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# ISEG NEWS

Bridging Communication Gap.....Dissipating Information



NHPC Ltd  
Pioneers in Hydropower Development



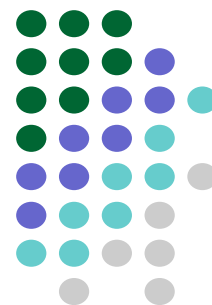
SJVN Ltd



Geological Survey of India  
(Ministry of Mines, Govt. of India)



Mineral Exploration Corporation Limited  
(A Mini Ratna Company of Govt. of India)



## ISEG COUNCIL 2016-17

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## MESSAGE FROM THE PRESIDENT

Dear Professionals,

It is a matter of great pride to all of us in ISEG that bi-annually we bring out newsletter, which is of highest professional standard imbued with information, knowledge and wisdom. We have successfully conducted the International Conference on Engineering Geological Solutions for Sustainable development "EGCON 2017", which was inaugurated by Shri Ajay Kumar Bhalla, Secretary (Power), Government of India and Valedictory session was chaired by Shri S.D. Dubey, Ex-Chairperson, CEA and now Member (Technical), Appellate Tribunal for Electricity.

The Conference was a grand success, where a number of key note lectures were delivered by eminent experts and high quality technical papers were presented. I wish to express my heartfelt gratitude to everybody involved in the successful conduct of the Conference.

In ISEG we, true to our slogan, try to bridge communications gap and dissipate information in order to build a world of Infrastructure Development where engineers and geologists are in perfect understanding and coordination with each other so that projects are completed in least cost and time through innovative ways.

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## MESSAGE FROM SECRETARY

Dear Colleagues;

The present council is at the last leg of its journey. The elections for the new council have been announced and the process will be completed by end of December to enable new body to take charge in 2018.

I have received most fervent encouragement from the President and veritable support from all, especially my Joint Secretary and the Editor. Others have also given me continuous stanchion in order to stand tall. In particular when I moved to Parbati Project the work was not encumbered. This immensely speaks of the affection of my colleagues in ISEG and in the council.

This is indeed a testimony of the strength of ISEG. The President and senior members of engineering and geological fraternity were highly impressed

by the organization of International Conference on "Engineering Geological Solutions for Sustainable Development" which was organized at New Delhi in October 2017. The venue, selection of key note lectures and the papers were of highest class. I have received very positive feedback regarding excellent comparing and arrangements in the hall. I once again thank the core committee wholeheartedly which has put in immense efforts in making this conference a success.

Well, engineering geology as a field is under great scrutiny in India. I would like to place on record here that not seeking geological advice for placement of a high dam or ignoring the recommendations of geologists for engineering advantages has often resulted in losses in the final analysis. We are of the strong opinion that geology must play a signifi-

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We are what we repeatedly do. Excellence, then, is not an act, but a habit.

—Aristotle



## BIANNUAL HIGHLIGHTS

May 2017 to October 2017

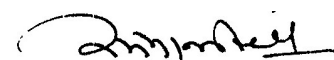
1. The 4<sup>th</sup> Executive Council Meeting of the ISEG was conducted on 13<sup>th</sup> May, 2017 at Expediting Office of SJVNL Ltd., IRCON Building, Saket, New Delhi under the Shri R. N. Misra, Chairmanship of President-ISEG. Shri Imran Sayeed, Secretary, ISEG conducted the meeting. Important matters such as finalization of issues pertaining to GOP-2017, organizing International Conference EGCON-2017, status of ISEG and IAEG membership and efforts taken to enhance the membership base were discussed. President, ISEG released the 1<sup>st</sup> Circular of EGCON-2017.
2. ISEG Delhi-NCR Chapter under the aegis of ISEG has successfully organized (GOP-2017) on 15<sup>th</sup> & 16<sup>th</sup> July, 2017 at Hotel Vibe, Lalit, Faridabad. The program was specially designed for young professionals engaged in various infrastructure development projects. The response to the Programme was overwhelming, in all 22 participants from 07 organizations attended the programme. It was inaugurated by Shri. R.N. Misra, President ISEG & CMD, SJVNL. The two days Orientation Program contained 08 interactive lecture sessions and a field session.
3. The 5<sup>th</sup> Executive Council Meeting of the ISEG was conducted on 5<sup>th</sup> August, 2017 at Expediting Office of SJVNL Ltd., IRCON Building, Saket, New Delhi under the Chairmanship of Shri R. N. Misra President-ISEG and CMD, SJVNL. Dr. Gopal Dhawan, CMD, MECL and former President of ISEG and other executive council members were also present in the meeting. Completion Report and Financial Closure Statement of GOP-2017 were presented by Shri N.K. Mathur, Convener. Various issues pertaining to EGCON-2017 viz., finalization of venue, organising committees, status of abstracts and full papers, financial status and sponsorship etc. were discussed. Finalization of dates for Election of next ISEG Executive Council for the term 2018-19 was also discussed. Shri R.N. Misra, President, ISEG released the Second Circular of EGCON-2017.
4. An International Conference "Engineering Geological Solutions for Sustainable Development" also called "EGCON-2017" was organized by ISEG on 7<sup>th</sup> & 8<sup>th</sup> October 2017 at Eros Hotel, New Delhi. Shri Ajay Bhalla, Secretary, Ministry of Power, Govt. of India inaugurated the conference. The conference was attended by more than 150 delegates from various Govt. organizations, PSU's, private companies and consultants. More than 60 abstract were received. Twelve Keynote lectures were delivered by eminent professionals and about 35 technical papers were presented during the two days conference. Golden Jubilee Volume of the journal was also released.

### MESSAGE FROM THE PRESIDENT

(Continued From Page 1)

This being last newsletter of present Council, I want to thank everybody and wish all the best to all of you. Let us promise that we shall work hard to take our society to the commanding heights.

With sincere regards



**(Ramesh Narain Misra)**  
President, ISEG

### MESSAGE FROM SECRETARY

(Continued From Page 1)

cant role in site selection. Still there are instances coming to light that major engineering projects in infrastructure sector or in hydropower have suffered because the decision makers have failed to strike the correct balance between engineering advantages and geological advice. And when it has been consciously decided to tackle poor geological conditions for a better engineering layout here no use of sniveling over spilt milk. It is also high time we appreciate that favorable geology in large engineering structures is also an engineering advantage because in the final analysis it results in timely completion of projects and cost cutting. Having said that let me also point out that even adverse geology can also be tackled if adequate measures are specified and time schedules are kept for the same.

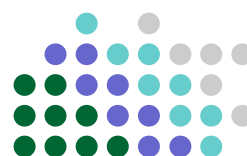
Thus the importance of multi disciplinary approach in site selection by seasoned professionals is a must where experience simply cannot be replaced by only enthusiasm. In site selection, unless you have deep and varied knowledge of the subject, perspicacity of relating engineering structures with topography, geomorphology, river characteristics for irrigation and power schemes, structural conditions and lithology success will not come.

*There is a popular saying that "half knowledge is dangerous" but I would like to add "half knowledge is disastrous as far as engineering geology is concerned".*

Special thanks are due to my Joint Secretaries for their support, particularly Sh. A. Chakraborty. I'm also indebted to Editor, who has really worked tirelessly to bring out publications of the Society as well as Souvenir and Proceedings of International Conference held in October 2017 in time maintaining highest standards.

Thus far it has been a wonderful journey with ISEG. As I say goodbye to you all, I will relish my association with this fabulous organization. I have enjoyed every moment of my service to ISEG which brought me in contact with wonderful people who also became my best friends.

Thanks and regards




**(Imran Sayeed)**  
Secretary, ISEG



## EDITORIAL

Dear members,

To create something new one has to give up the old so every new creation comes with a bit of heartbreak!!

As I pen down the editorial for the last issue of ISEG NEWS under present Executive Council, reminiscence of past two years flash through my mind. This council had a very eventful and challenging term and I hope all life members shall be feeling contended by our performance and service rendered to the Society. With the blessings and encouragement of our honorable President and guidance of Secretary, ISEG, the Editorial team had tried its best to give supporting hand to the Executive Council in all of their endeavors. We had put grave efforts in bringing out various ISEG publications including Journal of Engineering Geology and ISEG News un-interruptedly.

The Golden Jubilee Volume of the Journal of Engineering Geology and Abstract cum Souvenir Volume published during EGCON-2017 has been appreciated by one and all. International quality brochures & handouts were published for the International Conference and the GOP-2017.

Timely uploading of all circulars and brochures on ISEG websites have been the priority of the editorial team. Keeping in pace with the latest technology, exclusive ISEG pages and groups have been launched on social media sites such as Facebook and LinkedIn for interacting with the members in more effective manner.

**The only way to escape the corruptible effect of praise is to go on working.**

—: Albert Einstein

I'm extremely thankful to all the senior members of the Executive Council for their guidance and support. My deepest gratitude to the Joint Editor for constant help and assistance.

This issue in itself is indispensable as it carries elaborate reports on two major events which ISEG organized this year very successfully viz., GOP-2017 and EGCON-2017 along with the photographs. An interesting technical article on the deepest cut-off wall being executed at Polavaram Multipurpose Project is also published. I'm thankful to Sh. B.D. Patni for his contribution at a very short notice. This issue also carries a biography on Hans Cloos affectionately known as "Founder of Geomechanics" along with an interesting short article by Sh. Saikat Pal in the end. I hope the readers will find this issue of ISEG News informative as well as captivating.

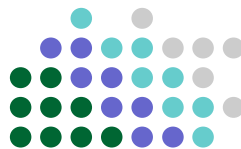
As the present council takes its coat off, I feel really indebted to all members of the Society and Executive Council for appreciating our efforts. Working as Joint Editor in previous Council and then as Editor of the Society in present Council has been a great learning experience. It has been a matter of honor and privilege to wear the shoes of past editors who have been great luminaries. I had tried my best to sustain the prestige of ISEG publications and sincerely wish that in future also, the ISEG publications and websites will attain greatest admiration and praise.

I'll like to end with a humble thought:

*Weeds are flowers too, if you get to know them...*

All the best!

Regards



**Rahul Khanna**  
Editor, ISEG



## ISEG MEMBERSHIP

- Admission fee (one time)  
New Members : Rs. 1000/-
  - Institutional/Associate Membership (Annual) : Rs. 2000/-
  - Individual Membership
    - (i) Annual Membership : Rs. 500/-
    - (ii) Life Membership
- For age < 35 years : Rs. 5000/-  
For age 35-50 years : Rs. 4000/-  
For age > 50 years : Rs. 3000/-

Membership forms available at [www.isegindia.org](http://www.isegindia.org)

## IAEG MEMBERSHIP

Indian Society of Engineering Geology (ISEG) is affiliated to International Association of Engineering Geology and the Environment (IAEG). Membership for IAEG is annual. Any ISEG Member, who wishes to join IAEG with bulletin, may pay the required fee 29 Euros and without bulletin 4 Euros.

In order to become IAEG Member, ISEG Members may pay the membership fee in ISEG Bank Account through online transfer and fill the Registration form available on ISEG website [www.isegindia.org](http://www.isegindia.org) indicating payment details and mail to Secretary. Bank details are given below:

**Name of the Bank:** UCO Bank, GSI Branch, Aliganj, Lucknow  
**Name of account:** 'INDIAN.SOC.OF.ENG.'  
**Account Number:** 90330200000045  
**IFSC Code No. :** UCBA0002024

## CONGRATULATIONS

## AWARD FOR BEST TECHNICAL TALK AT IAEG YOUNG ENGINEERING GEOLOGIST EVENT HELD IN KATHMANDU-NEPAL

Shri Mainak Ghosh Roy, Deputy Manager, NHPC has brought laurels to ISEG by winning Award for Best Technical Talk jointly with participant from New Zealand at Young Engineering Geologist Event on 27<sup>th</sup> November 2017 held during 11<sup>th</sup> Asian Regional Conference of IAEG in Kathmandu, Nepal.

Complements also to ISEG- the India National Group of IAEG for sponsoring Shri Mainak Ghosh for the above event after selecting his abstract from a number of applicants.

## ISEG ELECTION (FOR THE TERM 2018-2019)

### KEY DATES

- 30<sup>th</sup> November, 2017** : Last date for receiving nominations  
**8<sup>th</sup> December, 2017** : Last date for withdrawal of nominations, if any  
**9<sup>th</sup> December, 2017** : Scrutiny and acceptance of nominations and Declaration of nominations (for various posts) received (to be uploaded in ISEG website)  
**11<sup>th</sup> December, 2017** : Issue of Voting/Ballot papers  
**27<sup>th</sup> December, 2017** : Last date for receiving duly filled in voting slips/papers  
**30<sup>th</sup> December, 2017** : Date of election (if required) & Counting and declaration of election results  
**1<sup>st</sup> January, 2018** : Date of New Body takes Charge



## ISEG ORGANISES GEOTECHNICAL ORIENTATION PROGRAMME (GOP)- 2017 AT FARIDABAD

**N. K. MATHUR**

Ex General Manager, NHPC Ltd  
Course Coordinator, GOP-2017



Photograph 1 & 2: Shri R.N. Misra, President ISEG lightening lamp and welcoming all participants during the Inauguration function of GOP-2017

Photograph 3 : Shri R.N. Misra, President ISEG releasing April 2017 issue of ISEG News

ISEG Delhi NCR Chapter under the aegis of ISEG has successfully conducted the annual Geotechnical Orientation Program (GOP-2017) on 15<sup>th</sup> & 16<sup>th</sup> July, 2017 at Hotel Vibe, Lalit, Mathura Road, Faridabad. The program was specially designed for the young professionals engaged in various Civil Engineering, Mining and other Infrastructure development projects. The response to the Programme was overwhelming, in all 22 participants from 07 organizations viz. NHPC Ltd., SJVNL, UJVNL, Northern Railways and private consultants viz., Geo consult , Sai GR Impex etc. attended the programme. The participants were from vivid professional background such as Geology, Geotechnical Engineering, Civil Engineering and Earthquake Engineering. The registration kit given to the participants included a book on Engineering in Rocks for Slopes, Foundations and Tunnels by T. Ramamurthy along with study materials, a field diary and basic geometrical stationary items necessary for field work in a back pack with logo of ISEG printed at top.

Geotechnical Orientation Program (GOP-2017) was inaugurated by Shri. R.N. Misra, President ISEG & CMD SJVNL accompanied by Prof. K.S. Rao, IIT-Delhi, Shri. S. R. Roy, Executive Director NHPC and Shri. N. K. Mathur, Convener, ISEG Delhi NCR Chapter. President, ISEG also released April 2017 issue of ISEG News in presence of other dignitaries during the inauguration program.

The two days Orientation Program contained 08 interactive lecture sessions and a field session. The lecture delivered by various speakers covered major aspects of engineering geology with several case studies on tunneling, construction of road and railway bridges, dam construction, landslides, slope stability, rock mechanics, geodynamics, remote sensing etc. The first lecture was delivered by Prof. K.S. Rao wherein, starting from origin of Earth via plate tectonics and basics of engineering geology he voyaged the participants up to world's highest railway bridge under construction at the Udhampur- Srinagar-Baramulla rail link project. Further, the lecture series continued with a brief insight

to "Geodynamics of Himalaya" by Sh. Pradeep Sing, Director GSI then "Engineering Geology in Disaster Mitigation/Management" by Dr. V. K. Sharma Dy. DG, GSI (Retd.) followed by lecture on "Laboratory Testing of Intact Rocks" delivered by Dr. Hasan Abdullah, Director-CSMRS and "Investigation/Testing of naturally occurring construction materials" by Shri. G. K. Vij, Scientist-D, CSMRS.

The Second day of GOP started with the field work session within the outcrops of Aravali hills near Surajkund under the able guidance of Shri. N. K. Mathur, Ex-General Manager (Geotech), NHPC who was assisted by Shri. Vivek Sharma, DM (Geology), Shri. Mainak Roy Ghosh, DM (Geology) and Dr. Pranay Vikram Singh, AM (Geology) from NHPC. During the field session, participants were introduced to the basic concepts of geological mapping, process of geotechnical data collection for rock mass characterization and estimation of RMR values. Field session was followed by classroom session. The first lecture of Second day was delivered by Dr. Rajbal Singh, Joint Director (Retd.) CSMRS on "In situ Testing of Rock mass and usefulness". It was followed by lecture on "Application of Geophysics in Engineering Projects" by Shri. S. L. Kapil, General Manager (Geotech), NHPC. Third lecture of the day was delivered by Shri. Rahul Khanna, Manager (Geology), NHPC on "Application of Geotechnical Software in Engineering Geological Studies". The last lecture on "Remote Sensing Studies in Engineering Geology" was delivered by Sh. Anish Mohan, Assistant Manager (Geology), NHPC. Even though the classroom session covered highly diverse topics but due to interactive nature of speakers, the participants were immensely involved and appreciated the proactive approach of the speakers.

The last session involved hands-on exercises on geological maps, sections and stereo-net. This session was highly interactive where participants could freely discuss their problems with the faculty members.

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Photographs 3 &amp; 4 : GOP faculty members interacting with participants during field session



Photographs 5 &amp; 6 : Participants during hands-on session and class room session of GOP-2017



Photographs 7 &amp; 8 : Valedictory Session of GOP-2017



Photographs 9 &amp; 10 : Memento distribution to participants during Valedictory Session



The Geotechnical Orientation Program (GOP-2017) concluded with a well organized valedictory program. Shri. Imran Sayeed, General Manager (Geotech), NHPC and Sh. Yogendra Deva, IAEG-Vice President for Asia addressed the participants with their motivating words and distributed the Memento to all the participants. The Vote of thanks was given by one of the participants from Northern Railway where he expressed his gratitude towards ISEG for conducting such a useful program and informed that keeping in view the present industry requirements, the programme was designed in such a way that the participants can have a direct interaction with the experienced professionals of the field and this will help them in handling their current job responsibilities in a better manner and will also guide them for shaping up their professional career. In the end, Shri N.K. Mathur, the course coordinator of GOP 2017 thanked all faculty members, participants and distinguished guests from ISEG and IAEG. The successful conduction of GOP-2017 has been another milestone in the cherished history of the Society.



Row-1 (Sitting from Left) : Sh. Rahul Khanna, Sh. Arindom Chakraborty, Sh. S. R. Roy, Sh. R. N. Misra, Prof. K. S. Roy, Sh. N. K. Mathur, Sh. R. C. Sharma  
 Row-2 (Standing from Left): Sh. Bhanu Sharma, Sh. Sushil Kr. Maurya, Sh. Vivek Sharma, Sh. H. Debduddutta Singh, Sh. Tarun Singh, Dr. Shakti Prakash, Ms. Puja Kumari, Ms. Sashi Prasad, Ms. Shweta, Sh. Alok Kumar, Sh. A.B. Joshi, Sh. D. Rajababu, Sh. Bhavuk Sharma, Sh. Sandeep Tanvar, Dr. P. V. Singh  
 Row-3 (Standing from Left): Sh. Satyendra Kumar, Sh. Laxman Singh, Sh. Sumeet Thakur, Sh. Ravi Tej Pilli, Sh. R.K. Chaudhary, Sh. Saurabh Kumar, Sh. Anuj Kumar



## COMPLETE LIST OF ISEG MEMBERS (UPDATED OCTOBER 2017)

*INCLUDING DEASED\*\*, RESIGNED ^ AND THOSE MEMBERS WHOSE MEMBERSHIP HAS EXPIRED\**

Membership No	Membership Name	Station	Membership No	Membership Name	Station	Membership No	Membership Name	Station	Membership No	Membership Name	Station
LM 1	Alok, B.K.	Dehradun	M 101	Mohanti, A.K.*		LM 201	Deva Yogendra	Noida	M 301	Moghri, A.*	
LM 2	Agarwal, Y.K.		M 102	Mokashi, S.L.*		LM 202	Satyanarayan, G.C.		LM 302	Agarwal V.K.	Lucknow
LM 3	Aich, B.N.	Kolkata	M 103	Mukhopadhyay, M.S.	Kolkata	LM 203	Rawat, J.S.	Dehradun	M 303	Saxena, K.R.*	
LM 4	Andotra, B.S.		LM 104	Mukhopadhyay, U.M.		M 204	Lokras, K.V.*		LM 304	Hemmaday, A.K.R.	Mumbai
LM 5	Ashraf, Zamir	Lucknow	LM 105	Mullick, B.B.		LM 205	Mehrotra A.	Lucknow	LM 305	Narsimham, C.V.L.	
M 6	Bahadur, A.K.*		LM 106	Murti, N.G.K.**		LM 206	Chepe, A.B.	Nagpur	LM 306	Devatia, Miss. E.	New Delhi
LM 7	Balasundaram, M.S.**		M 107	Nanda, Kailashnath*		LM 207	Ahmed, M.J.	Bhubaneshwar	LM 307	Agarwal, K.K.	Jaipur
LM 8	Bandopadhyay, M.**		M 108	Naruvkar, P.H.*		LM 208	Patil, A.R.		LM 308	Joshi, V.K.	Nainital
LM 9	Bandyopadhyay, M.R.**		LM 109	Natu, S.V.	Mumbai	M 209	Sen, Aloke*		M 309	Jhala, H.P.*	
LM 10	Banerjee, K.	Kolkata	LM 110	Nautiyal, S.P.**		LM 210	Singh, Pratap**		LM 310	Nayak, A.K.	
LM 11	Bansode, R.B.**		LM 111	Obbron, Dr. L.E.		LM 211	Gupta, Dr. U.P.	Dehradun	LM 311	Sinha, Dr. A.K.	Lucknow
LM 12	Basu, A.R.	Kolkata	LM 112	Pande, Prabhas	Lucknow	LM 212	Dhar, Y.R.	Dhanbad	M 312	Prakash, N.D.*	
LM 13	Kumar, Asim	Kolkata	LM 113	Pant G.	Lucknow	LM 213	Prakash, Indra	Gandhinagar	M 313	Subramaniam, Dr. S.*	
LM 14	Basu, Sanat Kumar	Kolkata	LM 114	Parthasarathy, B.	Bangalore	LM 214	Rao, J.S.R. Mohan	Hyderabad	LM 314	Bhattacharya, A.K.	Kolkata
LM 15	Basu Chowdhary, S.		LM 115	Patil, B.B.		LM 215	Anabalan, R.	Roorkee	LM 315	VACANT	
LM 16	Bery, M.N.	New Delhi	M 116	Pattanaik, K.M.*		M 216	Basauraj, A.*		LM 316	Jha, V.K.	
M 17	Bhagat, R.K.*		LM 117	Phukan, S.N.		LM 217	Basavraj, R.	Ganeshgudi	M 317	Shah, M.M.*	
M 18	Bhandari, R.C.*	Noida	LM 118	Pradhan, S.R.	Nagpur	LM 218	Devraj, Char		LM 318	VACANT	
M 19	Bhandari, Dr R.K.*		M 119	Prakash, Munendra*		M 219	Ramaswamy, V.S.*		M 319	Rao, N. Subba*	
M 20	Bhatia, S.K.*	Pune	LM 120	Prakash, Dr. Samsheer		LM 220	Ketkar, D.J.	Mumbai	AM 320	PRO, NHPC	Faridabad
LM 21	Bhat, B.T.		M 121	Rahman, M.A.*		LM 221	Chikodi, D.G.		LM 321	Patel, Dr. P.P.	Vadodara
LM 22	Biswas, S.R.N.		M 122	Rai, R.A.*		M 222	Valdiya, K.S.*		IM 322	GSJ, Calcutta*	
LM 23	Borwankar, A.N.	Bhopal	LM 123	Raichur, Anand Ram-chandra		LM 223	Singh, Santosh Kumar		LM 323	Ametha, Dr. S.S.	Chittorgarh
LM 24	Chakravarty, D.C.*		LM 124	Rajagopalan, G.	Chennai	LM 224	Gupta, Sudhindra	Kolkata	LM 324	Avasthy, R.K.	Lucknow
LM 25	Chakraborty, R.B.	Kolkata	LM 125	Raju, K.C.C.	Hyderabad	LM 225	Didwal, Dr.R.S.	Jammu Tawi	LM 325	Sharma, Kumud	Lucknow
LM 26	Chandra Ramesh		LM 126	Rao, Dr. R.V.		LM 226	Singh, Alam	Jaipur	LM 326	Kumar, L.V. ^	
LM 27	Chatterjee, Dr. Barin	Kolkata	LM 127	Ramachandran, B.**	Chennai	M 227	Phukan, C.N.*		LM 327	Gupta, I.C.	
LM 28	Char, A.K.		LM 128	Ranade, S.G.		LM 228	Raha, L.C.		LM 328	Punj, S.K.	New Delhi
LM 29	Chatterjee, B.		LM 129	Ranganathswamy, A.P.	Hyderabad	LM 229	Parial, B.N.		LM 329	Jatana, B.L.	Agra
LM 30	Chatterji, G.C.**		LM 130	Rao, G. Ram Mohan		LM 230	Kaistha, G.K.	New Delhi	LM 330	Mukherjee, Dipak	New Delhi
LM 31	Chatterjee, P.K.	Kolkata	LM 131	Rai, M. Gopal		LM 231	Swamy, M.M.	Bangalore	LM 331	Krishan, Hari	
LM 32	Chaturvedi S.N.	Lucknow	M 132	Rao, N.S.*		LM 232	Goswami, P.C.		LM 332	Khan, P.A.	
LM 33	Chhibber, I.B.	Nagpur	LM 133	Rao, K.R. Narayan		LM 233	Sharma, V.S.		M 333	Bamzai, J.L.*	Jammu
LM 34	M.A. Chitale, M.A.		LM 134	Roy, B.C.**		LM 234	Kumar, Vinai	New Delhi	M 334	Bali, J.S.*	
LM 35	Chopra, B.R.		M 135	Sah, Radheyshyam*		M 235	Singh, R.P.*		M 335	Acharya, J.P.*	
M 36	Chopra, C.R.*		LM 136	Sahasrabudhe, Dr. Y.S.	Pune	M 236	Lal, A.K.*		LM 336	Dhaundial, D.P.	Dehradun
LM 37	Chopra, M.R.**		LM 137	Sain, Dr. Kanwar		M 237	Iyer, R.V.*		LM 337	Sehgal, M.N.	
LM 38	Choubey, V.D.	Noida	LM 138	Sanganeria, J.S.	Jaipur	LM 238	Chauhan R.P.S	Lucknow	LM 338	Pancholi, D.N.	Vadodara
LM 39	Choudhary, A.K.	Kolkata	M 139	Sarangi, B.B.*		LM 239	Srivastava MS	Lucknow	LM 339	Parikh, B.C.	Vadodara
LM 40	Chowdhary, A.K.**		LM 140	Sensharma, S.B.	Kolkata	LM 240	Anand, S.K.**	Lucknow	LM 340	Dhawan, Gopal	New Delhi
LM 41	Colback, P.S.B.		LM 141	Seth, N.N. ^		M 241	Behra, P.N.*		AM 341	AFCONS*	
LM 42	Cook, Dr. J.B.		LM 142	Shah, K.N.		LM 242	Dayal H.M.	Lucknow	IM 342	MERI*	
LM 43	Das, A.L.**		LM 143	Shah, S.D.	Mumbai	M 243	Purushothama, Gonella*		LM 343	Hegde, U.V.	New Delhi
M 44	Das, M.L.*		LM 144	Sharda, Dr.Y.P.	New Delhi	LM 244	Eswaraiah, H.V.		LM 344	Shukla, U.Z.	Gandhi Nagar
LM 45	Gupta, Praful Kumar Das		M 145	Sharma, M.C.*		M 245	Sharma, S.P.*		LM 345	Soni, P.H.	Vadodara
M 46	Datye, K.R.*		LM 146	Sharma, Dr. V.M.	New Delhi	M 246	Gupta, N.K.*		LM 346	Mahendra, A.R.	
LM 47	Desai, S.D.		LM 147	Shenoi, R.S.		M 247	Bhattacharya, B.B.*		LM 347	Bhutani, M.L.	
M 48	Deuskar, V.R.*		LM 148	Shome S.K.	Lucknow	M 248	Laxamanan, T.V.*		LM 348	Raju, V.S.N.	
LM 49	Dey, A.K.		LM 149	Sinha, Dr. B.N.	Bangalore	LM 249	Agarwal, A.N.**		LM 349	Nathani, J.K.	
M 50	Day, S.B.*		M 150	Sinha, G.S.*		LM 250	Upadhyay, V.S.		LM 350	Gupta, D.B.	Muzaffar Nagar
LM 51	Dhanota, A.S.		M 151	Sinha, P.N.*		M 251	Balasubranabuanm K.*		M 351	Srivastava, A.K.*	
LM 52	Dixit R.S.	Lucknow	M 152	Sinha, R.G.*		M 252	Manjunatha, H.*		M 352	Chabra, S.*	
M 53	Dubey, R.K.*		LM 153	VACANT		M 253	Krishnan, K.*		LM 353	Singh Dr. G.	Chandigarh
LM 54	Datta, B.	Guwahati	LM 154	Sinha Roy, P.T.	Kolkata	LM 254	Nag, R.B.	Jaipur	LM 354	Bhambrl, G.C.	Chandigarh
M 55	Datta, N.P.*		LM 155	Sinha Roy, R.N.	Kolkata	LM 255	Khar, P.N.		LM 355	Reddy, S.R.M.	
M 56	Engineer, M.N.*		LM 156	Singh, Chandrama		LM 256	Bhat, M.L.	Faridabad	LM 356	Choudhary, R.N.	Jodhpur
LM 57	Gangopadhyay, Dr. Suvinoy	Lucknow	M 157	Singh, J.P.*		M 257	Sreerangaraju, L.V.*		LM 357	Patel, V.P.	
LM 58	Ghosh Dr. D.K.		LM 158	Singh R.P.	Lucknow	M 258	Nagraj, M.S.*		M 358	Patel, A.R.*	
LM 59	Ghosh, S.K.		LM 159	Singh V.P.	Lucknow	M 259	Shreedhara, K.T.*		LM 359	Joshi, D.K.	Faridabad
M 60	Godboli, R.V.*		LM 160	Sohoni, S.B.		M 260	Kalyanshetty, V.M.**		LM 360	Desai, V.R.	Bharuch
LM 61	Gupta, D.N.		LM 161	Sondhi S.N.	Lucknow	M 261	Jayaxaju, S.*		LM 361	Patel, B.B.	
M 62	Gupta, Ram Nivas*		LM 162	Sreenivasiah, P.V.		LM 262	Mallikarjuna, P.R.	Bangalore	LM 362	Patel, V.B.	Vadodara
M 63	Gupta, S.D.*		LM 163	Srinivasan, P.B.	Chennai	M 263	Balagurumurthy, S.T.*		LM 363	Patel, D.T.	
LM 64	Gupta, S.K.	Lucknow	M 164	Srinivasan, V.*		LM 264	Shukla S.D.	Lucknow	M 364	Joshi, Y.S.*	
LM 65	Gupte, R.B.	Pune	LM 165	Srivastava Arun Kr.**	Lucknow	M 265	Chandra, Prakash*		LM 365	Joshi, C.P.	Vadodara
M 66	Gulati, Satindra (Aimil)*		LM 166	Srivastava J.P.	Lucknow	M 266	Madhvan, K.		LM 366	Lattoo, P.S.	Vadodara
LM 67	Doscher, Dr. Hans		LM 167	Srivastava, K.N.**		LM 267	Mittal, B.P.		LM 367	Patel, J.R.	
LM 68	Harkauli, A.N.	New Delhi	LM 168	Srivastava L.S.**		LM 268	Kulkarni, P.S.		LM 368	Parikh, M.M.	Vadodara
LM 69	Hazra, P.C.**		LM 169	Srivastava V.B.	Lucknow	LM 269	Guru Rao, S.N.	Bangalore	LM 369	Bulsara, D.H.	Valsad (Gujrat)
M 70	Hebl, C.S.		M 170	Subramanyam, S.N.*		LM 270	Agarwal, L.N.		LM 370	Bhatt, R.M.	Vadodara
LM 71	Hukku, B.M.	Lucknow	LM 171	Subrahmanyam, V.		LM 271	Rajvanshi, P.S.	Dehradun	LM 371	Bansode, U.V.	Vadodara
LM 72	Jalote P.M.	Lucknow	LM 172	Sundaram, R.K.		LM 272	Mahajan, J.L.		LM 372	Joshi, A.N.	Vadodara
LM 73	Jalote S.P.	Lucknow	M 173	Swarup, Ajay*		LM 273	Senapaty, A.M.		LM 373	Krishnani, R.P.	Vadodara
M 74	Jangle, J.T.*		LM 174	Thomas, K.C.	Trivendram	M 274	Natrajan, P.*		LM 374	Pophali, P.M.	Vadodara
LM 75	Joshi, N.G.		LM 175	Tikku, A.K.	Noida	LM 275	Basauraj, B.M.**		M 375	Patel, K.G.*	
LM 76	Judd, Dr. William		LM 176	VACANT		LM 276	Virdi, N.S.		M 376	Vyas, D.V.*	
M 77	Kant, B.*		LM 177	Tewary, G.P.	Varanasi	M 277	Radhakrishnan, K.G.*		LM 377	Desai, N.D.	
M 78	Kar, R.N.*		M 178	Tiwari, R.L.*		LM 278	Bhatia, S.K.	Pune	LM 378	Ahluwalia, P.P.	Ahmedabad
LM 79	Kasliwal, V.K.	Jaipur	M 179	Tripathi, B.N.*		LM 279	Goswami, S.C.	Dibrugarh	LM 379	Mahendra Kumar, C.	Vadodara
M 80	Kaul, P.N.*		LM 180	Tripathi, Jagannath		LM 280	Relan. A.K.	Faridabad			
M 81	Krishnamurthy, J.G.*		LM 181	Tripathi, S.C.	Bhubaneshwar	LM 281	Seshagiri, D.N.	Chennai	LM 380	Misri, B.L.	
LM 82	Krishnamurthy, K.S.	Bangalore	LM 182	Varadan, V.K.S.**		M 282	Raju, D.V.*		LM 381	Vaidya, Piyush H.	Vadodara
LM 83	Krishnaswamy, V.S.		M 183	Vasudeva, S.N.*		LM 283	Chari, Dr. K.V.R.**		LM 382	Munshi, R.N.	Gandhi Nagar
LM 84	Kulkarni, V.N.**		LM 184	Venkataramaiah, P.		LM 284	Parathasarathy, K**		M 383	Oza, H.S.*	
M 85	Kumar, Arun*		LM 185	Venkataraman, A.R.		LM 285	Mazumdar, N.		LM 384	Prasad, S.N.	Patna
LM 86	Kumar, Surendra	Dharamshala	LM 186	Verma, Harish Chandra		M 286	Vishwanadham, A.*		M 385	Sinha, P.	
LM 87	Lovas, Dr. L.		LM 187	Verma, Dr. P.N.	Greater Noida	M 287	Kameshwar, D.R.*		M 386	Rajan, S.	
LM 88	Madhavan, M.N.	Patna	LM 188	Vyavaharkar, D.A.	Mumbai	LM 288	Murty, G.S.		M 387	Sinha, R.P.	
LM 89	Mahajani, H.V.	Bhopal	LM 189	West, W.D.**		LM 289	Rao, S.L.		LM 388	Desai, B.I.	
LM 90	Mahalik, N.K.	Bhubaneshwar	LM 190	Ali, Hamzah **		M 290	Kumarswamy, M.*		LM 389	Modhwadia, K.E.	Ahmedabad
LM 91	Maitra, B.		LM 191	Anand, D.B.	New Delhi	LM 291	Rao, G.S.M.	Pune	LM 390	Shah, M.F.	
LM 92	Mazumdar, A.K.		LM 192	Vaidyanath, L.N.	Bangalore	LM 292	Rama Rao, V.	Hyderabad	LM 391	Suthar, R.M.	
LM 93	Mane, P.M.**		LM 193	Niyogi, B.N.**		M 293	Dharmraj, A.*		LM 392	Pancholi, D.I.	Vadodara
LM 94	Mathew, Kurien**		LM 194	Malbarna, B.D.	Jammu	LM 294	Tiwari, M.	Lucknow	LM 393	Mistry, J.F.	Vadodara
M 95	Mathur, P.C.*		LM 195	Ray, Sukanta		LM 295	Subrahmanayam, P.**		LM 394	Singha, D.R.	Greater Noida
LM 96	Mathur, S.K.	New Delhi	LM 196	Srivastava K.K.	Lucknow	M 296	Paul, Chinnoy*	Kolkata	LM 395	Prasad, Har	Greater Noida
LM 97	Mehta, D.N.		LM 197	Narula, P.L.	Lucknow	M 297	Verma, D.K.*		LM 396	Gupta, R.K.	
LM 98	Mehta, P.N. **		LM 198	Varma R.S.**	Lucknow	LM 298	Shah, C.S.	Vadodara	LM 397	Sharma, M.L.	
LM 99	Misra, K.L.		LM 199	Parathasarathy, A.		IM 299	Director, CDO, M.P.*		LM 398	Kotai, R.L.	
M 100	Misra, V.N.*		LM 200	Kamble, D.T.**		LM 300	Mandwal N.K.	Lucknow	LM 399	Jindal, S.K.	
									LM 400	Rana, G.S.	

# COMPLETE LIST OF ISEG MEMBERS (UPDATED OCTOBER 2017)

INCLUDING DESEASED\*\*, RESIGNED ^ AND THOSE MEMBERS WHOSE MEMBERSHIP HAS EXPIRED\*

Membership No	Name	Station	Membership No	Name	Station	Membership No	Name	Station	Membership No	Name	Station
LM 401	Singh, A.P.	Greater Noida	LM 501	Singh, Harpal		M 601	Ravendra, Nath*		LM 701	Srivastava, B.S.**	
LM 402	Rajvanshi, U.S.		LM 502	Chandra, Dinesh		M 602	Wadhwa, R.S.		LM 702	Gupta H.	Lucknow
LM 403	Khanna, M.M.L.		LM 503	Agarwal, C.K.	New Delhi	LM 603	Raina, B.N.	Agra	M 703	Nayar, K.M.*	
LM 404	Aggarwala, A.K.		LM 504	Arora, Brij Mohan	Lucknow	LM 604	Venkatappa, Rao. G.*		M 704	Munerudrappa, N.*	
LM 405	Thakkar, A.K.	Vadodara	LM 505	Arova, J.S.		LM 605	Ramamurthy, T.	New Delhi	M 705	Parthsarthy, N.*	
LM 406	Chaudhary, S.G.		LM 506	Agarwal, H.G.		LM 606	Gokhle, V.L.**		M 706	Bose, R.N.*	
LM 407	Patel, S.I.		M 507	Gupta, R.M.*		LM 607	Diwanji, S.N.	Nasik	M 707	Kakoty, I.S.*	
LM 408	Patel, N.I.		LM 508	Madan, S.K.		LM 608	Seshgiri, Rao. K.*		LM 708	Bhattacharya, A.	
M 409	Joshi, M.R.	New Delhi	LM 509	Giri, S.C.	Lucknow	LM 609	Bhatnagar, Shashank	Jammu Tawi	M 709	Phadke, N.K.*	
M 410	Desai, K.D.		LM 510	Pujji, J.S.		LM 610	Dalela I.K.	Lucknow	LM 710	Sharma, H.H.**	
411	VACANT		LM 511	Gupta, J.C.		M 611	Sarkar, V.K.*		M 711	Sangewar, C.V.*	
			LM 512	Gandhi, P	Kolkata	LM 612	Nagrajan, R.	Mumbai	M 712	Basu, D.L.*	
LM 412	Patel, Nalin M.	Vadodara	LM 513	Raina, Chamanlal		M 613	Singh, A.*		M 713	Chattopadhyay, B.*	
M 413	Tamhankar, A.D.		LM 514	DasfyorM Sujit		M 614	Singh, H.*		M 714	Ravindran, K.V.*	
M 414	Desai, Miss. J.K.		LM 515	Sharma. L.K.		LM 615	Sharma, L.D.		M 715	Biswas, R.K.*	
M 415	Mehta, Smt. D.Y.		LM 516	Rathi, A.K.		LM 616	Srivastava Ashwini K	Lucknow	M 716	Singh, K.N.*	
M 416	Shah, P.N.	Vadodara	517	VACANT		M 617	Garg, J.M.*		M 717	Sogari, K.C.*	
LM 417	Joshi, H.M.					M 618	Bhargava, S.K.*		LM 718	Shenolikar, A.K.	
M 418	Chauhan, M.F.		LM 518	Monde, O.D.	New Delhi	LM 619	Prasad, V.		M 719	Malhotra, A.N.*	
M 419	Tapilavala, V.C.		LM 519	Jain, K.K.		LM 620	Waza, J.L.**		M 720	Mukherjee, N.K.*	
LM 420	Patel, A.C.	Vadodara	IM 520	Research Officer*	Vadodara	M 621	Agarwal, B.M.*		M 721	Srivastava, V.C.*	
LM 421	Patel, B.J.		M 521	Sharma, D.K.*		M 622	Kumar, Rishi*		LM 722	Bagchi, A.	Kolkata
LM 422	Patel, A.P.		M 522	Dava Sonam*		M 623	Singh, T.*		LM 723	Agarwal, P.D.	
LM 423	Patel, N.M.		M 523	Vedanti, U.D.*		M 624	Srivastava, H.K.*		LM 724	Singh, V.	New Delhi
LM 424	Patel, B.P.	Gandhi Nagar	M 524	Patel, Bharat*		M 625	Chandra, Mahesh*		M 725	Roy, A.K.*	
LM 425	Patel, Y.L.		LM 525	Pathak, S.C.		LM 626	Roy Chowdhary, M.K.		M 726	Kumar, S.*	
LM 426	Soni, D.J.		IM 526	Geologist-I*		LM 627	Malpathak, Ganesh	Pune	M 727	Bajpai, S.*	
LM 427	Desai, J.T.		LM 527	Dhebar, N.I.		LM 628	Singh, Y.P.		M 728	Nath, S.K.*	
M 428	Patel, M.R.	Pune	LM 528	Govil, B.K.		M 629	Dungrakoti, B.D.*		M 729	Mathur, S.C.*	
M 429	Suthar, K.A.		LM 529	Guha, S.K.		M 630	Wadhwani, G.T.*		LM 730	Jaitley G.N.	Lucknow
LM 430	Patel, B.C.		LM 530	Patel, H.J.		M 631	Patel, G.D.*		M 731	Upadhyay, B.M.*	
M 431	Khatri, M.P.		LM 531	Negi, R.S.	Chandigarh	M 632	Gokhale, K.V.G.K.*		M 732	Kumar, S.K.*	
M 432	Saiyad, A.M.	Chandigarh	LM 532	Khorana, T.R.		M 633	Soni, S.K.*		LM 733	Mangla, Bhoj Prakash	Ghaziabad
M 433	Patel, B.R.		LM 533	Yadav, S.K.		LM 634	Rau, A.N.		IM 734	KIRI, S.E.*	
M 434	Shridhaxani, A.		LM 534	Dawar, Y.N.		LM 635	Iyengar, M.V.S.	Bangalore	M 735	Surya, V.J.*	
M 435	Shuka, D.C.		LM 535	Khorana, R.K.	Faridabad	M 636	Chakraborty, K.N.*		LM 736	Agarwal, Padam, P.	
M 436	Singh, L.P.	Faridabad	M 536	Yupandran, R.*		M 637	Chada, B.K.*		LM 737	Srivastava, K.L.	Jodhpur
M 437	Singh, K.M.		LM 537	Kumar, S.V.	Lucknow	M 638	Goela, R.K.*		LM 738	Singh, K.P.	
M 438	Mathur, N.K.		M 538	Singh, R.B.*		M 639	Narain, K.*		M 739	Rai, Awadh Bihari*	
M 439	Sharma, R.K.		LM 539	Sampath, P.	Bhopal	M 640	Tiwari, K.C.*		LM 740	Hayat, Abdul	Patna
M 440	Singh, G.S.	Bhopal	LM 540	Chandra, M.S.	Mysore	M 641	Gupta, B.K.*		IM 741	GSI, C.R.*	
LM 441	Jambusaria, Dr. B.B.		M 541	Dixit, J.P.*		M 642	Gupta, M.L.*		LM 742	Goyal, D.P.	Ghaziabad
LM 442	Patel, Nalin, H.		LM 542	Jain, B.R.	Ghaziabad	M 643	Mehta, P.*		M 743	Rayal, Y.B.*	
LM 443	Patel, P.M.		LM 543	Jahangirdar, M.L.	Ganeshgudi	LM 644	Chalapathi Rao, R.V.	Hyderabad	LM 744	Agarwal, R.C.	
M 444	Virmani, R.G.	Ganeshgudi	LM 544	Sanwal, R.K.	Lucknow	M 645	Debnath, B.*		LM 745	Kadkade, D.G.	New Delhi
M 445	Shah, M.R.		LM 545	Srivastava, V.K.	Dhanbad	M 646	Upadhyay, R.K.*		M 746	Das, Arun*	
LM 446	Patel, D.N.		M 546	Lakshmikanthan, C.B.*		LM 647	Panda, P.K.		M 747	Hussain, Altaf*	
LM 447	Shirke, Dr. J.M.**		M 547	Poddar, A.K.*		LM 648	Barmen, G.		LM 748	Prakash, Gyan	Aligarh
M 448	Bhavsar, S.V.*	Bhopal	LM 548	Shah, K.B.		LM 649	Rai, S.M.		M 749	Gupta, Shrikrishna*	
LM 449	Srivastava, V.N.**		LM 549	Gupta, B.N.	Hardoi	M 650	Madhav, Rao, M.R.*		LM 750	Mishra, V.N.	
M 450	Patel, P.H.*		M 550	Gupta, R.L.*		M 651	Srivastava, V.C.*		LM 751	Keshavayya, P.	
M 451	Desai, A.K.K.*		LM 551	Sinha, Purnendu	Lucknow	M 652	Prabhakar, Rao, P.*		LM 752	Kumar, Harsh	
452	VACANT	Lucknow	LM 552	Papalal, S.		M 653	Majumdar, S.K.*		M 753	Sinha, Amalendu*	
LM 453	Sangamnerkar, C.D.R.		M 553	Tiwari, R.P.*		M 654	Shukla, R.*		IM 754	Geologist(I) Narmada^	
M 454	Mody, D.C.*		M 554	Veerbhadrappa, S.M.		M 655	Srivastava, A.K.*		LM 755	Tahilyani D.R.A.	Lucknow
455	VACANT		M 555	Selvan, T.A.*		M 656	Mishra, S.P.*		LM 756	Singh, Ranivir	
LM 456	Vartak, R.G.	Lucknow	M 556	Joshi, A.*		M 657	Badri, Narain, S.*		LM 757	Arora, P.K.	
M 457	Khan, M.G.*		M 557	Rama Rao, A.P.*		M 658	Sharma, R.P.*		LM 758	Sharma, V.K.	Lucknow
LM 458	Sharma, D.P.		LM 558	Solanki, J.C.**		M 659	Rao, G.R.M.*		M 759	Sinha, Aalok Kumar*	
M 459	Singh, Bagh*		M 559	Godre, R.K.*		LM 660	Agarwal, N.K.	Lucknow	LM 760	Siddique, Dr. M.A.	
M 460	Singh, Prakash*	Lucknow	M 560	Dass, A.*		M 661	Hazaria, P.C. **		M 761	Naganian Arshad, Zamil* Saud	
M 461	Srivastava, A.K.*		M 561	Agarwal, R.C.*		M 662	Hunday, A.^				
M 462	Mittal, V.K.*		M 562	Singh, R.P.*		LM 663	Kapoor, A.K.	Lucknow	M 762	Nair, Unnikrishnan*	
M 463	Chhabra, S.K.*		LM 563	Gupta, S.K.		LM 664	Raju, M.	Kolkata	LM 763	Srivastava, V.P.	Kanpur
M 464	Tayal, R.A.*	Roorkee	M 564	Basu, S.*		M 665	Barua, A.K.*		M 764	Thakur, B.N.*	
M 465	Agarwal, K.K.*		LM 565	Lavania, Dr. B.V.K.		M 666	Balachandran, V.*		M 765	Khirod, Parida,*	
M 466	Gupta, R.G.*		LM 566	Alam, J.M.**		M 667	Venktesh, V.*		M 766	Kukreja, R.K.*	
LM 467	Gupta, V.K.		LM 567	Ramaswamy, R.		M 668	Karimuddin, M.*		LM 767	Srivastava, L.P.	Patna
LM 468	Yadav, V.K.	New Delhi	LM 568	Singh, Narendra		M 669	Srivastava, Dinkar	Lucknow	M 768	Prasad, Buniyad*	
M 469	Sharma, S.K.*		LM 569	Dhawan, A.K.		M 670	Dua, K.J.S.*		M 769	Much, U.S.*	
M 470	Bansal. L.R.*		LM 570	Mathur, R.S.		LM 671	Garg, R.L.		M 770	Mehta, S.V.*	
LM 471	Nim, H.K.*		LM 571	Joshi, A.B.**		M 672	Mukhopadhyay, S.K.*		LM 771	Samsuddin, Dr. A.K.	Sindri
LM 472	Nanda, M.M.	Lucknow	M 572	Chakravarty, A.*		M 673	Singh, J.*		M 772	Singh, B.P.*	
M 473	Saxena, G.C.*		M 573	Singhal, H.S.S.*		M 674	Ramamurthy, S.*		M 773	Goel, A.K.*	
LM 474	Sharma, K.L.		M 574	Gupta, Dr. M.V.*		LM 675	Srivastava, S.C.	Lucknow	LM 774	Sood, N.K.	Gurgaon
M 475	Singhal, Om Kumar*		LM 575	Agarwal, P.N.	Roorkee	M 676	Srivastava, M.C.*		LM 775	Nunjundappa, G.	Kadra
M 476	Gupta, R.K.*	Lucknow	M 576	Kanungo, S.C.*		M 677	Chandok, G.J.*		M 776	Roy, Chandradip*	
M 477	Singh, Raghubir*		LM 577	Agarwal P.P.		M 678	Rajal, B.*		LM 777	Agarwal, L. Narayan	
LM 478	Kumar, Manindra Nath		LM 578	Deshpandi, G.R.		M 679	Arur, M.*		LM 778	Chatterjee, Tustibrata	Kolkata
M 479	Subhash*		M 579	Goyal, B.B.L.*		M 680	Subramanian, C.S.*		LM 779	Sharma, R.P.S.	Muzzafarpur
M 480	Saxena, S.M.*	Dehradun	M 580	Banerjee, O.*		M 681	Bhargava, D.N.*		M 780	Flora, G.S.*	
M 481	Goyal, T.K.*		M 581	Mallik, D.K.*		M 682	Tiagi, S.S.*		IM 781	Supdt. Engineer Pat.*	
M 482	Garg, D.S.*		LM 582	Jain, A.K.		LM 683	Puri, S.N.	Hyderabad	M 782	Charyalu, M.B.V.*	
M 483	Shah, A.G.*		LM 583	Singh, B.K.		LM 684	Awasthy, S.C.		M 783	Aziz, Anwar*	
M 484	Sharma, B.K.*	Lucknow	LM 584	Manhas G.S.		M 685	Verma, K.K.*		M 784	Pant, V.K.	
M 485	Sharma, K.P.*		LM 585	Murthy, Y.K.	New Delhi	M 686	Mehta, H.S.**		LM 785	Rawat, U.S.	Dehradun
M 486	Narayan, K.S.*		LM 586	Sahay, B.K.		M 687	Murthym G.S.S.N.*		M 786	Sachan, M.*	
M 487	Gupta, V.K.*		LM 587	Chowdhuri, A.K.		LM 688	Natrajan, T.K.	Chennai	M 787	Sharma, R.K.*	
M 488	Sinha, B.P.*	Kolkata	LM 588	Roychodhury, J.		M 689	Pangtey, T.S. *		M 788	Sharma, M.S.*	
LM 489	Nagvan, V.K.		LM 589	Jain, P.K.		M 690	Saran, R.B.		M 789	Singh, Kaplan*	
M 490	Sadashivan, M.C.*		LM 590	Sharma, Brijendra K.	New Delhi	LM 691	Ghildiyal, S.K.	Faizabad	LM 790	Suhane, H.S.	Jabalpur
M 491	Hussain, R.*		IM 591	CWC*		LM 692	Prasad, L.M.*	Dehradun	LM 791	Sharma, U.C.	Bhopal
LM 492	Kumar, Sushil	Lucknow	M 592	Srivastava, S.P.*		M 693	Jyyar, D.S.N.*		M 792	Banerjee, Amit	
M 493	Agarwal, S.L.*		LM 593	Ulthhaje, Dr. A.V.	Varanasi	M 694	Dhawan, H.K.*		LM 793	Arora, N.D.	Faridabad
M 494	Sharma, C.P.*		M 594	Misra, S.*		LM 695	Kumar, P		M 794	Jain, Subhash Chand	
M 495	Patel, J.H.*		M 595	Bathula, Anjaiah*		M 696	Ramaswamy, S.K.*		LM 795	Mallick, H.K.	
LM 496	Srivastava S.K.	Lucknow	LM 596	Jain, V.K.*		M 697	Ahmed, M.*		LM 796	Sharma, Purshotam Das	
LM 497	Aggarwal, V.P.*		LM 597	Singh R.I.		M 698	Chandrasekhar, H.*		LM 797	Singh, Virendra Pal	
LM 498	Mallik, S.K. **		M 598	Gupta, J.P.		M 699	Parthsarthy, T.N.*		LM 798	Chandra, Sukhmal	
LM 499	Bajpai O.N.		M 599	Agarwal, R.K.*		M 700	Verma, N.K.R.*		LM 799	Jain, Arun	New Delhi
LM 500	Srivastava, N.K.	New Delhi	LM 600	Singh, S.K.					LM 800	Chourasia, Dr. L.P.	



## COMPLETE LIST OF ISEG MEMBERS (UPDATED OCTOBER 2017)

### INCLUDING DEASED\*\*, RESIGNED ^ AND THOSE MEMBERS WHOSE MEMBERSHIP HAS EXPIRED\*

Membership No	Name	Station	Membership No	Name	Station	Membership No	Name	Station	Membership No	Name	Station
LM 801	Guha, Kallol	Kolkata	LM 901	Jagannathan, V.		M 1001	Kansara, J.P.		LM 1102	Raval, C.J.	Panchmahal
M 802	Dhar, Gautam**		LM 902	Sarkar, Shekhar	Pune	M 1002	Dave, N.B.*		LM 1103	Pandit, Smt. S.R.	Ahmedabad
M 803	Biswas, R.S.**		LM 903	Tyagi, Vinod Kumar	Meerut	M 1003	Dandiawala, M.C.*		LM 1104	Kar, S.K.	Lucknow
M 804	Shandilya, A.K.*		M 904	Mahmood, Gauhar**		M 1004	Patel, R.H.*		LM 1105	Kumar, Naresh	Sunder Nagar
LM 805	Baruah, S.		M 905	Joshi, Y.C.**		M 1005	Patel, B.B.*		LM 1106	Srivastava Dr. A.K.	
LM 806	Das, N.C.		LM 906	Sinha, Suresh Chandra		M 1006	Patel, T.J.*		LM 1107	Surendranath, V.	
LM 807	Baruah, S.A.R. Haque	Imphal (Manipur)	M 907	Suri, Rajiv Kumar*		M 1007	Gandhi, J.M.*		LM 1108	Kaul, Surender	
LM 808	Singh, L. Angau		LM 908	Patel, G.P.	Gandhi Nagar	M 1008	Patel, D.P.*		LM 1109	Sharma, Brig B. D.	
LM 809	Barma, Chintamani		LM 909	Katti, G.B.		M 1009	Patel, M.H.*		LM 1110	Unial, K.C.	Tehri
LM 810	Gogoi, H.P.	Guwahati	LM 910	Subramanyan, Dr. V.	Thane (West)	LM 1010	Mahalingachari, A.C.	Bangalore	LM 1111	Jindal, Harsh Kumar	
LM 811	Bansal, L.K.	Rishikesh	LM 911	Murthy, B.S.N.	Bangalore	LM 1011	Sengupta, Pradeep	Kolkata	LM 1112	Mathur, N.K.	New Delhi
LM 812	Nageswaran, B.		LM 912	Misra, Sarvesh	Faridabad	LM 1012	Basak, Badri Narayan	Kolkata	LM 1113	Gupta, Pradeep Kumar	Faridabad
LM 813	Das, Swapan Kumar		LM 913	Manikanda, Mahesh Babu	Hyderabad	M 1013			LM 1114	Virmani, R.G.	Faridabad
LM 814	Raju, K.B.	Kolkata	LM 914	Reddy, K.K.		LM 1014	Kandpal, G.C.	Lucknow	LM 1115	Sayed, Imran	Faridabad
LM 815	Sood, A.K.	Gurgaon	LM 915	Harendranath, L.	Hyderabad	LM 1015	Gopalkrishnan, M.	New Delhi	LM 1116	Pant, Sanjay	
LM 816	Chadha, A.K.	Simla	LM 916	Chakradhar, Mariserla	Hyderabad	LM 1016	Mukhopadhyay, S.C.	Kolkata	LM 1117	Joshi, K.C.	Gangtok
LM 817	Verma, R.P.	Sarabai, Bhuntar	LM 917	Boliseti, Satyanarayana	Hyderabad	LM 1017	Detir, U.D.	Vadodara	LM 1118	Sanwal, Rajendra	Lucknow
LM 818	Sharma, K.S.	Ghaziabad	LM 918	Hashimi, S.		LM 1018	Dhurundhar, A. P.	Nagpur	LM 1119	Gairola, B.M.	Dehradun
M 819	Chauhan, V.P.S.**		LM 919	Ravindranath, K.	Secunderabad	LM 1019	Sharma, H.K.	New Delhi	LM 1120	Rana, Chandra Singh	Rishikesh
M 820	Sharma, J.K.*		M 920	Raman, M.S.*		LM 1020	Joshi, Sudhir Yeshwant		LM 1121	Kumar, Bhuvnesh	Noida
M 821	Keira, Dr. H.*		M 921	Kanse, A.B.*		LM 1021	Chaddha, Dr. D.K.	New Delhi	LM 1122	Patil, S.N.	Jaigaon
LM 822	Boni, O.N.		M 922	Vyas, A.B.*		LM 1022	Thatte, C.D.	Pune	LM 1123	Nemad, P.D.	
LM 823	Walvekar, Ashok S.	Faridabad	M 923	Dave, P.M.*		LM 1023	Soni, Arvind Keshavil	Vadodara	LM 1124	Prabhakar, Gote Atul	
M 824	Patel, C.K.*		M 924	Shaikh, J.J.*		M 1024	Shaikh, M.A.*		LM 1125	Kannan, S.	Bangalore
M 825	Shah, I.N.*		LM 925	Srivastava, A.K.		M 1025	Shaikh, G.G.*		LM 1126	Kakoty, I.S.	
LM 826	Upadhyay, R.K.*		LM 926	Mehta, M.V.	Rajkot	M 1026	Vyas, H.J.*		LM 1127	Kumar, S.	New Delhi
M 827	Patel, R.M.*		LM 927	Sahu, C.P.	Jabalpur	LM 1027	Littoria, P.K.		LM 1128	Yelsetty, Srinivasulu	Hyderabad
LM 828	Lal, Kuver Nath	Patna	M 928	Kumar, Manoj**		LM 1028	Deekshatulu, B.L.	Hyderabad	LM 1129	Pathak, S.K.	Indore
LM 829	Ali, Mashooq		LM 929	Prasad, Kasturi R.K.	Hyderabad	IM 1029	NRSA(Lib), Hyderabad*		LM 1130	Soni, C.K.	Indore
LM 830	Naik, M.F.	Vadodara	LM 930	Rao Suresh Kant Anand		LM 1030	Garg, Madan Murari		LM 1131	Haridas, R.	
LM 831	Kumar, Ashok	Lucknow	LM 931	Ali, Akram		LM 1031	Rastogi, Daya Nand K.		LM 1132	Gupta, M.C.	
LM 832	Prasad, Bharat	Patna	LM 932	Gopalauanni, M.		M 1032	Goel, Virendra Kumar*		LM 1133	Srivastava S.S.	Lucknow
LM 833	Sinha, H.P.		LM 933	Ghosh, D.K.	Kolkata	LM 1033	Shah, L. Mohanlal	Vadodara	AM 1134	M/s Gemat, New Delhi*	
M 834	Dasgupta, A.*		LM 934	Chatterjee, Kamlesh	Kolkata	LM 1034	Dudeja, Dinesh Kumar		LM 1135	Singh, R.K.	Lucknow
M 835	Gupta, P.K.**		LM 935	Chetty, G.L. Nagraja		IM 1035	Director, AMD, Hybd*		LM 1136	Mohan, Aditya	
LM 836	Rai, Anil	Faridabad	LM 936	Satish Kumar, H.B.		LM 1036	Upadhyay, R.K.		LM 1137	Tiwari, R.P.	Aizwal
M 837	Tripathi, D.C.*		LM 937	Rao Mullapudi Venkat		LM 1037	Rao Ande Ganeshwara		LM 1138	Shanker, Ravi	Lucknow
M 838	Rahut, A.K.*		LM 938	Reddy, V. Venkata Subba		LM 1038	Patel, M.M.	Vadodara	LM 1139	Muthu, R. Pitchai	Karur
M 839	Sayed, Imran*		LM 939	Rajuddin, S.M.		LM 1039	Sudhakar, A.M.		LM 1140	Mehta, O.P.	New Delhi
LM 840	Prabhakaran, B.*		LM 940	Dave, Chandresh, G.		M 1040	Sumar, N.M.*		LM 1141	Tripathi Kripa Shanker M.	Lucknow
LM 841	Varshney, Dr.R.S.	Ghaziabad	LM 941	Murti, Ramdenu Srinivas		M 1041	Purohit, A.B.*		LM 1142	Bid, Nripendra Chandra	Nagpur
LM 842	Singhal, J.B.*	Jabalpur	LM 942	Chebbi, S.M.		IM 1042	GSI, NER, Shillong*		LM 1143	Prasad, G.M.	Rishikesh
LM 843	Gupta, Raju*		LM 943	Jagannath, Jetty	Hyderabad	LM 1043	Chatterjee, Amresh	Jaipur	LM 1144	Singh, Shailendra	Rishikesh
M 844	Neelkanthan, J.*		IM 944	Geologist(I) NMC *		LM 1044	Rathore, Gopal C.	Vadodara	LM 1145	Singh, Gurcharan	S.A.S.Nagar
LM 845	Verma, Dinesh Chandra		LM 945	Mitra, Shyamal Kumar		M 1045	Patel, J.K.*		LM 1146	Joshi, Y.C.	Lucknow
LM 846	Patel, B. Dhulabhai*		LM 946	Bhattacharya, Dipendra N.	Kolkata	M 1046	Patel, A.R.*		LM 1147	Siddiqui M.A.	Lucknow
LM 847	Khanduri, H.C.	Hyderabad	LM 947	Roy, Sivaji Basu	Kolkata	M 1047	Soni, D.J.*		LM 1148	Bisht, B.S. **	Dehradun
LM 848	Sah, Lalgee		LM 948	Bhatnagar, A.K.		M 1048	Patel, K.G.*		LM 1149	Khare, Rakesh	Rishikesh
M 849	Singh, Virendra Kumar*		LM 949	Patel, A.S.		LM 1049	Desai, A.B.	Vadodara	LM 1150	Narang, J.L.	Rishikesh
LM 850	Saini, G.S.		LM 950	Bhalja, S.S.	Vadodara	M 1050	Oza, H.S.*		LM 1151	Vishnoi, R.K.	Rishikesh
LM 851	Dr. Goel, R.K.	Roorkee	LM 951	Lad, D.M.	Veraval	LM 1051	Dahiya, B.S.		LM 1152	Verma, A.S.	Rishikesh
LM 852	Verman, M.K.		LM 952	Raval, C.J.		LM 1052	Pradhan, N.C.		LM 1153	Lath, J.P.	Tehri
LM 853	Mukherjee, Shyamal	Roorkee	M 953	Suchde, J.V.*		LM 1053	Srivastava, A.K.		LM 1154	Sharma, Arjun Kumar	Gangtok
LM 854	Choube, Rabindra Nath	Gurgaon	M 954	Patel, S.C.*		LM 1054	Verma S.K.	Lucknow	LM 1155	Bhunia, Tsherin Tashi	Gangtok
M 855	Kannan, S.*		LM 955	Thakare, K.M.		LM 1055	Vaish Mathura Prasad	Lucknow	LM 1156	Khanal, Ganesh Chandra	Gangtok
IM 856	CSMRS, New Delhi*		LM 956	Pendharkar, D.K.		LM 1056	Miishra, H.R.		LM 1157	Lepcha, Gombu Tseten	Gangtok
LM 857	Kesamli, Dr. N. Chenna		M 957	Patel, V.K.*		LM 1057	Rammikhal, Vyas K.		LM 1158	Rana, S.S.	
858	VACANT		M 958	Patel, N.L.*		LM 1058	Khitolia, Dr. R.K.		LM 1159	Kapoor, Naresh K.	Rishikesh
			M 959	Patel, R.R.*		LM 1059	Nagar Mukesh	Lucknow	LM 1160	Jain, Atul K.	Rishikesh
LM 859	Mishra, D.N.		LM 960	Bhatt, J.L.		LM 1060	Gupta, Sushil K.	Ahmedabad	LM 1161	Bharat, H.L.	Koteswar
LM 860	Prasad, Rajeshwar **		LM 961	Rana, V.H.	Vadodara	LM 1061	Choksi, S.C.		LM 1162	Giri, Rajeshwar	Rishikesh
LM 861	Lahori, Durdendra Nath		LM 962	Pathan, A.K.		LM 1062	Venkateswarlu, Dr. V.	KGF	LM 1163	Yadav, V.S.	Lucknow
LM 862	Dr. Mukhtar, Gulzar A.	Srinagar	LM 963	Vyas, K.C.		LM 1063	Bisaria B.K.	Lucknow	LM 1164	Tewary, Kulbhushan	P.O. Michela
LM 863	Mahajan, S.C.	Gurgaon	LM 964	Trivedi, J.B.		LM 1064	Gulati, Keshav Ram		LM 1165	Sharma, Rajendra	Lucknow
M 864	Upadhyay, Dr. V.K.*		LM 965	Das, K.C.	Vadodara	LM 1065	Attre, J.K.	Lucknow	LM 1166	Rai Vikram	Lucknow
M 865	Modi, A.C.*		M 966	Trivedi, B.H.*		IM 1066	Geologist(Sr), Narmada*		LM 1167	Khan A.U.	Lucknow
M 866	Ganpathi, G.K.*		M 967	Mistry, V.V.*		LM 1067	Dixit Rama Shankar	Lucknow	LM 1168	Narain Shyam	Lucknow
M 867	Pal Pranab Kumar*		M 968	Ojha, P.K.*		LM 1068	Dubey, O.P.	Roorkee	LM 1169	Sharma, R.P.	Lucknow
LM 868	Sarkar, A.K.		M 969	Desai, B.K.*		LM 1069	Soni, R.D.	Vadodara	LM 1170	Singh, Ayodhya Prasad	Lucknow
LM 869	Lomas, Ashok Kumar		M 970	Goswami, K.M.*		LM 1070	Sahu, R.N.	Dhule	LM 1171	Rastogi, S.P.	Lucknow
LM 870	Awasthi, A.K.	Simla	M 971	Shah, A.J.*		M 1071	Ingreji, N.K.*		LM 1172	Ramanand	Lucknow
LM 871	Kanungo, N.D.		M 972	Nayar, P.S.*		LM 1072	Parekh, Vinod C. Ratilal		LM 1173	Singh, B.K.	Lucknow
LM 872	Ramarao, K.		M 973	Patel, N.D.*		LM 1073	Stampwala, V.R.	Vadodara	LM 1174	Kumar Alok	Lucknow
LM 873	Pant, Rajeev		M 974	Shah, A.N.*		LM 1074	Jadhav, Pradeep B.	Pune	LM 1175	Paul, Chinmoy	
LM 874	Sawanti Jagdish Singh		LM 975	Joshi, V.N.	Valsad	LM 1075	Singh, Jaya	Lucknow	LM 1176	Dwivedi, Jitendra Kumar	New Delhi
M 875	Chouksay, A.K.**		M 976	Hatti, B.G.*		LM 1076	Gupta, V.K.		LM 1177	Kumar, Suresh	
M 876	Datta, Sibnarayan*		M 977	Patel, V.K.*		LM 1077	Prakash Suraj		LM 1178	Mukherjee, Banibrata	Bhutan
M 877	Pant, Bipin*		M 978	Thandani, S.B.*		LM 1078	Trovedi, H.C.		LM 1179	Mishra, Prasanta	Kolkata
M 878	Jaiswal, D.C.*		M 979	Salaria, G.H.*		LM 1079	Josyula, P.	Hyderabad	LM 1180	Joshi, B.O.	
M 879	Prasad, I.B.*		M 980	Kirmani, M.A.*		M 1080	Kumar, Ashok*		LM 1181	Raghuvanshi, M.L.	Narmada Nagar
LM 880	Jain, Naresh*		M 981	Patel, H.H.*		LM 1081	Nawani, Dr. P.C.	Dehradun	LM 1182	Salheria, V.K.	
LM 881	Mauria, H. Lollen		M 982	Patel, V.T.*		LM 1082	Brahma, A.K.		LM 1183	Shrivastava, S.L.	
LM 882	Haq, Inamul	Jaipur	M 983	Vyas, M.P.*		M 1083	Badarinath, H.S.*		LM 1184	Singh, Moti Lal	
LM 883	Prashar, Ramakant		LM 984	Mittal, S.S.	Vadodara	LM 1084	Tripathi, S.K.	Dehradun	LM 1185	Sharma, Pramod Kumar	
LM 884	Badree Narayana, VV**	New Delhi	M 985	Sen, K.H.*		LM 1085	Khopkar, Chandra S.	Gurgaon	LM 1186	Verma, Mahendra Kishor	
LM 885	Toley, S.R.	New Delhi	M 986	Nayee, H.A.*		LM 1086	Singhal, M.M.L.	Meerut	LM 1187	Chauhan, Laxman Singh	Narmada Nagar
LM 886	Garg, Arvind		M 987	Jethi, G.G.*		LM 1087	Pradhan, Sushil P.	Kathmandu	LM 1188	Soni, Gyan Prakash	Narmada Nagar
LM 887	Jhingran, Dr.V.	Delhi	M 988	Sheth, A.N.*		LM 1088	Upadhyay, M.C.	Bhopal	LM 1189	Joshi, Sunil Kumar	
M 888	Sood, R.K.**		M 989	Parikh, R.R.*		LM 1089	Rawat, P.V.S.	Dehradun	LM 1190	Sharma, Deepesh	Narmada Nagar
LM 889	Dube, A.K.	Roorkee	M 990	Rathor, D.S.*		LM 1090	Dangwal, D.P.	Dehradun	LM 1191	Jhawar, Rajendra Kumar	
M 890	Dalela, R.K.*		M 991	Arora, R.R.*		LM 1091	Chandra, Prakash	Lucknow	LM 1192	Dhanani, Prafull Chandra	Narmada Nagar
LM 891	Srivastava, S.C.*		M 992	Patel, R.C.*		LM 1092	Sharma, Dr.D.N.	Kothagudem	LM 1193	Singh, Prabhat	P.O. Bhatlo
LM 892	Farooqui, Dr. S.A.*		M 993	Parmar, M.V.*		LM 1093	Srivastava Sharad P.	Lucknow	LM 1194	Rao, S. Laxman	
LM 893	Verma, K.C.	Gurgaon	M 994	Patel, S.S.*		LM 1094	Maini, Snch		LM 1195	Roy S.C.	Lucknow
LM 894	Pahuja, S.L.	New Delhi	M 995	Patel, D.N.*		LM 1095	Vyas, M.P.		LM 1196	Chellani, S.K.**	Nagpur
LM 895	Mukherjee, B.B.		LM 996	Patel, S.R.	Vadodara	LM 1096	Patel, V.K.	Ahmedabad	LM 1197	Radhakrishnan, S.	New Delhi
LM 896	Singh, S.K.	Delhi	M 997	Patel, J.S.*		LM 1097	Dabhi, J.S.		LM 1198	Sharma, Sonnath	Guwahati
LM 897	Bhatnagar P.S.**	Gangtok	998			LM 1098	Thakker, S.I.	Ahmedabad	LM 1199	Datta, Amiya Kumar	Chungthang
LM 898	Mehrotra, G.S.*					LM 1099	Shaikh, J.J.	Gandhi Nagar			North District
LM 899	Tilak, N.B.G.	Hyderabad	M 999	Patel, Navin, M.*		LM 1100	Patel, Jayantibhai K.	Sabarkantha			Kolkata
LM 900	Majumdar, Dr. Kiran	Guwahati	M 1000	Thakker, S.I.*							

## COMPLETE LIST OF ISEG MEMBERS (UPDATED OCTOBER 2017)

Membership No	Name	Station	Membership No	Name	Station	Membership No	Name	Station	Membership No	Name	Station
LM 1201	Mawar P.	Lucknow	LM 1273	Sasikumar, K.	East Sikkim	LM 1345	Vedanti, Uday Dattatraya	Godhra	LM 1414	Vashisht Nand Kishor	New Delhi
LM 1202	Sharma, Dr. L.N.	Chandigarh	LM 1274	Pargaien, Girish Chandra	Gurgaon	LM 1346	Button, Edward A.	Gurgaon	LM 1415	Piyush Singh	Gurgaon
LM 1203	Shrivastava, Vineet		LM 1275	Kumar, Sanjiv	Chandigarh				LM 1416	Sudip Ganguly	Ghaziabad
LM 1204	Pardhi, Atul		LM 1276	Naithani, Dr. Ajay Kumar	KGf	LM 1347	Punetha, Pankaj	Faridabad	LM 1417	Dr. M.R. Bhutiyani	New Delhi
LM 1205	Agarwal, N.K.	Dehradun	LM 1277	Srivastava, Dr. Mridul	Lucknow	LM 1348	Shivali, Ram Bachan	Delhi	LM 1418	Dr. T.N. Singh	Mumbai
LM 1206	Singh, Bhopendra	Dehradun	LM 1278	Rawat, Bhanu Prakash	Wangdue	LM 1349	Mishra, R.N.	Shimla	LM 1419	Arunanjay Kr. Singh	Noida
LM 1207	Joshi, Dr. Kaumudi	Dehradun	LM 1279	Bishwapiya, Akhouri	Lucknow	LM 1350	Khajuria, P.K.	Jammu Tawi	LM 1420	Awadhesh Kr. Singh	Noida
LM 1208	Garg, Mukul	Dehradun	LM 1280	Chitra, R.	New Delhi	LM 1351	Nithyan, K.R.	Thrissur	LM 1421	Dr. Rajbal Singh	New Delhi
LM 1209	Rawat, B.S.	Dehradun	LM 1281	Gupta, Manish	New Delhi	LM 1352	Sahu, S.K.	Balangir	LM 1422	Dr. Dahal Ranjan Kumar	Kathmandu
LM 1210	Bisht, Dr. K.S.**	Dehradun	LM 1282	Singh, Ram Jivan	Lucknow	LM 1353	Kumar, Anup	Hisar	LM 1423	Som Nath Chandel	Patna
LM 1211	Biyani, A.K.	Dehradun	LM 1283	Bhatnagar, Sharad	Faridabad	LM 1354	Basu, Manoj	Faridabad	LM 1424	Amlendu Tripathi	Rishikesh
LM 1212	Bhattacharjee, N.R.	Kolkata	LM 1284	Kumar, Ambrish	Lucknow	AM 1355	SJVN	New Shimla	LM 1425	Anil Kumar Sisodia	New Delhi
LM 1213	Bahuguna, Harish	Dehradun	LM 1285	Verma, Ajay K.	Faridabad	LM 1356	Tomar, N.K.S.		LM 1426	Mukat Lal Sharma	Roorkee
LM 1214	Gupta, M.L.	Noida	LM 1286	Acharya, Akshay	P.O. Jhakri	LM 1357	Gowaiakar Yashwant S.	Pune	AM 1427	Satish Ram Goyal	New Delhi
LM 1215	Awasthi, A.K.	Lucknow	LM 1287	Yachu, J.K.	Noida	LM 1358	Mukhopadhyay T.	New Delhi	LM 1428	Pradeep Singh	New Delhi
LM 1216	Jaiswal, Pankaj	Kolkata	IM 1288	Director*	New Delhi	LM 1359	Joshi Rahul Anant	Pune	LM 1429	Mansoor Ahmad Qazi	Kishtwar
LM 1217	Joshi, Dr Devidatt	Lucknow	LM 1289	Gajbhiye, Prakash	Dehradun	LM 1360	Amitabh Sharan	Faridabad	LM 1430	Dr. A.S. Senthil Vadivel	Kolkata
LM 1218	Gupta, Subhash Chander	Kishwar	LM 1290	Dixit, Rajesh	Gurgaon	LM 1361	Dr. Ranjit Rath	New Delhi	LM 1431	Ganvir Sunil Jaideo	Faridabad
LM 1219	Asthana, A.K.	Gurgaon	LM 1291	Pal, Sanjit Kumar	Gerukamukh	LM 1362	Dr. Amit Sahay	New Delhi	LM 1432	G.J.S. Prasad	Hyderabad
LM 1220	Bhandari, R.C.	Noida	AM 1292	Energy Infotech*	Gurgaon	LM 1363	Chaubey Jitendra	Noida	LM 1433	T. Nagaraj	Hyderabad
LM 1221	Jayachand, T.	Gurgaon	AM 1293	JAYPEE GROUP*	Noida	LM 1364	Dr. Shakti Prakash	Gurgaon	LM 1434	A. Ramesh Kumar	Chandigarh
LM 1222	Bahadur, A.K.	Dehradun	LM 1294	Raghuwanshi, Shiv Kumar	Bhopal	LM 1365	Dr. Ghoshal Timir Baran	Kolkata	LM 1435	Bonthu Ajaya Kumar	Hyderabad
LM 1223	Gusain, M.S.	Tehri	LM 1295	Prasad, Rajeev	Roorkee	LM 1366	Kant Ojha Nalini	Chamoli	LM 1436	Mrinmoy Chakraborty	Gurgaon
LM 1224	John, Biju	Lucknow	LM 1296	Khanna, Rahul	Faridabad	LM 1367	Batabyal Indrajit		LM 1447	Ajay Singh	Faridabad
LM 1225	Godara, Bhaira Ram	Zhemgang	M 1297	Ganapathy, Dr G.P.*	Vellore	LM 1368	Lahkar Kritibash	Bhutan	LM 1448	Mainak Ghosh Roy	Faridabad
LM 1226	Pandey, Vachaspati	Roing	LM 1298	Eswaraiah, H.V.	Bangalore	LM 1369	Dr. Sumit Dabral	Tawang	LM 1439	Sailendra Singh Barhia	Faridabad
LM 1227	Rawat, Rajendra Kumar	Sagar	LM 1299	Parihar, C.P.S.	Bhopal	LM 1370	Sharma Vivek	Faridabad	LM 1440	Dheeraj Raghuwanshi	Siliguri
LM 1228	Kumar, Hemant	Faridabad	LM 1300	Singh, Priyadarshan	Patna	LM 1371	Kawade Sumegh	Faridabad	LM 1441	U. Satyanarayan Raju	Vizianagaram
LM 1229	Badal, Dr Rajiv	New Delhi	LM 1301	Yadav, Dr. Suresh Prasad	Dhanbad	LM 1372	Kumar Girendra	Faridabad	LM 1442	Ankhur Viithal	Kurukshetra
LM 1230	Misra Rajnish	Lucknow	LM 1302	Thakur, Upnish Kumar	Tehri Garhwal	LM 1373	Mishra Barun Kumar	New Delhi	LM 1443	Prashant Chaudhary	Saharanpur
LM 1231	Jain, Ashwini	Faridabad	LM 1303	Chakraborty, Indranil	Kolkata	LM 1374	Jaiswal Lokesh Kumar	Faridabad	LM 1444	V.P.S. Chauhan	Noida
LM 1232	Rai, Prashant	Ghaziur	LM 1304	Aggarwal, R.K.	Jaipur	LM 1375	Mohan Anish	Faridabad	LM 1445	Sunil Singh	Shimla
LM 1233	Saxena, Rajeev	Faridabad	LM 1305	Ganpule, Vijay Trimbak	Mumbai	LM 1376	Khanna Pallavi	Faridabad	LM 1446	Brajesh Kumar Gupta	Shimla
LM 1234	Kumar, Santosh	Patna	LM 1306	Das, Rattan Kumar	Sainj	LM 1377	Bist Dhermendra Singh	Noida	LM 1447	Sushil Kumar Maurya	Kolkata
LM 1235	Sharma, Arun Kumar	Nainital	LM 1307	Patni, B.D.	New Delhi	LM 1378	Dutt Mahesh	Shimla	LM 1448	Devi Sudha	Shimla
LM 1236	Pal, Saikat	Gurgaon	LM 1308	Dhanya, Mrs. U.	Faridabad	LM 1379	Sharma Kuldeep	Shimla	LM 1449	Dharmendra Kumar Giri	Shimla
LM 1237	Pati, Prof. Jayant Kumar	Allahabad	LM 1309	Sharma, Rakesh Chandra	Faridabad	LM 1380	Brijesh Badoni	Shimla	LM 1450	Gorai Pada Shyama	Shimla
LM 1238	Kumar, Pankaj	Lucknow	LM 1310	Chowdary, V.Srinivas	Hyderabad	LM 1381	Sharma Umakant	Pathankot	LM 1451	Ajay Kumar	Shimla
LM 1239	Swarup, Anil	Roorkee	LM 1311	Sharma, V.P.	Jaipur	LM 1382	Singh Chauhan Kamlesh	New Shimla	LM 1452	Ksh Rajkumar Singh	Jammu
LM 1240	Bandaru, Naga Siva Naveen Kumar	Faridabad	LM 1312	Subrahmanyam, D.S.	Bangalore	M 1383	Singh Manwendra Pratap	Shimla	LM 1453	Dhorta Vipin	Jhakri
M 1241	Ghosh Roy, Mainak*	Sainj	LM 1313	Kalita, Girish	Bichom	LM 1384	Balraj Joshi	Faridabad	LM 1454	Radhendra Narayan Sahoo	Jammu
M 1242	Kumar, Sanjay*	Sainj	LM 1314	Ranjan, Rajanish	Kimi	LM 1385	Dr. K. Jayabalan	Chennai	M 1455	Tarun Singh	Delhi
M 1243	Kumar, Vinod*	Sainj	LM 1315	Singh, Lallan Prasad	Hyderabad	LM 1386	Chinnasamy Thanavelu	Thiruvananthapuram	LM 1456	Mukesh Kr. Bhorla	Faridabad
LM 1244	Gopalakrishnan, N	Chamoli	LM 1316	Jha, Prakash C.	KGf	LM 1387	Sarkar Niroj Kumar	Shillong	LM 1457	Sankhadip Chowdhury	Faridabad
LM 1245	Mishra, Binay Kumar	Faridabad	LM 1317	Nelliat, Sandeep	KGf	LM 1388	Budihal R. Yamanappa	Dharwad	LM 1458	H.S. Debdutta Singh	Bhutan
LM 1246	Nair, Anitha P	Faridabad	LM 1318	Borgohain, Binud	Kamki	LM 1389	Nautiyal Sunil Dutt	Dehradun	LM 1459	Babudan Singh Tanwar	Rewari
LM 1247	Rajput, Yogendra Kumar	Khandwa	LM 1319	Balaji, P.	Hyderabad	LM 1390	Sadishkumar Sambasivam	Faridabad	LM 1460	Atul Kohli	Pune
LM 1248	Kainthola, Harish	Dehradun	LM 1320	Bhandaru, B.K.	Hyderabad	LM 1391	Dr. Pranay Vikram Singh	Kishtwar	LM 1461	Ajay Pratap Singh Tomar	Jhakri
LM 1249	Asopa, Ravi	Khandwa	LM 1321	Reddy, B.S.S.	Hyderabad	LM 1392	Prof. K.S. Rao	New Delhi	LM 1462	Rizwan Ahmad	Jhakri
LM 1250	Bhatt, Vineet	Dehradun	LM 1322	Rahut, Alok Kumar	Gerukhamukh	LM 1393	Bhupender Singh	Dehradun	LM 1463	Apurva Ranjan	Uttarkashi
LM 1251	Verma, Vinod Kumar	Khandwa	LM 1323	Das, Chandanmani	Guwahati	LM 1394	Yogesh Sharma	Kishtwar	LM 1464	Dr. D.V. Sarwade	New Delhi
LM 1252	Singh, Virendra Kumar	P.O. Larji	LM 1324	Mukherjee, Jaydip	Kolkata	LM 1395	Sandeep Sharma	Jammu	LM 1465	Ashish Kumar Patra	Gurgaon
LM 1253	Aggarwal, Peeyush K.**		LM 1325	Singh, Devendra	KGf	LM 1396	Deepak Kumar	Kishtwar	LM 1566	Pundir Gambhir Patra	Uttarkashi
LM 1254	Chauhan, Devraj Singh	Aligarh	LM 1326	Kumar, Kishor	New Delhi	LM 1397	Ajay Kumar	Jammu	LM 1467	Hemant Kumar Thokcham	Imphal
LM 1255	Deshmukh, Rituraj	Balaghat	LM 1327	Venkatesh, Dr. H.S.	Bangalore	LM 1398	Vijay Kumar	Kishtwar	LM 1468	Anil Vasantrao Deshpande	Maharashtra
LM 1256	Rana, Shailendra Singh	Bhopal	LM 1328	Balasubramaniam, V.R.	KGf	AM 1399	Dr. Roy Sujit	Kolkata	LM 1469	Shishir Kumar Rath	Faridabad
LM 1257	Shukla RC	Bhopal	LM 1329	Jagannathan, R.	Hyderabad	LM 1400	Raina Autar Krishen	Maharashtra	LM 1470	Sandeep Bhardwaj	Hissar
LM 1258	Yadav, Nirmal Kumar	Siddharkut	LM 1330	Ramakrishna, D.	Chennai	LM 1401	Venugopal, K	Karnataka	AM 1471	Ashu Mathur	Nagpur
LM 1259	Vasantha Rao, Dr B.V.T.	Kothagudem	IM 1331	NIRM*	KGf	AM 1402	Arun Kumar Gupta	New Delhi	LM 1472	Manvendra Pratap Singh	Shimla
LM 1260	Dasgupta, Arunabh	Allahabad	LM 1332	Dash, Subhet Kumar	Chandrapuri	LM 1403	P. Narasimhan	Dharmapuri	LM 1473	Ashok Prasun	New Delhi
LM 1261	Narasimham, V.V.P.	Siddharkut	LM 1333	Kariyappa, K.B.	Kudathini	LM 1404	Kalamegam L.	Chandigarh	AM 1474	Vinod Kr.Jaiswal	Siliguri
LM 1262	Bezbaruah, Devojit	Gerukamukh	LM 1334	Srivastava, Prakash C.	Lucknow	LM 1405	Jina Mandal	Chandigarh	LM 1475	Shankar Kumar	Faridabad
LM 1263	Das, Surya Narayan**	Gurgaon	LM 1335	Narasimha Murthy, B.G.	Virgonagar	LM 1406	Dr. S. K. Wadhawan	Jaipur	LM 1476	Mahendra Singh Gadhavi	Ahmedabad
LM 1264	Nand, Triveni Shankar	P.O. Karounda	LM 1336	Garhia, Dr. S.S.	Gurgaon	LM 1407	Santanu Moitra	Navi Mumbai	LM 1477	Ajanta Goswami	Roorkee
LM 1265	Singh, Gajendra Pratap	Gerukamukh	LM 1337	Gupta, Naveen Kumar	Gurgaon	LM 1408	S.L. Kapil	New Delhi	LM 1478	Lalchand Goyal	Noida
LM 1266	Tripathi, Dinesh Chandra	Banikhet	AM 1338	GMR*	Gurgaon	LM 1409	Sankhwar Sanskar	Ghaziabad	LM 1479	Manoj Kumar Gupta	Noida
LM 1267	Prabhakaran, B.	Mandi District	LM 1339	Roy, Pratik	Noida	LM 1410	Chakraborty Dhrubajyoti	Nagpur	LM 1480	Rajeev Sethi	Noida
LM 1268	Annadurai, G.T.	N. Lakhimpur	LM 1340	Musthafa, Khaleel Mohd.	Salem	LM 1411	Prof. Tirlochan Singh	New Delhi	LM 1481	Shirish Dubey	Faridabad
LM 1269	Chakraborty,Arindom	Faridabad	LM 1341	Ghosh, Saibal	Kolkata	LM 1412	Dheeraj Raghuwanshi	Siliguri	LM 1482	Atul Nanda	New Delhi
LM 1270	Akhouri, Praveen	East Sikkim	LM 1342	Basu, Arindam	Kharagpur	LM 1413	Sumit Chauhan	Gandhinagar	LM 1483	Abhishek Kumar Mishra	Faridabad
LM 1271	Kannan, L. Gopi	Gurgaon	LM 1343	Bhatia, Jitender	Chanderkote				LM 1484	Dr. Atif Usmani	Gurugram
LM 1272	Das, Sandip Kumar	Indore	LM 1344	Natesan, Jayaprakash	Thiruvananthapuram				LM 1485	Alok Kumar	New Delhi
									LM 1486	J.Sivakumar Mathan	Chennai

*Don't gain the world and lose your soul, wisdom is better than silver or gold...*

*- Bob Marley*

## REPORT ON INTERNATIONAL CONFERENCE ON ENGINEERING GEOLOGICAL SOLUTIONS FOR SUSTAINABLE DEVELOPMENT "EGCON 2017"



### Introduction:

Indian Society of Engineering Geology (ISEG) is the India National Group of the International Association for Engineering Geology and the Environment (IAEG), which is affiliated to International Union of Geological Sciences (IUGS) and the UNESCO. The ISEG was formally inaugurated on 15<sup>th</sup> October 1965 at Kolkata by Dr. K.L. Rao, an eminent engineer and the then Minister of Irrigation and Power, Government of India.

An International Conference "Engineering Geological Solutions for Sustainable Development" also called "EGCON-2017" was organized by Indian Society of Engineering Geology (ISEG) on 7<sup>th</sup> & 8<sup>th</sup> October 2017 at Eros Hotel, New Delhi. The conference also commemorated 50 years of the publication of "Journal of Engineering Geology".

The Conference was organized with an objective to showcase the advancement that has taken place in the field of engineering geology and related fields and highlight the solutions that have been formulated and applied in recent years in order to face various challenges faced by engineers and geologist during construction of large infrastructure projects viz., tunnels, bridges, railways, dams, hydropower projects etc. Other important objective of this conference was to bring eminent experts from the field of infrastructure, hydropower, railway and surface transportation, water resources and urban development on a common platform. The conference has been well advertised by publication of brochures, flyers and announcements of ISEG websites and social media. The first circular of the conference was released on 13<sup>th</sup> May 2017 by Shri R.N. Misra, President, ISEG during Executive Council Meeting. The second circular of the conference was released on 5<sup>th</sup> August by President, ISEG at New Delhi. Subsequently, two nos. of Conference Flyers were also circulated to attract the delegates, sponsors and authors of technical papers. Regular updates were released w.r.t. the conference on ISEG websites and official face book page of the society and LinkedIn group.

The Conference was sponsored and supported by several companies including major PSU's including SJVNL, NMDC, NHPC, PFC, MHPA, Power Grid, RITES, MECL, NEEPCO, THDC and UJVNL. It has been attended by a number of delegates from PSU's such as SJVNL, NHPC, EIL, THDC, MECL, WAPCOS etc. and from Govern-

ment departments including GSI, CSMRS, NIRM, DTRL-DRDO, CSIR-CRRI, CIMFR etc. Beside a number of delegates from IIT's and other engineering colleges and universities attended the conference. A Souvenir cum Abstract Volume was published on the occasion which contains message from the Secretary-Power, Government of India and other dignitaries, 60 nos. abstracts received for the conference and advertisements. Conference of this magnitude is not possible without the support of sponsors and advertisers. The organizing committee is indebted to all the sponsors and advertisers for their support & encouragement and expresses deep gratitude to all of them. The organizing committee is extremely thankful to all the organizations that had sponsored the delegates for attending the conference.

### Inaugural Ceremony:

The Chief Guest for the Inaugural Session was Shri Ajay Kumar Bhalla, Secretary, Ministry of Power, Government of India who inaugurated the Conference. Shri Rajeev Mishra CMD Power Finance Corporation and Shri Balraj Joshi CMD NHPC Ltd who were Guest of Honor. Dr Gopal Dhawan CMD NHPC Ltd and Past President ISEG and Co-Chair Organizing Committee also graced the occasion. Members from CEA, Directors from PSUs, Director DRDO and a host of other dignitaries graced the occasion.

Shri R.N. Misra, President of ISEG and Chairman of Organizing Committee welcomed Shri Ajay Kumar Bhalla, Chief Guest along with Shri Rajeev Sharma, CMD, Power Finance Corporation Ltd. and Shri Balraj Joshi, CMD, NHPC Ltd, the Guests of Honor. Shri Misra also welcomed all other dignitaries and delegates to the Conference. He said the Conference shall offer opportunity to engineers and geologist involved in various infra-structural projects to interact with each other and understand the challenges faced by them and try to find out their solutions. He urged the delegates to take maximum benefit from the experienced shared by eminent speakers during the conference. Shri Ajay Kumar Bhalla, Secretary, Ministry of Power, Govt. of India eulogized the contribution of ISEG in the sustainable development of infrastructure in the country. He urged that there is an immense requirement of research and development in Power Sector in the country. Government is willing to support new and innovative technologies





which can bring sustainable development in this sector. He asked the Society to come up with some concrete recommendations at the end of the conference which can lead to some solutions. Shri Rajeev Sharma, CMD, PFC Ltd. congratulated the organizing committee for accommodating a large numbers of speakers within a span of two days and he urged speakers to maintain the quality and delegates to make maximum benefit from the proceedings. Shri Balraj Joshi, CMD, NHPC Ltd praised the Society for regularly organizing conferences and training programs for young professionals. He expressed his concern over the challenges being faced by hydro power developers in the country. He urged upon the need of developing projects within stipulated time schedule and without cost escalations. Shri Imran Sayeed, Secretary, Organizing Committee proposed vote of thanks for the inaugural session.

During the inaugural function following publications were released:

1. *Souvenir cum Abstract Volume.*
2. *Golden Jubilee issue of the Journal of Engineering Geology.*

Beside above publications, a CD-ROM having the full papers submitted for the conference was also distributed to all the delegates.

### Technical Sessions:

During the two day conference a total of 34 nos. oral presentations were made from various authors in four technical sessions and 12 nos. keynote lectures were delivered by eminent experts in two nos. special sessions. Besides 10 nos. technical poster presentations were also exhibited during both the days of conference. It is heartening to note that except one or two absentees, all the papers selected for oral presentations were made by the authors.

Initially 15 themes were identified for receiving abstracts and finally on the basis of response and receipt of full papers four themes were identified. It is noteworthy that 60 abstracts were received which have been compiled in Souvenir cum Abstract Volume and distributed to all delegates.

The papers were distributed in four technical sessions covering the themes as given below:

- **Underground Space Utilization.**
- **Exploration & Testing techniques.**
- **Infra-structural, Ground Water Resource and Engineering Geology of High dams, Seismic Studies and Earthquake Engineering.**
- **Slope Stability & Monitoring, Landslide Hazard & Ground Subsidence.**

In addition to the above, considering that significant ground has been made in infrastructural development within the country, it shall be prudent to expose the delegates to the recent developments in tunneling and discuss vibrant issues of climate change,

glaciology, landslide mitigation, challenges for hydropower development, earthquake engineering etc., eminent experts were invited to deliver keynote addresses in two Special Technical Sessions.

### Special Session: 1 (Day One)

The inaugural session was followed by First Special Session in which six Keynote Lectures were delivered by eminent experts. The details are given below:

*Chairman: Sh. R.N. Misra, President, ISEG and Co-Chairman: Sh. G. Vidyasagar, Add. Director General, GSI*

#### 1<sup>st</sup> Keynote Lecture

##### **Climate Change and Glaciology**

*Speaker: Sh. Narendra Kumar, ED (D & E Division), NHPC*

The speakers presented the impact of glacial retreat due to climate change and emphasized on the importance of GLOF (Glacial lake outburst flood) studies to mitigate the hazards caused by glacial lake outburst leading to rise in water level/flood in water resource projects. The role of NHPC in carrying out GLOF studies at its hydropower projects by identifying largest glacial lakes located upstream of dam bodies through remote sensing and aerial photographs and hydrodynamic modelling using different softwares.

#### 2<sup>nd</sup> Keynote Lecture

##### **Mitigation of Landslide in Himalayas: An Overview of Early Warning Systems**

*Speaker: Dr. M.R. Bhutiyani, Director, DTRL, DRDO*

The Speaker presented the importance of an effective monitoring system for early detection of occurrence of landslides through EWS (Early Warning System) study in the areas susceptible to landslides. The author proposed deployment of low cost IoT's (Internet of Things) based landslide monitoring framework in landslide prone sites like Himalayas as a more cost effective tool over conventional cable based monitoring systems like temperature sensor, accelerometer, piezometer, inclinometer etc. currently being used for monitoring landslides.

#### 3<sup>rd</sup> Keynote Lecture

##### **Application of Engineering Geological Techniques for Infra-structural Projects**

*Speaker: Prof. K.S. Rao, IIT Delhi*

The Keynote Speaker discussed the role of detailed geological investigations vis-à-vis rock mechanics study in overcoming challenges of difficult geological conditions for effective stability analysis of iconic infrastructural projects. A case study of world's highest rail bridge presently under construction over Chenab River which is a part of an ambitious project of Indian Railways to connect Kashmir with rest of India was presented. Detailed site investigations along with kinematic analysis, rock mechanics testing

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and numerical modelling for slope stability analysis carried out by IIT Delhi were discussed.

#### 4<sup>th</sup> Keynote Lecture

##### **Managing Geological Situations at Hydropower Projects in Himalayas**

*Speaker: Dr. Gopal Dhawan, CMD, MECL, Nagpur*

The Speaker addressed various geological problems being encountered in different hydropower projects in the Himalayas and geological uncertainties/challenges faced during construction in complex geological environment like Himalayas. He emphasized about the possible reasons for variations in geology and stressed on the importance of comprehensive investigations in a planned manner and risk management as a way out to minimize geological problems. He also stressed on the use of advanced technologies like LIDAR, Airborne Geophysical Survey, Directional Drilling, TSP etc. as a part of comprehensive investigations.

#### 5<sup>th</sup> Keynote Lecture

##### **History and Development of Engineering Geology in India**

*Speaker: Sh. M. Raju, Former DG, GSI, Kolkata*

The keynote speaker through his presentation narrated an illustrious journey depicting the role of Geological Survey of India (GSI) in the growth of Engineering Geology in the country over a passage of time. He divided the sequence of events into four phases (1850-1900, 1900-1950, 1950-2000 and 2000-till date) dating back to 1850, the year of foundation of GSI. He highlighted various achievements, developments as well as drawbacks/deterioration in the field of Engineering Geology in different phases of time.

#### 6<sup>th</sup> Keynote Lecture

##### **Hydropower Development in India-Solutions and Way Forward**

*Speaker: Sh. R.N. Misra, CMD, SJVNL, Shimla*

Sh. R. N. Misra summed up entire take away of the session by presenting the socio-economic changes that hydro power projects bring in the locality. He also emphasized the need for change in the mindset of the people misguided by few common myths such as development of hydropower lead to greenhouse gas emission, huge destruction of forests, high cost, huge investment which can be busted with logical reasoning. Speaker recommended proper utilization of manpower resources and adequate time for investigations to prevent hydropower projects from unnecessary delay in time and cost overrun.

#### **Special Session: 2 (Day Second)**

During the Special Session held on second day of the Conference, six more keynote lectures were presented by various eminent speakers. A brief account of the same is given below:

*Chairman: M. Raju, Director General (Retd.), GSI and Co-Chair: Dr. Rajbal Singh, WAPCOS, New Delhi*

#### 7<sup>th</sup> Keynote Lecture

##### **Three Dimensional Numerical Modelling Techniques for Large Underground Caverns.**

*Speaker: Sh. Sripad R. Naik, NIRM, Bengaluru*

Shri Naik presented various modelling techniques applied using UDEC/FLAC 2D/3D and 3DEC softwares for Sardar Sarovar and Nathpa Jhakri hydro power projects. He emphasized the need for applying modelling techniques for safe and optimum designing of various underground structures especially large sized caverns. Utilizing the geotechnical instrumentation data, the 3D models should be calibrated.

#### 8<sup>th</sup> Keynote Lecture

##### **Recent Advancements in Laboratory Rock Mechanic Testing**

*Speaker: Dr. Hasan Abdullah, Director, CSMRS*

The Speaker elaborately discussed on various issues of laboratory rock mechanics testing. He opined that since rock is highly variable in composition and extent, it is essential that in order to have representative test results laboratory tests should be performed on minimum of 15nos. samples from same rock type and at least 50nos. samples from one project. All laboratory test results should be presented considering the mineralogical composition of rock w.r.t. mineralogy and orientation of foliation planes.

#### 9<sup>th</sup> Keynote Lecture

##### **Tunnelling Challenges Faced, Techniques and Innovation Applied in Chenani Nashri Tunnel**

*Speaker: Shri J.S. Rathore, Project Director, IL &FS*

Shri Rathore spoke about various challenges faced during the construction of country's longest two lane road transport tunnel having length of 9.28 km located in the state of Jammu & Kashmir. Constructed under a maximum rock cover of about 1km, it had encountered sandstone, siltstone and clay stone of Siwalik ranges. Observational approach has been followed for erection of support system. Poly fibre Shotcrete and Swellex rock bolts are the key rock support. Instrumentation and tunnel monitoring was the key feature during the construction. Shri Rathore informed that it is the only tunnel in the country which has ITCS (Integrated Tunnel Control System) system. Several innovative features were adopted to complete the tunnel within stipulated time schedule. The tunnel excavation has been completed within five years period.

#### 10<sup>th</sup> Keynote Lecture

##### **Landslide Susceptibility Mapping in Hilly Terrain Through Empirical Modelling Technique**

*Speaker: Dr. Saibal Ghosh, Director, GSI, New Delhi*

Dr. Ghosh talked about the technique of Landslide Susceptibility





Analysis (LSA) for predicting the landslide using the spatial analysis including Heuristic direct and indirect methods and empirical approach. He informed the delegates w.r.t. NLSM ( National landslide Susceptibility Program) being undertaken by GSI covering about 23000 landslides in an area of about 70000 square km. He also talked about the web based landslide inventory mapping, earthquake triggered landslides and future plans of NLSM program.

The keynote session was followed by brief discussion in which the eminent speakers replied to various queries from the delegates.

### 11<sup>th</sup> Keynote Lecture Seismic Studies and Earthquake Engineering Techniques for Hydropower Projects

*Speaker: Shri S.L. Kapil, General Manager, NHPC Ltd.*

Shri Kapil presented case studies for Chamkarchhu, Bhutan, Tawang I & II, Loktak and Subansiri HE projects w.r.t. site specific seismic design parameter studies undertaken by NHPC Ltd for submission to NCSDP. He described the key features of micro earthquake studies undertaken for Subansiri lower project in an extent of about 50km around the project area. He also presented the key features of latest techniques of Local Earthquake Tomography (LET) studies undertaken for Dibang project. He informed w.r.t. extensive real time seismic data monitoring being undertaken by NHPC through installation of accelerograph network at various power stations. Till date no reservoir induced seismicity has been observed in the hydropower projects located in the Himalayas specifically NHPC projects and even in the largest reservoir of India at Indira Sagar Project in M.P.

### 12<sup>th</sup> Keynote Lecture Hydropower Development in Bhutan with Emphasis on Mangdechhu Hydropower Project

*Speaker: Shri Arvind Kr. Mishra, Managing Director, MHPA, Bhutan*

Shri Mishra could not attend the conference due to some urgency. Shri Pankaj Punetha, Chief (Geology) gave presentation on his behalf. He spoke about various geological challenges faced during the construction of head race tunnel, Surge shaft and underground powerhouse of the project. He informed that the construction activities are going on as per schedule and the project shall be commissioned within stipulated cost and without time overrun.

### Technical Sessions

On the day one, two technical sessions were held. A brief description of sessions is given below:

#### First Technical Session (Day one): Theme: Underground Space Utilization

This session was chaired by *Prof. K.S. Rao, IIT, Delhi* and co-chaired by *Dr. Atul Nanda, EIL, New Delhi*.

In this technical session six nos. papers were presented. First paper titled "Grout Intake Estimate for Underground Works" was presented by Sh. Gopi Kannan of EIL where a correlation between seepage and grout intake was proposed citing example through case study of a gas storage cavern project in India. Second paper titled "Assessment of rock mass of escape tunnel- A case study from Lift Irrigation Project, Telangana State, India" was presented by Sh. D.S. Rawat of NIRM where the author discussed about the success story of excavation of escape tunnel in challenging geological conditions by providing timely supports, implementation of effective ventilation system and finding an alternate way which considerably reduced the length of escape tunnel. Third paper titled "Intervention of highly permeable tunnel parallel joints in underground storage caverns" authored was presented by Sh. Saikat Pal of EIL. He discussed various methods adopted to tackle highly permeable tunnel parallel joints in an underground storage cavern in India. Fourth paper titled "Successful initial filling of 15km long 10.50m dia, head race tunnel of Rampur hydroelectric project (412MW) constructed in Himalayan Geology-risk and challenges" was presented by Sh. Lalit Mohan Verma of SJVNL. The author shared the experience of first filling of a large diameter HRT in challenging geological conditions and different risk mitigation measures like consolidation grouting. The fifth paper of this session titled "Different Techniques adopted to tackle the geological adversities during the construction of Rampur Hydropower station (412MW)-A case study of Head Race Tunnel" was presented by Dr. Uma Kant Sharma of SJVNL. It highlighted challenges of tunneling in difficult ground conditions citing different support measures like pre-grouting, pipe roofing and multi-drifting to tackle major cavities. The last paper titled "Geologically Problematic band and its treatment on upstream wall of large underground surge pool cavern-A case study from lift irrigation scheme-Telangana State, India" was presented by Dr. A.K. Naithani of NIRM.

#### Second Technical session (Day one): Theme: Exploration and Testing Techniques

This session was chaired by *Sh. M. Raju, DG (Retd.), GSI* and Co-chaired by *Dr. V.K. Sharma, Ex- Dy. DG, GSI*

In this session, ten technical papers were presented. The first paper titled "Laboratory Assessment of Rock-A case study" was presented by Sh. Sukhdev Singh of CSMRS. It highlighted different laboratory rock mechanics tests carried out in three variants of isotropic and anisotropic rocks to determine variation in strength properties and failure pattern with anisotropy and mineral composition in the three rock types. The second paper of this session titled "Shear strength of rockmass-interpretation and analysis" presented by Shri Hari Dev of CSMRS dealt with the significance of in-situ test as the best possible way for representing the rock mass as it takes into account rock discontinuities. The author also highlighted the





importance of data interpretation and experience in finalization of strength parameters from in-situ testing. The third paper titled "Interpretation of Deformability of rock mass at Dam site of Nyera Amari Hydropower project in Bhutan" was presented by Dr. Rajbal Singh compared deformability test results obtained from in-situ tests carried out at dam site of study area with modulus value determined by indirect method of Q-system. The authors proposed a multiplication factor of 2.5 with the modulus of deformation value obtained from in situ tests as a good representative value. The fourth paper titled "Geotechnical assessment regarding feasibility of proposed additional spillway site, Hirakud Dam project, Sambalpur District, Odisha" was presented by Sh. Debaprasad Sahoo. It described detailed geotechnical characterization carried out in the form of surface and subsurface investigations and rock mechanics tests at proposed spillway site of the study area to assess the feasibility of site to seat proposed spillway. An alternate site was proposed. The fifth paper titled "Geological Investigations on the causes of collapse of Irrigation Tunnel- a case study from Hulikere, Mandya district, Karnataka" was presented by Sh. A.V. Ganesh. It discussed collapse of oldest irrigation tunnel namely Hulikere in Karnataka causing heavy damage. Main causes for the collapse were analyzed and presented. The sixth paper titled "Investigation of Critical landslides and Design of remedial measures on National Highway-5, Himachal Pradesh" authored by Prasad P.S. and Kishore Kumar was presented by Sh. Prasad P.S of CSIR. In this paper, investigations of critical landslides and design of remedial measures citing a case study of National Highway-5, Himachal Pradesh was discussed. Based on the study, the authors stressed the need to involve multidisciplinary team of experts consisting of Geologist, Geotechnical engineers and Structural engineers for preparation of DPR. The seventh paper titled "Evaluation of geological properties of rockmass of Loktak downstream dams site with emphasis on its groutability" authored by Mainak Ghosh Roy and Imran Sayeed was presented by Sh. M.G. Roy of NHPC. A deterministic approach to assess groutability of rock strata in dam area of Loktak D/S project in terms of its relationship with geological and hydraulic characteristics has been presented. The authors recommended the need for studying mechanical behavior of rock and rheological properties of grout for selection of grout specification. The eighth paper titled "Prognosis and treatment of Buried channels in River Valley Projects- A Geotechnical Perspective" was presented by Sh. Vivek Sharma of NHPC. The paper evaluated the investigation techniques employed in few hydropower projects of NHPC for prognosis of buried channel along with treatment measures carried out to control seepage through them. The ninth paper titled "Generation of Lithological model using Rock Works software for Sankra Block Jaisalmer District, Rajasthan" was presented by Dr. L.N. Sharma. It focuses on the use of Rockworks software to understand aquifer characteristics and develop a 3D lithological model. The author claims that RW software provide useful results to develop a 3D hydro geological framework of the

study area. The tenth and last paper of this technical session titled "Electrical Resistivity Tomography for coal fire mapping over Jharia coal field, India" was presented by Dr. Abhay Kumar Bharti of CIMFR, Dhanbad. The authors presented subsurface coal fire mapping carried out in the study area using Resistivity Imaging measurement and separation of coal fire from non fire blocks using Resistivity anomaly for hazard assessment due to concealed subsurface coal fire.

### **Third Technical Session (Day Second): Theme: Infra-structural, Ground Water Resource and Engineering Geology of High dams, Seismic Studies and Earthquake Engineering**

This session was chaired by *Dr. K. Jayabalan, Dy. D.G., GSI* and Co-chaired by *Shri Niroj Kr Sarkar, Director, GSI*

For this session ten papers were selected for presentation. However, authors of three technical papers were not present therefore two alternative papers were presented from the standby list after the permission of the Chair. Only one paper could not be presented as the authors could not make to the conference. A brief account of this technical session is given below:

The first paper titled "Assessment of physico-chemical parameters of groundwater quality in Ramanagaram taluk, Karnataka" was presented by Sh A.V. Ganesh. It deals with groundwater quality issue of Ramanagaram taluk. Concentration of some parameters found to be higher than permissible limits are discussed in this paper. The second paper titled "Bacteriocin source tracing: Water reservoirs a potential source for producing an alternative to antibiotics" authored by Dr. Sabiha Imran throws light on the potential use of reservoirs of multipurpose projects as a source of Bacteriocin producing bacteria that could be utilized as alternative to antibiotics and promising anticancer agents. The third paper titled "Engineering Geology for high dams" was presented by Sh Vinod Thakur. The paper highlighted various engineering geological problems faced during construction of high dams in the Himalayan region. The fourth paper titled "Instrumentation in Concrete Gravity Dam with Special Reference to Nathpa Dam of SJVN Ltd" was presented by Sh B.K. Gupta. This paper make assessment of various geotechnical instruments installed at Nathpa dam. The fifth paper titled "Seismic Analysis & Design of Surface Power House, Rampur HEP (412 MW)" was presented by Manish Chauhan of SJVNL. The paper discusses layout optimization and designing methodology using seismic parameter values approved by NCSDP for Surface powerhouse of Rampur hydropower project. The sixth paper titled "Site Specific Seismicity Assessment of a Port in India" was presented by Sh Pranav Badrakia. The seventh paper titled "Importance of seismic aspects of underground structures in hydro power projects in Himalayan" was presented by Shri Revati Raman



of SJVNL. The paper discusses the importance of considering seismic aspects during designing of underground structures of hydropower projects in Himalayas. The eight paper titled "Geotechnical evaluation of access tunnel to underground powerhouse cavern, Kundah Pumped Storage Hydroelectric Project, Nilgiri district, Tamil Nadu" authored by K. Aravind and K. Jayabalan was presented by Shri K. Aravind from GSI. The ninth and final paper titled "Cavity Treatment in adverse geological condition - A case study of Transformer hall cavern of Vishnugad Pipalkoti HEP, Uttarakhand" was presented by Shri Ajay Kumar of THDC.

#### **Fourth Technical Session (Day Second), Theme: Slope Stability & Monitoring, Landslide Hazard & Ground Subsidence.**

Session was chaired by *Dr. M.R. Bhutiyani, Director DTRL, DRDO and Co-chaired by Shri N.K. Mathur, Ex- General Manager, NHPC Ltd.*

Eight technical papers were presented in this Session. The first paper titled "Landslide Susceptibility zoning for sustainable development: case study from eastern Kumaun Himalaya" was presented by Dr V.K. Sharma, Ex-Dy DG, GSI. The other presenters of this session included Sh Shyam Sunder Singh, Ms. Shikha Srivastava of DTRL, DRDO. Sh Sanjeev Gupta, Ms Vaani Sharma of DTRL, DRDO, Sh. Dharmendra Kumar of GSI. Dr. Michael Hembrom of DTRL, DRDO and Sh Ravi Shankar Chaubey of GSI.

#### **Poster Session:**

Technical Papers were also presented in two Poster Sessions on 1st and 2nd day of the Conference. About ten nos posters were exhibited during the conference. This event in particular generated great interest in lunch break also.

#### **Concluding Session:**

The two day conference was concluded with brief valedictory program which was also well attended and Chaired by Shri R.N. Misra, President ISEG. The chief guest during this session, Shri S.D. Dubey, Former Chairman, Central electricity Authority (CEA) was welcomed and felicitated by President, ISEG. President ISEG and Chair Organizing Committee also said that the conference was conducted with unprecedented popularity.

Veteran Members of ISEG were felicitated during the Valedictory session. Shri R.N. Misra, President ISEG and Chairman, Organizing Committee honored the senior members with shawls. The ISEG Best paper awards for the papers presented during the conference were announced by the Editor, ISEG.



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### Resolutions of Conference:

After detailed deliberations during the technical sessions and valedictory session of the conference following resolutions of EGCON 2017 were unanimously passed:

1. Issues of geological surprises have been debated in the conference. Many of the surprises are not actually surprises but geological difficulties. There is need to differentiate between geological problems and geological uncertainties. Many problems are known in advance but their precise location is not available. So it is essential for the authorities to be ready for such problems during construction of projects.
2. Probe drilling and advanced core drilling should be the part of the contracts and such activities should be integral part of time cycle for tunnel excavation. The contract documents should elaborately describe the geological problems anticipated along with proposed solutions.
3. There is need to understand and appreciate the geological reports in totality and a perfect coordination is needed to be maintained between geologist, designers and construction engineers.
4. Landslides in the mountainous regions are one of the major natural hazards. Assessment of landslides susceptibility using modelling techniques and computer aided technology has been discussed during the conference. Efforts made for the development of an Early Warning System were highlighted and need for adoption of the latest technology for mitigation and control measures was stressed upon.

Shri Imran Sayeed, Secretary, ISEG delivered vote of thanks for the conference and on behalf of OC thanked the Chief Guest, Dignitaries, delegates, veteran members, sponsoring organizations, advertisers, exhibition participants, Chair and Co-Chairs of technical sessions, keynote speakers, and all the members of OC.

**Secretary, ISEG**





# HANS CLOOS

## FOUNDER OF GEOMECHANICS

### BIOGRAPHY

Hans Cloos, a German geologist has played a significant role in the development of modern structural geology and is also known as "*Founder of Geomechanics*". Despite his writings being almost exclusively in the German, his thinking had an enormous influence at that time; it forms the basis of much modern structural geology. He was one of the pioneers to make use of physical models to investigate the rock deformations and mechanics of faulting.

Hans Cloos was born on 8<sup>th</sup> November 1885 in Magdeburg in Germany and he obtained doctorate in 1910 from the University of *Freiburg im Breisgau* which is located near the juncture of the Alps and the Black Forest. His Phd thesis dealt with the mechanism of disturbance of the Jurassic cover rocks which form the Jura mountain chain. He then travelled to South-West Africa at the invitation of his uncle where he mapped in the Erongo Mountains of Namibia. Subsequently, he worked as an oil exploration geologist in Indonesia before returning to Germany and beginning a lectureship at the University of Marburg until the First World War. During the war, he worked as a military geologist in France until being released due to ill-health. Following the war, he began a study of plutons and their interior structure. He was appointed as Professor of Geology at the University of Breslau at the young age of 34. During economically difficult post war period in Germany, when field work opportunity was restricted, he mapped granite quarries of Stehlen, 30km south of Breslau to come up with the relationship between joint orientation, mineral alignment and dykes associated with the intrusion and post-intrusion history. He co-related his findings from Stehlen with earlier observations at Erongo where he had observed the role of wall rock fracturing in controlling stoping at the granite contact and thus the intrusion of the igneous mass.

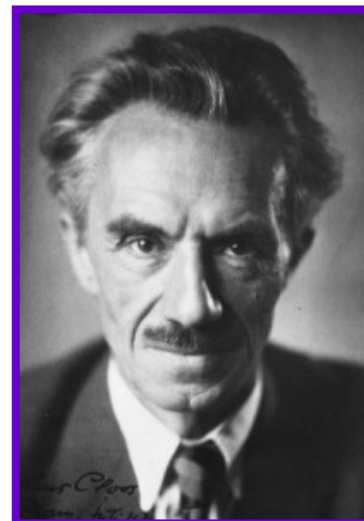
In 1925, Cloos became Head of Department of Geology at the University of Bonn where he remained till the end of his career. During this tenure, he was extensively involved in research work concentrating on relationship between folding and slaty cleavage, relative ages of quartz veins, variation in fold trends and the role of underlying basement rocks on the deformation of cover. Based on his field observations, he recognized that direction of the imposed stress influence the resulting fracture system in rocks. He then conducted numerous laboratory experiments in which large blocks of clay were progressively extended under tension. He believed that clay provided a suitable scaled medium by which to model rock mass behavior. He then applied the knowledge gained from his model to direct field observations made within the Rhine graben. He confirmed that the styles of faulting seen in the model were actually present at site. These observations which were unique at that time established him as one of the pioneer researcher in the field of tectonics.

Cloos travelled widely, carrying out geological studies in the Sierra Nevada (USA), Scandinavia, England and Germany. These travels and his work are described in his book "*Conversation with the Earth*" (1954), originally published in 1947

After the Second World war, Cloos was invited to become mayor of Bonn but he declined the offer, thus devoting himself to the subject of geology and to the needs of students and friends. He was an inveterate field sketcher. As a geologist he was outstanding, being able to translate field observations into dynamic processes. He had a major grasp of the literature, paying particular attention to clarity both in text and drawings.

Geological Society of America (GSA) in 1948 awarded Hans Cloos, the Penrose Medal recognizing his illustrious career as geologist who contributed enormously for its development. He died on 26<sup>th</sup> September 1951 in Bonn, Germany. Those who knew Cloos speak of him as being an inspirational teacher, kind, humorous, skilled in language and tolerant.

Cloos was not an engineering geologist, but he developed the precursors to practices we now take for granted, such as the practice of measuring defect orientations, classifying them and investigating and analyzing the movement documented in this way to identify the 'Geomechanics' of the rock system. As John Knill observed, he demonstrated all the key characteristics of a good engineering geologist, being an excellent field observer and recorder, relating laboratory test results to real life observations and he was able to present his findings in a three dimensional context. A 100 km long wrinkle ridge **Dorsum Cloos** on the Moon was named after Hans Cloos in 1976.



**Hans Cloos**  
(1885 –1951)



International Association for Engineering Geology & Environment (IAEG) has established "**Hans Cloos Medal**" in 1977 which is awarded after every two years to an engineering geologist of outstanding merit, who has gained international recognition for contribution to the development and advancement of engineering geology. Till 2016, twenty one eminent engineering geologists have received this prestigious medal from IAEG.

**Compilation by:**  
Rahul Khanna, Editor, ISEG

## CONSTRUCTION OF DEEPEST CUT OFF WALL IN INDIA AT POLAVARAM MULTIPURPOSE PROJECT "AN ENGINEERING MARVEL"

**B.D. Patni**  
Member (PMU)  
Polavaram Project Authority,  
Andhra Pradesh, India



Photo 1 A view of cut-off wall alignment

Polavaram Irrigation Project is a multipurpose project located on Godavari River near Ramayyapeta, Polavaram in West Godavari district, Andhra Pradesh, 42 km upstream of existing Sir Arthur Cotton Barrage. The storage water will be utilized for irrigation, drinking water and generation of 960 MW power. The project is approachable by road. The nearest railway station is Kovvur about 34 km away from site and the nearest airport is at Rajamundry which is about 60km from site. The geographical coordinates of the project are at longitude 81°39'46"E, latitude 17°16'53"N.

The project is being constructed for irrigation benefits to 4 lakh acres of land in East Godavari, Vishakhapattanam districts by Left bank Canal and to 3.2 lakh acres in West Godavari, Krishna districts by Right bank Canal. It is proposed to divert 80 TMC of water to Krishna River through right bank canal. The left bank canal covers a length of 181.50 km and right bank canal runs for a length of 174.00 km to irrigate 4.0 Lakh acres of land.

In addition to irrigation benefits, generation of hydro-electric power with installed capacity of 960 MW and water supply for industries in Vishakhapattanam besides drinking water supply to villages and towns' en-route are also proposed under the project.

The project components include:

- Spillway located on right bank along with connecting approach channel and spill channel;
- Earth dam in Gap I on left bank of river;
- Earth cum rock fill dam and cut off wall is (Gap II) located in main flow channel of Godavari River;
- Earth dam in Gap III located on right bank
- Surface powerhouse located in left bank having 12 Kaplan turbines of 80 MW capacities each.

The estimated design flood is 3.6 million cusecs and PMF is estimated as 5.0 million cusecs.

### Construction Methodology of Cut-Off Wall:

A cutoff wall 1432 meter long and 1.5 meter wide being constructed by L&T and Bauer in Polavaram Project has maximum depth of 96 meters. The total length of 1432 meter is divided into 400 panels including primary and secondary panels.

The methodology of the cutoff wall construction is divided into two stages. At the 1<sup>st</sup> 50 meter depth, length of primary panel is



Photo 2 Construction of cut-off wall at Polavaram Irrigation Project.

7 meter (1<sup>st</sup> bite 2.8m, 2<sup>nd</sup> bite 2.8m and 3<sup>rd</sup> bite 1.4m) and length of secondary panel is 2.8 meter. The length of the panel below 50 meter depth will be 2.8 meter each primary and secondary. As on date, concreting of 153 nos. panels has been completed. To start the work, the guide wall level was maintained at El 18m in the first phase.

The cut off wall alignment has been explored through 37 nos bore holes for delineating the sub-surface behaviour of the river bed material. The maximum depth is reported 105 meters in the existing river channel. Based on the core log results, the RBM consist of coarse grained sand and intermittent bands of black soil in the upper horizon of right bank. The drill hole results indicate that the thick river bed deposits are devoid of boulders, pebbles and cobbles. The thick deposit of sand followed by slightly weathered to fresh charnokite and quartzo-feldspathic-garnetiferous gneiss rock. At places fractured pegmatite bands were also recorded during excavation.

Keeping in view the nature of river bed deposit and its characteristics only grab machine is being used for excavation of RBM. However rock cutter has been deployed for excavation of bed rock for 2 meter deep socketing. The entire operation of excavation of cut off wall is under the continuous circulation of bentonite Slurry.

The strength of the plastic concrete maintained between 1.5 to 2.5 Mpa. Before pouring concrete slump, slump flow, temperature, air content test were conducted in the laboratory for quality assurance. There is eminent probability of collapses of panel wall in such a sandy media, therefore, Koden tests are being carried out for assessment of deviation and collapses, if any. As per the Koden test report, no manifestation of major collapses has been recorded. Regular monitoring of panels is being carried out with reasonable accuracy after completion of panels. As on date out of 1427m, 684.8 Rm length of the cutoff wall has been completed.

In general, the foundation rock along cutoff wall alignment has Fair to Good RQD and low to moderate permeability. The permeability values range from 0 to 30 Lu in most of the bore holes. However, bore hole no. 30 has shown exceptionally high value of 178 Lu near deepest portion of the cut off wall. As per past experience in Himalayan terrain, continuous circulation of bentonite clay in the panel reduces the permeability value to a great extent.

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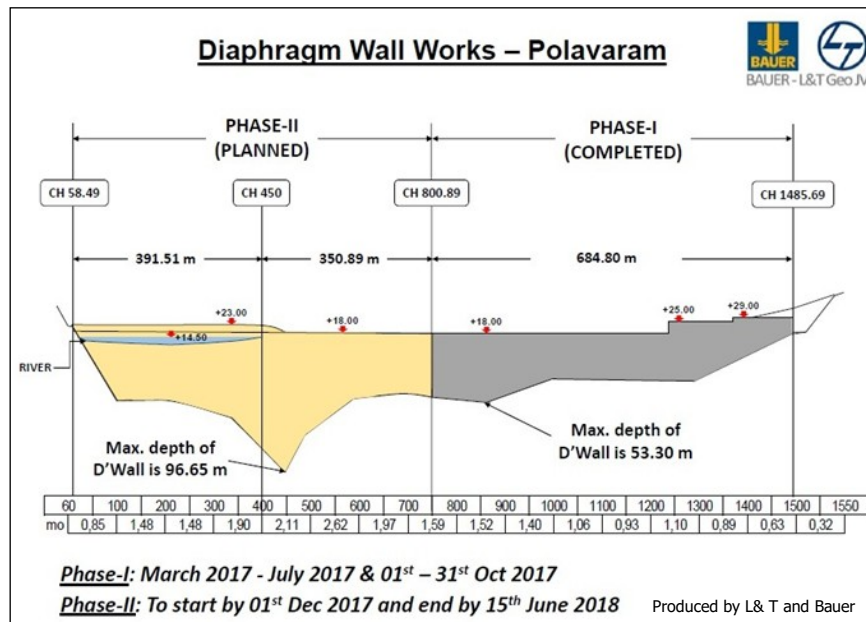
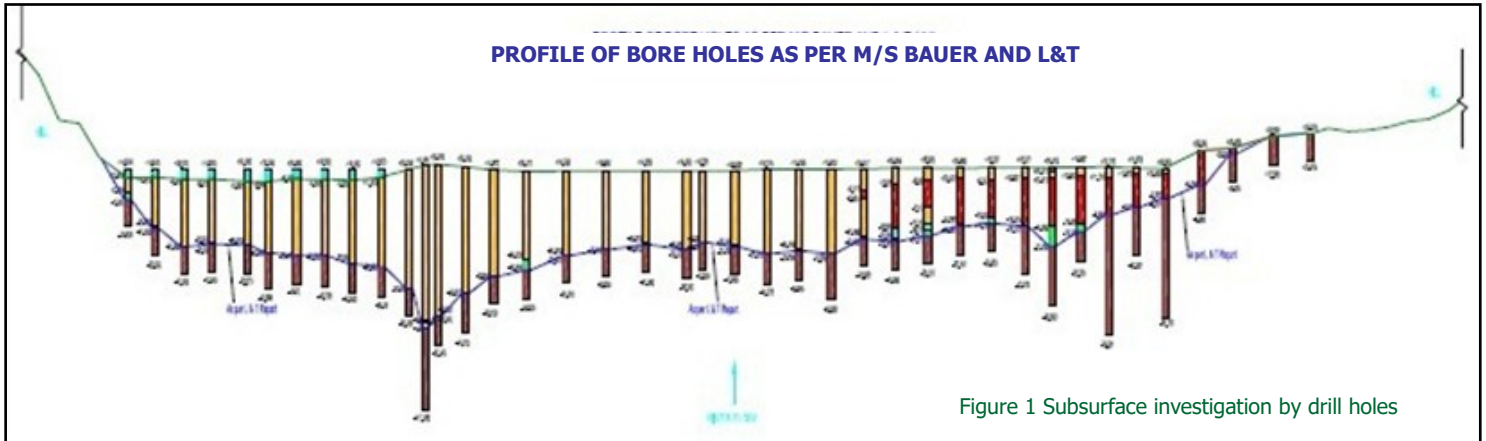


Photo 5 Cutter bits for excavation of rock



Photo 6 Excavation by Grab



Photo 3 Excavation of Guide wall.



Photo 4 Construction of Guide wall.



Photo 8 Koden Ultra Sonic Sensor

Photo 9 Koden test results (L&amp;T-Bauer)

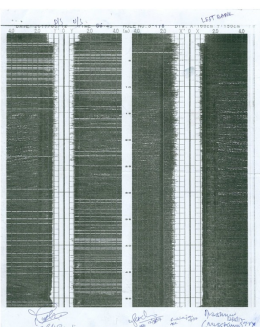
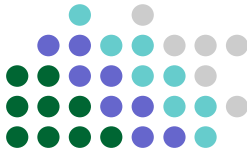


Photo 7 Pouring of plastic concrete

**Acknowledgement:**

The author is thankful to M/s L&T & Bauer for supplying relevant data and photographs.



## ISEG NEWS

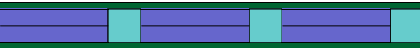
( A Biannual Newsletter of ISEG )

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### CHENANI NASHRI TUNNEL ( Jammu & Kashmir )



Chenani Nashri is India's longest road tunnel and Asia's longest bi-directional highway tunnel, it traverses a distance of 9.2 km connecting Chenani in Udhampur district with Nashri in Ramban district. Located at an altitude of nearly 4,000 feet, is built in a record time of 5 years by spending about Rs 3,720 crore. This tunnel is India's first and the world's sixth road tunnel with a transverse ventilation system, which basically means it has inlets at every 8m bringing fresh air into the main tube along with exhaust outlets every 100 m opening into the escape tube.

The tunnel comprises of two tubes which are connected by 29 cross passages at regular intervals along the entire length of the tunnel. Out of the two tubes, the main traffic tube has a diameter of 13m. The escape tunnel has a diameter of 6 m and can be used in times of distress or to tow any vehicle that has broken down. The tunnel is specially significant as it would reduce travel time on National Highway 44 between Jammu and Srinagar by almost 2 hours.

## THE WINGS OF ENGINEERING GEOLOGY

### Saikat Pal

Manager,  
Engineers India Ltd.  
New Delhi.

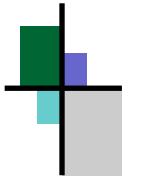


Photo 1 The muck hills of a project



Photo 2 Idle equipments during work stoppage

Engineering geology has come a long way across the globe from St. Francis dam to Three Gorges dam, from Fritchley Tunnel to Gothard Base Tunnel. India too, has laid many engineering geology footprints like high dams, road & railway tunnels to underground storage caverns. Needless to say, this voyage of engineering geology is an inseparable journey of the engineering geologists- the interpreters between engineering and a natural science. Hence, as a part of their profession they have learnt to absorb nature and assist engineers in understanding the same. That Engineering geology plays a unique role in successful completion of civil engineering projects is an unquestionable fact established throughout the history of engineering geology. What remains often camouflaged is how different non geological aspects of project management manoeuvre the geology of the project.

Does engineering geologist have any interest in availability of muck disposal site? Apparently, no, but if the non availability of disposal site lead to disposal of mucks near low cover zone of tunnels and consequently the deformation in the area is found alarming! The project is at stake and more so the role of engineering geologist. Similarly, engineering geologist does not have any distant relationship with work stoppages of the project but what if the stoppage, for whatsoever reason, stretches the stand up time of the unsupported span in the excavated tunnel or the cut-slope to a extent that lead some unexpected failure! It becomes a matter of great concern for engineering geologist. Does he require knowing the 'AHR' (Abnormally High Rate) and 'ALR' (Abnormally Low Rate) items? – Definitely yes, to understand the tendency to overdo or reluctant use of certain items related to rock support.

When we talk about sustainable solutions to engineering geology problems, the engineering geologist has to be flexible enough to find out amicable solutions without compromising the progress of the project or to work out the deadlock from within available logistics but what about the sustainability of the engineering geologist himself! The two major tools of engineering geology-rock supporting and grouting are often considered as non productive operations as they do not increase the 'progress'. The carrot being lost, only stick remains at the hand of engineering geologist! The story would definitely have been different if billing of payment could be raised for any excavated tunnel span only when the recommended rock support has been installed.

Inadequate mobilization of equipments, which hampers supporting and grouting works; inappropriate costing of items which contrive the under supporting or over supporting during execution; the downplay of timely support and grouting to prioritize the production i.e. excavation; all depicts the trait of non-geological factors influencing the geology of project in a big way to the extent impacting the health, time and cost of the project.

Some of the factors are results of unavoidable circumstances over the project span, some are use or misuse of loopholes in contract clause or schedule of rates to serve as a escape root under the shield of "geological surprise" or to extract the extent of profitability/ makeup of losses during project execution, while some others are result of tremendous pressure of owner to complete the project in/ ahead of time schedule. Whatever may be the reason; engineer geologists have to face the music due to direct/ distant links to geology and often become the sole responsible. The engineering geology in India has come to a crossroad from where, to increase their stake in success stories, the engineering geologists, needs to develop the knack of indulging in the facets of projects management: planning to contract management; mobilization to (muck) disposal; quality to bill of quantity of material and be vigilant in non-geological facts as well notwithstanding their pivotal role in engineering geology.

***To fly higher, engineering geology needs to spread its wing.***