USING PeMS DATA TO EMPIRICALLY DIAGNOSE FREEWAY BOTTLENECK LOCATIONS IN ORANGE COUNTY, CALIFORNIA

Robert L. Bertini
Portland State University

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Aaron M. Myton
Oregon Department of Transportation
Objectives

• Identify Freeflow → Congested Conditions
• Determine Bottleneck Locations
• Measure Queue Discharge Features
• Conclusions
Background

• Foundation for Understanding Freeway Operations
• Queues Cause Delays
• Loop Detectors Good Data Source
• Previous Studies
  – Throughput Increase 2-5% Prior To Queue
  – Diverge Bottleneck Identified
• PeMS Provides Opportunity for Detailed Data Analysis
Site Map

- Four Northbound Lanes
- One Northbound HOV Lane
- Freeway Ramps Between Stations, Except 100/110
Bottleneck Definition

- Queue upstream
- Freely-flowing traffic downstream
- Temporally and spatially variable
Data

- Freeway Performance Monitoring System (PeMS)
  - http://pems.eecs.berkeley.edu/Public
- Single Inductive Loops
- Vehicle Occupancy and Count
- Data Aggregated in 30-sec. Intervals
- On-Ramp/Off-Ramp Data Not Available
- Monday June 1, 1998
Methodology

• Cumulative Curves – Vehicle Count & Occupancy
• Oblique Plots N and T
Station 60 – Loops 1-4, Oblique N and T

- $N(60,t) - q_0 t'$, $q_0 = 8500$ vph
- $T(60,t) - b_0 t'$, $b_0 = 2000$ seconds per hour

SEGMENT #
- NO QUEUE
- QUEUE
## Results

<table>
<thead>
<tr>
<th>Queue</th>
<th>Input Station</th>
<th>Outflow Station</th>
<th>Pre-Queue Flow</th>
<th>Bottleneck Flow</th>
<th>Difference (%)</th>
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<tbody>
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<td>10500 vph</td>
<td>9600 vph</td>
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<td></td>
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<td>Flow vph</td>
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<td>Duration mm:ss</td>
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Conclusions

• Ten Queues Formed at Five Locations
• Flow Reduction of 3-15%
• No Queue in HOV Lanes
• Bottlenecks Typically Activated Near Ramps
• No Speed Threshold Needed
Future Research

• Study site on different days
• Manual replication of procedure
• Develop semi-automated method
Acknowledgements

• Prof. Pravin Varaiya and Prof. Alexander Skabardonis, U.C. Berkeley
• Dr. Karl Petty, Berkeley Transportation Systems
• Pherak Hay, Vu Mai, and Roger Lindgren
Station 40, Occupancy

Occupancy vs. Time

- 0% to 100% occupancy
- Time from 12:00 AM to 12:00 AM

Peaks at 8:00 AM and 10:00 AM
Station 70 – Loops 1-4 Oblique N and T

N(70,t) - q_0'(t), q_0 = 9500 vph

T(70,t) - b_0'(t), b_0 = 2400 seconds per hour
Station 60 – Loops 1-4, Oblique N and T

N(60,t) - q_0(60)t', q_0 = 8500 vph
T(60,t) - b_0(60)t'

Time, t

SEGMENT #

NO QUEUE
QUEUE