

ITEM 6 – Information

November 23, 2021

Connected and Automated Vehicles: Update on Recent Activities and Review of Draft Regional Principles

Background:

In preparation for inclusion in the 2022 update of Visualize 2045, staff has been working with several committees to develop a draft set of regional Connected and Automated Vehicles (CAV) principles. The draft principles were discussed at the September 10 and November 5 TPB Technical Committee meetings, November 19 TPB meeting, as well as at recent meetings of the Access for All Advisory Committee, the Community Advisory Committee, and the Systems Performance, Operations, and Technology Subcommittee. Staff have presented this draft set of CAV principles and asked the TPB to take action at a future meeting to approve these principles for inclusion in Visualize 2045.



MEMORANDUM

TO: Transportation Planning Board
FROM: Andrew J. Meese, TPB Program Director, Systems Performance Planning
SUBJECT: Connected and Automated Vehicles: Update on Recent Activities and Development of Regional Principles
DATE: November 10, 2021

This memorandum provides an update on regional activities related to Connected and Automated Vehicles (CAVs), and serves as an introduction to the attached draft regional principles regarding CAVs.

BACKGROUND ON PRINCIPLES DEVELOPMENT

The TPB's most recent long-range transportation plan, Visualize 2045 (approved in 2018), included only limited information on the potential impacts of future CAVs. Although CAVs are expected to be impactful between now and 2045, many uncertainties surround them from a planning perspective, including the global pace of technological development, and market forces (e.g., will vehicle buyers be quick or slow to adopt CAVs?).

Following 2018, staff took action to strengthen our understanding of CAVs, through a series of regional webinars, and a subject matter expert consultant-developed white paper on CAV planning considerations.

WHITE PAPER AS BACKGROUND TO CAV PRINCIPLES DEVELOPMENT

The white paper¹ was developed to assist the TPB in planning for CAVs on the region's transportation system. The white paper examined areas where TPB goals, policies, and activities may substantially interact with potential CAV deployment impacts (issues, challenges, opportunities). Table 1 on the next page, based on white paper information, shows the wide range of such impacts. Second, the white paper examined roles and responsibilities, with information on the differing but interacting federal, state, regional (including MPO), local, and private sector roles. Third, the white paper examined regional policy development and collaboration, including the idea of developing regional CAV principles for inclusion in Visualize 2045.

¹ ["Connected and Autonomous Vehicles \(CAVs\): Planning Considerations for the National Capital Region Transportation Planning Board."](#) Prepared by ICF on behalf of the Metropolitan Washington Council of Governments Department of Transportation Planning, June 2020.

Table 1: Potential Impacts of CAVs

Travel Impacts	Societal Impacts	Organizational Impacts
Access	Equity	Data Coordination
Active Transportation	Employment / Economic Development	Emergency Preparedness
Public Transportation	Environment	Funding
Goods Movement	Land Use / Urban Form	Infrastructure
Safety	Legal Liability	Operations
Travel Behavior		Reliability
		Security/Privacy
		Travel Forecasting

INTRODUCTION TO THE DRAFT CAV PRINCIPLES

Staff recently has developed such a draft list of principles, with reviews by the TPB Technical Committee, the Community Advisory Committee, the Access for All Advisory Committee, and the Systems Performance, Operations, and Technology Subcommittee. After incorporating the advice of these committees, staff will now present the draft set of principles for board review at the November 17, 2021 meeting, toward TPB approval at a subsequent meeting.

Staff's approach to the development of draft CAV principles was based on the following:

- Similarity in structure, phrasing, number, and length to documents previously approved by TPB (the Regional Freight Policies approved as part of the 2016 Regional Freight Plan were a particular model that staff emulated)
- Brevity and inclusiveness of topics were favored
- Positive phrasing was favored where possible (what should happen rather than what should not happen)
- Emphasis on topic areas generally in the purview of the TPB and its member jurisdictions (rather than state-level, national, or international issues)
- Avoidance of phrasing that would be interpreted as endorsing or promoting (or prohibiting) CAVs; rather, echoing and building upon TPB's previous policies regarding the region and our communities

- Emphasis on evergreen principles that will not depend on (or go out of date because of) quickly-changing technologies or market forces
- Emphasis on policy/principle viewpoints, and outcomes, rather than strategies or tactics.

Attached is the current draft, comprising 18 (eighteen) principles based on consultant white paper information, staff analysis, and committee discussions. The structure of the principles list is a single preamble: *The deployment, use, or operation of Connected and Automated Vehicles in the National Capital Region should...* followed by each of the 18 statements.

A presentation slide deck is also being included in read-ahead materials for the November 17 meeting, with additional explanatory information. For brevity during the presentation, staff plans to focus on just key highlights of the draft principles, but will be happy to discuss any of the principles or related information at the request of the board, and respond to direction that the board provides. Should a board member or staff have any questions for clarification purposes, please feel free to contact me by email at ameese@mwkog.org. Thank you.

Attachment: Draft TPB CAV Principles

National Capital Region Transportation Planning Board

Principles for Connected and Automated Vehicles

The deployment, use, or operation of Connected and Automated Vehicles (CAVs) in the National Capital Region should:

1. ensure the safety of everyone on or near transportation facilities, in all situations.
2. ensure CAVs' benefits are available equitably to all people in the region, and avoid disproportionate negative impacts to any group or community.
3. increase mobility options for all.
4. increase opportunities for and quality of accessible transportation, including for persons with disabilities.
5. maintain and enhance opportunities for and the quality of bicycling and walking in the region.
6. support the priority of transit on the region's roadways.
7. enhance the provision of transit, including providing opportunities for microtransit access to the region's high-capacity transit (HCT) stations.
8. bolster regional environmental and land use objectives, including prioritizing shared vehicles and advancing decarbonization of the transportation system.
9. prioritize reduction of vehicle miles of travel and minimize zero occupant vehicle miles of travel.
10. ensure freight and goods movements that help minimize disruptions and facilitate livability of the region's communities.
11. ensure security (including cybersecurity) and privacy, and prevent risks to people and infrastructure.
12. interoperate safely with non-automated vehicles, vehicles with differing levels of automation, and all other transportation system users.
13. be accompanied by addressal of legal liability issues relating to crashes, failures, and safety, including ensuring that CAVs at varying levels of capability are operated within those vehicles' technological capabilities and limitations.
14. bolster effectiveness of emergency and incident response, systems management by traffic operations centers, and information sharing among agencies and the public.
15. bolster interjurisdictional coordination and technical interoperability among TPB member agencies, in conjunction with relevant national efforts and standards.
16. provide public revenues that are no less than the costs they impose on infrastructure, transportation systems management and operations, and communities.
17. make data freely available to TPB member agencies to enhance planning, operations, and emergency preparedness and response.
18. be accompanied by robust efforts by TPB and member agencies to keep abreast of evolving technology to enhance support of TPB's goals.



UPDATED DRAFT REGIONAL CONNECTED AND AUTOMATED VEHICLE PRINCIPLES

Andrew Meese
TPB Program Director, Systems Performance Planning

Transportation Planning Board
November 17, 2021 – Agenda Item #10

Connected Intersection ([USDOT/Getty Images](#))



Overview

- Strengthening our regional understanding of Connected and Automated Vehicle (CAV) impacts – the path to developing a draft set of principles
- Approach and structure used in developing the principles
- Overview of the current set of draft Regional CAV Principles
 - As advised by the TPB Technical Committee, the Access for All Advisory Committee (AFA), the Community Advisory Committee (CAC), and the Systems Performance, Operations, and Technology Subcommittee (SPOTS)
- Outlook



CAVs in Visualize 2045

- Visualize 2045, the region's long-range transportation plan approved in 2018, had only limited information regarding CAVs
 - Many uncertainties surround CAVs, including the global pace of technological development and market forces
 - Following 2018, staff took action to strengthen our understanding of CAVs, through a series of regional webinars, and a consultant-developed white paper on CAV planning considerations



White Paper (2020)

- Developed by an expert consultant team to assist the TPB in planning for CAVs on the region's transportation system, examining:
 - Areas where TPB goals, policies, and activities may substantially interact with CAVs
 - Potential CAV deployment impacts (issues, challenges, opportunities)
 - Roles and responsibilities: federal, state, regional (including TPB), local, private sector



TPB Roles

- Information Sharing, Engagement, and Coordination:
 - Example: TPB 2020/2021 CAV webinar series
- Integrating CAV Considerations into Planning and Programs:
 - Enhanced emerging technologies section of Visualize 2045 update
- Regional Policy Development and Collaboration:
 - **Development of regional CAV principles for inclusion in Visualize 2045 update**



Potential Impacts of CAVs

Travel Impacts	Societal Impacts	Organizational Impacts
Access	Equity	Data Coordination
Active Transportation	Employment / Economic Development	Emergency Preparedness
Public Transportation	Environment	Funding
Goods Movement	Land Use / Urban Form	Infrastructure
Safety	Legal Liability	Operations
Travel Behavior		Reliability
		Security/Privacy
		Travel Forecasting



Principles Approach and Structure

Staff's approach to the draft principles was based on:

- Similarity to previous documents (e.g. 2016 Freight Plan)
- Brevity; positive phrasing
- Focus areas within TPB's purview
- Avoidance of promotion/endorsement or prohibition language
- Emphasis on evergreen principles
- Emphasis on policies and outcomes, not strategies or tactics
- Reflection of input received from committees/stakeholders

Preamble to all principles:

The deployment, use, or operation of Connected and Automated Vehicles in the National Capital Region should ... followed by each principle statement (the current draft has 18 such statements)

Summary List of Draft Principles

1. Ensure safety of everyone
2. Ensure equitable benefits
3. Increase mobility options for all
4. Increase opportunities for accessible transportation
5. Enhance bicycling and walking
6. Support priority of transit
7. Enhance transit including microtransit access to HCT stations
8. Bolster regional environmental and land use objectives
9. Prioritize reduction of VMT
10. Ensure freight/goods movements that minimize disruptions
11. Ensure security, cybersecurity, privacy
12. Interoperate safely at varying vehicle capability levels
13. Address legal liability issues
14. Bolster incident response
15. Interjurisdictional interoperability
16. Provide revenues no less than costs imposed
17. Make data freely available to TPB member agencies
18. Keep abreast of evolving technology to enhance support of TPB goals



Draft Regional CAV Principles

The deployment, use, or operation of Connected and Automated Vehicles in the National Capital Region should...

1. ensure the safety of everyone on or near transportation facilities, in all situations.

Notes:

- CAV safety benefits are often cited – but there are also risks
- Worded to include not just vehicle drivers and occupants
- CAV technology must be able to recognize and ensure safety of all pedestrians, regardless of skin color or mobility/ability levels
- Risks must not be borne disproportionately by any community or group



Draft Regional CAV Principles

The deployment, use, or operation of Connected and Automated Vehicles in the National Capital Region should...

- 2. ensure CAVs' benefits are available equitably to all people in the region and avoid disproportionate negative impacts to any group or community.**

Notes:

- Market forces may cause CAVs and benefits to be deployed inequitably
- Special efforts to provide CAV benefits to underserved communities
- Reasonable access/cost for all in region



Draft Regional CAV Principles

The deployment, use, or operation of Connected and Automated Vehicles in the National Capital Region should...

4. increase opportunities for and quality of accessible transportation, including for persons with disabilities.

Notes:

- Fair access/mobility for persons with accessibility needs
- Comprehensive range of choices



Draft Regional CAV Principles

The deployment, use, or operation of Connected and Automated Vehicles in the National Capital Region should...

6. support the priority of transit on the region's roadways.

Notes:

- Regional plans and programs have long emphasized multi-occupant vehicle travel over single-occupant vehicle travel
- Supporting transit is a core TPB goal, and should remain a priority
- Risks include facilitating low density living that may reduce transit ridership, and a negative spiral of transit revenues and service level reductions



Draft Regional CAV Principles

The deployment, use, or operation of Connected and Automated Vehicles in the National Capital Region should...

- 8. bolster regional environmental and land use objectives, including prioritizing shared vehicles and advancing decarbonization of the transportation system.**

Notes:

- Deployment as CASE vehicles (Connected, Automated/Accessible, Shared, Electric/Decarbonized) would be critical to enhancing these goals



Draft Regional CAV Principles

The deployment, use, or operation of Connected and Automated Vehicles in the National Capital Region should...

9. prioritize reduction of vehicle miles of travel and minimize zero occupant vehicle miles of travel.

Notes:

- Opportunities include that shared vehicles (if “CASE”) may reduce auto ownership, facilitating non-auto modes; bolster Mobility As a Service
- Risks include increased travel due to willingness to travel further or “zombie” zero-occupant-vehicle (ZOV) VMT



Draft Regional CAV Principles

The deployment, use, or operation of Connected and Automated Vehicles in the National Capital Region should...

12. interoperate safely with non-automated vehicles, vehicles with differing levels of automation, and all other transportation system users.

Notes:

- Scenarios for deployment vary, but some anticipate mixes of automated vehicles (automated at differing levels of capability and human driver involvement) and non-automated vehicles
- Choices of how CAVs are operated should be responsible, recognizing the limits of what vehicles' automation systems are capable of



Draft Regional CAV Principles

The deployment, use, or operation of Connected and Automated Vehicles in the National Capital Region should...

16. provide public revenues that are no less than the costs they impose on infrastructure, transportation systems management, and communities.

Notes:

- Opportunities include potential willingness to invest in infrastructure improvements to realize CAV benefits
- Risks include new infrastructure demands/costs outstripping ability to serve those demands
- CAV deployment must be done in ways to generate sufficient revenue to cover both infrastructure and equity impacts costs



Outlook

- Presented today for information
- Comments welcome – this is a strawman draft ready for your ideas
- Slated to return to TPB for approval at a subsequent meeting
- Early 2022 – incorporation into Visualize 2045 text



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National Capital Region
Transportation Planning Board

Additional Slides: The Full List of 18 Draft CAV Principles



Draft Regional CAV Principles

The deployment, use, or operation of Connected and Automated Vehicles in the National Capital Region should...

1. ensure the safety of everyone on or near transportation facilities, in all situations.

Notes:

- CAV safety benefits are often cited – but there are also risks
- Worded to include not just vehicle drivers and occupants
- CAV technology must be able to recognize and ensure safety of all pedestrians, regardless of skin color or mobility/ability levels
- Risks must not be borne disproportionately by any community or group



Draft Regional CAV Principles

The deployment, use, or operation of Connected and Automated Vehicles in the National Capital Region should...

- 2. ensure CAVs' benefits are available equitably to all people in the region and avoid disproportionate negative impacts to any group or community.**

Notes:

- Market forces may cause CAVs and benefits to be deployed inequitably
- Special efforts to provide CAV benefits to underserved communities
- Reasonable access/cost for all in region



Draft Regional CAV Principles

The deployment, use, or operation of Connected and Automated Vehicles in the National Capital Region should...

3. increase mobility options for all.

Notes:

- Interconnected multimodal transportation system that provides convenient access with reduced automobile reliance
- Comprehensive range of choices for regional travelers
- Accurate and user-friendly real-time transportation system info available to all regardless of traveler's mode or language
- Deployment as CASE vehicles (Connected, Automated/Accessible, Shared, Electric/Decarbonized) would be critical to enhancing these goals



Draft Regional CAV Principles

The deployment, use, or operation of Connected and Automated Vehicles in the National Capital Region should...

4. increase opportunities for and quality of accessible transportation, including for persons with disabilities.

Notes:

- Fair access/mobility for persons with accessibility needs
- Comprehensive range of choices



Draft Regional CAV Principles

The deployment, use, or operation of Connected and Automated Vehicles in the National Capital Region should...

5. maintain and enhance opportunities for and the quality of bicycling and walking in the region.

Notes:

- Opportunities for reduced motor vehicle reliance, but also risks of mixed operations, or exclusion from dedicated CAV facilities
- Deployment of CAVs in the region should be done only in ways that maintain or increase availability of bicycle and pedestrian infrastructure, and safety of bicyclists and pedestrians



Draft Regional CAV Principles

The deployment, use, or operation of Connected and Automated Vehicles in the National Capital Region should...

6. support the priority of transit on the region's roadways.

Notes:

- Regional plans and programs have long emphasized multi-occupant vehicle travel over single-occupant vehicle travel
- Supporting transit is a core TPB goal, and should remain a priority
- Risks include facilitating low density living that may reduce transit ridership, and a negative spiral of transit revenues and service level reductions



Draft Regional CAV Principles

The deployment, use, or operation of Connected and Automated Vehicles in the National Capital Region should...

- 7. enhance the provision of transit, including providing opportunities for microtransit access to the region's high-capacity transit (HCT) stations.**

Notes:

- Opportunities include operational benefits of technology, especially connectivity (e.g. Transit Signal Priority); last-mile shuttles; repurposing parking space for transit uses



Draft Regional CAV Principles

The deployment, use, or operation of Connected and Automated Vehicles in the National Capital Region should...

- 8. bolster regional environmental and land use objectives, including prioritizing shared vehicles and advancing decarbonization of the transportation system.**

Notes:

- Deployment as CASE vehicles (Connected, Automated/Accessible, Shared, Electric/Decarbonized) would be critical to enhancing these goals



Draft Regional CAV Principles

The deployment, use, or operation of Connected and Automated Vehicles in the National Capital Region should...

9. prioritize reduction of vehicle miles of travel and minimize zero occupant vehicle miles of travel.

Notes:

- Opportunities include that shared vehicles (if “CASE”) may reduce auto ownership, facilitating non-auto modes; bolster Mobility As a Service
- Risks include increased travel due to willingness to travel further or “zombie” zero-occupant-vehicle (ZOV) VMT



Draft Regional CAV Principles

The deployment, use, or operation of Connected and Automated Vehicles in the National Capital Region should...

10. ensure freight and goods movements that help minimize disruptions and facilitate livability of the region's communities.

Notes:

- Opportunities include economic benefits of freight efficiency; addressing driver shortages; efficiencies in freight delivery parking
- Risks include jobs disruptions; net increases in congestion/ VMT/ emissions; last-mile freight delivery vehicles using/crowding urban infrastructure



Draft Regional CAV Principles

The deployment, use, or operation of Connected and Automated Vehicles in the National Capital Region should...

11. ensure security (including cybersecurity) and privacy and prevent risks to people and infrastructure

Notes:

- Opportunities include increased operational information which, in turn, may increase security
- Risks include cybersecurity (e.g., breaches of privacy infrastructure and vehicle vulnerabilities to attack); vulnerabilities of electric and communications infrastructure and batteries (e.g. electromagnetic pulse, battery fire hazards, electrocution hazards for first responders)
- Security will be an ongoing (operational) challenge – security work will never be “finished”



Draft Regional CAV Principles

The deployment, use, or operation of Connected and Automated Vehicles in the National Capital Region should...

12. interoperate safely with non-automated vehicles, vehicles with differing levels of automation, and all other transportation system users.

Notes:

- Scenarios for deployment vary, but some anticipate mixes of automated vehicles (automated at differing levels of capability and human driver involvement) and non-automated vehicles
- Choices of how CAVs are operated should be responsible, recognizing the limits of what vehicles' automation systems are capable of



Draft Regional CAV Principles

The deployment, use, or operation of Connected and Automated Vehicles in the National Capital Region should...

13. be accompanied by addressal of legal liability issues relating to crashes, failures, and safety, including ensuring that CAVs at varying levels of capability are operated within those vehicles' technological capabilities and limitations.

Notes:

- Though legal liability is a state/national issue, this will still be critical for our region
- This will be an evolving issue as technologies advance and market forces come into play



Draft Regional CAV Principles

The deployment, use, or operation of Connected and Automated Vehicles in the National Capital Region should...

14. bolster effectiveness of emergency and incident response, systems management by traffic operations centers, and information sharing among agencies and the public.

Notes:

- CAV data could help transportation operations and emergency/incident response
- Risk of new operations uncertainties
- Risks regarding CAV behavior in unusual, unexpected, or incident situations (e.g. temporary lane closures, direction from traffic control officers)



Draft Regional CAV Principles

The deployment, use, or operation of Connected and Automated Vehicles in the National Capital Region should...

15. bolster interjurisdictional coordination and technical interoperability among TPB member agencies, in conjunction with relevant national efforts and standards.

Notes:

- Regionally collaborate on infrastructure and operations considering CAVs



Draft Regional CAV Principles

The deployment, use, or operation of Connected and Automated Vehicles in the National Capital Region should...

16. provide public revenues that are no less than the costs they impose on infrastructure, transportation systems management, and communities.

Notes:

- Opportunities include potential willingness to invest in infrastructure improvements to realize CAV benefits
- Risks include new infrastructure demands/costs outstripping ability to serve those demands
- CAV deployment must be done in ways to generate sufficient revenue to cover both infrastructure and equity impacts costs



Draft Regional CAV Principles

The deployment, use, or operation of Connected and Automated Vehicles in the National Capital Region should...

17. make data freely available to TPB member agencies to enhance planning, operations, and emergency preparedness and response.

Notes:

- CAVs may provide new/more data for transportation operations, but transportation operations centers will need investments to take full advantage



Draft Regional CAV Principles

The deployment, use, or operation of Connected and Automated Vehicles in the National Capital Region should...

18.be accompanied by robust efforts by TPB and member agencies to keep abreast of evolving technology to enhance support of TPB's goals.

Notes:

- CAV deployment will continue to evolve, staffs must keep up on the latest information
- Will remain an important emerging consideration for regional travel forecasting

