Highway Capacity Increases From Automated Driving

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Capacity increase opportunity

- **Today's highway capacity governed by human driver performance limitations**
- **Replacing driver with automation can increase capacity by:**
  - **Shorter vehicle-following gaps**
  - **Enhanced vehicle following stability IFF automation is cooperative (eliminating shock waves)**
  - **Narrower lanes for light duty vehicles based on more accurate steering**

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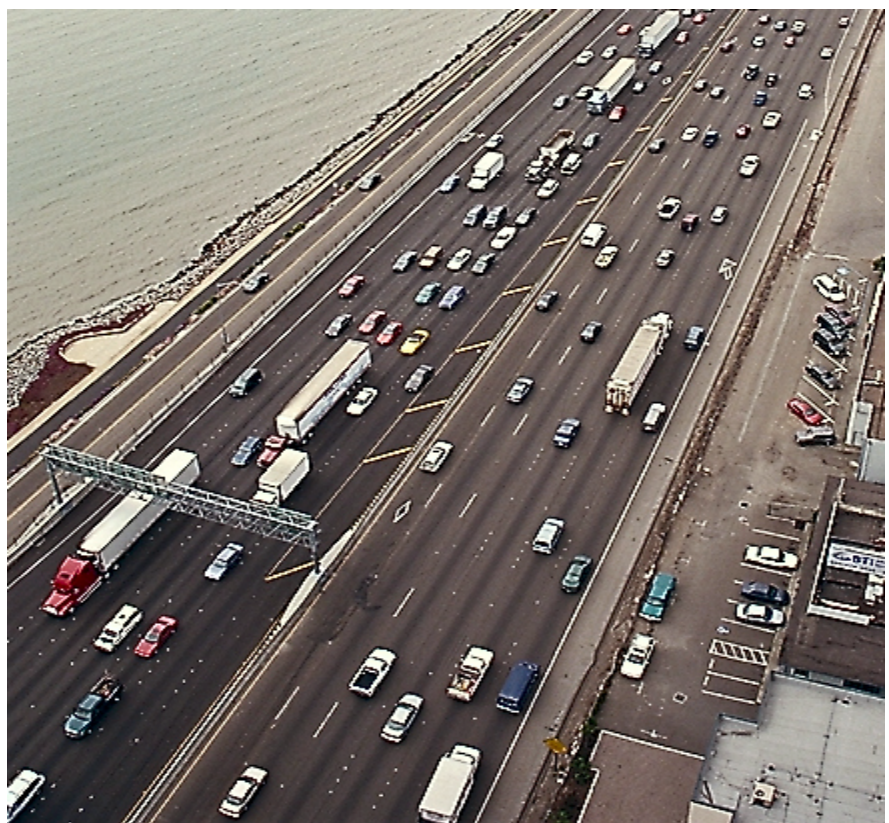
The Highway Capacity Challenge

- **<u>At maximum throughput</u> (2200 veh/hr/lane), vehicles occupy only 5% of road surface**



- **Half the lane width for a full-size car or SUV**
- **Average longitudinal gap = 9 car lengths**
- **2200 veh/hr = 1.64 s hwy**
- **At 60 mph (~100 km/h), this is 144 ft per vehicle (44 m or ~10 vehicle lengths)**

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Capacity Increase Opportunities

- **Partial automation – cooperative ACC to improve vehicle following dynamics and reduce gaps**
- **Full automation – driver removed from control loop, enabling operations outside driver response capabilities**

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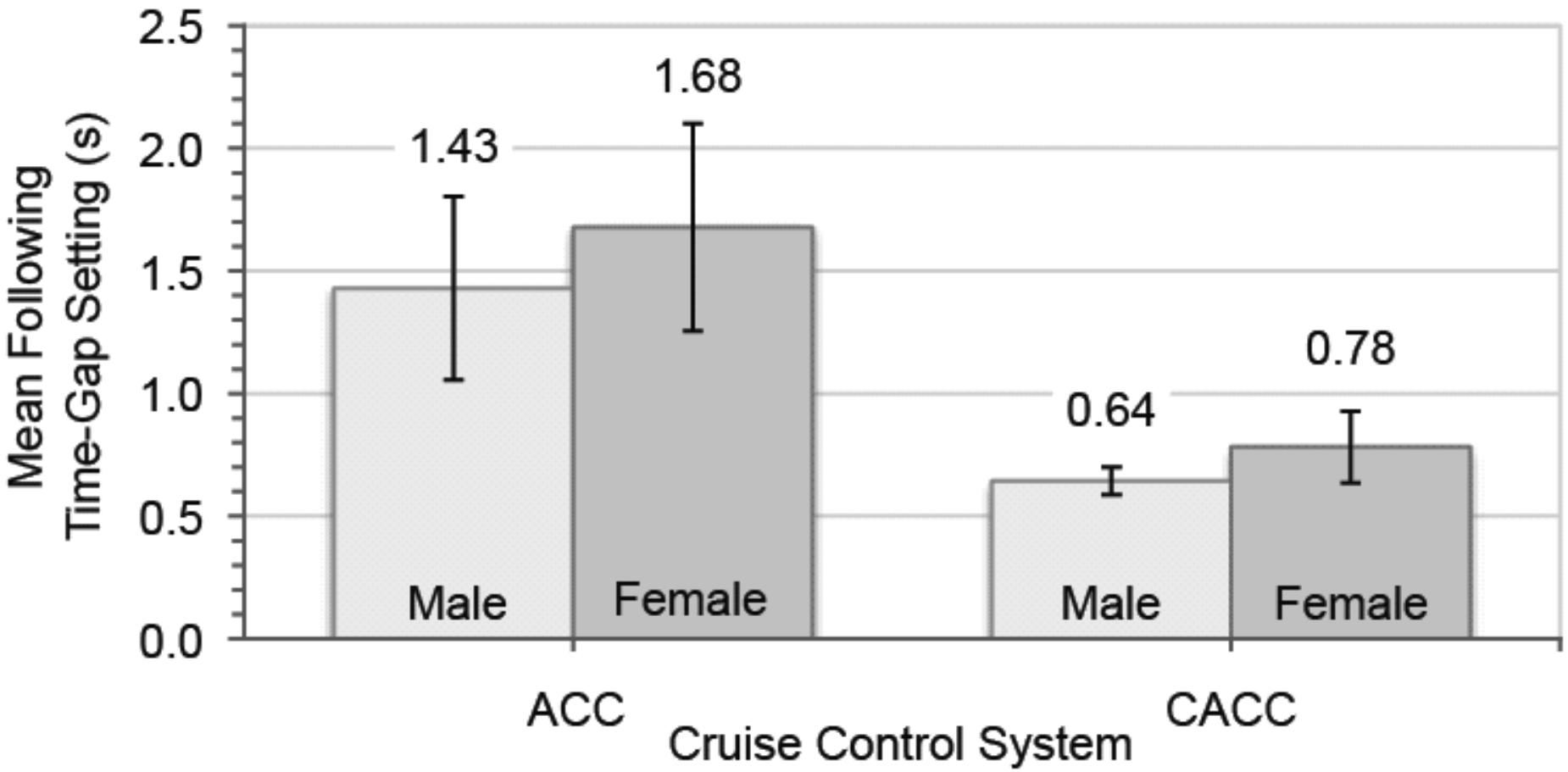
Mean CACC/ACC Time-Gaps Selected in Vehicle Following (Test Results)



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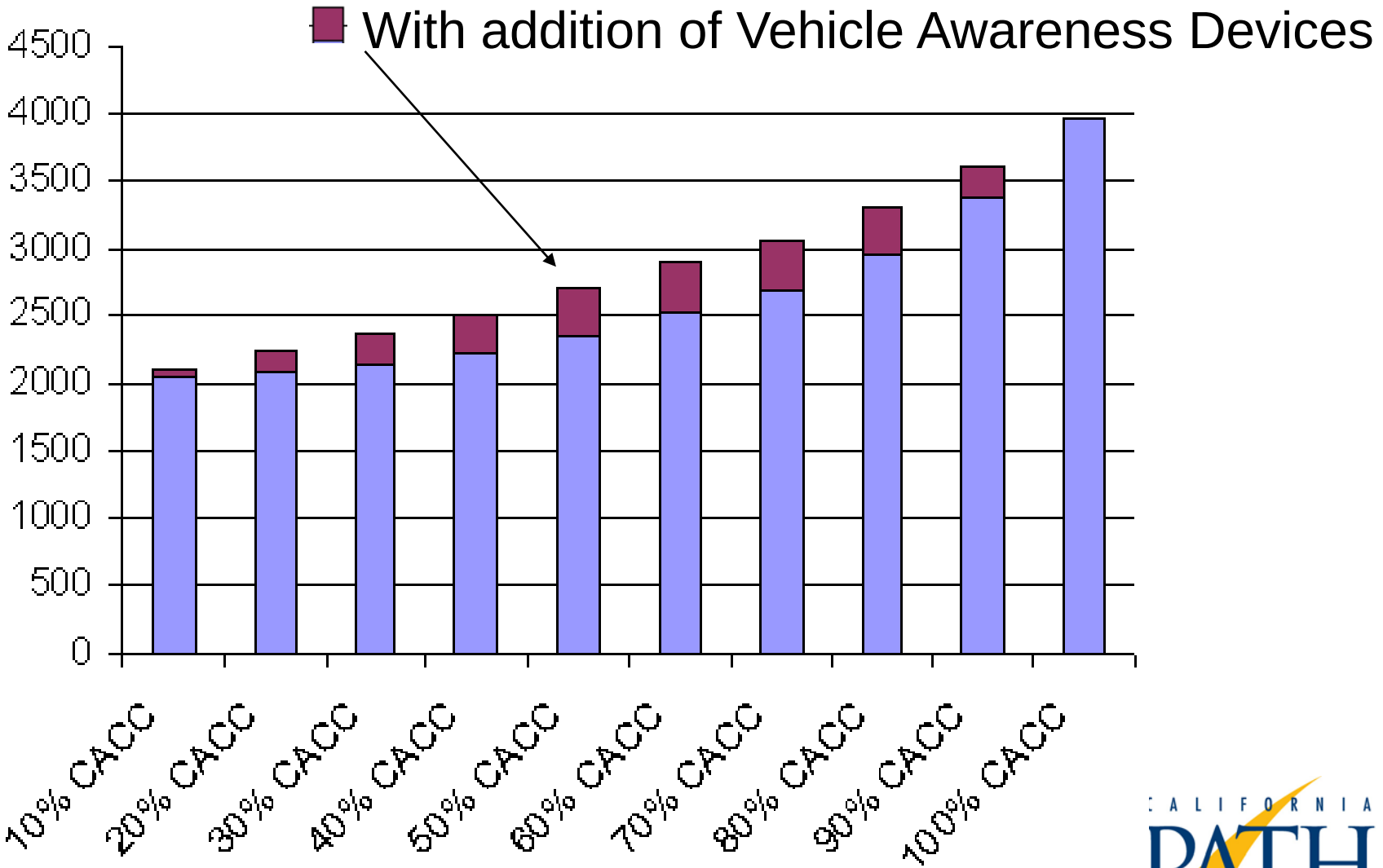
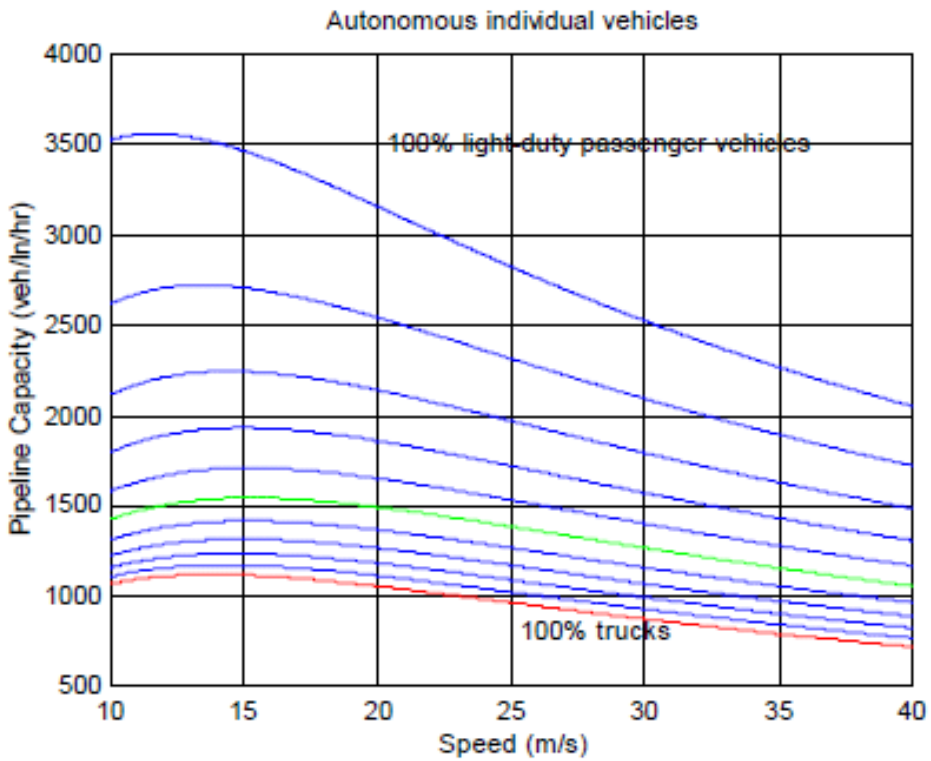
Simulated Lane Capacity vs. CACC Market Pen.

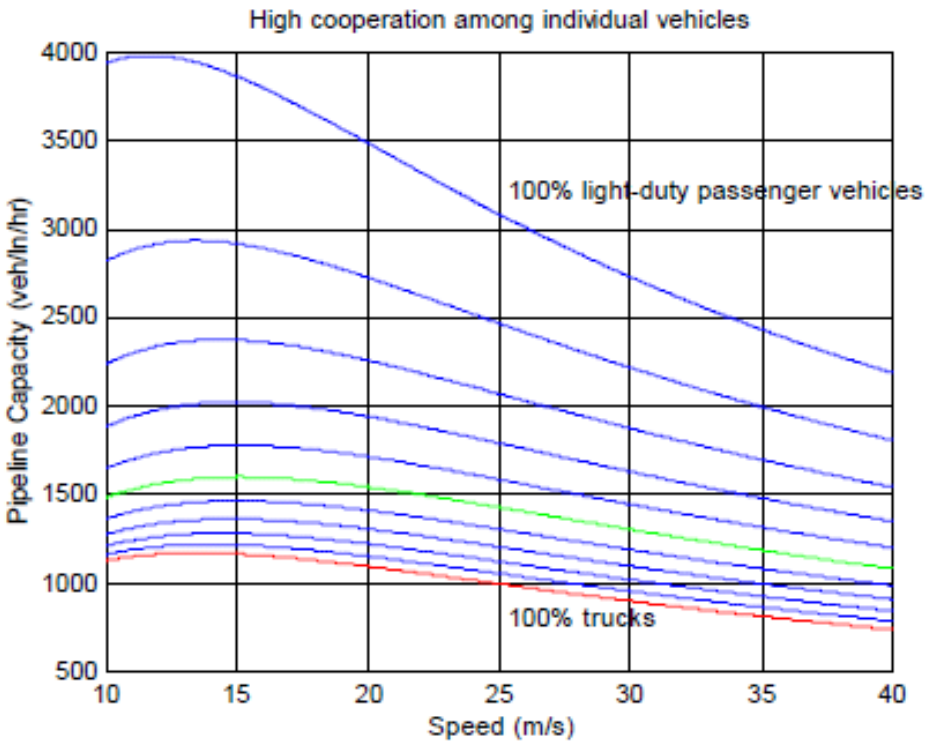


NAHSC "Pipeline" Capacity Estimates – Individual Automated Vehicles

Autonomous



Highly Cooperative



Achievable capacity will be ~25% less to allow for merging and lane changing

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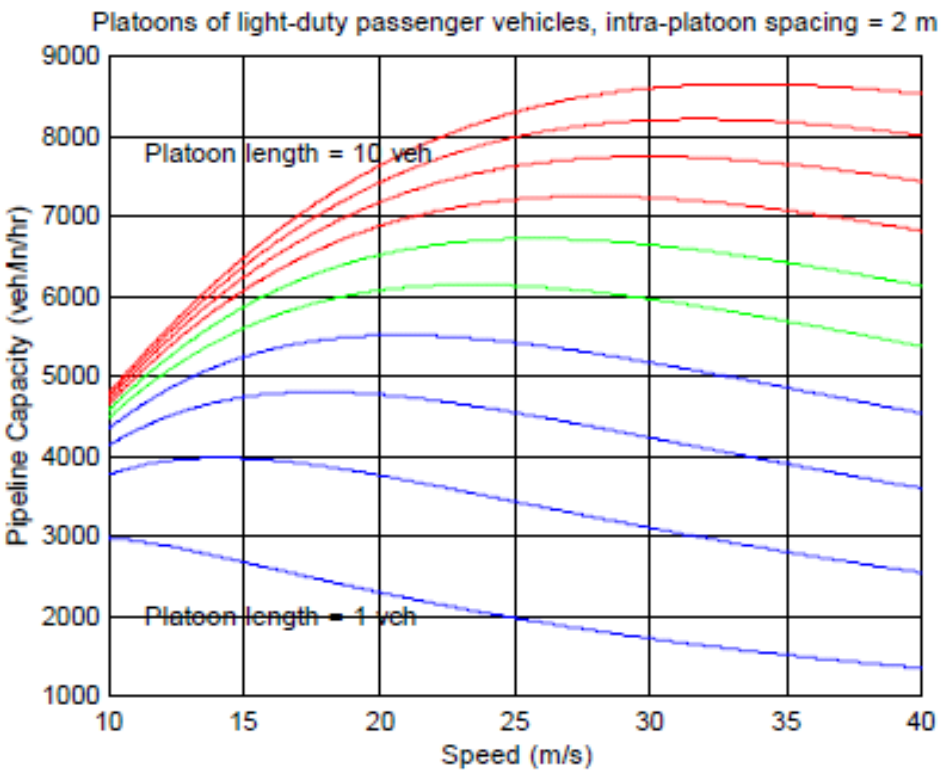
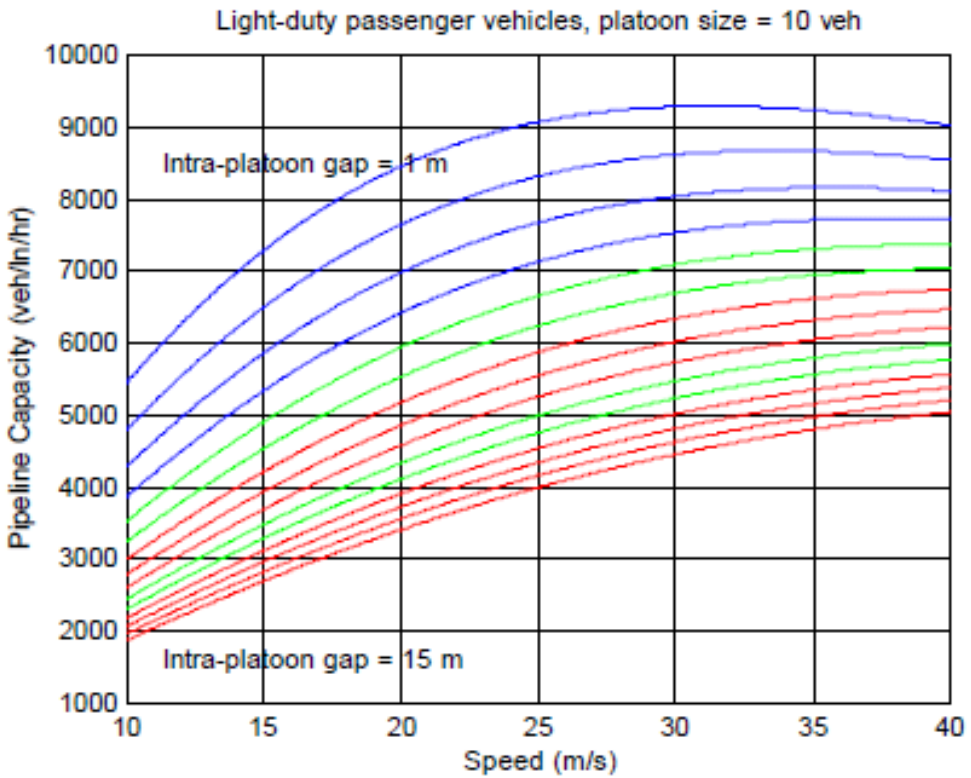
NAHSC "Pipeline" Capacity Estimates – Platooned Light-Duty Vehicles

vs. Platoon Length



vs. Intra-Platoon Gap



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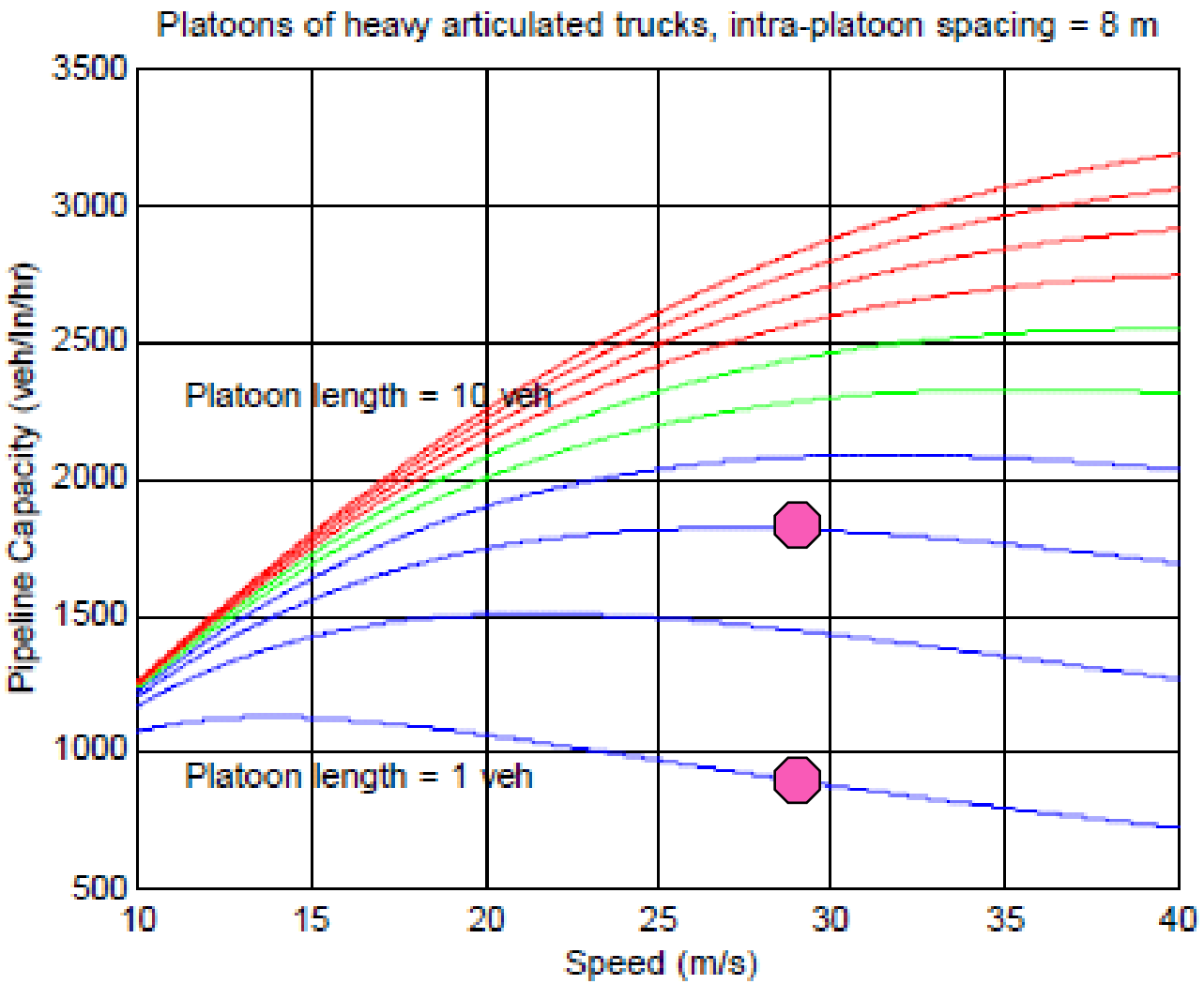
Automated Truck Platoon Capacity

- **NAHSC studies (1997)**



Traffic Flow Stability

- **Drivers' car-following response lags cause shock wave instabilities ("stop and go")**
- **Commercially available autonomous ACC systems can have comparable or worse lags**
- ***Cooperative* ACC dramatically reduces lags and improves stability**
- **Cooperative fully automated systems can also eliminate flow instabilities**

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