

CE 572 – Spring 2015

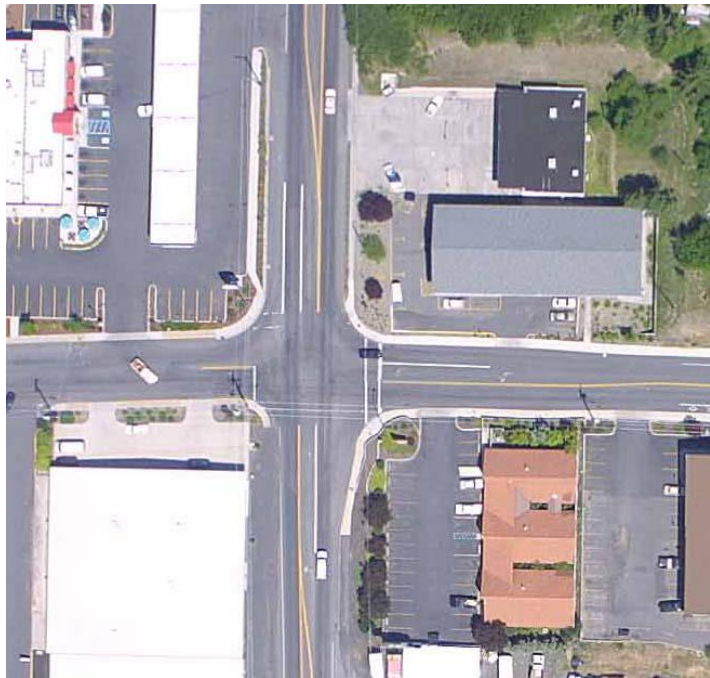
Intersection Traffic Operations

Class 01

16 January 2015

Case Study 1. U.S. 95 Corridor

Moscow, Idaho



City residents have asserted that increasing traffic volumes at the intersection of Styner Avenue, Lauder Avenue, and U.S. 95 are increasing delays for and reducing the safety of motorists traveling through the intersection.

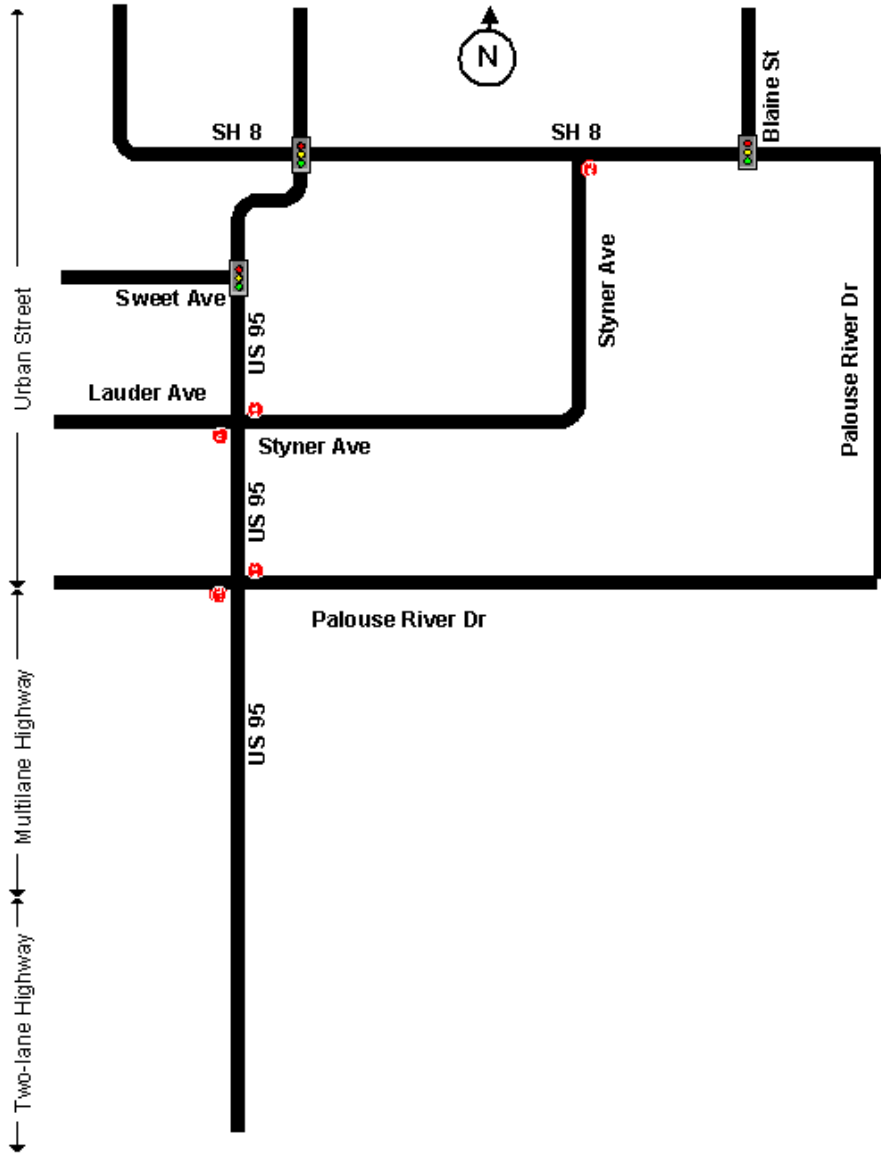
The city has requested that the Idaho Transportation Department signalize the intersection.



What issues do you think should be considered by the state's traffic engineer in resolving this problem?

Case Study 1. U.S. 95 Corridor

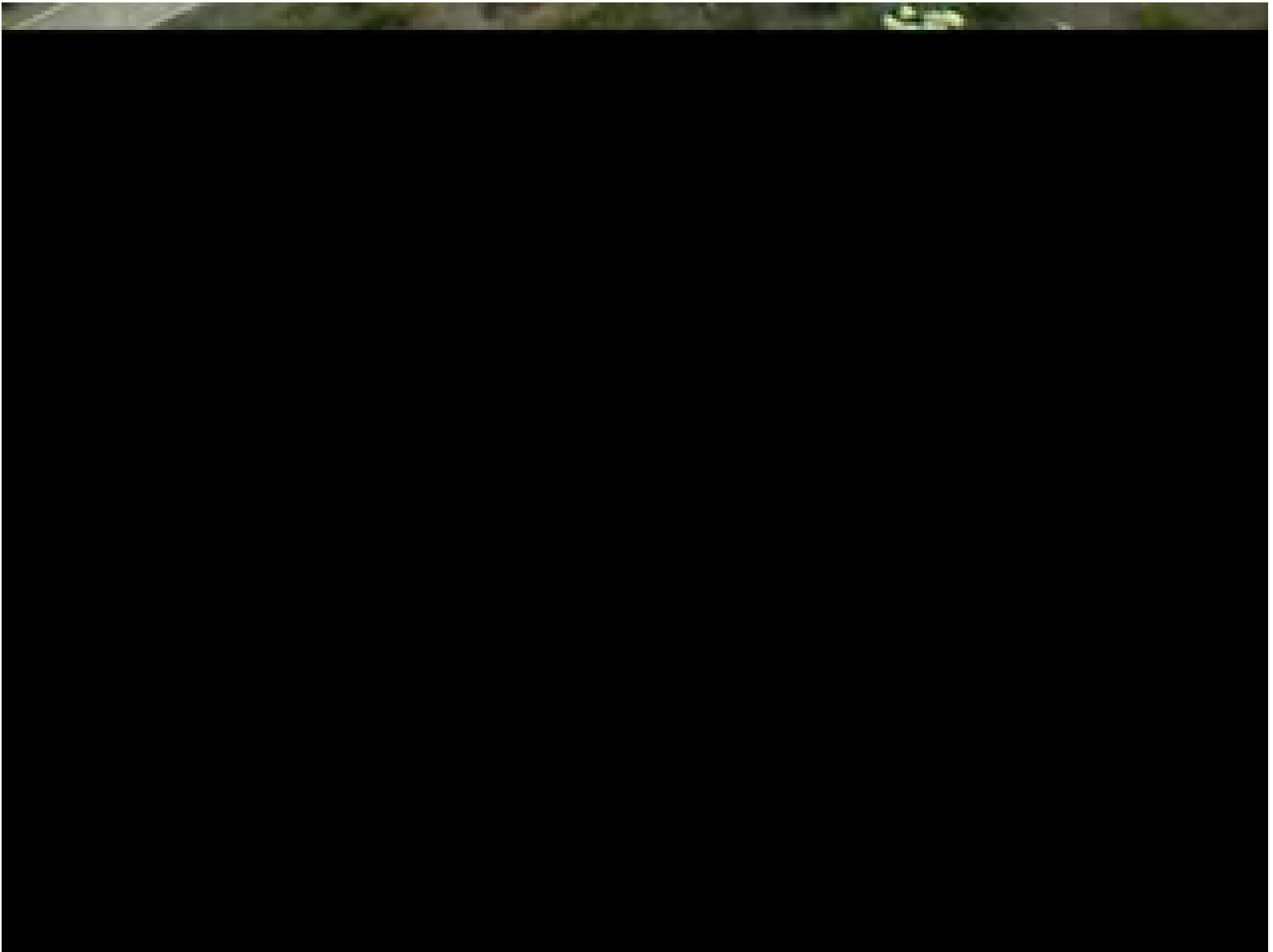
Moscow, Idaho













Incorporation of New Research

- NCHRP 3-60
(Interchange Ramp Terminals)
- NCHRP 3-64
(HCM Applications Guide)
- NCHRP 3-65
(Roundabouts in the United States)
- NCHRP 3-70
(Multi-Modal Arterial LOS)
- NCHRP 3-75
(Freeway Weaving)
- NCHRP 3-79
(Arterial Travel Speeds)



**HCM 2010 slides courtesy
of Mark Vandehey,
Kittelson and Associates**



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Incorporation of New Research (cont'd.)

- NCHRP 3-82 (Default Values for HCM)
- NCHRP 3-85 (Guidelines for the Use of Alternative Traffic Analysis Tools)
- NCHRP 20-7 (Two-Lane Highways)
- FHWA Research on Active Traffic Management
- NCHRP 3-92 supplemental research
 - *Signalized Intersection Methodology (new delay method and structure changes reflecting actuated control)*
 - *Gap acceptance for six-lane, two-way stop-controlled Intersections*
 - *75 mph speed-flow curve for freeways*



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HCM Evolution

- HCM scope has grown over time
 - *Increasing coverage of various system elements and modes*
 - *User interest in more-detailed procedures*
- HCM page count has grown correspondingly
 - *1950: 160 pages*
 - *1965: 432 pages*
 - *1985: 512 pages*
 - *2000: 1,224 pages*



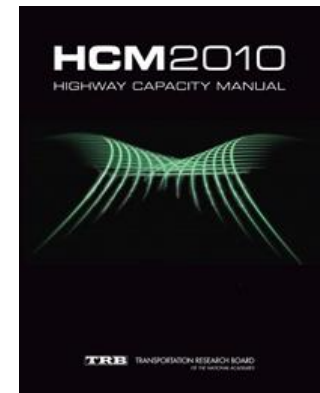
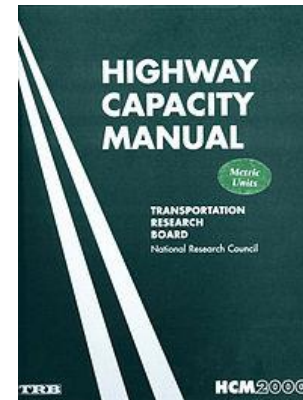
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Persistent Concepts: 1950 – 2010

Signalized Intersections

- Capacity
- Saturation flow rate
- Signal control system
- Left turns
- Arrival flow
- Unit of analysis
- Performance



Treatment of Persistent Concepts

Signalized Intersections

| Concept | Introductory Course | Graduate Course |
|-----------------|---------------------------------------|---|
| Capacity | $c = (g/C)s$ | $c = (g/C)s$ |
| Sat flow rate | No adjustments | Adjustments |
| Signal control | Pretimed | Actuated |
| Left turns | Protected | Permitted, protected |
| Arrival pattern | Uniform | Variable |
| Analysis unit | Movements | Lane group |
| Performance | Capacity sufficiency Uniform delay | Capacity sufficiency Uniform delay Back of queue size |

Overall Organization of HCM 2010

| Volume | Target Audience | Format | % Total Printed Pages |
|--|---|------------------|-----------------------|
| I: Concepts | New analysts and decision makers | Bound & PDF | 20 |
| II: Uninterrupted Flow Facilities | Analysts | Loose leaf & PDF | 30 |
| III: Interrupted flow Facilities | Analysts | Loose leaf & PDF | 50 |
| IV: Applications Guide and Supplemental Material | Analysts, software engineers, and researchers | Live/On-line | N/A |



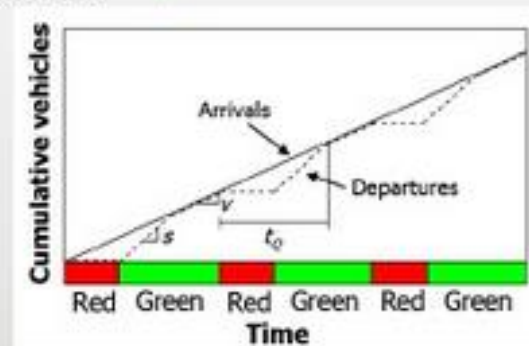
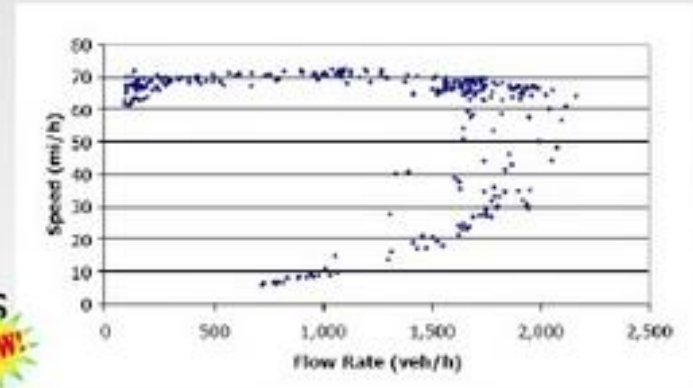
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Volume 1 Concepts

Front Matter

1. HCM User's Guide
 2. Applications
 3. Modal Characteristics
 4. Traffic Flow & Capacity Concepts
 5. Traveler Perception Concepts **NEW!**
 6. Analysis Tools
 7. Interpreting & Presenting Results
 8. Executive Summary/Policy Considerations **NEW!**
 9. Glossary & Symbols
- Volume 1 Index



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Volume 2

Uninterrupted Flow

How to Use Volume 2

10. Freeway Facilities

11. Basic Freeway Segments

12. Freeway Weaving Segments

13. Ramps & Ramp Junctions

14. Multilane Highways

15. Two-Lane Highways

Volume 2 Index



Photo: Lee Rodrigues



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Volume 3

Interrupted Flow

How to Use Volume 3

- 16. Urban Street Facilities 
 - 17. Urban Street Segments 
 - 18. Signalized Intersections 
 - 19. Two-Way Stop-Controlled Intersections
 - 20. All-Way Stop-Controlled Intersections 
 - 21. Roundabouts 
 - 22. Interchange Ramp Terminals
 - 23. Off-Street Pedestrian & Bicycle Facilities 
- Volume 3 Index



Photo: Lee Rodriguez



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Volume 4

2010 Highway Capacity Manual Volume 4 | Applications Guide - Windows Internet Explorer

http://dm.kitelson.com/hcm/v4/index.html

File Edit View Favorites Tools Help

AFTA AS DL NWA FTES HCM Vol 4 HCQS CASNet ODOT WA Sched TOQS TORP TRIP TRIS Timekeeper QC

2010 Highway Capacity Manual Volume 4 | Applications...

2010 Highway Capacity Manual Volume 4

Methodological Details Interpretations Technical Reference Library Applications Guide

Volume 4

Volume 4 of the HCM supplements the three printed volumes of the HCM with additional detail that many HCM users will find useful. The content of Volume 4 has been divided into the following four major areas, which can be accessed using the links at the top of the page:

1. **Methodological Details.** Most Volume 2 and 3 chapters (and one Volume 1 chapter) have a companion Volume 4 chapter. The specific content varies by chapter (see the Introduction section of each Volume 4 chapter for a summary of the chapter's contents), but will include material in one or more of these areas:
 - More-detailed descriptions of computational methodologies, written for users who seek a greater depth of understanding of the methodology or plan to develop HCM implementation software;
 - Sensitivity analyses, statistics on methodological uncertainty, worksheets, and data collection forms;
 - Example applications of alternative tools to situations not addressed by the Volume 2 or 3 chapter's methodology; and/or

Representation of Signalized Intersection

| Introductory Course | Graduate Course |
|---|---|
| <ul style="list-style-type: none">• Pretimed signal operation | <ul style="list-style-type: none">• Actuated signal operation |
| <ul style="list-style-type: none">• Automobile mode only | <ul style="list-style-type: none">• Automobile mode only |
| <ul style="list-style-type: none">• Exclusive LT lanes• 1-2 TH lanes | <ul style="list-style-type: none">• Two intersecting 1-way streets; Permitted LT operation |
| <ul style="list-style-type: none">• Uniform deterministic arrivals & departures• D/D/1 queuing model | <ul style="list-style-type: none">• Arrival pattern based on departures from upstream signalized intersection |
| <ul style="list-style-type: none">• Demand less than capacity | <ul style="list-style-type: none">• Demand exceeds capacity |

Graduate Course – Intersection Operations

Basic queuing models

Simplified scenarios

Computational engines and model testing

HCM Applications Guide

Theory

- Traffic flow (queuing models)
- Signal controller operations
- Predicting green duration
- Predicting arrival patterns
- Predicting delay
- Left turn phasing
- Predicting queue length

HCS

Phasing

Cycle, s: 102

Pre-Timed Signal

Offset, s: 0

Phase 2 Direction: EB

Phase 4 Direction: SB

Reference Phase: 2

Reference Point: Begin

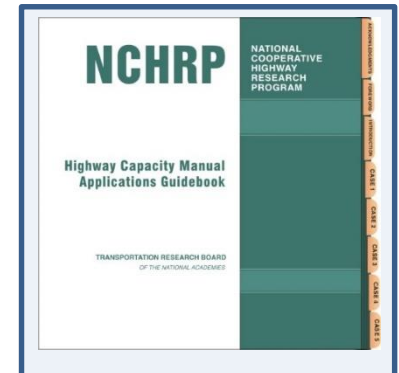
Force Mode: Fixed

Side Street Split Phasing

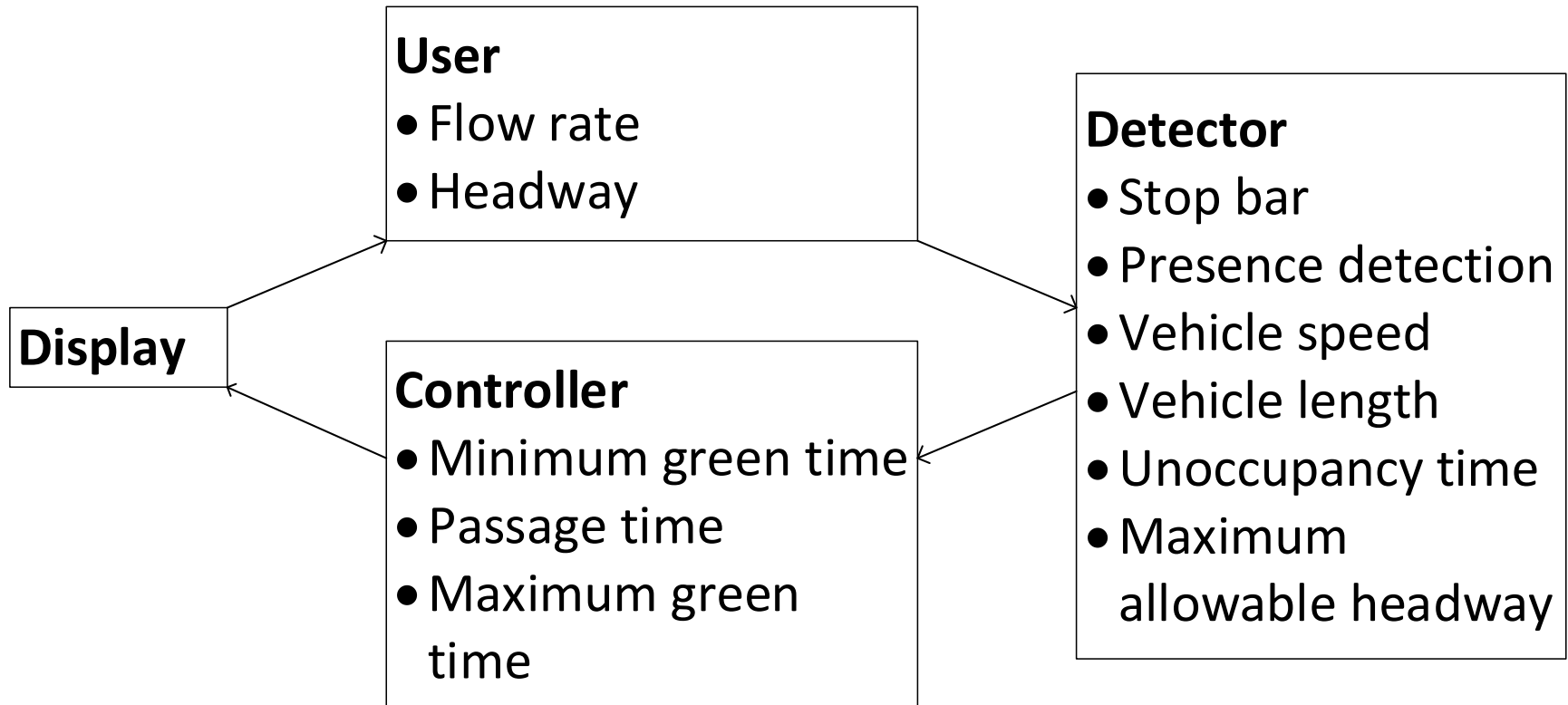
Uncoordinated Intersection

Field-Measured Phase Times

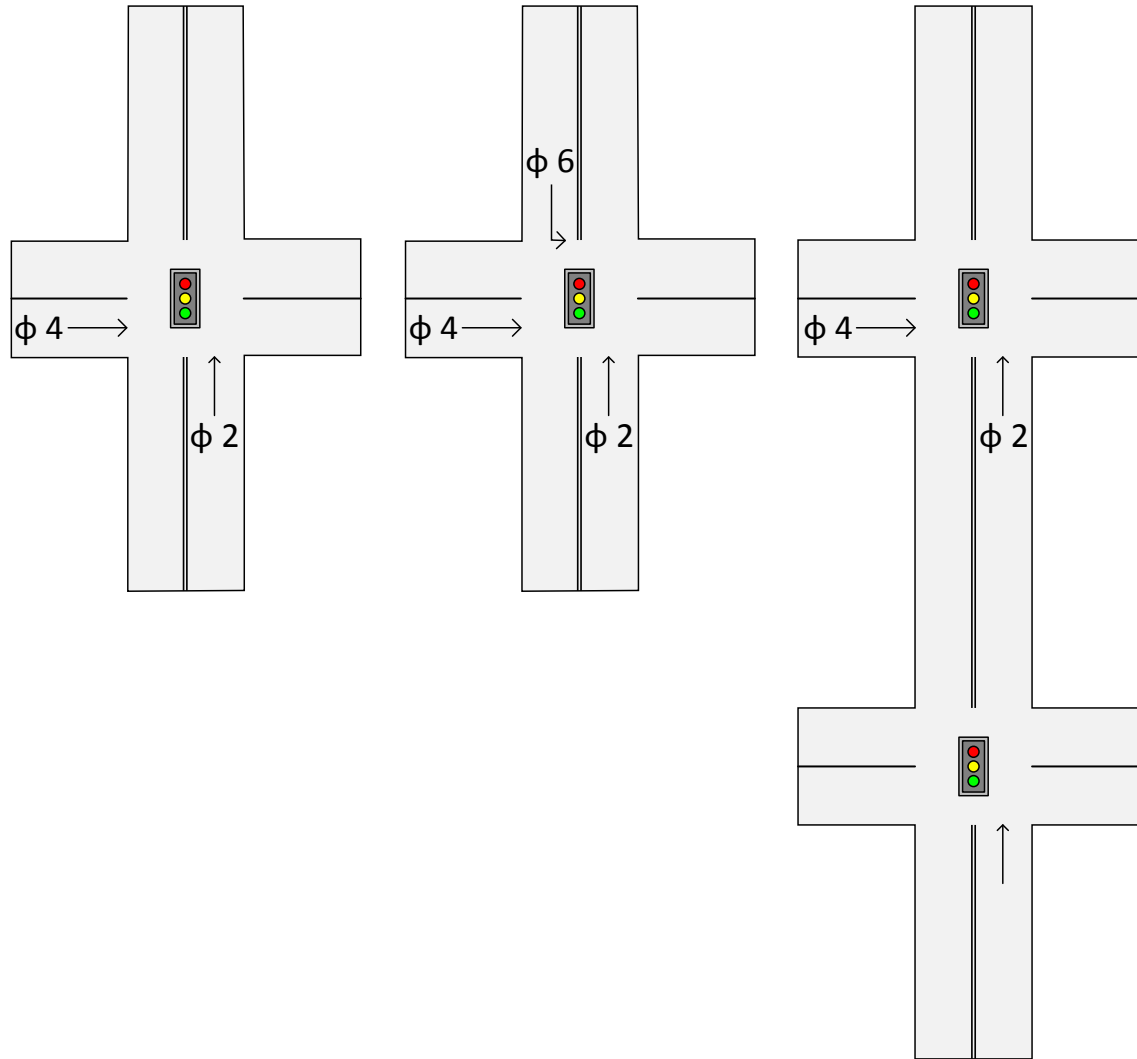
Phasing Wizard



Traffic Control Process Diagram...



Simplified scenarios...



CE 572 - SPRING 2015

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[Administration](#)

[Schedule/Activities](#)

[Resources](#)

[Assignments](#)

Welcome to the home for **CE 572 - Intersection Traffic Operations**.

There are three basic types of intersections, each defined by the type of control that is used: (1) signal controlled, (2) stop or yield sign controlled, and (3) uncontrolled. Each intersection type is most appropriately used for a given set of traffic volume and intersection geometry conditions. During this class, we will study the first two types, intersections that are controlled by traffic signals and stop or yield controlled intersections (such as all-way stop controlled intersections, two-way stop controlled intersections, and roundabouts).

Traffic operations analysis is a major focus of work for the transportation engineer. Engineers today are more likely to redesign or upgrade an existing facility than to prepare a design for a new facility. This emphasis requires the transportation engineer to have a thorough understanding of the dynamics of traffic operations and the basic elements of traffic flow. To help you to gain this understanding, we will investigate traffic operations of unsignalized and signalized intersections as part of this course.