NEWS AND VIEWS

Back Analysis in Rock Engineering

Various numerical methods of analysis, such as the Finite Element Method, the Boundary Element Method, the Distinct Element Method etc., have rapidly developed in rock mechanics during the last decade. They have been used extensively in engineering practices in designing tunnels, large caverns, slopes, dams and so on. However, even if these sophisticated numerical methods are used, it is not an easy task to predict the mechanical behavior of the structures with sufficient accuracy. This is simply due to the fact that there are many uncertainties involved in the input data for the numerical analysis, such as geological and geomechanical characteristics of rock, rock joint system, underground water table, permeability, initial state of stress, etc. Thus, it is not surprising that the real behaviour of the structures often differ from those predicted.

In order to fill the gap between the actual behaviour and the predicted one, field measurements are performed during construction to revise the input data used in the design analysis, as well as to monitor the stability of the structures.

Revising the input data can be done in such a way that discrepancies between the real and predicted behaviour of the structures are reduced to a minimum, and if necessary, the original design and the construction method may be modified in order to achieve a rational design of the structures.

This design/construction method based on field measurements is called the "observational method". In this method, however, a question may arise concerning how to quantitatively interpret the field measurements for assessing the original design and construction method. A technique called "back analysis" is a key to answering this question developed by the author and his co-workers.

Back analysis is generally defined as a technique which can provide the controlling parameters of a system by analyzing its output behavior. In back analysis of rock engineering problems, force conditions such as external loads and / or support pressures, and mechanical properties of rock such as modulus of deformation, Poisson's ratio, cohesion, angle of internal friction etc., are identified from displacements, strains and pressures measured during and / or after construction.

In back analysis, the usual procedure is to measure displacement, strain and/or

pressure, and then to assume a mechanical model. The mechanical constants of the model can then be back-analyzed from the field measurement results. Consequently, it is obvious that the back-analyzed values of the mechanical constants depend entirely on what model is assumed. Thus, modelling is more important in back analysis than in ordinary analysis. It must be emphasized that in back analysis the mechanical model should not be just assumed, but should be back analyzed from the actual field measurement data. However, the final aim of back analysis, as far as engineering practice is concerned, is not merely to identify the mechanical model and its material constants, but to assess the adequacy of the original design and construction methods. (Further research is needed urgently on the non-linear back analysis for reliable estimation of strength parameters).

- *Excerpts from an Article by Prof. S. Sakurai, Deptt. of Civil Engineering, Kobe University Kobe, Japan: ISRM News Journal, Vol.2, No.2, 1994.*

Water from Clouds Over the Himalaya

A camera designer from Toronto has set off to trap drinking water from the clouds above the Himalaya in Nepal in an innovative bid to alleviate the mountain kingdom's water problems. Mr Kevia Kowalchik, a pioneer with the IMAX Corporation which brought out the wide screen movie format, carried with him a thin polyethylene mesh, invented by environment Canada scientist Robert Schemenauer.

The mesh, which is stretched out in rectangular sheets between wooden posts and then placed in vertical arrays amid the clouds around mountains summits. was used to collect and supply water to mountain villages in the Chilean Andes in the mid-1980s.

A typical fog catcher is 12 metres wide, four metres high and sits about two metres off the ground. The 48 square metres of mesh produce some 250 litres of water a day at a very low cost.

A fog is just a cloud that is touching the ground and a cloud is composed of tiny water droplets. There are billions upon billions of these droplets in an average cloud and as the wind pushes them through the vertical meshing, they become trapped and will bead into larger and larger drops of water. The beads of water then drip off the bottom of the catcher into a trough, these create a flow of

water which runs off and is taken through pipes to a cistern or a reservoir below according to Mr. Schemeanauer.

The system could be a limited source of drinking water only during the non-monsoon season and beneficial to the local population.

The simple and inexpensive method of collecting water is like having micro hydroelectric projects which use simple means to divert water from the mountain side and this water is used to generate power in a cost effective manner.

- Excerpts from the News, The Hindustan Times, April 30, 1997.

Longest Suspension Bridge

Amid a spectator fireworks display, former British Pime Minister Margaret Thatcher opened the world's longest rail and road suspension bridge, a symbol of Hong Kong's vibrant economy in the last days of British rule on 28.4.97.

The 2.2 km long Tsing Ma Bridge links the Hong Kong main land to Lantau island and the islet of Chek Lap Kok, where $ 21 billion airport is to open next year. Its main span is 1,377 meters long. Mrs. Thatcher told the gathering that there was no better symbol than the bridge of the boldness, the vision and the energy of the people of Hong Kong.

- The Hindustan Times; April 29, 1997.

Earth Core Spinning Faster, Claim Experts

The American geologists have confirmed that the Earth's inner core is spinning faster than its outer surface by five degrees, a theory earlier discovered by J.J. Rawal of Nehru Planetarium 10 years ago.

The latest issue of the international journal, "Science," has reported the findings of the geologists, Dr. Glatzmaler of Los Alamos National laboratory, New Mexico, and Dr. Raymond Jeanolz, of University of California. Dr. Rawal's discovery was published in the international journal "Earth, Moon, Planets" in 1986 and again in 1989.

While studying the formation of the solar and satellite systems of planets way back in 1986, Dr. Rawal, an eminent astrophysicist showed that the sun and its planets including the earth were spinning fast at the time they came into being.

According to measurements of seismic paths, the earth is made up of four distinct layers-a rocky crust, a mantle of hot plastic rock, an outer core of liquid iron and an inner core of solid iron.

The Earth's inner core is described as a solid mass of blisteringly hot iron, 2,400-km wide, or slightly smaller than the Moon.

According to Dr Rawal, due to the breaking effects of the tidal forces towards their respective planetary or satellite systems and their respective magnetic fields, the outer layers of the central body have slowly "slowed down", generating what is called differential rotation.

The findings of the American scientists, who have studied the Earth's interior by means of seismic waves and super computer, have many implications in understanding Earth's geology, planetary formation, and tidal forces produced by the satellite system on "its respective parent planet" and the breaking effect due to the planet's own magnetic field in generating differential rotation of a planet, the `Science' journal said.

Scientists have suspected these implications to be related to the Sun but they have now come to the conclusion that similar situations are found in the case of planets as well.

The inner throes would eventually stir such upheavals at the surface in the form of earthquakes and volcanoes, Dr. Rawal, Dr Glatzmaier and Dr Raymond and other scientists believe, defining it as an "inner core (which) appears to be virtually a planet within a planet".

- Excerpts from the News,
The Hindustan Times;
January 8, 1997.

Geo-Thunder Bolt Due to Earthquake

Electromagnetic anomalous phenomena, associated with the South of Hyogo earthquake, hit Kobe and Awaji Island on 17 January 1995, has been observed in a various frequency range. Moreover earthquake lightening spread out from

the faulting zone of Nojima in Awaji island were witnessed by fishermen. If such lightening left some geological traces at the fault, it may provide a clue to examine a possible source mechanism for a seismic electromagnetic activity and related phenomena. Surveys including the boring-core examination of the fault zone were made around the Najima fault, where the lightening was witnessed.

We found, for the first time, a geological evidence of earthquake lightning at Nojima fault accompanied by the South of Hyogo earthquake. The fault gouge, existing between weathered granite and mudstone, was deep blackened and hardened, whereas the granite and mudstone were weak. The gouge was anomalously magnetized about 100-1000 times as high as the weathered granite and mudstone nearby the fault gouge, though their composition of minerals were almost same. Such hardened gouge extended from the ground surface down to the depth of about 10 m, but the fault gouge taken from 14 m deep was very soft.

The high power electric lines in the area around Nojima fault was not broken down, and there was no meteorological lightening at that time. Thus this fact suggested that intense electric current passed through the fault, causing earthquake lightening anomalous magnetization and spark plasma sintering of the gouge. Mudstone nearby the hardened fault gouge was also subjected to isothermal remanent magnetization (IRM) due to intense magnetic field accompanied by the earthquake lightening current. The intensity of IRM decreased with increasing distance from the fault. Then the estimated spark current was about 3 K.A. Anti clockwise direction of magnetization around the fault rocks indicates that current flowed from the depth to the surface passing through the fault gouge zone.

Based on this finding, a model is needed to explain why the electric discharge occur along with the fault plane, and the relationship to the seismic electromagnetic activity.

- *Y. Enomoto, Japan in the 29th General Assembly of the International Association of Seismology and Physics of the Earth's Interior, Greece, 1997, p. 309.*

New Godavari Bridge - a Milestone in Railway History of India

A unique blend of modern technology and aesthetics, the third railway bridge across the Godavari river in Rajahmundry is all set to become the fastest moving corridor across the river.

Aided by Swiss and German specialists, Indian engineers have built what they call "an architecturally elegant, structurally efficient and functionally superior structure".

Considered to be a milestone in the history of Indian Railways, perhaps in Asia, the bridge will soon replace the nearly century old rail bridge, which was built way back in 1900 by E.R. Walton.

Claimed to be the largest of its kind in Asia, its structure has been designed to withstand a speed of 200 km per hour. The main bridge measures 2,732 metres and the approaches about 1,200 metres long.

The bridge consists of 28 spans with a bore string of twin arches linked to the girder, all made of prestressed concrete.

The twin arches are also connected laterally by struts to withstand high wind velocity conditions, the deck and arches are joined by 24 dynamic hangers, each consisting of high tensile wires, which are tested for fatigue for two million cycles.

Explaining the technology during a trial run over the new bridge, chief engineer R. Sundar Rajan said when the train load comes on the girder, about 70 per cent of it is transferred by the hangers to the arches in the form of point loads.

The arch profile has a property of converting vertical point loads into axial compression and concrete being stronger in compression, arches are capable of sharing high loads and thus relieving the girder. By this method the size of girder is drastically reduced and the overall process leads to very economical and slender design.

- Excerpts from the News,
The Hindustan Times; April 11, 1997

Setting-up of High-powered Commission for Integrated Water Resources Development Plan in India

The Government of India, Ministry of Water Resources has considered necessary that scientific development of water resources be taken up considering river basin/ sub-basin as a unit. Maximising the availability of utilisable water may involve, inter alia, transfer of water from surplus basin to water-short basin in the overall interest of the country, in order to give much needed relief and to distribute the benefits more evenly.

Integrated development of water resources, both surface and ground water, can optimise benefits, resulting in economic use of available water. To achieve this objective, the government has set up a high-powered Commission under the chairmanship of Dr. G.V.K. Rao, former Member, Planning Commission, Government of India.

The following are the objectives of the said Commission:

* To prepare an integrated water plan for development of water resources for drinking, irrigation, industrial, flood control and other uses;

* To suggest modalities for transfer of surplus water to water deficit basins by inter-linking of rivers for achieving the above objectives;

* To identify important ongoing projects as well as new projects which should be completed on priority basis together with phasing;

* To identify a technological and inter-disciplinary research plan for the water sector with a view to maximise the benefits;

* To suggest physical and financial resource generation strategies for the water sector.

A Task force has also been set up for assisting the Commission in deciding the modus operandi and the action plan in regard to the work of the Commission.

- Excerpts, Institution of Engineers (India): News, March 1997.

Sesquicentennial Celebrations of the University of Roorkee

The year long Sesquicentennial Year Celebrations (SQCC) of the University of Roorkee (UOR) was launched on November 26, 1996. This marked various academic and professional activities involving the university community and its alumni. Established as the Thomason College of Civil Engineering in 1847, UOR has the distinction of becoming the first technical University in 1949, in India. UOR has the distinction of having produced several eminent engineers in practically every major engineering project in the country and in important administrative positions related to management of engineering education and research. It offers course on rock mechanics and tunnelling technology aspects in the Civil Engineering Department, Department of Earth Sciences, Water Resources Development and Training Centre and School of Earthquake Engineering in close cooperation with research centres as Central Building Research Institute, Central Mining Research Institute, U.P. Irrigation Research Institute, U.P. Irrigation Design Organisation and Structural Engineering Research Centre.

SQCC lecture by Prof. Shamsher Prakash on Liquefaction due to Seismic Waves

Prof Shamsher Prakash delivered SQCC lecture on 24 June 1997 at UOR. He talked on liquefaction of silts and silty clay mixtures. He emphasised that full scale monitoring and field testing is the key to success in geotechnical engineering. He cited that seismic waves have high frequencies in rocks and these are damped out as the wave travels upwards in the soil. So seismic waves in soils are of lower frequencies. He presented field data on full scale vibration tests on large groups of piles. This data has inspired many researchers to refine their non-linear dynamic models of piles. There is difference in behaviour of soil in machine vibrations and earthquake vibrations. Thus, chance of liquefaction also depends on the number of cycles particularly in silty soils (PI greater than 5).

Dr. Shamsher Prakash is Professor in Civil Engineering, University of Missouri Rolla, USA.

Roorkee Local Chapter, ISRM / TT

Lecture by Prof. Evert Hoek on tunnelling through squeezing grounds

Prof. Ever(es)t Hoek is famous for his Everest achievements. Prof. Hoek delivered lecture on "Tunnelling Through Rocks" on 7th February 1997 in the Department

of Civil Engineering, University of Roorkee. The lecture was overwhelmingly attended and appreciated by practicing engineers in and around Roorkee. He explained the successful use of yielding steel ribs to support highly squeezing grounds. He also narrated how subsidence above metro stations can be controlled by proper sequence of excavation in multi-drift method.

Prof. Hoek is an International Expert in Rock Mechanics from Canada. He delivered Rankine's Lecture in U.K. He is the fellow of Royal Academy of Engineering.

Vision of India-2020 for Increasing Self-Reliance

Mr. Dension, a well known economist of the U.S., has calculated the factors that contributed to the economic growth there between 1929 and 1983. India in 1996 is not much different from what the U.S. was in 1929. So, the U.S. experience in 1929 should be a lesson for us today. According to Mr. Dension, the contribution made by technology R&D in the economic growth of the U.S. was as much as 64 per cent, followed by education which accounted for 30 per cent. In contrast, the share of capital was barely 10 per cent, and that of land negative. Taking into account this past experience, the vision document advocates three policy changes: Shift investment from mindless expansion of congested cities to systematic empowerment of villages, empower villages to support large business districts. Change emphasis form bookish learning for previleged minority to employment oriented education for all, i.e., make scholarly studies optional and not compulsory.

Let indigenous technology development be the primary engine for economic growth; in place of foreign capital investment on which we have set all our hopes at present; i.e., rely on skills which we have in abundance rather than on money which we lack.

As Mr. Denison has shown, education is second only in importance to technology and applied research. We need a change of heart here. What our poor need is not more reservation in colleges but better education in elementary schools, followed by better training for productive work.

Mr. Denison's study found that land made a negative contribution to economic growth in the U.S.. That is, in the U.S., land was relatively a loss-making investment. In vivid contrast, the fastest way of making money in India is to buy land. Here is an important lesson for us to learn: wealth obtained by land speculation is apparent, not real.

The vision document suggests that villages be looped together through high quality

transport. That way, hundreds of thousands of villagers can be brought into close contact with each other. Such linked-villages will be able to support large markets and hence commercial and industrial development the way cities do.

Can India become a pleasant, prosperous and just society? Yes, certainly! Will, it? That depends. One single (unselfish) leader can make all the difference.

- Excerpts from an Article by P.V. Indersen, The Hindu August 7,1996

Indo-Norwegian Co-operation Programme

A three-year NIRM-NGI Institutional Co-operation programme commenced in November 1996 with an approved budget of Norwegian Kroner 2.77 million. Under this programme, the thrust areas of co-operation include:

* development of tailor-made intrinsically safe georadar for potential applications in coal mines.
* development of tomographic imaging facility using both georadar and seismic techniques for site characterisation, and
* strengthening Rock Mechanics facilities at National Institute of Rock Mechanics (NIRM).

- Excerpts from NIRM Bulletin; Vol.7, No.1, February, 1997

Putting People First

Quality, which in essence- means consumer satisfaction, is achieved through people and in accordance with a basic HRM principle - investment in people is a prerequisite for achieving high quality standards. Total quality Management (TQM) is an intensive and long-term effort at the creation and maintenance of high standards of product quality and it is important to the organisation's success. 'Total quality' can be defined as a systematic way of guaranteeing that all key features include:

* commitment from the top management to provide visible leadership to the whole approach;
* An objective of consumer satisfaction, both internal and external, at all levels within an organisation;

* Continuous improvement creating an environment where each individual is committed to seeking ways of enhancing performance;
* Measurement on a regular basis to ensure a clear focus on facts and data so that necessary improvements may be made.

Total Quality is based on the philosophy of 'success through people', which means putting people at the heart of that process.

In order to sustain the standard of good TQM, it is essential to measure the quality and determine the cost of quantity; to build TQM into accountabilities of every job and into related system; to form quality teams with integration, which can incorporate quality objectives into strategic plans; to obtain commitment from top management and recognise the same with reward for quality improvement.

TQM is a continuous performance and not a programme. A team which implies a finite beginning and end. Although the emphasis on quality can never be relaxed, they have had their uses as monitoring and measuring devices.

TQM is not simply a matter demanding everincreasing quality target levels and also not achieved by techniques such as quality Control, but it is an attitude of mind which leads to appropriate behaviour and actions with commitment at every level to a 'zero-deficit product'.

Quality management should be achieved by the application of basic principles on motivation throughout the oragnisation. It sets out how an organisation can establish, document and maintain an effective quality system, which ultimately proves itself to the customers. The top management sets the priorities and initial goals and allocates responsibilities and this process continues down through the hierarchy until the goals are set in such a way that everyone's work fits in with the organisation's priorities.

Strategic contribution

The HR specialist can give advice on the culture and climate of the organisation and its readiness to change in the direction of a quality approach and its contribution on the skill base, how it can be developed for TQM and finally, its effectiveness in the use of a communication system.

Operation contribution

At this level of the development of TQM, the HR function can play an important role in the education training, including quality awareness, approaches to achieve quality problem solving, teamwork and so on.

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At this level of the development of TQM, the HR function can play an important role in the education training, including quality awareness, approaches to achieve quality problem solving, teamwork and so on.

This need would motivate minds of researchers in Geology, Rock Mechanics, Hill Engineering, Hill Ecology etc. to make original and vital contributions. (Thus future is in the Himalaya).

- Prof. Harar
Israel, 1970.

How to have Fun at School, Find Free Time, and Get Good Grades Too!

Everything is made up of processes. To improve anything, you must first understand the processes involved. Most failures are caused by failure in the process, not the individual. Understand the process, improve it, and the quality of the product will improve. This applies to every product, whether it is a manufactured good, a service, or an education.

Education has two major processes: teaching and learning. Teaching is the sum of the processes an instructor uses to present materials. Learning is the sum of the processes used in acquiring knowledge. The student controls the learning processes. The instructor's presentation affects how the student receives information; however, it is ultimately up to the student to absorb that knowledge. The student's techniques of learning directly affect his or her ability to grasp the information presented. Students that improve their learning processes end up learning more with relatively less effort.

These are the principal elements this paper touches on to use to become a better student.

* You begin to believe that person is subhuman (This often happens during war; propaganda dehumanizes the enemy.) Consciously remove those epithets from your language. Substitute humane and decent terms, and over time, your attitude and behaviour will change.
* You are not "just a student"; you are a professional - in - training.
* The key is that improvement never ends.
* Time management directly contributes to getting all your assignment done on time.
* Adopt the new attitude.
* You are a professional in training and not a student.
* Use a profession work schedule.
* Go to all your classes.
* Take copious notes during class.
* Use your time effectively.

* School is your job.
* Set your goals and define success for each goal.
* Use the Deming wheel.
* Plan, do, check, act.
* Have fun!
* Be brutally honest with yourself.
* After a while, some of these new ideas will become a habit that will make learning easier for you.

- *Excerpts from an Article by Terry Terry; ASCE Journal of Professional Issues in Engineering Education and Practice, July 1995.*

Suggestions for Technical Writing (for M.E. & Ph.D. Scholars)

Theme- Solutions of major public - crisis - issues with global applications.

2. **Style -** EXPRESS THROUGH FIGURES/ARTISTIC COLOURFUL SKETCHES

- Avoid long sentences. Text should be readable. No footnotes.
- Use colour photos, figures of LARGE size and computer graphics.
- Projects may be named A,B,C to avoid hurting project authorities
- While editing reduce repetition, and cut out insulting / depressing words and adjectives (very, never, always, may for can).
- Ensure continuity of flow of material in chapters,
- Common errors (one word cannot, rock mass, author for I/ we, as follows for below, percent for %, ~ for about/range).
- Use articles carefully (a, the etc.)
- Highlight your work and ideas with LOTS OF CASE HISTORIES.
- Offer valuable and interesting conclusions - new, positive, precise, practical/ conceptual deduced from investigations. Give limitations.
- Figures and tables be placed where referred first. Write introduction in the last.

- Add abstract and summary of work done. For quality edit YOUR SELF.
- Final manuscript should be checked by 1 or 2 colleagues to point out vagueness and confusions which might have escaped your attention.

3. **Review of I terature** - Use past tense for work done in the past, "quotations". No text book material. Use CD-ROM and INFORMATION SUPER HIGHWAY for references and abstracts.

- Chronological order of research works. Review critically.
- Identify gaps of knowledge in the last article.
- All review in one chapter only and cite in other chapters.

4. **Units** - Use standard / SI abbreviation in singular.

- Convert units of old reference in SI units.
- m for metres, cm for cms, g for gms.(no dot), 0.065 for .065

5. **Figures** - Use Fig.3.6 in the sentence (with capital F)

- Figure 3.6 if initial word of sentence.
- Tracing NOT TOO CONGESTED, NOR TOO MANY FIGS on one page for readability.
- Lettering on the figure should be of PROPER size (3-3.5mm for title, 2.5-3 mm for axis annotation and 2-2.5 mm for text), use colour print
- Grid marked on the figure should be thinner than the main curve.
- Leave 40 mm margin for binding.
- Use computer enhanced colour xeroxing.
- Data points on experimental curves. No small dots on computer figs.
- A simple figure in place of table without too many details.

6. **Table** - Table 6.3 (With capitat T)

- Not too many, not too complicated. Put some tables in appendix.
- Computed values rounded off according to level of confidence.

7. **Author** - Fairhurst et al. (1973) (not et. al. or reference No.)
   - Use last name only without initials or designations in text.

8. **Title** - No full stop or colon at the end of the title, sub title and subdivisions. No underlining of any heading.
   - All capital letters for both Chapter number and Chapter heading.
   - All capital letters for main headng with numbering (3.1).
   - First letter of all words in the sub titles in capital with numbering (Art 3.1.1).
   - Only first letter capital of subdivisions without numbering (No. 3.1.1.1, not too many).

9. **Equation**- Number each equation (4.1) at the right margin.
   - No dot dot .... before equation number
   - Use Eq. 4.1, enough space above and below equation.
   - define symbols once only.

10. **Notations** - Standard / rational symbols

11. **References** - In alphabetical (order)
   - All references in the text should be listed (common slip)
   - Last name, initials (Year), title, publisher, vol., pp.

12. **Best time for writing** - At fixed time in solitude for faster flow of ideas and inspiration. Cultivation of diversity in interest will enable subconscious mind to churn ideas at faster rate.

13. **Typing-PC**- Word perfect for experimental works and chi writer for mathematical modelling and in double spacing for easy editing.

14. **Journal** - Budding international journal on your issue for moral support.

SUGGESTIONS FOR SUCCESSFUL PRESENTATION (For M.E. & Ph.D. Scholars)

1. Objective

- To make other understand your point of view.
- Reward - easy recognition

2. Time

- 20 minutes for seminar / viva-voce of M.E. student.
- 40 minutes for viva-voice of Ph.D. scholars.
- 5 to 10 minutes in conferences
- To allow more time for discussions for active participation of audience.
- 45 sec / transparency (graph), 1 min / transparency. (text), 1.5 Min / transparency. (table), 30 sec/slide.

3. Index Cards

- Make notes
- First of all state objectives of your investigations (new, different, simple, practical, timely)
- State a compelling thing/applications in field/questions for arousing curiosity.
- Skip review of literature except for seminar.
- Divide your cards into its main ideas.
- Key words / quotations to help your memory
- Do not offer oversimplification of really complex problems.

4. Transparencies

- Say it through figures, it is the best way to glue the attention of audience on the screen and heal their mood.
- Write in good handwriting in green colour in 15 cm width so as to be visible from back seat. Green is soothing to mind.
- Use coloured pens, colour printer; draw neat sketches, headlines.
- Do not write whole sentences and text and complete details. (these should be in your cards only). Write main points / ideas neatly.
- Do not project complete engineering drawing and specifications and big tables.

5. Preparation

- Use connective sentences and quotations.
- Repetition is essential to refresh memory. The ear cannot check back nor jump ahead as can the eye. Therefore, you must remind your audience of what it has heard and prepare them for what it is about to hear whenever you go from one idea to another.

6. Stage fright

- For preparedness, rehearse your speech and check projection material and machine. Arrange your cards, transparencies / slides in order.

7. Common Slips

- Too fast, too slow, speech in weak tone.
- Too fast show of awful slides / transparencies. No backup projector.
- Too wide and too many transparencies with typed material without telling X, Y coordinates.
- Unable to explain inferences from figures.
- Too many equations, tables, details on slides.
- Telling unclear concepts. No number and arrow on slide.

8. Presentation

- DO NOT READ PAPER IN NEWS STYLE
- Your audience wants to hear you talk, not listen you read, stand at an angle to screen and talk to audience.
- Use short simple sentences.
- Speak clearly with vitality and cheerfully in good mood.
- Care for persons sitting at the back.

9. Use of Black board

- Do not rub just after writing. Use other side of the board, if necessary.
- Neat sketches with coloured chalks.

- Break the chalk into half for no vibrations, rub the board well.
- Use coloured chalks

10. **Conclude**

- Conclusions on positive applications / solutions of challenging problems / major public - crisis - issues with case histories and limitations.
- Make your point in few polite and new words, as meaning of old words decay with time.
- Invent new blissful words and abbreviations. Big numbers impress.
- LONG PAUSE BEFORE AN IMPORTANT CONCLUSION IS MOST EFFECTIVE.

- *Faculty Members, University of Roorkee, Roorkee.*

Science and Perceptions

(A conversation between Rabindranath Tagore and Professor Albert Einstein)

Einstein: Do you believe in the Divine as isolated from the world?

Tagore: Not isolated. The infinite personality of Man comprehends the Universe. There cannot be anything that cannot be subsumed by the human personality, and this proves that the truth of the Universe is human truth. I have taken a scientific fact to illustrate this-Matter is composed of protons and electrons, with gaps between them; but matter may seem to be solid. Similarly humanity is composed of individuals, yet they have their interconnection of human relationship, which gives living solidarity to man's world. The entire universe is linked up with us in a similar manner, it is a human universe. I have pursued this thought through art, literature and religious consciousness.

Einstein : There are two different conceptions about the nature of the Universe :(I) The world as a unity dependent on humanity (2) .The world as a reality independent of the human factor.

Tagore : When our Universe is in harmony with man, the eternal, we know it as truth, we feel it as beauty.

Einstein : This is a purely human conception of the Universe.

Tagore : There can be no other conception. This world is a human world- the scientific view of it is also that of the scientific man. There is some standard of reason and enjoyment which gives it truth, the Standard of the Eternal man.

Einstein : This is a realisation of the human entity.

Tagore : Yes, one eternal entity. We have to realise it through our emotions and activities. We realise the Supreme man who has no individual limitations through our limitations. Science is concerned with that which is not confined to individuals, it is the impersonal human world of truths. Religion realises these truths and links them up with our deeper needs; our individual consciousness of truth gains universal significance. Religion applies values to truth, and we know truth as good through our own harmony with it.

Einstein : Truth, then, or beauty, is not independent of Man?

Tagore : No

Einstein : If there would be no human beings any more, the Apollo of Belvedere would no longer be beautiful?

Tagore : No.

Einstein : I agree with regard to this conception of beauty, but not with regard to Truth.

Tagore : Why not? Truth is realised through man.

Einstein : I cannot prove that my conception is right, but that is my religion.

Tagore : Beauty is in the ideal of perfect harmony which is in the Universal Beings; truth the perfect comprehension of the Universal Mind, own mistakes and blunders, through our accumulated experience, through our illumined consciousness - how, otherwise, can we know truth?

Einstein : I cannot prove scientifically that truth must be conceived as a truth that is valid, independent of humanity; but I believe it firmly. I believe, for instance, that the Pythagorean theorem in geometry states something that is approximately

true, Independent of the existence of man. Anyway, if there, is a reality independent of man there is also a truth relative to this reality; and in the same way the negation of the first engenders a negation of the existence of the latter.

Tagore : Truth, which is one with the Universal Being, must essentially be human; otherwise whatever we individuals realise as true can never be called truth - at least the truth which is described as scientific and can only be reached through the process of logic, in other words, by an organ of thoughts which is human. According to Indian Philosophy there is Brahman the Absolute Truth which cannot be conceived by the isolation of the individual mind or described by words, but can only be realised by completely merging the individual in its infinity. But, such a truth cannot belong to science. The nature of truth which we are discussing is on appearance - that is to say what appears to be true to the human mind and therefore is human, and may be called maya, or illusion.

Einstein : So, according to your conception, which may be the Indian conception, it is not the illusion of the individual, but of humanity as a whole.

Tagore : In science we go through the discipline of eliminating the personal limitations of our individual minds and thus reach that comprehension of truth which is in the mind of the Universal Man.

Einstein : The problem begins whether Truth is independent of our consciousness.

Tagore : What we call truth lies in the rational harmony between the subjective and objective aspects of reality, both of which belong to the Super-personal man.

Einstein : Even in our every-day life we feel compelled to ascribe a reality independent of man to the objects we use. We do this to connect the experiences of our senses in a reasonable way. For instance, if nobody is in this house, yet that table remains where it is.

Tagore : Yes, it remains outside... the universal mind. The table which I perceive is perceptible by the same kind of consciousness which I possess.
(Kindly forget the truth and be happy)

- The Hindustan Times, May 8, 1996.

The Nector of Life

Remember that you must behave in life as you would at a banquet. A dish is handed round and comes to you; put out your hand and take it politely. It passes you; do not stop it. It has not reached you; do not be impatient to get it, but wait till your turn comes. Bear yourself thus towards children, wife, office, wealth, and one day you will be worthy to banquet with the gods. But if when they are set before you, you do not take them but despise them, then you shall not only share the gods' banquet, but shall share their rule. For by so doing Diogenes and Heraclitus and men like them were called divine and deserved the name.

- Epictetus (60 A.D.)

Tunnel Engineering through the eyes of Khushwant Singh !

Once there was a global tender for laying an underground tunnel between London and Paris. M/s Banta Singh and Santa Singh of Patiala also participated in the tender and they were declared as the lowest bidder. The tender evaluation committee decided to call them to London to explain the tunnelling M/s Banta Singh & Santa Singh were to adopt. During the discussions, committee asked Singh brothers what experience they had in tunnelling. Banta Singh replied, that they have dug many wells in Punjab and there is no difference between a well and tunnel except the angle. On not being satisfied; the committee asked what method you are going to adopt for work. Banta said, I will start digging from - Paris and Santa will start digging from London and one day we will meet somewhere in tunnel, and the tunnel will be laid. The Committee said, but it is not so easy Banta, as you have to maintain a certain alignment. Banta after a little thought replied, " So what Sir, at the most there will be two tunnels in same cost" !