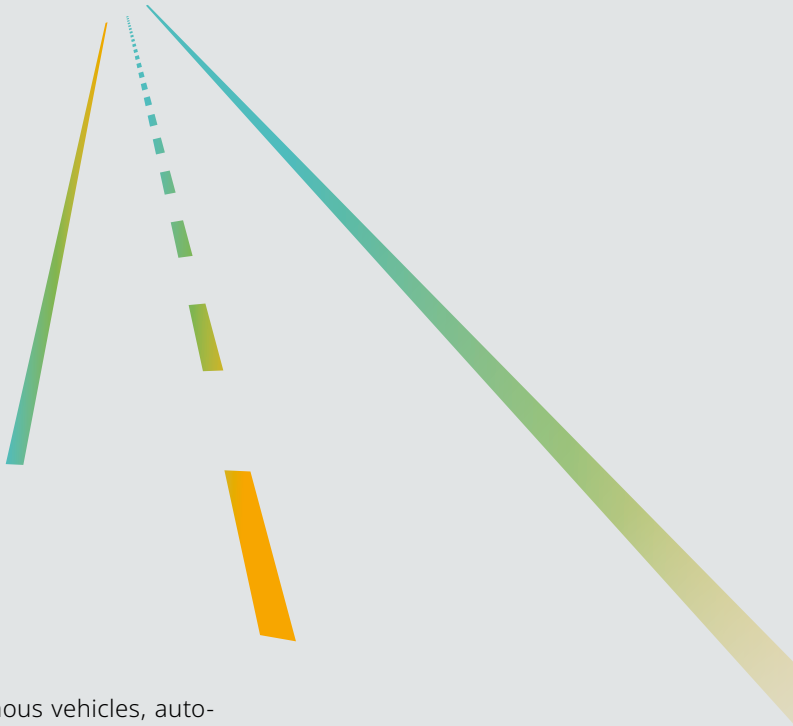
Intelligent Speed Assistance for Safer Driving

Fusing Cameras, Connected Maps, and Electronic Horizon

Cooperation by: Continental here Elektrobit

Introduction



As we move forward into the era of connected and autonomous vehicles, automakers are embracing driver-assist technologies that make driving simpler, more enjoyable, and vastly safer. One of the key representative functions is Intelligent Speed Assistance (ISA), an in-vehicle system that prompts drivers to acknowledge and comply with legal speed limits, irrespective of the availability of physical signs or other variables such as location, time, or weather conditions.

Speed remains a decisive factor in many road accidents, not only by increasing the likelihood of a driver losing vehicle control but also by shortening reaction times and intensifying the severity of collisions. According to the EU Mobility and Transport Commission, there were approximately 22,800 fatalities[(1)] and 120,000 serious injuries[(2)] caused by vehicle accidents on European roads in 2019. And while the number of deaths has decreased by 23 % since 2010, the figure still falls significantly short of previous EU targets[(1)].

The new EU General Safety Regulation 2019 / 2144 aims to significantly reduce both deaths and serious injuries over the next ten years, with an intensified focus on vehicle safety standards and the introduction of technological advancements to reduce road collisions. One of the most important announcements has been that ISA will become a mandatory requirement in all new M and N category vehicle types[(3)] from 2022, aimed at helping drivers to maintain compliance with legal speed limits while reducing both the frequency and severity of accidents.
And while some OEMs have already incorporated ISA into existing models, there are some significant technical and environmental challenges involved in making ISA an industry-standard feature across all new vehicles.

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What is Intelligent Speed Assistance (ISA)?

ISA is an in-vehicle safety system that warns or prevents drivers from exceeding the legal speed limit, which can often occur due to driver distraction, lack of visual speed limit information, or weather and environmental factors impacting visibility.

What is an Electronic Horizon?

An electronic horizon is embedded software that provides accurate and up-to-date information about the road ahead for predictive, ADAS, and automated driving functions. Drawing crowd-sourced map and road event data from the cloud, it allows vehicles to see beyond their sensor field of view and enables ADAS systems to optimize performance and safety.

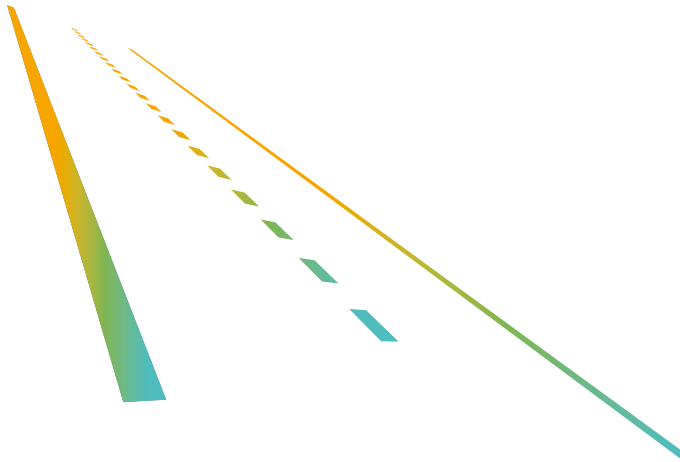
ISA displays the current speed limit within the vehicle at all times and can also restrict acceleration to maintain compliance, either manually or automatically. Providing drivers with accurate and reliable speed limit information – combined with mechanisms that can physically prevent drivers from speeding – forms part of a valuable ADAS system that can reduce both the frequency and severity of vehicle collisions.

ISA implementation can take one of three forms:

1. **Advisory:** ISA displays the legal speed limit at all times and alerts the driver when the speed limit has been exceeded, but the driver still retains standard acceleration control.
2. **Voluntary:** ISA alerts the driver when the displayed legal limit has been exceeded, and the driver can select whether the system restricts vehicle acceleration or not. Under manual control, the driver must place extra pressure on the foot pedal to accelerate beyond the legal limit but may receive warnings from the ISA system when doing so.
3. **Automated:** ISA automatically limits the vehicle's top speed in accordance with the displayed legal limit, although the driver can override the system if desired. The ISA automatically reengages each time the engine starts.

ISA can draw from several different data points to determine the current speed limit, such as front-facing onboard vehicle cameras and other in-vehicle sensors, digital maps, and electronic horizon technology. According to the European Transport Safety Council (ETSC), initial driver feedback of ISA has generally been positive[6], noting that while drivers take a short time to adjust to the new technology, the systems ultimately provide a reliable, intuitive, and user-friendly experience.

ISA History, Regulations, and Future Implications



ISA History, Content, and Applicability (Dec. 2022)

In May 2018, the European Commission proposed a new set of mandatory safety standards for all new vehicles sold within the European Union. ISA was one of the key technologies introduced under the new framework, with technical requirements and definitive timelines currently being finalized by the European Commission. The newly-revised General Safety Regulation (661/2009/EC), which was adopted in 2019, has made ISA mandatory in all new M and N category vehicle types (cars, vans, trucks, and buses) starting in 2022. By 2024, it is mandated that all new vehicles sold within the EU must include ISA as a standard line fit, and not as an aftermarket or additional solution. The European Commission is currently drafting new ISA technical requirements and future test procedures in a delegated act.

Safety, Financial, and Environmental Benefits

ISA is arguably the most effective in-vehicle system for preventing excessive speeding while enhancing driver and passenger safety. According to the European Transport Safety Council, mass-adoption of ISA can reduce road accidents by up to 30 % and road deaths by up to 20 %[4]. Lower speeds can also reduce the number of collisions between vehicles and other road users such as cyclists and pedestrians. In addition to improved safety, ISA also provides vehicle owners with several financial benefits, such as fewer speeding tickets, higher fuel or battery efficiency, and lower vehicle running costs. A report by the Road Safety Authority of Ireland concluded that mandatory use of ISA could increase fuel economy by up to 11 %[5] while significantly improving traffic flow and reducing congestion, particularly on regional and local roads.
There are also broader environmental benefits to ISA technology, as vehicle speeds directly correlate to CO_2 emissions. It is expected that vehicles fitted with ISA can see a reduction in exhaust emissions of up to 8 %[4], or in the case of electric vehicles, can travel longer distances between charges.

Euro NCAP Extra Scoring and 2019 Test Results

The European New Car Assessment Programme (Euro NCAP) is a voluntary car safety testing program that provides independent information to consumers regarding the safety of new passenger vehicles. Using a five-star rating system, Euro NCAP conducts a series of vehicle crash tests designed to simulate real-life situations that could potentially injure or kill vehicle occupants and other road users.
Euro NCAP has actively promoted ISA as a technology that can vastly enhance speed limit control and improve vehicle and driver safety. ISA systems that are proven to accurately identify speed limits and act accordingly can earn up to 20 additional points based on the system's advanced functions[4], which typically combine

Euro NCAP Speed Limit testing in 2019

How latest vehicles are performing

	Solution	Weather (Rain/Wetness)	Weather (Snow/Icy)	Time	Distance For/In	Arrows
Mercedes Benz G Class	Camera & Map	Pass	Pass	Pass	Pass	Pass
Mercedes Benz B Class		Pass	Pass	Fail	Pass	Pass
Tesla Model 3		Pass	Pass	N/A	Pass	N/A
Mercedes EQC		Pass	Pass	Pass	Pass	Pass
Mazda CX-3		Pass	Pass	Pass	Fail	Pass
Audi Q7		Pass	Fail	Pass	N/A	Pass
Ford Puma		Fail	Fail	Pass	Pass	Pass
Overall Trend (Vehicles passing the test)		6 out of 7	5 out of 7	5 out of 6	5 out of 6	6 out of 6
Honda CRV	Camera	Pass	Pass	Fail	Fail	Fail
Citroen C5 Aircross		Pass	Pass	Fail	Pass	Pass
Lexus UX		N/A	Pass	N/A	Pass	N/A
Renault Clio		N/A	Pass	N/A	Pass	Pass
Toyota Rav-4		Fail	Pass	Fail	Pass	Fail
Ford Focus		Fail	Fail	Fail	Pass	Pass
BMW 3 Series		Pass	Pass	Fail	Pass	Pass
Overall Trend (Vehicles passing the test)		3 out of 5	6 out of 7	0 out of 5	6 out of 7	4 out of 6

Data source: Euro NCAP Public SharePoint[7]

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onboard vehicle cameras, maps, and an electronic horizon. In addition to measuring the effectiveness and adaptability of ISA systems, Euro NCAP also assesses that they do not cause any needless distraction to the driver.

Euro NCAPs 2019 speed limit testing found that ISA systems utilizing a combination of maps and onboard vehicle cameras performed substantially better than those using cameras alone [4]. Of the seven vehicles tested using cameras and maps, at least five received a "pass" grade in each of the ten categories, and there were three categories in which every vehicle passed successfully.

Conversely, the seven cars using camera-only ISA systems received significantly lower overall scores, particularly in tests based on implicit speed limits determined by weather, location, and time of day. As expected, camera-only ISA systems performed well under circumstances in which physical speed limit signs were present, but poorly when no visual information was available.

Expected Outcomes for the Automotive Industry

ISA represents an exceptional opportunity for automakers to improve vehicle safety, increase consumer trust, and streamline the transition from manual to automated vehicles. Similar to other driver-assist functions, manufacturers can select from different ISA architecture implementations to suit particular vehicle models, price points, and markets. The deployment of ISA systems will also increase the utility of existing mapping, camera, and electronic horizon technologies, leading to more intelligent functions and accelerating the development of automated vehicles in the SAE 3-5 categories.

Euro NCAP Speed Limit testing in 2019

How latest vehicles are performing

Vehicle Categories	Implicit Speed (Highway/Motorway signs)	Implicit Speed (Limits: City Entry/Exit)	Implicit Speed (Limits: Residential Zones)	Dynamic Speed Limits	Solution	
Pass	Pass	Pass	Fail	Pass		Mercedes Benz G Class
Pass	Pass	Pass	Fail	Pass		Mercedes Benz B Class
Pass	Pass	Pass	Pass	N/A		Tesla Model 3
Pass	Pass	Pass	Pass	Pass	Camera & Map	Mercedes EQC
Pass	Pass	Pass	Pass	Pass		Mazda CX-3
Pass	Pass	Pass	Pass	Pass		Audi Q7
Pass	Pass	Pass	Pass	Pass		Ford Puma
7 out of 7	7 out of 7	7 out of 7	5 out of 7	6 out of 6		Overall Trend (Vehicles passing the test)
Pass	Fail	Fail	Fail	Pass		Honda CRV
Pass	Fail	Fail	Fail	Pass		Citroen C5 Aircross
Pass	N/A	N/A	N/A	Pass		Lexus UX
Pass	Fail	Fail	N/A	Pass	Camera	Renault Clio
Pass	Fail	Fail	Fail	Pass		Toyota Rav-4
Pass	Pass	Fail	Pass	Pass		Ford Focus
Pass	Fail	Fail	Fail	Pass		BMW 3 Series
7 out of 7	1 out of 6	0 out of 6	1 out of 5	7 out of 7		Overall Trend (Vehicles passing the test)

Data source: Euro NCAP Public SharePoint

Implications for OEMs

With ISA becoming a mandatory feature in most vehicles from 2022, there are many technical and financial challenges facing OEMs to ensure compliance with the new regulations, either by implementing new ISA technology or accelerating the development of existing solutions. Software and digital mapping technology, for example, will need updates more frequently in order to maintain ISA compliance. OEMs face the challenges of finding technical solutions to these requirements while measurably improving driver safety and balancing the additional costs across all vehicle models and trim levels.

Thankfully, many modern vehicles already feature some or all of the core technologies needed to either accelerate or simplify the development of ISA implementation. Following the "eCall" mandate of 2018 – in which vehicles must automatically send sensor and location data to emergency services in the event of an accident – all new cars sold within the EU now include some level of GPS functionality. This regulation directly assists OEMs to deploy ISA systems, as the existing GPS architecture can already gather location and speed limit information.

The new EU safety regulations stipulate that ISA systems must display the legal speed limit to the driver as a minimum, although there are different methods by which this can be achieved. Vehicles may feature an embedded map, which can provide speed limits based on system information, or connected vehicles may receive updates via a location-based service. ISA can also be deployed by combining front-facing cameras with a digital mapping system and an electronic horizon.

Real-World Challenges

While the broad concept of ISA is relatively straightforward, there are many technical and environmental factors that can impact the system's effectiveness and reliability. Some human drivers may have a good understanding of speed limits in different locations and circumstances, but ISA systems using front-facing cameras face a number of technical challenges:

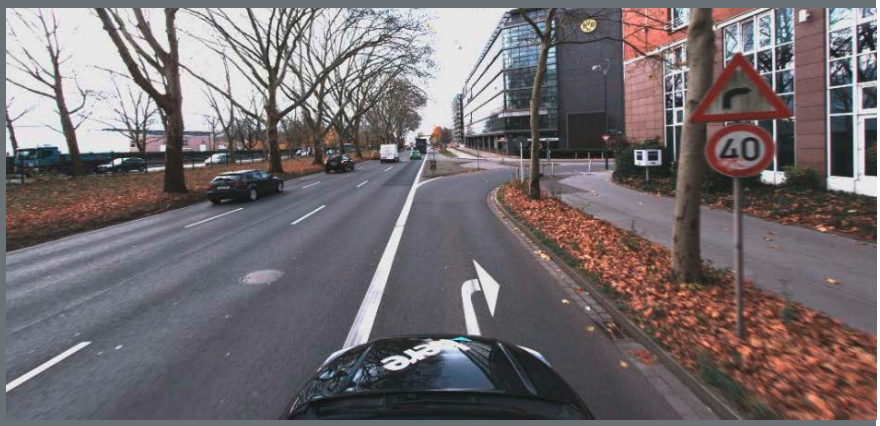
Speed limit signs are not always visible due to weather, damage or removal of signs, foliage growth, road construction, or lack of maintenance.

Speed limit signs are not always posted due to variability in speed limit sign density, or due to implicit speed limits for motorways, regional and urban areas, or school zones.

Built Up Area and End Built Up Area are not detected by sensor

Real-World Challenges

Some speed limits are conditional based on the time of day or year, weather conditions, or the specific lane in which the vehicle is driving.

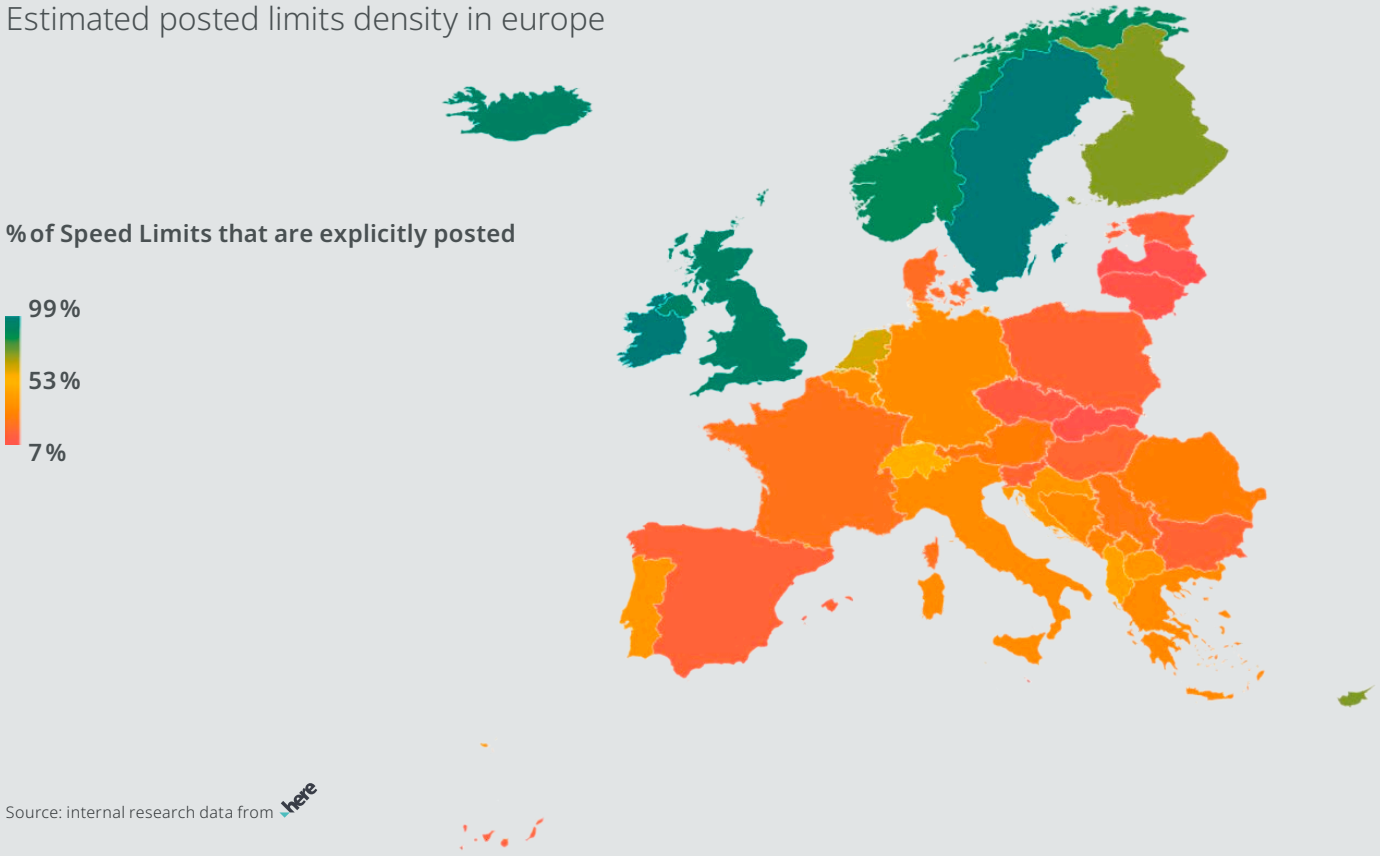


The SL40 has an arrow that indicates that the sign is meant for the upcoming right turn. This information is not received in the sensor data.

Some speed limits are contextual such as speed limit signs for trucks, which indicate the maximum legal speed for that specific vehicle and not all road users. These may be interpreted as general speed limits and create confusion within ISA systems.

This is a sensor limitation issue where the 50t weight limit sign is observed as a speed limit.

Estimated posted limits density in europe



Source: internal research data from here

Lack of Physical Speed Limit Signs in Certain Parts of the World

Across European countries, there is a large disparity in the density of explicitly-posted speed limit signs[4]. The frequency ranges from very high in the UK and Northern Europe, such as in Great Britain, Norway, and Sweden, to very low in Central, Southern, and Eastern Europe, in countries such as Spain, France, and the Czech Republic. This variance directly impacts the effectiveness of camera-only ISA systems, as they rely solely on visual information from the surrounding environment to advise the driver of the legal speed limit.

Implicit Speed Limits Based on Location

There are also many areas across Europe in which the legal speed limit is dependent on the circumstances or location and is not explicitly indicated with signage. For example, the German Autobahn uses signs to signify the end of applicable speed limits with a symbol rather than a number. Similarly, many built-up areas across Europe have a default speed limit of 50 km/h and may not feature a speed limit sign or may use a number of different colors and graphics.
Similarly, there are also circumstances in which vehicles approaching a junction may be required to reduce to a specific speed, but it is not indicated via a road sign. Speed limits can also change when crossing borders between countries or entering and exiting towns and suburban areas, which also may not feature explicit signage or may instead use a sign with a conditional limit.

Real-World Challenges

The 30SL has "0.3 KM" ahead condition on it. But we do not receive this information on the sensor data and so the sign is published.

Speed Limits Determined by Weather Conditions

In many areas of Europe, the legal speed limit varies depending on the weather conditions. In France, rain or snow reduces legal motorway speed limits from 130 km/h to 110 km/h, and rural roads from 90 km/h to 80 km/h. Similarly, most areas of Europe enforce a universal speed limit of 50 km/h in foggy conditions when visibility is less than 50 meters. While the adjusted speed limits are sometimes signaled on motorways via dynamic displays, they often rely on the driver's judgment in order to comply.

Other Environmental Variables

There are many other external factors that can impact the effectiveness of onboard vehicle cameras, in much the same way they may impair the vision of a human driver. Weather conditions such as fog, rain, and snow may limit visibility, foliage may cause obstructions, signs may be vandalized, or they may be damaged and not replaced for extended periods of time.

Considerations for Trucks and Commercial Vehicles

As the upcoming ISA mandate also applies to most trucks and commercial vehicles, consideration must also be given to their unique speed limit requirements. Across much of Europe, heavy trucks must often comply with substantially lower speed limits than passenger cars, particularly on motorways. There are also specific speed limit signs that apply only to vehicles exceeding a particular weight, which may be interpreted by onboard vehicle cameras as applying to all road users. OEMs will need to customize ISA functionality to suit specific vehicle types and ensure that cameras, maps, and electronic horizon technologies are equipped to differentiate between different vehicle classes.

Implementation Architecture Scenarios

There are several ways in which OEMs can implement ISA systems, depending on the selected technologies available within the vehicle. These can range from basic systems using only onboard vehicle cameras to more sophisticated architectures incorporating cameras, location data, digital maps, navigation, and electronic horizon technology.

Onboard Vehicle Camera-Only Implementations

Advantages

Front-facing onboard vehicle cameras are a fundamental technology in many ISA systems, capturing speed limit information that may otherwise go undetected due to driver distraction or visual limitations. Camera-only ISA implementations can effectively augment a human driver's field of vision and draw information from different sources in real-time, even when traveling at very high speeds.

Key Challenges

The limitation of camera-only ISA systems is their reliance on physical (i.e. posted) speed limit signs, and therefore they are only as accurate as the visual information in the immediate area. Where speed limits are either implicit, time, or location-based, or simply not represented with physical signs, onboard vehicle cameras have insufficient visual information with which to determine the current legal limit. Onboard vehicle cameras are also impacted by environmental conditions such as weather, low-light, foliage growth, and damaged or poorly-maintained signs, in addition to the variance of speed limit sign infrastructure throughout the EU.

Where physical signs are available, there is also the possibility that sensors may misinterpret their meaning or context and cause the ISA system to malfunction. Some examples include:

- Entry and exit ramps on highways, in which speed limit signs may appear on the exit ramp before the road branches, or contain no additional signs indicating that the speed limit is only valid for the exit ramp.
- "No overtaking" signs featuring symbols that may be identified as "end of speed limit" signs.
- Speed limits that come into effect only after a specified distance or are conditional to upcoming traffic light symbols.
- Speed limit signs on the back of trucks which only apply to that particular vehicle.
- Speed Limits applicable only to specific vehicle types or specific vehicle conditions e.g., carrying a trailer.

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Implementation Architecture Scenarios

- Detection of border changes when traveling through the EU and hence changes in default speed limits, or implicit speed limit rules.
- Complex driving scenarios in which the onboard vehicle cameras may detect multiple conflicting speed limit signs and may not be able to determine the correct limit.
- During vehicle turn maneuvers, in which the onboard vehicle cameras may recognize speed limit signs from other areas of the road.
- On close parallel roads, where the onboard vehicle cameras may not be able to distinguish the correct speed limit for a specific road.

Onboard vehicle cameras that misinterpret the meaning of signs can therefore relay inaccurate information, causing the ISA system to display the incorrect speed limit within the vehicle. This confusion can yield an unsatisfactory driving experience, erode the trust between drivers and their vehicles, and, ultimately, damage the reputation of the vehicle manufacturer.

Electronic Horizon + Maps

Advantages

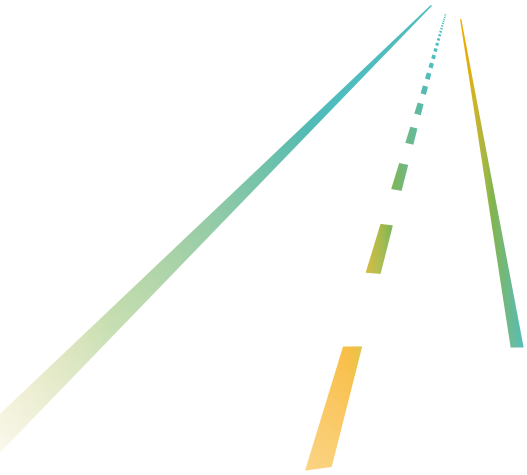
It is possible to implement ISA without the use of onboard vehicle cameras, instead determining the speed limit using GNSS (Global Navigation Satellite System) positioning data in combination with an electronic horizon utilizing either a static or connected map. Vehicle sensors are able to capture road and weather information in combination with the GNSS to determine the legal speed limit at any given location.

In addition to OEMs mitigating the costs of additional cameras, this combination carries the benefit of determining the legal speed limit irrespective of environmental conditions which may otherwise impair the effectiveness of cameras. Electronic horizon systems can also cache relevant map information to maintain the availability of data even in the event of the vehicle losing connectivity. For drivers, the combination of an electronic horizon and maps provides a reliable ISA offering while making the feature available across a broad range of vehicle models.

Key Challenges

The primary limitation of ISA systems without onboard vehicle cameras is that they are unable to draw visual information directly from the surrounding environment, and therefore depend on the availability and accuracy of digital map and electronic horizon data. Road construction, accidents, and temporary speed limit changes may not immediately relay to the driver via maps and electronic horizon, relying instead on the driver to maintain compliance. As this implementation does not include cameras, OEMs require a scalable, user-friendly update strategy – such as over-the-air updates – to maintain ISA accuracy and compliance.

Implementation Architecture Scenarios



Onboard vehicle cameras + Electronic Horizon + Maps

Advantages These ISA systems can draw information from multiple visual and embedded sources – such as onboard vehicle cameras, digital maps, and crowdsourced information about road sign content maintaining a high level of accuracy and allowing OEMs to offer additional ADAS functionality in vehicles with or without navigation systems.

A non-navigation ISA solution can be an effective method of optimizing vehicle material costs, particularly for entry-level vehicle models or trim levels.

In these cases, an embedded electronic horizon engine allows for the map info to be used by the vehicle to display legal speed limit information related to the current GNSS position. To display speed limit on the road ahead, the embedded electronic horizon engine of the vehicle may rely on most probable path (MPP) information.

Such ISA systems require either a manual update of the map data or can provide an automatic and reliable over-the-air update solution.

Where vehicles feature onboard navigation systems, they can be used to provide road details and speed limit information based on navigation routing. In cases where the map data is not up to date, navigation systems can be updated without changes to the core vehicle architecture.

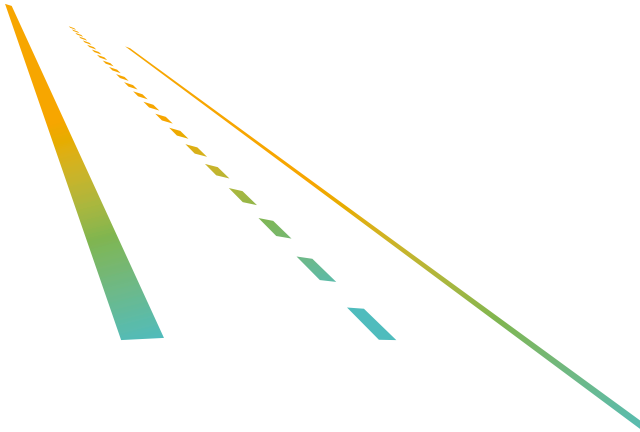
For drivers, a solution combining onboard vehicle cameras, electronic horizon, and digital maps provides the safest and most intuitive driving experience and helps to build greater trust not just with the ADAS system, but the vehicle itself.

Key Challenges ISA systems combining onboard cameras, electronic horizon, and maps still present challenges for OEMs as they require an update strategy to ensure the accuracy of the speed limit information. Some drivers may not be aware of the electronic horizon functionality or update requirements, and therefore solutions such as automatic over-the-air updates or increased consumer education to perform manual updates may be required to maintain an optimum user experience. These services also create additional costs for OEMs which need to be managed, while finding the desired balance between price and user experience.

Where in-built navigation systems are available, they can form an important component of a complete ISA solution. However, they also carry additional material costs for automakers, which, in some cases, may be prohibitive for entry-level vehicles or low-volume models released into small markets.

Conclusion

How Continental, HERE Technologies and Elektrobit have created an end-to-end ISA solution.



Through the continual research and development of ISA technology, it has become evident that the most robust, reliable, and accurate implementation of ISA is one that incorporates onboard vehicle cameras, electronic horizon, and digital maps into a combined embedded solution.

In a landmark collaboration between three of the automotive industry's most innovative companies, Continental, HERE Technologies, and Elektrobit are working together to create advanced solutions that enable OEMs to implement ISA in any new production vehicle and draw real-time information from multiple data points. This synergy ensures that the correct speed limit is always identified and displayed to the driver, regardless of time, location, weather, or any other external factors, supported by an automatic over-the-air update strategy to ensure ongoing compliance.

The Importance of Multiple Data Sources for Robust Implementation

The emerging ISA architectures incorporate vehicle sensors, digital maps, electronic horizon, and onboard vehicle cameras into a single system. Fusing multiple technologies and drawing location and speed limit information from a variety of sources ensures the greatest data accuracy and eliminates the variability of any single source.

Onboard vehicle cameras process visual information from the surrounding environment, displaying the legal speed limit within the vehicle to compliment the driver's own observations, or to alert the driver if they fail to observe a posted sign.

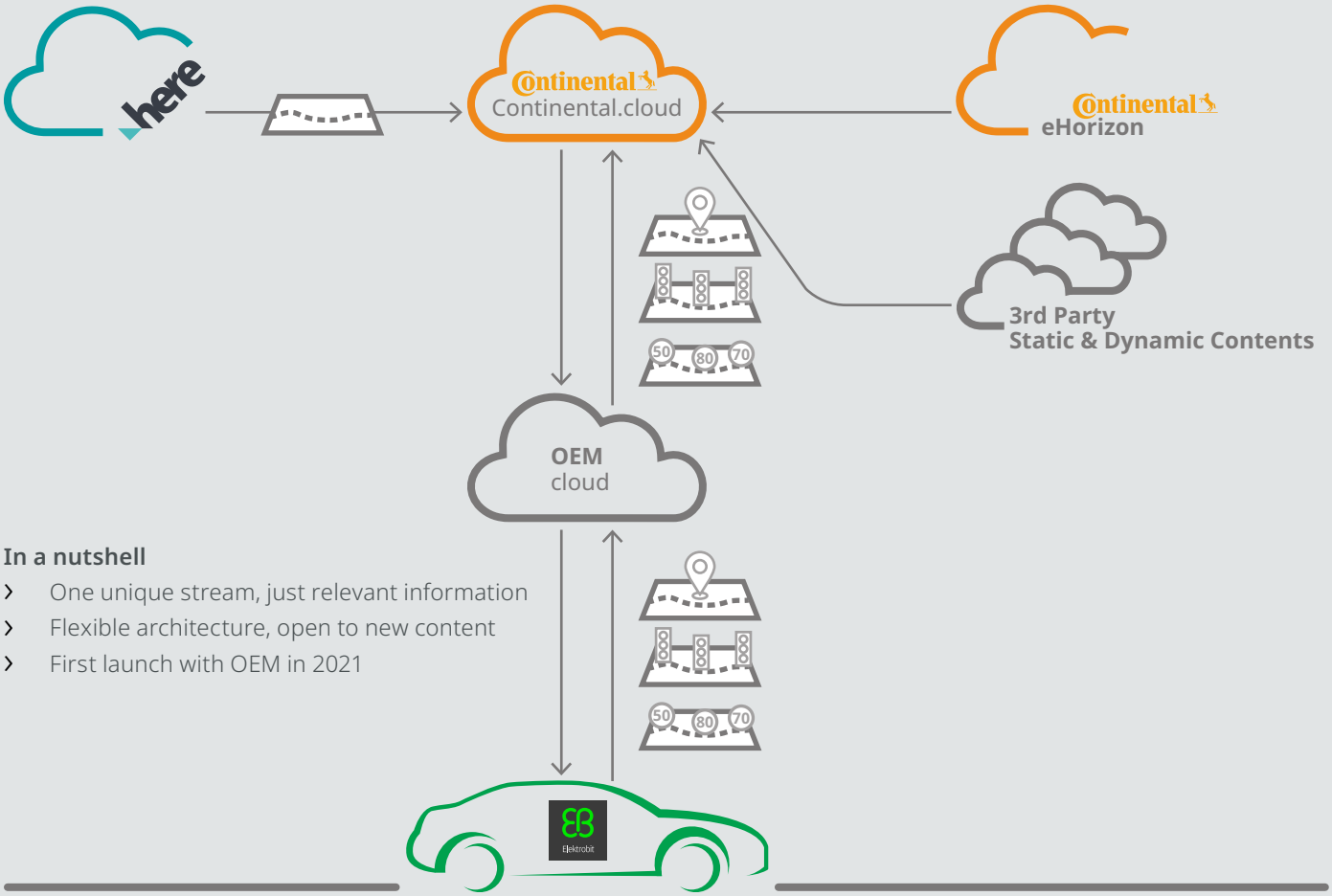
HERE Technologies offers a range of automotive-grade location technology products and services to effectively implement ISA systems across all vehicle models and trim levels. HERE Maps provide both explicit and implicit speed limit information in millions of vehicles for Navigation and ADAS systems. In addition, HERE Road Signs is a cloud service leveraging vehicle sensor data that delivers layers of up-to-date speed limit information to connected cars, giving road users the real-time data needed to prepare for changes along their journeys. HERE is the first in the industry to maintain the freshness of the map based on anonymized rich vehicle sensor data, pooled across multiple car brands. Drivers are then able to rely on accurate, fresh information, fed through their infotainment units or consumed by connected ADAS applications.

Elektrobit's EB robinos Predictor, electronic horizon solution makes the most recent map information available inside the vehicle, translating this data into actionable insights for the vehicle ECUs by using the ADASIS* map specification.

Continental's Electronic Horizon (eHorizon) is a cloud-based aggregation and distribution technology for connected map services, that provides predictive, accurate, and real-time data about the road ahead. Continental´s eHorizon platform combines HERE map information with Continental´s in-house developed services and sends it to Elektrobit's EB robinos Predictor. This flexible and scalable end-to-end solution provides automakers with access to a global, scalable solution that creates a safe, efficient and enjoyable driving experience.

*ADASIS (Advanced Driver Assistance Systems Interface Specification) defines an appropriate interface for exchanging information between the in-vehicle map database, ADAS, and automated driving applications. Leading car manufacturers, ADAS and software suppliers, map and data suppliers as well as navigation system manufacturers actively develop this specification.

The Global Platform for Connected ADAS and Automated Driving Use Cases



In a nutshell

- One unique stream, just relevant information
- Flexible architecture, open to new content
- First launch with OEM in 2021

Sharing Sensor Data to Keep Location Information Updated at Scale

With advanced eHorizon technology developed via collaboration between Continental, HERE Technologies, and Elektrobit, there is a growing network of connected vehicles sharing real-time road, weather, and speed limit information. This technology gives drivers a much clearer vision of the journey ahead and makes it easier to comply with all relevant speed and safety requirements. For OEMs, this advanced mapping and eHorizon technology significantly aids compliance with upcoming ISA mandates, improves vehicle safety ratings, and fosters stronger consumer confidence and trust.

Intelligent Speed Assistance is an innovative technology that has the potential to prevent thousands of deaths and serious injuries every year. With new safety regulations coming into effect over the next two years, OEMs face several unique challenges to deploy ISA technology at scale, while improving safety, reliability, and user-acceptance.

As a result of their joint collaboration, Continental, HERE Technologies, and Elektrobit have created a holistic, end-to-end ISA deployment solution that draws accurate information from several key systems, resulting in a more intuitive and vastly safer driving experience for all road users.

Further Resources

To learn more about building trust in automation using location technology, electronic horizon, and platform capabilities, view a **free webinar** featuring speakers from HERE Technologies, Elektrobit, and Continental.

Continental develops pioneering technologies to make commercial transport safer, more efficient, and more connected. The company's products and services deliver measurable impact for commercial vehicle manufacturers and the aftermarket. They benefit from a broad portfolio and from fully integrated systems. The portfolio includes tires, digital tire monitoring, fleet management, telematic solutions, Electronic Logging Devices (ELD) and tachographs, hoses, air springs, Electronic Control Units (ECU), displays, drivetrain, and exhaust aftertreatment systems, sensors, advanced driving assistance systems, as well as eHorizon maps and events and cloud-based services.

HERE Technologies, a location data and technology platform, moves people, businesses, and cities forward by harnessing the power of location. By leveraging our open platform, we empower our automotive customers to achieve better outcomes – from providing dynamic content based on real-time car probe data, developing software-as-a-service navigation solutions, increasing the reliability of ADAS, and supporting the development of HAD systems.

Elektrobit (EB) is an award-winning and visionary global supplier of embedded and connected software products and services for the automotive industry. A leader in automotive software with over 30 years serving the industry, EB's software powers over one billion devices in more than 100 million vehicles and offers flexible, innovative solutions for car infrastructure software, connectivity and security, automated driving and related tools, and user experience. EB is a wholly-owned subsidiary of Continental.

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