CE 742 Pavement Systems Engineering

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Pavement Types and Design Factors

- Historical Developments
- Pavement Types
  - Flexible; Rigid; Semi-rigid
- Design Factors
  - Traffic & loading; Environment; Material; Failure criteria
- Highway and Airfield Pavements
  - Traffic loading, configuration and repetitions

Stresses and Strains in flexible Pavements

- Stresses in homogeneous mass
  - Solutions by charts
  - Solutions at axis of symmetry
- Layered Systems
  - One layer, Two Layer, Three Layer
    - Solutions by charts and Tables
  - Multi Layer Systems
  - Linear elastic, non-linear elastic and viscoelastic layers
- Computer Programs for Layered Systems
  - Details of KENLAYER Program
- Fundamental design concepts

Stresses and Deflections in Rigid Pavements

- Introduction to Cement Concrete Pavements
- Environmental stresses
  - Stresses due to curling
  - Stresses due to friction
- Stresses due to loading
  - Closed form equations
  - Influence charts
  - Finite element method (KENSLAB Computer Program)
- Combination of stresses
- Design of Dowels and Joints

Analysis of Traffic Loading for Pavement Design

- Review of earlier methods
  - Equivalent single wheel load
- Wheel load configurations and legal load limits
- Equivalent Axle Load Factor (EALF)
- Equivalent Single Axle Load Approach
- Spectrum of axles approach

Material Characterisation

- Review of historical methods
- Characterisation of subgrade, subbase and unbound bases
  - CBR, resilient modulus and modulus of subgrade reaction
  - Correlations among the strength parameters
- Characterisation of asphaltic layers
  - Dynamic modulus and dynamic stiffness Modulus
  - Determining dynamic modulus from Correlations
- Distress models (Fatigue characteristics)
  - Fatigue cracking and rutting

Pavement Performance

- Distresses in flexible pavements
- Distresses in rigid pavements
- Methods of measuring distress
  - Roughness
  - Surface distress
  - Present serviceability index
  - Skid resistance
  - Deflection
- Pavement performance

Concepts of Reliability in Pavement Design

- Statistical concepts
- Variability in design parameters
- Probabilistic Methods of Design

Drainage Design

- Detrimental effects of water in pavement
- Methods of controlling water in pavements
- Drainage materials
  - Aggregates, geotextiles and pipes
  - Filter criteria
- Design procedures

Design of Flexible Pavements

- Mechanistic design procedure
- Asphalt Institute Method
- AASHTO Method
- IRC Method
- Stage Construction
- Design exercise using KENLAYER program

Design of Cement Concrete Pavement

- Mechanistic design procedure
- Portland Cement Association (PCA) Method
- AASHTO Method
- IRC Method
- Design exercise using KENSLAB program

Design of Overlays

- Types of overlays
- Design methodologies
  - Effective thickness approach
  - Deflection approach
  - Empirical mechanistic approach
- Design of asphalt overlay over asphalt pavement
- Design of asphalt overlay over CC pavement
- Design of CC overlay over asphalt pavement
- Design of CC overlays over CC pavement

Design of Bituminous Mixes

- Conventional asphalt mix design
- Superpave asphalt mix design
  - Binder grading system
  - Requirement of aggregates
  - Laboratory compaction
  - Mix design criteria

Pavement Construction & Maintenance

- Subgarde
- Subbase
- Base
  - Untreated and treated
- Interface treatments
- Binder course
- Wearing Course
- Cement concrete pavement
- Maintenance
  - Types of interventions