

Vehicle Technologies and Standards Inventory

1. Light passenger and commercial vehicles excluding motorcycles and mopeds ([MA, MB and MC, MD, NA class vehicles](#))

a) Continuous Driver Support

Description	Evidence of effectiveness	Extent of regulation: (1) Is fitment required in Japan, Australia, Europe or USA? (2) Does a standard exist for the technology?	Extent of fitment in new and used vehicles	Can it be retrofitted?	ANCAP	Other actions to increase uptake e.g. promotion	High level assessment of potential to improve safety outcomes
<p>Acoustic vehicle alerting systems (AVAS)</p> <p>Systems to increase awareness of road users, particularly cyclists and visually impaired pedestrians, to compensate for the quietness of electric motors in both hybrid and fully electric vehicles.</p>	<p>Electric cars and conventional electric hybrid cars operating solely on electricity emit almost no sound at low speeds, potentially posing a threat to cyclists and pedestrians. Requiring a vehicle to emit a noise should improve safety.</p> <p>A US statement says the so-called ‘quiet-car rule’ would prevent 2,400 injuries in the year 2020.</p>	<p>The EU is in the process of mandating for all electric vehicles to be fitted with AVAS by 2019. The US requires manufacturers to install this technology by September 2019. The United Nations has passed a regulation requiring AVAS to work on vehicles travelling between 0 – 20km/h, and Japan has published guidelines.</p> <p>Standards</p> <p>US Pedestrian Safety Enhancement Act of 2010 (S. 841)</p>	<p>Unknown.</p> <p>Toyota apparently already equips its hybrid models such as the Prius sold in Japan and the US to emit a sound when the engine is run. Similarly, some models of the Nissan Leaf and Mitsubishi Outlander sold in Japan and the US are fitted with noise generators.</p> <p>However, there are definitely relevant vehicles in use and being manufactured that do not have the technology.</p>	<p>In principle, but we do not know of actual implementations.</p>			<p>Could avoid future problems. At present, market penetration of EVs and conventional electric hybrids is too small for risk to be measured.</p> <p>Included in the Vehicle Standards Map.</p>

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<p>Adaptive cruise control</p> <p>Maintains the driver-set vehicle speed, adjusts the vehicle's speed to that of a preceding vehicle, and helps to maintain a pre-selected headway time to the vehicle ahead.</p> <p>Almost always paired with a pre-crash system, which will either warn the driver if a crash is likely, or will autonomously take action to stop the collision from occurring.</p>	<p>Can improve road safety when used on motorways with non-congested traffic or when used with low to moderate traffic density and when it is dry with no extreme weather conditions.</p> <p>Can reduce road safety when used in busy traffic and on rural and non main urban roads, or when used in busier traffic, as it can result in more lane change manoeuvres, a faster speed of these manoeuvres, and a smaller gap used when merging with another lane.</p> <p>A US study estimated that when vehicles are travelling at 88 km/h or over, 5.2% of crashes could be avoided, at speeds of 48 km/h and over, 29% could be avoided.</p> <p>Using "Stop and Go" ACC systems can result in users increasing their mean speeds, and decreasing their headway. Less advanced systems did not have these effects.</p>	<p>Not mandated.</p> <p>Standards</p> <p>ISO 15622:2010</p> <p>ISO 22179:2010</p> <p>SAE Std J2399</p>	<p>Partial adaptive cruise control (does not bring the vehicle to a complete stop) has is becoming more widespread.</p> <p>LINK</p>	No	NOT considered to be a Safety Assist Technology (SAT) by ANCAP.	Promoted by rightcar.govt.nz	
<p>Advanced (Adaptive) front lighting systems</p> <p>Headlamps that can steer and change pattern automatically depending on conditions. For example, systems may detect oncoming vehicles and switch from full beam to dipped, or may even split the full beam around the approaching vehicle. Headlamps also point into corners and self-level.</p>	<p>Most of the research in this area has been based around driving simulator experiments and this has shown that the system is beneficial for hazard detection and identification. The potential to reduce overall road crashes is estimated at around 0.5%, but optimistic estimates put it at 8%. An Insurance Institute for Highway Safety (IIHS) study appears to show real-world benefits above the higher end of this range, at about 10%.</p>	<p>Not mandated.</p> <p>Automatic high beam headlight technology is currently banned for use in the US.</p> <p>Standards</p> <p>ADR 13 (ECE 48 and ECE 123)</p>	<p>Fitted in some new vehicles. Variants have been deployed by Audi, Mazda and others.</p>	No	Considered to be a Safety Assist Technology (SAT) by ANCAP.	Promoted by rightcar.govt.nz	

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<p>Alcohol interlock</p> <p>An electronic device which prevents the use of a vehicle if alcohol is detected in a breath sample.</p>	<p>Studies show a drink driving recidivism reduction of between 28-65% when an interlock is used, when compared with groups who did not use the interlock.</p> <p>In another study, participants who were in the interlock programme were 15% to 69% less likely than controls to be re-arrested for drink driving.</p> <p>There is evidence that offending reduces while the interlock is installed in the vehicle but it can revert to previous levels once the interlock is removed. Interlock programmes are increasingly trying to incorporate alcohol and drug treatment into the programme to reduce the chances of recidivism once the interlock is removed.</p>	<p>Several jurisdictions, including New Zealand, most states in Australia, Canada, USA and Scandinavia apply interlocks as sentences imposed by the courts. In some jurisdictions (eg. Victoria, Australia) the interlock is a mandatory sentence if the qualifying offence criteria are met.</p> <p>Standards</p> <p>78 FR 26849</p>	<p>Optional in some new vehicles, such as BMW. Not known to be available in New Zealand (BMW would not set them for our 0.08 BAC).</p> <p>Sweden has considered making interlock technology a standard feature of all vehicles.</p> <p>Around 150 have been installed in New Zealand vehicles as part of drink-driving criminal convictions LINK.</p>	Yes	Considered to be a Safety Assist Technology (SAT) by ANCAP.		There is a reasonable potential to improve safety outcomes if they are applied in certain ways (e.g. they are mandatory sanctions, they are integrated with good quality treatment or rehabilitation and they are affordable).
<p>Automatic headlamps</p> <p>Headlamps that turn on automatically in response to low light levels.</p>	<p>It is common for drivers to neglect to turn on headlamps when visibility is poor but it is not actually dark, so automatic headlamps can be expected to improve the conspicuity of many vehicles in these conditions.</p> <p>Any extra benefit from automatic headlamps would be reduced if daytime running lights were also fitted.</p> <p>No research known for automatic headlamps, but research for daytime running lamps, which often includes headlamps, is relevant. The research suggests that automatic headlamp use in low light conditions is desirable.</p>	No known regulation.	Have been available since 1970s. Common on Japanese vehicles since the mid-2000s.	Yes, kits are available (approx \$80) but retrofitting is unlikely to be common.	Considered to be a Safety Assist Technology by ANCAP.	Promoted by rightcar.govt.nz Main selling point may be avoiding a flat battery from leaving headlamps on.	Low. Potential is reduced by daytime running lights (DRLs).

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<p>Automotive night vision</p> <p>System to improve a driver's perception, especially of people or obstacles on the road, at night or in conditions of low visibility. May use infra-red, radar or image processing to show the road ahead on a screen or head-up display.</p>	One study found that if market penetration was at 70% for this system, this could lead to a 17.5% reduction in road user crashes occurring in low visibility.	No known regulation.	Available in a few high-end vehicles since mid-'00s.	Yes, kits are available – including fairly simple and cheap kits.	Considered to be a Safety Assist Technology (SAT) by ANCAP.		Overtaken by AEB.
<p>Connected vehicle systems</p> <p>Connected vehicles (also known as Cooperative intelligent transport systems (C-ITS)) communicate with each other several times per second, and can warn drivers or vehicles of hazards beyond line of sight, or share information, entertainment and data.</p>	Research based on work conducted at the University of Michigan's Transport Research Institute, a world leading lab working on connected vehicle deployment, estimated that connected vehicles may address up to 80% of unimpaired crashes.	The US issued a notice of proposed rulemaking, on 13 December 2016. Some European car makers planning for voluntary deployment. No official proposal for regulation in EU or Australia, but strong expectation that this will eventuate as technology matures.	Some Japanese vehicles will be fitted with New Zealand non-compliant connected vehicle systems from 2015, but these are not expected in New Zealand in significant numbers until 2022.	Yes, with dedicated receivers and possibly with smartphone apps, but will likely exclude those systems that actively intervene.		Included as a key area of work under ITS Technology Action Plan 2014–2018	Expected to have a high safety and network efficiency benefits once commercialised.
<p>Crosswind assist</p> <p>A system that reacts to strong gusts of wind with targeted braking or suspension dampening to help prevent a vehicle from being blown out of the lane.</p>	The manufacturer shows some evidence of effectiveness and anecdotal evidence suggests it will increase safety.	No known regulation.	Available only in some high level Mercedes cars and vans.	In theory, as it is software applied to existing ESC systems.			

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<p>Daytime running lamps (DRLs)</p> <p>Lamps that are designed to increase a vehicle's visibility during the day. They turn on with the ignition and generally turn off when the headlamps are used.</p> <p>Ideally, DRLs are specially designed, dedicated lamps, but dipped headlamps may be used, or special settings for existing lamps (e.g. turn indicators or low power headlamps).</p> <p>DRLs have been shown to improve:</p> <ul style="list-style-type: none"> • Visibility – the possibility of being seen at all • Conspicuity – the likelihood of being noticed • Judgement of distance and approach speed • Identification of the type of vehicle. 	<p>Many studies find a strong safety benefit from DRLs but, overall, findings are mixed, with some studies finding no benefit</p> <p>It is likely that some of the less promising findings are due to the inferior performance of older headlamps as DRLs, compared to LEDs. A comprehensive analysis of 25 DRL studies carried out for the European Commission in 2003 concluded that the use of DRLs reduces the number of multi-party daytime accidents for cars by about 5-15% and has a benefit-cost ratio greater than 1. However, another analysis of the same studies found that a mean effect of only 5.9% could be supported and that a benefit-cost ratio greater than 1 could not be confirmed.</p> <p>The use of headlamps as DRLs has a direct cost due to extra fuel use (and flat batteries from accidentally leaving lights on). This has counted against mandating headlamp use during the day in NZ. LED-based DRLs are much more efficient, as well as more effective, and make it more likely that the benefits out-weigh the costs.</p> <p>The enhanced conspicuity of cars with DRLs has led to concerns that vulnerable road users, such as pedestrians, cyclists and motorcyclists, might become relatively less conspicuous, and so "masked" by the DRLs. Some studies suggest that a masking effect is possible, though no studies have shown an effect on safety. This potential risk could be mitigated by using low-output DRLs for cars and trucks, or by using distinctive lamps (colour, shape, flashing) for vulnerable vehicles.</p>	<p>Mandatory for new model vehicles in the EU and Canada. Russia requires the use of headlamps or DRLs during the day.</p> <p>Standards</p> <p>UN Regulation 87 and other standards exist.</p> <p>UN standards require DRLs to be white, but NZ allows amber (as does North America).</p> <p>In Canada and the USA, turn indicators may be used as DRLs.</p> <p>Italy, Hungary and Romania require daytime running lamps outside populated areas.</p>	<p>Not known, but quite low. Increasingly common for new cars – and often used as a styling element.</p>	<p>Yes – around \$150-250.</p> <p>It is possible to fit vehicles with a device that will automatically activate DRLs when the ignition is switched on but is overridden by full strength headlights.</p>	<p>Considered to be a Safety Assist Technology (SAT) by ANCAP.</p>	<p>Promoted by rightcar.govt.nz</p> <p>Promotion to fleet operators.</p>	<p>Significant use in fleets.</p> <p>Included in the Vehicle Standards Map.</p>

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<p>Fog lamps</p> <p>Front or rear lamps which help a driver to see in foggy, misty, dusty or snowy conditions and make the car more visible to other drivers. Fog lamps have a diffuse, rather than focussed light pattern and are ideally positioned low to avoid reflection back towards the driver or glare for other road users.</p>	<p>Studies have found that fog lamps do not provide better visibility for objects on the road. There is little evidence that current fog lamps offer visual benefits that will improve safety.</p> <p>Studies by the US National Highway Transport Safety Administration (NHTSA) on light transmission through windscreens suggest that measurable reductions in visibility do not seem to correspond to reductions in safety. A likely explanation is that drivers respond to lower visibility by reducing speed and taking more care. Similar considerations may apply to lighting.</p> <p>Rear fog lamps may be more promising, as they make a vehicle more visible to drivers following.</p> <p>Fog lamps are usually white, but most jurisdictions permit (and France used to require) a colour known as 'selective yellow', as it was once believed that these would cut through fog better (due to less scattering of longer wavelengths). That theory is not correct; however, there is some evidence that yellow beams might be easier to see in poor light conditions.</p>	<p>Fog lights can dazzle other road users, so all jurisdictions define performance standards that must be met for the lamps, and have fitting and use requirements.</p> <p>Standards</p> <p>UN Regulation 19 UN Regulation 48 SAE J583.</p>	<p>Fairly common on European and imported used Japanese vehicles.</p>	<p>Yes, numerous options less than \$100.</p>			
<p>Head-up display</p> <p>A visual display of information that appears directly in front of the driver, rather than on the dashboard, and so can be seen with the head up, and without directing the gaze away from the road.</p> <p>Usually the display is reflected off the windscreen or off a subsidiary screen, but other technologies are possible – including head-mounted displays such as Google glasses.</p> <p>Some smart-phone apps are designed to reflect a head-up display off a windscreen.</p>	<p>The length of time that a driver's gaze is diverted from the road is a key measure of risk from distraction (see MoT research papers about driver distraction and technology), so head-up displays have a theoretical safety advantage over other displays. On the other hand, the complexity of the information that might justify a head-up display could be a distraction in itself.</p> <p>While there is much research on driver distraction, little is known about the safety effect of new ways of presenting information.</p> <p>Head-up displays could be used to improve safety by displaying collision avoidance or perception enhancing information, such as night vision.</p>	<p>No known standards. Some uses of head-up displays might conflict with rules in most jurisdictions that prevent, for example, drivers watching television.</p>	<p>Has been available in a few cars since the '80s, but only recently have cars provided enough information to drivers to justify an extra display.</p> <p>Several vehicle manufacturers now offer head-up displays, and they are also being promoted by major electronics manufacturers.</p>	<p>Yes, though there are currently few options.</p> <p>Some smart-phone apps are designed as head-up displays.</p>			

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<p>High intensity discharge (HID) headlamps</p> <p>High intensity lights which use an electric arc rather than a filament, and which are more efficient and up to three times brighter than normal headlights.</p>	<p>Studies have found drivers using these headlights were better at detecting roadside hazards such as pedestrians. Off-axis visual performance is also improved.</p> <p>There are, however, concerns (especially in the USA) that the lights cause glare for other drivers, which could lead to worse outcomes.</p> <p>HID headlamps produce more light of a shorter wavelength than halogen lamps, so have a distinctive blue colour. This, independently of brightness, both improves visibility and increases discomfort from glare.</p>	<p>Not mandated.</p> <p>Standards</p> <p>Subject to the same requirements as other headlamps.</p> <p>ECE regulation 48 additionally requires lamps to be self-cleaning and self-levelling.</p>	<p>Available since the early '90s. Very common on used imports from Japan.</p>	<p>No as none of the aftermarket kits meet approved standards.</p>			
<p>Intelligent speed adaptation or assist (ISA)</p> <p>A system that uses GPS location information combined with a comprehensive map or road sign recognition to either help or force the driver stay within posted speed limits. These systems can provide an auditory or visual reminder to drivers that they are exceeding the speed limit, or take control of the vehicle to control speed.</p>	<p><u>Studies</u> into the effectiveness on ISA systems vary in their predictions for the technology, but most provide estimates in the range of around 10-20% reduction for injury crashes and by around 7-24% reduction in fatalities.</p>	<p>No known regulation</p> <p>Australia is a leader in the development of aftermarket systems, including a mobile application developed by Transport for NSW.</p>	<p>Unknown, though several brands of GNSS device warn drivers if they exceed the speed limit. Several cellphone apps also provide speed limit information and can function as ISA.</p>	<p>Yes, can be incorporated into global navigation satellite system (GNSS) navigation device or smartphone application.</p>	<p>Considered to be a Safety Assist Technology (SAT) by ANCAP which promotes [Intelligent] speed assist systems..</p>	<p>Promoted by rightcar.govt.nz</p>	<p>It may be possible to mandate ISA in aftermarket driving aids, e.g. GNSS systems, though this would require a nationwide map of speed limits.</p> <p>Contributes to Safe System approach to speed.</p> <p>Included in the Vehicle Standards Map.</p>

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<p>Position marker lamps</p> <p>Lamps on the side, back and front of vehicles which help to make a vehicles position and direction of travel clearly visible from different angles. Usually these are mounted at the edges of a vehicle, to give an indication of its outline.</p>	<p>One study found that side marker lamps reduce the number of night time angle collisions by 16% and personal injuries in these crashes by 21%.</p> <p>Lamps were not found to have an effect on fatalities, as when collisions of this type occur, vehicles are generally travelling at too high of a speed to stop or substantially slow down.</p>	<p>Side marker lamps mandated in the US since 1970.</p> <p>Standards</p> <p>Federal Motor Vehicle Safety Standards (FMVSS) 108</p> <p>UN Regulation 48 revision 6</p> <p>Land Transport Rule 32005</p>					
<p>Seat belt interlocks</p> <p>A vehicle can only be started when the vehicle's occupants have fastened their seat belts thereby increasing seat belt usage.</p>	<p>Research undertaken considered a scenario where seat belt interlocks were made mandatory in all new vehicle models from 2015 onwards. Results used to estimate a best case estimate of the potential effectiveness of seat belt interlocks showed that by 2030 there would be a potential 2% reduction in injuries requiring hospital admission and a 7% reduction in fatalities. The reductions would apply on top of any casualty savings made through enhanced vehicle technologies, infrastructure and regulations.</p> <p>Low cost technology for vehicles that have already seat belt reminders; however, may not provide much benefit over reminders.</p>	<p>No known regulation.</p>			<p>Considered to be a Safety Assist Technology (SAT) by ANCAP.</p>	<p>Promoted by rightcar.govt.nz</p>	
<p>Seat belt reminder</p> <p>Warns a driver with auditory and visual cues if a seat is occupied but the seat belt is not being used. Some systems are concerned only with the driver's seat belt, while others analyse all seating positions.</p>	<p>US studies found a 7% increase in seat belt use among drivers of cars with seat belt reminders.</p> <p>A Swedish study found reminders increased seat belt use by up to 17%.</p>	<p>North America mandated an audiovisual seat belt reminder system in the 1970s.</p>	<p>Common in most vehicles manufactured since the 1990's.</p>		<p>Required on front and 2nd row seats for a 5-star rating. From 2017 will be required on front seats for a 1-star rating.</p>		

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<p>Smart key</p> <p>Allows driver to keep key fob in pocket when unlocking, locking and starting their vehicle. Some have additional features such as preventing vehicles from exceeding certain speeds when a given key is used, and setting the stereo, steering wheel position, mirror positions and seat positions to user preferences.</p>	No research found about the safety effects of this technology.	Not mandated. Standards ISO 15693 ISO 14443	Becoming more common in newer vehicles.	Yes, although many of the safety features associated with the key wouldn't be able to be retrofitted.	Considered to be a Safety Assist Technology (SAT) by ANCAP.	Promoted by rightcar.govt.nz	
<p>Speed limiters</p> <p>A speed limiter is a governor used to limit the top speed of a vehicle.</p>	An Association for European Transport study in 2007 found that speed limiters in light goods vehicles could reduce accidents by about 3 %.	Not mandated in light vehicles, but common in heavy vehicles in Europe	Many new vehicles have speed limiters that are set at a high speed by vehicle manufacturers.	Yes	ANCAP does not support speed limiters.		
<p>Traffic sign recognition</p> <p>Uses cameras and image processing to enable a vehicle to recognise traffic signs, especially speed limit signs.</p>	The feature is useful to remind drivers of local speed limits, especially where they may have been altered temporarily. The system would have direct safety benefits if linked to an adaptive cruise control or intelligent speed adaptation system (discussed separately).	Not mandated and no evidence for any standards to define the application.	Technology fitted to a limited range of European vehicles, eg. Ford, Volvo and BMW.	Yes Several cellphone applications are available. Mobileye manufactures a camera based technology that can be fitted.	Considered to be a Safety Assist Technology (SAT) by ANCAP.	Promoted by rightcar.govt.nz	Useful for detecting temporary speed limit changes, such as around road works but information can generally be provided using map based tools.. May be replaced by wireless communications with connected vehicle technology

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<p>Workload manager</p> <p>Limits non-essential driver information and telematics activity if it determines driver is distracted or overloaded (e.g. blocks phone calls if a driver is turning at an intersection).</p> <p>May allow interaction with connected devices (e.g. cellphone, mp3 player) via voice command, and also 'read out' information, removing the need for physical or visual contact with the device.</p>	<p>No research found about the safety effects of this technology; however, distraction is known to be an important crash risk factor.</p>	<p>No known regulation.</p>	<p>Several proprietary systems exist in new cars, especially US & European – Ford Sync a notable example.</p>	<p>Unclear.</p>	<p>Considered to be a Safety Assist Technology (SAT) by ANCAP.</p>	<p>Promoted by rightcar.govt.nz.</p>	

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b) Collision Avoidance

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<p>Active rollover protection</p> <p>Recognises when a rollover is likely to happen and applies brakes selectively to resist the rollover. It is an enhancement of electronic stability control (ESC) that adds a sensor specifically to detect impending rollover independently of vehicle yaw (horizontal turn).</p> <p>This term is apparently also sometimes used to refer to roll bars that deploy actively (i.e. they pop up) in the case of a rollover – as are fitted to some convertible cars (although roll bars are technically a <i>passive</i> safety feature).</p>	<p>ESC is already very effective at preventing rollovers, but may not detect rollovers caused by hitting an object (such as the kerb), where there is little discrepancy between steering input and vehicle yaw. The extra sensor should make the system more effective, but we know of no specific research.</p>	<p>No known regulation.</p>	<p>May be hard to determine as it is often combined with ESC.</p>	<p>No.</p>	<p>Considered to be a Safety Assist Technology (SAT) by ANCAP.</p>	<p>Promoted by rightcar.govt.nz</p>	
<p>Advanced tow assist</p> <p>Allows drivers to reverse trailers into position automatically using surround camera systems.</p>		<p>No known regulation.</p>	<p>Available in VW Passat.</p> <p>Will be introduced on new Land Rovers in 2017.</p>				
<p>Autonomous emergency braking (AEB)</p> <p>Detects when a frontal collision is imminent and applies the brakes automatically to either prevent the collision or reduce its severity (Forward Collision Warning with Auto Brake).</p> <p>Some systems specifically look for pedestrians or cyclists, as well as other cars.</p>	<p>Research indicates significant benefits in the order of a 20-30% reduction in crashes. Effectiveness varies depending on type of system (whether radar or video-based, effective speed range etc).</p> <p>The US Insurance Institute for Highways Safety has found AEB reduces the chances of a rear-end collision by 40%.</p>	<p>Level 1 performance requirements mandatory in the EU for</p> <ul style="list-style-type: none"> • New type approval - 1 November 2013 • All new vehicles – 1 November 2015 <p>In the US 10 manufactures (including 2 of the big 3) have committed to making AEB standard in all new vehicles.</p>	<p>Very low market penetration at present – well under 1% of new vehicles at present.</p>	<p>No</p>	<p>Considered to be a Safety Assist Technology (SAT) by ANCAP.</p>	<p>Promoted by rightcar.govt.nz</p>	<p>Included in the Vehicle Standards Map.</p>

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<p>Blind spot warning system</p> <p>Senses cars coming up in drivers' blind spot behind or alongside their vehicle, and if the drivers' turn signal is on, it will alert them not to change lanes.</p>	<p>Studies have found that injury claims and property liability claims did decrease, however the results were not statistically significant.</p> <p>Studies indicate that the systems do increase the use of turn signalling, and no negative behaviour adaptations were observed.</p>	<p>Not mandated.</p> <p>Standards</p> <p>SAE Recommended Practice 2802.</p>	<p>Becoming available in a greater number of vehicles.</p>		<p>Considered to be a Safety Assist Technology (SAT) by ANCAP.</p>	<p>Promoted by rightcar.govt.nz</p>	<p>No formal assessment. Appears beneficial and is likely to be fitted due to driver demand.</p> <p>More scope for benefits in heavy vehicles</p>
<p>Brake assist system (BAS)</p> <p>Also known as brake assist (BA) or emergency brake assist (EBA)</p> <p>Drivers often do not fully apply their vehicle's brakes in an emergency stop, perhaps for fear of losing control of the vehicle, or because they do not realise how hard the pedal must be depressed. BAS is able to identify emergency stops by measuring the speed and force with which the pedal is depressed (and, in some cases, by how quickly the accelerator is released) and will automatically override the driver's input to fully apply the brakes. BAS works in conjunction with ABS, which pulses the brakes to prevent wheels from locking up.</p> <p>BAS can minimise the stopping distance of a vehicle and help to avoid a collision or reduce its severity.</p>	<p>A limited study of German accident data carried out by Mercedes Benz attributed a 13% reduction in car vs. pedestrian crashes (resulting in deaths or serious injury) and an 8% reduction in rear-end crashes for Mercedes vehicles equipped with Emergency Brake Assist.</p> <p>A 2004 study estimated that brake assist technology in passenger cars could reduce the German road toll by approximately 4% overall.</p> <p>Research by Transport Research Laboratory (TRL) has shown an effectiveness of 4 -16 % for vulnerable road crashes (involving cyclists and pedestrians) (Lawrence et al, 2006). Other studies have reported indicative effectiveness estimates of 6 -15 % for other crash types (Page et al, 2005, 2009; Breuer et al, 2007).</p>	<p>Jan 2009 - European Commission introduced Regulation (EC) No 78/2009 which requires that all new light passenger vehicles and light commercial vehicles be fitted with BAS in accordance with a phased in schedule from 2009 -2015.</p> <p>Jan 2014 – Australia mandated fitment of BAS as follows:</p> <p>2015 – all new models</p> <p>2016 – existing models of passenger vehicles</p> <p>2017 – existing models of light commercial vehicles.</p> <p>Standards</p> <p>UN Regulation No.13-H (R 13-H) includes requirements for BAS.</p>	<p>Probably over 90% for new passenger vehicles (based on fitment in Australia); less for light commercials.</p> <p>Lower for used imports, but more common than ESC, and seems to always be present if ESC is.</p> <p>ESC has been mandated for passenger vehicles in Japan from 2012 (new models) and 2014 (all models); and will be mandated for LCVs from 2015 (new) and 2017 (all) – so we assume these vehicles will also have BAS.</p>	No.	<p>Considered to be a Safety Assist Technology (SAT) by ANCAP.</p>	<p>Promoted by rightcar.govt.nz</p>	<p>Effectively mandated through ESC rule change.</p>

1. Light passenger and commercial vehicles excluding motorcycles and mopeds ([MA, MB and MC, MD, NA class vehicles](#))

b) Collision Avoidance

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<p>Brake override system</p> <p>Allows the brake to override the accelerator if both are applied. Most easily fitted to electronically actuated 'drive-by-wire' systems.</p>	<p>Seems to be mainly a response to US concerns about sudden unintended acceleration events, in which vehicles have reportedly accelerated by themselves. The phenomenon is controversial and in many cases appears to be caused by driver error.</p>	<p>No known regulation.</p>					
<p>Cross-traffic alert</p> <p>Uses radar or a camera to detect traffic approaching from the side of a reversing car and alert the driver. Can potentially trigger automatic braking.</p>	<p>Compensates for the fact that a driver reversing out of a garage or parking space often cannot see cross-traffic until the car has entered its path.</p>		<p>Available on some new cars, usually packaged as part of blind spot warning systems.</p>	<p>Yes – in principle.</p>			
<p>Electronic brake-force distribution (EBD)</p> <p>Optimises the braking effort on all four wheels to maximise deceleration.</p>	<p>No study into effectiveness. Tends to be packaged with ESC/EBA technology.</p>	<p>No known regulation.</p>	<p>Common in vehicles in NZ.</p>	<p>No</p>	<p>Considered to be a Safety Assist Technology (SAT) by ANCAP.</p>		<p>Effectively mandated through ESC rule change.</p> <p>More scope for benefits in heavy vehicles.</p>

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<p>Electronic stability control</p> <p>ESC uses braking and, usually, traction control to prevent loss of control. The system uses sensors to detect loss of control by comparing steering input with vehicle movement. It automatically applies braking or power to the relevant wheels to keep the vehicle on its intended path.</p>	<p>A Monash University study found a 32% reduction in single-vehicle crashes resulting in driver injury. 8% reduction in multi-vehicle crashes and 82% reduction in SUV Rollovers.</p>	<p>Mandated in the for all new and used light passenger and commercial vehicles entering the New Zealand fleet over 2015 to 2020.</p> <p>Mandatory in Japan for:</p> <ul style="list-style-type: none"> • all new passenger vehicle models – October 2012 • all passenger vehicles – October 2014 • all new light commercial vehicle models – 1 November 2019 • all light commercial vehicles – 1 November 2021 <p>Mandatory in Australia for:</p> <ul style="list-style-type: none"> • all new passenger vehicle models – November 2011 • all passenger vehicles – November 2013 (1 January 2011 in Victoria) • all new model light commercial – November 2015 • all light commercial- November 2017 <p>Mandatory in the EU for:</p> <ul style="list-style-type: none"> • all new passenger and light commercial models - November 2011 • all passenger and light commercial – November 2014 <p>Mandatory in USA Phased in from September 2008. All cars required to have ESC by September 2011.</p> <p>Standards GTR 8</p>	<p>Over 90% for NZ new vehicles, substantially lower for used imports.</p>	<p>No</p>	<p>Required by ANCAP to achieve 5 stars since 2008.</p>	<p>Promoted by rightcar.govt.nz</p> <p>Mandated in New Zealand in the Land Transport Rule: Light-vehicle Brakes Amendment 2014</p>	<p>The increase in ESC fitment in New Zealand over the next two decades is expected to prevent 432 deaths and 1992 serious injuries, including 22 deaths and 102 serious injuries prevented as a direct result of mandating the technology.</p>

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<p>Emergency stop signal</p> <p>Systems designed to indicate emergency braking to following vehicles and reduce the chance of rear end collisions.</p> <p>Such systems may indicate heavy braking by flashing the rear brake lights, increasing their intensity or by additionally flashing the hazard lamps. Brake assist systems that anticipate emergency braking by measuring the speed with which an accelerator pedal is released also allow the brake lights to switch on before braking commences.</p>	<p>Likely to be particularly useful in offsetting the increased risk of rear end collisions from systems that improve emergency braking (e.g. brake assist, autonomous emergency braking).</p> <p>Studies estimated that if systems reached 70% market penetration in the German passenger vehicle fleet, then 25% of rear-end crashes in moving traffic and 15% in stationary traffic would be affected, and this would lead to a 14% reduction in these types of crashes.</p>	<p>No known fitment requirement.</p> <p>Permitted in NZ by Land Transport Rule: Vehicle Lighting Amendment 2011.</p> <p>Standards ADR 13/00. ECE 48.</p>	<p>Available on an increasing number of new vehicles.</p>	<p>Unknown</p>	<p>Considered to be a Safety Assist Technology (SAT) by ANCAP.</p>	<p>Promoted by rightcar.govt.nz (called Emergency brake lighting systems).</p>	<p>Benefits likely to be found only on higher speed motorway driving.</p> <p>Included in the Vehicle Standards Map.</p>
<p>Fatigue warning systems (Attention assist)</p> <p>Detects behavioural or physiological indicators of driver fatigue and produces a warning.</p>	<p>Fatigue is a significant risk factor in crashes, so such systems have great theoretical potential.</p> <p>However, behavioural tests on fatigue warning systems in the United States found that they had no impact on objective or subjective driver fatigue, driving time, number of breaks, or break duration. In addition, results show that 30 minute breaks are ineffective at reducing fatigue related collisions.</p> <p>Apparently drivers tended to rely on the devices instead of responding to feelings of fatigue. The technology may be more effective if it can be designed to augment rather than replace subjective evaluations.</p> <p>Systems that go beyond warning, and actually intervene or prevent further driving may be more effective.</p>	<p>No known regulation however the EU project AWAKE has developed guidelines for fatigue warning systems.</p>	<p>First introduced by Volvo in 2007 and now available from a number of manufacturers.</p>	<p>Yes. For example, the Danish 'Anti Sleep Pilot'. Work is being undertaken on retrofittable systems for the mining industry in Australia</p>	<p>Considered to be a Safety Assist Technology (SAT) by ANCAP.</p>	<p>Promoted by rightcar.govt.nz</p>	<p>Benefits could be high with rental vehicles.</p> <p>Included in the Vehicle Standards Map.</p>

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<p>Forward collision warning systems</p> <p>Detects cars ahead and warns drivers of impending collisions.</p>	<p>Merely providing a warning was an earlier form of autonomous emergency braking and is perhaps a dead-end technology – production systems are now usually packaged with autonomous emergency braking which actively intervene. The technology may have benefit for retrofit, as it can be fitted into older vehicles.</p> <p>The technology appears to result in longer headways with leading vehicles, and a study estimated these systems may be able to reduce rear-end crashes by up to 57%.</p> <p>The US Insurance Institute for highways safety has found forward collision warning systems reduce the chances of a rear-end collision by 23%.</p>	<p>Israel has mandated fitment of forward collision warning (and lane departure warning) on all heavy vehicles built after 2000. The government is paying costs for retrofit of existing vehicles.</p> <p>Standards</p> <p>ISO 15623.</p>	Unknown	Yes. Mobileye produces a retrofittable model for around NZ\$1,500 installed	Considered to be a Safety Assist Technology (SAT) by ANCAP.		Likely to be superseded by AEB.
<p>Intersection collision warning system</p> <p>Also called right turn assist (in New Zealand) or Cooperative intersection collision avoidance systems (CICAS)</p> <p>Referred to as left turn assist in Europe and US where it is being developed. When a vehicle turns right, across the oncoming traffic, it will scan for oncoming vehicles or pedestrians and if the driver continues to move into the intersection will sound a warning or activate brakes. More advanced systems will use Cooperative Intelligent Transport Systems (C-ITS) to communicate between vehicles and use fixed cameras and other sensors at intersections.</p>	<p>A US report on CICAS development notes Intersection crashes account for thousands of injuries and fatalities in the United States every year. Drivers running stop - controlled and red – phased signalised intersections cost over \$7.9 billion in economic loss each year.</p> <p>Studies show that an intersection collision warning system could in general reduce the number of intersection crashes by 40-50%. In addition, driver's reaction times when braking in emergent situations were significantly shorter, speeds reduced and deceleration rates increased. The study also found audio warnings were more effective than visual warnings.</p> <p>A US DoT study found that infrastructure based and in-vehicle warnings effects were additive when combined, so effectiveness rose up to 95%.</p>	No reports of countries seeking to legislate for introduction. The US National Highway Traffic Safety Administration has declared it to be a High-Priority Safety Application.	No reported commercial fitment.	Potentially, especially if only as a warning device and not directly connected to vehicle's brakes.	Considered to be a Safety Assist Technology (SAT) by ANCAP.	Promoted by rightcar.govt.nz	<p>Intersection crashes are significant but generally low speed. Benefits may be from improved traffic flow and reduced accident damage.</p> <p>Refer collision avoidance systems.</p> <p>Included in the Vehicle Standards Map</p>

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<p>Lane departure warning systems</p> <p>Warns a driver when the vehicle begins to move out of its lane (unless a turn signal is on in that direction) where system can detect a lane. Current systems rely on cameras and image processing to detect lane markings. In principle, systems might instead use GNSS or internal maps.</p>	<p>Studies estimate that lane departure warning and control systems have the potential to reduce head-on collisions and off-part crashes by around 20 – 25%. A German analysis, assuming a 70% market penetration, estimated that it could reduce overall crashes by 2.9%.</p>	<p>European Union (EC) Regulation published on 31 July 2009 mandated the fitment of lane departure warning systems to M2, M3, N2 and N3 vehicles. (busses & trucks)</p> <ul style="list-style-type: none"> • New type approval – 1 November 2013 • All new vehicles – 1 November 2015. <p>Standards ISO 17361.</p>	<p>Low market penetration at present – but likely to increase relatively quickly.</p>	<p>Yes</p>	<p>Considered to be a Safety Assist Technology (SAT) by ANCAP.</p>	<p>Promoted by rightcar.govt.nz</p>	<p>Included in the Vehicle Standards Map.</p>
<p>Lane keep assist</p> <p>As for lane departure warning systems, but with active steering to keep the vehicle within the lane</p>	<p>One study estimated that if this system reached 70% market penetration, 25% of injury off-path crashes would be affected, which would reduce these types of crashes by 17.5%.</p> <p>The system was also found to reduce lane departures, and reduce the mean duration of the lane departures. Drivers were also more likely to signal their lane changes when this system was active.</p> <p>Young drivers have been found to be reluctant in accepting the intervening function of lane departure systems.</p>	<p>Not mandated.</p> <p>Standards ISO 11270</p>	<p>Low market penetration.</p>	<p>Not currently, as it is linked directly to car's steering.</p>	<p>Considered to be a Safety Assist Technology (SAT) by ANCAP.</p>	<p>Promoted by rightcar.govt.nz</p>	<p>Included in the Vehicle Standards Map.</p>

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<p>Reverse backup camera</p> <p>Enables drivers to see (or warns them) of any obstacles behind a vehicle, or in a vehicle's blind spot.</p> <p>Some systems also contain a proximity warning device, which provides a graphical representation and/or an auditory alert of obstacles.</p>	<p>The US National Highway Traffic Safety Administration estimates that about one-third of the estimated 292 reversing fatalities each year in the United States could be avoided if reversing cameras were made mandatory.</p> <p>In New Zealand, according to Safekids, five children die on average each year after being hit by a vehicle in a private driveway. Every fortnight a child is hospitalised with serious injuries in the same way.</p> <p>The European Commission estimates that the lack of visibility in the blind-zone towards the rear of a vehicle directly causes 500 deaths a year in the EU.</p>	<p>The US is reported to be considering requirement. An advanced notice of rule proposed making was issued in 2010 but implementation has been delayed several times Reversing cameras will now be required from 2018.</p> <p>Standards</p> <p>May be included as part of US NCAP standard.</p>	Unknown, but increasing.	Yes, readily available and can cost less than NZ\$50.	Considered to be a Safety Assist Technology (SAT) by ANCAP.	Promoted by rightcar.govt.nz	Cameras are only partially effective. In particular they don't work well in poor light.
<p>Road Departure Warning and Avoidance Systems</p> <p>Similar to lane departure warning and avoidance systems, but including curve speed warnings and object collision warnings – e.g. notifying a driver, or correcting behaviour, if they are approaching a corner too fast.</p>	<p>Kanianthra and Mertig (1997) have estimated that this technology could mitigate 24% of off road on straight and off road on curve crashes, particularly where fatigue was an issue. A US study by McKeever suggests an 8.4% reduction in fatal accidents and a 4% reduction in injuries. Higher reductions would be likely in New Zealand, where single vehicle crashes make up a much larger proportion of accidents.</p>	<p>Standards:</p> <p>ISO 17361</p>	Very low market penetration at present – well under 1% of new vehicles.	Yes			Refer lane keep assist.
<p>Traction control</p> <p>Uses sensors to detect the speed of each wheel. If a wheel spins faster than is consistent with the others, engine power to that wheel is reduced, to improve traction of the vehicle.</p>	<p>Traction control is effective in reducing wheel-slip in low friction conditions, and can improve a vehicle's stability. It is now usually a component of ESC.</p> <p>Traction control was developed and has been marketed more as a vehicle performance feature rather than a safety feature. Many vehicle improvements effectively allow either an increased margin of safety or increased performance.</p>	No known regulation.	Traction control has been available for since early 2000 and is mainstream.	Not practically.	NOT considered to be a Safety Assist Technology (SAT) by ANCAP.	Promoted by rightcar.govt.nz	Now usually integral with ESC.

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<p>Trailer stability control</p> <p>Electronic stability control (ESC) for trailers. Recognises early signs of trailer instability and activates brakes to slow the trailer down and ensure stability.</p>	<p>Anecdotal evidence of effectiveness is provided by promotional videos. It is not known what impact this technology might have on crash statistics for light vehicles.</p>	<p>No known regulation for light vehicle trailers.</p>	<p>Very low market penetration at present – well under 1% of new vehicles at present.</p>	<p>Yes.</p>	<p>Considered to be a Safety Assist Technology (SAT) by ANCAP.</p>	<p>Promoted by rightcar.govt.nz</p>	
<p>Tyre pressure monitoring systems (TPMS)</p> <p>Uses a warning light on the dashboard to alert the driver when a tyre is significantly under-inflated.</p> <p>The standard for this warning is to signal the driver when the tyre pressure is 25% below the tyre manufacturer's recommended inflation pressure.</p> <p>Simpler devices measure discrepancies in wheel rotation speed, while more sophisticated systems measure pressure directly and send a signal wirelessly.</p>	<p>Under-inflated tyres reduce handling and braking performance, increase tyre wear and fuel consumption, and are more prone to failure (a blow out).</p> <p>Tyre pressure monitoring systems were first mandated in the US in the mid-2000s after a series of SUV crashes. Most more recent studies focus on benefits to fuel efficiency from properly inflated tyres.</p>	<p>Mandatory in the US</p> <ul style="list-style-type: none"> All new passenger car models (M1) - 2008 <p>Mandatory in the EU for</p> <ul style="list-style-type: none"> All new type approval – 1 November 2012 All new passenger vehicles – 1 November 2014 <p>For N1 vehicles, TPMS are not mandatory, but if a TPMS is fitted, it must comply with the regulation.</p> <p>Standards</p> <p>US FMVSS 138</p> <p>ECE 64</p>	<p>Not known, but generally on late model vehicles from countries where this is required.</p>	<p>Yes. Prices of kits depend on the technology used. Trade me has sophisticated kits for \$250.</p>	<p>Considered to be a Safety Assist Technology (SAT) by ANCAP.</p>	<p>Promoted by rightcar.govt.nz</p>	<p>A valuable safety tool. Also reduces fuel use and CO₂ emissions.</p> <p>Included in the Vehicle Standards Map.</p>
<p>Vehicle to Vehicle (V2V) and Vehicle to Infrastructure (V2I) communications</p> <p>Allow vehicles to communicate with other vehicles or infrastructure providing drivers with information on hazards, emergency vehicles and traffic light changes.</p>	<p>Discussed under Connected Vehicle Systems above.</p>	<p>.</p>					

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<p>Additional occupant protection airbags</p> <p>Additional airbags that are not associated with crash tests conducted by ANCAP (e.g. centre console between front seats, rear seat frontal airbag, rear seat thorax side airbags and seat cushion airbags).</p>	<p>Front airbags and side curtain airbags have proven to be very effective in reducing the injuries they are designed to address. It is likely that airbags can also be used to address other kinds of injury. Vehicle designers are able to evaluate novel uses of airbags by using the tools that have previously been successful, but there has not been independent research into their effectiveness. (However, crashworthiness studies measure the net effect of safety design.)</p>		<p>Common place in most new vehicles.</p>	<p>No.</p>	<p>Affects performance in ANCAP crashes.</p>	<p>Promoted by rightcar.govt.nz</p>	
<p>Advanced airbag systems</p> <p>Designed to deploy air bags in such a way as to balance the protection of the passenger with the force by which the bag is deployed. The advanced system can help protect some adults, and especially small children, from the harmful affects of an air bag that deploys with too much force.</p>	<p>One US study found mortality rates were 10% lower for drivers of vehicles with airbags with advanced features than for those without the advanced features. The same study found the benefit was 16% for adults in the front passenger seat.</p> <p>However the newest airbags (certified-advanced) increased mortality rates when compared with airbags built to earlier standards by 12% for drivers.</p>	<p>Refer frontal impact protection systems.</p>	<p>Common place in most new vehicles.</p>	<p>No.</p>	<p>Affects performance in ANCAP crashes.</p>		<p>Consider as a part of frontal impact standards</p>
<p>Centre three-point seat belt</p> <p>The standard design – spreads out crash energy across the chest, pelvis and shoulders, to restrain the occupant and reduce the chance of injury caused by the seat belt.</p> <p>Considered superior to two-point lap belts, which are sometimes found in the middle rear seat and are associated with serious injuries from crashes.</p>	<p>Three-point seat belts in cars have been found to reduce fatalities of belted occupants by 50%, and reducing rollover fatalities by 74%.</p> <p>Although injuries associated with two-point seat belts are distinctive (so-called 'seat belt syndrome'), studies vary in the extent to which three-point belts are shown to be superior in comparable crashes.</p>	<p>Not required for front and rear middle seat positions in New Zealand. Not required for (older) vehicles to which they were not originally fitted.</p>	<p>Present in almost all new vehicles, but some commercials do not have three point centre seat belts.</p>	<p>Yes, but it depends on the structure of the vehicle.</p>	<p>Considered to be a Safety Assist Technology (SAT) by ANCAP.</p>	<p>Promoted by rightcar.govt.nz</p>	<p>Included in the Vehicle Standards Map.</p>

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<p>Crush and crumple zones Features of the vehicle's structure that protect occupants in a crash by absorbing or diverting crash forces away from occupants.</p>	<p>Analysis of actual crashes, and staged crash testing, show that vehicle structures have become increasingly effective at protecting occupants. This is one of the most important factors in the international trend towards lower numbers of deaths and injuries in crashes.</p>	<p>Refer to frontal impact protection systems.</p>	<p>All modern vehicles have crush and crumple zones, though designers continue to improve their effectiveness.</p>	<p>No</p>		<p>Promoted by rightcar.govt.nz.</p>	<p>Refer to frontal impact standards.</p>

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<p>Emergency call system (eCall) and proprietary systems</p> <p>System that detects when a severe crash has occurred and automatically notifies emergency services or manufacturer's appointed call centre.</p> <p>eCall contacts a Public Safety Access Point (PSAP) directly with a datastream containing accurate location data.</p> <p>Some of these systems contact a private call centre the vehicle owner has subscribed to with a data stream & voice communication. The data stream most commonly contains GNSS-based position data. Some also send data which can assess the type and severity of the crash. These call centres then contact a PSAP.</p> <p>Similar systems have been proposed for vehicles used off-road, especially on farms.</p>	<p>German research indicates a reduction in fatalities from serious crashes of 11%.</p> <p>Up to 2,500 fatalities prevented per year when fully implemented across Europe, according to European Commission estimates.</p> <p>There is concern about the ability of these devices to operate outside the zone for which they were originally intended, e.g. a system built for a vehicle in Japan will not work in New Zealand. Vehicles from other jurisdictions may try to phone 'home', communicate in a foreign language or experience an error, eliminating their effectiveness.</p> <p>These emergency call systems are fairly new so there is little evidence of activations or their effectiveness.</p>	<p>The EU has mandated eCall for all new vehicles by 2018.</p> <p>An interoperable, but distinct system has been mandated and rolled out in Russia: ERA-GLONAS. There are also numerous private providers of comparable devices in many countries.</p> <p>Some vehicle manufacturers (eg. BMW, Volvo) fit proprietary systems that ring call centres.</p> <p>Standards CEN 15722. ERA-GLONAS</p>	<p>We have little data on fitment of eCall in New Zealand. It is reported to be installed in some prestige-brand European vehicles imported both as new and used vehicles.</p> <p>Some proprietary systems are also fitted, including Ford and some European brands.</p> <p>No system has been activated to allow direct access to the New Zealand 111 system. Many systems (especially those involving overseas call centres) are likely to be fundamentally incompatible with New Zealand PSAP infrastructure as it stands. There is some pressure from manufacturers to make changes to NZ PSAP systems necessary to enable these systems to be activated.</p>	<p>Yes. Price estimates vary, but are reported to range upwards from around NZ\$100. It is not known if this includes fitment.</p>		<p>Promoted by rightcar.govt.nz</p>	<p>If not adopted outside the EU then there may be little chance of wide uptake in New Zealand. The policy question is how to manage systems that will arrive from Europe, and the proliferating proprietary standards.</p> <p>These may be particularly valuable in New Zealand due to our high rate of single occupant crashes, and accidents where topography may mean passers-by do not call for help – e.g. vehicle leaves road and goes down a bank out of view.</p> <p>Included in the Vehicle Standards Map.</p>

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<p>Frontal impact protection systems</p> <p>Includes seat belts, collapsible steering columns, airbags, head restraints, and crumple zones at the front of the vehicle.</p>	<p>Improvements in frontal impact protection are clearly evident in crashworthiness studies (such as MUARC's Used Car Safety Ratings) and crash testing (such as ANCAP). These improvements are a significant factor in reducing vehicle crash casualty trends in most countries.</p>	<p>Many of these technologies are already mandated, either directly or indirectly through Land Transport Rule: Frontal Impact 2001 and the Land Transport Rule: Seatbelts and Seatbelt Anchorages 2002</p>		<p>In principle, some systems, such as seat belts and head restraints, are retrofittable; others must be designed into the vehicle structure.</p>			<p>Arguably, the significance of this aspect of vehicle safety will be reduced by improved crash avoidance systems such as autonomous emergency braking.</p>
<p>Head restraints</p> <p>Limit head movement if a vehicle stops suddenly or crashes, reducing the risk of head injuries like whiplash. 'Active' head restraints which move forward in a crash are a recent development.</p>	<p>One study found that head restraints can reduce the incidence of neck injuries by 44%. Another found that head restraints can reduce neck extension by 51% in the event of a crash, but they must be fitted correctly or this benefit may fall below 10%.</p>	<p>Not mandated.</p> <p>Standards</p> <p>GTR 7 FMVSS NO. 202</p> <p>NZ - where fitted, must be designed and maintained to protect occupants head and neck in a crash (fitment itself not required).</p> <p>Land Transport Rule: Head Restraints 2001.</p>	<p>Most vehicles have head restraints in front seats and it is common in rear seats.</p>	<p>Yes</p>		<p>Promoted by rightcar.govt.nz.</p>	
<p>Helmets</p> <p>The wearing of helmets in passenger vehicles (as opposed to motorbikes) has been shown to be as effective at reducing injuries in some accidents as airbags, but is much cheaper and can be retrofitted.</p>	<p>Research by the Australian Transport Safety Bureau in the 1980s found that helmets for car occupants would be more effective at reducing head injuries than side curtain airbags and advanced restraint systems.</p> <p>While full-face helmets were preferred, even a 'headband' style helmet would provide significant benefits, reducing impact force by up to two thirds.</p>	<p>Not mandated.</p> <p>No known standards.</p>		<p>Yes</p>			

1. Light passenger and commercial vehicles excluding motorcycles and mopeds ([MA, MB and MC, MD, NA class vehicles](#))

c) Collision Mitigation

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<p>Inflatable safety belt</p> <p>In a crash, the seat belt automatically inflates to protect against head, neck and chest injuries. The inflated belt distributes crash forces over a wider area of the occupant's body and reduces movement. Most suited to rear seat fitment, where front airbags are less practical.</p>	<p>Has been shown to work as described, so should reduce injuries in a crash, but no published study is known.</p> <p>Ford claim that the (uninflated) belt is also more comfortable than standard belts, and could increase wearing rates for rear-seat passengers.</p>	<p>No known regulation.</p>	<p>Available in some new vehicles eg. Ford Mondeo.</p>			<p>Promoted by rightcar.govt.nz</p>	
<p>ISOFIX child restraint anchorages</p> <p>International standard for child restraint attachment points – enables child safety seats to be safely and quickly secured.</p>	<p>The safety benefit results from the use of the child restraint itself – but the ISOFIX anchorage makes it more likely that the seat will be correctly attached.</p>	<p>Mandated in new cars in the United States 2002.</p> <p>Legalised in Australia in 2014 (prior to this date they were not legal to install).</p> <p>Standards</p> <p>ISO 13216.</p>		<p>Yes</p>		<p>Promoted by rightcar.govt.nz</p>	<p>Potential for mandating or promoting top tether point?</p>
<p>Knee airbags</p> <p>Airbags designed to cushion knees during a crash.</p>	<p>A study found no association between knee airbags and risk of lower extremity fractures.</p> <p>Patterns that were not statistically significant were observed where there was a decreased risk of hip and thigh fractures, and increased risk of tibia/fibula and foot fractures.</p>	<p>No known regulation.</p>				<p>Promoted by rightcar.govt.nz</p>	
<p>Knee bolsters</p> <p>A crushable barrier under the dashboard that stops your knees from striking hard surfaces during a crash, reducing the likelihood of serious leg injuries.</p>	<p>Studies have found knee bolsters reduce knee fractures, but increase hip fractures and dislocations during a crash.</p>	<p>No known regulation.</p>					

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<p>Laminated window glass for side windows</p> <p>Laminated glass contains a layer of plastic material. It is stronger than normal tempered glass, does not shatter and resists penetration. Laminated glass has been standard for windscreens since the 80s (earlier in USA) and has greatly reduced injuries due to the ejection or partial ejection of vehicle occupants. It has also eliminated face and eye injuries distinctive of toughened glass windscreens.</p> <p>Ejection or partial ejection of occupants from vehicle side and rear windows is still a serious risk factor in crashes and would be reduced by fitting laminated glass.</p> <p>Laminated glass also contributes to roof strength.</p>	<p>The US National Highway Traffic Safety Administration (NHTSA) studied laminated side windows for 10 years before deciding in 2001 not to require them.</p> <p>"Advanced glazing systems have the potential to yield significant safety benefits by reducing partial and complete ejections through side windows, particularly in rollover crashes ... however, other safety countermeasures can also prevent ejections."</p> <p>However, in 2011, NHTSA introduced an ejection mitigation requirement that it expects to be met by fitting side curtain airbags, possibly supplemented by laminated glass.</p> <p>Some opponents of mandating laminated glass claim it would increase deaths from occupants being trapped in vehicles, such as drowning, but these are much less common than rollovers.</p> <p>See also Batzer, Stephen A.; Thorbole, Chandra K.; Herndon, G. Grant; Beltran, David Injury analysis of laminated and tempered side glazing The Engineering Institute United States.</p>	<p>Required everywhere for windscreens.</p> <p>Standards</p> <p>FMVSS No. 226</p> <p>"Ejection Mitigation" – a performance standard for side windows that laminated glass may help to meet.</p>	<p>Laminated glass is said to be five times the cost of tempered glass. It is fitted all round in many luxury vehicles, but is often marketed as a theft deterrent.</p>	<p>No</p>			
<p>Pedestrian protection systems</p> <p>Various systems including pop-up bonnets, pedestrian airbags, pedestrian detection systems and over-run prevention designed to protect pedestrians from injury in an accident.</p>	<p>UK studies suggest that meeting proposed EU requirements would prevent 8-10% of pedestrian fatalities in 3 years, rising to 20% after 8 years.</p> <p>The UK DETR estimates the benefit/cost ratio for the UK to exceed 7 to 1.</p> <p>Link</p>	<p>Likely to become mandatory in vehicle source markets over the next few years.</p> <p>Standards</p> <p>GTR 9.</p>	<p>Unknown</p>	<p>No</p>	<p>ANCAP carries out pedestrian impact testing.</p>		<p>See pedestrian impact standards</p> <p>Included in the Vehicle Standards Map.</p>

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<p>Pole side-impact standard</p> <p>Specifies the protection a vehicle must provide to its occupants if the vehicle collides side-on with a pole or similar object. Usually assessed by means of a crash test using a standard test dummy.</p>	<p>Thin objects such as poles and trees are common roadside hazards and vehicles often collide with them. Vehicle structures provide less protection from side-impacts than from front or rear impacts, and less protection from thin objects than from wider objects. Pole side impact protection is therefore an important and difficult safety problem.</p> <p>Improvements have mainly been achieved by fitting side intrusion beams in doors, and side curtain airbags. Another possibility is a mechanism that pulls occupants away from side impacts.</p>	<p>Standards</p> <p>GTR 14.</p> <p>FMVSS No. 226, "Ejection Mitigation".</p>	<p>Many newer vehicles have good side-impact protection, but most are not yet certified to a standard.</p> <p>Side curtain airbags have become common in the last few years.</p>	<p>Not for vehicles in ordinary use.</p>	<p>ANCAP conduct pole side impact test – required for 5 star rating.</p>		<p>Consider along with side curtain airbags. Different rules may be appropriate for new and used imports.</p> <p>Included in the Vehicle Standards Map.</p>
<p>Pop up bonnet</p> <p>In a collision between a vehicle and a pedestrian, the bonnet rises up to make a larger clearance between the bonnet and engine and to cushion the pedestrian.</p>	<p>Studies have indicated that some systems can reduce the risk of fatality from a frontal pedestrian crash from almost certain, to less than 15%.</p> <p>Some systems are unable to be reset, and this may mean the owner would be expensive to replace if the bonnet is activated.</p>					<p>Promoted by rightcar.govt.nz</p>	<p>Refer: Pedestrian impact standards</p>
<p>Rollover occupant protection systems (ROPS)</p> <p>Detects a rollover situation and deploys occupant protection systems such as inflatable curtains. Rollover-enabled air bags are designed to stay inflated after a crash for about five seconds vs. the 300 milliseconds of protection provided by head-curtain air bags that deploy in a side-impact collision.</p> <p>Fixed ROPS – usually some kind of roll cage – can be retrofitted and are common in some industries.</p>	<p>Manufacturers claim that the systems are effective, but no independent studies were found.</p> <p>Tests done for the Australian mining company BHP Billiton suggest that aftermarket ROPS are not effective crash protection; however, these findings are controversial.</p>			<p>Yes, but usually only for specialised uses such as off-road or in industries such as farming or mining.</p>	<p>Considered to be a Safety Assist Technology (SAT) by ANCAP.</p>	<p>Promoted by rightcar.govt.nz</p>	

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Roof crush standards Standards which help to ensure that in the event of a rollover crash, the roof does not crush down and damage the vehicle's occupants.	A US study found roof crush intrusion into the passenger cabin occurs in 10% of all crashes, but 80% of rollover crashes. Belted occupants in rollover crashes are primarily injured by roof contact and by contacts with other components within the vehicle's interior, and this injury was the most severe in 89% of cases. Having adequate standards is likely to prevent or mitigate many of these injuries.	The US requires vehicles to meet a specific standard – resistance to specified weight. Europe and Japan do not have a specific standard for roof crush, but frontal impact requirements are not completely independent. Standards FMVSS 216	Vehicle models sold in New Zealand that are also sold in the US <i>may</i> meet the US standard.	Not usually practical.	There is a roof crush component to ANCAP, but it may be removed in future.		
Seat belt load limiters A system which gradually feeds out the seat belt when a pre-determined load has been reached, to bring occupants to a stop more gradually and reduce injuries.	Intelligent restraint systems, such as seat belt load limiters, have been estimated to reduce the chance of a severe head or chest injury by 14 %.	May be included as part of frontal impact standards.		No			
Seat belt pretensioner In a crash pretensioners will pre-emptively tighten seat belts to prevent occupants from jerking forward.	Intelligent restraint systems, such as seat belt pretensioners, have been estimated to reduce the chance of a severe head or chest injury by 14 %.	Standards ISO 14451-7:2013	Common place on most new vehicles.	No		Promoted by rightcar.govt.nz	
Seat belt reminder Visual and audible warnings are issued when sensors detect a seat is occupied, but the seat belt is not in use.	Research indicates that the risk of dying in a crash could be reduced by around 60 % by using a seat belt and more when seat belts and airbags are used in combination. Studies have found seat belt reminders with both visual and audible warnings were most effective for increasing seat belt use. Another study found the seat belt wearing rate in cars with reminders was 97.5 % and 86 % in cars without the warning.	UNECE mandated fitment of seat belt reminder to the driver's seating position in all M1 category vehicles (passenger cars) from February 2014. Standards Australia's Department of Infrastructure and Transport tabled an update of the Australian Design Rule which required all new passenger vehicles to be fitted with a seat belt reminder for the driver's seat.	Common place on most vehicles manufactured since 1990.	Yes	Forms part of the ANCAP score.	Promoted by rightcar.govt.nz Austroads recommends mandating seat belt reminders.	Safe systems approach. Included in the Vehicle Standards Map.

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<p>Side curtain airbags</p> <p>Offer additional passenger protection from side impact collisions. Can be curtain or tubular air bags that deploy downward from the car's roof, or combination air bags that deploy upward from the seat back, and provide both head and chest protection.</p>	<p>A Monash University study found side curtain airbags could reduce rate of injury in struck side crashes by approx 60%.</p>	<p>Standards</p> <p>FMVSS No. 226, "Ejection Mitigation"</p>	<p>For New Zealand-new vehicles, fitment rate is over 90%.but fitment rate is lower for used imported vehicles. The rate for fitment will be higher than that for ESC.</p>	No	<p>Required by ANCAP for front seats to achieve 5 stars since 2004.</p> <p>To be extended to other star ratings and to rear seats.</p>	<p>Promoted by rightcar.govt.nz</p>	<p>Included in the Vehicle Standards Map.</p>
<p>Side impact protection system</p> <p>Driver and passenger seats are mounted on transverse rails, which allow the seats to move and distribute the energy of a side impact more widely. Combined with side curtain airbags.</p>	<p>No data is available. However, vehicles in which it is an option perform well in crash testing and actual crashes.</p>		<p>Optional on Volvo vehicles since 1991, wider fitment unknown.</p>	No			
<p>Whiplash protection system (WHIPS)</p> <p>A pivoting seat back and head restraint designed to minimise whiplash in a rear-end collision.</p>	<p>Whiplash is a genuine injury that vehicle seats and headrests can be designed to reduce.</p> <p>Studies suggest that WHIPS can reduce short term whiplash injuries by 30% and long term injuries (e.g. whiplash syndrome) by 50%.</p>	<p>No standards.</p>	<p>Fitted to all Volvos since 1999 only.</p>	<p>In theory, by replacing vehicles' seats. Unlikely in practice.</p>			
<p>Whiplash rating (including head restraints)</p>					<p>ANCAP tests whiplash performance (since 2011).</p>		

2. Motorcycles and mopeds (LA, LB, LC, LD, LE vehicle classes)

Description	Evidence of effectiveness	Extent of regulation: (1) Is fitment required in Japan, Australia, Europe or USA? (2) Does a standard exist for the technology?	Extent of fitment in new and used vehicles	Can it be retrofitted?	ANCAP	Other actions to increase uptake	High level assessment of potential to improve safety outcomes
<p>Adaptive cruise control</p> <p>Maintains the vehicle speed set by the driver, adjusts the vehicle's speed to that of a preceding vehicle, and helps to maintain a pre-selected headway time to the vehicle ahead.</p> <p>Almost always paired with a pre-crash system, which will either warn the driver that a crash is likely, or will autonomously take action to stop the collision from occurring.</p>	<p>This is now becoming common in passenger vehicles and is discussed above. No evidence for effectiveness in motorcycles</p>	<p>None known. Some reports of aftermarket devices available for motorbikes, intended for long distance touring market.</p>	<p>Unknown.</p>	<p>Possibly.</p>	<p>Not considered to be a Safety Assist Technology (SAT) by ANCAP.</p>		
<p>Airbags</p> <p>Designed both for motorcycles and motorcycle gear.</p> <p>Motorcycle airbags can be designed to reduce the forward velocity of a rider, preventing them from hitting the front of their motorcycle or being ejected in a frontal impact.</p> <p>Airbag jackets are triggered by an accelerometer or rip-cord tether when the rider is ejected from the motorcycle, and are designed to protect the rider from collisions with vehicles and road surfaces.</p>	<p>Research by the motorcycle manufacturer Honda suggests that most motorcycle accidents are frontal impacts, and the great majority of injuries (~75%) come from the rider impacting a vehicle or the road surface. The reduction in forward velocity provided by this airbag is likely to reduce the harm from these types of accidents.</p>	<p>None known</p>	<p>Limited fitment. It appears only Honda has fitted them and only to one model of their motorcycles – an 1800cc touring bike.</p> <p>The other approach is to develop airbag systems that the rider wears.</p>	<p>For integrated systems, no, but wearable airbags could be 'retrofitted' to the rider.</p>			
<p>Anti-lock braking systems (ABS), rear wheel lift-off protection (RLP) and traction control systems</p> <p>Prevent skidding, reduce stopping distance and allow riders to steer around obstacles. Also overcome riders' reluctance to apply full brake force in emergencies.</p> <p>ABS may operate on the front wheel only or both wheels.</p> <p>Sophisticated systems can brake both wheels even if only one brake is applied.</p>	<p>A German study concluded that in 93% of cases where a rider fell from their motorcycle, ABS would have avoided or reduced the severity of the crash. They estimated there would be an 8-10% reduction in fatal and severe injuries to motorcycle drivers.</p> <p>One estimate suggests that ABS might reduce the number of crash victims by at least 10%. (Spornier, A. (2000) Passive Sicherheit auch auf dem Motorrad - Möglichkeiten durch den Airbag. Fachtagung "Fahrzeugairbags", Essen.).</p>	<p>ABS systems will be mandatory in Europe for motorcycles over 125 cc, from 2016 for new models, and 2017 for all new motorcycles.</p>	<p>Beginning to appear, but mainly in high-end vehicles.</p>	<p>No</p>			<p>Included in the Vehicle Standards Map.</p>

2. Motorcycles and mopeds (LA, LB, LC, LD, LE vehicle classes)

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<p>Electronic stability control</p> <p>Uses braking and traction control to correct differences between steering input and actual path.</p>							
<p>Daytime running lamps (DRLs) or use of headlamps during the day</p> <p>Increase the visibility of motorcycle riders to other road users.</p>	<p>Motorcyclists are particularly vulnerable to crashes caused by other motorists not noticing them.</p> <p>The use of daytime running lights by motorised two-wheelers has reduced visibility-related crashes in several countries by between 10% and 16%. In Europe, motorcyclists who use daytime running lights have a crash rate that is about 10% lower than that of motorcyclists who do not.</p> <p>Recent research suggests that arrays of three or four DRLs, particularly using distinctive patterns (T or V-shapes) or colours (yellow or amber), increase the visibility and conspicuity of motorcycles – also making it easier to identify the vehicle and judge its distance and speed. The benefit seems to be due to the extra area illuminated, as well as the shape or colour.</p> <p>These benefits may be even greater when the lamps are used at night.</p> <p>Internationally, motorcyclists are particularly concerned about the supposed masking effect of other vehicles using DRLs. There is some evidence that there can be such an effect but, to date, no evidence of an effect on safety. Hence, motorcyclists are likely to prefer lighting arrangements that are distinctive to motorcycles.</p>	<p>New Zealand requires motorcycles manufactured from 1980 to be used with the headlamp or DRLs on during the day and allows arrays of up to 4 DRLs. DRLs must be fitted so that they cannot be used simultaneously with headlamps – but a proposal to relax this requirement, and so permit both to be used, is being considered.</p> <p>The use of daytime running lights (generally low beam) is compulsory in several EU Member States (e.g. Austria, Germany, Belgium, France, Spain and Portugal). Some of these require users to manually switch on headlamps.</p> <p>European standards for day time running lamps for motorcycles have been developed. New motorcycles are fitted increasingly with headlights which come on automatically with ignition.</p> <p>The USA and Canada permit headlamp modulators, which cycle the lamp between full and reduced brightness at about 4 Hz – effectively flashing the lamp.</p>	<p>Unknown, although New Zealand requires motorcycles manufactured after 1980 to use either headlights or DRLs during the day.</p>	<p>Yes</p>			<p>Included in the Vehicle Standards Map.</p>
<p>High visibility clothing</p>	<p>Although visibility is a well established risk factor for motorcyclists, the evidence for a benefit from high visibility clothing is mixed. The conspicuity of different colours depends on their contrast with background colours and patterns, and it is not clear whether any types of clothing</p>		<p>Clothing is not considered part of the vehicle. Light-coloured motorcycles may be safer and are, of course, readily</p>				<p>Low</p>

2. Motorcycles and mopeds (LA, LB, LC, LD, LE vehicle classes)

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	<p>are on average more conspicuous in real traffic environments.</p> <p>There is some evidence that light colours for clothing, helmets and bikes have a benefit, even over day-glow or hi-visibility colours.</p> <p>A very small safety differential has been shown for different colours of cars; it is not known how this differential is affected by vehicle (or rider) size. It is possible that the safety differential is reduced or eliminated by the use of DRLs.</p> <p>Susan Wells et al. (10 April 2004). "Motorcycle rider conspicuity and crash related injury: case-control study". BMJ.</p>		available.				
Helmet safety ratings	<p>Motorcycle helmets are crash tested to ensure compliance with legal standards, but some organisations also rate helmets against higher standards (e.g. ACU silver and gold ratings in the UK and Snell certification in the USA).</p> <p>2005 TRL proposal for improved helmet:</p>	<p>Most jurisdictions require that helmets meet specified minimum standards (e.g. ECE Regulation 22-05). Higher standards may be required by motorsport organisations regulating competition.</p>	<p>Not part of the vehicle, though analogous to vehicle safety structures.</p>	Yes			Included in the Vehicle Standards Map.
Leg protectors Injuries to the legs of motorcyclists occur in approximately 80% of all crashes. Leg protector (like side bars) are intended to reduce injury to legs.	<p>A large amount of research has been done in this area and there is some evidence for the effectiveness of the technology.</p> <p>Nonetheless, there is not widespread agreement on the efficacy of leg protectors. A lack of standards means that many leg protectors are not fit for purpose, and do not have the strength to provide adequate protection.</p> <p>Some research goes so far as to suggest that any reduction in injuries to the ankle or foot is balanced by an increased chance of injury to the upper leg or knee.</p> <p>Link pp. 101-108</p>						The continuing debate about the effectiveness of these devices makes drawing a conclusion difficult.
Linked braking systems A system which applies both front and rear brake if either brake is applied, especially in an emergency stop.							

2. Motorcycles and mopeds (LA, LB, LC, LD, LE vehicle classes)

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<p>Rear wheel lift-off protection system (RLP)</p> <p>Automatically regulates the braking force when the bike's rear end is likely to lift off during emergency braking situations. This system works in conjunction with the bike's ABS unit, coupled with a gyro-sensor to detect rear-end lift.</p>			Fitted to some high-end motorcycles e.g. BMW.	No			
<p>Traction control</p> <p>Decelerometers are used to detect wheel spin and limit the torque of the motorcycle.</p>	ABS combined with traction control provides the largest benefit, but the actual benefit is unknown.	None known.	10-15% of new bikes have traction control eg. KTM, BMW.	Yes			Included in the Vehicle Standards Map.
<p>Tyre pressure monitoring systems</p> <p>A warning light alerts the driver when a tyre is significantly under-inflated.</p> <p>The standard for this warning is to signal the driver when the tyre pressure is 25% below the tyre manufacturer's recommended inflation pressure.</p>	No specific data for motorcycles. Data from cars shows under-inflated tyres reduce handling and braking performance, increase tyre wear and fuel consumption, and are more prone to failure (a blow out). Performance is usually affected before 25% under-inflation.		Yes. Readily available	Unknown		Promoted by rightcar.govt.nz for cars	A valuable safety tool. Equally useful for reducing CO ₂ emissions.

3. Heavy Vehicles

Description	Evidence of effectiveness	Extent of regulation: (1) Is fitment required in Japan, Australia, Europe or USA? (2) Does a standard exist for the technology?	Extent of fitment in new and used vehicles	Can it be retrofitted?	ANCAP	Other actions to increase uptake	High level assessment of potential to improve safety outcomes
<p>Advanced emergency braking system (AEBS)</p> <p>The system, fitted to trucks and coaches, uses sensors to monitor the proximity of an object or a vehicle in front and detect situations where the relative speed and distance between the two vehicles suggests a collision will take place. The system provides the driver with a warning and, if necessary, activates the vehicle braking system to avoid or mitigate a collision.</p>	<p>A European study shows that fitting AEBS to trucks and coaches could save up to 1000 lives and 4000 serious injuries per year in the EU.</p> <p>Early research indicates significant benefits in the order of a 20-30 percent reduction in crashes, but effectiveness varies based on the specific type of system used.</p>	<p>Mandated in the EU for all new heavy vehicles as of 2015.</p>	<p>Very low market penetration at present – well under 1 percent of new vehicles.</p>	<p>No</p>		<p>Promoted by rightcar.co.nz</p>	<p>Included in the Vehicle Standards Map.</p>
<p>Blind spot warning system (BSWS)</p> <p>Senses cars coming up in drivers' blind spot behind or alongside their vehicles and, if the drivers' turn signal is on, it will alert them not to change lanes.</p>	<p>System was found to have the potential to prevent 5% of crashes involving large trucks.</p>	<p>Europe requires heavy vehicles to have blind spot cameras and Japan is reported to be considering this.</p>	<p>Unknown</p>	<p>Yes, aftermarket kits are available, but installation is quite complicated.</p>		<p>None</p>	<p>Included in the Vehicle Standards Map.</p>
<p>Electronic brake force distribution (EBD)</p> <p>EBD is an automobile technology that automatically varies the amount of force applied to each brake, based on variables such as road conditions, speed and loading.</p> <p>Helps to address loss of control crashes, particularly those involving variable surfaces or conditions.</p>	<p>There are no known studies into the effectiveness of EBD. It tends to be packaged with ESC/EBA.</p>	<p>No known regulation.</p>	<p>Common in vehicles in New Zealand</p>	<p>No</p>			<p>Included in the Vehicle Standards Map.</p>
<p>Electronic stability control (ESC)</p> <p>ESC uses anti-lock braking and traction control to reduce the danger of skidding. The system uses sensors to detect loss of control and automatically applies the brake to the relevant wheel to keep the vehicle on the intended path.</p>	<p>Initial estimates suggest that the benefits of ESC are higher for heavy vehicles than for passenger vehicles and light commercials. NHTSA research suggests that equipping heavy vehicles with ESC could prevent 40 – 56 per cent of 'untripped' rollover crashes and 14 per cent of loss of control crashes. US research suggests that 2/3 of heavy vehicle deaths are a</p>	<p>In America NHTSA 49 CFR Part 571 (2012) mandated the requirement for ESC to be fitted to articulated vehicles and certain busses over 11,793Kg from 2017.</p> <p>UNECE Regulation 13 (2007)</p>	<p>Unknown</p>	<p>The high value of heavy vehicles may make retro fitment feasible. It has been</p>		<p>ARTSA has been lobbying for fitment in Australia.</p>	<p>Included in the Vehicle Standards Map.</p>

3. Heavy Vehicles

Description	Evidence of effectiveness	Extent of regulation: (1) Is fitment required in Japan, Australia, Europe or USA? (2) Does a standard exist for the technology?	Extent of fitment in new and used vehicles	Can it be retrofitted?	ANCAP	Other actions to increase uptake	High level assessment of potential to improve safety outcomes
	<p>result of rollover crashes.</p> <p>ESC would also be particularly useful in preventing a 'jack-knife' crash resulting from an articulated vehicle over steering and bringing the tractor in to contact with the trailer.</p> <p>The Australian Road Transport Suppliers Association (ARTSA) has called heavy vehicle ESC "The single most significant safety solution for heavy vehicles in the last 20 years".</p>	<p>mandates the requirement for ESC to be fitted to heavy vehicles in Europe</p> <p>NSW requires all new dangerous goods tankers to have ESC, and by 2019 all dangerous goods tankers operating on its roads must have ESC.</p>		<p>suggested in the Australian parliament that the cost is \$5000-\$10,000.</p>			
<p>Lane departure warning systems (LDWS)</p> <p>Warns a driver when the vehicle begins to move out of its lane (unless a turn signal is on in that direction) on freeways and arterial roads.</p> <p>Aims at minimising crashes by addressing three main causes of collisions: driver errors, distractions and drowsiness.</p>	<p>Found to have potential to prevent 6.1% of crashes involving large trucks.</p> <p>Another study found that systems installed in heavy goods vehicles decreased the number of crashes of these vehicles by 10%.</p>	<p>Mandated in the EU for all new heavy vehicles as of 2015.</p> <p>ISO 17361: https://www.iso.org/standard/41105.html</p>	<p>Very low – less than 1 percent of heavy vehicles.</p>	<p>Yes</p>		<p>Promoted by rightcar.co.nz</p>	<p>Included in the Vehicle Standards Map.</p>
<p>Lane keep assist (LKA)</p> <p>Lane keep assist systems are similar to LDWS, but use active steering to keep the vehicle in the lane. LKA uses a variety of processing technologies to detect lane markings.</p> <p>Primarily addresses crashes where a driver drifts out of their lane due to inattention or fatigue.</p>	<p>One study estimated that if the system reached 75 percent market penetration, 25 percent of injury off-path crashes would be affected, reducing these types of crashes by 17.5 percent. LKA was also found to reduce lane departures and the mean duration of those departures.</p> <p>May be less useful in New Zealand than in Europe or the US due to our relatively small motorway network.</p>	<p>Not mandated</p> <p>ISO 11270</p>	<p>Uptake in new vehicles is increasing.</p>	<p>No</p>			<p>Included in the Vehicle Standards Map.</p>
<p>Position marker lamps</p> <p>Lamps on the side, back and front of vehicles which help to make a vehicle's position and direction of travel clearly visible from different angles. Usually these are mounted at the edges of a vehicle, to give an indication of its</p>	<p>One study found that side marker lamps reduce the number of night time angle collisions by 16% and personal injuries in these crashes by 21%.</p> <p>However, lamps were not found to have an effect on fatalities, as when collisions of this type occur, vehicles are generally travelling at too high of a speed to stop or substantially slow</p>	<p>Side marker lamps mandated for heavy vehicles in the US since 1970</p> <p>Standards</p> <p>FMVSS 108</p> <p>UN Regulation 48 revision 6</p> <p>NZ – Land Transport Rule:</p>		<p>Yes, though must meet Land Transport Rule: Vehicle Lighting 2004</p>			

3. Heavy Vehicles

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outline.	down.	Vehicle Lighting 2004 .					
<p>Rear-impact countermeasures</p> <p>Uses sensors to monitor area behind the vehicle (usually a bus). If another vehicle is detected within the space going too fast, visual warnings such as flashing lights are shown to the driver behind to attract their attention.</p>	<p>Drivers behave less riskily, braking sooner and only needing to brake lightly when following a driver with a flashing light.</p>						
<p>Roll stability control (RSC)</p> <p>An active vehicle safety system that automatically intervenes if a high rollover risk is detected while driving. If a rollover threat is occurring, the system intervenes and assists the driver in minimizing the rollover risk by automatically reducing vehicle speed.</p>	<p>RSC is an advanced form of ESC. NHTSA research suggests that equipping heavy vehicles with ESC could prevent 40 – 56 % of ‘untripped’ rollover crashes and 14 per cent of loss of control crashes. US research suggests that 2/3 of heavy vehicle deaths are a result of rollover crashes.</p> <p>The benefits of RSC are likely to be higher.</p>	<p>RSC is a requirement for trailers towed by 50 max trucks in NZ.</p>	<p>Fitted on most new trailers.</p>	<p>Yes</p>		<p>Driver training and promotion.</p>	<p>Included in the Vehicle Standards Map.</p>
<p>Roll over warning device</p> <p>Alerts drivers to the risk of rollovers.</p>	<p>Studies suggest that roll over warning devices can reduce rollover related crashes by 20 to 30%.</p>						
<p>Smart licence ignition key</p> <p>A driver licence must be swiped through a card reader before a vehicle can be started. The licence key confirms that the driver has a valid licence for the class of vehicle they are attempting to drive.</p>	<p>An Australian study identified that approximately 9% of fatal crashes involved a driver who did not hold a valid licence for the type of vehicle being driven.</p>	<p>Sweden has developed and tested a system.</p>		<p>Yes</p>			
<p>Speed limiters</p> <p>A speed limiter is a governor used to limit the top speed of a vehicle.</p>	<p>The Federal Motor Carrier Safety Administration (FMCSA) in the US determined that trucks equipped with speed control devices have a 50% lower crash rate compared to trucks not equipped with them.</p>	<p>In the UK a speed limiter must be fitted on:</p> <ul style="list-style-type: none"> vehicles with more than 8 passenger seats, goods vehicles with a maximum laden weight of 	<p>Unknown. Likely to be very low.</p>	<p>Yes</p>		<p>Promotion of safety benefits.</p>	<p>Included in the Vehicle Standards Map.</p>

3. Heavy Vehicles

Description	Evidence of effectiveness	Extent of regulation: (1) Is fitment required in Japan, Australia, Europe or USA? (2) Does a standard exist for the technology?	Extent of fitment in new and used vehicles	Can it be retrofitted?	ANCAP	Other actions to increase uptake	High level assessment of potential to improve safety outcomes
		more than 3.5 tonnes					
<p>Under Run Protection Device</p> <p>These devices are fitted to the side, front, or rear of a truck and prevent smaller vehicles, including cyclists, running under a truck in a crash.</p>	<p>An Australian study has found that heavy vehicles without under-run protection “significantly increase the chances of intrusion of parts of the heavy vehicle into the passenger space” of a colliding vehicle.</p> <p>Side under-run protection systems improves the fuel efficiency of trucks if they are aerodynamically designed.</p>	<p>Rear under-run device mandated on all Heavy vehicles >3.5Tonnes in the EU and all trailers >1020kg</p> <p>Standards:</p> <p>UN-ECE R58 UN-ECE R73 UN-ECE R93 USFMV Standard 223 & 224 EU Directive 221/1970 EU Directive 490/1979</p>	<p>Some models such as Scania and Mercedes fit some kinds of under-run protection.</p>	<p>Yes</p>		<p>NZTA “Safety tips for cyclists and truck and bus drivers” suggests heavy vehicle users consider fitting under run side protection devices.</p>	<p>Included in the Vehicle Standards Map.</p>

4. Cycling (AA, AB vehicle classes)

Description	Evidence of effectiveness	Extent of regulation: (1) Is fitment required in Japan, Australia, Europe or USA? (2) Does a standard exist for the technology?	Extent of fitment in new and used vehicles	Can it be retrofitted?	ANCAP	Other actions to increase uptake	High level assessment of potential to improve safety outcomes
<p>Airbag Helmet</p> <p>A 'helmet' that leaves the cyclist's head uncovered during normal riding, but inflates automatically when an accident occurs.</p>	<p>Hövdning (makers of the airbag helmet) claim their helmet significantly outperforms traditional rigid helmets. Their claims have been endorsed by the Swedish insurance company Folksam's test in 2012</p>	<p>Hövdning's helmet meets the EU requirements for personal protection equipment and is certified to some CE standards – though it may not be certified to those standards relevant for bicycle helmets in New Zealand.</p> <p>Helmets are not mandated for cyclists in the EU.</p> <p>Would require application for exemption to the helmet rule</p>	<p>Very low - may be illegal in NZ. High price overseas (€299) may make uptake slow.</p>				
<p>Anti-lock braking systems (ABS)</p> <p>Prevent skidding, reduce stopping distance and allow riders to steer around obstacles. Also overcome riders' reluctance to apply full brake force in emergencies.</p> <p>ABS may operate on the front wheel only or both wheels.</p>	<p>Unknown</p>	<p>None</p>	<p>Very low</p>	<p>Easily for about \$150</p>			
<p>Bicycle lane safety light</p> <p>A laser light that projects a red line on either side of a bike to indicate a safe passing distance, and increases the perceived size of a bike.</p>	<p>Anecdotal evidence suggests effectiveness may be low, but there is no firm evidence.</p>		<p>Unknown, likely to be low</p>	<p>Yes</p>			
<p>Bicycle lighting standards</p> <p>Technical standards for bicycle lights to ensure lights are bright enough and do not dazzle.</p>	<p>Studies seem to suggest that lights increase the conspicuity of bicycles at any time. Daytime running lights may help with being seen in the daytime. Head/helmet mounted lights are popular for off-road use, but may dazzle road users.</p>	<p>The Land Transport Rule: Vehicle lighting 2004 requires that the light be visible from 200m away,</p> <p>NZ Standard 5441.1:1987 covers lighting and retro reflectors for cycles</p> <p>New ISO standards are being developed</p>	<p>Lights are mandatory, from sunset to sunrise.</p>	<p>Yes</p>			

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<p>Bicycle mirror</p> <p>A small rear-view mirror either mounted to the handlebar end, wrist or cycle helmet</p>				Yes			
<p>Bicycle standards</p>		AS/NZS 1927:2010 Pedal bicycles - Safety requirements: Specifies safety requirements for the design, assembly, and performance of bicycles. It also specifies requirements for the instructions to be given in a manual on use and maintenance, and for the instructions for the assembly of bicycles.					
<p>Connected vehicle to everything (V2X) communication devices</p> <p>A bike-mountable device that communicates with nearby Connected Vehicles to alert the driver to take evasive action if required.</p>	Some research by Patil & Mattingly (Univ of Texas Arlington)			Not in market yet			
<p>Crash sensor</p> <p>A small device attached to helmet or bike, which sends alerts to contacts when rider is in an accident,</p>	e.g. ICEdot, BikeTag, see.sense			Yes			
<p>Disc brakes</p>	Typically more effective than calliper or V friction brakes			Yes			
<p>eBike speed-limiters</p> <p>Speed limiters would limit eBikes so that their performance remains comparable to human-powered bicycles.</p>	The Cycle Safety Panel has concerns about unlicensed persons, including children, using very powerful e-bikes.	European standards require e-bike motors to be activated only by pedalling, power to be cut to the motor at 25 km/h and motor power output to be limited to 250 W. In the UK, where e-bikes are limited to 200 W, they may only be ridden by those over 14.	Unknown	Unlikely			

4. Cycling (AA, AB vehicle classes)

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		New Zealand limits e-bike motor power output to 300 W, but does not limit the top speed beyond normal road speed limits. EN15194					
<p>High visibility clothing</p> <p>Clothes in high saturation (fluorescent) colours, often with retro-reflective strips to increase cyclists' visibility.</p>	<p>Studies are unclear about the benefits of high visibility clothing for cyclists.</p> <p>A TRL report recommends that cyclists should wear high visibility clothing.</p> <p>However other reports suggest that high visibility clothing may have negative effects by working against the normalisation of cycling.</p> <p>Another TRL report (about motorcycles, but of which the conclusions are relevant) suggests any benefits of high visibility clothing are likely to be overestimated. Conspicuity depends more on contrast between a rider and their background, rather than absolute brightness.</p>						
<p>Reflective wheel rims, tyres or spokes</p> <p>Bicycle components are reflectorised to be visible side-on to traffic</p>		Common in Europe		Yes			
<p>Safety flag</p> <p>A high flag mounted above the cycle to draw attention to the rider.</p>	Considered useful for recumbent bikes and low cycle trailers	No standards		Yes			
<p>Space saver flag</p> <p>A small (30-40cm) horizontal plastic device that swings out from the side of a cycle to deter overtaking vehicles from passing too closely</p>				Yes			

5. Environmental Standards and Technologies

Description	Evidence of effectiveness	Extent of regulation: (1) Is fitment required in Japan, Australia, Europe or USA? (2) Does a standard exist for the technology?	Extent of fitment in new and used vehicles	Can it be retrofitted?	ANCAP	Other actions to increase uptake	High level assessment of potential to improve safety outcomes
<p>Vehicle exhaust emissions standards</p> <p>The four major standard setting jurisdictions (USA, Europe, Australia and Japan) have been setting ever lower limits for specified emissions from vehicles.</p> <p>Vehicle exhaust emissions standards are specified with respect to fuel type and vehicle weight. In New Zealand, we further break them down according to whether the vehicle was imported new or used.</p>	<p>Emissions standards limiting the output of exhaust gases that are harmful to people's health have been very effective at reducing some types of emissions, especially carbon monoxide from petrol vehicles. However, they have been less effective at reducing other gases, such as oxides of nitrogen (NOx) and fine particulates (PM10) from diesel vehicles.</p> <p>Estimates of the benefits to health or social costs from more stringent standards are not easily available for New Zealand. Most monitoring data shows measured levels of emissions have reduced or plateaued, despite increasing vehicle numbers since emissions standards were required in New Zealand.</p>	<p>Vehicle exhaust emissions standards are broken down by fuel type (petrol/diesel) and vehicle weight (light/heavy). In New Zealand, they are further broken down by import status (new/used).</p> <p>Standards exist in virtually all countries and are set by the four major standard setting jurisdictions (US, Europe, Australia and Japan).</p> <p>In practice the most relevant standards are from Europe and Australia for new vehicles and Japan for used vehicles.</p> <p>The most important standards not implemented in New Zealand are Euro 6/VI for all new vehicles and Japan 09 for used diesel vehicles.</p> <p>Refer to 'description of relevant standards at end of document for further discussion of likely implementation dates.</p>	<p>All vehicles entering the fleet meet minimum emissions standards. Without further regulation it is unlikely manufacturers would introduce cleaner vehicles.</p>	<p>Retrofit of emissions control technology is possible, and is relatively common in Europe where low emissions zones have encouraged this.</p>			<p>The Euro 6/VI standards and their equivalents from the US and Japan will be important to ensure air quality improves, especially given the growth in heavy vehicle travel expected in coming decades.</p> <p>Included in the Vehicle Standards Map.</p>
<p>Vehicle fuel economy standards</p> <p>Fuel economy standards usually specify levels of CO₂ emissions per km for specific classes of vehicles, or specific corporate averages a vehicle manufacturer's entire range must meet.</p>	<p>Legislative approaches to vehicle fuel economy standards vary. Some jurisdictions combine targets for manufacturers with financial incentives to purchase efficient vehicles (or disincentives for inefficient vehicles).</p> <p>This issue is distinct from vehicle exhaust emissions as it is not possible to treat CO₂ emissions in a vehicle's exhaust.</p> <p>Where they have been implemented, mandatory fuel economy standards have clearly encouraged the purchase of more fuel efficient vehicles. It is less clear whether they have reduced on-road CO₂ emissions, as distances travelled may increase.</p>	<p>With the notable exception of Australia, virtually all developed countries legislated to improve the fuel economy of vehicles entering their fleets. Australia is currently consulting on the options to introduce a fuel economy standard.</p>	<p>Unknown</p>	<p>No</p>			<p>Emissions of CO₂ are not falling at the rate our models predict. Partly this seems due to factors such as increased congestion and slow fleet turnover. Benefits from standards may only be evident over longer time frames.</p> <p>Included in the Vehicle Standards Map.</p>

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<p>Fleet management systems standard</p> <p>This is a voluntary industry standard developed by the main European truck manufacturers. The standard allows communication between a truck's electronic sensors and on-board computers from which the data can be retrieved. The data that can be accessed using common protocols under the standard includes information on fuel consumption, vehicle speed and brake application.</p>	<p>The FMS standard is widely used in Europe by telematics providers (such as TomTom and Navman) to connect to vehicles' onboard sensors and so gain accurate information to enable fleet management. It also enables third-party software for tasks such as safe and fuel efficient driving.</p>	<p>A voluntary standard that is not mandated anywhere.</p>	<p>It is near universal on European-built trucks, but not used by Japanese manufacturers.</p> <p>The absence of such a standard (or even sensors to monitor relevant variables) on many Japanese vehicles, which make up some 80% of imports is an impediment to the uptake of safe and fuel efficient driving in New Zealand.</p>	<p>No</p>		<p>Increasing fuel prices may create a demand.</p>	<p>Because this is not an internationally recognised standard it is unlikely New Zealand would require it.</p> <p>Included in the Vehicle Standards Map.</p>
<p>Autonomous vehicles</p> <p>An autonomous vehicle is capable of sensing its environment and navigating without human input</p>	<p>Autonomous vehicles may enable the adoption of energy-saving driving practices, and facilitate changes in the design of individual vehicles or the transportation system as a whole that enable reductions in energy intensity.</p>				<p>No</p>		
<p>Predictive power train control</p> <p>A system which uses GNSS navigation and high-precision topographic trip data provided to the vehicle's "Adaptive Cruise Control" system to select the most efficient gear for fuel savings</p>	<p>One study suggests that fuels savings of 3–10% are possible.</p>	<p>No known standards .</p>	<p>Fitted to some European trucks such as Mercedes Trucks, but unlikely to be effective in New Zealand without upgrades to our GNSS.</p>	<p>No</p>		<p>Increasing fuel prices may create a demand.</p>	<p>Included in the Vehicle Standards Map.</p>
<p>Recyclability of vehicles</p> <p>Standards to measure the environmental cost of removing vehicles from the fleet. This includes assessing the reusability, recyclability and recoverability of a vehicle.</p>		<p>ECE/TRANS/WP.29/2013/125</p>					

5. Environmental Standards and Technologies

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<p>Conventional hybrid electric power train</p> <p>A vehicle where the petrol or diesel internal combustion engine is supplemented by an electric battery. This can reduce the fuel consumption compared to a similar non-conventional hybrid electric vehicle.</p>			The number of conventional hybrid electric vehicles is around 18,888 at the end of December 2018.	Yes, but may be impractical in many cases.			
<p>Plug-in hybrid electric power train</p> <p>A vehicle where the petrol or diesel internal combustion engine is supplemented by an electric battery charged from an external electricity source. This can reduce the fuel consumption compared to a similar non-plug-in hybrid electric vehicle</p>	Over 80 % of NZ's electricity currently comes from renewable sources. There is surplus renewable capacity at most times, in particular at off-peak times (when charging of electric vehicles will most commonly occur). Therefore, the uptake of plug-in hybrid electric will likely produce much fewer emissions than a comparable vehicle powered solely by petrol or diesel.	Standards for the plug adapter and voltage that electric vehicles use for charging. The Government is implementing its Electric Vehicles Programme, with a voluntary target of 64,000 electric vehicles in New Zealand by the end of 2021.	There were 857 plug-in hybrid electric vehicles at the end of December 2016	Yes, subject to Low Volume Vehicle Certification May be impractical in many cases		RUC exemptions in place until electric vehicles make up 2 % of the light and heavy vehicle fleet. Road controlling authorities can enable electric vehicle access to special vehicle lanes	
<p>Electric power train</p> <p>A vehicle fully powered by an electric battery, charged from an external electricity source. This leads to zero tail pipe emissions.</p>	Over 80 % of NZ's electricity (in recent times) has come from renewable sources. There is surplus renewable capacity at most times, in particular at off-peak times (when charging of electric vehicles will most commonly occur). The uptake of pure electric vehicles will produce fewer emissions over the vehicles life-cycle than a conventional petrol or diesel vehicle.	Standards for the plug adapter and voltage that electric vehicles use for charging. The Government is implementing its Electric Vehicles Programme, with a target of 64,000 electric vehicles in New Zealand by the end of 2021	The number of pure electric vehicles in New Zealand is around 1650 at the end of December 2016	Yes, subject to Low Volume Vehicle Certification	No	RUC exemptions in place until electric vehicles make up 2 % of the light and heavy vehicle fleet. Road controlling authorities can enable electric vehicle access to special vehicle lanes.	

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<p>Hydrogen fuel-cell power train</p> <p>A vehicle that is powered by an electric motor using electricity generated by a chemical reaction involving stored onboard hydrogen.</p>		<p>No known standards</p> <p>Being actively promoted by Japanese Government and in California.</p>	<p>None in New Zealand, Hundreds worldwide</p>				
<p>Mild hybrid</p> <p>A vehicle that uses a petrol or diesel engine for propulsion, but which has a large battery to power functions that otherwise reduce engine efficiency, such as valve actuation or turbo charging. The battery also allows recovery of energy through regenerative braking and more efficient engine management, such as stopping and restarting the engine in traffic.</p>	<p>Several manufacturers have said they will implement 48 volt electrical systems to take advantage of mild hybrid features.</p>	<p>In 2011, Audi, BMW, Daimler, Porsche and VW agreed to implement a 48V standard known as LV148.</p>	<p>Some features are already available.</p>	<p>Potentially</p>			
<p>Regenerative braking</p> <p>A system which allows an electrically powered car to recover some of the kinetic energy lost while braking, and uses it to charge the onboard battery.</p>	<p>In theory regenerative braking is able to recover energy at approximately ¾ of the efficiency with which wheels are driven. In practice driving style, air resistance and road layout will reduce this efficiency.</p>	<p>No known standards</p> <p>May need regulation if brake lights aren't activated when vehicle slows during regenerative braking</p>		<p>Potentially</p>			
<p>Platooning system</p> <p>Technology that allows vehicles (especially heavy vehicles) to follow each other very closely while maintaining safety.</p>	<p>This is a specific application of connected vehicle technology. Vehicles must be able to communicate instantly with each other to ensure safe driving.</p> <p>US company Peloton claims fuel savings of 7% for a two truck platoon (10% for the rear truck and 4% for the lead truck).</p> <p>The European Safe Road Trains for the Environment project achieved fuel savings of between 7-15 %</p>	<p>No known standards</p>		<p>Potentially. Currently all systems are retrofitted.</p>			
<p>Fuel use dashboard display</p> <p>Technology that displays fuel use continuously, averaged or as the peak use.</p>	<p>Raises awareness of fuel use by driver and supports interventions such as SAFED. Can also be part of eco-driving software</p>		<p>Unknown</p> <p>Some are simple (eg. show current l/100km), some are sophisticated (eg.</p>	<p>To some extent (eg. via smart phone or in cab devices added to</p>			<p>There is evidence for the benefits of direct feedback systems to positively influence</p>

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			growing a tree as you drive smoothly)	vehicle)			driver behaviour
<p>Fuel efficient tyres</p> <p>Fuel efficient tyres require less force to turn the wheels of a vehicle and therefore, less fuel is consumed.</p>	<p>Large differences in performance between tyres (up to 7.5% in fuel consumption), have been confirmed by consumer tests and also by check-testing activities as part of the Fuel Efficient Tyre Programme.</p> <p>There are may be differences in terms of braking performance in the wet.</p>	<p>Minimum performance standards for rolling resistance and wet grip exist in Europe, and also Korea (for example those not meeting those standards can no longer be sold.</p> <p>Standard test methods exist.</p>	Unknown..	<p>Yes, easily</p> <p>Also not necessarily a cost disadvantage , in many cases better overall total cost of ownership</p>		<p>Require fitment in government fleets</p> <p>Collaborative promotion of existing voluntary labelling scheme</p> <p>Consider minimum performance standards for tyres (rolling resistance and wet grip) to cut out the worst performers</p>	<p>Up to 7.5% fuel savings due to fuel efficient tyres, also significant differences in braking performance (up to 18m, from 80km/hr, between worst and best)</p>
<p>Speed limiters</p> <p>A speed limiter is a governor used to limit the top speed of a vehicle.</p>	<p>As well as improving heavy vehicle safety (see above) lower speeds can enhance fuel efficient driving habits. Evidence of increased fuel efficiency at speeds appropriate for HV's, by an estimated 1.5%.</p>	<p>In the UK a speed limiter must be fitted on:</p> <ul style="list-style-type: none"> vehicles with more than 8 passenger seats, goods vehicles with a maximum laden weight of more than 3.5 tonnes 	Unknown. Likely to be very low.	Yes		Promotion of safety benefits.	Included in the Vehicle Standards Map .
<p>Under run protection device</p> <p>These devices are fitted to the side, front, or rear of a truck and prevent smaller vehicles running under a truck in a crash.</p>	<p>As well as improving heavy vehicle safety (see above) side under-run protection systems can improve the fuel efficiency of trucks if they are aerodynamically designed.</p>						
<p>Tyre pressure monitoring systems</p> <p>Uses a warning light on the dashboard to alert the driver when a tyre is significantly under-inflated.</p> <p>The standard for this warning is to</p>	<p>Under-inflated tyres reduce handling and braking performance, increase tyre wear and fuel consumption, and are more prone to failure (a blow out).</p> <p>Tyre pressure monitoring systems were first</p>	<p>Mandatory in the US</p> <ul style="list-style-type: none"> All new passenger car models (M1) - 2008 <p>Mandatory in the EU for</p>	Not known, but generally on late model vehicles from countries where this is required.	Yes. Price of kits depend on the technology used. Trade Me has	Considered to be a Safety Assist Technology (SAT) by	Promoted by rightcar.govt.nz	A valuable safety tool. Also reduces fuel use and CO ₂ emissions.

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signal the driver when the tyre pressure is 25% below the tyre manufacturer's recommended inflation pressure.	mandated in the US in the mid-2000s after a series of SUV crashes. More recent studies focus on benefits to fuel efficiency from properly inflated tyres.	<ul style="list-style-type: none"> All new type approval – 1 November 2012 All new passenger vehicles – 1 November 2014 <p>For N1 vehicles, TPMS are not mandatory, but if a TPMS is fitted, it must comply with the regulation.</p> <p>Standards US FMVSS 138 ECE 64</p>		sophisticated kits for \$250.	ANCAP.		Included in the Vehicle Standards Map.
<p>Tyre pressure monitoring caps</p> <p>Can be screwed onto the tyre valve and indicates, usually by change in colour, when pressure is below a prescribed level</p>	Unknown		Unknown, unlikely to be high.	Yes, for about \$5 per tyre			

Description of relevant standards

1. Emissions standards

New vehicles

For new vehicles there remains only one major set of emissions standards that are not included in the Vehicle Exhaust Emissions Rule 2007. These are the Euro 6/Euro VI standards (heavy vehicle standards are identified by the use of roman numerals). These standards began to be implemented in Europe from 2013.

The preamble to the Rule proposes that New Zealand will implement standards two years after Europe and Japan, or on the same day as Australia. On this basis New Zealand should begin implementation of Euro 6/VI from 2015. However, Australia, which began consultation on the introduction of Euro 6/VI in late 2012, and consulted again in 2016, has not announced when it will implement these standards. Because most new vehicles are imported through Australia, until Australia legislates for these standards there is little reason to amend New Zealand's requirements. Media speculation suggests a likely implementation date of 2018, but there is no official statement to confirm this.

There is a further US standard known as US2010 considered equivalent to Euro 6/VI that has not been included in the current emissions Rule and should be. This would affect a small number of vehicles (<100 heavy vehicles and <1000 light vehicles at current levels). This will can be included at the same time (and with the same implementation date) as Euro 6/VI and the Australian equivalent are required.

The Japan 09 standard (introduced in 2009) is also considered equivalent to Euro VI for diesel vehicles (there is no Japanese equivalent to Euro 6 for petrol vehicles). This is already a minimum standard for new vehicles declared to Japanese standards. However, the Japanese government is implementing changes to their standards for heavy diesel vehicles that would bring the test procedure, as opposed to the emissions limit values, to use the world harmonised drive cycles, rather than their own unique standards. This has lead to a series of new standards for diesel vehicles in Japan that New Zealand would look to adopt at some point in the future.

- Euro 6:
- o Changes to the testing procedures for the Euro 6/VI standards are being considered through the UN-ECE process to better reflect real-world driving conditions. Among the changes are a move the testing process to use the World Harmonised Light Vehicles Test Cycle and the World Harmonised Transient Cycle for heavy vehicles
 - o Australia is considering the option of introducing Euro 6/. Euro VI, but has made no public statement on possible timing since late 2016.
 - o The Australian Federal Chamber of Automotive Industries is seeking a review of its government's commitment to introduce Euro 6/. Euro VI vehicle emission standards, highlighting the need for complementary fuel quality standards. Australian refineries would need to be upgraded to produce Euro 6 compliant fuel, whereas the New Zealand refinery already achieves that standard.
 - o The Ministry of Business, Innovation and Employment will alter petrol fuel specifications to enable Euro 6 petrol engine technologies to function from July 2018. New Zealand diesel is already suitable for operation of Euro 6/VI technology.

Used Vehicles

Around 95 % of our imported used vehicles come from Japan. We had expected to be able to introduce the so called Japan 09 standard as a minimum standard for all used vehicles. However, the 2009 standard does not cover light petrol vehicles, so Japan 05 remains the highest standard for petrol vehicles. No further emissions standards are expected for light vehicles at this time.

It is appropriate to consider introducing Japan 09 as a minimum standard for both light and heavy imported used diesel vehicles. At present only a relatively small number of used diesel vehicles are being imported (built to the Japan 05 standard), but the number is increasing again as the New Zealand economy improves and increasing numbers of vehicles become available in Japan. New Zealand will require Japan 09 for new diesel vehicles from 2018. Given the importance of diesel vehicles to air quality it may be appropriate to regulate both new and used diesel vehicles at the same time.

2. Australian Design Rules (ADRs)

The Australian Design Rules (ADRs) are national standards for vehicle safety, anti-theft and emissions. The ADRs are generally performance-based and cover issues such as occupant protection, structures, lighting, noise, engine exhaust emissions, braking and a range of miscellaneous items.

The current standards, the Third Edition ADRs, are administered by the Australian government under the Motor Vehicle Standards Act 1989. The Act requires all road vehicles, whether they are newly manufactured in Australia or are imported new or second-hand, to comply with the relevant ADRs at the time of manufacture and supply to the Australian market. When a road vehicle is first used on Australian roads the relevant state or territory government's legislation generally requires that it continue to comply with the relevant ADRs as at the time of manufacture.

3. CEN

CEN, the European Committee for Standardisation, is an association that brings together the National Standardisation Bodies of 33 European countries.

CEN is one of three European Standardisation Organizations (together with CENELEC and ETSI) that have been officially recognized by the European Union and by the European Free Trade Association (EFTA) as being responsible for developing and defining voluntary standards at a European level.

4. Federal Motor Vehicle Safety Standards (FMVSS)

The Federal Motor Vehicle Safety Standards are United States federal regulations specifying design, construction, performance, and durability requirements for motor vehicles and regulated safety-related components, systems, and design features. They are the US counterpart to the UN Regulations, discussed below, which are recognised to varying degrees by most countries except the United States. Canada has a system of analogous rules called Canada Motor Vehicle Safety Standards (CMVSS), which overlap substantially but not completely in content and structure with the FMVSS. The FMVSS/CMVSS requirements differ significantly from the international UN requirements, so private import of vehicles not originally manufactured for the United States market is difficult or impossible.

FMVSS are developed and enforced by the National Highway Traffic Safety Administration (NHTSA).

5. ISO Standards

ISO standards are produced by the International Organization for Standardisation. The standards provide requirements, specifications, guidelines and characteristics that can be used to ensure that materials, products, processes and services are fit for their purpose.

The ISO standards are voluntary and ISO doesn't regulate or legislate, however a number of ISO standards have been adopted in some countries as part of their regulatory framework.

ISO standards are sometimes written by a joint technical committee with the International Electrotechnical Commission (IEC) or the American Society for Testing and Materials (ASTM). When this is the case, ISOs will be formatted to show this. For example: ISO/IEC JTC1.

6. SAE International

SAE International provides a forum for companies, government agencies, research institutions and consultants to devise technical standards and recommended practices for the design, construction, and characteristics of motor vehicle components. SAE documents do not carry any legal force, but are in some cases referenced by the US National Highway Traffic Safety Administration (NHTSA) and Transport Canada in those agencies' vehicle regulations for the United States and Canada. Outside North America, SAE documents are generally not a primary source of technical provisions in vehicle regulations; the United Nations' World Forum for Harmonization of Vehicle Regulations includes expert working parties to devise technical prescriptions. Ongoing harmonisation efforts seek to bridge gaps between North American SAE technical prescriptions and the UN standards in use outside North America.

SAE publishes more than 1,600 technical standards and recommended practices for passenger cars and other road going vehicles. These provide industry references for measurement of engine power, motor oil classification, tool and fastener sizes, and onboard diagnostic connectors and codes. SAE also publishes standards and recommended practices for headlamps and other vehicular lighting, brakes, automatic transmission fluid, communication networks, electric vehicle charging systems, vehicle ergonomics, and numerous other aspects of vehicle design, construction, performance, and durability.

7. World Forum for Harmonization of Vehicle Regulations (WP. 29)

The forum was first established in 1952 as the UN working party on the construction of vehicles. In March 2000 it became the 'World Forum for Harmonization of Vehicle Regulations' (WP 29). WP.29 works on regulations (formally called UNECE Regulations, now called UN Regulations) which cover vehicle safety, environmental protection, energy efficiency and theft resistance. WP.29 currently administers three UN agreements (New Zealand is a signatory to two).

1958 Agreement

Participating countries agree a common set of technical prescription and protocols for type approval of vehicles and components. Each contracting party's type approvals are recognised by all other contracting parties.

Most countries, even if not a contracting party, recognise the UN Regulations and either mirror the UN regulations content in their own national requirements or permit the import and registration of UN type approved vehicles, or both (except for the United States, which has its own Federal Motor Vehicle Safety Standards, and Canada).

The agreement recognises self-certification as an alternative to type approval and, therefore, does not preclude those countries whose rules and regulations are implemented through self certification from becoming contracting parties.

As at 2012, there are 128 UN Regulations appended to the agreement.

1998 Agreement

The 1998 agreement runs parallel to the 1958 agreement and addresses the issue of non-signatory countries to the 1958 agreement which follow a system of self certification, eg., the United States of America and Canada. The 1998 agreement establishes a process through which countries can jointly develop UN **Global Technical Regulations (GTRs)** for vehicles and their components. A contracting party to the 1998 agreement can adopt any GTR.