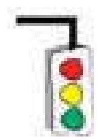
Laboratory 7.
Actuated Coordinated Traffic Signal Implementation



CONTENTS (LABORATORY 7)

1. INTRODUCTION

1.1 Background

The programming of an actuated-coordinated traffic control system is a complex task, much more so than the determination of the Cycle, Split, and Offset parameters that you covered in Laboratory 6. In fact a default traffic controller typically needs between 250 and 300 parameters configured to operate an a.m, p.m., and off peak coordinated schedule. In Laboratory 7, you will cover the step-by-step procedure necessary to program an actuated-coordinated system, and learn about the complex and interrelated data required to successfully operate such a system.

As part of this process, you will:

- Identify the phases used in the timing plan.
- Map detectors to phases.
- Specify the timing plans in a phase table, including the Yellow, All Red, Minimum Green, and Vehicle Extension times.
- Configure the coordination plans determining whether the plan will have fixed or floating force offs, the split patterns, and cycle and offset patterns.
- Configure the time-based scheduling plan, including linking coordination patterns to action plans, scheduling action plans to run certain hours of the day, and defining what day plans to run during each day, month, and year.

You will also exercise the controller to confirm that it has been properly configured, and observe the various aspects of its operation. When you have completed this lab, you will have the basis for a design checklist for a complete configuration of an actuated-coordinated traffic control system.

1.2 Goals and Learning Objectives

The goal of Laboratory 7 is to give you an in-depth understanding of the database elements required to define an actuated-coordinated traffic control system. When you have completed this lab, you will be able to:

- Identify and describe all of the parameters needed to operate an actuated-coordinated traffic control system.
- Successfully program a traffic controller with these parameters, and verify the operation of the system.
- Observe the operation of an actuated-coordinated traffic control system and identify various aspects of the performance of the system.

1.3 Organization and Time Allocation

Laboratory 7 is divided into five sections, including this introduction. The four sections that follow and the approximate time allocated to each section are listed in Table 1.

Table 1 Laboratory sections and approximate completion times

Section	Title	Approximate Time (min)
1	Introduction	5
2	Terms	5
3	Experiment #1: Programming controller parameters for coordination	60
4	Experiment #2: Design exercise- improving coordinated operation	60
5	Closure: Summary of key points learned	5

2. TERMS

Standard definitions for traffic signal terminology are provided by the National Electrical Manufacturers Association (NEMA) [9] and by the National Transportation Communications for ITS Protocol (NTCIP) 1202 document, "Object Definitions for Actuated Traffic Signal Controller Units" [2]. Definitions are also provided in the Federal Highway Administration's *Traffic Signal Timing Manual* [5]. The definitions presented here are adapted from these sources.

Actual Capacity: The maximum flow rate that could be served by a phase given its actual green time.

Actual Green: The amount of effective green time that a phase actually receives in a cycle. If a phase gaps out, its actual green will be less than the programmed green. If a phase receives additional green time from another phase that gaps out, its actual green may be greater than the programmed green.

Call: An actuation of a phase by vehicle detection or by an internal signal controller setting (a "recall"). A phase that is not called will be skipped.

Capacity: The maximum flow rate that can be served by a phase at an intersection. The units of this measure may be given as vehicles per hour per lane or vehicles per hour. The capacity of a phase represents the maximum volume that could utilize the phase.

Cycle Length: The amount of time needed to serve all of the called phases in a ring.

Effective Green: The amount of time in each split that is used by vehicles for movement. Because the start-up lost time is equal to the amount of clearance time in which vehicles move, the effective green is equal to the amount of time that the green indication is shown.

Effective Split: The proportion of the cycle that a phase is actually served. This may differ from the programmed splits, because of the reallocation of excess green due to phases gapping out.

Excess or Unused Green: The amount of green time that is yielded by a phase when it gaps out, or is skipped.

Fixed Force-Off: A force-off calculated relative to the cycle.

Floating Force-Off: A force-off calculated relative to the beginning of the phase.

Force-Off: The termination of a green indication at the point when the phase has reached its split time. The phase must terminate in order for following phases to be able to achieve their split times within the cycle length. Phases may extend beyond the split when they have acquired additional green time when preceding phases gap out or are not called.

Gap Out: A method of terminating a phase resulting when the Passage Timer expires.

Indication: The signal head color state (red, yellow, or green) displayed to a movement.

Lost Capacity: The maximum flow rate that can be served during the lost time, in which no movement takes place.

Lost Time: The amount of time in each split that is not used by vehicles for movement. It includes start-up lost time and unused clearance time.

Maximum Recall: A controller setting in which each phase is served to its force-off point. The controller operates as though there were calls constantly being placed on each detector. The resulting operation is equivalent to a fixed time plan.

Minimum Green: The minimum amount of time for a green indication that must be given to a phase.

Movement: A path of travel through an intersection that is regulated by a signal indication. Typical vehicle movements are left, through, and right.

Pattern: A set of cycle timing parameters (including cycle length and splits) that is used to control an operation. The splits are distributed based upon expected demand for movements. Various patterns are programmed into a controller.

Phase: A timing unit associated with the control of one or more indications or movements.

Programmed Capacity: The maximum flow rate that can be served by a phase given its programmed green time.

Programmed Green: The amount of effective green time that a phase would receive when in maximum recall mode. This time is determined by the split.

Ring: A series of phases that is repeated perpetually. In an eight-phase dual-ring configuration (shown in Figure 1), two rings run concurrently. Phases 1, 2, 3, and 4 form the upper ring, while phases 5, 6, 7, and 8 form the lower ring. The bold vertical lines in the figure are called barriers. A phase in one ring may run at the same time as a phase in the *other* ring that is on the *same side* of the barrier. For example, phase 1 may run at the same time as phase 5 or 6, but not at the same time as phase 2, or with phases 3, 4, 7, or 8.

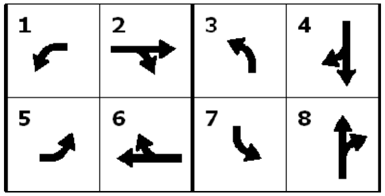


Figure 1 The ring diagram for a dual-ring, eight phase controller

Saturation Flow Rate: The maximum rate of flow that can be sustained through a lane of travel at an intersection. In this laboratory, a rate of 1900 vehicles per hour per lane is assumed.

Split: The percentage of a cycle that is expected to be used by a phase. This value is programmed into the controller, and used to determine the amount of green time given to the phase.

Split Time: The amount of time that is given to a phase expressed in seconds rather than a percentage.

Time of Day (TOD) Plan: The arrangement of controller patterns throughout a 24-hour period.

3. EXPERIMENT #1: PROGRAMMING CONTROLLER PARAMETERS FOR COORDINATION

3.1 Learning Objectives

- Understand the parameters that are needed to program a traffic controller for actuated-coordinated operation.
- Be able to program these parameters into the controller data base.

3.2 Overview

The purpose of this experiment is to provide you with an understanding of the set of parameters that are needed by the traffic controller to operate actuated-coordinated control. You will learn what parameters are needed, and what values need to be set for each parameter for the network that you will be considering. You will also gain experience in programming the ASC/3 controller with these parameters.

The system that you will use during this experiment is State Highway 8, a five-lane arterial located in the community of Moscow, Idaho. State Highway 8, shown here in Figure 2, consists of two through lanes in each direction and an exclusive left turn lane at each intersection. There is a distance of 3,065 feet between the intersections of Line Street on the right and Farm Road on the left.

3.3 Questions to Consider

As you begin this experiment, consider the following questions. You will come back to these questions once you have completed the experiment.

- How do the virtual controller and the database editor differ? Why is this important in this experiment?
- What is the difference between free and coordinated operation?
- What is the Split time?
- Why isn't the Maximum Green time needed in this timing plan?
- What is the effect of having different detectors call the same phase?
- What are the three parameters needed to specify a timing plan?

3.4 List of Steps

You will follow these steps during this experiment:

- Start the MOST software tool and open the input files.
- Identify and select the phases to be used.
- Map detectors to phases.
- Specify the timing plans in the phase table.
- Identify the coordination options and parameters, and enter the values for these parameters in the data base.
- Identify the time-based scheduling parameters to be used and enter the values for these parameters in the data base.
- Repeat steps 2 through 6 for the second controller.
- Run VISSIM to confirm that you have successfully entered the data correctly into the controller data base.

Figure 2 State Highway 8, Moscow, Idaho

3.5 Running the Experiment

During this experiment you will identify the data required by a traffic controller for the operation of a coordination-actuated traffic control system. Your primary tasks are to identify these parameters, understand their importance, document the values required for each parameter, and enter these data into the controller data base.

Step 1. Start the MOST software tool and open the input files.

- Start the MOST software tool and select "Open File."
- Locate the "MOST input files" folder.
- Go to the "Lab7" folder, then the "Exp1" folder
- Open the file: "lab7-exp1.inp."
- Select "Open ASC/3 Database Editor"
- Select controller 1001, then "Select Controller to View in Database Editor." See Figure 3.
- Figure 4 shows the controller screen for the ASC/3 database editor.

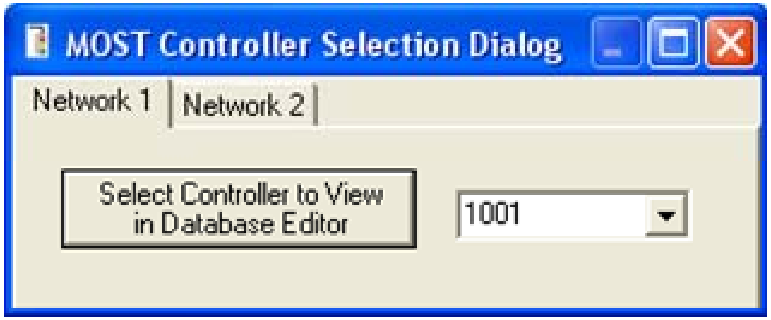


Figure 3 MOST Controller Selection

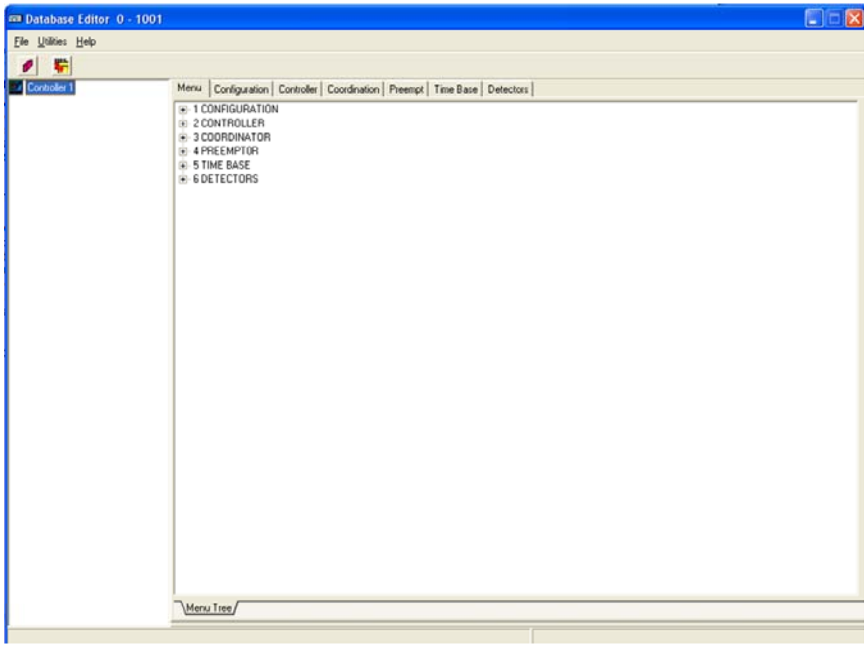


Figure 4 ASC/3 Database Editor

Step 2. Identify and select the phases used to be used.

- Study Figure 5 and Figure 6, which show the ring diagram and the phase and detector numbering, respectively, for each of the two intersections.

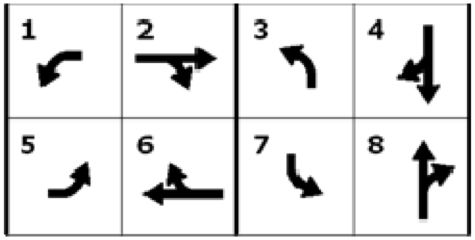


Figure 5 Ring diagram

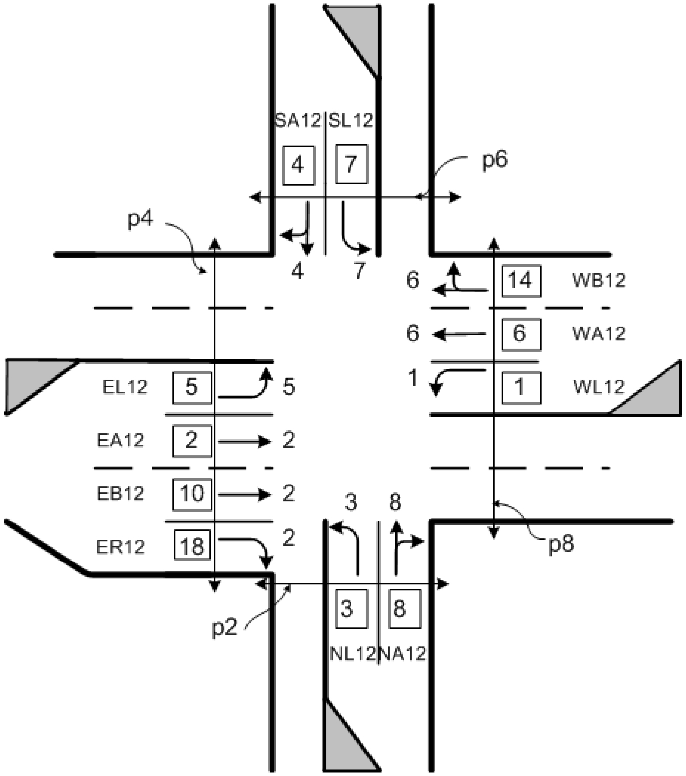


Figure 6 Phase and detector numbering

- Select the Configuration tab of the data base editor.
- Select the tab "Phase Sequence – Page 1" at the bottom of this screen.
- Enter the phases that operate in each ring, according to the ring diagram (Figure 5), in the box labeled in the figure as "Phases for each ring." For ring 1, the phases are numbered 1, 2, 3, and 4, in order. For ring 2, the phases are, in order: 5, 6, 7, and 8.
- Enter the phase compatibility data based on this ring diagram. Consult the ring diagram (Figure 5) to determine which phases are compatible and can operate concurrently. Then, enter an "X" in the appropriate boxes of the "Phase compatibility" matrix shown in Figure 7 for each pair of compatible phases.
- Select the tab "Phase Sequence – Page 2" at the bottom of this screen.
- Enter the "Phases in Use" data.

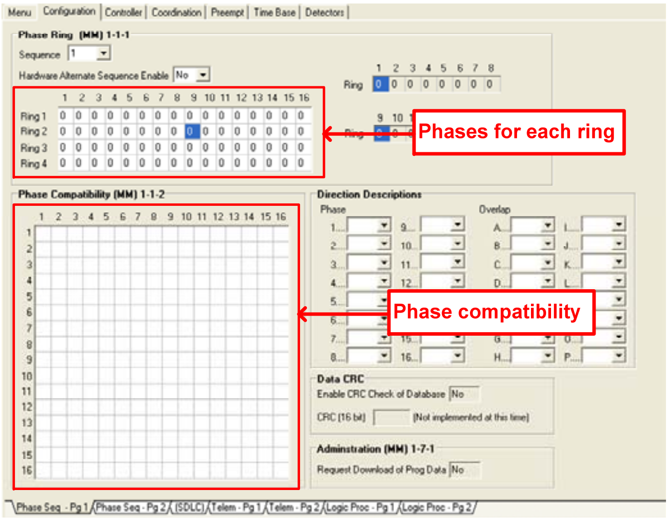


Figure 7 ASC/3 Controller data base screen (configuration)

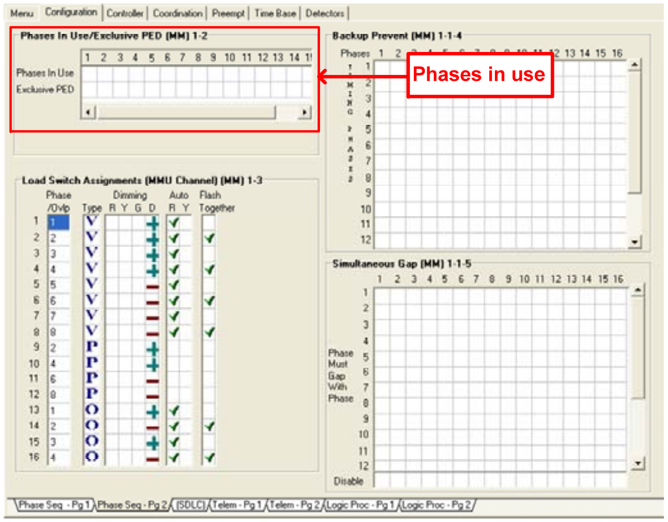


Figure 8 ASC/3 Controller data base screen (configuration)

Step 3. Map detectors to phases.

- Detector location and arrangement are important components of signal operation. Each of the two intersections is assumed to have stop bar detection with no advance detection. Each detector is assumed to be a 21' x 6' loop.
- The lane assignments of the detectors are shown in Figure 9 for both State Highway 8 intersections. The detectors are named based on lane and location. The boxed numbers represent the detector number. The arrows represent movements and the numbers nearest the intersection represent the phase number.
- Study Figure 9 to identify the manner in which detectors are mapped to the phases that they call. Also study the naming convention for the detectors and the lanes to which they are assigned.
- Table 2, shown on the next page, also provides detailed data for each detector and the phase to which it is mapped. This table contains both the NTCIP mnemonic and the object identifier (OID) that is used to precisely define what parameter is being entered.

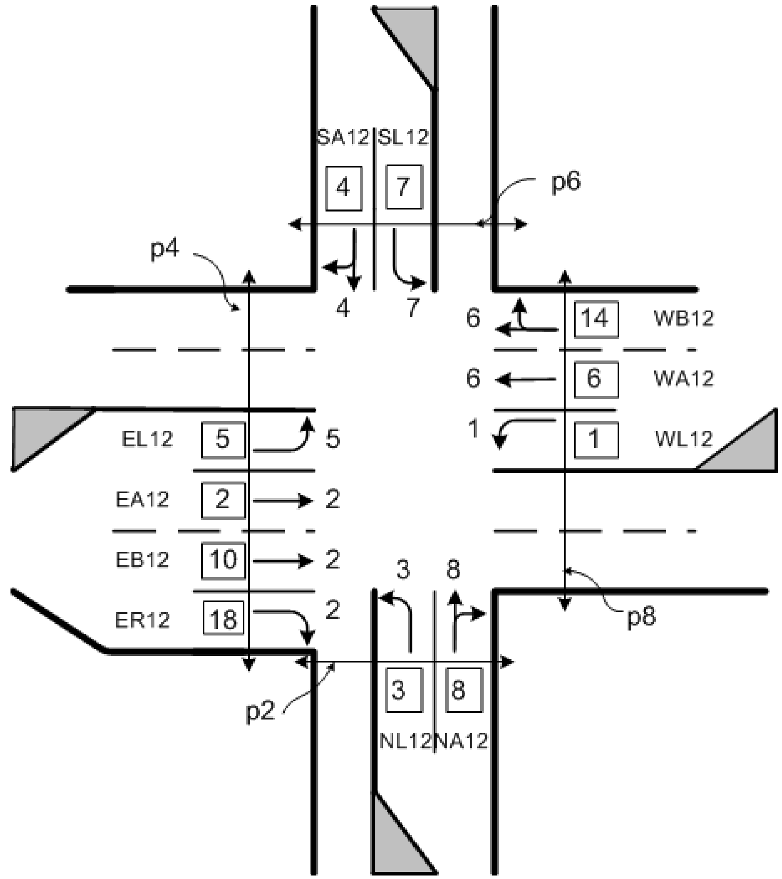


Figure 9 Phase and detector numbering

Table 2 Detector-Phase map

Channel	Lane name	Detector	Phase	Extend time
1	WL12	vehicleDetectorNumber.1 1.3.6.1.4.1.1206.4.2.1.2.2.1.1.1 1	vehicleDetectorCallPhase.1 1.3.6.1.4.1.1206.4.2.1.2.2.1.4.1 1	vehicleDetectorExtend.1 1.3.6.1.4.1.1206.4.2.1.2.2.1.7.1 0.0
2	EA12	vehicleDetectorNumber.2 1.3.6.1.4.1.1206.4.2.1.2.2.1.1.2 2	vehicleDetectorCallPhase.2 1.3.6.1.4.1.1206.4.2.1.2.2.1.4.2 2	vehicleDetectorExtend.2 1.3.6.1.4.1.1206.4.2.1.2.2.1.7.2 0.0
3	NL12	vehicleDetectorNumber.3 1.3.6.1.4.1.1206.4.2.1.2.2.1.1.3 3	vehicleDetectorCallPhase.3 1.3.6.1.4.1.1206.4.2.1.2.2.1.4.3 3	vehicleDetectorExtend.3 1.3.6.1.4.1.1206.4.2.1.2.2.1.7.3 0.0
4	SA12	vehicleDetectorNumber.4 1.3.6.1.4.1.1206.4.2.1.2.2.1.1.4 4	vehicleDetectorCallPhase.4 1.3.6.1.4.1.1206.4.2.1.2.2.1.4.4 4	vehicleDetectorExtend.1 1.3.6.1.4.1.1206.4.2.1.2.2.1.7.1 0.0
5	EL12	vehicleDetectorNumber.5 1.3.6.1.4.1.1206.4.2.1.2.2.1.1.5 5	vehicleDetectorCallPhase.5 1.3.6.1.4.1.1206.4.2.1.2.2.1.4.5 5	vehicleDetectorExtend.5 1.3.6.1.4.1.1206.4.2.1.2.2.1.7.5 0.0
6	WA12	vehicleDetectorNumber.6 1.3.6.1.4.1.1206.4.2.1.2.2.1.1.6 6	vehicleDetectorCallPhase.6 1.3.6.1.4.1.1206.4.2.1.2.2.1.4.6 6	vehicleDetectorExtend.6 1.3.6.1.4.1.1206.4.2.1.2.2.1.7.6 0.0
7	SL12	vehicleDetectorNumber.7 1.3.6.1.4.1.1206.4.2.1.2.2.1.1.7 7	vehicleDetectorCallPhase.7 1.3.6.1.4.1.1206.4.2.1.2.2.1.4.7 7	vehicleDetectorExtend.7 1.3.6.1.4.1.1206.4.2.1.2.2.1.7.7 0.0
8	NA12	vehicleDetectorNumber.8 1.3.6.1.4.1.1206.4.2.1.2.2.1.1.8 8	vehicleDetectorCallPhase.8 1.3.6.1.4.1.1206.4.2.1.2.2.1.4.8 8	vehicleDetectorExtend.8 1.3.6.1.4.1.1206.4.2.1.2.2.1.7.8 0.0
2	EB12	vehicleDetectorNumber.10 1.3.6.1.4.1.1206.4.2.1.2.2.1.1.10 10	vehicleDetectorCallPhase.10 1.3.6.1.4.1.1206.4.2.1.2.2.1.4.10 2	vehicleDetectorExtend.10 1.3.6.1.4.1.1206.4.2.1.2.2.1.7.10 0.0
6	WB12	vehicleDetectorNumber.14 1.3.6.1.4.1.1206.4.2.1.2.2.1.1.10 14	vehicleDetectorCallPhase.14 1.3.6.1.4.1.1206.4.2.1.2.2.1.4.10 6	vehicleDetectorExtend.14 1.3.6.1.4.1.1206.4.2.1.2.2.1.7.10 0.0
2	ER12	vehicleDetectorNumber.18 1.3.6.1.4.1.1206.4.2.1.2.2.1.1.18 18	vehicleDetectorCallPhase.18 1.3.6.1.4.1.1206.4.2.1.2.2.1.4.18 2	vehicleDetectorExtend.18 1.3.6.1.4.1.1206.4.2.1.2.2.1.7.18 0.0

Note: The data presented in each cell of the Detector, Phase, and Extend time columns include three parts, one listed in each row: (1) NTCIP description, (2) NTCIP OID, and (3) the value of the parameter.

- Select the “Detectors” tab in the data base editor.
- Using the data from Figure 9, enter the detector descriptions, detector setup, and the phase-detector mapping in the controller data base editor.
- By default, the detector number matches the assigned phase. As an example for detector 1, click on the pull down menu “Detector Number” under “Vehicle Detector Setup (MM) 6-2” Adjust this value to ‘1’. Also enter “1” in the “Assigned Phase” pull down. In the section noted as “Phase-Detector mapping” click a check in the box to the right of the word “Called” indicating that phase ‘1’ should be called.
- Repeat this assignment or mapping procedure for each detector number listed on the left of the screen. Note that only numbers 10, 14, and 18 are used beyond detector number 8. The key is to stay consistent and to be certain that a detector calls the appropriate phase for its location relative to the intersection.
- You do not need to enter any other data in this screen.

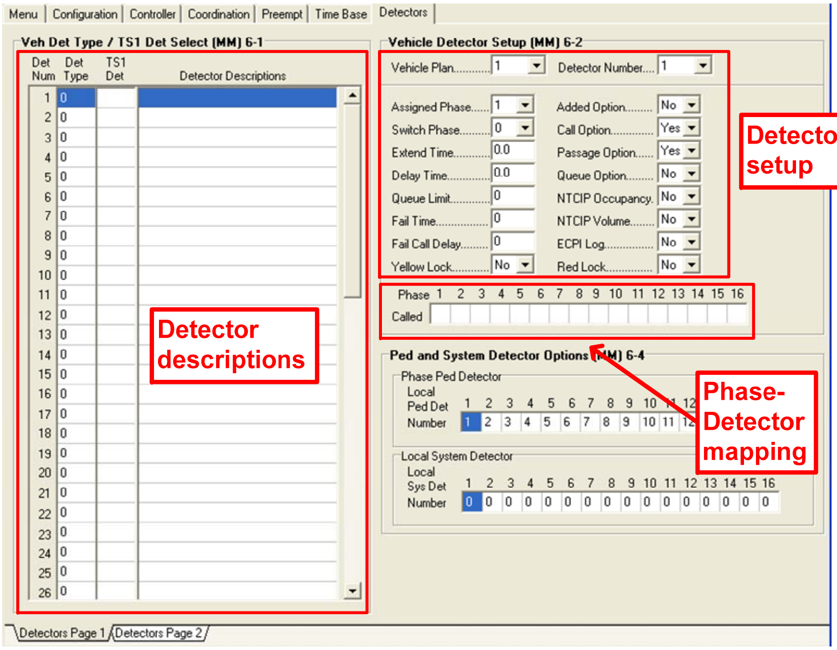


Figure 10 ASC/3 Controller data base screen (detector)

Step 4. Specify the timing plans in the phase table.

- Table 3 and Table 4 show the timing plan settings required for the phase table.
- The first column in each table shows the five parameters from the phase table that you will use: the plan number, the Yellow time, the Red clearance time, and the Vehicle Extension time.
- The second column lists the NTCIP object name and OID. As was discussed earlier, these NTCIP objects and OID's are defined in the NTCIP 1202 standard.
- The third column lists the value that you will enter into the data base.

Table 3 Timing plan settings (phase table data)

ASC3 Screen Parameter	NTCIP Object NTCIP OID	Value
Plan #	asc3tbTimingPlan: 1.3.6.1.4.1.1206.3.5.2.14.19.1.4	1
MinGreen	phaseMinimumGreen.1 1.3.6.1.4.1.1206.4.2.1.1.2.1.4.1	4
	phaseMinimumGreen.2 1.3.6.1.4.1.1206.4.2.1.1.2.1.4.2	4
	phaseMinimumGreen.3 1.3.6.1.4.1.1206.4.2.1.1.2.1.4.3	4
	phaseMinimumGreen.4 1.3.6.1.4.1.1206.4.2.1.1.2.1.4.4	4
	phaseMinimumGreen.5 1.3.6.1.4.1.1206.4.2.1.1.2.1.4.5	4
	phaseMinimumGreen.6 1.3.6.1.4.1.1206.4.2.1.1.2.1.4.6	4
	phaseMinimumGreen.7 1.3.6.1.4.1.1206.4.2.1.1.2.1.4.7	4
	phaseMinimumGreen.8 1.3.6.1.4.1.1206.4.2.1.1.2.1.4.8	4
Yellow	phaseYellowChange.1 1.3.6.1.4.1.1206.4.2.1.1.2.1.8.1	3.5
	phaseYellowChange.2 1.3.6.1.4.1.1206.4.2.1.1.2.1.8.2	3.5
	phaseYellowChange.3 1.3.6.1.4.1.1206.4.2.1.1.2.1.8.3	3.5
	phaseYellowChange.4 1.3.6.1.4.1.1206.4.2.1.1.2.1.8.4	3.5
	phaseYellowChange.5 1.3.6.1.4.1.1206.4.2.1.1.2.1.8.5	3.5
	phaseYellowChange.6 1.3.6.1.4.1.1206.4.2.1.1.2.1.8.6	3.5
	phaseYellowChange.7 1.3.6.1.4.1.1206.4.2.1.1.2.1.8.7	3.5
	phaseYellowChange.8 1.3.6.1.4.1.1206.4.2.1.1.2.1.8.8	3.5

Table 4 Timing plan settings (phase table data)

Red CLR	phaseRedClear.1 1.3.6.1.4.1.1206.4.2.1.1.2.1.9.1	2.0
	phaseRedClear.2 1.3.6.1.4.1.1206.4.2.1.1.2.1.9.2	2.0
	phaseRedClear.3 1.3.6.1.4.1.1206.4.2.1.1.2.1.9.3	1.8
	phaseRedClear.4 1.3.6.1.4.1.1206.4.2.1.1.2.1.9.4	1.8
	phaseRedClear.5 1.3.6.1.4.1.1206.4.2.1.1.2.1.9.5	2.0
	phaseRedClear.6 1.3.6.1.4.1.1206.4.2.1.1.2.1.9.6	2.0
	phaseRedClear.7 1.3.6.1.4.1.1206.4.2.1.1.2.1.9.7	1.8
	phaseRedClear.8 1.3.6.1.4.1.1206.4.2.1.1.2.1.9.8	1.8
Vehicle Ext	phasePassage.1 1.3.6.1.4.1.1206.4.2.1.1.2.1.5.1	3.0
	phasePassage.2 1.3.6.1.4.1.1206.4.2.1.1.2.1.5.2	3.0
	phasePassage.3 1.3.6.1.4.1.1206.4.2.1.1.2.1.5.3	3.0
	phasePassage.4 1.3.6.1.4.1.1206.4.2.1.1.2.1.5.4	3.0
	phasePassage.5 1.3.6.1.4.1.1206.4.2.1.1.2.1.5.5	3.0
	phasePassage.6 1.3.6.1.4.1.1206.4.2.1.1.2.1.5.6	3.0
	phasePassage.7 1.3.6.1.4.1.1206.4.2.1.1.2.1.5.7	3.0
	phasePassage.8 1.3.6.1.4.1.1206.4.2.1.1.2.1.5.8	3.0

- Select the "Controllers" tab in the data base editor. See Figure 11. You will use the first tab (of the five tabs shown at the bottom of the screen), marked "Timing Plan."
- Using the data from Table 3, enter the timing data in the data base editor, including the values for the following parameters:
  1. Minimum Green time.
  2. Yellow time.
  3. Red Clearance time.
  4. Vehicle Extension time.
  5. Max1 time.
- For the Max1 time, enter the following values:

Phase	Max1 time
1	8
2	20
3	8
4	24
5	8
6	20
7	9
8	23

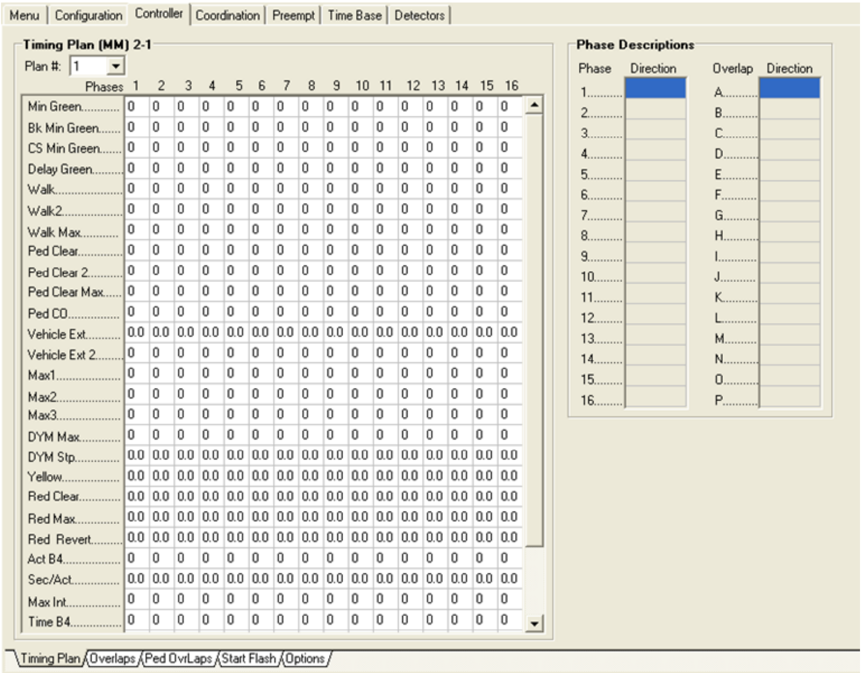


Figure 11 ASC/3 Controller data base screen (controller)

Step 5. Identify the coordination options and parameters and enter the values for these parameters in the data base.

- In this step you will enter the coordination options data, including floating or fixed force-offs, split patterns and cycle and offset patterns.
- A set of tables on the following pages document the required coordinator data.
- Table 5 shows the data for the coordinator “Options” settings.
- Enter these data in the “Options” portion of the Coordination screen, as shown in Figure 12.
- The purpose of changing the “Offset Ref” is to allow the offset to reference a fixed point necessary for keeping the cycle length consistent.
- The “Splits In” and “Offset In” define how the splits and offset are written into the controller. This is a user preference that can be set either way as long as the programmer is consistent in the related sections of the data base.

Table 5 Coordinator options settings

ASC3 Screen Parameter	NTCIP Object NTCIP OID	Value
Manual Pattern	coordOperationalMode.0 1.3.6.1.4.1.1206.4.2.1.4.1.0	0 (Auto)
INTCONT Format	asc3crdInterconnect Format 1.3.6.1.4.1.1206.3.5.2.13.13	3 (PTN)
Offset Ref	asc3crdOffsetRef 1.3.6.1.4.1.1206.3.5.2.13.4	4 (Yell)
Force Off	coordForceMode.0 1.3.6.1.4.1.1206.4.2.1.4.4.0	1,2(Float, Fixed)
Splits In	asc3ptnSplitUnit.1 1.3.6.1.4.1.1206.3.5.2.13.16.1.10	2 (Percent)
Offsets In	asc3ptnOffsetUnit.1 1.3.6.1.4.1.1206.3.5.2.13.16.1.11	1 (Seconds)

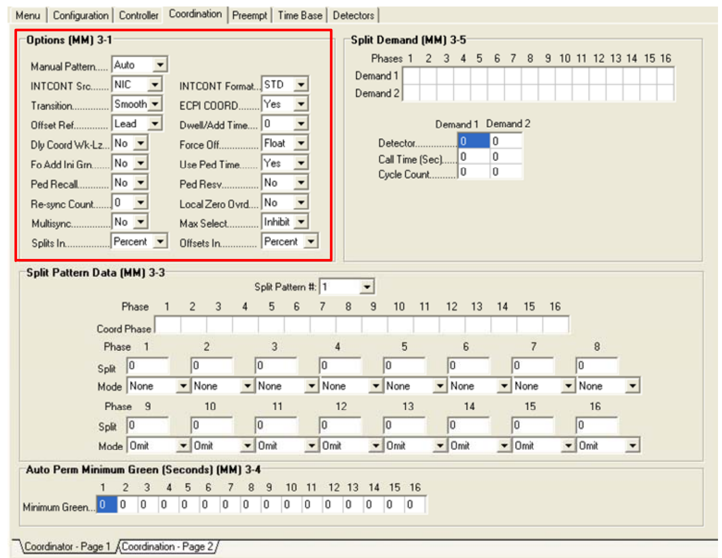


Figure 12 ASC/3 Controller data base screen (configuration)

- Table 6, Table 7, Table 8, and Table 9 show the "Split Pattern" data settings for Patterns 1, 2, 3, and 4, respectively. In the field, these might represent the AM, midday, PM, and night traffic demand at the intersection.
- The split pattern is defined by three sets of data. The coordinated phases are identified first. Then the split times and modes are set for each phase.

Table 6 Split Pattern data settings (Pattern 1)

ASC3 Screen Parameter	NTCIP Object NTCIP OID	Value
Split Pattern #	splitNumber1.1 1.3.6.1.4.1.1206.4.2.1.4.9.1.1.1.1	1
Coordinated Phase	splitCoordPhase.1.2 1.3.6.1.4.1.1206.4.2.1.4.9.1.5.1.2	1(2)
	splitCoordPhase.1.6 1.3.6.1.4.1.1206.4.2.1.4.9.1.5.1.6	1(6)
Split	splitTime.1.1 1.3.6.1.4.1.1206.4.2.1.4.9.1.3.1.1	17
	splitTime.1.2 1.3.6.1.4.1.1206.4.2.1.4.9.1.3.1.2	38
	splitTime.1.3 1.3.6.1.4.1.1206.4.2.1.4.9.1.3.1.3	17
	splitTime.1.4 1.3.6.1.4.1.1206.4.2.1.4.9.1.3.1.4	28
	splitTime.1.5 1.3.6.1.4.1.1206.4.2.1.4.9.1.3.1.5	17
	splitTime.1.6 1.3.6.1.4.1.1206.4.2.1.4.9.1.3.1.6	38
	splitTime.1.7 1.3.6.1.4.1.1206.4.2.1.4.9.1.3.1.7	17
	splitTime.1.8 1.3.6.1.4.1.1206.4.2.1.4.9.1.3.1.8	28
Mode	splitMode.1.1 1.3.6.1.4.1.1206.4.2.1.4.9.1.4.1.1	4 (Max)
	splitMode.1.2 1.3.6.1.4.1.1206.4.2.1.4.9.1.4.1.2	4 (Max)
	splitMode.1.3 1.3.6.1.4.1.1206.4.2.1.4.9.1.4.1.3	4 (Max)
	splitMode.1.4 1.3.6.1.4.1.1206.4.2.1.4.9.1.4.1.4	4 (Max)
	splitMode.1.5 1.3.6.1.4.1.1206.4.2.1.4.9.1.4.1.5	4 (Max)
	splitMode.1.6 1.3.6.1.4.1.1206.4.2.1.4.9.1.4.1.6	4 (Max)
	splitMode.1.7 1.3.6.1.4.1.1206.4.2.1.4.9.1.4.1.7	4 (Max)
	splitMode.1.8 1.3.6.1.4.1.1206.4.2.1.4.9.1.4.1.8	4 (Max)

Table 7 Split Pattern data settings (Pattern 2)

ASC3 Screen Parameter	Econolite Terminology	Value
Split Pattern #	splitNumber.2.1 1.3.6.1.4.1.1206.4.2.1.4.9.1.1.2.1	2
Coordinated Phase	splitCoordPhase.2.2 1.3.6.1.4.1.1206.4.2.1.4.9.1.5.2.2	1(2)
	splitCoordPhase.2.6 1.3.6.1.4.1.1206.4.2.1.4.9.1.5.2.6	1(6)
Split	splitTime.2.1 1.3.6.1.4.1.1206.4.2.1.4.9.1.3.2.1	14
	splitTime.2.2 1.3.6.1.4.1.1206.4.2.1.4.9.1.3.2.2	39
	splitTime.2.3 1.3.6.1.4.1.1206.4.2.1.4.9.1.3.2.3	12
	splitTime.2.4 1.3.6.1.4.1.1206.4.2.1.4.9.1.3.2.4	35
	splitTime.2.5 1.3.6.1.4.1.1206.4.2.1.4.9.1.3.2.5	14
	splitTime.2.6 1.3.6.1.4.1.1206.4.2.1.4.9.1.3.2.6	39
	splitTime.2.7 1.3.6.1.4.1.1206.4.2.1.4.9.1.3.2.7	20
	splitTime.2.8 1.3.6.1.4.1.1206.4.2.1.4.9.1.3.2.8	27
Mode	splitMode.2.1 1.3.6.1.4.1.1206.4.2.1.4.9.1.4.2.1	4 (Max)
	splitMode.2.2 1.3.6.1.4.1.1206.4.2.1.4.9.1.4.2.2	4 (Max)
	splitMode.2.3 1.3.6.1.4.1.1206.4.2.1.4.9.1.4.2.3	4 (Max)
	splitMode.2.4 1.3.6.1.4.1.1206.4.2.1.4.9.1.4.2.4	4 (Max)
	splitMode.2.5 1.3.6.1.4.1.1206.4.2.1.4.9.1.4.2.5	4 (Max)
	splitMode.2.6 1.3.6.1.4.1.1206.4.2.1.4.9.1.4.2.6	4 (Max)
	splitMode.2.7 1.3.6.1.4.1.1206.4.2.1.4.9.1.4.2.7	4 (Max)
	splitMode.2.8 1.3.6.1.4.1.1206.4.2.1.4.9.1.4.2.8	4 (Max)

Table 8 Split Pattern data settings (Pattern 3)

ASC3 Screen Parameter	NTCIP Object NTCIP OID	Value
Split Pattern #	splitNumber3.1 1.3.6.1.4.1.1206.4.2.1.4.9.1.1.3.1	3
Coordinated Phase	splitCoordPhase.3.2 1.3.6.1.4.1.1206.4.2.1.4.9.1.5.3.2	1(2)
	splitCoordPhase.3.6 1.3.6.1.4.1.1206.4.2.1.4.9.1.5.3.6	1(6)
Split	splitTime.3.1 1.3.6.1.4.1.1206.4.2.1.4.9.1.3.3.1	12
	splitTime.3.2 1.3.6.1.4.1.1206.4.2.1.4.9.1.3.3.2	34
	splitTime.3.3 1.3.6.1.4.1.1206.4.2.1.4.9.1.3.3.3	23
	splitTime.3.4 1.3.6.1.4.1.1206.4.2.1.4.9.1.3.3.4	31
	splitTime.3.5 1.3.6.1.4.1.1206.4.2.1.4.9.1.3.3.5	12
	splitTime.3.6 1.3.6.1.4.1.1206.4.2.1.4.9.1.3.3.6	34
	splitTime.3.7 1.3.6.1.4.1.1206.4.2.1.4.9.1.3.3.7	30
	splitTime.3.8 1.3.6.1.4.1.1206.4.2.1.4.9.1.3.3.8	24
Mode	splitMode.3.1 1.3.6.1.4.1.1206.4.2.1.4.9.1.4.3.1	2(None)
	splitMode.3.2 1.3.6.1.4.1.1206.4.2.1.4.9.1.4.3.2	4 (Max)
	splitMode.3.3 1.3.6.1.4.1.1206.4.2.1.4.9.1.4.3.3	2 (None)
	splitMode.3.4 1.3.6.1.4.1.1206.4.2.1.4.9.1.4.3.4	2 (None)
	splitMode.3.5 1.3.6.1.4.1.1206.4.2.1.4.9.1.4.3.5	2 (None)
	splitMode.3.6 1.3.6.1.4.1.1206.4.2.1.4.9.1.4.3.6	4 (Max)
	splitMode.3.7 1.3.6.1.4.1.1206.4.2.1.4.9.1.4.3.7	2 (None)
	splitMode.3.8 1.3.6.1.4.1.1206.4.2.1.4.9.1.4.3.8	2 (None)

Table 9 Split Pattern data settings (Pattern 4)

ASC3 Screen Parameter	NTCIP Object NTCIP OID	Value
Split Pattern #	splitNumber4.1 1.3.6.1.4.1.1206.4.2.1.4.9.1.1.4.1	4
Coordinated Phase	splitCoordPhase.4.2 1.3.6.1.4.1.1206.4.2.1.4.9.1.5.4.2	1(2)
	splitCoordPhase.4.6 1.3.6.1.4.1.1206.4.2.1.4.9.1.5.4.6	1(6)
Split	splitTime.4.1 1.3.6.1.4.1.1206.4.2.1.4.9.1.3.4.1	12
	splitTime.4.2 1.3.6.1.4.1.1206.4.2.1.4.9.1.3.4.2	34
	splitTime.4.3 1.3.6.1.4.1.1206.4.2.1.4.9.1.3.4.3	23
	splitTime.4.4 1.3.6.1.4.1.1206.4.2.1.4.9.1.3.4.4	31
	splitTime.4.5 1.3.6.1.4.1.1206.4.2.1.4.9.1.3.4.5	12
	splitTime.4.6 1.3.6.1.4.1.1206.4.2.1.4.9.1.3.4.6	34
	splitTime.4.7 1.3.6.1.4.1.1206.4.2.1.4.9.1.3.4.7	30
	splitTime.4.8 1.3.6.1.4.1.1206.4.2.1.4.9.1.3.4.8	24
Mode	splitMode.4.1 1.3.6.1.4.1.1206.4.2.1.4.9.1.4.4.1	2(None)
	splitMode.4.2 1.3.6.1.4.1.1206.4.2.1.4.9.1.4.4.2	4 (Max)
	splitMode.4.3 1.3.6.1.4.1.1206.4.2.1.4.9.1.4.4.3	2 (None)
	splitMode.4.4 1.3.6.1.4.1.1206.4.2.1.4.9.1.4.4.4	2 (None)
	splitMode.4.5 1.3.6.1.4.1.1206.4.2.1.4.9.1.4.4.5	2 (None)
	splitMode.4.6 1.3.6.1.4.1.1206.4.2.1.4.9.1.4.4.6	4 (Max)
	splitMode.4.7 1.3.6.1.4.1.1206.4.2.1.4.9.1.4.4.7	2 (None)
	splitMode.4.8 1.3.6.1.4.1.1206.4.2.1.4.9.1.4.4.8	2 (None)

- Enter these data into the “Split Pattern” portion of the Coordination screen, as shown in Figure 13.
- Each split pattern is defined by its number, using the “Split Pattern #” from the pull down menu. This value will be 1 through 4, each defining a different split pattern. Below the split number, mark the appropriate coordinated phases. In this case, the coordinated phases are 2 and 6. Under Phases 1 through 8 enter a number for split percentage and a mode.
- The values inserted for the Split are the percentages of each cycle provided for each phase. The mode describes how the split will operate. For example, “max” means the phase is in maximum recall and will operate as long as permitted by the split pattern. “None” means that the phase is not required to even start if there is not a vehicle call present for that phase. In this case a vehicle present would trigger the phase to run to its minimum green while detecting for vehicle extension.

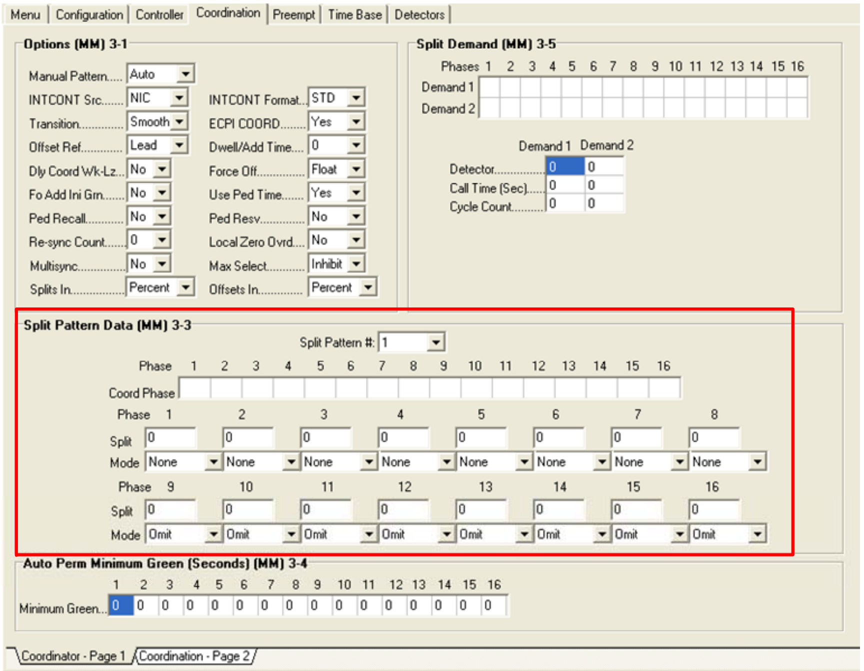


Figure 13 ASC/3 Controller data base screen (coordination)

- Table 10 shows the Auto Perm Minimum Green data settings.
- This parameter, and the value assigned to it, is a safeguard against a minimum green being accidentally set below a safe threshold given driver expectation.
- In this case, we will use a value of 4 seconds. Enter these data into the “Auto Perm Minimum Green” portion of the Coordination screen, as shown in Figure 14.

Table 10 Auto Perm Minimum Green settings

ASC3 Screen Parameter	NTCIP Object NTCIP OID	Value
Minimum Green	asc3crdAutoPermMinGrn.1 1.3.6.1.4.1.1206.3.5.2.13.19.1.1.1	4
	asc3crdAutoPermMinGrn.2 1.3.6.1.4.1.1206.3.5.2.13.19.1.1.2	4
	asc3crdAutoPermMinGrn.3 1.3.6.1.4.1.1206.3.5.2.13.19.1.1.3	4
	asc3crdAutoPermMinGrn.4 1.3.6.1.4.1.1206.3.5.2.13.19.1.1.4	4
	asc3crdAutoPermMinGrn.5 1.3.6.1.4.1.1206.3.5.2.13.19.1.1.5	4
	asc3crdAutoPermMinGrn.6 1.3.6.1.4.1.1206.3.5.2.13.19.1.1.6	4
	asc3crdAutoPermMinGrn.7 1.3.6.1.4.1.1206.3.5.2.13.19.1.1.7	4
	asc3crdAutoPermMinGrn.8 1.3.6.1.4.1.1206.3.5.2.13.19.1.1.8	4

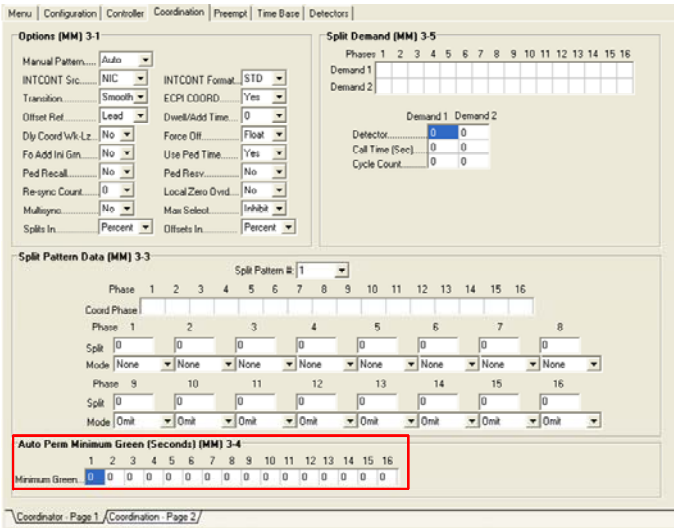


Figure 14 ASC/3 Controller data base screen (coordination)

- Table 11, Table 12, Table 13, and Table 14 show the "Coordinator Pattern" data settings.
- Enter these data into the "Coordinator Pattern Data" portion of the Coordination screen, as shown in Figure 15.
- Each coordination pattern is first entered by determining the "Coordinator Pattern #" from the pull down menu. This value will range from 1 through 4.
- Below the coordinator pattern number is a list of values that should be assigned based on the need of that coordinator pattern.
- The Cycle and Offset Value are given for each pattern.
- The Split Pattern is assigned a value of "1" for each coordinator pattern.
- The Sequence is assigned a value of "1".
- The Action Plan is assigned a number that is equal to the Coordinator Pattern number.
- The Timing Plan is assigned a value of "1".
- Do the settings for "Splits In" and "Offsets In" match your intention (either in percent or seconds)?
- Make sure the number for the "Action Plan" matches the numbers for the "Coordinator Pattern" and "Split Pattern". Although these values do not need to be the same, for the purpose of this experiment they should be. An example of using different values could be if you wish to use the Midday Split Pattern at night with a shorter Cycle Length. So a Coordinator Pattern numbered "4" could use a previously established Split Pattern, say "2".

Table 11 Coordinator pattern Data settings (Pattern 1)

ASC3 Screen Parameter	**NTCIP Object NTCIP OID**	**Value**
Coordinator Pattern	patternNumber.1 1.3.6.1.4.1.1206.4.2.1.4.7.1.1.1	1
Cycle	patternCycleTime.1 1.3.6.1.4.1.1206.4.2.1.4.7.1.2.1	60
Offset Value	patternOffsetTime.1 1.3.6.1.4.1.1206.4.2.1.4.7.1.3.1	15
Split Pattern	patternSplitNumber.1 1.3.6.1.4.1.1206.4.2.1.4.7.1.4.1	1
Sequence	patternSequenceNumber.1 1.3.6.1.4.1.1206.4.2.1.4.7.1.5.1	1
Actuated Coord	asc3ptnActuatedCrd Phase.1 1.3.6.1.4.1.1206.3.5.2.13.16.1.9.1	1 (Yes)
Action Plan	timebaseAscActionNumber.1 1.3.6.1.4.1.1206.4.2.1.5.3.1.1.1	1
Timing Plan	asc3tbTimingPlan.1 1.3.6.1.4.1.1206.3.5.2.14.19.1.4.1	1

Table 12 Coordinator Pattern Data settings (Pattern 2)

ASC3 Screen Parameter	**NTCIP Object NTCIP OID**	**Value**
Coordinator Pattern	patternNumber.2 1.3.6.1.4.1.1206.4.2.1.4.7.1.1.2	2
Cycle	patternCycleTime.2 1.3.6.1.4.1.1206.4.2.1.4.7.1.2.2	90
Offset Value	patternOffsetTime.2 1.3.6.1.4.1.1206.4.2.1.4.7.1.3.2	30
Split Pattern	patternSplitNumber.2 1.3.6.1.4.1.1206.4.2.1.4.7.1.4.2	2
Sequence	patternSequenceNumber.2 1.3.6.1.4.1.1206.4.2.1.4.7.1.5.2	1
Actuated Coord	asc3ptnActuatedCrd Phase.1 1.3.6.1.4.1.1206.3.5.2.13.16.1.9.2	1 (Yes)
Action Plan	timebaseAscActionNumber.2 1.3.6.1.4.1.1206.4.2.1.5.3.1.1.2	2
Timing Plan	asc3tbTimingPlan.1 1.3.6.1.4.1.1206.3.5.2.14.19.1.4.1	1

Table 13 Coordinator Pattern Data settings (Pattern 3)

ASC3 Screen Parameter	**NTCIP Object NTCIP OID**	**Value**
Coordinator Pattern	patternNumber.3 1.3.6.1.4.1.1206.4.2.1.4.7.1.1.3	3
Cycle	patternCycleTime.3 1.3.6.1.4.1.1206.4.2.1.4.7.1.2.3	90
Offset Value	patternOffsetTime.3 1.3.6.1.4.1.1206.4.2.1.4.7.1.3.3	65
Split Pattern	patternSplitNumber.3 1.3.6.1.4.1.1206.4.2.1.4.7.1.4.3	3
Sequence	patternSequenceNumber.3 1.3.6.1.4.1.1206.4.2.1.4.7.1.5.3	1
Actuated Coord	asc3ptnActuatedCrd Phase.1 1.3.6.1.4.1.1206.3.5.2.13.16.1.9.3	1 (Yes)
Action Plan	timebaseAscActionNumber.3 1.3.6.1.4.1.1206.4.2.1.5.3.1.1.3	3
Timing Plan	asc3tbTimingPlan.1 1.3.6.1.4.1.1206.3.5.2.14.19.1.4.1	1

Table 14 Coordinator Pattern Data settings (Pattern 4)

ASC3 Screen Parameter	**NTCIP Object NTCIP OID**	**Value**
Coordinator Pattern	patternNumber.4 1.3.6.1.4.1.1206.4.2.1.4.7.1.1.4	4
Cycle	patternCycleTime.4 1.3.6.1.4.1.1206.4.2.1.4.7.1.2.4	90
Offset Value	patternOffsetTime.4 1.3.6.1.4.1.1206.4.2.1.4.7.1.3.4	59
Split Pattern	patternSplitNumber.4 1.3.6.1.4.1.1206.4.2.1.4.7.1.4.4	4
Sequence	patternSequenceNumber.4 1.3.6.1.4.1.1206.4.2.1.4.7.1.5.4	1
Actuated Coord	asc3ptnActuatedCrd Phase.1 1.3.6.1.4.1.1206.3.5.2.13.16.1.9.4	1 (Yes)
Action Plan	timebaseAscActionNumber.4 1.3.6.1.4.1.1206.4.2.1.5.3.1.1.4	4
Timing Plan	asc3tbTimingPlan.1 1.3.6.1.4.1.1206.3.5.2.14.19.1.4.1	1

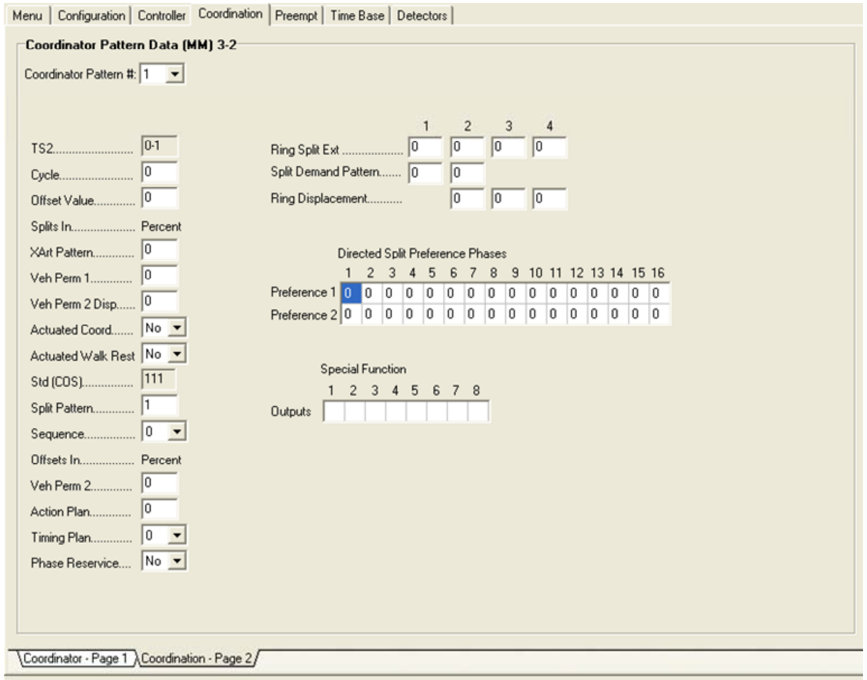


Figure 15 ASC/3 Controller data base screen (coordination)

Step 6. Identify the time-based scheduling parameters to be used and enter the values for these parameters in the data base.

- Time-based scheduling is the process of assigning specific days, weeks, months, and years to certain operating plans. As traffic changes constantly throughout the year, so should the operating plan. Using this feature, the controller allows the user to establish unique plans for each different traffic or operating condition. Commonly, four plans are used per weekday. Other variations include: Saturdays, Sundays, high travel days, and tourist season, each of which may warrant their own plans.
- Table 15 shows the parameters that define a schedule including the Schedule Number, the Day Plan number, the Month, the Day of Week (DOW), and the Day of Month (DOM). The values for each parameter are shown in the table.
- Table 16, Table 17, Table 18, and Table 19 show the parameters and values for each of the four Action Plans. Each Action Plan is linked to a Pattern.
- The Action Plans also define a Vehicle Detector Plan, a Controller Sequence, and a Timing Plan. These three parameters are the same for each Action Plan.

Table 15 Schedule and parameters

ASC3 Screen Parameter	NTCIP Object NTCIP OID	Value
Schedule Number	timeBaseSchedule Number.1 1.3.6.1.4.1.1206.4.2.6.3.3.2.1.1.1	1
Day Plan No	dayPlanNumber.1.1 1.3.6.1.4.1.1206.4.2.6.3.3.5.1.1	1
Month*	timeBaseSchedule Month.1 1.3.6.1.4.1.1206.4.2.6.3.3.2.1.2.1 asc3tbSelectAllMonths: 1.3.6.1.4.1.1206.3.5.2.14.22	Select all. Numerically this is “8190” in the database.
DOW*	timeBaseSchedule Day.1 1.3.6.1.4.1.1206.4.2.6.3.3.2.1.3.1 asc3tbSelectAllDOW: 1.3.6.1.4.1.1206.3.5.2.14.23	Select all. Numerically this is “254” in the database.
DOM*	timeBaseSchedule Date.1* 1.3.6.1.4.1.1206.4.2.6.3.3.2.1.4.1 asc3tbSelectAllDOM: 1.3.6.1.4.1.1206.3.5.2.14.24	Select all. Numerically this is “-2” in the database.
Clear All	asc3tbClearAll 1.3.6.1.4.1.1206.3.5.2.14.25	0

*Noted variable values are binary representation of flags shown in Figure 15.

Table 16 Action Plan settings (Linking Pattern 1 to Action Plan 1)

ASC3 Screen Parameter	NTCIP Object NTCIP OID	Value
Action Plan #	timebaseAscActionNumber.1 1.3.6.1.4.1.1206.4.2.1.5.3.1.1.1	1
Pattern	timebaseAscPattern.1 1.3.6.1.4.1.1206.4.2.1.5.3.1.2.1	1
Veh Detector Plan	asc3tbVehDetPlan.1 1.3.6.1.4.1.1206.3.5.2.14.19.1.1.1	1
Controller Seq	asc3tbCtlSequence.1 1.3.6.1.4.1.1206.3.5.2.14.19.1.5.1	1
Timing Plan	asc3tbTimingPlan.1 1.3.6.1.4.1.1206.3.5.2.14.19.1.4.1	1

Table 17 Action Plan settings (Linking Pattern 2 to Action Plan 2)

ASC3 Screen Parameter	NTCIP Object NTCIP OID	Value
Action Plan #	timebaseAsc ActionNumber.2 1.3.6.1.4.1.1206.4.2.1.5.3.1.1.2	2
Pattern	timebaseAsc Pattern.2 1.3.6.1.4.1.1206.4.2.1.5.3.1.2.2	2
Veh Detector Plan	asc3tbVehDetPlan.1 1.3.6.1.4.1.1206.3.5.2.14.19.1.1.1	1
Controller Seq	asc3tbCtlSequence.1 1.3.6.1.4.1.1206.3.5.2.14.19.1.5.1	1
Timing Plan	asc3tbTimingPlan.1 1.3.6.1.4.1.1206.3.5.2.14.19.1.4.1	1

Table 18 Action Plan settings (Linking Pattern 3 to Action Plan 3)

ASC3 Screen Parameter	NTCIP Object NTCIP OID	Value
Action Plan #	timebaseAsc ActionNumber.3 1.3.6.1.4.1.1206.4.2.1.5.3.1.1.3	3
Pattern	timebaseAsc Pattern.3 1.3.6.1.4.1.1206.4.2.1.5.3.1.2.3	3
Veh Detector Plan	asc3tbVehDetPlan.1 1.3.6.1.4.1.1206.3.5.2.14.19.1.1.1	1
Controller Seq	asc3tbCtlSequence.1 1.3.6.1.4.1.1206.3.5.2.14.19.1.5.1	1
Timing Plan	asc3tbTimingPlan.1 1.3.6.1.4.1.1206.3.5.2.14.19.1.4.1	1

Table 19 Action Plan settings (Linking Pattern 4 to Action Plan 4)

ASC3 Screen Parameter	NTCIP Object NTCIP OID	Value
Action Plan #	timebaseAsc ActionNumber.4 1.3.6.1.4.1.1206.4.2.1.5.3.1.1.4	4
Pattern	timebaseAsc Pattern.4 1.3.6.1.4.1.1206.4.2.1.5.3.1.2.4	4
Veh Detector Plan	asc3tbVehDetPlan.1 1.3.6.1.4.1.1206.3.5.2.14.19.1.1.1	1
Controller Seq	asc3tbCtlSequence.1 1.3.6.1.4.1.1206.3.5.2.14.19.1.5.1	1
Timing Plan	asc3tbTimingPlan.1 1.3.6.1.4.1.1206.3.5.2.14.19.1.4.1	1

- The Day Plan (as shown in Table 20) is based on an Event number. For this experiment, only one event will be assumed. This event will consist of all four previously defined Action Plans. The event will last for an hour, beginning at 16:30:00 and ending at 17:30:00.
- While we will only consider one Day Plan, the reality is that different times of year and days of the week or month may have special conditions that warrant different Day Plans.

Table 20 Day Plan settings (Linking Action Plan to Specified Time of Day)

ASC3 Screen Parameter	NTCIP Object NTCIP OID	Value
Event	dayPlan Number.1.1 1.3.6.1.4.1.1206.4.2.6.3.3.5.1.1.1.1	1
Action Plan (Plan #1)	dayPlanAction NumberOID.1.1 1.3.6.1.4.1.1206.4.2.6.3.3.5.1.5.1.1	1.3.6.1. 4.1.1206. 4.2.1.5. 3.1.1.1
Start Time (hr)	dayPlan Hour.1.1 1.3.6.1.4.1.1206.4.2.6.3.3.5.1.3.1.1 dayPlan Minute.1.1 1.3.6.1.4.1.1206.4.2.6.3.3.5.1.4.1.1	16:30
Start Time (hr)	dayPlan Hour.2.2 1.3.6.1.4.1.1206.4.2.6.3.3.5.1.3.2.2 dayPlan Minute.2.2 1.3.6.1.4.1.1206.4.2.6.3.3.5.1.4.2.2	16:36
Start Time (hr)	dayPlan Hour.3.3 1.3.6.1.4.1.1206.4.2.6.3.3.5.1.3.3.3 dayPlan Minute.3.3 1.3.6.1.4.1.1206.4.2.6.3.3.5.1.4.3.3	16:54
Start Time (hr)	dayPlan Hour.4.4 1.3.6.1.4.1.1206.4.2.6.3.3.5.1.3.4.4 dayPlan Minute.4.4 1.3.6.1.4.1.1206.4.2.6.3.3.5.1.4.4.4	17:12

Table 21 Schedule number settings (Scheduling time of day plan with day of year)

ASC3 Screen Parameter	NTCIP Object NTCIP OID	Value
Schedule Number	timeBaseSchedule Number.1 1.3.6.1.4.1.1206.4.2.6.3.3.2.1.1.1	1
Day Plan No	dayPlanNumber.1.1 1.3.6.1.4.1.1206.4.2.6.3.3.5.1.1	1
Month	timeBaseSchedule Month.1 1.3.6.1.4.1.1206.4.2.6.3.3.2.1.2.1 asc3tbSelectAllMonths: 1.3.6.1.4.1.1206.3.5.2.14.22	Select all. (Numerically this is “8190” in database)
DOW	timeBaseSchedule Day.1 1.3.6.1.4.1.1206.4.2.6.3.3.2.1.3.1 asc3tbSelectAllDOW: 1.3.6.1.4.1.1206.3.5.2.14.23	Select all. Numerically this is “254” in the database
DOM	timeBaseSchedule Date.1* 1.3.6.1.4.1.1206.4.2.6.3.3.2.1.4.1 asc3tbSelectAllDOM: 1.3.6.1.4.1.1206.3.5.2.14.24	Select all. (Numerically this is “-2” in the database)
Clear All	asc3tbClearAll 1.3.6.1.4.1.1206.3.5.2.14.25	0

- The data shown in the previous tables should now be entered into the screens shown in Figure 16 and Figure 17.
- Each of the four Action Plans will be given a time of day to operate in this step. In reality, an Action Plan should be provided for each time period during the day. For our case, we will assume that the period from 16:30 to 17:30 represents the entire day.
- The Schedule consists of the starting times for each plan. For this experiment, we will only one Schedule. This Schedule will operate the Day Plan on all days, weeks, and months of the year. This can be accomplished by checking all three of the “Select All” circles or manually checking all the applicable boxes.

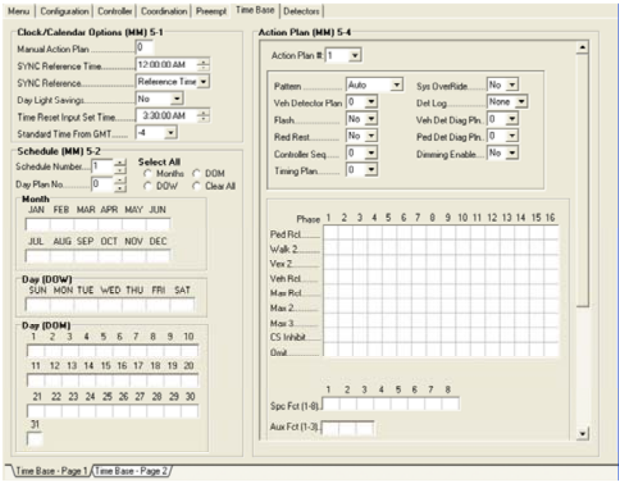


Figure 16 ASC/3 Controller data base screen (time base)

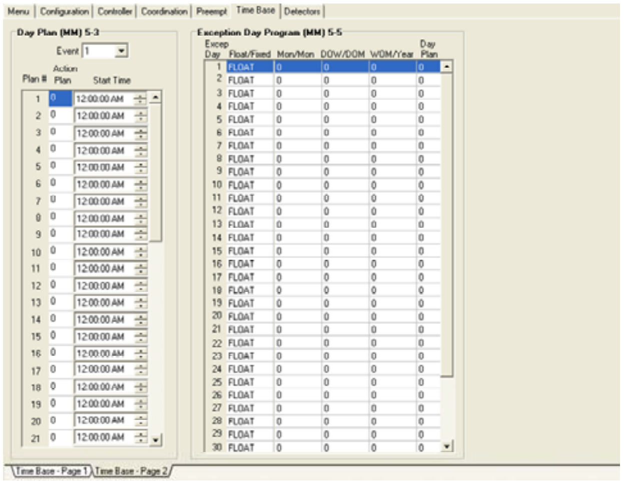


Figure 17 ASC/3 Controller data base screen (time base)

Step 7. Repeat steps 2 through 6 for controller 2001.

- Save the controller data base file for the first controller by selecting "Store Controller in Database".
- To begin the process of data entry for the second controller (2001), select "Open ASC/3 Database Editor".
- Select controller 2001, then "Select Controller to View in Database Editor."
- Repeat steps 2 through 6 for this controller.

Step 8. Run VISSIM to confirm that you have successfully entered the data correctly into the controller data base.

- Save the controller data base file, by selecting "Store Controller in Database".
- Select "Run Continuously" to observe the simulation. If you have entered the data in the data base correctly, your simulation should run correctly.
- You can check the operation by looking at the questions that were posed at the beginning of this experiment.

3.6 Discussion

Let's now consider each of the questions that were presented at the beginning of this experiment.

- How do the virtual controller and the database editor differ? Why is this important in this laboratory?
- What is the difference between free and coordinated and operation?
- What is the Split time?
- Why isn't the Maximum Green time needed in this timing plan?
- What is the effect of having different detectors call the same phase?
- What are the three parameters needed to specify a timing plan?

Take a few minutes to review each question and write brief answers to each question in the box on the right based on your observations from this experiment.

Answers to questions:

1. How do the virtual controller and the database editor differ? Why is this important in this laboratory?

→The database editor allows the user to easily manipulate the controller parameters in an off-line mode. The virtual controller provides real-time access to the controller parameters.

2. What is the difference between free and coordinated and operation?

→Free operation is not constrained by a cycle. Coordinated operation imposes a background cycle to facilitate progression with adjacent signals.

3. What is the Split time?

→A split time is an upper bound (typically) on the amount of time a phase may be active. This includes the green plus yellow plus all red time.

4. Why isn't the Maximum Green time needed in this timing plan?

→Typically controllers inhibit the use of maximum green when coordination is run and rely on the split timers to provide an upper bound on the green time.

5. What is the effect of having different detectors call the same phase?

→Each of these detectors provide an opportunity to re-trigger the phase extension timer. Care should be exercised to ensure extension timers are configured appropriately for the detector layout, particularly when multiple detectors channels are in the same lane.

6. What are the three parameters needed to specify a timing plan?

→Cycle, Split, and offset.

4. EXPERIMENT 2: DESIGN EXERCISE-IMPROVING COORDINATED OPERATION

4.1 Learning Objectives

- Be able to evaluate the performance of a coordinated system.
- Be able to identify offset changes to improve coordination.

4.2 Overview

The purpose of this experiment is to provide you with the opportunity to evaluate the performance of a coordinated system and determine what changes could be made to improve system performance. You will observe the operation of the two intersections on State Highway 8: Line Street and Farm Road. You will observe the EB and WB directions for both intersections for 3 cycles and assess the quality of the progression that results from the timing parameters that you set previously in experiment #1.

4.3 Questions to Consider

As you begin this experiment, consider the following questions. You will come back to these questions once you have completed the experiment.

- What is the quality of progression for the EB platoons?
- What is the quality of progression for the WB platoons?
- What changes can you make in the timing plan to improve progression?

4.4 List of Steps

You will follow these steps during this experiment:

- Open the movie file.
- Observe the field of view.
- Observe the departure of the EB platoon from Farm Road and its arrival at Line Street.
- Observe the departure of the WB platoon from Line Street and its arrival at Farm Road.
- Collect data to construct a time space diagram.
- Construct a time space diagram to determine needed changes to the offset.

4.5 Running the Experiment

In this experiment, you will observe a movie file that has been created using the traffic control settings that you programmed in experiment #1. The system includes two intersections on State Highway 8, Farm Road and Line Street. You will focus on the quality of progression as measured by the degree to which the platoon from the upstream intersection arrives during green at the downstream intersection.

Step 1. Open the movie file.

- Locate the “MOST input files” folder.
- Go to the “Lab7” folder, then the “Exp2” folder.
- Open the file: “lab7-exp2.wmv” and then select “Pause.”

Step 2. Observe the field of view.

- Figure 18 shows the State Highway 8 corridor, and the 3,113 feet between the two intersections of Farm Road on the west and Line Street on the east.
- Figure 19 shows a more focused field of view for the two intersections.
- The left window shows the intersection of Farm Road and State Highway 8. The EB platoon is stopped for red. It will eventually travel to Line Street, to the east. The right window shows the intersection of Line Street and State Highway 8. The WB platoon is also stopped for red. It will eventually travel to Farm Road, to the west
- The detector-to-phase map for each lane is shown in the top center of the figure. The controller status displays for each intersection are also shown
- Study each of these elements carefully before proceeding.

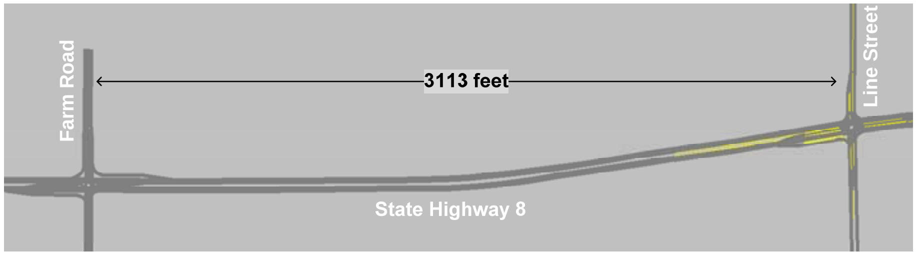


Figure 18 State Highway 8 corridor

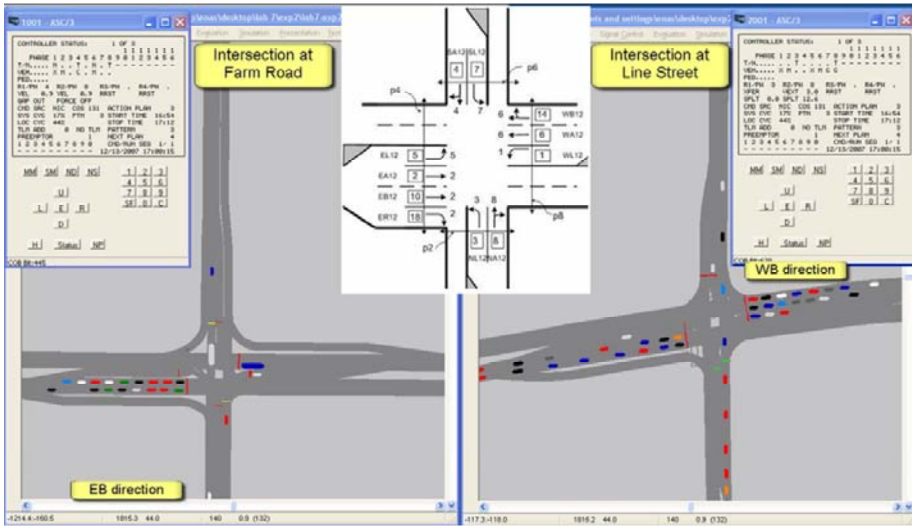


Figure 19 Field of view showing Farm Road and Line Street intersections

Step 3. Observe the departure of the EB platoon from Farm Road and its arrival at Line Street.

- Advance the simulation time to t = 1828. This is the start of the phase 2 green for the EB platoon as it leaves the Farm Road intersection. There are 20 vehicles in the queue. See Figure 20.
- Continue to observe the movie until the EB platoon arrives at Line Street. The average travel speed for vehicles along the State Highway 8 corridor is 35 miles per hour. At this speed, the earliest that the platoon will arrive at Line Street is t = 1888, or 60 seconds after the start of phase 2 green at Farm Road. However, because of the start-up time for vehicles at the beginning of green at Farm Road, as well as interactions amongst the vehicles as they travel along the arterial, the actual travel time is about 74 seconds. The first vehicle from the platoon arrives at Lines Street at t = 1902. What is your conclusion about the quality of the progression in the EB direction?
- The remains of the platoon are shown at t = 1920, the beginning of the phase 2 green at Line Street. The first vehicle from the platoon is delayed for nearly 20 seconds after its arrival. The quality of progression is extremely poor; all vehicles in the EB platoon from Farm Road are delayed at Line Street.

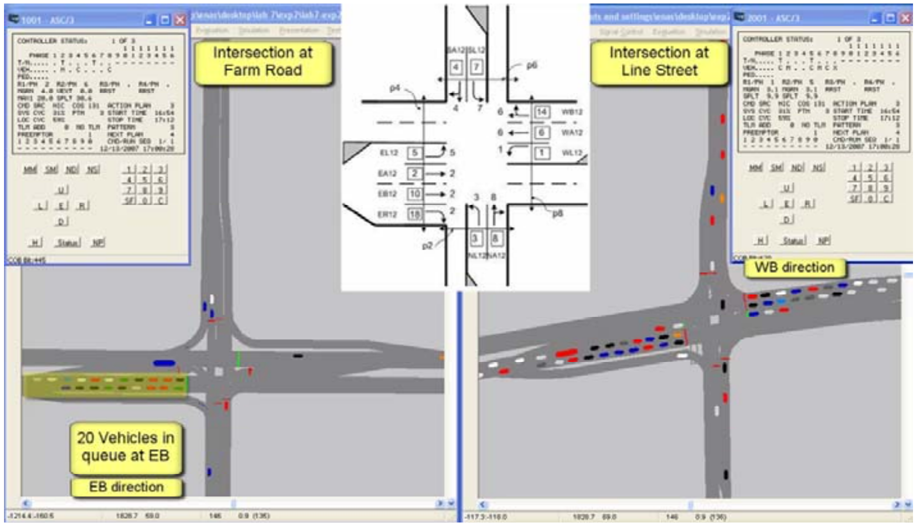


Figure 20 Start of phase 2 green at Farm Road (t = 1828.7)

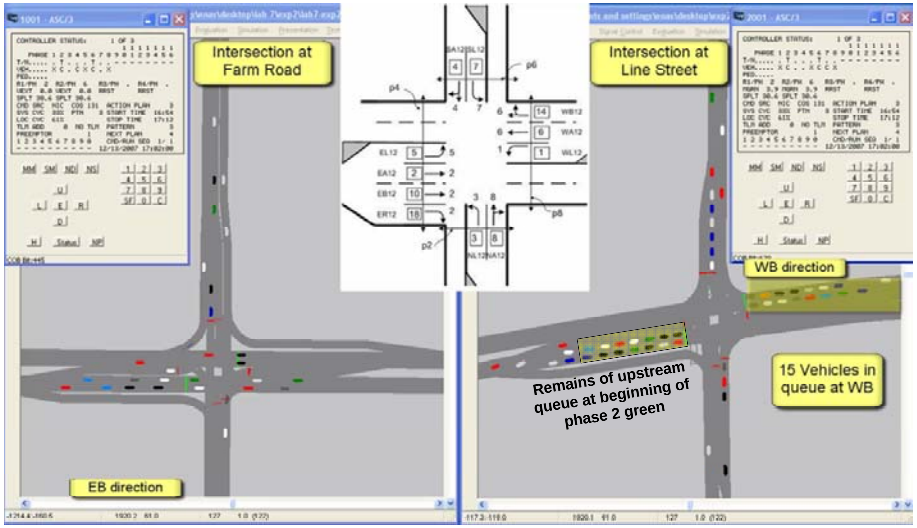


Figure 21 Start of phase 2 green at Line Street (t = 1920.1)

Step 4. Observe the departure of the WB platoon from Line Street and its arrival at Farm Road.

- Reset the simulation time to t = 1838. This is the start of the phase 6 green for the WB platoon as it leaves the Line Street intersection. There are 17 vehicles in the queue. See Figure 22.
- Continue to observe the movie until the WB platoon arrives at Farm Road. The average travel speed for vehicles along the State Highway 8 corridor is 35 miles per hour. At this speed, the earliest that the platoon will arrive at Farm Road is t = 1898, or 60 seconds after the start of phase 6 green at Farm Road. However, for reasons cited above, the actual travel time is about 80 seconds. The first vehicle from the platoon arrives at Farm Road at t = 1919. What is your conclusion about the quality of the progression in the WB direction?
- The phase 6 green at Farm Road begins at t = 1915, five seconds before the arrival of the platoon. Thus, there is no delay to any of the vehicles in the platoon arriving from Line Street. The quality of the progression is excellent.

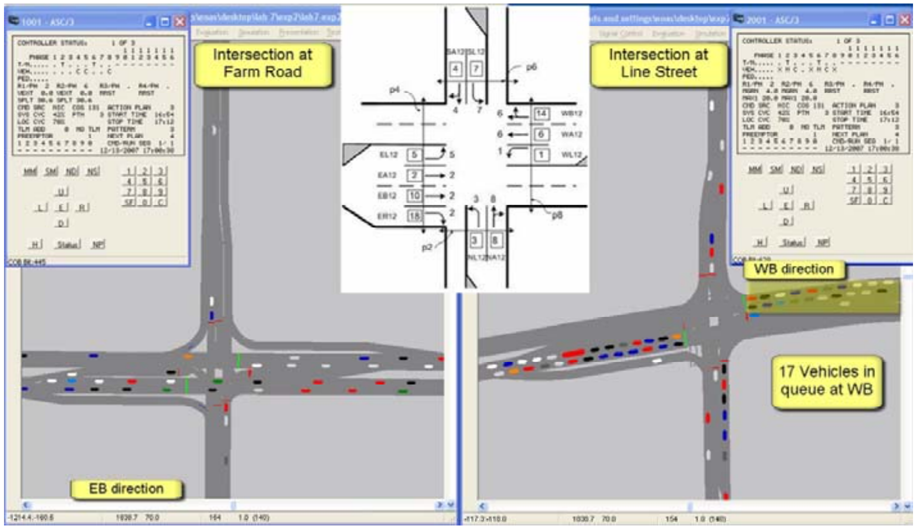


Figure 22 Start of phase 6 green at Line Street (t = 1838.7)

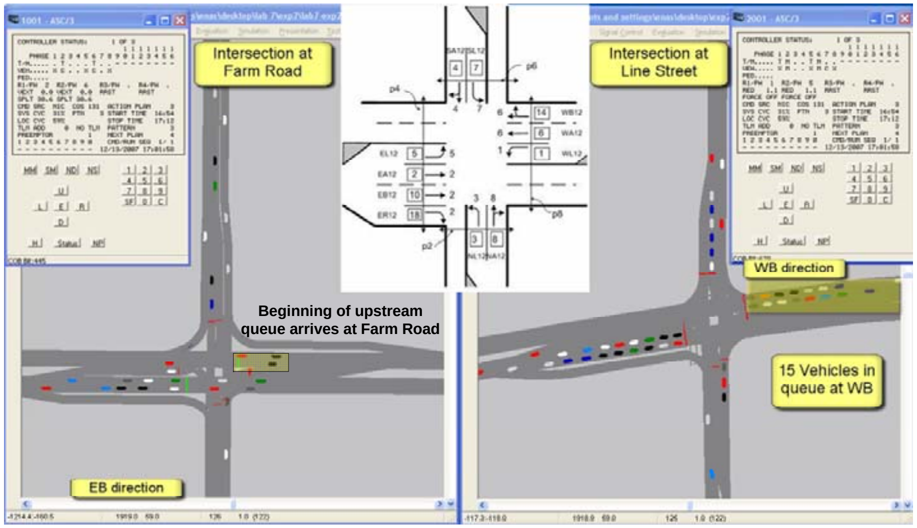


Figure 23 Beginning of upstream queue arrives at Farm Road (t = 1919.2)

Step 5. Collect data to construct a time space diagram.

- In steps 3 and 4, you identified that, for the first cycle, the progression in the EB direction was poor while the progression in the WB direction was excellent. In this step, you will construct a time space diagram to determine if you can modify the offset to improve progression in the EB direction while maintaining the quality of progression in the WB direction.
- Set the simulation time to t = 1828. Record the times that the first vehicle in the EB platoon (1) leaves Farm Road and (2) arrives at Line Street for three cycles in Table 22.
- Set the simulation time to t = 1838. Record the times that the first vehicle in the WB platoon (1) leaves Line Street and (2) arrives at Farm Road for three cycles in Table 23.
- Now record the start and end times for the green and red intervals at both Farm Road and Line Street for both phases 2 and 6 in Table 24 and Table 25 for the same three cycles as above.

Table 22 EB platoon

Cycle	Intersection	Distance	Time
1	Farm Road	0	
1	Line Street	3113	
2	Farm Road	0	
2	Line Street	3113	
3	Farm Road	0	
3	Line Street	3113	

Table 23 WB platoon

Cycle	Intersection	Distance	Time
1	Line Street	3113	
1	Farm Road	0	
2	Line Street	3113	
2	Farm Road	0	
3	Line Street	3113	
3	Farm Road	0	

Table 24 Display status – Line Street

Cycle	Distance	Start	End
1 – Green	3113		
1 – Red	3113		
2 – Green	3113		
2 – Red	3113		
3 – Green	3113		
3 – Red	3113		

Table 25 Display status – Farm Road

Cycle	Distance	Start	End
1 – Green	0		
1 – Red	0		
2 – Green	0		
2 – Red	0		
3 – Green	0		
3 - Red	0		

Step 6. Construct a time space diagram to determine needed changes to the offset.

- Using the data from Table 22, Table 23, Table 24, and Table 25, construct a time space diagram that includes (1) the trajectories for the first vehicle in each platoon and (2) the display status (showing red and green intervals) for phase 2 at Farm Road and phase 6 at Line Street. Use Figure 24 to construct your time-space diagram.
- Based on your time-space diagram, identify the change in the relative offset between the two intersections that you would recommend in order to improve progression.
- Write a brief justification for your recommendation in the box at right.

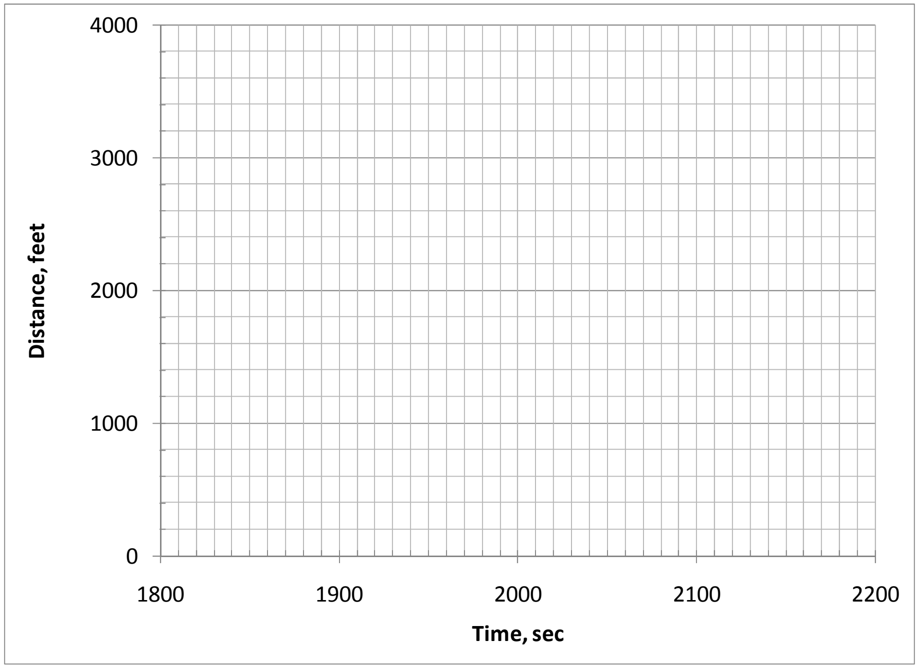


Figure 24 Time space diagram

Justification

4.6 Discussion

Let's now consider each of the questions that were presented at the beginning of this experiment.

- What is the quality of progression for the EB platoons?
- What is the quality of progression for the WB platoons?
- What changes can you make in the timing plan to improve progression?

Take a few minutes to review each question and write brief answers to each question in the box on the right based on your observations from this experiment.

Answers to questions:

1. What is the quality of progression for the EB platoons?

→The quality of the progression is poor for the EB platoons. All three platoons considered in the movie arrive during red. Table 26 and Table 27 show data supporting the conclusion that you reached by observing the traffic flow.

Table 26 shows the travel time for the first vehicle in the platoon from Farm Road to Line Street, as well as the delay experienced by this first vehicle for each of the three cycles. The delay ranges from 18 seconds during the first cycle to 33 seconds for the second cycle.

Table 27 shows the proportion of vehicles arriving during green at Line Street. The proportion for all vehicles during the three cycles is 0.18. This confirms our original observation that the quality of progression for the EB direction is poor.

Table 26 Quality of progression, EB platoons

Cycle	Start of phase 2 green, Farm Road	Arrival time of platoon at Line Street	Start of phase 2 green, Line Street	Travel time, Farm Road to Line Street	Delay at Line Street
1	1829	1902	1920	74	18
2	1914	1984	2017	70	33
3	2008	2079	2110	71	31

Table 27 Proportion of vehicles arriving on green, EB platoons

Cycle	Number of vehicles arriving on red	Number of vehicles arriving on green	Proportion of vehicles arriving on green
1	21	5	0.19
2	24	3	0.11
3	27	8	0.23
Total	72	16	0.18

2. What is the quality of progression for the WB platoons?

→The quality of the progression is good for the WB platoons. Two of the three platoons considered in the movie arrive during green. Table 28 and Table 29 show data supporting the conclusion that you reached just by observing the traffic flow.

Table 28 shows the travel time for the first vehicle in the platoon from Line Street to Farm Road, as well as the delay experienced by this first vehicle for each of the three cycles. The delay is zero for cycles 1 and 3, and 5 seconds for cycle 2.

Table 29 shows the proportion of vehicles arriving during green at Farm Road. The proportion for all vehicles during the three cycles is 0.95. This confirms our original observation that the quality of progression for the EB direction is quite good.

Table 28 Quality of progression, WB platoons

Cycle	Start of phase 6 green, Line Street	Arrival time of platoon at Farm Road	Start of phase 6 green, Farm Road	Travel time, Line Street to Farm Road	Delay at Farm Road
1	1839	1919	1915	80	0
2	1920	2003	2008	83	5
3	2018	2099	2085	81	0

Table 29 Proportion of vehicles arriving on green, WB platoons

Cycle	Number of vehicles arriving on red	Number of vehicles arriving on green	Proportion of vehicles arriving on green
1	2	26	0.93
2	0	15	1.00
3	1	17	0.94
Total	3	58	0.95

3. What changes can you make in the timing plan to improve progression?

→ Table 30, Table 31, Table 32, and Table 33 provide the data needed to construct the time-space diagram.

Table 30 EB platoon

Platoon	Intersection	Distance	Time
1	Farm Road	0	1829
1	Line Street	3113	1902
2	Farm Road	0	1914
2	Line Street	3113	1984
3	Farm Road	0	2008
3	Line Street	3113	2079

Table 31 WB platoon

Platoon	Intersection	Distance	Time
1	Line Street	3113	1839
1	Farm Road	0	1919
2	Line Street	3113	1920
2	Farm Road	0	2003
3	Line Street	3113	2018
3	Farm Road	0	2099

Table 32 Display status – Line Street

Cycle	Distance	Start	End
1 – Green	3113	1839	1866
1 – Red	3113	1866	1920
2 – Green	3113	1920	1956
2 – Red	3113	1956	2017
3 – Green	3113	2017	2045
3 – Red	3113	2045	2110

Table 33 Display status – Farm Road

Cycle	Distance	Start	End
1 – Green	0	1914	1967
1 – Red	0	1967	2009
2 – Green	0	2009	2045
2 – Red	0	2045	2086
3 – Green	0	2086	2147
3 - Red	0	2147	2186

Figure 25 shows the completed time-space diagram. Consistent with the earlier discussion, the EB platoons traveling from Farm Road to Line Street experience poor progression; each is delayed when it arrives at Line Street. Progression for the WB platoons is much better, showing only a small delay for the second platoon.

In the figure, the solid (red) line indicates the red interval, while the dotted (green) line indicates the green interval.

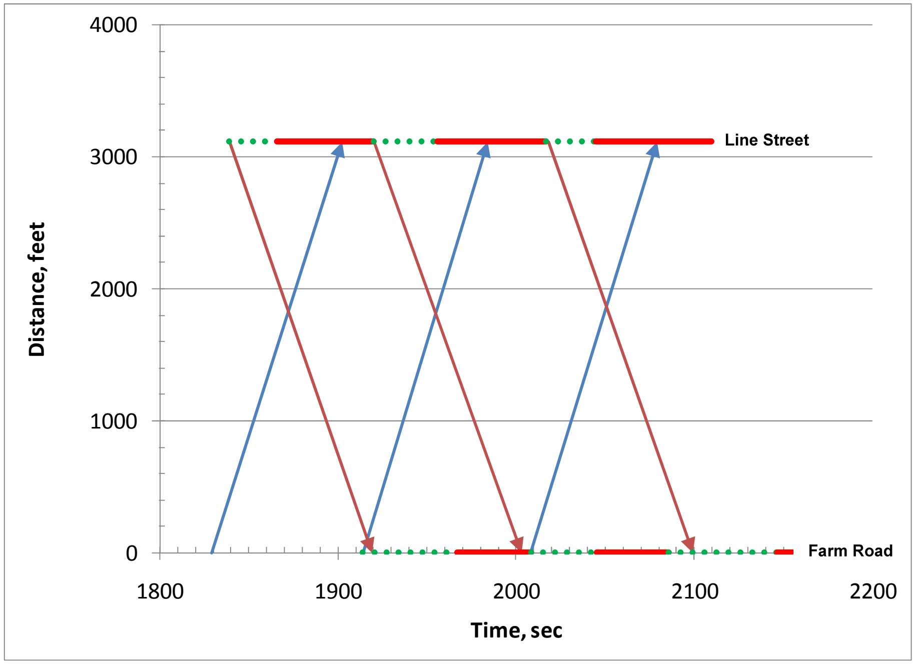


Figure 25 Time-space diagram

The period in the movie that you just observed is covered by Action Plan 3, the period from 16:54 (or 4:54 pm) to 17:12 (or 5:12 pm). The offset for both intersections is 65 seconds. Thus the relative offset is zero.

When the relative offset is changed, the delay will change. Figure 26 shows the change in the mean delay for the first vehicle in each of the platoons as a function of the relative offset. Careful study of the figure shows the following points:

- The lowest delay for the WB platoon is for a range of relative offsets from 5 seconds to 35 seconds.
- The lowest delay for the EB platoon is for a range of relative offsets from 45 seconds to 55 seconds.

Selection of the “best” offset depends on which of the two platoons should be favored. For example, if the peak direction during the afternoon peak period is WB, then an offset of from 5 to 35 seconds would be selected.

It should also be noted that the green bandwidth varies for each of the relative offset values and should be studied before a final selection of offset is made.

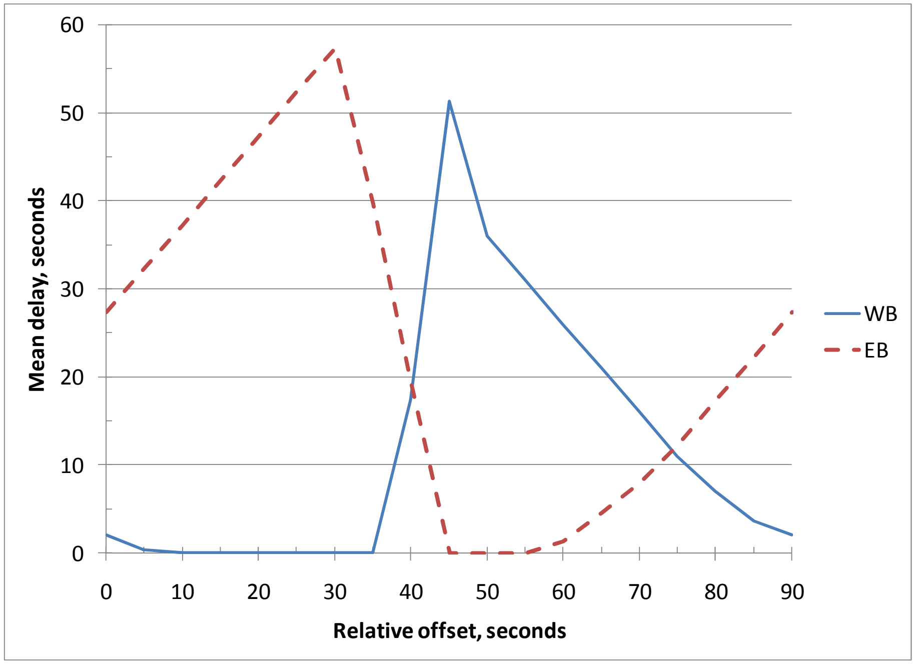


Figure 26 Delay as a function of relative offset

5. CLOSURE - SUMMARY OF KEY POINTS LEARNED

The programming of an actuated-coordinated traffic control system is a complex task, much more so than the determination of the Cycle, Split, and Offset parameters that you covered in Laboratory 6. In Laboratory 7, you learned how to program an NTCIP controller for actuated coordinated signal operation. You learned the value of each input required for successful controller operation.

You completed the following tasks in the first experiment:

- Identified the phases used in the timing plan.
- Mapped detectors to phases.
- Specified the timing plans in a phase table, including the Yellow, All Red, Minimum Green, and Vehicle Extension times.
- Configured the coordination plans determining whether the plan will have fixed or floating force offs, the split patterns, and cycle and offset patterns.
- Configured the time-based scheduling plan, including linking coordination patterns to action plans, scheduling action plans to run certain hours of the day, and defining what day plans to run during each day, month, and year.

In the second experiment, you observed the operation of the system, determining the quality of progression that results from varying offset values.

You now have the basis for a design checklist for a complete configuration of an actuated-coordinated traffic control system as well as a method to evaluate the quality of your actuated-coordinated timing plan.