Autonomous Vehicles and Our New Mobility
Introduction

Autonomous vehicles are moving from test tracks to public roads. As self-drive tech companies log millions of driverless miles each year and as driverless fleets commercialize, the U.S. is at the tipping point of our New Mobility—one that trades vehicle ownership for shared ridership.

For transit companies whose mission is to move people and things, the autonomous driving future could mean billions in safety, collision repair, and operations savings. But, they aren’t the only victors of innovation. Cities that plan now will be early adopters of autonomous technology, which could help them solve tough issues, such as traffic, air pollution, and isolated residents. By increasing mobility, cities may realize more economic development, which positively impacts city revenue and quality of life for citizens.

As with all emerging technologies, partnerships will propel autonomous vehicles, and we all have a role to play. Through timely collaboration, the industry will be able to plan and establish supportive charging, electric utility, and communication networks. Combined with a regulatory framework that encourages innovation, these essential digital infrastructure networks will enable the most significant transportation evolution to hit the roads in several decades.
Our New Mobility

The transportation industry is undergoing a landmark shift. City populations are rapidly growing, and city-dwellers are using transportation services and public transit more often to get around. The previous mindset of “transportation as an asset” is evolving into a new mobility in which transportation is viewed as a service.

As part of this new mobility, autonomous vehicles (AVs) have made a grand entrance. AVs, which piggyback on the electric vehicle (EV) platform, have grabbed the attention of fleet operators of vans, medium-duty vehicles, rental cars, ridesharing, airport shuttles, city transit, and long-haul trucking because AVs can dramatically improve business economics for companies whose mission is to move people and things from point A to point B.

Car buyer habits are changing, too. Consumers are buying into the convenience of shared mobility, and the satisfaction of knowing that their EV-based transportation choices reduce greenhouse gas emissions.

2. Business Insider. 2017. Only 20% of Americans will Own a Car in 15 Years, New Study Finds.
5. IHS Markit. 2018. Autonomous Vehicle Sales to Surpass 33 Million Annually in 2040, Enabling New Autonomous Mobility in more than 26 Percent of New Car Sales, IHS Markit Says.
5 Factors Accelerating Autonomous Vehicles

Momentum is growing across the industry as automakers, ride-hailing companies and self-driving technology leaders worldwide continue to form partnerships and make investments in electric autonomous technologies. Over $80 billion has been invested in the AV industry spanning auto electronics, artificial intelligence, sensors, physical systems and partnerships, like Toyota’s recent $500 million deal with Uber to advance driverless vehicle development. Recently, Uber ordered 24,000 AVs from Volvo, and Waymo is developing a self-driving version of Jaguar’s I-PACE SUV, with plans to add 20,000 to their taxi fleet. Lyft co-founder John Zimmer predicted that most of its fleet would be self-driving by 2021. Soon, AVs built from the ground up on an electric-powered foundation will begin shipping. The Tesla self-driving semi-truck is scheduled to go into production in 2019, and the company plans to produce 100,000 units a year. These bold market moves are prompted by the convergence of these five factors that will enable AVs to flourish in the next three years.

1. Vehicle Electrification
   Today, already 58% of autonomous light-duty vehicles are built over an electric vehicle powertrain, enabling cost-savings.

2. Connectedness
   13-15 million Americans use ride-hailing apps.

3. Data Crunching
   Exponential explosion of digital data organized by big data analytics to enable machine learning and decision-making.

4. City Living
   Car-ownership in a city is costly and residents want easy, affordable travel options door to door.

5. Cost Savings
   $5,000 annual savings for a family who uses autonomous ride-hailing versus owning a car. $19,000 to $36,000 annual savings per truck (depending on level of automation) for long-haul trucking fleet owners.

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The Autonomous Advantages

Fleets that use electric-powered autonomous cars, trucks, vans and buses have much to gain, but auto-centric companies aren’t the only groups excited about driverless vehicles. In the 2018 Strategic Directions: Smart Cities & Utilities Report, Black & Veatch found that half of municipalities and smart service providers surveyed believe that AVs will have a transformational impact on cities around the world.

Who wouldn’t be excited by the promise of a vehicle that is clean, quiet and increasingly cost-effective? While on-the-ground applications are still forming, the value of driverless vehicles is becoming clear.

Looking ahead, we can envision a future where daily life for multiple segments of society are transformed by driverless vehicles.

Taylor Traveler
Taylor used to drive almost 14,000 miles a year. Since switching to driverless ride-hailing, Taylor saved enough money to take an island vacation instead. Taylor doesn’t have to search for parking near her downtown condo, and no longer spends 335 hours per year behind the wheel. She uses her commute time to catch up on emails or read a good book.

Matt Transit Manager
Since deploying autonomous technologies, Matt solves last-mile transit problems efficiently by sizing on-demand autonomous shuttles to match the number of travelers. Matt also developed new business models to adapt to his new mobility, so he is able to meet the needs of constituents through an optimized system.

Lois with Limited Mobility
Lois had a hard time getting around because public transportation was too far to go in her wheelchair. But since Lois’s transit manager deployed an autonomous shuttle, Lois has convenient, reliable mobility service at her doorstep that helps her feel more independent and active.

Gabriel Goods Mover
Gabriel used to worry about trucking safety and escalating transport costs. Now, his electric autonomous fleet lets his drivers switch over to autonomous mode to combat fatigue and comply with driving hour caps. The delivery schedules show that Gabriel transports freight faster and more efficiently.
Transforming Trucking

The long-haul trucking industry will leverage self-driving fleets for safe, efficient, cost-effective operations.

**DRIVER SHORTAGE**

2018 (50,000)
2026 (174,000)

55 is the average age of a commercial truck driver

90% accidents caused in part by driver error.

$334,000 average cost per truck accident


**ECONOMIC SAVINGS**

$70 billion: in labor costs
$35 billion: in fuel costs
$36 billion: by reducing accidents
$27 billion: in increased productivity

**DRIVING TOWARD EFFICIENCY, SAFETY**

- Optimize depot fueling and loading operations.
- Safety operators may oversee driverless deliveries.
- Fleets have flexibility with driving time caps.
- Self-parking features and collision avoidance at loading.

The **TRANSITION** to self-driving trucks pilot projects are under way in several U.S. cities. Electric autonomous trucks are expected to hit the market in 2019.

**COOPERATION**

Collaboration by these organizations is needed to establish policy, charging hubs, travel corridors, and loading zones:

- City and states
- Legislators
- Utilities
- Telecommunications companies
- Fleet operators
- Insurance Companies

Sources:

SmartDrive. 2018. The Year of Not Living Dangerously: Are You Prepared and Protected?
But First Infrastructure
First, there must be a major upgrade to the infrastructure that supports electric AVs.

Before benefits can be fully realized, there must be a major upgrade to the infrastructure that supports electric AVs. This means planning and deployment of:

- A strategically placed network of high-powered charging stations at logistics hubs, in cities, and along highway corridors.
- A modern digital electric utility grid to accommodate the demands of electrification.
- A robust communications system to support the explosion of mobility-related data traffic.

**Charging Networks**

Electric vehicles are expected to provide most of shared, autonomous transportation because electric AVs are significantly cheaper to operate and reduce both fuel and maintenance costs. This translates to a lower total cost of ownership, especially for electric fleet management. AVs will need unique charging infrastructure to match business models around centralized and distributed charging.

Compared to the first half of 2017, electric vehicle sales were up 40% in the first half of 2018\(^\text{13}\), with August 2018 being the top month for U.S. electric vehicle sales to date\(^\text{14}\). These numbers show that consumer interest in electric cars continues to grow, with similar growth expected for fleets, battery-powered public transportation, semi-trucks, taxis, ride-sharing services, airport shuttles, car-sharing services and more.

Adding momentum, Bloomberg estimates that battery prices will drop 67% by 2030, further supporting the electric transportation boom\(^\text{15}\). Applying a predicted 20% electric vehicle growth rate, the U.S. Department of Energy predicts that 600,000 level 2 chargers will be needed to meet upcoming charging demands. And this is just light-duty vehicles. These calculations don’t include fleets.

**U.S. Electric Vehicle Non-Residential Charging Hubs: There’s been great progress, but will the U.S. meet the growing need?**

![Graph showing the growth of electric vehicle charging hubs from 2008 to 2030](image)

Source: Bloomberg New Energy Finance, Forbes and Statistica.

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\(^{13}\) S&P Global. 2018. US Sales of EVs up 40% in First Half of 2018, led by Tesla.


\(^{15}\) Bloomberg. 2018. Electric Cars May Be Cheaper Than Gas Guzzlers in Seven Years. March 22.
Utility Grid Modernization

The fast-tracked pace of electric vehicle adoption is forcing utilities to innovate. Like most distributed energy resources (DERs), electric autonomous vehicles can be challenging to manage on the grid because of the sometimes unpredictable spikes in power demand associated with charging.

But forward-thinking utilities are turning these risks into rewards by modernizing the grids to integrate electric vehicles and charging stations. They are working to anticipate the number of electric car adopters, the timing of charging sessions, and charging hub locations to use vehicles to optimize grid operations and manage peak load. Even better, these new grid elements can become the basis for innovative utility business models, market-based grid services, and ultimately, new sources of revenue.

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A Black & Veatch survey found 40% of utilities have digital grid modernization programs in place, and another 36% are actively developing smart grid plans. It’s important for all utilities to make their start, because while 2030 could seem far away, these capital-intensive modernization upgrades require careful coordination and have long lead times for engineering, permitting, and construction.

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Electric Autonomous Transition

Grid-Balancing Action

10% more energy needed across U.S. to support trucks

12.5% more energy needed across U.S. to support cars

Plan and budget for thousands of new and upgraded transformers

Predict electric/autonomous adoption and encourage managed charging

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Communications Networks Upgrades

New cars already come with some level of autonomous features, like collision avoidance and lane correction. Add to that the RADAR, LIDAR, vehicle cameras, and GPS required for an AV and the data numbers become staggering.

An average mobile phone and computer user generates 1.5 gigabytes of data daily. Compare this data consumption to a fully autonomous vehicle that will generate 4,000 gigabytes in 90 minutes of driving. It is startling to consider that driverless cars will have to make split-second-sense of incoming information to “think” and “act” by themselves. Secure, reliable connectivity, energy supply, and data processing is critical to ensure safe driving.

But chipmakers, carmakers, and mobile network operators are investing billions to upgrade today’s 4G wireless networks to 5G technology, which will enable AV. The major carriers have announced their upcoming 5G rollouts, with widespread deployment anticipated in 2020. These ambitious networks need multiple technologies and processes to generate the quantum leap needed to support a reliable, low-latency autonomous driving future.

5G will ignite innovation through expansive, reliable connections of people and things with no perceived delay, even in remote areas. With 5G, applications like AV can be fully developed.

Currently, the U.S. Department of Transportation is testing dedicated short-range communications (DSRC) for AV. This two-way short- to medium-range wireless system allows fast data transmission and interoperable connectivity for active safety communications between cars. While DSRC is the go-to technology right now—many automakers will include the DSRC hardware in future models — many industry leaders think that cellular systems, specifically 5G, will be better suited to support AV. With greater capacity and faster broadband connection, 5G will allow the AV technology to scale more quickly. It is likely that both 5G and DSRC will support the AV evolution.

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Autonomous Vehicles and Big Data

5G will move big data into hyperspeed, accelerating driverless car technology.

Edge computing and on-board processing enables fast, localized car response by shortening data processing time.

Data centers collect car data and use deep-learning tools to teach the car about the world around them.

Fiber optics are critical for the U.S. to reach its 5G potential.

5G and DSRC technologies talk to other driverless cars and roadside infrastructure for added safety when typical modes of “vision” are obscured, like during bad weather.

DSRC radio will allow autonomous vehicles to communicate with other vehicles and infrastructure.
Everyone has a role to play in our new mobility. Key players must form true partnerships and fulfill their roles for the industry, investors, communities, and citizens to fully realize the benefits.

**Legislators**
- Develop financial incentives for utilities to plan and invest in grid updates to support electric autonomous demand.
- Allow utilities to create programs that support rapid development of EV charging infrastructure.
- Encourage utilities to set rates to incentivize EV adoption while shaping charging behavior and patterns.
- Pass AV laws to support testing and deployment and that support electric shared mobility services, attract autonomous investors, and open new funding mechanisms.

**Utilities**
- Incorporate electrification in grid planning and be proactive in modernization.
- Investigate new revenue streams related to electric and autonomous vehicles.

**Logistics and Transportation Network Companies**
- Work with municipal agencies to develop new approaches to provide seamless transportation options that optimize traffic flows.
- Collaborate with cities and states to develop comprehensive good movement plans.

**Technology Integrators**
- Communicate with all stakeholders to coordinate and streamline planning and technology deployment.

**Municipalities**
- Work closely with utilities to thoughtfully site high-power EV charging stations.
- Create policies that streamline city deployment of 5G technologies like fiber and small cells.
- Develop a mobility plan that covers land use, transit planning, first/last mile connections, and pilot zones.

**Carriers, Third-Party Operators and Technology Providers**
- Continue to push boundaries of communication technology to meet the needs of data influx.
- Get ready for mass deployment and consider new business models to capture new opportunities.

**Citizens and Communities**
- Technology supports citizens by creating highly livable, sustainable communities.

**Industry**
- Disrupt the market with technology innovation.

**Investors**
- Provide financial backing to launch new technology.

**City Leaders**
- Make decisions that encourage technology investment.

**Legislators**
- Create a regulatory framework that supports innovation.
What Does our New Mobility Mean to You?

New Mobility means different things to different people. To an individual, New Mobility means the freedom to travel the way they want to, using convenient, on-demand services that are cheaper than owning a car. To cities, it means re-thinking how transportation services are integrated and delivered to meet the needs of their citizens. Industry sees New Mobility as a muse inspiring new technology and new business models. Broader still, technology integrators, like Black & Veatch, see this as an opportunity to apply technologies to reinvent travel and transport systems towards sustainable, cost-efficient movement of people and goods.

Regardless of the viewpoint, the key players of our New Mobility ecosystem need to build true partnerships for autonomous innovation to thrive and provide benefits to companies, cities, and citizens alike. As the parties come together, the result will be autonomous transportation plugged into an efficient, adaptive charging station infrastructure. And that means reduced greenhouse gas emissions, cleaner cities, and more efficient, economical and inclusive transportation options for everyone.

Our New Mobility is here. Black & Veatch integrates technologies and unites stakeholders to make our New Mobility work for everyone.
Information ahead of innovation.

Digital infrastructure deployment is accelerating. Coming soon: our eBook series fast-tracks industry transformation. Read on.

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