Calibrating LWR models

CE 391F

February 14, 2013

ANNOUNCEMENTS

- Homework 1 due today
- No class Tuesday

REVIEW

- Cell transmission model
- Comparison of LWR solution methods

Shock spreading demonstration

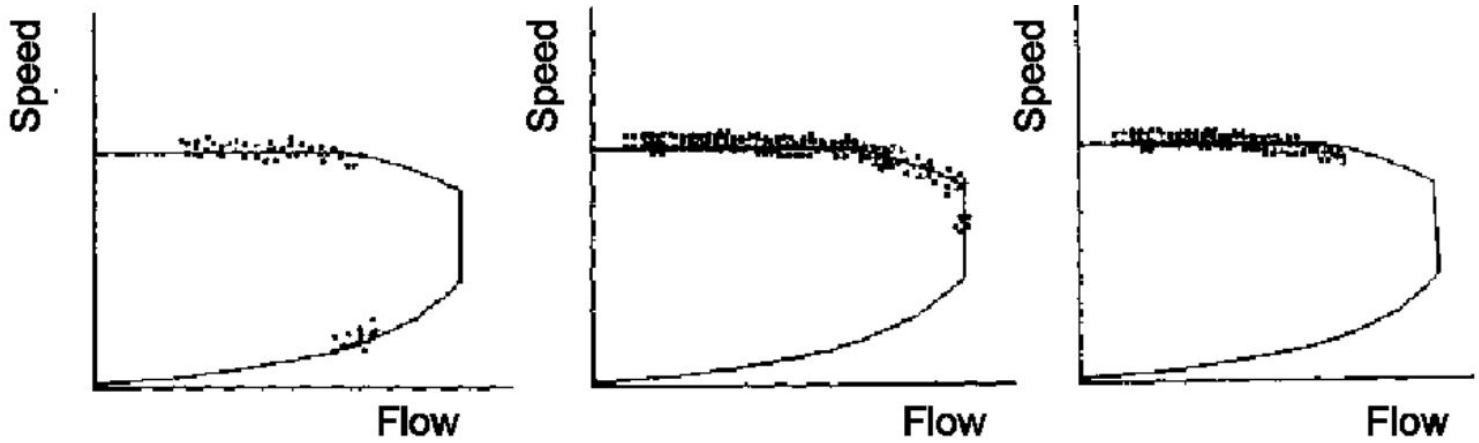
Assume $u_f = 1$, $w = 1/4$, $q_{max}\Delta t = 50$, $N = 250$. There is a stationary queue at jam density, and upstream of the queue the number of vehicles in each cell is $n = 50$.

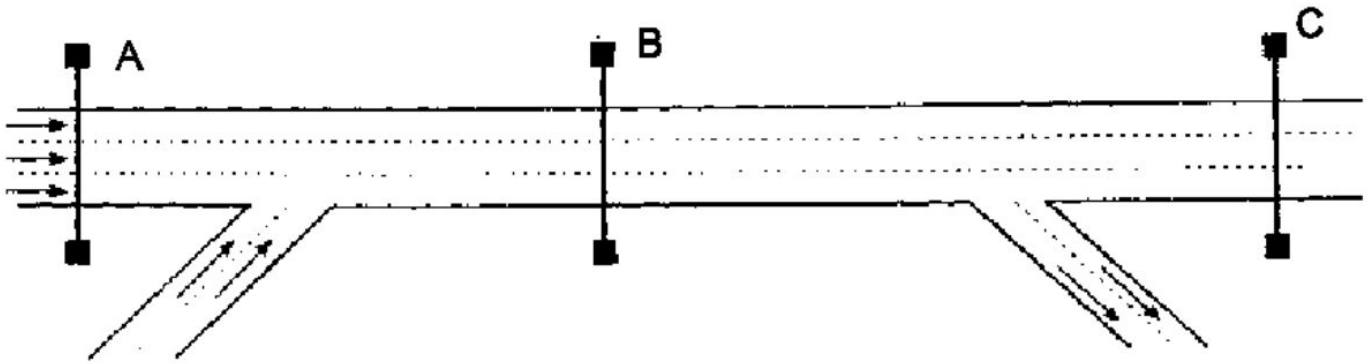
What would shockwave theory predict?

What does the CTM give?

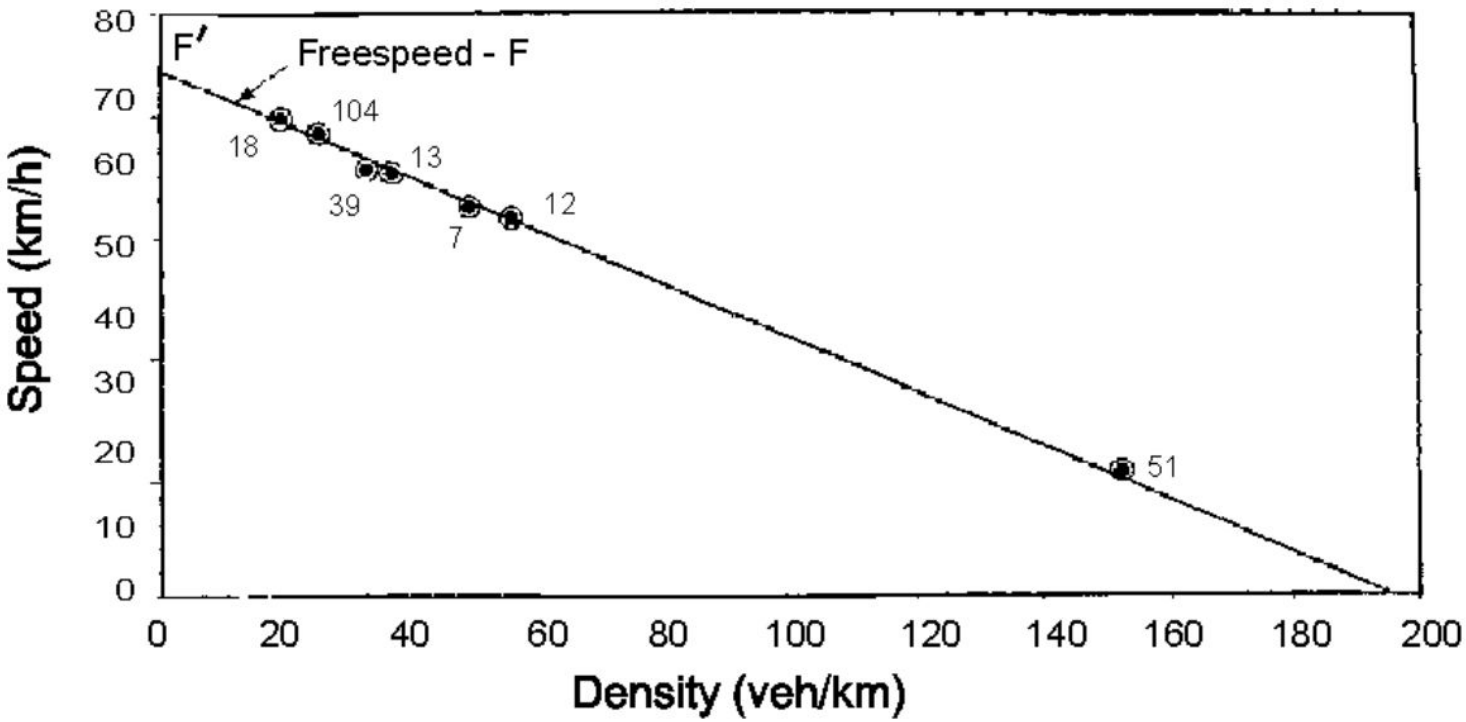
CALIBRATING LWR MODELS

Be cautious where you collect data!





The (in)famous Greenshields relationship

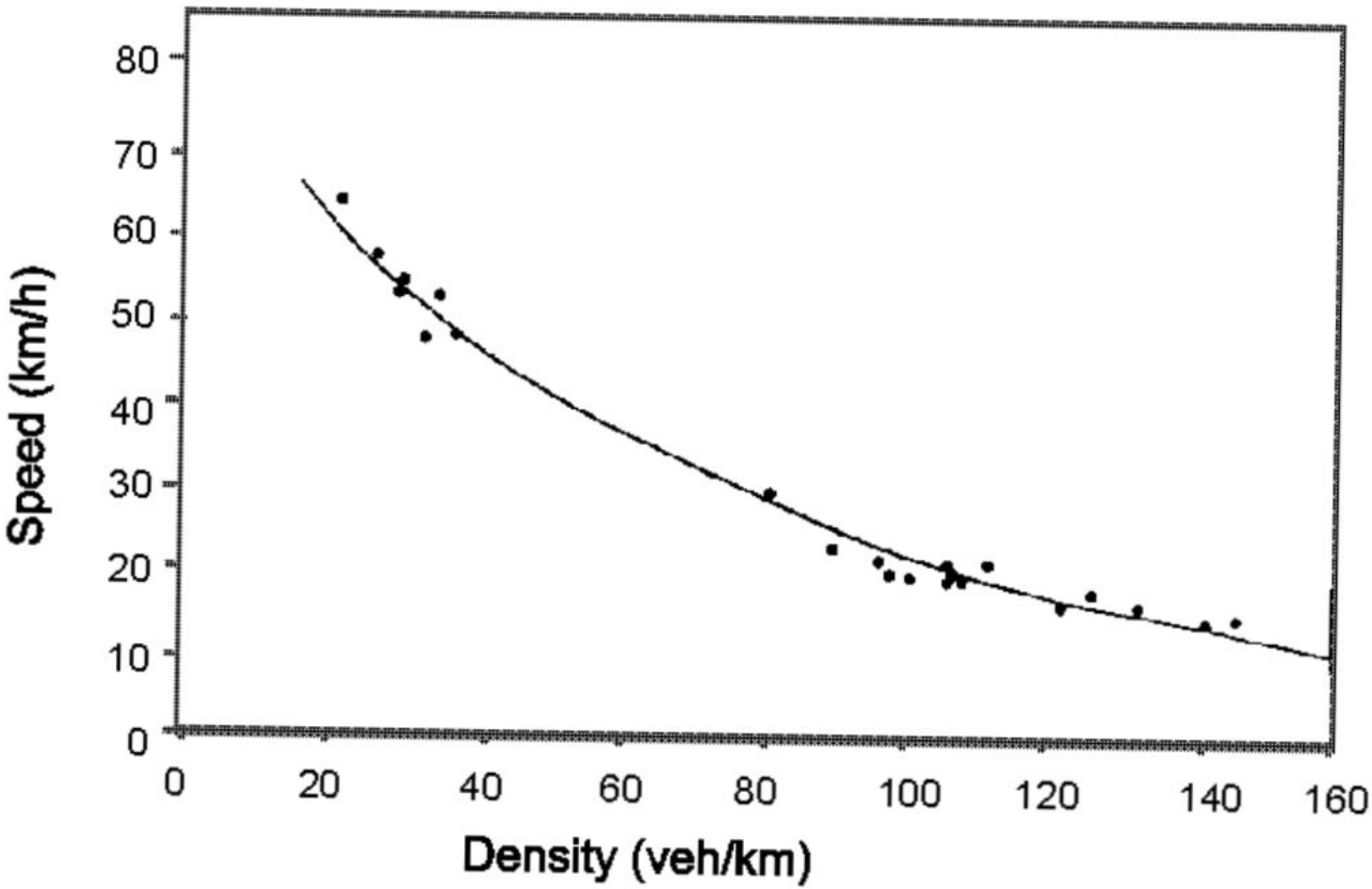


This data was collected by Greenshields on Labor Day in 1934, and was the basis of practice (and HCM) for roughly five decades.

This work is seminal, but infamous. Why infamous?

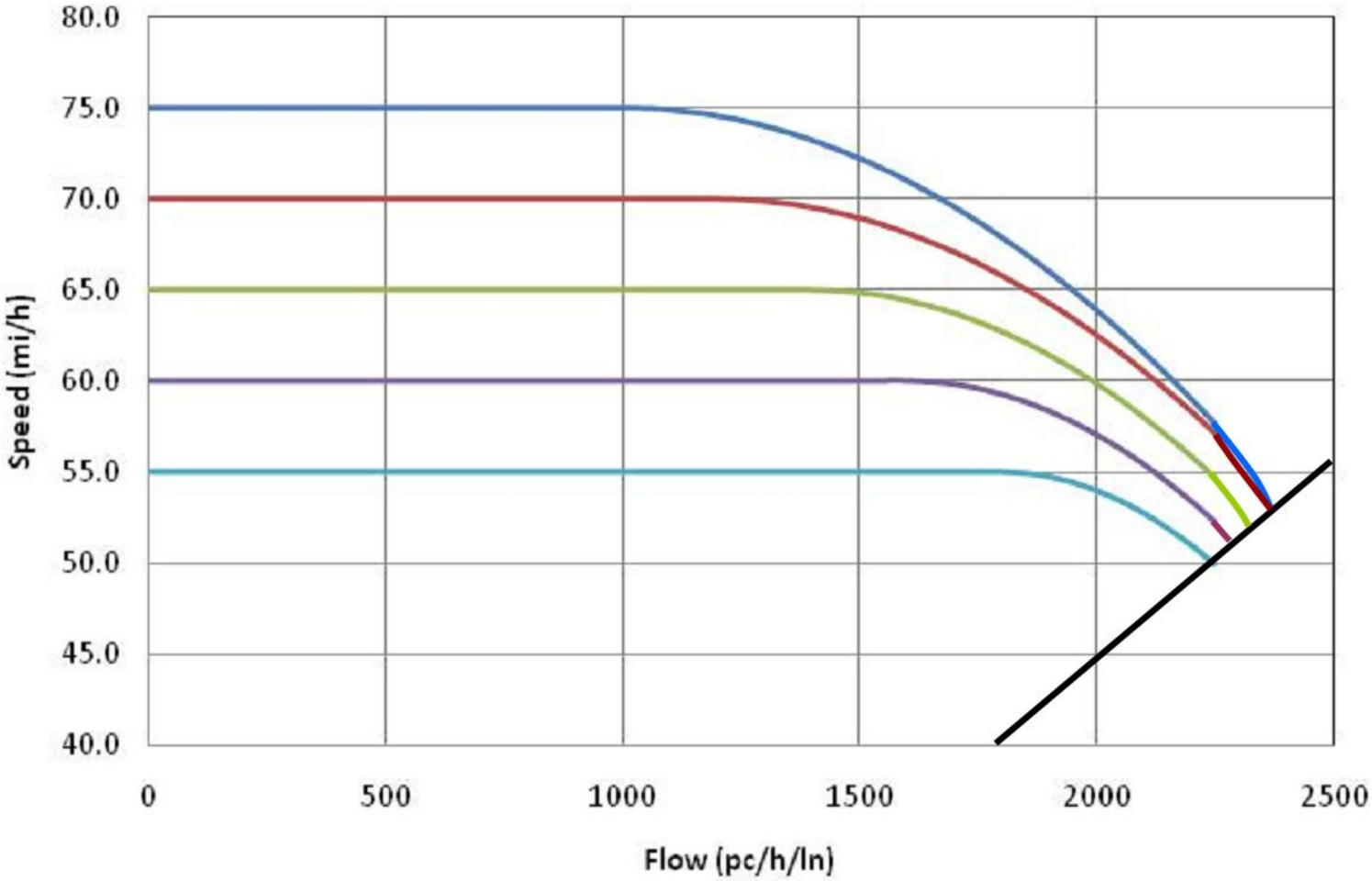
- Data collected on a one-lane road, not a freeway
- Vehicles were counted in "overlapping" groups of 100
- Some averaging occurred prior to regression
- The lone congested point was collected on a different roadway on a different day
- Model based on holiday traffic rather than regular commuters

The Greenberg model



Collected in the (one-lane!) Lincoln Tunnel in 1959, based on a logarithmic fit to data ($u \propto \log(k/k_j)$)

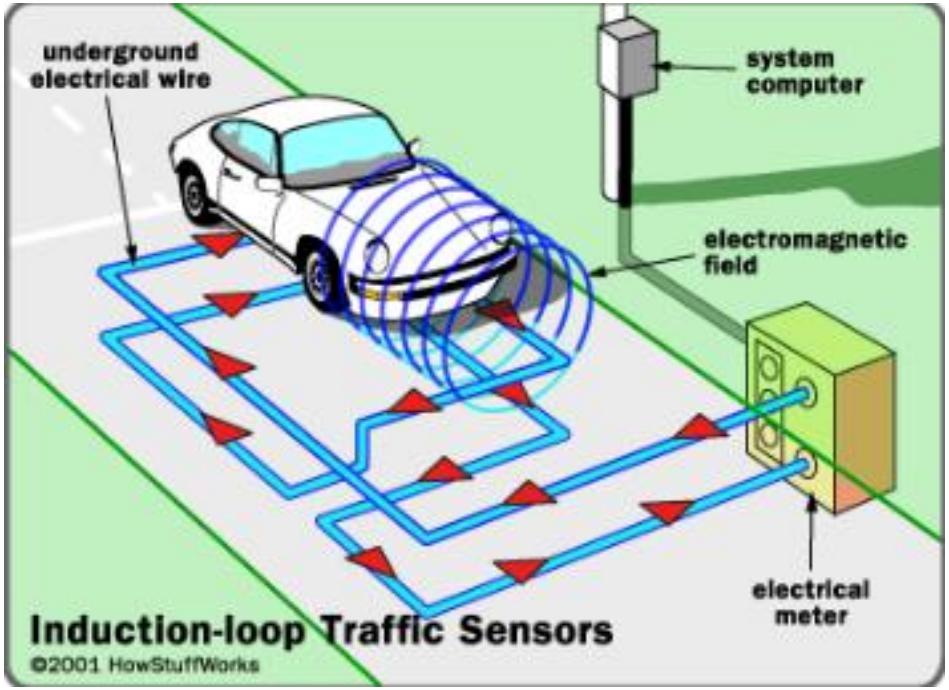
Highway Capacity Manual



Notice constant speeds for low flow rates, and that the "congested" piece isn't shown.

TRAFFIC DETECTION TECHNOLOGIES

Inductive Loops



Records: Volume and occupancy; can infer speed, density, etc. from these or from multiple detectors

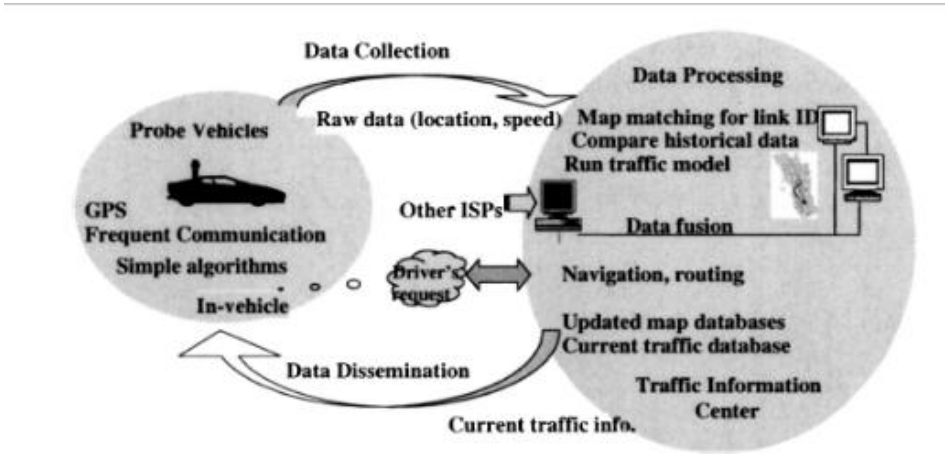
Advantages: Inexpensive, familiar

Disadvantages: In-pavement installation can cause maintenance and other difficulties

Video Detection

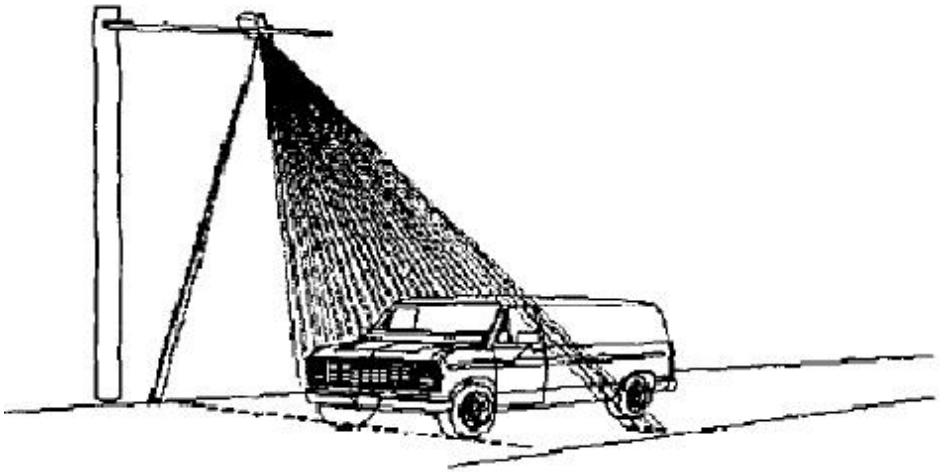
Records: Volume, density, speed, trajectories, classification
Advantages: Nonintrusive, comprehensive
Disadvantages: Image processing less effective at night or in poor weather, glare, etc.

Wireless Technology



Records: Trajectories, speeds and travel times; volume (indirectly)
Advantages: Low deployment and operational cost
Disadvantages: Coverage, privacy, accuracy of triangulation/GPS location

Laser Detection

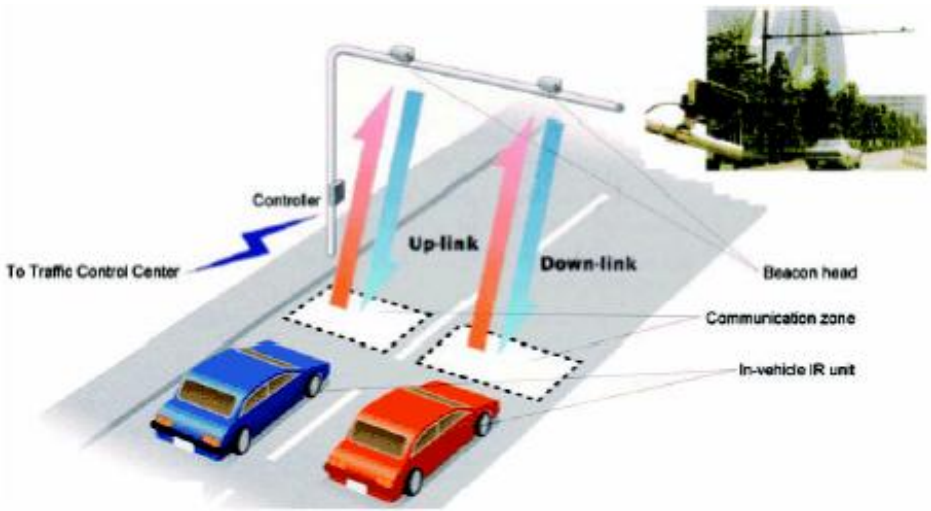


Records: Volume; speed (with two detectors), vehicle classification, lane position

Advantages: Works well even in poor weather or at night, no safety risk

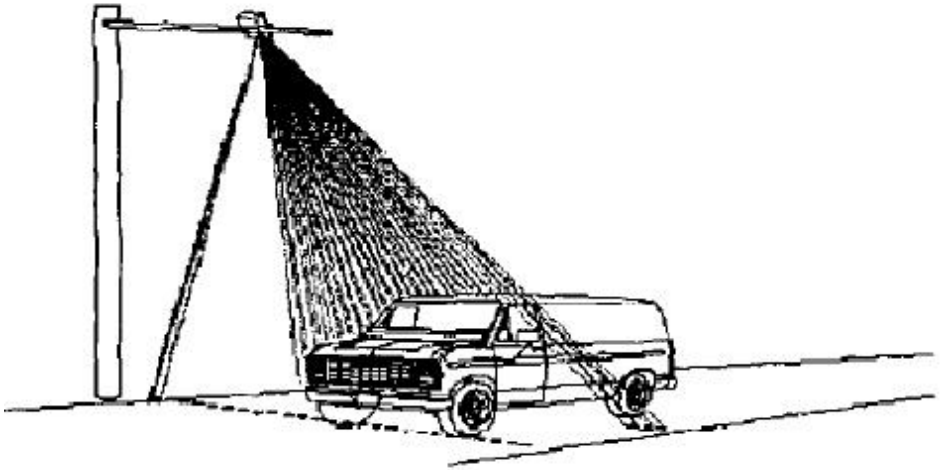
Disadvantages: Less accurate in stop-and-go conditions or extreme temperatures; subject to vandalism

Infrared Detection



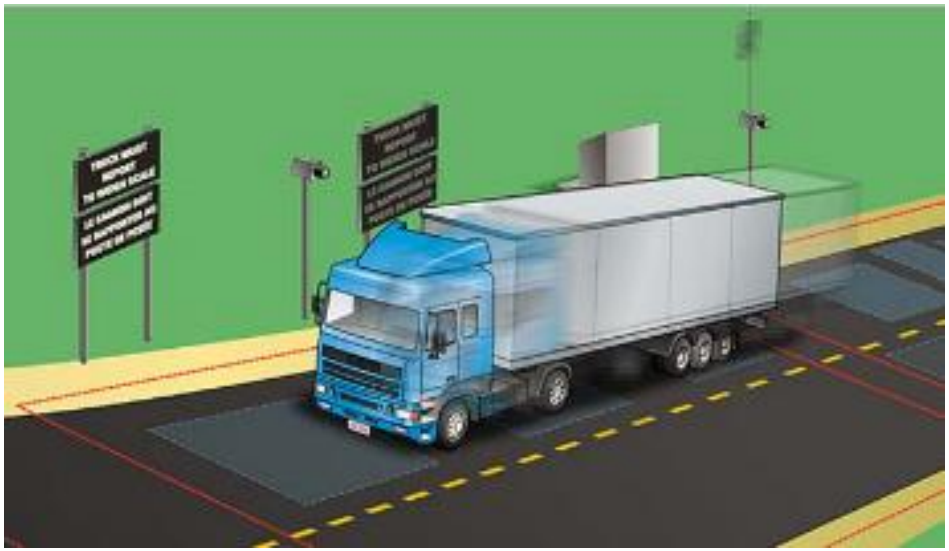
Similar to lasers, but less effective in rain and show

Radar/Acoustic Detection



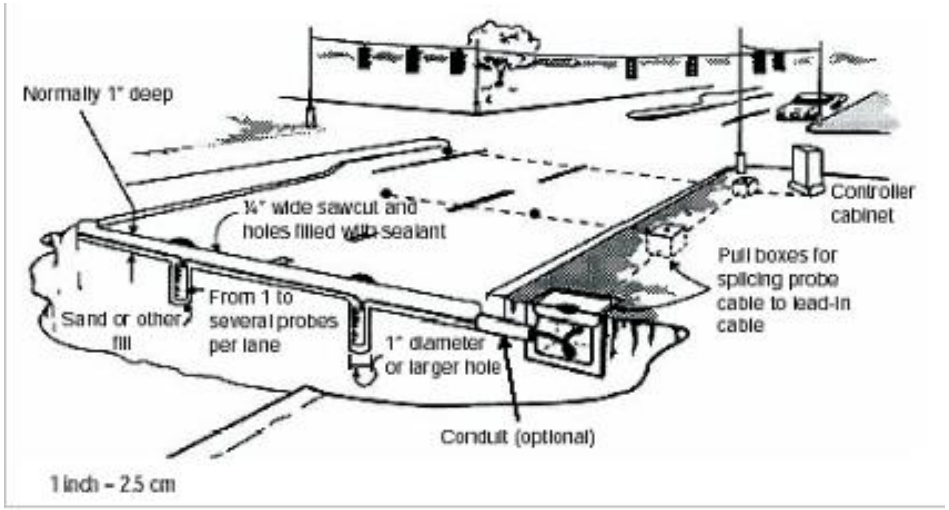
Records: Volume; speed, length, lane position
Advantages: Inexpensive and reliable
Disadvantages: Shadowing effects with large vehicles, less accurate for slow traffic

Weigh-in-motion



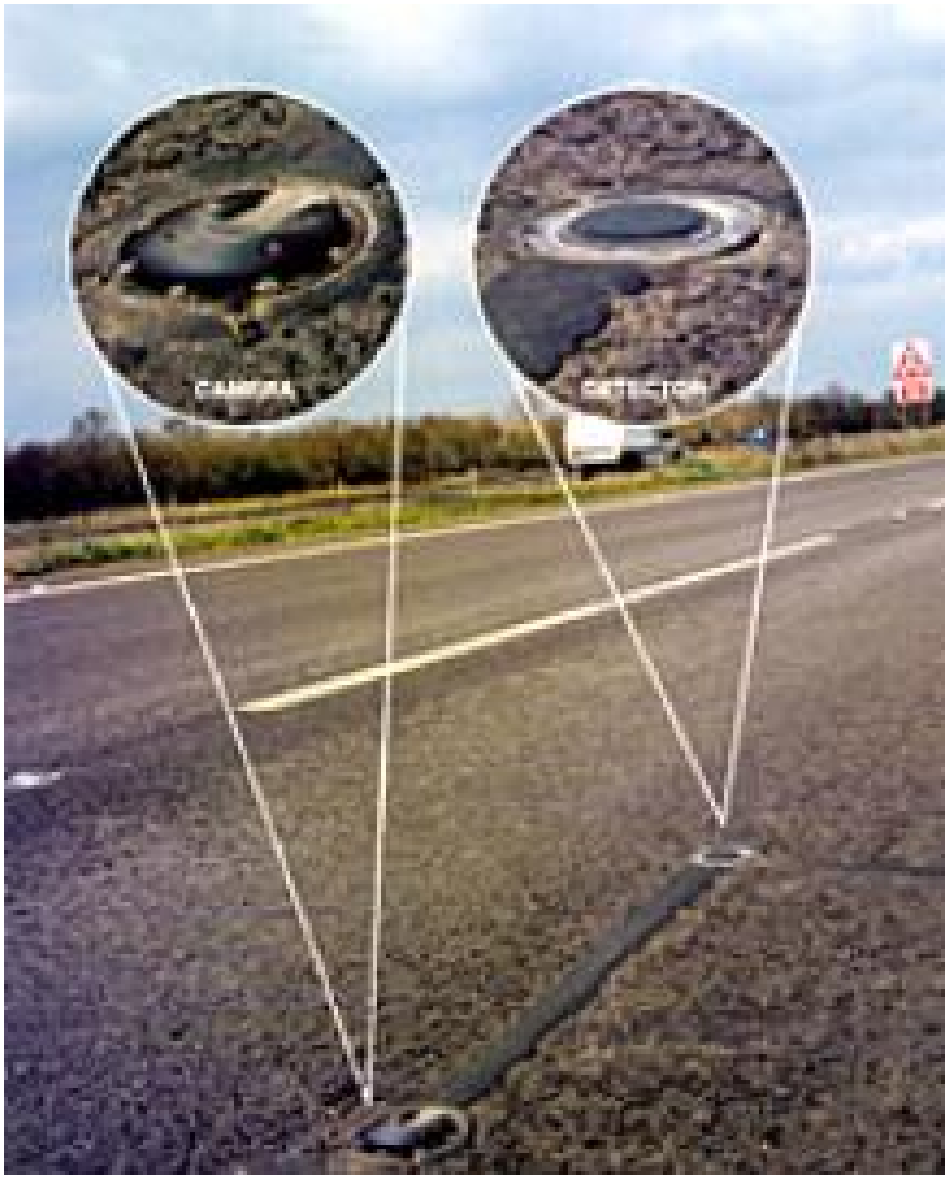
Records: Weight primarily, but can get volume and often classification
Advantages: Already in place at selected locations
Disadvantages: In-pavement installation

Wireless magnetic technology



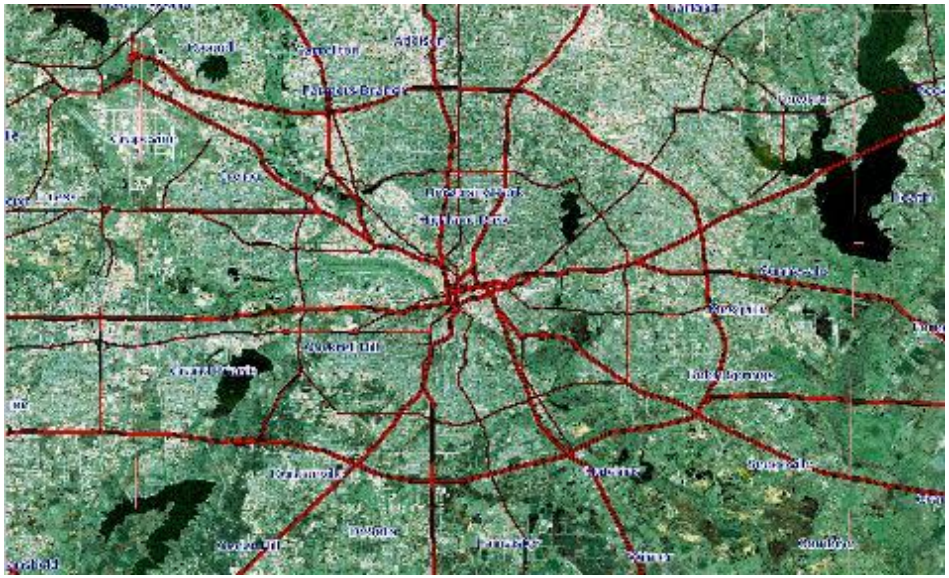
Records: Volume and speed
Advantages: Low-power
Disadvantages: Less effective at measuring vehicle perimeter (and thus length and occupancy)

Intelligent road studs



Records: Volume, speed, and classification

Aerial image analysis



Records: Density, queue lengths
Advantages: Highest possible coverage, internally consistent data
Disadvantages: Static image, cannot directly get volume or speed; expensive to obtain

INFORMAL EVALUATIONS

1. How is the pace of the class so far? (SLOW / OK / FAST)
2. What topic is most unclear at this point?
3. What about my teaching is most helpful to you?
4. What can I do better?
5. Any other comments?