CE740 Traffic Engineering

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L 0 Introduction to Transportation System Engineering:

ModuleI. 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.

Module III. Microscopictraffic 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 mesoscopic 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***: Robertsonprogression 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 updation.

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.
- ***L 19*** ***Multilane highways:*** Characteristics, capacity and level of service.
- ***L 20*** ***Freeway operations:***Operational considerations, capacity and level of service of a basic freeway segment, weaving operation.

L 21 ***Ramp metering:***Merging and diverging areas; speed at ramps; fixed, reactive, and predictive systems.

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

ModuleVI.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, confliting 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 performancemeasures.

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.

L 34 ***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 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.

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

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

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

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

Reference:

1. Roess, R. P. McShane, W. R. &Prassas, E. S. (1998), Traffic Engineering, Prentice – Hall.
2. May, A. D. (1990), Fundamentals of Traffic Flow, second edn, Prentice Hall.
3. Papacostas, C. S. (1987), Fundamentals of Transportation Engineering, Prentice-Hall, India
4. Kadiyali, L. R. (1987), Traffic Engineering and Transportation Planning, Khanna, India.
5. Highway Capacity Manual (2000), Transportation Research Board, USA
6. Khanna, S. K. & Justo, C. E. G. (1991), Highway Engineering, Nemchand Bros.,Roorkee.
7. Pingnataro, G. J. (1970), Principles of Traffic Engineering, McGraw-Hill.