

## **IGS Annual Lecture on Numerical Analysis of Underground Structures**

New hydropower projects are being taken up involving construction of more than 1000 km length of tunnels with sizes varying from 2.5 to 14 m diameter to add 16500 MW of hydropower by the end of 11<sup>th</sup> Five year plan (in India). After the success of metro rail project in Delhi with the state-of-the-art technology, the construction of metro rail project is planned in various cities including Mumbai, Bangalore, Hyderabad, Lucknow, Pune and Chandigarh. The Indian Railways is constructing the most challenging Jammu-Udhampur-Srinagar-Baramulla railway line in the difficult Himalayan terrain of Jammu and Kashmir and there are 42 tunnels of total length 107.96 km in the Katra-Quazigund section (142 km). The Konkan Railway Corporation has constructed 760 km Konkan railway line with 92 tunnels of total length 83.6 km. The Border Roads Organisation has planned a prestigious and challenging highway tunnel with a length of 8.9 km under the 3978 m high Rohtang pass on Manali-Leh road and the construction of the tunnel is to start shortly.

Among the existing tunnels, nearly 70% of them are used for hydropower projects. The shapes used are predominantly D-type, horse-shoe and circular. Conventional drilling and blasting method remains practically the dominant practice for tunnel excavation in India. Attempts have been made in the past to use tunnel boring machines (TBMs) with success in some and failure in others. For Delhi metro, (double shielded) TBMs and EPBMs have been used successfully.

Until recently, barring a few cases, the use of steel ribs with backfilling by tunnel muck or lean concrete was practically the only method of supporting in India. Lately there has been a considerable increase in the use of shotcrete as a support system particularly for large underground cavities. The use of steel fibre reinforced shotcrete (SFRS) is being used increasingly now.

- *Sharma, K.G. (2009), IGS Annual Lecture*  
*Source: Indian Geotechnical Journal, Vol.39, No.1, pp.1-630.*

## **The Big Questions in Rock Mechanics**

This question provided each ISRM member who responded with the opportunity to list three 'big' challenges that the profession needs to address. 880 such challenges were received with each challenge being assigned to one of 23 subject groups. The total number of challenges in each group was calculated and expressed as a proportion of the total number of challenges submitted. The groups are ranked according to the proportions. The 'top ten' groups are as follows:

1. Developments in rock mass characterization methods (10%).

2. Development and validation of rock mass failure criteria (9%).
3. Development and validation of realistic 2D and 3D numerical models (7%).
4. Developments in theories relating to fluid flow and hydro-thermal-mechanical coupling (6%).
5. Developments in theories relating to the response of rock masses to various excavation types (6%).
6. Improve techniques for measuring and estimating in-situ stress (5%).
7. Improve ground support and reinforcement technologies and techniques (5%).
8. Developments in theories of dynamic loading e.g. blasting, seismicity (5%).
9. Development of theories relating to the mechanical behaviour of intact rock (5%).
10. Developments in theories relating to the scale effect (4%).

Between 15 and 100 ‘questions’ were located in each group. Examples of some of the “questions” submitted to Group 1 are as follows.

- Representing rock fabric for design and stress analysis purposes.
- Characterisation of rock masses for slope stability evaluation - influences of rock bridges, interlocking.
- Obtaining meaningful and useful values of RQD for anisotropic masses.
- Determining rock mass and defect material strength properties for open pit slope stability analysis.
- How to improve on-site collection of data suitable for use in numerical models.
- How to characterize rock masses to better predict the performance of underground excavations.
- Incorporation of rock mass characterization data into risk analysis.
- Determining rock mass characteristics that influence time dependent behaviour.
- Establishing cost effective and reliable techniques for in-situ rock mass characterization including the detection of structures such as faults, dykes etc.
- The use of non destructive techniques (e.g. geophysical, acoustic televiewers, etc.) in rock engineering.
- Methods for better incorporating geology into geotechnical models, i.e. how to go beyond the GSI concept.

*Source: ISRM News Journal, Vol. II, December 2008, pp.33-39*

## **Meghalaya Caves Yield New Insect, Fish Species**

Adventure enthusiasts might have stumbled upon new aquatic species and insects deep down in the dark caves of Meghalaya. They include crickets with massive antennae and fish without eyes.

Earlier in February, the Meghalaya Adventure Association (MAA) had organized a caving expedition in the Nongkhlieh ridge under Saipung sub-division in Jaintia hills district. A fish, said to be a hitherto unrecorded species, was accidentally caught in one of the accessories of a caver.

“The caves, 120 km from State capital Shillong, also yielded crickets with antennae ten times the normal size besides blind insects and fish,” MAA chief Brian Kharpran Dally told HT. “A species of fish caught in one of the caves last year is under study.”

The last cave-dwelling crickets were discovered less than three years ago in the Grand Canyon in Arizona, USA. According to Dally, several groups of cavers have since 1992 mapped 300 km of caves. Some 100 km has been mapped in the 30 sq km Nongkhlieh area, which boasts of Krem Liatprah and Krem Synrang Pamiang, considered India’s longest and deepest caves respectively. Krem in the local language means cave.

“Some of these caves are very deep and dark, and they could be sustaining many aquatic species and insects the world is yet to know of,” Dally said. Cave creatures are referred to as troglobites and are invariably de-pigmented.

The Synrang Pamiang had a couple of years back yielded a new species of white-bodied loach. Named *Schistura papulifera* due to the presence of small skin projects on the lower half of the head, it was found to be different from a fairly known species – *Schistura sijuensis* found in Siju Cave in Garo hills, also in Meghalaya. Another species of fish, the *Brachydanio jaintianensis*, was also found in Meghalaya, as was *Bhavana auranachalensis* in Arunachal Pradesh’s Lohit district in the past couple of years. A new insect species, *Corticaromus rueekeri* – it helps in decomposing humus and enhancing soil productivity – as found in Nagaland too.

For the Northeast, the more notable wildlife discoveries in recent years were those of the leaf deer, black barking deer, the goat-like Chinese goral and Arunachal macaque (*Macaca munzala*). All of these were found in Arunachal Pradesh.

On the flip side, however, caves in Meghalaya are under threat from unscientific coal mining and limestone quarrying.

*Source: Hindustan Times, Match 2, 2009*

## **People’s Car**

### ***First Look at Nano***

*The car* powered by a 623 cc rear engine with 21 percent more interior space than Maruti 800.

*Variants:* Three: Standard Deluxe and Luxury. Standard will have no frills while deluxe will come with an air conditioner. The luxury or top-end variant will have an AC as well as power windows and central locking.

*Colours:* Six: yellow, red, saffron, white, silver and pearl white. Top-end variant will have options for metallic colours as well.

*Price:* Estimated on road price is between Rs. 1.3 lakh (US \$ 2500) and 1.8 lakh across the three variants.

*Where to get:* At Tata Motors dealerships across the country.

*Source: Hindustan Times, March 23, 2009*

### **Nano Facts**

*Looks* Snub-nosed four-door hatchback.

*Dimensions:* 3.1 metres (10.23 feet) long, 1.5 metres wide and 1.6 metres high. Can seat up to five people.

*Pollution:* Exceeds Indian regulatory requirements and can meet strict Euro IV emission standards. Tata says the car is better than two-wheelers manufactured in India currently.

*Safety:* Strong passenger compartment, intrusion resistant doors.

*Source: Hindustan Times, March 24, 2009*

## **The Zen of Business**

Michael Smith in his book *Beyond the Bottom Line* writes that at the turn of the century 51 out of the hundred highest revenue-generating institutions in the world were business corporations not nation states! In the next three years 51 became seventy four! The wealth of some business exceeded the GDP of nations and humanity virtually put all its faith in the business corporation and market institutions to deliver well-being. However, it has shown that enormous business power, as it is, has served only a minuscule number of people while, in fact, excluding most from the growth process. Smith sadly adds that the world's three richest people had personal wealth more than the combined GDP of over 30 poor nations! How can one believe now that capitalism can ever become 'compassionate', 'natural' or 'transformational'?

In the near collapse of several vital sectors of the market economy and enterprise worldwide it first seems that even the 'single bottom line' one of creating just money was not achieved sustainably, leave alone the creation of environmental and social value. So, this is nothing but the fundamental failure of overall character and ethics, and the perversion of the 'creative and distributive integrity of value creation' enshrined in a business enterprise.

While there is bound to be extensive debate over this assault on public trust, Prof. Haruo Funabashi's research on 'secrets of long-lived companies of Japan' brings some relief. First of all some stunning figures: 20000 companies in Japan are more than a hundred years old - 1200 of them more that 200 years, 600 over 300 years, 30 companies 500 and more, five more than a thousand years and one is fourteen hundred years! Why do so many long-lived companies exist in Japan? The answers seem simple, but quite

complicated in practice', says Funabashi. 'In Japan we say business not only has to make money but it should ultimately go beyond and serve the greater purpose and well-being of society.

Most companies are not really the big ones and they are into production goods for daily consumption - food, clothes, provide shelter, build temples and carve Buddha sculptures! The stories dwell on values, family-owned leadership charged with a kind of moral responsibility for handing down a legacy for all concerned people. It is a conscious effort, and one might even call it a 'strategy', to internalize the philosophies of Confucianism, Zen Buddhism and Japan's own long heritage handed down from the Imperial Royal family into daily life and work.

It is about religion in practice - every moment, everyday - such as a deep concern for employees, respect for customers; it is about ethical pricing, understanding suppliers' difficulty and so on. Innovation and change are on high priority - more as self-expressions of creativity and, if need arises, as tools for survival. Most important is the emphasis on empowering people, creating a culture of trust, quality and excellence, all the time.

Especially in the present - day context is the significance and value placed on 'frugality', stated more in the way the Swedish use the word 'logaan', meaning 'just right'; or as described in the Bhagwad Gita as Yukta or 'well balanced'. This way, everyone strives to find one's own benchmarks not expecting too much clarity from an external definition, prescription or standard! This is interesting because most present-day initiatives, focused on sustainability in business, come more from a proactive domain; they are voluntary and depend on the motivation of self-driven employees. 'Social responsibility' is also important, but it is deeply integral to behaviour and action rather than the usual external face to an otherwise self-serving business process.

Ultimately, the author explains how business processes have to go beyond the 'self' and flow through ground level interactions and transactions into creating a higher, a more 'collective and total' entity at a deeply spiritual level. Says Funabashi, 'Throughout the interviews and information gathered for research it shows how Japanese businesses are considerably influenced by Chinese, Indian and Japanese philosophies. Employees approach work from a mindset trained in Zen, which was originally founded by Bodhi Dharma. It helps value the work of people, perfection, mindfulness and excellence at the workplace or fairness in engaging employees.

It further sets objectives for the 'self' such as to attain a higher goal for one's life, which presumably extends to serve the larger purpose of an enterprise as well. In our own context, it is perhaps like the influence *Puranas*, the scriptures and value-based *paramparas* and *guru sampradaya* actually have on our personal character and everyday choices in life! While others may nibble at the fringe of this problem fixing a missing piece or two of the 'capitalism' formula, let us not lose sight of the basic purpose of business - service to create well-being - now confronting right in the face of our unchanging 'self-interest for insatiable personal gain'!

*Source: Economic Times, Nov. 20, 2008*

**Region / State wise Hydro Power Potential in India (At 60% Load Factor)**

Region/State	Potential Assessed (MW)	Potential Developed (MW)	Potential Under Development (MW)	Balance Potential	
				(MW)	%
<b>NORTHERN REGION</b>					
Jammu & Kashmir	7487.00	480.17	407.17	6599.66	88.15
Himachal Pradesh	11647.00	2007.07	525.33	9114.60	78.26
Punjab	922.00	454.67	375.00	92.33	10.01
Haryana	64.00	51.67	11.67	0.66	1.03
Rajasthan	291.00	192.67	8.00	90.33	31.04
Uttar Pradesh	9744.00	1127.00	1117.67	7499.33	76.96
<b>Sub Total</b>	<b>30155.00</b>	<b>4313.25</b>	<b>2444.84</b>	<b>23396.91</b>	<b>77.59</b>
<b>WESTERN REGION</b>					
Madhya Pradesh	2774.00	579.50	1211.05	983.45	35.45
Gujrat	409.00	138.67	110.67	159.66	39.04
Maharashtra	2460.00	1108.00	197.67	1154.33	46.92
Goa	36.00	0.00	0.00	36.00	100.00
<b>Sub Total</b>	<b>5679.00</b>	<b>1826.17</b>	<b>1519.39</b>	<b>2333.44</b>	<b>41.09</b>
<b>SOUTHERN REGION</b>					
Andhra Pradesh	2909.00	1392.92	43.70	1472.38	50.61
Karnataka	4347.00	2072.83	557.00	1717.17	39.50
Kerala	2301.00	1068.67	276.13	956.20	41.56
Tamilnadu	1206.00	944.67	69.33	192.00	15.92
<b>Sub Total</b>	<b>10763.00</b>	<b>5479.09</b>	<b>946.16</b>	<b>4337.75</b>	<b>40.30</b>
<b>EASTERN REGION</b>					
Bihar	538.00	119.95	211.00	207.05	38.49
Orissa	1983.00	722.17	387.28	873.55	44.05
West Bengal	1786.00	91.33	9.83	1684.84	94.34
Sikkim	1283.00	28.83	33.67	1220.50	95.13
<b>Sub Total</b>	<b>5590.00</b>	<b>962.28</b>	<b>641.78</b>	<b>3985.94</b>	<b>71.30</b>
<b>NORTHERN EASTERN REGION</b>					
Meghalaya	1070.00	121.67	0.00	948.33	88.63
Tripura	9.00	8.50	0.00	0.50	5.56
Manipur	1176.00	73.17	5.33	1097.50	93.32
Assam	351.00	111.67	90.83	148.50	42.31
Nagaland	1040.00	0.00	81.88	958.12	92.13
Arunachal Pradesh	26756.00	16.50	108.33	26631.17	99.53
Mizoram	1455.00	1.00	6.00	1448.00	99.52
<b>Sub Total</b>	<b>31857.00</b>	<b>332.51</b>	<b>292.37</b>	<b>31232.12</b>	<b>98.04</b>
<b>ALL INDIA</b>	<b>84044.00</b>	<b>12913.30</b>	<b>5844.54</b>	<b>65286.16</b>	<b>77.68</b>

- Chauhan, V.P.S. (2001). Keynote Address on Power Scenario (Hydroelectric)  
Source: Proc. Infrastructure Development in Uttaranchal –  
Problems and Prospects, Organized by I.E. (India) and  
Civil Engineering Dept., IIT Roorkee, India, pp. II-14 to II-19

## **Social Networking Site Users do Badly in Exams**

Fresh research has confirmed what many parents and teachers already feared: social networking sites are damaging students' academic performance.

The researchers discovered that the majority of students who use Face book every day are underachieving by as much as an entire grade compared with those who shun the site.

In order to reach their conclusion, researchers discovered how students who spend their time accumulating friends, chatting and "poking" others on the site may devote as little as one hour a week to their academic work.

"Our study shows people who spend more time on Facebook spend less time studying," the Times quoted Aryn Karpinski, a researcher in the education department at Ohio State University, as saying.

"Every generation has its distractions, but I think Facebook is a unique phenomenon," she added. In the study, Karpinski and a colleague questioned around 219 United States under-graduates and graduates about their study practices and general internet use, as well as their specific use of Facebook.

They found that 65 per cent of Facebook users accessed their account daily, usually checking it several times to see if they had received new messages.

The amount of time spent on Facebook at each log-in varied from just a few minutes to more than an hour.

The Ohio reports shows that 68 per cent of students who used Facebook had a "Significantly" lower grade point average than those who did not use the site.

"It is the equivalent of the difference between getting an A and a B," said Karpinski, who will present her findings this week to the annual meeting of the American Educational Research Association.

*Source: Times of India, April 14, 2009*

## **Secrets of Unconditional Love Revealed**

The secrets of unconditional love, one of the most mysterious emotions, are being uncovered by scientists tracing the unique brain activity it creates.

They have found that the emotion, experienced as a desire to care for another person without any thought of reward, emerges from a complex interplay between seven separate areas of the brain. Such brain activity has only limited overlap with the cerebral impulses seen in romantic love, suggesting it should be seen as an entirely separate emotion.

Professor Mario Beauregard, of Montreal University's centre for research into neurophysiology and cognition, who led the study, said: "Unconditional love, extended to others without exception, is considered to be one of the highest expressions of spirituality.

"However, nothing has been known regarding its neural underpinnings until now." Scientists are interested in unconditional love as evolutionary theory suggests we should feel such emotions only for people who help us pass our genes to future generations, such as spouses and children.

In the real world, however, unconditional love is often experienced towards people with whom there is no connection. The question is: why?

To carry out the study, Beauregard recruited subjects with proven ability to feel strong unconditional love: low-paid assistants looking after people with learning difficulties. Beauregard asked them to evoke feelings of unconditional love and hold them in their minds while they had a magnetic resonance imaging (MRI) scan.

Of the seven brain areas that became active, three were similar to those of romantic love. The others were different, suggesting a separate kind of love.

Beauregard's discoveries showed that some of the areas activated when experiencing unconditional love were also involved in releasing dopamine.

This chemical is deeply involved in sensing pleasure, with rising levels strongly linked to feelings of reward and even euphoria.

### ***Shape of Brain shows Personality***

Imagine getting to know what kind of personality your child could have in future by scanning the toddler's brain. Well, your imagination might become a reality soon, say researchers.

A new study has found that the shape of the brain can give a clue to what type of person one is - in fact, children are born with certain personalities and their brain develops differently depending on the type of person they become.

In fact, the researchers have based their findings on an analysis of the shape of brains of 85 people - they found that larger or smaller amounts of tissue in certain areas of the brains were linked to specific personality traits.

The four personality types were classified by the researchers as "novelty-seeking", "harm avoidance", "reward dependence" and "persistence". "Those with a novelty-seeking personality had an area of the brain above the eye sockets which was larger than in other people," lead researcher Annalena Venneri said.

*Source: Times of India, April 14, 2009*



### **Earthquake in Italy Shifted Earth by 15cm**

The Earth in the region of L'Aquila, in central Italy, hit by a major earthquake on April 13, 2009 has shifted by up to 15 centimetres, the Italian space agency said.

It compared interferogram satellite radar images taken before and after the quake from the same angle which show movement of the Earth with artificially coloured edges, each of which corresponds to a shift of 15 millimetres.

“The zone affected by the biggest shifts shows around 10 edges, or a displacements of the earth of around 15 centimeters”.

*Source: Times of India, April 14, 2009*

### **Humour**

I want you to know that you are very important to me, It's impossible for me to live without you, even for a second! You are my life and I can feel you everywhere.....

DON'T MIND I WAS TALKING ABOUT OXYGEN...