Connected & Automated Mobility

Tyre Industry Use Cases That Require Direct Access to In-Vehicle Data

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About ETRMA

Established in 1959, European Tyre & Rubber Manufacturers Association (ETRMA) is devoted to advocating the interests of the tyre and rubber manufacturing industries with the EU Institutions and other international organisations.

The Association represents around 4.400 companies across Europe, employing directly 370.000 individuals with a turnover of about € 75 b. The product range of its members is extensive from tyres to pharmaceutical, baby care, construction and automotive rubber goods.

ETRMA is committed to ensuring the development, competitiveness and growth of the tyre and rubber industry supporting all initiatives that contribute to safety and environment, health protection, mobility and road safety, as well as access to third markets, in coordination with EU authorities.

In this context, the industry's efforts are geared into two directions: towards sustainability – the reduction of CO_2 emissions while improving tyre safety and preserving industry competitiveness – and towards connectivity. These are the building blocks that will contribute to shape the tyre and rubber industry of today and tomorrow and which will influence its societal and environmental footprint as well as its position and competitiveness in the world.

This work is based on and supported by economic, technical and scientific studies, which are essential to deepen the knowledge of our products and their interaction with the surrounding environment. This activity is essential to empower our industry to contribute meaningfully to the legislative dialogue, as well as to anticipate the impact of future initiatives on the industry.

Executive Summary

The European Tyre and Rubber Manufacturers' Association (ETRMA) represents the voice of tyre and rubber goods producers vis-à-vis the European Institutions. Given its unique position as a critical link between vehicle, infrastructure and the consumer by means of its service network, the European tyre industry is well-positioned to help the automotive value chain as well as policymakers meet new safety and sustainability standards in the years ahead.

The current transformation to Cooperative, Connected and Automated Mobility (CCAM) is forcing the entire automotive sector to address fundamental questions with regards to fair and equal access to in-vehicle data. ETRMA intends to participate in a constructive dialogue with policymakers and all stakeholders. The European tyre industry can contribute to finding much-needed answers to mobility and environmental questions, tapping into a knowledge base built up over decades.

This is showcased by the business case of **Tyres-as-a-Service (TaaS)**, which fuses innovative telematics solutions together with one of the world's most original invention.

- Already today, consumers and businesses can benefit from TaaS, ranging from small micro services (apps or devices) and vehicle monitoring for individual drivers to fully-fledged service packages for fleets enabling the creation of large universal vehicle data platforms for third parties. These services can verifiably help drivers and fleet operators to save fuel, increase safety, increase vehicle uptime, and reduce congestion and harmful emissions from transport.

Beyond what is already on the market, there are two further examples of use cases with great future development potential:

- **Infrastructure quality management enhancement** is a field where cooperation between the tyre industry and (local) governments can yield significant gains in tackling mobility issues like congestion, fatalities and pollution. Advanced vehicle data measurement and modelling can inform drivers and authorities of road conditions, danger zones and traffic flow. The tyre industry has the means and resources to develop the advanced technology to realize this potential of the connected vehicle.

- Another use case is **vehicle platooning**, where vehicles are equipped with state-of-the-art driving support systems. With one closely following the other, vehicles form a 'platoon' which is kept together by smart technology, relying on sensory data input and vehicle-to-vehicle communication. With advanced processing of vehicle data, tyre manufacturers are able to evaluate in real-time the braking potential of the vehicles and optimize the convoy composition to maximise fuel economy while driving safe.

However, closed data concepts such as the Extended Vehicle (ExVe), as proposed by the European Automobile Manufacturers Association (ACEA), will halt innovation rather than facilitate or enable it. TaaS and the above use cases each depend fundamentally on access to onboard vehicle data and the driver. The current ExVe telematics proposal fails in many use cases on various levels.

ETRMA calls on the EU Commission to address **non-discriminatory digitalized services, including access to in-vehicle data, on-board computation, as well as access to HMI and standardized vehicle interface with a comprehensive, binding and timely action.**

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1 Introduction

1.1 A key player in mobility

Tyre companies are part of the automotive value chain as original equipment suppliers (OES), replacement suppliers in the aftermarket and as providers of a variety of services like tyre fitting.

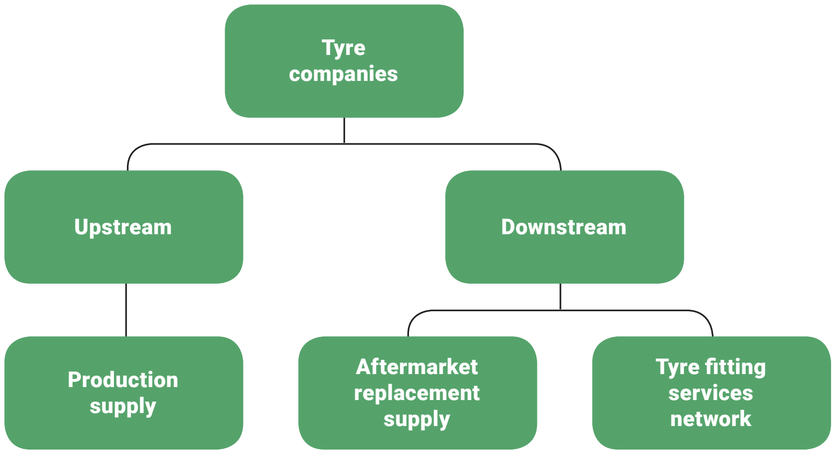


Figure 1: Tyre makers are active along the whole automotive value chain. Upstream through R&D (new tread design, composites, smart tyres) and downstream through fast supply logistics, a network of service points and online customer services.

The European tyre sector[1] provides approximately 289 million tyres for passenger vehicles and light commercial vehicles per annum. It generates revenues of €70 billion with over 200,000 jobs and more than 4,000 companies. This makes it a significant contributor to the European automotive industry.

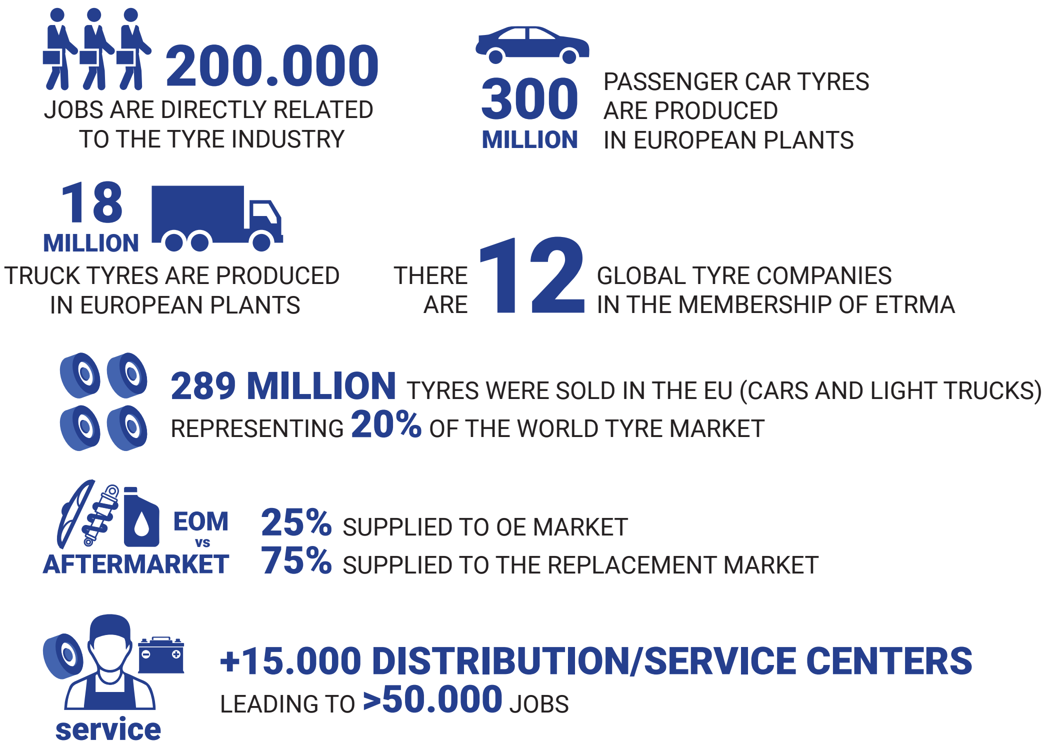


Figure 2: Key figures of the tyre industry. Source: ETRMA.

1 ETRMA statistics booklet edition 2017
http://www.etrma.org/uploads/Modules/Documentsmanager/20180329---statistics-booklet-2017---alternative-rubber-section-final-web.pdf

1.2 Investing in innovation

The European tyre industry has a strong track record of improving tyre technology with key benefits for the environment and safety. For example:

- Since the 1990s, run flat tyres for passenger and commercial vehicles increase control over the vehicle in case of a puncture.
- Tremendous improvements have been achieved in developing tyres that perform well in winter conditions, resulting in many countries imposing winter tyre regulations.
- In 2012, a tyre label was introduced with information on fuel efficiency, wet grip and the amount of road noise generated.
- In 2014, the tyre industry played a major role in setting the technical requirements for the Tyre Pressure Monitoring System (TPMS) that became mandatory in the European Union for newly registered cars.

For 2020, the tyre industry expects that the standardisation of Radio Frequency Identification (RFID)-enabled tyres will be completed at ISO level, following the key contribution of the European tyre experts. This would be the first step to make tyres digitally connected and unlock the benefits of the Tyres as a Service business case.

Tyre makers provide full end-to-end lifetime supplies and services. They have developed an extensive network of service centres throughout Europe[2] and entered into new fields such as vehicle telematics. They are expanding their service offering (e.g. maintenance, smart repair, mobile tyre fitting) in order to meet customer requirements and enhance customer experience. With an extensive service network and customer proximity, the transformation from selling a single product to a wide array of mobility services has already started.

1.3 Connectivity

Nowadays, many tools and devices, including vehicles, are connected and exchange their data because sensors are becoming smaller and cheaper, vehicle control units are becoming more advanced and high-speed low-power virtual networks are widely available.

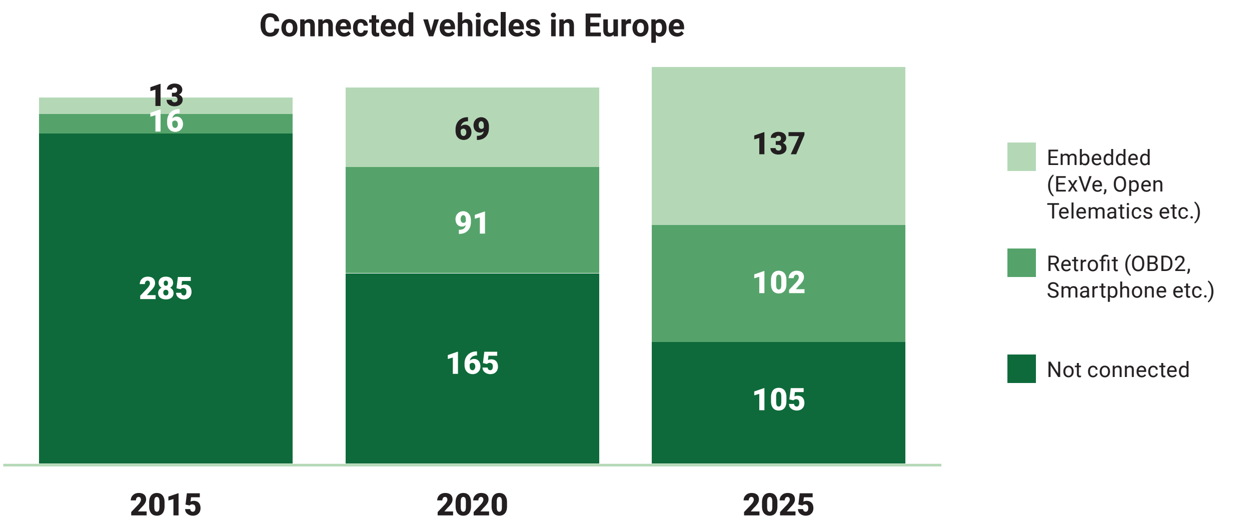


Figure 3: The share of vehicles not connected is still high today (91%), but by 2025, the vehicle park shall be 70% connected. Source: Roland Berger.

2 ETRMA member's distribution networks represent together about 10 000 stores and 50 000 jobs.

This growth in connectivity and the capacity to be connected to the Internet (or the Cloud) makes telematics part of **the Internet of Things** (IoT) wave.

One of the consequences of connectivity is that the business model of successful mainstream companies is moving from a purchasing to a subscription model as consumer preferences are shifting from asset ownership to asset usage. Not only across the music (Spotify), transportation (Uber) and housing (Airbnb) sectors, but also the provision of consumer goods and consequently tyres are becoming service-based. This has the advantage of simplifying the purchasing of tyres for customers (tyre selection, price benchmarking, garage identification) and saving upfront costs, thereby freeing up money for other uses.

1.4 Telematics

The automotive sector is currently facing major transformations led by changes in (i) the electrification of cars; (ii) integrating connectivity capabilities in vehicles; (iii) new technology companies entering the market; (iv) mobility-as-a-service; and (v) automated driving solutions.

These forces paired with the prospects of an uncertain economic climate and the next cyclical downturn, increase competitive pressures and raise the ambitions of vehicle manufacturers to gain more control over the relationship with the vehicle driver and/or owner. Due to a privileged control, OEMs will establish an exclusivity in providing services that instead now are offered by many actors in the aftermarket sector. Such access to the users of certain products represents a high value for business.

On the one hand, the majority of vehicle manufacturers have decided to develop and impose their own exclusive closed telematics platform. On the other hand, other innovative aftermarket players[3] are already fielding a variety of telematics-based platforms with functional or entertainment-related applications that make intensive use of vehicle/driver data.

Tyre makers have also developed and made commercially available large-scale telematics solutions that depend entirely on vehicle/driver data access. Although there are no objections against a standardisation in itself, ETRMA points out that imposing the future vehicle manufacturers' telematics framework fails to meet even the most basic requirements of existing (or future) services and innovations, which is evidenced by a set of potential use cases, developed further below.

3 For example: Geotab, Tom-Tom Telematics, Intel, Google with Android Auto, Apple with Car Play etc.

2 Use Case: Tyres as a Service

2.1 Tyres in the Cloud

With growing connectivity in the Internet of Things era, tyre makers have realised diverse telematics solutions for mobility, data sharing and connected vehicles. It is a strong trend that culminates in Tyres as a Service (TaaS).

TaaS is a wide concept, describing tyre manufacturers shifting from standalone tyre selling to providing a wide range of tyre related services that deliver outcomes and data-based solutions.

TaaS, in its most narrow sense, focuses on tyre optimality and develops cloud-based services around it. TaaS in the broader sense even goes beyond tyres and today tyre makers have already developed a diversified pool of telematics solutions[4].

Figure 4: TaaS has many beneficial impacts on other domains. For example, in insurance with usage-based insurance (UBI) schemes or dedicated TaaS for fleet owners that outsource tires management.

2.2 An example

While the optimal condition of tyres is key to vehicle safety, tyre care is often underestimated by the general public. A need for **better control** over tyre health gave rise to the development of a live service that connects to the Cloud through an on-board diagnostics (OBD) dongle and provides functionalities to the user via a smartphone interface (an app).

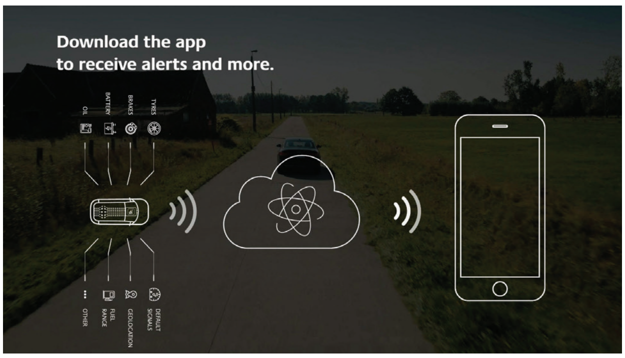


Figure 5: As a generic example, Tyres as a Service is established today and functionality is growing every day.

4 Examples: Goodyear Proactive Solutions, Michelin DDI, Michelin Track Connect, Pirelli CyberFleet, Bridgestone MySpeedy, Tirematics, FleetPulse, Tom Tom Telematics, Toolbox

This innovative telematics solution enables users:

- To monitor several parameters of the vehicle and tyre in real-time and to provide optimising feedback (if wanted)
  - E.g. tyre inflation pressure, load balance, wheel alignment, battery level, error code explanations...
- To receive prognostic analytics that provide insight regarding upcoming events
  - E.g. when maintenance is due, when tyres need replacement...
- To organise road assistance online (buy, appointment, check stock availability, or order towing)
  - E.g. a tyre fitter shop changing winter/summer or changing brake fluid...

2.3 Know-how

A TaaS application requires experience, extensive investments and expert resources:

- Tyre makers have utilised their experience to build advanced proven algorithms enabling many benefits such as additional fuel savings, for example.
- Tyre makers are well-positioned to provide optimal advice based on various road feedback and vehicle data.
- Moreover, in-vehicle data on tyres processed by tyre makers are more reliable than any approximations by other means or by other parties.
- Telematics hold time-critical on-board tyre analytics to ensure optimal safety, interoperability and secure operating conditions.

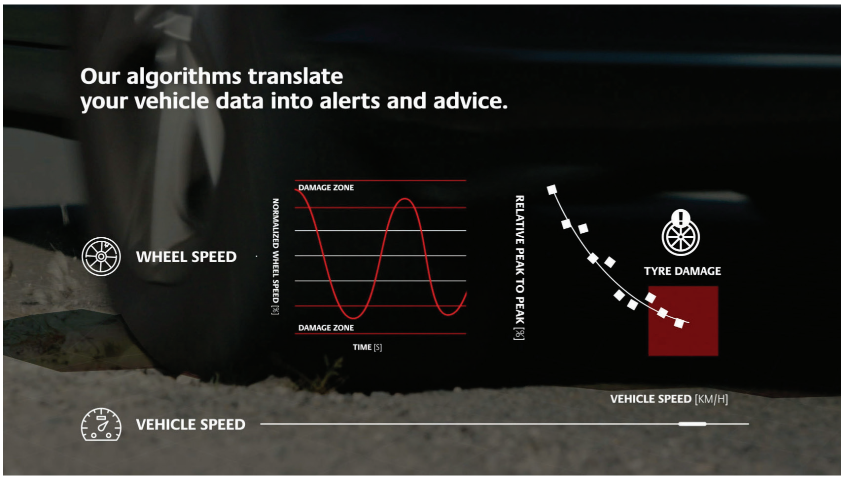


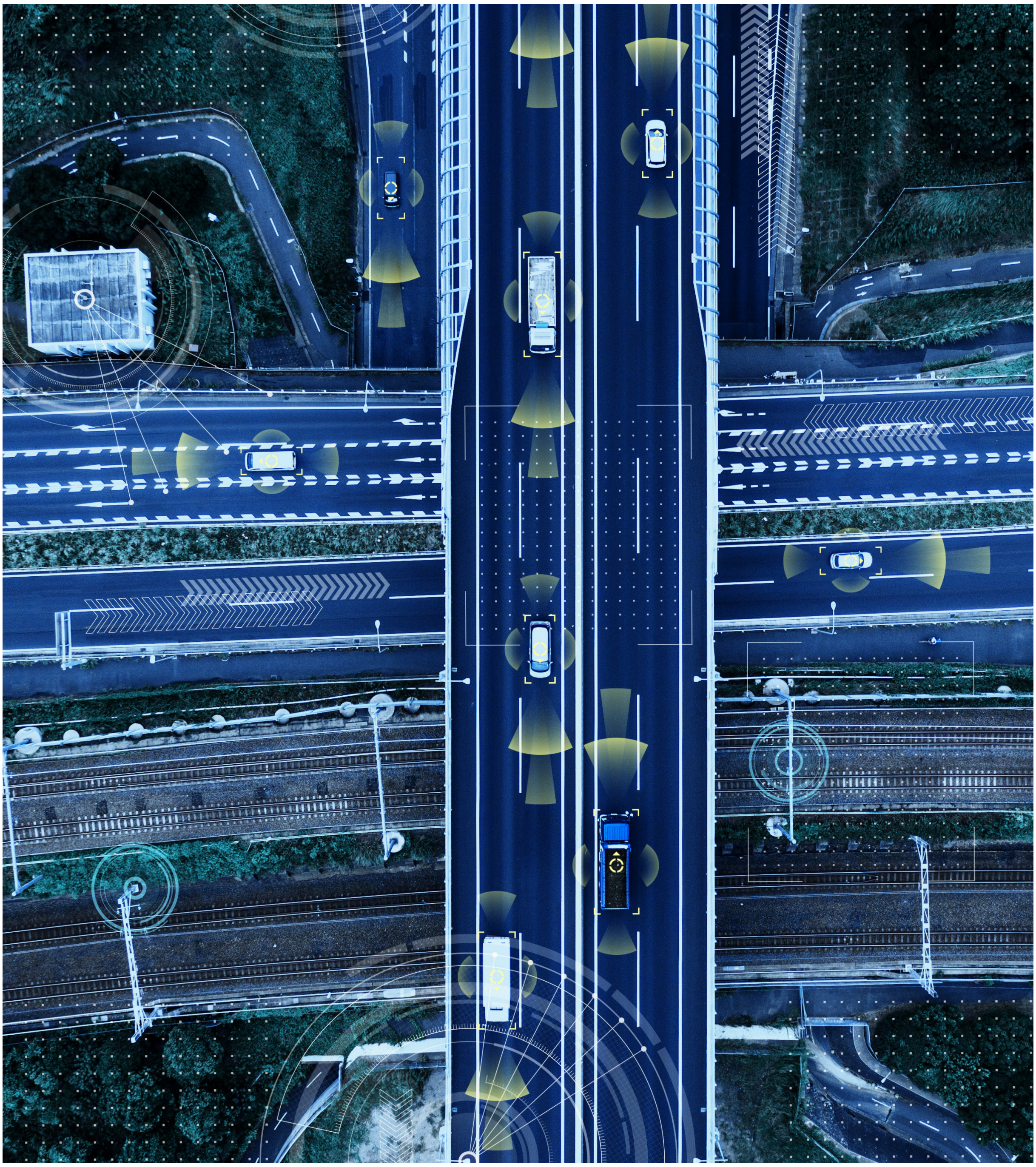
Figure 6: TaaS requires advanced and complex problem solving to reach smooth user experience and added value.

Platform development to connect the 'connected vehicle' to the right service providers is also key. Tyre companies have a large network, offer fixed and mobile tyre fittings, repair services and can provide small tyre-related businesses with a lot of support for the digital transformation to connect even more assistance at breakdown by simply using the untapped potential of a connected vehicle. For instance, digitisation offers the opportunity to diagnose problems, verify availability of replacement and fix garage appointment all in one single platform.

2.4 Benefits

TaaS brings consumers and businesses tangible societal, ecological and economic benefits:

- The optimal condition of tyres is key to road safety: a tyre failure could lead to severe consequences and almost half of all emergency roadside assistance calls are a result of issues related to tyres.[5]
- TaaS brings effectively many cost-saving benefits such as improved longevity, fewer breakdowns and lower fuel consumption.
- The services support the driver on his journey and yield **comfort**, consumer satisfaction and peace of mind.



5 Examples: Goodyear Proactive Solutions, Michelin DDI, Michelin Track Connect, Pirelli CyberFleet, Bridgestone MySpeedy, Tirematics, FleetPulse, Tom Tom Telematics, Toolbox

3 Data Access Requirements

3.1 Platform choices

Remotely accessing vehicle data is not a new development, but, amidst growing connectivity, it is a rapidly developing area.

The automotive sector is undergoing changes where different telematics implementations and data access solutions exist, but the lack of regulation or standardisation prohibit these from reaching critical mass. In line with the maturing of different vehicle and connectivity technologies, there are a number of data access models being developed and different solutions proposed.

The TRL report on Access to In-vehicle Data and Resources[6] basically identified five different types of data access models: three "off-board" with a server outside of the vehicle in which data and applications are stored and two "on-board" relying on storage inside the vehicle without dedicated servers.

- Off-board: There are three options:
  - The Extended Vehicle, which proposes direct access to an ISO-standardised interface from the vehicle manufacturers' servers,
  - The Shared Server, which proposes access from a server controlled by a consortium of stakeholders rather than the car manufacturer, and
  - The 3rd party or B2B Marketplace, which proposes an additional layer between the vehicle and the service providers fed by vehicle manufacturers' back-end servers for access by the market.

- On-board: Access to data using an (on-board) in-vehicle interface is enabled via an upgraded interface inside the vehicle. Any application using data would run outside of the vehicle system. Finally, the on-board integrated application platform would allow access to data and the execution of applications inside the vehicle environment.

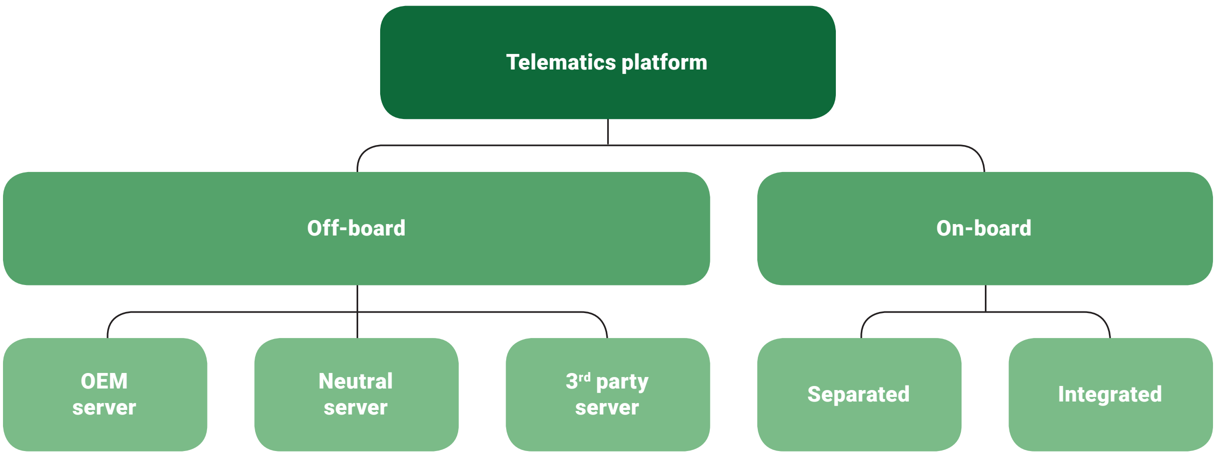


Figure 7: In general, five different modes of vehicle data access can be distinguished, although hybrid solutions exist.

6 TRL report: Access to In-vehicle Data and Resources, May 2017

3.2 Extended Vehicle

The main model for remote vehicle access being promoted and advocated by many vehicle manufacturers is the 'Extended Vehicle' (ExVe) concept, in which vehicle data is transmitted to an external server where it subsequently can be accessed by third parties. It is the first option in the five possibilities outlined above.

While the technical solutions for access to in-vehicle data as proposed by ACEA, the ExVe and the amended proposal of the Neutral Extended Vehicle (NEVADA), are still relatively new and not yet widely implemented in the industry, the number of studies addressing the topic from technical, regulatory and legal perspectives is rapidly growing.

Independent institutes, consumer organizations and academic research demonstrate that there are fundamental issues with the ExVe/NEVADA proposal by vehicle manufacturers. For example:

- No real-time data transmission
- No high-frequency data access
- Insufficient data sets available
- Data access controlled by vehicle manufacturers
- No direct access to driver
- Cumbersome consent handling
- Unfair access to data for third parties
- Monopolistic behavior
- Insight by vehicle manufacturers into data use of third party possible
- No bi-directional data transmission

In 2017, an extensive review by the Transport Research Laboratory (TRL) on behalf of the European Commission's Directorate-General for Mobility and Transport came to the conclusion that the ExVe is the worst of all options.[7]

A thorough technical analysis[8] conducted on behalf of AFCAR in 2018 also confirms many shortcomings, but moreover verifies that the ExVe concept is by design advantaging vehicle manufacturers, for example via dominant access to in-vehicle data on apps level (Level 3), exclusive driver access, better off-board access and earlier access to the driver. It also demonstrates that by far not all vehicle manufacturers have developed an ExVe solution but rather pursue their own on-board technical solutions. This means that there is no single standard.

3.3 Tyres as a Service (TaaS) requirements

Applications developed in the context of TaaS typically have a prognostics component. They require the processing of continuous signals received from the vehicle. Indeed it is the variation of the signal which contains the relevant information, not the signal itself.

7 Access to In-Vehicle Data and Resources, Final Report, TLR, May 2017

8 OEM 3rd Party Telematics – General Analysis, Knobloch & Gröhn Gbr, December 2018

Take for example a service to detect slow tyre leaks: to detect this problem it is necessary to collect the pressures of the tyres regularly and at high frequency (at least once a minute[9]). The received signal must be processed by an expert algorithm to separate false alarms from true pressure leaks. The pressure leakage information must then be returned to the driver, preferably in the vehicle, for the problem to be solved.

The nature of the required vehicle data is very broad and may be related to the following categories:

- Configuration of the vehicle (VIN, presence of trailer, number of axes, type of tires, on/off conditions...)
- Environment (status of wipers, weather, outside temperature ...)
- Geolocation (latitude, longitude, altitude ...)
- Cockpit (presence of driver, passengers, load, internal temperature, status of air conditioning, window status, ...)
- Driving aids status (ABS, ESP, AEBS, LKS, airbags ...)
- Vehicle dynamics (speed, acceleration, tire pressure, gear ratio, ...)
- Braking potential (braking torque, braking pressure ...)
- Engine operation (RPM, fuel, power demand, water temperature, oil level ....)
- Emissions (%Nox, particle filter status…)
- Maintenance (DTC)

Depending on the nature of the data, several collection typologies are needed for Taas, such as:

- Data of "reference" type, as in those that do not vary over time (VIN, number of doors, number of wheels, power of the engine ....)
- Data of "event" type whose variation in time is discrete (AEBS switched on, doors closed, oil level too low ...).
- And finally, data that varies continuously (speed of rotation of the wheels, tyre pressure, engine temperature, etc.). This type of data needs to be collected at a high sample rate to properly capture their variation. Reference and event data help contextualize the signal received.

This difference in data types explains why today tyre manufacturers have developed telematics to collect vehicle data that enable both in-vehicle data processing and over-the-air communication with back-end servers.

The processing of data within the vehicle (on-board) is essential for data that varies continuously. It is not economically nor technically feasible to receive such data streams over the air. In addition, edge (or on-board) computing facilitates the implementation of GDPR: some data that can be traced back to the linear speed of the vehicle cannot be exported out of the vehicle for privacy reasons.

Moreover, besides frequency, sufficient guarantees regarding timeliness of the data (meaning low latency between measurement and availability on-board or server-side) is also important. The data collection latency for TaaS is generally not very low but requires a permanent synchronization with the operation of the vehicle. In the case of slow pressure loss, it is not conceivable to send a notification to the user only once his tyre is flat. This also applies when an abnormal temperature increase of a truck tyre is detected at the entrance of a tunnel.

9 Remark that this is only a moderate example regarding the need for high frequency. In case of low quality road surfaces, the detection of harmful impacts (eg pothole), requires actually high frequency measurement (of order 100 times per second), or identification will be simply missed. Applications to infer and analyse the road surface type also highly depend on high frequency tyre vibration measurement.

Telematics experience suggests that on-board and off-board access are both required, and minimal service levels regarding frequency and latency are necessary to enable certain services that depend on it. It is clear that a lot of existing TaaS services will become more expensive, strongly reduced or others will not get a chance to be developed, if the ExVe model is imposed by vehicle manufacturers without fundamental adaptations to overcome its severe limitations.

- Simple data of geolocation, mileage, etc. has less relevance when it cannot be put in relation to functional vehicle data (odometer, accelerometer, brake levels, fuse readings). Therefore, full in-vehicle data access is required to offer basic functionalities and stimulate continuous innovation and advances in mobility in Europe. Moreover, the time-criticality and quality of the data need to be addressed so that existing innovative telematics applications can survive.

Access also requires interfacing with the driver. The tyre companies can offer a maximal tyre lifetime for example, but such service depends on communication with the driver about choices/agreement, reporting and driver feedback to choose from options and confirm these (the potential to realise savings depends on it).

- One can reasonably expect that if the consumer will be able to consider tyre or service choices via the HMI, then he or she will purchase/order tyres and related services online from within the vehicle. However, being excluded from the HMI access at that point, with the vehicle manufacturer having this ability, constitutes a clear case of discrimination, akin to the Internet Explorer/Microsoft case[10] that regulation has already addressed. With vehicle manufacturers having access to the HMI it is imperative that a level playing field exists with regards to online product and service offers, in analogy to the EU Commission's judgment related to Google Shopping.[11]

Moreover, the inherent monitoring of client interactions by vehicle manufacturers poses clear competition concerns. It is highly disturbing and unprecedented that vehicle manufacturers are allowed to monitor their competitors in such depth and on such a large scale.

The TaaS application requires	ExVe restricts the TaaS application
Odometer input, brakes level, load, control of tyre pressure, and… confidentiality	No comprehensive data access, which is moreover fully controlled and monitored by the vehicle maker
Direct onboard processing capacity at high data input rates, without latency	No sufficient real-time, nor high-frequency data access
To inform, warn or talk directly to the driver through the vehicle interface	No bi-directional communication access to driver

Figure 8: an overview of the top 3 areas where the ExVe model restricts an existing TaaS application.

ETRMA warns that closed data access models like the ExVe – if imposed the only way to communicate with the vehicle and the driver – cripple all existing TaaS innovations, stifle potential future innovation and severely limit consumer choice.

Looking ahead, in-vehicle data access and real-time data will be a pre-requisite for any future services. To that end, we selected the following two use case examples, that may be implemented in the future and depend on data access.

10 http://europa.eu/rapid/press-release_IP-13-196_en.htm
11 http://europa.eu/rapid/press-release_IP-17-1784_en.htm

4 Potential Use Case: Infrastructure Quality management Enhancement

4.1 Road quality

Many savings can be accomplished with optimal tyre condition and usage, however, equal attention needs to be paid to the quality of the existing infrastructure.

Tyre makers have the product expertise, models and computational capabilities to detect road quality through measurement of:

- Type of road surface (asphalt, concrete, etc.)
- Structural discontinuity damage (like cracks or potholes)
- Pavement roughness (de)gradations
- Slipperiness (lack of friction)
- Deformation through road profiling (track formation)
- Additional factors, such as network quality.

By analyzing high frequency technical parameters like tyre vibrations, pressure variations, steering wheel drag, suspension system sensors, load as well as environmental ones like weather conditions, tyre manufacturers are able to extract road quality metrics. Performing this on a large scale will allow to infer extensive knowledge to improve infrastructure.

Infrastructure quality management enhancement is truly a field where cooperation between the aftermarket and authorities can yield improvement of mobility problems like congestion, pollution and, worst of all, fatalities. Currently authorities perform such road quality with simple tools and through special vehicles, which is a time consuming and expensive task, but only for certain metrics and particular roads.

4.2 Need for data

In 2017, international road safety experts from more than 40 countries met at the 6th International IRTAD conference[12] in Marrakech (Morocco) to discuss issues related to the collection and analysis of road safety data as a critical tool to design effective road safety policies. As a result, road safety has been recognised as a global health emergency, and road safety is included in the UN Sustainable Development Goals.

There is a need for better and more data on road safety as "improvement made to the quality of road safety data will improve the quality of data driven policy decisions."[13]

12 6th IRTAD Conference: Better Road Safety Data for Better Safety Outcomes
https://www.itf-oecd.org/sites/default/files/docs/irtad-road-safety-annual-report-2018_0.pdf

13 On 10-12 October 2017, international road safety experts from more than 40 countries met at the 6th International IRTAD conference in Marrakech (Morocco) to discuss issues related to the collection and analysis of road safety data as a critical tool to design effective road safety policies. The participants agreed on a number of recommendations including this statement.

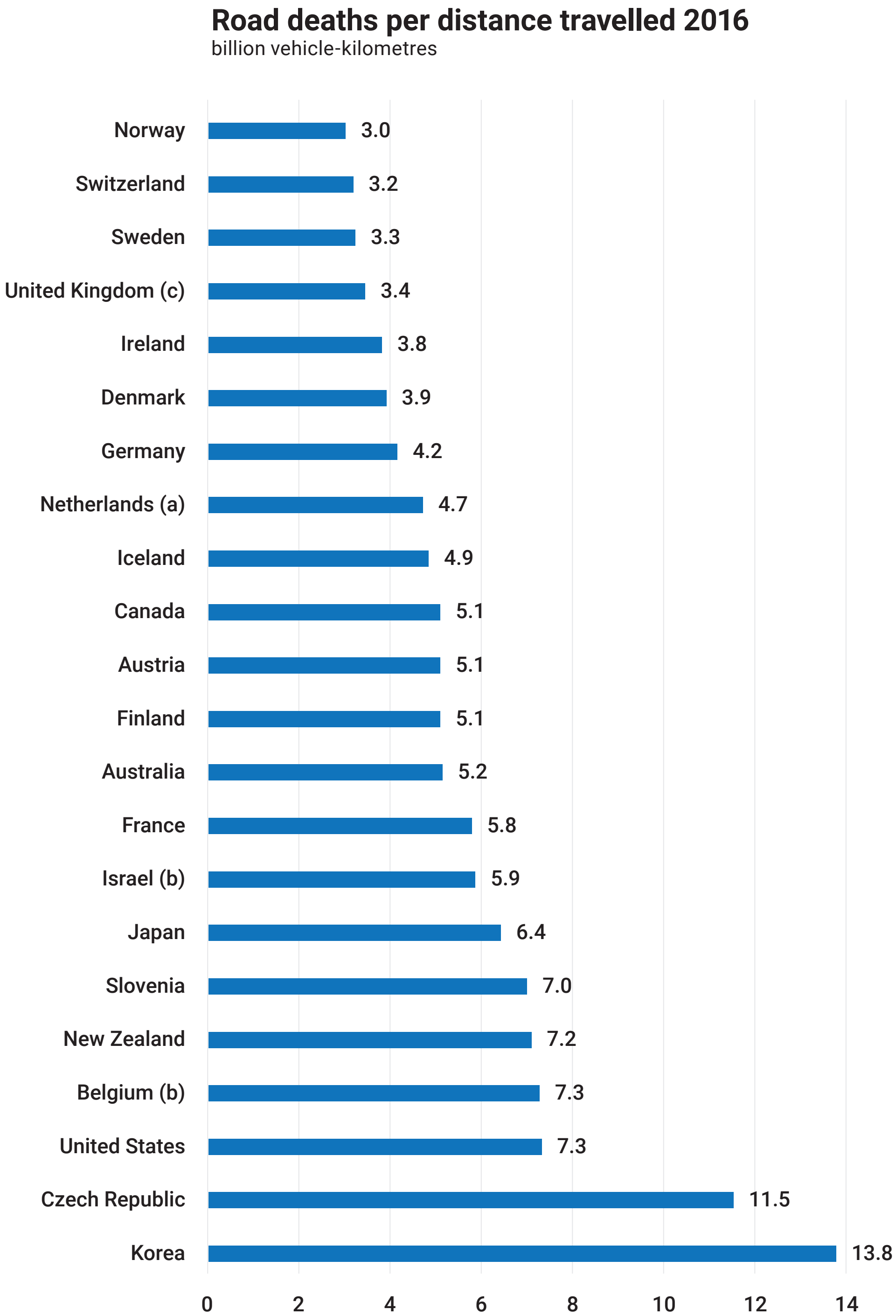


Figure 9: Traffic control and road safety is still a major concern in many European countries. There is a lot of room for improving infrastructure and road quality in Europe.

4.3 Know-how

Mass vehicle position and vehicle data measurements, combined with advanced tyre modelling, result in the creation of highly granular **road maps** with specific metrics of interest (e.g. road type, pothole zones, braking behavior, congestion, etc.). Collected over time, one can construct refined images of slippery roads, danger zones and congested traffic flow.

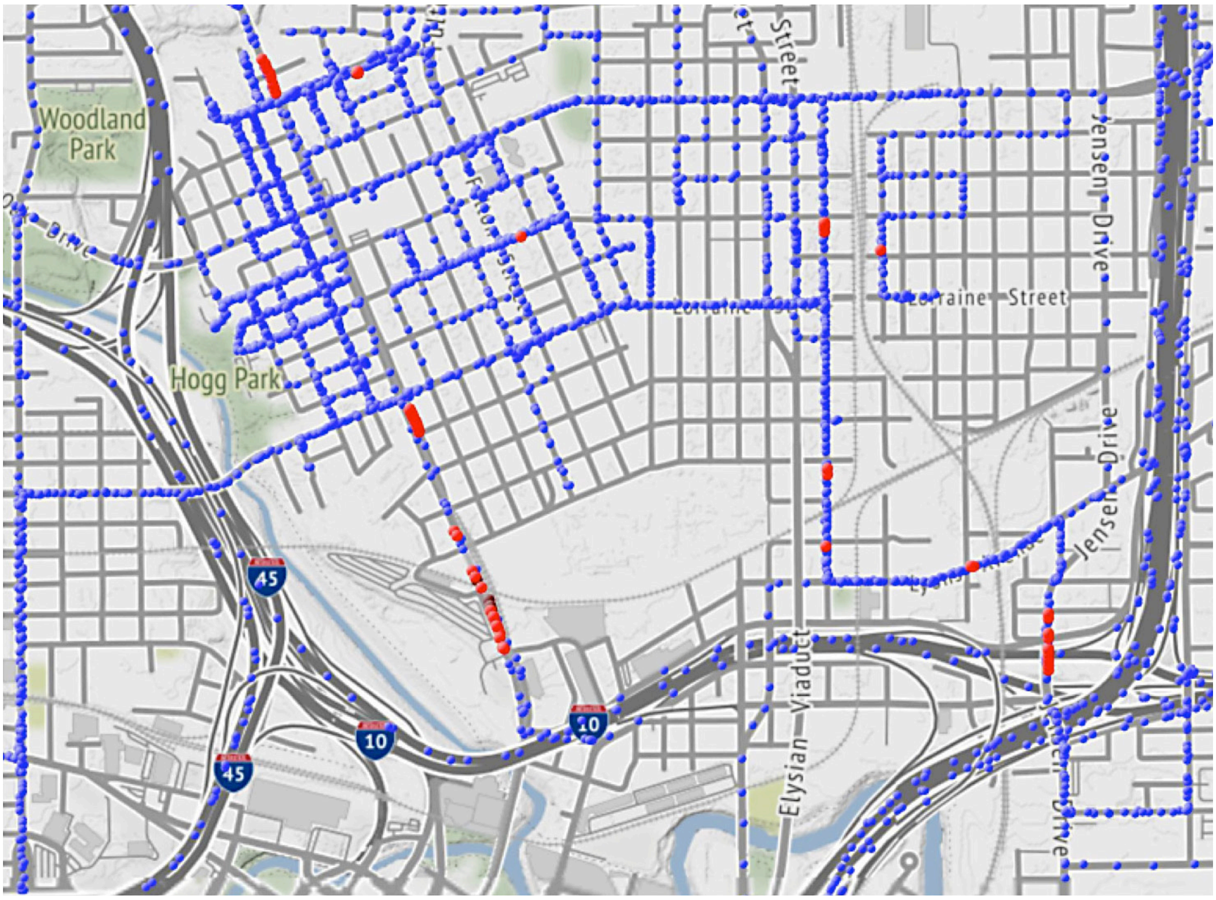


Figure 10: Example of an aftermarket player in telematics that already is active in infrastructure mapping with air particle detectors connected to their OBDII dongle. Project example from Houston, Texas: Locations with increased particulate matter pollution PM2.5 (>55 ug/m3) in red and driven routes in blue. 4 June to 21 July 2018. Source: Geotab

Consumers can benefit from this mapping by adapting their speed to the state of the roads or by avoiding obstacles. And with the maps, the authorities can benefit from targeted optimal resource allocation of their budgets to repair or treat roads, place road signs, or divert traffic in case of urgent and excess danger (traffic management). Thanks to the use of tyre sensor data, it is possible to analyze and eventually optimise urban traffic flows.

When combined with road mapping analytics, tyre companies can offer services to warn or even reroute the vehicle via communication with the GPS. They could also warn motorists well in advance when road quality requires driving style adaptation. The navigation option would suggest the optimal road instead of only the shortest or fastest way.

TaaS related to infrastructure also facilitates compliance. Customs authorities could dynamically charge the passing vehicle without requiring it to stop, for example. Tyre and geolocation data together with jurisdiction rules can also influence routing decisions. For example, preventing that one enters German roads in wintry conditions where winter tyres are obligatory. With vehicle data and HMI access, compliance limits can be computed and drivers can receive immediate warnings regarding speed limitations with certain tyre types in certain conditions. The same goes for load, season or tread requirements where the driver is to be aligned or warned of local authority regulations, restrictions or compliance rules.

Existing and near future services require the ExVe model to be fundamentally revised and regulated before it can be accepted as a standard for all automotive stakeholders, including drivers and authorities.

4.4 Benefits

Reducing **congestion** and increasing **mobility** are possible if innovation is supported by a competitive environment. Tyre makers with their unique analytic insights offer the potential to contribute to saving tens of billions each year lost in productivity due to the congestion[14] of European road traffic. The fundamental restrictions of the ExVe model regarding data access need to be resolved, if the free market is to be protected in the automotive ecosystem.

Vehicle to Infrastructure communication (V2I) is key to traffic **safety** as, for example, speed limitation warnings can be dynamically imposed or quicker medical response can be provided, resulting in less fatalities and injuries. Research[15] suggests that a 10-minute reduction in medical response time can be statistically associated with an average decrease of the probability of death by one-third, both on motorways and conventional roads. Vehicle to Vehicle communication (V2V) requires real-time warnings to vehicles from a vehicle ahead of them in case of danger (e.g. sudden accident, road damage).

Thus, requirements for data quality depend heavily on the use case and party that needs it. It is a must to have more automotive stakeholders involved in standardisation, rather than to let the car maker decide unilaterally.

Time-criticality of the data, meaning sufficient data measurements per second, and low latency of the signal, are required to obtain accuracy and completeness in infrastructure mapping services.

Ecological solutions (e.g. rubberised asphalt for quieter roads[16]) are being implemented and connectivity can scale this up. More infrastructure elements are waiting for applications to **reduce waste and recycle**.

V2I brings economic benefits, as **slippery roads** are avoided and **fewer breakdowns** will occur. Services that can collect and process detailed infrastructure data can offer optimality (e.g. fuel efficiency) and improved safety.

4.5 Requirements

Tyre companies are uniquely positioned to offer those mapping and safety services, but they require on-board processing of tyre dynamics in real-time to feed the advanced telematics implementation of V2I.

For complementary data, like braking levels and steering wheel movement, tyre companies need access to **in-vehicle data at the highest possible rate**. Optimal routes are only possible through a complete set of data inputs, combining both engine and **tyre data**, to develop advanced road analysis techniques. To warn the driver of unsafe road conditions ahead, access to the **vehicle telecommunication** platform is required.

If vehicle manufacturers will not share granular and timely data beyond repair/diagnostic information, impose the **ExVe** model at **monopolistic price settings**, or develop V2I in different formats or structures, then neither authorities nor citizens will benefit from free market innovation.

The use case of Infrastructure Quality Management Enhancement is under full development and real-life applications already exist today. However, it depends on European regulation to enable further innovative steps.

14 EU quote:" Congestion in the EU is often located in and around urban areas and costs nearly EUR 100 billion, or 1 % of the EU's GDP, annually".

15 The probability of death in road traffic accidents. How important is a quick medical response?, Sánchez-Mangas R1, García-Ferrrer A, de Juan A, Arroyo AM., Accid Anal Prev. 2010 Jul;42(4):1048-56.

16 ETRMA annual report 2017

5 Potential Use Case: Vehicle Platooning Safety Enhancement

5.1 Optimal distance

Vehicle platooning requires a series of vehicles to be equipped with state-of-the-art driving support systems – one closely following the other in a leader-follower configuration.

The purpose of platooning is to take advantage of a phenomenon called ‘drafting’, also known as ‘slipstreaming’, which reduces aerodynamic drag resulting in fuel savings and reduced carbon emissions. A consistent speed in platoon configuration also reduces driver errors and thus accidents.

Platooning is enabled by means of real-time redundant inter-vehicle distance evaluation (via radar, camera, GPS). These calculations are then exchanged via V2V communication between all trucks in the convoy. Trucks can then rely on this information to adapt the behaviour of their automatic braking and acceleration systems to achieve the minimum safe distance between vehicles. The 'safe following time' for platooned trucks[17] is typically reduced from 8 to 1 second at 80 km/h.

Braking distance depends on the tyre category, their wear level, weather conditions and the vehicle characteristics. Optimal braking distance computation requires advanced tyre modelling.

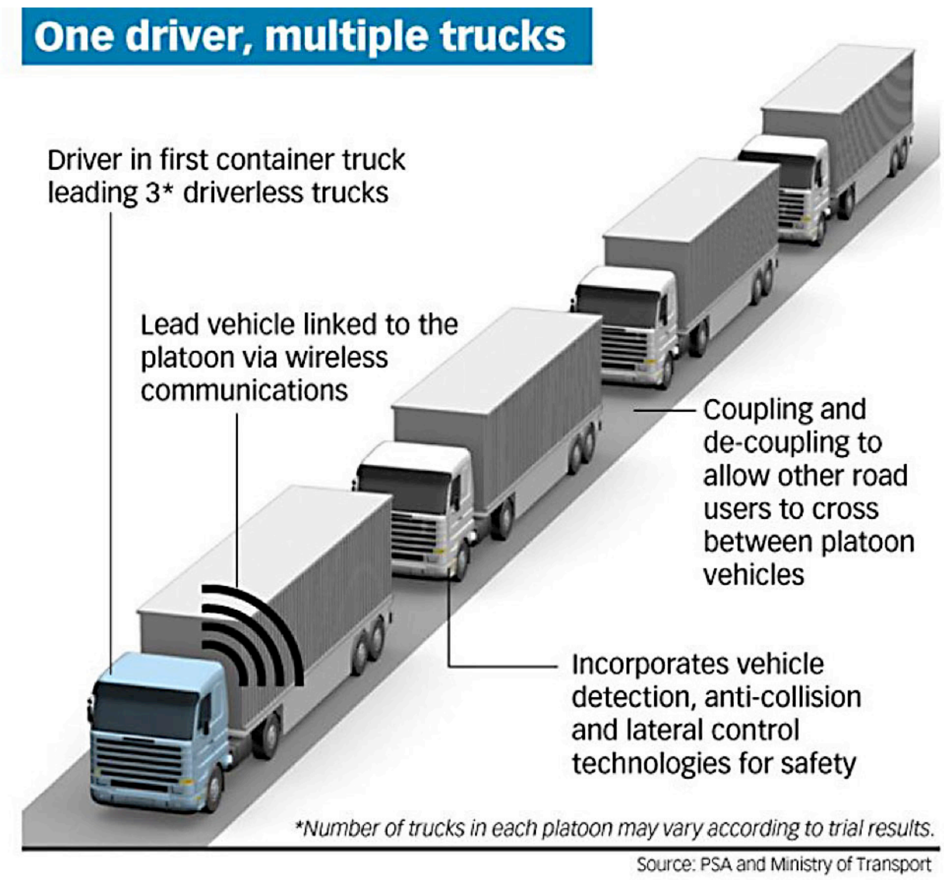


Figure 11: Vehicle platooning is enabled by smart technology and vehicle to vehicle communication.

17 European Truck Platooning Challenge, Lessons Learnt - EU TPC 2016, booklet.

5.2 Need for Cooperation

Platooning is complex. Tyre manufacturers can assist both in today's **aftermarket** research stage & future production integration stage of platooning. It is a true example of the proof that many can achieve more than one if brands and players cooperate. Various initiatives are ongoing:

- On the 14th of April 2016, the transport ministers of all 28 EU member states signed the Amsterdam Declaration[18], laying down agreements on the steps necessary for the development of connected, autonomous driving technology in the EU. The first cross-border field test with Heavy Duty Vehicles was then held in 2016 where six 'platoons' of semi-automated trucks completed their journeys from various European cities, reaching their final destination of the Port of Rotterdam. The final ENSEMBLE[19] multi-brand truck platooning demonstration is planned on public roads in 2021.

- Further tests were set up in the UK in 2017 and the Transport Research Laboratory (TRL) will present the findings from the platooning truck trials[20] at the Microlise Transport Conference in May 2019 in the UK. TRL aims to provide an independent impact assessment and to quantify possible benefits and drawbacks of the technology.

- Italy is also actively involved via the C-Roads ITALY project[21], which has set up a 2-year program to implement and test, in real traffic conditions, cooperative systems based on Vehicle to Everything (V2X) technologies.

- Outside of Europe, particularly in the US and Japan[22], research and various tests have been under-taken with different implementations since 2017.

5.3 Know-How

Platooning is based on the principle that the automatic system will have a much shorter reaction time than the human driver. It is therefore easy to reduce safety distances between vehicles compared to those in the current legislation. However, this reduction of distances between vehicles, which will lead to a reduction of CO_2 emission due to aerodynamics, cannot be made at the expense of safety. The only solution is to provide accurate information to the driver and the vehicle.

In the simplified case of two strictly identical vehicles, the safety distance directly depends on the time-delay that exists between the moment when the first truck brakes and the one where the second one starts to brake. This delay can be managed by sensors and communication between the vehicles without taking into account the differences in the vehicle systems. Even in this simplified case, tyres play a major role.

Indeed, many parameters will have to be taken into account in the joint braking of the two trucks in real-life vehicle conditions, as for example:

- The total mass of the vehicle (including its trailer)

- The joint braking capacity of the vehicle made of different elements:
    - Brake system response time
    - State of the braking system
    - Non-linearity of the braking system
    - Quality of braking control during emergency braking
    - Tyre condition (type, wear level, pressure)

18 https://ec.europa.eu/transport/sites/transport/files/com20160766_en.pdf
19 https://platooningensemble.eu/
20 https://trl.co.uk/news/news/government-gives-green-light-first-operational-vehicle-platooning-trial
21 https://www.c-roads.eu/pilots/core-members/italy/Partner/project/show/c-roads-italy.html
22 https://www.ttnews.com/articles/developers-seek-advance-truck-platooning-through-higher-automation-global-demonstrations or https://cleantechnica.com/2018/01/31/daimler-trucks-begun-testing-truck-platooning-tech-japan/
23 Implementation of Traffic Control With Heavy Duty Vehicle Anti-Platooning, J.P. Alvito, TRITA-XR-EE-RT 2013:009, KTH master thesis.

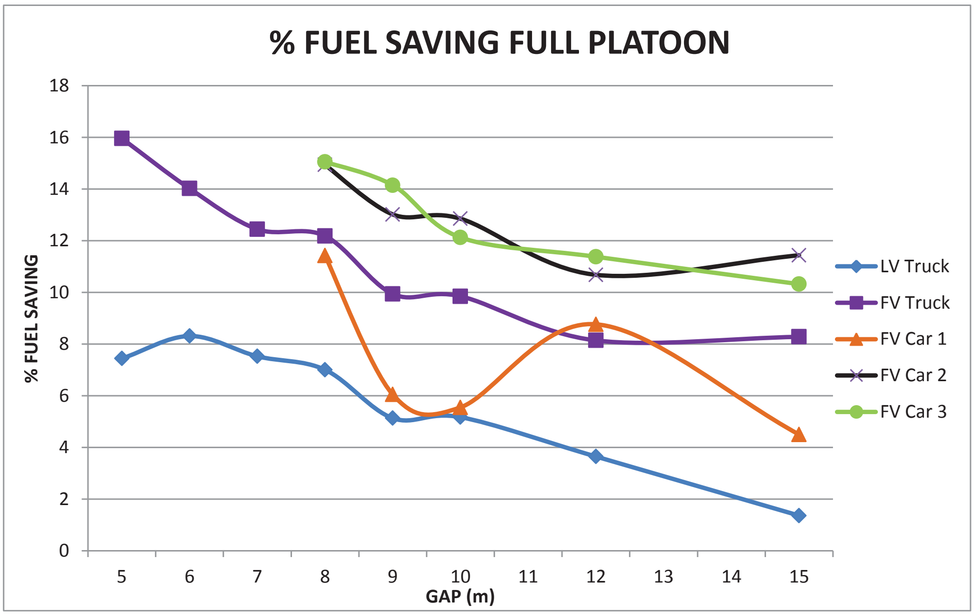
The condition of the road is not a first order parameter because the two trucks will "see" the same road (the first truck can even dry the road surface and thus make the braking of the second truck shorter, which reduces the risk of collision between the two trucks). The only problematic case could be a sudden change in the coefficient of adhesion. For example, the passage from a plate of ice to a black road, because the leading vehicle will see its deceleration increase sharply and therefore the distance between the trucks will be reduced transiently.

Today, platooning opportunities are limited by weather conditions (dry weather only) and drivers' trust in each other and in their vehicles to agree to be guided or followed. The additional tyre input is essential to ensure optimal performance under all weather conditions and to build drivers’ trust in the system, which is a crucial step to consider a platooning solution without a driver.

Leveraging some applications developed for TaaS like tyre wear prediction, tyre makers can offer an after-market service based on vehicle data to support platooning deployment. Based on a real-time analysis of the braking potential of the truck and its trailer in the given road and weather conditions, the driver receives advice on the best place for him in the platoon. It is also again very clear that driver communication is needed, for example to send warning messages in case of system failure or decisions.

5.4 Tyres’ contribution to platooning

Practical tests have revealed high potential for achieving benefits like lower fuel consumption, which is better at shorter inter-vehicular distances.



Graph of percentage of fuel saved for each vehicle relative to gap size

Figure 12: Fuel savings in function of the inter-vehicular distance. (Source SARTRE Study mixing trucks and cars).

Further benefits are driver cost reduction, reducing harmful tailpipe emissions, improved road safety, more efficient use of road capacity as well as driver workload reduction[24]. Platooning itself may mitigate the risk of the upcoming driver shortage problem and decrease the overall negative impact caused by road freight transport.

Because the societal stakes of platooning are high, it is necessary to facilitate its deployment as quickly as possible. The following illustration summarizes the main values of this use case.

24 European Truck Platooning Challenge, Lessons Learnt - EU TPC 2016, booklet.

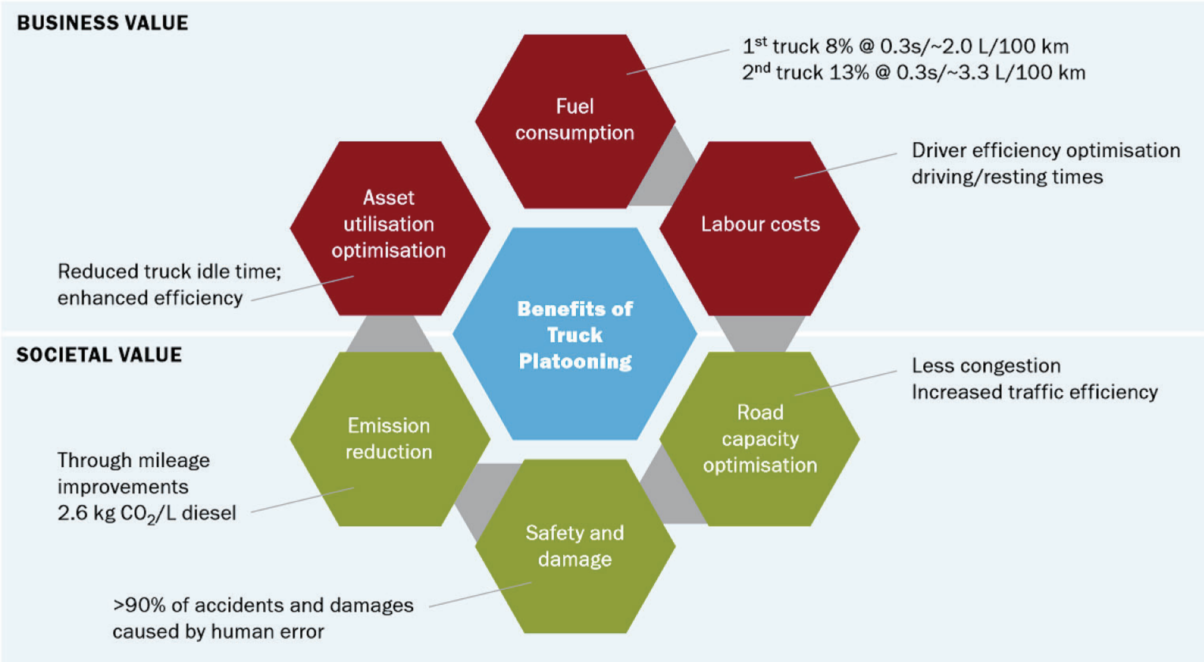


Figure 13: Benefits of Platooning

5.5 Requirements

To develop this “convoy positioning assistance” service, tyre manufacturers need:

- Access to vehicle data in a standardized format;
- In-vehicle information processing capability; and,
- Access to the HMI.

This service is fully independent of the manufacturer of the truck because it concerns the complete vehicle, trailer included. In this sense, it is a service where the “real-time” aspect is important: the trailer is hitched and uncoupled from the operations.

Among the key vehicle data required, one has for example:

- Presence of trailer, axles load, tire ID, braking system;
- Wheel speed, tire pressure and temperature, vehicle accelerations; and
- Geolocation, weather conditions (wipers status, external temperature).

The high frequency collected data will be processed in the vehicle combined with expert knowledge enrichment coming from the tyre manufacturers’ cloud, in order to determine the wear level of the tyres and then the adherence potential of the vehicle depending on the current weather conditions.

The service is time-critical because the driver needs the information at the time the platoon will be formed. Time latency is linked to weather changes because grip potential depends on it and because the relative performance of tyres on dry ground is not always the same on wet surfaces, especially when they wear out.

These requirements are today not compatible with the currently proposed ExVe interface. More generally speaking, the platooning principles are **incompatible with the ExVe** proposal:

- Platooning is one of the best examples of the ability to define a (pre)standard, but unfortunately the need for other automotive stakeholders beyond vehicle manufacturers to realise it is still being underestimated. This lack of inclusion leaves the door open for monopolistic behavior.
- Moreover, **interoperability between brands** is central, but that aspect is painstakingly lacking in the ExVe proposal. Each car maker can have different data formats and structures that all work according to their own protocol.
- It is noted that vehicle manufacturers stressed the importance of the nondisclosure undertaken during the platooning. The tyre industry therefore urges the aspect in the ExVe proposal where **vehicle manufacturers can freely monitor** which competitor uses which vehicle data information to be reconsidered (indeed a disturbing breach of nondisclosure which vehicle manufacturers themselves do not want to be subject to).

Finally, the call for access on different levels is again very clearly illustrated in this particular application:

- Platooning showcases the need for vehicle **data read access** (coordinates, speed, load etc.) and bi-directional real-time communication within the vehicle and over-the-air with the cloud.
- The necessity of **human interfacing** is present, as the system requires communication with the driver (V2D) for platoon decoupling and organisation.

6 Legislative amendments required

Since the turn of the century, the EU Commission has consistently applied the principle of ensuring a level playing field for authorised and independent aftermarket service providers in its regulation.[25]

However, past and current legislation[26] is lagging behind the pace of technological innovation, such that vehicle manufacturers are nowadays claiming total control over access to in-vehicle data and imposing de facto their own telematics based approach (termed "extended vehicle" or "neutral vehicle"[27]), with in-vehicle data being accessible via an external back-end server under their governance.[28]

The ExVe approach has serious shortcomings from a technical and competition law perspective. Various recently published studies[29] focusing on technical, legal and competition policy impacts consider it an inferior solution[30] compared to the interoperable on-board application platform.

The transition to ExVe is likely to cause independent stakeholders to be placed at a significant competitive disadvantage because of a lack of access to business-critical repair/maintenance data, and communication with the driver.[31]

Therefore, the lack of regulation in the area of in-vehicle data access is likely to cause market failures in regard to technological choice (ExVe vs. interoperable on-board application platform) with serious standardisation and inter-operability issues, hampered competition in automotive services and issues around data rights.[32]

25 e.g. EU regulations no. 1400/2002, 715/2007, 692/2008, 595/2009, 461/2010, 64/2012, 758/2015

26 Communication on automated and connected cars COM(2018)/283

27 standardized through the ISO 20077, 20078 series

28 ISO 20077-1:2017, Road Vehicles -- Extended vehicle (Extended Vehicle) methodology -- Part 1: General information, and ISO 20077-2:2018, Road Vehicles -- Extended vehicle (Extended Vehicle) methodology -- Part 2: Methodology for designing the extended vehicle

29 OEM 3rd Party Telematics – General Analysis, Knobloch & Gröhn GbR, December 2018

30 Access to In-Vehicle Data and Resources, Final Report, TLR, May 2017

31 Bertin Martens and Frank Mueller-Langer; Access to digital car data and competition in aftersales services, Digital Economy Working Paper 2018-06; JRC Technical Reports.

32 Data Access in Connected Cars: The problem of access to In-vehicle Data, Prof. Wolfgang Kerber, Philips University Marburg, November 2018

7 Call for action

With this publication, **ETRMA illustrates the obstacles to innovation and detriment to consumer benefits posed by the ExVe model by focusing on Tyres as a Service and two potential use cases.**

Despite the recent advances of vehicle manufacturers' quasi-monopolistic moves in the telematics field, the increasing uncertainty of investors to sponsor start-ups in the automotive domain and the estimated costs[33] (in the order of multiple tens of billion Euros each year) to the European citizen, ETRMA stresses the need for authorities to take action and establish a level playing field for (in) vehicle data access in the automotive value chain as detailed in ETRMA's position paper.[34]

ETRMA calls on the EU Commission to address **non-discriminatory digitalized services, including access to in-vehicle data, on-board computation as well as access to HMI and standardised vehicle interface with a comprehensive, binding and timely action.** The Association asks for consistency in long-established regulatory principles, as applied in the Digital Single Market (facilitation of cross border online selling), PSD2 (open data access for financial institutions), or Horizon 2020 investments in automotive start-ups (investment decisions depend heavily on vehicle data access).

ETRMA showcased the barriers for further innovation in the mobility and transport sector and poses a clear demand for solid intervention on the legal implications. There is a tremendous need for open, secure and industry-wide rules, which will benefit Europe's citizens and automotive innovation.

ETRMA members are fully committed to constructively participate in the legislative process.

★ ★ ★

33 Quantalyse Belgium, Schönenberger Advisory Services, (2019) "The automotive digital transformation and the economic impacts of existing data access models", Technical Report.

34 ETRMA Position Paper (10 April 2018): Safer drive, enhanced consumer choice in a Connected and Automated Mobility

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