

CE312 HIGHWAY AND TRAFFIC ENGINEERING

Co-ordinator: Professor M G H Bell (Room 608), m.g.h.bell@imperial.ac.uk

Status: Environmental Elective

Lecturers: Professor M G H Bell
Professor Richard Jardine (RJJ) (Room 534)
Dr Washington Ochieng (WYO) (Room 614)

Structure: 30 lecture hours, 8 tutorial hours and 12 project hours.

Links: Introduction to CE409

Aims

The Highway and Traffic Engineering option is designed to follow the whole process of planning, locating, designing, constructing and controlling highways. The first part of the course deals with the properties of traffic. The second part deals with process of designing and constructing a road. The third part deals with the monitoring and control of traffic once the road is built.

Subjects covered include the functions of different road types; ground models and their use in highway design; principles of route location; geometric link design; optimisation of horizontal and vertical alignments; calculation of earthworks quantities; design of pedestrian areas, cycleways and busways; principles of junction design; design of at-grade intersections, roundabouts and grade-separated intersections; design and construction of earth structures; pavement foundations; road materials; design of flexible and rigid pavements; maintenance of pavements; traffic variables and the Fundamental Diagram; shock waves; queuing processes; steady state and time-dependent delay formulae; methods of data collection; estimation of saturation flows; cycle time and green split calculation; cyclic flow profiles, TRANSYT and offset calculation; on-line signal control; pedestrians, cycles, buses and trams in signal control; motorway monitoring and control; theory of microscopic traffic simulation; use of VISSIM for design evaluation.

SYLLABUS

Introduction

Introduction to the highway planning process

Traffic Engineering

Traffic flow, speed and density – the Fundamental Diagram
Traffic flow theory and shock waves
Traffic flow data collection and analysis
Methods of speed measurement, moving observer surveys
Origin-destination surveys using registration numbers
Traffic flow forecasts
Accuracy of traffic data
Off-line calculation of traffic signal timings
On-line traffic signal control
Queuing processes
Delay formulae

Highway Design

Determination of need for a highway
Ground models and their use in highway design
Principles of route location
Geometric link design
Optimisation of horizontal and vertical alignments
Calculation of earthworks quantities
Design of pedestrian areas, cycleways and busways

Junction Design

Principles of junction design
Signal control at isolated intersections
Design of at-grade intersections
Design of roundabouts
Design of grade separated intersections

Geotechnical Aspects

Site investigation for highways
Design and construction of earth structures
Pavement foundations

Highway Engineering

Road materials
Design of flexible pavements
Design of rigid pavements
Maintenance of pavements

Tutorials

Analysis of traffic data
Traffic signal calculations
Use of VISSIM microscopic traffic simulation

Seminars

Signal control in London – Ioannis Ioannidis, TfL
SCOOT developments – David Bretherton, TRL
Long-life assets – Professor Anthony Swain, UCL
UTMC programme – Dr Ben Thancanamootoo, Mouchel

Coursework and submission dates

An essay on traffic engineering, week 11 (50% of coursework mark)
Geometric design calculations, week 21 (50% of coursework mark)

Assessment

One three hour written examination and two items of coursework.

Recommended Textbooks/Reading

Lecture notes supplied for each topic.

Department of Transport Design Manual for Roads and Bridges, obtained from www.officialdocuments.co.uk/document/ha/dmrb/index.htm

O'FLAHERTY, C A (ed) *Transport Planning and Traffic Engineering*. Arnold.

SLINN, M et al. *Traffic Engineering Design Principles and Practice*. Arnold.

Ransport and the Urban Environment. Institution of Highways and Transportation.

SALTER, R J and HOUNSELL, N B *Highway traffic analysis and design*. 4th Edition. Palgrave.

Learning Outcomes

- Understand the use of different road types in the highway network.
- Design a highway allowing for differing terrains, horizontal and vertical curves.
- Design suitable at-grade and grade-separated junctions.

- Understand the geotechnical aspects of road design.
- Understand the use of traffic signals.
- Calculation of traffic signal times.
- Understand the use of traffic simulation.
- Synthesis of disciplines.