CE740 Traffic Engineering (2018)

Tom V. Mathew
Department of Civil Engineering, IIT Bombay.

Module I. Traffic stream characteristics

L 1 ***Fundamental parameters of traffic flow***: speed, density, volume, travel time, headway, spacing, time-space diagram

L 2 ***Fundamental relations of traffic flow***: time mean speed, space mean speed and their relation, relation between speeds, flow, density, fundamental diagrams.

L 3 ***Traffic stream models***: Greenshield's model, Greenberg's logarithmic model, Underwood's exponential model, pipe's generalized model, multi-regime models.

Module II. Traffic measurement procedures

L 4 ***Measurement at a point:*** Traffic volume measurement, equipment for flow measurements, data analysis, concepts of ADT, AADT.

L 5 ***Measurement over a short section***: Speed measurements, 15^{th} and 85^{th} percentile speeds, design speed, speed distributions.

L 6 ***Measurement along a length of road:*** Density measurement, travel time measurement.

L 7 ***Moving observer method***: Concepts and derivation, illustration, Calibration of Greenshield's model.

L 8 ***Automated traffic measurement:*** GPS devices, loop detectors, video analysis, and other technologies.

Module III. Microscopictraffic flow modeling

L 9 ***Vehicle arrival models:*** Headway modeling, exponential, normal and Person distributions, Vehicle generation using exponential and Poisson distribution, evaluation of distributions.

L 10 ***Car-following models:*** Concept of stimulus-response, general mottoes models, safety distance, pscho-physical, optimal velocity, fuzzy logic models, and application, relationship with stream models.

L 11 ***Lane changing models:*** Conceptual framework, lane selection model, gap acceptance mode

L 12 ***Microscopic traffic simulation***: Vehicle generation, design, calibration, validation, applications, operational models.

L 13 ***Discrete simulation models***: Cellular automata concepts, discretization of time and space, rules for acceleration, deceleration, randomization, and vehicle updating.

Module IV. Macroscopic traffic flow modeling

L 14 ***Traffic flow modeling analogies:*** Fluid flow analogy, heat flow analogy, granular flow, Lighthill-Withams theory, shock waves.

L 15 ***Cell transmission models***: Flow conservation, flow transmission.

L 16 ***Traffic progression models***: Robertson progression model, platoon movement, dispersion index, applications.

Module VI. Traffic intersection control

L 17 ***Principles of traffic control:*** Requirements, basic driving rules, priority movements, principles of traffic control, intersections conflicts.

L 18 ***Traffic signs and road markings:*** Regulatory, warning, and information signs; longitudinal, transverse, and object marking.

L 19 ***Uncontrolled intersection:*** Level of service concept, priority streams, conflicting traffic, critical gap and follow-up time, capacity, queue length, control delay.

L 20 ***Channelization:*** channelizing devices, geometrical aspects, turning radius.

L 21 ***Traffic rotary:*** Conflict resolution in a rotary, geometric layout, design elements, capacity of rotary.

L 22 ***Grade separated intersection:*** Road over bridges, under pass, overpass, trumpet interchange, diamond interchange, fully and partial clover leaf intersection.

Module VI. Traffic signal design

L 23 ***Elements of traffic signal:*** Definitions, analysis of saturation headway, saturation flow, lost time, critical flows, derivation of cycle length.

L 24 ***Design principles of a traffic signal***: Phase design, cycle time determination, green splitting, pedestrian phases, and performance measures.

L 25 ***Evaluation of a traffic signal:*** Definitions and measurement of stopped and control delay, Webster's delay model, oversaturated conditions.

L 26 ***Capacity and Level of service LOS:*** Definitions, highway capacity, factors affecting LOS, HCM methods.

L 27 ***Capacity and Los analysis of a signalized I/S:*** HCM 2000 method of analysis of a signalized intersection and determination of the level of service.

L 28 ***Coordinated traffic signal:*** Concepts of offset, common cycle length bandwidth, offset for one-way and two way streets.

L 29 ***Vehicle actuated signals and Area traffic control***: Basic principles of vehicle actuation, collection of data, system architecture and algorithms.

Module VIII. Traffic impact studies

L 30 ***Parking Studies:*** Parking inventory, statistics, parking surveys; in-out, license palate, on-street and off-street parking.

L 31 ***Congestion studies***: Performance measures, intensity, duration, extent of congestion, traveler perception, remedial measures, congestion pricing.

L 32 ***Toll operation:*** Design and configuration, queuing characteristics, operation and maintenance issues.

Reference:

1. L R Kadiyali. Traffic Engineering and Transportation Planning. Khanna Pub., New Delhi, 1987.
2. S K Khanna and C E G Justo. Highway Engineering. Nemchand Bros., Roorkee, 1991.
3. A D May. Fundamentals of Traffic Flow. Prentice - Hall, Inc. 1990.
4. W R McShane, R P Roesss, and E S Prassas. Traffic Engineering. Prentice-Hall, Inc, 1998.
5. C S Papacostas. Fundamentals of Transportation Engineering. Prentice-Hall, New Delhi, 1987.
6. D R Drew. Traffic flow theory and control. McGraw-Hill Book Company, New York, 1968.
7. M Whol and B V Martin. Traffic system analysis for engineers and planners. McGraw Hill, 1983.
8. R J Salter, Highway Traffic Analysis and Design, Macmillan, 1985.
9. Highway Capacity Manual, Transportation Research Board. Washington, D.C., 2000.