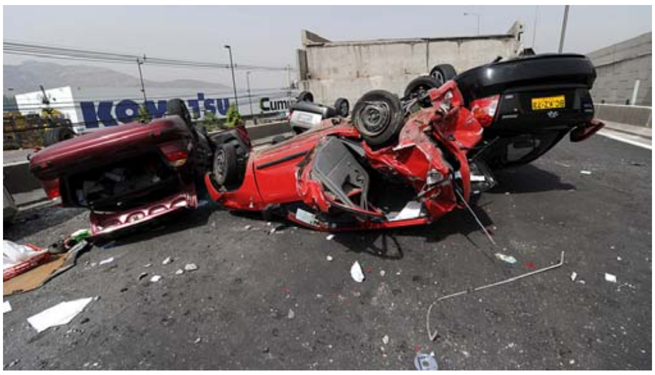




Οι μόνες περιοχές που επλήγησαν σοβαρά από τα παλιρροϊκά κύματα ήταν οι ακτές της νότιας Χιλής.

Passers-by look at the remains of a building split in half in Concepcion on Sunday.

The Bureo bridge along highway 5 is left severely damaged, making the route near Mulchen, Chile unpassable.



Flipped and mangled cars are strewn on the highway after a bridge collapsed in Santiago. Hundreds of people were killed in the quake.

A car is crushed under the ruins of a building in Curico, Chile. The quake's epicenter was located off the coast of Maule, about 200 miles southwest of Santiago.

Photos of damage in Santiago's fine arts district.

The city of Talca was badly hit, being close to the quake epicentre

Buildings were severely damaged in Concepcion, close to the epicentre

Roads and bridges have been damaged or destroyd

Damaged building in Santiago

The capital suffered widespread damage, despite being 325 km from the epicenter

The coastal town of Pichilemu suffered extensive structural damage

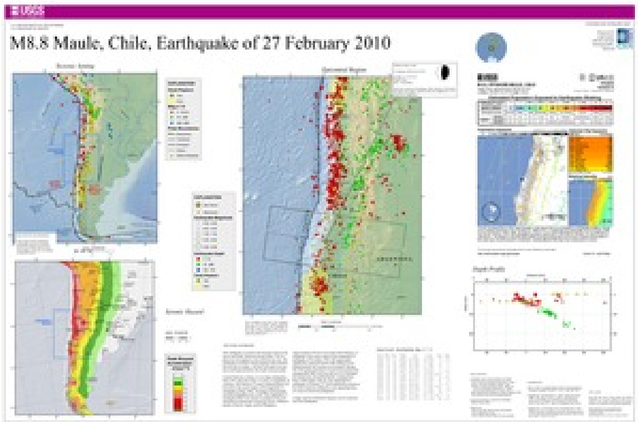
Damaged road embankment 50 km south of Santiago

Damaged church at Curico

Damaged bridge in Santiago

The tsunami triggered by the earthquake travelled across the Pacific. Japan saw high waves but no real damage – here a wharf is covered with seawater at Hanasaki port on Hakkaido.

Earthquake Summary



ΓΙΑ ΛΙΓΗ ΧΑΛΑΡΩΣΗ ΜΕΤΑ ΤΑ ΠΕΡΙ ΤΟΥ ΣΕΙΣΜΟΥ ΤΗΣ ΧΙΛΗΣ

Αρχαία Ελληνική Τεχνολογία…

After digging to a depth of 100 meters last year, Japanese scientists found traces of copper wire dating back 1000 years, and came to the conclusion that their ancestors already had a **telephone network** one thousand years ago.
So, not to be outdone, in the weeks that followed, Chinese scientists dug 200 meters and headlines in the Chinese papers read: "Chinese scientists have found traces of 2000 year old optical fibers, and have concluded that their ancestors already had advanced **high-tech digital telephone** 1000 years earlier than the Japanese."

One week later, the Greek newspapers reported the following: "After digging as deep as 800 meters, Greek scientists have found absolutely nothing." They have concluded that 3000 years ago, their ancestors were already using **wireless technology.**

Κατολισθήσεις…

ΚΑΙ ΠΑΛΙ ΣΤΑ ΣΟΒΑΡΑ

(το σκίτσο κυκλοφόρησε μεταξύ των συμμαθητών κάποιας ΣΤ' τάξης Γυμνασίου του 1969)

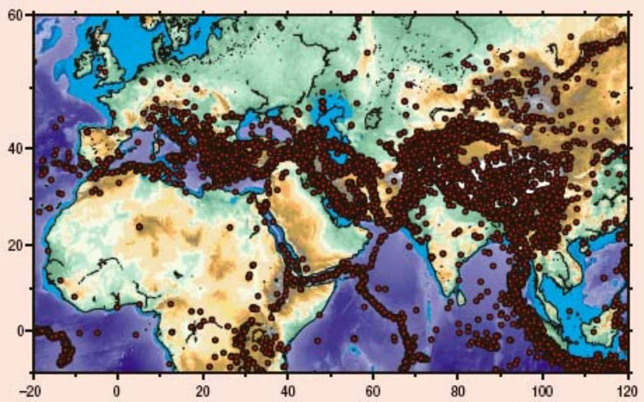
MOUNTAIN ROOTS AND THE SURVIVAL OF CRATONS

What controls the deformation of the continents, the survival of ancient cratons and the roots of mountains? James Jackson explains in his Harold Jeffreys Lecture, 12 November 2004.

ABSTRACT

In the last few years, evidence from the apparently unconnected fields of earthquake seismology, gravity, geochemistry, rock mechanics, mineralogy and petrology has come together to provide simple insights into the fundamental geological questions: why do the continents deform differ-ently from the oceans, and why do the ancient interiors of the continents (the cratons) survive apparently intact and undeformed for so long?

This is a detective story in the Earth sciences. From the earliest days of plate tec tonics it was known that the continents do not deform in the same way as the oceans. This is evident from a map of earthquake epicentres (figure 1), showing the narrow bands of earthquakes in the Indian ocean, contrasting with the epicentres distributed over the broad mountainous regions of the Middle East and Central Asia. Earthquakes occur when faults move, so a map of earthquakes is a map of active deformation. Plate boundaries in the oceans are essentially single faults, defined by joining the epicentre dots on a map, whereas the very concept of plate boundaries on the continents is often unhelpful: it is meaningless to ask what plates Lhasa or Athens are on, since Tibet and Greece are both parts of wide deforming regions, and not parts of any rigid plate.



1: Earthquake epicentres (red) in Asia and the Middle East are dispersed over very wide mountainous regions, and contrast with the narrow bands of earthquakes offshore in the central Indian and Atlantic oceans. This contrast between the deformation of the continents and oceans is fundamental. Earthquakes in central Asia result from the collision of India with the Eurasian continent, but note that India, an ancient continental craton, is relatively undeformed.

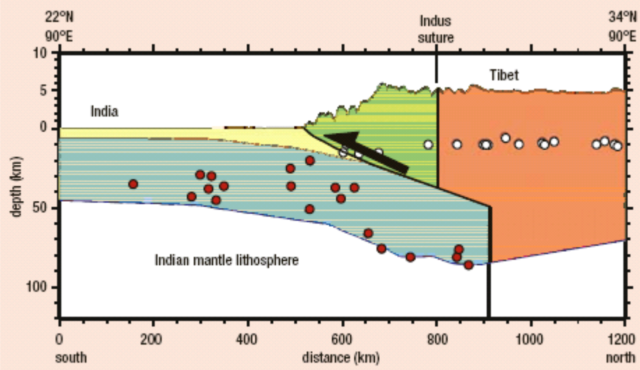
The ocean-continent contrast is not unexpected. The plates make up the lithosphere, the outer strong layer of the Earth, typically about 100 km thick and consisting of the crust and part of the underlying mantle. In the oceans the crustal part is a fairly uniform 7 km thick, whereas on the continents it is typically 30-80 km. The crust is less dense than the mantle, so a plate with thick continental crust is more buoyant, preventing it from sliding beneath another plate at collision zones. Instead it crumples to make mountains. Attempts to understand this process require a knowledge of the mechanical properties of continental lithosphere, and it is recent developments in this area that are the subject of this article.

Earthquakes and collisions

As so often occurs in Earth sciences, focus on one question inadvertently illuminates another. The earthquakes in figure 1 result from the ongoing collision between India and Asia, whose geological boundary lies in the Himalaya. Yet, whereas Asia has crumpled up as far north as Mongolia, ~3000 km from the geological contact, India is virtually undeformed. India is part of the Jurassic Gondwanaland super-continent that fragmented to make Africa, South America, Australia and Antarctica. The interiors of all these continents are ancient (usually older than 3 billion years), flat and have remained undeformed for a very long time: they are called shields or cratons. They have a history of colliding with other cratons to form mountain belts between them, which later split apart again along the same sutures, leaving the cratons themselves intact and undeformed. The ancient cratons have an ability to survive that has long puzzled geologists.

For many years people have used the depth distribution of earthquakes and the gravity anomalies associated with topographic loads as indicators of lithosphere strength, by which is meant the ability to sustain elastic stresses over geological timescales with negligible flow.

In the case of earthquakes, a temperature-dependent change from shallow, friction-dominated slip on faults to deeper, aseismic creep processes is expected, and in most continental regions, earthquakes are indeed restricted to the upper half of the crust. But variations are seen, and in particular, in some of the old cratons, such as north India and parts of East Africa, earthquakes occur throughout the thickness of the crust (figure 2). There is little evidence for earthquakes in the mantle beneath the continents, in spite of there being many earthquakes in the oceanic mantle, beneath the much thinner oceanic crust. (I am not referring here to the very deep earthquakes in cold oceanic lithosphere that is transported back into the mantle at oceanic trenches, but to earthquakes at depths up to ~40 km within the stable ocean basins.)



2: A north–south cross-section through the Himalaya at 90°E. Red dots are earthquakes within the crystalline crust of the Indian shield (blue), and occur down to the crust–mantle interface (the "Moho": thick blue line). White dots are shallower earthquakes in the Tibetan crust (orange) or the upper crust of India (green), which has been deformed, thickened and scraped off the lower Indian crust (black arrow) in the Himalaya. The positions of the boundaries between the green, blue and orange areas are conjectural at depth, but the Indus suture is the geological boundary between Tibetan and Indian rocks at the surface. The vertical line at 920 km distance is the northern limit of the Indian mantle lithosphere at depth, from seismic anisotropy. (Adapted from Jackson *et al.* 2004)

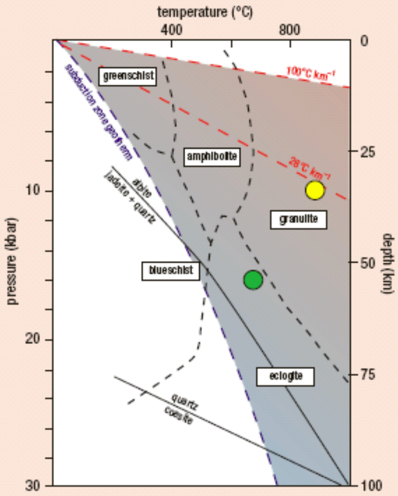
The wavelength on which the lithosphere bends, and creates gravity anomalies to support topographic loads, can be used to estimate the thickness of the strong elastic layer providing the support, in the same way that a thick plank bends on a longer wavelength than a thin one. Recent reviews of this rather technical and controversial subject (McKenzie and Fairhead 1997, Maggi *et al.* 2000, McKenzie 2003) found that the effective elastic thickness (*Te*) determined from gravity and topography tracked the thickness of the layer in which earthquakes occur (*Ts*). Thus larger values of elastic thickness were found where earthquakes occur throughout the crust. Although *Te* is not always well resolved by the data, they found, in general, that *Te* <*Ts* and they found nowhere where the data required that *Te* >*Ts*. As they pointed out, the simplest interpretation of these results is that the long-term strength of the continental lithosphere resides in the layer that generates the earth--quakes; which is either the upper crust or the whole crust, but does not include the mantle.

These results immediately contrasted the continents with the oceans, where the mantle both generates earthquakes and contributes to longterm elastic strength, but where the crust is much thinner. They also focused attention on the ancient cratons, and in particular north India, where the values of both *Te* and *Ts* suggested that the Indian shield was unusually strong (figure2).

Crustal thickness

As patterns in the earthquake depths and gravity anomalies became clearer, so too did our knowledge of crustal thickness variations. Modern, broadband digital seismometers can be used to determine the crustal thickness by detecting converted longitudinal-to-transverse waves generated by the crust–mantle interface. These waves arrive a little later than direct longitudinal waves from distant earthquakes and the delay depends on the crustal thickness. Widespread use of this technique on the continents produced two important results for this story.

Firstly, it was found that the thickness of the crustal root beneath southern Tibet reaches 80–90 km (figure 2): significantly thicker than we previously thought. It was always known that the crust was thick beneath continental mountains: the crust floats on the mantle like ice on water (though the mantle is solid, not liquid, and deforms by creep), and high elevations are supported by deep, buoyant roots. But a thickness of 80–90 km poses other problems: at those depths the minerals in typical continental rocks should transform to a different, much denser, mineral assemblage called eclogite (figure 3). They cannot have done so in the Himalayan root, or its greater density would mean both that Tibet would be at much lower elevation and that its higher velocity would make the crust–mantle interface there undetectable. The crust must somehow have remained in the less-dense mineral assemblage called granulite; but why?



3: This shows the expected mineral assemblages (white boxes) as a function of depth and temperature in the crust. The deepest part of the Himalayan root zone (50–90 km) should be in "eclogite" conditions since it will have followed a downward path similar to the blue line ("subduction zone geotherm"). But if this were true, the rocks would be very dense (~3.5 Mgm m^{-3}, compared with 3.2 Mgm m^{-3} in the mantle), and southern Tibet would not be at 5 km; the seismic velocities at depth would also be too high to see the Moho (crust–mantle interface). The crust must have remained metastable in the much less dense (~2.8 Mgm m^{-3}) "granulite" assemblage, characteristic of the ancient Indian shield where it is exposed at the surface. The yellow circle is the approximate temperature–pressure position recorded by the host granulite rocks in Norway (figure 5), even though the mineralogy in the "fossil earthquake" melts shows they reached the conditions of the green circle. The host granulite was again metastable, at pressures and temperatures beyond its nominal stability limit. (See Jackson *et al.* 2004)

An extra surprise was that some unusually deep earthquakes, 80–90 km beneath southern Tibet, were now seen to be so close to the crust–mantle boundary that we could not really distinguish which side they were on.

Secondly, there were more signs that the cratons were odd. For example, in Finland, part of the ancient Scandinavian craton, the crust can reach 65 km thickness, the same as that in the Alps, even though the country is essentially at sea level. Younger continental regions at sea level, such as the United Kingdom, usually have a crustal thickness around 30 km. Something must be unusual about the mantle part of the lithosphere beneath the crust in the cratons.

Lithosphere thickness

At this point, bearing in mind the puzzle that gravity and earthquake evidence appeared to show the continental mantle was weak, whereas the oceanic mantle appeared strong, we looked for independent evidence of lithosphere thickness and temperature. Such evidence exists in two forms: the geochemistry of mantle nodules brought to the surface in volcanic eruptions, and the imaging of velocity structure in the Earth by seismic tomography.

Figure 4a shows an estimate of the temperature profile beneath the NW part of the ancient Canadian craton. It uses pressure and temperature estimates from the chemical compositions of mantle nodules, to which are fitted a steadystate geotherm that has to connect with the convecting interior beneath the plates, whose temperature is known. An important feature of this profile is that the tem-perature gradient is much steeper in the crust, where ra-dioactive isotopes of K, U and Th are concentrated, than in the mantle lithosphere, where there is no significant inter-nal heat production. The other important effect, incorpo-rated here for the first time, is that conductivity in the man-tle is a strong function of temperature, changing by a factor of about two over the thickness of the lithosphere, so the mantle gradient is concave upwards.

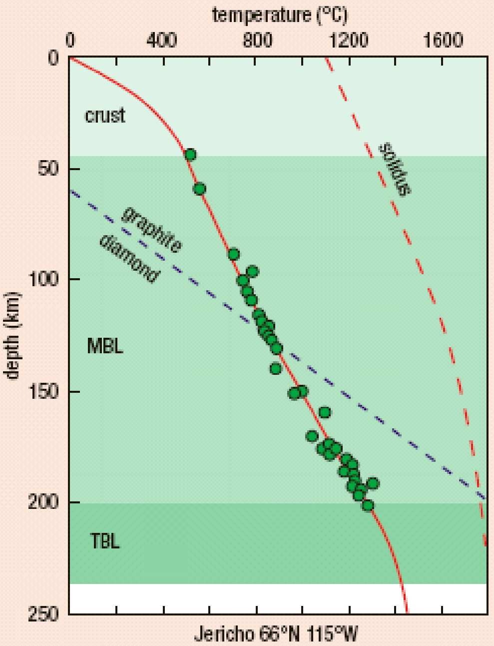
The profile in figure 4a predicts the heat flow at the surface, and is compatible with observations. It also suggests a lithosphere thickness of 220 km, which can be compared with the velocity structure from seismic tomography. The tomographic image in figure 4b shows the high velocity lid of the cold Canadian craton extending to precisely the depth suggested by the mantle nodule analysis. Thus, for the first time, the seismology, geochemistry and heat-flow measurements are all consistent and indicate that the lithosphere thickness is about 220 km: roughly twice that of young continental regions and the ocean basins. Both the nodules and the tomography show that this is a general result: the cratons have significantly thicker lithosphere, sometimes with an unusually thick crust as well.

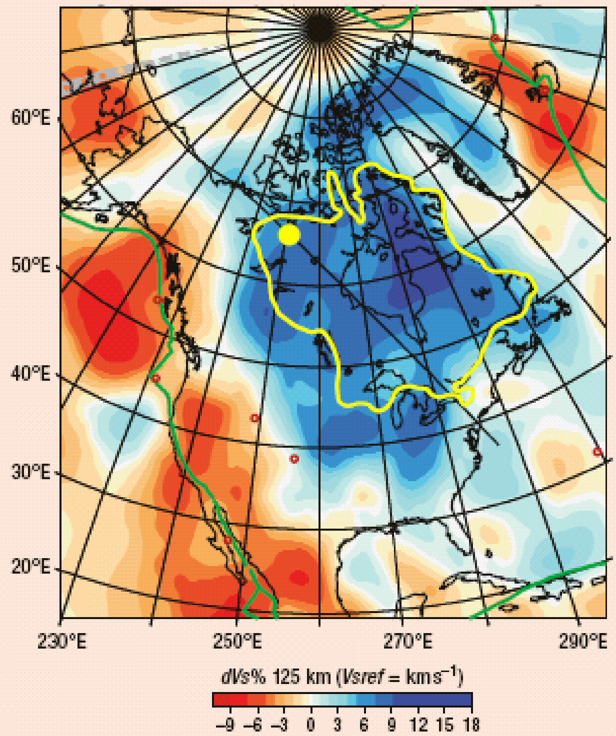
But the ability to construct accurate profiles like that in figure 4a also tells us something else: the temperature at the crust–mantle interface beneath the cratons. There are no earthquakes beneath this part of Canada, but where earthquakes occur in other cratons, such as Siberia and east Africa, it appears that the temperature at the interface is typically ~600 °C. This turns out also to be the temperature at which we estimate the mantle becomes aseismic in the oceans (allowing for the temperature-dependent conductivity). Thus the conundrum as to why earthquakes occur in the oceanic mantle but not the continental may have a simple solution: the mantle generates earthquakes only when it is colder than ~600 °C, which is common in the oceans but very rare on the continents. The neglect of temperature-dependent conductivity had previously led us to overestimate the temperatures in the oceanic mantle and underestimate them in the continents.

Fossil earthquakes in Norway

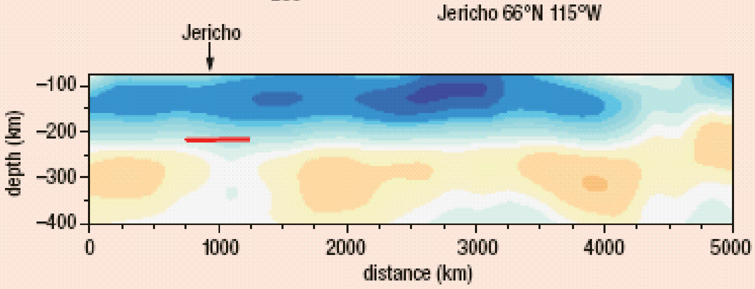
A remaining puzzle is why the cratons, such as north India, are both unusually strong and produce earthquakes in the lower crust. There are two obvious possibilities: that they are unusually cold, or that they are dehydrated (even very small amounts of water reduce creep strength dramatically). A clue to this puzzle came from an unexpected source: evidence of earthquakes about 400 million years old in Norway.

4 (a) right: A temperature profile through the lithosphere (plate) based on pressure–temperature estimates from the geochemistry of mantle nodules at the Jericho mine, in the northern Canadian craton (green circles). The lithosphere consists of the crust (lightest green) and part of the mantle, which in turn includes a rigid mechanical boundary layer (MBL) and a lower thermal boundary layer (TBL) that connects with a convecting interior below the plate. (Figure from Dan McKenzie)





(b) above: Seismic velocity perturbation relative to a standard Earth reference model at a depth of 125 km beneath North America. The high velocity of the Canadian shield, whose geological boundary at the surface is marked by a yellow line, is evident in the blue colours and is related to its lower temperature. The Jericho mine, in figure 4a, is the yellow circle.



(c) above: A vertical seismic velocity section along the black line in 4b through the Jericho mine. The high velocity lid of the Canadian shield has an abrupt base at about 220 km (red line), in good agreement with the base of the lithosphere estimated in 4(a) (roughly halfway through the TBL). (Figures 4b and 4c from Keith Priestley)

In the early 1990s, Håkon Austrheim and colleagues from Oslo described some friction generated melts from the exposed ancient root zone of the Norwegian Caledonian mountains (the same mountain system that formed the Appalachians and Scottish Highlands). These melts formed in earthquakes as the result of heating on fault-slip surfaces at high confining pressures (figure 5), and were immediately quenched to form glass. What is unusual about these melts is that their mineralogy, which in electron micrographs shows the original dendritic and skeletal forms char-acteristic of rapid growth in quenching, is that of the ec-logite assemblage (figure 3).

These were fossil earthquakes at depths of at least 60–70km, yet the host (unmelted) rock is still in the granulite assemblage. This indicates that the granulite was metastable and could only form the stable mineral assemblage when it melted.

Austrheim's group was able to show that the key to this process is water: very small amounts of hydrous mineral phases are seen in the eclogite melts, but the host granulite is completely anhydrous. Infiltration of water along cracks led to more pervasive eclogite formation, accompanied by a dramatic loss of strength: the eclogite is deformed by ductile flow, whereas the granulite is essentially undeformed except where offset by brittle slip on melt-generating surfaces.

Two things stand out from Austrheim's remarkable work. The first is the all-important effect of water, whose catalytic effect is that of an on–off switch: with no water the granulite–eclogite transformation simply does not occur, and the granulite remains metastable. This is not that surprising, as the transformation involves a wholesale reorganization of both chemistry and mineral structure and is known to be very difficult to achieve in the solid state unaided by a catalyst. The second is the association between metastability and mechanical strength. The metastable granulite retains its mechanical integrity and (inherited) internal structure until it transforms to eclogite and becomes weak.

Survival of cratons and roots

Thus we return to India. Whereas being either cold or anhydrous would account for the strength of Indian craton and its lower crust, penetrating beneath southern Tibet to form the massive Himalayan crustal root, the message from Norway is clear: only being dry will allow the Tibetan root to survive as metastable granulite. Thus it is likely that the unusual strength of the cratons derives from their dry lower crust: granulite is an anhydrous assemblage left behind after melting in the past extracted granite (and with it all the water) from the crust.

In Norway it seems that the transformation of granulite to eclogite along fractures is initiated by water, introduced during earthquake rupture; it may even be that water induces the fracture itself. At depths of 60–80 km the only reasonable source of water, given that the granulite is dry, is likely to be the mantle itself, possibly from the pressure-sensitive breakdown of hydrous mineral phases within it. Those enigmatic deep earthquakes beneath Tibet, so close to the crust–mantle boundary, may be modern analogues of the fossil earthquakes in Norway.

Thus we are beginning to see what is special about cratons: they achieve their extra strength through their dry lower crust. They also have unusually thick lithosphere, which is stabilized by chemically depleting the mantle beneath their crust. This too was achieved through earlier melting events, which are known to have removed garnet and reduced the iron content, thereby considerably reducing the density. The result is a mantle component of the cratonic lithosphere that is relatively buoyant compared to younger mantle lithosphere but, because it is much thicker than normal, reduces the overall buoyancy of the plate, thus allowing Finland, with its thick crust, to be at sea level. Cratons assembled of such material are virtually indestructible: much stronger than anything they are likely to run into, and too buoyant to be pushed back into the Earth's interior. They can ram into weaker continental crust, as India has into Tibet, but eventually the upper part of the Himalayan crustal root will be removed by erosion or tectonic processes leaving the lower crust of India to survive.

A typical story?

It is common in the Earth sciences for apparently simple questions, such as "what is special about the continental cratons?", to lead us in unexpected directions. This enquiry involved a range of clues, from earthquakes, gravity, mantle geochemistry, seismology, rock mechanics and even the metastability of minerals and ancient fossil earthquakes. Along the way other puzzles are illuminated, such as why the mantle beneath the oceans produces earthquakes but not that beneath the continents. It is very likely, for instance, that the same effects are present on other planets. Venus has mountains that rise 10km above the mean surface elevation. Because Venus contains much less water than Earth, such mountains are also likely to be supported by roots of metastable granulite. In many ways the story recounted here is a typical experience in the Earth sciences: important clues are in unexpected places; to recognize those clues requires a broad general knowledge of how the planet works; and focusing narrowly on what is apparently the core of the problem is often not the way to solve it. These lessons are all familiar to practising Earth scientists, but less so to scientific administrators and managers of directed science programmes.

James Jackson, Dept Earth Sciences, Bullard Laboratories, Cambridge. *This story touches on manybranches of Earth sciences and was a collaboration with my colleagues Dan McKenzie, Keith Priestleyand Håkon Austrheim, who I thank for producing, in turn, figures 4a, 4b, 4c and 5.*

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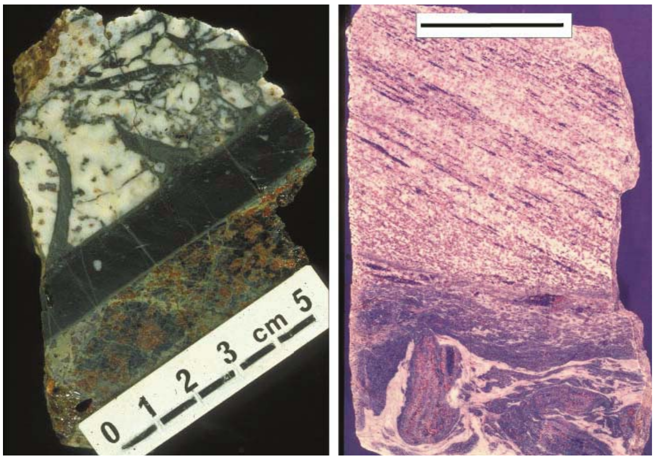
The Harold Jeffreys Lecture

The Royal Astronomical Society awards this lecture each year to a scientist distinguished for their work in geophysics, in memory of Harold Jeffreys, RAS President and Gold Medallist.



5 (a): Fossil earthquake in Norway. The black band with flame-like injections coming off it is frictional melt (quenched to glass) from an earthquake about 400Ma ago. The mineralogy of the quenched melt is that of the eclogite assemblage (figure 3) indicating a depth of at least 50km. The host rock is granulite.
(b): Granulite–ecologite mechanical contrasts in Norway. Scale bar is 10cm. The banded granulite (top) has behaved essentially rigidly (the banding itself is inherited from earlier deformation), while the eclogite (bottom) has flowed in a ductile shear zone. The transformation from granulite to eclogite requires water as a catalyst; without water, the granulite remains metastable. (See Jackson *et al.* 2004. Figures from Hεkon Austrheim [Austrheim and Boundy 1994, Bjornerud *et al.* 2002])

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FOUNDATION DESIGN APPROACH OF PAST, PRESENT, AND FUTURE

Bengt H. Fellenius, Dr. Tech., PEng., M.ASCE

In the past, practitioners designed from observed settlement response to load. Then, a number of papers published from the 1920s through the 1940s established geotechnique as a field that used analysis and calculations to arrive at an economical and safe foundation design. The Factor of Safety oη Capacity became the magic concept. Since the '20s, the profession has refined the analysis methods and these days, computer programs make everyone a "wizard" in analyzing a foundation's response to applied load. Amazingly, there has been very little advancement in what goes into these programs. The Standard Penetration Test (SPT) is still the dominant field exploration tool. Total stress - undrained shear strength - is still the most common soil parameter used as input for calculating capacity and linear elastic modulus is assumed when calculating movement.

The Historical Perspective

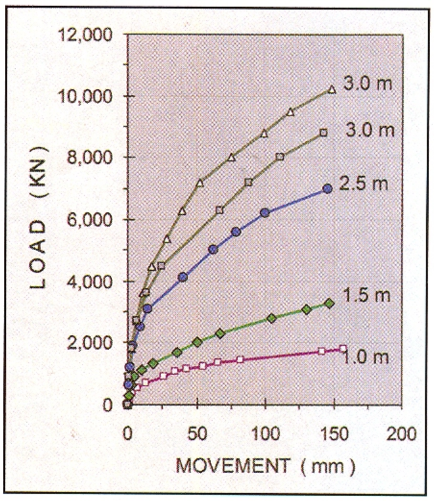
What analysis case can be simpler than that of loading a footing with a diameter of a metre or two placed a short distance into sand? Iη 1943, Terzaghi presented the "triple-N formula" for calculating the capacity of such a footing. Many others refined the original N-coefficients using ultimate resistance values from model footing tests. The range of published values for the N_q-coefficient varies by more than an order of magnitude. This wide range of the key parameter should have alerted the profession that perhaps the pertinence of the formula could be questionable. When critical state soil mechanics came about (advancing the concept proposed by Casagrande iη 1935), the reason for the model tests reaching an ultimate value became clear: model tests affect only the soil to a shallow depth, where even the loosest soil behaves as an overconsolidated soil. That is, on loading the model, after some initial volume change, the soil dilates and finally contracts, resulting in a stress-deformation curve that implies an ultimate resistance.

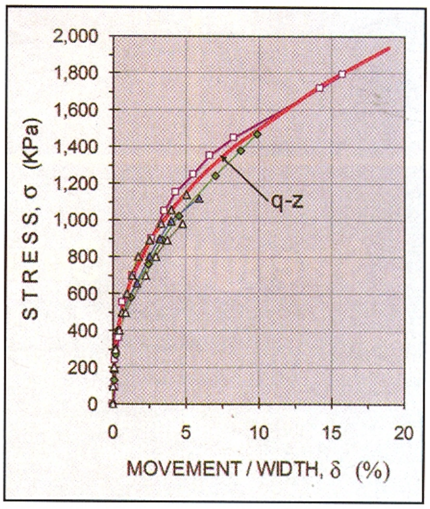
Actual footings do not behave the way model footings do. Figures 1 and 2, derived from tests on square footings conducted by Texas A&M, show no indication of failure even at the extreme movement of 15 percent of the footing width. Real footings do not reach an ultimate failure mode (unless the soil is clay and the loading is rapid, causing pore pressures to increase). Present-day tests call into question the results of model footing tests from the past, so for the future, let's abandon the "triple-N formula" and rely oη design using deformation characteristics. But what deformation characteristics should we use?

Where to Go From Here: Footings

It is common to calculate the settlementηt of a footing by applying an elastic modulus. The modulus value is often taken from test results, by choosing an average or a perceived representative value. However, the Texas A&M example tests indicate as many E-modulus values as there are applied loads. This variation of the E-moduli should not be surprising, as the observed movements are affected by immediate deformation, creep during load-holding, increased volume of soil affected from one applied load to the next, and, primarily, by a significant cementation or preconsolidation condition.

The easiest footing to design is the one that is identical to a tested footing. But, what to do when the footings are of different size and loaded to larger stress? As indicated in Figure 2, the curves can be approximated to a shape called q-z curve ("q" is stress and "Z" is movement) and extrapolated with confidence. A q-z curve can be expressed several ways.





Figures 1 and 2.

One of the most useful is:

$$\frac{\sigma_1}{\sigma_2} = \left(\frac{\delta_1}{_2}\right)^e$$

where:

σ_1 = stress No. 1
σ_2 = stress No. 2
δ_1 = movement at stress No. 1
δ_2 = movement at stress No. 2
e = exponent

Any two data pairs of series of load-movement data (or stress versus relative movement) that satisfy this equation can be used to determine the exponent "e." Figure 2 shows the q-z curve determined from the example test, where σ_1 and δ_1 were selected from the mid-range pair of values, and the σ_2-values were applied trying different values of e until the calculated δ_2 agreed with the measured. The procedure established an exponent of about 0.40 for the Texas A&M footing tests. This means that we can replace the present quasi-design approach of applying a certain factor of safety to the non-existent bearing capacity of footings, and base the design for deformation on a q-z correlation from full-scale footing tests.

Where to Go From Here: Deep Foundations

A similarity exists between the response to load of a footing and that of a pile toe. This similarity has led the profession to apply the bearing capacity formula also to a pile toe. Usually, the recommended values for the pile toe bearing capacity coefficient, N_t, ranges from two to three times the N_q-value often soil, but values smaller and larger are frequent. However, there is no more an ultimate resistance for the pile toe than there is an ultimate resistance for a footing. (Pile toe capacity can of course be defined as a toe load for a certain penetration or relative penetration, but as such it has little meaning.) This has very clearly been shown in numerous full-scale pile tests using the bi-directional pile test (the O-cell test developed by Jorj OsterbeIg and co-workers). This test measures load-movements of the pile shaft and of the pile toe separately. Figure 3 shows the results of a test performed on a 900-mm-diameter, 15-m-long drilled shaft in clayey silt saprolite and socketed a short distance into weathered bedrock. Similarly to the footing tests, the O-cell test pile-toe load-movement follows a slightly curved line and no ultimate resistance is discernable despite the maximum toe movement of 6 percent of the pile diameter.

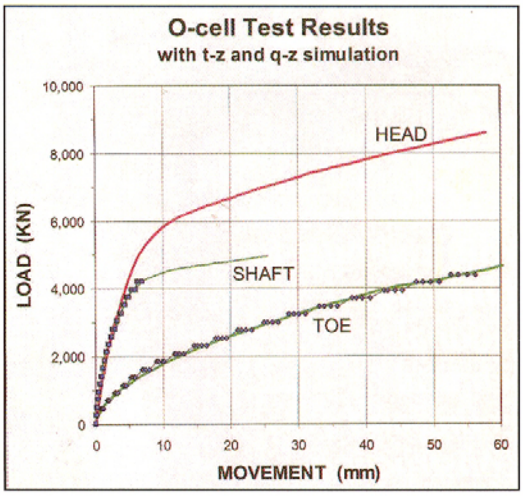
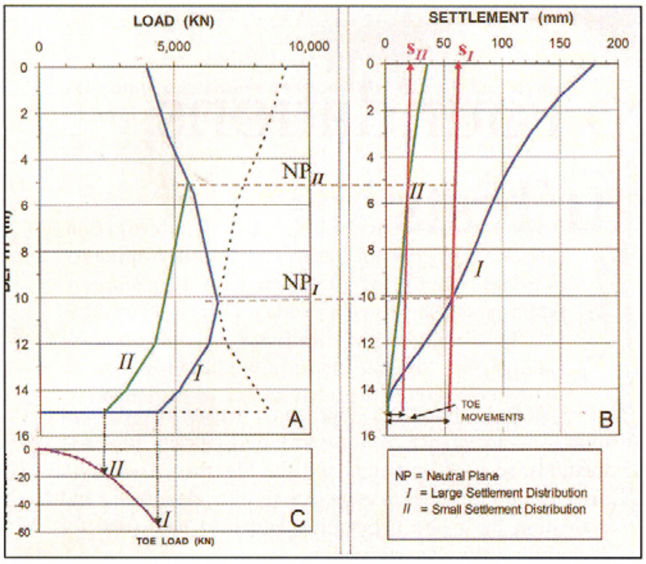


Figure 3.

The load-movement of the pile toe can be approximated by a q-z curve, and so can the load-movement of the shaft, which is then called "I-Z curve." The fits for the O-cell test are shown in Figure 3. They are achieved using an exponent of 0.55 for the pile toe data and 0.20 for the pile shaft data. The shaft resistance is determined assuming, conservatively, that the shaft was about to start developing ultimate resistance along its full length. The q-z and I-Z curves are combined to establish the equivalent head-down, load-movement curve, which incorporates the stiffness of the pile. Unfortunately, the pile head load-movement curve adds little insight to the assessment to the pile foundation assessment. Apply a larger load and the pile moves down more. Obviously, the conventional capacity thinking is here of limited relevance.

The more important result of the analysis is the distribution of load along the pile for long-term conditions.

Figure 4A shows the load distribution, determined from the test data (the test pile was strain-gage instrumented) for an assumed sustained load of 4,000 KN. Assume that the soils at the site for some reason will either experience a "large" settlement in the long-term or, alternatively, a "small" settlement, as shown by the 'I" and ''II" settlement distributions in Figure 4B. Negative skin friction will develop, of course, and the load will increase down the pile to a maximum at the neutral plane, the location of force equilibrium as well as of settlement equilibrium.



For Case I, the neutral plane will develop at a depth of about 10.2 m. Below the neutral plane, the shaft shear against the pile acts in the positive direction, and, as shown in Figure 4A, the force at the pile toe is equal to the maximum O-cell test load. As the measured O-cell load-movement diagram (Figure 4C) shows, the movement of the pile toe is then 55 mm. Figure 4B illustrates that for this toe movement, and considering the shortening of the pile and the shown interaction between forces and movement, the pile head will settle slightly more than 60 mm. If, on the other hand, the soil settlement is "small" (Case II), then the neutral plane is located higher up and the pile toe force is reduced to about 2,300 KN, which only requires a toe movement of 16 mm.

By the construction shown in Figure 4B, the pile head will then settle only about 20 mm.

The case history example demonstrates conclusively that what governs the long-term safe function of the piled foundation is the soil settlement at the site. Thus, in designing a piled foundation, settlement and soil compressibility at the site can be of utmost importance for the complete design.

This is unfortunately not generally recognized in current practice. It certainly will have to be recognized in the future.

Note that the analysis requires tests that can separate the shaft response from the toe response. Loading tests that only determine the pile head movement are of limited value for analysis.

Conclusion

The relatively recent shift to load and resistance factor design, LRFD, has caused consternation and uncertainty about the assuredness of a design in some cases. A check of the design in an analysis for deformation and settlement which is performed with unfactored values - serviceability limit states design - then offers the designer a reassurance needed in our litigious society. Indeed, in the future, capacity will lose its singular importance, and settlement and deformation analysis will be a required feature of foundation design.

Bengt H. Fellenius, DT. Tech., P.Eng., M.ASCE, is an internationally-recognized authority in the field of soil mechanics and foundation engineering, and, in particular, in deep foundations. He can be contacted at Bengt@Fellenius.net.

(από το περιοδικό Geo-Strata της ASCE)

ΑΝΑΣΚΟΠΗΣΗ ΓΕΓΟΝΟΤΩΝ ΓΕΩΤΕΧΝΙΚΟΥ ΕΝΔΙΑΦΕΡΟΝΤΟΣ

Διάλεξη Robert THURNER

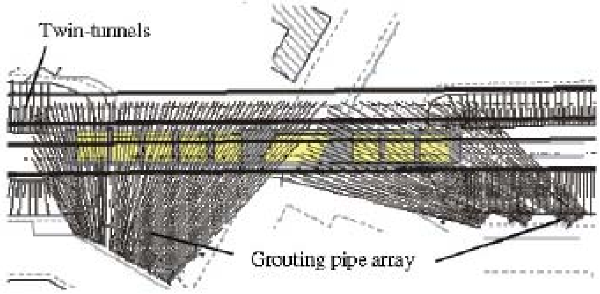
Την Τρίτη 13 Ιανουαρίου 2010 πραγματοποιήθηκε στο Αμφιθέατρο «ΕΥΘΥΜΙΟΣ ΜΑΣΤΡΟΓΙΑΝΝΗΣ» του Τμήματος Πολιτικών Μηχανικών της Πολυτεχνικής Σχολής του Πανεπιστημίου Πατρών και την Τετάρτη 14 Ιανουαρίου 2010 στην Αίθουσα Εκδηλώσεων της Σχολής Πολιτικών Μηχανικών ΕΜΠ στην Πολυτεχνειούπολη Ζωγράφου η διάλεξη του Dr. Robert Turner «Compensation grouting for limiting settlements of two railway bridges induced by a twin-tunnel excavation».

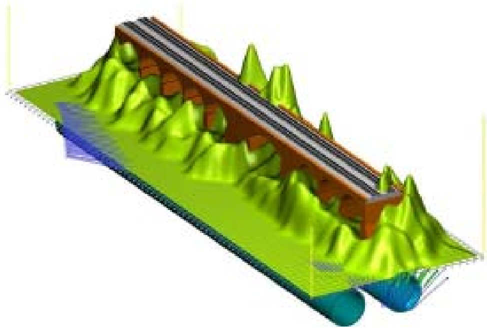
Περίληψη Διάλεξης

For the construction of the high speed railway line Rome-Milan, tunnelling operation took place directly underneath the alignment of the existing railway line in the city centre of Bologna. To minimize the effects of the tunnel excavation countermeasures were implemented for the protection of two railway bridges. The twintunnel excavation underneath these historical railway bridges was performed utilizing the Compensation Grouting technique in order to limit the effects of (differential) settlements induced on the bridges.

The tunnelling was made with two 9.4 m diameter EPB-shield machines with a cover of about 20 m. The excavation was performed in very heterogeneous alluvial strata. In the first part of the alignment the tunnels were excavated in lacustrine clay and loose sandy deposit below the water level, in the in the second part it consisted of Savena river deposits with mainly gravel and sand strata, locally with a high percentage of fines (lenses of clay and silt). The groundwater level was found underneath the tunnel excavation.

Compensation grouting was seen as the only measure to control and limit the deformations. For the grouting operations, two arrays of grouting pipes (TAMs) were installed by means of Horizontal Directional Drilling technique. With these curved drillings the pre-treatment of the ground and the consequent lifting of the structures were performed. All the activities were monitored with a hydraulic liquid levelling system. To prove the feasibility of the Compensation grouting concept, a real-scale field test was conducted prior to the grouting operation. Details of this compensation grouting work concerning concept, design, execution and quality management are given in this presentation.





Βιογραφικά Στοιχεία

Robert Thurner received his undergraduate Degree in Civil Engineering (Dipl.-Ing.) from the Graz University of Technology, Austria with main subject Geotechnical Engineering in 1996, and his Ph.D. in Geotechnical Engineering (Probabilistic analysis using deterministic Finite Elements calculations in Geotechnics) from the same university in 2000.

From 2001 – 2006 he was Head of the R&D-department of Keller South East Europe and from 2007 until today Managing Director for Southern East Europe of Keller.

The areas of his expertise are numerical modelling of geotechnical problems and concept, design and execution of projects using various techniques like anchors, low pressure grouting, piles, jet grouting, vibro stone columns etc.

6η ΑΘΗΝΑΪΚΗ ΔΙΑΛΕΞΗ ΓΕΩΤΕΧΝΙΚΗΣ ΜΗΧΑΝΙΚΗΣ
Prof. John Burland
«Interaction between geotechnical and structural engineers»

Την Δευτέρα 25 Ιανουαρίου 2010 παρουσιάσθηκε στην Αίθουσα Εκδηλώσεων του Κτιρίου Διοίκησης του ΕΜΠ στην Πολυτεχνειούπολη Ζωγράφου η 6η Αθηναϊκή Διάλεξη Γεωτεχνικής Μηχανικής από τον Prof. John Burland, CBE, DSc (Eng), FREng, FRS, Emeritus Professor, Soil Mechanics Section, Department of Civil and Environmental Engineering, IMPERIAL COLLEGE, London.

Η εκδήλωση άρχισε με σύντομη εισαγωγή από τον Πρόεδρο της ΕΕΕΕΓΜ Χρήστο Τσατσανίφο:

Αγαπητά μέλη και φίλοι της ΕΕΕΕΓΜ,

Πριν από 12 περίπου χρόνια η τότε Εκτελεστική Επιτροπής της ΕΕΕΕΓΜ, μετά από πρόταση του τότε Προέδρου Σπύρου Καβουνίδη, αποφάσισε την ανά διετία διοργάνωση της εκδήλωσης «Αθηναϊκή Διάλεξη Γεωτεχνικής Μηχανικής», κορυφαίας εκδήλωσης της εταιρείας μας, από Έλληνα και ξένο, εναλλάξ, ομιλητή καταξιωμένο γεωτεχνικό μηχανικό. Η 1η Αθηναϊκή Διάλεξη παρουσιάστηκε to 2000 από τον Harry Poulos, καθηγητή του University of Sidney, που θεωρήθηκε Έλληνας, η 2η to 2002 από τον Robert Mair, καθηγητή του Univeristy of Cambridge, η 3η το 2004 από τον Γιώργο Γκαζέτα, καθηγητή του Ε.Μ.Π., η 4η το 2006 από τον Alain Pecker, καθηγητή της Ecole Nationale des Ponts et Chaussées και η 5η το 2008 από τον Ανδρέα Αναγνωστόπουλο, καθηγητή του Ε.Μ.Π.

Η εφετεινή 6η Αθηναϊκή Διάλεξη Γεωτεχνικής Μηχανικής θα παρουσιασθή από ένα, ας μου επιτραπή η έκφραση, από τα ιερά τέρατα της εδαφομηχανικής και καθηγητή πολλών εκ των παρευρισκομένων John Burland, Emeritus Professor του Imperial College. Καλώ την Καθηγήτρια του Ε.Μ.Π. κα Γεωργιάννου, η οποία εξεπόνησε την διδακτορική διατριβή της στο Imperial College υπό την καθοδήγηση του καθηγητή Burland να τον παρουσιάση.

ΠΑΡΟΥΣΙΑΣΗ ΚΑΘΗΓΗΤΗ BURLAD

It is for me an honour and a privilege to introduce Professor John Burland on the occasion of his Athenian Lecture. John Boscawen Burland was born in 1936 in London. The family moved to Johannesburg when he was twelve years old, where he was educated at Parktown Boys' High School. He read Civil Engineering at the University of the Witwatersand under Professor Jennings. He returned to London in 1961 and worked with Ove Arup for a few years. He was awarded his Doctorate of Philosophy at the University of Cambridge in 1966. In his work with professor Roscoe he has made very significant contributions to Critical State Soil Mechanics.

After studying for his PhD at Cambridge, Professor Burland joined the Building Research Station in 1966, became Head of the Geotechnics Division in 1972 and Assistant Director in 1979. In 1980 Dr Burland was appointed Professor of Soil Mechanics at Imperial College in succession to the late Professor Alan Bishop.

Although many of his valuable contributions to the practice of Civil Engineering date back to his time at BRE when practitioners were struggling with subjects such as the settlement of buildings on sands, piled foundations or soil-structure interaction it is at Imperial College that Professor Burland established his reputation as a distinguished figure in Geotechnical Engineering and a remarkable teacher.

Professor Burland has delivered numerous state of the art papers and keynote lectures at international conferences all over the world. His special lectures have become events not to be missed because of his outstanding contributions to theory and practice as well as his presentational skills. He has received many awards for his one hundred or so publiccations, including the British Geotechnical Society Prize on 4 occasions, the Telford Premium of the Institution of Civil Engineering on 2 occasions and numerous other awards.

In addition to being very active in teaching and research, John Burland has been responsible for the design of many large ground engineering projects such as the underground car park at the Palace of Westminster and the foundations of the Queen Elizabeth II Conference Centre. He specialises in problems relating to the interaction between the ground and masonry buildings. He was London Underground's expert witness for the Parliamentary Select Committees on the Jubilee Line Extension and has advised on many geotechnical aspects of that project, including ensuring the stability of the Big Ben Clock Tower. He was a member of the international board of consultants advising on the stabilisation of the Metropolitan Cathedral of Mexico City and was a member of the Italian Prime Minister's Commission for stabilising the Leaning Tower of Pisa. The implementation of his ingenuous mild intervention solution resulted in his bestowment with the highest honour for a non-italian, the Order of the Star of Italy.

His major contributions to science and engineering have been recognized by the awards of the Baker and Kelvin Gold Medals of the Institution of Civil Engineers, the Harry Seed Memorial Medal of the American Society of Civil Engineers, the Gold Medals of the Institution of Structural Engineers, the Institution of Civil Engineers and the World Federation of Engineering Organisations. He has been awarded five Honorary Doctorates and he is a Fellow of both the Royal Academy of Engineering and the Royal Society. In 2002 he was President of the Engineering Section of the British Association and he was Vice President of the Institution of Civil Engineers, from 2002 to 2005. In 2005 the Queen appointed him Commander of the British Empire.

Having enjoyed the support and stimulation of the company of John Burland for over 20 years I can speak of his talents, which are given to few, from first hand. Engineers have much to learn from this brilliant, inspiring and cultured man. He has been an inspiration to geotechnical engineers, students even school children with his clarity of thought, that enables him to develop complex theories from first principles, or his modeling of physical systems in order to explain mechanisms of real behaviour. To this effect he has been acting as an ambassador for Civil Engineering giving for 6 consecutive years the Christmas Lecture at the Institution of Civil Engineers attended by 100 school children each year.

Over these years he has transformed from an inspirational figure to global fame. Yet, to our comments after an appearance on television or a newspaper interview he genuinely responded: "it is not a case of looking for fame it is about looking for the huge satisfaction that can come from using science in a creative way".

Professor Burland has been acknowledged as one of the GREAT of soil mechanics, but he is much more than that. In his endeavours he has followed the message of one of his great friends, Professor de Mello, and acted as human being first, engineer second and specialist third, and it is in this order I admire the man.

It is with this in mind that I have great pleasure and anticipation in inviting Professor John Burland to deliver the 6th Athenian Lecture.

ΠΕΡΙΛΗΨΗ ΔΙΑΛΕΞΗΣ

A structure, its foundations and the surrounding ground interact with each other whether or not the designers allow for this interaction. In some situations the interaction can be minimised by adopting very stiff foundation elements. In many situations this approach is too costly or it is not feasible, as in the case of deep basements and cut-and-cover construction. Thus ground-structure interaction must usually be taken into account in design and this involves important interactions between specialist Structural and Geotechnical Engineers. During his career the Author has encountered profound philosophical differences in approach between Structural and Geotechnical Engineers often leading to a lack of understanding and difficulties in communication. This paper explores these differences in approach and the reasons for them.

The term *modelling* is used extensively. It is defined as the process of idealising a full-scale structure including its geometry, material properties and loading in order to make it amenable to analysis and hence assessment for fitness of purpose. It is demonstrated that traditional structural modelling is very different from geotechnical modelling. Superficially, structural modelling appears to involves fewer idealisations for the geometry and material parameters than geotechnical modelling. In reality the idealisations in structural modelling hide huge uncertainties. It is shown that Structural Engineers tend to think in terms of force and stress whereas Geotechnical Engineers are often more concerned with deformation. The difficulties between the two approaches arise when elements of the structure and/or foundation reach their full strength, which is frequently the case.

In this paper extensive reference is made to Hambly's three and four legged stool, termed by Heyman (1996) as "*Hambly's paradox*". Hambly used the simple example of a four-legged stool to show that structural design calculations are frequently wide of the mark when it comes to analysing real-world structures. It is concluded that concepts such as *ductility* and *robustness* underpin the success of both structural and geotechnical modelling and more explicit recognition of these is needed. Case histories are given where ductility has been utilised and where lack of ductility has led to failure. The importance of gaining a clear understanding of mechanisms of behaviour prior to detailed analysis is also illustrated by means of case histories.

Μετά την παρουσίαση της διάλεξης ακολούθησαν ερωτήσεις προς τον καθηγητή Burland από το ακροατήριο και συζήτηση. Η εκδήλωση έκλεισε με τις ευχαριστίες προς τον ομιλητή από το μέλος της Εκτελεστικής Επιτροπής της ΕΕΕΕΓΜ και συμφοιτητή του στο University of Cambridge Δημήτρη Κούμουλο.

ΕΥΧΑΡΙΣΤΙΕΣ

The Executive Committee of the Hellenic Society for Soil Mechanics and Geotechnical Engineering asked me to propose the Vote of Thanks to our distinguished speaker who delivered the 6th Athenian Lecture this enening. This is an honour in itself.

You will allow me to speak in English because, although the proposal for the Vote of Thanks is addressed to you, it primarily concerns our speaker.

The Athenian Lecture has become the most popular and prestigious biennial event in the Hellenic Geotechnical Society's calendar and is well known among engineers of other disciplines in this country. Because of altering speakers from Greece and abroad, the Athenian Lecture is gaining a good reputation internationally. The Athenian Lecture has become an institution, ένας θεσμός.

Today is a special day for me because John Burland has been a very good friend for nearly half a century. We met in Cambridge at the Soil Mechanics Laboratory as first year research students in October 1963. Since then a lasting friendship was developed which has strengthened as the years passed.

When the name of our speaker became known more than twelve months ago, those who know Professor Burland enthusiastically expected that this year's Athenian Lecture would be educational, interesting and entertaining. This sense of expectation is reflected by the large number of people who gathered here this evening to enjoy his lecture on the "Interaction between Geotechnical Engineers and Structural Engineers".

For the benefit of the society it is our duty and responsibility as Engineers to design economic structures which will sit safely on the ground. This can be achieved by close cooperation of both Structural and Geotechnical Engineers; hence the interaction of two disciplines:

- The Structural Engineers on one hand who are dealing with materials with fixed properties, the numerical values of which are readily available from tables in codes and standards together with load factors, and

- The Geotechnical Engineers on the other hand who are dealing with the uncertainties of the ground, the properties of which have to be assessed on the basis of field investigations, laboratory testing and engineering judgment, as none of these properties have been previously tabulated. Besides, the Geotechnical Engineer must understand the mechanisms of behaviour of the structure and be acquainted with its limitations.

I am sure that almost all of you have experienced the beauty and the fascination of such interactions. You may have undoubtedly noticed how ideas are being continuously revised, while exchanging views, re-examining ground conditions and thinking hard in the process of the evolution of an optimum design leading to the most suitable and economic foundation method.

You have also noticed how much the Structural Engineers expect from us, quite often a lot more than what we can give them.

Professor Burland has presented some stimulating examples of such interactions of well documented case histories with great clarity. He approaches each problem by giving emphasis on local conditions, geology and peculiarities of the site. He then uses simple models and applies engineering judgment to arrive at a successful solution by challenging sometimes the logic of handbook approaches and occasionally some known design methods. We have all noticed that even quite simple physical or conceptual models can be used to gain an understanding of the key mechanisms of behaviour.

Let his methods of approach be a guide to all of us when dealing with similar problems.

It is my pleasure to invite you to join me in thanking Professor John Burland for this excellent and memorable 6th Athenian Lecture.

ΒΙΟΓΡΑΦΙΚΑ ΣΤΟΙΧΕΙΑ ΟΜΙΛΗΤΗ

Professor John Burland, CBE, DSc(Eng), FREng, FRS was educated in South Africa and studied Civil Engineering at the University of the Witwatersrand. He returned to England in 1961 and worked with Ove Arup and Partners for a few years in London.

After studying for his PhD at Cambridge University, Professor Burland joined the Building Research Station in 1966, became Head of the Geotechnics Division in 1972 and Assistant Director in 1979. In 1980 he was appointed to the Chair of Soil Mechanics at the Imperial College of Science, Technology and Medicine. He is now Emeritus Professor and Senior Research Investigator at Imperial College.

In addition to being very active in teaching (which he loves) and research, John Burland has been responsible for the design of many large ground engineering projects such as the underground car park at the Palace of Westminster and the foundations of the Queen Elizabeth II Conference Centre. He specialises in problems relating to the interaction between the ground and masonry buildings. He was London Underground's expert witness for the Parliamentary Select Committees on the Jubilee Line Extension and has advised on many geotechnical aspects of that project, including ensuring the stability of the Big Ben Clock Tower. He was a member of the international board of consultants advising on the stabilisation of the Metropolitan Cathedral of Mexico City and was a member of the Italian Prime Minister's Commission for stabilising the Leaning Tower of Pisa.

He has received many awards and medals including the Kelvin Gold Medal for Outstanding contributions to Engineering, the Harry Seed Memorial Medal of the American Society of Civil Engineers for distinguished contributions as an engineer, scientist and teacher in soil mechanics and the Gold Medals of the Institution of Structural Engineers, the Institution of Civil Engineers and the World Federation of Engineering Organisations. He has been awarded four Honorary Doctorates and he is a Fellow of both the Royal Academy of Engineering and the Royal Society. In 2002 he was President of the Engineering Section of the British Association and he was Vice President (Engineering) of the Institution of Civil Engineers, London from 2002 to 2005.

Areas of Expertise:

Soil-structure interaction; influence of foundation movements on building performance; deep excavations and tunnels; piled foundations; foundations on difficult ground including shrinking and swelling clays; the mechanical behaviour of unsaturated soils; the strength and stiffness of clays.

Η παρουσίαση του Professor Burland έχει αναρτηθή στην ιστοσελίδα της ΕΕΕΕΓμ (www.hssmge.gr) καθώς και στην ιστοσελίδα www.pangaea.gr.

ΠΡΟΣΕΧΕΙΣ ΓΕΩΤΕΧΝΙΚΕΣ ΕΚΔΗΛΩΣΕΙΣ

Για τις παλαιότερες καταχωρήσεις περισσότερες πληροφορίες μπορούν να αναζητηθούν στα προηγούμενα τεύχη του «περιοδικού» και στις παρατιθέμενες ιστοσελίδες.

GeoX2010 3rd International Workshop on X-Ray CT for Geomaterials, March 1-2, 2010, New Orleans, Louisiana, USA, Dr.Khalid Alshibli, alshibli@lsu.edu, Dr.Allen Reed, allen.reed@nrlssc.navy.mil

CAVING 2010 Second International Symposium on Block and Sublevel Caving, 20 – 22 April 2010, Perth, Australia, www.caving2010.com

CPT'10 2nd International Symposium on Cone Penetration Testing, May 9 - 11, 2010, Huntington Beach, California, USA.

The Seventeenth South Asian Geotechnical Conference, Taipei, Taiwan, May 10 – 13, 2010, www.17seagc.tw

ITA – AITES 1010 World Tunnel Congress and 36th General Assembly "TUNNEL VISION TOWARDS 2020", Vancouver, Canada, May 14 - 20, 2010, www.wtc2010.org

12ο Διεθνές Συνέδριο της Ελληνικής Γεωλογικής Εταιρείας, Πάτρα, 19 - 22 Μαΐου 2010, www.synedra.gr

78th ICOLD Annual Meeting & International Symposium "DAMS AND SUSTAINABLE WATER RESOURCES DEVELOPMENT", 23 – 26 May 2010, Hanoi, Vietnam, www.vncold.vn/icold2010

IX International Conference on Geosynthetics, Guarujá, Brazil, 23 – 27 May 2010 - www.igsbrasil.org.br/icg2010

Fifth International Conference on Recent Advances in Geotechnical Earthquake Engineering and Soil Dynamics and Symposium in Honor of Professor I. M. Idriss, May 24 – 29, 2010, San Diego, California, USA, 5geoeqconf2010.mst.edu

11th International Conference "Geotechnical Challenges in Urban Regeneration", 26th – 28th May 2010, ExCel London, www.geotechnicalconference.com/page.cfm/Link=20

Tenerife 2010 Cities on Volcanos, 3rd International Workshop on Rock Mechanics and Geo-engineering in Volcanic Environments, Canary Islands, 31st of May and 1st of June 2010, www.citiesonvolcanoes6.com

BRATISLAVA 2010 14th Danube-European Conference on Geotechnical Engineering, Bratislava, Slovakia, 2nd – 4th June 2010, www.decge2010.sk

NUMGE 2010 7th European Conference on Numerical Methods in Geotechnical Engineering June 2 - 4, 2010, Trondheim, Norway, www.ivt.ntnu.no/numge2010

2010 MOSCOW - International Geotechnical Conference GEOTECHNICAL CHALLENGES IN MEGACITIES, 7 – 10 June 2010, Moscow, Russia www.GeoMos2010.ru

2nd ISRM technical and cultural field trip to Switzerland, 13 – 14 June 2010, ISRM website: www.isrm.net

International Conference Underground Construction Prague 2010 Transport and City Tunnels, 14 – 16 June 2010, Prague, Czech Republic, www.ita-aites.cz

Rock Mechanics in Civil and Environmental Engineering, European Rock Mechanics Symposium (EUROCK 2010) ISRM Regional Symposium on Rock Mechanics, Lausane, Switzerland, 15 – 18 June 2010, lmr.epfl.ch

7th International Conference on Physical Modelling in Geotechnics, Zurich, Switzerland, 28 June - 1 July 2010, www.icpmg2010.ch

ER2010 Earth Retention Conference 3, August 1 – 4 2010, Bellevue, Washington, USA, content.asce.org/conferences/er2010

Isap Nagoya 2010 - The 11th International Conference on Asphalt Pavements, August 1 to 6, 2010, Nagoya, Japan, www.isap-nagoya2010.jp

ISRS V The 5th International Symposium on In-Situ Rock Stress, August 25-28, 2010 Beijing, China, www.rockstress2010.org

Pipelines Conference 2010, August 28 - September 1, 2010, Keystone Resort & Conference Center, Keystone, (Dillon) Colorado, content.asce.org/conferences/pipelines2010/call.html

14th European Conference on Earthquake Engineering, Ohrid, FYROM, August 30 – September 3 2010, www.14ecee.mk

Geologically Active 11th IAEG Congress, 5 – 10 September 2010, Auckland, New Zealand, www.iaeg2010.com

GBR-C 2k10 - 3rd International Symposium on Geosynthetic Clay Liners, 15 - 16 September 2010, Würzburg, Germany

1st International Conference on Information Technology in Geo-Engineering 16-17 September 2010, Tongji Univeristy, Shanghai geotec.tongji.edu.cn/ICITG2010

II International Congress on Dam Maintenance and Rehabilitation, 28th-30th September 2010, Zaragoza, Spain www.damrehabilitationcongress2010.com

International Symposium on Geomechanics and Geotechnics: From Micro to Macro 10 – 12 October 2010, Shanghai, China, geotec.tongji.edu.cn/is-shanghai2010

11th International Symposium on Concrete Roads, Seville (Spain) 13th - 15th October 2010, www.2010pavimentosdehormigon.org

ARMS – 6 ISRM International Symposium 2010 and 6th Asian Rock Mechanics Symposium "Advances in Rock Engineering", New Delhi, India, 23 – 27 October 2010, www.cbip.org, www.arms2010.org

2nd International Conference on Geotechnical Engineering - ICGE 2010 Innovative Geotechnical Engineering, 25 – 27 October 2010, Hammamet, Tunisia, www.enit.rnu.tn/fr/manifestations/icge2010/index.html

4th International Conference in Geotechnical Engineering and Soil Mechanics
November 2nd & 3rd 2010, Tehran, Iran
www.icgesm2010.ir

Dear ISSMGE members and Respected Colleagues,

First of all I would like to wish success and prosperity for you and all respected society members in coming New Year.

Following recent international progresses in various fields of Geotechnical Engineering, there has been a tremendous progress in this field in Iran. Following previous three international events in Iran organized by Iranian Geotechnical Society (IGS) as a member of International Society, the 4th International Conference in Geotechnical Engineering and Soil Mechanics (4th ICGESM) has been scheduled to be held on 2nd and 3rd of November, 2010. Also, one or two days workshop will be held before main conference. The theme for this Conference will be New Developments and Lessons Learned in Geotechnical Engineering.
More information about the conference is available at: "www.icgesm2010.ir". Participation of your colleagues is most welcomed and please kindly let them know about this event.

Best Regards & New Year Greetings,

Fardin Jafarzadeh, PhD.
Head of Scientific Committee of 4th ICGESM 2010;
Vice Chairman of Iranian Geotechnical Society;
Associate Professor, Sharif University of Technology;
Tehran, Iran.

ICSE-5 5th International Conference on Scour and Erosion, 7 – 10 November 2010, San Francisco, USA, www.icse-5.org

ISFOG 2010 2nd International Symposium on Frontiers in Offshore Geotechnics, 8 – 10 November 2010, Perth, Western Australia, w3.cofs.uwa.edu.au/ISFOG2010

ICSE-5
5th International Conference on Scour and Erosion
8 – 10 November 2010, San Fransisco, USA
www.icse-5.org

The International Conference on Scour and Erosion has become a respected event in the technical conference calendar for engineers, scientists, decision makers and administrators providing services in the areas of scour and erosion. Its importance and reputation was established by the technical successes of the first four conferences:

- College Station, Texas, USA(2002)
- Singapore (2004)
- Amsterdam, The Neterlands (2006)
- Tokyo, Japan (2008)

Conference Topics

- Scour of foundations
- Cohesive scour
- Scour in gravel, sand, and silt
- Rock scour
- Unknown foundations
- Levee scour
- Dam scour
- Bridge scour
- Erosion of soils
- Laboratory measurement of erosion properties and countermeasures
- Field studies / inspection
- Case histories
- International guidelines and practices
- Scour risk management
- Numerical modeling
- Physical model tests
- Internal dam erosion
- Pressure scour
- Debris scour
- General degradation and aggradation
- Pier and abutment scour
- Scour depth prediction
- Scour of underwater pipelines
- Scour of offshore platforms
- Countermeasure selection and design
- Stream stability/meander migration
- Scour monitoring
- Scour and stream ecology (e.g. habitat enhancement)

Cathy Avila, Organizing Committee Chair
Avila and Associates Consulting Engineers, Inc.
712 Bancroft Road, #333
Walnut Creek, CA 94598
Tel: 925-673-0549
cavila@avilaassociates.com

6ICEG 2010 - Sixth International Congress on Environmental Geotechnics, November 8 - 12, 2010, New Delhi, India www.6iceg.org

Italian Geotechnical Journal – Special Issue on Seismic geotechnical design and retrofitting, agiroma.rig@iol.it

5th International Conference on Earthquake Geotechnical Engineering, Santiago, Chile, 17 – 20 January 2011, www.5icege.cl

International Conference on Tunnelling and Trenchless Technology, 1-3 March 2011, Kuala Lumpur (Malaysia), www.iem.org.my/external/tunnel/index.htm

Geo-Frontiers 2011 - Advances in Geotechnical Engineering, 13-16 March, Dallas, Texas, USA, www.geofrontiers11.com cs ಐ

GEDMAR2011
Geotechnical and Highway Engineering Practical Applications – Challenges and Opportunities at the Future
3rd International Conference on Geotechnical Engineering for Disaster Mitigation and Rehabilitation 2011
combined with
5th International Conference on Geotechnical and Highway Engineering
4 - 6 May 2011, Semarang, Central Java, Indonesia
reliability.geoengineer.org/GEDMAR2011

Disaster Mitigation and Rehabilitation has increasingly become one of the major concerns of geotechnical Engineers and engineering geologist.

The 3rd International Conference on Geotechnical Engineering for Disaster Mitigation and Rehabilitation is held every three years by one of the national geotechnical societies supporting the Joint Working Group o Geotechnical Engineering for Disaster Mitigation and Rehabilitation (GEDMAR).

The first GEDMAR conference was successfully held in Singapore in December 2005. The second GEDMAR conference was held in Nanjing, China, in May 2008. The Joint Working Group on Geotechnical Engineering for Disaster Mitigation and Rehabilitation, Diponegoro University Indonesia, and Ministry of Public Works of the Republic of Indonesia are jointly organizing the Third International Conference on Geotechnical Engineering for Disaster Mitigation and Rehabilitation (GEDMAR 2011) in May 2011 in Semarang (The Heart of Javanese culture and Education, one of historic cities in Indonesia) in conjunction with the 5th International Conference on Geotechnical and Highway Engineering. The conference is supported by ISSMGE TC-39, TC-4, TC-3 and other international organizations. This conference will provide an excellent opportunity for Engineers, Professionals, Academicians, Researchers, Construction equipment and Materials manufactures Suppliers and Government officials to present and exchange the latest developments and case histories related to geotechnical and highway engineering for Disaster Prevention, Mitigation and Rehabilitation as well as other disciplines related to the theme of the conference.

Conference Theme

"Geotechnical and Highway Engineering Practical Application for Disaster Prevention and Rehabilitation Challenges and Opportunities at the Future"

Sub Themes may include but not limited to:

1. Case histories on recent and post natural disaster (earthquake, tsunami, landslides etc).
2. Mechanisms of natural and coastal disasters (Soil Dynamics, liquefaction, geological and environmental factors, earth quake analysis and modeling, sub aerial and submarine landslides, seismic ground motion, etc).
3. Disaster Mitigation and Rehabilitation techniques (Difficult soils, ground treatment, design against earthquake and other natural disaster, coastal protection, etc).
4. Risk analysis and geohazard prediction (risk, mapping, consequence evaluation, reliability analysis, etc).
5. Performance Prediction of Geotechnical and Highway constructions
6. Constructions of Roads over Problematic Soils
7. Soil Improvement, Stabilization and Reclamation
8. Soil and Rock Slope Failures and Remedial Measures
9. Foundation Engineering
10. Innovations in Rail and highway Infrastructure Development and Pavement materials
11. Geological and Rock Engineering
12. Application of natural and synthetic fabrics of preservation of environment, including the use of innovative barrier materials for landslides and
13. Slope Instability
14. Expansive soils
15. Foundations
16. Piles
17. Anchors and Reinforcement
18. Rock Mechanics
19. Environmental Geotechnics

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7th International Symposium on "Geotechnical Aspects of Underground Construction in Soft Ground", 16-18 May 2011, Roma, Italy, www.tc28-roma.org

WTC2011 Helsinki, AITES-ITA 2011 World Tunnel Congress and 37th General Assembly, 21-25 May 2011, Helsinki, Finland, www.ril.fi/web/index.php?id=641

XIV Asian Regional Conference Soil Mechanics and Geotechnical Engineering, Hong Kong, China, 23 - 28 May 2011

XV African Regional Conference on Soil Mechanics and Geotechnical Engineering Maputo, Mozambique, 13 - 16 June 2011.

IS – SEOUL 2011 Fifth International Symposium on Deformation Characteristics of Geomaterials, Wednesday-Friday, Aug. 31 – Sep. 3, 2011, Seoul, Korea, www.isseoul2011.org

6th International Symposium on Sprayed Concrete, 12-15 September 2011, Tromsø, Norway, www.sprayedconcrete.no

XV European Conference on Soil Mechanics and Geotechnical Engineering, 12 – 15 September 2011, Athens, Greece, www.athens2011ecsmge.org

euroGEO5 5th European Geosynthetics Conference, 16 – 19 September 2012, Valencia, Spain, www.eurogeo5.org

24th WORLD ROAD CONGRESS, 25 – 30 September 2011, Mexico City, Mexico

XIV Panamerican Conference on Soil Mechanics and Geotechnical Engineering (October) & V PanAmerican Conference on Learning and Teaching of Geotechnical Engineering & 64th Canadian Geotechnical Conference, Toronto, Ontario, Canada, 2 - 6 October 2011

Beijing 2011, 12th International Congress on Rock Mechanics, 16 – 21 October 2011, Beijing, China, www.isrm2011.com

2011 AFTES Congress
Lyon, France, 17 – 19 October 2011
www.aftes.asso.fr/congres_presentation-organisation.html

La première journée d'étude internationale relative aux souterrains fut organisée en 1971 à Lyon et donna naissance à l'AFTES, l'une des toutes premières nations membres de l'AITES. Depuis l'AFTES organise tous les 3 ans des journées d'étude accompagnées d'une importante exposition.

Depuis 1999, les associations belge, espagnole, italienne, suisse, et portugaise s'y sont progressivement jointes. En 2011, l'AFTES fêtera ses 40 ans, puisque l'AFTES a vu le jour en 1971 à Lyon (France) à l'occasion de ses premières journées d'étude.

La capitale rhodanienne bénéficie donc d'une légitimité forte pour accueillir ce congrès "anniversaire", du 17 au 19 octobre 2011.

The 2011 AFTES Congress is organized jointly with the national associations of neighbouring countries: Belgium, Spain, Italy, Portugal and Switzerland. We all wish this Congress to gather not only construction and operation oriented Engineers, but also Architects and Urbanists concerned about favoring a largeruse of the subsurface space. Underground construction can and should contributeto meet the environmental challenge.

This is why we have selected 5 main themes:

Theme A : The underground space, preferred tool of the "sustainable city". The city of the future, more dense, cannot avoid using the underground space.

- How to consistently combine and plan both surface and subsurface development?
- How to facilitate multi-purpose underground use for a better return on investment? How to make the community benefit from the non-financial gains?
- How to better value the climatic advantages of the subsurface? Which impact in terms of CO2?

Theme B : Technical innovation in underground works Technology is progressing fast and return on experience or retro-analysis of previous works are more than ever appreciated:

- Which are the success keys of long base-tunnels?
- Has the boundary been changed between the TBM method and the conventional sequential one?
- How to optimize: technology, financing and safety in metro construction?
- Which are the recent innovations allowing to make urban underground works safe?

Theme C : The long life of underground structures. Operation and related equipment matters take a growing part in the design and global cost of civil engineering structures:

- How to better integrate the operating costs – operation and maintenance – as from the design stage?
- Which lessons can be learned from the tunnel upgrading works performed after the fires suffered in the 90's?
- Which innovations can help for the diagnosis, repair and rehabilitation of structures?

Theme D : Make people appreciate the underground space Tomorrow's underground spaces must be real living places:

- Can the underground space become an architectural object?
- How to make it an attractive, accessible and secure crossplace (or workplace)?
- Examples of environment-friendly underground works without impact on the neighbourhood.
- How to "urbanize the underground" in order to get free spaces at ground level and re-unify a spread out town by using the subsurface space?

Theme E : Financing and contractualization of projects. Unknown factors are inherent to underground works. Including risks in the contracts may be a key factor for controlling costs:

- How to better involve the economic actors in financing projects?
- How to distribute the inherent risks associated to underground works?
- How to make the initial estimates reliable and properly adapt the studies and investigations to the actual stakes?
- How to control the cost increases of projects due to safety requirements?
- How to make the contractualization of the design and construction of underground structuresprogress toward a partnership?

11th Australia - New Zealand Conference on Geomechanics, Melbourne, Australia, 15-18 July 2012

GEOSYNTHETICS ASIA 2012 (GA2012) 5th Asian Regional Conference on Geosynthetics, Bangkok, Thailand, 10 -14 December 2012, www.set.ait.ac.th/acsig/igs-thailand

ΝΕΑ ΑΠΟ ΤΙΣ ΔΙΕΘΝΕΙΣ ΓΕΩΤΕΧΝΙΚΕΣ ΕΝΩΣΕΙΣ

International Association on Hydrogeology
Commission on Hardrock Hydrogeology - HyRoC
www.hyroc.geol.uoa.gr

Dear colleagues

This is a call addressed to the members of HyRock Commission, to the hydrogeologists working on fractured rocks and anyone else, eventually interested, including hydrogeologists, tectonic geologists, hydrochemists, hydraulics, etc.

The last meeting of the HyRock commission in Hyderabad decided to open the theme dealing with the *scale effect regarding hydraulic parameters, groundwater flow and quality.*

On the other hand, the problem of the approach to the establishment of a method or group of methods dealing with the *vulnerability and risk mapping for the protection of fractured rocks aquifers* still exists, according the private discussions with certain colleagues.

Those two subjects seem to form topics of major interest among the HyRock environment and could be the themes of our eventual new joint projects. In order to save time and to discover:

1. The global and specific existing level of knowledge
2. The will for participation in eventual proposals, working groups or special meetings
3. Any other point included or not in the above mentioned themes

we intend to start an OPEN DISCUSSION through the FORUM facility existing in our web page (www.hyroc.geol.uoa.gr). Your participation in the given discussion, even expressing your opinion for the above themes, will help us much. You can reed the necessary instructions in the web site in order to proceed to the given discussion.

There are still in abeyance the themes of *restructuring the Working Groups according the Climatic Change Conditions* and the time and place of our new *International Conference*, after Prague, as they were faced in Hyderabad. Your opinion about the above subjects will also help us much. Hoping to a mass and fruitful initial electronic discussion, please accept my best wishes and kind regards

George Stournaras
Chairman of HyRock Commission

Subjects to be faced (steps / work packages)

Memorandum of Understanding (MOU) is the interim target of the initial reconnaissance steps and it will be the base of the project continuity.

Tectonics[1] (megatectonics and microtectonics) for the establishment of the discontinuous regime and thus:

* The recharge regime

* The groundwater circulation

* The relation of the groundwater issues with springs and boreholes

The scale effect *will be considered, as it has been cited by J. Krasny in Hyderabad and in his known paper*.

Geomorphology[1] considered as a factor affecting the groundwater regime or the discontinuities regime. The consideration of the connection of the discontinuities with the erosion, alteration and, generally speaking, the mutual reactions between the lithology, the external factors, the internal factors and the aquifer will be faced.

Hydrochemistry. Mineralogy and natural or man made procedures. *The scale effect is proposed to be considered, as it has been cited by J. Krasny in Hyderabad and in his known paper.*

Groundwater Hydraulics, for the groundwater flow description and the hydraulic communications of the different points within a major block or of different blocks. Establishment, verification or modification of the models proposed i.e. in the synthetic publication by B. Feuga (BRGM) etc. Field works to be used boreholes pumping tests, springs discharge flow measurements for the hygrogram analysis, tracing experiments, isotopic analyses etc. water intrusion and detection of recharge and discharge areas will be also studied. *The scale effect will be considered, as it has been cited by J. Krasny in Hyderabad and in his known paper*.

Vulnerability. Analysis of the notions of Intrinsic and Specific Vulnerability in terms of the discontinuous media and description of the mechanisms of contaminants transportation and confrontation

Synthesis under the **Climatic Change Effect**. Description of the lithologic, tectonic and hydraulic models. Establishment of frames (eventually, methods) for the assessment and risk mapping of the discontinuous rocks vulnerability.

[1] Subjects to be faced eventually by special external associates

Working forms

* Electronic discussion, plenary discussions, meetings etc. of the working group or

* Separate activity in working groups, at least during the initial stage and plenary participation for the final stage

Working procedure

(After the electronic discussion). Initial meeting (in the frame of a Congress, eventually in Krakow or in a special meeting). Themes to be discussed

* General discussion focused on the HyRock vulnerability

* Composition and approval of the Memorandum of Understanding (MOU)

* Final composition of the above steps/work packages

* Classification of the attendants into the different WG, according the packages or otherwise

* Discussion and decision about the working forms

ΕΝΔΙΑΦΕΡΟΝΤΑ ΓΕΩΤΕΧΝΙΚΑ ΝΕΑ

ITALY: Massive Landslide Video

Από το Καθηγητή Γκαζέτα πήραμε το παρακάτω ηλεκτρονικό μήνυμα:

Συνάδελφοι και φίλοι,

Αξίζει να δείτε το επισυναπτόμενο βίντεο μιάς κατολίσθησης εν δράσει.

Γιώργος Γκαζέτας

http://www.youtube.com/watch?v=BmO_YLVjMCY

New sensor to monitor dangerous mountain
Canada to monitor Turtle Mountain for landslides

The Alberta government has installed a microwave imaging sensor on Canada's Turtle Mountain to monitor two large cracks on the South Peak. A landslide on the mountain in 1903 killed 70 people, and geological surveys suggest another landslide could be imminent. The $242,000 sensor is in addition to more than $1 million in equipment installed by the province in 2003.

Scientists are using a microwave imaging sensor to monitor Turtle Mountain. (CBC)

The Alberta government has installed a new piece of equipment to monitor geological movements on a dangerous mountain, part of which collapsed in 1903, killing 70 people in the town of Frank.

It was just after 4 a.m. on April 29, 1903, when an estimated 30 million cubic metres of rock slid down the east face of Turtle Mountain and into Frank, about 250 kilometres south of Calgary. The infamous event became known as the Frank Slide.

Today, as part of a multimillion-dollar monitoring program by the Alberta Geological Survey, scientists have installed a new $250,000 microwave imaging sensor to give warning should another catastrophic landslide seem likely to occur on Turtle Mountain.

A matter of time

Some experts believe it's just a matter of time before another major landslide occurs. Geological surveys in 1933 and 2000 suggest another five million cubic metres could tumble down the side of the south peak of Turtle Mountain, destroying everything in its wake. The province invested $1.1 million in equipment to monitor rock masses on the mountainside in 2003.

Engineer Corey Froese, the project lead on the Alberta Geological Survey's Turtle Mountain Monitoring project, said everyone in the world of geological engineering knows about the massive slide almost 107 years ago.

"Frank Slide is one of the most famous rock slides in the world," said Froese. "If you're a landslide specialist or an engineering geologist anywhere in the world, you know about this. The fact that your office is on the top of a mountain, it's pretty amazing. It's a pretty nice day job."

In the past six years, Froese and his colleagues have installed 80 sensors of various types above Frank, on and around Turtle Mountain.

2 large cracks

Each has a wireless antenna and its own power supply, but no protection from lightning strikes, snow and ice.

"It's an issue ... providing a reliable data stream to the base of the mountain," where the monitoring team has an operation base.

The new microwave imaging sensor is three kilometres from Turtle Mountain's peak and sits atop an old pumping station. Extremely sensitive, the new sensor is continuously bouncing signals off the mountain and two large cracks that have been discovered on the South Peak.

It complements the arsenal of existing equipment that is on the moutain to measure incremental movements in the rock mass.

Even from a distance, the scientists are able to monitor extremely minute changes in the time it takes for the microwave signals to echo off the rock face. Any change in the length of the signal indicates a movement on the mountain.

"If the time it takes for the signal to return changes, it means the mountain is moving," said Doug Martin, another member of the team who measures readings from the new sensor to those the team previously installed on the mountaintop.

If the devices reveal a significant shift in rock mass, a Code Yellow or Code Orange would be called and the public would be notified that a landslide is increasingly likely. In such a circumstance, an evacuation of the area would be called.

(ASCE SmartBrief, January 7, 2010)

Undersea tunnel could link Korea, Japan

Plans for an undersea tunnel linking Korea and Japan have been moving forward, but the project still faces obstacles. The project would connect Busan, Korea, to the Japanese island of Kyushu through a 50-minute high-speed train ride.

The 124-mile tunnel could take up to 10 years to build and would be the longest undersea tunnel in the world.

An artistic rendition of an undersea tunnel connecting Korea and Japan

Discussions for a Korea-Japan undersea tunnel have been gaining momentum among researchers, politicians and entrepreneurs, but the project faces many hurdles before it can become a reality.

If realized, the two countries would be linked by a 200-kilometer undersea tunnel from Busan to the Japanese Island of Kyushu.

A high-speed rail would connect the two countries in 50 minutes. The Korea Japan Tunnel Project Association in Busan and the Japan-Korea Tunnel Research Institute, a non-profit foundation in Tokyo, have been leading the research.

Studies on the tunnel has been initiated mostly by the private sector, but government support is likely to gain pace, particularly in light of the role it is expected to play in accelerating travel and business exchanges.

Busan Mayor Hur Nam-sik has already launched a related task force.

The tunnel would also facilitate bilateral trade, which rose from approximately $40 billion in 1999 to more than $89 billion in 2008. About 20,000 people traveled daily between the countries in 2009.

"The tunnel will stimulate business, ease tension and promote political stability in East Asia. It will also have a positive impact on the reunification of the Korean Peninsula," Prof. Shin Jang-cheol of Soongshil University in Seoul said.
He cited the expansion of the Eurasia transportation link and the possibility of facilitating the Korea-Japan FTA as other reasons for pursuing the project on a government level.

The project would be profitable, according to a study from Prof. Park Jin-hee, a professor at Korea Maritime University. It currently costs $665 to ship a container (20 cubic feet) from Osaka to Busan. The price would drop to $472 through the undersea transportation system.

The project will also promote balanced regional development. Some see it as a catalyst for the breaking down of psychological barriers and hostility stemming from centuries of conflict between the two neighbors.

However, opponents said engineering and cost concerns are major hindrances to the project. Construction costs are projected at around 60 trillion won to 100 trillion won and the project would take seven to 10 years to construct.

If completed today, it would be the longest undersea tunnel in the world.

The 50.5 kilometer Channel Tunnel between the United Kingdom and France, which has served as an inspiration for the project, took six years to complete.

Opponents have also said the Korea-Japan project is untimely due to lingering anti-Japanese sentiment. Some have warned that Korea would gain little from the tunnel, while it would ultimately "end up helping Japan advance into the Eurasian continent."

In addition, there are still many unsettled disputes among local governments in the southern region of the country. However, the Korean government has become more positive on the project.

A top Cheong Wa Dae official has said that the government will launch a feasibility study.

The idea was first conceived during the Japanese occupation at the turn of the 20th century. But more concrete planning didn't occur until 2003, when former President Roh Moo-hyun mentioned the idea.

So far, Japan has been more forward about the project than Korea.

Some Japanese officials have been promoting it as a "symbol of peace-building" since 2002, when the two nations co-hosted the FIFA World Cup. A former defense minister described the proposed tunnel as a "dream-inspiring" project.
About a year ago in Kyushu, a Japanese tunnel construction company started to study the possibility of building the undersea tunnel.

Supporters say that the time is approaching for an official accord between the two governments.

Daizo Nozawa, a former minister of justice of Japan, president of the Japan-Korea Tunnel Research Institute, and Kim Ki-chun, a former minister of justice and former vice chairman of the Korea-Japan Parliamentarians Union, said that "any engineering challenges can be met with present technology.

"Far more daunting is the historic psychological barrier between the two countries. There is no better way to bring people together than to engage them in a project requiring all their efforts."

Busan and its sister city of Fukuoka have been conducting various projects to create a common economic zone.

About half of Busan residents say that the project should be conducted irrespective of past differences between the two countries, according to a survey of 600 citizens by the Korea Maritime University in 2008. Around 60 percent said that the tunnel would be beneficial to Busan's economy.

(ASCE SmartBrief, January 25, 2010)

Dozens of San Antonio homes evacuated as land below shifts; retaining wall nearly splits in 2

SAN ANTONIO — Residents of 25 homes evacuated after a landslide split a retaining wall and threatened to topple hill-top homes will not be allowed to return for at least 10 days as engineers watch for further soil movement, the developer said Tuesday.

The residents, who live within one block of the slide, were evacuated Sunday after a man called 911 and told officials his backyard was sliding downhill. Enormous chasms, some 15-feet deep, quickly emerged, splitting a towering retaining wall below and exposing the foundations of three hilltop homes.

The developer, Centex Homes, worked Monday and Tuesday to stabilize the homes and the hillside. The land was still moving slightly Tuesday, but engineers believed it was nearly stable, said Laurin Darnell, a Centex vice president.
About 90 homes were initially evacuated, but residents farther from the slide were allowed to return Monday. No one was injured.

Valerie Dolenga, a spokeswoman for Pulte Homes Inc., Centex's parent company, said about half of the residents who remain evacuated may be able to return in the next 10 to 15 days after soil engineers make sure their property is stable.

AP PHOTO

Crevices, some 15 feet deep are seen across three homes at The Hills of Rivermist subdivision,in San Antonio Monday, Jan. 25, 2010. Eighty homes were evacuated Sunday night due to the landslide. The residents were moved out of the area after utilities were cut off the surrounding area for safety reasons.

The other residents, whose homes sit on and below the crumbling hilltop, will be displaced longer as officials determine whether the houses can be made safe, Darnell said. The company is working with those families to find longer-term accommodations, he said.

Pulte's engineers continue to investigate the cause of the landslide, but San Antonio Planning and Development Director Roderick Sanchez said improper construction of the 30-foot tall, 1,000-foot long retaining wall and improper compacting of the fill dirt on the home sites caused the slide.

Darnell conceded Centex had no city permit to build the retaining wall, but he said he thought the company followed city regulations and standard industry practices in its construction. He disputed the city's allegation that the wall was improperly built.

The near-vertical retaining wall likely failed under the weight of the area's clay soil that readily expands when drenched with heavy precipitation as it was last week, said Sazzad Bin-Shafique, an assistant engineering professor and soil expert at the University of Texas-San Antonio who went out to the site on Monday. Steep, tall retaining walls can hold up if built correctly, he said.

"It's safe, honestly. We have engineering solutions, but sometimes we do something because we want to reduce costs," Bin-Shafique said. "Many times, it will be OK, but sometimes, it will not."

AP PHOTO

In this Jan. 24, 2010 photo, San Antonio Fire Department personnel survey the damage to a retaining wall as the ground shifts beneath it in San Antonio.

An earlier retaining wall was torn down and the current one built after engineers found drainage problems in 2007, he said.

The company's engineers "feel this is very much an isolated incident. They feel it's being driven by some unique soil characteristics at the site," he said. He declined to describe those characteristics or comment on them further.

AP Photo

In this Jan. 24, 2010 photo, gaps are shown as the ground shifts beneath a home in San Antonio.

The engineering investigation should yield more answers on the slide's cause in the next couple of days, Darnell said.

"I know people want information now. We do more than anybody, but it's important that we do this in a methodical way," he said.

The development, which was started near the University of Texas at San Antonio in 2004, has nearly 750 homes with others still under construction. The upper middle-class neighborhood, with houses that sell for $250,000, is among dozens that sprung up on the hilly northwestern outskirts of San Antonio as the city grew to be the nation's seventh largest.

City officials released a statement Tuesday saying they would have an inspector monitor construction in the development and hire an independent structural engineer to evaluate whether the homes are safe. The city also plans to check permits for all other retaining walls Pulte built in the city.

Texas has a Residential Construction Commission with the power to perform inspections, determine fault and suggest remedies in incidents like this, but the state Legislature did not reauthorize the commission during the last session, so it can't take on this case.

Patrick Fortner, the commission's acting executive director, said complaints are being referred to local authorities or the Texas Attorney General's Office. Residents may want to have their homes independently inspected if they're worried about stability, he said.

Michelle Roberts, Associated Press Writer

(ASCE SmartBrief, January 26, 2010)

Thawing soil shifts ground for Boston trains
For Big Dig, soil was frozen; as it warms, costly steps required

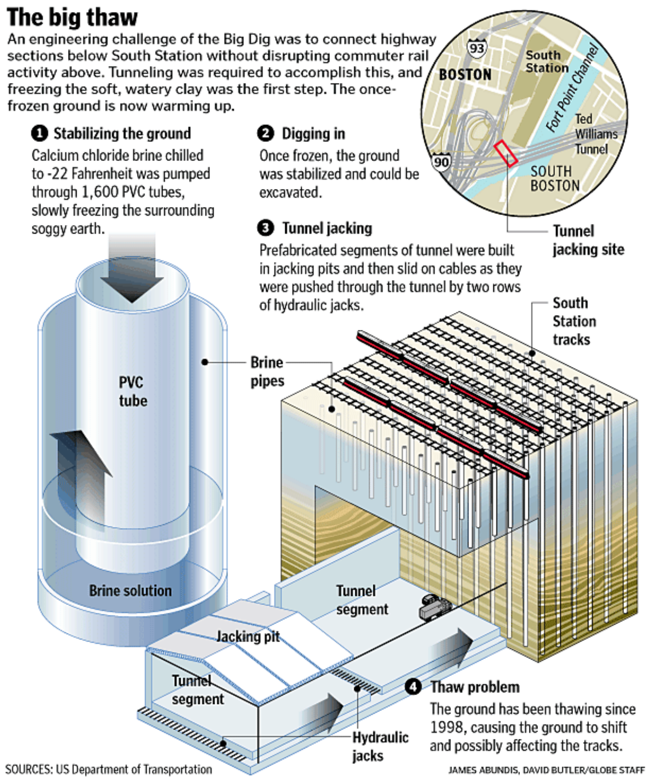
Engineers froze land around the South Station in Boston to allow trains to keep running during the Big Dig decades ago. However, the thawing soil has caused the ground to shift and move tracks by several inches. "We still have 10% of the settlement left, and we'll continue to monitor the tracks," said Frank DePaola, the Massachusetts Bay Transportation Authority's assistant general manager of design and construction.

It was among the more daunting feats required to complete the Big Dig.

Fourteen years ago, as engineers sought to extend the Massachusetts Turnpike to the Ted Williams Tunnel, they froze large swaths of the clay soil that surrounds South Station, allowing tens of thousands of rail riders to continue using the trains running through the area.

Since they completed the project in 1998 and contractors stopped pumping a chilling solution through 1,600 vertical pipes in the ground, the soil has steadily thawed. As a result, the ground has been shifting, and railroad officials have spent millions of dollars ensuring that the tracks do not become misaligned, an expenditure they said they anticipated.

This week, MBTA board officials voted to extend for two years a $346,000 contract that will allow contractors to closely monitor how the ground shifts and whether it moves the tracks. The MBTA has already spent more than $4 million on the project.



"There are no safety concerns now,'' said Frank DePaola, the MBTA's assistant general manager of design and construction. "It would only be a concern if we left it unaddressed and didn't pay attention to it. If we left it unaddressed, the track would settle and go out of alignment, and it could disrupt railroad operations coming in and out of South Station.''

To guard against buckling rails or depressions beneath the tracks, inspectors walk the tracks daily and take measurements of the ground and the rails monthly. They fix problems as they arise, including repairing tracks and grading the ground.

"It's not something you come and discover one morning,'' DePaola said. "It adds up cumulatively over time.''

He said surveys have shown that the ground in the tunnels has moved several inches since the project ended. He said it is likely to move several more inches before the thawing stops sometime in the next decade.

"Ninety percent of the expected settlement has already occurred,'' DePaola said. "We still have 10 percent of the settlement left, and we'll continue to monitor the tracks.''

But members of the board that oversees the MBTA said they did not expect that the ground would continue to move after so many years.

"It was just a surprise to me that this remains a persistent problem,'' said Andrew J. Whittle, a professor of geotechnical engineering and one of five MBTA board members. "This certainly is a cost that wasn't anticipated. I would say it's a problem associated with construction methods.''

Andrew Paven, a spokesman for Bechtel/Parsons Brinckerhoff, which oversaw the project, said last night that responsibility lies with other contractors who performed the work.

Whittle said he would have expected the thawing issues to continue for no longer than a decade, rather than the two decades MBTA officials anticipate.

"It's gone on longer than anyone expected,'' he said.

MBTA officials said the money being used to pay for the continuing maintenance is coming from the $350 million Big Dig settlement fund, which the state attorney general's office negotiated with contractors responsible for the persistent cost overruns and repairs.

Joe Pesaturo, an MBTA spokesman, said the maintenance has not affected service.

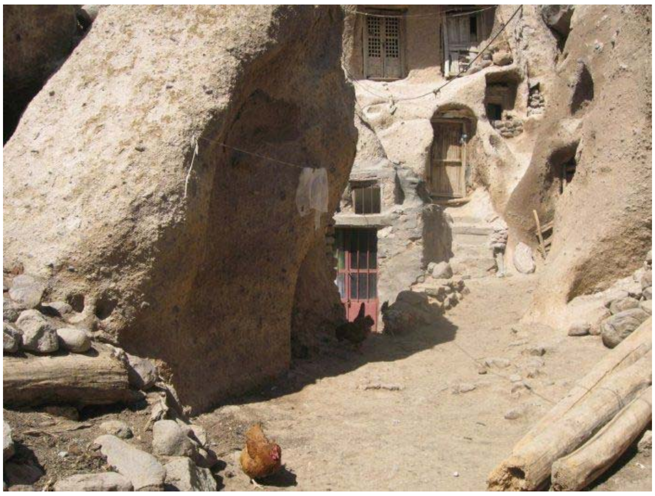
(ASCE SmartBrief, February 8, 2010)

ΕΝΔΙΑΦΕΡΟΝΤΑ (ΚΑΙ ΓΕΩΤΕΧΝΙΚΑ...)

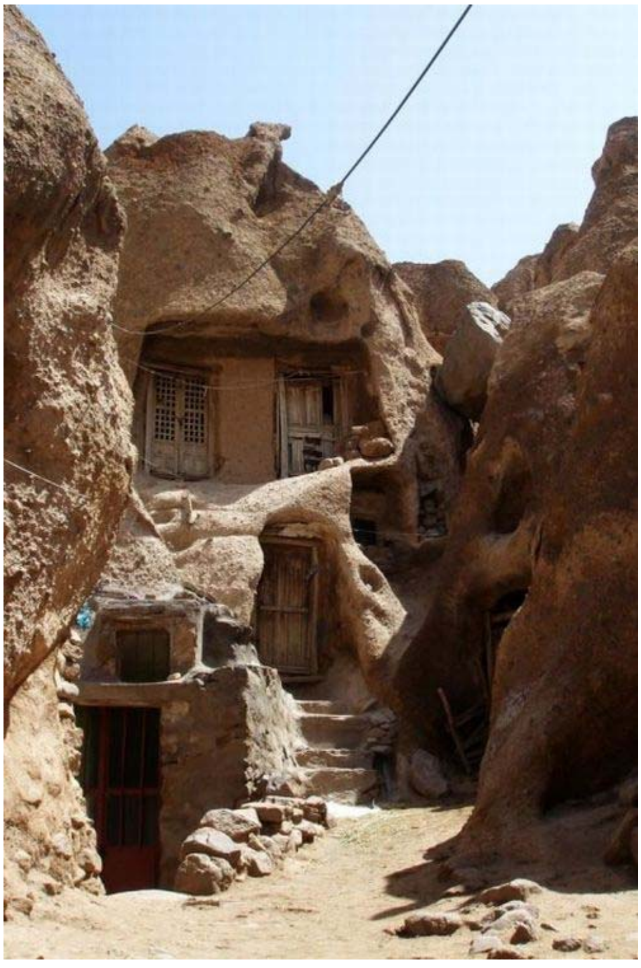
Iran - Village of Kandovan, near Tabriz, 700 years old

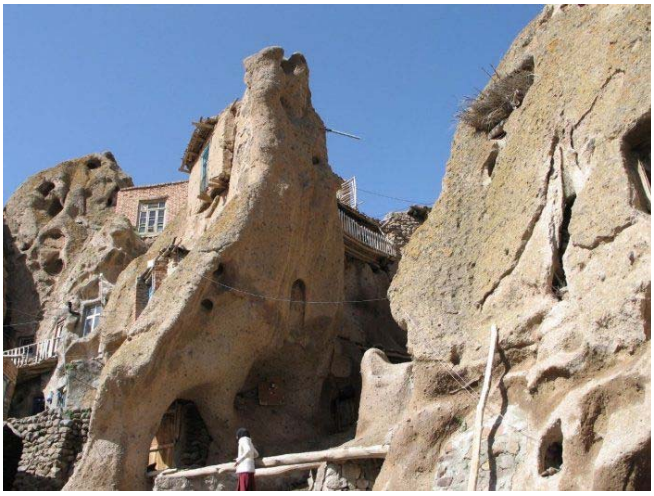
In the north east of Iran at the foot of Mount Sahand in Kandovan, the villagers live in cave homes carved out from the volcanic rock. The age of some houses is more than 700 years.

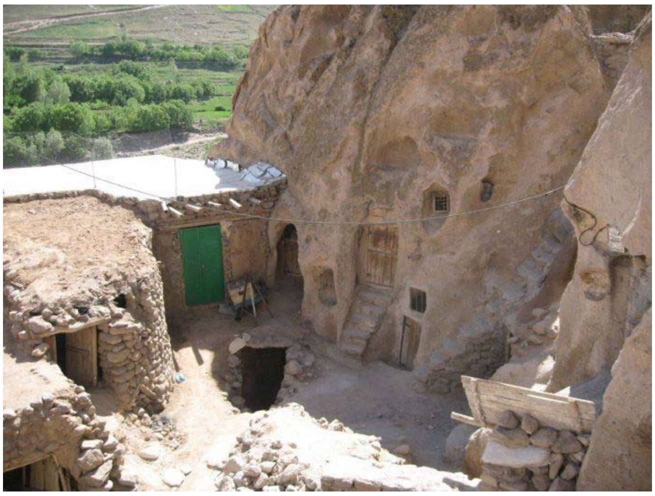
The word "Kandovan" is a plural form for "kando" means bee nest; the term refers to bee-nest liken houses carved inside mountain.

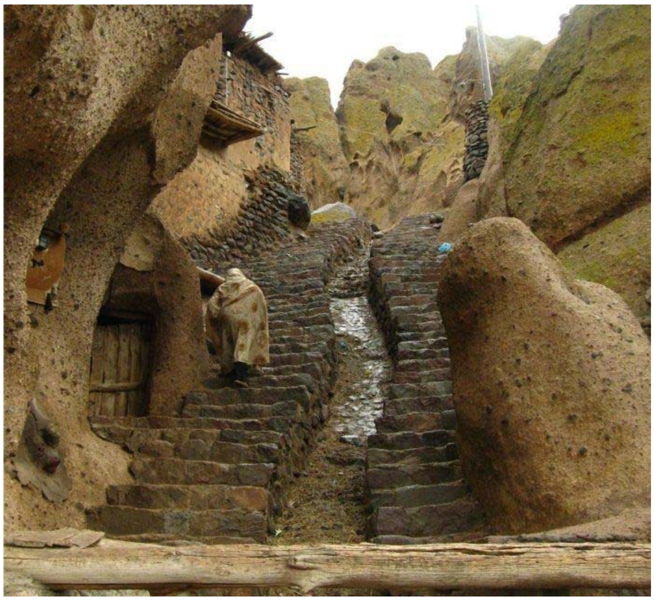


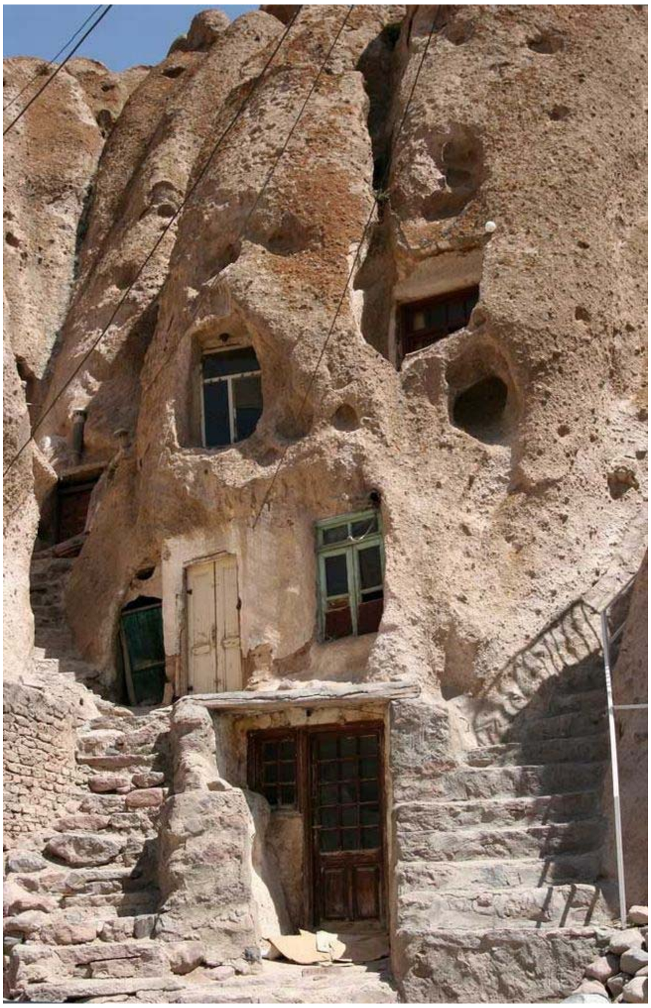
Village of Kandovan is located on 60 km soutwest of Tabriz, in the province of Azarbaijan, Iran. It is famouse for spactacular and unique architecture and its mineral water which is used to dissolve the bladder stone. The landscape of this picturesque village is made by volcanic activities. The inhabitants carve their houses out of the huge rocks; they carved kitchen, hall, and room out of stone and made windows for the rooms and decorated them with colorful glasses. It is said the initial habitants moved to this village due to the Mongol invasion and decided to hide in the caves and later on turn them into their permanent house. People's main occupations are agriculture and animal husbandry.

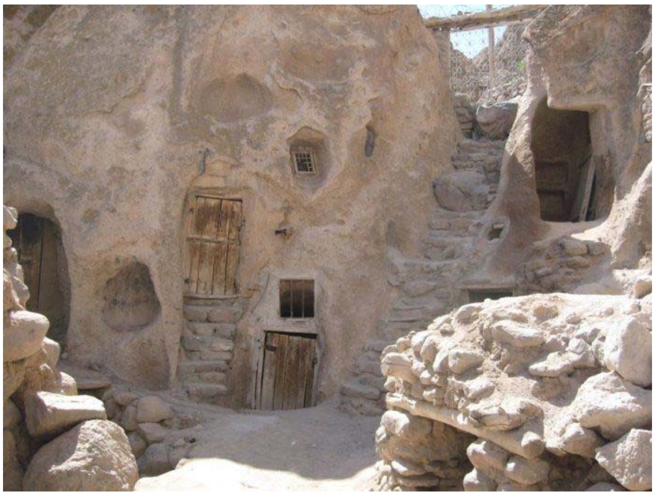


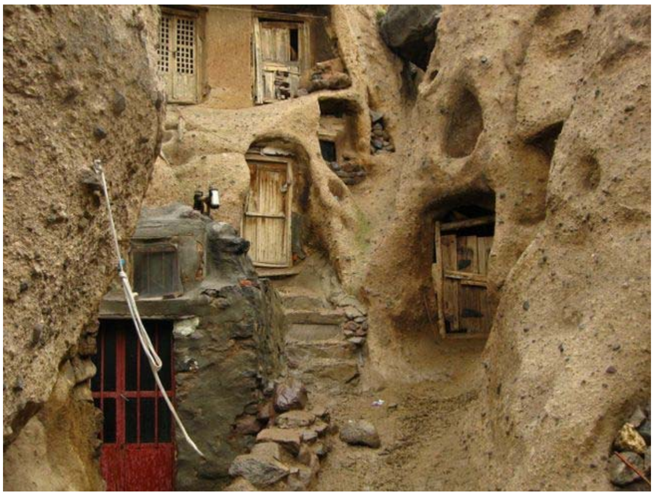
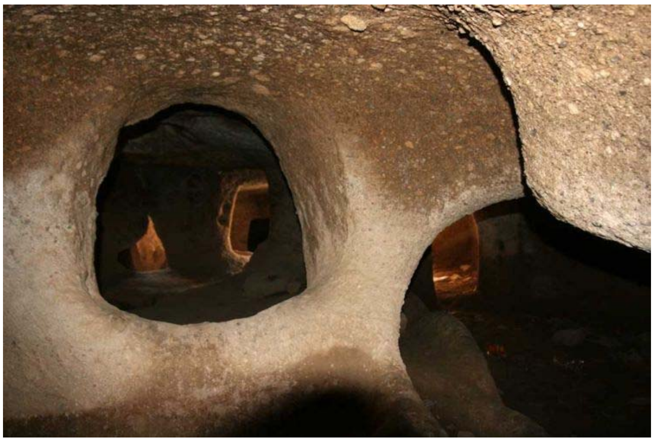
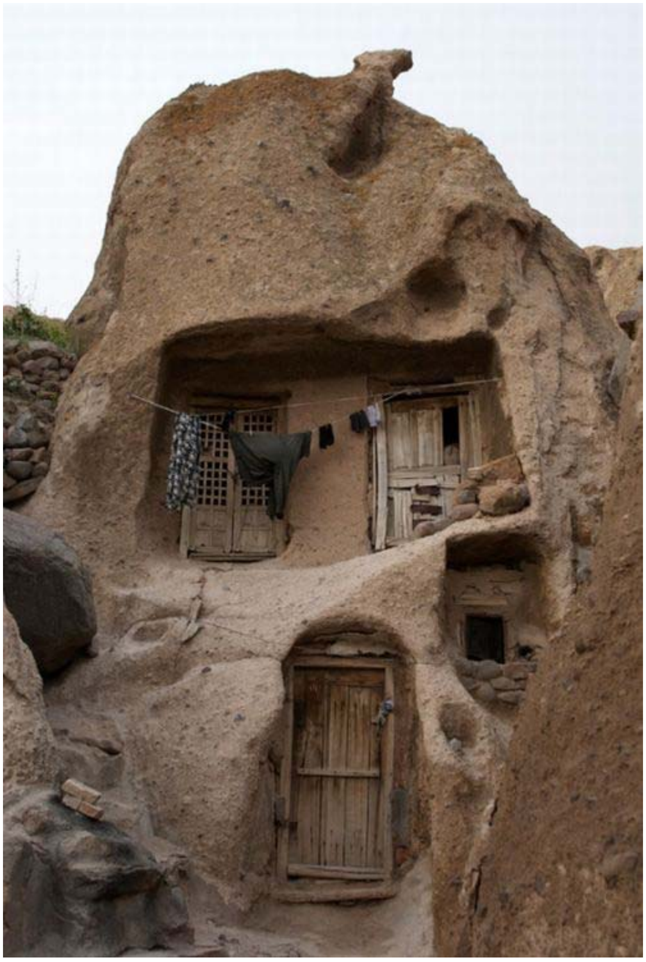
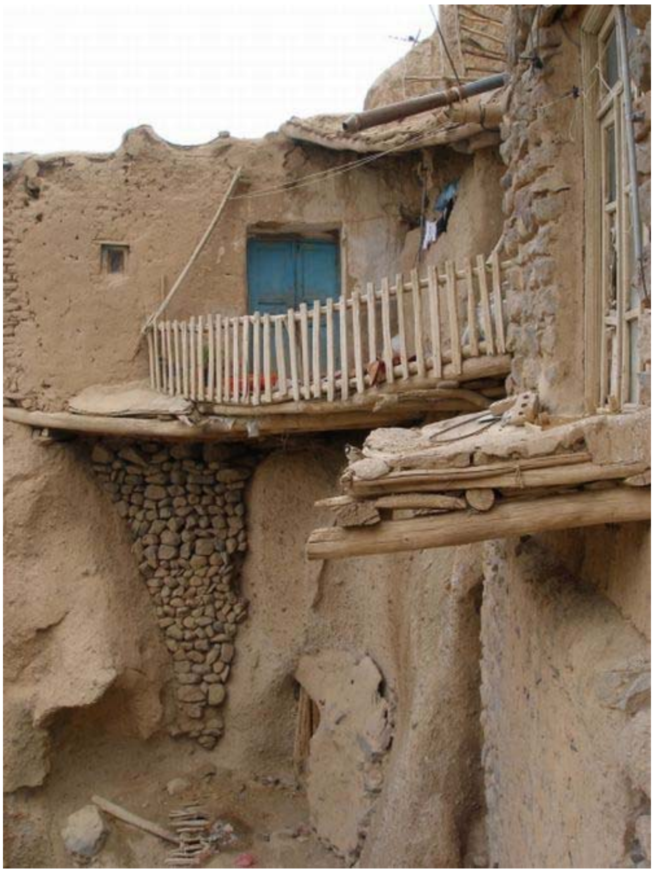
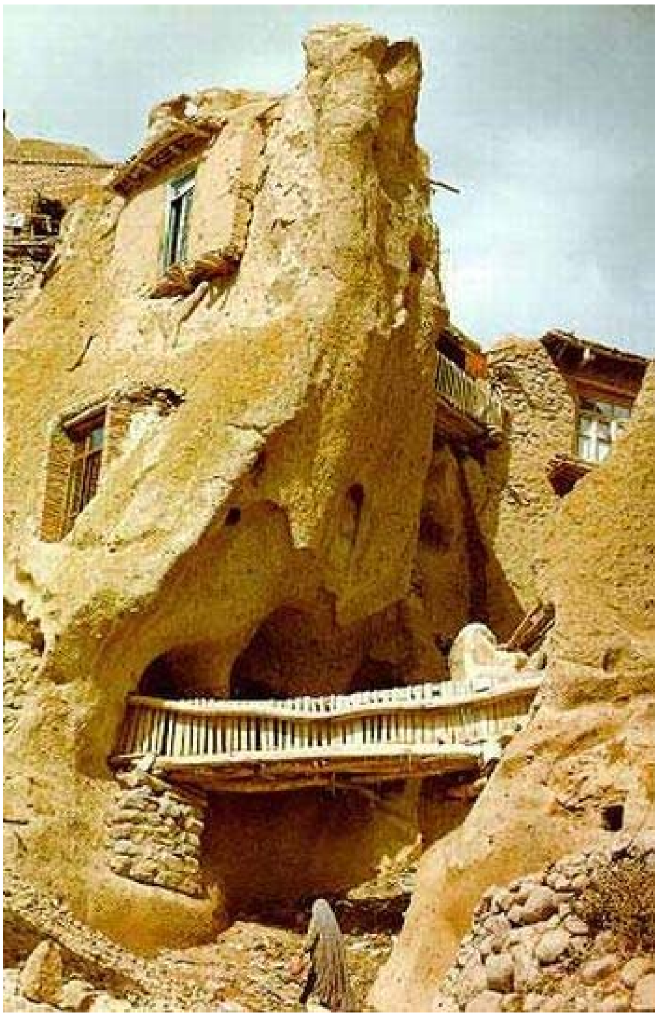


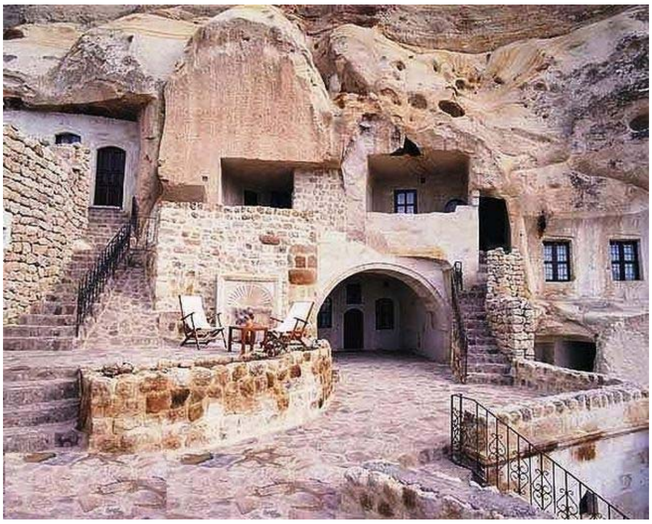








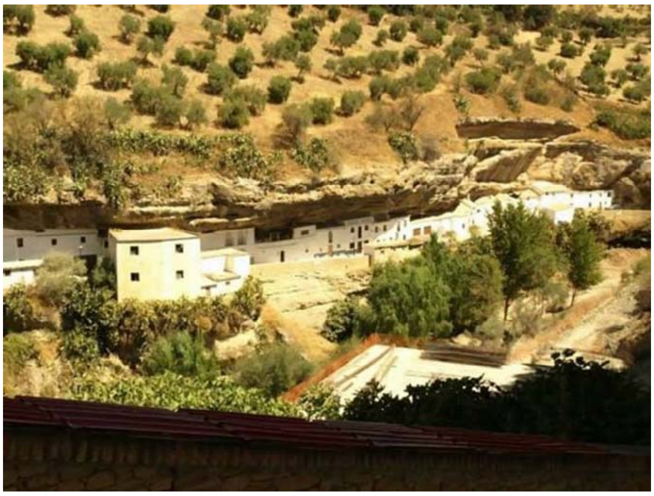






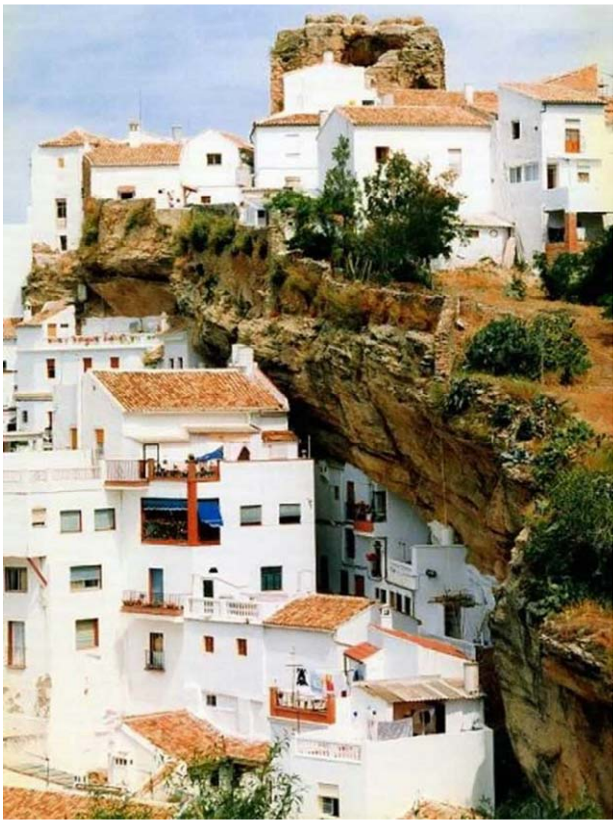


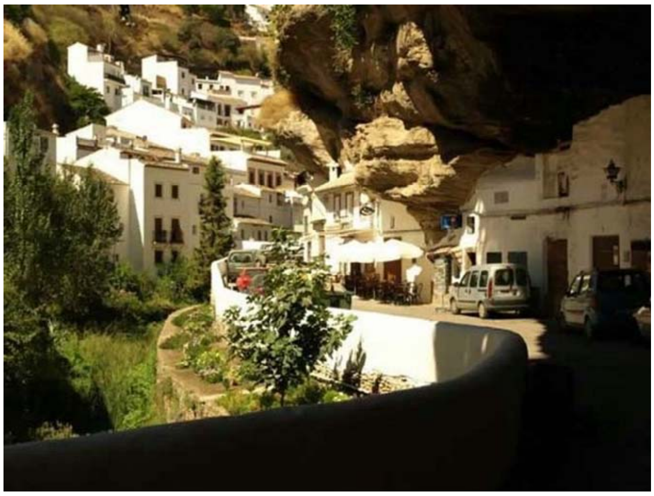
Hotel!

Setinil
Un village étonnant en Andalousie, Espagne

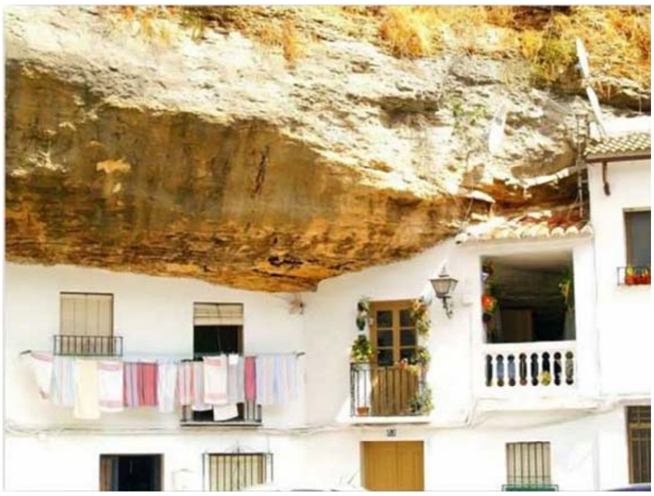
This village is built in a valley, and many of the houses are built into the cliff, so the back of the house is solid rock. The houses are whitewashed.








La Cueva



Sleeved braces reduce buckling effect in earthquakes

Several buildings on the West Coast have been constructed using "sleeved column" braces, apparatuses that surround, but do not touch, a core of high-performance structural steel. The sleeve appears to absorb the energy, and the brace doesn't buckle. An agreement among the inventor of the brace and two companies has brought the price down and the more floors the devices are used on, the lower the cost.

BANGALORE: Whenever US-based steel fabricators Star Seismic or CoreBrace are involved in the construction of a new hospital, school or a commercial building in the earthquake-prone American west coast, they pay $60-$80 (Rs 2,750-Rs 3,650) as royalty to Bangalore's Benne Narasimhamurthy Sridhara for each brace they supply to make the buildings safe as houses.

Fitted with 'sleeved column' braces, technology for which was developed and patented by the 74-year-old, the buildings sway under the onslaught of the most severe earthquakes and storms, but they don't buckle.

The sturdy brace apparatus developed by Mr Sridhara, a structural steel design consultant, is simple, yet effective. It surrounds a core of high-performance steel, but is spaced from the sides of the core. The sleeve absorbs and dissipates energy, but doesn't buckle under pressure.

Almost a decade ago, while experimenting with several designs that could withstand seismic pressures, Mr Sridhara took a thin rod and inserted it inside a transparent plastic pipe. "When I applied load, the plastic tube prevented the brace from buckling," he recalls.

The 56-floor Los Angeles Convention Center, the Bennet Federal Building in Salt Lake City, Utah, and the 60-storey One Rincon Hill building in San Francisco are among those fitted with the 'sleeved column' braces that emerged as a result of the experiment.

Despite being successfully implemented in the US, the design is yet to find takers in India even though the Murugappa group supported him and funded the validation of technology spending about Rs 1 crore.

"The destruction caused by the 2001 Gujarat earthquake could have been avoided if the buildings, at least those having more than six floors, had these braces," says Mr Sridhara, a civil engineer who was educated in Mysore and the US.

Conventional braces, which do not have any sleeved material for absorbing energy, can buckle under even in an earthquake measuring 5 on the Richter scale, he added. The Gujarat earthquake was recorded at 8 on the scale.

Mr Sridhara, whose invention is referred to in the US as Buckling Restrained Braced Frames (BRBF), is today helping construction firms in that country save at least 30% in costs for each brace. Moreover, Star Seismic and CoreBrace are also able to manufacture the braces in the US instead of importing them from Japan's Nippon Steel, the world's second largest steelmaker.

"Unlike in India, there are very stringent rules for constructing hospitals and schools in the US, and that is why this invention makes sense. Moreover, other technologies that require having more braces or even attaching bearings to the entire building can be twice as expensive," he observes.

For many American cities on the west coast, earthquakes are a common phenomenon and the local civil construction industry keeps seeking ways to build schools and hospitals that are more earthquake-resistant.

Despite getting a US patent in 2000 for his 'sleeved column' braces, the light of Mr Sridhara's invention was hidden under a bushel, until Badri K Prasad, an Indian engineer based in California, took notice and started educating the local industry.

Mr Prasad, a vice-president at California-based structural engineering consulting firm Thornton Tomasetti, helped spread the word about the technology in the US and ensured that the American Institute of Steel Construction (AISC) adopted his invention as part of its 'code of practice' in 2006.

"My colleague Rafael Sabelli was studying a similar technology from Nippon Steel and everybody thought it was invented in Japan, until I told them that it was actually invented by Mr Sridhara from Bangalore," he says.

Until few years ago, Nippon Steel was charging as much as $4000 to $5000 for each brace. After signing the licensing agreement with Mr Sridhara, Star Seismic and CoreBrace were able to bring down costs by nearly 30%. "Nippon Steel was trying to enter the US market a few years ago, but they had no patent. Mr Sridhara had," says Mr Prasad.

As the number of floors in a building rises, the cost per brace keeps falling. For instance, a building with seven or more floors can adopt buckling restrained braces at $700 each, compared to nearly $1100 for conventional braces. Anil Gupta of IIM-Ahmedabad, who is also the executive vice-chairman of the National Innovation Foundation, says that Mr Sridhara's invention must be adopted in countries such as India.

"What Mr Sridhara has achieved is remarkable; his invention is today influencing America's construction industry," he says. "This technology is not only applicable for big buildings, but also smaller structures in earthquake-prone areas across Gujarat and other states."

And since 'buckling-proof' design is needed in many other industries, Mr Sridhara's invention continues to find new takers. Recently, the National Science Foundation of Washington along with the Federal Railway Authority of US granted nearly $100,000 for conducting tests to validate the concept.

"This can be used to design crash-worthy and shock-absorbing coaches and wagons," says Mr Sridhara.

The next step for Mr Sridhara will be to get some Indian firms adopt the technology while constructing steel buildings. "We are currently in discussions with several firms, including L&T, and something would come out hopefully soon enough," he says.

However, it's not been easy so far bringing Mr Sridhara's invention to India. When he contacted several Indian Railways officials in the country, he was asked to meet engineers at the railways factory in Perambur, Tamil Nadu. "When I met the engineers, they asked me to make a wagon myself and then demonstrate it," he says.

Meanwhile, for Mr Sridhara, the commercial success of invention means that he no longer needs to seek funds from others for experimenting and validating his inventions. "I am earning more than what I earned during forty years of my work life here and can now fund my ideas myself."

A 'clog-free' shower cap and an air relief valve without any ball float are among the new products which he aims to develop in the days to come.

(ASCE SmartBrief, January 19, 2010 from The Economic Times (India) (1/19))

☙ ❧

Concrete Testing Company and Owner Are Convicted of Falsifying Work

The leading concrete testing company in New York and its owner were convicted on Wednesday of falsifying the test results of different concrete mixes that were eventually used in some of the most prominent projects in the city.

The verdict was a stunning defeat for the company, Testwell Laboratories, whose officials had denied any intent to defraud and said that any wrongdoing was limited to bookkeeping errors.

Jurors are still considering a more serious charge, enterprise corruption, against Testwell and its owner, V. Reddy Kancharla. It carries a maximum sentence of 25 years in prison. The jurors had yet to reach a verdict on that count when Justice Edward J. McLaughlin of State Supreme Court in Manhattan asked them to deliver the verdicts they had decided. The jury is scheduled to resume deliberating on Thursday.

Testwell, a 41-year-old company with headquarters in Ossining, N.Y., was hired to evaluate the strength of concrete used in projects including the new Yankee Stadium, the Freedom Tower and the Second Avenue subway line. Prosecutors and others familiar with the case have said that any falsified tests did not create safety hazards, although the stadium's concrete pedestrian ramps have been troubled by cracks that required repair.

The convictions delivered on Wednesday dealt with what are known as mixed-design reports. For these reports, testers are supposed to put different concrete recipes through an eight-week analysis that involves making several batches of concrete and storing them in controlled environments. Each batch must then be put to a strength test that involves applying pressure until the concrete cracks, prosecutors said. Based on these tests, the inspectors recommend a formula for a project, prosecutors said.
But on hundreds of occasions, Testwell skipped these tests, instead relying on strength estimates tabulated in a computer program, prosecutors said.

As they left the courthouse on Wednesday, Mr. Kancharla and his family, accompanied by his lawyers, wore grim expressions. The lawyers and Testwell declined to comment until all of the verdicts were in.

On Wednesday, the jury acquitted one of Mr. Kancharla's co-defendants, Wilfred Sanchez, of all the counts he faced. Before the verdict, Mr. Sanchez, who was a steel inspector for Testwell, was tense and shaking, according to his lawyer, Curtis J. Farber.

But once Mr. Sanchez heard the verdict, Mr. Farber said, "I just could see the tension from his face relax."

"They should never have brought this prosecution in the first place," Mr. Farber added, referring to the Manhattan district attorney's office. "There was just no evidence of any wrongdoing on the part of my client."

Mr. Farber had argued during the trial that Mr. Sanchez, who was accused of doctoring steel inspection reports and was charged with enterprise corruption, was merely a low-level Testwell employee who prosecutors thought was guilty by association.

The jury has not reached any verdicts relating to the final defendant, Vincent Barone, the company's vice president. Prosecutors have accused Mr. Barone, who also faces the enterprise corruption charge, among other things, of helping to falsify numerous inspection reports.

The jury, which sat through about four weeks of testimony and arguments and has deliberated for about five days so far, still has a number of charges to consider. Among them is a charge of scheme to defraud as it relates to the falsified mixed-design reports.

As for the enterprise corruption count, the defense lawyers argued that Testwell's top executives did not collude to run a criminal enterprise. It is possible that jurors could view the falsified reports as isolated bad acts, rather than a larger scheme to commit a crime.

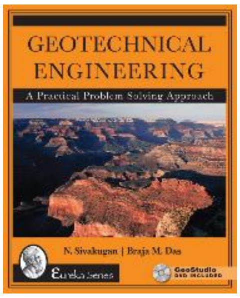
In his opening statement, Paul Shechtman, who represents Mr. Kancharla, attributed inaccuracies in reports to either errors or bad practices by low-level employees.

"Their sins were not his sins simply because Testwell is his company," Mr. Shechtman said. "Ask yourself, 'What did Mr. Kancharla know? What, if anything, did he do?' "

After the guilty verdicts on Wednesday, Thomas D. Thacher II, president of Thacher Associates, a company hired by Testwell customers to review several of Testwell's projects, said: "Anybody who is certifying as to issues that affect safety and structural integrity must be double-checked. It's too easy to cheat and the incentives are too great, and the Testwell conviction demonstrates that."

(ASCE SmartBrief, February 18, 2010 from The New York Times)

ΝΕΕΣ ΕΚΔΟΣΕΙΣ ΣΤΙΣ ΓΕΩΤΕΧΝΙΚΕΣ ΕΠΙΣΤΗΜΕΣ

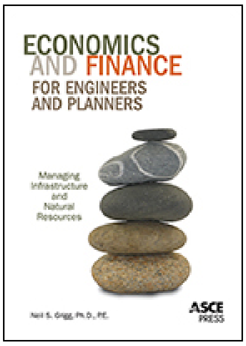


Geotechnical Engineering: A Practical Problem Solving Approach

Nagaratnam Sivakugan and Braja M. Das

Geotechnical Engineering: A Practical Problem Solving Approach covers all of the major geotechnical topics in the simplest possible way adopting a hands-on approach with a very strong practical bias. You will learn the material through several worked examples that are representative of realistic field situations whereby geotechnical engineering principles are applied to solve real-life problems. There are a few carefully selected review exercises at the end of each chapter with answers given whenever possible. Also included are closed-book quizzes that should be completed within the specified times and will make you think and point you to what you have missed.

(J. Ross Publishing, 2009)



Economics and Finance for Engineers and Planners: Managing Infrastructure and Natural Resources

Neil Sadler Grigg

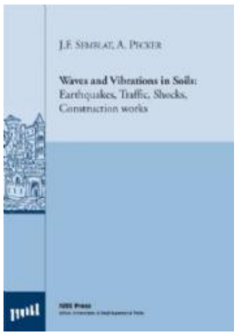
Civil engineers who design, construct, or manage infrastructure or environmental systems often find themselves facing decisions that involve factors outside technical and engineering requirements: Can a transportation system be made more sustainable? How can we balance environmental demands with available financing? How can priorities for building and repairing water systems be established in light of limited resources?

Economics and Finance for Engineers and Planners: Managing Infrastructure and Natural Resources presents the core issues of economics and finance that relate directly to the work of civil engineers, construction managers, and public works and utility officials. This book answers the practical questions that confront engineers involved in infrastructure, natural resources, and the environment. It explains the economic forces, reviews financial methods, and offers the management tools necessary for civil and environmental engineers to be successful.

This book will be an invaluable resource for civil and environmental engineers, construction managers, public works and utility officials, and anyone involved in the economics and finance of planning and management.

About the author:
Neil S. Grigg, Ph.D., P.E., D.WRE, is a professor and former head of the Department of Civil and Environmental Engineering at Colorado State University.

(ASCE Press, 2009)



Waves and Vibrations in Soils: Earthquakes, Traffic, Shocks, Construction works

J.F. Semblat, A. Pecker

The main scientific and engineering goal of this book is to deal simultaneously with soil dynamics/vibrations and wave propagation in soils (including seismic waves). These various fields are generally considered separately and the important links between them, both from scientific and practical points of view, are unfortunately not investigated. They are usually considered in separate disciplines such as earthquake geotechnical engineering, civil engineering, mechanics, geophysics, seismology, numerical modelling, etc.

The objective of the book is to offer in a single publication an overview of soil dynamics and wave propagation in soils with emphasis on engineering applications. It starts from a wide variety of practical problems (e.g. traffic induced vibrations, dynamic compaction, vibration isolation), then deals with 1D and 2D/3D wave propagation in heterogeneous and attenuating media (with application to laboratory and in situ dynamic characterization of soils), gives an overview of various numerical methods (e.g. FEM, BEM) to simulate wave propagation (including numerical errors, radiation/absorbing conditions, etc) and finally investigates seismic wave propagation and amplification in complex geological structures (e.g. irregular topographies, alluvial deposits).

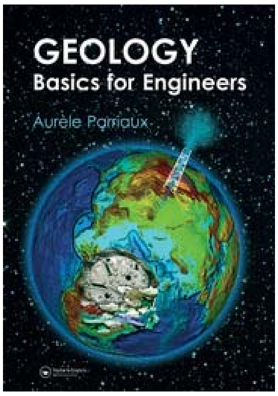
Jean-Franηois Semblat is Head of the Dynamics, Waves and Vibrations Unit in the Division for Soil and Rock Mechanics at Laboratoire Central des Ponts et Chaussιes (Paris, France) and Associate Professor at Ecole Polytechnique (Palaiseau, France). He has published over 100 technical papers in journals and conferences. He is on the editorial board of the International Journal of Geomechanics (ASCE) and European Journal of Environmental and Civil Engineering. He is member of the Scientific Committees of the French Association for Earthquake Eng. and the French Society of Soil Mechanics and Geotechnical Engineering. He is member of the board of the International Association for Computer Methods and Advances in Geomechanics and is associate member of the American Society of Civil Engineers (ASCE).

He has received several awards for his work: French Association for Earthquake Eng., European Association of Geoscientists and Eng., International Association for Computer Methods in Geomechanics.

Alain Pecker is Chairman and Managing Director of Geodynamique et Structure, Professor at Ecole Nationale des Ponts et Chaussιes and Visiting Faculty at the Centre for Post-Graduate Training and Research in Earthquake Engineering and Engineering Seismology (ROSE School, IUSS Pavia). He is member of the French National Academy of Technologies, Honorary President of the French Association for Earthquake Engineering, Past President of the French Society of Soil Mechanics and Geotechnical Engineering, President of the French Committee for Seismic Building Codes.

He is also a member of several international technical committees dealing with earthquake geotechnical engineering. He has also published over 80 technical papers in journals and conferences and has been invited as lecturer or State of the Art speaker in several international events. He is on the editorial boards of three international journals. He has received several awards for his work, among which one from the French National Academy of Sciences.

(IUSS Press, 2009)



Geology: Basics for Engineers

Aurele Parriaux

Geology – Basics for Engineers presents the physical and chemical characteristics of the Earth, the nature and the properties of rocks and unconsolidated deposits / sediments, the action of water, how the earth is transformed by various phenomena at different scales of time and space. The book shows the engineer how to take geological conditions into account in his projects, and how to exploit a wide range of natural resources in an intelligent way, reduce geological hazards, and manage subsurface pollution.

Through a problem-based-learning approach, this instructional text imparts knowledge and practical experience to engineering students (undergraduate and graduate level), as well as to experts in the fields of civil engineering, environmental engineering, earth sciences, architecture, land and urban planning.

The DVD that supplements the book contains solutions to the problems and animations that show additional facets of the living Earth.

*The original French edition of the book (2007) won the prestigious Roberval Prize, an international contest organized by the University of Technology of Compiegne in collaboration with the General Council of Oise, France. Geology, Basics for Engineers, was selected out of a total of 110 candidates.The jury praised the book as a "very well conceived teaching textbook" and underscored its highly didac-tic nature, as well as the excellent quality of its illustrations.
The book offers an exhaustive outline of the methods and techniques used in geology, with a study of the nature and proporties of the principal soils and rocks.

It allows students to understand how geological conditions should be taken into account by the engineer

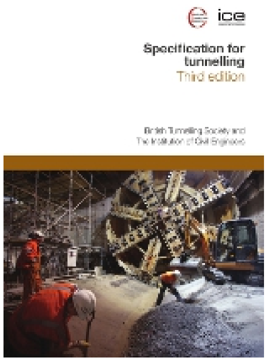
It presents the wide range of available basic resources and explains how these can be managed in an intelligent way

Taking a problem-solving approach, this highly didactic and synthetic work is intended for engineering students, as well as to experts in the fields of civil engineering, environmental engineering, earth sciences and architecture.

A CDROM supplements the work containing solutions to problems, along with animations illustrating some facets of the living Earth.

It is extensively illustrated and contains many examples.

(CRC Press – Taylor & Francis Group, 2009)



Specification for Tunnelling, 3rd edition

The British Tunnelling Society

The BTS Specification for Tunnelling has become the standard industry document for tunnelling contracts, and forms the basis of tunnelling specifications for projects throughout the world.

The specification has been revised in this third edition to reflect current industry best practice and to take account of the many advances in the field of tunnelling which have occurred over the last decade. Coverage of sprayed concrete has been expanded in recognition of its increased usage around the world and there are new sections on sprayed applied waterproof membranes and jacked box tunnelling. All references to codes, standards and other design documents have been comprehensively updated.

Drafted by an expert editorial committee with more than 250 years experience in the tunnelling industry between them, *Specification for Tunnelling, 3rd edition* will continue to be the de facto standard reference work for tunnelling in the UK and rest of the world.

Contents

- General requirements
- Materials
- Methods
- Ground stabilisation processes
- Working environment
- Index

(Thomas Telford Ltd, 2009 - This title will not be published until 12th March 2010)

ΗΛΕΚΤΡΟΝΙΚΑ ΠΕΡΙΟΔΙΚΑ

www.issmge.org

Κυκλοφόρησε το Bulletin Vol. 3, Issue 4, December 2009 της International Society for Soil Mechanics and Geotechnical Engineering.

www.geoengineer.org

Κυκλοφόρησαν τα Τεύχη #61 και #62 του Newsletter του Geoengineer.org (Ιανουάριος και Φεβρουάριος 2010) με πολλές χρήσιμες πληροφορίες για όλα τα θέματα της γεωτεχνικής μηχανικής. Υπενθυμίζεται ότι το Newsletter εκδίδεται από τον συνάδελφο και μέλος της ΕΕΕΕΓΜ Δημήτρη Ζέκκο (secretariat@geoengineer.org).

Κυκλοφόρησε το Τεύχος No. 29 (Ιανουάριος 2010) της World Road Association (PIARC).

INTERNATIONAL TUNNELLING AND UNDERGROUND SPACE ASSOCIATION

ita@news n°32
www.ita-aites.org/cms/index.php?id=488

Κυκλοφόρησε το Τεύχος No. 32 – Ιανουάριος 2010 των ita@news της International Tunnelling Association.

http://foundation.itacet.org/Newsletter/01_2010/NL_v1.php010

ΕΕΕΕΓΜ
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