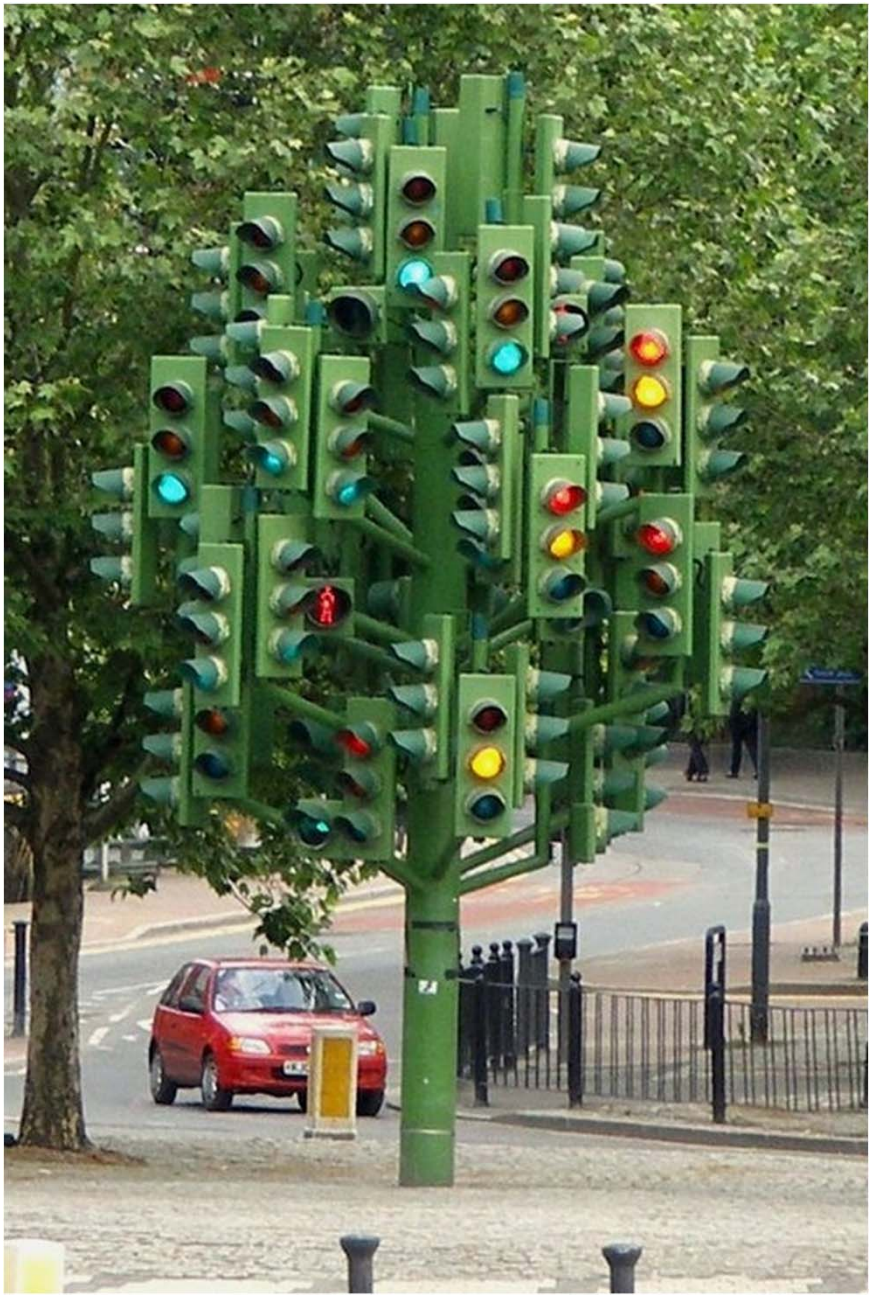
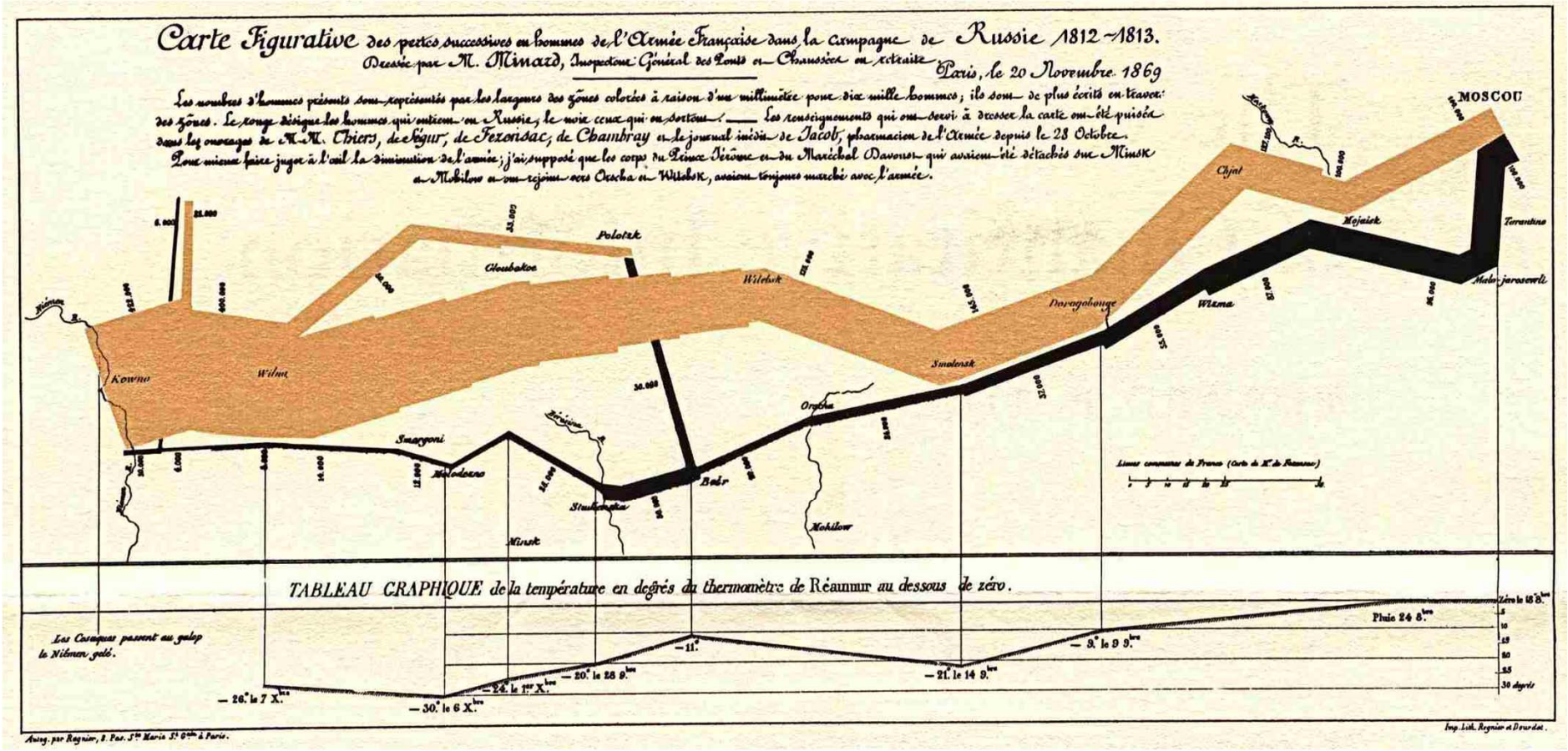


Uncovering Complex Processes Using Visualization Tools

Michael Kyte
University of Idaho

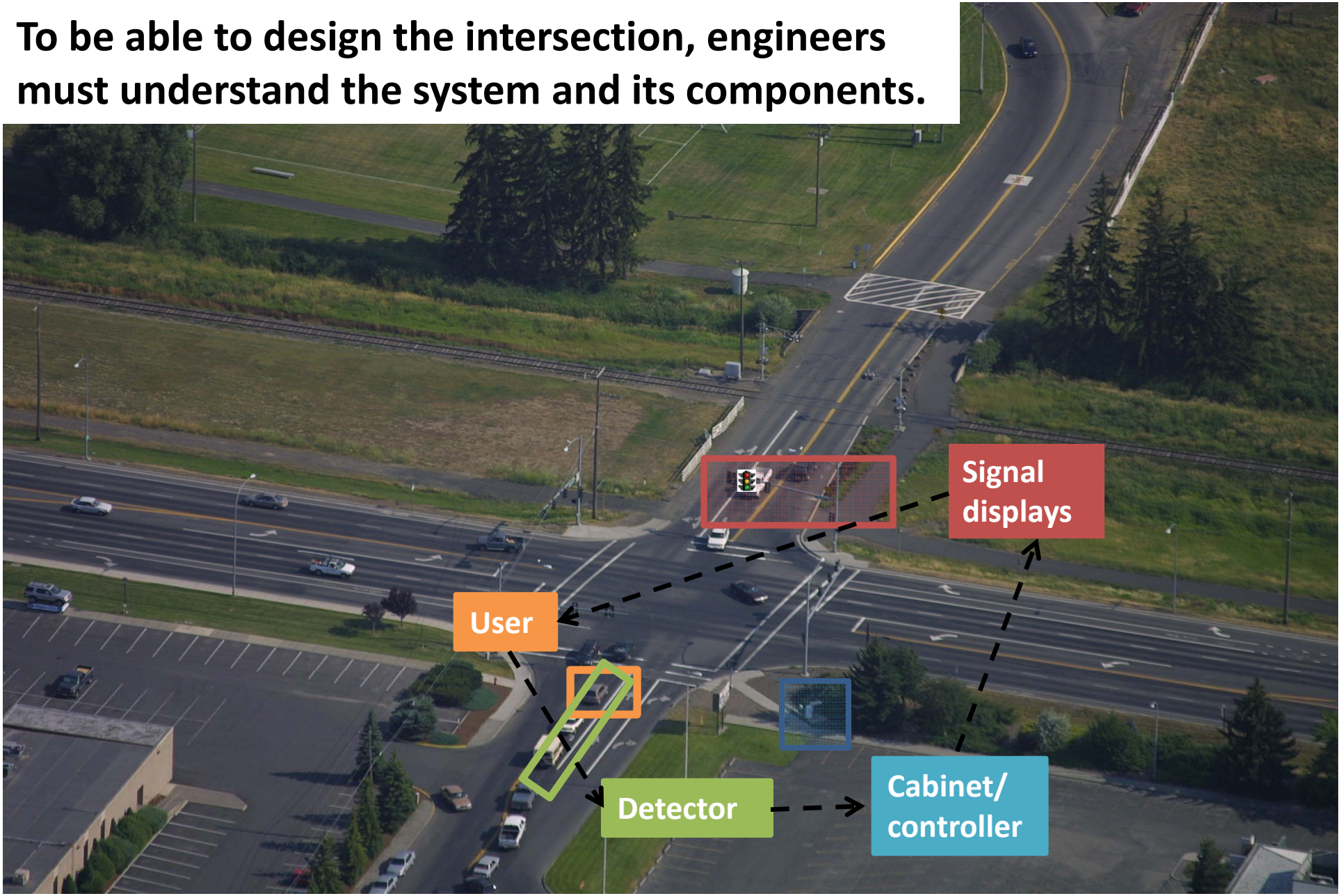
National Rural ITS Conference
Coeur d'Alene, Idaho

August 31, 2011


Carte Figurative des pertes successives en hommes de l'Armée Française dans la campagne de Russie 1812-1813.
Dressée par M. Minard, Inspecteur Général des Ponts et Chaussées en retraite
Paris, le 20 Novembre 1869
Les nombres d'hommes présents sont représentés par les largeurs des zônes colorées à raison d'un millimètre pour dix mille hommes; ils sont de plus écrits en travers des zônes. Le rouge désigne les hommes qui entrent en Russie, le noir ceux qui en sortent. — Les renseignements qui ont servi à dresser la carte ont été puisés dans les ouvrages de M.M. Thiers, de Ségur, de Fezensac, de Chambray et le journal inédit de Jacob, pharmacien de l'Armée depuis le 28 Octobre.
Pour mieux faire juger à l'œil la diminution de l'armée; j'ai supposé que les corps du Prince Jérôme et du Maréchal Davoust qui avaient été détachés sur Minsk et Mohilow se sont rejoints vers Orscha et Witebsk, avaient toujours marché avec l'armée.
Kowno
Wilna
Smorgoni
Molodexno
Minsk
Studienska
Pelotsk
Witebsk
Orscha
Mohilow
Smolensk
Dorogobouge
Wixma
Chjat
Mojaisk
MOSCOU
Terrantino
Malo-jaroswerli
Lieues communes de France (Carte de M.r de Fezensac)
TABLEAU GRAPHIQUE de la température en degrés du thermomètre de Réaumur au dessous de zéro.
Les Cosaques passent au galop le Niémen gelé.
— 26.° le 7 X.bre
— 30.° le 6 X.bre
— 24. le 1er X.bre
— 20.° le 28 9.bre
— 11.°
— 21. le 14 9.bre
— 9.° le 9 9.bre
Pluie 24 8.bre
Zéro le 18 8.bre
30 degrés
Imp. Lith. Regnier et Bourdet.
Imprg. par Regnier, 8 Pas. Ste Marie St Gmin à Paris.

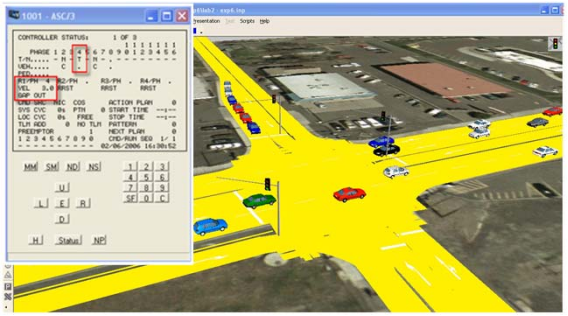

164th St SW & Alderwood
11/18/2008 15:35:27

To be able to design the intersection, engineers must understand the system and its components.

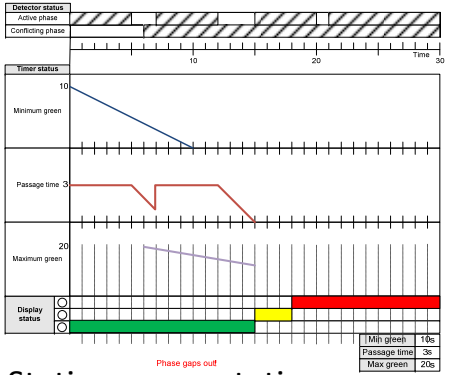


Technology and curriculum:
Some history

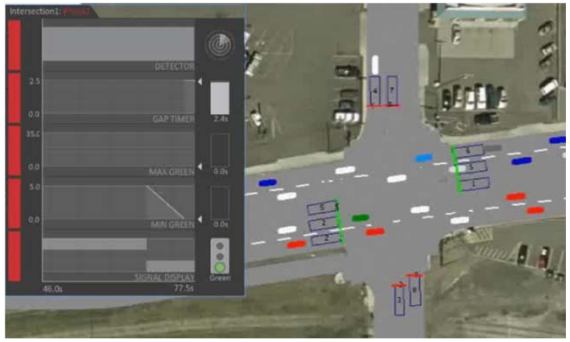
Traffic control system



Visualization paradigm



Static representation

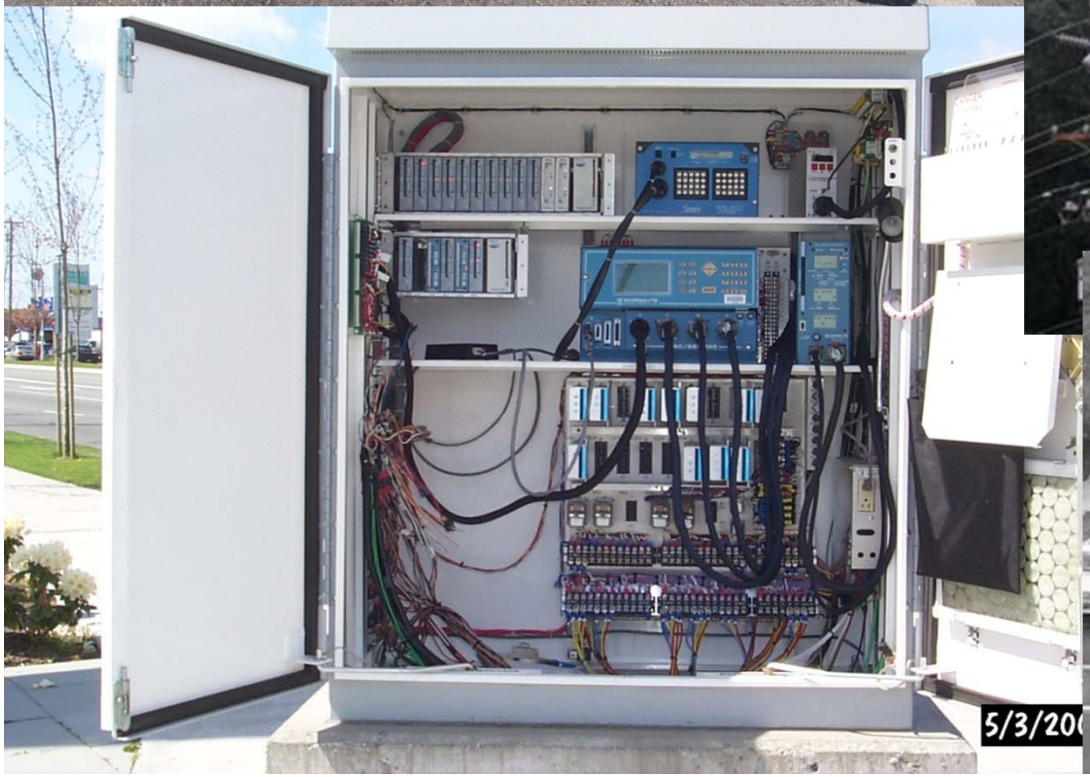


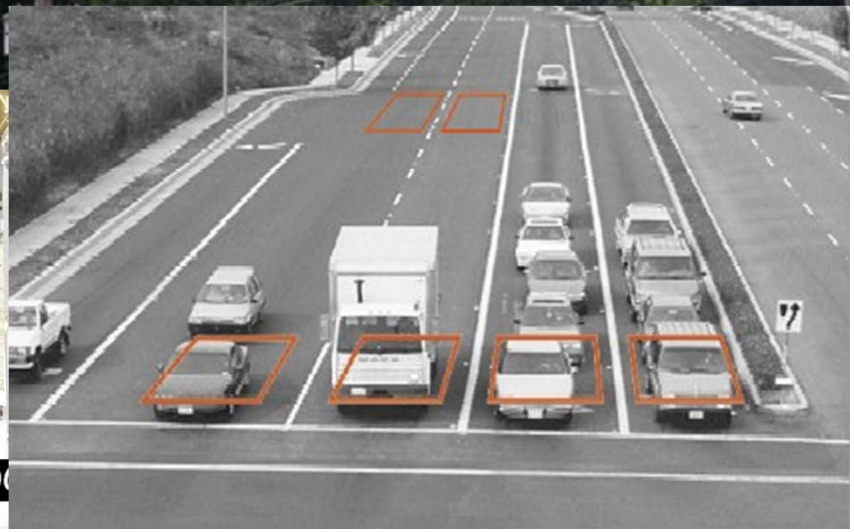
Dynamic visualizations

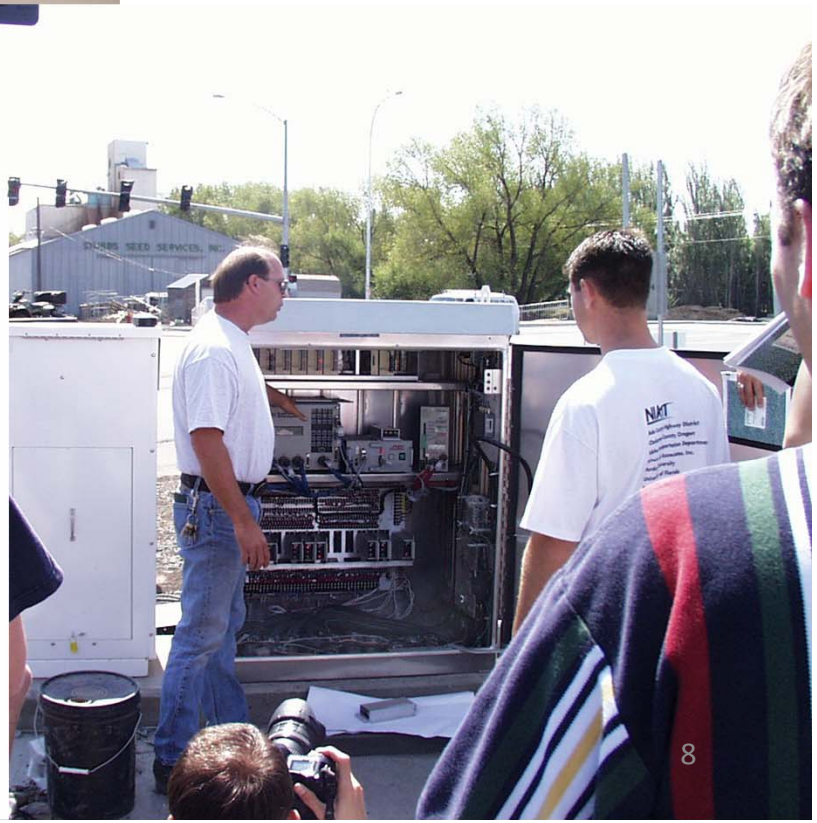

09 02 2003


29


ONLY
YIELD ON GREEN
Mendenhall Blvd
Valley Blvd


5/3/20





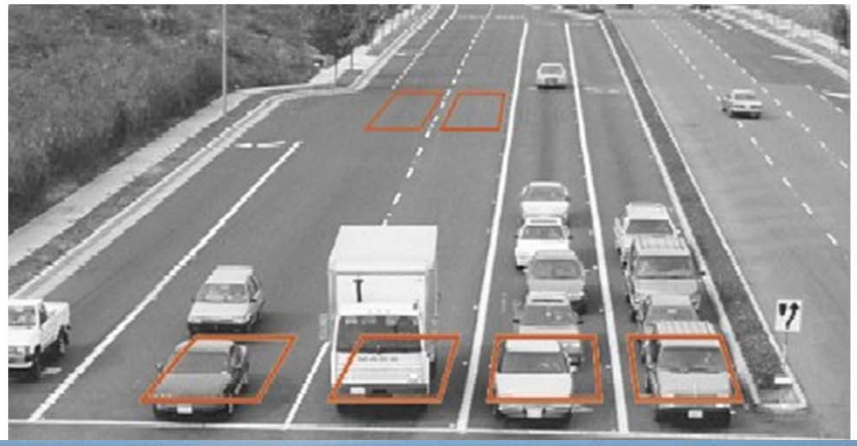
Traffic Signal Summer Workshop

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

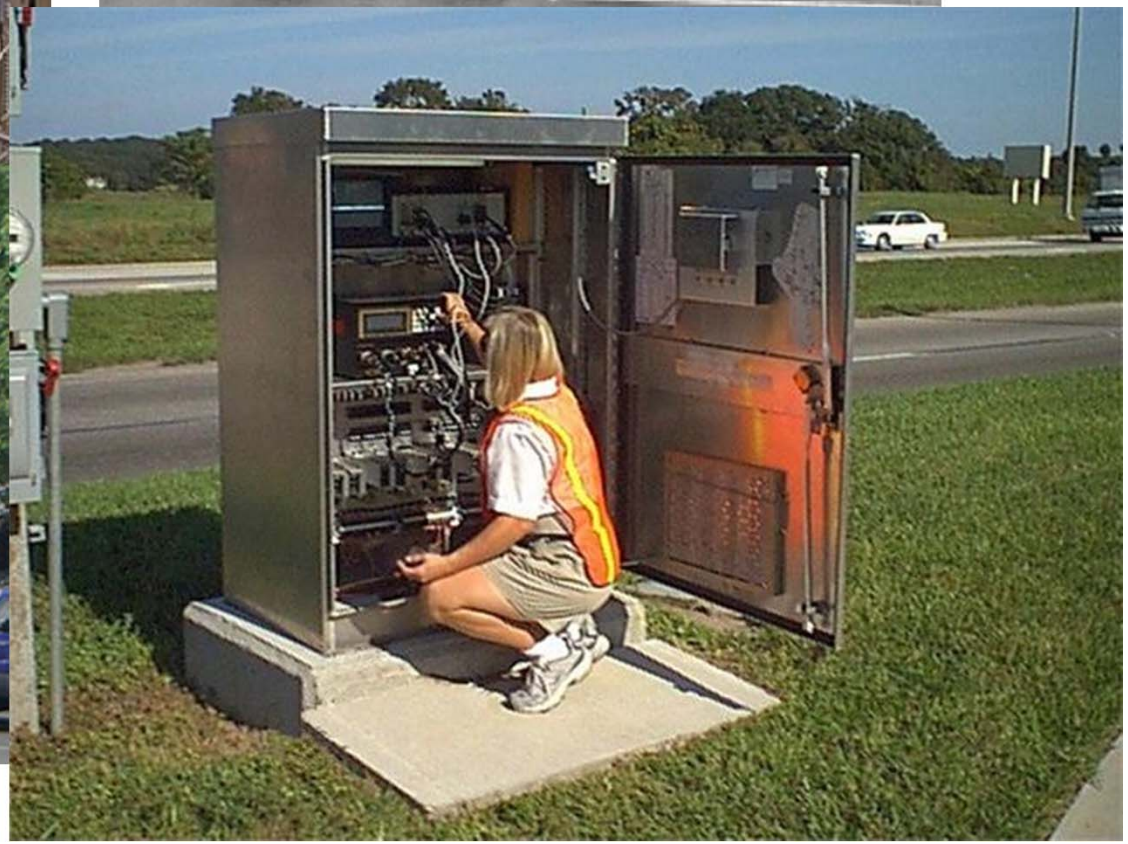
“The best parts of the week were the hands-on work and introductory lectures to the more advanced technologies of video detection and hardware-in-the-loop simulation. Exposure to this technology was worth the trip alone.”

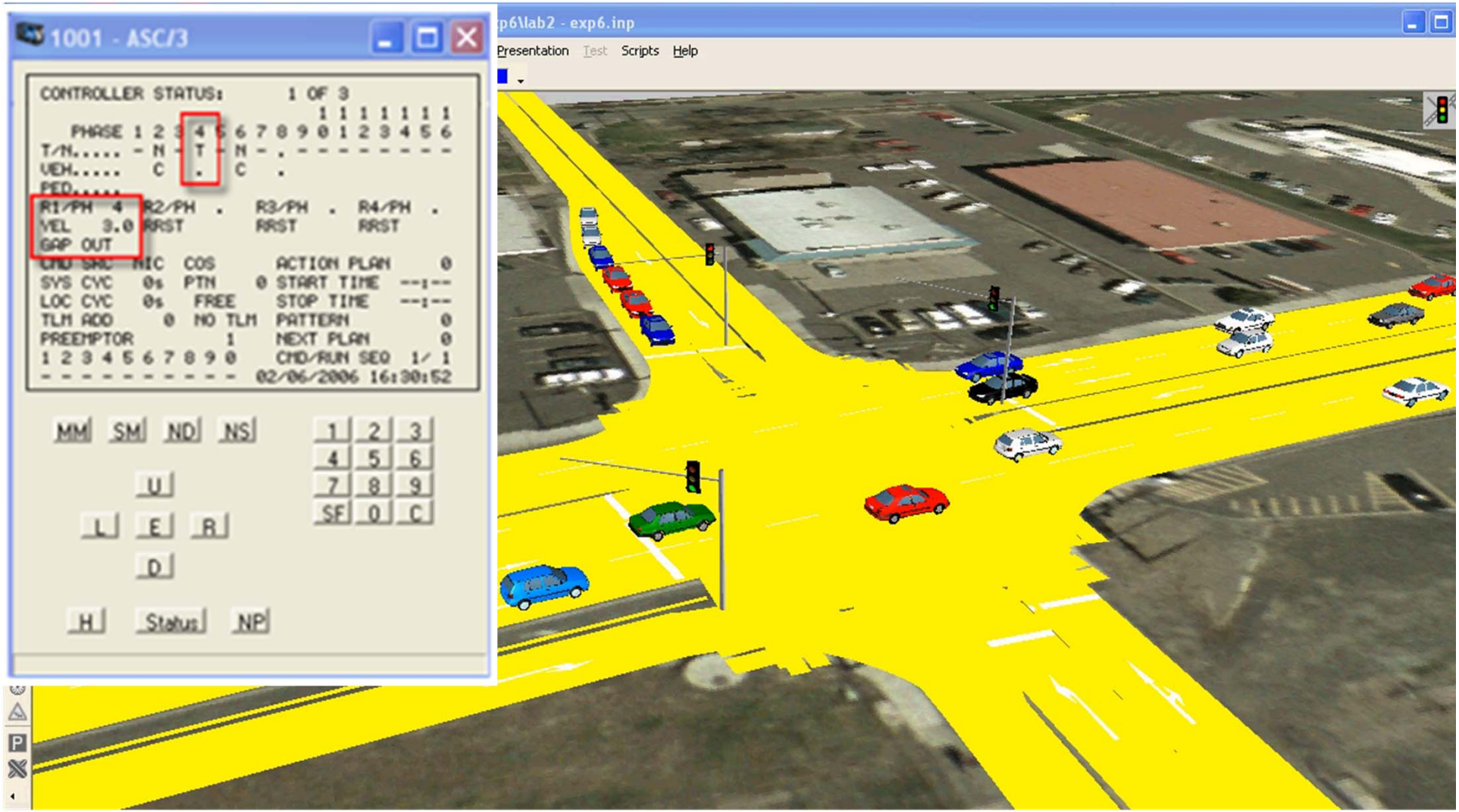
“I think the valuable part is that students don’t just look at pictures or mathematical equations. They get a chance to tinker, make mistakes, and ultimately get various components up and running… much like they will have to in the real world. This means when they are on their first job and things don’t 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.

Traffic Signal Summer Camp




ONE
WAY




1001 - ASC/3
CONTROLLER STATUS: 1 OF 3
PHASE 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6
T/N..... - N - T - N - . - - - - - - - -
VEH..... C . C .
PED.....
R1/PH 4 R2/PH . R3/PH . R4/PH .
VEL 3.0 ARST ARST ARST
GAP OUT
CMD SRC NIC COS ACTION PLAN 0
SYS CYC 0s PTN 0 START TIME --:--
LOC CYC 0s FREE STOP TIME --:--
TLM ADD 0 NO TLM PATTERN 0
PREEMPTOR 1 NEXT PLAN 0
1 2 3 4 5 6 7 8 9 0 CMD/RUN SEQ 1/ 1
- - - - - - - - - - 02/06/2006 16:30:52
MM SM ND NS
U
L E R
D
H Status NP
1 2 3
4 5 6
7 8 9
SF 0 C
p6\lab2 - exp6.inp
Presentation Test Scripts Help

- 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

- 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

Learning objectives

Overview

Questions to consider

List of steps

Running the experiment

Discussion

Structure of Experiments

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?

Structure of Experiments

- Learning objectives
- Overview
- Questions to consider
- List of steps
- Running the experiment
- Discussion

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.

Structure of Experiments

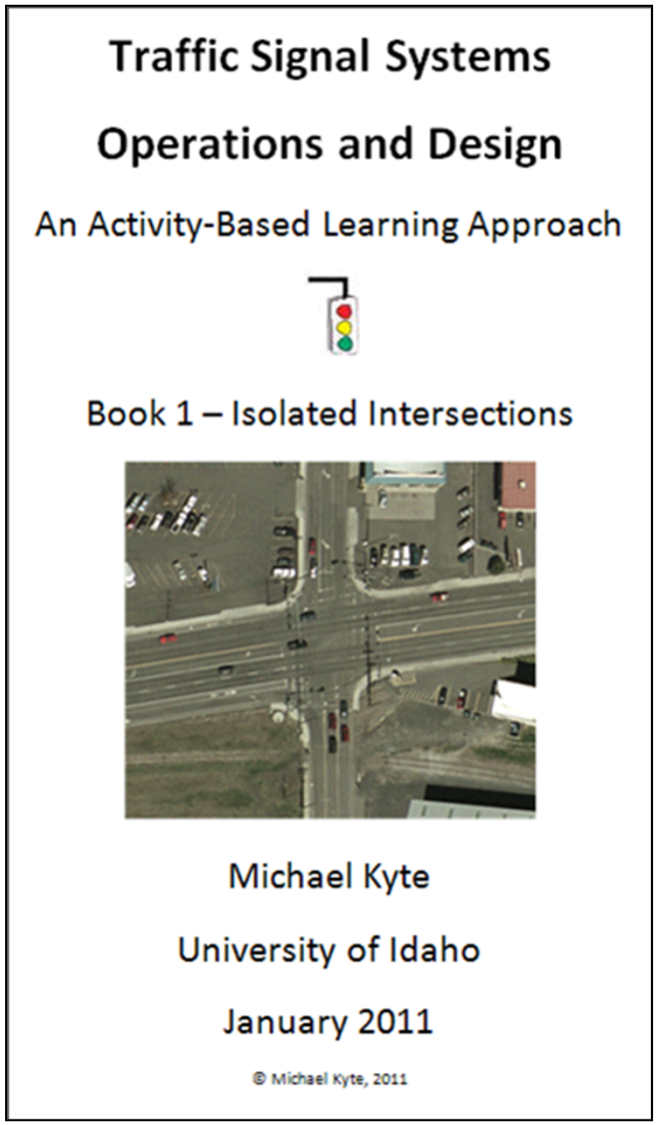
- Learning objectives
- Overview
- Questions to consider
- List of steps
- Running the experiment
- Discussion

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.



Base Knowledge	Expanding Understanding and Preparing Design	Final Design
Chapter 1 The Traffic Signal Control System	Chapter 5 Whose Turn Is It: Phasing, Rings, and Barriers	Chapter 12 Design Project: Putting It All Together
Chapter 2 Modeling What We've Observed	Chapter 6 Is There Enough Capacity: Using Critical Movement Analysis	
Chapter 3 Actuated Traffic Controller Timing Processes	Chapter 7 Timing Processes on One Approach	
Chapter 4 The Simulation Environment	Chapter 8 Timing Processes for Intersection as a Whole	
	Chapter 9 Adaptive-Actuated Traffic Control	
	Chapter 10 Right of Way Change: Change and Clearance Intervals	
	Chapter 11 Pedestrian Timing and Phasing	


Considering the Questions
is Minimum Green time too long?
long should Minimum Green time be in order to g
cles moving during early portion of green?
t are respective roles of Minimum Green time an
icle Extension time in producing efficient
erations?

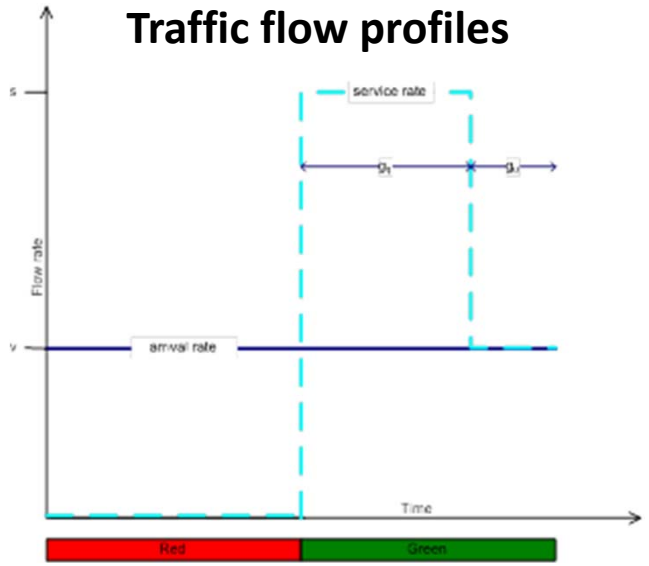
Time →

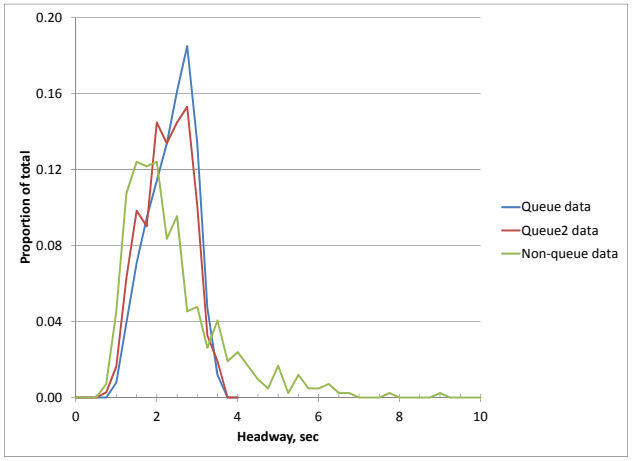
Minimum green

Green extension

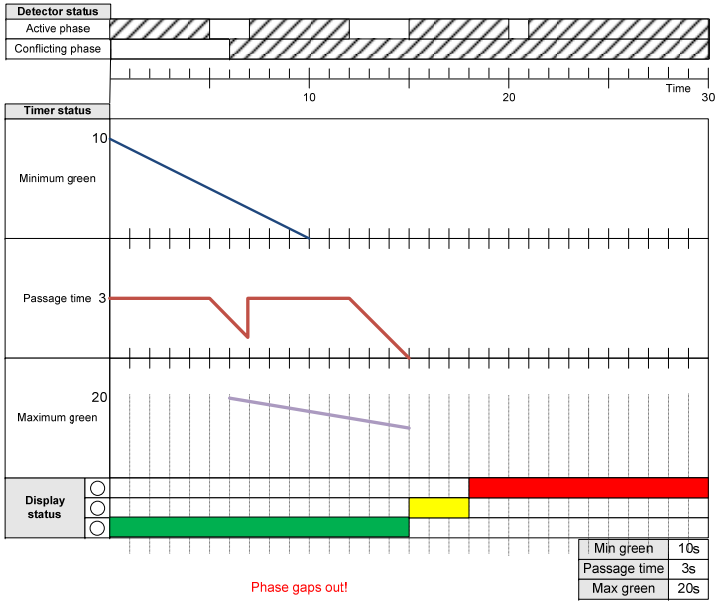
Maximum green

Traffic flow profiles

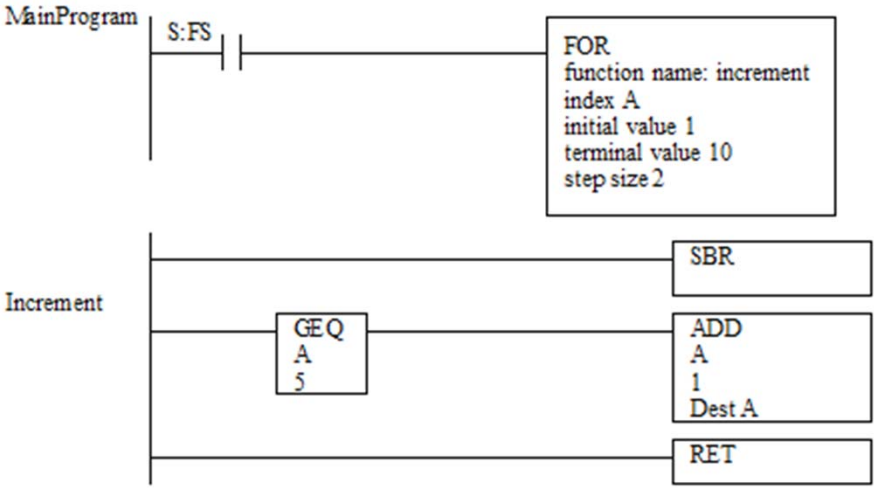




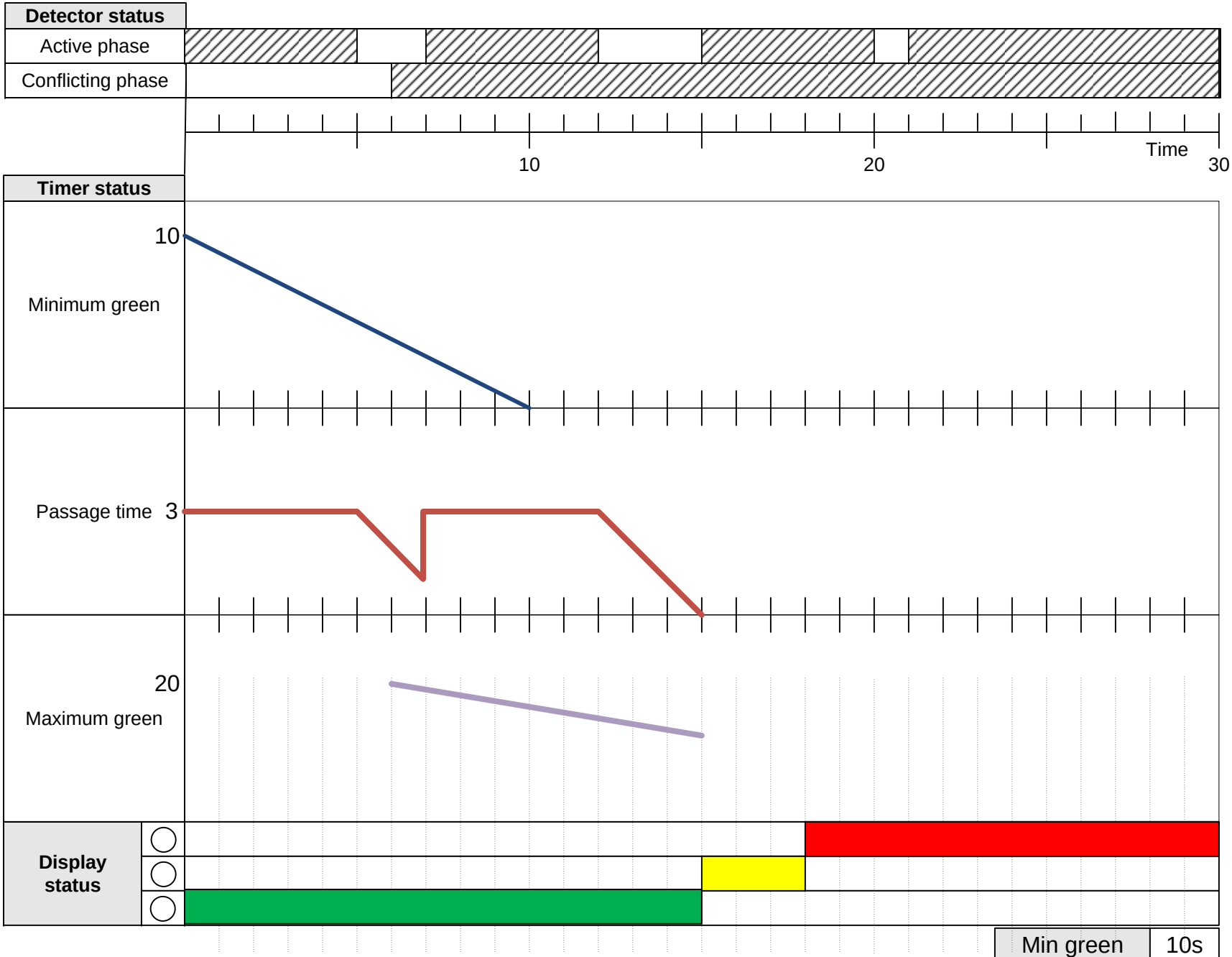
Statistical distributions



Timing processes

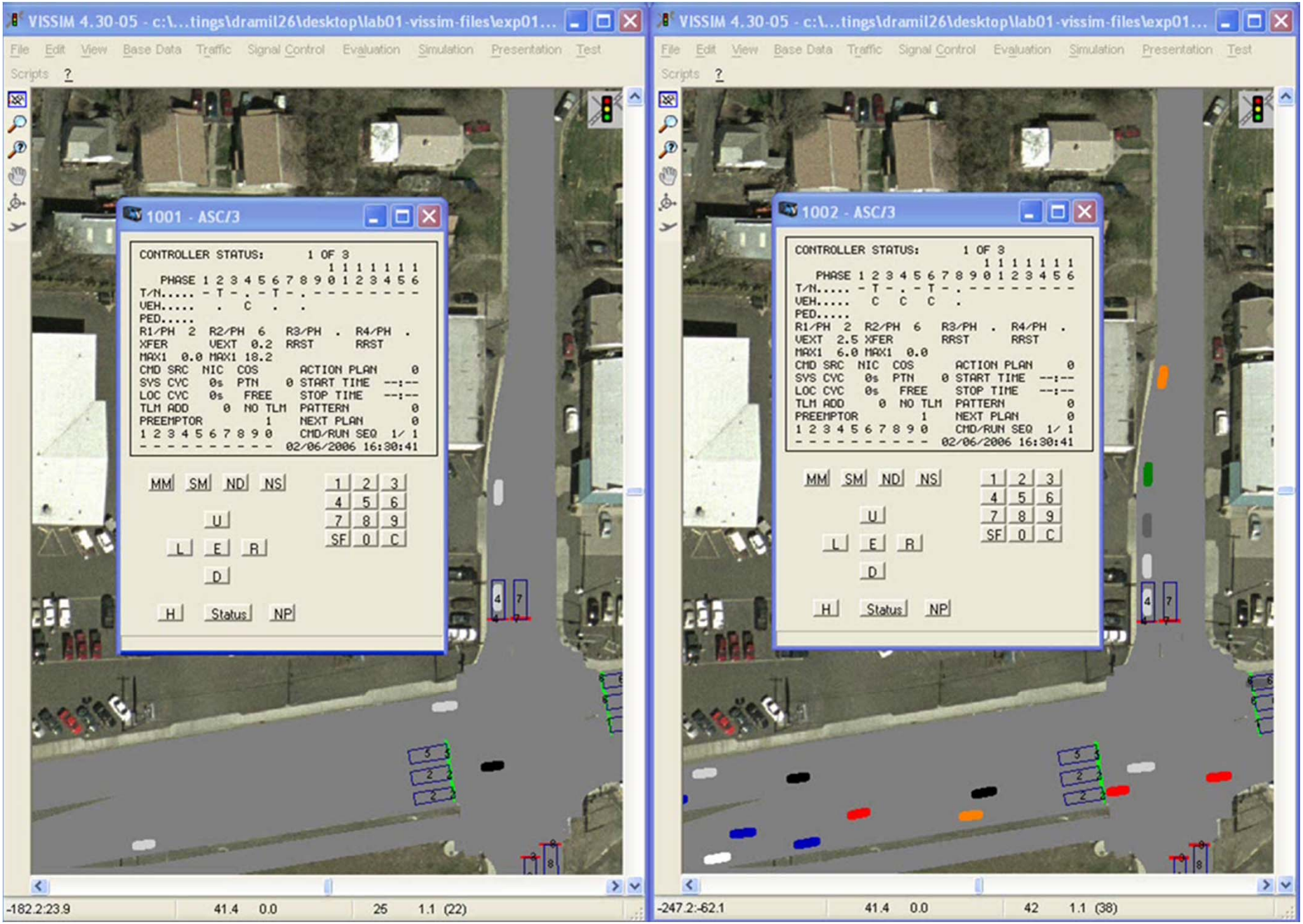


Logic processes



Min green	10s
Passage time	3s
Max green	20s

Phase gaps out!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T/N..... - T - . - T - . - - - - - - - - -
VEH..... . C . .
PED.....
R1/PH 2 R2/PH 6 R3/PH . R4/PH .
XFER VEXT 0.2 RRST RRST
MAX1 0.0 MAX1 18.2
CMD SRC NIC COS ACTION PLAN 0
SYS CYC 0s PTN 0 START TIME --:--
LOC CYC 0s FREE STOP TIME --:--
TLM ADD 0 NO TLM PATTERN 0
PREEMPTOR 1 NEXT PLAN 0
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02/06/2006 16:30:41
MM SM ND NS
U
L E R
D
H Status NP
1 2 3
4 5 6
7 8 9
SF 0 C
-182.2:23.9 41.4 0.0 25 1.1 (22)
VISSIM 4.30-05 - c:\...tings\dramil26\desktop\lab01-vissim-files\exp01...
File Edit View Base Data Traffic Signal Control Evaluation Simulation Presentation Test
Scripts ?
1002 - ASC/3
CONTROLLER STATUS: 1 OF 3
PHASE 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6
T/N..... - T - . - T - . - - - - - - - - -
VEH..... C C C .
PED.....
R1/PH 2 R2/PH 6 R3/PH . R4/PH .
VEXT 2.5 XFER RRST RRST
MAX1 6.0 MAX1 0.0
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SYS CYC 0s PTN 0 START TIME --:--
LOC CYC 0s FREE STOP TIME --:--
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02/06/2006 16:30:41
MM SM ND NS
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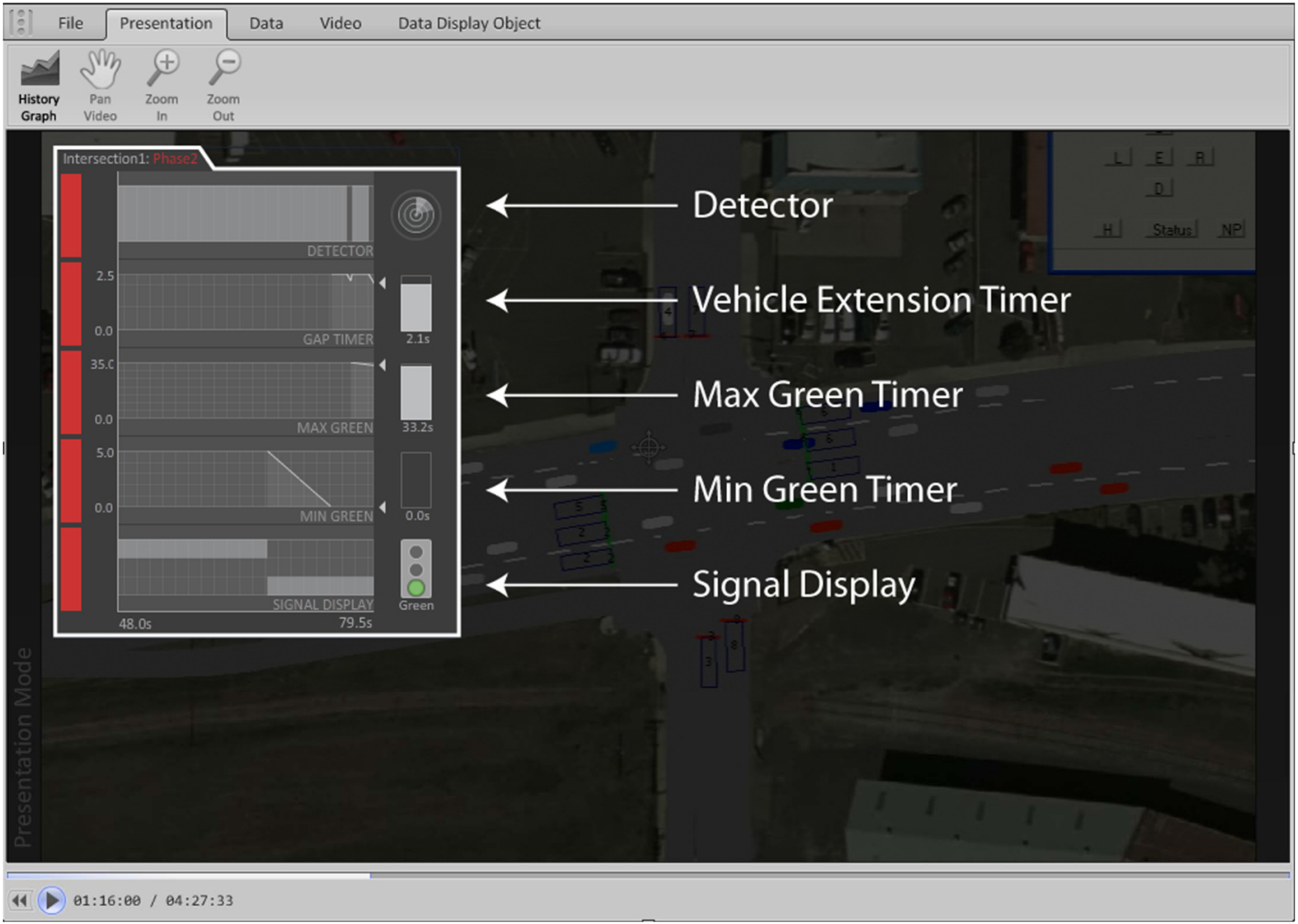
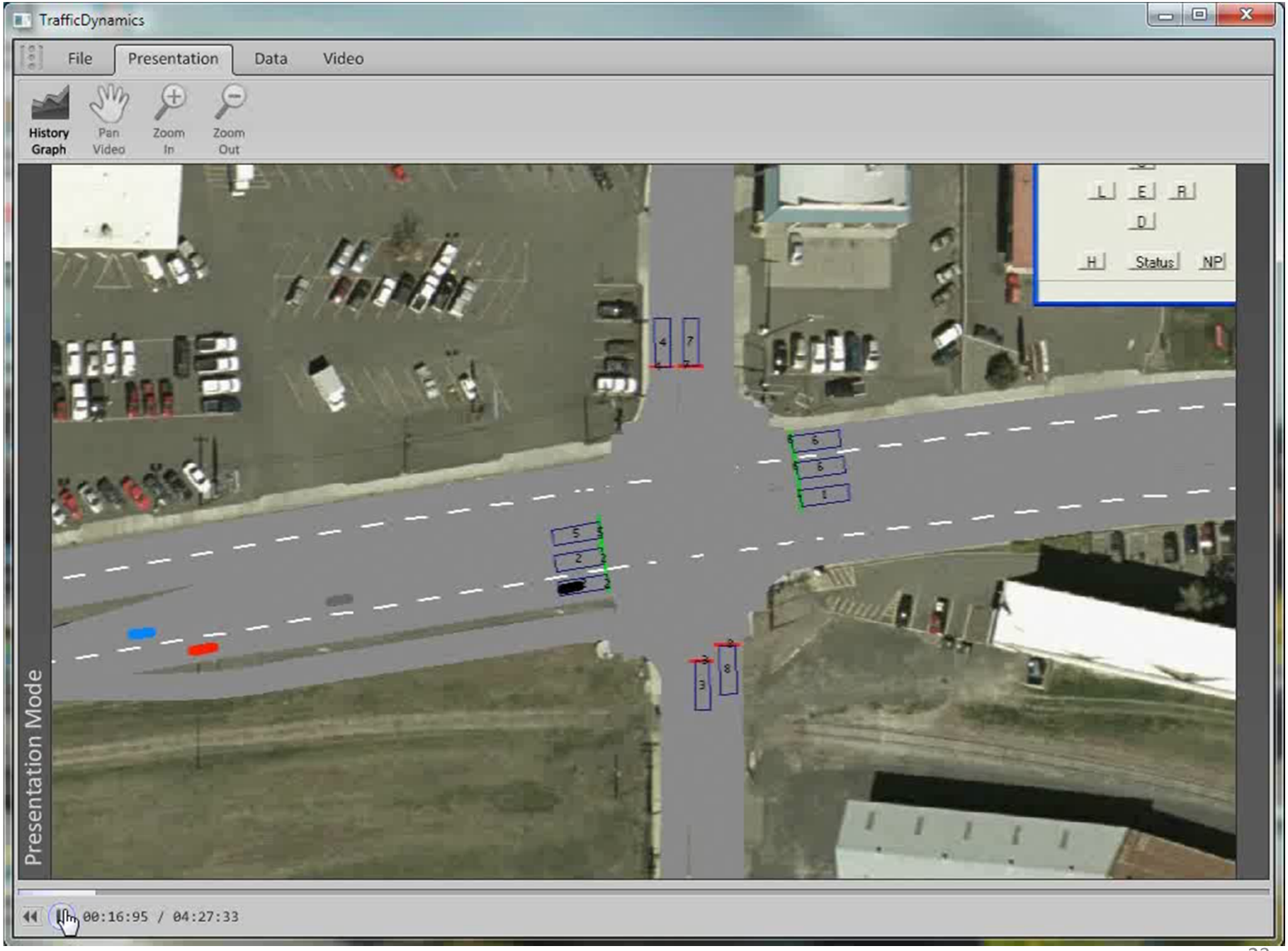

File
Presentation
Data
Video
Data Display Object
History Graph
Pan Video
Zoom In
Zoom Out
Intersection1: Phase2
DETECTOR
2.5
0.0
GAP TIMER
2.1s
35.0
0.0
MAX GREEN
33.2s
5.0
0.0
MIN GREEN
0.0s
SIGNAL DISPLAY
Green
48.0s
79.5s
Detector
Vehicle Extension Timer
Max Green Timer
Min Green Timer
Signal Display
Presentation Mode
01:16:00 / 04:27:33


TrafficDynamics
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Data
Video
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Zoom In
Zoom Out
L
E
R
D
H
Status
NP
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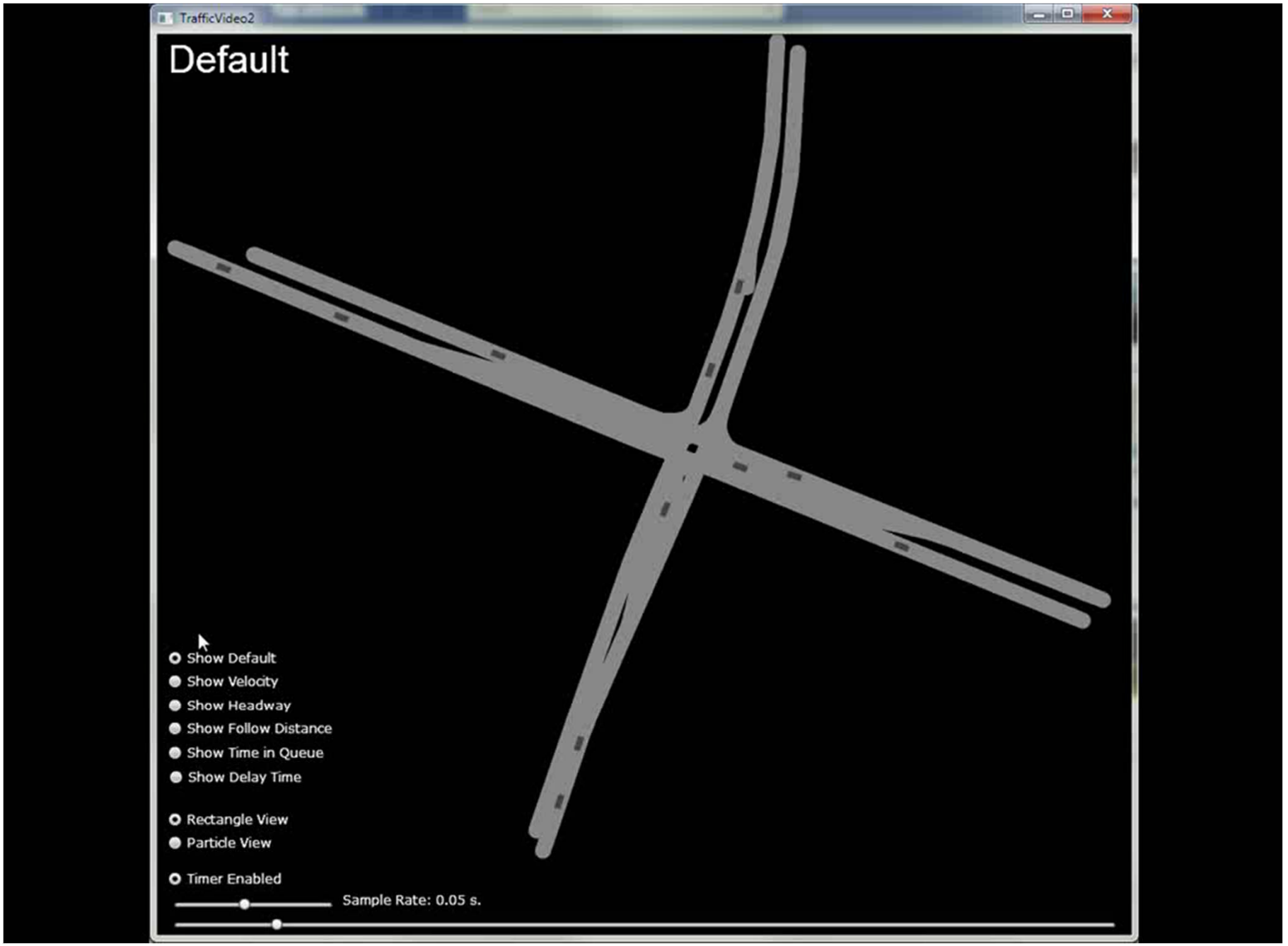
00:16:95 / 04:27:33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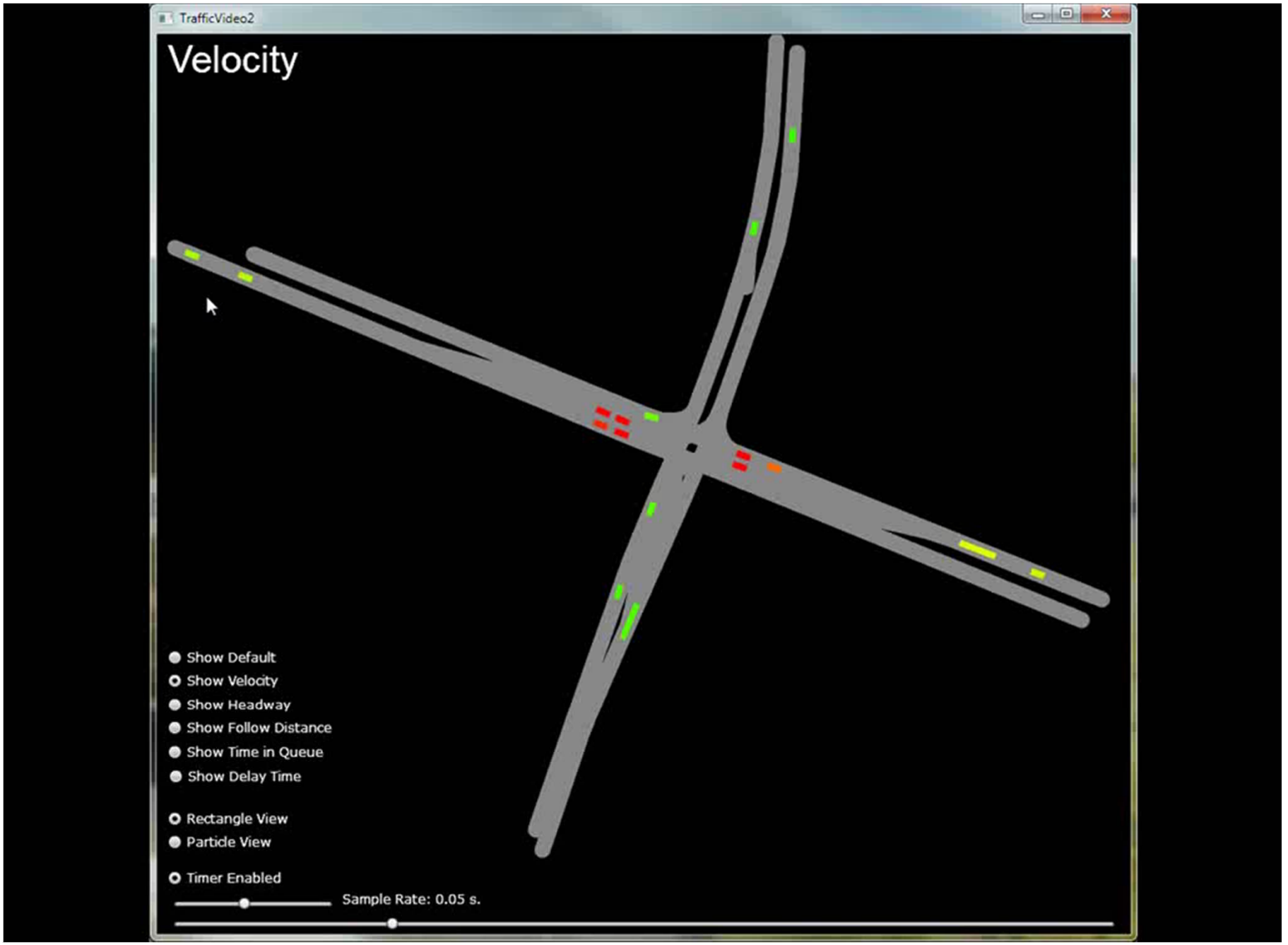
Show Velocity
Show Headway
Show Follow Distance
Show Time in Queue
Show Delay Time
Rectangle View
Particle View
Timer Enabled
Sample Rate: 0.05 s.


TrafficVideo2
Velocity
Show Default
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Rectangle View
Particle View
Timer Enabled
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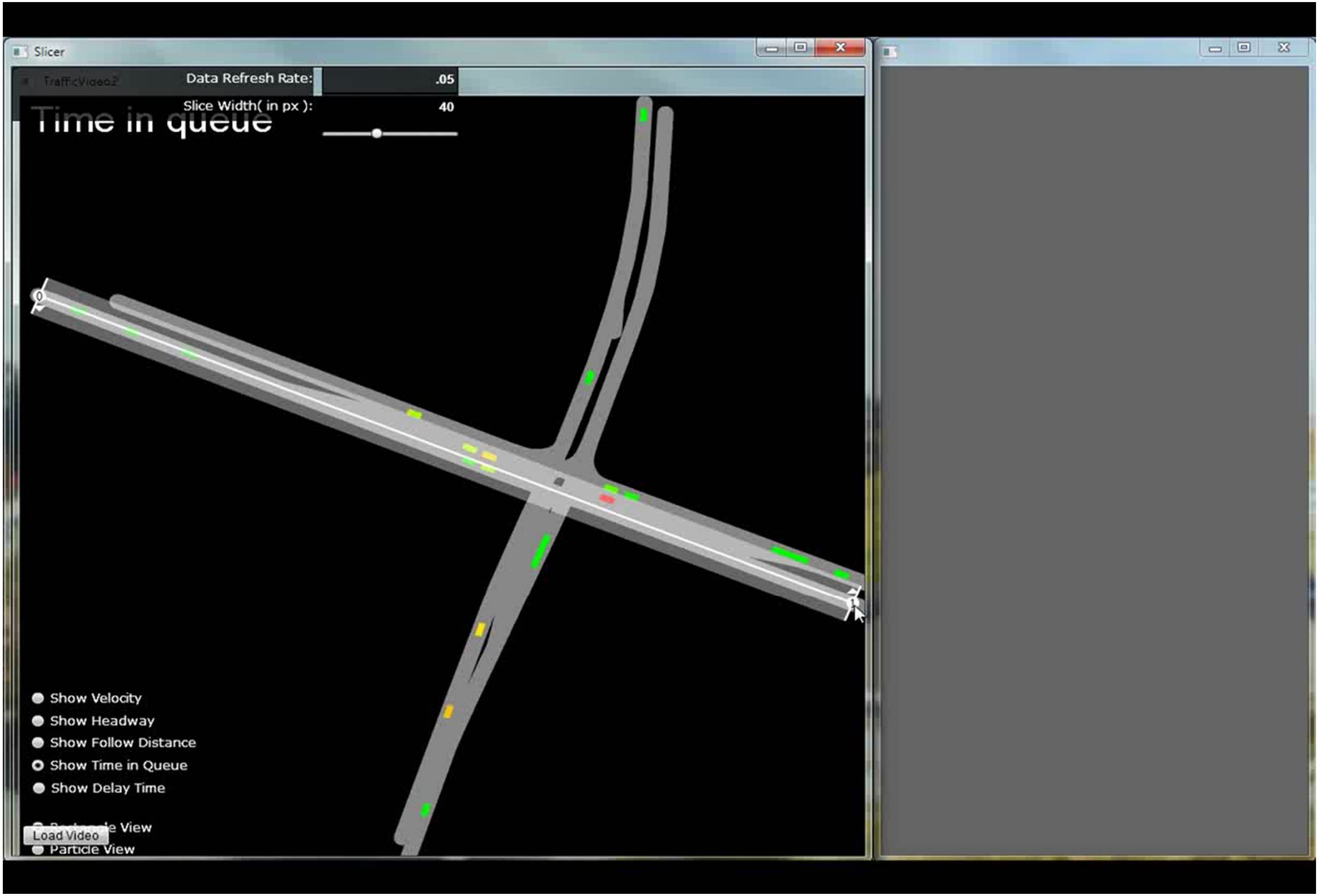
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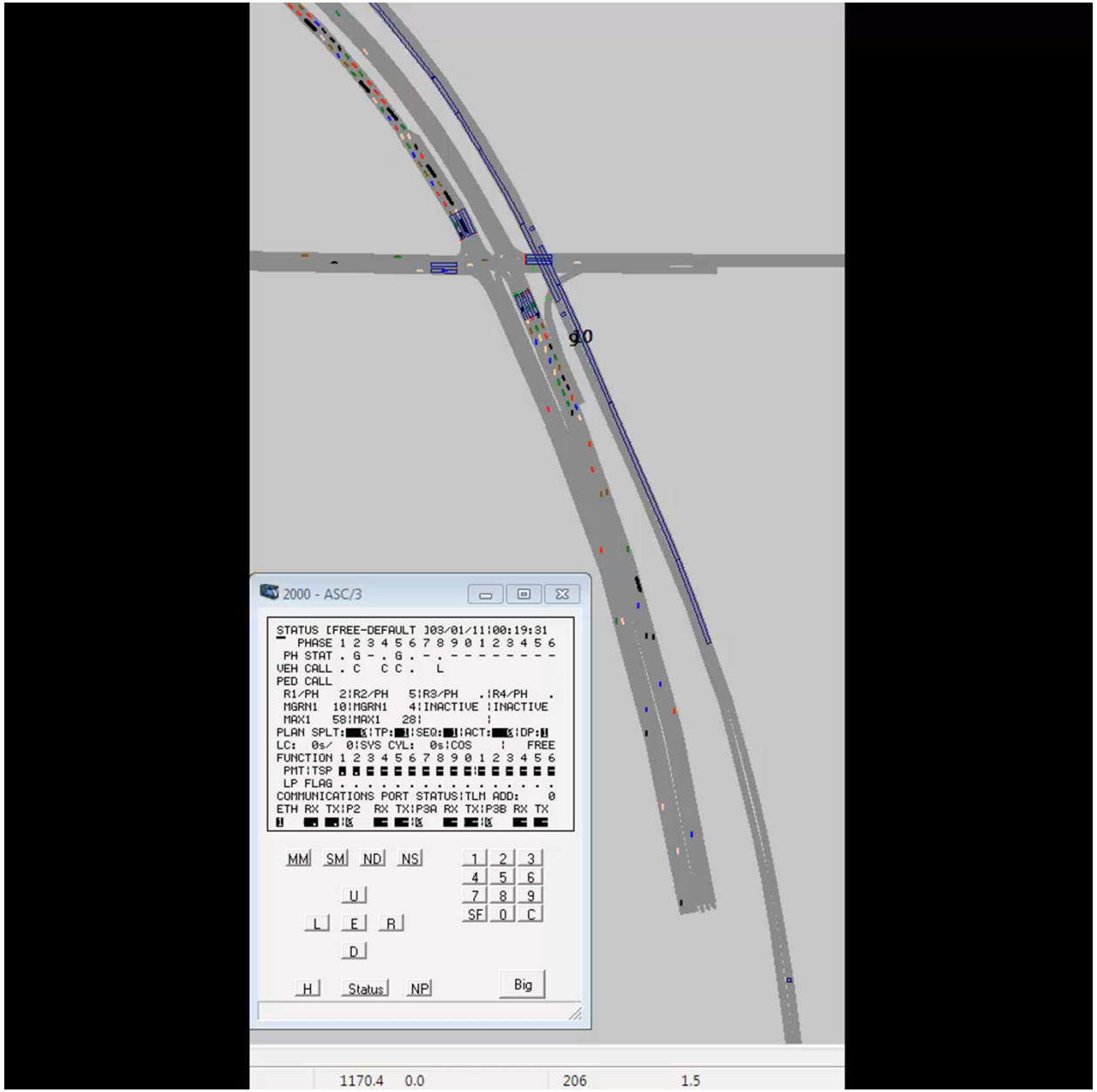
TrafficVideo2
Data Refresh Rate:
.05
Slice Width(in px):
40
Time in queue
Show Velocity
Show Headway
Show Follow Distance
Show Time in Queue
Show Delay Time
Load Video
Particle View


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
Velocity:
35 mph
Velocity:
0 mph
Velocity:
15 mph
Avg Velocity:
29.4 mph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PH STAT . G - . G . - . - - - - - - - -
VEH CALL . C C C . L
PED CALL
R1/PH 2:R2/PH 5:R3/PH .:R4/PH .
MGRN1 10:MGRN1 4:INACTIVE :INACTIVE
MAX1 58:MAX1 28:
PLAN SPLT:
LC: 0s/ 0:SYS CYL: 0s:COS ! FREE
FUNCTION 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6
PMT:TSP
LP FLAG . . . . . .
COMMUNICATIONS PORT STATUS:TLM ADD: 0
ETH RX TX:P2 RX TX:P3A RX TX:P3B RX TX
MM SM ND NS
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L E R
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H Status NP
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4 5 6
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SF 0 C
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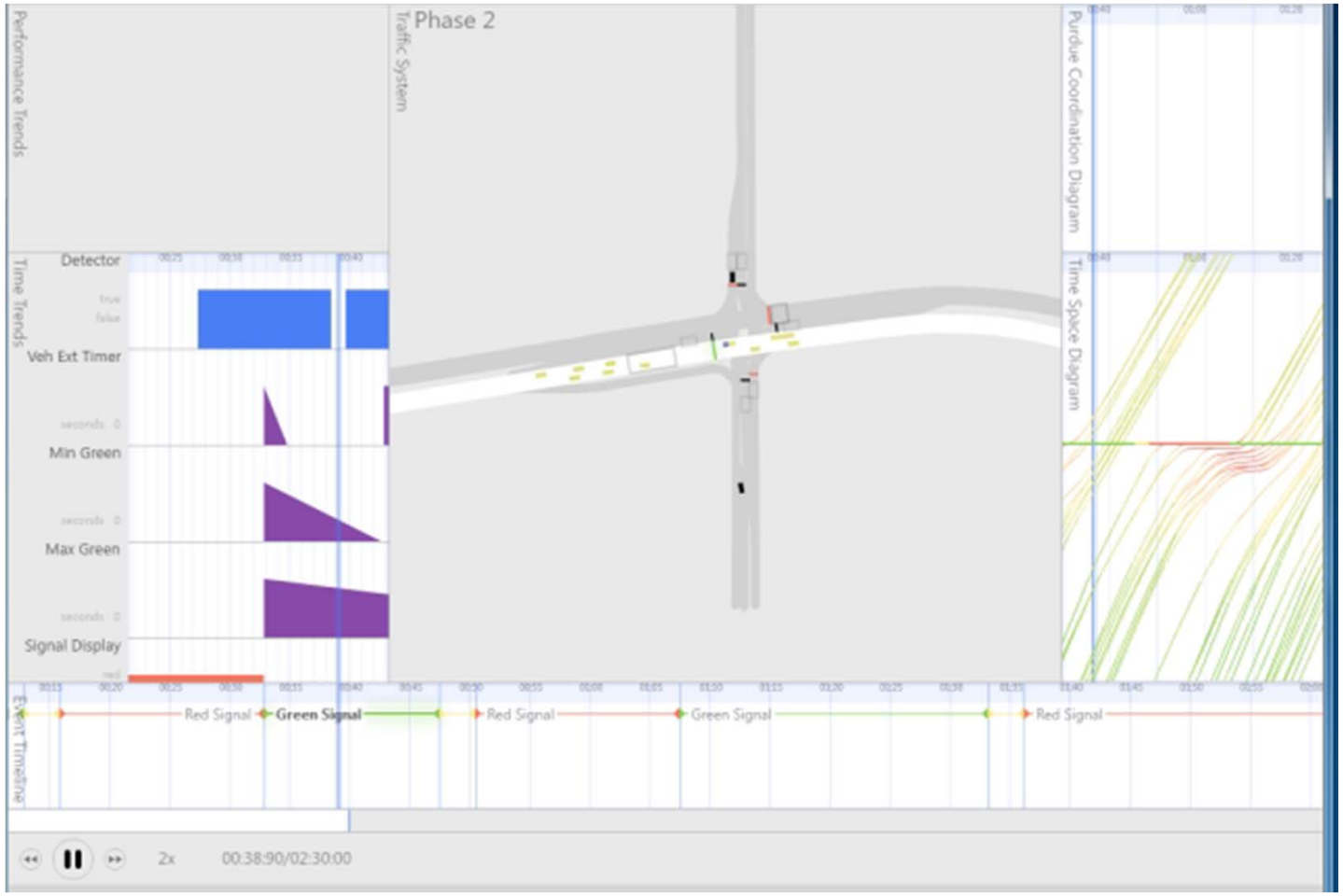
TrafficSense



- “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?