COORDINATED SIGNAL TIMING

We have learned to calculate cycle length, splits, and clearance intervals for pretimed traffic signals. This approach to design focuses on capacities of the various approaches to an intersection. We will now change our focus to coordinating signal timing for efficient traffic progression.

Coordination of traffic signals involves timing signals for opposing traffic streams with relation to one another, so that vehicles traveling at predetermined speeds will be able to successfully clear successive intersections on “green.”

In order to coordinate signals for opposing traffic streams, we use space-time diagrams.

Definitions:

Through band – space-time path intersecting green at successive signals.

Band width – width of total through band.

Offset- time difference between beginnings of green at two signals.

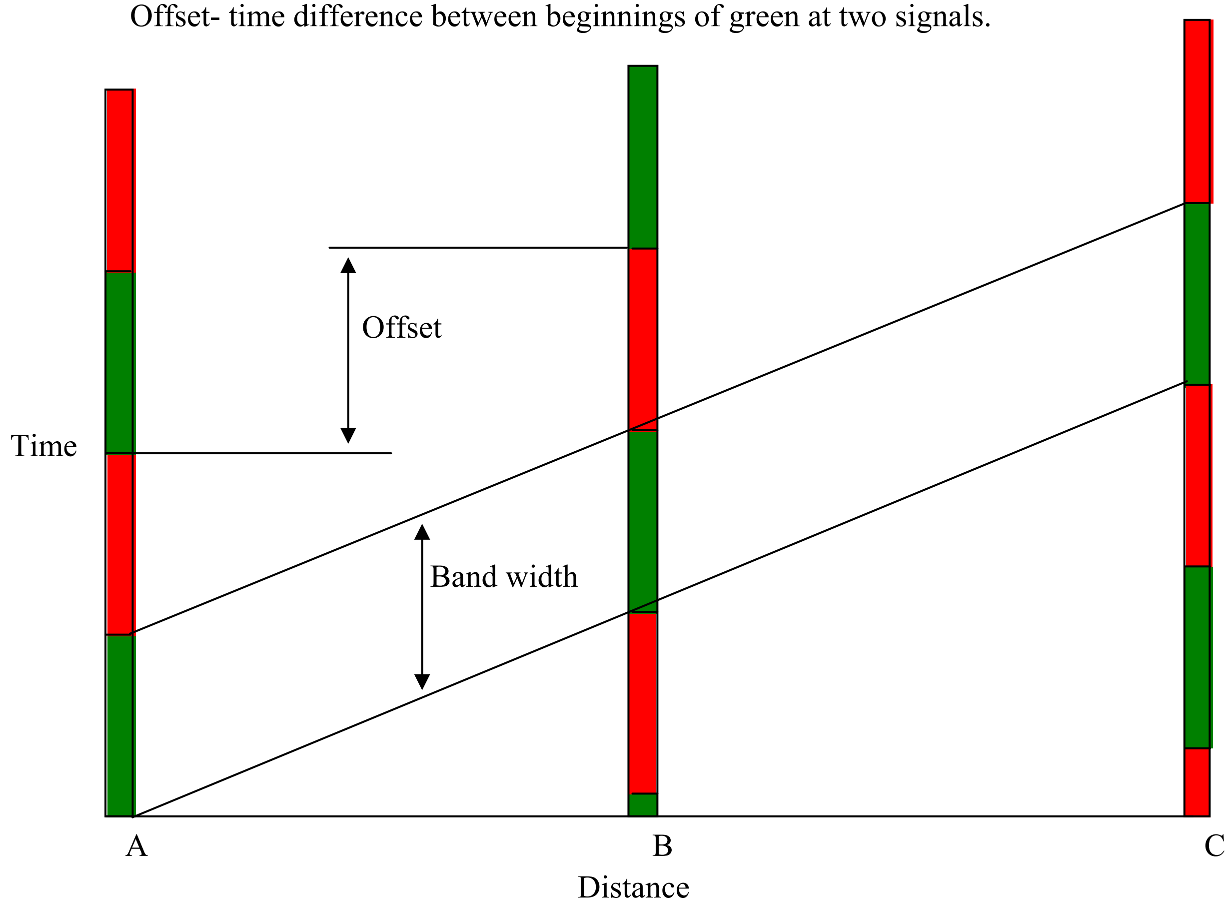

Figure 1. Space-Time Diagram

We will be considering only simple situations, where signal coordination can be determined by graphical methods, and calculations derived from the graph.

Example 1 – Design and Evaluation

Given:

Two intersections spaced 1400 ft. apart
Design speed of progression = 40 ft/sec
60 second cycle with 50-50 splits

a. Find the offsets required for progression in the direction A to B.
b. Assuming AB is a two-way street, find the bandwidth in the opposite direction.
c. Calculate the bandwidth efficiency for each direction.

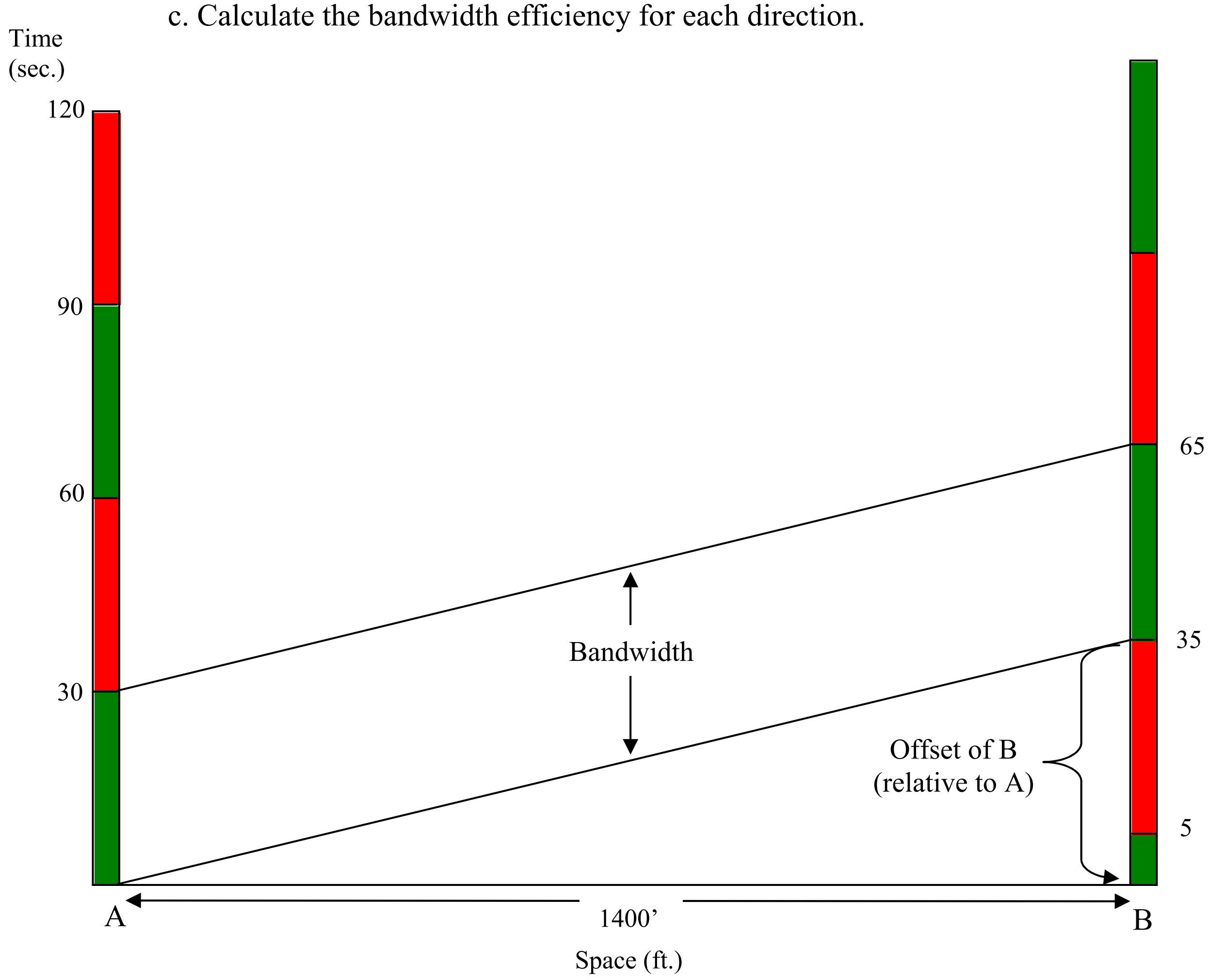

Figure 2. Analysis

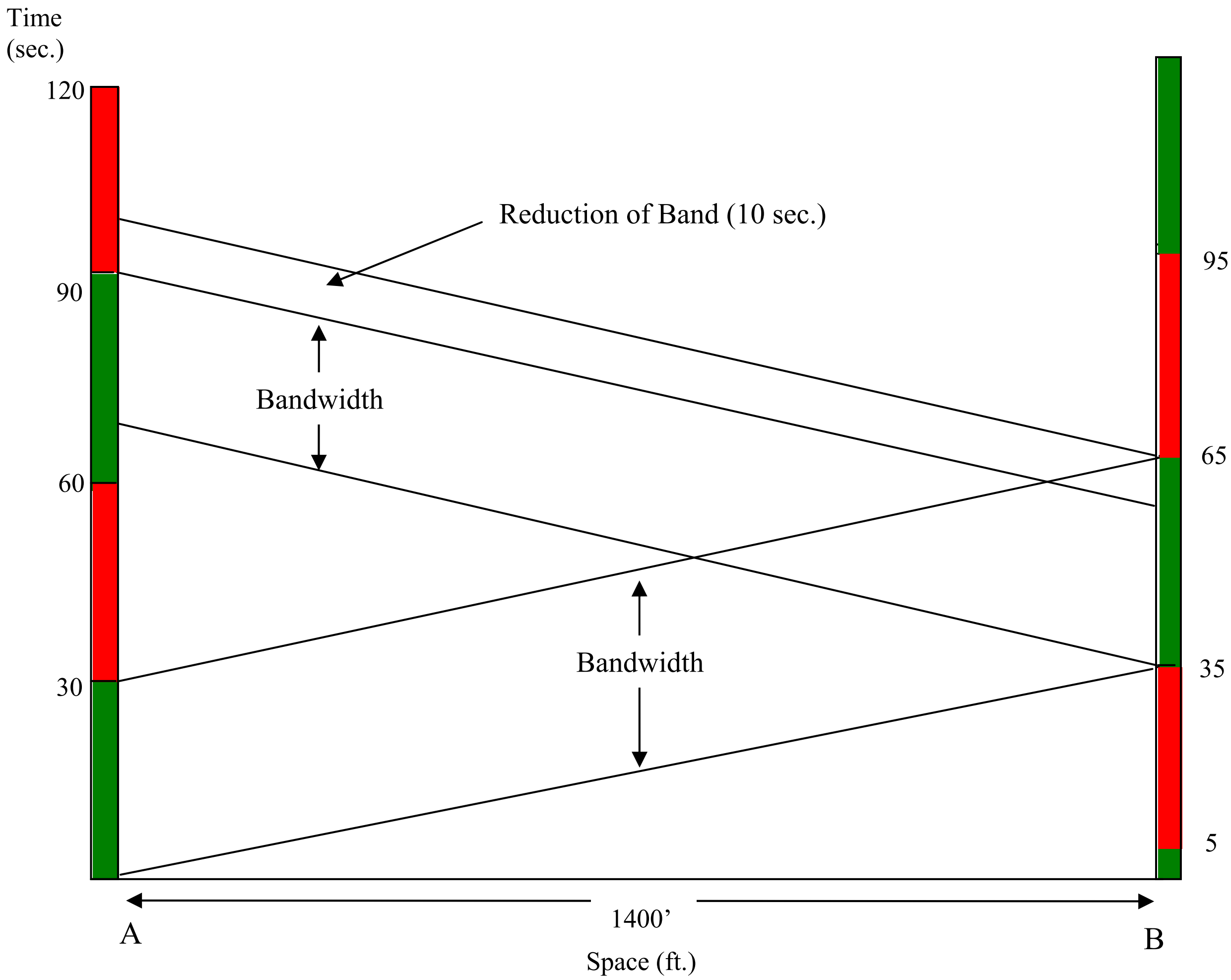

Figure 3. Evaluation

Steps:
Draw ideal band; Find loss; Find and draw total through band

Quality assessment: Bandwidth efficiency $= \left(\dfrac{BW}{C}\right)\times 100$

Where: BW = width of total through band (sec)
C = cycle length (sec)

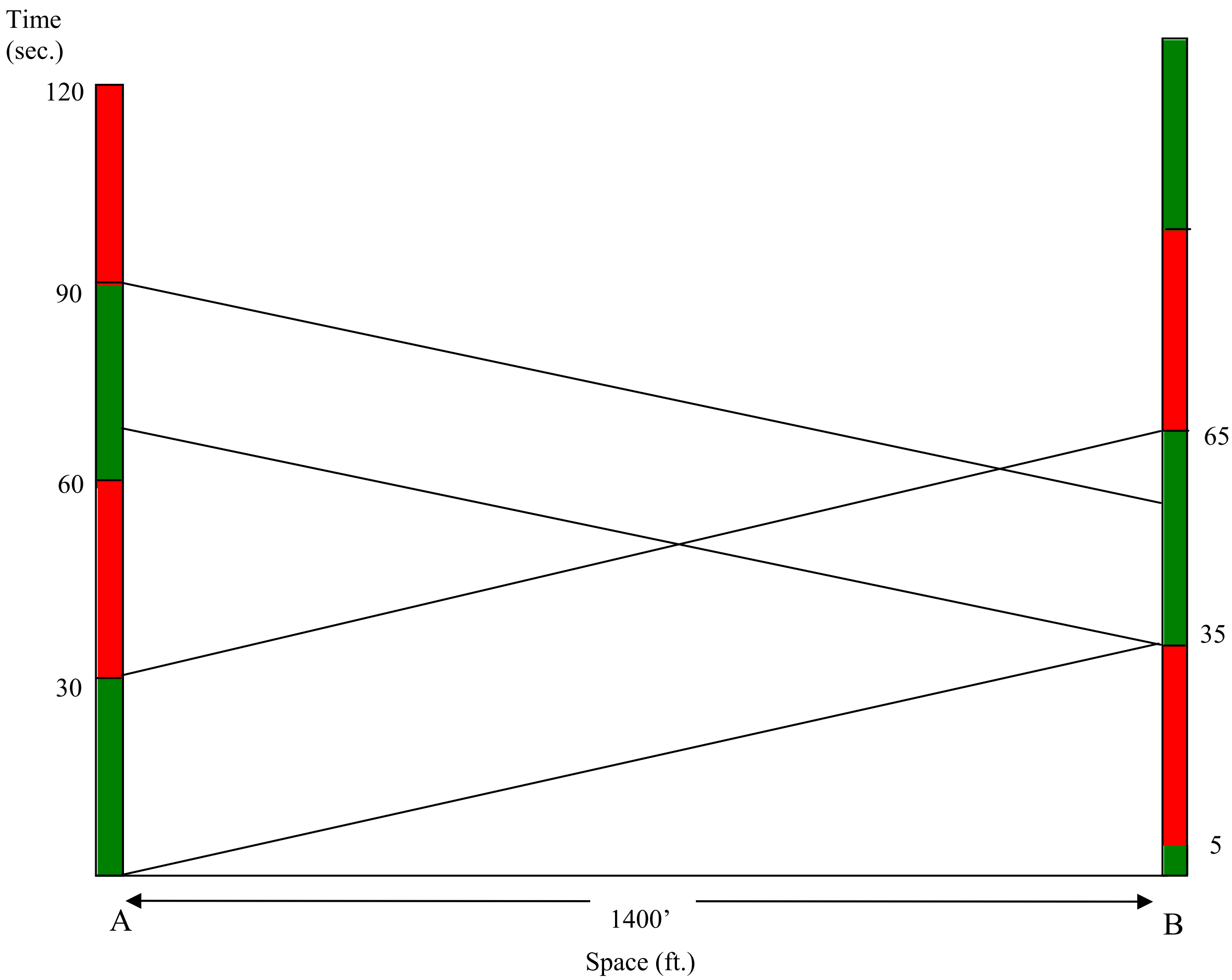

Figure 4. Final Product

Example 2 – Evaluation of Existing Operation

Given:

Intersection spacing shown in Figure 5.
Design speed = 40 ft/sec
60 second cycle with 50-50 splits
Half cycle offset at intersection B
Quarter cycle offset at intersection C

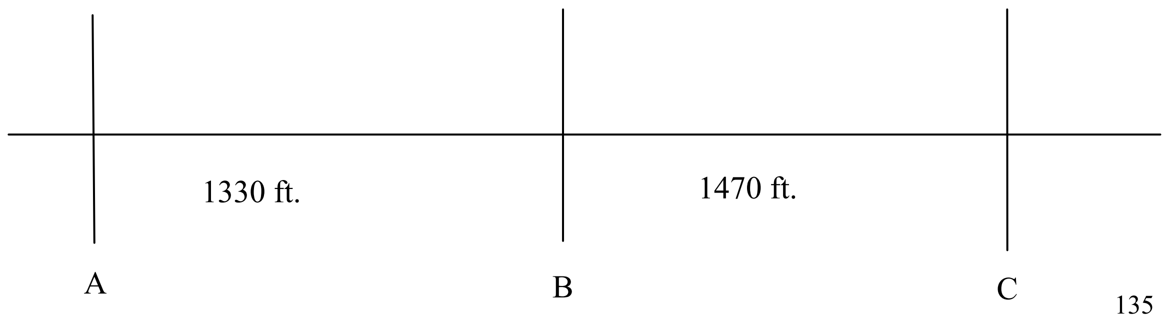

Figure 5. Block Spacing.

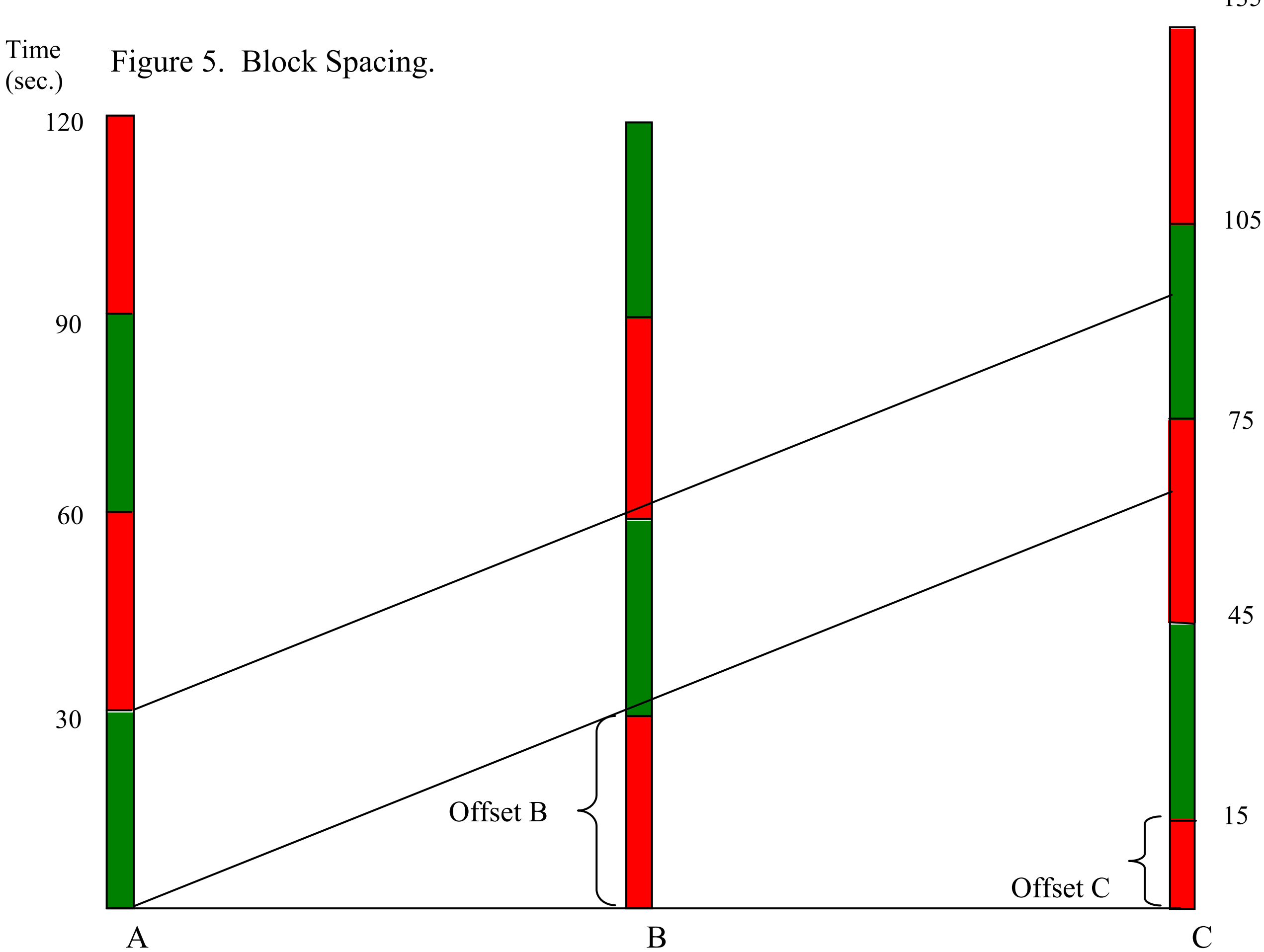

Figure 6. Show Ideal band, where edges hit red, calculate arrival times and signal changes.

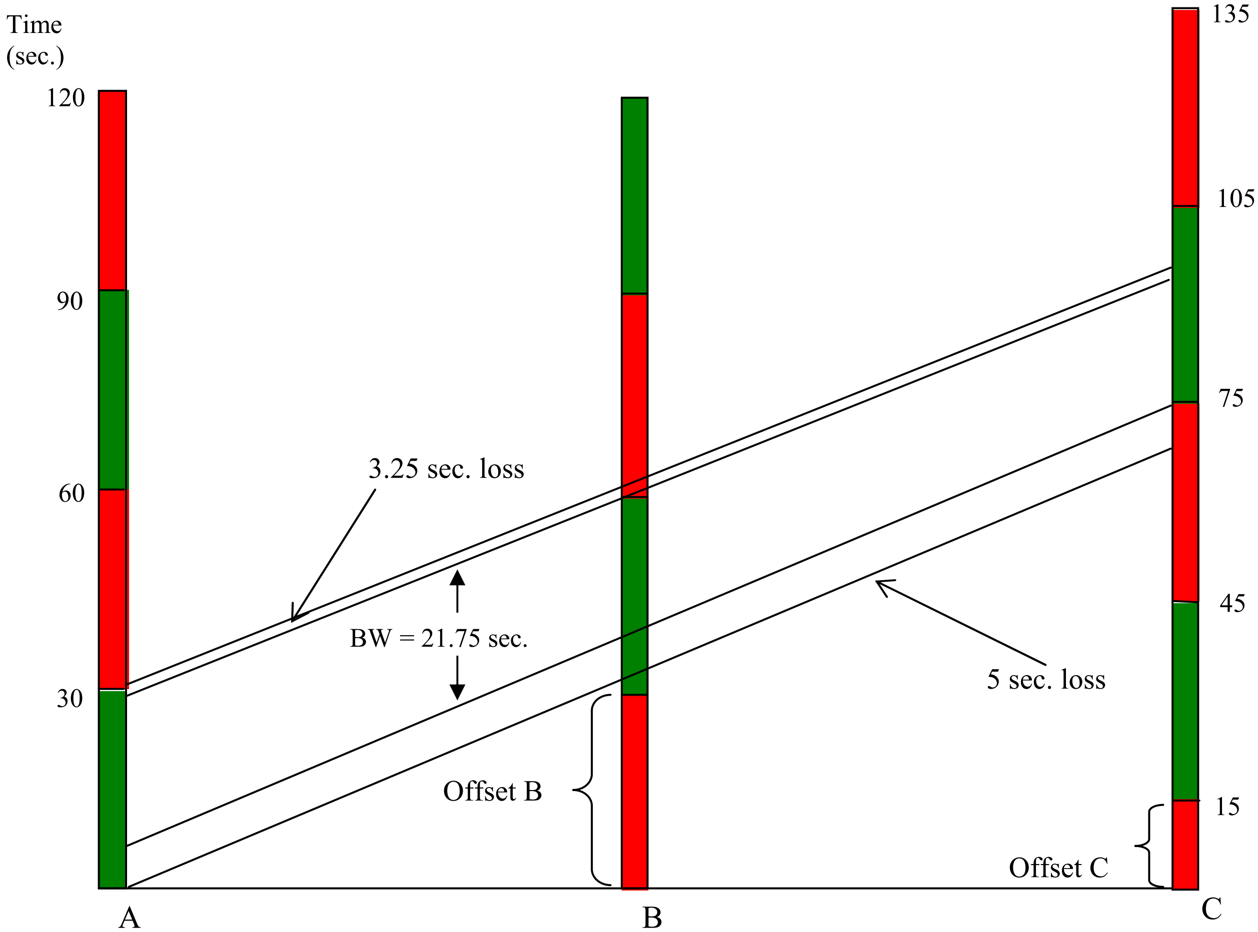

Figure 7. Draw the Total Through Band.

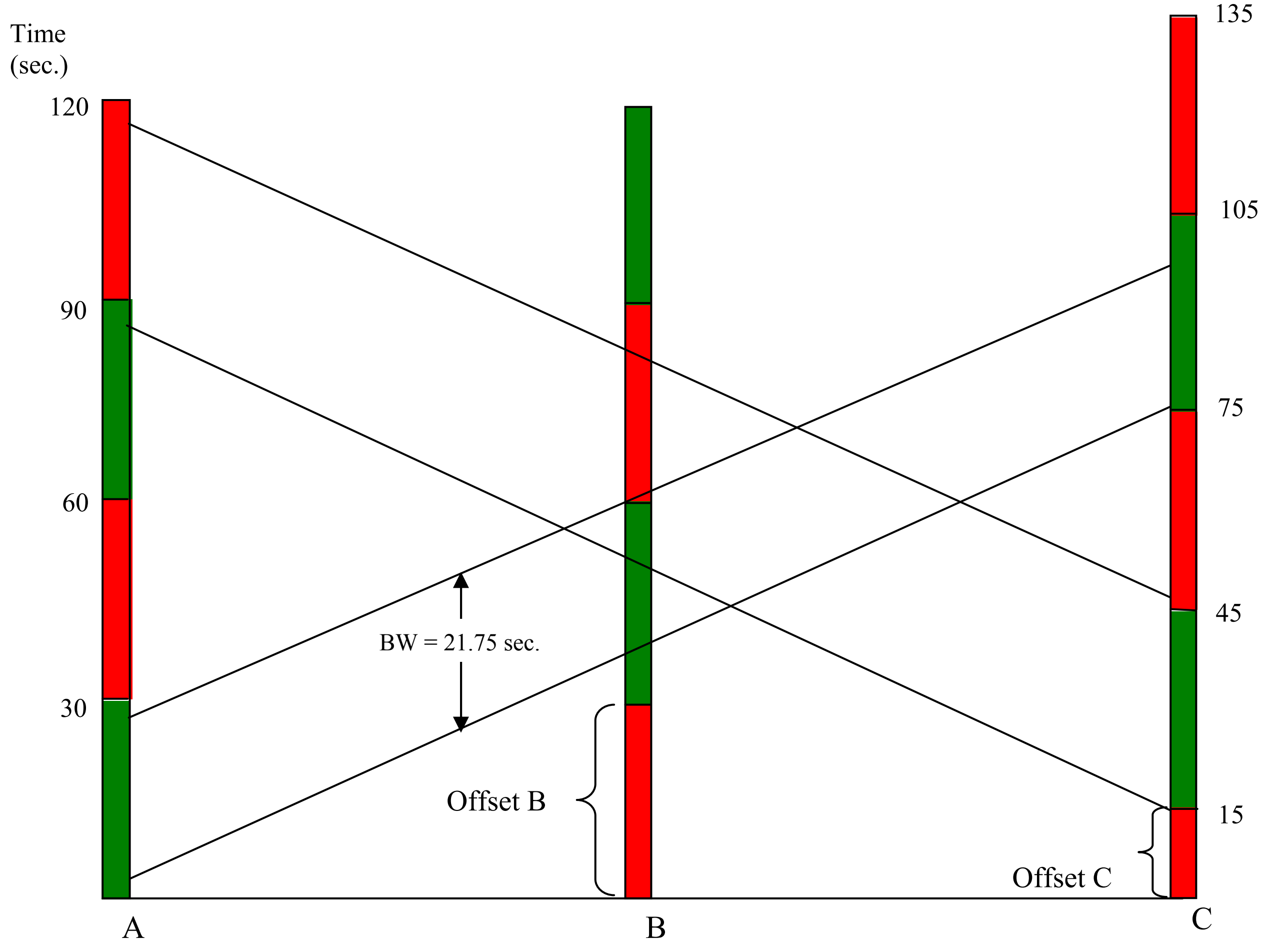

Figure 8. Find Ideal Band for Opposite Direction.

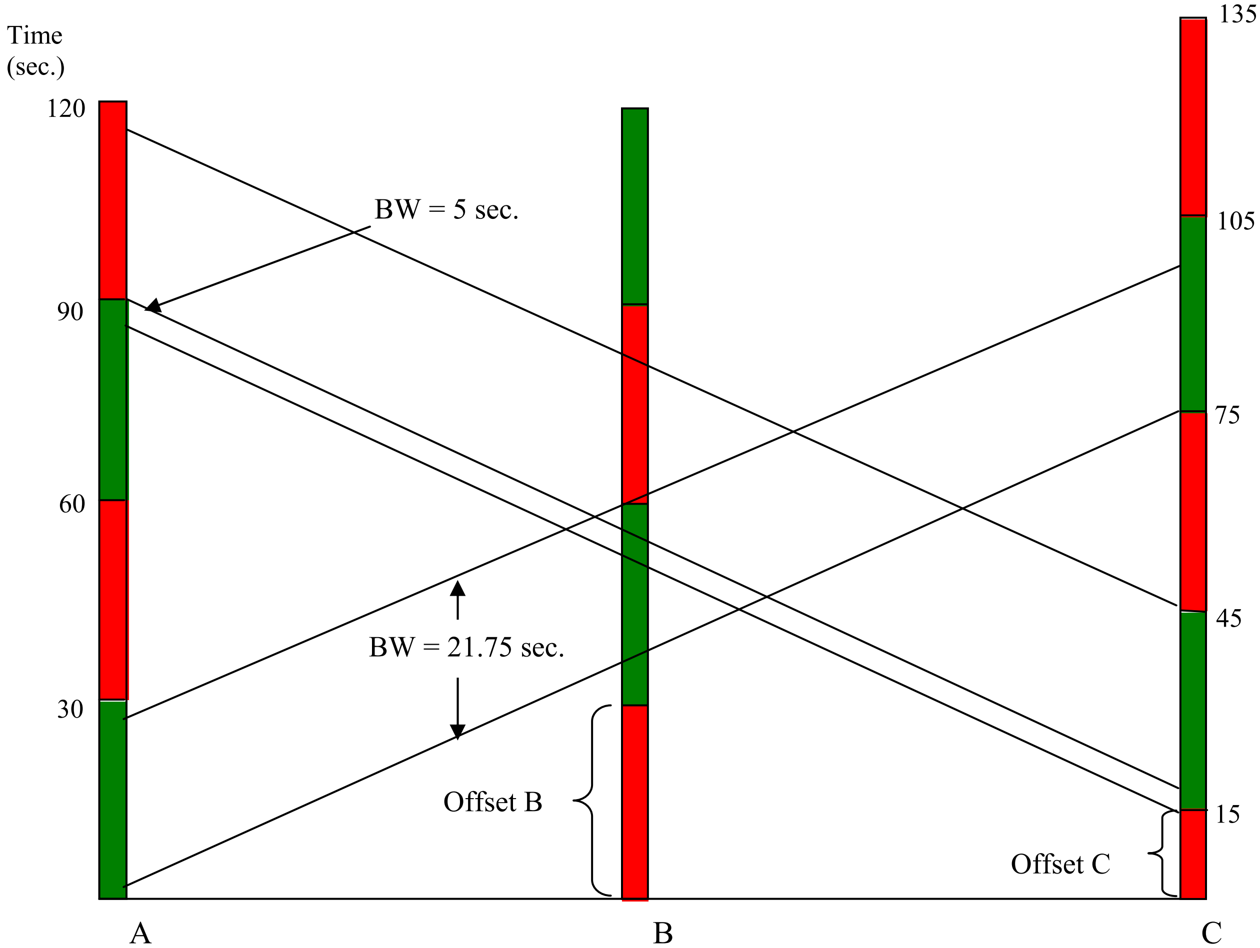

Figure 9. Draw Total Through Band.

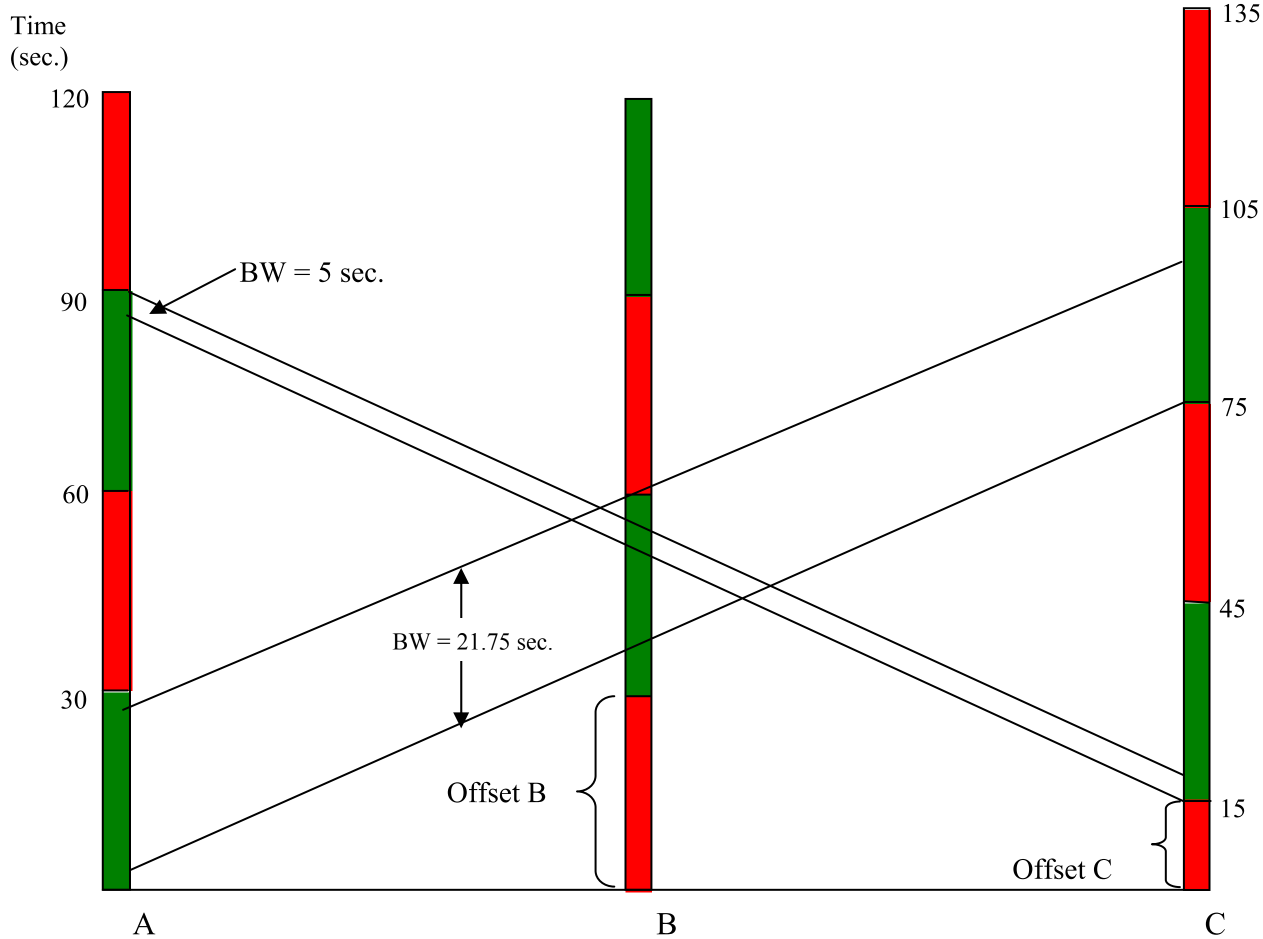

Figure 10. Final Diagram.

Signal Coordination Summary

1. For this course, you must have a common cycle length for each intersection in your system.

2. Identify the **reference intersection**, and determine all offsets with respect to it.

3. Offsets must be an increment between zero and the cycle length.

4. Progression band MUST go through entire system.

5. You must determine a bandwidth for each direction of traffic progression.

6. Good operation is achieved with bandwidth efficiencies of 30-40% or greater.

7. Cycle lengths and splits should be calculated so that all traffic is passed at each intersection.

8. It is typically not possible to have full progression in both directions.

9. Available software:
   a. Passer II
   b. TRANSYT 7F (GA Optimization)
   c. Synchro