ESTIMATING POTENTIAL CAPACITY INCREASE OF FREEWAY WEAVING SEGMENT DUE TO AUTOMATED VEHICLES

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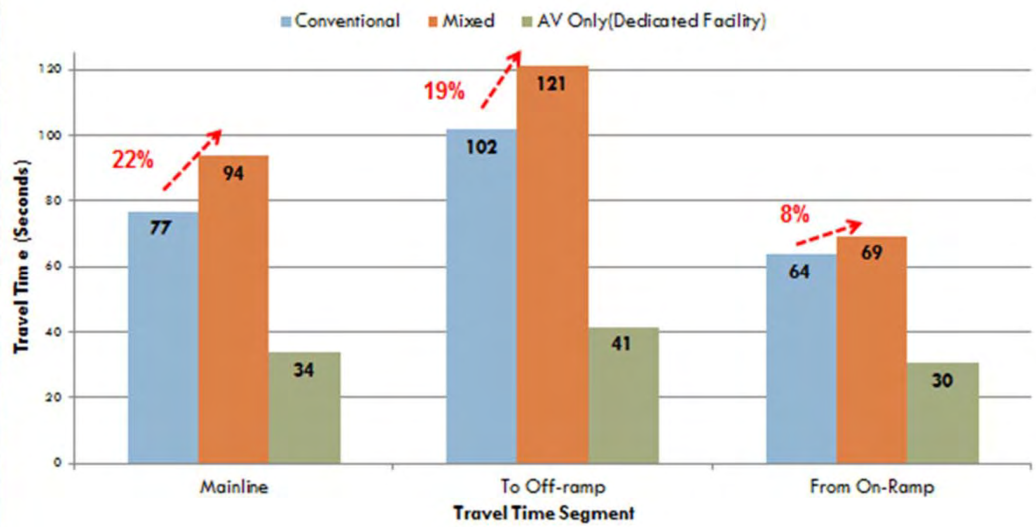
Agenda

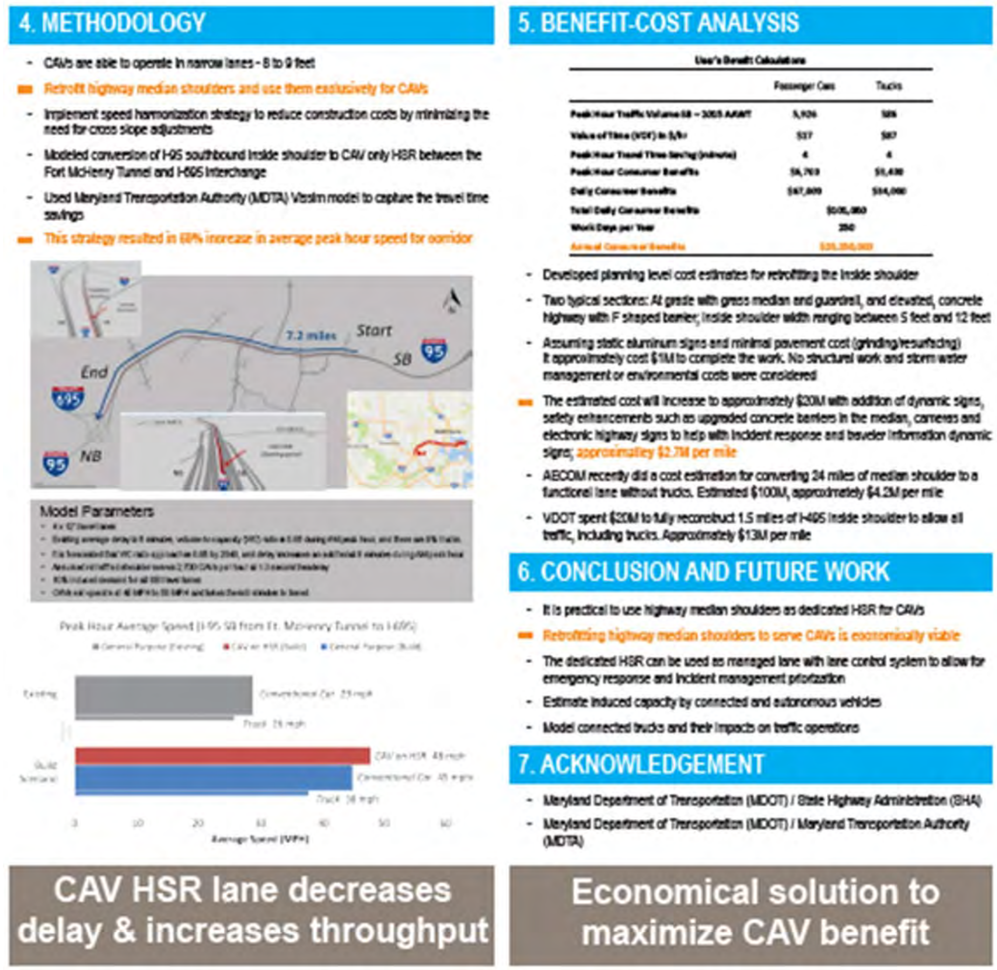
- Background
- Problem Statement
- Case study and Methodology
- Lesson Learned

Near Term Impact of AVs on Traffic Congestion

2017 ITE Mid-Colonial District Annual Conference



Business Case for Utilizing Highway Median Shoulders for AVs Deployment

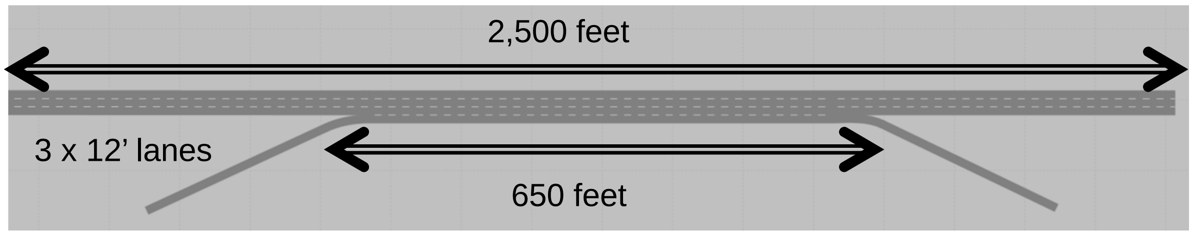


Problem Statement

- AVs are expected to increase roadway capacity
  - Automatic breaking system (2,000vphpl to 4,000 vphpl)
  - Platooning (2,000vphpl to more than 6,000 vphpl)
  - Smoother merge and diverge
- Requires high market penetration
- How much capacity will increase?
- How weaving impact theoretical capacity increase?

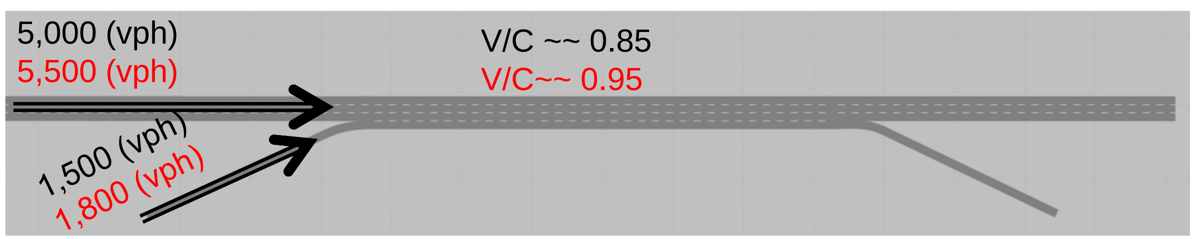
Case Study – Typical weaving segment

Geometry



Speed

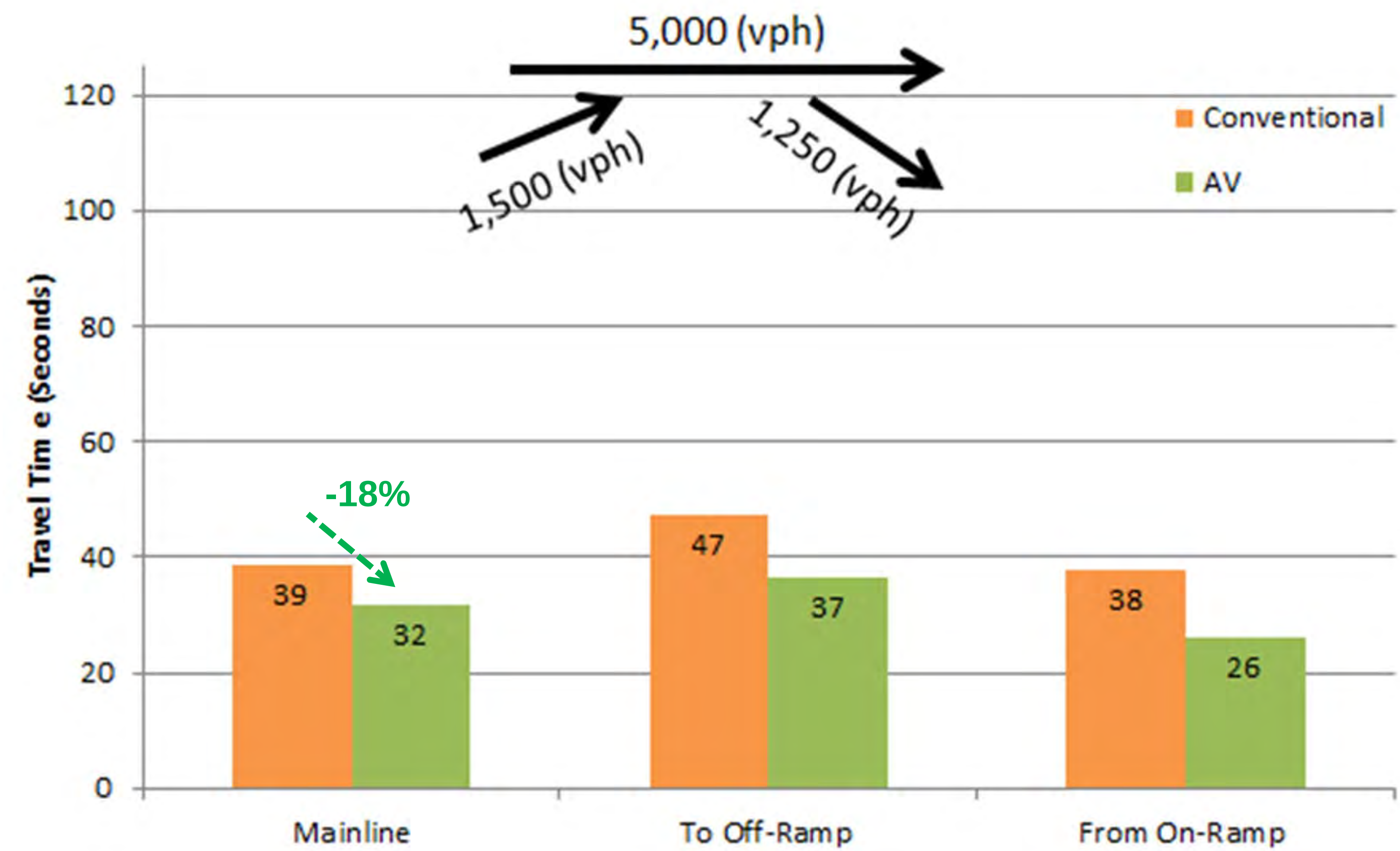
Traffic



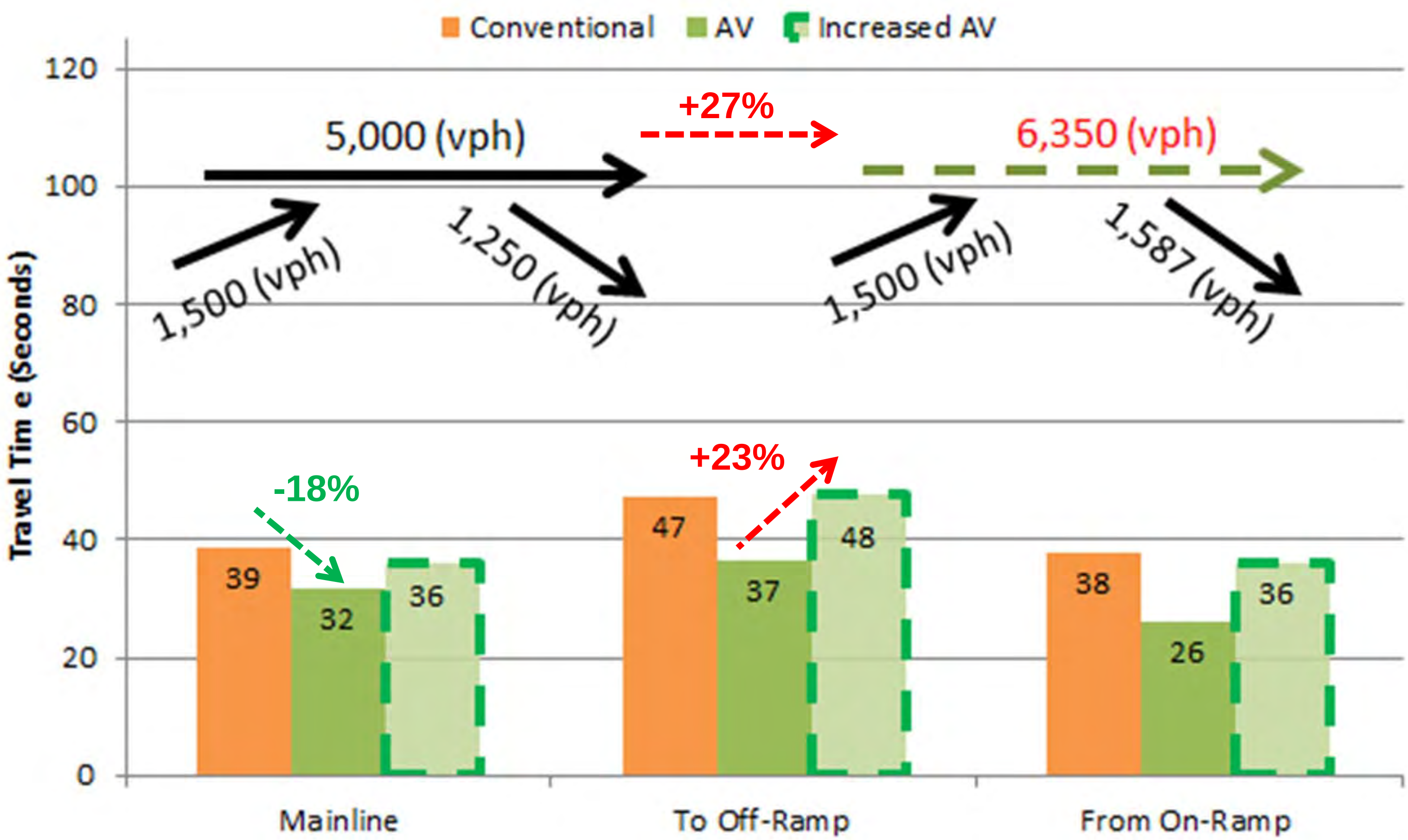
Methodology

- Used VISSIM to estimate travel time/delay for conventional and AVs
  - Through movement, on-ramp merge, off-ramp diverge
  - Moderate and heavy traffic volume
  - Used PTV's AV Modeling Assumptions
  - Used VDOT's TOSAM guideline for conventional vehicle modeling
- AVs reduced delay between 18 and 30 percent for moderate traffic
- Delay reduction increased as traffic congestion increased (+50% range)
- Increase AV volume to match conventional vehicle delays
  - Challenge: Increase of volume for a movement impacts other movements delay

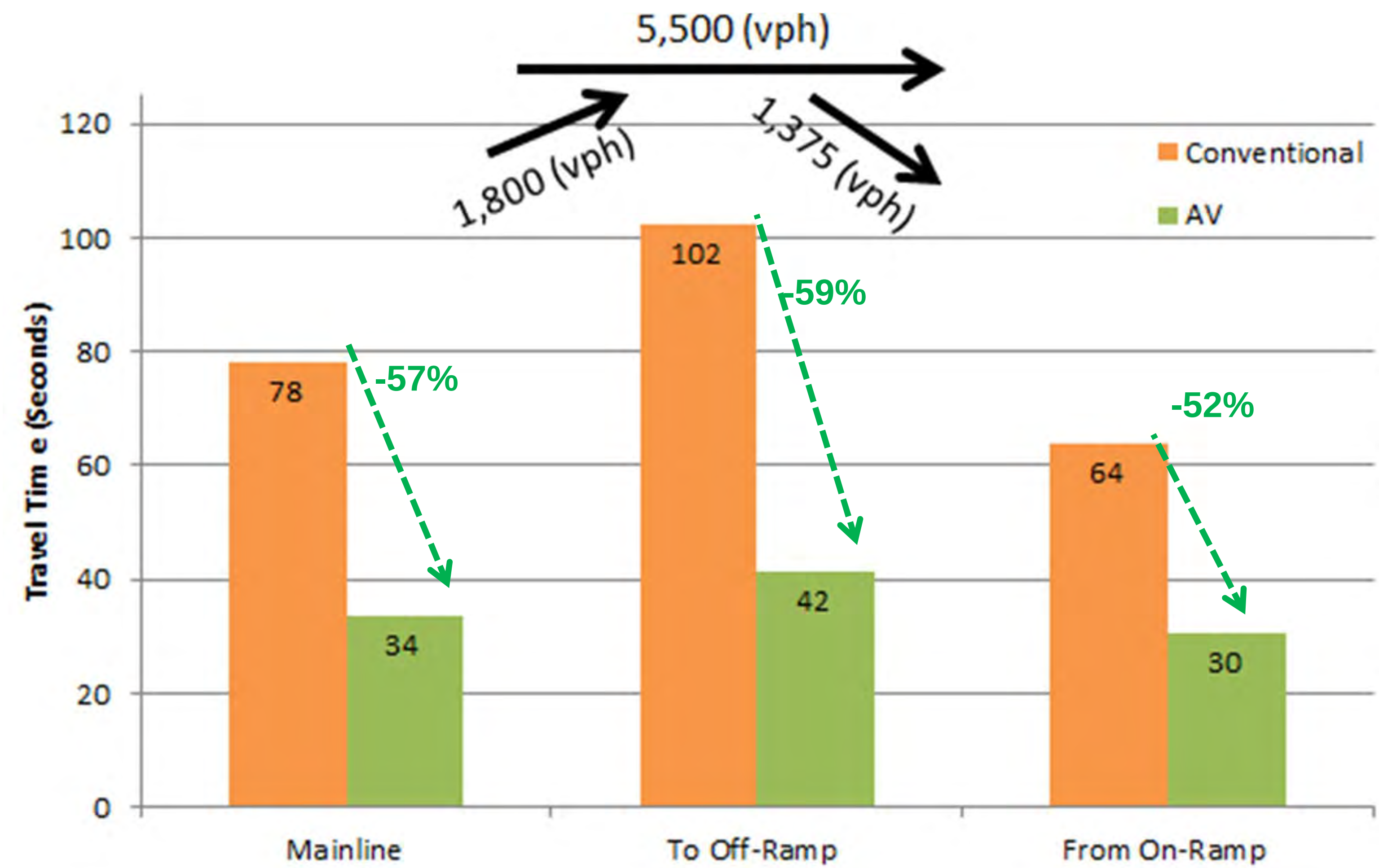
AV Impact on Travel Time for Moderate Congestion V/C ≈ 0.85



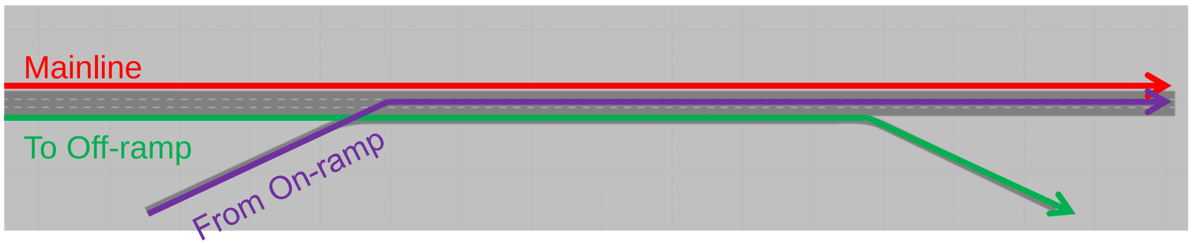
Increase AV volume for Moderate Traffic Congestion

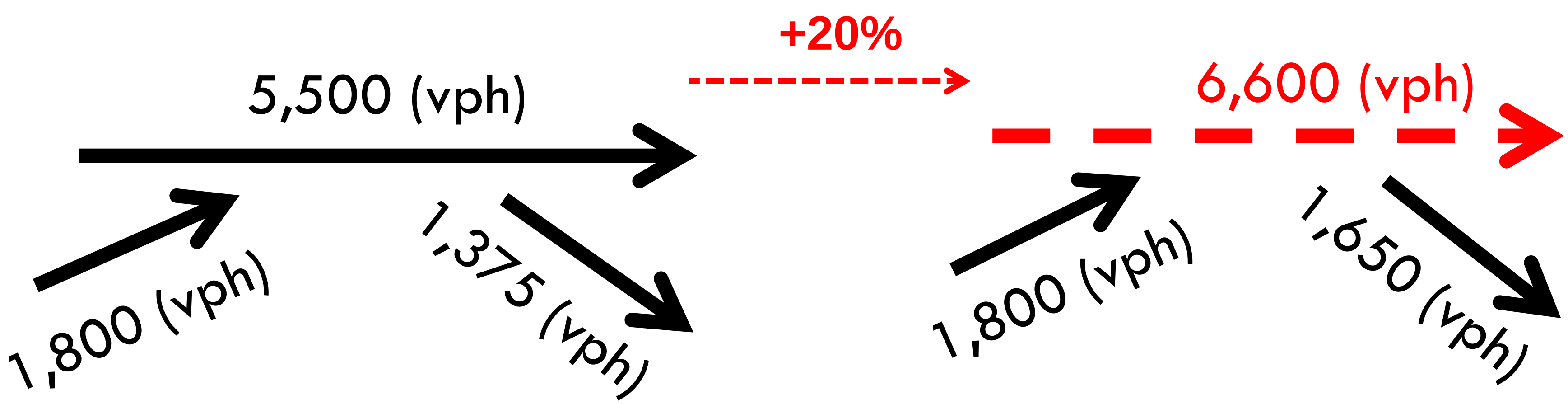


AV Impact on Travel Time for Moderate Congestion V/C ≈ 0.95

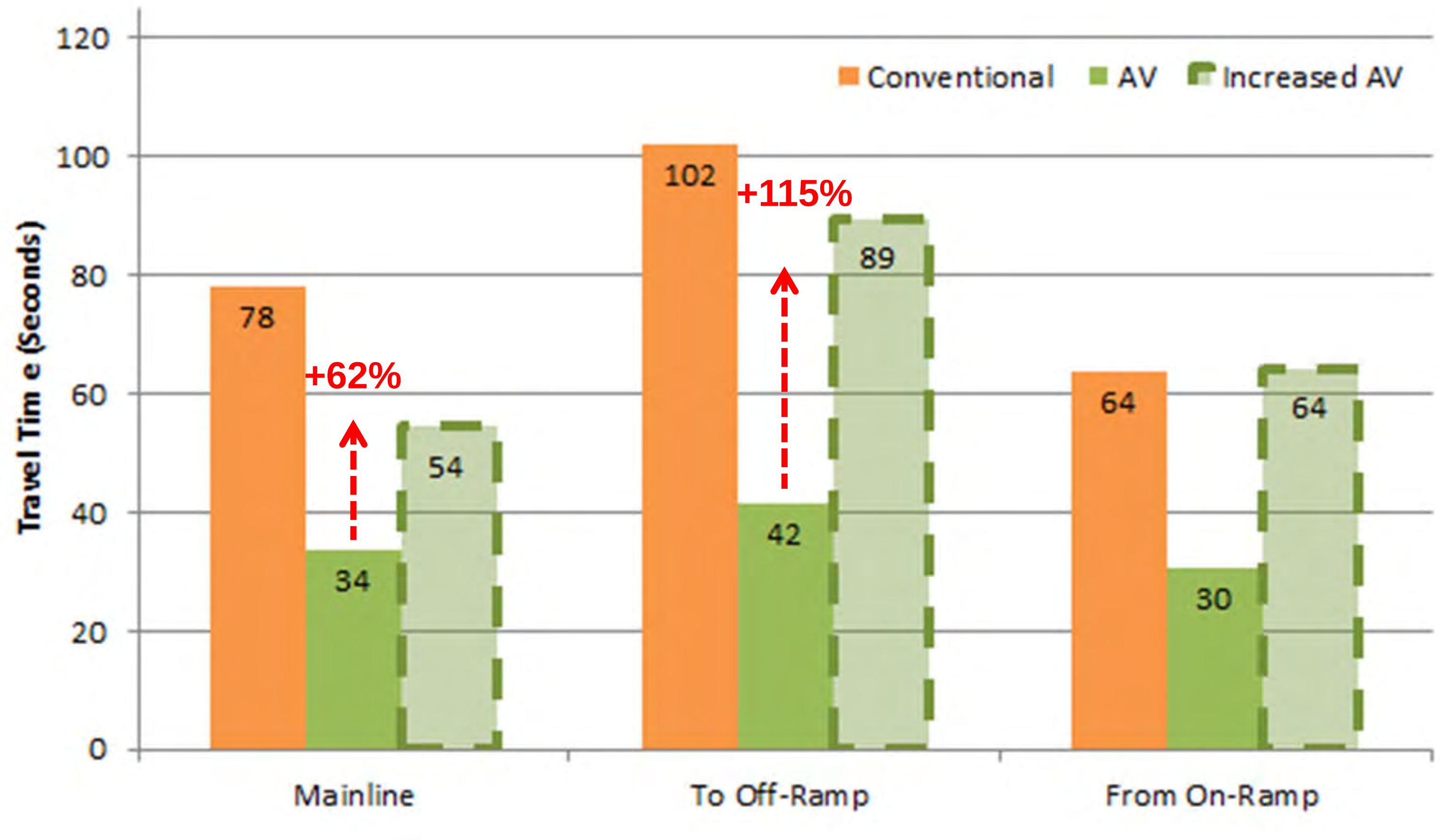


AV Impact on Travel Time for Moderate Congestion V/C ≈ 0.95

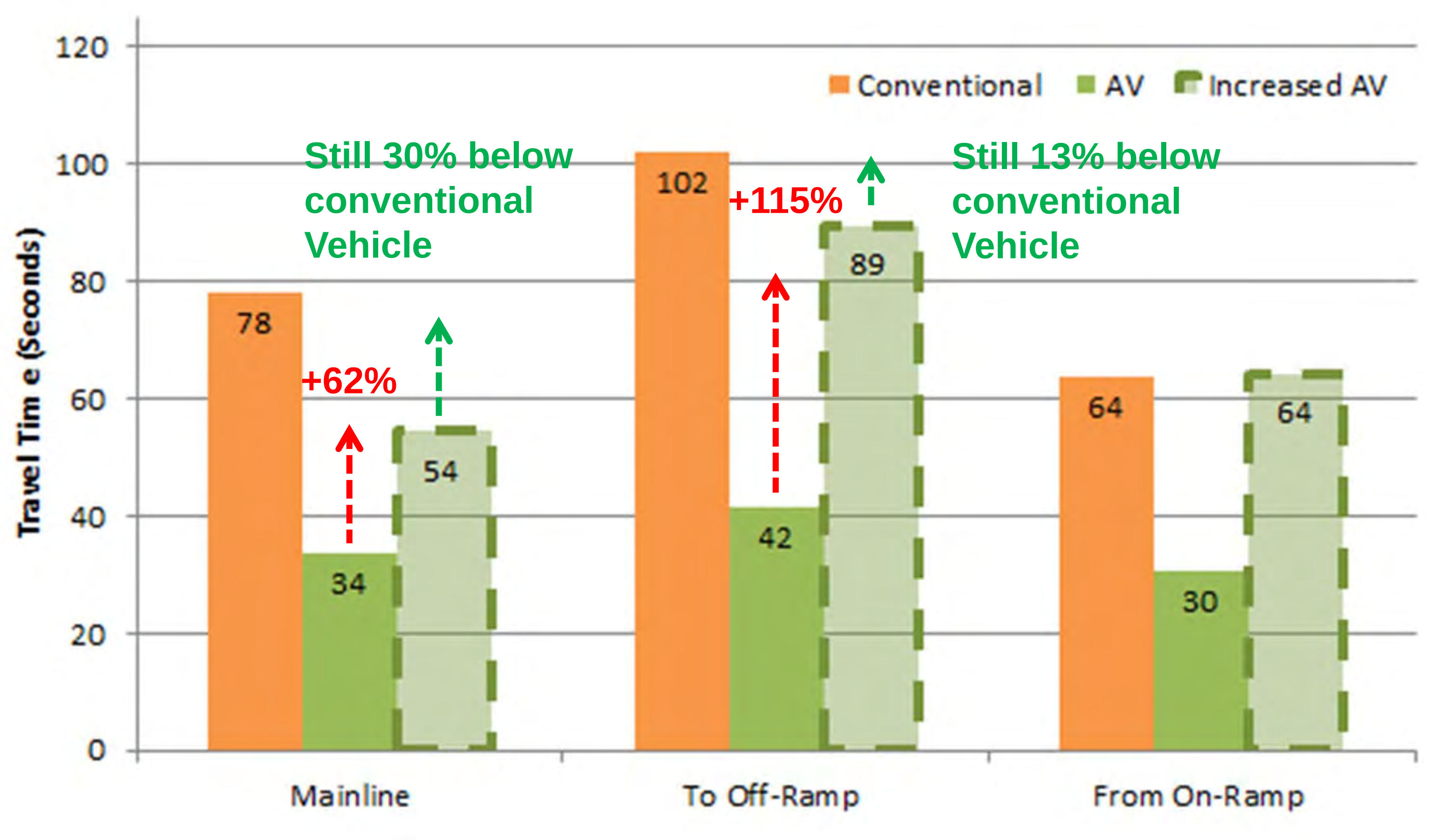




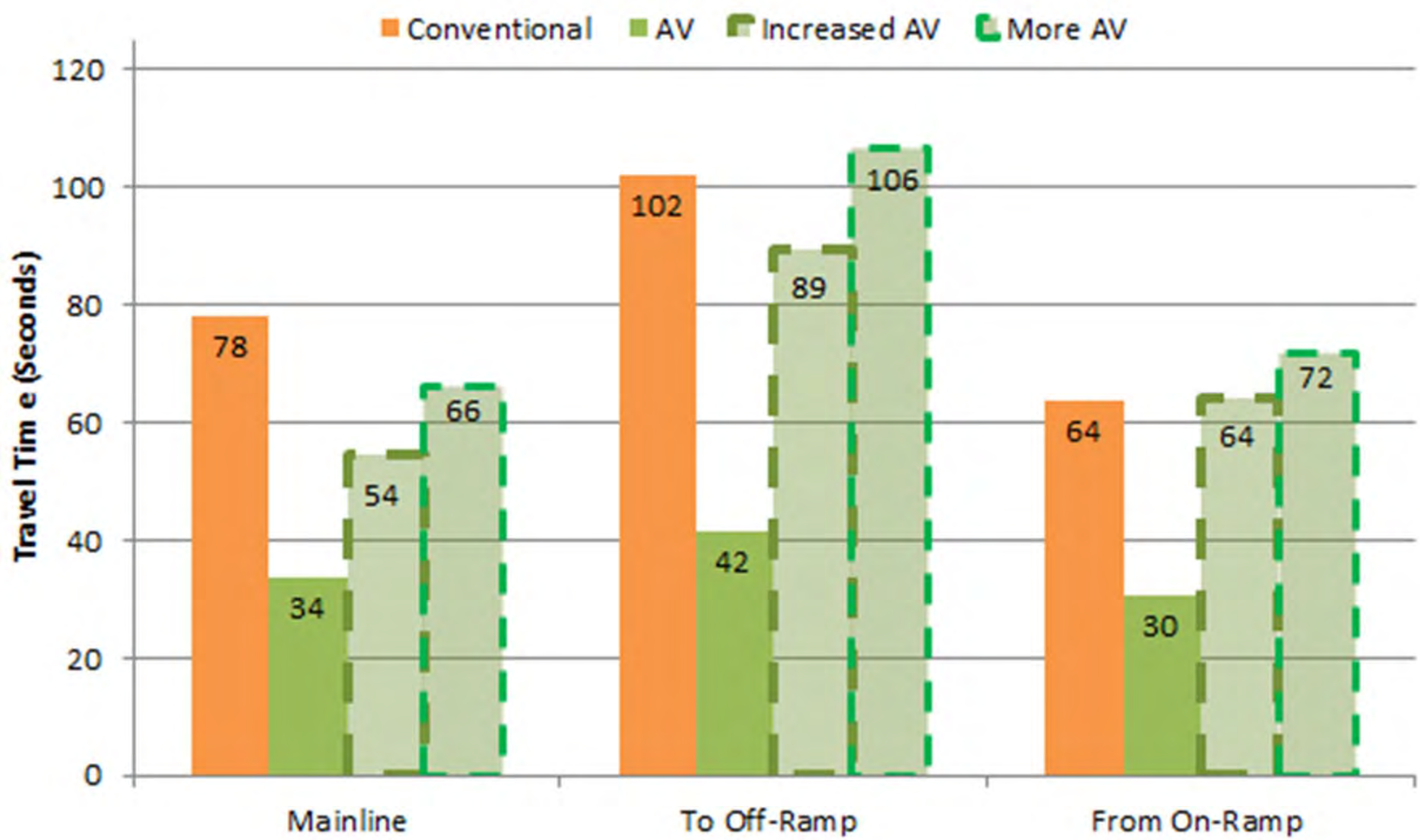
Increase AV volume for Heavy Traffic Congestion



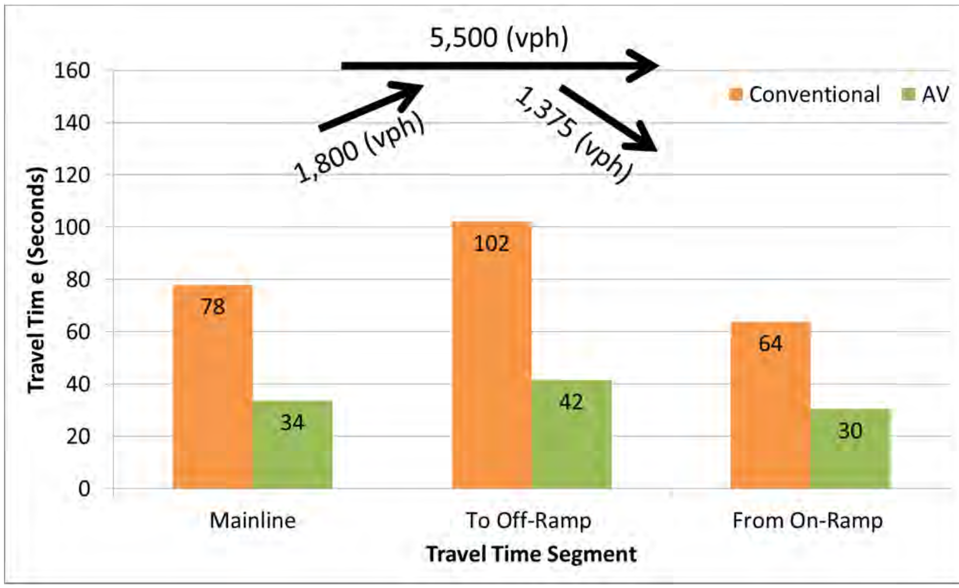
How many more vehicles can be processed?

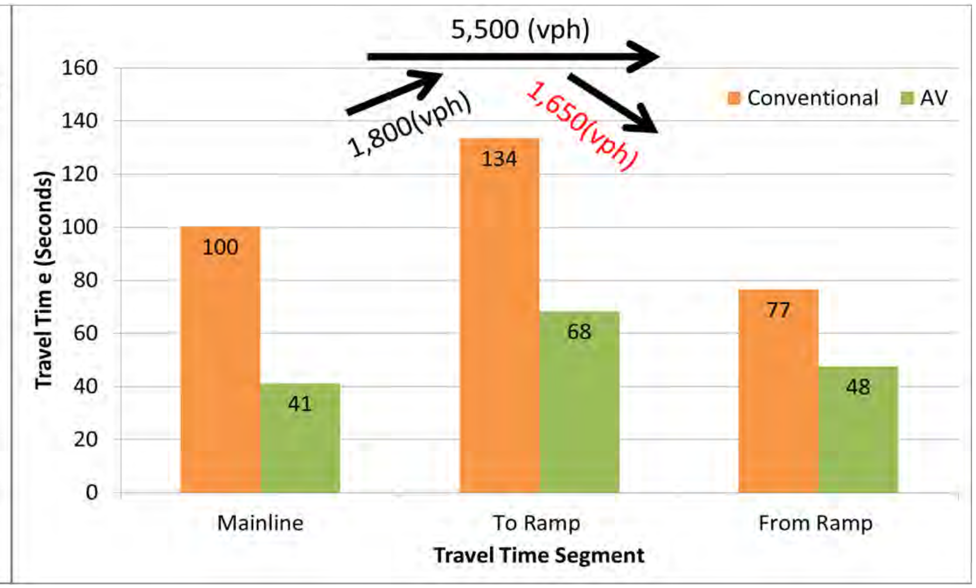


Delay Increases Rapidly for Heavy Congestion
1% Increase in Volume= 13% Increase in Delay

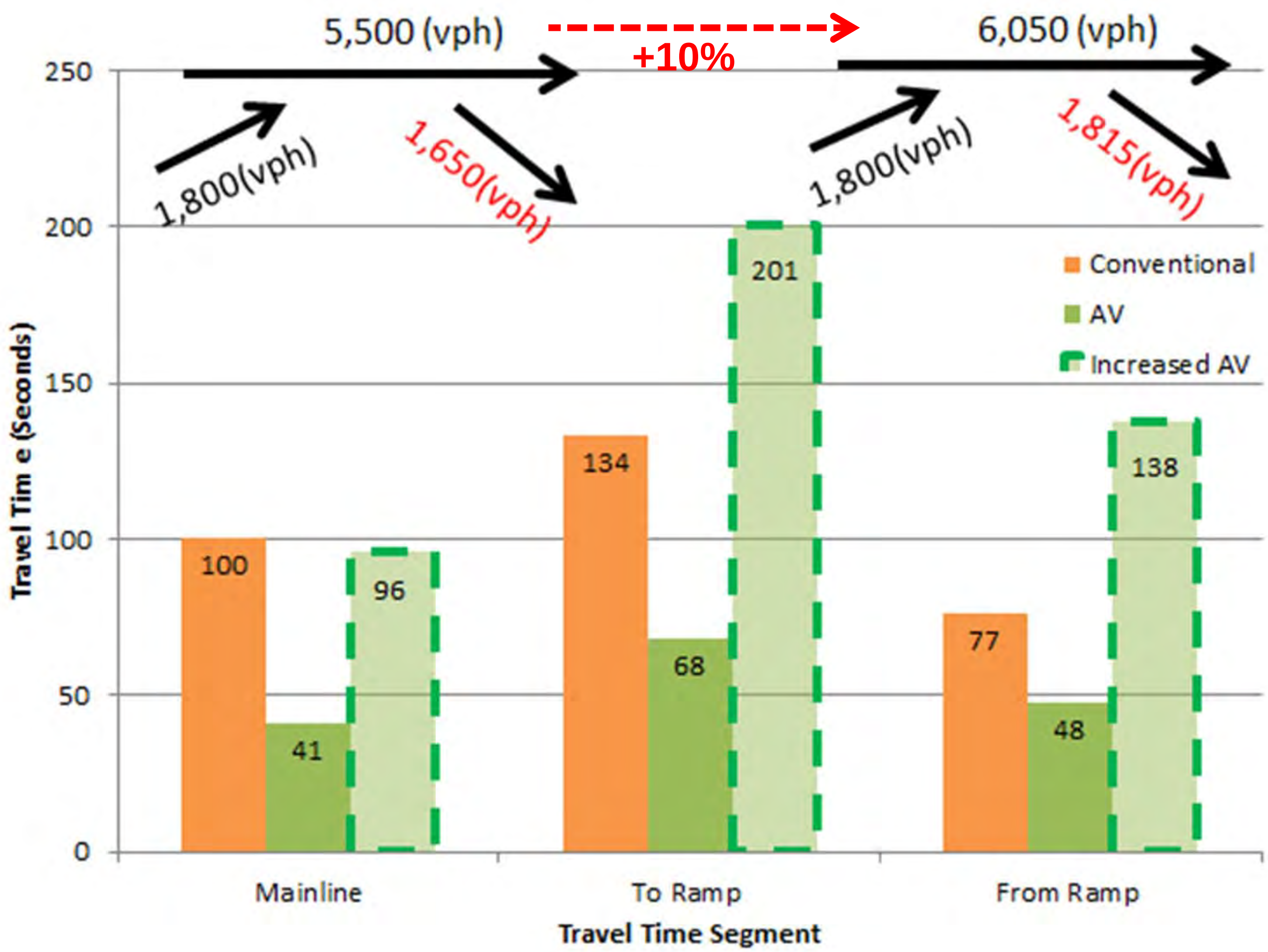


Impact of Higher Share of Off-Ramp Volume





Heavy Diverge Movement Limit Capacity Increase



Lesson Learned

- Weaving segments of the freeways limit the theoretical induced capacity of AVs
- Our tests points to 10 to 20 percent capacity increase at bottle necks
- Capacity increase was capped quickly for congested condition.
- Segments with heavy diverge movements are critical