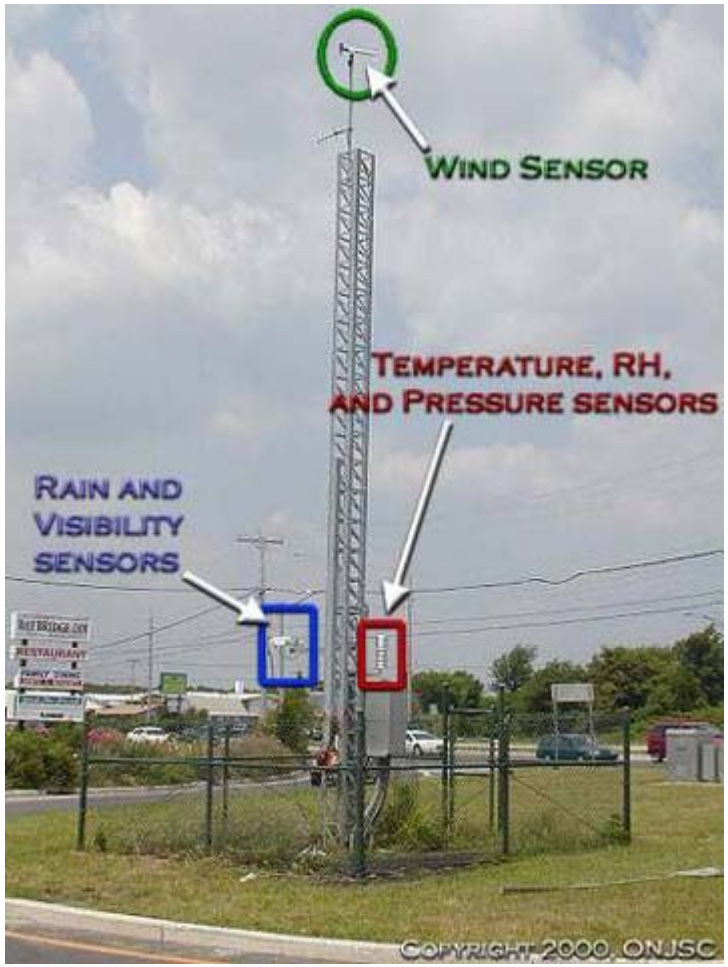
Intelligent Transportation Systems (ITS)

CEE 320
Anne Goodchild

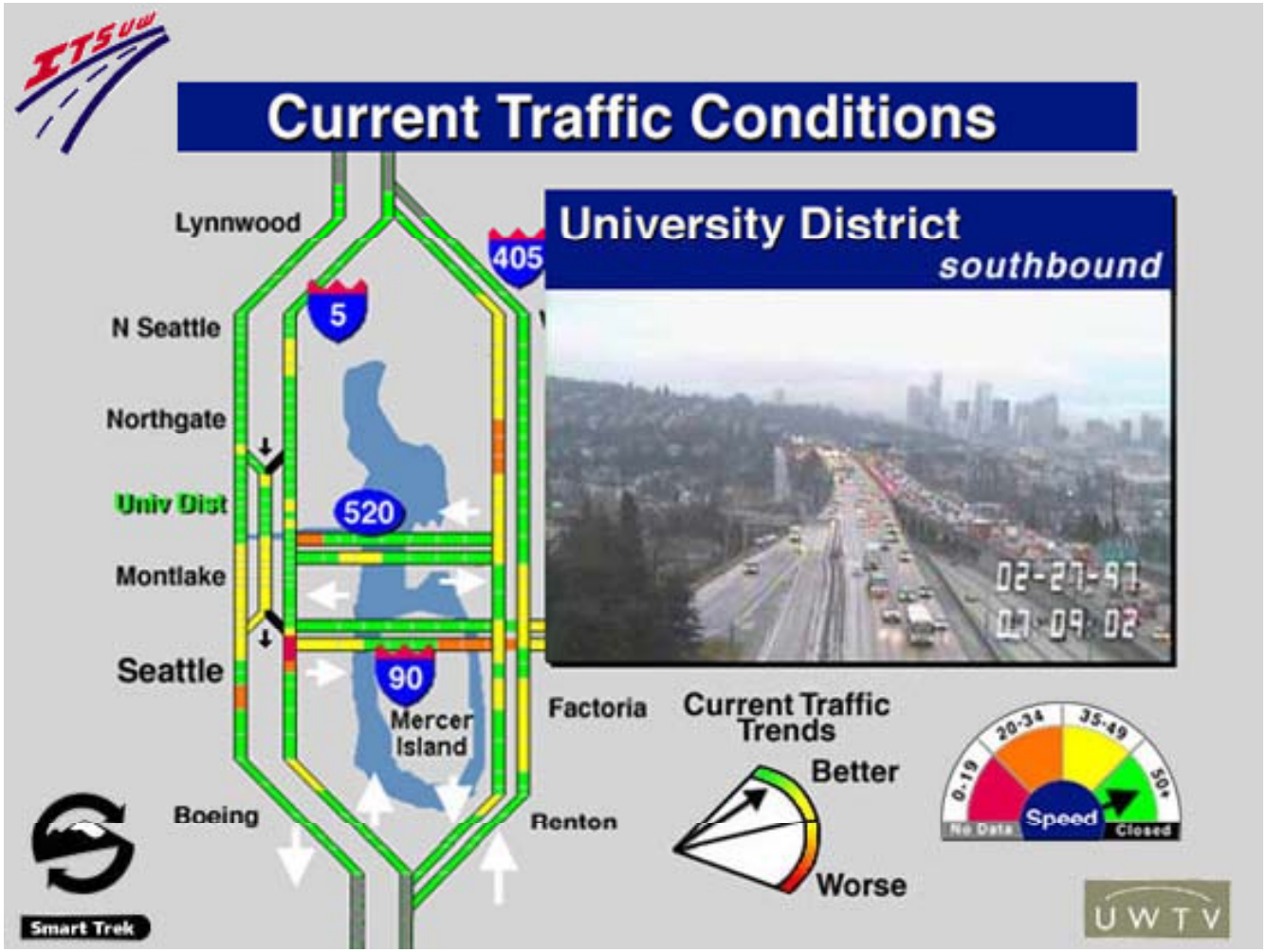
Advanced Traffic Management Systems

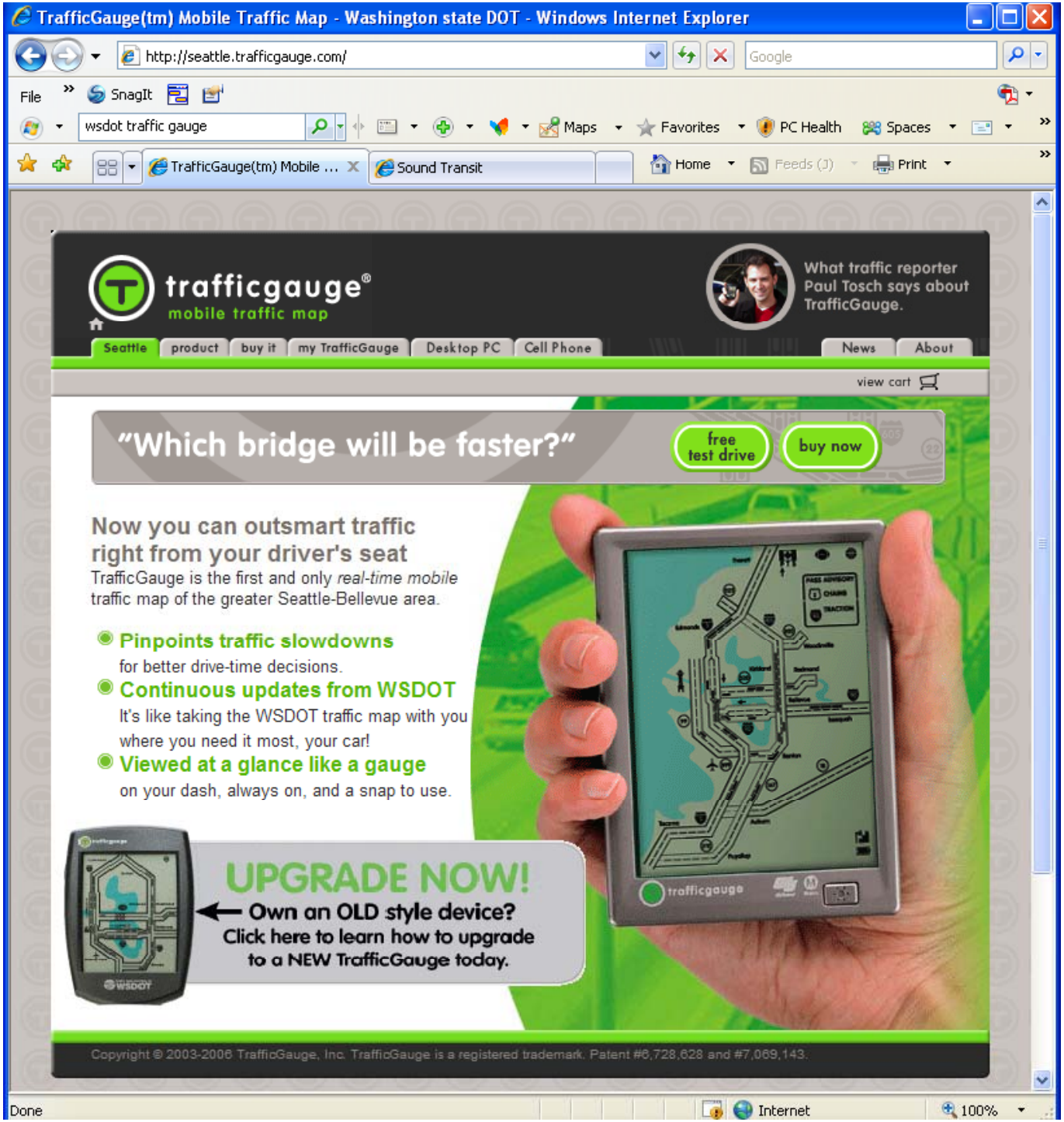
Photo from the Human-Computer Interaction Lab: University of Maryland

ATMS: Snoqualmie Pass



Advanced Traveler Information Systems



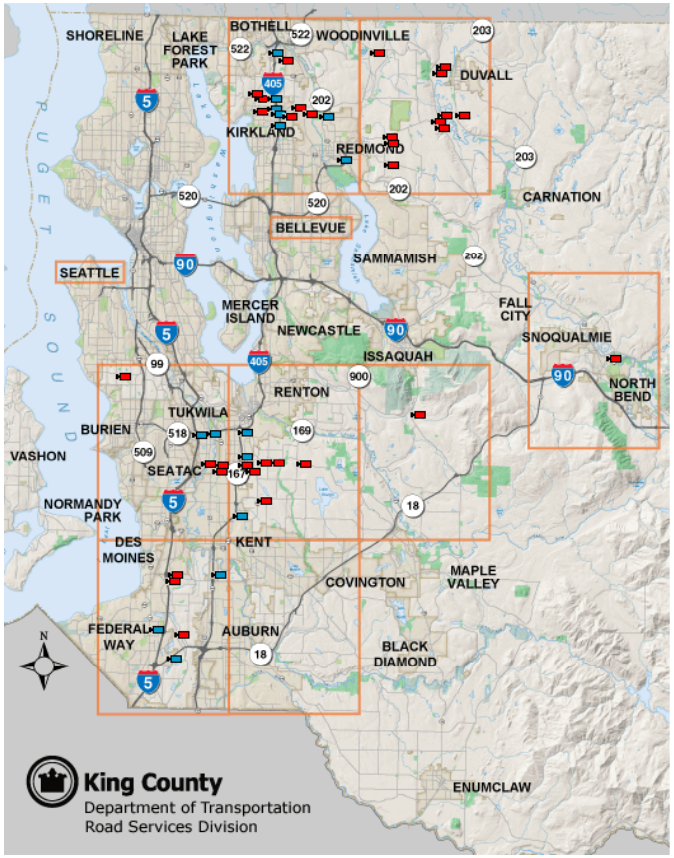


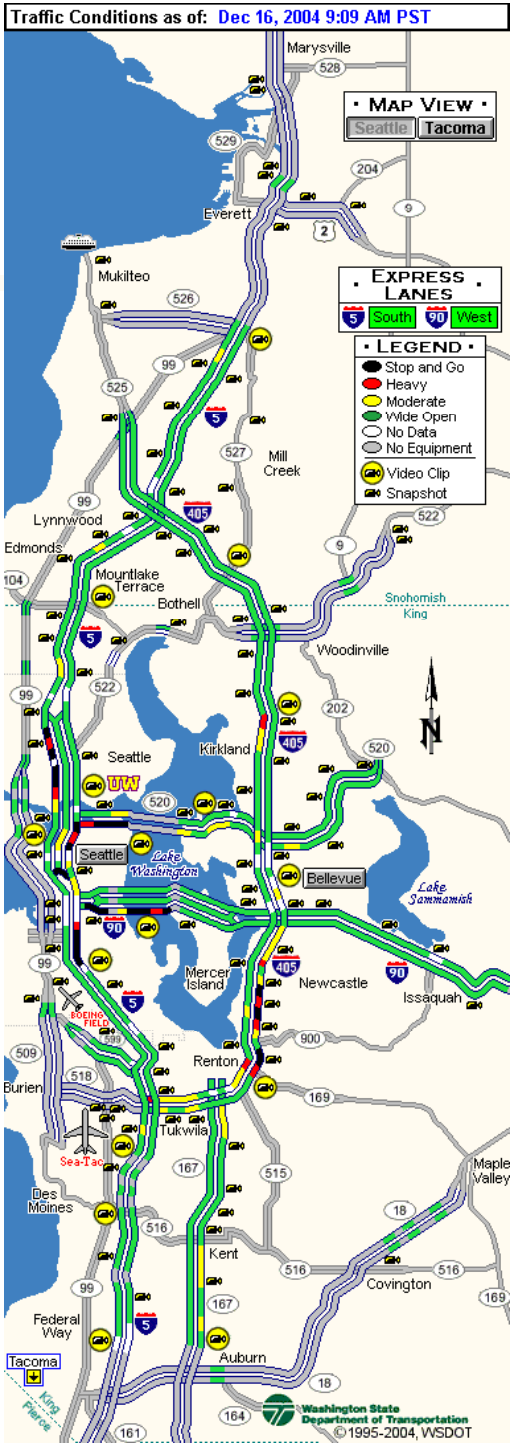
http://www.trafficgauge.com/index.html

WAP Traffic

www.wiresoft.net/traffic/seattle

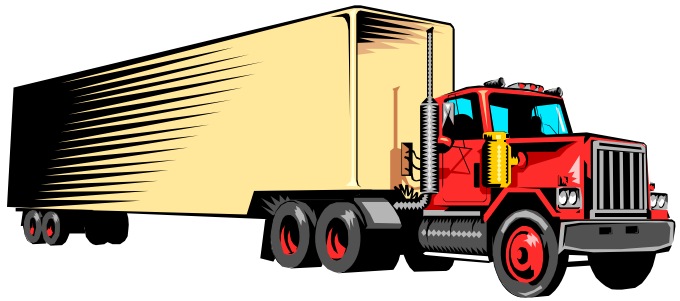
ATIS: Traffic Cameras



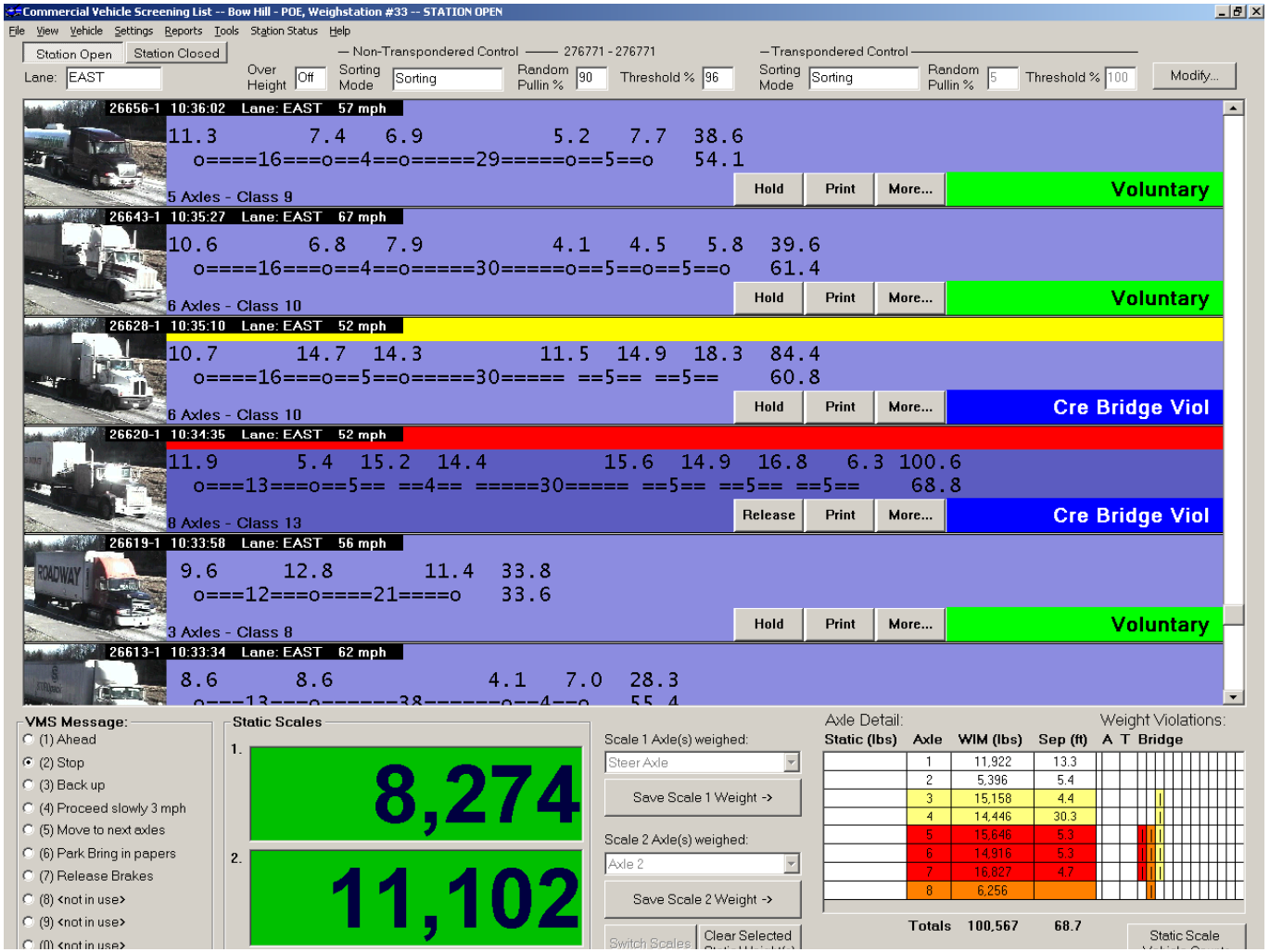


Commercial Vehicle Operations

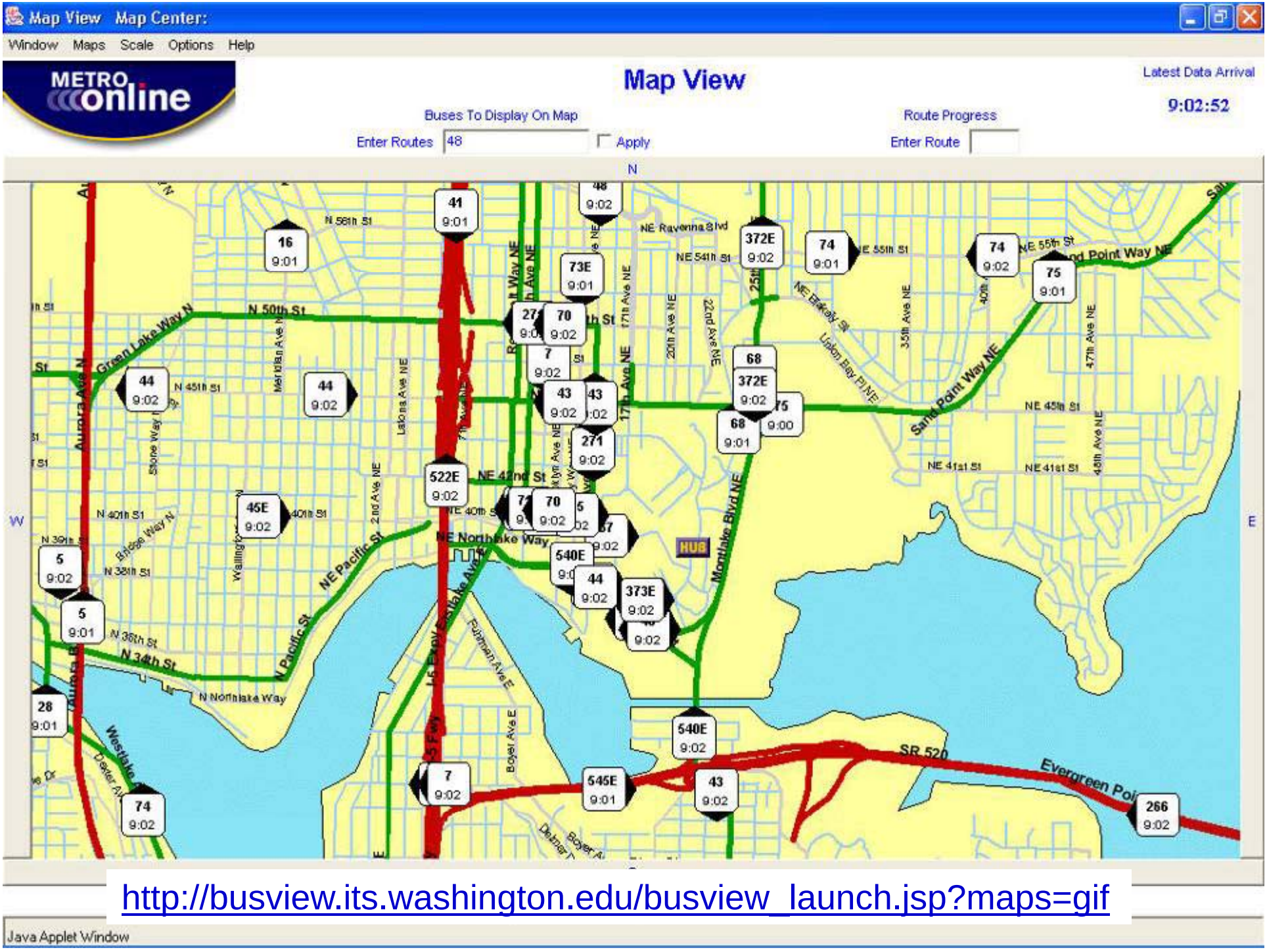
- **Apply, pay for and receive permits, registrations, and licenses electronically**
- **Share of common trucking data across agencies**
- **Exchange information electronically with roadside enforcement personnel**
- **Electronic “screening” of trucks for safety or other regulatory violations**
- **Share information across state lines and with Federal information systems**



CVO: Weigh-In-Motion System

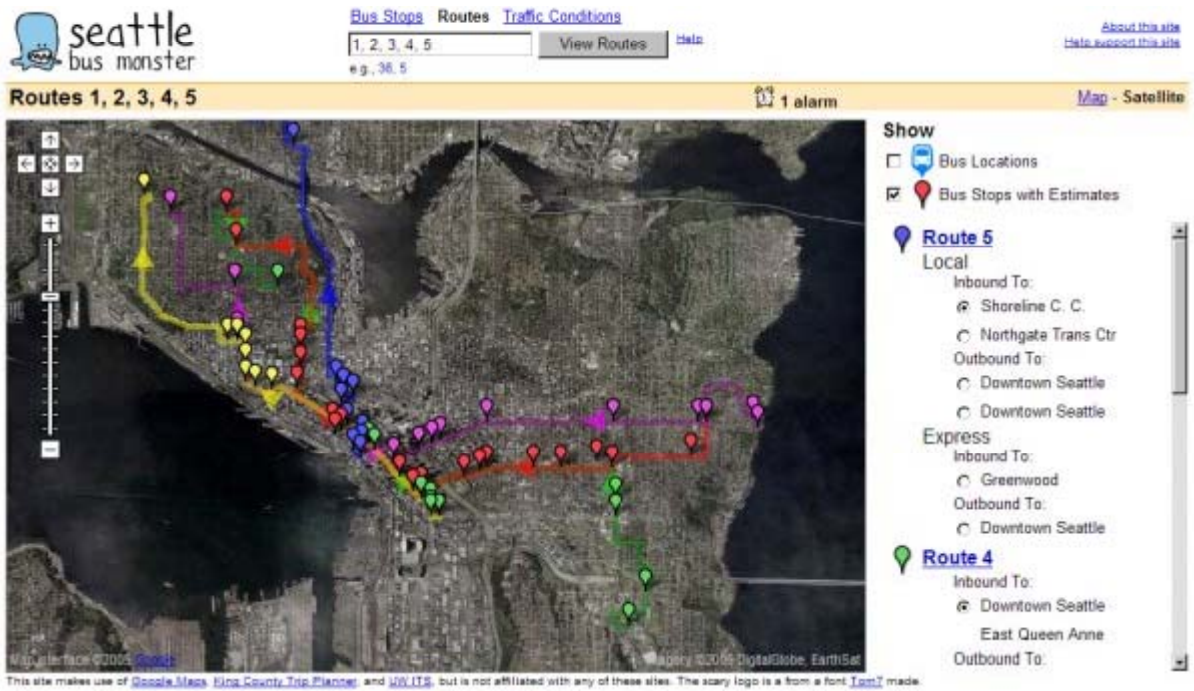


Advanced Public Transportation Systems

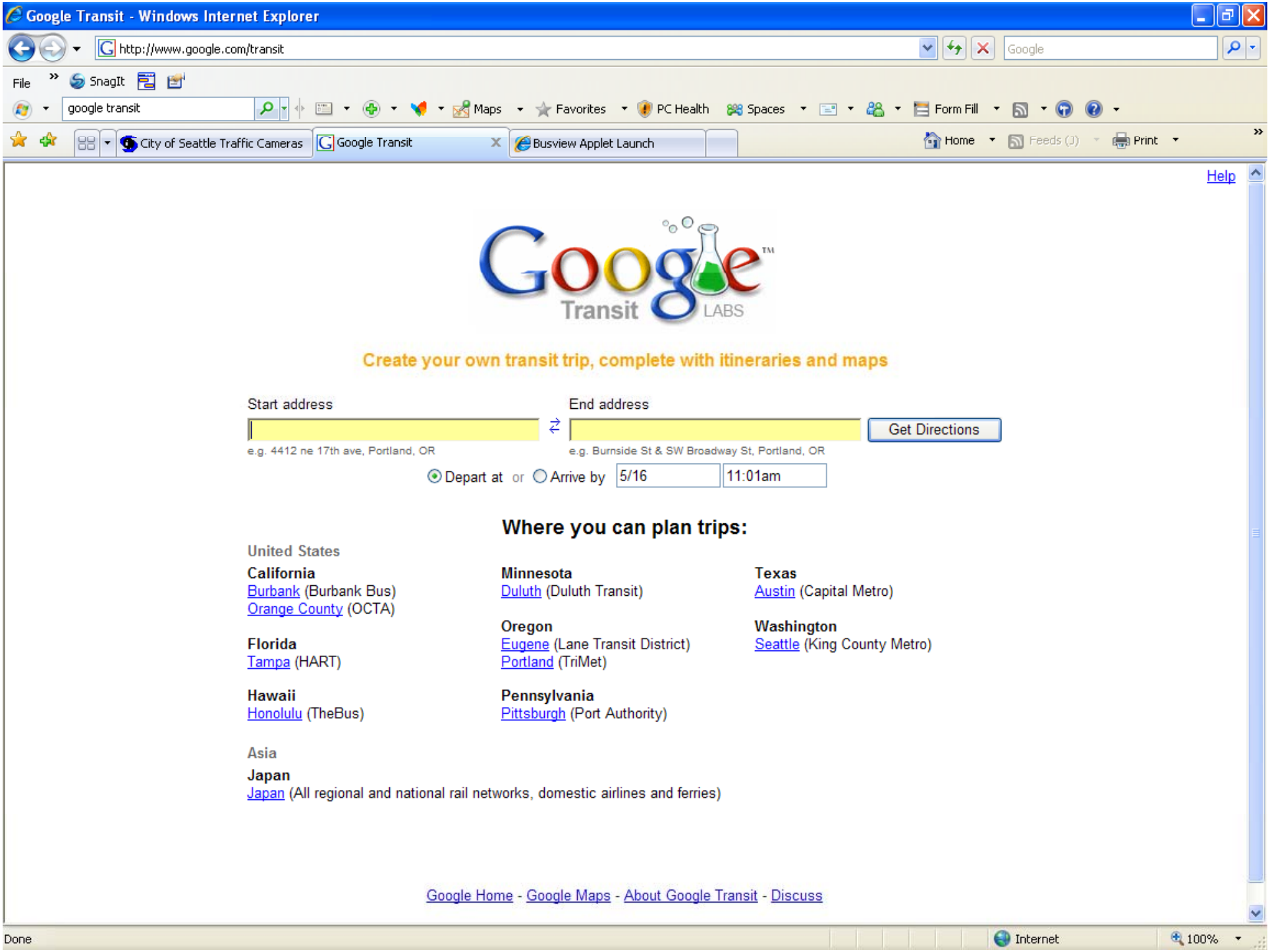


http://busview.its.washington.edu/busview_launch.jsp?maps=gif

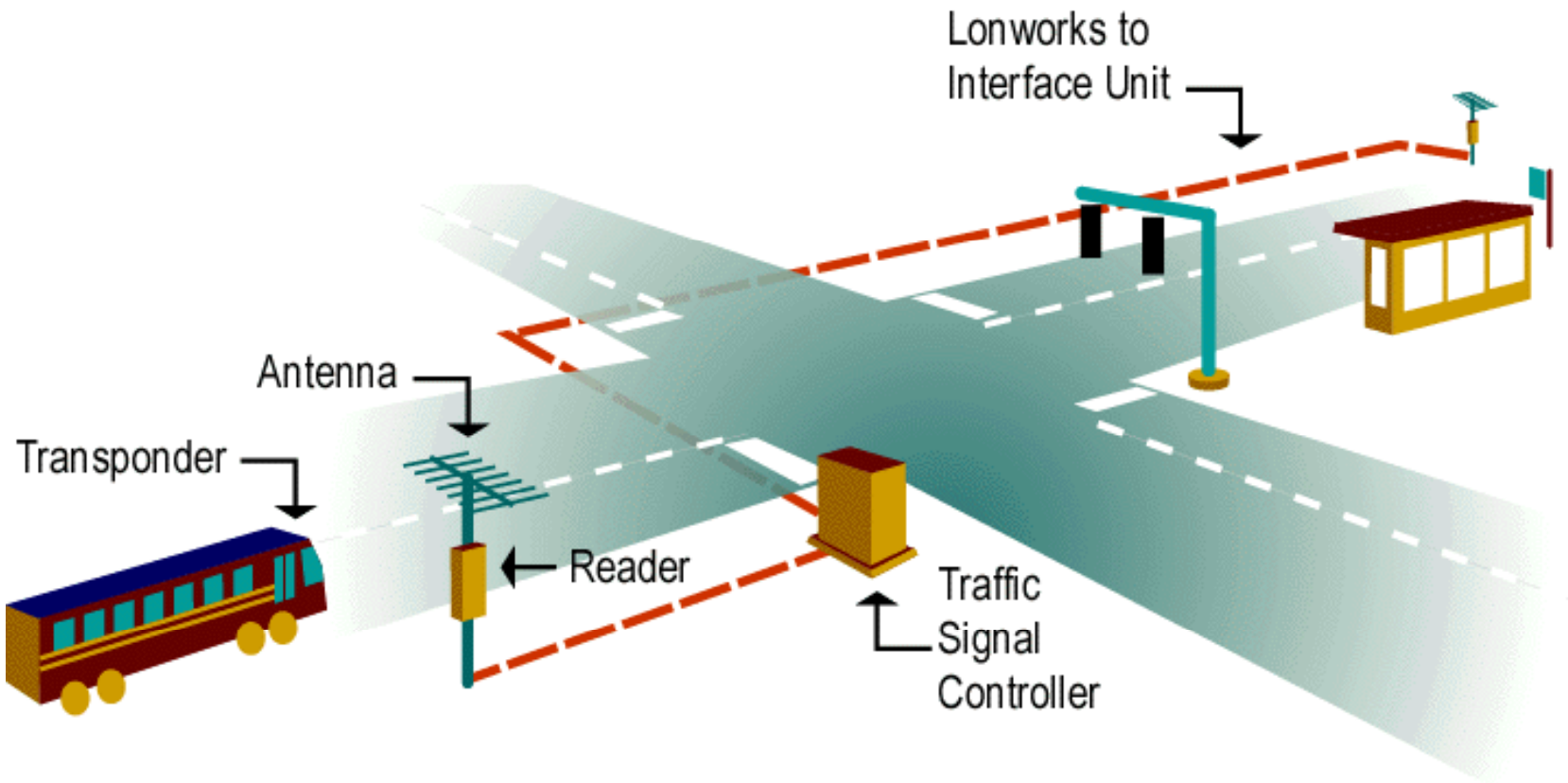
Seattle Bus Monster



http://www.busmonster.com


Google Transit - Windows Internet Explorer
http://www.google.com/transit
Google
File
SnagIt
google transit
Maps
Favorites
PC Health
Spaces
Form Fill
City of Seattle Traffic Cameras
Google Transit
Busview Applet Launch
Home
Feeds (J)
Print
Help
Google™
Transit LABS
Create your own transit trip, complete with itineraries and maps
Start address
End address
Get Directions
e.g. 4412 ne 17th ave, Portland, OR
e.g. Burnside St & SW Broadway St, Portland, OR
Depart at or Arrive by
5/16
11:01am
Where you can plan trips:
United States
California
Burbank (Burbank Bus)
Orange County (OCTA)
Florida
Tampa (HART)
Hawaii
Honolulu (TheBus)
Minnesota
Duluth (Duluth Transit)
Oregon
Eugene (Lane Transit District)
Portland (TriMet)
Pennsylvania
Pittsburgh (Port Authority)
Texas
Austin (Capital Metro)
Washington
Seattle (King County Metro)
Asia
Japan
Japan (All regional and national rail networks, domestic airlines and ferries)
Google Home - Google Maps - About Google Transit - Discuss
Done
Internet
100%

APTS: Bus Signal Priority



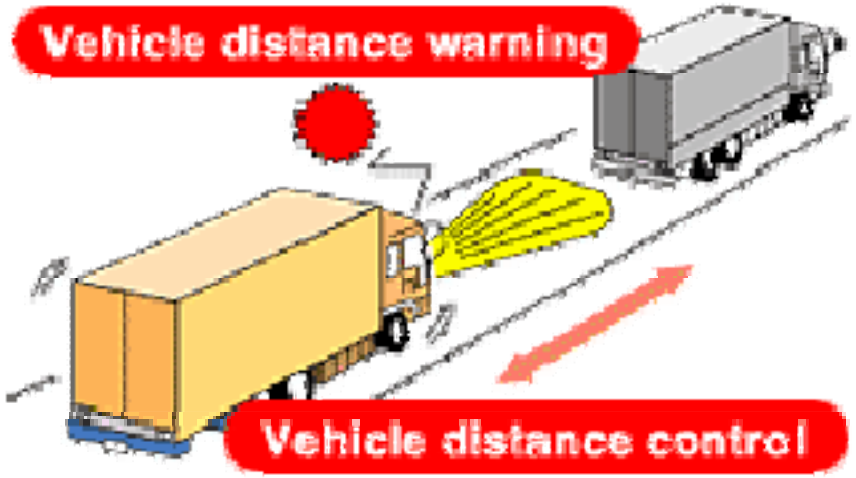
APTS: Smart Cards

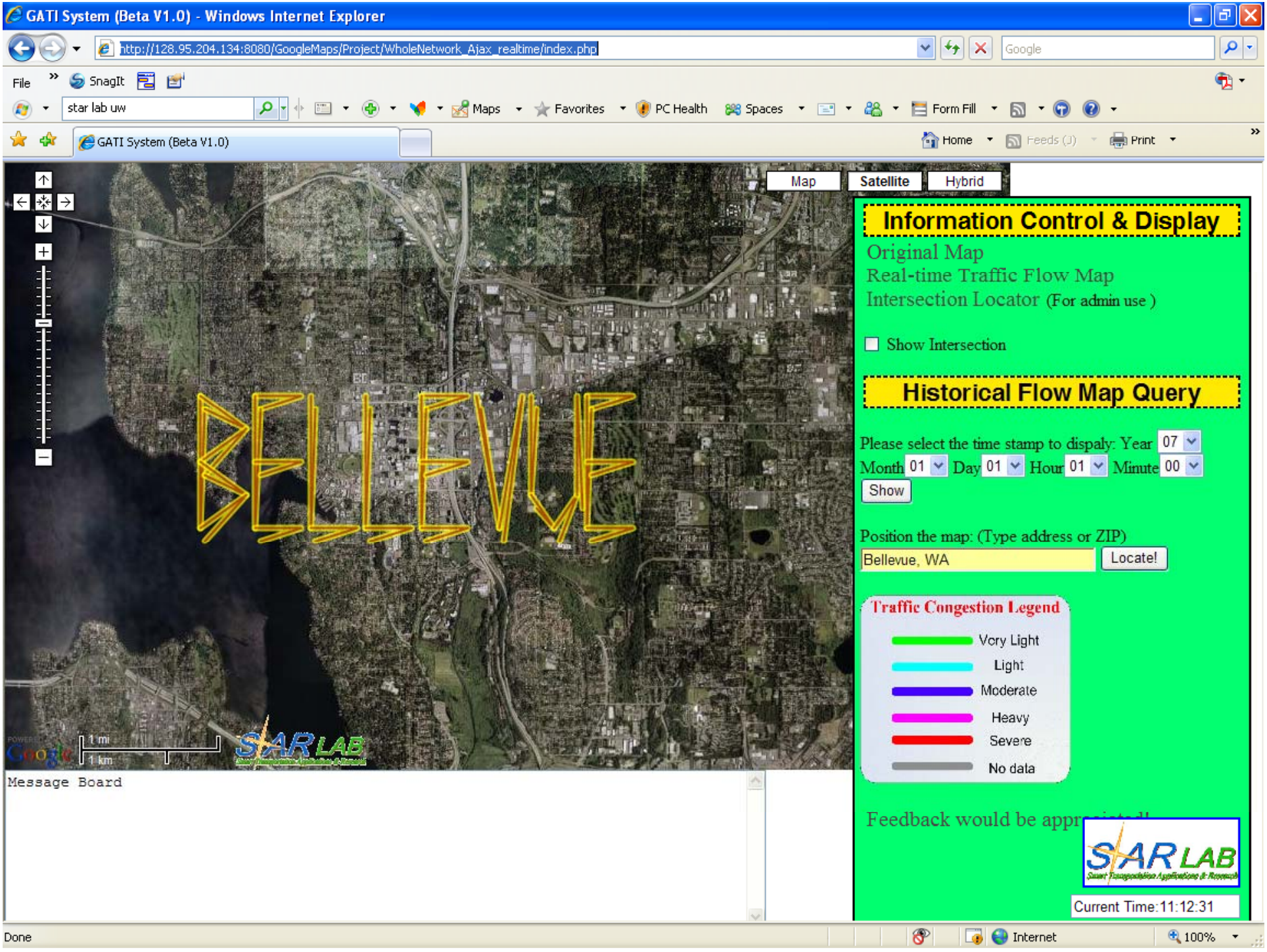
- No need for change
- Interoperable with other transit agencies
- Transit agency can track passengers for better system design and cost control

New Slide

Advanced Vehicle Control Systems

Intelligent
Cruise Control (ICC)
System




GATI System (Beta V1.0) - Windows Internet Explorer
http://128.95.204.134:8080/GoogleMaps/Project/WholeNetwork_Ajax_realtime/index.php
Google
File
SnagIt
star lab uw
Maps
Favorites
PC Health
Spaces
Form Fill
GATI System (Beta V1.0)
Home
Feeds (J)
Print
Map
Satellite
Hybrid
BELLEVUE
1 mi
1 km
Information Control & Display
Original Map
Real-time Traffic Flow Map
Intersection Locator (For admin use)
Show Intersection
Historical Flow Map Query
Please select the time stamp to dispaly: Year 07
Month 01 Day 01 Hour 01 Minute 00
Show
Position the map: (Type address or ZIP)
Bellevue, WA
Locate!
Traffic Congestion Legend
Very Light
Light
Moderate
Heavy
Severe
No data
Feedback would be appr
Current Time:11:12:31
Message Board
Done
Internet
100%

Five Primary Functional Areas of ITS

- **Advanced Traffic Management Systems (ATMS)**
  - **Managing incidents**
- **Advanced Traveler Information Systems (ATIS)**
  - **Giving users information about the system**
- **Commercial Vehicle Operations (CVO)**
  - **Simplifies regulations (with benefits)**
- **Advanced Public Transportation Systems (APTS)**
  - **Reduce obstacles to use, give priority to vehicles**
- **Advanced Vehicle Control Systems (AVCS)**
  - **Safer, more efficient driving**

Traffic Detection

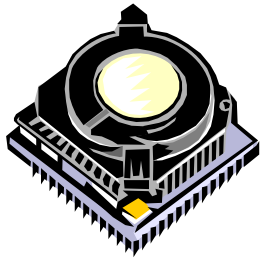
CEE 320
Anne Goodchild

What Are Traffic Detectors?

Devices that are used for detecting vehicles, bicycles, and pedestrians

Traffic Detection Systems Structure

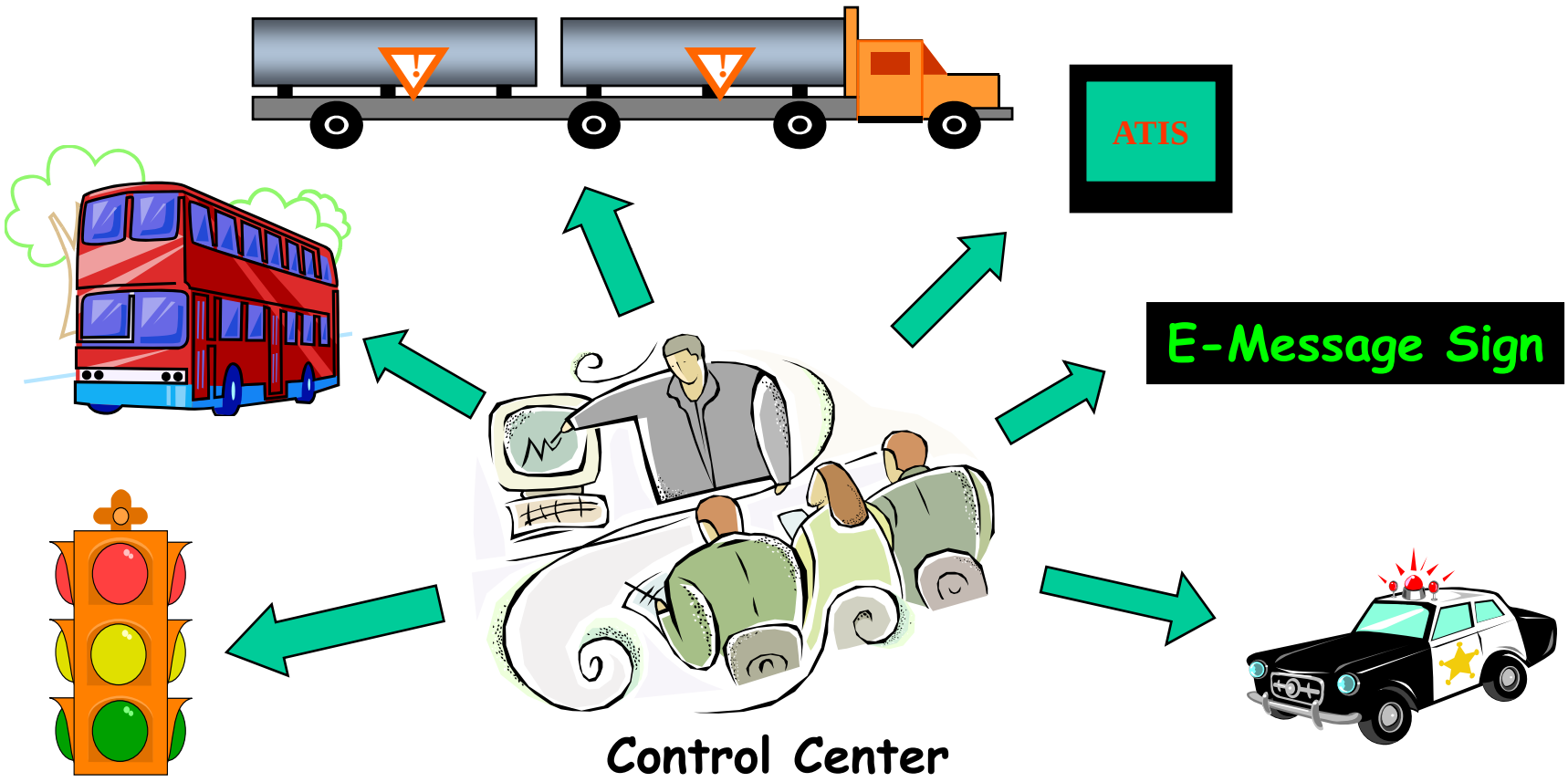
Detector → Processor/Controller → Storage



Applications

- **Monitor conditions**
  - **Reduce congestion**
- **Control operations**
  - **Signal timing**
  - **Variable speed limits**
- **Understand system for strategic planning**
  - **Infrastructure development**
  - **Improved management**

Why Is Traffic Detection Important?



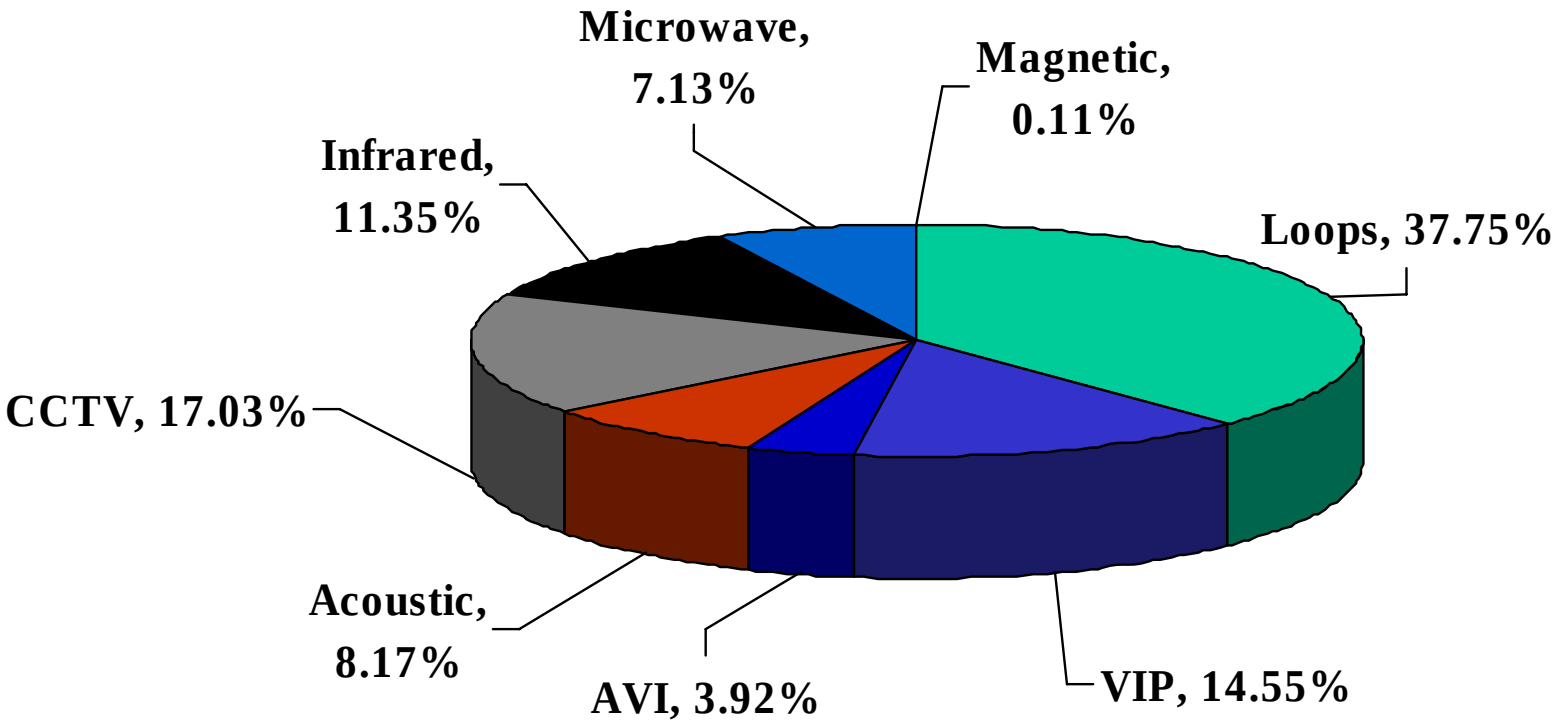
Quality Data

Traffic Detector Types

- **Inductive loops**
- **Video**
- **Microwave**
- **Infrared**
- **Acoustic**
- **Radar**
- **Magnetic**
- **Radio frequency**
- **Global positioning system (GPS)**

Use various waves and fields, frequencies, passive or active, mobile or fixed infrastructure

Share of Detector Types at new ATMS Sites



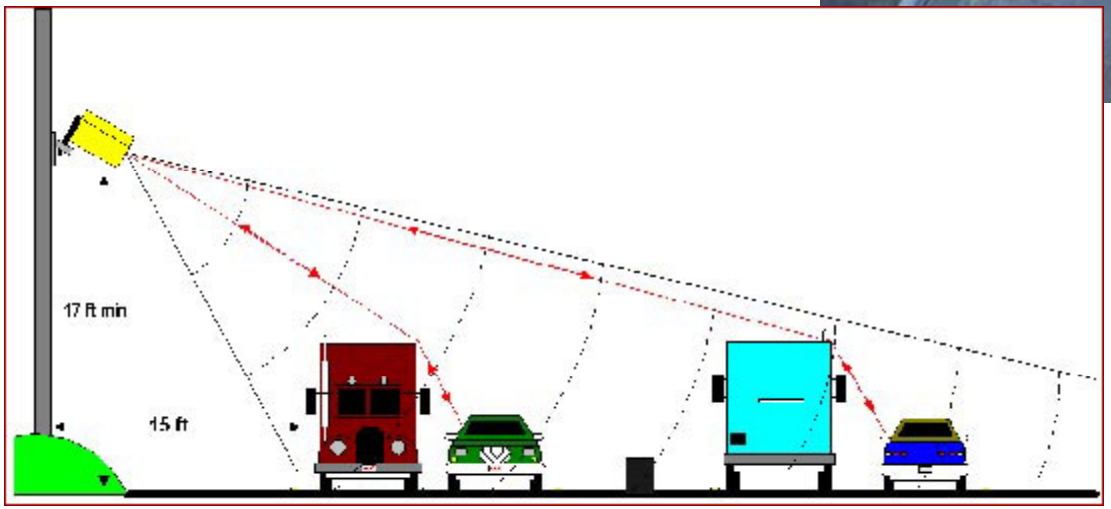
Environment, cost, application

Popular Traffic Detector Types

Inductive loops

Video Image Processors (VIPs)

Popular Traffic Detector Types



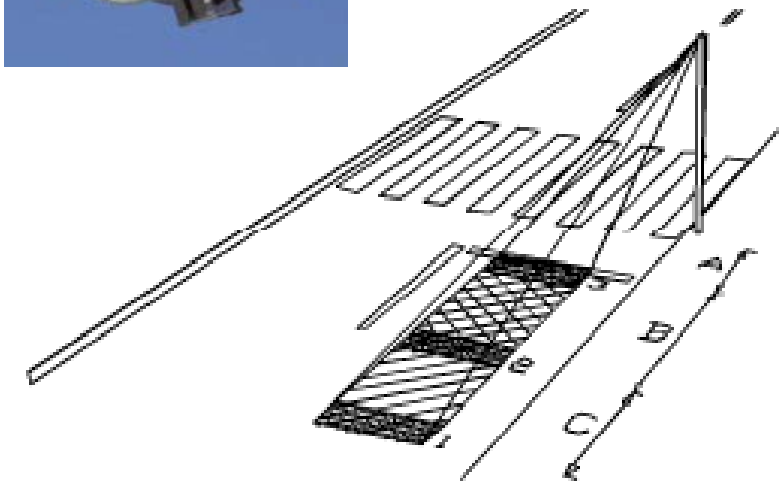
Remote Traffic Microwave Sensor (RTMS)

Photos and picture from Electronic Integrated Systems, Inc.

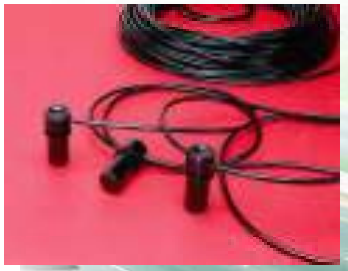
RTMS

- **Multi-zone traffic detector with few occlusion problems**
- **Unaffected by weather and light**
- **Low-power microwave signal**
- **Volume, Occupancy, Average Speed and Classification by length**

Popular Traffic Detector Types

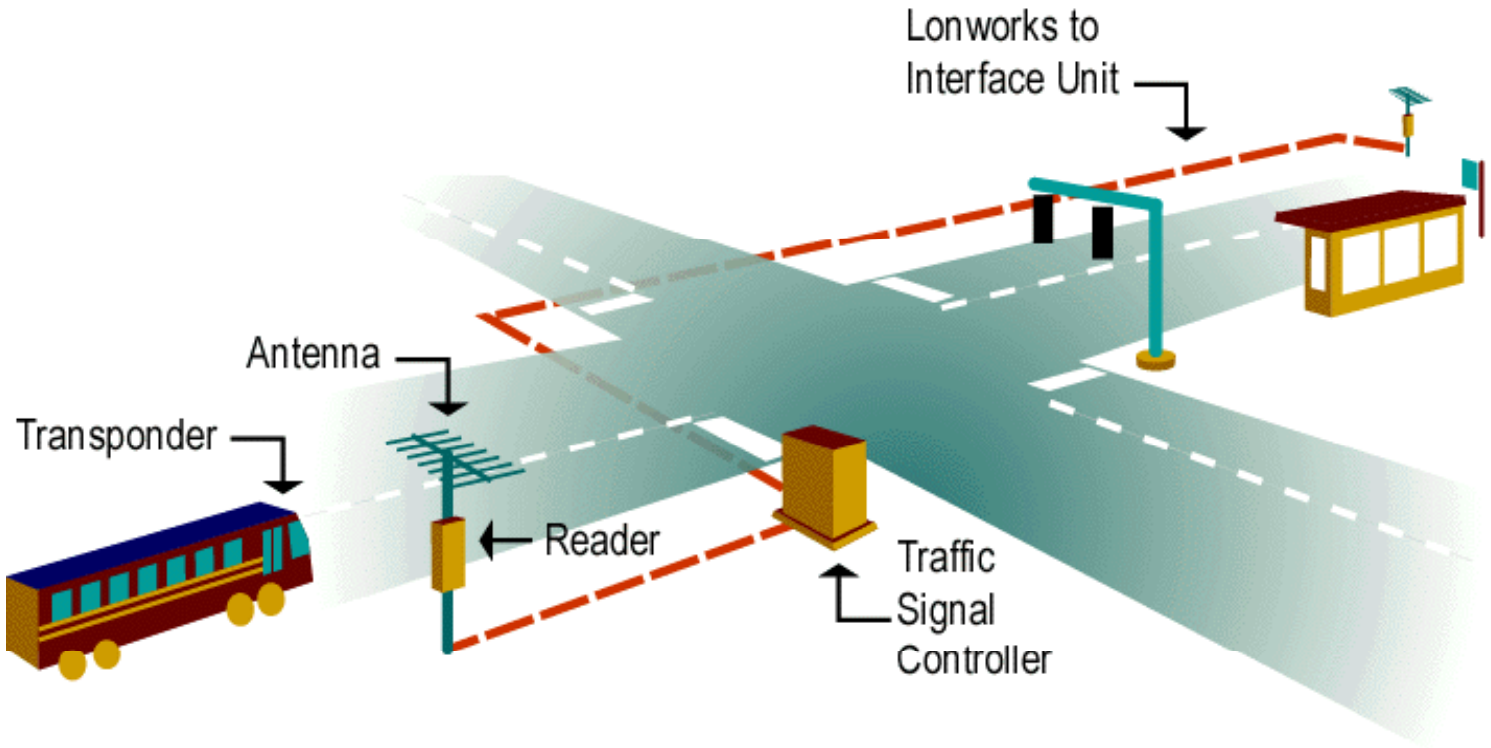


Infrared Sensors (temperature)



Magnetic Sensors

Popular Traffic Detector Types



Radio Frequency Tag for Transit Signal Priority and Signal Preemption

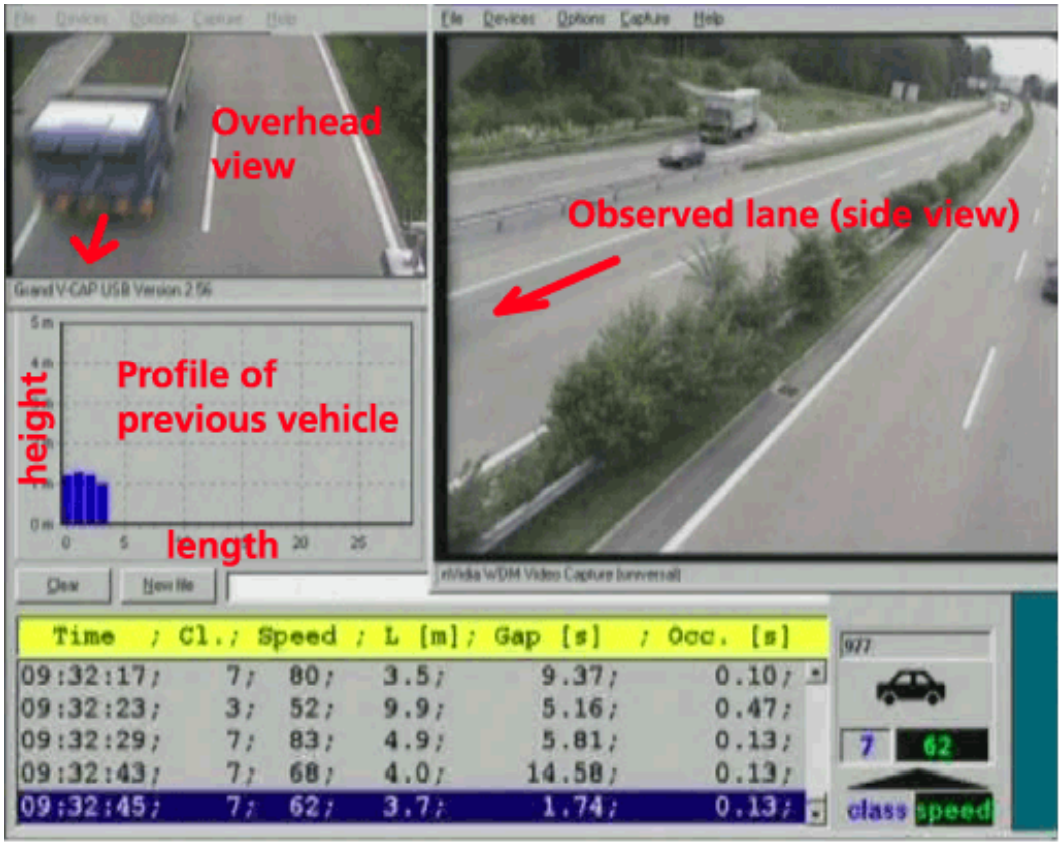
Popular Traffic Detector Types

ASIM TT 298: Doppler RADAR, ultrasonic, passive infrared.

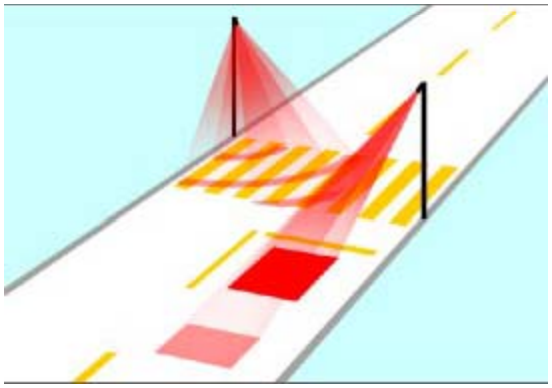
Volume, classification, speed, occupancy, queue detection, wrong-way

Popular Traffic Detector Types

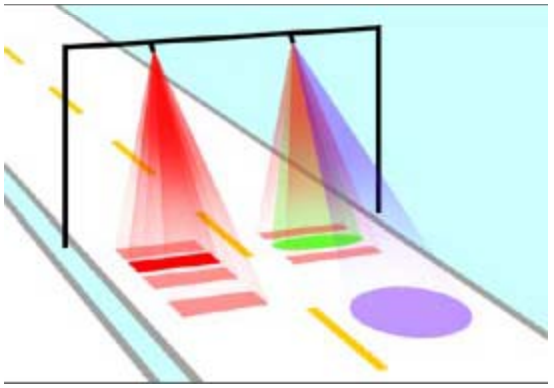
ASIM TT 298: Doppler RADAR, ultrasonic, passive infrared.



Popular Traffic Detector Types



Intersection Control



Traffic Data Acquisition

= infrared (counting)

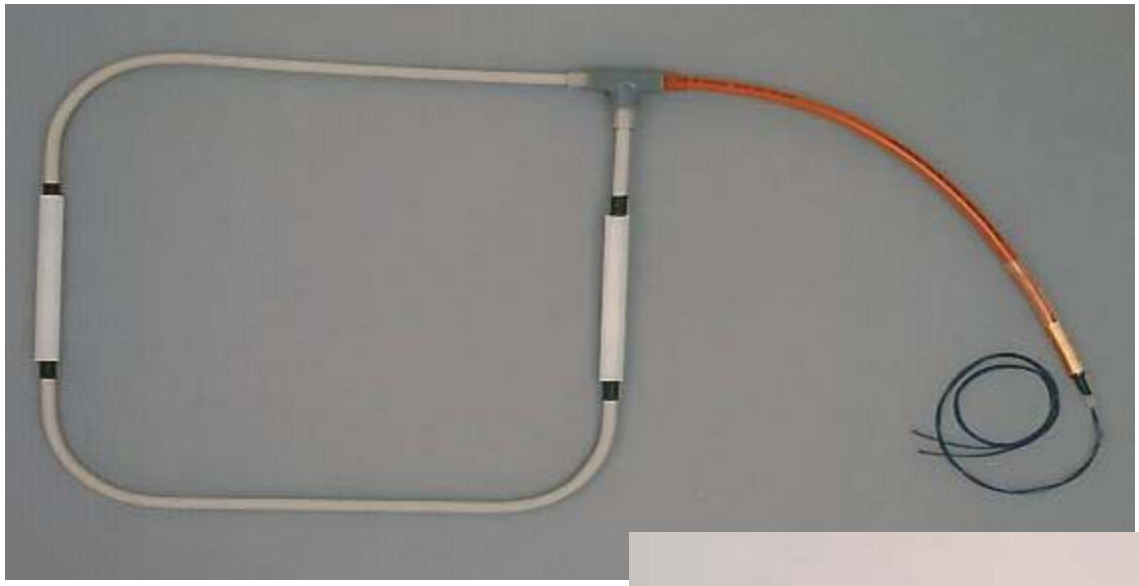
= ultrasonic (vehicle height)

= microwave doppler radar (speed)

Popular Traffic Detector Types

GPS-Based Tracking Systems

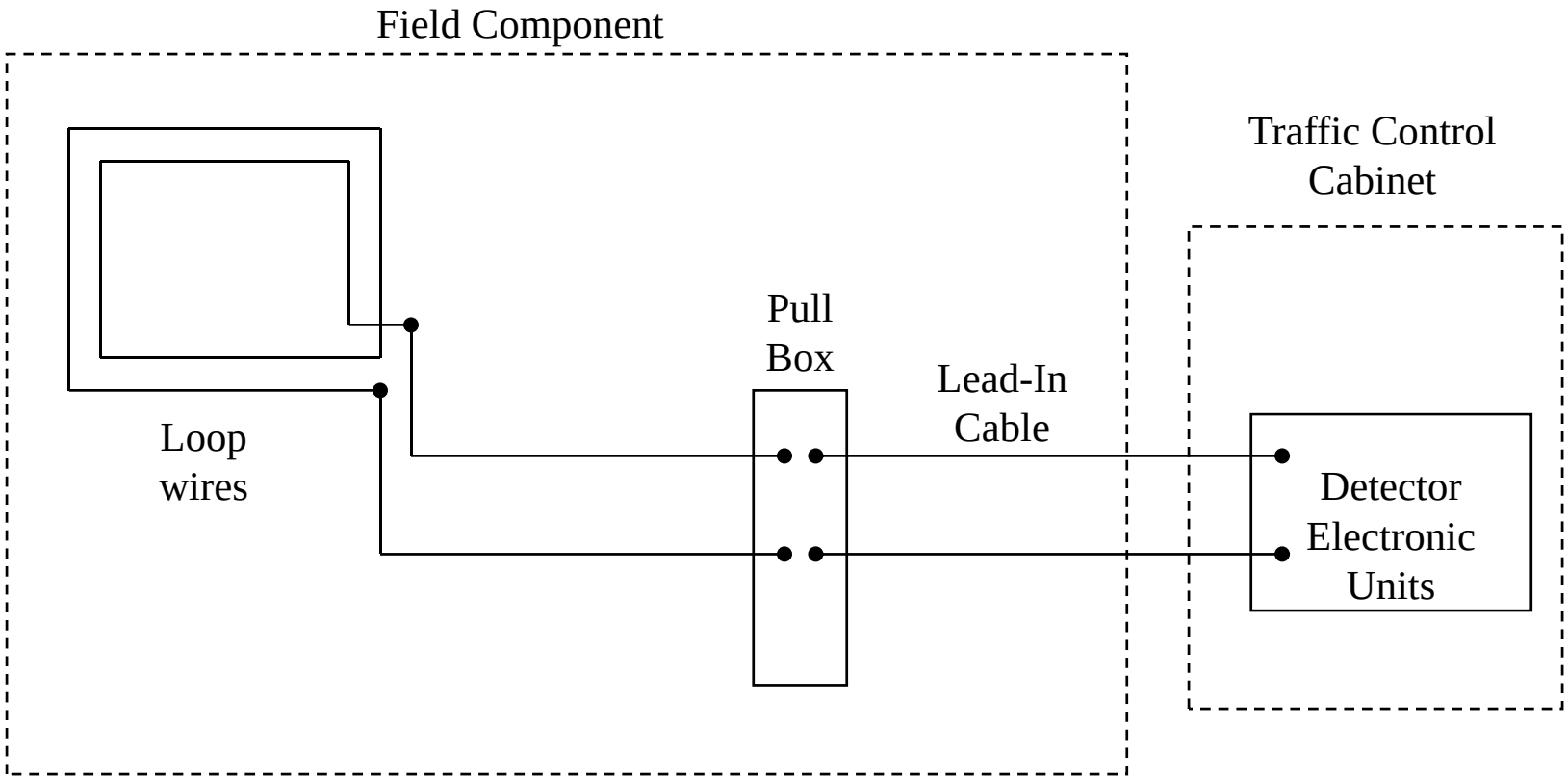
Inductance Loop Detectors



Photos from Never
Fail Loop Systems, Inc.

Inductance Loop Detectors

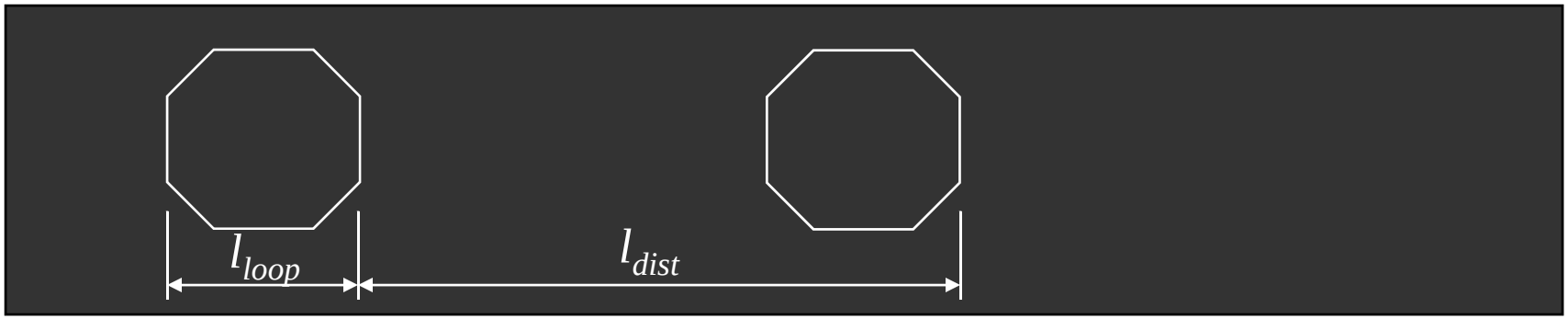
Inductance Loop Detectors



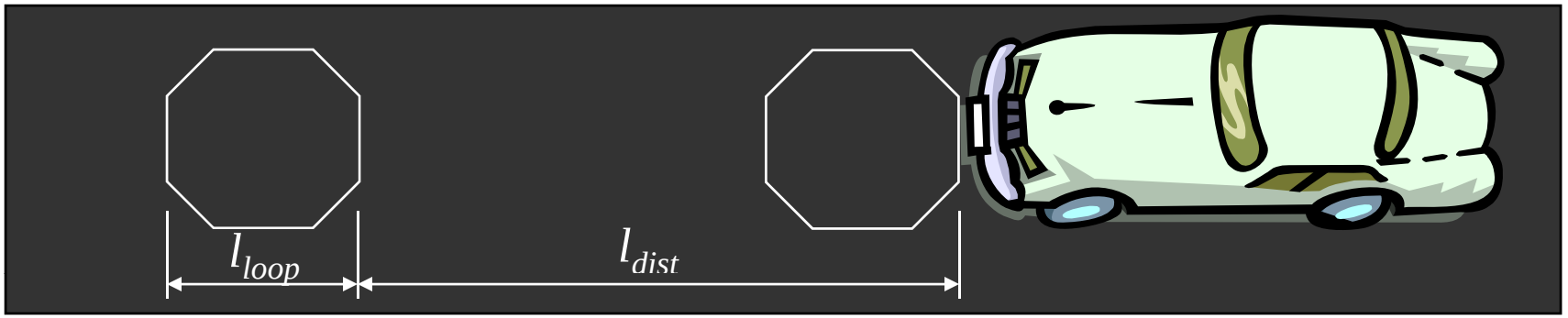
Inductance Loop Detectors

Dual Loop Detector

- Formed by two consecutive single loop detectors placed a short distance apart



Dual Loop Detectors



- **Dual loop measurements**

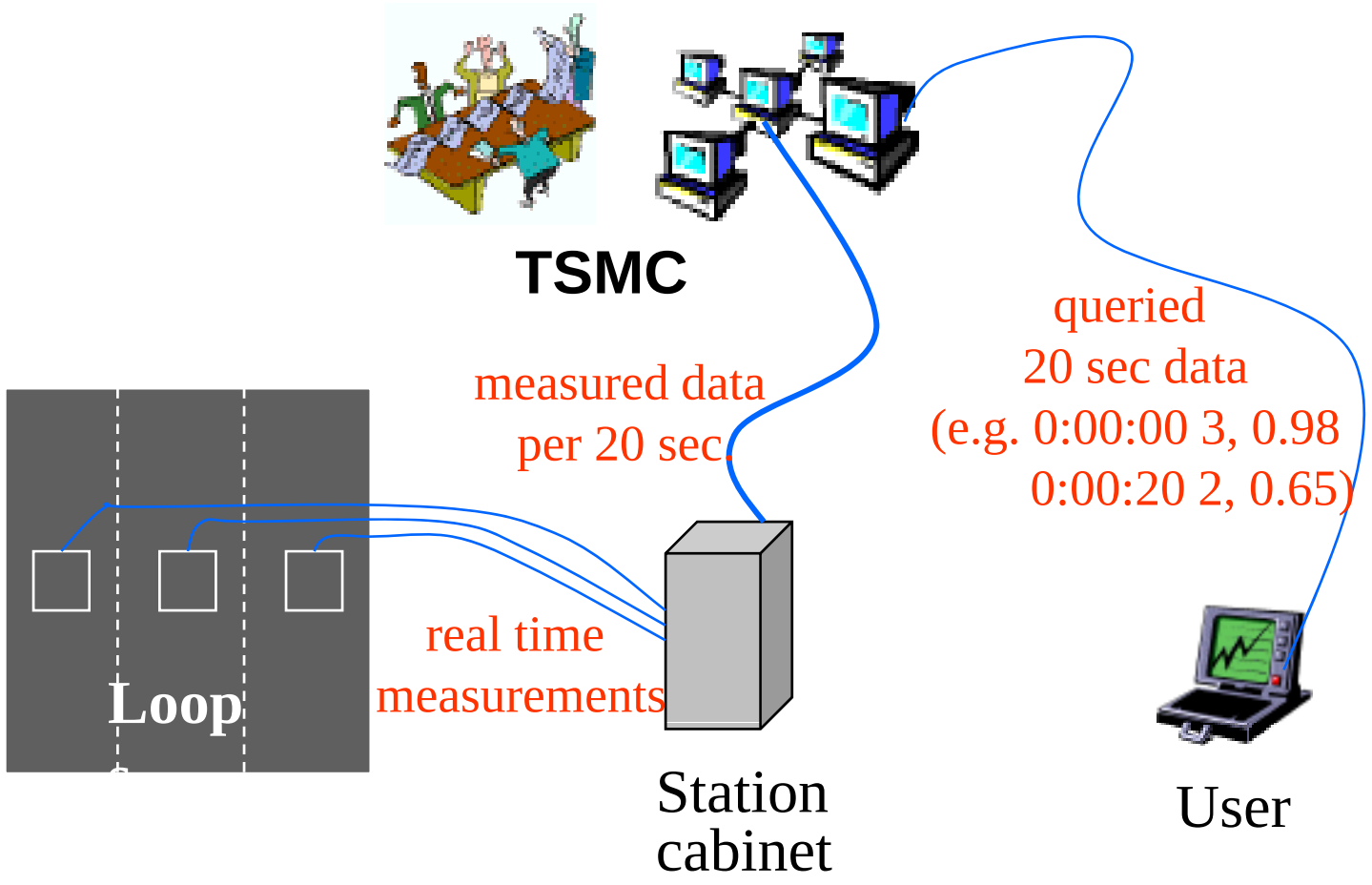
$$Speed = \frac{l_{dist}}{t_2 - t_1} \qquad L_{vehicle} = \frac{Speed(ot_2 + ot_1)}{2}$$

ot_i = on-time for loop detector i

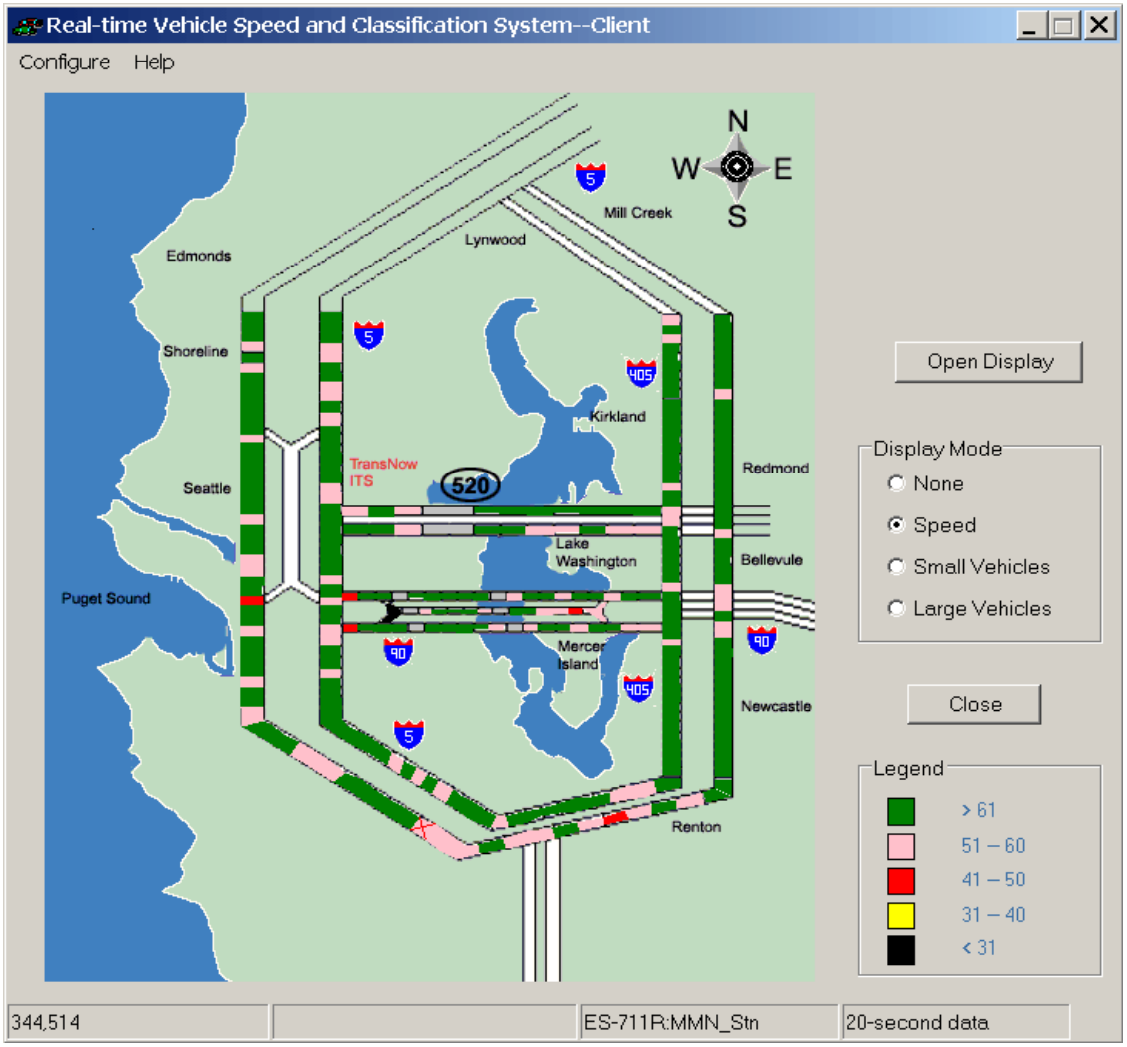
Measured vehicle lengths are used to classify vehicles into different categories, such as long and short.

Inductance Loop Detectors

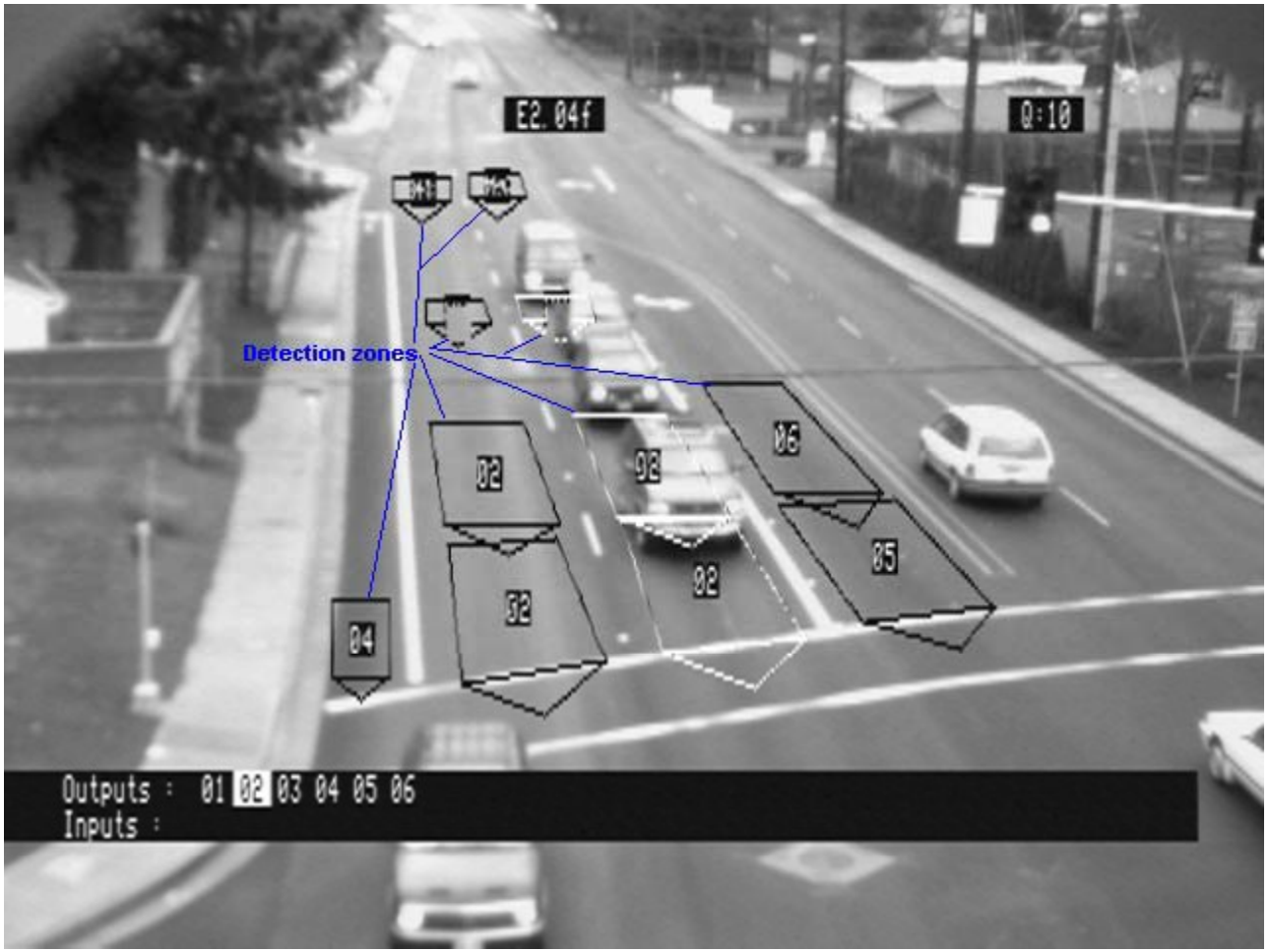
Only 20 sec aggregated data are available from TSMC



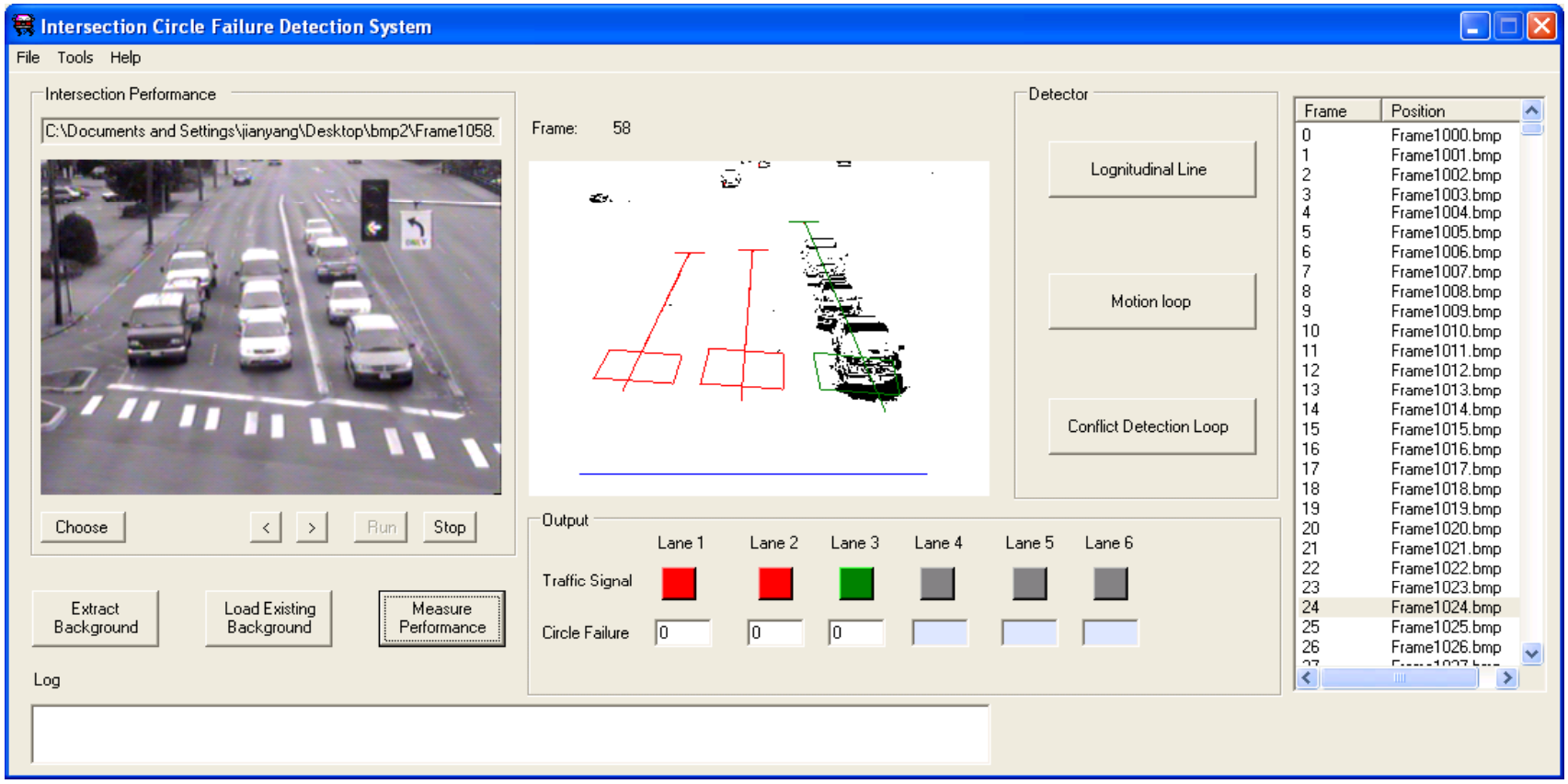
Inductance Loop Detectors



Video Image Processors



Video Image Processors



Much more promising for pedestrian detection.

A Use Example: Ramp Metering

Ramp Meter Schematic

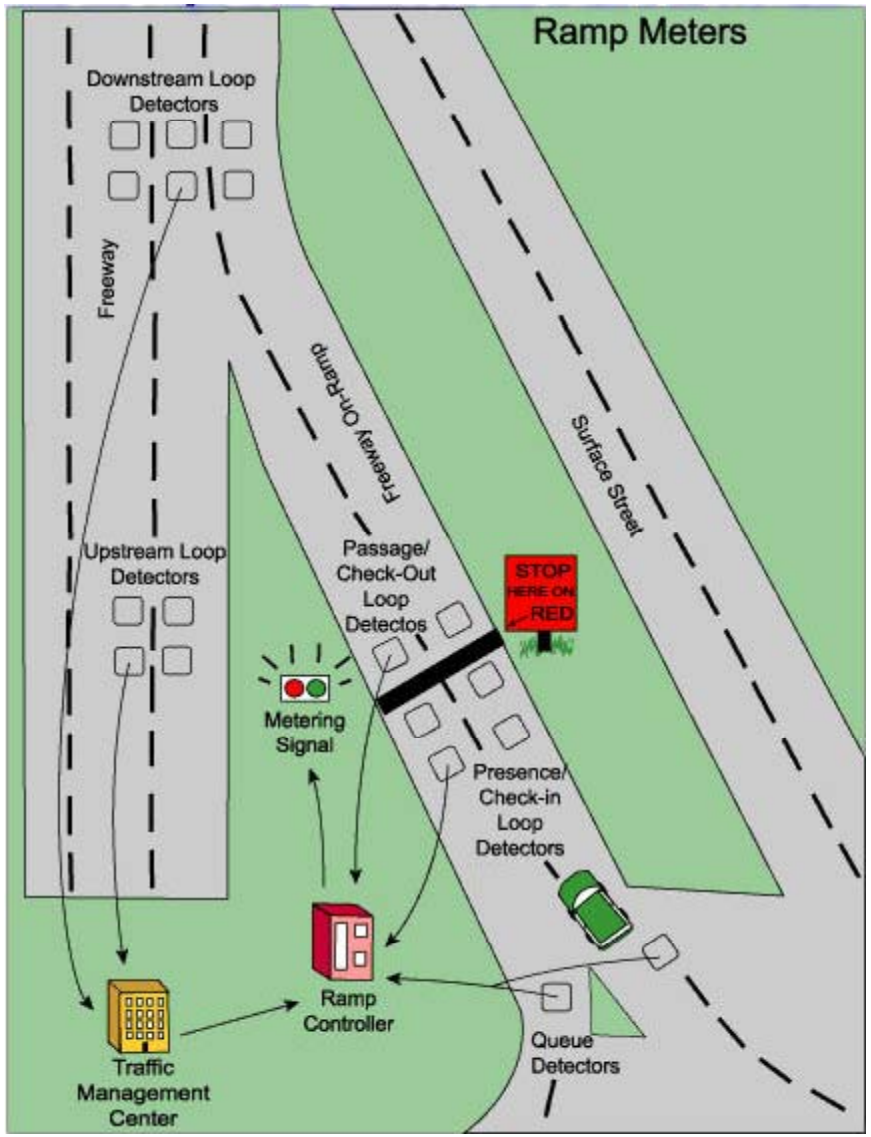


Diagram from
ITS Decision website

Example: SR 520

What is the Difference?