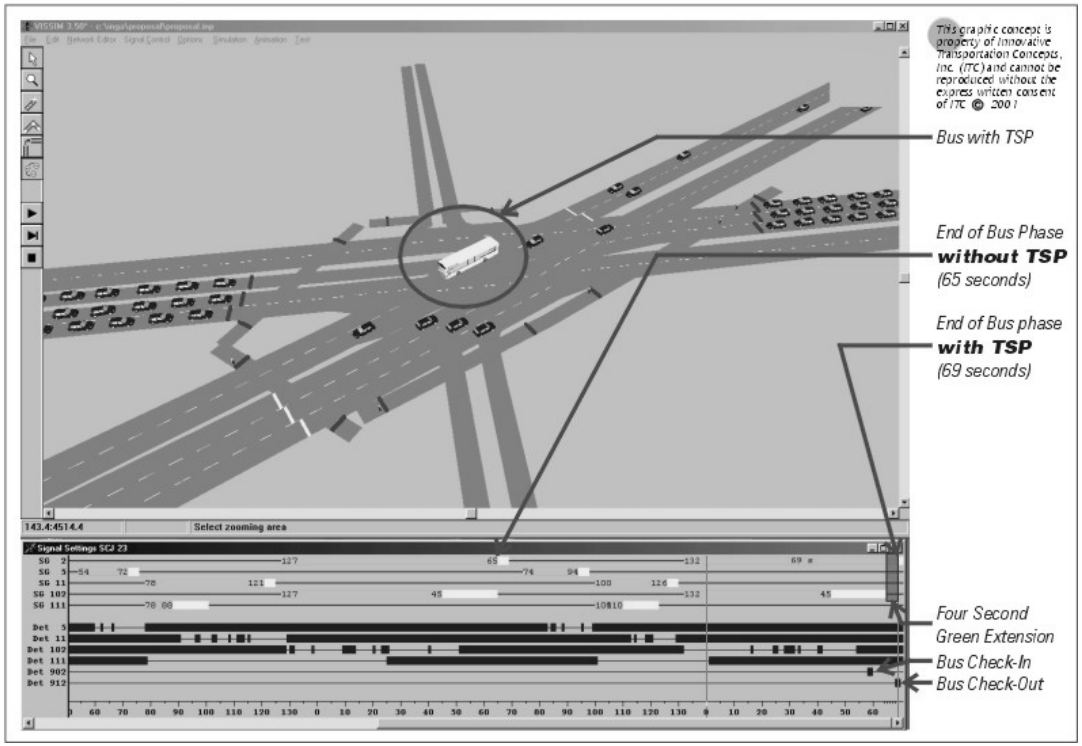
Simulating TSP with VISSIM



Analyzing TSP

- *The State-of-Practice* -

TRB
Signal Systems Committee

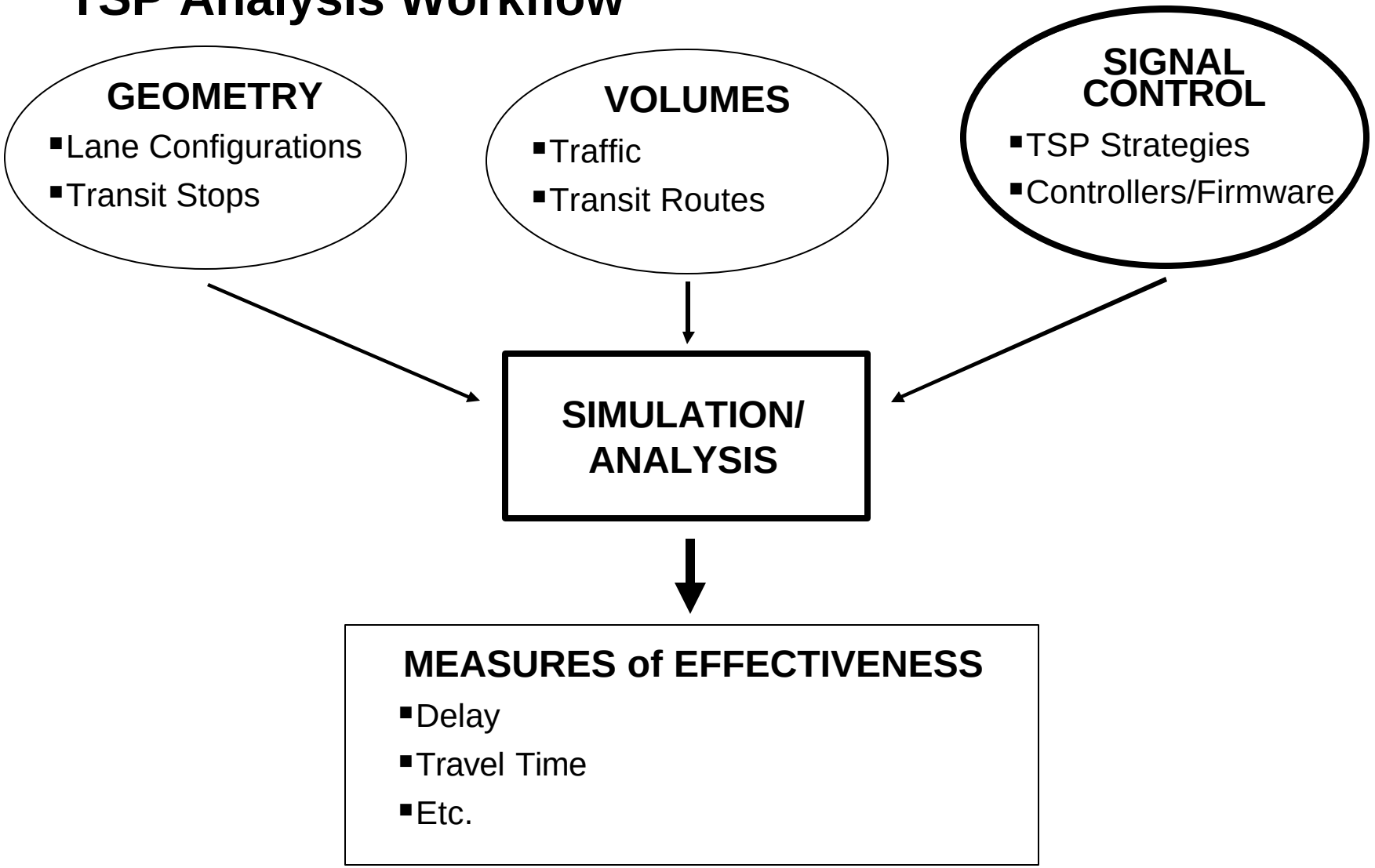
January 11, 2004

Jim Dale, P.E.
Innovative Transportation Concepts, Inc.

Presentation Points

1. Analysis Overview
2. TSP and the Signal Controller
   - TSP Strategies
   - TSP Logic—*Controller Differences*
   - TSP Parameters
3. Analysis
4. Lessons Learned

TSP Analysis Workflow



Measures of Effectiveness (MOEs)

▷ Transit

- Bus signal delay
- Bus travel time
- Bus schedule adherence
- Bus stop %

▷ Traffic

- Intersection control delay
- TSP conflicting delay
- Auto travel time
- Stops

▷ System

- Fuel consumption
- Emissions

▷ Other TSP MOEs

- Person delay
- Pedestrian delay
- Number of TSP events
- Duration of TSP event
- Time-to-recover

TSP Strategies

- Passive
  - Assumes transit is present every cycle
- Active
  - Requires bus to be present/detected
- State-of-the-Art
  - Requires bus to be present/detected
  - Requires knowledge about buses condition

TSP Strategies

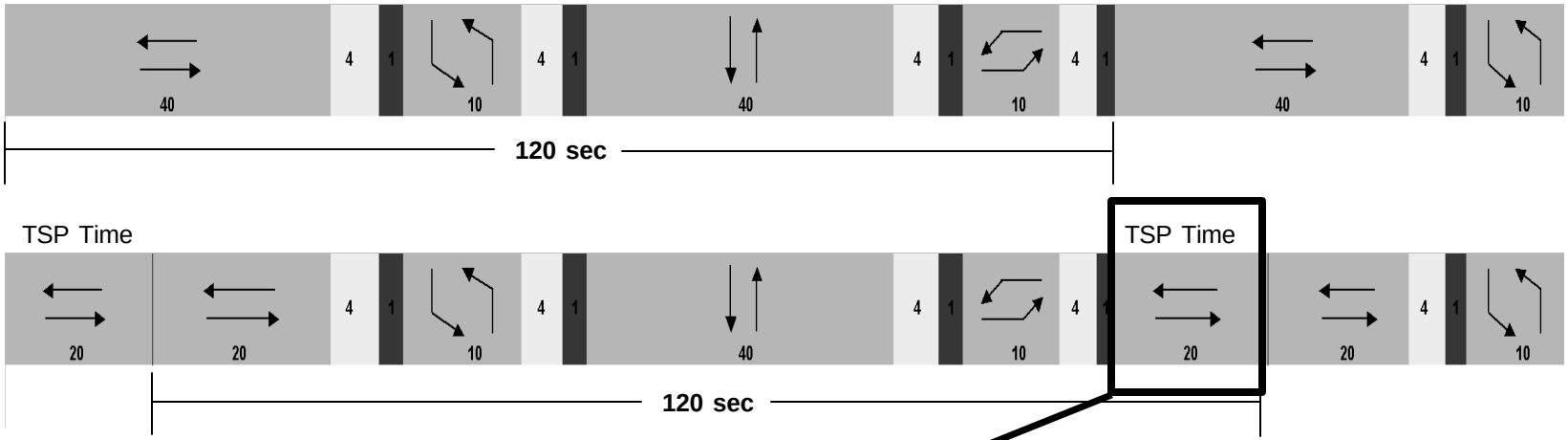
- Passive Priority
  - Cycle Length Adjustments
  - Priority Progression
- Active Priority
  - Early Green
  - Green Extension
  - Actuated Transit Phase
  - Phase Insertion
  - Phase Suppression
  - Phase Rotation
- State-of-the-Art
  - CAD/AVL
  - Real-Time

Traffic Signal Controllers

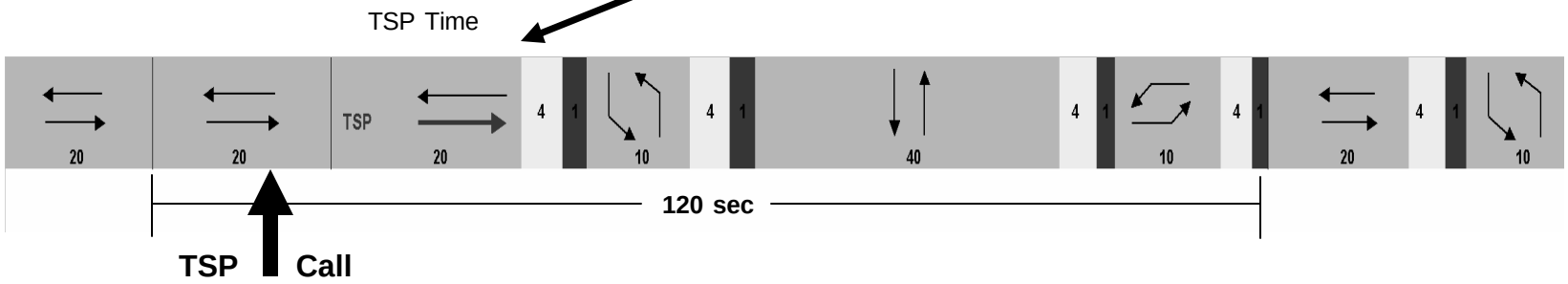
- Econolite ASC/2
- Eagle EPAC300
- PEEK
  - LMD9200
  - LMD40 (interval controller)
- VS-PLUS (2070)
- CALTRANS C8
- WAPITI
- NextPhase (2070)
- BI Tran
- Vector

Controller 1

Optimized Signal Timing



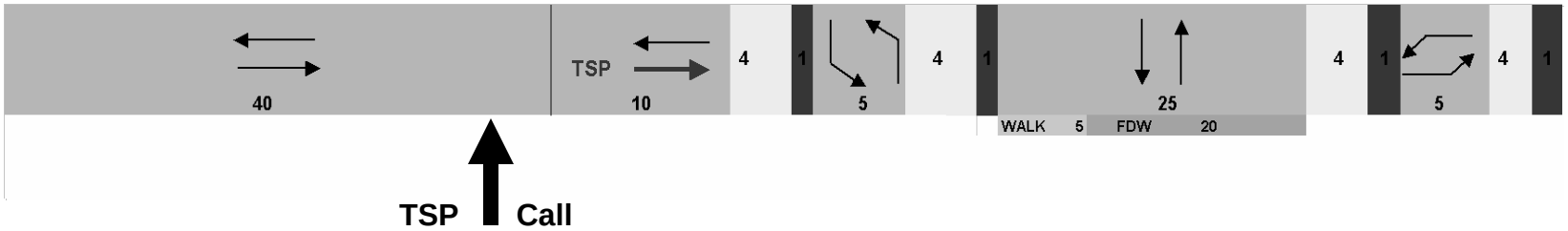
Controller 1 Green Extension



Controller 2

Optimized Signal Timing

Controller 2 Green Extension



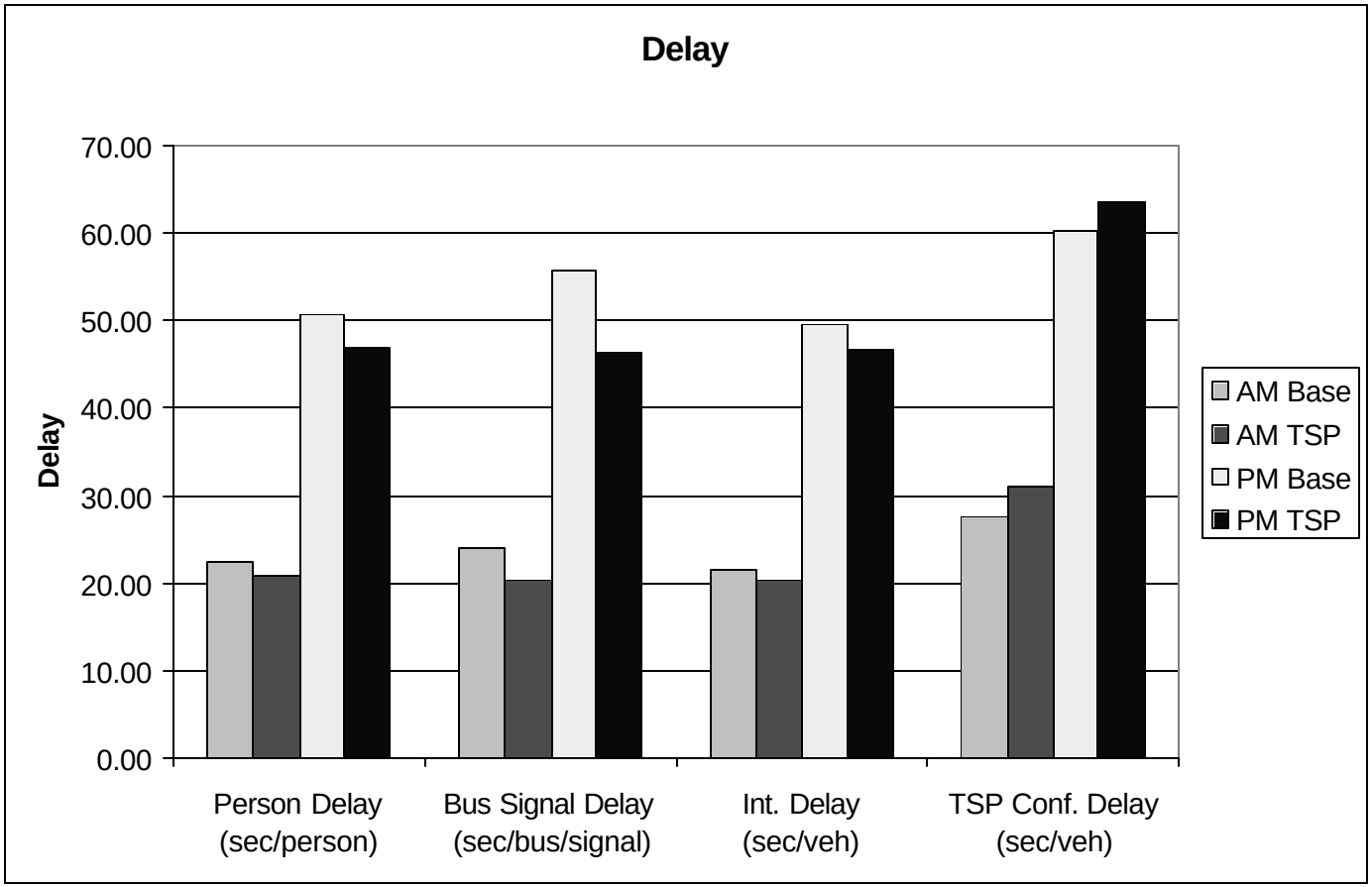
TSP Parameters

- Econolite
  - Estimated travel time
  - Max green time settings for TSP conflicting movements
- Eagle
  - Estimated travel time (“Duration”)
  - Coordination type
  - Max green time settings for all movements

Main Points to Remember About Controllers

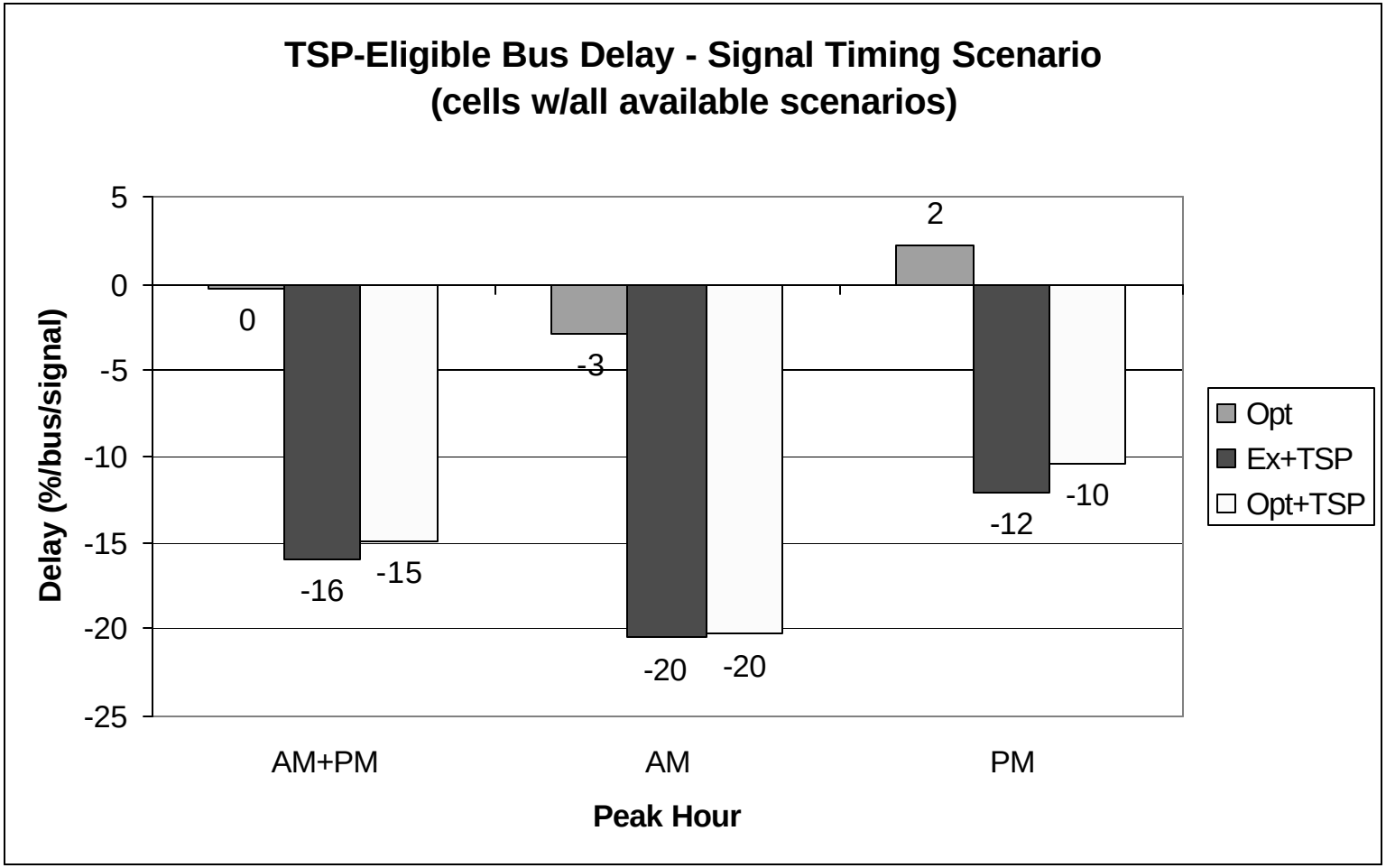
- All implement TSP differently
  - Multiple ways to configure TSP in certain controllers
  - Not all TSP strategies are available in each controller
  - Each has different parameter settings and terminology
- Like all software, constantly changing
- Highly guarded information
- TSP performance influenced by controller
  - Strategy
  - Logic
  - Parameter settings

Results (1)—*Delay*

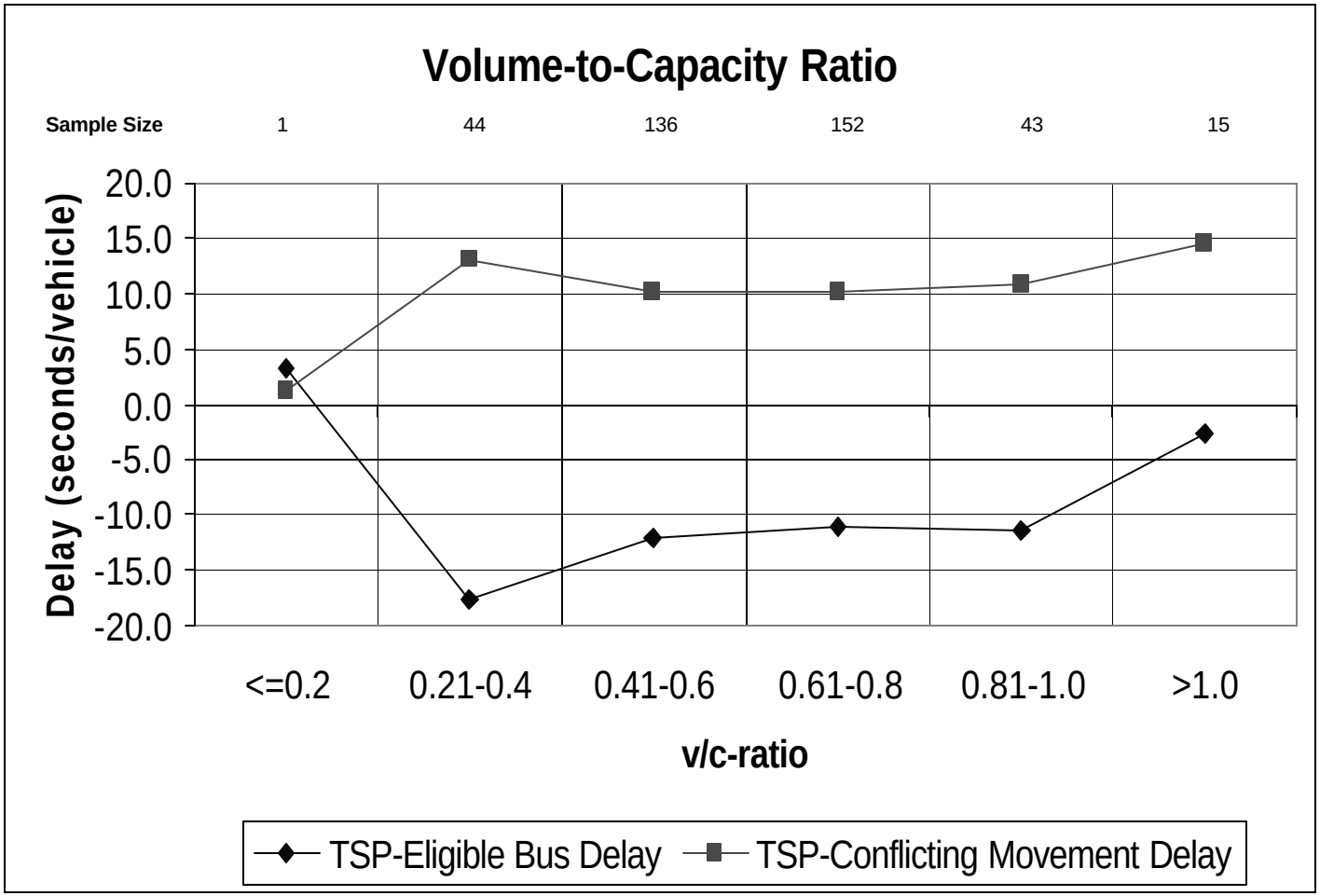


Segment 6-1, Archer Avenue

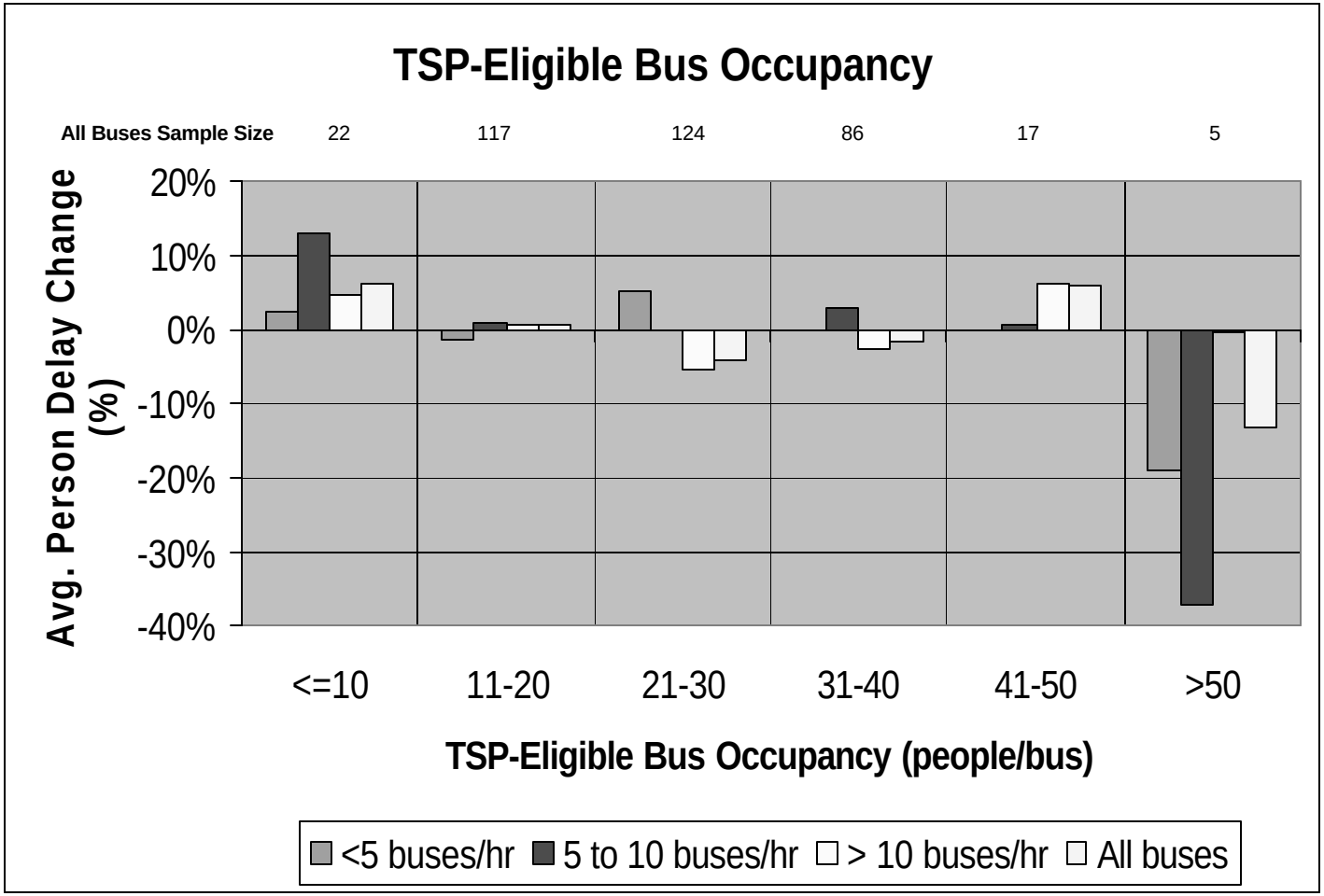
Results (2)—*Signal Timing Strategy*



Results (3)—*Volume-to-Capacity Ratio*

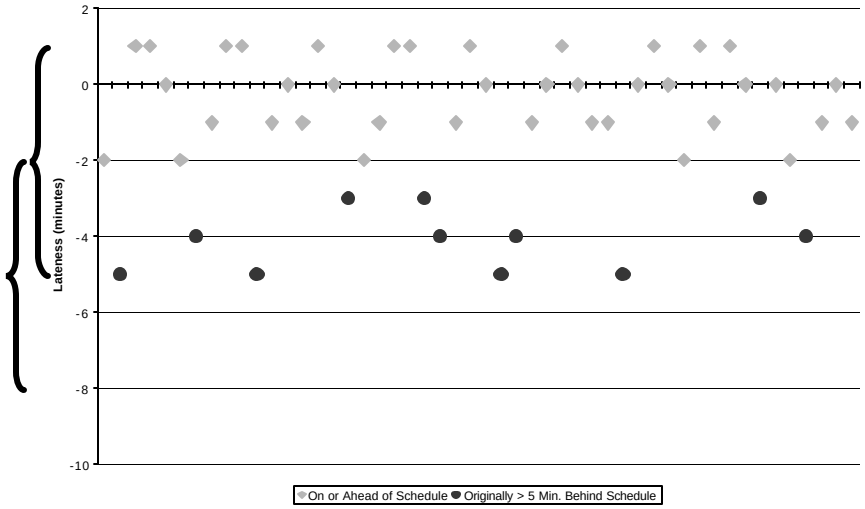


Results (4)—*Bus Occupancy*

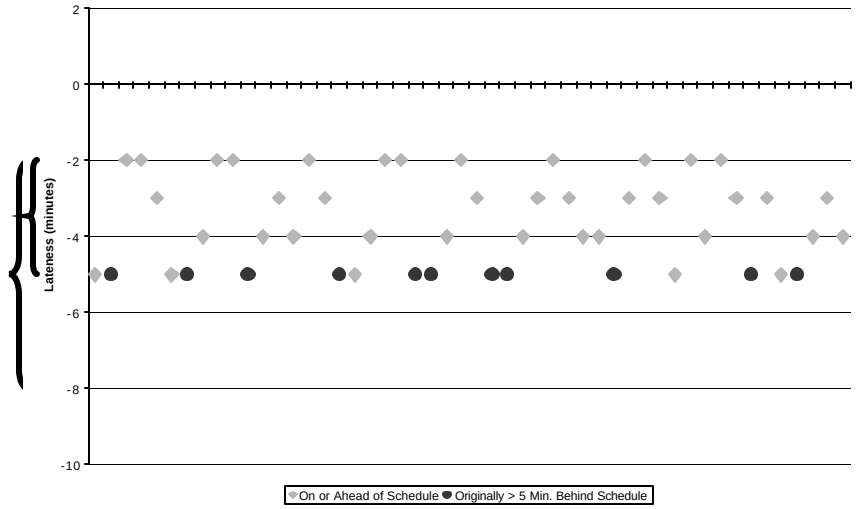


Results (5)—*Conditional Priority Background*

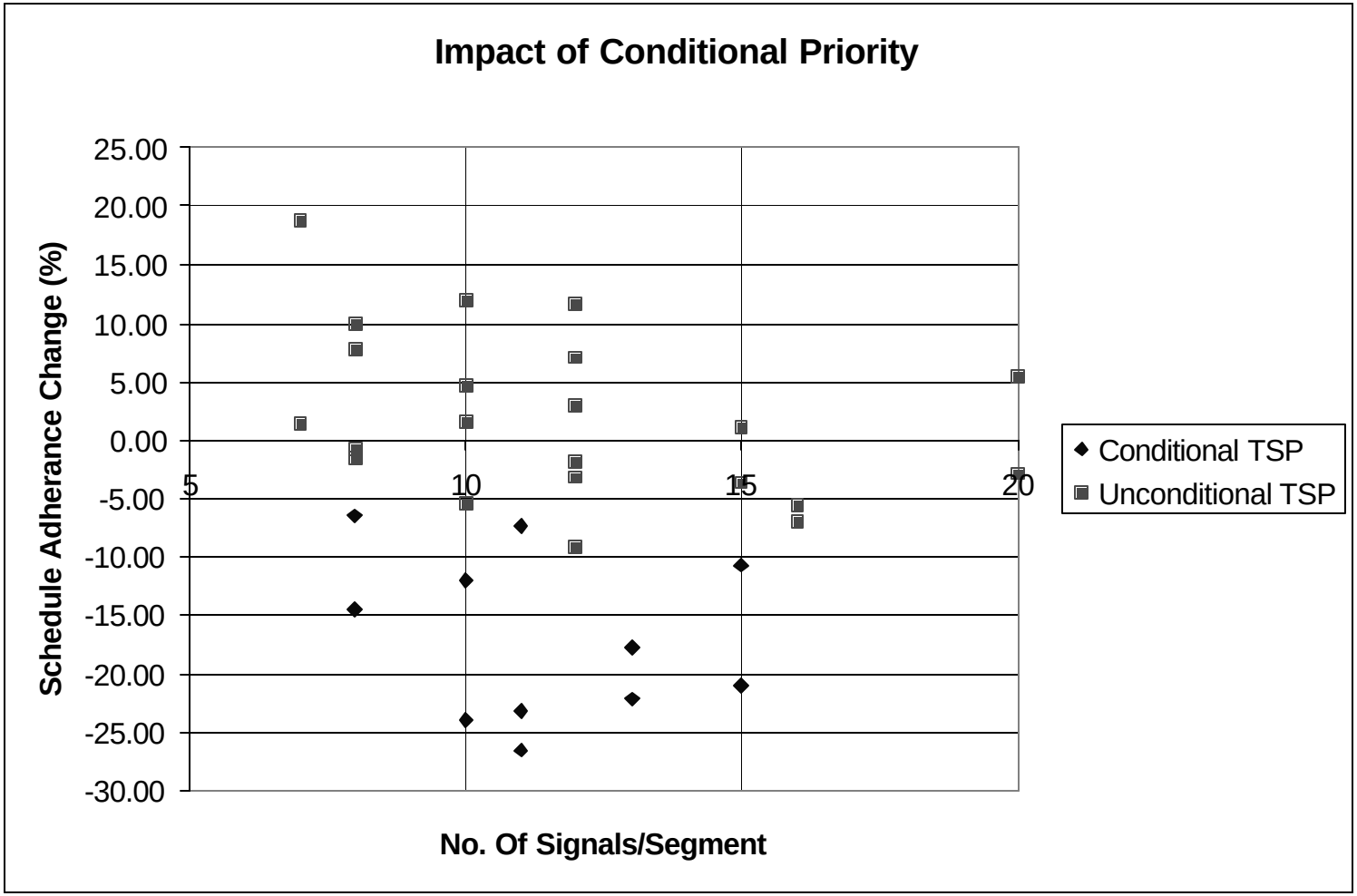
Unconditional Priority



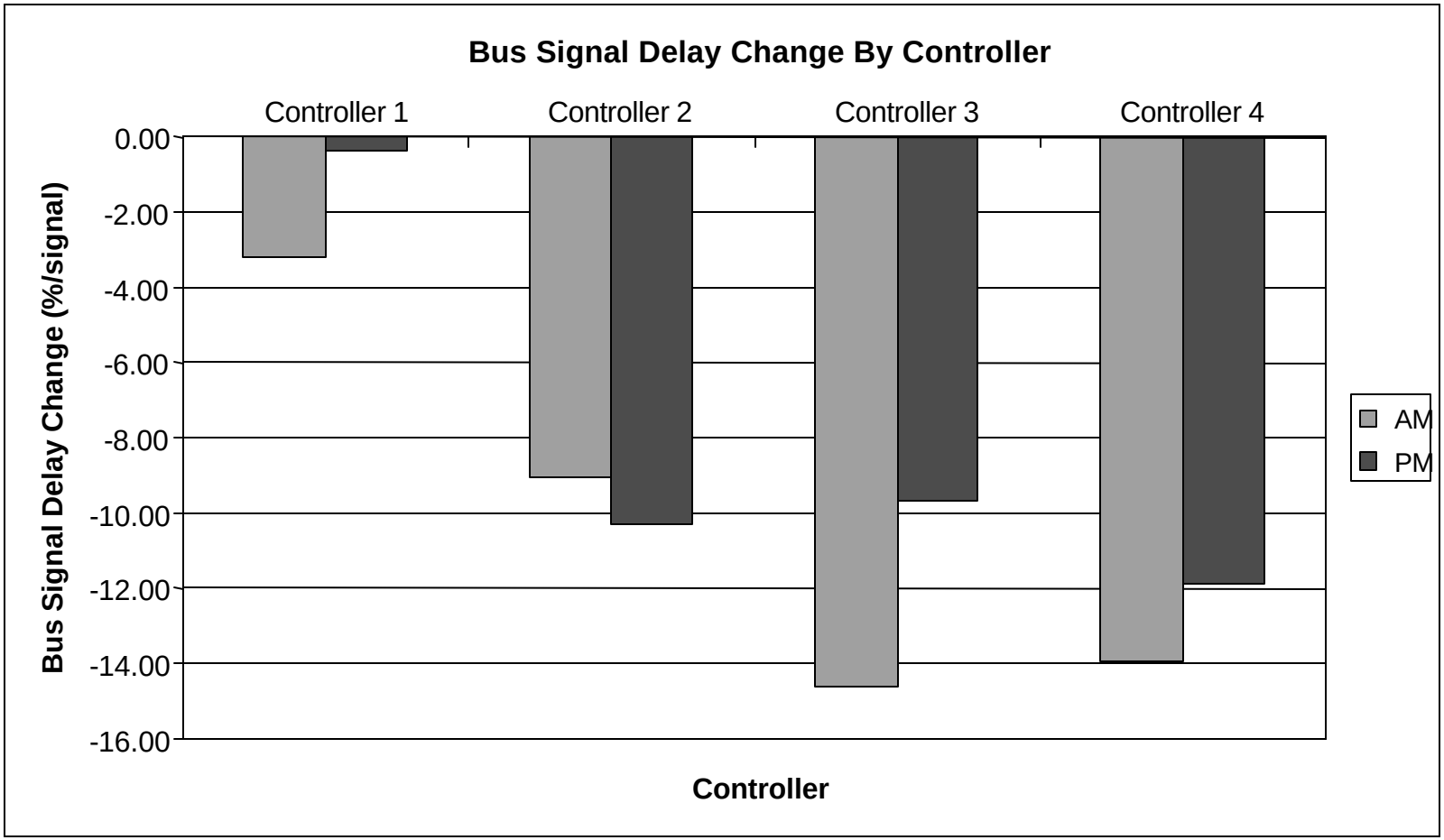
Conditional Priority



Results (5)—*Conditional Priority*



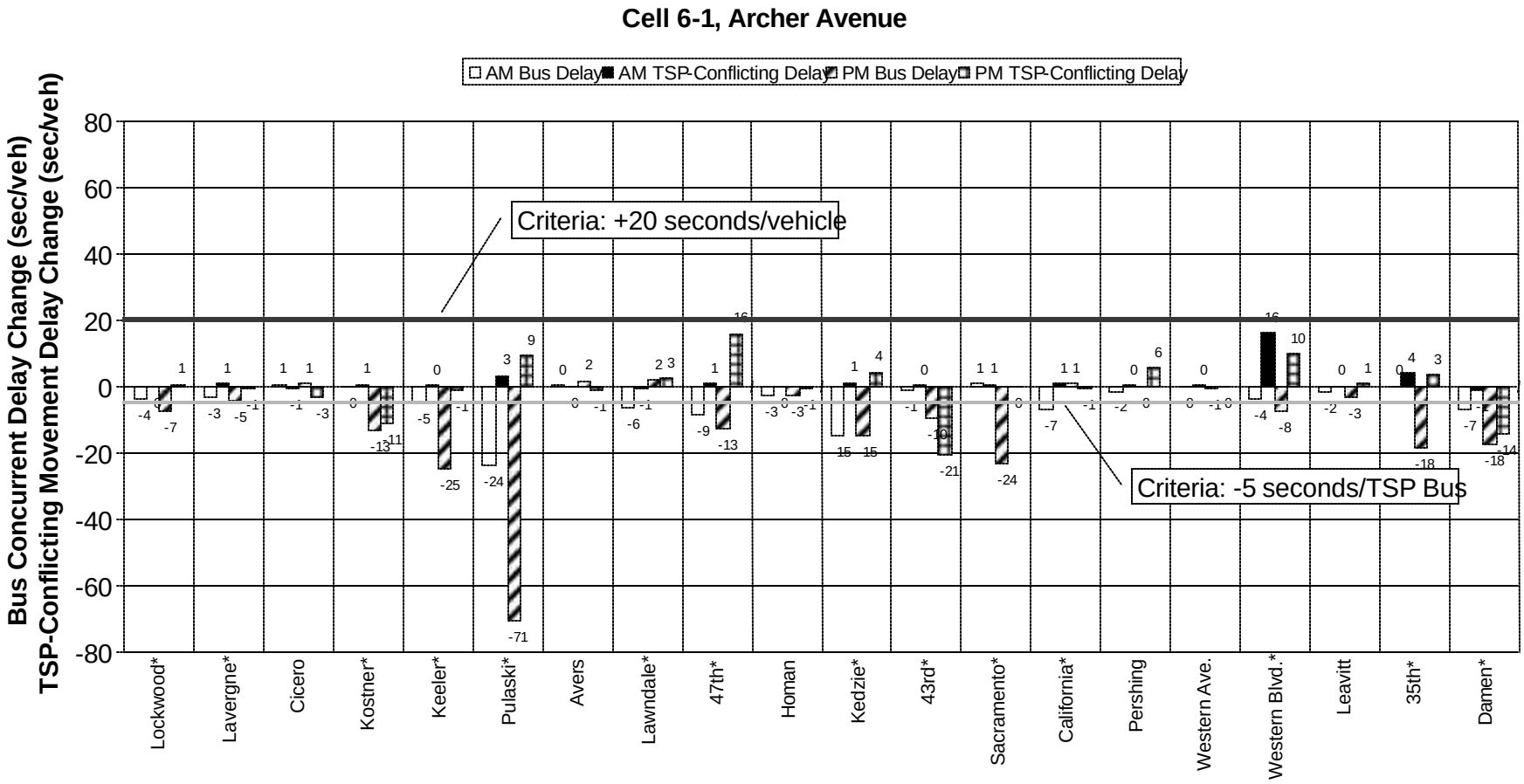
Results (6)—*Influence of Controller on TSP*



Where to Install TSP

- TSP Deployment Criteria
  - Delay Savings for TSP-Eligible Buses (= 5 sec/bus) **AND**
  - Delay Increase for TSP-Conflicting Movements (= 20 sec/veh)
- TSP Strategy
  - Conditional priority **AND**
  - Aggressive TSP control strategies and parameters

TSP Deployment Screening



Overall, deploying TSP at 44 percent of the signals achieves 98 percent of the delay savings if TSP was deployed at every signal!

Lessons Learned

- Every intersection is different
- Every controller is different
- The controller influences TSP performance
- Intersections may not have time available for TSP
- TSP is not needed at every intersection
- Using simulation for TSP analysis
  - Evaluation methodology
  - Small changes sometimes difficult to measure

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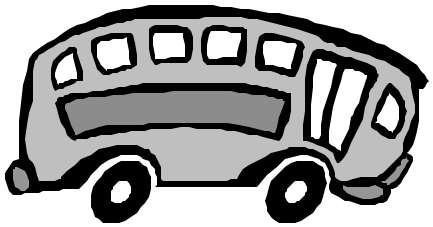

Thank You for Your Time