More road safety using a frontal brake light

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FEVR General Meeting
Münster 27.7.2019
Starting point: Still more traffic safety is needed!

- Death toll on roads of Europe still too high. So are numbers of serious injuries and social costs of medical care, rehabilitation and lost work amounting far over €100 billion a year.

- Target, also of EU, to reduce this: Need to take every opportunity to improve traffic safety!

- Triangular relationship between human, vehicle and environmental factors means: Improving traffic safety will necessarily rely on innovations.

- One of these: **Front Brake Light**
More communication to recognize others behaviour...

For a rear driver, braking of the vehicle in front is indicated by very visible brake lights

- prevents rear-end collisions

But it is difficult to recognize the braking process looking at the front of a vehicle

- Danger to pedestrians and crossing traffic
...with a Front Brake Light!
Scope of applications and potential benefits

- Improvement of communication, thus making road traffic more safely and more comfortable for all road users
  - not limited to asymmetric conflicts (e.g. vehicle / pedestrian),
  - also in vehicle / vehicle constellations.

- Main benefits expected to be
  - prevention of collisions in specific situations,
  - reduction of the severity of accidents by its warning function,
  - reduction of stress whilst driving and therefore reduction of failure,
  - compensation of road user communication issues (esp. with electric and/or highly automated vehicles).
Specific situations
Specific situations
Reduction of severity of accidents by warning function
Further information, scientific results etc.

www.frontbrakelights.com

www.vorderebremsleuchte.com
Study 1: Laboratory experiment with video material

Task of the participants

• Detection of braking in the video
• Variation of speed, deceleration, brake light activation
Study 1: Experimental design

Block I
- 100% Braking **without** frontal brake light

Block II
- 50% Braking **without** frontal brake light
- 50% Braking **with** frontal brake light
Results block II (mixed traffic)

- **no** frontal break light
- **with** frontal break light

<table>
<thead>
<tr>
<th>Speed &amp; deceleration</th>
<th>Reaction time [ms]</th>
</tr>
</thead>
<tbody>
<tr>
<td>50km/h 3.5m/s²</td>
<td>2500</td>
</tr>
<tr>
<td>50km/h 5m/s²</td>
<td>2200</td>
</tr>
<tr>
<td>30km/h 3.5m/s²</td>
<td>1500</td>
</tr>
<tr>
<td>30km/h 5m/s²</td>
<td>1200</td>
</tr>
</tbody>
</table>
Evaluation of the frontal brake light...

Street survey (Study 2)

- without examples rather neutral
- with concrete examples more positive

After participation in laboratory study (Study 1)

- clearly more positive!
Study 3: Field trial

Requirements

- limited number of vehicles and road users
- in a closed traffic area (outside of vehicle operating regulations)
- airside area of Tegel Airport (TXL)
Study 3: Field trial at Tegel airport

Method

- Providing 102 vehicles with a frontal brake light
- Operation of the equipped vehicles on the apron for three months
- Survey of 180 employees before (T1) and after (T2) 3 months of field trial
Positive and negative **experiences** with the Front Brake Light on **other** vehicles (N = 164)

1 = never
2 = rare
3 = occasionally
4 = often
5 = very often

- Understanding of the brake signal
- Misinterpretation of the intentions of others
- Faster understanding of brake intention
- Facilitation of traffic situations
- Hazard reduction

**Mean Values:**

- Misunderstandings: $M = 2.09$
- Dangerous situations: $M = 3.26$
Vote on a general introduction of a Front Brake Light

I'm against it.

I'm in favour of it.

Vote T1

Vote T2
Some comments on the Front Brake Light

**Anticipation and reaction (13)**

"You can see quicker that the vehicle is braking" / "You can respond more quickly to the braking of other road users."

**General positive comments (10)**

"That was very good." / "Good idea."

**Visibility (10)**

"Good. I expect it to be even more positive in winter." / "The version currently used on vehicles does not dazzle, but is very clearly visible."

**Feeling of safety (7)**

"As a road user, you feel safer." / "Safety has increased."
Some comments on the Front Brake Light

Communication (3)

"Improved communication among road users." / "The flow of traffic has improved."

Colour (3)

"Colour is noticeable."

Parking (1)

"The Front Brake Light helped with parking."

Other (7)

"Vehicles of other companies should also be equipped."
Summary of the scientific results

- The more experience with the FBL, the more positive the attitudes became.
- In simulated mixed traffic (laboratory study), braking was detected faster with FBL.
- In cars not fitted with FBL, the reaction was slower (more cautious).
- In the field trial, positive experiences with FBL were frequent, negative experiences were rare.
- After three months of experience, 76% of the field study participants were in favour of generally introducing the FBL.
Easily to introduce from a technical point of view

- 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.
Why green?

- New Light Signaling Function (LSF) on motor vehicles always means question of the appropriate light colour.
- Red lights to the front strictly forbidden by Vienna Convention.
- Other colours legally assigned already to special situations and / or special types of vehicles.
- Already existing high number and range of variation in forward-acting white light signals.
- Colour green not used for LSF on motor vehicles yet, but therefore offers the advantage of unambiguousness and fast signal identification.
Necessary to introduce **Front Brake Light** in the legal framework on type approval:

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

**Medium-term:**
Level of the Vienna Convention resp. framework of (UN) ECE type approval regulations.

**Short-term:**
Changes to be implemented as EU-specific extensions in application provisions of ECE type approval regulations for the EU area.

Nonetheless an introduction of the **Front Brake Light** for national areas and by national exception approval would be also very helpful.
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...” [Nr. 37].

Braking signals to the rear are quite sufficient today. Mentioning signal lights for deceleration in general gives a hint, signaling to the front might be promising.

Front Brake Light is in line with requirements set out to make driver assistance systems compulsory in future:

- Scientific evidence of significant contribution to increasing road safety
- Positive cost-benefit ratio
- (Given) Marketability
- No significant financial burden on the citizen (raising prices)
Thank you very much for your attention!

And:

We can make Traffic safety happen!