Planning, Design, Construction and Maintenance of Hill Roads

Time Period	Description of Topic
Day 1	
09:45 -13:00	**Distinctive Features of Hill Road to be considered in Planning, Design, Construction and Maintenance of Hill Roads** ➢ Steep Gradients ➢ Sharp & Blind Curves ➢ Hair Pin Bends ➢ Super Elevation ➢ Vision Berms ➢ Obligatory Points ➢ Geological Formation ➢ River Morphology ➢ Drainage Characteristics ➢ Ecological Considerations ➢ Survey including pegging of final centre line
14:00-17:15	**Geometrics Design of Hill Roads** ➢ Terrain Classification ➢ Capacity of Hill Road ➢ Elements of Roadway in Hill Roads- Carriageway, Shoulder, Drain, Parapet/Crash Barrier ➢ Camber ➢ Hill Road Cross section ➢ Design Speed ➢ Sight Distance ➢ Super Elevation ➢ Transition Curve ➢ Gradients, ➢ Vertical Curve, ➢ Grade Compensation at Curves ➢ Design of Hair- Pin Bend ➢ Passing Places ➢ Coordination between Horizontal & Vertical Alignment
Day 2	
09:45 -11:15	**Formation Works on Hill Roads** ➢ Earthwork in Excavation ➢ Rock Cutting ➢ Drilling & Blasting ➢ Temporary Works- Side Drain, Cross Drain, Bridge, Revetment etc. ➢ Box Cut ➢ Zigs
11:30- 13:00	**Special Considerations for Pavement Design in Hill Roads** ➢ Choice of Surfacing for Heavy Rainfall/Snow Bound Areas ➢ Choice of Bitumen ➢ Effect of Frost Action (Heaving & Thawing) on Flexible & Rigid

A-5, Institutional Area, Sector-62, Noida (UP) – 201 301 (India)
Tel 0120-2400085-86, 2405006-9, Fax 2400087
Email: director.iahe@gmail.com Website: iahe.org.in

	Pavement ➢ Frost Susceptibility of Soil
14.00-17:00	**Slope Protection Measures in Hill Roads** ➢ Classification of Slope Movement ➢ Causes of Slope Movements ➢ Stabilization of slopes- Excavation at Top of Slope, General Flattening of Slope, Benching of Slope, Complete Removal of Unstable Mass, Earth Fill at Toe Slope, Rock or Gravel Fill at Toe of Slope ➢ Selection of Structures for Protection-Debris Arrestors, Retaining Wall, Breast Wall, Toe Wall, Piles, benching, Filter beds, Tunneling, Easing of Slopes, Bitumen/ Asphalt mulching, Chutes and Sloping Aprons, Turfing ➢ Retaining Structures- Rock and Earth Fill Buttress at Toe of Slope, Cribs or Gravity Retaining Wall, Pile Walls, Caisson Toe of Slope, Barriers at Toe anchored by Tie- Back ➢ Method of increase of Shear Strength of Soil- Cementation, Freezing, Electro-Osmosis, Compaction , Rock Bolting, Blasting at Toe
Day 3	
09.45-13:00 & 14.0-17.15	**Drainage & Cross drainage of Hill Roads.** ➢ Hydrological Study of Rain & Snow Fall ➢ Computation of Run off ➢ Road Side Drain ➢ Catch-Water/Intercepting Drain ➢ Chute ➢ Sub-surface Drainage ➢ Classification of Cross-Drainage Structures ➢ Choice of Cross-Drainage Structures ➢ Essential Design Data- Catchment, Cross-Section, HFL, Longitudinal Section, Velocity, Design Discharge, Linear Water Way ➢ Causeways ➢ Submersible Bridges ➢ Culverts ➢ Stone Masonry Scupper ➢ High Level Bridges-RCC, PSC, Steel, Arch, Suspension Cable
Day 4	
09:45 - 13:00	**Safety in Hill Roads** ➢ Correction of Deficiencies in Geometrics to the extent possible ➢ Adequate Cautionary & Informatory Signs ➢ Appropriate Pavement Markings ➢ Protection Structures for Traffic ➢ Delineators for Low Visibility ➢ Gate System of Traffic ➢ Traffic Management during Landslide, Repair, Adverse Weather Condition etc.
14:00-17:15	**Maintenance of Hill Roads** ➢ Importance of Maintenance in Hill Roads ➢ Type of Maintenance- Routine, Periodic, Special/Flood Damage/Emergent ➢ Maintenance of Pavement & Shoulder ➢ Maintenance of Drain/Cross Drainage Works

	➢ Maintenance of Slopes and Slope Protection Structures ➢ Maintenance of Road Safety Items, Road Furniture ➢ Clearance of Landslide/Slip Debris ➢ Snow Clearance
Day 5	
09:45 - 13:00	**Prediction, Prevention and Control of Landslides on Hill Roads** ➢ What is Landslide ➢ Reasons for Landslide- Cloudburst, Earthquake, Rock Fall ➢ Actions in the aftermath of Landslide ➢ Landslide Data-Base and Mapping ➢ Landslide Monitoring System- Instrumentation ➢ Landslide Prediction & Warning System ➢ Measures to prevent Landslide
14:00-15:30	**Application of Geo-synthetics materials (Geotextile, Geogrid, Geo-web etc.) in Slope Protection and Sub-surface Drainage in Hill Roads**
15.45-17:15	Test, Feedback & Concluding the Programme

A-5, Institutional Area, Sector-62, Noida (UP) – 201 301 (India)
Tel 0120-2400085-86, 2405006-9, Fax 2400087
Email: director.iahe@gmail.com Website: iahe.org.in