# 28 Building a Simulation Model Network

DESIGN

## PURPOSE

The purpose of this activity is to give you the opportunity to learn how to build and use a simulation model network. You will use this network as you prepare a design for an isolated signalized intersection.

## LEARNING OBJECTIVE

○ Build and use a simulation network

## REQUIRED RESOURCES

○ Base VISSIM network (VISSIM .inp and other files)

○ VISSIM tutorial

## DELIVERABLES

○ Modified VISSIM files

○ Prepare an Excel spreadsheet that includes the data that you have collected, the sketches that you made, and your observations of the data and the simulation. This information represents the base data for the beginning of your design work, and against which you will compare the design plans that you develop. The spreadsheet should include tabs for each of the following:

**Tab 1:** Title page with activity number and title, authors, and date completed

**Tab 2:** Sketches as per Task 1

**Tab 3:** Evaluation data as per Task 6

**Tab 4:** A summary of the traffic flow characteristics that you observe in the animation

**Tab 5:** A summary of the evaluation data that you have collected, including your comments on the evaluation data and what you learn from these data

**Tab 6:** Answers to questions from Task 6

## CRITICAL THINKING QUESTIONS

1. Are your observations of the animation consistent with the output data produced in Task 6?

2. What traffic problems do you observe? (Some example traffic problems might include: queues not clearing before the end of green, or queues spilling out of a left turn pocket and into a through lane).

# TASK 1

Prepare two electronic sketches for your subject intersection:

○ Sketch #1: Prepare a sketch that shows the lane geometry, the numbered directional movements for each lane, and the phase numbers that control the movement in each lane. Add to this sketch a stop bar detector in each lane, numbering each detector with two digits, the first number equal to the phase number controlling that lane. The second number should correspond to the lane number beginning with one for the left most lane for that approach. For example, if you have two northbound lanes controlled by phase 2, your detectors would be numbered 21 for the left lane and 22 for the right lane as shown in Figure 106.

○ Sketch #2: Prepare a ring barrier diagram that represents a standard eight (or five, if T-intersection) phase NEMA pattern, with protected leading left turns, for the intersection



**Figure 106.** Signal head and detector numbering example

# TASK 2

Download the VISSIM network that you have been assigned, unzip it, and copy it to your hard drive. Open the VISSIM network. This network includes the link and node structure, a background photograph, priority rules governing vehicle interactions, vehicle routing decisions, and traffic volumes. Load the .ini file from "View," then "Load Settings." Run the network (by selecting the "Simulation Continuous" button) and observe the operation. What is missing?

# TASK 3

You will need to add several components to the network, including a signal controller (with a set of given timing parameters), one detector for each lane, and a signal head for each lane. The process for adding the signal controller, the detectors, and the signal head is described in the "VISSIM tutorial."

○ Add a Ring Barrier Controller (RBC) with the following signal timing parameters: yellow time = 3 seconds, red clearance time = 1 second, passage time = 5 seconds, minimum green = 15 seconds, and maximum green = 100 seconds

○ Add stop bar detection in each lane with length of 22 feet, and numbered according to the sketch that you prepared

○ Make sure that the detectors are correctly mapped to the phases

○ Add signal heads numbered as per the detector numbers that you have prepared

○ "Dual entry" should be set for through movements that have been designated as the "start phases"

# TASK 4

Verify that Node Evaluations have been added (to measure delay and queue length, and green time distribution). The process for adding evaluations to your network is described in the "VISSIM tutorial." Set the data collection period to begin at 300 seconds and continue to 3600 seconds. Set the interval to 3300 seconds.

# TASK 5

Run your network and debug as needed. When the network is debugged, complete a final run to collect your data. The following tests can be considered to determine if the network is debugged and operating correctly: (1) phases operate in sequence and for the expected durations, (2) vehicles respond to the signal displays in an appropriate manner, and (3) there are no conflicts between vehicles from different streams.

# TASK 6

Review the evaluation data produced by the simulation run. These data files will be in the same folder as your input files. Refer to the "VISSIM tutorial" and the VISSIM help file to learn more about the evaluation data. Your review should include an analysis of the delay data, the queue length data, and the green time distribution data.

- Prepare a table showing a summary of the delay and queue length data

- Prepare a histogram of the length of the green intervals for the through and left turn phases of your network, choosing the bin size so that your graph conveys a clear picture of the distribution. Note the mean green duration for each phase. Discuss the variations about the mean based on your histogram plot and why this variation occurs.

- These data will be used as the base case evaluation for comparison with your final design (that you will finish in Chapter 10)

# TASK 7

Demonstrate your completed (and working) network to your instructor. "Working network" means that traffic flows in response to displays, detectors respond to traffic, the controller responds to detectors, and the displays respond to the controller.

## THINGS TO CHECK (COMMON PROBLEMS)

Preparing a simulation file for the first time is a complex process requiring attention to a number of details. Following is a list of common problems that are often encountered during the preparation of a VISSIM simulation file:

1. Check carefully that the detectors have been mapped to the correct phases.

2. Make sure that you add the correct signal group (phase) number to the signal heads.

3. Don't double extend phase calls (note process in RBC controller setup).

4. Detectors shouldn't be in connectors.

5. Verify that evaluation nodes have been added.

6. Be sure that the signal heads are placed in front of a connector.

Student Notes:

Traffic Signal Systems Operations and Design: Isolated Intersections