

# The Transformation of Transportation

Study Looks at How We'll Get From Here to There as Caltrans Plans for Future

New technology, evolving economic and societal directions, and a changing climate are creating a seismic shift in the way California moves people and goods — and that makes transportation planning particularly challenging.

A new study commissioned by Caltrans suggests that the field of transportation is in the midst of a transformation not experienced since the invention of the automobile.

There are many intriguing possibilities and trends emerging, according to the Future of Mobility White Paper, which is intended to inform Caltrans planners who will lay the groundwork for California's transportation network into 2050.

"The rapid changes in the transportation industry will dramatically alter California's transportation system and affect the way Caltrans operates," said Chris Schmidt, Caltrans' Division Chief of Transportation Planning. "The Department will have to develop and implement realistic policies while taking into account rapidly changing technological advancements, many of which continue to evolve and new ones emerge."

The revolution in moving people and goods has already arrived. In just the last five years, ride-sourcing companies such as Uber and Lyft, car-sharing services like Getaround and car2go, and bike-sharing businesses such as Spin and Ford GoBike have expanded market share. Autonomous vehicles are a reality, drones and self-driving trucks could shake up the goods-moving industry, and technologies considered unthinkable a decade ago — such as hyperloop and air taxis — are no longer just science fiction imagination.

Not only are modes of transportation changing, but major advancements have been made in vehicle safety technology. The refinement of on-board cameras, radar and sensors have led to the development of accident avoidance systems that warn of possible collisions, lane departures or oncoming pedestrians, as well as advanced braking assistance and adaptive cruise control.



Many cities have embraced the shared car concept, establishing zones where short-term rentals can be picked up and dropped off.

The transformative changes described in the white paper study will be considered as Caltrans begins preparing its California Transportation Plan 2050, a long-range look at state transportation trends. State law requires Caltrans to update its transportation plan every five years, and the next one is due in 2020.

For the white paper study, a Caltrans team worked for about a year with the Transportation Sustainability Research Center at UC Berkeley.

According to the white paper, here are some key transportation trends that could affect Caltrans' planning decisions in the future:

## Car Sharing

The U.S. car sharing market in the U.S. has become a **\$23 billion industry**, and in 2016, Northern California was home to two million car-sharing members. That number is expected to grow.

On average, car-sharing members reduced the amount of vehicle miles traveled by 27 percent.

In a study analyzing the impact of car2go, the company claims that **each car2go vehicle removed seven to 10 privately owned vehicles** from city streets, a result of vehicles sold or purchases avoided. Forty-six percent of peer-to-peer members (who rent out privately-owned vehicles) said they did not have a car before joining, and 20 percent said they were driving less.

Vehicles in car-sharing programs were **in use 12 percent to 15 percent** of the time — far more than the 4 percent rate of privately owned vehicles.

## Bike Sharing

Ridership and development of bike sharing programs have grown steadily in the U.S. since the first one debuted in 2010. Today, **171 programs operate in the country**, and 60 cities run public programs.

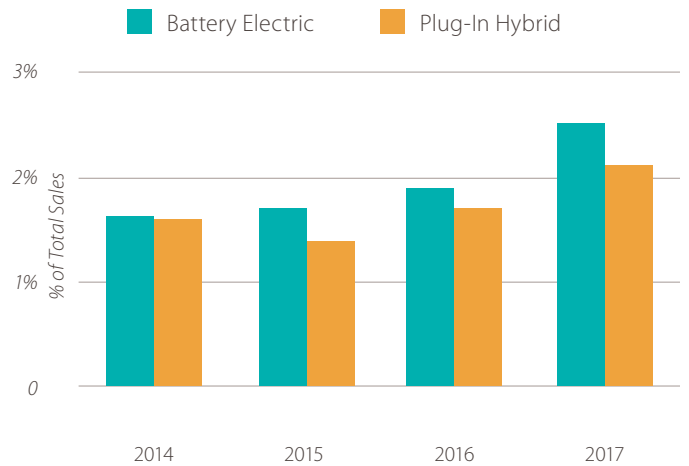
Bike sharing can be incorporated into existing transportation systems. For example, **bike stations** can be established in public transit hubs, and payment systems can be integrated.

More than 8,100 shared bicycles are in use in Northern California; about 4,700 in Southern California.



*Bike sharing has expanded quickly, with about 28 million users nationally as of 2016. Almost 14,000 shared bikes are in use in California.*

## Zero-Emission Vehicle Market Share in California



Source: IHS Markit

## Ride Sourcing/Transport Network Companies\*

Ride-sourcing services have expanded rapidly since their introduction in San Francisco in summer 2012. In California, **Uber operates in more than 172 urban areas; Lyft serves 92 cities.**

More than one-third of respondents in three reviewed studies said they would have taken public transit, biked or walked had services such as Uber and Lyft not been available.

In San Francisco, this type of service was responsible for about **20 percent of intra-city vehicle miles traveled** in 2016.

\* The report contends that more research is needed to document the impacts on ownership rates from ride sourcing, car sharing and bike sharing.

## Alternative Transit Services

Micro transit, which is usually a privately operated transit system, is starting to emerge as a **way to fill gaps in public transit networks**. In October 2017, Los Angeles Metropolitan Transit Authority released a request for proposals, and a private company has said it will launch similar service in Orange and Contra Costa counties and in the San Joaquin Valley in 2018 through partnerships with local transit agencies.

Earlier attempts at micro transit service struggled due to financial constraints and low ridership.

## Connected and Autonomous Vehicles

As of May 2018, **54 manufacturers had autonomous vehicle test permits**, according to the California Department of Motor Vehicles. A permit allows manufacturers to test on all public roadways in California. They don't need a permit to test on private roads.

In April 2018, companies could start testing vehicles on city streets with no one at the wheel. Currently, the DMV is reviewing two driverless testing applications — **no permits have been issued as of June 8, 2018.**

According to various studies, autonomous vehicles could make up anywhere from 20 percent to 95 percent of miles traveled on U.S. roads by 2030. By some estimates, autonomous ride-sharing services could be a **\$750 billion industry by 2030.** Although Uber temporarily stopped autonomous vehicle testing after a pedestrian was struck and killed in March, Waymo recently announced that it plans to buy and convert 20,000 Jaguar Land Rover vehicles to be part of an autonomous ride services fleet by 2020.

## Zero-Emission Vehicles (ZEV)

Sales of electric vehicles have climbed since 2013. In 2015, 172,895 ZEVs were registered in California — a 45 percent hike in one year. The totals jumped to 263,248 in 2016 and 337,483 in 2017.

But California has a significant **charging infrastructure gap.** The 2016 Zero Emission Vehicle Action Plan calls for the installation of one million charging stations by 2020.

## Shared Mobility Public Private Partnerships

In these partnerships, a **public entity and a private provider team up** to operate a transportation service. Public agencies are using them to reduce costs, and expand or improve service. *There are four main types:*

1. Providing first-and-last mile service to public transit, such as from a person's home to the train station. This is a key element in helping create a seamless transportation network in the future, according to Caltrans' draft 2018 California Rail Plan;
2. Filling gaps in existing service;
3. Serving disadvantaged populations;
4. Other mobility services

## Rail Service

According to the draft state Rail Plan, California's rail network could have the capacity by 2040 to accommodate **1.3 million daily trips.** The system today averages about 115,000 daily trips.

**Rail lines** in many parts of the state are scheduled to be **electrified** using renewable energy.

Integrated service is needed to **coordinate time schedules, payments, and transfers** between public and private transit providers.

Planning and initial construction of a **high-speed rail system** in California is continuing, which would offer a competitive option to driving or air travel.

## Freight and Goods Movement

**Electrification and automation** are predicted to drop per ton-mile trucking costs from 12 cents to 3 cents. Automation could boost industry revenue an estimated \$100 billion.

The adoption of **ZEVs in the freight industry** is expected to bring a 4 percent reduction in greenhouse gas emissions, and a 3 percent decline in nitrous oxide emissions.

**On-demand trucking services**, which connect trucks and shippers, may help cut costs that shippers and truckers pay to brokers.

**Truck platooning** is expected to become more common, especially at ports. Platooning consists of several trucks equipped with state-of-the-art driving support systems following each other. It is intended to improve safety, lower emissions and cut fuel costs.

Automation will likely **displace drivers and port workers**, and will be met with some resistance.

Transporting freight via the ocean routes could increase. Use of "**marine corridors**" is being studied, though it could be too slow for time-sensitive deliveries. This would emit fewer greenhouse gas emissions and could ease congestion on freeways.

California state agencies are collaborating on freight pilot projects to accelerate the transition to a **zero-emission freight system.**

## Cyber Security Risks

About **23 million vehicles worldwide are connected to the Internet**, and at least one study predicts 20 percent of all vehicles will have some form of wireless network connection by 2020.

**Researchers are worried about hackers.** In 2015, two computer programmers hacked into a *Wired* magazine reporter's vehicle and disabled the transmission, forcing the driver to the side of the road and prompting an automotive recall.

## Drones

Some companies have used drones to deliver packages. However, **widespread use may be limited** due to their (currently) small carrying capacity and governmental regulations.

It is estimated that about 20 drone trips are needed to replace one conventional delivery van trip.

## On the Horizon

**Blockchain technology:** The underlying structure behind cryptocurrencies such as Bitcoin, blockchain is a decentralized ledger that enables financial transactions and "smart contracts" — and some experts say it could be a boost in mobility-service transactions, such as peer-to-peer car rentals.

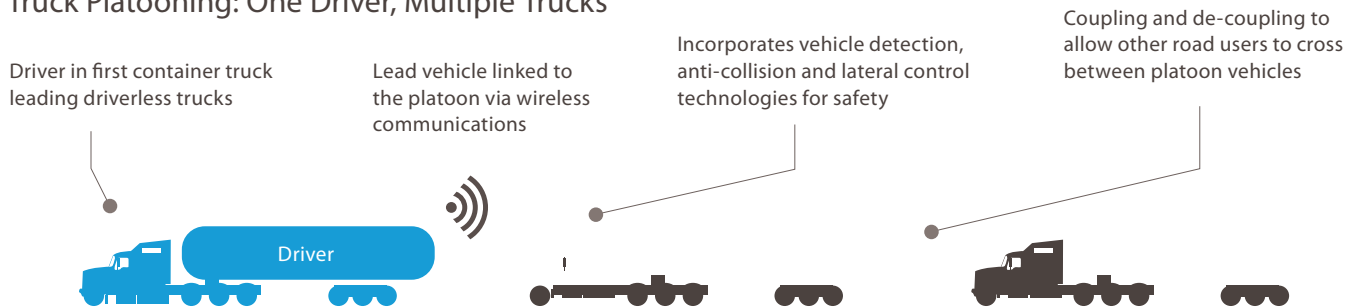
**3D Printing:** This "additive manufacturing" shortens supply chains since goods are made closer to the consumer, lessening the need for freight travel. Some companies are already making vehicles with 3D-printed materials.

**Hyperloop:** This high-speed technology, estimated to cost \$60 million per mile to build, uses magnets to carry pods in a vacuum tube, and is being eyed as a way to transport freight (and possibly people at some point). Routes are under consideration in California.

In conclusion, the report acknowledges that it's impossible to predict what the transportation network will look like in 2050, but that it's critical that policymakers consider the range of technologies and services that could transform how people and goods travel in the state. **MM**

Source: "Future of Mobility" white paper; Caltrans Office of State Planning; Next 10; California Department of Motor Vehicles

## Truck Platooning: One Driver, Multiple Trucks



## Hyperloop: Travel up to 600 MPH

