



Driven by Innovation: A Glimpse into the Future of Transportation

Connected, Autonomous, Shared, and Electric (CASE) Vehicles

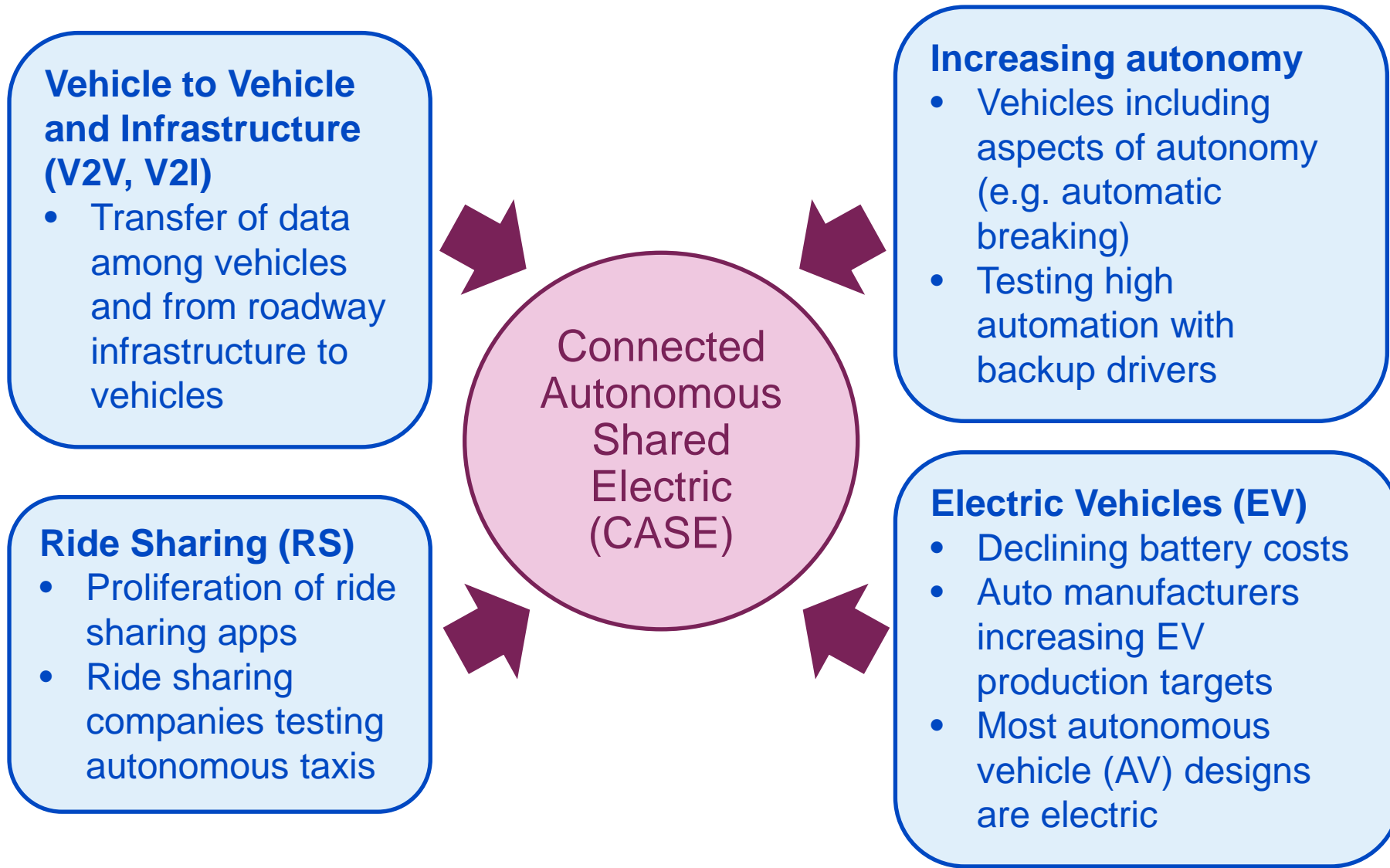
Scott Zuchorski

Senior Director, Co-Head U.S. Transportation, Global Infrastructure and Project Finance

March 13, 2019

FitchRatings

Technological Developments Are Changing Mobility



CASE Will Transform Transportation Demand Profiles



Toll Roads

- Potential increase in vehicle miles travelled
- Lower value of time could reduce willingness to pay tolls
- Tolls could link to vehicle miles travelled



Managed Lanes

- Less space between vehicles reduces congestion and could dampen demand for managed lanes (ML)
- ML could be used as test lanes for initial AV adoption



Parking

- Urban areas most vulnerable to reduced demand
- RS reduces individual car ownership
- Assets could be repurposed (charging, fleet maintenance)

What Infrastructure is Needed to Support CASE?

- **Connected Infrastructure: V2V,V2I**

- Connected traffic signals, road signs, and road side units
- Central information management system

- **Bandwidth and Cyber Security**

- Dedicated short range communication (DSRC),5G network
- Growing need for fiber optic cable
- Secured data processing and storage systems

- **Charging Stations**

- Public and Individual charging stations
- Robust grid network and power supply to meet new patterns of demand

- **Road Maintenance**

- Detectable lane markings
- Precise movement of AVs requires pavement that can sustain traffic concentrated in center of lane

Who Will Pay for New Infrastructure?

Private Investment

- AV technology developers are investing in infrastructure and partnering with cities for pilot programs

Federal Grants

- Portion of \$1.5 billion in BUILD Transportation Grants allocated to AV projects
- In Spring 2019, U.S. DOT is awarding up to \$60 million in federal grants for safe integration of automated driving systems

Municipalities

- Many pilot projects have been funded by a combination of state, local, and federal grant money
- Funding needs to be allocated for ongoing maintenance and operations

New Technology and Infrastructure Already Being Implemented

- **Autonomous Vehicle Technology**

- Ride sharing companies such as Uber and Lyft are actively testing AVs with backup human drivers and Waymo has tested full automation with no driver
- Major auto manufacturers are increasingly focused on production of EVs and are investing in their own AV prototypes

- **Infrastructure Development and Modification**

- U.S. DOT's connected vehicle projects are being tested in multiple cities and on highways

- **Charging Stations**

- Tesla currently owns the biggest charging network in U.S.
- No sustainable business model for commercial charging systems yet
- More than 21 States are offering incentives for individual and commercial charging stations

Partnership Examples

- **Panasonic and Colorado DOT (CDOT)**

- Panasonic developed a Network Operations Center to manage its connected system along I-70 and installed connected roadside units and vehicle onboard units
- “Connected Vehicles as a Service” model. CDOT owns the equipment. Panasonic installs, operates, and maintains the system and provides CDOT access to data

- **Alphabet and City of Toronto**

- Sidewalk Labs, owned by Alphabet, is leading the development of the waterfront district in Toronto
- The new district is designed with AV and EV infrastructure built in from start
- Sidewalk Labs promises to invest billions of dollars upfront to bridge the funding gap

- **U.S. DOT and Tampa Hillsborough Expressway Authority (THEA)**

- U.S. DOT grant awarded to improve traffic flow, safety, and carbon footprint
- Installation of roadside units and on-board units in buses, trolley cars, and private vehicles

How is Fitch Addressing Effects of CASE?

- **Effects of CASE are not yet directly incorporated into Fitch forecasts**
 - However, Fitch accounts for risk for all credits by applying haircuts to growth projections. For credits with unproven performance, Fitch takes a conservative view
 - The timing of technological developments is uncertain with widespread full autonomy not expected for over 20 years
 - Advances in technology could lead to faster implementation of CASE
- **Credits with long-term debt maturities (30+ years) will be exposed to changes in demand**
 - Monopolistic bridge systems and major arteries such as turnpikes are expected to be less vulnerable to demand erosion than congestion relievers
 - Fitch performs breakeven analysis on a case-by-case basis to assess asset strength if demand erodes
 - Structural elements such as cash sweep triggers and management strategy to de-lever with maintenance of high coverage ratios in outer years mitigate risk for credits more vulnerable to revenue declines



New York
33 Whitehall Street
New York, NY 10004

London
30 North Colonnade
Canary Wharf
London, E14 5GN

fitchratings.com

 [@fitchratings](https://twitter.com/fitchratings)

FitchRatings