

PER-MILE COST ESTIMATES FOR AUTOMATED VEHICLE AND SHARED MOBILITY IN THE UNITED STATES IN THE NEAR AND LONG TERM

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Research Question & Background

- What are the out-of-pocket costs for different travel options such as driving one's personal car or ride hailing?
- What are the impacts that electric and automated vehicles, and ride hailing can have on the future mobility systems from a dollar-per-mile perspective?

Table 1: Literature cost estimates (per vehicle or passenger mile, \$/VMT or \$/PMT) for automated light duty

Author	Power train	Included in cost?										Private LDV		On-demand commercial service LDV	
		Purchase	Fuel	Maintenance	Insurance	Tax	Parking & toll	Cleaning	Driver ^A	Overhead ^A	Units	Human driver	AV	Human driver	AV
Arbib & Seba (3)	ICEV	X	X	X	X	X					\$/VMT	0.65 - 0.78			
Arbib & Seba (3)	EV	X	X	X	X	X				X	\$/VMT	0.61 - 0.62		0.05 - 0.16	
Bridges (6)	EV	X	X	X	X	X				X	\$/VMT		0.38	0.06 - 0.24	
Sperling (21)	ICEV	X	X	X	X	X			X	X	\$/PMT	0.57 ^B		1.40-2.30	0.10 - 0.20
Boesch et al. (4)	ICEV	X	X	X	X	X	X	X	X	X	\$/PMT	0.78	0.81	4.39	0.66
Fulton et al. (12)	ICEV	X	X	X	X				X	X	\$/PMT	0.64		1.61	
Fulton et al. (12)	EV	X	X	X	X				X	X	\$/PMT	0.64	0.68	1.61	0.72
Walker & Johnson (14)	ICEV	X	X	X	X	X	X		X	X	\$/PMT	0.82		2.04	0.33 ^C - 0.86
Zia (22)	ICEV	X	X	X	X	X	X		X	X	\$/VMT	0.61 - 1.68	1.03 - 1.85	1.46	1.01

^A Only for on-demand commercial service LVD

^B \$0.57 refers to ICEV (source: Sperling, D. 2018. Three Revolutions, p.14)

^C \$0.33 refers to automated ridehailing service in electric sedan (source: Johnson, C. and J. Walker. 2017. Peak car ownership. The market opportunity of electric automated mobility services., p. 28)

Methods and Data

In our analysis, we consider a range of technologies and type of vehicles as follows:

- Three vehicle classes: a midsize car, small SUV, and medium SUV
- Four powertrain configurations: internal combustion engine (ICEV), hybrid (HEV) and plug-in hybrid (PHEV40), and battery electric (BEV200 and 300)
- Two energies: gasoline and electricity
- Privately owned vehicles vs. on-demand TNC service (ride hailing)
- Ride hailing solo vs. pooled
- Driven (circa 2020) vs. automated, driverless trip (2030-2035)

Table 2: Fixed and variable costs considered in this study

Fixed costs	Variable costs
Vehicle purchase/depreciation cost	Maintenance, repair and tires
Insurance cost	Fuel (including electricity)
Tax and registration fee cost	Vehicle cleaning
AV technology additional cost (only in 2030-2035 scenario)	Ridehailing overhead
	Ridehailing driver (only in 2020 scenario)

Results

Figure 1: Current ca. 2020 midsize vehicle (\$/PMT)

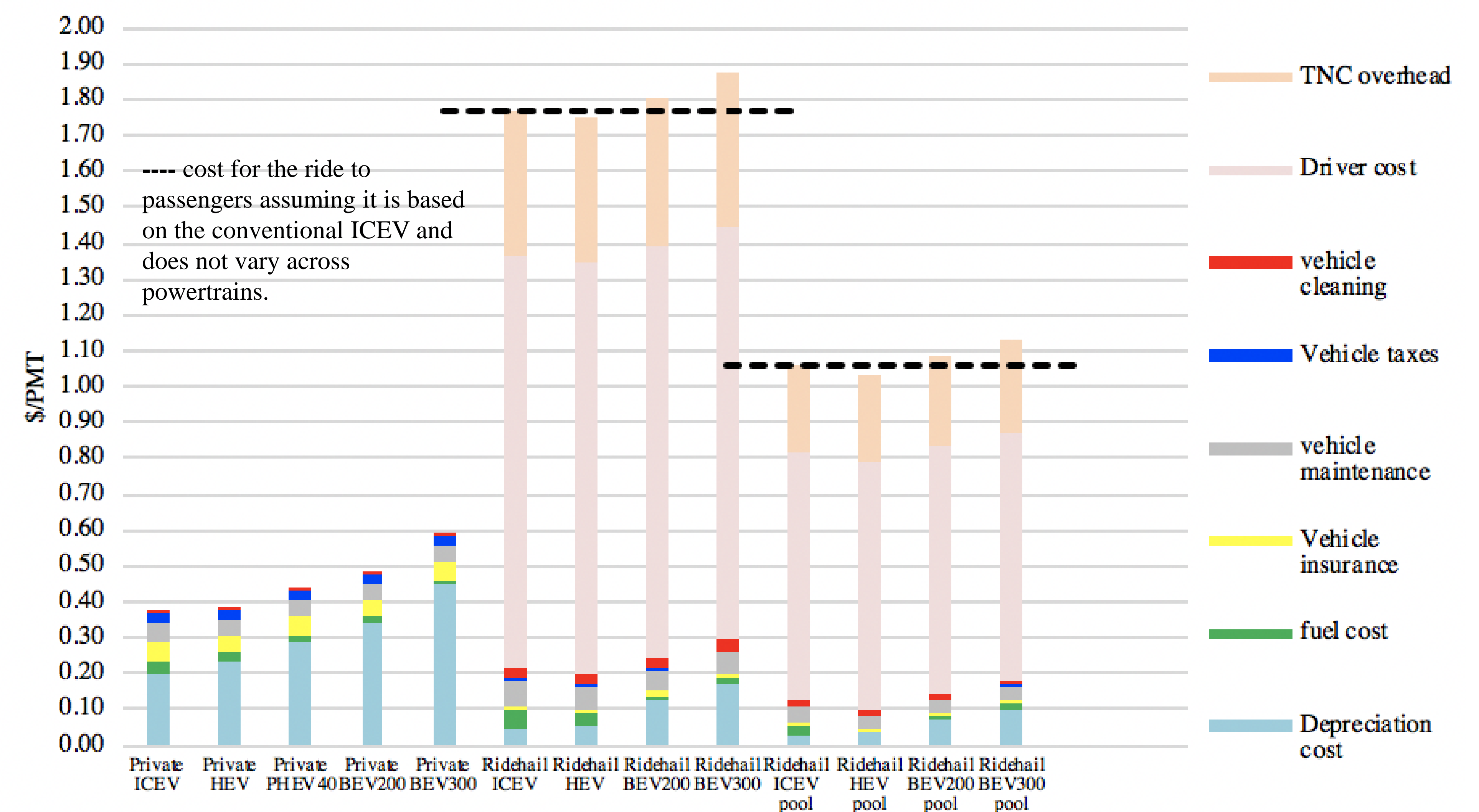
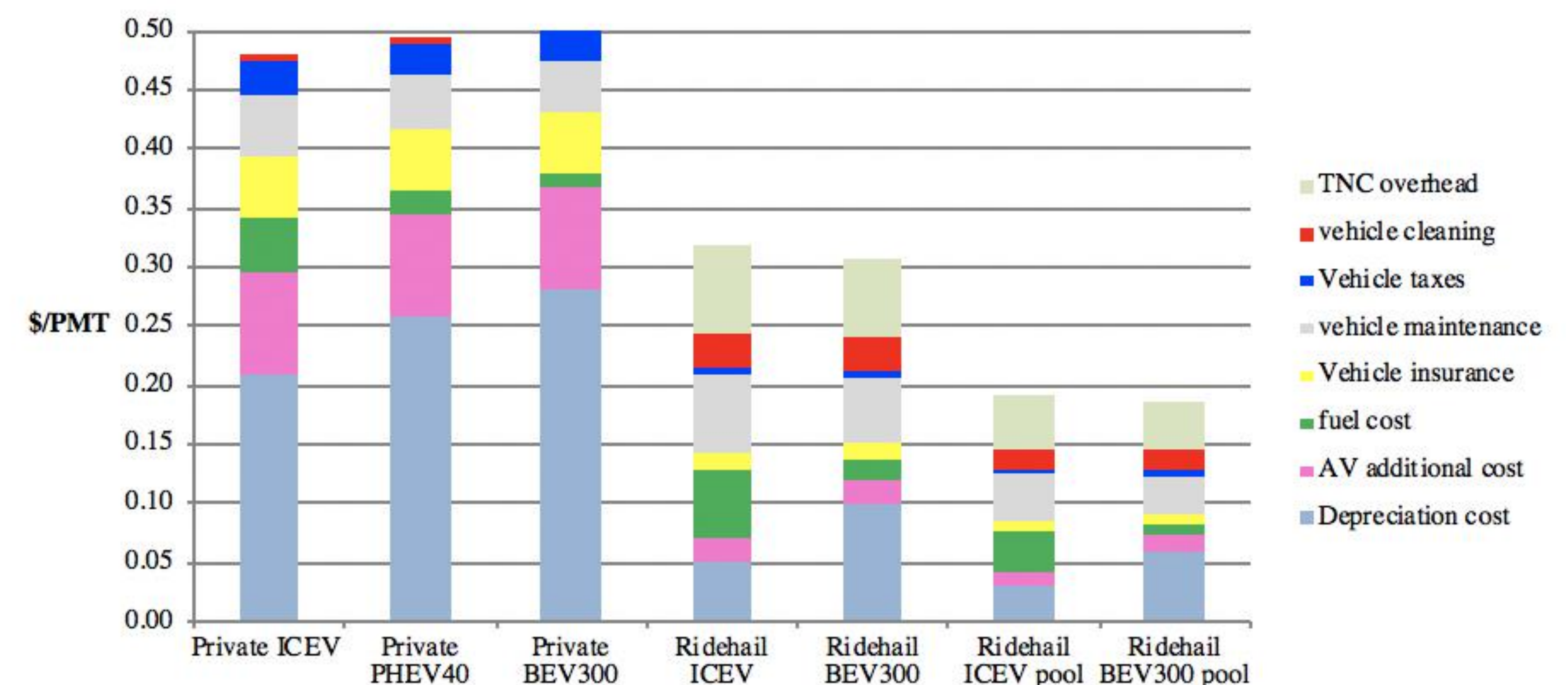


Figure 2: Future ca. 2030-2035 cost (\$/PMT) for driverless midsize vehicle



Next step is adding hedonic costs on these monetary costs

- For hedonic costs we mean monetizing non-market factors that limit or encourage individuals' willingness to select a travel mode, for example: value of travel time, value traveling next to a stranger (pooled ride hail), value of unreliable travel time, value of safety, etc.
- For now our plan is to base our investigation on: recently collected travel survey data in 1) major US cities, (data from private company – still not sure), 2) travel survey based on conjoint method in the US (UC Davis/NCST/Others? funded) 3) travel survey data in major metropolitan areas at an international level (WRI funded)

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