

22<sup>nd</sup> Annual Conference

## Arterial Performance Measures Based on High Resolution Data

Alex Skabardonis California PATH UC Berkeley

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Work with Pravin Varaiya, Zahra Amini, Robert Campbell





- Background
- Signalized Intersections:
  - Performance measurement
  - Timing plan development
- Arterial Performance
  - ATCS assessment on Pacific Coast Highway
  - Proposals for control improvements
- Looking Ahead

# Background (1):

**Traffic Flow Variability vs. Control** 

- Fixed-Time Plans
- Time of Day (TOD)
- A No Detection
  - May be actuated
  - Fixed time plans
- **B** Traffic responsive plan selection
  - System detection
  - Traffic responsive control
- **C** On-line timing development
  - Approach & system detection
  - Adaptive control
- **D** Measure & predict arrivals per cycle
  - Extensive detection



# **Backround (2): Traffic Control Systems**

- Most signal systems fixed-time control
  - Limited data
  - Out-dated timing plans
- Adaptive systems
  - High cost
  - Complex to understand and operate



Source: Alek Stevanovic, NCHRP Synthesis 403

## **Approach: Use of HR data\***

- Performance measures for operators and travelers
  - Use of existing infrastructure
  - No interference with controller operation
- Improving Signal Timing Plans
  - Performance derived signal settings
  - Robust timing plans
- On-Going/Future Work
  - Traffic volume prediction
  - Safety (red light running)
  - Multimodal (pedestrians, bicycles)

\*Work with P. Varaiya & Sensys Networks "Management of Urban Traffic with H-R Data" IEEE ITSC 2014

# **Data Collection System**





## **Selected Test Site: Beaufort, SC**







## **Intersection Volume: Daily Variation**

2/28/2015, 7AM to 8PM



Total volume (veh/cycle)

Peak Period, 4-7 PM



Total volume (veh/15 minutes)

## **Approach Volumes & Turning Movements**

#### Peak Period, 4-7 PM



Approach Volume (veh/15 min)

Turning Mov -Leg 2 (veh/ 15 min)





Wasted green time: time phase is active with no vehicle present and conflicting phase call Vehicle arrivals: % arrivals on green

# Performance: Average Delay (sec/veh) HCM Level of Service (LOS)



## **Performance: V/c and LOS**



# **Improving Signal Timing Plans**

- Volume clustering best set of volumes for the three timing plans available
- New timing plans reduce intersection signal delay by 10% on average





# **ATCS Assessment**

- 5 mile Section of Pacific Coast Highway (PCH)
- Nine signalized intersections
- LADOT ATCS Control System





#### Data Collection Periods

- Preliminary ATCS Data Collection (ATCS-2012): 4 days
- Primary ATCS Data Collection (ATCS): 8 days
- TOD-230 Data Collection (TOD-230): 6 days
- TOD Optimized Data Collection (TOD-Optimized): 6 days
- Detector data
- Signal Timing data
- Bluetooth data
- Probe vehicles
- Video cameras

# **Comparison of Data Sources**

#### **PCH Travel Times --Probe Vehicles vs. Bluetooth**



**SB PCH Travel Times** 

**NB PCH Travel Times** 

- Travel times based on Bluetooth data Median and inter-quartile range
- **H** Travel times based on probe vehicles Median and inter-quartile range
- Difference at this time is significant at 5% level

# NB PCH Travel Times: ATCS vs. TOD Plan

- ATCS Travel time median and inter-quartile range
- TOD-230 Timing Plans Travel time median and inter-quartile range
- Difference at this time is significant at 5% level



# **SB PCH Travel Times: ATCS vs. TOD Plan**

- ATCS Travel time median and inter-quartile range
- TOD-230 Timing Plans Travel time median and inter-quartile range
- Difference at this time is significant at 5% level





# **ATCS Operational Issues (1)**

#### **Inefficient Splits:**

At the Bottleneck Location

#### •At intersections upstream of the Bottleneck





# **ATCS Operational Issues (2)**

#### Wrong Offsets Downstream of the Bottleneck



(C)





## Alex Skabardonis California PATH Institute of Transportation Studies UC Berkeley

skabardonis@ce.berkeley.edu 510-642-9166