

Distr.
GENERAL

TRANS/WP.29/GRE/2002/43
18 July 2002

ENGLISH ONLY

ECONOMIC COMMISSION FOR EUROPE

INLAND TRANSPORT COMMITTEE

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

Working Party on Lighting and Light-Signalling (GRE)
(Forty-ninth session, 30 September - 4 October 2002,
agenda item 7.3.)

EXPLANATORY NOTES TO DOCUMENTS
TRANS/WP.29/GRE/2002/21/Rev.1 and
TRANS/WP.29/GRE/2002/22/Rev.1

Transmitted by the Expert from Germany

Note: The text reproduced below was prepared by the expert from Germany, in order to give explanatory notes to the proposals allowing the signalling of intensified/emergency braking (TRANS/WP.29/GRE/47, paras. 9 and 10).

Note: This document is distributed to the Experts on Lighting and Light-Signalling only.

1. INTRODUCTION

At the forty-seventh session of GRE, the expert from Germany made a presentation of the accident avoidance research, in which various possibilities of emergency braking brake light display were tested and evaluated, with various thresholds for activation and deactivation (informal document No. 11):

- (a) increased brake light surface area and intensity at high deceleration;
- (b) integral brake light (S3 lamp indicating braking deceleration degree);
- (c) flashing hazard warning lamps at high deceleration;
- (d) continuously alighted rear direction indicator lamps at high deceleration.

The expert from Germany drew attention to the final report of the study which is available in the website of the Bundesanstalt fuer Strassenwesen (Federal Highway Research Institute): <http://www.bast.de> .

At the forty-eighth session of GRE, a demonstration was given in the premises of the Palais des Nations of a number of configurations. On the basis of the ensuing discussion, the experts from Germany reviewed their proposals which are now presented in revised versions. Further, the Chairman proposed that all GRE participants reconsider the proposals with regard to the:

- (i) cost-efficiency of such a system,
- (ii) light-signalling device ("red coloured" stop-lamps or "amber coloured" hazard warning signal),
- (iii) illuminating surface (single lamp or additional lamp),
- (iv) mandatory or optional installation of emergency braking signalisation,
- (v) value of deceleration at which the system has to operate,
- (vi) flashing rates of the light-signalling device,
- (vii) vehicles already stopped in the traffic as a result of emergency or ordinary deceleration.

There are solutions possible, which are very cost efficient with regard to the profit of increased safety.

The colour of the signal Stop is red.

The colour of Warning signals is yellow (amber).

The following safety concept in addition to the revised proposals cover also the points (iii) to (vii) above.

An amendment in the Vienna Convention is necessary with regard to the red flashing of the Stop Lamps.

In addition, a diagram should pass on the idea visually, also a list of literature, which gives an impression about the activities and a number of research projects on this matter.

Safety concept for vehicle braking manoeuvres

In the past years, a series of investigations have shown that an improved brake signalling system may improve road safety!

The following concept is developed to improve the information "brake" by an increase of recognition through a brake force display. This improves traffic safety.

"normal" braking:

stop signal at "normal" light level signal colour red

activation of the service brake
 reduction of speed
 stop manoeuvre at low speed
 normal stop or brake manoeuvre in town traffic

"intensified" braking:

stop signal at intensified light level (optional only!) signal colour red

strong brake manoeuvre with high deceleration (e.g. $a > 5\text{m/s}^2$ on
 usual dry roads}

vehicle stops without problems
 and vehicle stops inside normal traffic conditions
 stopped vehicle is not necessarily an obstacle

"emergency" braking:

flashing stop lamps with high frequency ($f \sim 5\text{Hz}$) signal colour red
 braking with high deceleration in dangerous situations {e.g. $a > 7\text{m/s}^2$
 on usual dry roads}
 is function of speed, deceleration, additional information as Brake
 Assistance, ABS, etc.

protection of a stopped vehicle:

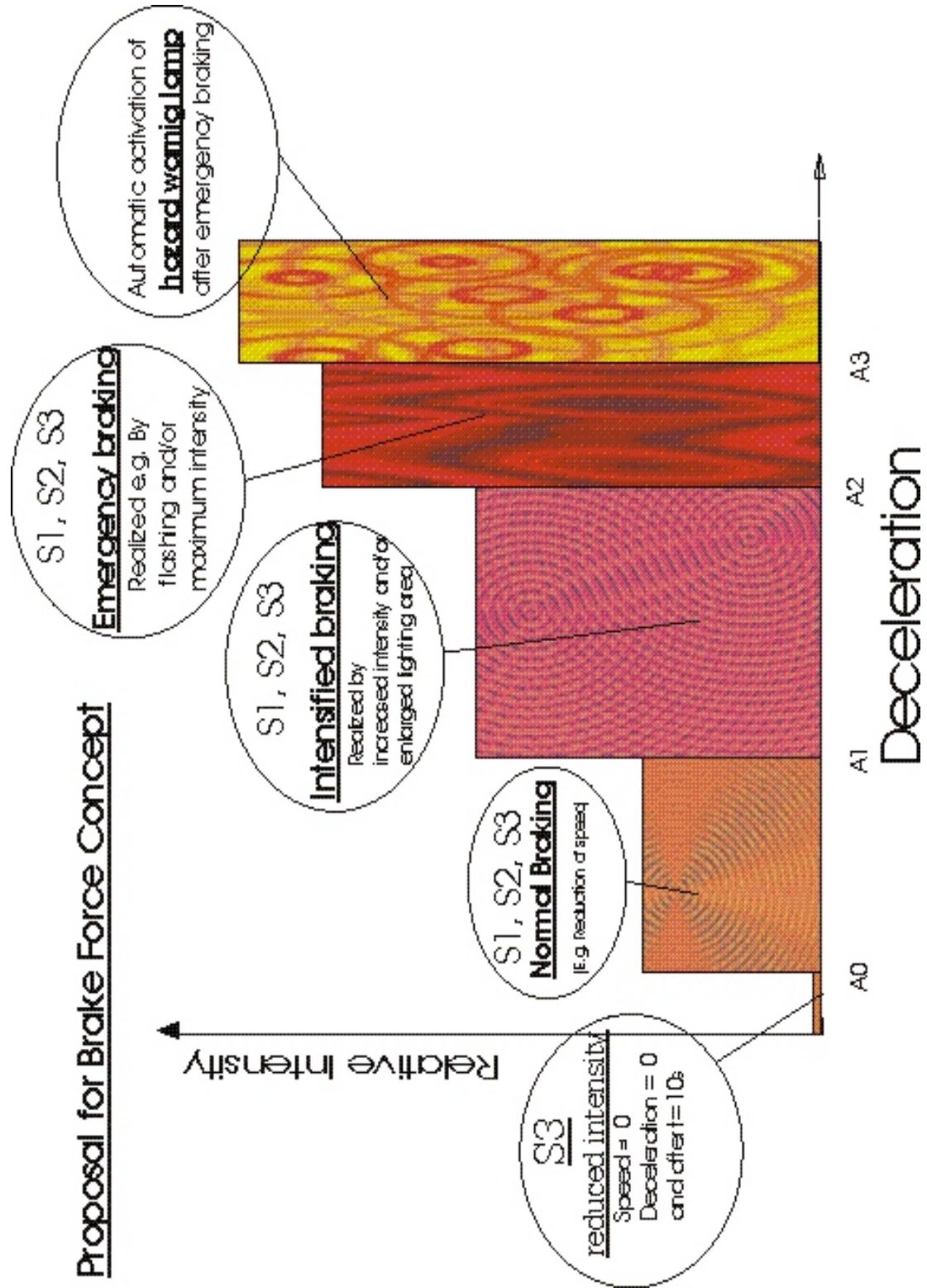
special signal for information "vehicle is an obstacle" → signal colour amber

stopped vehicle is a dangerous obstacle
 automatic activation of hazard warning lamps e.g. after
 "emergency" braking manoeuvre [and low speed ($v < 10\text{km/h}$)]
 or after a crash.

Vienna Convention Chapter II, Article 32, paragraph 13:

13. Hazard warning signal may be used only to warn other road-users of a particular danger:
- (a) When a vehicle which has broken down or has been involved in an accident cannot be moved immediately, so that it constitutes an obstacle to other road-users;
 - (b) When indicating to other road-users the risk of an imminent danger.

Proposal for Brake Force Concept



LITERATURE:

This is a collection of literature to the item "Improved Rear Lighting" without the claim of completeness!

The number of independent studies and investigations show the need for an improvement of the rear signalling system, especially the stop signal!

BOL, J., DECKER, H. J.: Verbesserung der Heckbeleuchtung von Kraftfahrzeugen, 1971

SIEVERT, W., SANDER, K.: Rückwärtiges Signalbild an Kraftfahrzeugen, Bundesanstalt für Straßenwesen, Mai 1999, not published

GELAU, C.: Bewegungsextrapolation und ihre altersabhängige Variation, Münster: LIT-Verlag, 1997

LEE, D. N.: A theory of visual control of braking based on information about timeto-collision, Perception, 5, 1976

McLEOD, R. W. & ROSS, H. E.: Optic-flow and cognitive factors in time-to-collision estimates, Perception, 12, 1983

SCHIFF, W. & DETWILER, M. L: Information used in judging impeding collision, Perception, 8, 1979

YILMAZ, E. H. & WARREN, W. H.: Visual control of braking: A test of the tau hypothesis, Journal of Experimental Psychology: Human Perception and Performance, 21, 1995

HORST, R. van der: Time-to-collision as a cue for decision-making in braking, in: A. G. GALE et al. (eds.), Vision in Vehicles III, Amsterdam, North-Holland: Elsevier Science Publishers, 1991

WINSUM, W. van & HEINO, A.: Choice of time-headway in car-following and the role of time-to-collision information in braking, Ergonomics, 39, 1996

JANSSEN, W. H., MICHON, J. A. & HARVEY, L. O.: The perception of lead vehicles movement in darkness, Accident Analysis & Prevention, 8, 1976

SANDERS, M. S. & McCORMICK, E. J.: Human factors in engineering and design, 6th ed. New York u. a.: McGraw-Hill, 1987

JOHANSSON, G. & RUMAR, K.: Drivers' brake reaction times, Human Factors, 13, 1971

BURCKHARDT, M.: Reaktionszeiten bei Notbremsvorgängen, Köln: Verlag TÜV Rheinland, Mai 1985

POSNER, M.: Orienting of attention, Quarterly Journal of Experimental Psychology, 32, 1980

EIMER, M., NATTKEMPER, D., SCHRÖGER, E. & PRINZ, W.: Unwillkürliche Aufmerksamkeit. In: O. NEUMANN & A. F. SANDERS (Hrsg.), Göttingen: Hogrefe, 1996

FENK, J., PRAXENTHALER, M.: Experimentelle Untersuchungen zur Verhaltenswirksamkeit mehrstufiger Bremsstärkeanzeigen, BMW AG, Oktober 1998, not published

FENK, J., PRAXENTHALER, M.: Zusammenfassender Bericht über die BFD-Felduntersuchungen von VTI und TRL, BMW AG, Juli 1999, not published

FENK, J. PRAXENTHALER, M.: Efficiency of Braking Intensity Indicator, PAL-Symposium 1997

FENK, J. PRAXENTHALER, M: Evaluation of braking performance with a Brake Force Display in a following-car situation, PAL-Symposium 1997

FENK, J. Schindler V.: Verfahren zur Optimierung der Wahrnehmbarkeit von Hindernissen für den nachfolgenden Verkehr, Procedure for Optimizing the Recognition of Obstacles by Following Traffic, Automobiltechnische Zeitschrift (ATZ) 96 (1994) p. 308; also distributed as Informal Document at 33rd GRE 17 to 21 October 1994

MUTSCHLER, H.: Warning systems in vehicles, Technical Report ISO/TC 22/SC 13/WG 8 N333, Karlsruhe: Beratungsbüro für Ergonomische Fragen, 2001

ELSCHNER, H.: Optimierung des rückwärtigen Signalbildes von Pkw sowie weitere Beiträge zur Kraftfahrzeugtechnik, Forschungsprojekt i. A. der Daimler Benz AG, 1992, not published

WOODSON, W. E., TILLMAN, B. & TILLMAN, R: Human factors design handbook, 2nd ed., New York u. a.: McGraw-Hill, 1992

AULBACH, J.: Rückwärtiges Signalbild bei Gefahrenbremsung, personal communication, 2001

AULBACH, J.: Optische Rückwärtswarnung, Abschlussbericht BMW AG Dezember 1988

GERHABER, M., WERMUTH, G., BARSKE, H.: Das Integral-Bremslicht IBL, ein wirksamer Beitrag zur Verminderung von Auffahrunfällen, Mai 1999

REICHELDT, W.: Optimierung Rückwärtiges Signalbild, power point presentation, personal communication, 2001

MESEBERG, H.-H.: Wirksamkeit vertikaler Leitelemente für Straßenarbeitsstellen, Bundesanstalt für Straßenwesen, November 1997

WINTERHAGEN, J.: Der neue Peugeot 607, Automobiltechnische Zeitschrift, 2000

WIEMANN, H.: Elektronisches 2-Stufen-Bremslicht, personal communication, 2001

ENGELS, K., KROJ, G., NELSEN, W., SCHLABNITZ, W.: Zweckmäßigkeit und Möglichkeiten einer verzögerungsabhängig gesteuerten Warnblinkanlage und eines Zwei-oder Mehrstufenbremslichts, Deutsche Kraftfahrtforschung und Straßenverkehrstechnik, Heft 205, 1970

GAIL, J.: Emergency Brake Display for Rear End Accident Avoidance, power point presentation, Informal Document No. 11, 47th GRE 2001

Schmidt-Clausen, H-J.: Brake Force Display; Informal Document 42nd GRE 14th to 16th April 1999

Armbruster D.: Optimierung der visuellen Informationsübermittlung durch adaptive Kraftfahrzeugleuchten, Thesis TU Darmstadt, Herbert Utz Verlag, München 2001

Ripperger J.: Lichttechnische Anforderungen an Schluss- und Bremsleuchten für Kraftfahrzeuge, Thesis TU Darmstadt, Herbert Utz Verlag, München 2001
