CALVERT COUNTY TRANSPORTATION PLAN

TECHNICAL MEMORANDUM #2

Assessing Smart Transportation Technologies and Opportunities for Calvert County

March 2019

SABRA & ASSOCIATES
Engineering Innovative Solutions

Note: This is the second in a series of technical memoranda prepared for the Calvert County Department of Planning & Zoning in developing the Calvert County Transportation Plan. The purpose of each technical memorandum prepared for is to present facts, analysis, ideas, issues and recommendations that will inform the plan. The views expressed, and recommendations offered in each memorandum are solely based on the consultant's judgment and should not be considered as endorsed by the Calvert County Department of Planning & Zoning or any other county department or officer.

This memorandum was prepared by Kimley-Horn and Associates, a subconsultant to Sabra and Associates.

Contents

Introduction

As part of developing Calvert 2040, the Calvert County Comprehensive Plan, the Department of Planning & Zoning has initiated an update of the county's transportation plan which was initially written in 1997. The purpose of the transportation plan is to guide the county's future investments in and advocacy for the County's multimodal transportation network. This memorandum surveys the current state of the art in transportation technology, summarize the state of transportation technology in Maryland and surrounding areas, and offers potential strategic goals and opportunities for the future of transportation in Calvert County.

This memorandum focuses on opportunities along MD 2/4 which is the county's transportation spine. While MD 2/4 is owned and operated by the MDOT State Highway Administration, the county can play an important advocacy role to encourage greater use of technology to address traffic congestion and safety. Maintaining a steady and safe flow of traffic (people and goods) through the town centers is critical the county's economic future and quality of life for all residents. Technology solutions may be leveraged to accommodate an increase of trips in the existing transportation network with minimal additional infrastructure; this approach advances the county's goals with respect to environmental protection.

Technology has been long-embraced at the state and local levels in Maryland, although certain corridors have been of greater focus than others. Numerous plans and programs have been established which embrace the approach that technology is one of the strongest tools to manage and mitigate growing traffic congestion. Beyond just roadways and traffic signals, a smart and technology-enabled transportation system requires a network of infrastructure including data collection equipment, communications equipment, data storage, monitoring systems, and dedicated maintenance staff. Together, these assets provide information that can aid in decision making and serve as tools to better manage traffic congestion when it occurs.

Current State of Smart Technology in the Transportation Industry

The transportation industry is currently undergoing a revolution with the integration of technology solutions that address key challenges to safety, mobility, and the environment. Many agencies are finding that there is no longer space to simply increase the capacity of roadways. As a result, technology is being leveraged to move people more efficiently within the available infrastructure. Additionally, the face of transportation is shifting dramatically with the proliferation of connected vehicle (CV) technology, automated vehicles (AV), and shared mobility solutions. While the industry is years away from leveraging this sector of transportation technology to its fullest, laying groundwork now will aid the seamless integration for whatever the future may hold. This section describes the state of the art in intelligent transportation systems (ITS), then describes the existing state and future potential for CV/AV (referred to herein as CAV).

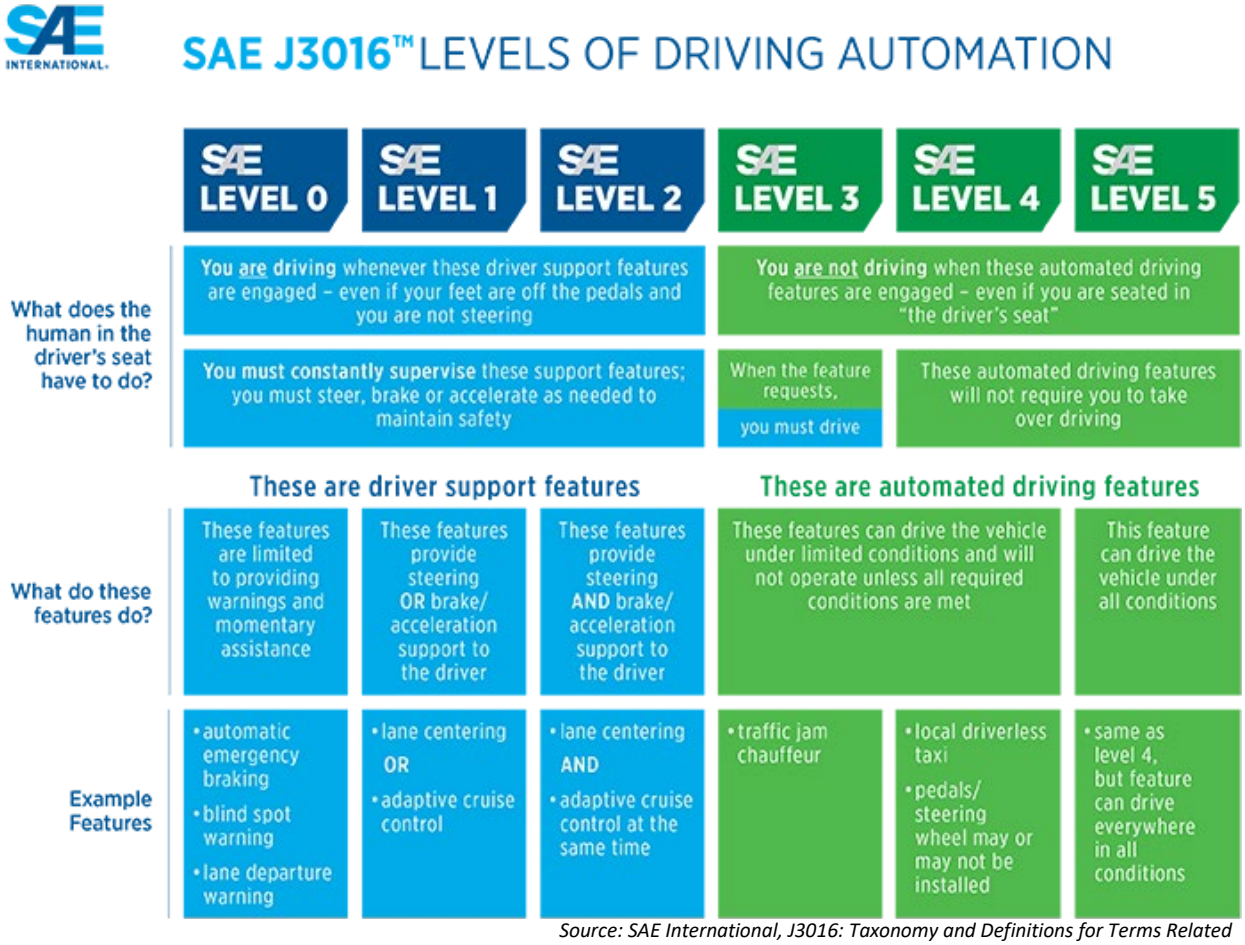
Intelligent Transportation Systems

The US Department of Transportation (USDOT) defines Intelligent Transportation Systems (ITS) as the integration of advanced communications technologies into the transportation infrastructure and in vehicles to enhance safety, mobility, and productivity[1]. ITS encompass a broad range of wireless and wire line communications-based information and electronic technologies. Examples of commonplace ITS applications include active traffic management, traffic data gathering/dissemination, traffic data management, and general data governance.

Connected and Automated Vehicles

Related to ITS is the emerging industry of Connected and Automated Vehicles (CAV). Automation is the use of electronic or mechanical devices to operate one or more functions of a vehicle without direct human input (USDOT). The six widely-accepted levels of driving automation, developed by the Society of Automotive Engineers (SAE), are described below.

[1] United States Department of Transportation, Intelligent Transportation Systems Joint Program Office



Source: SAE International, J3016: Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles, www.sae.org.

While levels of vehicle automation vary greatly, most technologies rely on some degree of digital communication and data exchange. Exchanges may happen between vehicles (vehicle to vehicle, or V2V), between a vehicle and surrounding wayside devices (vehicle to infrastructure, or V2I), or generally between any combination of vehicles and another transmitter/receiver (V2X). This data is useful at many levels of transportation infrastructure, from the control of a single vehicle to the management of an arterial corridor. In the future, this may mean vehicles relaying their positions to one another, transferring vehicle speeds to agency-managed traffic control centers, or identifying potential hazards within the vehicle's travel path. In the current state, much of the CAV technology relies on visual aids, including lane lines and highway signs. For example, a lane deviation warning and correction system must recognize pavement marking in order to determine if the vehicle's position is correct. Thus, prioritizing pavement marking and sign maintenance as well as ensuring clear lines of sight along roadways, are priorities that benefit both the current network and potential CAV integration.

Automation and connectivity has and will continue to have a growing role in the transportation industry. Paramount in this role is the ability for CAV to improve safety of transportation network users, followed by the management of congestion and potential increased capacity of existing infrastructure in the future. However, with the technology still evolving and with limited understanding of what the future

will look like, it is a challenge to assess the impact of CAV technology at this time. Research regarding CAV integration into existing infrastructure is ongoing, and it will continue to change the outlook of the industry.

Shared Mobility

Shared mobility is a growing trend in the transportation industry that describes the transition from single-occupancy, private vehicles to transportation resources and services that are shared among users, either concurrently or one after another (*Shared Use Mobility Center*). Technology has served to revolutionize this concept with mobile applications, data sharing, and communications innovations. Examples of shared mobility include car or bike sharing (such as Zipcar or Capitol Bikeshare), ridesharing (such as Via), Ridehailing or Ridesourcing (such as Uber or Lyft), public transit, or other kinds of transit shuttles.

State of Smart Transportation Technology in Maryland and Surrounding Areas

The state of Maryland is home to many transportation challenges including busy arterial corridors, dense urban cities, and aging critical infrastructure. In order to best manage the state's transportation resources and respond to these challenges, several programs and plans have been established concerning the future of transportation and technology in the state. These efforts are led by the Maryland Department of Transportation (MDOT) and its various business units, including Maryland State Highway Administration (SHA). This section will describe some of these programs and initiatives, including traffic control centers, a statewide congestion management plan, a statewide CAV strategic plan and working group.

Maryland Coordinated Highways Action Response Team

To improve traffic flow around the state, Maryland created the Coordinated Highways Action Response Team (CHART) as one its first ITS initiatives. The primary function of CHART is to maintain the safe and efficient flow of traffic throughout Maryland through the coordination of the Statewide Operations Center (SOC) and surrounding operations centers to monitor and adapt to changing conditions on Maryland Roadways. CHART coordinates a network of field technicians who patrol Maryland's principal arterials to assist in clearing incidents (crashes, debris, severe weather, etc.) and assisting approximately stranded motorists on Maryland roadways. CHART field technicians do not patrol MD 2/4 in Calvert County.

Source: Maryland CHART Traffic Operations Center, https://chart.maryland.gov/about/overview.asp

Smart Signals Program

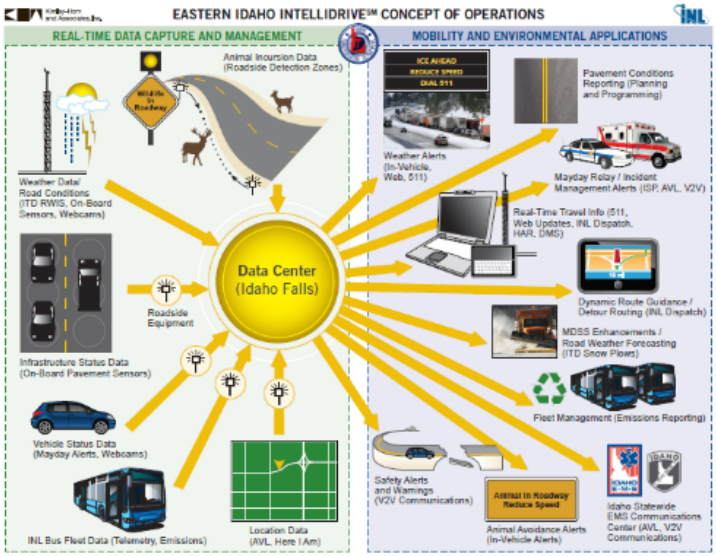
Maryland is executing a multi-phase traffic relief plan that involves a combination of geometric roadway capacity increases and installation of a 'Smart Signal System' on critical corridors throughout the state. These systems use real-time data to dynamically adapt signals to variable traffic demand. Using these systems, roadways that require additional vehicular capacity will receive more time when they need it for throughput, effectively reducing delay experienced system-wide. Neither MD 2 nor MD 4 in Calvert County is included in the Smart Signals program.

Maryland CAV Strategic Plan

MDOT SHA and the Motor Vehicle Administration (MVA) have identified CAVs as a key opportunity to improve traffic operations and safety – as well as the need to prepare Maryland's physical, social and legal infrastructure to accommodate the requirements of CAVs. MDOT's CAV vision is to "Embrace technology and next generation mobility trends to provide safe and reliable travel for people and goods within Maryland." This vision is supported with five goals, as summarized below:

1. Make Maryland an attractive partner for CAV development, testing, and production.
2. Begin deploying CAV technology and engaging in national activities.
3. Establish foundational systems to support future CAV deployment.
4. Enable CAV benefits for MDOT SHA customers.
5. Look for opportunities to leverage CAV technologies to support MDOT SHA business processes and objectives.

The execution of work to achieve these goals has already begun with the identification of key Maryland travel corridors as testing grounds for CAV technology. MDOT is pursuing expanded funding to continue to improve US Route 1 and I-95 in central Maryland by using advanced technology infrastructure deployments in these corridors. MVA is working with automotive automation organizations to identify strategic locations for testing; and is leading the development of new laws and regulations for the deployment of CAVs.



Source: Kimley-Horn and Associates, Tailored Connected Vehicle ConOps for rural issues, 2012

Source: Maryland DOT.

Smart Transportation Technologies used in and near Calvert County

The SHA has implemented several technologies in the areas surrounding Calvert County but has only limited deployments within the county. Currently, MD SHA maintains three video monitoring cameras: MD 260 at Cox Road in Chesapeake Beach, and two at the major bridge crossings of the Patuxent River (MD 4 and MD 231). Further north, MDOT has implemented the Smart Signals on MD 2 approaching Annapolis and dynamic message signs and traffic monitoring cameras along MD 301 through Anne Arundel and Prince George's Counties.

One limitation on MDOT SHA's ability to deploy transportation technology solutions in Calvert County is the limited communications infrastructure such as fiber optic lines which enhance the ability to implement additional video cameras, gather real-time data, operate dynamic message signs and implement real-time traffic signal control. These limitations will become more apparent as the number of connected vehicles using communications devices to convey and share information grows as CAV technology improves and expands. Calvert 2040, Calvert County's comprehensive plan, calls for the continued development of a broadband network for use in a variety of applications. This network could include greater communications capabilities with transportation technology. The plan prioritizes the provision of broadband in Town Centers and villages; as such, this makes these locations candidates for small scale transportation technology pilot projects.

Lastly, the automotive market is continuing to evolve to include electric vehicles (EV) as technology advances. Urbanized areas house most of the EV charging stations, making the use of electric vehicles in rural areas challenging because of the range of vehicles before they need to be charged.

MDOT, through its Electric Vehicle Infrastructure Council (EVIC), has identified electrification opportunities across the state and will continue to determine the needs and opportunities for electrified vehicles in the future.

Opportunities and Recommendations for Calvert County

The Calvert County Transportation Master Plan is an opportunity to increase the emphasis on transportation technologies to mitigate the growth in traffic congestion rather than building new travel lanes. Further, to mitigate the effect of events such as severe weather, traffic crashes, and delays in upstream traffic, increasing the use transportation technologies is an opportunity to improve public safety. Achieving these aims requires that Calvert County prioritize transportation technology improvements in making annual funding requests to MDOT.

As a first step, the County should request that MDOT SHA assess its communications infrastructure and develop a transportation technology plan specifically for MD 2/4. Specific improvements should include:

- Install CCTV coverage at key bottleneck locations.
- Deploy dynamic message signs (DMS) at decision points along MD 2/4 such as approaching MD 231 and MD 506 to direct traffic to the MD 231 bridge to avoid traffic incidents ahead

and approaching the MD 2/4 split when there is an incident further upstream near MD 301 and I-95.

- Inclusion of MD 2/4 through Prince Frederick and through Lusby/Solomons in the Smart Signals program

Emerging technologies can be applied to improve traffic safety with a specific opportunity for high-speed signalized rural intersections. Dilemma Zone Protection (DZP) is a technology-focused solution that modifies traffic signal timings based on the approach and speed of vehicles approaching the intersection, thus reducing or eliminating a potential dilemma zone where a driver may be unable to make a safe maneuvering decision. Dilemma Zone Protection is relevant to Calvert County's rural highways such as MD 2/4 and has the potential to reduce side-angle crashes caused by red-light running and rear-end collisions often caused by distracted driving.[2] Two pilot locations were studied by MDOT SHA and the University of Maryland with mixed results. As the technology improves, the County should encourage MDOT SHA to deploy Dilemma Zone Protection at key locations along MD 2/4.

[2] Maryland DOT-SHA Final Research Report, *Intelligent Dilemma Zone Protection System at High-Speed Intersections*, Park and Chang, Department of Civil and Environmental Engineering, University of Maryland, July 2017.