

Managed Lanes for Connected and Automated Vehicle Applications: Concept of Operations and Simulation Results

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Outline

- What are our objectives?
- What applications considered?
- Stakeholders engagement
- A possible early deployment scenario
- Initial simulation results
- Opportunities

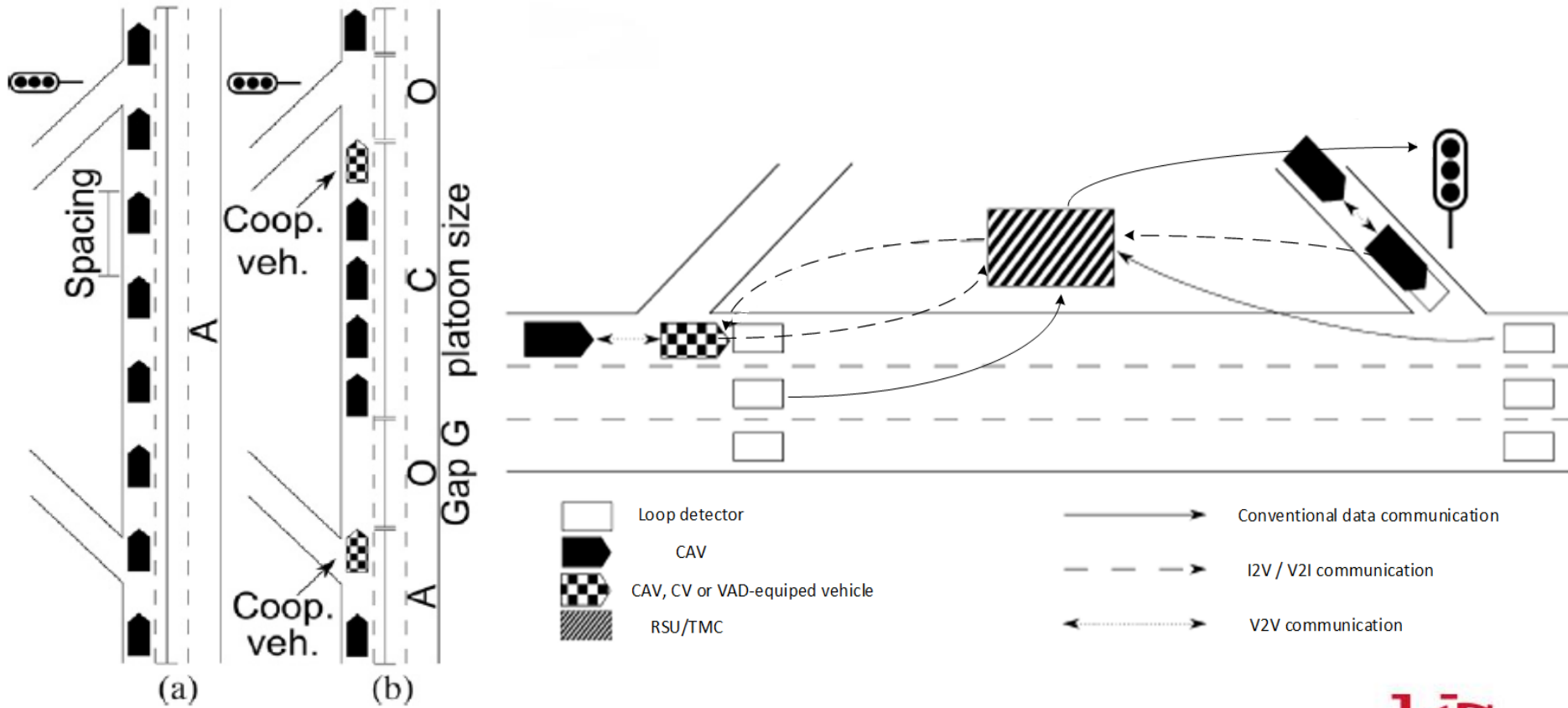
Objectives

- Use emerging automation technologies:
 - Reduce recurring congestion on urban freeways
 - Improve reliability, reduce travel times, and improve safety
 - Reduce fuel consumption and emissions
 - Maintain and increase car-sharing options

Applications

- Advisory and longitudinal control:
 - Speed Harmonization
 - Cooperative Adaptive Cruise Control
 - Cooperative merging
- Significant US DOT research investments
- Collaboration with automotive OEM's and states

At Merging Area



Stakeholders

- Roadway owners and operators, technology providers, vehicle owners
- All stakeholders must have incentives to participate and clear expectations
- Use of roadways must be limited to vehicles that improve utilization
- Need agreement or “compact” with users to set expectations, encourage investments, and measure performance

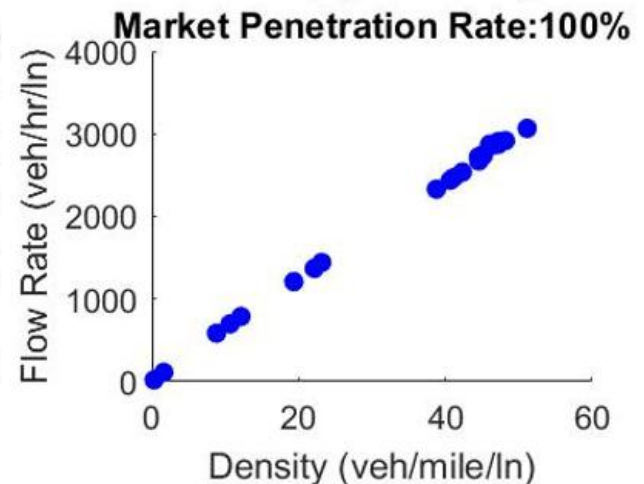
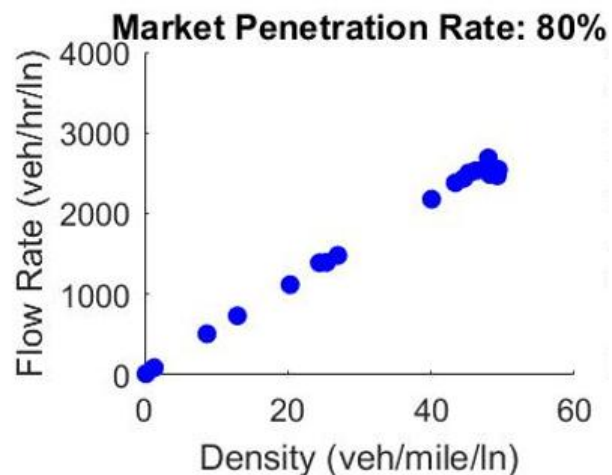
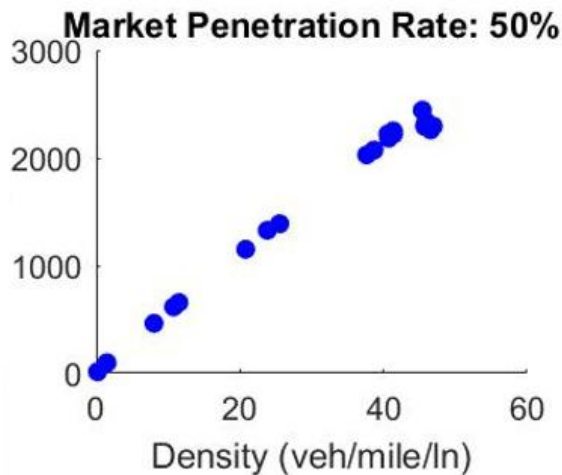
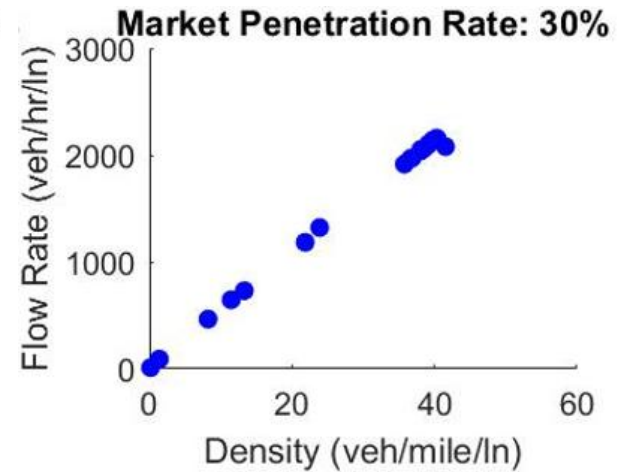
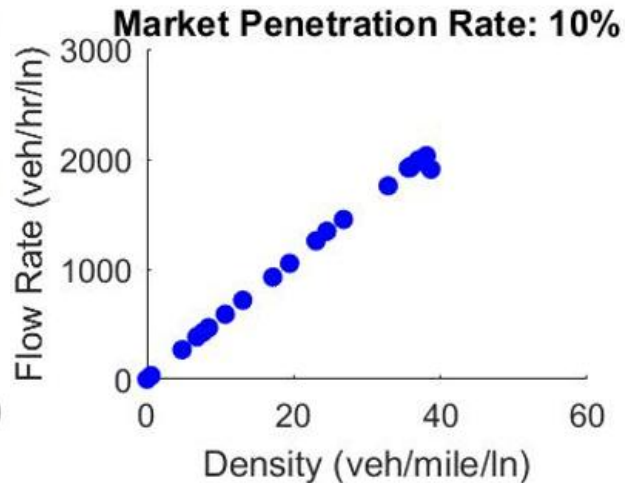
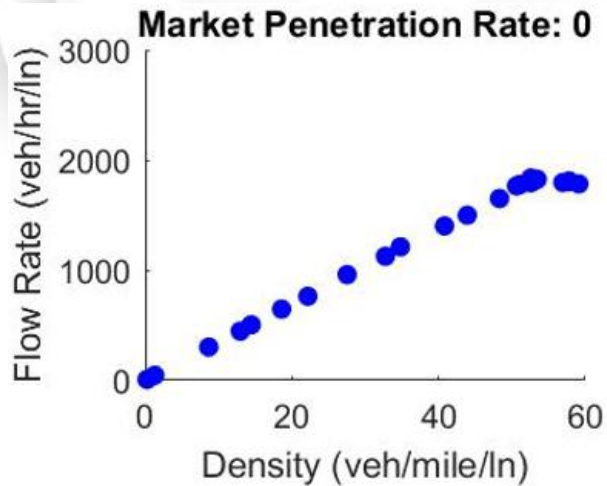
A Possible Scenario

- Existing HOV/HOT lane in a congested (peak period, at least) urban corridor
- Very simple topology, with long distances, controllable entry points, and limited (maybe no) exits until the end
- Limit use to vehicles equipped for:
 - CACC and speed harmonization
 - High occupancy tolls (HOT)
 - Registered car pools
 - HOT users with DSRC and transponders
 - Other vehicles with CACC and speed harmonization capabilities
 - Limit carpool/SU based on random selections, tightening over time, to encourage CACC conversion?

Initial Simulation Results

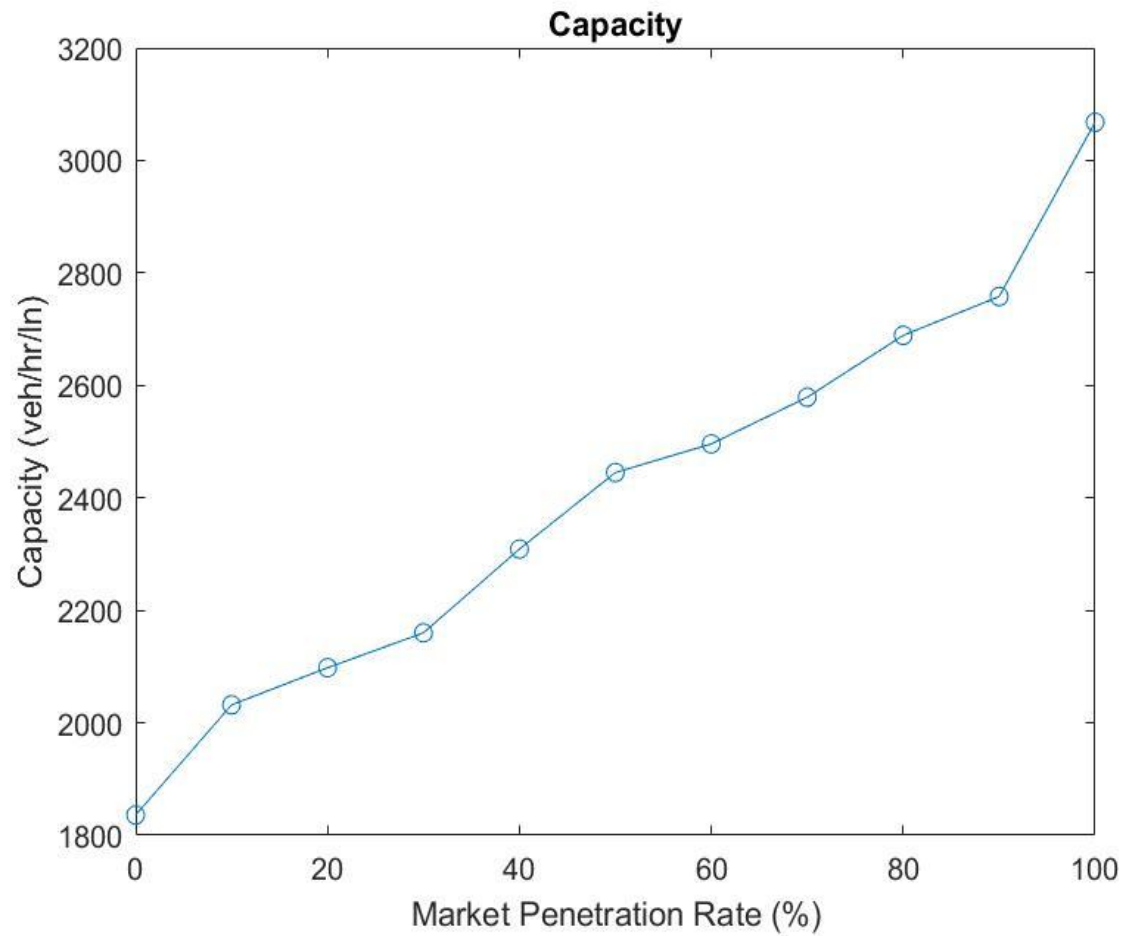
- Simulation on two networks
 - Synthetic merging segment
 - Calibrated I-66 simulation network with hypothetical managed lanes
- Questions
 - Capacity enhancement under different MP
 - Operational insights

Results (1)



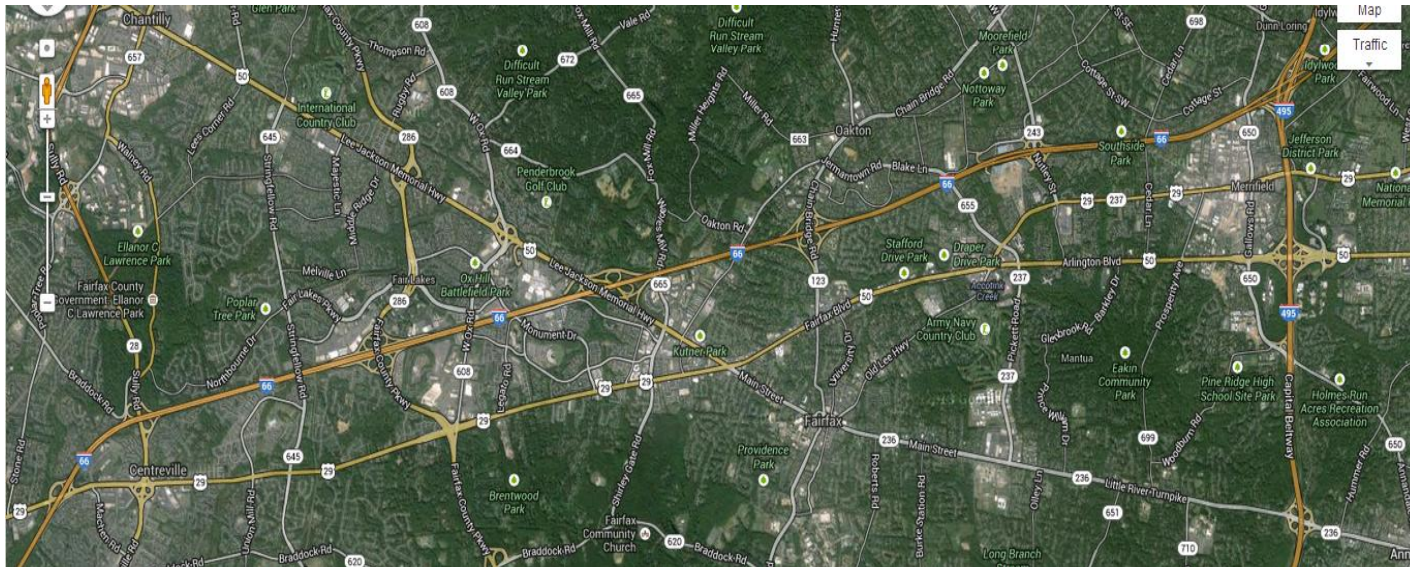
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Results (2)



Results (4)

- 13-mile stretch of Interstate 66 outside the Washington Beltway (I-495)



Results (5)

MPR on managed lane (%)	Overall average speed (mph)	General purpose lane average speed (mph)	Managed lane average speed (mph)	Managed lane throughput (veh/hr)	Demand latent (veh)
0	25.89	22.97	45.87	1490	900
10	26.00	22.77	47.85	1850	300
20	27.00	22.89	51.67	1950	200
30	27.20	22.43	53.00	2100	0
40	27.33	23.01	56.98	2100	0
50	27.47	23.09	58.76	2100	0
60	27.58	22.95	59.88	2100	0
70	27.66	22.86	62.45	2100	0
80	27.80	22.84	66.66	2100	0
90	27.89	23.77	66.66	2100	0
100	27.95	23.08	67.89	2100	0

Opportunities

- Use growing investments in managed lanes to introduce early automation technologies
- Encourage investments by roadway providers and consumers
- Significantly improve roadway capacity and performance

Next Steps

- Combination of CACC with other CAV technologies, i.e., Speed Harm and Cooperative merging
- Simulation on real networks for policy making
- Field demo and data collection with Saxon Lab CAV fleets

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Q&A

- Contact Information

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