# CE740 Traffic Engineering (2017)

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

***L 0*** ***Introduction to Transportation System Engineering***:

## 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.

***L 4*** ***Moving observer method***: Concepts and derivation, illustration, Calibration of Greenshild's model.

## Module II. Traffic measurement procedures

***L 5*** ***Measurement at a point:*** Traffic volume measurement, equipment for flow measurements, data analysis, concepts of ADT, AADT.

***L 6*** ***Measurement over a short section***: Speed measurements, $15^{th}$ and $85^{th}$ percentile speeds, design speed, speed distributions.

***L 7*** ***Measurement along a length of road:*** Density measurement, travel time measurement.

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

## Module III. Microscopic traffic flow modeling

***L 9*** ***Car-following models:*** Concept of stimulus-response, general mottoes models, safety distance, pscho-physical, optimal velocity, fuzzy logic models, and applications

***L 10*** ***Lane changing models:*** Conceptual framework, lane selection model, gap acceptance models.

***L 11*** ***Vehicle arrival models:*** Poisson distribution, headway modeling, random vehicle generation.

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

## Module IV. Macroscopic and meso-scopic traffic flow modeling

***L 13*** ***Traffic flow modeling analogies:*** Fluid flow analogy, heat flow analogy, granular flow, Lighthill-Withams theory, shock waves.

***L 14*** ***Cell transmission models***: Flow conservation, flow transmission.

***L 15*** ***Traffic progression models***: Robertson progression model, platoon movement, dispersion index, applications.

***L 16*** ***Discrete simulation models***: Cellular automata concepts, discretization of time and space, rules for acceleration, deceleration, randomization, and vehicle updating.

## 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. **[S]**

***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. **[S]**

***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. **[S]**

## 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. **[S]**

## Module VIII. Traffic impact studies

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

***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 L Manheim. Fundamentals of transportation systems analysis Vol.1. MIT Press, 1978.
8. M Whol and B V Martin. Traffic system analysis for engineers and planners. McGraw Hill, 1983.
9. R J Salter, Highway Traffic Analysis and Design, Macmillan, 1985.
10. Highway Capacity Manual, Transportation Research Board. Washington, D.C., 2000.


**[S] => Self study**