

# भारतीय राजमार्ग अभियंता अकादमी (सड़क परिवहन एवं राजमार्ग मंत्रालय, भारत सरकार) Indian Academy of Highway Engineers

(Ministry of Road Transport and Highways, Govt. of India)  
A-5, Institutional Area, Sector-62, NH-24 Bypass, Noida-201309, UP, India  
Tel 0120-2400085-86, 2405006-9, Fax 2400087  
Email: dinesh.iahe@gmail.com, iahe.training@gmail.com, www.iahe.org.in

IAHE/Trg/13/CRSEA/2015-16

21<sup>st</sup> March, 2016


**Subject: Certificate course on Road Safety Engineering and Audit – change of date regd.**

Sir/Madam,

Please refer to D.O. No. IATHE/Trg/13/CRSEA/2015-16 dated 25.02.2016 (copy enclosed) on the subject mentioned above. In this regard, it may be mentioned that the certificate course on 'Road Safety Engineering and Audit' which was scheduled to be organized w.e.f. 28.03.2016 has been postponed. Now, this course shall be organized w.e.f. 23.05.2016 at IAHE, Noida. **Brochure giving detailed schedule** along with qualification & experience requirement for participants, course module & contents, qualifying criteria/marks, evaluation criteria for certification, and nomination form for registration is attached herewith for your ready reference.

It is requested that you may kindly identify 1-2 suitable Officers meeting qualifying criteria who are involved/to be involved in road safety activities and send their nominations for participating in the course. The fee amounting Rs.1.00 lakh/participant be paid to 'IAHE' to confirm the participation.

Yours faithfully,

  
(Dinesh Sharma)  
Joint Director  
For Director

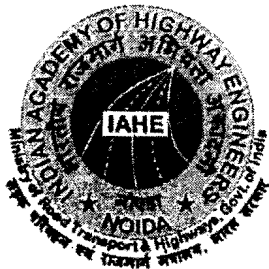
Encl: As above.

To,

1. Director General (RD) & Spl. Secretary, MORTH, Transport Bhawan, New Delhi
2. Joint Secretary (Transport), MORTH, Transport Bhawan, New Delhi
3. Director General, Border Roads Organisation, New Delhi
4. Chairman, NHAI, ROs of NHAI and CGMs of NHAI
5. Managing Director, NHIDCL and Executive Directors of NHIDCL
6. Director, NRRDA, New Delhi
7. All the Chief Engineers of MORTH, ROs/ELOs of MORTH
8. Principal Secretary/Secretary/E-in-C/CE(NH) of State/UT PWDs as per the mailing list.
9. Website of IAHE.

*Handwritten:*  
Dinesh Sharma  
20/5/16

*Handwritten:*  
L 639  
R 02/5/16



भारतीय राजमार्ग अभियंता अकादमी  
(सड़क परिवहन एवं राजमार्ग मंत्रालय, भारत सरकार)  
**Indian Academy of Highway Engineers**

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VL Patankar  
Director

D.O. IAHE/Trg/13/CRSEA/2015-16  
25<sup>th</sup> February, 2016

**Subject: Certificate course on Road Safety Engineering and Audit.**

Dear Sir,

As you are already aware, Ministry of Road Transport and Highways (MORTH) has issued guidelines making it mandatory to carry out road safety audit at Planning, Design, Construction and O&M stages of all National Highway projects. It is realized that roads built with full compliance to standards also need careful road safety audit. Acute shortage of trained and qualified road safety engineers and auditors is already felt keeping in view the huge requirements.

2) In order to bridge the gap, MORTH has approved a proposal to start an especially structured short-term certificate course on 'Road Safety Engineering and Audit' to be organized by Indian Academy of Highway Engineers (IAHE) in association with International Road Federation (India Chapter) and Australian Road Research Board (ARRB). MORTH has approved to subsidize the expenditure for four (4) such courses to be organized in next one year. MORTH will share more than 50% of course fee, **Rs.1.18 lakhs per participant including those from Private Sectors**, and balance fee, **Rs.1.00 lakhs** will be paid by the participant/sponsoring organization concerned.

3) This residential course shall have 6 weeks duration and shall be delivered in three Parts of two weeks duration. In each course, 30 participants will be registered on first-come-first-serve basis. **The first course is scheduled to start from 28.03.2016** at IAHE, Noida. A brochure giving details including qualification & experience requirement for participants, course module & contents, qualifying criteria/marks, evaluation criteria for certification, etc. alongwith a nomination proforma is attached herewith for your ready reference.

4) I therefore request you to kindly identify 1-2 suitable Executive Engineers who are involved in road safety activities and send their nominations. The fee amounting Rs.1.00 lakh/participant be paid to 'IAHE' to confirm the participation. I also request you to consider intimating key personnel of consultants/contractors carrying out road safety audit, if any, for participating in the course please. The pool of safety engineers and auditors developed under this initiative shall be gainfully engaged as key personnel in carrying out road safety audit on National Highway projects.

With warm regards,

Yours sincerely,

  
(VL Patankar)

Encl: as above.

To,

1. DG(RD)&SS, MORTH, JS(T) MORTH, NHAI, NHIDCL, BRO, CRR, SPA, IIT Delhi, Principal Secretary/Secretary/E-in-C/CE(NH) of State PWDs, Central/State PSUs, IITs, NITs, Academic institutions & Technical Universities, etc.
2. All the consultants, concessionaires, contractors and individual professionals working in highway sector.



**भारतीय राजमार्ग अभियंता अकादमी**  
(सड़क परिवहन एवं राजमार्ग मंत्रालय, भारत सरकार)  
**Indian Academy of Highway Engineers**  
(Ministry of Road Transport and Highways, Govt. of India)

**Nomination Form for Registration**

**Certificate course on Road Safety Engineering and Audit**

Organized by IAHE from 23.05.2016 to 29.07.2016 in association with  
IRF-India Chapter and ARRB at IAHE, Noida

S.No.	Particulars	To be filled by Applicant		
1.	Name in capital letters			
2.	Date of Birth (DOB) and Age	(DOB)	(Age)	
3.	Designation			
4.	Office Address, Telephone and Email Ids			
	Address for correspondence, Telephone and Email Ids			
5.	Mobile Nos.			
6.	Sponsoring Authority and Organization (Name, Designation, Address, Contact no, Email Id, etc)			
7.	Educational qualification(s) from Graduation onwards			
S.No.	Degree/Exam. Passed	University/Institution	Year of passing	Class/Grade
i.				
ii.				
iii.				
iv.				
8.	Employment			
S.No.	Position Held	Period (From – To)	Ministry/Department/Organization	
i.				
ii.				
iii.				
iv.				
9.	Years of Experience in Highways and Road Safety			
10.	Place of stay during training if not staying in IAHE Hostel			
11.	Health History			
	a) Whether sound health	Yes / No		
	b) If not, are you suffering from any chronic disease/ disease which may hinder you from staying in hostel? if yes, please specify	Yes / No		
Signature of Applicant		Signature of Sponsoring Authority with Seal		

### Module-3: Road Safety Engineering (5 days)

Road Safety: Road crashes situation, Causes of Road crashes, Safe System Approach, Engineering Interventions, Safe Infrastructure Safety, Education and Enforcement, Lead Agency for Road Safety, Road Safety Management, Road Safety Action Plan. Safety Elements in Road Link Design: Safety Principles, Safety in Alignment Design, Sight Distance, Horizontal Alignment, Vertical Profile, Cross sectional elements, Traffic Control Devices, Crash Restraint System, Vulnerable Road Users, At-grade rail crossing, Street Lighting. Safety Elements in Junction Design: Basic Principles, Selection of Junction type, Safety Elements in Priority Junction, Safety Elements in Junction with Ghost Island, Safety Elements in Junction with Single Lane Dualling, Traffic Control in Junction, Safety Elements in Signal Controlled Junction, Elements to Improve Safety in Junctions, Provisions in Junction for VRUs. Introduction to Road Safety Engineering: Definition of Road Accident, Significance of Engineering measures, Road Safety Engineering, Crash Prevention Approach, Crash Reduction Interventions, Blackspot Analysis and Improvement, Mass Action, Route Action, Area Action. Accident Investigation, Monitoring and Evaluation: Accident Data Collection, Analysis & Develop Factor Grid, Significance of Site Investigation, Physical and Operational Checklist, Problem Diagnosis, Marching Solution and Countermeasures, BCR for Countermeasures, Scheme Drawings and Detailed Design, Implementation and Evaluation, "Before" and "After" Study. Practical Sessions: Layout design with Ghost Islands and Physical Islands for Priority Junctions, Layout design with Ghost Islands and Physical Islands for Roundabout in a Major T Junction, Layout design for Signalised Junction including phasing of signal and signal coordination, Carry out Corridor Analysis for a section of road using a set of Dummy Accident Data and identify and prioritize blackspot and prepare an Accident Investigation and Prevention (AIP) Report, Develop scheme drawing for a blackspot (T Junction) with a set of Dummy Accident Data and compile a sample bid document.

### Module-4: Introduction to Road Safety Audit (5 days)

Road Safety Audit: What is meant by road safety audit?, What is not safety audit?, Stages of safety audit, Audit of land use development, Audit process, Checklists for safety audit, Format of audit reporting, Relevance of audit in design & implementation stages, Economic returns with safety audit, Road Safety Toolkit, Risk assessment & ranking audit recommendation. Speed Management: Consequences of high speed, Speed & Severity of Crashes, Villages with Speed Breakers, Villages with Soft Treatment, Pedestrian Clustered Locations, School Zones in Villages, Traffic calming Measures, Roadside Hazards, Side Road Gradient, Side Road Treatment. Roadside Hazard Treatment: Safe zone Concept, Type of barriers, Selection of barrier type, Warrants for Installation, Transition between barriers, Crash barriers, Crash cushion. Road Signs & Pavement Markings: Function of road sign, Types of road signs, Placement of signs, Designing of direction boards, Technology in Retro-reflective (RR) sheeting, Selection of RR sheeting for urban streets, inter-city roads, multi-lane highways, Priorities of signing in urban streets, inter-city roads, multi-lane highways, Pavement Markings, Priorities of marking in urban streets, inter-city roads, multi-lane highways, Placement of RRPM in urban streets, inter-city roads, multi-lane highways, Delineator posts, Low cost safety devices. Rural Road Safety: Principal aim of rural road safety, Rural Road Accident Characteristics, Mitigation Measures, Essential Safety Features, Measures for Curves in Rural Roads, Measures in rural road passing through Villages, Traffic calming Measures, Longitudinal Markings, Junctions in Rural Roads. Practical Session: Prepare sign plan for a Priority, Roundabout and Interchange including the design of direction boards, Develop sign and marking plan with all essential safety features of an urban street, Develop sign and marking plan with all essential safety features of a multi-lane highways using plan and profile drawings, Develop sign and marking plan with all essential safety features of an two lane undivided highways using plan and profile drawings, Night time audit of an urban and rural road.

### Module-5: Advanced Road Safety Audit with Practice (5 days)

Traffic Management during Construction & Pre Opening Audit: Principles of Traffic Management Plans at Work Zones, Temporary Traffic Control Zones, Traffic Control Zone, Traffic Control Devices, Traffic management practices, Applicable Layouts, Pre-opening audit. Tailor-made solutions for VRUs: Who are Vulnerable Road Users (VRUs), What works and what does not work in Indian context, Tailor made solutions for India situations, Pedestrian safety, Cyclist safety, Two/Three Wheelers safety, Safety for Animal drawn vehicles. Safety During Operation and Maintenance: Issues in operation stage, Safety without maintenance regime, Surface Condition and Safety, Crashes characteristics and mitigation, Carriageway narrowing for current traffic usage, Dangerous overtaking manoeuvres, Vehicles run off road, Vehicles hit object alongside carriageway, Restart and Overshoot in Junctions, Routine cleaning and maintenance of traffic control devices. Indian Code of Practices related to safety engineering: Road Signs: IRC 57 2012, Pavement Markings IRC 35 2015, Guidelines for Traffic Management at worksites IRC SP 35 2014, Six Lane Manual IRC SP 87 2013, Four Lane Manual IRC SP 84 2014, Two Lane Manual IRC SP 73 2015, Guidelines for Junction Design, Guidelines

for Crash Restraint system, Guidelines for Road Hump/Rumble strip, Field Demonstration Sessions (Safety Issues in Urban streets, Inter-city roads): How to determine safe negotiating speed for a curve to install sign and safety measures?, What is the proper convention of installing hazard markers?, How to determine whether to install "stop" sign or "giveaway" sign? How to install traffic control signs for a mirror road junction?, How to establish no-overtaking center line?, How to orient road signs to prevent glare effect?, Guidelines for selecting type retro-reflective sheeting, Practical Sessions on Preparation of RSA Report (Design Stage & Operation stage): Prepare a road safety audit report in the prescribed format for an Urban Road, Prepare a road safety audit (design stage) report in the prescribed format for a multi-lane highway, Prepare a road safety audit (operational stage) report in the prescribed format for an Expressway, Prepare a road safety audit (design stage) report in the prescribed format for a undivided rural road

### Module 6: Advanced Lessons on Safety Engineering and Practice Training for Certification of Safety Auditor (5 days)

Risk Assessment & Ranking of Recommendation: What is the risk? How to assess the risk?, Why to assess the risk? Ranking of audit recommendations, Solution and Percentage Effectiveness: Steps in selecting solutions, Percentage effectiveness on different accident types. Correction Action Reports: Structure of Correction Action Report, Examples of Correction Action Report. Roadside Hazard Management: Safe design for risk reduction, design to keep vehicles on road, Hazard Mitigation process, Evaluation of treatment options, International standards on crash restraint system and prevailing Indian guidelines. Showing of Films on roads designed and operated as per true standards Field & Classroom Practical Sessions: Audit of 2-Lane Inter-City Roads and Prepare Reports for the same, Audit of Multi-lane Inter-City Road and Prepare Reports for the same, Audit of Multi-lane Inter-City Expressway and Prepare Reports for the same, Audit of Urban Roads & Urban Junctions and Prepare Reports for the same, Audit an Urban Road in Night time and prepare the Reports for same. Practice Session Training: These will be carried as actual Practice Session training on safety auditing as well as in the preparation and presentation of safety auditor reports, which will be evaluated to award marks for the module.


About IAHE: IAHE (formerly NITHE), an apex institute of excellence, was established by the Ministry of Road Transport & Highways, Govt. of India in Jan, 1983, as a registered Society, to fulfill the needs for training of highway professionals. It organises various types of training programmes at entry level and during the service at different levels for Central & State Govts., Public and Private sectors working in the road sector. IAHE promotes co-operation and foster exchange of knowledge, ideas and experience in the sphere of highway engineering among highway professionals in India and Abroad. So far, it has organised about 1200 programmes for about 27,000 professionals from 50 Countries. Visit [www.iahe.org.in](http://www.iahe.org.in) for details. About ARRB Group Ltd: Provides research, consulting and information services to the road and transport industry in Australia and world over. ARRB applies research outputs to develop equipment that collects road and traffic information, and software that assists with decision-making across road-networks. ARRB is the leading provider of road research and best practice workshops in Australia. Visit [www.arrb.com.au](http://www.arrb.com.au) for details. About IRF-India Chapter: IRF is a not-for-profit worldwide federation of public & private entities promoting road development, with membership across more than 90 countries and 6 continents. The India Chapter (IRF-IC) functioning under the aegis of IRF Geneva Program Centre, was registered on 5th February 2009 as a Society. Visit [www.indiairf.com](http://www.indiairf.com) for details.

Contact for details:

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## Certification for Road Safety Engineers and Auditors

Accredited and Sponsored by  
Ministry of Road Transport and Highways  
Govt. of India

Organized by  
Indian Academy of Highway Engineers

In association with



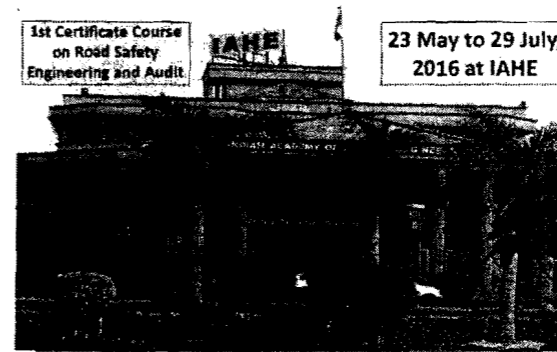
International Road Federation  
(India Chapter)



Australian Road Research Board  
Australia

1st Certificate Course  
on Road Safety  
Engineering and Audit.

23 May to 29 July,  
2016 at IAHE



**Background:** Road safety was never recognized as a major problem till the vehicle ownership boom in last 2-3 decades and wide-spread road network expansion for better mobility in India. With highest road fatalities in the world, India has recognized the social and health burden caused by this human tragedy, which costs the nation 2-3% of its GDP every year. It is also realised that the roads built with full compliance to standards also need careful road safety interventions, and therefore, the importance of road safety engineering and associated audits is understood. The curriculum in engineering colleges so far has not built in road safety engineering in any significant manner. Acute shortage of trained and qualified road safety engineers and auditors is felt since a long time to bring in the desired improvement in road safety scenario. Ministry of Road Transport and Highways (MORTH), Government of India (GOI) has taken several steps for improvement of road safety in the recent past. To bridge this gap and to develop well-versed road safety engineers and auditors, MORTH has agreed to support the initiative by bearing more than 50% of the cost and starting a 'Certified Road Safety Engineers and Auditors' programme which will be organised by Indian Academy of Highway Engineers (IAHE) in association with Australian Road Research Board (ARRB) and International Road Federation (IRF-India Chapter).

**Objectives:** The main objective of this certificate programme is to develop highway professionals as 'Road Safety Engineers and Auditors' who should be able to bring-in safety engineering elements in planning, design, construction, operation and maintenance stages systematically ensuring safety for the road users. They will also be used for the network in operation for identifying safety deficiencies and to suggest improvements based on thorough analysis & audit.

**Delivery:** The fully residential course has been designed to be delivered in 6 modules of 1 week duration each through class room lectures, field works and practical/demonstration aspects of learning combined with academic assignments. The two modules would be conducted in a sequence over two consecutive weeks comprised of theory, practical and assignments with a short break to allow for assimilation of the learned materials through the home assignments. The remaining four modules will have similar pattern of delivery, so that all the 6 modules are completed in 10-12 weeks period. The participants will undergo a systematic, rigorous learning and evaluation process covering the adequate details from fundamentals to the advanced traffic engineering and road safety audit, making them a group of trained and skilled professionals, certified as 'Safety Engineer and Auditor' duly accredited by the Ministry of Road Transport and Highways (MORTH), Government of India (GOI).

**Strategy:** This specially designed course shall be delivered with the help of international experts from ARRB, Australia to bring-in the best safety practices from Australia and around the world. The specially designed and developed course materials with help of Australian experts and team of Indian experts would also be provided to the participants. During the delivery, Indian safety engineering and audit experts/faculty including experts from IITs/NITs and other institutions would be invited to participate in the programme for moderating and interaction, and by sharing the best safety engineering principles and practices it is proposed to build capacity by developing a team of Indian Trainers for subsequent training programmes. Thereafter, these trained experts will be engaged in delivery of subsequent certificate programmes as per curriculum/pedagogy developed by the International Experts.

**Targeted Participants and Group Size:** The highway engineers working in public & private sectors with following qualification & experience will be enrolled to undergo this certificate programme and may be considered as targeted participants. A maximum of 30 participants per programme would be considered for enrolment and the slots would be confirmed in order of receipt of nominations along with prescribed fee for confirmation. Being a residential programme, all the participants will have to stay in trainees' hostel in IAHE campus. This will facilitate interaction and discussions amongst the participants themselves to accomplish daily assignments. All necessary facilities for lodging, boarding, recreational, DTH TV and dedicated wi-fi net access facilities, etc. are available in the hostel.

**Educational Qualification:** Essential: Should be holders of minimum of a Civil Engineering Bachelor's Degree. Desirable: Post-Graduate Degree like M.Tech./M.E./PG Diploma etc. in Highway Engineering/ Transportation Engineering/ Traffic Engineering/Transport Planning/ Transportation Systems Engineering, etc. **Experience:** Should possess minimum 3 years of working experience either from highway agencies associated with road development or from academic institutions dealing traffic and highway engineering discipline or from highway engineering/design consultancy or contracting firms.

#### Course Modules and Marks:

Modules	Name of modules	Minimum Qualifying Criteria	Duration	Maximum Marks	Minimum Qualifying Marks
Part-I	Module-1: Introduction to Traffic Engineering	Degree in Civil Engg. with 3 yrs relevant exp.	One week	100	75
	Module-2: Advanced Traffic Engineering	Module-1	One week	200	150
Part-II	Module-3: Road Safety Engineering	Module-2	One week	200	75
	Module-4: Introduction to Road Safety Audit	Module-3	One week	200	150
Part-III	Module-5: Advanced Road Safety Audit with Practice	Module-4	One week	200	150
	Module-6: Advanced Lessons on Safety Engg and Practical Training for Certification for Safety Auditor	Module-5	One week	200	150
Total marks for Certification				1000	800

**Course Fee:** The total cost of the 6-weeks course is Rs.2,18,500/- per participants. Out of which, Rs.1,18,500 would be borne by the MORTH and the balance amount as fee of Rs.1,00,000 per participants will have to be paid by individual participant or his/her sponsoring agency. The fee is inclusive of lodging and boarding of the participants in IAHE hostel. The fee should be paid in favour of 'Indian Academy of Highway Engineers' through local cheque/PO/DD/transferred through ECS/RTGS in IAHE's SB A/c 71221210000311, Bank of India, Sector-62 Noida Branch, IFSC Code: BKID0007122. The minimum qualifying marks are compulsory for moving to the next Part. In case a participant is not able to secure qualifying marks in a Part, he/she will have to repeat the Part at his time and cost along with the participants of next batch. The fee (participant's share) for repeat participant would be Rs.30,000 for Part-I, Rs.30,000 for Part-II & Rs.40,000 for Part-III. In case of leaving the programme at any stage, the fee deposited shall not be refunded back.

#### Schedule of the Course:

Modules	Name of Modules	Period
Part-I	Module-1: Introduction to Traffic Engineering	23.05.2016 to 09.06.2016
	Module-2: Advanced Traffic Engineering	
Part-II	Module-3: Road Safety Engineering	20.06.2016 to 01.07.2016
	Module-4: Introduction to Road Safety Audit	
Part-III	Module-5: Advanced Road Safety Audit with Practice	18.07.2016 to 29.07.2016
	Module-6: Advanced Lessons on Safety Engineering and Practical Training for Certification of Safety Auditor	

**Faculty:** Faculty will be eminent practicing professionals in the field of road safety and audit from public and private sectors including experts of ARRB, IRF and IITs/NITs.

**Training Materials:** International experts of repute from ARRB, IRF and other renowned Indian practising Road Safety experts have developed each module with specially designed curriculum, course material, assignments, practical aspects of safety-audits, including reporting and monitoring mechanism along with course evaluation methodology to fulfil the requirements of certified safety engineers and auditors for India.

#### Evaluation for Certification:

- There will be continuous evaluation or marking of the reports/assignments submitted by the participants for each module as well as based on written and oral examinations at the end of each module.
- For successful completion of each module, the participant has to score minimum 75% marks. On successful completion of two modules in each Part, participant will be considered as qualified for the next two modules, otherwise he/she will have to repeat the Part at his/her cost.
- Based on successful completion of all the 6 modules in three Parts, the participants will be evaluated for combined score in six modules and shall have to score minimum 80% marks out of combined total of 1000 marks for all six modules to be eligible for award of the Certificate.

**Certification/Accreditation:** MORTH has declared IAHE as its authorised institution for issuance of certificate for Certified Road Safety Engineer and Auditor. A Certificate will be given to each successful participant, duly evaluated as prescribed, by the IAHE as an authorised institution of MORTH. This certification would necessarily be required to be renewed by the individual professionals periodically at interval of every five years which will be renewed/re-accredited based on their involvement/performance in 'safety engineering and audit works/projects completed' during the intervening period. IAHE shall maintain a register/record and database of all the participants including evaluation records, certification, and renewal/re-accreditation records, who have successfully completed the Certification Course. IAHE shall maintain and will also keep updating the audit experiences/records of the certified Road Safety Engineer and Auditor. Further, MORTH shall be requested to issue the guidelines that all key personnel involved/to be involved in road safety audit on National Highway Projects should undergo this certification programme; and subsequently to allow only 'Certified' Road Safety Engineers and Auditors to undertake safety audit works for National Highway projects.

#### Module-wise Course contents

##### Module-1: Introduction to Traffic Engineering (5days)

**Traffic Engineering:** Traffic Engineering Elements, Vehicle characteristics, Concept of Design Vehicle, Turning Characteristics, Braking and Acceleration Characteristics, Human factor related to road safety, Road User Characteristics, Perception-Reaction Time, Visual Characteristics and Comfort of Driver, Psychological, Personality and Related Factors. **Road Geometric Characteristics:** Cross-Section, Surface condition, Slope and Curves, Horizontal Alignment, Geometric Characteristic of Horizontal Curves, Sight Distance on Horizontal Curves, Transition Curves, Curve Widening, Vertical Alignment, Geometric Characteristic of Vertical Curves, Sight Distance on Vertical Curves, Length of Vertical Curves, Harmonisation of geometry of curves. **Traffic Volume Studies:** Volume, Demand and Capacity, Field Techniques of Volume Studies, Intersection Volume Studies, Network Volume Studies, Specialized Counting Studies, Capacity and Level of Service, Pedestrian volume count, Pedestrian desire line, Speed and Delay Studies: Spot Speed Studies, Travel-Time Studies, Intersection Delay Studies. **Traffic Stream Parameters:** Volume and Rate of Flow, Speed and Travel Time, Density and Occupancy, Spacing and Headway, Relation between Flow Rate, Speed and Density. **Basic Statistics for Traffic Engineering:** Probability & Statistics, Normal Distribution, Other Distributions, Hypothesis Testing. **Practical Sessions:** Determine level of service of a road section (provided with base year traffic figure and growth rate) and also assess the year of capacity augmentation, Design of a curve i.e. horizontal, vertical and super elevation and extra widening etc., Develop typical cross section for 2/4/6 lane highway and also for urban arterial and sub-arterial highway with provision for VRUs, Conduct Spot Speed Survey and determine 85th Speed, Conduct Speed-Delay survey and determine average speed.

##### Module 2: Advanced Traffic Engineering (5 days)

**Traffic Facilities:** Introduction, Uninterrupted & Interrupted Traffic Flow, Stream Characteristic, Data Collection, Macroscopic Traffic Flow Models, Interrupted Traffic Flow, Traffic Flow at Signalized Intersection. **Traffic Control Devices:** History of Traffic Control, Legal Aspect of Control Devices, Traffic Signs, Traffic markings, Traffic Signals, Special Types of Control. **Design of Intersection:** Introduction, Design Principles & Intersection Control, Types of Intersections & Warrants, Capacity Assessment of Intersections, Priority Junction, Roundabout, Signal Controlled Junctions/Designs, Special consideration in urban areas, Intersection Channelisation, Interchanges, Warrants for Interchanges, Turning path of design vehicles. **Parking Facilities:** Studies & Characteristics: Parking Generation and Supply Needs, Design Aspects of Parking facilities, Zoning and space requirement, On-street parking for safety, Off-street parking, Vehicle Circulation, Truck Lay-bye and safety, Bus-bay and safety. **Public Transportation:** Introduction, Para-transit System, Street Transit System, Rapid Transit System, Route Development, Properties of Good Route Set, Determination of a Good Route Set, Stop Location and Stopping Policy, Schedule Development, Capacity of Transit System. **Intelligent Transportation Systems (ITS):** Introduction to ITS Application, Network Optimization, Sensing Traffic using Virtual Detectors, Route information, Commercial Routing and Delivery, Electronic Toll Collection, Congestion Pricing, Dynamic Assignment, Traffic Enforcement. **Practical Sessions:** Conduct a sample junction turning volume count, analyse and determine the capacity, Design of a Single lane dualling, Priority Junctions (capacity determination and layout design, Design of a Roundabout (capacity determination and layout design, Develop a safe layout plan for on-street parking.