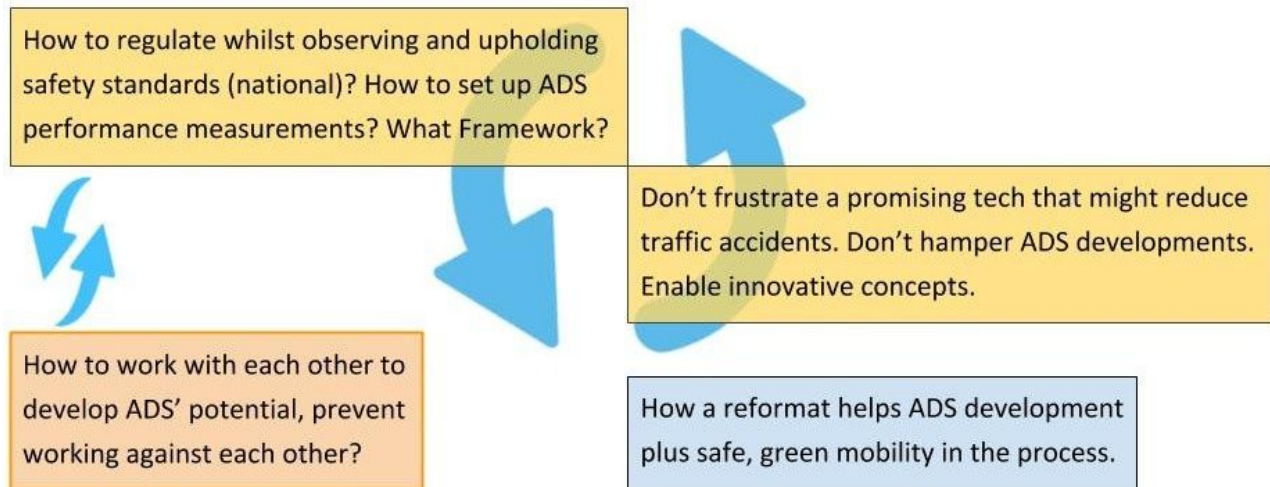


DEPARTMENT OF TRANSPORTATION
 National Highway Traffic Safety Administration
 49 CFR Part 571
 [Docket No. NHTSA-2020-0106]
 RIN 2127-AM15 Framework for Automated Driving System Safety



The approach/suggestion presented here addresses the NHTSA's aspects and questions (specifically, the ones **marked green**) mentioned in the docket. I won't go into the administrative and statutory aspects; they may flow forth from the suggestions I am presenting. I condensed my **green-printed comments** to the quintessential, so readers will get **'The Bigger Picture'**: it is best to REformat the car before turning it into an autonomous vehicle (AV). You might compare it to **NASA's Apollo project** meant to bring a man to the Moon, which was based on the blueprint of a modular format specced to meet very specific requirements, *before* latest technology was put in place (technology pull rather than technology push). Since the car already exists, my plea is for a REformat. This serves FIVE purposes:

1. Having an assessment program + performance measurement of different ADS technologies. Reformat in a nutshell: Have the AV 'mimic' the human head, as long as there's doubt that ADS can replace/substitute the human brain.
2. Actually improve safety in anticipation of (or regardless of) ADS.
3. Actual development of an AV for personal use, NOT a robo-taxi like so many are developed nowadays. Ride-hailing robo-taxis is not what the bulk of Next-Gen personal transit will be about.
4. Keep the human element, as a failsafe (when operated within city limits?) or for recreational purposes
5. Save the 'Ins Blaue Hinein' multi-billion dollar costs that may well be connected to the sort of full-autonomy ADS developers are striving for (see page 5).

NB: Even if ADS developers object to a car reformat as a development platform/reference tool, **you still have 2-3-4-5** as solid reasons to pursue a car reformat. As a matter of fact, ADS is a good 'excuse' to 'Green' Personal Mobility.

NHTSA ADS Executive Summary. "In general, the Agency's ADS-related publications issued so far address the challenges involved in determining which requirements of the existing Federal Motor Vehicle Safety Standards (FMVSS) are relevant to the safety needs of ADS-equipped vehicles without traditional manual controls, and then adapting or developing the requirements and the associated test procedures so that the requirements can effectively be applied to the **novel vehicle designs that may accompany such vehicles without adversely affecting safety.**"

“NHTSA envisions that a framework approach to safety for ADS developers would use performance-oriented approaches and metrics that would accommodate the design flexibility needed to ensure that manufacturers can pursue safety innovations and novel designs in these new technologies.”

“At this stage, NHTSA believes there are four primary functions of the ADS that should be the focus of the Agency's attention. First, how the ADS receives information about its environment through sensors (“sensing”). Second, how the ADS detects and categorizes other road users (vehicles, motorcyclists, pedestrians, etc.), infrastructure (traffic signs, signals, etc.), and conditions (weather events, road construction, etc.) (“perception”). Third, how the ADS analyzes the situation, plans the route it will take on the way to its intended destination, and makes decisions on how to respond appropriately to the road users, infrastructure, and conditions detected and categorized (“planning”). Fourth, how the ADS executes the driving functions necessary to carry out that plan (“control”) through interaction with other parts of the vehicle.”

“NHTSA seeks comments on how to select and design the structure and key elements of a framework and the appropriate administrative mechanisms to achieve the goals of improving safety, mitigating risk, and enabling the development and introduction of new safety innovations.”

New Car Assessment Program (NCAP)

“Short of setting a safety standard, an ADS competency evaluation could be added in NCAP. While an FMVSS obstacle-course performance test, standing alone, would likely be inadequate to evaluate ADS competence, such a test might form a useful foundation for consumer information under the NCAP program.”

NHTSA's FMVSS Setting Authority *(comment Ralph Panhuyzen: perhaps the core matter)*

“Establishing FMVSS prior to technology readiness hampers safety-improving innovation by diverting developmental resources toward meeting a specific standard. Such a regulatory approach could unnecessarily result in the Agency establishing metrics and standards without a complete understanding of the technology or safety implications and result in unintended consequences, including loss of potential benefits that could have been attained absent government intervention, a false sense of security, or even inadvertently creating additional risk by mandating an approach whose effects had not been known because regulation halted the technology at too early a stage in its development.”

Timing and Phasing of FMVSS Development and Implementation

“As described above, issuing performance standards for ADS competency has been and remains premature because of the lack of technological maturity and the development work necessary to support developing performance standards.”

A. Questions About a Safety Framework

- **Question 1.** Describe your conception of a Federal safety framework for ADS that encompasses the process and engineering measures described in this document and explain your rationale for its design. **A: see page 6.**
- **Question 2.** In consideration of optimum use of NHTSA's resources, on which aspects of a manufacturer's comprehensive demonstration of the safety of its ADS should the Agency place a priority and focus its monitoring and safety oversight efforts and why? **A: Vehicle safety aspects can't be dismissed in anticipation of ADS.**
- **Question 3.** How would your conception of such a framework ensure that manufacturers assess and assure each core element of safety effectively? **A: My conception provides clear criteria and measuring points (page 6-10).**
- **Question 4.** How would your framework assist NHTSA in engaging with ADS development in a manner that helps address safety, but without unnecessarily hampering innovation? **A: provide an objective basis.**

- **Question 5.** How could the Agency best assess whether each manufacturer had adequately demonstrated the extent of its ADS' ability to meet each prioritized element of safety? **A: By having them deploy their ADS within the conception I suggested. If not, you still have a reformat that's more suited to ADS; explained in detail page 6-10.**
- **Question 6.** Do you agree or disagree with the core elements (*i.e.*, "sensing," "perception," "planning" and "control") described in this document? Please explain why. **A: Yes, I agree. On page 5 it's explained why ADS is so complicated but nevertheless should be addressed in its entirety, more specific under hurdle #4.**
- **Question 7.** Can you suggest any other core element(s) that NHTSA should consider in developing a safety framework for ADS? Please provide the basis of your suggestion. **A: Vehicle safety as an ADS failsafe.**
- **Question 8.** At this early point in the development of ADS, how should NHTSA determine whether regulation is actually needed versus theoretically desirable? Can it be done effectively at this early stage and would it yield a safety outcome outweighing the associated risk of delaying or distorting paths of technological development in ways that might result in forgone safety benefits and/or increased costs? **A: The NHTSA should lay down the ground rules and the framework, not feel intimidated by the ADS technology push. Otherwise, NHTSA may 'feel pushed aside' as a result of the latest hype or pitch from an ADS entrepreneur who thinks he can bypass, outsmart authorities. Boeing's coaching of the FAA in getting approval for its 737 Max serves as a warning.**
- **Question 9.** If NHTSA were to develop standards before an ADS-equipped vehicle or an ADS that the Agency could test is widely available, how could NHTSA validate the appropriateness of its standards? How would such a standard impact future ADS development and design? How would such standards be consistent with NHTSA's legal obligations? **A: ADS development will be much more focused, defined, verifiable in its subsequent stages.**
- **Question 10.** Which safety standards would be considered the most effective as improving safety and consumer confidence and should therefore be given priority over other possible standards? What about other administrative mechanisms available to NHTSA? **A: Outside-the-vehicle safety (pedestrians, cyclists) and crash-impact worthiness (NCAP). Would you want an iffy-safe AV roam around your neighborhood where kids are playing?**

Introduction: premise and promise need to match

The green text above is explained in detail on the following pages. With so many ADS developers claiming that their system is best, it will take decades before there's any agreement and conformity about what will really work and what not, let alone regulate what's supposed to work. The 'plea' you are about to read is to think of getting a car from A to B primarily as an ergonomics issue, for lack of a better term: cars need to fit the way we utilize them, need to blend in with traffic, how we use the infrastructure, and now how ADS can be deployed with the lowest risk possible. If we agree on the ergonomics of car travel, then we may establish the new 'rules of engagement'. *Question is how to reduce risk in deploying ADS?*

Look, below is where we're at:



Dad, what's ergonomomy?

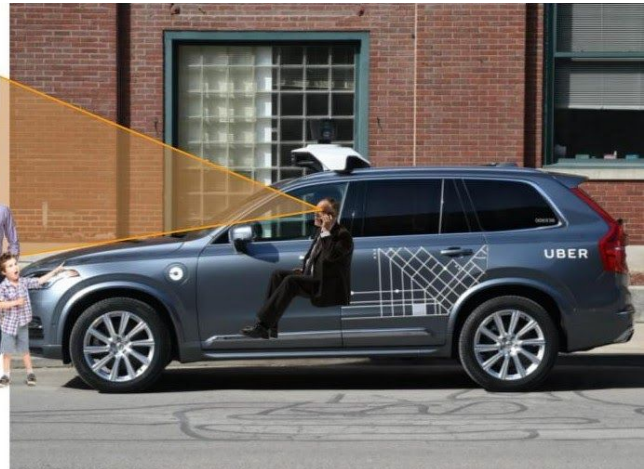
Dad: It's making kids tall enough not to have dads bend so much.

Dad, what's vehicle autonomy?

Dad: It's making traffic and authorities cope with new technology not to ruin the billion-dollar prospect of self-driving.

I. My 'conception' is to have a reformat, the reformat then becomes the framework how to advance ADS

"NHTSA's mission is to save lives, prevent injuries, and reduce the economic costs of roadway crashes through education, research, safety standards and enforcement activity. Advanced vehicle technologies hold the **promise** not only to change the way we drive but to save lives." If this is the intention, then the focus shouldn't go solely to ADS technology and regulations. It should also involve the car itself. After all, **that** is the physical thing that's supposed to displace itself autonomously. I am saying this to prevent, shall we say, working on how to force a round peg into a square hole. Because this is what has been going on for the last couple of years. No wonder authorities are concerned about how developments pan out and how experiments are conducted. Generally, equipment, tools and applications are shaped or set up in such a way that user safety and ergonomics are optimized. *So, why not think of getting an AV through traffic in a similar fashion?*



Nothing revolutionary here; **new technology tends to influence product format**. Best example: the **smartphone** which replaced the brick-like cellular phone. So, why then are ALL AV developers using cars that aren't the safest to begin with? Waymo favors the Chrysler Pacifica, and UBER the Volvo XC90. Some SUVs and of course trucks are even worse, like the Cadillac Escalade and the Ford F150. I guess that the industry still lives under the assumption that ADS is a (costly) feature to be put on luxury (bigger) cars firstly. Both the IIHS and the ETSC (European Transport Safety Council) have attributed the growing number of pedestrian fatalities to the increased popularity of SUVs with their typical higher frontends and compromised driver vision on the road.

Below is where we should be or could have been at:



Dad, what's ergonomics? No, really...

Dad: Use common sense instead of wishful engineering to establish what will work and what not.

Dad, what's vehicle autonomy?

Dad: For now, it's best to reformat a car before it's turned into an autonomous vehicle. It will at least speed up developments, prevent mishaps.

II. The FIVE main hurdles ADS developers and car makers cope with | 3-4-5 can be tackled through a reformat

Hurdle #1 - 'Other cars'. Ever realized that before you can expect autonomous vehicles to take over, you will probably need to phase out conventional, manually operated cars, and probably need overlaying grid control? AVs will be limited to campuses, industrial parks, gated communities, or 'smart cities' like the one Toyota is planning right now. As long as there are human drivers on the road, the two won't quite mix. It may at least take 25 years for AVs to reach ubiquity. That will happen when ALL new cars have a prescribed, standardized level of autonomy and manually steered cars are eventually banned from the road. Which is difficult since handling a car yourself is practically a Constitutionally protected right, particularly in the land of the V8, the United States.

Hurdle #2 - 'Road anomalies'. A lot will probably need to happen before AVs can be considered safe. Intersections may need to be changed, improved, standardized. 'Road anomalies' may have to be removed, not to confuse an AV. It's going to be a long and very costly process. Until that time, slow and cautiously maneuvering AVs will actually contribute to more congestion, which may even get worse when they are used as ride-hail providers (Uber, Waymo, Lyft, etc) want them to be deployed: constantly on the move for the next customer, avoiding having to pay parking fees.

Hurdle #3 - No Standardization in sight. There's a winner-beats-all mindset, in which each automaker is striving on its own to develop an AV. Not good from a standardization perspective, which may be the most important prerequisite for any system that's supposed to take over from human drivers. One of the biggest hurdles in devising self-driving cars involves figuring out unusual or oddball driving circumstances and the ability to prepare the AI drive systems to cope with those

situations. That requires all developers to open up and share their proprietary secrets. Fat chance that will happen any time soon. Unless all ADS developers use the same reference material.

Hurdle #4 - Sensing, perception, planning and control. Or mimicking/substituting the human brain. Billions of brain cells multiplied by tens of thousands of synapses in *each* individual human brain make for *more* instant connections than there are stars in 20 to 40 thousand galaxies. Housed in a roundish 'cockpit' capable of swiveling (human head), equipped with two amazingly effective optic and ditto hearing sensors (eyes and ears) and a hard-drive full of constantly updatable lessons, topped off by the human intuition, they enable us to split-sec reference what we see, hear and feel when driving. Hard to beat those, if ever. **Vehicle autonomy in the much more crowded and diffuse '2D pane', is much harder to accomplish than in the 3D. Nonetheless we use pilots on highly automated passenger jets.**

Hurdle #5 - The displacement aspect. The types of SUVs and MPVs which are used by ride-hail providers, are not exactly conducive to autonomously maneuvering. What's more, they make ride-hailing costlier than necessary, since the **average ride-hail trip consists of 1.2 passengers**, according to Boston Consulting Group. Developments like the Cruise Origin (a GM subsidiary) make things even worse. They are unnecessary big blocks of rolling real estate, out to invade even more precious public space. More and more city planners and policymakers may well object to them, favoring micro-mobility (Paris, London a.o.). Vulnerable road users like pedestrians and cyclists should obviously not become casualties of driverless taxis that can't quite cope with traffic, because of its inherently complicated nature and unpredictable fluidity. You can't pre-map all details, nor cover everything through the on-board AV technology. And I haven't even discussed the many legal intricacies.

III. 'The conception': Car Reformat tackles Hurdles, which speeds up ADS development in a verifiable manner

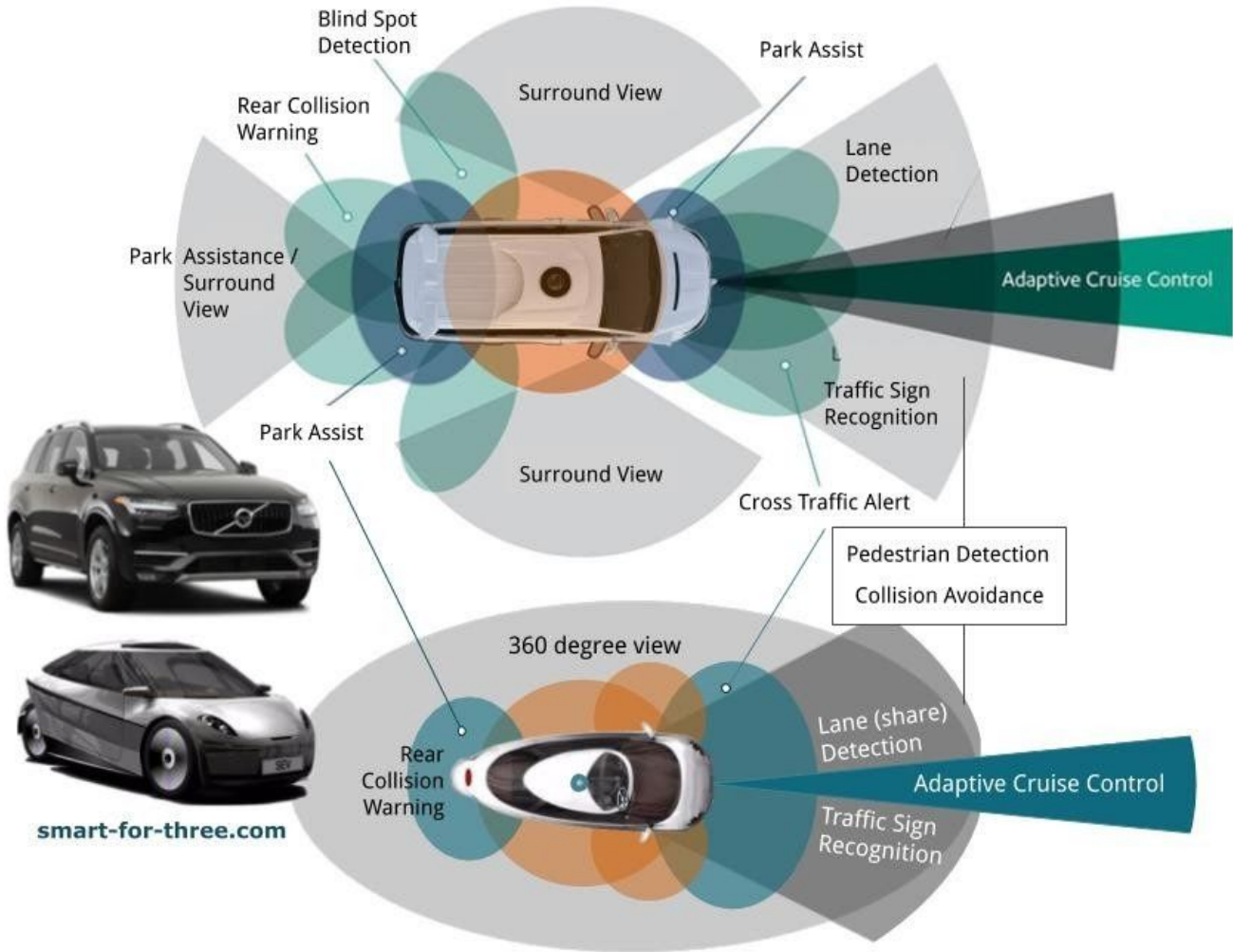
Ad Hurdle #3: If autonomy hasn't happened yet to the car, maybe the car should move towards ADS, after all its supposedly new brain. Is there a vehicle format out there that's more suited to autonomous deployment than the cars AV developers have been experimenting with so far? Yes, there is. Instead of putting ADS hard- and software in conventional cars as add-ons, reformat the car first to have it benefit optimally from ADS tech. The reformat then becomes the framework, which should at least help to standardize procedures and measurements. *Since pictures explain more than thousands of words, below are the ones that go into **three main aspects: 1. Better scanning/imaging 2. Better external safety 3. NCAP.***

Ad Hurdle #4: Have the AV 'mimic' the human head, as long as there's still doubt that ADS can replace the human brain. A self-driving vehicle can be set up like an elongated **360 degree vision motorcycle helmet**. Notice that the 'driver' is seated on the curbside of the vehicle, how the interior mirror complements the driver's peripheral vision, and how the driver can eye-contact the passengers without turning his/her head. Below: UBER's Volvo XC90. Don't use sensing, scanning and imaging devices on vehicles that are flawed to begin with because of their boxy shape which is full of blind spots. Since ADS is supposed to maneuver a car through traffic, better look at the car's displacement characteristics to begin with.



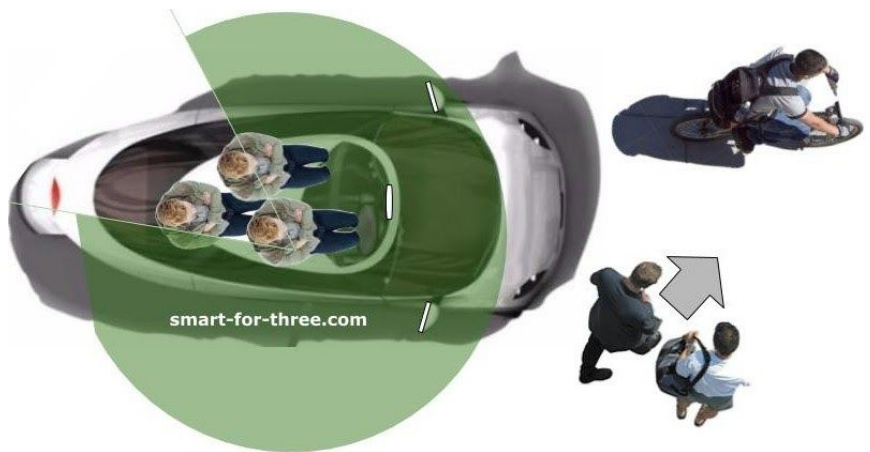
Ad Hurdle #5 - the displacement aspect. The smaller / sleeker the car's footprint:

- a. the more road space there is to maneuver and the more nimble to evade other road users,
- b. the more effectively the ADS can scan, sensor and image the car's vicinity,
- c. the better the all around view of the person behind the steering wheel, the more he/she will feel involved (important in case something goes wrong). Big cars tend to isolate the driver from what's happening outside. Yes, I do realize that what I'm suggesting here, is a more committed human driver as a failsafe for the ADS. **Why a THREE-seater?** Two is too limiting, also from a ride-hail perspective. Need more space? Better order 'the big car' then, which will undoubtedly be available via your car-share program or ride-hail provider. *On the next page, the same vehicle without manual controls.*



IV. The Reformat that beefs up sensing, scanning, imaging

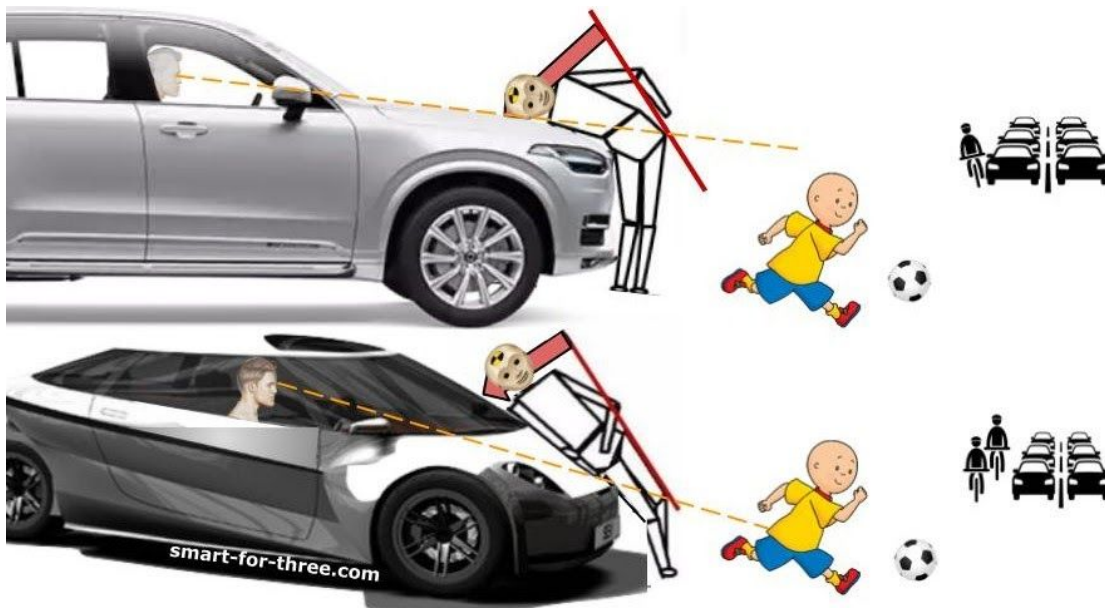
Works both ways: the more advanced the ADS technology, the better sleek-footprint vehicles will be able to benefit from it. Round-off and sloping contours greatly reduce fragmented imaging and scanning of the vehicle’s surroundings. No blind spots. Below: no passenger sitting next to the person seated curbside to hinder vision. Important when taking crossroads. Of course, controls may be left out more easily in a vehicle that’s safer to begin with, like you see below. Mind you, there is a difference between (slow) maneuvering robot-taxis in which passengers are seated opposite each other, and having an AV you might want to use (own) yourself, but that can also be deployed as a Next-Gen (ride-hail) rickshaw.



V. Improved safety of vulnerable road users in anticipation of ADS (or regardless of)

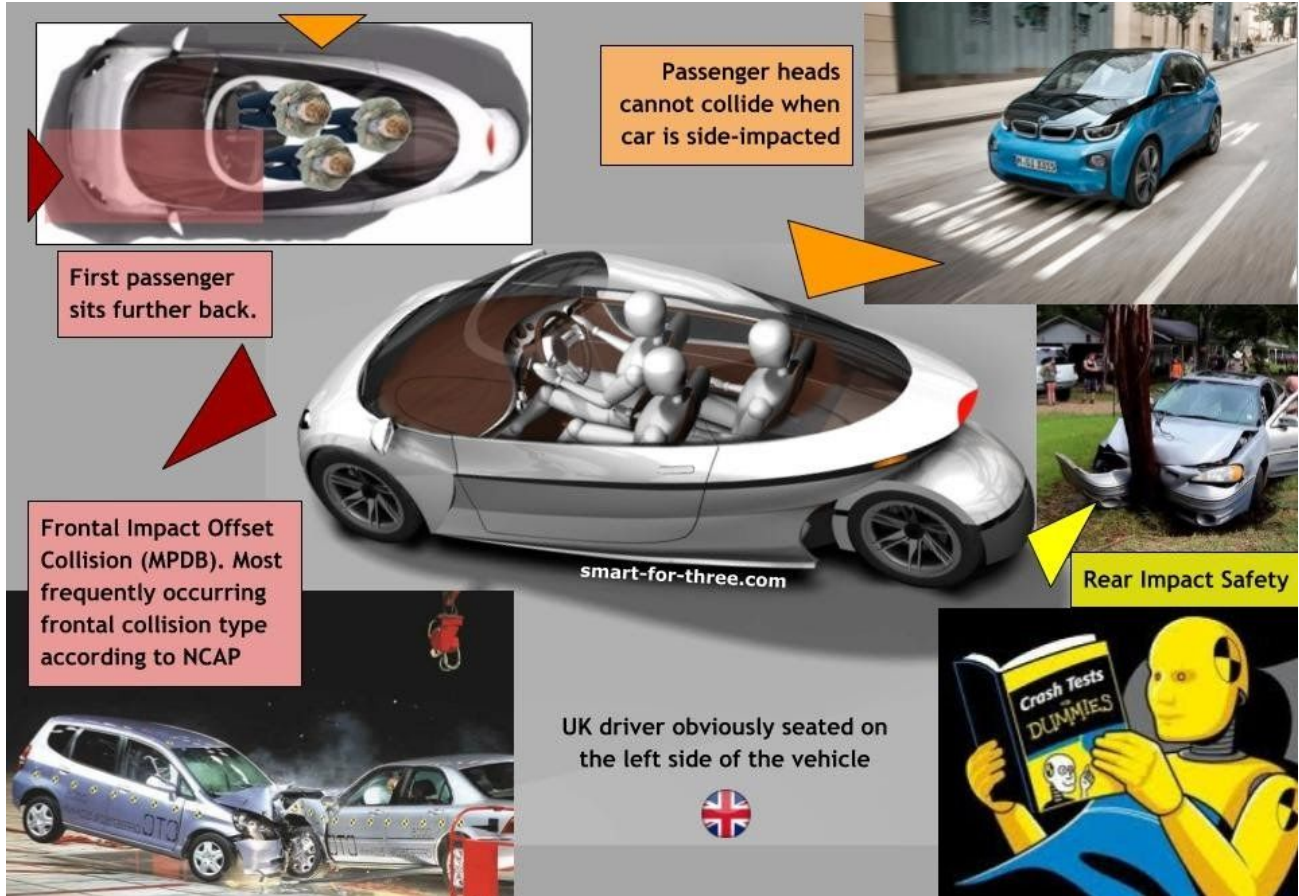


Insurance Institute for Highway Safety IIHS attributed the **steep 81% rise in the number of pedestrians killed** in SUV-involved accidents over 2008-2018 to “SUVs have higher front ends and the design is much more vertical”. Below: the more the pedestrian’s body hinges on impact, the greater the distance the upper torso travels, consequently the higher the speed with which the pedestrian’s head will hit the car, the more serious the injuries.



Cab-forward design and ‘driver’ seated curbside ensure better visibility, particularly with respect to children crossing in front of the car. An airbag which deploys between windscreen and hood, would soften the impact for a struck pedestrian.

VI. NEW levels of NCAP safety in anticipation of ADS (or regardless of)



The unusual three-seat layout, where people don't sit next to each other, makes it possible to combine a sleek body (low drag), plenty of legroom (comfort), ditto crash-impact safety plus great visibility on all sides. Below: nobody thinks of a Harley Davidson as a 'small vehicle'. Nor is the semi three-wheeler you see here a 'small car'. It does not look like one, doesn't work like one. See it as an aviation-inspired crossover between passenger car and motorcycle, with room for three. Because of its unusual track : wheelbase ratio, it will lean (tilt) whilst taking the bends to shrug off lateral forces. [Click on picture below for its core mission.](#)



Do 'we' want to advance ADS responsibly? Then use a dedicated development tool, a reference vehicle.

Not using a common platform / reference vehicle, complicates ADS development. Below: the five levels of Vehicle Autonomy with a twist, and Level 5 as depicted in **SF film Minority Report**. Notice the sleek-footprint maglevs whizzing by (how cool is that?) over what look like costly flyovers, which presupposes overall grid control, V2V, no road anomalies, the elimination of manual steering. Now think away those flyovers, then adjust expectations... There's a good chance that the sleek-footprint vehicle outlined here, will enter an **EU development program** next year. It is meant to bring a 'best of both' to market: the safety and comfort of a car, and the agility, plus space- and energy efficiency of a motor scooter, whilst enabling ADS. From a standardization viewpoint, it seems best to work together on this. **ADS and 'Green Mobility'** may well go hand in hand. Contact the author for more info.

VII. 'Helmet-on-wheels' vehicle safeguarding ADS deployment - moving up the SAE scale (level 4?)

Levels of Autonomy

- Level 5** full autonomy, no driver needed
still from SF film Minority Report 2002
- Level 4** 'helmet-on-wheels' AV safeguarding ADS deployment
smart-for-three.com
- Level 3** the driver doesn't have to keep their eyes on the road in certain situations
- Level 2** the car accelerates, steers and breaks on its own monitored by the driver
- Level 1** Basic assistance (ABS, ESP, cruise control, etc.)

