



How will emerging mobility technologies steer future planning?

Getting ready for connected and autonomous vehicles' impacts.

WHITE PAPER | JANUARY 2018

Driverless cars and trucks will change everything planners do. But when, how and to what degree remain tough questions to answer. This white paper considers the factors that decision makers and planners should take into account when considering how to incorporate the impact of connected and autonomous vehicles into short- and long-term planning.

In this white paper:

- Planning for the impacts of connected and automated vehicles
- Scenario-based planning
- HNTB's CAV planning timeline and implications matrix



Status Quo
Driver controls critical functions (ignition, steering, braking, etc.)



Transition
Vehicle controls some critical functions at driver discretion.



Fully Autonomous
Vehicle controls all critical functions; driver becomes dispatcher.

Defining the future

Tomorrow's world of driverless cars, trucks and buses will change everything – but when, how and to what degree are tough predictions to make.

Many planners are discovering that this transformative revolution in transportation will impact an unimaginable range of U.S. enterprises and quality of life for Americans nationwide. But their discovery is complicated by the lack of clarity in knowing the timing and magnitude of those impacts on land use, transportation, environmental and community planning.

That leaves decision makers and planners searching for answers to questions regarding when and in what fashion they should consider connected and autonomous vehicle (CAV) implications in planning.

The evolution of CAVs and their impacts

Planners across the nation have struggled with understanding the implications of CAVs. As far back as 2010, when they remained a futuristic dream, state departments of transportation and HNTB considered the possible impacts of autonomous freight trucks on the U.S. transportation network during the study of building dedicated truck lanes across 800 miles of Interstate 70 through Missouri, Illinois, Indiana and Ohio.

Today, almost every state department of transportation and most major metropolitan areas are considering how CAVs may affect interstate and intercity travel in the near term, along with mobility, safety, land use and quality of life. For example, the Mid-America Regional Council, the Greater Kansas City area's metropolitan planning organization, began including CAV policies into its long-range transportation plan in 2016. Other MPOs have followed suit. Transit agencies, campuses and airports are beginning to develop plans to incorporate AV technologies in their short- and long-range plans as well.

We also are beginning to see vehicles that have autonomous components such as adaptive cruise control, lane keeping and self-parking. These features are rapidly moving into every vehicle segment and will continue to move the fleet toward full autonomy.

Scenario-based planning

Policy planning lays the foundation for the future, but how do you forecast future travel conditions in such a dynamic environment? Planners have begun to evaluate different scenarios to support a spectrum of future possibilities. Scenario-based planning allows planners to assess combinations of factors, such as CAV penetration rates, vehicle ownership, population growth, employment growth and transit ridership, to derive a range of traffic projections. These projections can be adjusted periodically by changing any of the factors or adding new

ones that may surface during the planning horizon. This technique provides a way to assess future travel, considering what is most probable today. Confidence in the forecast and resolution of the future increase as the planning horizon narrows, but during that period new factors will surely arise, likely at an accelerated rate, to offer new uncertainties that will impact the forecast.

CAVs will change every planning discipline

Much is driving the speed with which CAVs are gripping the imagination of planners everywhere. Certainly, there is the "thrill of the new" – new tools, new "gold rush" opportunities associated with disruptive technologies, and new opportunities to fix many historical planning decisions that today make improving our metropolitan areas complex.

But more immediate, substantive considerations are at play. Already the federal government calls upon planners¹ and community leaders² to consider CAV impacts within the context of long-range urban and transportation planning. Urban planners looking at large-scale redevelopment projects like Kansas City, Missouri's Power & Light District, which took nearly 40 years from first concept to retail operation³, may already be behind the curve. In the same way, every new development property needs to begin to evaluate its pick-up and drop-off locations as parking lots will no longer be the primary location for building access.

Planners also are beginning to understand that the traditional planning cycle is no longer appropriate due to the changes in technology. Trying to predict travel patterns in 20 or 40 years in the environment with the number of unknowns in the CAV industry and the pace of change is virtually impossible.

In such an environment, planners clearly need to re-evaluate how they plan for a community's land use and infrastructure changes. New plans will have to analyze how to adjust the development and management of urban, suburban and rural areas to CAV-induced social, economic and environmental change. Consider these examples:

- Autonomous vehicles may end hundreds of millions of dollars generated from tickets and other penalties for bad human driving – dollars that provide significant funding for transportation infrastructure maintenance and many other public services⁴.
- It is safe to assume CAVs will cause impacts to businesses such as taxi or trucking companies, including legal and regulatory issues involving liability, taxation, and use of GPS and other vehicle-generated data.
- A recent McKinsey report⁵ estimated 75 percent of urban space devoted to parking will not be needed by 2050. This means 5.7 billion square meters of space will require repurposing or redevelopment in ways that preserve property

values, tax revenues, commercial and residential quality of life.

Unfortunately, it's still unclear when CAVs will noticeably affect planning decisions. Depending on the commentator, that momentum is coming in the next three years; after one full turnover of the U.S. automotive fleet, which would bring significant impacts in about 11-12 years⁶; or for the first planning cycle covering the 2050 full CAV adoption predicted by the McKinsey report cited earlier. Another important prediction to note comes from RethinkTransportation, which estimates that 60 percent of all vehicles and 95 percent of all vehicle-miles traveled will be in an automated vehicle by 2030.

But what are we planning for? When it comes to CAVs, what are the changes stemming directly from the type, rate and scale of technology innovation? How will they affect us? How will we recognize them and how should planners account for them?

Federal framework for CAV planning

One way is to look to an approach like the one provided by the U.S. Department of Transportation. It has provided a framework that planners can use to plan for connected and autonomous vehicles in their communities⁷.

This HNTB matrix uses the U.S. DOT approach and assesses planners' constraints to help planners decide when the time is right to thoroughly investigate CAVs in their planning efforts. In a very qualitative way, we believe this matrix captures a variety of planning issues that likely will hasten or delay CAV implementation in a particular region or locale.

Where CAVs will take planning – and vice versa

HNTB advises clients across the U.S. to be working now with elected officials and public staff to plan for connected and autonomous vehicles.

Our advice is to begin actively considering how local transportation systems will function in this new environment. That doesn't yet mean that such a collaboration has to involve an exhaustive, long-range plan full of details on what is still fairly unknown. But it is true we already are in a connected-vehicle environment, and this will continue growing as increasing benefits in safety, mobility and quality of life are achieved by wirelessly connecting vehicles, roads and communities.

As outlined in our planning matrix, we advise that CAV planning move front and center when certain conditions exist and/or when the planning horizon is 2030 or greater. Planners should focus on scenario planning and processes that generate agile and dynamic strategies for responding to the impact of CAVs.

CAV Planning Timeline and Implications

Factor	Sooner/Greater	Later/Lesser
Education Performance of local schools versus state/national averages.	Demands for safe, high-quality educational opportunities play a strong factor in deciding where to live, making CAV desirable to expand educational options.	High-performance districts or school options may favor compact development less amenable to CAV expansion.
Development Degree of community/regional sprawl compared to national averages.	Sprawl suggests willingness to commute for schools, housing, employment or other factors that drive earlier/greater CAV adoption.	Natural or artificial "green lines" may limit or delay demand for local/regional transportation system accommodation of CAV vehicles.
Parking Availability/affordability of parking as perceived by residents.	Lack of affordable parking provides incentive for decision makers and stakeholders to advocate for moving aggressively to CAV planning and implementation.	Available, affordable parking options may limit or delay demand for local/regional transportation system accommodation of CAV vehicles.
Income Local or regional incomes versus state/national averages.	Significantly higher incomes may signal higher percentages of early adapters or persons holding mobile office friendly jobs.	Average or below-average household incomes may suggest late CAV adoption.
Funding History of funding and innovation at planning or transportation agency versus peers.	An agency track record of innovation and adequate funding may indicate willingness to address CAV costs/benefits as soon as possible	Attitudinal or financial barriers may slow planning and deployment of CAV and/or anticipating/responding to potential impacts.
Transit Levels of service, funding and cooperation among local/regional transit system(s) in terms of perceived ability to meet local needs.	Weak or underfunded transit systems may prompt decision makers and stakeholders to advocate for moving directly to CAV options addressing transit challenges.	Robust transit systems may reflect levels of service and social factors likely to affect/slow CAV deployment/impacts.
Mobility Ease of access and movement in the most congested urban areas, corridors and nodes.	Congestion levels impede real or perceived ease of access to - and predictability of travel time between - jobs, amenities and residences.	Congestion levels are acceptable to most users and/or pose no real level of service impacts.
Safety Safety issues/costs created by driver/facility attributes not addressed by design, reconstruction.	Safety-related impacts or opportunities are quickly, easily and/or cheaply achieved through technology solutions.	Technology solutions are not available, cost more than the benefits accrued or create significant negative safety, economic or cultural impacts.

Next steps and more information

1. HNTB's Connected and Autonomous Vehicle Strategic Plan has five primary contacts ready to help you:
 - Jim Barbaresso, Intelligent Transportation Systems Practice Leader
 - Greg Krueger, Emerging Technologies
 - Kip Strauss, CAV Planning
 - Michael DeMent, CAV Education and Communication
 - Ben Walker, CAV Policy
2. Initiate discussion – Use this white paper and resources such as the federal framework for CAV Planning and the CAV Planning Timeline and Implications matrix to initiate discussions about CAV impacts.
3. Make a difference – Transportation agencies have planning documents they use as a framework for short-, mid- and long-term action. Examples of documents they can use to assess CAV impacts include:
 - Statewide/Regional Long-Range Transportation Plan
 - Statewide/Regional ITS Plan
 - Data and Technology Master Plan
 - Legislative Agenda for CAV Liability and Policies
 - Agency Policies and Guidelines

Resources

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References

¹ **U.S. Dept. of Transportation.** "2015 FHWA Vehicle to Infrastructure Deployment Guidance and Products."

² **U.S. Secretary of Transportation Anthony Foxx. "Remarks Regarding U.S. Transportation Issues."** Greater Kansas City Chamber of Commerce, Polsinelli Public Policy Up Close Speakers Series. August 2015.

³ **Rob Roberts, Reporter, The Kansas City Business Journal.** "Power & Light District: Timeline shows history of development." July 2013.

⁴ **Brookings Institute,** Local government 2035: Strategic Trends and Implications of New Technologies, by Kevin C. Desouza, David Swindell, Kendra L. Smith, Alison Sutherland, Kena Fedorschak, and Carolina Coronel). May 2015.

⁵ **Michele Bertoncello and Dominik Weep, McKinsey Company.** "Ten ways autonomous driving could redefine the automotive world." June 2015.

⁶ **IHS Automotive Inc.** "Average Age of Vehicles on the Road Remains Steady." June 2014.

⁷ **Planning for the Future of Transportation:** Connected Vehicles and ITS, U.S. Dept. of Transportation.

⁸ **Lawrence D. Burns, Director -** Program on Sustainable Mobility, The Earth Institute of Columbia University, et al. "Transforming personal mobility." January 2013.

⁹ **Dr. Anand S. Rao, Principal, Insurance Advisory Services Innovation Lead, PWC Analytics Group,** "The Insurance Industry in 2015."

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