

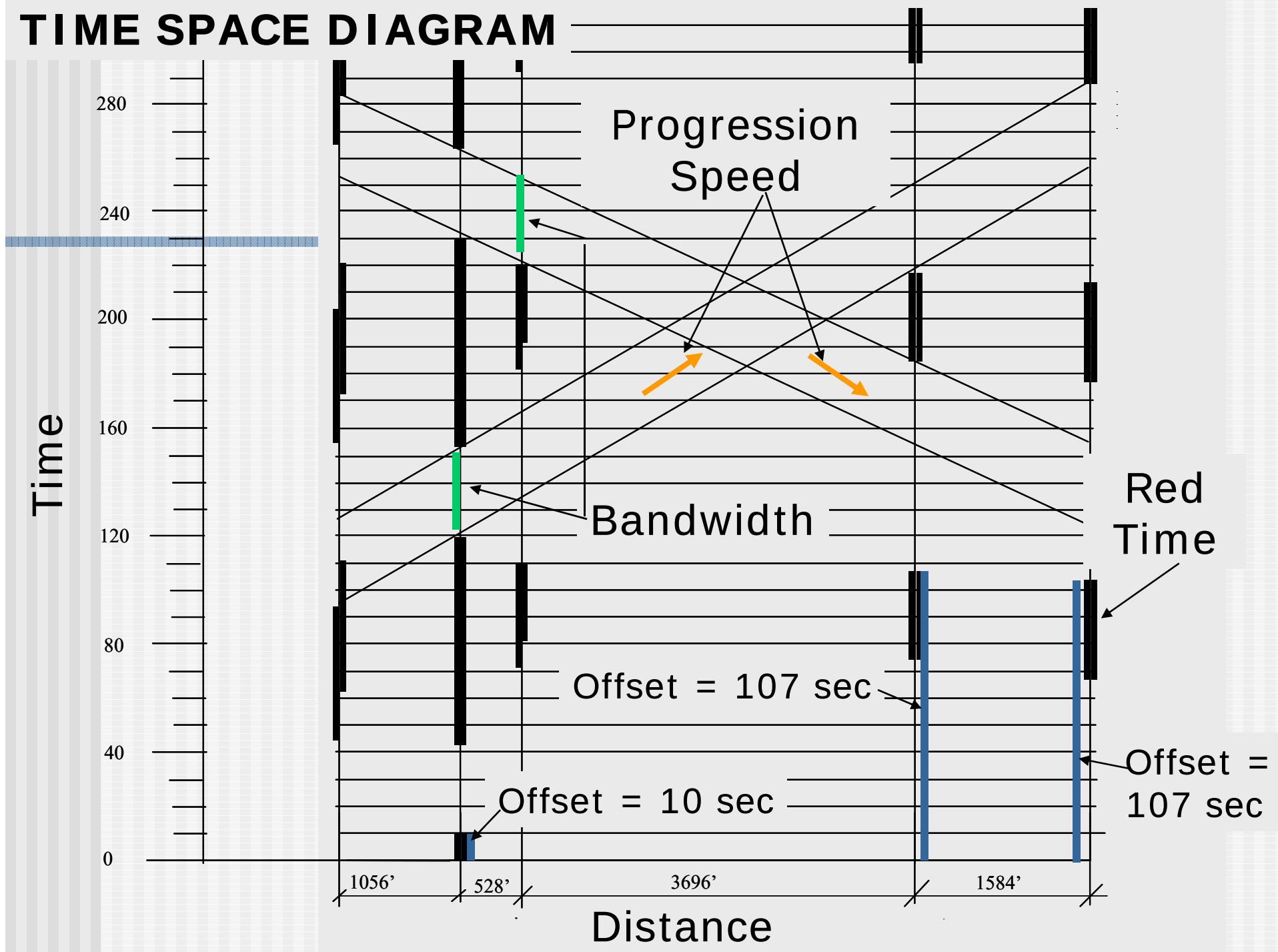


Progressive Signal Systems

Coordinated Systems

- Two or more intersections
- Signals have a fixed time relationship to one another
- Progression can be achieved if the offsets between adjacent signals permit continuous operation of groups of vehicles at a planned rate of speed

TIME SPACE DIAGRAM



-
- Bandwidth = time in seconds elapsed between the passing of the first and the last vehicle
 - Progression speed = speed at which the platoon drives through a series of signals without stopping
 - Slope of the band

Two Basic Types of Progressive System

■ Simultaneous System

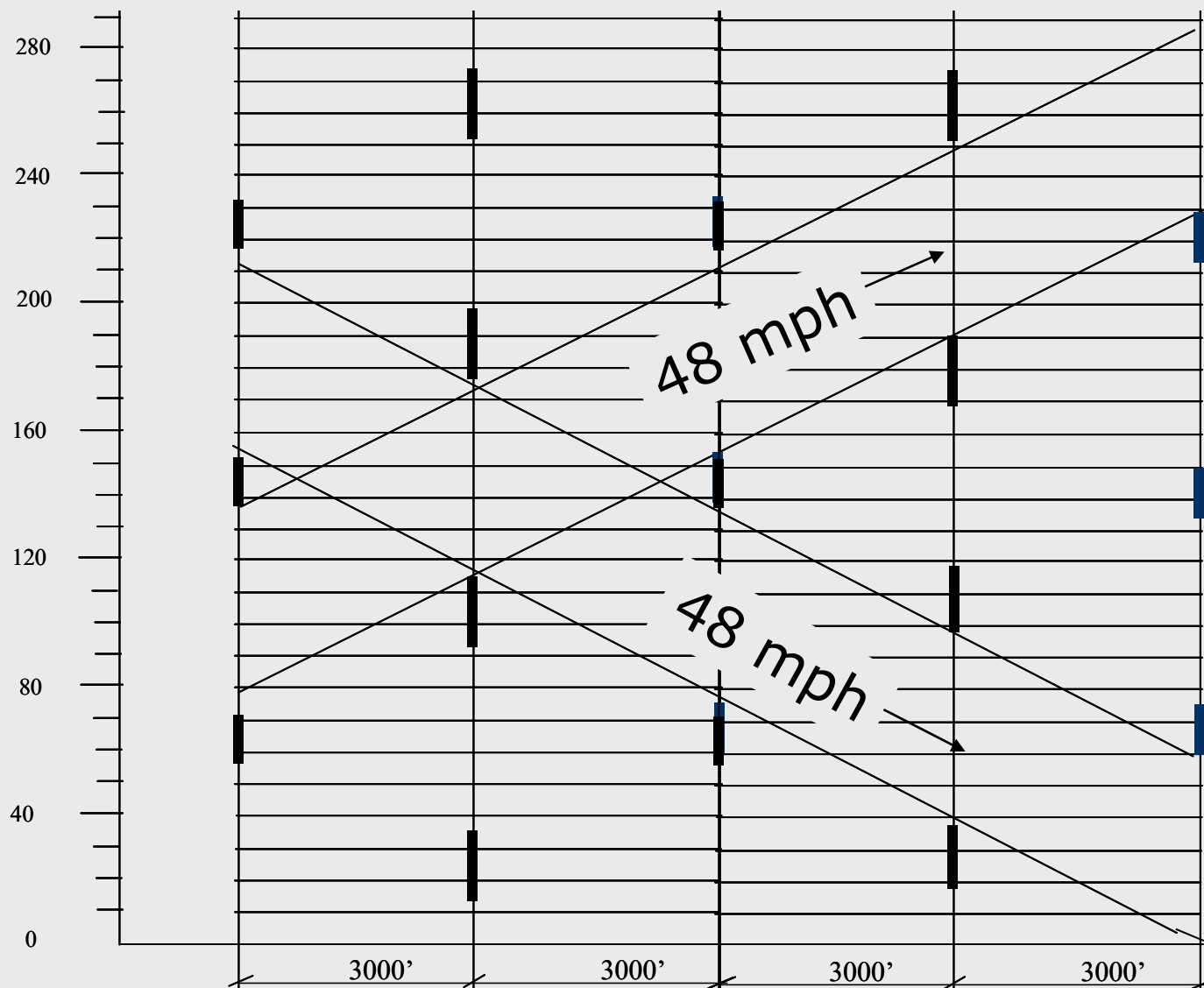
$$V = \frac{D}{1.47 C}$$

Where: V = speed in mph
D = signal spacing in feet
C = cycle length in seconds

■ Alternative System

$$V = \frac{D}{0.735 C}$$

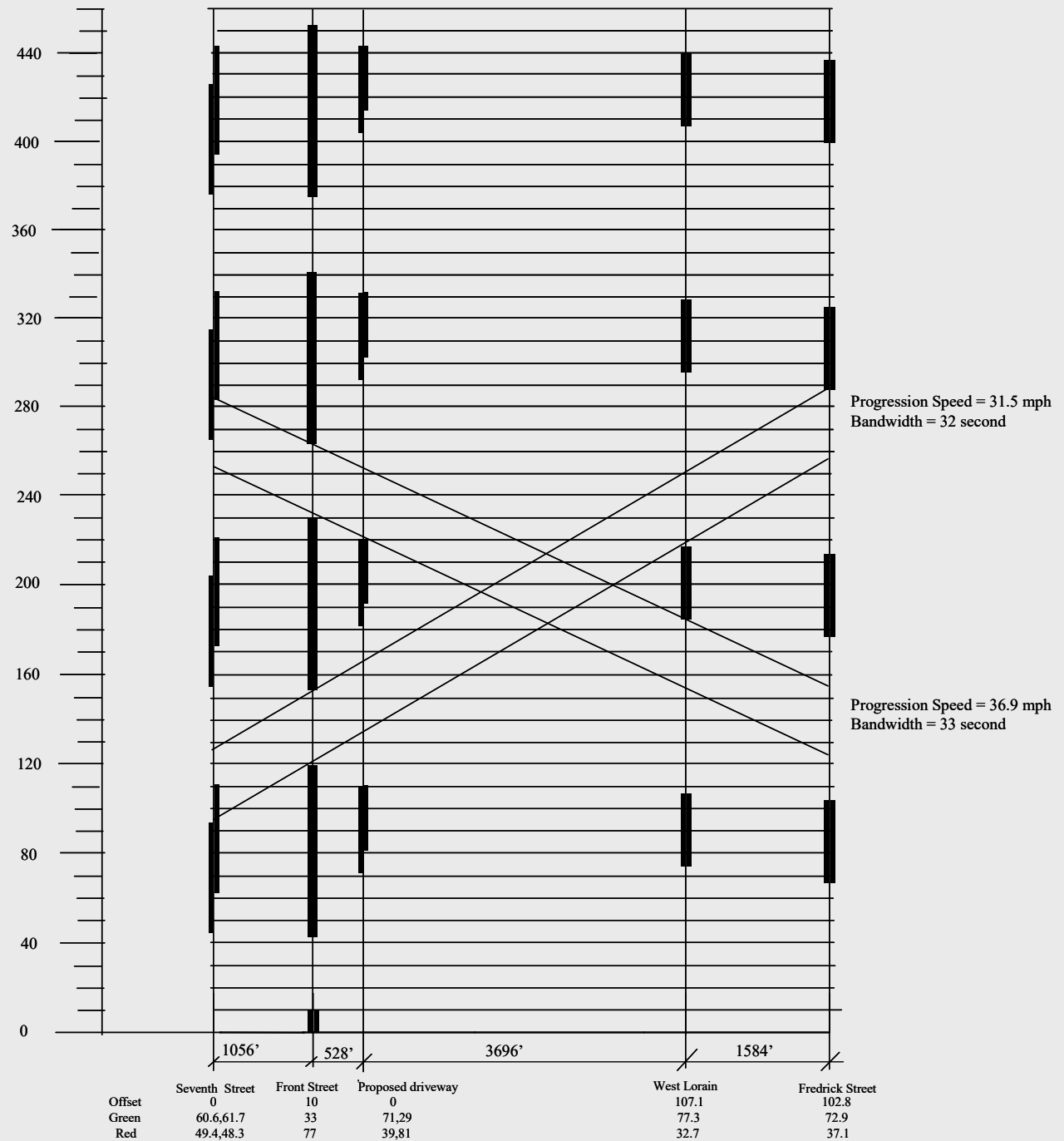
TIME (SEC)



$$V = \frac{D}{1.47 C} = \frac{3000}{1.47 * 80} = 25 \text{ mph}$$

$$V = \frac{D}{0.735 C} = \frac{3000}{0.735 * 80} = 51 \text{ mph}$$

Telegraph Road Corridor, Monroe, MI



Cycle Lengths

- All intersections in system are to have the same cycle length
 - **long enough to provide sufficient capacity at the busiest intersection**
- System cycle length is determined through a series of steps
 - **determine the minimum (optimum) cycle length at each intersection**
 - **as if they are isolated signals**

- **Speed and signal spacing are entered into the equation and solved for cycle length if the spacings between signals are approximately equal.**

- **Simultaneous System**

$$C = \frac{D}{1.47 V}$$

where: V = speed in mph
 D = signal spacing in feet
 C = cycle length in seconds

- **Alternative System**

$$C = \frac{D}{0.735 V}$$

-
- The pattern that has a cycle length closer to, but not less than the “maximum” cycle length is chosen
 - The cycle length may be selected from a range that has a lower limit calculated as 90% of the “maximum” cycle length

Offsets

- Number of seconds or percent of cycle length from the reference base of a time-space diagram to the first green indication
- Shown in time-space diagrams
 - The beginning of the first green from the reference base

Speed of Traffic versus Speed of Progression

- **Speed of progression**
 - **often selected to be the free-flow speed of traffic**
 - **Some engineers use it as speed limit.**
 - **speed that might be observed when volumes are light and the signals are continuously green on that route**
- **As traffic becomes heavy (peak periods)**
 - **traffic speeds tend to drop because of congestion**
 - **traffic starting up on a green signal may be stopped by a queue not yet into motion at the next signal downstream**

Definitions of Flow, Density & Speed

- **Flow** is defined as the number of vehicles traversing a point of roadway per unit time. *Unit: vehicles per hour.*
- **Density** is the number of vehicles occupying a given length of lane or roadway averaged over time.
Unit: vehicles per mile.
- **Speed** is defined as the distance traversed by a vehicle per unit time.
Unit: miles per hour.

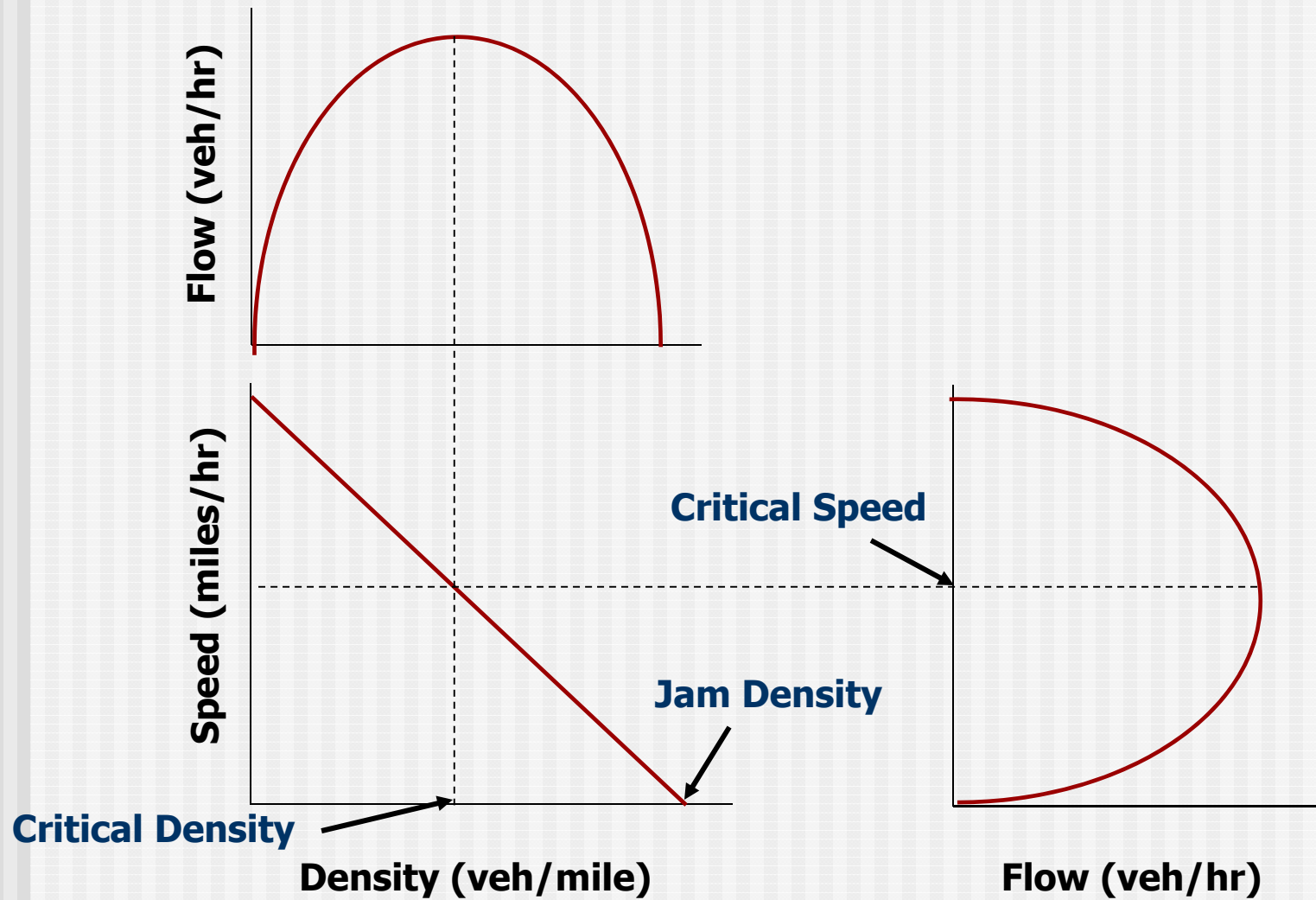
q-K-V Relationship

Flow (veh/hr)

= Density (veh/mile) x Speed (miles/hr)

Therefore, $q = K \times V$

q-K-V Curves



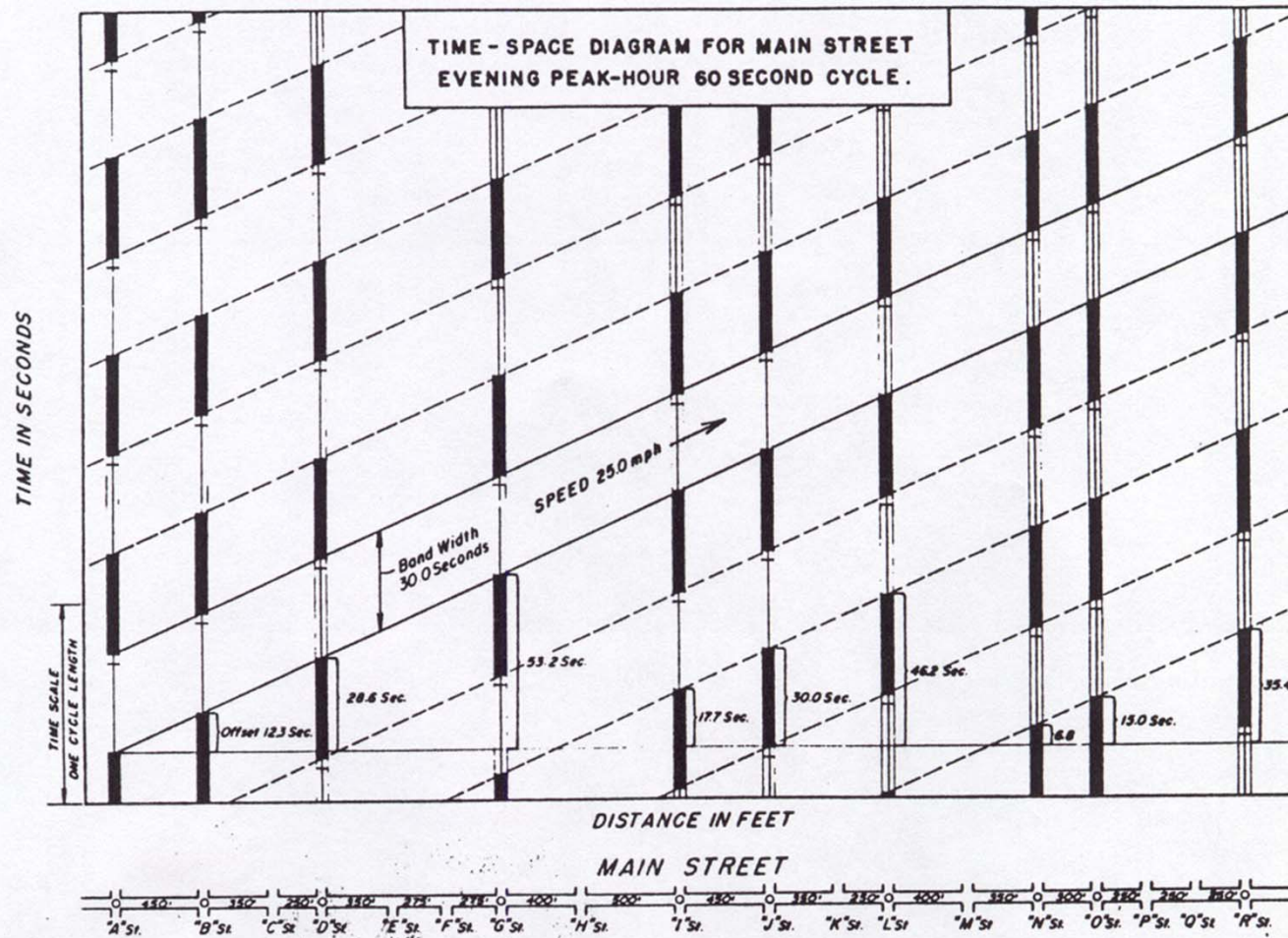


FIGURE 10 Time-space diagram favoring one direction of flow (36).

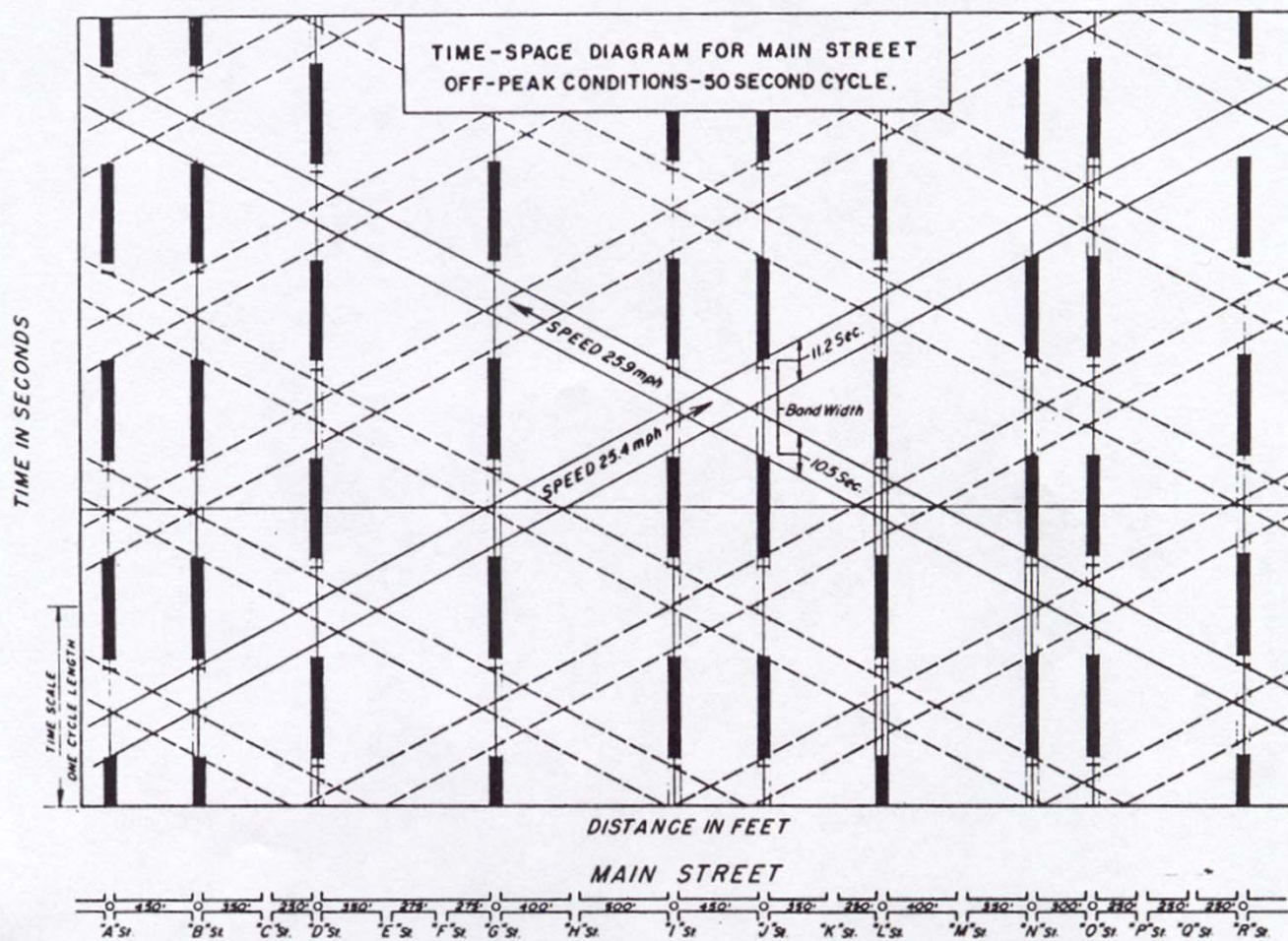
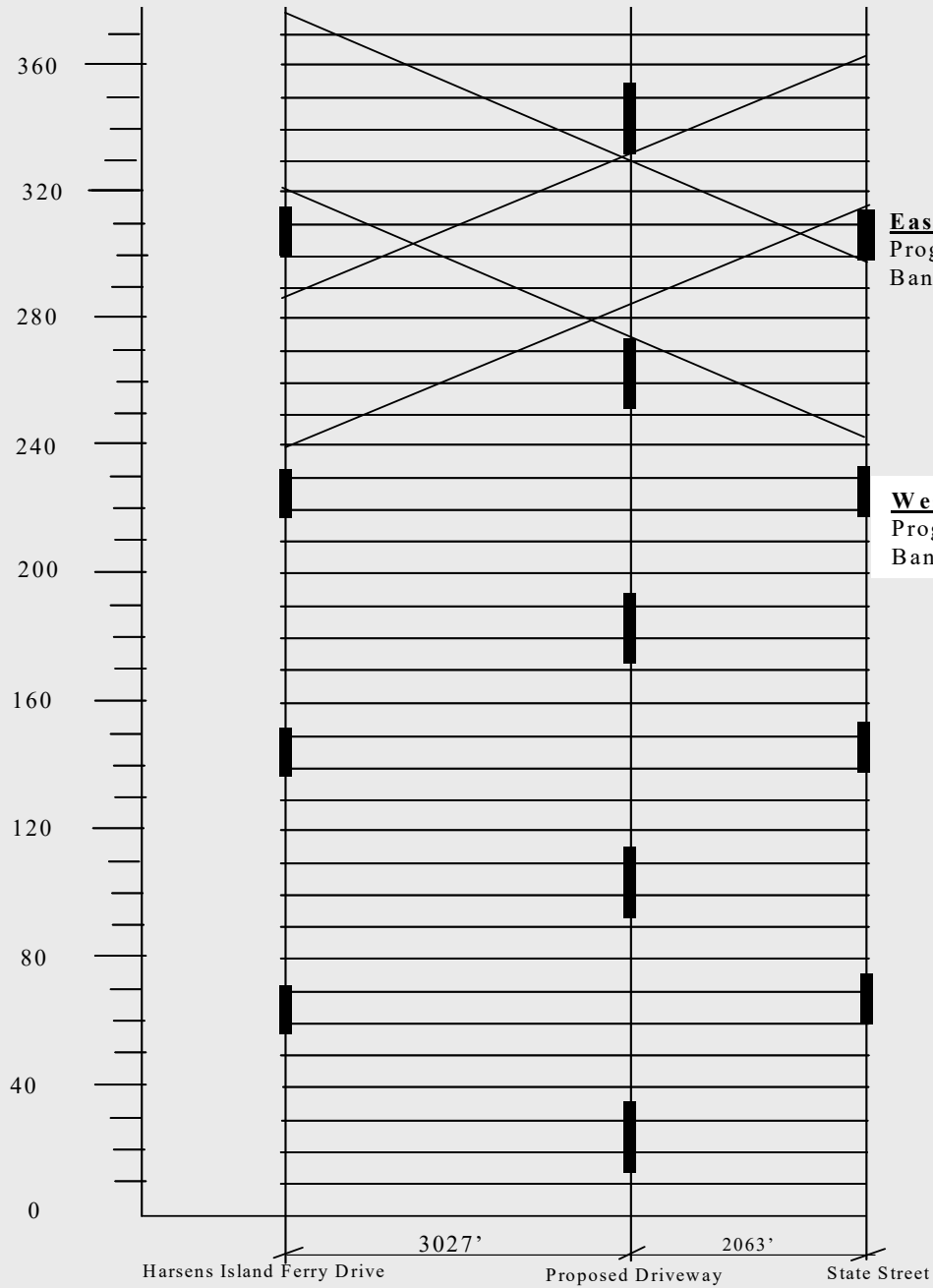


FIGURE 11 Time-space diagram favoring both directions equally (36).

Time Space Diagram for Progression on M-29 80-Second Cycle Length and 45 mph

TIME (SEC)



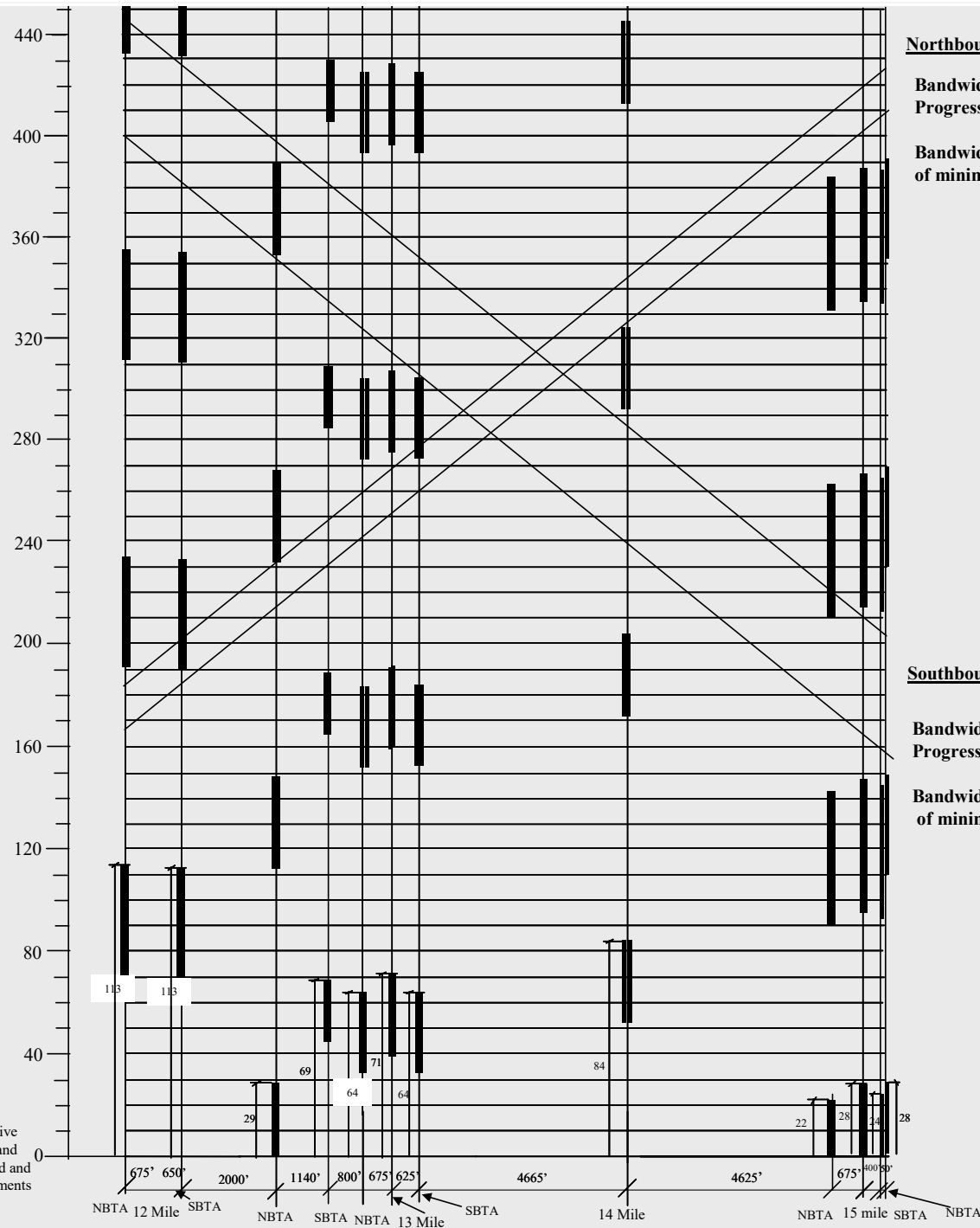
Eastbound Progression
Progression Speed = 45 mph
Bandwidth = 46 seconds

Westbound Progression
Progression Speed = 45 mph
Bandwidth = 55 seconds

Telegraph Road Corridor from 12 Mile Road to Maple Road

Existing PM Peak Hour

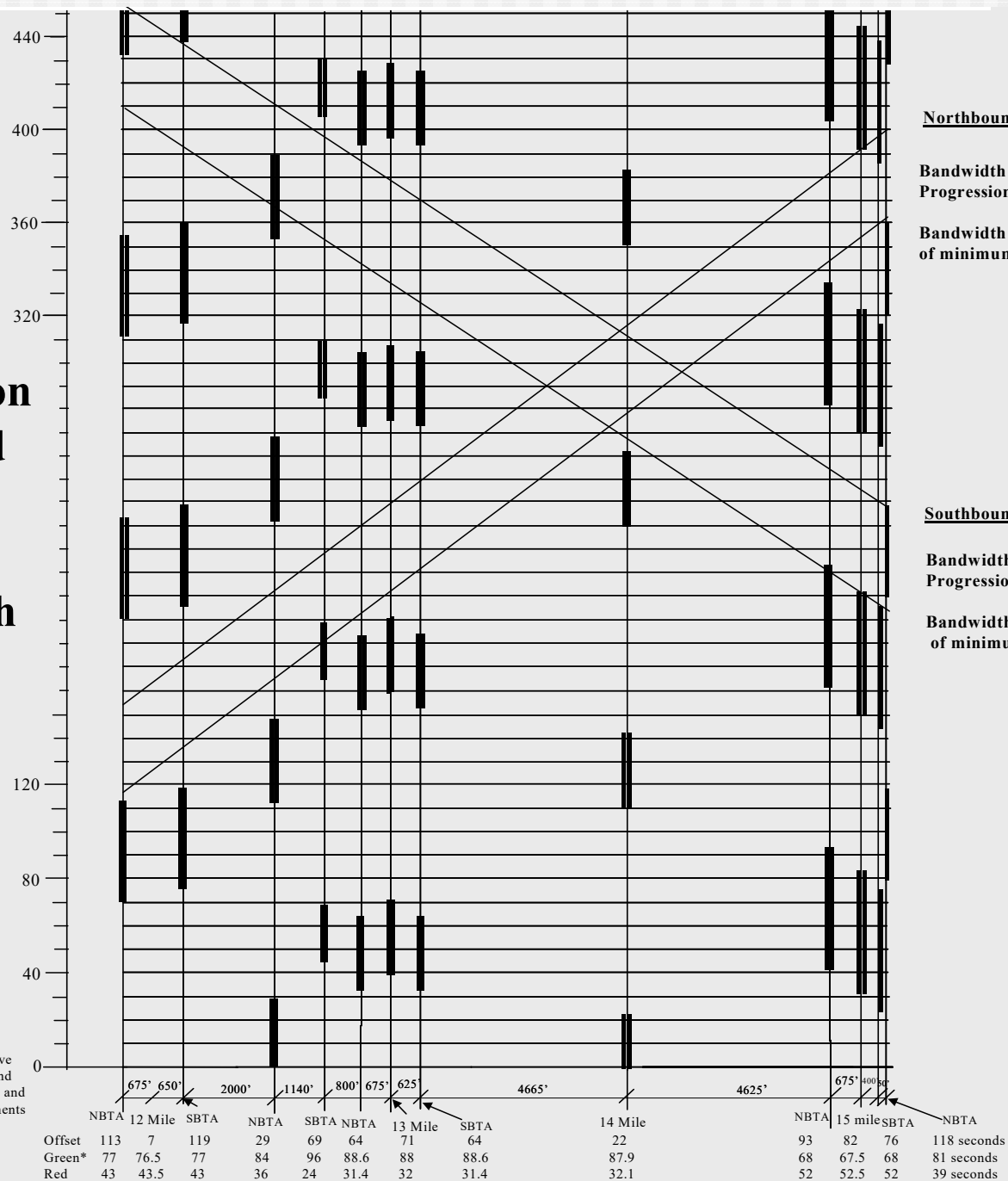
*Please note that the effective green time includes green and amber times for northbound and southbound through movements



Proposed Progression on Telegraph Road PM PEAK

120 sec Cycle length
For 45 mph

*Please note that the effective green time includes green and amber times for northbound and southbound through movements



Northbound Telegraph Road

Bandwidth = 40 sec
Progression speed = 45 mph

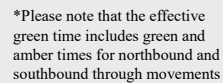
Bandwidth as a percent
of minimum green = 59 %

Southbound Telegraph Road

Bandwidth = 46 sec
Progression Speed = 50 mph

Bandwidth as a percent
of minimum Green = 68%

TIME (SEC)



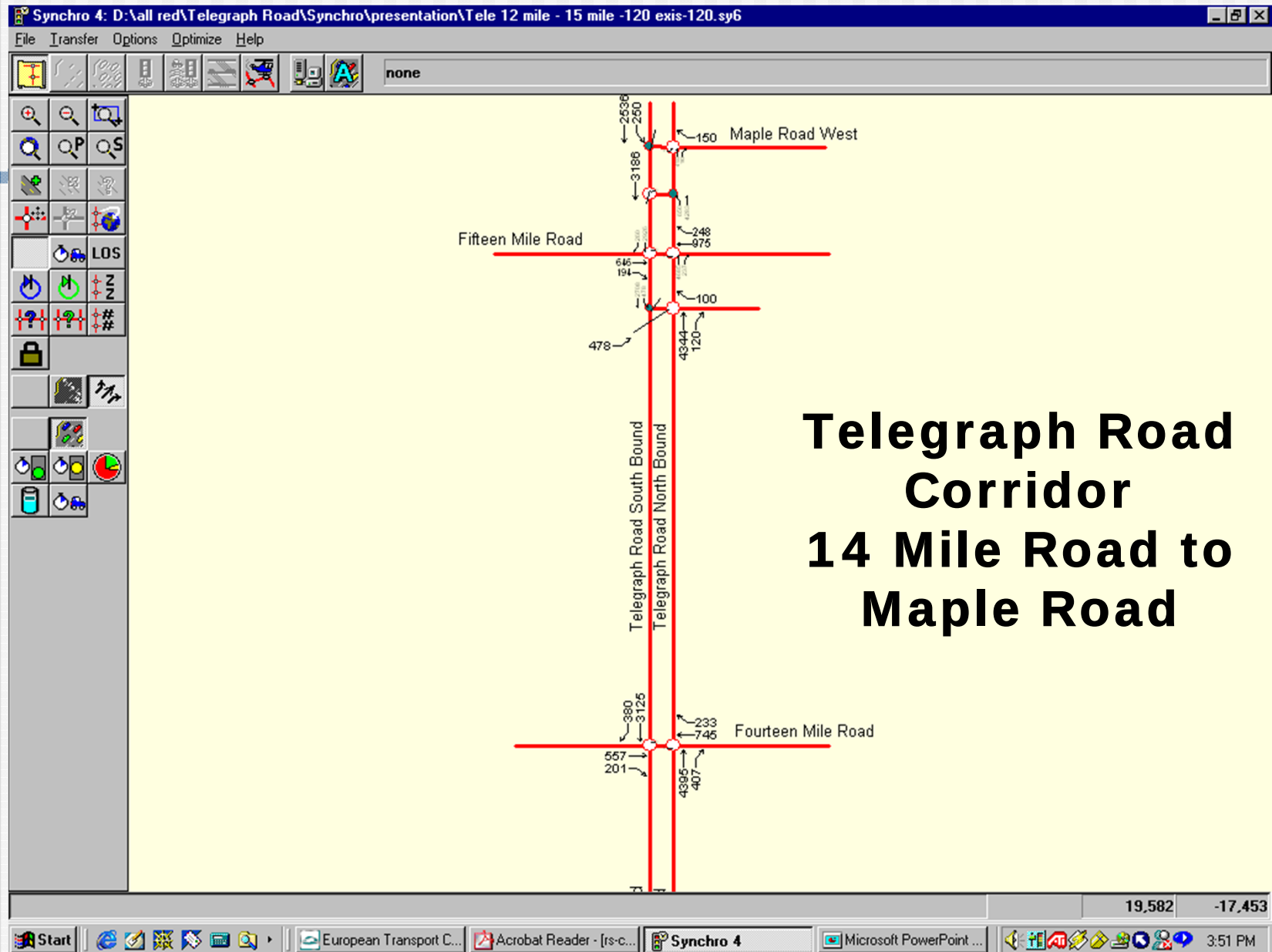
Other Considerations

- Traffic Turning into System
- Adjustments at End Intersections
- Adjustments for Left-Turn Phases
- Offsets for Maximum Bandwidths
- Offsets for Minimum Stops and Delay

Software Programs

- PASSER II- Optimize bandwidths
- TRANSYT 7F- Minimizes disutility function
- NETSIM- Optimizes synchronization
- Synchro- models and optimizes traffic signals
 - Optimizes to reduce delay
- SimTraffic- to check and fine tune signal operations

Synchro Software Program



SimTraffic 4: \\Datta14\c on DATTA14\G&G\algonac\ALGONAC\New synchro\m-29 sat future traffic 90-45.sy6

File Animate Graphics Options Help



Playback Time

7:00A 7:00:37A 7:10A



Proposed Drivew

SimTraffic Software Program M-29 Intersection in Algonac, MI

M-29

Boat Launch