Advanced Traffic Engineering
Optional Course ECIV 5332

Question 01

In traffic signals coordination, traffic signals on the same major highway are linked together using a master timing device or controller. This is used instead of individual timing devices at each intersection. ***Describe graphically the concept of signal coordination.***

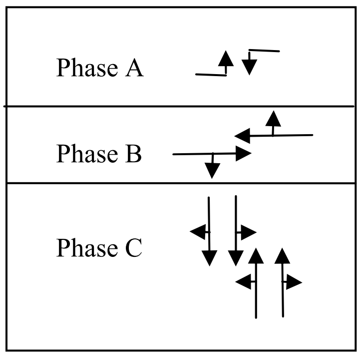
A non-nearside lane of a traffic signal approach has a width at entry of 3.0 m and a downhill gradient of 3 percent; 40 percent of vehicles turn left with a turning radius of 25 m. The cycle time is 60 s and the effective green time is 40 s. Two left-turning vehicles may wait within the intersection without obstruction to following straight a head vehicles and the ratio of pcu/vehicles is 1.5. ***Assuming non-opposing lane, calculate the saturation flow for this lane.***

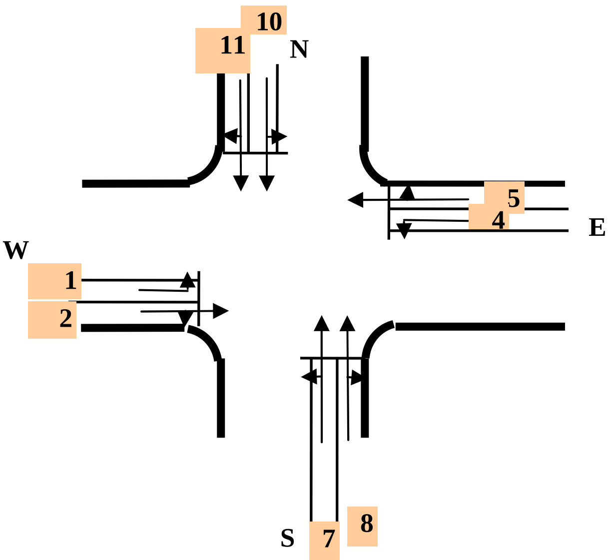
Question 02

The Figure below shows a sketch of the layout and a proposed 3-phase system at a signalized intersection. The approaching flow and the calculated saturated flow for each lane are as follows:

Lane number	1	2	4	5	7	8	10	11
Flow (PCU/hr)	250	400	400	380	150	200	160	300
Saturation flow (PCU/hr)	1200	1600	1300	1700	800	1500	800	1650

3-phase system





The actual periods of green time for phases A, B, and C were calculated to be 26, 33, 21 seconds respectively assuming the inter-green period to be 5 seconds. It is required to design this intersection as a roundabout with no flare. Assume that for all approaches, inscribed circle diameter is 25m, approach width is 7.3m, entry radius is 12m and the entry angle is 15 degrees. If the turning proportion in each shared lane is 15% ***decide which design, signal or roundabout, is better based on the total intersection capacity***. *Make any necessary reasonable assumptions.*

Question 03

Study the following statements & indicate if they are (True or False) & Comment.

1- As cycle length increases delay increases.
2- As proportion of turning vehicles in a lane increases as saturation flow rate decreases.
3- As intergreen time increases as capacity of signalized intersection increases.
4- As circulating flow increases the entry capacity of a roundabout increases.
5- Pavement markings always replaces traffic signs.

<u>Question 04</u>

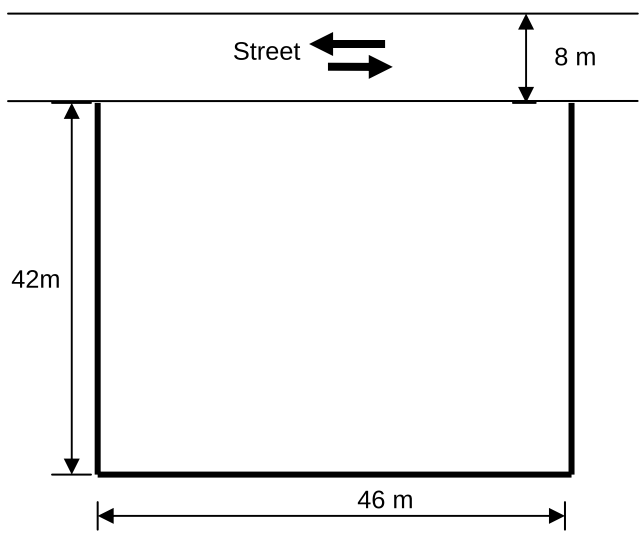
A traffic sign is defined as a device mounted on a fixed or portable support whereby a specific message is conveyed to road users.

- What are the three main functions of traffic signs?
- Give 2 examples of traffic signs of special shapes using a sketch, and explain the message conveyed by each sign.
- Describe graphically the pavement marking for each of the following:
  1. Two-lane-two-way marking with passing permitted in one direction.
  2. Lane division when travelling in the same direction
  3. Stop ahead (words).

<u>Question 05</u>

For the area described in the Figure below, ***design an off-street park*** that gives the maximum number of parking spaces, considering the following assumptions:

- All aisles (streets) inside the parking area are assumed to be **one way aisle** with a width of 7m.
- The space dimensions needed for parked vehicle are **2.5 x 5.5m**.
- All the areas which can't be used for parking are planted to add an aesthetic view, and used to drain the storm water into it.
- Consider only perpendicular **90°** parking angle.
- **One** entrance and **one** exit are used.
- The entrance is **7m**, which is the same width of the aisle.



Useful Formula

$$S_g = \frac{S_0 - 230}{1 + (T-1)f}$$

$$T = 1 + 1.5/r + t_1/t_2$$

$$t_1 = \frac{12(X_0)^2}{1 + 0.6(1-f)N_s}$$

$$t_2 = 1 - (fX_0)^2$$

$$S_c = \frac{P(1+N_s)\,(fX_0)^{0.2}\,3600}{\lambda\, c}$$

$$X_0 = \frac{q_0}{\lambda\, n_l\, s_0}$$

$$S_1 = \frac{(S_0 - 140\, d_n)}{(1 + 1.5\,\frac{f}{r})} \quad \cdots pcu/h$$

where:

$$S_0 = 2080 - 42\, d_g \times G + 100\,(w - 3.25)$$

$$C_0 = \frac{1.5L + 5}{1 - Y}$$

$$f_{HV} = 1 / [\, 1 + P_i\,(E_i - 1)]$$

$$Q_e = K\,(F - f_c * Q_c) \quad \cdots \text{when} \quad f_c\, Q_c \le F$$

$$Q_e = 0 \quad \cdots \text{when} \quad f_c\, Q_c > F$$

K = $1 - 0.00347(\phi - 30) - 0.978[(1/r) - 0.05]$

F = $303\ X_2$,

$\mathbf{f_c} = 0.210\ t_D\,(1 + 0.2\ X_2)$

where:

$X_2 = v + (e-v) / (1+2S)$

$S = 1.60\ (e-v)/l'$

$t_D = 1 + 0.5/(1+M)$

$M = \exp[(D-60)/10]$

$$\mathbf{n} = \frac{\mathbf{v\,t}}{\mathbf{u}}$$