

# CE 474 – Class 22

October 14, 2015

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**Class 21 (10.12)**

Discuss: A43 results  
Mini-lecture/CTQ: A45

**Class 22 (10.14)**

Do/Discuss: A47, A48, A49  
Homework (due 10.15):

- Prepare: A50

**Class 23 (10.15)**

Do/Discuss: A50 (due 10.19)

Do: A50-Revised  
Homework (due 10.19):

- Read: Chapter 9 overview
- Read: A52
- Do A52 CTQ
- Read chapter 4, K&T

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**Class 24 (10.19)**

Mini-lecture/CTQ: A52  
Field prep: A55

**Class 25 (10.21)**

[Field work: no class meeting]  
Do: A55 (field) (due 10.22)  
Homework (due 10.22):

- Prepare: A54, A56

**Class 26 (11.22)**

Preview: A62  
Preview: Exam #1  
Discuss: A55  
Do/Discuss: A54, A56 (due 10.26)  
Homework (due 10.26):

- Read: Chapter 10 overview
- Read: A58
- Preview: A59

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**Class 27 (10.26)**

Mini-lecture: A58  
Do: A59  
Do: A62  
Homework (due 10.29):

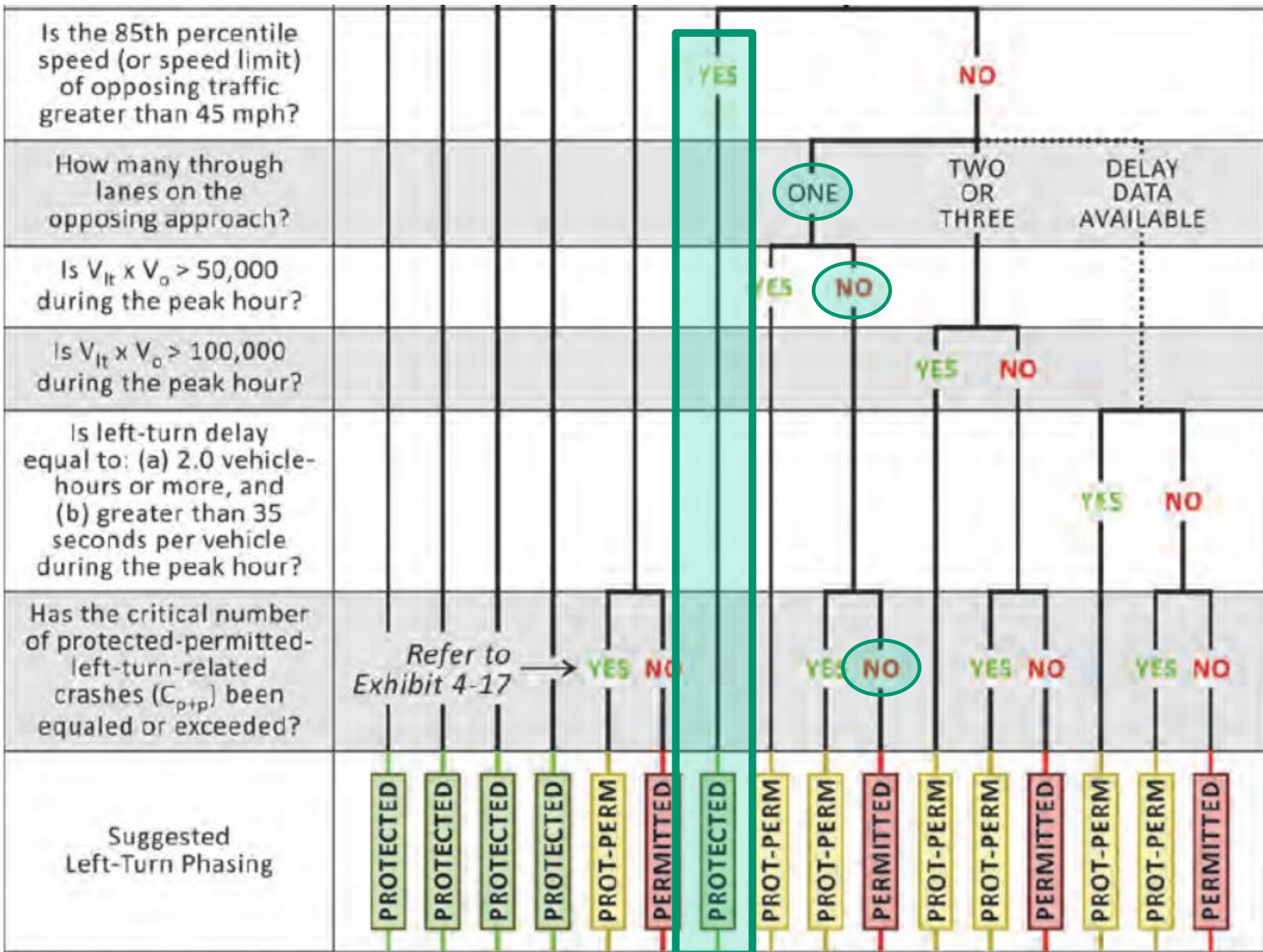
- Complete: A62

**Class 28 (10.28)**

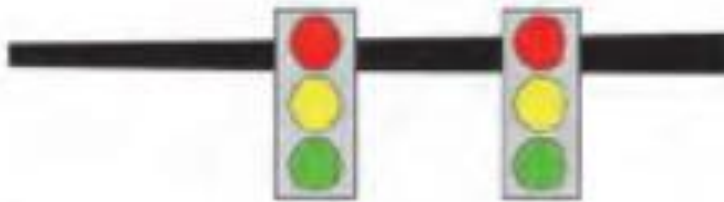
Exam #1

**Class 29 (10.29)**

Do: Report, presentation, oral examination

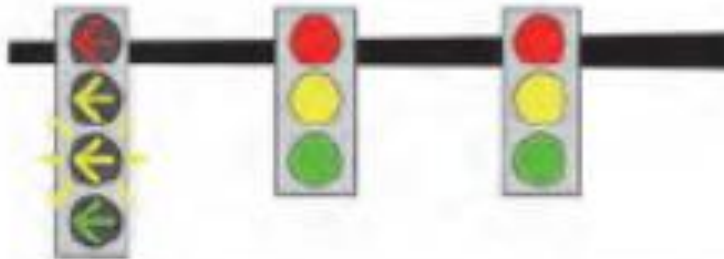


PERMITTED

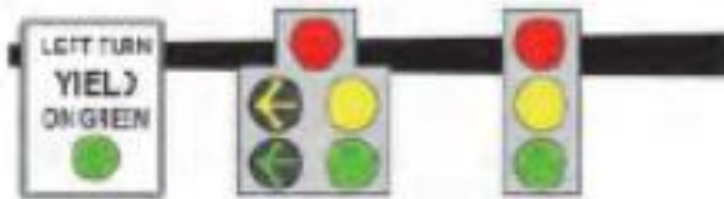


PERMITTED,  
PROTECTED-PERMITTED,  
OR PROTECTED  
Flashing Yellow Arrow

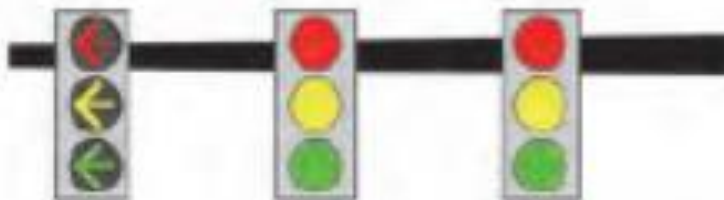
*Note: Controller can implement  
any of the three phasing types  
depending on traffic conditions.*

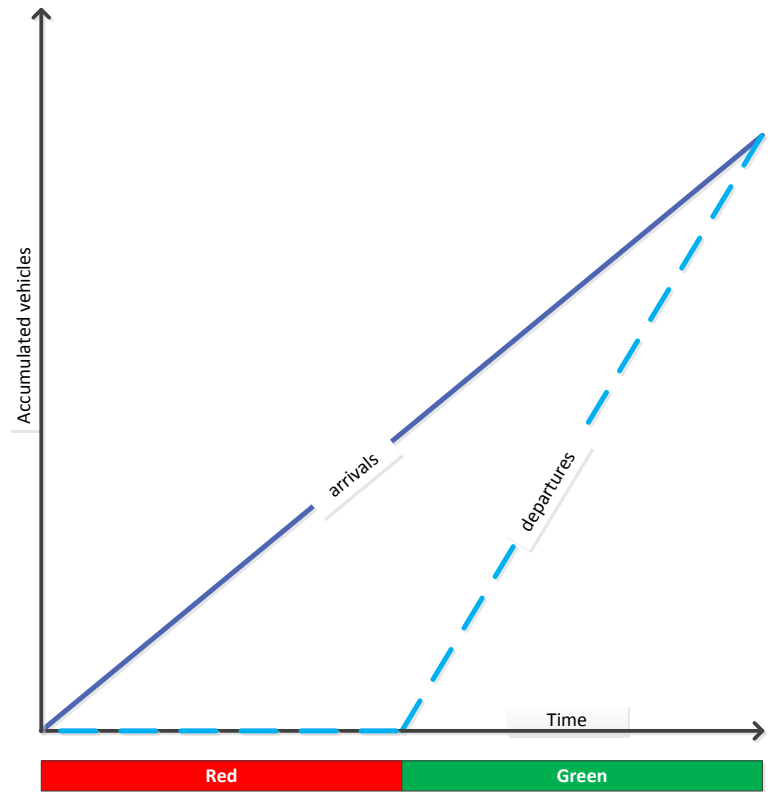
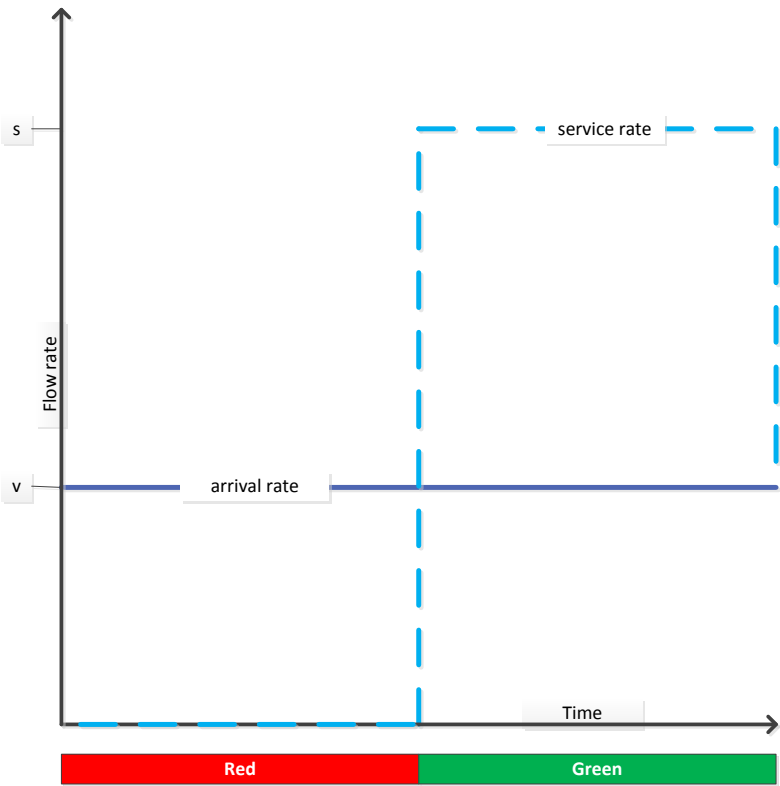


PROTECTED-PERMITTED  
Five-Section "Doghouse"

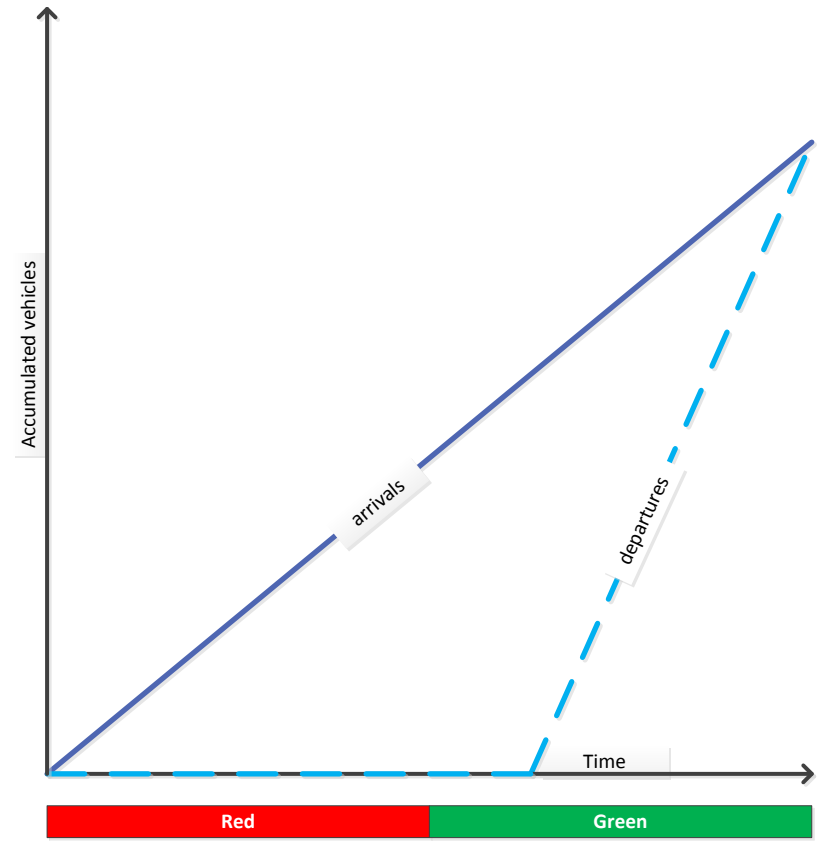
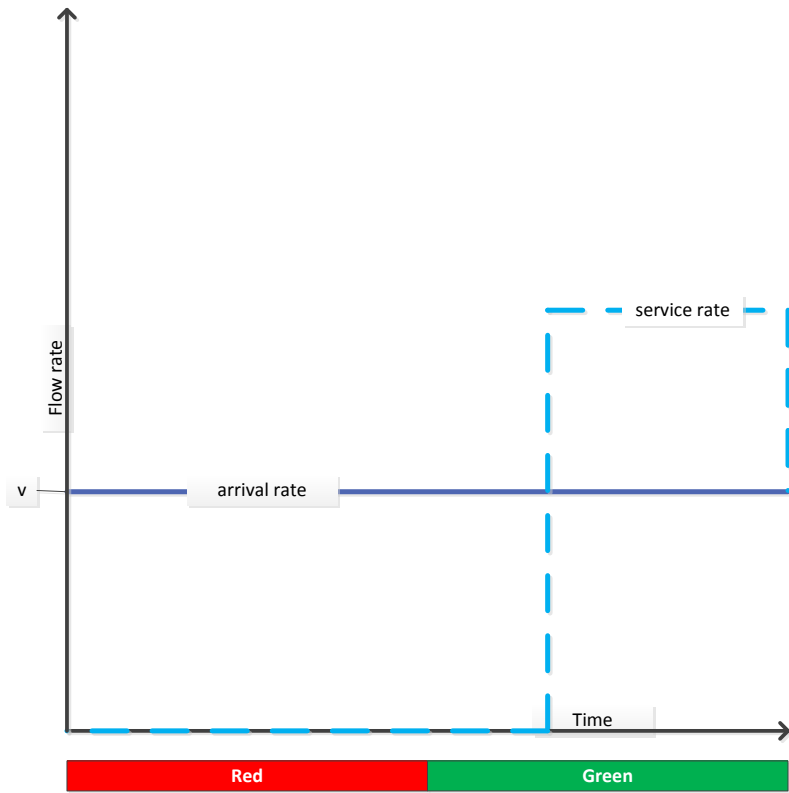


PROTECTED

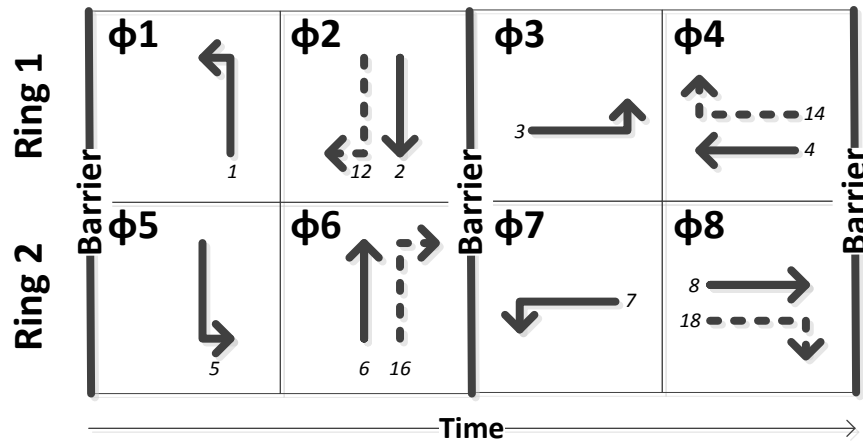




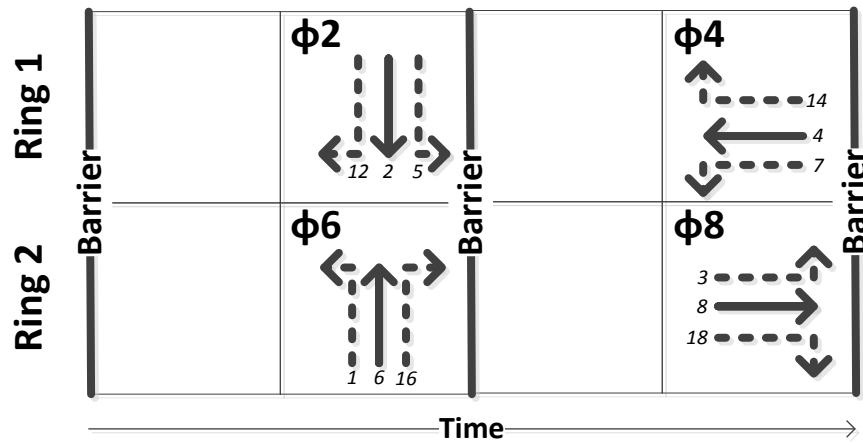
Protected leading LT  
 Protected lagging LT



Permitted LT

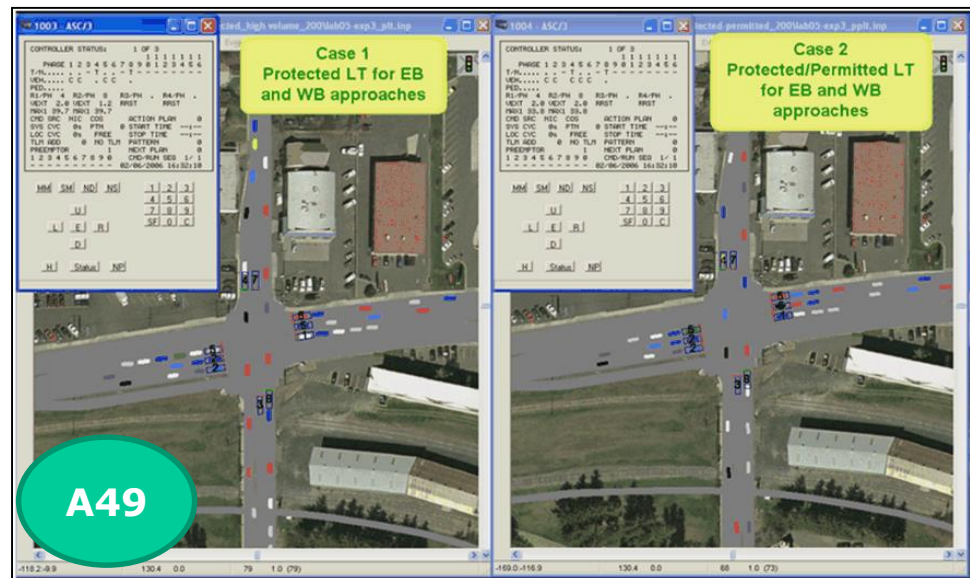
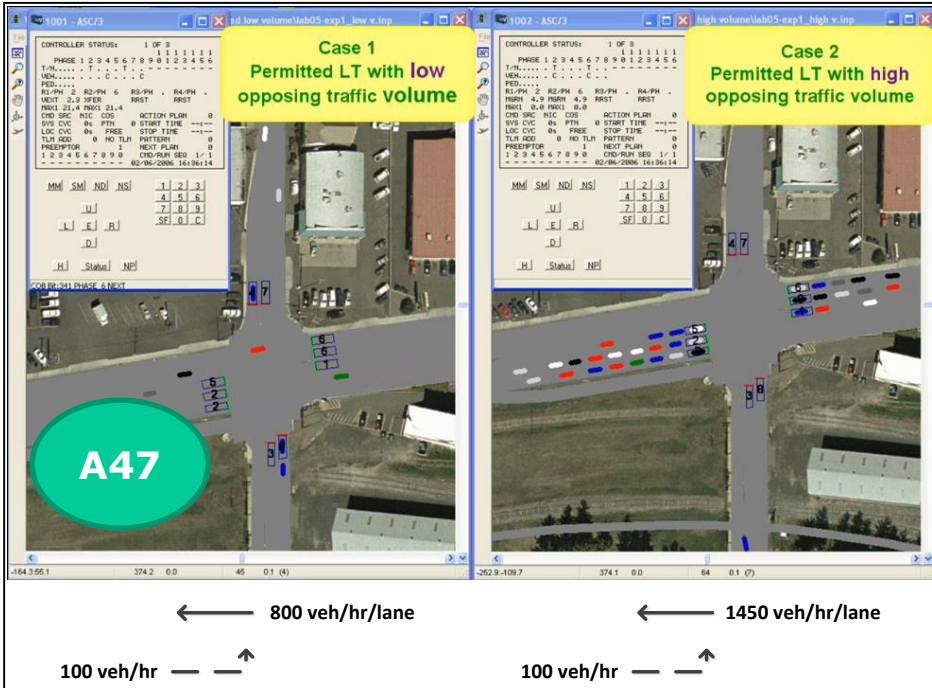


Protected leading LT



Permitted LT







# Learning Outcomes

- Be able to compare the performance of different left turn phasing alternatives.
- Understand the efficiency of different left turn phasing alternatives.
- Be able to determine an efficient left turn treatment.

# Deliverable...

- Complete A47, A48, A49
  - One Word document with all results to BBLearn by 800 am Thursday

ACTIVITY

# 47

## Permitted Left Turn Operations



DISCOVERY

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	.....	T	.....	T	.....	T	.....	T	.....	T	.....	T	.....	T	.....	T
VEN	.....	C	.....	C	.....	C	.....	C	.....	C	.....	C	.....	C	.....	C

R1/PH 2 R2/PH 6 R3/PH . R4/PH .  
 VEXT 2.3 XFER ARST ARST

MM SM ND NS

1	2	3
4	5	6
7	8	9
SF	0	C

L E R

D

H Status NP

COB BR:341 PHASE 6 NEXT

**Case 1**  
 Permitted LT with low  
 opposing traffic volume

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	.....	T	.....	T	.....	T	.....	T	.....	T	.....	T
VEN	.....	C	.....	C	.....	C	.....	C	.....	C	.....	C	.....	C	.....	C

R1/PH 2 R2/PH 6 R3/PH . R4/PH .  
 MGRN 4.9 MGRN 4.9 ARST ARST

MM SM ND NS

1	2	3
4	5	6
7	8	9
SF	0	C

L E R

D

H Status NP

**Case 2**  
 Permitted LT with high  
 opposing traffic volume

← 800 veh/hr/lane

100 veh/hr — — ↑

← 1450 veh/hr/lane

100 veh/hr — — ↑

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# Considering the Questions

- How does the opposing volume affect the quality of the left turn permitted operation for each of the two cases?
- What change to the phasing plan would you consider, if any, to improve the quality of the operation for case 2?

# Question 1

- How does the opposing volume affect the quality of the left turn permitted operation for each of the two cases?

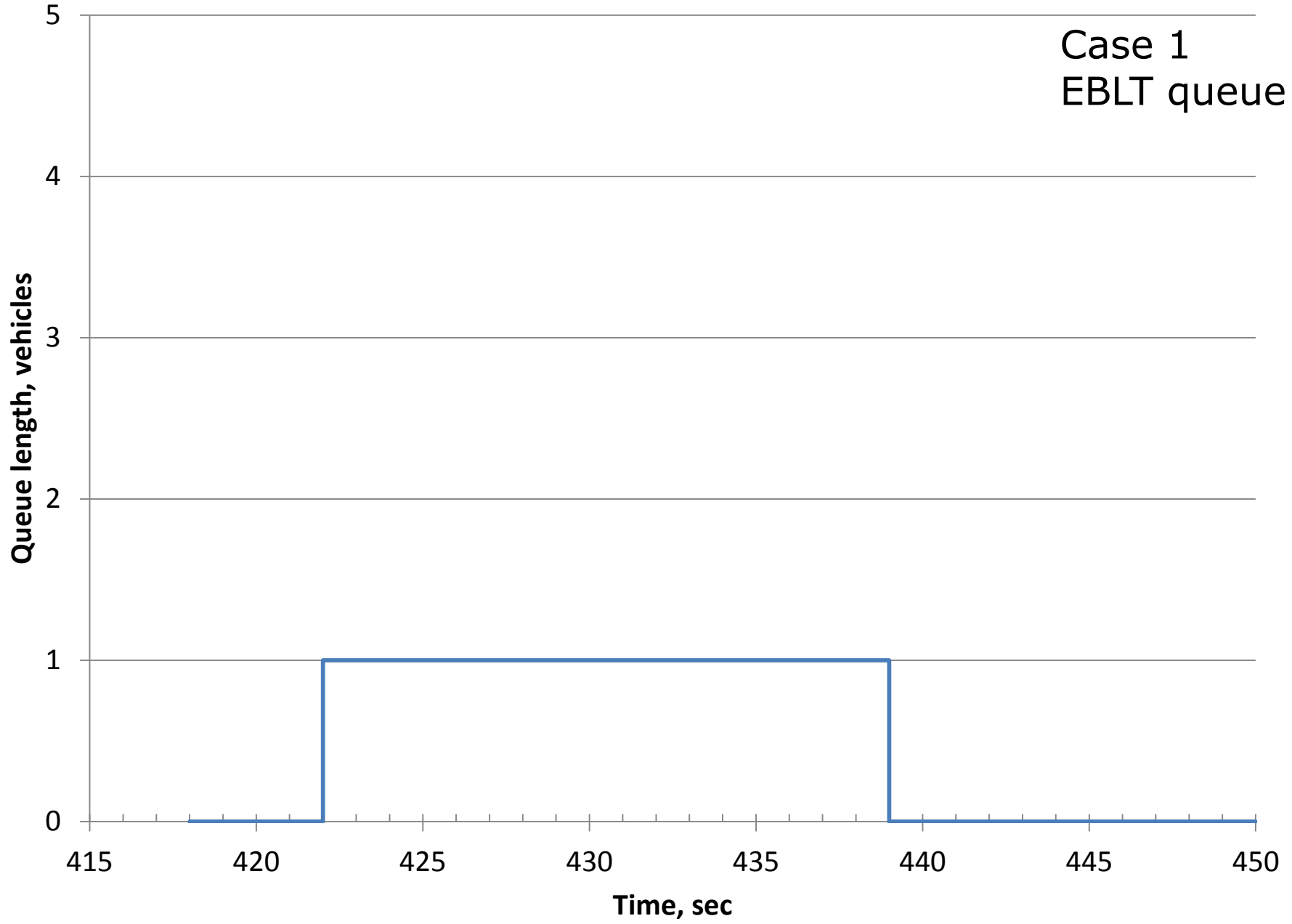
# Question 1

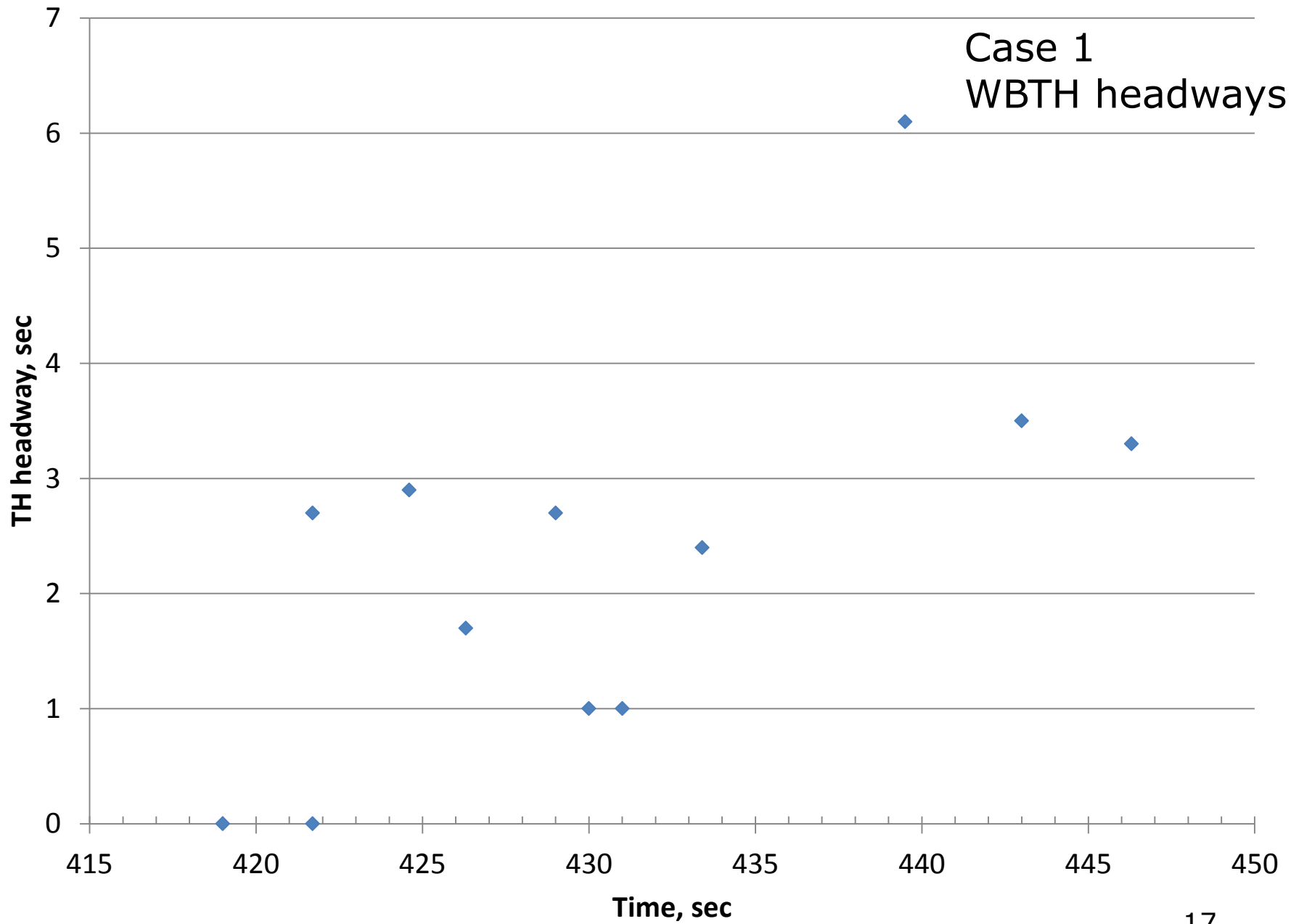
- Table 1 Average delay for each movement.

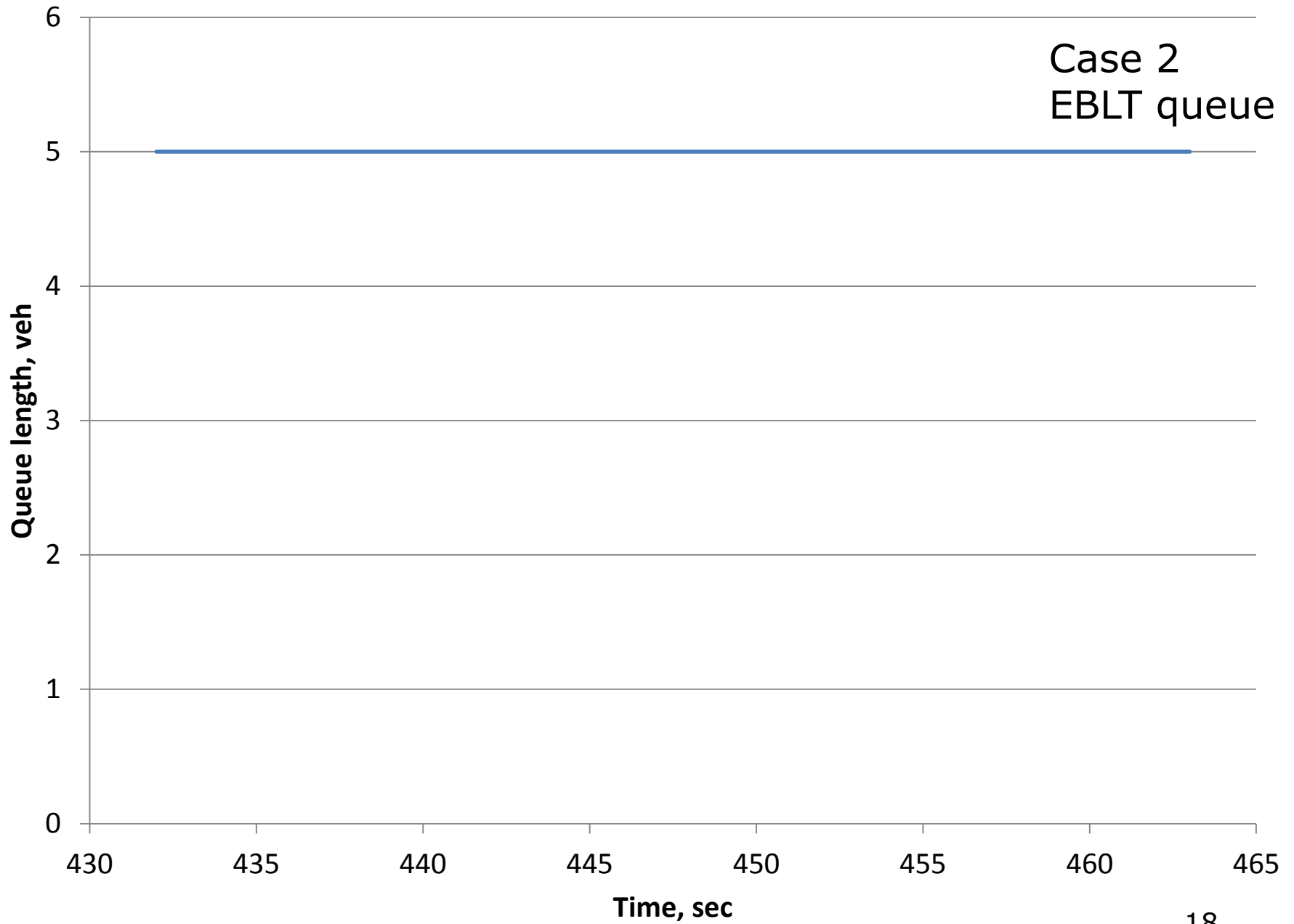
Movements	Average delay (sec/veh)	
	Low opposing TH volumes (800 vph)	High opposing TH volumes (1450 vph)
EBTH	9.4	12.3
WBTH	9.0	13.4
SBTH	19.4	19.1
NBTH	18.0	20.2
WBLT	19.0	72.6
EBLT	15.7	172.6
Intersection	13.3	18.0



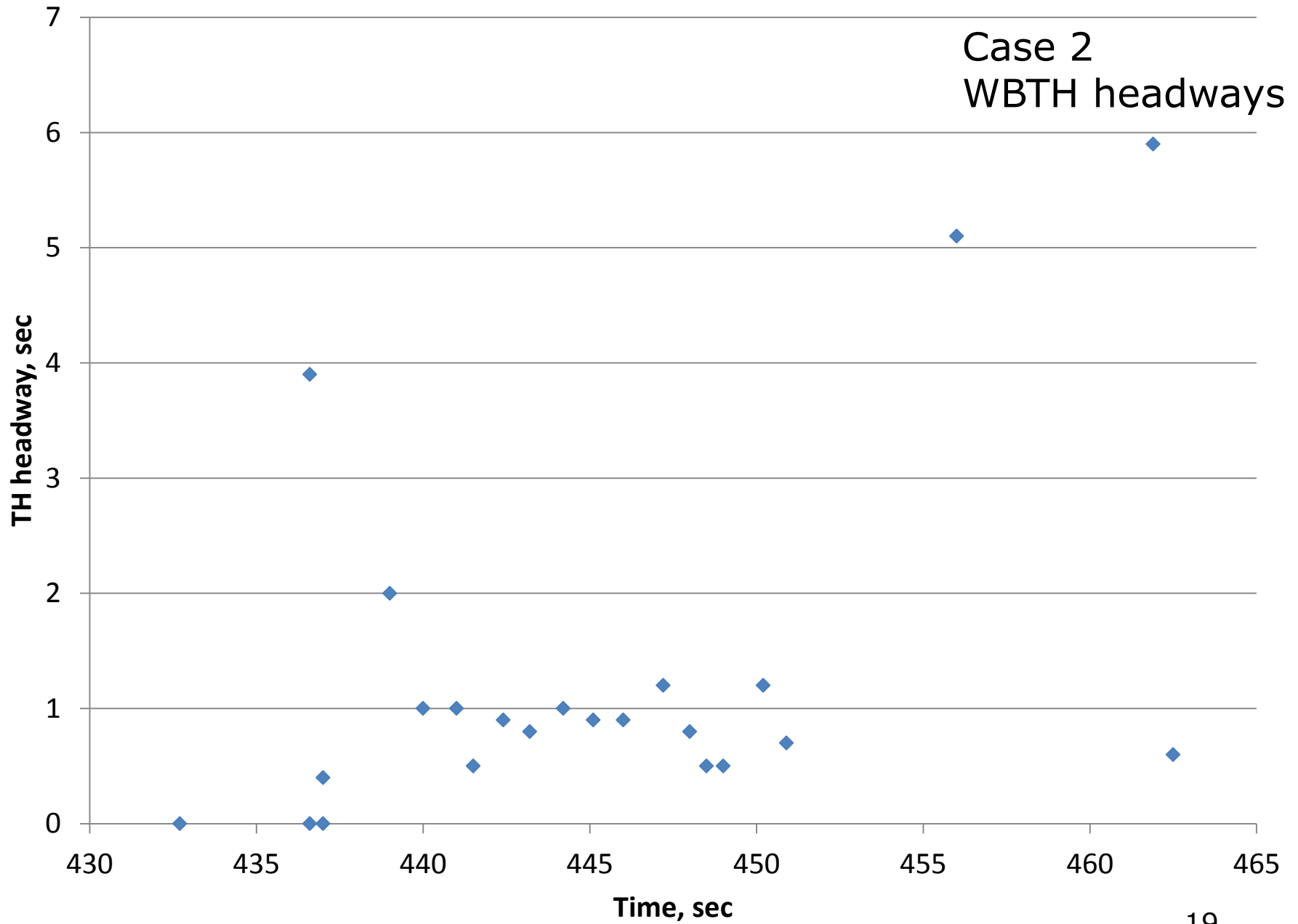
Case 1  
EBLT queue







Case 2  
WBTH headways



## Question 2

- What change to the phasing plan would you consider, if any, to improve the quality of the operation for case 2?

ACTIVITY

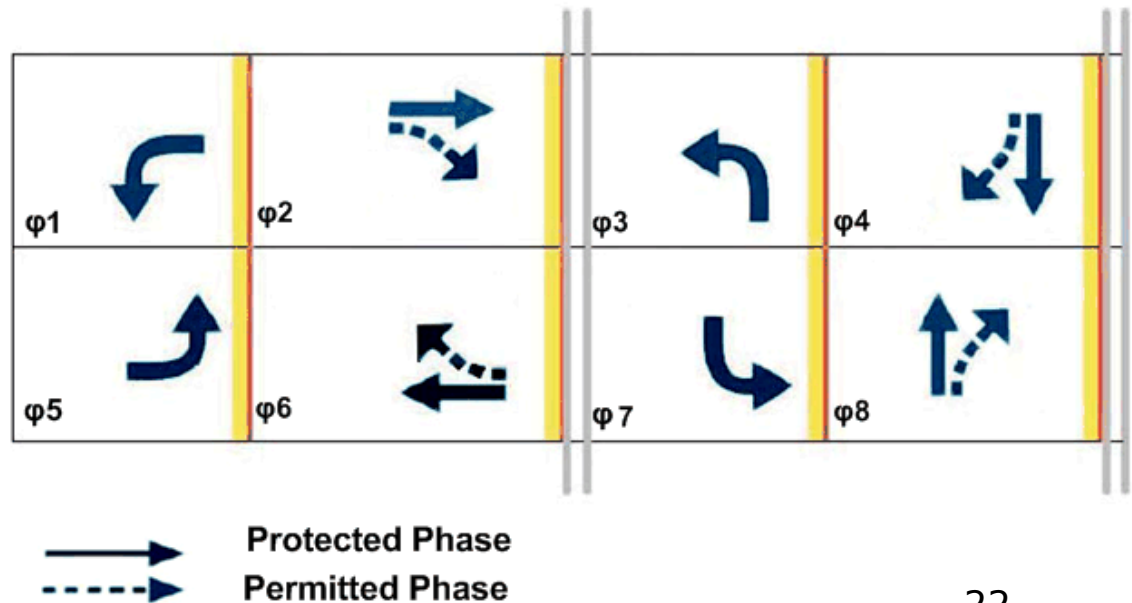
# 48

## Comparing Permitted and Protected Left Turn Phasing



# Comparing Permitted And Protected Left Turn Phasing

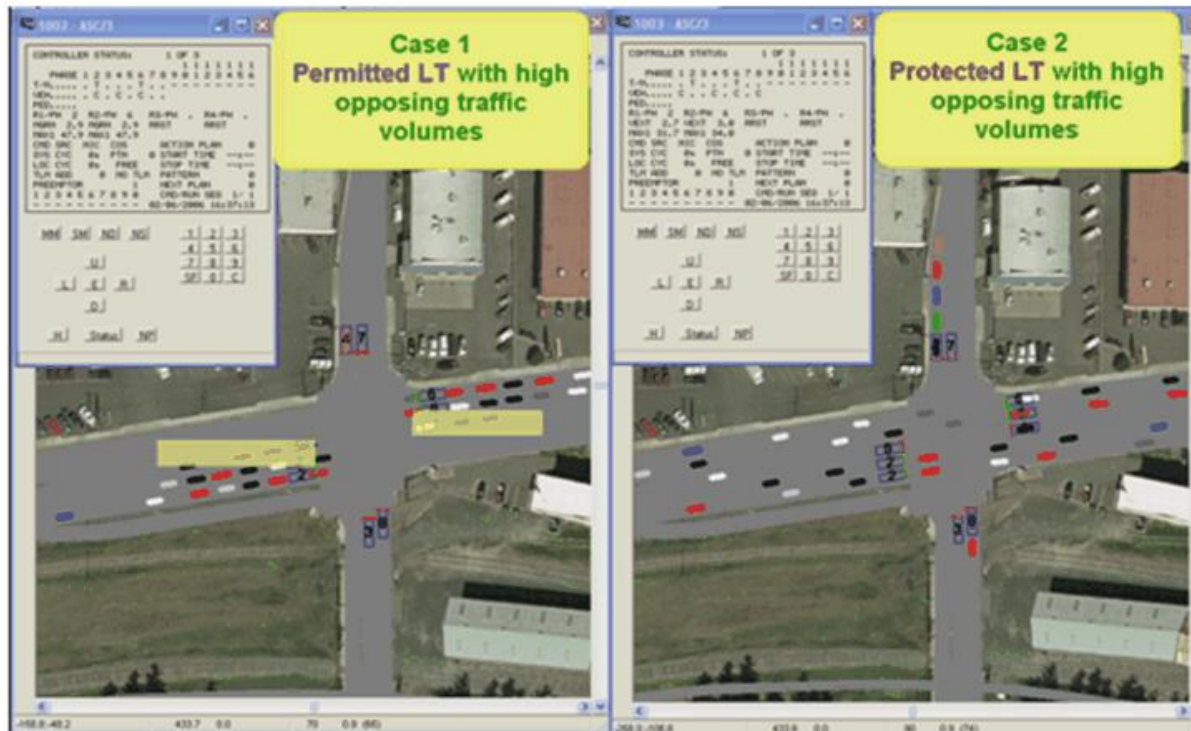
- Learning outcomes
- Overview
- Questions to consider
- Steps





# Running the Experiment

- Step 1. Open the movie file.
- Step 2. Observe the operation of the two cases.



# Considering the Questions

- How does changing from permitted to protected left turn phasing affect the LT operation and the operation of the entire intersection?

# Question 1

- How does changing from permitted to protected left turn phasing affect the LT operation and the operation of the entire intersection?

# Question 1

- Table 2 Average delay for each movement.

Movements	Average delay (sec)	
	Permitted LT	Protected LT
EB TH	12.3	19.7
WB TH	13.4	24.4
SB TH	19.1	27.1
NB TH	20.2	29.0
WBLT	72.6	54.5
EBLT	172.6	46.3
Intersection	18.0	24.7

ACTIVITY

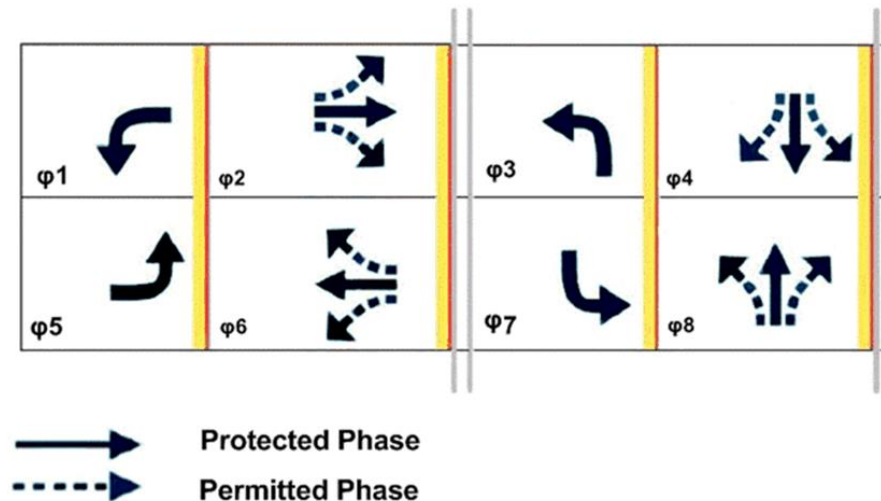
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# Comparing Protected/Permitted and Protected Left Turn Phasing



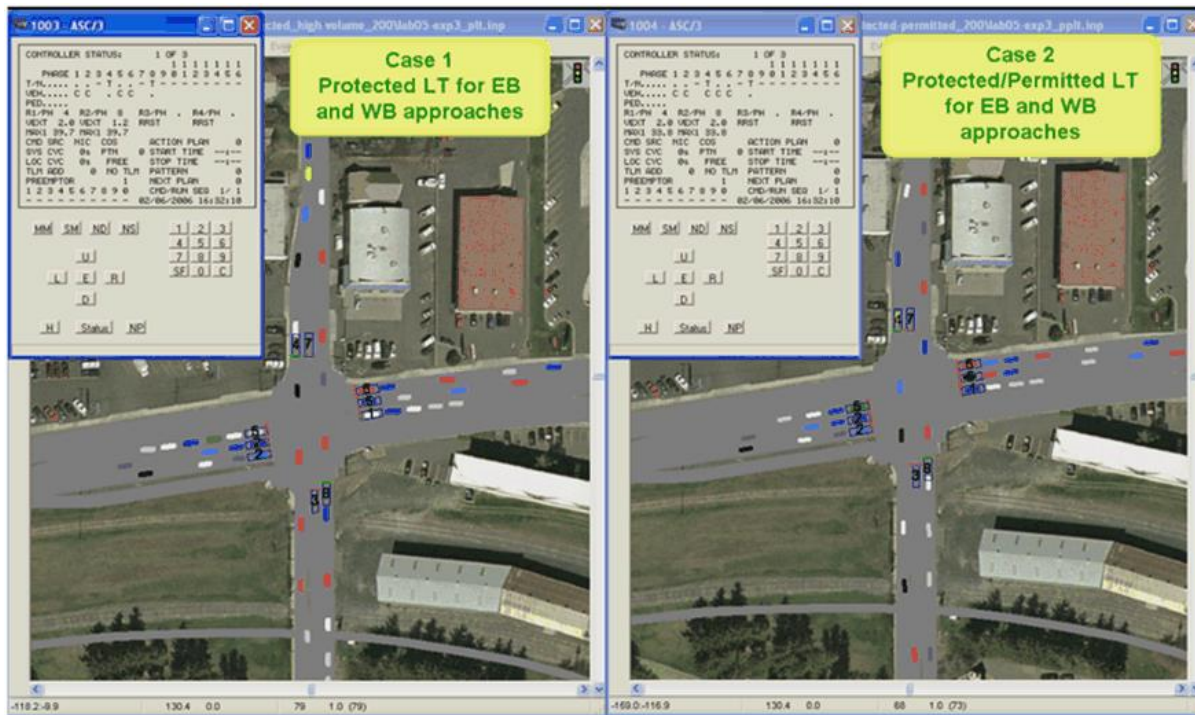
# Comparing Protected/Permitted And Protected Left Turn Phasing

- Learning outcomes
- Overview
- Questions to consider
- Steps



# Running the Experiment

- Step 1. Open the movie file.
- Step 2. Observe the operation of both simulations.





# Considering the Questions

- Why do the EBLT and WBLT movements have lower delay when they are operating as protected/permitted phasing as compared to the protected left turn case?

# Question 1

- Why do the EBLT and WBLT movements have lower delay when they are operating as protected/permitted phasing as compared to the protected left turn case?

# Question 1

- Table 3 Average delay for each movement.

Movements	Average delay (sec/veh)	
	Protected LT	Protected/Permitted LT
EBTH	24.9	25.2
WBTH	27.0	24.5
SBTH	31.9	31.2
NBTH	30.4	28.6
WBLT	56.0	32.4
EBLT	52.5	38.9
Intersection	29.3	26.9

# Question 1

- Table 4 Average green duration for each phase.

Phase	Average Green Duration (sec)	
	Protected LT	Protected/Permitted LT
EBTH	44.3	45.7
WBTH	44.2	44.7
SBTH	28.7	30.1
NBTH	28.7	30.1
WBLT	10.4	7.7
EBLT	10.6	8.9

# Closure: Summary Of Key Points Learned

- Be able to compare performance of different left turn phasing alternatives.
- Be able to describe efficiency of different left turn phasing alternatives.
- Be able to determine efficient left turn treatment.