

Fixed Time Signal Coordination

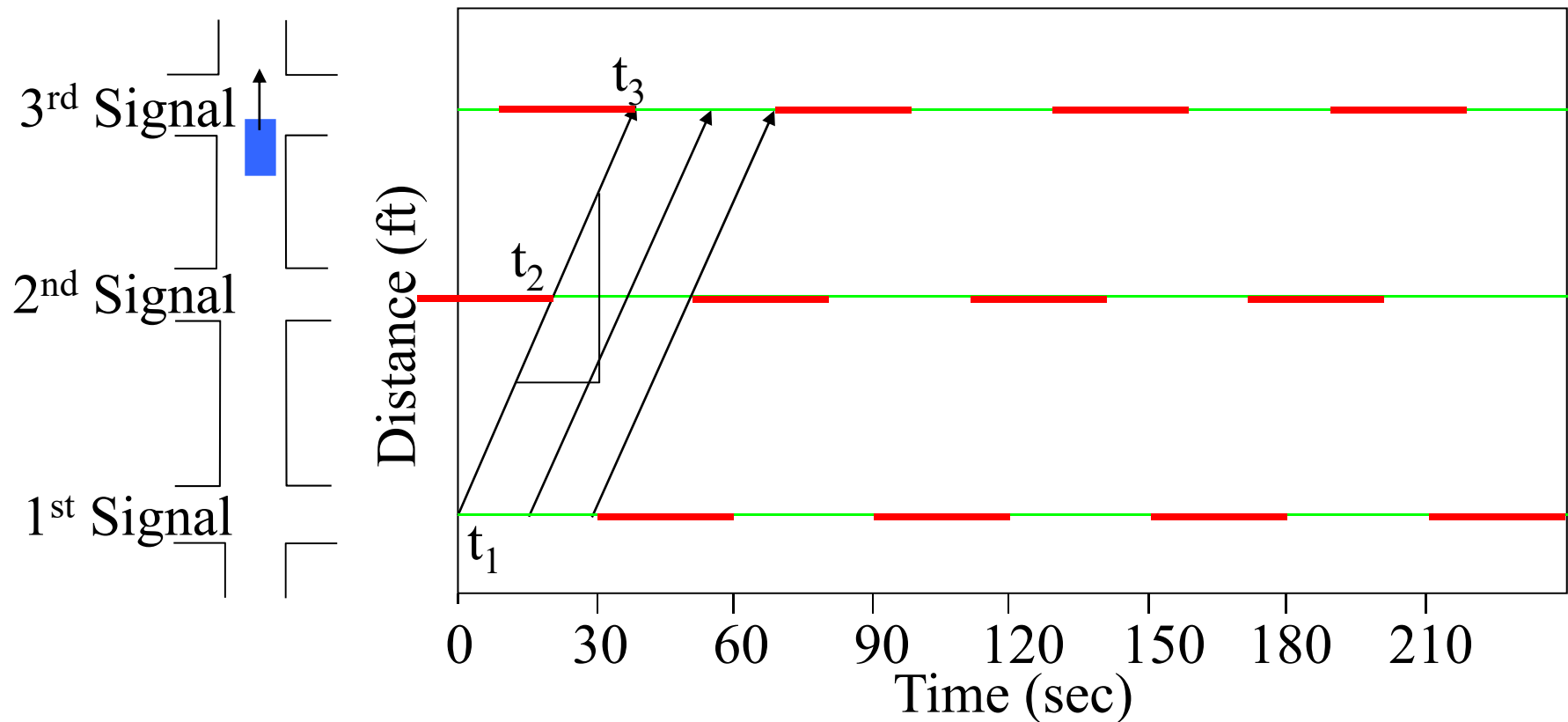
Objectives

- Factors affecting coordination
- Basic theory of signal coordination
- Application to arterial progression

Factors Affecting Coordination

- Benefits
- Purpose of signal system
- Factors lessening benefits
- Exceptions to the coordinated scheme

Concept: Maximize Progression By Adjusting Offsets



Note: Definitions of offset vary, but text convention is offset is $t_2 - t_1$ and $t_3 - t_2$

Benefits of Signal Coordination

- Stops and Delay
- Performance index: combining measures
- $\text{Cost} = A \times (\text{total stops}) + B \times (\text{total delay})$
- What are some other benefits?

Engineering Options

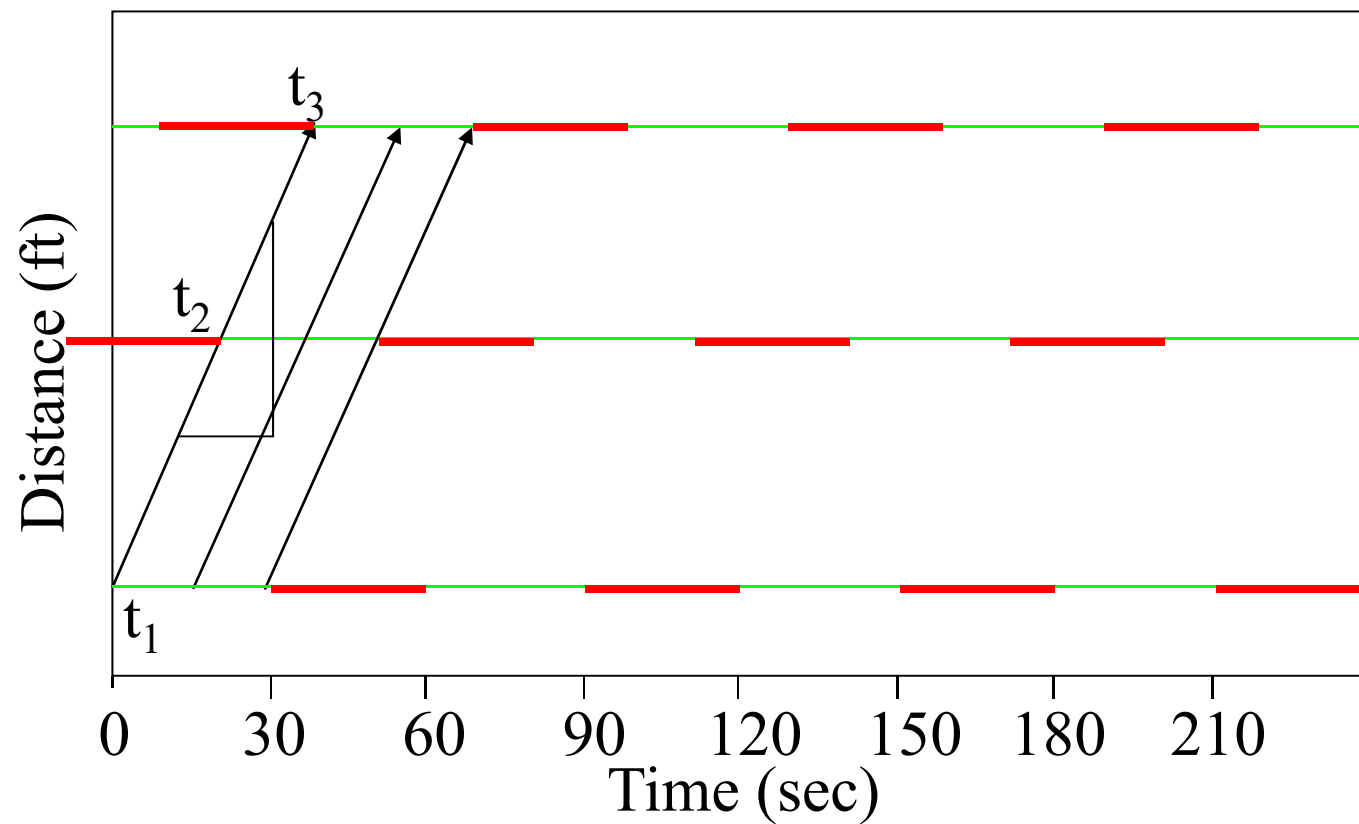
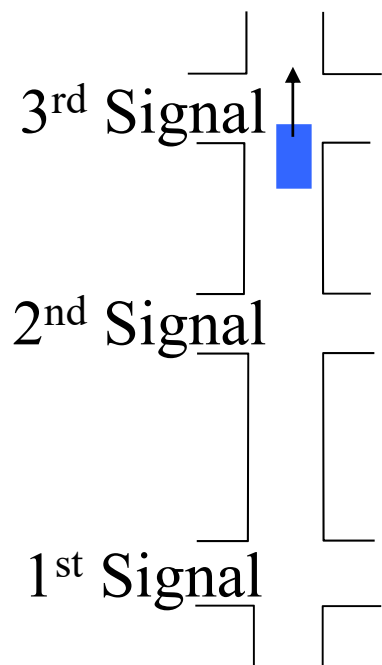
- Types of systems
- Movements to be coordinated
- Types of objectives
- Types of scenarios

Factors Lessening Benefits

- Inadequate roadway capacity
- Side friction
- Complicated intersection timing plans
- Wide variability in traffic speeds
- Short signal spacing
- Heavy turn volumes

Time Space Diagrams and Ideal Offsets

- What is an offset?
- What is an ideal offset?

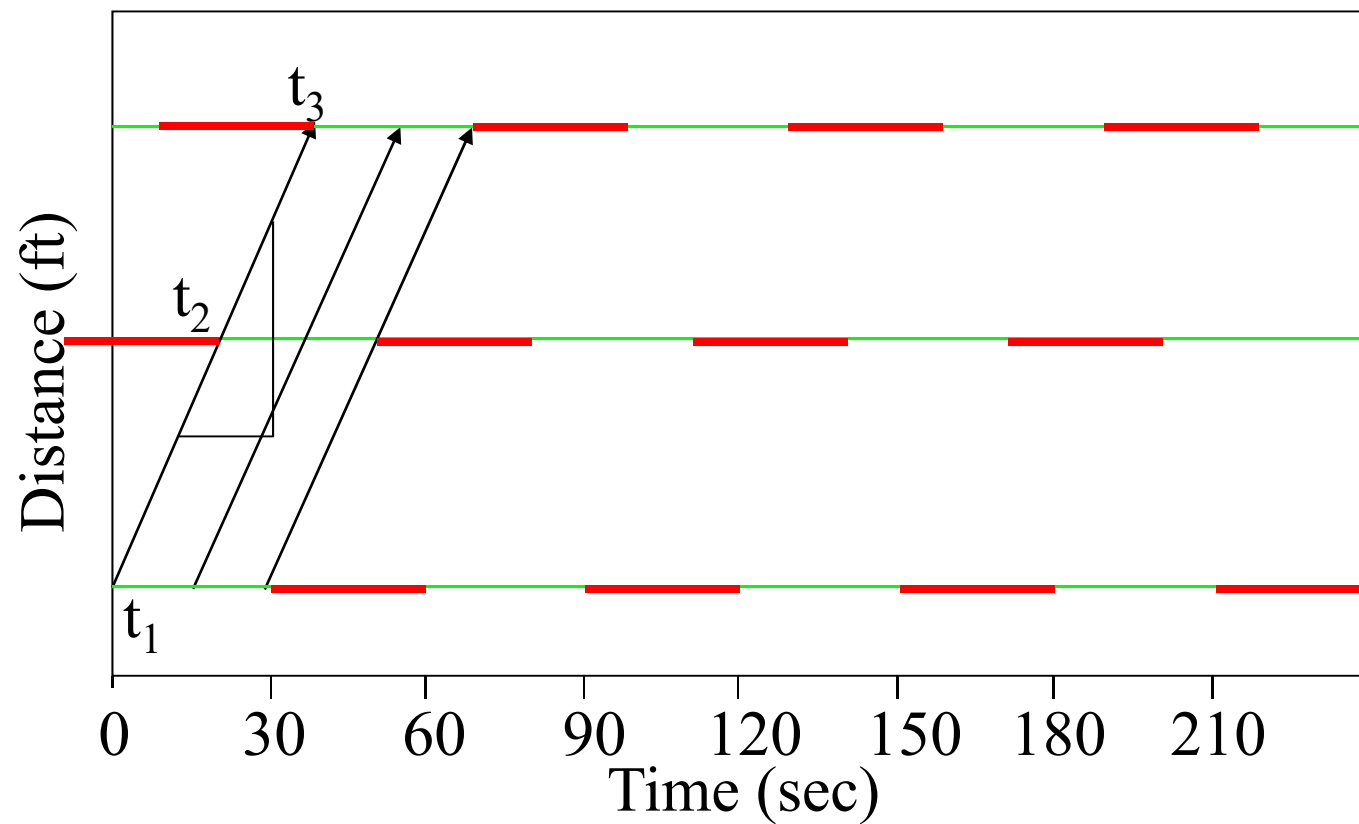
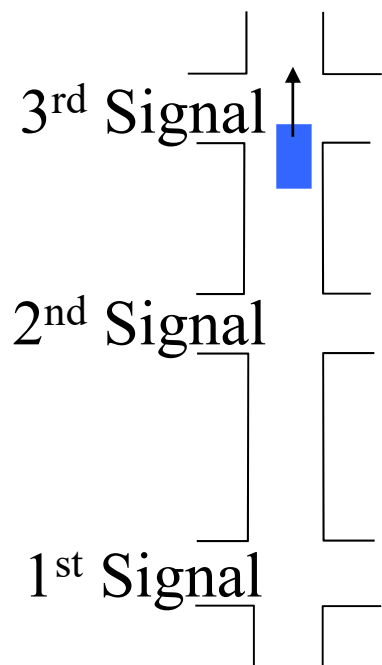


One-Way Progression

- Things to know for one-way progression offsets
 - Desired platoon speed
 - Length of queue at coordinated approaches
 - Block length
 - What does this list not consider, based on the list of factors lessening benefits?

One-Way Progression

- How do you construct a time-space diagram?
 - Vertical scale
 - Horizontal scale
 - Start first intersection on main street green with $t = 0$
 - Next intersection main street green starts at offset relative to downstream start of _____
 - Repeat for each intersection
- Note: You can specify offsets relative to one (master) intersection and it is expressed in terms relative to the master intersection



Effect of Queued Vehicles

How do you determine the offset with queuing?

$$t(ideal) = \frac{L}{S} - (Qh + Loss_1)$$

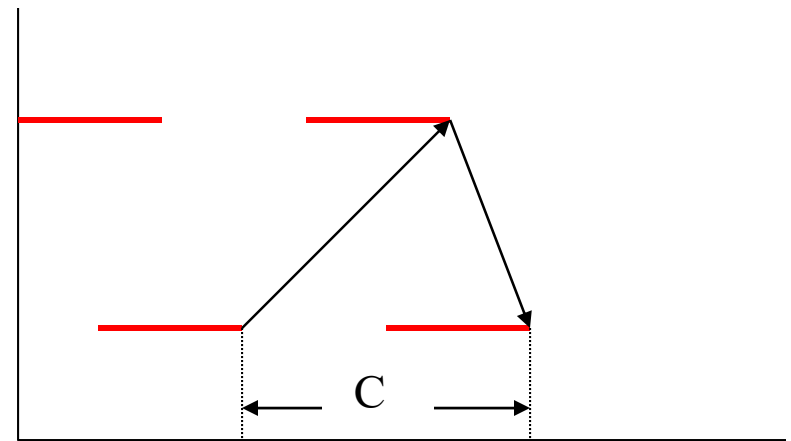
- Q number of vehicles queued per lane (veh/lane)
- h discharge headway of queued vehicle (sec/veh)
- Loss₁ loss time associated with vehicles starting from rest at the first downstream signal (sec)

Different Types of Progression

- What are the different types of progression?
 - Simple
 - Forward
 - Flexible
 - Reverse
 - Simultaneous

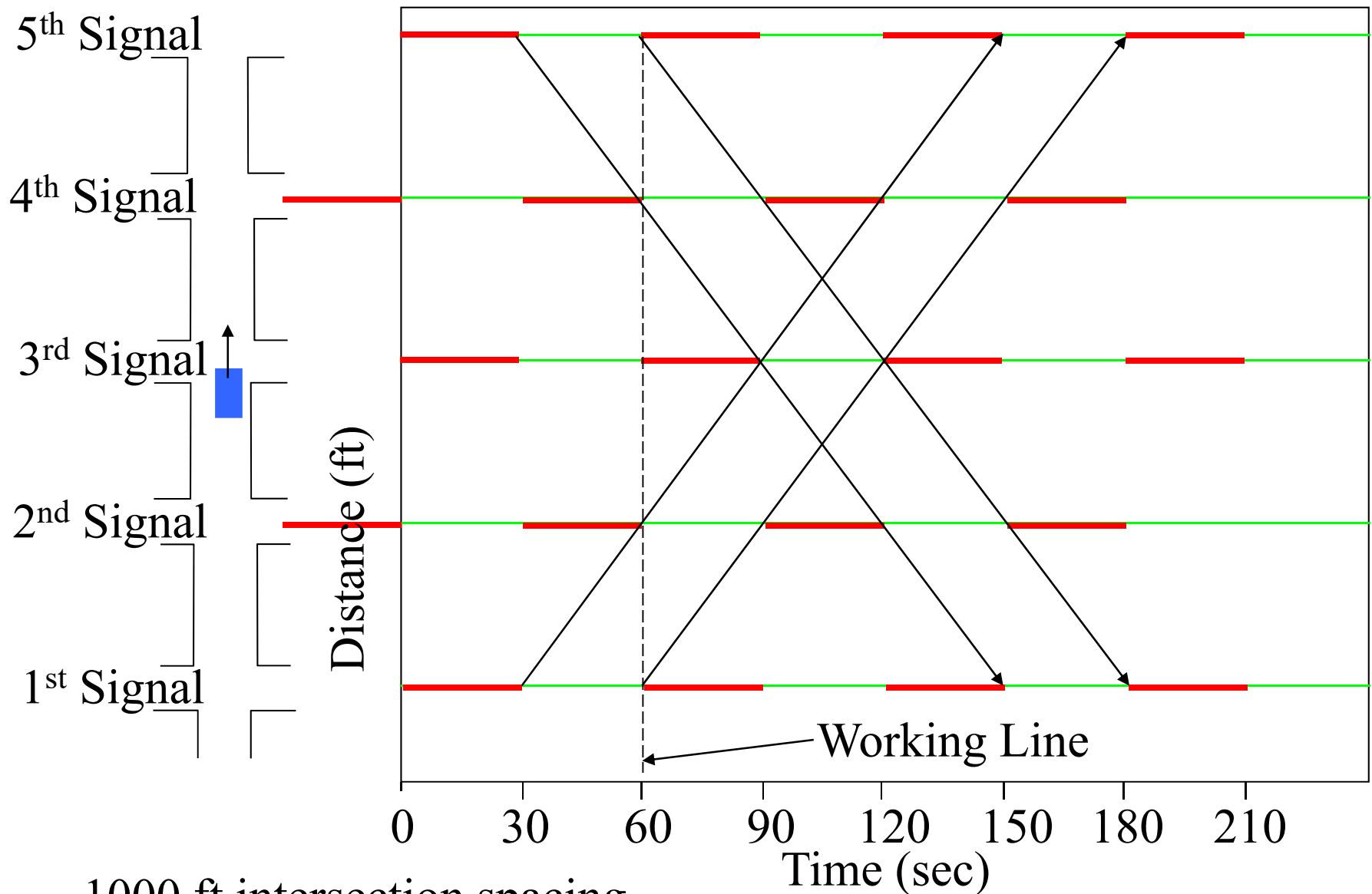
Two-Way Progression

- Progression in one direction suffers
- Segment offsets $t_{SB} + t_{NB} = nC$
- Maximizing bandwidth
 - Popular
 - Limited



Two-Way Progression (Cont.)

- Simultaneous progression
 - Closely spaced intersections
 - Queue management
 - Alternate progression
 - Uniform block length
 - 50:50 split
- $$C = \frac{2NL}{S}$$
- N the number of blocks with simultaneous green
 - How do you determine N?



1000 ft intersection spacing
 2 lanes in each directions
 $C = 60$ sec w/ 50:50 split

What is the progression speed?
 What is the nonstop volume?

Two-Way Progression (cont.)

- What about arterials with non-uniform intersection spacing?