University of South Australia
School of Natural and Built Environments

STUDY PERIOD 2 EXAMINATIONS, JUNE 2005

TRAFFIC SYSTEMS ENGINEERING

GENERAL INSTRUCTIONS TO CANDIDATES: **Reading Time: 10 min**
Exam Duration: 2 hours

1. Attempt all **FIVE** questions
2. Marks for each question are shown in brackets
3. Calculators are permitted
4. This is an **OPEN BOOK** examination

QUESTION 1

(1) During a 45-second period of observation that started at time t=0, vehicle arrival times were entered into the table below. Calculate the average headway for these vehicles. Determine the mean headway between vehicles over the 45-second period.

Vehicle number	1	2	3	4	5	6	7
Time of arrival (s)	7.53	8.04	17.68	27.43	32.93	36.73	42.98

[5 marks]

(2) Vehicle counts were made on one direction of a two-lane roadway three times on a Wednesday. The person who made the counts produced the data in the table below for your analysis. Calculate the flow rate for each of the three time periods.

Period	**Start time**	**End time**	**Number of vehicles**
A	07:00:00	7:45:00	511
B	14:16:45	14:46:45	249
C	17:06:45	17:33:30	481

[5 marks]

(3) Vehicles from a minor stream at a stop sign need an 8 seconds gap in the major stream to cross the road. Given a major stream traffic volume of 480veh/h, estimate the percentage of gaps exceeding 8 seconds. If the minor stream vehicles have a follow-up time of 2 seconds, determine the maximum number of minor stream vehicles that could cross the major stream during one hour.

[10 marks]

QUESTION 2

(1) The signals at intersections A, B and C of a one-way street have been grouped to form a coordinated signal system. The signal timing details are listed in the table below:

Intersection	Green	Yellow	Red	Offset	Distance from A
A	40s	5s	35s	0s	-
B	50s	5s	25s	40s	600m
C	35s	5s	40s	10s	1500m

Given a design speed of 50km/h, determine the signal cycle times for intersections A, B and C to make the coordination possible. Draw the time offsets on a trajectory diagram (time and distance). Calculate the times of the first vehicle crossing intersections B and C if it crosses A at time t=0 second. Can the last vehicle crossing A at time t=45 second pass B and C without delay (note: the effective green time includes yellow period)?

[10 marks]

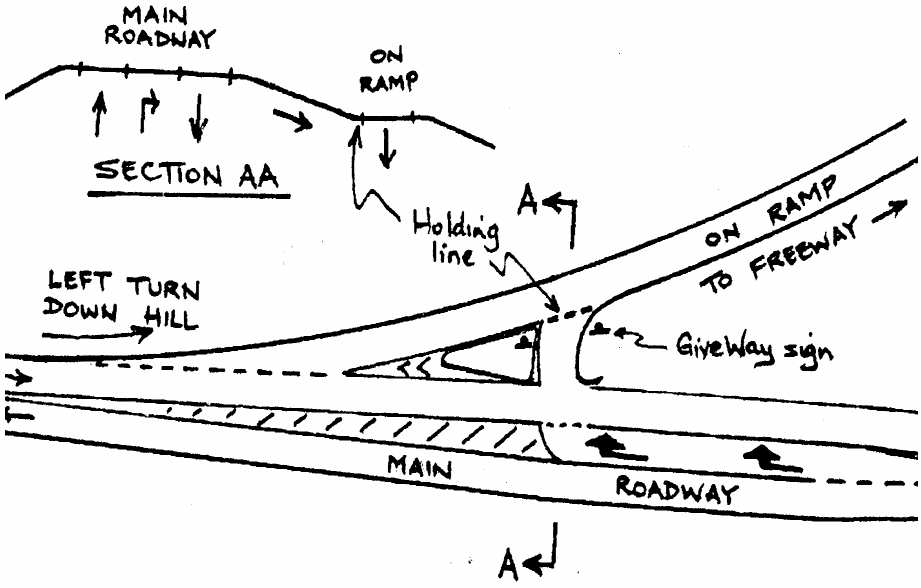
(2) On one approach of a signalised intersection with fixed cycle time, the vehicle arrival rate is 600 vehicles per hour, the effective green time is 30 seconds, the cycle time is 80 seconds and the saturation flow is 1700 vehicles per hour. Does any vehicle experience delay under the above traffic flow and signal condition? Due to a traffic incident, the saturation flow is reduced by 15 percent of the original value. Is there any delay under the new situation?

[10 marks]

QUESTION 3

(1) For a section of rural highway, vehicle speed on the main road is 60km/h. The main road also provide the opportunity for vehicles to access to a freeway through a ramp, the speed of the freeway is 100km/h. A GIVEWAY sign is located at the holding line for vehicles turning right to the ramp then go to the freeway as well. The plain and section views of the road section are provided in the sketch on next page. Identify the potential hazardous locations and explain the reasons.

[10 marks]



(2) What is the **FOUR-STEPS** model? Explain each of the steps.

[5 marks]

(3) Describe the merits of signalised intersections and roundabouts. What traffic conditions would favour the use of each?

[5 marks]

QUESTION 4

(1) Explain the differences in emphasis and objectives between traffic management applied to urban arterial roads and traffic management applied to local residential streets.

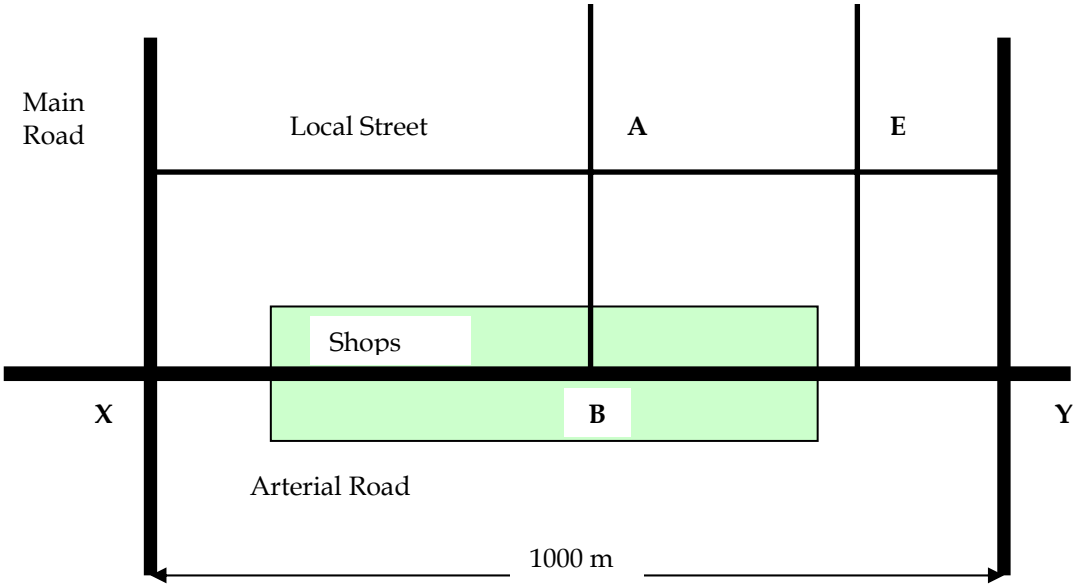
[4 marks]

(2) Using the concept of the functional classification of roads, explain the basic principles for selecting traffic control devices for urban intersections. What traffic and environmental factors are also considered when selecting a control device?

[6 marks]

(3) Consider the segment of a suburban road network shown below. What intersection controls would you consider for intersections X, A and B? The Arterial Road from X to Y includes a strip shopping centre and is often heavily congested, especially in the evening peak period. What might then be the effect on the parallel Local Street? What traffic management measures would you suggest for Local Street?

[10 marks]



QUESTION 5

You are working as a traffic engineer for a municipality. An application has been received for approval to construct a 50-bed private hospital. The application includes an estimate of daily traffic generation of 250 veh/day.

You are asked to assess this estimate, and your investigation yields the following research results:

Burgman (Australia, early 1990s)	4.5 - 6.2 vehicle movements/bed/day
Brindle (South Australia, late 1990s)	5.2 - 9.0 vehicle movements/bed/day
Institute of Transportation Engineers (USA, early 2000s)	12.2 vehicle movements/bed/day

(i) Compare these estimates with the estimate contained in the proposal.

(ii) Based only on the above information, what do you consider would be a reasonable estimate of the traffic likely to be generated by the proposed hospital?

(iii) Would you seek any additional information apart from that listed above before you made your assessment? If so, what? If not, why not?

[20 marks]