

Initial Assessment of Connected Vehicles and Autonomous Vehicles Technologies on System-wide Performance Measures

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Agenda

- Contra Costa Transportation Authority (CCTA) Overview and Goals
- Study Objective and Approach
- Sensitivity Analysis and Results
- Conclusion

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CCTA Overview and Goals

- Contra Costa Transportation Authority
 - Manages transportation sales tax program
 - Countywide transportation planning

"CCTA is responsible for maintaining and improving County's transportation system by planning, funding, and delivering critical transportation infrastructure projects and programs that connect our communities, foster a strong economy, increase sustainability, enhance safety and efficient mobility".

CCTA Transportation Leadership

- **GoMentum Station**
- City of Concord, Automobile manufacturers, Communications companies, Technology companies, Researchers and Public agencies
- 5,000 acres
- Facilitating R&D, testing, validation and deployment of CV/AV technologies
- Public-Private Partnership model

TJKM Transportation Consultants

- **Multi-disciplinary** firm with Nearly **45 Years** Track Record
- **Plan, Design, and Implement** Transportation Projects
- Delivering “**Projects**” that Support **Vibrant and Sustainable Communities**
- **Comprehensive Planning** Approach and **Innovative Designs** Backed by **Technical and Analytical** Strength

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Study Objective

- Evaluate the impacts of CV/AV technologies on system wide performance measures

Assessment of CV/AV Technologies

- CCTA is interested in understanding the impacts of CV/AV on transportation planning and policy
- Forecasting CV/AV technologies complex
- Early stages
- Initial assessment
- Traditional four-step travel demand forecasting



CCTA Travel Demand Model (1 of 2)

- CCTA Travel Demand Model provides traffic forecast through Year 2040 and covers the 9 San Francisco Bay Area counties.
- Travel Demand Model is used for:
 - Analyzing the effects of new developments
 - General plan update
 - Countywide Comprehensive Transportation Plan Update
 - Congestion Management Program



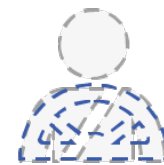
CCTA Travel Demand Model (2 of 2)

- TransCAD platform
- 3,200 TAZ's.
- Base Year 2010
- Future Years
 - 2020, 2030 and 2040
- Time Periods
 - AM Peak
 - PM Peak
 - Off-Peak
- Multi-modal including Transit
- Run time 8 hrs

Automation Levels - Definition

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE) AUTOMATION LEVELS

Full Automation



0

No Automation

Zero autonomy; the driver performs all driving tasks.

1

Driver Assistance

Vehicle is controlled by the driver, but some driving assist features may be included in the vehicle design.

2

Partial Automation

Vehicle has combined automated functions, like acceleration and steering, but the driver must remain engaged with the driving task and monitor the environment at all times.

3

Conditional Automation

Driver is a necessity, but is not required to monitor the environment. The driver must be ready to take control of the vehicle at all times with notice.

4

High Automation

The vehicle is capable of performing all driving functions under certain conditions. The driver may have the option to control the vehicle.

5

Full Automation

The vehicle is capable of performing all driving functions under all conditions. The driver may have the option to control the vehicle.

Source: SAE (<https://www.nhtsa.gov/technology-innovation/automated-vehicles-safety>)

Study Approach and Assumptions

- Establish a **2040 Baseline** with zero CV/AV scenario using the existing 2040 CTP model data set
- **4 sensitivity analyses** of system performance measures of effectiveness
- Limited Level 4 vehicle autonomy
- System performance measures of effectiveness:
 - Vehicle hours travelled (VHT)
 - Vehicle-miles-travelled (VMT) by speed bin
- Improved **platooning** results in increased freeway throughput from 2,000 to 3,300 VPHPL

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Sensitivity Analysis

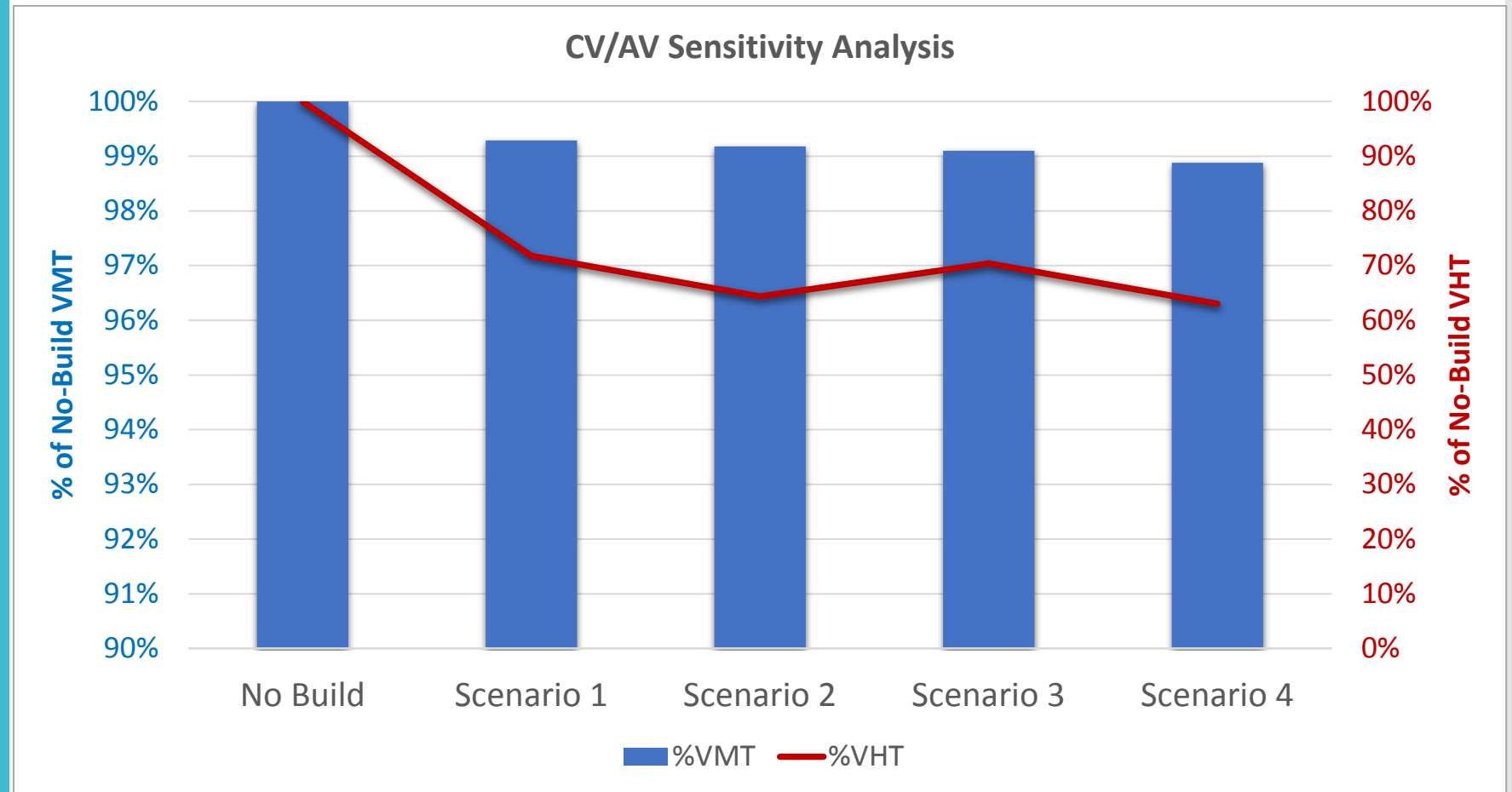
- Scenarios Tested:
 - Scenario 1 – Level 4 Autonomy with 30% capacity gain and 5% speed gain
 - Scenario 2 - Level 4 Autonomy with 70% capacity gain and 5% speed gain
 - Scenario 3 – Level 4 Autonomy with 30% capacity gain and 10% speed gain
 - Scenario 4 - Level 4 Autonomy with 70% capacity gain and 10% speed gain

Sensitivity Analysis Results

Scenario	Capacity Gain	Speed Gain	VMT	VHT
No CV/AV			50,530	1,825
Scenario 1	+30%	+5%	50,170	1,315
Scenario 2	+70%	+5%	50,115	1,175
Scenario 3	+30%	+10%	50,075	1,285
Scenario 4	+70%	+10%	49,965	1,150

VMT and VHT in Thousands (1,000)

CV/AV Sensitivity Analysis Results

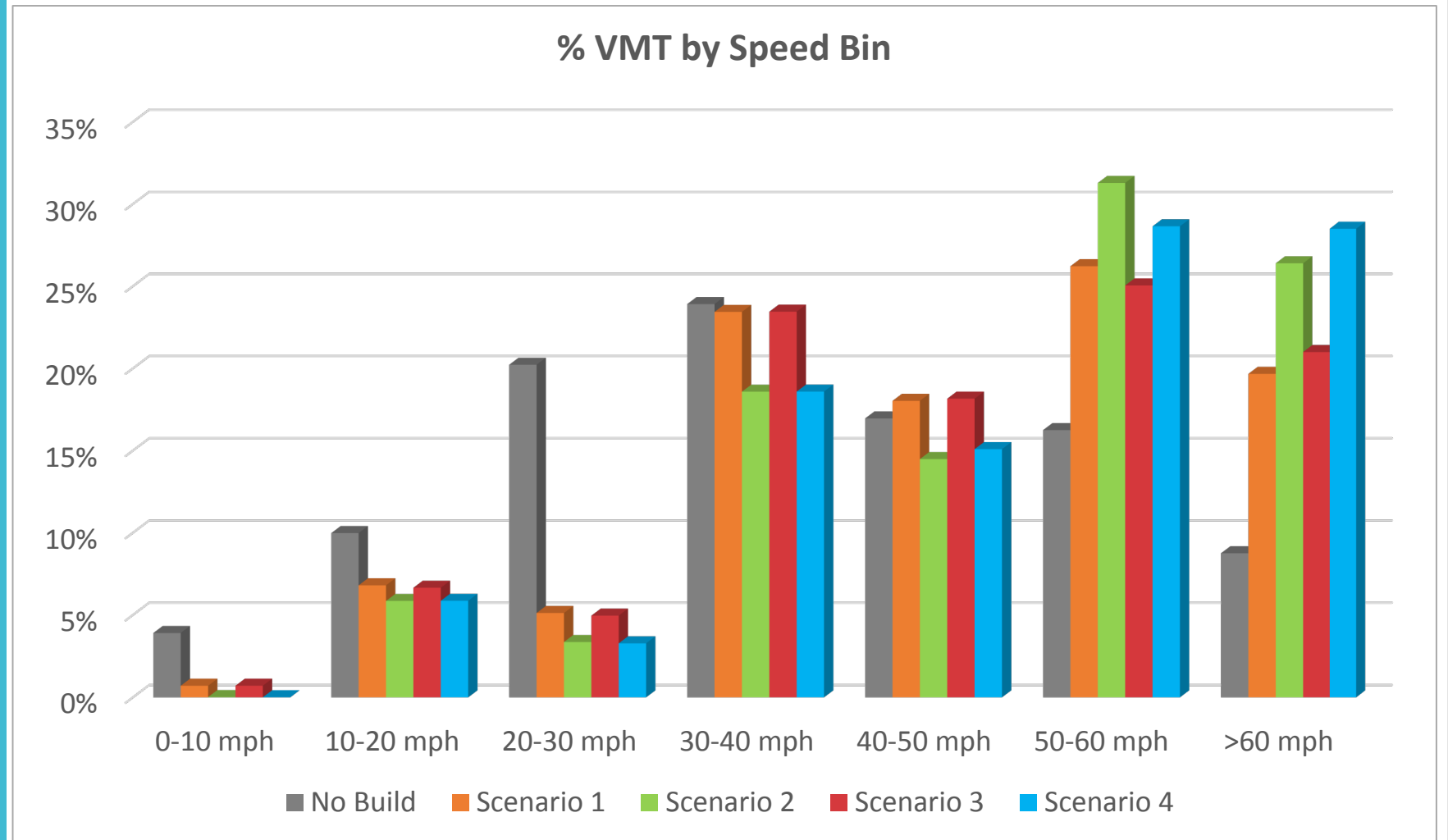


Changes in VMT by Speed

	No Build	Scenario 1	Scenario 2	Scenario 3	Scenario 4
0-10 mph	1,975	355	10	355	5
10-20 mph	5,045	3,415	2,935	3,335	2,930
20-30 mph	10,220	2,570	1,685	2,485	1,640
30-40 mph	12,085	11,760	9,315	11,745	9,290
40-50 mph	8,570	9,045	7,260	9,095	7,540
50-60 mph	8,210	13,155	15,680	12,545	14,315
>60 mph	4,425	9,870	13,230	10,515	14,240
Total	50,530	50,170	50,115	50,075	49,965

VMT in Thousands (1,000)

% VMT by Speed Bin



Limitations

- Auto ownership - ridesharing
- New trips by people who don't drive
- Last mile connectivity – mode shift
- Operational efficiencies

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Conclusion

- CCTA Travel Demand model **can quantify** the effect of CV/AV on VMT and VHT, **with limitations**.
- VMT were **projected to reduce** (by approximately 1%) as the impacts of CV/AV technologies on mode shift were ignored
- A **shift** of VMT occurs from low functional classification to higher functional classification roads
- VHT were **projected to reduce** (by approximately 37%) due to the capacity and speed gains
- More detailed analyses will need to be conducted with **advanced modeling tools**

Thank You