Effect of Transit Preferential Treatments on Vehicle Travel Time

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Presentation Overview

- Project Background
- Research Need
- VISSIM Modeling
- Results
- Implementation
Project Background

• **Mixed-traffic transit vehicles considered:**
  – Bus
  – Streetcar

• **Transit Preferential Treatments (TPT) considered:**
  – Queue jump
  – Queue bypass lane
  – Transit signal priority (TSP)

• **Transit stop location also considered**
Project Background

• **Queue Jump**
  - Inserts special phase to allow transit vehicle to receive green in advance of other vehicles
  - Can be used with either near- or far-side stop
Project Background

- **Queue Bypass Lane**
  - Allows transit vehicle to move around queued vehicles and then stop without hindering other traffic
  - Only used with a far-side stop
Project Background

• Transit Signal Priority
  – Signal timing treatment that modifies the signal phase in which a transit vehicle arrives
  – Green extension: allows the phase to extend so that an approaching transit vehicle can move through the intersection
  – Early green: allows the phase to begin earlier when a transit vehicle is waiting at a red signal
Research Needs

• What are the benefits of various TPTs?
• How do TPTs affect delay and travel time for transit / non-transit vehicles?
• In which situation is each TPT the preferred treatment based on transit headways, traffic volumes, cycle length, etc.?
VISSIM Model

- Use an existing 1.3-mile corridor in Fort Lauderdale, FL
- Contains both congestion and uncongested intersections
- Some volume adjustments made to simulate different scenarios
Scenario Development

- **Treatments**
  - Queue Jump
  - Queue Bypass Lane
  - Transit Signal Priority

- **Near-side vs Far-side Stop** (where applicable)

- **Volumes**
  - $v/c = 0.5, 0.8, 1.0$

- **Transit Headway**
  - 5, 10, 15 minutes
Model Calibration

- Queue jump phase can be modeled using VISSIM ring barrier controller
Model Calibration

- TSP can be modeled using series of detectors

Near-side Stop

Far-side Stop
Analysis of Results

• Sample size of 30 VISSIM runs for each scenario
• t-test of independent means
• $\alpha = 0.05$ used as significance level
Results (Base Case is Near-side Stop)

- Move Stop to Far Side

![Graph showing change in travel time for different v/c ratios.]
Results (Base Case is Near-side Stop)

- Add Queue Jump

![Graph showing change in travel time with v/c ratio]
Results (Base Case is Near-side Stop)

- Move to Far Side and Add Queue Bypass Lane
Results (Base Case is Near-side Stop)

- Add TSP
Results (Base Case is Near-side Stop)

- Move to Far Side and Add TSP

![Graph showing change in travel time for different v/c ratios]
Results *(Base Case is Far-side Stop)*

- Add Queue Jump
Results *(Base Case is Far-side Stop)*

- Add Queue Bypass Lane
Results *(Base Case is Far-side Stop)*

- Add TSP
Results (Base Case is Far-side Stop)

• What is the change in Intersection Delay for each TPT?

![Bar chart showing change in Intersection Delay for different v/c ratios and TPTs](chart.png)

- v/c ratio 0.5
- v/c ratio 0.8
- v/c ratio 1.0

- Add queue jump
- Add queue bypass lane
- Add TSP

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Key Observations

• Greatest benefit achieved by moving transit stop from near-side to far-side
• Benefits of queue bypass lanes and TSP increase when v/c approaches 1.0
• Queue jumps resulted in the least benefit within context of this study
• TPTs tend to increase side street delay, but effect is minimal when v/c approaches 1.0
Next Steps

• Publish Report
• Implementation
  – Highway Capacity Manual Urban Streets Analysis
  – Transit Quality of Service Manual
• Other Questions
  – Transit headway effect
  – Corridor implementation
Thank You!

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