Topic 8
(Handouts, Chapter 24)

Signal Timing and Coordination
Signal System Classification

- Traditional Systems
  - Closed-Loop (Field Master)
  - Centralized Computer Control

- Adaptive
Signal Timing Process

- Data Collection
- Signal Timing Development
- Field Implementation
Basic Terminology

- Cycle
- Phase Split
- Phasing Sequence
- Offset
- Force-off
Cycle Length and Split

- **Cycle Length**
  
  All signals must have a *common* cycle length to achieve coordination

- **Split**
  
  Split = Green + Yellow + All-red
Signal Coordination

Intersection #1

Intersection #2

East Bound
Offset

- Offset is the time difference between two reference points
- Offset must be specified by
  - Phase
  - Begin/end phase
- Offset = 0 ~ cycle length
Delay and Offset (CEE 663)

- Offset
Example

Assume a two-lane one-way street links two intersections \( i \) and \( j \), which is 800 feet apart. The one-way link flow is all through traffic and has a volume of 1000 vph. Saturation flow rate is all 1800 vph. Assume vehicle travel speed is 25 mph. The system cycle is 70 sec, and the effective arterial through greens for the upstream \((i)\) and downstream \((j)\) intersections are 35 sec and 30 sec, respectively. The offset is 20 sec, referencing to the start of green of the arterial phases (i.e., arterial phase green at \( j \) starts 20 sec later after \( i \)).

Calculate the uniform delay at intersection \( j \).
Time-Space Diagram
One-way Street

G=25  Y=5  R=30
φ2  φ6  φ8  φ4

G=35  Y=5  R=20
φ8  φ4  φ8  φ4

EB Band

Time

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Time-Space Diagram
Two-way Street

G=25  Y=5  R=30

EB Band

G=35  Y=5  R=20

WB Band

#1

#2

G=25  Y=5  R=30

EB Band

G=35  Y=5  R=20

WB Band

Time
Question 1:
φ2 and φ6 at intersection #1 turn to green at 60 sec, φ2 and φ6 at intersection #2 turn to green at 20 sec, what is the relative offset between intersection #1 and #2, assuming the offset is referenced to the start of green of φ2 and φ6?
Question 2:
Given the offset number in Q1, what the offset will be if the offset is referenced to the end of green of φ2 and φ6?
Question 3:
If the travel speeds are different for the two directions, will it affect the above offset results?
Bandwidth
(Dual LT Leading)
Bandwidth - Adjusted (Dual LT Leading)

EB: 20 sec

WB: 12 sec

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Bandwidth - Initial
(Lead/Lag)

EB: 20 sec
WB: 12 sec
MOEs

- **Bandwidth Concept (PASSER II)**
  - Bandwidth, seconds
  - Bandwidth Efficiency = Bandwidth/Cycle
  - Attainability = Bandwidth/g_{min}

- **System-Wide Delay (Synchro)**

- **System-wide Stops and Delay (TRANSYT-7F)**
“Yellow trap” is a situation faced by a left-turn movement when the display of “yellow” occurs to both the left-turn phase and the adjacent through phase, but the opposing through is not terminating.
Dallas phasing has louver that through vehicles cannot see.
Left-turn phase about to end
Through movements move both directions. Left-turn yield to opposing through.
Yellow trap occurs when the leading left-turn sees yellow and thinks the opposing through phase will also end.
Dallas phasing does not display yellow, and left-turn sees green ball and is supposed to still yield.
When left-turn sees yellow, the opposing phase also about to end.
Main street phases end, side street phases begin
Yellow Trap

- Only the leading left-turn has the “yellow trap” with protected/permitted phasing.
- Dallas Phasing solves the "yellow-trap" problem by holding a solid green indication.
- Louvers are used to shield the left-turn display so that the green display in the left-turn signal cannot be easily seen by thru drivers.

http://projects.kittelson.com/pplt/LearnAbout/Learn3.htm
http://projects.kittelson.com/pplt/display/dallas_doghouse_lag.htm
Summary

- Offset
- Bandwidth
- Time-Space Diagram

- What is “Yellow Trap” and when it occurs?
- What is the main purpose of using “Lead-Lag” phasing? Can “Lead-Lag” phasing increase an intersection capacity?
- What is the exception that a different cycle length can be used at an intersection while still maintaining coordination?