Pedestrian and Bicycle Data Collection

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Overview

- Introduction
- Traffic Monitoring Programs
- Counting Technologies
- Questions
- Counting Exercise

INTRODUCTION

Why measure walking & biking?

If we don't count it, it doesn't count.

Why measure walking & biking?

- Funding & policy decisions
- To show change over time
- Facility design
- Planning (short-term, long-term, regional...)
- Economic impact
- Public health
- Safety

How many bike and walk?

- Surveys
  - National
  - Regional
  - Local

- Counts
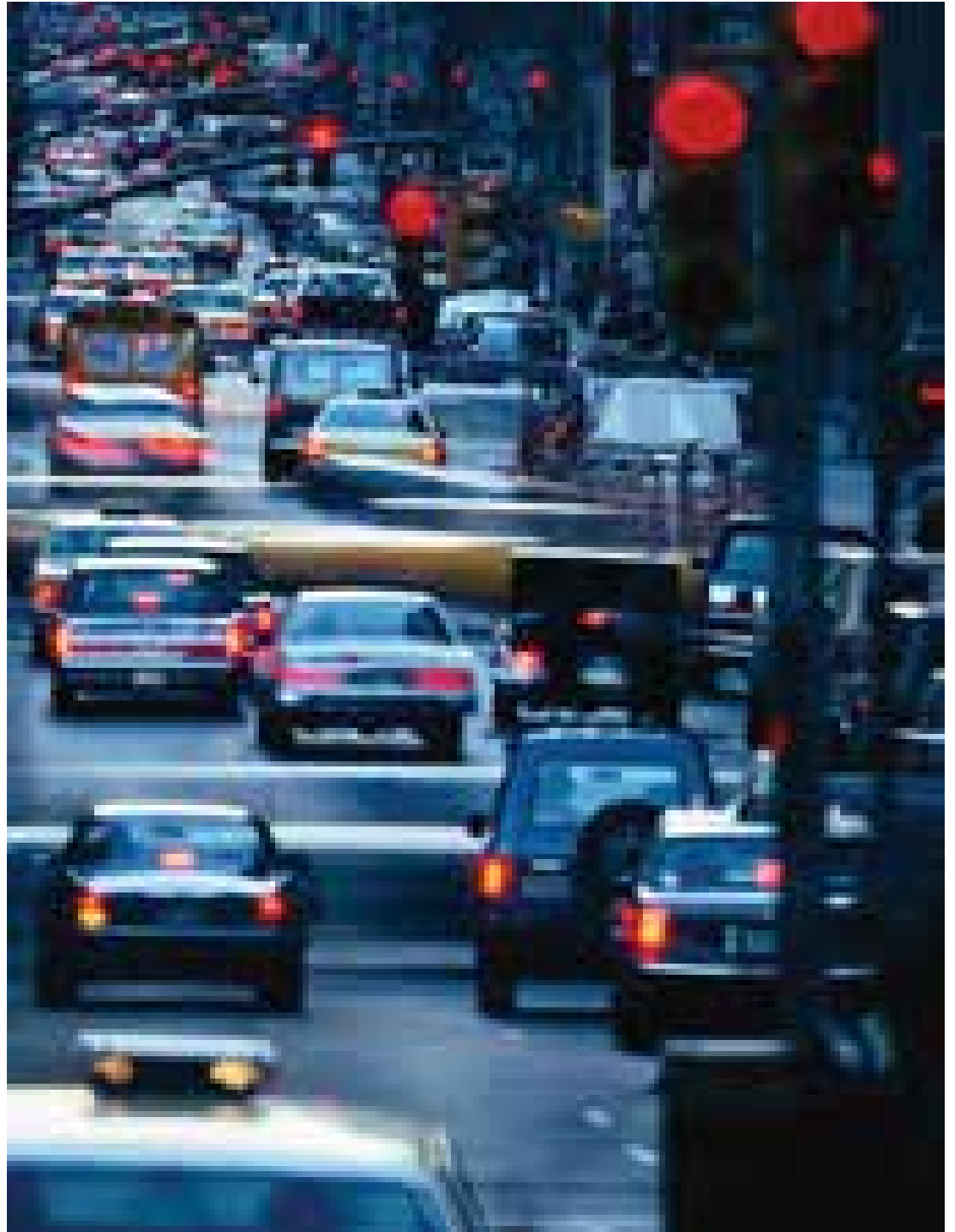 - Continuous
  - Short-term

What good are counts?

- Baseline use
- Basis for forecasting
- Validates modeling
- Design
- Signal timing
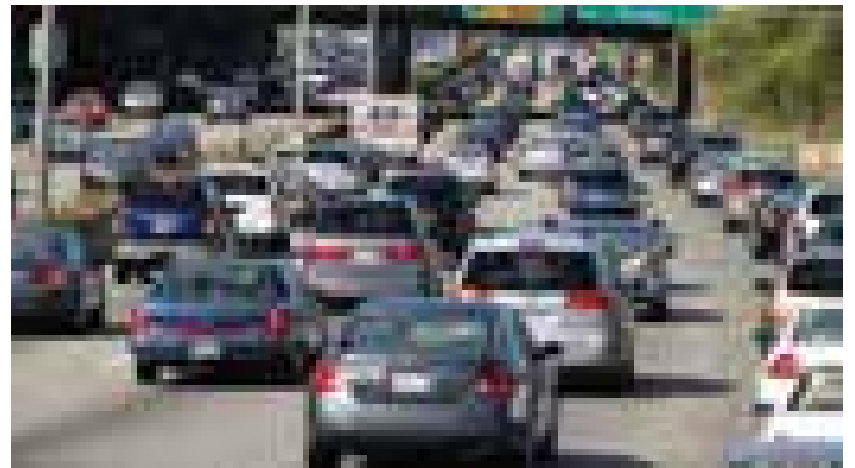- Safety analysis
- Funding
- Policies
- Commercial value

TRAFFIC MONITORING PROGRAMS

Traffic Monitoring

- Required by FHWA (MAP21):
  - **all urban and rural principal arterial roadways**
    - all intermodal connector roadways
    - the strategic defense highway network

- Historically used to allocate federal funds to state DOTs.

- Municipalities
  - Planning
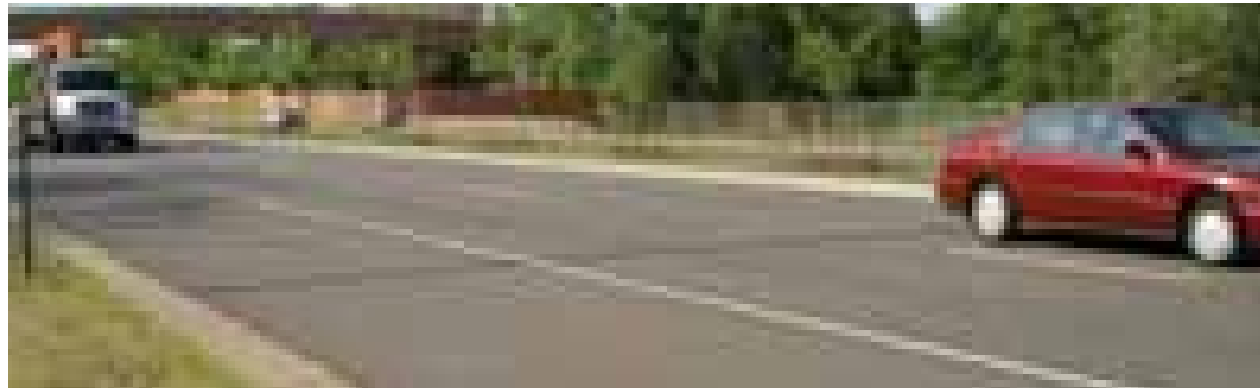 - Signal timing

State Traffic Monitoring

Continuous Counters

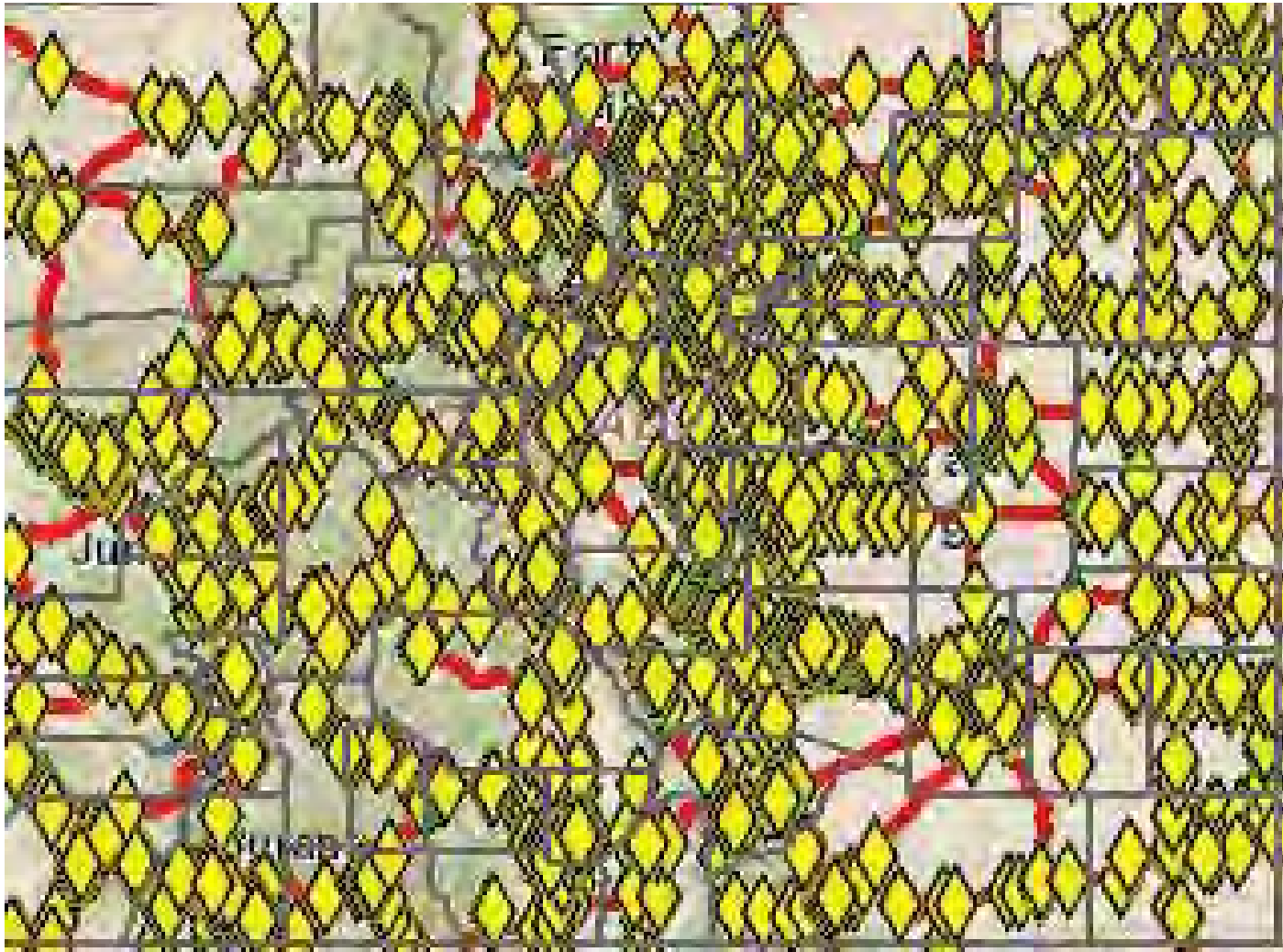Commonly inductive loops

Short-term Counters

Commonly pneumatic tubes

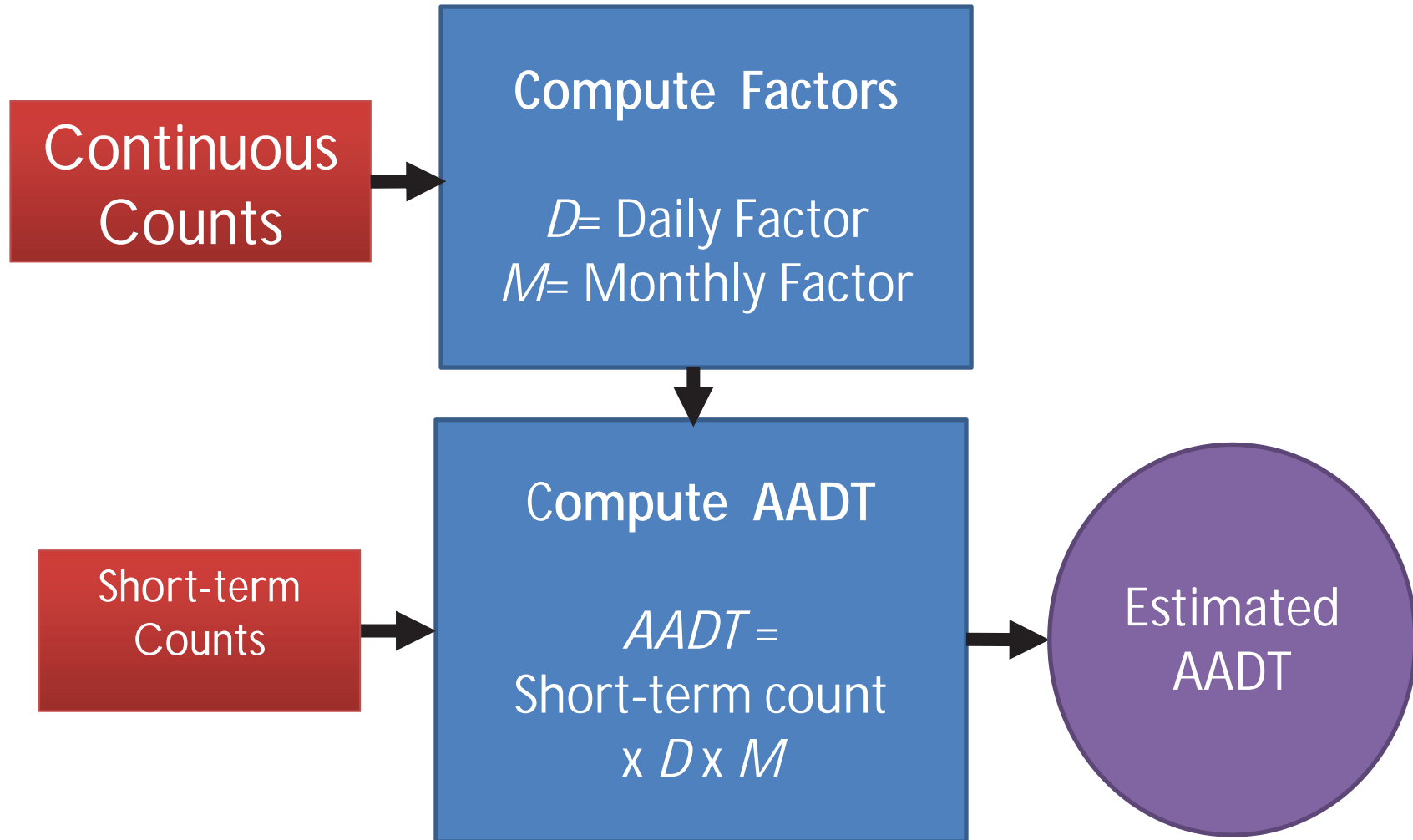# Colorado's Continuous Counters

Colorado's Short-Term Traffic Counter

Method to Calculate Annual Average Daily Traffic (AADT)

Continuous Counts → **Compute Factors**

D= Daily Factor
M= Monthly Factor

Short-term Counts → **Compute AADT**

$AADT =$ Short-term count x D x M

→ **Estimated AADT**

Can we apply these methods to biking and walking?

Compute
Annual Average Daily Bicyclists (AADB)

AADT for bicyclists!

Factoring Method

Adapted from Traffic Monitoring Guide

$$\text{AADB} = C_{known} * D * M$$

C_{known} = known manual count for 24 hours

D = Daily Factor

M = Monthly Factor

Monthly Factor

$$M = \frac{AADB}{MADB} = \frac{\overset{\text{July}}{500}}{1{,}000} = 0.5$$

July is 200% of AADB.

where

$MADB$ = Ave daily bike count in that month

3 Steps to Estimate AADB

1. Collect continuous counts
2. Compute factors
3. Collect short-term counts

Compute AADB

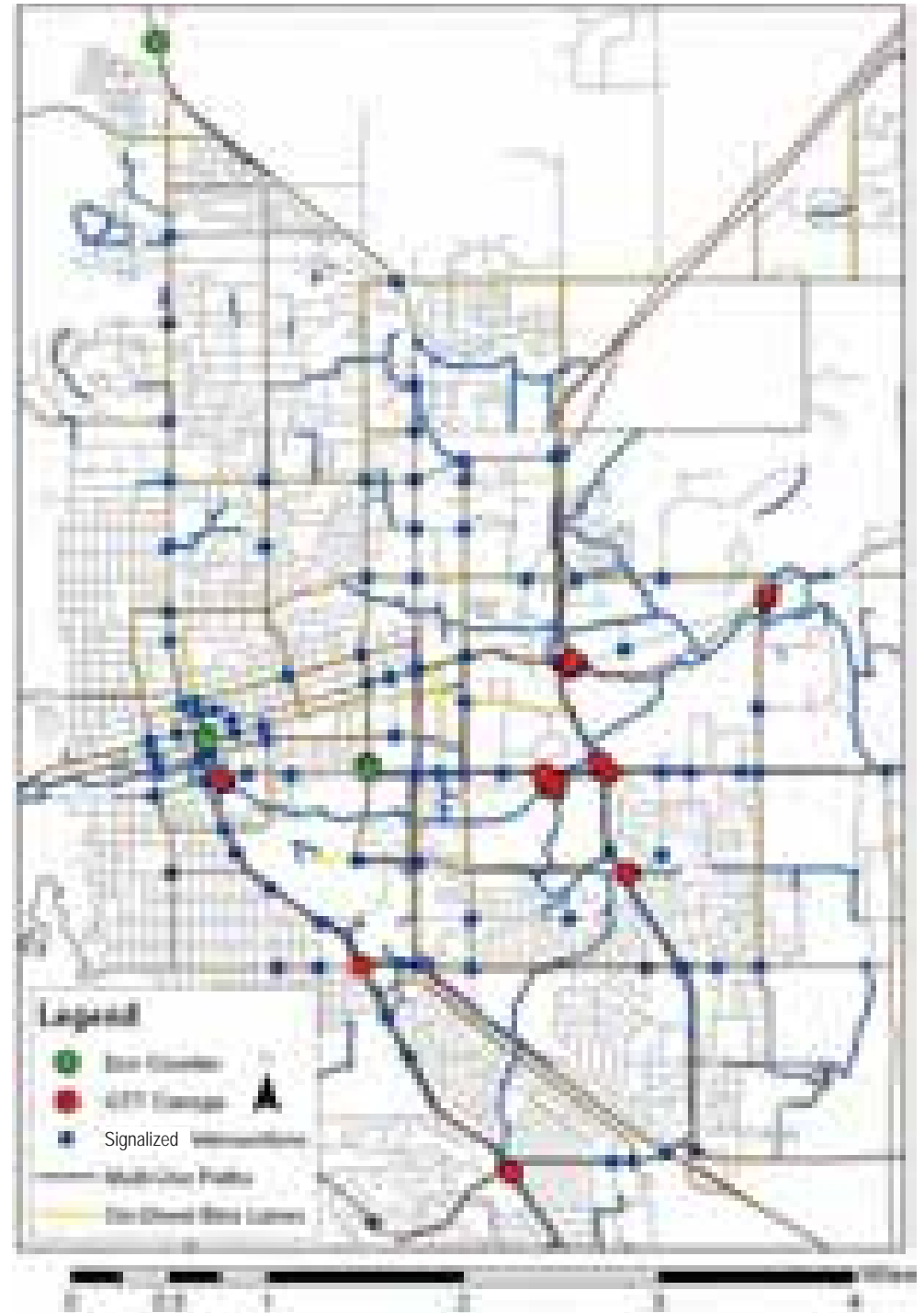- I know AADB at 25 continuous count stations.
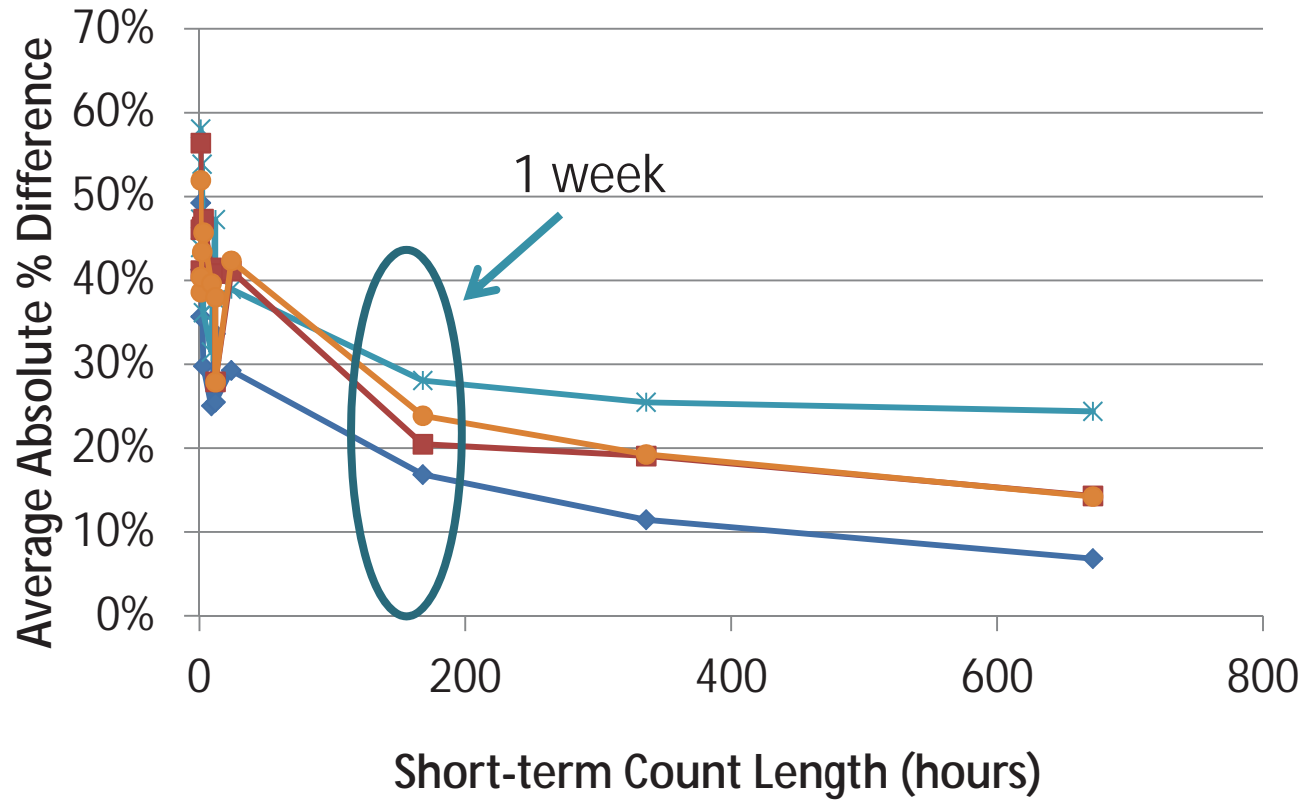
Continuous Counts

Compute AADB

- I know AADB at 25 continuous count stations.

Continuous Counts

- I conduct 3-hour counts at 100 more stations.

Short-term Counts

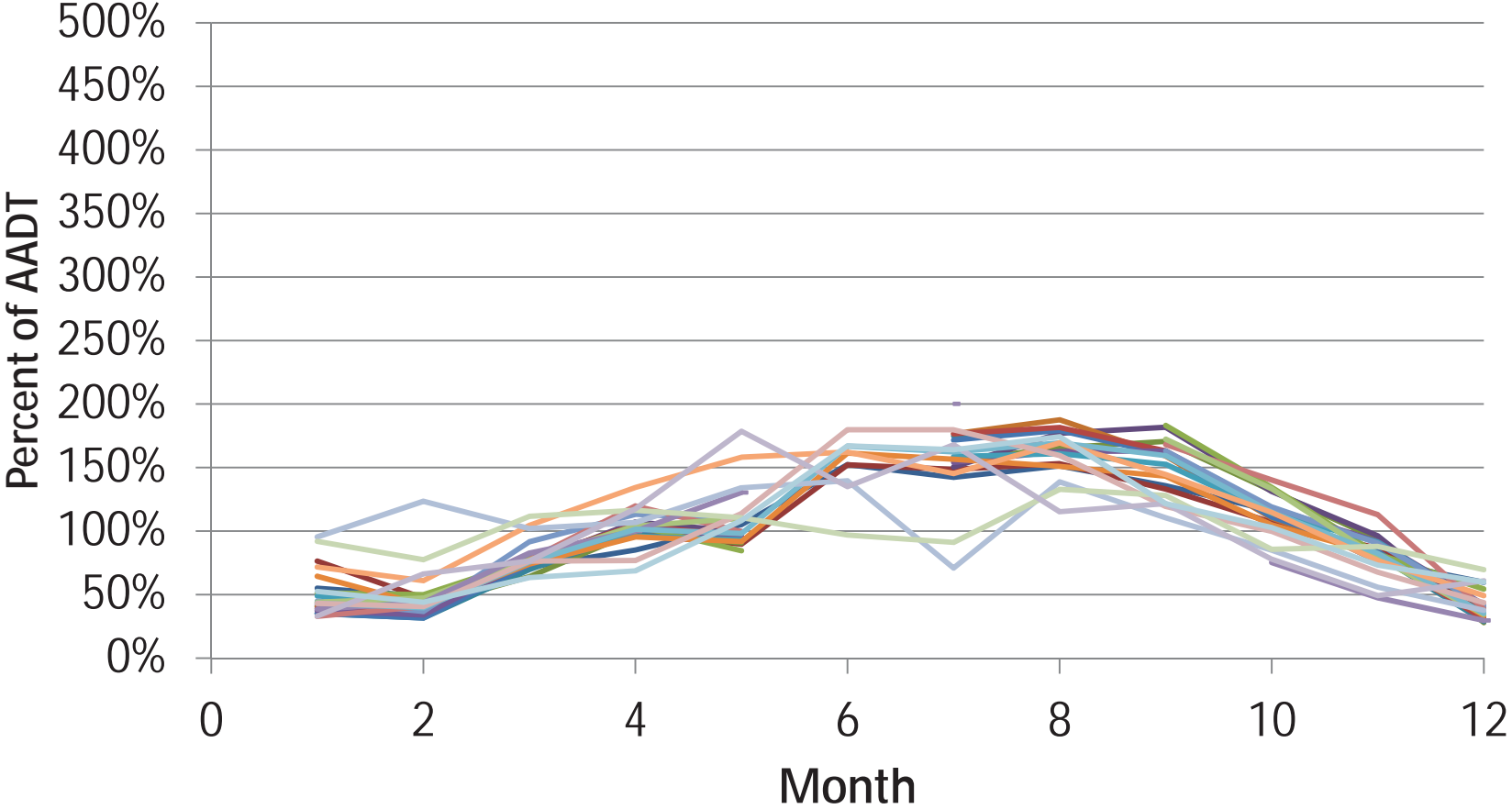AADB Error with
Length of Short-term Counts

Traffic Monitoring Guide 2013

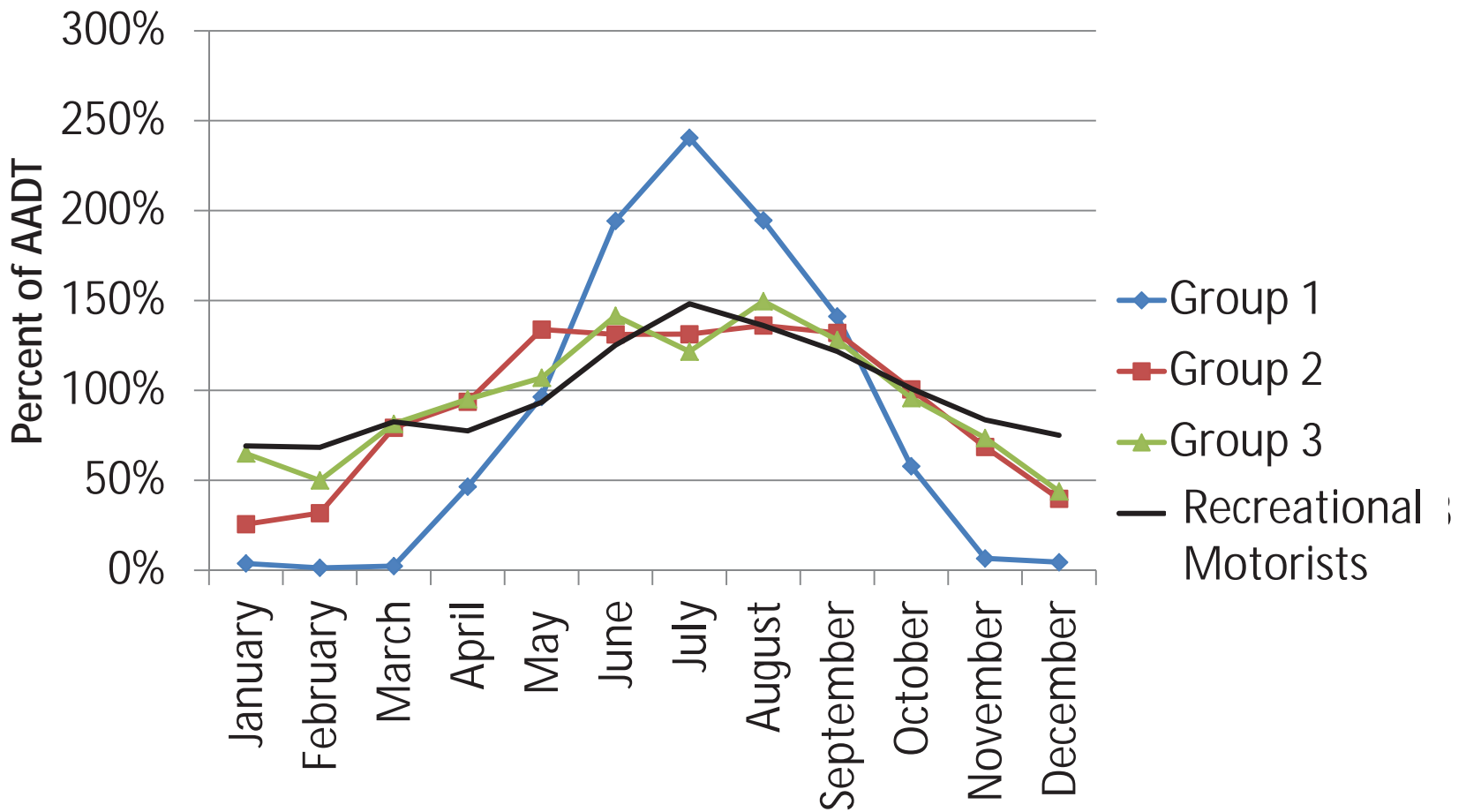## Chapter 4: Traffic Monitoring for Non-motorized Traffic

1. Review the existing continuous count program
2. Develop an inventory
3. Determine the traffic patterns
4. Establish factor groups
5. Determine the appropriate number of continuous monitoring locations
6. Select specific count locations
7. Compute factors for annualizing short duration counts

MONTHLY
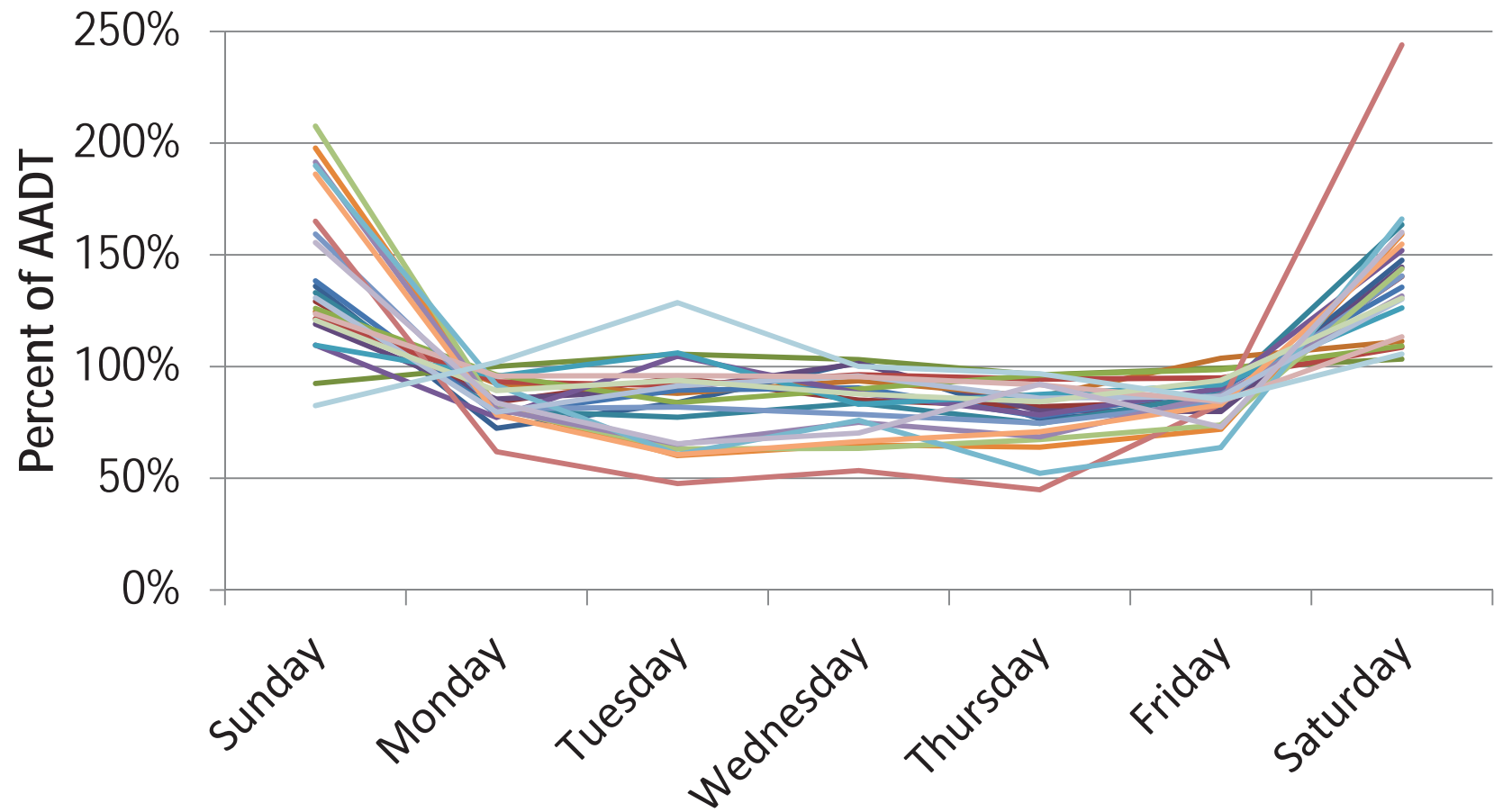
Monthly Patterns for Bike Only

Monthly Pattern for Bike/Ped

Bike/Ped and Motorist Factors

Y-axis: Percent of AADT (0% to 300%)

X-axis months: January, February, March, April, May, June, July, August, September, October, November, December

Legend:
- Group 1
- Group 2
- Group 3
- Recreational Motorists

DAILY

Daily Patterns for Bicycle Only

Daily Patterns for Bike/Ped

Bike/Ped and Motorists Factors

Chart showing "Percent of AADT" on the vertical axis (0% to 160%) versus days of the week (Sunday through Saturday) on the horizontal axis. Legend: Group 1, Group 2, Group 3, Recreational Motorists.
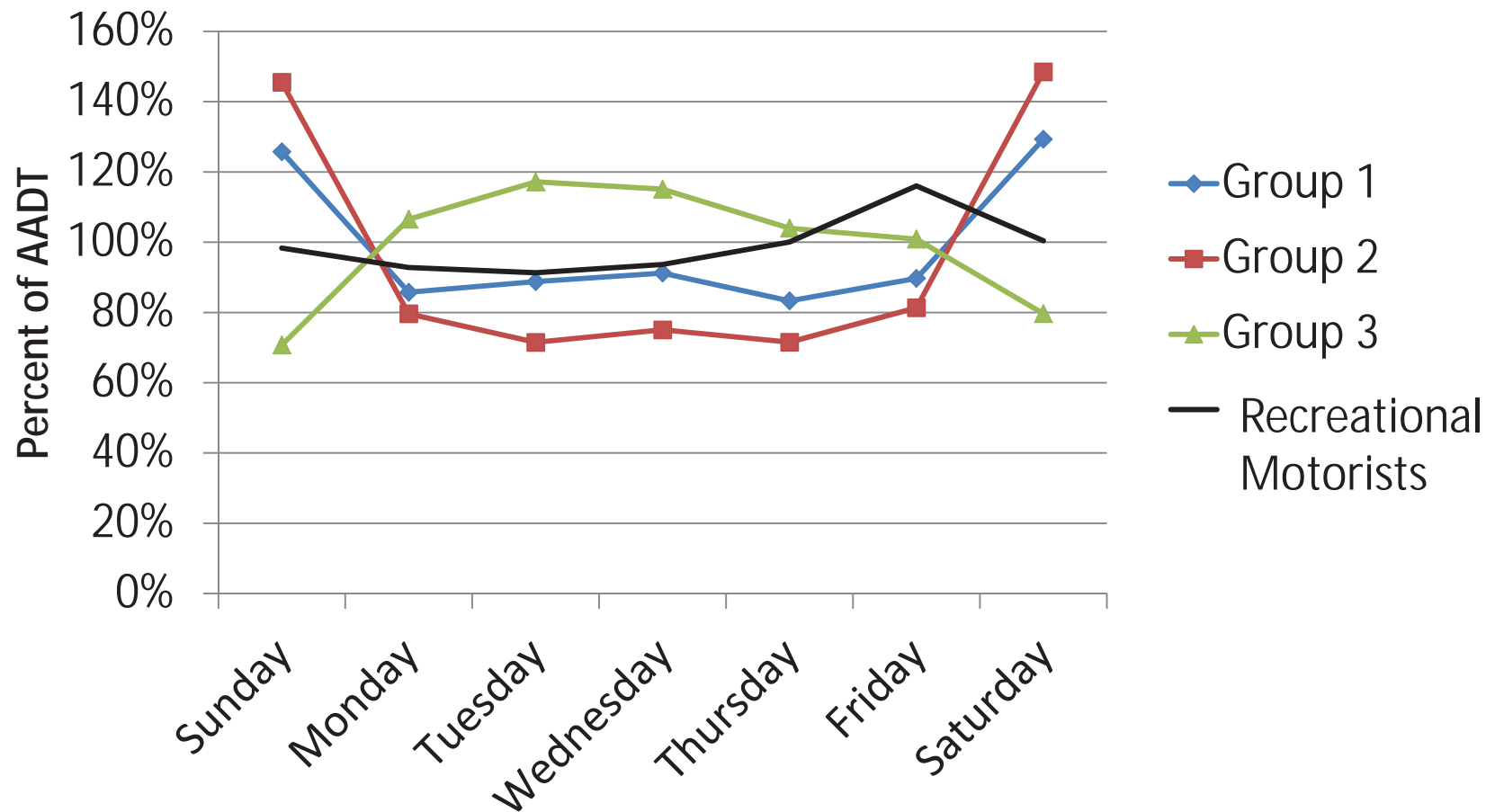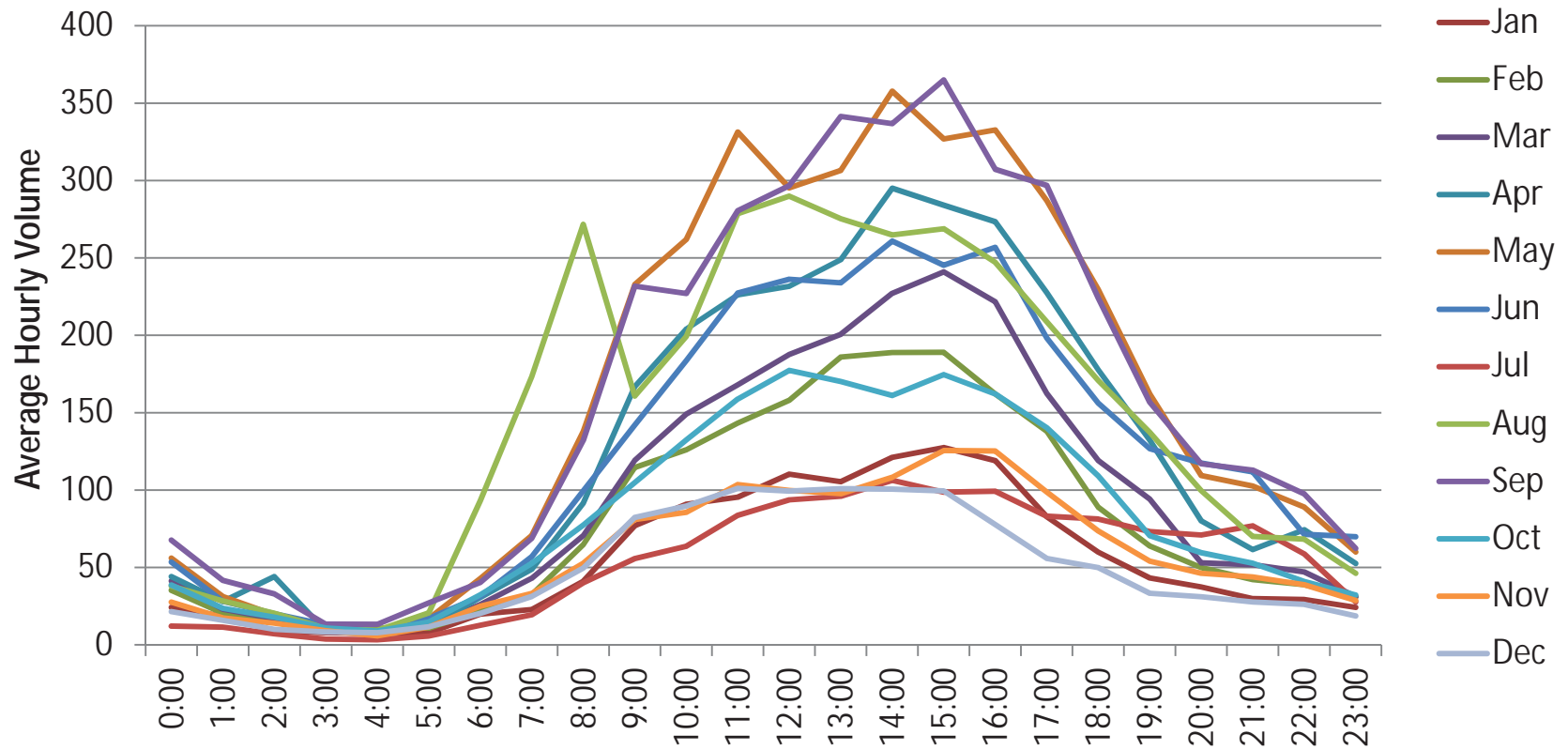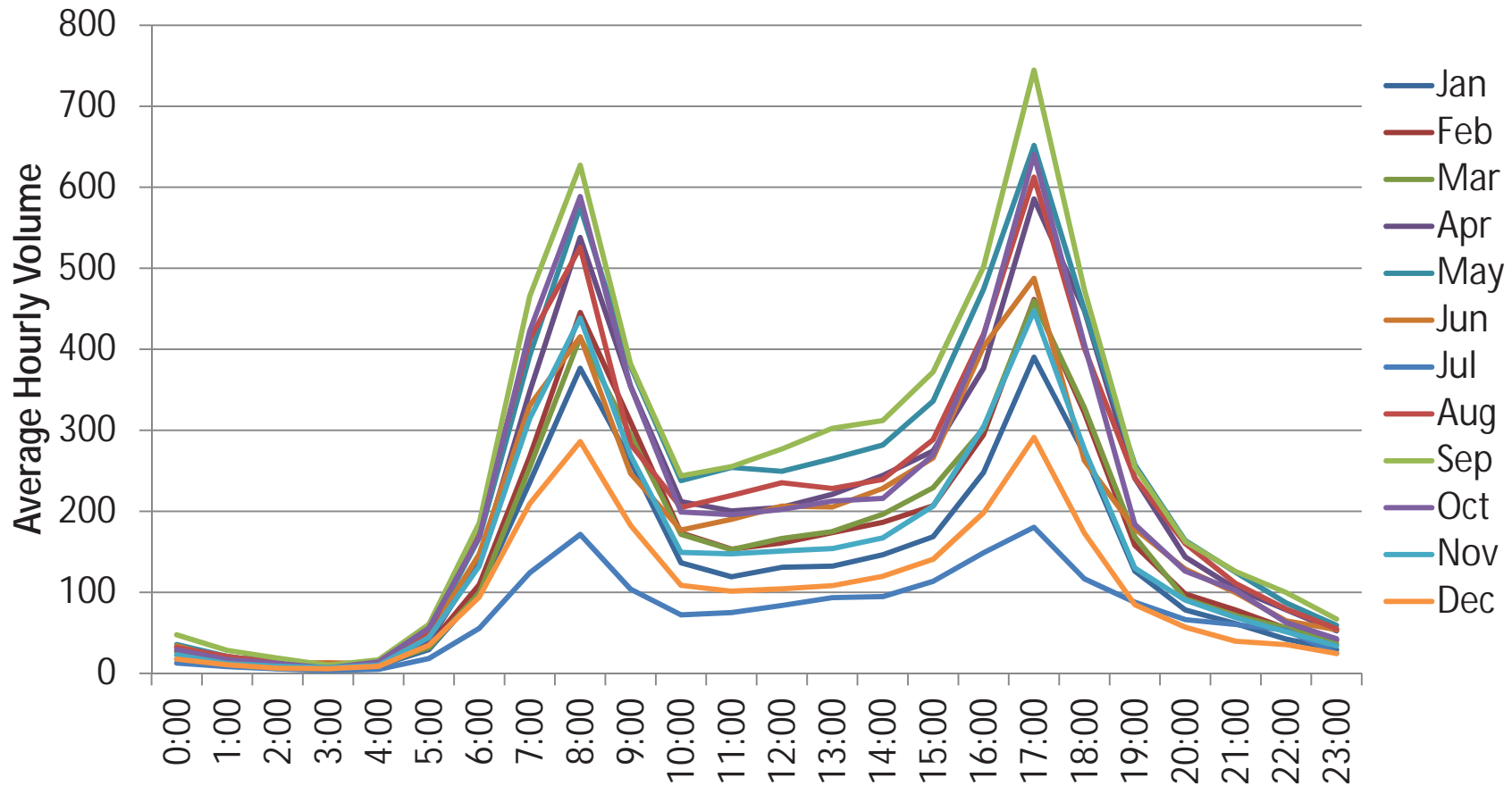
HOURLY

Hourly Non-commute Pattern

Source: Pam Johnson, PSU – Recreational Pattern

Hourly Commute Pattern

Source: Pam Johnson, PSU, from Hawthorne Bridge Data

COUNTING TECHNOLOGIES

Pedestrian Counts

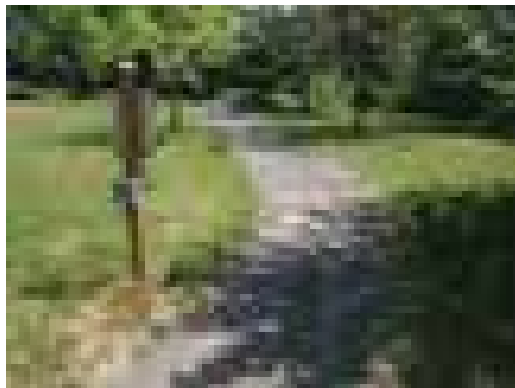- **Continuous**: Hourly Counts 24/7

Infrared

Video Image Recognition

Radar

Pressure Sensor

- **Short-term**: One hour to one month

Infrared

Manual

Passive Infrared Counters

Passive Infrared Counters

Traffic Monitoring Guide. 2013, FHWA: Washington, DC.

Active Infrared

Traffic Monitoring Guide. 2013, FHWA: Washington, DC.

Pressure Sensors

Before

After

Jean-Francois Rheault, Eco Counter
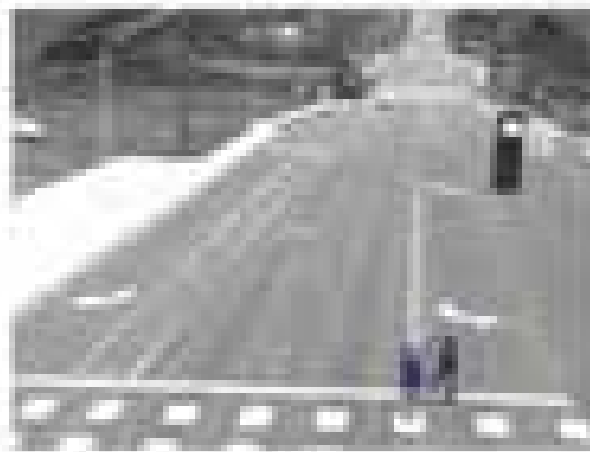*Traffic Monitoring Guide.* 2013, FHWA: Washington, DC.

Video Image Processing

Source: Nebrovzdra, Zhong, and Wang, 200X

Traffic Monitoring Guide. 2013, FHWA: Washington, DC.
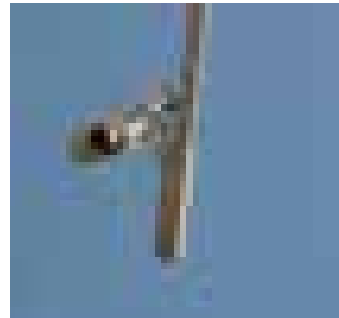
Proxy Measures

- Pedestrian signal actuations
- Crash data
- Transit use

Bicycle Counts

- **Continuous**: Hourly Counts 24/7

Inductive Loop

Video Detection

Video Image Recognition

Microwave

Magnetometers

- **Short-term**: One hour to one month

Manual

Pneumatic Tube Counters

1. What Are You Counting?

Technology	Bicyclists Only	Pedestrians Only	Pedestrians & Bicyclist Combined	Pedestrians & Bicyclist Separately	Cost
Inductance Loops[1]	●			◐	$$
Magnetometer[2]	○				$-$$
Pressure Sensor[2]	○	○	○	○	$$
Radar Sensor	○	○	○		$-$$
Seismic Sensor	○	○	○		$$
Video Imaging: Automated	○	○	○	○	$-$$
Infrared Sensor (Active or Passive)	○ [2]	●	●	◐	$-$$
Pneumatic Tubes	●			◐	$-$$
Video Imaging: Manual	○	○	○	●	$-$$$
Manual Observers	●	●	●	●	$$-$$$

2. How Long? Permanent → Temporary/Short Term

○ Indicates what is technologically possible.
● Indicates a common practice.
◐ Indicates a common practice, but must be combined with another technology to classify pedestrians and bicyclists separately.

$, $$, $$$: Indicates relative cost per data point.

[1] Typically requires a unique loop configuration separate from motor vehicle loops, especially in a traffic lane shared by bicyclists and motor vehicles.
[2] Permanent installation is typical for asphalt or concrete pavements, temporary installation is possible for unpaved, natural surface trails.
[3] Requires specific mounting configuration to avoid counting cars in main traffic lanes or counting pedestrians on the sidewalk.

Source: Federal Highway Administration.

Traffic Monitoring Guide 2013 Update, Chapter 4.

Combined Bicycle and Pedestrian
Continuous Counter

Inductive Loops

Inductive loop counters on paths

Inductive loop counters in bike lanes

Inductive loop counters in vehicle lane

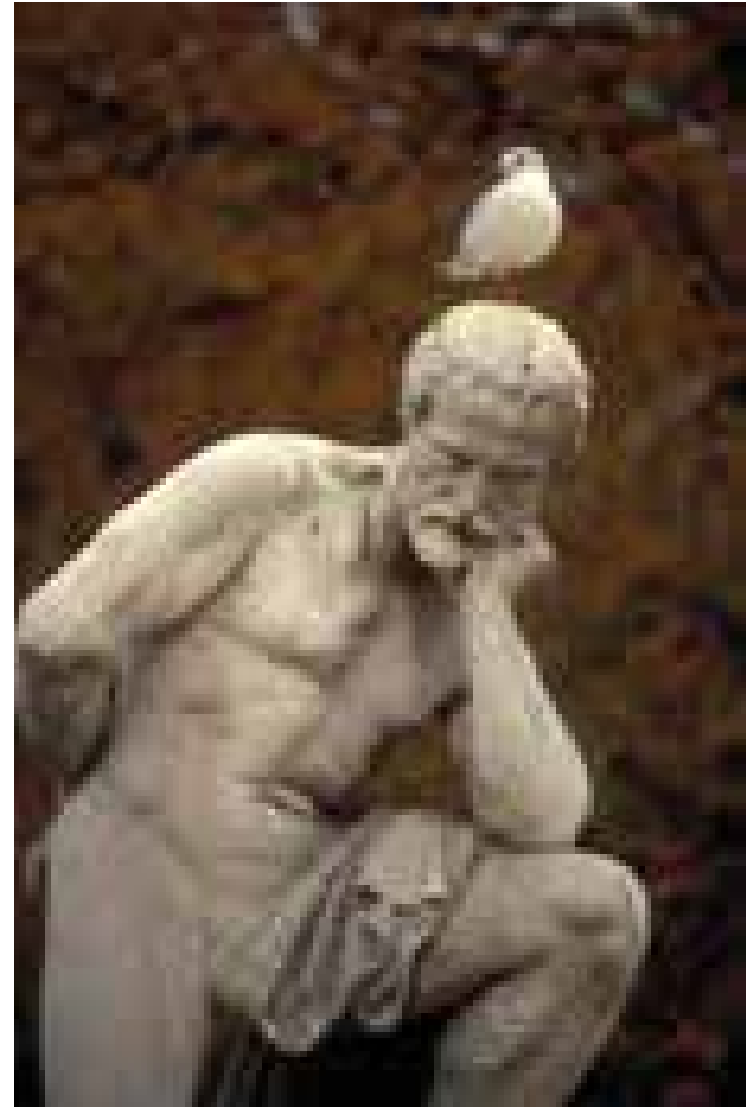# Video Detection

Pneumatic Tube Counting
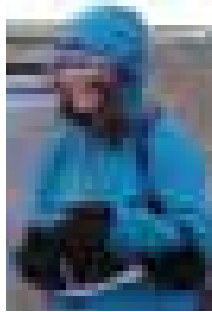

On Path

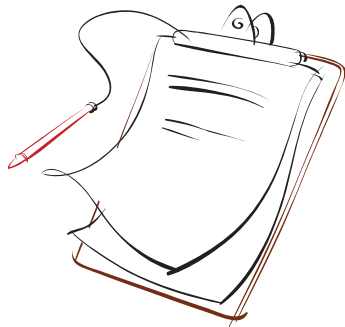On Road

Questions?

MANUAL COUNTING

Manual Counts

- Volunteer   vs.   Paid Staff

- Paper   vs.   Electronic count board

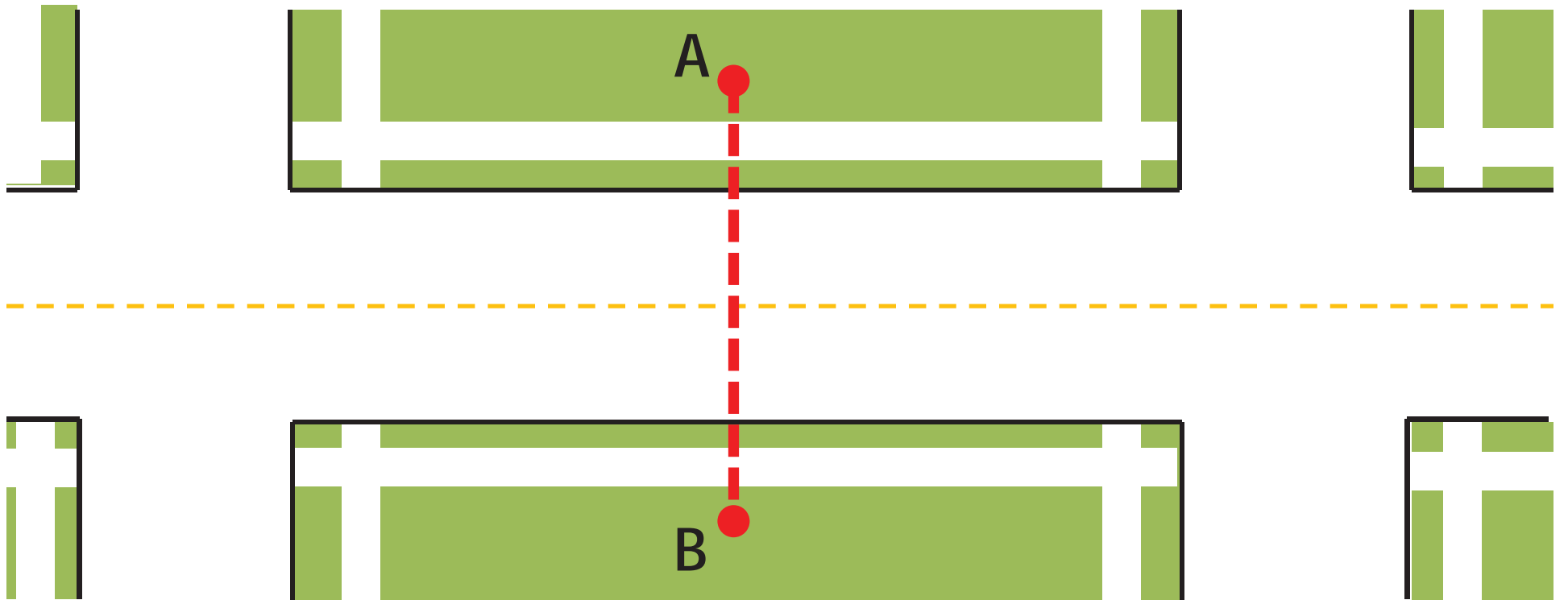http://www.ctre.iastate.edu/pubs/traffichandbook/3trafficcounts.pdf

- Screenline   vs.   Intersection Turning Movement Count
- On-site   vs.   Video watching in office

Screenline

National Bicycle and Pedestrian Documentation Project

	Bicycles		Pedestrians		Others
	Female	Male	Female	Male	
00-:15					
15-:30					
30-:45					
45-1:00					
1:00-1:15					
1:15-1:30					
1:30-1:45					
1:45-2:00					
Total					

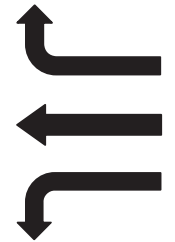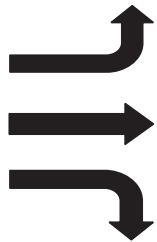http://bikepeddocumentation.org/downloads/
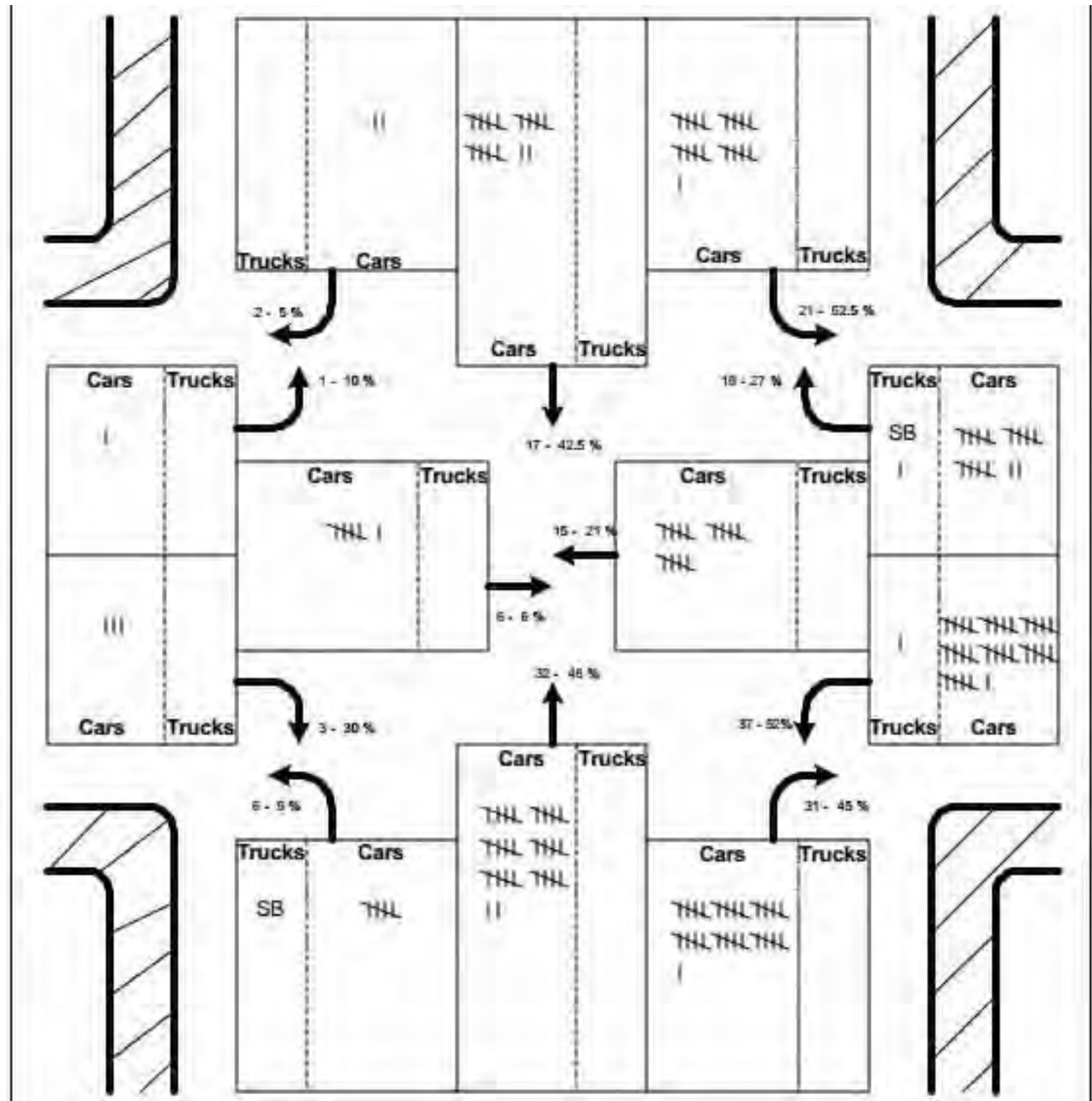
There's an app for that!

Manual
counting on
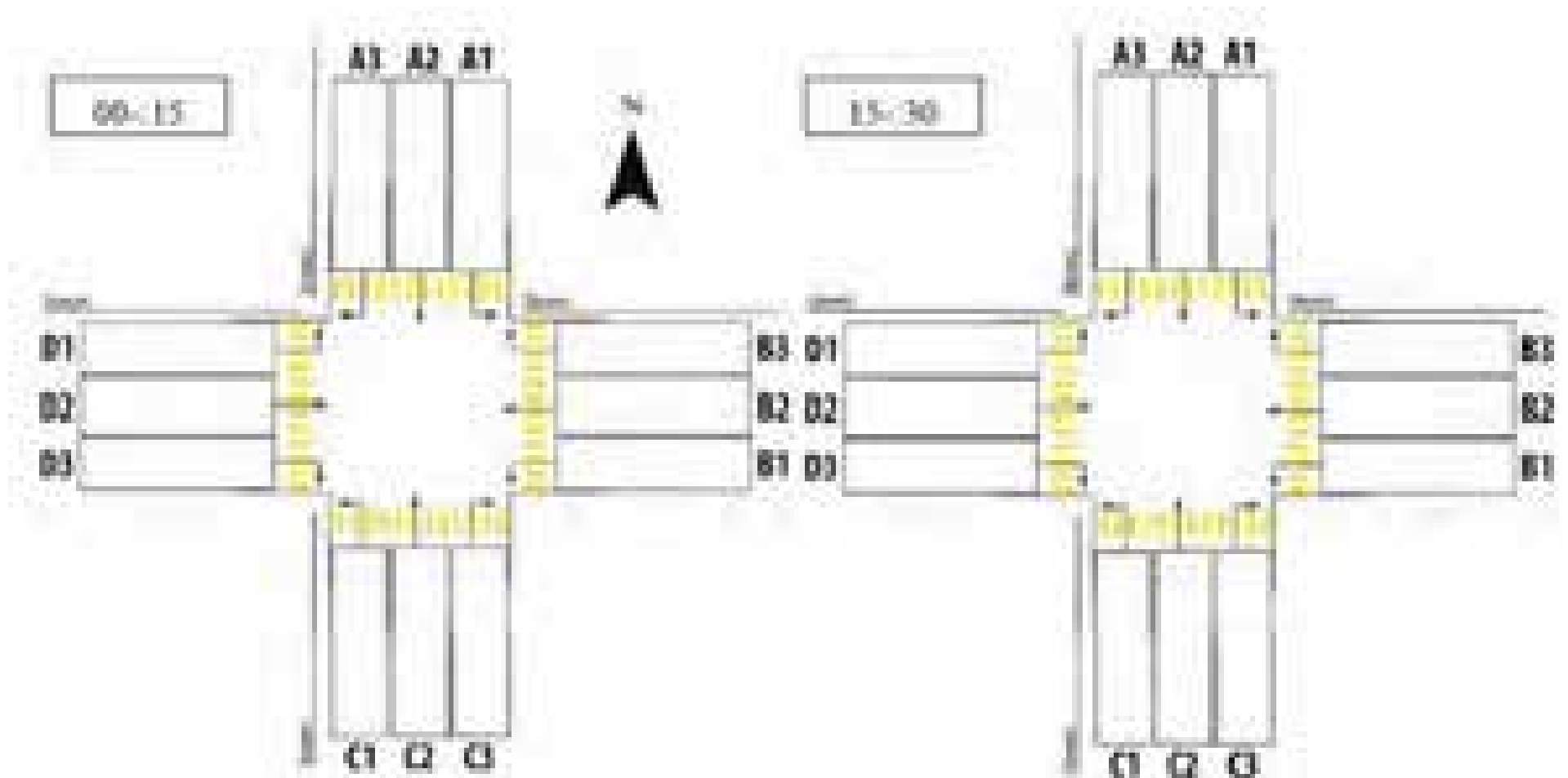your smart
phone!

by Thomas Götschi

Turning Movement Counts

Motor Vehicle Count Example

National Bicycle and Pedestrian Documentation Project

http://bikepeddocumentation.org/downloads/

Wash-ington State

	Gender	NORTHBOUND	SOUTHBOUND	EASTBOUND	WESTBOUND	TOTAL
Bicyclist	Male					
	Female					
Pedestrian	Male					
	Female					
Other (unknown, etc.)						
No Helmet (please provide a tally for each cyclist NOT wearing a helmet)						

Portland Volunteer Count Form

	Male	Female	Total
with helmet			
without helmet			
totals →			

Indicate movement thru intersection by using arrows to show direction of these bicyclists, through etc.) indicate north, rand legs of intersection. If not standard intersection, use blank form and draw to scale.
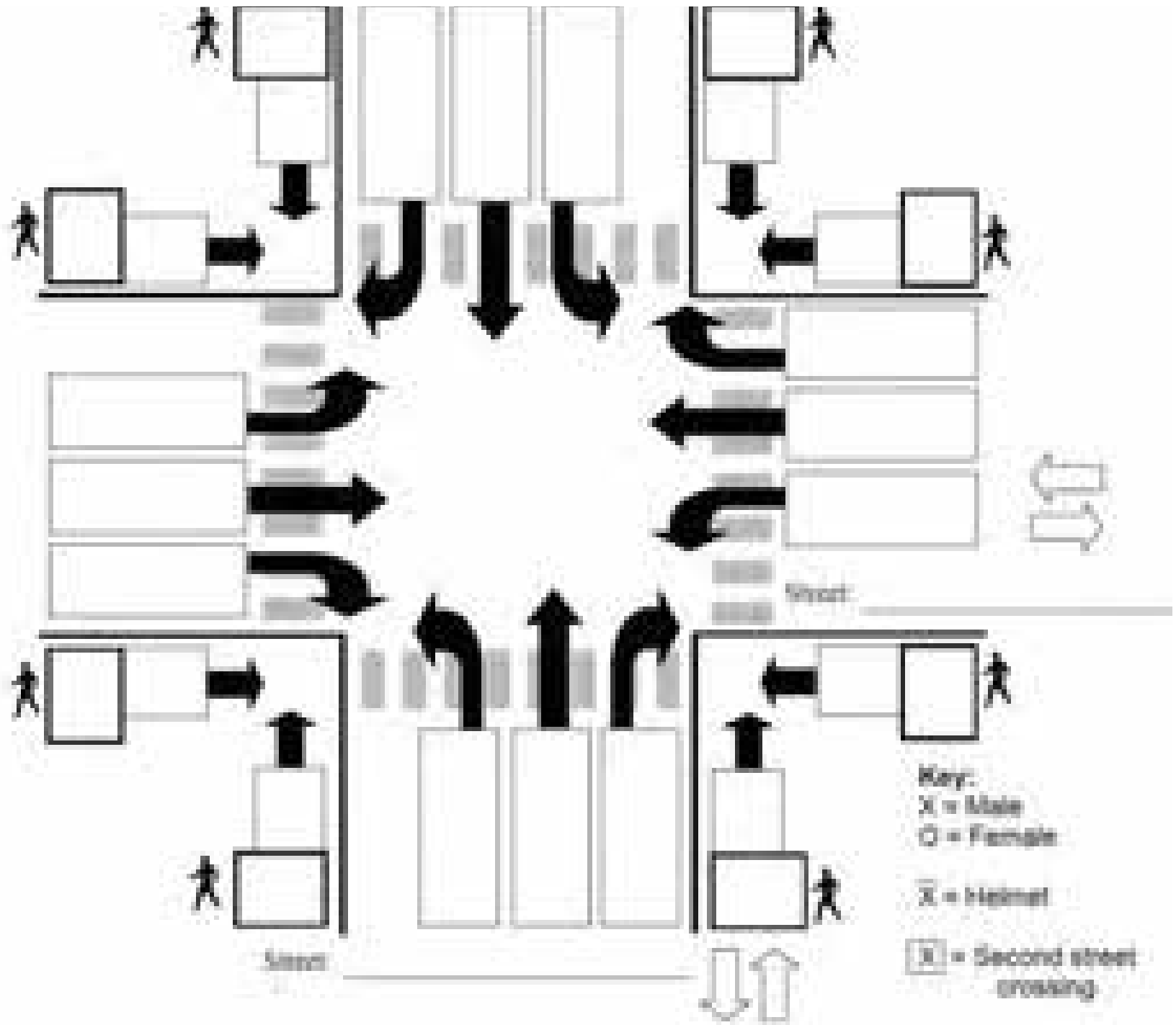
N

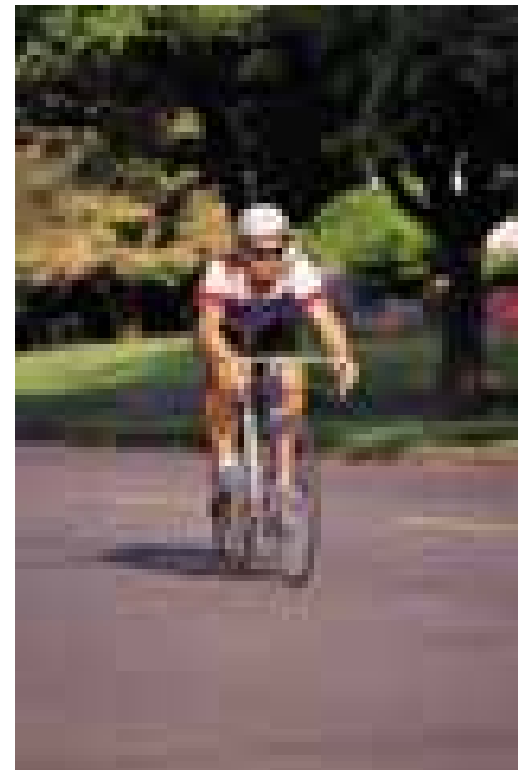4th Ave. and Madison

FIELD EXERCISE

Data sheet for today

- Turning movement counts
  - Motor vehicles
  - Bicycles
  - Pedestrians
- Screenline
  - Motor vehicles
  - Bicycles
  - Pedestrians

Key:
X = Male
O = Female

X̄ = Helmet

☒ = Second street
crossing

Screenline

Motor Vehicles					Bicyclists				
Manual Count					Manual Count			Machine Count	
Cars	Trucks	Buses	Total		Male	Female	Total		
									End Count
									Start Count
							with helmets		
							no helmets		
Total									

Go Forth!

What are counts not good for?

- Studying trip purpose
- Demographics

Bike/Ped Factors

Percent of AADT (y-axis)

Y-axis: 0%, 20%, 40%, 60%, 80%, 100%, 120%, 140%, 160%

X-axis: Sunday, Monday, Tuesday, Wednesday, Thursday, Friday, Saturday

Legend: Group 1, Group 2, Group 3

Bike/Ped and Motorists Factors

Bike/Ped Factors

Percent of AADT

- Group 1
- Group 2
- Group 3

January February March April May June July August September October November December

Introduction

Factor Method

- **Adapted from Traffic Monitoring Guide**

$$AADB = C_{known} * H * D * M$$

C_{known} = known manual count for one hour

H = Hourly Factor

D = Daily Factor

M = Monthly Factor

Factor Method

- **Adapted from Traffic Monitoring Guide**

$$AADB = C_{known} * H * D * M$$

C_{known} = known manual count for one hour

$$H = \frac{\text{Ave daily count on that day of the week in that month}}{\text{Ave count for that hour for that day in that month}}$$

$$D = \frac{\text{Ave daily count for that month}}{\text{Ave daily count on that day of the week in that month}}$$

$$M = \frac{\text{Ave daily count for that year}}{\text{Ave daily count in that month}}$$