

# Speed Data Issues

## Planning & Operations Perspective

Presented to:

**FHWA Speed Data Workshop**

Presented by:

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# Speed Data Issues

- Drivers for speed data
- Challenges
- Real life examples
- Using ATRs for speed monitoring
- Recommendations

# Drivers

- Congestion
- Mainstreaming operations and planning
  - Demonstrate value - Transportation System Management and Operations
- Reauthorization
  - Performance Measures
    - Speed, travel time reliability, incident response, detector health
- FHWA
  - 1201
- Increasing number of sources

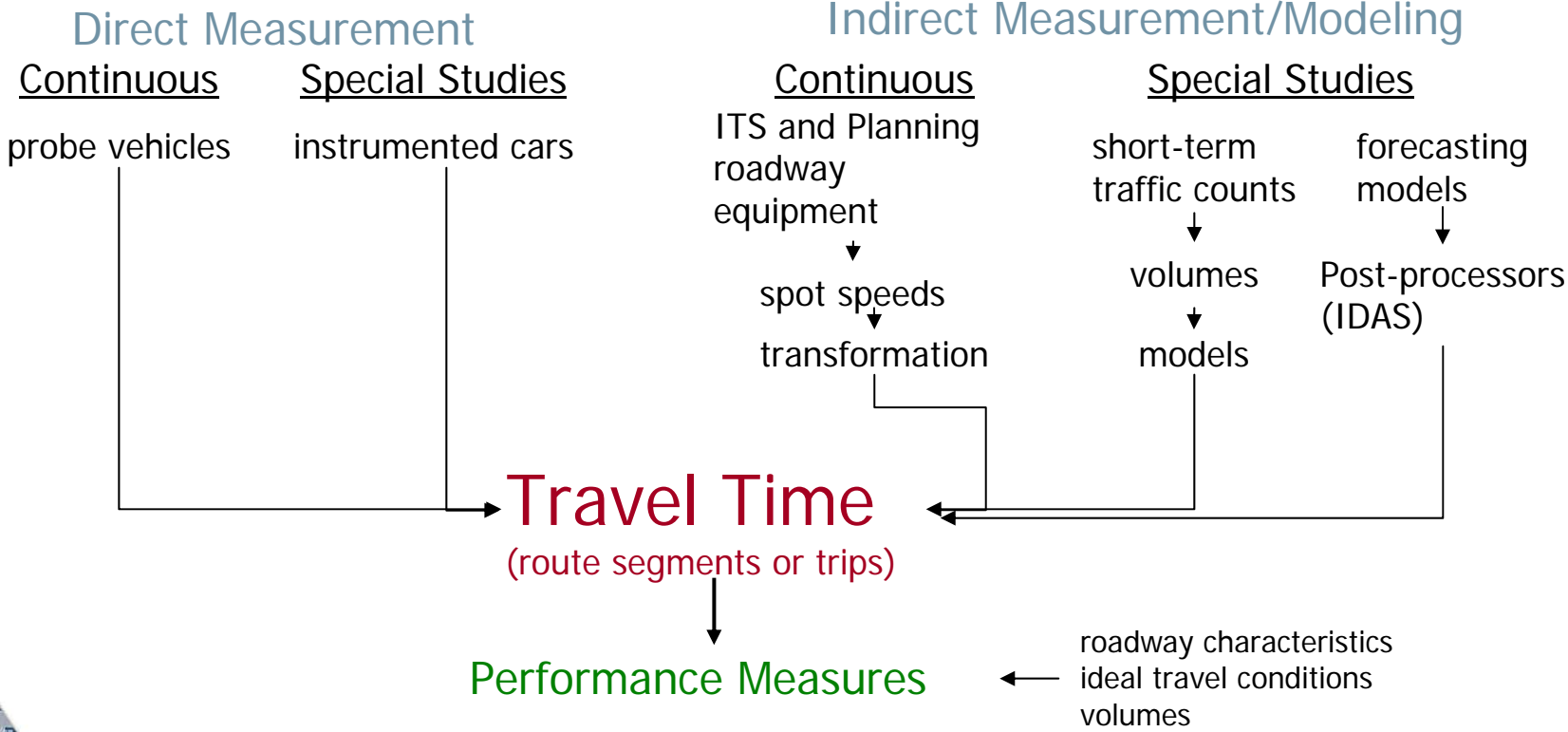
# Congestion – What can we do about it?

Problems, challenges	% of total urban delay	Example strategy/tools	Potential Effects % of total delay
<ul style="list-style-type: none"> <li>• Excess of demand over capacity</li> <li>• Geometric discontinuities</li> <li>• Operational friction</li> <li>• Lack of options for high-value trips</li> </ul>	20-30	Reduce variability and provide premium options <ul style="list-style-type: none"> <li>• Application of speed control/ramp metering/lane control</li> <li>• Premium/priced managed lanes</li> </ul>	5-10
Signal timing	4-13	Minimize delay and increase reliability <ul style="list-style-type: none"> <li>• Systematic retiming across all jurisdictions</li> </ul>	2-5
Crashes & breakdowns	20-42	Improve safety/security <ul style="list-style-type: none"> <li>• Integrated Freeway service patrol with DOT/PSA combined incident management program (quick clearance, towing incentives, etc.)</li> </ul>	10-20
Construction work	8-27	Minimize delay and improve safety <ul style="list-style-type: none"> <li>• MUTCD-compliant work zone traffic control</li> <li>• automated speed control</li> </ul>	4-13
Weather impacts (snow, ice and emergencies)	5-10	Minimize delay and improve safety <ul style="list-style-type: none"> <li>• Prediction/advisory</li> <li>• Advanced treatment regimes</li> </ul>	2-5

# SMART Performance Measures

- Non-recurrent congestion approximately 50 percent of delay in urban areas
- Performance measures are means to implement SMART Objectives
  - Specific, Measurable, Agreed upon, Realistic, and Time bound operations objectives are key to moving forward
- Operational analysis needs to be embedded into the planning process

# Travel Time Data Collection



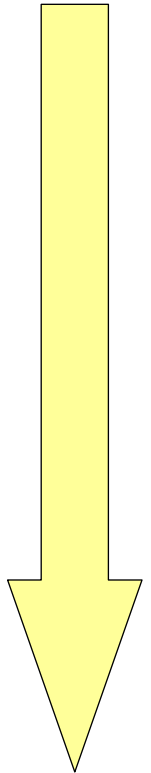
# Traffic Monitoring Equipment

- Continuous data collection
  - Probe vehicles
  - Point-based sensors
- Special studies (periodic)
  - Instrumented vehicles
  - Estimation from short-term counts
  - Estimation from demand forecasting models

Hypothesized accuracy

high

low





# Probe Vehicle Methods

- Methods:
  - Toll tags
  - Automated license plate matching
  - Satellite tracking (fleet, navigation)
  - Cell phone (other personal wireless devices)
  - Intellidrive
- Conceptually the most accurate but “it depends” (sample size)
- Direct measure of travel time, but flow (volume) must be estimated



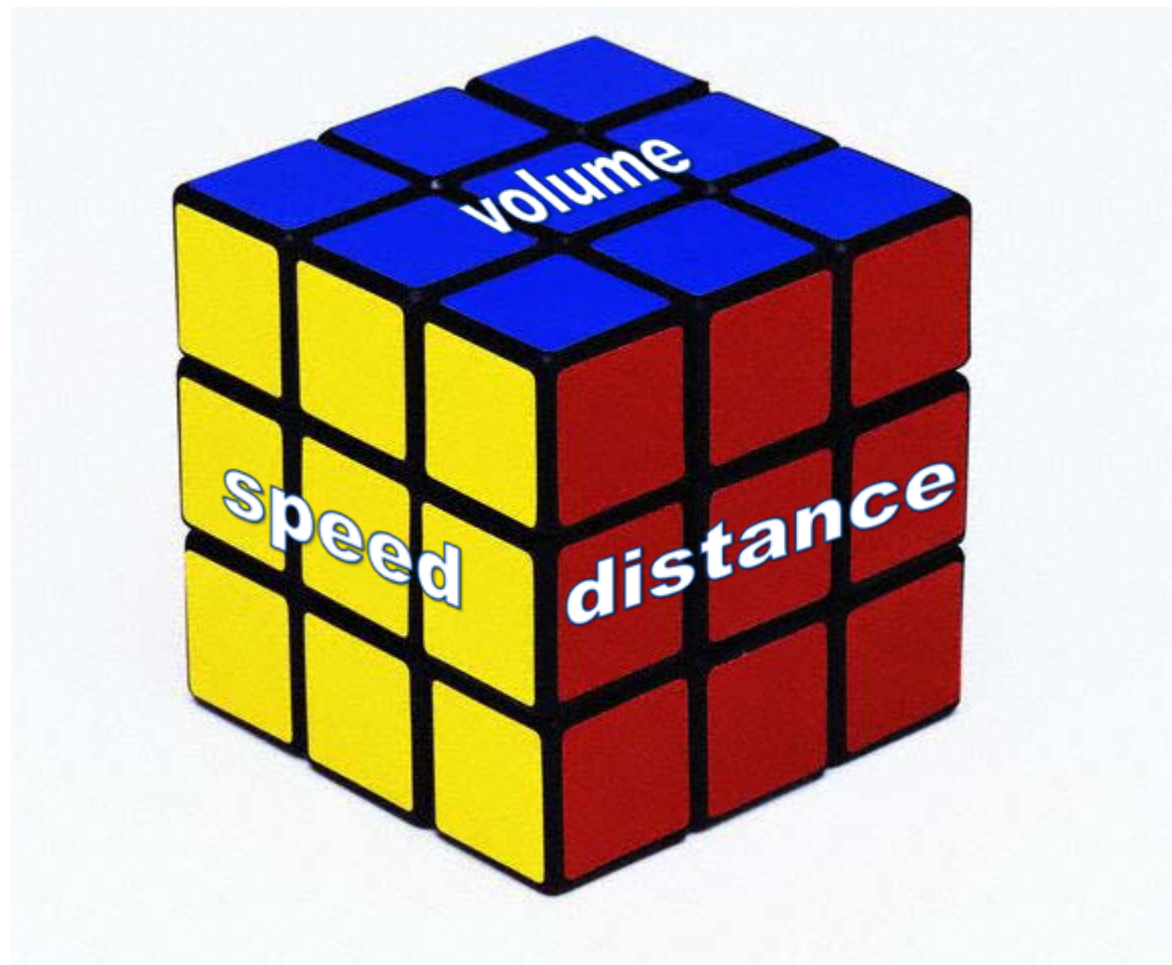
# Point-Based Sensors

- Methods:
  - Loop detectors
  - Non-intrusive (radar, acoustic, infrared, etc.)
- Direct measure of flow, but travel time estimated from spot speeds
- Accuracy depends on sensor location and spacing
- Most prevalent monitoring in urban areas

# Instrumented vehicles (Special studies)

- Methods
  - GPS
  - DMI: distance-measuring instrument
  - Manual: stopwatch & clipboard
- Not continuous
- Labor-intensive, costly
- Travel Time Data Collection Handbook (FHWA-PL-98-035)

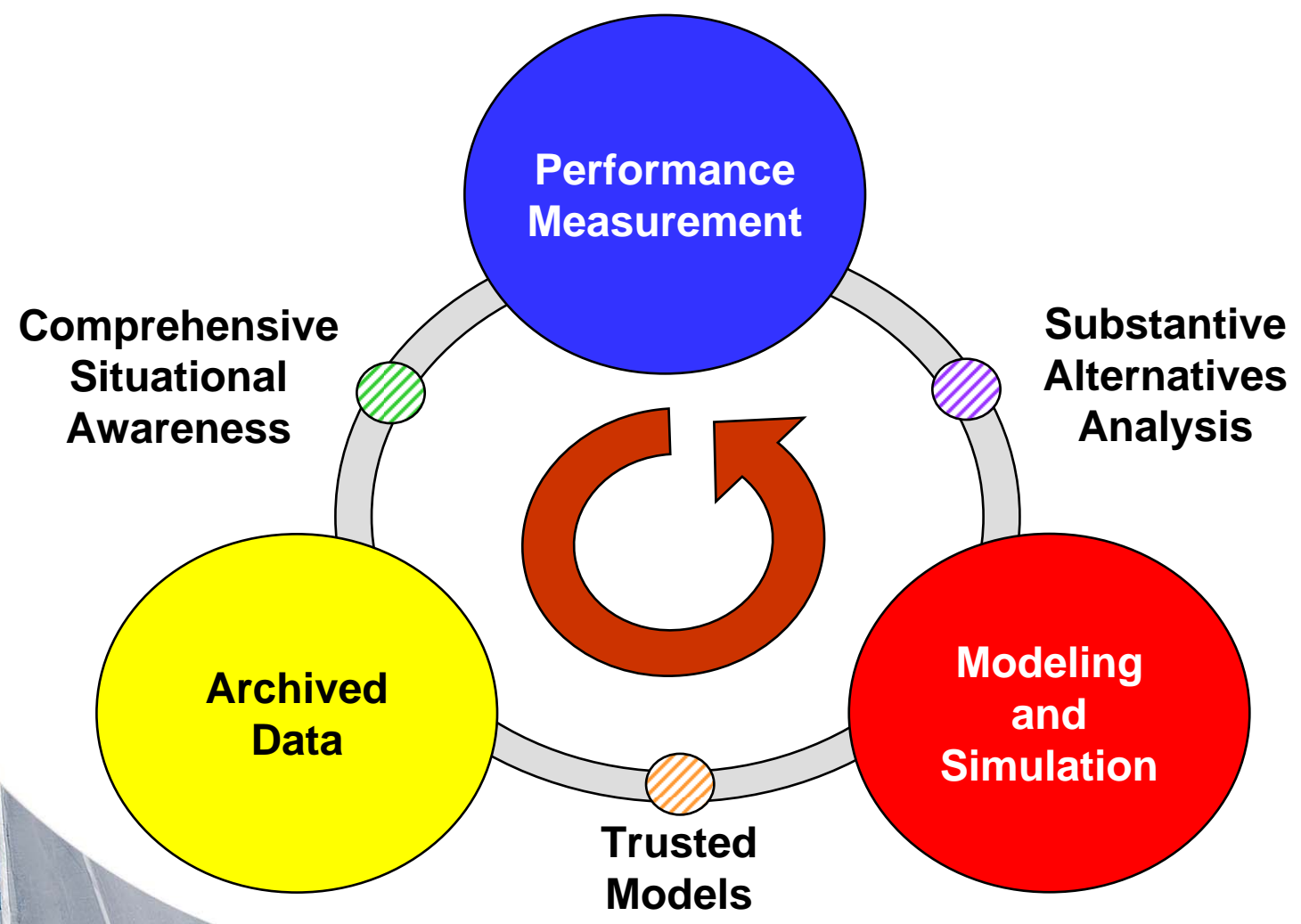
# The 3 D Future of Traffic Data



# Real Life Project Examples

- Integrated Corridor Management (ICM)-  
Caltrans
- Transportation System Management and  
Operations (TSM&O) - Florida

# ICM - A Process for Continuous Improvement



# The Purpose of ICM Analysis

- Invest in the right strategies
  - A predictive capability to help determine which combinations of strategies are most effective
- Invest with confidence
  - Minimize conflicts or unintended
- Improve effectiveness/success of implementation
  - Help in building consensus among stakeholders
  - Optimize implementation staging



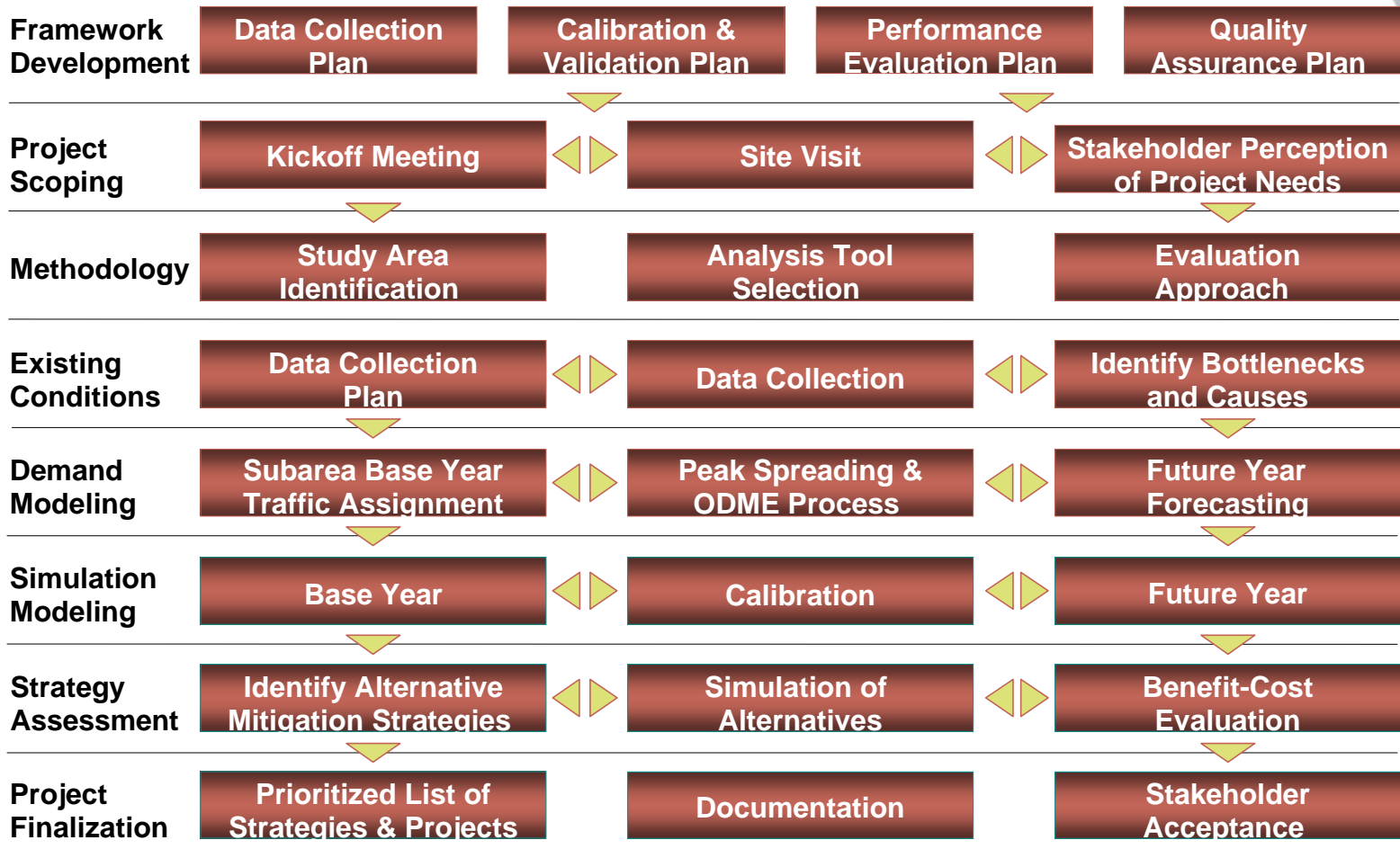
# Major ICM Analysis Efforts

- **USDOT ICM Program**
  - Three Stage 2 Sites (Minneapolis, San Diego, Dallas)
  
- **Caltrans CSMP**
  - Twenty major corridors in California
  - Sacramento, SF Bay Area, Los Angeles region, Monterey/Santa Cruz, Orange County, San Diego, some Valley locations
  
- **Atlanta GA**
  - Beltway and Radial Highways
  
- **New York**
  - Buffalo and Mid-town Manhattan



# ICM Analysis – Scope of Work

High-Level Analysis Framework



Project Specific

# ICM Analysis Operational Scenarios

Scenario	Minn.	Dallas	SD
No Incident		●	●
Major Freeway Incident	●	●	●
Minor Freeway Incident	●	●	
Major Arterial Incident	●		●
Minor Arterial Incident	●		
Transit Incident			●
Snow Event/Inclement Weather			
Ball Game/Special Event			●
High Demand	●	●	
Medium Demand	●	●	●
Evacuation Event/Disaster Response			●

# Data Challenges in the Analysis of ICM

- **Large data needs**
  - Quality, Consistency
- **Data across different operational conditions**
- **Arterial street data**
- **Transit data**
- **Bottleneck, queuing and congestion data**

# Data Challenges in the Operation of ICM

- **Volume, speed, bottleneck, queuing and congestion data**
  - Quality, Timeliness, Consistency, Comprehensiveness
- **Arterial street and Transit data**
- **Incident data**
- **Detection layout for optimal monitoring and identification of traffic patterns**

# Data Challenges in the Operation of ICM (con't)

- **Data filtering and fusion**
  - Standard ways to accept or reject field data
  - Addressing data gaps/missing data
  - Combining or fusing data from different technologies
- **Change in maintenance practices to focus on**
  - Quick replacement of defective data collection equipment
  - Installation and testing standards for sensor equipment

# TSM&O

*TSM&O is a **new program** within the Department of Transportation. It is based on **measuring performance, actively managing the multimodal transportation network** and delivering positive **safety and mobility** outcomes to the traveling public in Florida.*





# Purpose of the TSM&O Program

- Active Arterial Management
- Incident Management
- Performance Measurement





# Current Operations Challenges

- Congestion

- Variability in travel time as a result of less than optimal operation of system
- Inconsistent operating treatment of freeways/arterials (ITS and incident management)

- Processes

- Inconsistent approaches and plans for operating improvements
- Variety of stakeholders involved

# System Performance Measurement Areas

- Physical condition of infrastructure, vehicles, and equipment
- System usage
- System service levels - Travel time, Delay, Reliability
- Safety
- System operations
  - Time to clear incidents

“What gets measured gets better”







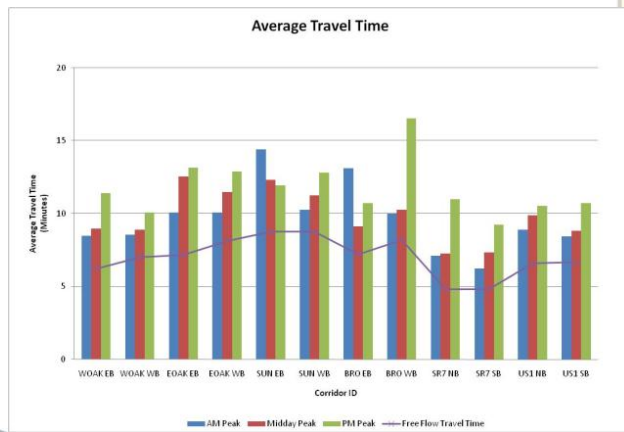
# Traffic Management Center



# Data Collection & Management

- Data processing
  - Travel Time Data – GeoStats TravTime Software
  - Other Data – Access Database Tool

- Data visualization
  - Includes table-, graph- and methods



# Performance Monitoring

- Data collection & management
  - Automate data collection activities
  - Automate data transmission from freeway, arterial and transit systems
  - Design and deploy central data archive
- Using performance results in the TSM&O Program
  - Accountability
  - Policy changes
  - Evaluation



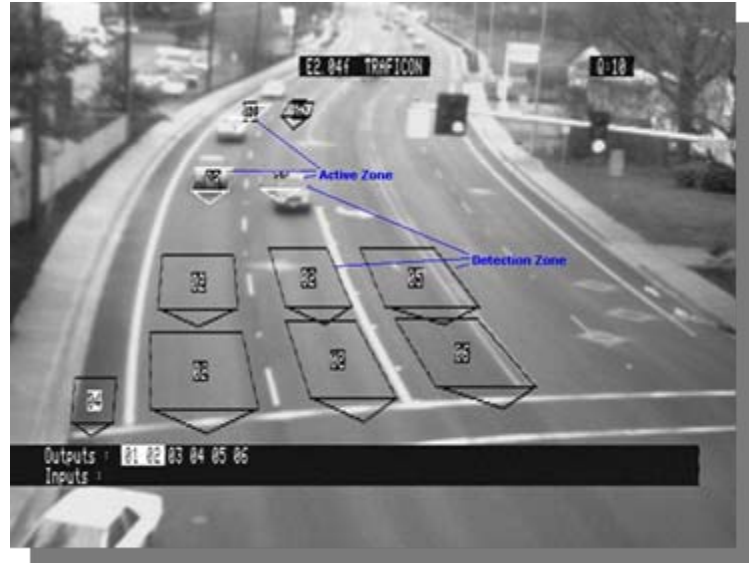
# Travel Time Experiments

- Objective in 1 year plan is to automate data collection
- Significant investments have been made to upgrade the signal systems
- Devices such as video vehicle detection cameras, CCTV traffic monitoring cameras, advanced signal software, etc.



# Travel Time Experiments

- Video Vehicle Detection Cameras detect vehicles and tell controller a vehicle is waiting for a green
- These cameras can also collect speeds and volumes
  - Can an algorithm be developed that will provide travel time in real time?



# Why National Speed Monitoring?

- Assumption

- Monitoring changes in speeds for ATRs provides a reasonable estimate of changes in congestion



# Advantages of Using ATRs for National Speed Monitoring

- Stable base of well-maintained locations
  - Problem with ITS detectors
    - Downtime of current detectors plus addition of new ones makes consistent areawide numbers difficult
- Would probably capture impacts of large scale events (weather, evacuations) but not more routine congestion which is localized

# Disadvantages of Using ATRs

- Locations
  - Limited number
  - Hard to characterize congestion on a facility from one spot speed measurement
- Only really relevant for freeways (midblock arterial speeds are not informative since delay happens at the signal)
- Speed bins will mask small changes

# What Should We Do?

- Test ability of urban freeway ATRs to track changes in congestion
  - Compare multiple year ATR estimates (% change in speed) to ITS or vehicle probe data for same facility/urban area
- Look for ways to combine ATR volume/VMT estimates with vehicle probe data
  - Vehicle probe data likely to be the source of systemwide congestion data, but only has speeds, not volumes