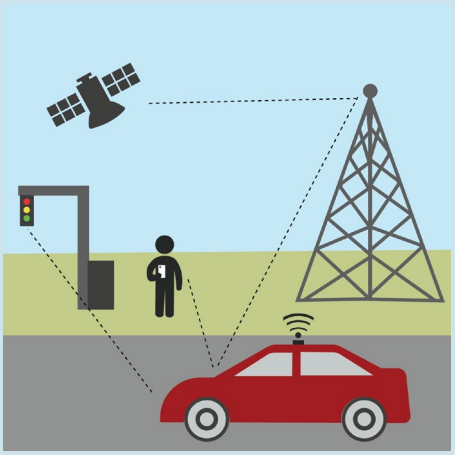
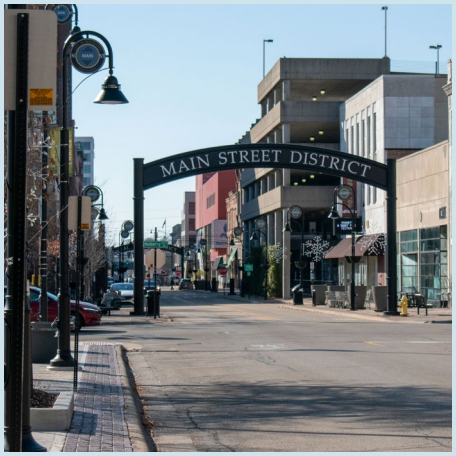
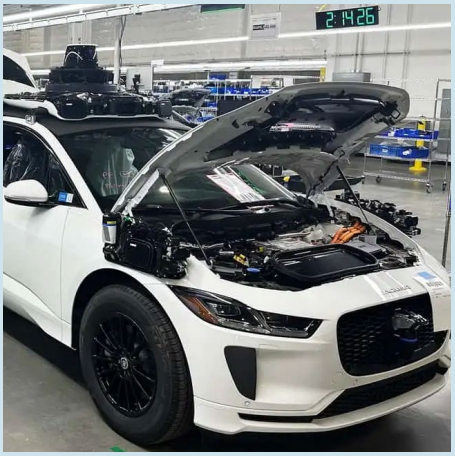











Connected and Autonomous Vehicle Plan

Part 1: Connected and Autonomous Vehicle Guidance

Final Report | 10.30.2026

Connected and Autonomous Vehicle Plan

Part 1: Connected and Autonomous Vehicle Guidance

Final Report | 10.30.2026

This document has been prepared by Region 1 Planning Council in collaboration with its member agencies, partnership organizations, and local stakeholders.

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The contents, views, policies, and conclusions expressed in this report are not necessarily those of the above agencies.

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Chapter 1: Introduction

Executive Summary

The purpose of the Connected and Autonomous Vehicle (CAV) Plan is to prepare the Rockford Region for the potential widespread adoption of advanced self-driving technology for road-using vehicles. The development of CAV technologies has the potential to deliver many benefits in terms of improving the safety and efficiency of the transportation system; however, it may also require new and upgraded infrastructure in order to fully realize these positive outcomes. In addition, it is necessary to prepare for CAVs in a manner that recognizes the uncertainty around the pace and extent of CAV rollout and the need to preserve capacity for legacy vehicles. The intended audience for the CAV Plan is the public, transportation professionals, automobile and technology companies, and local politicians and decision-makers within the Rockford Region.

Potential Benefits of CAVs

Safety: CAVs have the ability to prevent or reduce the number of crashes by taking preemptive actions to entirely avoid a crash or reduces its severity.

Mobility: CAVs allow drivers to make real-time decisions to cut travel time delays caused by congestion, improve travel time reliability, and increase the opportunity for multimodal connections. They would also enable operators to manage network performance in order to increase efficiency for transit vehicles and freight.

Environment: Technologies for CAVs can generate travel data in order to inform and support environmental targets aimed at reductions in fuel consumption and emissions. Additionally, improved CAV technology can help avoid unnecessary braking, idling, and stops, all of which affect fuel efficiency.

Plan Structure

The CAV Plan will comprise of two parts: Part 1. Connected and Autonomous Vehicle Guidance and Part 2. Connected and Autonomous Vehicle Readiness Assessment. This document is Part 1 of the Plan, and the preparation of Part 2 will commence immediately following the adoption of Part 1. While published as two separate documents, both parts are designed to constitute a single CAV Plan for the Rockford Region.

Phase 0. Project Scoping (2025)

In this phase, the project's goals, objectives, and timeline were defined. This phase took place prior to project kick-off on January 1, 2026.

Phase 1. Connected and Autonomous Vehicle Guidance (2026)

Part 1. Connected and Autonomous Vehicle Guidance involves data collection and analysis—specifically, research into current and predicted state of CAV technology; an analysis of existing federal, state, and local CAV policy, law, and guidelines, as well as planning efforts elsewhere in the country; and an overview of the existing conditions of the Rockford Region's roadways. Part 1 of the Plan is intended to raise awareness about CAVs, provide a broad strategy framework for CAV planning in the Rockford MPA, and set the foundations for future planning efforts, including Part 2 of the CAV Plan.

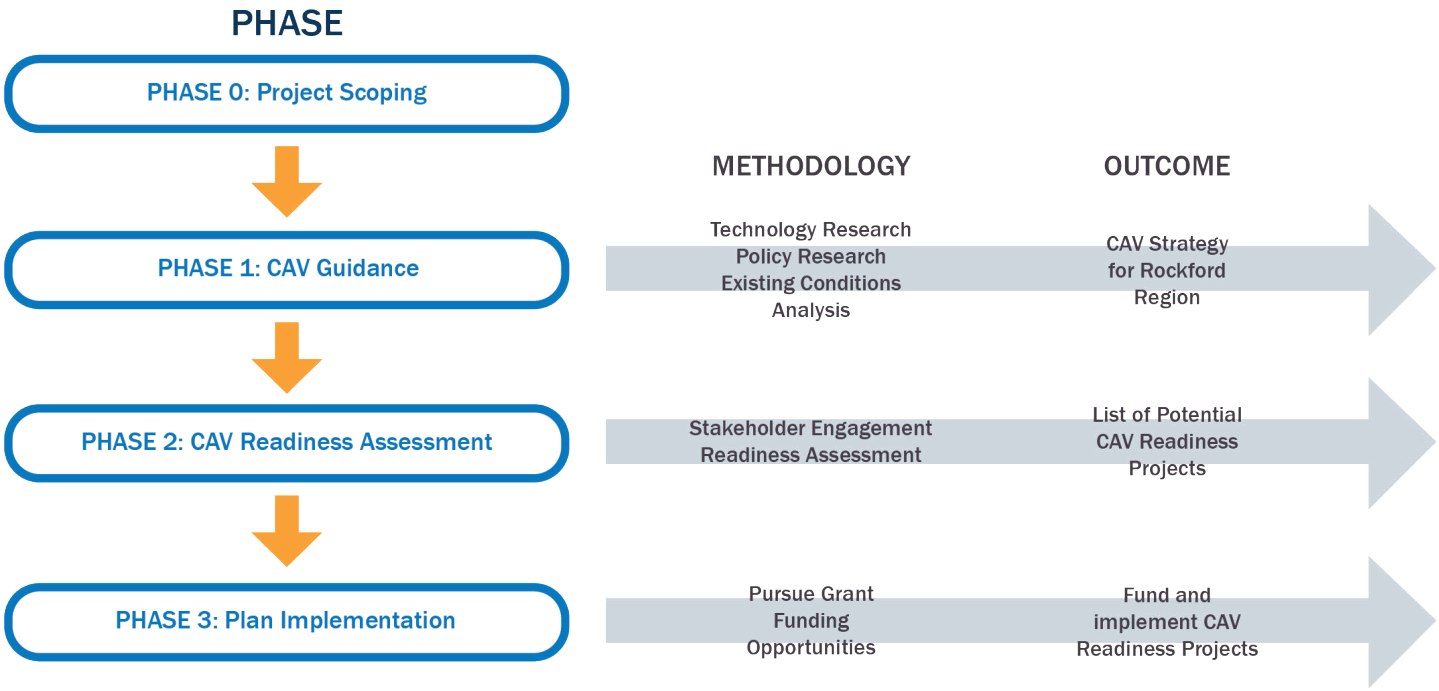
Phase 2. Connected and Autonomous Vehicle Readiness Assessment (2027)

Part 2. Connected and Autonomous Vehicle Readiness Assessment, will have two components. The first is stakeholder and community engagement with transportation professionals and the public, and the second is an analysis of the major roadways in the region using a scoring system to assess how ready they are for widespread CAV use. Part 2 of the CAV Plan is intended to provide recommendations for transportation projects which would be easy to implement, cost effective, and impactful in order to prepare the region to accommodate wider CAV usage, as well as to present options for grant funding opportunities for CAV projects.

Phase 3. Plan Implementation (2027+)

While the CAV Plan is due to officially conclude on December 31, 2027, with the adoption of Part 2, implementation will be an ongoing effort starting from the publication of Part 1 and moving through the five-year plan period and beyond. Phase 3 will involve the implementation of the strategies outlined in Chapter 6 of Part 1 via the Action Plan included in Appendix B, as well as the pursuit of grant funding opportunities—in particular the Advanced Transportation Technologies and Innovation (ATTAIN) program funding—for the potential CAV readiness projects identified in Part 2 of the CAV Plan. Phase 3 will also involve monitoring the state of CAV technology and ensuring that the CAV Plan is amended or updated periodically in order to reflect pace of the development of the technology as well as the uptake among the general public and businesses.

Figure 1-1: CAV Plan Development Process



Definitions & Terminology

Connected and autonomous vehicles (CAVs) are an emerging technology, and therefore the terminology used can be complicated and confusing for those not familiar with the industry.[i] As the name implies, connected and autonomous vehicles are vehicles which utilize two separate and distinct technologies. While the two technologies are not necessarily co-dependent—for example, an autonomous vehicle does not necessarily need to also be a connected vehicle—it is typical for modern vehicles to use both technologies to varying degrees. Therefore the terminology "CAV" has been adopted to refer to all modern vehicles which utilize some form of self-driving technologies.

Connected Vehicles

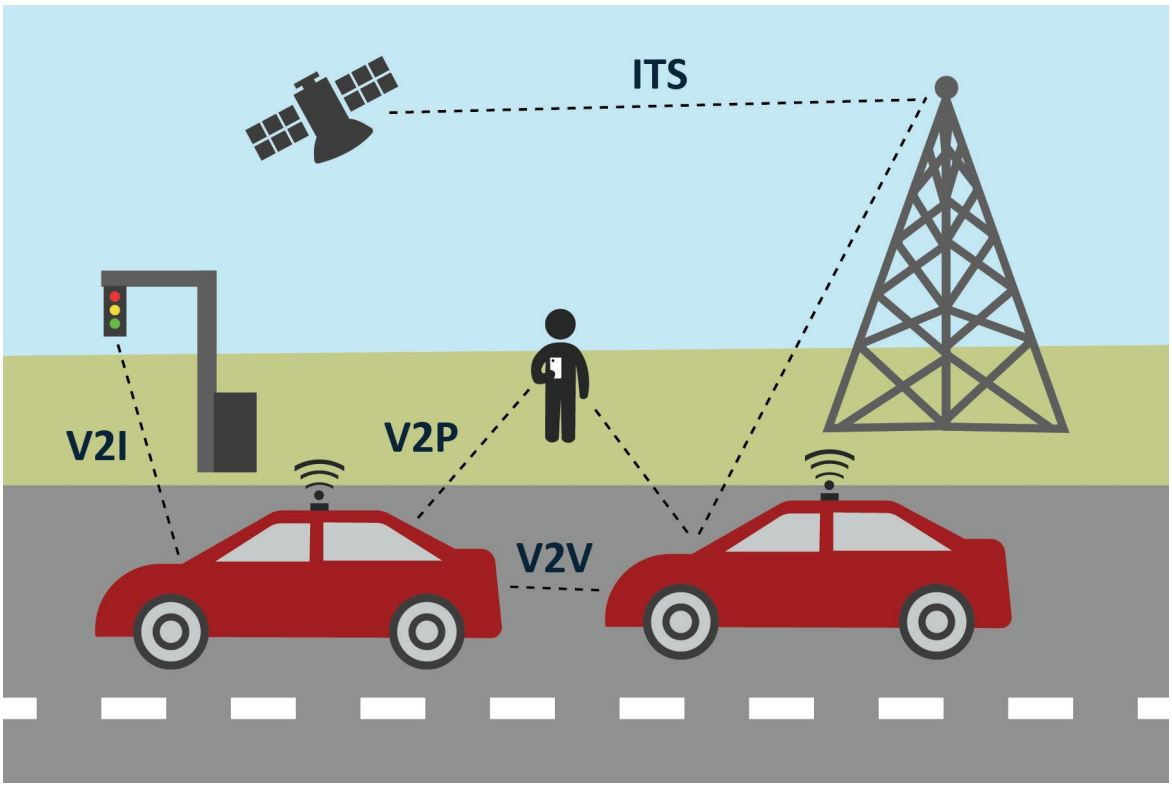
Connected vehicles (CVs) are vehicles which utilize wireless technologies to communicate with other vehicles, with infrastructure, and with mobile devices.[ii] There are many technologies which can be used to facilitate this connectivity, including cellular broadband network, Wi-Fi, satellite communications, Bluetooth, and dedicated short-range communications (DSRC), some of which are already utilized in vehicles. The devices used to enable communication are known as on-board units (OBUs). Presently, these technologies are primarily used for functions within the vehicle, such as navigation and media, but it is expected that in the future, with more reliable connections and wider adoption, such wireless connectivity could be used to assist in self-driving and traffic management. This concept of interoperability between vehicles, traffic infrastructure, and mobile devices is expected to enhance road safety and achieve the Vision Zero target promoted by the U.S. Department of Transportation (USDOT).[iii]

A suite of terminology has been developed to refer to the various possible connections that vehicles can make.

Table 1-1: Vehicle Connectivity Terminology

Term	Definition
V2V: Vehicle to Vehicle	V2V technology allows vehicles to communicate with other vehicles. Such connected vehicles can share real-time information such as position on the roadway, speed, and braking status in order to improve the flow and traffic and reduce the risk of collision.
V2I: Vehicle to Infrastructure	V2I technology allows vehicles to communicate with traffic infrastructure such as traffic signals, cameras, road signage, and parking meters. V2I technology will require legacy infrastructure to be upgraded to intelligent transportation systems (ITS) through the use of roadside units (RSUs). The benefits of V2I will be in traffic management and safety; for example, traffic signals could have their cycles altered in order to respond to traffic conditions.
V2P: Vehicle to Pedestrian	V2P technology makes connected vehicles aware of pedestrians and cyclists by connecting with their mobile device. V2P is dependent on pedestrians carrying a mobile device and therefore cannot entirely be relied on for safety purposes. However, it can be a useful tool when combined with other technologies.
V2X: Vehicle to Everything	V2X is the gold standard of CV technology and combines all of the previous connections described. V2X is ambitious but will likely be required in order to achieve the more advanced stages of self-driving which the automobile industry is striving towards. Figure 1-2 displays how the various communications in V2X would operate.

Figure 1-2: V2X Communication



Source: Region 1 Planning Council

Autonomous Vehicles

An autonomous vehicle (AV) refers to a vehicle where some functions are undertaken without direct input from the driver.[iv] Autonomous vehicle functions are controlled via the vehicle's on-board computer, utilizing various instruments and sensors which allow the vehicle to operate independently (i.e., without connectivity to other vehicles or devices). Numerous technologies can be deployed to allow the vehicle to sense the physical environment, such as cameras, radar, LiDAR, and ultrasonic wave emitters. Generally, some combination of these methods is required in order to form a reliable and accurate picture. The terms "autonomous vehicle" and "automated vehicle" are generally used interchangeably to refer to the same thing, and the industry has not yet adopted a standardized terminology. As with connectivity, a degree of automation is already in use in vehicles currently produced today; however, as will be described in forthcoming chapters, it is expected that vehicles will become increasingly autonomous, with more and more functions able to operate without driver intervention.

Image 1-1: Waymo Autonomous Vehicle



Image Source: Axios

Intelligent Transportation Systems

Intelligent transportation systems (ITS) is a framework which utilizes a suite of technologies to help to manage the transportation network.[v] The concept is not new and does not necessarily entail cutting-edge technology; ITS applications are already widely used for highway automation such as active traffic management, traffic signals synchronization, and satellite navigation.[vi] However, advances in wireless technologies promise to significantly enhance the capabilities of ITS in terms of improving road safety and reducing traffic congestion. Roadside units (RSUs) are wireless devices which are installed on physical traffic infrastructure to allow for real-time monitoring, traffic management, and enforcement; when combined with vehicle-to-infrastructure (V2I)–enabled CAVs, they have the potential to provide transportation authorities with unprecedented data on how vehicles are using the road network. In addition, it is expected that further advances in artificial intelligence (AI) will allow for the rapid processing of this data to devise strategies to improve the safety and capacity of the system. Essentially, ITS can be considered as the sister technology to CAVs which will help to realize their full potential on the network scale.

Image 1-2: Roadside Unit



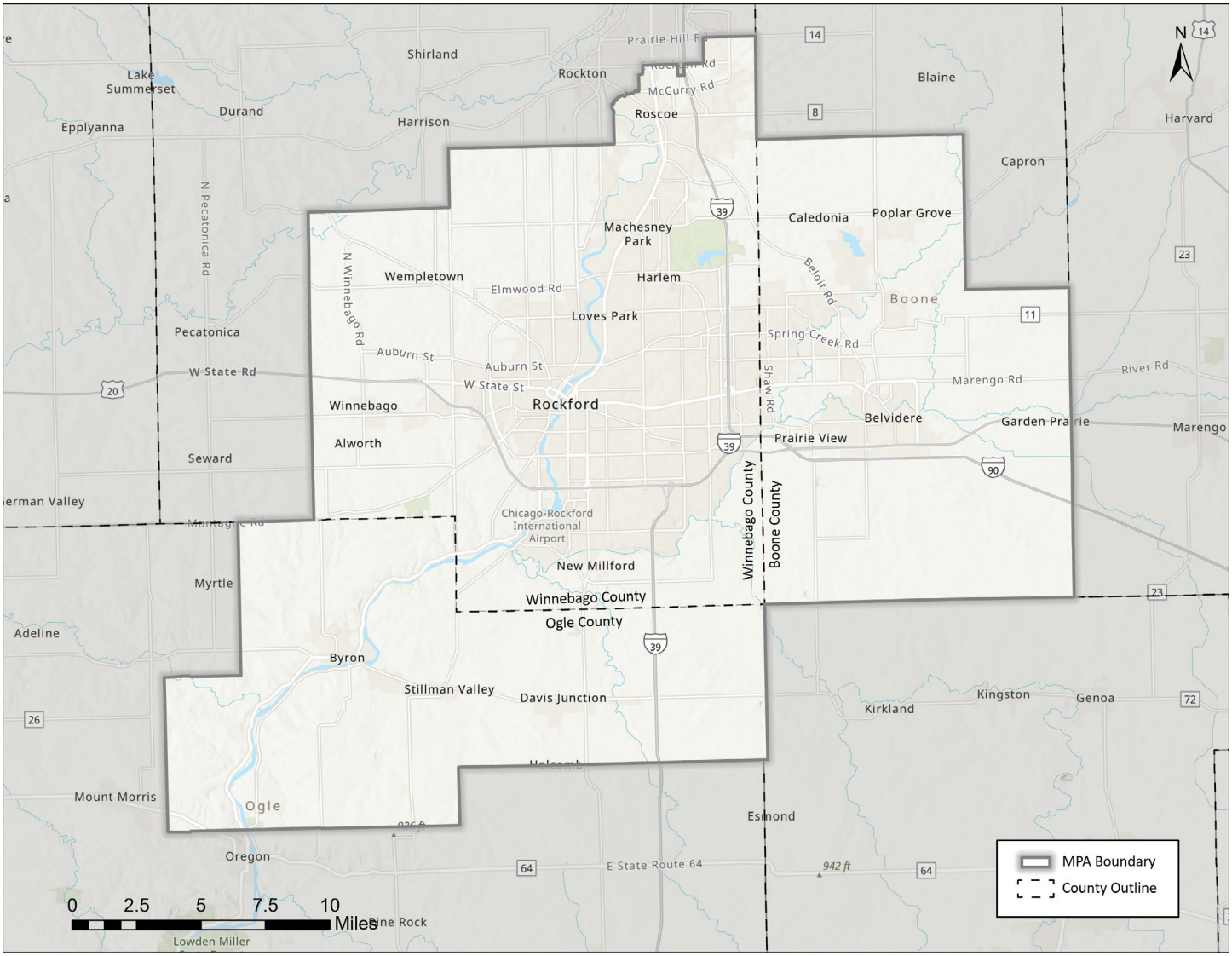
Image Source: Siemens

Study Area

The CAV Plan geographically encompasses the Rockford Metropolitan Planning Area (MPA), which is the planning jurisdiction of the Rockford Metropolitan Planning Organization (MPO), Region 1 Planning Council (R1). The MPA boundary is developed by R1 in partnership with local jurisdictions, local stakeholders, the State, and the MPO Policy Committee. The MPO helps coordinate transportation planning and improvement activities throughout the MPA. This is accomplished through communication and cooperation of Winnebago, Boone, and Ogle County officials serving on the MPO Policy Committee, MPO Technical Committee, and Alternative Transportation Selection Committee.

The MPA boundary covers portions of Winnebago, Boone, and Ogle counties. In total, the MPA boundary is approximately 682.32 square miles, and serves 323,738 people per the U.S. Census American Community Survey (ACS) 2023 5-year estimate. Figure 1-3 depicts the current MPA boundary.

Figure 1-3: Rockford MPA



Source: Region 1 Planning Council

Chapter 2: Technology Overview

The rapid introduction of connected and autonomous vehicle (CAV) technology indicates a major shift in how vehicles and transportation infrastructure elements interact, operate, and are managed. In order for the Rockford Region to identify opportunities to adapt its infrastructure alongside the emergence of this technology, it is important to first understand what CAV technology is and where it is heading. This chapter discusses key CAV concepts, current capabilities and deployment, and expert projections and public perception.

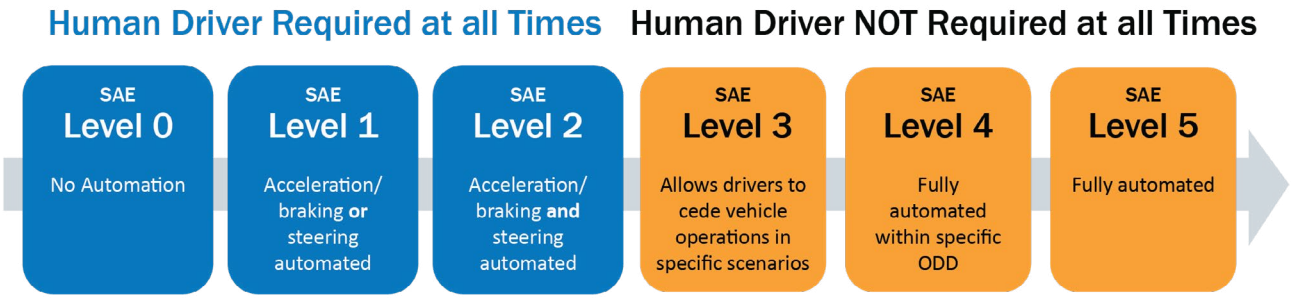
Levels of Vehicle Automation

The term "CAV technology" can encompass a wide range of vehicular technologies, from standard cruise control features to full self-driving modes. The automotive industry identifies certain benchmarks that separate these technologies into six distinct levels of automation.

SAE's Six Levels of Automation

The Society of Automotive Engineers (SAE) International is an aerospace and engineering organization that, in tandem with the International Organization for Standardization (ISO), develops the industry-accepted taxonomy for the various stages of vehicular automation.[i] SAE defines six levels of automation, with Level 0 (no driving automation) the lowest and Level 5 (full driving automation) the highest.

Figure 2-1: SAE Level Chart



Level 0

The lowest level of automation is no automation. At Level 0, drivers are fully responsible for all driving tasks, even if assisted by safety systems such as blind-spot warnings, parking sensors, or lane departure warnings.

Level 1

Vehicular automation technology emerges at this level. Drivers are fully responsible for operating the vehicle, while systems such as lane centering or adaptive cruise control provide assistance with acceleration/braking or steering.

Level 2

Level 2 systems, such as advanced driver assistance systems (ADAS), can provide assistance with acceleration/braking and steering at the same time. However, drivers are still responsible for all vehicle operations.

Level 0 vs Level 1:

Level 0 vehicles contain no automation technology, providing only momentary assistance. Level 1 vehicles have some automation technology that provides basic, continuous support.

Level 1 vs Level 2:

Level 2 systems can control steering and acceleration/ braking simultaneously, while Level 1 systems can only control one or the other at a given moment.

Level 3

Automated driving systems (ADS), which allow the driver to cede vehicle operation in specific scenarios, begin to emerge at this level. At Level 3, ADS handles all driving responsibilities, but only within limited operational design domains (ODDs). The driver must be prepared to take over when prompted.

Level 2 vs Level 3:

At Level 2, drivers must remain engaged at all times (eyes on the road, hands on the steering wheel, etc.). At Level 3, drivers can divert their attention while automation systems control the vehicle.

Operational Design Domain (ODD):

An ODD defines the specific conditions in which an autonomous vehicle system can safely operate.[ii] These conditions can include weather, specific vehicle maneuvers, traffic conditions, or other scenarios that require complex decision-making.

Level 4

Vehicles classified at SAE Level 4 are fully autonomous and require zero human input, but can only operate within a specified geographic area or under certain conditions. Level 4 systems have the ability to maneuver a vehicle to safety in cases of a systems failure or when encountering conditions outside of their ODD.

Level 3 vs Level 4:

Level 3 – Human override is required. Level 4 – Human override is not required.

Level 5

Level 5 is considered to be the highest level of autonomy. Vehicles under this classification are fully autonomous and require zero human input, can operate in all conditions, and are not beholden to a specified geographic area.

Level 4 vs Level 5:

Level 4 systems are limited to an ODD, whereas Level 5 systems are not.

Current State of CAV Deployment

Although CAV technologies have advanced significantly, real-world deployment remains uneven between automation levels and can be highly localized. Nearly all vehicles incorporating this technology that are available to consumers operate at lower automation levels, with the deployment of higher-level systems limited to select cities and specific use cases such as robotaxi services, pilot programs, and testing corridors. This section summarizes the scale at which CAVs are currently available across sectors.

Personal-Use Vehicles

Perhaps the most obvious application of CAV technology is its integration into personal-use vehicles available for consumer purchase. The features introduced by CAV technologies have rapidly become standard in most new vehicles on the market, particularly in the case of Level 1 and 2 technology. A breakdown of how the vehicle market has been impacted by CAVs is given below.

Level 0

Nearly all vehicles manufactured prior to 2012 are classified as Level 0 autonomous vehicles (AVs).[iii] As previously described, drivers of these vehicles are fully responsible for the vehicle's operation, even if momentary assistance is provided by technology. Some examples of technologies that can be present in a Level 0 car are given below:

- Cruise control
- Traction control
- Lane departure warnings
- Forward collision warnings[iv]

Level 1

The uptake of CAV technology has been rapid in recent years, particularly for Level 1 technology. In 2023, it was estimated that 63.6 percent of all cars sold globally in 2025 will have been classified as Level 1 AVs.[v] These technologies, such as lane centering assistance and adaptive cruise control systems, are now becoming standard features offered in newer vehicles.

Level 2

It is currently estimated that Level 2 driving systems account for 28.1 percent of cars sold globally and are projected to account for 51.2 percent in 2030.[vi] However, discerning between Level 1 and Level 2 vehicles can often be difficult,

as they include many of the same features, like adaptive cruise control and lane centering assistance, and are only differentiated by whether the system can provide both braking and steering simultaneously. Level 2+ has the same core capabilities as Level 2 but utilizes more modern and advanced technology and is considered to be a stepping stone in the wide technology gap between Levels 2 and 3. Examples of Level 2+ features are listed below:

- Lane change assist
- Highway merging
- Traffic jam support
- Parking assist
- Driver monitoring capabilities[vii]

Level 3

Level 3 vehicles are rare, estimated to account for only 0.7 percent of newly registered cars in 2025.[viii] There are currently only three automotive manufacturers that offer Level 3 vehicles available for consumers in select geographic areas:

- Mercedes-Benz Drive Pilot is available to California and Nevada residents.
- BMW Personal Pilot L3 is available in Germany.
- Honda Sensing Elite has been available to Japanese consumers since 2021.[ix]

Image 2-1: Mercedes Benz Drive Pilot



Image Source: Mercedes Benz Group

Level 4 & Level 5

There are currently no Level 4 or 5 AVs available as personal-use vehicles. As detailed in the forthcoming Looking Forward section of this chapter, it seems unlikely technologies at these levels will become widely available to consumers soon unless substantial breakthroughs occur.

Commercial Services

CAV technology has also found its way into the commercial sector. The most popular examples can be seen in rideshare services, like robotaxis and public transit, but also in freight and delivery services.

Robotaxis

Robotaxis are AVs that function as ride-hailing services without human drivers,[x] representing one of the most visible and advanced current applications of CAV technology. These services are primarily being deployed at Level 4 automation within geofenced urban environments, where vehicles can operate without a human driver in specified geographical boundaries. Thus far, deployment has been limited to select metropolitan areas and is often supported by extensive mapping, monitoring, and remote oversight.[xi]

Image 2-2: Robotaxi



Image Source: SilicanAngle

Public Transit

One notable recent development in CAV technology stems from the realm of public transit, where transit agencies have begun fitting their fleet vehicles, such as buses and vans, with CAV technology. Some agencies are beginning to roll out Level 4 AVs in controlled environments, such as campuses or dedicated lanes, as can be seen with Michigan State University's SpartanXpress and Jacksonville Transportation Authority's (JTA) Neighborhood Autonomous Vehicle Innovation (NAVI). Many other transit services are also incorporating Level 2 driver assistance features in their vehicles to enhance safety and operational efficiency.[xii]

Image 2-3: SpartanXpress



Image Source: Impact89FM

Freight & Delivery

Freight and delivery services are a major area of both present and future CAV development. Current deployments in the world of freight largely consist of Level 2 systems that support truck drivers through features such as adaptive cruise control, lane centering, and platooning.

Image 2-4: Truck Platooning



Image Source: BigWheels.my

> ***Platooning:***
> **Truck platooning is when two or more trucks align speed, acceleration and braking using CAV technology while drivers steer and intervene when needed.[xiii]**

Additionally, food delivery robots and parcel delivery vans have begun to emerge alongside robotaxi services as the sole Level 4 vehicles operating on a large scale. Similarly to robotaxis, these vehicles are typically only found in geofenced urban environments, but have seen success in carrying out operations that human drivers have been traditionally required for.[xiv]

Image 2-5: Delivery Robot



Image Source: Chicago Sun Times

Industry Landscape

The CAV industry is best understood as an interconnected ecosystem rather than a single linear supply chain. Different actors play distinct but overlapping roles in bringing automation technologies from development to real-world deployment. Companies within the CAV industry can be organized into three primary categories: vehicle manufacturers, who produce the physical vehicles in which CAV systems are deployed; mobility and freight operators, who deploy automated systems in live service environments; and technology companies, whose products enable sensing, decision-making, and connectivity.

Vehicle Manufacturers

Vehicle manufacturers play a foundational role in the CAV ecosystem by designing, producing, and selling the vehicles that ultimately incorporate autonomous technology. Manufacturers are mainly involved in the integration of ADAS and Level 2+ technologies into personal-use vehicles, either as independent developers of their own systems or as integrators of systems developed by external partners. Tesla and Lucid Motors illustrate these different approaches, with Tesla developing their Full Self-Driving (FSD) fully in-house,[xv] while Lucid's DreamDrive Pro system is being developed in tandem with NVIDIA.[xvi] Some manufacturers form partnerships with commercial service providers to supply cars built for service applications. This can be seen through Jaguar Land Rover partnering with Waymo to design and engineer the Jaguar I-Pace built for Waymo's rideshare service.[xvii]

Image 2-6: Waymo Jaguar Assembly



Image Source: Karmactive

Mobility & Freight Operators

Mobility and freight operators deploy CAV technologies in various service environments, including passenger transportation and delivery. Companies under this umbrella typically develop their own autonomous technologies and artificial intelligence (AI) systems, forming partnerships with vehicle manufacturers to incorporate their technology. This is demonstrated by robotaxi services operated by companies like Waymo, as well as autonomous freight pilots led by companies such as Aurora Innovation, which partners with Volvo to manufacture trucks.[xviii] Service-oriented CAV deployments are typically constrained to specific routes or geographic areas where operating conditions can be more effectively managed.

Image 2-7: Autonomous Volvo Truck



Image Source: Volvo Autonomous Solutions

Technology Companies

Technology companies are at the center of the CAV industry, developing the software systems and digital infrastructure that enable autonomous and semi-autonomous driving capabilities. These systems process data from vehicle sensors, interpret real-time road conditions, and support decision-making functions such as perception, planning, and control.[xix]

In many cases, technology companies exist as distinct entities that work closely with vehicle manufacturers to integrate their systems into production vehicles, as well as with mobility and freight operators by providing the hardware that enables AI processing. There are, however, as previously mentioned, some vehicle manufacturers that can also act as technology companies by developing their own proprietary systems in-house.

Capabilities & Limitations

CAV systems offer a range of capabilities including sensor-based perception, automated control, and real-time data processing to support driving functions. However, these systems still face limitations in complex environments, adverse weather, and unpredictable human behavior.[xx] Performance can also vary significantly depending on infrastructure quality and connectivity. This section examines what CAV technology can reliably do today and the key constraints that remain.

Strengths

CAV technologies demonstrate strong performance in controlled and well-defined operating environments, particularly where roadway conditions, traffic patterns, and infrastructure are consistent.[xxi] ADAS and higher-level automation can improve safety by reducing human error through features such as collision avoidance, lane keeping, and adaptive cruise control. Additionally, CAV systems are capable of continuously monitoring their surroundings using multiple sensors, allowing for a level of situational awareness that can exceed that of human drivers.

CAV technologies also offer potential operational and system-level benefits, particularly in commercial and fleet applications. These include improved traffic efficiency, optimized routing, and reduced fuel consumption through smoother driving patterns and coordinated vehicle movement.[xxii]

Constraints

Despite these strengths, technical and operational limitations restrict the widespread deployment of CAV technologies. System performance can degrade in adverse weather conditions where sensor reliability and perception are reduced. Image 2-8 showcases how snow can reduce visibility for CAV sensors. Additionally, CAV systems often struggle with complex and unpredictable scenarios, including irregular road layouts, unclear lane markings, and interactions with pedestrians and cyclists.[xxiii]

Image 2-8: Obstructed CAV Sensor



Image Source: Ansys

ODD constraints further limit where and how CAV systems can function effectively. As previously discussed, many higher-level autonomous systems are restricted to specific geographic areas, roadway types, and/or environmental conditions.

Gray-Area Cases

Between clearly defined strengths and limitations lie "gray-area" scenarios where CAV performance is less predictable. These include situations that rely heavily on human judgment and informal driving behaviors, such as negotiating four-way stops, interpreting hand signals, or responding to unexpected actions by other road users. Temporary conditions like construction zones, emergency response situations, and degraded weather environments can also introduce ambiguity that challenges current systems.[xxiv] These edge cases are particularly significant because they are difficult to standardize, test, and regulate, yet they occur frequently enough in real-world driving to impact system reliability and public confidence.

Looking Forward

The future of CAV technology is expected to unfold gradually, shaped by ongoing technical progress, regulation, and real-world deployment. Industry forecasts point to continued focus on lower levels of automation for personal-use vehicles, with advanced applications being integrated into service providers like robotaxis and autonomous freight over the next decade. This section examines both expert projections for CAV development and current public perceptions shaping its adoption.

Industry & Expert Projections

Industry experts broadly agree that the timeline for CAV deployment is progressing more slowly than earlier projections suggested. Current estimates point to early large-scale robotaxi rollouts around 2030, autonomous trucking viability by 2031, and Level 4 passenger vehicle pilots beginning near 2032.[xxv] In the near term, manufacturers are expected to continue focusing on refining Level 2+ driver assistance systems for personal vehicles, as consumer demand for higher levels of autonomy is lower than initially projected. This can also be attributed to liability concerns regarding the jump from Level 2, where drivers are expected to be aware at all times, to Level 3, where drivers are not expected to be aware at all times.[xxvi]

With Level 2+ technologies expected to dominate the personal vehicle market, higher levels of automation are viewed as more likely to gain traction in commercial applications. Autonomous trucking in particular is viewed by some as the most viable use, with the United States positioned to lead adoption due to its extensive freight network and minimal cross-border constraints.[xxvii]

While experts are starting to be more cautious in their advancement timelines, most note that sudden breakthroughs could spark rapid development at any time, particularly with the advancement of AI.[xxviii] Some, however, remain skeptical that Level 5 autonomy will ever be realized at scale, citing regulatory, liability, and demand-related concerns.[xxix]

Public Perception

Public sentiment toward CAVs remains generally cautious, particularly at higher levels of automation. Most individuals appear to be comfortable with lower-level systems that provide assistance and allow the driver to retain control, but trust declines significantly as human input is reduced or removed.[xxx] However, many indicate that they would support the use of CAVs to improve mobility for underserved populations, including elderly adults and individuals with disabilities.[xxxi] Some of the most commonly identified public concerns include legal liability for drivers, safety consequences, equipment failure, and interactions between CAVs and pedestrians and bicyclists.[xxxii]

On a large scale, public trust in CAVs has not improved with increased exposure and, in some cases, has declined in recent years.[xxxiii] However, individuals with direct exposure to higher-level CAV technologies often report higher levels of trust, particularly among those who have experienced riding in autonomous vehicles firsthand.[xxxiv] This could suggest that firsthand experience may improve perception, while broader skepticism may stem from limited exposure to or understanding of the technology.

Chapter 3: Infrastructural Requirements

Connected and autonomous vehicles (CAVs) rely on a combination of onboard sensing, data processing, and communication technologies to operate safely within the roadway environment. These systems allow vehicles to detect surrounding conditions, interpret potential hazards, and make driving decisions with limited or no human input. Understanding the capabilities and limitations of core vehicle technologies is important when evaluating how transportation networks can support reliable CAV operations. This chapter will explain how CAVs operate and examine how this affects the infrastructural requirements for CAV deployment.

Sensor Systems

CAVs rely on integrated sensor systems to perceive, interpret, and respond to their roadway environment (see Table 3-1). These systems form the foundation of automated driving and directly influence safety, reliability, and operational performance. For Metropolitan Planning Organizations (MPOs) and local highway authorities, understanding sensor capabilities and limitations is essential for developing infrastructure that supports consistent and predictable CAV behavior. Each sensor contributes unique data, and no individual sensor is sufficient under all operating conditions.

To address these limitations, CAV systems use sensor fusion to integrate data from multiple sources. This approach improves detection accuracy, reduces uncertainty, and enables redundancy.[i] CAVs detect and respond to unexpected road or user hazards by noticing a change in data over a period of driving time.[ii] If one sensor degrades or fails, others can compensate to maintain operational performance. Sensors are monitored and scanned for other issues by a denoising shrinkage autoencoder (DSAE).[iii] In addition, critical vehicle functions such as braking, steering, and power systems are duplicated to ensure continued operation under fault conditions.[iv]

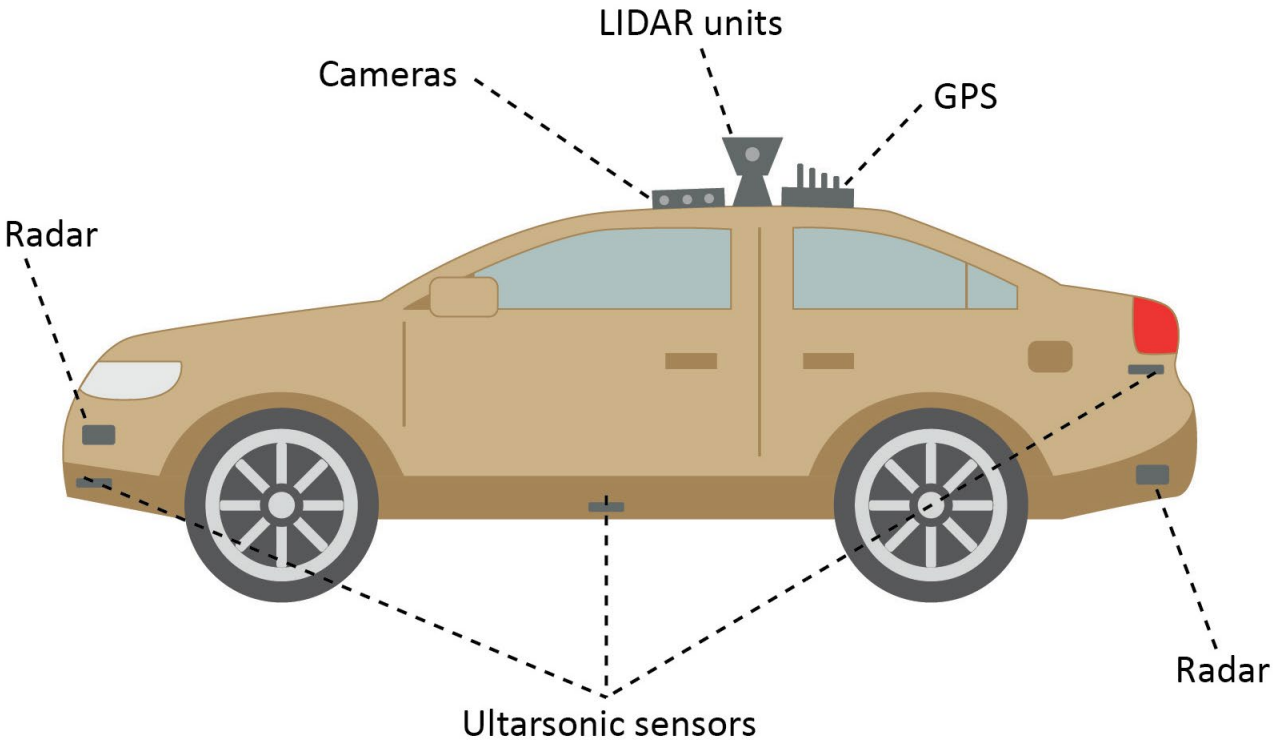
Vehicle-to-infrastructure (V2I) communication extends CAV awareness beyond the limits of onboard sensors. Through wireless communication systems, vehicles receive real-time information from roadway infrastructure, improving situational awareness and supporting proactive decision-making. V2I systems operate through roadside units (RSUs) and on-board units (OBUs). RSUs are deployed along corridors and at intersections to transmit data such as signal timing, roadway conditions, and traffic flow. OBUs within vehicles receive and process this information.

Table 3-1: CAV Sensor Systems

CAV Sensors	Range	Feature	Limitations	Cost
Radar	Short, medium, and long	Object detection distance measuring	Performs in adverse weather but lacks resolution	Medium
LiDAR	Long	High resolution 3D mapping	Sensitive to rain, fog, and low light	High
Cameras	Medium and long	Visual recognition	Sensitive to rain, fog, and low light	Low
GPS	Short, medium, and long	Positioning data	Obstructions may affect accuracy	Medium
Ultrasonic	Short	Short-distance detection	Limited Range	Low

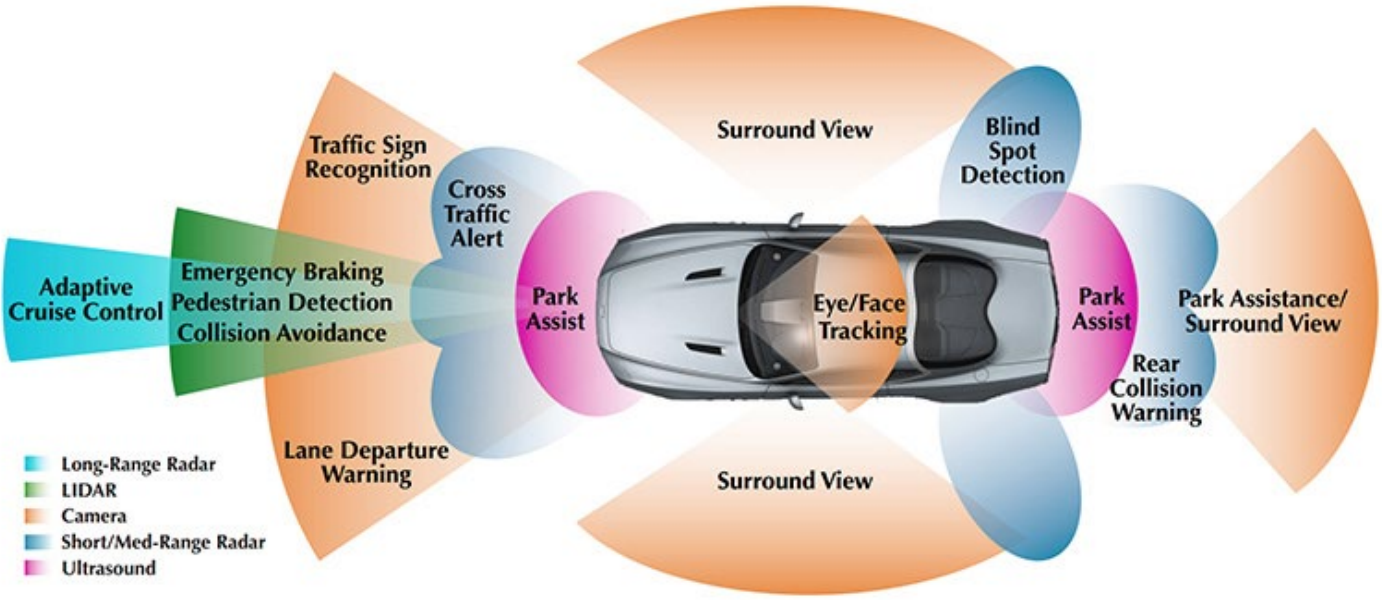
This communication enables vehicles to detect conditions that are not visible through sensors alone. For example, a vehicle can receive notice of signal phase changes, hazardous weather conditions, or the approach of emergency vehicles. This reduces reliance on line-of-sight detection and enhances safety in complex or constrained environments.[v]

Figure 3-1: Sensor Systems on CAV



Source: Region 1 Planning Council

Figure 3-2: CAV Sensor Awareness



Source: Ecotron

Compatible Roadway Infrastructure

While vehicle technology is central to automation, roadway infrastructure remains a critical factor in overall system performance. CAVs depend on consistent, legible, and well-maintained transportation networks to accurately perceive lane boundaries, interpret traffic control devices, and navigate complex roadway environments. Standardization of pavement markings is critical for machine readability. Variations in design, color, or placement introduce ambiguity and reduce detection reliability.[vi] Regular maintenance and the use of durable materials can mitigate potential hazards.[vii] Key considerations include pavement markings, signage, and digital communication systems.

Pavement markings are a primary input for CAV perception systems, which rely on them to identify lane boundaries, determine vehicle position, and support path planning. High-contrast, continuous, and well-maintained markings are essential for accurate detection. National standards for roadway elements help ensure these features remain consistent, visible, and detectable by automated systems.

Image 3-1: Pavement Markings

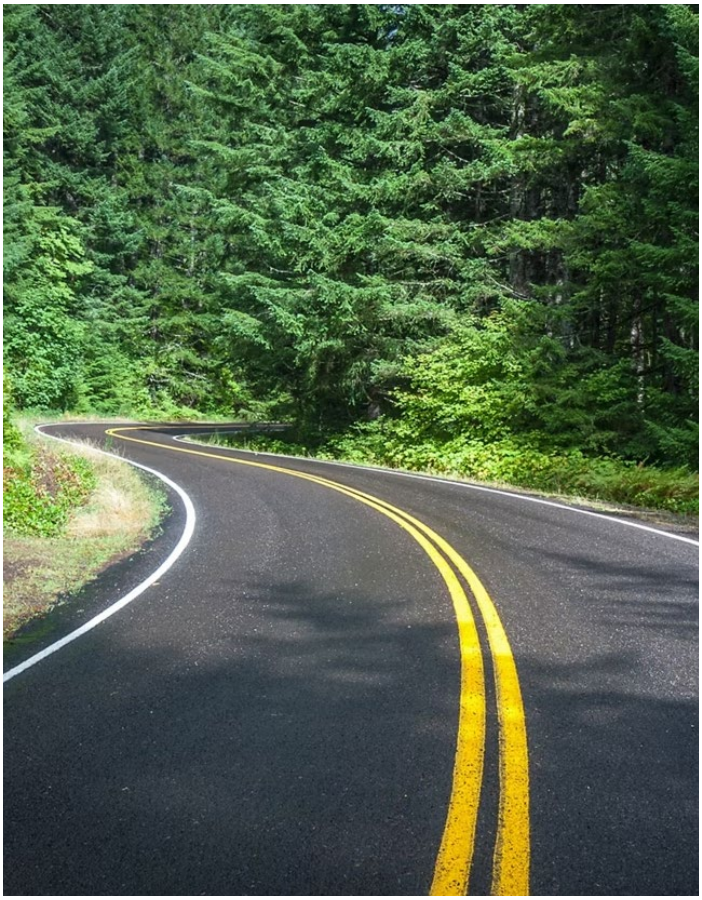


Image Source: Dow

The Federal Highway Administration's (FHWA) Maintenance Monitoring Program establishes a risk-based, performance-driven framework for maintenance oversight. It supports the identification, assessment, and prioritization of maintenance needs while ensuring compliance with Federal-aid highway requirements. Routine monitoring, including project reviews and process evaluations, verifies that infrastructure remains serviceable and performs as intended.[viii] Performance metrics are central to evaluating maintenance effectiveness. Key indicators, such as sign and pavement marking retro-reflectivity, repair response times, and completion rates of scheduled activities, enable agencies to assess program performance, identify deficiencies, and prioritize resource allocation. The National Highway Performance Program's Transportation Performance Management (TPM) framework defines condition-based thresholds for pavement performance standards.

Highway signage design follows the FHWA's Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD) standards to ensure consistent legibility and uniform communication across roadway types. Legibility is controlled through proportional spacing between letters, words, and lines, with spacing scaled relative to uppercase letter height.

Intersections present complex operating environments for CAVs due to the high density of interactions and potential conflict points. Vehicles, pedestrians, and cyclists must be detected and tracked simultaneously, requiring advanced perception and decision-making capabilities. Unpredictability is a key challenge. Human behavior, signal timing variations, and geometric complexity all contribute to uncertainty. Research indicates that intersections and roundabouts represent a significant proportion of CAV operational challenges, with 70 percent of CAV issues involving intersections and roundabouts.[ix]

Image 3-2: Intersection Interactions

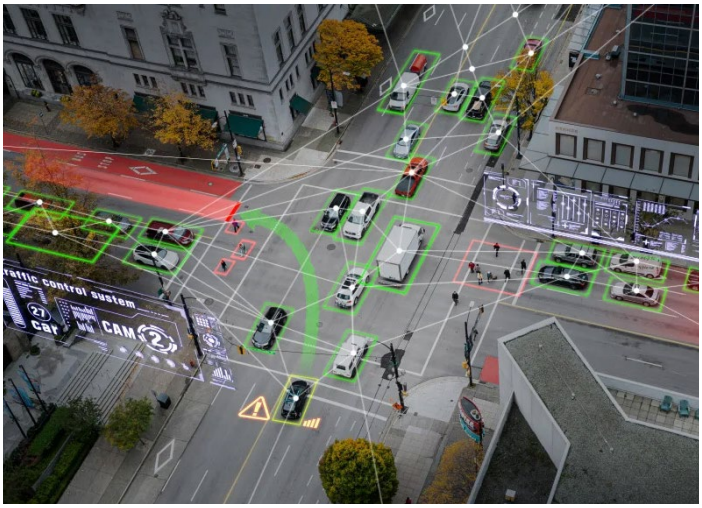
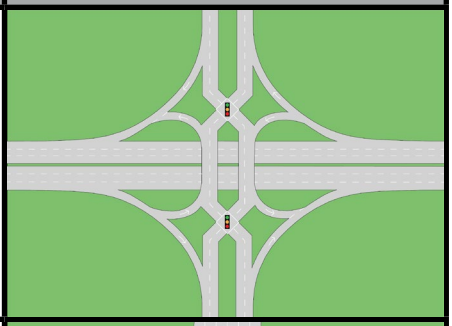
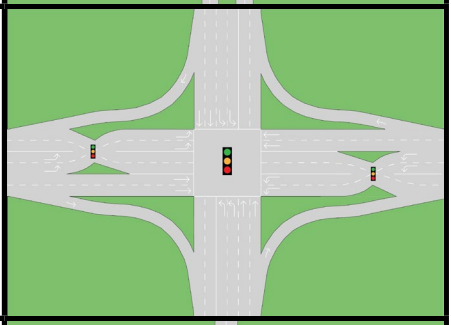
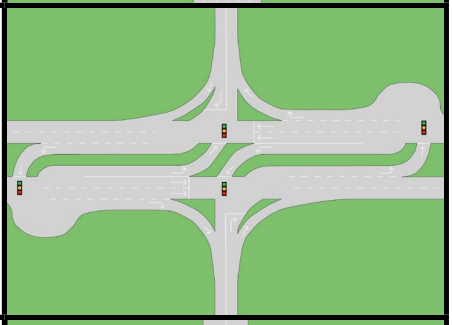
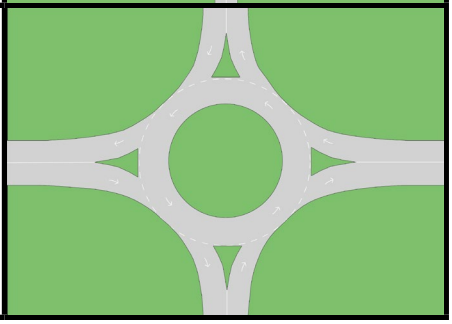


Image Source: Stokes Family Office

Infrastructure design can reduce this complexity. Clearly defined lane paths, consistent striping, and well-designed curb geometry improve predictability and support accurate sensor interpretation. Alternative intersection designs can further enhance performance by reducing conflict points and simplifying traffic movements. Examples include roundabouts, reduced conflict intersections (RCIs), and diverging diamond interchanges (DDIs). These designs create more structured environments that are easier for both human drivers and automated systems to navigate.[x] Examples of good intersection design for CAVs are displayed in Table 3-2.

Table 3-2: CAV Friendly Intersection Designs

Intersection Type	Advantage	Image
Diverging Diamond Interchange (DDI)	Shifts traffic to the left side between crossover intersections so left turns occur without crossing opposing traffic.	
Displace Left Turn (DLT)	Relocates left turn movements to upstream crossovers, allowing left turns and through traffic to move simultaneously while reducing signal phases and conflict points for more effective CAV operations.	
Reduced Conflict Intersection (RCI)	Directs crossing and left turn conflict points by rerouting movements into controlled U-turns.	
Roundabout	Provides low-speed, single-direction circulating flow with yield-controlled entry and reduced conflict points, creating highly predictable vehicle trajectories.	

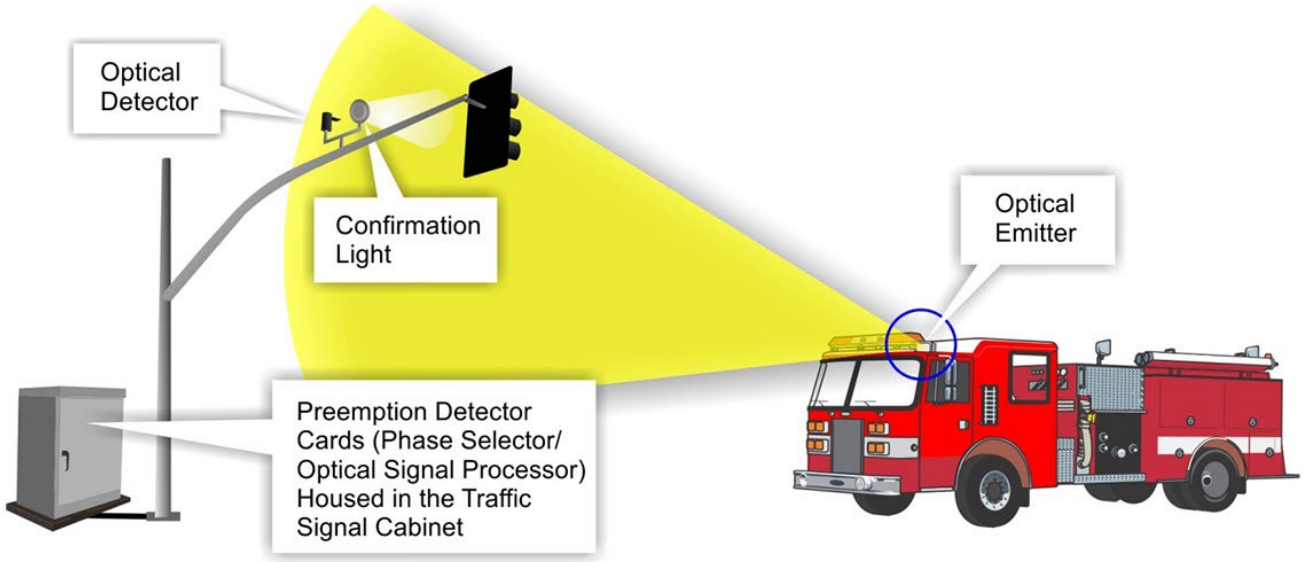
Source: Region 1 Planning Council

Digital Standards

In addition to physical roadway features, CAV operations depend on digital infrastructure capable of V2I communication, which provides real-time information on signal timing, roadway conditions, and traffic control operations. Investment in smart infrastructure including RSUs and 5G connectivity accelerates the ability of transportation networks to communicate intent, hazards, and traffic control information.[xi]

Connected infrastructure enables dynamic traffic management strategies that improve system efficiency and safety. Signal priority systems allow transportation agencies to adjust traffic signal timing in response to real-time conditions and vehicle needs. Transit signal priority (TSP) improves transit reliability by reducing delays for buses operating behind schedule. Emergency vehicle preemption (EVP) provides immediate right-of-way for emergency vehicles, reducing response times and improving safety outcomes. Figure 3-3 provides a simple illustration of how EVP systems function. Freight signal priority (FSP) supports efficient goods movement by minimizing stops for heavy vehicles.[xii] These systems rely on communication between vehicles and infrastructure to adjust signal timing dynamically. For CAVs, this creates a predictable operating environment where signal changes can be anticipated rather than reacted to. This reduces abrupt braking, improves traffic flow, and enhances overall network efficiency. Adaptive signal control systems further support these objectives by continuously optimizing signal timing based on real-time traffic conditions. When integrated with CAV technologies, these systems contribute to a more coordinated and responsive transportation network.

Figure 3-3: EVP Illustration



Source: Maricopa Association of Governments

The American Association of State Highway and Transportation Officials (AASHTO) Signal Phase and Timing (SPaT) Challenge identifies signalized intersections as an early deployment priority and encourages each U.S. state to equip at least one coordinated corridor or network of approximately 20 signalized intersections with dedicated short-range communications (DSRC) infrastructure broadcasting SPaT and MAP messages. DSRC is a low-latency wireless communication technology designed for direct vehicle and roadside data exchange. SPaT messages communicate current and upcoming traffic signal states and timing. MAP messages provide digital intersection geometry, including lane configurations and permitted movements. Together, these data improve speed control, intersection approach decisions, and route planning.[xiii]

FHWA research further supports standardized digital infrastructure through the Vehicle-to-Everything (V2X) Hub, an open-source connected vehicle software platform that enables communication among vehicles, infrastructure, pedestrians, cyclists, and emergency services. The platform uses SAE J2735, a national message standard that defines the data formats for connected vehicle communications, and National Transportation Communications for Intelligent Transportation (NTCIP) 1202 v2, a protocol that standardizes communication with traffic signal controllers. Supported applications include SPaT broadcasting, emergency vehicle preemption, pedestrian safety messaging, work zone traveler information messages, and system performance monitoring.[xiv]

Data

CAVs use data to perform several critical functions involving monitoring the vehicle's systems, navigation, and communicating with infrastructure and other vehicles. They also generate data by monitoring the conditions of the roadway using their onboard sensors. Given that CAVs both use and generate large quantities of data, consideration must be given to ensuring the storage of this data is suitable and secure, and does not infringe upon individual privacy. The current generation of

advanced CAVs operate using an operational design domain (ODD) restricted to a specific geographic area which is extensively mapped by the CAV technology provider prior to the introduction of the vehicles. In the future it is possible that this geographical data could be shared and updated using new data collected from the vehicles themselves to ensure that the CAVs can better respond to changes in the road environment such a temporary diversions or hazards. It is also expected that CAVs will be able to collect and share data regarding traffic and weather conditions to allow the navigations systems to better plan routes to ensure faster travel times and less congestion.

The management of data generated by CAVs involves both the automobile companies and public transportation agencies and will likely require these agencies to devise processes for data collection, storage, and protection. The data required for and generated by the CAVs themselves will be stored by the automobile/technology companies, and at a national and state level, it is important that robust regulations regarding how this data is stored and used are enforced. Where CAVs interact with infrastructure, data will be collected by transportation agencies themselves, and here it is vital to ensure that data regarding the travel patterns and location of individuals is not collect and stored without their consent. If storage of data is necessary and permitted, sufficient cybersecurity measures must be undertaken to ensure the data is adequately protected. It is essential that government agencies collaborate effectively to ensure a consistent approach to the management and sharing of data generated by CAVs.[xv]

Pilot Projects

Given that CAVs are an emerging transportation technology, pilot projects are vital tools, not only for manufacturers but also for transportation agencies. A pilot project helps planners to evaluate the potential of CAVs to improve road safety and reduce congestion, and also might help inform the types of policy solutions or infrastructure investments they wish to use to support CAV deployment. A pilot project generally involves designating a certain corridor or area for the use of vehicles utilizing Level 3 of automation or above, and typically the ODD of the automated vehicles will be restricted to a very limited geographical area. Pilot projects will require the involvement of a CAV manufacturer who will provide the vehicles; the State DOT, who will provide the legislation if required; and the local highway department, who will make any upgrades to the roadway or communications infrastructure. Part 2 of the CAV Plan will consider whether any pilot projects would be feasible or useful for the Rockford Region. Below are examples of the types of possible CAV pilot projects.

I-94 Connected and Automated Vehicle (CAV) Corridor Project

The Michigan Department of Transportation (MDOT), working with Cavnue, upgraded a 3-mile section of the westbound I-94 from between Ann Arbor and Detroit.[xvi] The left lane has been adapted into a segregated CAV lane used for testing during off-peak hours and RSUs have been installed on poles in the median along the length of the project area. Cavnue works with industry partners to test CAVs and how they react to the physical and digital infrastructure which has been installed.

Contra Costa Transportation Authority's Shared Autonomous Vehicle Program

The Contra Costa Transportation Authority (CCTA) has taken a very proactive stance towards innovation in transportation technologies, which includes the "GoMentum Station," an off-road, secure testing facility for CAVs for testing both the vehicles themselves, and the infrastructure which would enable CAV deployment.[xvii] In addition, CCTA is supporting on-road testing of CAVs with a pilot project to test low-speed, shared autonomous shuttles on the areas roadways.[xviii] These vehicles are branded as "Presto," and the CCTA has run several pilot projects, aiming to assess the viability of autonomous shuttle in improving "last mile" connectivity.

Image 3-3: Presto Shuttle



Image Source: Contra Costa Transportation Authority

Route on US 50

The Maryland DOT received $11.9 million in federal funding via the Advanced Transportation Technology and Innovation (ATTAIN) grant to help upgrade a 113 mile section to U.S Route 50 to include new technologies such as traffic sensors, traffic prediction, signal timing and curve warning, essentially creating a fully integrated intelligent transportation systems (ITS) along the corridor.[xix] While the project primarily seeks to improve the safety and capacity of legacy vehicles, it will also future-proof the corridor for increased CAV usage.

These examples show that CAV pilot projects can vary significantly in terms of scope and scale. They can also focus on different aspects of CAV technology, whether it is creating V2X infrastructure along a corridor, testing market CAV vehicles, or using CAV technology to find innovative solutions to public transport and mobility challenges. Part 2 of the CAV Plan will consider whether there are any suitable candidates for CAV pilot projects in the Rockford Metropolitan Planning Area (MPA), and if so, what would be the most useful approach in terms of preparing the region for the potential of widespread CAV usage.

Chapter 4: Existing Conditions

Connected and autonomous vehicles (CAVs) share the roadway network with conventional vehicles and for the most part have similar requirements in terms of infrastructure design. Therefore it is not expected that a transition to widespread CAV usage would require major alterations to the Rockford Region's roadways. It is, however, important to understand the character of the existing roadway network in order to assess how well placed the Rockford Region is for widespread CAV adoption and what upgrades might be advisable. A full assessment of the existing roadway network and its suitability for CAVs will be undertaken in Part 2 of the CAV Plan; however, this chapter will introduce a brief overview of the region's roadways with particular reference to the elements which are of importance to the safe and efficient operation of CAVs.

Road Network

The Rockford Region presents a practical environment for CAV testing and early deployment because it contains a diverse range of roadway contexts within a concentrated region. The metropolitan area includes characteristics of both larger urban networks and lower-density suburban development, providing opportunities to evaluate CAV performance under varying traffic volumes, intersection densities, land uses, and roadway geometries. Major arterial corridors, signalized intersections, commercial areas, residential neighborhoods, and freeway connections create conditions similar to those found in larger metropolitan areas while still offering a more manageable scale for pilot programs and phased implementation.

The Federal Highway Administration (FHWA) assigns functional classifications to various types of roadway based upon their physical characteristics and purpose.

Table 4-1: Functional Classification

Principle Arterials

Description	Illinois Roadway Information System (IRIS) Code
Interstates	1
Other Freeways and Expressways	2
Other Principal Arterials (OPAs)	3

Minor Arterials

Description	Illinois Roadway Information System (IRIS) Code
Minor Arterials	4

Collectors

Description	Illinois Roadway Information System (IRIS) Code
Major Collectors	5
Minor Collectors	6

Local Roads

Description	Illinois Roadway Information System (IRIS) Code
Local Roads	7

Interstates

Interstates are the highest classification of principal arterials and are designed to transport large volumes of vehicles over long distances.[i] Interstates are classified at the national level and comprise the Dwight D. Eisenhower National System of Interstate and Defense Highways. There are two interstates within the Rockford Metropolitan Planning Area (MPA): I-90, which connects Rockford to Chicago in the east and Wisconsin to the north, and I-39, which connects Rockford to Normal, Illinois, in the south and runs concurrently with I-90 northwards into Wisconsin.[ii]

Image 4-1: Interstate in Rockford (I-90)

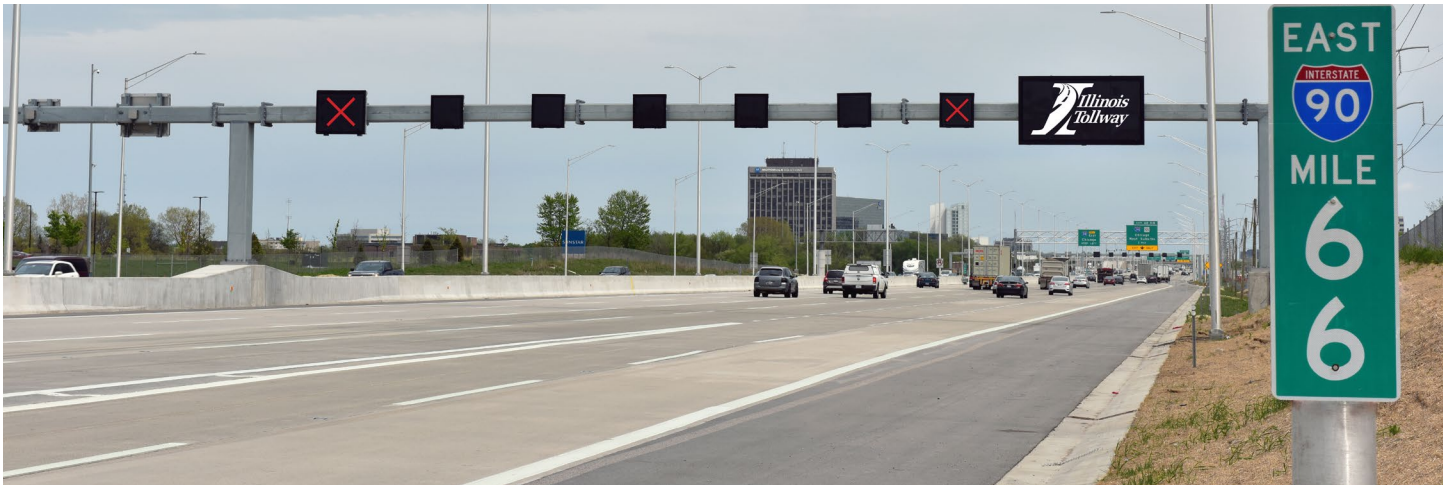


Image Source: Region 1 Planning Council

Other Freeways & Expressways

This category refers to roads which have similar characteristics to interstates, but which are not designated by the national government as part of the interstate network. The only freeway in the Rockford MPA is a section of US 20, which acts as the southern bypass for Rockford between the interchange with I-39 to the east and the interchange with US BUS 20 to the west of Rockford.

Image 4-2: Freeway in Rockford (US20)



Image Source: Google Maps

Other Principal Arterials

Other principal arterials (OPAs) are the highest classification of surface street. This type of street services the major commercial centers in a metropolitan area and have the highest traffic volumes of any surface street and should carry a high proportion of the traffic moving long distances through the urban area. There are numerous OPAs within the Rockford MPA; however, the main ones are US BUS 20/East State Street, which is the main east-west route through the urbanized area, and IL 2 and IL 251, which are the major north-south thoroughfares.

Image 4-3: Principal arterial in Rockford (E State Street)



Image Source: Region 1 Planning Council

Minor Arterials

Minor arterials act as connections between principal arterials, often serving as the main connectors between different neighborhoods within an urban area. They will vary significantly in terms of design but in urban areas will often function as main commercial streets, with businesses and homes accessed directly off of them. There are many examples of such streets in the Rockford Region, such as Kilburn Avenue and Olde Creek Road.

Image 4-4: Minor arterial in Rockford (Sandy Hollow Rd)

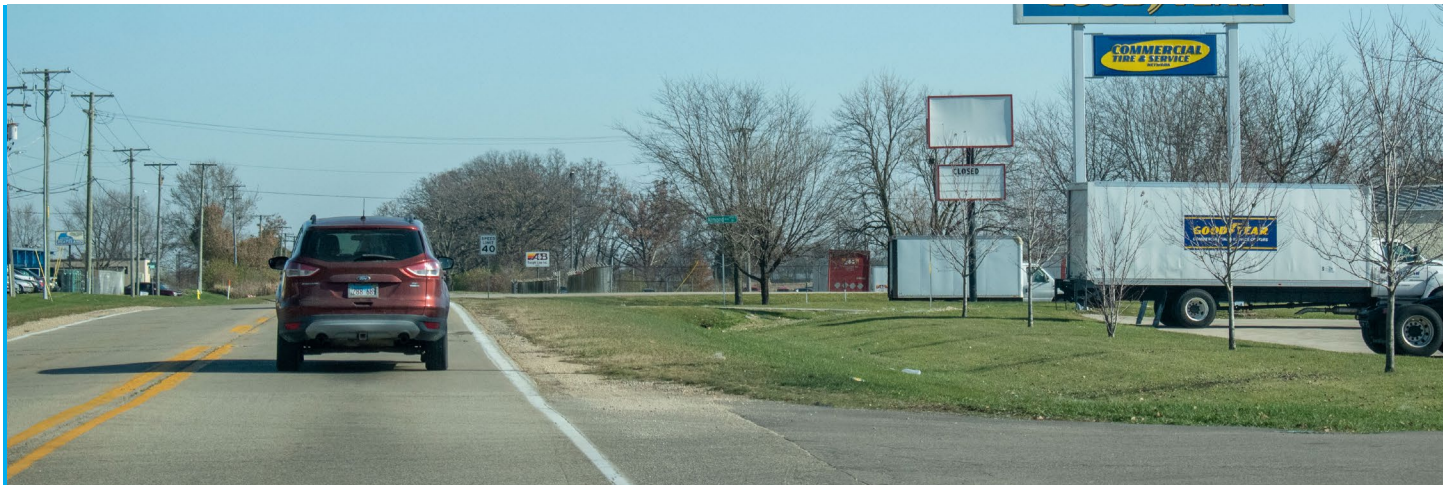


Image Source: Region 1 Planning Council

Major & Minor Collectors

The purpose of collectors is to provide a link between local roads and the arterial roadway system. They are split into major and minor, although there is not a significant difference between these two sub-classifications in terms of design and appearance. In suburban areas collectors will often be the main road within a subdivision, and in rural areas they will be longer routes connecting farms and houses to arterials. Examples in the Rockford MPA include Halsted Road, Pepper Drive, and Ohio Parkway.

Image 4-5: Collectors in Rockford (Halsted Rd)

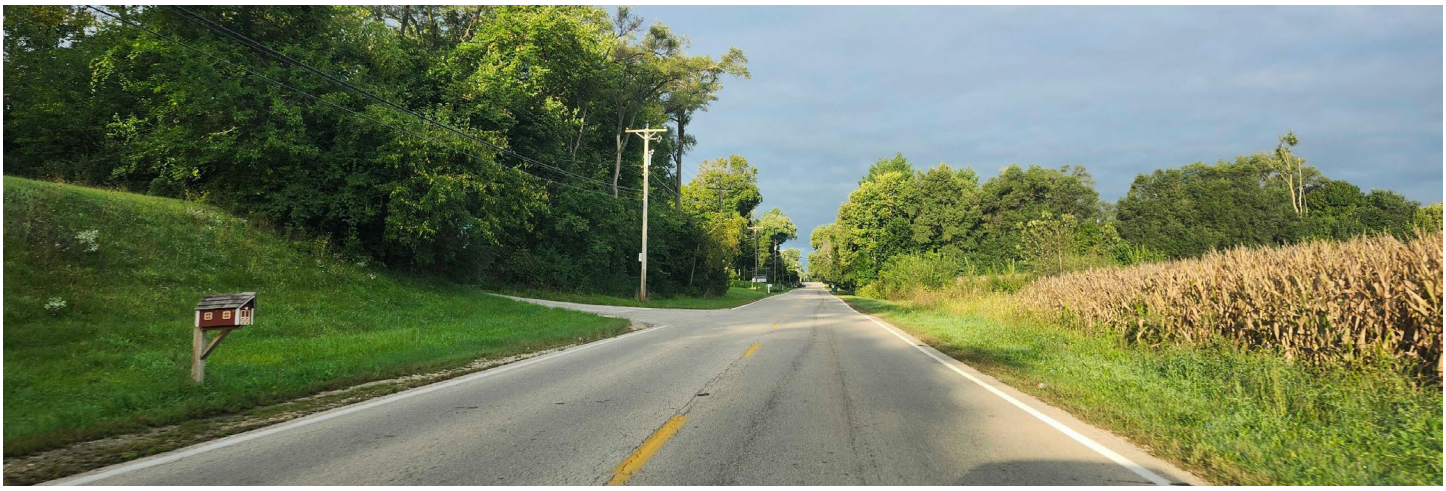


Image Source: Region 1 Planning Council

Local Roads

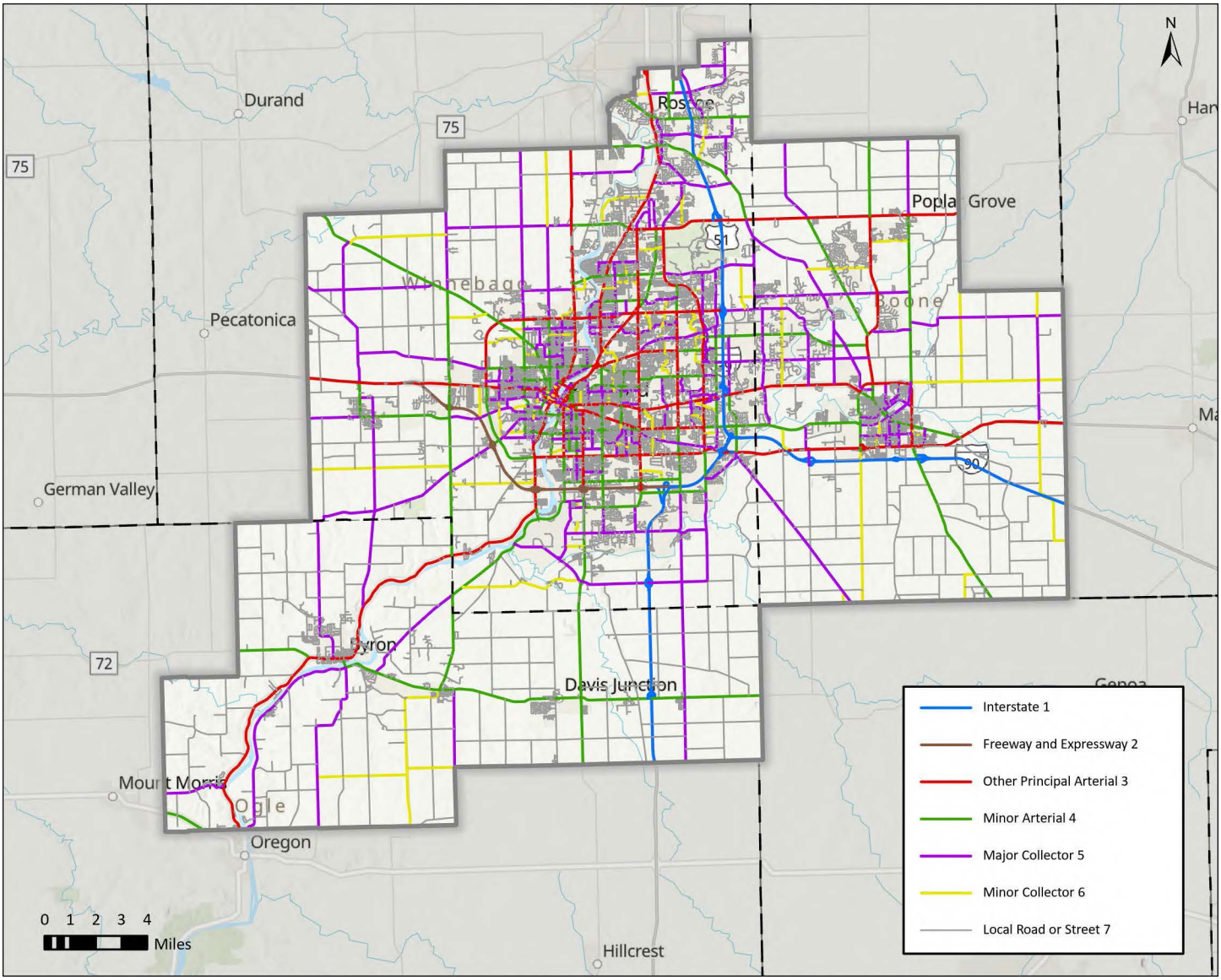
Local roads are the lowest classification of roads and by far the most numerous. The can take many forms: for example, traditional city streets, alleyways, suburban cul-de-sacs, and rural farm roads. The only shared factor between the various types of local roads is that they do not fall into any of the higher classifications. The purpose of local roads is not to carry high volumes of traffic long distances but instead to provide direct access to adjacent land and properties.

Image 4-6: Local Road in Rockford (Roxbury Rd)



Image Source: Region 1 Planning Council

Figure 4-1: MPA Roadways by Functional Classification



Source: Region 1 Planning Council

Roadway Design

The settlement that became Rockford is generally traced to 1834,[iii] and the street layout is largely reflective of the gridiron street layout that typified American cities founded in this era. Contrary to other neighboring cities such as Chicago, the Rockford grid is not standardized, and block size and shape vary throughout the city, as different areas of expansion were platted in different fashions. There are no significant topographical or natural constraints which affected Rockford's development other than the Rock River and other smaller watercourses, and the city developed in a relatively diffuse manner with little density outside the downtown core. This has resulted in a legacy city street network of wide, interconnected streets which are well suited to the use of CAVs and do not suffer from some of the challenging historic street or intersection layouts which older cities often do. Later twentieth and twenty-first century suburban expansions to Rockford are largely concentrated to the east and north of the city and, while deviating from the grid, are generally compliant with national road design standards.

The City of Rockford Department of Public Works has published the Engineering Design Criteria,[iv] which specifies the standards for new roadways. This is compliant with the Illinois Department of Transportation's (IDOT) Bureau of Local Roads and Streets Manual,[v] which in turn is informed by national highway design standards. Therefore any new or redesigned roadway within the Rockford Region in recent years or in the future will be compliant with national road design standards.

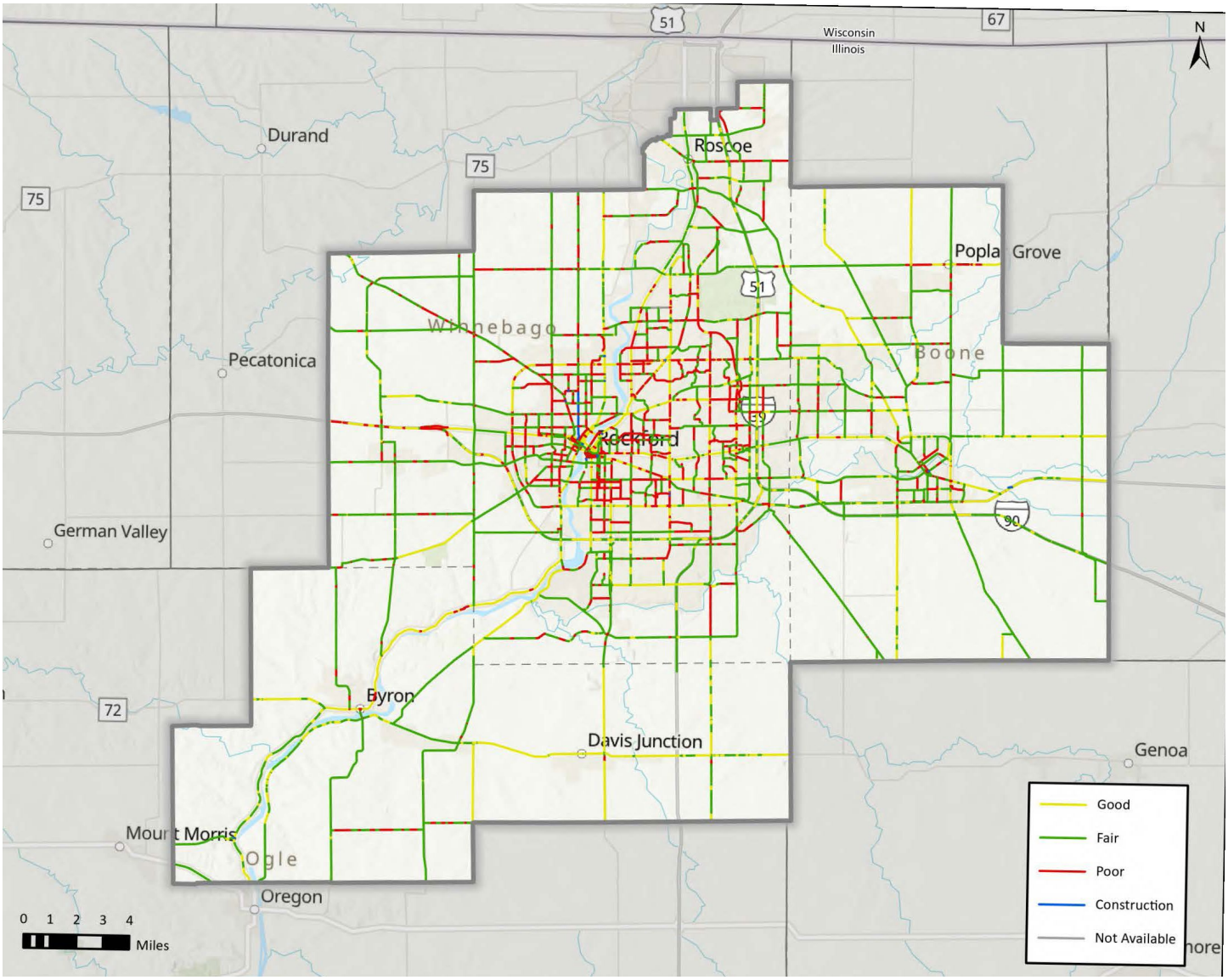
Standardized roadway design is an important factor for CAV usage, and given that both Rockford's legacy street network and its more recent roadways are for the most part compliant, Rockford is well placed in this regard for the use of CAVs.

Preservation & Maintenance

Preservation of roadway infrastructure, particularly of road markings and signage, is vital to the safe and efficient operation of CAVs. While no direct data is available regarding the maintenance and state of roadway markings, IDOT monitors the pavement condition of roadways classified as collector and above, which can act as a proxy for road marking condition, as there is a high degree of correlation between the condition of the roadway surface and the condition of the markings. Generally, when a roadway is resurfaced, it will have its road markings repainted; conversely, if a roadway surface is in poor condition, it is unlikely to have well-maintained markings. As of 2022, 426 lane miles (21 percent of lane miles) in the MPA received an overall rating condition of good, 1,120 lane miles (55 percent) received a rating of fair, and 472 lane miles (23 percent) received a rating of poor. The remaining 1 percent of lane miles were missing an overall rating score. Figure 4-2 displays the IDOT condition rating of collector-level and above roadways.

It will be important to improve the maintenance of the existing roadway assets and have more roadways be rated good and fewer as poor if widespread CAV usage is to be achieved in Rockford. This is particularly the case as modern vehicles, particularly electric vehicles (EVs), are heavier than legacy vehicles and therefore erode road surfaces and markings more quickly. Over the four fiscal years of 2027 to 2030, over $350 million is programmed to be invested in highway projects within the Rockford MPA which preserve the existing system.

Figure 4-2: MPA Pavement Condition



Source: Region 1 Planning Council

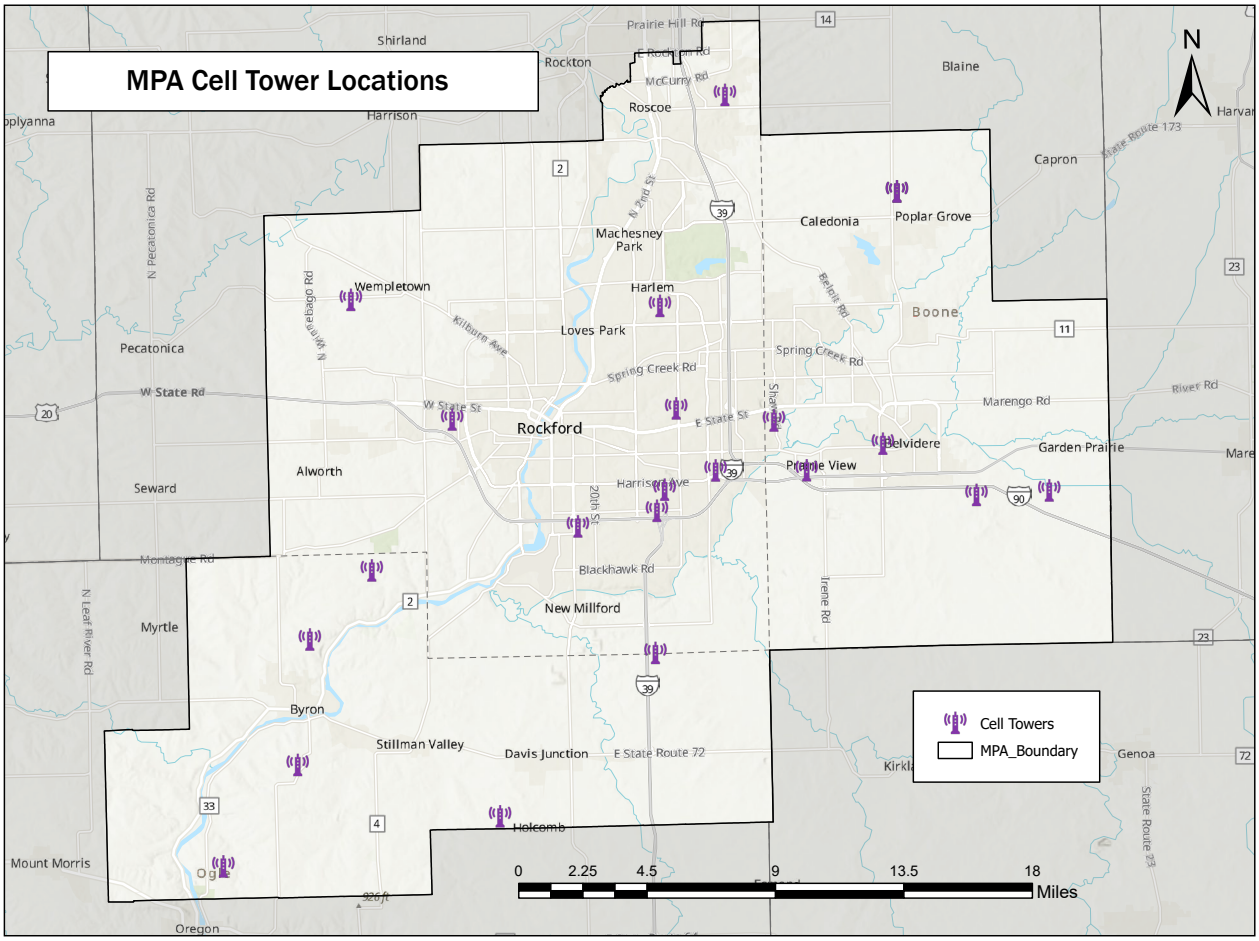
Wireless Coverage

There are two important categories of wireless communication infrastructure which are provided on a local level and are vital to the operation of CAVs: cellular network coverage and dedicated short-range communications (DSRC). Other communications technologies used by CAVs are either provided at the national/international level (e.g., GPS via satellites) or at the personal/private level (e.g., Bluetooth). It is therefore important to understand the cellular network coverage and DSRC coverage in the Rockford Region in order to ascertain how prepared the region is to facilitate connectivity between vehicle, infrastructure, and devices.

Cellular network coverage is provided mainly by three large telecommunications companies, Verizon, AT&T, and T-Mobile, and coverage varies between these three networks. Cellular coverage is provided by antennas which are mounted on masts, towers, buildings, or other tall structures. The MPA is home to approximately 27 cell tower structures, distributed across the region with additional antennas mounted on other structures. All three networks claim 5G+ coverage throughout the Rockford MPA,[vi] [vii] [viii] although their network maps display maximum coverage and actual coverage may be inconsistent, particularly in more rural areas of Winnebago and Ogle counties. Notwithstanding, the Rockford Region enjoys relatively fast and consistent wireless network coverage and does not suffer from any significant gaps which could negatively affect CAV deployment.

DSRC is provided via roadside units (RSUs), which may be deployed by any of the agencies responsible for the roadways in the region. There is not currently a centralized database showing the number or locations of RSUs in the region. The only agency operating in the region which currently utilizes RSUs on a widespread basis is the Illinois Tollway, which uses them mainly for tolling but also to operate some more advanced intelligent transportation system (ITS) functions on I-90 outside of the Rockford MPA. RSUs are therefore likely to be an area of infrastructure which would require increased investment and coordination prior to any widespread CAV deployment in the Rockford Region.

Figure 4-3: MPA Cell Tower Locations



Source: Region 1 Planning Council

Chapter 5: Policy Context

Connected and autonomous vehicles (CAVs) are an emerging technology, and as with all new technologies where there is not a well-established policy framework, the rules and requirements for this technology can sometimes appear opaque and inconsistent. Policymakers across the country are having to adapt to complex and rapidly advancing technological changes and are being asked to balance precaution and public safety against the potential benefits of unrestricted innovation. Broadly speaking CAV policy is being determined at four different levels of government; national, state, regional and local with each level of governance responsible for different aspects of automobile and roadway policy (see Table 5-1. CAV Policy can further be split between legislative policy, which directly dictates what CAV manufacturers and owners can and cannot do, and guidance (such as this document), which seeks to inform and influence how CAVs are used within a particular area or context. This chapter will attempt to summarize the existing CAV Policy context, with particular reference to how it applies to the Rockford region.

Table 5-1: Policy Responsibilities

Federal
Setting Federal Motor Vehicle Safety Standards (FMVSSs) for new motor vehicles and equipment
Enforcing Compliance with FMVSSs
Manging the recall and foxing of noncompliance with FMVSSs
Communicating with the public regarding motor vehicle safety
Ensuring federal safety targets are met through working with states.

Regional (MPO)
Responsible for long and short range transportation planning in a region
Consider transportation alternatives
Prepare a region for emerging transportation technologies
Identify projects which should be prioritized for federal funding
Travel modeling and forecasting

State
Licensing drivers and registering motor vehicles
Enacting and enforcing traffic laws and regulations
Regulating motor vehicle insurance and liability
Policymaking and legislating for CAVs

Local (City, County, etc.)
Maintain local roadway network
Set standards for new roadway construction, and ensure compliance

Federal Policy

Federal policy as it relates to CAVs is set by the U.S. Department of Transportation (USDOT), specifically the Federal Highway Administration (FHWA) and National Highway Traffic Safety Administration (NHTSA). The federal government's role in CAV policy is significant as it oversees how vehicles are built, largely via the Federal Motor Vehicle Safety Standards (FMVSS). Therefore, federal-level CAV policy is largely orientated towards legislation and guidance that applies to the manufacturers of CAVs, although it should also be noted that USDOT has a responsibility for ensuing national road safety targets are met, and therefore can also get involved via state DOTs regarding how the vehicles are used on the nation's roadways.[i] Given the national importance of the issue of CAV deployment, USDOT began issuing CAV policy early, and has created a series of four CAV policy documents which form the foundation of CAV policy in the United States.

Federal Motor Vehicle Safety Standards (FMVSS):

Federal Motor Vehicle Safety Standards are the official design standards created by the federal government to regulate the safety, performance and quality of new motor vehicle and equipment produced in the United States.

2016 Federal Automated Vehicles Policy

The 2016 Federal Automated Vehicles Policy is one of the earliest agency guidance documents developed by the NHTSA, which provides guidance for the development, testing, and deployment of automated vehicles in the United States, which the document calls highly automated vehicles (HAVs). It provides guidance for manufacturers of CAVs, covering such topics as data recording and sharing, ethical behaviors, object and event detection and response and "fall back" protocols.[ii] The document also sets a model state policy for CAVs and describes the existing and potential future regulatory tools which NHTSA can utilize to ensure compliance with design standards.

Image 5-1: 2016 Federal Automated Vehicle Policy

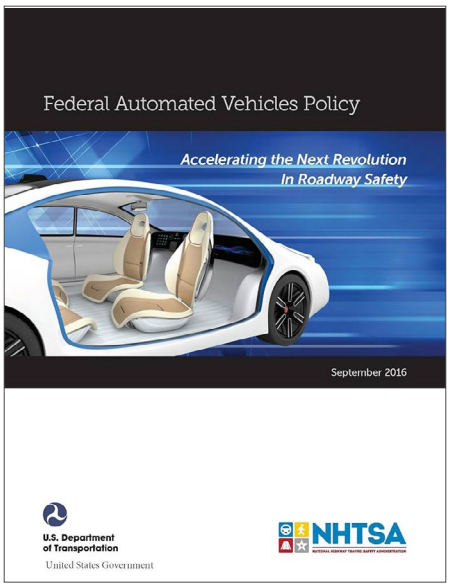


Image Source: U.S. Department of Transportation, National Highway Traffic Safety Administration

Automated Driving Systems 2.0 (2017): A Vision for Safety

Following the 2016 Federal Automated Vehicles policy, a series of updated guidance documents to reflect technological advancements and evolving regulatory needs were introduced by the federal government. The first of these updates was Automated Driving Systems 2.0: A Vision for Safety (ADS 2.0),[iii] released in 2017 by NHTSA. The policy highlights the importance of ensuring safety as the top priority in the development and deployment of autonomous vehicles. It encourages industry innovation through flexible, non-regulatory guidance and self-assessment. It emphasizes the need for robust safety and cybersecurity measures, thorough testing, and transparent reporting to build public trust. Additionally, the policy calls for close collaboration between federal and state governments to develop consistent laws and regulations, support infrastructure, and foster safe integration of automated driving systems (ADS) on public roads, while allowing flexibility and promoting continuous improvement as technology advances.

Image 5-2: Automated Driving Systems 2.0



Image Source: U.S. Department of Transportation, National Highway Traffic Safety Administration

Automated Vehicles 3.0 (2018)

Automated Vehicles 3.0: Preparing for the Future of Transportation (AV 3.0) builds on ADS 2.0 to encompass a broader, more coordinated strategy for automated vehicle integration.[iv] Unlike ADS 2.0, which focused primarily on safety and early deployment considerations, this guidance emphasizes the importance of coordination among agencies and across all transportation modes. The document reflects a shift toward a more holistic and integrated policy framework by providing guidance for states to consider for the training and licensing of test drivers. It also offers guidance for testing entities to consider driver engagement methods during testing.

Image 5-3: Automated Vehicles 3.0

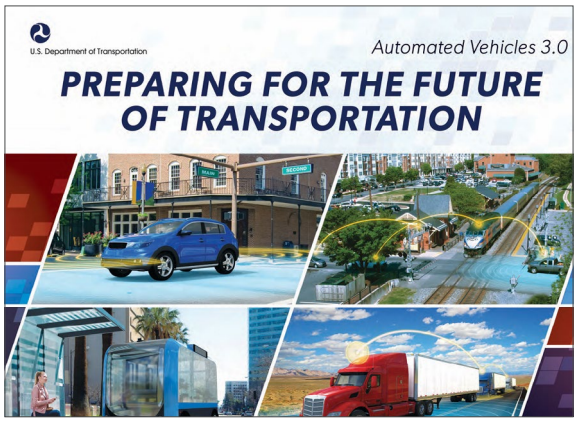


Image Source: U.S. Department of Transportation

Automated Vehicles 4.0 (2020)

Further advancing the federal strategy, Automated Vehicles 4.0: Ensuring American Leadership in Automated Vehicle Technologies (AV 4.0), considers how the federal government can support the CAV industry in order to maximize the benefits, not only in terms or road safety and efficiency, but also in maintaining America as a global technological leader. This policy's voluntary guidelines expanded on three previous versions of the framework, placing a stronger emphasis on passenger safety, modernization, and remaining technology neutral. AV 4.0 also updated the guidance on privacy, cybersecurity, patents, and accessibility of vehicles.[v]

Image 5-4: Automated Vehicles 4.0

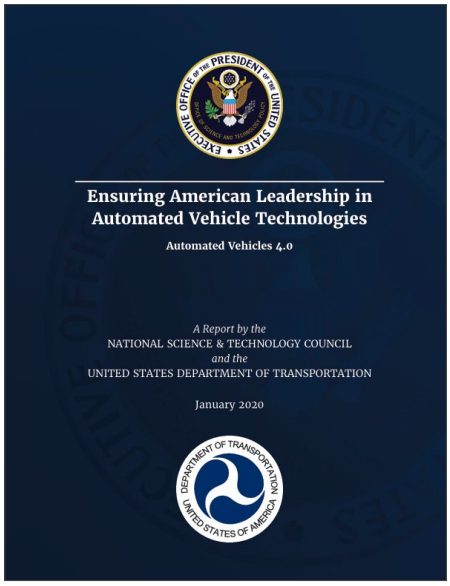


Image Source: U.S. Department of Transportation

Other Recent Federal Developments

The U.S. DOT is constantly updating legislation and standards to reflect the advancement of CAV technology. In 2021, NHTSA issued a Standing General Order on Automated Vehicle Crash Reporting, which requires identified manufacturers and operators of vehicles equipped with ADS or SAE Level 2 advanced driver assistance systems to report crashes to the agency.[vi] This marks a move away from voluntary to mandatory reporting, and will allow the agency to fully assess the purported safety benefits of CAVs. In 2022, NHTSA issued a Final Rule which updated the FMVSS to require all new light vehicles to be equipped with forward collision warning (FCW), automatic emergency braking (AEB), and pedestrian automatic emergency braking (PAEB).[vii] In order to encourage innovation and create a level playing field with foreign manufacturers of CAVs, NHTSA has created a program whereby domestic auto-manufacturers can apply for exemptions to certain requirements of the FMVSS. In recent years, particular emphasis has been placed on the cyber security implications of CAVs, particularly the potential of CAVs or components imported from competitor countries to pose risks to national security. To this end, the Bureau of Industry and Security, Department of Commerce issued a rule to restrict the importation and sale of connected vehicles hardware/software from China or Russia.[viii]

America Leads: DOT's National Strategy for Automated Vehicles (2026)

America Leads: DOT's National Strategy for Automated Vehicles (FY's 2026-2030) attempts create a cohesive and unified CAV strategy to supersede the four previous Federal CAV Plans which were unconcise and in some instances outdated.[ix] It sets out four AV Goals for the U.S.DOT which cover the issues of safety, regulatory consistency, promoting American innovation and ensuring interoperable infrastructure standards across the various state jurisdictions. The plan then goes on to outline the U.S. DOT's role with relation to CAVs and highlights some of the activities which will be carried out at the federal level. America Leads reemphasizes that the role of the Federal Government is primarily to provide a regulatory framework with relation to vehicle manufacture which promotes safety which removing barriers to innovation. Overall, America Leads is not a significant shift in policy direction from the previous four Federal CAV policy documents but does provide a more up-to date policy foundation for CAV deployment.

Image 5-5: America Leads

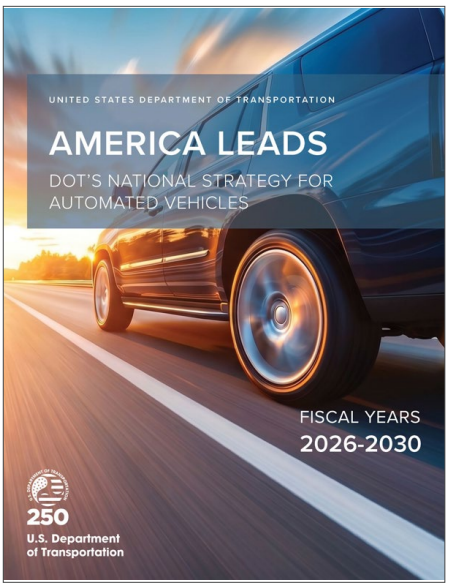


Image Source: U.S. Department of Transportation

State Policy

While federal authorities establish uniform standards for vehicle design and safety, states retain jurisdiction over how vehicles are operated within their borders. This has allowed for a wide variety of different policy frameworks between different states, with some states implementing a more permissive, innovation focused approach, while other states pursue a more precautionary and reactive stance.[x] State policy development for CAVs has progressed rapidly since Nevada became the first state to authorize autonomous vehicle testing in 2011. Since that time, over forty states have introduced legislation or executive actions addressing automated vehicle (AV) testing and deployment.[xi]

The Illinois Department of Transportation (IDOT) is the government agency responsible for transportation planning in the state of Illinois. IDOT's Illinois Statewide ITS Architecture: Concept of Operations (2019) was one of the state's earliest explorations of the potential policy implications of CAVs. The report considers the potential challenges and opportunities presented by CAVs and recommends agencies in the state of Illinois participate in the testing of CAV technologies in order for the state to remain "in the game" and not lag behind competitors.[xii] IDOT is currently in the process of developing a new Long Range Transportation Plan (LRTP) for the state which will include Connected and Autonomous Vehicle Planning and an Intelligent Transportation System Architecture Strategic Plan.[xiii] A draft plan is expected in 2026. Part 2 of this CAV Plan will include stakeholder engagement with IDOT to ensure that the CAV plan for the Rockford Region aligns with statewide transportation policy.

Image 5-6: ITS Architecture Concept of Operations

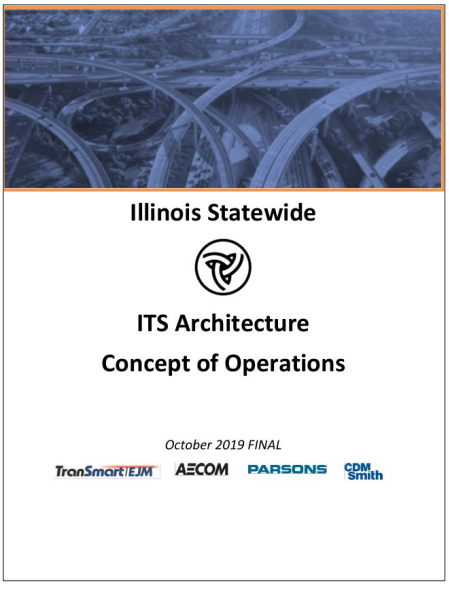


Image Source: Illinois Department of Transportation

Presently, there is legislation going through the Illinois House of Representatives which would prohibit the sale or operation of a vehicle classified as having Level 3 or above driving automation as designated by SAE.[xiv] This policy would put Illinois in the position of being relatively technology cautious with regards to CAVs. However, that legislation would relate specifically to private sale or operation of CAVs; there would still be scope for testing or pilot projects within Illinois. However, House Bill 4663 would limit CAV pilot project operational design domains (ODDs) to the counties of Cook, Sangamon, Madison, St. Clair and Monroe,[xv] and therefore the Rockford MPA could not be used for such a project without a change to the legislation. As of 2026, Waymo has begun the testing of driverless vehicles on the streets of Chicago;[xvi] while the pilot is currently limited to Cook County, it could, if successful, lead to more permissive attitudes to CAVs on a statewide basis.

Regional Policy

Developing a regional CAV policy for the Rockford area is the responsibility of Region 1 Planning Council (R1) as the Metropolitan Planning Organization (MPO) for the Rockford Region, and this document constitutes the first step in the process of considering CAV policy at a regional level. MPOs play an important but indirect role in the deployment of CAVs. By collaborating with local, state, and federal transportation agency partners in regional transportation investments and funding, MPOs have the power to strongly influence some of the aspects of the transportation system that could be affected by CAVs.[xvii] While there is currently no regional CAV policy for Rockford, other MPOs have carried out studies which could inform the approach Rockford could take.

Connected and Autonomous Vehicles and the Boston MPO – A First Look (2017)

Connected and Autonomous Vehicles and the Boston MPO – A First Look represents one of the earliest analyses of CAV impacts by an MPO. The study emphasizes the uncertainty associated with the deployment timelines of the technology, while highlighting key planning implications, including safety improvements, potential congestion changes, equity impacts, and changes in land use patterns.[xviii] In this report, MPOs are urged to be flexible while integrating CAV considerations into travel demand models, scenario planning, and LRTPs. Key recommendations include monitoring CAV developments at all levels, updating planning tools to account for CAV impacts, and developing strategic, shared-mobility plans that promote data sharing, interoperability, and regional coordination.

Image 5-7: Connected and Autonomous Vehicles and the Boston MPO – A First Look

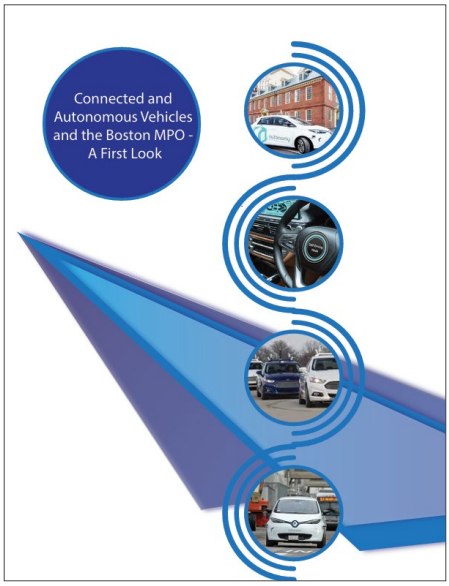


Image Source: Boston Region Metropolitan Planning Organization

MetroPlan Orlando CAV Readiness Study (2020)

MetroPlan Orlando's CAV Readiness Study took a more proactive approach to data gathering which involved extensive stakeholder engagement and data collection. Their recommendations focused on planning and policy, infrastructure guidelines, data collection and management, identifying pilot projects and staffing and training.[xix] This thorough, early and robust approach to CAV planning may have been a contributing factor to the introduction of Waymo's driverless rideshare service into the Orlando area in 2026.

Image 5-8: MetroPlan Orlando CAV Readiness Study

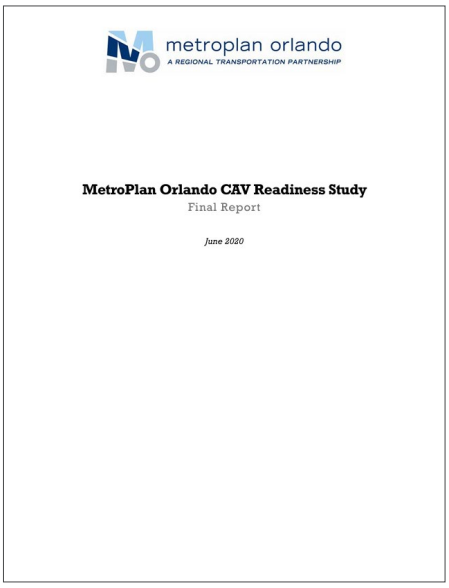


Image Source: MetroPlan Orlando

Plan Bay Area 2050+ (2026)

Other MPOs choose not have a dedicated CAV plan but instead incorporate CAV planning into their LRTP, such as the Bay Area's Metropolitan Transportation Commission's (MTC) Plan Bay Area 2050+. The context for this plan is a region with some of the highest CAV adoption rates in the country, and the plan is focused on protecting public transit, managing travel demand, and promoting equitable access to ensure that CAVs align with the region's wider transportation goals.[xx]

Image 5-9: Plan Bay Area 2050+

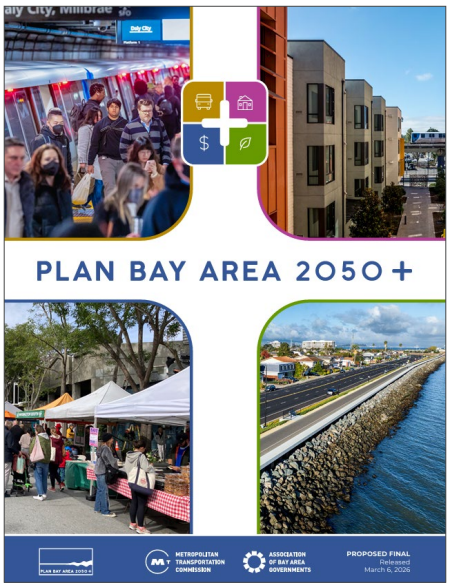


Image Source: Metropolitan Transportation Commission

Ultimately, the approach taken by R1 to CAV planning in the Rockford Region combines elements of all of the above examples: Part 1 of the CAV Plan adopts the approach taken in Boston, where the plan is a study into CAVs which provides broad guidelines for the approach to CAVs in the region, while Part 2 of the CAV Plan will be more similar to the approach taken in Orlando, where extensive data collection is undertaken in order to attempt to select particular CAV readiness projects which could be candidates for federal funding.

Local Policy

While local transportation agencies are not directly responsible for CAV planning, they are important stakeholders in the development of State and MPO CAV plans, and play a crucial role in developing and enforcing local roadway design and maintenance standards. Local transportation agencies are often the best placed for developing CAV readiness or pilot projects as they have the most in-depth knowledge of what local roadways would be suitable for such a proposal. City administrations

also play a role in deciding whether they wish to permit a CAV operator to introduce vehicles to their roadways, and whether they wish to use public money to invest in infrastructure which would make the area more suitable for CAV deployment. Thus while local agencies do not produce official CAV plans or policies, they remain significant players shaping CAV policy.

Future Policy

The policy landscape for CAVs continues to evolve as government agencies, planners, and private stakeholders seek to balance innovation with safety, equity, and societal goals. Federal, state, and regional frameworks each contribute unique capacities, but a joint effort is required in order to efficiently regulate CAVs and ensure public safety while also being flexible enough to allow for innovation.[xxi]

As the technology develops, there should be a shift from fragmented regional rules toward a nationally consistent approach. The United States has also witnessed a shift from self-assessment and self-regulation to a more formalized and mandatory approach to CAV regulations as the focus moves from encouraging innovation to ensuring public safety as the technology becomes more widespread. R1 will continue to monitor developments in federal and state CAV policy on an ongoing basis in order to ensure that CAV policy in the Rockford Region is responsive and up-to-date with national and state developments.

Chapter 6: CAV Strategy

The CAV Strategy for the Rockford Region has to balance the potential benefits of being an early adopter of connected and autonomous vehicle (CAV) technologies against the uncertainty about the pace and extent of the CAV rollout and the need to retain capacity and investment in traditional vehicle infrastructure. Region 1 Planning Council (R1) has therefore devised a proactive, forward-looking CAV Strategy which will place the Rockford Region in a good position to be ready for the CAV rollout without requiring excessive public investment or radical alterations to the roadway system. The purpose of the strategies outlined in this chapter are to inform the approach taken to CAV planning by R1 and other transportation agencies in the Rockford Region. In particular, these strategies will form the basis for Part 2 of the CAV Plan, which will use them to make strategic and targeted recommendations for how to prepare the region's roadways for CAVs.

Strategy Overview

The goal of the CAV Plan is to prepare the Rockford Region for a potential significant modal shift from legacy vehicles to CAVs in the medium to long term. Based upon the research conducted for Part 1 of the CAV Plan, in order achieve this goal, the following strategies are recommended:

Table 6-1: Strategies

Strategy	Outcome
1. CAV Awareness	To foster and improve CAV awareness in the Rockford Region
2. Policy Framework	To develop a policy framework for making planning and transportation decisions relating to CAV's in the Rockford Region.
3. Roadway Infrastructure Improvements	To identify opportunities for roadway infrastructure improvements in the Rockford Region.
4. Communications Infrastructure Improvements	To identify opportunities for communications infrastructure improvements in the Rockford Region.
5. Fleet Upgrades	To identify opportunities to upgrade the vehicle fleet in the Rockford Region to include more CAVs with higher levels of automation.

The following section describes each of these strategies in detail. Appendix B provides an Action Plan which prescribes steps which should be taken in order to deliver these strategies. This chapter also includes a description of the estimated timelines involved and the delivery partners responsible for implementing the CAV strategies.



Strategy 1: CAV Awareness

Timeline: **Short-term.**

Delivery Partners: **R1 Staff, MPO Technical Committee, MPO Policy Committee, Local Transportation Agencies, Community Groups, the General Public**

In order to prepare the Rockford Region for CAVs, it is vital to raise awareness of what CAVs are, how they work, and their potential benefits within the region. It is expected that better understanding of this technology will allow decision-makers, transportation professionals, and the general public to make informed choices about how to engage with CAVs. R1 has identified various groups and actions to promote CAV awareness. The two-part CAV planning process is intended to provide multiple opportunities to promote CAV awareness amongst the various groups in the short term, while implementation of the CAV Plan will involve raising awareness of CAVs on an ongoing basis.

In pursuing Strategy 1, R1 will adopt a "technology neutral" position with regard to CAVs and will not promote one transportation technology over another.[i] The purpose of Strategy 1 is to educate and inform the public and stakeholders about CAVs and to foster a constructive conversation about how they might be incorporated into the region's transportation networks, rather than to attempt to "sell" CAVs as the transportation technology of the future.

Strategy 2: Policy Framework

Timeline: **Short-term.**

Delivery Partners: **R1 Staff, Local Transportation Agencies, Local Planning Departments, State Representatives, IDOT, U.S. DOT**

In conjunction with the applicable national and state CAV polices outlined in Chapter 5 of this document, the CAV Plan is intended to act as the primary resource for CAV transportation planning in the Rockford Region. The strategies outlined in this section of Part 1 of the CAV Plan are designed as guidance to inform transportation related decisions relevant to CAVs in the Rockford Region, whereas Part 2 will suggest projects which could help to prepare the region for wider CAV adoption. The purpose of this Plan is not, therefore, to directly legislate local CAV policy, but to act as a resource for other local government bodies within the region to use when considering their own transportation policies relevant to CAVs. The CAV Plan will be reviewed and updated on an ongoing basis to ensure that it remains up-to-date and reflective of the developing state of the CAV industry.

Future CAV policy should be cognizant of and informed by the developing state of CAV technology and the public's attitude towards CAVs. As outlined in Chapter 2 of this document, the more ambitious industry predictions about the development of Level 4 and 5 automated vehicles within the next few years now seems unlikely, and it may be decades before full self-driving cars come to market. However, in the meantime vehicles are likely to be sold with more and more automated features and capabilities, and the Rockford Region's CAV policy should be reflective of this gradual and incremental approach.

CAV policy in the Rockford Region also needs to be mindful of the issue of public safety. While improved road safety is one of the biggest potential benefits of widespread CAV technology and early indications do appear to indicate that CAVs are safer than human drivers,[ii] it also must be acknowledged that CAVs can still pose a safety risk to other vehicles and pedestrians due to a number of potential variables from technology failures to extreme weather. Collisions involving CAVs which result in injury or fatalities are likely to have an impact on public perception of CAVs even if on average they are safer than human drivers, and the legal framework to attribute liability for such incidents is still underdeveloped. It is therefore recommended that any policy in the Rockford Region which might permit the use of more advanced stages of automation (Levels 3-5) exercise the precautionary principle in order to ensure that all reasonable steps are taken to ensure that the technology adopts the highest standards of safety and does not prioritize the safety of CAV passengers over that of other road users.

Strategy 3: Roadway Infrastructure Improvements

Timeline: **Medium to Long-term.**

Delivery Partners: **R1 Staff, Local Transportation Agencies, IDOT**

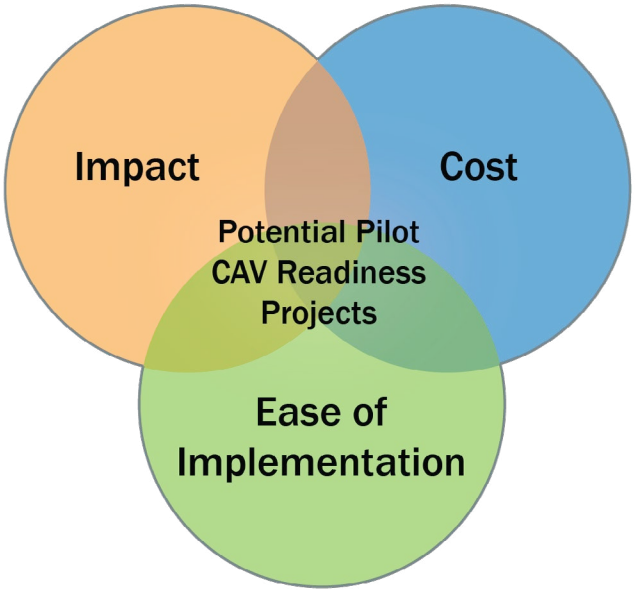
The most significant part of the CAV Strategy relates to physical improvements which can be made to the Rockford Region's roadway infrastructure in order to make it more suitable for widespread CAV usage. As described in previous chapters, there are a number of infrastructure improvements which can be made, including the installation of roadside units (RSUs) in traffic infrastructure, increased maintenance of roadway markings, and improvements to roadway geometries and intersection layouts to ensure compliance with national standards and best practice. R1's strategy for assessing CAV readiness improvements in the Rockford Metropolitan Planning Area (MPA) is to focus on three criteria:

Table 6-2: CAV Readiness Project Assessment Criteria

Criteria
1. Impact Which projects would have the most significant impact in terms of preparing the Rockford Region's transportation network for the widespread adoption of CAVs?
2. Ease of Implementation Which projects would be easiest to implement in terms of securing funding, securing the agreement of the relevant stakeholders, minimizing the impact on traditional road users, and avoiding constraints?
3. Cost Which projects are the least expensive?

In considering potential CAV readiness projects, only projects which meet all three criteria will be promoted or considered as a candidate for Advanced Transportation Technology and Innovation (ATTAIN) funding, as displayed in Figure 6-1.

Figure 6-1: CAV Readiness Project Assessment Tool



Part 2 of the CAV Plan will primarily involve a CAV Readiness Assessment of the region's key roadways, which will give the roads a CAV readiness score based on how well they accord with various criteria which make a road suitable for widespread CAV usage. The CAV Readiness Assessment will provide useful data on which roadways are currently in a good position in terms of CAV readiness and could potentially be used for pilot introductions of more advanced CAV technology, and which roadways are not well prepared for CAV usage and might require investment.



Strategy 4: Communications Infrastructure Improvements

Timeline: **Medium-term.**

Delivery Partners: **R1 Staff, Local Transportation Agencies, Local Planning Departments, Mobile Network Operators, Federal Communications Commission (FCC)**

The connected element of CAVs relies heavily on widespread coverage and good reliability of wireless communications technologies. A vital component of the CAV Strategy will therefore be to support the expansion of wireless communication infrastructure in the Rockford Region.

Some wireless communications, for example Global Positioning System (GPS), are owned and operated by public bodies, but the majority of the most widely-used systems are provided by a range of competing private companies with varying levels of service coverage. Strategy 4 recommends that R1 and other transportation organizations within the Rockford Region work with both private organizations and government bodies to support and expand coverage of the various wireless communications networks through the installation of wireless infrastructure, particularly infrastructure which supports wireless communications along the region's roadway network.

The Rockford Region is well placed to ensure the highest standards of connectivity. The region does not have many hills or tall buildings which can interfere with signal, and therefore individual cellular sites are able to maximize their utility, avoiding the need for excessive infrastructure. 5G and dedicated short-range communications (DSRC) all have relatively short range and therefore require more physical infrastructure in the form of antennas or RSUs than previous generations of wireless communication technologies. Strategy 4 supports the widespread rollout of RSUs throughout the region's transportation infrastructure and continued maintenance and expansion of the region's roadside cell network.



Strategy 5: Fleet Upgrades

Timeline: **Long-term.**

Delivery Partners: **R1 Staff, Local Transportation Agencies, Local Transit Providers, CAV Manufacturers, Freight Operators**

It is currently unclear how quickly and to what extent CAVs will be adopted by individuals for their private vehicles, and this will depend on both the pace of the development of the technology and how well the industry is able to market the technology and convince consumers to purchase CAVs. R1 will adopt the U.S. government's "technology neutral" approach to CAV technology.[iii] Notwithstanding private automobiles, there are potentially widespread benefits to CAV adoption for public transit vehicles, emergency vehicles, taxis/rideshare, and freight and delivery vehicles in the Rockford Region. The adoption of CAV technology into any of the vehicles fleets mentioned below would

require extensive stakeholder and public engagement in order to address any concerns and ensure the buy-in of the local community.

Public Transit

Public transit vehicles, specifically buses, operate on a fixed route with only minor deviations in the case of road closures, and therefore are an excellent candidate for early adoption of CAV technologies. This is important because it creates a closed environment where road and communications infrastructure can be upgraded in order to allow for advanced CAV use, without the possibility that the vehicle will stray far from the route and into an area which is not suitable for CAVs. CAV technologies have the potential to hugely improve the reliability of buses by adjusting their speed to ensure arrival at the correct time and to prevent bunching, thus making them a more appealing option and promoting the use of public transit. There are, however, still significant financial, operational, maintenance, and liability challenges associated with transitioning a bus fleet to CAVs which would need to be resolved before such a transition could be undertaken, and it is not likely that driverless buses are possible in the time period that this Plan encompasses.

Emergency Services

For emergency vehicles, the use of emergency vehicle preemption (EVP) systems at traffic signals are currently playing a role in reducing response times, and it is expected that CAVs will offer additional opportunities to increase the efficiency of emergency vehicles in responding to incidents. However, as with buses, it is not expected that emergency vehicles will be able to go driverless as they are often required to not adhere to traffic laws, whereas CAVs are designed to adhere strictly to traffic regulations except to avoid collision.

Taxis/Rideshares

With regard to taxis and rideshare, many companies are already on the vanguard of utilizing CAV technologies. An increasing number of cities in the U.S. have already granted licenses for the operation of driverless taxi ("robotaxi") services, with many other cities both nationally and internationally in discussions to bring service to their jurisdiction. While smaller urban areas such as Rockford are unlikely to be included in these initial waves of rollout, R1 will monitor these early adopters on the basis that Rockford would be a good candidate for these services due to its standardized and under-capacity road network.[iv]

Freight

Finally, freight and delivery vehicles also present a good opportunity for the early adoption of CAV technologies in the Rockford Region because they often operate on fixed routes (in the case of freight) or in a small, clearly-defined area (in the case of delivery). Given its status as a freight transportation hub, Rockford could be well placed to trial the use of CAV technologies in these vehicles. Autonomous delivery robots, which travel at very slow speeds and use the sidewalk rather than the roadway, may be the first stepping stone towards autonomous vehicles in the Rockford Region. However, while autonomous delivery robots are already deployed neighboring Chicago, the lack of density in Rockford may act against the use of these products, as their slow speed makes it impractical to cover large distances.

Timeline

Due to the uncertainty regarding the speed and extent of the development of CAV technology, it is prudent to provide a broad overview of CAV planning over an extended timeline. The CAV Plan is expected to cover a five-year period (the Plan period), but beyond that it is important to consider how CAV technology might progress and what planning responses might be required. This section considers CAV planning over a short-, medium-, and long-term timeline.

Short-Term (0-5 Years)

The CAV Plan period is expected to be an approximately five-year cycle. The strategies included in this chapter and the Action Plan outlined in Appendix B have been designed to be relevant over the five-year period of 2026-2031. By the end of this period, it is expected that vehicles operating with either Level 1 or Level 2 capabilities will account for over half of car sales globally.[v] Robotaxi and delivery services using higher levels of automation are expected to expand into more and more cities. During this period, the Rockford Region should make targeted and limited investments in upgrading its road and telecommunications infrastructure to prepare for wider CAV usage. This may involve identifying a pilot project for limited CAV introduction or pursing ATTAIN or other grant funding opportunities for projects which prepare the region's roadways or telecommunications network for wider CAV adoption.

Medium-Term (5-10 Years)

The CAV Plan will be reviewed following its five-year plan period, and if necessary an updated CAV Plan will be produced. By 2035 it is expected that approximately 4 percent of the new cars sold in the United States will have Level 3 self-driving capabilities,[vi] and therefore it is likely that Level 3-capable vehicles will be present on the Rockford Region's roadways. When mixed with the existing legacy vehicles and CAVs with lower levels of automation already in circulation, this will amount to a very small number of Level 3 vehicles on the road; however, the change will be significant and is likely to inform the public perception of self-driving cars. The transportation planning response to this is likely to be the formalization of policies relating to CAVs and more regular and widespread infrastructure improvements.

Long-Term (10+ Years)

It is very difficult to predict how CAV technology will look in the long term, although it remains possible that fully self-driving vehicles (Levels 4-5) will be produced for the consumer market within the next few decades. Similarly, it is difficult to envisage what kind of transportation planning response this might require, but if the technological optimists are correct and the higher levels of automation become widespread, transportation planning in the Rockford Region might involve the full rollout of a comprehensive intelligent transportation system (ITS), with significant reductions in traffic accidents and congestion as a result. On the other hand, if the technology fails to advance or is unaffordable for the average American, the region may see Levels 4-5 CAVs using the roadway as rare curiosities, similar to high-end sports cars today, with legacy vehicles and CAVs with lower levels of automation remaining dominant. Such an eventuality would require a much lower level of input from a transportation planning perspective. Consistent monitoring of the development of CAV technology and its progress and adoption will allow the Rockford Region to be prepared for and respond to either eventuality.

Agency Responsibilities

As the Metropolitan Planning Organization (MPO) for the Rockford Region, R1 is responsible for long-range transportation planning and considering transportation alternatives and emerging technologies, and it is therefore the responsibility of R1 to take the lead on CAV planning in Rockford in the short term. Developing this CAV Plan will be a catalyst for bringing other local agencies into the CAV planning process, particularly Part 2 of the Plan, which will involve stakeholder engagement with local transportation agencies. Should CAVs become more widely adopted in the long term, it is expected that much of the responsibility for CAV planning will shift towards local and state road authorities, such as city public works departments, county highway departments, and state departments of transportation (DOTs). In the meantime, however, CAV planning will largely be carried out by R1 staff in collaboration with local transportation agencies and the public of the Rockford Region. In addition, there is a role for the private sector, particularly CAV manufacturers and operators, to play in ensuring the region is adequately prepared for the introduction of vehicles capable of higher levels of automation. R1 will engage with any companies seeking to introduce vehicles with Level 3 automation or above into the Rockford Region whether for pilot project, private sale, or commercial use.

Funding Opportunities

The main funding opportunity for which Part 2 of the CAV Plan will seek to identify candidate projects is the Federal Highway Administration's (FHWA) Advanced Transportation Technologies and Innovation (ATTAIN) grant. This program is currently supported under the Infrastructure Investment and Jobs Act (IIJA), which was due to expire on the 30th of September 2026, although this has been extended until December 11th. It should be noted that reauthorization may result in changes to funding programs, funding levels, and project requirements. During the period of the IIJA (2022-2026), the ATTAIN grant provided $60 million per year to projects which deploy, install, or operate advanced technologies to improve safety, mobility, efficiency, system performance, intermodal connectivity, and infrastructure return on investment.[vii] ATTAIN funding is allocated to between five and 10 projects per year and can cover up to 80 percent of the total project cost. Part 2 of the CAV Plan should identify projects proposed by regional partners which may be eligible for ATTAIN funding, as well as consider if any new projects could be sponsored by R1 to help prepare the Rockford Region for CAVs. Full details of the ATTAIN funding program are included in Appendix C.

Appendix A: Acronyms and Glossary

Acronyms & Abbreviations

#

5G: 5th Generation (of wireless cellular technology)

A

AASHTO: American Association of State Highway and Transportation Officials

ACS: American Community Survey

ADAS: Advanced Driver Assistance Systems

ADS: Automated Driving Systems

AEB: Automatic Emergency Braking

AI: Artificial Intelligence

ATTAIN: Advanced Transportation Technologies and Innovation

AV: Autonomous (or Automated) Vehicle

C

CAV: Connected and Autonomous Vehicle

CCTA: Contra Costa Transportation Authority

CV: Connected Vehicle

D

DDI: Diverging Diamond Interchanges

DLT: Displaced Left Turn

DOT: Department of Transportation

DSAE: Denoising Shrinkage Autoencoder

DSRC: Dedicated Short-Range Communications

E

EV: Electric Vehicle

EVP: Emergency Vehicle Preemption

F

FCC: Federal Communications Commission

FCW: Forward Collision Warning

FHWA: Federal Highway Admiration

FMVSS: Federal Motor Vehicle Safety Standards

FSD: Full Self-Driving

FSP: Freight Signal Priority

FTA: Federal Transit Authority

FY: Fiscal Year

G

GIS: Geographic Information Systems

GPS: Global Positioning System

I

IDOT: Illinois Department of Transportation

IIJA: Infrastructure Investment and Jobs Act

ISO: International Organization for Standardization

ITS: Intelligent Transportation Systems

L

LRTP: Long-Range Transportation Plan

M

MDOT: Michigan Department of Transportation

MPA: Metropolitan Planning Area

MPO: Metropolitan Planning Organization

MTC: Metropolitan Transportation Commission

MUTCD: Manual on Uniform Traffic Control Devices for Streets and Highways

N

NRSS: National Roadway Safety Strategy

NTCIP: National Transportation Communications for Intelligent Transportation

O

OBU: On-Board Unit

ODD: Operational Design Domains

OPA: Other Principal Arterial

P

P3: Public-Private Partnership

PAEB: Pedestrian Automatic Emergency Braking

R

R1: Region 1 Planning Council

RCI: Reduced Conflict Intersection

RSU: Roadside Unit

S

SAE: Society of Automotive Engineers

SPaT: Signal Phase and Timing

SPF: State Planning Fund

T

TPM: Transportation Performance Management

TSP: Transit Signal Priority

U

U.S. DOT: United States Department of Transportation

V

V2I: Vehicle-to-Infrastructure

V2P: Vehicle-to-Pedestrian

V2V: Vehicle-to-Vehicle

V2X: Vehicle-to-Everything

VMT: Vehicle Miles Traveled

Glossary of Terms

A

Advanced Driver Assistance Systems (ADAS): Provide assistance with acceleration/braking and steering at the same time.

Automated Driving Systems (ADS): Allow the driver to cede vehicle operation in specific scenarios.

ATTAIN Grant: The ATTAIN program provides competitive grants to deploy, install and operate advanced transportation technologies to improve safety, mobility, efficiency, system performance, and intermodal connectivity and infrastructure return of investment.

Autonomous (or Automated) Vehicle (AV): A vehicle where some or all functions are undertaken without direct input from the driver.

C

CAV Plan: The Connected and Autonomous Vehicle Plan for the Rockford Region comprising of Part 1: CAV Guidance (this document) and Part 2: CAV Readiness Assessment.

Connected and Autonomous Vehicle (CAV): A Vehicle which utilizes wireless technologies to communicate with other vehicles, with infrastructure and with mobile devices and where some or all functions are undertaken without direct input from the driver.

Connected Vehicle: A vehicle which utilizes wireless technologies to communicate with other vehicles, with infrastructure and with mobile devices.

D

Dedicated Short-Range Communications (DSRC): A wireless communications technology which was specifically designed to allow vehicles to interact with other vehicles and infrastructure to facilitate ITS. Operates in the 5.9GHz band and is facilitated by OBU and RSU transceivers.

Denoising Shrinkage Autoencoder (DSAE): A piece of technology designed detect anomalies and faults with CAV sensors.

E

Electric Vehicle (EV): A vehicle which is operated by a chargeable electric battery rather than by a combustion engine.

F

Federal Motor Vehicle Safety Standards (FMVSS): Are the official design standards created by the Federal Government to regulate the safety, performance and quality of new motor vehicle and equipment produced in the United States.

Full Self-Driving (FSD): Tesla's bespoke SAE L2 driver assistance system.

G

Geofenced: A virtual geographic boundary has been created outside of which the CAV cannot operate.

H

Highly Automated Vehicle (HAV): A vehicle which achieves SAE L4 or 5.

I

Intelligent Transportation Systems (ITS): A framework which utilizes a suite of technologies to help to manage the transportation network.

L

Legacy Vehicles: Traditional automobiles which require human drivers to perform all actions necessary to control the vehicle.

M

Metropolitan Planning Area (MPA): Determined between the MPO and Governor. At a minimum it must include the urban area boundary (UAB) plus the contiguous area expected to become urbanized within the next 20 years. This is the MPO's boundary.

Metropolitan Planning Organization (MPO): The forum for cooperative transportation decision making for the metropolitan planning area (MPA). Any urbanized area over 50,000 in population is required to create an MPO.

Modal Shift: A transition from one dominant mode of transportation to another.

O

Operational Design Domains (ODD): Defines the scenario in which a CAV can operate automatically. The criteria generally include geographical area, weather conditions, and road and traffic types.

On-Board Unit (OBU): A wireless device on a connected vehicle which facilitates connection with infrastructure and other vehicles and devices.

P

Plan Period: The approximately five-year period that the CAV Plan will be the adopted CAV policy of R1 and the Rockford MPA (2026-2031).

Platooning: Truck platooning is when two or more trucks align speed, acceleration, and braking using CAV technology while drivers steer and intervene when needed.

R

Roadside Unit (RBU): A wireless device which is installed on physical traffic infrastructure to allow for real-time monitoring, traffic management and enforcement.

Robotaxi: A driverless taxi or ride share vehicle (see Shared Autonomous Vehicle).

Rockford Region: The Rockford metropolitan area, i.e., the MPA.

S

SAE International: A professional body which sets standards for automobile engineering. In this document, "SAE" is used to refer to the set of standards which they developed to categorize the levels of vehicle automation.

Secure-By-Design: An approach which builds resiliency and security into a given system.

Shared Autonomous Vehicle (SAV): A driverless vehicle taxi, ride share vehicle or bus (see Robotaxi).

Signal Phase and Timing (SPaT): A function of ITS which coordinates and manages traffic signals at intersections and ensure their timing is properly synchronized along a corridor. In this document it refers to the "SPaT Challenge," where the American Association of State Highway and Transportation Officials (AASHTO) challenged state and local transportation bodies to deploy ITS infrastructure to synchronize the signals along one corridor within their region.

T

Technology-Neutral Approach: A governance approach which does not favor or promote one technology over another, i.e., allowing the market to decide which transportation technology is the most efficient.

V

Vehicle-to-Infrastructure (V2I): V2I technology allows vehicles to communicate with traffic infrastructure such as traffic signals, cameras, road signage, and parking meters.

Vehicle-to-Pedestrian (V2P): V2P technology makes connected vehicles aware of pedestrians and cyclists by connecting with their mobile device.

Vehicle-to-Vehicle (V2V): V2V technology allows vehicles to communicate with other vehicles. Such connected vehicles can share real-time information such as position on the roadway, speed, and braking status in order to improve the flow and traffic and reduce the risk of collision.

Vehicle-to-Everything (V2X): V2X is a vehicle capable of V2I, V2P, and V2V.

Appendix B: Action Plan

Table B-1: Action Plan

Strategy 1: CAV Awareness

Action	Delivery Partners	Timeline	Outcome
1.1: Part 1. of CAV Plan reviewed and adopted by R1 MPO Technical and Policy Committees	R1 staff, R1 MPO Technical Committee, MPO Policy Committee	Fall 2026	Transportation professionals in Rockford MPO made aware of CAV Plan. Part 1. of the CAV plan is made available for public viewing on the R1 website.
1.2: Stakeholder Engagement for Part 2 of CAV Plan	R1 staff, Local Transportation Agencies	Winter 2026-Summer 2027	Transportation professionals in Rockford MPO give input on existing levels of CAV knowledge and capacity within the region.
1.3: R1 to identify CAV training opportunities	R1 staff, Local Transportation Agencies	Winter 2026	A list of online or in-person CAV training events is made available to R1 staff and MPO tech committee members.
1.4: R1 Present Part 1 of CAV Plan to the Community Advisory Forum (CAF)	R1 staff, community groups	Fall 2026	The local community in Rockford is made aware of CAV Plan, and introduced to the concept of CAVs.
1.5: Alternative Transportation Selection Committee consulted during Stakeholder Engagement for Part 2 of CAV Plan	R1 staff, Local Transportation Agencies	Summer 2027	ATSC representing Rockford Region transportation professionals and agencies provide input into the CAV plan.
1.6: CAF consulted during Stakeholder Engagement for Part 2 of CAV Plan	R1 staff, community groups	Summer 2027	CAF representing the Rockford public provide input into the CAV plan.
1.7: Public comments solicited for Part 2 of CAV Plan- create Engage R1 page	R1 staff, the general public	Spring-Summer 2027	Public provide feedback and input on the CAV Plan.
1.8: Part 2 of CAV Plan adopted and published	R1 staff	Fall 2027	Part 2. of the CAV plan is made available for public viewing on the R1 website.

Strategy 2: Policy Framework

Action	Delivery Partners	Timeline	Outcome
2.1: Review local road design standards to ensure CAV compatibility	R1 Staff, Local Transportation Agencies	Fall 2027 onwards	Improvements to Road Design Standards for CAV compatibility identified.
2.2: Comprehensive Plans to align with CAV Plan	R1 Staff, Local Transportation Agencies, Local Planning Departments	Fall 2027 onwards	New or revised Comprehensive Plans within the Rockford MPA to align with and reference CAV Plan where necessary.
2.3: Engagement with state and national CAV Planning efforts	R1 staff, State Representatives, IDOT, U.S. DOT	Ongoing	R1 staff to monitor state and local CAV planning efforts and to engage to ensure that the interests of the Rockford region are reflected in any new policy.
2.4: Monitoring of national and state legal precedent relating to CAV usage on public roads	R1 staff	Ongoing	R1 staff to update CAV Plan in light of developing legal framework regarding CAV usage.
2.5: CAV Plan review	R1 staff	Fall 2031	R1 staff to review CAV Plan to determine whether plan update or new CAV Plan is required.
2.6: Include CAV provisions in next Metropolitan Transportation Plan (MTP)	R1 Staff	Circa 2030	Next MTP to plan for higher CAV usage on the regions roadways.
2.7: Update Planning tools to be cognizant of CAVs	R1 Staff	Fall 2027 Onwards	Travel Demand Modelling for the Rockford Region should consider the impacts of CAVs.

Strategy 3: Roadway Infrastructure Improvements

Action	Delivery Partners	Timeline	Outcome
3.1: Carry out CAV Readiness Assessment	R1 Staff	Fall 2026-Fall 2027	CAV Readiness Assessment will show how prepared the regions roadways are for CAVs and recommend targeted projects to improve readiness.
3.2: R1 to work with Local Transportation professional's to identify projects which may be eligible for grant funding (ATTAIN)	R1 staff, Local Transportation Agencies	Fall 2027 onwards	A list of projects eligible for ATTAIN grant funding or any other CAV related funding identified by R1 is produced. R1 applies for grant funding for a CAV readiness project.
3.3: Implement CAV readiness project(s)	R1 staff, Local Transportation Agencies	Fall 2027 onwards	Improvements to specific roadways within the MPA to make more suitable for CAV usage.
3.4: Use CAV Plan as guidance for roadway improvements not directly related to CAVs	Local Transportation Agencies	Summer 2026 onwards	Design of new roadway projects in the region to consider CAVs.
3.5: Monitor additional funding opportunities for CAV readiness projects	R1 staff	Ongoing	Potential capacity to finance additional CAV readiness projects in the future.
3.6: Develop a maintenance approach to existing roadway infrastructure to improve their suitability for CAVs, in particular road markings	R1 staff, Local Transportation Agencies, IDOT	Fall 2027 onwards	Improved maintenance of existing roadway infrastructure and markings.

Strategy 4: Communications Infrastructure Improvements

Action	Delivery Partners	Timeline	Outcome
4.1: Carry out a full assessment of the wireless coverage along the regions roadways	R1 staff	Fall 2027 onwards	Gaps in coverage identified.
4.2: Work with telecommunications network providers to improve coverage	R1 Staff, Local Transportation Agencies, Local Planning Departments, Telecommunications Providers	Ongoing	Network coverage for various wireless communications improved.
4.3: Carry out a review of existing RSU locations within the MPA and map	R1 Staff, Local Transportation Agencies	Fall 2027 onwards	A resource created to allow for targeted placement of additional RSUs to create joined up corridors which may be suitable for CAV pilot projects.
4.4: Identify opportunities for the installation of RSUs	R1 Staff, Local Transportation Agencies	Ongoing	Traffic infrastructure can communicate with V2I enabled CAVs.
4.5: Monitor development of next generation of wireless technology (e.g. 6G) and bespoke CAV communication tech (e.g. DSCR)	R1 Staff	Ongoing	R1 has increased capacity to plan for and advise local strategy on future advanced communications rollouts.

Strategy 5: Fleet Upgrades

Action	Delivery Partners	Timeline	Outcome
5.1: Work with local transit Providers to consider if and how CAVs might be used in the regions public transport fleet	R1 staff, Local Transit Providers	Fall 2027 onwards	Opportunities for improved transit reliability considered.
5.2: Assess potential intersections to be upgraded to include EVP systems	R1 staff, Local Transportation Agencies	Fall 2027 onwards	Faster emergency vehicle response times, lower risk of collision.
5.3: Liaise with CAV ride-share and delivery service providers to identify opportunities for pilot rollout in Rockford region	R1 staff, CAV Manufacturers	Fall 2027 onwards	Potential limited introduction of L3+ CAVs onto the regions roadways. Will allow for direct monitoring of impacts.
5.4: Liaise with freight operators to identify opportunities for pilot rollout in Rockford region	R1 staff, Freight Operators	Fall 2027 onwards	Potential for the identification or a freight route to be upgraded for use as a pilot corridor for autonomous trucks.

Appendix C: ATTAIN Funding Information

Eligibility Information

Eligible applicants for ATTAIN Competitive Grant Program funds are:

- State or local governments;
- Transit agencies;
- Metropolitan planning organizations;
- Other political subdivisions of a State or local government (such as publicly owned toll or port authorities);
- Multijurisdictional groups; or
- Consortiums of research institutions or academic institutions

A grant recipient may use funds awarded under this program to deploy advanced transportation and congestion management technologies, including:

I. Advanced traveler information systems;

II. Advanced transportation management technologies;

III. Advanced transportation technologies to improve emergency evacuation and response by federal, state, and local authorities;

IV. Infrastructure maintenance, monitoring, and condition assessment;

V. Advanced public transportation systems;

VI. Transportation system performance data collection, analysis, and dissemination systems;

VII. Advanced safety systems, including vehicle-to-vehicle and vehicle-to-infrastructure communications, technologies associated with autonomous vehicles, and other collision avoidance technologies, including systems using cellular technology;

VIII. Integration of intelligent transportation systems with the smart grid and other energy distribution and charging systems;

IX. Integrated corridor management systems;

X. Advanced parking reservation or variable pricing systems;

XI. Electronic pricing, toll collection, and payment systems;

XII. Technology that enhances high occupancy vehicle toll lanes, cordon pricing, or congestion pricing;

XIII. Integration of transportation service payment systems;

XIV. Advanced mobility, access, and on-demand transportation service technologies, such as dynamic ridesharing and other shared-use mobility applications and information systems to support human services for elderly and disabled individuals;

XV. Retrofitting dedicated short-range communications technology deployed as part of an existing pilot program to cellular vehicle-to-everything technology, subject to the condition that the retrofitted technology operates only within the existing spectrum allocations for connected vehicle systems; or advanced transportation technologies, in accordance with the research areas described in section 6503 of Title 49.

Funding Information

This NOFO will award up to $120 million, $60 million for Fiscal Years (FYs) 2025 and 2026.

The actual amount available to be awarded under this notice will be subject to the availability of funds.

There is no minimum award for the ATTAIN Competitive Grant Program awards. The maximum amount awarded to a single recipient is limited to $12 million per FY that funds have been made available (23 United States Code (U.S.C.) 503(c)(4)(K)).

Source: U.S Department of Transportation, https://www.transportation.gov/rural/grant-toolkit/advanced-transportation-technology-and-innovation-attain

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