

CE474: Traffic Systems Design-Fall 2004

Class 7 – Exam-1 Review
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Ahmed Abdel-Rahim
Civil Engineering Department, University of Idaho

Examination preparation and review

- ◆ Purpose of exam: to test your understanding of terms, concepts, and design parameters that we have used as part of the first design project as well as materials covered in class
 - Format of exam: [Open book, open notes]
 - 50 minutes

Examination preparation and review

◆ What do I expect you to know?

- Understand basic terms and definitions and be able to use or apply them appropriately
- Understand basic traffic flow concepts for signalized intersections and be able to apply these concepts to various situations
- Be able to interpret and sketch graphical presentations of signal timing and traffic performance data
- Understand the factors that govern the selection of optimal timing parameters for a fixed time signal and the trade-offs involved in this process and be able to use graphical and tabular data to optimize signal timing parameters

Examination preparation and review

- *Example:*

- ◆ *What is v/c ratio and how is it used to allocate green time between the approaches at a signalized intersection?*

- Answer

- ◆ The v/c ratio is the volume/capacity ration. It is the ratio of the demand volume to the saturation flow rate. It is a measure of the proportion of the hour, or the signal cycle, that is needed to serve the demand for a given approach. The critical flow ratios for each phase are used to “split” the cycle length among each phase

Examination preparation and review

- *Example:*

- ◆ *How to determine the capacity of each phase in a fixed time signalized intersection, explain measures that you can take to increase the capacity of a phase*

- Answer

- ◆ Capacity = $g/c * \text{Sat Flow}$
- ◆ Measure to increase it: increase g/c ratio

Examination preparation and review

- *Example:*

- ◆ *How to determine the capacity of a signalized intersection under fixed time control, explain measures that you can take to increase the capacity of the intersection*

- Answer

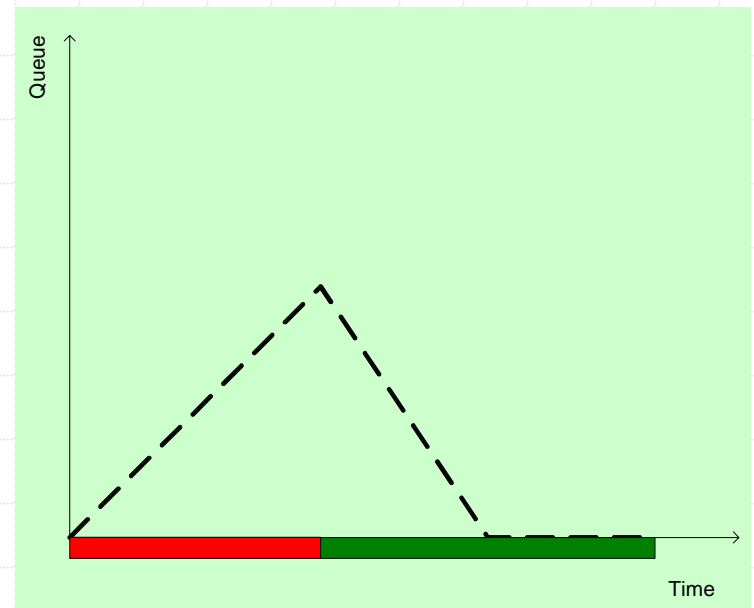
- ◆ Capacity = Sum of the capacity of individual phases
- ◆ Measure to increase it:???

Examination preparation and review

- *Example:*

- ◆ *What is the queue polygon diagram, how can we use it to determine the proportion of the unused green for a protected left turn in a signalized intersection*

- Answer



Examination preparation and review

- ◆ What else do I expect you to know?
 - Basic traffic flow theories at signalized intersection.
 - Arrival/departure headway distribution and their applications
 - Design of fixed time signal systems
 - Use CORSIM, HCS, and other resources (i.e. NIATT Tutorials)

Examination preparation and review

- *Example:*

- ◆ *An intersection has a LT volume of 360 vph, what is the probability that there is a spillback from the LT pocket at a given cycle? Cycle length=60 seconds. The length of the LT pocket is 160 ft*

- Answer

- ◆ Poisson distribution $m = 6$ LT vehicles/cycle
- ◆ Find Probability of $n > 8$

Examination preparation and review

■ *Example:*

- ◆ *Your observation of traffic on a major road indicated that 70% of the traffic is random (Poisson) with mean headway of 6 seconds and the remaining 30% is constant (Normal with an average headway of 2 seconds). What is the capacity of a stop controlled side street, if the accepted gap is 4 seconds.*

■ Answer

- ◆ Poisson distribution $m = 6$ seconds (70%)
- ◆ Normal distribution $\mu = 2$ seconds (30%)
- ◆ Number of headways ≥ 4 seconds/hour is the capacity of the side street

Examination preparation and review

■ *Example:*

- ◆ *Vehicles arrive at the gate of a national park with a rate of 200 vph (Poisson). It takes the operator on average 15 seconds (negative exponential) to process each vehicle, what is the average waiting time at the park entrance? What is the probability that a vehicle does not have to wait at the park entrance*

■ Answer

- ◆ Queuing theory M/M/1 case
- ◆ λ = arrival rate = 200 vph (0.05556 v/sec)
- ◆ μ = service rate = 240 vph (0.06667 v/sec)
- ◆ Find $E(w)$ and $P(0)$

Examination preparation and review

- *Example:*

- ◆ *How does HCM take into account different arrival headway distributions? Or Does it?*

- Answer

- ◆ HCM considers five different arrival type ranging from 1 to 5, 1 being most uniform and 5 being completely random

Examination preparation and review

- *Example:*

- ◆ *A signalized intersection has a cycle length of 75 seconds. The critical movements in the N/S and E/W directions are 650 vph and 820 vph. Use microscopic simulation to find the average queue length and stopped delay for each approach*

- Answer

- ◆ Use Corsim