

RESUME

NAME : HARISH BAHUGUNA



DESIGNATION : Superintending Geologist,
Group A, Central Geological Services
Geological Survey of India
Ministry of Mines
Government of India

UPSC BATCH : UPSC 1998 (All India rank 4th)

FATHER'S NAME : Sh. G.P.BAHUGUNA

D.O.B : 18-05-1970

EDUCATIONAL QUALIFICATION: MSC, Geology from HNB Garhwal University, (University Topper).
Pursuing PhD on the Foundation Evaluation of Koteswar Dam, Uttarakhand, India (Thesis to be submitted in May 2016)

CORE AREAS

OF EXPERTISE :

1) Engineering Geology and Geotechniques

2) Hydropower Development – Engineering Geological investigations pertaining to **Investigation and Planning, Pre-construction stage, Construction stage and Post Construction stage** works of Mega (Tehri Dam, Sardar Sarovar, Koteswar Dam, Srinagar Dam, Tapovan – Vishnugad) Medium, Small (Bhilangana Hydrel Scheme) and Mini Hydroelectric Projects in different parts of the country and in Nepal (Saptkoshi Multipurpose Project 3000 MW). Involvement in the development of power plants having a **cumulative installed capacity of about 3700 MW.**

3) Stabilisation of Hill Slopes in Himalayas

4) Landslide Investigations and Stabilisation (Varunavat Parvat Stabilisation in Uttarakhand).

5) Infrastructure -Investigations and Geological/Geotechnical assessment of Road alignments – Assessment for widening of NH-34 of BRO and Roads of PWD Govt. of Uttarakhand.

6) Bridges- Foundations and abutments of RCC and Suspension bridges.

7) Tunneling – Excavation and Stabilisation of long tunnels

8) Caverns - Excavation and Stabilisation of large caverns and power stations

9) Transmissions Routes – Assessment of routes for transmission lines and power pooling stations

10) Urban Development Planning – For Four Towns of Gujarat affected by Bhuj Earthquake of 2001 viz Anjar, Bhuj, Bhachau and Rapar

11) Disaster Management Studies – Assessment and Evaluation of the damages at temple township of Kedarnath and other parts of Rudraprayag district of Uttarakhand **after the disaster of June 2013.**

12) Macroseismic Surveys – Macroseismic surveys for Bhavnagar Earthquake swarm of 2000 and Bhuj Earthquake of 2001.

13) Post Construction Evaluation of Reservoir Rim – Stability assessment of areas above the rim of Tehri reservoir

14) Feasibility of River Linking Project – Satluj – Yamuna link project

IMPACTING CONTRIBUTIONS

- 1) Review of the foundation conditions of Dam and stilling basin at Koteswar Dam Project (IC 400MW, THDCIL), lead to a saving of **about rupees 200 million i.e. approx. \$3.6 million USD.**
- 2) Detail and in depth analysis of the stability conditions in the powerhouse cavern of Tapovan – Vishnugad HPP (IC 520MW, NTPC, Ltd), saved an additional expenditure of about rupees **7 million INR or \$ 0.12 million USD, saved about one year construction time** and also facilitated before time completion of excavation in the cavern.
- 3) Review of the layout of one small hydroproject of UJVNL in Gori Ganga valley, District Pithoragarh, Uttarakhand, resulted in enhancement of the installed capacity by about additional 8 MW which means a value addition of about **rupees 800 million INR or approx \$ 14 million USD.**
- 4) Geological assessment of foundation of one block of the main dam at Vyasi HEP saved the excavation and concreting to the tune of **about rupees 50 million INR or about \$ 1million USD.**

- 5) Review of the design of BVC at Vyasi HEP (IC 120MW, UJVNL) meant a saving of about **rupees 15 million INR or about \$ 0.26 million USD** and a construction time of about one year.

COMMITTEES :

- 1) Special Invitee to Project Review Panel (Experts from India and World Bank Panel) on Vishnugad - Pipalkoti Project, District Chamoli, Uttarakhand, India.
- 2) Attended and participated in the meetings of Technical Advisory Committee (TAC) on Tehri and Koteswar dam projects and National Committee on Seismic Design Parameters (NCSDP).
- 3) Member of the Enquiry Committee set up by Govt. of Uttarakhand, in 2007, on the Ground Subsidence in Chain Village, Distt. Chamoli, Uttarakhand, India.
- 4) Member of the Enquiry Committee set up by Govt. of Uttarakhand in July 2005 on Santudhar – Pilkhera Road, Distt. Pauri Garhwal, Uttarakhand, India.
- 5) Spearheaded the expert committee set up by Govt. of Uttarakhand on the assessment of the stability of the areas located above the rim of Tehri reservoir, District Tehri Garhwal and Uttarkashi, Uttarakhand, India.
- 6) Member of the Enquiry Committee set up by Govt. of Uttarakhand, in 2007, to investigate the cracks reported on the top of Neelkanth Peak in Badrinath area, Distt. Chamoli, Uttarakhand, India.
- 7) Member of the Enquiry Committee set up by Govt. of Uttarakhand, in 2010, to investigate the heavy ingress of water through the HRT of Tapovan – Vishnugad hydroelectric Project of NTPC, Distt. Chamoli, Uttarakhand, India.
- 8) Member of the Committee set up by Govt. of Uttarakhand, in 2005, to investigate the leakage of water from the HRT of Dhauliganga hydroelectric Project of NHPC, Distt. Pithoragarh, Uttarakhand, India.

MEMBERSHIP :

- 1) Life member of Indian Society of Engineering Geology (ISEG), Council member of the ISEG council for 2005-2007.
- 2) Annual Member of International Association of Engineering Geology (IAEG).
- 3) Life Member of Indian Society of Rock Mechanics and Tunneling Techniques (ISRMTT)
- 4) Life Member of Society of Earth Sciences (SES)

**PRESENT PLACE
OF POSTING :**

UJVN Limited,
Dehradun, Uttarakhand.

EXPERIENCE

From December 2013 – Till date

Place of Posting: UJVN Limited (Govt. of Uttarakhand Undertaking), Dehradun.

Heading the Geology and Environmental Cell of UJVN Limited. Responsible for Geological and Geotechnical Investigations, assessment and rendering advice to Govt. of Uttarakhand on all the major, small and microhydel projects located in the state of Uttarakhand.

At present engaged in the assessment of **Vyasi Hydroelectric Project (IC 120 MW) and Lakhwar Hydroelectric Project (IC 300 MW).**

Played a key role in getting the clearance from Geological Survey of India on the DPR'S of **Bowala Nandprayag HEP (IC- 300MW) as well as for Nandprayag – Langasu HEP (IC-100MW).**

Finalisation of design drawings pertaining to the excavation and stabilization of slopes, foundation and underground structures of Vyasi HEP. Cleared foundation of dam block nos. 1, 2 and 4 for concreting. Concreting in the foundation of block no.4 completed successfully.

Lining in the HRT started after lowering of the invert without disturbing the already excavated section.

Excavation and stabilisation of slopes above powerhouse pit completed up to B. L. road. The B. L. road has been shifted 7.5m inside the hill without putting any hindrance to the traffic movement and without inducing any instability on the slopes above and below it.

The key inputs from me during the preparation of the presentation and for the public hearing played an important role in successful completion of the public hearing for BNP on 18-10-2014.

Identification of the borrow areas for construction material for BNP. With the identification of new borrow areas, the expected quantity of material will be far in excess of what is required for BNP and remainder from it can be kept reserved for Nandprayag Langasu (NPL) HEP (just downstream of BNP).

Geological and geotechnical assessment of 12 nos. of SHP of the nigram was carried out by me, which helped the nigram in reviewing their status, planning for reconstruction and modifying the DPR.

Assessment of Paina gad SHP in Pithoragarh district helped in finalizing the layout of water conductor system and also in enhancing the installed capacity of this project from the presently planned 9MW to 17 MW i.e. value addition of about 8MW (about 70 – 80 crores of rupees).

Worked assiduously for successful conduction of the first consultation meeting on Sirkari Bhyol Rupsiyabagar HEP (IC 168MW) at CEA New Delhi on 20-07-2015.

I have provided valuable geological inputs during the site visit of the Chief Engineer and Directors of CWC to the Lakhwar MPP.

During the site visit to Kishau MPP along with GM (CNP) identified potential borrow areas for construction material.

I have attended the meetings of Expert Body constituted by MOEF or the directives of Honorable Supreme Court and prepared a number of notes and presentations on behalf of UJVNL.

I have attended a number of meetings from time to time at GSI, CWC, CEA and CSMRS which helped the interests of UJVNL.

From December 2013 – August 2013

Place of Posting: State Unit Uttarakhand, Geological Survey of India, Dehradun

As Superintending Geologist (JAG level officer of Govt. of India) responsible for Construction Stage Engineering Geological Investigations of Tapovan Vishnuprayag Hydropower Project (IC 520MW) and Srinagar Hydroelectric Project (IC 344 MW).

From August 2013 – August 2007

Place of Posting: State Unit Uttarakhand, Geological Survey of India, Dehradun

As Senior Geologist and party Chief of GSI for Tehri and Koteshwar Dam Projects continued the Engineering Geological Investigations of Tehri Dam, Koteshwar Dam Project, Bhilangana Hydel Scheme and Treatment of Varunavat Parvat landslide.

Koteshwar Dam Project (IC 400 MW) was commissioned successfully in 2011 and Bhilangana Hydel Scheme (IC 22.50MW) was commissioned in 2011.

Path breaking contribution was made while analyzing the excavation and stabilization of the machine hall of Tapovan Vishnugad HPP (IC 520MW), which saved about 12 months precious time and more than 70 lac rupees of the Government.

i) Tehri Pumped Storage Plant (PSP Stage-II)

Construction stage engineering geological investigations of second stage works of the first Pumped Storage Plant (PSP IC 100 MW) of Northern India at Tehri Dam Project were carried out and supervised by me as the Party Chief at camp Tehri. Completed construction stage engineering geological investigation of six numbers of approach adits covered a cumulative length of about 4000 meters. It includes construction of approach adit for the machine hall, a 270m long and 7.5m diameter pilot along the crown of the machine hall (to be widened as the machine hall cavern), approach adits for accessing the top and bottom levels of downstream surge shafts and a link adit, connecting two already excavated adits (adit 8 and adit 9) for haulage of excavated muck from the machine hall of PSP so that it does not hinder access to the machine hall of stage-I. **A de-novo approach of integrating the three classification systems i.e. Q, RMR and GSI** for classifying the rock mass was adopted by me. It helped in back analysis of the class of rock mass and also in optimizing the support system.

This new approach made it possible to foretell the excavation methodology and sequence of excavation ahead of the face which in turn helped the project authorities save the precious time and complete excavation in time. In fact the excavation of link adit 8-9 was completed in a record time in the history of Tehri project. In depth geotechnical analysis by me saved tremendously on the support measures without major stability problems.

ii) Koteshwar Hydroelectric Project (IC 400MW)

Construction stage engineering geological investigations, of 97.5m high, concrete gravity dam and its appurtenant structures. Completed construction of gravity dam, stilling basin, surface powerhouse, underground main access tunnel (MAT 376m long 8m dia), four vertical and horizontal penstocks, six numbers of drainage cum inspection galleries, one freight shaft and a surface switchyard. The geotechnical inputs provided by me were vital in deciding the foundation levels of surface structure which saved enormous excavation of hard rock and thus saved precious time and money. The stabilisation measures in underground structures were optimized as per the rock mass condition which not only optimized the support system but saved substantial amount of money. **3D analysis using the software 3DEC based on Discrete Element Analysis, with the help of Scientists from NIRM Bangaluru,** was carried out for assessing the stability of the slopes on either abutment of Koteshwar dam. It helped not only in revising the stability measures but also helped in optimizing the support measures for the slopes considering the operational life of the project. Project has been commissioned and running successfully.

iii) Tapovan Vishnugad Hydroelectric Project (IC 520 MW) in District Chamoli,

Uttarakhand- **Construction stage** engineering geological investigations of are being carried out by me as the Party chief. Construction of approx.12Km long HRT is in progress (8 Km by TBM and 3.8 Km by DBM) whereas excavation of Surge shaft, Machine hall, transformer hall, TRT manifolds, TRT (4nos.), horizontal penstocks(4nos.) and bus ducts (2nos.) has been completed. I used an integrated approach for understanding and analyzing the development of cracks on the left wall and part of the crown of the machine hall during the benching of wall below SPL. The design engineers had advised a stabilization sequence which might have put the construction activities at abeyance for a period of about seven months and lead to a colossal expenditure to the tune of about rupees 6 million (Rs 60 lac). The problem was analysed by me by combining the field geological data, records of the installed instruments and the report of 3D numerical modeling (by NIRM). A revised sequence of excavation and stabilisation was suggested by me which was duly acknowledged and followed by the project authorities and the excavation was completed without losing time and spending money.

iv) **33 KV Electric Substation of Uttarakhand Power Transmission Corporation (UPTCIL)**

Feasibility stage investigation of 33 Kv electric substations of Uttarakhand Power Transmission Corporation Ltd and Kot (Near Pauri) district Pauri, Garhwal, (Uttarakhand).

v) **Vishnuprayag-Muzaffarnagar Transmission line (PGCIL)**

Post Construction stage engineering geological investigation of re-routed alignment of tower foundations of the said transmission line and suggested foundation treatment and the slope stabilization measures.

International Project

Saptkosi Multipurpose High Dam Project (Nepal)

DPR stage Engineering Geological Investigations of 269m high earth core rock fill High Dam Project (**IC 3000 MW**) across river Saptkosi in Nepal. In a short stint of about 4 weeks, detailed geological mapping on 1:1000 scale of part of the left bank of Saptkosi dam was carried out. For the first time in the history of this project (1949 to 2010) an attempt was made to define the litho-units within the Kosi series of rocks. Going beyond the conventional approach, the rock mass characterization for the rocks, of the mapped part, has been attempted by using the field geological observations and using the empirical equations (by Barton 2002). The values for different parameters was back analysed by using the free software Roclab V1 which corroborated the results derived from the empirical equations. A paper bringing out these results has been presented in the International Conference on Underground Space Technology (ICUST 2011) organized by International Association of Engineering Geology.

Investigations during the Recent Uttarakhand Disaster of June 2013

Extensive geological studies were undertaken in Rudraprayag district of Uttarakhand which was worst affected during the recent disaster of 2013.

I was amongst the members of the first scientific team from Govt. of India to visit the Kedarnath temple and adjoining area.

The note on Geological assessment of Kedarnath area prepared by me was submitted to Govt. of Uttarakhand.

Attended several high level review meetings chaired by Shri V. K. Duggal, Member NDMA, Chief Secretary and other senior officials of Uttarakhand and presented the views of Geological Survey of India.

From Oct. 2002 – August 2007

Place of Posting: Uttaranchal Unit, Dehradun

1. Tehri Dam Project (2000 MW)

Construction stage engineering geological investigations of 260.5m high rock fill earth dam and its appurtenant structures, including geological mapping of the foundation of chute spillway, stilling basin, downstream protection work and cut-slopes on either bank of stilling basin, 3D geological mapping of shaft spillways and their separation chambers, approach adit for pumped storage plant, assessment of rock mass condition and suggesting stabilization measures, drill core logging in the grouting galleries for assessing the efficacy of grouting (consolidation & curtain) and investigation of Asena quarry for rip-rap material.

Project was successfully commissioned in 2006.

2. Koteswar Hydroelectric Project (400MW)

Construction stage engineering geological investigations, of 97.5m high, concrete gravity dam and its appurtenant structures. Geological sections along the dam axis, powerhouse and switchyard areas were vitally utilized for issuing construction drawings by the principal designer. The stripping limits and support system were revised based on the inputs supplied. At present geological mapping of main dam abutment foundation, cut slopes and 3D geological mapping of Penstock shafts is being continued.

3. Varunavat Parvat Landslide, Distt. Uttarkashi, Uttaranchal

Construction stage investigation and treatment, of Varunavat Parvat Landslide, inter-alia identification of dumping sites and location of construction material for retaining structures. Geological inputs were utilized by the designers for designing the stable slopes.

4. Bhilangana Hydel Scheme (22.5MW)

Carried out **Construction stage** investigations of the main weir, HRT, powerhouse areas. Also issued a feasibility report on the proposed transmission route of this scheme from Ghansali-Chamba (32Km).

5. Power pooling station of Power Grid Corporation (PGCIL)

Feasibility stage investigation of power pooling station of PGCIL at Man and Phafran villages, district Tehri, Garhwal, (Uttaranchal). It will utilized to pool power from second stage PSP of Tehri Dam and other schemes coming up in the region.

6. Vishnuprayag-Muzaffarnagar Transmission line (PGCIL)

Construction stage engineering geological investigation of tower foundations and suggested foundation treatment and the slope stabilization measures.

7. Study of Landslides

- i. Carried out geotechnical study of Govindghat landslide in Chamoli district, submitted the report, suggesting the remedial measures.
- ii. Carried out geotechnical study of Ramolsari landslide.
- iii. Carried out geotechnical study of Duadhar landslide in Tehri district, submitted the report, suggesting the remedial measures.
- iv. Carried out Detailed Geological Mapping of Bhatwari Landslide Area in Uttarkashi District Uttarakhand.
- v. Carried out Detailed Geological Mapping of Painsi landslide Zones in Chamoli District of Uttarakhand.

8. Communication networks (Roads and Bridges)

- i. Pulinda road in district Pauri, Garhwal. Carried out geotechnical assessment of landslide affected Pulinda road, also assessed the proposed alternate alignment. Report containing recommendations submitted to PWD.
- ii. Santudhar-Pilkhera road in district Pauri, Garhwal. Carried out geotechnical assessment and suggested stabilization measures.
- iii. Bhason bridge. Carried out **Construction stage** engineering geological investigations of Bhason bridge across Bhagirathi River. Geological inputs were utilized for issuing the construction drawings.
- iv) Syansu Gad Suspension Bridge – Assessment of anchor block foundation.

9. Tapovan-Vishnuprayag Hydroelectric Project (520MW)

From May 2000 – September 2002

**Place of Posting; Engineering Geology division
GSI, W.R. Jaipur, Rajasthan**

Projects Attended

1. Sardar Sarovar Dam (1200 MW) on Narmada River, Gujarat

Construction stage engineering geological investigations, of 110m high, concrete gravity dam and its appurtenant structures. Geological mapping of the foundation of approach channel, tail race channel, stop lock gates, stilling basin of irrigation bypass tunnel (IBPT) and 3D geological logging of IBPT.

2. Bhanwar-Semla Dam

Construction stage engineering geological investigations, concrete gravity dam at Bhanwar-Semla in Chittorgarh District, Rajasthan.

3. Mansi-Wakal Dam of Hindustan Zinc Ltd.

Preconstruction stage engineering geological investigations of Mansi-Wakal Dam on Mansi river in Udaipur District, Rajasthan.

4. Amarpura Dam

Construction stage engineering geological investigations of a 15 m high earth and rock fill dam which has a masonry overflow section. Geological mapping of the foundation of entire main dam core and all the blocks of overflow section was carried out. Foundation treatment and grout pattern was suggested based on the geological inputs.

5. Chhapi Dam

Post construction stage investigation of Chhapi dam in Jhalawar district, Rajasthan. Carried out geotechnical assessment of leakage from the main dam and suggested remedial measures.

6. Communication projects (Roads and Bridges) in Rajasthan

i. **Bridge across Mashi River, District Jaipur. Preconstruction and construction stage** investigations for the foundation. Geological mapping of the foundation of both the abutments and all piers. Suitable treatment in the abutment foundation were suggested which saved considerable excavation in the hard rocks of BGC.

ii. **Bridge across Ghora-Pachar river, District Bundi. Preconstruction stage** investigations, including drill core logging, which helped in deciding the depth of sound rock for placing the foundation.

7. Seismological Studies

i. Ground geological Survey of Bhuj Earthquake of 2001

Carried out ground geological and the standard penetration tests (SPT) in the four towns viz. Anjar, Bhuj, Bhachau and Rapar, affected by the Bhuj earthquake of 2001. The database (which also included geomorphological and seismotectonic inputs) so generated was utilized for preparing the urban development plan for the above mentioned towns by Gujarat Urban Development Company an undertaking of Govt. of Gujarat.

ii. Bhavnagar earthquake swarms of September 2000

Carried out ground geological survey of micro earthquake swarms in Bhavnagar, Gujarat. Prepared the isoseismal map of the area.

From April 1997 – May 2000

Place of posting; Project, Sikkim
GSI, N.E.R. Gangtok, Sikkim

- 1. Preconstruction stage** engineering geological investigation of head race tunnel in Rongli, East Sikkim.
- 2. Study of land slides**
 - i. As a member of technical team set up by Govt. of West Bengal, carried out geotechnical investigation of the land slides of 1998 in Kurseong subdivision of Darjeeling district. Report containing the treatment and preventive measures was submitted to Govt. of West Bengal.
 - ii. Geotechnical study of Burdang (20th mile) slide and Ranikhola (9th mile) landslide in East District, Sikkim.
- 3. Study of road alignment**

Carried out geotechnical assessment of road alignments of BRO in East Sikkim.
- 4. Mineral Exploration**

Carried out PII/EI stage mineral exploration of base metals in Pedong-Rhenock areas in Darjeeling and East Sikkim and in Legship area in West Sikkim. A de-novo occurrence of Rungdu copper mineralization was reported.
- 5. Geoenvironmental Studies**

Carried out geoenvironmental studies of the area between Singtam-Rangpo in East Sikkim.

Publications:

A) In International Journals and Proceedings

- 1. Harish Bahuguna**, Optimisation of Excavation and Support Measures for the Slopes back of Surface Powerhouse of Vyasi Hydroelectric Project, Journal of Engineering Geology, International Conference on Engineering Geology in New Millennium, ISEG/IAEG, New Delhi, India, Oct. 2015, ISSN: 0970-5317, pages 456 – 466.
- 2. PVS Rawat, A.P. Thapliyal, S. K. Tripathi, Harish Bahuguna et.al;** Quo-Vadis in Kedarnath : Post Disaster 2013, Journal of Engineering Geology, International Conference on Engineering Geology in New Millennium, ISEG/IAEG, New Delhi, India, Oct. 2015, ISSN: 0970-5317, pages 1339 – 1348.
- 3. Harish Bahuguna, R. Sanwal and T. B. Ghoshal;** Rock Mass Characterisation at Saptkoshi High dam Project in Nepal; Published in the International Conference on Underground Space Technology organized by International association of Engineering Geology and Indian Society of Engineering Geology, 17-19 Jan 2011, Misc-07 pp. 1 – 14.

- 4) Dr. P.C.Nawani, **Harish Bahuguna**, and H.C.Khanduri; Geoanalytical Approach in Locating and Executing Spillway Structures of Tehri Dam in Uttarakhand Himalaya, India; Published in the Proceedings of International Symposium and 7th Asian Regional Conference of **International Association of Engineering Geology (IAEG)**, **Chengdu, China**, 9 – 11 September 2009, Volume 1. 1, pp 154 -160.
- 5) **Harish Bahuguna**, H.C.Khanduri and D. P. Dangwal; Excavation of Large Diameter and Deep Vertical Shafts in Poor and Extremely Poor Geological Conditions: A Case from Tehri Dam, India; Published in the Proceedings of International Symposium and 7th Asian Regional Conference of **International Association of Engineering Geology (IAEG)**, **Chengdu, China**, 9 – 11 September 2009, Volume 2. 1, pp 655 - 663.
- 6) **Harish Bahuguna**, H. C. Khanduri, D. P. Dangwal, P. K. Gajbhiye and I. Chakraborty; Geotechnical Investigations in the Planning of Powerhouse Complex of Tehri Dam Project (Stage – I), India; Published in the Proceedings of The World Tunnel Congress Agra 22 – 24 Sept. 2008; Organised by **International Tunneling and Underground Space Association**, Vol 1; pp 54 – 63.
- 7) **Harish Bahuguna**, H. C. Khanduri, D. P. Dangwal and I. Chakraborty; Geological and Geotechnical Investigations in the Planning of A Small Hydroporproject – A Case from Bhilangana Hydrel Scheme, District Tehri Garhwal, Uttarakhand, India; **7th International R & D Conference** “ Development and Management of Water and Energy Resources”; 4th – 6th February 2009, Bhubaneshwar, Orissa; Abst. Vol. pp 96 – 97.
- 8) Dr. P.C.Nawani, H.C.Khanduri, and **Harish Bahuguna**; Geotechnical Aspects of Spillway Structures of Tehri Dam; Published in the Water and Energy International (CBIP); Special Issue on Tehri Dam Project, Volume 64 N0. 1, pp 70 -83, 2007.
- 9) Dr. P.C.Nawani, H.C.Khanduri and **Harish Bahuguna**; Geotechnical Aspects of Tehri Dam Foundation; Published in the Water and Energy International (CBIP); Special Issue on Tehri Dam Project, Volume 64 N0. 1, pp 58 -69, 2007.
- 10) H.C.Khanduri, Dr. P.C.Nawani and **Harish Bahuguna**; Rock Mass Characteristics of Underground caverns of Tehri Powerhouse Complex; Published in the Water and Energy International (CBIP); Special Issue on Tehri Dam Project, Volume 64 N0. 1, pp 84 -91, 2007.

B) National

- 1) **Harish Bahuguna**, H. C. Khanduri, D. P. Dangwal and I. Chakraborty; Treatment of A Highly Deformed Rock mass Zone in Control Gate Shaft Area, Tehri Dam Project, District Tehri Garhwal, Uttarakhand; Journal of Engineering Geology, Vol. XXXVI Nos. 1 – 4; **ISSN : 0970 – 5317; Indian Society of Engineering Geology (ISEG)** December 2009; pp 105 – 112.

- 2) **Harish Bahuguna**, H. C. Khanduri, D. P. Dangwal and I. Chakraborty; Excavation and Stabilisation of Right Bank Shaft Spillways, Tehri Dam Project, District Tehri Garhwal, Uttarakhand; Journal of Engineering Geology, Vol. XXXVI Nos. 1 – 4; ISSN : 0970 – 5317; **Indian Society of Engineering Geology (ISEG) December 2009; pp 113 - 122.**
- 3) **Harish Bahuguna** and D. P. Dangwal; Incidences of Slope Movement and Need for Monitoring the Slopes above the Rim of Tehri Reservoir, Tehri Dam Project, Uttarakhand; 2ND India Disaster Management Congress, Organised by National Institute of Disaster Management, New Delhi; 2009; Abst Vol. pp 64 – 65.
- 4) **Harish Bahuguna**, U. P. Gupta and D. P. Dangwal; Application of GB-SAR Technique for Monitoring the Stability of Slopes above Tehri Reservoir Rim, District Tehri Garhwal, Uttarakhand; National Conference on mass Instability and Earthquake Risk Management in Mountainous Regions: Challenges, Lessons Learnt and Future Strategies; 27th – 28th June 2008; Organised by Disaster Mitigation and Management Centre, Govt. of Uttarakhand, Dehradun; Abst. Vol. pp. 12 – 13.
- 5) P. K. Gajbhiye, **Harish Bahuguna** and U. P. Gupta; Scheme for Monitoring of Varunavat Parvat Landslide, District Uttarkashi, Uttarakhand; National Conference on mass Instability and Earthquake Risk Management in Mountainous Regions: Challenges, Lessons Learnt and Future Strategies; 27th – 28th June 2008; Organised by Disaster Mitigation and Management Centre, Govt. of Uttarakhand, Dehradun; Abst. Vol. pp. 16 – 17.
- 6) D.K.Rai, **H.Bahuguna** and S.S.Ameta; Bhavnagar (Gujarat) Earthquake Swarm with Special Reference to the Tremor, 12th September 2000 (Ext. Abs.); Proceedings on National Seminar on Geotechniques and Geological Hazards in the Indian context; April 24-26, 2001; pp- 251 - 253.
- 7) P. Tarafdar, **H. Bahuguna**, P.Bhowmik and N.C. Bhattacharya; Copper Occurrence of Rungdu-Sodunglakha - Karabari Area, East district Sikkim; Proceedings on National Seminar on Mineral Exploration and Resource Survey Basemetal, Strategic mineral and Rare Earths; December 19- 20 2001, PP 71 - 75.
- 8) K.N.Nanda, Mohd. Fahim and **H.Bahuguna**; Geoenvironmental Appraisal of Area between Singtam and Rangpo, East and South districts Sikkim; Proceedings on National Seminar on Geology, Mineral and Water Resources of Sikkim, 11th August 2006, PP46 - 47
- 9) P.Tarafdar, **H. Bahuguna** and P.Bhowmik; Basemetal Occurrence of Rungdu-Sodunglakha Area and Its Significance; Proceedings on National Seminar on Geology, Mineral and Water Resources of Sikkim, 11th August 2006, PP20.

Special Publication:

P.C Nawani., R Sanwal., H.C Khanduri., **Harish Bahuguna** and D.P.Dangwal;
Tehri Dam Project; A Geotechnical Appraisal; Bulletin Series B No. 62,
Govt. of India Publication PGSI - 282, GSI, Lucknow, 2006; ISSN: 0445 –
622X.

Reports:

I have authored **more than 45 reports** of different projects/items of investigation in GSI and have issued a number of notes/study notes to project authorities' viz. THDCIL, NTPC, AHPC/GVK and Govt. of Uttarakhand.

In UJVNL I have authored 12 reports on as many small hydro projects.

Records of Geological Survey of India

About **50** extended abstracts have been published in the records of GSI vol. 8.

Documentary

I, single handedly wrote the script, compiled and edited the documentary entitled “Bulandion Ke Hamsafar” on the role of Geological Survey of India in the investigation and construction of Tehri dam Project. It is the only and first documentary brought out officially by GSI in the field of Engineering Geology/Geotechniques.

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