Session 15: CAV Scenarios for High Speed Controlled Access Facilities

- Panel providing perspectives
  - Infrastructure owner/operator (Caltrans)
  - Infrastructure vendor (3M)
  - Vehicle/supplier (DENSO)
  - Emerging technology/toll collection (VTA)
- Discussed four high-speed scenarios from an operational perspective
  - work zone/incident
  - truck automation/platooning
  - mixed traffic
  - transit/shared mobility

Sponsoring TRB Committees:
- Freeway Operations
- Managed Lanes
- ITS
- Highway Capacity & Quality of Service
- Traffic Control Devices
Session 15: CAV Scenarios for High Speed Controlled Access Facilities

Summary of Breakout Discussion:

• CAVs offer improvement in safety, throughput, and congestion
• Consider the entire transportation network
• Many opportunities in data sharing, but also challenges
• Need for simulation tools to assess impacts / operations
• When/where can platoons operate (truck, car, bus, mixed)
• Change the way we design work zones based on CAV
• How to integrate CAVs into managed lane operation spectrum
Session 15: CAV Scenarios for High Speed Controlled Access Facilities

Recommended Action Items:

• No significant changes in infrastructure geometry in the near term
  • Opportunities for better planning, road markings, and signing
• Need to continue dialogue between OEMs/Suppliers and Infrastructure Owners/Operators
• 2 Synthesis Topics Identified
• Great input for Research Needs Statements for the sponsoring committees
Moore’s Law, Emerging Technologies, Managed Lanes and Automated Vehicles

Automated Vehicles Symposium 2017

July 11, 2017
Introductions

Casey Emoto
Deputy Director
Santa Clara Valley Transportation Authority
casey.emoto@vta.org

Nick Wood and Jason Wagner
Texas A&M Transportation Institute

Murali Ramanujam and Chris Augenstein
Santa Clara Valley Transportation Authority

Chuck Fuhs
Chuck Fuhs, LLC
Presentation Outline

• About VTA
• Moore’s Law and Managed Lanes
• Impact of Emerging Technologies
• Final Thoughts
About VTA

- A unique organization with wide-ranging authorities
- Transit Service Provider
- CMA for County
- Countywide Transportation Plan (VTP)
- Sales Tax Measure Authority
- Tolling Authority (express lanes)
- Project Delivery for all Modes
- Innovative Delivery Team with Caltrans (iTeam)
- Innovation Center / Transportation Technology
Moore’s Law and Managed Lanes

- 2014 Annual TRB Meeting
- Are we investing in technology and access arrangement approaches that could be outdated within a few years?
- **US 101/SR 85** – 58 centerline miles
- **SR 237/I-880** – 8 centerline miles

Source: www.investopedia.com/terms/m/mooreslaw.asp
Emerging Technologies Panel Members

CISCO
METROPOLITAN TRANSPORTATION COMMISSION
MGL
Microgrid Labs
More than renewable energy
CHP
J.P.Morgan
ARADA SYSTEMS
amigacloud
Savari
metrotech
U.S. Department of Transportation
Federal Highway Administration
The Toll Roads
Bay Area Toll Authority
HNTB
McHenry Engineering
QUALCOMM
Panel Recommendations Relative to Emerging Technologies & Managed Lanes

- Keep things simple for VTA
- Keep things simple for Customers
- Visioning to set goals
- Consider risks in contracts
- Collaborate with others
- Consider accessibility
- Consider incremental development and pilots
- Monitor development of technologies such as AV/CV and mobile applications
Mobile Solutions

- Responding to input from customers
- Developed real-time toll rate display for the web and mobile devices
- Open data policy and open source code on Github
- Working on data standard with Sidewalk Labs and others

Challenges and Opportunities Moving Forward

- **Staffing** - Ability of public agencies like VTA to maintain needed staffing; role for private sector
- **Timelines** - Ongoing mismatch between public agency design standards and development by private entities
- **Contracting/Agreements** - Public agency contracting challenges
- **Data** - Management of the amounts of data generated by today’s systems; access to data on travel
New Dimension to Managed Lanes

Source: Chuck Fuhs presentation, 2015.
Thank You!

“Guide to Silicon Valley’s auto corridor”
http://www.autonews.com/article/20140616/OEM/140619948/guide-to-silicon-valleys-auto-corridor...Automotive News
AVS Symposium – Breakout Session #15

CAV Scenarios for High Speed, Controlled Access Facilities
CAVs Allowed on Freeways in Mixed Traffic

Toronto, 1959
Los Angeles, 2009

Alexander Skabardonis
San Francisco, July 11, 2017
Projected Impacts

- Air quality
- Automation
- Connected Veh
- ATM

Capacity
Current technologies
Safety
Background: AHS Implementation

- Dedicated AHS lanes
- Automated Check-in
- Automated Check-out
- Lateral and Longitudinal Controls
- Automated merging/diverging
- Malfunction Management & Analysis

AHS Demo: San Diego 1997
Capacity of AHS Lane

\[
\text{Capacity } = C = \frac{v \cdot n}{[ns + a(n-1) + d]} \text{ veh / lane / hour}
\]

Assume \( v = 72 \text{ k/h}, s = 5\text{m}. \) Then

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Notes
- \( n=20 \) yields nearly 4 times today's capacity
- capacity proportional to speed
CAV Freeway Lane Capacity

Cooperative Adaptive Crouse Control (CACC)
Issues/Oppportunities/Challenges – Near Term

- Capacity and Operational Performance
  - Impact on Freeway Capacity
  - Impact on Operational Performance (reliability)
  - Implications for Planning Studies

- What are the Infrastructure needs to support the scenario?
- What additional traffic control needs would be required?
- What are ideas on implementation ready technologies?
Issues/Opportunities/Challenges – Long Term

▪ How data from CAVs can support agencies with facility operation?

▪ What are possible private and public sector business case ideas?

▪ What are the design issues for the facility to accommodate CAVs?
Multi-spectral sensing and connectivity plays integral role for cooperative safety
Example Safety Applications for V2V

Electronic Brake Lights
- Hard Brake
- Blocked Field of View
- Stopped Vehicles in Roadway

Example Environmental & Convenience Applications for V2V

Platooning for Fuel Economy

CACC for Safety & Comfort
V2V*

Cloud

Mapping Service Providers

- TOMTOM
- GeoDigital
- HERE

OEM Backend

- Ford
- Volkswagen
- Toyota
- Honda
- GM

Geo-location Server

Security

Mobile Data Market

Roadside Infrastructure

Source: Cisco VNI Mobile, 2017

Roadside Infrastructure

- Security

LTE/5G Mobile Edge

On-board Sensors

Vehicle

CE / IoT

VRU = Vulnerable Road User
CE = Consumer Equipment
IoT = Internet of Things

V2V* via 802.11p or C-V2X

V2V* = Traffic Participants

V2X = Cloud based Entities

LTE/5G

Exabytes per Month

2016: 7 EB
2017: 11 EB
2018: 17 EB
2019: 24 EB
2020: 35 EB
2021: 49 EB

Source: Cisco VNI Mobile, 2017