PERSPECTIVE ON AUTONOMOUS TRUCKING

AVS ARE ODD

Defining the operation design domain for automated vehicles is crucial.

Spend any time reading reports on automated or autonomous vehicles, and you quickly get deluged with acronyms. Acronyms are a curse. Elon Musk stated in a 2018 email to his employees, “Don’t use acronyms or nonsense words for objects, software or processes at Tesla. In general, anything that requires an explanation inhibits communication. We don’t want people to have to memorize a glossary just to function at Tesla.”

Yet they seem inescapable. The U.S. Department of Transportation January 2021 release Automated Vehicles Comprehensive Plan contains this statement about trucking operations: “Several automated trucking companies are developing Level 4 ADSs that are specifically for use on CMVs and have an ODD of limited-access highways, either from exit-to-exit or on-ramp to off-ramp.”

So back the truck up a bit. Four acronyms that show up frequently in SAE J3016 Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles are:

- **DDT** — dynamic driving task
- **ODD** — operational design domain
- **DAS** — driving automation system
- **ADS** — automated driving system

Putting this in perspective of you driving your own vehicle today, the DDT is affecting what you do when you are in control of the vehicle. ODD then is the set or subset of operations you perform with the vehicle. DAS is any system that automates a function, such as adaptive cruise control. ADS is special; it is where automation accomplishes all of the DDT for a particular ODD. SAE states that ADS only applies to Level 3, 4 and 5 automation, where Level 4 can completely do some ODDs in limited conditions, and Level 5 can do all ODDs in all conditions. SAE provides both the J3016 standard and a helpful graphic on the levels for free.

Defining the operation design domain for automated vehicles is crucial. As automated vehicles begin to enter commercial operations, they will operate within specific ODDs. For example, some AV developers are aiming to have automated operation between two depots located near a freeway, where the trailers or the entire tractor-trailer will then be driven by a human to an urban warehouse. The automated vehicle does not “do it all” but does everything once dispatched from the first depot and then traveling to the second.

That is a simplistic view of the world. Connecting to any one of the millions of existing freight trailers and container chassis today involves human interaction with the trailer connections and the landing gear, opening and closing and securing trailer doors, and performing inspections. In a future ideal world, perhaps the trailers and container chassis can do all of these things through automation, but for the immediate future, an automated tractor still will require some level of human interaction to pick up and drop off a trailer.

NACFE published a detailed report in 2019 looking at the potential to intentionally pair a specific tractor to a specific trailer titled Intentional Pairing. We identified that while there are some duty cycles where specific tractors and trailers stay mated, overall, the majority of industry operations rely on fairly random allocation of trailers to tractors. It’s often stated that there are on average three trailers for every one tractor, but the reality is that those three trailers can be any of millions in inventory and the probability of a specific tractor being assigned a specifically configured trailer is very small.

Once connected, the tractors have no idea what trailer they are connected to. There are no special communications between the tractor and the trailer that identify any of the...
About the Author: Rick Mihelic is Emerging Technologies Director for The North American Council for Freight Efficiency. He has authored for NACFE four Guidance Reports on electric and alternative fuel medium- and heavy-duty trucks and several Confidence Reports on Determining Efficiency, Tractor and Trailer Aerodynamics, Two Truck Platooning, and authored special studies on Regional Haul, Defining Production and Intentional Pairing of tractor trailers. President of Mihelic Vehicle Consulting LLC he has 38 years’ experience in the trucking and aerospace industries including 20 years in commercial vehicle development for PACCAR and Peterbilt. He was involved in the development of aerodynamic vehicles and groundbreaking systems including the Peterbilt/Cummins DOE SuperTruck and instrumental in developing compliance systems for EPA GHG regulations. He was awarded the prestigious SAE L. Ray Buckendale Award in 2016 and SAE Crawford award in 2020.