CE434 Traffic Analysis and Design
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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 Greenshield’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, 15th and 85th 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.

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. Advanced
L 11 Vehicle arrival models: Poisson distribution, headway modeling, random vehicle generation. Advanced
L 12 Microscopic traffic simulation: Vehicle generation, design, calibration, validation, applications, operational models.

Module IV. Macroscopic and mesoscopic traffic flow modeling

L 14 Cell transmission models: Flow conservation, flow transmission. Advanced
L 15 Traffic progression models: Robertson progression model, platoon movement, dispersion index, applications. Advanced
L 16 Discrete simulation models: Cellular automata concepts, discretization of time and space, rules for acceleration, deceleration, randomization, and vehicle updation. Advanced

Module V. Uninterrupted flow

L 17 Capacity and Level of service LOS: Definitions, highway capacity, factors affecting LOS, HCM methods.
L 18 Urban Street: Classification, operational performance measures, congestion management. Advanced
L 19 Multilane highways: Characteristics, capacity and level of service. Advanced
L 20 Freeway operations: Operational considerations, capacity and level of service of a basic freeway segment, weaving operation. Advanced
L 21 **Ramp metering:** Merging and diverging areas; speed at ramps; fixed, reactive, and predictive systems. Advanced

L 22 **Corridor analysis:** Segment capacity, free flow travel time, queue delay, transit corridor. Advanced

**Module VI. Traffic intersection control**

L 23 **Principles of traffic control:** Requirements, basic driving rules, priority movements, principles of traffic control, intersections conflicts.

L 24 **Traffic signs and road markings:** Regulatory, warning, and information signs; longitudinal, transverse, and object marking.

L 25 **Uncontrolled intersection:** Level of service concept, priority streams, conflicting traffic, critical gap and follow-up time, capacity, queue length, control delay.

L 26 **Channelization:** channelizing devices, geometrical aspects, turning radius.

L 27 **Traffic rotary:** Conflict resolution in a rotary, geometric layout, design elements, capacity of rotary.

L 28 **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 29 **Elements of traffic signal:** Definitions, analysis of saturation headway, saturation flow, lost time, critical flows, derivation of cycle length.

L 30 **Design principles of a traffic signal:** Phase design, cycle time determination, green splitting, pedestrian phases, and performance measures.

L 31 **Evaluation of a traffic signal:** Definitions and measurement of stopped and control delay, Webster’s delay model, oversaturated conditions.

L 32 **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 33 **Coordinated traffic signal:** Concepts of offset, common cycle length bandwidth, offset for one-way and two way streets. Advanced

L 34 **Vehicle actuated signals and Area traffic control:** Basic principles of vehicle actuation, collection of data, system architecture and algorithms. Advanced

**Module VIII. Traffic impact studies**

L 35 **Parking Studies:** Parking inventory, statistics, parking surveys; in-out, license palate, on-street and off-street parking.

L 36 **Accident Studies:** Accident data collection, statistics, safety audit, safety measures. Advanced-self-study

L 37 **Fuel consumption and emission studies:** Consumption models, pollutants, air quality models, mitigation measures. Advanced-self-study

L 38 **Congestion studies:** Performance measures, intensity, duration, extent of congestion, traveler perception, remedial measures, congestion pricing. Advanced-self-study

L 39 **Toll operation:** Design and configuration, queuing characteristics, operation and maintenance issues. Advanced

L 40 **Pedestrian studies:** Pedestrian counts, pedestrian volume and level of service, design principles of pedestrian facilities. Advanced-self-study

**Reference:**

5. Highway Capacity Manual (2000), Transportation Research Board, USA