September 8, 2020

Accelerating the CAV Industry in Central Florida

Central Florida Transportation Planning Group Webinar on August 17, 2020

Panelists:
Eric Hill, TSM&O Director, MetroPlan Orlando
Dr. Xiaopeng Li, P.E., Associate Professor of Civil Engineering, University of South Florida
Dr. Amr A. Oloufa, P.E., Professor of Civil Engineering at the University of Central Florida
Josh Pederson, P.E., Project Manager at Florida's Turnpike Enterprise
Dr. Robert L. Bertini, P.E., Executive Director of Center for Urban Transportation Research
Dr. Raj Ponnaluri, P.E., Connected Vehicles, Arterial Management, Managed Lanes, FDOT

Questions and Responses

Question 1. Is the industry still determined to roll out the technology even though various studies have indicated that it offers less protection to people of color, especially pedestrians of color than to fairer-complexed pedestrians? How does the industry plan to address issues of equity thus raised?

Response. Eric Hill

Unfortunately, this is a fatal flaw in coding, but fortunately it can be resolved through coding too. I think I mentioned my understanding of coding is like writing a novel or song, a piece of the writer is subconsciously embedded in the results. This means that the bias of the coder is part of the code and this could account for the flaw. My understanding also is that the technology companies are starting to include psychologists, anthropologists, demographers, and ethnographers on their teams to address this matter, so you don't just get math theories to guide the functions of the vehicle. The implication of this approach is that it gives value to skin color, with certain shades equating to a higher value and more protection in decision-making.

Question 2. Will the slides of the presentation be provided?

Response. Yes.

Question 3. What is the policy plan for assisting all the people who will lose their jobs to autonomous vehicles (delivery drivers, taxi drivers, people in freight, etc.)?

Response. Eric Hill

There has been fierce opposition to enabling CAV technology in the freight industry. See segment on 60 Minutes:

Automated Trucking, A Technical Milestone That Could Disrupt Hundreds Of Thousands Of Jobs, Hits The Road: https://www.cbsnews.com/news/driverless-trucks-could-disrupt-the-trucking-industry-as-soon-as-2021-60-minutes-2020-08-23/. This has caused a lot of the delay in drafting legislation in Congress to allow this technology to be deployed. No doubt it will affect the other industries that rely on humans to operate. Once the log-jam in Congress is cleared and the technology matures, workers in these industries will be faced with deciding on retraining, career change or education in another area.

Question 4. How is the industry adapting to the loss of bandwidth reserved for transportation from the FTC?

Response. Dr. Ponnaluri

Industry has been developing dual-mode roadside units (RSUs) capable of transmitting CV messages on both communication network (DSRC and C-V2X) and within the reallocated bandwidth (30MHz).

Question 5. What happens if the network connection is lost while the CAV is being operated?

Response 1. Dr. Li

Then CAV becomes AV that may operate with its in-vehicle sensors alone. Traffic operations may still proceed, though with less efficiency and more delay due to loss of platooning and cooperative control relying on vehicle connectivity.

Response 2. Dr. Oloufa

Automated Vehicles can operate without receiving external data (except of course its sensors). Automated Vehicles require some type of connection.

Question 6. Has any research been done on how CAVs age (i.e., how they function as sensors and different components wear out over time)?

Response. Dr. Li

I don't know any empirical study on CAV aging since CAVs are pretty new and haven't been deployed on public roads. But there are plenty of studies analyzing errors and reliability of

different sensors and components of CAVs. You can do a google scholar search and can find lots of articles on this topic.

Question 7. How much more expensive are CAVs than traditional vehicles? Are there any concerns that this will reduce vehicle or transportation access to people which will in turn reduce housing and employment opportunities?

Response 1. *Dr. Li*

L1-L2 AVs are relatively economic (you may get it in $20k range new vehicles). Higher level CAV (with both connectivity and automation) are expected to be more expensive, and its cost depends on the scale of the production (cheaper if mass production happens). In general, it might be expensive to keep a private CAV for an individual, but the cost will be much more reduced if CAVs are shared and operate in a Transportation-as-a-service business model.

Response 2. *Eric Hill*

These vehicles will probably cost more than standard vehicles today. If, through a subscription service, the number of vehicles needed in an area is reduced, this may lead to reuse of certain land-uses such as parking facilities, which can be used for housing or green space. The impact on housing such as increase in TODs can enhance transit ridership and improve the reduce the spatial mismatch between housing and employment.

Question 8. Can you explain why having vehicles take over certain driver functions is preferable to instituting more rigorous driver education, enforcement, ignition lock-out technology, etc.?

Response 1. *Dr. Li*

I guess driving by a vehicle (or robot) is more predictable and easier to control by other monitors compared with human drivers.

Response 2. *Dr. Oloufa*

Any type of education/training depends on the learner who also gets tired and is impacted by emotions and the environment.

Question 9. Would there be a mechanism for the owner of a CAV to delete the data their vehicle collects and to control how the data is shared?

Response 1. *Eric Hill*

This is a good question that owners will need to decide after reading the fine print, which is often overlooked. Current vehicles are doing this now most owners have given it a second thought. This is a part of the education that needs to occur for potential owners and operators of these vehicles.

Response 2. *Dr. Li*

There should be some protocols and agreements just like our use of cell phones.

Question 10. Will a CAV be able to sense a speed hump if it is not marked?

Response. *Dr. Li*

It is possible to use AI algorithms to analyze sensor data (Lidar and video) to recognize a speed bump.

Question 11. Can you speak about the type of data collection by CAV? For instance, is the outfitting of CAV with sensors to measure smoothness being considered?

Response. Dr. Ponnaluri

CAV data consists of standard messages defined by the Society of Automotive Engineers (SAE) and the Institute of Electrical and Electronics Engineers (IEEE). For instance, SAE J2735 defines all messages that are transmitted from vehicle-to-vehicle and vehicle-to-infrastructure.

Question 12. Where is SunTrax located? Is this the track near FL Polytechnic Campus?

Response. *Josh Pederson*

SunTrax is a large-scale, cutting-edge facility being developed by the Florida Department of Transportation and Florida's Turnpike Enterprise, dedicated to the research, development and testing of emerging transportation technologies in safe and controlled environments. SunTrax is located off I-4 between Orlando and Tampa. Yes, it is located near the Florida Polytechnic University. More information can be found at http://www.suntraxfl.com/.

Question 13. Speaking of preparedness, how prepared--realistically--are governments to fund the infrastructure associated with CAVs? Many communities can't afford to keep the infrastructure they have maintained, such as paving, striping, bridges, etc. Doesn't it make sense for vehicles to be self-reliant on their own sensor suites, which is the approach Tesla is pursuing?

Response. *Josh Pederson responded to this question during the live session.*

Question 14. Regarding the mention of assuring interoperability between geographic areas, I'm reminded of how many years passed before SunPass worked for parking at Tampa International Airport--and the obstacles to earlier interoperability weren't technical.

Response. Dr. Ponnaluri responded to this question during the live session.

Question 15. I hope LIDAR development will be discussed today, especially current progress and the prospects for a truly dramatic reduction in cost and size.

Response. Dr. Li

Our lab vehicles are using Lidars. They are getting cheaper but still expensive. You may check CES for newest Lidar technologies.

Question 16. I set the car-following feature on a Tesla to the longest headway and it still followed too close for safety. What if the humans who write the software don't themselves know what constitutes safe driving?

Response 1. Dr. Li

Our study indicated that there is a tradeoff between mobility and safety. I guess some automakers would put a weight on mobility (e.g., a reasonably short headway to prevent other vehicles from cutting in), which may compromise the driver's perception of safety (e.g., too short headway).

Response 2. Dr. Oloufa

Safe driving for AVs is very different than for machines. Reaction time for machines is a lot faster so one should not compare the two.

Question 17. The big gaps in vehicle flow are introduced by traffic signals deliberately creating platoons so the next signal can be coordinated. How will AVs help with big, capacity-wasting, gaps between platoons created by traffic signals?

Response. Dr. Li

We have to make AV to CAV (with connectivity) to coordinate and collaborate with infrastructure controllers (e.g., traffic lights). Traffic lights need to be timed based on arrival CAV patterns and CAV controls need to suit the traffic light time plans. We proposed a cooperative control paradigm and detailed algorithms for the FHWA CARMA TSMO use cases. Please stay tuned on recent CARMA developments.

Question 18. Pay-by-plate tolling seems to be working fine. How much better could tolling by CAV be?

Response. Josh Pederson

It is true that Toll-by-Plate is already a mature technology, although there are still incremental improvements being made, especially in the license plate recognition software and hardware capabilities. Connected vehicle technology may provide certain additional opportunities related to tolling due mainly to the continuous.

Question 19. Slide 5 shows Lidar atop the test cars--are the actual test cars using Lidar?

Response. Josh Pederson

Light Detection and Ranging (LIDAR) is currently being incorporated into the sensor suites utilized in the majority of automated driving system platforms, along with cameras, radar, and GPS. (Tesla, who has taken the position that LIDAR is unnecessary, is the notable exception).

Question 20. If there is time (doubtful), could a panelist speak the suitability of e-vehicle to AV control compared to ICE vehicles?

Response. Josh Pederson

Nearly all AVs currently in development are being tested and planned to be deployed on Electric Vehicles. This likely due to the power demand of the on-board computing needed to operate a self-driving vehicle.

Question 21. Are the test vehicles able to navigate the circular intersection on the Test Track?

Response. Josh Pederson

Roundabouts do still offer challenges to some automated driving systems. The safe and seamless interaction with other vehicles/drivers poses as much or more of a challenge as the maneuver through the intersection.

Question 22. How can you be sure AVs are safe for all those edge situations without massive real-world testing, and only Tesla is doing that?

Response. Dr. Li

Before real-world tests, there are ways of using simulation and augmented reality to test CAV safety. It may not be 100% to ensure the safety but may help quickly identify many safety issues with relatively cheap cost. Scholars from the University of Michigan have done relevant studies.

Response. Dr. Oloufa

A lot of companies are testing, and not just Tesla. AI, generally speaking, is limited by the scenarios it has "seen" or trained on. So safety at "edge" situations is a concern but we should also compare it with "edge" situations for humans as a result of fatigue, distraction and vision issues.

Question 23. One problem with testing in the wild in Florida is that Florida maintains travel lane edge striping much better than some other states.

Response. Josh Pederson

It is true that Florida's striping and signing and the overall condition of roadways is better for automated vehicles. This could actually lead to Florida being a more optimal state for initial deployments of AV's. To navigate "bad" conditions (in controlled, safe, and repeatable conditions), companies can always come to SunTrax!

Question 24. CAV - 3 goals listed on a slide are safety, mobility and congestion. Is there an industrywide assumption that we cannot achieve these goals without the systemwide implementation of CAV/AV?

Response. Dr. Ponnaluri

There is no such assumption. CAV is meant to improve safety, enhance mobility, achieve economic development through transportation technology.

Question 25. Is the data collected from the Tampa CAV project available for use to different districts?

Response. Dr. Bertini

https://www.its.dot.gov/data/.

Question 26. This question is for Josh if possible; Can you provide the name of the CAV technologies?

Response. Josh Pederson

AV technologies include the sensor suites of the platform (generally cameras, radar, LIDAR, and GPS) as well as the software/algorithm that fuses all the sensor data and makes the driving decisions. Recent advancements in artificial intelligence and machine learning, combined with more abundant data have been the enablers to make these systems much closer to actual feasibility in the real world. When discussing CV technologies, there are two that should be

discussed; Dedicated Short-Range Communications (DSRC) and CV2X, which are based on different protocols and offer different pros and cons.

Question 27. For Adaptive Cruise Control (ACC) of many existing vehicles, the shortest headway allowed of ACC is similar to the headways between current vehicles. Will our roadways accommodate much more vehicles in our roadways with CAVs?

Response. Dr. Li

This is a good question. AV without connectivity may only slightly improve the capacity from our study. For more significant capacity improvement, CAV with communications and connectivity will be needed.

Response. Dr. Oloufa

Yes, due to more efficient control, headways could be reduced leading to capacity increases.

Question 2.8 Please ask the question regarding liability issues associated with CAV implementation. How are we a8ddressing this issue? The key issue is the foreseeable of a reasonable and prudent person, professional, agency, entity, etc.

Response. Dr. Ponnaluri

CAV fundamentally deals with enabling communication. Liability is up to the automobile manufacturer and the legislature.