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OPTIMIZATION OF TRAFFIC FLOW BY USING RUNNING LIGHTS

In recent years road traffic has significantly increased. On crowded road sections there are more and more often traffic congestions.

These traffic congestions are often caused by the uneven driving style of individual drivers. In heavy traffic the drivers in following vehicles can only make up for the speed variations by braking. These oscillations in the traffic flow can even bring traffic to a standstill. On extremely crowded road sections a very uneven driving style can lead to traffic jams.

There is a particularly strong speed variation on road sections, which are unfamiliar to drivers, e.g. in tunnels. In this case, the environment provides no information about the driven speed. By the regular design of tunnel walls, it is not possible to perceive any speed. In addition, drivers are insecure because of the restricted space within the tunnel.

In order to improve the drivers' orientation on such road sections, so-called running lights are a possible solution to the problem. Running lights are lights being attached to the tunnel wall one after another. Thus the drivers get the subjective impression of seeing lights running. The running light speed corresponds to the ideal speed for the road section in question. Compared to frequently used acoustic signs, the advantage of this visual stimulus is, that it is perceptible permanently.

As a basis for evaluating such a system, we should consider the current traffic flow. There have been studies of a tunnel section, which starts with a downgrade and transitions to an upgrade. Initially the real driving behaviour and the traffic volume on this road section were measured.

These measurements were gained by using measuring loops on the road and also by the use of a measuring vehicle owned by the Forschungsgesellschaft Kraftfahrwesen mbH Aachen. By using the installed distance and differential speed sensors it is possible to sketch the speed profile of the vehicles ahead without influencing them. Acceleration in the downgrade section and deceleration in the upgrade section were indicated as the characteristic behaviour. These speed variations lead to traffic congestions in this extremely crowded part of the road. The description of the driving behaviour forms the basis for the following studies.

Using PELOPS, a traffic flow simulation program which was developed at fka in cooperation with the BMW AG, the effects of new measurements on traffic flow can be anticipated. By a detailed picture of the road, the vehicle, and the driver, the conditions can be replicated very precisely in the section considered. Therefore, the simulations account for driving behaviour and speed variations.

In the simulation the running lights' influence was examined by assuming that drivers adjust their desired speed to the running speed. The desired speed is the speed, a driver wants to drive without being influenced by the surrounding traffic. Because of the altered driving behaviour, a significantly more even driving style of all drivers became obvious. The simulations also showed, that the emergence of or reduction in traffic jams can be influenced in a positive way by creating even traffic flow. In all, traffic jam reductions of approx. one hour per day could be predicted.

These promising results led to more studies dealing with the running light design and the driving behaviour. In the driving simulator of the "Interdisziplinäres Zentrum für Verkehrswissenschaften" of Prof. Krüger at the Würzburg University, the visibility in a tunnel can be exactly reproduced. The tests were carried out in cooperation with the "Institute of Psychology" of the RWTH Aachen University, chaired by Prof. Heller. Different blinking patterns, -frequencies, and -durations were considered. It turned out that a running light in which several lights aligned with each other are switched on, convey the impression of a light band. Thus, the best results can be achieved.

