6XS02

OLLSCOIL na hÉIREANN , GAILLIMH
NATIONAL UNIVERSITY OF IRELAND, GALWAY
SECOND SEMESTER EXAMINATIONS, 2000

THIRD CIVIL ENGINEERING
THIRD ENVIRONMENTAL ENGINEERING

HIGHWAY AND TRAFFIC ENGINEERING 1
(CE 313)

Professor R. Falconer;
Professor P. E. O'Donoghue;
M. J. Brennan.

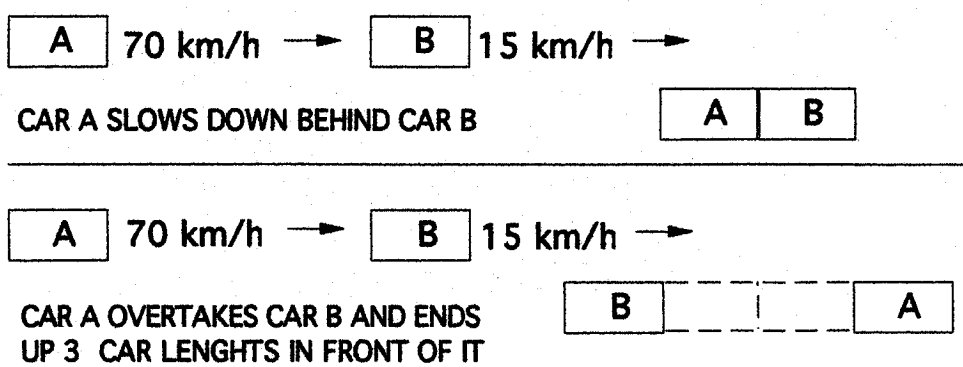
Time allowed: two hours.
Answer all questions.

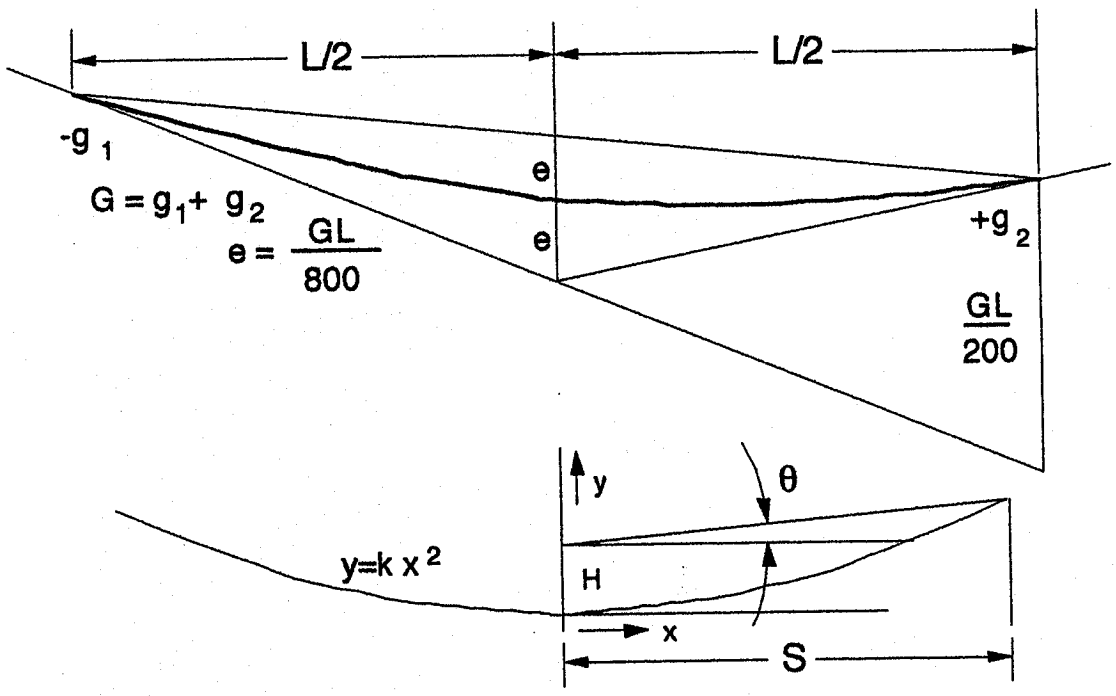
1

(a) (5%) Explain the assumptions that are used in calculating non-passing sight distance for two-lane two-way roads. Note the speeds of travel that are assumed, acceleration and deceleration assumptions for the three vehicles, and the critical condition for which the passing distance is calculated.

(b) (10%) A car travelling at 70 km/h catches up with a car travelling at 15 km/h. Ignoring reaction times and using a rate of deceleration of 3.5 m/s^2, how close can they get, i.e. front bumper to front bumper, before the fast vehicle must slow down to avoid a rear-end collision? The two cars are 5 m long. (See sketch below)

(c) (10%) How long will it take the fast vehicle to pass by the slow vehicle and end up three car lengths ahead of it if the fast vehicle overtakes by accelerating at 0.5 m/s^{2}when it reaches the critical stage at which it must either slow down or overtake? (See sketch below)





2.(15%)

A sag curve is required at the intersection of two intersecting gradients of –2.5% and +3.5%. The required sight distance is 80 m. The height of the headlamps of the vehicle above the road, H, is 0.6 m and the headlamp beam slopes upwards at an angle, θ, of 1° from the plane of the vehicle.

Using the diagrams that are provided above, establish where the required length of curve, L, is greater or less than the required sight distance.

3. The layout, approach widths and the phasing diagram for a two-phase traffic signal controlled junction is shown on page 3. There are separate right-turning lanes on the Crescent and Salthill approaches. There is a special provision for right turning vehicles in the first phase. The vehicular flows are tabulated below:

APPROACH	FLOW(veh/h)
Crescent	180
Crescent (right turning)	125
Taylor's Hill	315
St. Mary's Rd.	745
Salthill	360
Salthill (right turning)	240

The inter-green times are 5 s after phase 1 and 4 s after phase 2. The amber times are 3 s and the combined starting and stopping lost times are 2 s may for each phase but there is no lost time during the changeover in the middle of phase 1. The saturation flow, s, is given by s (veh/h) = 480 x approach width(m)

(a) (10%) Examine the phasing diagram and note whether there is a late release or early cut-off in phase 1.

Using the standard formulae that are provided:

(b) (10%) determine the optimum cycle time, c_o, that will minimise the total delay, to the nearest second;

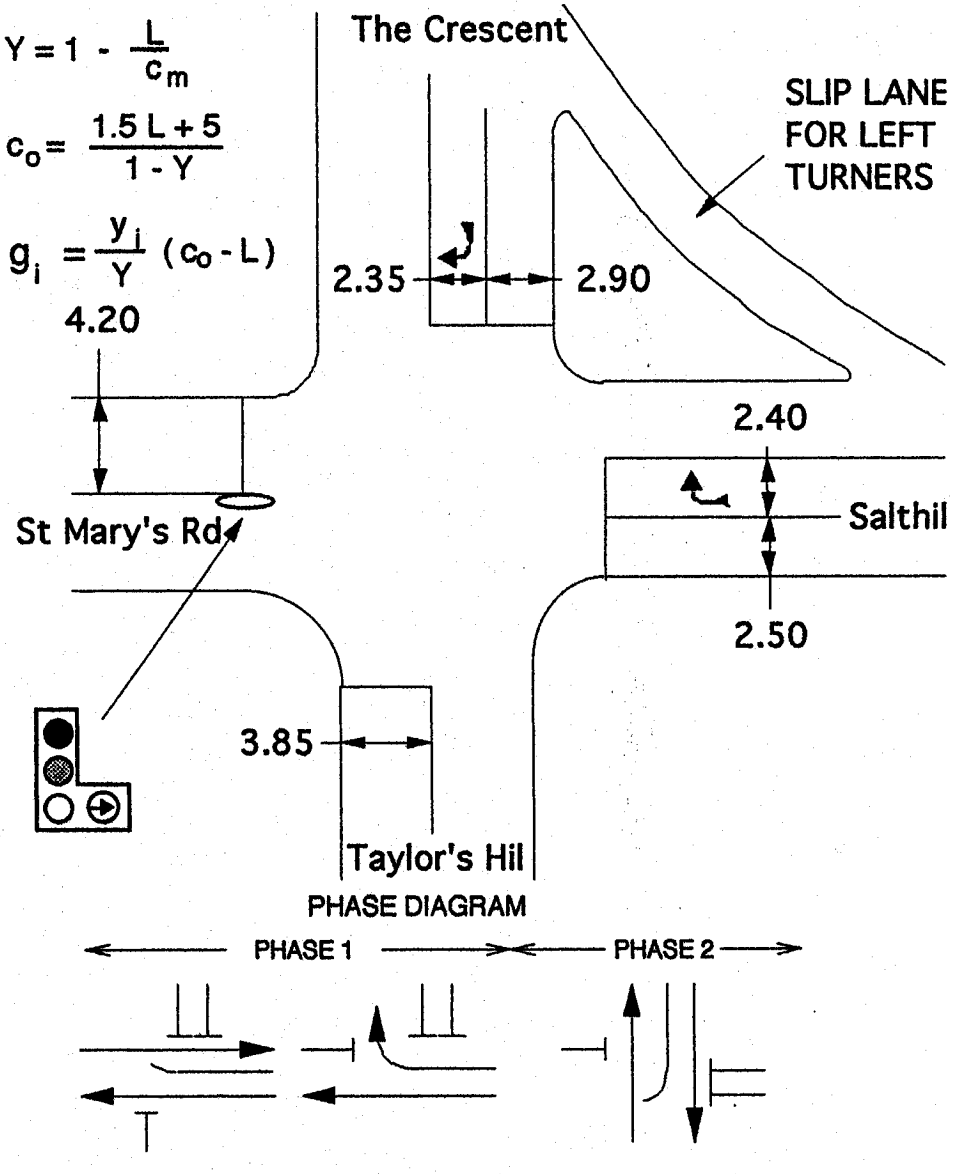
(c) (10%) determine the optimum effective green times, g_i, for each traffic movement, to the nearest half-second;

(d) (10%) counting from the start of the green time in phase 1, compute to the nearest half second when the green signal for vehicles coming from St. Mary's Rd. ends and the green arrow signal for right-turners from Salthill commences and ends.

$$Y = 1 - \frac{L}{c_m}$$

$$c_o = \frac{1.5\,L + 5}{1 - Y}$$

$$g_i = \frac{y_i}{Y}\,(c_o - L)$$



4.

(a) (10%) Write a short description of the following three pavement defects and note how they can arise on a pavement comprising a surface dressing on a granular roadbase: bleeding, ravelling and potholes.

(b) (10%) PAVER deduct value curves are provided below. For a pavement sample unit that is 6 m wide and 50 m long, compute the pavement condition index for the following list of defects.

DEFECT	Number /Area/ Length
Rutting (low severity)	10 m^2
Bleeding (low severity)	15 m^2
Bleeding (medium severity)	24 m^2
Patching (low severity)	6 m^2
Patching (medium severity)	6 m^2
Ravelling (medium severity)	3 m^2