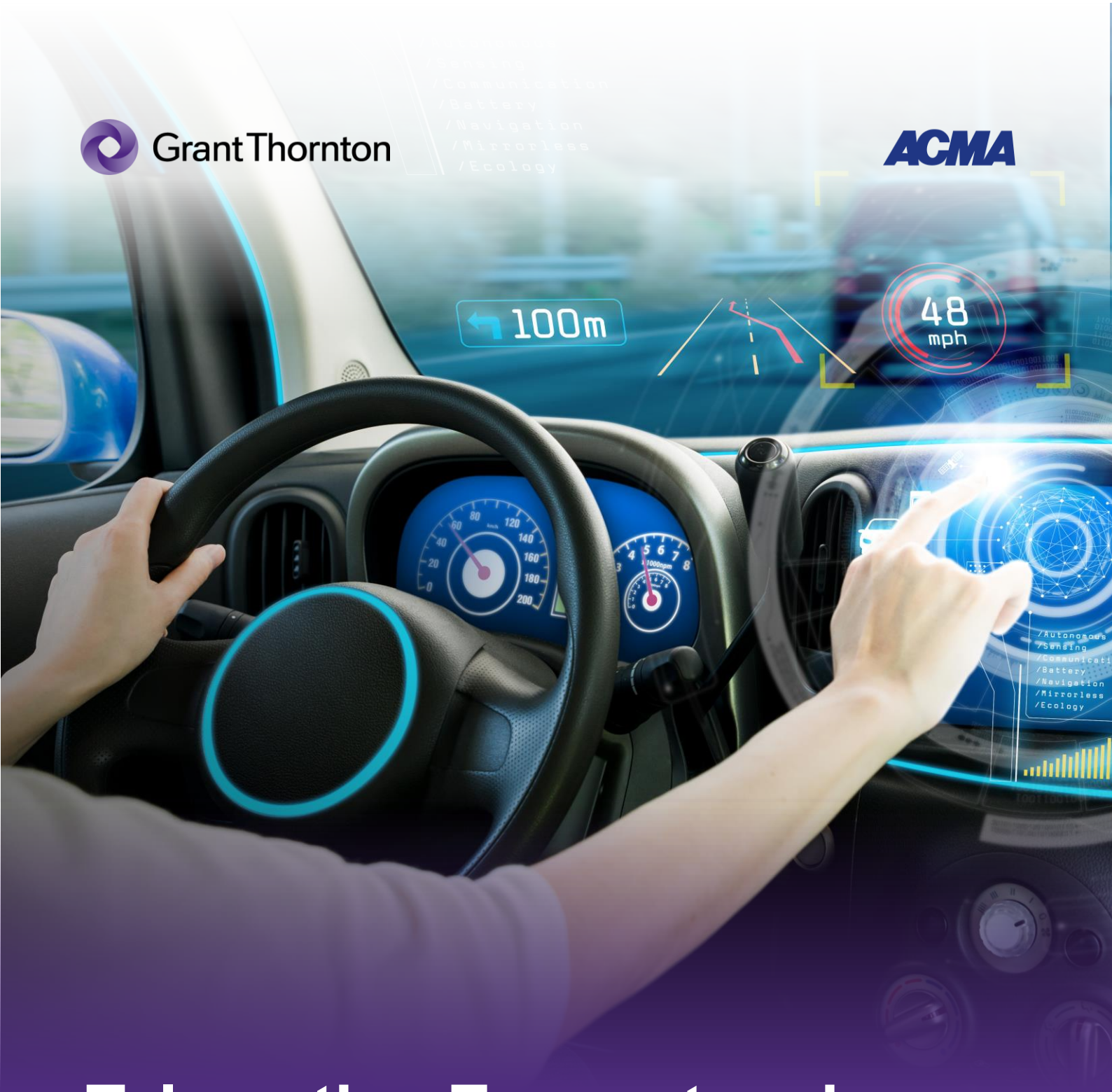

Telematics Ecosystem in India

Submitted to

Automotive Component Manufacturers Association of India (ACMA)

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Grant Thornton Bharat LLP

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Industry information has been obtained from various secondary sources and validated through primary research wherever possible.

All assumptions made in order to develop the report were based on information or opinions that are current. In the course of our analysis, we were provided with both written and verbal information, including limited information on the market, financial and operating data which we accepted as accurate. Nothing has come to our attention to cause us to believe that the facts and data set forth in this report are not true or correct.

Foreword

The last two years have subjected the automotive industry to volatility, disruptions in production / supply chains, and fluctuating demand, to which the industry has displayed remarkable resilience and evolved to come out stronger. The rapid growth of the electronics industry has paved the way for newer opportunities in auto-electronics, making this the opportune time for telematics to transform and set its future course of growth in the market. Telematics, in the past, has largely been used in vehicle communication for road safety (track and trace) in the case of public vehicles and productivity (fleet management) for private vehicles. Commercial vehicle manufacturers seeing telematics offerings as a differentiator and timely government intervention by means of legislations such as AIS-140 has largely shaped the current market construct i.e. CV dominant and compliance driven.

The technological evolution of telematics in India has progressed rapidly, passing through the first two phases of Bluetooth connectivity and portable navigation, and currently in the phase of embedded connectivity with active progress being made by some OEMs and Telematics solution providers on future phases such as service integration and machine to machine (M2M) communication. Basis this foundation, telematics now shows huge potential for being an enabler to a myriad of advanced vehicle connectivity trends that are displaying high traction globally such as ADAS (Automated Driving Assistance Systems), Electrification, V2X (Vehicle to everything), Autonomous mobility, etc. A market currently valued at INR 555 Cr is set to grow by ~7x to ~3800 Cr by 2026, on account of increased uptake expected in passenger vehicles owing to in-vehicle personalization of features and telematics enabled services such as usage-based insurance.

Keeping in line with the government's increased focus on road safety, the successful establishment of ITS (Intelligent Transport Systems) by means of AIS-140 compliant VLTD (Vehicle Location Tracking Devices) would be a major step forward in ensuring visibility of public transportation vehicles and passenger safety. While the homogeneous implementation of the same has been underway, there are on-ground challenges / discrepancies noted in the past three years. With appropriate action at this juncture, the future course of the telematics industry, and connected vehicle as a whole, can be positively impacted to unlock an array of safety, productivity and expandability options.

Another focus for telematics in India is now to, as an industry, look inwards and transform itself in line with the Prime Minister of India's vision of an 'Atmanirbhar Bharat' to localize manufacturing of key components. Along with the active assistance from the Government, investment in technology and product development will not only de-risk the ecosystem but also allow telematics solution providers to offer systems more in tune with the needs of the consumers.

The way forward will require strong industry-wide collaboration, policy led support from the Government of India and proactive deliberations, where ACMA will continue to strive to play a pivotal role. The effectual participation of all ACMA members has been instrumental in bringing about active discussion further leading to key action points mentioned in the report. I would like to acknowledge the support of the Governments at the Centre and States, who have been extremely receptive to ACMA's suggestions and inputs. I am particularly grateful for the support extended to us by MoRTH, ARAI, ICAT and other industry bodies.

I am confident that the recommendations and best practices enumerated in the report, formulated basis detailed industry and policy analysis, ACMA member inputs, and global benchmarking, will enable integration of all the stakeholders and widespread ecosystem development.

Mr. Sunjay J Kapur
President
Automotive Component Manufacturers Association of India

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Executive Summary

Telematics, the fusion of telecommunication and informatics, has brought about revolutionary changes in safety, productivity and advanced vehicle communications in the automotive industry globally. Its origin can be traced back to the 1980s with the advent of GPS based navigation technology. Though the past three decades have brought forth a great deal of technological advancements, the primary purpose of telematics remains to be facilitation of preventive and responsive road safety measures. Active safety measures such as vehicle alerts, remote prognostics / diagnostics, advanced driver assistance systems features have proven to improve road safety by helping the driver in managing or avoiding emergency situations pro-actively. Passive safety measures such as airbags and seatbelts alerts are nowadays strongly supplemented by telematics devices, that record a broad set of metrics such as speed, driver behavior, etc. in real time to address and avert emergencies. Similar impact can be expected in India through increased penetration of telematics fitments.

With vehicle intensity increasing, so is the accident severity. The Ministry of Road Transport and Highways (MoRTH) reported 4.12 lakh accidents, 1.53 lakh deaths, and 3.84 lakh serious injuries in 2021[I]. These figures place India at the top of global road fatality rankings, where India accounts for 11% of deaths even though it contributes to only 1% of the global vehicle population. The Ministry has targeted to reduce the number of road accidents and fatalities by 50 per cent by 2025 and is actively implementing and scoping for technologies and mechanisms to improve the scenario. This is where Telematics fits in as a key enabler for road safety.

The telematics market in India is currently at a nascent stage and is valued at ~ INR 555.6 Crs, making up ~ 0.08% of the global market. First introduced in the market as early as 2004, telematics adoption has been majorly driven by OEMs[1]. The past use cases in India have been heavily centred around the commercial vehicles, with the segment making up 66% of the total market, owing to the larger productivity benefits CV operators and logistics players can derive from fleet telematics. Indian telematics device manufacturers have adapted to the various challenges specific to India, such as the automatic switching between multiple profiles feature on eSIMs for a higher QoS to tackle with sporadic network availability. Going forward, the focus of use cases should shift towards road safety considering that as many as 45% (59,400) of on-road fatalities involve over speeding trucks, and the commercial fleet industry suffers efficiency losses of up to INR 48,000 crore every year due to accidents and fleet breakdowns. The uptake of driver behavior and vehicle health monitoring solutions can actively counteract these issues and lead to better in-vehicle and on-road safety for all.

The year 2012 brought about increased focus on passenger safety & security in public transportation vehicles, which was met by the Government through the AIS-140 mandate in 2016. Seeing the intended benefits, the mandate has also been extended to good vehicles, national permit trucks, oxygen carrying tankers, vehicles carrying dangerous goods and hazardous material. Currently more than 2 million AIS-140 compliant devices are already fitted, with major CV OEMs such as Ashok Leyland, Tata Motors, VECV, Daimler, etc., having adopted 100% factory fitment for the past two years irrespective of MoRTH mandate category. While its homogenous implementation is still ongoing, the provision of emergency buttons and vehicle tracking in all trucks, buses, taxis and cabs has led to increased awareness of telematics in the country. The successful establishment of an Intelligent Transport System (ITS) through AIS-140 in the country would lead to increased visibility of public transportation in the country and lay the foundation for expansion of the scope of the standard (CCTV provision, auto-connection to nearest police station, etc.) to strengthen the emergency response system in the country. Going forward, the introduction of e-Call can be explored as an option to improve post-crash systems, seeing the positive results in Russia and EU where the response time of emergency services reduced by up to 40-50%.

Though the adoption of telematics in passenger vehicle segment is currently low, at INR 106 Crs, it is expected to grow to a dominating share in the future owing to increased uptake of electric vehicles and increasing consumer appetite for more advanced connectivity. In-vehicle personalization of telematics features and the uptake of ADAS L0 (Basic) and L1 (Driver assistance) would greatly contribute to improving on-road driving behavior. OEMs in India are realizing the opportunities (efficient recall management, remote vehicle prognostics, diagnostics and maintenance) that telematics, and the data it collects, presents for driving the total cost of vehicle ownership down.

All these changes are expected to lead to a gamut of ecosystem benefits, as noted in other advanced markets. Usage based insurance (UBI), a success story in UK, has shown the direct benefits of using telematics data to

1 OEM – Original Equipment Manufacturer, referring to vehicle manufacturers

monitor, inform and incentivise better driving behaviour. Similarly, route optimisation accesses different datasets to derive smart insights and identify 'black spots' such as junctions that are poorly maintained, ill-organised or infamously unsafe. Metrics such as violations, bottlenecks and harsh braking are used to recognise dangerous routes and re-route or alert the driver to the same. The domino effect of data monetisation and information symmetry would not only help in making roads safer but also for developing smart infrastructure such as Vehicle to infrastructure (V2I) communications in public key infrastructure (PKI).

Future development of the telematics ecosystem, and derivation of subsequent safety benefits, in India can have some impediments owing to the current market challenges that are faced by various stakeholders. Regulatory intervention is required for the integration of all the current automotive and non-automotive stakeholders, and the extended ecosystem players who will arise from the mobilisation of telematics data. The primary regulation in place in India pertaining to telematics is AIS-140. While it is structurally sound and the guidelines are exhaustive in terms of applications, there have been gaps noted at the ground level implementation in various states which need to be mitigated basis the recommendations mentioned in the report to meet the larger goal of ministry of road safety. The increasing electronics in vehicles from telematics fitments also calls for more stringent cybersecurity engineering practices across the entire value chain to combat threats such as consumer data breach or vehicle thefts and ensure physical safety in connected cars. There is a need to strengthen regulations such as those pertaining to component level specifications, telecommunication modules, etc. to address the white spaces and pave the way for further mandates.

This white paper explores all the aforementioned aspects in detail to give a comprehensive view of the Indian telematics market construct. It covers the past evolution, current market scenario, future use cases for evolution, regulatory scenario of the Indian telematics market and presents the possible technological advancements in line with global telematics evolution. It examines the current regulatory framework for all stakeholders and presents structural changes / global best practices that can be adopted for the growth of the ecosystem.

1 Evolution of telematics in India

In the last 2 decades, the automotive industry has seen cutting edge technology, higher convenience functionalities, improved vehicle security, increased digitization and electrification of car components, etc. All this is driven by the integration of wireless communication and GNSS based technology in automobiles. This revolution, dubbed as Telematics, has brought an intriguing array of in-car services that have improved the driving experience, set new lifestyle requirements, raised brand awareness, and improved customer experience.

1.1 Emergence of telematics in India

The first instance of use of telematics in India was in 2003. Telematics solutions such as GNSS-enabled navigation and vehicle tracking were first introduced in the market as early as 2004. Some key milestones in the telematics evolution in India has been driven by OEMs and government policy changes.

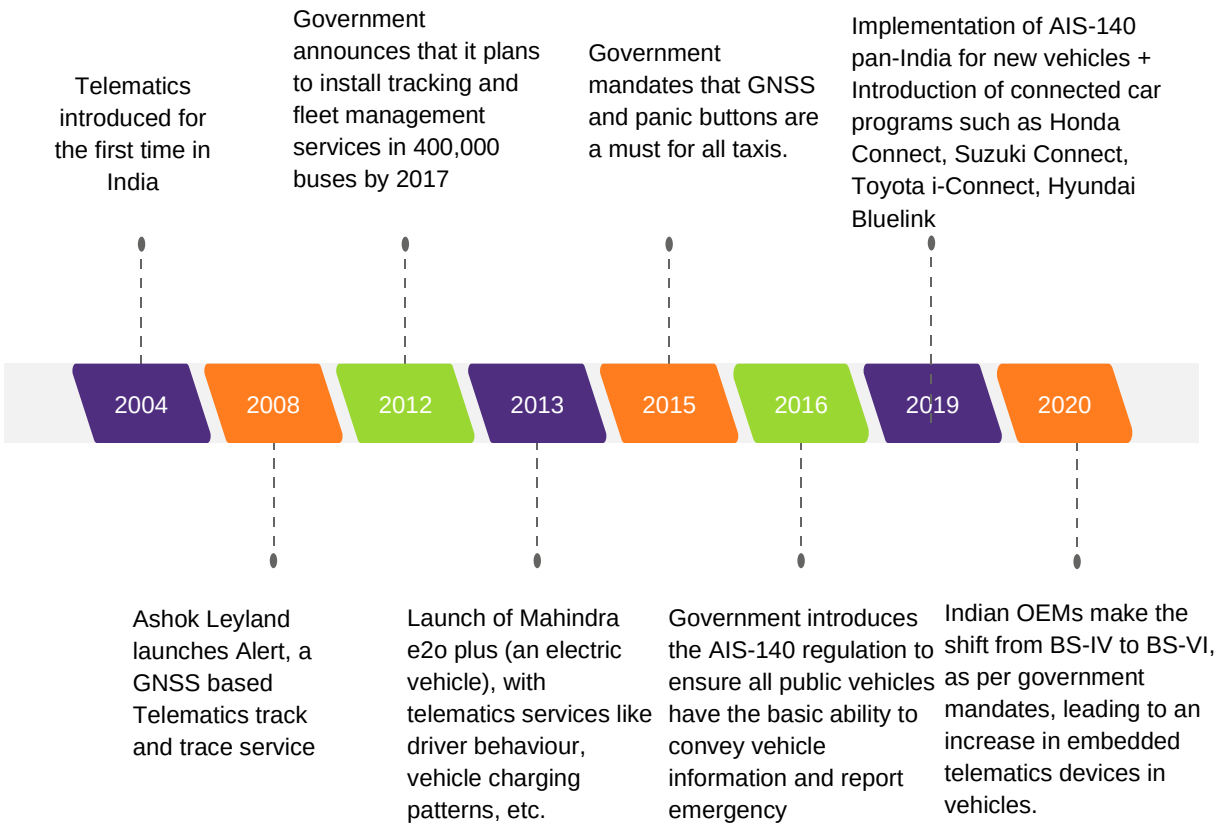


Figure 1 - Figure 1.1.1 - Evolution of telematics in India[2]

2004: Maruti Suzuki was amongst the first to use telematics for fleet management in their car-carrying trailers. Maruti Suzuki and Hero Honda made it mandatory for their fleet contractors to have a tracking device and implemented an exception alert-based monitoring to drive “On Time Delivery” performance and “Improved Turn Around Time”. Subsequently the Fleet owners realized the value and started proactively adopting such solutions

2 GT analysis – Primary interviews and secondary sources

beyond their customers mandate. Reliance Petroleum also came out with “Trans Connect”, a fuel loyalty program that offered “Trans-Track” telematics-based fleet management solutions to commercial vehicle owners.

2008: Ashok Leyland launched the **'Alert' GNSS-enabled telematics platform**, which was designed specifically for Indian operating circumstances. 'Alert' used an On-Board Unit (OBU) to deliver second-by-second location, speed, direction of travel, date and time for Vehicle tracking and the Passenger Information System (PIS) services. The data was stored in memory and sent to a data centre for a set amount of time or when the customer requested it.

2012: Central government announced a plan to install tracking and fleet management systems in 400,000 buses. Almost all new public transportation buses now come equipped with a telematics-based intelligent transport system. The electronic ticket vending machines found with ticket issuers are GNSS enabled and help exchange information on the number of tickets sold, as well as the location, route, and direction of travel.

The first OEM in-line telematics fitment also started in 2012, with Mahindra Navistar. Daimler followed suit with similar fitments in their Bharat Benz trucks. VECV also initiated similar initiatives.

2013: The collaboration between Mahindra Electric and Bangalore-based Lithium happened in the field of **cloud-based GNSS system operation** and **telematics in electric vehicles**. Lithium maintained a fleet of Mahindra e2o electric cars with telematics, which gave data on driver behaviour, vehicle charging patterns, and so on.

2015: In response to calls for greater safety for women riding in taxis, the government made it mandatory for taxis to have a GNSS and a panic button. Telematics has been effectively used by Ola, Uber, and other radio taxi companies to collect data, track vehicles, monitor driver behaviour, and conduct commerce. Mahindra and Ola collaborated on a prototype e-taxi service in Nagpur in 2017, using the same e2o electric automobiles. The pilot established the potential for commercialisation of e-taxis in other parts of the country. It also highlighted the **successful implementation of telematics in the operation of both electric and conventional taxis.**

2016: The Ministry of Road Transport and Highways (MoRTH) introduced the **AIS-140 legislation**, which was a solid step in the right direction. All commercial vehicles and public transportation, according to the AIS-140, shall have the basic ability to transmit real-time location and other vehicle information, as well as emergency buttons throughout the vehicle.

Odisha had adopted the draft AIS-140 standard available in 2016 for the implementation of coal and other mining vehicle tracking system. The implementation involved 9 empaneled Telematics Suppliers, a central command and control room, 14 zonal control room, a mobile app with 100k+ users and state map layers for deep mining areas. This case showed much better utilization of trucks with load planning, unloading without delays, predictive availability of trucks, improved TAT and freight optimization. Within 3 months of implementation, 6 cases of hijacked trucks were recovered and crime rate reduced.

2019: AIS-140 was mandated from 1st Jan 2019 for new vehicles and since then 100+ device and auto-parts manufacturers[i] have got their AIS-140 devices “Type Approved”. Implementation has been ongoing, though deferrals have been taken since 2017, with most of the states and union territories and some commercial vehicle OEMs are yet to implement the same.

In private car segment, multiple OEMs launched connect car programs such as Suzuki Connect, Honda Connect, Toyota i-Connect, Hyundai BlueLink, etc. during the year. Common telematics features offered are geo-fencing, speed alerts, SOS / panic notifications, destination sharing tested rigorously in India, keeping the conditions in mind along with the needs of the customers.

2020: The central government mandated that vehicle makers must manufacture, sell, and register only BS-VI (a unit emission norm that sets the maximum permissible level for pollutants that an automotive or a two-wheeler exhaust can emit) vehicles from April 1, 2020. The shift from BS-IV to BS-VI saw the application of telematics devices and multiple Indian CV OEMs such as Ashok Leyland, Tata Motors, VECV, Daimler, Suzuki, etc came out with embedded telematics in their BS-VI compliant range of trucks.

The technological evolution of telematics in India has been in line with telematics journey of other countries. with five distinct phases, all of which are characterized by ongoing improvement.

- The first phase was hands-free calling and navigation, which is already widely used today in cars, via in-built display systems with Bluetooth connectivity
- Portable navigation and satellite radio devices which are prevalent today are a part of the second phase where telematics fitments consist of receivers for information transmission.

- Phase three included complete vehicle connectivity through embedded sims for enabling solutions. While OEMs in India are offering solutions in this space, its prevalence and consumer awareness is low.
- Phase four expanded this connectivity to include an all-encompassing service network of seamless mobility and online service integration.
- Phase five offers reliable vehicle-to-vehicle (V2V) and vehicle-to-infrastructure(V2X) communications by enabling connectivity with IoT devices.

India has just entered Phase 3 of this evolution with some OEMs and Telematics solution providers making significant strides in keeping up with the global technology offerings in Phase 4 / Phase 5.

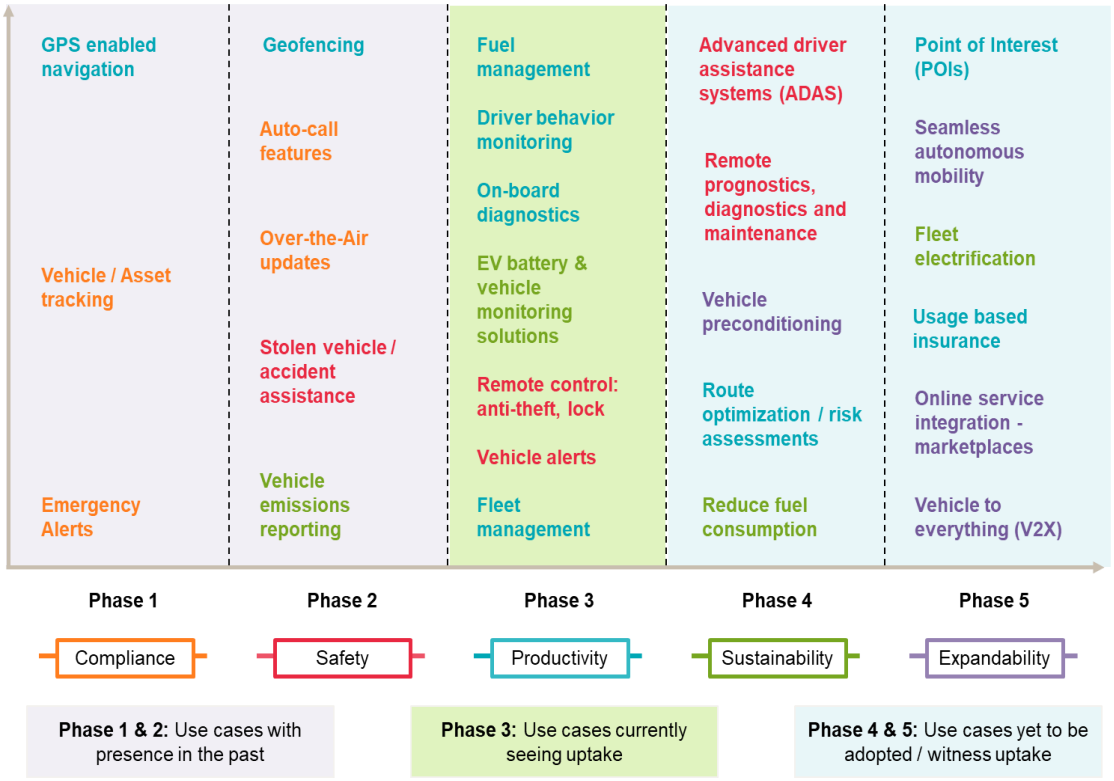


Figure 2 - Figure 1.1.2 – Technological evolution of solutions and their use-cases in India[3]

Note: The above list is not exhaustive, there are other telematics applications across the five phases and use-case buckets.

Telematics solutions in India are constantly evolving their scope of coverages. Initially when launched in the market, the solutions were majorly focused on basic navigation and track and trace features. One major driver for the uptake of telematics solutions has been the mandated vehicle tracking and emergency panic button in public transportation vehicles and cabs as per AIS-140. This paved the way for mass fitments of devices and for multiple device manufacturers to be certified and be a part of the ecosystem. Similarly, the shift to BS-VI led to more embedded telematics fitments in vehicles for monitoring the increasingly complex engine and for real time emission reporting.

Currently, while the implementation of mandates is still driving some market segments, there is a shift from compliance focused solutions to more customer-centric productivity and safety solutions (having a prominent role in passenger and commercial vehicle segments). Telematics is expanding from a closed system to an open platform as technology keeps progressing. OEMs can combine different types of hardware accessories, software, and mobile apps for increased efficiency and visibility into organizational processes thus creating wider use cases for telematics solutions which are driving OEM adoption of telematics. Additionally, they are also able to strengthen their customer understanding and capabilities by leveraging telematics data. Over-the-air updates and diagnostics features are helping to build their after-sales service offerings.

3 GT analysis – Primary interviews and secondary sources

1.2 Differences in global telematics vs. Indian telematics market

The global telematics market is currently valued at over INR 683,800 Crs ($88 Bn) and has been growing at a CAGR of +18%. The Indian Telematics market currently makes up ~ 0.08% of the total global market and is valued at INR 555 Crs.

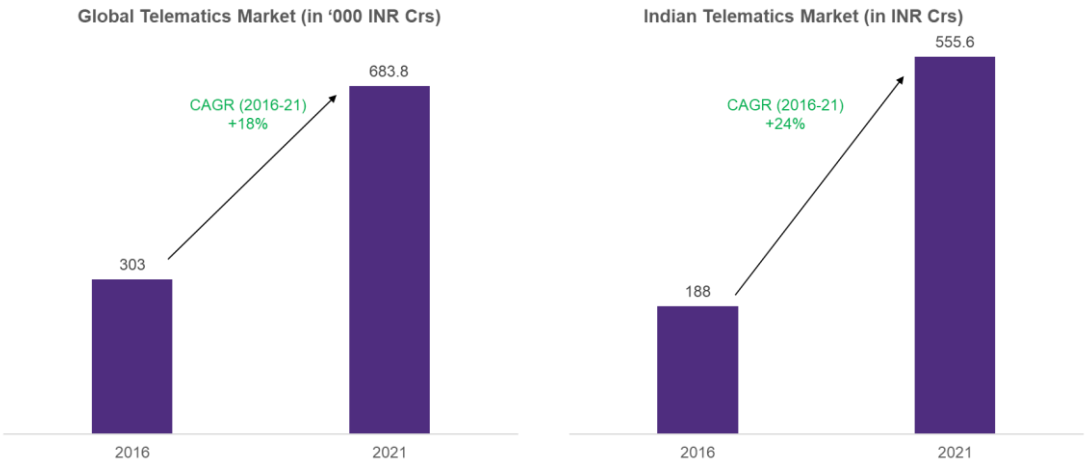


Figure 3 - Figure 1.2.1 – Global and Indian telematics market by value (in INR Crs)[4]

1. Value creation potential of telematics solutions is low in India as compared to global markets such as North America and Europe, since adoption has been very low in passenger cars and trucks: Globally, OEMs and customers are seeing the value creation potential in telematics across levers like car attractiveness, internal usage (reduction in quality & consumption costs), aftersales (preventive repair and maintenance) and connected services (convenience, value add services like User based insurance - UBI, Over the air updates – OTA, etc.). There are many ecosystem development benefits that get unlocked with wider adoption of telematics across the country – road safety related advantages such as vehicle tracking, anti-theft begins at low telematics-adoption rates (<20%) as these are independent services; other advantages, such as traffic optimization, lower insurance premiums owing to better mapping of driving behaviour, require much greater adoption levels (>40%), while smart-city infrastructure benefits need an even greater telematics presence (~80%)[ii]. Thus, the cost of lifetime ownership of a vehicle is going down because of these optimised solutions and continuous value-add / adaption of scope. This potential has yet to be realised in India as compared to global markets owing to the lower adoption in passenger cars and trucks (due to many single truck owners for whom installing high-cost telematics would affect margins more than fleet owners; there is less value perception as well) as compared to commercial trailers, taxi companies, and fleet operators.
2. Connected vehicles and autonomous mobility are at a more advanced stage of adoption in leading global markets: By 2025, 90 % of global passenger cars (as of new sales) will be connected[iii] and an estimated 600 million cars with embedded telematics will be on the road, with India accounting for approximately 40 million (~7%)[iv]. The connected car (vehicles communicating through internet with OEM platforms, mobile applications, infrastructure, etc.) is a major trend in the global automotive industry and virtually most of the world's leading carmakers have launched mass-market services in key regions. Connected vehicles have embedded hardware in the Telematics Control Unit (TCU) that establishes the connection between the car and the network. Therefore, telematics fitments are more common in these vehicles due to their use cases in integration of advanced automotive offerings.
3. The drivers behind the global adoption of telematics are majorly commercial and regulatory. This is mirrored in the Indian telematics market but at a conservative capacity: Regulatory initiatives relating to safety and security

4 GT Analysis - Secondary sources

have made a decisive impact on the adoption of telematics in Europe – For e.g. the EU's eCall initiative and Russia's ERA-GLONASS have mandated that all new car models sold include an automatic emergency call device. Commercial services in North America have driven the adoption of OEM telematics services, which have evolved from a differentiator to a mainstream feature now offered by majority of the leading car brands on many of their models, owing to consumers' increasing appetite for greater connectivity and intelligence in their vehicles. In India, the regulatory push of AIS-140 standard for commercial vehicles has initiated the growth which would eventually open up and facilitate other use cases.

4. OEM fitment of telematics is higher globally, as compared to India: 62% of all new passenger cars sold worldwide in 2020 were equipped with an embedded telematics system fitted at the OEM level, with US at 77% and EU at 72%[v], while India remains at less than 10%[vi]. Several categories of car telematics applications are offered on a commercial basis by most leading carmakers globally. Examples include roadside assistance, stolen vehicle tracking (SVT), vehicle diagnostics, connected navigation and infotainment, Wi-Fi hotspots, concierge services and convenience applications. Convenience applications mainly rely on embedded telematics devices to enable remote control of vehicle functions such as door lock/unlock, vehicle preconditioning (heating or cooling of the passenger compartment before a trip), EV charging management and parking assistance. OEM fitments in India have majorly been limited to track & trace, mainly due to high price elasticity. Even though versions of global solutions are offered by Indian OEMs and telematics solution providers, an increase in the vehicle price can cause volumes to fall dramatically in a cost-centric market like India.

5. Development of value-add services using telematics applications is more prevalent abroad owing to integration of all stakeholders in the ecosystem: Several other applications of telematics also exist globally, for instance usage-based insurance, leasing and rental fleet management as well as electronic toll collection and road charging. Global carmakers are also gradually exploring in-vehicle commerce platforms and data exchanges to offer telematics data to third-party service providers. While these opportunities have been discussed in India, there is a long road ahead in their implementation which requires major strides from all stakeholders in the Indian telematics ecosystem.

6. Telematics has been identified as a vehicle component category that might contribute more to the cost per vehicle (CPV) in the coming years, both globally and in India. The depth of offerings abroad is much more diverse because of the wider scope of regulatory coverages and active demand from customers. Currently the product development ecosystem of telematics devices in India is largely focused on product design, software development and integration. Majority of the hardware components are sourced for assembly in India due to less maturity of the manufacturing ecosystem thus limiting the overall market growth.

1.3 Current dominance of telematics in Indian CV industry

Commercial vehicle telematics is the dominant segment in the Indian telematics market, currently being driven majorly by regulatory telematics fitments in public transportation vehicles.

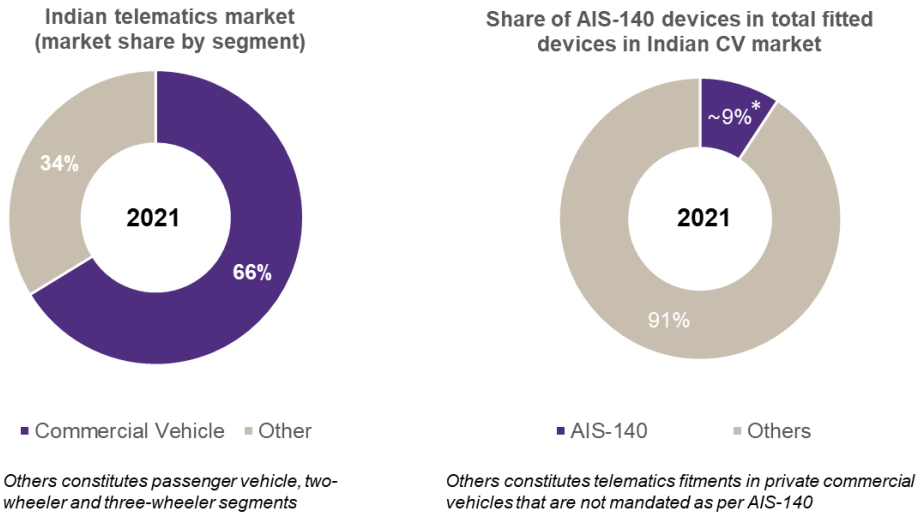


Figure 4 - Figure 1.3.1 – Dominance of commercial vehicle segment in Indian Telematics market[5]

The CV telematics market makes up ~66% of the total Indian market and was valued at INR 3.68 billion in 2021; it constitutes ~ 0.45% of the global CV telematics market. The total telematics installed base in commercial vehicles is approximately more than 2 million+ fitments with 10,19,000 AIS-140 devices uploaded (1,85,000 fitted devices) on Vahan portal.[6] As AIS-140 mandate implementation isn't done in all states, Vahan figure is less considering AIS-140 fitments carried out at OEM level.

In general, CV telematics finds applications in various fields such as:

Passenger / cargo safety and security: Various companies dealing in perishable, hazardous goods or precious cargo are compelling their logistics partners to invest in telematics not just as a track and trace tool, but as the one that will improve safety and reduce risks. Telematics fitments provide visibility of driving behaviour and patterns, can alert regarding incidents, route changes, rash driving, etc. Advanced telematics sensors can also communicate details pertinent to the goods being transported such as temperature and weight.

Customer relationship management: Real time tracking and reporting of commercial vehicles is hugely beneficial for logistics players when it comes to maintaining transparency and communicating timelines with clients. Telematics provides an accurate view of the on-ground situation and helps manage the same by setting geofencing mechanisms in place.

Business services such as fleet management: Fleet management presents a myriad of operational benefits for commercial vehicle / fleet managers. For instance, saving a few minutes of idling time or rerouting around heavy traffic across a fleet results in enormous fuel savings. Overall better use of the fleet and driver can raise the accessibility of machinery with current resources to satisfy client requirements. The prominent telematics offerings in India by various CV OEMs and the developing value-add business models are as follows:

5 GT analysis - Secondary sources, Government sources – Vahan portal

6 As per Vahan Parivahan portal on September 2022

* Note: ~9% AIS-140 fitments in Figure 4 is basis fitted devices count (1,85,000 devices) as shown on Vahan Parivahan portal

Tata Motors	• Tata has connected vehicle solutions developed in-house since 2012 and is a market leader in CV telematics solutions with more than 300,000+ of their MHCV having been fitted with telematics units. • Tata Motors announced launch of **Tata Motors Fleet Edge** in 2020– a connected vehicle solution that enables fleet management, with informed decision making. • Fleet Edge processes data generated by the Telematics Control Unit (TCU) and provide insights for track and trace, vehicle health, driving behavior, real-time fuel efficiency and fuel loss alert. Customers will also be able to track the due date of the important vehicle documents. These insights will be available to customers through an interface on Tata Motors Fleet Edge portal, also accessible via the smartphone app.
Ashok Leyland	• Ashok Leyland has been a pioneer in the Indian telematics market with its **Alert** solution, developed with Trimble in 2008. More than 200,000 vehicles are present on its connected vehicle platform. • In 2020, Ashok Leyland came out with **i-Alert 3.0,** an updated version of their solution. The latest version offers solutions such as vehicle tracking, trip management, fuel management solutions suite, fleet insights, geo fencing, driver management, fleet management, proactive vehicle service support, alerts and notifications
Mahindra	• Tech Mahindra Ltd. is a specialist provider of connected solutions, rolling out the first instance of Usage Based Insurance (UBI) for auto insurers in India in 2014 using a big data and predictive analysis driven platform. • Mahindra Truck and Bus (MTB) launched **Mahindra iMAXX** in 2020, a differentiated next gen fleet telematics solution which deploys technology like Dual CAN, 4G, ML and AI to provide powerful insights on vehicle health and performance. Some of its features include Fuel management suite, prognosis and remote diagnostics capabilities, API library, vehicle tracking, driver management, trip management and multiple operations reports.
VECV	• VECV has been offering telematics as a standard in all its trucks and buses since August 2020 powered by Eicher LIVE, becoming the first CV player to introduce 100% connected vehicles across its entire product portfolio with advanced telematics solution. • All their new vehicles come with 2 years' subscription at company cost and free Uptime Services. The telematics features include fuel management, uptime management - 24x7 Eicher uptime centre support, trip management
Logistics players: Volvo & Delhivery	• Delhivery and Volvo Trucks have tested and deployed, an articulated Volvo FM 4x2 solution for express trucking operations in 2019, addressing challenges of speedy delivery and cost efficiencies of services. • These custom-built tractor trailer solutions make use of telematics to ensure that exhaustive data is captured, analysed and correction happens throughout the truck's journey. • The reduced delivery time helps Delhivery to fulfil their business goal of delivery to their customers in the shortest possible time, substantially reducing order cancellations and productivity improvements of up to 20%.
Logistics players: Rivigo	• For emerging business models in logistics like Rivigo's, there is a need for telematics solutions to ensure effective business operations and monitor quality of service delivery. Rivigo has introduced a **Relay Model and Relay as a service (RAAS)** in Indian logistics space, which reduce the transit times by 50-70%. • The system calls for a new driver takes over at a pit stop located every few hundred kilometres — for its 4,000 trucks. For example, on the 1,370-km Delhi-Mumbai stretch, pit stops have been set up every 250km. A driver makes the four to five-hour journey from one pit stop to the next, and then another driver takes over the truck, while the first one drives back to the starting point in another truck after a mandatory rest period. • Rivigo has seen improvements in the Delhi-Mumbai travel time from 80-100 hours to 30-32 hours as the truck is constantly on the move. Sensors and telematics have played a key role on their trucks to monitor driver behaviour and have also reduced fuel pilferage and accidents.
SML	• SML Izuzu launched **SML Saarthi** in 2018, developed jointly with its partner Minda iConnect, offered as a standard fitment in all their new gen Global Series (GS) trucks and later in all their buses as well.
Daimler	• Daimler globally has multiple collaborations and partnerships since 2011 to introduce robust telematics services for their vehicles. • In India, Daimler launched **Truckonnect** in 2020, an application that helps fleet owners in tracking vehicles real-time and monitoring vehicle parameters like vehicle speed, fuel level, AdBlue content, vehicle health, driver behavior and more. Using this application, fleet owners can optimize their fleet performance through features such as Driving Analysis, Trip Analysis & Truck Analysis.

Figure 5 - Figure 1.3.2 – Telematics offerings in CV industry in India[7]

Demand for telematics in the CV segment is driven by need for fuel efficiency, advancement of logistics and e-commerce in India, need for cargo and vehicle safety, rise in transit losses and policy support for enablement of safety in public transport. An estimated 7.42 million commercial vehicles are on Indian roads, serving various industries such as transport and logistics, oil and gas, construction, utilities, service and maintenance, retail, ecommerce and delivery[vii]. Of these, transport and logistics, oil and gas offer the highest opportunities for growth in the CV segment for telematics service providers owing to the plethora of benefits than can be derived from adoption of fleet management solutions.

7 GT analysis - Secondary sources: company websites

1.4 Current role of component manufacturers and non-automotive stakeholders

The successful development of telematics is dependent on not just telematics solution providers or OEMs. Telematics has grown in the last several years resulting in touching a lot of prominent allied industries such as telecom players, IT companies, cloud storage service providers, GIS mapping service providers, etc. Putting together such an ecosystem for the Indian automotive industry that is evolving at a similar pace has led to changes in dynamics, roles and underlying industry principles. With the increase in applicability of telematics in various use cases such as insurance, in-car infotainment and advertising, the ecosystem has widely evolved to involve diversified competencies and new non-traditional stakeholders

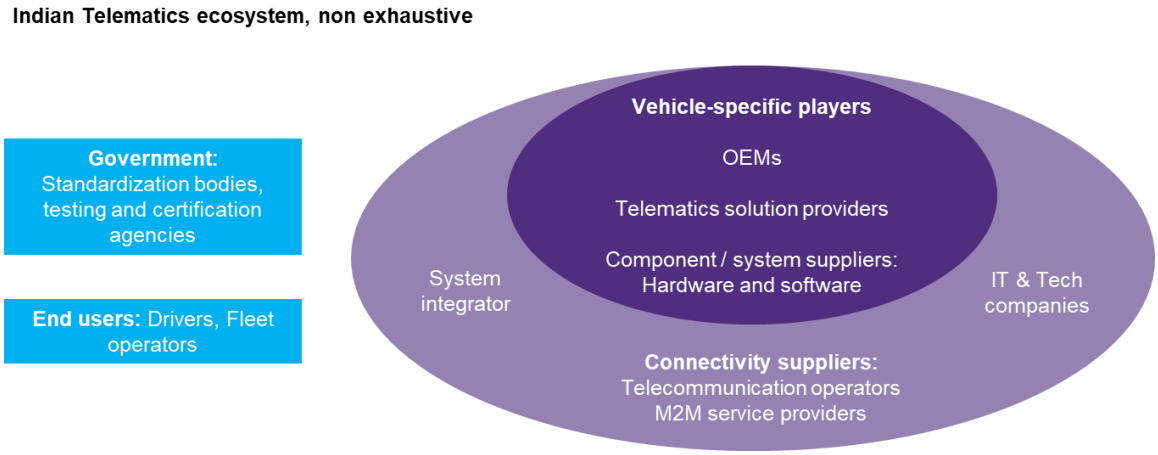


Figure 6 - Figure 1.4.1 – Telematics service delivery ecosystem in India

Vehicle-specific players: Telematics solution providers & component / system suppliers

The Indian telematics manufacturing ecosystem has over 100 type approved local and national device manufacturers. There are end-to-end solution providers with complete in-house software and hardware development and manufacturing, or solely hardware / software focused players, or PV/CV segment focused players in the market as well. These telematics solution providers collaborate with OEMs on specifications of devices for their vehicles.

Telematic devices consist of a multitude of automotive grade components – both hardware and software. Hardware is an important constituent of overall telematics market, having the predominant share for the past decade. However, there is a shift in the automotive industry from traditional hardware organisations to agile software-enabled architectures. Software segment of telematics currently accounts for ~40% of the total market in India and is expected to register highest growth among the hardware, software and installation segments[viii]. Automobile manufacturers embed software in their vehicles to manage the complex system of hardware such as sensors, processors, and storage devices. To reduce complexity, OEMs are also opting for more centralized electrical / electronic vehicle system architecture (E/E Architecture), moving from single function ECUs to more multifunctional and more flexible domain controllers. The software capabilities of Indian players are evolved and focused on creating / customising specific solutions for the Indian market and consumer, but there is a high dependency on imports for multiple key hardware components with limited manufacturing in India.

Connectivity supply - Telecommunication operator: A key functionality of a telematics device is communication of data collected to be further analysed by stakeholders for insights and enable applications. This communication is facilitated by telco players. Seamless supply of connectivity services enables telematics devices to function at their optimum capacity, reduces latency in data sharing, and creates opportunities for more device applications. In India, currently the minimum mandated network is 2G.

M2M service providers are another major stakeholder in the telematics ecosystem. They provide standard-compliant M2M (Machine to Machine) connectivity to telematics solution providers. They deliver several essential requirements including reliable network connectivity, robust service agreements, telco agnostic, effective application integration, and flexible rate plans. Major strides have been taken in terms of M2M policy rollouts since 2016 with the issue of 13-digit numbering scheme for SIM based M2M devices, instructions for implementing restrictive features for M2M SIMs and instructions for e-SIMs, etc. in 2018. As per TRAI, TEC guidelines and DoT M2M policy of India, M2M Service providers are undertaking registration with DoT, with the count of total M2M SPs in double digits in India.

IT / Tech companies: The increasing focus on telematics data has illuminated the foremost step as selection of the proper cloud service with storage and accessibility solutions becomes important to develop further applications for customers. Further, the integration of more intelligent systems in telematics also requires the intervention of IT infrastructure and service providers. A key role is that of a system integrator, governing the deployment-to-operation lifecycle and specializing in bringing together component subsystems into a whole and ensuring that those subsystems function together.

Government: The Government has / will be a key stakeholder for the historical / future growth of telematics in India. With favourable policy making to boost the manufacturing ecosystem, introduction of industry standards and mandates, comprehensive testing and certification norms to ensure device safety, they have been instrumental in standardising the ecosystem and driving adoption so far. Additionally, they are also able to derive benefits from telematics technology in terms of increased road, passenger safety and visibility of public transportation vehicles. The implementation and advancement in scope of AIS-140 will enable benefits such as better utilization tracking and resource maximization of public fleets, streamlined emergency response, improved emissions, safer driving habits and asset security.

Industry Speak

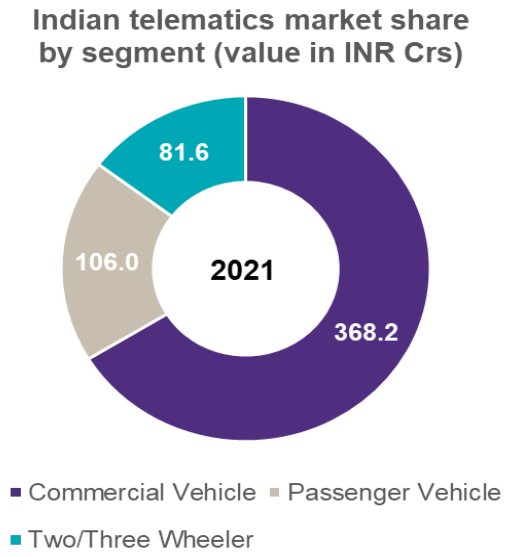
"Government is one of the largest customers of basic telematics, which includes track and trace devices, owing to the fitments in public transportation vehicles as per the AIS-140 mandate. They are also driving fitments in the compliance telematics space through the introduction of progressive vehicle emission norms and road safety initiatives."

– – **Vadiraj S Katti,** *iTriangle Infotech*

End users: Customers for telematics include businesses who use telematics to enable newer, more agile business models in evolving industries like logistics / mobility. e.g. Rivigo's Relay as a service (RAAS) model, Delhivery's collaboration with Volvo trucks, Ola's collaboration with Mahindra, etc. The end-users also include the single truck / cab drivers whose value perception from telematics remains very low – currently the fitments at this level remain compliance driven.

2 Telematics market in India

2.1 Telematics installed base by market segments



In 2005, the segment value of passenger vehicle telematics was a meagre INR 49 Crores and now 20 years later, the segment is set to reach INR 1219 Crores in 2025. Over the previous decade, basic in-car entertainment, navigation, and in-car networking (for example, via Bluetooth) have progressed significantly and are an incumbent part of PV OEM offerings. Advanced telematics capabilities that use car sensor data, driving behavior, and vehicle-health characteristics are also growing, but they have yet to gain widespread popularity among private car owners. The segment is picking up and expected to register the largest growth owing to consumer appetite for advanced technologies, and renewed focus of OEMs and telematics service providers to deliver the same. The commercial vehicles segment presents a slightly different picture as historical growth of this segment being largely owed to regulatory support (i.e., AIS-140).

Figure 7 - Figure 2.1.1 – Indian Telematics market – by value[8]

Large fleet operators, logistics firms, and taxi companies have also taken a more positive view of telematics services due to the greater ROI, supply chain visibility and direct implications to their business operations. Every major CV maker in India is currently offering AIS-140 compliant fleet telematics and asset tracking solutions, developed in-house or through tie-ups with telematics service providers. Despite the government push, the use of telematics has some barriers as it continues to be low in single truck operations because of the value proposition as against device cost.

The two-wheeler segment has yet to make a large impact on the Indian telematics market owing to limited capability for telematics in terms of device size & cost. The current fitments are exclusively in electric two-wheelers or high-end motorcycles. Hero MotoCorp's XPulse 200 was the first motorcycle to offer connectivity to riders through Hero Connect, using telematics hardware with a built-in SIM and has basic telematics features such as vehicle tracking and alerts, driver behaviour analysis, etc. Ather Energy Scooters and Ola Electric

Industry Speak

"Telematics industry is now changing from tracking, tracing, navigation to secure data communication and user experience. In the past, growth has been observed primarily through Government regulation e.g. AIS-140, However, now rapid rollout of telematics features in the passenger vehicle segments have been noticed due to customer usage experience and focus on connectivity. This is expected to suffuse through all vehicle segments, and to further open up new avenues like Usage based car insurance (UBI)."

– **Sumit Tiwari**, *Lumax Industries*

8 GT analysis - Secondary sources

Mobility are some of the prominent EV 2W manufacturers who have a telematics hub integrated with the smart dashboard of their vehicles.

In India, <15% of the fitments in commercial and passenger vehicles happens at an OEM level. 85-90% of the basic solutions are being fitted at the aftermarket level.

2.2 Trends and drivers that have shaped the market in India so far

The Indian Telematics market has been largely driven by a few factors that have remained constant over the past decade since the advent of mobile technology, smart phones, the internet and GNSS receivers.

Telematics market drivers:

1. Early focus of regulations in the CV space: The Government's increasing involvement in passenger safety and security has been a boost to the industry, and the current fitments have been majorly done because of AIS-140's mandate for telematics devices and solutions in public transportation vehicles, taxis and cabs, National Permit Trucks, Oxygen Carrying Tankers & Hazardous goods carrying vehicles.
2. Increased awareness of customers on larger benefits and reduction in cost of vehicle ownership: High-end vehicle segment customers have been exposed to more advanced telematics technology integration in their vehicles and are aware about the bundle of benefits focused on safety & security like vehicle alerts, geofencing, remote vehicle control, and multitude of driving behavior and analytics like driving routes, harsh braking, speed sensing and impact sensing. Additionally, remote prognostics and vehicle maintenance features ultimately are resulting in less total cost of ownership.
3. Increasing adoption in PV space in line with developed markets: Telematics solutions with smartphone integration are being offered by many Indian OEMs with common standard features such as vehicle tracking, live vehicle status, driving score, and emergency alerts.
4. Increased EV uptake across vehicle segments: The rising popularity of electric vehicles across all vehicle segments is also driving telematics due to the need for battery life and health monitoring, and charging information that telematics fitments can convey to the user.

Telematics market trends:

1. **Fleet operators see telematics as a cost saving lever:** Factors such as spiralling fuel prices & fuel pilferage, cargo safety risks, growing instances of accidents and thefts, and need for optimisation of navigation routes have increased the appetite of larger logistics transporters for greater connectivity and intelligence in their vehicles. Insights derived from telematics data applied across an entire fleet can greatly impact operational costs and business efficiency.
2. **OEMs are using telematics use cases to differentiate from competition:** There are a myriad of over 50 connectivity features being offered by each leading OEM. While they have some standard offerings and mobile connectivity, some additionally offer unique features such as e-call & voice commands in MG Hector, in-car air quality monitoring in Kia Seltos, etc.
3. **OEM benefits from telematics:** OEMs are seeing value in telematics because of the convenience of Over-the-air updates, ECU programming & reprogramming, prognostics and remote diagnostics which in the long run bring down vehicle recall and after-service costs down significantly. Their focus is also shifting towards telematics data and the opportunities it presents for them to understand consumer preferences and driving behaviour better to build better future technology. Effectively leveraging the data captured and using technology like AI, ML, IoT to communicate actionable insights and alerts to the customer presents benefits for the overall ecosystem.

2.3 Key challenges for the market stakeholders

#	Key Challenge	OEM	Device mnfctr	Compo-nent mnfctr	TSPs	Govt	IT Infra	End Users (Commercial)
1	Limited awareness of telematics and its extended use-cases in the market.							
•	Low renewal of annual subscriptions							
2	Limited knowledge of telematics technology							
3	Low production volumes / Limited economies of scale							
4	Lack of uniform network coverage across the country							
5	Substandard / cheap imported devices sold by unorganised players in the aftermarket							
6	High dependency on imports for telematics hardware components							
7	Gaps in the integration of extended ecosystem players – regulatory and otherwise							
8	Lack of regulations pertaining to data privacy and cybersecurity							
9	Non-unification of different industry and government bodies							
10	Non-compliance of common state backend implementation protocol							
11	No deadlines for implementation of AIS-140 in existing vehicles							

Not perceived as a challenge for the stakeholder	Perceived as a challenge for the stakeholder

Table 1 - Figure 2.3.1 – Key challenges for market stakeholders

OEM – Original Equipment manufacturers

TSPs – Telecommunication Service Providers

3 Telematics market outlook by 2025

Market outlook in 2025

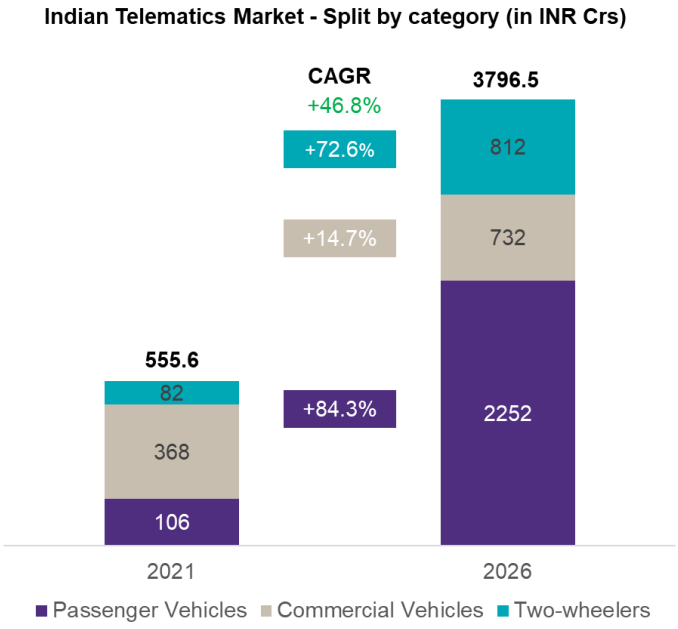


Figure 8 - Figure 3.1 – Indian Telematics market outlook by 2026[9]

The Indian telematics market is at a precipice of change and set to grow rapidly from INR 555 Crs in 2021 to INR 3796 Crs by 2026, registering 46.8% growth during the period. With a shift in growth segments and OEM focus on solutions with more system applicability, the market drivers will be:

Regulatory implementation of AIS-140 in the remaining states: The CV segment growth will be largely driven by the continued and homogeneous implementation of AIS-140 in the public transportation vehicles in remaining states, who had deferred the implementation owing to reasons such as Covid-19.

The evolution of use cases is expected to shift towards the PV segment: Telematics solutions in India are currently merely providing real-time location of vehicles and some fleet management solutions. A change can be noted from simple, plain track-and-trace solutions to much more improved on-board diagnostics devices such as OBD II (implemented based on ISO 15031 standard) based solutions which have the ability to not only providing location info but also vehicle info relating to powertrains, emission ECUs, diagnostic trouble codes, etc. These devices can be used to monitor driving behaviour as well as to detect any potential problems with the vehicle which increases OEM level adoption for these solutions.

9 GT analysis - Secondary sources

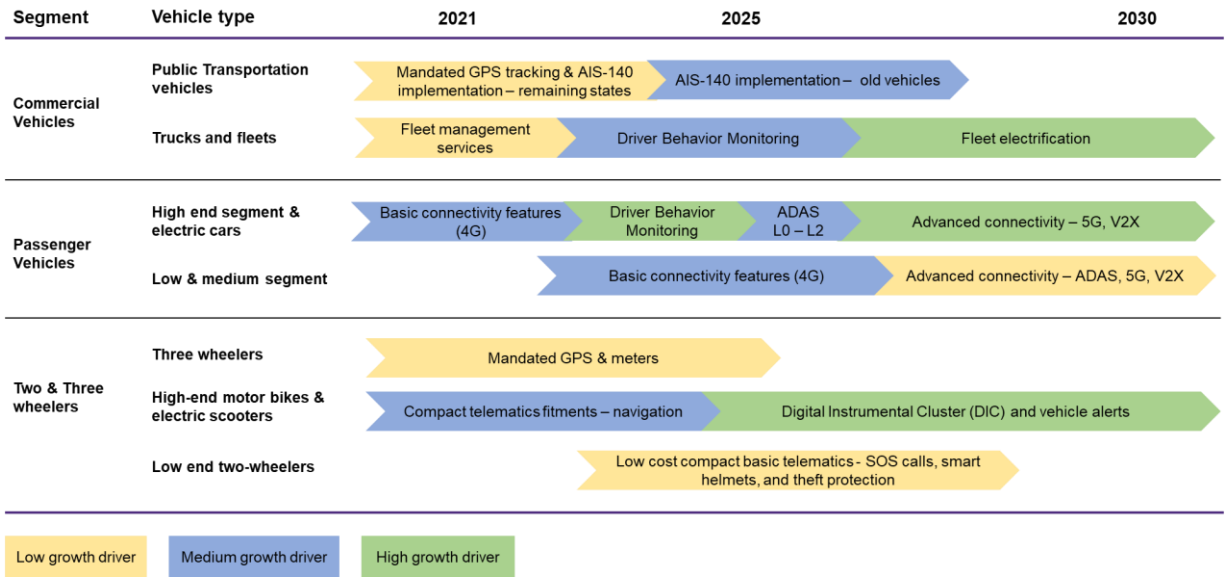


Figure 9 - Figure 3.2 – Future evolution of use cases in India[10]

Increased EV uptake: Indian EV market is evolving rapidly, with ~0.32 million vehicles sold in 2021, up 168% YoY, and a projected CAGR of 36% till 2030. While EV vehicles currently are fitted with telematics devices, there is limited mobilisation of the data and customer focused insights. The newly evolving use cases are expected to improve battery management, and provide charging information. Given the high interest and acceptance seen from young customers towards electric vehicles, this will drive greater telematics technology knowledge proliferation. NITI Aayog targets 80% EV penetration in the two-wheeler segment by 2030 which will be a huge driver for the growth of the two-wheeler segment with solutions such as Digital Instrumental Cluster (DIC) taking prominence.

Industry Speak

"Telematics will have a prominent place in the future trends of the passenger vehicle segment, including for electric vehicles, shared mobility services, and connected safety systems, because of its capabilities to provide nearby hazard information, enable e-commerce, improve cybersecurity, and implement software updates for new features."

– **Jaidev Venkataraman**, *Continental Automotive Components India Pvt Limited*

"The power of telematics is in connecting technology with real time scenarios. It mobilizes vehicle intelligence for fleets enabling them to address the new demands and trends of the freight and passenger transportation industries while still overcoming existing challenges."

- **V Ramanathan**, *ZF Group*

10 GT analysis - Primary interviews

"While productivity improvements have been able to draw in the attention of logistics players / fleet operators, now the focus should also be directed towards the safety benefits that can be derived from driver behavior monitoring and alerts to cut down road fatalities and efficiency losses. As the datasets increase, the utility of the data must be ensured to drive more direct benefits for customers in the CV/PV/2W segment to enable a higher ROI, while also mobilizing the data collected for route optimization, black spot detection, etc. to drive ecosystem benefits."

- **Dr. A K Prakash**, *Varroc Engineering Ltd*

With better data sharing and monetisation protocols expected to be in place in the future, this opens up the possibilities of more players being integrated in the telematics ecosystem.

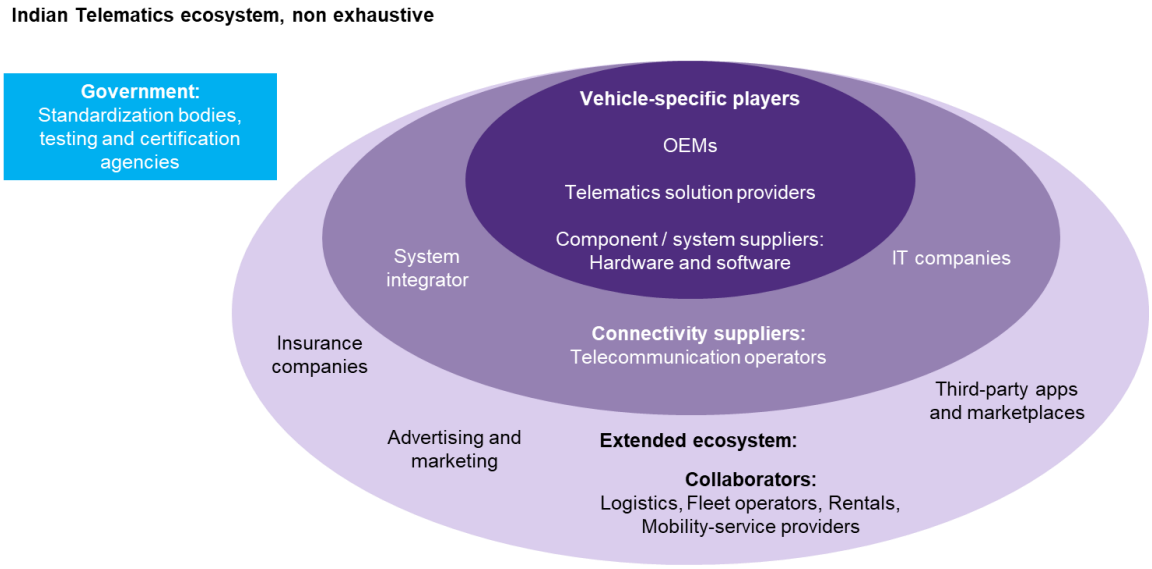


Figure 10 - Figure 3.3 - Extended telematics ecosystem considering future growth opportunities

3.1 Key growth factors in the market

1. Telematics in Insurance

Personal auto insurance carriers globally are rapidly approaching a moment of truth when it comes to usage-based insurance (UBI) programs, in which a driver's behaviour is monitored via a telematics device.

Generally, while most car insurers rely on data such as credit ratings, age, gender and type of vehicle to evaluate risks, they cannot accurately determine the driving behaviour, check vehicle dynamics, or prevent mishaps. Technologies such as telematics, on-board diagnostic (OBD) devices, and adaptive cruise control (ACC) fill this void by monitoring vehicles in real-time through the use of sensors. These sensors send signals about drivers and their surroundings, which can help car insurance companies assess risks better. For example, insurers can analyse real-time driving data to determine fair insurance rates, develop tailored products, personalise / incentivise road safety programs, and even provide driving assistance to prevent accidents.

In India, insurers have the opportunity to leapfrog to the latest cutting-edge technologies such as Telematics and adapt their policies for the Indian ecosystem. Drivers and passenger in India see about 12 percent of global road fatalities, and more than 80 percent of road accidents involve some aspect of driver error[ix].

2. GNSS Tolls

GNSS tolling is an efficient way to monitor movement of vehicles on highways, establish an electronic system for toll payments and aid in national road infrastructure. It requires wide-spread application of telematics for geofencing and GNSS/RFID based toll fee collection. In India, after Fastag's success and noted benefits, the Government is planning for GNSS-based tolls. This requires near to live data sharing with uniform network coverage of the Telecom operator whose connectivity is used in such devices. Considering practical situation of connectivity issue in remote areas across all operators, Indian standards such as AIS-140, IS-16833 and DoT's M2M Policies has already adopted e-SIMs with multi-profile configuration and auto switching to the available network amongst multiple operators. Such e-SIMs also has over the air subscription update facility to avoid telco locking and necessary flexibility in choosing appropriate networks based on demography of deployment. In addition to this, for this implementation to work, it will require maturity of location mapping and network service availability in the remote regions of the nation to ensure entry and exit points are closed and there are no long stretch of complete network non-availability. V2I (Vehicle to Infrastructure) can hugely improve the accuracy of toll collection and avoid false toll collection at entry and exit points, as the position of the vehicle is more precisely mapped by the infrastructure objects. The history of the path followed by vehicle up to configurable distance can also be done to avoid false toll collections from nearby roads or roads below elevated roads. Establishing this system would also provide scope of expansion to other V2I applications in improving road safety in the future.

Case: e-TOLL in Poland

To maintain modern transport infrastructure and its safety, the country of Poland has switched to a new toll collection system on sections of paid roads. Launched in June 2021, e-TOLL is an advanced solution developed, implemented, maintained, and monitored by the National Revenue Administration, with the toll collection functionality for vehicles driven on toll sections of roads in Poland. e-TOLL is replacing the earlier introduced system, and it is mandatory for all motor vehicles, buses and vehicle trains with the maximum allowed mass >3.5 tonnes. The newly introduced solution is based on satellite positioning technology. Based on this, drivers and fleet owners have a choice of different methods of transmission of location data to the mentioned system including On-Board Units – vehicle GNSS trackers. Overall, more than 1.3 million vehicles registered in Poland, mostly corporate fleets, fall into that category and all of them must be equipped respectively by authorised telematic service providers and integrators.

Other successful e-Toll programs include LKW-MAUT in Germany, Platon ETC (Electronic Toll Collection) in Russia, etc.

3. Route Risk assessments

Route risk assessments are a key aspect of on-road risk management that leverages existing telematics data to optimize future transport routes. It is part of new route planning requirements and involves physical risk assessment of the proposed routes. The assessment identifies high risk areas and ensures that appropriate route alterations can be made to minimize risks to as low as reasonably practicable to ultimately ensure driver, passenger and cargo safety. The route risk assessments further identify safe stop areas, road and weather conditions and applicable safety precautions.

In India, this might prove to be a major growth driver for commercial vehicle telematics and for electric vehicles but is contingent on mobilising existing vehicle data to parties such as OEMs, emerging logistics and EV solution providers in this space.

4. POI – Point of interest

A POI (point of interest) can be anything like office locations, GNSS coordinates of specific work, fuel stations, home. These POIs are used to understand the driver and specific physical locations that they may find interesting. Restaurants, retail stores, and grocery stores are all examples of points of interest. There is major data monetization opportunity of these POI databases - POI data API's name their products 'Places Data APIs'.

Case in US: Retailers and retail analytics firms use POI databases to get lists of where stores are located. Along with store location info, they use metadata about a POI such as the category and foot traffic (visitor counts) to power site-selection and trade area analysis. AdTech companies create geofences around points of interest to

identify location-based audiences and carry out in-vehicle advertising. They also join the GNSS data with POI geofences for advertising measurement.

5. Telematics in Emergency services

The three primary emergency service functions provided by local state governments - police, fire and emergency medical services, have protecting the safety of people and property as their primary goal. Using telematics, these services can be better streamlined through greater visibility and optimization of the services provided and increases their preparedness for more future use cases.

AIS-140 standard was originally developed to create an emergency response system and has defined a dedicated IP only for emergency alerts. The standard was developed keeping in mind the heterogeneous emergency system adopted by various States including Dial 112. Dial 112 is now being implemented across states and AIS-140 devices can have seamless integration with the same. Currently in India, there have been isolated measures taken across few states in some services to bring about telematics integration which have proved to be successful.

The Rajasthan government issued an order in 2021 making it mandatory for all ambulances (including those over three years old) to have an AIS-140 compliant vehicle tracking system installed. This was a result of the issues noted during Covid-19 when there was no control on the movement and charges of the emergency medical vehicles. While the implementation was deterred by a lot of state-level issues, this move has helped to curb cases of overcharging, ambulance operators taking longer routes, ill-treatment of patients and other criminal activities. Similar benefits have been noted in telematics fitments in GVK EMRI, Indian Red cross, National Rural Health Mission, etc. While these measures have been a step in the right direction, there are much more larger advantages to gain from telematics integration in ambulances considering video transmission, V2X, etc.

Uttar Pradesh is home to the largest police force in the world, with over 232,000 police officers, looking after a population of 200 million peoplex. Owing to the increased need for faster response to distress calls, UP launched the first high-tech police response system in India – UP100, a state-level contact centre made for receiving distress calls. The dispatch is powered by telematics solutions like real-time tracking and geofencing to optimize routes and where the vehicles and officers are stationed. By positioning them strategically based on distance, route and area coverage, the possible response time was dramatically lowered to under 20 minutes in rural areas, and under 15 minutes in urban centres.

Police forces in UK and US have been using fleet management services in their CAD (Computer aided dispatch) to monitor their police vehicles, officer shift changes, officer driving behaviour, etc. The potential for video telematics technology in ambulances also looks promising for additional support in emergency first response and protection against liability issues, as noted in the UK. V2X has the possibility to mitigate the traffic congestions for emergency vehicles and have a smarter traffic management system to optimize the existing infrastructure to make the lifesaving emergency services more effective.

3.2 Monetization opportunity including 3rd parties

The aforementioned drivers present the following monetisation opportunities in the future:

1. Telematics in Insurance:

With the availability of technology-based driver and vehicle insights, there is an ability to provide customized solutions to the consumers. Some of the available options are

PAYD (Pay as you drive) - In this particular UBI variation, the insurance coverage provided to the driver fully depends on the actual distance that is travelled by the vehicle. The data is gathered from the reading of the odometer of the vehicle.

PHYD (Pay how you drive) - In this type of UBI scheme, the insurance coverage is decided on the basis of the mileage that is collected from the GNSS data or the overall time that the car has taken to travel the particular distance. Using a vehicle-independent module transmitting data via RF technology or cell phone the total number of minutes is calculated.

PAYG (Pay as you go) - This UBI variation offers an insurance coverage after considering several data points like the time of the day, driving actions, the time taken to cover the distance, and the historic risk factor of the road etc.

Developing a pricing model for PAYD, PHYD and PAYG for the Indian market will need enormous telematics data to be generated and analysed for building the necessary algorithms. In this regard, the insurance industry would need to have free access to the data generated by multiple sources in the long-term interest of better terms for consumers.

2. Telematics in advertising and marketing – POI and Geofencing:

With POI data, marketers can easily target customers with great accuracy. POI data provides audience intelligence for advertising which reveals insights about customer preferences. It allows advertisers to plan a strategy targeting their customers at the right time and place with relevant advertisements. It is helpful in strategizing how to place ads such as billboards so that they reach a specific audience in areas where these people spend most time.

Geofences can be set up around very large areas such as shopping malls, universities, and airports which will notify when a target customer enters that zone/area in real-time. It also targets certain users based on their previous behaviour (online and offline) towards brands they have shown interest in.

3.3 Telematics as an enabler for electrification

Telematics plays an important part in many levels for an electric vehicle and acts as an enabler for electrification. EVs require telematics for improving the driver experience and ease of ride and for communicating critical and useful information to the user. The applications and benefits derived from telematics in EVs are as follows:

1. **Driving experience:** In EVs, it is very important for the driver to know the range of the vehicle, know their next charging station, and plan their trip accordingly. The telematics unit can determine the location of the vehicle and, through mapping and information on the range and available charging infrastructure, can help pre-book the charging spot at a location to save time. Many startups in India are developing nationwide charging station infrastructure mapping so EV users can get the ease of battery charge.
2. **Charging analytics and EV energy usage:** Telematics can help monitor the charge level and battery health and provide valuable data required to improve the vehicle algorithms. Continuous updates and advancements on charging time, battery size, and weight are being taken up by EV manufacturers. The real-time data provides the manufacturers with a rich data source for their development and analytics. Such analytics can also help notify about the battery status of the vehicle. Telematics in the future will provide communication between the power grid and Vehicle (V2G - vehicle to grid communication), so users have access to the peak load hours, and they can utilize the grid power according to the peak charges schedule to reduce charging cost.
3. **Fleet management and route mapping:** A lot of last-mile delivery trucks globally are now powered through batteries. Field-service managers can work through an effective route management, benchmark vehicle utilization, monitor charge reporting, and measure whether their plans are effective in reducing costs and emissions. Knowing the current available battery range of a vehicle is beneficial in managing real world conditions since the energy usage of the vehicle will depend on factors such as weather conditions, time of day (use of heating/cooling, lighting, wipers), number of hills to climb, traffic etc. Some of the fleet vehicles are likely to experience less capacity depreciation than others if they are being used on routes with lower energy uses and/or charged more conservatively.
4. **Alerts and notifications:** The telematics units can determine the state of charge of the battery and alert the driver through an SMS on the need to find a charging spot immediately. Alerts such as an issue with the battery can be provided in real time to the driver to avoid troublesome situations on the road.
5. **Firmware updates**: With continuous advancements on the charging algorithms and software of an EV, the telematics unit can also act as a bridge for firmware updates of the ECU and electronics within an EV. The telematics unit with LTE connectivity can be connected to a server for updates and an OTA (over the air) update mechanism.

Industry Speak

While AIS-140 has fuelled the much-awaited growth of Indian Telematics industry with one national standard and interoperable framework, the next large pull from the market will be emerging from the demand of EV segment. Unlike ICE vehicles where Telematics predominantly was a value added feature, for Electric Vehicles, Telematics integrated with BMS will be a necessity. With aggressive plan of EV conversion and necessary subsidy from the Government, the EV volume on road and built-in telematics products and solutions are going to be the next Telematics growth driver in India.

- **Karn Nagpal**, *Rosmerta Technologies Limited*

4 Regulatory scenario and cybersecurity

4.1 Current status and challenges for implementation of telematics regulations

4.1.1 Prevailing standards for vehicle tracking in India - AIS-140 / IS 16833

AIS - 140

The Automotive Industry Standard 140 commonly known as AIS 140, is a standard published by the Automotive Research Association of India (ARAI) for all public transportation systems to build an Intelligent Transportation System (ITS) in India. This mandatory move came about when the Government realized the dire need of increasing passenger safety in 2012. Under the ITS, traffic management and mitigation, public transport management, crisis management are taken care of. It is a globally proven system that allows the transport authority to gain visibility of the entire transportation movement in the country.

According to the Automotive Industry Standard 140 (AIS 140), mandated by Morth GSR No. 1095(E) dated 28.11.2016, it is mandatory for all public transport and commercial vehicles to deploy vehicle tracking systems with emergency buttons. This will help the department in tracking the vehicle in case of any emergency and enable the passengers to apprise the control room of any kind of mishap or other emergencies. All public service vehicles, whether run by the government or private entities, will have to comply with AIS-140. This includes Intra and Inter City Public Transport Vehicles, School Buses, Employee Transportation Buses/Cabs, etc. The transport authorities are tasked with ensuring that all stipulated vehicles abide by the guidelines laid down by the standard.

CMVR (Central Motor Vehicle Rules, 1989) 125 H mandated the fitment of AIS 140 compliant VLTD (Vehicle Location Tracking Devices) in all Passenger Service vehicles on 1st April 2018. Looking at the benefits and potential for other use cases, the same had been extended to Goods Vehicles as well (GSR 1081(E), 2.11.2018). MoRTH has further included Vehicle carrying dangerous goods vide GSR No. 617(E) dated 03.08.2022 - “every vehicle of categories N2 and N3, manufactured on and after the 1st Day of September, 2022, in the case of new models, and 1st day of January, 2023, in the case of existing models, carrying dangerous or hazardous goods, shall be fitted with a vehicle tracking system device as per AIS 140.”

While the initial implementation plan mandated fitments in all existing and new vehicles from 1st April 2018, it was then deferred. MORTH SO 5454(E) dated 25.10.2018 made VLTD fitment mandatory for vehicles registered from 1st January 2019. It also mentioned that the state was to notify implementation date for old vehicles (vehicles registered prior to 31st December 2018)

The intended benefits from the standard are as follows:

1. **To ensure passenger safety:** Ensuring passenger safety is one of the prime motivating factors for the government to start implementing safety measures in public transport vehicles. Both the panic button and GNSS tracking features have proven to be crucial in quickly locating criminal incidents and help law-enforcement officials to respond faster.
2. **To optimize public transport vehicles:** AIS-140 brings in real-time location tracking and hence optimises public transport operations. Route optimisation, traffic regulation, and ensuring that vehicles run on time are the first set of benefits. There is also the possibility of building atop these benefits, and creating services that help people stay updated on traffic movements and arrival and departure times.
3. **To monitor driver behaviour:** AIS-140 compliant device fitments make it possible to know if a particular vehicle, or its driver, is adhering to traffic norms. Behaviour like over speeding, engine idling, drunk or rash driving can all be tracked, and help in curbing road accidents.

4. **To improve vehicle performance:** The regulation also includes provisions for monitoring vehicle performance metrics. Data pertaining to speed, fuel usage, engine performance, air pressure etc, is all collected, and can be shared with the driver and public fleet operators. This can help ensure timely repairs and servicing, and reduce off-route time for vehicles.

   The standard details many mandatory **specifications** for a device to be AIS-140 certified such as:

   a. Obtaining real-time location information using Global Navigation Satellite System (GNSS)

   b. Requirements for interfacing with external systems, internal battery, etc.

   c. Transmission of PVT (position, velocity and time) to back-end control room

   d. Configuration of IP address(s) for emergency events and for data sharing

   e. Device to backend communication mechanism enabled by embedded SIM (e-SIM), multi-slot GPRS, A-GNSS

   f. 'Over the Air' (OTA) firmware and configuration updates

   g. Unique IMEI number

   h. Other operational specifications

Emergency Button in an AIS-140 compliant device is 'Normally Closed' (NC) type. The form factor of Emergency Buttons in the standard calls for the button is easy to press in case of an emergency, while also minimizing the possibility of accidental or unintended press thereby causing a false alert. On pressing of Emergency button, the system implementing VLT function sends the emergency Alert to the Backend Control Server (Government authorized server) as per the Communication Protocols mentioned. The devices transmit data to the Backend Control Centre using 2G/3G/4G wireless connectivity via GPRS (with SMS fall back).

Device health monitoring: AIS-140 devices send status of health parameters at configurable intervals and this threshold value is also configurable over the air. Device health parameters such as internal battery percentage, low battery threshold value, flash memory percentage used, data update rates when ignition off and ignition on, digital I/o status and analog input-output status can be fetched on demand via command.

The functionality thresholds of the entire device, data message formats, inbuilt vehicle alerts & messages, and commands for OTA configuration are also mentioned.

The standard details out 4 areas of testing with 30+ different types of tests to be carried out in total:

- Functional (10)
- Performance and durability (12)
- Environmental (7)
- Protocol Tests (Field description, device memory, messages & alerts)

There are multiple direct stakeholders who influence the implementation of AIS – 140 like Central Government bodies such as MoRTH, BIS, Telecom and IT ministries, State Government transport departments (and their functionaries), State RTOs, State-wise backend implementation agencies, Device testing & approval agencies such as ARAI, ICAT, etc., Vehicle OEMs, Device OEMs - AIS 140 device manufacturers, Telecom service providers, and Vehicle owner (buyer of device). Thus, there is a need for coordination between the above for successful implementation of the project on the intended scale and to derive the results outlined in the objective.

IS 16833

IS 16833 is the BIS standard that expands the scope of AIS-140 to include other configurations/applications of automotive tracking device (ATD) systems. At the time of drafting AIS-140, both BIS and AIS had panels that were formulating standards on ITS. AIS-140 was initially mandated for faster implementation and adoption, and experts in BIS panel had co-opted to work in the AIS panel to make it as robust as possible. The vision was on successful implementation of AIS-140 and elimination of all implementation problems in this emerging technology, the BIS standard can be improved with further inclusions, if any, resulting from consultations with the wider stakeholder community.

The purpose of this Indian standard is to define the basic architecture and performance requirements of the automotive tracking systems. It majorly has 4 coverages.

1. **ATD with integrated emergency system**: Similar to AIS-140
2. **ATD with an integrated emergency system and Fare Meter:** ATD System shall be integrated with fare meter complying with IS 2747 (Taximeters – Performance Requirements) in cab as well as in auto rickshaw. The system will have a printer displaying details such as vehicle number, start time, end time, trip details, trip distance, waiting time, and night time flag/charge on the printed receipt, an LCD display, and buttons or mechanisms with trip start, trip end, waiting (visual display), emergency button to trigger the alert message, and print button to get the bill printed.
3. **ATD with CCTV system with an integrated emergency system for buses:** For buses that are already fitted with GNSS devices with emergency alerts, the on-board CCTV System will comprise various devices such as video recorder without an integrated vehicle tracking module, CCTV cameras and emergency buttons. This expands on the previous scope to include video in the emergency alerts. In case of press of any Emergency button, the video recorder (mDVR or mNVR) will get the input regarding the alert. The video recorder will start sending the video and audio to the backend at a specified frequency and resolution
4. **ATD with CCTV system with an in-built tracking system and integrated emergency system for buses:** This section specified additional specifications for tracking functionality in the mDVR or mNVR in the case of a CCTV system with in-built tracking.

The Draft notification of MoRTH Vide GSR 106(E) dated 11.02.2022 has been published to adopt IS – 16833 to supersede AIS-140. When the migration from AIS-140 to IS 16833 happens, there will be no additional testing or changes that need to be made to current AIS-140 certified devices and manufacturers. The industry stakeholders have been involved in the process of discussing amendments, and upgradation from AIS-140 to IS 16833 to be carried out by means of a formal request to the government agency (draft notification of MoRTH GSR 106(E) dated 11.02.2022).

Gaps in prevailing standards - AIS-140 / IS 16833:

Limited implementation despite deferrals and extension of deadlines: The necessary funding scheme to the States / UTs for implementation were announced by MoRTH in January 2020 and close to 30 State / UTs have taken funds for implementation. MoRTH further issued detailed operating process (SOP) in February 2021 and also published technical standard and the state-wise backend implementation guidelines as model RPF in June 2021. However, very few States have started implementation on ground. Post COVID-19 related delays, though MoRTH has been reviewing the implementation with the States, as per industry inputs, only 6 states have initiated AIS-140 implementation on ground. While Uttarakhand has initiated implementation on old vehicles, Delhi, Himachal Pradesh, Jammu & Kashmir, Chhattisgarh earlier initiated implementation on new vehicles in pre-pandemic time but are yet to notify the date for implementation for existing vehicles. Maharashtra has notified all RTOs to check VLT Device fitment before new vehicle registration but are yet to come up with any uniform State Software and necessary checks and balances as defined in MoRTH SOP, resulting in mass unchecked fitment on ground. Kerala had implemented the project completely deviating from AIS-140 standard and guidelines resulting in major customization of VLT Devices and making them non-compliant to AIS-140 national standard. The implementation done in certain cases has been erratic in terms of activation and does not cover all the applicable vehicle categories such as passenger service cabs, maxi cabs, buses and goods vehicles. Multiple states have initiated documentation for implementation, yet on-ground implementation is pending. This status is despite fund allocation under the Nirbhaya Fund to states to cover the state backend software, server & control centre costs implementation on ground is yet to take place across the country. Such delays, partial implementation or even worse non-compliant implementation (Kerala by C-DAC) will defeat the major objective of the standard which was passenger safety.

State-wise specifications impacting uniform implementation: As part of AIS-140 implementation across the States and Union Territories, the mandate allows for some additional parameters to be added by respective state/UT's for their additional requirement. However, Kerala has adopted a complete deviation from AIS-140 framework. This has proven to be an issue for OEMs/ national telematics solution providers who need to put in a

larger investment to cater to their clients. While addition of extra parameters has been allowed in the standard by adding additional fields after the AIS-140 protocol, complete deviation of protocol is a major issue. If the individual State/Union Territory starts adopting such customization beyond AIS-140 framework, it will lead to repetitive device level changes even after AIS-140 approval has been obtained from designated testing agencies. It also leads to duplication of the efforts, higher approval costs without any value additions.

The State/Union Territory empanelment requirements also includes a state level empanelment, infrastructure requirements in the State to have service / retro fitment centres in the State/Union Territory and commercials such as Bank Guarantee / Performance Guarantee / other fees. While accountability of VLT Device suppliers are required, these requirements are not always logical and varies extensively from State to State/Union Territory.

While MoRTH SOP clearly defines fitment and activation of VLT Devices only by vehicle manufacturers or their authorized agencies for new vehicles being registered w,e,f 1st January 2019, many State Transport Departments are issuing empanelment requirements without considering this mandated requirement leading to non-standardized implementation and defeating the very purpose as envisaged by MoRTH.

The non-compliance of the common protocol followed by State for backend implementation is leading to device manufacturers having to maintain multiple firmware for the different implementing states, which has proven to be technologically complex and, given the scale, will hamper speed of implementation. As noted in the case of C-DAC software in Kerala, the implementation of customized firmware and protocol which is not in accordance with AIS-140 standard had led to telematics device manufacturers having to make major firmware changes to the devices to make it compatible to C-DAC software.

Low compliance with quality standards: There are some devices (mainly noted in the aftermarket) that have complied with the standard's requirements at the time of type approval during testing and certification, but the fitments on ground are of substandard quality and security, with low device uptime. Since random data sampling is not done, the annual checks that take place do not detect different kinds of defective performance such as

- e-Sim validity requirements – 2 years for new vehicles & 1 year for old vehicles,
- Low quality critical components – potential fire hazard from wiring harnesses that are non-complaint with IS 2465,
- Temporary compliance-driven fitments, including giving device on hire for vehicle registration
- Supplying deviated or compromised or even altogether different device than what was type approved.

While such problem has been successfully avoided for new vehicles wherein responsibility of VLT Device fitment and activation in VAHAN has been given to Vehicle OEMs, the system checks in VAHAN to stop activation of devices by Non-OEM players in new vehicles are yet to be put in place in VAHAN VLTD Maker. But for existing vehicles such problems due to compromised quality would lead to a major implementation flaw. ACMA has earlier represented to Ministry to allow Vehicle OEM or their approved device fitment for existing vehicles too, which would ensure no compromise in on-ground quality.

Non-uniform implementation of coal and other mining vehicle tracking systems: Government of India vide notification No. S.O. 2817(E) dated 22.11.2010 constituted Justice M. B. Shah Commission of Inquiry to look into large scale illegal mining in the country and as per the recommendation of Honorable Justice M.B. Shah Commission, *vehicle tracking has been mandated for all the vehicles engaged in the coal and other mineral ore transportation.* Since then state government mining departments and PSUs under Coal Ministry have been in the process of implementation of vehicle tracking system. Some states like Andhra Pradesh, Odisha, Jammu & Kashmir, Jharkhand have adopted AIS-140 standard, but few States / PSUs are coming up with different technologies in isolation as per their available knowledge source for technology selection. Adopting a separate specification by various Government departments would eventually lead to the vehicle owners being over burdened with fitment of multiple devices for complying to multiple state department norms. Vehicle Tracking implementation by various Central and State Govt bodies can follow AIS-140 standard instead of publishing non-standard VTS devices for their respective requirement. Same applies to other departments like Public Distribution System (PDS), National Rural Health Mission, etc.

Industry Speak

"Going forward, all the industry stakeholders are looking optimistically for the country to transition from the current regime of 'Regulate and Enforce' model for arresting alarming road deaths on Indian roads to an 'Assist and Alert' way of working, as with poor enforcement, current regime is proving to be ineffective. 'Assist and Alert' regime will need public and private investments in Telematics solutions to drive the genuine ADAS market, both in OEM and Aftermarket ecosystem. With recent announcement of "Pay as you drive and Pay how you drive" for offering innovative insurance products, market for telematics will see further potential with many solutions for analyzing driver behavior of road users and save lives on Indian roads"

– **Rama Shankar Pandey**, *Hella India Lighting*

"The successful implementation of AIS-140 in a highly regulation driven market like India would be a strong supporting case for the adoption of telematics in all vehicle segments. Understanding and mitigating all the gaps would set the precedent for clearly outlining enforcement responsibilities for future mandates such as IS 16833."

– **Kartikeya Joshi,** *Uno Minda Group*

4.1.2 Operational gaps in effective rollout of standards for non-automotive stakeholders

a. Telecommunication providers / M2M SP:

The requirements placed on Indian telecommunications systems are to develop a modern infrastructure to support the growth of telematics, availability of a range of services to support integration with technologies that require a higher bandwidth, and continual investment in the infrastructure to improve network coverage across the nation.

Scope of current provisions: AIS-140 has instructed for provisions of e-SIM / e-UICC (SIMs that can latch to 2 networks alternatively basis the network availability & strength) as per GSMA / DoT (TEC) Guidelines. Automatic switching between multiple profiles on e-SIMs for a higher QoS was the solution to tackle with the network coverage issue faced by device manufacturers and users. The device module has both GSM and GPRS, which work together since GSM is still integrated for accessing services when the network connectivity is low and is shifted to when GPRS is unable to acc ess the internet.

Gaps:

- The current mandate has specifications for the multi-network e-SIM and SMS fallback in case of unavailability of GPRS. This has increased the possibilities of getting near live data from vehicles wherever any kind of network is available. However, the network coverage, even for 2G, is sparse in many areas particularly on National and State Highways / Roads. No network availability is leading to latency of the telematics data collected in Devices.
- GSM strength is a parameter that is considered for enquiry at the backend, as per MoRTH guidelines, this parameter if closely monitored would provide details of network black zones and such inputs can be taken up with DoT for resolution to avoid prolonged unavailability of network and avoid latency of device sending data to servers.

Shift to 4G / 5G: Though newer modules with both GSM and GPRS versions have been developed with 4G/5G, the fact still remains that many areas in India still operate on 2G cellular networks. A large majority (>90%) of telematics devices in India currently operate on 2G. This could hamper growth of telematics devices with advanced integrated technologies, that require audio/video sharing or generate large amounts of telematics data, that require higher bandwidths for smooth and efficient functioning. The shift from 2G to 4G/5G though imminent will still take a few years to materialize, considering only a few telematics service providers have adopted the same, and while this may pose separate challenges for device manufacturers and OEMs in upgradation of telematics units, it also calls for better integration of telecommunication operators with the telematics ecosystem.

b. Component manufacturers:

Scope of current provisions: Testing and certification in India happens only at the device level, with more than 25 tests being carried out under various functional parameters. There are no tests that are carried out at component level – components are tested and certified at source and this is to be presented at the time of device certification. There are no specific Indian standards in place for components such as security modules, GNSS unit, engine interface, external interface unlike US or EU, since most automotive grade hardware components used in telematics are imported and comply with global standards such as IEEE.

Gaps: Lack of manufacturing infrastructure

India has developed vast expertise in chip designing and in delivering technical services around microchip design but has high dependency on countries like China and Taiwan for import of components required in chip manufacturing and even for fabrication of the designed chips due to lack of required manufacturing facilities. Chip design and manufacturing is a highly capital-intensive business and calls for a developed ecosystem for the business to thrive and achieve commercially viable scale in India. Else, without justified costs and volumes, companies will have no choice but to source components from abroad. There is a need for huge enablement to take place for this sector to startup in India with access to capital, favourable policies and investment on the ecosystem from design to application engineering. The Government has accepted the expensive truth of the industry, as evident from its recent thrust to incentivise and make capital available for setting up chips and semiconductor manufacturing plants and also for capacity enhancement of the existing ones. Notable initiatives undertaken by the Indian government for the development of the semiconductor industry include the enhancement of allocations of Modified Special Incentive Package Scheme (M-SIPS) and the Electronic Department Fund (EDF), apart from the two infrastructure support schemes spearheaded by MeitY.

The recent semiconductors and chips shortage crisis largely rerouted the supply away from the automotive sector due to the increase in demand for personal computers, tablets, and smartphones. The long-standing practice of automotive OEMs to engage in Just-In-Time (JIT) to keep costs low have contributed to the imbalance in the chips supply to OEMs across several auto components and technology segments. Automakers have begun to do-away with some features and electronic capabilities to manage the chip shortages they face today, which poses a huge threat to the advancement of telematics in passenger vehicles.

Industry Speak

"The crux of telematics remains in the effective communication of the data collected to the concerned users such as the Government backends, OEMs, etc. Shortcomings in the implementation of telecommunication standards in the case of e-SIMs/e-UICCs and the subsequent gaps in data sharing that happens between the different operators and aggregators remains relevant in its application in telematics devices as well."

– **Hitesh Ahuja**, *Nippon Audiotronix Pvt.*

"Indian telematics device manufacturers have strong design, software & manufacturing capabilities; however, basic electronic components and modules are still imported, as its manufacturing needs economies of scale. With overall growth of the market, especially from the demand side and Govt.'s initiative to push domestic electronic component manufacturing through various initiatives including PLI, complete value chain of telematics could be a very lucrative area for in-house domestic manufacturing."

– **Rama Shankar Pandey**, *Hella India Lighting*

4.1.3 Micro and macro details including subcomponents level information, backend requirement, hardware & software requirements

1. **Subcomponent level information:** The current standards' coverage with respect to subcomponents has been limited to the device functionality. Clear upper and lower limits for the specific parts / modules and their outputs have been mentioned as requirements for device certification.
2. **Backend requirement:** The requirement for the **state backend system** has been detailed in terms of the approved implementation agencies' scope of work and functional, technical and operational requirements. This provides for applications such as System Administration Requirement, User Management, Access Control & Identity Management, Vehicle Location Tracking (VLT) Software, Secure Communication and Device Management, Graphical User Interface (GUI) Requirement, Route, Geo-fence & MIS, Geographic Information System (GIS) Map which includes real-time plotting and tracking, points of interest (POI), map based tools, track & trip view, etc., Health Monitoring of VLT device and Emergency buttons, and Alert Management. It also specifies norms for data exchange/sharing with external system, data sharing with MoRTH, reports and dashboard requirement, data archival. Testing, audit and certification norms include functional testing, reliability testing, usability testing, performance and load testing and security testing. As defined in MoRTH Funding scheme (January 2020) and MoRTH SOP (February 2021), testing of AIS-140 standard compliance is defined under the scope of testing agencies referred to in Rule 126 of the Central Motor Vehicles Rules, 1989. Additionally, the security testing is to be performed by CERT-IN agencies. While it has been observed that some backend software companies / organizations are referring to old documents and trying to bypass these testing requirements by just doing STQC testing. Further there are instances that some prototype software is being certified with testing agencies but on-ground implementation is with different software. It is required that like VLT Device post type approval the conformity of Production (COP) is also done by the testing agencies, the software which is deployed for the State is tested for compliance post deployment in production environment. As per Industry feedback, this is already being planned in next amendment in IS 16833.

   VLTD manufacturers backend system was allowed while making the fitment in new vehicle mandatory from 1st January 2019, as during that time there was no State backend options or National Common Layer that was available. As an interim measure, using VLT device manufacturers backend systems was allowed with due certification from the testing agencies as per rule 126 of the CMVR. However, with MoRTH funding to

State in January, 2020 for establishing their unified software, such provision of VLTD manufacturers backend is no more required.

3. **Hardware and software requirements:** The hardware requirements have been specified for the devices under the scope of AIS-140 / IS 16833. This includes the different hardware components for ITS (AIS) and ATD (BIS). With respect to software, the coverage of both AIS-140 and IS 16833 is currently limited to mandatory provisions for OTA updates. The update shall be allowed only over an 'authenticated' channel and calls for setting / change of the Primary or Secondary IP and port number, the APN, Emergency control SMS Centre Number(s), set configuration parameters such as sleep time, overspeed limit, harsh braking, harsh acceleration, rash turning threshold limits etc., configuring the vehicle registration number, the frequency of data transmission in normal / Ignition state / OFF state sleep mode/ Emergency state, etc., the time duration for Emergency state, capability to reset the device, and command to get the IMEI of the device. Configurable commands involve the following features - SET: For setting the parameters, GET: For enquiring regarding the parameters such as mobile number, GSM strength, vehicle number and other important parameters and CLR: For clearing certain commands, alarms, alerts, etc.

Challenges:

Subcomponents are to comply with international standards such as IEEE 802.11p while testing or certification at source / country of origin. There are no specific standards in India for the same because of the limited in-house manufacturing of telematic components. This poses risks in terms of device functional safety and cybersecurity, if the devices do not comply with the standards.

It is observed that "Type approval" taken from testing agencies for backend infrastructure by testing a sample prototype solution, nowhere ensures that the same tested software is deployed by them in the State. (E.g. CDAC in Kerala) The problem in backend software is similar to the problem of taking "Type Approval" for a device and supplying different devices in the State by the device manufacturers.

VLTD manufacturer's individual backend allowed initially by some States like Himachal Pradesh had resulted in unintegrated implementation. Any backend software other than monitoring, also ensures check on devices compliance. Hence VLT Device manufacturer's backend not only results in multiple monitoring software with in a State but it also defeats the purpose of device compliance check. Since MoRTH has now released funding to the States and also released necessary guidelines and model specifications and since BSNL National Common Layer single platform solution is also available, this provision of multiple VLTD manufacturers multiple backend for a single State need to be withdrawn.

4.1.4 Ecosystem development for new business models including hardware / software integration, value added services, etc.

Hardware / software integration using telematics has been a major boost in OEM adoption of telematics. The shift from BSIV to BSVI vehicle emission norms was an instance where the key use case of telematics in future integration was highlighted. From a regulatory standpoint, there is minimal action in terms of norms for hardware / software integration in new telematics devices. This has been left to the OEMs and telematics solution providers to adopt global benchmarks and industry best practices.

The ecosystem development for new business models is largely dependent on the data sharing norms that need to reviewed and standardized. The coverages need to be comprehensive in terms of ownership, data sharing and portability, and personal data privacy to enable mitigation of risks and success of such arising new business models. Unless there is a structure in place for the existing ecosystem players, it will be difficult to integrate other stakeholders like insurance companies, advertising agencies, etc.

Integration of hardware/software and establishment of data sharing norms will enable and accelerate the following business models:

1. **GNSS Tolls:** The FASTag method of collecting toll is proposed to be replaced by a GNSS based toll collection method. Here, vehicles would be fit with GNSS based FASTags and the money would be collected using

GNSS imaging. It is proposed that the entire National Highway network would be geofenced so as to record the entry and exit of vehicles. This would ensure visibility and digitisation of the entire national / state highway toll collection / payments and remove some of the gaps in the current FASTag method. It is also beneficial for public / private fleet operators since vehicles will pay for the exact distance they have covered.

2. **GST, e-way bills –** The finance ministry had introduced e-way bills to prevent the issues faced due to fake invoicing. The integration of VLTD data to verify the declared movement in this regard can support as an additional check. This would directly benefit the government in its endeavor to digitize and validate GST invoices to actual movement of goods.

3. **Telematics in Insurance:** The IRDAI has proposed the adoption of Telematics in motor insurance. This would enable the tracking of driver behaviour and habits, to determine the risk profile of the consumer. With the introduction of this, insurance policies would no longer be based on model of the car, but it would be based on driving habits of the customer. By using telematics data, customer scoring logic would be built by individual insurance companies and insurer systems will be integrated with the data to fetch the score in real time basis.

4. **V2X:** Vehicle to everything (V2X) can have major applicability in the future once current measures are successfully implemented. While these systems can be established without dependencies on the advanced telecommunication network or infrastructure needs, when all public and commercial transports are brought under the ITS/ATD systems or GNSS tolling is implemented, India will have a completely interconnected network of transport services. V2X implementation would lead to the creation of a smart mobility framework, making public transport intelligent, convenient, and stress-free. Vehicle to Infrastructure communications can be set in place to further optimise road safety and maximize the usage of existing infrastructure with smart traffic lights for recording and collection of fines for breaking road rules, etc.

4.2 Role of cyber security and key aspects to eliminate risk, laws applicable for data security

Today, many connected and automated vehicles are being developed in India and telematics features involving information sharing is increasingly being used for additional vehicle maintenance and safety features. This has also increased the risk of cyberattack on vehicles by hackers and thus leads to challenges in vehicle cybersecurity. Given that the Indian telematics ecosystem is at a nascent stage, some of the potential cybersecurity risks that we envisage are based on incidents and safety measures observed in developed markets.

1. **Vehicle thefts:** Cyber criminals have already succeeded at intercepting keyless entry commands in parking lots and even home garages, allowing them to simply drive off with the car whenever they would like. This technique could potentially be applied on a much larger scale considering the fact that many cars today are equipped with expansive remote command features that are processed through a cloud-based application. Using those commands to execute commands like unlocking the car or pressing the ignition does not even require proximity to the vehicle. As such, a hacker could potentially send remote unlock commands to an entire fleet of cars at once and drive away with them

2. **Consumer data breaches:** Cars have become the centres of consumers' connected lives, controlling volumes of valuable sensitive data and personal information (PI)- a person's location, credit card information, e-mails and phone calls, travel history, and much more. Cyber criminals have invented ways to remotely wiretap into vehicles through on-board assistance features as well as capture information from the broadcast signals cars send out. Another consideration is the overall damage that could be done if a hacker breaches the vehicle network of corporates, such as an enterprise's private security detail service for executive travel or a package delivery service, such as an armoured car fleet. With sensitive routing data and mapping data at their fingertips, hackers would have the opportunity to locate a car's valuables (both physical and digital).

3. **Physical safety:** Physical safety has been the hallmark of the automotive industry for years. Passengers feel safe because of all the technology built into the car. However, core aspects of the connected car ecosystem potentially create a tremendous amount of risk to drivers and passengers. Attackers can also target third parties and other intermediaries in the ecosystem to gain access to vehicle users' data and/or the car. And when you consider the interconnected nature of the automotive supply chain, the risk expands further. With many

manufacturers sharing common suppliers of hardware and software components and common clouds, a cyber breach to a key supplier of safety-critical parts, such as chip sets that control braking mechanisms, could easily ripple across the entire industry.

Hence cybersecurity becomes very crucial for the successful ecosystem development and for emerging business models to scale. In other developed markets advancements have happened because they have incorporated the following standards in their policies

Industry Speak

"Telematics can act as a gateway to many functionalities such as software updates, diagnostics and maintenance, ADAS, V2X, etc. only if tightly coupled with cybersecurity. With the increasingly interconnected nature of electrical / electronic (E/E) architecture in vehicles, all components and modules must be well engineered to resist cyber threats, else they may lead to the downfall of the entire system."

– **Kartikeya Joshi,** *Uno Minda Group*

Currently, **ISO 26262 "Road vehicles – Functional safety"** serves as the international standard for functional safety of electrical and/or electronic systems in production automobiles. This ISO standard is not focused on software development or detailing the cybersecurity infrastructure of car subsystems. It defines the baseline cybersecurity guidelines for the cars' development phase, ranging from the specifications, design, implementation, integration, verification, validation, and production release of car subsystems to fulfil safety level requirements. It does not have specific requirements for post-production, decommissioning phases, automotive cybersecurity, or dealing with specific cybersecurity incidents.

The newly introduced **ISO/SAE 21434 "Road vehicles – Cybersecurity engineering"** sets standards specific to items for identification such as the use of embedded controllers, the long lifecycle of vehicles, and the safety implications of these technologies in cars. Ultimately, OEMs are responsible for the homologation of their vehicles and demonstrating their adherence to regulations and mandatory legal requirements. However, since OEMs and telematics solution providers source a large share of their components from suppliers and semiconductor manufacturers, their upstream value chain partners will also be required to follow and implement state-of-the-art practices to mitigate cybersecurity risks and manufacture vehicles that are secure by design. While certain practices are already in place today, the upcoming ISO regulations calls for higher levels of enforcement, and potential liability implications will require a much more explicit agreement between parties along the automotive telematics value chain on what exactly is expected of each other.

Governing standards for cybersecurity are in the process of being finalized in India.

Their coverages are of 2 parts:

- Part 1 would cover qualification for a vehicle OEM basis the laid down norms for cybersecurity, implementing the same across the entire automotive value chain and certification of cybersecurity management systems / fail-secure systems
- Part 2 would be specific to the offerings of the vehicle and has additional considerations relating to the number of IoT features, etc.

4.3 Opportunities in telematics to enhance safety, security and how it integrates with future technology

Indian OEMs and telematics solution providers are looking at advanced technological applications such as ADAS and V2X to be implemented aggressively and be incumbent parts of high-end segment vehicles by 2030. These technologies will have a huge impact on road safety, traffic management and smart city development. They pose opportunities to optimize emergency services and save lives, reduce congestion on roads and generate revenue, provide road safety to commuters, monitor and regulate driving behaviour, and manage traffic by optimizing routes.

ADAS (Automated driving assistance systems) has multiple safety systems aimed at increasing car and road safety. Basis the driving culture, road traffic sense in India, suppliers must work on dedicated ADAS for Indian Automotive market. Government has de-licenced use of devices or wireless microphones in the frequency bands of 36-38 MHz, 433-434.79 MHz, 302-351 kHz and 76-77 GHz. De-licensing of these low frequency bands has enabled the vehicle manufacturers to use this frequency through radar-based system and focus on selective ADAS features development. ADAS is defined by one of the six feature levels: L0-L5.

L0: Basic - Includes front and rear collision warning indicators, blind spot detectors, and lane departure warnings.

L1: Driver assistance - Includes automatic emergency braking, adaptive cruise control, lane keep assist, distance control, automatic speed limiting, interaction assistance, and collision avoidance.

L2: Partial automation - Includes adaptive cruise control with lane keep assist in parallel, advanced cruise control, automatic emergency steering and braking, and fully automatic parking assist.

L3: Conditional automation - Highway piloting with automatic lane changes, full environmental monitoring, remote parking, and no human interaction from exit to exit.

L4: High automation - Fully automated driving in some situations without need for humans as fall back (aka "chauffeur mode"). This isn't currently offered or announced in a production vehicle.

L5: Full automation - A fully autonomous, self-driving vehicle with no need for a human driver. Currently unavailable and not expected until 2030 or 2035 at the earliest.

Basis global implementation plans and projections, most global markets are targeting highest penetration of L1 features in new cars by 2025, with US at 50%, Europe at 46% and China at 30%xi. Due to stricter regulations and effective rollout of implementation plans, Europe is expected to have almost 100% penetration of ADAS in new vehicles by 2025 (L1: 46%, L2: 39%, L3: 14%). In line with these, it is expected that India would also see the prominence of L0 and L1 in the near future.

V2X (Vehicle to everything) has M2M (machine to machine) a subset of IoT enabled transportation system that includes telematics and all types of communications in vehicles, between vehicle and citizens/Authorities (vehicle to person), between vehicles (e.g. vehicle to vehicle), and between vehicles and fixed locations (e.g. vehicle-to-infrastructure). Standardization work in Telecommunication Engineering Centre (TEC) has been underway for the past 2-3 years across verticals, namely M2M Gateway & Architecture, Security in IoT domain and Communication Technologies in M2M/ IoT domain, and has released 11 technical reports with 2 reports having specific automotive focus:

1. M2M Enablement in Intelligent Transport System - This document covers the Indian scenario, challenges, use cases, available standards and further course of action.
2. V2V/ V2I Radio Spectrum and Embedded SIM - This document covers the technologies related to V2V/ V2I communication and the spectrum requirement. Embedded SIM is the innovation in SIM technology and based on GSMA guidelines.

While there has been push from the industry to bring about more regulations that are in line with future growth prospects, due to lack of standardization and interoperable technologies, industries are working in silos and on proprietary solutions with limited compatibility at device, network and application levels.

4.4 International regulatory impact on Indian telematics for at-least 4 to 5 years and compliance with ISO 21434

The joint working group of the standardization organizations ISO and SAE has recently established a committee draft of the "ISO/SAE 21434 Road Vehicles - Cybersecurity Engineering" standard. From the point of view of the automotive industry, this standard achieves a common understanding of security by design in product development and along the entire supply chain. ISO/SAE 21434 was created as a new baseline standard after contributions and consultations from more than 80 entities related to the automotive industry, cybersecurity, electronic parts

manufacturing companies, and other groups. It covers all stages of a vehicle's lifecycle — from design through to decommissioning by the application of cybersecurity engineering. This applies to all electronic systems, components, and software in the vehicle, plus any external connectivity. The standard requires automotive manufacturers and suppliers to demonstrate due diligence in the implementation of cybersecurity engineering and that cybersecurity management is applied throughout the supply chain to support it. ISO 21434 has specific requirements for software development including analysis to check for inherent weaknesses and the overall consistency, correctness, and completeness with respect to cybersecurity requirements.

Implications for India: The implementation of ISO 21434 in EU will happen in July 2022. Given the technological evolution that is still happening in India, the learnings from other countries would be instrumental in formulating Indian automotive cybersecurity norms similar to UNECE WP.29. The ISO standard describes the need for automotive organizations to establish a culture of cybersecurity using governance, policies, processes, and tools to enable the engineering of electronic parts for vehicles to keep up with evolving technologies and attack methods and serves as a comprehensive industry benchmark in cybersecurity for OEMs and allied component manufacturers in India. As some of the leading companies anticipate its influence towards their respective customers and the corresponding laws it inspires for enactment, these organizations are expected to intentionally plan their upcoming models and designs around the standards over the next few years. The industry is highly tiered, so each change requires coordinated management regardless of the supply chain direction. The effect of these changes will affect the cybersecurity of newly manufactured vehicles.

4.5 Guidelines to comply with data privacy

Telematics data constitutes personal data, and therefore is subject to data protection laws, on the basis that it records the activities of individual drivers, or several individuals. Monitoring driver activities and behaviours is a key aspect of telematics to predict and prevent accidents – and thus improving the efficiency of the fleet and the safety of the staff.

In India, there are no general personal data privacy norms; discussions are underway in BIS TED-28 committee to formulate the same and it is expected that the coverages would be applicable to the personal data collected by OEMs.

AIS-140 coverage of data privacy: One of the major concerns which was raised during the panel meetings during the formulation of AIS-140 was on the issue of privacy encroachments by ITS systems. Towards this, the panel had submitted a document titled ‘Data Privacy in Transportation ITS’ to help the system developers deal with these issues. Further, they also recommended that OEMs and telematics solution providers take guidance from **‘IS/ISO/TR 12859: 2009 - Intelligent Transport Systems — System Architecture — Privacy Aspects in ITS Standards and Systems’** while developing their systems to meet the requirements of this standard.

Globally, EU, US and China have already taken measures to ensure data privacy. Laws such as General Data Protection Regulation (GDPR) in EU and Personal Information Protection Law (PIPL) in China are trailblazers in this regard. Some key takeaways from these regulations can be instrumental in data privacy compliance by Indian OEMs till regulations are set in place.

1. **GDPR** is a European Union law ensuring the protection of individuals with regard to the processing of their personal data and on the free movement of such data. GDPR goes beyond data reporting around vehicle IT to promote security by paying attention to the use of personal data in line with integrity friendly principles. There are requirements for companies to design systems with data protection in mind (e.g. amount of information collected, the extent of processing, storage period and accessibility). This will be relevant to OEMs who will have to design products and services with privacy and security in mind, such as encryption and hacking tests. The user of the vehicle would also have the ability to delete profile information and other personal information relating to them from the vehicle.
2. **PIPL** focuses on providing more comprehensive data protection regulation measures for personal information usage by companies that operate in China. Although GDPR and PIPL are aligned on many aspects, such as mandating workforce training and allowing class-action lawsuits on behalf of data subjects, there are a few

key differences for OEMs to consider in China. PIPL places restrictions on data portability rights. It requires data handlers to provide individuals with a safe “channel” that will only initiate data transfer when prescribed security conditions are met. In addition, PIPL requires every foreign data handler to have a representative based in China. Although it uses GDPR’s “lawful basis” approach to data processing, it does not include “legitimate interests” as an acceptable reason for accessing or collecting personal data. PIPL classifies financial information as “sensitive,” while GDPR does not. In the event of a data breach, it requires handlers to provide immediate notification to users, compared to GDPR’s 72-hour grace period.

Location privacy is another key aspect of data privacy with respect to telematics devices. For instance, in India telematics devices majorly have basic track and trace features where location information is continuously monitored and logged for real-time functionalities. Although location data is critical to the operation of applications, there is a precarious balance between the necessary dissemination of location information and the potential for abuse of this private information. Countries like US have comprehensive GNSS location privacy against monitoring of employees, customers, and other people since it raises questions about individual privacy rights.

Key takeaways from these regulations and best practices for India to consider would be as below:

Data processing must have a defined purpose: Personal information cannot be collected and stored “just in case” for future use. OEMs need to be open and honest in their intentions and individuals have a right to know how their data is being used. Organisations must only store personal data as long as it is necessary. Additionally, the processing must be safe and secure. Organisations must have and maintain the proper documentation that shows that they comply with the regulations.

Data collected must be for legal reasons: Both regulations have listed out base principles for data collection such as performance of a contract, using personal data to prevent fraud, national security or carrying out marketing, etc. Similar possibilities must be identified and contextualised for the Indian scenario

Reporting of personal data breaches: If personal data is disclosed, accessed, changed or stolen, OEMs are responsible to act. GDPR allows for a grace period to assess and determine any risks and reporting on the basis of the same, while PIPL requires immediate notification. Norms for reporting also need to be established considering classifications of sensitive data.

5 Global best practices

5.1 India vs. global comparison on functional safety of embedded parts, standardization of certification ecosystem

Vehicles today are being equipped with an increasing number of embedded systems either to make them a lot safer for users or to provide enhanced user experience. This exponential growth of the embedded systems in cars puts forth the challenge to everyone involved in the development supply chain to ensure that the system is failsafe and fool proof. To address this issue, the concept of functional safety is introduced in the development of such embedded systems that go into an automobile. Functional safety has a specific meaning when applied to auto-electronics and embedded systems - it is an active system that has safety mechanisms in place to detect, avoid and control failures or mitigate their harmful effects and a measure of the system behaving correctly in response to a range of failures. Keeping ahead in terms of functional security is a fundamental requirement, despite the increasing complexity of telematics systems. The primary objective is to protect all vehicle/machine functions from cyber-attacks that gain access through the radio interfaces of the telematics system. India currently lacks in both these aspects as compared to global counterparts due to the lack of Indian standards for the same. The certification and testing ecosystem are currently well defined in India, however there is scope for more inclusions and opportunities for enhancements as seen in US and China.

	Comparison parameters	Global	India	Observations
1	Functional safety of embedded parts	✓	✗	**Functional safety standards exist globally** - IEC (International Electrotechnical Commission) 61508, ISO (International Organization for Standardization) 26262 - Automotive Safety Integrity Level (ASILs from A to D), SAE (Society of Automotive Engineers) J2980, and MISRA C (Motor Industry Software Reliability Association - UK)
2	Functional security of embedded parts	✓	✗	**Functional security standards exist globally** – UNECE WP.29 regulation on cybersecurity and software updates sets an organizational framework and minimum requirements that impact all automotive players along the value chain. China has the National Cybersecurity Law (CSL) and over 30 MIIT (Ministry of Industry and Information Technology) and SAC (Standardization Administration of China) standards
3	Certification required for telematics	✓	✓	Certification standards in India are focused on the device and are not inclusive of all components and stakeholders. **Certification standards for non-automotive stakeholders exist globally.** For instance, US requires PTCRB[a] certification for GSM, UMTS, and LTE telematics devices, FCC certification to ensure that any electromagnetic interference caused by these devices are below set standards, apart from carrier certifications
4	Testing ecosystem	✓	✓	Automotive testing agencies like ICAT in India carry out testing and certification, and are equipped with testbed. **Scope for strengthening the testing ecosystem** exists – In China, ministry has authorized six closed testing grounds to enhance the tests' safety level, and strengthen R&D and testing involving vehicles and infrastructures (V2I)

✗ - Not prevalent ✓ - Prevalent but there is scope for improvement ✓ - Prevalent

Table 2 - Table 5.1.1 – Global vs. India comparison on functional safety of embedded parts, standardization of certification ecosystem

5.2 Telematics ecosystem in India vs. global - Benchmarking on key components modules like 5G modems, etc.

When delving into the comparison of the quality of devices offered in India vs. abroad, the general impression is that there are no major differences in the caliber of the devices in India. The focus of the ecosystem for telematics, as with other auto-components, remains on design and assembly of devices and software capabilities which is our strong suite, while the manufacturing ecosystem will require a large push from the Government and a gestation period to attain relevant cost advantage from economies of scale. Key component modules might continue to be imported till a robust ecosystem is developed. Automotive grade components fall under international benchmarks and standards such as IEEE for electrical components (simple resisters/transistors) since they are imported.

While the global market witnessed a shift from 2G to 3G / 4G modems in their telematics devices in the early 2010s, India still depends majorly on 2G connection to transmit telematics data. Auto 5G modems are being offered in global markets since 2018 but India still has a long way to go. The telematics solutions being offered in the Indian market do not necessarily currently require a 5G bandwidth. The advancement in telematics technology towards more video services, V2X, etc. might create a real need for 5G modems in the market in future.

6 Recommendations and call to action

Recommendations for establishing a circular framework for implementation of Telematics ecosystem:

6.1 Recommendations for the Government to make structural changes

1. Recommendations for AIS-140 Implementation gaps

- The ***availability of backend infrastructure in each of the States & UTs*** will have to be ensured for realizing the intended safety benefits of AIS 140 implementation. State layers should follow common communication protocol (TCP) to ensure interoperability as well as standard implementation across all states, keeping in line with 'One Nation One Protocol'. Mitigating gaps in sharing of the emergency alerts to various state backends in interstate travel routes is crucial to achieve security objectives of MoRTH.
- Backend deployment in states needs to be **validated / *certified by the testing agencies listed in CMVR post deployment and before go-live*** to ensure that type approved software is actually being deployed. Standards for "Type Approval" for Backend has to be clearly defined and mandated.
- Due to MoRTH funding to States and the availability of multiple backend providers who are complying with defined specifications as per AIS-140 such as NIC, BSNL, DIMTS and CDAC, homogeneous implementation of AIS-140 in all states is expected to be achieved. Post this, ***removal of VLTD manufacturer's backend*** is recommended as an option.
- As per MoRTH SO 5454(E), fitment of VLT Device is mandatory for all vehicles being registered w,e,f 1st January 2019**. NIC has developed necessary system lock to prevent vehicle registration without VLT Device fitment by vehicle OEMs or their authorized agencies as per CMVR 125H.** However, this lock is not enabled across the country resulting in non-compliance to CMVR. **This needs urgent implementation.**
- ***AIS-140 fitment in new transport vehicles to be done by OEMs*** at the production stage itself including vehicles already dedicated for usage as commercial cabs / taxis (example: Maruti Tour range, Hyundai Prime range etc.). For other vehicles in the Commercials cabs / Taxi segment, OEMs need to ensure availability of their approved VLTD kits at their dealership for fitment in these vehicles being sold as Cab / Taxis. Pan-India implementation through vehicle manufacturers or their authorised agencies, as outlined in MoRTH Standard Operating Procedures (SOP) dated 22nd Feb 2021, will ensure uniformity & quality of fitments in a time bound manner. In some cases, traders are doing fitment in new vehicles in absence of any system check at VAHAN to validate respective OEM approval.
- ***AIS-140 fitment in existing vehicles to be done by OEMs.*** In the interest of quality implementation of AIS-140, the similar model of implementation through ***vehicle manufacturers or their authorised agencies is recommended for existing vehicles as well.*** This recommendation and representation has been made by ACMA as well as SIAM during MoRTH meeting on draft SOP held on 25th January 2021.
- ***MoRTH to set an urgent deadline for AIS-140 implementation in existing vehicles,*** as done in the case of new vehicles. Post the same NIC needs to put a system lock before fitness renewals for existing vehicles in VAHAN.
- ***Implementation of Vehicle Tracking Systems in Coal and other Mining, Public Distribution Systems (PDS), and Health departments by various Central and State Government bodies must follow AIS-140 standard*** instead of publishing non-standard VTS for their respective requirement. AIS-

140 is a national standard ensuring interoperability across States and integration with many states' backend simultaneously. Hence one nation one standard can be ensured by adopting the national standard for mining sector as well. Public service departments who are not mandating AIS 140 may have to be enforced to use AIS 140 ecosystem.

- When the migration to IS 16833 is enforced, it is recommended to add **three-wheeler vehicles as a part of the mandate's coverage**. Mandating ATD with an integrated emergency system and Fare Meter for auto-rickshaws as per Annexure-B of IS:16833 (already implemented in Delhi and initiated in Tamil Nadu) would enable larger visibility and safety in this key mode of transportation in India.
- The current AIS-140 mandate is response centric, i.e., after an emergency alert is generated, the relevant vehicle location and owner information is shared to the police station nearest to vehicle's POIs. For a ***transition from this response centric approach to an action centric*** one by enhancing the AIS-140 / IS 16833 mandate's capability, the following should be considered:

    a. **Quality audits of on-road devices –** Inconsistencies in the quality of devices initially certified against those that are on-road is majorly noted among aftermarket fitments. In addition to the annual Conformity of Production (COP) checks that are currently in place to ensure active transmissions from fitted devices, the quality of the device, crucial components and e-Sim validity, etc. should also be assessed by leveraging the data that is stored in the backend by means of random sampling to ensure consistency in device functionality. Drivers / users can also be educated on the shortcomings of these devices urging them to invest in better telematics fitments.

    b. **Future use cases –** AIS-140's successful implementation presents opportunities for strengthening the emergency response system in the country with CCTV footage transmission (IS 16833), impact sensing and alerts in cases of debilitating accidents, auto-call on pressing emergency button and automatic connection to nearest police station, and much more.

    c. **Interoperability –** The framework for interoperability should be taken into consideration to create synergetic, safe and reliable policies and standards for India-specific problems. This foundation will be crucial for the applicability of advanced telematics technologies.

2. Shift from 2G dependency to 4G / 5G

Depending on current telematics industry readiness, a natural on-demand migration pull to 4G/5G is expected owing to diminishing 2G network availability in the country and future use cases involving video data, transmission of high bandwidth data from ECUs, OTA ECU updates, etc. Given the 2G concentration in the current telematics ecosystem and AIS-140 requirement for lower size data packet, the migration from 2G to 4G (with 2G fall back) is advised to be taken into consideration by the government in a phased manner keeping in mind the huge inventory of 2G devices and components available in the ecosystem.

Considering monetization opportunities and subsequent ecosystem development such as ADAS and V2X (intelligent traffic management systems) mentioned in the paper, a shift from manufacturing devices with 2G dependency to 4G / 5G can be considered by device manufacturers in the future. Stakeholders can weigh out the benefits from the improvement in telematics features being introduced in the market against the cost considerations to implement the same in a phased manner considering component availability, manufacturer readiness with device design, and testing and validation by agencies. OEMs and telematics solution providers need to ensure supply of differentiated solutions with 4G / 5G integration to cause progress in the market.

3. Support for domestic manufacturing of telematics and IoT component ecosystem

Though the government has spearheaded PLI schemes with coverage of auto-electronic components and is working to create a robust domestic manufacturing environment, manufacturing support is one part of the puzzle. It needs to be complimented with many other factors to ensure adequate support for the ecosystem.

India as a country needs to assess and address aspects such as:

a. Cost disadvantages – potential demand, estimated production volumes for commercial viability and infrastructure development costs for semiconductors, sensors, etc.

b. Talent and skill gaps in terms of availability of skilled workforce

c. Technology and knowledge gaps and take necessary calls on potential components which can be incentivised for local manufacturing.

Rationalization of duty structure for imported components required for VTS device would be an effective tool to address the cost disadvantages and diminish the import of sub-standard and cheap devices. Some of the other aforementioned aspects can be addressed by facilitating trainings through university partnerships with institutes of national importance, company to company linkages with favourable countries for knowledge transfer and to establish connection for future prospects, etc.

4. Formulation of guidelines for IoT devices:

Considering that majority of the Automotive IoT device manufacturers are global firms and IoT component manufacturing also does not take place in India, there is a need to outline guidelines for those wishing to offer IoT manufacturing services in India. Communication protocols for devices connected by IoT and their functional safety / security engineering from an Indian context are currently being formulized by various working groups such as Telecommunication Engineering Centre (TEC). Working closely with policy makers while laying the foundation for such technology can greatly accelerate the implementation as current regulations can be framed with future prospects such as V2X in public key infrastructure (PKI) in mind.

Forming of V2X working group to start working towards drafting standards and proposals from the identified use cases which can have maximum benefit with low cost should be initiated. While the implementation and adoption could be set at a later stage, the lead time for preparation of initial draft including security topics, communication protocols and V2X technologies like DSRC (Dedicated Short-Range Communications) and C-V2X (Cellular V2X) would itself be around 4 to 6 years.

5. Identification of priority areas for increased safety

While improving network coverage across all areas in India would require capex investments, the various government stakeholders such as MoRTH, DoT, TRAI, government agencies such as relevant crime units, backend implementation agencies, etc. should work in collaboration to identify priority areas with weak coverage, such as areas with higher crime rates, so that passenger safety purpose of the AIS-140 standard is met (through better data connectivity, lower call drops etc.)

6. Scrappage policy guidelines w.r.t Telematics devices

Given the volumes in India, there is no immediate need for a dedicated scrappage policy for telematics devices - considering the nascency of the Indian telematics market and the typical life of a telematics device being 7 to 10 years. Clear inclusion of telematics devices in current vehicle scrappage policy and e-waste policy are the requirement at this stage. Separate need can be explored further in the future.

Industry Speak

"The implementation of 'One Nation - One Protocol' would lead to the standardization of IT infrastructure in the country. The integration of state backends to a common layer would allow interoperability, ensure state level security and encryption of unsecured data."

– **Vadiraj S Katti,** *iTriangle Infotech*

"Pan-India fitments at production stage, when implemented with deadlines from MoRTH and tagged to the national backend, will lead to quality implementation, a more efficient and accurate supply chain planning from the VLT device manufacturer side and homogenous roll-out from the OEM side"

– **Hitesh Ahuja**, *Nippon Audiotronix Pvt. Ltd.*

6.2 Best practices that can be adopted by the market ecosystem

Telecommunication players:

- Ensure availability of network coverage in and around state and national highways.
- Leverage data collected at the state backends, specifically the GSM strength parameter, to identify areas with low coverage and high volumes of data sharing.
- Increasing connectivity in remote and rural areas can be driven by DoT under existing provisions of USOF (Universal Service Obligation Fund).

Must have for: Overall ecosystem

Component manufacturers:

Strengthen the export and import linkages to ensure the supply of key components for the short term - build better international relationships with key component supplying countries, leverage current foreign trade relationships to reduce duties, etc.

Must have for: Overall ecosystem

Given that telematics components are majorly imported, at this stage the detailed testing at component level for all is not required.

- **Components crucial from a cybersecurity standpoint, such as security modules, GNSS unit, engine interface, external interface, etc. should be vetted during telematics device testing.**
- Formulation of component standards for the same can be considered to ensure functional safety and security of parts and the entire telematics system.
- Global standards such as ISO 26262, IEC 61508, SAE J2980, etc. can be benchmarked for formulation of the same.

Must have for: Overall ecosystem

AIS-140 implementation:

The MoRTH guidelines are exhaustive in terms of the operational capabilities of the backend to carry out applications such as geofencing, POI, etc. At the implementation level, currently there is limited mobilisation of the data collected which should change to ensure more use cases.

Must have for: Central agencies using telematics data

Currently, as per VAHAN parivahan portal 19 states are active, with 15 approved backend service providers. However, basis discussions with stakeholders, it has been understood that formal implementation and active management is underway only in few states (just 6 states have mandated implementation with formal orders / notifications to stakeholders – Vehicle owners, device manufacturers, RTOs etc. for implementation), with the rest of the states still in process. Although deferrals were taken in the past by states to delay the implementation of the AIS-140 owing to various reasons, the steering committee must ensure capacity building and homogeneous implementation by all states. **MoRTH should understand the reasons for non-compliance in the remaining states, UTs and fast track the implementation by setting deadlines for the same and ensure activation of all the existing backends.**

Must have for: Effective AIS-140 implementation

Considering the issues faced by OEMs and telematics solution providers catering to clients nationally, the additional changes for AIS-140 implementation should be framed by states post joint agreement with MoRTH and only if absolutely critical. Changes in alerts, data packet formats, etc. also pose challenges in terms of high-level integration in the future.

Must have for: OEMs and Telematics solution providers

States VLT Device empanelment criteria should have vehicle OEM approved product as a criteria to comply with MoRTH SOP dated 21st February 2021 and to ensure vehicle OEMs factory fitted devices are allowed for vehicle registration in every state uniformly.

Must have for: Vehicle OEMs

Creating accountability of the VLTD manufacturers is understandable. However, on the amount collected as a bank guarantee / performance guarantee, there are some factors to consider to streamline the variation in the fees currently being collected across states. A cap on the amount to be collected as a bank guarantee / performance guarantee can be set basis state-wise variables such as vehicle population applicable for AIS-140, vehicle ownership, etc. Another consideration is changing the security deposit charged by states from per model to companywide, to reduce the commercial burden on respective device manufacturers.

Must have for: OEMs and Telematics solution providers

Effective implementation of recommendations and best practices pertaining to AIS-140 would be key to ensuring quality and uniformity in the ecosystem. The homogenous implementation of AIS-140 would greatly help fulfil national security objectives of woman safety and better emergency response and lay the foundation for future technology integration and corresponding regulatory intervention.

Future technology integration:

It is imperative for India to set cybersecurity standards by benchmarking counterpart standards in EU or China, or international standards published such as SAE (Society of Automotive Engineers) J2980, ISO (International Standards Organization) 26262, UNECE WP.29 (UN Harmonization of Vehicle Regulations), IEEE (Institute of Electronics Engineers) 802.11p, etc.

Must have for: Overall ecosystem

Best practices inferred from Data Privacy laws such as GDPR and PIPL should be practiced by Indian OEMs and telematics solution providers till the general data privacy policy is in place in India: (1) Data processing must have a defined purpose (2) Data collected must be for legal reasons (3) Responsible reporting of personal data breaches

Must have for: Overall ecosystem

The MoRTH guidelines currently detailed out are for the state level backend servers but data collected at the OEM level has no prescribed guidelines. The lack of the same poses many risks and also delimits the data monetisation opportunities due to there being no permissions in place. Democratisation of data sharing, once personal data privacy guidelines are in place, would enable a plethora of monetisation opportunities and value-add services.

Must have for: Extended ecosystem players like insurance providers, etc.

Other industries including leading tech companies, and critical infrastructure companies in India have developed best practices such as checks at vendor infrastructure level, security controls, assessment plans, etc. for secure technology development. OEMs and all other automotive players can lean on these best practices and combine them with the upcoming international standards for the automotive industry to develop the new capabilities required throughout the full development cycle – not only for hardware and software development.

Good to have for: OEMs and Telematics solution providers

A point of consideration is that AIS-140 is specific only to public transportation vehicles, good vehicles, and vehicles carrying dangerous or hazardous goods and its scope is limited to tracking and transmitting of location data in case of emergencies. There are no mandates to push uptake of telematics in other vehicle segments. Mandates such as e-Call, as done in EU and Russia, can be explored in India to strengthen our emergency response systems in all vehicle segments.

Good to have for: Overall ecosystem

Appendix

#	Recommendation Area	Immediate Action Points & Stakeholders Responsible
Central Government - MoRTH		
1	AIS-140 Implementation	Set deadlines for implementation & activation of backend infrastructure in all states and active monitoring for accomplishing the same
2		Set deadlines, monitor and ensure OEM production / dealer level AIS-140 fitments as per MoRTH SOP dated 22nd Feb 2021 for new vehicles
3	Stakeholder integration	Formulate and rollout component standards for components crucial from a cybersecurity standpoint
4		Formulate SOP for democratisation of data sharing (once personal data privacy guidelines are in place)
Certification / testing agencies like ICAT		
5	AIS-140 Implementation	Certification of backend deployment in states post deployment and before go-live to ensure compliance with type approval
6		Quality audits of on-road devices – e-Sim validity, component quality, etc.
7		Carry out annual backend server surveillance as per common protocol established
8	Stakeholder integration	Check components crucial from a cybersecurity standpoint at the time of telematics device testing
Working groups of different Central Government bodies		
9	AIS – 140 Implementation	Identify priority areas for increased safety & ensure network provision in these areas and all state / national highways (Central Government bodies such as MoRTH, DoT, TRAI, relevant crime units and backend agencies)
10		Formulate guidelines for additional state-wise changes for AIS-140 implementation - only if absolutely critical, prior MoRTH approval required, etc. (Government bodies such as MoRTH and various State Governments)
11	Future ecosystem development	Formulate guidelines (testing, certification, etc.) for providing IoT devices in India and the communication protocols for these devices (Central Government bodies such as MoRTH, MeITY, relevant working groups such as TEC and relevant councils involved in standard formulations such as AISC)
12		Formulate and roll-out cybersecurity standards for automotive electronic / electrical (E/E) engineering (Central Government bodies such as MoRTH and relevant councils involved in standard formulations such as CMVR-TSC, AISC)

13		Expedite introduction of IS 16833 to supersede AIS 140 and ensure mitigation of all current gaps in VLTD regulations.
Working groups of Central Government (MoRTH) and industry stakeholders		
14	Future ecosystem development	Amend SOP for AIS-140 fitments in existing vehicle to mandate fitments by vehicle manufacturers or their authorized agencies (ACMA, SIAM and MoRTH)
15		Rationalize duty structure for imported components required for VTS device to promote domestic manufacturing

Acknowledgements

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Primary sources:

We were able to garner valuable insights into the telematics market in India through our primary interactions with key ACMA member firms and other important stakeholders in the ecosystem:

- Itriangle Infotech
- ZF Group India
- Nippon Audiotronix Pvt. Ltd.
- Lumax Industries
- Bosch
- Hella India Lighting
- Varroc
- Uno Minda Group
- Delhi Integrated Multi-Modal Transit System (DIMTS) Ltd.
- Continental Automotive
- International Centre for Automotive Technology (ICAT)
- Qualcomm Technologies Inc.
- Tata Motors
- Rosmerta Technologies Ltd.

Secondary sources:

For understanding the regulatory scenario and benchmarking the same against global standards, the following Indian and international policy documents have been considered:

Topic	*Source*	*Report Title*
Regulatory scenario – Current standards	Automotive Research Association of India (ARAI)	Automotive Industry Standard (AIS) – 140: Intelligent Transportation Systems (ITS) - Requirements for Public Transport Vehicle Operation

Regulatory scenario – Implementation of current standards	Ministry of Road Transport and Highways (MoRTH)	Model request for proposal (RFP) for "Vehicle Tracking platform for safety and enforcement as per AIS-140 standard
Regulatory scenario – Current standards	Bureau of Indian Standards (BIS)	IS 16833: 2018 - Automotive Tracking Device (ATD) and Integrated Systems
Regulatory scenario – Cybersecurity	International Organization for Standardization (ISO) and Society of Automotive Engineers International (SAE)	ISO/SAE 21434 "Road vehicles – Cybersecurity engineering"
Regulatory scenario – Cybersecurity	International Organization for Standardization (ISO)	ISO 26262 "Road vehicles – Functional safety"
Regulatory scenario – Data privacy	European union regulation 2016/679	General Data Protection Regulation (GDPR)
Regulatory scenario – Data privacy	People's Republic of China (PRC)	Personal Information Protection Law (PIPL)
Regulatory scenario – Telecom operational gaps	Indian Telecommunication Security Assurance Requirements (ITSAR)	Pluggable (U)ICC (SIM, USIM and other (U)ICC based applications)
Regulatory scenario – Future technology integration	Telecommunication engineering centre (TEC) – M2M automotive working group	Technical reports – (1) M2M enablement in Intelligent transport systems (2) V2V / V2I radio communication and embedded sim
Telematics market outlook – Telematics in insurance	Insurance Regulatory and Development Authority (IRDAI)	Exposure Draft: Report of the Working Group on Revisiting the product structure of Motor Own Damage

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[x] uppolice.gov.in

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About ACMA

The Automotive Component Manufacturers Association of India (ACMA) is a apex body representing India's Component Industry. It boasts a membership exceeding 850 manufacturers, contributing to more than 85% of the auto component industry's total turnover. ACMA proudly holds ISO 9001:2015 certification.

ACMAs primary mission revolves around stimulating growth, job creation, and economic prosperity. Through its relentless dedication to research & development initiatives, ACMA ensures that India maintains a leading position in global automotive component manufacturing.

With its continually expanding network, ACMA empowers businesses by providing invaluable resources, industry insights, and opportunities for collaborative endeavours. The organization plays an indispensable role in shaping policies and regulations that nurture an environment conducive to sustainable growth.

India's automotive industry is a vital sector, contributing 49% to the country's manufacturing GDP, 7.5% to the overall GDP, and supporting approximately 38 million jobs. Despite challenges like chip shortages, overbooking, fuel price-induced inflation, and rising commodity prices, the overall industry is valued at $150 billion.

In the fiscal year 2022-23, on the back of strong vehicle sales, a robust aftermarket, and growing exports, the auto component industry achieved unprecedented success. It reached a size of Rs. 5.60 lakh crore (USD 69.7 billion), recording a remarkable growth of 32.8%, surpassing the previous high turnover of Rs. 4.20 lakh crore in FY21-22. Exports increased by 5.2% to Rs. 1.61 lakh crore (USD 20.1 billion), while imports grew by 10.9% to Rs. 1.63 lakh crore (USD 20.3 billion). The Aftermarket, estimated at Rs. 85,333 crores, also saw steady growth, registering a 15% increase. Auto component sales to OEMs in the domestic market surged by 39.5% to Rs. 4.76 lakh crore.

This growth in domestic auto component sales to OEMs, reaching Rs. 4.76 lakh crores (USD 59.3 billion), reflects a 39.5% increase compared to the previous year. The demand for higher-value components and a shift towards larger, more powerful vehicles contributed to this growth.

In 2022-23, exports of auto components grew by 5.2% to Rs. 1.61 lakh crore (USD 20.1 billion) compared to Rs. 1.41 lakh crore (USD 19.0 billion) in 2021-22. North America accounted for 32% of exports, with an 8% growth, while Europe (31%) and Asia (26%) saw 3% and 4% growth, respectively. Key export items included drive transmission and steering, engine components, body/chassis, suspension, and braking systems.

Domestic market traction also led to an increase in component imports into India, growing by 10.9% in 2022-23 to Rs. 1.63 lakh crore (USD 20.3 billion) from Rs. 1.36 lakh crore (USD 18.3 billion) in 2021-22. Asia represented 66% of imports, followed by Europe (26%) and North America (6%), with growth rates of 12%, 6%, and 23%, respectively.

Post-pandemic, increased vehicle movement and demand for used vehicles boosted the aftermarket across all segments. The aftermarket turnover in FY 2022-23 reached Rs. 85,333 crore (USD 10.6 billion), compared to Rs. 74,203 crore (USD 10.0 billion) in the previous year.

ACMA plays a crucial role in the industry's development in India, actively engaging in trade promotion, technology enhancement, quality improvement, and information dissemination. It participates in international trade fairs, sends trade delegations overseas, and publishes materials on various automotive industry-related subjects.

ACMA also contributes to manufacturing advancements by offering skills training and mentoring through cluster programs and special projects such as 'Asset Turnover Improvement,' 'Uptime Improvement,' 'Zero Defect Quality,' and 'Sustainable Manufacturing,' among others. Additionally, ACMA is well-represented on various government panels, committees, and councils, helping shape policies and regulations for the Indian automotive industry.

For information exchange and cooperation in trade matters, ACMA has signed Memoranda of Understanding (MoUs) with counterparts in multiple countries, including Argentina, Australia, Brazil, Canada, Egypt, France, Germany, Hungary, Iran, Japan, Kazakhstan, Malaysia, Mexico, Nigeria, Pakistan, Poland, Russia, South Africa, South Korea, Spain, Sri Lanka, Sweden, Taiwan, Thailand, Tunisia, Turkey, the UK, Italy, the USA, and Uzbekistan.

You can find more information and data about the Indian automotive industry on the ACMA website: www.acma.in

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