Effect of Transit Preferential Treatments on Vehicle Travel Time

ITE Mid-Colonial District
Annual Meeting
13 April 2015

Kittelson & Associates, Inc.
Transportation Engineering/Planning

MOVINGFORWARDTHINKING

Presentation Overview

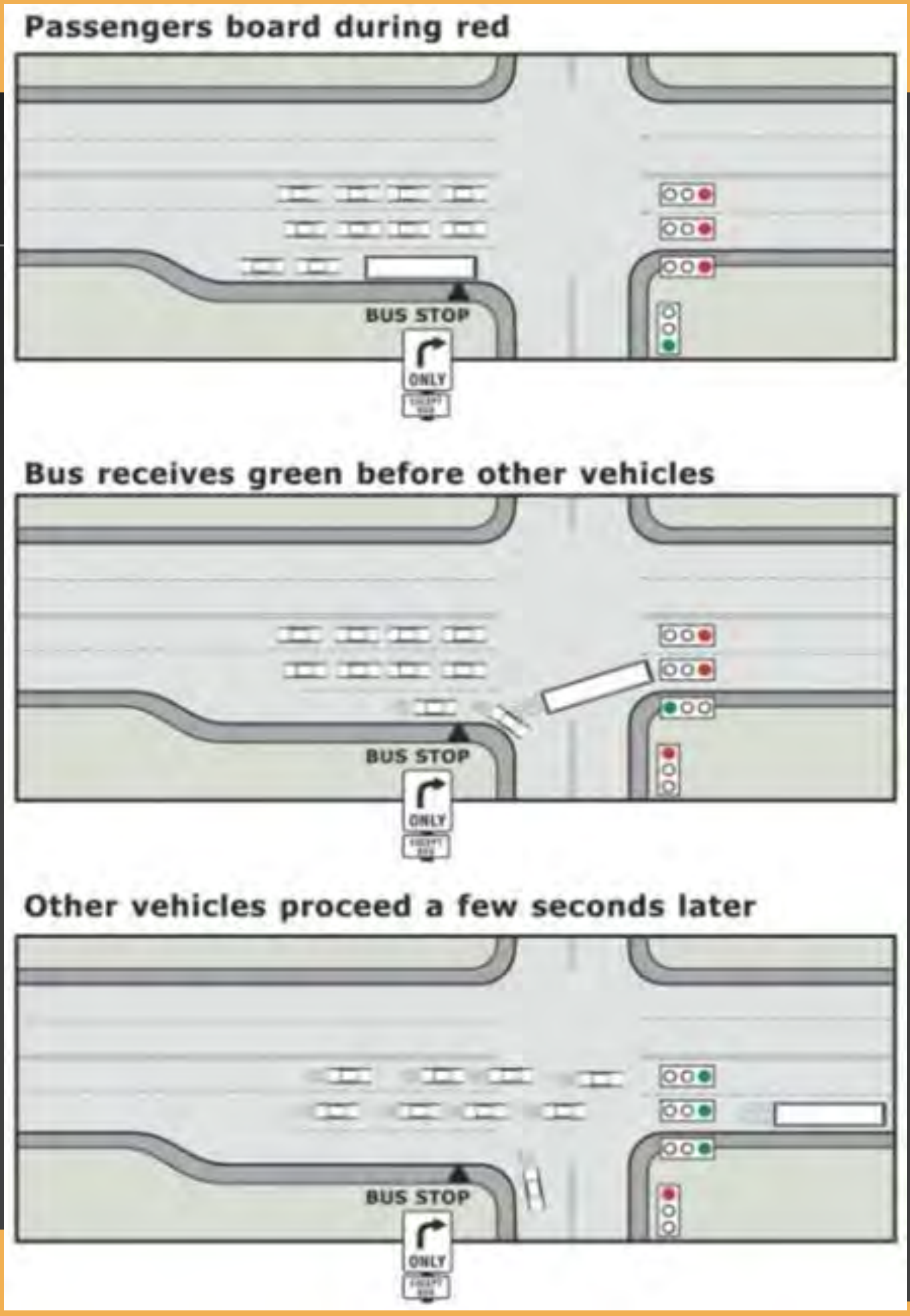
- Project Background
- Research Need
- VISSIM Modeling
- Results
- Implementation

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

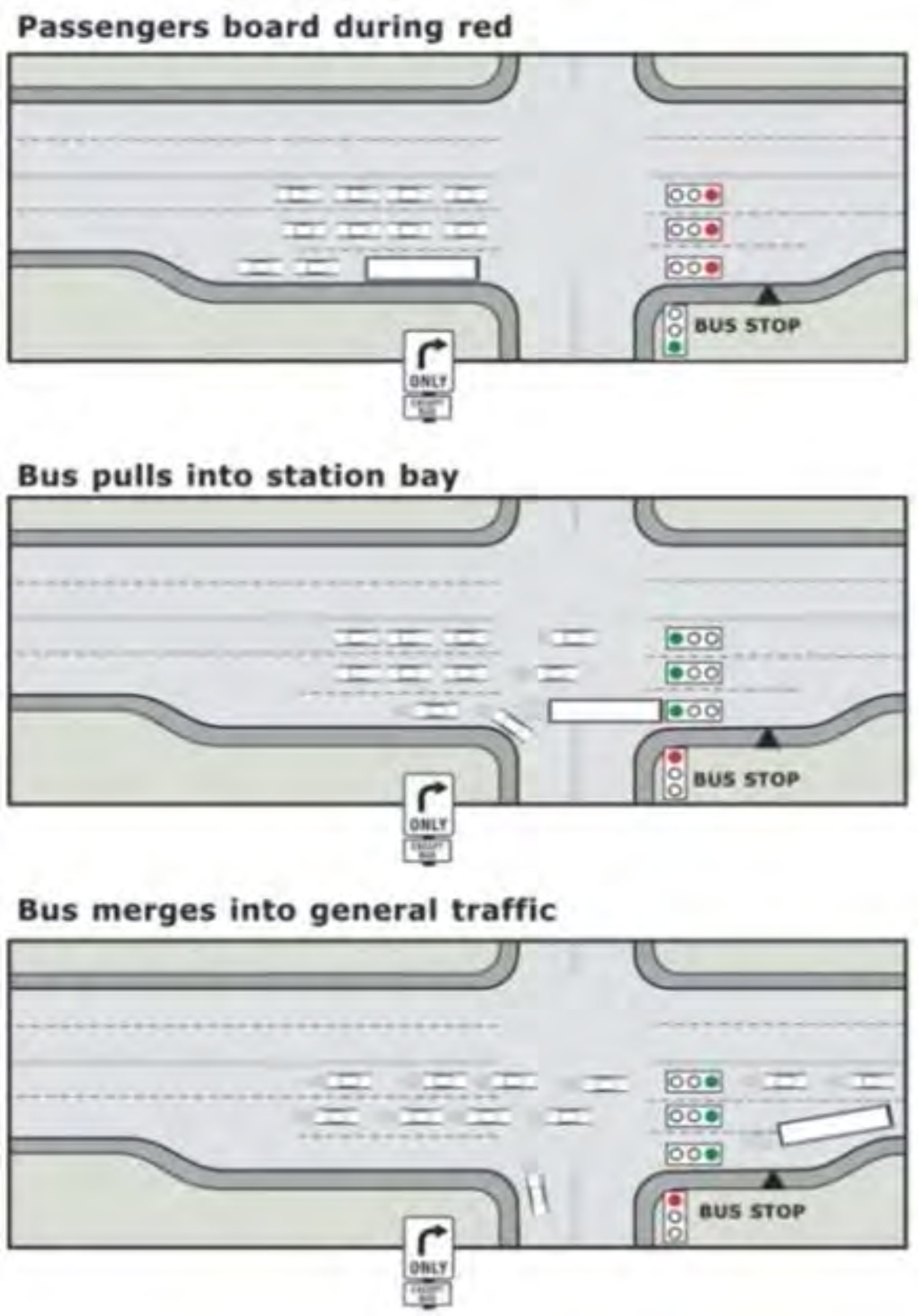
Project Background

- 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

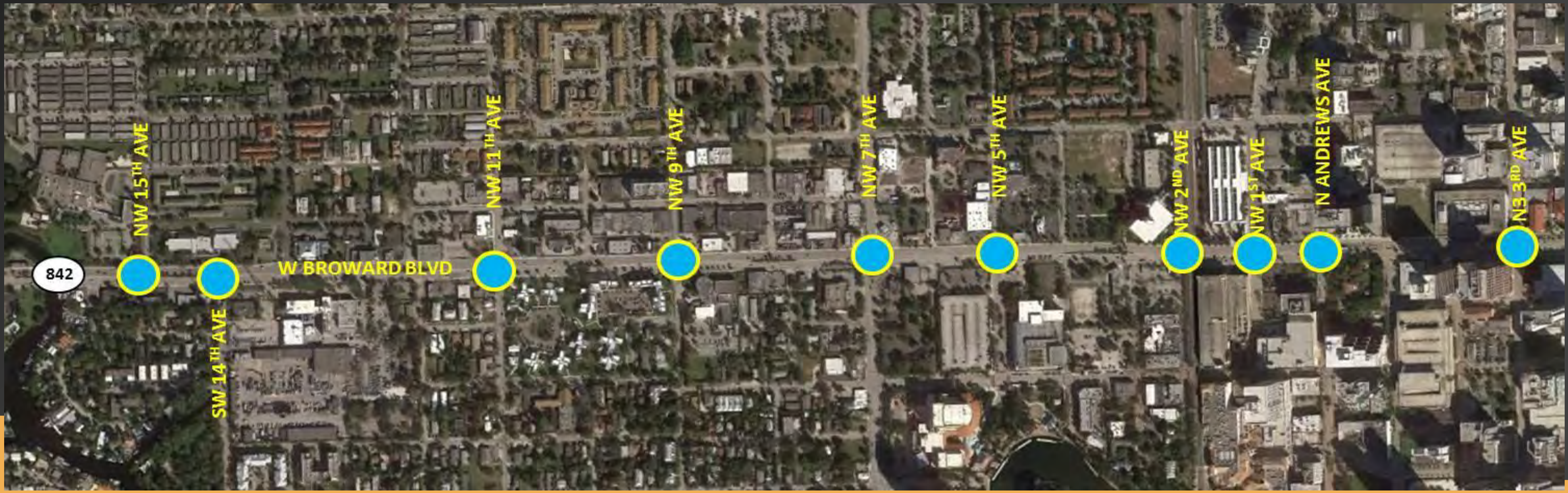
- Transit Signal Priority
  - Signal timing treatment that modifies the signal phase in which a transit vehicle arrives
  - Green extension: allows the phase to extend so that an approaching transit vehicle can move through the intersection
  - Early green: allows the phase to begin earlier when a transit 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



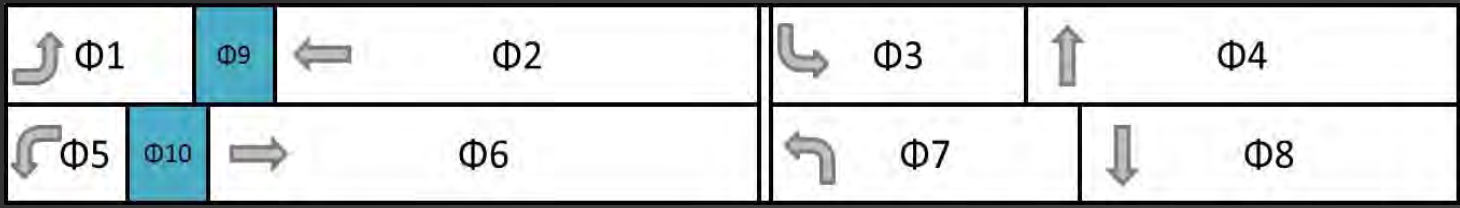
Scenario Development

- 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

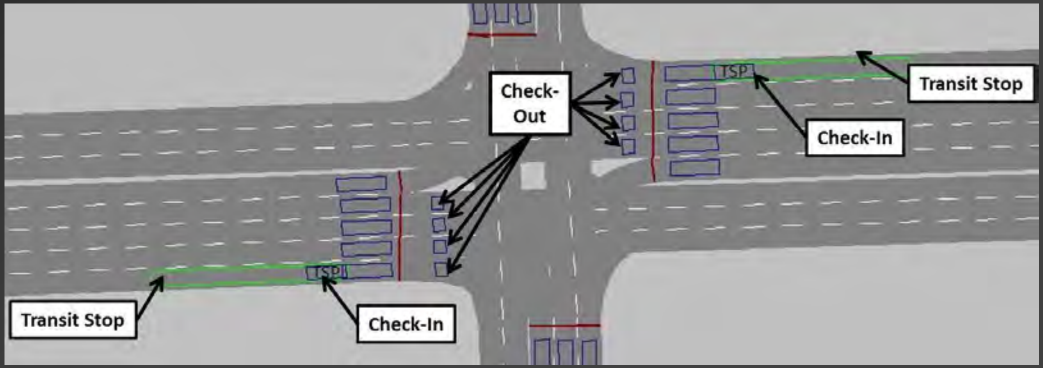
Queue jump phase insertion



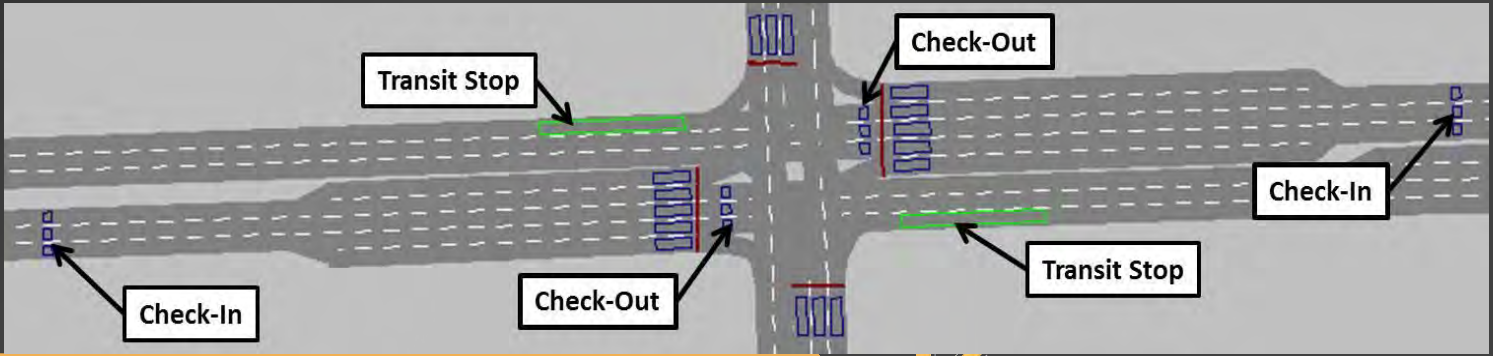
Model Calibration

- TSP can be modeled using series of detectors

Near-side Stop



Far-side Stop

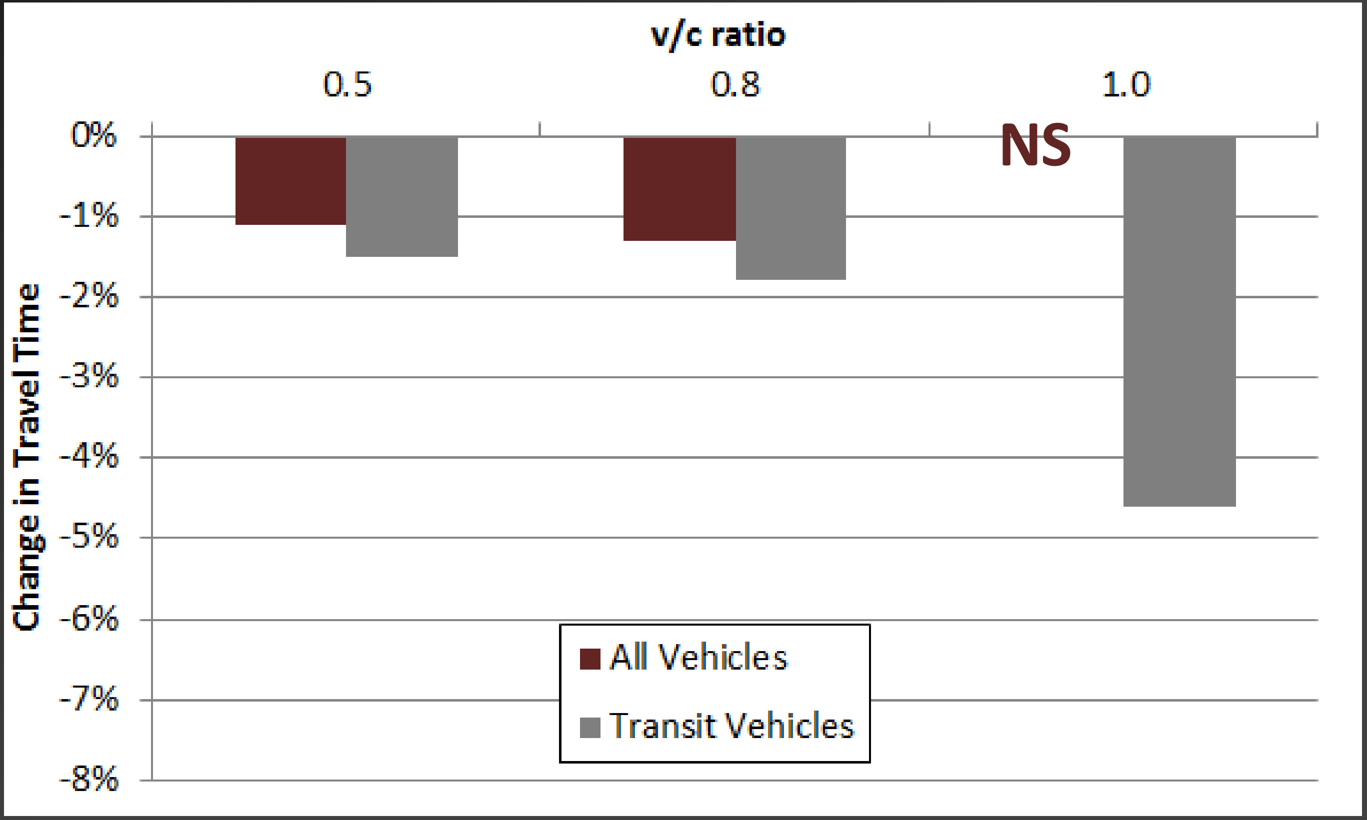


Analysis of Results

- Sample size of 30 VISSIM runs for each scenario
- t-test of independent means
- $\alpha = 0.05$ used as significance level

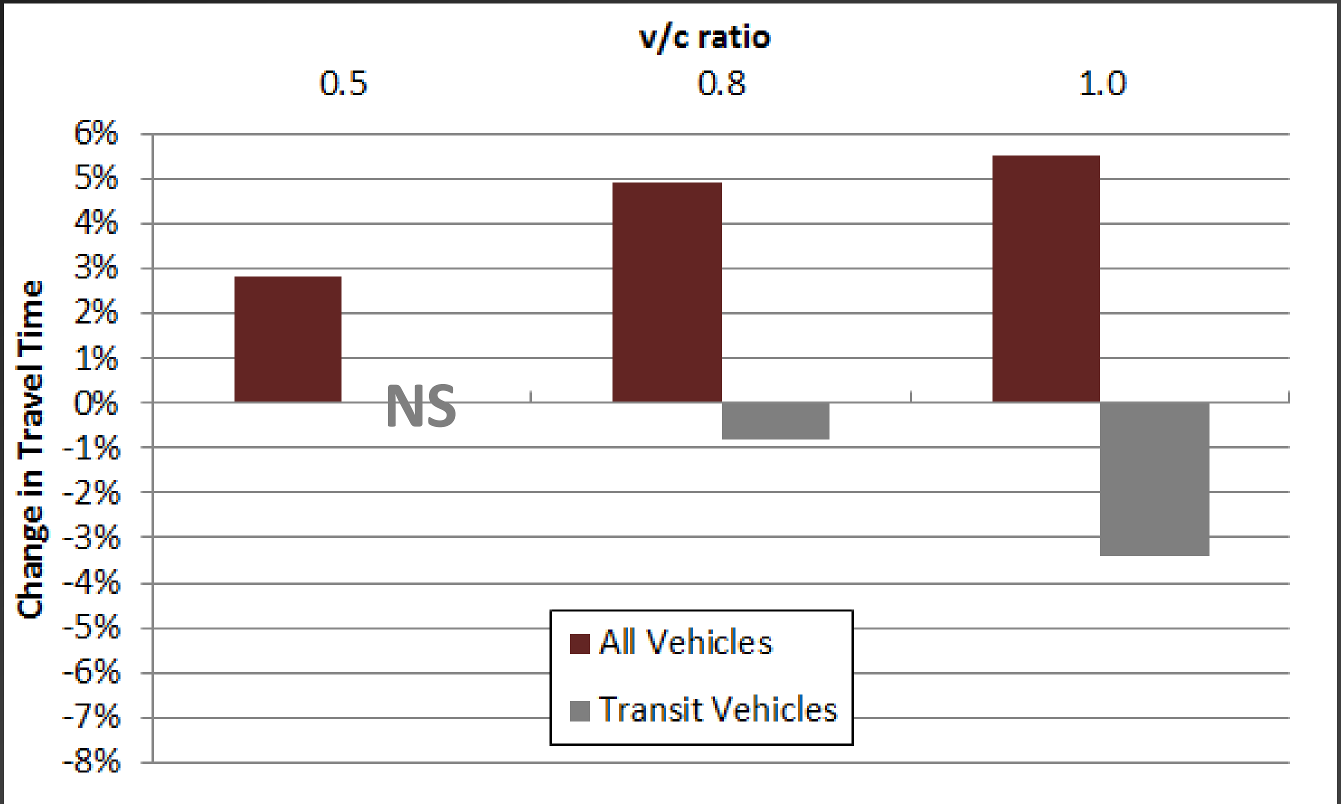
Results (Base Case is Near-side Stop)

- Move Stop to Far Side



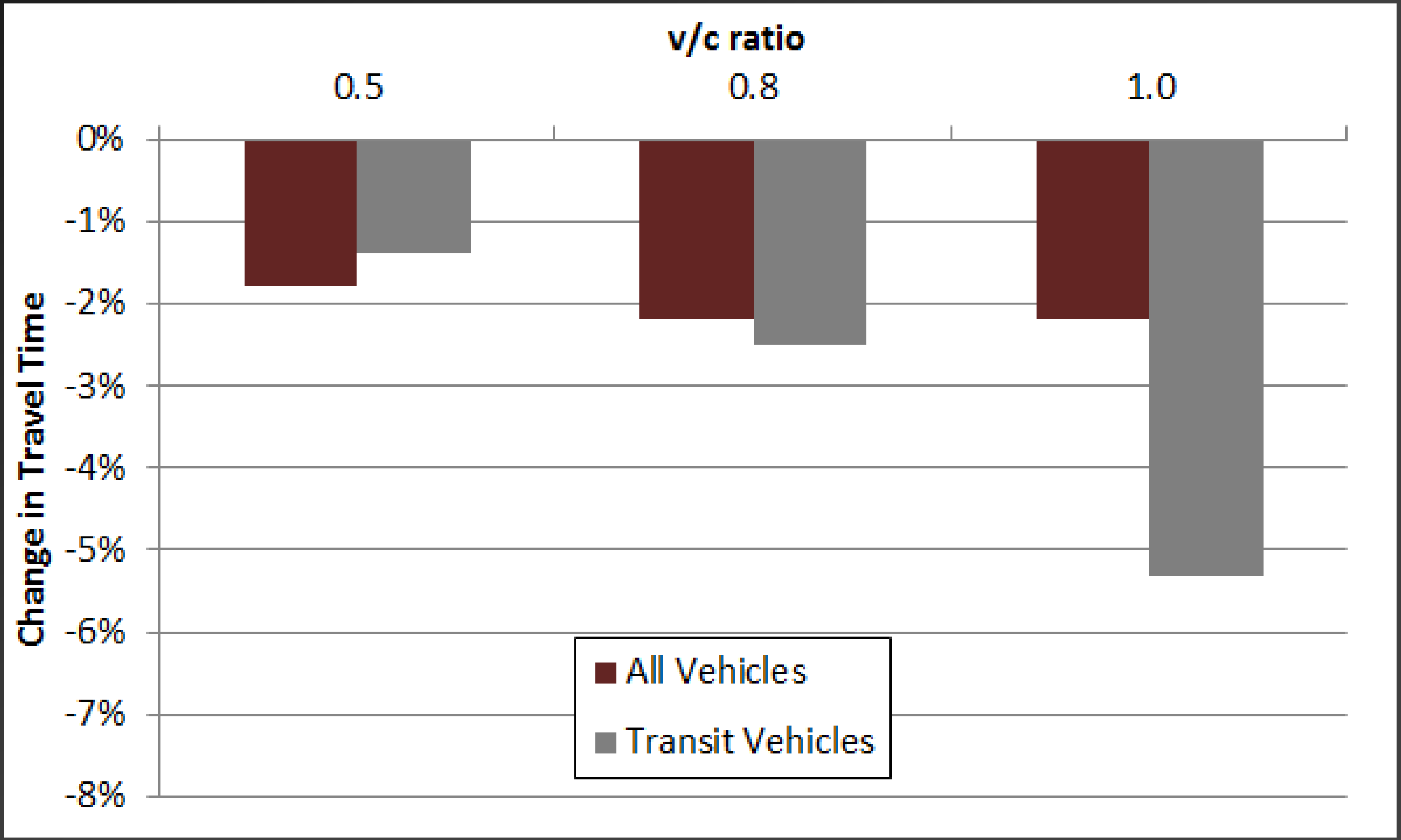
Results (Base Case is Near-side Stop)

- Add Queue Jump



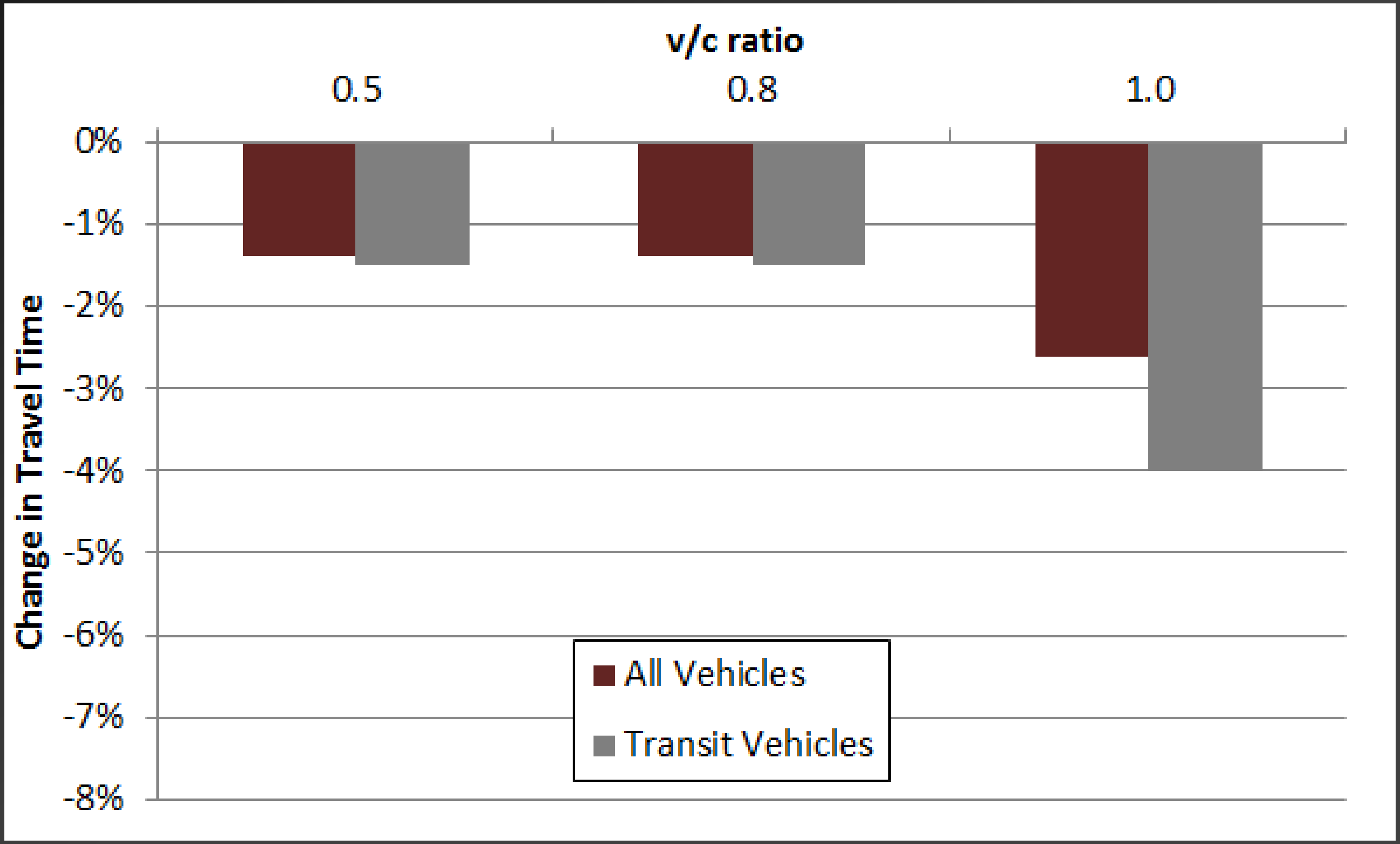
Results (Base Case is Near-side Stop)

- Move to Far Side and Add Queue Bypass Lane



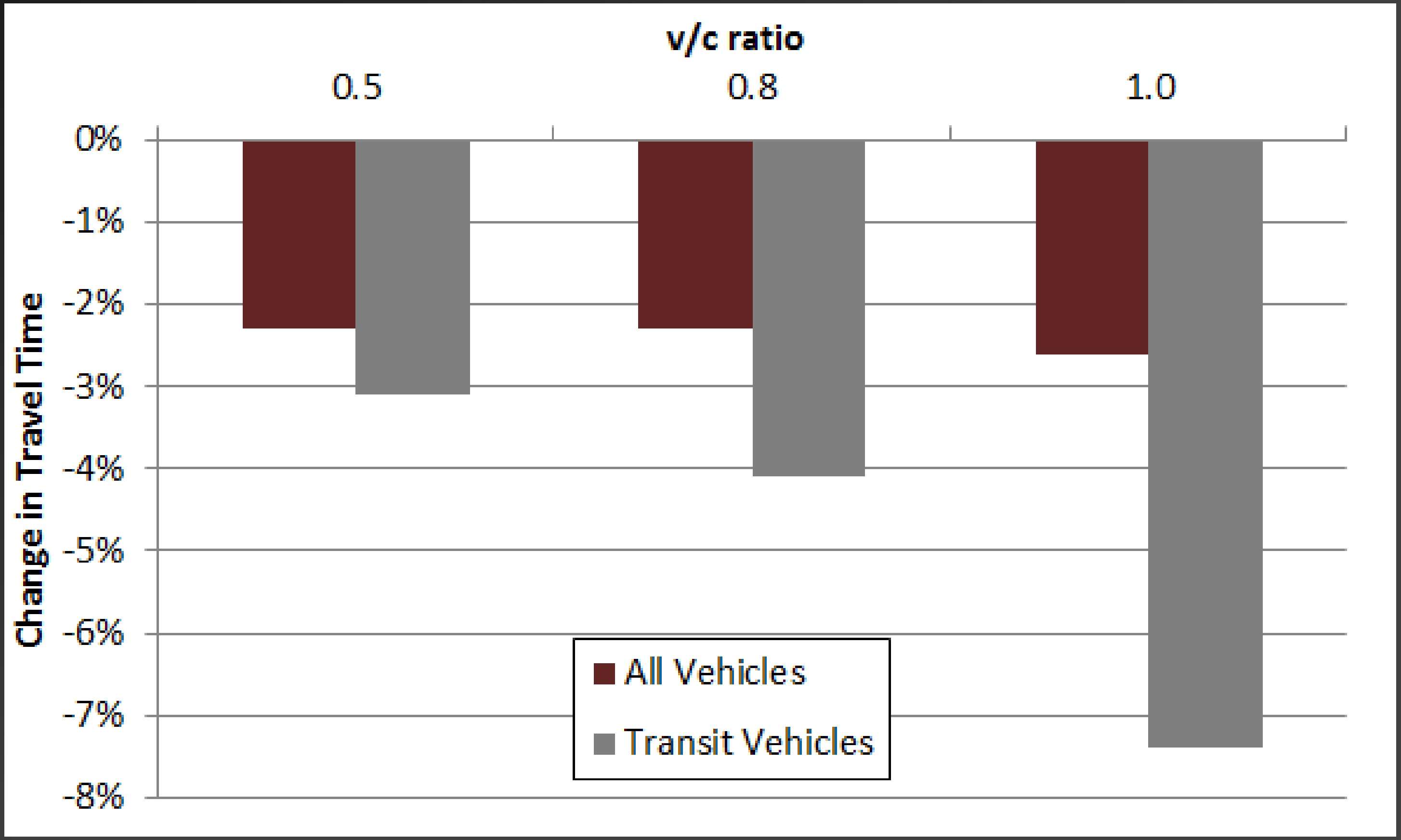
Results (Base Case is Near-side Stop)

- Add TSP



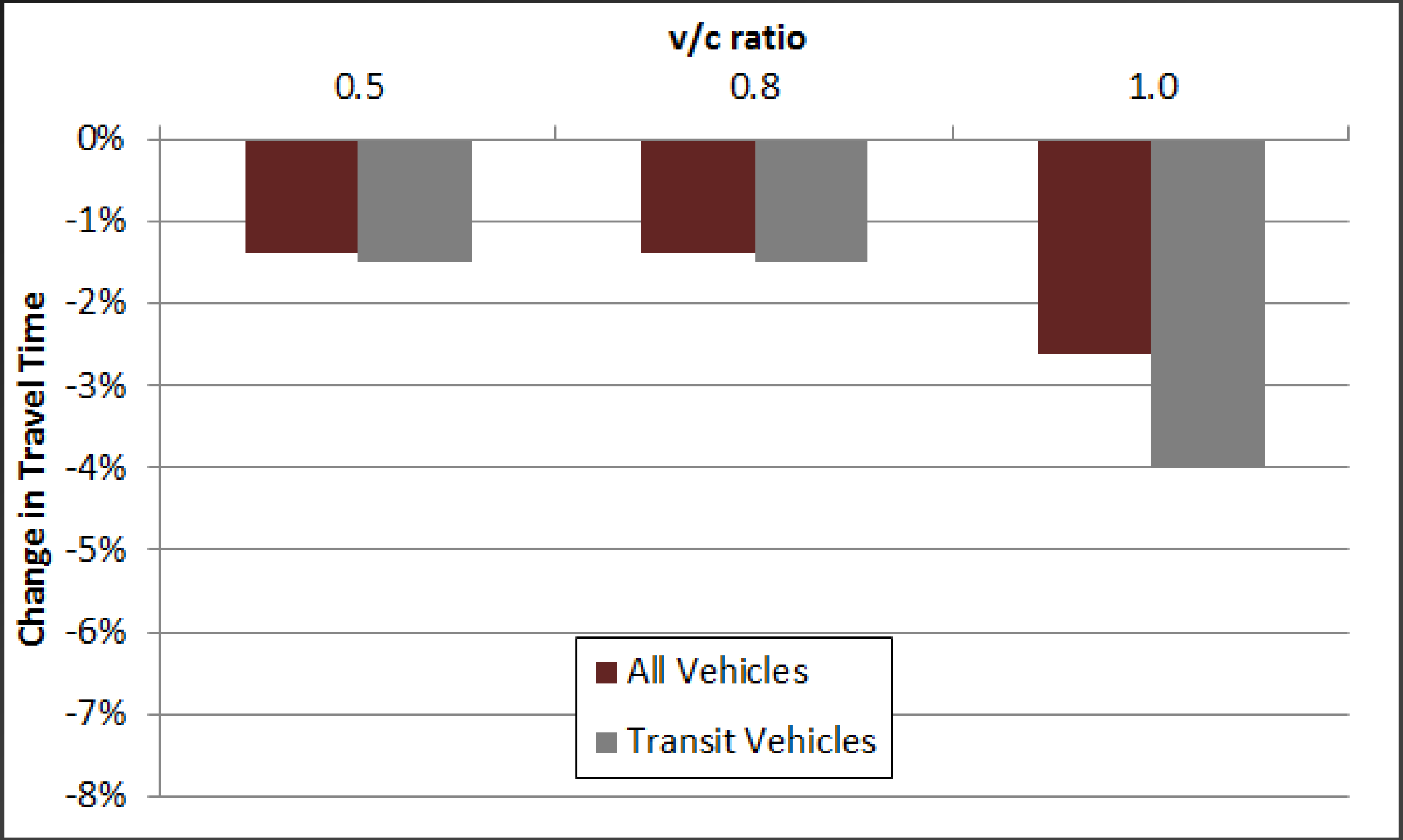
Results (Base Case is Near-side Stop)

- Move to Far Side and Add TSP



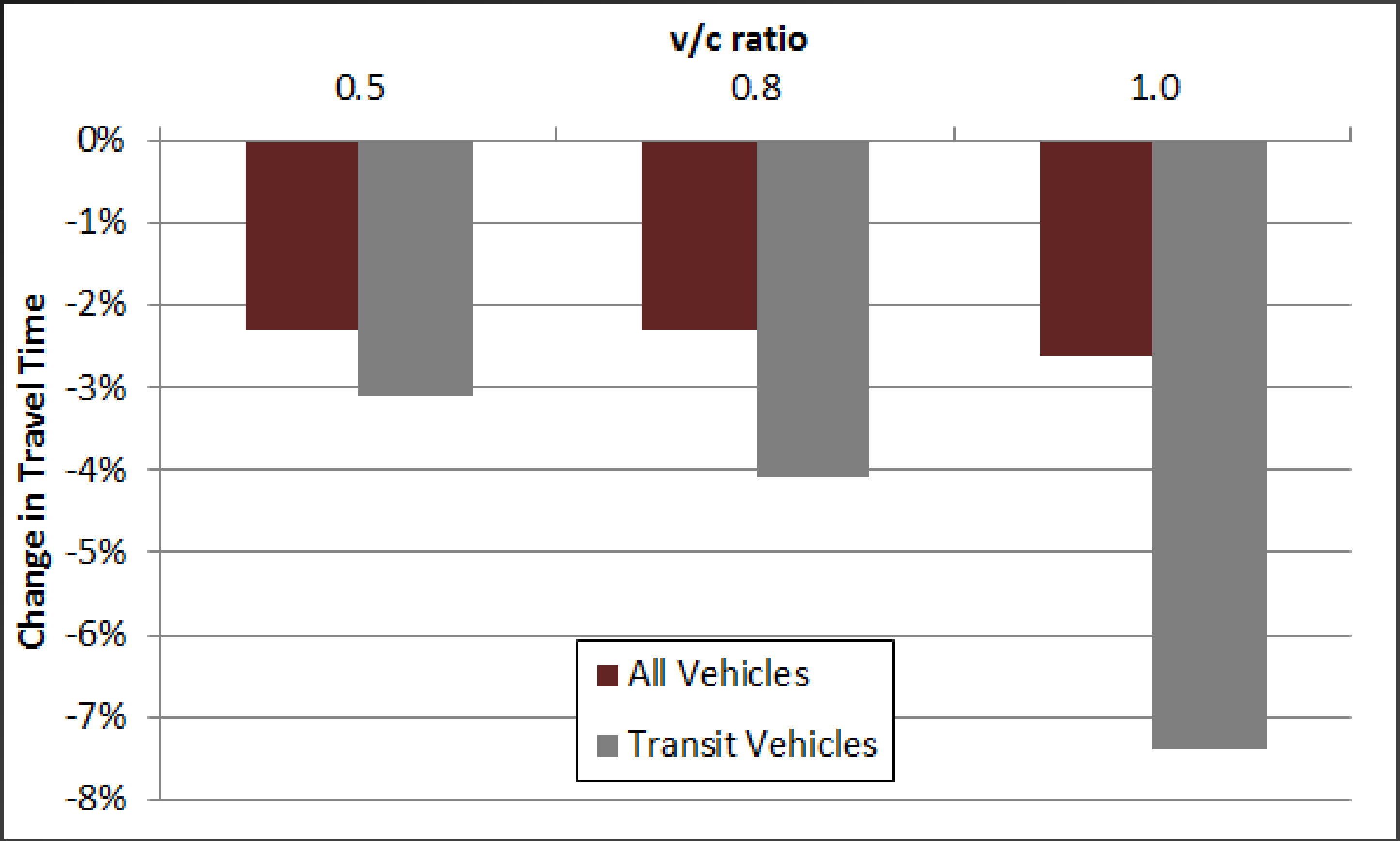
Results (Base Case is Far-side Stop)

- Add Queue Jump



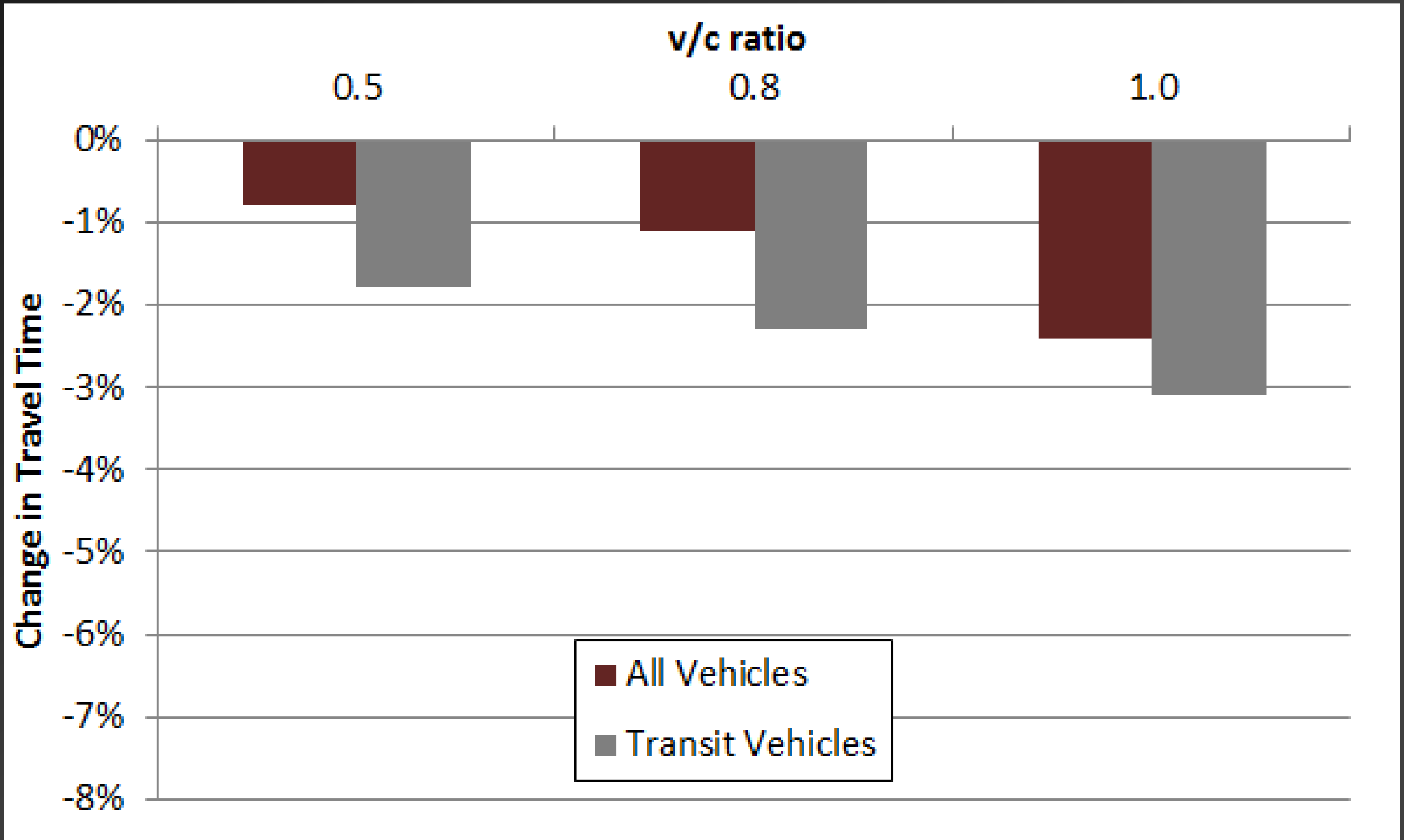
Results **(Base Case is Far-side Stop)**

- Add Queue Bypass Lane



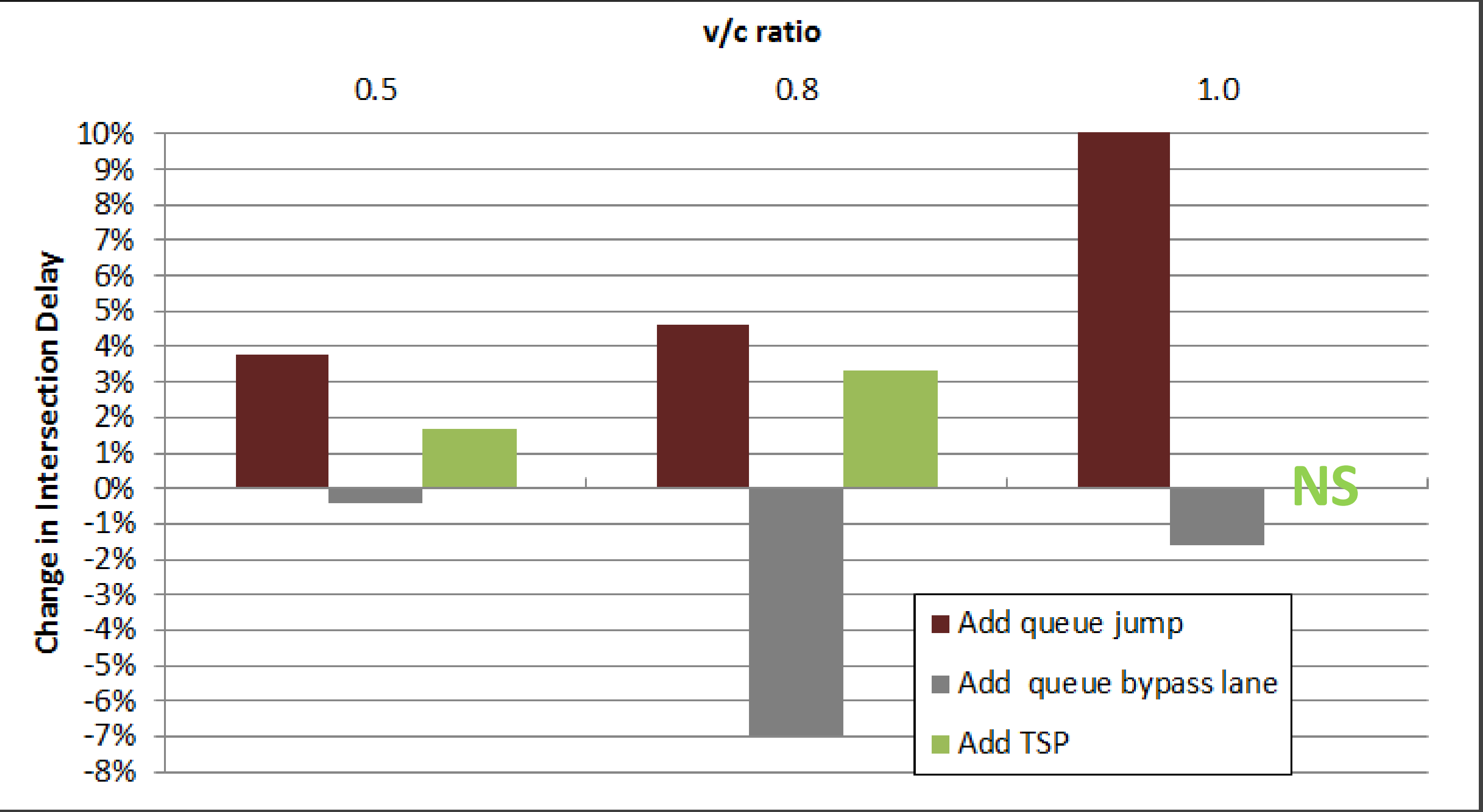
Results (Base Case is Far-side Stop)

- Add TSP



Results (Base Case is Far-side Stop)

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



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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