

The Front Brake Light

Idea, conception and experimental evidence
for more traffic safety



Mobility and safety!



Imprint

Copyright BIRVp, Bonn, Germany, www.birvp.de
on behalf of Lumaco Innovations AG, Wollerau,
Switzerland, 2018.

Pictures provided within this brochure as well as
further information, videos and other downloads
from the homepage www.frontbrakelight.eu
may be published further on without alterations
for all legal purposes which are free of charge,
not advertising and not demeaning the idea of
a front brake light.

For further information please also contact:
Bonner Institut für Rechts- und Verkehrs-
psychologie, Siegfriedstr. 28, 53179 Bonn,
Germany, www.birvp.de



Introduction

Increasing traffic safety by improving communication in road traffic!

Dealing with road traffic is a daily part of life for almost all members of society. As a result, traffic safety is an ever-present issue whose importance increases in line with increases in traffic density. According to a study by the road safety campaign „Get Off Gas“, one casualty in a traffic collision affects an average of 113 other people – family members, friends, acquaintances and emergency services personnel –, sometimes permanently.

With an annual death toll of around 25,300 on the roads of Europe in 2017, some 135,000 serious injuries and the social costs of medical care, rehabilitation and lost work amounting to about € 120 billion a year, the EU has set itself the target of reducing road deaths between 2010 and 2020 to around 16,000.

Achieving this objective will require taking every opportunity to improve traffic safety!

Given the complex triangular relationship between human, vehicle and environmental factors, advances in traffic safety will always have to encompass a variety of innovations.

One of these could be the **Front Brake Light**, a front mounted, forward-facing lighting device that illuminates simultaneously with the rear brake lights and tells on-coming road users that the car is braking.

Scientific Approach

In 1971 an initial study was already undertaken in the U.S. on the usefulness of such a **Front Brake Light** with a number of private vehicles. Afterwards the participants just like a control group both considered the **Front Brake Light** to be useful in communicating with other drivers and pedestrians – especially under conditions of poor ambient lighting as well as to communicate behavioural intentions.

To examine this more closely a laboratory study took place in 2016, which also highlighted the information asymmetry between motor vehicle drivers and pedestrians. Whilst drivers may fall back on direction of movement and body language of pedestrians to understand their intentions, pedestrians themselves have – especially when facing oncoming traffic – very few indications as to the intended behaviour of drivers.

Without any special signal in the front of a vehicle (i.e. a **Front Brake Light**) it is significantly harder for pedestrians to perceive braking. This problem is of particular importance when either using pedestrian crossings or crossing side roads in front of turning vehicles; situations in which collisions commonly occur.





Building on this, a more extensive longitudinal field test was carried out at Berlin-Tegel Airport in 2017, in which both – the drivers of vehicles equipped with a **Front Brake Light** and other road users who had experienced those vehicles in live traffic – were questioned. The results of this also showed wide support and recognition for the concept.

Open comments: Examples of positive comments broad support and recognition for the concept. (the number of comments is given in parentheses)

Category	Comments (examples)
Anticipation and reaction (13)	<p>“You can see quicker that the vehicle is braking“</p> <p>“You can respond more quickly to the braking of other road users.“</p>
General positive comments (10)	<p>“That was very good.“</p> <p>“Good idea.“</p>
Visibility (10)	<p>“Good. I expect it to be even more positive in winter.“</p> <p>“The version currently used on vehicles does not dazzle, but is very clearly visible.“</p>
Feeling of safety (7)	<p>“As a road user, you feel safer.“</p> <p>“Safety has increased.“</p>
Communication (3)	<p>“Improved communication among road users.“</p> <p>“The flow of traffic has improved.“</p>
Colour (3)	<p>„Colour is noticeable.“</p>
Parking (1)	<p>“The Front Brake Light helped with parking“</p>
Other (7)	<p>“Vehicles of other companies should also be equipped.“</p> <p>„You have to get used to it.“</p>

Scope of application and potential benefits

The catalogue of possible applications of a **Front Brake Light** includes multiple cases to improve communication between road users and thus ensure greater traffic safety. Such cases are by no means limited to asymmetric conflicts (e.g. vehicle / pedestrian). Also in a vehicle / vehicle constellation the **Front Brake Light** has potential to make road traffic more safely and more comfortable.

Main benefits for all road users are expected to be

- prevention of collisions in specific situations (see appendix A),
- reduction of the severity of accidents by its warning function (see appendix B),
- reduction of stress whilst driving and therefore reduction of failure (see appendix C),
- compensation of road user communication issues (esp. with electric and / or highly automated vehicles).

Easily to introduce from a technical point of view

A **Front Brake Light** must be regarded as a light-signalling function (LSF) within the meaning of authorization, as a version with a lower light intensity would not be fit for purpose.

For the conception of a new LSF on motor vehicles, there is always the question of the appropriate light colour to be used – as well from a legal as a factual point of view. As other colours are legally assigned already to special situations and / or special types of vehicles, choice is left between green and white.

Given the already existing high number and range of variation in forward-acting white light signals (dipped beam, high beam, fog lights, etc.), the use of a white **Front Brake Light** could result in ambiguous information being received, thus nullifying its benefit for traffic safety.

The colour green, however, is not used for LSF on motor vehicles yet, but therefore offers the advantage of unambiguousness and fast signal identification. Furthermore it is well known in road environment (i.e. traffic signals) and for purpose of a Front Brake Light will also be supported by psychological points of view against other colours, especially red.

It is assumed that the **Front Brake Light** is linked directly to the rear brake lights and thus only one more device must be connected to otherwise identical circuits in the control unit(s). With regard to the design of a **Front Brake Light**, a number of variants are conceivable, depending on the type of vehicle and its vehicle design. Therefore implementing a **Front Brake Light** within existing technical conceptions of vehicles is most easy from a technical point of view.



Front Brake Light within the framework of EU-objectives

Amongst its wide-ranging review on means and demands to increase traffic safety, the European Parliament's own-initiative report *On saving lives: boosting car safety in the EU* in 2017 stresses that,

"in order to improve road safety, the deceleration of vehicles should be rendered easier for other road users to perceive by means of clear signal lights on vehicles, and expects the compulsory use of an emergency braking indicator in the form of a flashing brake light or flashing hazard lights" [Nr. 37].

Mentioning signal lights for deceleration in general and not reduced to emergency braking, gives a strong hint to the need of permanent and regular signalling to the front, regarding that rear signalling of deceleration long exists.

Thus the presented concept of a **Front Brake Light** is absolutely in line with those objectives set out, in particular because by using the colour green it also provides the required uniqueness of the signal.

At the same time, the future requirements for compulsory driver assistance systems were raised in that report. Even when at present the introduction of a **Front Brake Light** is sought only on a voluntary basis, it may be deduced that a system, fulfilling even those requirements, especially complies with the objectives of the EU:¹

- Scientific evidence of significant contribution to increasing road safety
- Positive cost-benefit ratio
- (Given) Marketability
- No significant financial burden on the citizen (raising prices)
- Integration into the Periodical Technical Inspection



¹ More explanation to these topics to find in the document "comprehensive overview", please see www.frontbrakelights.com

Legal framework / next steps for introduction

Necessary for the introduction of a **Front Brake Light** as a significant contribution to traffic safety it will be, to alter or to extend two parts of the legal framework on type approval:

- Green must be approved as a colour of LSF on motor vehicles.
- Brake signals must also be allowed to be given to the front.

In the medium-term these steps must be agreed on internationally at level of the Vienna Convention resp. the framework of (UN) ECE type approval regulations.

A sensible and promising way in addition, to achieve that gain in safety for road users in the EU as soon as possible, appears to be via the EU's legislation itself. Accordingly, it would be desirable those changes to be implemented as EU-specific extensions within the scope of the respective application provisions of ECE type approval regulations for the EU area. Further progress would then be in line with the normal course of action under EU regulations and directives.

Nonetheless an introduction of the **Front Brake Light** for national areas and by national exception approval would be very helpful.



Conclusion

The Front Brake Light should be recognised as an additional, cost-effective and easily implementable measure to reduce traffic collisions, accident effects and stress in road traffic – not least in terms of reducing the actual risk to pedestrians.

It is stated, that the conception of the **Front Brake Light** would even comply with the high requirements set by the European Parliament for driver assistance to become compulsory. All the more then it must be possible to introduce such a system as a „milder remedy“ on a voluntary basis.

It is now assigned to the political part, to clear the way for its introduction by small legislative alterations in the framework of type approval. Or to give way for national exception approvals to start with, in order to gain significant improvements for road safety the sooner the better.

Since the beginning of the research and increasingly from the beginning of 2018, the concept of a **Front Brake Light** has already been presented to an enlarging number of experts in traffic safety research. It should be noted that the concept was generally positively regarded.

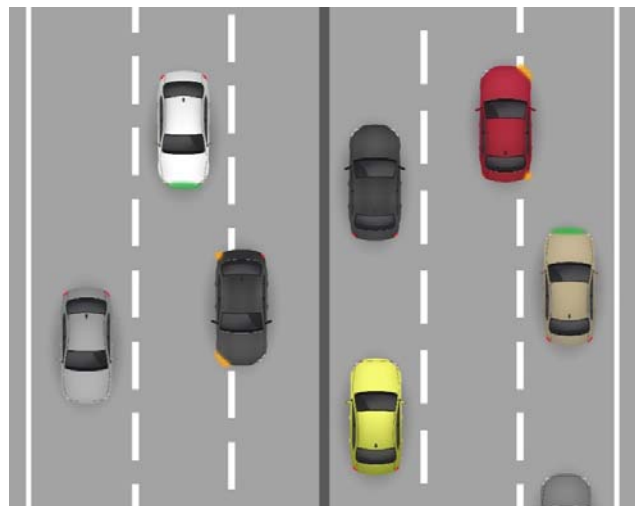
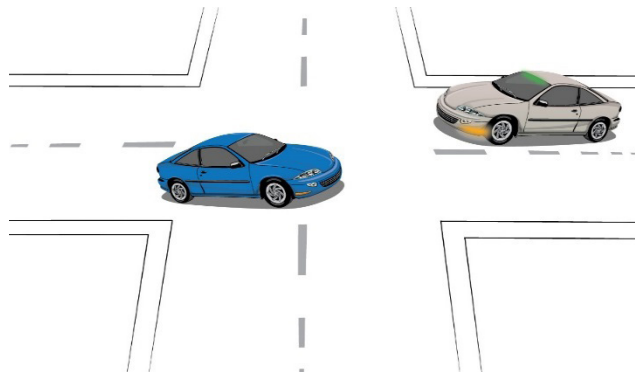
It is now assigned to the political part, to make more road safety happen!

Appendix A – real-world examples where a Front Brake Light would increase traffic safety

Real-world traffic situations in which a **Front Brake Light** on a vehicle would assist communication between road users and therefore increase traffic safety by accelerating the recognition of other one's behavior.

Note: The illustrations depict driving on the right, but the comments are equally applicable to countries where driving is on the left.

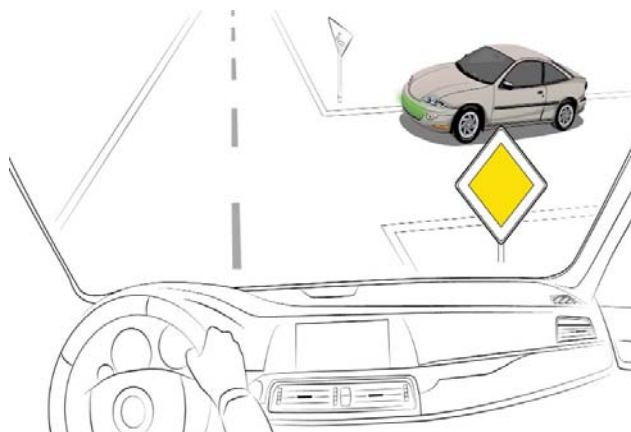
Situation	Advantage
	It becomes easier for other road users to recognize the behaviour ...
Typical situations	
Turning left	... of the driver turning left and to decide, if their right to go straight is given.
Changing lanes, especially in dense traffic	... of the vehicle right behind and to decide, when they wish to change lanes in front of the FBL vehicle



Situation	Advantage
	It becomes easier for other road users to recognize the behaviour ...
Typical situations	

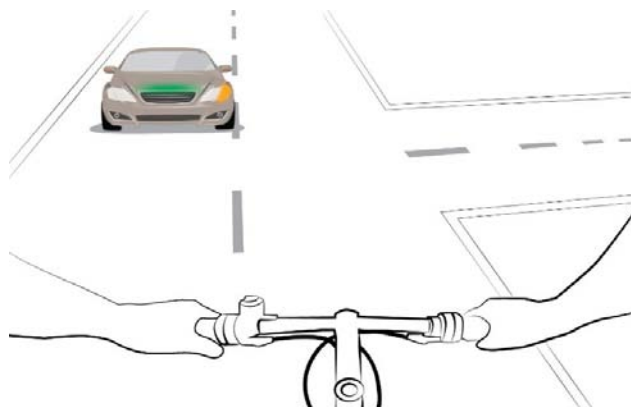
Approaching intersections

...of the vehicle from the right for drivers who have the right of way, making it easier for them to decide whether or not it is safe to exercise that right.



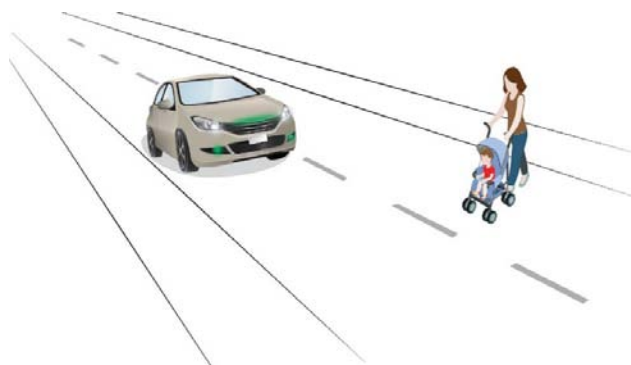
Straight ahead over intersection for weaker/slow road users despite vehicle crossing their way

... of a vehicle possibly crossing their way and therefore to decide whether to proceed or better give up their right of way.



Waiting to cross the road (away from designated crossing places)

... of the oncoming vehicle and facilitate judging whether or not to cross the road.



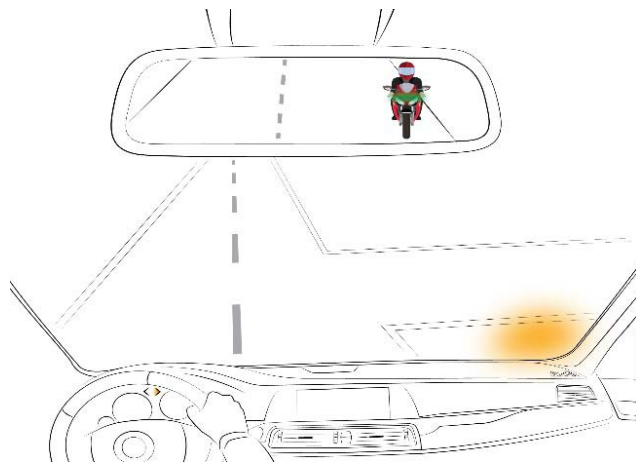
Situation
Advantage

It becomes easier for other road users to recognize the behaviour ...

Typical situations

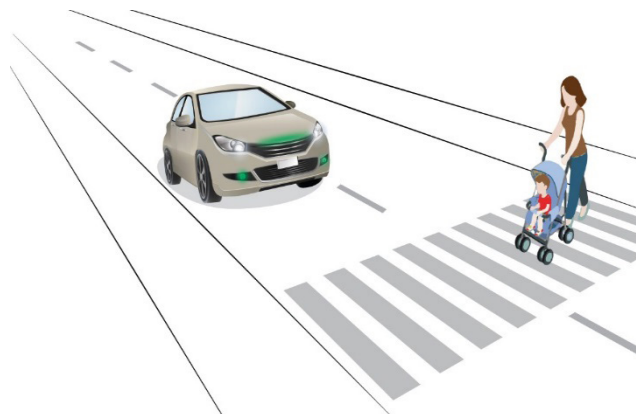
Turning of cars through (motor) cyclist's track

... of the motor-cyclist and to decide whether or not to cross its path.



Designated crossing place where the pedestrian has priority

... of the oncoming vehicle and to see if it is safe to exercise their right of way.



Situation	Advantage
Dangerous situations	

Vehicle break-down in ongoing traffic

Missing front braking signal means danger and to get off in time.



Dangerous situations with emergency vehicles demanding right of way

The driver of the emergency vehicle can determine more easily if he is given way or not and if a dangerous situation arises.



Furthermore, by its communicative effect a **Front Brake Light** would help to compensate deficiencies of highly automated and electric powered driving:

- As driving becomes more highly automated and the driver becomes less involved in the actual task of driving, it will be necessary to provide new communication signals to replace those currently used by drivers (such as facial expressions, hand signals and the like) to inform other road users of their intentions.
- Also, as the proportion of electric and hybrid-powered vehicles increases, it gets more difficult for road users both to hear motor vehicles and to detect any change in their speed.

In both cases, a **Front Brake Light** could make an important contribution to traffic safety by compensating lesser human or acoustic signalling.

Appendix B – potentially improvements in biomechanics of trauma in case of an accident

Besides its potential for preventing traffic accidents (see appendix A), it is further expected that a **Front Brake Light** gives potential to relieve the degree of injury in still remaining accidents.

Thus being a result of its warning function in a situation when its signal is missing and an on-coming vehicle is not braking obviously (this was one of the results of the Berlin-Tegel field study). The possible victim in that case might at least be able to recognize the situation and (better) adjust to it, which should in numerous situations lead to a decrease in biomechanical harm and damage.

To underline this hypothesis, an opinion¹ on biomechanical aspects of trauma was called to answer the question (amongst others)

...

3. Which effect would the early warning of an impact have upon vehicle occupants? Can it be hypothesised that the warning and an increased preparedness (e. g. adopting the brace position, stiffening of neck muscles, etc.) can alleviate the resultant injuries such as cervical spine trauma? One could imagine the difference between a body thrown back and forth by the impact, because it is unrestrained, and one that has braced itself and, therefore, is less likely, at least in theory, to be flipped back and forth.

Opinion (excerpt)

“In principle, at least, it can be assumed that, if the crash victim has prior warning, the severity of the crash will be reduced or the crash could even be avoided completely.

...

Question 3:

The car occupants would be forewarned that an uncontrolled or late braking vehicle is approaching them. Results from international research studies suggest that forewarning has a positive effect. For example, unprepared passengers have a higher injury severity than informed and thus muscular-tensed drivers. Even evasive movements can be better planned by the driver or, in the future, by automatic driving systems.

...

So-called spinal cord injuries occur in approximately 50–70% of all car crashes involving injured persons. Here, an advance warning, which was tested in volunteer tests on the test sled, has a positive injury-reducing or avoidance effect, too. In Germany, the annual cost of the estimated 200,000 cases of cervical spine injuries resulting from road crashes amounts to around 500 m annually.

¹ This opinion was given by Dr. med. Wolfram Hell, chairman of Gesellschaft für Medizinische und Technische Biomechanik GMTTB e. V.; for complete document please see www.frontbrakelights.com

A reduction by, for example, 10% would therefore have a significant effect. Likewise, in the case of even more serious injuries (AIS 2+), a more substantial cost saving could be expected.

For the next decade (2020–2030), the EU is particularly targeting the reduction of serious injuries.

...

In the case of rear-end collisions, it mainly results in cervical spurs that are not life-threatening (AIS 1 injury severity) but very common (50–70% of all car collisions) and 10% of so-called long-term cases (resulting in more than six weeks of occupational disability). Accordingly, the effect of a **Front Brake Light** and its potential for injury prevention should also be scrutinised in detail on the basis of real road crashes.”

Appendix C – reducing stress in traffic by introducing a Front Brake Light

Besides its potential for preventing and reducing the effects of accidents (see appendix A and B) it is further expected, that a **Front Brake Light** also will contribute significantly to reduce stress in road traffic:

- Especially in urban traffic situations with numerous road users it is important to a driver or pedestrian to recognize the behavior of one another quite fast, as he has to take a lot of other road users into account.
- A **Front Brake Light** will support this by giving the possibility to recognize faster if another vehicle is braking or not and therefore to save time, which can be invested in paying more attention to certain road users, who threaten to come to a critical situation with.
- This will lead to more control of the overall situation and therefore to a reduction of individual stress in road traffic.

To support this thesis in a first step a scientific theoretical derivation was done:¹

(excerpt)

“A driver’s stress, strain and load are terms that have barely been thoroughly investigated in the context of increasing traffic safety, avoiding traffic accidents and offences, and further reducing traffic-related deaths. Their relevance for traffic safety and the further development of a safe multisystem driver-vehicle-traffic interaction is undisputed.

...

The term stress, within the multi-systemic and complex context of the driver-vehicle-traffic system, describes a human psychophysical state of regulation which is relevant for an individual, if the personal human-environment relationship can no longer be compensated with behavioural routines and reaction automatisms.

...

Any reduction in the complexity of the safety-related signals to be observed and controlled is a contribution to stress reduction through preventive interventions ... Any attempts to reduce stress by reducing irritation and improving regulation by adding safety-related and control effort-reducing signals can stabilise behaviour and safety in traffic.

...

The following explanations therefore relate in particular to the situation design and technical equipment on the motor vehicle, which must allow by clear signal reduction to reduce stress by security of perception and control. Stress management processes are thus also facilitated by external resources on the vehicle if, for example, these facilitate the perception of and attention to braking from the front, which also increases traffic safety.

...

¹ Prof. Dr. Konrad Reschke, Dr. Udo Kranich, Institute for Psychological Therapy e.V., Leipzig;
for complete document please see www.frontbrakelights.com

More control over behaviour in road traffic can also be achieved through the use of technical means. These may, for example, help to improve/defuse and / or better identify dangerous situations in traffic. This increases the predictability of potential hazards, reducing the sense of threat, which in turn can reduce stress. In particular, the process of information processing is facilitated because the human brain can handle unique signals more easily than ambiguous ones. In particular, it is not capable of simultaneously processing various signals in complex request situations (multitasking).

...

The more the road user keeps control in (ambiguous) traffic situations, the less they are perceived as threatening. This in turn can be considered as a stress reducing factor. More control for road users can also be achieved through the use of technical means such as signals.

...

By implementing the **Front Brake Light**, uncertainty factors could be minimised in traffic situations that are neither clear nor unambiguous...”



Günter Wickler, ligatur, Copyright BRVp, Bonn 2017



More traffic safety by Front Brake Light –
make it happen!

www.frontbrakelight.eu / www.frontbrakelights.com