Louis Berger

Willingness to Pay in the Autonomous Vehicle Age

IBTTA Summit on Finance & Policy July 24, 2018

Solutions for a better world.

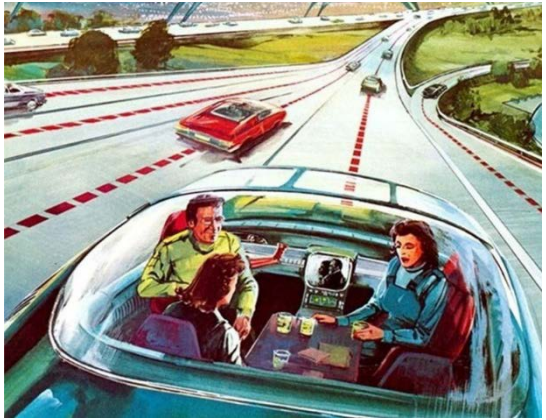
PREMISE

- **Autonomous Vehicles (AVs)** are coming.
- AVs will impact long-term planning and project prioritization.
- AVs will impact user fee assets. How? Not clear yet

PREMISE

Willingness to pay / **Value of Time (VoT)** is a key assumption in Traffic and Revenue (T&R) forecasting, which is today's primary means of valuating toll roads and managed lanes assets.

How does Traveler's VoT change in the AV age?



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WHAT IS WILLINGNESS TO PAY AND VALUE OF TIME?

1. Did you fly to Portland **direct** or **with stops**?
   - Tradeoff between **time and cost**

2. Did you select an airline based on **on-time performance**?
   - Consideration for **travel time reliability**

3. Would your flight choice changed if you were **paying** for your own ticket?
   - Differences in **trip purpose**

4. For the local travelers, was the **ability to work** / make a call / read a decision factor in taking TriMet / Amtrak?
   - Value of **productivity.**

OBJECTIVE

Louis Berger conducted a study to evaluate willingness to pay for travelers using AVs

- Leveraged experience in
  - Traffic and Revenue (T&R) for public and private sector clients
  - Stated preference survey development
  - Estimation of willingness to pay

- Outputs useful to sensitize T&R forecasts
- First step in series of tests that can inform risk assessment and upside cases in toll asset valuations.

WHAT DO WE KNOW SO FAR?

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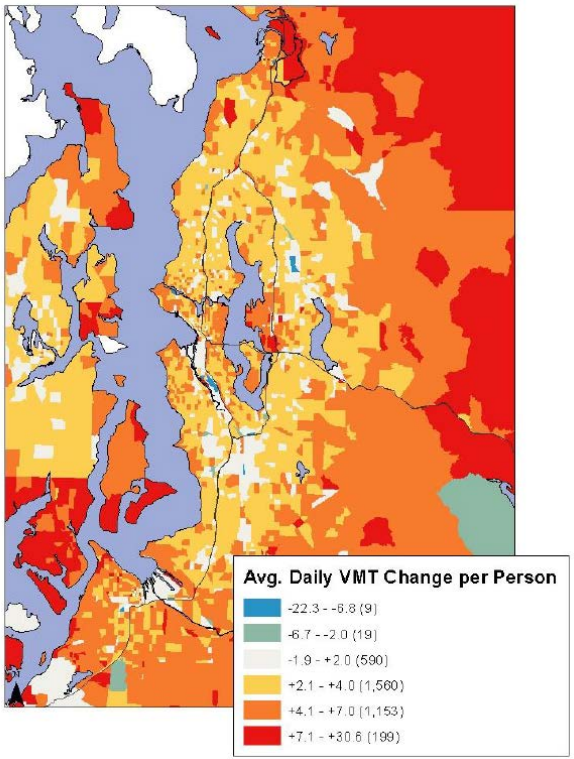
WHAT WE FIND IN THE LITERATURE



MODELING AND RESEARCH FINDINGS

- **Modeling study in Puget Sound:** Higher capacity and lower VoT assumptions lead to higher VMT.
- **Millennial Study**: Mode choice highly influenced by ability to use laptop, and have a **have lower VOTTS** for travel and wait times.
- **Perceived train travel times**: Depends on ability to stay productive. Perceived travel time can be more influential than actual travel time.
- **Travel time perception in an AV** is less negative than traditional car and similar to riding in public transport.
- **Willingness to pay** in TX to **share a ride is lower than traveling alone**, Newer generations value privacy more.

VALUE OF "BEING PRODUCTIVE"

Mode Choice study based on a survey of 2120 Northern California commuters on mode choice found that greater perceived "**multitaskability**" of a mode adds to its utility.
(A. Malokin, G. Circella and P.L. Mokhtarian, 2015)

RESPONDENTS THAT ARE LIKELY TO BE PRODUCTIVE DURING TRAVEL

Higher Utilities
- Commuter Rail
- Shared Ride

Lower Utilities
- Drive Alone
- Transit

Why lower utilities for transit?

Transit is an unsupportive environment for productive tasks:
- Crowded
- Short trip legs and transfers

STUDY DESCRIPTION

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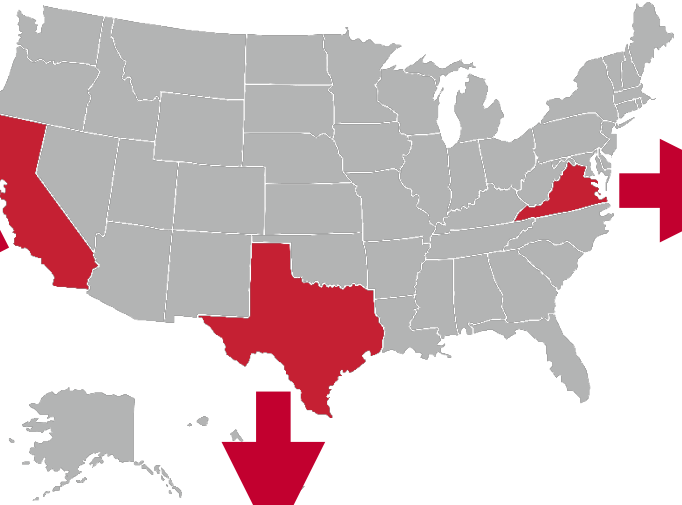
LOCATIONS

SR 91 Express Lanes in California

- 18 miles
- AADT on SR91: 230,000
- Travel Time at Free Flow Speed (70 mph): approx. 15 minutes



I-10 - Katy Managed Lanes (Katy Tollway) in Houston, Texas

- 12 miles
- AADT on I-10: 220,000
- Travel Time at Free Flow Speed (70 mph): approx. 10 minutes

I-95 / I-495 Express Lanes in Northern Virginia

- 38 miles
- AADT on I-95 / I-495 : 190,000 – 220,000
- Travel Time at Free Flow Speed (70 mph): approx. 35 minutes

SURVEY ADMINISTRATION

E-Panel – 600 completes per region

Virginia:
- Washington, DC
- Fairfax, VA
- Falls Church, VA
- Fairfax City, VA
- Alexandria, VA
- Prince William, VA
- Manassas, VA
- Stafford, VA
- Fredericksburg, VA
- Loudoun, VA
- Spotsylvania, VA

Texas:
- Harris, TX
- Waller, TX
- Austin, TX
- Fayette, TX
- Colorado, TX
- Lavaca, TX
- Bastrop, TX

California:
- Riverside, CA
- Orange, CA
- Los Angeles, CA
- San Bernardino, CA

Data cleaned to remove results from "speeders" (time to complete the survey less than 30% of average)

SURVEY STRUCTURE

Overview

Section 1: Screening

Section 2: Reference Trip

Section 3: AV Description

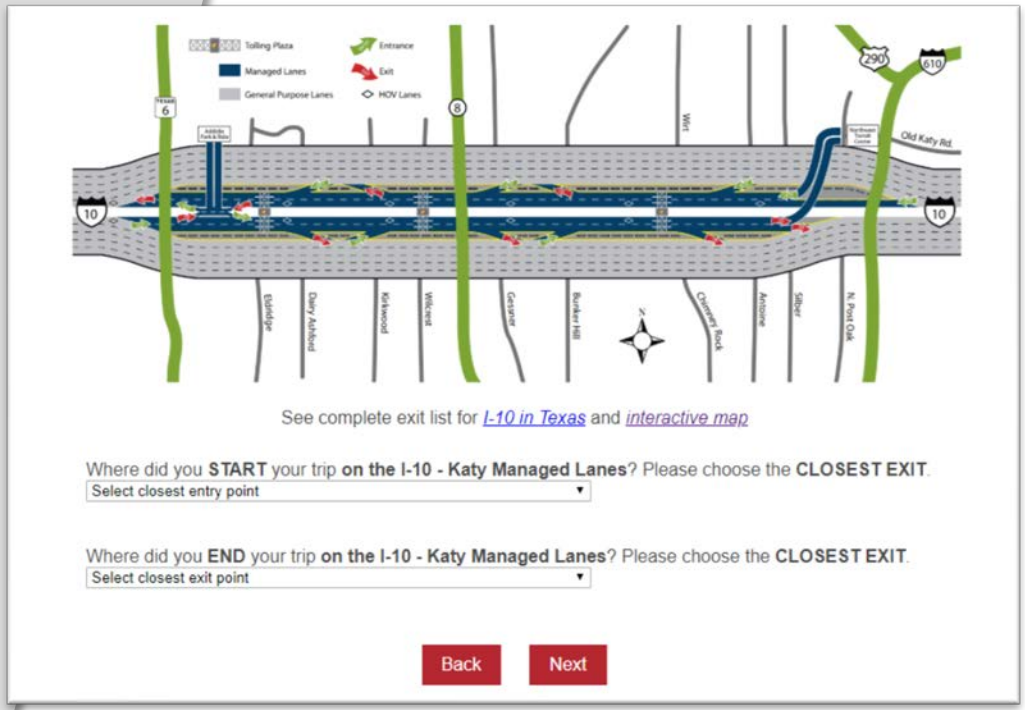
Section 4: Choice Exercise

Section 5: Opinion and Preference Questions

Section 6: Socio-Economic Characteristics

SURVEY STRUCTURE

SECTION 2:
Reference Trip



- Trip Direction, Purpose, & OD
- **Calculation of miles driven on tolled section**
- Day & Time of Trip
- Who Paid for the Trip
- Number of people in vehicles
- Importance of on-time arrival
- Trip Frequency
- Consideration of alternative modes

SURVEY STRUCTURE

SECTION 3:
AV Description

AUTONOMOUS/DRIVERLESS VEHICLES

An autonomous car (also known as a driverless car, self-driving car, robotic car) is a vehicle that is capable of sensing its environment and navigating without human input.

In the future we will be able to move around without having to pay attention to the road, as the car irself will drive for us to our preferred destination. We will be free to use that driving time for any other activities, like making phone calls, working on our computer, watching a movie, sleeping, or even working out!

SURVEY STRUCTURE

SECTION 4:
Choice Exercise

Six randomized choice tasks per scenario

SCENARIO 1: Traditional Driving

Scenario 1. You are driving a traditional car

You are paying for the toll.

If these were your only options, which would you choose?

(1 of 6)

Option	Free, I-10 - Katy Freeway general purpose lanes	I-10 - Katy Managed Lanes
Travel Time	12 minutes	9 minutes
Total Cost	Free	$8.00
	Select	Select

SCENARIO 2: Autonomous Vehicle

Scenario 2. You are NOT driving the car, you are in an anutonomous vehicle, and you can spend your time however you want

You are paying for the toll.

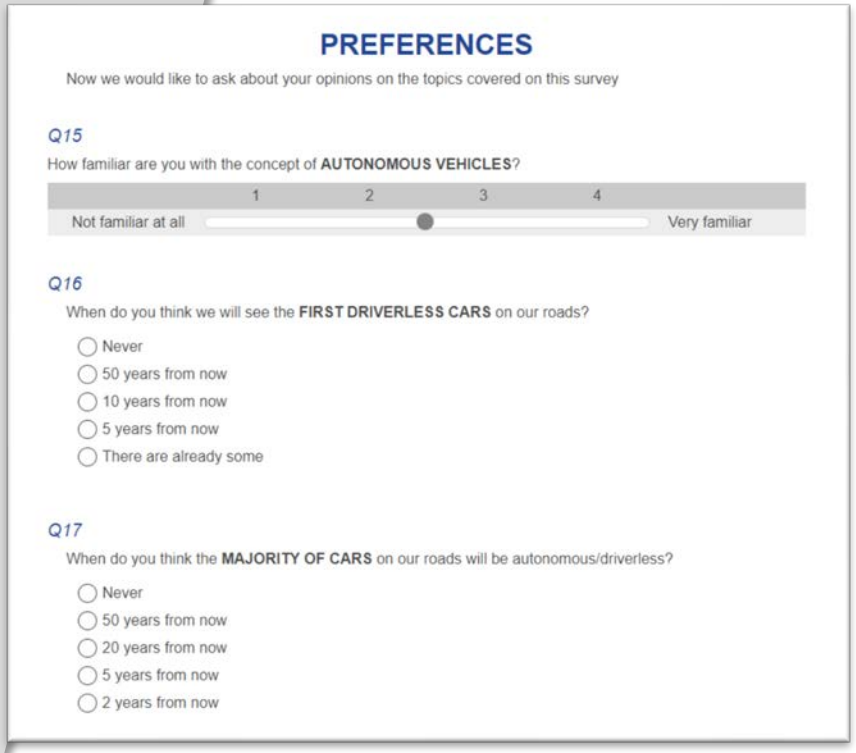
If these were your only options, which would you choose?

(1 of 6)

Option	Free, I-10 - Katy Freeway general purpose lanes	I-10 - Katy Managed Lanes
Travel Time	14 minutes	10 minutes
Total Cost	Free	$9.60
	Select	Select

SURVEY STRUCTURE

SECTION 5: Opinion and Preference Questions



PREFERENCES

Now we would like to ask about your opinions on the topics covered on this survey

Q15

How familiar are you with the concept of **AUTONOMOUS VEHICLES**?

1	2	3	4
Not familiar at all			Very familiar

Q16

When do you think we will see the **FIRST DRIVERLESS CARS** on our roads?

- ◯ Never
- ◯ 50 years from now
- ◯ 10 years from now
- ◯ 5 years from now
- ◯ There are already some

Q17

When do you think the **MAJORITY OF CARS** on our roads will be autonomous/driverless?

- ◯ Never
- ◯ 50 years from now
- ◯ 20 years from now
- ◯ 5 years from now
- ◯ 2 years from now

- Familiarity with AV's
  - **Stated** (*how familiar are you with AV's?*)
  - **Measured** (*When will wee see the first AV's?*)
- Interest in AV's
- Attitude towards Tolled Express Lanes
- Attitude towards punctuality
- Consideration of Travel Time RELIABILITY
  - Current
  - In a future AV scenario
- Attitude towards being in a car
  - In general
  - As the Driver
  - As the Passenger
  - With the possibility of being PRODUCTIVE
- Attitude towards Commute Time

SURVEY OUTPUTS

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SURVEY SAMPLE CHARACTERISTICS

SAMPLE CHARACTERISTICS MOSTLY SIMILAR ACROSS THE 3 LOCATIONS

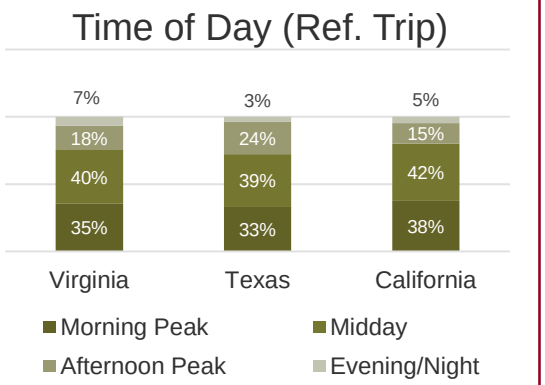
REFERENCE TRIP

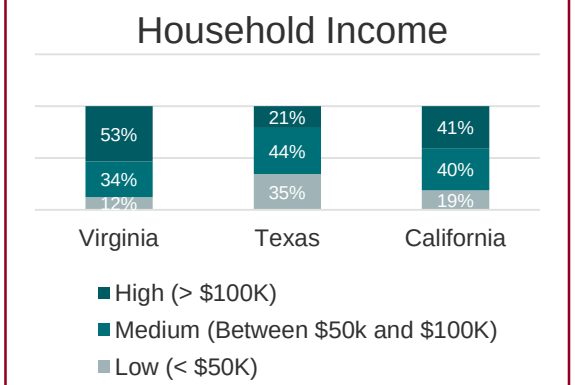
- Trip Purpose: 50% work-related, 50% recreational/social
- Day of Week: 70% weekday, 30% weekend
- Frequency: 70% frequent trip, 30% occasional trip

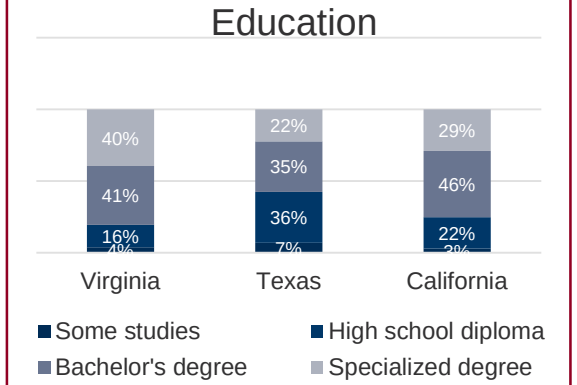
SOCIO-ECONOMIC CHARACTERISTICS

- Gender: 50% male, 50% female
- Age: equally distributed

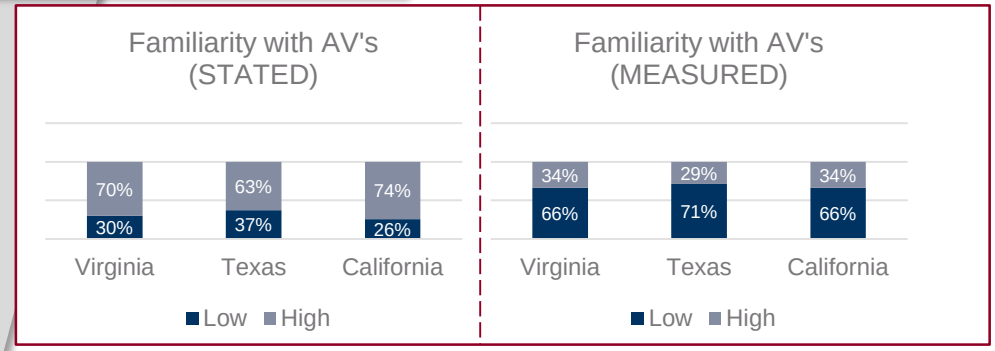
NOTABLE DIFFERENCES ACROSS 3 LOCATIONS

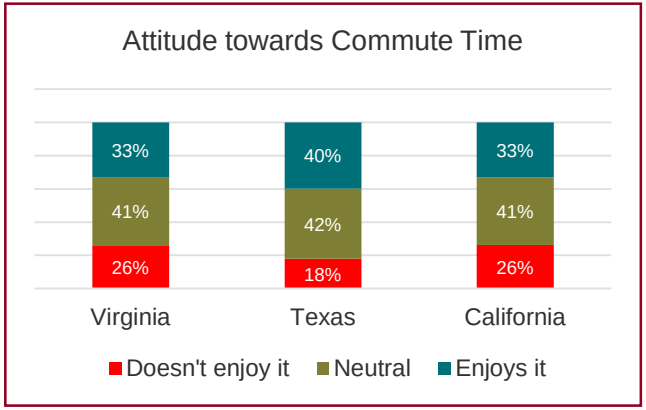


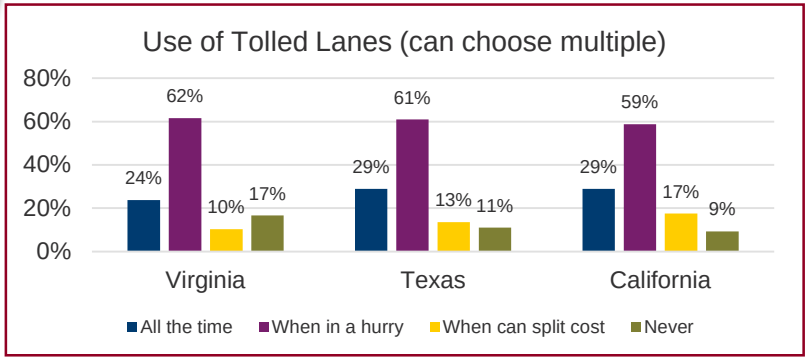


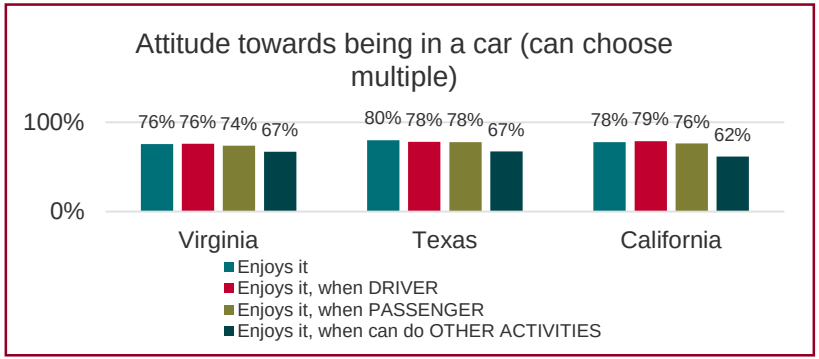


SURVEY SAMPLE CHARACTERISTICS





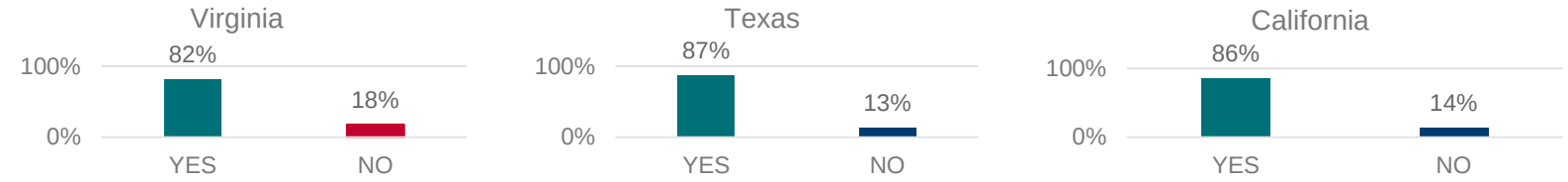




VALUE OF RELIABILITY

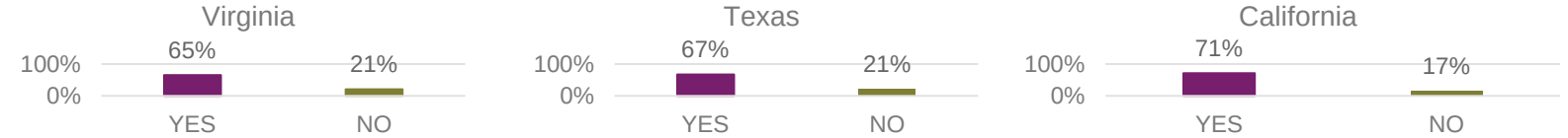
The majority of respondents confirmed that **they consider RELIABILITY** when they choose the Express Lane

Is a RELIABLE TRIP DURATION something you consider when you choose to take the express lane?



This would **NOT change** for 65% to 71% of respondents **in an AV scenario**. They will still take the express lane to ensure a reliable travel time

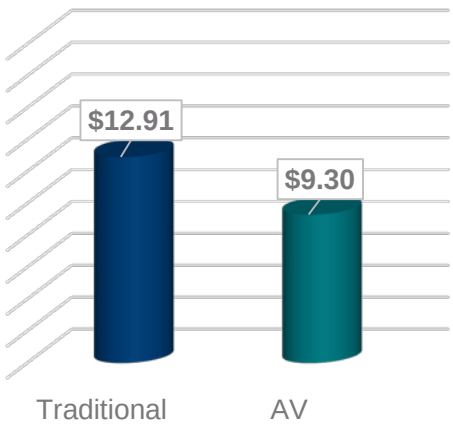
Would certainty in travel time be as important if you were in an AUTOMATED VEHICLE?



RESULTS

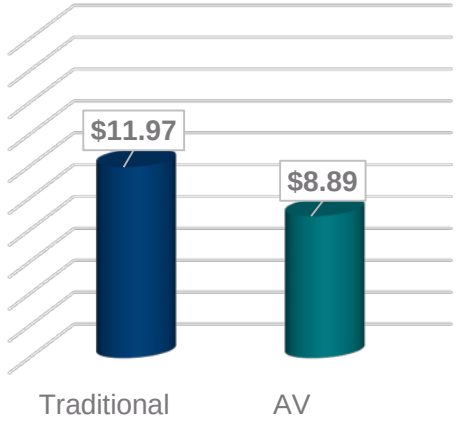
VALUE OF TIME ACROSS RESPONDENTS *($ per hour, 2018 Dollars)*

VIRGINIA



VOT Difference	Percentage Difference
-$3.61	-28%

TEXAS



VOT Difference	Percentage Difference
-$3.08	-26%

CALIFORNIA

VOT Difference	Percentage Difference
-$5.71	-29%

VOT BY TRIP PURPOSE

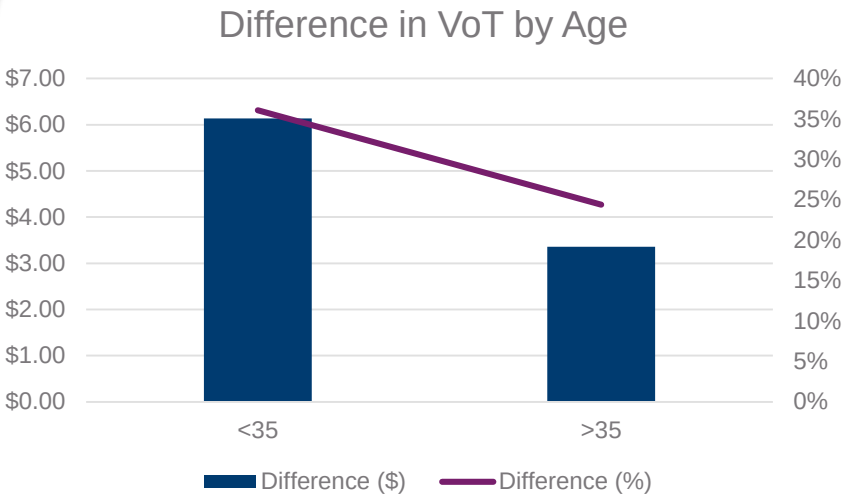
PLAUSIBLE RANGES FOR VALUES OF TRAVEL TIME SAVINGS (Per person-hour as a percentage of total earnings)				
CATEGORY	SURFACE MODES* (Except HSR)	SURVEY RESULTS VA	SURVEY RESULTS CA	SJRVEY RESULTS TX
TRADITIONAL OPTION				
Personal	35% - 60%	42%	61%	44%
Business	80% - 120%	72%	124%	58%
AV OPTION				
Personal	35% - 60% **(?)**	28%	46%	25%
Business	80% - 120% **(?)**	56%	91%	61%

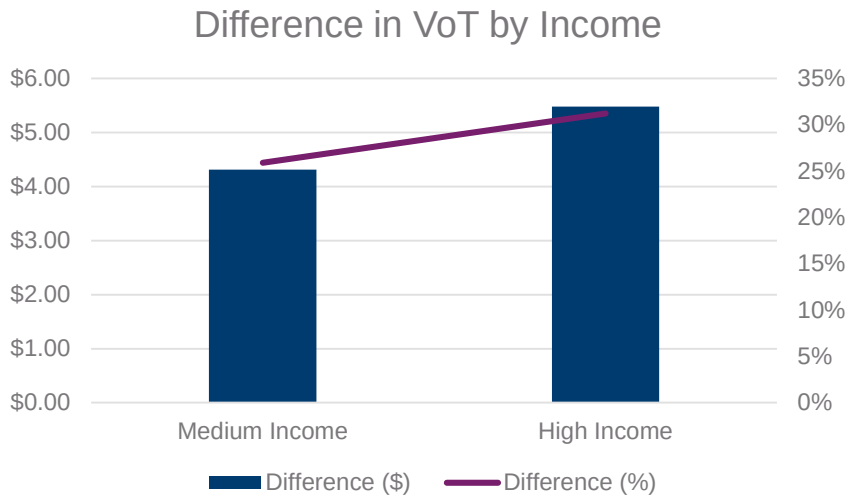
Source: Louis Berger; US DOT Departmental Guidance on Valuation of Travel Time in Economic Analysis

VOT SEGMENTATION: AGE & INCOME

VALUE OF TIME ACROSS RESPONDENTS *($ per hour, 2018 Dollars)*

Results averaged for three geographical locations





HIGHER AND LOWER VOTs

Behavioral change in an AV Scenario (**difference between VoT for traditional and AV scenarios)**, compared to average across all respondents

HIGHER VoT difference than all respondents' average in all 3 locations

(*they would not mind spending more time traveling, if it's in an AV*)

- People with **high** AV knowledge
- People that are **driving alone**
- People with a **positive** attitude towards AV's
- People **younger than 35**

LOWER VoT difference than all respondents' average in all 3 locations

(their behavior would not change much if using an AV)

- People with **low** AV knowledge
- People that are **sharing a vehicle**
- People with a **negative** attitude towards AV's
- People **older than 35**
- People that **do not enjoy being in a car**
- People that enjoy being a **passenger** in a car

HIGHEST INFLUENCED SEGMENTS

HIGHEST INFLUENCED travelers in the AV Scenario *(their VoT decreases substantially = they wouldn't mind spending more time in the car*):

Travelers with higher AV knowledge	Travelers driving alone	Travelers who don't enjoy commuting	Younger People
• Better understanding of AV potential	• Higher productivity payoff	• Might not like driving • Would prefer to spend time differently	• Early technology adopters • Flexible users of laptops / mobile phones

KEY TAKEAWAYS

- On average, for all geographies, trip purposes, and ages, willingness to pay is lower with AVs.
- There are clear tendencies for VoT being higher or lower than average when market is segmented into discrete groups
- Travel time reliability is remains a key consideration regardless of total trip time.
- Study findings are consistent in terms of VoT as percentage of hourly wage and consistent with findings in literature

NEXT STEPS & LIMITATIONS

- Testing value of reliability (VoR) as part of choice experiment
- Testing ridesharing vs. drive-alone in AV scenario
- Evaluate other assets (e.g. traditional toll roads)
- Analyze a mixed logit model

THANK YOU

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