# Intelligent Transportation Systems (ITS)



#### **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**

Ute         Wate         State         Description         Transpondered Control         Transpondered Control           Control Open         State Control         Over, Mindow         State Control         Model         State Control         Model         State Control         Model         Model         State Control         Model         State Control         Model         Model         State Control         Model         Model         State Control         Model	Commercial Vehicle Screening List	t Bow Hill - POE, We	eighstation #33 STA	TION OPEN										_ 8 >
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#### **Advanced Public Transportation Systems**





#### **Seattle Bus Monster**



#### http://www.busmonster.com



## **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







#### **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



### What Are Traffic Detectors?



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

#### **Traffic Detection Systems Structure**















## **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?



## **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



Inductive loops



Video Image Processors (VIPs)



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



Infrared Sensors (temperature)

**Magnetic Sensors** 



Radio Frequency Tag for Transit Signal Priority and Signal Preemption

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



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

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





**Intersection Control** 



Traffic Data Acquisition

- = infrared (counting)
  - = ultrasonic (vehicle height)
- = microwave doppler radar (speed)







#### **GPS-Based Tracking Systems**



Photos from Never Fail Loop Systems, Inc.













## **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<sub>i</sub> = on-time for loop detector i

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

#### Only 20 sec aggregated data are available from TSMC





## **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?

SR 520 Eastbound Morning Congestion, I-5 to Lake Washington Blvd Wednesday July 25, 2001



SR 520 Eastbound Morning Congestion, I-5 to Lake Washington Blvd Thursday September 6, 2001

