

# *HOUSE OF TRANSPORT PLANNING & TRAFFIC ENGINEERING*

*Research – Learning - Consultancy*

*Learning Modules & Training Courses*

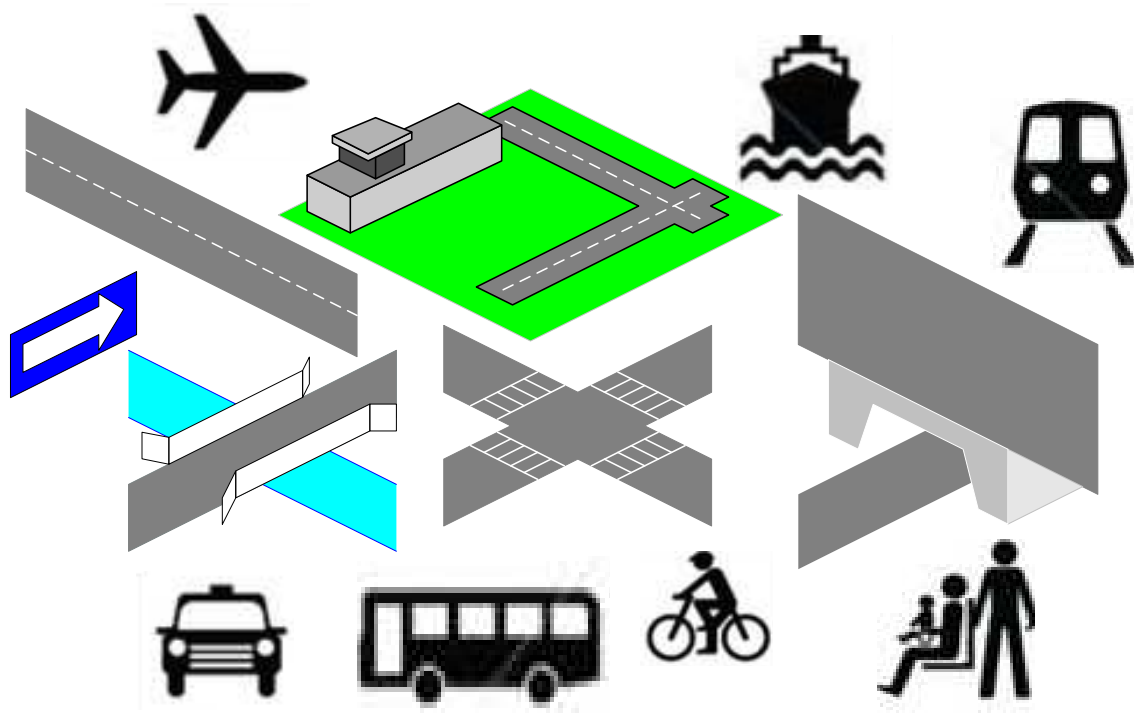
*By*

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# **LEARNING MODULES & COURSES: TEACHING AND TRAINING OFFERED**

**By**

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The following represents a sketchy outline of courses that was developed and taught by me. In addition, the list includes some other courses under preparation. These, combined, can form graduate/undergraduate program or a training diploma in the fields of:

- Transportation policy and planning
- Transport management and Logistics
- Traffic management, safety and the environment.

The proposed courses can be grouped under four headings:

## **Module I: Transportation Policy & Planning (Four Courses)**

1. Transportation Policy and Planning
2. Transportation Demand Modelling
3. Evaluation of Transport Schemes
4. Transportation and Land Use Development

## **Module II: Transport Management and Logistics (Two Courses)**

1. Transport Management
2. Management of Business Logistics

## **Module III: Traffic Management, Safety and the Environment (Five Courses)**

1. Traffic Engineering and Control
2. Road Congestion Management
3. Traffic Accidents and Safety Management
4. Traffic Impact Assessment
5. Environmental Impact Assessment of Transport Projects

## **Module IV: Other Courses**

1. Privatization of Transport Infrastructure
2. Total Quality Management in Transit Agencies
3. Performance Measures Used for Assessing the Achievements of Transport Organisations
4. Information Systems for Transport Management
5. Management Training in Transport Organisations

## **MODULE I: TRANSPORTATION PLANNING**

### **I.1. TRANSPORTATION POLICY AND PLANNING**

#### **COURSE OBJECTIVES**

1. To gain an overall view of the transport system.
2. To be trained on how to outline goals, objectives, strategies and policies as related to the transport sector.
3. To understand what is meant by transportation planning.
4. To learn the process involved in conducting a transportation planning study.
5. To be familiar with some of the traditional methods/techniques used for data collection and modeling required by the transportation planning process.

#### **COURSE DESCRIPTION**

This course starts by defining the transport system and laying down its role in the society. Components of the transport system are identified and the interactions among these components are thoroughly discussed. The concept of multi-dimensionality of the transport system is introduced by examples and the characteristics of transport supply and demand are also presented. Some generic problems of the transport system and some suggested relief solutions for these problems are discussed. This introductory component of the course is concluded by presenting the various transportation-related subject areas and sciences.

The course proceeds by showing the various types of ownership that exist within the transport system. The course attempts to disseminate by examples the hierarchical differences and relations between goals, objectives, strategies and policies in the transport sector.

This thorough introduction helps to set the picture to answer the question what do we mean by transportation planning and why we need to plan for transportation systems. The basic definitions, objectives and levels of transportation planning are introduced. The concept of supply-demand equilibrium checks is used to demonstrate the importance of transportation planning.

The course presents the framework for transportation planning using the classic four-stage transportation models. Such framework includes several preliminary and core phases. These include: the preliminary steps for setting the study area, the data collection and knowledge acquisition phase, the development of the classic four trip making models, the development of future alternative scenarios and schemes, the use of trip making models in prediction, and finally the evaluation of alternative transportation scenarios and schemes.

Each of these phases is discussed, starting by the setting of the study area which includes defining the study area, the zoning system, and the network representation. This is followed by the data collection exercise where demographic, socio-economic, land-use, car ownership, modal characteristics, network description and travel patterns data are collected. In collecting travel data several survey methods can be employed. These include: home based surveys, network/mode based surveys, observational surveys, and other surveys. These methods are demonstrated in the course.

The course moves on to the core of the transportation planning process that is the development of trip making models, referred to as the four stage procedure. The course looks at each of these stages. These are trip generation, trip distribution, mode choice and route choice (assignment) stages. Techniques used for modeling each of these stages are covered in the course. The course concludes by giving a brief background of how alternative transport schemes can be evaluated.

## COURSE OUTLINE

Definition and role of the transport system  
Components and interactions of the transport system  
Activities of the transport system  
Multi-dimensionality of the transport system  
Characteristics of transport demand  
Characteristics of transport supply  
Generic problems and relief solutions of the transport system  
Ownership in the transport industry  
Goals, objectives, strategies and policies in the transport system  
Definition of transportation planning process  
Objectives of transportation planning  
Levels of transportation planning  
Importance of transportation planning  
Transportation planning approaches  
Preliminary steps for transportation planning studies  
Framework of transportation planning studies  
Data collection and knowledge acquisition  
Travel survey methods  
    Home based surveys (household questionnaires, travel diaries, post card questionnaires)  
    Network/mode based surveys (external cordon surveys, screen line surveys)  
    Observational surveys (registration number recording, coloured/punched card recording)  
    Other surveys  
Travel survey techniques  
    Cross-sectional surveys/Time series surveys/Longitudinal panel surveys  
    Revealed preference surveys/Stated preference surveys  
Sampling  
    Methods of sampling  
    Pilot surveys  
    Types of error  
Trip generation models  
    Growth-factor models  
    Regression analysis models  
    Category analysis models  
Trip distribution models  
    Growth factor methods (Constant factor, Average factor, Frator, Furness)  
    Gravity models (Synthetic models)  
Mode choice models  
    Trip interchange modal split models  
    Binary Logit models  
    Multi-Nomial Logit models  
    Hierarchical Logit models  
    Direct demand models  
Traffic assignment models  
    All-or-nothing assignment models  
    Diversion curves assignment models  
    Capacity restrained assignment models  
    Stochastic assignment models

## **I.2 TRANSPORTATION MODELLING**

### **COURSE OBJECTIVES**

1. To understand the purpose of constructing transportation models.
2. To gain an insight of modeling philosophies and techniques that can be applied in the transport sector.

### **COURSE DESCRIPTION**

This course is concerned with presenting the main modeling philosophies that can be used to develop transportation models. The purpose of constructing transportation models is presented. The contemporary requirements for modelling transportation problems are discussed.

Modeling techniques can be grouped into several groups. This course explores five of these groups, namely: conceptual models, statistical versus causal models, static versus dynamic models, deterministic versus stochastic models, and simulation versus optimization. Different approaches to transportation planning are discussed. These include: the classic four-stage transportation models, economic-based direct demand models, disaggregate individual choice models and activity-based models.

The course discusses the current emphasis on dynamism in transport modelling. The course concludes with discussing two modelling techniques., namely the System Dynamics Methodology and the Expert Systems Technology.

### **COURSE OUTLINE**

#### Modeling philosophies

- Mental models
- Explanatory models
- Descriptive models
- Mathematical models
- Normative models
- Prescriptive models
- Statistical models
- Causal models
- Static models
- Dynamic models
- Deterministic models
- Stochastic models
- Simulation models
- Optimisation models

#### Transportation planning approaches

- Four-stage transportation models (Aggregate models)
- Direct demand models (Simultaneous models)
- Discrete choice models (Disaggregate models)
- Activity-based models

#### System Dynamics methodology

#### Expert Systems technology

## **I.3 EVALUATION OF TRANSPORT SCHEMES**

### **COURSE OBJECTIVES**

1. To understand what is meant by evaluation of transport schemes.
2. To gain an insight of techniques that can be applied in the evaluation of transport schemes.
3. To learn the process involved in conducting an appraisal for a transport scheme.

### **COURSE DESCRIPTION**

Every scheme providing or improving transport facilities and service involves expenditure of resources. Before committing these resources, methods are needed for assessing the effects of such improvements and the value of realizing these. These ways will range from a financial appraisal by a transport operator examining the effect of altering his prices or investing in a new vehicle on his revenue to the broadest socio-economic and environmental assessment of the impacts of a major transport investment, based upon many different criteria and affecting many different groups within a community.

The course starts by introducing the importance of the evaluation of transport schemes. The course categorizes the different methods used to evaluate transport schemes according to the size of investment and the community affected by it. Each of the methods used in the evaluation is discussed. These include: technical, environmental, financial, economic and social appraisals. Main rules governing feasibility studies of transport projects are raised and discussed. Respective roles of politicians versus professionals are presented. Implications, viewpoints and limitations of transport schemes are also presented. Differences between public and private sector evaluation are detailed.

The course emphasis is on financial and economic appraisals including cost-benefit analysis, social cost-benefit analysis and framework analysis. The criteria for choice of appropriate evaluation method are discussed. A general framework for conducting financial and economic feasibility studies for transport schemes is outlined. This is followed by a detailed discussion of the procedure involved. The estimation of user-benefits in cost-benefit analysis is discussed as well as the valuation of operating costs savings, travel time-savings, accident savings and environmental savings. In this respect, a demonstration of risk, cost and benefit allocation is shown.

This is followed by showing how costs and benefits are treated through time. Cash flow diagrams and formulas are presented. The concept of salvage value is also discussed. An emphasis is laid on presenting the different cost-benefit analysis criteria that could be employed in the economic evaluation. These include: Net Present Value (NPV), Benefit-Cost ratio (B/C ratio), Internal Rate of Return (IRR).

The course also covers the procedure involved in conducting an environmental impact assessment for a transport scheme. Several other important issues are covered by the course. These include: time preference, opportunity costs, shadow pricing, discount rates, and interest rates of return.

### **COURSE OUTLINE**

Importance of evaluation of transport schemes

Feasibility Studies

    Technical Feasibility

    Environmental Feasibility

    Financial Feasibility

    Economic Feasibility

    Social Feasibility

- Main Rules governing feasibility studies for transport projects
- Roles of politicians versus professionals in evaluation
- Implications of transport schemes
- Different viewpoints
- Differences between public and private sector evaluation
- Practical Limitations
- Different methods for economic evaluation transport schemes
  - Cost-benefit analysis
  - Social cost-benefit analysis
  - Framework analysis
- Criteria for choice of appropriate evaluation method
- Procedure for ranking schemes
- Framework for conducting financial and economic feasibility studies for transport schemes
- Detailed procedure for conducting financial and economic feasibility studies
- Risk, Cost and Benefit allocation
- User-benefits
  - Valuation of operating costs savings
  - Valuation of travel time savings
  - Valuation of accident savings
  - Valuation of environmental changes
- Treatment of Cost and Benefit through time
  - Cash Flow Diagrams
  - Cash flow formulas
  - Salvage Value
- Framework for conducting environmental impact assessment

## **I.4. TRANSPORTATION AND LAND USE DEVELOPMENT**

### **COURSE OBJECTIVES**

1. To gain an overall view of the feedback dynamic relations that exist between the transport system and land development.
2. To gain an insight of modeling philosophies and techniques that can be applied in land use models.
3. To understand what is meant by traffic impact assessment.
4. To gain an overall view of the process involved in conducting a traffic impact study.
5. To gain an insight of techniques that can be applied in measuring the intensity of traffic problems as a result of potential land developments.
6. To be familiar with some of the traditional methods/techniques used for data collection and modeling required by the land use planning process.

### **COURSE DESCRIPTION**

This course starts by defining the transport system and laying down its role in the society. Components of the transport system are identified and the feedback dynamic interactions between such components and land development are thoroughly explored. The classic transportation planning and land use models are reviewed. These include the four-stage transportation model, and the famous LOWRY land use model. In addition other land-use models, such as EMPRIC type models and the POLIS model are discussed. .

A discussion of transportation and site planning principles is introduced. This includes site planning, traffic analysis, functional circulation systems, intersection design, access and site circulation, parking and service facilities as well as drive in facilities. The course takes an emphasis on Traffic Impact

Analysis. Traffic impact studies are studies that project traffic, identify traffic problems and suggest ways for relieving problems resulting from new or expansion of existing land use developments. The course identifies the stakeholders involved in Traffic impact studies. The process involved in conducting a traffic impact assessment is thoroughly presented and discussed. Generic traffic problems are identified and discussed. Ways and methods for measuring the intensity of such problems are presented.

Traffic data collection is the basis of most if not all traffic studies. Methods of traffic data collection are presented. The traffic stream characteristics are defined. This includes defining traffic volume (flow), speed, and density. The fundamental traffic stream relationships are explored. These include: speed versus flow relationship, speed versus density relationship, and flow versus density relationship. The two concepts of highway capacity and level of service are discussed. Methods for computing the base year levels of service for all the main links and intersections surrounding the development area are shown.

The projection of traffic into the future of the development is composed of the natural growth pattern in addition to generated traffic as a result of the development. The course will show how to project such traffic and how to select and apply trip generation rates in accordance with the type and the intensity of new land uses.

As land use is developed, more trips are generated, traffic volumes increase, and several traffic-related problems occur. Problems include congestion, degradation of level of service for surrounding road network, parking and pedestrian problems, as well as safety and environment related problems. There is an increasing need to manage, control and relieve these problems. It is the responsibility of developers to mitigate such problems caused by their developments. The course moves to presenting and discussing the main traffic relieve strategies and their consequent policies and measures. These are classified into supply and demand related strategies. These also include measures related to the road, the vehicle and the driver. The course concludes with introducing concepts involved in developing a transport friendly urban center.

## **COURSE OUTLINE**

- Definition and role of the transport system
- Interactions between the transport system and land development
- Definition of transportation planning process
- Objectives of transportation planning
- Preliminary steps for transportation planning studies
- Land-use models (LOWRY, EMPRIC, POLIS models)
- Traffic Impact Assessment (Introduction and Definitions)
- Process for conducting Traffic Impact Assessment
- Methods for traffic data collection and presentation
- Traffic Stream Characteristics
- Capacity and Level of Service
- Trip Generation Rates
- Traffic Projections
- Traffic problems
- Causes of Traffic problems
  - Demand and supply related causes/Root and direct causes
- Strategies for relieving traffic problems
  - Policies and measures related to network expansion strategy
  - Policies and measures related to Traffic management and control strategy
  - Policies and measures related to Travel Demand Management Strategy
  - Policies and measures related to Land Use management strategy
- Case Studies



## **MODULE II: TRANSPORTATION MANAGEMENT**

### **II.1 TRANSPORT MANAGEMENT**

#### **COURSE OBJECTIVES**

1. To be trained on how to outline goals, objectives, strategies and policies as related to individual transport organizations.
2. To understand the components and the interactions among the main activities exercised by transport organizations.
3. To learn the process involved in conducting transportation planning at an organizational level.
4. To be familiar with some of the traditional methods/techniques used for data collection and modeling required by transportation planning at an organizational level.

#### **COURSE DESCRIPTION**

The course starts by introducing the framework for managing a transport organization whether a passenger or a freight organization. This is known as the management cycle. Various elements of this cycle are discussed.

There are three types of resources required by a transport organization, namely financial, human and physical resources. The course demonstrates ways of providing these resources. The management of a transport organization is responsible to utilize these resources into the operation of its fleet in order to produce service and financial outputs. Types of outputs are thoroughly covered in the course.

In the process of producing these outputs the organization incurs several types of operational expenditure. These include staff costs, running costs, maintenance and depreciation costs, and other costs such as licensing, taxation, ..etc. The various types of costs are explained. Their contribution to the operational costs and measures to reduce these costs are discussed.

The main functions and activities of a transport organization are presented in a framework where the interactions between the various activities are explored. The activities presented include: market analysis and demand prediction, planning of maintenance and repair, inventory control, planning for operation, vehicle procurement (additions and replacements), cost accounting, fare policies and fare determination, finance and budgeting, manpower development and training, marketing, and finally evaluation of performance. Each of these activities is thoroughly discussed, explored and presented in the course sessions. Hands on experience with a simulation model is provided. This model allows users to get an insight and understanding of the bus transit system in a relatively short time as well as to investigate the effect of different combinations of scenarios on the performance of the bus transit system and test the sensitivity of key output performance indices to changes in key input parameters.

The course concludes with presenting what is meant by developing an information system for transport management and how this can be utilized in developing decision support systems for management.

#### **COURSE OUTLINE**

The management cycle

Inputs of a transport organization

Outputs of a transport organization

Framework for planning activities/functions in a transport organization

Travel demand prediction (Market analysis)

Maintenance Planning  
Inventory Planning  
Procurement Planning  
Operation Planning  
Cost Accounting  
Fare/Tariff determination  
Human resource management and training  
Marketing  
Finance and budgeting  
Performance evaluation  
Information and decision support systems for management

## **II.2 MANAGEMENT OF BUSINESS LOGISTICS**

### **COURSE OBJECTIVES**

1. To understand what is meant by logistics and supply chain management.
2. To understand the components and the interactions involved in a logistics chain.

### **COURSE DESCRIPTION**

The course starts by introducing the basic nature of logistics in an organisation. Logistics is defined, and the interest in the area is explained. Logistics activities are explored and the relationships of logistics to the areas of materials management and physical distribution channels within a company are discussed.

The course considers the purchasing and the storage processes. The storage process includes inventory management and warehousing decisions. Emphasis is given to the transportation activity as being the largest logistics element for a company. The relationship of transport activity to other functional areas is examined, a carrier selection framework is developed, and a discussion of the economic and operational characteristics of the various modes is presented within the context of the carrier selection determinants. Other activities in the logistics chain are presented. This includes receiving and quality control, production planning, materials handling and packaging, and customer service including order processing.

The course discusses the type and role of information in logistics. Key steps for designing a logistics program are introduced. The problems associated with organising the logistics functions in a company and the alternative organisational structures for logistics are explored. Finally, ways for measuring the logistics and the logistics management performance are presented. The course concludes with presenting several case studies where logistics chain analysis acted as the basis for understanding, modelling and assessing activities within industrial companies and acted as the basis for improving performance.

### **COURSE OUTLINE**

The Meaning of Logistics  
    Definitions and Origin of Logistics  
    Logistical Activities  
Approaches to Analysing Logistics Systems  
    Materials Management Versus Physical Distribution  
    Cost Centers  
Purchasing in the Logistics System  
    Purchasing/Procurement Framework  
    Vendor Selection Criteria  
    Receiving and Quality Control

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## Production Planning

### Transportation in the Logistics System

- The Transport Selection Decision (Transportation Services)
- The Basic Modes of Transportation
- Legal Classifications of Carriers (Common, Contract, Exempt, Private)
- Intermodal Transportation (Containerisation, Piggyback, Birdyback, Fishyback)
- Indirect and Special Carriers (Freight Forwarders, Shippers Associations, Brokers, ..etc)
- Documentation (Bill of Lading, Freight Bill, F.O.B.)
- Bases for Transportation Rates
- The Transportation Pricing System

### Inventory in the Logistics System

- Rationale for Carrying Inventory
- Functional Types of Inventory
- Inventory Cost

### Approaches To Managing Inventory

- Fixed Order Quantity Approach (Condition of Certainty)
- Fixed Order Quantity Approach (Condition of Uncertainty)
- Fixed Order Interval Approach
- Just-In-Time (JIT) Approach
- Materials Requirements Planning (MRP)
- Distribution Resource Planning (DRP)
- Evaluating the Effectiveness of Inventory Management

### Warehousing in the Logistics System

- The role of the Warehouse in the Logistics System
- Basic Warehouse Decisions
- Basic warehouse Operations
- Warehouse Layout and Design
- Materials Handling and Packaging

### Customer Service

### Logistics Information System

### Key Steps for Designing a Logistics Program

### Structuring of Logistics Organization

### Measuring Logistics and Logistics Management Performance

## **MODULE III: TRAFFIC MANAGEMENT, SAFETY AND THE ENVIRONMENT**

### **III.1 TRAFFIC ENGINEERING AND CONTROL**

#### **COURSE OBJECTIVES**

1. To gain an overall view of the traffic system.
2. To understand what is meant by traffic engineering.
3. To identify traffic problems, their causes and main strategies for relieving them.
4. To gain insight of techniques applied in traffic engineering.
5. To learn the process involved in conducting traffic studies.
6. To be familiar with some of the traditional methods/techniques used for traffic data collection.

#### **COURSE DESCRIPTION**

The purpose of the course is to provide the basic principles and proven techniques governing the practice of traffic engineering. The course starts by presenting the components of the road traffic system. These include: the authorities responsible for road construction, maintenance and management; the types and classification of roads; types and classification of vehicles; road users; road non-users; supporting facilities and services; and the road furniture. The course goes on to discuss these basic components, namely road characteristics, road furniture, vehicle characteristics and road user characteristics.

The geometric design for roads is discussed. The term geometric design refers to the three dimensional features of highway that relate, affect, or are directly related to its operational quality and safety. These features include the cross section (lanes and shoulders, roadside slopes, and clear areas), intersections (channelisation, interchanges) and the horizontal and vertical alignment of the highway.

The course moves on to present the need and use of traffic control devices. These include traffic signs and markings that are used to regulate, warn and guide traffic on streets and highways. It also includes traffic signals by which traffic is warned or directed to take some specific action. What drivers must see to operate their motor vehicles satisfactorily and how to provide for the visibility required by roadway lighting is discussed. The course goes on to discuss vehicle operating characteristics. The discussion of vehicle operating characteristics addresses vehicle types and dimensions; design vehicles; turning radii and offtracking; resistance to motion; power requirements; acceleration and deceleration performance; vehicle operating costs; and transit and buses.

The human factor in highway transportation relates to the capabilities and limitations of the road user (driver, cyclist, pedestrian). Characteristics of road users and their interaction with the other elements of the traffic system are discussed.

The course moves on to present a discussion of traffic characteristics. This includes defining traffic volume (flow), speed, and density as well as defining spacing and headway. Fundamental traffic stream relationships are explored. These include: speed versus flow relationship, speed versus density relationship, and flow versus density relationship.

The two concepts of highway capacity and level of service are discussed. The three primary activities that traffic engineering professionals perform and that depend on capacity and level of service analyses are presented. These include: planning new facilities and expanding existing ones, upgrading existing facilities and finally conducting economic and environmental analyses when considering facility improvements.

Traffic studies are discussed in detail. These studies are designed to gather facts on traffic or parking conditions. These include traffic inventories, volume studies, speed studies, travel time and delay studies, intersection studies, public transit studies, parking studies and traffic impact studies. Data collection forms the basis of most if not all traffic studies. Methods of traffic data collection are presented. The components constituting the system for collecting traffic data include: monitoring, detection (sensing), interpreting, recording, sorting, coding and data entry. There exist several systems to be used for conducting a comprehensive traffic data collection exercise. The course reviews these methods and the criteria that can be used for evaluating and determining their applicability and suitability. Ways that can be used to analyse and present traffic data are also discussed. The course concludes by presenting the state of the art in traffic engineering practices mainly Intelligent Vehicle Highway Systems (IVHS).

### **COURSE OUTLINE**

Definitions and Objectives  
Components of the road traffic system  
Road Characteristics and Classification  
Road Furniture (Signs, Markings, Channelisation, Barriers)  
Traffic signals  
Roadway lighting  
Vehicle operating characteristics  
Road user characteristics  
Traffic Stream Characteristics  
Capacity and Level of Service  
Traffic studies  
    Intersection and Link Studies  
    Parking Studies  
    Pedestrian Studies  
    Public Transport Studies  
    Traffic Impact Studies  
    Traffic safety Studies  
    Environmental Impact Assessment Studies  
Methods for traffic data collection and presentation  
Intelligent Vehicle Highway Systems

### **III.2 ROAD CONGESTION MANAGEMENT**

#### **COURSE OBJECTIVES**

1. To gain an understanding of the problem of traffic congestion.
2. To learn the state of the art strategies, policies and measures that can be utilised to relieve traffic congestion.

#### **COURSE DESCRIPTION**

As vehicle ownership grows and trip rates increase, traffic congestion on our roads eventually occurs. The problem of traffic congestion and its consequences are reviewed. There is an increasing need to manage and control traffic flow on both urban and rural networks. The course presents and discusses the main congestion management strategies and their consequent policies and measures. These can be used to reduce the problem of congestion through calming, regulating and restraining traffic flow. These are divided into supply oriented measures and demand oriented measures. These include measures related to the road, the vehicle and the driver. Some of these measures are selected and thoroughly detailed.

## **COURSE OUTLINE**

Problem of traffic congestion

Congestion management strategies, policies and measures

Supply-Based

Transportation System Management

Traffic Management and Control

Demand -Based

Travel Demand Management

Land Use Management

## **III.3. TRAFFIC ACCIDENTS AND SAFETY MANAGEMENT**

### **COURSE OBJECTIVES**

1. To understand what is meant by traffic safety.
2. To identify accident causes and main strategies for relieving them.
3. To gain an insight of techniques that applied in traffic accident investigation and safety management.
4. To be familiar with some of the traditional methods/techniques used for accident data collection.

### **COURSE DESCRIPTION**

Accidents are inevitable deleterious outcomes of the transport system. Accidents could range in their severity from damage only accidents to injury and fatal accidents. A prime concern of traffic engineers and planners as well as of traffic police must be to ensure that both persons and goods can reach their destinations safely. This course starts by presenting the types of accidents and the factors leading to their occurrence. The course discusses the relation between the risk of accidents occurrence, the exposure and the severity of accidents. Approaches to traffic safety are presented. These include: identification and treatment of blackspots, area wide approach, and integrated approach.

The framework of integrated safety management approach considered to be the state of the art in traffic safety is discussed in detail. This includes several stages namely accident reporting system, accident analysis and investigation system, accidents locations and victims patterns, diagnosis of causes of accidents, setting of safety goals/objectives, identification of potential safety countermeasures, costing of safety countermeasures, valuation of traffic accidents, evaluation of safety countermeasures, development of an integrated package of safety countermeasures, implementation of integrated traffic safety package, monitoring implementation of traffic safety program, post program evaluation, development of an information base on traffic safety countermeasures. All stages are presented in detail.

### **COURSE OUTLINE**

Types of Accidents

Road User Accidents

Pedestrian accidents (high risk groups)

In vehicle passenger accidents

Vehicle Accidents

Factors Leading to the Occurrence of Accidents

Traffic Behaviour of Road Users

Road Environment

Surface condition/Geometric alignment

Road furniture/ Speed limits

Traffic management and control

- Traffic congestion
- Sidewalks/Crossing facilities
- Vehicle Condition and Type
- Traffic Enforcement
  - Police presence/behaviour
  - Level of enforcement
- Risk of Accidents Occurrence
- Traffic Exposure
- Severity of Accidents
  - Damage Accidents
  - Fatal Accidents
  - Injury Accidents
- Traffic safety Approaches
  - Identification and Treatment of Blackspots
  - Area Wide Approach/Integrated Approach
- Integrated Approach to Traffic Safety
  - Types of Integrated Approach to Traffic Safety
  - Framework for an Integrated Approach to Traffic Safety
- Accident Reporting System
  - Where did an accident take place?
  - When did an accident take place?
  - Who was involved in an accident?
  - What happened in terms of fatalities, injuries, damages?
  - How did an accident took place?
  - Why did an accident happen?
- Accident Analysis and Investigation System
- Accidents Locations and Victims Patterns
  - Trends of Accidents Numbers
  - Trends of Accidents Rates
  - Trends of Accidents Severity Indices
- Diagnosis of Causes of Accidents
  - Direct Causes
  - Root Causes
  - Post Causes
- Setting of Safety Goals/Objectives
- Identification of Potential Safety Countermeasures
  - Institutional Measures
  - Planning Measures
  - Transportation Planning and Management Measures
  - Educational Measures
  - Training Measures
  - Road and Traffic Engineering Measures
  - Vehicle Engineering Measures
  - Legislative Measures
  - Enforcement Measures
  - Information Measures
  - Health-Related Measures
  - School-Related Measures
  - Research-Related Measures
- Costing of Safety Countermeasures
- Valuation of Traffic Accidents

- Gross Output Approach
- Net Output Approach
- Life-Insurance Approach
- Court-Award Approach
- Implicit Public Sector Valuation Approach
- Willingness to Pay Approach
- Evaluation of Safety Countermeasures
- Development of an Integrated Package of Safety Countermeasures
- Post Program Evaluation
  - Effectiveness Measures
  - Efficiency Measures
  - Before and After Studies and Statistics
  - Regression and Correlation
- Development of an Information Base on Traffic Safety Countermeasures
- Implementation of Integrated Traffic Safety Package
  - Implementation Program
  - Operation and Actual Implementation
- Monitoring Implementation of Traffic Safety Program

### **III.4. TRAFFIC IMPACT ASSESSMENT**

#### **COURSE OBJECTIVES**

1. To understand what is meant by traffic impact assessment.
2. To gain an overall view of the process involved in conducting a traffic impact study.
3. To identify traffic problems, their causes and main strategies for relieving them.
4. To gain an insight of techniques that can be applied in measuring the intensity of traffic problems as a result of potential developments.

#### **COURSE DESCRIPTION**

Traffic impact studies are studies that project traffic, identify traffic problems and suggest ways for relieving these problems resulting from new or expansion of existing land use developments. The course identifies the stakeholders involved in Traffic impact studies. The process involved in conducting a traffic impact assessment is thoroughly presented and discussed. Generic traffic problems are identified and discussed. Ways and methods for measuring the intensity of such problems are presented.

Traffic data collection is the basis of most if not all traffic studies. Methods of traffic data collection are presented. The two concepts of highway capacity and level of service are discussed. The traffic stream characteristics are defined. This includes defining traffic volume (flow), speed, and density. The fundamental traffic stream relationships are explored. These include: speed versus flow relationship, speed versus density relationship, and flow versus density relationship. Methods for computing base year levels of service for all the main links and intersections surrounding the development area are shown.

The projection of traffic into the future of the development is composed of natural growth pattern in addition to generated traffic as a result of development. The course shows how to project such traffic and how to select and apply trip generation rates in accordance with type and intensity of the new land use

As land use is developed, more trips are generated, traffic volumes increase, and several traffic-related problems occur. Problems include congestion, degradation of level of service for surrounding road network, parking and pedestrian problems, as well as safety and environment related problems. There is an increasing



need to manage, control and relieve these problems. It is the responsibility of developers to mitigate such problems caused by their developments. The course moves to presenting and discussing the main traffic relieve strategies and their consequent policies and measures. These are classified into supply and demand related strategies. These also include measures related to road, vehicle and driver.

### **COURSE OUTLINE**

Traffic Impact Assessment (Introduction and Definitions)  
Process for conducting Traffic Impact Assessment  
Methods for traffic data collection and presentation  
Traffic stream characteristics  
Capacity and level of service  
Trip generation rates  
Traffic projections  
Traffic problems  
Causes of traffic problems  
    Demand and supply related causes  
    Root and direct causes  
Policies and measures related to network expansion strategy  
Policies and measures related to Traffic management and control strategy  
Policies and measures related to Travel Demand Management Strategy  
Policies and measures related to Land Use management strategy

### **III.5. ENVIRONMENTAL IMPACT ASSESSMENT OF TRANSPORT PROJECTS**

#### **COURSE OBJECTIVES**

1. To understand what is meant by environmental impact assessment.
2. To gain an overall view of the process involved in conducting an environmental impact assessment.
3. To identify the main environmental impacts resulting from the transport and traffic systems.
4. To gain an insight of techniques that can be applied in measuring the intensity of environmental problems resulting from the construction, operation and maintenance of transport projects.

#### **COURSE DESCRIPTION**

It is vital for the economic development and sustainability of societies to guarantee the efficient, effective and safe movement of people and goods through space and time dimensions. This entails the construction of transportation infrastructure, the manufacturing of automobiles and the management, operation and control of traffic movements. However, it is widely acknowledged that transport systems have harmful impacts on the local, regional, national and global environments. Impacts range from local air and noise pollution to harming the global life-support systems, consumption of non-renewable resources, endangering living conditions, deteriorating human health and causing safety problems. This entails the planning, evaluation and construction of transportation infrastructure taking into consideration all expected environmental issues. It also entails the manufacturing of transport mobile units and the management, operation and control of traffic in an environmentally friendly way.

In the context of sustainable development, this course addresses the transport issue of how to make social and economic progress possible with the least damage to the human, natural and built environments. The course presents a conceptualization of the process known as Environmental Impact Assessment (EIA). Within this process, the course identifies and classifies the environmental systems expected to be affected as a result of transport projects. These are classified into physical, natural, man made and social

environmental systems. The course identifies and discusses the potential environmental impacts resulting out of the transport system. Ways and means that can be used for measuring these impacts are presented. Finally, the course concludes by identifying and classifying the strategies, policies and remedial measures that can be applied to mitigate the deleterious environmental effects of transport projects.

### **COURSE OUTLINE**

Importance of transport in achieving sustainable socio-economic development

Environmental impacts associated with the transport system

- Air pollution

- Water pollution

- Noise pollution

- Visual impacts

- Traffic accidents

- Other effects

Methods to measure these impacts

- Quantitative measurements

- Qualitative measurements

- Models

Environmental Impact Assessment (EIA)

- Framework

- Techniques

Policies and measures to mitigate the environmental effects of the transport system

Case Studies

## **MODULE IV: OTHER COURSES**

### **IV.1. PRIVATIZATION OF ROAD INFRASTRUCTURE USING BOT SYSTEM**

#### **COURSE DESCRIPTION**

This course starts by discussing the various sources available for financing transport infrastructure. These include traditional and non-traditional sources. The course emphasizes the options available for the provision of infrastructure by the private sector. The most widely followed forms of private finance of infrastructure utilities, namely Build-Operate-Transfer (BOT) concessions are discussed. Main stakeholders, their objectives, benefits and interactions in a BOT road project are identified and discussed.

A conceptualization of the main generic phases and stages throughout the life cycle of a BOT road project is presented. The core of the course lies in presenting a detailed generic systematic approach to assist in conducting a comprehensive and structured financial feasibility assessment of private investment in road projects. The structure of the developed system approach constitutes eight generic stages, namely defining the objectives of the project, traffic analysis, conducting environmental impact assessments, estimation of potential costs, forecasting of project revenues, estimation of key financial criteria and comparing these with project financial objectives so as to determine project viability. Finally, the eighth stage is concerned with minimizing uncertainties and risk through a three level procedure of conducting scenario analysis, followed by sensitivity tests and then risk analysis.

The importance to forecast and analyze the development of traffic flows over the life of a BOT road project is noted. This forecast should particularly run over the time period considered for evaluating the proposed BOT scheme using disaggregate traffic demand forecasting models. Parameters critical to the financial success of a BOT road project are identified and discussed. These include: length of the concession period, toll categories and rates, traffic growth rates, discount rate, etc.

#### **COURSE OUTLINE**

Primary sources available for financing transport investments in transport infrastructure.  
Options available for the provision of infrastructure by the private sector.  
Stakeholders, objectives, benefits and interactions in a BOT road project  
Conceptualization of generic phases and stages throughout the life cycle of a BOT road project  
Generic approach for conducting financial feasibility assessment of private investment in road projects.  
Parameters critical to the financial success of a BOT road project.

### **IV.2. TOTAL QUALITY MANAGEMENT IN PUBLIC TRANSPORTATION**

#### **COURSE DESCRIPTION**

The course starts by defining what is meant by Total Quality Management (TQM), and explores the main principles of TQM. A historical perspective of TQM is presented. This includes the experiences of applying TQM in Japan, USA and Europe. A review of the application of TQM in the private and the public sector is discussed. Lessons of success and failure of applying TQM are noted. The course details the three phases for applying TQM namely: the foundation phase, the momentum phase and the commitment phase. The course emphasises the importance of leadership as the main TQM driver.

The course explores the TQM principles that ought to be adopted by the public transport industry. The efforts of some selected American and European transit agencies in launching TQM initiatives are described including a chronology and assessment of their progress.

## **COURSE OUTLINE**

Definition of TQM  
TQM principles  
Historical perspective on TQM  
    TQM in Japan  
    TQM in USA  
    TQM in Europe  
TQM in public sector  
TQM in private sector  
Lessons of success and failure of applying TQM  
Phases for applying TQM  
TQM in public transport industry

## **V.III. PERFORMANCE MEASURES FOR ASSESSING ACHIEVEMENTS OF TRANSPORT ORGANISATIONS**

### **COURSE DESCRIPTION**

A transport organisation should be capable of quantifying the effects that might occur as a result of changes in its strategic objectives, policies, decisions or lines of action. It is imperative that managers spend time in thinking of the most effective ways to present the output of their organisations. One of the most powerful means of presenting the information output of an organisation is in the form of a set of performance measures. These are meant to describe the financial, operational and level of service development of the organisation at any point in its lifetime. Many decisions concerning a transport organisation can be made on the basis of these performance measures/indicators.

The course emphasises the importance of performance measures mainly in monitoring, evaluation and modification. It shows how these measures are computed. It presents and compares the different types of performance indicators. Three areas should be covered to represent the performance of a transport organisation, these are the financial, operational and level of service performance. Four main types of performance measures will be discussed in the course. These are productivity/utilisation, absorption/consumption, efficiency, and effectiveness.

The achievements of a transport organisation need to be evaluated. This can be carried out by comparing the actual performance of the organisation by a selected acceptable performance i.e. cut off values used to distinguish between good and poor performance of each indicator. There exist several ways to determine values for the selected acceptable performance measures which act as the base for evaluation by comparison. These will be discussed in the course.

### **COURSE OUTLINE**

Importance of performance measures  
Areas of performance  
    Financial  
    Operational  
    Level of service  
Types of performance measures  
Computation of performance measures  
Evaluation of performance measures  
Methods to determine cut-off values for performance

## **V.4. INFORMATION SYSTEMS FOR TRANSPORT MANAGEMENT**

### **COURSE DESCRIPTION**

Organisations are always liable to many changing factors. The role of the management is to control these changes in a way that could help to develop the performance of the organisation. To implement this there must be an effective system for providing information about the organisation and the changes that are occurring. This is meant to guide the organisation towards achieving its desired results.

The course starts by setting out the difference between data and information. It then goes on to establish why it is crucial in the field of transport to have an information system. The course attempts to answer four related questions. These are what types of information do we need, what are the methods that can be utilised in obtaining this information, what to do with this information, and finally how can we manipulate data and information. This part concludes with a discussion related to the media for storing information and the types of error in data/information.

The course explores the different structures of information systems that could be formed and how that one of the main factors for achieving success to any organisation is the existence of a management information system that can present quick and accurate reports regarding changes and performance of an organisation.

The process of management of a transport organisation is explored. This is a dynamic process whereby environment is thoroughly studied, targets are clearly set and defined, policies are well chosen, decisions are correctly implemented, performance is monitored and evaluated and necessary modifications are carried out. The position and role of the information system in this process is discussed.

### **COURSE OUTLINE**

Difference between data and information  
Why do we need information in transport?  
What types of information do we need?  
How can we get information?  
What to do with information?  
How can we manipulate data and information?  
Media for storing information  
Types of error in data/information  
The management process

## **V.5. MANAGEMENT TRAINING IN TRANSPORT ORGANISATIONS**

### **COURSE DESCRIPTION**

In many countries of the world, powerful political and economic forces are affecting the size and the structure of the transport sector, as well as the objectives and structure of the transport organisations. Management of transport organisations is becoming an increasingly complex and sophisticated task. Innovative operational and management practices are needed to steer the organisations safely towards reaching more stable grounds and conditions. There is a need for managers with high levels of expertise and communication skills.

The development of human resources is an essential ingredient for success. There is always a need for continuous professional development, both for the individual and the organisation, to cope and be up-dated with the rapidly and constantly changing ideas, methods, techniques that govern the work environment. This is meant to achieve the organisational objectives with optimum use of resources.

This course explores the different components of the training process within a transport organisation. These include: knowledge of organisational goals, setting of training objectives, assessment of training needs, design of training, delivery of training, measuring training outputs, and evaluation of training.

### **COURSE OUTLINE**

Why do transport organisations train? i.e. what are their objectives of training?

Where do transport organisations train? i.e. what are the factors that govern their choice of training establishments?

Whom do transport organisations train? i.e. what are the criteria used for selecting nominees for training?

What do transport organisations want their trainees to learn? i.e. what are the course topics that are perceived as most relevant in the current period the organisation is going through?

When do transport organisations want training activities to take place? i.e. what are the appropriate times for training?

How do transport organisations want training to be carried out? i.e. details regarding number of trainees in a group, contents of courses, background of trainers, language and method of training, ..etc.