Planning Level Roadway Capacity Analysis Adjustments for Connected and Automated Vehicles: The Future is Now

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Outline

» Background Information
» Preliminary Research Results
» Conclusion
San Diego Union Tribune. October 11, 2016

- “say no to SANDAG: reject backward looking Measure A”

- “… projects that may not be necessary in a future in which networks of autonomous vehicles reduce congestion”

- “… no one has a firm grasp on what those needs will be in five- or ten-years time”
Safety Implications of Automated Vehicles

<table>
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<tr>
<th>Accident Rate</th>
<th>Traditional Vehicles</th>
<th>Automated Vehicles</th>
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?
The Challenge of Full Automation
Steps in Typical Highway Capacity Manual Process

- Observe Operations to Determine Appropriate Parameters
- Data Collection
- Data Analysis to Determine Sensitivity of Input Parameters
- Develop Model
  *Analysis Supplemented by Simulation*
- Calibrate Model Based on Observed Data
- Validate Model
- HCM Procedures
  *Planning (Simple) and Operations (Complicated)*
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Technical Advisory Committee (TAC)
- Brian Dunn, Oregon DOT
- Tony Knudson, Oregon DOT
- Peter Calcaterra, Connecticut DOT
- Grant Farnsworth, Utah DOT
- Joe Hummer, NCDOT
- Jessie Jones, Arkansas DOT
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  - Jiaqi Ma

TRB Committee on Highway Capacity and Quality of Service
... at 70 mi/h travel speed

- 2,400 pc/h/ln → 1.5 seconds → 154 feet
- 3,600 pc/h/ln → 1.0 seconds → 103 feet
- 7,200 pc/h/ln → 0.5 seconds → 51 feet
Basic Freeway Segments → Effects of Market Penetration

Steady Increase in Capacity with Increasing Market Penetration
Basic Freeway Segments
→ ACC vs CACC

Capacity significantly lower with ACC (Autonomous Vehicles without Platooning)
If they follow previous vehicle technologies autonomous vehicles it will take one to three decades to dominate vehicle sales, and one or two more decades to dominate vehicle travel, and even at saturation a significant portion of vehicle travel may continue to be human operated, indicated by the dashed lines.
Conclusions

- CAVs will likely increase capacities, but
  - ...not as soon as you may think
  - ...not as much as media may suggest

- Actual capacity is a function of many factors and assumptions

- The HCM may soon have planning-level estimates to help inform decision-making, but agencies should understand modeling assumptions

- Dedicated CAV-Only Facilities may happen sooner