

Chapter 8 Emerging Trends

In order to plan effectively in 2023, it is important to discuss emerging transportation technologies such as electric vehicles (EV) and autonomous vehicle (AV) technology. Every year, EV technology assimilates more into society, as exemplified with the many new public EV charging stations located throughout Carroll County (County), from Mount Airy to Hampstead, and with the many new EV models being offered by vehicle manufacturers. Increasing EV production and utilization can be attributed to advancements in battery technology, increased federal and state monetary incentives, along with increasing public sentiment for a more sustainable future. AV technology is currently emerging in a society that will bring about positive changes and uncertainties. In the County, AV development is being spearheaded by the Mid-Atlantic Gigabit Innovation Collaboratory, Inc. or MAGIC, leading the charge with building an autonomous corridor in the City of Westminster, that connects institutions of higher education and retail centers with downtown.

Carroll County Master Plan, as amended in 2019 (Master Plan)

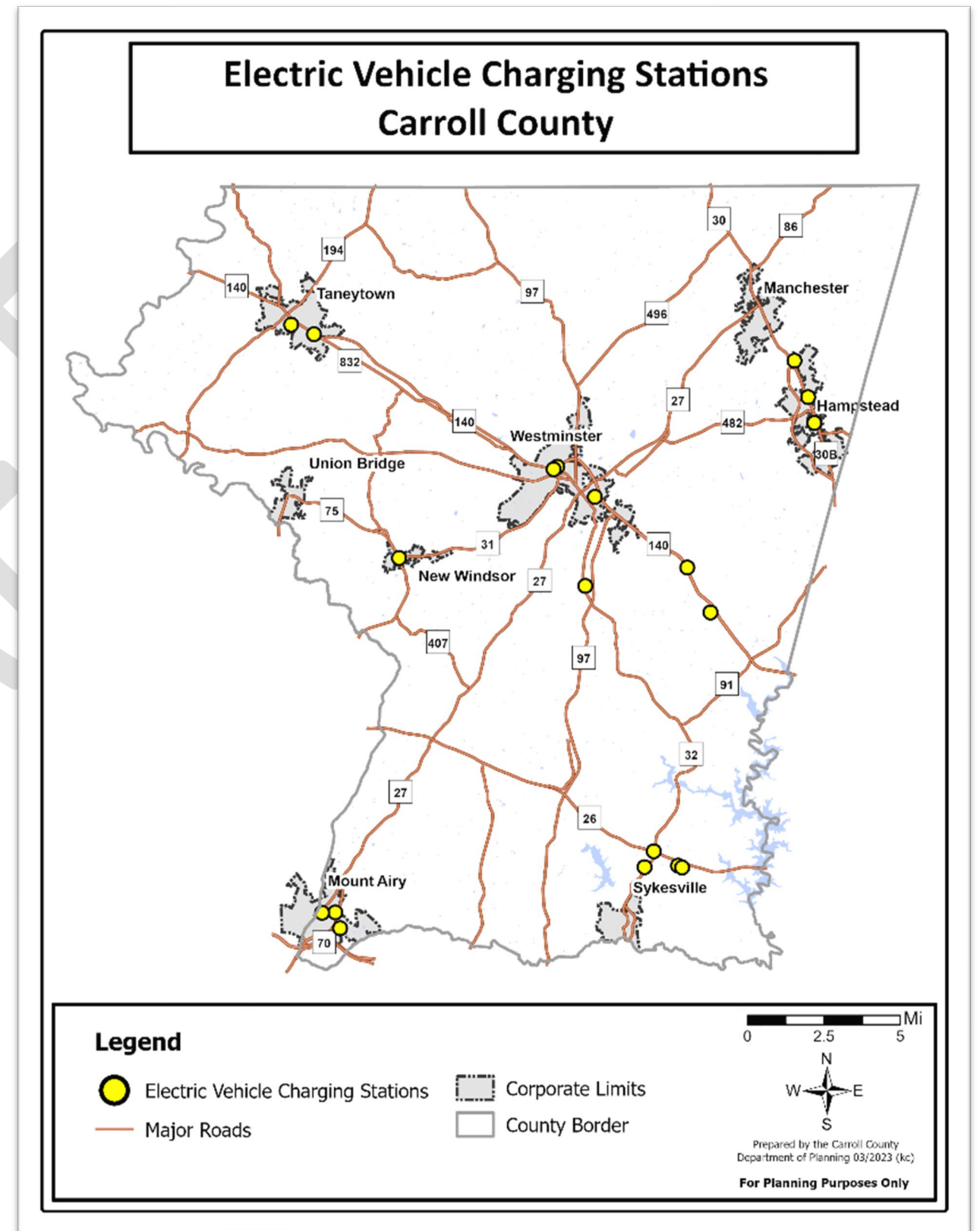
The Master Plan references emerging transportation trends in Appendix A: Implementation Strategies, Chapter 7, P., that states, “Encourage the use of alternative transportation, such as bicycles, transit, and carpools, to improve air quality by reducing the number of vehicles on the road during the week” [Emphasis added].¹ EV and AV technology may not reduce the number of vehicles on Carroll’s roadways, but EV and AV technology will improve air quality from the reduction of burning oil as explained more in detail below. It should be noted for the purposes of this plan, AV’s are assumed to incorporate EV technology.

Electric Vehicles (EVs)

The most extensive trend in the transportation world today is the transition from vehicles powered by the internal combustion engine (ICE) to vehicles powered by electric motors, for the following reasons:

1. **Sustainability:** In a more sustainably conscious world that currently relies on oil, consumers are starting to consider transitioning away from the ICE. According to the United States Environmental Protection Agency, “transportation

Right photo: EV Charging Stations in Carroll County Map



¹ 2014 Carroll County Master Plan. (2023). Retrieved April 14, 2023

accounted for the largest portion (27%) of total U.S. Greenhouse Gas (GHG) emissions in 2020”.² Reducing dependence on the ICE alone can dramatically reduce GHG emissions since, according to the U.S Department of Energy, only about 12 to 30 percent of energy generated in ICE vehicles are used to power the vehicle as compared to 77+ percent of energy generated in EVs.³

2. Federal and state incentives: In 2021 and 2022, federal legislation allocated up to \$9.2 billion in EV incentives including, \$5 billion “focusing on adding public charging stations in underserved communities and along highways”.⁴

Transitioning from ICE to EVs requires adapting our lifestyles and the way we plan the County. Range anxiety is a concern stemming from fewer charging stations in the County as compared to gas stations. For instance, according to current County Geographic Information Systems (GIS) data, there are 19 EV charging stations located throughout the County, as shown in the EV Charging Stations in Carroll County Map. For a geographic comparison, in the North Carroll area of Hampstead and Manchester, there are three EV charging stations as compared to seven gas stations. Two of the three EV charging stations are located on public property. The County must ensure that both private and public sectors provide an adequate supply of EV charging infrastructure not only for our resident population who owns and will soon own an EV but also for visitors that own an EV so they can easily patronize local businesses within the County. In 2023, the Maryland General Assembly voted to require all new single-family dwellings and townhomes to be EV equipped by requiring a dedicated circuit for charging, so when this technology becomes more common, it will be easier and cheaper for residents to adapt. Additionally, the Governor announced a plan ending the sale of ICE vehicles in Maryland by 2035.⁵ EV charging infrastructure, that we must adequately plan for, can be defined into three different levels: ⁴

1. Level One – Uses a standard 120-volt power outlet and usually takes eight to 12 hours to fully charge an EV. This is most typical for home charging without any special charging equipment.
2. Level Two – Uses a 240-volt power outlet that will typically charge an EV in four to eight hours. This is most typical for home charging that uses special charging equipment.
3. Level Three – Uses 480-volt power outlet that can fully charge an EV in about 30 minutes.

Special Considerations:

For residents that have a private driveway/garage, home charging, especially while asleep, is feasible and thus adapting to EV charging technology is easier than for those who do not, and whom will have to rely more heavily on publicly accessible charging stations. Such publicly accessible charging stations will have to be planned and installed in the most equitable way possible so all County residents will be able to charge their EVs. To ensure equity, special attention should be sought to prevent “charging deserts” or areas that are often defined as beyond a ten-minute walk from an EV charging station.⁴ Some jurisdictions within the United States have tried to solve issues with charging station accessibility by incorporating EV charging stations into light posts ([Los Angeles](#)). Additionally, from a business perspective, EV charging infrastructure conveniently located adjacent to retail and businesses should be explored so customers can charge their vehicle while they shop. Industrial developments will inevitably need to retrofit and plan for *Level Three* charging infrastructure that can fully charge a large EV (such as a semi-truck or construction equipment) fast for industrial use. For any EV charging location utilizing on-street parking, an accessible location should be utilized, with two-hour time limits, so everyone can equally share. The County may wish to assess whether design guideless should be implemented for EV charging stations, so developers and the public alike have clear and accessible standards when considering infrastructure installation. As EV technology continues to evolve, quality of life will only be sustained by adapting to new forms of transportation technology by adequately planning for its associated infrastructure.

Autonomous Vehicles (AVs)

² United States Environmental Protection Agency. (2022, July 14). Fast Facts on Transportation Greenhouse Gas Emissions. EPA. Retrieved March 27, 2023, from <https://www.epa.gov/greenvehicles/fast-facts-transportation-greenhouse-gas-emissions>

³ U.S. Department of Energy. Where the energy goes: Gasoline vehicles. www.fueleconomy.gov - the official government source for fuel economy information. Retrieved March 27, 2023, from <https://www.fueleconomy.gov/feg/atv.shtml>

⁴ Lubinsky, A. (2023, March 1). Planning for on-street EV charging infrastructure. American Planning Association. Retrieved March 27, 2023, from <https://www.planning.org/publications/document/9266315/>

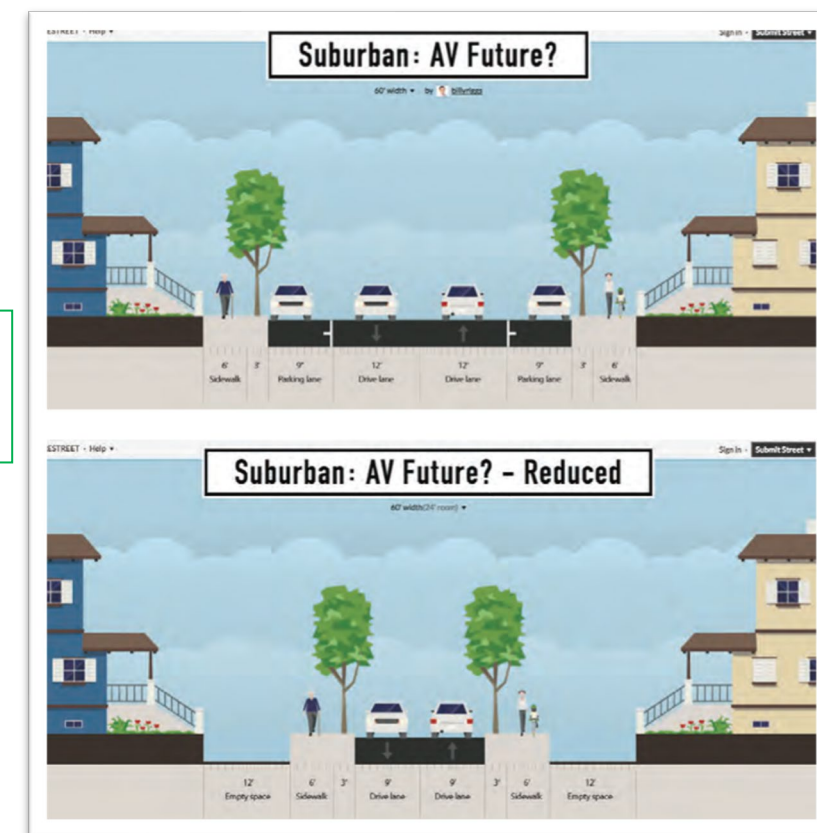
⁵ CBS Baltimore Staff. (2023). Gov. Wes Moore announces 12-year plan to phase out gas-powered cars. Retrieved April 14, 2023, from <https://www.cbsnews.com/baltimore/news/gov-wes-moore-announces-12-year-plan-to-phase-out-gas-powered-cars/>

AV transportation technology has the potential to drastically shape how we live, work, and play. AVs are in the preliminary stages of testing which means that it is imperative that we strive to make this technology safe and equitable before it is even partially integrated into society. AV technology is poised to have numerous benefits over and above those provided by EVs such as improved safety, supporting aging in-place, reduced transportation costs (if shared), reduced congestion, and reduced right-of-way devoted to transportation. A challenge is incorporating AVs into a society that is currently dominated by human drivers and people who are skeptical about this evolving form of technology. Effectively educating the public along with a clear vision and goals from the County, Regional, State, and Federal Governments will be necessary to fully integrate AVs throughout our evolving and connected society.

To start the conversation on AVs, everyone should know about the different levels of vehicle autonomy. Some of our vehicles are currently equipped with some level of autonomy already. According to the American Planning Association, there are currently five levels of vehicle autonomy, that include⁶:

- Increase in Autonomy ↓
1. "Level One - driver assistance (i.e., adaptive cruise control)"
 2. "Level Two - partial automation (i.e., Tesla's autopilot)"
 3. "Level Three - conditional automation (i.e., human drivers serve as backup for an autonomous system that operates under certain conditions)"
 4. "Level Four - high automation (i.e., Google/Waymo test cars)"
 5. "Level Five - full automation (i.e., no steering wheel in the vehicle)"

Right photo: from app.restreet.com as seen in 7.



What will incorporating AV technology into society physically look like, from a planning perspective, moving forward? Let's examine the positives and uncertainties:

Positive aspects include increases in traffic safety since AVs will be operating without human interference that will also allow narrower right of way widths (because of narrower travel lanes) spurring right-of-way reallocation which can take the form of "enhanced bicycle and pedestrian facilities, and redevelopment that may create excellent opportunities to revitalize urban centers", such as space for green infrastructure, and public gathering places⁷. Of special note is the "increased mobility for special populations" that are unable to operate a motor vehicle would have increased transportation options⁷. In addition to greater right-of-way efficiency, AVs platooning capabilities could enhance the efficiency and effectiveness of travel lanes by as much as 100 percent and increase trucking fuel economy by ten percent⁷. Furthermore, full automation AVs are poised to eliminate distracted human driving which will drastically improve public safety, since, according to research from the American Planning Association "more than 90 percent of traffic crashes are caused by human error"⁷.

Uncertainties related to this technology that must be taken into consideration include fiscal impacts on government revenues. A reduction in traffic violations (caused by human error) reduces citation fees collected, and if AVs become shared, which the American Planning Associations predicts a 43 percent reduction in privately owned automobiles, how will vehicle licensing and parking fees be affected?⁷ Platooning also must be carefully considered since safety challenges could be encountered with human drivers operating around truck platoons.⁷ Crute et al., mentions that restricting "the length of platoons to two to four trucks" may be an option to address safety concerns⁷. According to the Maryland Department of Transportation, two trucks is the current maximum allowed platooning limit in the State.⁸ Additional uncertainties include the "potential to reinforce auto-oriented sprawl" and the increase in VMT⁷. More research must be conducted at the Federal, State, Regional, and County levels to address these and other uncertainties.

To help local governments assimilate to this new form of transportation technology and assist in quelling any uncertainties, the Baltimore Metropolitan Council (BMC), Carroll County's Regional government transportation agency, has created a Connected and Autonomous Vehicles working group (CAV). County Planning Department Staff are members of the (CAV) and provide professional planning insight on how CAVs will affect the County. The CAV Work Group has outlined ten topics where action should be focused preparing for CAV impacts, including: 1). Travel & Mobility, 2). Infrastructure, 3). Planning and Land Use, 4). Accessibility & Equity, 5). Stakeholders and Organizational Readiness, 6). Workforce & Education, 7). Funding, Financing, and Fiscal Health, 8). Automated Freight and Goods Delivery, 9). Public Safety, and 10). Data Privacy and Security. Local governments can utilize this information to draft and adopt policies that will effectively incorporate CAVs into our region and society.

Shared Use AV:

According to Crute et al., "many researchers have predicted that the three revolutions in urban transportation will be the automation, electrification, and sharing of the transportation system".⁷ Therefore, special attention should focus on rethinking parking requirements since not as many vehicles will be privately owned and will not require as much available parking infrastructure. The reduction in parking infrastructure, that typically consumes much of the developable property on a buildable lot, will make our cities and towns more compact and will be more consistent with Smart Growth principles. Therefore, parking ordinances should be reviewed to make sure the right amount

⁶ American Planning Association. Autonomous vehicles. American Planning Association - Autonomous Vehicles. Retrieved April 10, 2023, from <https://www.planning.org/knowledgebase/autonomousvehicles/>
⁷ Crute, J., Riggs, W., Chapin, T. S., & Stevens, L. (2018). (rep.). Planning for Autonomous Mobility. American Planning Association. Retrieved April 11, 2023, from <https://www.planning.org/publications/report/9157605/>.
⁸ Maryland Department of Transportation. Maryland's Connected and Automated Vehicle Program: Platooning in Maryland. Retrieved April 11, 2023, from <https://cav.mdot.maryland.gov/platooning/#:~:text=What%20is%20Platooning%3F,braking%2C%20speed%2C%20and%20oncoming%20obstacles>

of parking that is demanded will be equitably supplied and located. Shared use AVs will require loading and unloading locations both on and off the public street which should be properly delineated. Additionally, increased amounts of data collected and used during any AV commute will need to be linked to the grid. This data connectivity will need adequate communications infrastructure to interface with and may thus require communications investments all throughout the County. A major concern for local governments is what will happen to current funding sources if/when shared AVs are implemented (i.e., further reduction in vehicle registration, sales taxes, parking revenue, and traffic fines)?

Other Transportation Considerations



Left photo:
from 9

Future transportation considerations should focus on delivery robots and their impact on the County's transportation infrastructure. With the rise of e-commerce and the ever-increasing demand for expedited shipment of goods, companies have turned to new forms of technology to fill this evolving expectation. According to an article in *Planning*, local transportation plans should consider "allowable travelways" where delivery robots can operate with an added consideration on "sidewalk maintenance roles and responsibilities".⁹ How will these types of robots operate on County sidewalks within dense urban areas? Any type of regulations would have to be discussed in a joint meeting with the County's eight municipalities since municipal boundary lines are not uniform and developed areas contain land both inside and outside the municipality. Delivery robots do not seem as feasible on rural roads with high speeds that make up most of the geographic land in the County, but delivery robots may find a useful place in and around our municipalities.

From ground transportation we move to air transportation and to the safe and equitable use of unmanned aerial vehicles (UAV) that are sometimes called drones and are being explored to transport lightweight packages, medical supplies, food and other goods. Currently, companies in the U.S. and worldwide are actively vying to define their markets and begin operations. This newer mode of transportation has the potential to change last-mile delivery economics for smaller and lighter packages by replacing deliveries currently made by traditional car, van, or truck delivery services. Potential benefits of UAV delivery include reductions in traffic congestion, environmental pollution, delivery times and transportation costs. There are, however, significant challenges to broader overall usage and acceptance of drone delivery systems. Their use in the region for such purposes is expected to be limited throughout the planning period. While broader usage of UAVs or drones for delivery remains a challenge, MDOT currently uses drones in a variety of ways. Current uses of drones by MDOT include assessing damage to the transportation network, conducting stormwater facility inspections, tracking construction projects, assessing utilization of Park-and-Rides and viewing geohazards such as sinkholes. Moving forward, we must prioritize safety, security, privacy, noise, and coordinate with the Federal Aviation Administration and "utilities and existing infrastructure" operators, while developing no-fly zones, "urban flight corridors", etc.⁹

Advanced Air Mobility (AAM) may be closer to reality than we all think! According to an article by Johamary Pena, AICP, NASA cites that, "advanced air mobility (AAM), or the use of automated transportation technology to transport people and cargo at lower altitudes in places not traditionally served by aviation, is likely to be a commercially viable transportation option."¹⁰ AAM is foreseen to utilize docking stations, that would need to be equitably dispersed throughout the County, for vehicle charging and communications, with access to unobstructed flight paths. County land use regulations will need to properly regulate incompatible adjacent land uses to not affect the safe and efficient functioning of this new form of transportation technology. According to a report by the American Planning Association, benefits of AAM include reductions in 1). travel time, 2). increased direct travel routes, 3). less roadway congestion, and 4). reductions in parking demand.¹¹ On the contrary, future regulations must address 1). noise pollution and 2). congested skies.¹¹ In the future people may wish to utilize this type of transportation to avoid traffic delays on Carroll's and/or other jurisdictions more congested roadways. Additionally, emergency and medical services may wish to utilize this type of transportation to transport people to hospitals in a more effective and efficient manner. However, we must strive to make sure this new form of technology will not affect others' lives in an adverse way. AAM should be on everyone's radar so when this type of transportation becomes reality, we can plan accordingly.

Other noteworthy emerging trends include EV-charging roads, E-Bikes, Cargo Bikes, Micro mobility, and Mobility-as-a-service (MaaS).¹²

Goals

⁹ Nisenson, L. (2020, April). Primed for deliveries. American Planning Association. Retrieved April 11, 2023, from <https://www.planning.org/planning/2020/apr/primed-for-deliveries/>

¹⁰ Pena, J. (2021, January 1). Flying taxis are coming and communities need to prepare. American Planning Association. Retrieved March 27, 2023, from <https://www.planning.org/planning/2021/winter/flying-taxis-are-on-the-horizon/>

¹¹ Gomez, A. (2021). Urban Air Mobility. Retrieved March 27, 2023, from <https://www.planning.org/publications/document/9211442/>

¹² Hurtado, P., Shah, S., DeAngelis, J., & Gomez, A. (2023, January 24). 2023 Trend Report for Planners. American Planning Association. Retrieved April 11, 2023, from <https://www.planning.org/publications/document/9263250/>

Goal 1 – Provide assessable and equitable locations for EV charging infrastructure throughout the County:

- Review and compare data to understand where EV charging infrastructure would most effectively and equitably be located, taking into consideration areas with lower income populations, to prioritize.
- Review concentrations of existing commercial and industrial areas to determine optimum EV charging locations.
- Consider creating design guidelines that depict how charging infrastructure should be located and designed.
- Consider instituting two-hour time limits at public charging infrastructure that is equitably accessible.
- Review current laws to streamline permit approval for residential properties, for Level Two chargers, to comply with the newly adopted state law.
- Consider requirements for Level Two charging infrastructure in all new development.

Goal 2 – Educate the Public about EV, AV, and other new forms of transportation technology:

- Provide educational information to students in public schools and colleges.
- Provide demonstration seminars during highly attended community events.
- Provide information on the County website.

Goal 3 – Collect feedback of how to best incorporate new technology on Carroll’s roadways:

- Provide a forum where citizens can review the overall vision/goals for future transportation technology in the County.
- Continuously collect feedback to evaluate policies, such as reducing parking standards.
- Maintain any transportation information in the most secure way possible.

Goal 4 – Coordinate with Federal, State, Regional, and Local Agencies to implement EV and AV technology:

- Continue to collaborate with State and Regional Agencies about how best to implement EV and AVs.
- Work with State, Regional, County Public Works, and Local Governments to prepare the County’s roadways for AVs.
- Work with MAGIC to help implement the AV corridor.

Right photo:
from 7
(Diagram of
automated
vehicle
technologies)

