

ANALYSIS AND DESIGN OF BITUMINOUS PAVEMENTS

MULTI-FACULTY

PRE-REQUISITES : This is a self-contained course for students and practitioners alike, and hence, no prerequisite is required. For those who do not have an undergraduate degree in civil engineering, familiarity with the construction of bituminous pavements will be helpful.

INTENDED AUDIENCE : 1. Graduate students in Transportation Engineering stream
2. Practising Highway Engineers

INDUSTRY SUPPORT : Engineering Staff working in State and Central Highways Departments and PWD, Ministry of Road Transport and Highways, and National Highways Authority of India.

COURSE OUTLINE :

More than 90% of the highway system in India are constructed with bituminous materials. This course will introduce the fundamentals of stress analysis procedures for bituminous pavements. Analysis of traffic, material characterization for design and distress, and aspects of reliability related to bituminous pavement design will be discussed thereafter. The students of this course will also get hands-on training on the use of IRC37 and understand the boundaries within which such design guidelines should be used

ABOUT INSTRUCTOR :

Prof.M. R. Nivitha is currently a faculty member in the Department of Civil Engineering, PSG College of Technology, Coimbatore. She received her Ph.D. from IIT Madras in 2016. Her research interests include rheological and microstructure characterization of bitumen and bituminous pavement design. Prof. Neethu Roy is working as Dean (R&D) and Professor, Department of Civil Engineering, Mar Baselios College of Engineering and Technology, Kerala. She got her Ph.D. from IIT Madras in 2013. Her research interest includes rutting and fatigue characterization of bituminous mixtures, bituminous pavement design and pavement management system. Prof. A. Padma Rekha is currently working as an Associate Professor in the department of Civil Engineering, SRM Institute of Science and Technology. She received her Ph.D. degree from IIT Madras in 2013. Her area of research interest includes the Rheological characterization of bitumen and bituminous mixture, ageing characteristics of bituminous material and bituminous pavement design. Prof. J. Murali Krishnan is currently a faculty member in the department of civil engineering at IIT Madras since 2004. He obtained his Ph.D. from IIT Madras in 1999 and was a post-doctoral research associate at Texas A&M University, College Station, the USA, from 1999 to 2004. Before his Ph.D., he worked as a bituminous pavement engineer in various construction firms for more than six years.

COURSE PLAN :

Week 1: Overview of pavement design/distress – Pavement cross-sections with different combinations of layers and their functions. Pavement distress considered for design – Rutting/Fatigue damage/Temperature cracking/Moisture damage/IRI

Week 2: Single-layer stress-strain analysis – Introducing three-dimensional stress functions, Layered structure analysis - Boussinesq equation and numerical to determine stresses and strain at different locations of the layer

Week 3: Two-layered and multi-layered structural analysis and determination of stresses and strain for a different combination of layers with numerical examples

Week 4: Traffic characteristics – Traffic volume, growth rate, lane distribution factor, modal distribution, Axle configuration, Equivalent single wheel load for different criteria and Equivalent wheel load factor, Axle load survey, distribution, Truck factors, ESAL and computation of the number of repetitions with numerical examples

Week 5: Traffic characteristics – Traffic volume, growth rate, lane distribution factor, modal distribution, Axle configuration, Equivalent single wheel load for different criteria and Equivalent wheel load factor, Axle load survey, distribution, Truck factors, ESAL and computation of the number of repetitions with numerical examples - cont

Week 6: Material and climate – Soil characteristics, granular material characteristics, and bituminous material characteristics

Week 7: Material and climate – Climate variation, estimation and prediction model, Influence of climate in material characteristic functions.

Week 8: AASHTO method of pavement design - 1993 and Reliability of pavement design

Week 9: Distress transfer functions and damage accumulation

Week 10: IRC37 guidelines for flexible pavement design and IITPAVE software

Week 11: Design examples based on the IRC37 method of pavement design

Week 12: Kenlayer software for the stress, strain analysis – Demo and Projects