Highway Materials

Soil: classification, nomenclature, desirable properties, laboratory and field test, IRC/MORT&H standards, materials for low-cost roads, stabilized soil, lime, fly ash, and cement and soil-bitumen stabilization. Aggregate: classification, gradation, physical properties test, soil-aggregate and aggregate bitumen mixes, sub base, base and wearing course materials, quality manufacture of aggregates with respect to IRC/MORT&H specifications (clause 400) BM, soft aggregates, artificial aggregates, industrial waste as road aggregate, blending of aggregate by triangular chart, trial and error proportioning methods. Bitumen: origin, extraction, physical properties test, various terms related to tar and bitumen, uses and application of different bituminous material in highway construction, bitumen chemistry, constituents structure, ageing, rheology of bituminous binders, Adhesion, failures, weathering of bituminous road materials, bituminous mixes, requirements of bituminous mixes, Marshall and other methods of bituminous mix design, IRC/ MORT&H specifications (clause 500), bitumen modification. Cement: constituents, environmental issues concrete, properties of cement in fresh and hardened state, test methods, durability properties, mineral admixtures, material specifications, Concrete Mix Design.

Pavement Analysis and Design

Components of pavement structure, importance of sub-grade soil properties on Pavement performance. Functions of sub-grade, sub-base, base course and Wearing course. Effects of dual wheels and tandem axles, area of contact, tire pressure, CBR value of different layers, design methods for flexible pavement: sustainable cost-effective options for roads. Elements in design of rigid pavements: Wheel load, stresses, basic properties of concrete elasticity, shrinkage & creep, durability of Concrete, dry lean concrete, rigid pavement design, concrete mix design, admixture. Temperature stresses: Effect of temperature variations on concrete pavements. Combination of stresses due to different causes, Types of distress: structural and functional, serviceability, fatigue cracking, pavement deformation and low temperature shrinkage cracking, factors affecting performance. Pavement overlays: Flexible overlays and Rigid overlays. Micro surfacing, gap grading, cold mixes using emulsion and foam Bitumen etc. recycled material.

Intersection Analysis and Design

Type of intersection, general considerations for the location of various intersection types, principles of intersection design, types of maneuvers, relative speed, conflict points and areas, design surveys for intersection, intersection geometrics for various types including approach and exit details. Capacity and performance analysis of various types of intersections for various types of operation-capacity level of service, intersection delay, uncontrolled priority controlled and roundabout intersection- their capacity and delay analysis, and overall design. Design and operational evaluation of weaving sections. Design of speed change lanes and median lanes. Grade separated intersection and interchanges-types, suitability and economic justifications. Design of intersection controls-signalization design and analysis, turn control, general traffic control by islands, pedestrian control, signs, markings, intersections lighting etc. Road Safety Audit – Introduction, Case studies.

Transportation Planning

Transportation planning methodology, hierarchical levels of planning-statewide, regional, urban passenger and goods transportation. General concept and process of transportation planning. Urbantransportation planning, urban travel characteristics: private and public, travel behavior analysis. Travel demand estimation and forecasting. Transportation Analysis Zone Design; Travel demand Analysis; Land use – Transportation Modelling; Route Planning; Decision support for

Transportation Planning. Trip classification and socio-economic variable in trip making, trip generation; multiple regression analysis, category analysis, comparative study. Modal split analysis-traditional analysis, behavioralapproach to mode choice, two-stage modal split models. Trip distribution: Growth factor method, gravity model. Intervening opportunity and competing opportunity models, comparative study. Traffic assignment network assignment, capacity restrained.Land-use transport planning: Land-use transport intersections, transport related land use models and their use in transportation planning

Highway Construction

Classification of types of highway construction, Suitability of each type under Indian conditions, selection of base course and surface course. Earth work & Soiling: Selection of soils, construction of embankments, excavation and compaction equipment's. Field and laboratory tests for quality control. Stone soiling, brick soiling, current practices. Construction of earth roads, gravel roads, soil stabilized roads; water bound macadam, paved roads, bricks, stones. Bituminous construction: properties, requirements and specifications of materials, equipment's and plants. Detailed construction procedure of each type. Field and laboratory tests for quality control. Choice of binders under different conditions. IRC and MORTH specifications. Recommendations under Indian conditions: Bituminous surface treatments, interface treatments – primecoat and tack-coat, surface dressing and sealcoat, grouted or penetration macadam, bituminous bound macadam, bituminous concrete, mastic asphalt. Cement Concrete Road Construction: Necessity of providing a base course under cement concrete road. Selection of materials, construction methods, Quality control tests (lab. and field), Construction equipment's. Joints in cement concrete pavements: Classification of various types of joints, necessity, method of construction, load transfer devices, dowel bars, tie bars. Joint filler and sealer materials, IRC specifications. Reinforced Cement Concrete Road Construction:

Traffic Engineering

Introduction: definitions and normal scope of study within traffic engineering. Traffic characteristic: Review of road user characteristics and vehicular characteristics. Various traffic studies: i. Spot speed studies - data analysis and interpretations ii. Speed and delay studies- Purpose, course of delay, various methods of speed and delay studies. iii. Traffic volume studies and characteristics iv. Origin and destination studies: Various methods of O and D studies and sampling. v. Traffic capacity studies- Volume and density relationships, critical density, basic, possible and practical capacities. Factors affecting possible and practical capacities. vi. Parking studies and characteristics – Public interest in parking studies, cordon count, space inventory, parking practices. Evaluation of parking controls. vii. Accident studies and characteristics – Course of accidents, accident studies and records, reports, application of accident studies, preventive measures. Traffic controls and operations, a. Traffic regulations and various means of traffic control, traffic islands, rotaries & signals. b. Traffic management- Techniques and applications. c. Roadway Lighting-Design and layout.