



EARTHQUAKE RESISTANT DESIGN OF FOUNDATIONS

PROF. B. K. MAHESHWARI

Department of Civil Engineering

IIT Roorkee

PRE-REQUISITES : Soil Mechanics and Foundation Engineering

INTENDED AUDIENCE : BE/ B Tech (Civil Engineering) as an elective in the final year. ME/MTech either in Geotechnical Eng. or in Structural Engineering

INDUSTRIES APPLICABLE TO : NPCIL, BHEL, THDC, NTPC, NHPC, ONGC, RDSO, RVNL, CPWD, NBCC, L&T, KELLER, Fugro, Maccaferri, GENSTRU, STRATA etc.(probably)

COURSE OUTLINE :

The course covers various types of foundations, required soil investigations, soil parameters, and codes of practice. Design considerations for seismic resistant design of foundations. The course will focus on techniques of design of foundations so that it does not fail during earthquakes. This will cover both shallow and deep foundations. Major focus will be on the design of deep foundations for lateral loads.

ABOUT INSTRUCTOR :

Prof. B.K. Maheshwari is currently a Professor at Dept. of Earthquake Engineering, IIT Roorkee, India. He secured Bachelors Degree in Civil Engineering from Univ. of Jodhpur, Masters Degree in Earthquake Engineering from Univ. of Roorkee and Ph.D. in Geotechnical Earthquake Engineering from Saitama University Japan. Dr. Maheshwari worked for about two years in industry in Tokyo, Japan and then joined Washington University in St. Louis, Missouri, USA as a post-doctoral fellow. Since Dec. 2004, Dr. Maheshwari is a faculty at Dept. of Earthquake Eng., IIT Roorkee. Prof. Maheshwari has about 25 years of research experience and working in the areas of Dynamic Soil-Structure Interaction, Liquefaction, Dynamic Soil Properties, Constitutive Modeling, Nonlinear Finite Element Analysis, Slope Stability, Landslides and Disaster Mitigation & Management. He has published about 140 research articles in journals and conferences of international repute. Under Dr. Maheshwaris guidance, six Ph.D. theses are awarded and another four are in progress. Prof. Maheshwari worked on 6 sponsored research projects. Dr. Maheshwari served as an Associate Editor of International Journal of Geomechanics, ASCE during 2015-18. He also served as an Editor of ISET Journal of Earthquake Technology during 2013-17. Dr. Maheshwari is an editorial board member of Indian Geotechnical Journal. Dr. Maheshwari is a member of ASCE, EERI, ISSMGE, IACMAG, a life fellow of ISET, IGS and Institute of Engineers (India). Professor Maheshwari served as a Head of Centre of Excellence in Disaster Mitigation and Management, IIT Roorkee during February 2015 to February 2018. He was the Organizing Secretary for prestigious 16th Symposium on Earthquake Engineering held during December 20-22, 2018 at IIT Roorkee.

COURSE PLAN :

Week 1: Introduction: General requirements, types of shallow and deep foundations and their use; performance of various types of foundations during past earthquakes.

Week 2: Shallow Foundations: IS codes for bearing capacity and settlement of foundations. foundation design, modes of soil failure, safe bearing capacity, differential & total settlements, increase in permissible stress under earthquake loads

Week 3: Shallow Foundations: Raft foundation, modulus of sub grade reaction, Winkler model, beam on elastic foundation. Dynamic Bearing Capacity under Transient & Earthquake Type Loads: Types of dynamic loads; Footing requirements to account for settlements and earthquake induced forces; Pseudo-Static analysis of footings with eccentric & inclined loads. Effect of horizontal load and moment. Dynamic Analysis of shallow foundations for various modes of vibrations

Week 4: :Pile Foundations: Types of piles based on usage, material, construction etc. pile load capacity in compression, Bearing capacity of piles, group action of piles, settlement of a pile group;

Week 5: :Pile Foundations: Laterally loaded piles, elastic analysis; Reese and Matlock approach, fixity of pile heads, dimensionless factors; Pile with dynamic loads.

Week 6: Pile Foundations: soil-pile analysis with spring-mass & FEM idealisation, elements for slip and separation, soil-pile interaction, IS code of practice for design of pile foundations, piles through liquefiable soils

Week 7: Well Foundations & Caissons: Types; components; scour depth, depth & bearing capacity of wells, static forces considered in stability of wells; Lateral stability of well foundations. Pseudo-static analysis with earthquake induced loads, Lateral load resistance of well foundation; Terzahi's approach; IRC, IS and Indian Railway Codes, their limitations.

Week 8: SSI for Deep Foundations: Soil-Structure Interaction, Modelling of Unbounded Soil Media for Dynamic Loads, Free Field Motion, Kinematic Interaction and Inertial Interaction.