ECF Position on the Revision of the General Safety and Pedestrian Protection Regulations

European Cyclists' Federation

Ceri Woolsgrove c.woolsgrove@ecf.com

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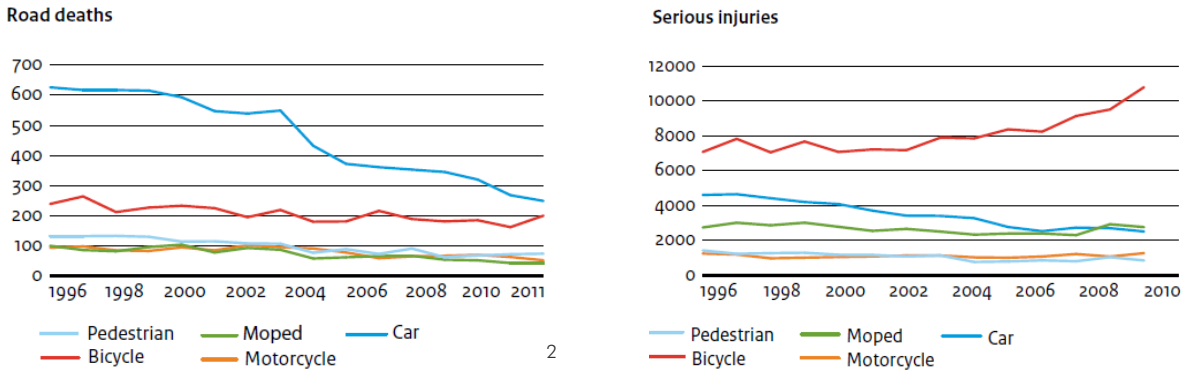
Executive Summary

- EU vehicle regulations should focus on pedestrian, cyclists and other 'vulnerable' users in order to achieve parity with the reduction in car occupants
- An intervening Intelligent Speed Assistance system should be mandatory in all new vehicles, including private motor cars and larger vehicles
- There should be direct vision regulations put in place in order for legislation to provide testing procedures for all new large vehicles
- For those larger vehicles used in urban areas a lower driving position, better direct vision through the windscreen and side windows should be improved and included in type approval for all new vehicles
- Side underrun protection should be mandatory and should be closed off so as to stop pedestrians or cyclists being caught in or through the guard
- Exemptions for the use of underrun protection must be tightened up as this often affects those vehicles that are most likely to be involved in VRU/HGV collisions
- Automatic Emergency Braking technologies for cyclists and pedestrians should be integrated into the Pedestrian Protection Regulations for both motor cars and large vehicles, particularly those in urban areas
- Improvements should be made to testing procedures for 'Head Impact on A-Pillars and Front Windscreen' passive safety design. This should be used in conjunction with ISA and AEB to maximise a reduction in cycling and pedestrian fatalities and serious injuries
- The European Commission should take into account wider 'social' elements within a thorough impact assessment of all possible safety systems as well as the cost/benefit economic analysis

Cycling road safety in the EU

Infrastructure development and driver behaviour are important road safety interventions, but vehicle regulation has an overriding European mandate. It is here that the EU can make a major difference and improvements in road safety across the EU. There has been an increase in a number of possible vehicle safety measures, but if the EU wishes to continuously improve it must look beyond the occupant of the car and concentrate further on pedestrians and cyclists that make up more than a quarter of all fatalities[1].

The number of cyclists being killed and seriously injured is decreasing, but it is decreasing at a much slower rate than for car occupants.

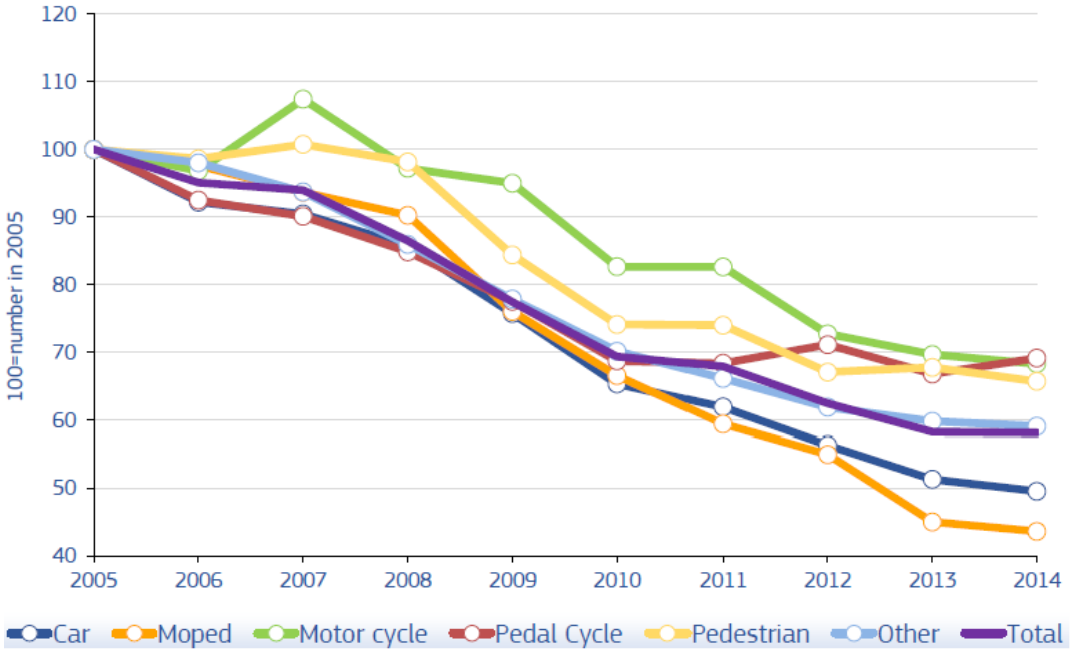


Various modes reduction in fatality and serious injuries in the Netherlands 1996 - 2011

A 2012 Netherlands report shows the fall in car fatalities and serious injuries, while cycling fatalities have stagnated or even, in the case of serious injuries, risen. Although this rise could be partly explained by a rise in cycling numbers, there has also been a rise in car use but still with a reduction in casualties. The International Transport Forum (ITF) has shown that in IRTAD countries between 2010 and 2014 car occupant fatalities have fallen at an average of -22%, while cycling fatalities have *increased* by 11%[3].

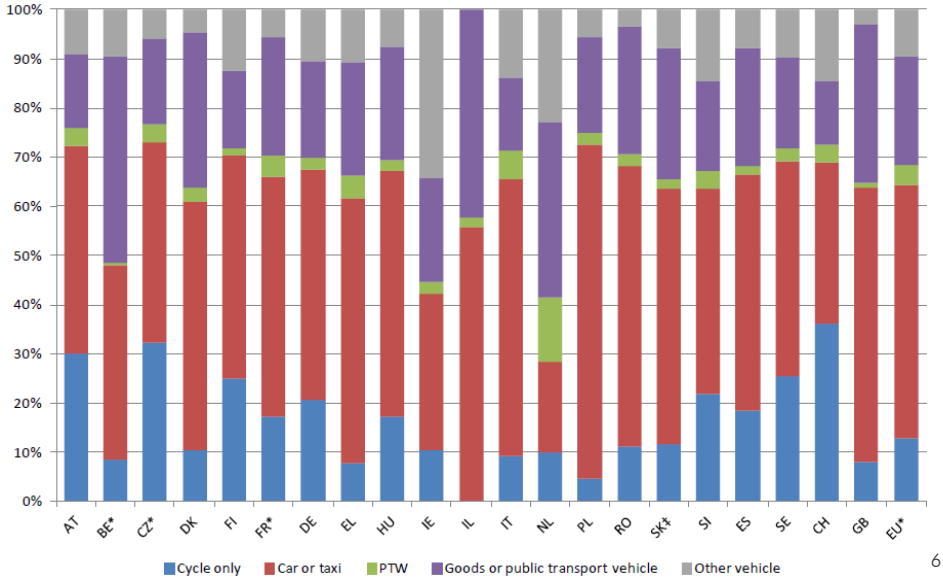
More specifically in the EU the number of cyclists being killed and seriously injured is decreasing, but it is still at a slower rate than for car occupants. While car occupant fatalities has dropped by 50% over the past ten years, cycling fatalities has stalled at around 25% and even increased slightly in 2014 - 15[4].

[1] http://ec.europa.eu/transport/road_safety/specialist/knowledge/pedestrians/index_en.htm
[2] Netherlands policy document on road safety road safety ministry of infrastructure and the environment 2012 https://www.government.nl/binaries/government/documents/leaflets/2012/11/14/policy-document-road-safety/policy-document-road-safety.pdf
[3] http://www.itf-oecd.org/road-safety-annual-report-2016
[4] Commission Care database http://ec.europa.eu/transport/road_safety/specialist/statistics/index_en.htm



Index (2005=100) of road fatalities by mode of transport, EU, 2005-2014

Unfortunately this does not take into account the possible increase in cycling numbers. However the UK does provide distance travelled figures, which saw almost a 44% drop in car occupant fatalities per distance travelled from a 2005-2009 average to 2013, while cycling fatalities only fell 16% between those years. There was a 34% drop in car occupant serious injuries with a 31% *rise* in cyclist serious injuries over that same time period[5]. And indeed as the graph below shows it is in collisions *with* motorized vehicles that are major factors in most cycling fatalities.



[6] Cycling fatality vehicle collision

[5] UK DfT Reported Road Casualties in Great Britain: 2013 Annual Report 2013
https://www.gov.uk/government/statistics/reported-road-casualties-great-britain-annual-report-2013
[6]Pedalling towards Safety BIKE, ETSC 2012

Conclusion; although cycling fatalities in Europe has made good progress generally the fall in cycling (and pedestrian) fatalities is not keeping pace with other road user modes. This trend has shown that there has generally been an increase in road safety in general and this has been a great European success story, in particular for motor vehicle safety and for those inside the vehicle; however there is considerably less success for those outside of the vehicle.

General Safety Regulations and Pedestrian Protection Regulations

The European car industry leads the world in vehicle technologies and the EU leads the world in vehicle safety thanks to progressively stronger vehicle regulations. The European commission will during 2016 release a report followed by a legislative proposal to update the General Safety Regulations and pedestrian protection type approval regulations in 2017[7]. These Regulations provide an excellent opportunity to update vehicle safety to also include safety for those outside the vehicle

We have a major opportunity with the technologies currently available to have genuine VRU specific technologies mandated for all new vehicles. A Transport Research Laboratory report[8] for the commission which looked at the cost/benefit of potential new technologies that could be included in the GSR update researched many excellent possible technologies that could be mandatory for all new vehicles and gave positive benefit to costs for Intelligent Speed Assistance, Autonomous Emergency Braking for cyclists/pedestrians; truck design underrun protection and improved testing procedure for bonnet design.

Recommended Vehicle Safety Measures to Reduce Cyclist Casualties

Intelligent Speed Assistance (ISA)

Up to 30% of drivers exceed speed limits on motorways*, up to 70% on roads outside built-up areas and as many as 80% in urban areas* exceed speed limits, when asked if they ever broke the speed limit only 7% of drivers replied that they did in urban areas[9]. Reducing speeds of motor vehicles in urban areas is crucial in getting more people to use bicycles, not only does this decrease the real danger but it also decreases the perceived danger that those interested in taking up cycling, feel[10][11]. With regards to actual safety, results from a study by the Norwegian Institute of Transport Economics have shown that "…there is a strong statistical association between speed and road

[7] http://ec.europa.eu/growth/sectors/automotive/safety/index_en.htm
[8] http://bookshop.europa.eu/en/benefit-and-feasibility-of-a-range-of-new-technologies-and-unregulated-measures-in-the-field-of-vehicle-occupant-safety-and-protection-of-vulnerable-road-users-pbNB0714108/
[9] http://archive.etsc.eu/documents/Intelligent_Speed_Assistance_FAQs_2013.pdf
[10] http://www.gov.scot/Publications/1999/10/38560fea-6e19-4098-95cd-37be45958aa8
[11] http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1763332/pdf/v058p00837.pdf Morrison D, Thomson H, Petticrew M. Evaluation of the health effects of a neighbourhood traffic calming scheme. Journal of Epidemiology and Community Health. 2004;58(10):837-840. doi:10.1136/jech.2003.017509

safety…it can be estimated that a 10% reduction in the mean speed of traffic will result in a 37.8% reduction of the number of fatalities[12]". To put this in perspective it was estimated that a 10% reduction in "Exposure to darkness" and "Drink-driving" gives reductions of only of 1.7% and 1.0% in fatalities respectively. Enforcement is an extremely difficult operation in budget-stretched administrations, ISA can help to improve levels of compliance enormously with many trials and studies showing the beneficial effects of ISA on road safety. There are three types of ISA:

- Informative or advisory ISA gives the driver feedback on the current speed limit
- Supportive ISA warns the driver when exceeding the limit by audio, visual or haptic feedback
- Intervening/assisting ISA actively aids the driver to keep under the limit, either by reducing fuel injection or by requiring a "kick-down" by the driver if he or she wishes to exceed the limit

ISA can be overridable if an overtaking manoeuvre is necessary. Assisting ISA is by far the most effective Carsten[13] has shown that assisting ISA could reduce crashes by 33% on urban roads. Intervening/assisting ISA could reduce all road deaths by 21% and with a non-overridable ISA this figure could rise to 46%[14].

The European Commission published a study[15] last year looking at the positive safety benefits of speed limiters for larger vehicles. We would like to see ISA replacing speed limiters in larger vehicles as well. The Transport Research Laboratory report on road safety cost/benefits also provides a large benefit to cost ratio of ISA in new vehicles[16].

ECF Recommendations –

- Mandatory fitment of ISA in all new passenger cars, eventual extension to vans, HGVs and other large vehicles. The system should be intervening but overridable. However the system should be active from the moment the car starts, rather than having to be manually activated by the driver; the default position should be 'on'.

Lorries, HGVs, Trucks and Larger Vehicles

According to the European Transport Safety Council, lorries are involved in around 4,200 fatal crashes in Europe every year. Many of these fatalities, almost 1,000[17], are "vulnerable road users" such as cyclists and pedestrians. In countries with high rates of cycling, lorries are often the single biggest threat to cyclists: In Belgium, 43% of cycling fatalities involve larger vehicles[18], in the

[12] Elvik, R et al (2004) Speed and road accidents: an evaluation of the Power Model https://www.toi.no/getfile.php/Publikasjoner/T%C3%98I%20rapporter/2004/740-2004/Repsumm.pdf
[13] Carsten O., Fowkes M., Lai F., Chorlton K., Jamson S., Tate F., & Simpkin B. (2008), ISA-UK intelligent speed adaptation Final Report.
[14] Calculations by Carsten, O. based on Carsten O., Fowkes M., Lai F., Chorlton K., Jamson S., Tate F., & Simpkin B. (2008), ISA-UK intelligent speed adaptation Final Report
[15] http://ec.europa.eu/transport/road_safety/pdf/vehicles/speed_limitation_evaluation_en.pdf
[16] http://bookshop.europa.eu/en/benefit-and-feasibility-of-a-range-of-new-technologies-and-unregulated-measures-in-the-field-of-vehicle-occupant-safety-and-protection-of-vulnerable-road-users-pbNB0714108/
[17] FKA, Design of a Tractor for Optimised Safety and Fuel Consumption 2011.
[18] www.etsc.eu/documents/BIKE_PAL_Safety_Ranking.pdf

Netherlands 38% and in the UK 33%[19]. In some cities, like London, lorries are responsible for around 56% of cyclist deaths[20]. HGVs have a much higher relative danger in urban areas, as shown below by data based on UK Department for Transport figures[21];

Traffic in billion veh kms	HGV traffic	All motorised traffic	HGV %	% fatalities involving at least 1 HGV	**Ratio of HGV to all motor vehicles**
Motorway	10.9	99.8	10.9%	52.3%	**480%**
A	11.7	217.3	5.4%	18.1%	**335%**
Minor	2.4	167.0	1.4%	7.2%	**514%**

2012 data HGV traffic and fatal crashes by road type

The data shows that relative risk of HGVs on minor roads, in and around urban areas has risen over the past 6 years[22] from 352.6% in 2007 to the 514% of 2011. The level of urbanisation is expected to rise to 82% by 2050[23] this will mean increased demand for goods, services and building works in our cities. HGVs/lorries and trucks of all types will become a more common vehicle in our cities. We have to make these vehicles fit for purpose to be allowed in urban areas, with the rise in these vehicles mentioned as something that may affect cost/benefit calculations. As will the increase in cycling, the future may mean more exposure between these two vehicles, given the higher levels of risk that HGVs pose for cyclists this should also be taken into account.

Rise of relative risk of HGVs in urban areas in the UK

2007	352.6%
2008	361.8%
2009	384.3%
2010	427%
2011	387%
2012	514%

Better direct vision[24]

There have been many studies that have underlined the danger of the current design of HGVs[25] with one of the occurring themes is that of better direct vision. In Europe, unlike with motor cars, there are no rules guiding what a lorry driver should be able to see directly through the windscreen or side windows (direct vision). Instead European regulation focus on indirect vision, i.e. through mirrors, but while these are also essential, the multitude of mirrors and their often distorted images are no substitute for decent direct vision. There are problems with indirect vision, a slight mistake

[19] According to the EU CARE database the ratio of HGV to bus involvement within all type of collisions is around 5:1, meaning that HGVs are the main contributor http://ec.europa.eu/transport/road_safety/specialist/statistics/index_en.htm

[20] http://www.lbhf.gov.uk/Directory/Council_and_Democracy/mgHomepage.asp?mgpage=mgAi.aspx%26amp%3BID%3D11596

[21] Traffic statistics table TRA0104, Accident statistics Table RAS 30017, both DfT. In http://www.bettertransport.org.uk/sites/default/files/research-files/HGV_fatal_ax_cf_to_all_2012.pdf

[22] ibid

[23] http://ec.europa.eu/transport/themes/urban/doc/ump/swd(2013)524-communication.pdf

[24] https://ecf.com/groups/ecf-report-hgv-cabs-direct-vision-and-amendments-directive-9653-full-report

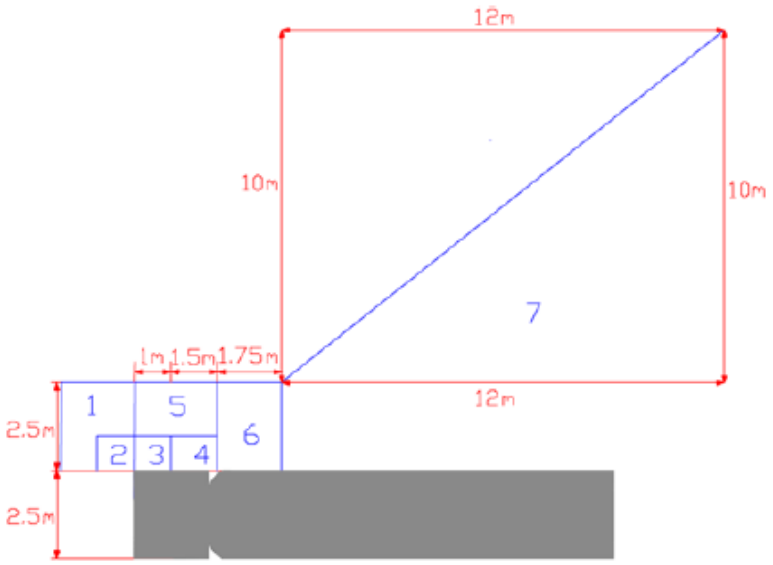
[25] http://www.transportenvironment.org/sites/te/files/media/4846_defreportEdB.pdf; http://www.ecf.com/wp-content/uploads/ECF-_-HGV-Vision-_-Directive-9653.pdf; http://www.tfl.gov.uk/cdn/static/cms/documents/construction-logistics-and-cyclist-safety-technical-report.pdf; http://www.transportenvironment.org/publications/ending-lorries-deadly-track-record-matter-direct-vision;

in adjusting the mirrors can leave a large blind spot in the driver's vision[26]. A Danish study[27] found that of the 25 HGVs they studied that were involved in collisions with cyclists, 21 had incorrectly adjusted mirrors, 8 of which were directly related to the collision.

It has been estimated that it takes about a second for a driver to glance into a mirror and then turn to the next mirror[28]. So there are three/four main mirrors at the passenger side, one up front, a look ahead through the windscreen and then the manoeuvre. That's about 4-6 seconds from looking in the first mirror to looking in the last and then making the manoeuvre. A lot can happen in that first mirror in five seconds. This is another blind spot, a temporal blind spot rather than a spatial one, but a blind spot none the less. Better direct vision would reduce glance time and improve cognitive visual appreciation of the environment around the cab.

Most crashes with cyclists occur at the front/side and around the cabs, improved vision around the cab would reduce driver recognition of danger in those areas. TNO[29] found that some 36% of fatalities were in "blind spot" crashes, defined as goods vehicles turning right and cycles/mopeds going straight ahead. With regards to positioning of the blind spot crashes TNO found that though many of the incidents occur behind the door and along the side of the HGV there are also a significant amount that occur at the front, front/side and side, in other words to the front of the door or at the door of the HGV.

Area	Per cent
2	5.3%
2 and 5	5.3%
1 and 2	5.3%
3 and 4	5.3%
2, 3 and 4	5.3%
3, 4 and 5	5.3%
1	10.5%
1 and 5	10.5%
4 and 6	10.5%
5 and 6	36.8%
Total	100.0%



Position of crashes with HGV and two wheel vehicles

[26] Dodd, M. 2009. Follow on study to the heavy goods vehicle blind spot modelling and reconstruction trial. Published report PPR403

[27] Danish Road Accident Investigation Board , 2006, Ulykker mellem højresvingende lastbiler og igeudkørende cyklister

[28] Taoka, 1990, Duration of Drivers' Glances at Mirrors and Displays http://www.ite.org/membersonly/itejournal/pdf/JJA90A35.pdf;
Sodhi, M. & Reimer, B., (2002) Glance analysis of driver eye movements to evaluate distraction http://link.springer.com/article/10.3758%2FBF03195482

[29] Fields of vision related victims among small two-wheeled vehicles: a European perspective, TNO, November 2001

Within the context of the revision of the Weights and Dimensions Directive 96/53, the European Parliament called for, and which was very much supported by ECF[30], better direct vision and better deflective shape, for lorries and trucks that are allowed a larger cab design for better aerodynamics. This should also be considered for type approval of all new larger vehicles, in other words if longer cabs would assist better direct vision (lower seating position for example). A better deflective shape should also be considered, work on this has been done with the APROSYS project which also looked at the deflective shape of HGV/lorry fronts[31].

There are currently on the roads examples of cab design that can be used for tipper/construction or delivery trucks. The Mercedes Econic is a good example that has been used for many different purposes, including construction, cement, refuse, freight and delivery.

For a full report on HGV/lorry vision problems and solutions also refer to ECF documents and reports here https://ecf.com/what-we-do/road-safety/safer-lorriestrucks-cyclists

Mercedes Benz Econic: Source BIFFA

Underrun Protection

Currently side underrun protection regulation does exist for trucks and trailers, which are used to prevent cyclists, pedestrians and motorcyclists from falling under the wheels of a truck if they are knocked to the floor, mainly at a right turn incident. However the legislation in place allows for an 'open frame'. We believe that a closed frame would be a very useful update. ETSC have estimated[32] that there could be a reduction by as much as 45% if cycling/pedestrian fatalities in these types of crashes with trucks and lorries.

A major issue with regards to underrun protection is that many vehicles are exempt from their use. This includes many tipper, construction, cement lorries etc. These vehicles involved in the construction industry are often responsible for many of the cycling fatalities; these exemptions in type approval need to be tightened up. These vehicles are more likely to be traveling on urban roads than on building sites. Building sites of today are much less likely to be These are the vehicles that are often doing the most harm, for example 'off road' vehicles are often construction or tipper lorries which are responsible for a many cycling fatalities. The TRL makes excellent points on this and should be followed up. TRLs work for TFL on construction lorries and cycling fatalities[33].

ECF Recommendation

- There is a glaring omission in larger vehicle regulation, there is nothing dealing with direct vision. We need to see Direct Vision regulations for new HGV as it is with other motorised vehicles

[30] http://www.ecf.com/wp-content/uploads/ECF-_-HGV-Vision-_-Directive-9653.pdf
[31] http://www.transport-research.info/web/projects/project_details.cfm?id=35419
[32] 2001 Priorities for EU Motor Vehicle Design www.imobilitysupport.eu/library/imobility-forum/working-groups/concluded/emergency-call-ecall/1338-ecall-wg-etsc-priorities-for-eu-motor-vehicle-safety-design
[33] http://www.tfl.gov.uk/cdn/static/cms/documents/construction-logistics-and-cyclist-safety-technical-report.pdf

- A lower driving position for drivers of larger vehicles particularly those vehicles used in urban areas. Better vision through the windscreen and side windows should be improved. These should be included in type approval safety regulations
- Side underrun protection should be mandatory and should be closed off so as to stop pedestrians or cyclists being caught in or through the guard
- Exemptions for the use of underrun protection must be tightened up as this often affects those vehicles that are most likely to be involved in VRU/HGV collisions.
- Investigations on the possibility of amber side markers on the side of lorries acting as turning indicators should be undertaken

Detection of cyclists/pedestrians and Automated Braking

By November 2015 all new Heavy Goods Vehicles (HGV) are to be fitted with advanced emergency braking, however many HGV vehicles will be exempt. However the types of automatic braking systems that are referenced with current type approval[34]are not those that are useful in urban scenarios with vulnerable road users. The major cause of collisions between cyclists and HGVs is the right hand turn over a cyclist (left in Cyprus, Ireland, Malta and UK). Since, as we have seen, many cyclist crashes occur as right hand turn manoeuvres an automatic braking system would very much help avert these kinds of crashes saving many cyclist and pedestrian lives per year.

Progress is being made with regards to HGV automated sensing and braking/warning for pedestrians and cyclists[35]. Though this technology is harder to perfect than with straight ahead vehicle recognition and braking (cyclists also ride to the side and behind the vehicle unlike pedestrians), it could be a powerful tool to prevent blind spot and turning crashes with cyclist/motor vehicle collisions. However targeting a specific collision such as the HGV/truck right hand turn at low speeds may yield better implementation of this type of technology and it is certainly a technology that should be encouraged.

For private motor cars AEB technology is also advancing at great speed. There currently exists many class and brand of car that offer pedestrian detection systems (around 5% of vehicles currently on the market. There are some manufacturers which already purport to have cyclist AEB on board (Jaguar XE, Volvo XC90 for example)[36]. EuroNCAP provides testing procedures for AEB for pedestrians and will by 2017-2018 also provide them for cyclist. The technology is close to being stable enough for use throughout all vehicle classes. Bundling technology together for use with vehicle AEB and Forward Collision Warning can bring the benefit cost in favour of regulatory implementation and should be considered for inclusion in type approved measures. With

[34] outlined under implementing Regulation 347/2012 and 2007/46
[35] http://www.volvocars.com/uk/top/about/news-events/pages/default.aspx?itemid=175
[36] Other interesting possible use could also be for reducing 'dooring'9 incidents where the door handle gives haptic feedback if a cyclist is passing, with the Volvo explicitly claiming that their sensing system can also be used for dooring warning systems. If 'bundled' into other sensing systems the cost may also be minimal. http://newsroom.jaguarlandrover.com/en-in/jlr-corp/news/2015/01/jlr_bike_sense_200115/

EuroNCAP integrating these systems into its rating classifications making it even more attractive for the development of AEB for cyclists and pedestrians.

ECF Recommendation

- AEB technologies for cyclists and pedestrians should be integrated into the Pedestrian Protection Regulations for both motor cars and trucks, particularly those in urban areas

Head Impact on A-Pillars and Front Windscreen

ECF has commissioned a study from AGU Zurich to look into incorporating cyclist impacts into the Pedestrian Protection Regulations of type approval[37]. The conclusions of the study are that currently cyclist impact is not considered in this regulation, this has serious implications for reducing impact seriousness

"Although the impact scenarios for pedestrians and cyclists are generally similar, there is evidence that some relevant differences exist. Consequently these differences must be addressed in a revision of the test procedures to also consider safety of cyclists and thus increase the impact of this safety regulation."

Cyclists tend to impact higher up on the car, on the windscreen and on the A-pillars of the vehicle. Passive and safety systems act as multipliers on the benefits of each other and should be seen as a whole pedestrian/cyclist safety system. Used in conjunction with Intelligent Speed Assistance and Autonomous Emergency Braking could have a huge impact in the reduction of cycling fatalities and serious injuries.

ECF Recommendations

- to keep the methodology of the test procedures as described in regulation ECE R127
- but to consider the larger wraparound distance of cyclists which results in a larger head impact area
- depending on the vehicle design this requires extending the impact test zone to the upper windscreen area including A-pillars and the roof
- furthermore the impact conditions in terms of impact velocity and impact angle should be revisited, but it is suggested to use the same impactors as today
- it is expected that such minor modification of the regulation will lead to improved safety of vulnerable road users in short term in which active safety measures will not yet be widely available in the European vehicle fleet

[37] https://ecf.com/sites/ecf.com/files/ECF_AGU%20ZURICH%20final%20report%20on%20passive%20safety.pdf

Further General Comments

Wider social externalities

It should be important to mention impacts that improved safety can have that are not so easy to define within a traditional road Cost/Benefit analysis within the remit of traditional transport road safety. For example the benefits associated with a rise in quality of life in areas that see lower speeds, or the increased health/air/congestion benefits in the shift to active modes of transport with safer, calmer traffic, or the decrease in carbon/particulate emissions that road safety measure like lower speeds/safer HGVs can bring.

With regards to cycling specifically if safer vehicles, calmer roads, lower speeds (through ISA for example) can lead to increased cycling there are a whole host of wider social benefits that could be taken into account. ECF has attempted to quantify many of these[38] with regards to an increase in cycling and though they may be difficult to shoehorn into a traditional road safety cost/benefit these elements should be included within a broader 'impact assessment' by the European Commission when considering inclusion of safety systems.

Autonomous vehicles

The buzzwords in road transport at the moment are autonomous vehicles and driverless cars[39]. Many European countries are expecting and altering road regulations to allow autonomous vehicles on the roads and there are manufacturers claiming that these vehicles will be on the roads by 2019 - 2020[40]. Many of the technologies that are necessary for these vehicles are also described above. They are essential to the use of autonomous vehicles on the road. The hype surrounding these vehicles is currently at fever pitch, this is great as it means that the technologies that we have been advocating in this paper and elsewhere must be effectively stable and ready. ISA and AEB are absolute necessities for autonomous vehicles, ISA is also one of the technologies that is the most mature. This all bodes well for implementation and mandating for the introduction of these technologies in all new vehicles. Lead in times should also be short since the industry as a whole is actively moving towards this future vision of driverless cars

[38] https://ecf.com/what-we-do/cycling-economy/economic-benefits and https://ecf.com/what-we-do/cycling-economy/jobs-and-job-creation-european-cycling-sector
[39] See ECF discussion document on autonomous vehicles and cycling here https://ecf.com/sites/ecf.com/files/ECF%20Discussion%20Doc%20on%20C_ITS%20Autonomous%20Vehicles.pdf
[40] http://www.driverless-future.com/?page_id=384