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Characterizing illuminance levels and perceived work environment in an automotive industry

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INTRODUCTION:

Automotive Industry in Portugal, is these days a dynamic and competitive industry. For components production such as cables, comfort systems or others is require observation, human touch and must be done manually using man power capability (Ismail et al, 2010). Thus the quality of the product heavily depends on worker's comfort in the working environment. Environmental factors are considered to have influence for acceptability and performance on the occupant's premises (Ismail et al, 2010). One of them, such lighting, is determined by the satisfaction of three basic human needs: visual comfort, where the workers have a feeling of well-being, in an indirect way also contributing to a high productivity level; visual performance, where the workers are able to perform their visual tasks, even under difficult circumstances and during longer periods and safety (EN 12464-1, 2011).

Proper lighting is a prerequisite for obtaining a good working environment. Poor lighting may increase the risk of accidents and could also cause a variety of symptoms. The variables that determine a good working visual environment are: the even distribution of luminance, proper lighting, the absence of reflections, the right direction of light, no flicker, appropriate choice of lamp color and availability of natural light (Calleja and Pérez, 2011).

OBJECTIVES:

Considering that proper lighting could be one way to improve productivity and well-being of workers (Juslén et al, 2007), this study has the main objective to assess and characterize the illuminance levels of several workstations of an automotive industry and obtain workers perception of light conditions.

MATERIALS AND METHODS:

A descriptive study was developed to assess occupational lighting levels in an automotive industry. One hundred and forty four tasks/workplaces were evaluated, and more than seven hundred and sixty measurements (task and surrounding areas) were performed. The tasks/workplaces evaluated were assembly lines, laboratory tasks and warehouses.

In the evaluations of lighting levels, the measurements were carried out for a sufficient time for the stabilization of illuminance levels. The measurements followed the methodology suggested by the EN 12464-1:2011 and Portuguese Institute of Accreditation (IPAC) clients' information nº 3/2008. Some variables, such the day period when the measurements were carried out and weather, were taken into account, due to their possible influence on measurements results. The equipments used to determine the illuminance levels, were two light meters, brand Gossen, model MAVOLUX 5032C USB. These devices are calibrated annually by an accredited calibration laboratory, being able to measure the mentioned variables by complying with the applicable acceptance criteria. The results were compared with the lighting requirements for interiors (areas), tasks and activities given by the EN 12464-1:2011. To analyze the perception of workers in their work places, it was adapted and applied a questionnaire, in order to

characterize work conditions and comfort. This questionnaire was an adaptation of a questionnaire developed by Lofberg & Staffan (1997).

RESULTS AND DISCUSSION:

In some workplaces evaluated the type of activity implies performing demanding visual tasks with medium details and others that do not require high visual acuity. The reference values of required illuminance for these tasks, varied from 100 to 500 lux.

It was found that 49,3% of the measured values were below the normative recommended values. Concerning the illuminance of immediate surroundings, 13,9% of the workplaces had values below the recommended. A representative sample (n=57) of workers answered the questionnaire. The majority of the subjects were females (63,4%). The results obtained through the questionnaire, shows that relating to the satisfaction level of the existing illumination, 88,0% of workers were satisfied. The perception of workers contrasts with the measured levels of illuminance, since they consider that the illuminance levels are adequate or sufficient to consider the accomplishment of their task. This was evidenced by Juslén et al (2007), in their study in a food industry that assessed the perception of workers about the lighting before and after implementation of local lighting at workstations. They concluded that the workers before the change were satisfied with the lighting levels and that after the implementation, admitted that the lighting levels were better and helpful for them to perform their tasks more effectively and efficiently.

Concerning health outcomes, 44,0% of the participants, reported that suffer from eye pathology (mostly astigmatism and myopia) and 37,0% use glasses. Only 19,1% of workers reported visual fatigue at the end of the work day. It would be expected that most participants felt visual fatigue, not only because the low illuminance levels, but also because the majority of the tasks requires looking closely at small objects increasing the possibility of eyestrain (Kroemer and Grandjean, 2005).

CONCLUSION:

Results show that lighting conditions are below recommended guidelines. According to the observations made corrective measures should be taken. In addition to the natural lighting should be provided artificial lighting adequate for the type tasks performed in this kind of industry, taking into account that lighting levels shall not exceed the recommended, due to the increasing possibility of occurrence of accidents and also excessive energy consumption.

A maintenance program of luminaries is also important to consider for maintaining proper lighting conditions.

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