# TRAFFIC COUNTING



# OUTLINE

- Introduction
- Types of Traffic Counts
- Definitions
- Why Count Traffic?
- Where to Count
- When to Count
- How to Count
- Requirements
- References

# INTRODUCTION

- The measurement of traffic volumes is one of the most basic functions of highway planning and management.
- Traffic counting can include volume, direction of travel, vehicle classification, speed, and truck weighing.
- The INVENTORY requires you to log both volume and vehicle classification.

# Each local highway agency has its own:

- Traffic counting needs
- Priorities
- Budgets
- Geographic and organizational restraints

But all highway agencies collect the same basic types of data

# TYPES OF TRAFFIC COUNTS

**There are three different but complimentary types of traffic counts.**

- **Continuous Counts:** Counts which are taken 365 days a year at a small number of locations. Usually uses most sophisticated permanent counting equipment available.
- **Control or Seasonal Counts:** Counts vary greatly in frequency and duration. Main purpose of control counts is to provide seasonal variation to factor short counts to AADT.
- **Coverage Counts:** These are short duration counts ranging from 6 hours to 7 days. Counts are distributed throughout the system to provide point-specific information.

# DEFINITIONS

- **Average Annual Daily Traffic (AADT):** is the average of 24 hour counts collected every day in the year.
- **Average Daily Traffic (ADT):** is the average of 24 hour counts collected over a number of days greater than one but less than a year.
- **Adjustment Factors:** factors applied to raw traffic data in order to estimate annual average volumes and account for variability (i.e. Time, Location, Seasonal, and Trucks)

# DEFINITIONS (cont.)

- **Peak Hour Volume (PHV):** is the maximum number of vehicles that pass a point on a highway during a period of sixty consecutive minutes.
- **Vehicle Classification:** Volume with respect to the type of vehicle. For example; passenger cars, two-axle trucks, three-axle trucks and etc.
- **Vehicle Miles Traveled (VMT):** Is the product of the traffic volume and the length of the roadway to which the volume is applicable. Also known as Vehicle Distance Traveled (VDT).

# WHY COUNT TRAFFIC?

- Directly relates to how much road money is generated
- Fundamental planning tool
  - Identify & prioritize current needs
  - Forecast future needs
- Engineering tool
  - Pavement design
  - Road geometry
  - Cross section
  - Design speed
  - Intersection design

# WHERE TO COUNT

- Wherever the actual ADT is higher than the default ADT
- Each section if traffic varies
- Area which is representative of value your seeking
- Away from driveways and entrances (turning areas)
- Somewhere it can be secured
- Avoid rutted or busted up pavement sections
- On gravel roads, avoid soft and washboard areas

# DEFAULT ADTs

| | |
|---|---|
| CLASS 1 | 10,000 |
| CLASS 2 | 100 |
| CLASS 3 | 25 |
| CLASS 4 | 50 |
| CLASS 5 | 50 |
| CLASS 6 | 50 |
| CLASS 7 | 50 |
| CLASS 8 | 20 |

# WHEN TO COUNT

- ASAP, ensure counts on all roads are current
- 3 year cycle thereafter (minimum)
- 48 hour counts (minimum)
- Representative days

  For ADT this means no unusually high or low volume days (no holidays, weekends, etc.)

# HOW TO COUNT

COMMON TYPES OF COUNTERS

- Manual Counters (intersections)
- Loop Detectors (vehicles)
- Road Tubes (axles)
  - 1 tube – volume only
  - 2-4 tubes – volume, classification & speed

# HOW TO COUNT (cont.)

TOOLS NEEDED

- Orange Safety Vest
- Pry Bar (to extract nails from pavement)
- Small Sledge Hammer
- Concrete Nails or 12” Earth Spikes
- Several Figure-Eight Grips
- Road Tube End Plugs
- Duct Tape (optional)
- Chain and Lock (to secure counter)

# HOW TO COUNT (cont.)

SAFETY

- Wear a bright orange or yellow safety vest
- Have a partner to watch traffic while you are in the roadway
- Don’t assume that drivers always see you
- Don’t assume that drivers know what direction you are going to move next.
- Don’t hold onto the road tube while vehicles drive over it

# HOW TO COUNT (cont.)

INSTALLATION

- Use rubber tubing designed for vehicle counting
- ¼” ID for Paved, 3/8” ID for Gravel recommended
- Keep length of road tube between 40 and 100 feet
- End of road tube(s) should be plugged to allow air switch to work properly
- The road tube(s) need to be secured at the edges of road
- Set road tube(s) so that it is perpendicular to traffic flow

# HOW TO COUNT (cont.)

INSTALLATION (cont.)

- Stretch the road tube(s) between the two securing grips about 10%
- For best results on gravel, stretch road tube(s) half as much (5%)
- Plug the road tube(s) into the counter air switch input(s)
- Reset the counter
- Secure the counter using chain and lock
- Start log entry for count

Example: Sample Data Collection Log

DATA COLLECTION LOG

| Site ID # | Route | County | State | Mileposts | Date Collected | Deployment | | Removal | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Driving Time | Setup | Driving Time | Retrieval |
| | | | | | | | | | |
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| | | | | | | | | | |

Figure G-6 Refer to Chapter 3.

# HOW TO COUNT (cont.)

REMOVAL

- Disconnect road tube(s) from counter
- Remove road tube(s) from securing devices
- Remove concrete nails or earth spikes
- Download data from traffic counter
- Complete log entry for traffic count

Example: Sample Data Output from Traffic Counter

NU-METRICS CDH FRAME STUDY — CDH Version 1.9 05/27/93

[ Report #1 DATE/TIME/VOLUME Report ]

| | | | | | |
|---|---|---|---|---|---|
| Survey #: | 7E | Begin: | 12/30/91 12:00 | End: | 12/31/91 12:00( |
| Route: | East Street | Lane: | East - IN | Hours : | 24 hrs( Loc/Sta |
| Oper: | JRS AdjF: 1.000 | Period: | 60 min | City: | Vanderbilt, PA |
| Posted: | 25 mph | Raw Count: | 1182( | | |
| County: | Fayette | AADT Factor: | 1.00 | AADT | |

| Day | Date | Time | Count |
|---|---|---|---|
| Mon | 12/30/91 | 12:00 | 10 |
| Mon | 12/30/91 | 13:00 | 2 |
| Mon | 12/30/91 | 14:00 | 30 |
| Mon | 12/30/91 | 15:00 | 40 |
| Mon | 12/30/91 | 16:00 | 50 |
| Mon | 12/30/91 | 17:00 | 60 |
| Mon | 12/30/91 | 18:00 | 70 |
| Mon | 12/30/91 | 19:00 | 80 |
| Mon | 12/30/91 | 20:00 | 90 |
| Mon | 12/30/91 | 21:00 | 100 |
| Mon | 12/30/91 | 22:00 | 10 |
| Mon | 12/30/91 | 23:00 | 20 |
| Tue | 12/31/91 | 00:00 | 30 |
| Tue | 12/31/91 | 01:00 | 40 |
| Tue | 12/31/91 | 02:00 | 50 |
| Tue | 12/31/91 | 03:00 | 60 |
| Tue | 12/31/91 | 04:00 | 70 |
| Tue | 12/31/91 | 05:00 | 80 |
| Tue | 12/31/91 | 06:00 | 90 |
| Tue | 12/31/91 | 07:00 | 100 |
| Tue | 12/31/91 | 08:00 | 10 |
| Tue | 12/31/91 | 09:00 | 20 |
| Tue | 12/31/91 | 10:00 | 30 |
| Tue | 12/31/91 | 11:00 | 40 |

NU-METRICS CDH FRAME STUDY -- CDH Version 1.0 05/27/93(

[ Report #2 Weekly VOLUME Report ]

Survey #: 7E Begin: 12/30/91 12:00 End: 12/31/91 12:00
Route: East Street Lane: East - IN Hours : 24 hrs
Loc/Sta Oper: JHS AdjF: 1.000 Period: 60 min
City: Vanderbilt, PA Posted: 25 mph Raw Count: 1182
County: Fayette AADT Factor: 1.00 AADT Count: 1182

12/30

| Time | Mon 1/ 6 | Tue 12/31 | Wed 1/ 1 | Thu 1/ 2 | Fri 1/ 3 | Sat 1/ 4 | Sun 1/ 5 | Wkday Avg. | Week Avg. |
|---|---|---|---|---|---|---|---|---|---|
| 0:00 | -0- | 30 | -0- | -0- | -0- | -0- | -0- | 30 | 30 |
| 1:00 | -0- | 40 | -0- | -0- | -0- | -0- | -0- | 40 | 40 |
| 2:00 | -0- | 50 | -0- | -0- | -0- | -0- | -0- | 50 | 50 |
| 3:00 | -0- | 60 | -0- | -0- | -0- | -0- | -0- | 60 | 60 |
| 4:00 | -0- | 70 | -0- | -0- | -0- | -0- | -0- | 70 | 70 |
| 5:00 | -0- | 80 | -0- | -0- | -0- | -0- | -0- | 80 | 80 |
| 6:00 | -0- | 90 | -0- | -0- | -0- | -0- | -0- | 90 | 90 |
| 7:00 | -0- | 100 | -0- | -0- | -0- | -0- | -0- | 100 | 100 |
| 8:00 | -0- | 10 | -0- | -0- | -0- | -0- | -0- | 10 | 10 |
| 9:00 | -0- | 20 | -0- | -0- | -0- | -0- | -0- | 20 | 20 |
| 10:00 | -0- | 30 | -0- | -0- | -0- | -0- | -0- | 30 | 30 |
| 11:00 | -0- | 40 | -0- | -0- | -0- | -0- | -0- | 40 | 40 |
| 12:00 | [ 10] | -0- | -0- | -0- | -0- | -0- | -0- | 10 | 10 |
| 13:00 | [ 2] | -0- | -0- | -0- | -0- | -0- | -0- | 2 | 2 |
| 14:00 | [ 30] | -0- | -0- | -0- | -0- | -0- | -0- | 30 | 30 |
| 15:00 | [ 40] | -0- | -0- | -0- | -0- | -0- | -0- | 40 | 40 |
| 16:00 | [ 50] | -0- | -0- | -0- | -0- | -0- | -0- | 50 | 50 |
| 17:00 | [ 60] | -0- | -0- | -0- | -0- | -0- | -0- | 60 | 60 |
| 18:00 | [ 70] | -0- | -0- | -0- | -0- | -0- | -0- | 70 | 70 |
| 19:00 | [ 80] | -0- | -0- | -0- | -0- | -0- | -0- | 80 | 80 |
| 20:00 | [ 90] | -0- | -0- | -0- | -0- | -0- | -0- | 90 | 90 |
| 21:00 | [ 100] | -0- | -0- | -0- | -0- | -0- | -0- | 100 | 100 |
| 22:00 | [ 10] | -0- | -0- | -0- | -0- | -0- | -0- | 10 | 10 |
| 23:00 | [ 20] | -0- | -0- | -0- | -0- | -0- | -0- | 20 | 20 |
| 12, 16, 18 & 24 Hour Totals | | | | | | | | | |
| 7-19:00 | 262 | 200 | -0- | -0- | -0- | -0- | -0- | 231 | 231 |
| 6-22:00 | 532 | 290 | -0- | -0- | -0- | -0- | -0- | 411 | 411 |
| 6-24:00 | 562 | 290 | -0- | -0- | -0- | -0- | -0- | 426 | 426 |
| 0-24:00 | 562 | 620 | -0- | -0- | -0- | -0- | -0- | 591 | 591 |
| AM PEAK | | | | | | | | | |
| Volume | -0- | 100 | -0- | -0- | -0- | -0- | -0- | 100 | 100 |
| Time | ---- | 7:00 | ---- | ---- | ---- | ---- | ---- | | |
| PM PEAK | | | | | | | | | |
| Volume | 100 | -0- | -0- | -0- | -0- | -0- | -0- | 100 | 100 |
| Time | 21:00 | ---- | ---- | ---- | ---- | ---- | ---- | | |

# HOW TO COUNT (cont.)

TRAFFIC COUNT LOG

- Route number
- Road name
- Road section number
- Location of count (distance to nearest intersection)
- Road surface type
- Date & time count began (include day of week)
- Count interval (hours)
- Purpose of count (ADT, PHV, classification & etc.)

Example: Sample Field Worksheet

# FIELD WORKSHEET

FIELDWS.XLS

JOB#

TECH NAME:

JOB LOCATION:

| SITE# | MACH# | LOCATION: | | | |
|---|---|---|---|---|---|
| | | TYPE:( V / DV / BI / .5 TUBE / S / C ) | | DIRECTION: ( N / S / E / W ) | |
| | | CH#1 = | CH#2 = | LENGTH:( 24 / 48 / 72 / ) | INTERVAL: |
| *RETV#* | | START: | | STOP: | |
| | | | | *P/U VOLUME* | |
| | | | | *CH#1 =* | |
| | | | | *CH#2 =* | |

| SITE# | MACH# | LOCATION: | | | |
|---|---|---|---|---|---|
| | | TYPE:( V / DV / BI / .5 TUBE / S / C ) | | DIRECTION: ( N / S / E / W ) | |
| | | CH#1 = | CH#2 = | LENGTH:( 24 / 48 / 72 / ) | INTERVAL: |
| *RETV#* | | START: | | STOP: | |
| | | | | *P/U VOLUME* | |
| | | | | *CH#1 =* | |
| | | | | *CH#2 =* | |

| SITE# | MACH# | LOCATION: | | | |
|---|---|---|---|---|---|
| | | TYPE:( V / DV / BI / .5 TUBE / S / C ) | | DIRECTION: ( N / S / E / W ) | |
| | | CH#1 = | CH#2 = | LENGTH:( 24 / 48 / 72 / ) | INTERVAL: |
| *RETV#* | | START: | | STOP: | |
| | | | | *P/U VOLUME* | |
| | | | | *CH#1 =* | |
| | | | | *CH#2 =* | |

| SITE# | MACH# | LOCATION: | | | |
|---|---|---|---|---|---|
| | | TYPE:( V / DV / BI / .5 TUBE / S / C ) | | DIRECTION: ( N / S / E / W ) | |
| | | CH#1 = | CH#2 = | LENGTH:( 24 / 48 / 72 / ) | INTERVAL: |
| *RETV#* | | START: | | STOP: | |
| | | | | *P/U VOLUME* | |
| | | | | *CH#1 =* | |
| | | | | *CH#2 =* | |

| SITE# | MACH# | LOCATION: | | | |
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| | | TYPE:( V / DV / BI / .5 TUBE / S / C ) | | DIRECTION: ( N / S / E / W ) | |
| | | CH#1 = | CH#2 = | LENGTH:( 24 / 48 / 72 / ) | INTERVAL: |
| *RETV#* | | START: | | STOP: | |
| | | | | *P/U VOLUME* | |
| | | | | *CH#1 =* | |
| | | | | *CH#2 =* | |

# HOW TO COUNT (cont.)

TRAFFIC COUNT LOG (cont.)

- Date & time count complete  (include day of week)
- Counts by interval and by type
- ADT
- Classification (% trucks)

# Factoring

- Adjustment factors are applied to short duration volume counts
- In order to estimate annual average volumes
- Highway agencies must develop adjustment procedures that allow accurate estimations

# Adjustment Factors

- Adjustments must be made to account for variability in the traffic stream.
- Common necessary adjustments include:
  - Time of day adjustments for counts less than 24 hours
  - Day of week adjustments
  - Seasonal adjustments are consensual in importance
  - Axle correction adjustments

# Inventory Requirements

- DOT requires the following documents regarding ADT counts.
  - Raw Traffic Data (Backup Data)
  - Method and calculations for adjustment of Raw Data
  - Map showing traffic counter locations
  - Derived ADT values

# POSSIBLE VENDORS (Assignment)

- MetroCount 1-800-576-5692
- Diamond Traffic Products 541-782-3903
- Jamar Technical 1-800-776-0940
- TAPCO 262-814-7000 (Peek Corp. Counters)
- PAT America 877-892-2432 (Dan LaBlanc)
- TimeMark Inc 503-363-2012 (Tim Miner)

# Traffic data collection

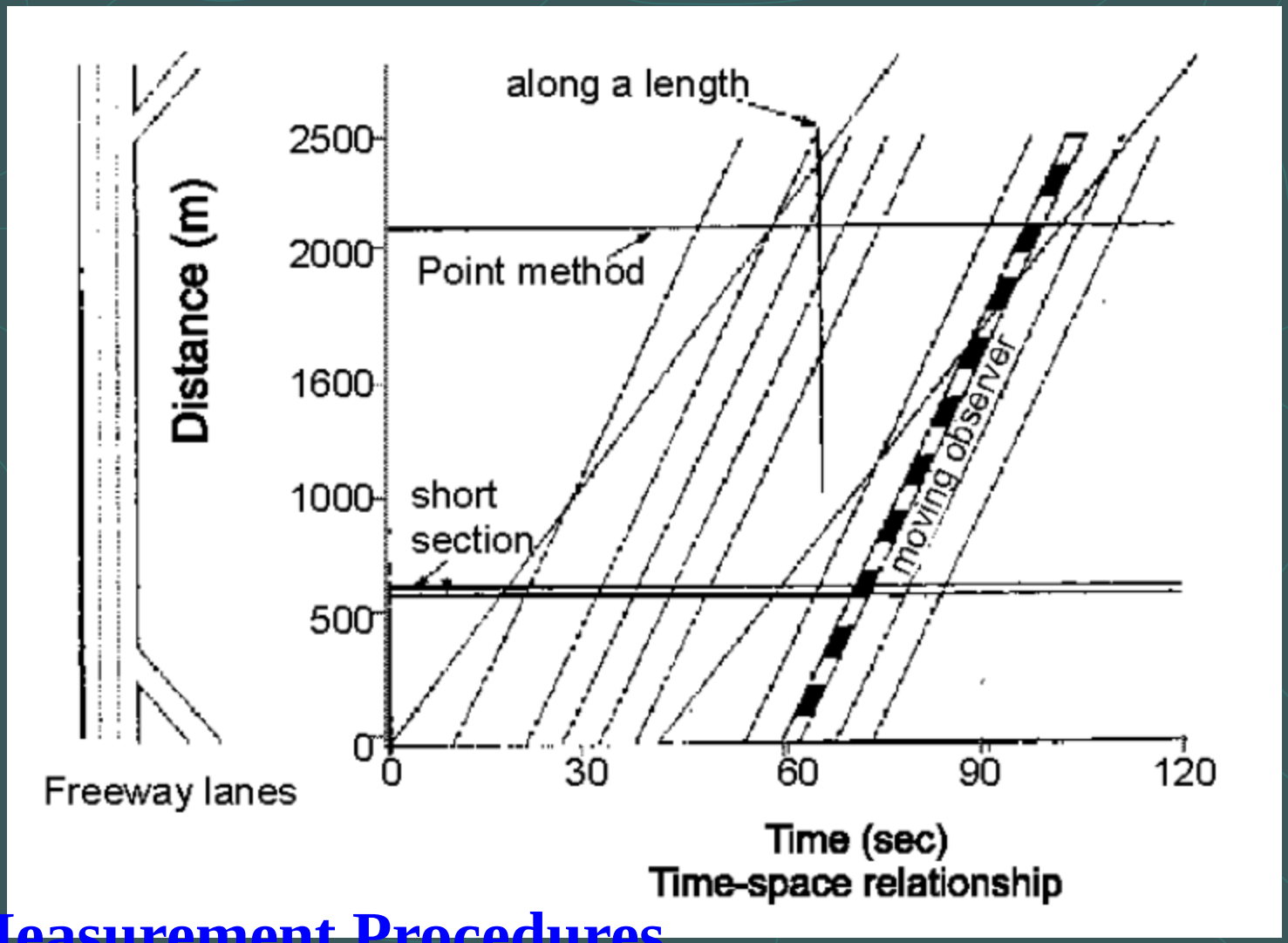


# Introduction

- Outline
  - Point measurement
  - Measurement over a short stretch
  - Measurement over a long stretch
  - Measurement over an area
  - Moving observer method

- Stream characteristics from field
  - Flow
  - Speed
  - Density, occupancy
  - Travel time
  - Spacing
  - Headway

# Introduction




**Measurement Procedures**

# Traffic stream parameters

- Measurement Procedures
  - Measurement at point on the road
  - Measurement over a short section of the road (less than 500 metres)
  - Measurement over a length of the road (more than about 500 metres)
  - Wide area samples obtained from number of locations
  - Use of an observer moving in the traffic stream

# Measurements at a point

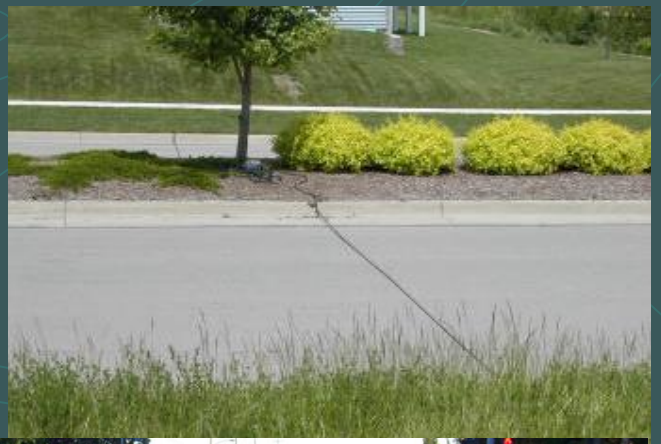
- Point Measurement
  - Flow or volume count
  - Manually
    - Observer will stand at the point of interest
    - Count the vehicles with the help of hand tallies.
    - Interval of 5, 10, or 15 minutes

# Measurements at a point

- Point Measurement
  - Types of vehicles
    - Cars
    - Two wheelers
    - Three wheelers
    - LCV
    - HCV
    - Multi axle trucks
    - Non-motorised vehicles
      - bullock cart
      - hand cart

# Measurements at a point

- Point Measurement
  - Automatic
    - Inductive loop detector
    - Pneumatic tubes
    - Video camera

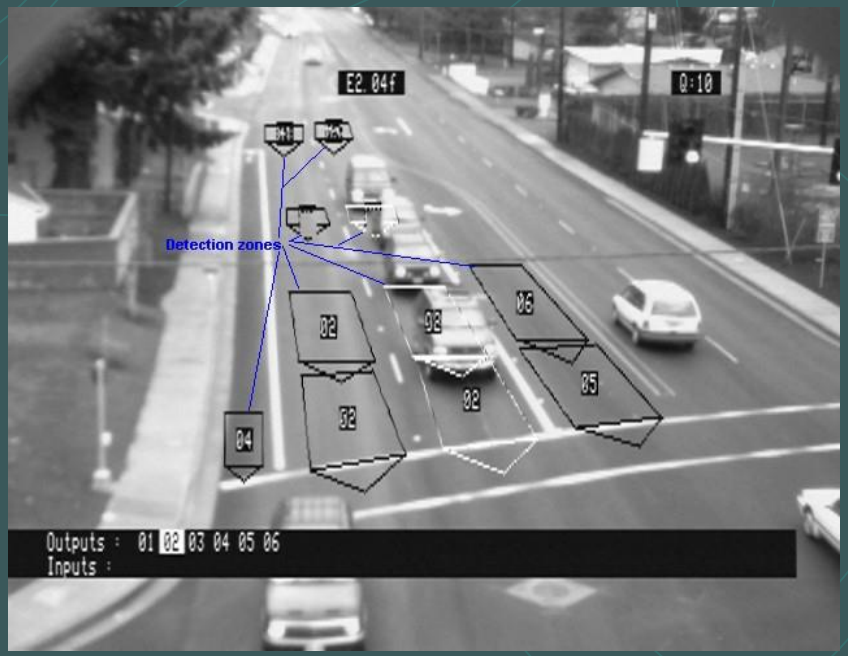




# Measurements at a point

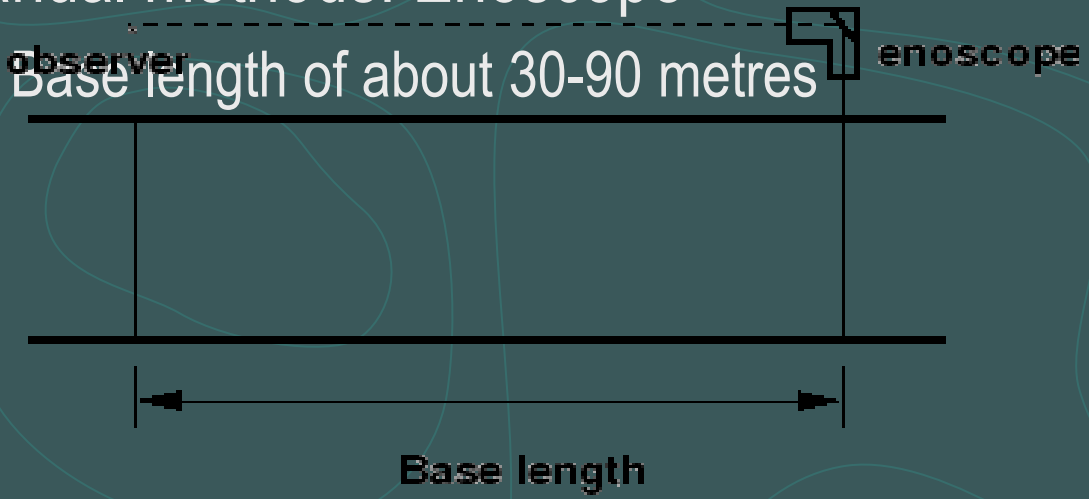


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# Measurements over short section

- Spot speed of vehicles
  - Manual methods: Enoscope
    - Base length of about 30-90 metres




**Working principle of Enoscope**

# Measurements over short section

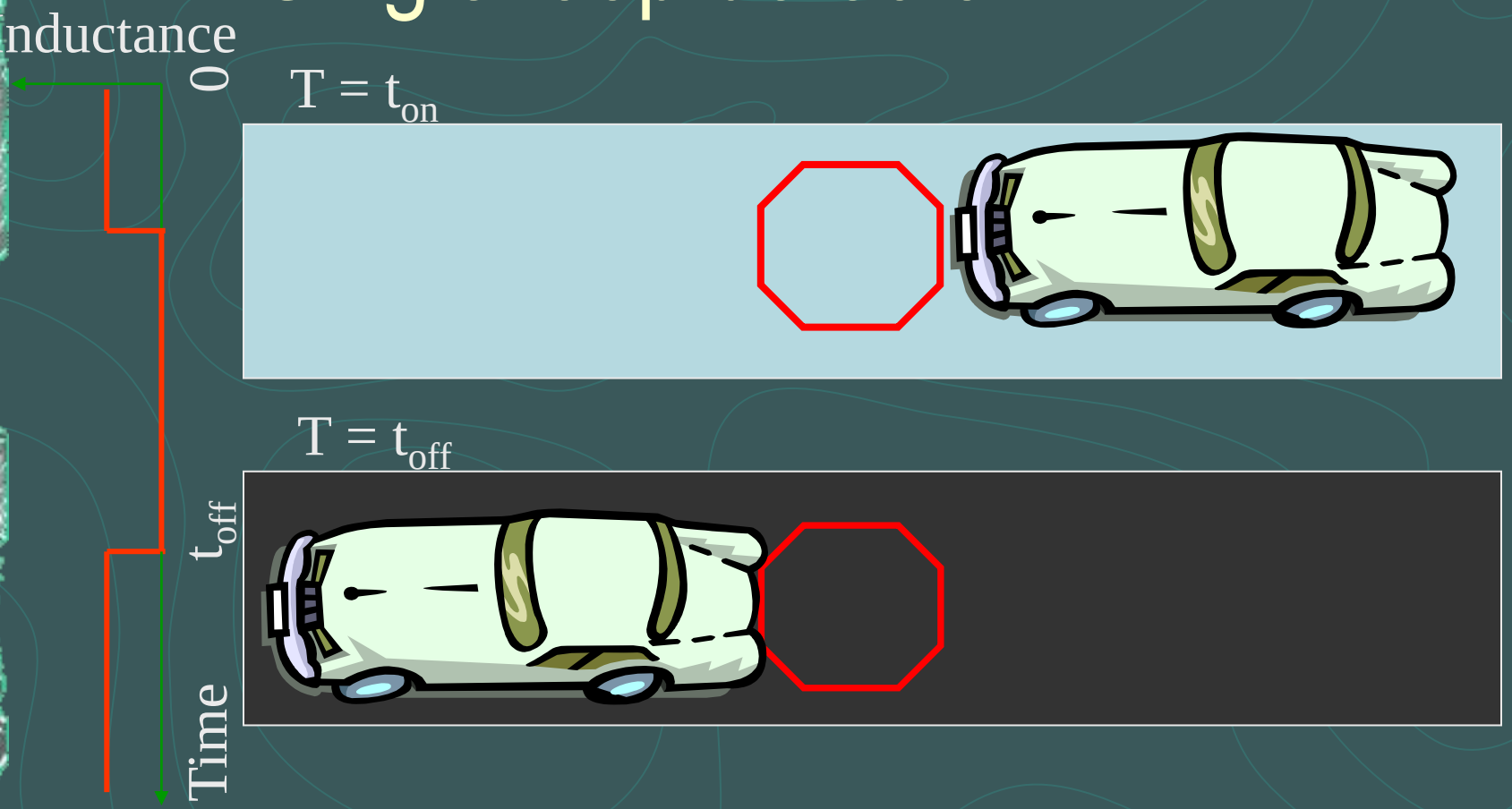
- Spot speed of vehicles
  - Pr



# Measurements over short section

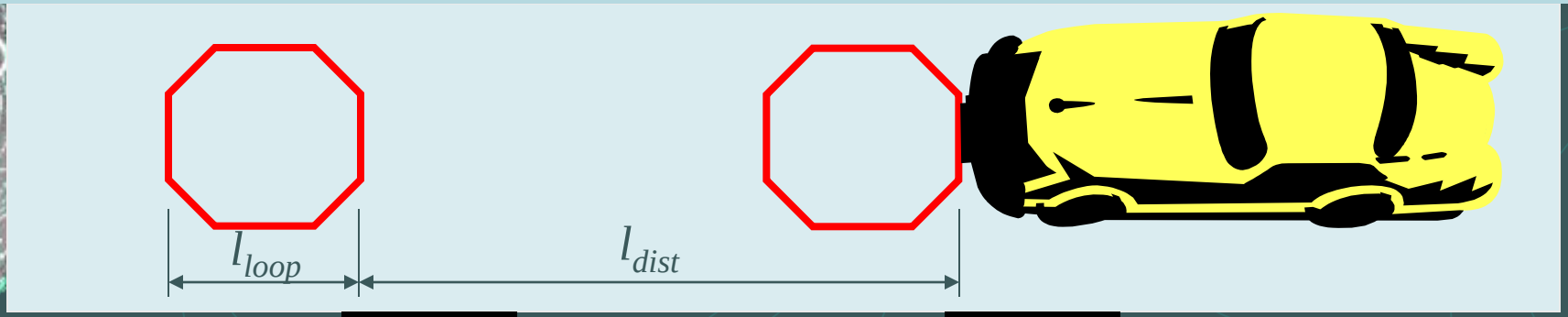
- Inductive loop detector
  - Principle of magnetic inductance
  - Metallic content in the vehicle passes over it
  - A signal will be generated and the count of the vehicle can be found automatically
  - Continuous counts
  - Errors due to noise signals generated by heavy vehicle passing adjacent lanes

# Single loop detector




- Loop inductance decreases when a car is on top of it.

# Dual loop detector




$T = t_2$

$$Speed = \frac{l_{dist}}{t_2 - t_1}$$

$T = t_1$

$$L_{vehicle} = \frac{Speed(ot_2 + ot_1)}{2}$$

- **Measured vehicle lengths are used to classify vehicles into different categories**

$ot_i$ = on-time for loop detector i

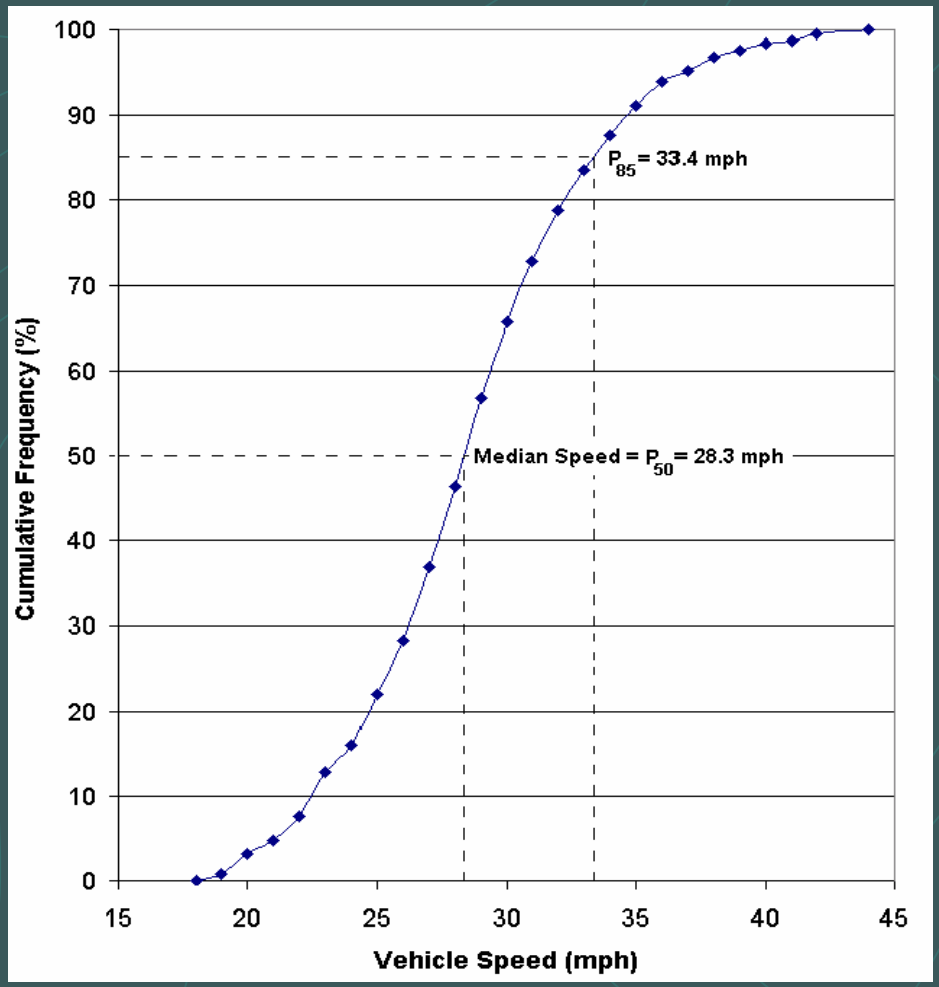


# Measurements over short section

- Speed data analysis
  - Time and Space Mean Speed
  - 85th Percentile Speed
  - 95th Percentile Speed
  - Median (50th Percentile Speed)
  - Speed Variance: The difference in travel speeds for vehicles on the road.

# Measurements over short section

Cumulative Frequency Distribution Plot for Sample Speed Data



# Measurements over long section

- Density
  - Using aerial photography
  - Single frame give only density
  - Time lapse photography
    - several frames can give speed
    - speeds can be computed from the distance covered between the two frames and time interval

# Measurements over long section

- Density



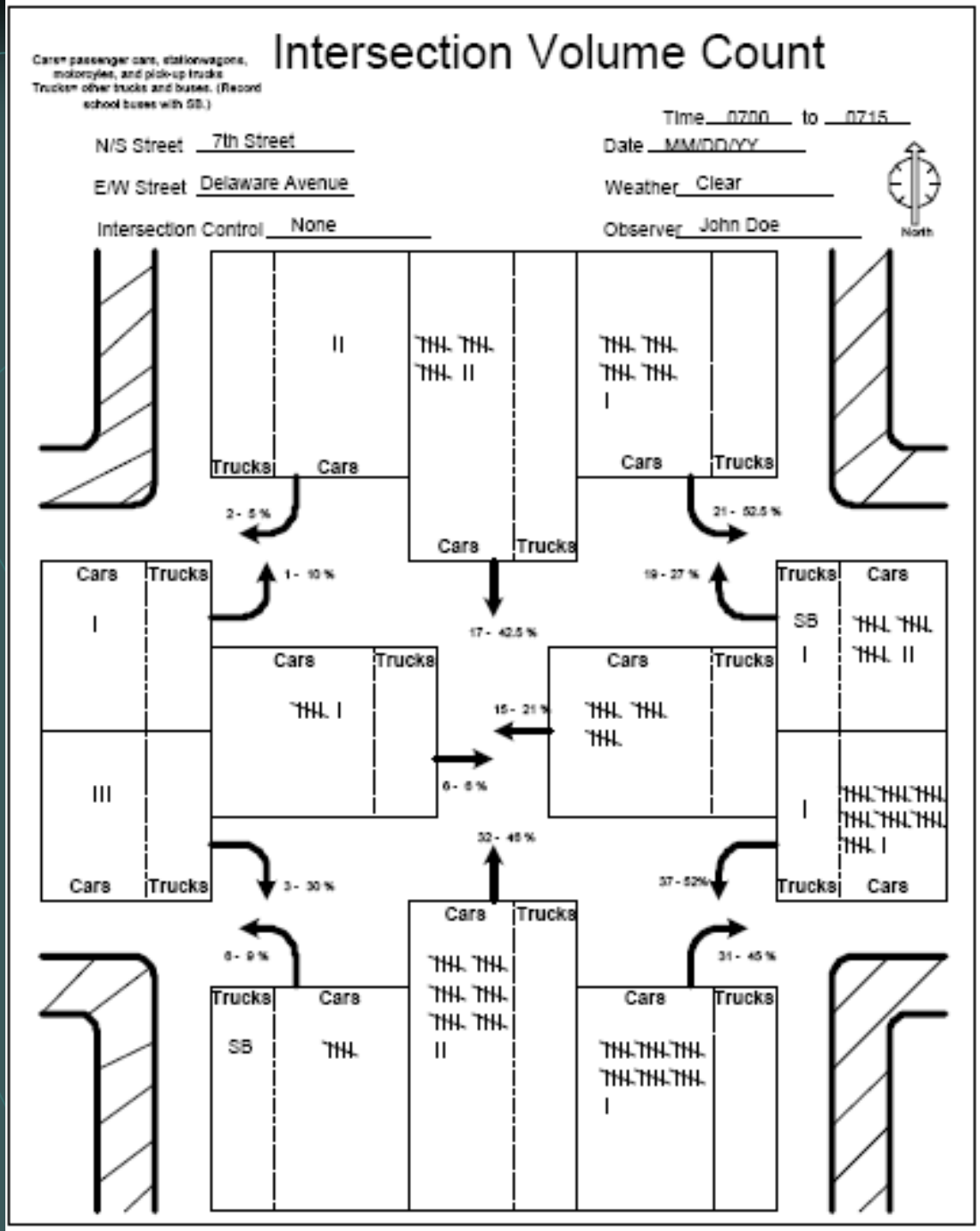
# Measurements over long section

- Travel time
  - Stretch of length more than 500 metres
  - To obtain variations in speed

# Moving observer method

- Overview
  - Obtain relationship between fundamental stream characteristics
  - Observer moves in the traffic stream
  - Derived by Wardrop and Charlesworth (1954)
- Suitability
  - Rural traffic, Urban traffic with low volume
  - Driver follows average speed

# Intersection Volume Count



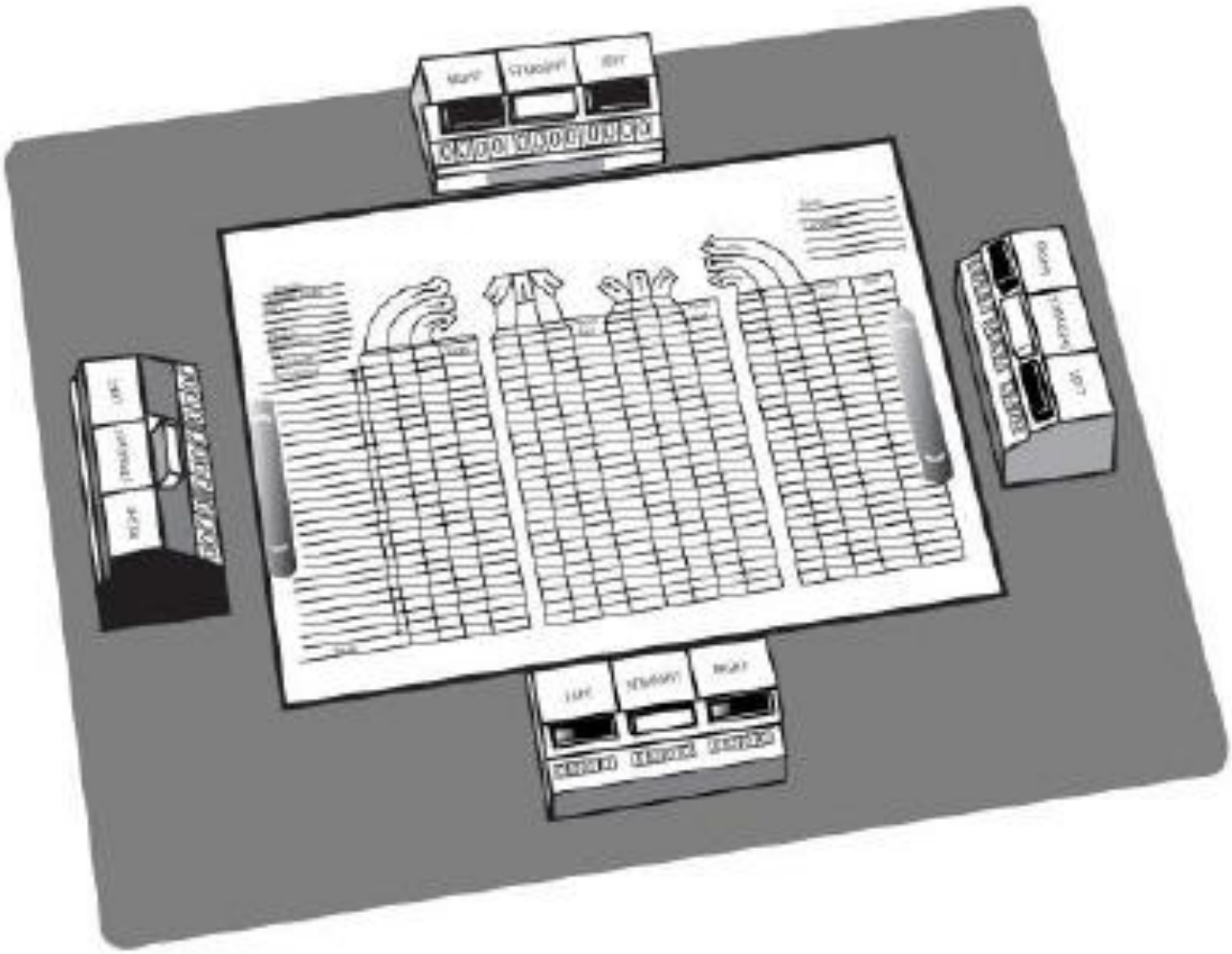


Figure 3.1. Mechanical Counting Board

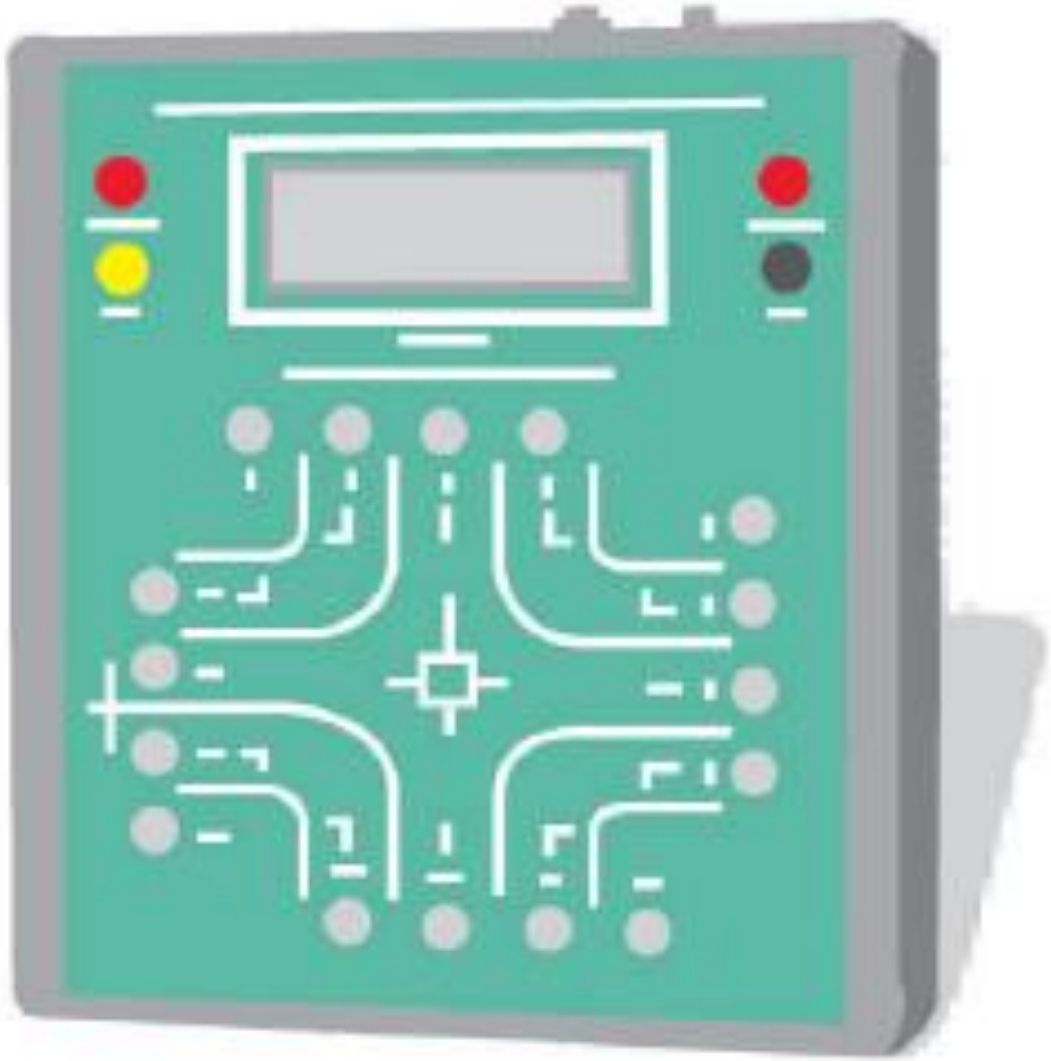


Figure 3.2. Electronic Counting Board

# SUGGESTED REFERENCES

- Traffic Monitoring Guide, 3rd Ed. *Federal Highway Administration (FHWA)*
- A Policy on Geometric Design of Highway and Streets 2001, 4th Ed. (AASHTO)
- Wisconsin DOT, Steve Wiswell (608) 246-3266
- Iowa DOT, Lavern Verav (515) 239-1445
- Michigan DOT, Dave Shade (517) 335-2914
- Good Website **www.fhwa.dot.gov/ohim**

- BIADOT Branch of Engineering and Operations
  201 3rd ST NW Suite 430
  Albuquerque, NM 87102
  (505) 346 – 6834 Phone
  (505) 346 – 2549 Fax