Advanced Traffic Visualization and Mining System (ATVMS)

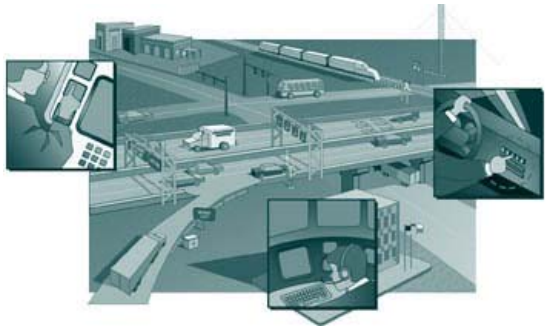
Spatial Data Management Lab

Presented by Arnold P. Boedihardjo

Motivation

- Transportation Manager
  - How is the freeway performing today? Yesterday?
  - Which locations are worst performers?
- Traffic Engineer
  - Where are the congestions (in time and space)?
  - Which of these recurrent congestion?
  - Which loop detection are not working properly?
- Traveler, Commuter
  - What is the travel time on a route?
  - Will I make to destination in time for a meeting?
  - Where are the incidents and events?

Real-Time Analysis

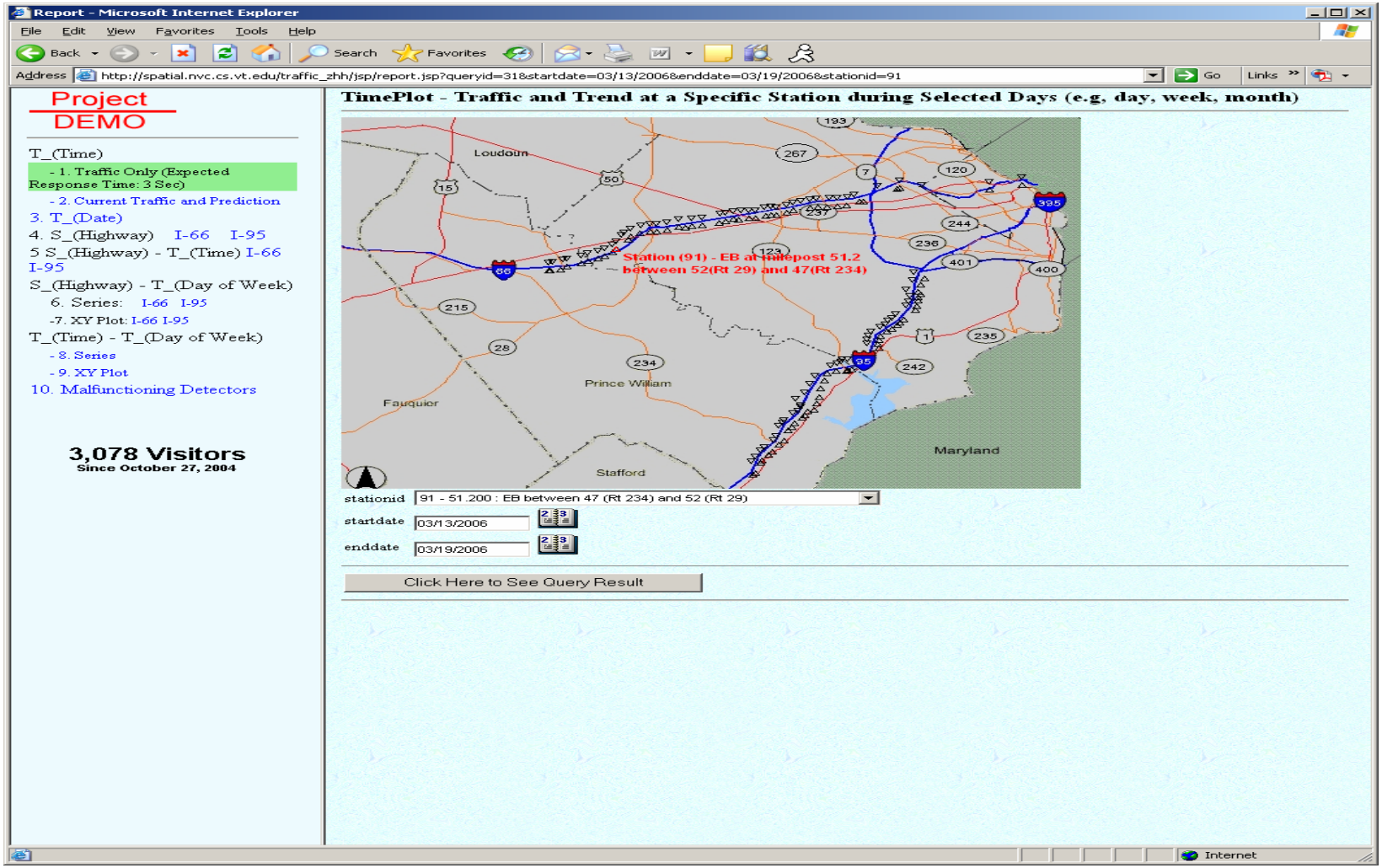


ATVMS: At a Glance

- Tool for **real-time** monitoring and analysis
  - HOV/non-HOV traffic visualization
  - Traffic behavior prediction
  - Traffic comparison
  - Travel time estimation
  - Automatic incident detection
  - Detector status monitoring

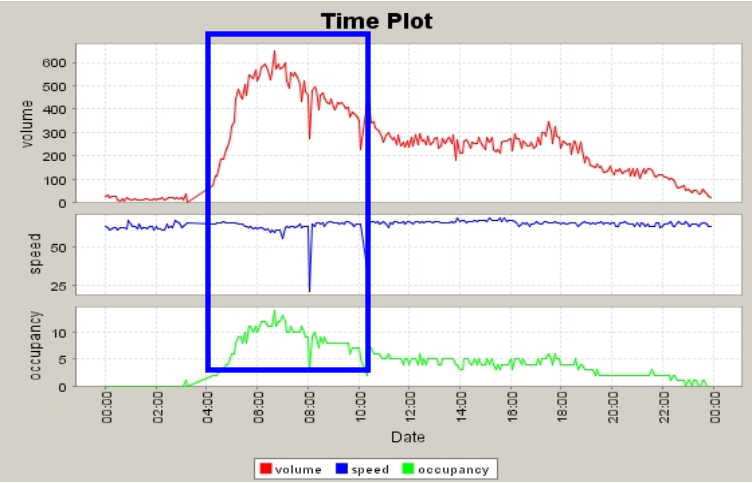
- High performance
  - Quick response time: 3 seconds/query
- Web-based user interface

Main Web Interface

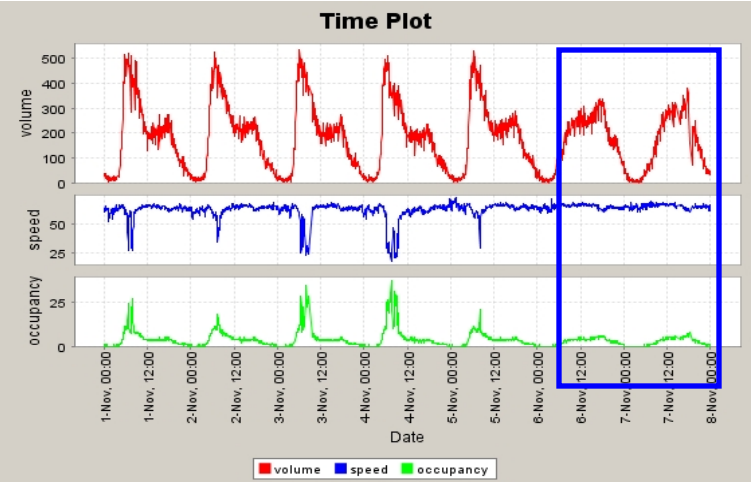


Time Plots

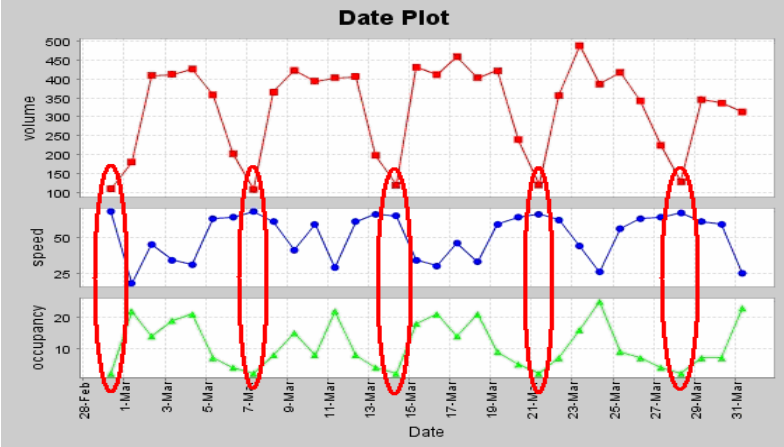
I-66 EB Station 121



Daily Pattern



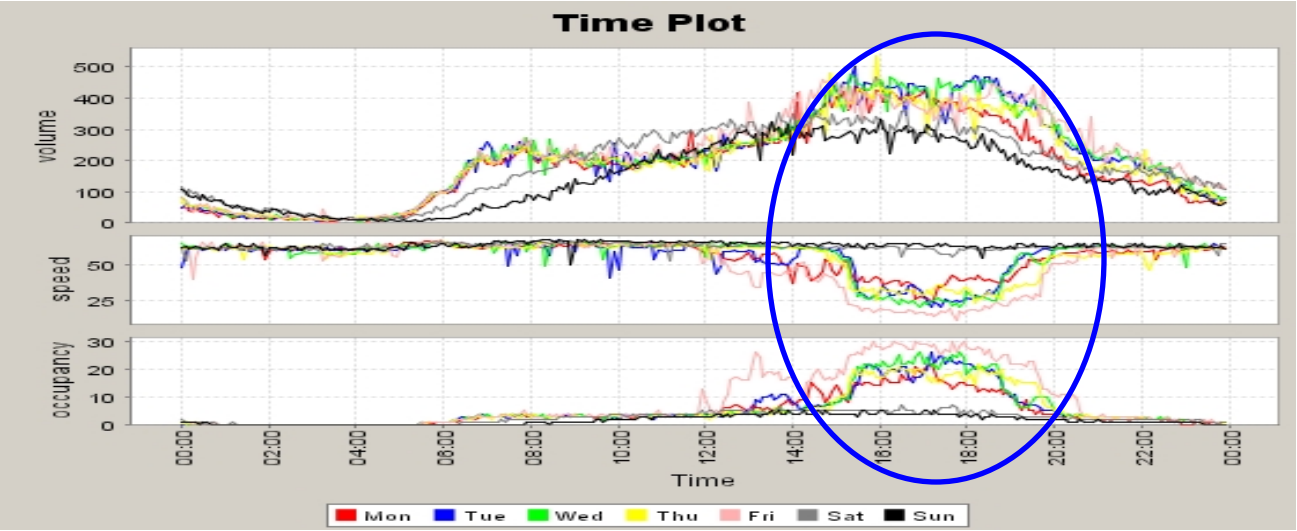
Weekly Pattern



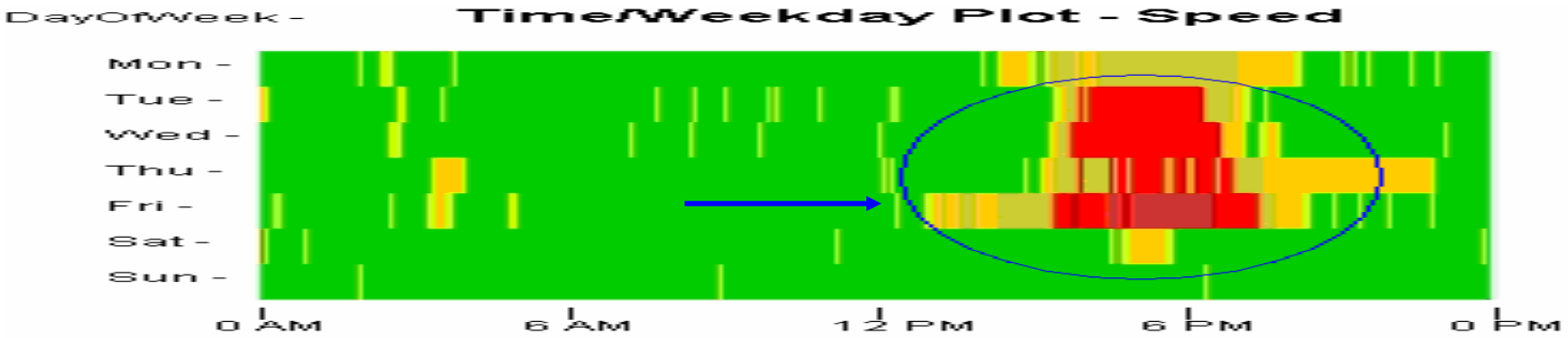
Monthly Pattern at 8:30 AM

Time Plots

I-66 WB Station 52



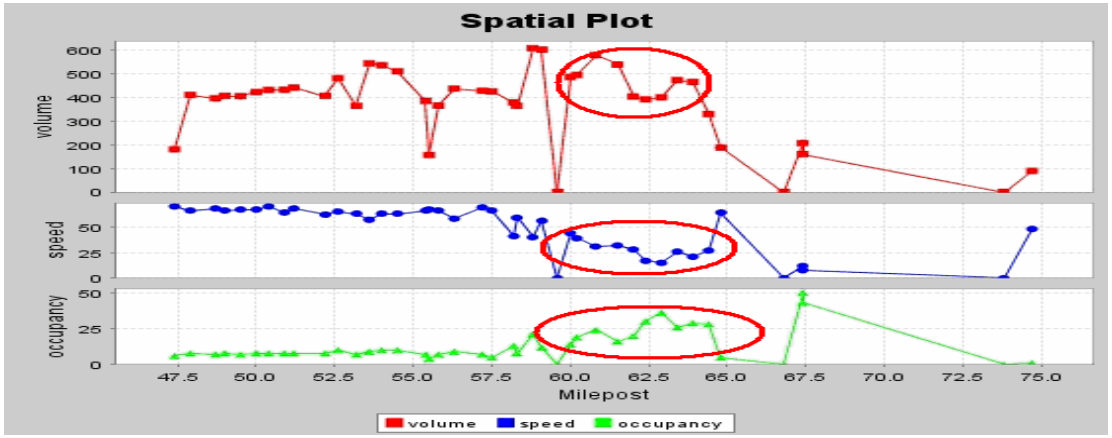
Composite View



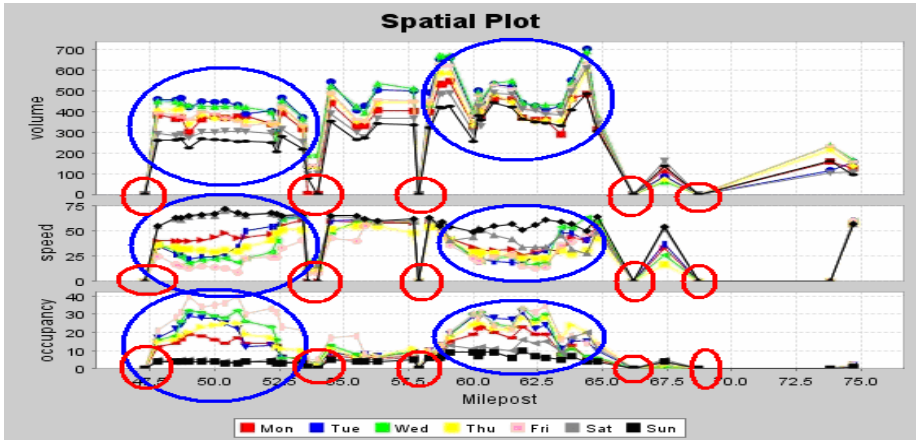
Color-valued Plot

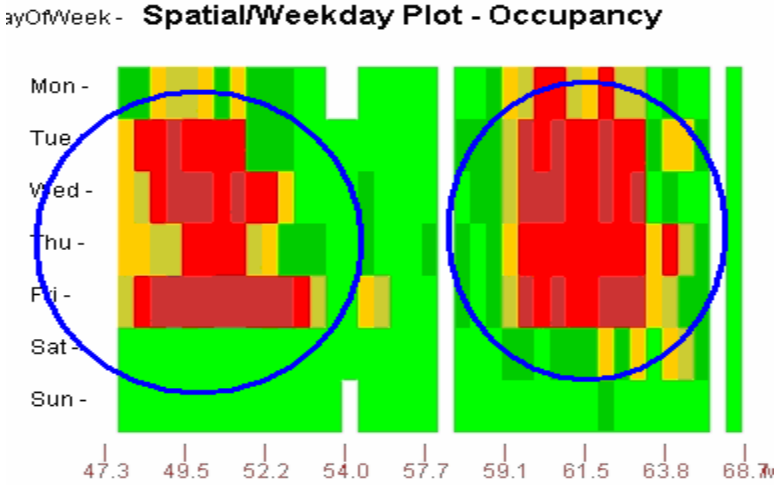
Spatial Plots

I-66 All stations



Single Day View (EB 8:30AM)



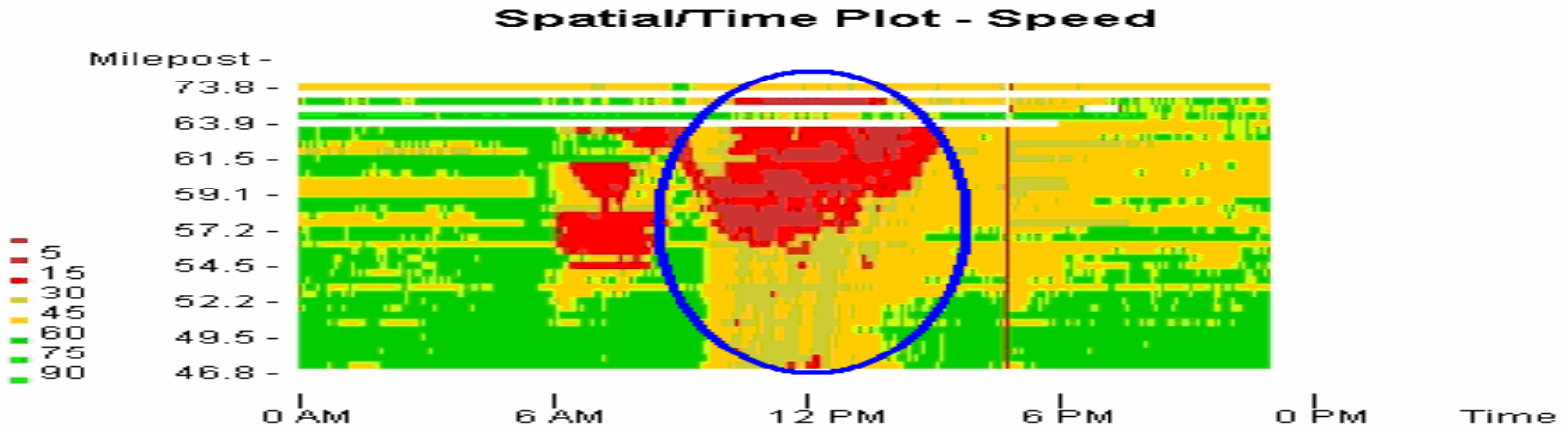


Composite Views (WB 6PM)

Spatiotemporal Plots

I-66 All stations in a given day

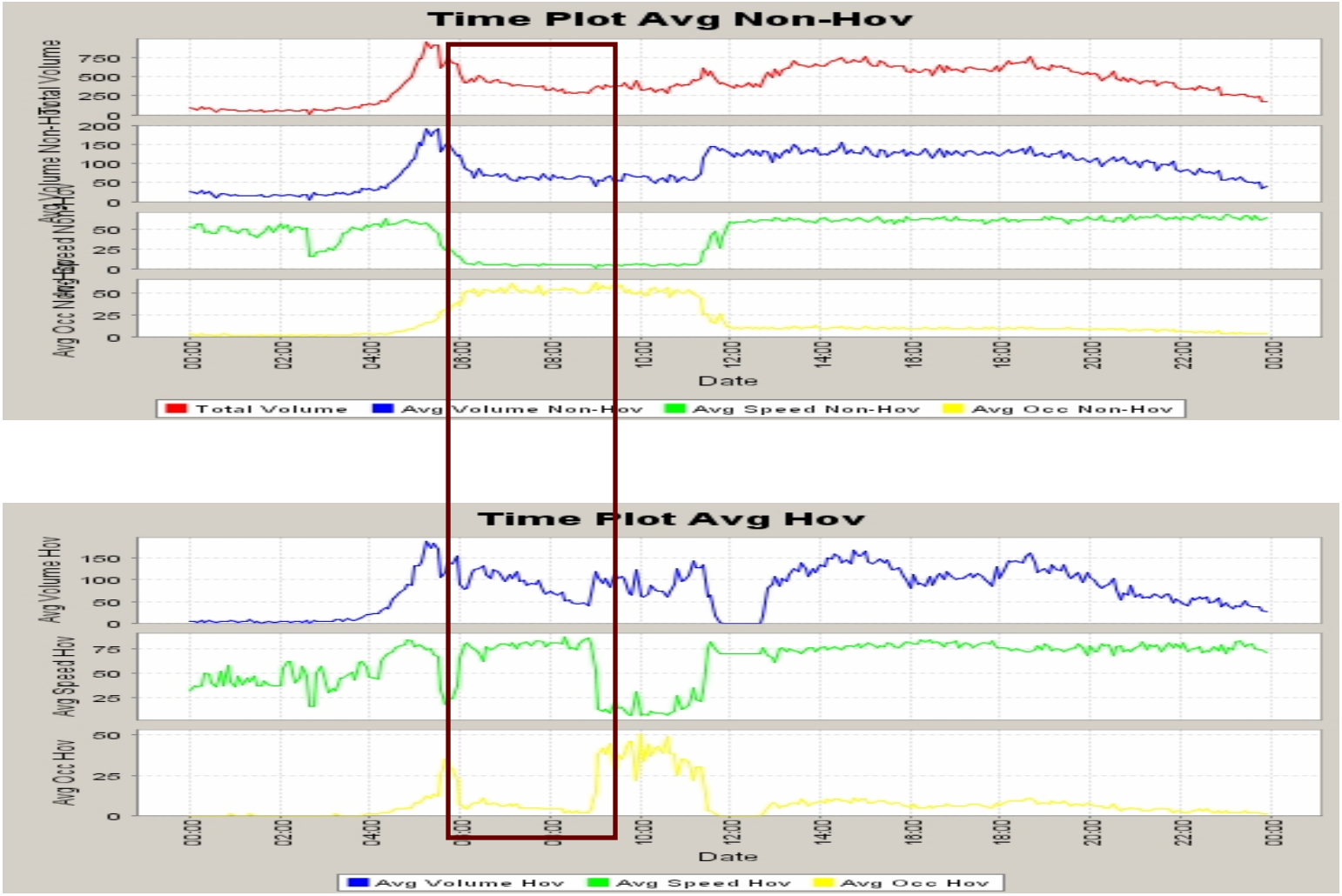
I-66 Saturday Accident



I-66 Severe Inclement Weather

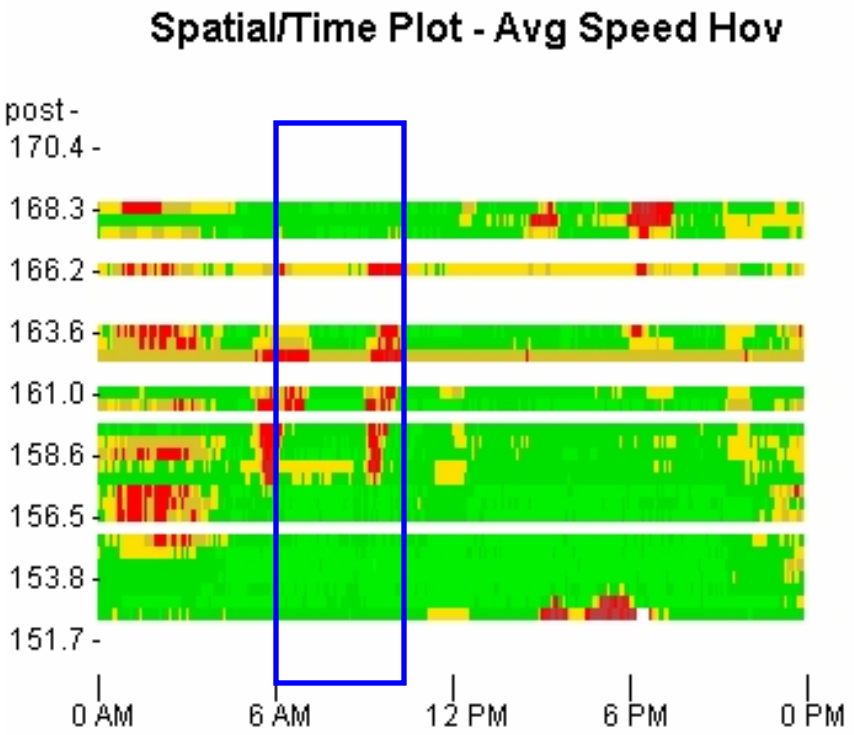
HOV vs. Non-HOV Lanes Time Plots

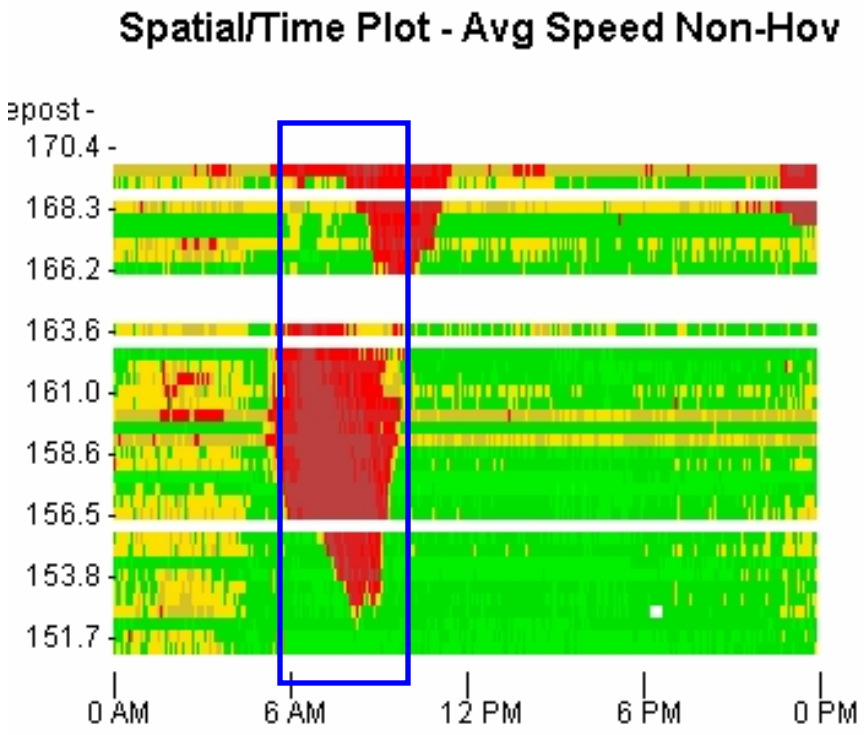
I-95 NB



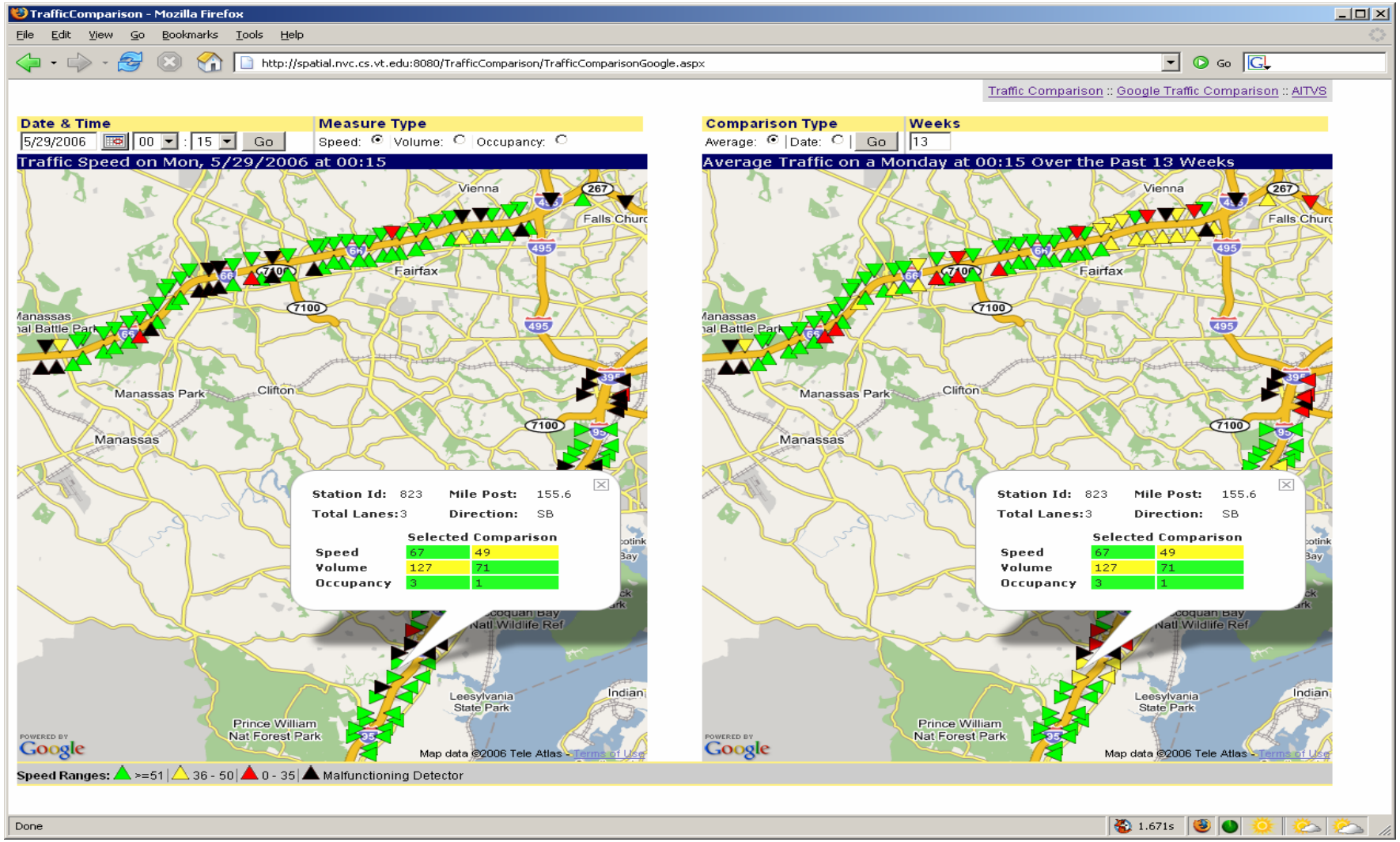
Spatiotemporal HOV Monitoring

Weekday, I-95 NB, Traffic Flow (All Stations)



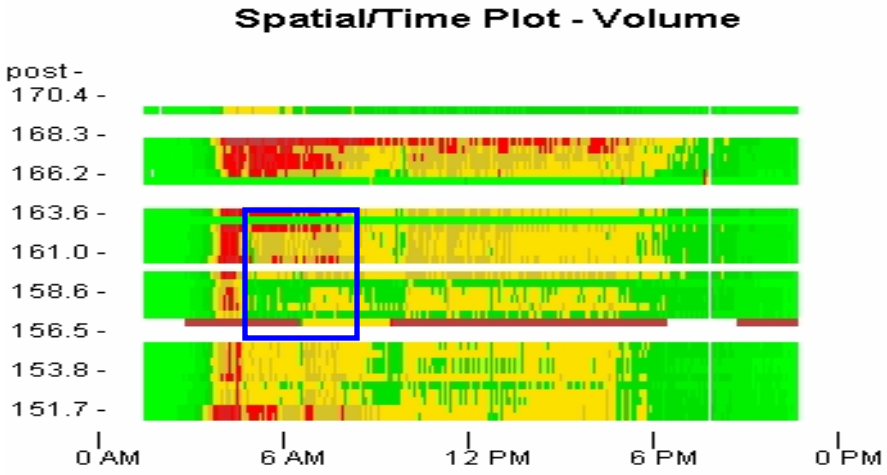


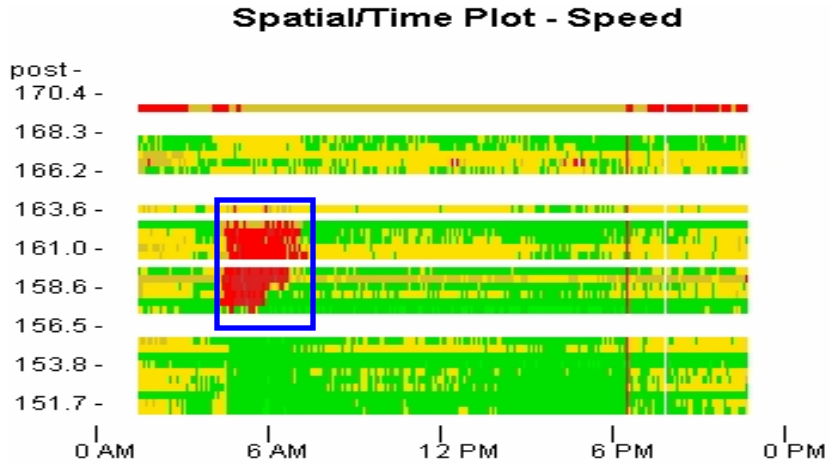
Traffic Comparison and Detector Monitoring

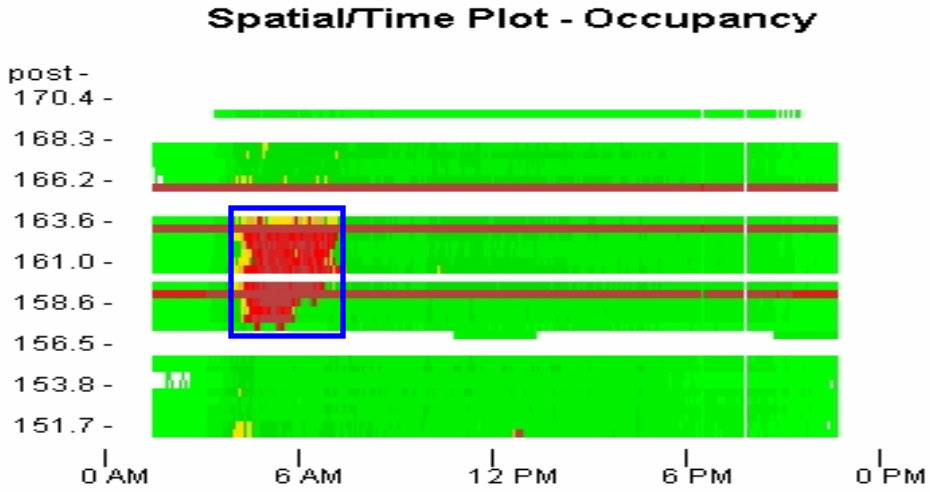


Case Study: #3 Ranked Congestion

Weekday, I-95 NB, Dale Blvd and Prince William Pkwy (Milepost 157-161), 5-7AM

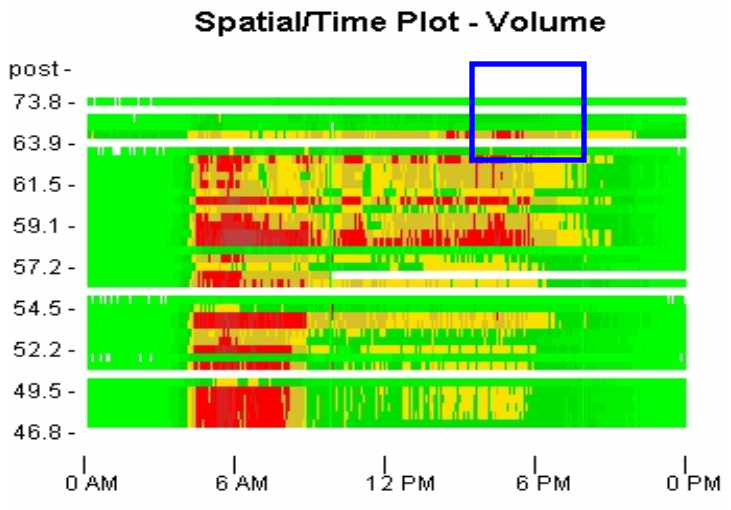


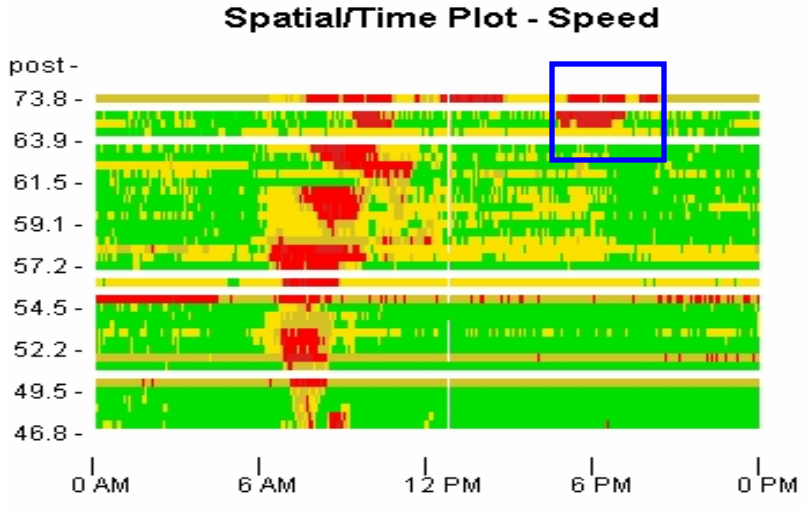


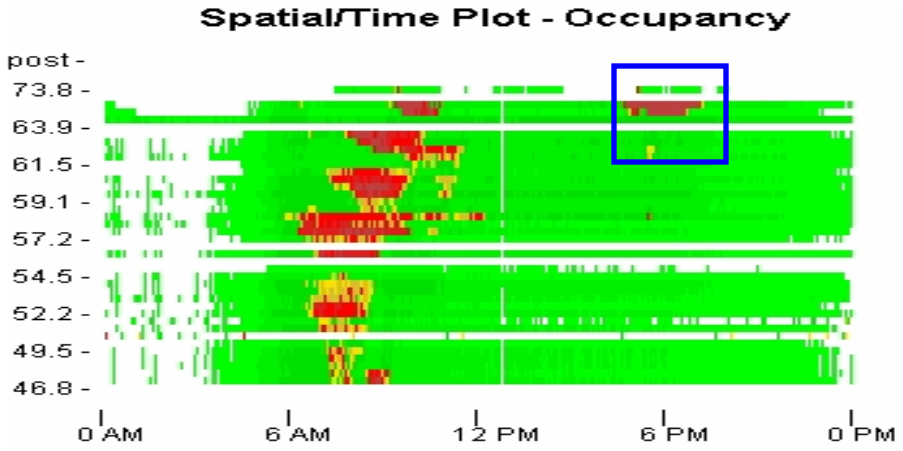


Case Study: #7 Ranked Congestion

Weekday, I-66 EB, between dulles toll and westmoreland st (milepost 64.8-68.7), 5-7PM

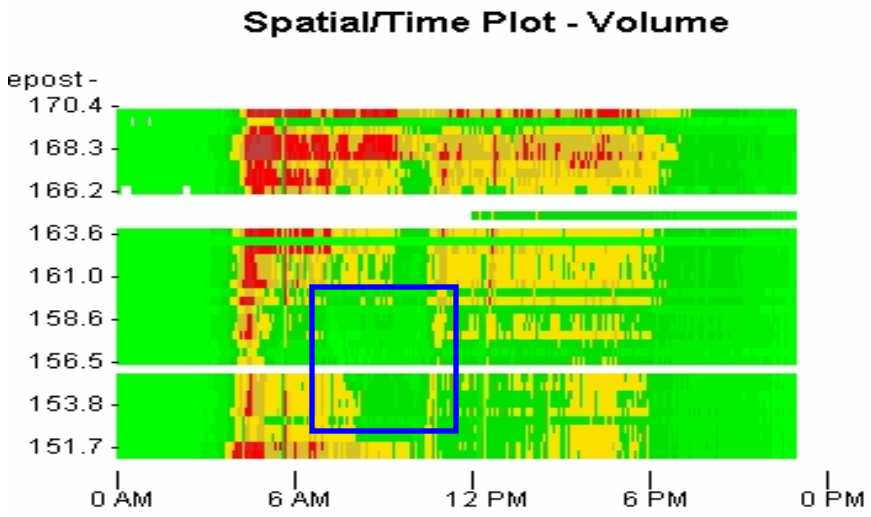


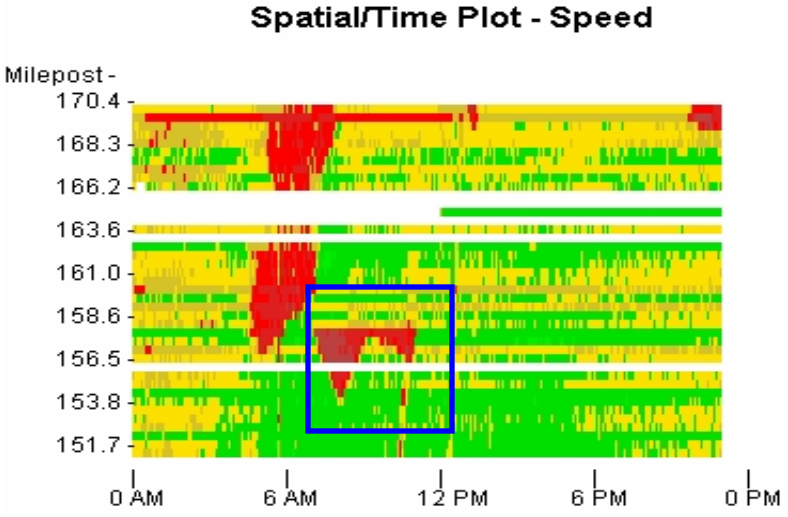


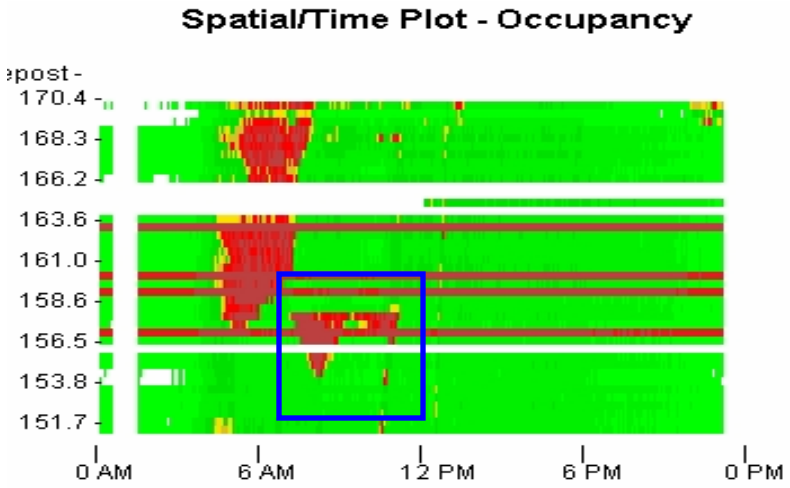


Case Study: Highway Closure

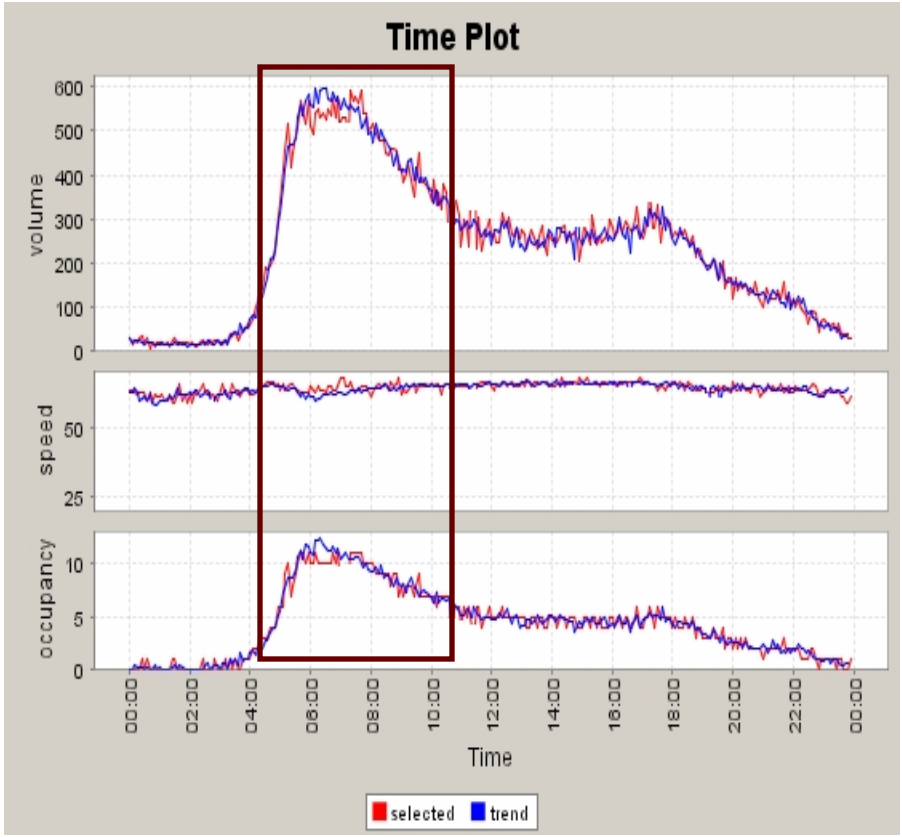
2/8 (Wed), 2006 I-95 NB, Traffic Flow (All Stations), Incident 8-10AM:10-12PM, MP 153.8-157



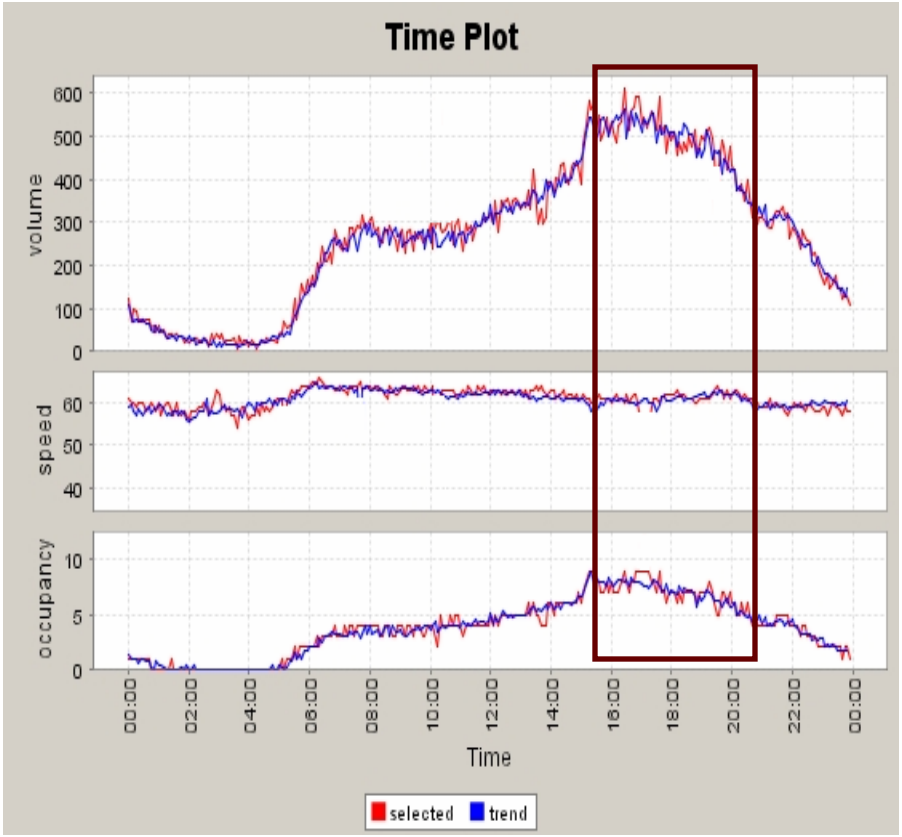




Traffic Prediction

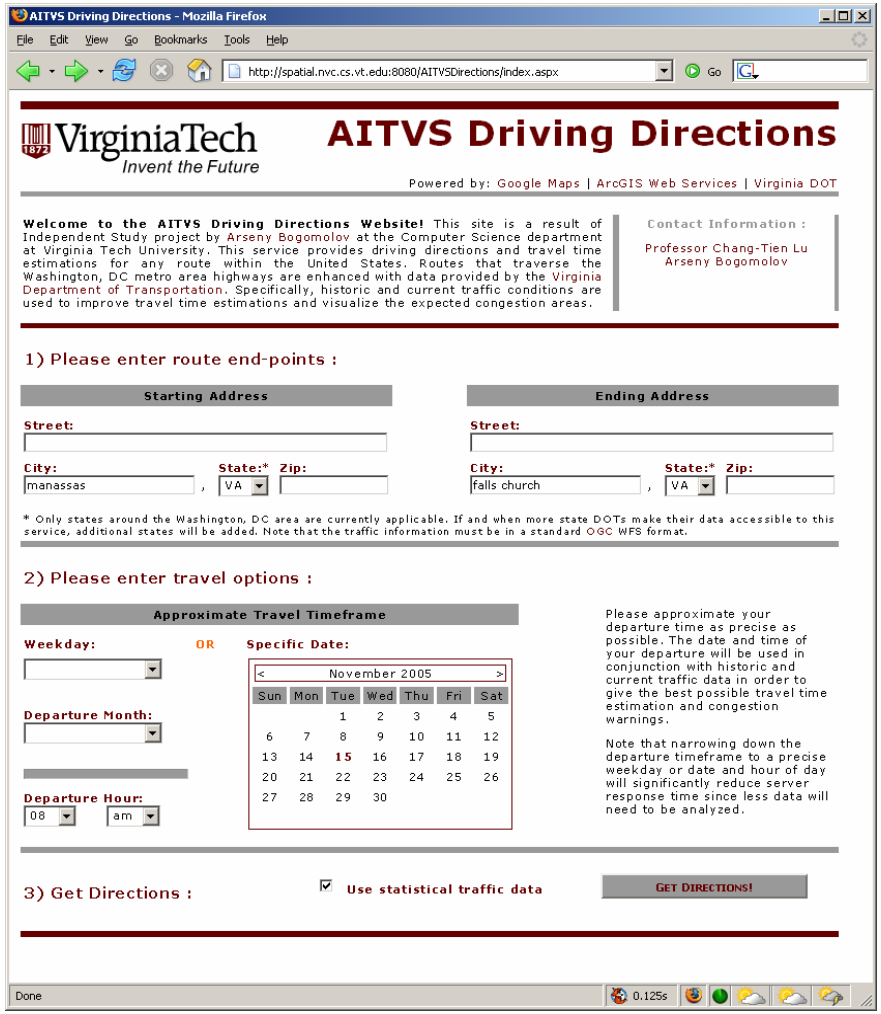


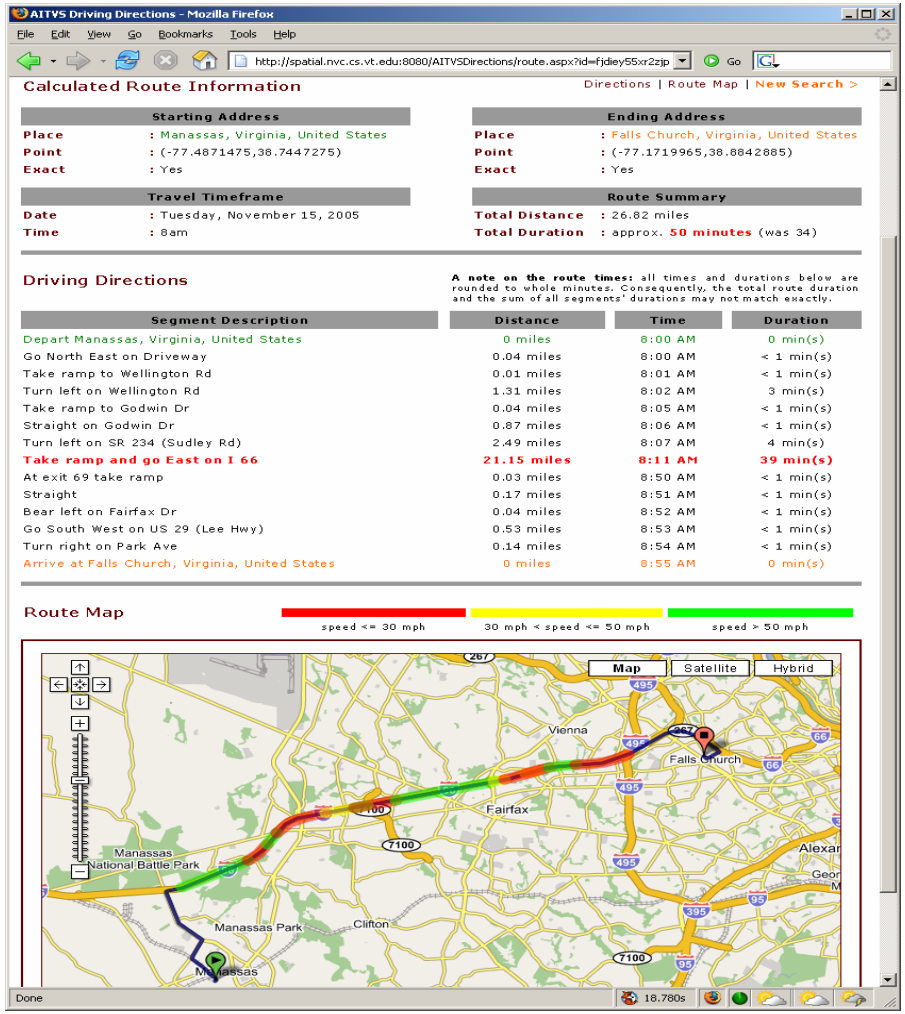
I-66 East bound traffic



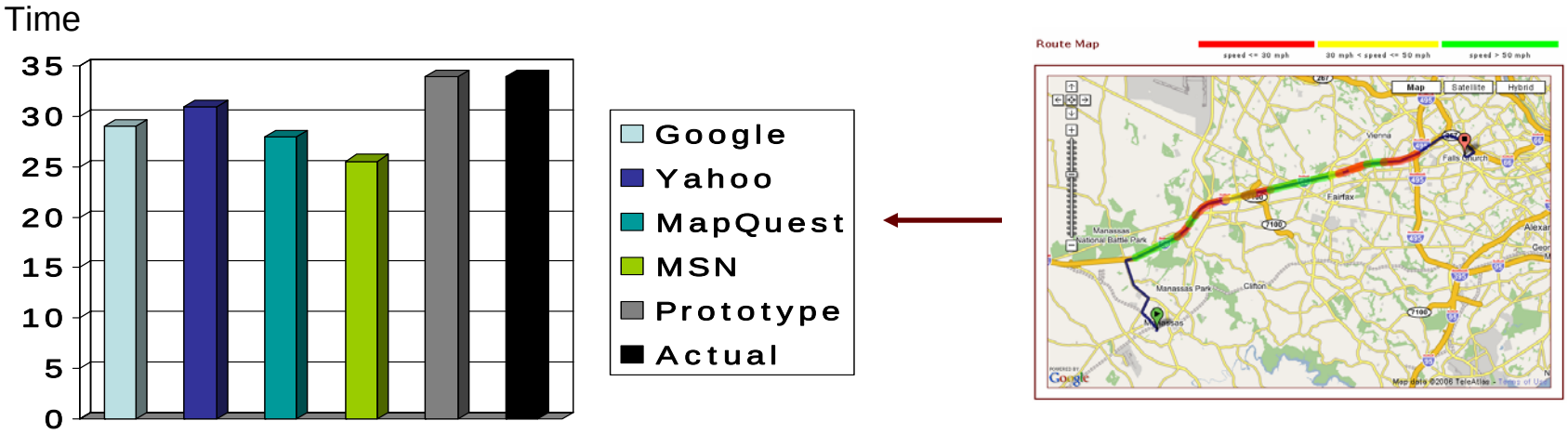
I-66 West bound traffic

Travel Time Estimation

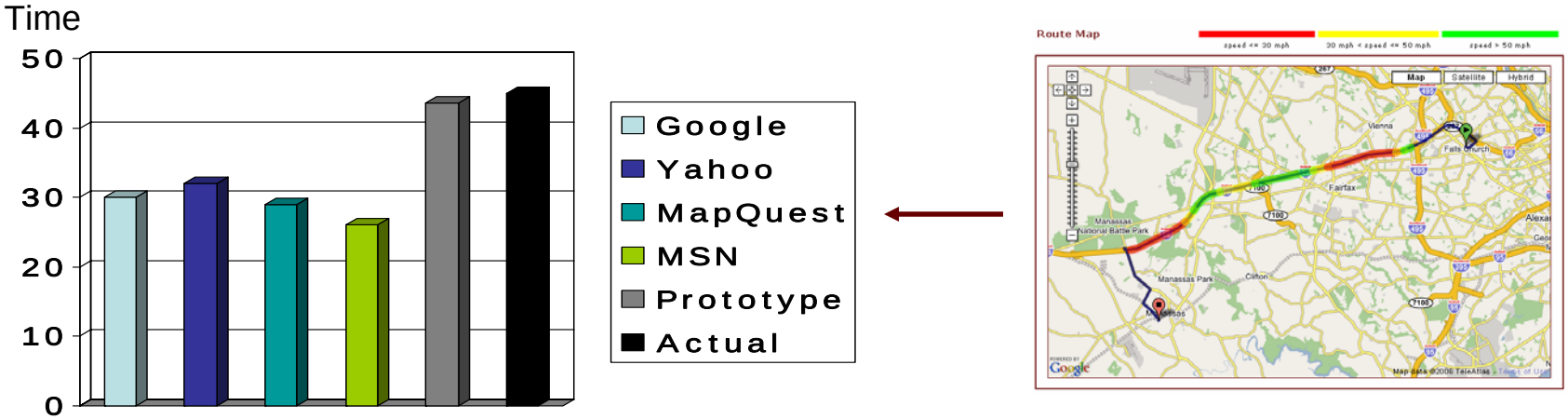




Travel Time Estimation

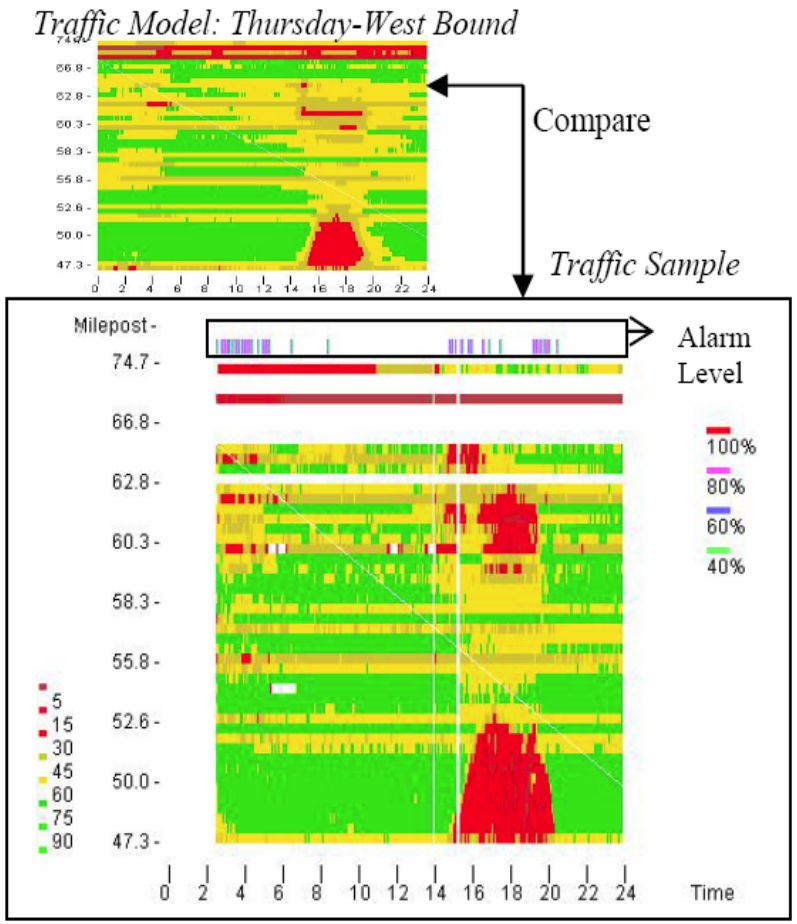


Manassas -> Falls Church (8AM)

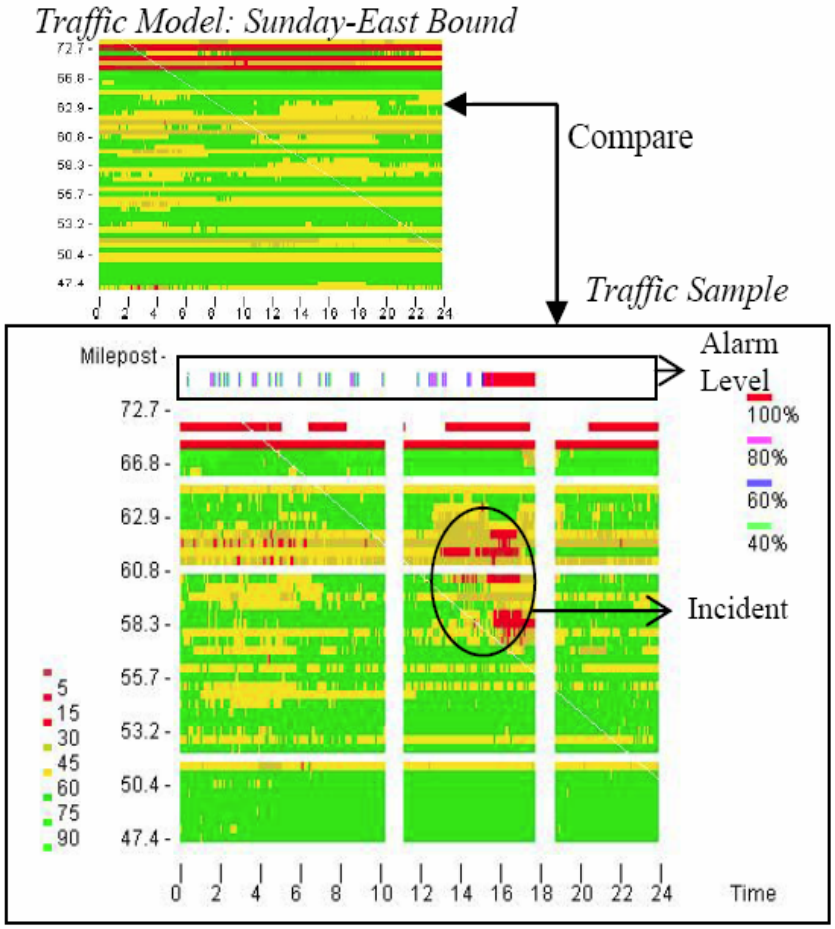


Falls Church -> Manassas (4PM)

Automatic Incident Detection

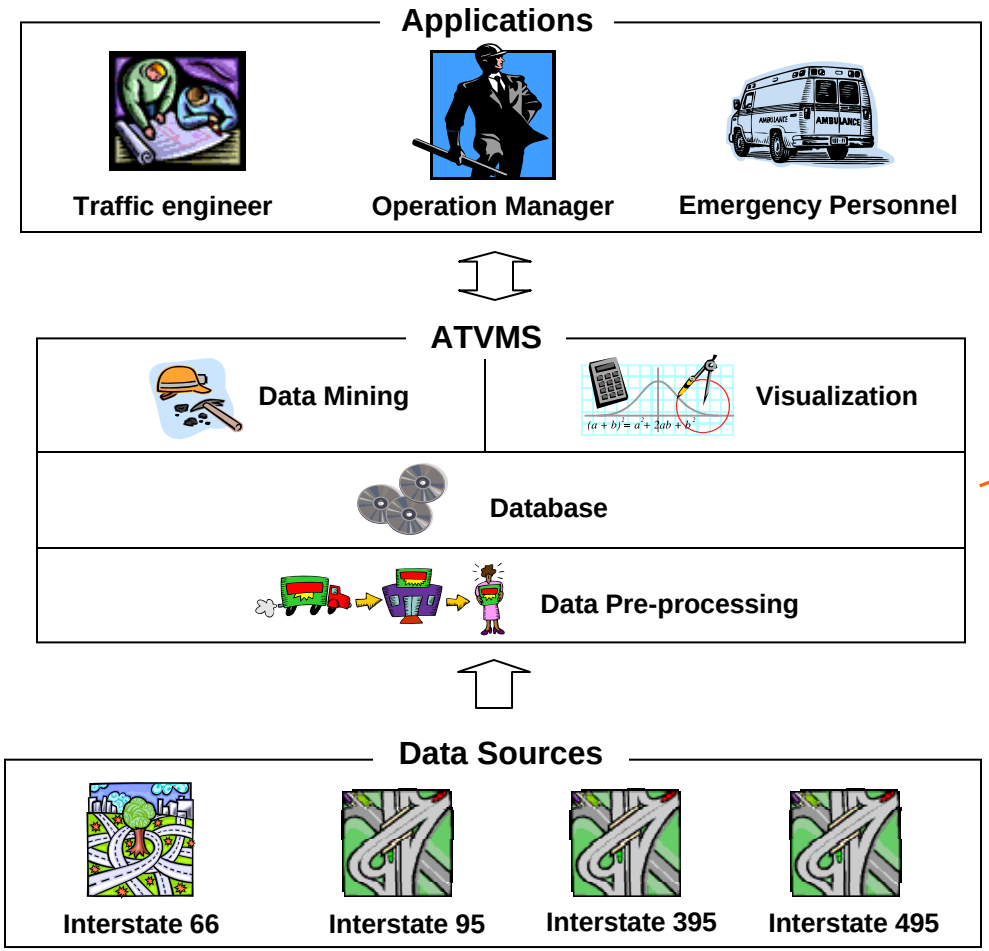


No Incident



Incident

ATVMS Architecture



- Quick response times
- Multiple visualization components

- Components and layers
- Real-time constraints
- Composite indexing
- Data caching

- Raw detector data
- Stored and compressed

Conclusion

- Multiple visualizations
- Support data mining tasks
- High performance
- Application: Operations
  - Routing and guidance for travelers and commuters
  - Ramp meter control (freeway operation)
  - Incident management

Acknowledgements

- Principal Investigator
  - Professor Chang-Tien Lu
- Research members
  - Arnold Boedihardjo
  - Arseny Bogolomov
  - Jeff Joyner
  - Kenneth Nehring
  - Jack Zhang
  - Jinping Zhang