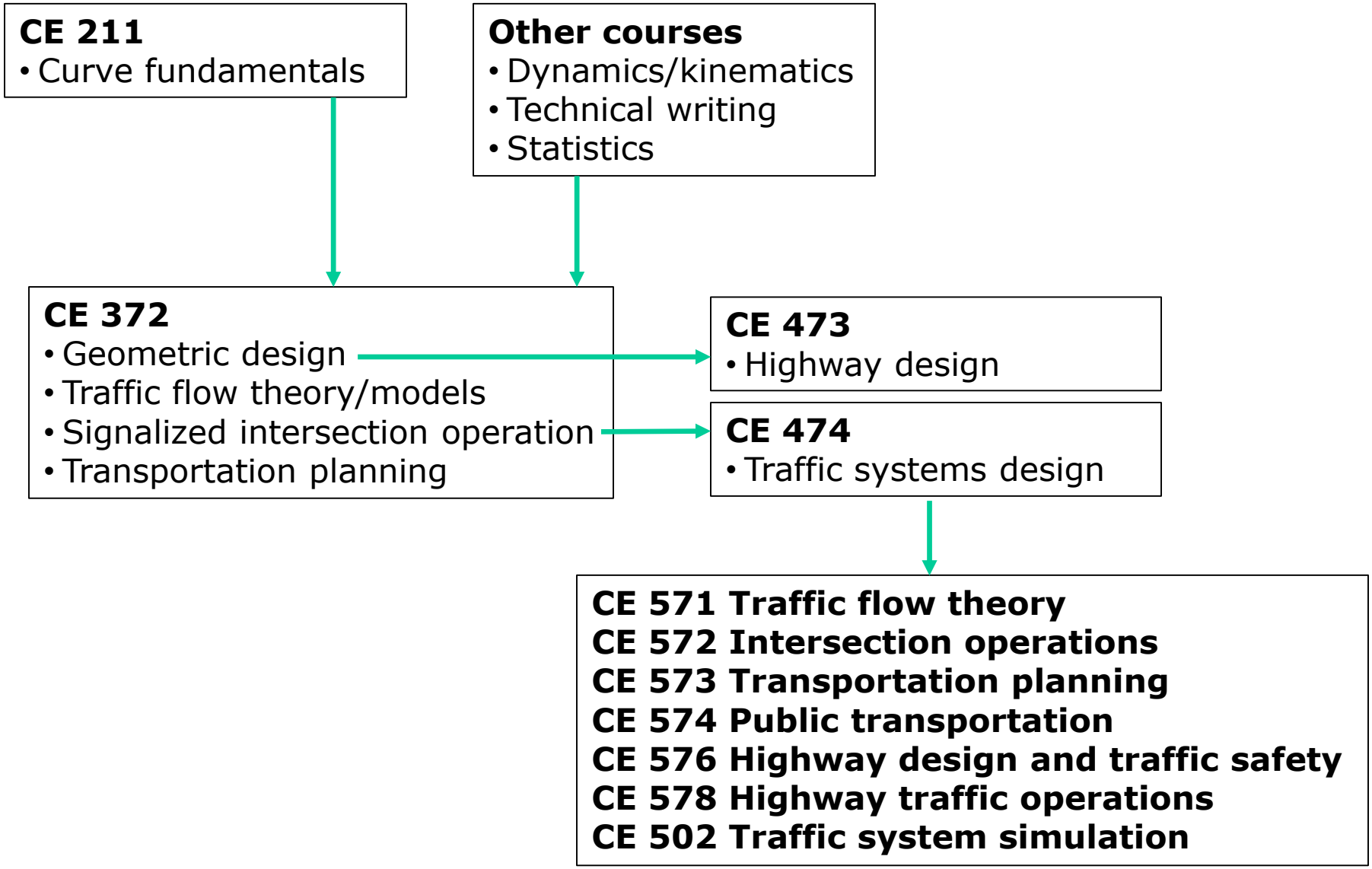
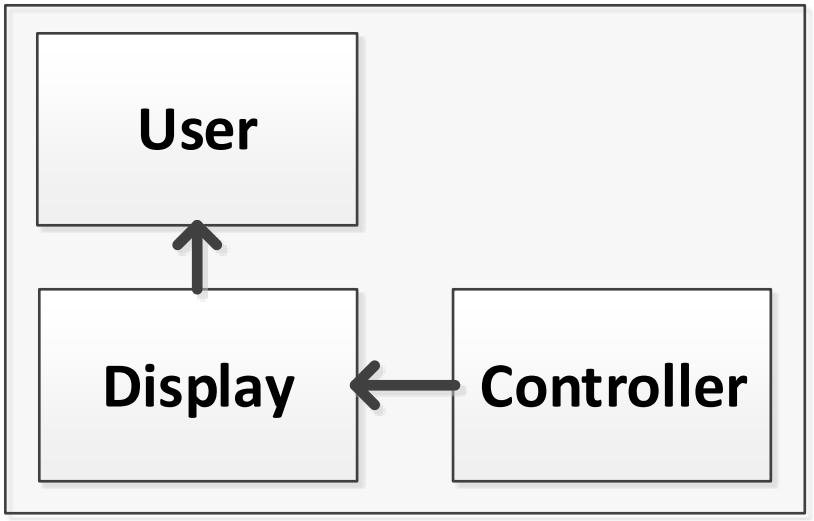
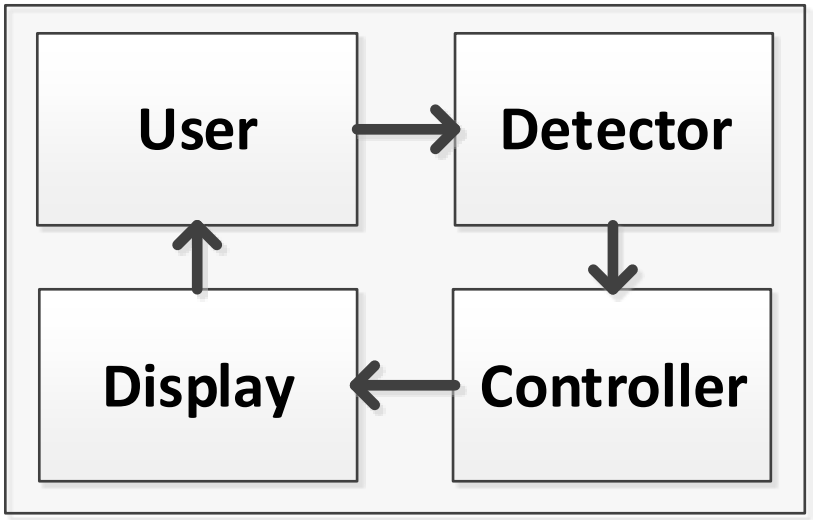
CE 474 – Class 01 Traffic Signal Control Systems: Operations and Design

August 24, 2015

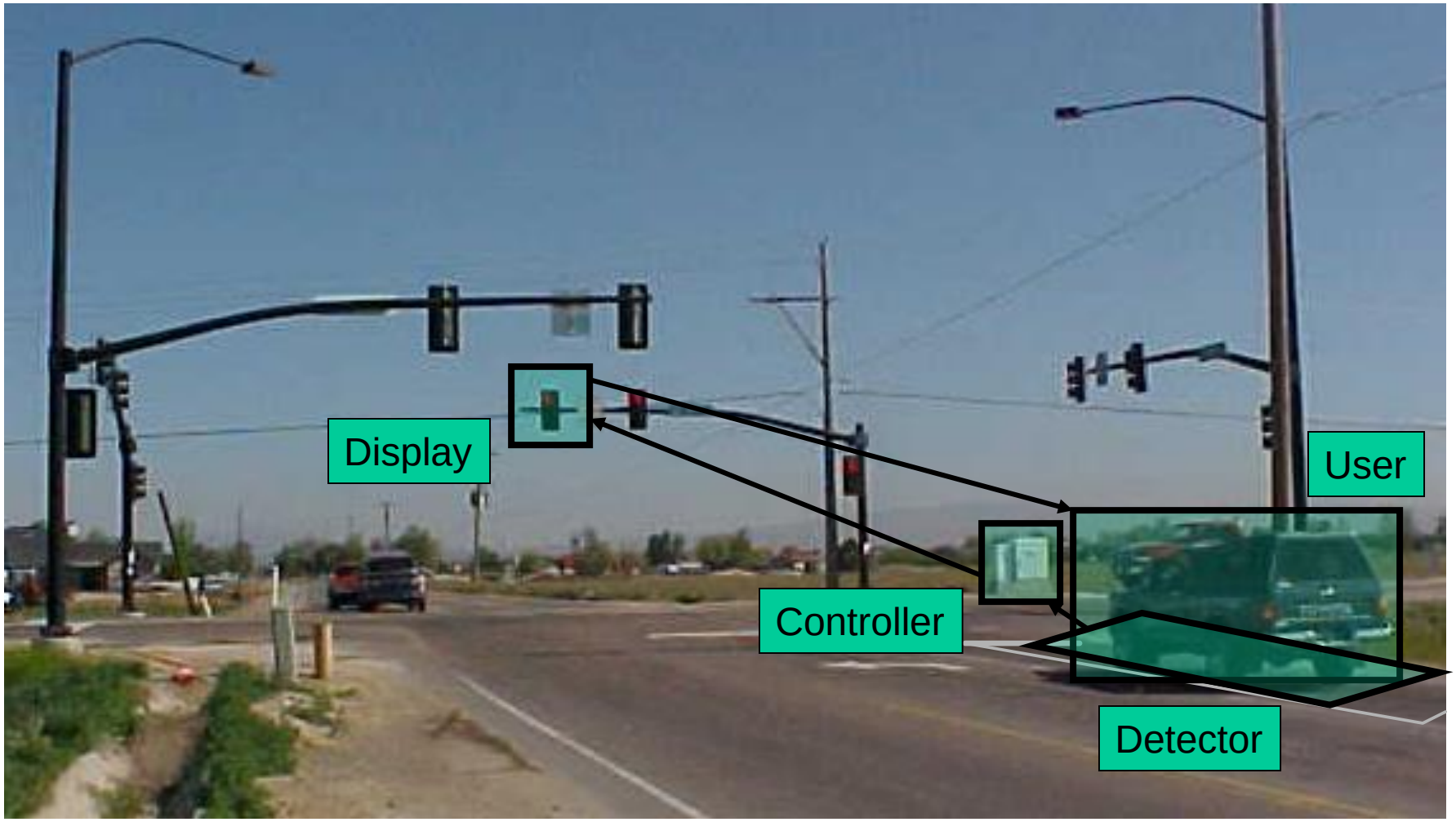

CE 211
• Curve fundamentals
Other courses
• Dynamics/kinematics
• Technical writing
• Statistics
CE 372
• Geometric design
• Traffic flow theory/models
• Signalized intersection operation
• Transportation planning
CE 473
• Highway design
CE 474
• Traffic systems design
CE 571 Traffic flow theory
CE 572 Intersection operations
CE 573 Transportation planning
CE 574 Public transportation
CE 576 Highway design and traffic safety
CE 578 Highway traffic operations
CE 502 Traffic system simulation



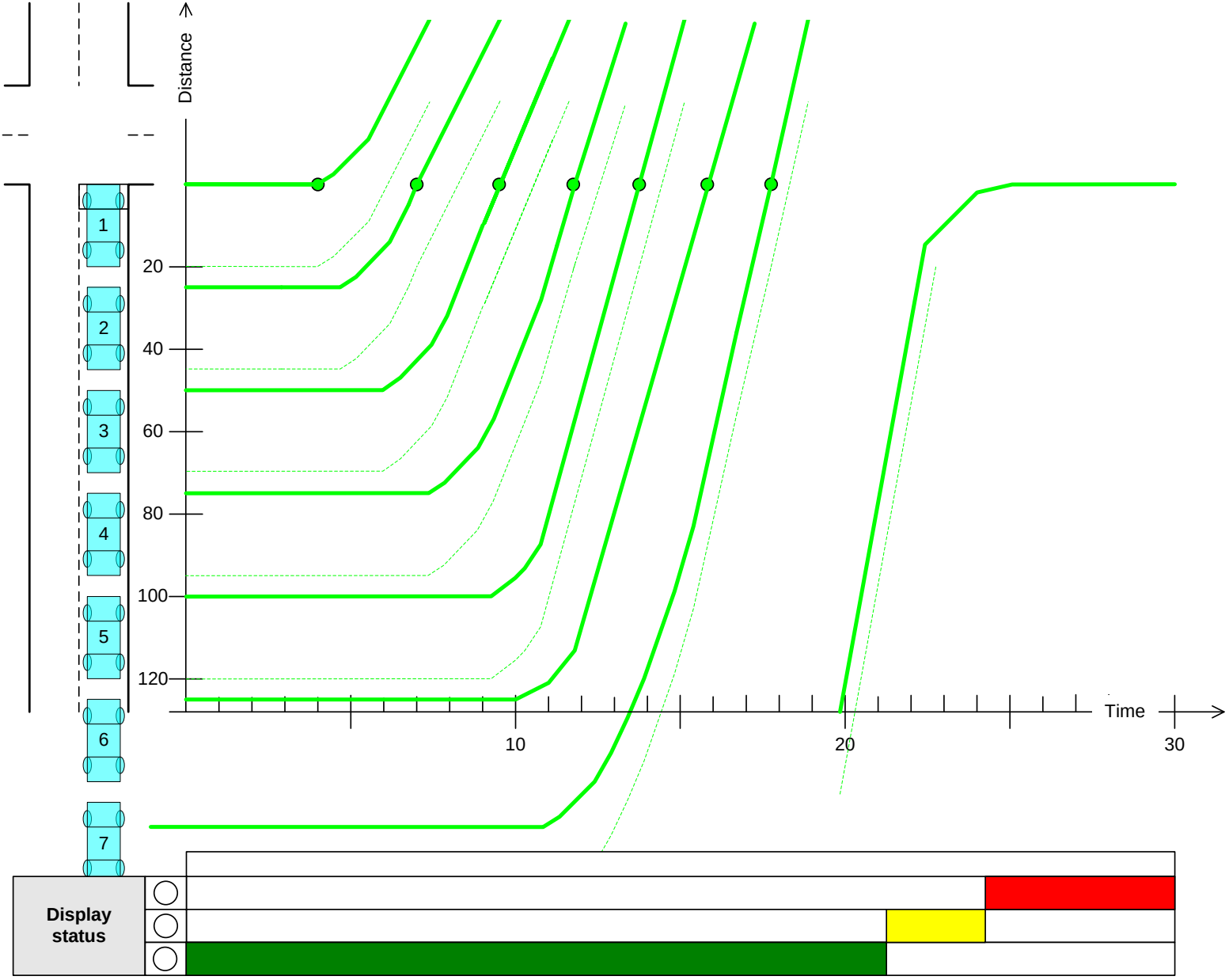
Pretimed control

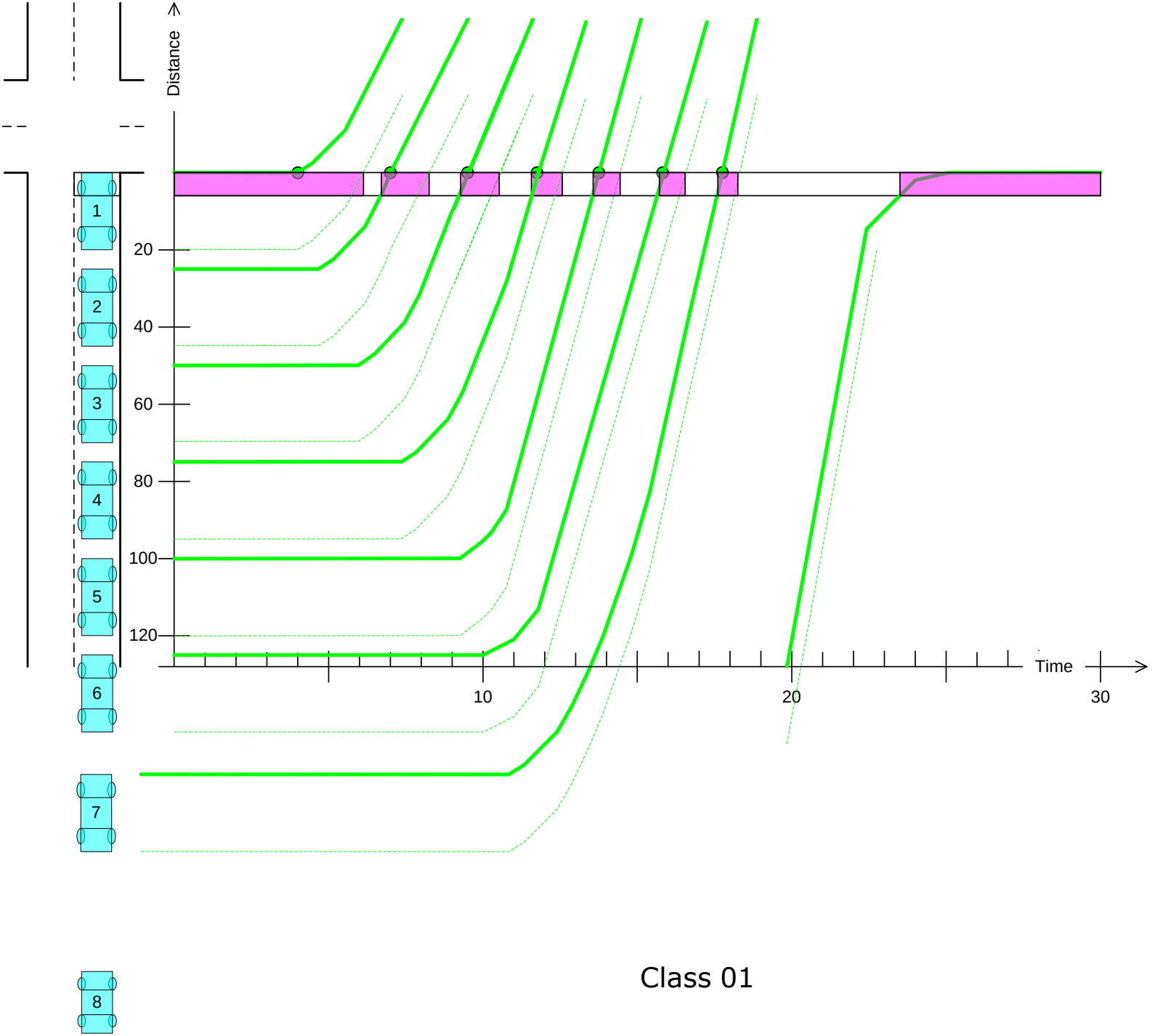


Actuated control



User – Detector – Controller – Display System


Distance
1
2
3
4
5
6
7
8
20
40
60
80
100
120
Time
10
20
30
Display status


Distance
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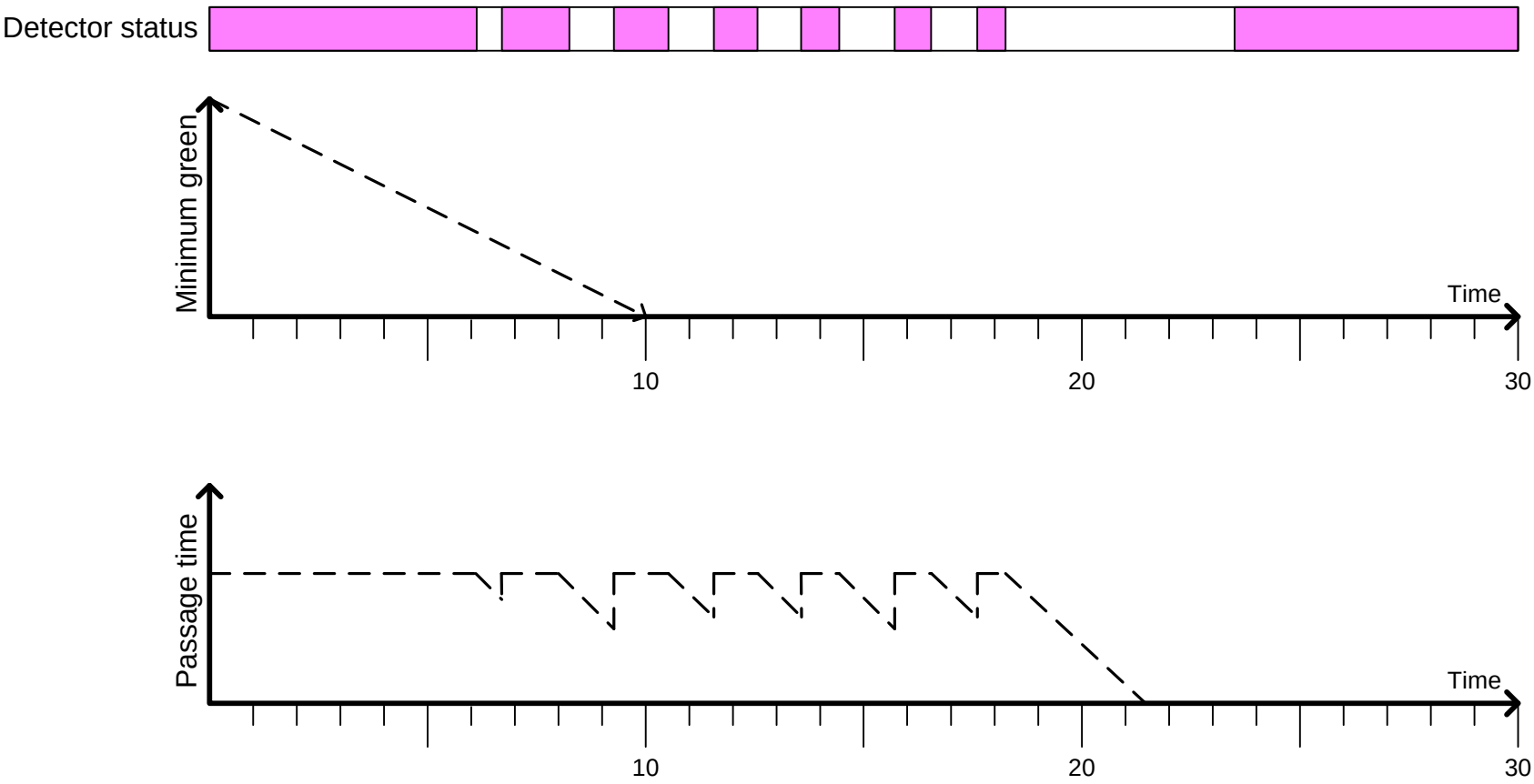
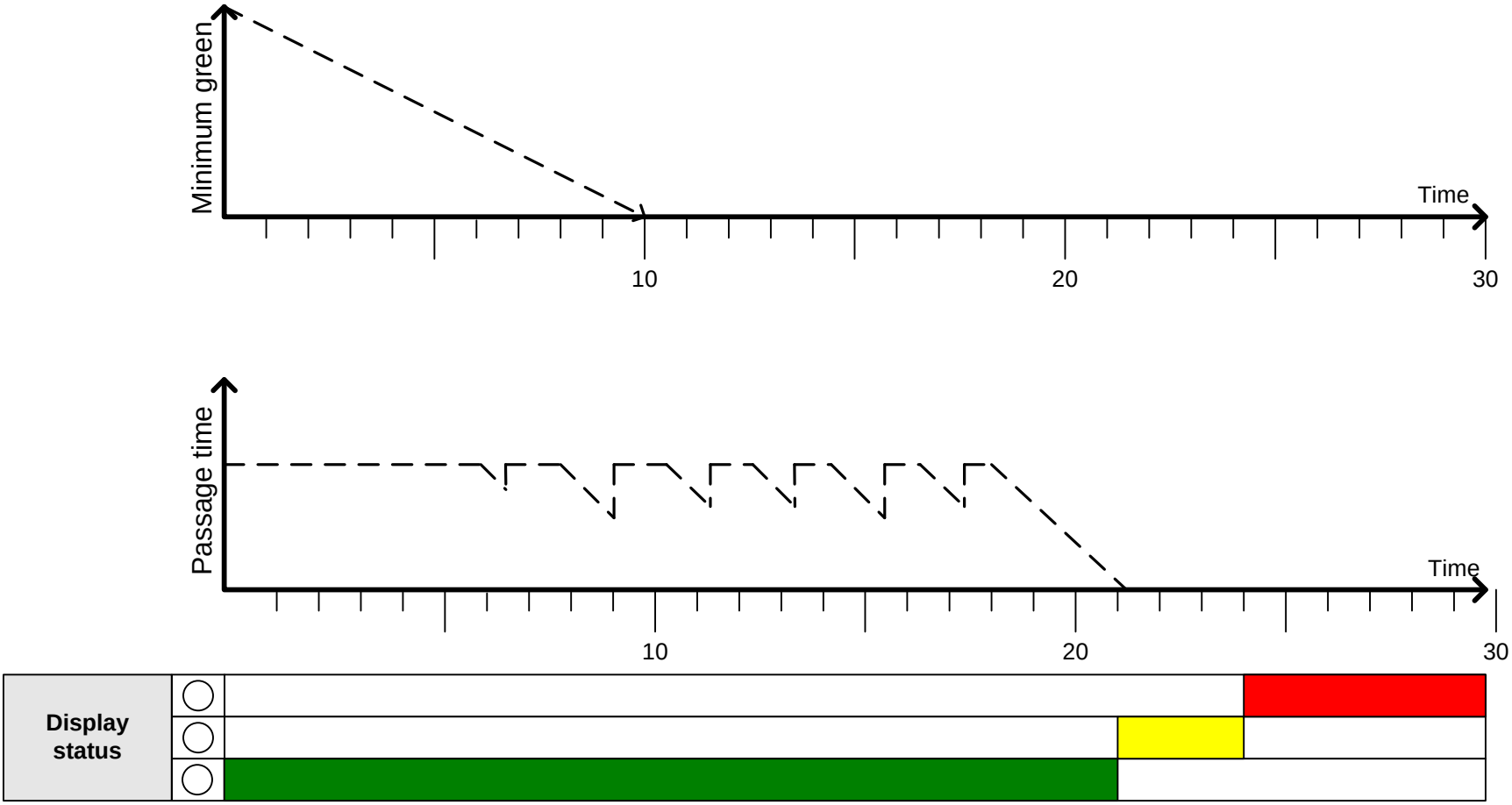

Detector status
Minimum green
Time
10
20
30
Passage time
Time
10
20
30


Minimum green
Time
10
20
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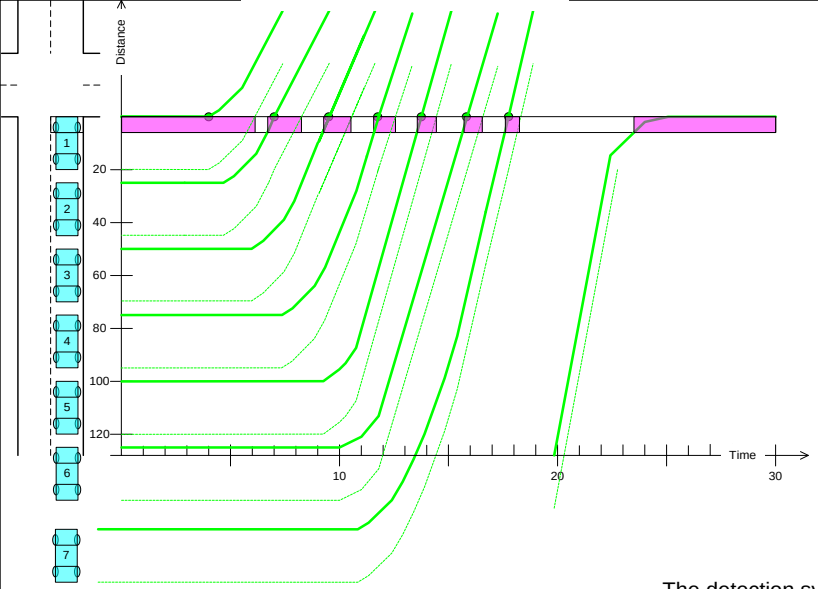
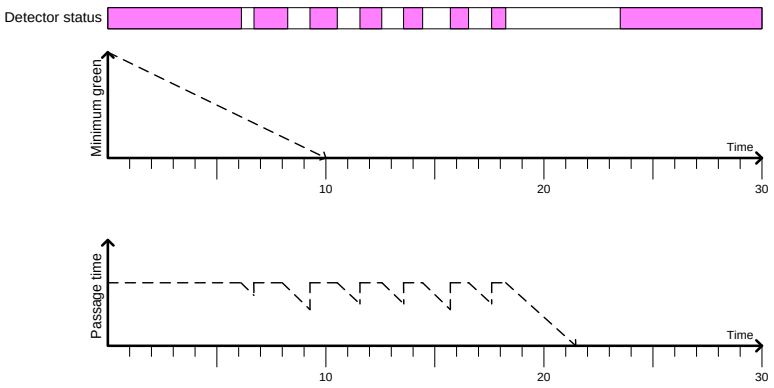
Passage time
Time
10
20
30
Display status



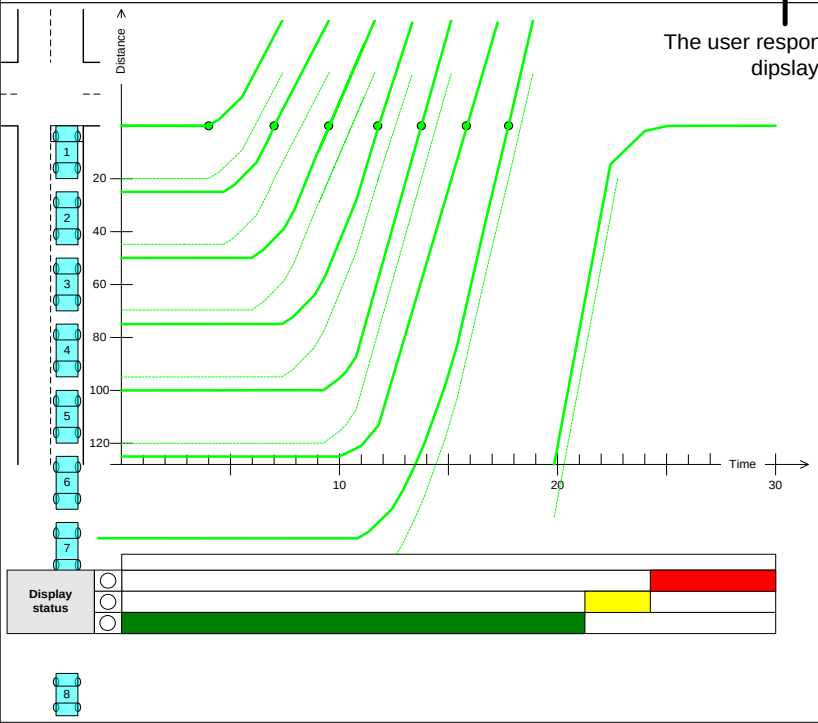


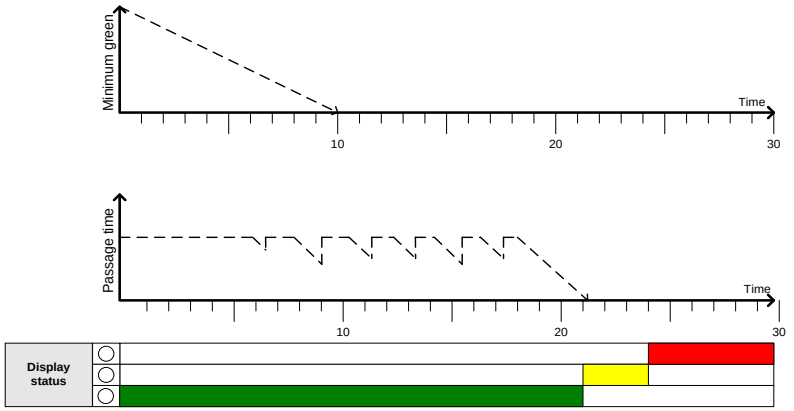
The detection system responds to the user

The control system responds to the detections

The user responds to the dipslay

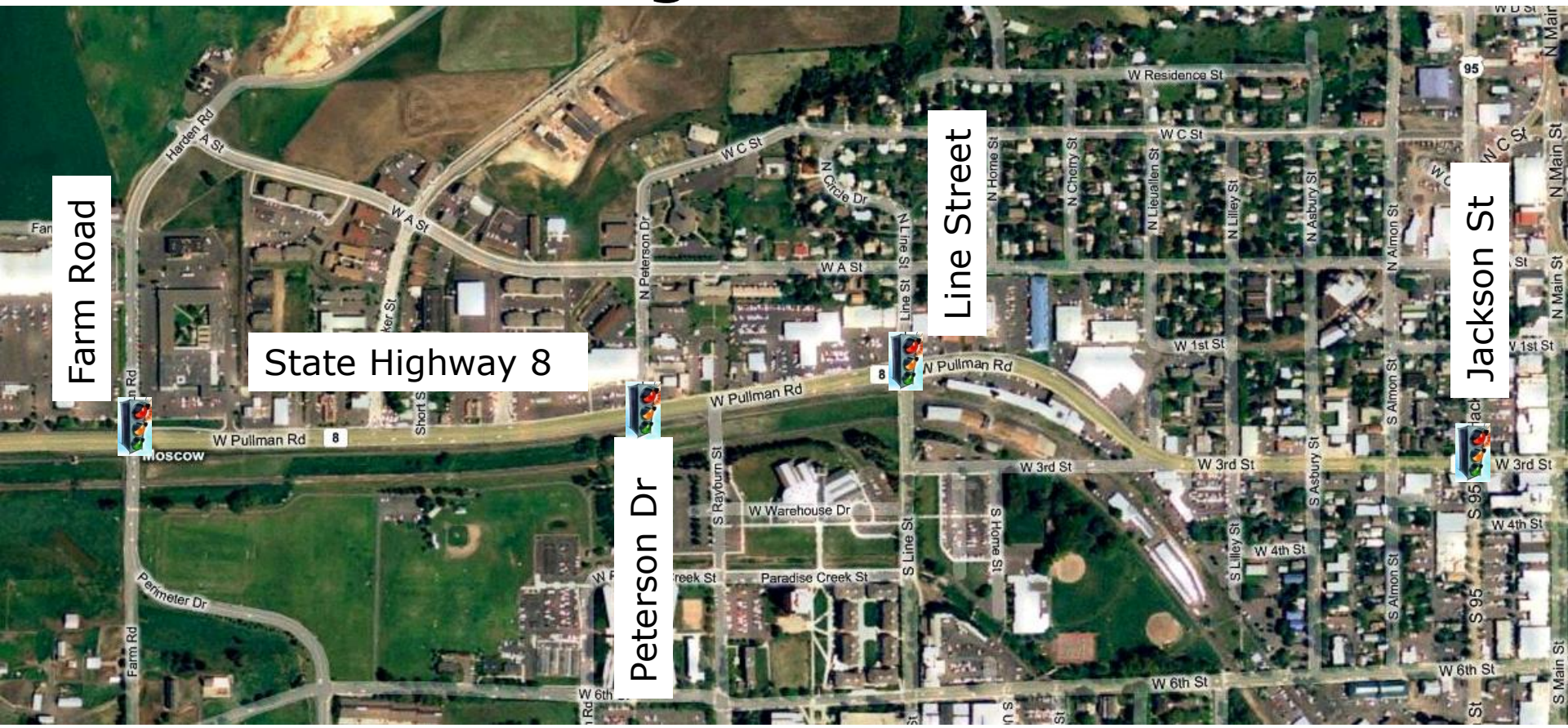
The display responds to the control system





Class 01

Design Problem



Design project #1
Isolated intersection
August 24-October 29

Design project #2
Coordinated system
November 2-December 10

August September October November December

Introductions

- Find someone that you don’t know
- In 5 minutes, find out their name and one INTERESTING thing that they did this summer or one SURPRISING thing about them that not very many people know
- Be prepared to introduce them to the rest of the class using the information that you learn about them

Syllabus

- About the course
- What you will do
- Meeting times
- Course instructor
- Textbooks
- Assignments, exams, expectations
- Learning styles
- Schedule

CE 474 FALL 2015

HOME | ADMINISTRATION | SCHEDULE/ACTIVITIES | RESOURCES | REFLECTIONS

http://ce474fall2015.weebly.com/

Consider these questions

Why study traffic signal systems? Why are signal systems important to our nation's transportation system? What are the components of a traffic signal system and how does one prepare a design for these systems and their components? What standards are used by professionals in preparing these designs? How do traffic controllers work and how do the settings used in these controllers affect traffic flow? And, how do design teams effectively work together to prepare a design? You will be able to answer these questions for yourself as we work our way through the course during the next several months.

Consider these points

Our nation needs an efficient, safe, reliable, and secure transportation system. Our growing and migratory population relies upon the efficient movement of people and goods from place to place. Efficiency means the shortest possible travel time and the least amount of energy expended. This efficiency depends, to a large degree, on proper traffic signal management: nearly two-thirds of all miles driven each year in the U.S. are on roadways that are controlled by traffic signals. In some urban areas, signals at busy intersections control the movement of more than 100,000 vehicles per day. And, 20 percent of the fuel used on urban arterials is expended by vehicles waiting at red lights! Poorly designed, inefficient, and uncoordinated signal timing results in a high cost from wasted time, inefficient use of precious energy resources, damage to the environment, and unsafe conditions for motorists and pedestrians.

You will find that traffic systems design is more than rocket science since it not only involves advanced technology but people as well: drivers who behave in different and sometimes unpredictable ways and elected officials who may not have a thorough understanding of all of the technical issues involved in traffic signal systems. You will be exposed to some of each during this course!

What you will do

You will have three primary tasks during this course:

- Build a knowledge base on traffic flow and control at signalized intersections.
- Determine the signal timing components for an actuated intersection and a coordinated system.
- Prepare a final signal timing design for each.

BASE KNOWLEDGE

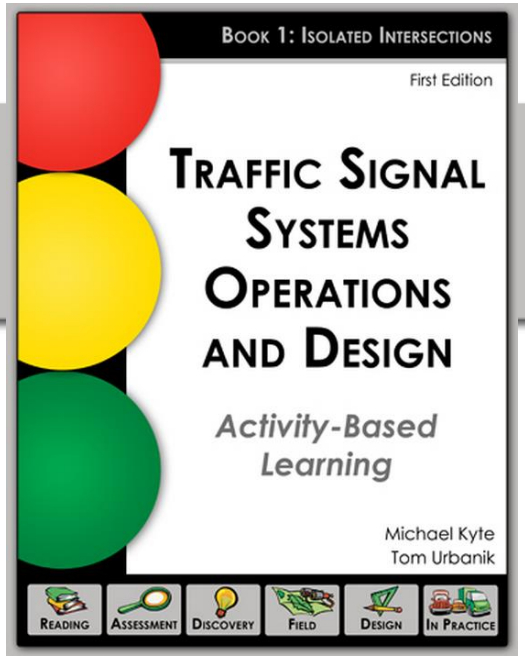
- **Chapter 1** The Traffic Signal Control System
- **Chapter 2** Modeling What We've Observed
- **Chapter 3** Whose Turn Is It?
- **Chapter 4** Actuated Traffic Controller Timing Processes

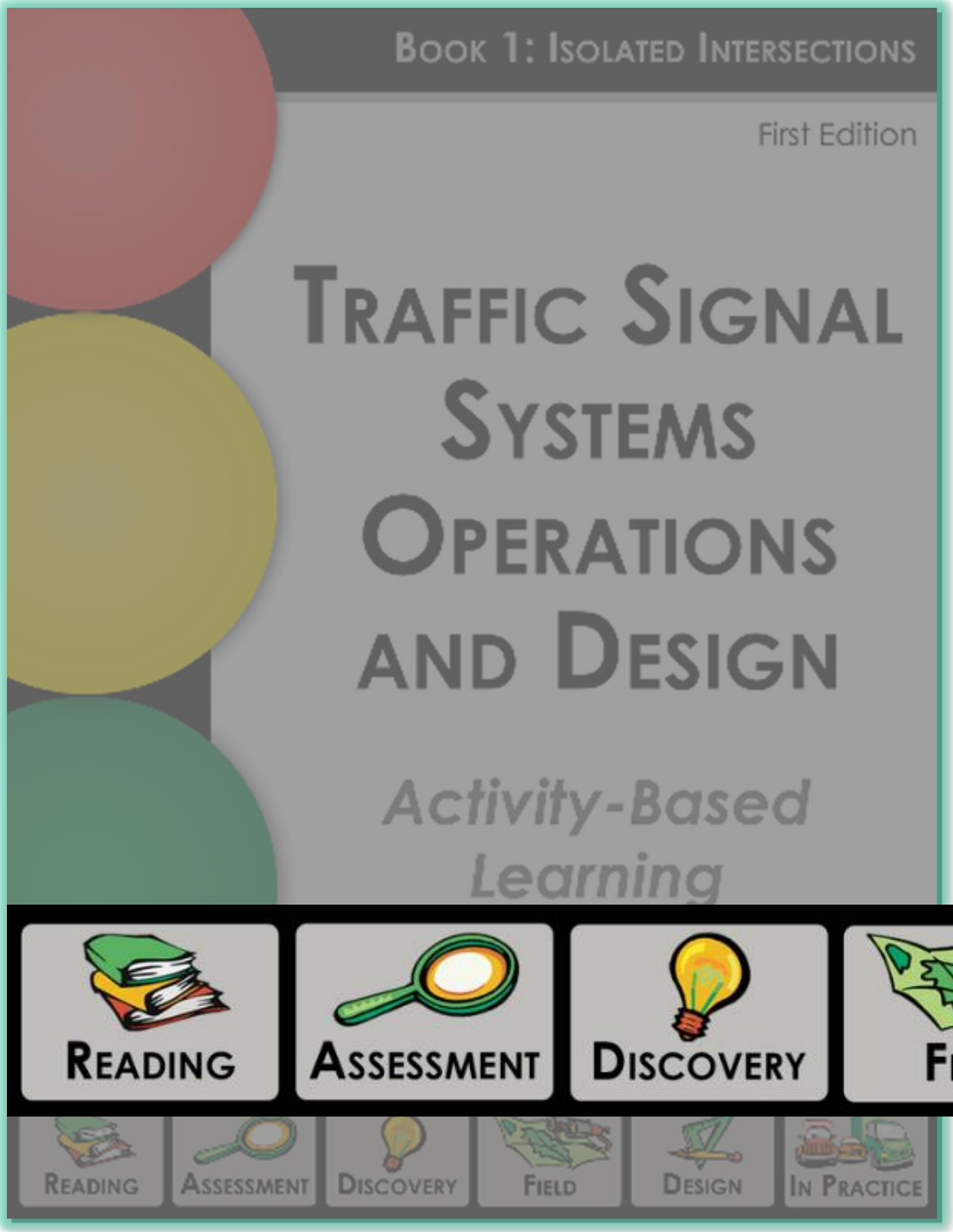
EXPANDING UNDERSTANDING AND BUILDING THE DESIGN

- **Chapter 5** The Simulation Environment
- **Chapter 6** Timing Processes on One Approach
- **Chapter 7** Timing Processes for Intersection
- **Chapter 8** Left Turn Phasing
- **Chapter 9** Right of Way Change

FINAL DESIGN

- **Chapter 10** Your Final Design




Book 1: Isolated Intersections
First Edition
Traffic Signal Systems Operations and Design
Activity-Based Learning
Reading
Assessment
Discovery
Field
Design
In Practice

ACTIVITY 4

Learning to See: The Simulation Environment in Which We Will Work

DISCOVERY

PURPOSE

The purpose of this activity is for you to appreciate how realistic a simulation model can be in replicating traffic flow at a real signalized intersection.

LEARNING OBJECTIVES

- Assess the realism of a simulation environment by comparing it with a video of actual field operations
- Develop your ability to "see" and "
  section and relate these observation

REQUIRED RESOURCE

- Movie file: A04.wmv

DELIVERABLE

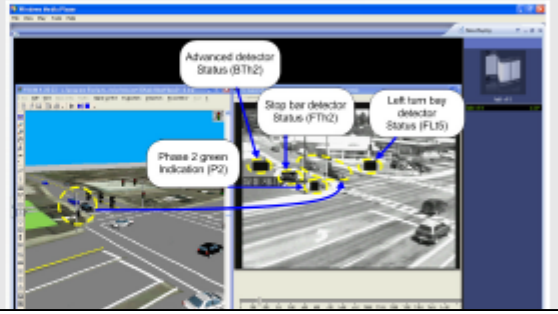
- Prepare a document with your answ

CRITICAL THINKING QUESTIONS

As you begin this activity, consider the
you have completed the activity.

INFORMATION

Not all models realistically duplicate traffic flow conditions found in the field. However, if a simulation model such as VISSIM is calibrated correctly, the results can closely approximate conditions that you would observe in the field. You will observe two videos, each of the intersection of State Highway 8 and Line Street in Moscow, Idaho. In this activity you will compare a field video with the simulation of the same intersection and conditions. When you start
will look
shows the
the right
traffic flo



TASK 1

Open the movie file, A04.wmv.

TASK 2

Watch the video all the way through. Keeping in mind the Critical Thinking Questions for this activity, observe the traffic flow, detection information, and display status for both the southbound approach (upper left in both the video and animation) and the eastbound approach (bottom left). Phase 2 serves the southbound approach and phase 4 serves the eastbound approach. Make notes on your observations.

TASK 3

Based on the notes that you made during your observation of the video, prepare brief answers to the Critical Thinking Questions.

COMPANION WEB SITE

Required Resources

Activity	File	Activity	File
#3	a03.wmv (22MB)	#32	a32.wmv (1MB)
#4	a04.wmv (32MB)	#33	a33.wmv (3MB)
#10	a10.xlsx	#34	a34.wmv (1MB)
#19	a19.mp4 (8MB)	#35	a35.wmv (1MB)
#20	a20.wmv (4MB)	#36	a36.xlsx
#21	a21.xlsm	#41	a41.wmv (12MB)
#27	a27.mp4 VISSIM 5	#42	a42-1.wmv (13MB)
	a27.mp4 VISSIM 6		a42-2.wmv (14MB)
#28	network01.zip	#47	a47.wmv (9MB)
	network02.zip	#48	a48.wmv (14MB)
	network03.zip	#49	a49.wmv (14MB)
	network04.zip	#54, #55	a54.xlsx
	network05.zip		
	network06.zip		

Note: The networkxx.zip files (Activity #28) have been updated to run with VISSIM v6.

Videos are also available on Vimeo.

Helpful References

Signal Timing Manual

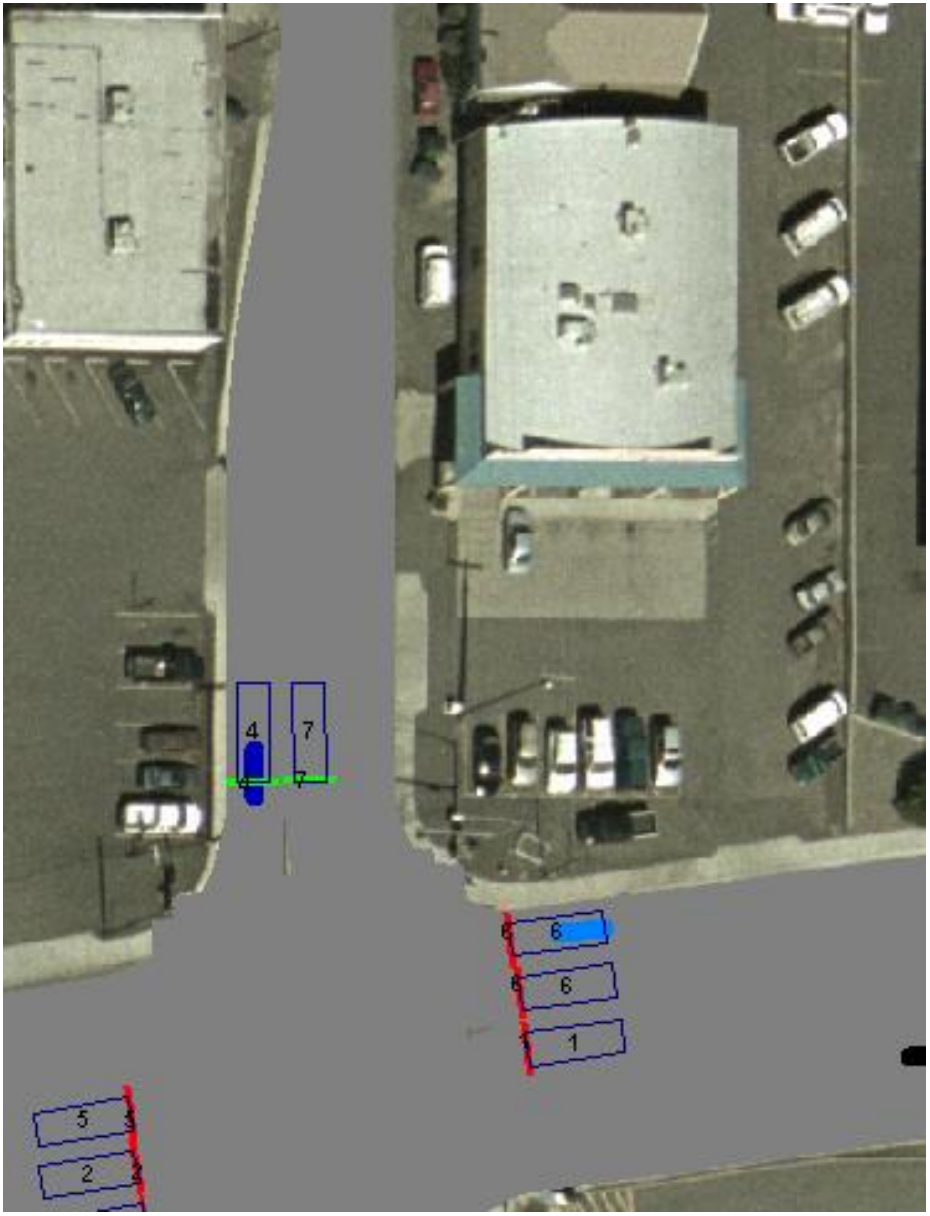
Traffic Analysis Toolbox (2004)
Vol I: Traffic Analysis Tools Primer

Traffic Analysis Toolbox (2004)
Vol III: Guidelines for Applying Traffic Microsimulation Modeling Software

PTV America (VISSIM) website

Signal Timing on a Shoestring (FHWA, 2005)

http://trafficsignalsystems.weebly.com/companion-web-site.html


4
7
6
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1
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2


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/M..... - 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 MIC 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
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4 5 6
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Project No. 3-103 COPY NO. X

UPDATE OF THE SIGNAL TIMING MANUAL

PRELIMINARY DRAFT
FINAL REPORT

Prepared for
National Cooperative Highway Research Program
Transportation Research Board
of
The National Academies

TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES
PRIVILEGED DOCUMENT

This report, not released for publication, is furnished only for review to members of or participants in the work of the CRP. This report is to be regarded as fully privileged, and dissemination of the information included herein must be approved by the CRP.

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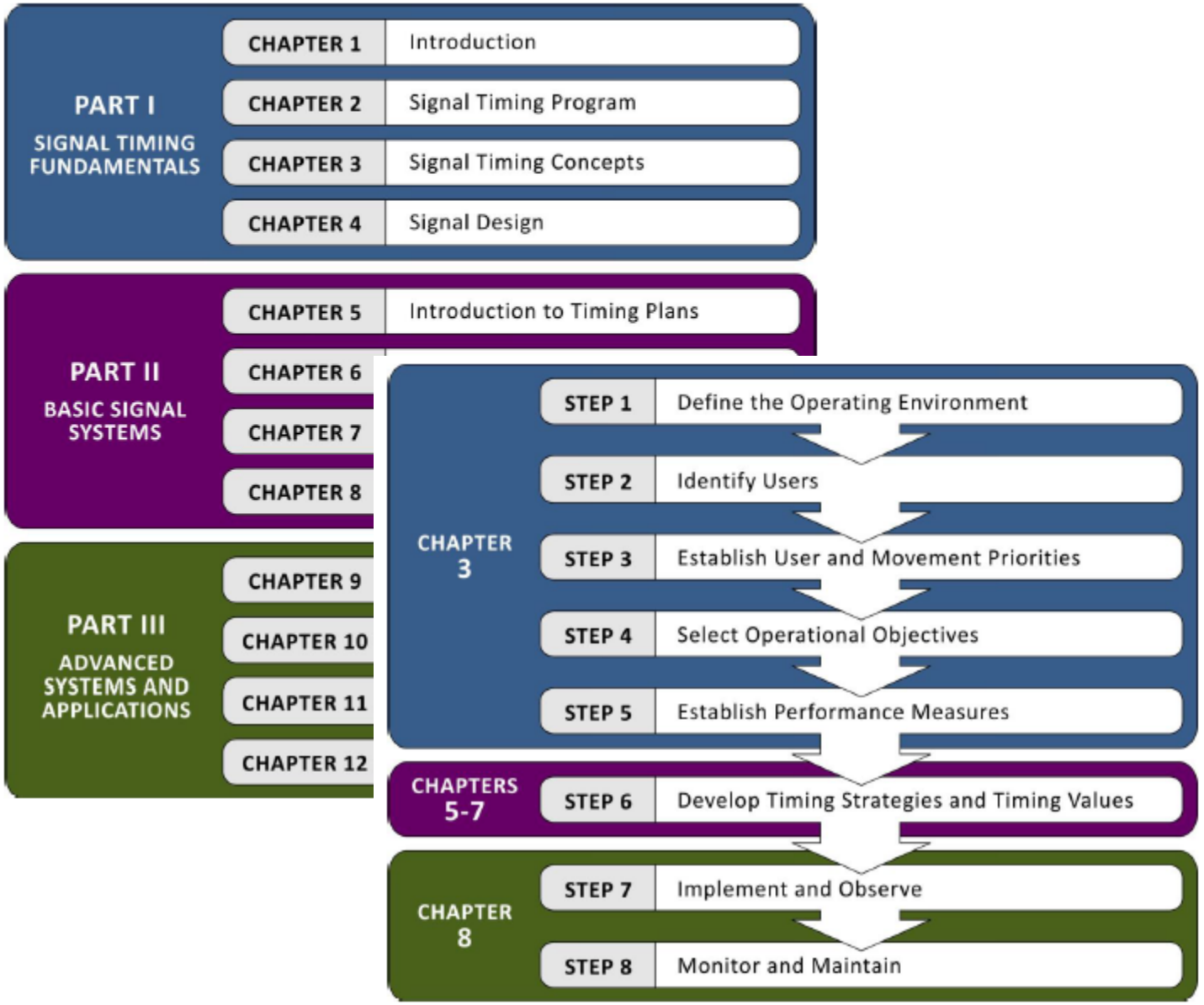
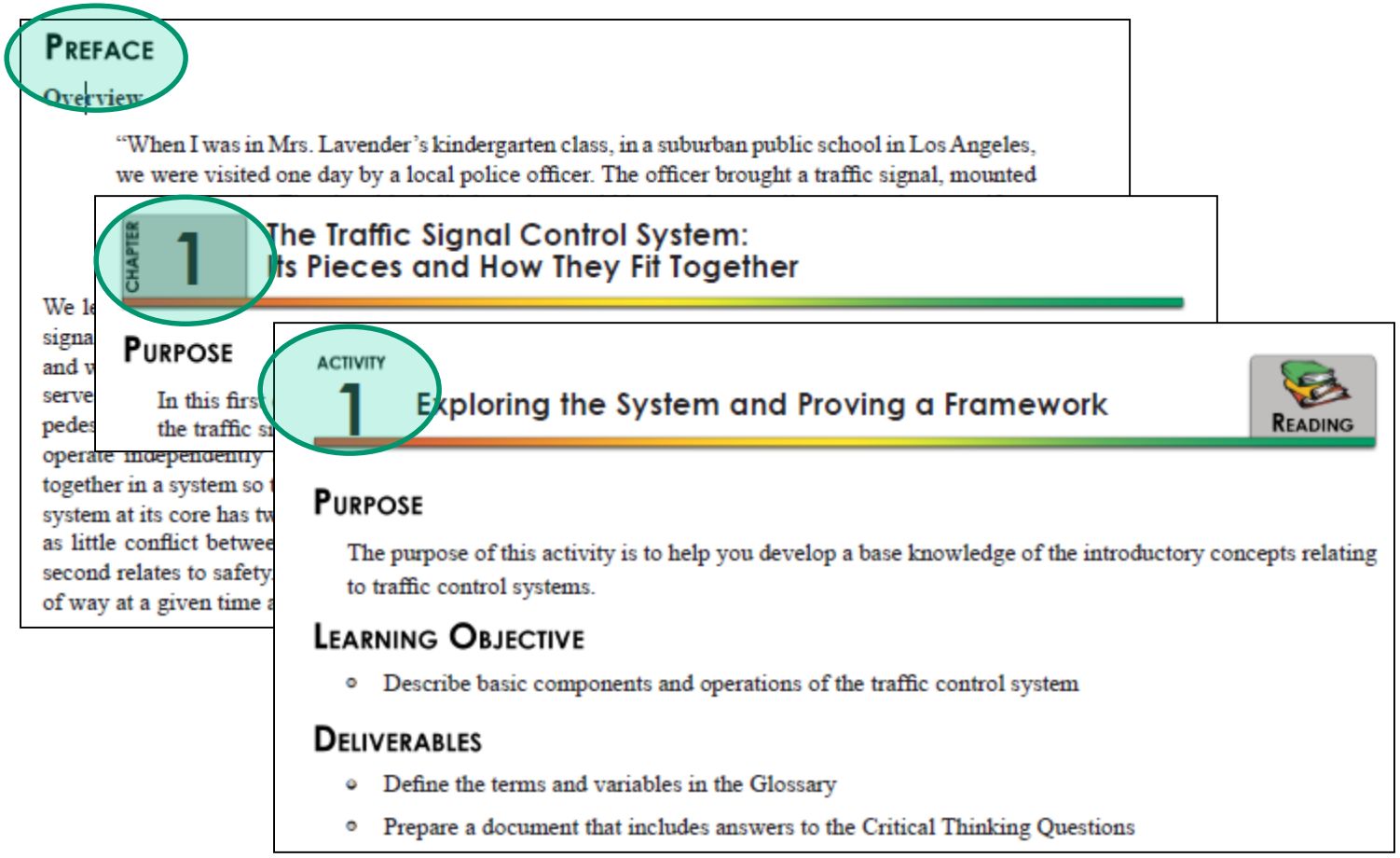
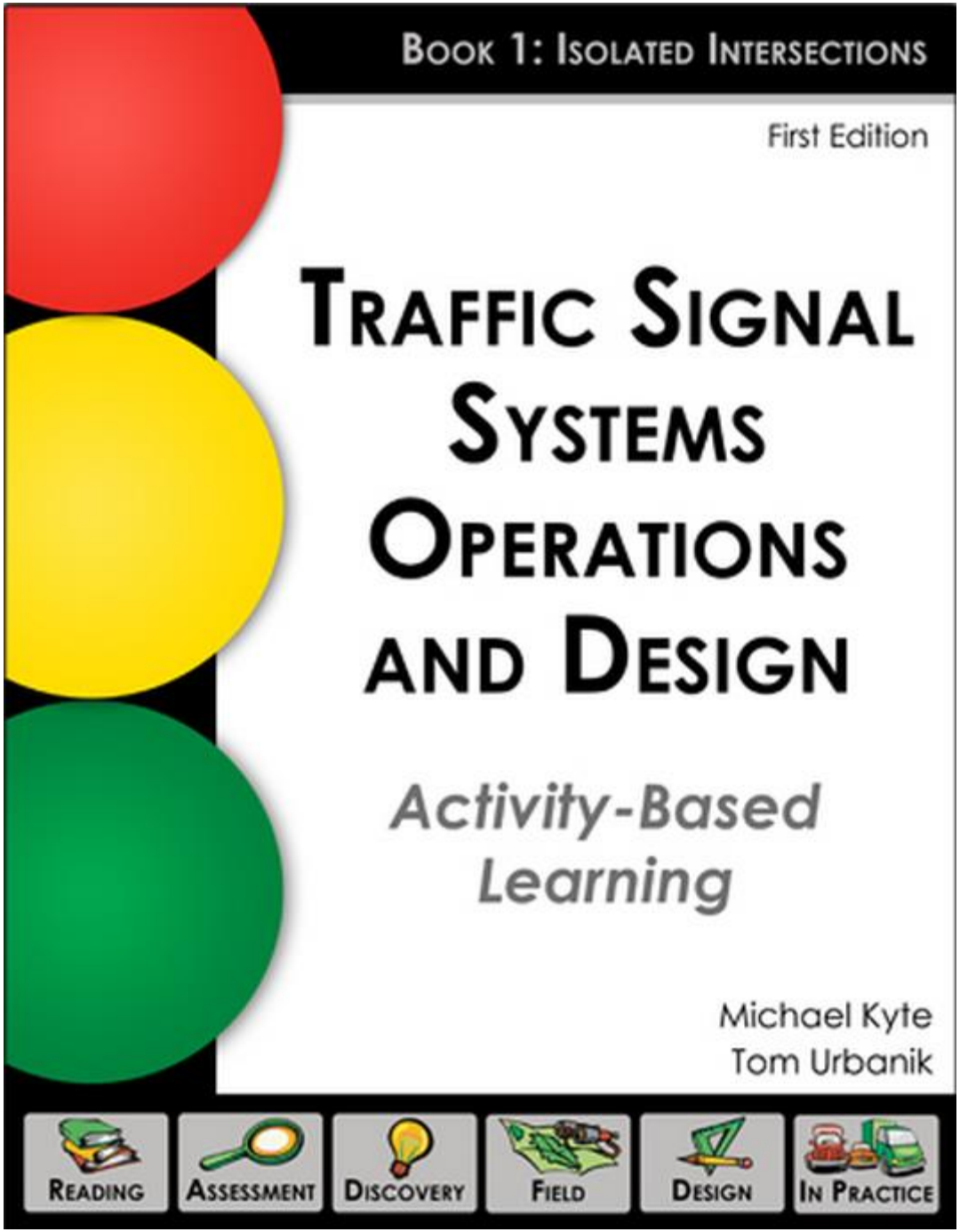


Cautions (from previous students)

- Team work is a challenge
- Didn’t take class seriously enough early enough
- Simulation models are difficult to use effectively
- Critical movement analysis: they get it but have difficulty in applying it
- Connecting theory with field observations is important but challenging!
- There is a lot of data to manage and analyze!



- **Due: 26 August (class 02)**
  Read the preface (pp vii-xiii) and the introduction to chapter 1 (pp 1-2)
- Read Activity #01 (pp 3-16)
- Deliverable: Critical Thinking Questions for A#01 in Word document. (Submit electronically and bring hard copy to class)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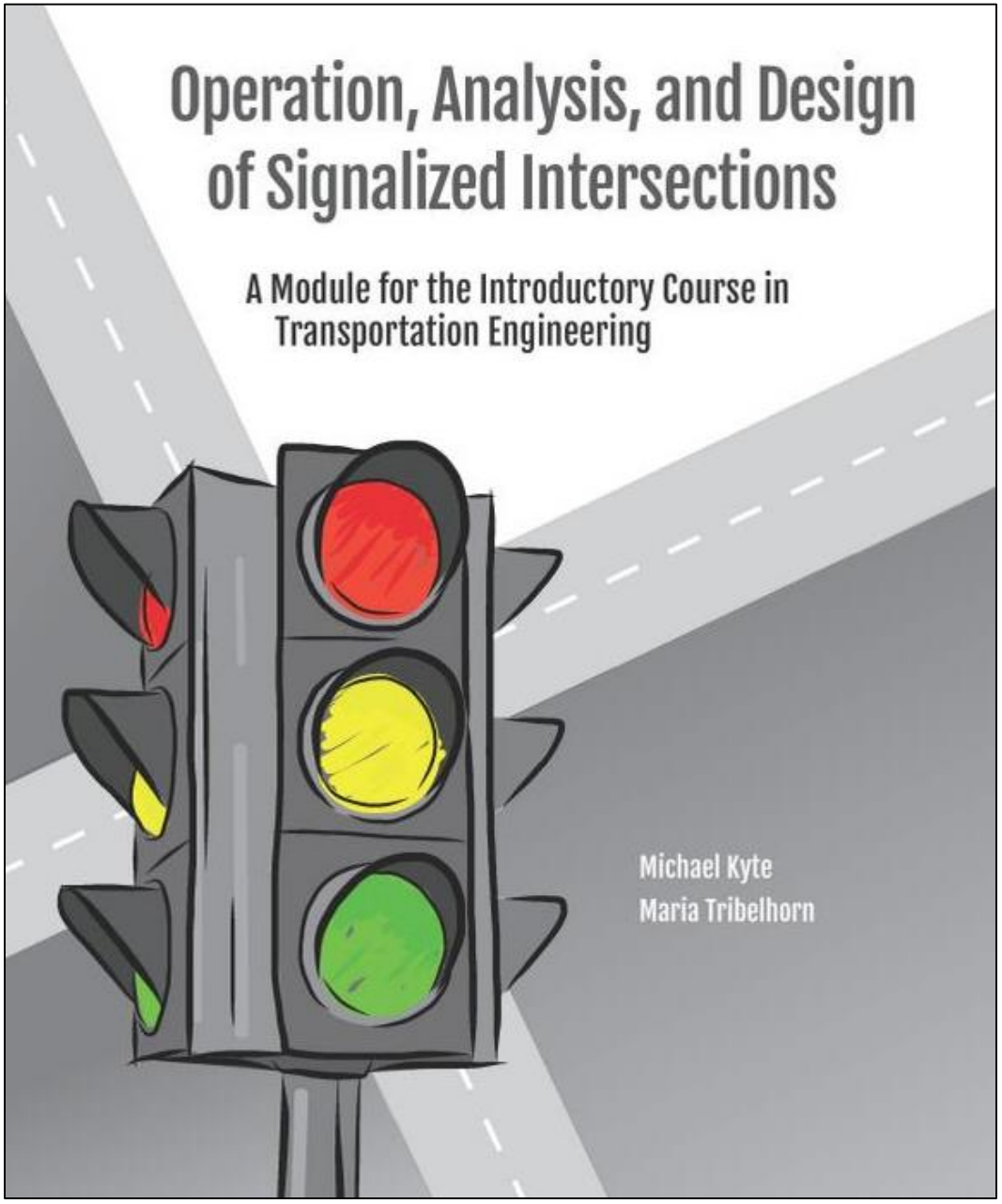
Operation, Analysis, and Design of Signalized Intersections
A Module for the Introductory Course in Transportation Engineering
Michael Kyte
Maria Tribelhorn

What's next…

Class 01 (8.24)

Course overview

Homework (due 8.26):

- Read pp vii-viii
- Read pp 1-2
- Read A01
- Do: A01 CTQ

Reflection and questions?….

→Reflect on what we discussed during class today. Write two questions or comments that you have on the material that we've discussed or on the course itself; send it to me via email by 430 pm today: mkyte@uidaho.edu