Using Bluetooth Detection to Estimate Traffic Impacts of Bridge Construction Alternatives for a Construction Manager/General Contractor Project in Fairbanks, Alaska
Overview

- Project
- Bluetooth Methodology
- Alternative Analyses and Results
- Conclusions
University Avenue

- Existing Conditions
  - Principal north-south arterial
  - 4-lane undivided
  - Serves 17,750 vehicles per day
  - Expected to serve 22,000 vehicles per day by 2035
  - Bridge over the Chena River
City of Fairbanks

- 7 bridges crossing the river
- One is on University Avenue
University Avenue Rehabilitation and Widening Project

- Improve safety for road users
- Widen to include center median with openings and left-turn pockets at regular intervals
- Adds sidewalks and bicycle lanes
- Positive left-turn offset lanes
- Reconstruct the bridge
Construction Manager/General Contractor (CM/GC)

- Retained early in design process
  - In Alaska – Qualification based selection
- Advises using construction expertise
  - Provides inputs about the constructability of design
  - Can propose recommendations and alternatives
- Negotiates contract prices
  - Project not bid
- Complex high-risk projects
  - Becoming the preferred delivery method
University Avenue Bridge

• Existing Conditions
  o 4 lanes
  o No shoulders
  o 4-foot sidewalks

• Proposed Re-design
  o 4-lanes with center median
  o 6-foot bike lanes
  o 6.5-foot to 8.5-foot sidewalks
Bridge Construction Alternatives

- Continuously maintain 2 lanes of traffic
  - Traffic merges to enter bridge
  - Pedestrians and bicyclists use sidewalk

- Completely close bridge
  - Divert all traffic
  - Pedestrian bridge
  - Proposed by Contractor
    - Speed construction
    - Reduce construction costs
Questions:

- What would the impacts be on surrounding traffic if the bridge is to be reduced in lanes?
- What would the impacts be on surrounding traffic if the bridge is closed?
- What mitigations are necessary for both alternatives?
Study Area
Bluetooth Detectors

- Point-to-Point Networking Protocol
- Unique MAC addresses
- Records time and MAC address
  - Travel Time
  - Origin-Destination Trends
Bluetooth Deployment
Bluetooth Detector Volumes vs. Actual Volume Counts

![Graph showing Bluetooth Detector Volumes vs. Actual Volume Counts]
Origin-Destination Traffic Distribution
Two-lane Reduction Analysis

- Worst-case scenario
  - Traffic enters in platoons from signals
  - Vehicles towards end of platoons have most delay
- Entering Flowrates
  - Turning movement counts, signal timings, and 95th percentile queues
- Discharge Flowrate = 1800 vehicles per hour
Two-lane Reduction Results

- Expected Conditions, PM Peak

<table>
<thead>
<tr>
<th></th>
<th>Northbound</th>
<th>Southbound</th>
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</thead>
<tbody>
<tr>
<td>Average Additional Delay (s)</td>
<td>29</td>
<td>7</td>
</tr>
<tr>
<td>Maximum Additional Delay (s)</td>
<td>46</td>
<td>19</td>
</tr>
<tr>
<td>Maximum Number of Queued Vehicles</td>
<td>25</td>
<td>9</td>
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- Travel Time to Redirect Traffic to Alternate Route

<table>
<thead>
<tr>
<th></th>
<th>Parks Highway</th>
<th>Peger Road</th>
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<tbody>
<tr>
<td></td>
<td>Northbound</td>
<td>Southbound</td>
</tr>
<tr>
<td>Additional Travel Time (s)</td>
<td>260</td>
<td>300</td>
</tr>
</tbody>
</table>

- Few drivers would choose to take an alternate route
- No mitigation necessary
Complete Bridge Closure Analysis

- Conservatively assumes all traffic would use either the Parks Highway or Peger Road
- Origin-destination data used to redistribute traffic
- Modeled using Synchro Software
Bridge Closure Results
Parks Highway SB Ramp at Geist Road

- Westbound Left Movements
- Mitigation
  - Protected-Permissive Left-Turn Phasing
  - Shorten cycle length
Peger Road at Airport Way

- Operating at capacity
- Impacted movements
  - Eastbound left
  - Southbound left
  - Westbound through
Peger Road at Airport Way

- Mitigation
  - Alter eastbound lane configuration
  - Extend cycle length and operate at split-phased

Existing Configuration:

Proposed Configuration:
Conclusion

- Two-Lane Reduction
  - Minimal Delay
  - No mitigations needed
- Full Bridge Closure
  - Several heavily impacted intersections
  - Mitigations needed
- AK DOT&PF decided on full closure
  - Go forward with proposed mitigations
Thank You