CV of Dr. B. Hanumantha Rao

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2005-09: Ph.D. (Geotechnical Engineering) from IIT Bombay

2003-05: M.Tech. (Geotechnical Engineering) from IIT Bombay

1999-03: B.E. (Civil Engineering) from Osmania University, Hyderabad

1995-98: Diploma (Civil Engineering) from Govt. Polytechnique, Kothagudem

Professional Experience

- Associate Professor, IIT Bhubaneswar, October 2022 – till present.
- Assistant Professor, IIT Bhubaneswar, December 2011 – October 2022.
- Assistant Professor, NIT Rourkela, August 2011 – December 2011.
- Scientific Officer-D, NPCIL, November 2010 – July 2011.
- Assistant Professor, KL University, AP, June 2010 – November 2010.
- Post-doctoral Research Fellow, University of Saskatchewan, Canada, and September-2009 - April-2010.
- Research Assistant, IIT Bombay, January 2009 – June 2009.

Research Interests

- **Ground Improvement**
  - Expansive Soil Stabilization
  - Clay Mineralogy and Oxides Influence
- **Sensors and Sensing Techniques for Geosystems**
  - Geomaterial Characterization
  - Linear and Volumetric Strain Measurements
  - Contaminant Detection
  - Slope Monitoring
- **Geoenvironmental Engineering**
  - Geotechnics & Waste Valorization: *Red Mud, Fly Ash, Phosphogypsum*
  - Tailings Management
  - Thermal Effects on Geomaterial Behavior: *Thermal Conductivity & Thermal Storage, Phase change materials*
  - Biopolymers and Geopolymers
  - Microbiogeotechnology
  - Remediation of Contaminated Sites: *Elecrokinetics, Biotreatment, Phytoremediation*

Teaching Experience

Courses taught

UG Level	PG Level

○ Foundation Engineering ○ Ground Improvement ○ Geoenvironmental Management ○ Engineering Drawing and Computer Graphics ○ Structural Detailing and Drawing ○ Soil Mechanics Laboratory ○ Engineering Mechanics ○ Soil Mechanics ○ Geotechnics of waste and waste containment	○ Foundation Analysis and Design ○ Ground Improvement ○ Advanced Geotechnical Engineering ○ Environmental Geotechnics Lab ○ Advanced Soil Mechanics ○ Applied Soil Mechanics ○ Geotechnics of waste and waste containment ○ Geotechnics of polluted sites ○ Insitu testing of soils laboratory

Courses Developed

- Geotechnics of waste and waste containment
- Geotechnics of polluted sites
- Transportation geotechnics
- Unsaturated soil mechanics
- Insitu testing of soils laboratory

Research Developments

- Developed Hydro-pneumatic based constant load application device;
- Synthesized and developed geopolymer concrete using fly ash-red mud-slag combination;
- Developed an environmental friendly chemical additive for neutralization of extreme alkaline wastes;
- Developed a considerable data bank on nature and behavior of Indian expansive soils;
- Developed a laser based sensing system for measuring crack geometry of clay liner systems and covers;
- Developed laser based sensing system for measuring linear and volumetric strains in soils;
- Developed custom designed, in house, sensing system for measuring simultaneous movement of heat and moisture in barrier materials used for clay liner systems;
- Developing hydro-pneumatic constant load application device for swell pressure measurements and consolidation;
- Developed a concept called MICP (Microbially Induced Carbonate Precipitation) for stabilizing the wastes by biocementation process;
- Thermal probe for determining the thermal properties of soils
- Accelerated diffusion test setup for determining the diffusion characteristics of intact rocks
- Impedance cell for determining electrical properties of soil
- Mini-compaction set-up

Sponsored Research Projects

2014-17 Studies on characterization of unsaturated soils using thermal flux **sponsored by IIT Bhubaneswar**

2014-17 Establishment of swelling and cracking characteristics of expansive soils from suction measurements, sponsored by **CSIR**

2014-17 Investigations on Strength and Volume Change Properties of Red Mud for its Effective Utilization in Geotechnical Applications, sponsored by **DST under Fast Track scheme**

2014-17 Synthesis, characterization, and development of red mud-fly ash based geopolymer concrete, sponsored by **NALCO**

2015-19 Characterization and utilization of red mud as a structural fill and embankment material, sponsored by **DST**

2018-21 Characterization studies of nano-enhanced phase change material (NEPCM) in thermal storage devices for sustainable building designs in India, sponsored by **DST under CERI scheme**

2018-19 Estimation of morphodynamicity and its remedial action using red-mud based concrete at coastal zone of Eastern Odisha, sponsored by **Ministry of Mines**

2019-22 A novel Biotreatment of bauxite residue for conversion into sustainable geomaterial, sponsored by **MHRD under SPARC**

2019-21 Geoenvironmental and geotechnical issues of coal mine overburden, sponsored by **MHRD under SPARC**

2022-24 Green and sustainable construction materials from waste industrial by-products-red mud and waste gypsum by **DST under Indo-Slovenia bilateral scientific and technical cooperation project**

Consultancy Projects

- Soil testing for widening & strengthening of Bhawanipatna-Gunupur-Kasipur road, Arkitech Pvt Ltd
- Design and stability analysis of an embankment for new BG rail line, Tracks and Towers Infratech (P) Ltd
- Assessment of compressibility characteristics of cut spoil, Tracks and Towers Infratech (P) Ltd
- Testing of soil for embankment of BG rail line, IVRCL
- Design of rural road using fly ash, JK Paper Mills Ltd.

Awards/Merits/Scholarships

- Novel technology developed on "Geopolymer concrete product with industrial wastes" stood among one of the top innovative projects (out of 77) in **ALL IIT R&D Fair 2021**.
- Best presentation award (Oral) of the paper presented in IGC-2019 held at NIT Surat, India from 19th - 21st December 2019.
- **Second Ranker** in Engineering Common Entrance Test, ECET-1999.
- **PRATIBHA** award with **Scholarship** from the Government of Andhra Pradesh, 1999-2003.
- Fellowship from **BRNS, Mumbai** for pursuing full-time Ph.D. at IIT Bombay from 2005 to 2009.
- Post-Doctoral Research Fellowship from the **University of Saskatchewan, Canada,** from 2009 to 2010.

Thesis Guidance

Ph.D. Thesis

Name	Title of thesis	Status	Co-Supervisor
Janardhan Tahasildar	Establishment of Swelling Characteristics of Expansive Soil from Suction Properties	2017[$]	-
M. Srinivasula Reddy	Synthesis, development, and characterization of geopolymer concrete made with industrial wastes of fly ash and red mud	2019	Dr. Dinakar Pasla
Shamshad Alam	Characterization of coarse fraction of red mud as a civil engineering construction material	2018	Prof. SK Das
N. Gangadhara Reddy	Geotechnical and geoenvironmental characterization of red mud with different amendments: mineralogical and morphological investigations	2020	-
P. Srikanth Reddy	Characterization of expansive soils from different parts of India: Correlating swelling behavior to different properties	2022	Prof. Bijayananda Mohanty
Manas Chandan Mishra	Chemical treatment methods for mitigating alkalinity in the bauxite residue: pH rebound and leaching studies	2022	-
Bheem Pratap	Development of composite materials using red mud and phoshopgypsum	Joined-2018	Dr. Somenath Mondal
Goushya Begum	Stability analysis of bauxite residue tailings facility: effect of climatic impacts	Joined-2020	-
Benazeer Sultana	Microbial methods for treating of bauxite residue: pH rebound and leaching studies	Joined-2021	-
Shubojit Saha	Synthesis and development of pavement composites using bauxite residue and phosphogypsum	Joined-2021	-
Kummari Sekhar	Synthesis of construction materials from waste industrial byproducts - red mud and phosphogypsum	Joined-2022	

$withdrawal after synopsis presentation

M. Tech. Dissertation

Name(s) of student	Title of thesis	Co-Supervisor	Status
P. Pavithra	Development and behavioral characteristics of fly ash based geopolymer concrete	Dr. Dinakar Pasla	2015
K. Sateesh	Characteristics study of stabilized red mud waste as a resource material for pavement	Dr. P P Dey	2018
N. Robinson	Investigations on biopolymer treated bauxite residue as a resource material for subgrade in low volume roads	Dr. Debasis Basu	2019
Vishal Khanna	Microbial treatment for stabilization of granular lateritic soils for pavement applications	Dr. Umesh Sahoo	2019
Tapan Kumar Barik	Performance assessment of alkali activated fly ash and slag combination for stabilization of lateritic soils	Dr. Umesh Sahoo	Temporary withdrawal
Ajay T	Stabilization of soft soils using Graphene oxide	Dr. Debasis Basu	2021

Samay Murmu	Integrated geophysical approach (micro-gravity, electrical resistivity tomography and ground penetrating radar) for ground water exploration in hard rock region-A case study	Prof. Rambhatla G Sastry	2021
Shivesh Kumar	Rheological properties of tailings: Red mud	-	2021
Tanmay D Deshpandhe	Improvement in Bearing Capacity of Soft Clay underneath a Railway Embankment using Encased-Stone Column Technique	-	2021
Gunanshu Bhargava	Development of geopolymer mortar with industrial wastes following the concept of circular economy	-	2022
Naseera KK	Development of geopolymer mortar using fly ash by circumventing elevated temperature curing	-	2022
Ujjawal Chaudhary	Synthesis of alkali activated cementitious product from red mud, phosphogypsum and fly ash	-	2022
Siddhant Yashwant Gajbhiye	Seepage detection and monitoring of tailings dam at Vedanta Aluminium Plant at Lanjigarh (Odisha) using resistivity method	Prof. R.G. Sastry	2022
Savi Kadse	Biopolymers for remediating fugitive dust emissions of tailings facility		2023
Rajendra Prasad K	Studies on leachate volume estimation of hazardous waste management facility	Dr. RR Dash	2023

B. Tech. Thesis

SI. No.	Name(s) of student	Year of Completion
1.	Saurah Kumar, Surodeep Ghosh	2013
2.	Gauri Prasad, PK. Reddy	2013
3.	M Rahul Bhaskar, M Sambhakar	2014
4.	Swaraj Jena, H.P. Meena	2014
5.	Monia Tudu, Saurav Sen	2015
6.	RS Yadav, AS Raghu Charan	2015
7.	Ujjwal Kumar, B Bharat Naik	2016
8.	S Atul Bhimani, Sandeep Kumar	2016
9.	CH Anusha	2017
10.	**DESHA SHENTHAN**: Bearing capacity calculation of encased stone column for varying insertion depths	2022
11.	**Deepak meena**: Stability analysis of deep vertical cuts in soils	2022
12.	**C SUPRITHA REDDY**: Pile capacity estimation considering variability in adhesion factor of soils	2022
13	**Pramod:** Influence of confinement on lateral resistance of encased stone column	2023
14	**B Vishnumurthy:** AI for swelling soils parameter estimation	2023
15	**Yuvraj Singh:** Dike strengthening by soil nailing technique	2023

Continuing Education Program

11-22 July-2016 Fundamentals of Geosynthetic Engineering sponsored by MHRD under

		GIAN programme
25	July-5 Aug-2016	Polluted Sited: Characterization and Remediation sponsored by MHRD under GIAN programme
13–15 June 2018		Low clinker high performance cement composites (HPCC)
5–9 July 2021		Design of landfills and waste containment systems sponsored by AICTE

Research Publications

International / National Journals:

1. B. Hanumantha Rao. B, A. Dalinaidu and DN Singh, (2007) "Accelerated Diffusion Tests on Intact Rock Mass", Journal of Testing and Evaluation, *ASTM*, Vol. 35, No. 2, pp: 111-117.
2. B. Hanumantha Rao, Ajaz M. Bhat, and DN Singh, (2007) "Application of Impedance Spectroscopy for Modeling Flow of AC in Soils", Geomechanics and Geoengineering: an International Journal, 2(3), 197-206.
3. B. Hanumantha Rao and DN Singh, (2008) "Determination of Diffusion Characteristics of Intact Rock Mass: A Critical Comparison", Geotechnical Testing Journal, ASTM, 31(6), 490-502.
4. B. Hanumantha Rao, V. Sridhar, RR Rakesh, DN Singh, PK Narayan, and PK Wattal, (2009) "Application of In-situ Lysimetric Studies for Determining Soil Hydraulic Conductivity", Geotechnical and Geological Engineering Journal, Vol. 27(5), 595-606.
5. B. Hanumantha Rao and DN Singh, (2010) "Establishment of Soil-water Characteristic Curve from Electrical Measurements", ASCE Journal of Geotechnical and Geoenvironmental Engineering, 136(5).
6. Ajaz Massod Bhat, B. Hanumantha Rao and DN Singh, (2007) "A Generalized Relationship for Estimating Dielectric Constant of Soils", Journal of ASTM International, ASTM, 4(7), Published Online: 15 August 2007, pages 12, DOI: 10.1520/JAI100635.
7. DN Arnepalli, B. Hanumantha Rao, S. Shanthakumar, and DN Singh, (2008) "Comparison of Methods for Determining Specific Surface Area of Fine-grained Soils", Geotechnical and Geological Engineering, 26(2), 121-137.
8. Yusuf Erzin, B. Hanumantha Rao and DN Singh, (2008) "Artificial Neural Network Models for Predicting Soil Thermal Resistivity", International Journal for Thermal Sciences (4.779), 47(10), 1347-1358.
9. K. Venkataramana, B. Hanumantha Rao, and DN Singh, (2009) "A Critical Review of the Methodologies Employed for Determination of Tensile Strength of Fine-grained Soils", Journal of Testing and Evaluation, 37(2), published online 1st March-2009, pages 8.
10. Yusuf Erzin, B. Hanumantha Rao, Anjan Patel and DN Singh, (2010) "Application of Artificial Neural Network Models for Predicting Electrical Resistivity of Soils from their Thermal Resistivity," International Journal of Thermal Sciences (4.779), 49(1), 1189-130.
11. B. Hanumantha Rao and DN Singh, (2010) "Application of Thermal Flux for Establishing Soil-water Characteristic Curve of Kaolin", Geomechanics and Geoengineering: An International Journal, 5(4), 259-266.
12. Dalinaidu. A, B. Hanumantharao, Shanthakumar. S, and DN Singh, (2010) "Determination of Distribution Coefficient of Geomaterials and Immobilizing Agents", Canadian Geotechnical Journal (4.167), 47, 1139-1148.
13. B. Hanumantha Rao, K. Venkataramana, and DN Singh, (2011) "Studies on Determination of Swelling Properties of Soil from Suction Measurements", Canadian Geotechnical Journal (4.167), 48(3), 375-387.

14. B. Hanumantha Rao, and Singh. DN (2011) "Moisture Content Determination by TDR and Capacitance Techniques: A Comparative Study", Int. Journal of Earth Sciences and Engineering, 4(6), 132-137.
15. B. Hanumantha Rao and DN Singh, (2012) "Establishing SWCC and Determination of Unsaturated Hydraulic Conductivity of Kaolin by Ultra Centrifugation and Electrical Measurements", Canadian Geotechnical Journal (4.167), 49(12), 1369-1377.
16. B. Hanumantha Rao, V. Sridhar, RR Rakesh, DN Singh, PK Narayan, and PK Wattal, (2013) "Modeling Radioactive Contaminant Transport in Soils", International Journal of Environment and Waste Management (IJEWM), 12(3), 318-119.
17. B. Hanumantha Rao, (2014) "A methodology for determination of crushing strength of stabilized waste from shear wave velocity". International Journal of Geotechnical Engineering, 8(1), 84-93.
18. Reddy GN, Tahasildhar J and Rao BH (2015) Evaluating the influence of additives on swelling characteristics of expansive soils. International Journal of Geosynthetics and Ground Engineering (0.55), 1(7), 13 pages.
19. Rajes S, Rao BH, Sreedeep, S, and Arnepalli DN (2015) Environmental Geotechnics: An Indian perspective. ICE publishing Environmental Geotechnics Journal (2.556), 2(6): 331-335.
20. P Pavithra, M Srinivasula Reddy, P Dinakar, B. Hanumantha Rao, BK Satpathy, AN Mohanty, (2016) A mix design procedure for geopolymer concrete with fly ash, Journal of Cleaner Production (11.072), 133, 117-125.
21. M. Srinivasula Reddy, P. Dinakar, B. Hanumantha Rao (2016) A review of the influence of source materials oxide composition on the compressive strength of geopolymer concrete, Journal of Microporous and Mesoporous Materials (5.876), 234, 12-23.
22. Tahasildar J and BH Rao (2016) Determination of swelling characteristics using soil water characteristic curve parameter, Indian Geotechnical Journal, 46(3), pp: 319-326.
23. B. Hanumantha Rao, (2016) A device for studying the simultaneous heat and moisture movement in soils, Environmental Geotechnics Journal (2.556), 3(5), 302-311, DOI: 10.1680/envgeo.13.00118.
24. N. Gangadhara Reddy and B. Hanumantha Rao, (2016) Evaluation of the Compaction Characteristics of Untreated and Treated Red Mud, ASCE, GSP-272, 23-32.
25. P. Pavithra, M Srinivasula Reddy, P. Dinakar, B. Hanumantha Rao, BK Satpathy, AN Mohanty, (2016) Effect of Na_2SiO_3/NaOH Ratio and NaOH Molarity on the Synthesis of Fly Ash Based Geopolymer Mortar, ASCE, GSP 272, 336-344.
26. M. Srinivasula Reddy, P. Dinakar, B. Hanumantha Rao, BK Satpathy, AN Mohanty, (2016) A Study on the Effect of Oxide Compositions on Compressive Strength Characteristics of Geopolymer Concrete, ASCE, GSP 272, 1-10.
27. Tahasildar J, B. Hanumantha Rao and Shukla SK (2017) Mineralogical compositions of some Indian expansive soils and their influence on swelling characteristics, International Journal of Geosynthetics and Ground Engineering (0.56), 3(2): 5.1-10.
28. Tahasildar J and B. Hanumantha Rao (2018) Development of relationships between swelling and suction properties of expansive soils, International Journal of Geotechnical Engineering, 12(1), 53-65.
29. Alam S, Das SK and Rao BH (2017) Characterization of Coarse Fraction of Red Mud as a Civil Engineering Construction Material", Journal of Cleaner Production (11.072), 168, 679-691.
30. N. Gangadhara Reddy and B. Hanumantha Rao (2018) "Compaction and Consolidation Characteristics of Untreated and Treated Red Mud Waste" Geotechnical Research, ICE Publishing, 2018, 5(2), pp: 106-121, https://doi.org/10.1680/jgere.18.00005.

31. N. Gangadhara Reddy and B. Hanumantha Rao (2018) "Characterization of Settled Particles of the Red Mud Waste Exposed to Different Aqueous Environmental Conditions" Indian Geotechnical Journal, doi.org/10.1007/s40098-018-0300-z, pages: 1-15.
32. N. Gangadhara Reddy, B. Hanumantha Rao and Krishna R Reddy (2018) "Biopolymer treatment for mitigating dispersive characteristics of red mud waste" Geotechnique Letters (1.89), 8(3), 1-7.
33. M.S. Reddy, P. Dinakar, and B.H. Rao, "Mix Design Development of Fly Ash and Ground Granulated Blast Furnace Slag based Geopolymer Concrete" Journal of Building Engineering (7.144), 20(2018): 712-722.
34. Alam S, Das SK and Rao BH (2019) "Strength and durability characteristics of alkali activated GGBS stabilized red mud as geomaterial", Construction & Building Materials (7.693), 211: 932-842.
35. Manas Chandan Mishra; Karra Sateesh Babu; N. Gangadhara Reddy; Partha Pratim Dey; and B. Hanumantha Rao, "Performance of Lime Stabilization on Extremely Alkaline Red Mud Waste under Acidic Environment", Journal of Hazardous, Toxic, and Radioactive Waste, 2019 23(4): 04019012-1-14.
36. Manas Chandan Mishra and B. Hanumantha Rao, "Neutralization of red mud with organic acids and assessment of their usefulness in abating pH rebound", Journal of Hazardous, Toxic, and Radioactive Waste, 24(1) 2020.
37. Reddy NG, Robinson N, Basu DB and Rao BH "Application of biopolymers for improving the strength properties of red mud waste", Environmental Geotechnics Journal (2.556) (2020).
38. Reddy PS, Mohanty, B, and Rao BH "Influence of clay content and montmorillonite content on swelling behavior of expansive soils", Int. J. of Geosynthetics and Ground Engineering 6(1), 1-12 pages, 2020.
39. Reddy PS, Reddy NG, Serjun VZ, Mohanty B, Das SK, Reddy KR and Rao BH "Properties and assessment of applications of red mud (Bauxite residue): current status and research needs", Waste and Biomass Valorization (3.449), 12(3), 1185-1217, 2021.
40. Reddy NG, Mishra MC, and Rao BH "Potential of citric acid for amendment of extremely alkaline bauxite residue: effect on geotechnical and geoenvironmental properties", Journal of Hazardous, Toxic and Radioactive Waste, 24(4), 2020.
41. El-Zein A, Fei X, Ganaraj K, Goli VSNS, Li D, Liu X, Mohamed AMO, Mohammad A, Nezhad MM, O'Kelly BC, Paleologos EK, Patel A, Rao BH, Sarris TS, Sharma S, Shashank BS, Shi Y, Singh DN, Wang JJ, and Xiao L. "Microplastics in Soils: An Environmental Geotechnics Perspective, Environmental Geotechnics Journal, 2021, 8(8): 586–618.
42. Deshpande TD, Kumar S, Begum G, Basha SAK and Rao BH "Analysis of Railway Embankment Supported with Geosynthetic-Encased Stone Columns in Soft Clays: A Case Study", International Journal of Geosynthetics and Ground Engineering, 7, 43(2021).
43. Reddy PS, Mohanty B, and Rao BH Investigations for Chemical Parameters Effect on Swelling Characteristics of Expansive Soils. KSCE Journal of Civil Engineering (2.115), 25(11), 4088-4105, 2021.
44. Rao BH, Reddy PS, Mohanty B, and Reddy KR, Combined effect of mineralogical and chemical parameters on swelling behavior of expansive soils. Nature Scientific Reports-Springer Nature (4.996), 11, 1, 16562(2021), 1-20 pages.
45. Kumar S and Rao BH, Rheological properties of bauxite residue: the role of tailings gradations and solids concentration, Innovative Infrastructure Solutions, 7 Article number: 96, 2022.

46. Reddy PS, Mohanty B, and Rao BH "Influence of Na and Ca Contents on Swelling Behavior of Expansive Soils in India", Arabian Journal of Geosciences, 14: 2675, 23, 1-22 pages, 2021.
47. Reddy PS, Mohanty B, and Rao BH, Influence of Testing Methodology on Swelling Characteristics of Expansive Soils, Arabian Journal of Geosciences 15, article number: 1132(2022), 2022.
48. Reddy PS, Mohanty B and Rao BH "Understanding the Role of Chemical Constituents in Swelling Behaviour and Suggestions for Additive Selection towards Stabilization of Natural Expansive Soils as a geomaterial in Earthen Structures", submitted to Journal of Rock Mechanics and Geotechnical Engineering, 2022.
49. Mishra MC, Reddy NG and Rao BH, "Geoenviromental characterization of bauxite residue ameliorated with different amendments", accepted for publication in Journal of Hazardous, Toxic and Radioactive waste. 2022.
50. Bheem Pratap, S Mondal and BH Rao, Development of geopolymer mortar using phosphogypsum neutralized bauxite residue in pavement applications, submitted revised version to Environmental Geotechnics Journal 2022.
51. Ajay Jatoliya, Subhojit Saha, Bheem Pratap, Somenath Mondal and B. Hanumantha Rao, Assessment of Bauxite Residue Stabilized with Lime and Graphene Oxide as a Geomaterial for Road Applications, submitted revised version to Soils and Rocks Journal, 2022.

International/National Conferences:

1. B. Hanumantha Rao and D. N. Singh, "Determination of Diffusion Characteristics of Rocks", *Civil Engineering Systems-2006,* National conference held by the Department of Civil Engineering, Osmania University, Hyderabad, June 1-3, 2006.
2. D. N. Singh, B. Hanumantha Rao, and Rakesh, R. R., "In-situ Studies on Hydraulic Conductivity of Unsaturated Soils", Proceedings of 9th Technical Program Discussion Meeting of BRNS Projects, TPDM, February 23-24, 2007, Mumbai, India, pp: 94-98.
3. D. N. Singh and B. Hanumantha Rao, "Modeling Techniques for Geoenvironmental Problems", An Invited paper: In Proceedings of the Korean Geotechnical Conference for International session, September 14-15, 2007, Busan, Korea, pp: 542-557.
4. K. Venkataramana, B. Hanumantha Rao, D. N. Singh, and C. S. Harindranath, "Some Studies on Cracking Characteristics of Fine-grained Soils", In the Proc. of 12th IACMAG International Conference held in Goa from 1-6, October-2008, India, pp: 1532-1538.
5. R. R. Rakesh, P. K. Narayan, P. K. Wattal, S. Anil Kumar, B. Hanumantha Rao, and D. N. Singh, "In-Situ Lysimeter Studies for Radionuclide Migration, In Undisturbed Unsaturated Soil Under Geo-Environmental Condition", In the Proc. of 12th IACMAG International Conference held in Goa from 1-6, October-2008, India, pp: 2320-2326.
6. B. Hanumantha Rao and D N Singh, "Moisture content determination by TDR and capacitance techniques: a comparative study" In, Int. Conf. on Advances in Civil Engineering International conference, at Department of Civil Engineering, KL University, Guntur, India held on October 21-23, 2011.
7. B. Hanumantha Rao, K. Srinivas, P.A. Abhishek, "Parameters Influencing Performance of Geopolymer Concrete: A Review", Symposium on Sustainable Infrastructure Development (SID), 7th-9th February 2013, IIT Bhubaneswar, Bhubaneswar, Odisha, India.
8. B. Hanumantha Rao, "A Device for studying simultaneous heat and moisture movement through soils", *Int. Symposium on* Coupled Phenomenon in Environmental Geotechnics (CPEG)-2013, July 1-3, 2013, Torino, Italy, pp: 519-523.

9. B. Hanumantha Rao and S.K. Das, "Use of red mud for construction of an embankment", an invited paper in Gopracice-2013 symposium, Organized by Department of Civil Engineering, JNTU Hyderabad, Hyderabad, India, 4th, October-2013.
10. B. Hanumantha Rao, Saurabh Kumar and Sourodeep Ghosh. Establishment of water retention properties of granite saw dust using ultracentrifuge, In Proc. of International Conference on Unsaturated Soils: Research & Applications, UNSAT-2014, 2-4 July-2014, Sydney, Australia, Pages:1571-1578.
11. B. Hanumantha Rao, R. L. Sahu, SK Das, Correlations between swelling and suction properties of expansive soils, In Proc. of 14th IACMAG International Conference, 22-25th September-2014, Kyoto, Japan.
12. B. Hanumantha Rao, R.C. Meena, N. Meena, RL Sahu, Influence of aspect ratio on crushing strength of sands and granite saw dust materials, In Proc. of 14th IACMAG International Conference, 22-25th September-2014, Kyoto, Japan.
13. Janardhan Tahasildar and B. Hanumantha Rao (2016) Measurement of zeta potential of expansive soils, Accepted for publication in *19th Southeast Asian Geotechnical Conference & 2nd AGSSEA Conference (19 SEAGC &2AGSSEA)*, Kuala Lumpur, 31 May- 3 June 2016 pp: 373-377.
14. NG Reddy, BH Rao and NPH Padmanaban (2016) Surface charge properties and particle size analysis of red mud waste from zeta potential measurements, In Proceedings of Indo-US workshop on Geoenvironmental Practices and Sustainability (Editors: GLS Babu, KR Reddy, A De, and M Datta), Chicago, USA, Organized by Department of Civil and Materials Engineering, University Illinois at Chicago, pp: 60-66.
15. NG Reddy, BH Rao and BK Satpathy (2016) Variations in the mineralogical compositions of red mud waste calcined at different temperatures, 5th Annual IBAAS (International Bauxite, Alumina & Aluminum Society) Conference, held in Goa from September 26-28, 2016 at Radisson Blue Hotel & Resort, Binder: Volume V, 151-158.
16. Reddy NG, Chandra S, and Rao BH (2016) Assessment of industrial wastes as a road construction material: a review, 1st Int. Con. on Recent Innovations in Engineering and Technology (ICRIEAT-2016), held from 22-23rd December 2016, Hyderabad, Telangana, India, pp: 28-34.
17. Alam. S, Das SK, and Rao BH (2017) Particle shape analysis of coarse fraction of red mud as a construction material, TRB 96th Annual Meeting, January 8-12, 2017, Washington, D.C., USA, pages: 16.
18. M.S. Reddy, P. Dinakar, B.H. Rao, A Study on the Effect of Sodium Silicate Modulus on the Mechanical Properties and Microstructure of Fly Ash Based Geopolymers, Advances in Construction Materials and Systems, 71st RILEM Annual Week & ICACMS, India, September 3-8, 2017.
19. A. Chawla, M.S. Reddy, P. Dinakar, and B.H. Rao, "Effect of Curing Conditions on Compressive Strength of Fly ash-Ground Granulated Blast Furnace Slag based Geopolymer Concrete", 2nd IC-ISE, India, December 2017.
20. M.S. Reddy, P. Dinakar, and B.H. Rao, "A Study on the Compressive Strength and Mineralogical Properties of Fly ash and Red mud based Geopolymer Mortar", 2nd International Bauxite Residue Valorization and Best Practices Conference, (BR-2018), 7-10/May/2018, Athens, Greece, pp: 341-348.
21. N. Gangadhara Reddy and B. Hanumantha Rao (2017) "Assessment of Dispersion Characteristics of Red Mud Waste from Physical Tests" Indian Geotechnical Conference-2017, Theme 5, Article 546, p. 4, 14-16/Dec/2017, IIT Guwahati, India.
22. K. Sateesh Babu, N. Gangadhara Reddy, B. Hanumantha Rao, and Partha Pratim Dey (2018) "Susceptibility to Compaction of Lime and Ground Granulated Blast-furnace Slag Stabilized Red Mud Waste" Bauxite Residue Valorisation and Best Practices conference (BR-2018), 7-10/May/2018, Athens, Greece, pp: 301-308.

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25. Mishra MC, Rao BH, and Senapati S, "Advances in Bioremediation of Extremely Alkaline Bauxite Residue: A Review", In Proc. of Indian Geotechnical Conference 2020 December 17-19, 2020, Andhra University, Visakhapatnam, 753-764.
26. Reddy PS, Lahoty R, Mohanty B, and Rao BH, "Establishment of Relationships Between Compaction Parameters and Oxides Composition of Industrial Waste Materials", In Proc. of Indian Geotechnical Conference 2020 December 17-19, 2020, Andhra University, Visakhapatnam.
27. Reddy G N and Rao BH (2021) Physico-Chemical and Mechanical Characterization of Ferrochrome Slag Aggregates for Utilization as a Road Material, Advances in Transportation Geotechnics IV eBook ISBN: 978-3-030-77230-7, Editors: Erol Tutumluer, Soheil Nazarian, Imad Al-Qadi and Issam I.A. Qamhia, pp: 645-657.
28. Kumar S and Rao BH (2021) Correlation of rheological properties with slump and undrained shear strength of bauxite residue, In Proc. of Indian Geotechnical Conference 2021 December 16-18, 2021, NIT Trichy.
29. Reddy PS, Lahoty R, Mohanty B, and Rao BH, (2021) Influence of Oxides Composition on Plasticity and Compaction Characteristics of Bauxite Residue, 3rd Int. Conf. in Geotechnical engineering, ICGE-Colombo-2020 6-7 December 2021, 285-290, organized by Sri Lankan Geotechnical society 2021.
30. Reddy PS, Mohanty B, Rao BH (2022) Influence of Exchangeable sodium and calcium contents on consistency limits of expansive soils: A critical review, In Proc. of RAiSE2022, Feb 25-26 2022, Uttar Pradesh, India.
31. Reddy, P. S., Mohanty, B., and Rao, B. H. (2022). "Montmorillonite Content of Expansive Soils and its Relationship with Swelling and Consistency Properties." In Proceedings of the 2nd Int. Conf. on Materials, Mechanics and Structures (ICMMS 2022), on the Theme "Construction and Building Materials", Organized by Dept. of Civil Engg., NIT Calicut, Kerala, India, March 10–12th.
32. Rao, B. H., Reddy, P. S., and Mohanty, B. (2022). "Exchangeable Cations and their Role in the Selection of Barrier Materials for Waste Disposal Facility." In Proc. of 3rd Int. Conf. on Environmental Geotechnology, Recycled Waste Materials and Sustainable Engineering (EGRWSE), Hosted by Dokuz Eylül University, Dept. of Civil Engg., Geotechnics Division, Izmir, Turkey, September 15th – 17th. (Accepted)

Book Chapters

1. Mishra MC, Swagatika S, and Rao BH, "Soils of Odisha" in Geotechnical Characteristics of soils and rocks of India", (Ed: Sanjay K Shukla), 1st edition, Springer Singapore, 2021.
2. Reddy PS, Huang H, Huang X, Erzin Y, Guixiong M, Garg A, and Rao BH, A Comprehensive Study for Assessing Parameters Influencing Tensile Strength Behaviour of Fine-Grained and Coarse-Grained Soils, Lecture Notes in Civil Engineering Book, **Editors**: Garg A, Solanki CH, Bogireddy C and Liu L, Published by Springer Singapore, 2021, PP: 39-64. Print ISBN978-981-33-4323-8.
3. Mishra MC, Reddy NG, Rao BH. and Das SK, A Study on Evaluating the Usefulness and Applicability of Additives for Neutralizing Extremely Alkaline Red Mud Waste", Sustainable Environmental Geotechnics Book, **Editors**: Reddy, K.R., Agnihotri,

A.K., Aksoy, Y.Y., Dubey, B.K., Bansal, A. Published by Springer Singapore, 2020, pp: 139-149. Print ISBN978-3-030-51349-8

4. Reddy NG and Rao BH, Effect of additives on consistency limits of red mud waste: a comparative study, Proc. Of 8th Int. Congress on Environmental Geotechnics Book, **Editors**: Zhan, Liangtong, Chen, Yunmin, Bouazza, Abdelmalek, Published by Springer Singapore, 2019, pp: 234-241. ISBN 978-981-13-2221-1
5. Reddy NG, Rao BH, and Reddy KR, Chemical analysis procedures for determining the dispersion behavior of Red Mud waste" Recycled Waste Materials Book, **Editors**: Agnihotri, Arvind Kumar, Reddy, Krishna, Bansal, Ajay, Published by Springer Singapore, 2018, pp: 19-26. ISBN 978-981-13-7017-5
6. Reddy GN, and Rao BH, "Zeta potential and particle size characteristics of red mud waste" in Geoenvironmental Practices and Sustainability: Linkages and Directions (ISBN: 978-981-10-4076-4) **Editors**: GLS Babu, KR Reddy, A De and M Datta, Published by Springer Singapore, 2017, pp: 69-89.

Patents

- Geopolymer product development (Combined use of fly ash, red mud and GGBS) and mix design procedure by Rao BH, Dinakar P, Reddy MS, Kar S, Patra B, and Khuntia A.
- Apparatus and method for establishing soil water characteristic curve and determining hydraulic conductivity of soils, Sing DN and Rao BH, P No.: 362250.
- Gypsum-red mud composites for non-structural applications by Srikant G, Rajendra G, Chaitanya P, Rao BH, Dinakar P, Vijayakrishna K.
- Naseera, K.K., Hanumantha Rao, B., Refinement of methodology to circumvent elevated temperature curing for developing fly ash based geopolymer mortar.
- Gunanshu, B., Hanumantha Rao, B., Development of mortar with industrial wastes (bauxite residue, fly ash, and lime grit) by geopolymerization process.

Key Note/Invited/Expert/Memorial Lectures

- Darcy's memorial lecture on "Characterization of Indian expansive soils: Influences of physical and mineralogical properties", in IGC Raipur chapter jointly organized by GC Raipur chapter and NIT Raipur on 10th June 2022.
- Keynote presentation on "Geotechnics and valorization of industrial wastes in promising applications", in two-day Int. Conf. on "Advances in Civil Engineering (ICACE-2021), organized by Department of Civil Engineering, KL Deemed to be University, Guntur, Andhra Pradesh, from 19th – 20th June 2021.
- Expert talk on "Geotechnics and valorization of industrial solid wastes", in IGS Warangal chapter lecture series organized by Department of Civil Engineering, NIT Warangal, August 29th 2021.
- Invited talk on "Amendment of bauxite residue with biopolymers: characterization and perspective utilization", in National Seminar on Treatment and Utilization of Industrial/Mining Waste for Sustainable Environment (TUIMW-2020) held by Department of Chemistry, Synergy Institute of Engineering and Technology, Dhenkanal, Odisha on 24th February 2020 under TEQIP-III programme.
- Expert talk on "Biopolymer amendment for improving strength characteristics of waste materials", in Civil Techno Symposium NIRMAAN 19 held under TEQIP-3 by Department of Civil Engineering, GCE, Keonjhar from 24th – 26th October 2019.
- Invited talk on "Development of geopolymer concrete using industrial solid waste materials", in 3rd National Workshop on Recent Advances in Engineering (RACE-2019),

held by Department of Civil Engineering, VSSUT Burla, Odisha, from 29th July to 2nd August 2019.

- Keynote lecture on "A Study on Evaluating the Usefulness and Applicability of Additives for Neutralizing Extremely Alkaline Red Mud Waste", during the 2nd Environmental Geotechnics, Recycled Wastes and Sustainable Engineering (EGRWSE) 2019 International Conference held at University of Illinois at Chicago from 16-20th June 2019.
- Invited talk on "development of geopolymer concrete using industrial solid wastes" in the 3rd National Workshop on Recent Advances in Civil Engineering (RACE 2019), held by Department of Civil Engineering, VSSUT Burla from 29th July – 2nd August 2019.
- Delivered a lecture on "Introduction to Environmental Geotechnics," at IGS Bhubaneswar, held on 22nd August 2012.
- Delivered a lecture on "SPT data interpretation and its applications," at ICE, Brahmpuram, to working field engineers, 27th January 2013.
- Delivered a lecture on "Use of geosynthetics in road and bridge works", a workshop on Application of New Materials and Technologies in Rural Roads, 13th-15th September 2013.
- Delivered an invited lecture on "Use of red mud for construction of an embankment", in Gopracice-2013 symposium, Organized by Department of Civil Engineering, JNTU Hyderabad, Hyderabad, India, 4th, October-2013.
- Delivered a lecture on "Use of geosynthetics in problematic soils" in PMGSY workshop on "Application of Nonconventional Materials and Technologies in Rural Roads", 15th Feb-2014.
- Delivered an invited lecture on "Use of fly ash waste in civil engineering construction" in a seminar organized by Kalam Institute of Technology, Brahmapur, Odisha.
- Delivered a talk on "Influence of mineralogical and chemical compositions on the swelling behavior of expansive soils", in the workshop on "Significance of Geotechnical Engineering in Hydraulic Structures" held by Department of Civil Engg., Andhra University, from 1-2 October-2016.
- Delivered a lecture on "foundations for structures", during 2nd Training programme for Third Party Quality Monitoring for Bridges, Roads and Buildings, organized by ARKITECHNO Consultants (P) Ltd., at Angul, Odisha, on 18.11.2016.

Professional Affiliations

- Life member, Indian Geotechnical Society (IGS), India.
- Member American Society of Civil Engineering
- Member International Society of Environmental Geotechnics

Reviewer and Editorial Assignments

- Geotechnical Testing Journal, ASTM
- Geotechnical and Geological Engineering Journal, Springer
- Journal of Materials in Civil Engineering
- Journal of Hazardous, Toxic and Radioactive Waste
- Environmental Geotechnics
- International Journal of Geotechnical Engineering
- Natural Hazards Journal, Springer

- International Journal of Geosynthetics and Ground Engineering
- Acta Geophysica
- Journal of the Institution of Engineers (India): Series A
- Indian Geotechnical Journal
- Waste Management and Research
- KSCE Journal of Civil Engineering
- Engineering Geology
- Scientific Reports
- Bulletin of Engineering Geology and Environment
- Geomechanics and Geophysics for Geo-Energy and Geo-Resources
- Construction and Building materials
- Cleaner Engineering and technology
- Soils and Foundations
- Transportation Infrastructure Geotechnology
- Reviewer 12th IACMAG International Conference.
- Editor of the proceedings of 12th IACMAG International Conference, held in Goa from 1-6th October-2008, India.

Citation Index

AD Scientific Index — Rankings for Scientist — University, Subject, Country, Region, World

World Scientist and University Rankings 2021

Name	H INDEX			H INDEX			CITATION		
	Total	Last 5 year	Last 5 year / total	Total	Last 5 year	Last 5 year / total	Total	Last 5 year	Last 5 year / total
Hanumantha Rao B	18	16	0.889	26	25	0.962	1094	876	0.801

Research Statement

Dr. Rao has over 10 years of teaching and research experience within the field of **Geotechnical and Geoenvironmental Engineering**, specifically focusing on *ground improvement*, *sensors and sensing techniques for geosystems*, and *geoenvironmental engineering topics*. The main focus areas of research interests include:

Ground Improvement

- Expansive Soil Stabilization
- Clay Mineralogy and Oxides Influence

Sensors and Sensing Techniques for Geosystems

- Geomaterial Characterization
- Linear and Volumetric Strain Measurements
- Contaminant Detection
- Slope Monitoring

Geoenvironmental Engineering

- Geotechnics and Waste Valorization: *Red Mud, Fly Ash, Phosphogypsum*
- Tailings Management
- Thermal Effects on Geomaterial Behavior: *Phase change materials, Thermal Conductivity & Thermal Storage*
- Cracking Characteristics: *Landfill Liners, Covers, Expansive Soils*
- Geopolymers & Biopolymers
- Microbiogeotechnology
- Remediation of Contaminated Sites: *Elecrokinetics, Biotreatment, Phytoremediation*

Towards the sustainable use of industrial wastes/by-products, Dr. Rao has successfully developed (a) geopolymer concrete using the combination of fly ash-red mud-slag as binder materials and (b) gypsum boards by partially replacing lime with red mud. These two are the major research contributions towards sustainable valorization of wastes or by-products. NALCO is the biggest beneficiary of the former research outcome. The process for development of geopolymer product, jointly with NALCO, and usability of red mud as a partial filling material are now filed for patent.

The concept of circular economy in enhancing the utilization of wastes/by-products is recently popping-up, wherein one waste is considered as feedstock resource material to another waste. At present, Dr. Rao is intensely focused on circular economy model aiming to conserve variety of wastes/by-products generated by industry. Adopting circular economy model, our research team has successfully developed geopolymer mortar with the combination of red mud, fly ash and lime grit. Adding to it, our research team has successfully refined the design mix methodology for developing geopolymer mortar circumventing elevated temperature curing requirement. The focus is now being made to step forward for field demonstration of these products.

The other major research contributions of Dr. Rao include proposing novel chemical treatment techniques to amend the alkaline waste for converting it into functional geomaterial, stabilizing wastes or soils by state-of-the-art MICP technique, evolving novel applications of biopolymers and geopolymers for mitigating dispersion and erosion problems in wastes/by-products.

He also created a unique database on a few swelling soils of Indian regions, specifically quantifying the montmorillonite content and relating with swelling parameters. Dr. Rao's research contribution also encompasses development of sensors and sensing techniques for geosystems. Development of hydro-pneumatic based constant load application device and laser-based sensors for measuring volumetric strains are unique research contributions by him as well.

Short-term Research Goals: Specific focus is being made on valorization of waste materials, especially, for synthesis and development of cementitious products and aggregates (fine and coarse), and exploring usability of amended materials in roads and other geotechnical applications. Exploring the feasibility of microbial treatment integrated with chemical treatment methods and alkali activation methods for stabilization of wastes/by-products for converting them into safe to use geomaterials, chemical treatment methods for neutralization of alkaline wastes, quantitative mineralogy and geomaterials behavior, Thermal properties of geomaterials etc., are a few short-term goals.

Long-term Research Goals: Development of values added products from waste materials following the concept of circular economy and thereby, promoting sustained and large-scale usage of industrial wastes. Comprehensively characterizing these products for environmental acceptability is also a long-term goal of my research work. Remediation of contaminated sites, clean-up of same and immobilization of pollutants within geoenvironment is a great to deal with in the near future. Emerging phyto-, electrokinetic, bio-chemical based or combination of these techniques are reported to be sustainable and eco-friendly for achieving the same. Developing low-cost instrumentation system for slope monitoring is also a long-term goal.

Refining methods for precise determination of additive content based on mineralogy and oxides content is another long-term potential goal. In-house development of sensors and sensing systems for various geosystems with focus on slopes and polluted sites will also be explored as potential research interest.

Developing PCM impregnated constructional materials is also one of the future research agenda of Dr. Rao.

His research has completed several projects and a number of projects are in progress. These projects have been funded by the Department of Science and Technology, the Council of Scientific and Industrial Research, the Ministry of Mines, NALCO and by several prominent industries.

Collaborations: Dr. Rao has led several collaborations with the faculty at IIT Bhubaneswar and other faculty in Indian universities and abroad as well as several prominent industries including NALCO, Utkal Alumina, Vedanta Alumina, Jindal thermal etc. These collaborations provided multi-disciplinary knowledge needed to address the complex problems from fundamental advancements to evolution of practical feasible solutions.

Instrumentation Facility Created for Development of Geoenvironmental Engineering Laboratory at IIT Bhubaneswar

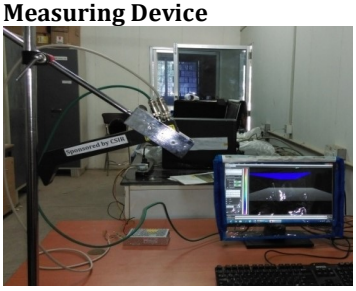
Hydro-Pneumatic Constant Load Device

Laser Based Volume Change Measuring Device

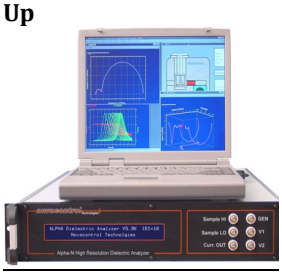
Mini-Compaction Set-Up

Zeta Potential cum Particle Size Analyzer

Dew Point Potentiameter



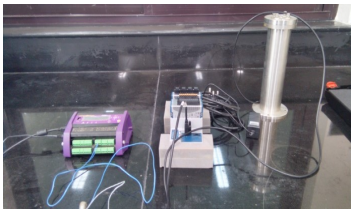
Laser Profiler Device



Impedance Analyzer

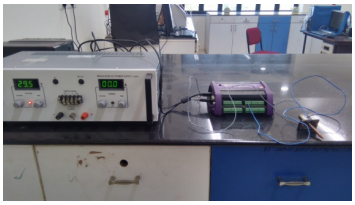
Thermal Imaging Camera

Triaxial with Flexipan



Sensor for THM Modeling

Geotechnical Centrifuge



Thermal probe

Humidity chamber

Tensile strength measuring apparatus

Vibro-press

Peristaltic Pump