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THE MAY 2024 ISSUE IN BRIEF

THIS MAY ISSUE is mostly musings. I reflect on two transport-related incidents, both resulting in deaths. There was a container ship that collided with a bridge support in Baltimore in which six workers who were on the bridge perished, and there was a woman who drove her car into a lake and drowned. These have been classified as accidents because there seems to have been no malicious intent involved in either incident. However, both were preventable if those who were in charge of setting policies had made different decisions than the ones which allowed these deaths to occur. The pilot of the ship that collided with the bridge pier, and the driver of the vehicle that ended up in the water, bear responsibility for those actions which were under their control. The politicians who decided not to put guards around the piers, and the car manufacturer who decided to make gear shifting a test of video gaming acumen, share some the accountability. But the voters who put the politicians in their comfortable chairs, and the shareholders who have applauded the inventiveness and ingenuity of company leadership, do not escape criticism. Ultimately, it should not be a city or a state that decides whether to protect vital (and very expensive) infrastructure from being hit by wayward ships, and it should not be individual car companies who decide whether their cars can be driven by individuals who are incapacitated as a result of alcohol or drugs.

Own up to mistakes. Apologize for a wrongdoing. Promise to do better and then make sure you do. We expect this of our politicians and business leaders, but we don't seem to want to expect it of ourselves. Politicians and business leaders are a reflection of the people who put them where they are. If those voters do not want their loved ones killed by drivers affected by drugs and alcohol, vote for politicians who will pass laws that prevent it, and encourage good business leaders by voting with your money.

THE DISPATCHER

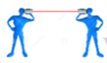
Mobility Industry Insights by Michael L. Sena
May 2024 – Volume 11, Issue 7

Feature: The Business of Safe Car Design

Feature Articles



The real case for driverless mobility



Vehicle-related telecommunications



Automotive artificial intelligence



The business of delivering transport systems



People and transport – the effects of how and where we live, work, and recreate on our requirements for transport



Standardization and regulation of transport systems

Getting out is more important than getting in

THE MOTIVATION FOR writing this article was a tragic occurrence: A person drove their car into a body of water and died. This incident became international news for two reasons: 1) the person who drove the car was well-known and very wealthy; 2) the person was the sister of Elaine Chao, who is both a former U.S. Secretary of Transportation and the wife of the current U.S. Senate Minority Leader, Mitch McConnell. The fact that the car was a TESLA added to the interest because the reason the car ended up in the water was linked to TESLA's unconventional gear-shifting design.

Approximately 400 people die each year in the U.S. in car accidents involving vehicle submersion.¹ That is, the car enters the water and the person cannot get out before the inside of the car fills up with water and the person drowns. Four hundred is around 1% of all U.S. traffic-related deaths. We don't know how many of those deaths were intentional, or 'autocide' to use the official term, with the driver using the vehicle and water rather than intentionally colliding with an oncoming car or purposely steering their car into a tree. What we do know is that it is effective, because once a car is in the water and sinking, it is not easy for the driver or occupants to get out of the car, especially with most newer-model vehicles that have power windows and automatic door locks. That's the problem. A great deal of care is dedicated by car designers to how we enter and exit cars under normal conditions, and doors and windows are controlled, but cars are not designed for easy exit once they have entered into and are submerged under water, as the Angela Chao incident illustrates.

¹ <https://www.autosafety.org/wp-content/uploads/import/Drowning-Deaths-in-Motor-Vehicle-Traffic-Accidents.pdf>

It is not often that a car accident is described in such detail as the one involving Angela Chao. The entire event had many witnesses as the drama played out over two hours between when the car entered the water and when the victim was pronounced dead. Among the witnesses was Ms. Chao herself, who made a phone call to a friend as soon as the car was in the water, and she continued to talk to this person for eight minutes, relating the status of the water level rising inside the car and providing details of how the car ended up in the water. What we know about the incident is what was released by the police in a public report.

Ms. Chao had invited seven close friends to the 4,500-acre ranch owned by her and her husband for a weekend party to celebrate the Chinese New Year. The party took place in a cottage on the ranch some distance from their home. The cottage is in close proximity to a pond. At around 11:37 p.m., security footage captured Chao walking alone and unsteadily to her vehicle, a *Tesla Model X*, wrapped in a blanket and holding a phone in her right hand. As she attempted a three-point turn, the vehicle suddenly "shot backwards" down an embankment (or over a retaining wall; there are two variants of the story) and into the pond at 11:38. A toxicology report, ordered as part of the investigation into her death, revealed that Chao had a blood alcohol concentration of 0.233, well above the legal driving limit of 0.08 in Texas.

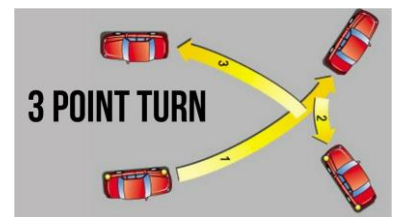
Chao called one of her friends who was at the party at 11:42 p.m. At this point she had not followed the first rule of surviving a water-related accident, and the call violated the second rule.²

Rule #1: When a car is entering the water, open a window and prepare to exit the vehicle as soon as it hits the water. The vehicle's electrical system should continue to function for at least a few minutes, so even electric window controls should work.

Rule #2: Don't waste precious time calling the emergency services until you are out of the vehicle. They won't get to you in time to keep you from drowning. A car can fill up with water in 60 seconds; the Tesla Model X took eight minutes.

The vehicle at this point was apparently floating but sinking slowly during the eight-minute phone call. Chao told her

² [How to escape from a sinking car | The AA](#)



friend she had put the car in reverse instead of drive – a mistake she had made before, she told her friend – causing the vehicle to go over an embankment and into the pond. She told her friend that the water was rising inside the car, and she was going to die.

Someone (Another friend at the party?) called 911. Emergency units arrived at 12.23. a.m. We don't know if the inside of the car had filled with water at this point. Rescuers stood on top of the submerged vehicle and tried unsuccessfully to enter the vehicle, attempting to break the windows with a pole. A tow truck arrived, but the *Tesla* was over 20 meters from the shore, too far into the pond for the truck's chains to reach it. Additional emergency responders then arrived with diving gear and managed to break a side window, extracting Chao from the vehicle at approximately 12:56 a.m. EMS responders performed "advanced life support" for 43 minutes in an attempt to resuscitate her, but she was ultimately pronounced dead at 1:40 a.m.

What we can assume from the report, but which was not specifically stated:

- The vehicle was not in more than 10 feet of water because the first rescuers could stand on top of the vehicle with their heads out of water.
- Chao did not attempt to exit the vehicle.

Faulty design or a series of unfortunate mistakes

News reports of the incident focused on how Angela Chao ended up in a car submerged under water, not on why she couldn't (or wouldn't) get out on her own. I want to address the issue of exiting a submerged car, but I feel it is important to be clear about how the car got into the water in the first place. Backing her car into the water at some distance from shore, whether it was down an embankment or over a retaining wall, was being blamed on TESLA and its non-conventional gear shifting method on the *Model X*. Incorrect shifting does not explain why she drove the car so fast to make it "shoot backward". Was her high blood alcohol level the reason she made both the shifting and driving mistakes? I decided to ask the readers of *THE DISPATCHER* who own or drive a TESLA for their opinion on the gear issue with the caveat that I would make their replies anonymous.

There are various theories about how the incident occurred (accident or sabotage³), but one of them is that she swept her finger the wrong way when changing gears, and the car backed into the water rather than moving forward. My questions to readers were:

1. *Could such a mistake happen?*
2. *I have checked, and it appears that every model has a different method to change gears, with all of them somehow involving the large display screen. Can you confirm this?*
3. *Do you have thoughts on why it was not possible to unlock the door or open the windows from inside? It is not clear from any of the reports whether she died from lack of oxygen or if water seeped into the vehicle and she drowned. She was on the phone with a friend for over eight minutes as the car was sinking.*

None of the readers responding owned or has driven a *Model X*, so they could not say whether they had a similar experience. One reader sent a clip from the *Model X* manual. "To manually shift into Reverse, swipe down on the drive mode strip located on the touchscreen, or, if the touchscreen is unavailable, press R on the drive mode selector located on the center console (shown below right along with an enlarged image of the touch-sensitive shifting buttons). You can shift into Reverse when the *Model X* is stopped or moving less than 5 mph (8 km/h)." Another reader who has a *Model Y* said that he has put his car into the wrong gear, even though it is a physical control located on the steering column behind the wheel, not a screen-based gear shift like the *Model X*. The *Model 3* has a shifter paddle on the steering column, with down being Drive and up being Reverse. There is no other way to shift on the *Model 3*, says the reader.

All ten of the readers who sent me their thoughts offered the same conclusion. Anyone can put any car in the wrong gear, but your physical and mental capacities have to be compromised to drive a car at high speed in the wrong direction — unless there is something wrong mechanically with the car. Although Angela Chao had a blood alcohol level three times over the legal limit, she did have the presence of mind to make a phone call. However, neither she nor the person on the other end of the call had the presence of mind to focus on the main problem, which was how to get out of the car



A Model X Center Console.



³ One journalist speculated that her car's software had been hacked, but so far, there is no evidence of foul play.

before it was too late. If she had pressed the window control button at this point, it might well have opened and I would not be writing this article.

When your car is sinking, it's too late to read the manual

It seems that Angela Chao put all of her hopes on being rescued, effortlessly lifted out of the water inside her car so she could get on with her life. Maybe she thought she would drown instantly if she opened a window or tried to open a door. When the car settled on the bottom of the pond, it was only a few feet to the surface. When the car was sinking and the water level was rising inside the car, the last thing she would think of doing was to reach for the manual to find out how to open a door or window when the electrical system fails. (The manual is on the screen, so "reaching for the manual" wasn't an option.) If she had read the manual before she found yourself in the water, she would have known that it is possible to unlock both the gullwing front and rear doors manually. The front doors are straightforward to unlock. There is a lever behind the window control buttons. You pull it up, and the door unlocks. Opening the door will be a struggle because it is very heavy, and it might have been difficult for a petite Angela Chao, especially with the added pressure of the water, but it appears that neither she nor the person she was talking with on her phone knew about this lever. If she knew this, or if someone at her party knew it, she could have used all her strength to open the door wide enough for her to escape, and I would not be writing this article.

Why couldn't Ms. Chao or the rescuers break the glass? The *Model X* has laminated double-pane glass windows. There are two sheets of glass that sandwich a polyvinyl butyral film. The film keeps the window from shattering, slightly reduces road noise, makes it harder to break into a *Tesla*, and prevents a driver from being thrown out of the car in a crash. However, laminated double-pane glass windows are nearly impossible to break underwater, according to testing done by the AMERICAN AUTOMOBILE ASSOCIATION.⁴ You need special tools, which the final group of rescuers apparently had. There is nothing unique or special about TESLA's window design, and, unlike the *Cybertruck*, the windows on the *Model*



The emergency door opening lever for the Model X front doors is located behind the window control buttons

⁴ <https://www.caranddriver.com/news/a28422725/car-windows-glass-aaa-unbreakable/>

X, Y, 3, and S are not bulletproof. New cars have been fitted with laminated glass for over ten years.

Safety authorities playing the percentages

I said earlier that 1% of all annual U.S. road deaths, or 400, are the result of drowning in a submerged vehicle. A larger problem in terms of fatalities was drivers and passengers being ejected from vehicles in crashes. In a 1999 study for NHTSA by TRANSPORTATION RESEARCH CENTER, INC., it was found that there were 5,000 deaths each year from vehicle ejections.⁵ In a 2011 report on fatality studies, NHTSA found that passengers are 64% less likely to die if they are not completely ejected in a crash. So, NHTSA added a new rule to the *Federal Motor Vehicle Safety Standard* for Ejection Mitigation.

49 CFR Parts 571, 585 226

This final rule establishes a new Federal Motor Vehicle Safety Standard No. 226, "Ejection Mitigation" to reduce the partial and complete ejection of vehicle occupants through side windows in crashes, particularly rollover crashes. The standard applies to the side windows next to the first three rows of seats, and to a portion of the cargo area behind the first or second rows, in motor vehicles with a gross vehicle weight rating (GVWR) of 4,536 kilogram (kg) or less (10,000 pounds (lb) or less). To assess compliance, the agency is adopting a test in which an impactor is propelled from inside a test vehicle toward the windows. The ejection mitigation safety system is required to prevent the impactor from moving more than a specified distance beyond the plane of a window.

The new rule required a combination of stronger windows and side airbag curtains to keep occupants inside the vehicle during a rollover. Tests developed by NHTSA required vehicle manufacturers to demonstrate that side windows are "strong enough to cause a maximum allowable deflection at specific speeds and forces designed to simulate a person's head or shoulders impacting glass." So, it was then that car manufacturers began to install laminated glass inside windows and sunroofs. I have found no indication that the studies and the final rule on ejection mitigation took into account the negative effects of the change of glass type on exiting vehicles in the case of submersion or any other reason. The laminated glass is difficult to break, either from the inside or the outside, and if you have only seconds to get out of a sinking or burning vehicle, if you can't roll down the windows

⁵ https://www.nhtsa.gov/sites/nhtsa.gov/files/sduffy_sae2k2.pdf

or open a door, and if you don't have the right kind of tool with easy reach, you are not going to get out.

What about the automatic door locking? Most modern cars are fitted with automatic door locking.⁶ After the car reaches a speed of around 20 km/hr. (10-12 mph), the doors are automatically locked. When the car comes to a stop and the car is put into park, the doors unlock. There is no regulation governing automatic car locking; it has developed all on its own as a safety feature, to make carjackings more difficult, and as an added measure to help ensure that car doors stay closed in a crash.

Conclusion: Staying in and keeping out took priority

It is more probable that Angela Chao would have been involved in a carjacking or an accident in which her car rolled over than finding herself submerged under six-to-ten feet of water. The laminated windows that proved difficult to break by those attempting to rescue her, and the heavy doors that she may not have been able to open – even if she had located the unlocking lever – would have helped to save her life and kept her from harm in an accident on land. It is not clear from the information that we have that she would have been much better off if she were driving a 1963 VW Beetle, with lighter-than-air doors and roll-down windows. It seems she was frightened by the thought of leaving the vehicle, but this is pure speculation.

How many of the four hundred others who die each year in submerged vehicle events don't know how to escape, or are afraid to attempt an escape? This accident can contribute to reducing that number of deaths by encouraging car companies to build in ejection-enabling functions that work in various types of emergency situations, including submersion. Ending up in the water and quickly escaping from the vehicle is not top-of-mind for either car designers or regulators, but it should be. Also, there is clearly a need for significantly better driver information and education systems so that drivers know what they should and should not be doing if they wind up in the unfortunate situation with their car sinking in a river or lake. Information should be part of driver training and licensing examinations.

⁶ [locks - What is the point of automatically locking doors? - Motor Vehicle Maintenance & Repair Stack Exchange](#)

I have saved my most important thought for last. Imagine if Ms. Chao's car had an alcohol lock installed. She never would have gotten as far as starting the motor. Anyone can install an alcohol lock on their vehicle if they want to make sure they, or someone else with the keys to the car, don't drive when they have had too much to drink. In some places, a repeat DUI offender is obligated to have one installed. Twenty states require it; Texas is not one of them. Buses and taxis have them by law in some countries, like Sweden. Why don't all cars have them? Because there are enough people telling their politicians that if they push through legislation requiring them, they won't vote for them in the next election.

In the Bipartisan Infrastructure Law passed by the U.S. Congress in 2021, there is a clause requiring the installation of devices to prevent drunk or impaired driving. In December 2023, NHTSA stated it had taken the first step toward requiring these devices. It had (finally!?) started the process to put a new federal safety standard into the *Federal Motor Vehicle Safety Standards (FMVSS)* to require the technology in all new passenger vehicles.⁷ It will take months or, more likely, years for this process to result in a new rule, especially if there are large enough groups both inside and outside the legislature who want to prevent its adoption.

Personally, I believe it is time we stopped allowing people to kill other people in the name of their personal freedom. If someone wants to drive their vehicle in an impaired state without endangering the lives of others, that's their business. But as soon as they have the possibility of killing me or anyone else, they have exceeded the limits of freedom.



⁷ US agency takes first step toward requiring new vehicles to prevent drunk or impaired driving | AP News

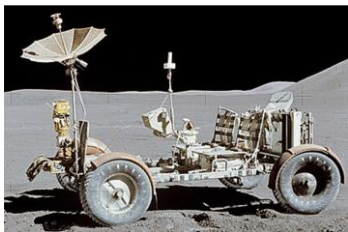
Dispatch Central



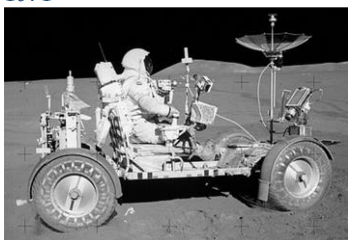
The topics covered in Dispatch Central are newsworthy, but I leave it to others to deliver them "as they break". I give them a little time to settle in, and try to provide an analysis of their impact.

The Moon Buggy will ride again

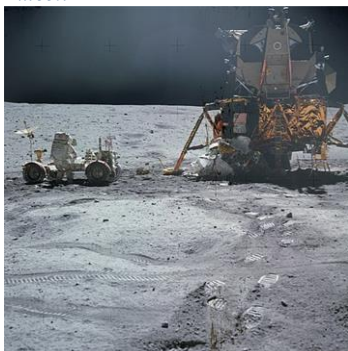
REMEMBER THE *LUNAR ROVING VEHICLE (LRV)* in the American Apollo Program? The Apollo Program landed the first, and to-date, the only humans on the Moon. The first manned mission, Apollo 11, landed on the moon on the 20th of July 1969. Commander Neil Armstrong and pilot Buzz Aldrin became the first men to walk on the moon. The event was broadcast on radio and television around the world. I heard it on my car radio while driving my VW Beetle in Vermont. Future Apollo missions repeated and expanded on the first for a total of six successful human lunar landings by 1972.



The U.S. Apollo Lunar Roving Vehicle from Apollo 15 on the Moon in 1971

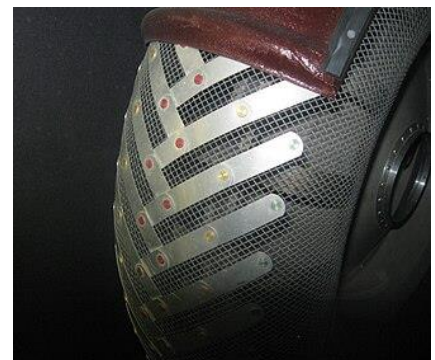


Apollo 15 - Commander David Scott drives the Rover near the LM Falcon



John Young works at the LRV near the LM Orion on Apollo 16 in April 1972.

The *LUNAR ROVING VEHICLE*, also called the "Moon Buggy" (a play on "Dune Buggy", which it resembled), first saw duty in 1971 on Apollo Mission 15. It would be called into duty on the Apollo Program's last three missions, 15, 16, and 17, during 1971 and 1972. It was a battery electric vehicle, designed and manufactured by BOEING and GENERAL MOTORS. Each wheel had its own non-rechargeable electric drive made by DELCO, then a subsidiary of GM, a brushed DC electric motor capable of 0.25 horsepower (190 W) at 10,000 rpm, attached to the wheel via an 80:1 harmonic drive, and a mechanical brake unit. The key feature were its wheels, designed and manufactured by GM DEFENSE RESEARCH LABORATORIES in Santa Barbara, California. They consisted of a spun aluminum hub and a 32-inch (81 cm) diameter, 9-inch (23 cm) wide tire made of zinc-coated woven 0.033-inch (0.84 mm) diameter steel strands attached to the rim. Titanium chevrons covered 50% of the contact area to



provide traction. Inside the tire was a 25.5-inch (65 cm) diameter titanium bump stop frame to protect the hub.⁸

That was then. NASA is now preparing for a return to the Moon with its Artemis Program, scheduled to land humans on the Moon in the 2030s. The Program needs a new lunar rover, which NASA has renamed the *LUNAR TERRAIN VEHICLE (LTV)*. It put out a request for proposals and received five replies. GM, Lockheed Martin, and Northrop Grumman were part of the mix. After a series of delays in issuing follow-up RFPs, NASA announced on the 3rd of April 2024 that Intuitive Machines, Lunar Outpost, and Venturi Astrolab will be developing an LTV concept as part of a "12-month feasibility and demonstration phase". Each of these companies have the assignment to design a vehicle that will accommodate two suited astronauts. They must feature robotic, remote operation capabilities as well so that NASA can perform tests and explore the Moon's surface even when the astronauts are not on the Moon.⁹

Who are these companies, and why is NASA handing them the baton instead of the usual aerospace suspects? INTUITIVE MACHINES, INC., based in Houston, TX, was founded in 2013 as a space exploration company. Its principal accomplishment is landing a lunar module on the surface of the moon in February 2024, albeit on its side. It was the first landing of a U.S. Moon vessel in more than fifty years. LUNAR OUTPOST is the prime contractor in a consortium that includes LOCKHEED MARTIN, GM, GOODYEAR TIRE, and MDA SPACE (so the usual suspects are actually involved). VENTURI ASTROLAB started life in the early 2000s as a battery electric car maker. Its big idea was to charge the car with solar energy. Note the solar panels on the top surface of their 2006 concept car. VA's concept for the LTV is less inspiring, looking more like a late 19th century horseless carriage.

As of 2023, NASA plans to launch the *LTV* on Artemis 5, which is expected to launch no earlier than March 2030. I expect we will see more prototype images as the teams beaver away on their designs.

⁸ https://en.wikipedia.org/wiki/Lunar_Roving_Vehicle

⁹ NASA reveals new moon car that will help astronauts unlock secrets of space (lad-bible.com)



Concept image of the buggy (NASA)



Venturi Astrolab's 2006 BEV above, and its FLEX LTV below.



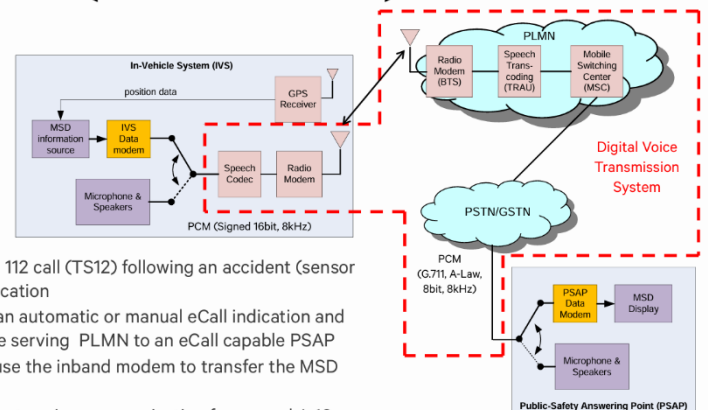
Shutting down 2G/3G impacts EU-eCall

THOSE OF US who purchased a new car after the 31st of March 2018 may not be able to drive it in the very near future. The reason has nothing to do with the vehicle, but with the mobile telecommunications networks. Cars sold after the 31st of March 2018 within the EUROPEAN UNION and countries that voluntarily comply with certain EU regulations (e.g., Switzerland, Norway, and the UK) were required by law to have an emergency call system, called *EU eCall*, installed in the vehicle. In case of a crash, this system automatically triggers a 112-voice phone call to the emergency services (Public Service Answering Points - PSAPs) and sends a data message within the voice call. **NB: An SOS button that is manually pushed is also a mandatory part of the EU eCall system.**

The technology used for *EU eCall*, an in-band modem,¹⁰ works with 2G and 3G circuit switched networks, not with the later 4G and 5G packet switched networks. When the mobile network operators turn off their 2G and 3G networks, as they plan to do, vehicles with 2G/3G phone systems that rely on the in-band modem will no longer function.

If *EU eCall* doesn't affect the operation of the vehicle, why can't owners continue to drive those vehicles, you might ask. Following the establishment of the *EU eCall* Regulation,¹¹ a functioning *EU eCall* system is tested as part of the EU Type Approval regimen. Tests of the systems are also incorporated into the annual inspections performed in each country. If the system doesn't function, for whatever reason, it does

Operation of CS eCall (with Inband Modem)



- The IVS instigates a 112 call (TS12) following an accident (sensor trigger) or user invocation
- The 112 call carries an automatic or manual eCall indication and can be routed by the serving PLMN to an eCall capable PSAP
- The PSAP and IVS use the inband modem to transfer the MSD over the voice path
- MSD transfer interrupts voice communication for around 4-10 secs at the start of the eCall

MSD – Minimum Set of Data
PLMN – Public Land Mobile Network
IVS – In-vehicle System
PCM – Pulse-code Modulation – a method used to digitally represent analog signals.

Source: Qualcomm (https://doc-box.etsi.org/Workshop/2021/202103NGeCall_webinar/Ralf_Weber_Next_Generation_eCall_vs_Legacy_eCall.pdf)

¹⁰ In telecommunications, in-band signaling is the sending of control information within the same band or channel used for data such as voice or video.

¹¹ REGULATION (EU) 2015/758 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 29 April 2015 concerning type-approval requirements for the deployment of the eCall in-vehicle system based on the 112 service and amending Directive 2007/46/EC

not obtain Type Approval and it does not pass annual inspection. In the first case, it cannot be sold, and in the second case it cannot be driven.

If you are thinking that this sounds like a typical Catch 22, you would be correct. *The European Commission* was warned by both the automobile industry and the mobile network operators from the first time their 112-based proposal saw the light of day back in 2004 that mandating a particular hardware device based on a particular mobile network technology would cause problems for vehicle manufacturers, vehicle owners, and the PSAPs. Alternatives were suggested, including mandating that each manufacturer install their own so-called third-party systems, like the *Volvo On Call* system.

No point talking if nobody's listening

Of course, making the call from the car is only one-half of the job. The PSAP must be able to receive the call, extract the data sent via the in-band modem, and locate the scene of the accident on a tool used by the PSAP call agent. Installing the equipment in PSAPs in all EU countries was a large part of the reason it took sixteen years from the time the EU decided it would have a 112-based e-call system—which was actually in 2002—and when the first calls could be made from vehicles. According to EU regulations, all countries should have been able to receive EU eCalls six months prior to vehicle sales of EU eCall-equipped vehicles, but it was never clear if this requirement was met—or is met today.

Time to start over with Next Generation EU eCall

It was no secret that the mobile network operators would close down their 2G and 3G networks (called 'sunsetting') in the not-too-distant future when the EU passed a regulation mandating a system that would be out of date when it finally went live. The EU made the judgment that after more than a decade, it had to save some portion of its face, so it went ahead knowing it would need to begin a new process to develop standards for what became known as *Next Generation eCall*. This would be based on using packet switched networks.

Next Generation eCall for 4G (NG eCall) standardization began in 2013 and was completed in 2017. Support for 5G has since been added. IP Multimedia System (IMS) replaces the circuit switched in-band modem emergency call. In case of an

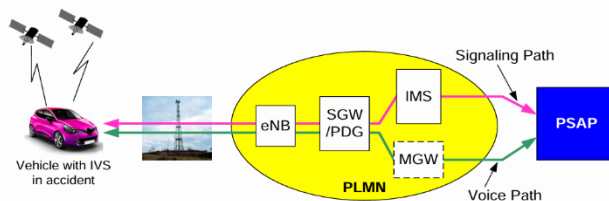
accident, or when the SOS button is pushed, the IVS with a 4G/5G phone system initiates an emergency call over IMS. The serving PLMN separates the voice call from the MSD message. If the receiving PSAP is set up for circuit switched data (i.e., has not converted to IP), a media gateway (MGW) converts the VoIP voice to CS voice.

What is clear from this revised standard is that a PSAP may continue to operate with its circuit switched-based system even after a mobile operator shuts down its 2G/3G network,

but both the vehicle manufacturers and the mobile network operators must accommodate both CS- and PS-based workflows. The only organization calling for a review of this process and additional time for developing solutions that also take into consideration the issue of millions of legacy in-band modem-based systems is ACEA (EUROPEAN AUTOMOBILE MANUFACTURERS' ASSOCIATION). None of the other organizations involved in this issue, especially the EUROPEAN COMMISSION, seems to understand that if a mobile network operator in one country shuts down its 2G/3G network, an IVS that is based on a 2G/3G phone module will not work in that country. In addition, if it is replaced with a 4G/5G module, it will not work in those markets where the 2G/3G networks have not been shut down and 4G/5G has not been built out. In addition, replacing that module involves significant cost.

ACEA has pointed this out on many occasions without the message being accepted by the COMMISSION. Telecoms hardware manufacturer, ERICSSON, also made valiant attempts to put the problem into terms that should have been understandable to the COMMISSION, and offered alternatives that would have ensured we would not be in the situation we are currently in. Throughout this entire process, the EUROPEAN COMMISSION has acted like the in-vehicle system is a zero-cost component, and something like a headrest cover that can be replaced on a whim.

Operation of NG eCall for 4G (LTE)



- The IVS instigates an emergency call over IMS following an accident or user invocation
- The serving PLMN establishes a call to a PSAP with a SIP/IP signaling path through an IMS (pink arrow) and a separate voice path (green arrow) for transfer of VoIP
- If the PSAP uses CS access and not IP, an MGW transforms the VoIP into CS voice
- The MSD is transferred in a SIP INVITE message sent to the PSAP over the signaling path
- The voice path is not interrupted or affected by the MSD transfer
- 5G support is similar (e.g. a gNB replaces the eNB and a UPF replaces the SGW/PDG)

SIP/IP – Session Initiation Protocol/Internet Protocol
 eNB – evolved Node B (for LTE access)
 SGW/PDG – Serving Gateway/Package Data Network Gateway
 MGW – Media Gateway

Source: Qualcomm



Car headrest covers to match your house decor can be replaced on a whim, while in-vehicle systems cannot.

Third-party systems solved all of these problems

There was one battle that the *COMMISSION* did not win, although it tried its best to do so. Germany, France, Italy, and Sweden said they would not vote in favor of the regulation mandating *EU eCall* if the regulation did not also include an allowance for vehicle manufacturers to offer their own emergency notification services, such as the *Volvo On Call* system. BMW and VOLVO CARS had started installing emergency systems in their vehicles in 2001, and many other car companies were doing the same.

Third Party Systems (TPS) are included in the EU Regulation with the following stipulations:

- They must comply with EU approved technical standards.
- They must ensure an automatic switch to the 112 eCall if the TPS does not work.
- They must allow the owner of the vehicle to choose between the 112-based eCall and the TPS service; and
- They must not allow any exchange of data to take place with the 112 eCall system

Car companies operating in both Europe and the U.S. learned their lessons about sunseting in the U.S., with the closure of first the analog system, AMPS, and then the TDMA/CDMA networks. They have been careful to follow the progress of mobile networks and ensure their cars had the latest technology as soon as it was operational. There will be vehicles that are over 12-15 years old that will have 3G phone modules, but most vehicles sold with TPSs made the switch to 4G at the time the first EU eCalls were being installed.

What's the bottom line?

Right now, we do not know whether the EU through the *Commission* will push the problem on the car companies and force them to offer an aftermarket 4G-based IVS to replace the 3G-based *EU eCall* systems. We do not know if there will be any form of compensation offered to the car companies for installing these systems, or subsidies to vehicle owners who will then pay for the new systems. The last thing car owners will want to hear is that their car has a device which they did not pay for (directly, since it had to be included in the price

of the vehicle), did not ask for, and probably did not even know was there, and that unless they upgrade it, they will not be able to drive their car when something happens that is totally invisible to them, that is, the turning off of the 2G/3G network.

The moral of this tale is that governments should not be in the hardware specification business. They should be in the requirements specification business. Double period.

Turing Test org questions driverless future

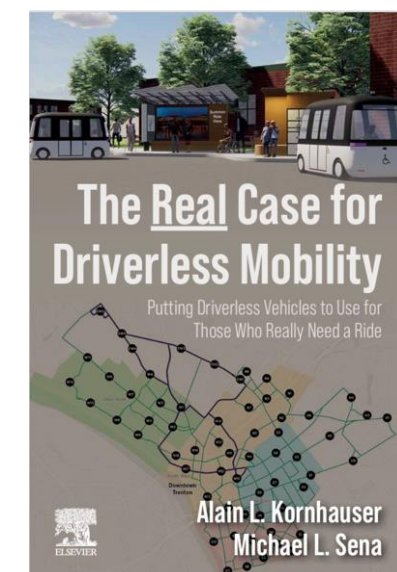
THE ORGANIZATION THAT selects the recipient of the annual *Turing Award*¹² for "contributions of lasting and major technical importance to computer science", the ASSOCIATION FOR COMPUTING MACHINERY (ACM), says in a recent report that developing driverless vehicles in the hope they will be safer than vehicles driven by humans is a waste of time and money. "The feasibility of reaching the goal (of delivering a safer future for the traveling public in a widespread way) is uncertain," writes Larry Medsker, chair of ACM's U.S. Technology Policy Committee and the report's lead author, while noting that "driverless vehicles have thus far caused serious injuries, deaths, and other problems during testing and commercial deployments".

Here are the policy implications of ACM's critical analysis:

- 1) Regulators should not assume that fully automated vehicles will necessarily reduce road injuries and fatalities.
- 2) It is unclear that fully automated vehicles will be able to operate safely without a human driver's attention, except on limited roadways and under controlled conditions.
- 3) Improved safety outcomes depend on appropriately regulating the safety engineering, testing, and ongoing performance of automated vehicles.

I and my co-author of **The Real Case for Driverless Mobility**, Alain Kornhauser, more or less agree with these three statements. However, like almost everything that is written

¹² The award is named after Alan Turing, who was a British mathematician and reader in mathematics at the University of Manchester. Turing is often credited as being the founder of theoretical computer science and artificial intelligence, and a key contributor to the Allied cryptanalysis of the Enigma cipher during World War II. From 2007 to 2013, the award was accompanied by a prize of US\$250,000, with financial support provided by Intel and Google. Since 2014, the award has been accompanied by a prize of US\$1 million, with financial support provided by Google.



about driverless vehicles, the ACM's critical analysis of driverless vehicles makes no mention of WHY these vehicles SHOULD BE developed, and who might actually benefit from their deployment. They miss the main and most important difference between driverless vehicles and vehicles that are driven by a human: driverless vehicles don't have a driver, and unless the driver is driving himself, he has an associated cost. The cost can be calculated in monetary terms if the driver is paid for her services, or it can be calculated in time, if the driver is doing the rider a favor.

As we wrote in our book, *"What we have had for the almost twenty years that work has progressed on driverless vehicles is technical innovation, with incremental improvements in sensors and algorithms building on each other, allowing increasing amounts of self-driving by the vehicle. But what we have not had is the disruption of entrepreneurial innovation, the one that turns an invention into a product or service that is valued and desired by consumers, that solves a problem that needs solving, not just does something that is already being done but with a slight twist. People who can afford to take taxis or who own their own cars don't need to have cars that drive themselves. They may think it's neat or cool, but their lives and livings don't depend on it. What has been missing in the CRUISES, AURORAS, WAYMOS and the others working on driverless vehicle solutions, either as divisions of large, established companies like GM and Alphabet, or as independent start-ups, is the spark for a real innovation that will truly disrupt the provision of mobility. We need a great leap if we are going to be able to provide mobility for a large portion of the population who need it but who cannot obtain it when they need it for a price they can afford."*¹³

Here is a partial list of the eventual customers who need the flexibility that a car can provide, but do not have access to one or to someone who can give them a ride, and cannot afford to be chauffeured for a fee:

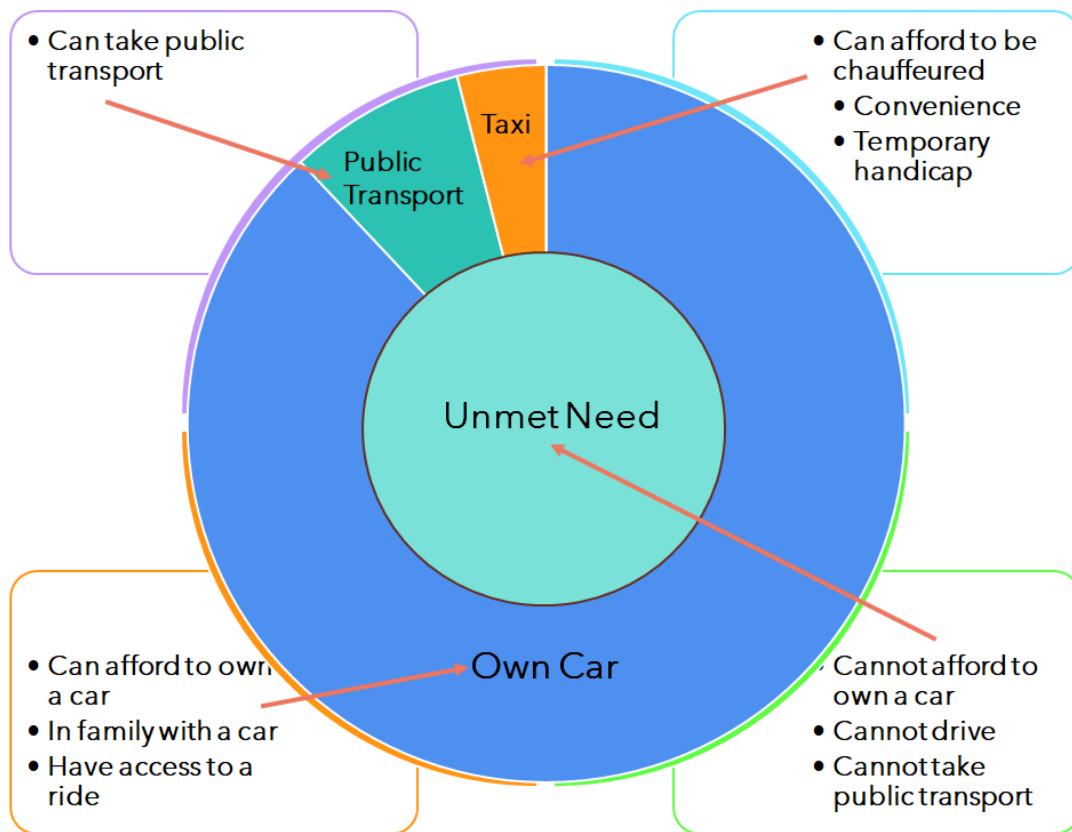
- Those who cannot afford their own cars
- Those who are too old to drive themselves
- Those who are physically challenged, either permanently or temporarily (broken leg, eye surgery, prescribed medication)
- Those who are too young to drive themselves

¹³ Sena, Michael and Kornhauser, Alain. [The Real Case for Driverless Mobility](#). Elsevier, Inc. (2024). Page 133.

- Those who are members of families that own a car, but the car is used by other family members
- Those who have had their drivers' licenses revoked
- Those who have a car, but are going to a place where they cannot afford the parking fee



How big is the potential customer base? Given the complete lack of attention accorded to it by companies working on driverless solutions, pundits writing about it, and financial analysts making recommendations to investors, you might think it is insignificant, a few million, perhaps. You would be wrong. In the U.S. alone, it approaches 100 million potential riders, and most of them are not being served today. They represent an unmet need. Details can be found in our book.



The largest majority of trips taken today for whatever purpose in the U.S. and Europe are in cars. In cities with good public transport systems, more people use those systems. Taxis – and the so-called 'robotaxis' under development – are for people who can afford to be chauffeured. Those who cannot afford to own a car, cannot drive, or cannot take public transport are the forgotten ones, and meeting their unmet needs is the real case for driverless mobility.

Crew Comments

A reader's thoughts on LEO and transport

In the April 2024 issue of *THE DISPATCHER*, in *Musings*, I wrote about the potential of Low Earth Orbit satellites for transport applications.

Anders Fagerholt, formerly in charge of all of ERICSSON's intelligent transportation system activities, offered thoughts of his own on LEO for transport. He wrote:

GNSS/GPS benefits greatly from Real-time Kinematic (RTK) Networks that provide real-time corrections for errors in current satellite navigation systems. In 4G and 5G, RTK data can be sent from base stations (which know where they are) along with the signaling and synchronization information. We do this in the test nets at ASTA Zero¹⁴, for example. Also, very good for autonomous vehicles in gravel pits, open-pit mines, etc. A standard feature in mobile systems. So, satellite and terrestrial can actually support each other. (The closer you are to the "RAK transmitter" the better the GPS position).

City canyons are much worse for satellite systems than for cellular because cellular "always" works with multipath and collects the largest reflections in the signal flow. GPS can easily be 50 meters wrong on fairly normal inner-city streets.

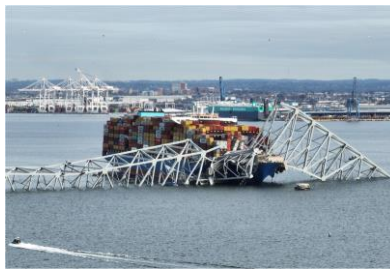
Finally - New Guinea's highest point is 4884 meters above sea level and most of the population farms in the highlands, so sea level rise is probably one of the least of their worries. Those with problems are the Maldives and Micronesia 😊.



Musings of a Dispatcher: Policy Frameworks



The Francis Scott Key Bridge before being struck by the MV Dali Container Ship



...and after.



Deciding what to do and what not to do

In politics, our choices often come down to which insoluble problems we are best able to live with – or think most worth living with.

Joshua L. Cherniss, Liberalism in Dark Times¹⁵

A GIGANTIC SHIP plowed into one of the piers supporting Baltimore's Francis Scott Key Bridge, and the bridge collapsed within forty seconds. The bridge has been one of Baltimore's landmarks since it opened in 1977. I have driven over it a number of times; luckily, not at 1:28 a.m. on the 23rd of March 2024. On that night, the *MV Dali* container ship briefly lost all electrical power as it approached the bridge and drifted, uncontrolled, into a pier. The entire central truss portion of the bridge crumpled and fell into the Patapsco River. Six men were on the bridge when it collapsed, repairing the road surface. They all perished.

When I heard this, my first question was: "Why was it possible for the ship to get close enough to the pier to be able to hit it?" Look at the lower photo (left) showing the collapsed bridge and two high voltage power poles. What is at the base of each of the power poles that is not around the base of the piers on the top photo? Pier guards. The electric power company made a decision to protect its poles, while the MARYLAND TRANSPORTATION AUTHORITY, under the direction of the *Maryland State Roads Commission*, which is responsible for the building and operation of the Key Bridge, decided that it would be too costly to construct pier guards. That decision was made when the bridge was first built, and then confirmed after the September 11, 2001 terrorist attacks. "We can live without them," the COMMISSION and *Authority* decided.

As the illustration on the next page shows, container ships in 2001 were only about 20% longer than those built at the time the Key Bridge was constructed and the

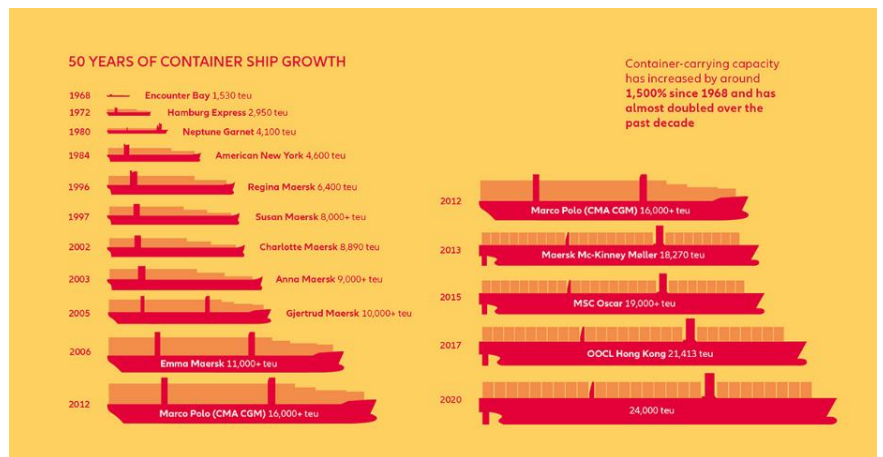
¹⁵ Cherniss, Joshua L. *Liberalism in Dark Times: The Liberal Ethos in the Twentieth Century*. Princeton University Press (2021).

COMMISSION and *Authority* decided it could live without pier guards, but they carried double the tonnage. By 2020, these ships had grown prodigiously. They were over four times longer and carried six times the tonnage. The piers without sturdy guards were no match for them. It is likely that many of the bridges that the behemoths pass under all around the world are as poorly protected as the Key Bridge was.

My second question was: "What about the ship? How could it lose power? Didn't it have back-up power generators? Do these ships really have only one engine?" According to what has been reported thus far, a few minutes before the ship hit the pier, all power on the ship was lost. The engine (yes, only one) stopped, all lights went off, and the ship could not be steered. A *NEW YORK TIMES* article written one week after the event provides information on where the investigations related to the ship's system functions are focusing. Much of that focus is on the "electrical generators that power nearly every system on the 984-foot (300 meter)¹⁶ vessel, not only the lights, navigation, and steering, but the pumps that provide fuel, oil, and water to the massive diesel engine."

Experts are having difficulty reconciling the complete blackout reported by the ship's pilot with the current state of ship design, with computerized monitoring, built-in redundancies, and back-up systems that are designed to prevent such a mishap. *MV Dali* was equipped with the latest fail-safe systems, but were they operational? Have they been properly tested and maintained? Another potential cause of the problems is contaminated fuel. The same fuel source is used by both primary systems and secondary back-up generators. If it was the fuel, a second engine would not have been of any help unless that engine had its own, separate fuel source and the fuel came from a different supplier.

¹⁶ Just to give this a bit of perspective, three American football Super Bowls could be played simultaneously on its deck when it is clear of containers, including plenty of room for the fans.

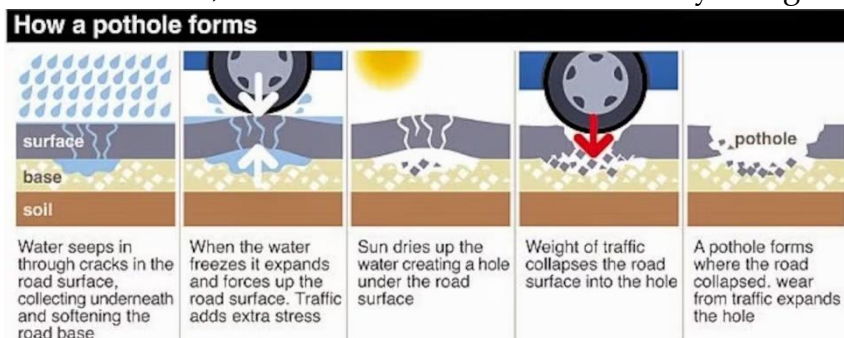


These were not mistakes; they were policy decisions

Investigative journalists are paid for finding catastrophes and identifying the parties whom they will figuratively burn at the stake for their culpability. Witch hunts have been going on for centuries, perhaps millennia. Today, it is the media, not the Church, which run the inquisitions. Even if it was one person who said, "We can live without pier guards," or a person of authority in the shipping company that owns the *MV Dali* who said, "Buy the cheapest diesel fuel," these decisions were made within the context of policy frameworks that were established with the explicit or tacit agreement of the citizens of Maryland and Baltimore, or the owners of the ship. In the case of the public agency, we gave the "deciders" our vote or allowed them take control by our inaction. In the case of the shipping company, its shareholders/owners gave the board, and therefore the company's management, the right to make whatever decisions they made. They decide what we get, and what we don't get, and their decisions are based on how much we are willing to pay in taxes or accept in share value and dividends, how we want the money we pay to be divided up among all the competing demands, and what level of discomforts we are willing to abide in return for keeping a larger portion of our money to do with what we please.

This is how he works. We all know it, but we force this knowledge to the back of our minds when it comes time for a reckoning, when a decision made by the political party we voted for materially affects us—personally. We gave the bums our mandate, but now we want to throw the bums out.

Let's take a simple example to illustrate this point: potholes. As it turns out, the six men who were on the Key Bridge at



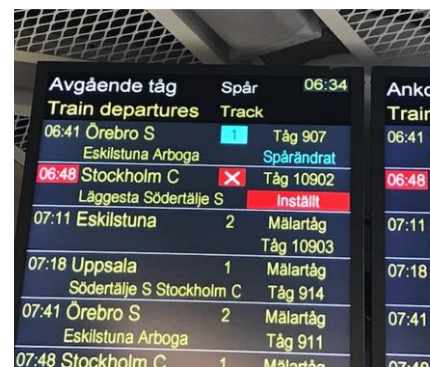
the time it was rammed by the *MV Dali* were fixing potholes. What better time is there to fix potholes than the middle of the night, when traffic levels are at their lowest? But potholes

are not like a lightbulb that has exceeded its expected life. Potholes are a symptom of a problem with road maintenance. The asphalt surface is worn out, often because the road is carrying more weight than it was originally designed to carry. The average weight of passenger cars has increased by almost 300 kilograms (660 pounds) during the past twenty years.¹⁷ Today, a fully loaded semi-truck in the U.S. weighs 36,000 kgs (80,000 pounds), while empty it is around 16,000 kgs (35,000 pounds). Weight matters. It wears down the surface, opening cracks and allowing water to seep in. The water freezes, expanding the surface, and when it dries, a hole is created under the surface. The surface collapses under the weight of vehicles, and potholes are the result.

If you don't maintain the asphalt surface, you have doomed road users to live with the dangers and discomfort of potholes. You have accepted that you will respond to complaints by drivers (and insurance companies that have to pay for repairs to cars damaged by driving into potholes) when they grow too loud to ignore to fill the holes. That is what the workers were doing on the Key Bridge in the middle of the night on the 23rd of March 2024.

I had never experienced a pothole on a Swedish road until several years ago, neither on local roads owned and maintained by local authorities, nor on national roads owned and maintained by the *NATIONAL ROAD AUTHORITY (VÄGVERKET/TRAFIKVERKET)*. I had grown up in a city that was known for its potholes, and lived for eighteen years in a state, Massachusetts, which had the perfect climate for growing potholes. But Sweden was a pleasant change until it changed. It seemed that potholes began showing up at about the same time as the trains began to stop running on time and there were increasing numbers of cancelled departures, like the one I had booked on the 11th of April ("Inställt" means Cancelled). What had changed? The answer: Swedish transport policy had shifted as part of a move from Collectivist to Individualist government.

Although the differences between the main center-right and center-left parties in Sweden are not as great as the divide between radical Republicans and the so-called "democratic



¹⁷ <https://1point5.caneurope.org/france-weight-passenger-vehicles/>

socialists" in the U.S., they represent the sides of the Individualist/Collectivist spectrum. Individualists believe there should be a minimum amount of government direction and regulation to ensure that individuals benefit from their labors, while Collectivists believe that the state is the high authority and must arbitrate and decide what is in the best interests of all those who are ruled by its laws.

From maximum to minimum regulation

During the middle of an eight-year period between 2006 and 2014, when Sweden was led by a right-of-center coalition under a *Moderate Party* Prime Minister, these politicians realized their long-sought goal of eliminating the national railroad's monopoly on running trains. At the same time, the government merged the *NATIONAL ROAD AUTHORITY (VÄGVERKET)* with the *NATIONAL RAILROAD AUTHORITY (BAHNERKET)*, forming today's *TRAFIKVERKET*. From that point on, one, merged organization haggled over how much it would spend on maintaining the rails, and how much it would spend on maintaining the roads. Both are suffering badly. Pre-merger, *VÄGVERKET* had 3,000 employees with a budget of SEK 24 billion, while *BAHNERKET* had 6,558 employees and a SEK 2,027 billion budget. Today, *TRAFIKVERKET* has 9,000 employees and a budget of SEK 75 billion. Everything, from road surface maintenance, track maintenance, train operation was opened to private firms with competitive bidding. What happened to the SEK 1.976 billion difference?

There is surely a report locked up in a special cabinet inside the Swedish *MINISTRY OF INFRASTRUCTURE*, the government sector responsible for *TRAFIKVERKET*, that explains how the investments the mostly *Social Democrat*-led government was making in road maintenance were benefitting individuals and businesses by saving them significant amounts of money in vehicle repairs, and saving insurance companies piles of cash in personal injury and vehicle damage claims. By reducing budgets for road repair, and implementing competitive bidding for that maintenance, the money saved could be used to allow tax cuts. The tax cuts would be visible to voters, while the car damages and personal injuries would be under the surface, so to speak. A similar report on the financial benefits of privatizing the railroads and outsourcing right-of-way maintenance most likely exists as well. There is probably some nice words around those SEK 1.976 billion.

Policy frameworks change with the political tide

In some states, like Maryland, where *Democrats* have controlled the government for the most part of the past century, and countries, like Sweden, where *Social Democrats* with supporting parties have had a lock on a parliamentary majority since 1936, citizens settle into the status quo that those parties' policies have established, whether it's putting up with potholes or enjoying pothole free drives, having pier guards at the base of bridges or hoping that the future is filled with best-case scenarios. We—the majority—stick with the status quo as long as we see things moving in what we judge is the right direction. We are able to get a job; our kids are able to get a decent enough education; we feel we are paying a fair amount of taxes; and we don't have the sense that other groups are advancing at our cost.

Great Britain is a textbook case on policy swings. Conservatives brought Britain through World War II, but as soon as the guns stopped firing in Europe, a Labor government was voted in. Voters were wooed by Labor's policies on workers' rights, social reforms, cradle-to-grave healthcare, low unemployment, and the promise of a classless society. Clement Atlee's Labor party was only in power for four years, but it nationalized everything in sight, from the Bank of England to railways, coal mines, steel mills, health care, electricity, communications, gas production, transport, postal services, automobile and truck production, and more. However, after four years, having put in place most of what was in their manifesto, Labor was voted out. Citizens didn't feel they were up to the task of actually running the country.

In spite of their short stint at the wheel of state, their policies held for over thirty years. When workers were not on strike, things seemed to work just fine. Buses, trains, the underground ran according to posted schedules, at least during the year I lived in London in 1972-73. Eventually, Britain's citizens grew weary of the strikes and the abysmal level of growth and voted in a Conservative government in 1979 that promised to change the country's policy framework from the ground up. Margaret Thatcher's Conservative "free marketers" government during the 1980s undid much of what the "nationalizers" had done after the war. Strikes no longer paralyzed Britain "After Thatcher", but some things, like the trains, did not work quite as well as they did when

under state control. Nevertheless, in spite of a thirteen-year period at the start of the New Millennium when Labor ruled, Thatcherism has prevailed.

Is it truly a choice between cholera and the plague?

Does it come down to a choice between, on the one hand, having pothole-free roads and cancellation-free trains, and on the other hand, having centralized control of everything? Switzerland and Japan have great roads and punctual trains, and my Swiss and Japanese friends tell me they enjoy living in their countries. These countries seem to have gotten the Goldilocks recipe for their political porridge just right, not too hot and not too cold.

Potholes are like ticks (the nasty insects that spread TBE); neither serves any good purpose. Would you vote for a government that promised to increase the number of ticks in your neighborhood? Why would you vote for a government that has proven to be incapable of eliminating potholes, or that has changed the laws so trains cannot run on time? The answer infuriates those who prioritize a tick-free society, and that is that others value something else higher, like lower taxes, lower prices, fewer regulations in some areas and more regulations in others, and these people form the majority of those who vote.

It is not the politicians who choose which insoluble problems we are able to live with: We do. The majority of us, when we cast our votes on election day, have decided what we view as most important, and in those places with potholes, unguarded bridge piers, and trains that do not run on time, something else has fixed our gazes. Crime reduction? Lower taxes? Higher subsidies? Immigration restrictions? We get the politicians and the politics we ask for. The good news is that in democracies with real elections, we can always throw the bums out. I suppose the bad news is that we can always let them back in as well, but the alternative, a present and future full of wannabe Stalins and Maos, is not an option I would like to live with.



Illustration by Arthur Rackham, 1918, in Goldilocks and the Three Bears in English Fairy Tales by Flora Annie Steel.

About Michael L. Sena

Through my writing, speaking and client work, I have attempted to bring clarity to an often opaque world of highly automated and connected vehicles. I have not just studied the technologies and analyzed the services. I have developed and implemented them and have worked to shape visions and followed through to delivering them. What drives me – why do what I do – is my desire to move the industry forward: to see accident statistics fall because of safety improvements related to advanced driver assistance systems; to see congestion on all roads reduced because of better traffic information and improved route selection; to see global emissions from transport eliminated because of designing the most fuel-efficient vehicles.

This newsletter touches on the principal themes of the industry, highlighting what, how, and why developments are occurring so that you can develop your own strategies for the future. Most importantly, I put vehicles into their context. It's not just roads; it's communities, large and small. Vehicles are tools, and people use these tools to make their lives and the lives of their family members easier, more enjoyable, and safer. Businesses and services use these tools to deliver what people need. Transport is intertwined with the environment in which it operates, and the two must be developed in concert.



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