

LIGHTS DURING DAYTIME IN POLAND

Tomasz Targosiński

*Motor Transport Institute
Jagiellonska Street 80, 03-301 Warszawa, Poland
tel.: +48 22 8113231 ext.157, fax: +48 22 81100906
e-mail: tomasz.targosinski@its.waw.pl*

Abstract

From 1992 in Poland was obligation to use passing beam headlights in automotive traffic during daytime in autumn and winter. From April 2007 was introduced extension of this obligation to spring and summer. This obligation caused controversies and discussions. In some, mostly European countries this obligation is present during part of year or during full year on all or selected roads. Known research shows that profits of this obligation understanding as decreased number of killed and injured people exceed costs understanding as additional fuel consumption and light sources replaced. This law in Poland is used till now some month more over one year. The results and differences can be observed only for few months of 2007 in relation to adequate few months in 2006. It is to short period of time to reach final conclusions. Because in 2007 the total number of accidents increases comparing 2006 there is a pressure of part of mass media and public opinion to withdraw this law. Preliminary detailed analysis of accidents connected with using lights during daytime shows rather decreased number of daytime light-dependent accidents when is observed increased number of night accidents. It means that common feeling regarding using lights in daytime and nigh-time can be far from objective research results. The base is differences in perceptions between people and mistakes of subjective assessment. In this paper is presented preliminary analysis of problems and results of using lights during daytime in Poland in spring/summer period.

Keywords: *transport, traffic safety, illumination, law, daytime running lights*

1. Introduction

From 1992 in Poland was obligation to use passing beam headlights in automotive traffic during daytime in autumn and winter. In April 2007 was introduced extension of this obligation to spring and summer. The basic lights suggested for this ourpose are passing lights and in addition can be used special daytime running lights (DRL). In many countries such obligation is present as part or full year and on all or selected roads (e.g. outside urban areas or on motorways only). Known research shows that profits of this obligation understanding as decreased number of killed and injured people exceed costs understanding as additional fuel consumption and light sources replaced. As this law is used in Poland till now some month only the results and differences can be observed only for few month of 2007 in relation to adequate few month in 2006. It is to short period of time to reach final conclusions. Because in 2007 the total number of accidents increases comparing 2006 there is a pressure of some politicians, part of mass media and public opinion to withdraw this law. Preliminary detailed analysis of accidents connected with using lights during daytime shows rather decreased number of light-dependent accidents but unfortunately increased number of night accidents. It means that common feeling regarding lights in daytime and nigh-time can be far from objective research results.

2. Performance of passing lights for daytime driving

Passing lights beam is split for two parts: lower brighter, serving for road illumination and upper, darker, serving for signalling presence of vehicle on the road (Fig. 1).

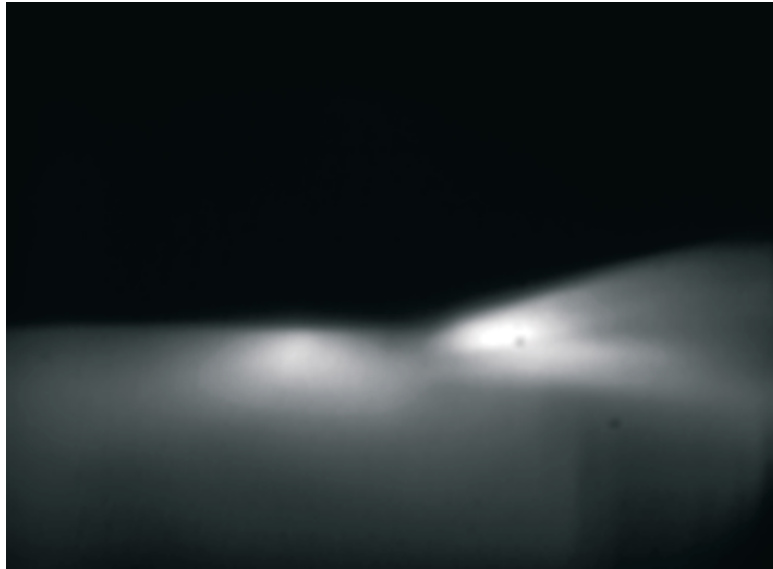


Fig. 1. The example of passing beam on vertical screen

As early as in the sixties of 20 Century there was observed that upper part cause improvement of vehicle visibility also in daytime. Because this part of passing beam should not glare during night at the day should not glare as well. That was justification to allow in some countries use passing lights during the day to improve recognition vehicle in move. In next years following traffic progress and collecting experience in some countries was introduced obligatory to use lights during daytime. Extent of this obligation was different regarding time, roads and areas.

Profitable performance of upper part passing beam become the base to work out special daytime running lights (DRL). There were described technical and photometrical requirements very similar as for upper part of passing beam [1]. Main difference is that beam pattern of DRL is more uniform and symmetrical. This lights cannot glare independently on aiming because illumination is restricted. They are also much more energy saving as do not need to illuminate the road which can be visible good enough during the day.

The use passing beam during the day can be very easy realised without any additional outfit because it is obligatory equipment of each motor vehicle. DRL are presently not very often fitted by factory. From 11 July 2008 new type approved vehicles according Regulation 48 UN ECE should be equipped with DRL [2]. Transitional provision for this requirement are from 30 to 48 month. Additional fitting of DRL-s is not expensive and not complicated.

3. Lights at daytime - profits and costs estimations

The use of lights during the day is commonly consider as profitable and reducing traffic hazard. To objectively prove this profits is complicated process. Judgement of influence of lights for given traffic accident is very difficult in practical conditions. Especially crash avoidances are not registered and are not present in statistics. Conclusions can be indirect only, on the base of changed number of accidents which are connected with lighting. There are also empirical research and analysis which can prove relation between light and accident.

In [3] states that use lights during daytime can decrease number of accidents with two vehicles from 5% to 15% and number accidents with motorcycles up to 32%. Other sources [4] informs that using lights during daytime all over the year on EU area can reduce number of killed persons in two vehicle accidents of 20% and total killed persons of 7%. These estimations are not equal and concern generalized situations, as length and quality of roads, technical state of vehicles or drivers behaviour.

Main cost of using lights during daytime is additional fuel consumption. It is estimated for passing lights at level from 0.5% to 2.5% depending on kind of vehicle and traffic condition. For

heavy trucks this percentage is lower, as a result of relation between lights power and vehicle engine power than for small cars. For vehicles standing in traffic jam values will be some times greater than for driving with high speed.

It is important that before introducing spring/summer obligation in autumn/winter time all vehicles used lights during day. Also many drivers (average more than 50%) used lights during sunny days in spring and summer. It can be approximate that 20% to 50% of preceding estimation is real additional fuel consumption and pollutions emission. Is important that there are many much more effective ways of fuel consumption reduction as economical driving style teaching, traffic smoothing, road and motorways building etc.

4. Subjective visual light perception

Visual perception it is complex and complicated process. It is observed continuous significant deterioration of visual acuity after 25 year of life. There are also observed significant differences between persons in the same age. Is obvious that average age of drivers is increasing and prohibiting driving over given age could be not accepted. There are the reason that subjective feelings are diversified in the same objective situation. Important is that the youngest drivers with lowest experience can see better and assume that other road users can see similar. This age group of drivers causes most severe accidents because of bravado and insufficient knowledge, experience and imagination.

Detailed analysis of visual perception shows that vehicle passing lights and DRL-s can be seen inside much bigger angle and from bigger distance than less contrast objects. It concern also pedestrians which can earlier seen vehicles and give them way.

Important factor is drivers visual assessment of speed and distance. Different size, brightness and separation of headlamps sometimes can cause difficulties. But it is factor mostly discouraging for risk manoeuvres as overtaking. This can profits in crash avoidance. Mistake in distance/speed recognition of dark vehicle in shadow could be fatal in effects because of approximately doubled speed and crash results in second power of it.

There are many detailed situations in which lights improve visibility during the day but are also many in which no difference is observed. One of advantage is easier visibility in mirror during rain and wet road spray condition but also motorcycles in any conditions.

Here presented analysis concern responsible behaviour of road users. But is observed some irrational behaviour against road obligations when drivers intentionally switch off the lights and cyclist drive on roads with heavy traffic or people installing prohibited light sources in headlamps. There are human reactions which complicates situations and are difficult to asses by numbers.

Important factor is glaring. It is effect of incorrect aiming of passing beam. In daytime it is not very significant for perception regarding night-time but can cause discomfort and cannot be ignored as impact for safety by intensive traffic.

By analogy disturbing are other stimuli as big advertisements or seller offering their agriculture products close to road. Lights significantly focus perception on traffic in such situations.

Interesting research regarding perception were done in Austria last summer [5]. Examination of points of sight concentration were done in coincidence with lights in day. It basically confirmed known effects but find out that by very intensive sunlight perception time concentrated on lights is increased of 20% to 25%. The impact of this effect for traffic safety was not specified. This research had preliminary complexion and were simplified. Finally no strict conclusion were defined, especially against using lights during daytime.

It will be very advisable to perform similar but more advanced research in Polish conditions connected with assessment quality of beam pattern of lights.

5. Quality of passing lights and its influence for daytime driving

Examination of quality of headlight done in Motor Transport Institute shows that significant percentage passing beams are incorrectly aimed. Even more easy access to incorrect or illegal light source (higher wattage or xenon replacement of halogen bulbs) causes installing it and as result glaring even by correctly aimed headlamps. Glaring illumination in extreme situation overcome legal values more than 20 times! As result it could be impossible distinction and recognition of direction indicator incorporated with such headlamp. It also causes negative feelings of drivers and can cause opposition against using lights during daytime. This is serious problem concerning much more night-time driving and probably has significant impact for increasing number of accidents during night.

6. First results of all-day all-year lights use obligation

Reliable assessments of impact of daytime lighting for traffic safety needs objectively done tests and research. It needs time and oriented examinations. It is really complex enterprise.

It is important that considered obligation causes many discussions and emotions which are the result of subjective visual perception. There have some impact for mass media and furthermore for decisive bodies. It was emphasized that in next year after introduction of obligation (in 2007) it was increased number of traffic accidents and killed people. Detailed analysis of statistics shows rather profits than losses. In 2007 comparing to 2006 total number of killed increase by 6% but in day by 4% and in night by 9%. Comparing analogous periods (from May to September) of 2006 and 2007 is possible to see that number of killed persons in accidents increase in day only by 0.5% when in night increase up to 8% [6].

In categories of accidents considered as directly connected with use of lights during daytime-crashes with participation of two vehicles - number of killed people decrease (!) by 6% and in front crashes number of killed people decreased by 8%. In the same time in night number of killed people increase by 17% [6].

In spite of this first optimistic results total assessment of described obligation should be treated carefully. Many diverse factors influence for arising accidents. Very short time of observation and statistical deviations can lead to ambiguous conclusions.

Much more important problems than daytime is night-time vehicle headlighting. It is outside discussion because there were no changes in requirements an law from many years.

Conditions of perception at night are much worse. The same incorrectly aimed headlights which are reason for complaints during the day in night dazzle significantly more and dangerous. Research concerning this problem shows generally insufficient quality of lights. There is important that number of fatalities in night comparing number vehicles in traffic is much higher than during the day. Last year in Poland significant increase was observed. Probably the quality of lights play significant role in this process.

Improvement in this field is relatively easy to obtain by more intensive inspections by police, periodical technical inspections and also by education and mass media information. Improvement of technical requirements and testing is also possible.

7. Conclusions

Introducing all-day all-year obligation to use light in Poland should be continued. Preliminary observations confirm profits in traffic safety. But discussion involving politics and mass media do not take place on reasonable way.

It is needed detailed research and analysis of influence of this obligation for traffic safety and drivers behaviour. It should be utilised systematic depth research considering possibly all important factors. It also need more time to be sure that statistical data give big enough value and accuracy.

There are some examples of useful research:

- advanced statistical analysis „before” and „after”,
- subjective reactions of drivers and their relation to obligation,
- precise assessment of additional fuel consumption and pollution,
- examine change in perception in automotive traffic, distance and speed recognition of different traffic participants and important objects,
- testing illumination conditions (overcast, sunrays angle, shadow) and their impact for perception with lights „on” and „off”,
- testing performance of lighting devices and their impact for quality and comfort of perception road traffic users.

References

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