Change of the Light Intensity Emitted from the Headlamps

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ABSTRACT---- *During the reduced visibility is the illumination of road covered by headlamps of the vehicle. This illumination road ahead of the vehicle has direct impact on the distance to which the drivers are able to detect an object. With the length of this distance varies a safe driving speed. Longer distance of sight the driver is more save driving speed. It therefore has a direct bearing on road safety. Distance of the sight the driver depends on the beam of headlamps. It varies in dependence on the intensity of illumination the road by the headlamps of the vehicle. The light flux emitted by headlamps is not constant, but there is a time of change. This work deals with the effect of the length of duration the headlamps to its light flux, as well as the influence of voltage on the terminals of headlamp to intensity illumination that is produced by headlamps.*

Keywords – headlamp, intensity of illumination, sight, illumination distance

1. INTRODUCTION

By driving in poor visibility is an important indicator of road safety driver's ability to recognize an object during the drive so that he can stop the car in time. This ability is characterized by sight, illumination distance and visibility to the object. All these parameters are affected by the condition of headlamps and intensity of light produced by them.

2. ANALYSE

Impacts on the driver's ability detect an object

Illumination distance on the road is in case of high beam distance, when the driver of road vehicle recognize objects on the road or on the verge. In case of low beam it is the distance that the headlamps of low beam illuminate the road so the distance interfaces lit and unlit section of the road. Illumination distance on the road is influenced by their downgrade. This parameter is specified by the manufacturer for basic adjustment.

The sight distance is the distance ahead vehicle on which is the road efficient lighting. On this distance is the driver able to observed the object on the road and evaluate it more. This distance is not a constant value, but it changes during the driving. When vehicles are traveling at the night the effective illumination of the road ensure headlamps of the vehicle. Space effectively illuminate the road is bordered by isolux curve. It is a space where the light intensity is greater than 1, 50 lux. It should be known that the object is situated at the distance of illumination limit in the plane of the road, has illuminated only the lower edge at the point of contact with the ground wire and it can be not observed. The object can be observed only when is effectively illuminated about the high 0, 40 to 0,50 m above the ground level. [1] [3]

When vehicle is driving at night the sight is characterized by the distance to which the driver of the vehicle can recognize the object in the light of the spotlight of headlamps. This distance is related not only with the illumination distance but depends on the ability to object reflect the light too and it is important the contrast of the object compared to the surroundings.

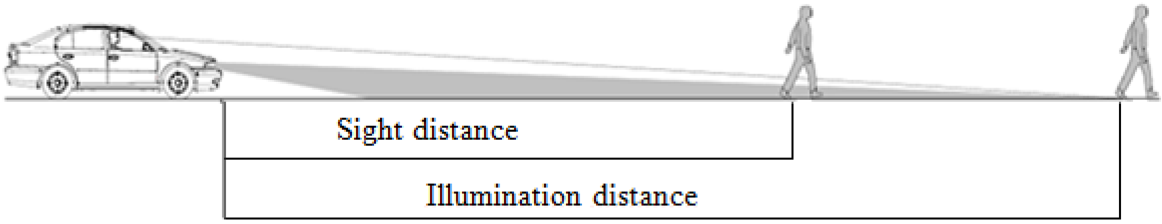

Figure 1: Illumination distance and the sight from vehicle [1]

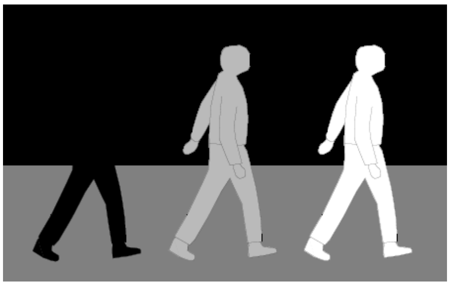

Figure 2: The ability to identify object depending on the contrast of clothes [1]

If the vehicles move in load of the low beam, the road is sufficiently illuminated to distance 45 – 65 m. If the driver should recognize object, among the illuminated part of road and the potential object must arise the difference of brightness – contrast, such value to be to the human eye perceptible. With increased contrast increases the visibility of the object with human eye too. For example the figure dressed in white reflects all incidents light and is highly visible. Figure dressed in black absorbs all incidents light and therefore is more difficult to detect it with the eye. Figure 2 shows the ability to identify objects depending on the contrast of clothes with surroundings. Combination of size the object and contrast is necessary for the perception of human eye. The fact that the pedestrian is in effectively illuminate part of road does not mean that it can be also recognize by the driver of vehicle. [1] [2]

Intensity of illumination

As follows from the previous text, one of the basic assumptions for observe the objects is illumination of road in front of vehicle sufficient intensity of light. Intensity of illumination 1 lux is caused by luminous lux of 1 lumen impinging on the surface of 1m^2, irrespective of the reflectance of the surface. Or otherwise – Lux is a unit expressing the areal destiny of the impinged light flux $1\ lx = \frac{1\ \mathrm{lm}}{m^2}$.

Light flux of headlamps changes in operation of the vehicle and thus changes intensity of illumination of road ahead the vehicle. If we assume, that the reflectivity of reflective surfaces of the headlamps does not change and does not change the translucency of their glasses, the reason may be the loss of ability the filament bulbs emit the light. This fact we tried to verify by the laboratory experimentation. We used to assembly of Figure 3.

Figure 3: Assembly for the measurement

One of the reasons for variations of intensity the light is the supply voltage variation. We simulated the location of headlamp in real car. Therefore, the headlamp was supplied by the current from battery. Just to be sure, that to measure will not be used battery with low capacity battery status was checked by measuring device of the battery pack. His condition was set at 75%. The battery will after a certain time loss voltage at the terminals. In the real vehicle is a source of electrical energy accumulator, which is connected to a power supply, which is the alternator. Such an assembly guarantees that that battery is recharged in service and charged and not decreasing the voltage at the terminals or the ability to supply the required current intensity.

That in our line-up voltage alters the battery was permanently connected to batteries recharger. As a light source was used halogen headlamp designed filament lamp. Therefore, we have installed to the headlamp filament lamp H4. Measurements have been performed with the passing fiber lighting. This leaves simulated location of headlamp in normal vehicle. Check whether during the measurement there isn't change of voltage and current, we carried out by voltmeter in detecting light intensity. We examined the illumination distance of 1,2 m in front of headlamp, where we put luxmeter Tondaj LX1010BS FIG, figure 4.

Figure4: Digital Luxmeter Tondaj

It operates in three ranges:

0 – 1999 with resolution ± 1 Lux,
2000 – 19999 with resolution ± 10 Lux and
20000 – 100000 with resolution ± 100 Lux.

First measurement intensity of light was performed in a plane perpendicular to the axis of the headlamp and in space at the highest intensity of light. To avoid inaccuracies, we performed measurement intensity of light at all times in the same place and we checked whether the other place is not higher intensity of light. To avoid the risk of fire due to short circuit the device, or its overheating, measurement was carried out only in the presence of each person performing the measurement. The measurement was started at 1. December and completed at 16. January 2015. The cause of the measurement was the fact, that a fuse has blown fibers measured Bulbs. The results are summarized in Table 1.

Table 1: Change the intensity of light depending on the length of the lighting [Lux]

Date	Hours	Voltage [V]	Ampere[A]	Intensity of illumination [Lux]
12. 1. 2014	8,0	12,47	4	6860
12. 2. 2014	6,5			
12. 3. 2014	8,0			
12. 4. 2014	7,0			
12. 5 2014	6,0	12,4	4	6200
12. 8. 2014	8			
12. 9. 2014	5,5			
12. 10. 2014	9,0	12,89	4	4750
12. 11. 2014	7,0			
12. 12. 2014	3,0			
12. 16. 2014	7,0			
1. 7. 2015	9,0			
1. 8. 2015	10,0	12,83	4	4360
1. 9. 2015	9,5			
1. 12. 2015	9,0			
1. 13. 2015	9,0			
1. 14. 2015	7,0			
1. 15. 2015	10,0	12,70	4	3980
1. 16. 2015	8,0			
Total	146,5			

The table shows that with the increase time of illumination reduce the intensity of illumination. Of the initial 6860 lux light intensity decreased to 3980 lux, which was found the day before the occurrence of failure. Failure occurred after a relatively short time, 146, 5 hours lighting. Standard lamp should achieve significantly longer life. Short life is probably related to the fact that during the illumination of the reflector was not cooled. In normal traffic while driving while headlamp is cooled by the air stream and cooling is interrupted for a short period while is waiting for reasons related to road traffic (intersection, waiting in front of object, etc.). We don’t carry the measurement intensity of illumination on each day, because the difference in the light intensity between days was immeasurable.

Measurements introduced were carried out with the assumption that the terminal of headlamp is practically constant voltage. Measurements show that this precondition was met and decrease intensity of illumination was associated only with a length of lighting. In operation, however, may be the voltage at the terminals of the headlamp lower. This decrease may be cause by worn parts of alternator, fault voltage of regulator, poor contact to terminals, insufficient grounding the lamp or alternator, etc. Dependence the light intensity from the voltage at the terminal of the battery we investigated at the assembly accord the figure 3, but recharger was used only at the firs measurement. Then was disconnected ant the only source of power was the battery. Over time his discharge was also decrease the voltage at the terminals. Table 2 shows the results of this measurement.

Table 2: Change the light intensity depending on the length at the lighting [Lux]

The voltage at the terminals of the battery [V]	Intensity of light [Lux]
13,07	6570
12,50	5280
12,20	5050
12,00	4860
11,60	4840
11,25	4550
10,85	3990

From the table one can see that, in terminal voltage decreased to 83%, the intensity of light decreased to 60,7 % compared to a mean of measurements.

3. SUMMARY

Measurement results showed that the intensity of light decreases with the length of lighting here decreased the light intensity to 58% of the original value. A similar dependence showed the illumination depending on the voltage drop at the terminals of the headlamp. Here was a decrease to 60, 7 % of the original value.

These changes in the light intensity directly affect the distance at which has driver sight distance in the poor visibility. This distance is the distance at which the driver must be able to stop the vehicle. When is the length of sight distance the driver shorter, the more safe driving speed is lower. Clearly true that safe driving speed is directly related to the technical condition of the vehicle lighting.

4. ACKNOWLEDGMENT

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