Uncovering Complex Processes Using Visualization Tools

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To be able to design the intersection, engineers must understand the system and its components.
Technology and curriculum: Some history

Traffic control system

Visualization paradigm

Static representation

Dynamic visualizations
“The hands-on experiences were what I liked most about the week’s activities.”

“The best parts of the week were the hands-on work and introductory lectures to the more advanced technologies of video detection and hardware-in-the-loop simulation. Exposure to this technology was worth the trip alone.”

“I think the valuable part is that students don’t just look at pictures or mathematical equations. They get a chance to tinker, make mistakes, and ultimately get various components up and running… much like they will have to in the real world. This means when they are on their first job and things don’t work exactly as expected during a [system] turn-on, they will have their wits about them and know how to debug the system and get it running.
• Introduction to MOST
• Glossary
• Laboratory 1. Introduction to the Simulation Tools
• Laboratory 2. Effect Of Detector And Timing Parameters On The Operation Of The Cross Street of An Isolated Intersection
• Laboratory 3. Developing Timing Plans for Efficient Intersection Operations During Moderate Traffic Volume Conditions
• Laboratory 4. Impact of Detector and Timing Parameters on Arterial Street Operations at Isolated Intersection
• Laboratory 5. Selecting Left Turn Phasing for Various Volume Conditions
• Laboratory 6. Actuated Traffic Signal Coordination Concepts
• Laboratory 7. Actuated Traffic Signal Coordination Implementation

• Number of modules: 7
• Number of experiments: 37
• Number of learning objectives: 70
• Number of VISSIM simulations: 47
• Number of movie files: 37
• Number of discussion questions: 110
• Number of pages in MOST book: 456
3.1 Learning Objective
- Be able to describe the two primary methods for the termination of a traffic phase at an isolated intersection.

3.2 Overview
The purpose of this experiment is to observe the timing of a traffic phase and the method by which the phase terminates. You will observe the SB approach (phase 4) of the intersection of State Highway 8 and Line Street. This approach (Line Street) has two lanes, a left turn lane and a through/right turn lane. State Highway 8 is the major street and serves as a primary east-west route through the city. It also serves as the major access to a university. See Figure 1. You will monitor traffic on the through/right turn lane of this approach.

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.
- Why does the phase terminate for each of the two cases that you observe?
- What is the process followed by the Minimum Green timer from the beginning of the green indication, until the timer expires?
- What is the process followed by the Vehicle Extension timer from the beginning of the green indication, until the timer expires?
- What is the process followed by the Maximum Green timer from the beginning of the green indication, until the timer expires?
- What are the two conditions that separately cause the termination of the green indication?
3.5 Running the Experiment

In this experiment, you will consider two cases, each illustrating a different method for the termination of phase 4 (which serves the SB through/right turn movements). You will observe how the phase times (the timing processes for the Minimum Green, Vehicle Extension, and Maximum Green timers), and how it terminates for each case. The two cases have been placed side-by-side in a movie format so that you can observe the traffic flow and timing processes at the same time. The simulation has been set to run at less than real time, slow enough so that you can observe all timing and traffic flow processes.

Step 1. Open the movie file.
- Locate the “MOST input files” folder.
- Go to the “Lab2” folder, then the “Exp1” folder.
- Open the file: “lab2-exp1.wmv.”

Step 2. Observe the status at the beginning of phase 4 green.
- Move the animation to $t = 45.6$ seconds (which is equivalent to about 00:23 on the Windows Media Player clock). Observe the following conditions for the scene on the left for the SB approach.
3.6 Discussion
Let’s now consider each of the five questions that were presented at the beginning of this experiment.

- Why does the phase terminate for each of the two cases that you observed?
- What is the process followed by the Minimum Green timer from the beginning of the green indication, until the timer expires?
- What is the process followed by the Vehicle Extension timer from the beginning of the green indication, until the timer expires?
- What is the process followed by the Maximum Green timer from the beginning of the green indication, until the timer expires?
- What are the two conditions that separately cause the termination of the green indication?

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.
Time ➔

Minimum green ➔ Green extension ➔ Maximum green
Traffic flow profiles

Statistical distributions

Timing processes

Logic processes
Phase gaps out!

**Detector status**
- Active phase
- Conflicting phase

**Timer status**
- **Minimum green**
  - 10s

- **Passage time**
  - 3s

- **Maximum green**
  - 20s

**Display status**
- Min green 10s
- Passage time 3s
- Max green 20s
Get property value tool tips from timespace
- Single values
- Average value
- Decompiling px color(s) back into a value
- Each px can give out a reading
TrafficSense
• “Working with MOST and VISSIM were really cool and the most effective tool for helping me to understand how everything fits together/relates to/and affects everything else.”
• “The MOST videos and activities positively supported my learning because it was helpful to see the vehicles moving through the intersections along with the timers that were operating.”
• “The use of both MOST and VISSIM was the best tool for learning about what is going on since traffic systems are such a visually oriented subject.”
• “I really enjoyed the simulations and seeing how adjusting certain parameters can greatly affect the intersection’s effectiveness. This strengthened my learning and ability to visualize what we were doing.”
• “The ability to interact with the controller itself and see the results of our selections was HUGE.”
• Students like the visualizations and learn from them
• Requires instructors to know details and technology
• Can be done working alone but is much richer with instructor support and students discussion and feedback
• Students like to be able to change system components and see the results
• Risks of using technology in the classroom, especially in distance learning environment
Lessons Learned

• Study by Shane Brown and students
• Hands on environment is helpful
• Visualization is helpful
• Creates more active, hands on learning environment (more participatory)
• Curriculum and technology tools must be developed jointly
Lessons Learned

• Learning process for visualization students
• Many students will want “to be told” (given knowledge) and are often reluctant to do the hard work of observing and creating their own knowledge from these observations
• You must be committed to your discipline and to observe how learning is taking place in each situation
Next Steps

• Complete books with supporting technology
• Create community that will support and use the technology and curriculum
• Learn what whether visualization tools are really helpful or just neat to use
Questions?