AUTOMATED DRIVING

URBANISM NEXT EUROPE 2021

Autonomous Vehicle Implementation Predictions

Implementation of Automated Road Transport

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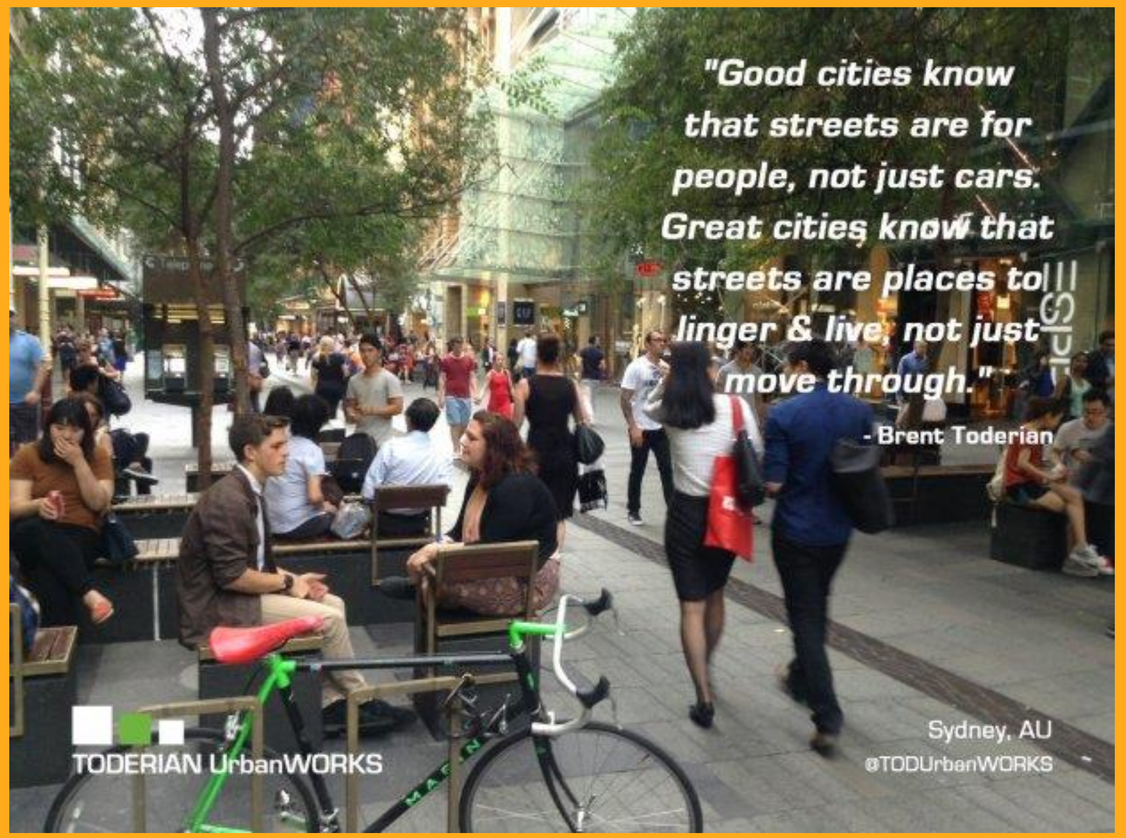
Why Transportation is Important

- 60-90 daily minutes
- 15-25% of household budgets
- Affects affordability and economic opportunities
- Affects development costs and location
- Streets are the main public realm
- Affects local economic productivity
- Affects health and safety
- External costs (congestion, accident risk and pollution)



Past Visions of Future Transport

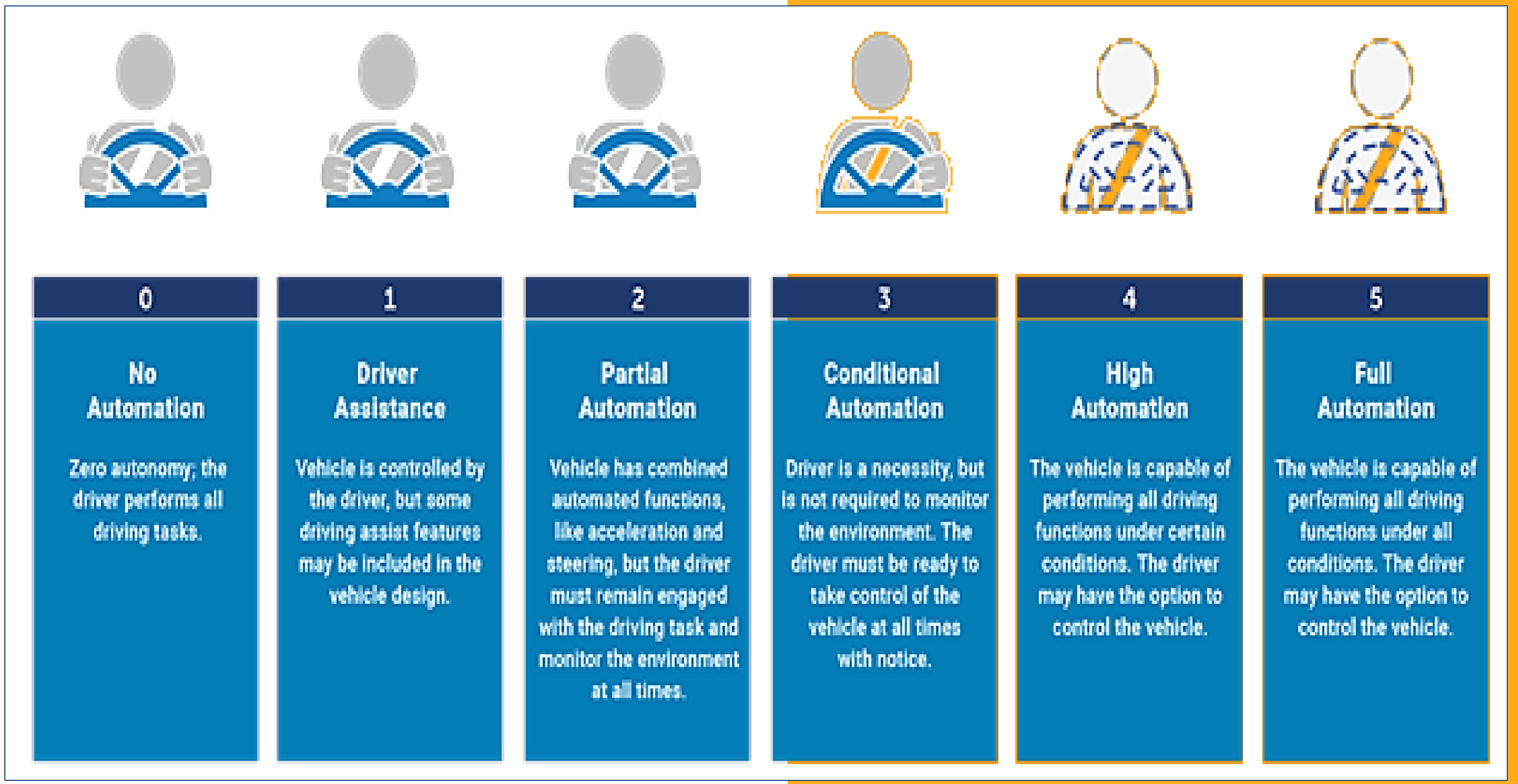
Supersonic Concord (1976-2003)

Wheeled Luggage

What about autonomous vehicles?

- How will they affect our lives and communities?
- How should we prepare for them?

Levels of autonomy



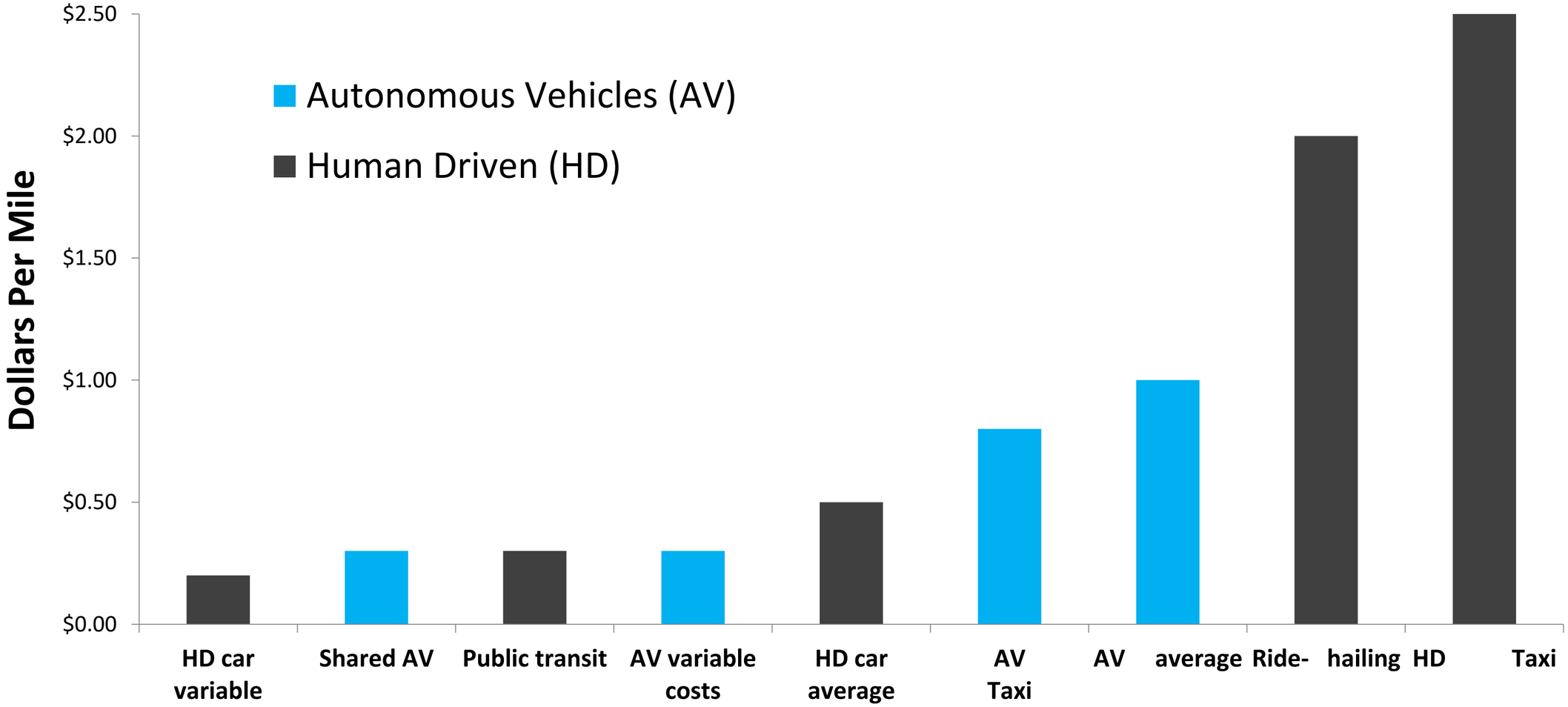
Operational models

	Advantages	Disadvantages	Appropriate Users
Personal autonomous vehicles - Motorists use their own self-driving vehicles	Maximum convenience and response speed.	High costs. Users cannot choose different vehicles for different types of trips.	People who travel a lot, reside in sprawled areas, want a particular vehicle, or leave items in their vehicles.
Shared autonomous vehicles – Autonomous taxis transport individuals and groups	Moderate convenience. Cheaper than owned vehicles and faster than micro-transit.	Users must wait for vehicles. Limited service (no driver to help passengers and ensure safety) and privacy.	Lower-annual-mileage users.
Shared autonomous mobility - Self-driving micro-transit takes several passengers to or near destinations.	Cheapest option.	Least convenience, comfort and speed, particularly in sprawled areas.	Lower-income urban residents.

Direct user benefits

- Less stress.
- Cost savings compared with paid human drivers.
- More productivity during travel.
- Independent mobility for non-drivers.

Cost comparison



Safety impacts

- **Hardware and software failures.** Complex electronic systems can fail. Self-driving vehicles will certainly have errors that cause crashes; the question is how frequently.
- **Malicious hacking**. Self-driving technologies can be manipulated for amusement or crime.
- **Increased risk-taking.** When travellers feel safer they tend to take additional risks, for example, reduced seatbelt use and less caution by other road users.
- **Platooning risks.** Many potential benefits, such as reduced congestion and pollution emissions, require platooning. This can introduce new risks.
- **Increased total vehicle travel.** Autonomous driving may increase total vehicle travel and therefore crashes.

Congestion impacts

May reduce congestion:

- If vehicles have dedicated lanes for platooning
- If all vehicles are connected

May increase congestion:

- Increases total vehicle travel.
- It is often cheaper to drive on public roads than pay for urban parking.
- May reduce public transit services.

Bus	Human-Driven Cars	Self-Driving Cars

Requirements

- Many benefits, such as reducing congestion and pollution, and improved mobility for non-drivers, require that level 4-5 vehicles become common and affordable.
- Reduced congestion, energy consumption and pollution emissions require *platooning*, with vehicles travelling a few meters apart on dedicated highway lanes.

Owned vs. shared

Many projected benefits depend on vehicle sharing, but motorists have reasons to own their cars:

- **Convenience.** Motorists often keep items in their vehicles, such as car seats, tools, and other supplies.
- **Response speed**. In suburban and rural areas, taxi response can be slow and unreliable.
- **Costs.** Vehicle sharing is generally only cost effective for motorists who drive less than about 6,000 annual miles. Most higher annual mileage drivers will own their cars.
- **Cleaning and vandalism.** Autonomous taxis will lack privacy and comfort features.
- **Status.** Many drivers are proud of their skills and vehicles, and so may prefer to own and drive personal cars.

Equipment costs

- Requires high-quality and redundant sensors, computers, controls, plus subscriptions to high-quality maps and specialized maintenance.

- This will add several thousand dollars to vehicle purchase prices, plus a hundreds of dollars in annual maintenance and service costs, probably increasing annual costs by $1,000 to $3,000.

- These incremental costs may be partly offset by fuel and insurance savings.

Travel impacts

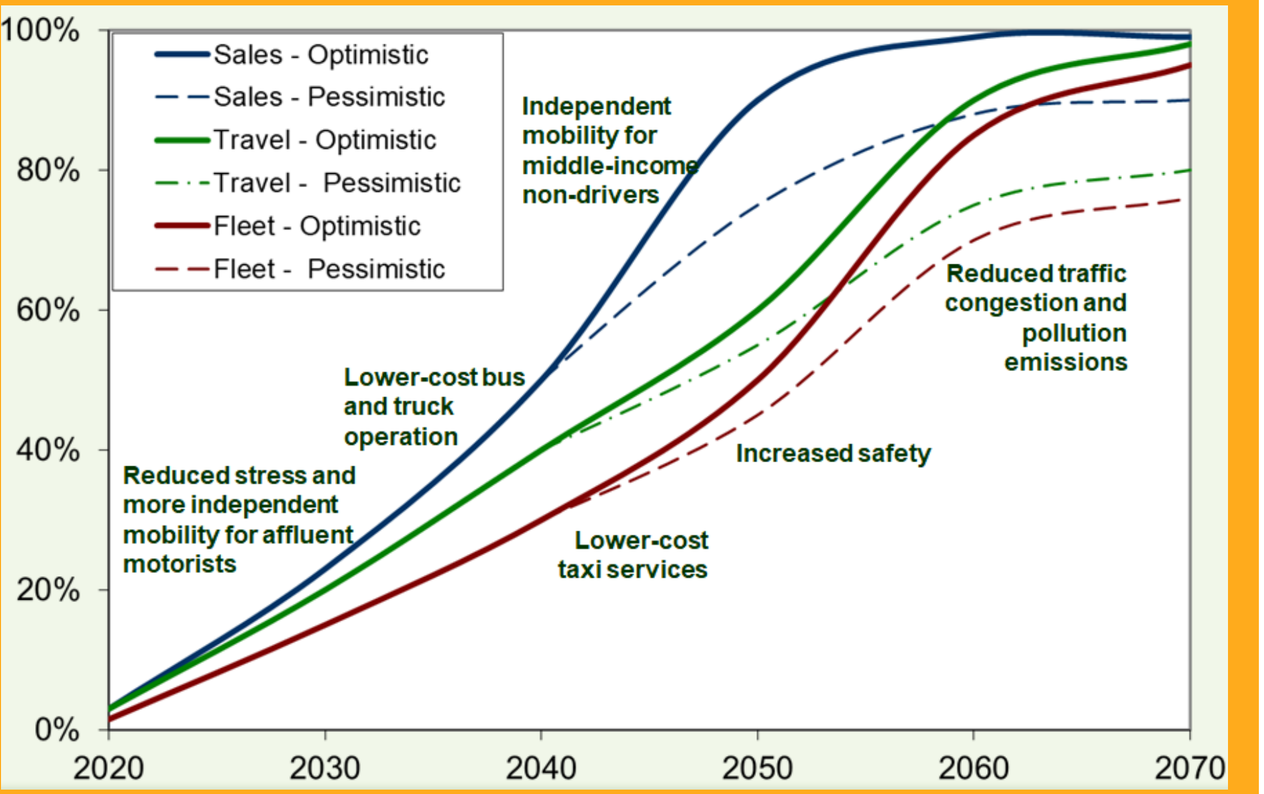
Increases Vehicle Travel	Reduces Vehicle Travel
• Provides vehicle travel to non-drivers (people who are disabled, young or impaired). • Increased convenience and productivity increases travel. • Empty vehicle travel when dropping off or picking up passengers • Encourage sprawled development. • Reduces traffic congestion and vehicle operating costs.	• Convenient shared vehicle services reduce vehicle ownership and use. • Increases vehicle ownership and operating costs. • Self-driving buses improve transit services. • Reduced traffic risk and parking facilities make urban living more attractive. • Reduces some vehicle travel, such as cruising for parking.

	Benefits	Costs/Problems
Internal (user Impacts)	*Reduced drivers' stress and increased productivity.* Reduces stress and allows motorists to rest, play and work while travelling. *Mobility for non-drivers.* Provides independent mobility for non-drivers which can reduce motorists' chauffeuring burdens and public transit subsidy needs. *Reduced driver costs.* Reduces costs of paid drivers for taxis and commercial transport.	*Increased vehicle costs.* Requires additional vehicle equipment, services and fees. *Additional user risks.* Additional crashes may be caused by system failures, platooning, higher travel speeds, additional risk-taking (offsetting behavior) and increases in total vehicle travel. *Reduced security and privacy.* May be vulnerable to information abuse (hacking), and features such as location tracking and data sharing may reduce privacy.
External (Impacts on others)	*Increased safety.* May reduce crash risks and insurance costs. May reduce high-risk driving. *Increased road capacity and reduced costs.* More efficient vehicle traffic may reduce congestion and roadway costs. *Reduced parking costs.* Reduces demand for parking at destinations. *Increase fuel efficiency and reduce pollution.* May increase fuel efficiency and reduce pollution emissions. *Supports vehicle sharing.* Could facilitate carsharing and ridesharing, helping to reduce total vehicle ownership and travel, and associated costs.	*Additional risk to others.* Additional crash risk may harm other road users. *Increased traffic problems.* By inducing additional vehicle travel, traffic congestion, pollution and sprawl-related costs may increase. *Reduced security.* May be used for criminal and terrorist activities (e.g. bomb delivery and crashes). *Social equity concerns.* May have unfair impacts, for example, by reducing convenience and safety of non-auto travel. *Reduced employment and business activity.* Jobs for drivers may decline. *Reduced support for other solutions.* Optimistic predictions of autonomous driving may discourage implementation of other transport improvements and management strategies.

Autonomous vehicles can provide various user benefits and costs, and external impacts on other people.

Conclusions - Development

- During the 2020-30s they are likely to be expensive novelties with limited abilities. It will probably be the 2040s before most middle-income families can purchase reliable and affordable autonomous vehicles, and longer before lower-income households can own them.
- Some people may prefer driving. Saturation levels are uncertain and depend on public policies.
- It is unlikely that most vehicles to be autonomous before 2050 unless many functional vehicles are scrapped to accelerate deployment.



Conclusions - Deployment

- Vehicle innovations tend to be implemented more slowly than for other technological change due to high costs, strict safety requirements, and slow fleet turnover.
- Automobiles cost fifty times as much and last ten times as long as personal computers and phones. Consumers seldom purchase new vehicles simply to obtain new technologies.
- Many people may probably prefer human-operated vehicles.
- It is unlikely that most vehicles to be autonomous before 2050 unless large numbers of functional vehicles are scraped to accelerate deployment.

Conclusions – benefits and costs

- There is considerable uncertainty concerning autonomous vehicle benefits, costs and travel impacts.
- Recent predictions that autonomous vehicles will soon be cheap and ubiquitous, and by 2030 will displace most private vehicle travel, are mostly by people with financial interests in the industry based on experiences with disruptive telecommunications technologies
- Advocates often exaggerate net benefits by ignoring new costs and risks, rebound effects, and harms to people who do not to use the technology.

For more information

“Autonomous Vehicle Implementation Projections”

“Transportation Cost and Benefit Analysis”

“New Transportation Planning Paradigm”

“The Future Isn’t What It Used To Be”

“A New Traffic Safety Paradigm”

and more...

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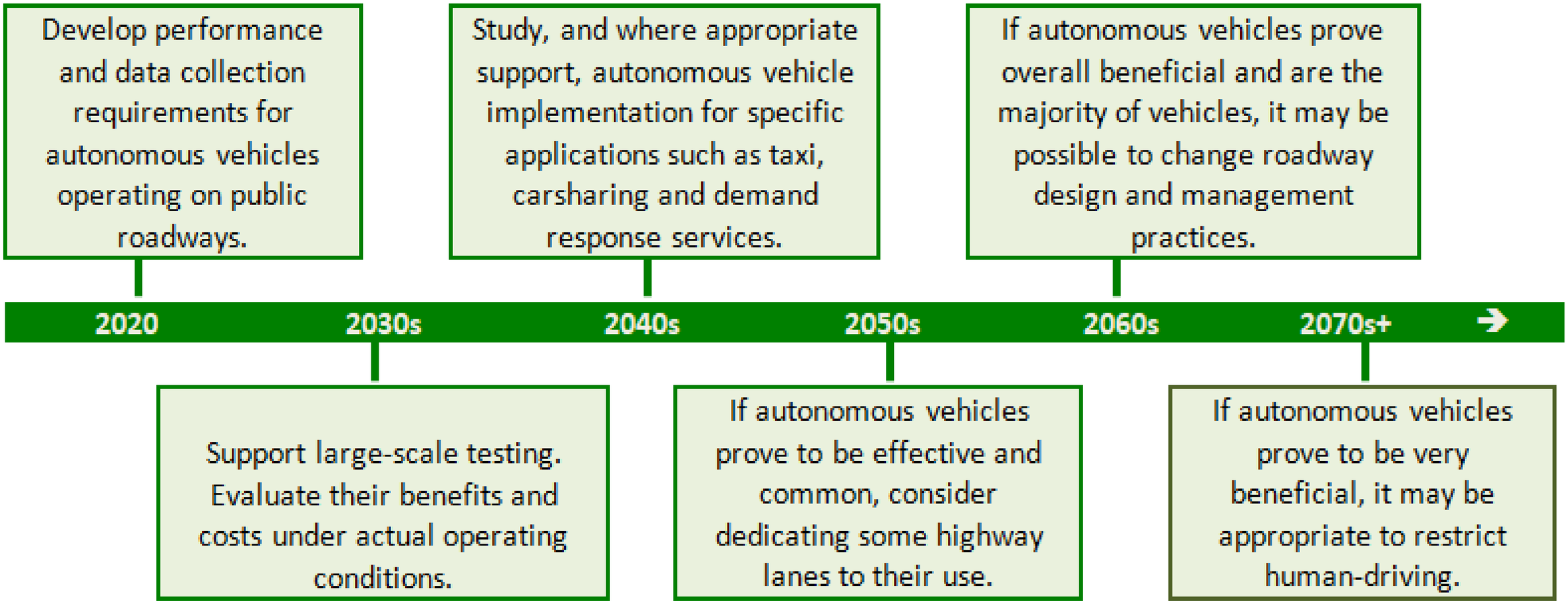
Heaven and hell

Heaven	Hell
• More vehicles are shared so total vehicle ownership declines. • Self-driving cars help create a more diverse and efficient transport system. • Walking, cycling and public transit conditions improve. • Less total vehicle travel. • Total transport costs decline.	• Most autonomous vehicles are privately-owned. • Support for walking, cycling and public transit services decline. Transport systems become more auto-dependent. • Total vehicle travel increases. • Traffic problems (congestion, accidents, pollution, user costs) increase.

Planning timeline



This timeline summarizes how autonomous vehicles are likely to impact transport planning.

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Thank you!

Do you have any question?

Ask Todd Litman, Victoria Transport Policy Institute (litman@vtpi.org)

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